

# Starry Smooth-hound

## (*Mustelus asterias*)

### Summary

<b>Size (total length)</b>	Max 180 cm
<b>North East Atlantic</b>	Avg. 120 cm
<b>Lifespan</b>	Male 13 years Female 18 years (Farrell et al., 2010b)
<b>Size of maturity (L<sub>50</sub>)</b>	Male 70-78 cm
<b>North East Atlantic</b>	Female 82-87 cm
<b>Fecundity</b>	6-20 pups
<b>Reproductive frequency</b>	Biennial
<b>Capture methods</b>	Fixed nets Bycatch – nets & trawls
<b>Minimum Conservation Reference Size</b>	-
<b>Fishing Season</b>	Year-round



### Description

There are three species of smooth-hound in the North Atlantic: starry smooth-hound (*Mustelus asterias*), common smooth-hound (*Mustelus mustelus*), and black-spotted smooth-hound (*Mustelus punctulatus*). In UK and northern European waters, the starry smooth-hound is the dominant species (ICES, 2017). There has been confusion over the distribution of common smooth-hound in UK waters due to the species morphological similarity to starry smooth-hound. The white spots on the starry smooth-hound are often used to identify it from the common smooth-hound however, the spots are highly variable and may not always be present. Therefore, the absence of spots does not necessarily indicate that a specimen is a common smooth-hound (Heemstra, 1973 cited in Farrell et al., 2009). Genetic analysis has confirmed the natural distribution of the common smooth-hound lies further south to the UK, along the west coast of Africa, Mediterranean Sea and western Europe (Farrell et al., 2009; ICES, 2017). Farrell et al, (2009) indicated only starry smooth-hound are present in UK waters and it is likely that historical records of the common smooth-hound are misidentifications and probably refer to the starry smooth-hound (Farrell et al., 2009; ICES, 2017). Black-spotted smooth-hound, the third species of smooth-hound in the North Atlantic, occurs in the Mediterranean Sea and off North west Africa (ICES, 2017).

The starry smooth-hound is distributed from Scotland and southern Norway down to the Western Sahara and the Canary Islands. Specimens in the Mediterranean Sea are considered a separate stock from the Atlantic based on differences in reproductive biology (Jabado et al., 2021).

A relatively small demersal shark, the starry smooth-hound is widespread around the British Isles in waters of 10-199 m depth. It is most abundant along the southern and western coasts of the UK (Ellis et al., 2005). Starry smooth-hound prefer sandy and gravelly bottoms with juveniles often found in bays and large estuaries (Ebert and Stehmann, 2013). The species has a special crushing dentition which helps it feed on crustaceans such as the velvet swimming crab, brown crab and hermit crabs (Ellis et al., 1996).

## Reproductive Life history

Members of the *Mustelus* genus are all viviparous meaning fertilisation and embryo development takes place internally and the female gives birth to live young. During embryonic development, the embryo is nourished by the yolk of the egg and is not connected to the female via a placenta (Ebert and Stehmann, 2013; Wheeler, 1978). The reproductive cycle of the starry smooth-hound is not yet fully understood but it is thought the gestation period is around 12 months followed by a resting period before the female mates again (Farrell et al., 2010). Therefore, it is likely that the reproductive cycle is biennial (Farrell et al., 2010a; McCully Phillips and Ellis, 2015). In the eastern English Channel new-born pups have been observed in surveys in June-July whereas in the western English Channel pups are often caught February-March (Ellis et al., 2005; McCully Phillips and Ellis, 2015). Differences in spawning times across the starry smooth-hound's distribution indicate that there is either two separate spawning seasons across the stock range or one prolonged spawning season from spring until the end of summer (McCully Phillips and Ellis, 2015).

Females have been estimated to produce between 6-20 pups with the number of pups increasing with total length of the female (Farrell et al., 2010b; McCully Phillips and Ellis, 2015). Furthermore, the size of the female also positively relates to the length and weight of the pups with larger females producing larger, heavier pups (McCully Phillips and Ellis, 2015). The average length of starry smooth-hound pups at birth is estimated at 30 cm (Farrell et al., 2010a) although the smallest free-living fish observed by McCully Phillips and Ellis (2015) in surveys across British waters was 24 cm. They also found the size of full-term pups ranged between 20.5 and 32.9 cm with an average length of 26 cm (McCully Phillips and Ellis, 2015). Once shark pups are born they are fully developed and independent. Most records of starry smooth-hound pups from UK beam-trawl surveys are found in the southern North Sea, English Channel (including the Solent) and the Bristol Channel (Ellis et al., 2005). Based on studies of smooth-hound species in other areas it is thought immature individuals show high site fidelity to nursery grounds (Espinoza et al., 2011 cited in ICES, 2017).

