

Influence of weather and climate on fisheries: overview of emergence, approval and perception of the idea, 1850 –1950s.

Julia A. Lajus

St. Petersburg Branch of the Institute for the History of Science and Technology, Russian Academy of Sciences, and Centre for Environmental and Technological History, European University at St. Petersburg
jlajus@popbio.zin.ras.spb.ru, jalajus@yahoo.com

Fishermen have long known that fisheries appear and disappear in time. Such events were attributed to changes in fish migration routes, harmful growth in numbers of natural predators of fish, and to the human impact: overfishing and water pollution (Smith, 1994, pp. 21-34). To note that weather, especially the changes in wind direction, could influence fisheries, was easier than to suppose that large periods of fish abundance could be connected with the fluctuation of climate. For example, Karl Ernst von Baer, famous German zoologist, who worked in Russia and in addition to many diverse activities was a head of several expeditions which surveyed the state of fisheries in 1850-s, explained the severe decline of herring fisheries during several years in the eastern part of the Baltic Sea by very cold and windy springs occurred these years. He supposed that the winds pushed out the spawning herring from their usual spawning grounds (Baer, 1860). But at the same time he did not apply this kind of argumentation when he discussed the possible causes for the cessation of the very prosperous herring fisheries in Bohuslan region on the western coast of Sweden in the beginning of the 19th c. He supposed instead that it was the human-induced pollution due to fish oil production. For the first time the climatic explanation for the periodicity of these fisheries was suggested by Axel Ljungman in Sweden (Ljungman, 1882). He noted that the herring catches varied cyclically with a period of the fifty-year sunspot cycle and assumed that this relationship might be explained with changes in the weather. However, he was not able to propose the mechanism for that connection.

When the International Council for the Exploration of the Sea (ICES) formed its Committees in 1902, they were named according to the main problems, which understanding would provide the better knowledge of the reasons of fluctuation of catches in fisheries – Migration Committee and Overfishing Committee. Hydrographical Committee was established in 1905. While the importance of studies of the environment for understanding the distribution of marine life was the core idea which led to the foundation of the ICES, during several decades the interdisciplinarity of research efforts was proposed but not fully achieved. According to T.R. Parsons this dichotomy continued through the 1960s: fisheries biology concentrated mostly on population dynamics, excluding the role of environment in controlling the absolute abundance of various fish species (Parsons, 1980). The exception was the situation in Russian marine studies where fishery science was merged with oceanography several decades earlier, forming the fisheries oceanography. Interest to the environmental forces was very much pronounced in Russian biology at the expense of the development of population modelling.

While it was “the struggle to link fish to their ocean environment” within the ICES (Rozwadowski, 2002, pp. 111 -145), to link fish with the climate was even more difficult task, as the relations between ocean and the atmosphere remained enigmatic. In 1910s Johannes Petersen from Denmark and Otto Pettersson from Sweden discovered connections between the water temperature in the North Atlantic and the position of the air pressure minimum (Icelandic low), but the nature of these connections were not obvious (Petersen, 1910, Pettersson, 1912).

However, already the first ten years of studies under ICES umbrella had resulted in the discovering of the unexpectedly high variability in the ocean. As it was pointed out in the ICES Memorandum in 1923: “We started from the assumption that the hydrographic conditions, as well as the fishlife and the plankton of these tributaries of the Atlantic, seemingly so well separated both from each others and from the main basin of the Ocean by narrow channels and submarine thresholds, would remain on the whole stationary, subject only to seasonal influences from the atmosphere. Experience has led us to other views. There exists an interchange of waters of living marine animals and plants between the different parts of the Ocean on a far greater scale than our most experienced oceanographers and biologists considered to be possible twenty years ago” (Pettersson, Drechsel, 1923). The notion of far greater scale of variation in both physical and biological phenomena than it was considered as real or even possible was a main tendency in the discovering the environmental forces driving living organisms in general. It was especially true for the climate, which was perceived as much more stable than it occurred to be. For example, Russian biologist and geographer Leo Berg in his book “Climate and life” (Berg, 1922) compared climate with a species and weather with an individual, arguing that weather is very changeable, while climate could changes only very slowly. The same was an opinion of Russian oceanographer Nikolai Knipowitsch who was the Russian delegate in ICES before the WWI. He considered the Gulf Stream system as a stable one and thus was extremely surprised when the significant increase of the water temperature in the Gulf Stream branches in the Barents Sea was discovered in 1921 (Knipowitsch, 1921). In 1926 Otto Pettersson wrote a classical paper, in which he demonstrated very clearly the connections between catches of herring and winter temperatures in the Kattegat channel (Pettersson, 1926, see also Svansson, 1999).

