

# PATTERN AND COLORATION OF *PERICLIMENES RATHBUNAE* FROM THE TURKS AND CAICOS ISLANDS, WITH COMMENTS ON HOST ASSOCIATIONS IN OTHER ANEMONE SHRIMPS OF THE WEST INDIES AND BERMUDA

STEPHEN SPOTTE<sup>1</sup>, RICHARD W. HEARD<sup>2</sup>,  
PATRICIA M. BUBUCIS<sup>1</sup>, ROY R. MANSTAN<sup>3</sup>,  
AND JERRY A. McLELLAND<sup>2</sup>

<sup>1</sup>Sea Research Foundation and Marine Sciences Institute,  
The University of Connecticut, Noank, Connecticut 06340;

<sup>2</sup>Invertebrate Zoology Section, Gulf Coast Research Laboratory,  
P.O. Box 7000, Ocean Springs, Mississippi 39564;

<sup>3</sup>Department of the Navy, Naval Underwater Systems Center,  
New London, Connecticut 06320

**ABSTRACT** The commensal shrimp *Periclimenes rathbunae* Schmitt, 1924, lives in association with the sea anemones *Condylactis gigantea* Weinland, 1860, and *Stichodactyla* (= *Stoichactis*) *helianthus* Ellis, 1767, in the Turks and Caicos Islands, British West Indies. We describe its pattern and coloration in life. Published reports of distribution and host acceptance by *P. rathbunae* and three of its congeners (*P. anthophilus* Holthuis and Eibl-Eibesfeldt, 1964; *P. pedersoni* Chace, 1958; and *P. yucatanicus* Ives, 1891) are reviewed. The last two species are recorded for the first time from the Turks and Caicos, and the association of *P. yucatanicus* with *Stichodactyla helianthus* on the Caicos Bank is a new host record. Finally, we offer the first direct evidence that *P. yucatanicus* leaves the host anemone temporarily to "clean" fishes, discounting a previous suggestion of its role as a noncleaning mimic of *P. pedersoni*.

## INTRODUCTION

The commensal shrimp *Periclimenes rathbunae* Schmitt, 1924, lives in association with sea anemones in shallow waters of the West Indies. Schmitt (1924) and later Holthuis (1951) based descriptions on preserved specimens from which the pattern and coloration had been extinguished. In this report we extend the range of the species to the Turks and Caicos Islands (British West Indies), provide a description of the pattern and coloration in life, summarize what is known about distribution, and discuss host associations. We also describe the distribution and host associations of three congeners (*P. anthophilus* Holthuis and Eibl-Eibesfeldt, 1964; *P. pedersoni* Chace, 1958; and *P. yucatanicus* Ives, 1891), report a new host association (*P. yucatanicus* with the sea anemone *Stichodactyla helianthus* Ellis, 1767), and offer the first direct evidence that *P. yucatanicus* may be a "cleaner" of fishes.

## MATERIALS AND METHODS

*Periclimenes rathbunae* was collected at depths of 1-3 m in the vicinity of Pine Cay (~21°53'N, 72°05'W). Specimens collected on the fringing reef were always associated with the anemone *Stichodactyla* (= *Stoichactis*) *helianthus*. Dunn (1981) discussed taxonomic problems of the genus *Stichodactyla*; our nomenclature follows hers. The shrimp were photographed at an image size of 1/1 or 1/2, then captured in plastic bags. Photographs of a typical adult and juvenile are presented in Figures 1 and 2. In the laboratory we recorded pattern and coloration under a dissecting microscope. Notes were made of six adults and three juveniles. Specimens were fixed while still alive in 10% formalin-seawater and identified from characters in Chace (1972, pp. 29-31, 38). Preservation was in 70% ethanol. We collected several *P. rathbunae* from the anemone *Condylactis gigantea* Weinland, 1860, on the Caicos Bank. These differed from the others in pattern and coloration. The unique characters of one specimen (an ovigerous female) are in boldface in the description below. *Periclimenes pedersoni* and *P. yucatanicus* were observed over two years in shallow waters of the Caicos Bank or during dives on the fringing reef off Pine Cay and Providenciales. Specimens were collected intermittently and preserved for identification.

## RESULTS

**PERICLIMENES RATHBUNAE ADULTS** (Figure 1) — Protopodites of pleopods clear with orange spots; or orange spots separated intermittently by white spots; some orange spots with darker centers; exopods and endopods clear or Ova olive green. Pereopod 3 clear except for red spots on basis; or propodus and carpus washed with white; other preopods clear with orange and white spots, the latter smaller and irregular in shape; or with extensive white, either as a patternless wash or rows of closely spaced spots. Pereopods 4 and 5 with a white stripe extending strongly as a dorsal line from ischium through most of merus; junctions of ischium and merus appear white-banded; or propodus and carpus covered almost completely with white; merus and ischium clear with one or two rows of small white spots nearly opposite larger orange spots, the latter with darker centers. Coloration may be strongest on last two pereopods, followed in descending order by pereopods 2 and 1. Pereopod 2 with transverse rows of orange (or russet) and white spots giving the appearance of bands. First and second maxillipeds

clear; third maxilliped with orange or russet spots. Eyestalks with longitudinal white stripes, or as closely spaced spots, and interspersed with orange spots. Antennular peduncle with orange and white spots extending onto stylocerite, some white spots in a thin longitudinal line from base of eyestalks to proximal portion of outer antennules giving the appearance of white stripes. Posterior portion of outer antennules with orange spots, anterior edges clear; or outer antennules clear and washed strongly with white; inner antennules clear, or clear and russet. Antennal scale orange- and white-spotted for a short distance on dorsolateral surface, then clear. Antennae clear with several faint orange or russet bands. Cornea orange ringed with white or pale gold with an orange band. Ventrum with prominent white pattern extending from telson into ventroposterior portion of carapace. Ventral surfaces of abdominal somites orange-spotted. Ventrolateral portion of first somite with faint pattern of white spots similar to ventroposterior portion of third somite; second somite with white ventral patches anteriorly and posteriorly, the white circumscribed with orange spots; or with circular white spots merging strongly into an ellipse. Midlateral areas of

