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MARINE ISOPOD BIODIVERSITY OF THE INDIAN RIVER LAGOON, FLORIDA

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ABSTRACT

Twenty-one species of free-living isopods, and six species of parasitic bopyrids are recorded from the Indian River Lagoon. The distribution of this fauna bears out the zoogeographically transitional nature of the area, but also emphasizes its strong subtropical affinities. The seasonal abundance of the three most common species in *Halodule* seagrass beds, viz. *Erichsonella attenuata, Harrieta faxoni,* and *Edotea montosa* suggests that the various regions of the Indian River Lagoon are not biologically closely coupled, and that seasonal predation pressure may account for lowered numbers during the summer months.

The marine isopod fauna of the Indian River, Florida has been mentioned in few publications, the majority of these being ecological studies, often of specific habitats: Young and Young (1977) in an investigation of seagrass communities list four species and mention the presence of bopyrids; Virnstein et al. (1983) mention isopods in a study of invertebrates associated with seagrass beds and sand bottoms; Nelson and Demetriades (1992) include five species in a study of peracaridans from polychaete worm rock in Sebastian Inlet. A few unpublished reports (Young, 1975; Young et al., 1976; Kehl, 1990) also mention isopods in the course of benthic ecological studies. We have attempted to draw together all published and unpublished records of isopods from the Indian River Lagoon (IRL), and to present the limited information available on isopod abundance.

MATERIALS AND METHODS

Material for the faunistic part of this study was obtained from the Harbor Branch Oceanographic Museum, the collections of the National Museum of Natural History, Smithsonian Institution, and collections made by the authors in the area of the Indian River around the Smithsonian Marine Station at Link Port, Fort Pierce. Sources of published isopod records for Florida in general and the Indian River in particular include Richardson (1905), Schultz (1969), Young and Young (1977), Reish and Hallisey (1983), Virnstein et al. (1983), Kensley and Schotte (1989), Nelson and Demetriades (1992).

Patterns of isopod abundance within the IRL are described from a 6-year (1974–1979) study of macrobenthos associated with the seagrass *Halodule wrightii* that was initiated at three study sites spaced 190 km apart, along the north-south axis of the lagoon (Young, 1975; Young et al., 1976; Young and Young, 1977). The Haulover Canal site was near the northern end of the IRL. The Link Port site was located 140 km to the south in the central portion of the lagoon, about 9.5 km north of Fort Pierce Inlet. The St. Lucie site was located towards the southern end of the lagoon, immediately north of St. Lucie Inlet and 43 km south of the Link Port site. Detailed descriptions of the study sites are given in Young and Young (1977).

Samples (N = 4) of seagrass macrobenthos were collected with a post-hole type coring device (15 × 15 × 15 cm) and processed on 1-mm mesh. Details of sample processing are given in Young and Young (1977).

Mean abundances of isopods among sites were statistically compared with the non-parametric Kruskal-Wallis test on ranks because heterogeneous variances could not be corrected by transformation of the data. An a posteriori multiple comparisons test, Dunn's method, was carried out to determine which sites differed from each other. Mean abundance data within each sample site were transformed into standardized normal deviates using the site grand mean and standard deviation. Linear regression analysis was carried out on the standardized data versus time, to determine statistically significant temporal trends in abundance.

Pearson product-moment correlation coefficients were computed for all pairwise combinations among the three sample sites for mean monthly isopod abundances.

Table 1. Species list and ecological characteristics of Isopoda from the Indian River Lagoon

