

SHELFZ Project: Arctic Shelf Zooplankton Populations in the Vicinity of Barrow Underwater Canyon - Preliminary Results

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Abstract

Underwater canyons cutting through continental shelves often generate unique hydrography and may facilitate exchange between shelf and abyssal biotas contributing to increased local oceanic productivity. Zooplankton composition and distribution in the vicinity of Barrow canyon was investigated in summer 2013 as a part of SHELFZ (Shelf Habitat and EcoLogY of Fish and Zooplankton), a multidisciplinary project in which nearshore (< 20 m isobath) and offshore (> 20 m isobath) data were concurrently collected for fish, zooplankton, fisheries acoustics, and water mass properties along Alaska's Chukchi Sea coast. While majority of zooplankton comprised wide-spread shelf species such as *Calanus glacialis*, substantial amounts of large-bodied Arctic deepwater *Calanus hyperboreus* along with less common *Pareuchaeta glacialis*, *Metridia longa* and *Themisto abyssorum* were recorded nearshore, indicating penetration of cold (~ < 1°C) and saline (~ > 32) winter water into the study area. Pacific influence was indicated by low numbers of *Eucalanus bungii* and *Neocalanus* spp. Euphausiids and large hyperiids *Themisto libellula* formed dense aggregations at some stations. The presence of lipid-rich Arctic species was likely beneficial to a variety of planktivorous predators from fish to whales observed in the study area.

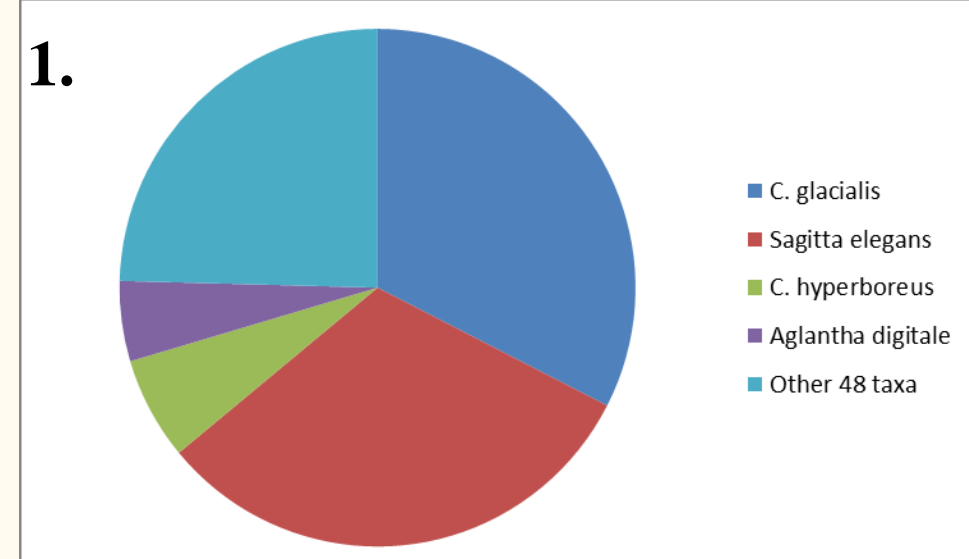
Methods

Sampling: Zooplankton samples and conductivity-temperature-depth (CTD) were collected on the eastern Chukchi Sea shelf as a part of the SHELFZ research effort from 17 August – September 2013. The sampling was conducted in the nearshore (<20 m isobath) and offshore (>20 m isobath) shelf domains from two vessels. Large zooplankton were collected with a 1 m² Tucker trawl system having 505 µm mesh net and equipped with a flow meter to monitor volume filtered. Environmental data were collected with a Seabird FastCAT CTD profiler was attached to the trawl offshore, and with a Seabird SeaCAT profiler nearshore. The trawl was fished obliquely from near the bottom to the surface. The zooplankton were preserved and identified, enumerated and weighed in the lab.

