The Pacific Species of the Clinid Fish Tribe Starksiini[1]

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THE ATLANTIC SPECIES of the clinid fishes of the tribe Starksiini were revised by Böhlke and Springer (1961), who synonymized the nominal genus *Brannerella* with *Starksia,* and regarded the group as monogeneric. They recognized eight species, describing two as new. Subsequently three additional Atlantic species have been described (C. R. Gilbert, 1965; C. R. Gilbert, in press). The Pacific forms were last treated by Al-Uthman (1960) who recognized two species, describing *Brannerella spinipenis* as new. Our study began with the collection of an obviously undescribed species in the Gulf of California. Further examination of starksiin material revealed that the species that had been called *Starksia cremnobates* by recent authors (Hubbs, 1952; Al-Uthman, 1960; Böhlke and Springer, 1961) could not be referred to *cremnobates* of Gilbert and had never been named. This species differs so strongly from the other starksiin species that a new genus is proposed for it. This, coupled with the discovery of seven additional undescribed species of *Starksia,* bringing the total for the eastern Pacific to nine, has necessitated an extensive treatment of all the Pacific species.

MATERIALS AND METHODS

Material utilized in this study is housed in the following institutions: American Museum of Natural History (AMNH); University of California at Los Angeles, Department of Zoology (UCLA); Los Angeles County Museum of Natural History (LACM); National Museum of Natural History (USNM); Scripps Institution of Oceanography (SIO); Division of Systematic Biology, Stanford University (SU); and University of Arizona (UA).

Methods of measuring and counting correspond to those of Hubbs and Lagler (1964) except that all the elements of the dorsal, anal, and caudal fins were counted. Osteological preparations were done by X-ray or alizarin-staining and clearing.

In the descriptions, the range for counts is given, followed by the mean and the standard error of the mean in parentheses. Pectoral counts are the total of the left and right fins. Counts for the holotypes of the new species are given in Table 1 and measurements in Table 2. Certain characters common to the species of *Starksia* are mentioned in the generic description, and not repeated.

TRIBE STARKSIINI

Hubbs (1952) proposed the tribe Starksiini to include those labrisomine species in which the reproductive mode is "viviparity," and with the "anterior portion of anal fin in males modified to serve as an intromittent organ," in addition to a few minor characters. The description of new species has made it necessary to modify the definition of the tribe as follows: Labrisomine clinids with first anal spine of males free from second and usually united with an elongate genital papilla to form a compound intromittent organ; reproductive mode ovoviviparity. Species small, maximum adult size 20–60 mm. Combination of: head cirri unbranched, dorsal soft rays 7–11, vertebrae 30–37, no branched caudal rays, no opercular spine. Two genera, *Starksia* Jordan and Evermann and *Xenomedea* n. gen.

Reproduction

Although Hubbs (1952) and Al-Uthman (1960) considered the species of *Starksia* to be viviparous, Böhlke and Springer (1961) questioned the statement, pointing out that no evi-

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dence had been presented; they further stated that none of the females examined by them contained embryos. However, our material includes gravid females of four of the 10 Pacific species and indicates that ovoviviparity is indeed the mode of reproduction in the Starksiini.

A partially dissected female of *Xenomedea rhodopyga* is shown in Fig. 1. One ovary was removed from each of three females of *X. rhodopyga.* A 28-mm-long specimen (UCLA 56-22) from Isla Partida in the northern Gulf of California contained 12 eyed-embryos in the right ovary; these were tightly curled and about equal in size. (ca. 5 mm long). None of the embryos were surrounded by a chorion but they were in follicles rather than in the lumen of the ovary. In addition to embryos, the ovary contained 42 eggs with diameters ranging from 0.7–0.9 mm. The right ovaries of two females taken in Bahia de Los Angeles in April (SIO 62-227, 39.5 mm; SIO 62-233, 34.0 mm) contained 117 and 69 eyed-embryos respectively. In the larger female the embryos were approximately 2.5 mm long and most were surrounded by a chorion. In the smaller female the embryos were approximately 3.0 mm long and all but one were free from the egg. In both ovaries there were also developing eggs. A few oocytes (.09–.13 mm) could also be seen.

The single available gravid female of *Starksia fulva* (SU unnumbered, *Te Vega* VIII-12, 24 mm) contained 68 embryos and about half that many developing eggs. The only gravid female of *S. spinipenis* in our material (SIO 65-186, 35 mm) had 121 eggs in the blastodisc stage, no large unfertilized eggs, a small number of developing eggs, and numerous oocytes. A gravid paratype of *S. hoesei* contained 64 embryos, all in eggs (with a diameter of 1.1–1.3 mm), no developing eggs, and scattered oocytes. In all of the females examined, the eggs and embryos were in ovarian follicles and not free in the lumen of the ovary.

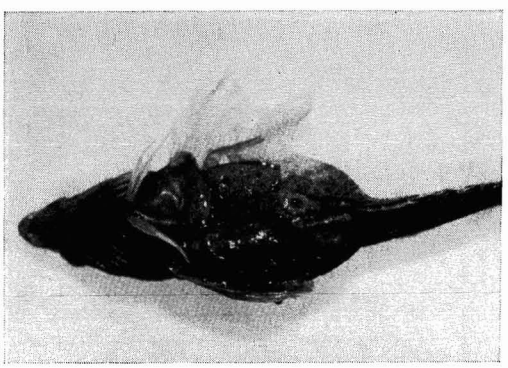

FIG. 1. Female *Xenomedea rhodopyga* dissected to show eyed embryos in ovaries (UCLA 56-72).

The presence of numerous large developing eggs in addition to embryos in *Xenomedea rhodopyga* suggests that there may be more than one brood per year. This contrasts with *Starksia hoesei* in which the ovary contained only developing embryos and oocytes. *S. fulva* and *S. spinipenis* are intermediate in this respect with a few large developing eggs. In all females examined, the embryos were at about the same developmental stage, suggesting that a batch of eggs develop and are fertilized together.

We cannot offer an explanation for the lack of reports of gravid females of *Starksia* from the Atlantic. It is unlikely that the Atlantic species are oviparous. *Xenomedea rhodopyga* has several primitive features and we have not been able to find any morphological character that distinguishes the Atlantic species of *Starksia* as a group from those of the Pacific. It would thus be necessary for viviparity to have evolved independently in *Starksia* and *Xenomedea.* Alternatively, it could have been lost independently in all the Atlantic species. Neither supposition seems probable.

Relationships

The starksiins agree with the more advanced members of the subfamily Clininae in that they are ovoviviparous. However viviparity is almost certainly of independent origin. The most primitive members of the Clininae, the Myxodini (Hubbs, 1952; Penrith, 1969), are oviparous, and the fleshy penis of males of the viviparous clinins is very different from the intromittent organ of the starksiins. Also, in the clinins embryonic development takes place in the lumen of the ovary, the walls of which are highly vascularized, and the young are born at a large size, long after the yolk is gone (Penrith, 1965). The starksiins are allied with the labrisomines by a number of characters, and the group could easily be derived from an *Auchenionchus* or *Labrisomus*-like ancestor.

TABLE 1

MERISTIC DATA FOR THE PACIFIC SPECIES OF THE TRIBE STARKSIINI

SPECIES	DORSAL SPINES					DORSAL RAYS				
	XIX	XX	XXI	XXII	XXIII	7	8	9	10	11
Starksia cremnobates				2*			2*			
S. fulva	8	43*	3				2	49*	2	
S. galapagensis		1	28	4*			8*	24		
S. grammilaga	1	24*				1	21*	3		
S. guadalupae		6	6*					8*	4	
S. hoesei		1*	2	1				1	3*	
S. lepidogaster	1	10*				1	10*			
S. posthon			1					1		
S. spinipenis	8	63	5				11	60	5	
Xenomedea rhodopyga		3	121	69*	3		1	69	113*	13

SPECIES	TOTAL DORSAL ELEMENTS							ANAL RAYS						
	27	28	29	30	31	32	33	16	17	18	19	20	21	22
Starksia cremnobates				2*							2*			
S. fulva		8	42*	3					10*	43				
S. galapagensis			6	25*	1			2	1	8	22*			
S. grammilaga	1	22*	2					4	19*	2				
S. guadalupae			3	8*	1				1	4	6*	1		
S. hoesei				1*	3							2*	2	
S. lepidogaster	2	9*							11*					
S. posthon				1							1			
S. spinipenis		13	59	4				1	9	58	8			
Xenomedea rhodopyga			1	27	127	39*	2			2	9	114	60*	9

TABLE 1 (*continued*)

SPECIES	TOTAL PECTORAL RAYS							LATERAL LINE SCALES										
	24	25	26	27	28	29	30	35	36	37	38	39	40	41	42	43	44	45
Starksia																		
cremnobates			2*									2*						
S. fulva			1	2	47*	1	1		3	13	10*	23	2					
S. galapagensis		3	28*		2						4	14	6	4*	5			
S. grammilaga			3	3	19*				7	6	8*	2						
S. guadalupae			8*	1	2					1	3	3*	3		1			
S. boesei			3*		1									1*	1	2		
S. lepidogaster	1		9*	1				3	7*									
S. posthon			1									1						
S. spinipenis				2	70	2	2				3	28	27	4	3			
Xenomedea																		
rhodopyga	1	2	163*	19	10							3	21	58	50	41*	13	6

* Count of holotype.

We regard *Xenomedea rhodopyga* as the most primitive of the Starksiini. This conclusion is based primarily on the nature of the skeletal support of the anal spines of *X. rhodopyga,* which represents the generalized clinid condition. We have examined eight genera of labrisomines and four genera of clinines for comparative purposes. There is much variation in pterygiophore shape and arrangement, indicating that a study of anal supports in all clinids might be rewarding. However, only in *Exerpes* and *Parastathmonotus* are there fewer than two pterygiophores before the first haemal spine. In *Exerpes* the pterygiophore arrangement is much like that found in females of *Starksia,* and in the highly specialized *Parastathmonotus* the relationship between the anterior anal pterygiophores and the first few caudal vertebrae is unlike that seen in any other clinid. In the remaining genera, including primitive members of both subfamilies (*Auchenionchus, Labrisomus, Myxodes* and *Gibbonsia*), the anal pterygiophore arrangement agrees with that of *Xenomedea* as primitive.

Other features of *X. rhodopyga,* such as its large size (to 60 mm, as opposed to 41 mm—the largest known individual of *Starksia*), high counts (especially the larger number of vertebrae), and the well-developed third pelvic ray, are in agreement with the interpretation of *Xenomedea* as primitive.