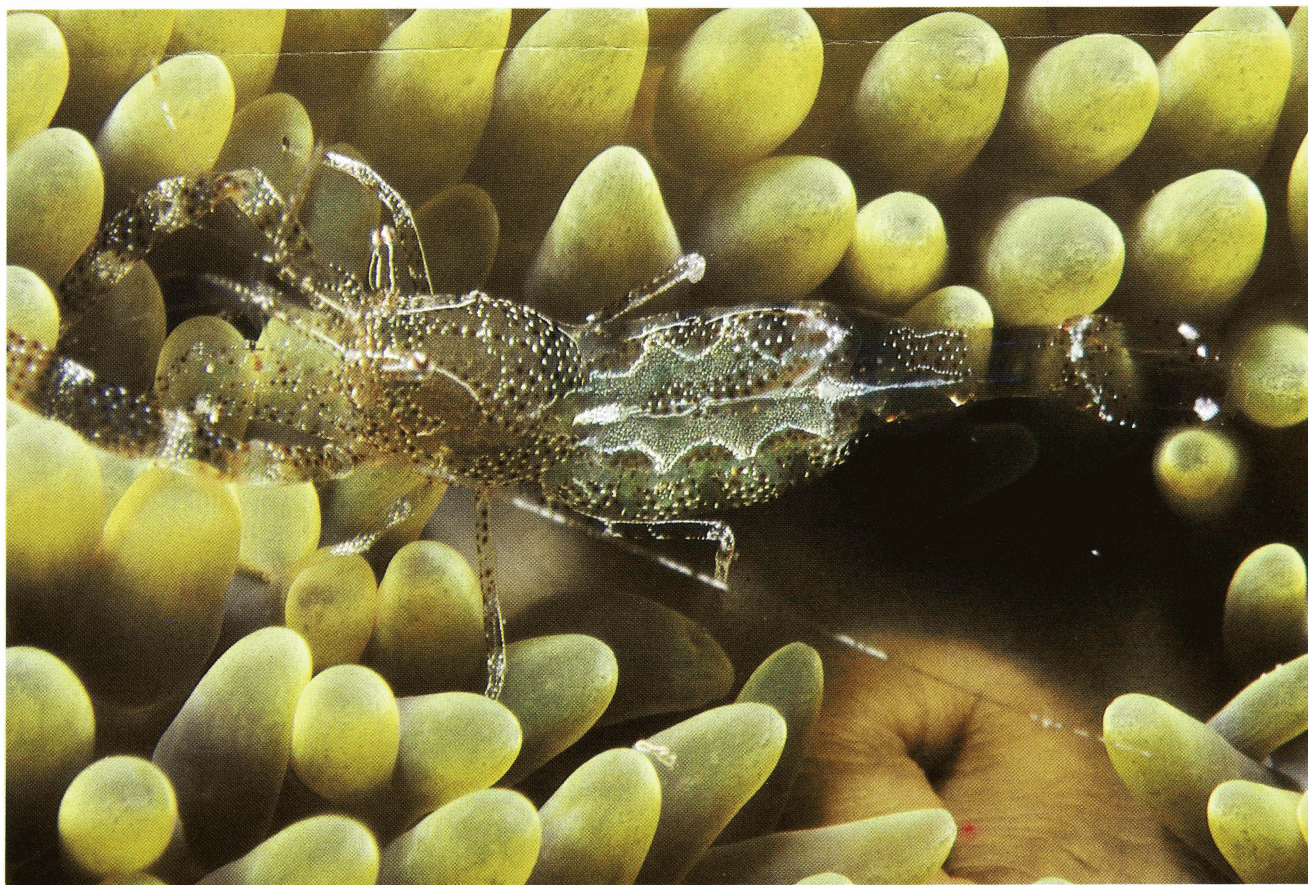


Figure 1. Adult female *Periclimenes rathbunae* (ovigerous) photographed 19 April 1989 on *Stichodactyla helianthus*. Fringing reef, Pine Cay, Turks and Caicos Islands. Image size 1/1, depth 3 m.

somites clear; second and third somites marked with a large saddle clear in center with solid or interrupted orange edges extending anteriorly (or clear anteriorly); entire saddle edged faintly in white; or posterior portion of saddle consisting of white spots mingled with larger orange spots having darker centers; fourth and fifth somites clear with spots similar to those second and third somites but with the pattern outlined in small white spots. Sixth somite with orange and white dorsal spots extending to proximal surfaces of outer uropods; inner uropods and telson clear; or anterior section of telson and uropods with common white band; outer uropods terminating in orange spots with one or two white spots in no evident pattern; or with large white spots on outer edges and a row of russet spots with darker centers around inner edge. Carapace clear with partial dorsal saddle of orange and white spots extending onto rostrum; midlateral sections clear with orange and white spots, the former dominant. In life, the overall appearance is olive green with chelae of pereopod 2 orange and white-banded. The same banded appearance is evident in life, but the shrimp is clear with no hint

of olive.

