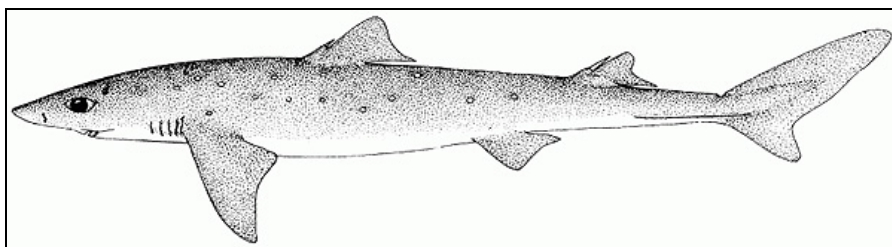


Nomination

Squalus acanthias, Spurdog or Piked dogfish

Spurdog or Piked dogfish *Squalus acanthias* (Linnaeus 1758)



Geographical extent

- OSPAR Regions: I, II, III, IV, V
- Biogeographic zones:
5,8,9,10,11,12,13,14,15,16
- Region & Biogeographic zones specified for decline and/or threat: as above

Squalus acanthias occurs in temperate and boreal waters along continental shelves and slopes. It is most common on or near the seabed in coastal waters. In the OSPAR Area, it occurs from Iceland and Murmansk south to Gibraltar. Elsewhere, it is found in the Mediterranean and Black Seas, South Atlantic, North and Southeast Pacific, New Zealand and Australia (Figure 1). Seasonal migrations take place in coastal waters, but trans-Atlantic genetic exchange is very limited (Hammond and Ellis 2005).

Application of the Texel-Faial criteria

Global importance

Squalus acanthias occurs on all temperate and boreal continental shelves and slopes. Most of its distribution lies outside the OSPAR Area, which is not of global importance for the whole species.

Regional importance

Heessen (2003) identified a single Northeast Atlantic stock of spurdog, distributed from the north of the Bay of Biscay to the Norwegian Sea. Trans-Atlantic genetic exchange is very limited, indicating that Northeast and Northwest Atlantic stocks are separate (Hammond and Ellis 2005, ICES WGEF in prep.). If the Texel-Faial criteria applied to stocks, the OSPAR Area would be of regional, if not global importance for this species.

Rarity

No.

Sensitivity

Very sensitive. This species' slow growth rate, late maturation, longevity, low fecundity and long gestation period results in very low resistance to fisheries. This is intensified by the aggregating nature of mature and pregnant females, which are the highest value segment of the stock and preferentially targeted in fisheries. It is also sensitive to bycatch in demersal fisheries. Its life history characteristics also result in one of the lowest known potential intrinsic rate of population rebound of any shark species (Smith *et al.* 1998), hence very low resilience and extremely slow potential for recovery following depletion. ICES WGEF (in prep.) confirmed that this species is biologically sensitive and highly susceptible to exploitation.

Keystone species

No.

Decline

Severely declined and still currently threatened. Fisheries statistics have been recorded for *Squalus acanthias* in the OSPAR Area since 1906 (Figure 2).

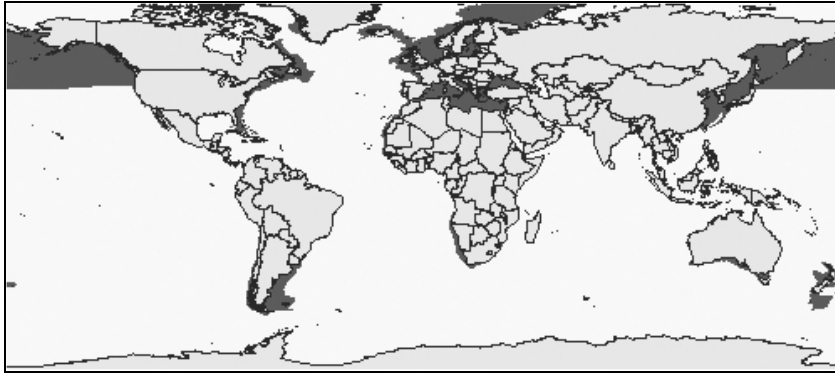


Figure 1: Global distribution of *Squalus acanthias* (from FAO FIGIS 2007)

