

Dr. George Hunt
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From sea ice to seabirds: Bottom-up control of Bering Sea energy flows

The timing of sea-ice-retreat sets the table for southeastern Bering Sea consumers from walleye pollock and Pacific cod to seabirds such as black-legged kittiwakes, common murre and short-tailed shearwaters. The timing of sea-ice retreat in spring determines the match or mis-match between ice algae availability and the egg production and larval growth of large calanoid copepods and euphausiids over the Middle Shelf Domain. If there is a mis-match, the recruitment of the copepods and euphausiids is weak, juvenile fish seeking food for growth and lipid deposition do poorly, and, at least for pollock, over-winter survival of age-0 fish is low. Seabird numbers and cross-shelf distributions shift between years with early and late sea-ice retreat, with a greater proportion of some species occupying the Middle Shelf Domain in years when there is a mis-match between sea-ice-retreat and zooplankton needs, and more age-0 pollock are found in surface waters there. Other seabird species move to the Inner Front, where prolonged primary production supports zooplankton populations. As the southeastern Bering Sea warms, we can expect an increased frequency of mis-match between the availability of ice algae and zooplankton needs, increased frequency of weak year-classes of Pollock and cod, and changes in the distribution and abundance of seabirds.