It is difficult to discern lines of relationships within the genus *Starksia.* External characters provide few clues, and the numerous species are distinguished by relatively minor variations on a central theme. The compound intromittent organ is quite consistent in basic structure, except for the Atlantic species *S. hassi* and *lepicoelia* in which the genital tube is completely separated from the first anal spine. We regard this condition as derived, rather than primitive, because the first anal spine of both species is separated from the second and provided with a fleshy sheath. Also, in *S. hassi* the first anal pterygiophore of males is specialized.

It is likely that the nature of the first anal pterygiophore of males will prove to be an important character. In some of the species it is slender proximally and differs little in shape from the others. In several species, however, it

TABLE 2

COMPARATIVE MEASUREMENTS OF THE PACIFIC SPECIES OF THE TRIBE STARKSIINI IN THOUSANDTHS-OF-STANDARD LENGTH

	Xenomedea rhodopyga				*Starksia spinipenis*				*S. fulva*			
	RANGE	$\bar{X}$	N	TYPE	RANGE	$\bar{X}$	N	TYPE	RANGE	$\bar{X}$	N	TYPE
Standard Length (mm)	27.4–45.4	—	—	41.0	27.1–39.0	—	—		26.3–41.6	—	—	40.5
Head Length	282–329	296	31	329	295–329	309	32		284–335	313	31	309
Orbit Length	64–92	78	32	76	63–90	77	32		69–93	80	33	74
Snout Length	65–88	74	32	74	62–105	75	32		62–89	74	33	62
Upper Jaw Length	117–165	148	32	158	129–166	149	32		130–175	154	33	150
Body Depth at Anal Origin	202–244	220	30	226	176–216	192	32		204–246	221	31	210
Peduncle Length	71–103	88	32	98	63–109	78	32		58–95	81	33	84
Peduncle Depth	84–109	96	32	98	91–111	100	32		90–111	102	33	98
Predorsal Length	249–285	267	30	268	271–319	291	31		253–317	277	32	277
Preanal Length	470–557	505	31	486	494–561	520	32		482–594	541	32	546
Longest P_2 Ray	219–279	248	32	258	210–244	228	32		190–258	229	33	225

	S. galapagensis				*S. guadalupae*				*S. hoesei*			
	RANGE	$\bar{X}$	N	TYPE	RANGE	$\bar{X}$	N	TYPE	RANGE	$\bar{X}$	N	TYPE
Standard Length (mm)	26.6–35.4	—	—	34.9	19.5–44.6	—	—	32.5	35.0–38.5	—	—	38.5
Head Length	268–320	290	35	286	284–328	301	11	295	286–314	303	4	286
Orbit Length	61–88	77	30	72	67–87	76	11	77	74–85	79	4	78
Snout Length	50–84	66	30	72	62–78	71	11	77	65–74	70	4	65
Upper Jaw Length	130–156	143	30	146	130–156	140	11	138	129–150	137	4	132
Body Depth at Anal Origin	179–204	193	31	186	185–224	196	11	185	197–212	204	4	208
Peduncle Length	53–88	74	30	86	55–86	72	11	65	85–91	87	4	91
Peduncle Depth	83–100	92	30	86	77–108	91	11	77	84–91	86	4	91
Predorsal Length	250–291	268	32	264	250–308	272	11	274	257–272	264	4	260
Preanal Length	491–567	519	32	516	500–576	532	11	523	481–543	503	4	481
Longest P_2 Ray	197–249	225	29	226	204–256	230	11	228	212–257	237	4	221

TABLE 2 (*continued*)

	S. grammilaga				*S. lepidogaster*				*S. posthon*	*S. cremnobates*
	RANGE	$\bar{X}$	N	TYPE	RANGE	$\bar{X}$	N	TYPE	HOLOTYPE	*USNM 44371
Standard Length (mm)		—	—	24.2		—	—	18.5	27.9	28.3
Head Length	293–354	318	15	293	323–363	337	10	335	302	286
Orbit Length	83–107	95	15	87	98–119	106	10	103	83	74
Snout Length	62–83	74	15	62	65–80	74	10	70	75	67
Upper Jaw Length	143–166	151	15	145	152–169	162	10	162	147	123
Body Depth at Anal Origin	200–231	216	15	202	232–256	241	10	254	190	173
Peduncle Length	73–102	87	15	91	68–94	82	10	81	61	78
Peduncle Depth	101–127	115	15	107	108–133	125	10	124	86	78
Predorsal Length	272–311	290	15	273	286–329	307	10	303	260	—
Preanal Length	480–580	531	15	496	515–556	533	10	541	466	515
Longest P_2 Ray	207–254	233	15	207	215–261	233	9	216	186	—

NOTE: $\bar{X}$, mean; N, number in sample; Type, measurement in holotype.
* No measurements were taken from the type.

is enlarged and flattened. This condition is exemplified by *S. spinipenis* (Fig. 2*A*). The condition is essentially the same in *S. hoesei* and *S. galapagensis*. The first anal pterygiophore is somewhat less expanded in *S. fulva, grammilaga, hassi,* and *posthon,* in descending order. In *S. nanodes,* so far as we can determine from radiographs, both anal pterygiophores are enlarged and thickened, but not flattened. The first anal pterygiophore of *S. guadalupae* and *S. ocellata* is not thickened or expanded, and this is likely also true for *S. lepidogaster* (the largest male specimen is probably immature). On the basis of radiographs it appears that the anal-spine pterygiophores are little, if any, enlarged in *S. fasciata, lepicoelia,* and *y-lineata.*

The general applicability of this feature cannot be determined at this time. To describe it with certainty it is necessary to have cleared and stained material of mature males. We have found X-radiographs to be sometimes misleading, as the flattened portion of the pterygiophore may not be visible with exposures that show the medial portions and the vertebrae. For several species, as noted above, our material did not contain a sufficient number of mature males to allow clearing. It is especially unfortunate that *S. cremnobates,* the genotype, is known only from females.

There do not seem to be any particularly close relationships between species of the Atlantic and Pacific. *S. spinipenis* is similar in size, general appearance, penis structure, and, to a lesser degree, in color pattern to the doubtfully distinct Atlantic species pair *ocellata* and *guttata.* However the first anal pterygiophore of *S. spinipenis* is much enlarged and flattened, and that of *S. ocellata* is not. *S. spinipenis* is much more like the Pacific species *galapagensis* and *fulva.*

S. lepidogaster of the Pacific agrees with the Atlantic *S. lepicoelia* in that the belly is scaled in both, but in *lepicoelia* the genital papilla is free from the first anal spine. This and the lack of similarity in general appearance (*lepidogaster* is deep bodied and chunky, *lepicoelia* is elongate) and color pattern indicate that the two cannot be considered a geminate pair.

Distribution

The distribution of the Pacific species of the Starksiini is indicated in Figs. 3 and 4. The

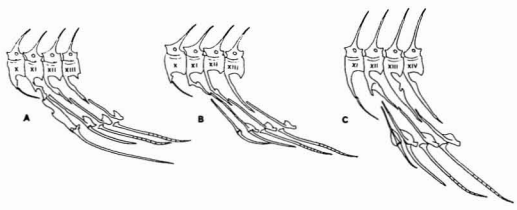

FIG. 2. Vertebrae and fin supports associated with anal fin spines and first two anal soft rays in *Starksia spinipenis* (*A*, male; *B*, female) and *Xenomedea rhodopyga* (*C*, male).

pattern of the starksiin species parallels that of the species of *Paraclinus* (Rosenblatt and Parr, 1969) in striking fashion. As in *Paraclinus* there is a marked disparity in the number of species between Mexico and Central America. Six of the nine known species of *Starksia* occur north of lat. 20° N and *Xenomedea rhodoypga* is restricted to the Gulf of California. In contrast only two species occur on the Central American coast between Nicaragua and Ecuador. The remaining southern species is endemic to the Galápagos Islands. This difference in the case of *Paraclinus* was attributed to a difference in collecting effort. This may be true in the case

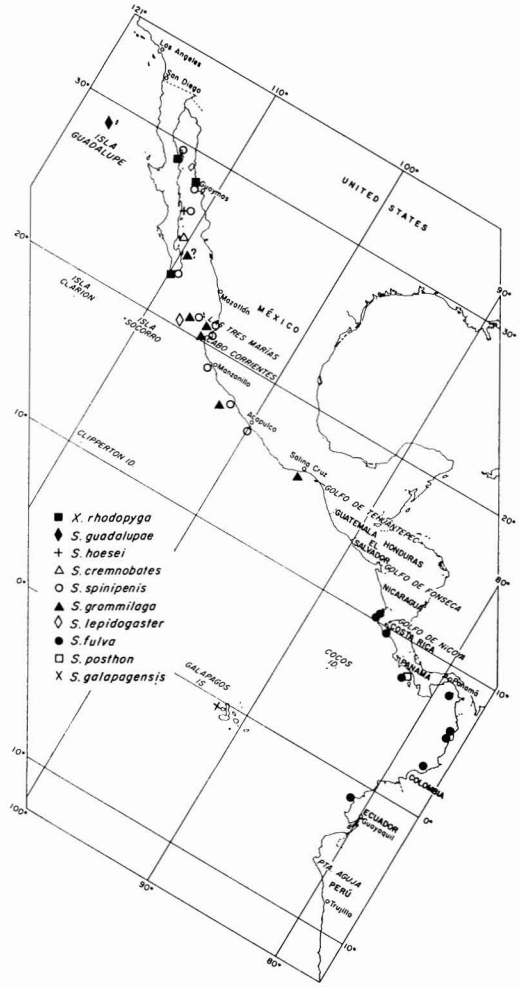

FIG. 3. Distribution of the Eastern Pacific species of the genera *Xenomedea* and *Starksia* based on material examined by us except for the northernmost record of *S. spinipenis*. For detailed distribution of Gulf of California species see Figure 4.

