

## New Records and Observations of Epibionts from Loggerhead Sea Turtles

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**Abstract** - Loggerhead sea turtles *Caretta caretta* (Linnaeus) were sampled (n = 304) for epibionts while nesting in Georgia from 1998-2003. Twelve newly documented epibiont species were observed and represent the first records of a hermit crab and a sea star as sea turtle epibionts. We report some physical, behavioral and ecological characteristics of the newly documented epibionts, particularly because nothing is known of their life history in Georgia as sea turtle epibionts. We also discuss the role of epibiotic crabs as facultative associates of loggerhead turtles.

### Introduction

Loggerhead sea turtles *Caretta caretta* (Linnaeus) nest during the summer months (May-August) along ocean beaches from Virginia through Florida (Dodd 1988). Over the course of a single nesting season, an individual turtle will nest approximately 4 or 5 times, with an inter-nesting interval of 10-15 days (Williams and Frick 2001). During inter-nesting periods, loggerheads reside in estuarine and near-shore outer marine habitats adjacent to the nesting beach (Stoneburner 1982). Here, female loggerheads are exposed to a variety of local fouling forms. As a result, nesting turtles are observed hosting diverse and often large epibiotic communities, particularly on the carapace region (Caine 1986, Frick et al. 1998).

The present study reports 12 new records of previously undocumented epibiont species from loggerhead turtles, including the first reports of an echinoderm and a hermit crab as sea turtle epibionts. We report data on the behavioral, physical, and ecological characteristics of some of the newly identified epibionts; particularly because little is known of these epibionts as free-living forms in Georgia, and nothing is known of the natural history of these species as sea turtle epibionts. We also discuss the role of epibiotic crabs as facultative associates of loggerhead turtles.

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## Methods

During May–August of 1998 through 2003, 304 loggerhead turtles were surveyed for epibionts while nesting on Wassaw Island, Wassaw National Wildlife Refuge, GA, in Chatham County (31°53.4'N, 80°58.4'W), and Jekyll Island, in Glynn County (31°0.39'N, 81°24.9'W). Each turtle was marked with flipper tags bearing unique serials. Turtles were examined and sampled for conspicuous epibionts following Frick et al. (1998). These samples were then studied in the lab under light microscopy (magnification up to 1000x) for inconspicuous or hidden epibionts (cryptofauna). Samples were then sorted and identified to the lowest taxonomic level possible.

The appropriate morphometrics for the newly documented epibiota were recorded in mm using Vernier calipers or a computer-interfaced stereomicroscope/micrometer. The diets of the brachyuran crabs presented herein were obtained by removing the contents of the cardiac and pyloric chambers from each crab. Diet samples were then viewed under light microscopy, sorted and identified to the lowest taxonomic level possible. Within the following section, an asterisk (\*) will be used to denote whether the species in question is a new record.

## Results and Discussion

Host turtles were an average of 100.7 cm long (curved carapace length; range = 88–120 cm). Twelve previously unreported epibiont species were identified. All new records occur as free living forms in the western North Atlantic; thus, these associations do not appear to be obligate.

A single adult male porcelain crab, *Porcellana sigsbeiana* A. Milne-Edwards\*, (carapace: length = 20 mm, width = 18 mm) was collected from the 4<sup>th</sup> vertebral scute (on the posterior hump) of the turtle's carapace: a similar location noted for *P. sayana* (Leach), another porcellanid associate of nesting *C. caretta* (Frick et al. 2002). Williams (1984) noted the coloration of *P. sigsbeiana* in alcohol to consist of an "irregular pattern of reddish longitudinal mottlings on white background." In life, the *P. sigsbeiana* collected here bore the same markings as stated above; however, the color of the pattern was initially violet and faded to red in 95% ethanol.

Like *P. sayana*, *P. sigsbeiana* was associated with a relatively bare host turtle that hosted few (less than 10) barnacles, *Chelonibia testudinaria* Linnaeus, along the posterior-most tip of the carapace. In the gaps and sinuses between barnacles were small anemones *Diadumene leucolena* (Verrill). A small (5 cm high) cluster of the red algae *Hypnea musciformis*\* was also growing from a gap between

barnacles. Another cnidarian, a hydrozoan, *Hydractina echinata* Fleming, covered the rest of the turtle's carapace, as did a thin "slime" layer of micro-algae, diatoms and, presumably, bacteria.

*Eurypanopeus abbreviatus* (Stimpson)\* (n = 7) were only present on nesting turtles (n = 5) hosting dense aggregations of tunicates, *Molgula manhattensis* (DeKay), and hydroids, *Tubularia crocea* (L. Agassiz). Small, juvenile *E. abbreviatus* (n = 6; carapace width [CW] = 3.0–6.0 mm) were associated with the stalks and hydranths of *T. crocea*. A single adult female *E. abbreviatus* (CW = 11.5 mm) was collected from a dead barnacle shell (*C. testudinaria*) that was overgrown by *M. manhattensis*; the respective host turtle also hosted dense tufts of *T. crocea*, which bore two of the aforementioned juvenile *E. abbreviatus* as well.

