25 Catsharks (*Scyliorhinidae*) in the Northeast Atlantic

Advice for stocks in this ecoregion was last provided in 2017 and will next be provided in 2019. Therefore, this chapter only contains minor edits and updates to landings tables and figures. The advice for 2018 and 2019 is reproduced in Section 25.2.3.

25.1 Stock distribution

This section addresses four species of catshark that occur on the continental shelf and upper slope of the ICES area: Lesser-spotted dogfish (or small-spotted catshark) *Scyliorhinus canicula*, greater-spotted dogfish *Scyliorhinus stellaris*, black-mouth dogfish (or black-mouth catshark) *Galeus melastomus* and Atlantic catshark *Galeus atlanticus.* Other catsharks that occur in deeper waters (*Apristurus* spp. and *Galeus murinus*) are not included here (see Section 5). All catsharks are demersal and oviparous (egg-laying) species.

These species have been referred to as catsharks, dogfishes and other names including hounds. Names recognised by FAO may not be suitable to minimise confusions with *Scyliorhinus canicula* being referred to as small-spotted catshark and *S. stellaris* as nursehound. Therefore, ICES refer to these species as follows:

English name	Scientific name
Lesser-spotted dogfish	Scyliorhinus canicula
Greater-spotted dogfish	Scyliorhinus stellaris
Black-mouth dogfish	Galeus melastomus
Atlantic catshark	Galeus atlanticus

The meta-population structure is not known, but tagging data indicate that movements are generally quite limited (e.g. Burt *et al*., 2013 WD for *S. stellaris;* Rodriguez-Cabello *et al*., 2004, 2007 for *S. canicula*). In relation to lesser-spotted dogfish, STECF (2003) assumed that "*separate stocks reside in separate ICES Divisions and that immigration and emigration from adjacent populations are either insignificant or on a par*" and that such species would best be managed as local populations (i.e. on the level of an ICES Division or adjacent Divisions).

Lesser-spotted dogfish: *S. canicula* is an abundant species occurring on a range of substrates (from mud to rock) on the European continental shelves, from coastal waters to the upper continental slope, but is most abundant on the shelf. Its distribution ranges from Norway and the British Isles to the Mediterranean Sea and Northwest Africa (Ebert and Stehmann, 2013). ICES currently consider 4 stock units for this species: (i) North Sea ecoregion (Subarea 4 and Divisions 3.a and 7.d), (ii) Celtic Seas and west of Scotland (Subarea 6 and Divisions 7.a–c and 7.e–j), (iii) northern Bay of Biscay (Divisions 8.a–b and 8.d), and (iv) Atlantic Iberian waters (Divisions 8.c and 9.a).

Greater-spotted dogfish: *S. stellaris* is a locally frequent inshore shark of the Northeast Atlantic continental shelf and is generally found from shallow water to depths of about 125 m on rough or rocky bottoms, including areas with algal cover (e.g. kelp forests) (Ebert and Stehmann, 2013). It is Europe's largest catshark, growing to at least 130 cm.

This species is currently only assessed for the Subareas 6 and 7, as it is locally common in parts of this area, and data are limited for other parts of the species' biogeographic range, where it occurs at lesser density.

Black-mouth dogfish: *G. melastomus* is a small-sized shark (<90 cm), found on the upper slope in the Mediterranean Sea and the Atlantic from northern Norway and the Faroe Islands to Senegal (Ebert and Stehmann, 2013).

This species is currently assessed over two management units (i) Celtic Seas and west of Scotland (Subarea 6 and Divisions 7.a–c and 7.e–j), and (ii) Bay of Biscay and Atlantic Iberian waters (Subarea 8 and Division 9.a).

Atlantic catshark: *G. atlanticus* is a small catshark found on the continental slopes living in depths of 330–790 m. Its distribution in the Eastern Atlantic ranges from Spain (off Galicia) to Portugal into the Mediterranean and further south to Morocco and possibly to Mauritania. Northern range limits are unknown (Ebert and Stehmann, 2013), as there is confusion between this species and *G. melastomus* (see Rey *et al.*, 2006 for distinguishing characters). The stock status of *G. atlanticus* is not assessed.

25.2 The fishery

25.2.1 History of the fishery

Catsharks are a bycatch of demersal trawl, gillnet and longline fisheries over much of the ICES area. They are usually of low commercial value and, with the exception of some seasonal, small-scale fisheries in some coastal areas, are not subject to target fisheries.

The retention patterns of catsharks in the North Sea and Celtic Seas ecoregions are highly variable, with varying proportions retained/discarded (Silva *et al*., 2013 WD). Larger individuals are landed for human consumption (more so in the southern parts of the ICES area). They are also landed in some areas as bait for pot fisheries, especially in fisheries for whelk *Buccinum undatum* or brown crab *Cancer pagurus* around the British Isles.

25.2.2 The fishery in 2017

No changes to the fishery were reported.

25.2.3 ICES Advice applicable

Historically, ICES' advice for catsharks was included in the regional demersal elasmobranch advice. Specific advice sheets have been given since 2012.

The last assessments of catsharks were published in 2017 for 2018 and 2019 and were based on the ICES approach to data-limited stocks. Quantitative advice for some stocks was provided for the first time (see table below).

STOCK	STOCK CODE	ASSESSMENT CATEGORY	ADVICE BASIS	ADVISED LANDINGS IN 2018 AND 2019
Lesser-spotted dogfish (*Scyliorhinus canicula*) in Subarea 4 and Divisions 3.a and 7.d	Syc.27.3a47d	3	Precautionary	Catch of 3380 t
Lesser-spotted dogfish (*Scyliorhinus canicula*) in Subarea 6 and Divisions 7.a-c and 7.e–j	Syc.27.67a-ce-j	3	Precautionary	4296 t
Lesser-spotted dogfish (*Scyliorhinus canicula*) in Divisions 8.a-b and 8.d	Syc.27.8abd	3	Precautionary	Catch of 5592 t, equal to landings of 611 t.
Lesser-spotted dogfish (*Scyliorhinus canicula*) in Divisions 8.c and 9.a	Syc.27.8c9a	3	Precautionary	1178 t
Greater-spotted dogfish (*Scyliorhinus stellaris*) in Subareas 6 and 7	Syt.27.67	3	Precautionary	Decrease by 36%
Black-mouth dogfish (Galeus melastomus) in subareas 6 and 7 (West of Scotland, southern Celtic Seas, and English Channel)	Sho.27.67	3	Precautionary	Increase by no more than 20%
Black-mouth dogfish (*Galeus melastomus*) in Subarea 8 and Division 9.a	Sho.27.89a	3	Precautionary	156t.

The advice for 2016 and 2017 can be found in the 2017 working group report (ICES 2017a).

25.2.4 Management applicable

These species are not subject to fisheries management in EU waters.

Galeus melastomus was originally included in the list of deep-water sharks, but Council Regulation (EC) 1182/2013 removed this species from this list following ICES advice. This review was based on the fact that its main distribution extended to upper slope and outer shelf habitats, which are not considered deep-water habitats, and that it had different life-history traits from other species on the list (with the assumption of lower vulnerability towards fishing pressure). No management has been applied for this species since.

25.3 Catch data

25.3.1 Landings

Landings of catsharks were traditionally reported in category groups (e.g. dogfishes and hounds) in some countries, though in recent years more species-specific landings

have become available. The lack of historical landings data and the uncertainty associated with recent species-specific information suggest data herein should be viewed with caution.

Nevertheless, in areas where S*cyliorhinus canicula* is much more abundant than *S. stellaris*, reported landings may be regarded as representative of the former species. The species is of minor interest to small-scale fisheries and local markets and most landings have been sold through fish auction markets.

Landings data for the period 2005-2015 were revised in 2016, following the WKSHARK2 workshop (ICES, 2016) and the dedicated data call where the 10-year time-series was requested. In 2017, the data call for WGEF requested an update of 2015 and report of 2016 landings. The ICES estimates of data presented (Tables 25.1a–f) are based upon an analysis of reported landings data, following the two data calls, and the updated 2018 data call. Some reported data were corrected, allocation to stocks were consolidated based on expert knowledge.

i) Some landings of catsharks have probably been reported in generic ´dogfish´ categories, this fraction of the landings is reducing in recent years to a few percent since 2016;

ii) Some landings reported as either *S. canicula* or *S. stellaris* may comprise a fraction of the other species. For example, Portuguese landings from 9.a assigned to *S. stellaris* are likely to correspond to *S. canicula* only;

iii) It is unclear as to whether catsharks used for pot bait are reported in landings data.

The confusion between *S. canicula* and *S. stellaris* is likely to have a greater impact on the lesser abundant *S. stellaris*.

Nominal landings data for *S. canicula* (including possible mixing with *S. stellaris*) from Subarea 4 and Divisions 3.a and 7.d (Table 25.1a), Subareas 6 and 7 (Table 25.1a), Divisions 8.a–b and 8.d (Table 25.1.c) are reported mainly from France, while those from Divisions 8.c and 9.a are reported by Spain and Portugal.

Nominal landings data for *G. melastomus* from Subareas 6 and 7 (Celtic Seas) were only declared by France and Spain (Table 25.1e). There are no reported landings prior to 2002. It is likely that this species was caught in deep-water fisheries prior to these years, but were potentially discarded or reported under generic landing categories.

