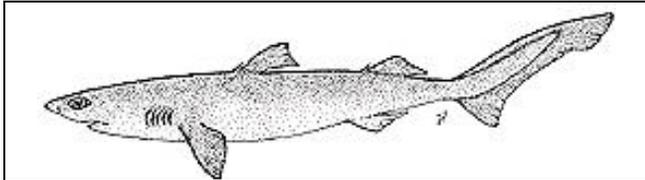


Nomination

Centrophorus squamosus, Leafscale gulper shark

Leafscale gulper shark *Centrophorus squamosus* (Bonnaterre, 1788)



Geographical extent

- OSPAR Regions: I, II, III, IV, V
- Biogeographic zones: 8,12,13,14,16,17,18,19
- Region & Biogeographic zones specified for decline and/or threat: as above

Centrophorus squamosus is widely distributed in the OSPAR Area from Iceland and the Faroes on the Atlantic slope to Africa, including Madeira and Azores, on the Mid-Atlantic Ridge from Iceland to the Azores (Hareide and Garnes 2001), and on the Hatton Bank (Heessen 2003) (Figure 1). It also occurs in a few regions in the Western Indian Ocean and the Western Pacific (Compagno 1984 and in prep; Froese & Pauly 2006; White 2003).

The species can live on or near the seabed at depths of 230–2400 m on continental slopes, occur in the upper 1250 m of oceanic water, well above the seabed in depths of around 4000 m (Compagno and Niem, 1998). The species appears to be highly migratory (Clarke *et al.* 2001, 2002). Pregnant females and pups are found in mainland Portugal and Madeira, with only pre-pregnant and spent females in the north (Moura *et al.* 2006; Garnes pers. comm. to ICES WGEF (ICES WGEF in prep.)).

Figure 1: Global distribution of *Centrophorus squamosus* (from Compagno *et al.* 2005)



Centrophorus squamosus

Collins 2005 Field Guide

Application of the Texel-Faial criteria

Global importance

This species is widely distributed, occurring in the Atlantic, Indian and Pacific Oceans. The OSPAR population is not of global importance.

Regional importance

The IUCN WGEF (2006, in prep) has adopted a single stock assessment unit in the Northeast Atlantic, possibly linked with the western Africa stock. At a stock level, the OSPAR Area is of regional importance, but not at species level.

Rarity

C. squamosus is not rare in the OSPAR Area.

Sensitivity

Deepwater elasmobranchs are adapted for life in a very stable, cold, low-productivity environment, and have an even lower productivity than coastal and pelagic sharks. *Centrophorus* species are considered to be among the deepwater sharks that are most sensitive to depletion by fisheries because of their severely limiting life history characteristics, particularly longevity, late maturity and low reproductive output (e.g. ICES WGEF in prep.). Where data are available on *Centrophorus* fisheries catch per unit effort (CPUE), these are initially high, then almost invariably decline quickly.

This species usually gives birth to some five to eight pups per litter (Compagno *et al.* 2005) and has ovarian fecundity estimates of up to ten mature oocytes (Girard and DuBuit, 1999; Clarke *et al.* 2001). Though the gestation period is not yet known, it is likely to be at least as long as for related species, i.e. approximately 22-24 months (Last and Stevens 1994, Cox and Francis 1997). Preliminary age estimates (Clarke *et al.* 2002) suggest that this is the longest-lived shark species yet examined. These factors combine to make it extremely vulnerable to overexploitation and population depletion.

Pregnant females of *C. squamosus* have only very rarely been found in commercial landings in the Northeast Atlantic, indicating that these are fortunately segregated away from current commercial fisheries. This slightly decreases the sensitivity of this species compared with those deepwater sharks that have no refuge from fisheries. Should fisheries expand into areas where pregnant females are located, the sensitivity of this species will increase significantly.

The sensitivity of this species to deepwater fishing activity and its low intrinsic rate of population increase means that recovery of depleted populations will be slow and likely take longer than 25 years, even if deepwater fisheries close and all bycatch ceases.

Keystone species

No information.

Decline

Accurate assessments of the decline rate for this species are difficult to achieve because landings and CPUE data for *C. squamosus* are generally combined with *Centroscymnus coelolepis* as 'siki shark'. In 2005, ICES WGEF compiled available catch per unit effort (CPUE) data for *C. squamosus* (see Figure 2 and summary below). Some of these represent very short time series and are only preliminary estimates. The following are from ICES WGEF (2005) unless otherwise noted.

