Too cold to eat

Kelly Boisvert, Tufts University

Whitman, K. L., J. J. McDermott, and M. Scott Oehrlein. 2001. Laboratory studies on suspension feeding in the hermit crab *Pagurus longicarpus* (Decapoda: Anomura: Paguridae). *Journal of Crustacean Biology* 21: 582-592.

Hermit crabs (*Pagurus longicarpus*) are an omnipresent scavenger throughout New England intertidal zones and play an important role in detritus removal and nutrient cycling. Despite their commonality, few studies have focused on how environmental factors affect feeding rates in *P. longicarpus.* Whitman et al. (2001) sought to address such gaps by examining the impact of temperature on feeding rates in *P. longicarpus* (Figure 1). In this study, adult hermit crabs were allowed to feed on planktonic nauplii of the brine shrimp, *Artemia spp.*

Specimens of *P. longicarpus* were collected from wild populations along the New Jersey coast. Upon return to the lab, the hermit crabs were removed from their shells, sexed, and starved for at least one day prior to experimentation. Although sex and the presence or absence of a shell had no statistically significant impact on feeding rates, only unshelled males (n=69) were used to assess the influence of temperature. These individuals were acclimated to their treatment temperature for at least 20 hours prior to the start of the experiment. Each hermit crab was then provided with 200 freshly hatched *Artemia* nauplii (brine shrimp) and allowed to feed freely. Individuals at 13°C (n = 14), 20°C (n = 30), and 30°C (n = 14) were allowed 5 minutes to feed. Individuals at 6°C (n = 11) were allowed 20 minutes to feed in order to compensate for slowed movements at such a reduced temperature.

Figure 1 demonstrates the relationship between ambient temperature and the mean number of *Artemia* nauplii consumed per minute of feeding opportunity. **The researchers found that increased temperature led to a significantly increased feeding rate up to 20°C, but that feeding rates failed to increase, and may have begun to decline somewhere between 20 °C and 30 °C**. Preliminary data from 12 hermit crabs (not graphed) found a drastically reduced feeding rate of 7.9 ± 7.8 SD *Artemia* nauplii per min when tested at 33 °C. This decrease in feeding rate was accompanied by a notable increase in mortality, strongly suggesting that the hermit crabs were experiencing severe thermal stress at these higher temperatures.

This relationship between temperature and feeding rates in *P. longicarpus* has important implications for evaluating the impacts of climate change on hermit crab populations and those of their prey. If warmer water increases feeding rates and the hermit crabs are predating on planktonic larvae in the field (as found by Whitman et al. 2001, but not discussed here), warmer ocean water may increase the predation rates on these larval prey species, exacerbating the impact of climate change on prey species.

Note that this study was performed in a laboratory with no opportunity for hermit crabs to escape the elevated temperatures. Individuals of *P. longicarpus* in the wild are known to travel to deeper waters during the winter, and might conceivably do so at elevated temperatures as well, thereby possibly reducing the influence of seasonal temperature changes on feeding rates. Further research is needed to evaluate how such behavioral responses influence the feeding rates of *P. longicarpus* and their impact on their community.

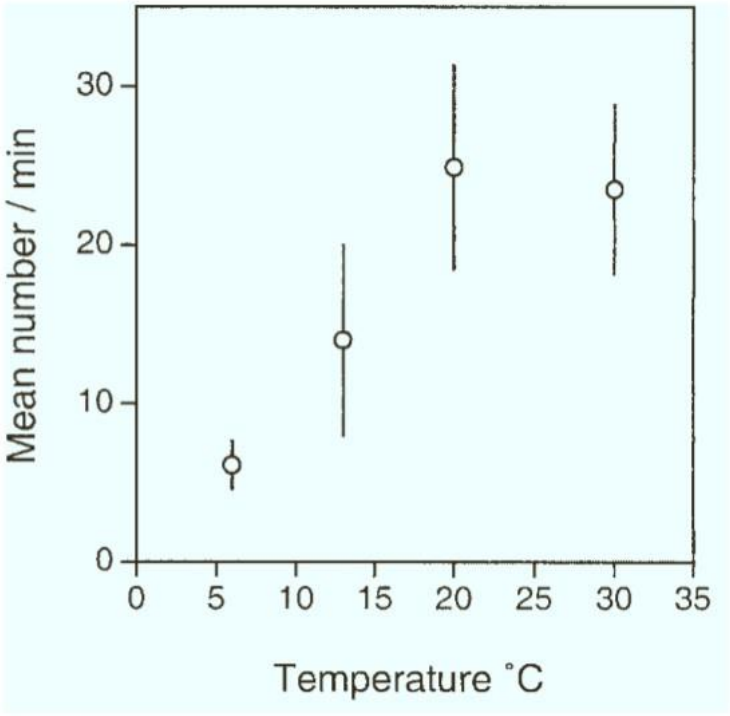

Fig. 1. The effect of water temperature at 6°, 13°, 20°, and 30°C on the mean number (± 1 SD) of *Artemia* nauplii consumed by *Pagurus longicarpus*.