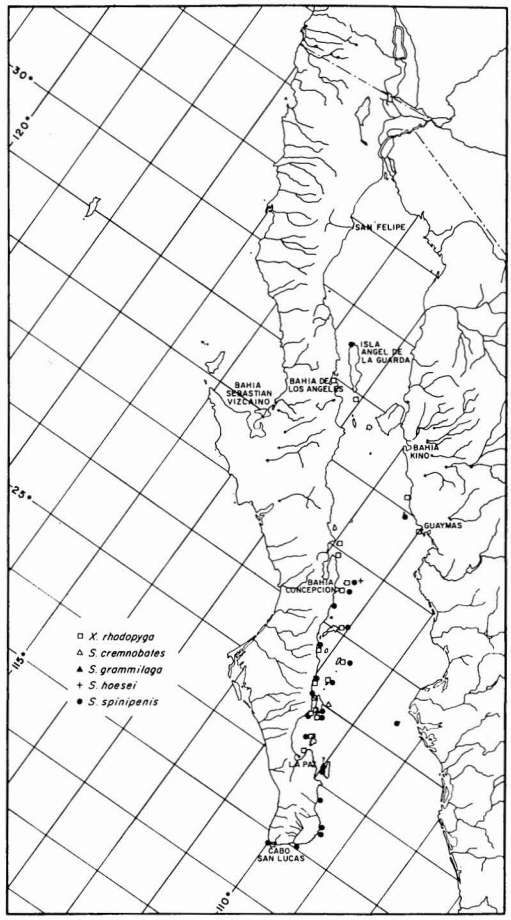

FIG. 4. Distribution within the Gulf of California of the species of *Xenomedea* and *Starksia*. Based on specimens examined except for the Isla Angel de la Guarda record of *S. spinipenis* from Al-Uthman (1960).

of *Starksia,* but recent collections in a variety of habitats in Panama have yielded only *S. fulva.*

Half of the known Pacific starksiins have been taken in the Gulf of California. However only two, *S. spinipenis* and the endemic *Xenomedia rhodopyga,* are common in habitats thus far sampled. (The major habitat as yet unsampled is that of rocky areas at depths greater than 33 meters.) There is considerable sympatry in range between *Starksia spinipenis* and *Xenomedea rhodopyga* within the Gulf (Fig. 4). However, there are detailed differences in their distributions within their ranges. Of 100 stations that were positive for starksiins between Bahia de Los Angeles and Cabo San Lucas only 19 contained both species. All of these stations were in the south-central part of Baja California between Isla Espiritu Santo and Isla Carmen. Especially noteworthy is the absence of *X. rhodopyga* from the area between Punta Prieta and Los Frailes, although 13 stations along this stretch of coast produced 57 *Starksia spinipenis. Xenomedea rhodopyga* occurs disjunctly at Cabo San Lucas, although it is less abundant there than *Starksia spinipenis.* An analogous pattern is seen to the north. Although there is a single record of *S. spinipenis* from Isla Angel de La Guarda (Al-Uthman, 1960), 17 stations from Punta Concepcion, Islas Santa Inez, and Bahia de Los Angeles produced 455 *Xenomedea rhodopyga,* and no *Starksia spinipenis.* It is clear from our records that *Xenomedea rhodopyga* is much more abundant in the Gulf of California (except for the coast south of Punta Prieta) than *Starksia spinipenis.* Our Gulf collections contain over 1,900 specimens of *Xenomedea rhodopyga* and fewer than 300 specimens of *Starksia spinipenis,* although the number of positive stations for each, 62 and 52 respectively, are not very different.

KEY TO PACIFIC SPECIES OF THE TRIBE STARKSIINI

1a. A dark spot on first dorsal fin between second and third spines. A red area on flanks above and anterior to anus. First anal spine of males shorter than second. Adult (35 mm) males with complex fleshy folds around genital papilla and along anterior part of anal base (Fig. 5); females with a black ridge running back from anus on either side of anal base, to level of second soft ray. Pterygiophores of anal spines before first haemal spine, which is borne on 12th vertebra. Third anal pterygiophore supported by first haemal spine (Fig. 2*C*) ..... *Xenomedea rhodopyga* n. gen., n. sp.

1b. No dark spot between second and third dorsal spines. No red area on flanks. First anal spine of mature males longer than second (Fig. 5) (not known for *Starksia lepidogaster* or *S. cremnobates*). Neither sex with folds or ridges along anal base (male of *S. cremnobates* not known). Pterygiophores of anal spines supported by first haemal spine, which is born on 11th vertebra. Third anal pterygiophore supported by second haemal spine (Fig. 2 *A, B*) 2

2a. Belly completely scaled; lateral line scales 35–36 ..... *S. lepidogaster* n. sp.

2b. Belly naked or with 3–5 rows of scales in advance of anus; lateral line scales usually 37–43 (3 of 17 *S. grammilaga* with 36 scales—see Table 1) 3

3a. Nasal cirri notably long, varying from one-half orbit diameter to twice orbit diameter 4

3b. Nasal cirri shorter, their length less than one-half orbit diameter 5

4a. Anal soft rays 20–21; lateral line scales 41–43; penis of mature male strongly curved, tip of genital papilla scarcely extending beyond fleshy tip of first anal spine (Fig. 5); no dark spot between first and second dorsal spines ..... *S. hoesei* n. sp.

4b. Anal soft rays 19, lateral line scales 39 in only known specimen, first anal spine of mature male almost straight, tip of genital papilla extending well beyond fleshy tip of first anal spine (Fig. 5); a dark spot between first and second dorsal spines ..... *S. posthon* n. sp.

5a. Body mostly dusky with 6–8 horizontal light lines parallel with scale rows on posterior part of body; a light vertical bar just behind eye ..... *S. grammilaga* n. sp.

5b. No horizontal light lines parallel with scale rows on posterior part of body; body uniformly olivaceous (*S. cremnobates*), heavily spotted, or with variously developed bars or saddles made up of blotches or spots 6

6a. Lateral line scales on straight posterior portion with exposed pores and lacking tubes; nasal tentacle shorter than tube from which it arises ..... *S. cremnobates* (Gilbert)

6b. Lateral line scales mostly tubed, those in posterior series usually tubed with rear margin also notched or lobed, never unmodified except for an exposed pore; nasal tentacle equal to or longer than nasal tube 7

7a. Tip of genital papilla of mature males not extending beyond fleshy tip of first anal spine (Fig. 5). Total pectoral rays modally 26 8

7b. Tip of genital papilla of mature males extending beyond fleshy tip of first anal spine (Fig. 5). Total pectoral rays modally 28 9

8a. Body strongly barred, lips with two bars on each side of the midline. Caudal evenly dusky. Third pelvic ray rudimentary, visible only in stained material. First anal spine of males with a fleshy knob at its tip, end of genital papilla separated from first anal spine (Fig. 5). First anal pterygiophore of males enlarged and flattened ..... *S. galapagensis* n. sp.

8b. Body with weak saddles under the dorsal, not strongly barred; lips evenly pigmented. Caudal with two pigmented areas basally, above and below the midline. Third pelvic ray reduced but separated from second by a membrane; obvious. No pronounced knob on end of second anal spine. Genital papilla attached to anal spine almost to tip (Fig. 5). First anal pterygiophore of males similar to second ..... *S. guadalupae* n. sp.

9a. A row of prominent black spots along base of dorsal. Two round black spots on pectoral base; caudal barred. Body tan with faint bars, or heavily spotted. Three to five scale rows across belly just anterior to anus. Genital papilla of mature males barely extending beyond swollen tip of first anal spine (Fig. 5) ..... *S. fulva* n. sp.

9b. No prominent black spots along base of dorsal. Pectoral base plain; caudal plain. Body with numerous subquadrate to polygonal blotches (forming a series of prominent bars on the sides in Gulf of California specimens). Belly naked. Genital papilla of mature males extending well beyond fleshy tip of first anal spine (Fig. 5) ..... *S. spinipenis* Al-Uthman

Xenomedea n. genus

Diagnosis

D. XX–XXIII, 8–11. A. II, 18–22. Total pectoral rays 24–28. Lateral line scales 39–45. Principal caudal rays 13. Total vertebrae 34–37. A labrisomine clinid with the first anal spine of males much shorter than the second and modified as an intromittent organ, pterygiophores of anal spines anterior to first haemal spine, third anal pterygiophore supported by first haemal spine. Mature males with anterior por-

tion of anal fin surrounded by rugose black folds, females with a low black ridge in the analogous position. Reproductive mode ovoviviparity. Simple cirri at nape, on dorsal margin of eyeball and anterior nostril tube. No branched rays in fins. Dorsal soft rays never fewer than eight. Pelvic rays I, 3. Other characters are those of the single species.

Genotype

Genotype is *Xenomedea rhodopyga* n. sp.

The generic type of *Xenomedea, X. rhodopyga,* differs from the other starksiin species in features of the external genitalia and in the nature of the skeletal support of the anal spines. In male *X. rhodopyga* there are black fleshy folds along the anal base and between the anus and genital papilla. In the females this structure is represented by a pair of black dermal ridges. *X. rhodopyga* differs more fundamentally in the nature of the fin supports. In the species of *Starksia* the pterygiophores of the anal spines are supported by the first caudal vertebra, the 11th, and in males the pterygiophore of the first anal spine is firmly attached to the haemal spine. The third pterygiophore, which bears the first and second soft rays, is associated with the second caudal vertebra (Fig. 2 *A, B*). In *Xenomedea rhodopyga,* however, the pterygiophores of the anal spines lie before the first caudal vertebra, the 12th, and the third pterygiophore is associated with the haemal spine of the first caudal vertebra, rather than the second. (Fig. 2*C*).

In addition to the Pacific species of *Starksia,* we have examined X-radiographs or cleared specimens of the following Atlantic species: *S. fasciata, S. hassi, S. lepicoelia, S. nanodes, S. ocellata,* and *S. y-lineata.* Unfortunately the generic type of *Starksia, S. cremnobates,* is known only from females, but the pterygiophore arrangement of the holotype agrees with that of females of the other species referred to *Starksia* (Fig. 2*B*).

Böhlke and Springer (1961) have discussed generic classification of the Starksiini in connection with their review of the Atlantic species of *Starksia.* They applied the name *Starksia cremnobates* to the species here called *Xenomedea rhodopyga,* and argued that the species of *Brannerella* (= *Starksia* of Jordan and Evermann) could not be separated generically from it.

