WORKING GROUP ON ELASMOBRANCH FISHES (WGEF)

VOLUME 7 | ISSUE 92

ICES SCIENTIFIC REPORTS

RAPPORTS SCIENTIFIQUES DU CIEM

ICES INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA

CIEM CONSEIL INTERNATIONAL POUR L'EXPLORATION DE LA MER

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

H.C. Andersens Boulevard 44-46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

ISSN number: 2618-1371

ICES Scientific Reports

Volume 7 | Issue 92

WORKING GROUP ON ELASMOBRANCH FISHES (WGEF)

Recommended format for purpose of citation:

ICES. 2025. Working Group on Elasmobranch Fishes (WGEF).
ICES Scientific Reports. 7:92. [Insert page count] pp. https://doi.org/10.17895/ices.pub.30137623

Editors

Sophy McCully Phillips • Teresa Moura

Authors

Aurelien Delaval • Barbara Serra Pereira • Catarina Maia • Christopher Griffiths • Cristina Rodríguez-Cabello • Damian Villagra Villanueva • Graham Johnston • Guzman Diez • Joana Silva • Katinka Bleeker • Klara Jakobsdottir • Loïc Baulier • Megan Shipton • Matthias Schaber • Nair Vilas Arrondo • Nana Afranewaa • Noémie Deleys • Régis Souza Santos • Sophy McCully Phillips • Tanja Miethe • Teresa Moura • Thomas Barreau • Wendell Medeiros Leal

ICES
International Council for the Exploration of the Sea
CIEM
Conseil International pour l'Exploration de la Mer

Contents

i Executive summary

ICES WGEF is responsible for providing assessments and advice on the state of the stocks of sharks, skates, and rays throughout the ICES area. In 2025, WGEF provided advice for 5 stocks of skates and rays distributed in the North Sea and Azores ecoregions and seven stocks of sharks, six distributed in the Celtic Seas, Bay of Biscay/West Iberia and North Sea ecoregions and one distributed in the Northeast Atlantic.

Three stocks were assessed at Category 2 level for the second time. WGEF also applied, for the second time, the empirical methods for stock assessment and catch advice developed by WKLIFE X to assess nine category 3 stocks and to provide advice within the ICES MSY framework. No advice was provided for category 5 and 6 stocks, as those will follow quadrennial advice.

Discard estimates continue to remain uncertain due to the fact that elasmobranchs are primarily caught as bycatch in a variety of fisheries. Achieving precise and unbiased estimates would require a high level of sampling effort. However, the group has made diligent efforts to collate and harmonize discard data (since 2009) categorized by country, fleet segment, and stock code. This has enabled the inclusion of discard data in this report for comprehensive presentation. Nevertheless, for most stocks, advice is provided in terms of landings.

No benchmark assessments have been proposed for 2026.

ii Expert group information

Expert group name	Working Group on Elasmobranch Fishes (WGEF)
Expert group cycle	Annual
Year cycle started	2025
Reporting year in cycle	1/1
Chair(s)	Sophy McCully Phillips, UK
	Teresa Moura, Portugal
Meeting venue(s) and dates	4-5 June , Online (data prep)
	16 June, Online
	24-28 June, Online and Hafnarfjörður, Iceland, 23 participants

1 Introduction

1.1 Terms of Reference

2024/AT/FRSG14 The **Working Group Elasmobranch Fishes** (WGEF), chaired by Sophy McCully Phillips (UK) and Teresa Moura (Portugal), will meet:

online 4–5 June 2025 to:

a) Compile the catch and length data for all elasmobranch stocks;

and in Hafnarfjörður, Iceland, from 24–28 June 2025 to:

b) Address generic ToRs for Regional and Species Working Groups.

c) Update the description of elasmobranch fisheries for deep-water, pelagic and demersal species in the ICES area and compile landings, effort and discard statistics by ICES Subarea and Division, and catch data by NEAFC regulatory areas. Describe and prepare a first Advice draft of any emerging elasmobranch fishery with the available data on catch/landings, fishing effort and discard statistics at the finest spatial resolution possible in the NEAFC RA and ICES area(s);

d) Evaluate the stock status for the provision of biennial advice due in 2025 for: (i) skate stocks in the North Sea ecoregion, the Azores and MAR; (ii) catsharks (Scyliorhinidae) in the Greater North Sea, Celtic Seas and Bay of Biscay and Iberian Coast ecoregions; and (iii) smooth-hounds in the Northeast Atlantic;

e) Collate landings and discard data from countries and fleets according to the ICES data call to follow recommendations from WKSHARK5 to: (i) address the following issues: data quality and onboard coverage; raising factors; discard retention patterns between fleets and countries; discard survival; (ii) advise on how to include discard information in the advisory process; and (iii) develop a coherent data-base for landings/discard information used in the assessments.

f) Follow the outcomes of WKSKATE and make the best use of survey indices in the assessments where appropriate.

g) Work intersessionally to draft/update stock annexes and then develop a procedure and schedule for subsequent reviews.

The assessments will be carried out on the basis of the stock annex in National Laboratories, prior to the meeting. The assessments must be available for audit on the first day of the meeting.

Material and data relevant for the meeting as specified in the 2025 ICES data call must be available to the group no later than 14 days prior to the starting date.

Only experts appointed by national Delegates or appointed in consultation with the national Delegates of the expert’s country can attend this Expert Group.

1.2 Background and history

The Study Group on Elasmobranch Fishes (SGEF), having been first established in 1989 (ICES, 1989), was re-established in 1995 and had meetings or met by correspondence in subsequent years (ICES, 1995–2001). Assessments for elasmobranch species had been hampered by a lack of data. The 1999 meeting was held concurrently with an EC-funded Concerted Action Project meeting (FAIR CT98-4156) allowing greater participation from various European institutes (ICES, 1999).

Exploratory assessments were carried out for the first time at the 2002 SGEF meeting (ICES, 2002), covering eight of the nine case-study species considered by the EC-funded DELASS project (CT99-055). The success of this meeting was due largely to the DELASS project, a three-year collaborative effort involving 15 fisheries research institutes and two subcontractors (Heessen, 2003). Though much progress was made on methods, there was still much work to be done, with the paucity of species-specific landings data a major data issue.

In 2002, SGEF recommended the group be continued as a working group on Elasmobranch Fishes (WGEF). The medium-term remit of this group being to extend the methods and assessments for elasmobranchs prepared by the EC-funded DELASS project; to review and define data requirements (fishery, survey and biological parameters) for stock identification, analytical models and to carry out such assessments as are required by ICES customers. Since 2003 WGEF meets annually to continue the work on stock assessment and to support the advisory process. Further details on the history and achievements of WGEF can be found in an earlier report (ICES, 2021a).

In 2020 and 2021, WGEF met online due to COVID-19 restrictions. For the 2020 working group, data submission and processing had been altered to reduce issues in terms of data call interpretation as well as the delivery of non-uniform data sets. The WGEF 2020 data were submitted to InterCatch for the first time, extracted and processed using R-code available in TAF. Next landings data are collated to the landings spreadsheet containing the historical landings data. This process was repeated in 2021 and 2022. The incorporation of a two-day data preparatory meeting in 2023 was pivotal in the advancement of the harmonisation of fleet names, stock codes and species codes of the historic landings data. This meeting had three focus groups: 1) landings data, 2) discards data and 3) length data. Each group retrieved data submitted through InterCatch and Accessions and collated them using existing, and by developing new, code. Data were checked, missing data were identified and chased up, resulting in three data tables holding all submitted data in one place (see Section 27.4). This meant for the first time in 2023, the working group started the assessment meeting with (near) final data sets with which to run their assessments – something which was crucial in the management of workload. The incorporation of a data-preparatory meeting will remain as standard for this group going forward and was equally successfully implemented in 2024.

WGEF in 2025 was a full assessment meeting with updates for 12 stocks. All the assessments followed the category 2 or 3 methodologies, applied, for the first time, in 2023. Three stocks were assessed with the stochastic surplus production model in continuous time (SPiCT; Pedersen and Berg, 2017). The remaining nine stocks considered the empirical methods for stock assessment and catch advice developed by WKLIFE X to provide advice within the ICES MSY framework (ICES, 2021b), particularly the rfb (eight stocks) or rb-rule (one stock).

1.3 Planning of the work of the group

Given the large number of stocks that WGEF addresses, WGEF and the ICES Secretariat have developed the timeframe for advice presented in Tables 1.1 and 1.2. Category 5 or 6 stocks were moved to quadrennial advice (instead of biennial as previously).

Table 1.1. Elasmobranch stocks with biennial assessments and advice carried out in 2025.

ICES stock code	Stock name	Ecoregion	Last advice update	Advice
raj.27.1012	Rays and skates (mainly thornback ray) in the Azores and Mid-Atlantic Ridge	Widely distributed and migratory stocks	2025	Biennial
rjc.27.3a47d	Thornback ray (*Raja clavata*) in Subarea 4, and Divisions 3.a and 7.d (North Sea, Skagerrak, Kattegat and eastern English Channel)	North Sea	2025	Biennial
rjh.27.4bc7d	Blonde ray (*Raja brachyura*) in Divisions 4.b, 4.c and 7.d (Central and southern North Sea and eastern English Channel)	North Sea	2025	Biennial
rjm.27.3a47d	Spotted ray (*Raja montagui*) in Subarea 4, and Divisions 3.a and 7.d (North Sea, Skagerrak, Kattegat, and Eastern English Channel)	North Sea	2025	Biennial
rjn.27.3a4	Cuckoo ray (*Leucoraja naevus*) in Subarea 4 and Division 3.a (North Sea and Skagerrak and Kattegat)	North Sea	2025	Biennial
sdv.27.nea	Starry smooth-hound (*Mustelus* spp.) in the Northeast Atlantic	Widely distributed and migratory stocks	2025	Biennial
sho.27.89a	Black-mouth dogfish (*Galeus melastomus*) in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters)	Bay of Biscay and Iberian seas	2025	Biennial^
syc.27.3a47d	Lesser-spotted dogfish (*Scyliorhinus canicula*) in Subarea 4, and Divisions 3.a and 7.d (North Sea, Skagerrak, Kattegat, and Eastern English Channel)	North Sea	2025	Biennial
syc.27.67a-ce-j	Lesser-spotted dogfish (*Scyliorhinus canicula*) in Subarea 6 and Divisions 7.a–c. e–j (Celtic Seas and west of Scotland)	Celtic Seas	2025	Biennial
syc.27.8abd	Lesser-spotted dogfish (*Scyliorhinus canicula*) in Divisions 8.a,b,d (Bay of Biscay)	Bay of Biscay and Iberian seas	205	Biennial
syc.27.8c9a	Lesser-spotted dogfish (*Scyliorhinus canicula*) in Divisions 8.c and 9.a (Atlantic Iberian waters)	Bay of Biscay and Iberian seas	2025	Biennial
syt.27.67	Greater-spotted dogfish (*Scyliorhinus stellaris*) in Subareas 6 and 7 (Celtic Sea and West of Scotland)	Celtic Seas	2025	Biennial

^ In the 2025 Advice Drafting Group, this stock was subsequently moved to quadrennial advice, so will next be addressed in 2029.

Table 1.2. Elasmobranch stocks with quadrennial assessments and advice carried out in 2023 (next advice in 2027).

ICES stock code	Stock name	Ecoregion	Last advice update	Advice
rjb.27.3a4	Common skate (*Dipturus batis*-complex) in Subarea 4 and Division 3.a (North Sea and Skagerrak)	North Sea	2023	Quadrennial
rjr.27.23a4	Starry ray (*Amblyraja radiata*) in Subareas 2, 3.a and 4 (Norwegian Sea, Skagerrak, Kattegat and North Sea)	North Sea	2023	Quadrennial
agn.27.nea	Angel shark (*Squatina squatina*) in the Northeast Atlantic	Widely distributed and migratory stocks	2023	Quadrennial

ICES stock code	Stock name	Ecoregion	Last advice update	Advice
bsk.27.nea	Basking shark (*Cetorhinus maximus*) in the Northeast Atlantic	Widely distributed and migratory stocks	2023	Quadrennial
cyo.27.nea	Portuguese dogfish (*Centroscymnus coelolepis*) in the Northeast Atlantic	Widely distributed and migratory stocks	2023	Quadrennial
guq.27.nea	Leafscale gulper shark (*Centrophorus squamosus*) in the Northeast Atlantic	Widely distributed and migratory stocks	2023	Quadrennial
rja.27.nea	White skate (*Rostroraja alba*) in the Northeast Atlantic	Widely distributed	2023	Quadrennial
sck.27.nea	Kitefin shark (*Dalatias licha*) in the Northeast Atlantic	Widely distributed and migratory stocks	2023	Quadrennial
thr.27.nea	Thresher sharks (*Alopias* spp.) in Subareas 10, 12, Divisions 7.c-k, 8.d-e, and Subdivisions 5.b.1, 9.b.1, 14.b.1 (Northeast Atlantic)	Widely distributed	2023	Quadrennial
gag.27.nea	Tope (*Galeorhinus galeus*) in the Northeast Atlantic	Widely distributed and migratory stocks	2023	Quadrennial
raj.27.3a47d	Other skates and rays in the North Sea ecoregion (Subarea 4, and Divisions 3.a and 7.d)	North Sea	2023	Quadrennial
rjh.27.4a6	Blonde ray (*Raja brachyura*) in Division 4a and Subarea 6 (Northern North Sea and west of Scotland)	North Sea	2023	Quadrennial
sho.27.67	Black-mouth dogfish (*Galeus melastomus*) in Subareas 6 and 7 (Celtic Sea and West of Scotland)	Celtic Seas	2023	Quadrennial

Table 1.3. Elasmobranch stocks with biennial assessments and advice carried out in 2024 (next advice in 2026).

ICES stock code	Stock name	Ecoregion	Last advice update	Advice
dgs.27.nea	Spurdog (*Squalus acanthias*) in Subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters)	Widely distributed	2024	Biennial
por.27.nea	Porbeagle (*Lamna nasus*) in subareas 1-10, 12 and 14 (the Northeast Atlantic and adjacent waters)	Widely distributed	Roll-over	TBC
rjc.27.6	Thornback ray (*Raja clavata*) in Subarea 6 (West of Scotland)	Celtic Seas	2024	Biennial
rjc.27.7afg	Thornback ray (*Raja clavata*) in divisions 7.a and 7.f-g (Irish Sea, Bristol Channel, Celtic Sea North)	Celtic Seas	2024	Biennial
rjc.27.8abd	Thornback ray (*Raja clavata*) in divisions 8.a-b and 8.d (Bay of Biscay)	Bay of Biscay and Iberian seas	2024	Biennial
rjc.27.8c	Thornback ray (*Raja clavata*) in Division 8.c (Cantabrian Sea)	Bay of Biscay and Iberian seas	2024	Biennial
rjc.27.9a	Thornback ray (*Raja clavata*) in Division 9.a (Atlantic Iberian waters)	Bay of Biscay and Iberian seas	2024	Biennial
rje.27.7fg	Small-eyed ray (*Raja microocellata*) in divisions 7.f and 7.g (Bristol Channel, Celtic Sea North)	Celtic Seas	2024	Biennial
rjh.27.9a	Blonde ray (*Raja brachyura*) in Division 9.a (Atlantic Iberian waters)	Bay of Biscay and Iberian seas	2024	Biennial

ICES stock code	Stock name	Ecoregion	Last advice update	Advice
rjm.27.67bj	Spotted ray (*Raja montagui*) in Subarea 6 and divisions 7.b and 7.j (West of Scotland, west and southwest of Ireland)	Celtic Seas	2024	Biennial
rjm.27.7ae-h	Spotted ray (*Raja montagui*) in divisions 7.a and 7.e-h (southern Celtic Seas and western English Channel)	Celtic Seas	2024	Biennial
rjm.27.8	Spotted ray (*Raja montagui*) in Subarea 8 (Bay of Biscay)	Bay of Biscay and Iberian seas	2024	Biennial
rjn.27.678abd	Cuckoo ray (*Leucoraja naevus*) in subareas 6-7 and divisions 8.a-b and 8.d (West of Scotland, southern Celtic Seas, and western English Channel, Bay of Biscay)	Celtic Seas	2024	Biennial
rjn.27.8c	Cuckoo ray (*Leucoraja naevus*) in Division 8.c (Cantabrian Sea)	Bay of Biscay and Iberian seas	2024	Biennial
rjn.27.9a	Cuckoo ray (*Leucoraja naevus*) in Division 9.a (Atlantic Iberian waters)	Bay of Biscay and Iberian seas	2024	Biennial
rju.27.7de	Undulate ray (*Raja undulata*) in divisions 7.d and 7.e (English Channel)	Celtic Seas	2024	Biennial

Table 1.4. Elasmobranch stocks with quadrennial assessments and advice carried out in 2024 (next advice in 2028).

ICES stock code	Stock name	Ecoregion	Last advice update	Advice
raj.27.67a-ce-k	Other rays and skates (Rajiformes) in Subarea 6 and divisions 7.a-c and 7.e-k (Rockall, West of Scotland, Celtic Sea and western English Channel)	Celtic Seas	2024	Quadrennial
raj.27.89a	Other rays and skates (Rajidae) in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters)	Bay of Biscay and Iberian seas	2024	Quadrennial
rjb.27.67a-ce-k	Common skate complex (Blue skate (*Dipturus batis*) and flapper skate (*Dipturus intermedius*) in Subarea 6 and divisions 7.a–c and 7.e–k (Celtic Seas and western English Channel)	Celtic Seas	2024	Quadrennial
rjb.27.89a	Common skate complex (Blue skate (*Dipturus batis*) and flapper skate (*Dipturus intermedius*) in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters)	Bay of Biscay and Iberian seas	2024	Quadrennial
rjc.27.7e	Thornback ray (*Raja clavata*) in Division 7.e (western English Channel)	Celtic Seas	2024	Quadrennial
rje.27.7de	Small-eyed ray (*Raja microocellata*) in divisions 7.d and 7.e (English Channel)	Celtic Seas	2024	Quadrennial
rjf.27.67	Shagreen ray (*Leucoraja fullonica*) in subareas 6-7 (West of Scotland, southern Celtic Seas, English Channel)	Celtic Seas	2024	Quadrennial
rjh.27.7afg	Blonde ray (*Raja brachyura*) in divisions 7.a and 7.f-g (Irish Sea, Bristol Channel, Celtic Sea North)	Celtic Seas	2024	Quadrennial
rjh.27.7e	Blonde ray (*Raja brachyura*) in Division 7.e (western English Channel)	Celtic Seas	2024	Quadrennial
rji.27.67	Sandy ray (*Leucoraja circularis*) in subareas 6-7 (West of Scotland, southern Celtic Seas, English Channel)	Celtic Seas	2024	Quadrennial
rjm.27.9a	Spotted ray (*Raja montagui*) in Division 9.a (Atlantic Iberian waters)	Bay of Biscay and Iberian seas	2024	Quadrennial
rju.27.7bj	Undulate ray (*Raja undulata*) in divisions 7.b and 7.j (west and southwest of Ireland)	Celtic Seas	2024	Quadrennial
rju.27.8ab	Undulate ray (*Raja undulata*) in divisions 8.a-b (northern and central Bay of Biscay)	Bay of Biscay and Iberian seas	2024	Quadrennial
rju.27.8c	Undulate ray (*Raja undulata*) in Division 8.c (Cantabrian Sea)	Bay of Biscay and Iberian seas	2024	Quadrennial
rju.27.9a	Undulate ray (*Raja undulata*) in Division 9.a (Atlantic Iberian waters)	Bay of Biscay and Iberian seas	2024	Quadrennial

1.4 ICES approach MSY

Most elasmobranch species are slow growing, with low population productivity. Some species (e.g. basking shark) are on several lists of 'threatened' or 'endangered' species. They may also be listed under international trade agreements such as the Convention on the International Trade on Endangered Species (CITES), which may place limitations on fishing for or trade in these species. Because of this, F_{MSY} is not believed to be an appropriate or achievable target in all cases, particularly in the short term. However, the ICES F_{MSY} methodology has evolved in recent years and ICES advice is provided under the Maximum Sustainable Yield framework (MSY).

Maximum sustainable yield is a broad conceptual objective aimed at achieving the highest possible yield over the long term (an infinitely long period of time). It is non-specific with respect to: (a) the biological unit to which it is applied; (b) the models used to provide scientific advice; and (c) the management methods used to achieve MSY.

The MSY concept can be applied to an entire ecosystem, an entire fish community, or a single fish stock. The choice of the biological unit to which the MSY concept is applied influences both the sustainable yield that can be achieved and the associated management options. Implementation of the MSY concept by ICES will first be applied to individual fish stocks. Further information on the background to MSY and how it is applied to fish stocks by ICES can be found in the General Context to ICES Advice.

In 2020, the Workshop on the Development of Quantitative Assessment Methodologies based on Life-history traits, exploitation characteristics, and other relevant parameters for data-limited stocks (WKLIFE X; ICES 2021b) developed methods for stock assessment and catch advice for stocks in ICES Categories 3 and 4, focusing on the provision of sound advice rules that are within the ICES MSY framework. WKLIFE emphasized the need to have assessment methods which accounted for the uncertainty and being more effective and precautionary compared to the two over five rule used to provide advice on elasmobranch stocks. Additional work on advice rules for stocks in Category 3 based on life-history traits (k), tested through simulation and management strategy evaluation (MSE), showed that the addition of specific multipliers based on the stock's life-history characteristics decreases the risk of the control rule´s performance. These new advice rules for category 3 stocks are implemented from 2022 onwards.

1.5 Community plan of action for sharks

An Action Plan for the Conservation and Management of Sharks (EU, 2009) was adopted by the European Commission in 2009. Further details on this plan and its relevance to WGEF can be found in an earlier report (ICES, 2009).

The utility of the Prohibited species list on TAC and quotas regulations

The list of prohibited species on the TACs and quotas regulations (e.g. Council Regulation (EU) 2025/202) is an appropriate measure for trying to protect the marine fish of highest conservation importance, particularly those species that are also listed on CITES and various other conservation conventions. Additionally, there should be sufficient concern over the population status and/or impacts of exploitation that warrants such a long-term conservation strategy over the whole management area.

There are some species that would fall into this category. For example, white shark and basking shark are both listed on CITES and some European nations have given legal protection to these species. Angel shark has also been given legal protection in the UK.

It should also be recognized that some species that are considered depleted in parts of their range may remain locally abundant in some areas, and such species might be able to support low levels of exploitation. From a fisheries management viewpoint, advice for a zero or near-zero TAC, or for no target fisheries, is very different from a requirement for 'prohibited species' status, especially as a period of conservative management may benefit the species and facilitate a return to commercial exploitation in the short term.

Additionally, there is a rationale that a list of prohibited species should not be changing regularly, as this could lead to confusion for both the fishing and enforcement communities. The STECF meeting on management of skates and rays has recommended issuing guidelines for the inclusion and removal of species on the prohibited species list (STECF, 2017).

In 2009 and 2010, undulate ray, *Raja undulata* was moved on to the prohibited species list. This had not been advised by ICES. Following a request from commercial fishers, the European Commission asked ICES to give advice on this listing. ICES reiterated that undulate ray would be better managed under local management measures and that there was no justification for placing undulate ray on the prohibited species list. The healthy status of one of the undulate ray stocks (rju.27.7de) assessed in 2022 and the corresponding advice for a rather high catch level confirms this view. There have been subsequent changes in the listing of this species. It was removed from the Prohibited Species List for Subarea 7 in 2014 (albeit as a species that cannot be retained or landed). In 2015, undulate ray was only maintained in the prohibited species list in subareas 6 and 10. Small TACs were established for stocks in the English Channel and Bay of Biscay in 2015 and for the stock in the Iberian ecoregion in 2016. In 2019, the list of prohibited species in the TACs and quota regulations was amended. An extensive list of prohibited species, including white shark, basking shark and hammerhead sharks have been taken up in the regulation on the conservation of fisheries resources and the protection of marine ecosystems through technical measures (EU regulation 2019/1241).

1.6 Sentinel fisheries

ICES advice for several elasmobranch stocks suggests that their fisheries should, for example "*consist of an initial low* (level) *scientific fishery*". In discussions of such fisheries (e.g. rju.27.9a), WGEF would suggest that a 'sentinel fishery' is a science-based data collection fishery conducted by commercial fishing vessel(s) to gather information on a specific fishery over time using a commercial gear but with standardized survey protocols. Sentinel fisheries would:

- Operate with a standardized gear, defined survey area, and standardized index of effort;
- Aim to provide standardized information on those stocks that may not be optimally sampled by existing fishery-independent surveys;
- Include a limited number of vessels;
- Be subject to trip limits and other technical measures from the outset, in order to regulate fishing effort/mortality in the fishery;
- Carry scientific observers on a regular basis (e.g. for training purposes) and be collaborative programmes with scientific institutes;
- Assist in biological sampling programmes (including self-sampling and tagging schemes);
- Sampling designs, effort levels and catch retention policy should be agreed between stakeholders, national scientists and the relevant ICES assessment expert group.

1.7 Mixed fisheries

Several elasmobranch stocks, and particularly skates and rays, are caught in mixed fisheries so their catches may be limited by restrictive effort limitations or management in place for other species. In general, these are not referred to within the text, but must be taken into consideration when looking at landings trends from within these areas.

1.8 Current ICES expert groups of relevance to the WGEF

Elasmobranchs are found across all ICES areas from shallow shelf seas and estuaries to the deep-sea, and are taken in both target and mixed fisheries and as bycatch. Therefore, the work of this expert group will be of relevance to all regional assessment groups e.g.:

- the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK)
- the Working Group for the Celtic Seas Ecoregion (WGCSE)
- the Working Group for the Bay of Biscay and the Iberian Waters Ecoregion (WGBIE)

as well as other broader assessment groups such as the Working Group on the Biology and Assessment of Deep-sea Fisheries Resources (WGDEEP). For more information on the relevance to these groups, refer to earlier reports (e.g. ICES, 2024).

Another group of increasing relevance to the WGEF is the Working Group on Bycatch of Protected Species (WGBYC), which collates and analyses information from across the Northeast Atlantic and adjacent sea areas related to the bycatch of protected, endangered and threatened species, which includes elasmobranch species, particularly species that are not assessed by WGEF. In addition, elasmobranch species selected are listed in the EU priority list and also in ICES roadmap for bycatch advice. This group will undertake a dedicated benchmark (Bycatch Evaluation and Assessment Matrix: WKBEAM) later in 2025 to evaluate the status of inputs required to assess the impact of bycatch by ecoregion and gear and that can be applied to elasmobranch species selected in the future.

The assessment of many stocks undertaken by WGEF is reliant upon fishery-independent survey data the majority of which is coordinated by the International Bottom Trawl Survey Working Group (IBTSWG) or the Working Group on Beam Trawl Surveys (WGBEAM). WGEF works closely with both groups prior to the meeting to understand any significant impacts to the data which is used in the assessments, and WGBEAM carries out some analysis of catch rates and distribution of certain skate species from their surveys.

1.9 Other meetings of relevance to WGEF

1.9.1 ICCAT

WGEF have conducted joint-meetings and assessments with ICCAT in 2008 (Madrid) and 2009 (ICES headquarters). These meetings were useful in pooling information on highly migratory pelagic shark species, including porbeagle, blue shark and shortfin mako. It is intended that these collaborations continue to usefully assess and update knowledge of pelagic shark species.

In 2022, WGEF hosted a joint ICCAT-ICES meeting on porbeagle. The meeting focused on the Northeast Atlantic stock, and discussed the benchmark and new advice outcome, as well as the process and timeline of advice provision within ICES and similarly within ICCAT. The timelines to provide final advice, and management programmes of both organisations differ. In addition, ICCAT scientists question the approach of applying a generic Harvest Control Rule (HCR) to assess elasmobranch stocks as the rule has not been tested on long-lived species. As a result this has led to inconsistent perceptions of the stock status and any associated catch advice. Consistency between the advice from each organisation is important and future alignment of process and outcomes. Therefore, in 2024, this SPiCT assessment was not updated and a roll-over of the 2022 advice provided. Further information on the 2022 joint meeting on porbeagle is found in section 6 of this report.

WGEF considers that further collaborative meetings with the ICCAT Shark Species Group should continue. There are ongoing studies analysing the genetics, tagging of several shark species and modelling approaches. Both organisations should invest time and effort to collaborate in sharing these data and knowledge in order to improve our understanding of stock structure and status of several shark species. Such collaboration may be facilitated by the establishment of an MoU between ICES and ICCAT which was signed in January 2025.

1.9.2 General Fisheries Commission for the Mediterranean (GFCM)

WGEF consider that ICES and the GFCM would benefit from improved interaction due to the overlap in the distribution of certain stocks, and also in comparing stock assessment methods for data-limited stocks. Further information on collaboration between ICES and GFCM can be found in an earlier report (ICES, 2021a).

1.10 Relevant biodiversity and conservation issues

ICES work on elasmobranch fish is becoming increasingly important as a source of information to various multilateral environmental agreements concerning the conservation status of some species. Table 1.5 lists species occurring in the ICES area that are considered within these fora. An increasing number of elasmobranchs are 'prohibited' species in European fisheries regulations (EU 2019/1241, EU 2025/202), and these are summarised in Table 1.6.

Additionally, whilst not forming the basis of a legal instrument, the International Union for Conservation of Nature (IUCN) conduct Red List assessments of many species, including elasmobranchs, which has been undertaken at global (e.g., Dulvy *et al*., 2021), North-East Atlantic (Gibson *et al*., 2008), Mediterranean (Cavanagh and Gibson, 2007; Abdul Malak *et al.,* 2011) and European scales (Nieto *et al.*, 2015). IUCN listings are summarised in the relevant species sections. In 2025 the IUCN Species Survival Commission Shark Specialist Group delineated 124 Important Shark and Ray Areas (ISRAs: https://sharkrayareas.org/), 30 Areas of Interest and 5 candidate ISRAs, across the European Atlantic. This initiative is expert-driven and although ISRAs are not afforded with any protection, the identification of such critical habitats for e.g. reproduction, feeding, and migration, could support place-based conservation and management initiatives in the future.

1.10.1 OSPAR Convention

The OSPAR Convention (www.ospar.org) guides international cooperation on the protection of the marine environment of the Northeast Atlantic. It has 15 Contracting Parties and the European Commission represents the European Union. The OSPAR list of Threatened and/or Declining Species and Habitats, developed under the OSPAR Strategy on the Protection and Conservation of the Ecosystems and Biological Diversity of the Maritime Area, provides guidance on future conservation priorities and research needs for marine biodiversity at risk in the region. To date, eleven elasmobranch species are listed (Table 1.5), either across the entire OSPAR region or in areas where they were perceived as declining. In 2020, ICES was requested to review and update OSPAR status assessments for stocks of listed shark, skates and rays in support of the OSPAR Quality Status Report 2023 (QSR2023) (WKSTATUS, ICES, 2020b).

1.10.2 Convention on the Conservation of Migratory Species (CMS)

CMS recognizes the need for countries to cooperate in the conservation of animals that migrate across national boundaries, if an effective response to threats operating throughout a species' range is to be made. The Convention actively promotes concerted action by the range states of species listed on its Appendices. The CMS Scientific Council has determined that 35 shark and ray species, globally, meet the criteria for listing in the CMS Appendices (Convention on Migratory Species, 2007). Table 1.5 lists Northeast Atlantic elasmobranch species that are currently included in the Appendices.

CMS Parties should strive towards strict protection of endangered species on Appendix I, conserving or restoring their habitat, mitigating obstacles to migration and controlling other factors that might endanger them. The range states of Appendix II species (migratory species with an unfavourable conservation status that need or would significantly benefit from international co-operation) are encouraged to conclude global or regional agreements for their conservation and management.

CMS now has a Sharks MOU, comprising an Advisory Committee (AC) and Intercessional Working Group (IWG).

1.10.3 Convention on International Trade in Endangered Species (CITES)

CITES was established in recognition that international cooperation is essential to the protection of certain species from overexploitation through international trade. It creates an international legal framework for the prevention of trade in endangered species of wild fauna and flora, and for the effective regulation of international trade in other species which may become threatened in the absence of such regulation.

Species threatened with extinction can be listed on Appendix I, which basically bans commercial, international trade in their products. Appendix II includes "*species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival*". Trade in such species is monitored closely and allowed if exporting countries can provide evidence that such trade is not detrimental to wild populations of the species.

Resolution Conf. 12.6 encourages parties to identify endangered shark species that require consideration for inclusion in the Appendices if their management and conservation status does not improve. Decision 13.42 encourages parties to improve data collection and reporting of catches, landings and trade in sharks (at species level where possible), to build capacity to manage their shark fisheries, and to take action on several species-specific recommendations from the Animals Committee (CITES, 2009).

1.10.4 Convention on the Conservation of European Wildlife and Natural Habitats (Bern convention)

The Bern Convention is a regional convention that provides a binding, international legal instrument that aims to conserve wild flora, fauna and natural habitats. Appendix II (or III) lists strictly protected (or protected) species of fauna (sometimes identified for the Mediterranean Sea only). Contracting Parties should "*take appropriate and necessary legislative and administrative measures to ensure the special protection of the wild fauna species specified in Appendix II*" and "*protection of the wild fauna species specified in Appendix III*".

Table 1.5. Elasmobranch species listed by Multilateral Environmental Agreements (noting that this list is not exhaustive of all elasmobranch species listed, rather selected for those which do or may occur across the ICES area). Source; OSPAR (http://www.ospar.org/), CITES (https://cites.org/), CMS (http://www.cms.int/) and Bern Convention (http://www.coe.int/t/dg4/cultureheritage/nature/bern/default_en.asp).

Family	Species	Multinational Environmental Agreement			
		OSPAR	CMS	CITES (Europe)	Bern
Squalidae	Spurdog *Squalus acanthias*	✓	App II (Northern hem. pop.)		
Triakidae	Tope *Galeorhinus galeus*		App II		
Centrophoridae	Gulper shark *Centrophorus granulosus*	✓			
	Leafscale gulper shark *Centrophorus squamosus*	✓			
Somniosidae	Portuguese dogfish *Centroscymnus coelolepis*	✓			
Squatinidae	Angel shark *Squatina squatina*	✓	App I & II		App III (Med)
Rhincodontidae	Whale shark *Rhincodon typus*		App I & II	App II	
Alopiidae	Pelagic thresher *Alopias pelagicus*		App II	App II	
	Bigeye Thresher *Alopias superciliosus*		App II	App II	
	Common Thresher *Alopias vulpinus*		App II	App II	
Cetorhinidae	Basking shark *Cetorhinus maximus*	✓	App I and II	App II	App II (Med)
Odontaspididae	Sand tiger shark *Carcharias taurus*		App I and II		
Lamnidae	White shark *Carcharodon carcharias*		App I and II	App II	App II (Med)
	Shortfin mako shark *Isurus oxyrinchus*		App II	App II	App III (Med)
	Longfin mako shark *Isurus paucus*		App II	App II	
	Porbeagle shark *Lamna nasus*	✓	App II	App II	App III (Med)
Carcharhinidae	Carcharhinidae			App II	
	Silky shark *Carcharhinus falciformis*		App II	App II	
	Oceanic white-tip *Carcharhinus longimanus*		App I	App II	
	Dusky shark *Carcharhinus obscurus*		App II	App II	
	Blue shark *Prionace glauca*		App II	App II	App III (Med)
Sphyrnidae	Scalloped hammerhead *Sphyrna lewini*		App II	App II	
	Great hammerhead *Sphyrna mokarran*		App II	App II	
	Smooth hammerhead *Sphyrna zygaena*		App II	App II	
Pristidae	Sawfish Pristidae		App I and II	App I	

Family	Species	Multinational Environmental Agreement			
		OSPAR	CMS	CITES (Europe)	Bern
Rhinobatidae	Common Guitarfish *Rhinobatos rhinobatos*		App I (Mediterranean pop.) and II	App II	
Glaucostegidae	Giant guitarfishes *Glaucostegus* spp.			App II	
	Blackchin Guitarfish *Glaucostegus cemiculus*		App I (Mediterranean pop.) and II	App II	
Rajidae	Common skate (*Dipturus batis*) complex	✓			
	Thornback ray *Raja clavata*	✓ North Sea			
	Spotted ray *Raja montagui*	✓			
	White skate *Rostroraja alba*	✓			App III (Med)
Myliobatidae	Bull ray *Aetomylaeus bovinus*		App II		
	Lusitanian cownose ray *Rhinoptera marginata*		App II		
Mobulidae	Manta rays *Mobula* spp.			App II	
	Reef manta ray *Mobula alfredi*		App I and II	App II	
	Giant manta ray *Mobula birostris*		App I and II	App II	
	Giant devil ray *Mobula mobular*		App I and II	App II	App II (Med)
	Chilean (or sicklefin) devil ray *Mobula tarapacana*		App I and II	App II	
	Smoothtail mobula *Mobula thurstoni*		App I and II	App II	

Table 1.6. Elasmobranch taxa listed as Prohibited Species on EU fisheries regulations. Adapted from EU (2017/2107; 2019/1241; 2025/202).

