shelly beach at Sanibel. Selection on small individuals for crypsis on shelly beaches may be an important factor in maintaining the polymorphic banding patterns in donacid clams.

ACKNOWLEDGMENTS

I thank K. and E. Mayer for their hospitality at Sanibel Island.

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DATE ACCEPTED: May 28, 1981.

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BULLETIN OF MARINE SCIENCE, 32(1): 344–347, 1982

STUDIES ON WEST INDIAN STENOPODIDAE, 2. OCCURRENCE OF *RICHARDINA SPINICINCTA* A. MILNE EDWARDS, 1881 (CRUSTACEA: DECAPODA; STENOPODIDEA) OFF THE DRY TORTUGAS

Joseph W. Goy

The genus *Richardina* presently contains two species: *R. fredericii* Lo Bianco, 1903 recorded from the Mediterranean, and *R. spinicincta* A. Milne Edwards, 1881 recorded from the Bay of Biscay and waters off southwest Ireland (Holthuis, 1946). *Richardina spinicincta* has been taken from depths between 1,200 and 1,230 m (A. Milne Edwards, 1881; Kemp, 1910; Zariquiey Alvarez, 1968), while *R. fredericii* has been collected between the depths of 950 and 1,100 m (Lo Bianco, 1903; Zariquiey Alvarez, 1968) and recently at a depth of 400 m off Barcelona, Spain (MacPherson, 1978).

Among unidentified stenopodidean shrimp in the collection of the National Museum of Natural History, Washington, D.C., a single male specimen of *Richardina spinicincta* (USNM119885) was found. The specimen was collected by W. L. Schmitt on 3 August 1932, 16–20 miles southwest of the Dry Tortugas, Florida, at a depth of 455–655 m.

The specimen is in fairly good condition. The total length of the animal is approximately 27 mm, the rostral carapace length 9.1 mm and the post-orbital carapace length 6.3 mm. Generally, this specimen follows closely the descriptions in the literature (A. Milne Edwards, 1881; Kemp, 1910; Holthuis, 1946). It was also compared with an ovigerous female (BMNH 1911–2330) collected off west Ireland which is in the Norman Collection of the British Museum (Natural History), London.

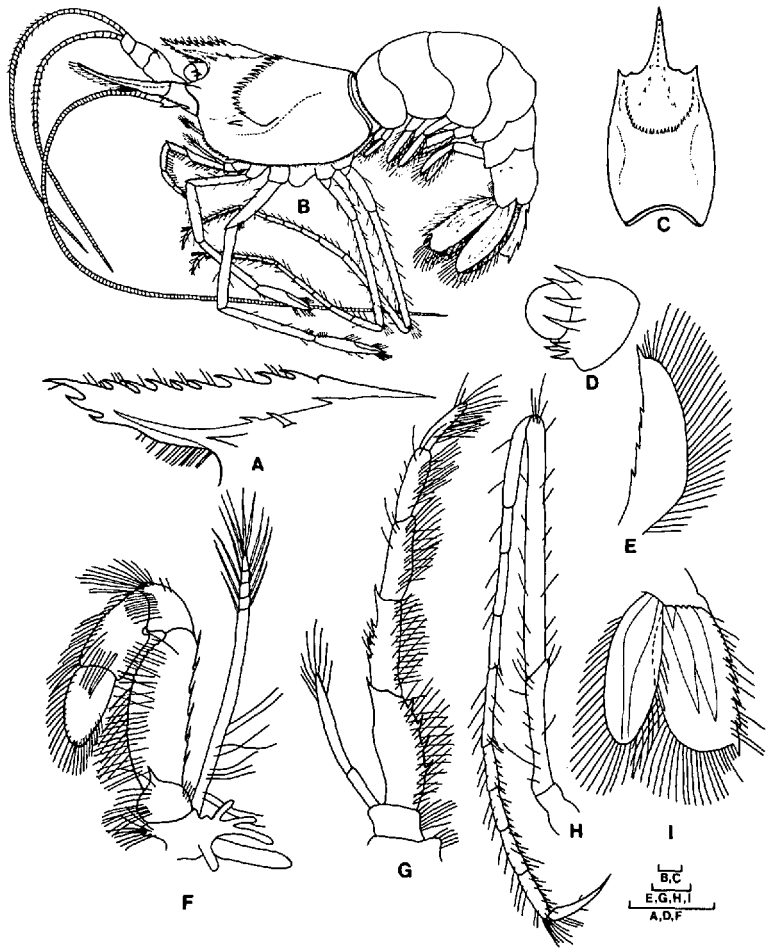

Figure 1. *Richardina spinicincta* A. Milne Edwards, 1881. A, Lateral view, rostrum; B, Lateral view; C, Dorsal view, carapace; D, Eye; E, Scaphocerite; F, Second maxilliped; G, Third maxilliped; H, Fifth pereiopod; I, Uropods. Scale bars represent 1.0 mm.

The body is slender and compressed. The rostrum (Fig. 1A) is well developed with 8 dorsal spines behind which is a blunt tubercle, while the ventral margin bears 2 spines distally and numerous setae proximally. The carapace (Figs. 1B, C) has a very distinct cervical groove, with a cincture of 30 spines on its posterior margin. Behind the base of the rostrum there is a row of 4 spines on each side that are along a carina which runs back from the rostrum. The anterior margin of the carapace is rounded below the orbit with a small antennal spine and 10 pterygostomian spines.

