

# Introduction

*Taxonomy:* Horse mackerel (or scad) *Trachurus trachurus* (Linnaeus, 1758) (Order: Perciformes, Family: Carangidae) is the only resident carangid species in the waters of north-western Europe [1]. Other carangids reported from this area are vagrants.

common names										
Danish	Hestemakrel	Icelandic	Brynstirtia							
Dutch	Horsmakreel	Latvian	Stavrida							
English	Horse mackerel / scad	Norwegian	Taggmakrell							
Estonian	Hobumakrell	Polish	Ostrobok pospolity							
Faeroese	Rossamakrelur	Portuguese	Carapau							
Finnish	Piikkimakrilli	Russian	Ставрида							
French	Chinchard	Spanish	Chicharro / Jurel							
German	Stöcker	Swedish	Taggmakrill							

*General:* Horse mackerel is a southern species, reaching its northerly distribution limit in the northern North Sea. It is fished and landed mainly for human consumption, but the market in northern Europe is small and the larger part is exported. In autumn, horse mackerel leave the North Sea to return in the spring.

Minimum Landing Size: 15 cm.

### Distribution

*Biogeographical distribution:* Horse mackerel is abundant and widespread in the tropical and temperate East Atlantic and Mediterranean, ranging from Norway to South Africa (where it is considered a distinct subspecies *T. trachurus capensis*) [1].

Horse mackerel form large shoals that occur in bottom waters and mid-water during the day, whereas during the night they disperse and form a layer just off the seabed [2]. The range of vertical migrations decreases during the winter, when activity is lower [3]. The species typically occupies shelf seas, down to 200 m, but specimens have been reported to depths of 500 m [1].



*Spatial distribution in North Sea:* Horse mackerel has a restricted distribution during summer (Fig. 1), with the greatest densities in the south-eastern North Sea and adults also being found along the shelf edge in the northern North Sea [4]. The species is notably absent from the central North Sea. Large catches in the northern North Sea tend to be associated with influxes of Atlantic water earlier in the year [5]. During the winter, the fish largely disappear from the North Sea [6].



Figure 1. Average annual catch rate (number per hour fishing) for juvenile (<15 cm) and adult ( $\geq$ 15 cm) horse mackerel in the quarter 3 IBTS survey, 1991–2004.

*Habitat characteristics:* Horse mackerel is a widely distributed pelagic species, and habitat preferences are poorly understood. However, a variety of hydrographical features may be expected to affect their distribution, temperature being an important one [7].

### Life history

Age, growth rates, longevity, length-weight relationship: Horse mackerel may grow to about 60 cm length, but are more common in the size range of 15–40 cm [1]. they grow rapidly during the first years of life and much more slowly after age 3. They are reported to reach 40 years of age [8], although ageing methods are somewhat uncertain. Both growth and age at maturity fluctuate, possibly because of density-dependent responses to the extremely large fluctuations in year-class strength [9].

The average length and weight at age, and catch in numbers at age (for the period 1995-2003) for North Sea horse mackerel is given below [10]:

Age	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
Mean weight, g Mean	71	103	123	138	159	181	196	213	231	247	290	294	320	309	349
length, cm Proportion,	19.0	21.7	23.2	24.4	25.7	26.8	27.5	28.9	29.6	30.1	30.9	32.4	33.2	31.8	33.1
%	10.3	15.2	14.9	12.8	9.6	8.1	6.9	6.7	4.1	3.1	1.4	1.9	1.6	2.0	1.5





**ICES-FishMap** 

The following relationship between weight (W) and total length (L) has been reported [11]:  $W = 0.0034 * L_{3.2943}$ 

*Reproduction:* Horse mackerel is a batch spawner, females releasing 5–16 batches of eggs over a period of several months [8]. Peak spawning in the North Sea falls in May and June [12,13], and spawning has been reported to occur off the coasts of Belgium, the Netherlands, Germany, and Denmark. Horse mackerel mature at between 16–25 cm length (2–4 years old), although this varies regionally, and first maturity may be reached after 1 year [8]. Females from west of the British Isles produce up to 1,655 eggs per gram body weight and an average-sized seven-year-old female (220 g, 30 cm) would produce 364,000 eggs during the spawning season [9,14]. The pelagic eggs are 0.8–1.0 mm in diameter [13] and hatch after three to four days at local temperatures [15]. Newly hatched larvae measure 2.5 mm [13,16]. Pelagic 0-group of about 4.4 cm are found in the Channel and Southern Bight by mid-August. They reach approximately 12 cm by the end of the year [2].