Family	Species	Area
Hexanchidae	Bluntnose sixgill shark *Hexanchus griseus*	UE, UK and international waters of ICES zones 1, 2 (except UK waters of division 2a), 5 to 10, 12 and 14, and CECAF areas 34.1.1, 34.1.2 and 34.2, as well as in UE and UK waters of ICES division 2a and subarea 4
Chlamydoselachidae	Filled shark *Chlamydoselachus anguineus*	
Centrophoridae	*Centrophorus* spp.[1]	
	Birdbeak dogfish[2] *Deania calcea*	
Somniosidae	Portuguese dogfish[2] *Centroscymnus coelolepis*	
	Longnose velvet dogfish *Centroscymnus crepidater*	
	Knifetooth dogfish *Scymnodon ringens*	
	Greenland shark *Somniosus microcephalus*	
Dalatiidae	Kitefin shark[2] *Dalatias licha*	
Oxynotidae	Sailfin roughshark *Oxynotus paradoxus*	
Etmopteridae	Black dogfish *Centroscyllium fabricii*	
	Great lantern shark[3] *Etmopterus princeps*	
	Velvet belly *Etmopterus spinax*	
	Smooth lantern shark *Etmopterus pusillus*	EU waters of Division 2.a and subarea 4; EU and international waters of subareas 1, 5–8, 12 and 14
Squatinidae	Angel shark *Squatina squatina*	All waters
Alopiidae	Bigeye thresher shark *Alopias superciliosus*	ICCAT convention area
Cetorhinidae	Basking shark *Cetorhinus maximus*	All waters
Lamnidae	White shark *Carcharodon carcharias*	All waters
	Porbeagle shark *Lamna nasus*	All waters
	Shortfin mako shark *Isurus oxyrinchus*	All waters ICCAT convention area (north of 5°N)
Odontaspididae	Sand tiger shark *Carcharias taurus*	All waters other than the Mediterranean
Triakidae	Tope *Galeorhinus galeus*	When taken by longline in UK and UE waters of ICES subareas 4, UK waters of division 2a, UK and international waters

Family	**Species**	**Area**
		of subarea 5 UK, UE and international waters of subareas 6, 7 and 8, and international waters of subareas 12 and 14
Carcharhinidae	Silky shark *Carcharhinus falciformis*	ICCAT convention area
	Oceanic whitetip shark *Carcharhinus longimanus*	ICCAT convention area
	Hammerheads (Sphyrnidae), except for *Sphyrna tiburo*)	ICCAT convention area
Pentachidae	Deep-sea catsharks *Apristurus* spp.	UE, UK and international waters of ICES zones 1, 2 (except UK waters of division 2a), 5 to 10, 12 and 14, and CECAF areas 34.1.1, 34.1.2 and 34.2, as well as in UE and UK waters of ICES division 2a and subarea 4
	Mouse catshark *Galeus murinus*	
	Blackmouth dogfish *Galeus melastomus*	
Rhincodontidae	Whale shark *Rhincodon typus*	All waters
Pristidae	Narrow sawfish *Anoxypristis cuspidata*	All waters
	Dwarf sawfish *Pristis clavata*	All waters
	Smalltooth sawfish *Pristis pectinata*	All waters
	Largetooth sawfish *Pristis pristis*	All waters
	Green sawfish *Pristis zijsron*	All waters
Rhinobatidae	All members of family	EU waters of subareas 1-10 and 12
Rajidae	Round skate *Raja fyllae*	UE, UK and international waters of ICES zones 1, 2 (except UK waters of division 2a), 5 to 10, 12 and 14, and CECAF areas 34.1.1, 34.1.2 and 34.2, as well as in UE and UK waters of ICES division 2a and subarea 4
	Arctic skate *Raja hyperborea*	
	Norwegian skate *Raja nidarosiensis*	
	Starry ray *Amblyraja radiata*	UK and UE waters of ICES subarea 4 and division 7d, UK waters of division 2a and UE waters of division 3a
	Common skate (*Dipturus batis*) complex (*Dipturus cf. flossada and* *Dipturus cf. intermedia*)	UK and UE waters of ICES subareas 4, 6, 7 and 8, UK waters of division 2a and subarea 5 and UE waters of subareas 3, 9 and 10
	Thornback ray *Raja clavata*	EU waters of Division 3.a
	Undulate ray *Raja undulata*	UK and EU waters of subarea 6 and UE waters of ICES subarea 10
	White skate *Rostroraja alba*	EU waters of subareas 6-10
Mobulidae	Reef manta ray *Manta alfredi*	All waters

Family	Species	Area
	Giant manta ray *Mobula birostris*	All waters
	Longhorned mobula *Mobula eregoodootenkee*	All waters
	Lesser (or Atlantic) devil ray *Mobula hypostoma*	All waters
	Spinetail mobula *Mobula japanica*	All waters
	Shortfin devil ray *Mobula kuhlii*	All waters
	Giant devil ray *Mobula mobular*	All waters
	Munk's (or pygmy) devil ray *Mobula munkiana*	All waters
	Lesser Guinean devil ray *Mobula rochebrunei*	All waters
	Chilean (or sicklefin) devil ray *Mobula tarapacana*	All waters
	Smoothtail mobula *Mobula thurstoni*	All waters

[1] Shall also apply to leafscale gulper shark (*Centrophorus squamosus*) in Union and United Kingdom waters of ICES division 2a and subarea 4.

[2] Shall also apply in Union and United Kingdom waters of ICES division 2a and subarea 4.

[3] Shall also apply in United Kingdom and Union waters of ICES subarea 4, United Kingdom waters of division 2a and international waters of subareas 1 and 14

1.11 Data availability

1.11.1 General considerations

WGEF members agree that future meetings of WGEF should continue to meet in June, as opposed to meeting earlier in the year, as (a) more refined landings data are available; (b) meeting outside the main spring assessment period should provide national laboratories with more time to prepare for WGEF, (c) it will minimize potential clashes with other assessment groups (which could result in WGEF losing the expertise of stock assessment scientists) and (d) given that there are not major year-to-year changes in elasmobranch populations (cf. many teleost stocks), the advice provided would be valid for the following year.

The group agreed that survey data should be provided as disaggregated raw data, and not as compiled indices or data. The group agreed that those survey abundance estimates that are not currently in the DATRAS database are also provided as raw data by individual countries. It is recommended to have the data and code to calculate the survey indices to be made available on TAF.

WGEF recommends that Member States provide detailed explanations of how national data for species and length compositions are raised to total catch as per the data call guidelines, especially when there may be various product weights reported (e.g. gutted or dressed carcasses and livers and/or fins).

1.11.2 ICES Data Call

Landings data for years 2005 and later come from Data Calls (see above). WGEF uses some landings data extracted from ICES catch statistics, for time-series going back in time further than 2005. These data were mostly collated before 2005 although this task was hampered by the use by many countries of "nei" (not elsewhere identified) categories. Although strongly improving over time, for all years, the Working Group's best estimates are still considered inaccurate for a number of reasons:

i. Quota species may be reported as elasmobranchs to avoid exceeding quota, which would lead to over-reporting;
ii. Fishers may not take care when completing landings data records, for a variety of reasons;
iii. Administrations may not consider that it is important to collect accurate data for these species;
iv. Some species could be underreported to avoid highlighting that bycatch is a significant problem in some fisheries;
v. Some small inshore vessels may target (or have a bycatch of) certain species and the landings of such inshore vessels may not always be included in official statistics.

A Workshop to compile and refine catch and landings of elasmobranchs (WKSHARK2) was held in January 2016 (ICES, 2016), and following this, the 2016 Data Call requested a standardised approach to data submission, including for a longer period. Since 2016 data were submitted to the accessions folder using a common InterCatch format. This still resulted in considerable issues with data collation, formatting and QA that had to be addressed in the early stages of the meetings.

During the 2019 meeting, continuing issues with how the Data Call is interpreted, the non-uniformity of the dataset and as well as the many issues with species coding and stock allocations were discussed at length. A dedicated group met with the ICES Data Centre prior to the 2020 Data Call to explore options to facilitate the process of rendering a by the group accepted landings table before the start of WGEF. The group developed a more automated process using InterCatch and an R-coding procedure available in the Transparent Assessment Framework (TAF). The procedure to obtain the landings data is described in the 2020 WGEF report (ICES, 2020c). The issue list, stock allocation file and R-code is available on github: https://github.com/ices-taf/WGEF_catches.

Since 2020, the data call requested nations to upload landings and discard data into InterCatch, including length data. The use of InterCatch facilitates data processing, improve transparency and allow members to conduct initial assessments prior to the meeting, removing a serious time-constraint.

InterCatch is solely used as a database to store official landings and discard data. Landings figures are supplied by individual members, and are later extracted and formatted by WGEF (e.g. allocation to stock, quality assurance, reallocation of misidentified species). These corrected data are considered to be more accurate than official statistics as regional laboratories can better provide information on local fisheries and interpretation of nominal records of various species (including errors in species coding).

It should be noted that not all nations have followed up on the data call and submitted the data to data.call@ices.dk. As such, part of the landings data were retrieved from the Accessions folder.

1.11.3 Discards data

The EU requires Member States to collect discard data on elasmobranchs. This discarding may include both regulatory discarding, when quota is limited, as well as the discarding of smaller and less marketable individuals. Whilst WGEF want to make progress from 'landings' to 'catch'-based advice, data from discard observer programmes has suffered from quality issues often related to the variety of raising procedures employed by Member States. However, to-date eight stocks now include discard data in their assessment and provision of catch advice, as they have transitioned from a Category 3 to Category 2 assessment using surplus production models.

EU countries have implemented national on-board observer programs to estimate discards of abundant commercially important species (e.g. hake, *Nephrops*, cod, sole, and plaice). The adopted sampling designs have been defined considering the métiers, seasons and areas relevant for those species. As a consequence, national sampling programmes might not be optimal for estimating precise and unbiased discards for elasmobranchs.

In 2017 and 2019, workshops were held to address the issues surrounding the use of discards in the elasmobranch assessments (ICES, 2017; 2020a). WKSHARK3 reviewed i) the suitability of national sampling programs to estimate elasmobranch discards (including rare species), ii) the discard information available and iii) the procedures/methods to calculate population level estimates of discards removals for different countries (ICES, 2017). WKSHARK5 investigated i) the raising method for elasmobranch fishes, ii) the data quality and onboard coverage, and iii) proposed method on how to include the data in the advisory process (ICES, 2020a).

In 2021, discard data over the period 2009 to 2020 were collected and merged into a single spreadsheet in Excel. Since 2022 this spreadsheet has been updated yearly with new data, making discard data available and easily accessible from 2009 onwards. It was noted that for many stocks the discard data were incomplete for many of the years. In addition, raising to national catch levels is uncertain and procedures are not standardized. Particularly problematic are the cases of species which are not landed, i.e. being either not commercial or being subject to conservation measures (e.g. zero TAC).

Overall, the main issues concerning the estimation of elasmobranch total discards are presented in the 2021 WGEF report (ICES, 2021a).

1.11.4 Discard survival

Owing to the apparent high survival of some elasmobranchs after capture it is important to obtain separate estimates for dead and surviving discards. As a proportion of the discards would be alive, catch data (landings and estimated discards) do not equate with "dead removals" in terms of population dynamics. Understanding the survival rates of discarded individuals is therefore fundamental for informing potential exemptions from the EU landings obligation.

Discard survival is considered for some stocks, for which assessment considers dead catch (e.g., rjm.27.3a47d, rjh.27.4bc7d and rjc.27.3a47d). In 2025, the discard survival was considered for cuckoo ray in the North Sea, and some lesser-spotted dogfish stocks, to estimate f proxy based on length-based indicators.

However, to date there have been only limited scientific studies on the discard survival of skates and catsharks in European fisheries, and data on the immediate, short-term survival and longer-term discard survival of these species are lacking for most fisheries. A summary of those studies was compiled in WKSHARK3 (ICES, 2017). To inform discussions on the future EU landing obligation and to improve the quantification of dead discards, WGEF recommend the need to implement scientific studies to better assess and quantify the discard survival of the main commercial skates caught by the trawl fleets, especially otter trawlers operating in the Bay of Biscay and Iberian waters, beam trawl and flyshoot fleets operating in northern Europe and for gill- and trammel net fisheries used by the inshore polyvalent fleet.

1.11.5 Length data

In 2022, there was a recommendation to change the way ICES provides advice for data limited stocks (DLS) using WKLIFE X methods (ICES, 2021b). A data call was put out, requesting supporting information on life history parameters and length compositions for landings and discards as far back in time as possible. The data have been submitted to InterCatch. Before WGEF convenes, the data coordinator request ICES to extract all length data submitted as requested by the WKLIFE X Data Call. In addition, missing data were looked up in the WGEF accessions folders. All data were collated to produce a large overview table containing length data on landings and discards by country, year, species, fishing area, and fleet. Data were checked and assigned to an ICES stock code using an automated process derived from the way the WGEF landings table is constructed. The same approach was followed in 2023 and 2024.

1.11.6 Stock structure

This report presents the status and advice of various demersal, pelagic and deep-water elasmobranchs by individual stock component. The identification of stock structure has been based upon the best available knowledge to date (see the stock-specific sections for more details). However, it has to be emphasized that overall, the scientific basis underlying the identity of many of these stocks is currently weak. In most cases, stock identification is based on the distribution and relative abundance of the species, current knowledge of movements and migrations, reproductive mode, and consistency with management units.

WGEF considers that the stock definitions proposed in the report are limited for many species, and in some circumstances advice may refer to 'management units'.

WGEF recommends that increased research effort be devoted to clarifying the stock structure of the different demersal and deep-water elasmobranchs being investigated by ICES.

1.11.7 Taxonomic problems

Incorrect species identifications or coding errors affect many relevant data sets, including commercial data and even some scientific survey data. WGEF consistently attempt to correct and report these errors when they are found. The FAO produced an updated guide to the chondrichthyan fish of the North Atlantic (Ebert and Stehmann, 2013).

1.12 Methods and software

Many elasmobranchs are data-limited, and the paucity of data can extend to:

- Landings data, which are often incomplete or aggregated;
- Life-history data, as most species are poorly known with respect to age, growth and reproduction;
- Commercial and scientific datasets that are compromised by inaccurate species identification (with some morphologically similar species having very different life-history parameters);
- Lack of fishery-independent surveys for some species (e.g. pelagic species) and the low and variable catch rates of demersal species in existing bottom-trawl surveys.

Hence, the work undertaken by WGEF often precludes the formal stock assessment process that is used for many commercial teleost stocks. The analysis of survey, biological and catch data are used in most cases to evaluate the status of elasmobranch species/stocks. This limitation may be eased by new data-poor assessment approaches, which have the potential to allow some ray stocks to be moved from assessment Category 3 to Category 2. To date, ten stocks have been through a benchmark and now use a Surplus Production model such as SPiCT and a State-Space Bayesian Model to provide advice. Since 2022, ACOM has recommended the use of the WKLIFE X Empirical approaches to assess category 3 stocks within the MSY framework (ICES, 2021b).

1.13 References

Abdul Malak, D., Livingstone, S.R., Pollard, D., Polidoro, B.A., Cuttelod, A., Bariche, M., Bilecenoglu, M., Carpenter, K.E., Collette, B.B., Francour, P., Goren, M., Hichem Kara, M., Massutí, E., Papaconstantinou, C. and Tunesi, L. 2011. *Overview of the Conservation Status of the Marine Fishes of the Mediterranean Sea*. Gland, Switzerland and Malaga, Spain: IUCN. vii + 61pp.

Cavanagh, R.D. and Gibson, C. 2007. *Overview of the Conservation Status of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea*. IUCN, Gland, Switzerland and Malaga, Spain. vi + 42 pp.

CITES. 2009. Conservation and management of sharks and stingrays. AC24 WG5 Doc. 1. http://www.cites.org/common/com/AC/24/wg/E–AC24–WG05.pdf.

Convention on Migratory Species. 2007. Report of the Fourteenth Meeting of the Scientific Council of the Convention on the Conservation of Migratory Species of Wild Animals. http://www.cms.int/bodies/ScC/Reports/Eng/ScC_report_14.pdf.

Dulvy, N.K., Pacoureau, N., Rigby, C.L., Pollom, R.A., Jabado, R.W., Ebert, D.A., Finucci, B., Pollock, C.M., Cheok, J., Derrick, D.H., Herman, K.B., Sherman, C.S., VanderWright, W.J., Lawson, J.M., Walls, R.H.L., Carlson, J.K., Charvet, P., Bineesh, K.K., Fernando, D., Ralph, G.M., Matsushiba, J.H., Hilton-Taylor, C., Fordham, S.V. and Simpfendorfer, C.A. 2021. Overfishing drives over one-third of all sharks and rays toward a global extinction crisis. Current Biology 31: 1-15 https://doi.org/10.1016/j.cub.2021.08.06.

Ebert, D.A. and Stehmann, M.F.W. 2013. Sharks, batoids, and chimaeras of the North Atlantic. FAO Species Catalogue for Fishery Purposes. No. 7. Rome, FAO. 523 pp.

EU. 2009. Communication from the Commission to the European parliament and the council on a European Community action plan for the conservation and management of sharks. COM (2009) 40.Gibson, C., Valenti, S.V., Fordham, S.V. and Fowler, S.L. 2008. *The Conservation of Northeast Atlantic Chondrichthyans: Report of the IUCN Shark Specialist Group Northeast Atlantic Red List Workshop*. viii + 76 pp.

Heessen, H.J.L. (Ed.) 2003. Development of elasmobranch assessments DELASS. Final report of DG Fish Study Contract 99/055, 605 pp.

ICES. 1989. Report of the Study Group on Elasmobranch Fisheries, 26–28 April 1989, Dublin, Ireland. ICES Document CM 1989/G: 54, 37 pp.

ICES. 1999. Report of the Study Group on Elasmobranch Fishes, 23–27 March 1999, Santander, Spain. ICES Document CM 1999/G: 11, 18 pp.

ICES. 2002. Report of the Study Group on Elasmobranch Fishes, 6–10 May 2002, Copenhagen, Denmark. ICES Document CM 2002/G: 08, 119 pp.

ICES. 2009. Report of the Joint Meeting between ICES Working Group on Elasmobranch Fishes (WGEF) and ICCAT Shark Subgroup, 22–29 June 2009, Copenhagen, Denmark. ICES CM 2009/ACOM:16. 424 pp.

ICES. 2010. Report of the Benchmark Workshop on Deep-water Species (WKDEEP). 17–24 February, Copenhagen, Denmark. ICES CM 2010/ACOM:38, 247 pp.

ICES. 2016. Report of the Workshop to compile and refine catch and landings of elasmobranchs (WKSHARK2), 19–22 January 2016, Lisbon, Portugal. ICES CM 2016/ACOM:40, 69 pp.

ICES. 2017. Report of the Workshop to compile and refine catch and landings of elasmobranchs (WKSHARK3), 20-24 February 2017, Nantes, France . ICES CM 2017/ACOM:38. 119 pp.

ICES, 2018. French request for updated advice on Undulate ray (*Raja undulata*) in divisions 7.d–e and 8.a–b. 13 July 2018. In Report of the ICES Advisory Committee, 2018. ICES Advice 2018, sr.2018.13.

ICES. 2020a. Workshop on incorporating discards into the assessments and advice of elasmobranch stocks (WKSHARK5, outputs from 2019 meeting). ICES Scientific Reports. 2:87. 94 pp. http://doi.org/10.17895/ices.pub.7494

ICES. 2020b. Workshop to review and update OSPAR status assessments for stocks of listed shark, skates and rays in support of OSPAR (WKSTATUS). ICES Scientific Reports. 2:71. 152 pp. http://doi.org/10.17895/ices.pub.7468

ICES. 2020c. Working Group on Elasmobranch Fishes (WGEF). ICES Scientific Reports. 2:77. 789 pp. http://doi.org/10.17895/ices.pub.7470

ICES, 2021a. Working Group on Elasmobranch Fishes (WGEF). ICES Scientific Reports. 3:59. 822 pp. https://doi.org/10.17895/ices.pub.8199

ICES. 2021b. Tenth Workshop on the Development of Quantitative Assessment Methodologies based on LIFE-history traits, exploitation characteristics, and other relevant parameters for data-limited stocks (WKLIFE X).ICES Scientific Reports. 2:98. 72 pp. http://doi.org/10.17895/ices.pub.5985

ICES. 2022 Benchmark Workshop for selected elasmobranch stocks (WKELASMO). ICES Scientific Reports.

ICES. 2023. Benchmark workshop 2 on development of MSY advice using SPiCT (WKBMSYSPiCT2). ICES Scientific Reports. 5:65. 472 pp. https://doi.org/10.17895/ices.pub.23372990

ICES. 2024. Benchmark Workshop 3 on Selected Elasmobranch Stocks (WKBELASMO3). ICES Scientific Reports. 6:74. 321 pp. https://doi.org/10.17895/ices.pub.26935492Nieto, A., Ralph, G.M., Comeros-Raynal, M.T., Kemp, J., García Criado, M., Allen, D.J., Dulvy, N.K., Walls, R.H.L., Russell, B., Pollard, D., García, S., Craig, M., Collette, B.B., Pollom, R., Biscoito, M., Labbish Chao, N., Abella, A., Afonso, P., Álvarez, H., Carpenter, K.E., Clò, S., Cook, R., Costa, M.J., Delgado, J., Dureuil, M., Ellis, J.R., Farrell, E.D., Fernandes, P., Florin, A-B., Fordham, S., Fowler, S., Gil de Sola, L., Gil Herrera, J., Goodpaster, A., Harvey, M., Heessen, H., Herler, J., Jung, A., Karmovskaya, E., Keskin, C., Knudsen, S.W., Kobyliansky, S., Kovačić, M., Lawson, J.M., Lorance, P., McCully Phillips, S., Munroe, T., Nedreaas, K., Nielsen, J., Papaconstantinou, C., Polidoro, B., Pollock, C.M., Rijnsdorp, A.D., Sayer, C., Scott, J., Serena, F., Smith-Vaniz, W.F., Soldo, A., Stump, E. and Williams, J.T. 2015. *European Red List of marine fishes*. Luxembourg: Publications Office of the European Union, iv + 81 pp.

OSPAR Commission. 2010. *Report of the OSPAR workshop on defining actions and measures for the OSPAR list of threatened and/or declining species and habitats*. OSPAR Commission, 131 pp.

Pedersen, M. W., Berg, C. W. 2017. A stochastic surplus production model in continuous time. Fish and Fisheries, 18(2), 226-243.

STECF (Scientific, Technical and Economic Committee for Fisheries) 2017. Long-term management of skates and rays (STECF-17-16). Publications Office of the European Union, Luxembourg. 85 pp.

2 Spurdog in the Northeast Atlantic

The assessment was not updated during WGEF 2025, the next advice for this stock is due in 2026.

3 Deep-water sharks; leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14)

3.1 Stock distribution

A number of species of deep-water sharks have been exploited in the ICES area. This section deals with leafscale gulper shark *Centrophorus squamosus* and Portuguese dogfish *Centroscymnus coelolepis*, which have been the two species of greatest importance to commercial fisheries.

3.1.1 Leafscale gulper shark

The leafscale gulper shark has a wide distribution in the Northeast (NE) Atlantic, from Iceland and Atlantic slopes south to Senegal, Madeira and the Canary Islands. On the Mid-Atlantic Ridge, it is distributed from Iceland to the Azores (Hareide and Garnes, 2001). The species can be demersal on the continental slopes (at depths of 230–2400 m) or have a more pelagic behaviour, occurring in the upper 1250 m of oceanic areas with seafloor around 4000 m (Compagno and Niem, 1998).

Available information suggests that this species is highly migratory (Clarke *et al*., 2001; 2002; Moura *et al*., 2014; Rodríguez-Cabello *et al*., 2016). In the NE Atlantic, the distribution pattern formerly assumed considered the existence of a large-scale migration, where females would give birth off the Madeira Archipelago, as there were reports of pregnant females (Severino *et al*., 2009) in that region. Geo-referenced data show that pregnant females also occur off Iceland, indicating another potentially important reproductive area in the northern part of the NE Atlantic (Moura *et al*., 2014). Juveniles are only caught rarely. Segregation by sex, size and maturity seems to occur, likely linked to factors such as depth and temperature. Post-natal and mature females tend to occur in relatively shallower sites. Pregnant females are distributed in warmer waters compared to the remaining maturity stages, particularly immature females, which are usually found at greater depths and lower temperatures (Moura *et al*., 2014). Although based on a small sample size, tagging studies have observed movements from the Cantabrian Sea to the Porcupine Bank (Rodríguez-Cabello and Sánchez, 2014; Rodríguez-Cabello *et al*., 2016) and north to the Faroes Islands (Rodríguez-Cabello, personal comm.).

Results from a molecular study, using six nuclear loci, did not reject the null hypothesis of genetic homogeneity among NE Atlantic samples (Veríssimo *et al*., 2012). The same study showed that females are less dispersive than males and possibly philopatric. In the absence of clearer information on stock identity, a single assessment unit of the Northeast Atlantic has been adopted.

3.1.2 Portuguese dogfish

The Portuguese dogfish is distributed widely in the NE Atlantic. Stock structure and spatial dynamics are poorly understood. Specimens below 70 cm have been recorded rarely. The absence of small fishes in the NE Atlantic may be a consequence of their concentration in nurseries outside the sampling areas, movement to pelagic or deeper waters, gear selectivity or to different habitat and/or prey choices, with juveniles being more benthic (Moura *et al*., 2014). Consistent results among different studies show that females move to shallower waters for parturition (Girard and Du Buit, 1999; Clarke *et al*., 2001; Moura and Figueiredo, 2012 WD; Moura *et al*., 2014). Similar size ranges and different maturity stages exist in both the northern and southern European continental slopes. The occurrence of all adult reproductive stages within the same geographical area and, in many cases in similar proportions among different areas, suggests that this species is able to complete its life cycle within these areas (Moura *et al*., 2014).

Population structure studies developed so far using microsatellites and mitochondrial DNA show no evidence of genetic population structure among collections in the NE Atlantic (Moura *et al*., 2008 WD; Veríssimo *et al*., 2011; Catarino *et al*., 2015). In the absence of clearer information on stock identity, a single assessment unit of the Northeast Atlantic has been adopted.

3.2 The fishery

3.2.1 History of the fishery

Fisheries taking leafscale gulper shark or Portuguese dogfish are described in their respective stock annexes.

Since 2010, EU TACs for some deep-water sharks, including these two species, have been set at zero, and, consequently, reported landings have been very low or zero.

The EU fixed, for 2017-2020, a restrictive by-catch allowance, permitting limited landings of unavoidable by-catches of deep-sea sharks in directed artisanal deep-sea longline fisheries for black scabbardfish (Council Regulation (EU) 2016/2285; Council regulation (EU) 2018/2025). Since 2021, both species are prohibited by several regulations and cannot be retained on board, transhipped, relocated or landed in a great extent of the NE Atlantic. Discards are known to occur but were not quantified. See section 3.2.5 (Management applicable) for more details.

3.2.2 Species distribution and spatial overlap with fisheries

Geostatistical studies (Veiga *et al*., 2013; Veiga *et al*., 2015 WD) using deep-water longline black scabbardfish fishery data (vessel monitoring systems, logbooks and official daily landings) were conducted with the aim of evaluating the spatial distribution and spatial overlap between i) black scabbardfish and leafscale gulper shark and between ii) black scabbardfish and Portuguese dogfish taken by the longline fishery operating off mainland Portugal (Division 9.a). Results obtained indicated that in fishing grounds where black scabbardfish is more abundant and where fishing takes place, the relative occurrence of both deep-water shark species was reduced. These differences on the relative occurrence have implications for alternative management measures to be adopted in the deep-water longline black scabbardfish fishery, particularly in what concerns the minimization of deep-water shark bycatch. The existence of differences in the deep-water sharks' abundance between fishing grounds for black scabbardfish and deeper fishing grounds was further supported by results from a short-duration pilot survey on board commercial fishing vessels belonging to the Portuguese mainland black scabbard fishery in 2014 (Veiga, 2015 WD). Under this survey, ten fishing hauls were carried out by five vessels, each vessel performing one haul at the fishing grounds exploited by the black scabbardfish fleet (BSF fishing grounds) and other located at deeper areas adjacent to these fishing grounds, using the same gear, hook size and fishing practices. For all vessels, the proportions of each shark species (~ quotient between the caught weight of the deep-water shark under analysis and the sum of the caught weight of black scabbardfish and of that deep-water shark) was significantly smaller in hauls performed at the BSF fishing grounds and those located deeper.

In addition to the conclusions drawn by these studies, an analysis of onboard data collected at commercial vessels belonging to the Portuguese deep-water longline fishery that takes place in ICES Subarea 9 suggested that *C. squamosus* and *D. calceus* have a larger spatial overlap with the fishery for black scabbardfish than *C. coelolepis* (Figueiredo and Moura, 2019 WD). *C. squamosus* and *D. calceus* have a widespread distribution and undertake migrations associated to reproduction (although those of *D. calceus* are less understood).

As a reaction of the restrictive EU management measures adopted for deep-water sharks, fishing vessels also tend to avoid fishing grounds where deep-water sharks are more likely to be caught. No survival of sharks when returned to the sea is expected. See section 3.3.4. for more information on discard survival.

3.2.3 The fishery in 2024

No new information.

3.2.4 ICES advice applicable

Leafscale gulper shark: in 2023, ICES advised that "*when the precautionary approach is applied there should be zero catches in each of the years 2024–2027*".

Portuguese dogfish: in 2023, ICES advised that "*when the precautionary approach is applied there should be zero catches in each of the years 2024–2027*".

3.2.5 Management applicable

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

Year	ICES subareas		
	5–9	10	12 (includes also *Deania histricosa*(5) 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)
2012-2016	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
2021-2025(6)	---	---	---

(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.

(5) Recent studies demonstrated that there is not enough scientific support to discriminate *Deania hystricosa* from its congener *Deania calceus*; they are likely the same species (Rodríguez-Cabello *et al*., 2020; Stefanni *et al*., 2021)

(6) Species included in the prohibited list of the TAC regulations

Since 2013, the deep-sea shark list includes the following species (Council Regulation (EU) 1182/2013): Deep-water catsharks *Apristurus* spp., frilled shark *Chlamydoselachus anguineus*, gulper sharks *Centrophorus* spp., Portuguese dogfish *Centroscymnus coelolepis*, longnose velvet dogfish *Centroselachus crepidater*, black dogfish *Centroscyllium fabricii*; birdbeak dogfish *Deania calceus*; 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*. The black mouth dogfish (*Galeus melastomus*) was again included in the list of deep-water sharks in 2025 (Council Regulation (EU) 2025/202).

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, Centroselachus crepidater, Dalatias licha, Etmopterus princeps, Apristurus spp, Chlamydoselachus anguineus, Deania calceus, Galeus melastomus, Galeus murinus, Hexanchus griseus, Etmopterus spinax, Oxynotus paradoxus, Scymnodon ringens* and *Somniosus microcephalus*.

Since 2015, the leafscale gulper shark and the 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 (EU) 2015/104).

A bycatch 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 (Council regulation (EU) 2016/2285; Council Regulation (EU) 2018/2025). 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. According to this 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 and 7 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 in 2017–2018 and 2019–2020, respectively. 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.

Since 2021 there is a prohibition to fish, to retain on board, to tranship, to relocate or to land some deep-water sharks species from the EU list (including leafscale gulper shark and Portuguese dogfish). In its last version, the regulation applies to the Union, United Kingdom and international waters of ICES zones 1, 2 (except United Kingdom waters of division 2a), 5 to 10, 12 and 14, and CECAF areas 34.1.1, 34.1.2 and 34.2, as well as to Union and United Kingdom waters of ICES division 2a and subarea 4 (Council Regulation (EU) 2025/202).

EU regulations on some deep-water fisheries also contributed to the reduction of the deep-water sharks fishing mortality. 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 (EU) 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 (EU) 41/2007). Since 2009, the “rasco (gillnet)” fishing gear was banned at waters deeper than the 600 m isobath (Council Regulation (EU) 43/2009). 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 2016, and in order to mitigate the potential damaging impacts of bottom trawling, fishing with bottom trawls was ban at depths deeper than 800 metres (Council Regulation (EU) 2016/2336).

3.3 Catch data

The distribution of many of these species extends into the NEAFC Regulatory Areas, but the respective catches in the area cannot be determined.

3.3.1 Landings

Landings of leafscale gulper shark and Portuguese dogfish have historically been included by many countries in mixed landings categories (e.g. sharks 'nei' and dogfish 'nei'). Figure 3.1 shows the Working Group estimates of combined landings of the two species by country and by ICES area.

During WKSHARK2, landing data provided by country was revised in relation to data quality (including taxonomic categories). Protocols to better document the decisions to be made when estimating WG landings were developed (ICES, 2016). For the years before 2005, it was not possible to determine identity to species level for some countries and hence the landings presented here are of "siki" sharks. "Siki" landings are a mixed category comprising mainly *C. squamosus* and *C. coelolepis* but also including unknown quantities of other species (Table 3.1). Landings estimates from 2005 onwards were revised following WKSHARK2 and are presented by species (Figure 3.2; Tables 3.2 and 3.3).

Landings have declined from around 10 000 t in 2001–2004 to one tonne in 2012. Such decreases in landings are related to the imposition of the EU TAC, which was restrictive from 2005 to 2009 and set at zero catch since 2010. From 2017 to 2020, landings were reported in division 9a due to the deep-water sharks by-catch allowance in the black scabbard longline fisheries. Since 2021, and due to the regulations in place since then, landings of both species are very low or inexistent. In 2024, 2 kg of Portuguese dogfish were reported for Portugal and 455 kg for the UK.

3.3.2 Discards

Given the restrictive EU TACs for deep-water sharks, it was admitted that discarding in deep-water fisheries had increased. However, with the several EU regulations in place, particularly the ban of gillnet, entangle and trammel net fisheries at depths >600 m and trawl deep-water fisheries at depths >800 m, the potential bycatch and subsequent discarding of Portuguese dogfish and leafscale gulper shark is now thought to be relatively low. Since 2010, that discard information is limited to some years and countries (Tables 3.4 and 3.5).

Portugal. The IPMA on-board sampling programme of Portuguese commercial vessels that operate deep-water longlines to target black scabbardfish (métier LLD_DWS_0_0_0), started in mid-2005. Sampling effort was fixed at three trips per quarter and sampled trips and vessels were selected in a quasi-random sampling (Fernandes *et al*., 2011 WD). However, it is considered that spatial coverage by the sampling is insufficient to allow discards to be raised to the whole fleet (Prista *et al*., 2014 WD).

To evaluate the level of shark bycatch and discards, and to increase knowledge of the fishery, a pilot study on the Portuguese trammel net fishery targeting anglerfish in Division 9.a (200–600 m deep) took place, under the PNAB/DCF from 2012–2014 (Moura *et al*., 2015 WD). Results showed that the fishery targeting anglerfish at depths of 200–600 m had a low frequency of occurrence of

Portuguese dogfish. No specimens of leafscale gulper shark were ever sampled. Despite these results, higher frequencies are likely to be observed at depths >600 m.