ICES Sub-area V (OSPAR Region I):

- CPUE from French trawlers was reduced in 2001 to around 20% of the level recorded in 1995.

ICES Sub-area VI (OSPAR Region III):

- CPUE from French trawlers was reduced in 2001 to around 34% of the level recorded in 1995.
- CPUE from Scottish trawl surveys was reduced in 2004 to around 20% of that in 2000.

ICES Sub-area VII (OSPAR Region III):

- CPUE from French trawlers was reduced in 1999 to around 23% of the level recorded in 1995.
- CPUE from Irish trawlers was reduced in 2004 to around 14% of the levels recorded in 2001.
- CPUE from Irish commercial longliners shows a reduction from 2001 to 2003 (but Irish longline surveys, which took place in 1997 and 1999, showed no changes in CPUE).

ICES Sub-area IX (OSPAR Region IV):

- CPUE from Portuguese longliners was reduced in 2004 to around 74% of that in 2001 (but a new analysis in 2006 showed no trend).

ICES Sub-area XII (OSPAR Region V):

- CPUE by French trawlers was reduced in 1999 to around 32% of that in 1995.
- CPUE by Norwegian commercial longliners was reduced in 2001 to around 1% of that in 1999; Norwegian longline surveys also decreased in 1999 to about 2% of that in 1998.

ICES WGEF (2006) considered new French commercial trawl data that were considered to provide a more accurate estimate of *C. squamosus* stock abundance. These data showed an overall decline in CPUE in all ICES subareas exploited by French commercial trawlers since 1995. In 2005 in subareas V and VI, the level of CPUE was about 10% of the level estimated in 1995. In subarea VII the level of CPUE in 2005 was less than 10% of the level estimated in 1995. The decline in CPUE between 2001 and 2005 was consistent across all areas and also supported by CPUE data from Irish trawlers. In contrast, the CPUE series in the south (ICES Division IXa), although short, appears stable.

Although CPUE has been falling sharply, the ICES WGEF (2006) estimates of species-specific landings of *C. squamosus* from the Northeast Atlantic rose significantly from 2000 to 2005 (Figure 3). Overall catches for the whole of the ICES/OSPAR areas do not reflect overall stock status, particularly because market demand remains high and new fisheries open and fishing effort can move rapidly from fished to unfished grounds as stocks decline, or as restrictive management measures are introduced (the latter in recent years). For example, ICES WGEF (in prep.) notes that new gillnet and longline fisheries developed in Sub-area VIII and Division IXb in 2006. This represents a displacement of effort from VI and VII, due to the ban on gillnet fishing in those areas. Reported landings from these fisheries are about 250 t from UK registered vessels, including 23 tonnes of deepwater shark from Subarea VIII and 135 tonnes, plus 31 tons of livers and oil, from Subarea IX.

Figure 2: Catch per unit effort series for leafscale gulper shark (*C. squamosus*) (ICES 2005).

