

## 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 A few unpublished reports (Young, 1975; Young et al., 1976; Kehl, 1990) also mention isopods in the course of benthic ecological studies. We have attempted to draw together all published and unpublished records of isopods from the Indian River Lagoon (IRL), and to present the limited information available on isopod abundance.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
<b>Suborder Anthuridea</b>			
<i>Amakusanthura magnifica</i>	Intertidal–137 m	sand, seagrass, oyster shoal	scavenger ?
<i>Paranthura infundibulata</i>	Intertidal–12 m	sabellariid worm rock	algal feeder
<i>Ptilanthura tricarina</i>	Intertidal–153 m	seagrass	scavenger ?
<i>Xenanthura brevitelson</i>	Intertidal–145 m	<i>Spartina</i> bed	scavenger ?
<b>Suborder Asellota</b>			
<i>Carpas minutus</i>	floating on <i>Sargassum</i>	floating <i>Sargassum</i>	micrograzer
<i>Joeropsis</i> sp.	Intertidal	sabellariid worm rock	micrograzer
<i>Uromunna reynoldsi</i>	Intertidal–shallow infratidal	submerged dead tree	micrograzer
<b>Suborder Flabellifera</b>			
<i>Excorallana delaneyi</i>	Intertidal–shallow infratidal	mangrove roots, dead tree	predator
<i>Exosphaeroma diminuta</i>	Intertidal–shallow infratidal	pilings, oyster shoal	scavenger ?
<i>Harrieta faxoni</i>	Intertidal–shallow infratidal	seagrass	scavenger ?
<i>Limnoria simulata</i>	Intertidal	on pilings	wood borer
<i>Limnoria tripunctata</i>	Intertidal	on pilings	wood borer
<i>Paracerceis caudata</i>	Intertidal–127 m	ubiquitous except in sand	micrograzer
<i>Paradella diana</i>	Intertidal	mangrove roots, <i>Sargassum</i>	scavenger ?
<i>Sphaeroma quadridentata</i>	Intertidal–shallow infratidal	pilings, mangrove roots	wood borer
<i>Sphaeroma terebrans</i>	Intertidal	pilings	wood borer
<i>Sphaeroma walkeri</i>	Intertidal	mangrove roots, dead tree	wood borer
<b>Suborder Oniscidea</b>			
<i>Ligia baudiniana</i>	High intertidal–supratidal	docks, seawall	dead plants
<i>Ligia exotica</i>	High intertidal–supratidal	beach	dead plants
<b>Suborder Valvifera</b>			
<i>Edotea montosa</i>	1–47 m	<i>Halodule</i> seagrass	herbivore
<i>Erichsonella attenuata</i>	Intertidal		
<b>Suborder Epicaridea</b>			
<i>Aporobopyrus curtatus</i>	Parasitic on porcellanid crabs		
<i>Bopyrina abbreviata</i>	Parasitic on <i>Hippolyte</i> spp.		
<i>Diplophryxus</i> sp.	Parasitic on alpheid shrimps		
<i>Probopyria alpei</i>	Parasitic on <i>Alpheus</i> spp.		
<i>Probopyrinella latreuticola</i>	Parasitic on <i>Latreutes fucorum</i>		
<i>Probopyrus pandalicola</i>	Parasitic on palaemonid shrimps		

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

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

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## 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

