



Clupea harengus Image © Scandinavian Fishing Year Book

The annual catch of herring (*Clupea harengus*) in the North Atlantic, Baltic and Arctic Oceans is approximately 2.4 million tonnes (t) (1). Total landings into the UK in 2011 were 39,600 of which 31,300t were by UK vessels. UK vessels landed 30,300t abroad in 2011. The majority is exported to countries such as Germany and the Netherlands. Other species of the Clupeidae family are sprats, pilchards (sardines) and the Pacific herring (*Clupea pallasii*), but *Clupea harengus* is the only species described as herring on UK markets (3).

Herring stocks are highly variable, but there has been a long history of management action to protect them. The major stock of herring; the Norwegian Spring spawning stock, is inside safe biological limits, although yields are expected to decrease. The North Sea autumn spawning and the Celtic Sea autumn/winter spawning stock are also inside safe biological limits. The Irish Sea and the West of Scotland autumn spawners, together with three Baltic stocks are also inside safe biological limits. However, there are restrictions on some Baltic stocks due to contamination

(see page 12). One stock in the western Baltic is at increased risk of being outside safe biological limits. The fungal infection in the Icelandic summer spawning stock has now virtually disappeared and the stock is recovering and is above safe biological limits. Across the Atlantic, three stocks are known to be inside safe biological limits, and four whose status is less certain. Nine herring fisheries have achieved MSC certification.

The purpose of this guide is to outline the status of herring stocks and describe some of the measures being taken to protect them.

BUYERS' TOP TIPS

Know your source of supply and stock status

Biological stocks are distinct populations which inhabit geographical areas; each one has a different spawning area but there is some mixing between them. Herring are divided into 'management stocks' which mostly coincide with biological stocks. These areas contain the main fisheries. This guide will help you to understand stock status and enable you to find out the management stock from which the fish has been caught

An informed buying policy

There are some stocks of herring which are at risk of depletion. Under the precautionary approach plans have been made, in some cases enhanced by stakeholder participation, to improve the stocks' chances of recovery.

Consider seasonal quality

Different stocks of herring spawn at different times of the year (spring, summer, autumn and winter) affecting the seasonal condition of the roes and the fishes' fat content.

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Status of herring stocks July 2013

Biology

Herring (*Clupea harengus*) is a pelagic (mid-water) species widespread throughout the shelf-sea areas of the North Atlantic (4). Herring produces eggs which are attached to a gravely substrate on the seabed, on rocky ledges in the Norwegian fjords and in eel grass (*Zostera*) beds in parts of the Baltic. Natural variability in the survival of the eggs and larvae produces large fluctuations in abundance of each year class of fish. Stocks are divided into spring, summer and autumn spawners. The planktonic animals herring feed on have a high fat content which results in the fish being very oily, particularly during the Summer (5).

Maximum Sustainable Yield (MSY) and the Precautionary Approach (PA)

Current ICES advice on herring stocks is given on the basis of MSY and the precautionary approach (6). MSY means fishing at a level that takes the maximum catch (yield) that can safely be removed from a fish stock, on a continuous basis, whilst maintaining its long-term productive capacity, and is achieved by keeping the stock above the biomass action point $MSYB_{trigger}$. The precautionary approach aims to limit fishing mortality (F) and catches to levels that avoid depleting the stock's reproductive capacity, keeping its spawning stock biomass (SSB) above its biomass reference level (defined as B_{pa}).

These concepts are illustrated in the schematic (Fig. 1), which shows how catches from an unfished stock would increase in line with exploitation (or fishing mortality, F), up to a point where the total mortality on the stock causes so many fish to be caught at a relatively small size (and discarded or landed) that the potential production of the stock due to growth of individual fish is not realised ('growth overfishing'). The peak of this curve represents MSY and indicates approximately where F_{MSY} lies.

However, providing sufficient fish survive to become adults and spawn, they may still have the reproductive capacity to replace themselves. Stock collapse can occur when fishing mortality reaches a level (F_{lim}) such that removals from a stock are so high, and its spawning capacity is so diminished, that fewer and fewer juveniles are produced. So, not only is the size of the stock being reduced by too high a level of exploitation, but there are fewer juvenile fish to replace those that are caught, and stock levels are likely to fall even lower ('recruit overfishing'). The yellow area between the green (inside safe limits) and red (outside safe limits) zones in the schematic and stock trajectories (Figs 3 & 4, page 9) represents levels of F or SSB that management should seek to avoid to ensure that the stock has a high probability of remaining sustainable.

