Mole Crabs: Silent Killers?

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Introduction

Pacific Mole Crabs (*Emerita analoga)* are one of the most important and abundant invertebrates in the sandy beach ecosystem. They are a vital link in the food chain because they are a primary food source for many shorebirds, fishes, and marine mammals (Oliva *et al.* 2008). Mole crabs are found in the swash zones (wet sand) from Alaska to Baja California (Barnes and Wenner 1968). Their legs and uropods have hairy margins for filtering their food from the ocean (Fig. 1). This crustacean is an intermediate host for *Profilicollis altmani,* a parasite within the phylum Acanthocephala (thorny-headed worms). Mole crabs accidentally filter the eggs of these parasites along with their food (Oliva *et al.* 2008). Eggs (cystacanths) encyst in the coelum of the crab. After the mole crab is ingested by the definitive host (e.g. a fish or a bird) the eggs excyst and attach to the lining of the gut (Fig.2, Garey 1996). In the host the parasite reproduces in the digestive system and the eggs are defecated into the ocean, allowing the cycle to continue (Thompson 1985).

There is evidence that *Profilicollis altmani* is contributing to deaths of the southern sea otter (*Enhydra lutrisnereis*) and is known to infect, and increase mortality of other vertebrates. Purposes of this study are to (a) examine the abundance of crabs at high tide and low tide, (b) investigate the effects of the warm water released from the power plant on crab abundance, and (c) examine parasite loads across the sexes and size class.

