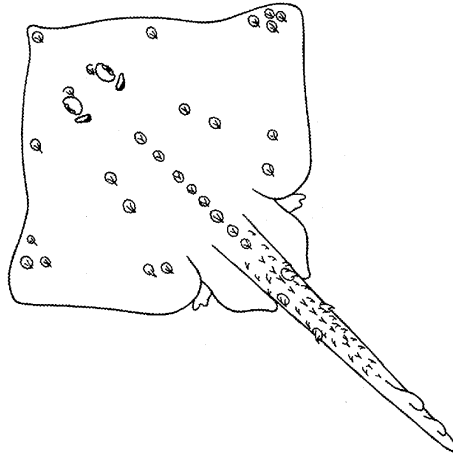


**Thornback Ray***Raja clavata*  
Family RajidaeMax size: 100 cm  
Max age: 15 years

## Introduction

**Taxonomy:** The thornback ray (or roker) *Raja clavata*, Linnaeus, 1758 (Order: Rajiformes, Family: Rajidae) is one of about 13 species of skate that are known from the North Sea and adjacent waters.

common names			
<i>Danish</i>	Sømrokke	<i>Icelandic</i>	Dröfnuskata
<i>Dutch</i>	Stekelrog	<i>Latvian</i>	Dzelkņraja
<i>English</i>	Roker / Thornback ray	<i>Norwegian</i>	Piggskate
<i>Estonian</i>	Astelrai	<i>Polish</i>	Raja nabijana a. ciernista
<i>Faeroese</i>	Naglaskøta	<i>Portuguese</i>	Raia lenga / Raia brocheada
<i>Finnish</i>	Okarausku	<i>Russian</i>	Колючий скат
<i>French</i>	Raie bouclée	<i>Spanish</i>	Raya de clavos
<i>German</i>	Nagelroche	<i>Swedish</i>	Knaggrocka

**General:** Thornback ray is one of the more common and widespread skates in the NE Atlantic and Mediterranean and is also one of the dominant species in commercial landings.

**Minimum Landing Size:** Although there is no EU regulation, individuals <40 cm length tend to be discarded. Regional Sea Fisheries Committees in England and Wales have the option of establishing by-laws for the fisheries operating in the inshore waters (extending to 6nm from shore). Within the North Sea area, the Kent and Essex Sea Fisheries Committee has established a minimum size of 40 cm disc width for skates and rays (disc width being used because the tails are often cut before landing).

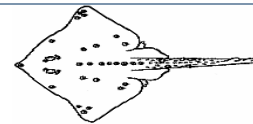
## Distribution

**Biogeographical distribution:** Thornback ray occurs in coastal waters of the North-East Atlantic from the Faeroe Islands, Iceland and Norway in the north to northwestern Africa, including the Skagerrak, Kattegat and western Baltic Sea, and the Mediterranean and Black Seas [1]. It also occurs off western Africa, including South Africa and, more recently, has been found in the Southwestern Indian Ocean [2]. However, the taxonomic status of southern African populations is far from certain.



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Thornback ray is a bottom dwelling species on the shelf and upper slope from inshore to depths of 300 m, but occurs mainly from 10–60 m [1,3].

*Spatial distribution in North Sea:* Formerly quite widespread and abundant, especially in the southern and central areas. Although the thornback ray may sometimes have been confounded with other skate species, contemporary surveys indicate that thornback ray is most abundant in the south-western North Sea, especially in the Outer Thames Estuary and the Wash (Fig. 1). These areas also include spawning and nursery grounds. The occurrence of this species is sparser in the deeper, offshore grounds of the central and northern North Sea.