They recognized some of the differences between the species but felt that the only notable character known to them, the fleshy folds around the anal base of *Xenomedea rhodopyga,* was not of sufficient magnitude to allow generic separation. Their further statement that *Starksia ocellata* is especially close "structurally" to *Xenomedea rhodopyga* is inexplicable. The two species do agree in attaining 40-mm standard length or more, but so do at least five other Pacific species of *Starksia. S. ocellata* and five other species here referred to *Starksia* agree in usually having 14 pectoral rays. *Xenomedea rhodopyga* usually has 13, and certainly does not agree with *Starksia ocellata* in "a high number of pectoral rays," although it must be admitted that Böhlke and Springer do not specify their criterion for a high number. The supposed similarities in coloration are trivial. Likewise, the statement of Böhlke and Springer that the intromittent organs are "essentially similar" cannot be accepted. The intromittent organ of *S. ocellata* is very similar to that of *S. guttata* and *S. spinipenis* and quite different from that of *Xenomedea rhodopyga.* Further, the internal support of the anal spines of *Starksia ocellata* agrees with that of the species of *Starksia,* rather than that of *Xenomedea rhodoypga.*

Derivation of Name

The name is derived from the Greek *xenos,* strange, and *medos,* genitals, in reference to the distinctive penis and associated secondary sexual characters of this form.

Xenomedea rhodopyga n. sp.

Figs. 2, 5, 6

Starksia cremnobates not of Gilbert. Hubbs, 1952, p. 95 (Gulf of California); Al-Uthman, 1960, p. 164 (Descr., Gulf of California); Böhlke and Springer, 1961, pp. 31–32.

Description

D. XXI–XXIII, 8–11; A. II, 18–22; total pectoral rays 24–28 (26.2 ± .050); principal caudal rays 13; lateral line scales 39–45, ver-

tebrae 11 + 23–26. All counted characters except pectoral rays showed geographical variability and are discussed separately under "variation." Proportions of certain body parts are given in Table 2.

Snout short, eyes narrowly spaced and near dorsal profile of head. Circumorbital pores biserial. Anterior nostril in a tube surmounted by a tentacle which is slightly longer than interspace between anterior and posterior nostrils. Nuchal cirri flattened, palmate to subrectangular, margin either entire, crenulate, or with small projections; orbital cirri slender, one-third to one-half eye diameter in length.

Teeth conical, recurved and pointed, a lateral row on each jaw which continues forward to enclose a patch of smaller teeth anteriorly. Vomer toothed, palatine toothless.

Body scaled, except for pectoral base and a small triangular area at beginning of dorsal anterior to and above lateral line. Head naked. Belly with 3–4 rows of scales before anus. Lat-

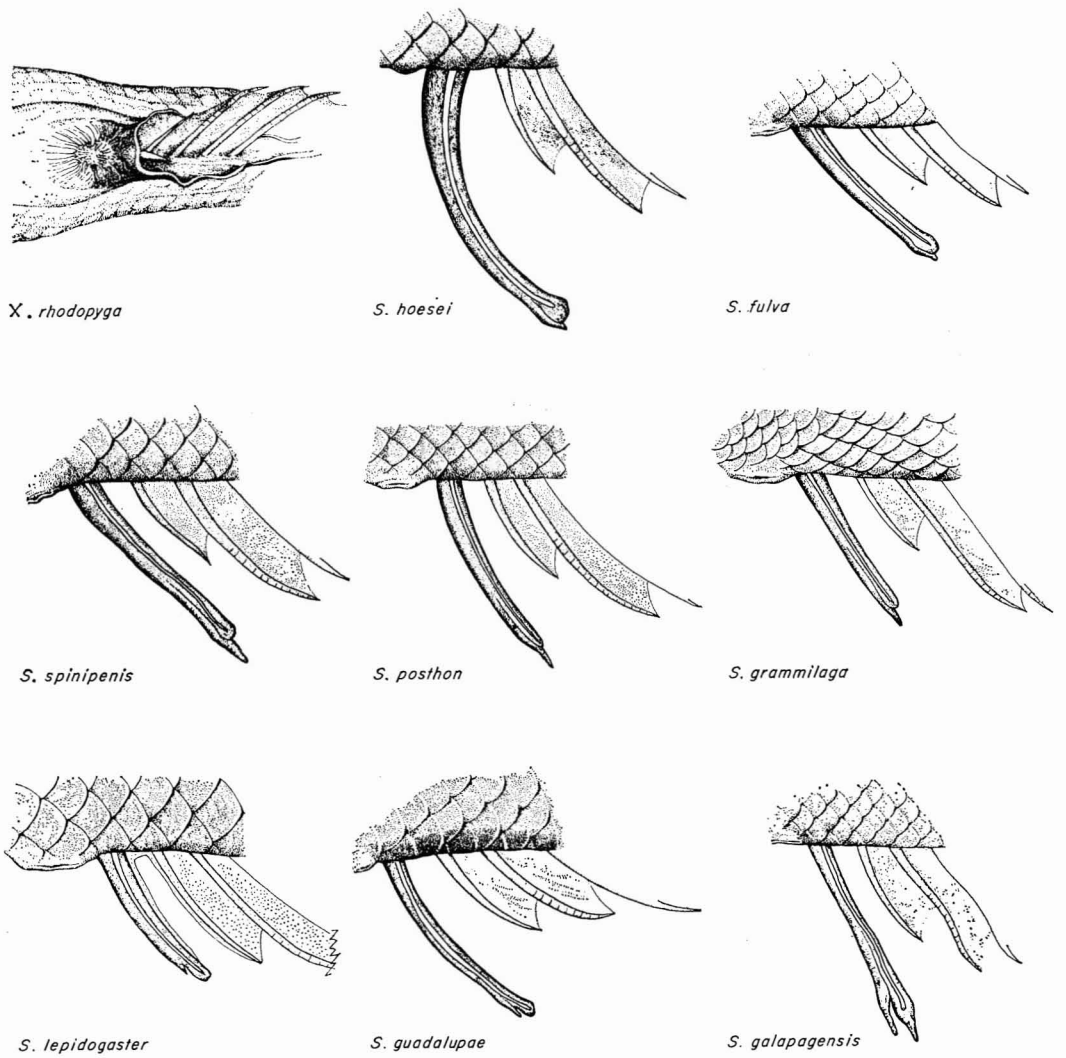

FIG. 5. Intromittent organs of nine Pacific species of Starksiini. Drawn from the holotypes (except for *X. rhodopyga*), *S. fulva* (LACM 6894-3), *S. spinipenis* (SIO 65-336) and *S. guadalupae* (SU 48144). The holotype of *S. lepidogaster* is probably immature.

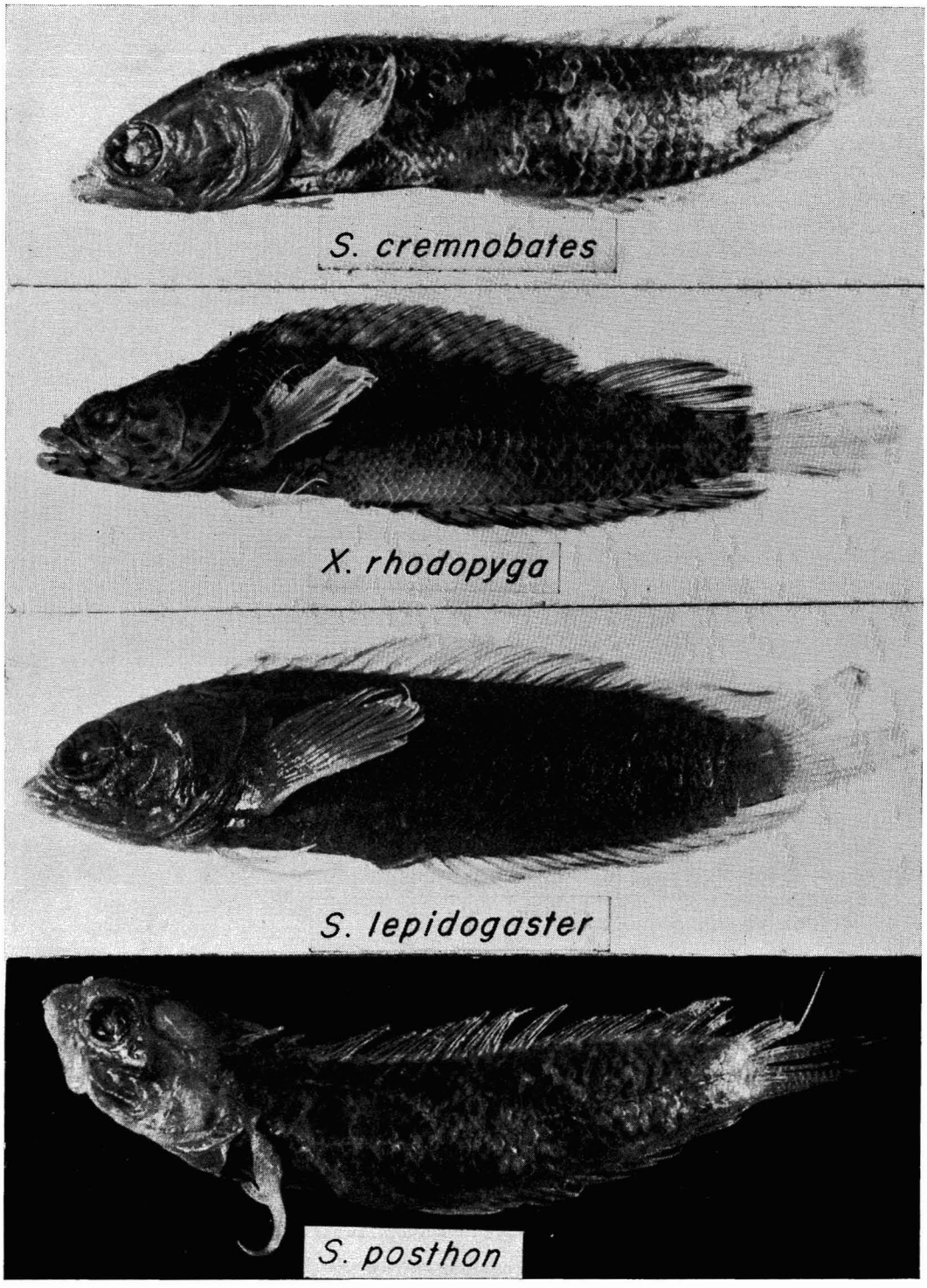

FIG. 6. Four Pacific species of Starksiini (all photographs are of holotypes except *S. cremnobates*, USNM 44371. The right side of *S. posthon* is illustrated; the print is reversed).

eral line arched, commencing immediately above upper corner of opercle, and arching upward along contour of back to a point below 10th to 12th dorsal spines, then abruptly descending to midline and continuing along it to caudal base. First scale with a prominent pore at ventral margin. Lateral line scales tubed, pores hidden, some posterior scales with posterior margin shallowly notched.