Landings data for *G. melastomus* from Subarea 8 are reported mainly by Spain, whereas most landings from Division 9.a are from the Portuguese fleet (Table 25.1f). Since 2010, reported landings declined due to the introduction of the zero-TAC for deep-water sharks (where this species was previously included). Following the removal of this species from the list of deep-water sharks in 2013, international landings returned to similar levels as reported prior to 2009.

Given the widespread discarding of catsharks, reported landings are not considered representative of catch.

25.3.2 Discards

Scyliorhinus canicula and other catsharks are often discarded from continental shelf fisheries (e.g. Silva *et al.*, 2013 WD). The potentially high discard survival of species in the Scyliorhinidae family, at least for continental shelf fisheries, means that landing data are likely to be more representative of dead removals.

In 2017, several aspects of the discards were investigated in WKSHARKS3, however overall estimates of discards were not achieved (ICES, 2017b).

Discard data for *G. melastomus* and *S. canicula* from the Iberian and Celtic Sea are available from Spanish on board observations (Santos *et al*., 2010 WD).

Discard information of *S. canicula* and *G. melastomus* is also available from several countries in Subarea 8 and Division 9.a (Table 25.2). For *S. canicula,* discard estimates in the period 2009–2016 ranged from 33–195% of the total landed weight, with trawlers being the main fleet considered. Discards of *G. melastomus* in Subarea 8 and Division 9.a have been higher than reported landings throughout the time-series. However, these preliminary estimates may be an artefact of raising factors applied to the subsampling of commercial catches.

In the Portuguese crustacean bottom otter trawl fishery operating in Division 9.a, the most frequently discarded demersal elasmobranchs were *G. melastomus* and *S. canicula*. Discard estimates for the artisanal fleet are not available, but proportions of discards by métier in sampled trips are presented in Table 25.3. S*. canicula* and *G. melastomus* are among the most discarded species by commercial fishing vessels with a fishing permit to set gillnets or trammel nets (LOA>=12 m) (Figueiredo *et al*., 2017). Frequency of occurrence (%) of both species in the discards from hauls with gillnets and/or trammel nets from those vessels range between 31 and 57% for *S. canicula* and between 0 and 6% for *G. melastomus* (Figueiredo *et al*., 2017). For further details regarding estimated total discarded weight, length distribution and sex ratio for both species please refer to ICES (2014), Prista and Fernandes (2013) and Figueiredo *et al.* (2017).

Discards in French fisheries from 2011 to 2016 have been estimated for stocks syc.27.347d,syc.27.8abd, syc;27.7a-ce-j, syt.27.67, sho.27.67,sho;27.89a (and presented at WKSHARKS3) using two methods: i) standard method for raising discards to the landings of the species and ii) method where observed discards are raised to the total landings of all species combined (ICES, 2017a). *S. canicula* is a bycatch in most French fisheries and a high number of DCF level 6 métiers catch it. For métiers which do not land the species (100% discards) discards were estimated by raising to the total landings (all commercial species of fish, molluscs and crustaceans combined). An overall discarding rate (discards/landings) was calculated to 170%. This rate varied from 10–100% across métiers.

25.3.3 Discard survival

S. canicula have been shown to have a high discard survival in beam and otter trawl fisheries (Revill *et al*., 2005; Rodriguez-Cabello *et al*., 2005), and anecdotal observations suggest that it would also have high survival in coastal longline fisheries. There are no data for discard survival of these species in gillnet fisheries. There are also no data for the survival of *G. melastomus* caught in fisheries operating along the outer continental shelf and upper slope. Recently, a studied carried on survival of deep-water sharks caught by longline indicated some survivorship for this species using this fishing gear (Rodríguez-Cabello & Sanchez, 2017).

25.3.4 Quality of catch data

Accurate species-specific landings data are not currently available. The 2012–2014 French programme "Mislabelling of Chondrichthyans in French landings" aimed to better evaluate the relative proportion of species mixed under a single landing name, as it is for *S. canicula* and *S. stellaris* (see above).

Discarding can be high, but is variable. Furthermore, there is potentially high discard survival, at least for *Scyliorhinus* spp., and so further studies are required to estimate 'dead removals'.

25.4 Commercial catch composition

Data from national observer programmes have provided information on the size distribution of the retained proportions of the catch. Generally, only larger individuals (L_T larger than 45 cm) are landed (Silva *et al.*, 2013 WD).

The length distributions for *S. canicula* from France (Subareas 7–8; 2012–2014) and Spain (OTB Basque fleet in Subarea 8 for 2000–2004 and 2011–2013) were shown in ICES (2014). Length-distributions of *S. canicula* from the Basque country trawl fleet are shown on figure 25.1. Catch length ranges from 10 cm to 73 cm. However, the proportion retained is from 40 cm to 73 cm, while fish of lengths from 10 cm to 66 cm are mostly discarded.

S. canicula caught by the Dutch beam trawl fleet included some smaller fish (35–40 cm L_T) in 2014 than in previous years (Figure 25.2), but most sampled fish were in the 50–65 cm L_T size categories.

Length-distributions of *S. canicula* from the Portuguese trawl and artisanal fleets (2009–2016) were similar for both nets and trawlers, and between years (ICES, 2016; Moura *et al.*, 2017a; Figure 25.3a). Length-frequency distributions of *S. canicula* retained and discarded in fishing trips using set nets, between 2011 and 2014 (n=49) are presented in Figure 25.3b (Figueiredo *et al.*, 2017). A DCF pilot study on trammel nets (GTR_DEF_>=100_0_0; 2012–2014) showed no major differences in the length frequencies of *S. canicula* between sexes or between years (Figure 25.3c).

The length-distribution for *S. stellaris* caught by the French fleet in 2012–2014 was 44–124 cm (ICES, 2014).

25.5 Commercial catch–effort data

Commercial catch and effort data have not been analysed for most scyliorhinid stocks in the ICES area.

S. canicula (8.c): Landings per unit of effort data from the Basque Country OTB fleet (Subarea 8; Figure 25.4) showed an increasing trend over the period 2001–2017, with a more stable trend (ca. 200 kg.day^{-1}) since 2009 except for a peak in 2015 (280 t).

25.6 Fishery-independent information

Groundfish surveys provide valuable information on the spatial and temporal patterns in the species composition, size composition, sex ratio and relative abundance of catsharks. It is noted that these surveys were not designed primarily to inform on these populations, and so the gears used, timing of the surveys and distribution of sampling stations may not be optimal. However, these surveys provide the longest time-series of species-specific information.

Depending on the area and species, one to several surveys provide reliable time-series of data (see table below).

ICES STOCK CODE	SURVEY USED FOR ASSESSMENT
Syc.27.3a47d	Q1 and Q3 NSIBTS, UK-7d-BTS and CGFS++
Syc.27.7a-ce-j	EVHOE, IGFS, Spanish Porcupine Bank survey and UK-7af-BTS (2001-2016).
Syc.27.8abd	EVHOE
Syc.27.8c9a	Spanish surveys in the South (Gulf of Cadiz) IBTS-GC-Q1-Q4 (ARSA) and in the North of Spain (SpNGFS-WIBTS-Q4) and Portuguese survey (PT-PGFS-Q4)
Syt.27.67	UK-7af-BTS
Sho.27.67	Spanish Porcupine Bank survey
Sho.27.89a	EVHOE survey in Subarea 8, Spanish IBTS-CG-Q1-Q4 (ARSA) and the Portuguese Crustacean Surveys/*Nephrops* TV Surveys (PT-CTS UWTV (FU 28-29)).

For syc.27.67a-ce-j, earlier analyses of the Scottish surveys in Division 6.a suggested increasing catch rates (see ICES, 2010), but updated analyses are required. Despite survey catch trends in the UK-7e-BTS not being used for assessment, *S. canicula* is by far the most abundant elasmobranch caught across the survey grid, with a full length range (8–73 cm) observed. This species is most abundant in the outer parts of Lyme Bay, Eddystone grounds and parts of the Normano-Breton Gulf (Silva *et al.*, 2014 WD).

Previously, the Basque ITSASTEKA survey reported two demersal sharks, *G. melastomus* and *S. canicula*, the latter was the second most abundant species in the survey and often encountered in all trawl stations except areas of shallower waters where they were less abundant (depths <250 m) (ICES, 2014). This survey ceased in 2014 and is therefore no longer used for assessment (for further information, see ICES, 2014).

For Syt.27.67 in is noteworthy that *S. stellaris* has a more restricted distribution than *S. canicula*, preferring rocky and inshore habitats. Hence, most surveys do not sample their main habitats effectively, resulting in low catch rates, especially the smallest size groups. The catchability of larger individuals may also be low in some survey trawls. The UK-7af-BTS is one of the few surveys to encounter this species regularly, especially around Anglesey and Lleyn Peninsula and in Cardigan Bay.

Other surveys: Whilst *S. stellaris* is caught only occasionally in the North Sea ecoregion, it is captured regularly in the eastern Channel (Division 7.d). It is taken in small numbers during the UK-7d-BTS and the French CGFS. Whilst data for the former are too limited to inform on trends in relative abundance, this species is observed in most years (Ellis, 2015 WD).

The Spanish SpGFS-WIBTS-Q4 survey catches *G. melastomus.* However, data are only shown as general trends and not used for assessment since most of the biomass (nearly the 75%) is caught in the additional deeper hauls (depths over 500 m) that are not standardized. In 2016, the biomass of *G. melastomus* in standard hauls remained close to the previous year with the main biomass in 8.c Division (Figure 25.11a). There seems to be no clear pattern to their geographical distribution. The length-distribution of *G. melastomus* caught in 2014 ranged from 14–71 cm over standard stratification (70–500 m) (Ruiz-Pico *et al*., 2017 WD).