The movements of the starry smooth-hound across its range are still not fully known but a recent study by Griffiths et al, (2020) suggests the stock in the north east Atlantic may comprise of at least two sub-populations. One population is thought to spend April to September in the coastal waters of the southern North Sea and English Channel

before migrating to the deeper waters of the western English Channel, Celtic Sea and northern Bay of Biscay from October to March. Whilst the other sub-population appears to reside in the Bristol Channel, Irish Sea and Celtic Sea throughout the year. Currently, ICES consider the north-east Atlantic starry smooth-hound as a single stock.

The maximum size of starry smooth-hound is uncertain due to taxonomic confusion with other *Mustelus* species but estimates range from 120-180 cm (sizes reviewed in McCully Phillips and Ellis, 2015). The largest specimens observed in UK maturity studies were 124 cm and 112 cm (McCully Phillips and Ellis, 2015; Farrell et al., 2010b). Starry smooth-hound have been estimated to live for 13 and 18.3 years for males and females respectively (Farrell et al., 2010b).

### Size of maturity (SOM)

Size of maturity (SOM) is often used to help establish an appropriate Minimum Conservation Reference Size (MCRS) to ensure individuals can reproduce at least once before capture. SOM for elasmobranchs (sharks, rays and skates) is commonly accepted as the total length (L) at which 50% of a population are mature and is referred to as the  $L_{50}$ .

Maturity is determined using criteria to define maturity stages either externally or internally. External observations are based upon analysing the length of claspers in males and the cloaca in females in relation to total body length. Internal examination includes macroscopic inspection of reproductive organs e.g., coiling of the vas deferens and development of the testes in males; development of the ovaries, ova and nidamental glands in females (Saglam and Ak, 2012).

McCully Phillips and Ellis (2015) examined the maturity of starry smooth-hound across British waters with samples (n=504) taken from the southern North Sea, English Channel, North Sea, Bristol Channel and Irish Sea. The smallest mature male and female identified were 65 cm and 69 cm (flexed total length), respectively. The largest immature individuals were 74 cm (male) and 87 cm (female). Length at 50% maturity was estimated to be 81.9 cm for females and 70.4 cm for males. All males were mature at 75 cm and 100% maturity was attained in females at 88 cm.

A previous maturity study undertaken in the Celtic Sea ecoregion (Irish Sea, Bristol Channel, Celtic Sea and west of Ireland) found 50% maturity to be considerably larger than McCully Phillips and Ellis (2015) (table 1). Farrell et al, (2010a) estimated SOM at 78 cm and 87 cm for males and females, respectively. The smallest mature male reported was 72 cm and female 83 cm, both much larger than specimens examined by McCully Phillips and Ellis (2015). The largest immature male and female was also larger in the Celtic Sea ecoregion at 85 cm and 91 cm, respectively. It is thought the differences in size may be a result of slightly different maturity keys used in each study (ICES, 2017).

Farrell et al, (2010a) estimated 50% age at maturity to be 4-5 years for males and 6 years for females. Male starry smooth-hound mature earlier and at a smaller size than females, which is common among *Mustelus* species (ICES, 2017).

Table 1. Size of maturity estimates for the starry smooth-hound (*Mustelus asterias*) in the North East Atlantic. Male and female lengths at 50% maturity ( $L_{50}$ ) and given in cm. For more details about each study please refer to the appendix.

Location	Male	Female	Reference
British Waters	70.4	81.9	McCully Phillips and Ellis, 2015
Celtic Sea ecoregion	78	87	Farrell et al., 2010a

## Southern IFCA Fishery

### Fishing activity

There is limited targeting of smooth-hounds in the Southern IFCA district, usually by fixed nets, for human consumption. Much of what is landed is caught as bycatch in trawl and gillnet fisheries although many fishers will discard smooth-hounds depending on market demand (ICES,2017). Smooth-hounds are also sold as bait for pot fisheries, particularly whelk. Discard survival for European *Mustelus* species is not known but studies outside of Europe indicate variable survival rates depending on gear type. Arabian smooth-hound (*Mustelus mosis*) caught in a prawn trawl fishery were reported to experience 29% at-vessel mortality (AVM) whilst AVM ranged from 24% to 93% for triakid sharks (family of ground sharks that smooth-hounds belong to) caught in Australian and Tasmanian gillnet fisheries (Ellis et al., 2017). A lower AVM rate of 25% was reported for triakids captured by longline (Ellis et al., 2017).

### Recreational

Smooth-hounds are a relatively important sport angling fish and can be caught from the shore or by vessel. They are most abundant in Southern IFC District waters from March to October with charter boats offering fishing trips throughout the summer months to target them. Most anglers practice catch-and-release when fishing for smooth-hounds.

