PROC. BIOL. SOC. WASH.
102(3), 1989, pp. 620–636

STENORHYNCHUS YANGI, A NEW WESTERN ATLANTIC SPECIES OF ARROW CRAB (CRUSTACEA, BRACHYURA, MAJIDAE) AND A REDESCRIPTION OF *S. SETICORNIS* (HERBST, 1788)

Gary D. Goeke

Abstract.—The common arrow crab of the western Atlantic has a complicated taxonomic history as two species have long been confused under the name *Stenorhynchus seticornis* (Herbst, 1788). Through study of living specimens and preserved material in museums of North and South America, as well as Europe, the genus *Stenorhynchus* Lamarck, 1818, is reviewed, *S. seticornis* is restricted, its synonyms discussed, and a previously undescribed species, *S. yangi*, is recognized. Adults of these two species are described and illustrated, their morphologic variations analyzed, colors differentiated, known geographic and bathymetric ranges recorded, and their larvae compared. The species differ in rostral setation, shape of male first pleopod, and in other characters. Moreover, two ecophenotypes related to substrate can be recognized within *S. seticornis*.

The common shallow-water arrow crab, *Stenorhynchus seticornis* (Herbst, 1788), of the western North Atlantic is such an obvious component of the marine fauna that it has been described under several different scientific names over the past 200 years. It has become evident through the work of Yang (1967, 1976) on larval development in majids and on taxonomic problems in the genus *Stenorhynchus* Lamarck, 1818, that two species are confused under the name *Stenorhynchus seticornis* (Herbst, 1788) (Fig. 1).

Historical Review

The group of spider crabs currently assigned the generic name *Stenorhynchus* has a wide distribution in warm and temperate waters of the Atlantic and eastern Pacific oceans. Species now grouped within this genus were previously assigned to various genera until taxonomic consistency was reached with the use of the generic name *Leptopodia* Leach, 1814. Arrow crabs are very common and led Milne-Edwards (1875: 173) to state, "Cette espèce est si bien connue, et elle a été si souvent figurée, qu'il est inutile d'en donner ici une description." *Leptopodia* is now known to be a junior synonym of *Inachus* Weber, 1795, and not a valid generic name for this group. *Cancer sagittarius* Fabricius, 1793 (=*Stenorhynchus seticornis*) was transferred to the genus *Leptopodia* by Leach in 1815 and was considered the type for the genus. However, *Leptopodia* was erected for *Cancer phalangium* Pennant, 1777, and *Leptopodia tenuirostris* Leach, 1814. Because *Cancer sagittarius* was not mentioned in the original description of *Leptopodia*, it could not serve as the type species. Lamarck (1818) erected the genus *Stenorhynchus* for *Cancer seticornis* Herbst, 1788, and *Cancer phalangium*. The latter species, however, is a member of the genus *Inachus*. Since the des-

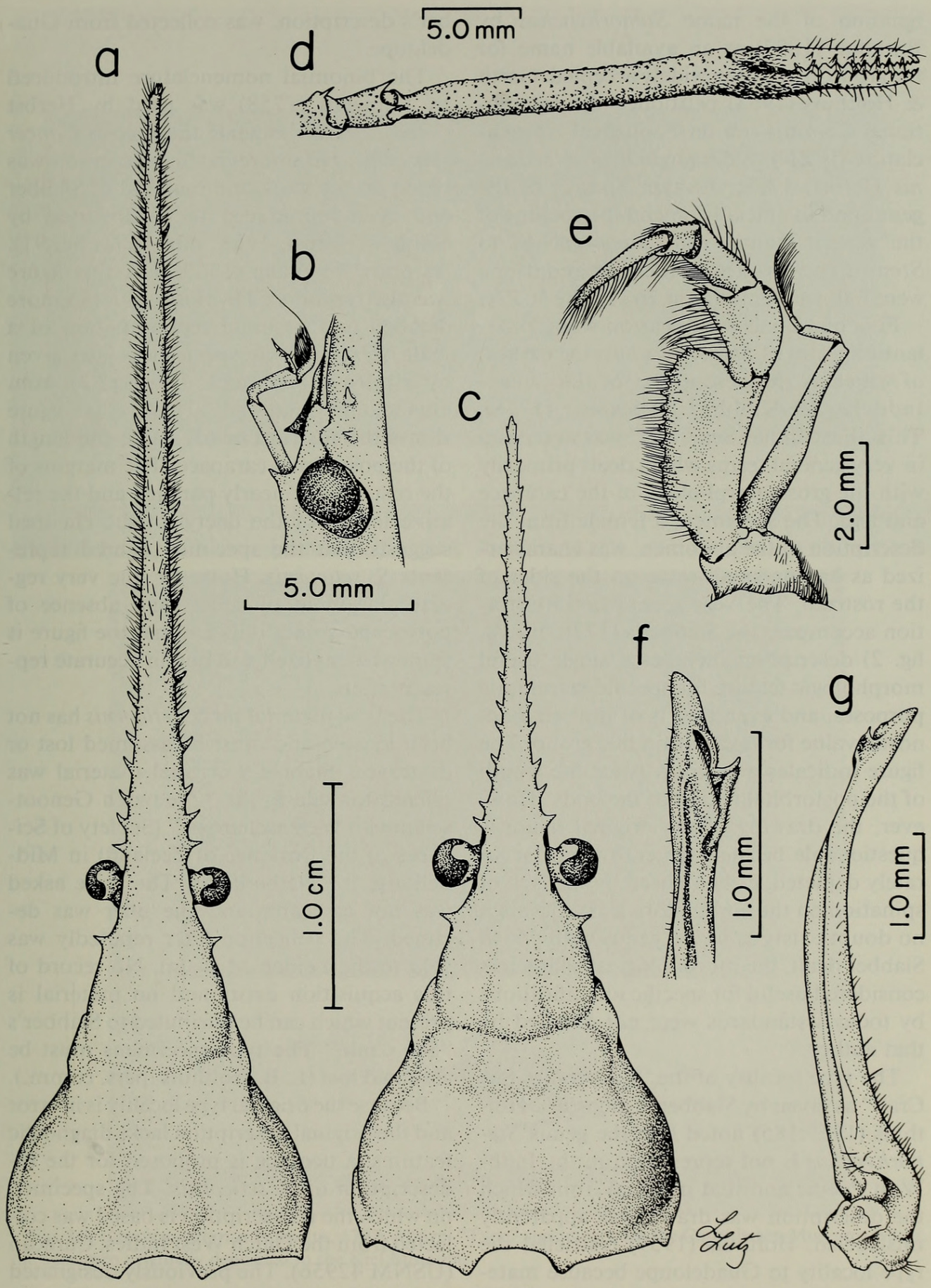


Fig. 1. *Stenorhynchus seticornis*, a, b, d, e, f, and g; *Stenorhynchus yangi*, c.

ignation of the name *Stenorhynchus* by Rathbun (1897) as an available name for the group, it has been widely accepted. Garth & Holthuis (1963) petitioned the International Commission on Zoological Nomenclature (ICZN) to designate *Cancer seticornis* Herbst, 1788, the type species of the genus and to officially emend the spelling of the generic name from *Stenorynchus* to *Stenorhynchus*. These recommendations were followed in opinion 763 of the ICZN.