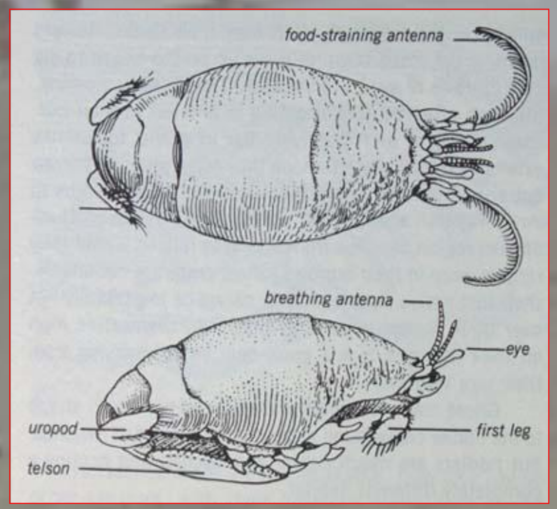

Fig. 1 Diagram of Pacific Mole Crab

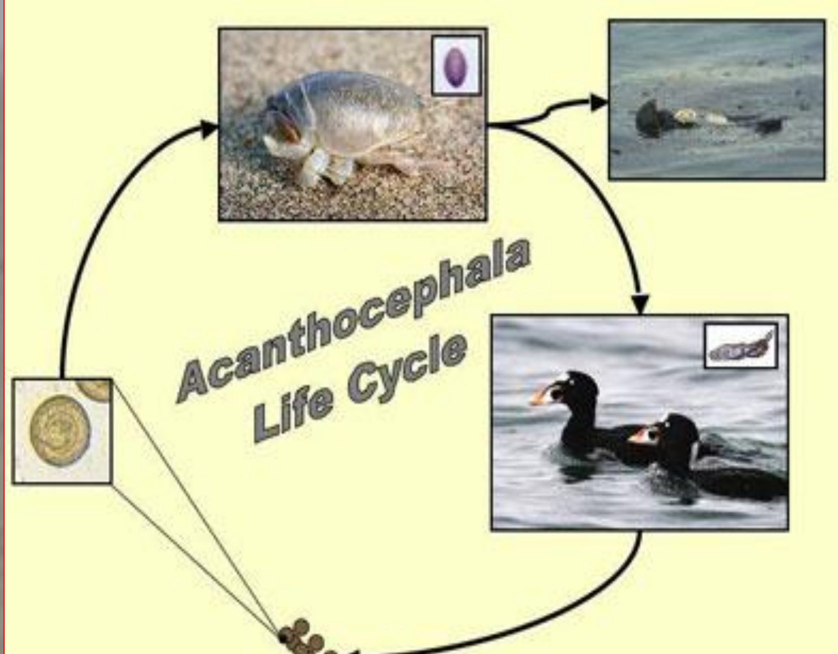

Fig.2

Study Site

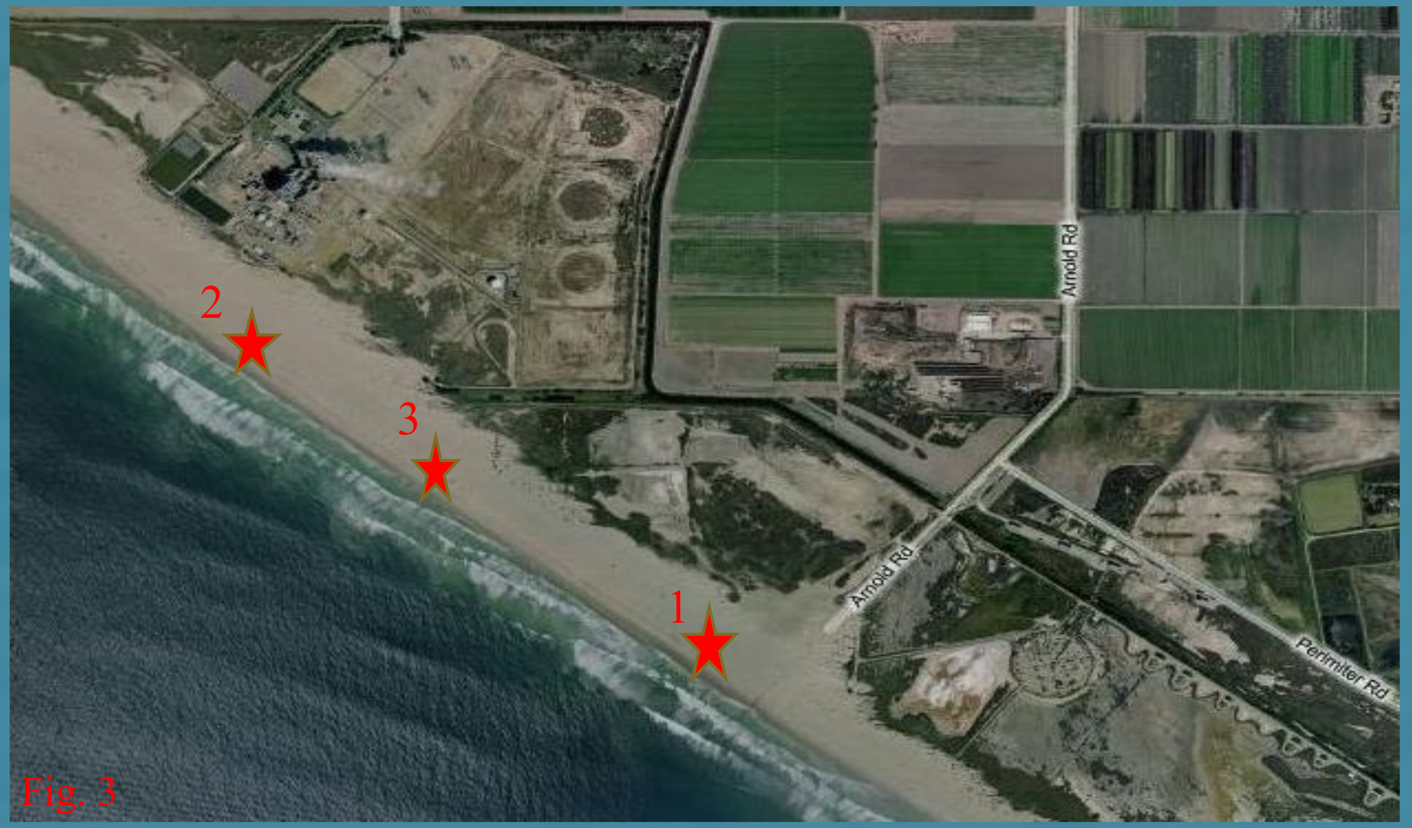

Fig. 3

Questions

1. Is the sex ratio of crabs equal?
2. Was there a difference in abundance of crabs between low and high tide?
3. Was there a difference in abundance of crabs in front of the power plant?
4. What is the parasite load?
5. Is there a correlation between carapace length and parasite load?

Methods

We collected our samples of mole crabs from Ormond Beach, California from three study sites (Fig. 3). Fifty samples were taken from transect lines covering an area of 100sq/m within the swash zone. The samples were taken, using shovels, in four days over a three-week period in May and June. Sand was sieved using 5mm mesh in the base of a bucket. Mole crabs were sexed, measured, recorded, and 30 per day were taken and frozen for later analysis in the lab. The mole Crabs were dissected and numbers of cystacanths recorded. Data was entered into Excel and PASW for analysis.

