

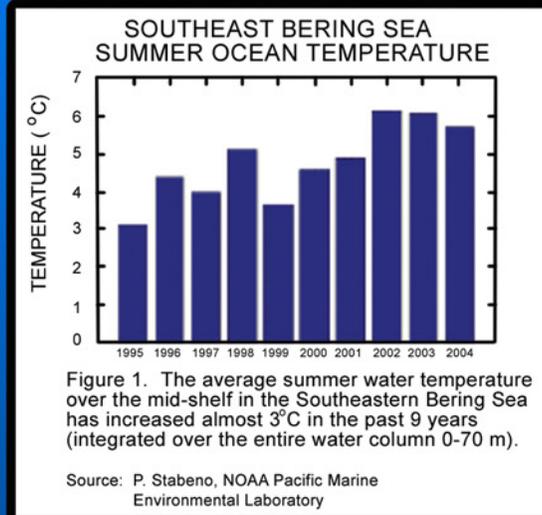
CLIMATE AND ECOSYSTEM RESEARCH TO ADVANCE FISHERIES MANAGEMENT

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INTRODUCTION

Alaskan fisheries account for approximately 50% of the U.S. commercial fishery landings, with annual landings valued at about \$1 billion. Global climate models predict climate change and variability will be most severe at high latitudes and there are many indications that environmental conditions are already changing in these regions (Figs. 1 and 2). The need for resource management to account for this forcing mechanism is clear, as changes in physical forcing in the region may drastically alter the structure and functioning of the marine ecosystem and cause profound geographic shifts in species distributions (Fig. 3, showing the distribution of Alaska pollock, which has annual landings valued at \$200 million). An ecosystem approach to management requires understanding the effects of climate fluctuations. The North Pacific Climate Regimes and Ecosystem Productivity (NPCREP) study, initiated in 2004, is building this understanding for the Eastern Bering Sea by investigating the physical and biological controls on the ecosystem and how these are affected by climate variability and change.



BERING SEA ICE HAS RETREATED OVER THE LAST THREE DECADES



PERCENT ICE COVERAGE IN REGION OF BLUE BOX

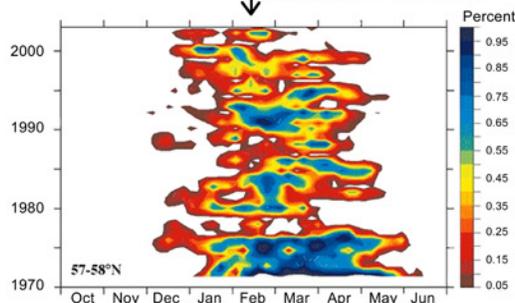


Figure 2. In the early 1970s, the ice arrived early in the year and stayed late. In the late 1970s, ice began to be less persistent in the southeast, and the trend has continued.

Source: P. Stabeno, NOAA Pacific Marine Environmental Laboratory

METHODS

A combination of retrospective, monitoring, process, and modeling studies are advancing the understanding of the impacts of climate on the fisheries in the region. The NPCREP project is establishing a network (Fig. 4) of shipboard surveys, moorings, drifters, and satellites that supplements existing observations with measurements critical to the success of the project. Coupling these data with information from NPCREP retrospective and process studies generates the necessary foundation for understanding climate-ecosystem relationships. The NPCREP project is conducted by scientists at NOAA's National Marine Fisheries Service Alaska Fisheries Science Center, and at NOAA Research's Pacific Marine Environmental Laboratory, along with academic partners.

BOTTOM TEMPERATURE AND POLLOCK DISTRIBUTION

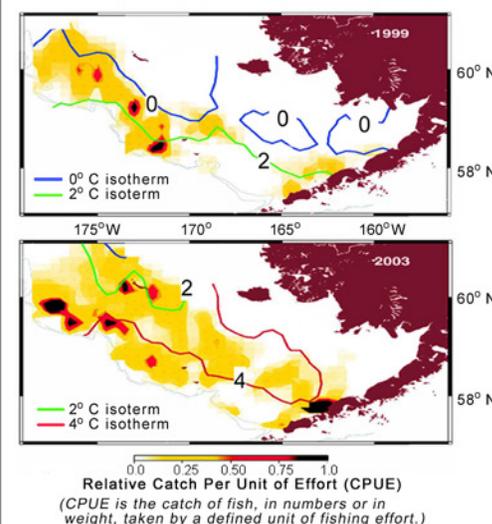


Figure 3. Climate warming may be affecting the Bering Sea Ecosystem by a northward shift of distributions of major commercial fisheries, including Alaska pollock, with the retreating cold pool. This introduces major new predators in some areas and may affect recruitment and harvest.

Source: J. Ianelli, NOAA Alaska Fisheries Science Center

NOMINAL NPCREP OBSERVING SYSTEM

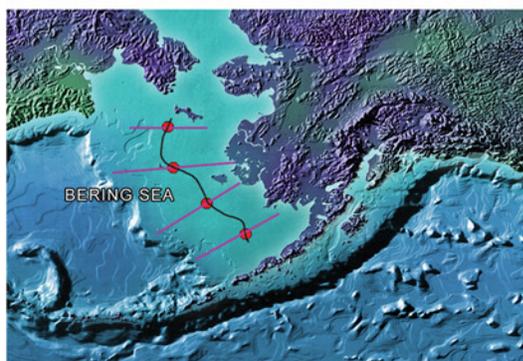


Figure 4. Moorings (red dots) obtain year-round measurements of temperature, salinity, nutrients (nitrate) and currents throughout the water column; in summer, surface air temperature, wind, humidity and light are also collected. The spring biophysical survey conducted along the 70 m isobath (black line) and cross-shelf transects (purple lines) measures temperature, salinity, nutrients, chlorophyll, and zooplankton. Funding from other sources is leveraged to support the moorings and surveys.



RESULTS

The NPCREP project provides direct support to fisheries stock assessments. Its contributions include a variety of products and services that are used by National Marine Fisheries Service stock assessment scientists and/or are included in the *Ecosystems Considerations* chapter of the North Pacific Fishery Management Council's Stock Assessment and Fisheries Evaluation plan. The NPCREP project contributes to the development or operational generation of 20 indices and assessment tools that are incorporated into assessments, projections, and advisories. These products and services range from climate indices that summarize environmental conditions and ecosystem status, to models that predict recruitment for fish larvae. The results are directly used in the management process, including recommendations on total allowable catch. The NPCREP scientists interact on a regular basis with the North Pacific Council. Products are also made available on the Internet: www.beringclimate.noaa.gov