Fin rays unbranched. Dorsal fin begins over posterior margin of opercle and extends back almost to caudal base; anal fin originates beneath 10th to 11th dorsal spines and extends to a point even with end of dorsal. Last dorsal and anal rays free from caudal, bound to caudal peduncle by a membrane. Pelvics with one spine and three soft rays, third soft ray separated from second by a membrane. Genital papilla and first anal spine of males modified for internal fertilization. First anal spine of males shorter than second, genital papilla connected to and investing first anal spine. First anal spine of females flattened. In mature males rugose black folds border anal fin base from anus to base of second or third soft ray, and a skin fold separates first anal spine from anus (Fig. 5). In females a black ridge runs back from anus along either side of anal base to level of second anal soft ray. In nonbreeding males the folds regress to a condition resembling that of females or juveniles (see discussion of variation).

Pterygiophores of anal spines of males and females similar, the first not modified in either sex. Both pterygiophores of anal spines in front of first haemal spine. First haemal spine on twelfth vertebra. Third anal pterygiophore supported by first haemal spine (Fig. 2*C*).

In preservative, body tan, with six to eight broad bars extending to ventral margin, except in vicinity of anus, where there is a pale area (red in life). Bars variously expressed, background coloration so dark as to obliterate them in some individuals. Ground color of head like that of body. Cheeks, isthmus, and branchiostegal membranes with scattered pigmentation, sometimes organized into definite spots; often a pair of spots or lines behind eye. Lips more or less uniform in color, but with vague bars in many individuals. A prominent black spot on dorsal, between first and second or third spines. Remainder of fin mottled, with pairs of short bars basally above body bars with margin dark, or evenly dark. Anal usually evenly dusky with tips of rays abruptly lighter, sometimes with dark spotting basally. Pelvics clear, base dusky. Pectorals varying from clear to dusky, usually a crescent-shaped dark mark on base of rays and a pair of elongate spots basally on fin rays. Caudal clear or membrane clear and rays dusky.

Reproductive Cycle

Males of this species show considerable size-independent variation in the extent of development of the genital papilla and surrounding fleshy tissues. In some individuals the condition is as illustrated in Fig. 5. The genital papilla and associated soft tissue surrounds the first anal spine so that it is visible only when the penis is examined with strong transmitted light. The fleshy folds around the anus and anal base are complexly folded and so high as to hide the penis when the fish is viewed from the side. In these individuals the testes are large and the liver is restricted to the anterior ventral part of the body cavity. In others the fleshy folds are reduced to ridges, and the transverse fold between the anus and penis is rudimentary. The soft tissue of the penis is reduced and the first anal spine is clearly visible. In some individuals, probably sexually mature on the basis of size, the urogenital papilla does not reach the tip of the anal spine. In these individuals the testes are small and difficult to distinguish, and the liver is greatly enlarged, filling the body cavity ventrally, with a lobe crowding the viscera dorsally.

Individuals of both types are seldom found together in our collections, and the phenomenon seems to be seasonal. Numerous collections in the southern portion of the Gulf of California made in late June and in July contained mostly inactive males. Very rarely a male with a small liver and enlarged penis and folds was found. The females in these collections had only small eggs in the ovaries and only one of them (SIO 61-227, taken in early June) was gravid. The livers of these nongravid females were enlarged. Most of the adult females taken in April in Bahia de Los Angeles in northern Baja California were gravid and had small livers. Males from these collections exhibited well-developed secondary sex characters, with enlarged testes

and small livers. Collections made in the same area in August contained many adults. However, none of the females were gravid, and their livers were enlarged. The condition of the males varied considerably, but all those examined had enlarged livers. Males and females collected at Guaymas, Sonora, during the week of March 17–24, 1970 were in breeding condition. Females from these collections had either large eggs or eggs with embryos, and the testes of the males were enlarged. The livers were small in both sexes.

The available scanty evidence suggests that parturition takes place in the spring, and the males are in breeding condition at that time. During this period the livers are small in both sexes. Following this, there is a period of sexual inactivity and enlargement of the liver. Presumably the stores in the liver are used when the gonad products are maturing during the winter. Our collections are not properly spaced to determine whether the males simply remain in breeding condition after mating, or if mating takes place after parturition, with consequent sperm storage. Following the breeding period the secondary sex characters of the males regress, although they may rarely be maintained, especially in the largest adults.

Variation

Xenomedea rhodopyga, unlike the Pacific species of *Starksia,* exhibits considerable geographic variation. Counts were made of dorsal, anal, and pectoral rays, and lateral line scales on material collected throughout the range of the species. Analysis of variance by the method of Scheffé (1959), which allows multiple testing, indicates that the data can be grouped in four geographic categories without loss of information. The geographical areas chosen and the numbers of specimens utilized are shown in Fig. 7. The gap between the northern and southern portions of area I reflects scarcity or absence of the species, since many stations at appropriate depths have been occupied in the intervening region. However the gap between areas III and IV represents lack of collecting effort.

Meristic data are presented in Table 3. The matrices directly below the frequency tables give the results of the multiple comparisons of

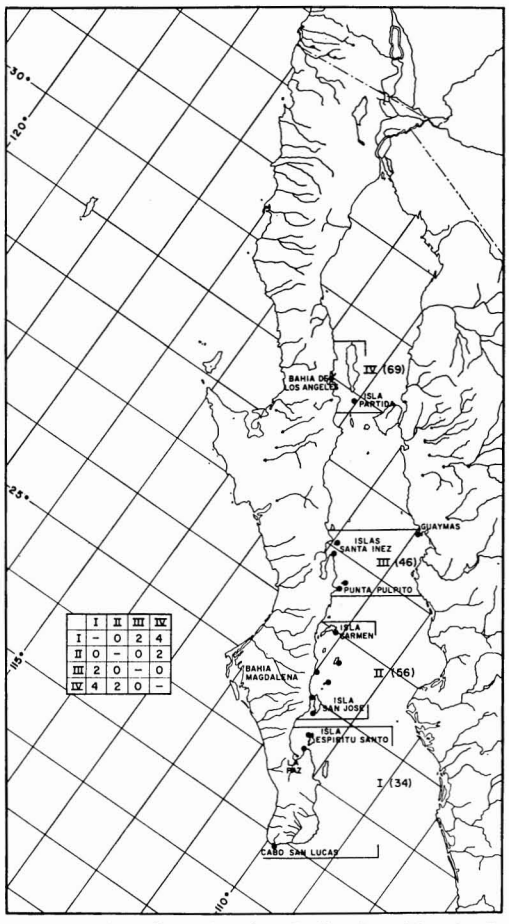

FIG. 7. Localities in the Gulf of California for *X. rhodopyga* used in the analysis of meristic variation. Roman numerals are the areas compared; numbers in parentheses indicate the number of specimens from the various areas. The insert gives the number of differences between any two areas, with a maximum of four.

pairs of means by the Scheffé test (Scheffé, 1959; Eberhardt, 1968). A "+" indicates significance at the .01 level. No matrix is given for dorsal spines since none of the means differed. It will be seen that in all cases the northern populations have the greater number of parts. Area I differs from area IV in dorsal soft rays, total dorsal elements, anal soft rays, and lateral line scales, and the differences are of considerable magnitude. Such differences have often been used to define subspecies; however inspection of the data and the comparison matrices indicates that the variation is clinal in nature.

TABLE 3

MERISTIC COUNTS OF *Xenomedea rhodopyga* FROM FOUR AREAS (SEE FIG. 7) IN THE GULF OF CALIFORNIA WITH COMPARISON MATRICES

	DORSAL SPINES					DORSAL SOFT RAYS					TOTAL DORSAL ELEMENTS					
	XX	XXI	XXII	XXIII	$\overline{X}$	8	9	10	11	$\overline{X}$	29	30	31	32	33	$\overline{X}$
I		25	9		21.3	1	20	13		9.4	1	13	18	2		30.6
II	2	35	19		21.3		22	31	3	9.7		8	42	6		31.0
III		20	16		21.4		10	24	2	9.8		1	26	9		31.2
IV	1	41	25	3	21.4		17	45	8	9.9		5	41	22	2	31.3

	I	II	III	IV
I		−	−	+
II	−		−	−
III	−	−		−
IV	+	−	−	

	I	II	III	IV	V
I		I	II	III	IV
II	−		−	+	+
III	+	−		−	−
IV	+	−	−		−

	ANAL SOFT RAYS						LATERAL LINE SCALES							
	18	19	20	21	22	$\overline{X}$	39	40	41	42	43	44	45	$\overline{X}$
I	1	7	24	2		19.8	3	7	11	8	5			41.1
II	1	2	44	8		20.1		12	15	16	8	2	1	41.6
III			21	13	2	20.5		2	14	12	6	2		41.8
IV			25	37	7	20.7			18	14	22	9	5	42.5

	I	II	III	IV	V
I		−	+	+	
II	−		−	+	
III	+	−		−	
IV	+	+	−		

	I	II	III	IV	V
I		−	−	+	
II	−		−	+	
III	−	−		−	
IV	+	+	−		

NOTE: I, Cape San Lucas region and Isla Espiritu Santo; II, Isla San Jose, Isla Santa Cruz, Bahia Agua Verde, Isla Santa Catalina, Punta Nopolo, Isla Carmen; III, Isla Ildefonso, Punta Pulpito, Punta Concepcion, Isla Santa Inez, San Carlos (Sonora); IV, Bahia de Los Angeles and Isla Partida. A "+" indicates a significant difference ($p < .01$) in means (see text).

The results of the comparisons of the means for the different populations were scored in the following manner. The maximum number of differences between any two localities is four, the number of characters used. The localities were arranged in a 4 × 4 table and the number of significant differences entered. This is shown in the table in Fig. 7. Areas I and IV differ in all four characters, areas I and II differ in none, areas I and III in two characters, areas IV and II differ in two characters, and areas II and III and III and IV differ in none.

The clinal nature of the variation is exemplified by the data for anal soft rays. Here area I differs from areas III and IV, and area IV differs from area II as well as I, but the intermediate areas II and III do not differ from each other.