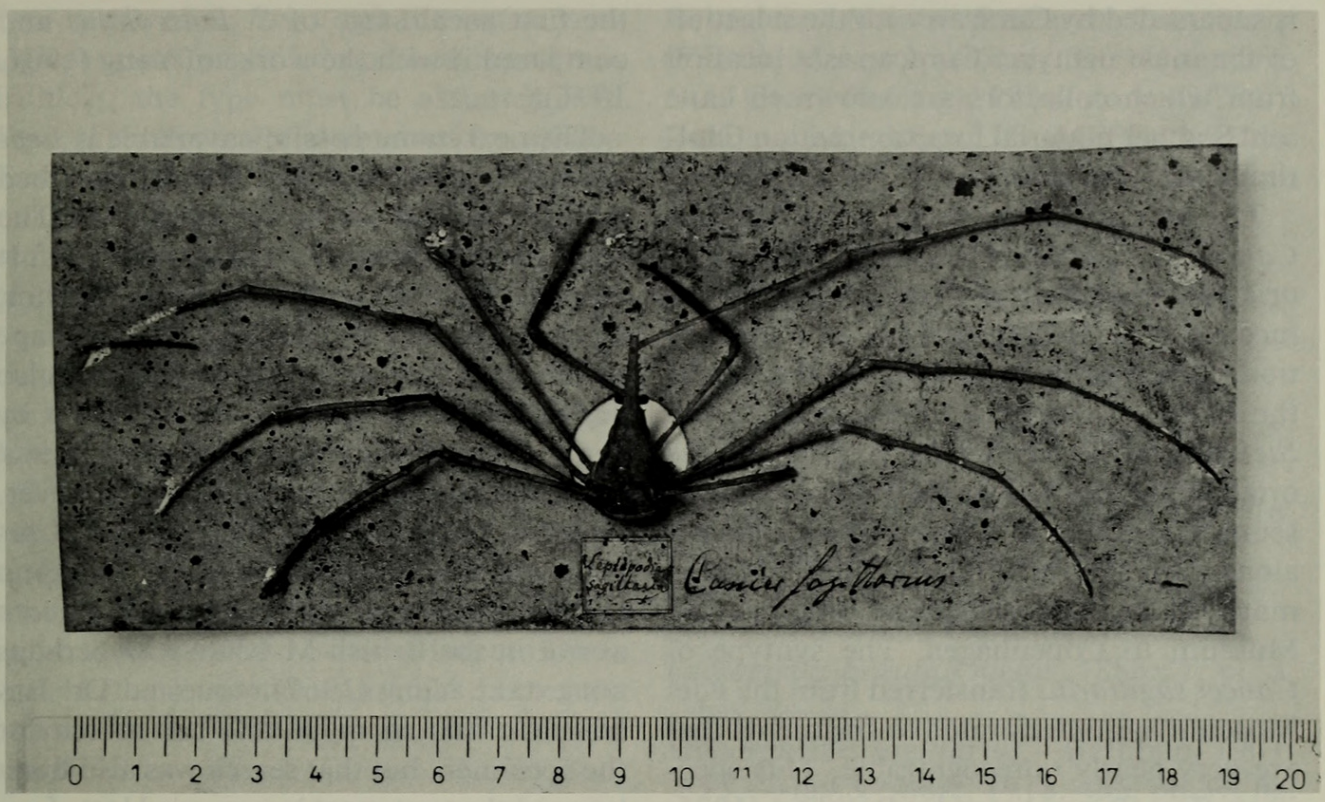
Five binomials may bear on western Atlantic species of *Stenorhynchus*, the earliest of which is the description of the "Oost-Indische Zee-Krabbe" by Slabber (1778). This "East Indies Sea Crab" was described in very general terms which dealt primarily with the gross morphology of the carapace and legs. The specimen, a female from the description of the abdomen, was characterized as having small setae on the sides of the rostrum. The very generalized illustration accompanying Slabber's (1778: pl. 18, fig. 2) description includes a single useful morphologic feature for specific taxonomic purposes, and even that is of limited diagnostic value for taxa within this group. The figure indicates a rostrum twice the length of the postorbital region of the body. However, the drawing of the original figure is questionable because the crab is not accurately depicted, as evidenced by the lack of spination on the ambulatory legs. Although no doubt exists as to the genus with which Slabber dealt, the morphological characters considered useful for specific identifications by today's standards were not detailed by that author.

The type locality of the "East Indies Sea Crab" as given by Slabber is incorrect. Holthuis (1959:185) noted that the genus *Stenorhynchus* is not represented in the Indo-West Pacific and that material from which the description was drawn was apparently mislabeled. Holthuis (1959) restricted the type locality to Guadeloupe because material examined by Herbst, following Slabber's description, was collected from Guadeloupe.

The binomial nomenclature introduced by Linnaeus (1758) was used by Herbst (1788:229) to designate the species *Cancer seticornis*. His abbreviated description was based on the work and material of Slabber and even reproduced the figure used by Slabber (Herbst, 1788: tabl. XVI, fig. 91). As noted by Yang (1967:211), this figure was also reproduced by Bosc (1802). A more detailed and accurate representation of a male *Stenorhynchus* species was later given by Herbst (1803: tabl. LV, fig. 2) from Guadeloupe material. This latter figure shows the rostrum nearly twice the length of the postorbital carapace. The margins of the rostrum are nearly parallel, and the relative length of the dactyl of the cheliped suggests that the specimen figured represents *S. seticornis*. However, the very regular placement of spines and absence of postocular spines indicate that the figure is somewhat stylized and not an accurate representation.

The type material for *S. seticornis* has not been located and must be assumed lost or destroyed. Slabber's original material was offered for sale to the "Zeeuwsch Genootschap van Wetenschappen" (Society of Sciences of the Province of Zeeland) in Middelburg, the Netherlands. The price asked was not agreeable and the offer was declined. The collection later reputedly was sold to the Leiden Museum. No record of this acquisition exists and no material is present which can be attributed to Slabber's "Sea Crab." The type specimens must be assumed lost (L. B. Holthuis, pers. comm.).