Species	Depth distribution	Habitat	Feeding type
Suborder Anthuridea			
Amakusanthura magnifica	Intertidal–137 m	sand, seagrass, oyster shoal	scavenger ?
Paranthura infundibulata	Intertidal–12 m	sabellariid worm rock	algal feeder
Ptilanthura tricarina	Intertidal–153 m	seagrass	scavenger ?
Xenanthura brevitelson	Intertidal–145 m	*Spartina* bed	scavenger ?
Suborder Asellota			
Carpias minutus	floating on *Sargassum*	floating *Sargassum*	micrograzer
Joeropsis sp.	Intertidal	sabellariid worm rock	micrograzer
Uromunna reynoldsi	Intertidal–shallow infratidal	submerged dead tree	micrograzer
Suborder Flabellifera			
Excorallana delaneyi	Intertidal–shallow infratidal	mangrove roots, dead tree	predator
Exosphaeroma diminuta	Intertidal–shallow infratidal	pilings, oyster shoal	scavenger ?
Harrieta faxoni	Intertidal–shallow infratidal	seagrass	scavenger ?
Limnoria simulata	Intertidal	on pilings	wood borer
Limnoria tripunctata	Intertidal	on pilings	wood borer
Paracerceis caudata	Intertidal–127 m	ubiquitous except in sand	micrograzer
Paradella dianae	Intertidal	mangrove roots, *Sargassum*	scavenger ?
Sphaeroma quadridentata	Intertidal–shallow infratidal	pilings, mangrove roots	wood borer
Sphaeroma terebrans	Intertidal	pilings	wood borer
Sphaeroma walkeri	Intertidal	mangrove roots, dead tree	wood borer
Suborder Oniscidea			
Ligia baudiniana	High intertidal–supratidal	docks, seawall	dead plants
Ligia exotica	High intertidal–supratidal	beach	dead plants
Suborder Valvifera			
Edotea montosa	1–47 m	*Halodule* seagrass	herbivore
Erichsonella attenuata	Intertidal		
Suborder Epicaridea			
Aporobopyrus curtatus	Parasitic on porcellanid crabs		
Bopyrina abbreviata	Parasitic on *Hippolyte* spp.		
Diplophryxus sp.	Parasitic on alpheid shrimps		
Probopyria alphei	Parasitic on *Alpheus* spp.		
Probopyrinella latreuticola	Parasitic on *Latreutes fucorum*		
Probopyrus pandalicola	Parasitic on palaemonid shrimps		

Table 2. Zoogeographical components of the Indian River isopod fauna (Epicaridea excluded)

U.S. East Coast, Gulf of Mexico, and Caribbean, 35%
Amakusanthura magnifica
Exosphaeroma diminuta
Limnoria simulata
Paracerceis caudata
Paranthura infundibulata
Uromunna reynoldsi
Xenanthura brevitelson
Widespread Distribution, 25%
Ligia exotica
Limnoria tripunctata
Paradella dianae
Sphaeroma terebrans
Sphaeroma walkeri
U.S. East Coast and Gulf of Mexico, 25%
Edotea montosa
Erichsonella attenuata
Harrieta faxoni
Ptilanthura tricarina
Sphaeroma quadridentata
Caribbean and Gulf of Mexico, 10%
Excorallana delaneyii
Ligia baudiniana
Bermuda, 5%
Carpias minutus

Results and Discussion

Zoogeography and Distribution.—Twenty-one species of free-living isopods, and six species of bopyrid epicarideans have been recorded from the Indian River (Table 1).

While at first glance the isopod fauna, with only 21 species may seem impoverished, a closer examination reveals that, given the available habitats, most of the expected faunal elements are present. Of the approximately 40 species that could occur in the Indian River region, about 10 are recorded exclusively from depths below 33 m. A further five or six species are found exclusively in the shallow high-energy waters off sandy beaches. While the small-scale environmental requirements for many isopod species are not known, it is likely that the calm, sometimes lower salinity water and the muddy, high organic sediments of parts of the Indian River would exclude a number of species. Thus some species, e.g., *Xenanthura brevitelson,* that can be found near the inlets, will be unable to penetrate further into the lagoon. Gore et al. (1981) found that decapod crustacean diversity in the Indian River was a function of habitat complexity; this factor almost certainly also plays a role in the isopod diversity. The list of isopod species can be analysed for habitat occurrence, ecological role, depth distribution, and geographical range (Table 1). That the Indian River lies in a transitional biogeographic zone between the warm-temperate Carolinian province to the north and the tropical Antillean province to the south has long been recognized (Gore, 1972). It is to be expected that the isopod fauna would reflect this transitional character, as indeed it does. The isopods can further be broken down into five