Catsharks occur out of the range of assessment stock units. *S. stellaris* is a coastal species that is caught only occasionally in surveys in the Biscay and Iberian ecoregions. *G. melastomus* is caught in the northern North Sea (Division 4.a) and Norwegian Deep, but

most IBTS survey stations are <200 m deep, and so catch rates may not be informative of stock size.

25.7 Life-history information

Catsharks can have protracted spawning periods, with *S. canicula* bearing egg cases observed for much of the year. This protracted egg-laying season may result in no apparent cohorts in length distributions. Age and growth parameters are uncertain for all the species considered here.

The reproductive biology of *S. canicula* has been studied in different regions by different authors. According to Ellis and Shackley (1997), males in the Bristol Channel mature at lengths of 49–54 cm ($L_{50\%}$ at 52 cm) and females at 52–64 cm ($L_{50\%}$ at 55 cm). The egg-laying season lasts at least ten months with a peak in June and July, and fecundity increases with fish length. Egg cases are often laid on erect, sessile invertebrates (e.g. bryozoans, poriferans and hydroids). Although, data for *S. stellaris* in the Atlantic may be lacking, studies in the Mediterranean suggested that for both sexes length-at-maturity ranges from 76–79 cm (Capapé, 1977).

The reproductive biology of *G. melastomus* was studied from specimens collected off the Portuguese southern slope by Costa *et al.* (2005). Sex ratio from specimens caught by commercial crustacean trawlers was 1:1. This species is sexually dimorphic with males approaching maturity at smaller sizes than females ($L_{50\%}$ males= 49.4 cm; $L_{50\%}$ females= 69.7 cm). Mating and egg deposition were found to take place all year round, with peaks of reproductive activity in winter and in summer.

25.8 Exploratory assessment models

ICES (2014) report GAM analyses of survey trends for *S. canicula* in the CGFS, UK-7d-BTS, IBTS-Q1 and IBTS-Q3 surveys.

Biomass indices of *S. canicula* for Portuguese waters (Division 9.a) were standardized using the catch rates by haul from the Portuguese groundfish survey PT-GFS. In the standardization process of CPUE, a generalized linear mixed model (GLMM) with Tweedie distributed errors was applied. CPUE index time-series was estimated based on the relationship between CPUE and available predictive factor variables, selected depending on their significance after model adjustment. In the tested models, the logarithm of catch rate of the species in each haul ($kg.h^{-1}$) was the response variable used. Apart from factor year, the final model included the variables depth stratum (intervals of 100 meters) and fishing sector, the latter as the random variable. More details on the methodology used are presented in Figueiredo and Serra-Pereira (2012 WD) and Moura *et al.* (2015b WD).

Biomass indices of *G. melastomus* for Portuguese waters (Division 9.a) were standardized using catch rates by haul during the Portuguese Crustacean Surveys/*Nephrops* TV Surveys (PT-CTS (UWTV (FU 28-29))). Data were restricted to depths >500 m. In the standardization process of CPUE, a generalized linear model (GLM) was applied. In the tested models, the logarithm of catch rate of the species in each haul ($kg.h^{-1}$) was the response variable. The final model included the variables year and fishing sector, and followed a Gaussian distribution (Moura *et al.*, 2015a WD).

25.9 Stock assessment

25.9.1 Approach

Scyliorhinidae stocks were assessed using survey trends. These stocks are ICES category 3.2 using the ratio of the (possibly combined) survey index in the two last years to the previous five years. Survey data used are described above (see Section 25.6).

25.9.2 Lesser-spotted dogfish (*S. canicula*) in Subarea 4, and Divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, Eastern English Channel)

Survey indices increased by 5–132% for Q1 NSIBTS, Q3 NSIBTS and UK-7d-BTS, with a decrease of 4% on the CFGS survey. The combined index (Figure 25.5a) showed that catch rates for 2013–2014 were 52% higher than the five preceding years (2008–2012).

25.9.3 Lesser-spotted dogfish (*S. canicula*) in Subarea 6 and Divisions 7.a–c and 7.e–j (Celtic Seas and West of Scotland)

The results of 2015 analyses indicated that survey indices decreased by 4–46% in the IGFS and EVHOE surveys, whilst indices for the UK-7af-BTS and Spanish Porcupine Bank survey increased by 12–134% (Figure 25.6a). The combined index (Figure 25.6b) showed that catch rates for 2013–2014 were 17% higher than the five preceding years (2008–2012). The increase may be explained by the highest observed annual CPUE that occurred in 2013 (Fernández-Zapico *et al.*, 2015 WD).

25.9.4 Lesser-spotted dogfish (*S. canicula*) in Divisions 8.a–b and 8.d (Bay of Biscay)

The results of 2015 analyses indicated that survey indices in the EVHOE survey (Figure 25.7) for 2013–2014 were 37% lower than the five preceding years (2008–2012).

25.9.5 Lesser-spotted dogfish (*S. canicula*) in Divisions 8.c and 9.a (Atlantic Iberian waters)

The results of 2017 analyses indicated that there was an overall sustained increase in the biomass indices (Figure 25.8a). The combined survey index (Figure 25.8b) showed that catch rates for 2015–2016 were 32% higher than the five preceding years (2010–2014).

25.9.6 Greater-spotted dogfish (*S. stellaris*) in Subareas 6 and 7 (Celtic Seas and West of Scotland)

The results of 2015 analyses indicated that catch rates for 2013–2014 were 6% lower than the five preceding years (2008–2012), although this should be viewed in the context of a longer-term increase (Figure 25.9). However, this slight "decrease" should be viewed in the context that this species' preferred habitats are limited to certain areas of the survey grid, and there is the indication of a longer-term increase over the entire time-series (Ellis, 2015 WD; Figure 25.9).

25.9.7 Black-mouth dogfish (*Galeus melastomus*) in Subareas 6 and 7 (Celtic Sea and West of Scotland)

Catch rates for 2015–2016 were 39% higher than the five preceding years (2010–2014) (Figure 25.10a).

25.9.8 Black-mouth dogfish (*Galeus melastomus*) in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters)

Survey indices in the four surveys examined (Figure 25.11b) showed that catch rates for 2015–2016 were 20% higher than the five preceding years (2010–2014). This is related to the strong increase observed in EVHOE and slight increases in PT-CTS UWTV. The ARSA survey indicate a longer-term increase in the abundance of *G. melastomus* in the Gulf of Cadiz (Figure 25.11c), with peaks in 2006 and 2013.

25.10 Quality of the assessments

Although the trawl surveys used in this report were not designed to sample catsharks, *S. canicula* and *G. melastomus* are sampled in large numbers in various surveys. Survey indices are considered to properly track stock abundance trends for these species.

In relation to *G. melastomus*, fisheries-independent data in the Portuguese surveys suggest that this species may have been historically aggregated with *G. atlanticus*, and there may be some problems with misidentification of these two species, especially historically (Moura *et al.*, 2015a WD; Moura *et al.*, 2017b WD). Data from the Portuguese crustacean surveys/*Nephrops* TV Surveys (PT-CTS (UWTV (FU 28-29))) conducted in 2014 showed that *G. melastomus* is more abundant and distributed mainly >500 m deep, and so data from depths ≥500 m were considered for assessment purposes.

Survey effort on rocky, inshore grounds is limited, and so catch rates for the larger-bodied *S. stellaris* are low in some surveys, as this species favours rocky, inshore habitats.

Commercial data are more problematic due to the widespread use of generic categories (e.g. "dogfish"), especially in earlier years. Although a greater proportion of the data is reported to species or genus level, the quality of these data has not been evaluated. Other issues may constrain the use of these data, for example possible misidentification in areas such as the Celtic Seas where both *S. canicula* and *S. stellaris* occur. Furthermore, historical data may be underestimated as these species may have not been marketed for human consumption, and might therefore not have all been included on official landings, e.g. in those areas where *S. canicula* may be landed for use as bait in pot fisheries. Therefore, landings data are not considered to be accurate and should be viewed as preliminary results.

Catsharks are mainly caught as bycatch and have a moderate market value (including no human consumption market for the smaller fraction) resulting in a high level of discarding. Previous studies have shown that *S. canicula* may have a high survival rate (see Section 25.3.3), and while there are no current studies for *S. stellaris*, it can be assumed that the survival of this shallow-water species may be equally high. Therefore, discards of Scyliorhinidae should not be considered exclusively as dead removals. However, for *G. melastomus* anecdotal information suggests survival will be lower. Further studies should be considered if more accurate information on the level of discarding is to be inferred for the two latter species.

25.11 Reference points

No reference points have been proposed for these stocks.

25.12 Conservation considerations

Both *S. canicula* and *G. melastomus* are listed as Least Concern, and *S. stellaris* and *G. atlanticus* as Near Threatened on the IUCN Red List (Gibson *et al.*, 2008) and in the recent Red List of European marine fish (Nieto *et al.*, 2015).

S.canicula, S. stellaris and *G. melastomus* are listed as Least Concern on the Irish Red List of Cartilagenous Fish (Clarke *et al.* 2016).

25.13 Management considerations

Catsharks are generally viewed as relatively productive in comparison to other elasmobranchs (e.g. McCully Phillips *et al.*, 2015). Given this, and that they are a low value, bycatch species, catsharks are typically of lower management interest in comparison to other elasmobranchs.