*Migrations:* After spawning in the Southern Bight, the horse mackerel disperse into the German Bight and over adjacent areas, and from October onwards they leave the North Sea through the Dover Strait to overwinter in the warmer waters of the Channel and Celtic Sea [17]. It is during this period that horse mackerel may form densely packed shoals near the bottom [18]. Quarterly surveys indicate clearly that North Sea horse mackerel are most abundant in the southern North Sea during the spring and summer, although juveniles stay somewhat longer than the adults (Fig. 2). The catches of adults in the northern North Sea during summer and autumn belong to a different unit stock inhabiting the waters west of Great Britain (western stock). The western stock spawns in the Celtic Sea in June, after which it makes a northerly feeding migration along the western edge of the British Isles. This stock enters the North Sea from the north, and increased abundance is associated with a strong influx of Atlantic water in the preceding months [5]. Return migrations occur in late autumn (October-November), to the overwintering area off southwest Ireland [2,18].



Figure 2. Average quarterly catch rate (number per hour fishing) for juvenile (<15cm, above) and adult ( $\geq$ 15cm, below) horse mackerel in the IBTS survey, 1991–1995.



*Trachurus trachurus* Family Carangidae



*Food habits:* Juvenile horse mackerel are pelagic feeders that predate on planktonic organisms such as euphausiids and copepods [2]. Larger individuals feed increasingly demersally, and small fish become more important in their diet [18], with 0-group herring, cod, and whiting (5–7 cm long) representing major prey [19,20].

*Predation:* Like most pelagic species, horse mackerel are eaten by pelagic sharks, large teleosts, sea birds and cetaceans.

# **Population structure**

*Age and length composition:* Overall, the age composition of the landings of North Sea horse mackerel is quite broad, although strong year classes (e.g. 1982, 1998 and 2001) may dominate for several years [10].

Immature horse mackerel are very abundant in the southern North Sea during the 3<sup>rd</sup> quarter surveys, and catch rates of immature individuals tend to increase toward the shore. In the northern North Sea, mature fish dominate the catches. The length-frequency distribution of IBTS catches highlights the abundance of immature specimens (8–16 cm) in both the Skagerrak and North Sea, while larger, mature specimens (30-40 cm) are restricted to the North Sea (Fig. 3).



Figure 3. Length-frequency of horse mackerel caught in Q3 IBTS survey, 1991–2004.

*Changes in abundance:* North Sea landings increased after World War II from a few t to a few 100 t, annually. In the 1960s, landings increased again to a few 1000 t and in the 1970s to 10 000s of tonnes [6], while in the 1990s catches exceeded 100 000 t (Fig. 4). These fluctuations may largely reflect the interest of the fisheries and do not tell us much about changes in abundance, although it is quite clear that annual landings were variable in the short term. The winter IBTS data indicate occasional outliers during warm winters [7], but this tells us little about the abundance during summer, the main season. And the summer IBTS surveys have only been carried out since 1991 and tell little about long-term trends, although they indicate an increasing trend.



*Trachurus trachurus* Family Carangidae



*Stock structure:* The North Sea stock is supposed to comprise the eastern Channel (VIId), the southern and central North Sea (IVb,c) and Skagerrak (IIIa). The more abundant western horse mackerel stock, which is distributed from the Cantabrian Sea to the northern North Sea and extending into the Norwegian Sea, is assessed as a separate unit stock.

# **Exploitation in the North Sea**

*Main métiers targeting the stock:* Traditionally, horse mackerel has been discarded in the human consumption fisheries because of its low value. With the ascent of the small-mesh industrial fisheries, it also has been targeted for reduction purposes. However, in the 1970s eastern European fleets started to exploit the species in human consumption fisheries [6] and more recently the fleets of western European countries have taken over this fishery. Because of lack of a local market, the catch is largely exported.

*Landings:* The economic importance of horse mackerel in northern Europe has increased greatly in recent years, but the fishery targets mainly the much larger western stock (spawning stock biomass of the western stock in 1990 was estimated at 1.7 million t in 1990 compared to a North Sea stock of 255,000 t). Catches of horse mackerel in the North Sea tend to reflect changes in interest (fishing effort), in the variable quantities of the western stock entering the North Sea, and the varying year-class strength in both stocks. However, it remains difficult to assign the North Sea/Skagerrak landings to the individual stocks. Landings increased steeply between 1987 and 1990, remained high through 1995 and then declined, although annual variations have been large (Fig. 4).



Figure 4. Landings (1000 t) of horse mackerel in the North Sea (Subarea IV) and Skagerrak (Division IIIa) [21].

*Stock status:* The North Sea stock can not be currently assessed, in absence of sufficient and appropriate reference points have not been estimated. However, the ICES advice has been to restrict the fishery and that catches should not exceed the 1982–1987 average of 18 000 tonnes [21].

*Protection and management:* There are no explicit management objectives for the North Sea stock. The overall TAC for the Norwegian and North Seas (Division IIa, Division IIIa and sub-area IV) is not compatible with the known stock structure of the species. This TAC has been decreased from 58 000 t in 2002 to 42 727 t in 2006, but there is no control how the actual landings are composed in respect of the two stocks.