Spain. The Spanish Discards Sampling Programme for Otter and Pair Bottom Trawl (OTB and PTB) fleets, covering ICES subareas 6–7 and divisions 8.c and 9.a started in 1988; however, it did not have annual coverage until 2003. The sampling strategy and the estimation methodology used follows the "Workshop on Discard Sampling Methodology and Raising Procedures" guidelines (ICES, 2003) and more details of this applied to this area were explained in Santos *et al*. (2010 WD).

Discards estimates of *C. squamosus* from the Spanish Discards Sampling Programme for Otter and Pair Bottom Trawl (OTB and PTB) fleets, covering ICES Subareas 6, 7, 8c and North 9a in the period 2003-2013 are presented in Table 3.6. It should be noted that the CVs from these estimates are very high (>50%) (Santos et al., 2010 WD), which can be related with the sampling not being stratified to account for the depth effect (*C. squamosus* generally distributes at high depths*)*. The results presented in Table 3.6 can therefore not be considered reliable estimates of the quantities discarded. They are included in this report as indicative that some discarding of the species occurred in the period considered.

Estimated discards of leafscale gulper shark in 2024 and in ICES divisions 8c and 9a were 3.4 tonnes.

France. French bycatch of Portuguese dogfish and leafscale gulper shark occurs mainly, if not only, in the deep-water fishery to the West of Scotland. Estimates for the period 2005–2014 are available in Table 3.7. It was previously shown that estimated discards may vary strongly with the auxiliary variable used for raising observed discards to the French fleet. Available auxiliary variables are fishing time, number of trips, number of fishing operations, number of fishing days and total landings of all species caught. Raising to the landings of the same species is not suitable as these sharks are not landed. Raising to available variables returned different discard estimates, which range from 13–200 tonnes of Portuguese dogfish and from 40–700 tonnes of leafscale gulper shark. Estimated discards for recent years (2020-2022) were not scrutinized by WGEF.

Ireland. Discard data from Ireland is available from 2009 to 2017 and 2023 for the Portuguese dogfish from the trawl fleet operating in ICES divisions 27.6.a and 27.7.bgj. Although 4.3 t were reported in 2023, discards are considered negligible as values estimated are <1 tonne in most of the years.

3.3.3 Quality of the catch data

Historically, very few countries have provided landings data disaggregated by species. Portugal has supplied species-specific data for many years. Since 2003 onwards, other countries have increased species-specific reporting of landings but some of these data may contain misidentifications.

It is believed that immediately prior to the introduction of quotas for deep-water species, in 2001, some vessels may have reported deep-water sharks as other species (and vice versa) in an effort to build up track record for other deep-water species (or deep-water sharks). It was also likely that, before the introduction of quotas for deep-water sharks, some gillnetters may have reported monkfish as sharks.

Misreporting is likely to have increased as a reaction to the EU restrictive measures adopted for deep-water sharks. As an example, the data from the DCF landing sampling programme at Sesimbra landing port in 2009 and 2010 revealed the existence of misidentification problems (Lagarto *et al*., 2012 WD). In 2014, sampling data derived from 13 trips on deep-water longliners (a small proportion of the total number of trips) indicated that nearly 50% of the sampled specimens landed as *Galeorhinus galeus* corresponded to leafscale gulper shark and Portuguese dogfish. Misidentification issues persisted until 2016.

3.3.4 Discard survival

No information is available. Scientific studies have recently tagged leafscale gulper sharks caught by longline at depths of 900–1100 m, indicating that they are capable of surviving after capture and release (Rodríguez-Cabello and Sánchez, 2014; Rodríguez-Cabello and Sánchez, 2017). In these studies, at-vessel mortality (proportion of fish that are dead when the fish are brought on board) for *C. squamosus* and *C. coelolepis* was low: 1.2%, and 4.5%, respectively. However, if including also specimens scored in poor condition, at vessel mortality increased to 18.9% and 38.6%, respectively.

It is important to remark that in these studies, the soaking times were restricted to 2–3 hours and the fishing gear was hauled in at a much slower speed (0.4–0.5 m s^{-1}) than under normal fishing practices.

3.4 Commercial catch composition

3.4.1 Species composition

No new information.

Past efforts made by WGEF to assign mixed landings by species are described in the Stock Annex. Briefly, the benchmarked procedure agreed by WKDEEP 2010 was further explored by a dedicated workshop on splitting of deep-water shark historical catch data in 2011 (ICES, 2011a). Results from this meeting indicated that the ratio between leafscale gulper shark and Portuguese dogfish varied considerably both temporally and spatially. Data from 2005 onwards was revised in WKSHARK2.

3.4.2 Length composition

Length information from discards have been submitted by Ireland and Spain for some years but the data is not adequate for further analysis as only few records are available.

3.4.3 Quality of catch and biological data

Despite past efforts to improve the quality of the data, particularly on species composition, considerable uncertainties persist on historical data (ICES, 2011a; ICES, 2016).

Since the reduction of EU TACs to zero, significant quantities of the two deep-water shark species under consideration are likely to be discarded by deep-water fisheries. Despite some sampling effort on discards has been undertaken, the sampling effort is clearly insufficient to estimate the quantities caught by species and size composition.

3.5 Commercial catch-effort data

Information on past commercial catch-effort data is presented in the stock annex. No new information is available.

3.6 Fishery-independent surveys

Since 1996, Marine Scotland Science has been conducting a monitoring deep-water survey in Subarea 6 at depths ranging from 300–2040 m [G6642]. This survey can be considered to be standardised in terms of depth coverage since 1998. More information on this survey is presented below.

In September, from 2006 to 2008, and in December 2009, Ireland carried out annual deep-water surveys in subareas 6 and 7. Fishing hauls were performed off north-western Ireland and west of Scotland, and the Porcupine Bank area to the west of Ireland at depth strata: 500 m, 1000 m, 1500 m and 1800 m. The Irish deep-water survey and other surveys were part of a planned coordinated survey in the ICES area, through the Planning Group on Northeast Atlantic Continental Slope Surveys (WGNEACS).

A new Irish trawl survey (IAMS) began trawling deep-water stations in 2018, but data have not yet been analysed.

From 2015 to 2023, AZTI conducted a deep-water longline survey (PALPROF) along the Basque Coast, Bay of Biscay (ICES Division 8.c), onboard a commercial longliner [L4398]. More information on this survey is presented below.

The WGNEACS (ICES, 2011b) was dedicated mainly to the design of a longline survey in Bay of Biscay and Iberian waters. One of its main objectives would be to clarify the distribution of all the deep-water sharks and to provide data to monitor their stock status, in the absence of commercial fisheries data.

3.7 Life-history information

Information on life history is presented in the corresponding stock annexes. No new information is available.

3.8 Exploratory assessments

3.8.1 Scottish deep-water survey data (ICES Subarea 6)

Survey indicators from the Scottish deep-water survey have been investigated since 2012 (Campbell, 2018WD; ICES, 2019). The survey takes place every two years, and the most recent information refers to 2023. In 2024, species mean weight and numbers per tow (for the hauls at 500 – 1800m and 700 – 1900m, respectively) were submitted to WGEF (Figures 3.3 and 3.4). Portuguese dogfish shows an increasing trend in both indicators since 2012, with relatively high values since 2019. Although not so evident as for the Portuguese dogfish, the leafscale gulper shark also shows higher values in the last four years, with the mean value in 2021 being the highest of the series (but with relatively high error values associated).

3.8.2 PALPROF survey (ICES Division 8c)

New information from the PALPROF survey in the Bay of Biscay was presented, updating the data presented previously (see Diez *et al.*, 2025 WD and Diez *et al.* 2021 for details). The PALPROF survey has been conducted annually since 2015 in a commercial longliner with the main objective of estimating and assessing the inter-annual variation of the abundance and biomass indices of the deep-water sharks and other ichthyofauna. The surveyed area is located 10.5 km North of the Cape Matxitxako (ICES 27.8.c east) close to a narrow canyon of about 28 km length, where the bottom depth progressively increases from 500 to 2500 m. Based on canyon valley depth profile, and for a depth range from 650 m to 2400 m, 400 m depth interval strata were considered. Six fishing hauls were performed each year, at the same position and time, in order to get homogeneous and comparable data.

To minimize the mortality of deep-water sharks, the number of hooks of a former commercial deep-water-sharks longline was reduced to 300 (Figure 3.5). Depth, temperature and salinity are continuously monitored through CTD sensors (every 30 s).

Data on status of the hook were recorded during the hauling and the recovering of the long line. The categories considered were: i) **E** - Hook with bait; ii) **C** - Hook with bait partially eaten; iii) **R** - Broken-Tangled hook; iv) **V** - Empty hook (no catch, no bait); v) **P** - Hook with catch and vi) **N.O.** - Hook status not Observed/recorded during recovering of the line.

On board, all fish specimens caught were sorted and species identified to the lowest taxonomic level possible. Also, each specimen was measured (cm), sexed and the condition (dead or alive) recorded. Individual body weight was estimated based on species length/weight relationships. The effective fishing effort performed in each stratum (EFFORTst) corresponded to the number of hooks able to fish during the haul, i.e. P + E + C divided by the total of hooks and multiplied by the soaking time (minutes):

EFFORTst: ((P + E + C) / total hooks) x soak time (minutes)

For each *stratum* the CPUE of species **i** was calculated as the ratio of catch of i^{th} species (kg) and EFFORTst.

In the estimates presented to WGEF in 2025, the catch per unit of effort (CPUE) was adapted to the units usually used in the assessments based in survey trends. Therefore, the CPUE was raised to 60 min and the biomass and abundance indices were calculated in kg/h and n/h, respectively.

During the ten years of the survey, among chondrichthyans, 13 different species of sharks and two chimaeras were caught. The highest CPUE values were recorded for *C. coelolepis*. CPUE values for this species showed no major trends until 2020 but decreased since then (Figure 3.6). The CPUE values for *C. squamosus* increased over time (with oscillations) but are relatively stable since 2021 (the maximum value was reported for 2018). Abundance of *C. coelolepis* is highest in the 1451–1850 strata whereas *C. squamosus* presented similar percentage of abundance in the 1051–1450 m and in the 1451–1850 strata and relatively high values in the 1851-2250 strata.

3.8.3 On-board Portuguese data (ICES Division 9a)

IPMA analysed the onboard data collected under Data Collection Framework (PNAB/DCF) for the deep-water sharks *Centroscymnus coelolepis*, *Centrophorus squamosus* and *Deania calceus* (Figueiredo and Moura, 2019WD). The analysis covered a period from 2009 to 2018 during which data on deep-water sharks was collected by onboard observers of the deep-water longline fishery targeting the black scabbardfish (LLD-DWS *métier*) in Division 9.a. Details and results have been provided in previous reports (ICES, 2019).

The initial objective of this analysis was to estimate the level of by-catch of the main deep-water sharks by year and by area (see section 3.2.2) in addition to evaluate any potential trend during this time period, to compare with catch levels prior to 2007 (when the TAC started to restrict landings). However, the sampling effort achieved is considered insufficient to provide reliable information on the abundance or biomass trend of deep-water shark species. The spatial locations of the fishing hauls are heterogeneously dispersed along time and the vessels sampled also changed. It should be noted that given the vessel site fidelity, there is a confounding effect between the fishing vessel and the fishing grounds and with the distribution patterns of each species, difficult to disentangle. The results obtained from the onboard analysis are presents below, by species.

Portuguese dogfish. The relative occurrence of *C. coelolepis* at the sampled fishing hauls, by year, varied between 33 and 100%. The number of specimens caught varied, not only among years, but also among vessels. The highest number of specimens caught by fishing haul were consistently recorded in some places. The geographic information of the catches of *C. coelolepis* supports previous studies where it was concluded that the black scabbardfish fishery operate at locations of lower abundance of *C. coelolepis* (Veiga *et al.*, 2015 WD; ICES, 2024).

Leafscale gulper shark. *Centrophorus squamosus* was quite frequently caught but its relative occurrence by fishing haul and by year varied between 17 and 100%. Also, the number of specimens caught per fishing haul varied not only among years but also among vessels. The data available were considered insufficient to estimate the level of by-catch and did not put in evidence any temporal trend. This fact might be associated with the spatial changes of the sampled fishing hauls along time (ICES, 2024).

3.9 Stock assessment

No new assessments were undertaken in 2025.

3.10 Quality of the assessments

Several regulations on catch opportunities and fisheries operations are in place in the NE Atlantic since 2005 to protect deep-water sharks' populations (or with effect on their protection), being recognized that fishing effort to these species has been reduced in a great extent (see Section 3.3.5). However, data to evaluate the impact of those management measures and current stock status of these species are deficient. Despite not being conducted yearly, the Scottish deep-water survey provides a meaningful time-series of species-specific data, but this started after the fishery being established and only covers part of the stock range for both the leafscale gulper shark and the Portuguese dogfish. The PALPROF survey in the Bay of Biscay provides new fishery-independent data since 2015 but also covers a small area. Fishery-independent data from other areas of the stock range are limited or lacking.

Fishery dependent data are lacking. The data derived from discards sampling is not adequate to estimate the quantities caught or needs further investigation.

Therefore, a major scientific investment is required to gain a full understanding of the spatial and temporal population dynamics of deep-water sharks to enable estimates of sustainable exploitation levels.

Several strategies to be adopted to monitor species abundance and evaluate fishing impact on their populations by the different deep-water fisheries have been discussed in previous meetings and included the: i) increase of close monitoring of deep water shark populations; ii) development of specific studies to assess the distribution patterns of species and estimate the spatial overlap with fisheries; iii) evaluate the effect on the bycatch of deep water sharks of modifications in deep water fishing operations (Figueiredo and Moura, 2016 WD).

Many countries formerly reported landings of Portuguese dogfish and leafscale gulper shark combined with other deep-water sharks in categories such as "siki sharks". Unless suitable data can be found to enable splitting of the catch data, historical catch levels by species will remain uncertain.

3.10.1 Historical assessments

In 2010, an exploratory assessment method was proposed for the Portuguese dogfish stock (cyo.27.nea) (ICES, 2010). The demographic model proposed is a state-space model that divides the population system dynamics into two processes running in parallel: an unobserved process that describes the female sharks' population abundance in number, and an observational model, annual catches, that allows establishing the connection between the unknown states (ICES, 2010). However, the application of the model requires catch data discriminated by species from the different areas within the stock NE Atlantic. Such data is deficient, as historical data is not split by species and current catch estimates are also not quantified.

3.11 Reference points

There are no reference points for these stocks.

3.12 Conservation considerations

The Red List of European marine fish considered both leafscale gulper shark and Portuguese dogfish to be Endangered (Nieto *et al*., 2015).

Recent IUCN assessments for a group of deep-water sharks classified the Portuguese dogfish as globally Near Threatened with signs of increase in the population inhabiting the NE Atlantic (Finucci *et al*., 2020a). The leafscale gulper shark was classified as globally Endangered, with signs of reduction of the population in the NE Atlantic (Finucci *et al*. 2020b).

Both species are included in the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) List of Threatened and/or Declining Species & Habitats (OSPAR, 2021).

3.13 Management considerations

Some species of deep-water shark are considered to have very low population productivity.

Whilst the zero TAC for deep-water sharks has prevented targeted fisheries for deep-water sharks, these species can still be a bycatch in some deep-water fisheries. The level of bycatch in these fisheries is uncertain but is now assumed to be relatively low given the EU regulations adopted for deep-water fisheries (see Section 3.3.5).

3.14 References

Campbell, N. 2018. Analyses of Scottish deep-water survey data. Working Document presented in the ICES Working Group on Elasmobranch Fishes (WGEF), Lisbon, June 2018. 12pp.

Catarino, D., Knutsen, H., Veríssimo, A., Olsen, E. M., Jorde, P. E., Menezes, G., Sannaes, H., Stankovi, D., Company, J.B., Neat, F., Danovaro, R., Dell'Anno, A. Rochowski, B., Stefanni, S. (2015). The Pillars of Hercules as a bathymetric barrier to gene flow promoting isolation in a global deep-sea shark (*Centroscymnus coelolepis*). Molecular Ecology, 24: 6061-6079.

Clarke, M.W., Connolly, P.L. and Bracken, J.J. 2001. Aspects of reproduction of deep-water sharks *Centroscymnus coelolepis* and *Centrophorus squamosus* from west of Ireland and Scotland. Journal of the Marine Biological Association of the United Kingdom, 81: 1019–1029.

Clarke, M.W., Connolly, P.L. and Bracken, J.J. 2002. Age estimation of the exploited deep-water shark *Centrophorus squamosus* from the continental slopes of the Rockall Trough and Porcupine Bank. Journal of Fish Biology, 60: 501–514.

Compagno, L. J. V. and Niem, V. H. 1998. Squalidae. In FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Volume 2. Cephalopods, crustaceans, holothurians and sharks, pp 1213–1232. Ed. by K.E. Carpenter and V.H. Niem. FAO, Rome.

Diez, G., L., Basterretxea, M., Cuende, E., Mugerza, A., Zumeta, X., Mendizabal, A. 2025. Abundance, biomass and CPUE of deep-water sharks in the longline survey (PALPROF) in the Bay of Biscay (ICES 8.c). Update from 2015 to 2024. Working Document presented to ICES WGEF 2025, 11 pp.

Diez G, Arregi L, Basterretxea M, Cuende E, Oyarzabal I (2021). Preliminary observations on abundance and distribution of fish fauna in a canyon of the Bay of Biscay (ICES Division 8c). Journal of the Marine Biological Association of the United Kingdom, 101, 169-178, https://doi.org/10.1017/S0025315420001265

Fernandes, A. C., Prista, N., Jardim, E., Silva, D. and Ferreira, A., P. 2011. Results from the 2010 Portuguese onboard sampling programme of the deepwater longline fleet with an emphasis on elasmobranch species. Working Document presented in the ICES Working Group on Elasmobranch Fishes (WGEF), Copenhagen, June 2011.

Figueiredo, I., Moura, T. 2016. The Portuguese black scabbardfish longline fishery in ICES division IXa: data needed to assess the by-catch of deep-water sharks and to develop advice on possible mitigation measures to reduce the by-catches. Working Document for the ICES Working Group on Elasmobranch Fishes, Lisbon, 15-24 June 2016. 13 pp.

Figueiredo, I., Moura, T. 2019. Onboard sampling information for deep-water sharks in Portuguese mainland waters (2009-2018). Working Document presented in the ICES Working Group on Elasmobranch Fishes (WGEF), Lisbon, 18-27th June. 21 pp.

Finucci, B., Cheok, J., Cotton, C.F., Kulka, D.W., Neat, F.C., Pacoureau, N., Rigby, C.L., Tanaka, S. and Walker, T.I. 2020a. *Centroscymnus coelolepis*. The IUCN Red List of Threatened Species 2020: e.T41747A2955293. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T41747A2955293.en.

Finucci, B., Bineesh, K.K., Cheok, J., Cotton, C.F., Dharmadi, Kulka, D.W., Neat, F.C., Pacoureau, N., Rigby, C.L., Tanaka, S. and Walker, T.I. 2020b. *Centrophorus squamosus*. The IUCN Red List of Threatened Species 2020: e.T41871A68614964. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T41871A68614964.en.

Girard M., Du Buit M. H. 1999 Reproductive biology of two deep-water sharks from the British Isles, *Centroscymnus coelolepis* and *Centrophorus squamosus* (Chondrichthyes: Squalidae). Journal of the Marine Biological Association of the UK, 79: 923–931.

Hareide, N. R. and Garnes, G. 2001. The distribution and catch rates of deep-water fish along the Mid-Atlantic Ridge from 43 to 61 N. Fisheries Research, 519: 297–310.

ICES. 2003. Report of ICES Workshop on Discard Sampling Methodology and Raising Procedures. Charlottenlund, Denmark, 2–4 September 2003.

ICES. 2010. Report of the Benchmark Workshop on Deep-water Species (WKDEEP), 17–24 February 2010, Copenhagen, Denmark. ICES CM 2010/ACOM:38. 247 pp

ICES. 2011a. Report of the Workshop on splitting of deep-water shark historical catch data 2011 (WKSHARK). 17th June 2011, Copenhagen, Denmark. ICES 2010/2/ACOM36; 25 pp.

ICES. 2011b. ICES Advisory Committee on Fishery Management. Report of the Working Group for Northeast Atlantic Continental Slope Survey (WGNEACS). Archimer, archive institutionnelle de l'Ifremer, ID : 10670/1.dbyb7u

ICES. 2016. Report of the Workshop to compile and refine catch and landings of elasmobranchs (WKSHARKS), 19–22 January 2016, Lisbon, Portugal . ICES CM 2016/ACOM:40. 69 pp.

ICES. 2019. Working Group on Elasmobranch Fishes (WGEF). ICES Scientific Reports. 1:25. 964pp. http://doi.org/10.17895/ices.pub.5594

ICES. 2024. Report of the Working Group on Elasmobranch Fishes (WGEF). ICES Scientific Reports. 06:75. 994 pp. https://doi.org/10.17895/ices.pub.26935504

Lagarto, N., Moura, T., Farias, I., and Figueiredo, I. 2012. Sampling information from deep-water sharks caught in the black scabbardfish fishery from mainland Portugal. Working Document to ICES WGEF; 5 pp.

Moura, T., and Figueiredo, I. 2012. Reproductive strategy and population structure of *Centroscymnus coelolepis*. Working Document to ICES WGEF; 6 pp.

Moura, T., Figueiredo, I. and Gordo, L. 2008. Analysis of genetic structure of the Portuguese dogfish *Centroscymnus coelolepis* caught in the Northeast Atlantic using mitochondrial DNA (Control Region)-Preliminary results. Working Document to ICES WGEF.

Moura, T., Jones, E., Clarke, M.W., Cotton, C.F., Crozier, P., Daley, R.K., Diez, G., Dobby, H., Dyb, J.E., Fossen, I., Irvine, S.B., Jakobsdottir, K., López-Abellán, L.J., Lorance, P., Pascual-Alayón, P., Severino, R.B., and Figueiredo, I. 2014. Large- scale distribution of three deep-water squaloid sharks: integrating data on sex, maturity and environment. Fisheries Research, 157: 47–61.

Moura, T., Fernandes, A., Figueiredo, I., Alpoim, R., Azevedo, M. 2015. Results from the pilot study on the Portuguese trammel nets fishery targeting anglerfish in ICES Division IXa. Working Document to ICES Working Group on Elasmobranch Fishes (WGEF), Lisbon, 2015; 7 pp.

Nieto, A., Ralph, G.M., Comeros-Raynal, M.T., Kemp, J., Garcia Criado, M., *et al*. 2015. European Red List of marine fishes. Luxembourg: Publications Office of the European Union.

OSPAR. 2021 Status assessment 2021 - leafscale gulper shark. https://oap.ospar.org/en/ospar-assessments/committee-assessments/biodiversity-committee/status-assesments/leafscale-gulper-shark/

Prista, N., Fernandes, A.C., Maia, C., Moura, T., and Figueiredo, I. 2014 WD. Discards of elasmobranchs in the Portuguese fisheries operating in ICES Division XIa: Bottom otter trawl, deepwater set longlines, set gillnet and trammel net fisheries (2004–2013). Working Document ICES WGEF. 18 pp.

Rodríguez-Cabello, C., and Sánchez, F. 2014. Is *Centrophorus squamosus* a highly migratory deep-water shark? Deep Sea Research Part I, 92: 1–10.

Rodríguez-Cabello, C., González-Pola, C., and Sánchez, F. 2016. Migration and diving behaviour of *Centrophorus squamosus* in the NE Atlantic. Combining electronic tagging and Argo hydrography to infer deep ocean trajectories. Deep Sea Research Part I, 115: 48–62.

Rodríguez-Cabello, C., and Sánchez, F. 2017. Catch and post-release mortalities of deep-water sharks caught by bottom longlines in the Cantabrian Sea (NE Atlantic) (in press). Journal of Sea Research, 130: 248-255.

Rodríguez-Cabello, C., Pérez, M. and Grasa, I. 2020. Taxonomic research on *Deania calcea* and *Deania profundorum* (Family: Centrophoridae) in the Cantabrian Sea (Northeast Atlantic) with comments on Deania hystricosa. Regional Studies in Marine Science 37. https://doi.org/10.1016/j.rsma.2020.101321

Santos J., H. Araújo, I. Salinas and N. Pérez. 2010. Elasmobranches Results from Spanish Discard Sampling Programme. Working Document presented to WGEF 2010.

Stefanni, S., Catarino, D., Ribeiro, P.A., Freitas, M., Menezes, G.M., Neat, F. and Stankovic´, D. 2021. Molecular Systematics of the Long-Snouted Deep Water Dogfish (Centrophoridae, Deania) With Implications for Identification, Taxonomy, and Conservation. Front. Mar. Sci. 7:588192. doi: 10.3389/fmars.2020.588192

Severino, R., Afonso-Dias, I., Delgado, J., and Afonso-Dias, M. 2009. Aspects of the biology of the leaf-scale gulper shark *Centrophorus squamosus* (Bonnaterre, 1788) off Madeira archipelago. Arquipélago-Life and Marine Sciences, 26: 57–61.

Veiga, N. 2015 WD. Onboard data from the Portuguese deep-water longliners: study of the spatial overlap between deep-water sharks and the black scabbardfish. Working Document to ICES Working Group on Elasmobranch Fishes (WGEF), Lisbon, 2015; 4 pp.

Veiga, N., Moura, T., and Figueiredo, I. 2013. Spatial overlap between the leafscale gulper shark and the black scabbardfish off Portugal. Aquatic Living Resources, 26: 343–353.

Veiga, N., Moura, T. and Figueiredo, I. 2015 WD. Spatial overlap between Portuguese dogfish and the black scabbardfish off Portugal. Working Document to ICES Working Group on Elasmobranch Fishes (WGEF), Lisbon, 2015; 18 pp.

Veríssimo, A., McDowell, J.R., and Graves, J.E. 2011. Population structure of a deep-water squaloid shark, the Portuguese dogfish (*Centroscymnus coelolepis*). ICES Journal of Marine Science, 68: 555–563.

Veríssimo, A., McDowell, J.R., and Graves, J.E. 2012. Genetic population structure and connectivity in a commercially exploited and wide-ranging deepwater shark, the leafscale gulper (*Centrophorus squamosus*). Marine and Freshwater Research, 63: 505–512.

3.15 Tables and Figures

Table 3.1. Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Working Group estimate of combined landings of Portuguese dogfish and leafscale gulper shark (t) by ICES area from 1998 to 2004. Landings by species not available in these years, UA, unknown area.

	4.a	5.a	5.b	6	7	8	9	10	12	14	UA	Total
1988	0	0	0	0	0	0	560	0	0	0		560
1989	12	0	0	8	0	0	507	0	0	0		527
1990	8	0	140	6	0	6	475	0	0	0		635
1991	10	0	75	1013	265	70	1075	0	1	0		2509
1992	140	1	123	2013	1171	62	1114	0	2	0		4626
1993	63	1	97	2781	1232	25	946	0	7	0		5152
1994	98	0	198	2872	2087	36	1155	0	9	0		6455
1995	78	0	272	2824	1800	45	1354	0	139	0		6512
1996	298	0	391	3639	1168	336	1189	0	147	0		7168
1997	227	0	328	4135	1637	503	1311	0	32	9		8182
1998	81	5	552	4133	1038	605	1220	0	56	15		7705
1999	55	0	469	3471	895	531	972	0	91	0		6484
2000	1	1	410	3455	892	361	1049	0	890	0		7059
2001	3	0	475	4459	2685	634	1130	0	719	0		10105
2002	10	0	215	3086	1487	669	1198	0	1416	12		8093
2003	16	0	300	3855	3926	746	1180	0	849	4		10876
2004	5	0	229	2754	3477	674	1125	0	767	0		9031

Table 3.2. Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Working Group estimate of landings of Portuguese dogfish (t) by ICES area. FAO34, FAO area 34, UA, unknown area. 0 = landings <0.5 t.

	27.2	27.4	27.5	27.6	27.7	27.8	27.9	27.10	27.12	27-UA	TOTAL	FAO34
2005	0	2	149	414	392	92	541	0	8	60	1657	256
2006	0	1	138	244	214	106	537		0		1240	25
2007	0	2	133	186	14	29	143				507	0
2008		0	121	145	7	361	86				394	0
2009		0	27	47	3	4	33				114	
2010		0	31	24	2	0	1				58	0
2011			1		1		1				2	
2012			4				0				4	
2013			2				0				2	0
2014			5								5	0
2015		0				0	0				1	
2016					0	0					0	
2017							3*				3	
2018						0	2*				2	
2019							11*				11	
2020						0	9*				9	
2021												
2022												
2023												
2024					0		0					0

*** Landings from the deep-sea longline fisheries for black scabbardfish (Council Regulation (EU) 2016/2285; Council Regulation (EU) 2018/2025).**

Table 3.3. Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Working Group estimate of landings of leafscale gulper shark (t) by ICES area. FAO34, FAO area 34; UA, unknown area. 0 = landings <0.5 t.

	27.2	27.4	27.5	27.6	27.7	27.8	27.9	27.10	27.12	27-UA	TOTAL	FAO34
2005	0	0	32	189	249	154	457	0	1	64	1147	565
2006		0	47	158	95	50	508		0		858	50
2007	0	0	44	28	26	2	231				331	0
2008		0	41	43	15	3	87				190	7
2009		0	50	83	4	1	26				165	13
2010		0	58	59	12	0	4				134	5
2011					3		1				3	3
2012					1		1				2	5
2013							0				0	4
2014			32		0		0				33	3
2015		1	9			0	0				10	
2016							0				0	
2017							7*				7	9*
2018							2*				2	9*
2019							17*				17	11*
2020		0					4*				4	8*
2021							0				0	
2022							0				0	
2023												
2024												

*** Landings from the deep-sea longline fisheries for black scabbardfish (Council Regulation (EU) 2016/2285; Council Regulation (EU) 2018/2025).**

Table 3.4. Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Discards of Portuguese Dogfish available in the period 2010-2023.

Year	Ireland - all other bottom trawls		France - all other bottom trawls				France - set nets
	27.6.a	27.7.b.g.j	27.7.h		27.6.a	27.5.b	27.8.b
2010	0.13						
2011	0.44						
2012	0.12						
2013	0.04						
2014		1.51					
2015	0.03						
2016	0.41						
2017	0.12						
2018			4.18	165.60	1.79	0.06	4.18
2023		4.29					

Table 3.5. Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Discards of leafscale gulper shark available in the period 2010-2024.

Year	Spain - all other bottom trawls		Spain - set nets	
	27.8c	27.9a	27.8c	27.9a
2018	12.49	6.39		
2019	0.26	0.13		
2021			4.93	0.59
2024	2.4	1.0		

Table 3.6. Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Spanish discard data for Leafscale gulper shark. Numbers of sampled trips and total trips are not available for the years 2010 onward.

Year	Celtic Sea (subareas 6–7)			Iberian Waters (divisions 8.c–9.a))		
	Sampled trips	Total trips	Raised discards (t)	Sampled trips	Total trips	Raised discards (t)
2003	9	1172	0	51	18 036	0
2004	11	1222	0	53	20 819	0
2005	10	1194	0	97	11 693	4.5
2006	13	1152	3.2	75	18 352	4.1
2007	12	1233	0	95	17 750	0
2008	11	1206	67.3	103	15 114	0
2009	15	1304	61.1	116	14 486	85.9
2010			0			29.2
2011			0			0.9
2012			173.4			0.7
2013			0			0

Table 3.7. Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Total number of fishing trips, number of hauls and number of hauls with catch of Portuguese dogfish and leafscale gulper shark in French on-board observations (2005–2014).

Year	Country	Total number of:		Portuguese dogfish (positive hauls)		Leafscale gulper shark (positive hauls)	
		Trips	Hauls	Number	Proportion	Number	Proportion
2005	France	18	212	26	0.12	9	0.04
2006	France	9	106	18	0.17	1	0.01
2007	France	6	15	1	0.07	35	0.14
2008	France	18	245	12	0.05	143	0.24
2009	France	42	605	89	0.15	120	0.24
2010	France	48	504	93	0.18	71	0.16
2011	France	29	443	67	0.15	93	0.21
2012	France	32	449	35	0.08	79	0.18

Year	Country	Total number of:		Portuguese dogfish (positive hauls)		Leafscale gulper shark (positive hauls)	
		Trips	Hauls	Number	Proportion	Number	Proportion
2013	France	36	447	27	0.06	72	0.20
2014	France	31	365	34	0.09	9	0.04

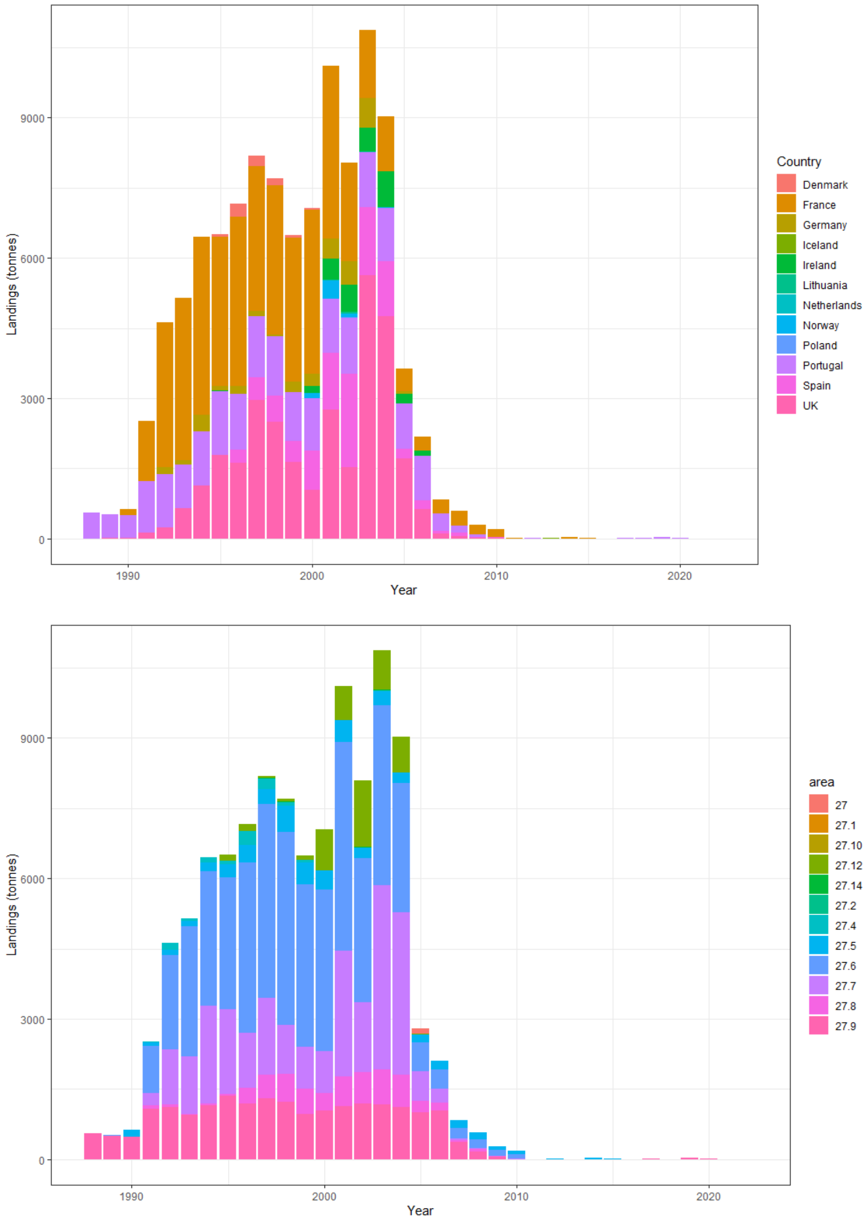


Figure 3.1. Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Working Group estimates of combined landings of the two species, by country (top) and by ICES Subarea (bottom).

