

Environmental History and Historical Fish Populations in the Baltic

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Human interference or natural causes?

From one year to the next, there are large variations in the quantities of new young cod, herring and other kinds of fish that are produced in the Baltic. This variability makes it difficult to predict future fish stocks and accordingly diminishes the value of recommendations for fishery quotas. Gradually we have acquired considerable knowledge about the different mechanisms, which can partly explain some of the variability. Whenever we try to make prognoses for the next two or three years, however, uncertainty predominates. History may help us to understand the reasons for these fluctuations.

The two main explanations of fish stock dynamics are well-known in the public debate. Violent changes are attributed either to human interference (through fishing, eutrophication, pollution, and so on) or to Nature itself. Should we look for an explanation of decreasing populations in previous overfishing, or could shifting temperatures be the reason? Might a growing fish population be explained by an increas-

ing inflow of saltwater into the Baltic or by human discharge of nutritive substances? Accordingly the debate surges back and forward. One reason why we are unable to come up with any clear answers to these questions is that the factors governing fish populations are very complicated and interdependent (for example, the fishery itself, differences in growth and survival rates, migration patterns). Another reason is the relatively short time-scales of most biological and environmental data series concerning fisheries. Usually the data cover relatively short periods of around 20–30 years, which makes the statistical calculations less valuable. Even worse, some of the natural and human effects are detectable only during a medium to long time-scale of 10 to 100 years. While the scientific data are only available on a decadal time-scale, we need information on a centennial scale.

A possible solution to this problem might be to try to lengthen our time-scales, using less perfect but on the other hand much longer time-scales, stretching back to a time when fishing activities were less intense

or the fish populations were larger. For this purpose we can use historical records, offering us a possibility to estimate the stock sizes and levels of variability in the past. There are written sources dating from the Middle Ages up to the present day, consisting of tax and tithe lists, fishery sales fees and reports from the inspections of certain fisheries. The archives of Nature consist of innumerable fish scales from the dead fish of ancient times. Under some circumstances (e.g., along the Californian coast) they have been preserved in the bottom of the sea and are accordingly available for examination whenever samples are collected from the seabed. Both sources have turned out to be very helpful in the reconstruction of reliable long time-scales, showing the existence of both fish and marine mammals. Marine environmental historians and historical ecologists have worked together on these types of information and demonstrated that fish populations are exposed to moderate to large variations. Once these historical changes have been established,

they may be examined against human and climatic indicators to test our theories of anthropogenic and natural causes of change.

The hydrography of the Baltic

The Baltic is a semi-enclosed brackish sea, consisting of fresh upper layers of water and more saline ones further down. The condition of these layers is determined by the inflow of salt water from the North Sea, particularly during winter storms, and the continuous discharge from the large rivers. The extent of this inflow to the Baltic is determined by the climate. In between the large inflows, a lack of oxygen may occur at the bottom of the sea. At other times, violent storms can add well oxygenated salt water from the North Sea and the Skagerrak, which, for a short time, will provide good breeding conditions for animals and plants living at the bottom. Compared to the North Sea, for example, there are relatively few species in



The Baltic Sea is affected by both natural and human causes.

the Baltic, many species being exposed to permanent physiological stress due to the strong spatial gradient in salinity throughout the Baltic. In addition to this strain, species in the Baltic become stressed due to temporal variations in concentrations of salt and oxygen.

The climatic influences in the Baltic are partly related to the so-called North Atlantic Oscillation (NAO), an index of the difference in atmospheric pressure between Iceland and the Azores. A high NAO index is related to heavy, relatively warm winter storms from the west, while a low NAO index brings very cold air masses from Siberia. NAO- positive winters are mild and stormy, while the cold NAO-negative winters bring a strong coating of ice to the inner, brackish parts of the Baltic. The climatic changes affect the entire ecosystem, such as the development of plankton and the survival possibilities of young stages of fish.

Another essential influence on the ecological system of the Baltic is eutrophication. In the 20th century, an increasing discharge of nitrogen, caused by, among other things, the use of fertilizers in farming, led to reduced water transparency and fewer large algae in deep waters, as well as an increase in the occurrence of oxygen depletion. Eutrophication probably affected the fish as well (for example, the population of herring and sprat increased concurrently with increasing eutrophication), although it is difficult to prove causal connections.

