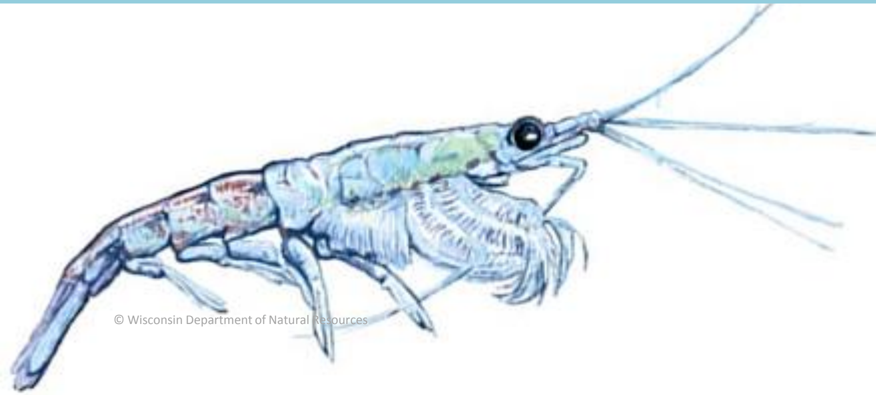
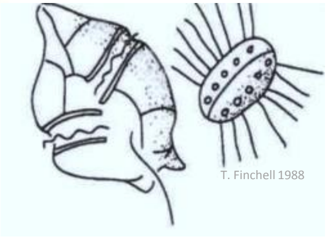
# Trophodynamics of krill and its potential role in blue whale feeding in the Perth Canyon, south-east Indian Ocean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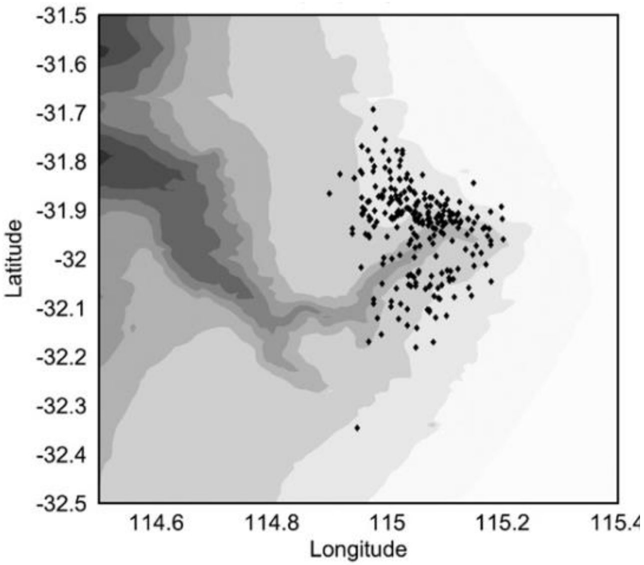
# Perth Canyon




Boat survey sightings of pygmy blue whales; Rennie et al. (2009)

- 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]

# Aim

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.

[1] Rennie et al. 2009; [2] Branch et al. 2007; [3] McCauley et al. 2004; [4] Sutton et al. 2015; [5] Sutton & Beckley, *submitted*; [6] Falk-Peterson et al. 2000; [7] Virtue et al. 1995; [8,9] Schmidt et al. 2003,2006

# 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 were obtained by filtering seawater
- Biopsy sample obtained from a pygmy blue whale

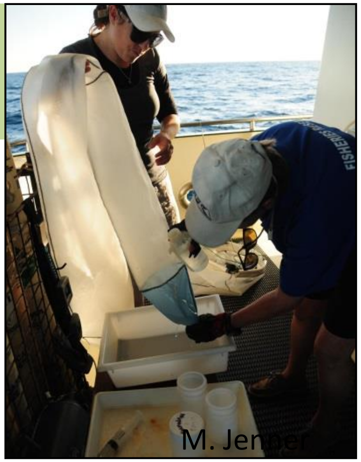

## Stable isotopes

- Krill analysed for $\delta^{15}N$ and $\delta^{13}C$
- 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

