BEST-BSIERP Bering Sea PROJECT
UNDERSTANDING ECOSYSTEM PROCESSES IN THE BERING SEA 2007–2013

Zooplankton Populations in the Eastern Bering Sea

LINKING CLIMATE, ZOOPLANKTON AND FISHERIES

Zooplankton are large and small animals, mostly invertebrates, that drift in the water. Information on zooplankton abundance is being used by the Bering Sea Project to assess the health of the Bering Sea ecosystem and to aid in understanding the potential effects of global climate change on Bering Sea fisheries. Since the Bering Sea sustains large commercial fisheries and subsistence resources for native communities, understanding the potential effects of climate change on zooplankton and the fish populations that feed on them will help policy makers plan for and mitigate climate-related impacts on the fishing and indigenous communities along the Bering Sea coast.

How We Did It

We collected 675 zooplankton samples from the eastern Bering Sea, covering all shelf domains and extending from the Alaska Peninsula in the south to the St Lawrence Island in the north. Because many zooplankton taxa spend daytime in the deep and ascend to the surface during the night, we fished a MOCNESS (Multiple Opening/Closing Net and Environmental Sensing System) at night (Fig. 2) to ensure representative collections. The samples then were brought to the lab and preserved critters were identified and counted. These samples will be stored at the University of Alaska for at least 20 years and made available upon request to future researchers. The data on zooplankton composition and the surrounding environment, which were simultaneously collected with automated sensors during the net tows, were uploaded into the Bering Sea Project interdisciplinary database (beringsea.eol.ucar.edu) for public availability.

continued on page 2

Fig. 1

Russ Hopcroft, NOAA

Pelagic predatory amphipod Themisto libellula *flourish in cold Arctic and Bering Sea waters.*

The Big Picture

Ecosystem studies over the last decade revealed substantial declines in populations of large zooplankton during the warm period of 2002 – 2006. These declines were accompanied by declines in the survival of juvenile pollock, a major commercial fish on the Bering Sea shelf. Since large zooplankton are an important food for young pollock, the declines in large zooplankton are a potential reason for observed declines in survival of young pollock. In addition, large zooplankton are an important food for salmon, herring, capelin, and other large fish species. In the absence of large zooplankton, other large fish were consuming juvenile pollock, thus lowering pollock survival and stock size. As fish stocks decline, the supply of fish to the fishery also declines, resulting in lower incomes and employment in fishing communities. As assessed by the Bering Sea Project, colder temperatures in 2007 – 2010 were accompanied by a recovery of large zooplankton populations. Increases in abundance of large zooplankton during the recent cold period are further evidence that declines in zooplankton during the warm period were temperature-related.

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Fig. 2

Chris Lindner, WHOI

Nighttime deployment of the Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS) off the stern of USCG Cutter Healy.

In addition to increases in populations of large zooplankton during the cold period of 2007 – 2010, large Arctic zooplankton species, such as pelagic amphipod *Themisto libellula* (Fig. 1), occurred in the samples. These arctic species had not been observed in the southern Bering Sea since the 1970s. Arctic species can be an important food source for seabirds and commercial fish, so their reappearance on the Bering Sea shelf is an indication that climate change can impact the Bering Sea ecosystem by changing the species composition of the constituent populations in addition to changing population size.

Why We Did It

The species composition and abundance of plant and animal populations in ecosystems are continuously changing in response to climate. Since climate warming is predicted to occur rapidly in arctic and subarctic environments, these changes in species composition and abundance are likely to accelerate and increase in amplitude. Nevertheless, ecosystems are extremely complex and can change in unpredictable ways. Therefore, sound resource management in a changing world requires continuous assessment of the plant and animal populations to allow resource managers to modify management policies in a timely manner, minimizing the potential impacts of unexpected changes in fish and wildlife populations on the coastal communities that depend on these resources for subsistence and commercial harvests.

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