XIII-38 Faroe Plateau: LME #60

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The Faroe Plateau LME surrounds the Faroe Islands in the northeast Atlantic Ocean. It is a high latitude environment characterised by a sub-arctic climate that affects productivity through changes in temperature, currents, tides and seasonal oscillations. The Faroe Plateau is a well-defined and geographically uniform LME, with a surface area of 150,000 km^2 (Sea Around Us 2007). The islands have a relatively broad shelf and are surrounded by a persistent tidal front that separates shelf waters from the open ocean. The circulation of water masses is anticyclonic, with a branch of the North Atlantic Drift current flowing north. Gaard *et al*. (2002) and UNEP (2004) have described this LME.

I. Productivity

For a map of the Faroe Islands and surrounding LME, with a typical position of the tidal front that separates the shelf water from the ocean water, see Gaard *et al*. (2002, p. 246). Climate (e.g., temperature) is the primary force driving the LME, with intensive fishing the secondary driving force. The dynamic system of ocean currents in the area, in particular the inflow of warm Atlantic waters to the Nordic seas, is an important feature. Currents, tides and seasonal oscillations affect productivity. The shallow parts of the shelf are well mixed by extreme tidal currents, with no stratification occurring during the summer. For a map of salinity at 50 m depth, see Gaard *et al*. (2002, p. 248).

The Faroe Plateau LME is considered a Class II, moderately productive ecosystem (150-300 $gCm^{-2}yr^{-1}$). Primary productivity and phytoplankton biomass are very low during winter, but increase during spring and summer. Neritic phytoplankton and zooplankton communities are found on the shelf, and are somewhat separated from the offshore areas while receiving variable influence from the offshore environment. The shelf production of plankton is the basis for production in the higher trophic levels. The LME also serves as an important feeding ground for pilot whales and other marine mammals. Monitoring data show simultaneous fluctuations in several trophic levels in the ecosystem. Plankton production, fish recruitment, seabird recruitment and growth, and ultimately fish landings, vary inter-annually. For more information on trophic interactions, and on the large numbers of seabirds, see Gaard *et al*. (2002).

Oceanic Fronts: The Faroe Plateau LME is surrounded by tidal mixing fronts (Belkin *et al*. 2009). These fronts (Figure XIII-38.1) define the ecosystem and its important fishery grounds, especially of herring and cod (Hamilton *et al*. 2004). Unlike their counterparts around the British Isles, the Faroese tidal mixing fronts have not been studied in detail. A large-scale water mass front between the Plateau waters and the North Atlantic waters exists at the boundary of this LME, running along the Faroe-Shetland Channel (Sherwin *et al*. 2001).

Faroe Plateau LME SST (after Belkin (2009)
Linear SST trend since 1957: -0.14°C.
Linear SST trend since 1982: 0.75°C.

Like the Iceland Sea, the Faroe Plateau experienced long-term cooling of 1.2°C from 1960 through 1993, followed by rapid warming (1.3°C in 10 years) by 2003. All major extremums – maxima of 1960 and 2003, and minimum of 1993-1995– were also observed in the Iceland Shelf LME.

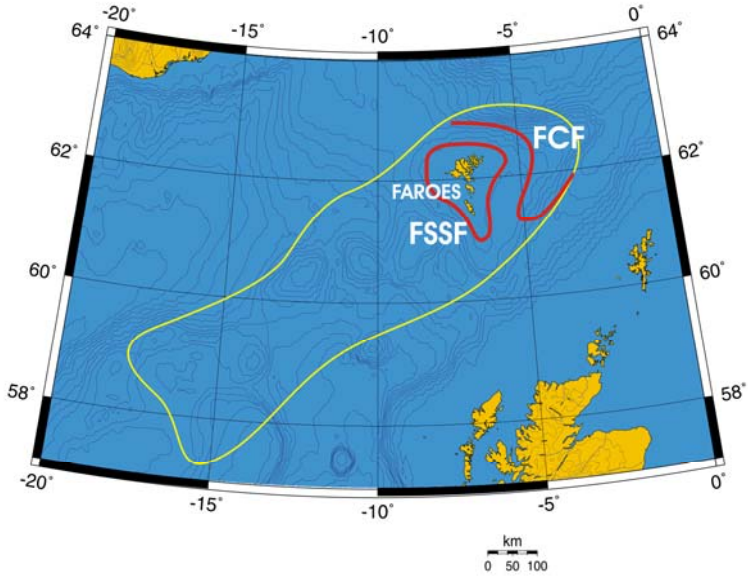

Figure XIII-38.1. Fronts of the Faroe Plateau LME. FCF, Faroe Channel Front; FSSF, Faroes Shelf-Slope Front. Yellow line, LME boundary. After Belkin et al. (2009).