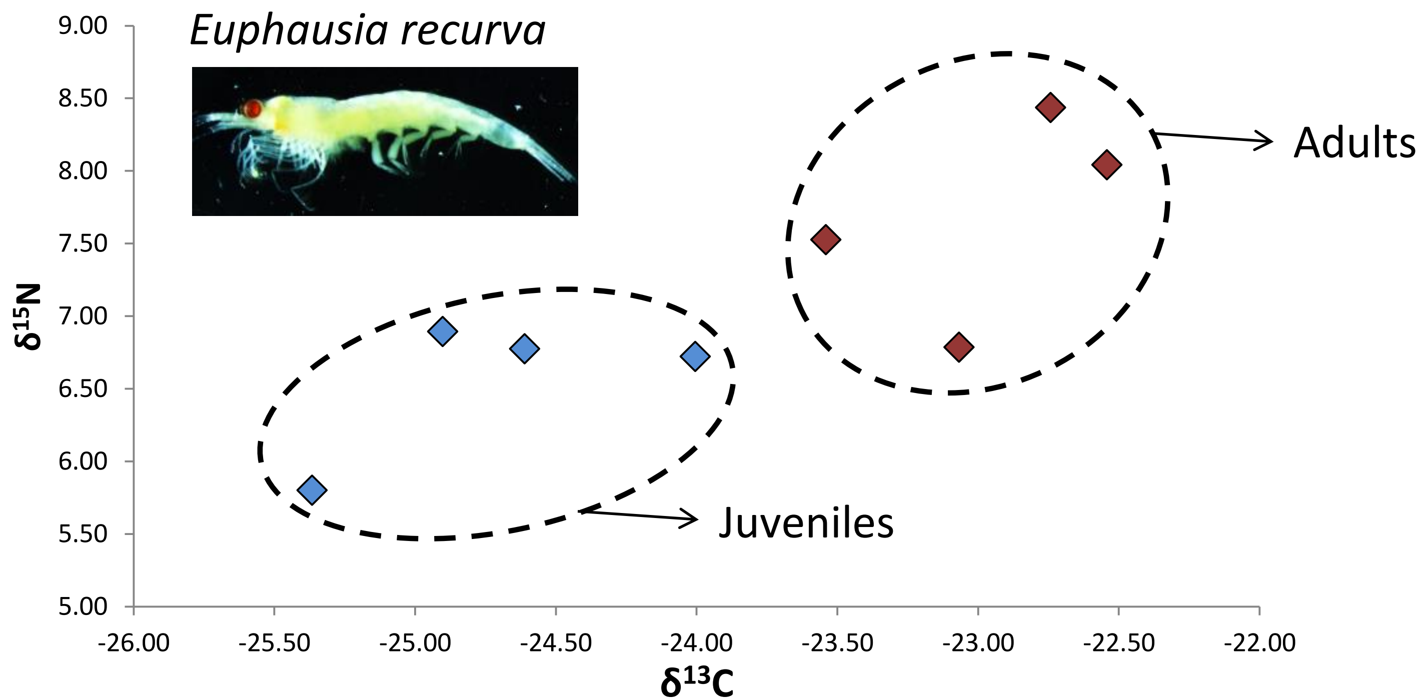



# Krill fatty acids and stable isotopes

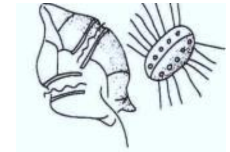
- All krill had high polyunsaturated fatty acids (PUFA) (~50%), particularly omega-3 PUFA
- The high DHA : EPA ratio reflected a dinoflagellate diet rather than a diatom diet