**PERICLIMENES RATHBUNAE JUVENILES** (Figure 2) — Protopodites of pleopods clear; exopods and endopods clear. Pereopods 1 and 2 clear; pereopod 3 clear except for russet spots on basis and coxa; pereopods 4 and 5 clear with orange spots; all pereopods devoid of white. Sixth abdominal somite clear; ventral surfaces of first five somites with faint, parallel, longitudinal russet stripes. First and second maxillipeds clear; third maxilliped with orange spots. Antennular peduncle clear. Outer antennules with orange spots; inner antennules clear. Antennae clear with several faint orange bands. Cornea dark. Anterior portions of uropods and telson with faint russet wash; otherwise clear. Carapace clear except for a pattern of russet spots extending onto dorsal surface of rostrum; midlateral areas of carapace clear with orange and white spots, the former dominant. In life, the overall appearance is clear with russet or orange spots, occasionally with a faint green iridescence. The characteristic pattern becomes increasingly more developed and complex with age, and white is the last color to appear.

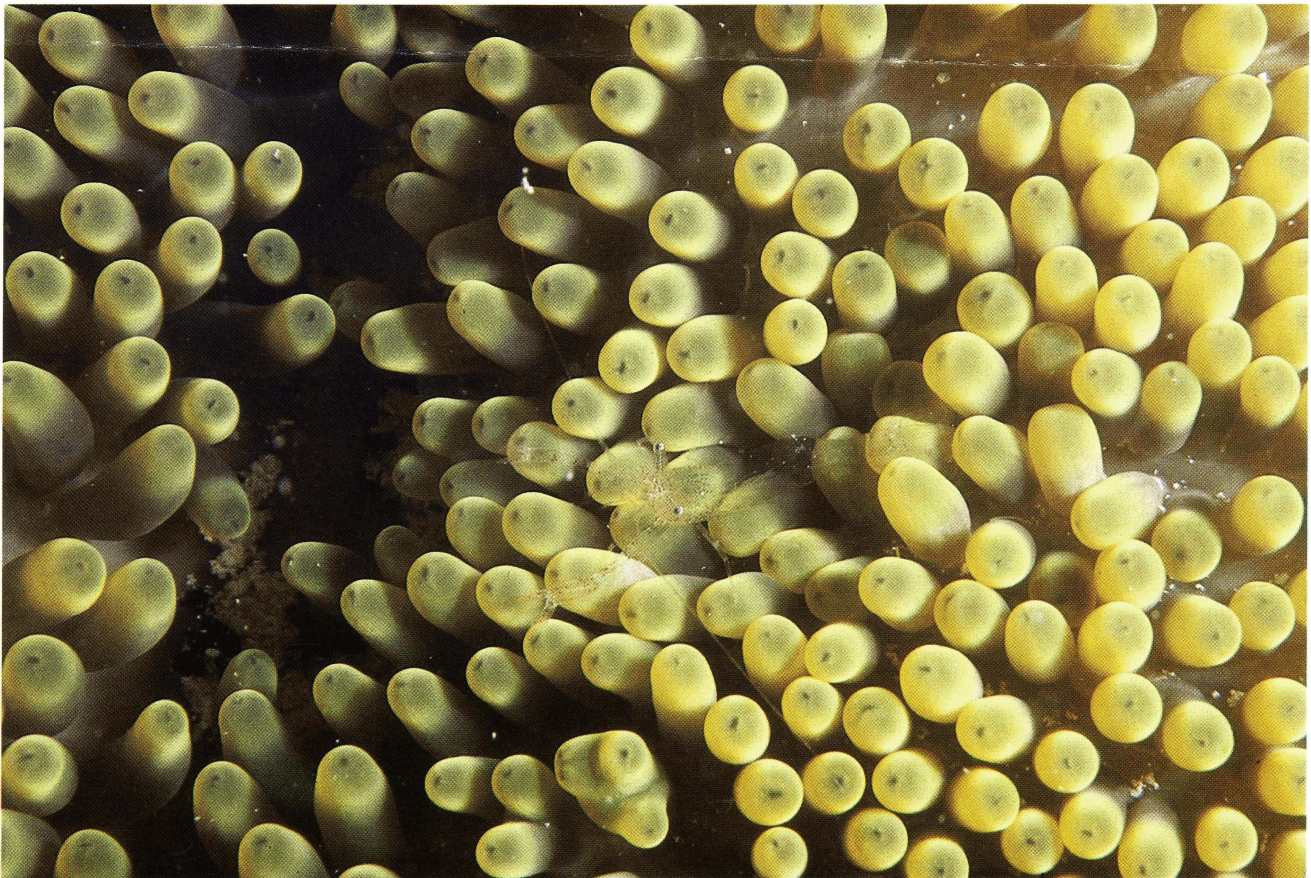


Figure 2. Juvenile *Periclimenes rathbunae* photographed 16 November 1989 on *Stichodactyla helianthus*. The nearly transparent shrimp is positioned near the center of the photograph and facing left. Fringing reef, Pine Cay, Turks and Caicos Islands. Image size 1/2, depth 2.7 m.

## DISCUSSION

## COMMENTS AND OBSERVATIONS —

*P. rathbunae* — The above descriptions suggest that the pattern and coloration of *P. rathbunae* are age-dependent, but also influenced by the host. Mahnken (1972) ascribed to *P. yucatanicus* a limited capacity to match the coloration of its host anemone, but we could find no additional information on the subject with respect to other anemone shrimps of the genus *Periclimenes*.