Scientific advice given under the twin MSY/precautionary approach strategy will aim to either achieve catches consistent with fishing levels that would result in F_{MSY} , or reduce fishing mortality to return the stock to within safe biological limits ($> B_{pa}$). For many fish stocks, parties exploiting the stock have management plans, and ICES also provides advice on catches compatible with such plans. Where such plans have been developed and evaluated the advice is based firmly on the plan which takes precedence over MSY targets

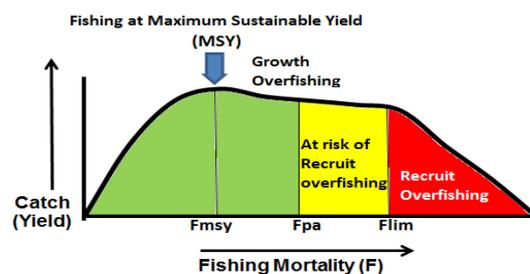


Figure 1 Schematic of ICES' MSY and PA reference points in relation to fishing mortality and Yield

| Management Stock (keyed to Figure 1 map on page 6) | Agreed TAC 2013(t) (8, 9) | Advisory TAC 2013 (t) | Scientific advice and management June 2013 ICES advice unless otherwise stated (10) |
|--|---------------------------|---|---|
| NORTH EAST ATLANTIC AND BALTIC HERRING STOCKS (<i>Clupea harengus</i>) www.ices.dk | | | |
| Inside safe biological limits | | | |
| Norwegian Spring Spawners (Atlanto-Scandian). ICES sub area I, divisions IIa,Va,Vb | 619,000 | 619,000 | <u>September 2012 advice.</u> Stock is highly migratory, distributed over a wide area of the North East Atlantic. Agreement between Norway, Faroe Islands, Iceland, Russia and EU for a long-term management plan (1999). ICES consider the plan to be consistent with precautionary approach. Spawning stock has been declining since 2010. It is currently above precautionary levels but predicted to fall below Bpa by 2014. Recruitment since 2004 has been low which has led to the recent reduction in SSB. Catches expected to decrease over the coming years even if fished according to the management plan. Currently fished at below F MSY but above management plan targets. See ref 11 for MSC certified fisheries. A major concern for this fish stock is that in 2013 the Faroese declared their intention (outside the agreement) to increase their percentage take from 5.61 to 17%, which would result in a total catch of 692,280t, 12% above the advisory TAC (p 9). |
| North Sea, Eastern English Channel autumn spawners ICES sub area IV, division VIIId | 492,400 (inc. bycatch) | 2013: Mgmt plan= 480,200 MSY/PA = 529,400 (incl bycatch) 2014: 481,200 – 514,200 (incl. bycatch) | A change in the stock assessment model in 2011 led to changed perception of stock status with increases in SSB averaging 30% over the past ten years. New model considered an improvement with 95% confidence intervals on the estimates of SSB and F. The advice for 2013 assumes no overshoot of the TAC in 2012; Before 2009 the TAC was regularly overshoot by 13-15% reduced to <5% since then. Year classes from 2002 onwards are estimated to be the weakest since the late 1970's and recruits produced per spawner are the lowest in the historic time series. This could be due to planktonic ecosystem changes affecting the survival of the larvae over the past ten years. Year classes 2008/9 are above the mean. ICES advice is that the stock is still in a low productivity phase but is considered at full reproductive capacity and harvested sustainably. Management plan in place– ICES evaluated current and new options in 2012 and concluded that they all included precautionary options. The plan currently has primacy over ICES MSY framework in providing advice. Fished below MSY. See (11) for MSC certified fisheries and page 8 for further explanation. |
| Celtic Sea and SW Ireland (Autumn/Winter spawners), ICES divs VIIg,h,j,k plus division VIIa (S of 52°30'N) | 22,193 | Management plan <18,500 2014: 22,360 FMSY= <35,942 | Stock has recovered to inside precautionary levels since 2008 and continues to improve. Spawning stock biomass well above management plan target since 2009 and currently at highest level in the time series back to 1958. Three strong recent year classes (2003/4, 2005/6 and 2007/8). A long-term management plan was agreed by the Irish industry in 2011 and evaluated by ICES as in accordance with the precautionary approach. The EU has stated a preference for the advice to follow the MSY framework. Fishing mortality has been below MSY since 2006. |