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

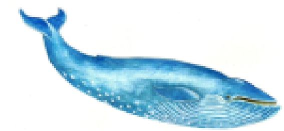
- Stable isotopes positions *E. recurva* as a first, possibly second order consumer (5.8 - 8.4 $\delta^{15}N$) and phytoplankton as the likely source of carbon (-18 to -24 $\delta^{13}C$)



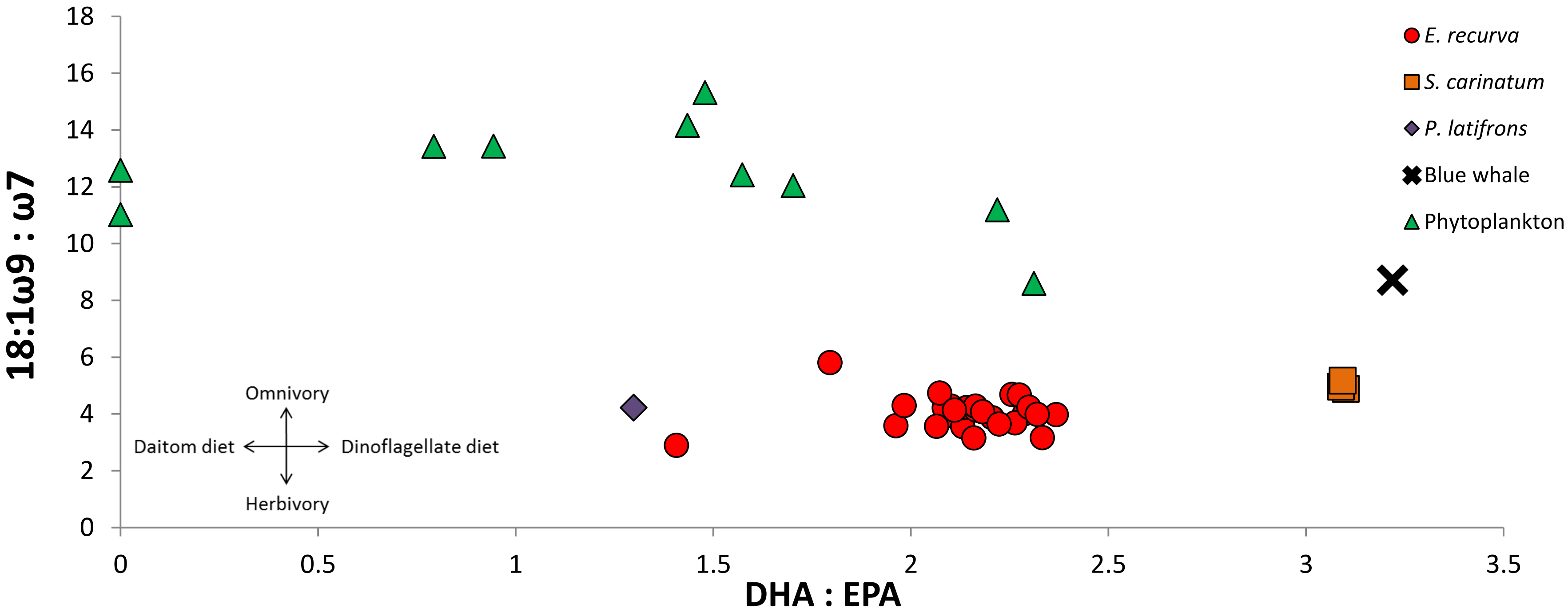
# Phytoplankton and blue whale fatty acids



- 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[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[11,12,13]
- Smaller phytoplankton dominate off WA which is typical of a microbial food web and oligotrophic conditions[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[14,15,16]


## Acknowledgements

- ANZ Holsworth Wildlife Grant, WABC, Max Wellington, Lara Marcus, Peter Mansour, Eric Raes



[10] Suh & Choi 1998; [11] Hanson 2004; [12] Hanson *et al*. 2005; [13] Koslow *et al*. 2008; [14] Hooker et al. 2001; [15] Koopman et al 1996; [16] Olsen & Grahl-Nielsen 2003