Pacific Science (1980), vol. 34, no. 2

A Description of the Vexillifer Larvae of *Pyramodon ventralis* and *Snyderidia canina* (Pisces, Carapidae) with Comments on Classification[1]

DOUGLAS F. MARKLE[2] and JOHN E. OLNEY[3]

ABSTRACT: The first identified vexillifers (4.4, 6.0 mm HL) and 2 juveniles (10.5, 11.4 mm HL) of *Pyramodon ventralis* are described and compared with vexillifer larvae of *Snyderidia canina* (3.6, 5.7 mm HL). The presence of pelvic fins, a visceral cradle, and a greater number of pectoral-fin rays distinguishes larvae of *P. ventralis* from larvae of *S. canina*. Pyramodontine vexillifers are characterized as follows: a deep, compressed head and trunk with a depth at the first anal ray of 0.77–0.92 HL; a short predorsal distance of 1.12–1.27 HL; more than 24 pectoral-fin rays; a proximal vexillum radial with a descending anterior process, a wavy ventral contour, and a posterior process passing under the anterior dorsal-fin radials; a pronounced second neural spine; and long anal-fin radials. Identification of a vexillifer larva of *Pyramodon* establishes the vexillifer larva as a unique specialization of all Carapidae and reinforces the classification of *Pyramodon* as a close relative of *Snyderidia*.

THE MONOTYPIC GENUS *Pyramodon* Smith and Radcliffe is known from 9 specimens taken in the western Indian and Pacific Oceans (Smith 1955; McCann 1972). It is considered closely allied to *Snyderidia* Gilbert (Gosline 1960), a carapid genus with two nominal species: *S. canina*, known from 6 adults and 1 larva in the Pacific and a single Indian Ocean specimen; and *S. bothrops*, known from 10 specimens from Atlantic localities (Robins and Nielsen 1970). These two genera presently comprise the carapid subfamily Pyramodontinae (Robins and Nielsen 1970), a classification based in part on Strasburg's (1965) identification of the vexillifer larva of *S. canina*. Vexillifers are elongate larvae with a highly modified first dorsal ray (vexillum) detached from and preceding the remaining unmodified rays of the dorsal fin proper (Olney and Markle 1979). As part of our continuing studies on the systematics of carapid larvae, we report in this note the first identified vexillifer larvae of *Pyramodon ventralis*, compare them with additional larvae of *Snyderidia canina*, and comment on the classification of the genera.

MATERIALS AND METHODS

All specimens are deposited in the United States National Museum of Natural History, Washington, D.C. (USNM). In the following list of material, we record, where available, the museum catalog number, specimen head length (HL) or number of specimens and range of head lengths, vessel or cruise designation, station designation, coordinates, station depth (m), date of collection, time of collection, collection gear, depth of collection (m), and surface temperature (°C).

PYRAMODON VENTRALIS: juveniles: USNM 219340, 219341, 2 specimens 10.5 and 11.4 mm, J12/46/75, 37°40′18″ S, 177°17′48″ E, 15 August 1975, 2204 hrs, midwater trawl, 0–120 m, 16.4°C; vexillifers: USNM 219342, 6.0 mm, J7/56/75, 37°28′30″ S, 177°13′00″ E, 9 May 1975, 0240 hrs, midwater trawl, 80–

[1] Manuscript accepted 22 October 1979. This is a joint contribution from The Huntsman Marine Laboratory and the Virginia Institute of Marine Science (VIMS Contribution 984).

[2] The Huntsman Marine Laboratory, St. Andrews, New Brunswick, E0G 2X0, Canada.

[3] Virginia Institute of Marine Science and the College of William and Mary, Gloucester Point, Virginia 23062.

