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FEEDING BIOLOGY, DISTRIBUTION, AND ECOLOGY OF TWO SPECIES OF BENTHIC POLYCHAETES: *PARAONIS FULGENS* AND *PARAONIS PYGOENIGMATICA* (POLYCHAETA: PARAONIDAE)

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ABSTRACT *Paraonis fulgens* and *Paraonis pygoenigmatica* inhabit sandy littoral and sublittoral sediments of the northern Gulf of Mexico and U.S. East Coast, but seldom overlap in distribution. The purpose of this study was to compare the feeding ecology and distribution of these species. We analyzed distributions and gut contents of Gulf of Mexico specimens and found that *P. fulgens* inhabited substrates with slightly more silt and clay than those inhabited by *P. pygoenigmatica*. Although *Paraonis fulgens* ingested more diatoms than *P. pygoenigmatica*, this distinction likely resulted from habitat differences, not selective feeding. Previous studies suggested that *P. fulgens* fed selectively on diatoms only.

Introduction

The genus *Paraonis* Cerruti, 1909, contains just two species, *Paraonis fulgens* and *Paraonis pygoenigmatica*. *Paraonis fulgens* is distributed worldwide in shallow estuarine and marine habitats (Strelzov 1973). However, *P. pygoenigmatica* occurs only in coastal waters of the U.S. Atlantic (Jones 1968) and northern Gulf of Mexico (Gaston 1984). Both species inhabit sandy substrates; *P. fulgens* generally inhabits littoral and sublittoral sediments and *P. pygoenigmatica* lives in slightly deeper water. Apparently, only *P. fulgens* occurs in dense populations (Gaston 1984). Roder (1971) and Risk and Tunnicliffe (1978) reported that *P. fulgens* fed solely on diatoms, but little else is known about the feeding ecology of these species.

The purpose of this study was to compare the feeding ecology and distribution of these two species in northern Gulf of Mexico habitats. We investigated ingested foods to determine if differences in food accounted for their distinct distributions.

Materials and Methods

Most of the specimens examined for this study were collected by Gulf Coast Research Laboratory (GCRL) personnel off Biloxi, Mississippi, Ship and Horn Island, Mississippi and Perdido Key, Florida (Rakocinski et al. 1991, McLelland and Heard 1991). Additional specimens were collected as part of a Bureau of Land Management (now Minerals Management Service) Gulf of Mexico Outer Continental Shelf baseline study conducted during 1975-1981 (Uebelacker and Johnson 1984); along the Florida Gulf Coast by Mote Marine Laboratory personnel; off Padre Island, Texas (Rabalais and Flint 1983); in Pelican Bay, Alabama during the EPA Environmental Monitoring and Assessment Program (EMAP); and off Alabama, Texas, and the Middle Atlantic Bight by the author (Gaston 1985, 1987).

Percentage of ingested food was estimated under compound microscopy as percentage represented by diatoms (estimated volume) versus percentage represented by detritus. None of the guts examined were entirely empty. Statistical analyses involved a T-test for significant differences ($\alpha = 0.05$) between species (when the Bartlett Test indicated homogeneity of variables) using arcsine-transformed percentage data (percentage of food represented by diatoms).

Results and Discussion

Both *P. fulgens* and *P. pygoenigmatica* inhabited sandy substrates with similar sediment characteristics (Table 1). *Paraonis fulgens* was most abundant in sandy intertidal and shallow subtidal habitats with 96-99% sand (i.e., less than 4% silt and clay) as indicated in Table 2. *Paraonis pygoenigmatica* inhabited slightly deeper-water habitats with 2-3% silt and clay (Tables 1 and 2).

