

# Biology and Ecology of Symbiotic Decapods Associated with Cnidarians and Echinoderms in the Gulf of California

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## Abstract

The symbiosis among decapod crustaceans and macroinvertebrates is the result of several evolutionary processes and co-diversification. The biology and ecology of most decapod symbionts is currently unknown, and in some cases, alpha taxonomy is still under debate. The present investigation contrasts the hypothesis that the symbiotic interaction of decapods with macroinvertebrates is predominantly an adaptive response of protection against predators, rather than a response to obtain food or reproductive advantage. This hypothesis was contrasted comparing biological and ecological factors of four symbiotic decapod species (*Manucomplanus varians*, *Quadrella nitida*, *Sandyella tricornuta*, and *Zenopontonia soror*) distributed in the Gulf of California that presumably have a symbiotic interaction gradient from general commensal (*Z. soror*) to an obligated mutualism (*M. varians*). This information was later compared with published information for other symbiotic and non-symbiotic decapod species distributed in other regions of the world. For this purpose, the taxonomic status, reproduction, relative duration of the symbiosis in relation to the life phases; also feeding habits and population structure were investigated for the four decapod species to infer the strategies and degree of symbiotic interaction between the decapod-host and their respective macroinvertebrate. The four decapod species have a stable population in the study region and with a continuous reproductive strategy, except for *Q. nitida*, which has a reproductive season occur mainly during winter and spring. *Zenopontonia soror* and *S. tricornuta* have populations numerically dominated by females (up to 60%) and only *S. tricornuta* and *Q. nitida* showed evidence of partially dependence of feeding on the basibiont. All four species have numerous morphological and chromatic adaptations to mimic the host in response to protection against predators. *Sandyella tricornuta* has mimetic morphology and coloration. It is concluded that once the symbiont crustacean is protected through protective adaptations (morphology, coloration, defense behavior or den regardless of the degree or type of symbiosis) its survival rate increases and that adaptations for trophic and reproductive strategies are adopted by those species as a result of secondary adaptations once symbiosis increases survival success. This means, protection is the predominant factor (but not the only one) in the symbiotic coevolution between decapod crustaceans and macroinvertebrates, offering a favorable microhabitats in the host during most part of its life cycle (embryonic, juvenile and adult phase) except during the short dispersal phase and without symbiotic interaction with other macroinvertebrates during their larval zooplanktonic stages.

## Keywords

Mimicry, Coevolution, Protection, Reproduction, Eating Habits, Benthos