Historical fisheries in the Baltic

In the Middle Ages, herring was the basis of substantial fisheries in the Baltic and in the Sound, attracting fishermen and tradesmen as well as tax collectors, who were to exact fishing dues on behalf of the king. This is why, as early as the 15th century, we have access to some information about the extent of the fisheries. The tradesmen of the German Hanseatic League played a decisive role in developing the marketing of the fish, herring becoming one of the most important commodities of medieval trade. The actual fishing was

carried out with thousands of small drift-net dinghies with crews of four or five men, in the Sound and in the Baltic between the island of Bornholm and the province of Skåne. There were two sub-species of herring, *Clupea harengus harengus L.* and *Clupea harengus membras L.* The proportion between those two is not known, however. Herring fishing was developed already before the rise of the Hanseatic League in the 12th century. It became the most important merchandise of the Hanseatic tradesmen. It is worth noting that decline of the League in the 16th century more or less coincided with the decline of the herring fishing.

The fishing season lasted from August to late October. The fish was split and put into brine and packed in barrels, where it would keep for a year, to be transported all over northern and Central Europe, in particular to the large German market. In medieval Europe, the fisheries in the Sound were the most substantial. It was not until the 16th century that they were surpassed in size by the Dutch North Sea fisheries. Tens of thousands of people from the entire Danish area took part in fishing. To be allowed to go fishing, a fisherman had to buy a small leaden marker. In the 1520s, according to customs registers, as many as 37,000 such markers were sold. In the 1540s, however, a severe decrease in fishing occurred. This low level prevailed throughout the century, resulting in dire social consequences for the coastal villagers, whose income had been largely dependent on the herring. There was a short revival in 1620, but nothing similar ever occurred again. Even though the fishermen of the Sound and of Bornholm maintained a less extensive fishing, the herring population in the Sound seems to have been greatly and permanently reduced.

But how large was the decrease, actually? Around 1200, Saxo writes that in the Sound, herring was so densely packed that a lance could stand upright among them, making it possible to catch the fish with one's bare hands. Around 1400, the estimated annual haul was close to 40,000–50,000 tons, according to Holm and Bager (2002). In the beginning of the 20th century, Danish landings fluctuated between 100 and 10,000 tons. The Swedish catch would probably

have had similar dimensions. Thus, the best years of the medieval fishery may have been two to three times larger than those around 1900. The technology remained probably more or less the same throughout the centuries since drift-net fishing seems to have been completely developed at an early stage. Nevertheless, the fishing pressure as represented by number of men and boats was probably much larger in the Middle Ages than in later years since the fish price was relatively much higher in the Middle Ages than at the beginning of the 20th century. Hence, while the her-ring population may have been larger in the Middle Ages, it is unlikely that it was much larger than in the early twentieth century.

Cod in the eastern Baltic

Since the early 1950s, cod has been intensively fished in the Baltic, reaching a maximum yield of about 400,000 tons in the 1980s. (Diagram) By far the largest part of the catches was taken from the area east of Bornholm. Before the 1950s, the exploitation was small, less than 10,000 tons a year. The catches do not necessarily reflect fluctuations in the true size of the population, however. Instead biologists believe that the eastern population of spawning cod varied quite strongly after the mid-1960s, reaching a peak of ~800,000 tons of spawning biomass in the early 1980s, while today it amounts to approximately 90,000 tons.

On the other hand, due partly to the fact that fishing was simply not very well developed earlier, little is known about the size of the cod population before 1950. Polish fishermen complained about bad hauls in the 1930s, as compared to the 1880s and 1890s. A more recent analysis by Thurow in 1999 shows that between 1900 and 1930, the historical biomass in all of the Baltic may have been no more than 20,000–50,000 tons, or less than half of the lowest estimate of biomass since 1966. This analysis corresponds with more widely spread contemporary observations, seemingly pointing to a small population, which grew in the 1930s and 1940s.