### Landings & Value of Fishery

Landings data for starry smooth-hound is often recorded under the generic heading of smooth-hounds due to identification confusion between starry and common smooth-hounds. Figure 1 shows smooth-hound landings into ports within the Southern IFC District, some of which would have been fished outside the District. It is most likely that all smooth-hound landings into the District are starry smooth-hounds as this is the main species of smooth-hound thought to be in UK waters (Farrell et al., 2009).

In 2019, around 41 tonnes of smooth hound were landed into ports within the District, valued at an estimated £34,000 (fig.1). Since 2014, smooth-hound landings increased considerably from previous years ranging between 20-45 tonnes per year between 2014 and 2019. Before 2014 landings were consistently below 8 tonnes per year except for 2007 and 2008 when 10 and 12 tonnes were landed, respectively. The

increase in landings in the District is in line with increases across the UK and is thought to be attributed to a growing market demand for the species as an alternative to restricted shark species such as the spurdog (*Squalus acanthias*) and an increase in smooth-hound abundance (ICES, 2012; Griffiths et al., 2020). Average price per tonne of smooth-hound has declined from £1,480 between 2010-2014 to £825 between 2015-2019.

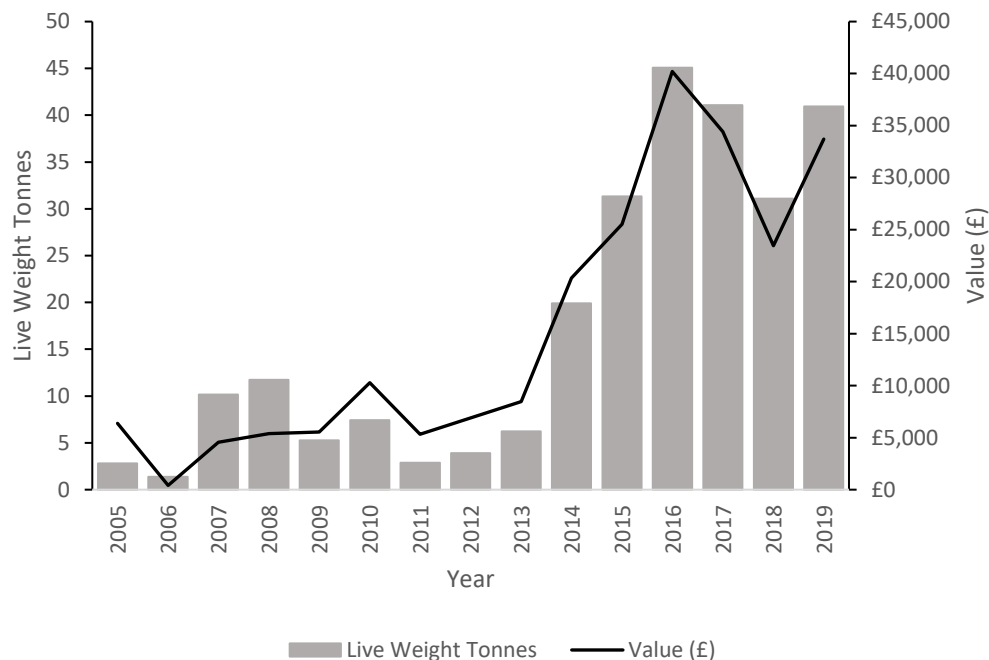


Figure 1. Landings of smooth-hounds (*Mustelus spp.*) into ports within the Southern IFC District from 2005 to 2019. Data sourced from the Marine Management Organisation (MMO)

Smooth-hound stock size in the Northeast Atlantic has increased over the past two decades but ICES advises a precautionary approach with no more than 4,626 tonnes to be landed in 2021 as catch rates, discarding and landings data are not fully known (ICES, 2019). The status of starry smooth-hound has recently been updated from Least Concern to Near Threatened on the IUCN Red List of Threatened Species (Jabado et al., 2021). However, this status refers to the starry smooth-hound population as a whole and is attributed to declining populations in the Mediterranean Sea.

### Associated management

There are no specific management measures for smooth-hound in the Southern IFCA district or wider North East Atlantic.

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## Appendix

Table A. Size at maturity estimates ( $L_{50}$ ) for starry smooth-hound (*Mustelus asterias*) in studies undertaken in the North East Atlantic. Measurements given in cm.

Study location	Total No. surveyed	No. of individuals (n)		Length Data		Total No. of individuals	No. of individuals (n)		Size at Maturity Data								Reference
				Size range					Size of smallest mature individual		Size at 50% maturity ( $L_{50}$ )		Age at 50% maturity (years)		Size range of mature individuals		
		M	F	M	F		M	F	M	F	M	F	M	F			
British Waters	504	238	266	24-99	28-124	504	238	266	65	69	70.4	81.9	-	-	-	-	McCully Phillips and Ellis, 2015
Celtic Sea ecoregion	231	113	118	35-104	43-112	-	-	-	72	83	78	87	4-5	6	-	-	Farrell et al., 2010a