

North Eastern Atlantic Mackerel:

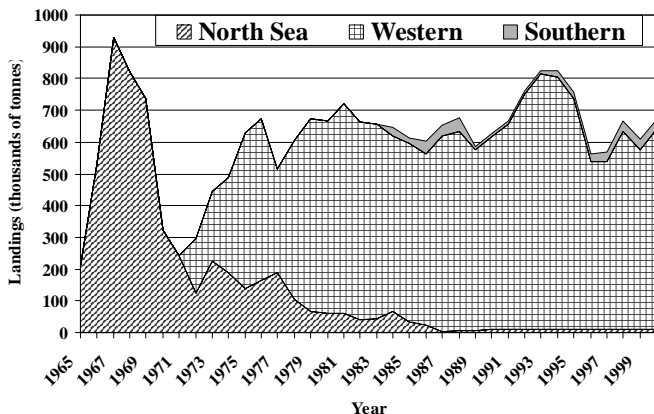
John Simmonds, Pelagic Group, FRS Marine Laboratory Aberdeen.

With an annual value at first sale of around £50 million mackerel is a very important species for the Scottish fleet. By weight, it is by far the most abundant species landed by Scottish fishermen.

The North Eastern Atlantic mackerel is thought to be a single stock with three separate components: the North Sea, the Western and the Southern. These differ in their spawning location and both juvenile and adult migration patterns. North Sea mackerel mixed with the Western component spends the winter in the deep water to the east and north of Shetland and on the edge of the Norwegian Deep. In the spring, the North Sea component migrates south into the central part of the North Sea and spawns during a period from May until July. The Western component moves along the continental slope migrating south west to mix with the Southern component and spawning at the same time as those in the North Sea, in an area stretching northwards from the bay of Biscay to the Wyville Thompson Ridge. When spawning is finished, the Western Mackerel move back to the feeding grounds in the Norwegian Sea and the northern North Sea. The Southern mackerel is less distinct, spawning in the same area as the Western component, but the juveniles and young adults remain in the southern part of the area, mostly in the Bay of Biscay. Recently a number of tagging studies have been carried out and these show that adult mackerel found on the Spanish coast are later caught throughout the whole western area from the Bay of Biscay to the Norwegian coast. In contrast no adults tagged north of Porcupine Bank have yet been recovered south of the English Channel and very few of the tagged mackerel have been recovered from the central North Sea. On occasions some small Western mackerel are observed entering the North Sea through the English Channel before migrating to the Norwegian Deep.

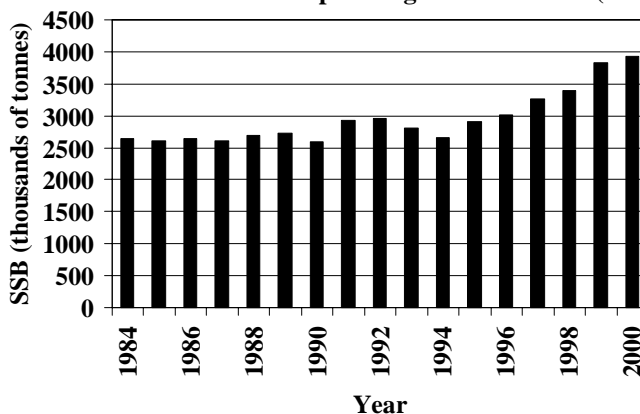
Over the past twenty years, the pattern of the southerly migration of the Western component has changed dramatically in both timing and route. In the 1970s and 1980s this southward movement occurred in late summer and autumn with the fish passing through the relatively shallow waters of The Minch. Since then the migration has occurred gradually later in the year and further offshore. The pattern of the northerly return journey, after spawning, has remained relatively unchanged. The boundaries of the spawning areas are rather variable but may have also changed over the years, with an increase in spawning activity in the north of the area and to the west of the shelf edge.

Catches of North Eastern Atlantic Mackerel 1965-2000



There were large catches of the North Sea mackerel in the late 60s which peaked at around 650,000 tonnes per year for the four years 1966-69, then declined to around 150,000 tonnes during the 70s and finally collapsed completely by 1985. Since then the catch of this component has never recovered. Occasionally aggregations of mackerel, some of them spawning, are observed in the North Sea. However, the substantial spawning that used to occur in this area has not been observed. As the fishery on the North Sea component reduced, the fishery on the Western component increased. Total reported catches of mackerel were relatively steady until the early 90s, and then increased until 1996 when a more restrictive TAC was introduced and reported catches fell back to around 600,000 tonnes.