Paraonis fulgens was one of the most abundant macrobenthic organisms collected in the shallow waters off Perdido Key, Florida and Horn and Ship Islands, Mississippi. Their numbers peaked at both Ship Island and Horn Island during August 1990 at over 10,000/m^2 (Table 1). Colonization of the sediments by settling juveniles apparently occurred during summer. *Paraonis pygoenigmatica* was seldom as abundant as *P. fulgens* (Table 1). It occurred from subtidal to outer continental shelf waters, and seldom was collected at the same sites as *P. fulgens* (Table 1). In Perdido Key, *P. fulgens* inhabited sandy sediments between the beach and sand bar just offshore (0 - 5.5m) and *P. pygoenigmatica* occurred beyond the sand bar (5.5 - 5.8m) as shown in Table 2.

TABLE 1

Selected distribution records and population densities of *Paraonis fulgens* and *Paraonis pygoenigmatica* in the Gulf of Mexico and southern Florida Atlantic Coast. Depths in meters.

Site	Depth(s)	Sediments	Density/m^2	Source
Paraonis fulgens				
Horn Island, MS	<1.0–30.0	>97% sand	1500–10,000	GCRL *
Ship Island, MS	15.0–30.0	>96% sand	2000–12,000	GCRL *
Biloxi Bay, MS	0.1–0.2	sand	<500	Matulewski **
Pelican Bay, AL	2.4	sand	<10	Gaston **
Mobile Bay, AL	2.4–3.6	sand	20–800	Gaston **
Mobile Bay, AL	4.0–6.5	sand	<500	Johnson 1980
Perdido Key, FL	1.0–5.5	sand **	500–8000	GCRL *
FL Continental Shelf	19.0–20.0	fine sand	<10	Gaston 1984
Marco Island, FL	0.5–1.0	sand	<50	Milligan **
Padre Island, TX	0.1–2.0	fine sand	mean = 200	Rabalais et al. 1983
Paraonis pygoenigmatica				
Ft. Lauderdale, FL	10.0	sand		Milligan **
Perdido Key, FL	1.0–5.5	sand ***	<50	GCRL *
off Tampa, FL	20.0–24.0	fine sand	10–60	Gaston 1984

* Data from two Gulf Coast Research Laboratory studies (McLelland and Heard, 1991; Rakocinski et al. 1991).

** Unpublished data: K. Matulewski (University of Southern Mississippi), G. Gaston (University of Mississippi), M. Milligan and A. McAllister (Mote Marine Laboratory), EMAP-NC 1991 Gulf of Mexico estuary survey.

*** See Table 2 for more sediment data.

Paraonis fulgens is a subsurface detritivore. It feeds in tight spirals beneath the sediment surface, and moves upward or downward as it completes a feeding spiral (Risk and Tunnicliffe 1978). Previous research indicated that *P. fulgens* selectively ingested benthic diatoms (Roder 1971, Risk and Tunnicliffe 1978), whereas other paraonids feed on drift debris or detritus and are probably non-selective (Fauchald and Jumars 1979, Gaston 1983). Roder (1971) noted that specimens he examined contained no detritus, only diatoms. Although diatoms were ingested by many specimens that we examined (Table 3), diatoms were apparently ingested passively with other detritus. Most of our specimens were filled with detritus, which included a few dinoflagellate and diatom tests. It did not appear that diatoms and/or dinoflagellates were selectively ingested; most ingested diatoms were small, unlike those observed by Roder (1971), and there were several diatom species represented. Furthermore, diatoms seldom composed even

TABLE 2

Habitat and sediment characteristics of sites where *Paraonis fulgens (P.f.)* and *Paraonis pygoenigmatica (P.p.)* were collected at Perdido Key, Florida. Abundances: C = Common (>1000 m^{-2}); R = Rare (<20 m^{-2}). From Rakocinski et al. (unpublished data).

