

Ecosystem responses to recent climate variability: comparison of four northern hemisphere regions

Ken Drinkwater, Franz Mueter, Kevin Friedland, George Hunt, Jon Hare, Cecilie Broms, Webjørn Melle, and Maureen Taylor

Results of comparative studies examining the ecosystem responses to recent climate changes in four high-latitude regions of the northern hemisphere are presented. The regions include two in the Pacific (Bering Sea and Gulf of Alaska) and two in the Atlantic (Georges Bank/Gulf of Maine and the Barents/Norwegian Seas). Air temperature, heat fluxes, and windforcing over the four regions are examined and their effects on the physical oceanography of the regions are compared and contrasted, including changes in ocean temperatures, salinities, stratification, and circulation. The relative roles of advection and air–sea fluxes in controlling the physical variability will also be discussed. In addition, changes in seasonal sea-ice cover are compared between those regions where it occurs. The responses of phytoplankton and zooplankton to the physical changes are then discussed. Phytoplankton production is found to increase with increasing temperature in the Bering Sea, Barents Sea, and the Gulf of Maine regions but not in the Gulf of Alaska or Norwegian Sea. The responses of the higher trophic levels include distributional shifts and changes in production, which are species dependent. Evidence of both bottom–up and top–down control is provided. The implication of these results for developing ecosystem responses to future climate scenarios is also discussed.

Keywords: ecosystem comparisons, Atlantic, Pacific, physical oceanography, biological oceanography, fish.

Contact author: Ken Drinkwater, Institute of Marine Research, PO Box 1870, Nordnes, 5817 Bergen, Norway [tel: +47 55236990, fax: +47 55238687, e-mail: ken.drinkwater@imr.no].