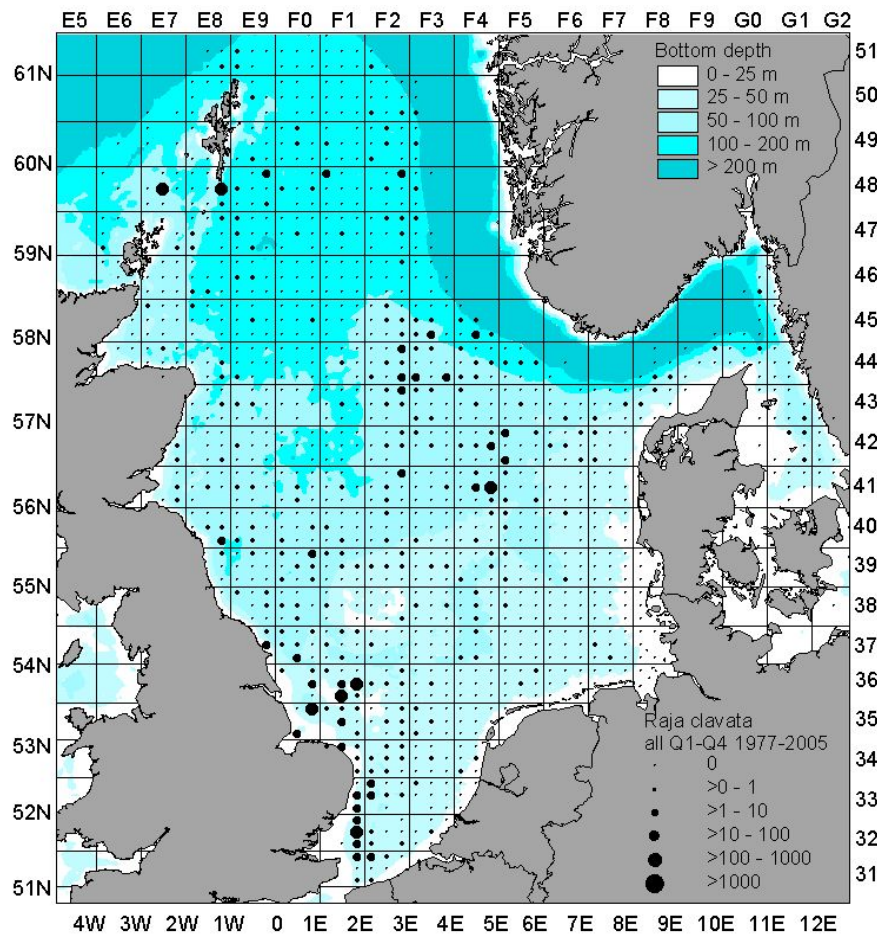


Figure 1. Average annual catch rate (number per hour fishing) for thornback ray in the IBTS survey, 1977-2005 (all quarters).

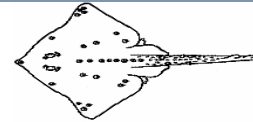
*Habitat characteristics:* Thornback ray occur on a variety of sediment types, including mud, sand and gravel [4], but is less frequent on coarser grounds. Juveniles are most often encountered in inshore waters [5,6].

### Life history

*Age, growth rates, longevity, length-weight relationship:* Ageing is typically based on examination of vertebrae [7-11], but results have sometimes been inconsistent, and ageing is considered problematic. A new method that uses caudal denticles seems promising [12]. The maximum length is about 100 cm, with females generally attaining a larger size than males. Maximum lifespan is at least 15 years [7].



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The relationships between disc width (D) and total length (L), and total length and total weight (W) are given by the following relationships (unpublished data):

$$D = 0.6930 L - 0.2480$$

$$W = 0.0042 * L^{3.1129}$$

**Reproduction:** Thornback rays are oviparous, with mature females depositing horny rectangular egg-cases on the sea floor, one at a time and each containing one embryo. The length and age at 50% maturity for North Sea populations of thornback ray are estimated at 77 cm (8.8 years) and 68 cm (7.1 years) for females and males respectively [7]. Elsewhere in the North-east Atlantic, males and females have been reported to mature at 60-81 cm and 60-101cm total length respectively [8, 13-15]. The egg-laying season for the population as a whole is protracted [8,16], though the egg-laying period of individual fish may be restricted to much shorter periods [17]. Both the number and the maximum diameter of oocytes increase with increasing body size [7]. Maximum estimates of fecundity range from 140-160 eggs per year [16,18,19], though more recent studies indicate that fecundity is lower, and in the range of 48-74 [8,17]. Spawning generally occurs in inshore areas, between March and September [20]. Embryonic development lasts about 4–6 months [17,20], depending on water temperature [19]. The young hatch at approximately 11–13 cm total length (8–9 g wet weight) [17,19,20]. The sex ratio of recently hatched fish is about 1:1 [17].

