U.S. Global Ocean Ecosystem Dynamics (GLOBEC)

Issue:

Global climate change represents one of society's greatest challenges. Predicted changes in atmospheric and oceanic temperatures, as well as the resulting wind, precipitation, and currents, will have profound consequences for the ocean, marine life, and society. It is critically important that we develop an understanding of the potential effects of climate change on large ocean ecosystems.

Marine species depend on ocean currents for dispersal and on frontal zones and other oceanic features for optimal feeding locations. Changes in the physical characteristics of the ocean will potentially affect the production of microscopic plants and animals at the base of the food web, and the distribution and abundance of marine animals higher in the food web, including economically important species.

Projected Impacts of Climate Change on the World's Oceans

- Increased water temperature and melting of sea ice
- Altered salinity, leading to changes in ocean stratification
- Changes in current strength and wind-related ocean mixing
- Effects on upwelling and downwelling at coastal margins
- Shifts in distribution and abundance of marine animals

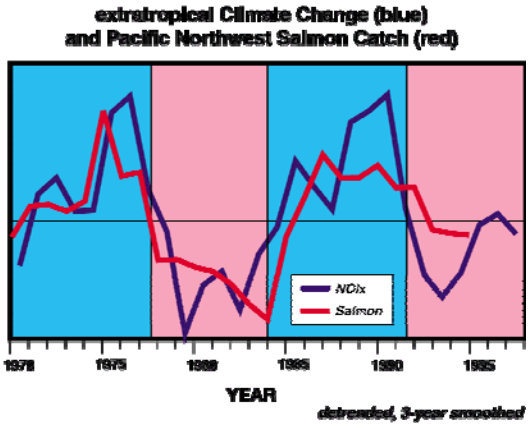
Approach:

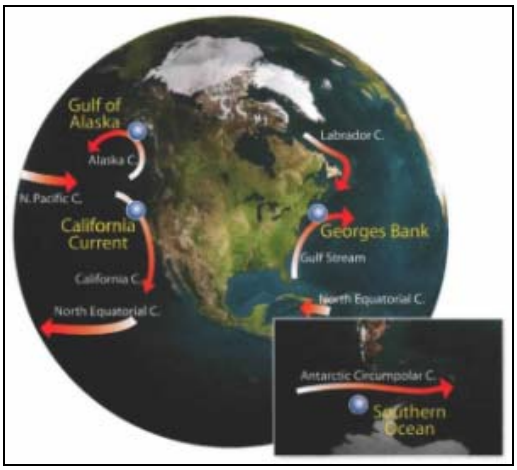
GLOBEC (GLOBal Ocean ECosystems Dynamics) is a research program designed to examine the potential impact of global climate change on marine animal populations. U.S. GLOBEC is a component of the International Geosphere-Biosphere Programme and the U.S. Global Change Research Program and is linked to worldwide research on this topic through the International GLOBEC Program. The objective of U.S. GLOBEC research is to understand the basic mechanisms through which climate change affects the distribution and abundance of marine species. This requires the collaboration of atmospheric scientists, physical and biological oceanographers, fisheries biologists, and ocean modelers. The program focuses on the biological-

physical interactions affecting larval and juvenile fish, and their zooplankton prey.

Management/Policy Issues:

U.S. GLOBEC supports regional studies in the Northwest Atlantic ocean on Georges Bank, and in the Northeast Pacific ocean, including the northern California Current off Oregon, and the coastal Gulf of Alaska. In each region, GLOBEC has selected target species for their ecological importance, their likely sensitivity to climate change, and their economic importance. In the Atlantic, cod and haddock have been mainstays of the commercial fisheries off New England for centuries, but are now depleted by overharvesting. In the Northeast Pacific ocean, salmon have served as important food resources for native people for millennia, and now support important commercial and recreations fisheries. In both these regions, climate will interact with other anthropogenic impacts (including fishing) to influence the success and survival of these important species. By understanding these effects, and developing predictive capabilities, managers can better integrate climate change into fishery policy.





Accomplishments:

U.S. GLOBEC researchers are developing and applying computer models of the physics and biology of the seas, to link global climate models with regional ecosystem impacts. Oceanic indicators are being developed to predict how changing ocean conditions will result in changes in target species. Several research results have already found their way into management decisions, including:

- Use of a circulation model developed under the GLOBEC Georges Bank program to evaluate the effectiveness of closed areas as a scallop management strategy on Georges Bank.
- A web-based description of eleven ocean productivity indicators which enable forecasts of west coast adult salmon returns six months to one year sooner than previous techniques.

To learn more about this program and its accomplishments, go to http://www.usglobec.org.

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