The tentacles of *S. helianthus* ordinarily are green to olive, and the column ranges from dark olive to almost brown. The coloration of *C. gigantea* is variable: the tentacles can be uniformly white, cream, or various shades of tan, occasionally tipped with red, pink, or lavender. The column, which is just as variable, can be cream, tan, or orange. Specimens of *P. rathbunae* collected from *S. helianthus* and observed *in vitro* were transparent, tinted slightly with olive. The more intense olive appearance in nature is attributable not to inherent coloration, but to light transmitted through the shrimp from the surface of the anemone. The *C. gigantea* from which *P. rathbunae* were collected on the Caicos Bank had cream-colored tentacles. The shrimp were transparent and without any background coloration of note; in other words, similar to the unconfirmed specimen in Figure 3. These observations indicate that *P. rathbunae* can modify its overall coloration to match that of the host, but such capacity is limited.

Schmitt (1924, 1936) made no mention of habitat when describing *P. rathbunae* and was unaware that the species is a symbiont. Before Schmitt's descriptions, Duerden (1900, p. 166) had written that in Jamaica *Stichodactyla helianthus* is host to "a small, brightly-coloured Crustacean," perhaps *P. rathbunae*. Manning (1970) found *P. rathbunae* in Dominica associated with a sea anemone described as *Stoichactis* sp. Colin (1978, p. 344) depicted what appears to be an adult *P. rathbunae* among the tentacles of *S. helianthus*. The shrimp, photographed in color off Puerto Rico, was described simply as "an unidentified specimen of *Periclimenes*." An unidentified shrimp shown in another photograph (Colin 1978, p. 193) is possibly a juvenile *P. rathbunae*. Mercado and Capriles (1982) recorded *P. rathbunae* as a symbiont of both *S. helianthus* and *Homostichanthus duerdeni* Carlgran, 1900, in Puerto Rico. R.N. Mariscal (1979, pers. commun. to Dunn 1981, p. 81) reported having seen *P. rathbunae* on *S. helianthus* in the British Virgin Islands. Hermskind et al. (1976) observed "*P. c.f. rathbunae*" to be a common symbiont on *Lebrunia danae* Duchassaing and Michelotti, 1860, at Grand Bahama. These and other known host associations of *P. rathbunae* and three of its congeners are summarized in Table 1. We keyed three shrimps collected by M.R. Dardeau at Carrie Bow Cay, Belize, to *P. rathbunae* (host unknown).

All *P. rathbunae* observed by us in the Turks and Caicos have been associated with *S. helianthus*, except those on the Caicos Bank. At Bonaire two of us (Manstan and Spotte) photographed shrimps that appear to be *P. rathbunae* on *C. gigantea* (Figure 3). The specimens were not collected. Criales (1984) listed *Bunodosoma granulifera* Leseur, 1817, *C. gigantea*, and *S. helianthus* as hosts of *P. rathbunae* in Santa Marta, Colombia. Captive *P. rathbunae* will accept *C. gigantea* if *S. helianthus* is unavailable. An adult female captured at Pine Cay in April 1989 and placed in a laboratory aquarium with three *C. gigantea* immediately accepted one as host. At Curacao, Criales (1980) reported finding a single *P. rathbunae* on the gorgonian *Eunicea tourneforti* Milne-Edwards and Haime, 1857. Mahnken (1972) collected shrimps similar to *P. rathbunae* (perhaps undescribed) from *Bartholomea annulata* Duchassaing and Michelotti, 1866, and other (unnamed) species of anemones in the U.S. Virgin Islands. Criales (1980) wrote that *P. rathbunae* "... has been reported living in association with several sea anemones (Holthuis 1951, Chace 1972) ...." Neither author cited, however, mentioned a host. Holthuis (1951, p. 60) stated that the single specimen deposited in the U.S. National Museum (Schmitt 1936) had been collected at Bonaire "under stones." According to Chace (1972, p. 38), "Most of the documented specimens in the [U.S. National Museum's] collection were taken from coral reefs in 1-5 feet of water; one specimen was found on a dead coral flat and one along a rock-studded sandy beach."

COMMENTS AND OBSERVATIONS — *P. anthophilus*, *P. pedersoni*, *P. yucatanicus* -

Of anemone shrimps of the genus *Periclimenes* indigenous to the Western Hemisphere, *P. anthophilus* is the most limited in its host associations (Table 1). Nizinski (1989) found *P. anthophilus* at Bermuda associated only with *C. gigantea*, despite the presence of *B. annulata*. The shrimp sighted by Sargent and Wagenbach (1975) at Bermuda occupied *C. gigantea* exclusively. In their original description of *P. anthophilus*, Holthuis and Eibl-Eibesfeldt (1964) remarked that this shrimp was observed on *C. gigantea* and *Actinia bermudensis* McMurrich, 1889, but never *B. annulata*. To our knowledge, *P. anthophilus* is restricted to Bermuda waters. Criales and Corredor (1977) did not observe *P. anthophilus* at Santa Marta and St. Vincent (we assume St. Vincent and the Grenadines). Criales (1984) later claimed to have seen the species associated with *B. annulata* and *C. gigantea* at Santa Marta, but the vagueness of her descriptions leads us to question their validity.

*Periclimenes pedersoni* and *P. yucatanicus* seem more plastic in their host acceptance. Early records of these species did not include mention of hosts (Table 1). At Santa Marta, *P. pedersoni* associates with *Aiptasia*