**Migrations:** Tagging studies indicate that juveniles are non-migratory and remain on inshore nursery grounds, with adults undertaking seasonal migrations, moving into shallower water during summer, and offshore in the winter [21,22]. Feeding migrations may also occur [21,22]. The North Sea stock may best be described as a series of local concentrations with regular but limited exchange of individuals. Individual movements may cover up to several hundred km, although the majority of tagged rays move no further than 50–60 km from the release site [23]. In the Bay of Douarnenez (Brittany, 0–30 m deep), one-year-old thornback rays and mature specimens enter the bay at the end of the winter. The bay serves as a nursery area for the one-year-olds, which probably stay there for at least two years. The adults use the bay as a mating site and leave the area after mating in the spring [5]. Studies using Data Storage Tags indicate that some rays tagged and recaptured in the Thames Estuary have moved throughout the southern North Sea [24].

**Food habits:** The young feed predominantly on small crustaceans (e.g. amphipods, mysids and crangonid shrimps), with larger individuals preying on larger crustaceans (e.g. swimming crabs) and fish (e.g. sandeels, small gadoids and dragonets) [25-27].

**Predation:** Adults are large-bodied and have few predators. Juveniles are fed upon by larger fish, including common skate (*Dipturus batis*) and larger thornback rays [21]. The eggs may also be predated on by fish and various molluscs (e.g. necklace shells *Polinices*) [28].

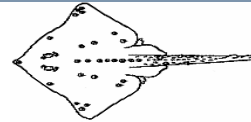
## Population structure

**Age and length composition:** Skates caught during IBTS surveys are not routinely sampled for age determination, but length data and, in more recent years, maturity data are available.



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Thornback ray often associate in groups of similar-sized fish. IBTS catches are dominated by immature specimens between 30–50 cm total length (Fig. 2). Neonatal fish are represented by the small peak at 10–18 cm total length. Fish >80 cm represent mature females. Both groups are poorly represented in IBTS surveys.

*Sex ratio:* The sex ratio of recently hatched fish is 1:1, and this is also generally true for juveniles. Maturing and mature rays often aggregate by sex and size, and so the sex ratio in catches may deviate to the advantage of either sex.

*Changes in abundance:* Historical and contemporary fishery-independent survey data indicate that thornback ray have declined in the North Sea, especially in terms of the area occupied [29,30].

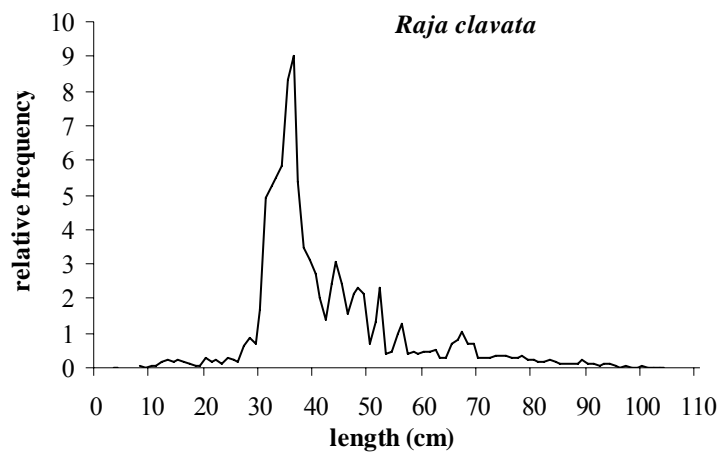


Figure 2. Length-frequency of thornback ray caught in IBTS surveys in the North Sea, 1985–2005.

*Stock structure:* The main concentration of thornback rays is found in the Outer Thames Estuary and these fish move quite widely in the southern North Sea. Comparatively few tagged fish have moved into the eastern English Channel. For assessment purposes, the southern and central North Sea is viewed as comprising one unit stock.

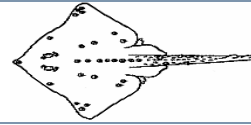
### Exploitation in the North Sea

*Main métiers targeting the stock:* Rays and skates are often landed and reported as one generic category, consisting of several species. Although no species-specific landings data are available, market sampling indicates that thornback ray is one of the most frequently landed skates. They are taken as a by-catch in otter and beam trawl fisheries, and targeted gillnet, while targeted long-line fisheries operate in inshore waters at certain times of the year.



