Wintertime grazing rates of Antarctic krill, *Euphausia superba*, along the Northern Antarctic Peninsula

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Introduction

- Antarctic krill, *Euphausia superba* (hereafter known as ‘krill’), are a critical part of the Antarctic marine food web, providing nourishment for species like penguins, seals, and whales.
- New stressors on krill, primarily climate change and increased fishing pressures, have created concern that krill populations will decline.
- Population recruitment is heavily influenced by the overwintering survival of larval krill (called furcilia), whose success has been correlated with winter sea ice conditions.
- Years of increased winter sea ice extent and duration are associated with the initiation of robust krill cohort, since furcilia feed within the sea ice on phytoplankton and algal ice biomass.
- Climate change has reduced the duration and extent of winter sea ice, creating a deficit in food supply between the time of the last phytoplankton bloom and sea ice formation.

Methods and Materials

- This study took place during the austral winter (June–Sept.) of 2016 aboard the RVIB Nathaniel B. Palmer.
- Krill samples were collected from four different regions around the Northern Antarctic Peninsula (Fig. 1) using a standardized Isaac-Kidd Midwater Trawl net.
- Krill were measured and staged, frozen, and once back in the lab at OSU instantaneous gut pigment content was found using a Turner Designs Trilogy Fluorometer.
- Daily ingestion rates were calculated from gut pigment measurements following methods described in Bernard *et al.*, 2012.

Results

Figure 2: Ingestion (grazing) rates were higher at more northerly (lower) latitudes. Lower latitudes receive more sunlight during the winter.

Figure 2. Ingestion rates of Antarctic krill (excluding furcilia) by latitude and percent sea ice coverage.

Figure 3: Ingestion rates of Antarctic krill maturity stages in regions with differing percent sea ice coverage.

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Figure 4: Ingestion rates of dominant Antarctic krill maturity stages as a function of body weight in regions with differing percent sea ice coverage.

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Figure 1. Map of Northern Antarctic Peninsula, depicting (red circles) our four survey areas: West, Elephant Island, Jonville, and South.

Summary and Conclusions

- As was expected, we found higher grazing rates at more northerly latitudes that receive more sunlight, which is conducive for phytoplankton growth.
- Grazing rates tended to decline with increasing latitude, but a few exceptions existed in areas with 100% sea ice coverage. This indicates that even in southerly locations where light is limited, sea ice provides a substrate for ice algae and phytoplankton to grow, thus creating important habitat/food supply for krill.
- Furcilia consumed more chlorophyll per gram of body weight than adult krill, which supports previous studies suggesting that sea ice is a crucial habitat for their overwinter survival.
- If winter sea ice continues to decline in extent and duration, larval krill and subsequent krill population recruitment will be threatened, leading to severe ecosystem consequences.

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References