**Title:** Atlantic walrus signal latitudinal differences in the long-term decline of sea ice-derived carbon to benthic fauna in the Canadian Arctic

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**Trophic position equations**

We estimated trophic position for each individual using three commonly-used published equations that utilize trophic-source amino acids pairs of glutamic acid (Glu) and phenylalanine (Phe) and a combination of single- and multi-trophic discrimination factors (TDF). Both amino acids are used in the most commonly applied trophic position equation of Chikaraishi et al. (2009):

 $ TP=1+ \left\{\frac{δ^{15}N\_{Glu}-δ^{15}N\_{Phe}- β}{TDF\_{Glu-Phe}}\right\}$ (1)

where δ15NGlu and δ15NPhe represent the stable isotope nitrogen values of glutamic acid and phenylalanine of the consumer, β represents the difference in δ15NGlu and δ15NPhe of primary producers (3.4‰; McLelland & Montoya, 2002) and TDFGlu-Phe represents the constant trophic discrimination factor between diet and consumer at each trophic step (7.6‰; Chikaraishi et al., 2009). Germain et al. (2013) developed a multi-TDF approach that incorporates a seal-specific TDF estimated from controlled feeding experiments on harbour seals (*Phoca vitulina*):

 $TP=2+ \left\{\frac{δ^{15}N\_{Glu}-δ^{15}N\_{Phe}- TDF\_{Glu-Phe}}{β}\right\}$ (2)

where most variables and values are the same as described in equation (1) except for TDFGlu-Phe which is a seal-specific TDF value of 4.3‰ (Germain et al., 2013). McMahon et al. (2015, 2019) also developed a multi-TDF approach estimated from captive gentoo penguins (*Pygoscelis papua*) during a controlled feeding trial:

 $TP=2+ \left\{\frac{δ^{15}N\_{Glu}-δ^{15}N\_{Phe}- TDF\_{Glu-Phe}-β}{TDF\_{\left(Glu-Phe\right) average}}\right\}$ (3)

where most variables and values are similar to equations (1) and (2) except for TDFGlu-Phe which is specific to penguins (3.5‰) and an additional variable, TDF(Glu-Phe) average which represents an average TDF of 6.3‰ characteristic of planktonic marine food webs (McMahon & McCarthy, 2016; McMahon et al., 2019).

For both Jones Sound and Foxe Basin Atlantic walruses, equation (1) produced lower trophic position estimates (range = 1.9 – 2.3) by approximately 1 trophic level compared to equation (2) (range = 2.8 – 3.2) and approximately 0.5 to 1 trophic level compared to equation (3) (range = 2.5 – 3.0). Trophic position estimates ranging from 1.9 – 2.3 is unrealistically low for a species known to forage upon bivalves that are primary consumers who therefore occupy a trophic position of 2. Equations that use a universal trophic discrimination of 7.6‰ (Chikaraishi et al. 2009) have typically underestimated trophic position estimates for upper trophic level predators such as large bony fish (Lorrain et al., 2015), sharks (Hussey et al., 2015), seabirds (McMahon et al., 2019) and marine mammals (Matthews & Ferguson, 2014; Matthews et al. 2020). Atlantic walrus are generally secondary consumers, and as such, equation (2) and (3), which use a multi-trophic discrimination factor, estimated more-realistic trophic positions ranging from 2.8 – 3.2 and 2.5 – 3.0, respectively. Within each equation, the estimated trophic positions of Atlantic walrus were similar between Jones Sound and Foxe Basin with no changes occurring over time.

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