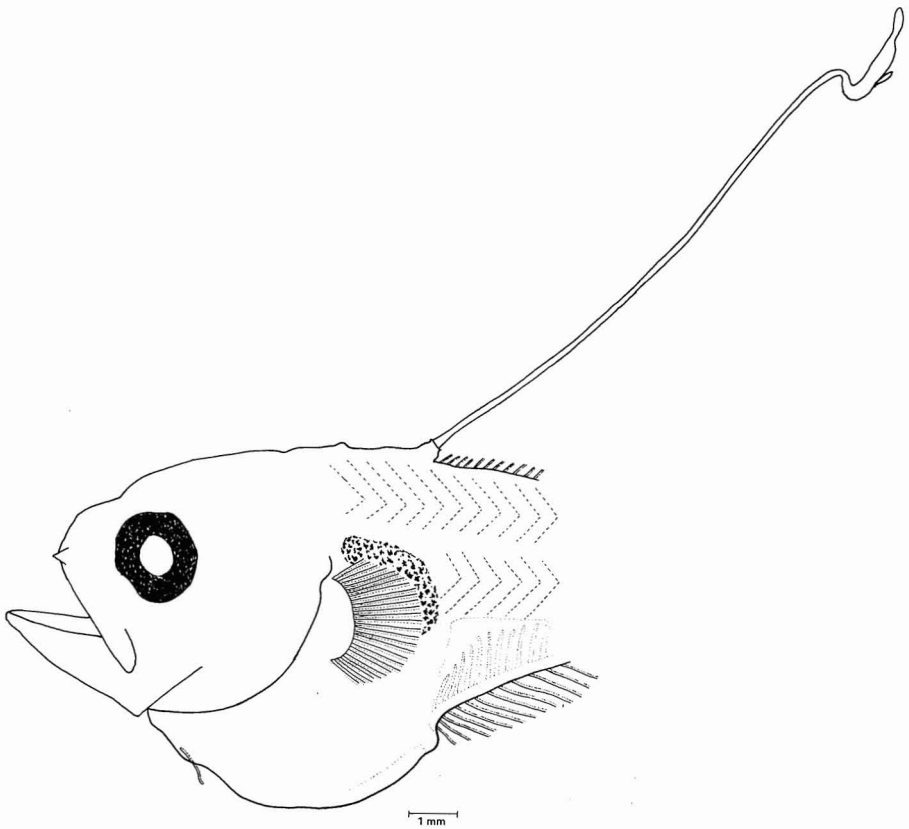

FIGURE 1. *Pyramodon ventralis*, USNM 219342, 6.0 mm HL.

386 m, 18.8°C; USNM 219343, 4.4 mm, International Indian Ocean Expedition, "Anton Bruun," cr. 4A, st. 162–983, 17°38′ S, 54°58′ E, 26 September 1963, 0–1000 m.

SNYDERIDIA CANINA: vexillifers: USNM 219344, 5.7 mm, "Te Vega," cr. 8, st. 323, 01°52′ N, 160°53′ W, 19 July 1965, 1-m plankton net, 0–125 m; USNM 219345, 3.6 mm, "Te Vega," cr. 8, st. 318, 01°45′ N, 166°45′ W, 17 July 1965, 1-m plankton net, 0–120 m.

Our measurements, counts, and clearing and staining procedures follow standard methods as outlined in Olney and Markle (1979). One vexillifer (USNM 219342) and one juvenile (USNM 219341) of *P. ventralis* and one larva of *S. canina* (USNM 219344) were cleared and differentially stained for cartilage and bone.

DESCRIPTION

Gross Morphology and Morphometrics

Pyramodontine vexillifers (Figures 1, 2) may be characterized as follows: head large, deep and compressed; gut short, bulbous, in a flat coil; eye large; trunk deep; body tapering; nasal rosette and gas bladder conspicuous; anterior maxillary flange projecting beyond premaxilla; long anterior anal-fin radials visible even in unstained material; second neural spine visible as a small dorsal protuberance anterior to the vexillum in preserved material; pelvic fins present (in *Pyramodon* only); vexillum present; dorsal-fin and anal-fin bases long; caudal fin present; origin of vexillum, dorsal fin, and anal fin immediately posteriad of pectoral-fin base.