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**Landings:** Skates and rays are typically landed by size category and not by species. North Sea landings of skates and rays peaked in the 1960s. Average annual landings from the 1970s to the early 1990s have been in the order of 4 500 t, but have declined in recent years to approximately 3 000 t for the period 1997–2003, well below the TAC (Fig. 3). Species-specific landings data submitted by France indicated that, between 1982 and 1994 inclusive, thornback rays accounted for >30% of all skates and rays. Limited market sampling in other European nations also indicate that thornback ray is the dominant species landed from the southern North Sea, though spotted ray (*R. montagui*) or blonde ray (*R. brachyura*) may dominate in specific ports.

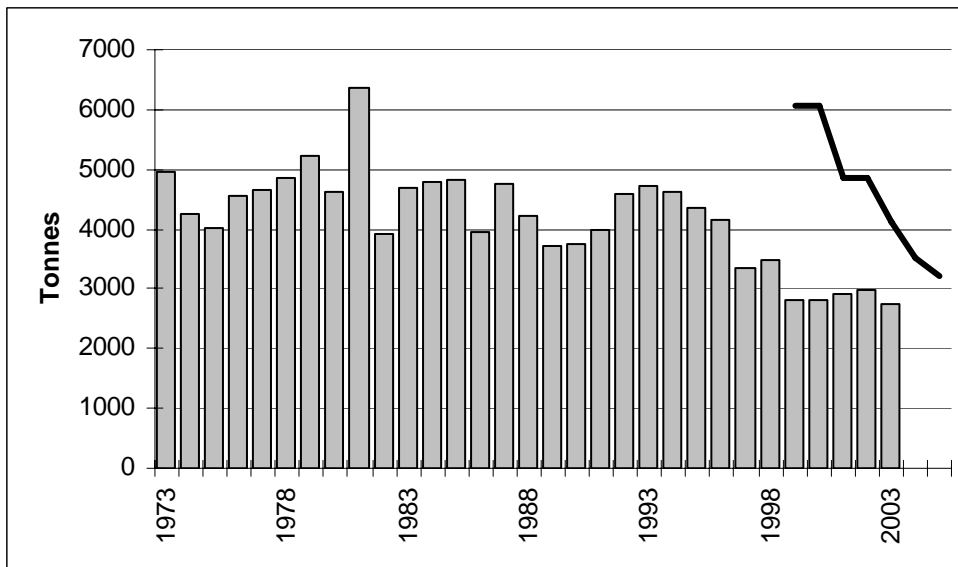


Figure 3. Landings (t) of skates and rays (combined) in the North Sea and Skagerrak (Source: ICES), with TAC allocated to EU vessels indicated (black line).

**Stock status:** Historical and contemporary fishery-independent survey data indicate that thornback ray have declined in the North Sea, especially in terms of the area occupied [29,30], and they are now most abundant in the Outer Thames Estuary and the Wash [6]. Based on the reduced distribution area and the decline in abundance in survey data, the North Sea stock is considered depleted [31].

**Protection and management:** Currently managed by TAC, although the quota are set for all rajids combined and covers EU waters in the North Sea and Norwegian Sea (ICES Divisions IV and IIa). The TAC for skates and rays has been reduced by approximately 47% between 1999 and 2005 (Table 1), but the TAC has exceeded the actual landings in all years.

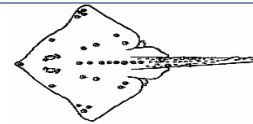
Table 1. TAC (t) for skates and rays in the EU waters of the North Sea (IV) and IIa

Year	EC	EC Regulation No
1999	6060	48/1999
2000	6060	2742/1999
2001	4848	2848/2000
2002	4848	2555/2001
2003	4121	2341/2002
2004	3503	2287/2003
2005	3220	27/2005





Thornback ray

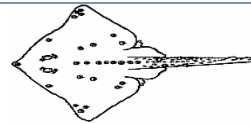
*Raja clavata*  
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