The abdomen is more or less compressed, with the first somite slightly overlapping the second and the second overlapping the third. There are minute spinules on the posterior margins of the fourth and fifth somites and the sixth somite is without spinules.

The telson is incomplete with a median groove flanked by 2 longitudinal ridges bearing 3 strong spines. The posterior half of the telson is broken off just below the strong lateral spine on each side.

The eye (Fig. 1D) is rather distinct, with the peduncle longer and broader than the cornea and bearing 7 strong spines. The cornea is small and degenerate, but distinctly separated from the stalk; it is without pigment and with only faint traces of facets.

The antennular peduncle and basal segments of the antenna have some spinules. The scaphocerite (Fig. 1E) is elongate, slightly convex at its base and straight in the upper part. Its outer margin has 4 teeth separated to some extent from a terminal tooth.

The second and third maxillipeds (Figs. 1F, G) each have an exopodite. The outer margin of the merus of the second maxilliped bears 6 evenly-spaced minute spines. The ischium of the third maxilliped bears a terminal spine on its outer margin and 4 spines on its inner margin, while the outer margin of the merus has 4 spines at about mid-length and a larger terminal spine.

The first and second pereiopods are chelate and similar, but the second is slightly longer. Both are glabrous except for small tufts of setae on the tips of the chelae. The second pereiopod also has a setiferous organ on the lower surface of the carpus and propodus. The third pereiopods are missing in this specimen. The fourth and fifth pereiopods (Fig. 1H) are very long and slender with each carpus and propodus composed of 5 segments and 4 segments respectively. The distal 2 segments of the carpus have a terminal movable spine on their inner margin, while the propodi bear 17 movable spines.

The first pleopods are uniramous and the others are biramous, with all pleopods bearing no spinules.

The uropodal exopodite (Fig. 1I) is quadrangular with 5 teeth on its outer margin, not including the terminal tooth; the dorsal surface bears 2 parallel longitudinal ridges. The endopodite is elongate and slightly triangular without teeth on its margins and only one dorsal longitudinal ridge.

Even though this specimen is lacking some essential characters (incomplete telson, third pereiopods), I do not hesitate to assign it to *R. spinicincta* because it agrees remarkably well with the type description and loaned material. Kemp (1910) gave excellent figures of specimens collected off the coast of Ireland that only differ in not having a distinct separation between the cornea and peduncle of the eye, like in the present specimen. Kemp's specimens also have two stout spines on the lower proximal margin of the sixth abdominal somite that are missing in the present material. This is only the sixth known specimen of the species and the first record of the genus in the Western Atlantic. It represents a considerable range extension for *R. spinicincta* and is the largest recorded specimen (27 mm); previous specimens ranged between 16.0 and 21.5 mm in total length. The collection depth (455–655 m) is in agreement with MacPherson's (1978) record of 400 m for *R. fredericii* and suggests that the genus occurs at shallower depths than those recorded in previous literature.

Acknowledgments

I would like to thank Dr. R. B. Manning, U.S. National Museum of Natural History, for the opportunity to examine this specimen; Dr. A. A. Fincham, British Museum (Natural History), for the loan of comparative material; and J. D. Standing for reviewing the manuscript.

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DATE ACCEPTED: April 9, 1981.

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BULLETIN OF MARINE SCIENCE, 32(1): 347–350, 1982

SEASONAL SPAWNING CYCLES OF TWO CALIFORNIA FLATFISHES, *PLEURONICHTHYS VERTICALIS* (PLEURONECTIDAE) AND *HIPPOGLOSSINA STOMATA* (BOTHIDAE)

Stephen R. Goldberg

The hornyhead turbot, *Pleuronichthys verticalis* and the bigmouth sole, *Hippoglossina stomata* are two of the common flatfishes that occur sympatrically in the coastal waters of southern California. *P. verticalis* is found from Magdalena Bay, Baja California and the northern Gulf of California to Point Reyes between depths of 9–187 m and *H. stomata* ranges from the Gulf of California to Monterey Bay between depths of 12–137 m (Miller and Lea, 1976). Budd (1940) and Fitch (1963) previously reported on spawning in *P. verticalis*. Eggs of both species are described in Sumida et al. (1979). This report contains the first information on the seasonal spawning cycle of *H. stomata*.

MATERIALS AND METHODS

Fishes were collected off the coast of southern California by otter trawl at depths of 45–64 m. Collections were taken from San Clemente (33°20'N, 117°38'W) to Santa Monica Bay (33°53'N, 118°37'W). Specimens were analyzed from collections made from September 1974–October 1979. Only female specimens were examined. Both species are medium sized flatfishes with *P. verticalis* from my study averaging 198 mm standard length (SL) (range 142–250 mm) and *H. stomata* averaging 215 mm SL (range 150–283 mm).

Fishes were preserved in 10% formalin. Histological sections from 140 *P. verticalis* and 110 *H. stomata* ovaries were cut at 8 μm and stained with Heidenhain iron hematoxylin (Humason, 1979). Seasonal gonosomatic indices (GSI) (ovary wt/fish wt × 100) were calculated from preserved ovaries.

RESULTS

Ovaries were histologically classified into four stages (Table 1). Stage 1 (regressed or regressing ovary): the non-spawning condition consists principally of primary oocytes (100 μm diameter). Stage 2 (pre-vitellogenic): slightly enlarged vacuolated oocytes (230 μm diameter) predominate prior to onset of yolk deposition. Stage 3 (vitellogenic): yolk deposition in progress. Stage 4 (spawning): mature (ripe) oocytes predominate.