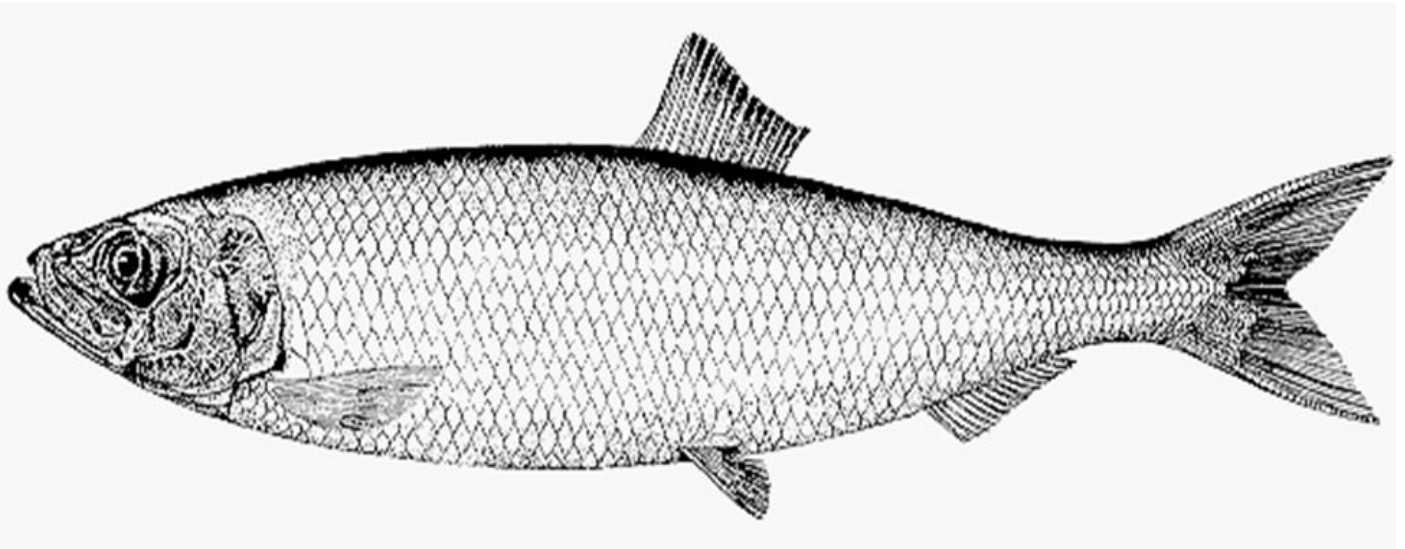


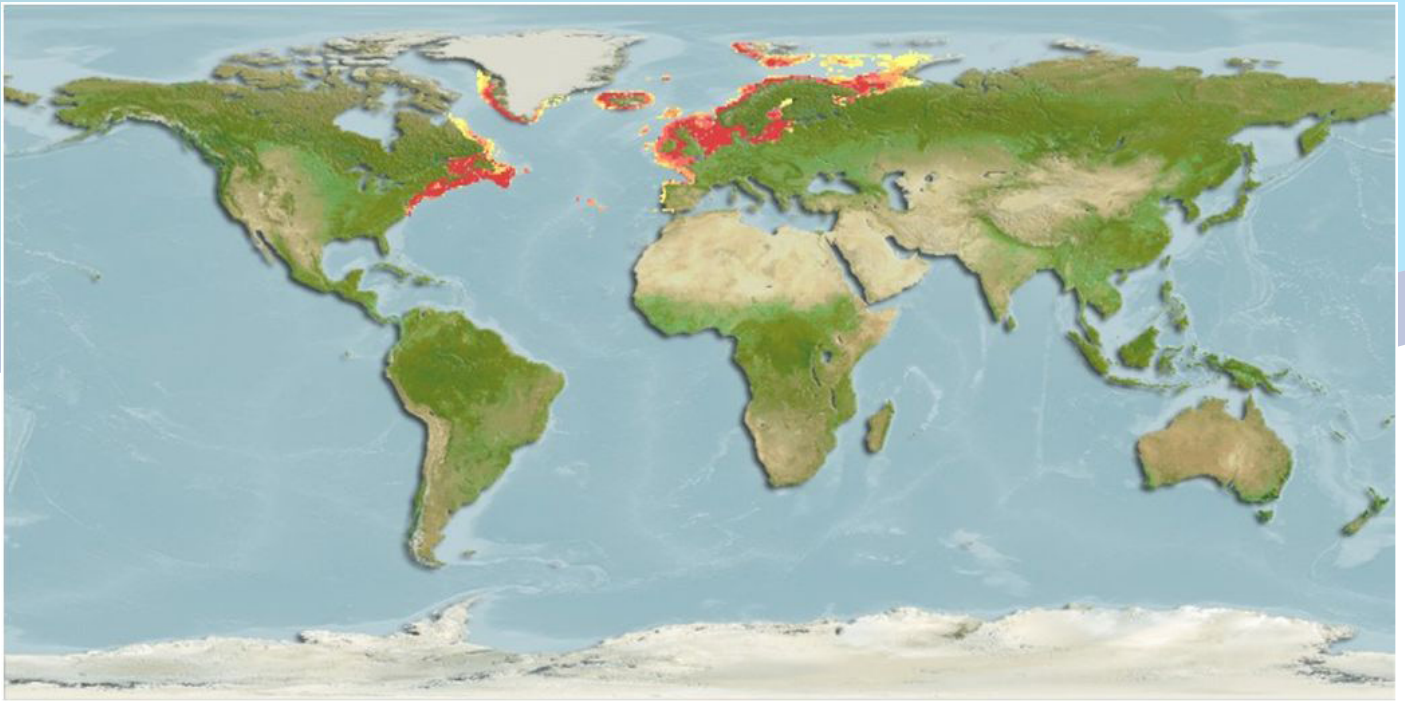
Herring (*Clupea harengus*)



(Whitehead et al. 1988)

Introduction

Herring are a planktivorous forage fish belonging to the family *Clupeidae*. They are an abundant and commercially important schooling species found throughout the waters of the North Atlantic (Whitehead et al. 1988). Irish Sea herring are thought to be part of a Malin shelf stock complex, with a proportion of the Irish Sea herring stock migrating to the north of the Irish Sea during the summer feeding period. Meanwhile juveniles from Celtic and Irish Seas mix during summer and pre spawning periods in Irish Sea (Burke et al. 2009). Herring spawning grounds in the Irish Sea are found in coastal waters to the west and north of the Isle of Man and on the Irish Coast at around 54°N (ICES, 1994; Dickey- Collas et al., 2001). Irish Sea herring are predominantly autumn spawners with spawning taking place from September to November (ICES 2013). Stock sizes are naturally highly variable possibly due to changing environmental conditions such as temperature and prey availability influencing early life history survival (Nash and Dickey-Collas 2005; Fässler et al. 2011).



Reviewed distribution maps for *Clupea harengus* (Atlantic herring), with modelled year 2100 native range map based on IPCC A2 emissions scenario. www.aquamaps.org, version of Aug. 2013. Web. Accessed 4 Feb. 2016.

Life history overview

