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Evolution of the theory of rational fishing. The case study of the North Sea

Sidney J. Holt [a,*], Saša Raicevich [b,c]

[a] Voc. Palazzetta 68, Paciano (PG), Italy
[b] Italian National Institute for Environmental Protection and Research (ISPRA), Chioggia, Italy
[c] Institute of Marine Sciences, National Research Council (ISMAR-CNR), Ancona, Italy

HIGHLIGHTS

- In the 19th century the North Sea fisheries were subjected to substantial expansion.
- From the second half of the 19th century this expansion changed fish stocks.
- These events stimulated much discussion and research about how to manage fisheries.
- After World War II the idea of obtaining MSY by setting TAC gained hold worldwide.
- When implemented, the "less than" MSY EU management policy will provide benefits.

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ABSTRACT

Demersal fishing in the North Sea has a long and fairly well documented history. The Southern North Sea seems to be a biologically rich region in which all the coastal states around it have participated in the demersal fishing opportunities especially operating near coasts. However, the expansion to deeper, offshore waters in the 19th century was mostly by English fishers, with Scottish involvement in the more Northerly zone. The expansion was generated by the construction of railways and availability of manufactured ice, making it possible to provide fresh fish in good condition to the expanding population. Towards the end of the century, the entry of steam vessels caused further expansion and increase in fishing intensity. From the second half of the 19th century, it became apparent that this was changing the fish stocks. Annual catches did not increase in proportion to the increase in intensity, and the average sizes of fish in the catches declined. These events stimulated much discussion and research about how to manage these fisheries. This situation was strengthened by the establishment of the International Council for the Exploration of the Sea in 1902. After the World War II, the idea of managing to obtain Maximum Sustainable Yields by setting Total Allowable Catch limits gained hold worldwide. In the last few years, the EU has changed the target to limiting fishing intensity to some level less than would be needed to obtain MSY –a quantity which is still poorly and ambiguously defined. This 'less than' management policy has yet to be implemented, but if and when it is it will provide huge benefits to the economics of fishing but will also reduce the deleterious impact of industrialized fishing for target species by reducing unwanted incidental catches of other species and harm to the marine environment.

1. Introduction

The North Sea is a semi-enclosed basin, defined by the UNCLOS (1994) as: 'a gulf, basin or sea surrounded by two or more States and connected to another sea or the ocean by a narrow outlet or consisting entirely or primarily of the territorial seas and exclusive economic zones of two or more coastal States.' The Southern and Eastern North Sea exits, to The Channel and the Baltic Sea virtually close it physically (Fig. 1). Its connections to the Northeast Atlantic, to Norway and North America are ecological virtual closures as far as demersal fishes are concerned (partly because of water depth limitations), but highly migratory pelagic species such as herring regularly pass through the virtual boundaries.

We focus here on the demersals because it was they that led to the development of a modern theory of fishing. The trigger to this development was the expansion of bottom-trawling – especially for flatfishes – during the 19th century, at first by sailing vessels towing beam trawls (i.e. a cone-shaped body ending in a bag or codend, which retains the catch; in these trawls the horizontal

* Corresponding author.
E-mail address: sidneyholt@mac.com (S.J. Holt).

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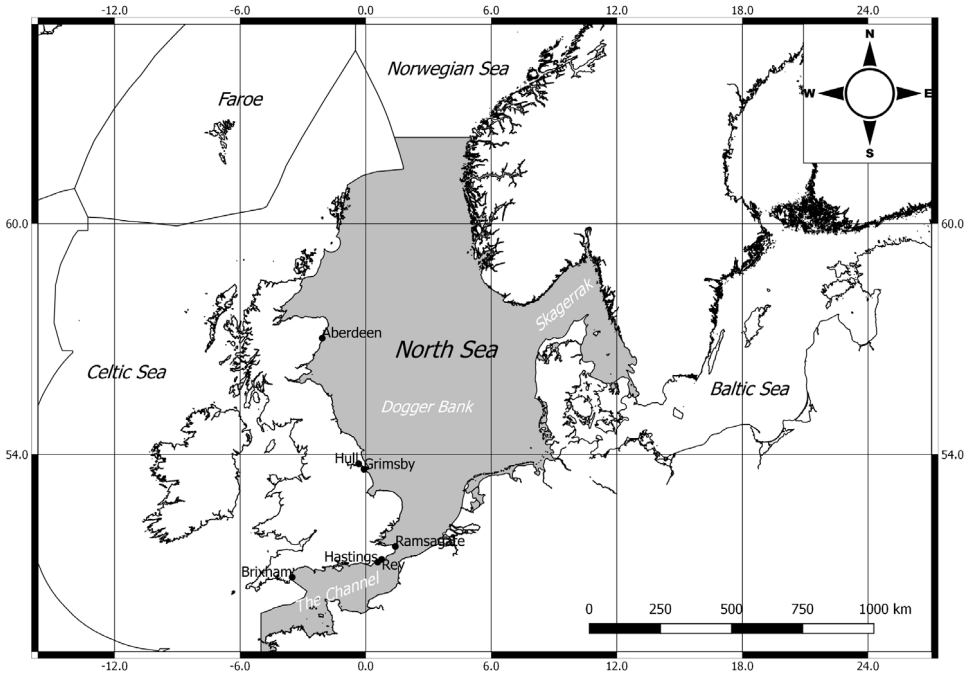