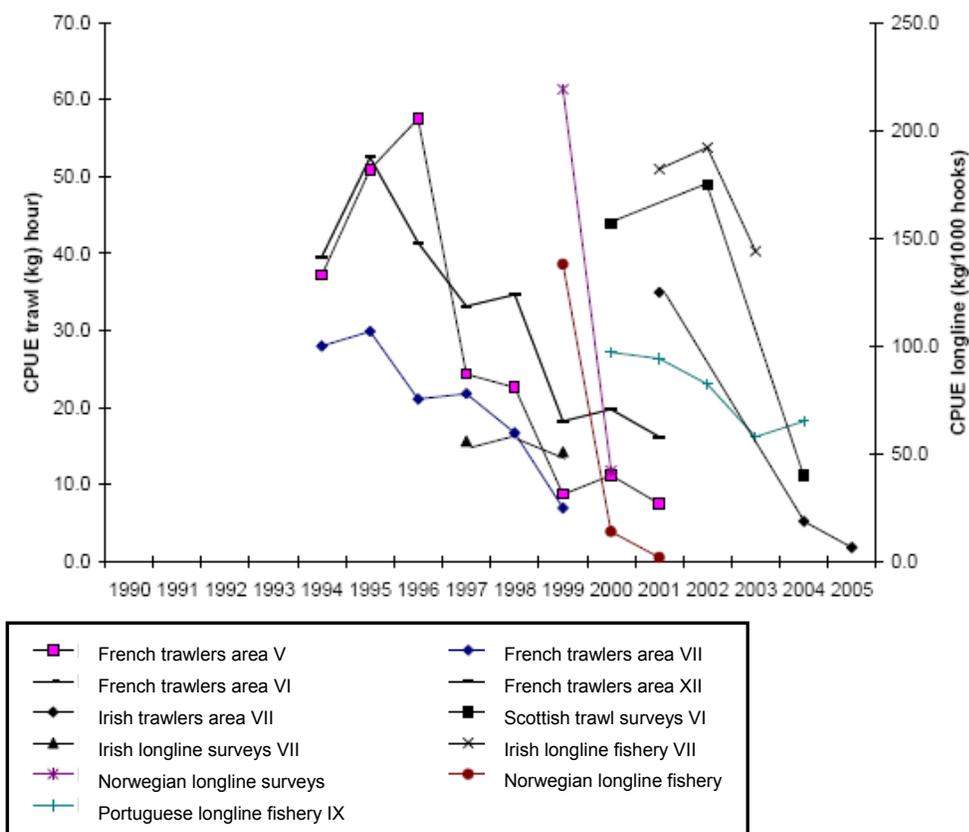
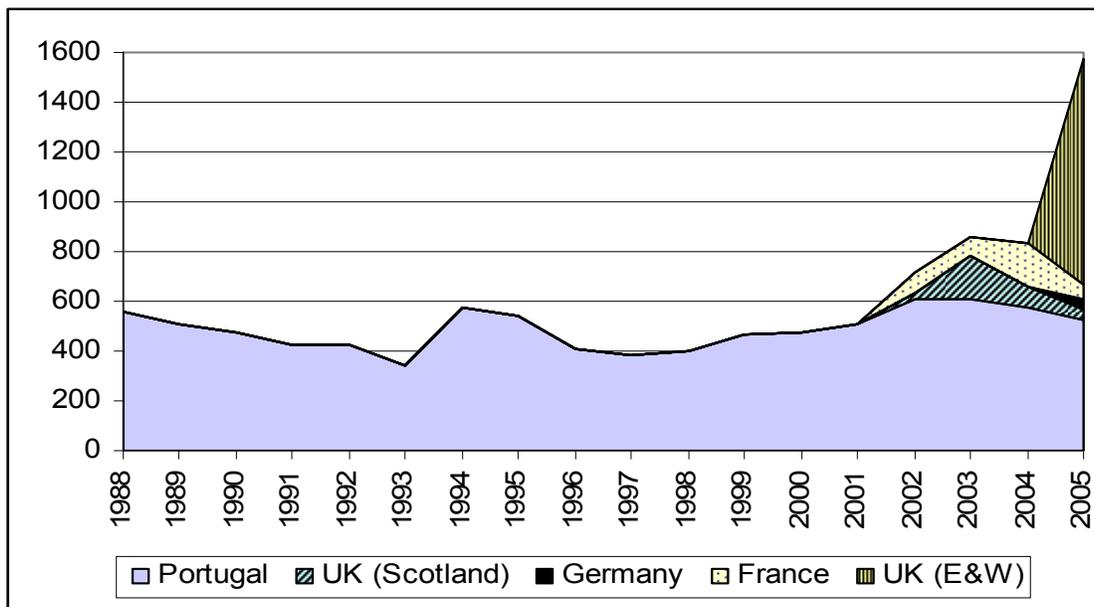


Figure 3: Estimated catch of leafscale gulper shark (*C. squamosus*), 1988 to 2005, (ICES WGEF 2005).



Recent landings of the two species of siki shark, combined, are much lower than the Total Allowable Catches (TACs) available (7,100 t), although TACs are restrictive in some areas. CPUE data sets for these two siki species combined have also declined significantly. ICES ACFM (2005) advised that, based on these data, stocks of Portuguese dogfish and leafscale gulper shark are considered to be depleted and likely to be below any candidate limit reference point. In 2006, ICES advised that no target fisheries should be permitted unless there are reliable estimates of current exploitation rates and stock productivity. ICES also advised that the TAC should be set at zero for the entire distribution area of the stocks and additional measures should be taken to prevent by catch of Portuguese dogfish and leafscale gulper shark in fisheries targeting other species.

Threat

Centrophorus squamosus is an important component of mixed trawl fisheries, and mixed and directed longline and gillnet shark fisheries on the continental slope to the west of Ireland, Spain, Portugal and France (ICES WGEF 2005). The flesh and liver are marketed from this species in many areas. The fresh meat is in high demand as 'siki' for human consumption in Europe and is also utilized elsewhere, dried and salted for human consumption. The liver oil is a source of squalene (Compagno 1984 & in prep.).