Also present on turtles hosting *E. abbreviatus* were *Cerapus* sp. amphipods\*. It is worthy to note that the *Cerapus* sp. amphipods were unidentified because the specimens in question have yet to be taxonomically assigned as to species (Richard Heard; pers. comm.). *Cerapus* tubes were attached parallel to the stalks of *T. crocea* and directly to the host turtle's carapace, in a horizontal fashion.

The tubes of *Cerapus* were easily visible in the diet of the adult female *E. abbreviatus* that was collected from the *C. testudinaria* shell. This crab also contained diatoms, unidentified algal and animal material, portions of an amphipod gnathopod and hydroid tentacles. All juvenile *E. abbreviatus*, those from *T. crocea*, contained diets comprised of diatoms, digested algal material, and unidentified animal material.

Little is known of the life history of free-living *E. abbreviatus* (Williams 1984). To our knowledge, ours is the first report of the diet of *E. abbreviatus*. Throughout the range of *E. abbreviatus* in the Atlantic, South Carolina to Brazil (Williams 1984), free-living specimens commonly reside amongst a variety of fouling forms, many of which are analogous to types reported from nesting loggerhead turtles. Thus, it is possible that the life history of epibiotic *E. abbreviatus* is similar to that of free-living specimens.

A single immature male spider crab, *Libinia dubia* H. Milne Edwards\*, was collected from the second vertebral scute of a turtle, the flattest portion of the loggerhead carapace. The crab measured 32 mm carapace length and 27 mm width (including marginal spines). Similar sized, immature *L. dubia* have been reported as epibionts of other motile organisms, particularly jellyfishes (Corrington 1927, Jackowski 1963). The spider crab was covered in the following epibionts: 1 small (1.1 mm rostro-carinal diameter) *Chelonibia patula* (Ranzani) barnacle, poriferans *Haliclona loosanoffi* Hartman and *Lissodendoryx isodictyalis* (Carter), a hydroid *Halocordyle disticha* (Goldfuss), and a

tunicate *Eudistoma carolinense* van Name. All were small specimens and were closely situated over the entire carapace of the spider crab. Empty tubes of *Cerapus* sp. amphipods were found clinging to the branches and stalks of *H. disticha*.

The same host turtle also harbored a heavy load of *Sabellaria vulgaris* Verrill, a polychaete worm that constructs a hard sand tube and aggregations will often form large reefs. Worm tubes covered 98% of the entire carapace. Some tubes were situated atop others causing the sabellariid colony to be 100 mm high in some places.

Seventy-one *S. vulgaris* and their tubes were measured. Worms were 10–20 mm long (mean = 13.1 mm) and constructed their tubes primarily of quartz, but hornblende grains were occasionally present. The tubes of the aforementioned worms ranged from 20–30 mm (mean = 23.3 mm) long. The spider crab was situated within a hollow surrounded by worm tube aggregations up to 75.6 mm high. This relatively wide spot, which was exposing the turtle carapace, was 10 cm in diameter. It appeared almost as if the repeated turning and foraging of the *L. dubia* had created the hollow in the sabellariid reef. The spider crab was initially observed grazing along sabellariid worm tubes with its chelipeds prior to collection.

Stomach content analysis of the spider crab revealed a full gut comprised primarily of unidentified animal matter. However, the golden oral bristles of *S. vulgaris* were frequently present amongst the animal matter as were grains of quartz sand. To our knowledge, *S. vulgaris* has not been reported in the diet of *L. dubia*.

The crab also contained a cluster of cnidarian tentacles within its esophagus. A source of cnidarian tentacles within the diet of *L. dubia* may have been from small anemones (mean = 1.1 mm in diameter and 1.5 mm tall;  $n = 125$ ) *Anthopleura carneola* (Verrill)\* that were present throughout the sabellariid worm community. These anemones were attached directly to worm tubes within  $\approx 2$  mm x 1 mm gaps between tall aggregations of worm tubes. The hydroid, *H. disticha*, and anemones, *Aiptasia pallida* (Verrill), were also found within the gaps between worm tubes. Small bivalves, *Sphenia antillensis* Dall and Simpson (average = 5mm wide;  $n = 31$ ) and *Anadara ovalis* (Bruguere) (1.75 mm wide;  $n = 12$ ) were also present in gaps between worm tubes.

Inhabiting empty sabellariid tubes were specimens of the green polychaete worm, *Phyllodoce fragilis* Webster\*. The green worms were situated within mucus tubes lining the sand tubes they were associated with. The average size of 226 *P. fragilis* was 20 mm long (range = 19–43.1 mm long). The longest specimen (43.1 mm) was found situated in a mucus tube within a narrow, long gap between worm tube aggregations. *Phyllodoce fragilis* are commonly found within oyster aggregations and

it is not surprising to find them also situated within similar gaps and sinuses produced from sabellariid colonization.

