Trophodynamics of krill and its potential role in blue whale feeding in the Perth Canyon, south-east Indian Ocean

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Blue whales migrate along the WA coast and feed on krill within the Perth Canyon ¹,²,³

More than 30 species of krill occur in the region ⁴,⁵

*Euphausia recurva* is one of the most abundant species ¹,⁴,⁵

The importance of krill in marine food webs has led to a number of trophodynamic studies investigating their fatty acid and stable isotope compositions ⁶,⁷,⁸,⁹

To relate biochemical data obtained for *E. recurva*, as well as *Stylocheiron carinatum* and *Pseudeuphausia latifrons*, with their potential food source, phytoplankton, and one of their potential predators, the endangered pygmy blue whale (*Balaenoptera musculus brevicauda*), sampled in the Perth Canyon.
Sample collection

- Zooplankton samples collected with a surface net on board R.V. Whale Song, April 2014
- *E. recurva*, *P. latifrons* and *S. carinatum* identified and frozen
- Phytoplankton samples obtained by filtering seawater
- Biopsy sample obtained from a pygmy blue whale

Stable isotopes

- Krill analysed for δ\(^{15}\)N and δ\(^{13}\)C
- Analysed at the West Australian Biogeochemistry Centre (WABC)

Lipids and fatty acids

- Modified Bligh and Dyer (1959) method
- Obtained lipid classes and fatty acid composition for krill, phytoplankton and blue whale outer blubber layer
All krill had high polyunsaturated fatty acids (PUFA) (~50%), particularly omega-3 PUFA.

The high DHA : EPA ratio reflected a dinoflagellate diet rather than a diatom diet.

High oleic acid (18:1ω9) : vaccenic acid (18:1ω7) ratio is indicative of an omnivorous diet.

Stable isotopes positions *E. recurva* as a first, possibly second order consumer (5.8 - 8.4 δ¹⁵N) and phytoplankton as the likely source of carbon (-18 to -24 δ¹³C).
Krill fatty acid profiles did not match that of the surface phytoplankton sampled.

Phytoplankton low in PUFA and more reflective of degraded and detrital material.

Pygmy blue whale outer blubber layer was high in monounsaturated fatty acids (MUFA) (58%) rather than PUFA.

Did not accurately reflect the krill fatty acid composition.

High DHA : EPA ratio in blubber indicates a diet originating from dinoflagellates, as for krill.
Discussion

• High PUFA, particularly omega-3 PUFA, is typical for krill species

• *E. recurva* has fed on diatoms, dinoflagellates, formaniferans and crustaceans in the western North Pacific\(^\text{10}\)

• Krill may be feeding at the deep chlorophyll maximum, rather than surface waters

• Phytoplankton are often restricted to the deep chlorophyll maximum (50 - 120 m) off WA in autumn\(^\text{11,12,13}\)

• Smaller phytoplankton dominate off WA which is typical of a microbial food web and oligotrophic conditions\(^\text{1}\)

• Stratification in FA composition is evident across the depth of marine mammal blubber, the inner layer is thought to be a better indicator of prey than outer blubber layer\(^\text{14,15,16}\)

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\(^\text{10}\) Suh & Choi 1998; \(^\text{11}\) Hanson 2004; \(^\text{12}\) Hanson *et al.* 2005; \(^\text{13}\) Koslow *et al.* 2008; \(^\text{14}\) Hooker *et al.* 2001; \(^\text{15}\)Koopman *et al.* 1996; \(^\text{16}\)Olsen & Grahl-Nielsen 2003