## ISOPODA

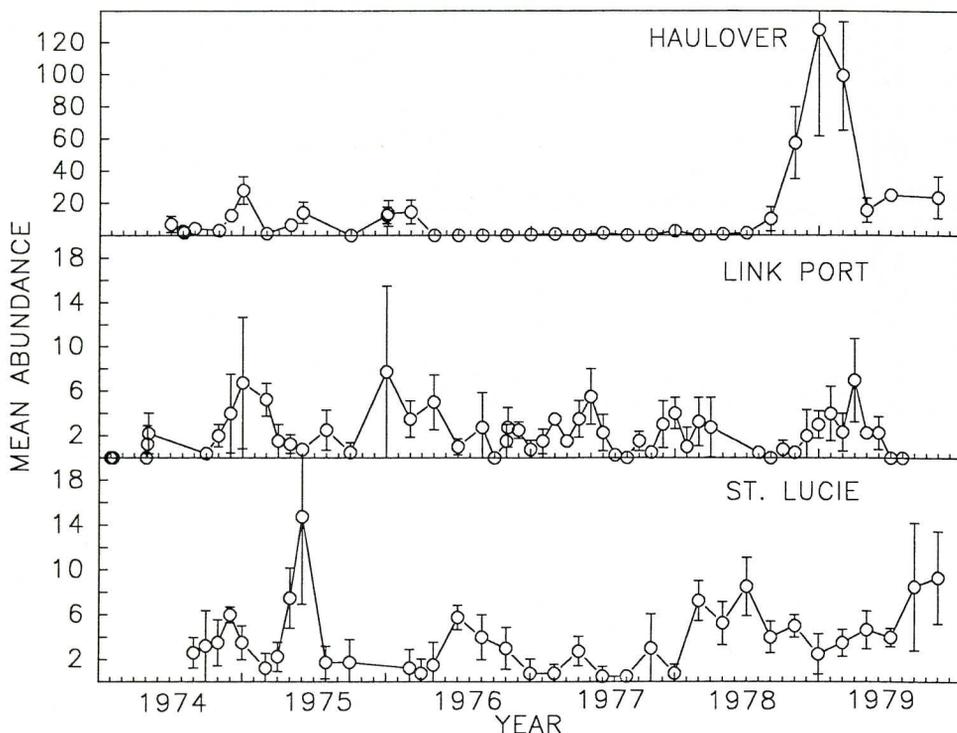


Figure 1. Mean isopod abundance per sample date over a 6-year period, from three study sites within the Indian River Lagoon.

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 *Carpis 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  $2,053\text{-m}^{-2}$ . 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