| Management Stock (keyed to Figure 1 map on page 6) | Agreed TAC 2013(t) (8,9) | Advisory TAC 2013 (t) | Scientific advice and management June 2013 ICES advice unless otherwise stated (10) |
|---|----------------------------------|--|--|
| Inside safe biological limits | | | |
| West of Scotland autumn spawners, ICES div VIa (N of 56°N), (incl in Vb/VIb) | 27,480 | Mgement. Plan /MSY= 27,480 2014: 28,067 | The stock has been fluctuating at low levels relevant to the pre 1974 period and has been in a period of reduced productivity since the late 1980s (thought to be due to environmental conditions similar to those affecting North Sea and Norwegian Spring spawning stocks). Spawning stock biomass has been above the biomass limit level since 1979 although MSYB _{trigger} is not defined and the stock is managed on the basis of F targets. The management plan is consistent with the precautionary approach. Fishing mortality has been mainly below FMSY over the past eight years and well below it in 2011 and 2012. |
| Iceland Summer spawners Va | 2012/2013 ¹ 68,500 | 2012/2013 ² ; FMSY= 67,000 2013/2014 ² FMSY= 87,000 | The overall effect on the stock of the fungal infection since 2008 and high mortalities in the winter of 2012/2013 is now considered to be less than anticipated in recent assessments and current infection mortality is observed to be zero. SSB has been above the MSYB _{trigger} level since 2002 and well above the (200Kt) for the whole time series dating back to 1987. Recruitment has been around the long term mean since 2002 but is estimated to have fallen below it in 2013 (2010 year class). There is no formal management plan. The precautionary approach F reference point, on which management is based, is considered to be consistent with the MSY approach. |
| Irish Sea Autumn spawners, ICES division VIIa | 4,993 | FMSY <5,100 2014; F MSY= 5,251 | Stock assessment is now carried out using the same model as for the North Sea stock. The assessment is based on a mixed stock which includes juveniles migrating from the Celtic Sea. SSB was low over the period 1991 to 2006 but has increased steadily to the highest level since 1975. SSB is currently more than double the MSYB _{trigger} level and predicted to increase again in 2013. Fishing mortality has been decreasing since 2003, is below FMSY and at its lowest in the time series dating back to 1961. A management plan is being developed. |
| Baltic Sea ² including Gulf of Finland Spring spawners, ICES III d (sub div.25-27, 28.2, 29, 32) | 90,000 | 117,000 2014; 164,000 | Fishing mortality has been below FMSY since 2003. SSB was over one million tonnes through the 1970s and 80s but declined steadily through to late 1990s and fell below the safe biomass limit level in 2001. SSB increased to above MSYB _{trigger} by 2006 and has, now stabilised at around 60% of long term mean. Recruitment has generally been lower since the 1980s but with occasional good year classes such as those in 2002, 2007 and 2011. There have been significant changes in the Baltic ecosystem which has affected stock productivity. |

¹ Icelandic fishing year = Sept – August

² The marketing of Baltic herring is restricted due to contamination (see page 12)