Because the original type locality is in error and the original description lacks diagnostic features, a neotype is proposed for the redescription of *S. seticornis*. The specimen on which the redescription is based was collected from the Dutch West Indies, Curaçao (USNM 42956). The previously designated type locality of Guadeloupe (Holthuis 1959)



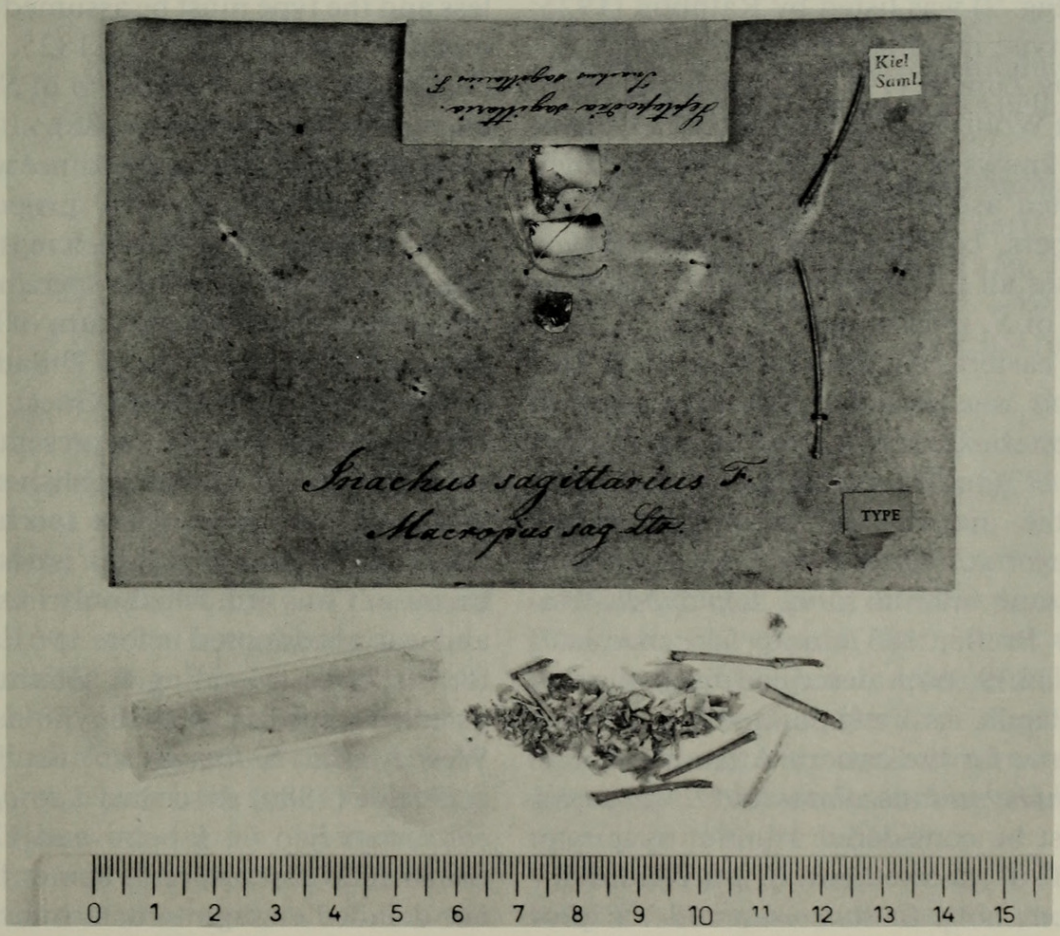


Fig. 2. *Cancer sagittarius* Fabricius, 1793: Above, "Type" specimen from the Copenhagen Museum; Below, the specimen originally deposited in the Kiel Museum.

is superseded by Curaçao with the selection of the male neotype. Curaçao is a location from which collectors are known to have sent Slabber material for examination (Holthuis, pers. comm.).

The second name to be considered is *Cancer sagittarius* (Fabricius, 1793). The original description of *Cancer sagittarius* is inconclusive. However, from an examination of the syntypes, it has been confirmed the Fabrician material is conspecific with *Stenoyrhynchus seticornis*. A syntype was originally deposited in the Zoological Museum, Copenhagen, and a second syntype, along with the remainder of the Fabrician material, has been transferred from the Kiel Museum to Copenhagen. The syntype of *Cancer sagittarius* transferred from the Kiel Museum has deteriorated to fragments that are very nearly unrecognizable. This specimen (Fig. 2) was listed by Rathbun (1925: 14) as type material. However, it was not listed by Zimsen (1964) as a syntype. Prof. Torben Wolff (Zoological Museum, Copenhagen) knows no reason why one specimen was listed as the type by Zimsen and not both (pers. comm.). This female syntype possesses all the characters listed below as typical of *S. seticornis*.

The eastern Atlantic species of *Stenorhynchus* was considered conspecific with the western Atlantic species until Yang (1967, 1976) showed it to be distinct. Apart from the unavailable *Leptopodia vittata* Kingsley, two names have been applied to the eastern Atlantic form, *Leptopodia lanceolata* Brullé, 1837, and *L. canariensis* Brullé, 1839, both described from the Canary Islands. As Yang pointed out, the correct name for the eastern Atlantic taxon is *Stenorhynchus lanceolatus* and *L. canariensis* must be considered a junior synonym. Yang (1967) showed how *S. lanceolatus* differs from both *S. seticornis* and the proposed new species and Manning & Holthuis (1981) presented considerable data on the biology and distribution of *S. lanceolatus*. Paula (1987) has most recently described the first zoeal stage of *S. lanceolatus* and compared it with the works of Yang (1967, 1976).

The next name possibly available is *Leptopodia ornata* Guilding, 1825, described from St. Thomas in the Caribbean Sea. The original description in Latin is very brief. It treats a majid crab with a serrate rostrum, and includes few details as to general shape of the legs or other features. Guilding also corrected the definition of *Leptopodia* by detailing the arrangement of the abdominal segments. By today's standards, however, there are no characters described for *L. ornata* that are of diagnostic value. Rathbun (1925) listed the type specimen of *L. ornata* as not in the British Museum and perhaps not extant. Yang (1967) requested Dr. Isabella Gordon to make another search for the specimen, but that search was also fruitless and the type must be assumed lost. *Leptopodia ornata* Guilding, 1825, is herein designated a junior synonym of *Stenorhynchus seticornis* (Herbst, 1788).

Another name in the literature which may have precedence for the proposed new species is *Leptopodia vittata*. Kingsley (1880) reported the presence of a specimen within the collections of the Museum of the Academy of Natural Sciences of Philadelphia labeled "*Leptopodia vittata* Guer., Senegal." He stated that it might represent a manuscript name and that no published description could be found of the species. *Leptopodia vittata* Kingsley, 1880, is not available because it was published only in synonymy and was not adopted before 1961 as a name for a species. Manning & Holthuis (1981) listed this species as synonymous with the West African *S. lanceolatus* Brullé, 1837.

Goeldi (1886) described *Leptopodia lineata* from Rio de Janeiro and Cabo Frio, Brazil. The description is somewhat vague, not detailed enough to determine which of the 2 western Atlantic species it represented, and the illustrations are not sufficiently detailed to accurately identify the taxon by today's standards. An attempt to locate the

type series of *L. lineata* at the major zoological museums of Europe and Brazil was fruitless; the type must be assumed lost. *Stenorhynchus* material obtained from Cabo Frio and Rio de Janeiro revealed only *S. seticornis*. A search by Dr. W. Zwink (Museu Nacional, Rio de Janeiro) of holdings of local specimens of *Stenorhynchus* showed no representatives of a second species. It may be conclusively presumed that this taxon is conspecific with *S. seticornis* and is herein designated a junior synonym.

The only remaining specific name that needs to be mentioned here is *Pactolus bosci*, Leach, 1815. This species was based on a single specimen of unknown origin found in the holdings of the British Museum (Natural History). As the name has been suppressed by the ICZN (opinion 763) it is not available for use.