Fig. 1. The Greater North Sea (gray area) ecoregion boundaries according to ICES classification. Fishing ports mentioned in the paper and Dogger Bank fishing ground are shown.

opening of the net is provided by a beam, made of wood or metal). Then by steam and, ultimately, diesel-powered vessels. The latter were mainly used to tow otter trawls (i.e. a cone-shaped net consisting of a body closed by one codend; a bottom trawl is kept open horizontally by two otter boards). The twin stimuli for this expansion were the establishment of ice-making factories and the construction of railways in southern and eastern England, permitting access of fresh fish to the large markets of London and other growing industrial cities.

In addition to trawls some of the sailing vessels also deployed hooks and lines. These, however, mostly caught what were at the time low-value species, such as haddock: much of their catch was discarded at sea.

Beam-trawling was at first mainly carried out from Channel ports, such as Ramsgate, Brixham, Rye and Hastings, moving to the North Sea in the 1830s, following the discovery there of Silver Pits, a ground with abundant sole – the most highly valued demersal species. We are lucky to have a first rate comprehensive historical account of the English industry by Holdsworth, published in 1874 (Holdsworth, 1874). By the 1870 s there were about 1000 sailing trawlers of sizes up to 70 tons working in offshore areas of the North Sea in depths up to 100 m. Many, being based in Hull and Grimsby, on the north-east coast of England, were fishing as far north as the Dogger bank, and later reaching Iceland and the Faroes. It is sure that by then the North Sea populations of the most valuable whitefish, such as plaice, had been substantially reduced from their pristine abundance. In 1866 a legal change in Britain opened the way to the great trawling expansion in the second half of the 19th century. A Royal Commission of Inquiry into the state of the fishing industry advised the Government that "All Acts of parliament that Profess to Regulate or restrict the Modes of Fishing in the Open Sea be Repealed and that Unrestricted freedom of Fishing be generally permitted thereafter" (Report on sea fisheries, 1866). That approach prevailed until World War II.

Motorized vessels with steam engines began to be introduced in the 1870 s as tugs and reefers, then steamers with paddle-wheels were tried without success, but by 1882 steam trawlers began operating from Grimsby and Aberdeen. At first they did not work as far to the North as the sailing vessels, possibly because of limited capacity for carrying fuel, but gradually they were improved, increased in size and efficiency.

In 1894 the previously widely used beam trawl was being rapidly discarded and replaced by the otter trawl (Cunningham, 1896; Kerby et al., 2012). The increased towing power of fishing vessels made otter-trawls become the preferred fishing gear, and also powered winches for longer and sturdier cables were introduced. In the following decades, up to the 1930s, the size and efficiency of the otter-trawls were greatly increased, particularly thanks to the introduction in early 1920s of the Vigneron–Dahl modification (Hickling, 1931), that was widely used from 1926 onwards (Beverton and Holt, 1957; Kerby et al., 2012).

Eventually, the motorized trawlers were regularly fishing around Iceland and also further North and eventually to the Norwegian and Barents Seas (Robinson, 1996). Coal was replaced by oil as the preferred fuel, and eventually steam power by internal combustion engines. This great expansion of the English trawl fishery in the North East Atlantic region continued until 1972, when the fishing power of United Kingdom bottom trawlers peaked (Thurstan et al., 2010). With the loss by the UK of the 2nd and 3rd Anglo–Icelandic Cod Wars (in 1972–1973 and 1975–1976), both settled in favor of Iceland, Britain's formerly very important fishing in 'Icelandic distant waters' virtually ceased in 1977 (Kerby et al., 2012). The accession of United Kingdom to the ECC in 1973 and the binding regulations of the Common Fisheries Policy (formally adopted in 1983 with the Council Regulation (EEC) No 170/83; EC, 1983), also triggered the decline of English fleets. The potential of England distant-water fleet was further reduced when the United Nations declared, on 16 November 1994, that waters adjacent to coasts in the new Exclusive Economic Zones (EEZs) up to 200 miles from the coast would come under the jurisdiction of the coastal states to which they are adjacent.

2. Inexhaustible vs. limited resources

The idea that fishing must not be restricted was supported around the time of the UK Commission by the insistence of the

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