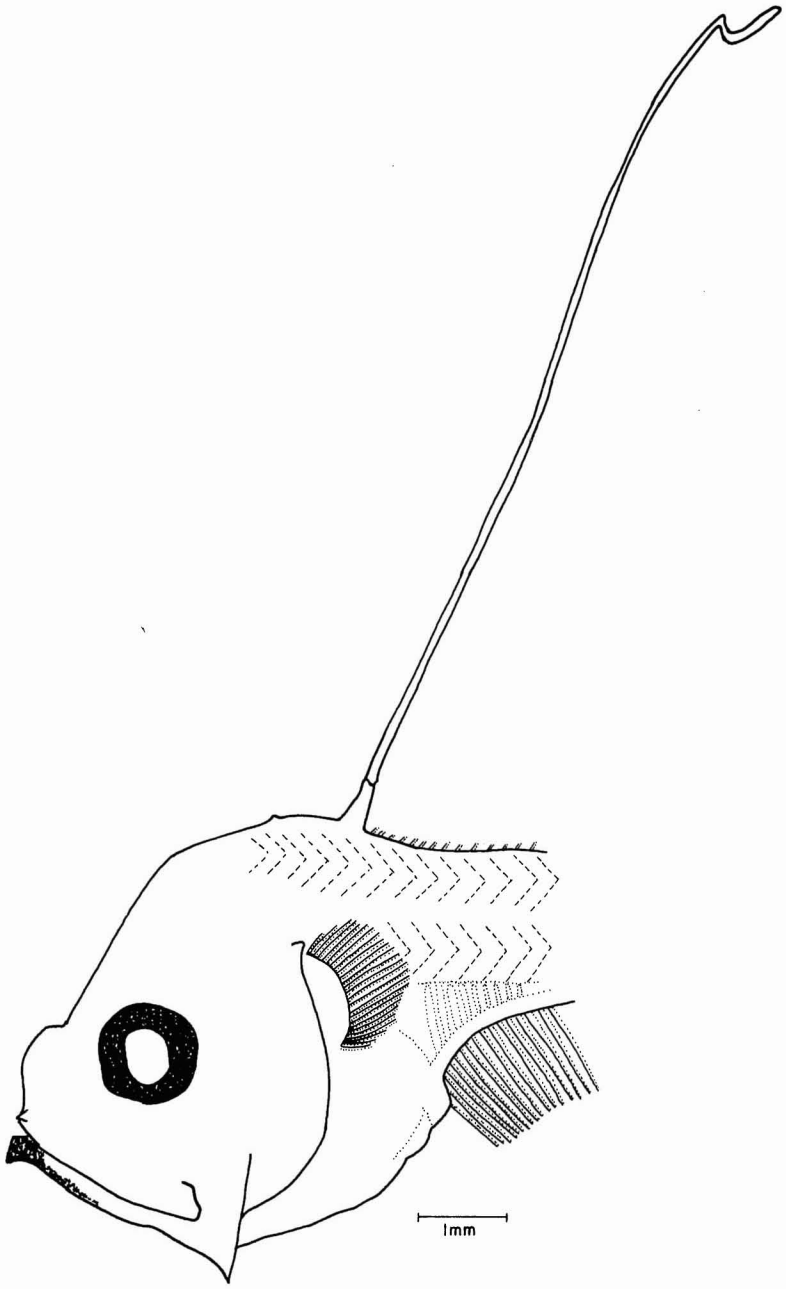

FIGURE 2. *Snyderidia canina*, USNM 219345, 3.6 mm HL.

TABLE 1

A MORPHOMETRIC COMPARISON OF *Pyramodon ventralis* AND *Snyderidia canina*

	P. ventralis				*S. canina*	
	USNM 219340	USNM 219341	USNM 219342	USNM 219343	USNM 219344	USNM 219345
Total length	61	70	55	33	38	20
Head length	10.5	11.4	6.0	4.4	5.7	3.6
Snout length	0.22	0.20	0.23	0.23	0.23	0.34
Orbit diameter	0.26	0.26	0.33	0.32	0.32	0.38
Eye diameter	0.22	0.25	0.29	0.26	0.28	0.32
Upper jaw length	0.50	0.54	0.45	†	0.59	0.59
Lower jaw length	0.55	0.59	0.61	†	0.68	0.77
Pelvic-fin ray length	0.41	0.49	0.08	0.06	*	*
Snout to vexillum	*	*	1.29	1.14	1.11	1.13
Predorsal distance	1.16	1.25	1.38	1.18	1.12	1.19
Preanal distance	1.28	1.37	1.43	1.20	1.32	1.30
Snout to anus	1.23	1.32	1.37	1.18	1.29	1.28
Depth at lst anal-ray	0.55	0.47	0.92	0.91	0.81	0.77
Vexillum length	*	*	1.19	1.18	1.11	1.13

