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Are rock lobster larvae gourmets or gluttons?

Neither! New research suggests that larvae live in a nutritional poorhouse

By Anya M. Waite (University of Western Australia)

At the start of our study on lobster larval nutrition in the eastern Indian Ocean, we originally posed the question "Are Rock Lobster larvae gourmets or gluttons?", but initial results suggest that except for when rock lobster larvae find tidbits of their favourite food, they are in fact living on the nutritional equivalent of gruel in the poorhouse. The FRDC-funded project "*Biological Oceanography of Western Rock Lobster Larvae*" (2010-2013) has yielded some key new insights into how the Westerns' larvae, the *phyllosoma*, feed in the wild.

Our first published journal paper, in the international journal *PLoS One* (Saunders *et al.*, 2012), indicated that late stage phyllosoma have a marked preference for arrow worms, or chaetognaths (Fig. 1), above other prey such as krill and salps. However the prey field suggests that they may contact chaetognaths only rarely (Säwström et al., in preparation). Further, genetic analyses indicate that many phyllosoma are in fact starving, such that prey densities may be critical determinants of phyllosoma health (O'Rorke *et al.*, 2012). Between high-quality prey encounters, surprisingly, phyllosoma have been recorded to

consume animals that may not have great nutritional value, such as colonial radiolarians. This is the first time these organisms have been detected as phyllosoma prey.

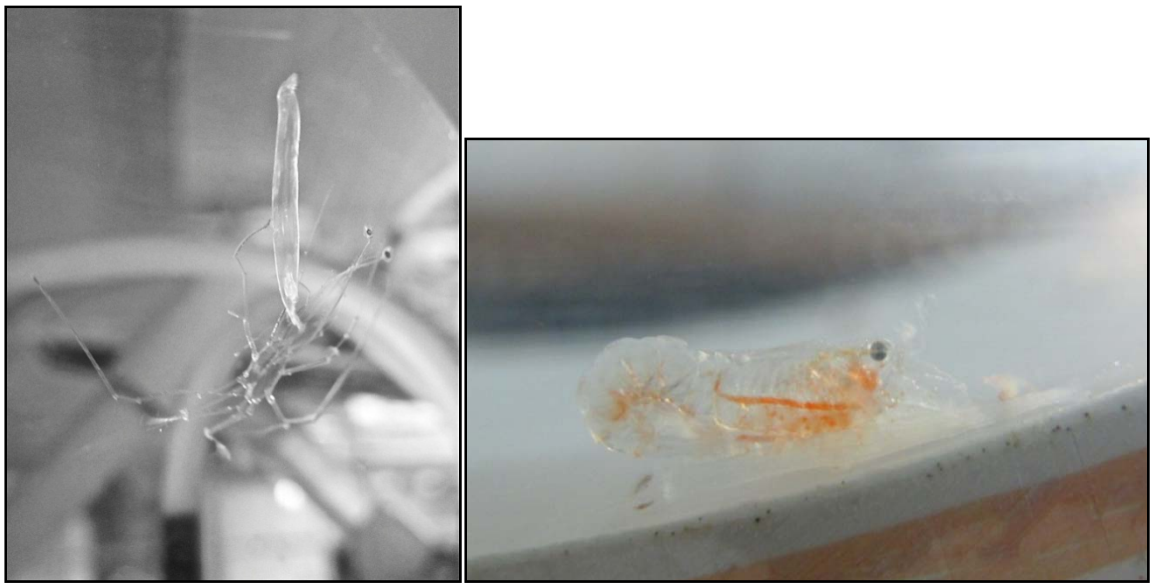

Figure 1. Left: *Freshly caught phyllosoma ingesting their favourite food, an arrow worm, or chaetognath, at sea July 2010.* ***Right****: newly hatched puerulus emerged from stage IX phyllosoma in ship-board tank, July 2010. Field of view is approximately 6 cm in width. Photos: Megan Saunders.*

Cruises in July 2010 and August/September 2011 targeted waters from 111^{o} E to 115^{o} E and from 28^{o} to 33^{o} S. We found phyllosoma at the surface (primarily at night) in almost all waters west of the core flow of the Leeuwin Current (which moves along continental shelf break). We have noticed that Leeuwin Current waters forms thin warm layers on the ocean surface, sometimes reaching far offshore. Beneath this warm layer is salty warm water from the central Indian Ocean, only slightly cooler than the Leeuwin Current itself. Surges and instabilities in the Leeuwin Current moving against the rotation of the earth set water in wide circular motion forming rotating water masses known as eddies which can be up to 200 km in diameter and last for up to a year as they move slowly west across the Southern Indian Ocean. The eddies can impact concentration of prey for phyllosoma.

It is into this complex ocean system that the phyllosoma are released, and here they must make a living. Our work has illuminated that phyllosoma of the Western Rock Lobster are likely to be strongly food limited, and that fluctuations in the ambient prey field will

have a major impact on their nutritional state as they move shoreward to settle as puerulus on Western Australian coastal reefs.

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Journal Papers:

O'Rorke, R., Lavery, S., Chow, S., Tsai, P., Beckley L.E., Thompson, P.A., Waite A.M. & Jeffs. A.G. Determining the diet of larvae of Western Rock Lobster (*Panulirus cygnus*) using high-throughput DNA sequencing techniques, *PLoS ONE,* **7(8)**, e42757. doi:10.1371/journal.pone.0042757

Saunders, M.I., Thompson, P.A., Jeffs, A.G., Sawstrom, C., Sachlikidis, N., Beckley, L.E. & Waite, A.M. 2012. Fussy Feeders: Phyllosoma Larvae of the Western Rocklobster (*Panulirus cygnus*) Demonstrate Prey Preference. *PLoS ONE* **7(5)**, e36580. doi:10.1371/journal.pone.0036580

Säwström, C., Saunders, M.I., Waite, A.M., Thompson, P.A. & Beckley, L.E. Dynamic zooplankton prey field in the SE Indian Ocean; linkage with oceanography and relevance to *phyllosoma* larvae, *Panulirus cygnus* distribution. ***In manuscript***.