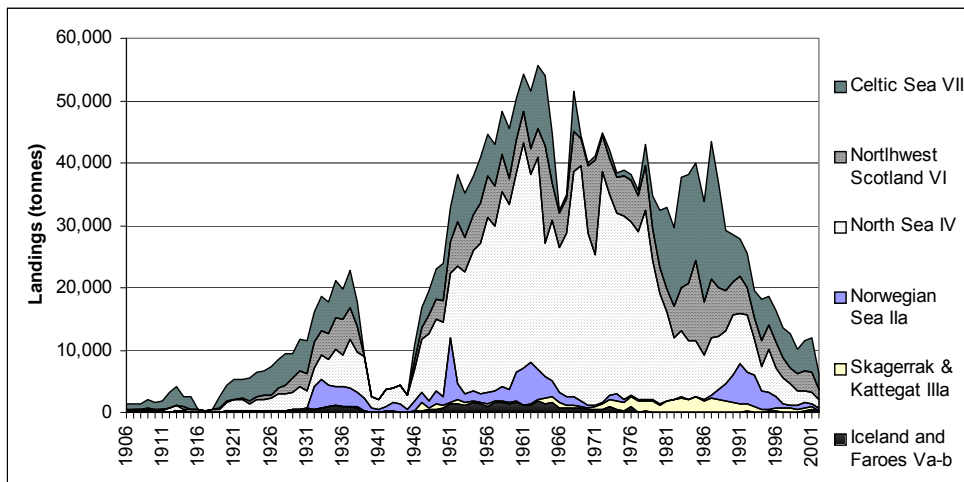


Figure 2: *Squalus acanthias* landings in ICES areas, 1906-1999. (Source ICES WGEF)

Biological investigations commenced in the Northeast Atlantic in the 1950s. More recently, this stock has been the subject of detailed fisheries assessment since 2002 (e.g. research and stock assessments summarised in ICES SGEF 2002, 2004; Heessen 2003; Hammond and Ellis 2004; ICES WGEF 2005, 2006 and in prep.; Figures 3 and 4). These report that current total biomass throughout the Northeast Atlantic (OSPAR Area) is approximately 5% of the pre-exploitation level in 1905 and 7% of that in 1955 (lightly exploited). Total recent landings have been about 15–17% of their peak values.

Warnings of overfishing of the Scottish-Norwegian sector of the Northeast Atlantic stock commenced in the 1960s (Holden 1968). The Norwegian fishery had collapsed by 1978 (Hjertenes 1980). The North Sea fishery declined steeply from a peak in the early 1970s to 10% of former landings in recent years, and target fisheries here were closed in 2007. The Celtic Seas fisheries peaked in 1987, before declining steeply.

Iberian Peninsula spurdogs are near the edge of range of the main Northeast Atlantic stock and may be distinct, but are experiencing similar trends. Landings per unit effort have declined steeply in recent years (ICES WGEF 2006). Portuguese landings declined 51% between 1957 and 2000 (DGPA), and future projections predict that, at current exploitation effort, a further 80% decline of landed biomass will take place over the next three generation period due to stock depletion (Fordham *et al.* 2006). The IUCN Red List Assessment for the Northeast Atlantic stock is, therefore, Critically Endangered.