NOTE: Total length and head length are given in millimeters, other characters as a ratio to head length.
*Absent
†Damaged

A morphometric comparison of vexillifer larvae and juveniles of *P. ventralis* and vexillifers of *S. canina* is presented in Table 1. In *P. ventralis*, the most conspicuous ontogenetic changes are the loss of the vexillum, a decrease in body depth with increasing head length (HL), and an increase in pelvic-fin ray length. In larval *Snyderidia*, as in larval carapines (Olney and Markle 1979), vexillum length decreases relative to increasing HL. The vexillum may attain its greatest absolute length in *S. canina* (Strasburg 1965). Based on our small sample, it appears that vexillifers of *Pyramodon* and *Snyderidia* are morphometrically indistinguishable at comparable sizes but contrast sharply with carapine vexillifers (see table 1 in Olney and Markle 1979). The most noticeable differences are the relatively deep, compressed head and trunk and a forward placement of the vexillum and first dorsal ray. In the pyramodontine genera, body depth at the first anal ray varies from 77 to 92 percent of HL and predorsal distance varies from 112 to 127 percent of HL; in carapines body depth is less than 0.6 HL and predorsal distance is more than 1.6 HL.

Pigmentation

Pigmentation in pyramodontine vexillifers is sparse. In *P. ventralis* vexillifers (Figure 1), melanophores associated with the posterior portion of the gas bladder are conspicuous in our largest specimen but badly faded in USNM 219343, probably as a result of long preservation. The black pigment persists in *P. ventralis* tenuis larvae which also possess darkly pigmented stomach and esophageal walls. Black stomach pigment is also reported in *Snyderidia* spp. adults (Strasburg 1965; Robins and Nielsen 1970).

In *S. canina* (Figure 2) melanophores are present at the mandibular symphysis; scattered at the upper base of the pectoral and on the cranium; and near the pelvic girdle. This latter pigment is hidden from lateral view by the angular in USNM 219345 (Figure 2). Strasburg's (1965) larva of *S. canina* agrees in this pattern but has additional pigment on the neck and abdomen.

Meristics

In *P. ventralis* vexillifers the following meristic variation was recorded: P 27–29,

V 1, D 153, A 153, branchiostegal rays 7, number of D rays to beginning of 31st vertebra 50, number of A rays to beginning of 31st vertebra, 50, vexillum origin over 6th vertebra or 6th myomere, dorsal origin over 7th vertebra or 7th myomere, anal origin under 8th vertebra or 6th myomere, vertebrae (precaudal + caudal = total, including urostyle) 17 + 83 = 100, caudal fin complete in cleared and stained specimen and with 7 rays.

The *S. canina* vexillifers showed the following meristic variation: P 25–25, V absent, D 145+, A 143+, branchiostegal rays 7, number of D rays to beginning of 31st vertebra 51, number of A rays to beginning of 31st vertebra 46, vexillum origin over 6th vertebra, dorsal origin over 7th vertebra, anal origin under 9th or 10th vertebra, vertebrae incompletely formed except anteriorly. Gosline (1960) reports 15 precaudal centra for adult *S. canina*.

Vexillum, Axial Skeleton, and Fins

Olney and Markle's (1979) characterization of the vexillum applies to *Pyramodon* and *Snyderidia* as well as all other carapid genera (unpublished observations). The separation of the vexillum into a short proximal and a long distal portion is a noticeable feature, even in material which has not been cleared and stained (Figure 1, 2). In larval *S. canina* and *P. ventralis*, the vexillum is variously ornamented with 0–5 short, fleshy tabs along the distal portion of the shaft and with a terminal, fleshy, hooked pennant (Figure 1, 2, and see Strasburg 1965).