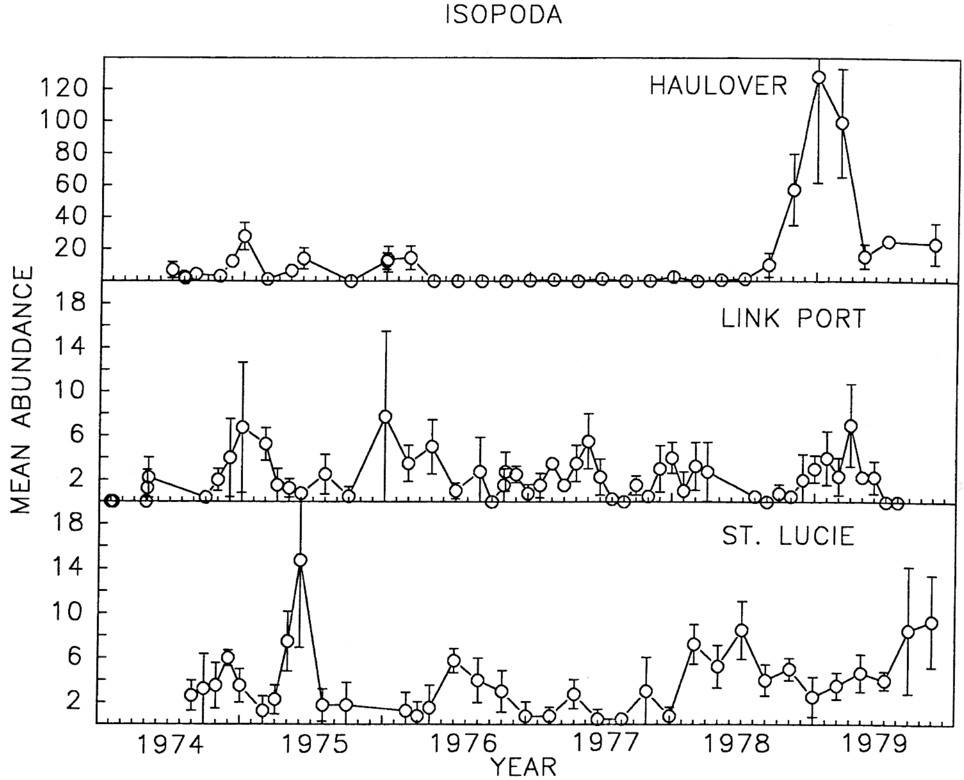

Figure 1. Mean isopod abundance per sample date over a 6-year period, from three study sites within the Indian River Lagoon.

components, which gives a clearer view of the complexity of the fauna and its affinities (Table 2).

Several points regarding this breakdown merit comment. The presence in floating *Sargassum* alga of *Carpias minutus,* previously known only from Bermuda, demonstrates one method of dispersal for small tropical crustaceans.

Fully 65% (13 species) of the Indian River isopod fauna also occurs in the Gulf of Mexico, which emphasizes the strong subtropical component.

Abundances.—Aside from the data we report here, information on isopod abundances in the IRL come from a study of sabellariid worm rock in Sebastian Inlet (Nelson and Demetriades, 1992), from a comparative study of *Halodule* and *Caulerpa* (Kehl, 1990), and from a study of seagrass and sand bottom faunas (Virnstein et al., 1983).

Isopod abundance patterns within the IRL are best known from beds of the seagrass *Halodule wrightii.* Mean abundance of isopods over a 6-year period ranged from 0.0 to 128.3 per core at Haulover, 0.0 to 7.8 per core at Link Port, and 0.8 to 14.8 per core at St. Lucie (Fig. 1). The maximum isopod density corresponds to approximately 2,053·m^{-2}. Minimum abundances of isopods were generally found during the months of June through October (Fig. 1). Nelson et al. (1982) found a lower abundance and species richness of amphipods in the summer months, and suggested that this was primarily related to seasonal patterns