Systematics

Due to the extremely common nature of *Stenorhynchus* species and their wide geographic range, it is nearly impossible to detail all of the workers who have dealt with western Atlantic members of the genus in the past 200 years. It is not attempted here. In most cases, it is not feasible to determine accurately from the literature which of the two species was the subject of each report. A great many of the citations are species listings and not accompanied by diagnoses, ecological data, or illustrations which would help to determine the identity of the taxon reported. However, a few records are sufficiently detailed (e.g., Hay & Shore 1918; Williams 1965, 1984) or have illustrations which help to clear up some of the confusion. For these reasons, the synonymies that follow are abbreviated and by no means detailed accounts of references to *Stenorhynchus* species in the literature.

The materials examined in the following species accounts are housed at the United States National Museum of Natural History (USNM), Florida Department of Natural Resources, Marine Research Laboratory (FSBC), Museu Nacional, Rio de Janeiro, Gulf Coast Research Laboratory (GCRL), Dauphin Island Sea Lab (MESC), and the University of Southwestern Louisiana (USLZ).

Stenorhynchus seticornis (Herbst, 1788), redescription

Figs. 1a, b, d–g, 2, and 3

Oost-Indische Zee-Krabbe Slabber, 1778: 162, pl. 18, fig. 2.

Cancer seticornis Herbst, 1788:229, pl. 16, fig. 1; & 1803:27, pl. 55, fig. 2.

Cancer sagittarius Fabricius, 1793:442.

Leptopodia ornata Guilding, 1825:335.

Leptopodia lineata Goeldi, 1886:37, pl. 3, figs. 24–31.

Stenorynchus sagittarius.—Rathbun, 1901: 53.—Hay & Shore, 1918: 455, pl. 37, fig. 8 (in part).

Stenorynchus seticornis.—Rathbun, 1925: 14, pls. 2 and 3 (in part).—Abele, 1970: 137 p.

Stenorhynchus seticornis.—Williams, 1965: 244, figs. 222 and 223K (in part).—Felder, 1973:48, pl. 7, fig. 1.—Yang, 1976.—Felder & Chaney, 1979:27.—Wicksten, 1980:150.—Williams, 1984:304 (in part).

Material examined.—Table 1.

Diagnosis.—Carapace naked, rostrum covered with short dense felt and setae, becoming longer and thicker distally. No spines at distal end of basal antennal article, single inter-antennular spine directed posteriorly. Chelipeds hairy, palm from three to four times length of fingers in mature males, not as stout in females. Merus of third maxilliped normally with small spine on anterodistal angle. Pereopods, abdomen, and sternum bearing short pubescence.

Description of male neotype (USNM 42956).—Carapace subtriangular, smooth, naked, regions slightly defined; intestinal and cardiac region inflated and separated by shallow furrow from posterior regions; branchial region inflated, delimited by shal-

Table 1.—Material examined; *Stenorhynchus seticornis*.

Catalog number	Location	Material	Depth (m)
USNM 42956 (Neotype of *Stenorhynchus seticornis*)	Curaçao, Suriname	1 ♂	—
USNM 19941	Rio de Janeiro, Brazil	1 ♂	—
USNM 76441	Gallows Bay, St. Croix, Virgin Islands	1 ♂	—
USNM 46697	Aucilla, FL	1 ♀	13
USNM 43065	Montego Bay, Jamaica	2 ♂	—
USNM 43066	Jamaica	1 ♂	—
USNM 19580	Kingston Harbor, Jamaica	1 ♂	—
USNM 31040	Grolding Cay, Bahamas	1 ♂	—
USNM 11232	33°34′N, 77°42′W	1 ♂, 1 ♀	16.5
USNM 19940	Bay of Bahía, Brazil	1 ♀	—
USNM 22554	Santa Marta, Colombia	1 ♂	—
USNM 69601	18°30′N, 66°04′W Puerto Rico	1 ♂	366
USNM 101712	16°05′N, 82°05′W	1 ♂	44
USNM 137761	Grand Island, Trinidad	3 ♂	69
USNM 137020	00°15′S, 46°45′W	1 ♂, 2 ♀	28
USNM 171562	Tongue of the Ocean, Bahamas	1 ♂	—
USNM 184122	Palm Beach, FL	1 ♂	22
USNM 58047	Shoal Banks, Barbados	1 ♂	55
USNM 154711	Grenada	1 ♂	—
USNM 321390	Belize	1 ♀	—
USNM 103268	06°51′N, 54°53′W Suriname	1 ♀	51
USNM 43060	Montego Bay, Jamaica	1 ♂	—
USNM 105004	08°40′N, 77°10′W Gulf of Darien	1 ♀	61
USNM 137020	00°15′S, 46°45′W Para, Brazil	1 ♂, 1 ♀	27
USNM 107804	off Houma, LA	1 ♂	—
USNM 103267	06°49′N, 55°54′W	1 ♀	47
USNM 103504	07°40′N, 57°34′W	1 ♂	—
USNM 17374	22°18′N, 87°04′W	1 ♂	44
USNM 49082	10 miles south of Key West, FL	1 ♀	229
USNM 42955	Curaçao	1 ♀	—
USNM 101713	01°50′N, 47°31′W	1 ♀	85
USNM 43062	Montego Bay	1 ♂	—
USNM 7653	St. Thomas	1 ♂	—
USNM 17373 (in part)	35°08′30″N, 75°10′W	1 ♂	90
USNM 137019	04°46′N, 51°21′W	1 ♂	59
USNM 103265	06°48′N, 54°54′W	2 ♂	46
MESC 6187-0121	28°26′N, 84°21′W	3 ♂, 3 ♀	—
MESC 6187-0113	28°25′N, 84°19′W	6 ♂, 4 ♀	—
MESC 6187-0114	30°02′30″N, 86°06′30″W	2 ♂	31
MESC 6187-0109	28°36′N, 84°16′W	7 ♂, 5 ♀	—
GCRL I64:695	29°43′N, 88°26′W	1 ♂, 3 ♀	—
FSBC I 31042 (in part)	30°30′N, 80°15′W	2 ♀	47
FSBC I 31045 (in part)	30°20′N, 80°14′W	1 ♂	65
FSBC I 31043 (in part)	30°31′N, 80°10′W	1 ♂, 2 ♀	64
FSBC I 31044 (in part)	30°20′N, 80°17′W	1 ♀	46
FSBC I 31032	27°40′N, 80°06′W	1 ♀	27
FSBC I 31030	27°10′N, 80°01′W	1 ♀	46
FSBC I 31029	27°10′N, 80°01′W	1 ♀	45
Museu Nacional Rio de Janeiro	Cabo Frio, Brazil	1 ♂, 1 ♀	—
Museu Nacional Rio de Janeiro	Rio de Janeiro, Brazil	1 ♂, 1 ♀	—
Museu Nacional Rio de Janeiro	Guanabara, Brazil	1 ♂, 1 ♀	—

low margin; hepatic region inflated, with well-defined ventral margin, but remaining ventral margin ill defined. Simple, strong deflexed postorbital spine; supra-orbital furrow shallow; rostrum flattened basally between eyes; short setae from base of rostrum to tip, setae dense and increasingly long distally; subhepatic region inflated posteriorly, margins well defined; 1st rostral spine directed laterally, slightly deflexed, followed by up to 16 large spines on lateral margins, directed forward and occasionally downward; rostrum 1.8 times length of carapace behind transverse line connecting base of eyestalks dorsally. Basal antennal article elongate, with longitudinal ventral furrow, strong spine anterolaterally directed on ventral margin; septum dividing antennular sinuses with posteriorly directed spine; anterolateral margin of sinus defined by upturned border; lateral and anterior margins of buccal cavity with raised ridge, acute small spine at anterolateral angle of mouth frame. Exopod of third maxilliped with maximum width one-third distance from base, narrowing distally; internal margin of merus straight, with strong spine at anteromesial angle and small spine on exterior margin posterior to articulation with palp.