The proximal radial supporting the vexillum in pyramodontine vexillifers (Figure 3) is not compound as in *Echiodon* (Olney and Markle 1979), and extends from the 3rd to the 8th centrum in *P. ventralis* (Figure 3*a*) and from the 3rd to the 7th centrum in *S.* canina (Figure 3*b*). In the cleared juvenile of *P. ventralis* (USNM 219341) a predorsal bone extends from centra 4 to 6. In both species the proximal radial is characterized by a descending anterior process, a wavy ventral contour, and a posterior process passing under anterior dorsal-fin radials. This configuration agrees well with the structure of the predorsal bone in adult *S. canina* (Strasburg 1965).

In both *P. ventralis* and *S. canina*, the 2nd neural spine is wider and longer than adjacent spines (Figure 3) and, in preserved material, produces a small protuberance anterior to the vexillum (Figures 1, 2). In addition, both species exhibit an accessory cartilage anterior to this spine which is similar to that observed in *Carapus bermudensis* (Olney and Markle 1979).

The anal-fin radials of pyramodontine vexillifers are relatively longer than those of carapines and are clearly visible even in unstained material (Figures 1, 2). In *P. ventralis* these radials have been further modified to permit the viscera to pass posteriad between them. In the cleared vexillifer of *P. ventralis* radials 3 through 22 bend to the left or right in alternating sequence away from the midline (Figure 4) and thus form a cradle which allows viscera to extend posteriad. This visceral cradle persists in the cleared juvenile of *P. ventralis* in which radials 1 through 24 bend alternately away from the midline. A visceral cradle was not present in the *Snyderidia* larvae examined nor has it been reported from adult material (Gosline 1960; Robins and Nielsen 1970; Strasburg 1965).

Distribution

Our material of *P. ventralis* extends the known species range in the Indian Ocean northward to northeast Madagascar and confirms the presence of all larval stages as well as adults in northern New Zealand waters. The capture of *S. canina* larvae in equatorial waters of the Indo-West Pacific region corresponds closely to data provided by Strasburg (1965).

CONCLUSIONS

Identification of a vexillifer larva of *Pyramodon* establishes this form as a unique specialization of all Carapidae and reinforces