Landings data are highly uncertain, and further efforts are required to construct a meaningful time-series.

In recent years, catch rates of *S. canicula* have been increasing in almost all surveys. As one of the more productive demersal elasmobranchs that is often discarded (with a high discard survival) and is known to scavenge on discards, it is unclear as to whether or not the increasing catch rates observed are a sign of a healthy ecosystem.

Discard survival of *Scyliorhinus* spp. is considered to be high, but estimates for discard survival for *Galeus* spp. are currently unavailable.

25.14 References

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Table 25.1a. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Preliminary estimates of landings (t) of lesser-spotted dogfish *Scyliorhinus canicula* in Subarea 4 and Divisions 3.a and 7.d (North Sea, Skagerrak and Kattegat, Eastern English Channel). Based on WGEF revised landings 2005-2017. NOTE: These data should be viewed with caution as some countries may have aggregated both *S. canicula* and *S. stellaris* as Scyliorhinidae and the proportion of species-specific may be unknown as both species occur in this area.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Belgium	238	267	264	337	309	290	311	249	231	325	416	343	338
France	2265	1857	1843	1822	1758	2055	2150	2061	2021	2189	2090	2173	1747
UK	92	121	104	94	118	146	185	181	184	146	185	330	280
Netherlands	56	48	32	29	37	37	47	35	36	45	85	122	141
Total	2652	2293	2243	2282	2222	2528	2693	2526	2472	2705	2776	2968	2506

Table 25.1b. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Preliminary estimates of landings (t) of lesser-spotted dogfish *Scyliorhinus canicula* in the Sub-areas 6 and 7 (Celtic Seas). Based on WGEF revised landings 2005-2016. NOTE: These data should be viewed with caution as some countries may have aggregated both *S. canicula* and *S. stellaris* as Scyliorhinidae and the proportion of species-specific may be unknown as both species occur in this area.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Belgium	240	225	199	165	168	165	227	236	216	141	252	194	209
Spain	34	33	37	12	17	28	48	109	26	18	20	9	12
France	2936	2873	3101	2728	2479	2368	2359	2060	2284	2292	2024	1969	1748
UK	123	22	115	191	226	111	111	241	380	389	1282	1333	1067
Ireland	92	42	128	248	190	232	317	221	310	336	367	425	524
Netherlands		0			0	6	1	1	4	0	3	1	0
Total	3426	3195	3579	3344	3080	2909	3064	2868	3219	3176	3948	3932	3560

Table 25.1c. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Preliminary ICES estimates of landings (t) of lesser-spotted dogfish *Scyliorhinus canicula* in Divisions 8.a–b and 8.d (Bay of Biscay).

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Belgium	10	13	13	18	24	28	28	32	23	26	27	32	26
Spain	355	338	327	460	445	302	303	472	54	92	130	239	498
France	1229	1247	1352	1382	1117	1085	1000	912	883	720	734	731	698
UK	3						0	2					
Total	1597	1598	1691	1863	1586	1415	1330	1418	960	838	891	1003	1222

Table 25.1d. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Preliminary estimates of landings (t) of lesser-spotted dogfish *Scyliorhinus canicula* in Divisions 8.c and 9.a (Atlantic Iberian waters).

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
France	1	1	1	1	1		0	0	0	0	0	0	0
Spain	297	333	327	272	229	336	354	555	577	464	417	398	448
Portugal	568	591	595	546	535	522	551	544	520	521	554	589	619
Total	866	925	923	819	765	858	905	1099	1097	985	971	987	1067

Table 25.1e. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Preliminary estimates of landings (t) black-mouth dogfish *Galeus melastomus* in Subareas 6 and 7 (Celtic Seas). Data 2005–2016 revised at WGEF 2016.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
France	.	.	.				0.1	0	0.4	0.05	0.02	0		0.26	0.13	0
Spain	9	1	.	0.1	2.9	0.4							0			
Total	9	1	0	0.1	2.9	0.4	0.1	0	0.4	0.05	0.02	0	0	0.26	0.13	0

Table 25.1f. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Preliminary estimates of landings (t) of black-mouth dogfish *Galeus melastomus* in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian waters). Data for the period 2005–2016 were revised at WGEF 2016.

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Subarea 8	France										1	1	2	2	3	0	0	1	0	1			0
	UK																1						
	Spain							4	3	6	36	46	67	74	53	21		8	13	49	47	37	34
	Spain (Basque Country)	4	3	6	2	3	1	1	1	1	*	*	*	*	*	*	*	*	*	*	+	*	*
	Total	4	3	6	2	3	1	5	4	7	37	47	69	76	56	22	1	9	13	50	47	37	34
Division 9.a	Portugal	17	17	16	20	37	29	35	29	57	37	28	24	12	16	7	2	2	1	21	25	26	34
	Spain										17	22	37	29	22	3		0	2	5	76	104	90
	Total	17	17	16	20	37	29	35	29	57	53	50	61	41	38	10	2	2	3	25	101	130	124
Subarea 8 and Division 9.a combined	Portugal	17	17	16	20	37	29	35	29	57	37	28	24	12	16	7	2	2	1	21	25	26	34
	Spain	0	0	0	0	0	0	4	3	6	53	68	103	103	75	24		8	15	54	123	141	124
	Spain (Basque Country)	4	3	6	2	3	1	1	1	1	*	*	*	*	*	*	*	*	*	*	+	*	*
	France										1	1	2	2	3	0	0	1	0	1			0
	UK																1						
	Total	21	20	22	22	40	30	40	33	64	91	97	130	116	93	32	3	11	16	75	148	167	158

*** Included in Spanish landings.**

Table 25.2. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Discard estimates (t) of *S. canicula* and *G. melastomus* by country in Subarea 8 and Division 9.a (* denotes estimates from the trawl fleet only)

S. CANICULA						
	Spain (9.a, 8.b–c)	Spain (Basque country) (8.a–b, 8.d)	Portugal (9.a)	France (8.a–b, 8.d)	Belgium (8.a–b, 8.d)	TOTAL
2003	1933	348				2281
2004	799	654				1453
2005	397	275				672
2006	1723	173				1896
2007	954	417				1371
2008	300	641				941
2009	954	1092				2046
2010	635	688	30*			1353
2011	721	1054	164*	3342		5281
2012	753	905	N.A.	4835	34	6527
2013	1137	64	N.A.	2497	22	3720
2014	2081	499	140*	4432	192	7204
2015		534	N.A.	8616		9150
2016		389	69*	8821		9279

G. melastomus					
	Spain ((9.a, 8.b–c)	Spain (Basque country) (8.a–b, 8.d)	Portugal (9.a)	France ((8.a–b, 8.d)	TOTAL
2003	589	0			589
2004	244	227			470
2005	527	5			533
2006	553	1			554
2007	1063	N.A.			1063
2008	226	23			249
2009	904	0			904
2010	1272	34			1306
2011	731	7			737
2012	1433	0	36*		1469
2013	749	3	17*		769
2014	1123	9	N.A.		1131
2015		13	35*		48
2016		2	167*		169

Table 25.3. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Proportion of *S. canicula* and *G. melastomus* discarded by gear from trips sampled under the Portuguese DCF program in Division 9.a.

	G. MELASTOMUS	*G. MELASTOMUS*	*S. CANICULA*
Year	**GNS, GTR**	**LLS (DWS)**	**GNS, GTR**
2011	0.87 (14)	0.22	0.15
2012	1.00 (14)	0.68	0.16
2013	0.00 (14)	0.28	0.17
2014	1.00 (14)	1.00	0.34

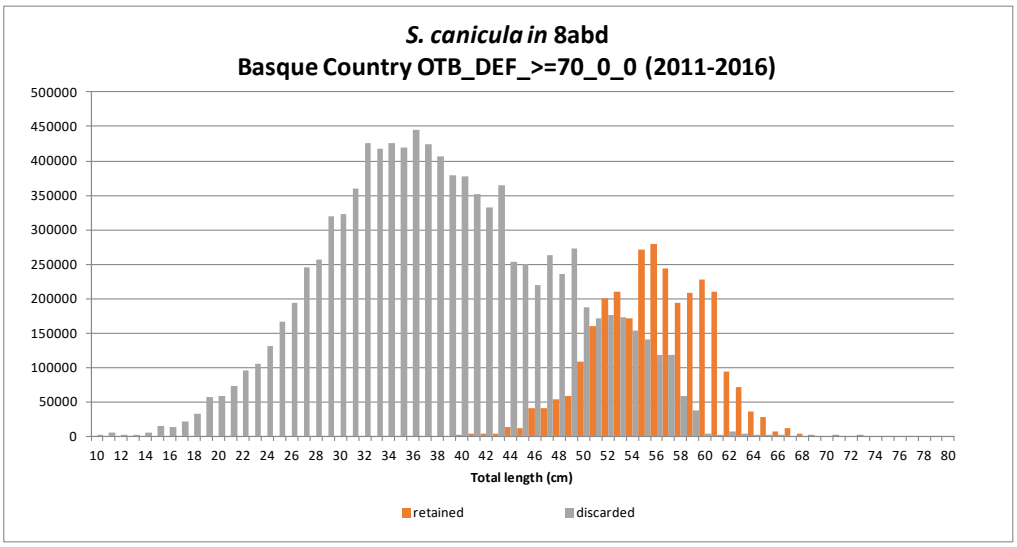


Figure 25.1. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Length frequencies of *S. canicula* retained (in red) and discarded (blue) recorded from the trawl fleet of the Basque country from 2011 to 2016 in ICES div. 8abd.