| Management Stock (keyed to Figure 1 map on page 6) | Agreed TAC 2013(t) (8,9) | Advisory TAC 2013 (t) | Scientific advice and management June 2013 ICES advice unless otherwise stated (10) |
|---|--------------------------|--|---|
| Inside safe biological limits | | | |
| Baltic; Gulf of Riga ³ Spring spawners ICES division III d (sub-div 28.1) | 30,600 | F MSY <23,200 2014: FMSY= 25,800 | Although the spawning stock biomass has been above MSY trigger over the past twenty five years the stock has been fished at well above FMSY for most of that period. The advisory catch is consistent with transition to FMSY by 2015. Management is complicated by the mixture of Central Baltic herring taken in the Gulf of Riga. |
| At risk of being outside safe biological limits and below biomass action point MSYB_{trigger} | | | |
| Skagerrak and Kattegat III a North Sea Autumn Spawners and Subdivisions 22-24 Western Baltic Spring spawners | 55,000 2012 45,000 | FMSY= <51,900 2014; 41,602 | Management of herring in this area is complicated by the overlap of the West Baltic Spring Spawners (WBSS) with the North Sea Autumn Spawners (NSAS). It is further complicated by permitted transfer of up to 50% of III a TAC into the North Sea. This is a measure designed to protect the more vulnerable WBSS component in III a. Spawning stock biomass has been below Bpa and the MSYB _{trigger} since 2008 and fell close to the safe biomass limit level in 2009. It is predicted to increase above MSYB _{trigger} in 2013 and 2014 but this is based on uncertain estimates of recruitment. The stock has been in a period of sustained low productivity since 2006. Stock is consistently fished at well above FMSY. |
| Outside safe biological limits | | | |
| North and west of Ireland Autumn and winter spawners ICES VI a (S of 56°N), VII b,c | Not established | Zero 2014; Zero | Exploratory assessments carried out and are indicative of trends only. They currently indicate a very low SSB which has been below the safe biomass limit level (80,000t) since 1995. Recent fishing levels are uncertain, but appear to be well above FMSY.. Recruitment estimates are uncertain. ICES advises there should be no catches from this stock until a revised rebuilding plan is evaluated and implemented. Assessment and management of this stock is complicated by migration of fish from other areas. |
| Reference points fully defined | | | |
| Clyde Spring spawners VI a | Not established | No advice | A small estuarine Spring spawning stock. Catches were estimated at 303t in 2012 compared with 201t in 2011 and a 14 year high of 754t in 2009. No assessment or other information is available. |
| English/Bristol Chns. ICES VII e,f | Not established | Precautionary | Insufficient data for a separate assessment. Catches in 2012 were 440t in VII e and 113t in VII f. |
| Thames Estuary spring spawners | No TAC | No Advice | Small Spring spawning stock, spawning in Blackwater and off Kent coast. No longer assessed. Catches were 63t in 2012 (13). |

| NORTH WESTERN NORTH ATLANTIC STOCKS | | | |
|---|------------------------|---------------------|--|
| Management Stock (keyed to Figure 2 map on page 6) | Agreed TAC | Advisory TAC | Scientific advice and management |
| Inside safe biological limits | | | |
| South-western Gulf of Maine/Georges Bank. NAFO 5 | 2010-2012; 90,000 | | Stock now covered by a trans boundary agreement between US and Canada. Stock status has improved substantially since 1980s collapse. Exploited close to maximum sustained yield (MSY) (15). |
| NAFO 4T (autumn spawners) | 2010 /2011 65,000 | 2012: 42,842 | In early 2012 the stock continued to be at a moderate level of abundance. The SSB was estimated at 183,000t which was 11,000 t above the upper stock reference (precautionary) level and well above the biomass limit level of 51,000 t. A catch of 42,842 t in 2012/13 (April-March) would result in a 50% chance that the fishing mortality would be above the reference level removal rate (equivalent to Fpa; Fig 1). Projections based on mean recruitment over the past 20 years show that the probability that SSB would fall below the upper (precautionary) stock reference level in 2014 varied from 14% with a catch of 20,000t to 58% with a catch of 50,000t. (14). |
| Outside safe biological limits | | | |
| NAFO 4T (Spring spawners) | 2010/ 2011 2,000 | 2012; 1,000 | The stock is now considered to be in the critical zone and outside safe biological limits. The SSB was estimated at 18,300t in 2012 which is below the biomass limit reference point (22,000t) and well below the upper stock reference level of 54,000t. Both Spring and Autumn spawners (above) are taken in the purse seine fishery and can only be apportioned retrospectively. The lowest practical TAC therefore has to be agreed and this measure has kept Fishing Mortality in 2010 and 2011 at the lowest levels in the time series at F0.1. A catch option of around 1,000 t in 2012 would provide a 90% probability of at least a 5% increase in biomass in 2013/2014 (14). |
| Reference points not fully defined | | | |
| NAFO 3KLOP | 2010: 13,400 | 2010: 13,400 | A total of five separate stocks are present in this management area each with a separate TAC and separate stock assessments, last carried out in 2009. The current status of three of the stocks has deteriorated since 2009 and stock abundance is much lower than in the 1970s. One of the stocks has slightly improved although still at a low level historically. Scientific data are insufficient to assess the stock status in Conception Bay / Southern Shore |