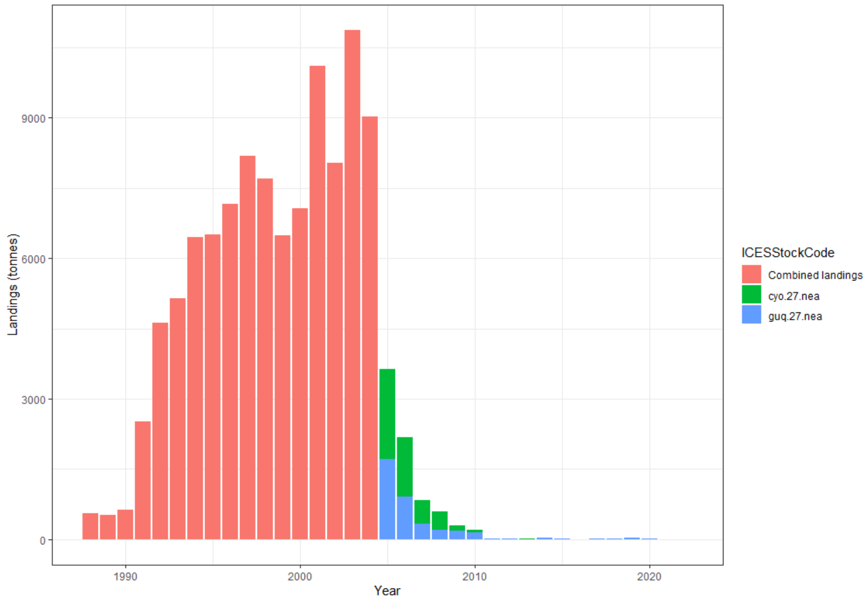


Figure 3.2. Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Working Group estimates of landings (combined landings from 1988 to 2004; by species from 2005 to 2024).

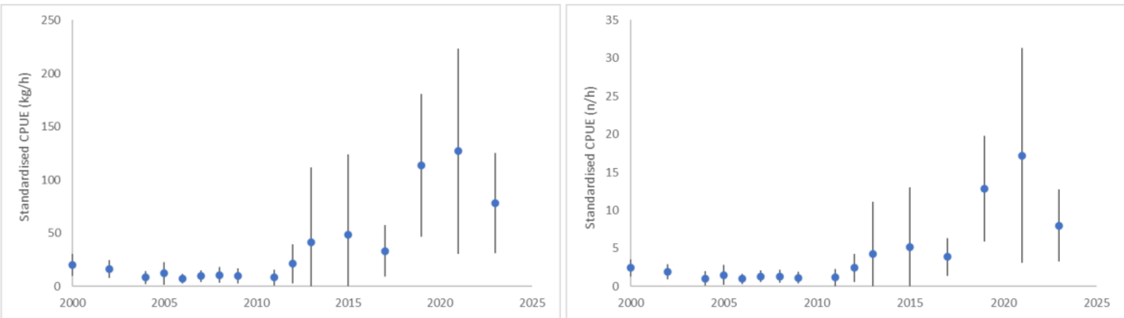


Figure 3.3. Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Mean weight and number of Portuguese dogfish per tow in Scottish deep-water surveys 2000 to 2023.

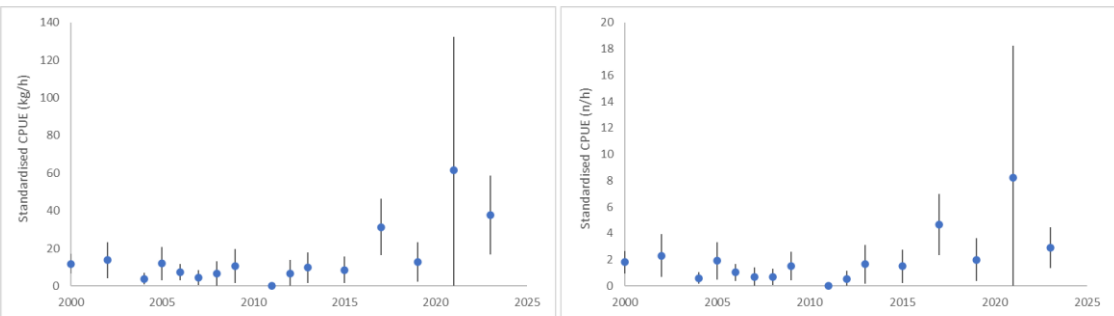


Figure 3.4. Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14). Mean weight and number of leafscale gulper shark per tow in Scottish deep-water surveys 2000 to 2021.

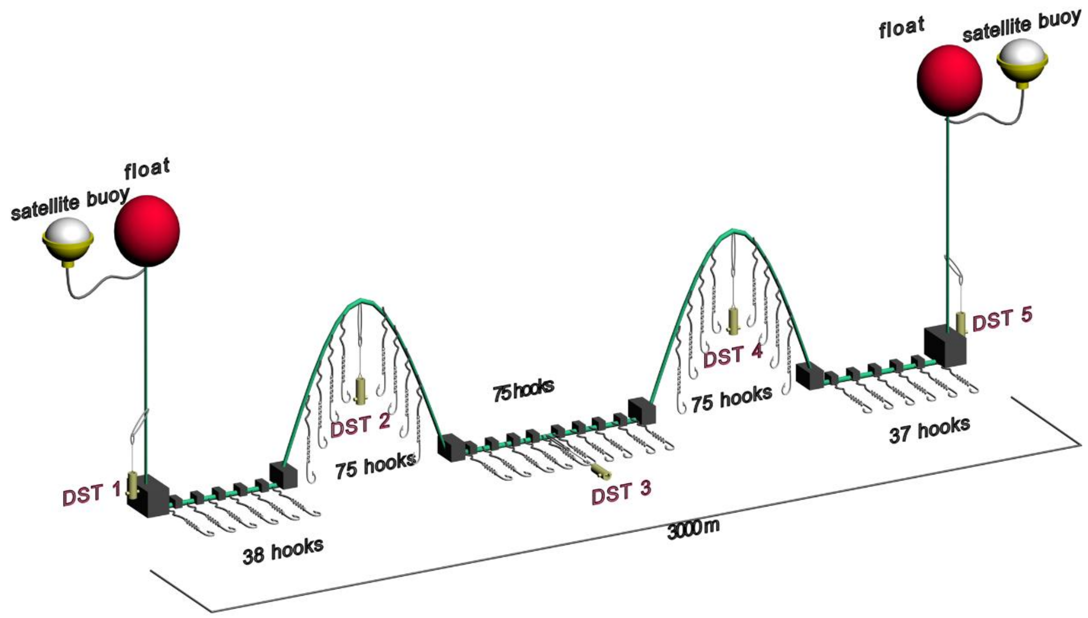


Figure 3.5. Deep-water sharks - Scheme of the final design of long-line fishing gear used in the PALPROF survey (from WD01 - Diez *et al.*, 2020).

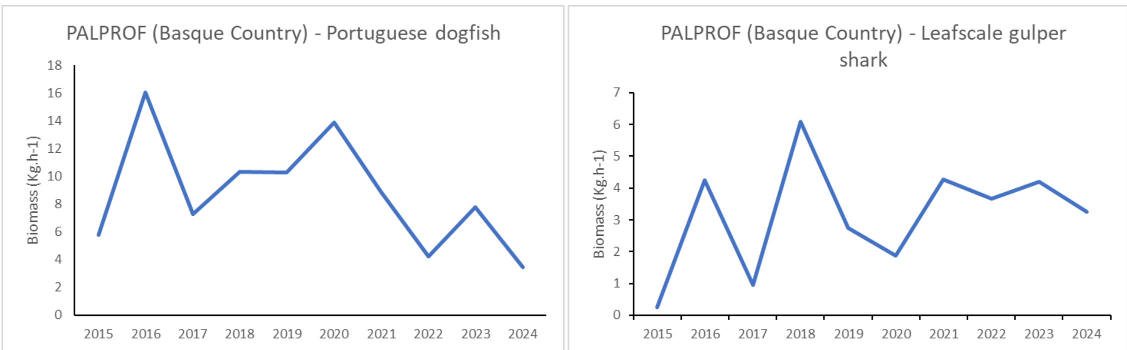


Figure 3.6 Deep-water sharks - Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14)– CPUE (kg hook^{-1} min^{-1}) estimates for *C. coelolepis* and *C. squamosus* in the PALPROF survey (2015–2024).

4 Kitefin shark in the Northeast Atlantic (entire ICES Area)

4.1 Stock distribution

Kitefin shark *Dalatias licha* is distributed widely in the deeper waters of the northeast Atlantic, from Norway to northwest Africa and the Gulf of Guinea, including the Mediterranean Sea and NW Atlantic.

The stock identity of kitefin shark in the NE Atlantic is unknown. However, the species seems to be more abundant in the southern area of the Mid-Atlantic Ridge (Subarea 10). Elsewhere in the NE Atlantic, kitefin shark is recorded infrequently. The species is caught as bycatch in mixed deep-water fisheries in subareas 5–7, although at much lesser abundance than the main deep-water sharks (see Section 3), and the species composition of the landings is not accurately known.

For assessment purposes, the stock is considered as a management unit covering ICES Subareas 1-10, 12, and 14. The Azores archipelago (Subarea 10) is composed of nine islands with almost no geological continental shelf, and an Exclusive Economic Zone (EEZ) with 461 identified seamounts. Most of the available data used on the assessment come from Subarea 10, where the species is more abundant, but the Azores ecoregion lies within a much larger open ocean ecosystem, and straddles the Mid-Atlantic Ridge (ICES, 2020a).

4.1 The fishery

4.1.1 History of the fishery

A detailed description of historical fisheries can be found in Heessen (2003) and ICES (2003).

Fishing in the Azores ecoregion occurs mostly around the island slopes and the numerous surrounding offshore seamounts (ICES, 2020b). Historically, Azorean landings of kitefin shark began in the early 1970s and increased rapidly to over 947 tonnes in 1981, fluctuating considerably thereafter, at least in part due to market fluctuations. Landings peaked at 937 tonnes in 1984 and 896 tonnes in 1991. In the 1990s, these landings have declined, possibly as a result of economic problems related to markets. The Azorean target fishery stopped at the end of the 1990s.

Elsewhere in the North Atlantic, it is an infrequent bycatch in various deep-water fisheries. Since the early 1990s that there are reported landings from other areas, which have declined from 2005 following the implementation and reduction over time of the TAC for deep-sea sharks.

4.1.2 The fishery in 2024

Currently there are no target fisheries for kitefin shark. Landings in the northeast Atlantic have been at low levels since 2005, with most of the catches reported from subareas 6, 7and 10 (Tables 4.1–4.6 and Figure 4.1). Small amounts are reported for other subareas but in some cases, landings may correspond to coding errors.

4.1.3 ICES advice

ICES advised that when the precautionary approach is applied, there should be zero catches in each of the years 2024–2027.

4.1.4 Management

The EU TACs (in tonnes) that have been adopted for deep-sea sharks in European Community waters and international waters in different ICES subareas are summarized in the table below. The deep-sea shark category includes the kitefin shark *Dalatias licha* (Council regulation (EC) No 2285/2016).

Year	Subareas 5–9	Subarea 10	Subarea 12 (includes also *Deania histricosa* and *Deania profundorum)*
2005-2006	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)
2012-2016	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
2021-2025(5)	---	---	---

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

(2) Bycatches of up to 10% of 2009 quotas are permitted.

(3) Bycatches of up to 3% of 2009 quotas are permitted.

(4) Bycatch only for bottom longline fisheries targeting black scabbardfish.

(5) Species included in the prohibited list of the TAC regulations.

Council Regulation (EC) No 1568/2005 banned the use of trawls and gillnets in waters deeper than 200 m in the Azores, Madeira and Canary Island areas.

Council Regulation (EC) No 41/2007 banned the use of gillnets by Community vessels at depths greater than 600 m in divisions 6.a-b, 7.b-c, 7.j-k and Subarea 12. A maximum bycatch of deep-water shark of 5% is allowed in hake and monkfish gillnet catches and 10% on the bottom long-line fisheries targeting black scabbardfish.

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 these waters by 1 February 2006.

In 2009, the Azorean Regional Government introduced new technical measures for the demersal/deep-water fisheries (Ordinance 43/2009, May 27th) including area restrictions by vessel size and gear, and gear restrictions (hook size and maximum number of hooks on the longline gear). These measures have been adapted thereafter. In Azorean waters, there is a network of closed areas (summarized in Section 20). The Condor seamount has been closed to demersal/deep-water fisheries since 2010.

Since 2015 that the kitefin shark is 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 2015/104, Art. 12:1(g)). In 2016 the EU established specific conditions for fishing for deep-sea stocks in the Northeast Atlantic (EU Regulation 2016/2336).

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 (Council regulation (EU) 2016/2285; Council regulation (EU) 2018/2025). 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. According to this, 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.

Since 2021 there is a prohibition to fish, to retain on board, to tranship, to relocate or to land deep-water sharks species from the EU list (including the kitefin shark). In its last version, the regulation applies to in the Union, United Kingdom and international waters of ICES zones 1, 2 (except United Kingdom waters of division 2a), 5 to 10, 12 and 14, and CECAF areas 34.1.1, 34.1.2 and 34.2, as well as to Union and United Kingdom waters of ICES division 2a and subarea 4 (Council Regulation (EU) 2025/202).

4.2 Catch data

4.2.1 Landings

The annual landings reported from each country are given in Tables 4.1–4.6 and in Figure 4.1.

4.2.2 Discards

There are new discard data reported by France which corresponds to a total of 14.70 tonnes in 2018 (ICES subdivision: 27.6.a, 27.7.h, 27.7.j, and 27.7.k) from bottom trawls.

No new data for the Azorean commercial fisheries were presented this year. Discard rates of 15–85% of the kitefin shark caught per set were reported from the sampled Azorean longliners during 2004–2010 (ICES, 2012). Since 2011, discards may have increased due to management restrictions (decreasing TACs followed by prohibition) or been landed as unspecified elasmobranchs.

Sporadic and low levels of kitefin shark discards were reported from the Spanish trawl fleets operating in divisions 8.c and 9.a in 2010–2012.

4.2.3 Quality of catch data

Historical landings of deep-water sharks taken in the Azores commonly consisted of gutted, finned, beheaded and skinned individuals. Only the trunks and, in some cases, the livers, were landed. Misidentification problems were likely to occur with other deep-water shark species in ICES Division 10.a.

The reported Azorean landings data come exclusively from the commercial first sale of fresh fish at auctions and so landings data (Table 4.5) may be underestimated.

4.3 Commercial catch composition

No new information.

4.4 Commercial catch–effort data

No new information.

4.5 Fishery-independent surveys

Research surveys carried out in the stock distribution area rarely catch kitefin shark, as the surveys are not designed for the species, and thus will not provide relevant information for the assessment. Still, data available for some surveys are presented below.

Relative abundances of kitefin shark (ind. h^{-1}) from the Scottish deep-water trawl survey (depth range 500–1000 m) were submitted in 2016 to the group (Table 4.7). These data confirm that only low numbers are caught, with a total of 34 specimens (8 males of 60–110 cm, and 26 females of 40–140 cm) being recorded over the entire survey period.

Relative biomass estimates of kitefin shark (kg $haul^{-1}$) from the Spanish Groundfish Survey in the Porcupine Bank were provided to WGEF (Ortiz *et al.*, 2025 WD). Mean biomass and abundance index of *D. licha* decreased in 2024 (Figure 4.2). However, the mean stratified biomass in the last two years was slightly above the previous five years (Figure 4.3). In 2024, a total of 5 hauls showed presence of this species, between 474 and 767 m deep, with a total of 7 specimens from 42 to 108 cm total length were found, mainly in the deepest strata in the south and west of the study area (Figure 4.4–4.5).

Relative biomass estimates of kitefin shark (kg $haul^{-1}$) from the bottom trawl survey in the Northern Spanish Shelf were submitted to the group in 2025 (Fernández-Zapico *et al.*, 2025 WD). Two individuals measuring 52 cm and 125 cm were found in separate hauls at depths of 584 m and 941 m, one in the south of Galician area and one near Peñas Cape.

The Azorean longline survey (ARQDAÇO [L6563]) has on average of 30 fishing stations per survey, covering a depth range 50–1200 m (Pinho *et al.*, 2020). During the period 1995–2018, a total of 102 kitefin sharks were caught, averaging about five individuals per year (Santos *et al.*, 2020). Over the entire time period, specimens were caught at depths of 150–850 m and their total length ranged from 43–150 cm (Santos *et al.*, 2020).

The PALPROF survey in ICES Division 8.c did not provide survey indicator for kitefin shark as the species was only caught in one out of nine years of this survey.

4.6 Life-history information

There is no new information available.

4.7 Exploratory assessment models

Exploratory kitefin shark stock assessments were conducted during the 1980s, using an equilibrium Fox production model (Silva, 1987). The stock was considered intensively exploited with the average observed total catches (809 tonnes) near the estimated maximum sustainable yield (MSY = 933 tonnes). An optimum fishing effort of 281 days fishing bottom nets and 359 trips fishing with handlines was proposed, corresponding approximately to the observed effort.

During the DELASS project (Heessen, 2003), a Bayesian stock assessment approach using the Pella-Tomlinson biomass dynamic model was applied to two fisheries, handline and bottom gillnet (ICES, 2003; 2005). Based on the probability of the Biomass 2001 to be less than B_{MSY}, the stock was considered depleted.

4.8 Stock assessment

No new assessment was undertaken in 2024.

In the last assessment (2023), the ICES framework for category 6 was applied (ICES, 2012). For stocks without information on abundance or exploitation, 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.

Landings have declined after the early 1990s, which is considered to be partly due to market conditions. In line with the zero TAC, landings have been negligible since 2010 and there are no new data to assess the status of the stock.

4.9 Quality of assessments

No new assessment was undertaken.

4.10 Reference points

No reference points have been proposed for this stock.

4.11 Conservation considerations

Kitefin shark is listed as 'Vulnerable' on the IUCN Red List (Finucci *et al*., 2018).

4.12 Management considerations

Initial assessment results suggested that the stock might have been depleted to about 50% of virgin biomass (Silva, 1987). However, further analysis is required to better understand the actual status of the stock. Fisheries for kitefin shark have been affected by fluctuations in the price of shark liver oil. An analysis of liver oil prices may provide some information on historical exploitation levels of this species.

There are no adequate fishery-independent surveys to monitor the stock. WGEF recommends that the development of a fishery should not be permitted unless data on the level of sustainable catches become available. If an artisanal sentinel fishery is established, it should be accompanied by a data collection programme.

4.13 References

Heessen, H. J. L. 2003. Report of the DELASS Project.

ICES. 2003. Report of the Working Group on Elasmobranch Fishes. ICES CM 2003/G:09, 155 pp.

ICES. 2005. Report of the Working Group on Elasmobranch Fishes. ICES CM 2006/ACFM:03, 224 pp.

ICES. 2012. Report of the Working Group on Elasmobranch Fishes. ICES CM 2012/ACOM:19, 532 pp.

ICES. 2020a. Azores ecoregion – Ecosystem overview. In Report of the ICES Advisory Committee, 2020. ICES Advice 2020, Section 3.1. https://doi.org/10.17895/ices.advice.7628.

ICES. 2020b. Azores ecoregion – Fisheries overview. In Report of the ICES Advisory Committee, 2020. ICES Advice 2020, section 3.2. https://doi.org/10.17895/ices.advice.7600 .

Fernandez-Zapico, O., Ruiz-Pico, S., Blanco, M., Rodríguez-Cabello, C., Ortiz, P., González-Irusta, J.M., Punzón, A., Velasco, F. 2025. Results on main elasmobranch species captured in the 2024 Northern Spanish Shelf Groundfish Survey. Working Document presented to ICES WGEF 2024, WD; 47 pp.

Finucci, B., Walls, R.H.L., Guallart, J. & Kyne, P.M. 2018. *Dalatias licha*. The IUCN Red List of Threatened Species 2018: e.T6229A3111662. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T6229A3111662.en

Ortiz, P., Fernandez-Zapico, O., Ruiz-Pico, S., Blanco, M., Martínez-Vázquez, J.M., Rodríguez-Cabello, Velasco, F., C., Baldó, F. 2025. Results on main elasmobranch species from the 2024 Spanish Groundfish Survey on the Porcupine Bank (NE Atlantic). Working Document presented to ICES WGEF 2024, WD; 41 pp.

Pinho, M., Medeiros-Leal, W., Sigler, M., Santos, R., Novoa-Pabon, A., Menezes, G., Silva, H. (2020). Azorean demersal longline sur-vey abundance estimates: Procedures and Variability. Regional Studies in Marine Science, 39: 101443. https://doi.org/10.1016/j.rsma.2020.101443

Santos, R., Novoa-Pabon, A., Silva, H., Pinho, M. 2020. Elasmobranch species richness, fisheries, abundance and size composition in the Azores archipelago (NE Atlantic), *Marine Biology Research*, 16:2, 103-116. doi: 10.1080/17451000.2020.1718713

Silva, H. M. Da. 1987. An assessment of the Azorean stock of kitefin shark, *Dalatias licha*. ICES Copenhagen, ICES CM 1987/G:66, 10 pp.

4.14 Tables and Figures

Table 4.1. Landings (tonnes) of kitefin shark *Dalatias licha* from Subareas 5 and 6.

Year	5.b	6.a	TOTAL
	France	UK	
2005		19.1	19.1
2006	1.30	25	26
2007		1.84	1.84
2008			
2009			
2010			
2011			
2012			
2013			
2014			
2015			
2016			
2017			
2018			
2019			
2020			
2021			
2022			
2023			
2024			

Table 4.2. Landings (tonnes) of kitefin shark *Dalatias licha* from Subarea 7.

Year	7.b			7.c		7.e-g	7.j-k			TOTAL
	France	UK	Ireland	UK	Ireland	France	UK	Germany	Ireland	
2005		0.37	0.02	11.3	4.6		58	21	2.6	99
2006			0.36	0.34	5.3		3.7		3	12.8
2007		0.34					2.27			2.6
2008										
2009										
2010	0.085					0.0037				0.089
2011										
2012										
2013										
2014										
2015										
2016										
2017										
2018						0.3				0.3
2019										
2020										
2021										
2022										
2023										
2024										

Table 4.3. Landings (tonnes) of kitefin shark *Dalatias licha* from Subarea 8.

Year	8.a	8.b	8.c		8.d	8.e	TOTAL
	France	France	France	UK	UK	UK	
2005		1.06					1.06
2006	0.48	1.38	0.1	0.69	0.074	1.475	4.2
2007		0.95	0.0142		0.23		1.19
2008		0.85					0.5
2009	0.00125	0.18					0.181
2010		0.42					0.42
2011		0.59	0.072				0.66
2012		0.0055					0.0055
2013		0.0033					0.0033
2014	0.0057	0.023					0.028
2015							
2016	0.018	0.143					0.161
2017		0.0062					0.0062
2018	0.026	0.065					0.091
2019		0.03					0.03
2020							
2021							
2022							
2023		0.058					0.058
2024							

Table 4.4. Landings (tonnes) of kitefin shark *Dalatias licha* from Subarea 9.

Year	9.a	9.b	TOTAL
	Portugal	UK	
2005	3.2		3.2
2006	6.5	4.2	10.7
2007	2.5		2.5
2008	1.08		1.08
2009	1.1		1.1
2010	0.079		0.079
2011	0.164		0.164
2012	0.42		0.42
2013	0.003		0.003
2014	0.006		0.006
2015			
2016	0.133		0.133
2017	0.055		0.055
2018	0.062		0.062
2019	0.009		0.009
2020	0.027		0.027
2021			
2022			
2023			
2024			

Table 4.5. Landings (tonnes) of kitefin shark *Dalatias licha* from Subarea 10.

Year	10.a	Unallocated	TOTAL
	Portugal	Ireland	
2005	14.3	0.44	14.8
2006	9.6		9.6
2007	6.5		6.5
2008	9.6		9.6
2009	6.3		6.3
2010	1.92		1.92
2011			
2012			
2013			
2014			
2015			
2016			
2017			
2018			
2019			
2020			
2021			
2022			
2023			
2024			

Table 4.6. Landings (tonnes) of kitefin shark *Dalatias licha* from unallocated ICES Subarea.

Year	France	TOTAL
2005		
2006		
2007		
2008		
2009		
2010	1.2	1.2
2011		
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		

Table 4.7. Relative abundance (number per hour trawling) of kitefin shark *Dalatias licha* from Scottish deep-water survey (depth range 500–1000 m: Only one fish has been caught outside this core depth range) in Subarea 6.

Year	Nº hauls	Nº positive hauls	Nº fish	Mean Nph
1998	17	2	2	0.05
2000	13	0	0	0.00
2002	16	2	4	0.13
2004	14	2	2	0.07
2005	13	1	4	0.15
2006	20	3	8	0.20
2007	15	2	7	0.23
2008	20	3	5	0.13
2009	27	1	1	0.06
2011	15	1	1	0.07
2012	18	0	0	0.00
2013	11	1	1	0.09

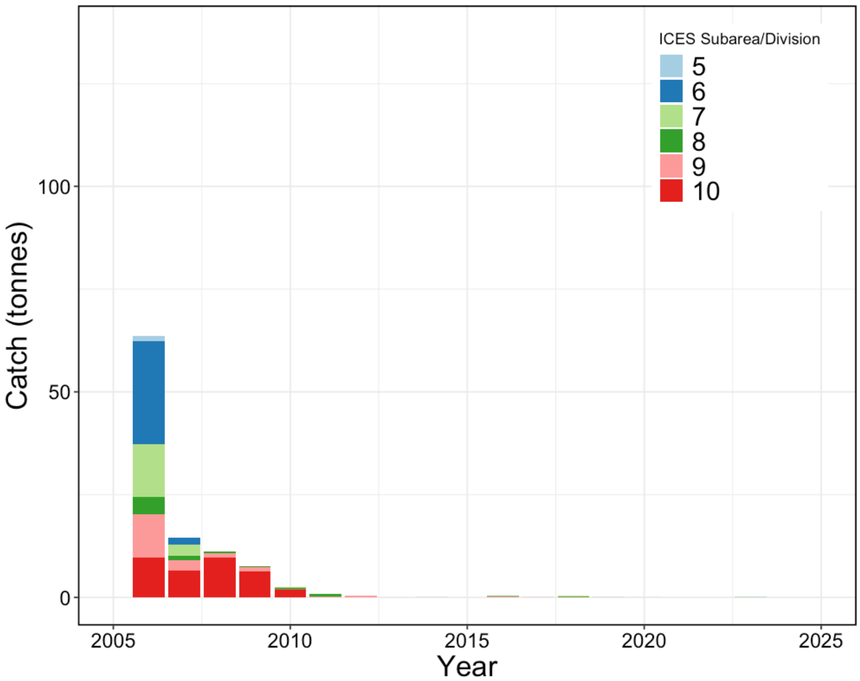


Figure 4.1. Stacked barchart of reported landings (tonnes) of kitefin shark *Dalatias licha* by ICES Subarea.

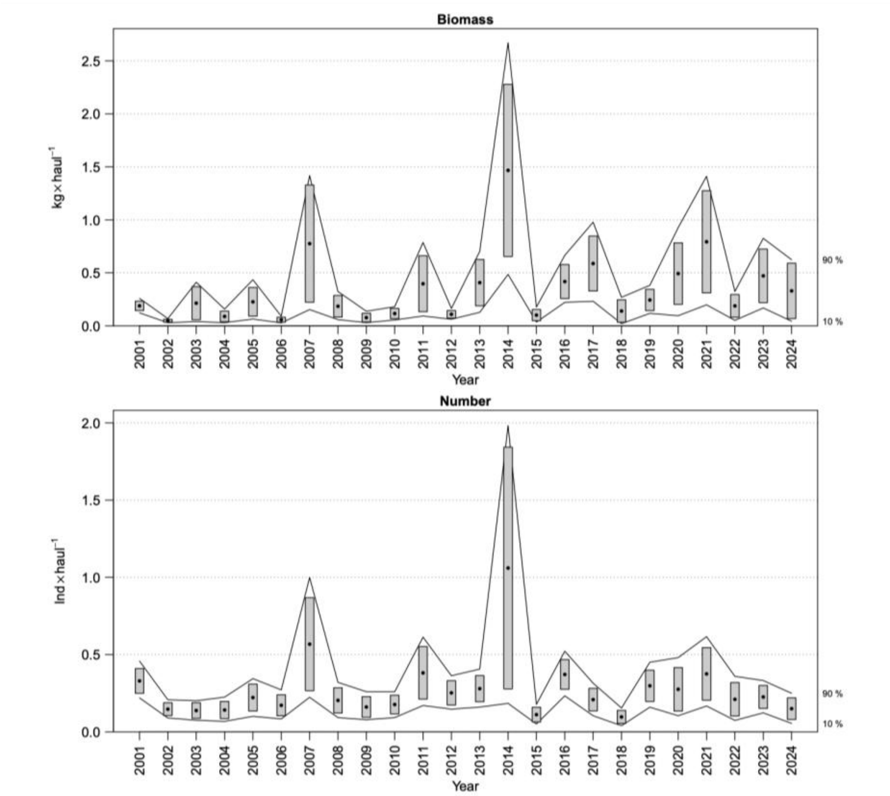


Figure 4.2. Relative abundance of kitefin shark *Dalatias licha* in weight (kg/haul) and number from the Spanish groundfish survey on the Porcupine bank. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000). Source: Ortiz *et al.* (2025 WD).

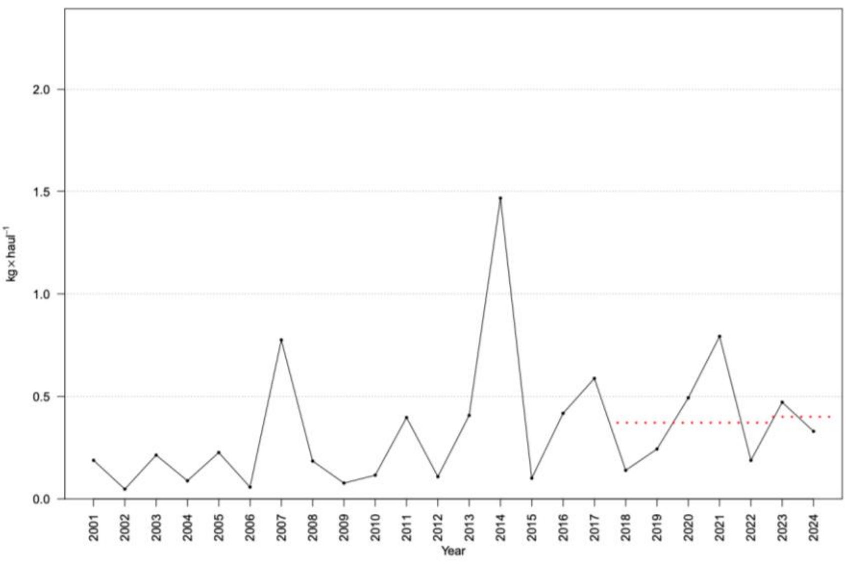


Figure 4.3. Evolution in kitefin shark *Dalatias licha* biomass index in Porcupine surveys (2001–2023). Dotted red lines compare mean stratified biomass in the last two years (2023–2024) with the five previous years (2018–2022). Source: Ortiz *et al.* (2025 WD).

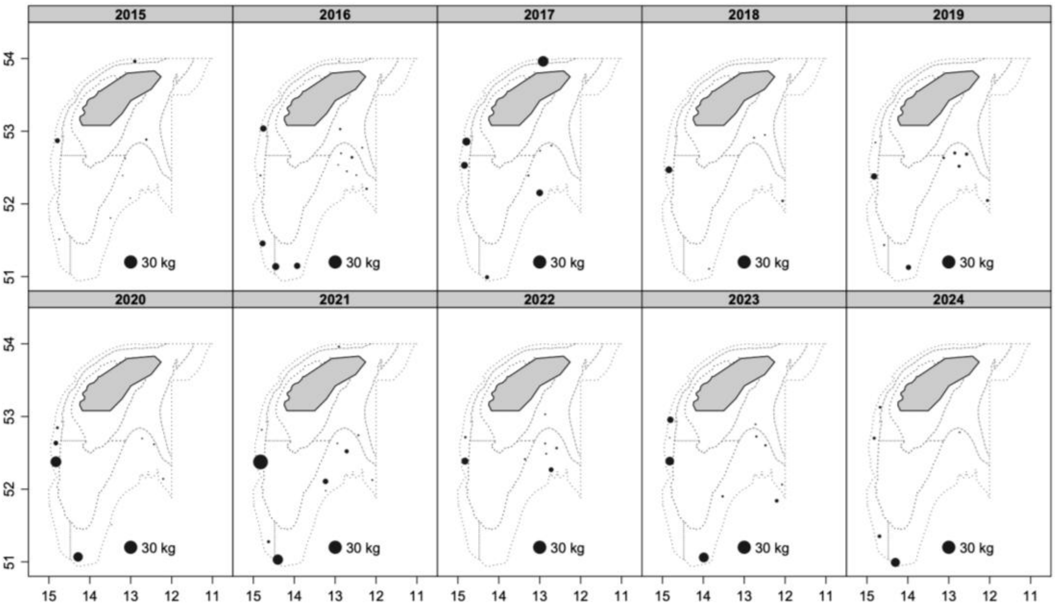


Figure 4.4. Annual (2014–2024) spatial distribution of kitefin shark *Dalatias licha* (kg/30 min haul^{-1}) on the Porcupine bank survey. Source: Ortiz *et al.* (2025 WD).

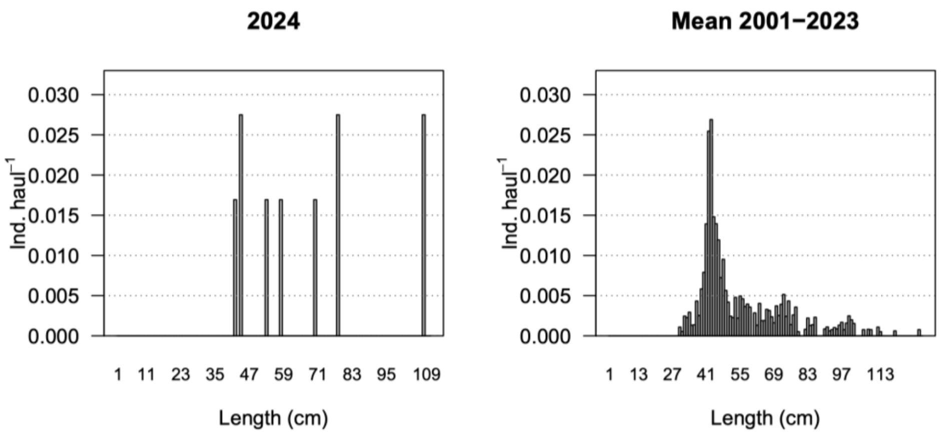


Figure 4.5. Annual length composition of kitefin shark *Dalatias licha* from the Spanish groundfish survey on the Porcupine Bank. Source: Ortiz *et al.* (2025 WD).

5 Other deep-water sharks and skates from the Northeast Atlantic (ICES subareas 4–14)

5.1 Stock distributions

This section includes information about deep-water elasmobranch species other than Portuguese dogfish and leafscale gulper shark (see Section 3), kitefin shark (see Section 4) and Greenland shark (see Section 24). Limited information exists on the majority of the deep-water elasmobranchs considered here, and the stock units for these species are unknown.

The species and generic landing categories for which data are presented are: gulper sharks *Centrophorus* spp., birdbeak dogfish *Deania calceus*, longnose velvet dogfish *Centroscymnus crepidater*, black dogfish *Centroscyllium fabricii*, lanternsharks *nei Etmopterus* spp. Historical catches of knifetooth dogfish *Scymnodon ringens*, arrowhead dogfish *Deania profundorum*, bluntnose sixgill shark *Hexanchus griseus*, mouse catshark *Galeus murinus,* velvet belly lanternshark *Etmopterus spinax* and 'aiguillat noir' (which may include *C. fabricii, C. crepidater* and *Etmopterus* spp.) were also presented in the past reports (see ICES, 2018). Other deep-water sharks in the ICES area include: deep-water catsharks *Apristurus* spp., frilled shark *Chlamydoselachus anguineus*, great lanternshark *Etmopterus princeps* and sailfin roughshark (sharpback shark) *Oxynotus paradoxus.*

Fifteen species of skate (Rajidae) are known from deep water in the NE Atlantic: Arctic skate *Amblyraja hyperborea*, Jensen's skate *Amblyraja jenseni*, Krefft's skate *Malacoraja kreffti*, roughskin skate *Malacoraja spinacidermis*, deep-water skate *Rajella bathyphila*, pallid skate *Bathyraja pallida*, Richardson's skate *Bathyraja richardsoni*, Bigelow's skate *Rajella bigelowi*, round skate *Rajella fyllae*, Mid-Atlantic skate *Rajella kukujevi*, spinytail skate *Bathyraja spinicauda*, sailray *Rajella lintea*, blue pygmy skate *Neoraja caerulea* and Iberian pygmy skate *Neoraja iberica*.