Figure 3: Typical total biomass (left) and recruitment (right) trends for Northeast Atlantic *Squalus acanthias*, 1900–2005, from a population dynamic model (Source: ICES WGEF 2006)

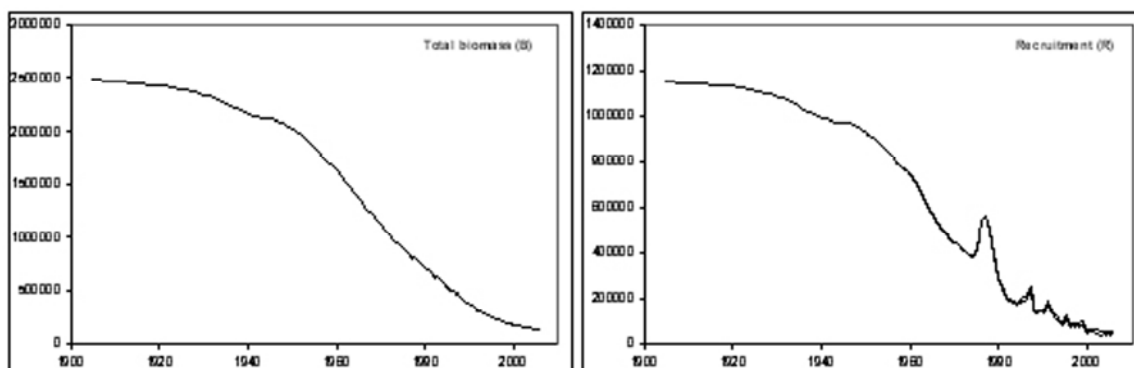
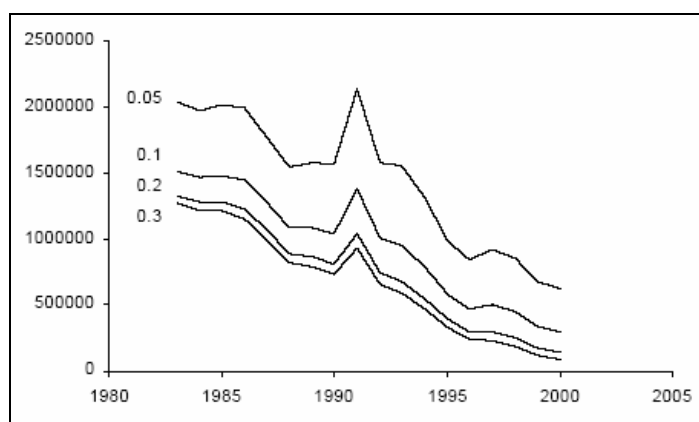


Figure 4: Trends in total numbers of mature fish in the Northeast Atlantic, 1980–2000. (Source: Heessen 2003)



A Separable VPA analysis of the catch numbers at age was used to estimate these trends in total population numbers. Each line represents a different assumption for terminal F (0.05–0.3) on the reference age in the final year (Heessen 2003).

Threat

Spurdog is a highly migratory and aggregating species with high market value and demand in Europe. It was, until very recently, the most important commercially-fished elasmobranch species in the OSPAR Area. Although the majority of large-scale target fisheries here have now collapsed, this species' aggregating habit makes it highly vulnerable to localised, seasonal fisheries. These fisheries still target aggregations of mature and gravid females, other than in the North Sea where target fisheries were closed in January 2007 (ICES WGEF in prep.). It is also a valuable utilised bycatch in other demersal fisheries. Target and bycatch fisheries for this species are continuing despite ICES advice that a zero TAC should be set throughout the OSPAR/ICES Area.

Relevant additional considerations

Sufficiency of data

Very good. Fisheries data for spurdog have been collected in the OSPAR Area since the beginning of the 1900s, fisheries research commenced in the 1950s, and detailed stock assessments have been undertaken during the 2000s (e.g. ICES SGEF 2002; Heessen 2003; ICES WGEF 2003, 2004, 2005, 2006 and in prep.).

Changes in relation to natural variability

There is little natural variability known for this species, but it is probable that geographically separated populations differ in their population genetics. Tagging research suggests that spurdog in the OSPAR Area are comprised of a single stock, ranging from the Barents Sea to the south (ICES WGEF 2006). Genetic exchange across the Atlantic is considered very limited (Hammond and Ellis 2005). Franks *et al.* (2005) found two major

lineages in *Squalus acanthias* stocks, one in the North Pacific, and another in the South Pacific and Atlantic. Detailed population genetics need further research.