First pereopods greatly elongate, covered with short dense pile; basis inflated, tuberculate, with spine on interior margin; merus tuberculate, with region of few tubercles dorsolaterally, six to nine strong spines on mesial row, single spine dorsally, two spines in lateral row, ventral spine toward distal margin, three or four spines at articulation with carpus; carpus with three strong spines dorsally, three distal spines ventrally and numerous tubercles; propodus covered with strong tubercles and low pile which becomes denser and longer at base of finger, pile extends laterally along propodus and onto ventral surface at base of finger, propodus three times length of dactyl; dactyl stout, with long dense setae dorsally and laterally at base, thinning distally to become sparse long setae, tuberculate dorsally.

Second pereopod longer than first and covered with short dense pile; merus with 4 longitudinal rows of spines, 5 or 6 spines in dorsal row, 5–7 spines in lateral row concentrated in distal ½, 11 mesial spines distributed along length of segment, 2 ventral spines in distal ½; 3 spines at articulation with carpus slightly longer than others; carpus with pair of dorsal spines at midlength and 3 spines at articulation with propodus longer than others; length of carpus and propodus equal to dactyl but shorter than merus; propodus with 11–13 spines, slightly compressed laterally, 2 spines at articulation ventrolaterally; dactyl elongate, slightly curved, little compressed laterally, with 5 longitudinal rows of setae.

Third pereopod shorter than second, covered with short dense pile; merus with 5 dorsal spines along length, 8–10 spines along inner row, 3–4 spines in distal ½ on external row, single spine on ventral margin in distal ½, 3 spines at articulation with carpus; carpus with pair of dorsolateral spines at midlength and 3 spines at articulation with propodus; propodus with 11–13 small spines, slightly compressed laterally, with 2 spines at articulation; dactyl ⅘ length carpus and propodus combined, with 5 longitudinal rows of setae, curved slightly in distal ½.

Fourth pereopod shorter than third, with covering of short pile; merus with four to five spines on internal row and ventrolateral spine at articulation slightly enlarged; carpus with pair of dorsal spines at midlength and three spines at articulation with propodus; propodus with eight or nine small spines; dactyli damaged, slightly compressed laterally, and bearing five longitudinal rows of setae.

Fifth pereopod shorter than fourth, covered with short dense pile; merus with 4 dorsal spines, single ventrolateral spine and 2–4 mesial spines; carpus with pair of spines dorsolaterally at midlength, 3 terminal spines at articulation; propodus with 9–10 low spines, slightly compressed; dactyl elon-

gate, curved distally with 5 rows of longitudinal setae.

Abdominal segments 5 and 6 fused, with sutures indicated; segment 1 slightly longer than wide, naked along elevated midlength but with setae in depressions; segments 3 and 4 subequal, longer than 2; 3 widest anteriorly, segments 5 and 6 fused, segment 7 is 1.75 times long as wide with hollowed protuberance for locking mechanism and a small tubercle medially in proximal one-half. Sternum with 22 large tubercles and few low setae; sternite 5 with 2 tubercles at articulation with basis of maxilliped; sternite 4 with 8–9 tubercles at articulation with first pereopod; plastron with arcuate ridge in anterior ½ lined with setae, lateral margin parallel.

Color.—Carapace with alternating stripes of off-white and brown-maroon, white stripes on dorsum of carapace reminiscent of inverted V's, large white bands originating dorsally between fourth and fifth legs join anterior to eyes, every other white stripe smaller than preceding; white bands originating at tip of dactyl of pereopods, continuing dorsally along leg onto carapace, or originating at posterior margin of carapace between coxae of legs. Carapace with 4 major white longitudinal bands, one running along the pterygostomial ridge. Distal ⅔ of fingers on chelae blue. Inner surface of fingers each with 2 whitish spots, forming rough circle when fingers close. Merus of cheliped with large orange-yellow spot at base of distal spine. White band bordered with maroon extending obliquely across merus and palp of third maxilliped. Broad yellow-white band connecting coxae of first pereopods with area under third maxilliped.

Range.—Material assignable to *S. seticornis* has been examined from Cape Fear, North Carolina, through the Gulf of Mexico southward to the mouth of the Amazon River, and Cabo Frio, Brazil. Bathymetric records are from 1 to 366 m.

Remarks.—The above technical description is drawn from the designated neotype, a mature male collected at Curaçao, Dutch West Indies. This specimen is the form commonly found on the rock outcroppings or coral reefs in temperate and tropical waters of the western Atlantic, and reported by Herbst (1803) from Guadeloupe.

Variation.—*Stenorhynchus seticornis* exhibits considerable morphological variation which appears to be related to the substrata from which the specimens are collected. One variant, herein designated *S. seticornis* form A, is most often collected on hard rocky bottoms (i.e., rock outcroppings, reefs, jetties) or immediately adjacent to these hard-bottom types. It is a large heavy bodied form, having an extremely long rostrum with subparallel margins throughout most of the length. This form was mentioned by Yang (1967) as "atypical."

Stenorhynchus seticornis form B differs from the above by characters enumerated below. Form B is the ecotype most often found in the northern Gulf of Mexico on mud bottoms and in grass beds. It was listed by Yang (1967, 1976) as *Stenorhynchus seticornis* and the complete larval development has been described. It is the smaller of the two forms. In SEM micrographs, the male pleopod of *S. seticornis* form A (Fig. 3) shows little variation, other than size, from that of *S. seticornis* form B (Fig. 3). The somewhat narrower opening of the apex and the slightly shorter apex may represent differences in the orientation of the gonopod at the point where the photographs were taken. This very minor difference, and the observed gradation between the two forms, are well explained by ecophenotypic variation.

Stenorhynchus seticornis form B is separated from *S. seticornis* form A by: 1) smaller overall body size, 2) females and subadult males with large hiatus at base of moveable fingers, and 3) setae on the dactyl and propodus of the first leg not forming thick mat continuous on dorsal surface.