The observed synchronism between Iceland Shelf and Faroe Plateau can be explained by the prevalence of northward transport, of various branches of the NAC. Therefore any SST anomaly transported by them would reach both LMEs at approximately the same time. Ocean circulation around the Faroes also effectively protects the islands from being directly affected by cold waters from the Nordic Seas. Subarctic cold waters could only reach the Faroes with easternmost branches of the North Atlantic Current, particularly the Irminger Current and Rockall Trough branch, after completing a rather circuitous journey around the Subarctic Gyre (Orvik and Niiler, 2002; Arhan, M. 1990.).

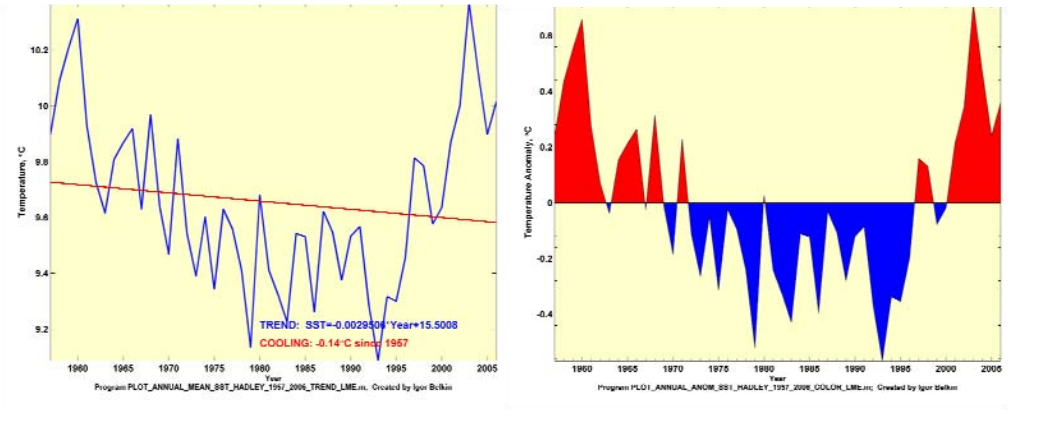

Figure XIII-38.2. Faroe Plateau LME Annual Mean SST and annual SST anomalies, 1957-2006, after Belkin (2009).

***Faroe Plateau LME Chlorophyll and Primary Productivity*:** The Faroe Plateau LME is considered a Class II, moderately productive ecosystem (150-300 $gCm^{-2}yr^{-1}$).

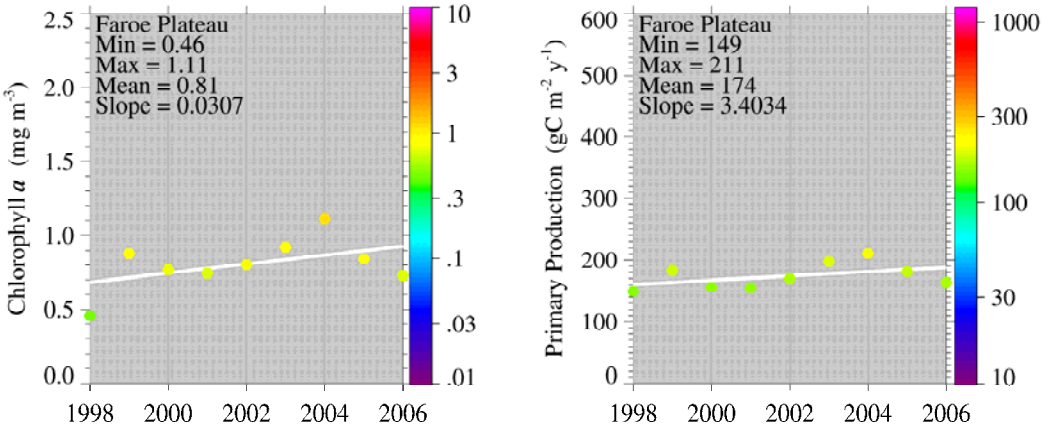

Figure XIII-38.3. Faroe Plateau LME trends in chlorophyll *a* (left) and primary productivity (right), 1998-2006. Values are colour coded to the right hand ordinate. Figure courtesy of J. O'Reilly and K. Hyde. Sources discussed p. 15 this volume.