| Management Stock (keyed to Fig 2 map pg 6) | Agreed TAC | Advisory TAC | Scientific advice and management |
|--|---------------------------|-----------------|---|
| Reference points not fully defined | | | |
| NAFO 4R | 20,000 | 20,000 | There are spring and autumn spawning components. Last analytical assessment was in 2004. An acoustic survey was re-started in 2009 and repeated in 2011. Survey provides a total biomass index for the spring and autumn spawning components. Surveys show proportion of spring spawners fallen from 32% in 2002 to 12% in 2011. Catches dominated by autumn spawners and large 2000 year class. Advice not to increase catches (14). |
| NAFO 4S | Precautionary: TAC 4,000t | 4,000 | Stock status last assessed by acoustic survey in 2010. The biomass indices, from this survey were 3,500t of spring spawners and 80,855t of autumn spawners. Annual catches are small, averaging 308t over the past ten years (403t in 2010). Catches could probably be increased but there is currently insufficient information to determine by how much (14). |
| NAFO 4VWX | 2012/13; 50,000t | 2012/13 50,000t | Includes three separate spawning components plus a fishery based on migrant juveniles from NAFO sub-area 5. Major component is SW Nova Scotia/Bay of Fundy component - the only one with an annual TAC for catches (with recommended allocations for the other two spawning components). Mgmt of stock is subject to an Integrated Fisheries Management Plan which aims to keep F below 0.1. Acoustic biomass of main component has been increasing since 2010 - now above long term mean Landings have tracked the TAC since 2002. No new information on offshore Scotian Shelf component – landings decreased from 10,455t in 2011 to 1,210t in 2012. Allocation not to exceed 12,000 t in 2013. Coastal Nova Scotia component survey biomass declined from 5 yr mean (24.3Kt) to 3.7Kt in 2012. Landings 2,654t (2011) 2,150t (2012) against allocations of 2,094t and 2,188t respectively (14). |

Organisation key

CSPMC: Celtic Sea Pelagic Management Committee and; This is a cross disciplinary committee which participates in the management of Celtic Sea pelagic stocks.

EU: The European Union manages fisheries within the European Exclusive Economic Zones.

FAO: The Food and Agriculture Organisation of the United Nations acts as a neutral forum for nations to negotiate agreements and debate policy.

ICES: International Council for the Exploration of the Sea. Responsible for providing scientific advice for North East Atlantic fishery management.

NAFO: Northwest Atlantic Fisheries Organisation for science and management in international waters.

NEAFC: North East Atlantic Fisheries Commission. Recommends measures to maintain rational exploitation of fish stocks in the high seas.

MSC: The Marine Stewardship Council is an independent, non-profit organisation that promotes responsible fishing.

Figure 2: Stock areas for North Atlantic herring – ICES (east) and NAFO (west) areas shown. Stocks colour keyed by status see below for key