Expert judgement

Survey data, species-specific landings data and stock assessments are available. The latter have explored a number of different methods, including surplus production models, separable age-based assessments, length-structured approaches and frequency of occurrence in survey hauls. All methods indicate similar stock trends and a seriously depleted stock that is in danger of collapse. Seasonal target fisheries exploit aggregations of mature female spurdog, but the majority of landings in the OSPAR Area are as utilised bycatch in mixed demersal fisheries (these are reported in landings data). Bycatches of spurdog in other fisheries (e.g. pelagic trawl) are likely but these will not generally be landed (ICES, 2005).

ICES Evaluation

ICES has been reviewing fisheries and stock status for this species for several years. All experimental assessments indicate that the stock is at a record low level. Frequency of occurrence in trawl surveys has declined and, although large shoals are still caught, the frequency of these has declined. Survey CPUE also indicate a declining trend. Trends in fishing mortality and the continuous decline in landings indicates that exploitation has been, and continues to be well above sustainable levels (e.g. ICES WGEF 2006 and in prep.). Management advice has been provided annually since 2005, with repeated warnings that the stock is depleted and in danger of collapse. Although ICES has recommended a zero quota for this species throughout the OSPAR Area, TACs are still being set for spurdog, although only bycatch fisheries are still permitted in the North Sea (see 'Management considerations', below).

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.

ICES has presented strong evidence that the observed depletion and near-collapse of the Northeast Atlantic stock of spurdog was caused by over-exploitation in fisheries (Figure 5). This

exploitation continues at unsustainable levels and is therefore a threat that is linked to human activity.

Management considerations

A total allowable catch (TAC) was set for the North Sea (ICES Areas IIa and IV) in the late 1990s, but at a level significantly higher than recent landings. The North Sea TAC was reduced significantly and may have become restrictive in 2005.

ICES advice was first requested in 2005. This recognised the threats to spurdog and recommended an extension of the TAC to cover the entire stock distribution area (ICES ACFM 2005). Other management measures suggested including regulating fisheries that take a high proportion of mature female spurdogs and implementing a maximum landing size to protect this highly vulnerable part of the stock. In 2006, ICES warned that "the stock is depleted and may be in danger of collapse. Targeted fisheries should not be permitted to continue, and by-catch in mixed fisheries should be reduced to the lowest possible level. The TAC should cover all areas where spurdog are caught in the northeast Atlantic and should be set at zero for 2007."

Management measures adopted in 2007 included a further reduction in the TAC for the North Sea and closure of target fisheries in this region. Fisheries were also prevented from targeting vulnerable aggregations; spurdog "*shall not comprise more than 5 % by live weight of the catch retained on board*". A TAC has also been set for the remainder of the stock area, as advised by ICES in 2005. This quota may be restrictive (i.e. lower than recent reported landings). Although management measures are being more widely adopted, ICES advice for a zero quota throughout the ICES/OSPAR Area has not been adopted. ICES advice needs to be followed and all fisheries closed if the stock is to recover.