Species such as common skate complex, Norwegian skate *Dipturus nidarosiensis*, shagreen skate *Leucoraja fullonica*, starry ray *Amblyraja radiata* and longnose skate *Dipturus oxyrinchus* also distributed in shallower waters down to 500 m and are not considered in this section. The electric ray *Torpedo nobiliana* may also occur in deep waters.

Eight species of rabbitfish (Chondichthyes; Holocephali), including members of the genera *Chimaera, Hariotta* and *Rhinochimaera* are a bycatch of some deep-water fisheries and are sometimes marketed. The current zero-TACs for deep-water sharks, whose livers were used to extract squalene, may have led to the increased retention of rabbitfish, particularly common chimaera *Chimaera monstrosa* in Norway to produce "ratfish oil". Catches of Chimaeridae are included in the report of the ICES Working Group on the Biology and Assessment of Deep-sea Fisheries Resources (WGDEEP).

5.2 The fishery

5.2.1 History of the fishery

Most species of other deep-water shark and skate species are taken as by-catch in mixed trawl, longline and gillnet fisheries together with Portuguese dogfish, leafscale gulper shark, kitefin shark and deep-water teleosts.

5.2.2 The fishery in 2024

Deep-water elasmobranch species are usually taken as bycatch in mixed fisheries. Regulations in place (see below) for deep-water sharks' and difficulties in monitoring limit the information available for this group of species.

5.2.3 ICES advice applicable

No species-specific advice is given for the shark and skate species considered in this section.

5.2.4 Management applicable

The EU TACs that have been adopted for deep-sea sharks in European Community waters, UK 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)* (5)
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)
2012-2016	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
2021-2025(6)	---	---	---

(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.

(5) Recent studies demonstrated that there is not enough scientific support to discriminate *Deania hystricosa* from its congener *Deania calceus*; they are likely the same species (Rodríguez-Cabello *et al.*, 2020; Stefanni *et al.*, 2021)

(6) Some species included in the prohibited list of the TAC regulations

Since 2013, the deep-sea shark list includes the following species (Council Regulation (EU) 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 calceus*; 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*.

In 2025, the black mouth dogfish (*Galeus melastomus*) was again included in the list of deep-water sharks for which the EU regulations apply (Council Regulation (EU) 2025/202). The species is not considered in this section but in section 25 (Catsharks).

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., *Chlamydoselachus anguineus, Deania calceus, Galeus melastomus, Galeus murinus, Hexanchus griseus, Etmopterus spinax, Oxynotus paradoxus, Scymnodon ringens* and *Somniosus microcephalus*.

Since 2015, the birdbeak dogfish (*D. calcea*) and the great lanternshark (*E. princeps*) 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 (EU) 2015/104).

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 (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 and 7 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 in 2017–2018 and 2019–2020, respectively. 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.

Since 2021 there is a prohibition to fish, to retain on board, to tranship, to relocate or to land deep-water sharks species from the EU list (including some considered in this chapter). In its last version, the regulation applies to Union, United Kingdom and international waters of ICES zones 1, 2 (except United Kingdom waters of division 2a), 5 to 10, 12 and 14, and CECAF areas 34.1.1, 34.1.2 and 34.2, as well as Union and United Kingdom waters of ICES division 2a and subarea 4 (Council Regulation (EU) 2025/202).

EU regulations in force for some deep-water fisheries likely contributed to the reduction of the deep-water sharks fishing mortality. 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 (EU) 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 (EU) 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 (Council Regulation (EU) 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.

Since 2016, fishing with bottom trawls was permitted only < 800 metres (Council Regulation (EU) 2016/2336) in order to mitigate the potential damaging impacts of bottom trawling at these depths.

5.3 Catch data

The distribution of many of these species extends into the NEAFC Regulatory Areas, but the respective catches in the area cannot be determined.

5.3.1 Landings

Landings estimates from 2005 onwards were revised following WKSHARK2 (updated in WGEF 2018). Information, by species, is presented below. Past information is presented in ICES (2018). Due to the management measures in force for deep-water sharks, landings in 2024 continued to be low (Tables 5.1–5.7).

Gulper sharks *Centrophorus* spp. (excluding *C. squamosus*)

WGEF landings estimates of gulper sharks are presented in Tables 5.1 and 5.7.

No landings were reported in 2024 for gulper sharks (*Centrophorus* spp).

Birdbeak dogfish *Deania calceus*

WGEF landings estimates of birdbeak dogfish are presented in Tables 5.2 and 5.7.

In 2024, landings of 70 kg were reported by Norway.

Longnose velvet dogfish *Centroscymnus crepidater*

WGEF landings estimates of longnose velvet dogfish are presented in Tables 5.3 and 5.7.

No landings were reported in 2024 for this species.

Black dogfish *Centroscyllium fabricii*

Reported landings of black dogfish are presented in Tables 5.4 and 5.7.

In 2024, Iceland reported landings of 1.4 t for this species.

Lanternsharks *Etmopterus* spp.

Reported landings of velvet belly lanternshark *Etmopterus spinax* are presented in Table 5.5 until 2004. Revised landing data provided to WGEF from 2005 onwards indicates that landings assigned to *E. spinax* should be considered as *Etmopterus* spp. Those figures are provided in Tables 5.6 and 5.7.

In 2024, Norway reported *E. spinax* landings of 664 tonnes.

Catches of this species by Russian deep-water longline fisheries in the Faroese Fishing Zone and other North-eastern Atlantic areas were reported in working documents to WGEF (Vinnichenko and Fomin, 2009 WD; Vinnichenko *et al*., 2010 WD). Landings data from this fishery were not subsequently available to the working group.

Other species

There are landings information for other deep-water shark species, presented in Table 5.7. Other reported landings are sporadic and very low and thus were not presented.

5.3.2 Discards

Given the restrictive EU TACs for deep-water sharks (set to zero in 2010) and current prohibition, it was admitted that the discarding in deep-water fisheries had increased. However, with several EU regulations in place, particularly the ban of gillnet, entangle and trammel net fisheries at depths >600 m and trawl deep-water fisheries at depths >800 m, the potential bycatch and subsequent discarding of deep-water sharks is now thought to be relatively low. Since 2010, that discard information is limited to some years and countries.

Historical discards from Portugal (Azores and mainland) and Spain are available in ICES (2018).

Ireland: Discard data from Ireland are available from 2009 to 2020 and in 2024 from the trawl fleet operating in ICES divisions 27.6.a and 27.7.bgj and for different species (Table 5.8). Discards are considered negligible as values estimated are <1 tonne in most of the years.

Denmark: Discard data from *E. spinax* is available from 2009 to 2017 (Table 5.8). This species is mostly discarded by the trawl fleet from areas 27.3.a, 27.4.a and 27.4.b. Discards varied among years but has remained around 5–6 tonnes in 2016 and 2017.

Sweden: Discard data from *E. spinax* is available for 2019 and 2022 to 2024 (Table 5.8). In 2024, 1.8 tonnes were reported from trawlers.

Spain: Discard estimates for *B. spinicauda* taken by the trawl fleet operating in ICES divisions 27.1b and 27.2b were submitted for 2024 (22 tonnes).

5.3.3 Quality of the catch data

Data provided to WGEF since 2017 followed WKSHARK2 guidelines. Despite the decisions taken regarding the assignment of landings to species or higher *taxa* some problems persist. For example, some quantities of deep-water species are maintained grouped in generic categories such as "sharks indetermined", "unidentified deepwater sharks" or "Squaliformes".

As a result of restrictive quotas for deep-water sharks, landings of these species may have been misreported.

5.3.4 Discard survival

No data available to the Working Group.

5.4 Commercial catch composition

No new information is available.

5.5 Fishery-independent surveys

5.5.1 ICES Subarea 6

The Scottish deep-water trawl survey has operated since 1996 at depths of 300–2000 m along the continental slope between approximately 55˚N and 59˚N (see Neat *et al.*, 2010 for details). Since 2013 that the survey takes place every two years. Neat *et al*. (2015) analysed catches of deep-water elasmobranch species from Scottish deep-water trawl survey. This information is available in past reports (e.g., ICES, 2018).

5.5.2 ICES Subarea 7

The Spanish survey on the Porcupine Bank (SpPGFS-WIBTS-Q4) in ICES divisions 7.c and 7.k covers an area from longitude 12°W to 15°W and from latitude 51°N to 54°N following the standard IBTS methodology for the western and southern areas (ICES, 2010). A random stratified sampling design is used (Velasco and Serrano, 2003) with two geographical sectors (North and South) and three depth strata (<300 m, 300–450 m and 450–800 m). Haul allocation is proportional to the strata area following a buffered random sampling procedure (as proposed by Kingsley *et al*., 2004) to avoid the selection of adjacent 5×5 nm rectangles. More details on the survey design and methodology are presented in ICES (2017). Results for 2024 are presented in Ortiz *et al*. (2025 WD). In the 2024 survey, only 67 of the 80 hauls were conducted, due to the vessel breakdown. As a result of this breakdown the south-eastern sector could not be completed. The most abundant deep-water shark species in biomass in these surveys were *D. calceus* (birdbeak dogfish), *S. ringens* (knifetooth dogfish), *E. spinax* (velvet belly lantern shark) and *H. griseus* (bluntnose sixgill shark). Length distributions for these species are presented in the working document presented to WGEF (see Ortiz *et al*., 2025 WD).

5.5.3 ICES divisions 8.c and 9.a

From 2015 to 2023, AZTI conducted a deep-water longline survey (PALPROF) along the Basque Coast (600–2400 m deep) onboard a commercial longliner, with the objective of estimating and assessing the inter-annual variation of the abundance and biomass indices of the deep-water sharks and other ichthyofauna (see details in Diez *et al*., 2025 WD; Diez *et al.* 2021). More information is presented in Section 3.9.2. from Section 3 (3. Deep-water sharks; Leafscale gulper shark and Portuguese dogfish in the Northeast Atlantic (subareas 4–14)).

The Spanish survey in the Cantabrian Sea and Galician waters (SpGFS-WIBTS-Q4) has covered this area annually since 1983 (except 1987), obtaining abundance indices and length distributions for the main commercial species and elasmobranchs. A new vessel (R/V Miguel Oliver) is in use since 2013, but in 2021, due to the vessel breakdown the survey was also partially conducted in R/V Vizconde de Eza, using the same gear. More details on the survey design, methodology and results can be found in ICES (2017). Elasmobranchs represented 14% of the total fish caught in the survey in 2024 (Fernández-Zapico *et al*., 2025 WD). Length distributions for the most abundant species are presented in the working document presented to WGEF (see Fernández-Zapico *et al*., 2025 WD).

5.5.4 ICES Subarea 10

Data from the Azorean bottom longline survey (ARQDAÇO-L6563) in subdivision 10.a2 were given in Pinho and Silva (2017 WD) and Santos et al. (2020). *Deania* spp. were the most representative (abundant) species in the survey. *Centroscymnus crepidater* was common, but much less abundant. Other species occurred in very low numbers (averaging 1–4 individuals per year). Depth ranges and length composition data are available. It should be noted that the gear configuration used is not adequate for sampling all the species (Pinho and Silva, 2017 WD).

5.6 Life-history information

See ICES (2018) for further details.

5.7 Exploratory assessments analyses of relative abundance indices

The exploratory assessments below are all based on analyses of relative abundance or biomass indices in fishery-independent surveys.

Information previously submitted to WGEF for the black dogfish *C. fabricii,* the longnose velvet dogfish *C. crepidater,* the greater lantern shark *E. princeps,* the small-eye catshark *A. microps,* the pale catshark *A. aphyodes* and other deep-water skates and rays are presented in ICES (2018).

5.7.1 Summary of occurrences and trends by species

Birdbeak dogfish *Deania calceus* and Arrowhead dogfish *Deania profundorum*

In the Spanish Porcupine survey (SpPGFS-WIBTS-Q4) time series, these two species were traditionally registered together, but have been better separated since 2012. The biomass and abundance index of *Deania calceus* peaked in 2014 and 2016 and decreased in the following years. In 2023 the biomass value remained among the average values of the time series (Figure 5.1). The biomass and abundance of *D. profundorum* in this survey is low (Ortiz *et al.*, 2025 WD).

In the SpGFS-WIBTS-Q4 in the Cantabrian Sea and Galician waters, both species are more frequent in additional deeper hauls (>500 m) and scarce or absent on the standard hauls (70–500 m) (Figure 5.2). Biomass values are, however, low for both species. After two years without records, *Deania calceus* has been caught since 2019. In 2024, the biomass caught of *D. profundorum* decreased in 2024 (Fernández-Zapico *et al.*, 2025 WD).

Deania calceus has been frequently caught in the PALPROF survey in ICES Division 8.c (2015–2024; Diez *et al.*, 2025 WD). The CPUE values are variable but show a decrease in biomass since 2022 (Figure 5.3).

Knifetooth dogfish *Scymnodon ringens*

In SpPGFS-WIBTS-Q4, the biomass of *S. ringens* decreased in 2024, to levels similar to 2022 and higher than the minimum values observed in the early 2000´s (Figure 5.4) (Ortiz *et al.*, 2025 WD).

Biomass values of this species in the SpGFS-WIBTS-Q4 survey in the Cantabrian Sea and Galician waters are low. This species is mostly caught in the additional deeper hauls (Figure 5.5) (Fernández-Zapico *et al.*, 2025 WD).

The species is caught irregularly in the PALPROF survey (Diez *et al.*, 2025 WD).

Velvet belly lanternshark *Etmopterus spinax*

In the SpPGFS-WIBTS-Q4, the biomass values of *E. spinax* have been fluctuating throughout the time series without any trend (Figure 5.6; Ortiz *et al.*, 2025 WD).

In the SpGFS-WIBTS-Q4 survey in the Cantabrian Sea and Galician waters the biomass of *E. spinax* in standard hauls decreased to the lowest value since 2016 (Figure 5.7). However, the highest fraction of the biomass of this elasmobranch is usually found in hauls deeper than 500 m. In these additional deep hauls, the biomass caught by haul increased in latest years (Fernández-Zapico *et al*., 2025 WD).

Bluntnose six-gill shark *Hexanchus griseus*

This is not a frequent shark in the SpPGFS-WIBTS-Q4 and results should be considered with caution. Abundance and biomass of *H. griseus* are presented in Figure 5.8 (Ortiz *et al*., 2025 WD).

Hexanchus griseus is not frequent in the SpGFS-WIBTS-Q4 and results should be considered with caution. In 2024, the biomass of *H. griseus* in standard was similar to the value registered in 2023, which is among the highest of the time series (Figure 5.9). Very few individuals are caught in the deep hauls (Fernández-Zapico *et al*., 2025 WD).

The species is caught irregularly in the PALPROF survey (Diez *et al*., 2025 WD).

Other deep-water elasmobranchs

In the 2024 SpPGFS-WIBTS-Q4, there are also records of *Centroscymnus crepidater, Apristurus laurussonii, Apristurus manis, Apristurus melanoasper, Galeus murinus, Centroscyllium fabricii, Oxynotus paradoxus, Neoraja caerulea and Rajella fyllae* (Ortiz *et al*., 2025 WD). These species are usually found outside the standard stratification, in the deep hauls of the Porcupine Seabight.

In 2024, the SpGFS-WIBTS-Q4 also recorded *Heptranchias perlo* (Fernández-Zapico *et al*., 2025 WD).

Centroscymnus crepidater and *Etmopterus princeps* were regularly caught in the PALPROF survey in ICES Subdivision 8.c and CPUE data is available for the period 2015–2024 (Figure 5.3; Diez *et al*., 2025 WD). In this survey, other less frequent species are *Centrophorus granulosus*, *Etmopterus pusillus* and *Pseudotriakis microdon*.

5.8 Stock assessment

No formal assessments are undertaken for these stocks.

5.9 Quality of assessments

No formal assessments are undertaken for these stocks.

5.10 Reference points

No reference points have been proposed for any of the species.

5.11 Conservation considerations

The European Red List of marine fishes considers *C. granulosus* to be Critically Endangered, *Echinorhinus brucus* and *D. calceus* as Endangered; and *Centrophorus uyato* and *Oxynotus centrina* as Vulnerable (Nieto *et al*., 2015).

IUCN assessments for a group of deep-water sharks classified *C. crepidater*, *D. profundorum*, *D. calceus* and *H. griseus* as globally Near Threatened, *S. ringens* as globally Vulnerable, *C. granulosus*, *C. uyato* and *E. brucus* as globally Endangered. All these species were considered to have their populations stable or increasing in the NE Atlantic (Finucci *et al*. 2020a-h).

The gulper shark is included in the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) List of Threatened and/or Declining Species & Habitats (OSPAR, 2008).

5.12 References

Diez, G., L., Basterretxea, M., Cuende, E., Mugerza, A., Zumeta, X., Mendizabal, A. 2025. Abundance, biomass and CPUE of deep-water sharks in the longline survey (PALPROF) in the Bay of Biscay (ICES 8.c). Update from 2015 to 2024. Working Document presented to ICES WGEF 2025, 11 pp.

Diez, G., Arregi, L., Basterretxea, M., Cuende, E., Oyarzabal, I. 2021. Preliminary observations on abundance and distribution of fish fauna in a canyon of the Bay of Biscay (ICES Division 8c). Journal of the Marine Biological Association of the United Kingdom, 101, 169-178, https://doi.org/10.1017/S0025315420001265

Fernandez-Zapico, O., Ruiz-Pico, S., Blanco, M., Rodriguez-Cabello, C., Ortiz, P., González-Irusta, J.M., Punzón, A., Velasco, F., 2025. Results on main elasmobranch species captured in the 2024 Northern Spanish Shelf Groundfish Survey. ICES Working Group on Elasmobranch Fishes, 24-28 June 2025, Hafnarfjörður, Iceland. https://doi.org/10.20350/digitalCSIC/17297.

Finucci, B., Bineesh, K.K., Cheok, J., Cotton, C.F., Dharmadi, Kulka, D.W., Neat, F.C., Pacoureau, N., Rigby, C.L., Tanaka, S. and Walker, T.I. 2020a. *Centrophorus granulosus*. The IUCN Red List of Threatened Species 2020: e.T162293947A2897883.
https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T162293947A2897883.en

Finucci, B., Bineesh, K.K., Cotton, C.F., Dharmadi, Kulka, D.W., Neat, F.C., Pacoureau, N., Rigby, C.L., Tanaka, S. and Walker, T.I. 2020b. *Centrophorus uyato*. The IUCN Red List of Threatened Species 2020: e.T41745A124416090. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T41745A124416090.en.

Finucci, B., Cheok, J., Cotton, C.F., Kulka, D.W., Neat, F.C., Pacoureau, N., Rigby, C.L., Tanaka, S. and Walker, T.I. 2020c. *Centroselachus crepidater*. The IUCN Red List of Threatened Species 2020: e.T46864A68615502. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T46864A68615502.en.

Finucci, B., Cheok, J., Cotton, C.F., Kulka, D.W., Neat, F.C., Pacoureau, N., Rigby, C.L., Tanaka, S. and Walker, T.I. 2020d. *Deania calcea*. The IUCN Red List of Threatened Species 2020: e.T41798A68619155. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T41798A68619155.en

Finucci, B., Cheok, J., Cotton, C.F., Kulka, D.W., Neat, F.C., Rigby, C.L., Tanaka, S. and Walker, T.I. 2020e. *Deania profundorum*. The IUCN Red List of Threatened Species 2020: e.T161551A44016720. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T161551A44016720.en.

Finucci, B., Bineesh, K.K., Cheok, J., Cotton, C.F., Kulka, D.W., Neat, F.C., Pacoureau, N., Rigby, C.L., Tanaka, S. and Walker, T.I. 2020f. *Echinorhinus brucus*. The IUCN Red List of Threatened Species 2020: e.T41801A2956075. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T41801A2956075.en.

Finucci, B., Barnett, A., Bineesh, K.K., Cheok, J., Cotton, C.F., Dharmadi, Graham, K.J., Kulka, D.W., Neat, F.C., Pacoureau, N., Rigby, C.L., Tanaka, S. and Walker, T.I. 2020g. *Hexanchus griseus*. The IUCN Red List of Threatened Species 2020: e.T10030A495630. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T10030A495630.en.

Finucci, B., Cheok, J., Cotton, C.F., Kulka, D.W., Neat, F.C., Pacoureau, N., Rigby, C.L., Tanaka, S. and Walker, T.I. 2020h. *Scymnodon ringens*. The IUCN Red List of Threatened Species 2020: e.T161717A116739828. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T161717A116739828.en.

ICES. 2018. Report of the Working Group on Elasmobranch Fishes (WGEF), 19–28 June 2018, Lisbon, Portugal. ICES CM 2018/ACOM:16. 1306 pp.

Kingsley, M.C.S., Kanneworff, P., and Carlsson, D.M. 2004. Buffered random sampling: a sequential inhibited spatial point process applied to sampling in a trawl survey for northern shrimp *Pandalus borealis* in West Greenland waters. ICES Journal of Marine Science, 61: 12–24.

Neat, F. C., Kynoch, R.J., Drewery, J. and Burns, F. 2010. Deepwater survey manual. Marine Scotland Science: http://www.scotland.gov.uk/Resource/Doc/295194/0103756.pdf.

Neat, F. C., Burns, F., Jones, E. and Blasdale, T. 2015. The diversity, distribution and status of deep-water elasmobranchs in the Rockall Trough, north-east Atlantic Ocean. Journal of Fish Biology, 87: 1469–1488.

Nieto, A., Ralph, G. M., Comeros-Raynal, M. T., Kemp, J., Garcia Criado, M., et al. 2015. European Red List of marine fishes. Luxembourg: Publications Office of the European Union.

Ortiz, P., Fernández-Zapico, O., Ruiz-Pico, S., Blanco, M., Martínez-Vázquez, J.M., Rodríguez-Cabello, C., Velasco, F., Baldó, F. (2025). Results on main elasmobranch species from the 2024 Spanish Groundfish Survey on the Porcupine Bank (NE Atlantic). ICES Working Group on Elasmobranch Fishes, 24-28 June 2025, Hafnarfjörður, Iceland. https://doi.org/10.20350/digitalCSIC/17296./

OSPAR. 2008. Case Reports for the OSPAR List of threatened and/or declining species and habitats. Biodiversity Series. 261 p.

Pinho, M.R. and Silva, H. 2017. Resuming elasmobranchs survey data from the Azores (ICES 27.10a). Working Document presented to ICES WGEF WD2017-11; 18 pp.

Rodríguez-Cabello, C., Pérez, M. and Grasa, I. 2020. Taxonomic research on *Deania calcea* and *Deania profundorum* (Family: Centrophoridae) in the Cantabrian Sea (Northeast Atlantic) with comments on *Deania hystricosa*. Regional Studies in Marine Science 37. https://doi.org/10.1016/j.rsma.2020.101321

Santos, R., Novoa-Pabon, A., Silva, H., Pinho, M. 2020. Elasmobranch species richness, fisheries, abundance and size composition in the Azores archipelago (NE Atlantic), *Marine Biology Research*, 16:2, 103-116. doi: 10.1080/17451000.2020.1718713

Stefanni, S., Catarino, D., Ribeiro, P.A., Freitas, M., Menezes, G.M., Neat, F. and Stankovic´, D. 2021. Molecular Systematics of the Long-Snouted Deep Water Dogfish (Centrophoridae, *Deania*) With Implications for Identification, Taxonomy, and Conservation. Front. Mar. Sci. 7:588192. doi: 10.3389/fmars.2020.588192

Velasco, F., and Serrano, A. 2003. Distribution patterns of bottom trawl faunal assemblages in Porcupine Bank: Implications for Porcupine surveys stratification design. Working Document presented to IBTSWG 2003; 19 pp.

Vinnichenko, V.I. and Fomin K. Yu. 2009. Russian research and fisheries of sharks and skates in the Northeast Atlantic in 2008. Working document presented to ICES WGEF 2009; 12 pp.

Vinnichenko, V.I., Dolgov, A.V. and A.S.Yurko. 2010. Russian Research and Fisheries of Sharks and Skates in the Northeast Atlantic in 2009. Working Document to ICES WGEF WD2010-14.

5.13 Tables and Figures

Table 5.1. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of gulper sharks (*Centrophorus granulosus* and *Centrophorus* spp.) in tonnes. Portuguese landings (1) are assigned to *Centrophorus* spp. (not *C. squamosus*) whereas Irish landings (2) are assigned to *C. granulosus*. Estimates from 2005 onwards were revised following WKSHARK2. Blank cells = no data; 0 = landings <0.5 t.

	UK	Portugal[1]	Spain	Ireland[2]	Total
1990		1056			1056
1991		801			801
1992		958			958
1993		886			886
1994		344			344
1995		423			423
1996		242			242
1997		291			291
1998		187			187
1999		95			95
2000		54			54
2001		96			96
2002		159	8		167
2003	643	203			846
2004	481	89			570
2005		49		14	64
2006		100			100
2007		62			62
2008		56			56
2009		17			17
2010		7			7
2011		2	0		2
2012		1			1
2013		0			0
2014		0			0
2015		0			0
2016		0			0
2017		2			2
2018		4			4
2019		0			0
2020		0.5			0.5
2021		0			0
2022		0			0
2023		0			0
2024					

Table 5.2. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of birdbeak dogfish (*Deania calceus*), in tonnes. Estimates from 2005 onwards were revised following WKSHARK2. Blank cells = no data; 0 = landings <0.5 t.

	Ireland	Spain	UK	France	Portugal	Norway	Total
1990							
1991							
1992							
1993							
1994							
1995							
1996							
1997							
1998							
1999							
2000					13		13
2001			1		37		38
2002		5	+		67		72
2003			3		72		75
2004			38		157		195
2005			50		146		195
2006			22		75		96
2007					37		37
2008				5	57		62
2009				2	22		25
2010				+	3		3
2011					1		1
2012	2				1		3
2013					0	0	0
2014						0	0
2015					0	0	0
2016						0	0
2017					2	0	3
2018					1	0	1
2019					5	0	5
2020					2	0	2
2021						0	0
2022						0	0
2023						0	0
2024						0	0

Table 5.3. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of longnose velvet dogfish (*Centroscymnus crepidater*), in tonnes. Estimates from 2005 onwards were revised following WKSHARK2. Blank cells = no data; 0 = landings <0.5 t.

	France	Ireland	UK	Portugal	Spain	Total
1990						
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999	0		0			0
2000	0		0	1	85	86
2001	0		0	3	68	71
2002	13		0	4		17
2003	10		21	2		33
2004	8		7	1		16
2005	10		209	3		222
2006	4		409	7		420
2007	2	2	109	18		131
2008	4			33		37
2009	6			27		33
2010	40			0		40
2011						
2012						
2013						
2014				0		0
2015				0		0
2016	0			0		0
2017				1		1
2018				1		1
2019				1		1
2020				0		0
2021						
2022						
2023						
2024						

Table 5.4. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of black dogfish (*Centroscyllium fabricii*), in tonnes. Estimates from 2005 onwards were revised following WKSHARK2. Blank cells = no data; 0 = landings <0.5 t.

	France	Iceland	UK	Spain	Ireland	Total
1990						
1991						
1992		1				
1993						
1994						
1995		1				
1996		4				
1997						
1998						
1999	0					
2000	382			85		467
2001	395			91		486
2002	47	0				47
2003	90	0	0			90
2004	49	.	0			49
2005	12		5			17
2006	3					3
2007	6					6
2008	136					136
2009	99	1				101
2010	85	10				95
2011	0	1				1
2012	1	3				3
2013	0	1				1
2014	9	0				9
2015	0	2				2
2016	0	0				0
2017						0
2018						
2019						
2020		0				0
2021		0				0
2022		0				0
2023		0.5				0.5
2024		1.4			0	1.4

Table 5.5. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of velvet belly lanternshark (*Etmopterus spinax*), in tonnes. Blank cells = no data; 0 = landings <0.5 t.

	Norway	Denmark	Spain	France	Total
1990					
1991					
1992					
1993		27			27
1994		0			0
1995		10			10
1996		8			8
1997		32			32
1998		359			359
1999		128			128
2000		25			25
2001		52			52
2002			85		85
2003					
2004					

Table 5.6. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings of *Etmopterus* spp., in tonnes. Estimates from 2005 onwards were revised following WKSHARK2. Blank cells = no data; 0 = landings <0.5 t.

	Denmark	Norway	France	Spain	Portugal	UK	total
1990							
1991							
1992							
1993							
1994			846		0		846
1995			2388		0		2388
1996			2888		0		2888
1997			2150		0		2150
1998			2043				2043
1999			0				0
2000			0	38	0		38
2001			0	338			338
2002			0	99			99
2003			0				0
2004			0		0		0
2005	16			2	0	9	27
2006	17			27	0		44
2007	9			87		8	103
2008	46		0	6		20	72

	Denmark	Norway	France	Spain	Portugal	UK	total
2009			1	9			9
2010	4	9	2				15
2011		4	1	1*	0	0	5
2012		13	0	2*	0		13
2013		19	0			0	19
2014		47				0	47
2015		27	1		0	0	28
2016		59	0				59
2017		129	0				129
2018		106**				4**	110
2019		163**				7**	170
2020		171**					171
2021		117**				0.52**	118
2022		136**					136
2023		282**				0.50**	283
2024	0**	664**					664

*** assigned to *Etmopterus pusillus***
**** assigned to *Etmopterus spinax***

Table 5.7. Other deep-water sharks and skates from the Northeast Atlantic. Working Group estimates of landings by species since 2005, after revision following WKSHARK2 (in tonnes), (DWS = Unspecified deep-water sharks). Blank cells = no data; 0 = landings <0.5 t.

Species	Knifetooth dogfish	Arrowhead dogfish	Bluntnose sixgill shark	Mouse catshark	Unidentified DWS*
2005	65		13		110
2006	56		13		62
2007	161	1	54	0	111
2008	156		2	0	51
2009	36	0	5	3	37
2010	53	1	2	2	40
2011	2	2	2	5	42
2012	3	1	1	1	175
2013	0		2	4	89
2014	0		0	4	118
2015		0	1	2	85
2016			0	3	91
2017		1			131
2018					150
2019					168
2020			0		155
2021					
2022					
2023	32		0		
2024	15				78

*** Also allocated to "Squaliformes" and "unidentified deep-water squaloid sharks and dogfishes"**

Table 5.8. Other deep-water sharks and skates from the Northeast Atlantic. Discards estimates from Ireland and Denmark (in tonnes). Unspec. DWS = Unspecified deep-water sharks. Blank cells = no data.

	Ireland					Denmark	Sweden
	C. fabricii	*E. princeps*	*H. griseus*	*E. spinax*	Unspec. DWS	*Etmopterus* spp.	*Etmopterus spinax*
2009		0.97				23.49	

	Ireland					Denmark	Sweden
	C. fabricii	*E. princeps*	*H. griseus*	*E. spinax*	Unspec. DWS	*Etmopterus* spp.	*Etmopterus spinax*
2010	3.05					146.61	
2011		0.01				50.70	
2012		0.04				16.34	
2013						24.82	
2014						3.63	
2015	1.50	3.24				34.30	
2016	12.06	0.68		0.34	5.40	5.54	
2017	0.17					5.41	
2018			5.83	5.83			
2019				0.07			12.72
2020				1.07			
2021							
2022							2.37
2023							1.46
2024				2.7			1.82

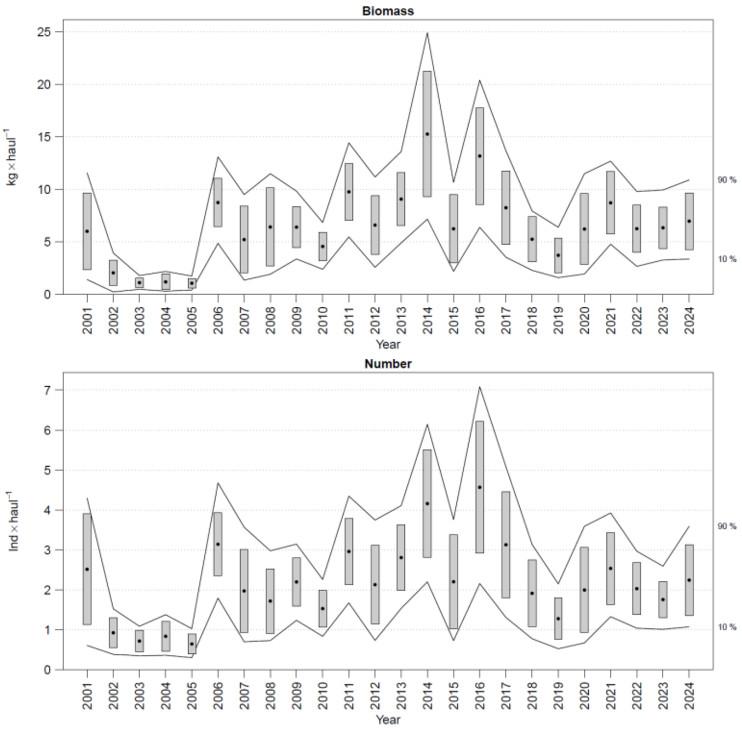


Figure 5.1. Other deep-water sharks and skates from the Northeast Atlantic. *Deania* spp., mainly birdbeak dogfish *Deania calceus* biomass index (kg haul^{-1}) from the Spanish Porcupine survey time-series (SpPGFS-WIBTS-Q4, 2001–2024). Boxes show parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000). From Ortiz *et al.* (2025 WD).

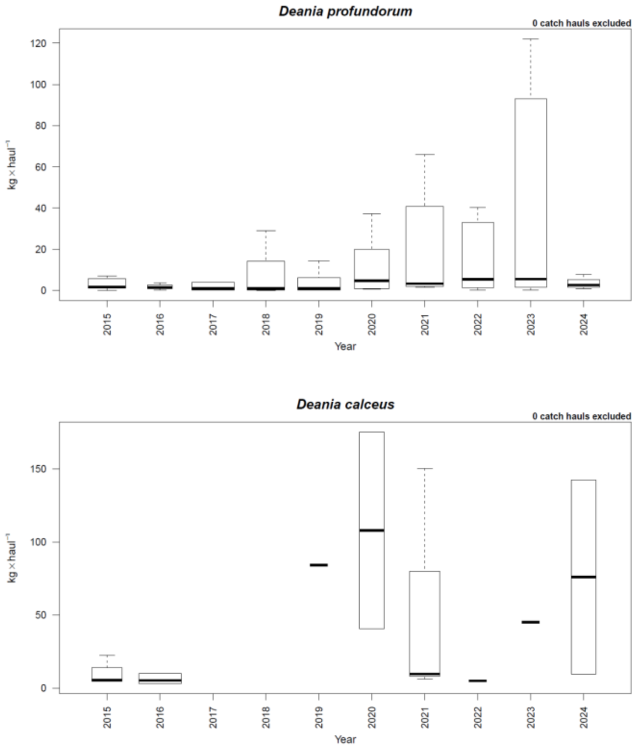


Figure 5.2. Other deep-water sharks and skates from the Northeast Atlantic. Evolution of *Deania profundorum* and *Deania calceus* catches in additional deep hauls during the North Spanish shelf bottom trawl survey time series (SpGFS-WIBTS-Q4, 2014–2024). Boxplots represent the median and interquartiles of the biomass catches in the deep hauls performed. Confidence intervals are estimated only when there are two or more hauls with catch of the species. From Fernández-Zapico *et al*. (2025 WD).