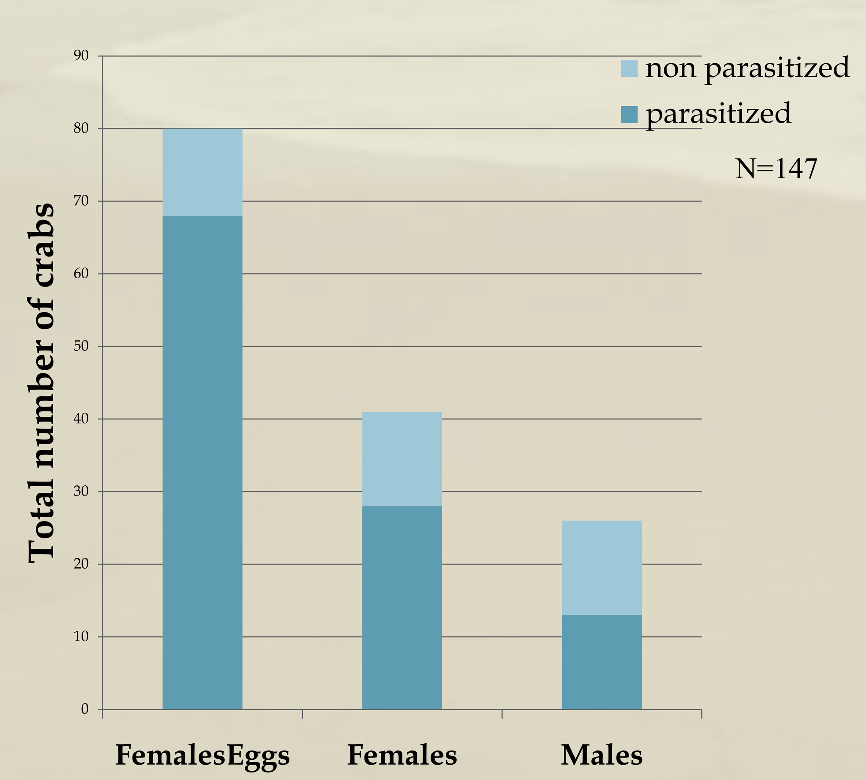

Fig. 4 Numbers of parasites by sex class

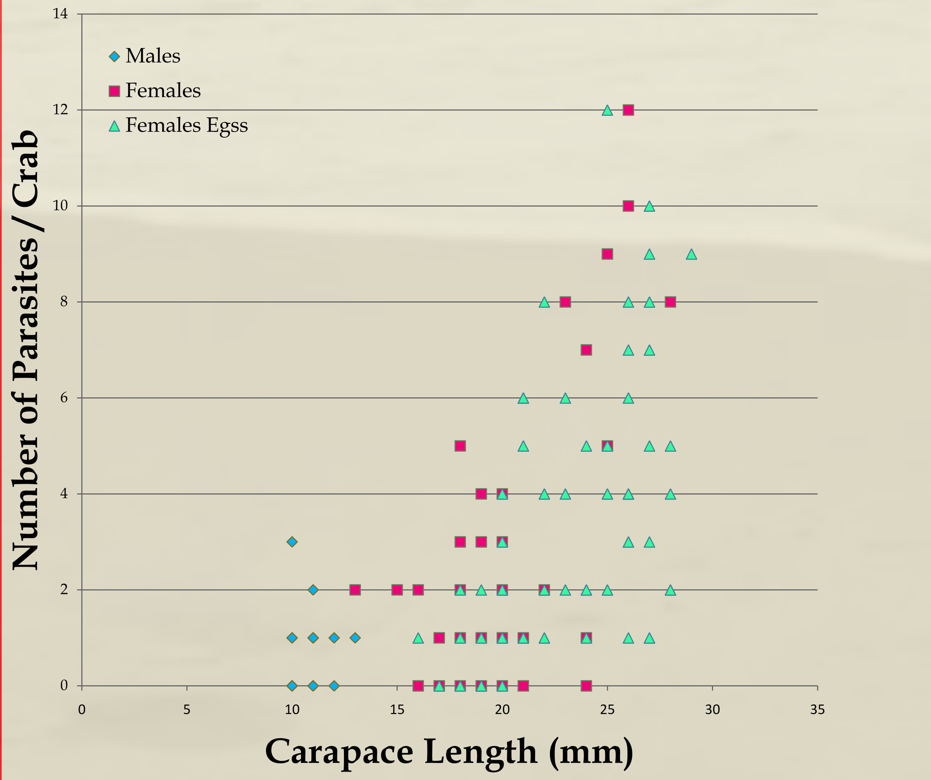

Fig. 5 Relationship between carapace length and parasite load

Results

We found a skewed sex ratio of approximately 1 male : 5 females (Fig. 4). There were significantly more crabs at low tide (χ^2, $P = 0.000$). There was no difference in abundance of crabs in front of the power plant (study site # 2) compared to the other two sites. Each crab had an average load of 2.49 parasites. The range of eggs per crab was between 0-12; 74% of all crabs were parasitized ($n = 147$). Parasite load differed between the sexes; there were 0.61 parasites per male, 2.56 for females, and 3.07 for females with eggs. There was a significant difference in carapace length between females with no eggs and females with eggs (Mann Whitney U = 867, $P = 0.000$). A strong correlation was found between carapace length and parasite load (Spearman rho $r_s = 0.648$, Fig. 5). As the size class increased the parasite load increased (Fig. 6 and 7).

