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Commercial Fish Stocks in the North Sea: Comparison in Stock sizes between 1880 and 2010.

Using scientifically researched data, we have recorded here the wild stock sizes of the main commercial fish species in the North Sea for 1880 and 2010, and compared these stocks levels for their decline over this period.

Table: Estimated Total Stock in the North Sea in tonnes.

Species	1880 stock size, tonnes *	2010 stock size, tonnes	% Decline between 1880 and 2010
Haddock	916,000	849,000	7%
Whiting	454,000	334,000	26%
Plaice	3,561,000	520,000	85%
Mackerel	148,000	20,000	86%
Sole	545,000	50,000	91%
Cod	2,427,000	212,000	91%
Herring	16,836,000	217,000	99%
Bluefin tuna	177,000	0	100%

* Maximum estimated stock level. Measuring stock sizes is an imprecise science, so there is a large measure of uncertainty around all estimates. The 1880 figures are extrapolations based on catch data recorded at the time. The extrapolations are calculated as a maximum, middle and minimum stock level, and thus cover a range in their estimation. The 1880 figures recorded above are the maximum figures in the range, and the middle and minimum figures are provided further on in this briefing. The scientific sources of the 1880 and 2010 figures are recorded overleaf.

The date of 1880 has been chosen in scientific studies because, prior to this date, the use of steam had not been introduced into fisheries. The use of steam to power fishing vessels was a significant development, creating the capability for the use of larger nets by the introduction of steam powered capstans. Consequently the 1880 date and related stock levels is a benchmark, recording North Sea stock levels before intensive, mechanised fishing commenced. The 2010 date provides the most up to date stock figures available. Stock levels are based on total biomass estimates and thus include all fish in the stock, including juveniles.

Sources: The **1880 figures** are from: S. Mackinson, 2002, *Representing trophic interactions in the North Sea in the 1880s using the Ecopath mass-balance approach, ref. Table 1.16.* In S. Guénette, V. Christensen, D. Pauly (Editors), *Fisheries impacts on North Atlantic ecosystems : models and analyses. Fisheries Centre Research Reports 9(4).* The **2010 figures** are from the International Council for the Exploration of the Sea (ICES). To see the ICES data on haddock, whiting, plaice sole and cod: http://www.ices.dk/workinggroups/ViewWorkingGroup.aspx?ID=31 and click on the 2010 reports and then the document titled "WGNSSK2010.pdf". To see the 2010 data on mackerel: http://ices.dk/workinggroups?ViewWorkingGroup.aspx?ID=273 , and to see the 2010 data on herring: http://ices.dk/workinggroups?ViewWorkingGroup.aspx?ID=25

Notes:

1. The Bluefin tuna level in the North Sea is no longer monitored by ICES. It is widely accepted by all scientific sources that the North Sea commercial bluefin tuna stock is effectively extinct.

2. The North Sea is ICES Area IV (IVa, IVb and IVc). It covers an area of about 220,000 sq mi (570,000 sq km), with depths generally ranging from 120 to 300 ft (37 to 91 m). The ICES 2010 data for cod and whiting stocks also includes the stocks in Skagerrak (ICES Area IIIa) and East Channel (Area VIId), and the 2010 haddock data also includes the East Channel stock (Area VIId). For a clear explanation of the ICES system of stock measurement and a map of the ICES North Sea area, see the following publication: Scottish Government: *Scotland fish and shellfish stocks 2010* : http://www.scotland.gov.uk/Resource/Doc/295194/0097503.pdf

Management of Stock Levels:

In the forthcoming changes that are proposed for the management of fish stock levels a key tool is Maximum Sustainable Yield (MSY). This is a biologically-based concept, and is defined as "*In raw terms, maximum sustainable yield is the maximum yield that may be taken year after year. It is characterised by a level of fishing mortality that will, on average, result in a stock size that produces maximum sustainable yield*" (Ref: EU Commission: COM(2006) 360.final.4.7.2006). MSY enables a catch quota to be set anually, and over the longer term, which does not damage the ability of the stock to reproduce itself. Thus, in the long run, the stock size should increase.

