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Changing Sea Ice Dynamics on West Antarctic Peninsula Underlying Ecosystem Alterations

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The sea ice of the West Antarctic Peninsula (WAP) has experienced significant change over the last fifty years. Using 25-year spatial time series collected by the Palmer Long Term Ecological Research program, we assess long-term patterns in sea ice, upper mixed layer depth and food web dynamics (phytoplankton, zooplankton, higher trophic levels). Over decadal time scales, the heating on the WAP has been driven by subsurface intrusions of the warm Antarctic circumpolar current onto the shelf that is topographically steered to the coast terminating in regions of abundant penguin colonies presumably fueled by high productivity phytoplankton blooms. Sea ice has steadily declined from the 1980's until a recent reversal that began in 2008. In the southern WAP, upper ocean mixed layer depth has shallowed significantly and associated with the shallower mixed layer is enhanced phytoplankton carbon fixation. Associated with the recent increases in sea ice has been a large increase in the photosynthetic efficiency in both the northern and southern. Using a decade of glider data, shallower mixed layers appear to promote phytoplankton blooms. There was significant inter-annual variability in phytoplankton blooms, but high chlorophyll years, associated with diatoms, were associated with high krill recruitment suggesting a tightly coupled ecosystem and strong bottom-up control of the food-web. Results demonstrate the close fidelity between the biology and physics on the WAP.