II. Fish and Fisheries

Climatic variability has a major impact on fish landings in the LME. The most important species group is pelagic fish, representing on average 52% of the total catch, and cod, saithe and haddock, representing more than 30% of the catch. For landings of cod and haddock between 1903 and 1998, see Gaard *et al*. (2002, p. 247). The long-term average of annual landings of cod fluctuates between 20,000 and 40,000 tonnes. Landings of haddock fluctuate between 15,000 and 25,000 tonnes per year. In the early 1990s, cod and haddock annual landings reached the lowest values recorded. Cod and haddock do not always fluctuate simultaneously due to their different reproductive strategies. Other important species are saithe, halibut and the Norway pout. The latter is not caught commercially but serves as a food supply for fish (mainly cod and haddock), seabirds and grey seals. A marked increase in fishing effort has not resulted in an increase in fish landings.

Total reported landings have been on a rise, recording about 450,000 tonnes in recent years (Figure XIII-38.4). Blue whiting account for the largest share of the landings since the late 1970s, with 75% of the total landings in 2004. From 1986 to 1994, landings of Norway pout were also significant, averaging between 14,000 and 27,000 tonnes per year. The value of the reported landings recorded 355 million US$ (in 2000 real US$) in 2003 (Figure XII-38.5).

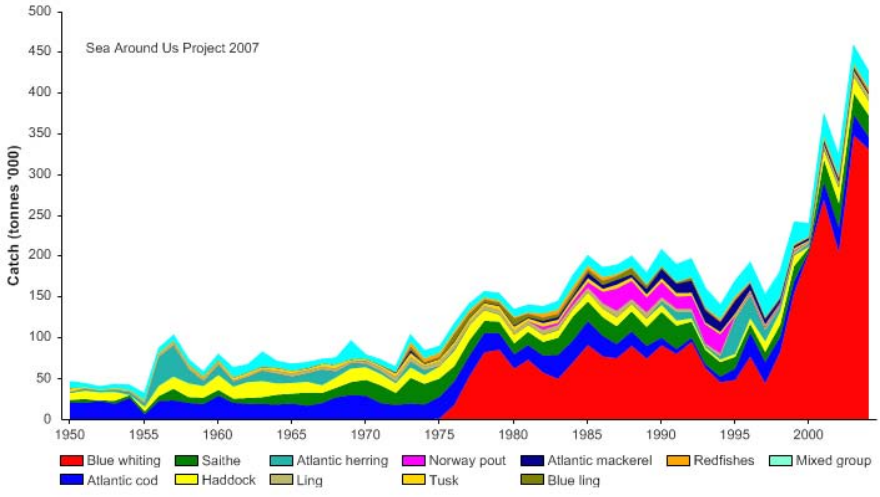

Figure XIII-38.4. Total reported landings in the Faroe Plateau LME by species (Sea Around Us 2007).