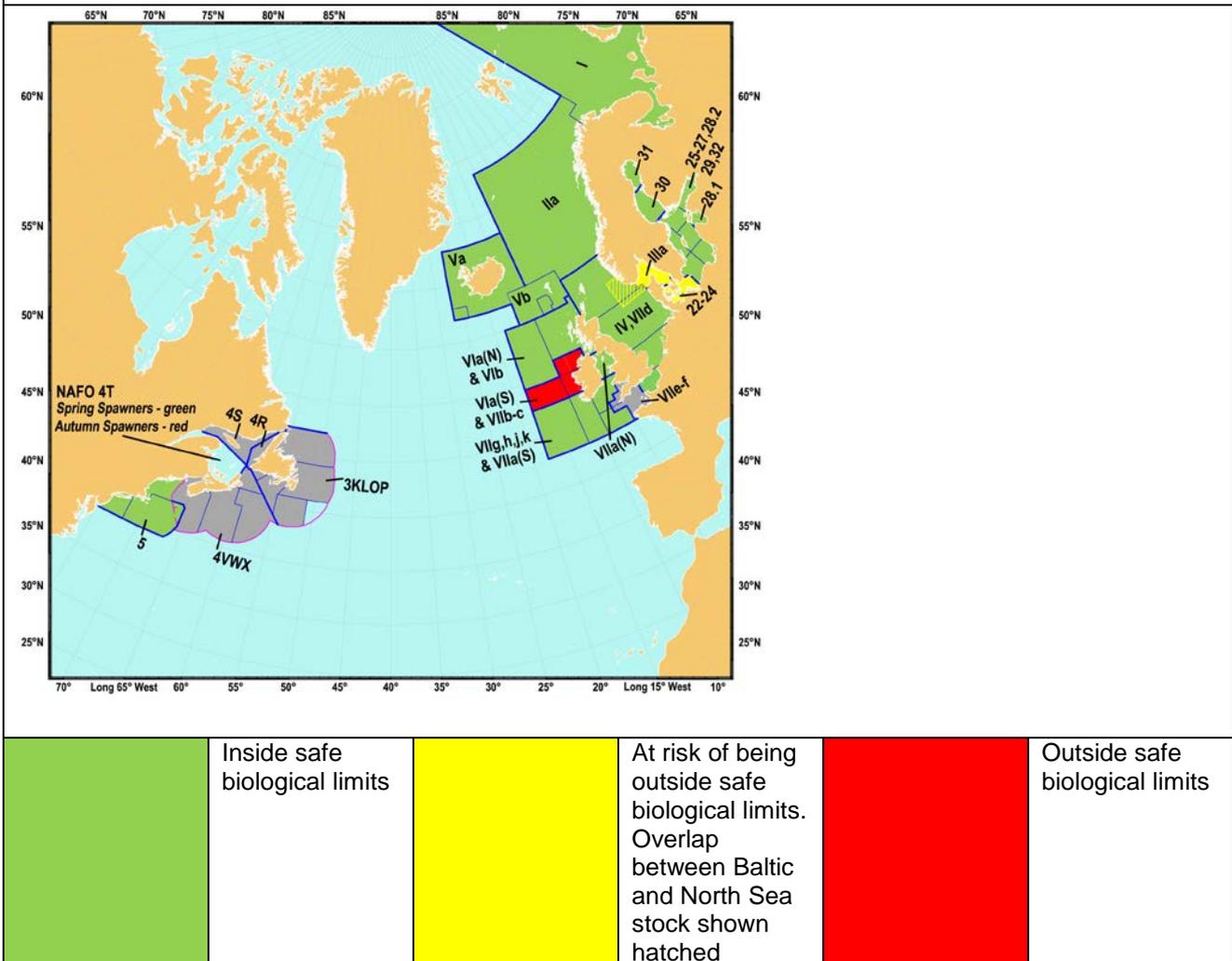
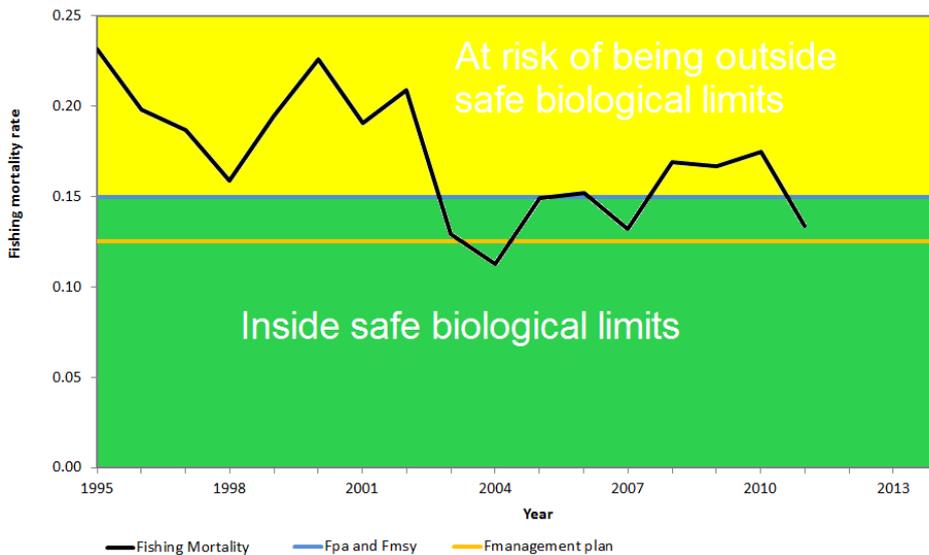
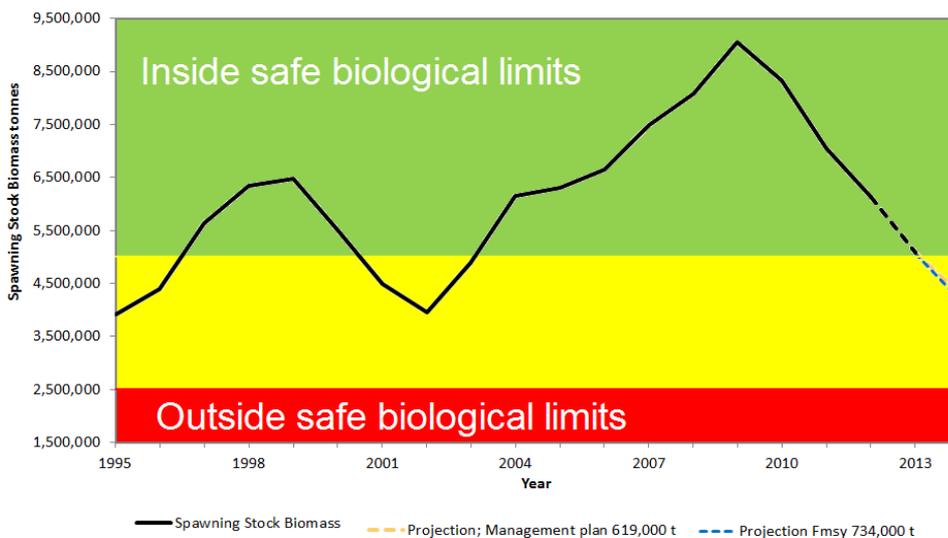