Offshore - F/V Alaska Night (143feet)

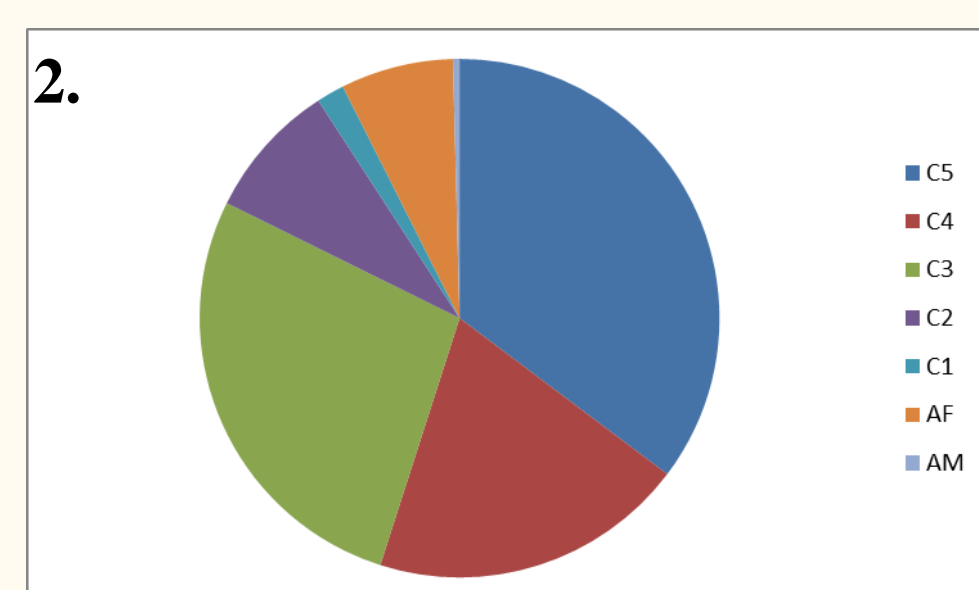


Nearshore - R/V Ukpik (50 feet)

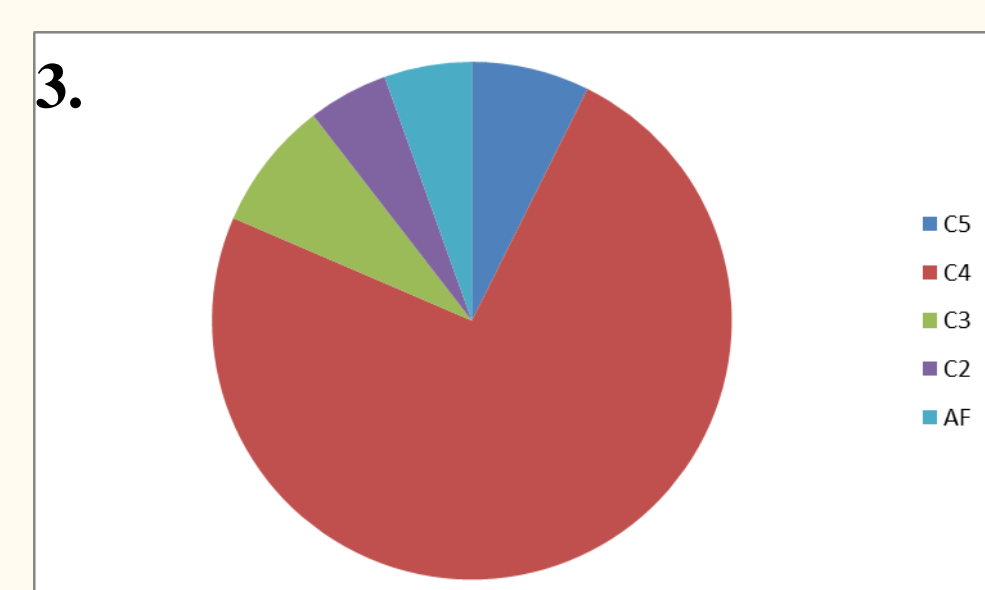


Zooplankton taxa composition and their contribution to total biomass: Only four taxa out of 52 (Figure 1.) found in the study area contributed substantially to the overall zooplankton biomass. Lipid-rich copepods *Calanus glacialis* and *C. hyperboreus* totaled ~40% of biomass, while soft-bodied chaetognats *Sagitta elegans* and hydrozoan jellyfish *Aglantha digitale* contributed 36%.