The significant warming in the North Atlantic which started in the 1920s and was more pronounced in the 1930s provided many new evidences of the influence of climate on fish distribution. The effect was especially visible at the north-west - in the Greenlandic waters and at the north-east – in the Barents Sea. A.S. Jensen and P. M. Hansen (1931) observed the expansion of cod and halibut along the west coast of Greenland in comparison with 1908 and the 1920s. The warming of the Barents Sea also was accompanied by the large changes in the distribution of stocks of commercial fishes. The tremendous amount of herring never seen before near the Russian coasts of the Barents Sea was observed in 1932-34. Herring was observed even in the mouths of large Siberian rivers (Esipov, 1938; Galkin, 1940). In the same years cod appeared in the quantities suitable for fisheries at the eastern parts of the sea and even near the Novaya Zemlia costs (Esipov, 1935). Thus “warming of the Arctic”, which was noticed firstly by climatologists and oceanographers became an important issue for biologists. In Russia it was summarized in 1934 by Sergei Averintsev (Averintsev, 1934) for the Barents Sea and more generally by Leo Berg (1935).

The perception of the rapid climatic changes and their influences on fish resources was rather contradictory. Most of the scientists considered this as the random event, others tried to discuss this in terms of the periodicity. Both considerations were very unfavorable for fishery managers who would like to have in hands the control sticks for the ruling of fish stocks while referring to the climatic factors moved them far away from this practical task. Contradiction between the supporters of the overfishing as a main factor influencing the fish stocks and scientists who believed more in the environmental forces was appeared very clear in the dispute between W. F. Thompson and Martin Burkenroad over the fate of the halibut stock in the Pacific (Smith, 1994, pp. 267-276).

The marginal but interesting example came from the Soviet history: in 1930s it was a period when managers and authorities opposed the very idea of influence of climatic changes upon fish stocks, because it put serious limitations to the will of reconstruction of nature by the human voluntary. The paper by Averintsev mentioned above became a point of severe

criticism, because the linkage between the warming of the Arctic and the increasing of the catches of herring and cod led to the assumption that when the warming will stop or the cooling will start (the climate is so uncertain and mysterious thing!) the catches undoubtedly will reduce. This pessimistic view was not appropriate for the optimistic position of the conquerors of nature and for the planned Soviet economy.

Growing understanding of the importance of climate influence led to the organizing of special meeting on this subject in 1948 (ICES, 1948). H. W. Ahlmann in his introductory speech pointed out that extent of warming of the northern waters which was documented in 1930-1940s was part of a global change of larger scale pronounced by increasing of air temperature, receding glaciers, decreasing Arctic ice extent and thickness. From that time we could trace the formation of the interdisciplinary research program intended to the discovering of the mechanisms of the influences of climate changes on fish. The development of this research program which core was the assumption that the climate changes have significant influence on fish and fisheries was smoothed by the describing of several important phenomena such as the Great Salinity Anomaly, North Atlantic Oscillation and El Niño, which were connected with the dynamics of the fish populations (Drinkwater, 2000).

After summarizing book by D. H. Cushing (1982) the notion that climate change could influence the fish resources and therefore fisheries became a commonplace, but the question is still very important and new facts and correlations are discussing by fishery scientists in cooperation with climatologists (Cod and Climate Change, 1994 and many others). The real issue is whether there is a direct causal link, or these are merely correlated consequences of larger scale processes (Sharp, 2003).

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