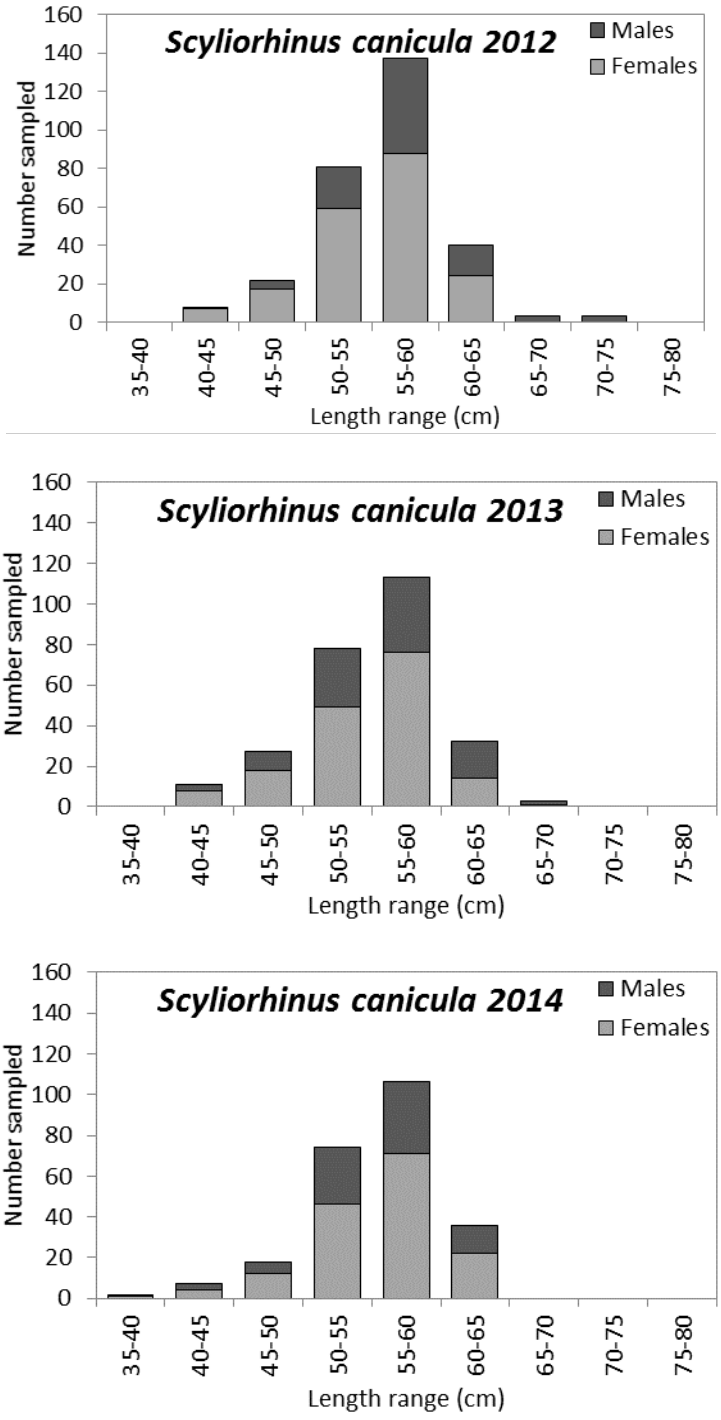


Figure 25.2. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Length–frequency distribution of *S. canicula* measured during a pilot market sampling programme of the Dutch beam trawl fleet (2012–2014).

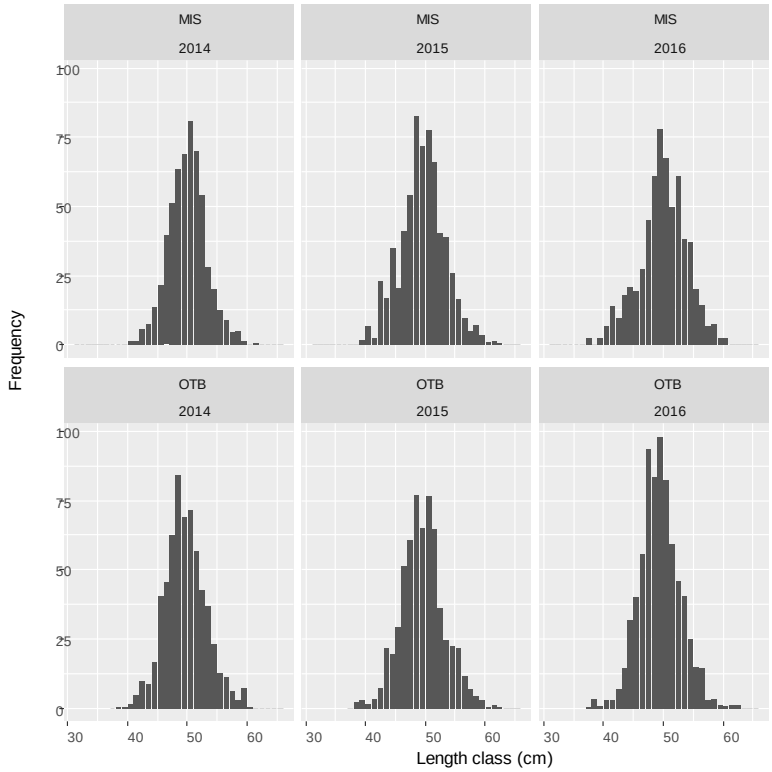


Figure 25.3a. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Length–frequency distribution of *S. canicula* from specimens sampled at Portuguese landing ports from artisanal (MIS) and trawl (OTB) fleets (2014-2016).

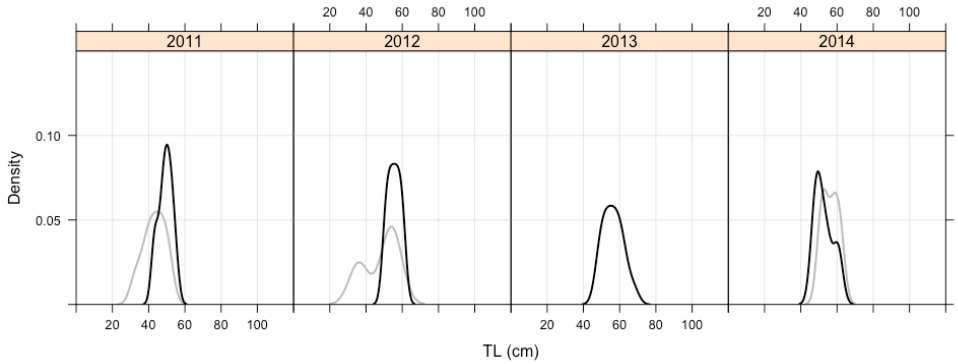


Figure 25.3b. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Length frequency distribution of S. canicula retained (black) and discarded (grey) fractions observed onboard vessels using set nets, between 2011 and 2014. The length frequencies were not raised to the total landings. n=227 sampled individuals.

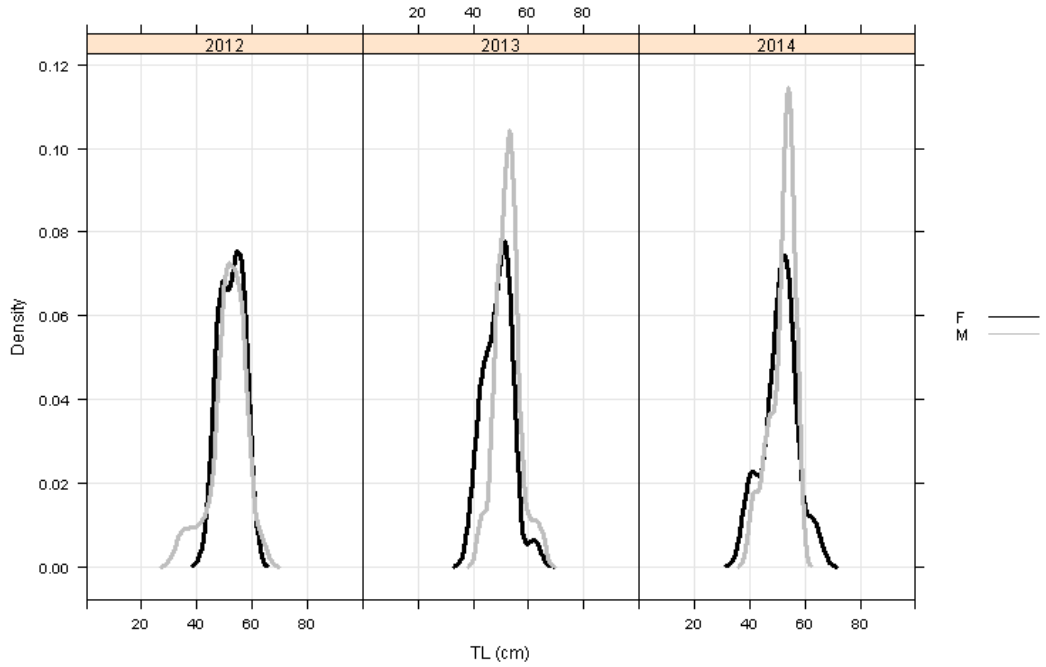


Figure 25.3c. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Length frequencies of *S. canicula* catches during the DCF pilot study on Portuguese trammel net fisheries (GTR_DEF_>=100_0_0; on-board sampling 2012–2014).

