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Introduction to the first symposium on the biology of the parasitic Crustacea

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The parasitic Crustacea represent a diverse group with members in several classes and orders, including the Cirripedia, Isopoda, Amphipoda, Branchiura, Copepoda, Tantulocarida, and Pentastomida. Their biology is as diverse as their morphological and phylogenetic disparity would indicate, and includes egg mimicry, parasitic castration, host feminization, epigametic sex determination, venomous secretions, and bizarre adaptations of the life cycle. However, convergent adaptations to the parasitic lifestyle are common and must be considered when studying the evolution of the organisms, their behaviors, and morphological modifications. Recently, there have been several important papers on the evolution of parasitic crustaceans, but most of these have covered narrow groups, such as the Rhizocephala (e.g. Høeg 1995, Schram & Høeg 1995, Høeg and Lutzen 1996) and the parasitic copepods (e.g. Huys and Boxshall 1991, Ho 2001, Boxshall 2004). Additional papers have highlighted interesting biological attributes of specific parasitic groups, such as polyandry in sea lice (Todd et al. 2005), host preferences, and ecological effects in nicothoid copepods (e.g. Shields et al. 2006 for a review of those on lobsters), and even the effects of climatic warming on species of *Argulus* (Hakalahti et al. 2006). Such papers have provided new data and new ways of looking at these organisms that give insights into questions about their broader biology.

Given the continued interest in the adaptations of parasitic crustaceans, as well as in the effect of these organisms on important aquaculture and fishery species, we organized a symposium at the Society for Comparative and Integrative Biology (SICB) meeting in Boston for 2009, to provide a reference point for broader discussions on the topic. The symposium was structured with topics in evolution, life history, molecular biology, and pathology. As far as we know, there have been no other symposia devoted entirely to the parasitic Crustacea; thus, the First Symposium on the Biology of the Parasitic Crustacea was held at the SICB Annual Meeting, in Boston, January 4–5, 2009. However, it is important to note that there have been several specialized symposia on diseases of Crustacea (Symposium on Diseases of Commercially Significant Crustaceans, International Crustacean Conference VI, Glasgow, 2005; The Biology of the Rhizocephala, The Crustacean Society Annual Meeting, Williamsburg, 2003; Diseases of Crustacea, National Shellfisheries Association Annual Meeting, Mystic, 2002; as well as several on viral infections in shrimp) and a few symposia on specific taxonomic groups such as the parasitic copepods of fishes (e.g. Symposium on the Parasites of Fishes and Other Aquatic Organisms, IX European Multi-colloquium of Parasitology, Valencia, 2004; V International Symposium on Fish Parasites, České Budějovice, 1999; Sea lice and Other Parasitic Copepoda, 1st European Crustacean Conference, Paris, 1992). Hence, our attempt to encompass a broader view of parasitism across the Crustacea was timely and provided an opportunity for experts in diverse taxa to compare and contrast questions broadly between systems.

The program for the symposium was organized around different taxonomic groups. There were 11 primary papers in the symposium and five in a complementary session. Several of the papers were reviews of the existing literature. The papers given were:

Main session

- Boyko CB, Williams JD. Parasites as phylogenetic indicators in decapod evolution (This talk was a

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last minute substitution for the scheduled presentation "Bopyrids of the thalassinidean transition: first phylogenetic data and evolutionary implications," when that project ran afoul of issues of insertions in the isopod DNA).

- Ho J-S. The five wonders of the parasitic Copepoda.
- Boxshall GA. The comparative biology of Copepoda parasitic on three host taxa: fishes, polychaetes, and crustaceans.
- Costello MJ. Progress in understanding the ecology of sea lice, copepod parasites of wild and farmed salmonids.
- Heuch PA, Bjorn PA, Finstad B, Asplin L, Holst JC. Salmon lice infection of farmed and wild salmonids in Norway: an overview.
- Kolbasov GA. Parasitic microcrustaceans of the class Tantulocarida, external and internal morphology, development, and life circle.
- Moeller OS. Branchiura - parasitic crustaceans with a sting.
- An J. A review of bopyrid isopods infesting crabs from China.
- Huys R and Llewellyn-Hughes J. What can 18S rDNA do for copepod phylogeny and classification?
- Tanaka K. Life history of gnathiid isopods: a brief overview.
- Overstreet RM, Jovonovich J, Ma H. Parasitic crustaceans as vectors of viruses.

Complementary session

The symposium generated a complementary session with five additional papers on parasitic isopods and rhizocephalans.

- Shields JD, Miller TL, Boyko CB. A first look at the phylogeny of the Entoniscidae.
- Asakura A, Imazu M. Occurrence of the rhizocephalan and isopod parasites on three intertidal hermit crabs in Japan.
- O'Brien JJ. Factors affecting the distribution and infection success of two North American sacculinids (Rhizocephala).
- Williams JD, An J. First report of *Orthione griffenis* Markham, 2004 (Isopoda: Bopyridae: Pseudioninae) from China and comparison with types specimens and collections from the west coast of the United States.
- Mcdermott JJ. Hypersymbioses in the pinnotherid crabs (Decapoda: Brachyura: Pinnotheridae): a review.

These presentations were well-attended and generated lively discussions in several breakout sessions. Four of these presentations, by Kolbasov, An, Williams, and An, and Overstreet, are represented by papers in this volume. Taken together, these papers give an excellent sense of the diversity of talks presented at the symposium, ranging from basic taxonomy to biogeographic issues, from questions about species introductions to developmental and life-cycle issues, and include concerns about parasitic crustaceans as vectors of viruses in commercially important host species. These papers illustrate nicely the breadth of the questions under study in the parasitic crustaceans from the basic taxonomic framework, which is still poorly understood in nearly all groups, to the complex interactions of these organisms with their hosts. Although parasitic crustaceans have been known to science since at least the days of Linnaeus, we still have much to learn about them at all levels of biological understanding. We sincerely hope that the First Symposium on the Biology of the Parasitic Crustacea will be the springboard to many more symposia on these fascinating creatures.

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