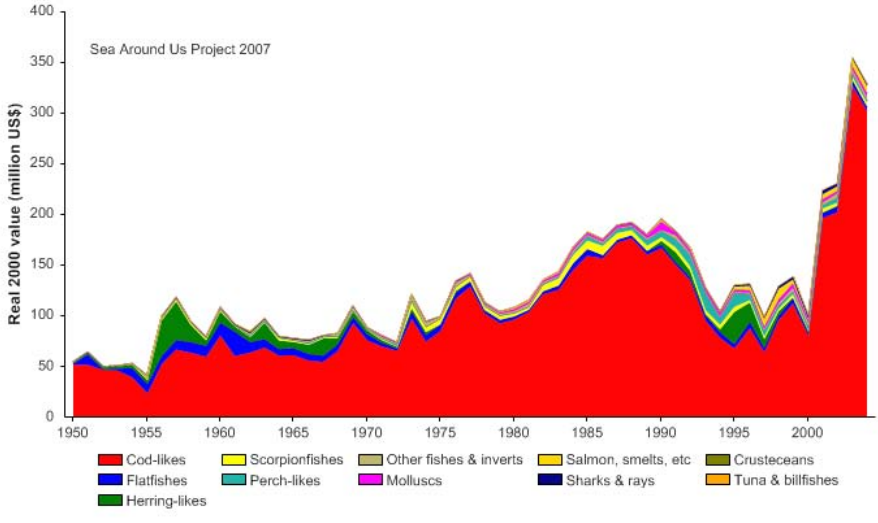

Figure XIII-38.5. Value of reported landings in the Faroe Plateau LME by commercial groups (Sea Around Us 2007).

The primary production required (PPR; Pauly & Christensen 1995) to sustain the reported landings in this LME has reached a level that far exceeds the observed primary production of the region (Figure XIII-38.6). While there might be other causes (e.g., problems with the landings statistics, and/or with the primary production estimate used here), it is probably due to fish being caught in the LME recruiting from and/or feeding outside the LME, which thus subsidize the productivity of the Faroe Plateau LME. Faroe Islands, Russia and Norway account for the largest share of the ecological footprint in this LME.

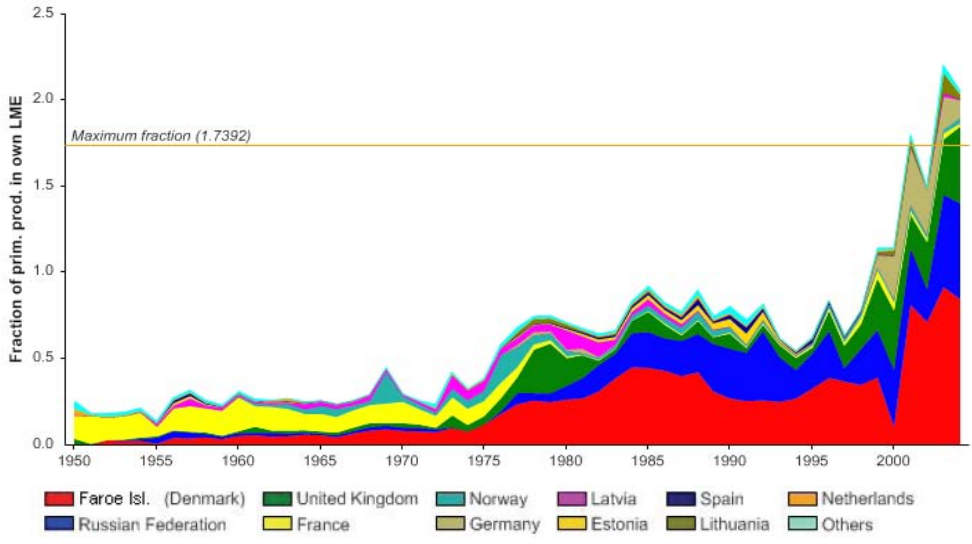

Figure XIII-38.6. Primary production required to support reported landings (i.e., ecological footprint) as fraction of the observed primary production in the Faroe Plateau LME (Sea Around Us 2007). The 'Maximum fraction' denotes the mean of the 5 highest values.

No clear trend can be observed in the mean trophic level of fisheries landings (i.e., the MTI; Pauly & Watson 2005) until mid-1990 (Figure XIII-38.7 top). Since then, however, the level appears to increase, presumably due to the almost exclusive, and increasing landings of blue whiting (Figure XIII-38.4), which could be masking any possible 'fishing down' effect in the LME (Pauly *et al.* 1998). The expansion of the blue whiting fisheries is also evident in the FiB index (Figure XIII-38.7 bottom).