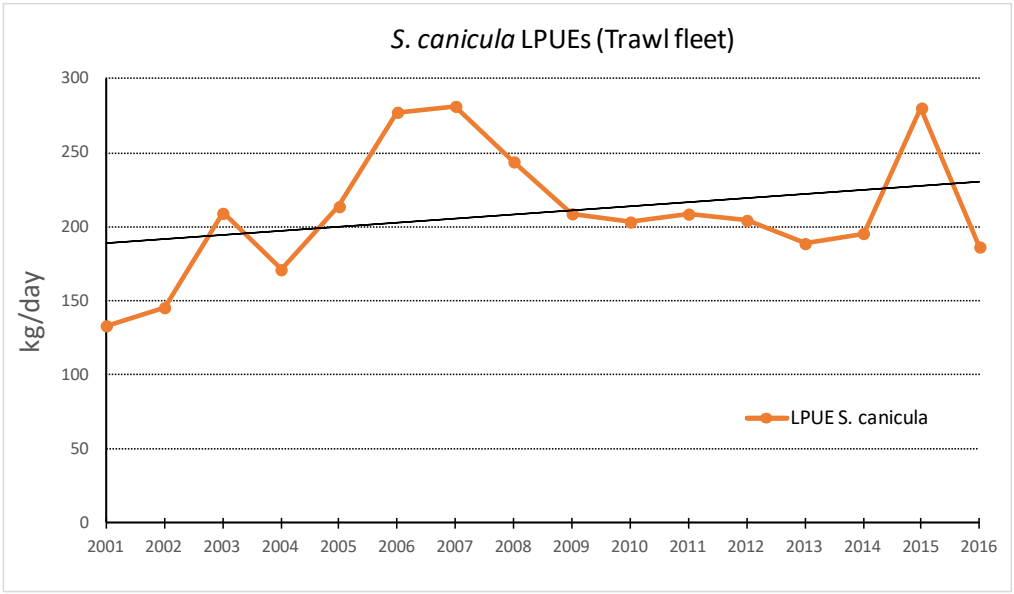


Figure 25.4. Landings per unit of effort data (LPUE) from the Basque Country trawl fleet (OTB_DEF_70) in ICES Div. 8 abd) for *S. canicula*.

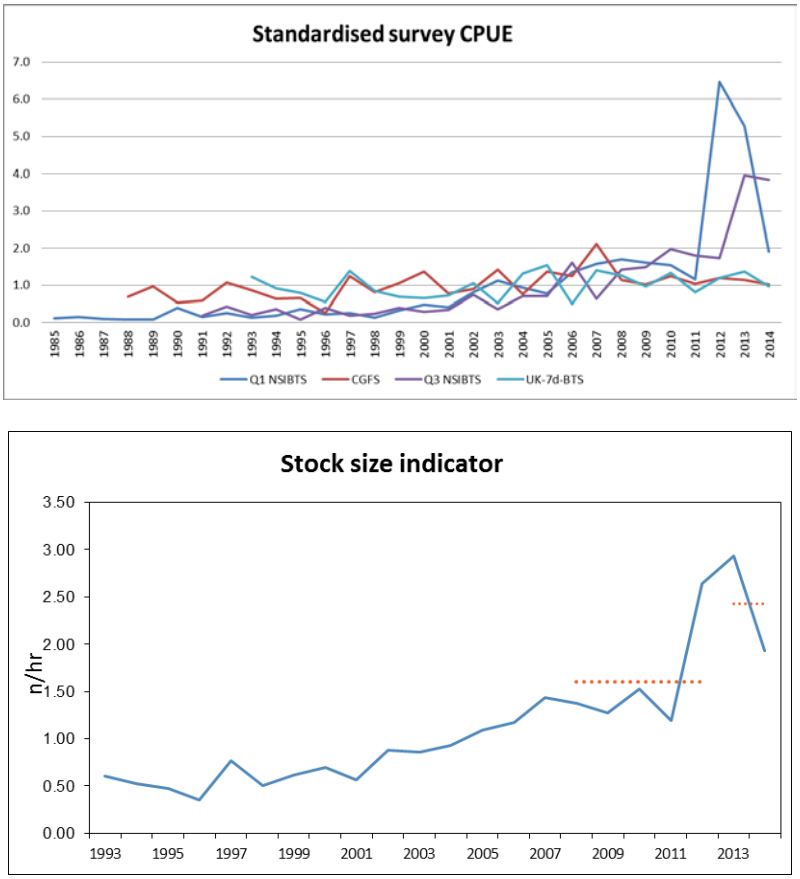
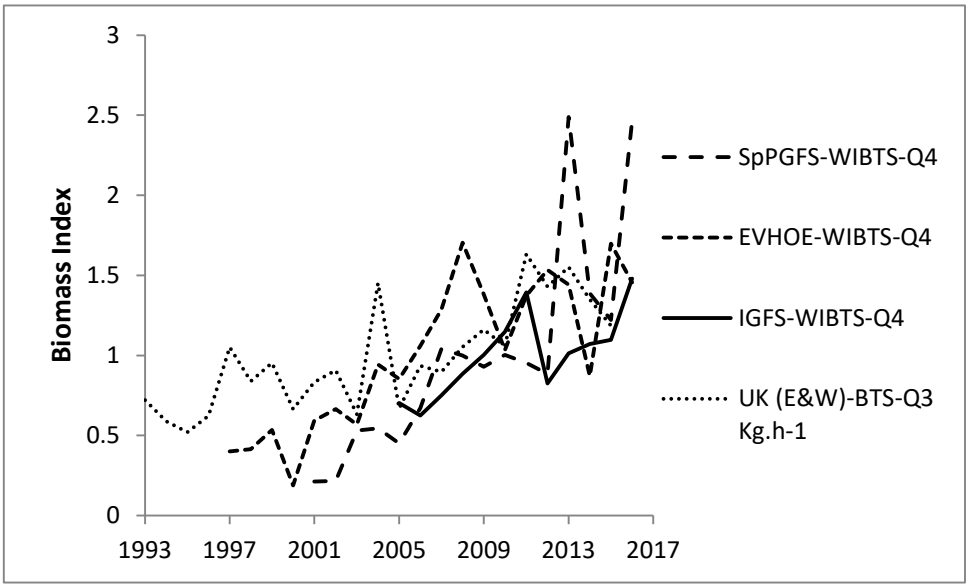


Figure 25.5a. Catsharks (Scyliorhinidae) in the Northeast Atlantic. *Scyliorhinus canicula* in the North Sea, Skagerrak, Kattegat and eastern Channel. Standardised survey indices from four surveys Q1 NSIBTS, Q3 NSIBTS, UK-7d-BTS and CGFS (top) and overall stock size indicator (bottom) for the time period 1993–2014. Dotted lines indicate the average of the last two years and the average catch for the preceding five years.



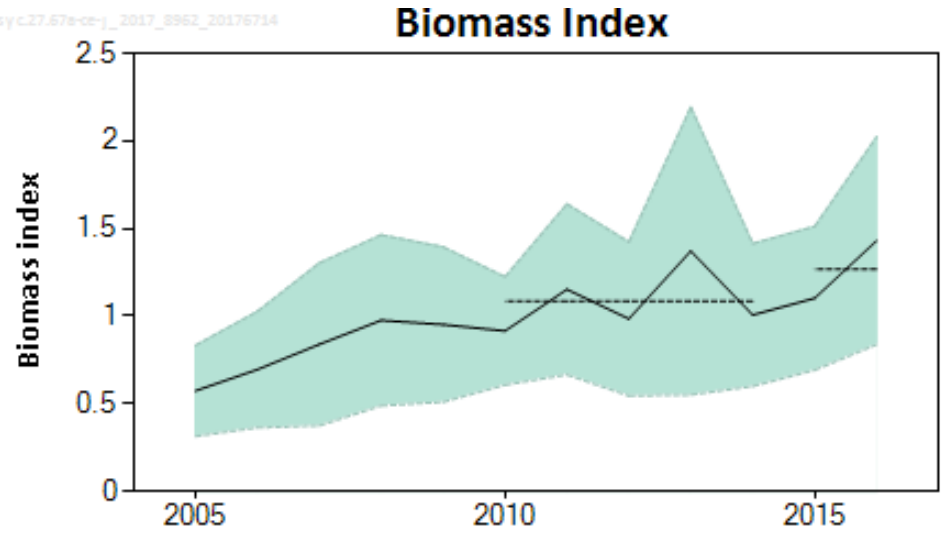


Figure 25.6a. Catsharks (Scyliorhinidae) in the Northeast Atlantic. *Scyliorhinus canicula* in the Celtic Seas Ecoregion. Standardised survey indices from four surveys IGFS, Spanish Porcupine Bank survey, UK-7af-BTSm EVHOE (top) and overall stock size indicator (bottom) for the time period 2005–2016. Dotted lines indicate the average of the last two years and the average catch for the preceding five years.