Station	Abundance *P.f.* / *P.p.*	Depth (m)	% Sand (md. dia)	% Silt/clay
1. Littoral *	C -	1.0	98.8 (0.29)	1.2
2. Littoral	C -	2.0	99.6 (0.25)	0.4
3. Longshore bar	C -	1.0	98.9 (0.21)	1.1
4. Sublittoral **	C -	2.1	99.6 (0.20)	0.4
5. Sublittoral	C -	3.7	98.6 (0.20)	1.4
6. Sublittoral	C -	4.3	98.7 (0.28)	1.3
7. Sublittoral	C R	5.5	99.5 (0.30)	0.5
8. Sublittoral	- R	5.5	99.7 (0.32)	0.3
9. Sublittoral	- R	5.5	97.4 (0.28)	2.6
10. Sublittoral	- R	5.5	96.7 (0.25)	3.3
11. Sublittoral	- R	5.8	97.7 (0.24)	2.3

* Littoral = between beach and longshore bar.

** Sublittoral = outside the longshore bar.

half of the matter ingested (Table 3), and many lacked chlorophyll, indicating that they were probably empty frustules when ingested.

Like many paraonids, *P. pygoenigmatica* is a subsurface detritivore (Fauchald and Jumars 1979, Gaston 1983). It is less commonly collected than *P. fulgens*, as evidenced by the few numbers of specimens on Table 3. Whether or not it feeds in spirals is unknown. Gut contents of specimens collected in Perdido Key and in the Middle Atlantic Bight were filled with detritus, but included fewer diatoms than were ingested by *P. fulgens* ($P < 0.01$, Table 3).

These two species of *Paraonis* are members of the sandy littoral and sublittoral communities of the Atlantic and Gulf of Mexico. Their communities were numerically dominated by crustaceans in the northern Gulf; off West Ship Island, Mississippi the dominant taxa were an amphipod (*Lepidactylus* sp.), an isopod (*Exosphaeroma diminutum*), a cumacean (*Spilocuma watlingi*), two polychaetes (*P. fulgens* and *Dispio uncinata*), and a tanaid (*Kalliapseudes* sp.) (Rakocinski et al. 1991). A similar trophic group dominated their communities off Mobile Bay, Alabama and Perdido Key, Florida, including haustoriid amphipods, the isopod (*E. diminutum*), and the same polychaetes (Gaston 1986, Rakocinski et al., manuscript). These dominants were collected in habitats of both species of *Paraonis* at Perdido Key, even though *P. fulgens* and *P. pygoenigmatica* seldom were collected together (Table 2).

The sediments where *P. fulgens* was most abundant were more dynamic than those inhabited by *P. pygoenigmatica*. Perhaps more diatoms were buried in the dynamic sediments and became detritus for grazing *P. fulgens*, as suggested by Risk and Tunnicliffe (1978). Unfortunately, the environmental and gut-contents data provided little additional information on the distinction of the habitats of these two species. Apparently, *P. fulgens* feeds on detritus that includes diatoms, but *P. pygoenigmatica* does not.

TABLE 3

Gut-contents data of two species of *Paraonis* from three locations in the Gulf of Mexico. Percentage values are percent volume, estimated to the nearest 5%. Specimens collected in different samples are presented as separate data.

Site	Number examined	% Diatoms	% Detritus
P. fulgens			
Horn Island, MS	6	10	90
Horn Island, MS	2	25	75
Horn Island, MS	1	50	50
Perdido Key, FL	2	<5	95
Perdido Key, FL	4	10	90
Perdido Key, FL	7	25	75
Perdido Key, FL	4	50	50
Pelican Bay, AL	1	<5	95
Totals/Means	27	21.1	78.9
P. pygoenigmatica			
Perdido Key, FL	10	<5	>95
off Tampa, FL	2	0	100
Totals/Means	12	1.6	98.4

Thus, even though these two species are closely related, their feeding biology is distinct. We propose that dissimilar habitats, and the abundance of diatoms in those habitats, account for their distinctive feeding biology. *P. fulgens* forages for detritus (which may be diatom-laden detritus) in dynamic sediments of littoral and sublittoral zones, while *P. pygoenigmatica* is associated with less diatomaceous detritus in lower energy habitats beyond the swash zone.

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