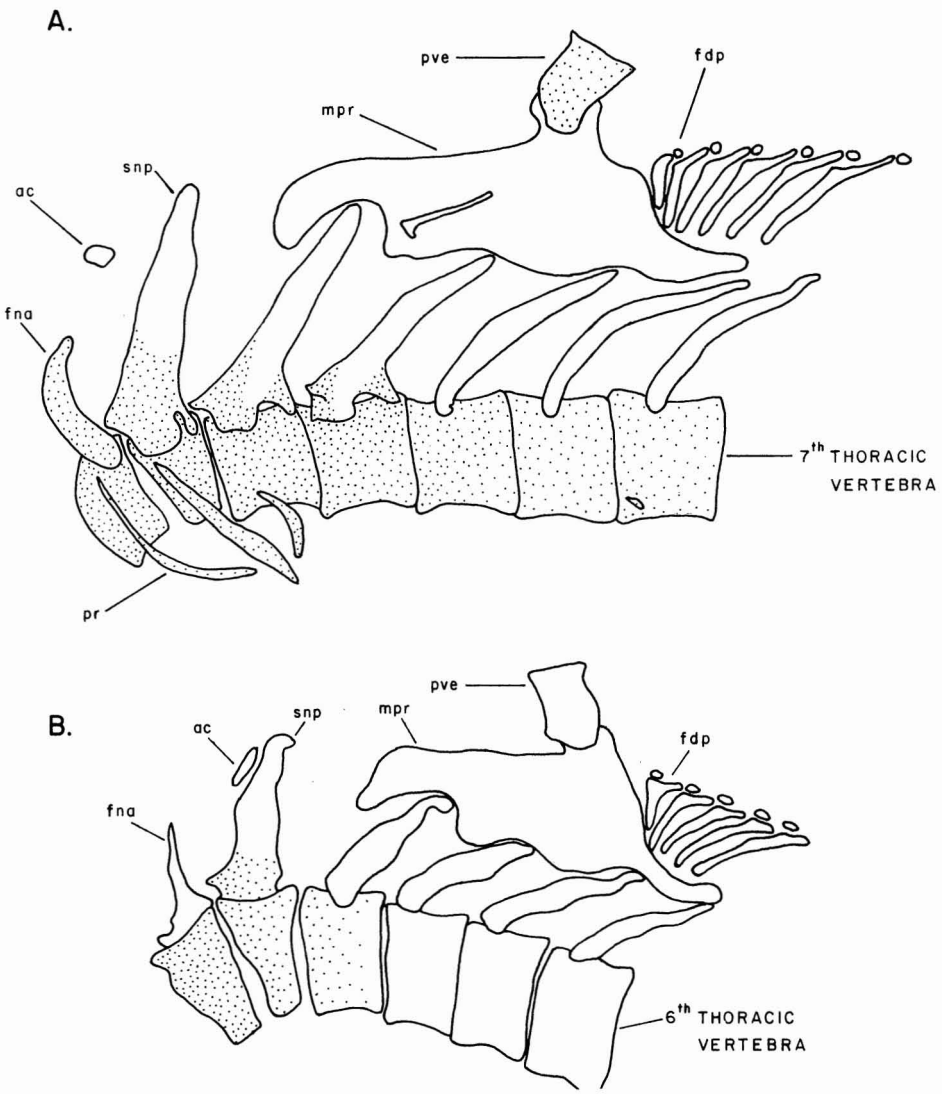

FIGURE 3. Pyramodontine vexillar support and anterior axial skeleton. *ac*, accessory cartilage; *snp*, second neural spine; *mpr*, modified proximal radial; *pve*, proximal vexillar element; pr_1, pleural rib of first vertebra; *fdp*, proximal and distal radial of first dorsal pterygiophore; *fna*, neural arch of first vertebra.

A, *Pyramodon ventralis*, USNM 219344, 6.0 mm HL, left lateral view of first 7 vertebrae and vexillar support skeleton.

B, *Snyderidia canina*, USNM 219342, 3.6 mm HL, left lateral view of first 6 vertebrae and vexillar support skeleton.

the current classification (Gosline 1960; Robins and Nielsen 1970) of *Pyramodon* as a close relative of *Snyderidia*. Larvae of these genera share the following unique characters: a deep, compressed head and trunk with a depth at the first anal ray of 0.77–0.92 HL; a short predorsal distance of 1.12–1.27 HL; more than 24 pectoral rays; a proximal vexillum radial with a descending anterior process, a wavy ventral contour, and a posterior process passing under the anterior dorsal-fin radials; a relatively wide and long second neural spine; and relatively long anal-fin radials. In addition, larvae of *Pyramodon*