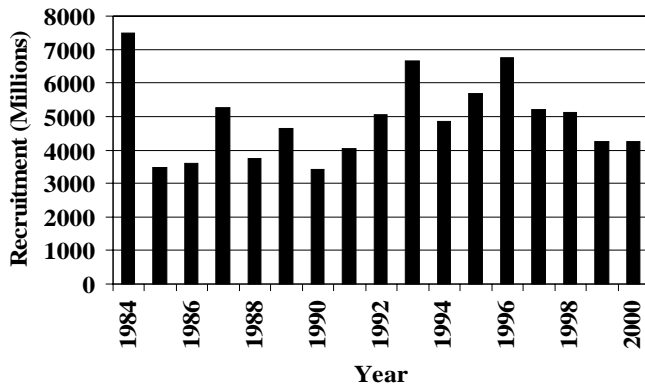
North Eastern Atlantic Spawning Stock Biomass (SSB)



Mackerel stocks are now managed as one unit, the methods used being similar to those used for North Sea herring. However, in contrast to herring where stock surveys are annual the assessment of the current state of the mackerel stock depends on an egg survey carried out every 3 years. The resources required for this survey are similar to that required for herring but are concentrated into a single year.. Each triennial survey is made up of around 13 individual surveys covering the area from the North Spanish coast to the Faeroe-Shetland Channel over the period from March to July. The FRS Marine Laboratory carries out two of these surveys one in April and the other in June using FRV SCOTIA. The number of eggs produced is proportional to the number of adult mackerel in the population. Samples of mackerel are collected at the beginning of the spawning season and the ovaries are examined under a microscope to estimate the proportion of the eggs that will be spawned that year. Typically each female fish spawns about 250,000 eggs in about 20 separate batches. Once the number of eggs spawned over the whole area and during the spawning season have been estimated from the surveys, the number of mackerel that produced these eggs can be calculated from the average number of eggs produced by individual female fish. The latest survey was carried out this year however, the final results from this are not yet available

The Spawning Stock Biomass (SSB) appears to have remained relatively steady over the period 1984 to 96, with signs of a rise in the last few years. The recruitment, (the number of mackerel joining the population in a year) is also rather stable with the largest year class being only just over twice smallest. The mackerel's spawning strategy, utilising a large area and long spawning season is much more robust than the strategy used by herring which spawn once in a year on single discrete spawning sites. Mackerel has a much more stable recruitment pattern than the North Sea herring.

North Eastern Atlantic Mackerel Annual Recruitment



The stock assessment of North Eastern Atlantic mackerel suggests a rather stable population with a steady robust recruitment, which can sustain the current level of fishery. However, the recent rise in SSB shown in the figure above must be treated with caution. The egg survey in 1998 is the main reason for the rise in stock and it is just one observation. It might be more realistic to say that since 1998 there have been no signs that the stock had declined.

It is tempting to think that the mackerel stock has evolved over the last 30 years primarily in response to the fishery.

- That the disappearance of the North Sea component is the result of too high a fishery in this area in the 60s.
- That the Western component moved to an offshore migration as the Minch fishery took fish preferring this inshore route giving a distinct advantage to those fish migrating offshore.
- Finally that the delayed southward migration of the Western component is due to the behaviour of the fishing fleet, which waits to the west of the overwintering grounds and takes a higher proportion of early migrating fish thus allowing those that preferred a later migration to survive.

This is a rather attractive explanation, for the changes we have observed, however, it is impossible to prove. It should nevertheless be remembered that the fishery is the largest cause of adult mortality for this species and it is likely to have had an affect on the population and its behaviour.

There is one important issue for the management of the North Eastern Atlantic mackerel stock. We have no experience from the past of what will happen to the Western component of the stock should this undergo too much fishing pressure. The quality of data particularly on the fishery is therefore crucial for accurate stock assessment. Increases in unreported catch would hide the true situation, making it possible to miss early signs of a declining stock. The real spectre at the feast is the example given by the history of the North Sea component. Here the heavy fishery in the late 1960s and early 70s seems to be responsible for the depletion of this component of the stock and it is worrying that it has never subsequently recovered. This collapse provides a salutary example of what could happen to a component of this otherwise robust stock if it was being exploited too heavily. Currently from the reported catches it is believed that the mackerel stock is exploited at a rather low level and that this exploitation is sustainable. However, if the catches were to rise (particularly if this rise was unreported) the stock could quite quickly fall to a level that has not been previously seen as happened in 1996. In this case we would be in a situation of great uncertainty resulting in even more restrictive TACs. It is therefore important that the level of fishery be kept at the levels similar to those following the reduction in 1996. If recruitment continues at the levels seen over the last 20 years this level of fishery should be sustainable.