The nature of the variation—that the northern populations are characterized by higher counts—can be related to water temperature. Our data indicate that the young of *Xenomedea rhodopyga* are developing in the spring. The earliest date of collection of a gravid female in our material is February 20, and we have a number of pregnant females taken in March and April. A single gravid female was taken in June, but approximately 50 specimens taken during the same month were not gravid. None of the many collections made in July and August contained pregnant females. The available data (Roden, 1964) indicate that mean sea surface temperatures in March, April, and May are 15.6°, 17.1°, and 18.0° C, respectively, at Bahia de Los Angeles. Temperatures at La Paz for the same periods are 21.6°, 22.7°, and 24.3° C. Mean temperatures at Cabo San Lucas for the months of April and May are 20.6° and 23.1° C, respectively.

We have collected pregnant females in Bahia de Los Angeles in April. The temperatures associated with these collections were 18° C surface and 16.5° C at 3 meters. Pregnant females with early embryos were taken at Guaymas, Sonora, during the week of March 17–24, 1970. The temperatures associated with these collections ranged from 17°–20° C. These values agree well with the long term averages for the months given by Roden.

The differences in temperature in the northern portions of the Gulf of California during development could account for the observed differences in mean number of fin rays and scales. The clinal nature of the variation may reflect a gradation in temperature. Data for temperatures throughout the Gulf are inadequate, but Roden's (1964) figure for isotherms at a depth of 10 m indicates that in February and April there is a fairly regular decrease in temperature northward in the Gulf, although there is some crowding of isotherms in the north-central portion.

Although the foregoing argues strongly that meristic variation in *X. rhodopyga* is a phenotypic effect of the environment, the genetic component cannot be discounted without experimental evidence, which is lacking here. However, the variation indicates that there is restricted mixing between populations, whether the differences be genetic or environmentally caused. According to Roden, currents in the Gulf are predominantly southeasterly in the spring. Despite the mixing effect of the currents, the populations obviously maintain considerable integrity. It may be that the pelagic larval stage is very short, or the larvae may have behavioral mechanisms that would keep them close to the site of birth.

Range

The range of this species is the Gulf of California from Isla Angel de la Guarda and Guaymas to Cabo San Lucas (Fig. 4).

Habitat

Xenomedea rhodopyga has been collected in depths ranging from 2–100 ft (0.7–33 m). A rotenone station at 30 ft (10 m) yielded over 200 specimens; a station at 80–105 ft (26–34 m) yielded 84. Records from depths greater than 33 m are lacking, probably because of the dearth of collecting effort at such depths. This species is usually found among rocks and cobbles which have some algal cover.

Material Examined

HOLOTYPE: A 42.4-mm male, SIO 62-212, from east side of Isla Cerraja, Bahia de Los Angeles, Baja California (lat. 29°00.3′ N, long. 133°33.7′ W). Taken with rotenone and SCUBA in depths of 0–20 ft on boulder bot-

tom by a Scripps Institution of Oceanography party on April 19, 1962.

PARATYPES: Morphometric and meristic data were taken from the following lots of specimens, all considered as paratypes—Bahia de Los Angeles, SIO 62-212, 69 (27–46); SIO 62-216, 13 (30–40); SIO 62-225, 6 (34–43); SIO 62-227, 7 (17–47); SIO 69-358, 23 (17–47); SIO 69-360, 121 (16–60); Isla Partida, UCLA 56-22, 21 (28–38; Isla Santa Inez, SIO 65-306, 61 (23–45; Punta Concepcion, SIO 65-314, 4 (29–30); Isla Ildefonso, SIO 65-329, 84 (16–36); SIO 65-330, 274 (17–40); Punta Pulpito, SIO 65-319, 67 (29–40); Punta Mangles, SIO 65-336, 1 (30); Isla Carmen, SIO 65-299, 16 (20–48); SIO 65-321, 4 (21–36); SIO 65-322, 6 (25–34); SIO 65-323, 2 (28–29); SIO 65-325, 1 (28); Bahia Agua Verde, SIO 65-290, 30 (17–43); Isla Catalina, SIO 65-337, 93 (12–40); Isla Santa Cruz, SIO 65-342, 8 (27–36); SIO 65-354, 133 (23–32); Punta Nopolo, SIO 65-270, 107 (15–35); Cabeza de Mechudo, SIO 65-345, 5 (25–33); Isla Espiritu Santo, SIO 61-264, 3 (23–36); SIO 61-272, 46 (11–36); Bahia de Lobos, SIO 61-279, 3 (27–31); Cabo San Lucas, SIO 61-227, 6 (16–34); SIO 65-185, 5 (15–26); SIO 65-186, 1 (25); SIO 69-217, 1 (36); Guaymas, Sonora, UCLA 55-246, 41 (22–30). An additional 594 specimens from the following localities were utilized for comparative purposes: Bahia de Los Angeles, SIO 59-235, 2; SIO 62-210, 56; SIO 62-233, 1; UCLA 60-6, 2; Isla Santa Inez, SIO 65-307, 4; Punta Concepcion, SIO 5-311, 20; SIO 65-312, 38; UCLA 57-32, 1; Isla Ildefonso, SIO 65-331, 124; SIO 65-332, 7; Punta Pulpita, SIO 65-317, 24; SIO 65-318, 1; Isla Carmen, SIO 65-301, 16; SIO 65-326, 13; SIO 65-327, 2; Isla Santa Catalina, SIO 65-338, 8; SIO 65-340, 16; Isla Santa Cruz, SIO 65-341, 19; SIO 65-343, 66; Bahia Agua Verde, SIO 65-280, 2; SIO 65-291, 8; SIO 65-295, 1; Punta San Telmo, SIO 65-283, 20; SIO 65-287, 41; Punta Nopolo, SIO 65-273, 8; SIO 65-280, 5; Isla San Jose, SIO 65-260, 41; SIO 65-263, 1; SIO 65-265, 27; Isla San Francisco, SIO 65-347, 6; Isla Espiritu Santo, SIO 61-269, 3; SIO 61-278, 11; SIO 61-280, 55; SIO 65-351, 48; SIO 65-352, 15; Cabo San Lucas, SIO 61-233, 13; Guaymas region, SIO 70-74, 2; SIO 70-83, 3; UCLA 56-72, 2.

Starksia Jordan and Evermann

Starksia Jordan and Evermann in Jordan, 1896, p. 231. Type *Labrosomus* [*sic*] *cremnobates* Gilbert, 1890.

Brannerella Gilbert, 1900, p. 180. Type *B. brasiliensis* Gilbert, 1900 (= *Clinus ocellatus* Steindachner, 1876).

Andracanthus Longley, 1927, p. 222. Type *Clinus ocellatus* Steindachner, 1876.

Description

D. XX–XXIII, 8–11. A. II, 18–22. Total pectoral rays 24–28 (usually 26). Lateral line scales 39–45. Principal caudal rays 13. Total vertebrae 30–35.

Snout short, eyes narrowly spaced and near dorsal profile of head. Circumorbital pores uniserial or biserial. Nostril surmounted by a short tube, from the posterior rim of which a simple, slender, nasal cirrus is produced. The length of this cirrus varies from moderately short to long, as in *S. hoesei* (2.0 times in eye in females, 0.5 times in males). Simple orbital cirrus on dorsal portion of eye (except in *S. atlantica*) and a pair of simple nuchal cirri. Teeth conical, recurved and pointed, a lateral row on each jaw which continues forward to enclose a patch of smaller teeth anteriorly. Teeth always present on vomer, may be lacking on palatines.

Body scaled, except for pectoral bases and a small triangular area at beginning of dorsal fin anterior to and above lateral line. Head naked. Belly scaled, naked, or with a few rows of scales anterior to anus. Lateral line arched, commencing immediately above upper corner of opercle and curving upward to a point below 10th to 12th dorsal spines, then abruptly descending to midline and continuing along it to caudal base. Lateral line scales generally tubed with pores hidden, but may be notched or pored posteriorly in some species. First scale with a prominent pore at ventral margin.

Fin rays unbranched. Dorsal fin begins over posterior margin of opercle and extends back almost to caudal base; anal fin originates beneath 9th to 11th dorsal spines and extends caudad to a point even with end of dorsal fin. Neither fin has a membranous connection to caudal base. Pelvic fins with one spine and three soft rays. In most forms, only the first and sec-

ond rays are visible without dissection; the third ray is splinted to the second and is usually reduced. It is most clearly apparent in *S. guadalupae, S. hoesei,* and *S. hassi.* Pelvic spine short and closely attached to first soft ray.

Pterygiophores of anal spines associated with haemal spine of first caudal vertebra (11th). First anal pterygiophore of males in some species enlarged, flattened, firmly attached to haemal spine in all; second anal pterygiophore just behind haemal spine. First anal pterygiophore of females unmodified; first pterygiophore just ahead of, and second just behind, haemal spine. Third pterygiophore supported by second haemal spine (Fig. 2 *A,* B).

Three of the Pacific species (*S. hoesei, S. spinipenis,* and *S. fulva*) are known to be ovoviviparous. In all species the first anal spine of males is modified as an intromittent organ; variously developed among species, this structure is the most helpful single character in distinguishing them. In all species except *S. hassi* and *S. lepicoelia,* in which the genital papilla is free of the spine, the organ is a complex association of the elongated tubular genital papilla and the extended first anal spine. The two anal spines are separate in males and joined by a membrane in females.

Color predominantly brownish and blackish tones with touches of red, yellow, or blue in a few species. Pattern disruptive and limited to small spots or blotches which may be loosely organized into bars or saddles. Median fins pale, distinctly mottled or dusky. Pectoral and pelvic fins never pigmented although the fin bases may bear some markings.

Starksia cremnobates (Gilbert)

Fig. 6

Labrosomus [*sic*] *cremnobates* Gilbert, 1890, p. 100. *Albatross* station 3001, Gulf of California.

Starksia cremnobates. Jordan, 1896, p. 231 (placed in *Starksia*); Jordan and Evermann, 1896, p. 468 (listed), 1898, p. 2365 (original description repeated); Jordan, Evermann, and Clark, 1930, p. 456 (listed); Fowler, 1944, p. 520 (Gulf of California listing only).

Description

D. XXII, 8; A. II, 19; total pectoral rays 26; lateral line scales 39. A nuchal cirrus on left side, none on right in holotype, nuchal cirri absent in other specimen. Orbital cirri slender, one-half eye diameter in length; anterior nostril a slender tube with a short, slender cirrus in holotype, cirri absent in second specimen; vomer and palatines toothed in holotype, palatines toothless in second specimen; only a few lateral line scales on straight portion with tubes, the remainder with pores in center, or on posterior one-third of scale. Belly naked; third pelvic ray not apparent (but probably present); nature of anal spines of male not known. According to the original description the color was: "uniform light olivaceous, a small dusky spot behind orbit and one below and behind it. Opercle dusky. In one specimen the rays of soft dorsal, anal and caudal are finely barred with dusky."