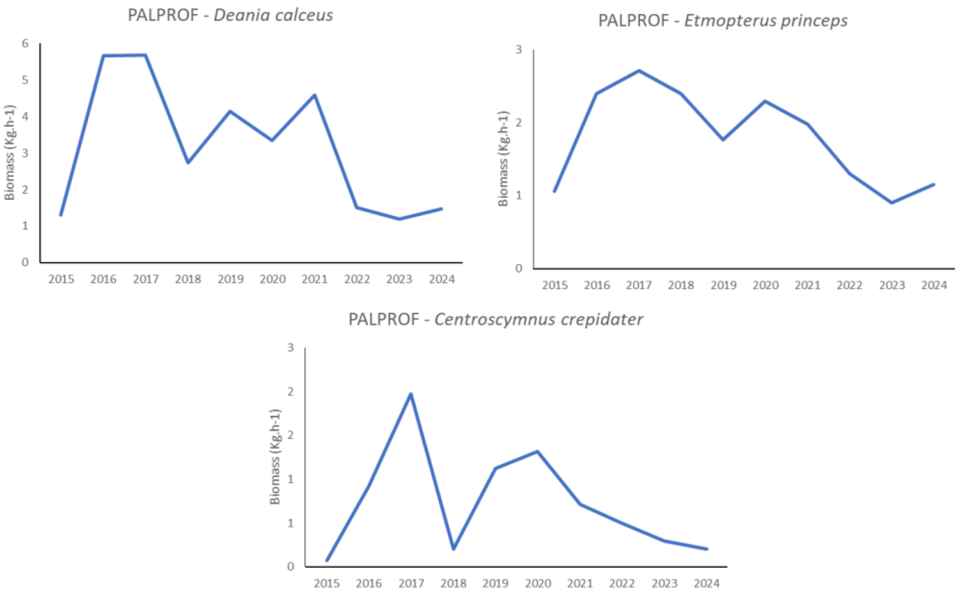


Figure 5.3. Other deep-water sharks and skates from the Northeast Atlantic. CPUE of *Deania calceus*, *Etmopterus princeps* and *Centroscymnus crepidater* caught by the PALPROF survey conducted in the coast along the Basque Country in the period 2015–2024. From Diez *et al*. (2025 WD).

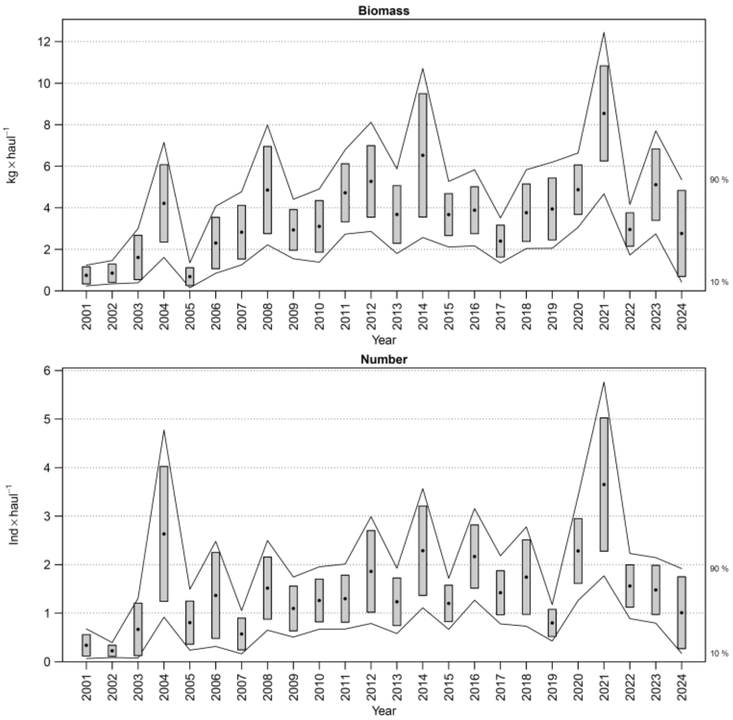


Figure 5.4. Other deep-water sharks and skates from the Northeast Atlantic. Knifetooth dogfish *Scymnodon ringens* biomass index (top, kg haul^{-1}) and abundance index (bottom, numbers). Haul in the Spanish Porcupine survey time-series (SpPGFS-WIBTS-Q4, 2001–2024). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000). From Ortiz *et al.* (2025 WD).

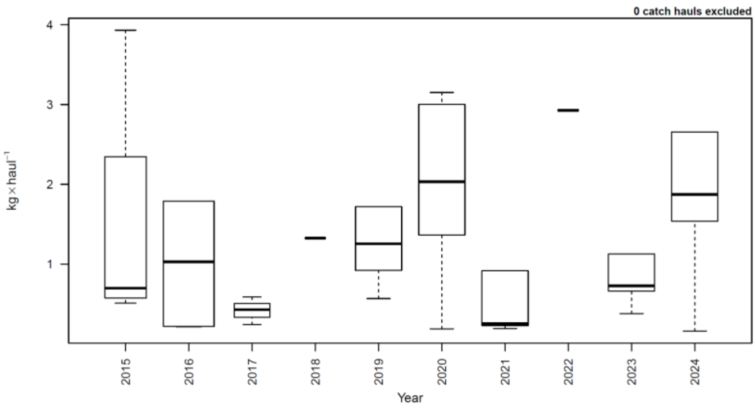


Figure 5.5. Other deep-water sharks and skates from the Northeast Atlantic. Evolution of *Scymnodon ringens* catches in additional deep hauls during the North Spanish shelf bottom trawl survey (SpGFS-WIBTS-Q4, 2014–2025). Boxplots represent the median and interquartiles of the biomass catches in the deep hauls performed. Confidence intervals are estimated only when there are two or more hauls with catch of the species. From Fernández-Zapico *et al.* (2025 WD).

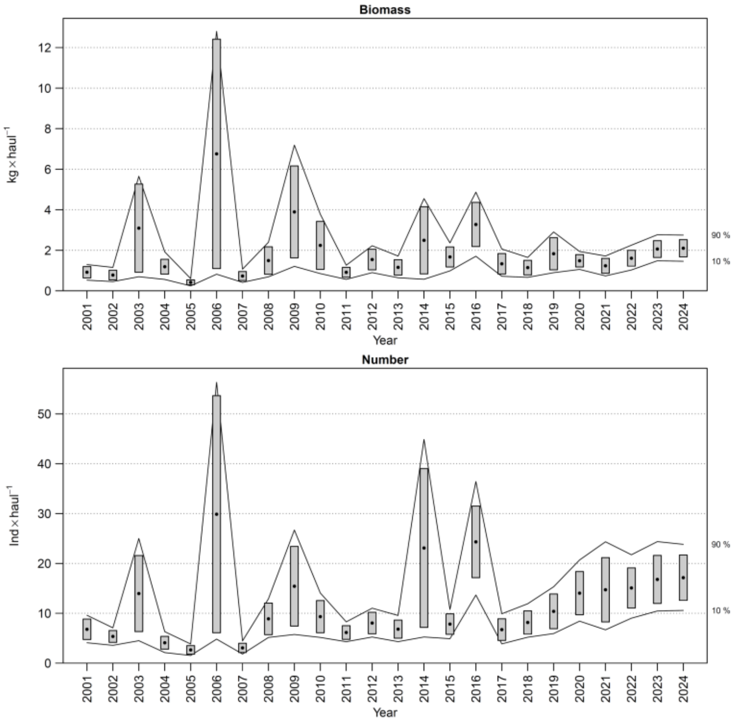
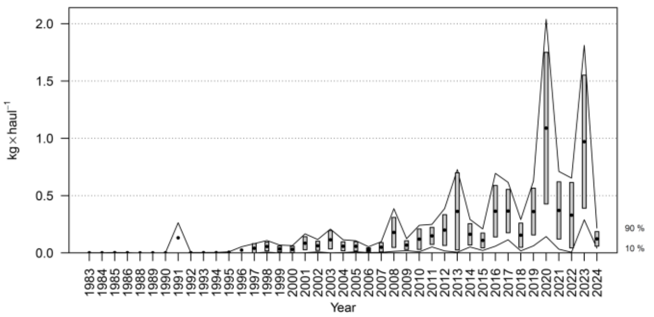
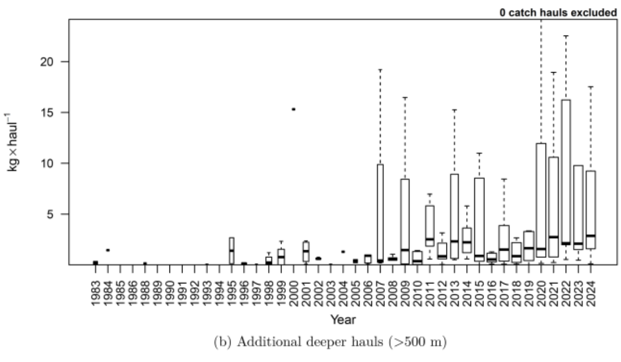


Figure 5.6. Other deep-water sharks and skates from the Northeast Atlantic. *Etmopterus spinax* biomass index (top, kg haul–1) and abundance index (bottom, numbers haul–1) during Porcupine survey time-series (SpPGFS-WIBTS-Q4, 2001–2024). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000). From Ortiz *et al.* (2025 WD).



(a) Standard hauls (70-500 m)



(b) Additional deeper hauls (>500 m)

Figure 5.7. Other deep-water sharks and skates from the Northeast Atlantic. Evolution of *Etmopterus spinax* stratified biomass index in standard hauls and in additional deep hauls during the North Spanish shelf bottom trawl survey time series (SpGFS-WIBTS-Q4, 1983–2024) covered by the survey. Boxes mark parametric standard error of the stratified

biomass index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000). From Fernández-Zapico *et al.* (2025 WD).

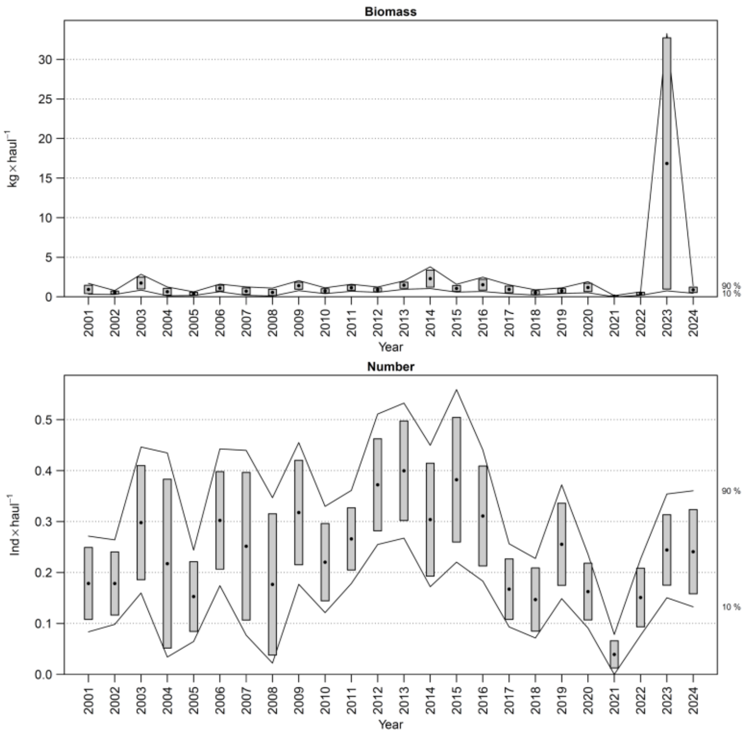


Figure 5.8. Other deep-water sharks and skates from the Northeast Atlantic. Changes in bluntnose six-gill shark *Hexanchus griseus* biomass index (kg haul^{-1}) during Porcupine survey time-series (SpPGFS-WIBTS-Q4, 2001–2024). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000). From Ortiz *et al.* (2025 WD).

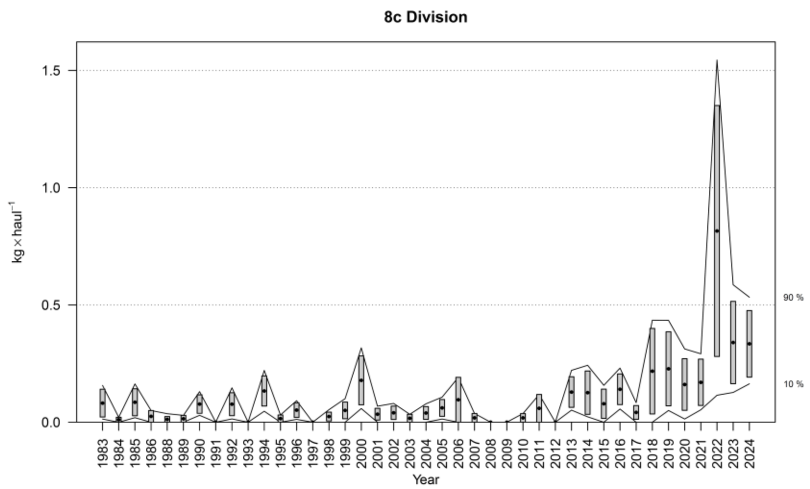


Figure 5.9. Other deep-water sharks and skates from the Northeast Atlantic. Evolution of *Hexanchus griseus* stratified biomass index in standard hauls and in additional deep hauls during the North Spanish shelf bottom trawl survey time series (SpGFS-WIBTS-Q4, 1983–2024). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α = 0.80, bootstrap iterations = 1000). From Fernández-Zapico *et al*. (2025 WD).

6 Porbeagle in the Northeast Atlantic (subareas 1–14)

6.1 Stock distribution

WGEF consider that there is a single stock of porbeagle *Lamna nasus* in the Northeast Atlantic (NEA) that occupies the entire ICES area (subareas 1–14), extending southwards to 5° N.

The supporting information is provided in the Stock Annex.

6.2 The fishery

6.2.1 History of the fishery

Porbeagle has been exploited primarily in the NEA by four directed longline fisheries with the first notable landings in 1926 until applicable management largely reduced landings in 2010 (see Section 6.2.4). Norway first developed a directed fishery from 1926 to 1986, then Denmark from 1946 to probably the 1970s or in the early 1980s, followed by the Faroe Islands from 1953 to 1960, and finally France from 1971 to 2009. All together, these four countries contributed 98% of the total landings from 1926 to 2009. A detailed history of the fishery can be found in the Stock Annex.

6.2.2 The fishery in 2024

The WGEF estimated landings are 8.7 t in 2024 and since the zero TAC was implemented in 2010, the mean (2010–2024) WGEF estimate is 13.4 t per year (Table 6.1). However, since 2010 data must be considered as unrepresentative of removals, as dead discards are not quantified. Discards are expected to have increased with the absence of landing opportunities.

6.2.3 ICES advice applicable

In 2022, following the WKELASMO benchmark (ICES 2022a), the stock was upgraded to assessment category 2. It was first assessed under this new status in 2022 using a surplus production model (SPiCT, Pedersen and Berg, 2017). A summary of the conclusions of WKELASMO is provided in Section 6.9.2. The 2022 advice, based on the 15th percentile of the expected catch distribution when applying F_{MSY}, led to a recommendation of catches of 219 tonnes and 231 tonnes for 2023 and 2024, respectively.

In 2024, in the absence of new biomass indices since 2019, a rollover of the 2022 advice was given, with a recommendation of catches of 231 tonnes for each of the years 2025 and 2026.

6.2.4 Management applicable

EC Regulation 1185/2003 prohibits the removal of shark fins and subsequent discarding of the body of this species. This regulation is binding on EC vessels in all waters and non-EC vessels in Community waters. In June 2023, 'The Shark Fins Act 2023' was passed in the UK banning the import and export of detached shark fins, including all products containing shark fins.

EC Regulation 40/2008 first established a TAC (581 t) for porbeagle taken in EC and international waters from ICES Subareas 1–12 and 14 for 2008. The TAC was reduced by 25% in 2009 and a maximum landing length of 210 cm (fork length) was implemented.

From 2010–2014, successive EC Regulations (23/2010, 57/2011, 44/2012, 39/2013 and 43/2014) had established a zero TAC for porbeagle in EU waters of the ICES area and prohibited EU vessels to fish for, to retain on board, to tranship and to land porbeagle in international waters.

Since 2015 it has been prohibited for EU vessels to fish for, to retain on board, to tranship or to land porbeagle, with this applying to all waters (Council Regulation (EU) 2015/104, 2016/72, 2017/127, 2018/120, 2019/124, 2020/123, 2021/92 and 2022/119). Fisheries consultations between the UK and the EU in 2021 and 2022 have also included porbeagle in the list of prohibited species in Union and UK waters[1]. Porbeagle has been maintained on this list despite the non-zero catch advice given by ICES in 2022.

It has been forbidden to catch and land porbeagle in Sweden since 2004; and in 2007, Norway banned all direct fisheries for porbeagle but bycatch could be landed up to 2011. Since that year, live specimens must be released, whereas dead specimens can be landed, but this is not mandatory. The species is therefore exempt from the general Norwegian landings obligation, and the payment of the sold catch is therefore withdrawn, except for 20% to cover the cost of landing.

In 2017, a regulation was issued to ban all targeted fishing in Icelandic waters for spurdog, porbeagle and basking shark and stipulating that all viable catch in other fisheries must be released.

6.3 Catch data

6.3.1 Landings

Landings of porbeagle in the Northeast Atlantic from 1926 to 2024 are shown in Table 6.1 and Figure 6.1 and 6.2.

These data were revised during the WKELASMO meeting (ICES, 2022a). The main changes from the WGEF landings tables in 2021 were: Faroe Islands landings added from 1953 to 1960 (from ICCAT database), French landings revised (mainly 1972 to 1977), conversion of Norwegian landings from gutted weight to round weight units (1926 to 1968, excepted 1958-60, and 1971), Spanish landings from 2008 (ICCAT landings series adopted). In addition to these revisions, 2021 landing figures were included (7 t) and Danish landings were updated for the years 2005, 2006, 2007 and 2009 (one tonne added each year), as these data were not previously provided in response to the 2021 WKELASMO data call. Since 2010, landings are below 50 t and mainly occur in the Faroe Islands and Norway.

More detailed information on landings is presented in the Stock Annex.

6.3.2 Discards

Because of the historically high commercial value of this species, it is likely that most specimens caught incidentally were landed prior to the zero quota from 2010. Analysis of at-sea observer programme for UK (E&W) fisheries confirms this (Silva and Ellis, 2019). Historical discards are consequently thought to be negligible.

---

[1] Fisheries: consultations between the UK and the EU in 2021

Since the EU zero TAC was introduced in 2010, discards are likely a large proportion of the catches but they are unquantified. In recent years, the only discard estimates available were provided by France in 2018 (88.7 t) and Spain in 2023 and 2024 (5.4 t and 2.8 t, respectively). However, it should be noted that these may be imprecise estimates as the underlying data relate to few observations and specimens. Porbeagle discards have been more frequently reported in logbooks of French vessels in recent years (e.g. 3.2 t. in 2024). However, the observed increase in reporting frequency is not thought to reflect an increase in porbeagle discards, with the corresponding values being likely to be much lower than actual discards. Anecdotal information suggests that French pelagic trawlers and tuna long liners discard porbeagle, but their total dead discards are unknown as are seasonal discards in some métiers (e.g. in the Celtic Sea (Bendall *et al.*, 2012a, b; Ellis and Bendall, 2015)). Porbeagle is also a regular bycatch in the Norwegian pelagic trawl fishery for blue whiting in the Norwegian Sea. All specimens are reportedly dead when hauled onto the vessels.

This species is taken by recreational fishers in some areas. However, the full extent of fish captured recreationally has not been quantified. A time series of catch is only available for the UK catch and release fishery (Jones *et al.*, 2021). The porbeagle catches are largely incidental bycatch of blue shark recreational fisheries. Catches increased from zero between 1999–2011 to 333 individuals between 2015 and 2020. Other recreational fisheries are known to occur in Ireland and the Faroe Islands, but no data are available. No data are available either to estimate the post-release mortality of individuals caught and released in recreational fisheries.

More detailed information on discards is presented in the Stock Annex.

6.3.3 Quality of catch data

The quality of the catches from 1926 to 2009 can be considered good after the revisions made by the WKELASMO (ICES, 2022a).

Since the EU zero TAC / prohibited listing was introduced, discards have likely increased, but no estimates of discards are available.

More detailed information on quality of catch is presented in the Stock Annex.

6.3.4 Discard survival

Data on discard survival are too limited to estimate dead discards. Available data are presented in the Stock Annex.

6.4 Commercial catch composition

Only limited length data are available. However, length-distributions by sex are available for 2008 and 2009 for the French longline fishery that targeted porbeagle until 2009 (Hennache and Jung, 2010; Figure 6.3). These distributions are considered representative of international catches because during that period France was the major contributor to catch (Figures 6.1 and 6.2).

Catch data derived from the French longline fishery highlighted the dominance of porbeagle (89%) in the total catch. Other species included blue shark (10%), common thresher (0.6%) and tope (0.3%).

Additional information on commercial catch composition is presented in the Stock Annex.

6.4.1 Conversion factors

Length–weight relationships are available for different geographic areas and time periods (Table 6.2). Relationships between alternative length measurements with total length in porbeagle are presented in the Stock Annex.

6.5 Commercial catch and effort data

Three commercial CPUE series are available for the NEA porbeagle stock, all standardized using a GLM:

- A Norwegian longline CPUE series from 1950 to 1972, in number of fish by day, from personal logbooks of five vessels of the Norwegian directed fishery, in number of fish by day (Biais, 2022a,b);
- A French longline CPUE series from 1972 to 2009, in weight by trip, from logbooks of 19 vessels of the French directed fishery (Biais, 2022c,d);
- A Spanish longline CPUE series from 1986 to 2007, in weight per thousand hooks by trip, from the surface longline targeting swordfish (Mejuto *et al*., 2010).

They are briefly presented in the following sections. Further information can be found in the Stock Annex as well as in the report of the WKELASMO (ICES, 2022a).

6.5.1 The Norwegian longline CPUE series

The Norwegian CPUE series was obtained from logbooks for five longliners of the directed fishery. This provided daily catches in numbers per 1°x1° rectangle for the period 1950 to 1972 (years 1965-67 missing) and for an area extending from 49°N to 69°N. To avoid autocorrelations, CPUEs were selected when there were least five days between successive catches when taken in same or contiguous rectangles, based on Kendall's rank correlations (p-value<0.05).

The CPUEs were standardized comparing three GLM approaches. On the basis on five-fold cross validations, Akaike’s Information Criteria and quantile residual plots, the GLM model involving the effects of year, month and subarea and using a negative binomial error structure was selected as final model. The series of relative annual abundance indices obtained with this model shows a downward trend in the second half of the 1950s, but this trend seems to have stabilized in the early 1960s, followed by a slight increase in the late 1960s and early 1970s (Figure 6.4).

Relative biomass indices were derived from these abundance indices using mean catch weight calculated from landing weights available for most of the trips in the logbooks.

6.5.2 The French longline CPUE series

CPUEs of longliners in the French directed fishery are available from 1972 to 2009. These CPUEs are in weight per trip for a fishing area which extends mainly on the shelf edge of the Bay of Biscay, but also in the Celtic Sea. Nineteen boats with a sufficiently long presence in the fishery (at least six years over the full time-series or more than four years from 1999) were selected. CPUEs were standardized with a GLM, using a Gamma error distribution with a log link. The variables considered were the year, the month, the area (ICES divisions 7 a&f-g, 7 h-j-k and subarea 8), the vessel and their interactions. The selection of the final model was performed as for the Norwegian CPUEs. This model involves the four variables considered but not their interactions. The relative abundance index obtained decreases in the 1970s, but thereafter varies without trend (Figure 6.5).

6.5.3 The Spanish longline CPUE series

The Spanish longline CPUEs are bycatch by trip (in weight per thousand hooks) of the surface longline fishery targeting swordfish in eastern Atlantic (East 20°W from 35°N to 55°N). Data are available from 1986 to 2007. The portion of this area north of 45°N comprises about half of these catches, although it is reported that traditional longline occurs in this area only sporadically during certain years and quarters, taking advantage of local concentrations of porbeagle. CPUEs were standardized using GLM procedures assuming a delta-lognormal error distribution. The final model was selected using Akaike's Information Criterion, Bayesian Information Criterion and the likelihood ratio test (variables included: year, area, quarter, bait, year*area, year*quarter). The relative abundance index obtained (Figure 6.6) includes higher values in the 2000s, with large interannual variations.

6.6 Recreational catch and effort data

CPUE (fish by trip) of the United Kingdom recreational porbeagle catches are available from 1960 to 2020 in Division 7e (Jones *et al.*, 2021). This fishery has been conducted on a catch and release basis since 1994, largely as an occasional bycatch of blue shark recreational fisheries. The data are collated from historical records of the Shark Angling Club of Great Britain (SACGB) from 34 different boats with additional data from 13 skippers. Since 2015, resulting CPUEs have significantly increased (Figure 6.7). Available length distributions indicate that this increase has been driven by the abundance of small fish in Division 7e (median length close to 100 cm).

Further information can be found in the stock annex.

6.7 Fishery-independent surveys

A composite CPUE survey series is also available for the porbeagle stock in the NEA. This series was thus named because it combines the CPUE of a French commercial vessel, from 2000 to 2009, with the CPUE of a fishery-independent survey carried out in 2018-2019. This was done to construct a series long enough to provide information on the trend in abundance in the absence of commercial CPUEs since the zero TAC/prohibited species listing.

The survey was carried out for around 6 weeks in May-June 2018 and 2019, using a chartered longliner. The gear was a longline with 336 hooks. Two sets per day were planned in the same ICES rectangle, with one to three fishing days by statistical rectangle (but generally two) that must be at least 10 days apart. The survey area comprised 16 ICES rectangles extending along the shelf edge of the Bay of Biscay and the southern Celtic Sea (Biais, 2022e).

Combining the CPUE from this survey with a commercial CPUE was made possible by obtaining detailed data from personal logbooks provided by a vessel captain involved in the directed fishery for the years 2000 to 2009. This vessel contributed about 10% of the total French landings each year from 2000 to 2008. Sets with 252 or 336 hooks were considered comparable to the survey CPUEs (after scaling to 336 hooks when 252 hooks are deployed) because the same fishing gear and technique were used in both cases, assuming that catchability is not affected by a small difference in the number of hooks. Complementing this 2000-2009 commercial CPUE with the fishery-independent survey CPUE required a double selection for consistency. On the one hand, the commercial CPUE were selected to have independent observations of abundance, as were the survey CPUE due to the sampling plan, using the same process as for the Norwegian CPUE

(Biais, 2022f). On the other hand, the survey CPUE were selected so that the spatial distribution was comparable to that of the commercial CPUE (Biais, 2022g).

The commercial and survey CPUE thus obtained were merged (with "short" for longline type) to form a CPUE series that was supplemented with the commercial CPUEs provided based on 756 or 840 hooks (included with "long" for longline type), after scaling to the same number of hooks and selecting to have independent observation series. The resulting composite CPUE series was standardized with a GLM using a Tweedie distribution with a log link. The model involving year, type of longline and area was selected (Biais, 2022 f, g) based on five-fold cross validations, the Akaike's Information Criterion (AIC), analysis of deviance tables and quantile residual plots. The relative abundance index series obtained shows a moderate increase in abundance of porbeagle in the Bay of Biscay and the southern Celtic Sea area from 2009 to 2019 (Figure 6.8).

Relative biomass indices were derived from the abundance indices using 2008-2009 mean individual weight (from data provided by Hennache and Jung, 2010) for years 2000 to 2009, because available information supports the assumption that mean weights have not changed much in the 2000s. The 2018 and 2019 indices were calculated using the mean individual weights given by the weight-length relationship and the length distributions from survey catches.

Further information can be found in the Stock Annex.

6.8 Life-history information

Life-history information (including habitat description) is presented in the Stock Annex.

6.8.1 Movements and migrations

Migrations of three porbeagle tagged off Ireland with pop-up satellite archival tags (PSATs) in 2008 and 2009 are described by Saunders *et al.* (2011). One specimen migrated 2400 km to the northwest off Morocco, residing around the Bay of Biscay for about 30 days. The other two remained in off-shelf regions around the Celtic Sea/Bay of Biscay and off western Ireland. They occupied a vertical distribution ranging from 0–700 m and at temperatures of 9–17°C, but during the night they preferentially stayed in upper layers.

The UK (CEFAS) launched a tagging program in 2010 to address the issue of porbeagle bycatch and to further promote the understanding of porbeagle movement patterns in UK waters. Altogether, 21 PSATs were deployed between July 2010 and September 2011, and 15 tags popped up after two to six months. However, four tags failed to communicate. The tags attached to sharks in the Celtic Sea generally popped up to the south of the release positions while those to sharks off the northwest coast of Ireland popped up in diverse positions. One tag popped up in the western part of the North Atlantic, one close to the Gibraltar Straits and another in the North Sea. Several tags popped up close to the point of release (Bendall *et al.*, 2012b).

From 2011 to 2019, France (IFREMER, with IRD and CEFAS in 2011; see Biais *et al.*, 2017) deployed 60 PSATs that yielded 43 reconstructed tracks. They were used to map the spatiotemporal distributions by sex and length class of the exploitable fraction of the porbeagle stock present in the Bay of Biscay and the southern Celtic Sea in May-June (Biais *et al.*, 2022e). Quantitative estimates of area and period occupancy were derived. Based on 21 deployments that lasted more than 11 months (336 days), an estimated 76-86% of porbeagle exhibited annual return to the Celtic Sea and Bay of Biscay after frequent migrations far into the North Atlantic Ocean.

In a recent study (Bortoluzzi *et al.*, 2024), three adult females tagged off the northern coast of Ireland and off northern Norway have been shown to perform extensive movements, sometimes up to 100km in a day. The trajectories of these female porbeagle strongly differed, especially between the two individuals caught off the Irish coast, which were tagged the same day.

6.8.2 Reproductive biology

A research programme carried out by the NGO APECS (Hennache and Jung, 2010) provided information based on a large sampling (n = 1770) of the French catch in 2008–2009. Spatial sex-ratio segregations are documented and information is provided on the likelihood of a nursery ground in St. George's Channel and of a pupping area in the grounds along the western Celtic Sea shelf edge. Further evidence of parturition close to the western European shelf was provided by the captures of 9 newborn pups on the Bay of Biscay shelf break in May 2015 and July 2016 (Biais *et al*., 2017) as well as by the captures of pregnant females during the 2018 and 2019 fishery-independent survey. Historic information (Gauld, 1989) indicated that parturition might be slightly later (summer or autumn) in more northern areas such as east Scotland and the Shetland Isles.

6.8.3 Genetic information

A first study of the genetic diversity (mitochondrial DNA haplotype and nucleotide diversities) was carried out by Pade (2009). This study was based on 156 individuals caught both on the Northeast and Northwest Atlantic; the results obtained show no significant population structure across the North Atlantic. These findings were supported by another study which examined 224 specimens from eight sites across the North Atlantic and the Southern Hemisphere (Testerman, 2014). However, this study showed strong genetic difference between the North Atlantic and Southern Hemisphere, which indicates two genetically distinct populations.

Pade (2009) found also that while the mtDNA haplotype diversity was very high, sequence diversity was low, which suggests that most females display reproductive philopatry, and indicates that the stock is likely to be genetically robust.

Viricel *et al*. (2021) observed also high levels of genetic diversity at the mitochondrial DNA control region in North Atlantic, using 49 individuals caught in the Bay of Biscay from 2013 to 2019, 6 individuals from the Indian Ocean and 155 sequences obtained from Genbank from both North and South Atlantic. A significant genetic difference was found between individuals sampled in Norway and Denmark and others selected among samples from the Bay of Biscay and Celtic Sea, based on westward migrations. These results are considered preliminary, as they were obtained using a single locus and small sample sizes. They need to be complemented with Single Nucleotide Polymorphism (SNP) analysis, more robust for low sample sizes.

Further studies examining genetic structure of Mediterranean Sea porbeagle are still required.

6.9 Exploratory assessment models

6.9.1 Previous studies

The first assessment of the Northeast Atlantic stock was carried out in 2009 by the joint ICCAT/ICES meeting (ICCAT, 2009; ICES, 2009) using a Bayesian Surplus Production (BSP) model (Babcock and Cortes, 2009) and an Age-Structured Production (ASP) model (Porch *et al.*, 2006).

Using the French CPUE series as well as the Spanish CPUE series, stock projections based on the BSP model demonstrated that low catches (below 200 t) may allow the stock to increase under most credible model scenarios and that the recovery to B_{MSY} could be achieved within 25–50 years under nearly all model scenarios. More detailed results are provided in the Stock Annex.

6.9.2 Benchmark

A benchmark of the stock was conducted jointly by ICES and ICCAT in 2022. A total of 27 Surplus Production in Continuous Time (SPiCT) exploratory assessment runs (Pedersen and Berg, 2017) were submitted to WKELASMO (ICES, 2022a) with two additional JABBA exploratory assessments. For all assessments, the 1926-2020 landings, revised as part of the WKELASMO meeting, were used for the catches. Considering that discards were negligible before 2010, but unknown afterwards, the standard deviation of the observation error on catches was multiplied by 5 from 2010 onwards. The biomass indices provided by standardizing the three available commercial CPUE series and the composite CPUE survey series were used (Figure 6.9), with the ratios of their standard errors from the GLMs to their respective means (CV) as input for the relative standard deviations of indices. The biomass was assumed close to the virgin state in 1926 as all available information shows that porbeagle were only caught incidentally in limited quantities by Norwegian fisheries in the absence of a local market (median of the informative prior for initial B/K set at 0.99).

All the exploratory assessments set the median of the prior for the intrinsic rate of increase r to 0.059, as per the 2020 ICCAT stock assessment (Cortes and Semba, 2020), and the shape parameter of the surplus production function n to 2, which implies a Schaefer production model. The exploratory runs focused primarily on the effect of having informative (sd =0.2) or semi-informative (sd=0.5) priors for these parameters as well as on the inclusion of the Spanish longline biomass index in the assessment. Setting the sd of log (n) to 0.5, led to an average of the posterior of n close to 1 which was in contradiction with a low prior for r. Therefore, the sd was set to 0.2 for log(n) for further exploratory assessments. For the prior for r, a sd set to 0.5 was retained because the acceptance criteria for a SPiCT assessment (ICES, 2020b) are met without restriction only for this input. After several sensitivity runs with different priors for the sd of the Spanish longline biomass index, it was incorporated with a large and informative prior for its sd (median=1.1) in the final assessment, on the basis of acceptance criteria.

With respect to the comparison between the JABBA and SPiCT assessments, it should be noted that, despite some differences in model configuration, the two modelling approaches provided very similar outlooks of the status of the NEA porbeagle stock.

6.10 Stock assessment

The 2022 stock assessment was carried out using the SPiCT model with priors agreed upon during the final benchmark assessment (prior for B_{2026}/K: median=0.99, sd of log(B_{2026}/K)=0.2; prior for n: median=2, sd of log(n)=0.2; prior for r: median=0.059, sd of log(r)=0.5; priors for the sd_{Sp} of the Spanish longline biomass index: median=1.1, with sd of log(sd_{Sp})=0.1). The landings were updated but the biomass indices remained the same, because the survey was not carried out in 2020.

The posterior n is the same as that of the final benchmark assessment (median=1.7). The model is thus close to a Schaefer model, with an inflection point of the production curve close to B_{MSY}/K=0.5. The posterior of r is also the same as that of the final benchmark assessment (median=0.089). The exploited biomass decreases below B_{MSY} in the early 1950s (Figure 6.10). Despite an increase in the 2010s due to the fishing restriction in place since 2010, B/B_{MSY} was well below B_{MSY} in 2020, but above $B_{trigger}$ ($0.5 \cdot B_{MSY}$; see section 6.13). Overfishing was no longer occurring, with the low values of current F consistent with the landing prohibition in effect since 2010 (Figure 6.11).

The retrospective patterns are consistent and all peels are within the confidence intervals. For relative biomass the Mohn's rho of -0.035 is below the threshold, while the Mohn's rho of the relative F analysis is above 0.2 (Figure 6.12). This was not observed in the retrospective analysis made at the WKELASMO for the final assessment but occurred for the 2022 assessment when using the SPiCT package 1.3.6 with the same landings as during the benchmark. However, given the very low catches in recent years, a Mohn's rho of the relative F analysis slightly above 0.2 cannot be considered a relevant criterion for not accepting the assessment, as was agreed during the WKELASMO for some exploratory assessments.