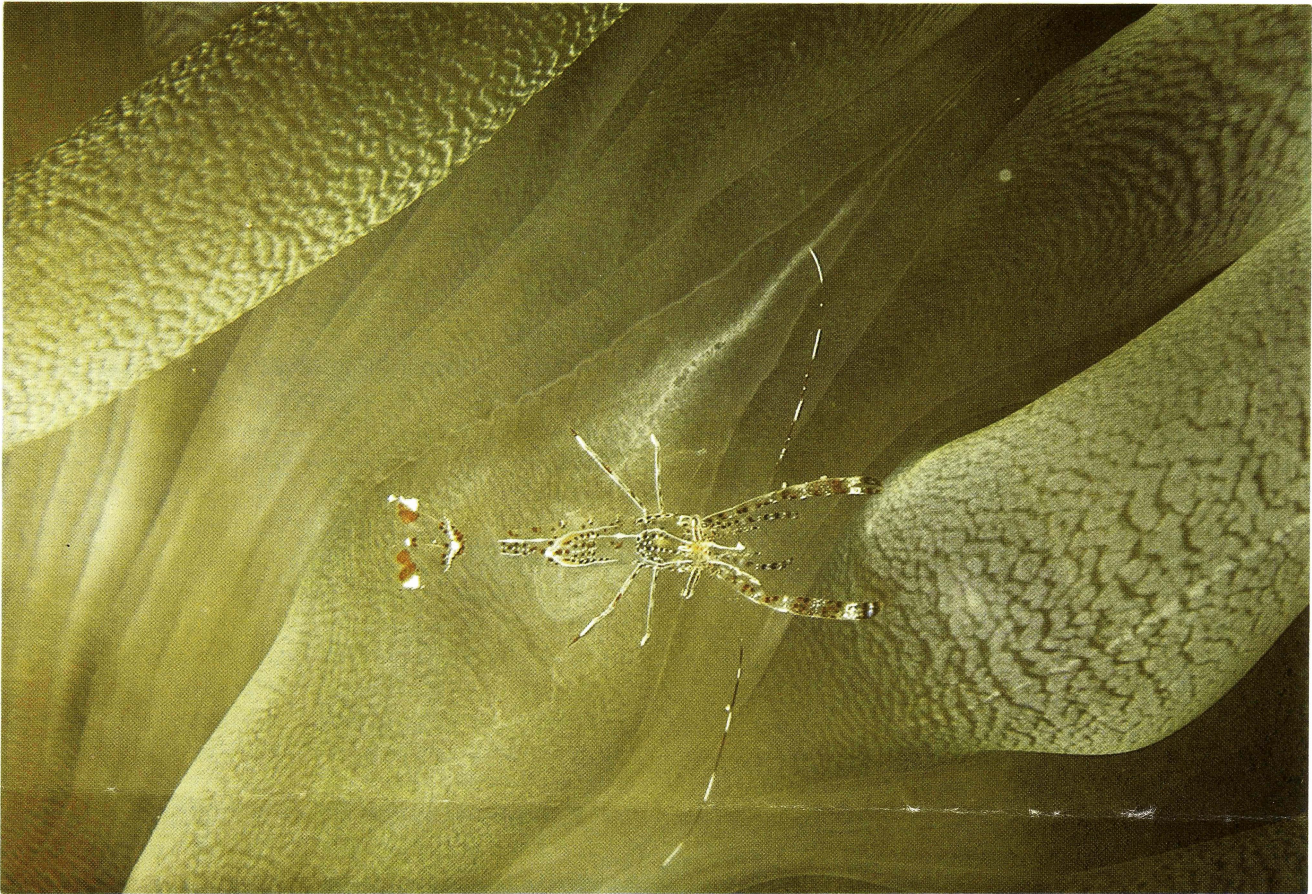


Figure 3. *Periclimenes* c.f. *rathbunae* photographed April 1982 on *Condylactis gigantea*. Bachelors Beach, Bonaire, Netherlands Antilles. Image size 1/2, depth 6 m.

*pallida* Verrill, 1864 (Criales 1984), *B. annulata* (Criales 1984, Criales and Corredor 1977), and *L. danae* (Criales 1984, Criales and Corredor 1977). Criales (1984) also listed *B. granulifera*, *Cerianthus* sp., and the medusa *Cassiopea xamachana* Bigelow, 1892, as hosts of *P. pedersoni* at Santa Marta. At St. Vincent, Criales and Corredor (1977) reported *P. pedersoni* in association with *B. annulata*, *C. gigantea*, and *Heteractis lucida* Duchassaing and Michelotti, 1860. Both shrimps are found commonly on *B. annulata* in the U.S. Virgin Islands (Mahnken 1972). Mahnken (1972) also reported finding *P. yucatanicus* on the medusa *Cassiopeia* [sic] sp. and two "large green anemones" (*S. helianthus?*). Limbaugh et al. (1961) stated that in the Bahamas, Virgin Islands (presumably the U.S. Virgin Islands), and Puerto Rico, *P. yucatanicus* associates with *B. annulata* and *C. gigantea*. Specimens of *P. pedersoni* collected by these authors in the Bahamas, Antigua (Antigua and Barbuda), and Virgin Islands (presumably U.S.) were always associated with *B. annulata*. One of us (Spotte) has observed *P. pedersoni* and *P. yucatanicus* on *B. annulata* at Coki Beach, St. Thomas (U.S. Virgin Islands). One of us

(Spotte) has photographed a shrimp that resembles *P. yucatanicus* on the corallimorpharian *Rhodactis sanctithomae* Duchassaing and Michelotti, 1860, off Rocher du Diamont, Martinique, French West Indies. The shrimp was not collected.

Chace (1958) recorded *P. pedersoni* in the collections of the U.S. National Museum from Lyford Cay (New Providence Island, Bahamas), Hog Island (Nassau Harbor, Bahamas), and St. John (U.S. Virgin Islands). Chace (1972, p. 38) listed specimens from Antigua and Tortola (British Virgin Islands). Only the Antigua specimens are known to have been associated with a host (*B. annulata*).

