

Abstract

This is the report of the PICES Fishery Science Committee Working Group on *Climate Change, Shifts in Fish Production, and Fisheries Management* (WG 16). There is general agreement that climate change strongly affects the production of many species around the North Pacific and that the impact of greenhouse gas-induced changes on key species and their fisheries are poorly understood. Some PICES member countries consider global warming effects on fish populations to be less important than fishing impacts and natural climate cycles.

The productivity of key species in the fisheries off Canada is generally recognized to be related to climate and climate change. Regime-scale changes in climate variability affect many important fisheries. If global warming results in more frequent and more intense Aleutian Lows, as might be indicated by climate change trends since the 1970s, then the productivity of the many species that had increased marine survival in the 1980s may improve. However, species at the southern limits of their distributions may decline even if there is an intensification of the Aleutian Low.

A major influence on fish productivity in the Japanese coastal and offshore fisheries is the structure and dynamics of the subarctic Oyashio current, the subtropical Kuroshio and Tsushima currents, and the transition area between the Oyashio and the Kuroshio. Climate and ocean conditions are known to have major impacts on the abundance of key species in the Japanese commercial fisheries. If winds are reduced by future warming of the ocean, the primary production in the seas around Japan may also decrease because of reduced vertical ocean mixing in the winter. In general, however, the impacts of climate and ocean changes vary among areas and species, and are poorly understood, but it is clear that climate and ocean conditions are major influences in the productivity of fishes in the seas around Japan. Thus, it is predicted that global warming-induced changes will affect future fisheries.

The People's Republic of China has the largest marine fisheries in the world. It also has the largest sea water aquaculture production that exceeds their wild catch. Climate and ocean conditions are known to affect production and distribution, but fishing is considered to be the major factor influencing the population dynamics of key commercial species. There are distinct patterns in ocean temperatures that appear to be a result of regional rather than global influences.

Catches of marine species by the Republic of Korea (most commercially important species range around the Korean Peninsula) were relatively stable from the late 1980s to the mid-1990s and have declined slightly in recent years. Overfishing has been, and continues to be, a serious threat to productivity, resulting in populations of smaller, very young individuals. Climate-related ocean changes also profoundly affect productivity. It is recognized that future climate change will have important impacts on productivity which will require reducing the effects of overfishing. However, the impacts of global warming are speculative.

Climate and ocean conditions have traditionally been a major consideration in Pacific fisheries science in Russia. Natural cycles in atmospheric circulation, sea surface temperatures, lunar and solar cycles are all associated with the aggregate productivity of marine ecosystems. In particular, it appears that there is a natural 50- to 60-year periodicity that is proposed to continue to influence fish productivity in the 21st century. Russian fisheries scientists assess global warming impacts relative to these natural cycles. Because these cycles are so influential on physical and biological processes in the ocean, global warming impacts are not considered as the first priority problem, at least for the next few decades, especially because the Far Eastern seas have cooled in recent years.

There is convincing evidence that natural climate-related changes strongly affect the dynamics of key commercial species in the United States fisheries off Alaska. A major change in ecosystem dynamics and species composition occurred after the 1977 regime shift, indicating the importance of large-scale climate changes that can be relatively fast. It is generally agreed that future climate change will alter the ecological dynamics of marine ecosystems but the mechanisms that regulate recruitment are so poorly understood that it is difficult to do more than speculate on the impacts of global warming.