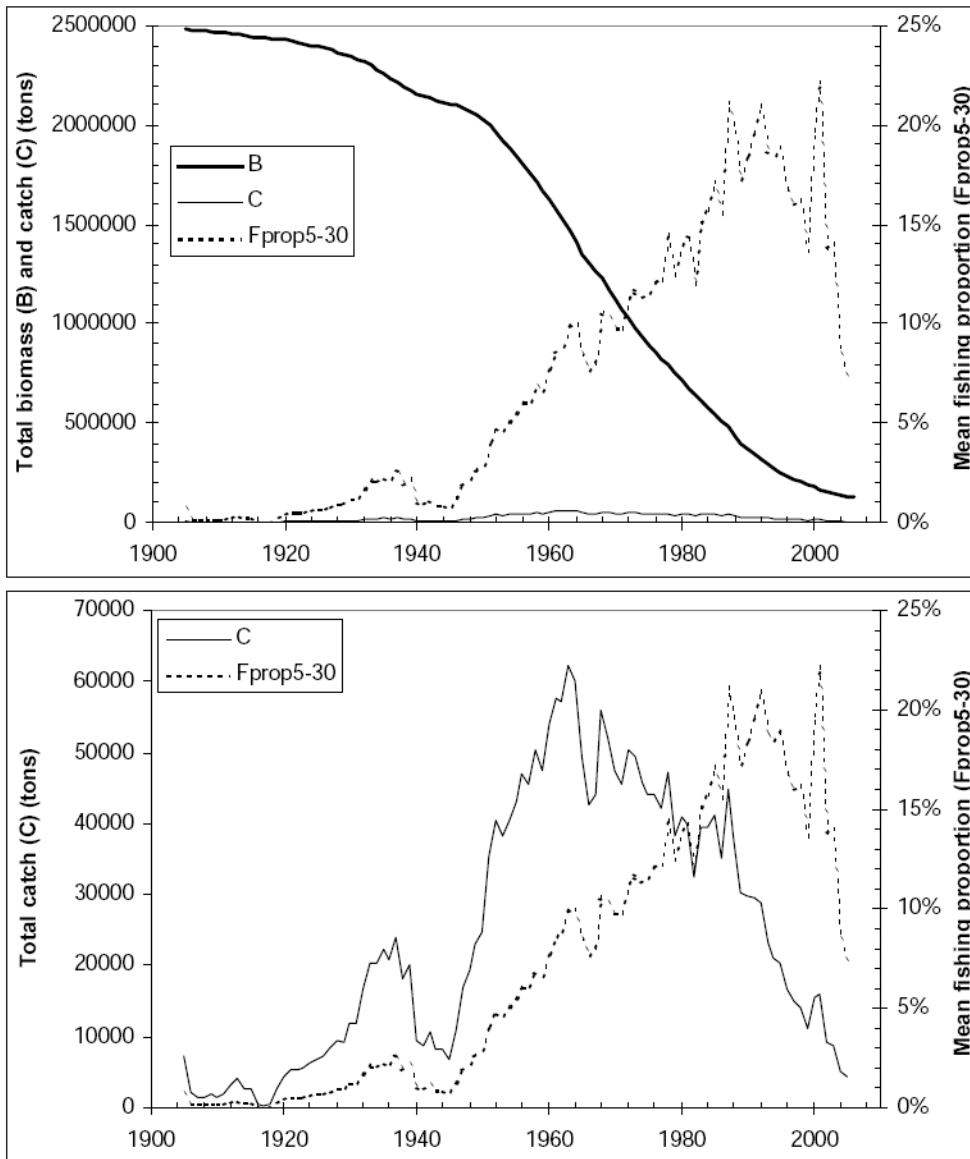
In regions where spurdog are taken largely as by-catch, a low TAC (which only regulates landings) could increase discard levels. Discard survival is unknown. Because spurdog is caught as a bycatch in demersal fisheries, they would benefit from a reduction in overall demersal fishing effort. Spurdog forms size and sex specific schools and these have been subject to directed fisheries specifically targeted large females.

Additional management measures which would deter the targeting of mature females could include, for example, a minimum landing length (ICES WGEF 2006). The minimum landing size

established in Norway in order to protect mature females is of limited value for a migratory species that is intensively fished in other parts of its range (Fordham *et al.* 2006).

This species is classified as Critically Endangered in the Northeastern Atlantic in the IUCN Red List, and Vulnerable worldwide (Fordham *et al.* 2006). It is Critically Endangered in the Baltic Sea (at the edge of its range), and listed on the HELCOM 2006 Red List as a priority species.

Figure 5: Top: Base-case model estimates of total biomass (B), mean fishing proportion ($F_{prop5-30}$) and total annual catch (C). Bottom: as above but without total biomass. (ICES WGEF 2006)



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