Chace (1972, p. 38-39) noted the origins of *P. yucatanicus* deposited at the U.S. National Museum. Specimens from St. Christopher ("St. Kitts;" St. Christopher-Nevis), had been recovered from *B. annulata*; those from Peter Island (British Virgin Islands) were recorded simply as having been found "on the usual anemone." Hosts for the remaining material are unknown (Table 1). Specimens from Horseshoe Island (Florida Keys) in the possession of M.R. Dardeau keyed to *P.*

*yucatanicus*. They had been collected from *C. gigantea*. Other specimens in the Dardeau collection from Carrie Bow Cay (Belize) were keyed by us to *P. pedersoni* and *P. yucatanicus* (hosts unknown). At Santa Marta, *P. yucatanicus* associates with *A. pallida* (Criales and Corredor 1977), *B. annulata* (Criales 1984, Criales and Corredor 1977), *C. gigantea* (Criales 1984), *L. danae* (Criales 1984), and *C. xamachana* (Criales 1984, Criales and Corredor 1977). At St. Vincent, *P. yucatanicus* is found on *B. annulata* and *C. gigantea* (Criales and Corredor 1977). Herrnkind et al. (1976) found *P. pedersoni* and *P. yucatanicus* associated with *L. danae* at Grand Bahama. These authors also saw anemone shrimps hosted by *B. annulata*, but referred to them simply as "*Periclimenes* spp."

Our Turks and Caicos collections have been made on the Caicos Bank and offshore fringing reef, both localities in the vicinity of Pine Cay. On the reef, *B. annulata* and *C. gigantea* are occupied by *P. pedersoni* and *P. yucatanicus*; sometimes the same *B. annulata* hosts both species. On the reef, *B. annulata* is the more common anemone. The reverse is true on the Caicos Bank. There both *B. annulata* and *C. gigantea* are occupied by *P. yucatanicus*, but *P. pedersoni* has not been seen. An ovigerous *P. yucatanicus* was recovered 12 April 1988 from *S. helianthus* on the Caicos Bank. This appears to be a new host record. One of us (Manstan) photographed shrimp that probably were *P. pedersoni* on *L. danae* at a depth of 25 m on the outer reef off Providenciales. The specimens were not collected.

"CLEANING" — Mahnken (1972) never observed *P. rathbunae* in the act of "cleaning" fishes, and neither have we. So far as we can judge, the species has no "cleaning dance" comparable with that of *P. anthophilus*, *P. pedersoni*, and *P. yucatanicus* (Limbaugh et al. 1961, Mahnken 1972, Sargent and Wagenbach, 1975). During these "dances" the shrimp positions itself in a prominent location (e.g., near the tip of one of its host's tentacles), faces the prospective client, rocks sideways, and lashes its antennae (Limbaugh et al. 1961). We add to this the observation that the first and second pairs of pereopods are held together tightly and stretched out as a single unit in front of the shrimp. Holthuis and Eibl-Eibesfeldt (1964) observed this last behavior in *P. anthophilus* and without experimentation or further discussion termed it "fright posture." Sargent and Wagenbach (1975) described the cleaning behavior of *P. anthophilus*, but did not mention "fright posture." In our opinion this designation is inaccurate.

Of anemone shrimps found in the West Indies and Bermuda, only *P. anthophilus* and *P. pedersoni* had been observed previously to leave the host and board

client fishes, often entering the opercular cavity and mouth (Limbaugh et al. 1961, Sargent and Wagenbach, 1975). However, *P. pedersoni* on the west coast of Florida reportedly neither associates with anemones nor cleans fishes (Limbaugh et al. 1961). Holthuis and Eibl-Eibesfeldt (1964) did not observe *P. anthophilus* to clean fishes, but Sargent and Wagenbach (1975) described its cleaning behavior in detail. A literature search yielded no direct evidence of cleaning by *P. yucatanicus*. Limbaugh et al. (1961) never observed this species to clean fishes, nor did Criales and Corredor (1977) or Mahnken (1972). According to Limbaugh et al. (1961), contact with fishes that paused near the host anemones was fleeting, and the shrimp did not leave the substratum. They suggested that *P. yucatanicus* mimics other cleaners (presumably *P. pedersoni*), a possibility rejected by Mahnken (1972). We can now state that *P. yucatanicus* possesses what appears to be a full repertoire of cleaning behaviors, including leaving the substratum and boarding the client.

On 19 April 1989, one of us (Spotte) observed cleaning by an adult *P. yucatanicus*. The incident occurred off Pine Cay on the Caicos Bank in water 1.5 m deep. The shrimp, which was associated with a *C. gigantea*, was seen cleaning a Nassau grouper (*Epinephelus striatus* Bloch, 1792) about 15 cm in length. The grouper was at least 10 cm from the anemone. The shrimp was first noticed as it was backing out of the grouper's left opercular cavity, which it had entered until its entire body disappeared from view. The shrimp then walked down the fish's back to the caudal peduncle, paused for slightly more than a minute, and proceeded up the left side of the fish. During this time it paused every few seconds and appeared to be picking objects from the grouper's skin with its chelipeds. After about three minutes it dropped off the fish, returned to the anemone, and the fish swam away. The shrimp was collected and its identity confirmed.

#### ACKNOWLEDGMENTS

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TABLE 1

Known and unconfirmed hosts of *Periclimenes anthophilus*, *P. pedersoni*, *P. rathbunae*, and *P. yucatanicus*.