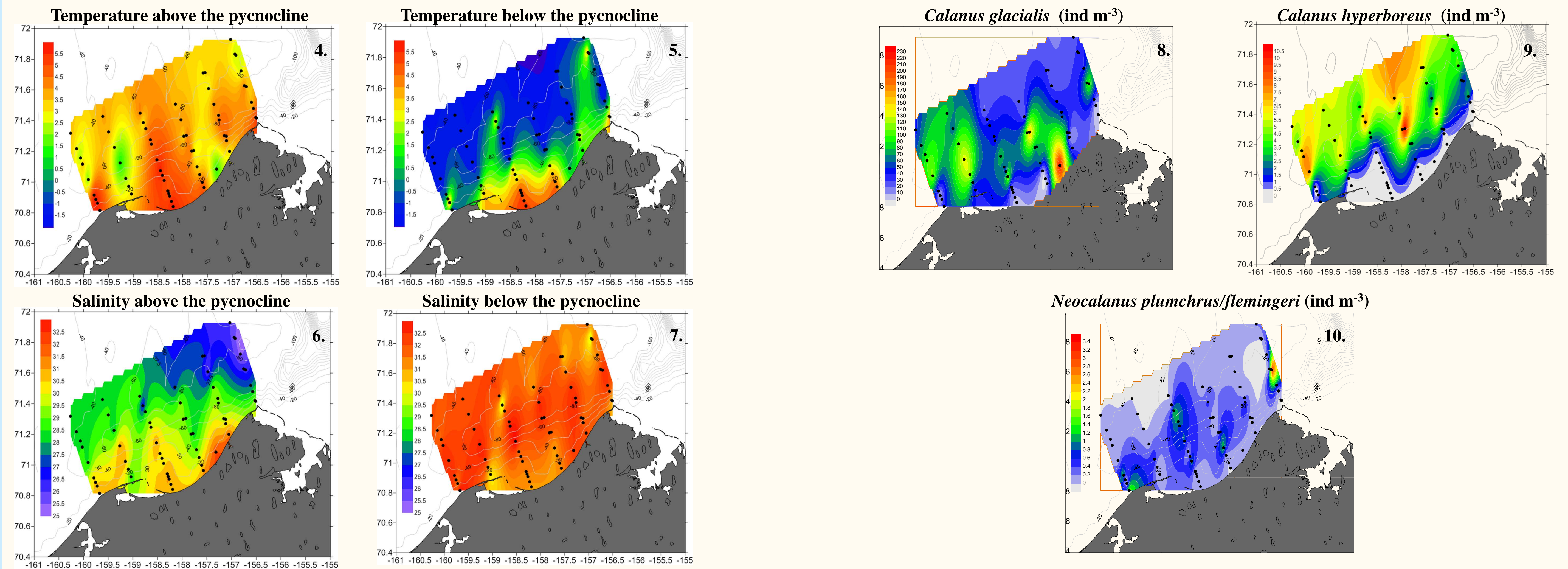
Calanus glacialis



Calanus hyperboreus

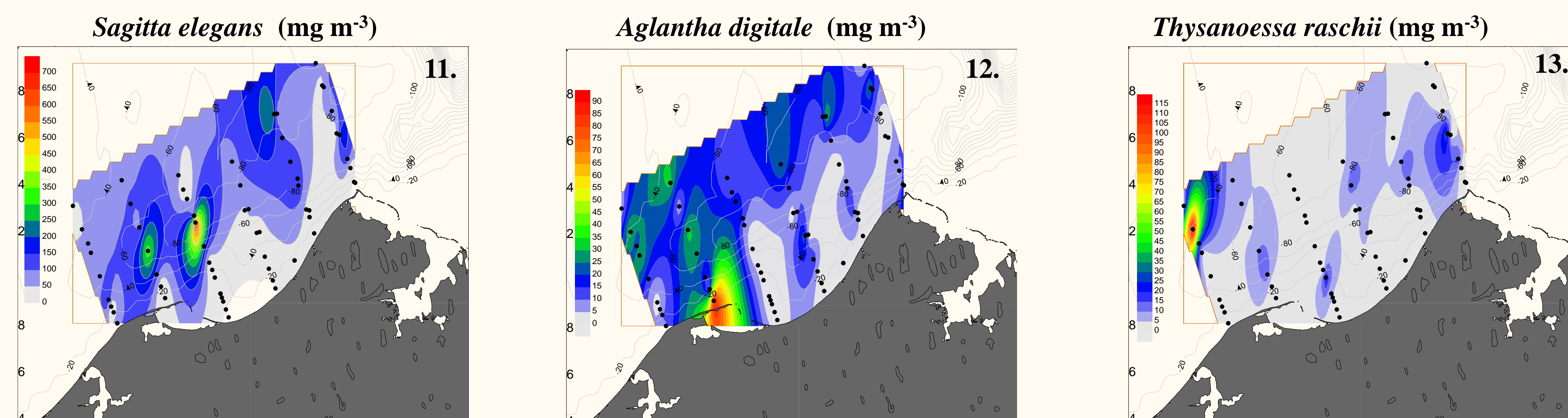


Population structure of *Calanus* species: Stage-specific composition differed between the two *Calanus* populations. *Calanus glacialis* (Figure 2.) population was presented by later copepodite stages in nearly equal proportion indicating a prolonged spawning and growing season. In contrast, *C. hyperboreus* (Figure 3.) population was dominated by C4 copepodite stage. *C. hyperboreus* originates from the Arctic basin where it typically overwinters at C4 stage. It is not clear if *C. hyperboreus* copepodites observed in this study were ready to enter the winter diapause or if they continued growing.



Temperature (°C) and Salinity (PSU) above and below the pycnocline: The offshore area was substantially stratified with cold (<0°C) saline layer underlying relatively thin (15-20 m) warm and low-saline surface layer (Figures 4, 5, 6 and 7.) . A surface intrusion of brackish water was observed in the northeast of the study area (Figure 6.) . In contrast, the nearshore area was well mixed with warm moderately saline water, which may create favorable conditions for small neritic zooplankton production.

Spatial distribution of copepod taxa of different origin: *Calanus glacialis*, (Figure 8.) a common inhabitant of the arctic continental shelf, occurred over the entire study area forming denser aggregations in areas of apparent increased vertical mixing as indicated by patchy