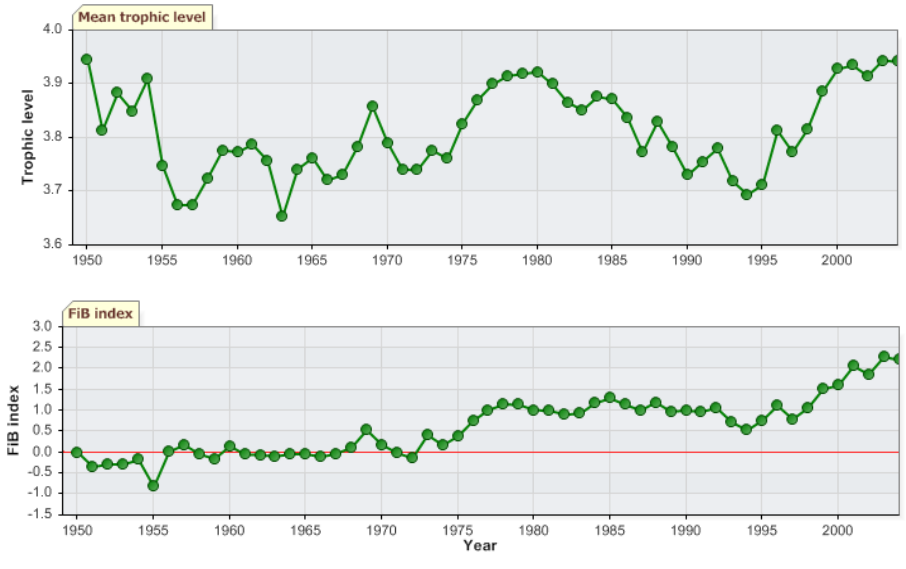

Figure XIII-38.7. Mean trophic level (i.e., Marine Trophic Index) (top) and Fishing-in-Balance Index (bottom) in the Faroe Plateau LME (Sea Around Us 2007).

The Stock-Catch Status Plots indicate the high proportion of stocks defined as 'collapsed' in the LME (Figure XIII-38.8, top). However, fully exploited stocks contribute almost 90% of the reported landings biomass (Figure XIII-38.8, bottom), a result of the increase in the blue whiting landings.

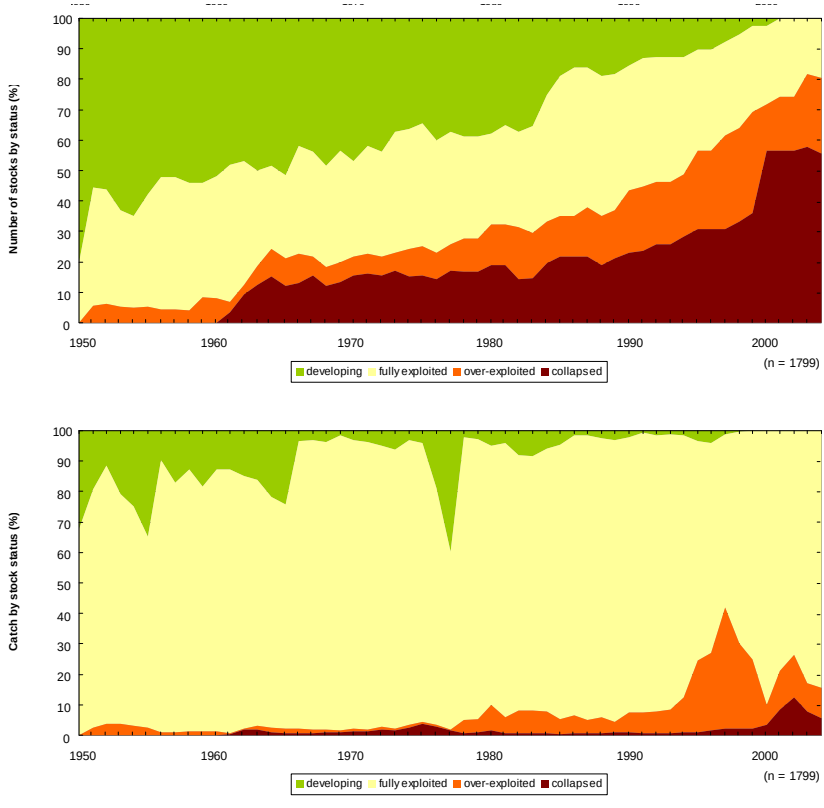

Figure XIII-38.8. Stock-Catch Status Plots for the Faroe Plateau LME, showing the proportion of developing (green), fully exploited (yellow), overexploited (orange) and collapsed (purple) fisheries by number of stocks (top) and by catch biomass (bottom) from 1950 to 2004. Note that (n), the number of 'stocks', i.e., individual landings time series, only include taxonomic entities at species, genus or family level, i.e., higher and pooled groups have been excluded (see Pauly *et al*, this vol. for definitions).