HOST	LOCATION	SOURCE
<i>Periclimenes anthophilus</i>		
<i>Actinia bermudensis</i>	Bermuda	Chace (1972), Holthuis and Eibl-Eibesfeldt (1964)
<i>Bartholomea annulata</i>	Santa Marta, Colombia <sup>+</sup>	Criales (1984)
<i>Condylactis gigantea</i>	Bermuda	Chace (1972), Holthuis and Eibl-Eibesfeldt (1964), Nizinski (1989), Sargent and Wagenbach (1975)
	Santa Marta, Colombia <sup>+</sup>	Criales (1984)
<i>Periclimenes pedersoni</i>		
<i>Aiptasia pallida</i>	Santa Marta, Colombia	Criales (1984)
<i>Bartholomea annulata</i>	Antigua, Antigua and Barbuda	Chace (1972), Limbaugh et al. (1961)
	Bahamas	Limbaugh et al. (1961)
	Pine Cay, fringing reef, Turks and Caicos Islands	This report
	Santa Marta, Colombia	Criales (1984), Criales and Corredor (1977)
	St. Thomas, Coki Beach, U.S. Virgin Islands	This report
	St. Vincent, St. Vincent and the Grenadines	Criales and Corredor (1977)
	U.S. Virgin Islands	Limbaugh et al. (1961), Mahnken (1972)
<i>Bunodosoma granulifera</i>	Santa Marta, Colombia	Criales (1984)
<i>Cassiopea xamachana</i>	Santa Marta, Colombia	Criales (1984)
<i>Cerianthus</i> sp.	Santa Marta, Colombia	Criales (1984)
<i>Condylactis gigantea</i>	St. Vincent, St. Vincent and the Grenadines	Criales and Corredor (1977)
	Pine Cay, fringing reef, Turks and Caicos Islands	This report
<i>Heteractis lucida</i>	St. Vincent, St. Vincent and the Grenadines	Criales and Corredor (1977)
<i>Lebrunia danae</i>	Grand Bahama, Bahamas	Hermkind et al. (1976)

	Providenciales, fringing reef, Turks and Caicos Islands*	This report
	Santa Marta, Colombia	Criales (1984), Criales and Corredor (1977)
Host unknown	Carrie Bow Cay, Belize	M.R. Dardeau, this report
	Florida west coast**	Chace (1972), Limbaugh et al. (1961)
	Hog Island, Nassau Harbor, Bahamas	Chace (1958)
	Lyford Cay, New Providence Island, Bahamas	Chace (1958)
	St. John, U.S. Virgin Islands	Chace (1958)
	Tortola, British Virgin Islands	Chace (1972)
<i>Periclimenes rathbunae</i>		
<i>Bartholomea annulata</i>	U.S. Virgin Islands*	Mahnken (1972)
<i>Bunodosoma granulifera</i>	Santa Marta, Colombia	Criales (1984)
<i>Condylactis gigantea</i>	Bonaire, Bachelors Beach, Netherlands Antilles*	This report
	Pine Cay, Caicos Bank, Turks and Caicos Islands	This report
	Santa Marta, Colombia	Criales (1984)
<i>Eunicea tourneforti</i>	Curacao, Netherlands Antilles	Criales (1980)
<i>Homostichanthus duerdeni</i>	Puerto Rico	Mercado and Capriles (1982)
<i>Lebrunia danae</i>	Grand Bahama, Bahamas*	Hermkind et al. (1976)
<i>Stichodactyla helianthus</i>	British Virgin Islands*	R.N. Mariscal in Dunn (1981)
	Dominica	Manning (1970)
	Jamaica*	Duerden (1900)
	Pine Cay, fringing reef, Turks and Caicos Islands	This report
	Puerto Rico*	Colin (1978)
	Puerto Rico	Mercado and Capriles (1982)
	Santa Marta, Colombia	Criales (1984)
Host unknown	Antigua, Antigua and Barbuda	Chace (1972)
	Bahía de la Ascensión, Yucatan State, Mexico	Chace (1972)
	Bonaire, Netherlands Antilles	Chace (1972), Holthuis (1951), Schmitt (1936)



	Carrie Bow Cay, Belize	M.R. Dardeau, this report
	Curacao, Netherlands Antilles	Chace (1972), Holthuis (1951), Schmitt (1924, 1936)
	Guadeloupe, French West Indies	Chace (1972)
	Loggerhead Key, Dry Tortugas, Florida*	Chace (1972), Holthuis (1951)
	St. Lucia, French West Indies	Chace (1972)
	<i>Periclimenes yucatanicus</i>	
<i>Aiptasia pallida</i>	Santa Marta, Colombia	Criales and Corredor (1977)
<i>Bartholomea annulata</i>	Bahamas	Limbaugh et al. (1961)
	Pine Cay, fringing reef and Caicos Bank, Turks and Caicos Islands	This report
	Puerto Rico	Limbaugh et al. (1961)
	Santa Marta, Colombia	Criales (1984), Criales and Corredor (1977)
	St. Christopher (St. Kitts), St. Christopher-Nevis	Chace (1972)
	St. Thomas, Coki Beach, U.S. Virgin Islands	This report
	St. Vincent, St. Vincent and the Grenadines	Criales and Corredor (1977)
	U.S. Virgin Islands	Limbaugh et al. (1961), Mahnken (1972)
<i>Cassiopeia [sic] sp.</i>	U.S. Virgin Islands	Mahnken (1972)
<i>Cassiopea xamachana</i>	Santa Marta, Colombia	Criales (1984), Criales and Corredor (1977)
<i>Condylactis gigantea</i>	Bahamas, U.S. Virginia Islands, Puerto Rico	Limbaugh et al. (1961)
	Horseshoe Island, Florida Keys	M.R. Dardeau, this report
	Pine Cay, fringing reef and Caicos Bank, Turks and Caicos Islands	This report
	Santa Marta, Colombia	Criales (1984)
	St. Vincent, St. Vincent and the Grenadines	Criales and Corredor (1977)
"large green anemones" ( <i>S. helianthus?</i> )	U.S. Virgin Islands	Mahnken (1972)
<i>Lebrunia danae</i>	Grand Bahama, Bahamas	Hermkind et al. (1976)
	Santa Marta, Colombia	Criales (1984)