Herring migrate between spawning and wintering grounds in coastal areas and feeding grounds in open water, showing generally stable patterns that may persist for some years, but occasionally change markedly, due to environmental or stock changes (Corten 2002). Juveniles often shoal close inshore, while adults are found more offshore, spending the day in deeper water, while rising to shallower water at night (Harden-Jones 1968; ICES 1994). A facultative zooplanktivorous filter-feeder, (i.e. can switch to filter-feeding if the food density and particle size are appropriate) (Blaxter 1990), herring feed mainly on copepods. Herring schools in turn often attract predators such as fish, birds, and marine mammals (Holst 2004). The main fish predators on herring in the Irish Sea include whiting (*Merlangius merlangus*), hake (*Merluccius merluccius*) and spurdog (*Squalus acanthias*) (Armstrong 1979; Newton 2000). Irish Sea herring mature around the 2-ringer stage (ICES 1994). The Irish Sea herring use traditional spawning grounds to the north and east of the Isle of Man and off the Irish coast (Mourne ground) (Dickey-Collas et al. 2001). A demersal spawner herring releases a ribbon of sticky eggs that sink to the sea bed (Holliday 1958) and adhere to the substrate, usually on gravel or rocky bottoms. The eggs released by a spawning population may be several layers thick which may deprive eggs in the bottom layers of oxygen, causing egg mortality (Holst 2004, Geffen 2009). Fecundity ranges from 10,000-60,000 eggs (ICES 2009). Hatching may take up to 3 weeks, depending on temperature (ICES 2009). Larvae are pelagic and drift with the local currents.