Identification

The presence of scales with simple pores in the straight portion of the lateral line distinguishes *S. cremnobates* from the known Pacific species of *Starksia.* The probable absence of nuchal cirri and the feeble development of the nasal tentacle should also prove to be useful characters, when more material becomes available.

Discussion

This species has not been taken since its description. Subsequent literature records of specimens all apply to *Xenomedea rhodopyga* n. sp. Gilbert listed two specimens from the *Albatross* station 3001 as the type material. The National Museum collections now contain a single specimen from this station, USNM 48262, here selected as lectotype. There is another specimen, USNM 44371, from *Albatross* station 3005, that is probably the cotype. We do not consider this specimen to be a lectoparatype, because there is no internal evidence in Gilbert's description pointing surely to this specimen as the second cotype.

Range

Species is known only from two localities in the Gulf of California, near Isla San Jose (lat.

25°02′45″ N, long. 110°43′30″ W) and near Isla Santa Catalina (lat. 24°55′15″ N, long. 110°39′00″ W).

Habitat

Species was taken in 21 and 33 fathoms (37.8 and 59.4 m), making this one of the deepest-living known species of *Starksia.*

Material Examined

HOLOTYPE: USNM 48262 a 29-mm-long female from the *Albatross* station 3001 taken in a dredge in 33 fathoms (59.4 m) at lat. 24°55′15″ N, long. 110°39′00″ W on a bottom of fine grey sand and broken shells.

Additional Material

USNM 44371, a 29-mm-long female from the *Albatross* station 3005, lat. 25°02′45″ N, long. 110°43′30″ W, at a depth of 21 fathoms (37.8 m).

Starksia fulva n. sp.

Figs. 5, 8

Starksia cremnobates not of Gilbert. Nichols and Murphy, 1944, p. 255.

Brannerella spinipenis Al-Uthman, 1960, p. 172. In part, southern morphological type only.

Description

D. XIX–XXI (19.91 ± .060, 8–10 (9.00 ± .040); A. II, 17–18 (17.81 ± .054); total pectoral rays 26–30 (27.98 ± .064); lateral lines scales 36–40 (38.2 ± .147).

Proportions of certain body parts are given in Table 2. Nuchal cirri varying from slender (width 4–5 in length) to broad (width 2–3 in length). Orbital and nasal cirri slender, about one-third orbit diameter in length. Circumorbital pores biserial. Palatines and vomer toothed. Posterior lateral line scales with tubes. Posterior margin of posterior lateral line scales with small membranous projections in line with tube. Belly with five–eight scale rows anterior to anus. Third pelvic ray tightly splinted to second; visible only on dissection. Genital papilla of male connected to first anal spine and extending slightly beyond tip of anal spine (Fig. 5).

Orbit ringed with black; cheek with two prominent dark spots and irregular markings. Two prominent bars across lips, just behind tip of snout. Pectoral fin with two spots basally, the upper over rays 1–4, the lower over rays 6–11. Dorsals spotted; a series of black dots basally, and smaller spots distally on rays. Usually the basal spots are conspicuous, but in some individuals they are no larger than the distal spots. Anal color varies from mottled to uniformly dark, tips of anal rays light, caudal weakly to strongly speckled, the pigmented areas on the rays sometimes aligned to form narrow lines.

Much variation in intensity of markings. The specimens from Islas Perlas, Panama were yellowish in life and without spots but with six–eight weakly contrasted bars. Fresh material from the Islas Secas and Contreras, Panama is quite dark, with the dark markings all intensified. There may be several dark spots on the pectoral base and the body bars are broken up into spots. Also there may be a series of dots along the anal base.

Range

Range is Port Parker (Bahia Elena), Costa Rica to Isla de la Plata, Ecuador (Fig. 3).

Habitat

This species has been taken in depths ranging from barely subtidal to about 6 m in association with rocky bottoms without coral as well as in association with corals. In the Secas Islands, Panama, specimens were collected by breaking up coral heads.

Derivation of Name

Species named *fulva,* tawny, because of the distinctive background color of the holotype.

Material Examined

HOLOTYPES SIO 67-37, a 40.5 mm-long female from Isla San Jose, Islas Perlas, Panama. Taken March 28, 1967 at a depth of 0–4 feet from a rock and sand bottom by Richard Rosenblatt, Ira Rubinoff, and Anthony Mann.

PARATYPES: Costa Rica—Port Parker, SU 48142,[3] 5 (19–31); Playa del Coco, LACM 6894-3,[3] 1 (27); Samara Bay, UCLA 63-141,[3] 6 (23–28); Puerto Culebra, LACM 21017,[3]

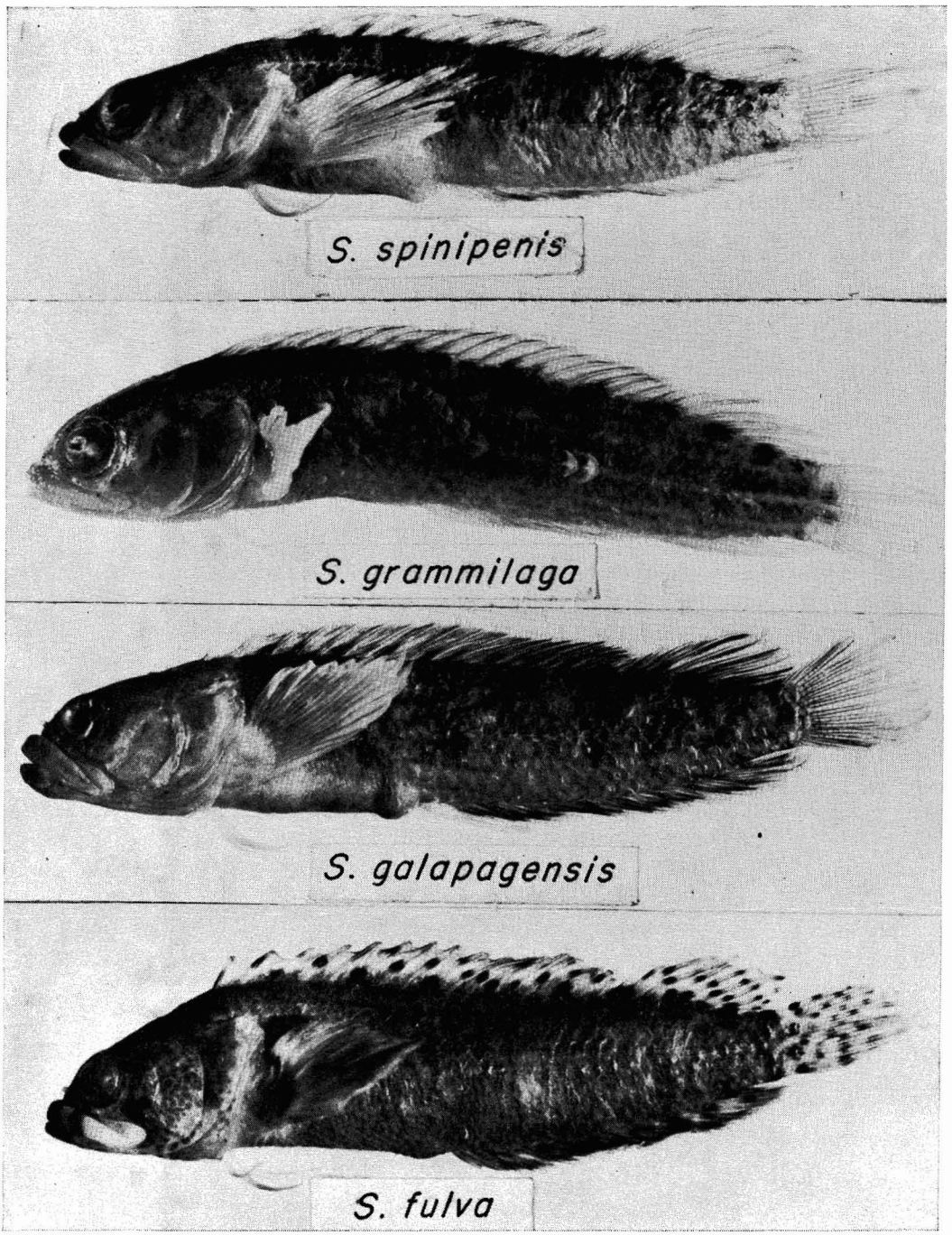

FIG. 8. Four Pacific species of *Starksia* (all photographs are of holotypes except *S. spinipenis*, SIO 65-318).

3 (15–24); Isla del Caño, SIO 60-344,[3] 1 (18). Panama—Islas Secas, SIO 70-136, 12 (12–26); SIO 70-137, 1 (17); SIO 70-139, 5 (13–27); SIO 70-140, 11 (12–35); LACM 20823,[3] 6 (15–25); LACM 21019, 2 (18–26); Isla Uva, SIO 70-135, 8 (13–30); Isla Perlas, SIO 67-35,[3] 5 (13–31); SIO 67-36, 1 (26); SIO 67-37,[3] 46 (14–41); SIO 67-38, 2 (30–34); SIO 67-39,[3] 4 (23–38); SIO 67-40, 3 (14–30). Columbia—Octavia Bay, LACM 21018,[3] 5 (19–29); Port Utria (Ensenada Utria), LACM 20822, 3 (26–27); Isla Gorgona, AMNH 16106,[3] 4 (19–27); AMNH 20297,[3] 2 (21–25); open ocean between Isla Gorgona and mainland (beneath jellyfish), lat. 2°48′ N, long. 78°11′ W, AMNH 16111,[3] 1 (21). Ecuador—Isla de la Plata, AMNH 16110,[3] 2 (18–25). Material from the following localities was examined for comparative purposes: Costa Rica—Puerta Culebra, USNM 101955, 1; USNM 164256, 1; Port Parker, USNM 164254, 6. Panama—Islas Secas, USNM 101940, 1; USNM 101941, 5; Bahia Honda, USNM 109422, 2; Bahia Pinas, USNM 101996, 1; USNM 101997, 1. Colombia—Port Utria, USNM 101937, 2; USNM 101991, 1; USNM 101993, 1; USNM 109423, 4; Octavia Bay, USNM 101994, 1; USNM 101998, 3; Gorgona Island, USNM 10989, 6.