The commercial fishing fleet of the Faroe Plateau is comprised mainly of coastal vessels, long-liners and ocean trawlers. The Faroese fisheries management system with restrictions on fishing-days was adopted in 1996. The fishing-day system manages fishing capacity and effort rather than allocating specific quotas for species and stocks and was put in place for the management of demersal fisheries in the 200-mile fisheries zone around the Faroe. Vessels are grouped according to size and gear type, and each group is allocated a set number of fishing days per year, which are allocated among the vessels. This scheme is combined with gear restrictions designed to protect juvenile fish, as well as closures of extensive areas to active gear such as trawls in order to protect nursery and spawning stocks (Zeller & Reinert 2004).

III. Pollution and Ecosystem Health

Fisheries are totally dependent on a sound and healthy marine ecosystem. Safeguarding the marine environment and ensuring the sustainable use of its valuable resources is a

necessity, in view of the dependence of the population on these resources. Monitoring of environmental parameters of the Faroe Shelf LME was initiated in the mid 1990s. International conventions are the basis for Faroese national legislation to protect the marine environment, mainly the MARPOL convention for the Prevention of Pollution from Ships and the OSPAR Convention for the Protection of the Marine Environment in the North-East Atlantic, which, amongst others, lays down rules for the discharge from offshore installations. The 2004 GIWA assessment of the marine waters around the Faroes reports that toxic contamination of the tissue of marine mammals is causing human health problems and may also affect the economically important fisheries sector (www.giwa.net/publications/r13.phtml). The report cites long distance transport of pollutants by ocean currents and air from industrial areas in Europe, North America and Asia among the sources of the contamination. The traditional consumption of whale meat has occasioned concern that elevated levels of mercury might be found among pregnant women (Booth & Zeller 2005).

IV. Socioeconomic Conditions

In 1998, the Faroe Islands had an estimated population of 44,000 persons who are almost totally dependent on fisheries and on fish farming, which began in the 1980s. Fishery is the main industry: fishery products, including farmed salmon, represent more than 95% of total Faroese exports and nearly half of the GDP. Bioaccumulation of mercury in whales, pelagic fish, and seabirds has already warranted warnings regarding human consumption of them (online at www.giwa.net/publications/r13.phtml, causal chain analysis chapter; Booth & Zeller (2005). The phasing out of government subsidies to the fisheries sector has been a major factor in reducing over-capacity and stimulating more effective, market-driven approaches to fisheries.

The challenge for the future is to ensure that fisheries management can continue to be flexible and adaptive to changes in the resource base and the industry, in order to ensure both biological and economic sustainability. As pollution in the Faroe Islands is largely caused by long-distance transport of the pollutants by ocean and atmospheric currents from the highly industrialized countries, solutions will be international in scope. Petroleum production is being explored in areas close to the Faroe Islands, and between the Faroe and Shetland Islands.

V. Governance

The Faroe Islands are a self-governing overseas administrative division of Denmark, a major fishing nation that is attempting to integrate fisheries and environmental policies. An ecosystem approach was used officially for the first time in 1995 at the international level with the Convention on Biological Diversity. Denmark participates in ICES. The Faroe Islands participate in the NEAFC (Northeast Atlantic Fisheries Commission, see http://www.neafc.org); NAFO (North-west Atlantic Fisheries Organisation, see http://www.nafo.ca); NASCO (North Atlantic Salmon Conservation Organisation, see http://www.nasco.org.uk); and NAMMCO (the North Atlantic Marine Mammal Commission, see http://www.nammco.no). Greenland participates in the Arctic Council as part of Denmark and the Faroe Islands (see the Barents Sea LME).

The Faroese Parliament adopted UNCLOS in 2003 and the UN Agreement for the Implementation of the Provisions of the Convention relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks in 1995. Information on the Faroe Islands is available at: www.faroeislands.org.uk.

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