This analysis raises the important question whether, in previous centuries, the population has experienced similar increases and decreases, and, if that is the case, what the reason for these variations might be. The answer to this question will be of obvious importance to future guidance on fishing in the Baltic, since it will show whether the low population of today is historically unique or an expression of natural fluctuations in population (MacKenzie et al. 2002).

Tax accounts show that cod has been fished since at least the 15th century. Archaeological finds of cod bones in excavations of settlements on Bornholm as well as on the east coast of Sweden show that cod was being fished as early as the 6th–7th and 12th centuries, according to Enghoff (1999). More exact information can only be had from the early 17th century,



There are still some big fish left in the Baltic Sea.

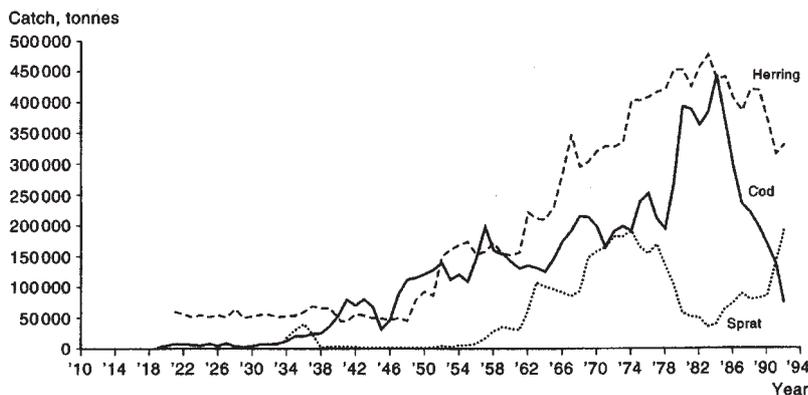


Diagram: Commercial landing of cod, herring and sprat in The Baltic Sea, 1910–1994.

however. Hence a current study of original sources by the historian Maibritt Bager shows the existence of considerable cod fishing in the waters between Bornholm and the province of Blekinge during the first half of the 17th century. Political and military conflicts between Sweden and Denmark after 1658 may have destroyed or jeopardized the fishing, which did not redevelop in earnest until the mid-18th century. In the years between 1760 and 1830, an intensive trade in live cod was carried on from Bornholm. In specially-designed well smacks, the fish were brought live to the fish market in Copenhagen. After 1830, however, the fishing off Bornholm seems to have decreased. Instead the smack skippers of Bornholm started buying cod from other Danish waters. The historical material makes it possible to imagine two earlier periods with good populations of cod occurring before the large populations during the second half of the 20th century, namely during the first half of the 17th century and the second half of the 18th century, i.e. in periods of 100–150 years between the eras of greatness. The material is still too scant, however, for us to be able to draw reliable conclusions. Above all there is a need for a complete survey of the preserved historical data dealing with Bornholm as well as with Sweden, and, preferably, with other parts of the Baltic. Formerly, the spread of cod into the Baltic would, from a general point of view, have been an indication of a larger

population. Once there is more material available, it will be necessary to interpret these data together with environmental (e.g. NAO) and socio-economical factors.

To be able to follow these and other tracks in order to reconstruct the ancient ecosystems, a group of historians, biologists and natural historians (palaeo-ecologists) have begun working together on the project called History of Marine Animal Populations. This project is being carried out under the global research programme Census of Marine Life and is supported financially by, among others, the American A.P. Sloan Foundation. The aim of this cooperation is to procure, within the next five years, completely new historical knowledge in order to be able to reconstruct past ecosystems and the history of interaction between humans and the Baltic Sea.

Conclusion

Throughout history, during decades and centuries, there have been very large fluctuations in the populations of cod and herring in the Baltic and in the Sound. Little is known, however, about the exact course of events and the reasons for these fluctuations. To enable us to predict future variations in populations and find out more about the relations between effects caused by Nature and those caused by society,

the acquisition of more knowledge about ancient times is essential. The cooperation between historians, palaeoecologists and biologists, which has now been initiated around the Baltic, makes it possible for us to hope that the next few years will bring substantial new knowledge.

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