Summary of life history and habitat parameters

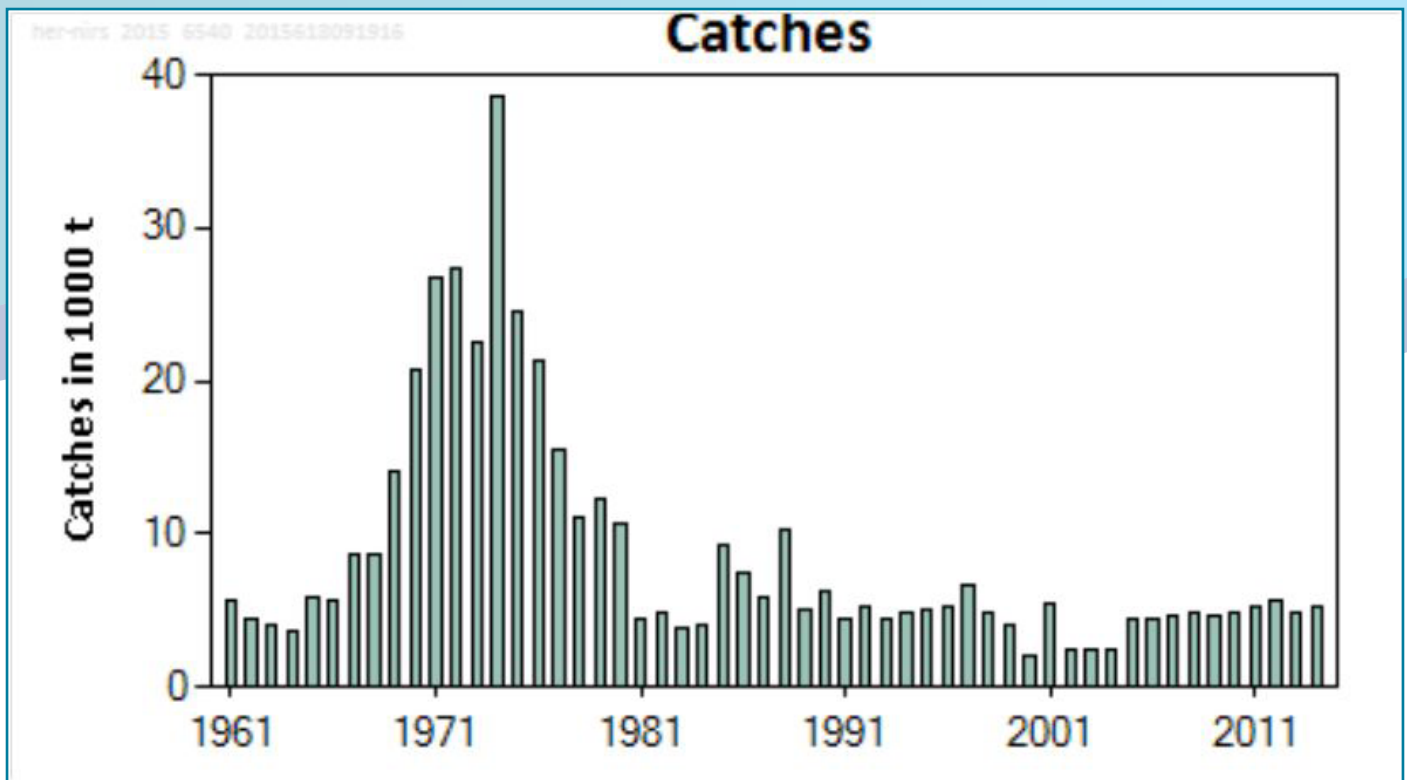
Species: <i>Clupea harengus</i> (Herring)				
Life Stage	Size and Growth	Habitat	Substrate	Temperature
Eggs	Eggs are 1.0-1.4mm in diameter	Herring deposit a sticky ribbon of eggs that form a carpet on the seabed, rocks, or seaweed. Well oxygenated waters. ⁸	Atlantic herring in the area located west of the British Isles actively select gravel beds for their egg deposition ²	Found to develop and hatch at temperatures 4-16°C. ⁷
Larvae	The mean hatching size of herring larvae is about 6.5 mm ³ . In the Irish Sea hatching occurs between 5-9mm with yolk sac stage lasting ~8d ⁵	Larvae are widespread in November in eastern Irish Sea and adjacent to spawning areas in western Irish Sea. They are transported by the prevailing currents. ¹ Autumn spawned larvae mainly confined to tidally energetic mixed zones ⁴	Pelagic. Most collected <60m in Irish Sea	Positive growth at temperatures 6 -14°C when feed ad libitum ⁶ . Lab study shows larvae tolerate wide temperature range (-1.8 to 24°C). ⁷
Juveniles	Commonly assumed that majority of herring leave nursery areas when they are 2-ring fish ¹	Surveys of O-ring herring show that young herring to be most abundant inshore in bays and sea-lochs. The highest densities of O-ring herring were inshore along the Coast of Ireland from about 53°40'N to 54°20'N, as found in earlier Irish trawling surveys. The distribution of I-ring herring was similar but more widespread. Herring of 2-rings and older were widely scattered in low densities in summer	Pelagic in inshore areas. Spatial distribution affected by currents, frontal zones, and availability of zooplanktonic food organisms ⁷	Lab studies show that juveniles prefer 8-12°C, physiological stress occurs < 4°C and > 16°C ⁷ ,