In 2024, new exploratory SPiCT runs were performed. Only the series of landings could be updated, as no new survey indices were available compared to the 2022 assessment. The various priors were kept identical to the ones selected in 2022. The estimated trajectories of biomass and fishing mortality were very similar to the ones obtained during the 2022 assessment. Expectedly, the posterior distributions of model parameters were virtually unaffected by this update. However, the uncertainty associated with the most recent estimates of B/B_{MSY} and F/F_{MSY} increased significantly, which caused the exploratory runs to fail to pass the SPiCT acceptance diagnostics.

6.11 Forecasts

The Benchmark Oversight Group (BOG) accepted the conclusions of the WKELASMO (ICES, 2022a). Therefore, the porbeagle stock in the NEA became an ICES Category 2 stock in 2022, as its status could be assessed with SPiCT. According to the ICES technical guidance for harvest control rules and stock assessments for stocks in category 2 (ICES, 2022b), the default rule for the catch advice is to use the fractile rule with the 35th percentile of the predicted catch distribution estimated when applying F_{MSY}.

During the meeting, catch scenarios were established for two years, considering that a four-year advice as in 2019 was justified by a zero-catch advice then, but that if this was to change, an advice every two years would be more suitable for monitoring the exploitation of the porbeagle stock. However, there were some concerns raised by ICCAT experts about the approach of applying the ICES default rule for the porbeagle catch advice when they may not have been tested on a long-lived species. This warning suggested making long-term projections (to 2053 to encompass two generations) with constant catch options to provide tables of probabilities p($B>B_{MSY}$), p($F<F_{MSY}$) and p ($B>B_{MSY}$ & $F<F_{MSY}$), as required for ICCAT advice. This was considered useful to ensure consistency between ICCAT and ICES advice, although long-term projections are not required for ICES catch advice. An online meeting was agreed upon for mid-July to review the results of these long-term projections and possible additional catch scenarios to be considered for the catch advice for 2023 and 2024. Unfortunately, the results showed some inconsistencies for the early years of the long-term forecast with constant catches that could not be resolved quickly. These were due to the way SPiCT accommodates large increase in projected catches (i.e. it produces an increase in B to limit the variation of F). However, these problems do not arise when making long-term projections for constant fishing mortalities, which are relevant for ICES advice because they allow estimation of F_{p05}, the fishing mortality that results in a less than 5% probability of $SSB < B_{lim}$ in the long term (ICES, 2022c). Probability tables for constant fishing mortalities were sent in July by the stock coordinator to WGEF members, with the addition of probabilities p($B>B_{trigger}$) and p($B>B_{lim}$) to include ICES biomass reference points (Table 6.3 a, b & c). The probability p($B>B_{MSY}$) is above 0.5 in 2053 when F=0.7·F_{MSY}. The probability p($B>B_{lim}$) is above 0.95 in 2053 when F=0.3·F_{MSY} ($F_{p0.5}$). The latter option was included in the catch scenario tables for 2023 and 2024 of the draft for the advice.

6.12 Quality of assessments

In 2022, WGEF meeting participants included scientists involved in ICCAT shark assessments. Previously, several of them participated in WKELASMO, of which the chair of the 2020 ICCAT porbeagle assessment meeting was an external expert. Therefore, the porbeagle benchmark by the WKELASMO and the following assessment by the WGEF were conducted in cooperation with ICCAT scientists. It was the first time since the ICCAT 2009 Porbeagle Stock Assessments Meeting which was held as a joint meeting of WGEF and the ICCAT Shark species group (ICCAT, 2009; ICES, 2009). At this 2009 meeting, the lack of CPUE data for the peak fishery was highlighted as a major caveat to the quality of the assessment by a surplus production model. This issue has been resolved with the availability of the Norwegian longline CPUE series which begins in 1950, when catches were still above 3000 t.

The 2009 request for an independent survey of the fishery was also taken into account with the organisation of two fishery-independent abundance surveys in 2018 and 2019. This generated a composite survey series combining commercial and survey CPUEs, obtained after successive improvements (Biais 2022 e-g). This work greatly benefited from the participation of members of the ICCAT shark species group at WKELASMO, as did the standardization of the Norwegian and French CPUE series (Biais 2022a-d). Members of the ICCAT shark species group provided also additional assessments using JABBA, with very similar results giving the same perception of the stock as the final accepted SPiCT assessment.

Treatments to avoid autocorrelation of CPUE addressed warnings about the potential for index hyperstability that searching for concentrations generates in directed fisheries (Biais, 2022a and f). It should also be noted that the standardization of the French longline CPUE series, already used in the 2009 exploratory assessment, is now documented (Biais, 2022c and d). The validity of including the Spanish longline index in the assessment was questioned during WKELASMO, due to its large variation and the area selected to build the CPUE series. Nevertheless, this index was used, but with a large standard deviation. An examination of the possibility of increasing the quality of this index would be of interest as well as its extension beyond 2007. Furthermore, the porbeagle subgroup of the WGEF indicated that any future WKLIFE meetings could be asked to examine the assessment of a lower productivity species such as porbeagle with a surplus production model.

The quality of porbeagle assessment would benefit from improved knowledge of stock structure. While there seemed to be strong indication of site fidelity and repeated migration routes, the genetic differentiation among different regions in the Northeast Atlantic was not strong, and based on a limited number of samples (ICES, 2022a). In its porbeagle subgroup, the WGEF held discussions on ongoing genetics and tagging studies and how collaborations and the sharing of materials can be developed to improve our understanding of the stock structure in the Northeast Atlantic. Any future joint ventures or assessments would benefit from a more coordinated approach with collaborative drafting of agendas, ToR and more advanced planning to ensure that the aims, expectations and results are as aligned as possible within the operational constraints of each organisation.

6.13 Reference points

SPiCT provides relative fishing mortality (F/F_{MSY}) and relative biomass (B/B_{MSY}) reference points. F_{MSY} and B_{MSY} are estimated directly from the SPiCT assessment model and, therefore, change when the assessment is updated.

For the MSY approach, the reference points are F_{MSY} and $B_{trigger}$= 0.5 B_{MSY} (ICES, 2021).

For the precautionary approach, the reference points are F_{lim} = 1.7 × F_{MSY} (ICES, 2017) and B_{lim}= 0.3 B_{MSY} (ICES, 2021).

6.14 Conservation considerations

The porbeagle shark subpopulation of the Northeast Atlantic was listed as Critically Endangered in the IUCN red list in 2015 (Ellis *et al*., 2015). In 2019, IUCN assigned the porbeagle to the vulnerable category in a global assessment of the species (Rigby *et al*., 2019a). This review was carried out using a Bayesian state space tool for each region where data were available (Rigby *et al*., 2019b). In the NEA, the results of the 2009 ICCAT-ICES meeting were used. The median population decrease over three generations was estimated to be 56% in 2009. As a result, the global assessment is based on a NEA population classified in the endangered category.

In 2013, a renewed proposal to list porbeagle shark on Appendix II of CITES was accepted at the Conference of Parties (16) Bangkok, and it has been listed since September 2014.

6.15 Management considerations

A dedicated longline survey covering the main parts of the stock area is needed to monitor stock status appropriately in the future. The surveys carried out by France in 2018 and 2019 have shown that a fixed-station survey design can provide consistent annual indices. Continuing this spring-summer survey with an expansion to other areas within the stock distribution would be advantageous, as this would provide the necessary sampling effort to take the large distribution of porbeagle into account in order to monitor stock size. This species has low population productivity, and is thus highly susceptible to overexploitation. Consequently, WGEF considers that target fishing should not proceed without a programme to monitor stock abundance feeding into regular updates of the NEA porbeagle stock assessment. The current fishing ban renders estimates of discards difficult to obtain, but they are considered to have increased in recent years in the Bay of Biscay as well as in the northern part of the distribution area of the stock. Logbook-reported discards are currently not provided by all vessels catching porbeagle. They are most likely insufficient to derive a new biomass index, but this possibility should be reconsidered in the future when more data are expected to have been collected.

A maximum landing length (MLL) was adopted by the EC in 2009. It was considered a potentially useful management measure in targeted fisheries, as it could deter targeting areas with mature females. However, the fishery-independent survey data question both the efficacy and practicality of such a measure and, given the short time period of implementation prior to a zero TAC, the effectiveness remains unevaluated.

Studies on porbeagle bycatch should be continued to develop operational ways to reduce bycatch, to decrease at-vessel mortality and to improve the post-release survivorship of discarded porbeagle.

All fisheries-dependent data should be provided by countries having fisheries for this stock, including countries targeting other species with longlines in the stock area.

During the WGEF, discussions were initiated regarding both the process and timeline of advice provision within ICES and similarly within ICCAT. The timelines to provide final advice, and management programmes of both organisations differ, with the ICES advice released after the ICCAT meeting of the Standing Committee on Research and Statistics (SCRS). This has the potential to lead to inconsistent perceptions of the stock status and any associated catch advice. Consistency between the advice from each organisation is important and future alignment of process and outcomes may be facilitated by an MoU between ICES and ICCAT.

6.16 References

Babcock, B. A., and Cortes, E. 2009. Bayesian surplus production model applied to porbeagle catch, cpue and effort data. ICCAT, Collective Volume of Scientific Papers, SCRS/2009/068, 7 pp.

Bendall, V. A., Ellis, J. R., Hetherington, S. J., McCully, S. R., Righton, D., and Silva, J. F. 2012b. Preliminary observation on the biology and movements of porbeagle *Lamna nasus* around the British Isles. Working document to the ICES Working Group on Elasmobranch Fishes, Lisbon, 19–26 June 2012. 21 pp.

Bendall, V. A., Hetherington, S. J., Ellis, J. R., Smith, S. F., Ives, M. J., Gregson, J. and Riley, A. A. 2012a. Spurdog, porbeagle and common skate bycatch and discard reduction. Fisheries Science Partnership 2011–2012, Final Report; 88 pp.

Biais, G. 2022a. Standardized catch rates of porbeagle in the Northeast Atlantic Ocean from Norwegian longliner logbooks. ICES WKELASMO 2022 Working Document, 14 pp

Biais, G. 2022b. Standardized catch rates of porbeagle in the Northeast Atlantic Ocean from Norwegian longliner logbooks. Supplement. ICES WKELASMO 2022 Working Document, 5 pp

Biais, G. 2022c. Standardized catch rates of porbeagle in the Northeast Atlantic Ocean from French longliner data by trip. ICES WKELASMO 2022 Working Document, 10 pp.

Biais, G. 2022d. Standardized catch rates of porbeagle in the Northeast Atlantic Ocean from French longliner data by trip. Supplement. ICES WKELASMO 2022 Working Document, 4 pp.

Biais, G. 2022e. Porbeagle abundance survey in the Bay of Biscay and in the Celtic Sea in 2018 and 2019. ICES WKELASMO 2022 Working Document, 10 pp.

Biais, G. 2022f. Porbeagle abundance survey in the Bay of Biscay and in the Celtic Sea in 2018 and 2019. Supplement. ICES WKELASMO 2022 Working Document, 8 pp.

Biais, G. 2022g. Porbeagle abundance survey in the Bay of Biscay and in the Celtic Sea in 2018 and 2019. Supplement 2. ICES WKELASMO 2022 Working Document, 7 pp.

Biais, G., Coupeau, Y., Séret, B., Calmettes, B., Lopez, R., Hetherington, S., and Righton, D. 2017. Return migration patterns of porbeagle shark (*Lamna nasus*) in the Northeast Atlantic and implications for stock range and structure, ICES Journal of Marine Science, 74(5), 1268–1276. doi:10.1093/icesjms/fsw233.

Bortoluzzi, J.R., McNicholas, G.E., Jackson, A.L., Klöcker, C.A., Ferter, K., Junge, C., Bjelland, O., Barnett, A., Gallagher, A.J., Hammerschlag, N., Roche, W.K. and Payne,N.L., 2024. Transboundary movements of porbeagle sharks support need for continued cooperative research and management approaches. *Fisheries Research*, 275: 107007. https://doi.org/10.1016/j.fishres.2024.107007

Cortes E. and Semba Y, 2020. Estimates of vital rates and population dynamics parameters of interest for porbeagle shark in the Western North Atlantic and South Atlantic oceans. SCRS/2020/090. 13p.

Ellis, J. R. and Bendall, V. A. 2015. Preliminary estimates of bycatch rates of porbeagle shark *Lamna nasus* in gillnet fisheries in the Celtic Sea (ICES Divisions VIIf–h) and associated biological observations. Working Document to ICES Working Group on Elasmobranch Fishes (WGEF), Lisbon, 2015; WD2015-02, 9 pp.

Ellis, J., Farrell, E., Jung, A., McCully, S., Sims, D. & Soldo, A. 2015. *Lamna nasus*. The IUCN Red List of Threatened Species 2015: e.T11200A48916453. Downloaded on 03 July 2020.

Ellis, J. R., and Shackley, S. E. 1995. Notes on porbeagle sharks, *Lamna nasus*, from the Bristol Channel. *Journal of Fish Biology*, 46: 368–370.

Gauld, J. A. 1989. Records of porbeagles landed in Scotland, with observations on the biology, distribution and exploitation of the species. Scottish Fisheries Research Report No. 45. Department of Agriculture and Fisheries for Scotland. Aberdeen, UK. 15 pp.

Hennache, C., and Jung, A. 2010. Etude de la pêche palangrière de requin taupe de l'île d'Yeu. Rapport Final. Association pour l'étude et la conservation des sélaciens (APECS), http://www.asso-apecs.org/IMG/pdf/APECS_EPPARTIY_Rapport_ final_BD.pdf. 64 pp.

ICCAT. 2009. Report of the 2009 Porbeagle Stock Assessments Meeting. Copenhagen, Denmark, 22–27 June, 2009. ICCAT, Collective Volume of Scientific Papers, SCRS/2009/014. 42 pp.

ICES. 2009. Report of the Joint Meeting between ICES Working Group on Elasmobranch Fishes (WGEF) and ICCAT Shark Subgroup, 22–29 June 2009, Copenhagen, Denmark. ICES CM 2009/ACOM:16. 424 pp.

ICES. 2017. ICES fisheries management reference points for category 1 and 2 stocks. ICES advice technical guidelines. 20 January 2017. https://doi.org/10.17895/ices.pub.3036

ICES. 2021. Benchmark Workshop on the development of MSY advice for category 3 stocks using Surplus Production Model in Continuous Time; SPiCT (WKMSYSPiCT). ICES Scientific Reports. 3:20. 316 pp. https://doi.org/10.17895/ices.pub.7919.

ICES. 2022a. Benchmark Workshop for selected elasmobranch stocks (WKELASMO). ICES Scientific Reports. 4:47. 136 pp. http://doi.org/10.17895/ices.pub.21025021

ICES. 2022b. ICES technical guidance for harvest control rules and stock assessments for stocks in categories 2 and 3. In Report of ICES Advisory Committee, 2022. ICES Advice 2022, Section 16.4.11. https://doi.org/10.17895/ices.advice.19801564

ICES. 2022c. Advice on fishing opportunities. *In* Report of the ICES Advisory Committee, 2022. ICES Advice 2022, section 1.1.1. https://doi.org/10.17895/ices.advice.19928060

Jones G., Alsop A., Chapman R. S., Collings M., Davis P., Faisey K. A., Forester M., Hodder L., Howell A., Malia O., Margetts D., McKie K. A., McMaster J. D., Murphy S., Rogers J., Somerfield P. J., West D., Whittaker P., Wright S., Wyatt K., Uren D. and Thomas S. F., 2021. Summary of data from the United Kingdom recreational porbeagle fishery from 1960-2020. Collect. Vol. Sci. Pap. ICCAT, 78(2): 1-15

Kohler, N. F., Casey, J. G., and Turner, P. A. 1995. Length–weight relationships for 13 species of sharks from the western North Atlantic. *Fishery Bulletin*, 93: 412–418.

Mejuto, J., and Garcés, A. G. 1984. Shortfin mako, *Isurus oxyrinchus*, and porbeagle, *Lamna nasus*, associated with longline swordfish fishery in NW and N Spain. ICES CM 1984/G:72 Demersal Fish Committee.

Mejuto, J., Ortiz, J., García-Cortés, B., Ortiz de Urbina, J., and Ramos-Cartelle, A. M. 2010. Historical data and standardized catch rates of porbeagle (*Lamna nasus*) caught as bycatch of the Spanish surface long-line fishery targeting swordfish (*Xiphias gladius*) in the Atlantic Ocean. ICCAT, Collective Volume of Scientific Papers, SCRS/2009/053. 23 pp.

Pade, N. 2009. Molecular and Spatial Ecology of Porbeagle Sharks, *Lamna nasus* (Bonnaterre, 1788), in the North Atlantic Ocean. Unpublished PhD thesis, University of Aberdeen, Scotland.

Pedersen, M. W., and Berg, C. W. 2017. A Stochastic Surplus Production Model in Continuous Time. Fish and Fisheries. Wiley Online Library. doi:10.1111/faf.12174.

Porch, C. E., Eklund, A-M, and Scott, G. P. 2006. A catch-free stock assessment model with application to goliath grouper (*Epinephelus itajara*) off southern Florida. Fishery Bulletin, 104(1): 89–101.

Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019a. Lamna nasus. The IUCN Red List of Threatened Species 2019: e.T11200A500969. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T11200A500969.en. Downloaded on 07 January 2021.

Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Herman, K., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. & Winker, H. 2019b. Saunders, R. A., Royer, F., and Clarke, M. W. 2011. Winter migration and diving behaviour of porbeagle shark, *Lamna nasus*, in the Northeast Atlantic. *ICES Journal of Marine Science*, 68: 166–174.

Silva, J. F. and Ellis, J. R. 2019. Bycatch and discarding patterns of dogfish and sharks taken in English and Welsh commercial fisheries. *Journal of Fish Biology*, 94: 966–980. https://doi.org/10.1111/jfb.13899.

Stevens, J. D. 1990. Further results from a tagging study of pelagic sharks in the North-east Atlantic. *Journal of the Marine Biological Association of the United Kingdom*, 70: 707–720.

Testerman, C. B. 2014. *Molecular Ecology of Globally Distributed Sharks.* Doctoral dissertation. Nova Southeastern University. Retrieved from NSUWorks, Oceanographic Center. (6) http://nsuworks.nova.edu/occ_stuetd/6.

Viricel, A., Dourdin, T. S. and Biais, G. 2021. Population structure of the porbeagle shark in the Bay of Biscay inferred using molecular markers. Working Document 02 to the ICES Working Group on Elasmobranch Fishes, 2021, 7pp.

6.17 Tables and Figures

Table 6.1 Porbeagle in the Northeast Atlantic. Working Group estimates of porbeagle landings data (tonnes) by country (1926–2023). Data derived from ICCAT, ICES data calls and national data. Note: blank when no catch,; '0' = < 0.5 t.

Year	Denmark	Faroe Islands	France	Germany	Iceland	Ireland	Netherlands	Norway	Portugal	Spain	Sweden	UK	Japan	Total
1926								363						363
1927								595						595
1928								794						794
1929								1082						1082
1930								1957						1957
1931								1438						1438
1932								2084						2084
1933								5049						5049
1934								4714						4714
1935								2591						2591
1936								3197						3197
1937								3647						3647
1938								3553						3553
1939								2877						2877
1940								135						135
1941								368						368
1942								374						374
1943								458						458
1944								417						417
1945								1206						1206
1946	1400							1414						2814
1947	3300							3671						6971
1948	2100							2490						4590
1949	1700							1626						3326
1950	1900							1765		4				3669
1951	1600							1013		3				2616
1952	1600							789		3				2392
1953	1100	100						927		4				2131
1954	651	300						772		1				1724
1955	578	100						1167		2				1847
1956	446							1132		1				1579
1957	561	100						1426		3				2090
1958	653	300						1080		3		7		2043
1959	562	600						1183		3		9		2357

Year	Denmark	Faroe Islands	France	Germany	Iceland	Ireland	Netherlands	Norway	Portugal	Spain	Sweden	UK	Japan	Total
1960	362	500						1929		2		10		2803
1961	425							1369		5		9		1808
1962	304							577		7		20		908
1963	173							157		3		17		350
1964	216							116		6		5		343
1965	165							265		4		8		442
1966	131							283		9		6		429
1967	144							397		8		7		556
1968	111							880		11		7		1009
1969	100							909		11		3		1023
1970	124							269		10		5		408
1971	311	1	550					208		11		7		1088
1972	523		1317					293		10		19		2162
1973	158	5	1350	6	2			209		12		27		1769
1974	170		967	3	2			165		9		15		1331
1975	265		1251	4	4			304		12	3	16		1859
1976	233	1	1373		3			259		9		25		1903
1977	289	5	1188		3			78		10				1573
1978	112	9	538					76		11	5			751
1979	72	25	703		1			106		8	1	1		917
1980	176	8	589		1			84		12	8	3		881
1981	158	6	451		1			93		12	5	2		728
1982	84	17	450		1			32		14	6	1		605
1983	45	12	517		1			33		28	5	2		643
1984	38	14	307		1			118		20	9	5		512
1985	72	12	200		1			79		23	10	12		409
1986	114	12	246		1			23		26	8	6		436
1987	56	33	223		1			25	3	30	5	3		379
1988	33	14	350		1			12	3	69	3	3		488
1989	33	14	357		1			27	2	42	3	15		494
1990	46	14	577		0			46	2	26	2	9		722
1991	85	7	292		0			34	1	47	2			468
1992	80	20	452		1			43	0	15	4			615
1993	91	76	632	1	3			24	1	21	3			852
1994	93	48	815		4			26	1	52	2			1041
1995	86	44	635		5			27	1	19	2	0		819
1996	72	8	442		3			28	1	41	1		3	599
1997	69	9	489		2			17	1	25	1		2	615

Year	Denmark	Faroe Islands	France	Germany	Iceland	Ireland	Netherlands	Norway	Portugal	Spain	Sweden	UK	Japan	Total
1998	85	7	428	2	3			27	1	25	1	1		580
1999	107	10	306	0	3	8		32	0	18	1	6		491
2000	73	13	385	17	2	2	0	23	15	13	1	7		551
2001	76	8	380	1	4	6		17	4	24	1	10		531
2002	42	10	528	3	2	3		14	11	54		7		674
2003	21	14	443	5	0	3	0	19	4	27		25		561
2004	20	5	423	6	1	0		24	57	11	5	24		576
2005	3	18	298	5	0	3	0	12		14	0	24		378
2006	3	21	223	0	1	4		27		34		12		325
2007	2	14	369	2	0	8	0	10		8	0	26		439
2008	2	10	319	2	1	7		12		41	0	15		409
2009	4	13	291		1	3		10		77		11		410
2010		14	7		1	0	0	12						34
2011	2	18	1		1			11						33
2012	3	25	2		1			17				0		48
2013		17	1		1			9						28
2014		15	1		0			5						21
2015		7			1		0	4						12
2016	0	3			2			6						11
2017	0	1	1		1			6						9
2018		1	1		1			3						6
2019	1	1	2		3			4						11
2020	0	1			3			3						7
2021		3						5						7
2022		1	0		2			8				0		10
2023	0		0		4			7						12
2024					4			5						9

Table 6.2. Porbeagle in the Northeast Atlantic. Length–weight relationships of porbeagle from scientific studies.

Stock	L-W relationship	Sex	n	Length range	Source
NW Atlantic	$W = (1.4823 \times 10^{-5})\ L_F\ 2.9641$	C	15	106–227 cm	Kohler *et al.*, 1995
NE Atlantic (Bristol Channel)	$W = (1.292 \times 10^{-4})\ L_T\ 2.4644$	C	71	114–187 cm	Ellis and Shackley, 1995
NE Atlantic (N/NW Spain)	$W = (2.77 \times 10^{-4})\ L_F\ 2.3958$	M	39		Mejuto and Garcés, 1984
NE Atlantic (N/NW Spain)	$W = (3.90 \times 10^{-6})\ L_F\ 3.2070$	F	26		Mejuto and Garcés, 1984
NE Atlantic (SW England)	$W = (1.07 \times 10^{-5})\ L_T\ 2.99$	C	17		Stevens, 1990
	$W = (4 \times 10^{-5})\ L_F\ 2.7316$	M	564	88–230 cm	Hennache and Jung, 2010

Stock	L-W relationship	Sex	n	Length range	Source
NE Atlantic (Biscay / SW England/ W Ireland)	W = (3 x 10⁻⁵) L_F 2.8226	F	456	93–249 cm	
	W = (4 x 10⁻⁵) L_F 2.7767	C	1020	88–249 cm	

Table 6.3 a. Porbeagle in the Northeast Atlantic. Catch per year for each fishing mortality option (upper panel), probabilities (in %) of B>B_{lim} (middle panel) and B>B_{lim} and F<F_{MSY} (lower panel) per year from 2023 to 2053 for fishing mortalities increasing from 0 to 1.2 F_{MSY}. Catch in 2022 corresponds to F status quo (8t).

Catch per F and Year	Year																														
Fishing mortality	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
F = 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F = 0.1 F_{MSY}	63	67	72	76	81	86	91	96	101	106	111	116	121	126	131	136	141	146	151	155	160	164	168	172	176	180	184	187	190	194	197
F = 0.2 F_{MSY}	126	133	142	150	159	167	176	185	194	203	213	222	231	240	249	258	267	276	284	292	300	308	316	323	330	337	343	350	356	361	367
F = 0.3 F_{MSY}	188	199	210	221	233	245	257	269	281	294	306	318	331	343	355	367	378	390	401	412	423	433	444	453	463	472	481	489	497	505	512
F = 0.4 F_{MSY}	250	263	277	291	305	319	333	348	362	377	392	406	421	435	449	463	477	490	503	516	529	541	553	565	576	587	597	607	617	626	635
F = 0.5 F_{MSY}	312	327	342	358	373	389	405	421	437	453	470	485	501	517	532	548	563	577	592	606	620	633	646	659	671	683	695	706	716	727	737
F = 0.6 F_{MSY}	373	390	406	423	439	456	473	490	507	524	540	557	573	590	606	622	637	653	668	682	696	710	724	737	750	762	774	786	797	808	818
F = 0.7 F_{MSY}	435	451	468	485	502	520	537	554	571	588	605	621	638	654	670	686	701	716	731	746	760	774	788	801	813	826	838	849	861	871	882
F = 0.8 F_{MSY}	496	512	529	546	563	580	596	613	630	646	662	679	694	710	726	741	756	770	784	798	812	825	838	851	863	875	887	898	909	919	929
F = 0.9 F_{MSY}	556	572	589	605	621	637	653	668	684	699	714	729	744	759	773	787	801	814	828	841	853	865	877	889	900	911	922	932	943	952	962
F = F_{MSY}	617	632	647	661	676	691	705	719	733	747	761	774	788	801	813	826	838	850	862	873	884	895	906	916	926	936	946	955	964	973	981
F = 1.1 F_{MSY}	677	690	703	716	729	742	754	766	779	790	802	814	825	836	847	857	868	878	888	898	907	916	925	934	942	951	959	966	974	981	989
F = 1.2 F_{MSY}	737	748	758	769	780	790	800	810	820	829	839	848	857	866	874	883	891	899	907	914	922	929	936	943	950	956	962	969	974	980	986

P(Bt>Blim)	Year																														
Fishing mortality	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
F = 0	81	83	85	87	89	90	91	92	93	94	95	96	96	97	97	98	98	99	99	99	99	99	100	100	100	100	100	100	100	100	100
F = 0.1 F_{MSY}	81	83	85	86	88	89	90	91	92	93	94	95	95	96	96	97	97	98	98	98	99	99	99	99	99	100	100	100	100	100	100
F = 0.2 F_{MSY}	81	82	84	86	87	88	89	90	91	92	93	93	94	95	95	96	96	96	97	97	97	98	98	98	98	99	99	99	99	99	99
F = 0.3 F_{MSY}	81	82	84	85	86	87	88	89	90	90	91	92	92	93	93	94	94	94	95	95	95	96	96	96	96	96	97	97	97	97	97
F = 0.4 F_{MSY}	81	82	83	84	85	86	87	88	88	89	89	90	90	91	91	91	92	92	92	92	92	93	93	93	93	93	93	93	93	93	93
F = 0.5 F_{MSY}	81	82	83	84	84	85	86	86	87	87	87	88	88	88	88	89	89	89	89	89	89	89	89	89	89	89	89	89	89	88	88
F = 0.6 F_{MSY}	81	81	82	83	83	84	84	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85	84	84	84	84	84	84	83	83
F = 0.7 F_{MSY}	81	81	82	82	83	83	83	83	83	83	83	83	83	83	82	82	82	82	82	81	81	81	80	80	80	80	79	79	79	79	78
F = 0.8 F_{MSY}	81	81	81	81	82	82	82	81	81	81	81	80	80	80	79	79	79	78	78	78	77	77	76	76	76	75	75	75	75	74	74
F = 0.9 F_{MSY}	81	81	81	81	81	80	80	80	79	79	78	78	77	77	76	76	76	75	75	74	74	73	73	72	72	72	71	71	71	70	70
F = F_{MSY}	81	80	80	80	79	79	79	78	77	77	76	75	75	74	74	73	73	72	71	71	70	70	70	69	69	68	68	68	67	67	67
F = 1.1 F_{MSY}	81	80	80	79	78	78	77	76	75	75	74	73	72	72	71	70	70	69	69	68	68	67	67	66	66	65	65	65	64	64	64
F = 1.2 F_{MSY}	81	80	79	78	77	76	75	74	74	73	72	71	70	69	68	68	67	67	66	65	65	65	64	64	63	63	63	62	62	62	61

P(Ft>Fmsy & Bt>Blim)	Year																														
Fishing mortality	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
F = 0	70	72	74	76	78	80	82	83	85	86	87	88	89	90	91	91	92	92	93	93	94	94	94	95	95	95	95	95	96	96	96
F = 0.1 F_{MSY}	69	72	74	76	77	79	81	82	83	84	86	86	87	88	89	90	90	91	91	92	92	92	93	93	93	94	94	94	94	94	94
F = 0.2 F_{MSY}	68	70	72	73	75	76	77	79	80	81	82	83	84	84	85	86	86	87	87	88	88	89	89	89	89	90	90	90	90	91	91
F = 0.3 F_{MSY}	66	67	68	69	71	72	73	74	75	76	77	78	79	80	80	81	81	82	82	83	83	84	84	84	85	85	85	85	86	86	86
F = 0.4 F_{MSY}	62	63	64	65	66	68	69	70	71	71	72	73	74	74	75	76	76	77	77	77	78	78	79	79	79	79	80	80	80	80	80
F = 0.5 F_{MSY}	59	59	60	61	62	63	64	65	66	67	67	68	69	69	70	70	71	71	72	72	73	73	73	73	74	74	74	74	74	74	75
F = 0.6 F_{MSY}	55	56	56	57	58	59	60	61	61	62	63	63	64	65	65	66	66	66	67	67	67	68	68	68	68	68	68	69	69	69	69
F = 0.7 F_{MSY}	52	52	52	53	54	55	56	56	57	58	58	59	60	60	60	61	61	62	62	62	62	62	63	63	63	63	63	63	63	63	63
F = 0.8 F_{MSY}	48	48	49	50	50	51	52	53	53	54	54	55	55	56	56	56	57	57	57	57	58	58	58	58	58	58	58	58	58	58	59
F = 0.9 F_{MSY}	45	45	46	46	47	48	48	49	50	50	51	51	51	52	52	52	53	53	53	53	53	53	53	54	54	54	54	54	54	54	54
F = F_{MSY}	42	42	43	43	44	44	45	46	46	47	47	47	48	48	48	49	49	49	49	49	49	49	49	50	50	50	50	50	50	50	50
F = 1.1 F_{MSY}	39	39	40	40	41	42	42	43	43	43	44	44	44	45	45	45	45	45	45	46	46	46	46	46	46	46	46	46	46	46	46
F = 1.2 F_{MSY}	37	37	37	38	38	39	39	40	40	41	41	41	41	42	42	42	42	42	42	42	42	42	42	42	42	42	42	43	43	43	43

Table 6.3 b. Porbeagle in the Northeast Atlantic. Catch per year for each fishing mortality option (upper panel), probabilities (in %) of $B>B_{trigger}$ (middle panel) and $B>B_{trigger}$ and $F< F_{MSY}$ (lower panel) per year from 2023 to 2053 for fishing mortalities increasing from 0 to 1.2 F_{MSY}. Catch in 2022 corresponds to F *status quo* (8t).

Catch per F and Year	Year																														
Fishing mortality	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
F = 0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F = 0.1 F_{MSY}	63	67	72	76	81	86	91	96	101	106	111	116	121	126	131	136	141	146	151	155	160	164	168	172	176	180	184	187	190	194	197
F = 0.2 F_{MSY}	126	133	142	150	159	167	176	185	194	203	213	222	231	240	249	258	267	276	284	292	300	308	316	323	330	337	343	350	356	361	367
F = 0.3 F_{MSY}	188	199	210	221	233	245	257	269	281	294	306	318	331	343	355	367	378	390	401	412	423	433	444	453	463	472	481	489	497	505	512
F = 0.4 F_{MSY}	250	263	277	291	305	319	333	348	362	377	392	406	421	435	449	463	477	490	503	516	529	541	553	565	576	587	597	607	617	626	635
F = 0.5 F_{MSY}	312	327	342	358	373	389	405	421	437	453	470	485	501	517	532	548	563	577	592	606	620	633	646	659	671	683	695	706	716	727	737
F = 0.6 F_{MSY}	373	390	406	423	439	456	473	490	507	524	540	557	573	590	606	622	637	653	668	682	696	710	724	737	750	762	774	786	797	808	818
F = 0.7 F_{MSY}	435	451	468	485	502	520	537	554	571	588	605	621	638	654	670	686	701	716	731	746	760	774	788	801	813	826	838	849	861	871	882
F = 0.8 F_{MSY}	496	512	529	546	563	580	596	613	630	646	662	679	694	710	726	741	756	770	784	798	812	825	838	851	863	875	887	898	909	919	929
F = 0.9 F_{MSY}	556	572	589	605	621	637	653	668	684	699	714	729	744	759	773	787	801	814	828	841	853	865	877	889	900	911	922	932	943	952	962
F = F_{MSY}	617	632	647	661	676	691	705	719	733	747	761	774	788	801	813	826	838	850	862	873	884	895	906	916	926	936	946	955	964	973	981
F = 1.1 F_{MSY}	677	690	703	716	729	742	754	766	779	790	802	814	825	836	847	857	868	878	888	898	907	916	925	934	942	951	959	966	974	981	989
F = 1.2 F_{MSY}	737	748	758	769	780	790	800	810	820	829	839	848	857	866	874	883	891	899	907	914	922	929	936	943	950	956	962	969	974	980	986

P(Bt>Btrigger)	Year																														
Fishing mortality	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
F = 0	50	55	59	63	66	69	72	75	77	80	82	83	85	87	88	90	91	92	93	94	95	96	96	97	97	98	98	99	99	99	99
F = 0.1 F_{MSY}	50	54	58	62	65	68	71	73	75	78	79	81	83	84	86	87	89	90	91	92	93	93	94	95	96	96	97	97	97	98	98
F = 0.2 F_{MSY}	50	54	58	61	64	67	69	71	74	75	77	79	80	82	83	84	85	87	88	88	89	90	91	92	92	93	93	94	94	95	95
F = 0.3 F_{MSY}	50	54	57	60	63	65	68	70	71	73	75	76	78	79	80	81	82	83	84	84	85	86	86	87	87	88	88	89	89	89	90
F = 0.4 F_{MSY}	50	54	57	59	62	64	66	68	69	71	72	73	75	76	77	77	78	79	79	80	81	81	81	82	82	82	83	83	83	83	84
F = 0.5 F_{MSY}	50	53	56	58	61	63	64	66	67	69	70	71	72	72	73	74	74	75	75	76	76	76	77	77	77	77	77	77	77	77	77
F = 0.6 F_{MSY}	50	53	55	58	59	61	63	64	65	66	67	68	69	69	70	70	71	71	71	72	72	72	72	72	72	72	72	72	72	72	72
F = 0.7 F_{MSY}	50	53	55	57	58	60	61	62	63	64	65	65	66	66	67	67	67	67	68	68	68	68	68	68	68	68	68	68	68	68	68
F = 0.8 F_{MSY}	50	52	54	56	57	59	60	61	61	62	63	63	63	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64	64
F = 0.9 F_{MSY}	50	52	54	55	56	57	58	59	59	60	60	61	61	61	61	61	61	61	62	62	61	61	61	61	61	61	61	61	61	61	61
F = F_{MSY}	50	52	53	54	55	56	57	57	58	58	58	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	59	58	58	58	58
F = 1.1 F_{MSY}	50	51	52	53	54	55	55	56	56	56	56	57	57	57	57	57	57	57	57	57	57	57	57	57	56	56	56	56	56	56	56
F = 1.2 F_{MSY}	50	51	52	53	53	54	54	54	54	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	54	54	54	54	54

P(Ft>Fmsy & Bt>Btrigger)	Year																														
Fishing mortality	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
F = 0	50	53	56	58	61	63	65	68	70	71	73	75	76	78	79	80	81	82	83	84	84	85	86	86	87	87	88	88	88	89	89
F = 0.1 F_{MSY}	50	53	55	58	60	62	64	66	68	70	71	73	74	76	77	78	79	80	81	82	82	83	84	84	85	85	86	86	87	87	87
F = 0.2 F_{MSY}	49	52	54	56	58	60	62	63	65	67	68	70	71	72	73	74	75	76	77	78	79	79	80	81	81	82	82	83	83	83	84
F = 0.3 F_{MSY}	48	50	52	53	55	57	59	60	62	63	64	66	67	68	69	70	71	72	73	74	74	75	76	76	77	78	78	79	79	79	80
F = 0.4 F_{MSY}	46	48	49	51	52	54	55	57	58	59	61	62	63	64	65	66	67	68	69	69	70	71	71	72	73	73	74	74	74	75	75
F = 0.5 F_{MSY}	44	45	46	48	49	50	52	53	54	56	57	58	59	60	61	62	63	64	64	65	66	66	67	68	68	69	69	69	70	70	70
F = 0.6 F_{MSY}	42	43	44	45	46	47	49	50	51	52	53	54	55	56	57	58	59	60	60	61	61	62	63	63	64	64	64	65	65	65	66
F = 0.7 F_{MSY}	40	40	41	42	43	44	46	47	48	49	50	51	52	53	53	54	55	56	56	57	57	58	58	59	59	59	60	60	60	61	61
F = 0.8 F_{MSY}	38	38	39	40	41	42	43	44	45	46	47	48	48	49	50	51	51	52	52	53	53	54	54	54	55	55	55	56	56	56	56
F = 0.9 F_{MSY}	35	36	36	37	38	39	40	41	42	43	44	45	45	46	47	47	48	48	49	49	50	50	50	51	51	51	51	51	52	52	52
F = F_{MSY}	33	34	34	35	36	37	38	39	40	40	41	42	42	43	44	44	45	45	45	46	46	46	47	47	47	47	47	48	48	48	48
F = 1.1 F_{MSY}	31	32	32	33	34	35	36	36	37	38	39	39	40	40	41	41	41	42	42	42	43	43	43	43	44	44	44	44	44	44	44
F = 1.2 F_{MSY}	30	30	30	31	32	33	34	34	35	36	36	37	37	38	38	38	39	39	39	39	40	40	40	40	40	40	41	41	41	41	41

Table 6.3 c. Porbeagle in the Northeast Atlantic. probabilities (in %) of B>B_{MSY} (upper panel), F<F_{MSY} (middle panel) and B>B_{MSY} and F<F_{MSY} (lower panel) per year from 2023 to 2053 for fishing mortalities increasing from 0 to 1.2 F_{MSY}. Catch in 2022 corresponds to F status quo (8t).