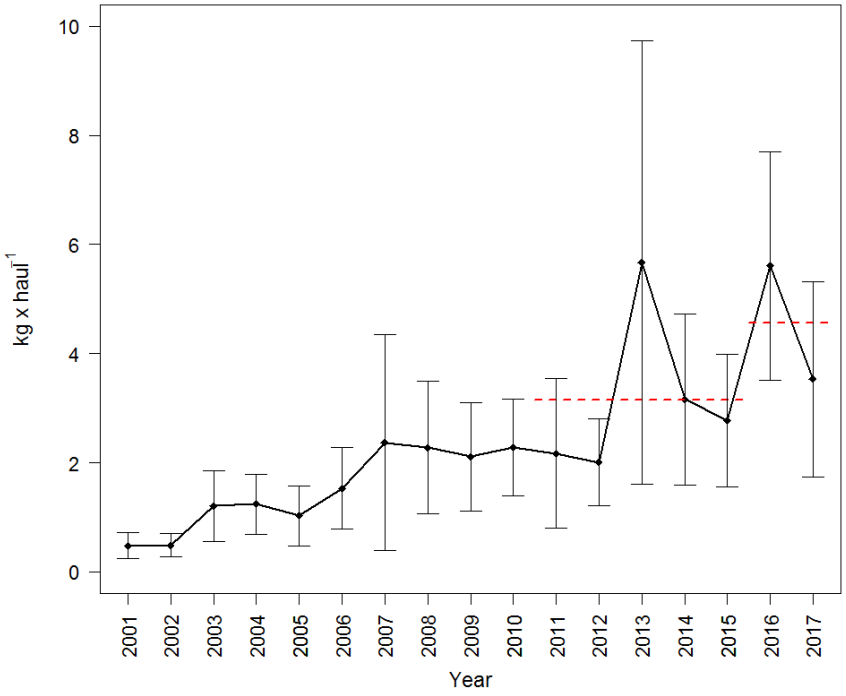


Figure 25.6b. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Changes in the *S. canicula* biomass index during the Porcupine Bank survey (2001–2017). Vertical bars correspond to the associated 95% confidence intervals. Dotted lines compare mean stratified biomass in the last two years compared to the preceding five years.

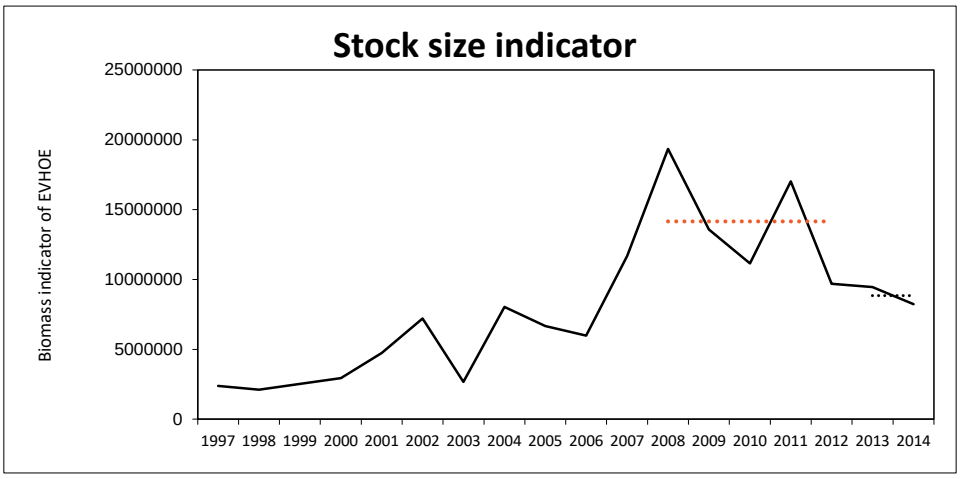


Figure 25.7. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Trends in the stock size of *Scyliorhinus canicula* in the Bay of Biscay (ICES Div. 8.abd), as estimated from the EVHOE survey.

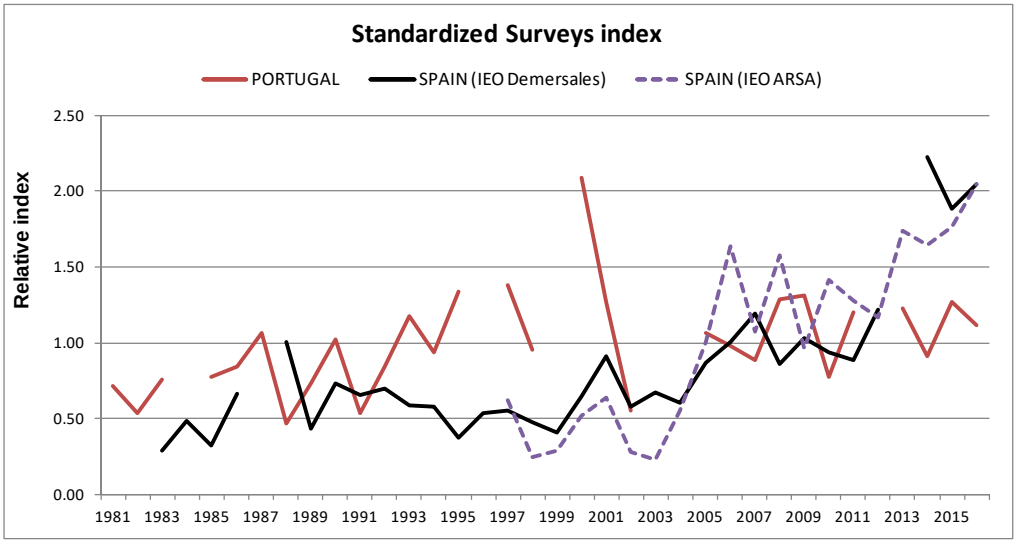


Figure 25.8a. Catsharks (Scyliorhinidae) in the Northeast Atlantic. *Scyliorhinus canicula* in the Atlantic Iberian waters (Divisions 8.c and 9.a). Standardised survey indices from three surveys ARSA (average of spring and summer surveys), Portuguese PT-GFS and North Spanish Shelf bottom survey (top).

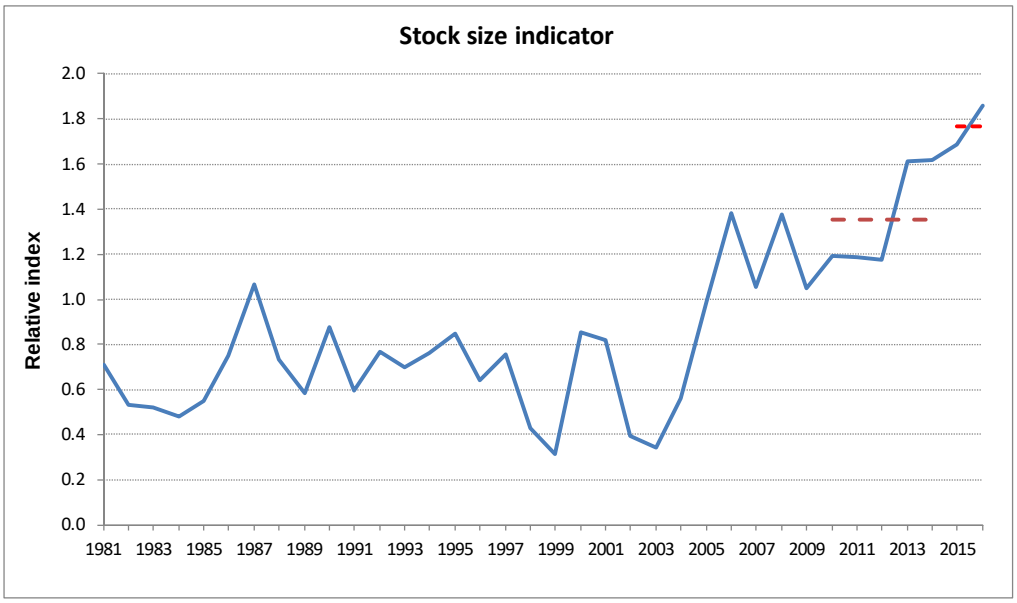


Figure 25.8b. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Scyliorhinus canicula in the Atlantic Iberian waters (Divisions 8.c and 9.a). Overall stock size indicator combined for these surveys (bottom). Dotted lines indicate the average of the last two years and the average catch for the preceding five years.

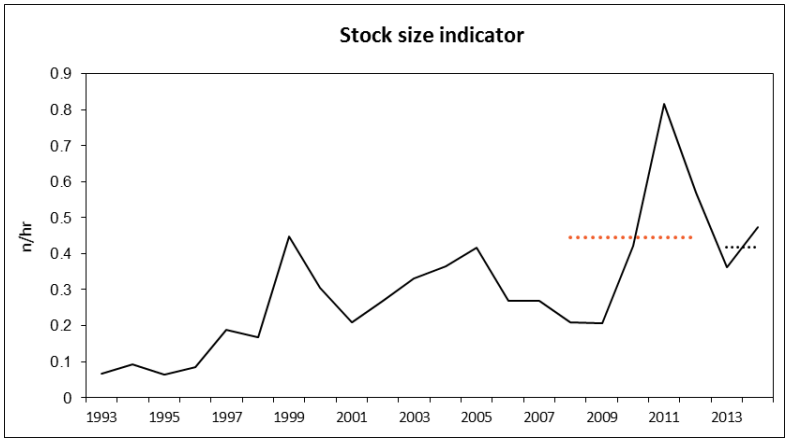


Figure 25.9. Catsharks (Scyliorhinidae) in the Northeast Atlantic. *Scyliorhinus stellaris* in Subareas 6 and 7 (Celtic Seas and West of Scotland). Overall stock size indicator from UK-7af-BTS. Dotted lines indicate the average of the last two years and the average catch for the preceding five years.