#### *Trachurus trachurus* Family Carangidae



**ICES-FishMap** 

#### References

- 1 Smith-Vaniz, W.F. 1986. Carangidae. *In* Fishes of the North-eastern Atlantic and the Mediterranean Volume II (Whitehead, P. J. P., Bauchot, M.-L., Hureau, J.-C., Neilsen, J., and Tortonese, E., eds.) UNESCO, Paris, 815-844.
- 2 Macer, C.T. 1977. Some aspects of the biology of the horse mackerel [*Trachurus trachurus* (L.)] in waters around Britain. Journal of Fish Biology 10: 51-62.
- 3 Nazarov, N.A. 1989. Peculiarities of distribution and behaviour of horse mackerel in the Northeast Atlantic. ICES CM 1989/H:7. 20 pp
- 4 Knijn, R.J., Boon, T.W., Heessen, H.J.L. and Hislop, J.R.G. 1993. Atlas of North Sea Fishes. ICES Cooperative Research Reports, 194. Copenhagen. ICES. 268 pp.
- 5 Iversen, S.A., Skogen, M.D., and Svendsen, E. 2002. Availability of horse mackerel (*Trachurus trachurus*) in the north-eastern North Sea, predicted by the transport of Atlantic water. Fisheries Oceanography, 11(4): 245-250.
- 6 Postuma, K.H. 1978. Immigration of southern fish into the North Sea. Rapports et Procèsverbaux du Conseil international pour l'Exploration de la Mer, 172: 225-229.
- 7 Corten, A., and Van de Kamp, G. 1996. Variation in the abundance of southern fish species in the southern North Sea in relation to hydrography and wind. ICES Journal of Marine Science, 53:1113-1119.
- 8 Abaunza, P., Gordo, L., Karlou-Riga, C., Murta, A., Eltink, A.T.G.W., Santamaria, M.T.G., Zimmermann, C., Hammer, C., Lucio, P., Iversen, S.A., Molloy, J., and Gallo, E. 2003. Growth and reproduction of horse mackerel, *Trachurus trachurus* (Carangidae). Reviews in Fish Biology and Fisheries, 13(1): 27-61.
- 9 ICES 1991. Working group on the Assessment of the Stocks of Sardine, Horse Mackerel, and Anchovy. ICES CM 1991/Assess:22. 138 pp.
- 10 ICES 2005. Report of the Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine, and Anchovy (WGMHSA). ICES CM 2005/ACFM:08, 472pp.
- 11 Coull, K.A., Jermyn, A.S., Newton, A.W., Henderson, G.I. and Hall, W.B. 1989. Length/Weight relationships for 88 species of fish encountered in the north- east Atlantic. Scottish Fisheries Research Report, 43: 81pp.
- 12 Macer, C.T. 1974. The reproductive biology of the horse mackerel *Trachurus trachurus* (L.) in the North Sea and English Channel. J. Fish Biol., 6(4): 415-438.
- 13 Russell, F.S. 1976. The eggs and planktonic stages of British marine fishes. Academic Press, London. 524 pp.
- 14 Eltink, A. 1991. Horse mackerel egg production and spawning stock size in the North Sea in 1990. ICES CM 1991/ H:27, 14 pp.
- 15 Pipe, R.K., and Walker, P. 1987. The effect of temperature on development and hatching of scad, *Trachurus trachurus* L., eggs. Journal of Fish Biology 31: 675-682.
- 16 Heincke, F., and Ehrenbaum, E. 1900. Eier und Larven von Fischen der deutschen Bucht. II. Die Bestimming der schwimmenden Fischeier und die Methodik der Eimessungen. Wissenschaftliche Meeresuntersuchungen, Abteilung Helgoland. Neue Folge 3: 127-332.
- 17 ICES 1990. Report of the Working Group on the Assessment of the Stocks of Sardine, Horse Mackerel, and Anchovy. ICES CM 1990/Assess:24. 123 pp.
- 18 Eaton, D.R. 1983. Scad in the North-East Atlantic. MAFF Laboratory Leaflet 56: 1-20.
- 19 Dahl, K., and Kirkegaard, E. 1986. Stomach contents of mackerel, horse mackerel and whiting in the eastern part of the North Sea in July 1985. ICES CM 1986/H:68, 17 pp.
- 20 Dahl, K., and Kirkegaard, E. 1987. The diet and consumption of horse mackerel (*Trachurus trachurus*) in the eastern North Sea, August 1986. ICES CM 1987/H:43. 23 pp.
- 21 ICES 2006. http://www.ices.dk/committe/acfm/comwork/report/2006/oct/hom-nrtn.pdf