P(Bt>Bmsy)	Year																														
Fishing mortality	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
F = 0	12	16	19	23	26	30	33	36	40	43	46	48	51	54	56	59	61	63	66	68	70	72	74	75	77	79	80	82	83	85	86
F = 0.1 F_{MSY}	12	15	19	22	25	29	32	35	38	41	43	46	49	51	53	55	58	60	62	64	65	67	69	70	72	73	75	76	78	79	80
F = 0.2 F_{MSY}	12	15	18	22	25	28	31	34	36	39	42	44	46	48	50	52	54	56	58	59	61	62	64	65	66	68	69	70	71	72	73
F = 0.3 F_{MSY}	12	15	18	21	24	27	30	32	35	37	40	42	44	46	48	49	51	53	54	55	57	58	59	60	61	62	63	64	65	65	66
F = 0.4 F_{MSY}	12	15	18	21	24	26	29	31	34	36	38	40	42	44	45	47	48	50	51	52	53	54	55	56	57	58	58	59	59	60	60
F = 0.5 F_{MSY}	12	15	18	20	23	26	28	30	33	35	37	39	40	42	43	45	46	47	48	49	50	51	52	53	53	54	55	55	56	56	56
F = 0.6 F_{MSY}	12	15	17	20	23	25	27	30	32	34	35	37	39	40	42	43	44	45	46	47	48	49	49	50	51	51	52	52	52	53	53
F = 0.7 F_{MSY}	12	15	17	20	22	24	27	29	31	33	34	36	38	39	40	41	43	44	44	45	46	47	47	48	48	49	49	50	50	50	51
F = 0.8 F_{MSY}	12	15	17	19	22	24	26	28	30	32	34	35	37	38	39	40	41	42	43	44	44	45	46	46	47	47	48	48	48	49	49
F = 0.9 F_{MSY}	12	15	17	19	21	23	25	27	29	31	33	34	36	37	38	39	40	41	42	43	43	44	44	45	45	46	46	46	47	47	47
F = F_{MSY}	12	14	17	19	21	23	25	27	29	30	32	34	35	36	37	38	39	40	41	41	42	43	43	44	44	45	45	45	46	46	46
F = 1.1 F_{MSY}	12	14	16	18	21	23	25	26	28	30	31	33	34	35	36	37	38	39	40	41	41	42	42	43	43	44	44	44	45	45	45
F = 1.2 F_{MSY}	12	14	16	18	20	22	24	26	28	29	31	32	34	35	36	37	38	38	39	40	40	41	42	42	42	43	43	44	44	44	44

P(Ft<Fmsy)	Year																														
Fishing mortality	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
F = 0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
F = 0.1 F_{MSY}	98	97	95	93	92	90	89	88	87	86	85	84	83	82	81	81	80	79	79	78	78	77	77	76	76	76	75	75	75	74	74
F = 0.2 F_{MSY}	93	90	88	85	83	82	80	79	78	77	76	75	75	74	73	73	72	72	71	71	70	70	70	69	69	69	68	68	68	68	67
F = 0.3 F_{MSY}	87	83	81	78	77	75	74	73	72	71	70	70	69	68	68	67	67	67	66	66	66	65	65	65	64	64	64	64	64	63	63
F = 0.4 F_{MSY}	80	77	74	73	71	70	69	68	67	66	66	65	65	64	64	63	63	63	63	62	62	62	62	61	61	61	61	61	60	60	60
F = 0.5 F_{MSY}	74	71	69	67	66	65	64	64	63	63	62	62	61	61	61	60	60	60	60	59	59	59	59	59	58	58	58	58	58	58	58
F = 0.6 F_{MSY}	68	66	64	63	62	61	61	60	60	59	59	59	58	58	58	58	57	57	57	57	57	57	56	56	56	56	56	56	56	56	56
F = 0.7 F_{MSY}	63	61	60	59	59	58	58	57	57	57	56	56	56	56	55	55	55	55	55	55	55	55	55	54	54	54	54	54	54	54	54
F = 0.8 F_{MSY}	58	57	56	56	55	55	55	54	54	54	54	54	54	54	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53	52
F = 0.9 F_{MSY}	54	53	53	53	53	52	52	52	52	52	52	52	52	52	52	52	52	51	51	51	51	51	51	51	51	51	51	51	51	51	51
F = F_{MSY}	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
F = 1.1 F_{MSY}	46	47	47	48	48	48	48	48	48	48	48	48	48	48	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
F = 1.2 F_{MSY}	43	44	45	45	46	46	46	46	46	47	47	47	47	47	47	47	47	47	47	48	48	48	48	48	48	48	48	48	48	48	48

P(Bt>Bmsy & Ft<Fmsy)	Year																														
Fishing mortality	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053
F = 0	24	27	29	31	34	36	38	41	43	45	47	49	51	53	54	56	57	59	60	61	63	64	65	66	66	67	68	69	69	70	70
F = 0.1 F_{MSY}	24	27	29	31	33	35	37	39	41	43	45	47	49	50	52	54	55	56	58	59	60	61	62	63	64	65	65	66	67	67	68
F = 0.2 F_{MSY}	24	26	28	30	32	34	36	38	39	41	43	45	46	48	49	51	52	53	54	56	57	58	59	60	60	61	62	63	63	64	65
F = 0.3 F_{MSY}	24	26	27	29	31	32	34	36	37	39	40	42	43	45	46	48	49	50	51	52	53	54	55	56	57	58	59	59	60	61	61
F = 0.4 F_{MSY}	23	25	26	28	29	31	32	34	35	37	38	39	41	42	43	45	46	47	48	49	50	51	52	53	54	55	55	56	57	57	58
F = 0.5 F_{MSY}	23	24	25	26	28	29	30	32	33	34	36	37	38	40	41	42	43	44	45	46	47	48	49	50	50	51	52	53	53	54	54
F = 0.6 F_{MSY}	22	23	24	25	26	27	29	30	31	32	34	35	36	37	38	39	40	41	42	43	44	45	46	46	47	48	49	49	50	50	51
F = 0.7 F_{MSY}	21	22	23	24	25	26	27	28	29	31	32	33	34	35	36	37	38	39	39	40	41	42	43	43	44	45	45	46	46	47	47
F = 0.8 F_{MSY}	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	34	35	36	37	38	38	39	40	40	41	41	42	42	43	43	44
F = 0.9 F_{MSY}	20	20	21	21	22	23	24	25	26	27	28	29	30	31	31	32	33	34	34	35	35	36	37	37	38	38	39	39	39	40	40
F = F_{MSY}	19	19	20	20	21	22	23	24	25	26	26	27	28	29	29	30	31	31	32	32	33	33	34	34	35	35	35	36	36	36	37
F = 1.1 F_{MSY}	18	18	19	19	20	21	22	23	23	24	25	26	26	27	27	28	28	29	29	30	30	31	31	31	32	32	32	33	33	33	33
F = 1.2 F_{MSY}	17	17	18	18	19	20	21	21	22	23	23	24	24	25	25	26	26	27	27	27	28	28	28	29	29	29	29	30	30	30	30

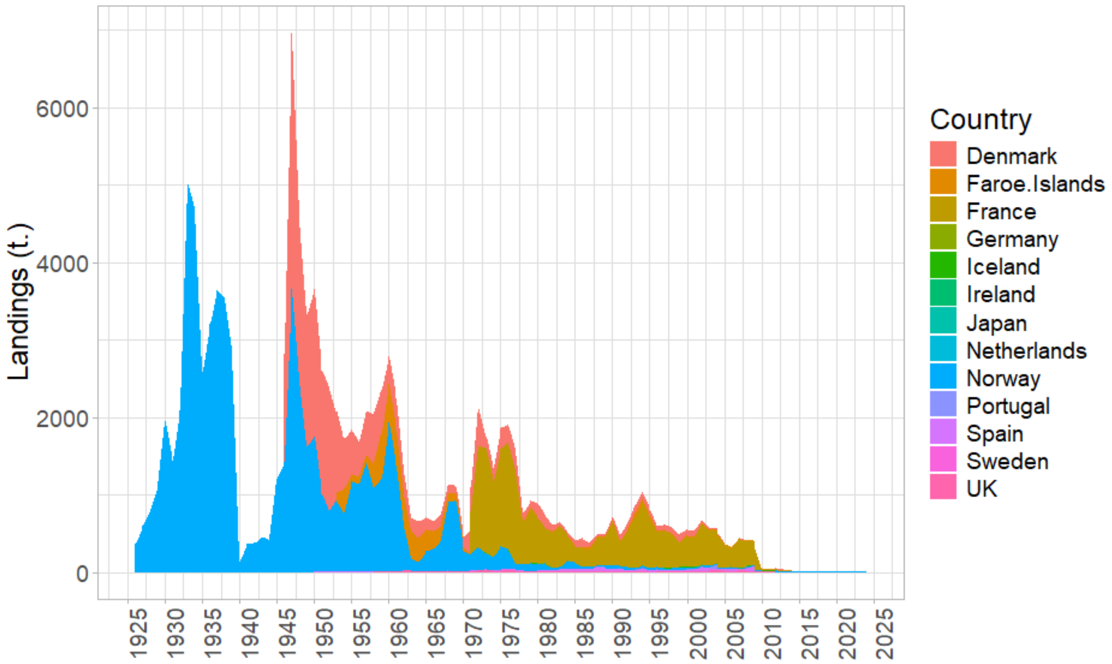


Figure 6.1. Porbeagle in the Northeast Atlantic. Working Group estimates of longer-term trend in landings of porbeagle in the Northeast Atlantic (1926–2024).

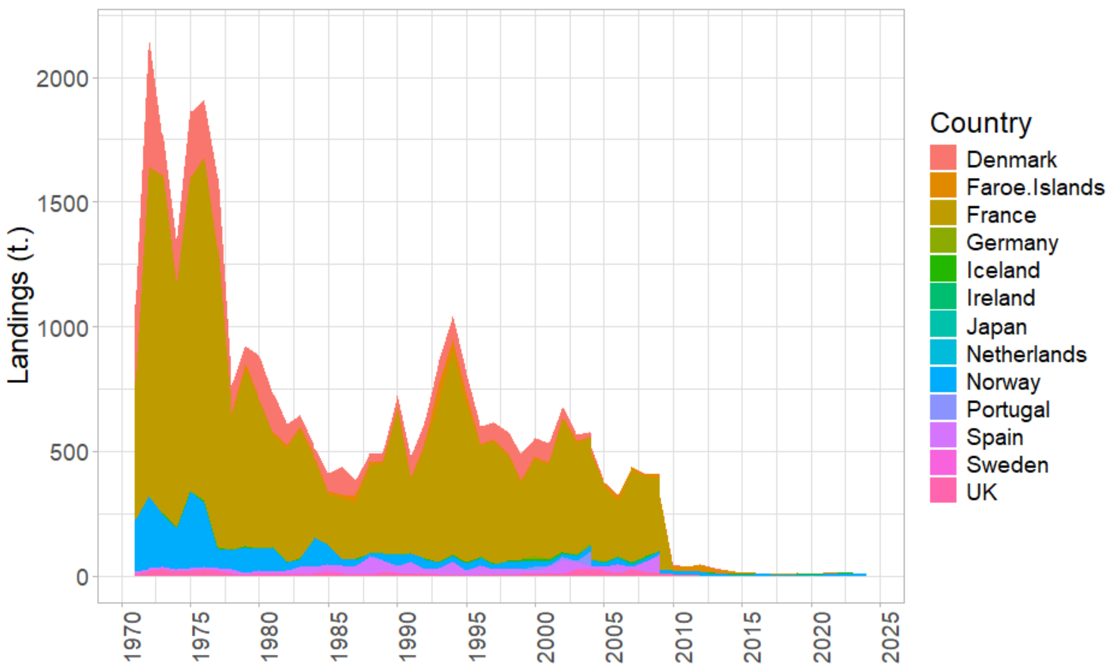


Figure 6.2. Porbeagle in the Northeast Atlantic. Working Group estimates of landings of porbeagle in the Northeast Atlantic for 1971–2024 by country.

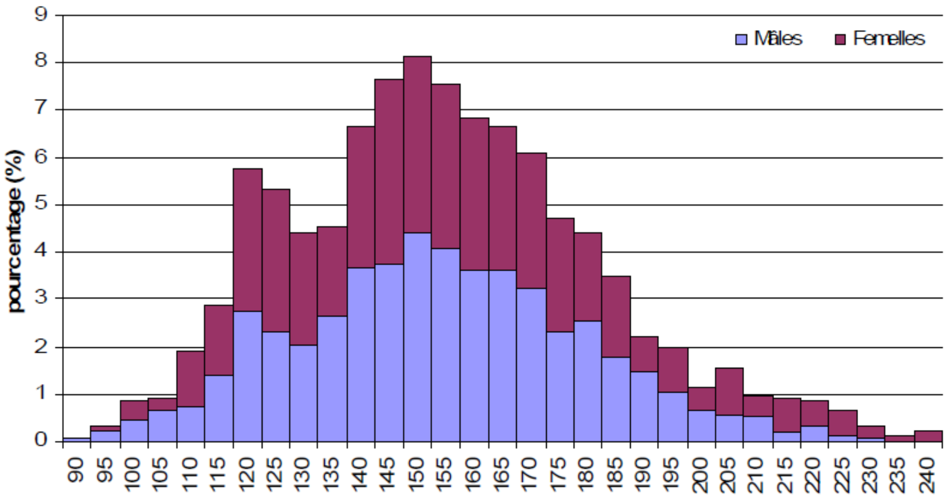


Figure 6.3. Porbeagle in the Northeast Atlantic. Length–frequency distribution of the landings of the Ile d'Yeu target fishery for porbeagle (2008–2009; n = 1769). Source: Hennache and Jung (2010).

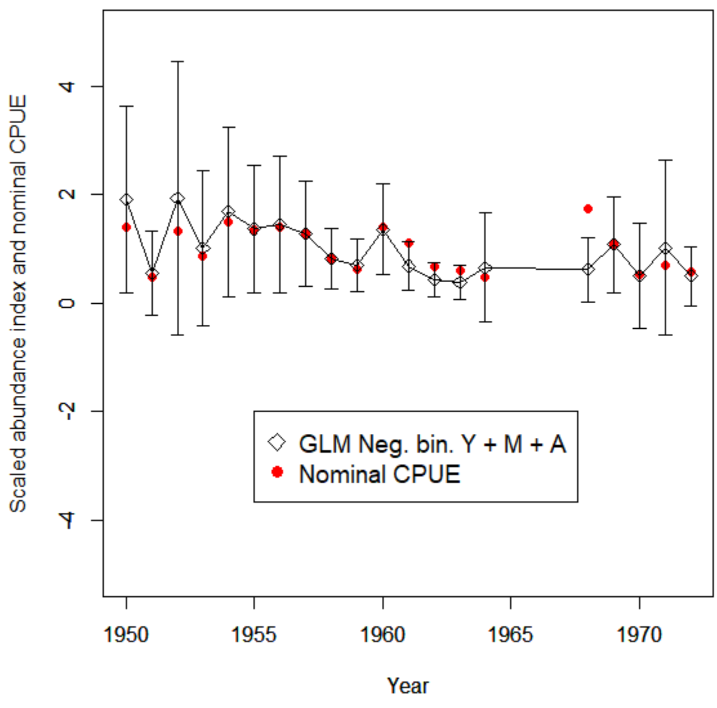


Figure 6.4. Porbeagle in the Northeast Atlantic. Relative abundance annual indices (± SE) provided by the standardization of CPUE of five longliners of the Norwegian directed fishery (with a GLM using a negative binomial error distribution with a log link; variables included: year, month and area) with the nominal CPUEs (both scaled by the mean). Source: ICES 2022.

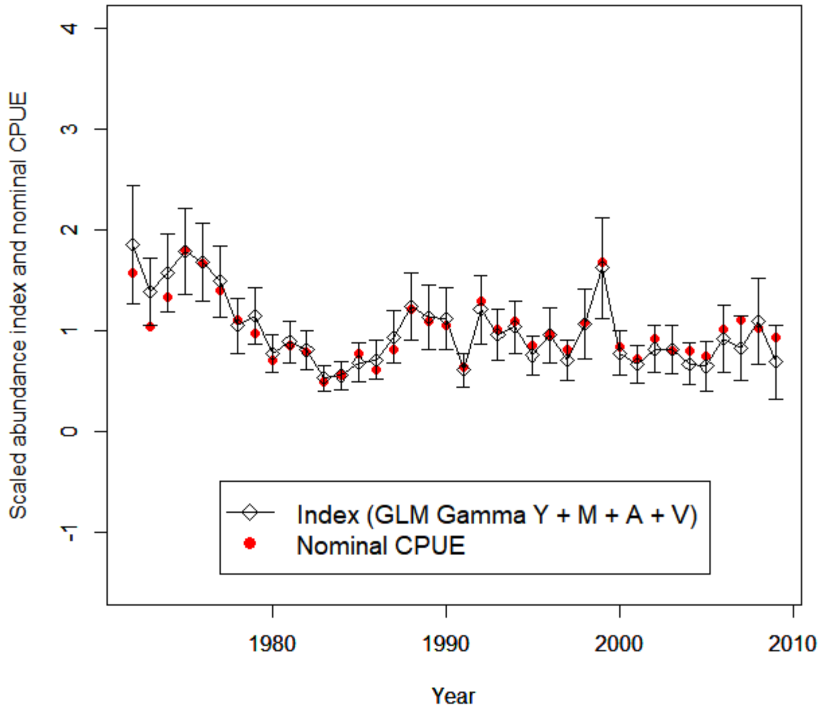


Figure 6.5. Porbeagle in the Northeast Atlantic. Relative abundance annual indices (± SE) provided by the standardization of CPUE of 19 longliners of the French directed fishery (with a GLM using Gamma error distribution with a log link; variables included: year, month, area and vessel) with the nominal CPUEs (both scaled by the mean). Source: ICES, 2022.

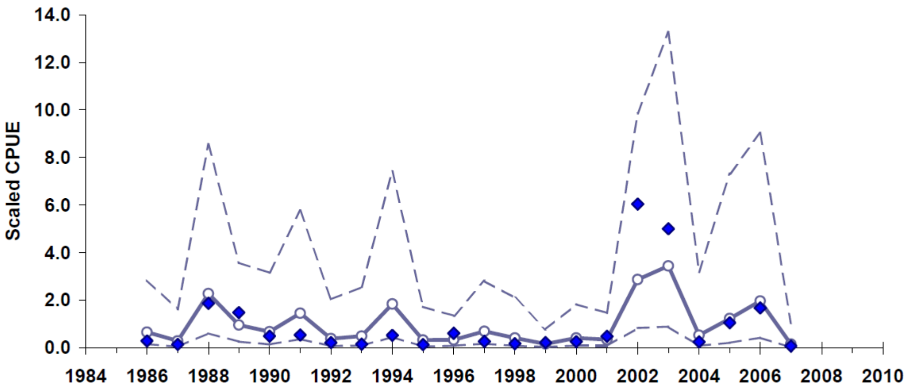


Figure 6.6. Porbeagle in the Northeast Atlantic. Relative abundance annual indices provided by the standardization of CPUE of the Spanish surface longline fishery targeting swordfish (with a GLM using delta-lognormal error distribution; variables included: year, zone, quarter, bait, year*zone, year*quarter) with confidence limits and the nominal CPUEs (blue rhombuses, scaled by the mean as the indices). Source: Mejuto *et al.*, 2010.

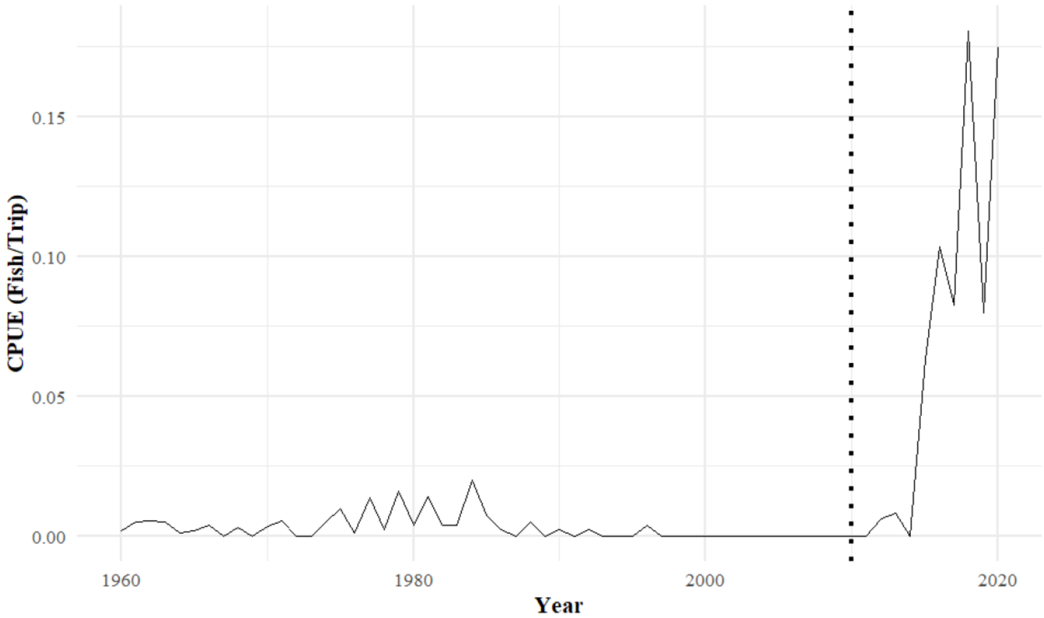


Figure 6.7. Porbeagle in the Northeast Atlantic. Temporal trends in CPUE (fish/ trip) of the UK recreational fishery in ICES Division 7e from 1960 to 2020 (n=478). Vertical dotted line represents imposition of zero TAC for the species by the EU. Source: Jones *at al.*, 2020.

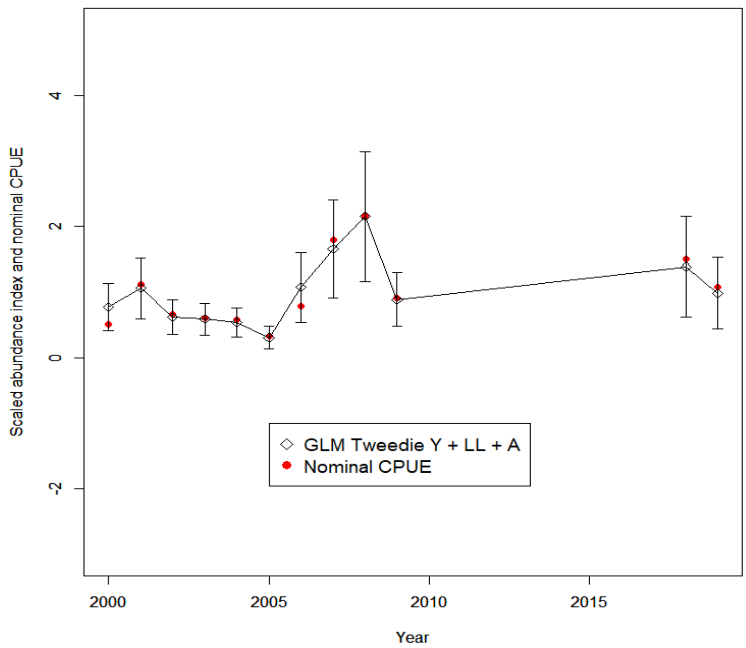


Figure 6.8. Porbeagle in the Northeast Atlantic. Relative abundance annual indices (± SE) provided by the standardization of CPUE of the composite survey CPUEs (with a GLM using Tweedie error distribution with a log link; variables included: year, type of longline and area) with the nominal CPUEs (both scaled by the mean). Source: ICES, 2022.

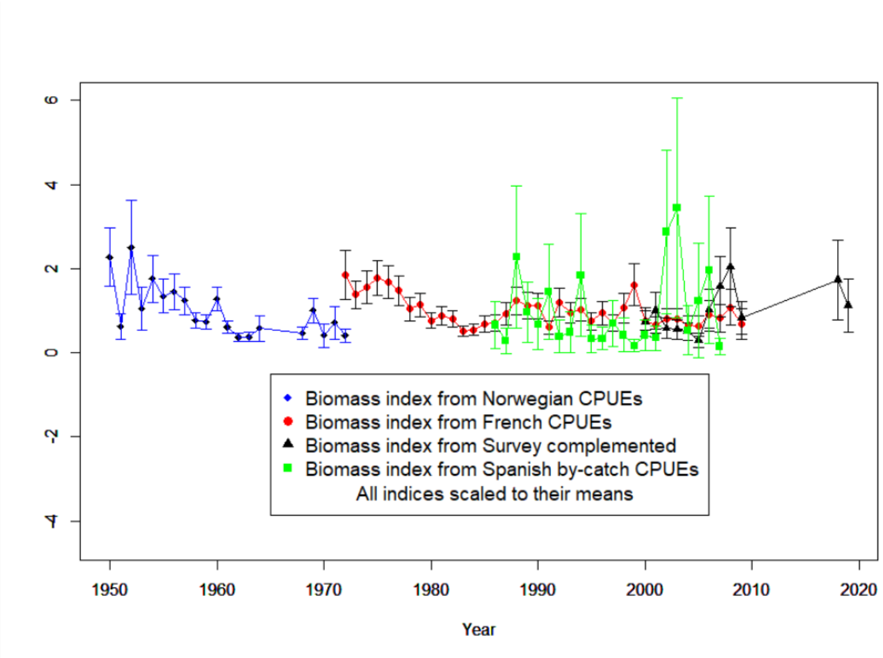


Figure 6.9: Porbeagle in the Northeast Atlantic. Relative biomass indices used in the porbeagle SPiCT assessments provided by the standardization of the four available CPUEs series. Source: ICES, 2022.

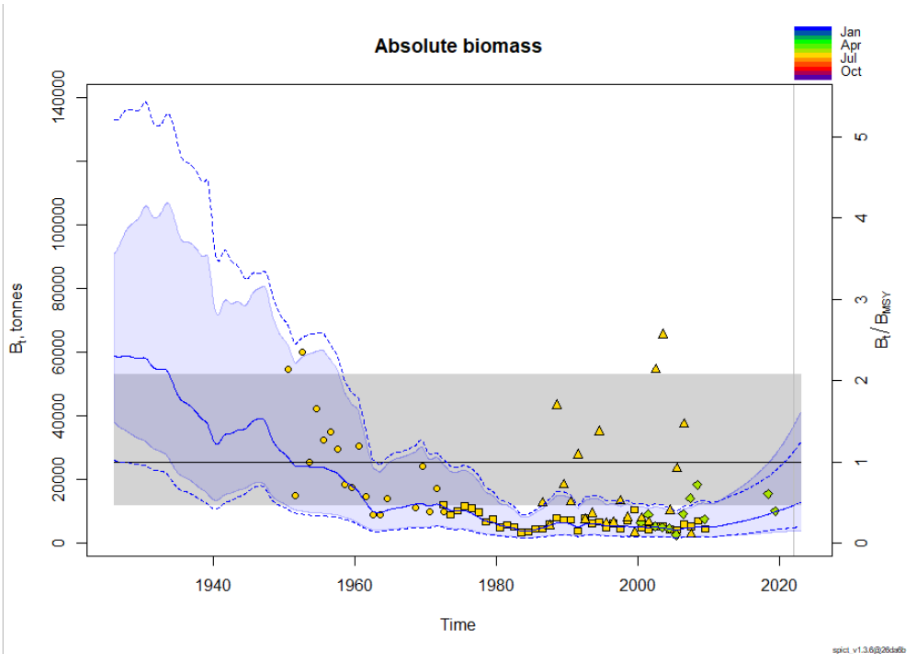


Figure 6.10: Porbeagle in the Northeast Atlantic. Absolute and relative biomasses from the 2022 SPiCT assessment.

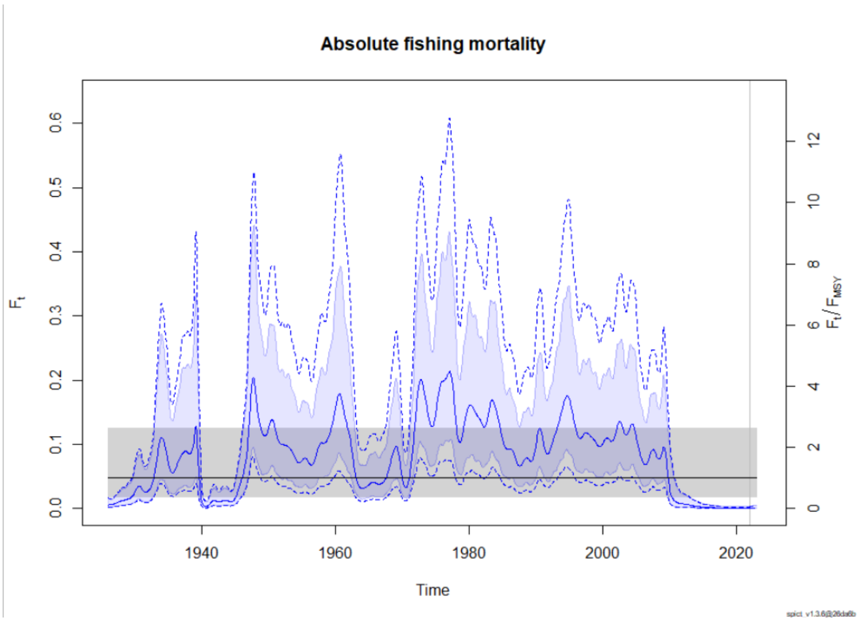


Figure 6.11: Porbeagle in the Northeast Atlantic. Absolute and relative fishing mortalities from the 2022 SPiCT assessment.

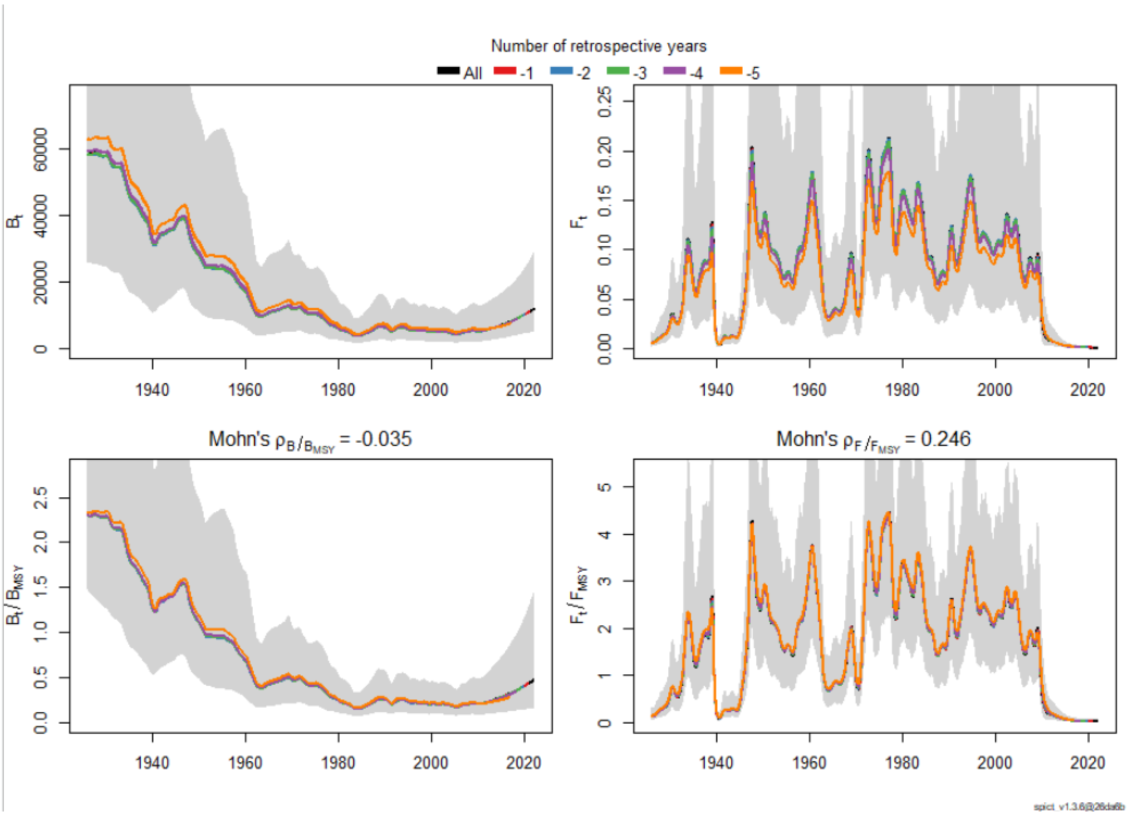


Figure 6.12: Porbeagle in the Northeast Atlantic. Retrospective plots from the 2022 SPiCT assessment.