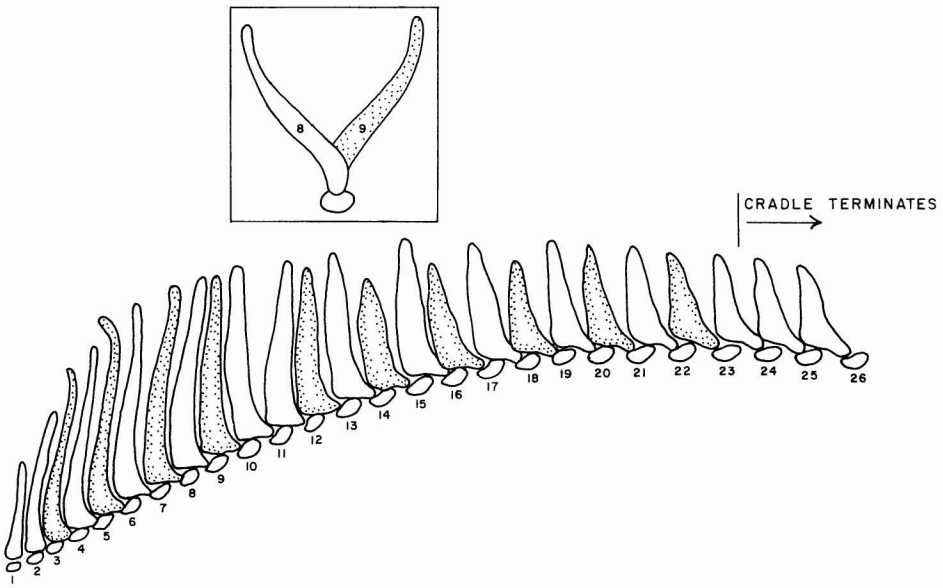

FIGURE 4. *Pyramodon ventralis*, USNM 219342, 6.0 mm HL, first 26 anal-fin radials and visceral cradle. Proximal radials that are shaded lean toward viewer; those that are not shaded lean away from viewer. Insert: Anal-fin radials 8 and 9 viewed along the axis of the fin (counterclockwise rotation of 90°).

and *Snyderidia* contrast sharply with vexillifers of other carapines (Olney and Markle 1979 and unpublished observations), a condition which may support the present subfamilial classification of the 2 genera. Further examination of larval characters in the Carapidae is necessary to elucidate generic relationships.

ADDENDUM

After this manuscript went to press, additional material was made available to us by Tom Clarke, University of Hawaii, and Les Knapp, Smithsonian Oceanographic Sorting Center. This material consists of four *Pyramodon ventralis* (3.2 to 9.4 mm HL) and four larval *Snyderidia canina* (1.0 to 5.4 mm HL), and provides new data on pigmentation variability. In all material on hand, gas-bladder pigmentation is present in both species but appears variable due to length of preservation; pigment on the mandibular symphysis is always found in *S. canina* and never in *P. ventralis*; and all other pigmentation (pectoral, cranial, pelvic) is variable. All of the new material came from two localities (21°20–30′ N, 158°20–30′ W and 24°31′ N, 157°50′ W), thus extending the known range of *P. ventralis* to Hawaiian waters.

ACKNOWLEDGMENTS

Our sincere thanks are extended to Dr. D. A. Robertson, Fisheries Research Division, Ministry of Agriculture and Fisheries, Wellington, New Zealand, for his generous gift of material and his comments on the identification of *Pyramodon* larvae. We also thank François Conand, Centre ORSTOM, Nouvelle Calédonie, for the gift of comparative larval carapine material and Dr. D. M. Cohen, National Marine Fisheries Service, Systematics Laboratory, for the loan of material and his continued interest in our studies of larval carapids. Drafts and final copy of this report were prepared by the VIMS Report Center. Travel expenses were defrayed by The Huntsman Marine Laboratory.

LITERATURE CITED

GOSLINE, W. A. 1960. Hawaiian lava flow fishes, part IV. *Snyderidia canina* Gilbert, with notes on the osteology of ophidioid families. Pac. Sci. 14(4)373–381.

MCCANN, C. 1972. Additions to the deep sea fishes of New Zealand. New Zealand J. Mar. Fresh. Res. 6:619–640.

OLNEY, J. E., and D. F. MARKLE. 1979. Description and occurrence of vexillifer larvae of *Echiodon* (Pisces: Carapidae) in the western North Atlantic and notes on other carapid vexillifers. Bull. Mar. Sci. 29(2): 365–379.

ROBINS, C. R., and J. G. NIELSEN. 1970. *Snyderidia bothrops*, a new tropical, amphi-Atlantic species (Pisces: Carapidae). Stud. Trop. Oceanogr. 4(2):285–293.

SMITH, J. L. B. 1955. The genus *Pyramodon* Smith and Radcliffe, 1913. Ann. Mag. Nat. Hist., Ser. 12, 8:545–550.

STRASBURG, D. W. 1965. Description of the larva and familial relationships of the fish *Snyderidia canina*. Copeia 1965 (1):20–24.