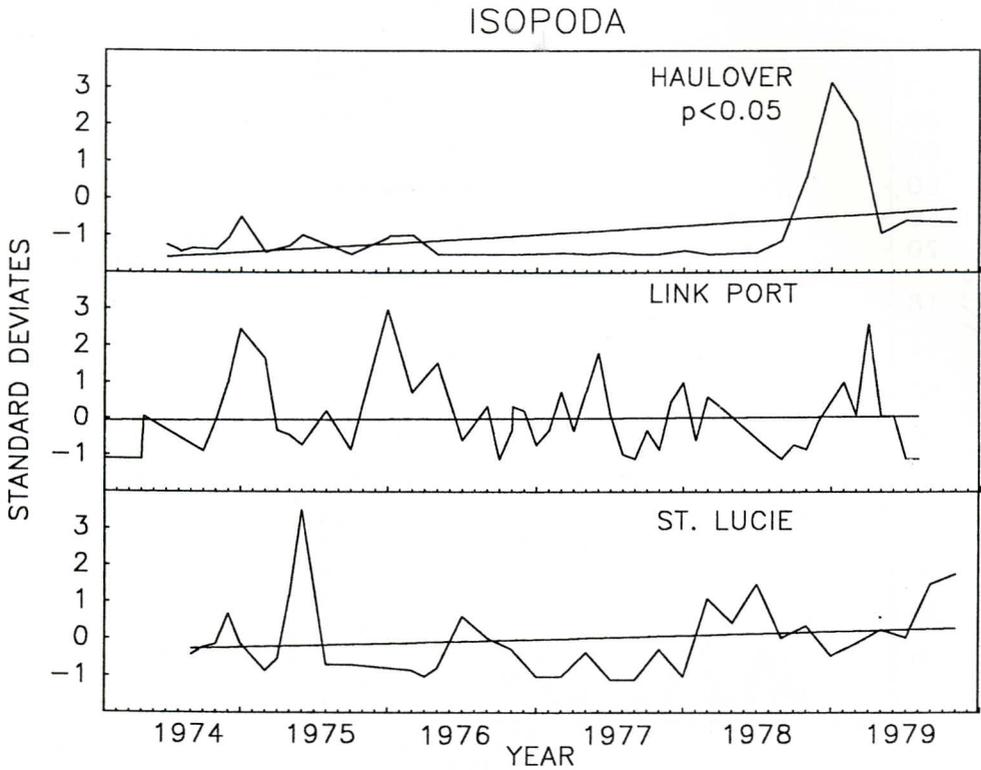


Figure 2. Regression of normalized isopod abundance data versus time over a 6-year period from three study sites within the Indian River Lagoon.

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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#### LITERATURE CITED

- Bonsdorff, E. and W. G. Nelson. 1981. Fate and effects of Ekofisk crude oil in the littoral of a Norwegian fjord. *Sarsia* 66: 231-240.
- Gore, R. H. 1972. Zoogeographical aspects of decapod Crustacea in the Indian River region of Florida. *Am. Zool.* 12,4: 509.
- , E. E. Gallaher, L. E. Scotto and K. A. Wilson. 1981. Studies on decapod Crustacea from the Indian River region of Florida. XI. Community composition, structure, and biomass and species-areal relationships of seagrass and drift algae-associated macrocrustaceans. *Est. Coast. Shelf Sci.* 12: 485-508.
- Kehl, M. J. 1990. Comparisons in habitat use between the seagrass *Halodule wrightii* and the alga *Caulerpa prolifera* for macrofauna in the Banana River Lagoon, Florida. M.S. Thesis, Florida Institute of Technology, Melbourne, Florida. 165 p.
- Kensley, B. and M. Schotte. 1989. Guide to the marine isopod crustaceans of the Caribbean. Smithsonian Institution Press, Washington and London. 308 p.
- Nelson, W. G., K. D. Cairns and R. W. Virnstein. 1982. Seasonality and spatial patterns of seagrass-associated amphipods of the Indian River lagoon, Florida. *Bull. Mar. Sci.* 32: 121-129.
- and L. Demetriades. 1992. Peracarids associated with sabellariid worm rock (*Phragmatopoma lapidosa* Kinberg) at Sebastian Inlet, Florida, U.S.A. *J. Crust. Biol.* 12,4: 647-654.
- Reish, D. J. and M. L. Hallisey. 1983. A check-list of the benthic macroinvertebrates of Kennedy Space Center, Florida. *Fla. Sci.* 46(3/4): 306-313.
- Richardson, H. 1905. A monograph on the isopods of North America. *Bull. U.S. Nat. Mus.* 54: 1-727.
- Schultz, G. 1969. How to know the marine isopod Crustacea. W. C. Brown Publishers, Dubuque, Iowa. 359 p.
- Virnstein, R. W., P. S. Mikkelsen, K. D. Cairns and M. A. Capone. 1983. Seagrass beds versus sand bottoms: the trophic importance of their associated benthic invertebrates. *Fla. Sci.* 46(3/4): 363-381.
- Young, D. K. 1975. Studies of benthic communities of the Indian River region. Pages 104-118 in D. K. Young, ed. Indian River coastal zone study, Annual Report 1974-1975, Vol. 1. [Unpublished report, Harbor Branch Oceanographic Institution, Fort Pierce, Florida]
- , K. D. Cairns, M. A. Middleton, J. E. Miller and M. W. Young. 1976. Studies of seagrass-associated macrobenthos of the Indian River. Pages 93-108 in D. K. Young, ed. Indian River

coastal zone study, Annual Report 1975-1976, Vol. 1. [Unpublished report, Harbor Branch Oceanographic Institution, Fort Pierce, Florida]

——— and M. W. Young. 1977. Community structure of the macrobenthos associated with seagrass of the Indian River Estuary, Florida. Pages 359-381 in B. C. Coull, Ecology of marine benthos. The Belle W. Baruch Library in Marine Science, number 6. University of South Carolina Press, Columbia, South Carolina.

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