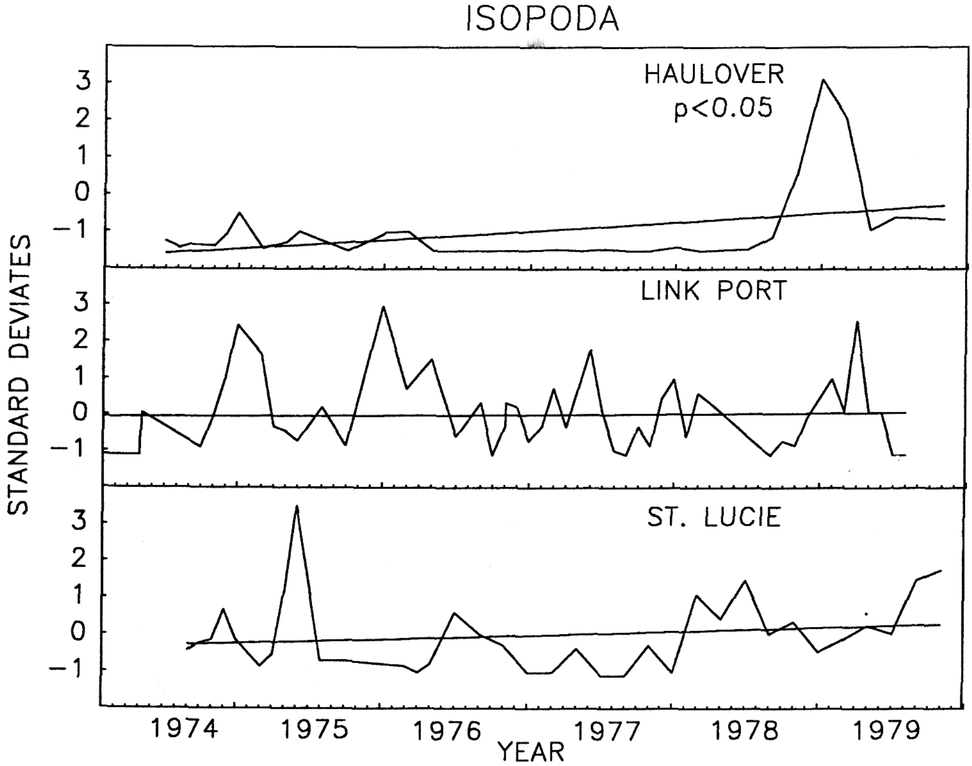

Figure 2. Regression of normalized isopod abundance data versus time over a 6-year period from three study sites within the Indian River Lagoon.

of predation pressure from a variety of crabs, shrimps, and fishes. Such predation pressures could also be affecting isopod abundances.

Median abundances of seagrass isopods were significantly higher at the Haulover site over the 6-year sample period than at either of the other sample locations ($P = 0.012$), which did not differ significantly from each other in mean abundance.

The dominant isopod species in seagrass beds were *Erichsonella attenuata* and *Harrieta faxoni* (Young and Young, 1977; Virnstein et al., 1983; Kehl, 1990), with *Edotea montosa* being present in far lower abundance.

Isopod abundance increased significantly at Haulover Canal, but not at the other two sites, over the 6-year period (Fig. 2). Temporal variability of isopod abundance was high at all three study sites. Strong abundance peaks did not generally occur in synchrony among the sites (Fig. 2), and there was no significant correlation of isopod abundance between any pair of sites. The long-term increase in abundance at only one site and the lack of correlation in abundance among sites both suggest that various regions of the IRL are not closely coupled biologically with regard to isopod population dynamics.

Management Considerations

The majority of the free-living isopod species found within the IRL are widely distributed, typically occurring along both the U.S. east coast and Gulf of Mexico.

The species are therefore not unique to the IRL, and considerable populations exist in geographically adjacent areas. Ecologically, many of the free-living species are generalized in terms of depth and habitat requirements. Thus the isopod fauna is somewhat buffered against localized or even regional habitat disturbance.

However, the seagrass-associated species are more habitat-restricted. These isopods are sufficiently abundant to constitute an important food resource for juvenile fishes utilizing seagrass beds as nursery habitat. Thus, any decline in seagrasses may negatively affect the isopods, in turn affecting fish populations.

The parasitic isopod species recorded from the IRL are specialized on shrimps and crabs, primarily those associated with seagrass beds. Factors that negatively affect seagrasses will ultimately impact the parasitic isopod species as well.

The threat to isopod diversity from other potential environmental problems such as chemical pollution are difficult to evaluate at present. In comparison to the amphipod crustaceans, isopods are less sensitive to some forms of chemical stress such as oil pollution (Bonsdorff and Nelson, 1981).

The greatest potential threat to amphipod biodiversity in the IRL would at present appear to be loss of seagrass habitat.

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