The difficulty with the MSY concept lies in whether the preferred stock size (the size that must be maintained in order to assure the reproducton of the stock) is based on a **historic stock** figure, or on the **current depleted stock** figure which has resulted from overfishing. Given that the purpose of Maximum Sustainable Yield as a fisheries management tool is to rebuild a stock to a level which guarantees a sustainable fishery, both for the benefit of the fishing industry itself and for the nations of the EU via "food security", it is imperative therefore that the MSY stock is based on a **historic stock** figure (or as close as current ecological conditions will allow).

Consequently, it is essential that Maximum Sustainable Yield management is not used in isolation. Not only must it be referenced to historic stock levels and not current depleted levels, but it must also be used in conjunction with other ecosystem-based management tools, one of the most important of which is **"no-take" fisheries-based protected areas** (marine reserves) which allow a heavily overfished commercial fish stock to re-establish a normal age profile.

Take the North Sea cod stock as an example. Cod can live until the the age of 25 years. Cod are sexually mature at six years, and every time a female adult doubles in size and length so does its producton of eggs also double. Therefore older adult cod in the North Sea are vital for the stock's reproduction and its long-term restoration. Current fishing practices (net size and the fishing of cod's spawning areas) virtually eliminate all cod above the age of six years. Effectively, this is akin to asking the human population to survive on the sexual capabilities of its adolescents.

Therefore, as well as referencing Maximum Sustainable Yield management to **historic stock** levels, "no-take" protected areas, based on spawning and nursery grounds, must be used to rebuild the **full age profile** of all commercial fish stocks – a key legal requirement of the EU's Marine Strategy Framework Directive, 2008/56/EC.

Additional Historical and Technical Data:

Estimates of 1880 North Sea Total Stocks:

Data for 1880 stock levels is sourced from S. Mackinson, 2002, *Representing trophic interactions in the North Sea in the 1880s using the Ecopath mass-balance approach, ref. Table 1.16.* In S. Guénette, V. Christensen, D. Pauly (Editors), *Fisheries impacts on North Atlantic ecosystems : models and analyses. Fisheries Centre Research Reports 9(4).* This data on stock levels is based on extrapolations from catch data recorded at the time, and these extrapolations provide a maximum, middle and minimum stock figure. We have already cited the maximum figure, and the middle and minimum estimated stock levels are now provided below:

Table: North Sea, 1880 Total Stock (Middle Estimate) relative to 2010 Total Stock in tonnes.

Species	1880 stock size, tonnes †	2010 stock size, tonnes	% Decline between 1880 and 2010
Haddock	516,000	849,000	+ 65%
Whiting	302,000	334,000	+ 11%
Plaice	2,373,000	520,000	78%
Mackerel	99,000	20,000	80%
Sole	363,000	50,000	86%
Cod	1,618,000	212,000	87%
Herring	11,224,000	217,000	98%
Bluefin tuna	177,000	0	100%

† Middle estimated stock level

Table: North Sea, 1880 Total Stock (Minimum Estimate) relative to 2010 Total Stock in tonnes.

Species	1880 stock size, tonnes #	2010 stock size, tonnes	% Decline between 1880 and 2010
Haddock	117,000	849,000	+ 727%
Whiting	151,000	334,000	+ 221%
Plaice	1,187,000	520,000	56%
Mackerel	49,000	20,000	59%
Sole	182,000	50,000	72%
Cod	809,000	212,000	74%
Herring	5,612,000	217,000	96%
Bluefin tuna	177,000	0	100%

Minimum estimated stock level

Note: There is a very wide range between the estimated maximum and minimum stock levels, based on catch data. Evaluating where the actual (historic) level is truest is therefore conjectural. However our actual knowledge of the decline of North Sea fish stocks between 1880 and 2010 suggests that the maximum figure is the truest because the middle and minimum estimates suggest that certain stock sizes have increased in size during this period, a reality which is difficult to sustain from all other data (e.g. decline in current landing levels of fish caught and the decline in the fishing fleet size). Therefore, in terms of probability as opposed to possibility, there are good grounds for believing that the maximum estimated 1880 stock levels provide the truest figure.