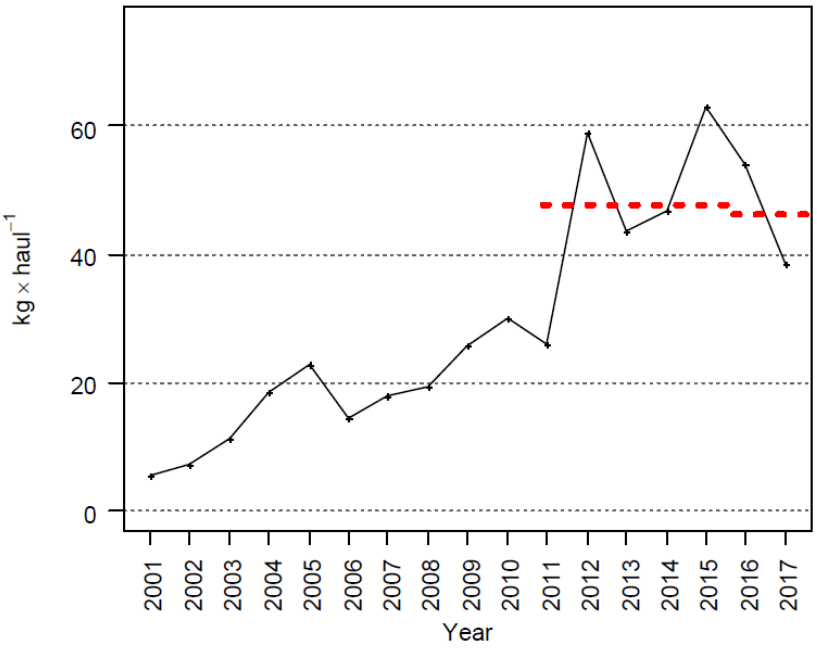


Figure 25.10. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Changes in the biomass index of *Galeus melastomus* during the Porcupine Bank survey (2001–2017). Dotted lines compare mean stratified biomass in the last two years and in the preceding five years.

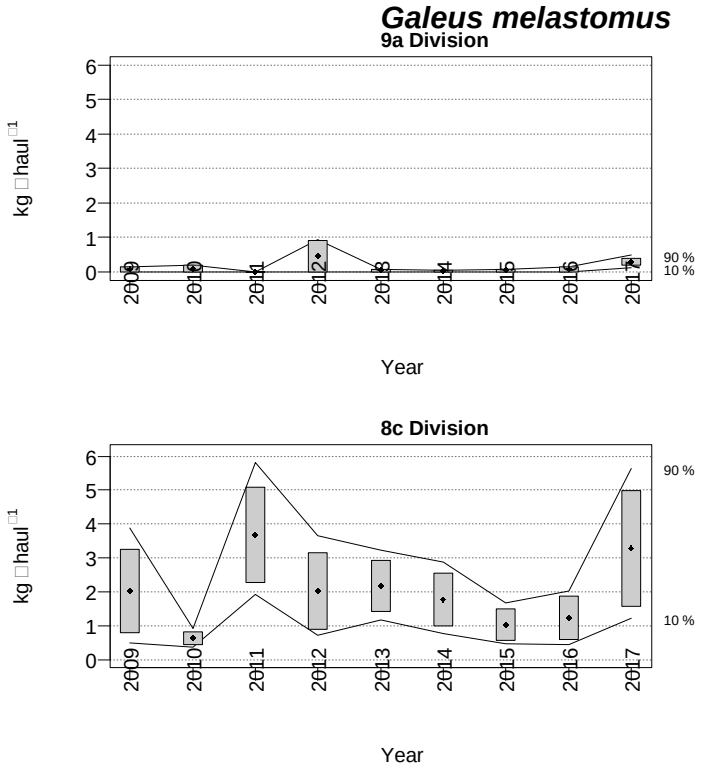


Figure 25.11a. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Changes in *Galeus melastomus* stratified biomass index (only with standard hauls between 70 and 500 m) during the North Spanish shelf bottom trawl survey (SpGFS-WIBTS-Q4) between 2009 and 2017 in the two ICES Divisions. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (P= 0.80 bootstrap iterations = 1000).

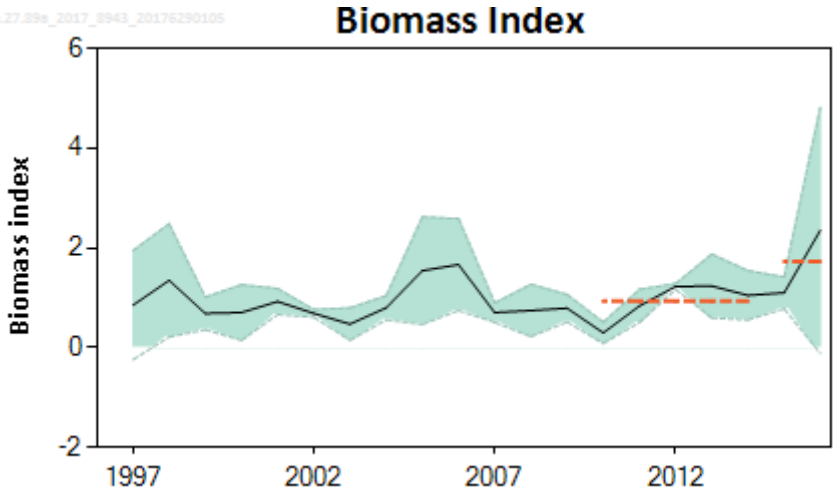


Figure 25.11b. Catsharks (Scyliorhinidae) in the Northeast Atlantic. *Galeus melastomus* in Subarea 8 and Division 9.a (Bay of Biscay and Atlantic Iberian Waters). Standardised survey indices for ARSA, Portuguese 9.a, North Spanish shelf bottom trawl, and EVHOE. Dotted lines indicate the average of the last two years and the average catch for the preceding five years.

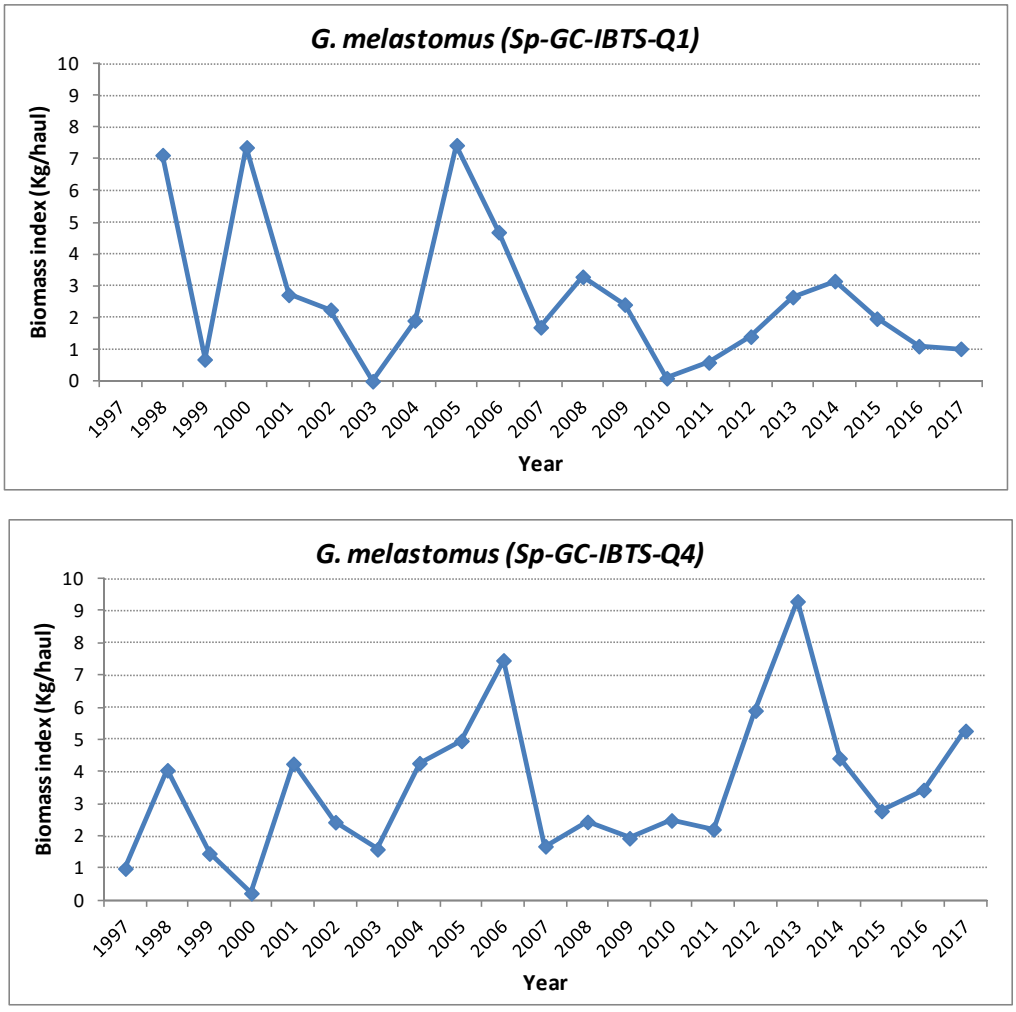


Figure 25.11c. Catsharks (Scyliorhinidae) in the Northeast Atlantic. Temporal trends in the biomass index during the South Spanish shelf bottom trawl survey (ARSA) in the Gulf of Cadiz ICES Div. 9a) time-series (1997–2017) in Division 9.a for spring Q1 (top) and autumn Q4 (bottom) surveys respectively.