Two juvenile male *Pilumnus sayi* Rathbun\* were found from two different host turtles. One male (CW = 6.4 mm) was collected from and aggregation of dead *Balanus eburneus* Gould barnacles growing upon an inconel metal flipper tag. Another juvenile male *P. sayi* (CW = 6.0 mm) was collected from an aggregation of live barnacles (*Balanus amphitrite*, Darwin) growing on the posterior carapace region of a nesting turtle.

Upon collection, the crab was seen grazing in patches of epizoic algae growing on *B. amphitrite*. The gut contents of this juvenile male contained algal material, although some unidentified animal material was found as well. The gut from the latter specimen was empty. To date, the only information available on the diet of *P. sayi* is a study by Chamberlain (1961), which reports that larval *P. sayi* reared in the laboratory matured most rapidly when fed an omnivorous diet; specimens reared on algae alone died.

Free-living *P. sayi* have been collected from a variety of near-shore habitats, often amongst sessile fouling organisms (Cain 1972, Lunz 1937, Pearse 1934, Pearse and Williams 1951). Thus, it is not surprising that we found *P. sayi* from a turtle that also hosted sessile epibiota. *Pilumnus sayi* is commonly found from North Carolina to the West Indies, and it is likely that additional monitoring will yield more specimens from nesting loggerheads in the future.

Upon the same host turtle harboring the 6.0 mm *P. sayi* was an aggregation of barnacles (*C. testudinaria*) located on the turtle's third vertebral scute. The orange-crust bryozoan *Schizoporella unicornis* (Johnston)\* was found encrusting the shell of a dead *C. testudinaria* (25 mm rostro-carinal diameter). The barnacle was pried off of the turtle, revealing the presence of a single brittle star *Axiognathus squamatus* (delle Chiaje)\* (2.1 mm disk diameter) residing within the empty barnacle shell, along with a cluster of 22 unidentified gastropod eggs located on the inner surface of the barnacle's carinal plate. Also growing atop the aforementioned barnacle that housed *A. squamatus* were two smaller cirripeds (*Balanus trigonus* Darwin and *B. eburneus*; 4.0 and 3.0 mm rostro-carinal diameter, respectively).

*Axiognathus squamatus* is colloquially known as the brooding brittle star because it broods its young in ten genital bursae located beneath its disc. However, the aforementioned specimen was not gravid. Unlike other members of the Amphiuroidae, which are predominately burrowers, these brittle stars are commonly found amongst fouling forms, likely why the species can exist as an associate of *C. caretta* that harbor fouling forms like barnacles.

A juvenile male *Micropanope urinator* (A. Milne-Edwards)\* (CW = 4.0 mm) was found on the posterior-most tip of the carapace of a host

turtle amongst an aggregation of barnacles (*C. testudinaria* and *B. trigonus*). This turtle also hosted green algae (*Chaetomorpha linum*) and caprellid amphipods (*Caprella penantis* Leach) on the same region of the carapace. Stomach contents from the *M. urinator* contained fragments of unidentified diatoms.

Little is known of the natural history of *M. urinator*, with the exception of water depths and localities associated with collected specimens (Williams 1984). These small xanthids are known from deeper waters (146 to 457 m) and have been found from Cape Hatteras and Cape Lookout, NC; and the Florida Keys to St. Croix. Another *Micropanope*, *M. nuttingi* (Rathbun), has been found to associate with nesting hawksbill sea turtles (*Eretmochelys imbricata* Linnaeus) in Antigua, West Indies (Frick et al. 2001).

A single female *Iridopagurus reticulatus* García-Gómez\* (dimensions of anterior shield = 1.5 mm long and 1.6 mm wide) was found walking atop a sabellariid worm reef formation (members as described above for *L. dubia*) that covered the entire carapace of the host turtle. The hermit crab inhabited the shell of a *Nassa* snail *Nassarius albus* (7 mm long; opercular opening was 1.75 mm long and 2.5 mm wide).

The specimen was similar in color to *I. reticulatus* described by García-Gómez (1983); however, we noted that large red/brown spots were located centrally on the inner surface of the carpus and merus of each cheliped. A similar spot was present in the center of the outer surface of the meri as well.

The bathymetric distribution for *I. reticulatus* specimens examined by García-Gómez (1983) is 1–38 m and de Saint Laurent-Dechancé (1966) recorded specimens from 1–15 m. Currently, *I. reticulatus* is believed to occur at the shallowest depths of all known Atlantic *Iridopagurus*. Loggerhead turtles in Georgia have been reported to inhabit live bottom habitats at similar depths inbetween nesting events (Stoneburner 1982).

Gut contents from the crabs collected during this study indicate that these epibionts are facultative associates of *C. caretta*. Grapsid crabs of the genus *Planes* have been shown to be facultative associates of loggerheads as well (Frick et al. 2004). However, the extent to which the cleaning behavior of epibiotic crabs actually benefits host turtles is unknown. It is possible that motile epibionts, like crabs, are more frequently associated with sea turtles than currently believed or detected. The facultative association between epibiotic crabs and host turtles could play a substantial role in the population ecology and dispersal of many crab species and, as a result, the structuring of the marine habitats occupied by sea turtles and their epibionts.

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