Associations between seabirds and their prey in the northern Bering Sea during summer of 2017 and 2018

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In 2018, there was little sea ice in the northern Bering Sea (NBS). Numerous strandings of seabirds (mainly *Uria* spp.) along the coast of St. Lawrence Island and reproductive failure of seabirds breeding on the island were also observed in 2018. To determine the mechanism of these unusual events on seabirds in 2018 in the NBS, we compared boat-based at-sea data on seabird and their prey around St. Lawrence Island in the summer (July) of 2017 and 2018. Seabird density and biomass of potential prey (fish and zooplankton) were measured by at-sea seabird observations and scientific acoustic surveys (38- and 120-kHz transducers), respectively, during *T/S Oshoro-maru* (Hokkaido University) cruises in both years. At-sea seabird densities in 2018 (planktivorous divers: 5.6 birds/km^2, piscivorous divers: 4.8, surface omnivores: 7.0, short-tailed shearwaters: 0.8) were lower than those in 2017 (planktivorous divers: 9.2 birds/km^2, piscivorous divers: 13.1, surface omnivores: 10.7, short-tailed shearwaters: 10.7). Acoustically-determined biomasses of potential prey in 2018 (fish: 10.5 m^2/NM^2, zooplankton: 1132) were also lower than those in 2017 (fish: 19.7 m^2/NM^2, zooplankton: 2475). Strongest correlations between seabird density and acoustically-determined biomass of potential prey in 2017 and 2018 were observed at 3- and 30-km scales (among 0.3-, 3-, 10-, and 30-km grids), respectively, indicating that seabirds should search for a larger area (i.e. increasing search cost) in 2018 when prey biomass was lower. Satellite images of our survey region showed that sea ice concentrations and spring (May) chlorophyll *a* concentrations in 2018 were lower than those in 2017. Our study suggests that ice-free area with no ice-associated phytoplankton blooms in the NBS may cause low biomass of secondary consumers and hence affect at-sea seabird density and their foraging behaviors.

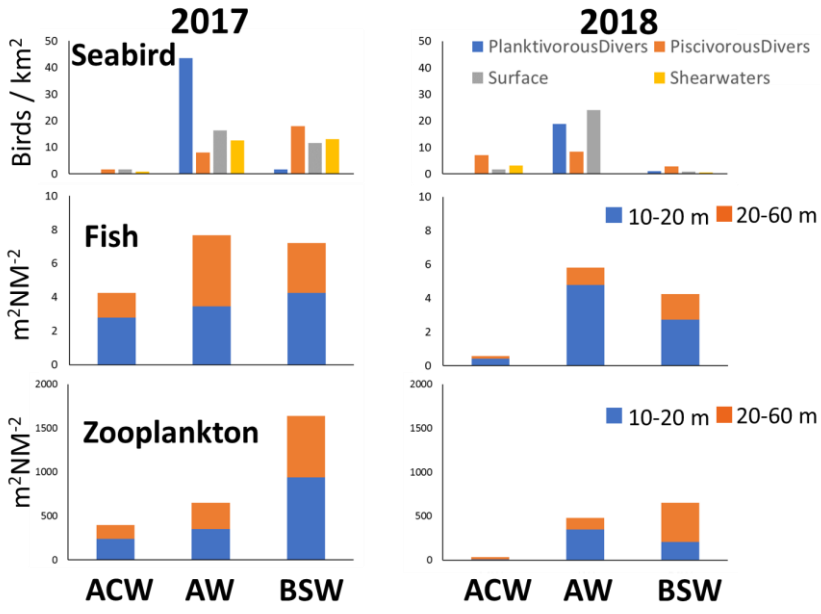

Figure 1. Densities of seabirds and acoustically-determined biomasses of potential prey (fish and zooplankton) with respect to the water masses (ACW: Alaska Coastal Water, AW: Anadyr Water, BSW: Bering Shelf Water) in the northern Bering Sea during the summer of 2017 and 2018.