Figure 3 - Fishing mortality trajectory; Norwegian Spring Spawning herring stock.



The fishing mortality has fluctuated around F_{MSY} for the past decade. In this case F_{MSY} and F_{pa} have the same value at $F=0.15$; that is the stock is considered at risk, when it is yielding its maximum. The target fishing mortality under the management plan $F=0.125$ is shown in orange.

Figure 4 Spawning stock biomass trajectory; Norwegian spring spawning herring stock.



The stock is currently inside safe biological limits but with a downward trajectory. The forward trajectory is likely to be somewhere between the projection under the management plan in orange and the projection for F_{MSY} in blue, because of the extra catch the Faroese are planning to take (see p 3) in 2013. Once the Spawning Stock Biomass is below $MSYB_{trigger}$ of 5 million t the management plan requires the parties to reduce catches to reduce risk of further depletion.

Management and conservation measures

The key to successful management of fisheries is to design regulations to control them and which take account of the biology of the fish and environmental factors that influence the populations' dynamics and production. A key element in herring fisheries is the high variability from year to year.

Stock variability

North Sea herring year class strength (numbers of juveniles) has fluctuated by as much as 40-fold over the past 50 years; herring stocks are resilient, with both the Norwegian and North Sea stocks recovering from very low stock sizes in recent decades; this has implications for management (16).

Recently, there were six successive very poor year classes (2002-2007) with only a slight improvement since then, possibly due to variability in the environment affecting food supply (17). Further north, the Norwegian Spring spawning stock has also had a succession of poor year classes since 2005 with the 2010 and 2011 year classes the lowest since the collapse of the stock in the 1970s. In the Baltic Sea, recent models have suggested that cod and herring populations may be inhibited by high levels of sprat. Hence the Spawning Stock Biomass reference points for herring and cod are being revised (18).

Fishing mortality

The main tools fisheries' managers have to control fishing effort are regulations such as TACs, effort regulation, closed areas and seasons and minimum landing sizes (MLS). These are all used, to varying degrees, in managing herring fisheries. Most catches of herring are from single-species fisheries, which make catch limits more practical than in mixed fisheries. Firm management action in 1996 (the North Sea TAC was halved mid year) prevented the likelihood of a stock collapse similar to the one which occurred in the 1970s. The introduction of a maximum herring by-catch quota in sprat fisheries, to reduce the juvenile herring mortality, has also proved very successful.

The North Sea herring stock is currently in a period of low productivity following a succession of poor or well below average year classes. The full reproductive capacity of the stock has been maintained but the survival ratio between larvae production and subsequent recruitment has been low compared with the period before 2001.