areas with moderately cool (1 to 3°C) and moderately saline (29 to 32) water . In contrast, *C. hyperboreus*, (Figure 9.) which populate the Arctic basin, appeared to be confined by extent of the cold near-bottom layer, reaching nearshore in the southwest. The Pacific *Neocalanus* species (Figure 10.) were associated with warm and moderately saline surface water.



Spatial distribution of soft-bodied zooplankton and euphausiids: A chaetognat *Sagitta elegans* and hydrozoan jellyfish *Aglantha digitale* (Figures 11 and 12.) showed similar distribution generally staying offshore and accumulating most biomass in the western part of the study area. Euphausiid *Thysanoessa raschii* (Figure 13.) formed occasional aggregations at some stations without any clear pattern.

Conclusions:

1. While common shelf species *Calanus glacialis* and *Sagitta elegans* dominated zooplankton biomass in the study area, substantial amount of Arctic taxa originated from the Arctic basin were recorded in vicinity of the coast.
2. It appears that the distribution of Arctic taxa as exemplified by *Calanus hyperboreus* is driven by the extent of the cold near bottom layer on the arctic shelf.
3. The majority of zooplankton biomass over the study period were located in the relatively shallow water in the west.
4. The combination of two lipid-rich *Calanus* species is likely to provide a favorable feeding environment for planktivorous fish such as Arctic Cod.

Acknowledgements

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