Species: <i>Clupea harengus</i> (Herring)				
Adults (feeding)		This dispersed phase of the adult fish appears to last from October / November until the following April / May period. Adult fish may leave through North Channel to feed north of Irish Sea	Adults more abundant in areas of northern North Sea where, thermocline 25-45 m deep, and difference between surface and bottom water temperatures was only 3°C. Pelagic ⁷	Adults more abundant in areas of northern North Sea where summer sea surface temperatures are 11-14°C ⁷
Adults (Spawning)		The adult stocks are found on the spawning grounds off Douglas during September and October and Kilkeel from September to November. After spawning the shoals appear to disperse over a large area of the north Irish Sea and are commonly found as a by-catch in various trawl fisheries and in demersal surveys ¹	Pelagic. Pre-spawning aggregations more abundant over gravel/sand in northern North Sea. ⁷ Also associated with seabed features, banks and depth changes in seabed (Beggs, per obs)	

(ICES 1994)¹; (ICES 2010)²; (Heath 1993)³, (Heath et al. 1988)⁴; (Dickey-Collas et al. 2001)⁵; (Fässler et al. 2011)⁶; (Reid et al. 1999)⁷; (Ellis et al. 2012)⁸

Fishery

The main herring fishery in the Irish Sea has been on the fish that spawn in the vicinity of the Isle of Man. The fish are caught as they enter the North Channel, down the Scottish coast, and around the Isle of Man. Traditionally this fishery supplied the Manx Kipper Industry, which required fish in June and July. The fishery has been prosecuted mainly by UK and Irish vessels. TACs were first introduced in 1972, and vessels from France, Netherlands and the USSR also reported catches from the Irish Sea during the 1970s before the closure of the fisheries from 1978 to 1981. By the 1990s only the fishery on the Manx fish remained, and by the late 1990s this was dominated by Northern Irish boats. A small gillnet fishery operates on the Mourne grounds.



Herring in Division VIIa North of 52°30'N (Irish Sea). (ICES. 2012.)

Stock Status

ICES advises that when the MSY approach is applied, catches in 2016 should be no more than 4575 tonnes. ICES advises, under precautionary considerations, that activities that have a negative impact on the spawning habitat of herring should not occur, unless the effects of these activities have been assessed and shown not to be detrimental.

The spawning-stock biomass (SSB) has been above MSY Btrigger since 2006. Fishing mortality (F) has decreased since 2003 to the lowest in the time-series and is now around FMSY. Recruitment is relatively high and stable; estimated above the average of the time-series since 2006.

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