Seabirds as the sentinels of changing trophic linkages in the Bering Sea.

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During 1999-current, we have been testing the hypothesis that diminishing winter sea ice and warming water temperatures cause a reorganization of foodwebs in the south-eastern Bering Sea continental shelf ecosystem, which induces opposite effects on planktivorous and piscivorous seabirds breeding in the region. Winter sea ice affects the timing and magnitude of the spring phytoplankton bloom. This spring conditioning of trophic pathways coupled with the summer water temperatures influence the transfer of energy to zooplankton, fish, and seabirds. During cold years, high productivity of the shelf ecosystem supports a large biomass of meso-zooplankton, increasing prey availability and reducing food stress incurred by planktivorous seabirds (Fig. 1, left panel), while cold water temperature prevents the expansion of forage fish into the shelf regions. This reduces the availability of prey and increases food stress incurred by piscivorous seabirds (Fig.1, right panel). Foraging conditions are reversed during warm years, when the biomass of meso-zooplankton declines due to the combined effects of low ecosystem productivity and potentially high predation pressure by abundant forage fish, whose distribution is no longer limited by the cold water temperatures. Thus, under current conditions, warming of the south-eastern Bering Sea ecosystem appears detrimental to planktivorous top-predators (1), but at least in short-term, it might be beneficial to piscivorous top-predators breeding in the region (2). It is currently not well understood whether continuous warming or cooling of the ecosystem will lead to a radical re-organization of foodwebs and negatively affect both planktivore and piscivore populations.

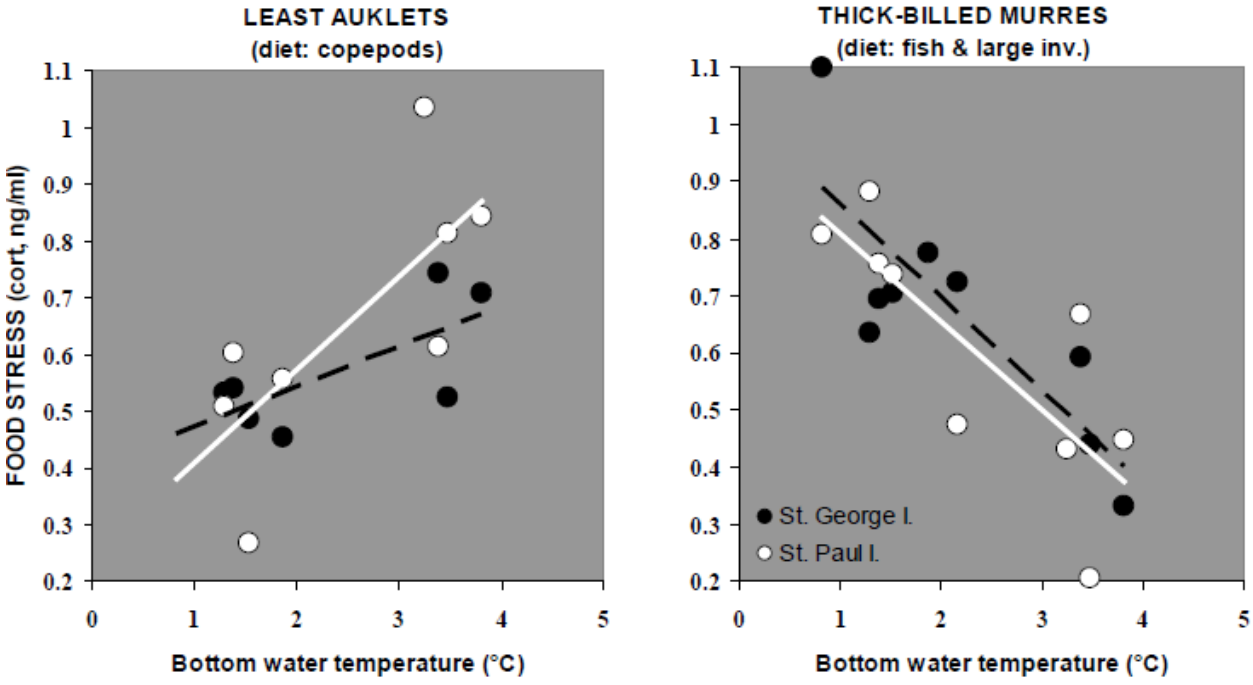

Figure 1. In the sub-Arctic continental shelf regions with seasonal ice cover, warming might be beneficial to fish-eating predators: i.e. thick-billed murres breeding on the Pribilofs during 1999-2013 incurred less food stress during warm compared to cold oceanographic conditions. Figure shows average annual levels (log-transformed) of stress hormone corticosterone in blood of birds breeding on St. Paul and St. George Islands (the Pribilofs) plotted against standardized summer bottom temperatures from the NMFS bottom trawl survey in the eastern Bering Sea (temperature data are courtesy of Robert Lauth, AFSC, NOAA).

References

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