Considerable intergradation is found between the two forms of *S. seticornis*, espe-

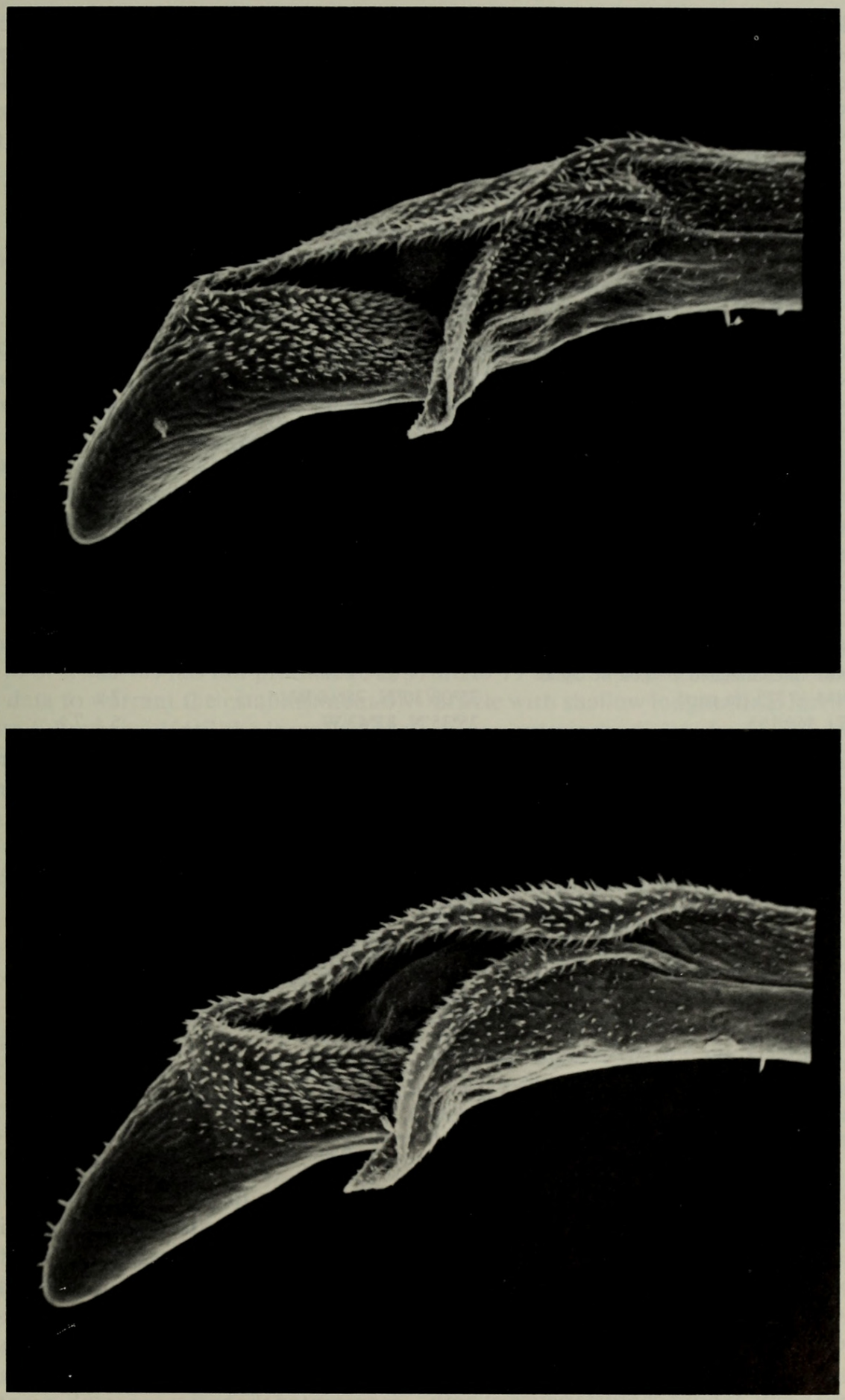


Fig. 3. Scanning electron micrographs of the tips of male gonopods: Above, *Stenorhynchus seticornis* form A; Below, *S. seticornis* form B.

Table 2.—Material examined; *Stenorhynchus yangi.*

Catalog number	Location	Material	Depth (m)
USNM 211812 (HOLOTYPE)	33°49′N, 76°43′W	1 ♂	81
USNM 211855 (PARATYPE)	26°45′70″N, 84°00′13″W	1 ♂	89
USNM 211803 (PARATYPES)	33°48′46″N, 76°35′W	3 ♂, 2 ♀	60
USNM 67800	18°30′30″N, 66°23′50″W	1 ♂	73
USNM 101715	34°17′N, 76°01′W	1 ♀	137
USNM 120135	Dominican Republic	1 ♀	—
USNM 103269	6°52′N, 54°53′W	1 ♂, 1 ♀	288
USNM 73401	Barbados	1 ♂	—
USNM 73086	Grand Cayman	1 ♂	220
USNM Uncatalogued Oregon St. 4391	12°33′N, 71°09′W	1 ♂, 1 ♀	73
USNM Uncatalogued Oregon St. 3605	12°16′N, 82°53′W	1 ♂	73
USNM 69601	18°30′30″N, 66°04′05″W	1 ♂	365
USNM 92646	21°15′N, 92°16′W	1 ♂	64
USNM 211815	33°48′42″N, 76°34′12″W	1 ♂, 1 ♀	102
USNM 24418	Mayaguez Harbor, Puerto Rico	1 ♂	137
USNM 11379	Key West, FL	1 ♀	108
USNM 11219	Martha's Vineyard	1 ♂	62
USNM 211807	33°47′36″N, 76°34′24″W	2 ♀	116
USNM 9496	Key West	1 ♂, 1 ♀	—
USNM 103504	70°40′N, 57°34′W	1 ♀	—
USNM 6934	9°30′15″N, 76°20′30″W	3 ♂, 3 ♀	—
USNM 9862	33°18′30″N, 77°07′W	1 ♂	174
USNM Uncatalogued Oregon St. 4391	12°33′N, 71°09′W	1 ♂, 1 ♀	73
USNM Uncatalogued Oregon St. 3605	12°16′N, 82°53′W	1 ♂	73
USNM 17373 (in part)	35°08′30″N, 75°10′W	2 ♀	90
GCRL I60:165	25°35′N, 83°42′W	5 ♂, 7 ♀	110
FSBC I 31031	27°40′N, 79°59′W	2 ♂, 1 ♀	64
FSBC I 31049	30°00′N, 80°15′W	1 ♂	91
FSBC I 31042 (in part)	30°30′N, 80°15′W	1 ♀	47
FSBC I 31048	30°11′N, 80°15′W	1 ♂	64
FSBC I 31033	27°50′N, 79°58′W	1 ♂, 1 ♀	92
FSBC I 31045 (in part)	30°20′N, 80°14′W	10 ♂, 4 ♀	65
FSBC I 31041	30°40′N, 80°06′W	2 ♂, 1 ♀	91
FSBC I 31036	28°40′N, 80°06′W	1 ♀	64
FSBC I 31043 (in part)	30°21′N, 80°10′W	1 ♂, 1 ♀	64
FSBC I 31046	30°20′N, 80°12′W	1 ♂	92
FSBC I 31040	30°40′N, 80°07′W	1 ♂	64
FSBC I 31037	28°50′N, 80°09′W	1 ♂	64
FSBC I 31034	28°30′N, 80°01′W	1 ♀	91
FSBC I 31047	30°10′N, 80°14′W	1 ♀	91
FSBC I 31038	29°00′N, 80°10′W	1 ♀	64
FSBC I 31044 (in part)	30°20′N, 80°17′W	1 ♀	46

cially in areas of rock outcroppings adjacent to muddy bottoms. In this situation, specimens are larger than those found on muddy bottoms, but often possess the hiatus at the base of the fingers and the greatly elongated rostrum of the form common to reefs. Similarly, specimens from grass beds adjacent to coral heads exhibit characteristics of both forms A and B.