Deepwater shark fisheries in the OSPAR Area were described in detail by ICES WGEF (2005, updated in 2006 and in prep.) and Hareide *et al.* (2004). Most catches have been from the northern area (ICES subareas V-VII, OSPAR Regions I and the northern part of V). Some 12 countries report landings of deepwater sharks. IUU fishing also occurs in international waters (ICES WGEF in prep.).

Discarding was negligible after the early years of the fishery, once markets had developed for the flesh, but may be increasing now as a result of restrictive quotas for deepwater sharks in some southern areas, where deepwater mixed fisheries are still underway and these sharks are still fairly commonly taken as bycatch. Some discard of decaying carcasses occurs from deepwater net fisheries when soak times are excessive (STECF 2006). ICES WGEF (2006) reported on retrieval survey of lost nets west of Ireland. One fleet of deepwater nets (7.5 km) was retrieved that had been left at sea while the gillnet vessel was landing. A total catch of 6500 kg of deepwater sharks was recorded of which 96% was *Centrophorus squamosus*. About 70% of the catch was decayed and not fit for human consumption.

In 2005, ICES WGEF advised that the current level of these deepwater shark fisheries is unsustainable, and should cease. In 2006, this advice was repeated: no target fisheries should be permitted

unless there are reliable estimates of current exploitation rates and stock productivity. The TAC should be set at zero for the entire distribution area of the stocks and additional measures should be taken to prevent by catch of Portuguese dogfish and leafscale gulper shark in fisheries targeting other species. In 2007, the WGEF noted that management measures had resulted in diversion of effort to previously unexploited fishing grounds inside and outside the OSPAR/ICES Area, and expressed concern that these new fisheries are developing without prior evaluation of sustainable catches having been carried out (ICES WGEF in preparation).

Relevant additional considerations

Sufficiency of data

As noted above, species-specific data on *Centrophorus squamosus* are limited; the species is often recorded with other deepwater shark species (particularly *Centroscymnus coelolepis*), often with no separate statistics are available. However, the ICES WGEF has provided sufficient species-specific data on rising landings and the declines in catch per unit effort caused by unsustainable fisheries exploitation to demonstrate the urgent need for conservation measures for this species.

Changes in relation to natural variability

Nothing has been published on natural variability, but the low intrinsic rate of population increase in this species demonstrate that population size and distribution are unlikely to fluctuate naturally. Nothing is known about the population genetics of *Centrophorus squamosus*. Studies of the population genetics of this species are urgently needed to determine whether populations in different areas are genetically distinct.

Expert judgement

The shortage of information on population size and trends for this species in the OSPAR Maritime Area means that expert judgement has also played a part in this nomination. It rests on recognition that the threats to this deepwater shark are known, that such threats occur in the OSPAR Maritime Area, that they have already led to significant declines in the number of this and other deepwater shark species in this Area and elsewhere, and that further declines are likely to take place as fishing effort moves to previously un-exploited grounds – unless new management measures are introduced and enforced.

ICES Evaluation

Early attempts at stock assessment (for *C. squamosus* and *C. coelolepis* combined) were undertaken by SGDEEP (ICES 2000) and the DELASS study (Heessen 2003). The ICES Working Group on Elasmobranch Fisheries reviewed information on this and other important species of deepwater shark in 2005, 2006 and 2007. Deepwater sharks are mostly caught in mixed trawl fisheries for deepwater species, particularly in northern areas of the Northeast Atlantic, as well as in directed shark fisheries using longlines and gillnets. Gillnet and longline fisheries targeting sharks and deepwater crab are now developing in previously unexploited fishing grounds due to displacement of effort from areas where gillnet fishing has been banned. These fisheries are expanding, landings are rising, and catch per unit effort is falling sharply.

Since 2005, the ICES Advisory Committee on Fisheries Management (ACFM) has advised that stocks of Portuguese dogfish and leafscale gulper shark are depleted and likely to be below any candidate limit reference point. They have recommended that the total allowable catch (TAC) for deep water sharks in mixed fisheries should be set at zero for the entire distribution area of the stocks, with no target fisheries permitted unless there are reliable estimates of current exploitation rates and stock productivity. Catches of sharks are generally not recorded to the species level; they should be. Additional measures should be taken to prevent by catch of Portuguese dogfish and leafscale gulper shark in fisheries targeting other species. ICES WGEF (in prep.) notes that there are no obvious measures that could mitigate by-catch of this shark in commercial fisheries.