<i>Rhodactis sanctithomae</i>	Martinique, Rocher du Diamont, French West Indies*	This report
<i>Stichodactyla helianthus</i>	Pine Cay, Caicos Bank, Turks and Caicos Islands	This report
Host unknown	Antigua, Antigua and Barbuda	Chace (1972)
	Barbuda, Antigua and Barbuda	Chace (1972)
	Cape Florida, Florida	Holthuis (1951)
	Cape la Vela, Colombia	Holthuis (1951)
	Carrie Bow Cay, Belize	M.R. Dardeau, this report
	Isla de Cozumel, Yucatan State, Mexico	Chace (1972)
	Long Key, Dry Tortugas, Florida	Holthuis (1951)
	Peter Island, British Virgin Islands	Chace (1972)
	Virgin Gorda, British Virgin Islands	Chace (1972)
	Yucatan State, Mexico	Ives (1891)

\*Questionable identification

\*Unconfirmed or uncertain identification

\*\*Reported by Limbaugh et al. (1961) not to associate with anemones.

#### REFERENCES CITED

- Chace, F.A. Jr. 1958. A new shrimp of the genus *Periclimenes* from the West Indies. *Proc. Biol. Soc. Wash.* 71:125-130.
- Chace, F.A. Jr. 1972. The shrimps of the Smithsonian-Bredin Caribbean expeditions with a summary of the West Indian shallow-water species (Crustacea: Decapoda: Natantia). *Smithson. Contrib. Zool. No. 98*, Smithsonian Institution Press, Washington, 179 pp.
- Colin, P.I. 1978. *Caribbean reef invertebrates and plants*. TFH Publications, Neptune City, N.J., 512 pp.
- Criales, M.M. 1980. Commensal caridean shrimps of Octocorallia and Antipatharia in Curacao and Bonaire. *Stud. Fauna Curacao* 61:68-85.
- Criales, M.M. 1984. Shrimps associated with coelenterates, echinoderms, and molluscs in the Santa Marta region, Colombia. *J. Crust. Biol.* 4:307-317.
- Criales, M.M. & L. Corredor. 1977. Aspectos etologicos y ecologicos de camarones limpiadores de peces (Natantia: Palaemonidae, Hippolytidae, Stenopodidae). *An. Inst. Inv. Mar. Punta Betin* 9:141-156.
- Duerden, J.E. 1900. Jamaican Actiniara. *Sci. Trans. R. Dublin Soc.* VI(Ser. II):133-220. [pp. 161-166, plate XIV].
- Dunn, D.F. 1981. The clownfish sea anemones: Stichodactylidae (Coelenterata: Actinaria) and other sea anemones symbiotic with pomacentrid fishes. *Trans Am. Philos. Soc.* 71 (Part 1):1-115.
- Hermkind, W., G. Stanton, & E. Conklin. 1976. Initial characterization of the commensal complex associated with the anemone, *Lebrunia danae*, at Grand Bahama. *Bull. Mar. Sci.* 26:65-71.
- Holthuis, L.B. 1951. A general revision of the Palaemonidae (Crustacea Decapoda Natantia) of the Americas. I. the subfamilies Euryrhynchinae and Pontoniinae. *Allan Hancock Found. Publ. Occas. Pap.* (11):58-60, Plate 17 (p. 235).
- Holthuis, L.B. and I. Eibl-Eibesfeldt. 1964. A new species of the genus *Periclimenes* from Bermuda (Crustacea, Decapoda, Palaemonidae). *Senck. Biol.* 45:185-192.
- Ives, J.E. 1891. Crustacea from the northern coast of Yucatan, the harbor of Vera Cruz, the west coast of Florida and the Bermuda Islands. *Proc. Acad. Nat. Sci. Phila.* (1891):176-207, Plates V and VI.
- Limbaugh, C., H. Pederson, and F.A. Chace Jr. 1961. Shrimps that clean fishes. *Bull. Mar. Sci. Gulf Carib.* 11:237-257.
- Mahnken, C. 1972. Observations on cleaner shrimps of the genus *Periclimenes*. *Sci. Bull. Nat. Hist. Mus. Los Angeles Co.* 14:71-83.
- Manning, R.B. 1970. *Mithrax (Mithraculus) commensalis*, a new West Indian spider crab (Decapoda, Majidae) commensal with a sea anemone. *Crustaceana* 19:157-160, Plates 1 and 2.

- Mercado, L.M. and V.A. Capriles. 1982. Description of two commensal complexes associated with the anemones, *Stoichactis helianthus* and *Homostichanthus duerdeni* in Puerto Rico. *Carib. J. Sci.* 17:69-72.
- Nizinski, M.S. 1989. Ecological distribution, demography and behavioral observations on *Periclimenes anthophilus*, an atypical symbiotic cleaner shrimp. *Bull. Mar. Sci.* 45:174-188.
- Sargent, R.C. & G.E. Wagenbach. 1975. Cleaning behavior of the shrimp, *Periclimenes anthophilus* Holthuis and Eiblsfeldt (Crustacea: Decapoda: Natantia). *Bull. Mar. Sci.* 25:466-472.
- Schmitt, W.L. 1924. The macruran, anomuran and stomatopod Crustacea. In: Bijdragen tot de Kennis der Fauna van Curacao. Resultaten Eener Reis van Dr. C.J. van der Horst in 1920. *Bijdr. Dierk.* 23:61-81.
- Schmitt, W.L. 1936. Macruran and Anomuran Crustacea from Bonaire, Curacao and Aruba. *Zool. Jb. Syst.* 67:363-378, 3 plates.