Specimens of *S. seticornis* exhibit great variation in a number of characters, including length of the rostrum and the fingers. To document this variation, I measured the total postorbital carapace lengths and total carapace lengths on specimens for which the rostrum was unbroken on specimens which represented the entire geographic range. The postorbital measurement was determined

from the posterior margin of the carapace to a point midway between the base of the eyestalks. Additional measurements of the moveable finger and palm length were taken. The range of the ratio of postorbital length to total carapace length is slightly different in males (n = 20:0.27–0.40) and females (n = 5:0.33–0.42), but no real dimorphism in carapace dimensions is evident which is attributable to the sex of the specimens. These differences bear no relationship to either the size of the individual or the location from which it was collected. However, differences in the range of ratios of the finger to palm lengths do seem attributable to sexual dimorphism. Although there is some overlap in the range, males (n = 22) tend to have shorter fingers, relative to the palm length (0.24–0.39) than do females (n = 7:0.37–0.45). This trend is also evident in *S. yangi*.

A detailed examination of the variation found in *S. seticornis* has not produced sufficient data to warrant the establishment of separate subspecies. Until the larval development of *S. seticornis* form A has been documented, I prefer the designation "form" to a questionable subspecies status.

Stenorhynchus yangi, new species
Fig. 1c

Stenorynchus sagittarius.—Hay & Shore, 1918:455, pl. 37, fig. 8 (in part).
Stenorynchus seticornis.—Rathbun, 1925: 14, pls. 2 and 3 (in part).
Stenorhynchus seticornis.—Williams, 1965: 244, figs. 222 and 223K (in part).—1984: 304 (in part).
Stenorhynchus sp. A.—Yang, 1967; 459 p.—1976:158.

Material examined.—Table 2.

Diagnosis.—Carapace naked, rostrum devoid of setae or felt; no spines at distal end of basal antennal article; interantennular septum without posteriorly directed spinous process; chelipeds hairy, palm only twice length of moveable fingers in males, 1.5 to 2 times length of dactyl in females. Merus of third maxilliped with vestigial spine at anteromedial angle. Ambulatory legs, abdomen and sternum without pubescence. Regions of carapace well defined and inflated.

Description of holotypic male (USNM 211812).—Carapace subtriangular, smooth, naked, regions well defined; branchial regions inflated; intestinal and cardiac regions elevated in midline and separated from branchial and cardiac regions by sulcus; gastric region inflated; hepatic region moderately inflated and defined by furrows on all sides. Strong postorbital tooth bifid, deflexed and directed slightly forward. Shallow supraorbital furrow; rostrum flattened between eyestalks, devoid of setae; subhepatic region inflated posteriorly with well defined margins; first rostral spine directed slightly forward; rostrum about equal to length of postorbital carapace, naked, broad basally and tapering to acute apex, bearing 17 to 19 large lateral spines; basal antennal article with shallow longitudinal furrow and strong anteriorly directed spine on ventral margin; septum dividing antennular sinuses well developed, with rounded ventrum; anterolateral margin of sinus simple. Lateral and anterior margins of buccal frame with raised margin and weak spine at anterolateral angle; exopod of third maxilliped with maximum width at one-half length from base, narrowing distally, internal margin of merus concave, occasionally with small spine at antero-internal angle, small spine posterior to articulation with palp.

All pereopods with few scattered setae. First pereopod greatly elongate; ischium slightly inflated, smooth; merus with numerous spines in longitudinal rows; two spines in distal one-half of lateral row; three spines in dorsal row evenly spaced, enlarged terminal spine at articulation with carpus; six spines on interior row; carpus with two dorsal spines at midlength and pair of terminal spines ventrally; propodus with small scattered tubercles. Felt and dense setae laterally at base of finger in small patch with longer sparse setae on immoveable finger;

dactyl with small patch of setae at base, with few long scattered setae on surface, small hiatus at base.

Second pereopod elongate, longer than first; ischium very short, tuberculate dorsally; merus greatly elongate, with about 20 spines arranged in 4 longitudinal rows, 3 larger terminal spines; carpus short, about 1/5 length of merus, with 3 dorsal and 3 terminal spines; propodus elongate, 3/4 length of merus, with numerous spinules and tubercles, 1 lateral terminal spine; dactyl elongate, 4/5 length of merus, slightly compressed laterally, lined with spinules and with corneous tip.

Third pereopod shorter than second; ischium very short, tuberculate; merus elongate, with approximately 15 spines arranged primarily in 2 dorsal rows, 3 terminal spines; carpus short, 1/4 length of merus, 3 dorsal and 3 terminal spines; propodus elongate, 2/3 length of merus, with approximately 10 dorsal and 2 terminal spines; dactyl elongate, 4/5 length of merus, with numerous spinules, slightly compressed laterally with corneous tip.

Fourth pereopod shorter than third, ischium tuberculate, very short; merus elongate, roughly 20 spines arranged in 2 primary dorsal rows, 3 terminal spines; carpus short, 1/4 length of merus with 3 dorsal and 3 terminal spines; propodus elongate, 2/3 length of merus with about 10 spines dorsally and 3 terminal spines; dactyl elongate, 4/5 length of merus with numerous spinules and corneous tip, slightly compressed laterally.

Fifth pereopod shorter than fourth, ischium very short, slightly tuberculate; merus elongate, with 10 spines in 2 dorsal rows, and 3 terminal spines; carpus short, 1/3 length of merus, with 3 dorsal and 3 terminal spines; propodus elongate, equal in length to merus, with spinules mainly in single dorsal row, slightly compressed laterally, numerous spinules along length; dactyl with corneous tip.

First abdominal segment little longer than wide, elevated along midline, segments 2 and 3 very short but broad; segments 4 and 5 somewhat longer and constricting to narrowest part of abdomen, segments 6 and 7 fused, no external indication of fusion visible. Tubercles scattered on sternum with very few setae apparent; anterior extension of sternum with ridge below mouth frame bearing setal row and two spines at center of process.

Color.—Carapace with four triangular white stripes, yellow and orange-reddish-brown areas surrounding white stripes. Lateral white stripe passes through orbital area and is continued onto lateral edge of rostrum. Lateral teeth of rostrum white; tip of rostrum dark brown. Fingers of cheliped purple for distal two-thirds to three-fourths of length, teeth white, remainder of fingers tan; carpus tan with brown stripe proximally; merus dark brown distally, pale yellow spot behind large distal tooth. Ambulatory legs with faint light dorsal stripe continuous from carapace, distal ends of segments darker, merus with darker areas; dactyli with distal 1/3 white, apex translucent with penultimate tan band and then white. Legs with faint dark/light bands.

Range.—*Stenorhynchus yangi* has been collected from Martha's Vineyard south through the Gulf of Mexico to Suriname in depths from 31 to 365 m.