Preventing bycatch mortality will be very difficult to achieve, requiring the identification and implementation of measures to avoid any by-catches of deep water sharks in these fisheries. If this is not possible, reduction of catches in the mixed fisheries that take deep water sharks as a by-catch will require a reduction in overall fishing effort to the lowest possible level. Current quotas are higher than total catches and only restrict the catches of deepwater sharks in a few areas.

ICES WGEF (in prep.) reviewed an earlier draft of this nomination, concluding that it is appropriate to list the leafscale gulper shark *C. squamosus* as Threatened and Declining in OSPAR Regions I–V.

Threat and link to human activities

Cross-reference to checklist of human activities in OSPAR MPA Guidelines

Relevant human activity: Fishing, hunting, harvesting; *Category of effect of human activity:* Biological – removal as target and non-target species by fisheries.

Catch per unit effort data for this species, demonstrate that steep population declines have taken place in most OSPAR Regions. These declines result directly from unsustainable target and bycatch fisheries. Total catches are significantly lower than total quotas available, fisheries management is not underway in all fishing areas, and fisheries are expanding into new grounds. The population decline is therefore a continuing threat that is directly linked to human activity.

Preliminary information from retrieval surveys of gillnets suggests that excessive soak time leads to high discard rates of sharks (ICES WGEF 2006). Lost or discarded gillnets (ghost fishing) may also add to deepwater shark mortality (ICES ACFM 2005).

Management considerations

There is no agreed management plan for these stocks. They are managed by a combination of TACs, effort regulations and technical measures (fishing gear restrictions) in different OSPAR/ICES areas.

In 2007, the TAC for deepwater sharks in international waters of ICES Sub-areas V, VI, VII, VIII and IX (parts of OSPAR regions IV and V) is 2,472 t. In 2008, the TAC for these species in these areas will be reduced to 1,646 t. In 2007 and 2008, the TAC for deepwater sharks is set at 20 t annually in ICES Sub-area X, and 99 t in Sub-area XII (part of OSPAR region V). These TACs apply to a list of 13 deepwater shark species, including leafscale gulper shark. They are not restrictive in all sub-areas, but quota restrictions have contributed towards the decline in landings from around 10,000 t in 2004, to about 2000 t in 2006. Gillnet bans have also resulted in a decline in the proportion of international landings from the gillnet fishing countries (UK and Germany). Overall, recent landings are the lowest since the fishery reached full development in the early 1990s, and much lower than the total 7,100 t of TACs available. (ICES WGEF in prep.) ICES ACFM has, since 2005, recommended a zero quota for deepwater sharks.

European Council Regulations have regulated effort in deepwater fisheries. Regulation (EC) No 2347/2002 set maximum capacity and power (kW) ceilings on individual Member States' fleets fishing for deepwater species, and Regulation (EC) No 27/2005 set a limit of effort (kilowatt days) at 90% of the 2003 level for 2005, and 80% for 2006.

Regulation (EC) 1568/2005 banned the use of trawls and gillnets in waters deeper than 200 m in the Azores, Madeira and Canary Island areas. In 2006, a ban on gillnetting was applied to waters deeper than 200 m in ICES Divisions VIa, b, VII b, c, j, k and Sub-area XII following concern over excessive deepwater shark mortality. Following a review by STECF in 2006, Regulation (EC) No 41/2007 revised this measure, banning the use of gill nets by Community vessels at depths greater than 600 m (thus permitting hake and monk netting, but protecting many deepwater shark stocks previously targeted). A maximum by-catch of deepwater shark of 5% is allowed in hake and monkfish gillnet catches above 600 m. This ban does not cover Sub-areas VIII or IX.

A gillnet ban in waters deeper than 200 m is also in operation in the NEAFC regulatory Area (international waters of the ICES/OSPAR Areas).

Bycatch mortality, whether discarded or utilised, poses a particular challenge for the management of deepwater sharks; these species cannot be returned alive following capture in commercial fisheries. Deepwater trawls, in particular, are not species-selective and take a bycatch of non-commercial species, including deepwater sharks (Allain *et al.* 2003). The long soak times and discards of nets from gillnet fisheries increase bycatch mortality (Hareide *et al.* 2005). There are no obvious measures that could mitigate the bycatch of this shark in these commercial fisheries

This species was classified as Vulnerable globally on the 2003 IUCN Red List (White 2003). A regional listing of Endangered in the Northeast Atlantic is currently in preparation by the IUCN SSC Shark Specialist Group (Hareide, Crozier, Ebert and Blasdale, in prep.).

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