In spite of low productivity the spawning biomass has been maintained well inside safe biological limits (above 800,000t) and is currently well above the precautionary level (above 1.0 million t) and predicted to increase. The sustainable performance of this fishery over the past fifteen years is attributable to a raft of management measures implemented through a robust and flexible management plan and rigorously enforced. Misreporting and underreporting of catches, which has in the past led to the annual TAC being exceeded by over 100,000t, has now been virtually eliminated. Over the most recent period, of low recruitment, the annual catch in the North Sea and Eastern English Channel (TAC area) has been severely reduced from over 600,000t in 2005 to less than 200,000t in 2009 and 2010 increasing to 218,000t in 2011. Fishing mortality on both adults

and juveniles has been reduced to below the management plan targets since 2005. As a consequence of the resultant increasing level of spawning biomass the TAC for 2012 was increased to 405,000t for adults with a by catch ceiling of 18,000t. The total catch in 2012 was 425,000t, The agreed TAC for 2013 was 478,000t for adults with a by catch ceiling of 14,400t. The agreed TAC was 13,000t above the predicted level, following the management plan, but well below that predicted for MSY. It is accepted that, following the revised perception of the stock from 2012, fishing mortality, corresponding to MSY, needs to be re-evaluated. The advice for the fishery in 2014 follows the management plan with catches of 470,000t in the main fishery and a by catch ceiling of 12,400 t. Following the MSY approach the main fishery TAC would be 503,000 t however the current management plan restricts annual increases in the TAC to no more than 15% The annual TACs are agreed following EU/Norway negotiations, involving government fisheries' managers and scientists, industry representatives and other stakeholders.

Minimum landing sizes are only effective in fisheries where mesh selection works to release viable fish. This is not the case in pelagic trawl and purse seine fisheries for herring due to high mortality of the escaping fish (19). Minimum landing sizes are effective with passive methods such as drift nets, gill nets and traps that permit small fish to pass through the meshes undamaged. Species selection, by selecting out cod and saithe, is practised in some Norwegian mid-water trawl fisheries (20), but is not needed in most fisheries as by-catches are very low (21).

Ecological considerations

Within marine food webs, herring are important as predator and prey for many other fishes, seabirds and marine mammals. Good management of herring stocks, would be expected to have an effect beyond the management of single-species herring fisheries.

Herring spawning areas, being generally near the coasts and on the seabed, are sensitive to human pressures. The environmental impact assessment for marine sand and gravel extraction and seismic surveys must identify the location of herring spawning areas to safeguard them from dredging activity. Due consideration must also be given to the fact that herring abandon and repopulate spawning grounds and that an absence of spawning in any particular year does not mean that the spawning ground is no longer required. Also some herring spawning grounds, for example off the North East coast of England, are seasonally closed to trawling for their protection.

There is a risk of small cetaceans (dolphin and porpoise) being taken in pelagic-trawl fisheries. Recent monitoring of UK vessels (required by EU regulation (22)) found no by-catch of cetaceans in herring trawl fisheries. Small numbers of salmon (23) are taken occasionally.

Stakeholder participation

In herring fisheries, mechanisms include a coastal states' agreement for the Norwegian Spring spawning stock, the EU Pelagic Regional Advisory Council and the Irish Celtic Sea Pelagic Management Committee.

Product characteristics and seasonal cycles

Herring is a smooth fish with a slender body and a silvery skin, and a hint of green and blue. The lower jaw protrudes slightly beyond the upper. There is a single short dorsal fin on the back, a short anal fin near the tail, and a deeply forked tail fin. Herring ranges in size from 100-450gms.

Herring stocks spawn in different seasons of the year; Spring, Summer and Autumn. This enables buyers to source herring with their roes in different condition at different times of the year. For full details of the implications of seasonal cycles on herring condition, handling, processing and kippering (24). In the Baltic there is an issue with high levels of contamination which restricts the marketing of Baltic herring (25).

Supply chain standards

Responsible practice in the chilled and frozen supply chain depends on correct catching, gutting, washing, chilling or freezing, processing and handling practices throughout the chain. There are standards which cover these aspects from capture to retailer:

- **Seafish Responsible Fishing Scheme.** Sets best practice standards for fishing vessels, based on British Standards Institution specifications (BSi: PAS 72:2006);
- **British Retail Consortium (BRC) Global Standard & Safe & Local Supplier Approval (SALSA) certification.** Designed to raise standards in the seafood processing and wholesaling sectors.

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