Variation.—Within *S. yangi*, variation has been noted in the shape of postorbital spines, characteristic robustness of the carapace and relative lengths of the rostrum and moveable finger of the first leg. Williams (1965:244) reported the postorbital spine of *S. seticornis* as "occasionally bifid." During the course of this study, no specimens of *Stenorhynchus seticornis* were observed which possessed bifid postorbital spines. However, it is common to come across large specimens of *S. yangi* with this condition. Several large individuals of *S. yangi* were examined which had single and double spines on alternate sides of the carapace. Specimens with trifid spines were also

observed, and it is probable that the individuals reported by Williams (1984) with bifid spines represent *S. yangi*, as the gonopod figured in that work (fig. 2410) corresponds with *S. yangi*, not *S. seticornis*. The characteristic robustness or swelling of the various regions of the carapace also varies within *S. yangi*. This and the relative lengths of the pereopods are probably related to maturity of the individual. Considerable variation was also noted in spination of the pereopods.

Perhaps the two features which exhibit the greatest degree of variation are the ratio of total carapace length to postorbital carapace length and the ratio of finger to palm length of the first pereopod. Only individuals with the rostrum intact (n = 29) were used for carapace length measurements, with individuals from the extreme ends of the geographic range included. Among males (n = 19), the postorbital carapace length accounted for one-fourth to one-half of the total length of the individual (0.27–0.49); little difference from this ratio was noted among females (0.31–0.48). However, the range ratio of finger to palm length was notably different among males (n = 22:0.24–0.39) and females (n = 13:0.36–0.49).

A single anomaly was noted in a specimen from the Caribbean (USNM Accession #42869). This individual is a mature male with a bifid rostrum, but is normal in all other respects.

Etymology.—It is my pleasure to name this species for Dr. Won Tack Yang (Texas Biomedical Institute) who, on the basis of larval characters, first recognized the possibility of its distinctness.

Remarks.—Yang (1967, 1976) performed much of the complicated work involved in reviewing the confused history of this genus and gave definitive proof that at least two species of *Stenorhynchus* are present in western Atlantic waters. His work was the first to correct the mistaken records of *S. seticornis* in the eastern Atlantic and showed *S. lanceolatus* Brullé, 1837, to be the correct name for the West African species.

Yang (1967) indicated that *S. yangi* may be a deep water species and presented data which appeared to show that the species was most often collected in waters deeper than 65 m. He noted that in the collections at the University of Miami Marine Laboratory and those examined from the U.S. National Museum of Natural History, this species' bathymetric range was from 31–119 m. He suggested the possibility of an isotherm dividing the preferred habitats of the two species. Abele (1970) indicated a restricted occurrence of *S. yangi* to waters over 50 m. However, because I have not re-examined that material, that report of the species encountered is unconfirmed.

The robust nature of the carapace of this species, the absence of the interantennular spine, the lack of rostral setation, the shape of the first male pleopod and the form of the spermathecae of the female easily distinguish *S. yangi* from *S. seticornis*. Differences in the color patterns of the two species also aid in their identification; however, this difference may be quickly obscured by preservation techniques and be of little use to the researcher studying museum specimens. Differences in relative lengths of the ambulatory legs may also be of aid in the separation of *S. yangi* from *S. seticornis*. However, the fragile nature of members of this genus makes studies of this type very difficult as legs are rarely collected intact.

Discussion.—Taxonomic confusion surrounding the identity of *S. seticornis* and *S. yangi* is partly due to the great amount of variation found within the two taxa. The range of variation in the ratio of postorbital to total carapace lengths differs little from *S. seticornis* (0.27–0.49) to *S. yangi* (0.27–0.42). A broad range of variation is also evident in the ratio of finger to palm length (0.24–0.49 in *S. seticornis* and 0.24–0.45 in *S. yangi*).

Because of the taxonomic problems, ecological works that have dealt with this group

must be used with reserve. Bathymetric records (Rathbun 1925), distributional records (Holthuis 1959; Williams 1965), substrate preferences (Rathbun 1925) and ecological and behavioral works (Hartnoll 1965; Barr 1971, 1975) must all be viewed with caution and records re-examined where feasible. Although the specific identity of the arrow crabs used in the reproductive studies may be of little significance in the understanding of the group's behavior, it must be recognized that doubt exists as to which taxon was being studied by Schone (1968). Barr's (1971, 1975) field work suggests that *S. seticornis* is a facultative filter feeder which climbs to the top of an outcropping or reef at dusk. By sitting motionless, the crab allows the passing debris to collect on the setae of its body during the night, and the following day is spent cleaning off the entrapped food. No data were given by that author to indicate the frequency of this feeding mode. R. H. Gore (pers. comm.) noted that in aquaria, *S. seticornis* will snip off and eat the protruding siphon of the gastropod *Nassarius vibex*. Mary K. Wicksten (pers. comm.) has indicated that *S. seticornis* may perform an unusual decorating act by storing food gathered from the substratum on the rostral setae to be eaten later. This is a modification of the usual decoration behavior used for concealment and camouflage (Wicksten 1980). An alternative feeding behavior is dictated for *S. yangi* because of the lack of rostral setae. No study has been accomplished to define the niche requirements of these two species and how these requirements may differ.

The complete larval development of *S. seticornis* form A was described by Yang (1967, 1976). He detailed three zoeal stages and the megalopa obtained from females collected in Biscayne Bay, Florida. Yang (1967) specifically mentioned the hiatus at the base of the fingers, a character previously listed as useful in separating the two forms of *S. seticornis*. A single zoeal stage of *S. yangi* (*Stenorhynchus seticornis* of Yang 1967, 1976) was described from a specimen collected in about 225 m of water. The larvae of the two species are sufficiently distinct to allow quick separation of the species because of a large lateral bifurcation on the carapace of *S. yangi*. This situation is unusual in that the adults are similar enough to have been united under a single name for many years, but the larvae are quite different at the first zoeal stage.

Acknowledgments

This study has benefitted from the help of many individuals over several years. However, because of the diversity of opinions offered (often conflicting), not all of the reviewers' suggestions have been incorporated into this report. Any oversights or shortcomings of this report are the sole responsibility of the author. John S. Garth and Jurgen Sieg helped gather obscure original descriptions. Robert H. Gore, Joseph Fitzpatrick, Richard W. Heard, Jr., Austin B. Williams, Raymond B. Manning, Robin M. Overstreet, Lipke B. Holthuis, and Darryl L. Felder all provided helpful discussions, comments or reviews. Thomas S. Hopkins, David K. Camp, Walter Zwink, Darryl L. Felder and Torben Wolff provided material. Darryl L. Felder and the staff of the University of Southwestern Louisiana Electron Microscopy Center provided the SEM micrographs. The reviewers of the journal provided much needed guidance in a very gracious manner. Linda Lutz prepared Fig. 1 and Cynthia B. Dickens typed the original manuscript. My gratitude is extended to each of these for their help.

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Gary D. Goeke, Minerals Management Service, Gulf of Mexico OCS Region, Office for Leasing and Environment, 1201 Elmwood Park Boulevard, New Orleans, Louisiana 70123-2394.