Fig. 6 Average number of parasites per size class

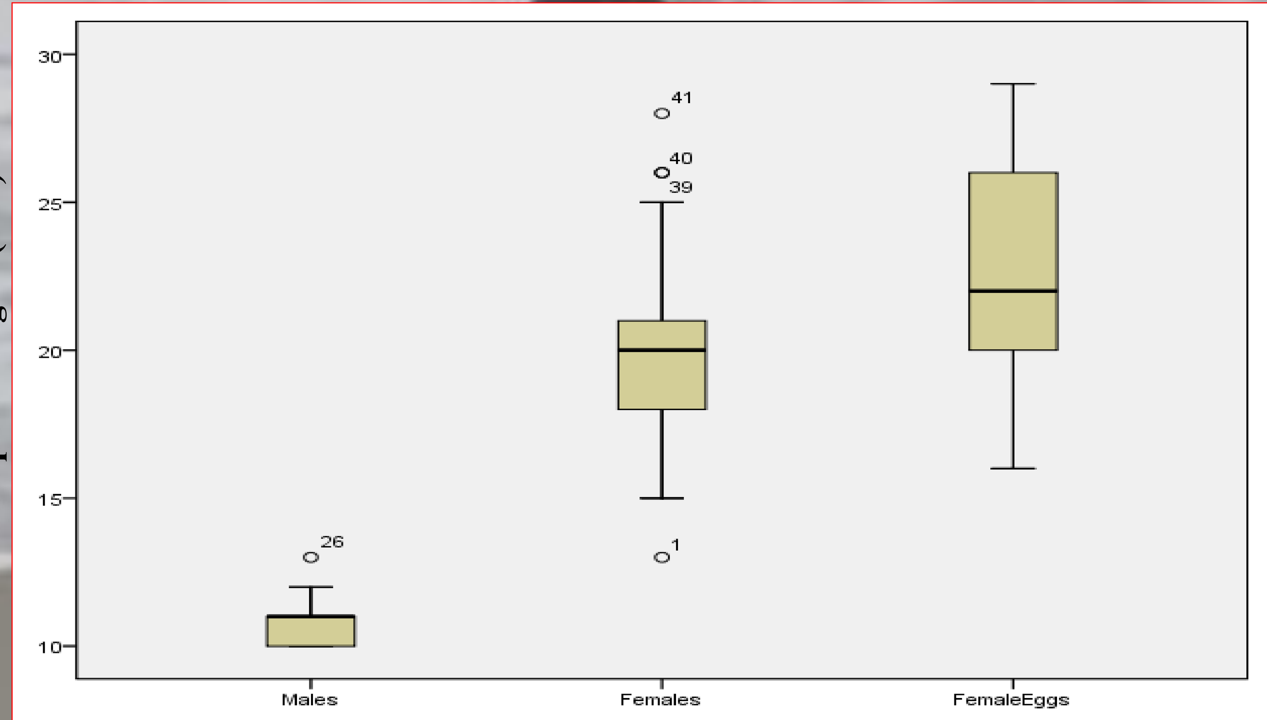

Fig. 7 Carapace length for males, females, and females with eggs

Discussion

Small crabs are probably at an advantage being male because it is less costly to produce sperm than eggs. Conversely, females need to be large because its more energetically expensive to produce eggs. It has been suggested that these organisms are sequential hermaphrodites, but to date there is no evidence to show this. Size differences between males and females may be explained by differential growth rates. Predator pressure from shore birds may explain why there is greater abundance of crabs lower down in the swash zone. However, if the crabs migrate into the deeper waters they become more susceptible to aquatic predators. For further investigation we would take monthly samples over several years to capture the seasonal variation of this species. Also sampling at different beaches would give a better understanding of spatial variation.

References

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