Starksia galapagensis n. sp.

Figs. 5, 8

Brannerella spinipenis Al-Uthman, 1960, p. 168 (in part, Galápagos material only).

Description

D. XX–XXII (21 ± .005), 8–9 (8.8 ± .006); A. II, 16–19 (18.5 ± .021); total pectoral rays 25–28 (26.0 ± .01); lateral line scales 38–42 (39.8 ± .05).

Proportions of certain body parts are given in Table 2. Nuchal cirri slender; orbital and nasal cirri slender, one-third orbit diameter in length. Circumorbital pores biserial, but inner row absent anteriorly. Vomer and palatines toothed. Scales of posterior portion of lateral line tubed, some with posterior margin shallowly notched. Belly naked. Third pelvic ray a rudiment at base of second ray. First anal spine of male twice the length of second and free from it; genital papilla connected to anterior edge of first anal spine for most of its length; distal one-sixth free. Fleshy tip of first anal spine extends slightly beyond tip of genital papilla (Fig. 5).

Body with a series of eight–nine dark saddles, continuing downward on sides as bars. First saddle begins over posterior margin of opercle, about 4 scale rows wide. Second and third equally spaced and equal in width to first. Remaining saddles less regular and may be broken up by pale areas and concentrations of pigment forming a series of spots. Last saddle often represented by a series of spots or blotches at caudal base; in faded specimens only these blotches may remain.

Upper and lower lips each with a dark area just posterior to midline; these line up to form a bar. The central area of the bar may be lighter, so that there is a tendency for the formation of two bars. In a few individuals the lips are rather evenly pigmented. Head dark, a dark spot immediately behind eye. An oblique dark line along posterior portion of maxilla, which angles sharply up and back to middle of cheek. A dark spot on opercle. Chin dusky, darkest at tip, remainder of underside of head light. Head markings may be vague and ill-defined. Head markings as described are present in the holotype, but do not show well in the figure.

Pectoral and pelvic fins pale; pectoral base often with a concentration of pigment which may form a spot. Dorsal with a series of spots on the bases of alternate rays; anal and caudal plain, either pale with dusky streaks along the rays, or dusky.

Identification

S. galapagensis is most similar in color pattern to *S. spinipenis;* however, that northern species differs in that the tip of the genital papilla extends well beyond the fleshy tip of the first anal spine, and the total pectoral rays are modally 28 rather than 26. *S. guadalupae,* which is similar in pectoral count and in some features of the structure of the intromittent organ, has a very different color pattern.

Range

This species is found in the waters off the Galápagos Islands (Fig. 3).

Derivation of Name

Species named *galapagensis* for the island group to which the species is endemic.

Material Examined

HOLOTYPE: A 34.5-mm-long mature male, SIO 70-246, formerly UCLA 67-35, from Isla Genovesa (Tower Island) Galápagos Islands, Ecuador. Taken with rotenone in depths of 10–15 ft on a lava rock and coral bottom by E. Hobson, V. Walters, L. Trott, and B. Tidwell, on February 5, 1967.

PARATYPES: Isla Genovesa (Tower Island), SIO 70-246, formerly UCLA 67-35, 49 (14–34); UCLA 67-36, 32 (13–32); Isla San Salvador (James Island), UCLA 64-42, 4 (19–24); LACM 20824, 4 (12–35); Isla Santa Cruz (Indefatigable Island), UCLA 64-16, 9 (23–34); UCLA 64-38, 13 (16–29); LACM 21023, 4 (15–27); Isla Santa Maria (Charles Island), UCLA 67-43, 8 (17–31); LACM 21020, 1 (30); Isla Santa Fe (Barrington Island), SIO 64-1012, 4 (17–30); UCLA 64-33, 9 (16–34); Isla Isabella (Albemarle Island), LACM 21021, 3 (19–26); Isla Baltra (So. Seymour Island), LACM 20825, 5 (15–30); Isla Fernandina (Narborough Island), Senckenberg Museum unnumbered, 1 (28).

Starksia grammilaga n. sp.

Figs. 5, 8

Brannerella spinipenis Al-Uthman, 1960, p. 168. In part, SU 48141, two Zihuatanejo paratypes only.

Description

D. XIX–XX (20.0 ± .040) 7–9 (8.1 ± .080); A. II, 16–18 (16.9 ± .098); total pectoral rays 26–28 (27.6 ± .140); lateral line scales 36–39 (37.2 ± .208). Proportions of certain body parts are given in Table 2. Nuchal cirri simple and small, one to four times the diameter of nuchal pore in length. Orbital cirri usually slender, occasionally flattened, one-third to one-half eye diameter; nasal cirri simple, one-third to one-half longer than nasal tube and equal to, or slightly less than, space between anterior and posterior nostrils. Circumorbital pores mostly biserial. Lateral line scales almost always tubed; some on posterior portion notched. Belly naked. Third pelvic ray tightly bound to second for its entire length; not clearly visible. First anal spine of males longer than second and free from it, genital papilla attached to first anal spine for entire length and extending past tip of spine (Fig. 5). Body dusky with scattered squarish spots and six–eight light horizontal lines with dark borders running along last half of body. Eight to ten dark blotches along base of dorsal fin. Pectoral base dusky; belly pale. Cheek with a light vertical bar with dark borders behind eye; lips dusky.

Remarks

A 16.9-mm-long specimen, SIO 61-256, from Isla Ceralbo, Gulf of California, is referred to this species but not designated as a paratype. It agrees with the southern material in counts (D. XX, 8; A. II, 16; pectorals 13, 13; lateral line 38) and in that most of the lateral line scales on the straight portion are tubed. However, it lacks the characteristic light lines on the posterior part of the body and thus is referred to *Starksia grammilaga* with some doubt.

Range

Species is found from Islas Tres Marias, Mexico to Bahia Tangola Tangola, Mexico (Fig. 3) and possibly north to Isla Ceralbo (see "Remarks").

Derivation of Name

Species is named for the distinctive horizontal lines on the posterior half of the body; from the Greek *gramme,* line, and *lagon,* flank.

Material Examined

HOLOTYPE: USNM 102014, a 24.2-mm-long male from Isla Tangola, Bahia Tangola Tangola, Mexico, taken on March 1, 1934 by W. L. Schmitt.

PARATYPES: Isla Isabel—USNM 116223, 2 (20.5); USNM 116224, 2 (15–19); SIO 62-63, 2 (20–21); Bahia Banderas—SIO 62-30, 1 (21); Isla Cleopha—SIO 62-55, 1 (19); Ensenada Chacala, Nayarit—UCLA 58-2, 1 (24); Isla Jaltemba, Nayarit—UA, LTF 690820-1, 8 (19–26); Zihuatanejo—SU 48141, 2 (18–20) (listed by Al-Uthman as paratypes of *S. spinipenis*); SIO 59-350,

5 (11–19); Tangola Tangola—USNM 205212 (from the same collection as the holotype), 1 (21).

Other Material

Also examined was Isla Ceralbo SIO 61-256, 1 (17).

Starksia guadalupae n. sp.

Figs. 5, 9

Brannerella spinipenis. Al-Uthman, 1960, p. 168 (in part, Guadalupe Island material only).

Description

D. XX–XXI (20.3 ± .028), 9–10 (9.3 ± .028); A. II, 17–19 (18.6 ± .059); total pectoral rays 26–28 (26.5 ± .059); lateral line scales 37–42 (38.9 ± .301). Proportions of certain body parts are given in Table 2. Nuchal cirri slender; orbital cirri one-half orbit diameter, nasal cirri one-fifth to one-third eye diameter. Circumorbital pores biserial. Vomer toothed; palatines toothed in holotype and 7 of 11 paratypes. Scales of posterior portion of lateral line tubed, most with rear margin acute, sometimes produced into a median lobe. Belly mostly naked, but with three–four rows of scales in advance of anus. Third pelvic ray not splinted to second but separated from it by a membrane. Genital papilla free from first anal spine only distally; fleshy tip of first anal spine barely extends past tip of genital papilla (Fig. 5).

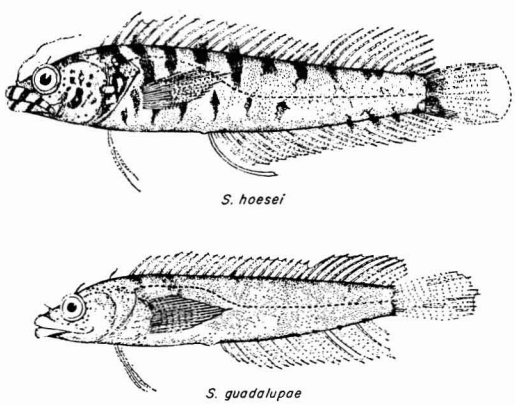

FIG. 9. Holotypes of two Pacific species of *Starksia* (holotype of *S. guadalupae* is an immature male).

Alcohol specimens pale yellowish brown with a hint of duskiness on top of head. Eight weakly developed vertical bars on body extending downward to midline of body. Vertical fins dusky.

The following color description is taken from notes made by C. L. Hubbs on three of the paratypes (SU 48144) when they were freshly dead; General color olive, with lateral flecks of bluish and deep brown on scales. All speciments with paired blackish stripe along base of dorsal above weak saddles on back. Very weak cross bars on body in smaller specimen, these still weakly apparent in next larger. Some black specks near caudal base. Head olive, becoming blackish on occiput and cream on throat. Lips tan medially. A blackish wedge behind eye, separated from eye and upper lip by a pale streak. Dorsal amber-tan, with a bare trace of reddish brown in largest specimen. Anal variegated with rich brown and with light border. The first ray with conspicuous blue-gray tip. Caudal pale olive. Pelvics pale blue-gray in smallest, grading to amber in larger. Pectorals watery olive, becoming dull red below in largest specimen.

Identification

In addition to the characters utilized in the key, *Starksia guadalupae* differs from the other Pacific species of the genus in coloration. All the other species, except *S. fulva* n. sp. have strongly contrasted patterns with bars or blotches. *S. fulva* which lacks body bars, has a row of prominent black spots on the dorsal base, two round black spots on the pectoral base, and prominent bars in the lips.

Range

The range is Isla Guadalupe, off Baja California, Mexico (Fig. 3). See addendum.

Derivation of Name

Species is named *guadalupae* for the island where it was first collected.

Material Examined

HOLOTYPE: A 32.5-mm-long immature male, SIO 60-14, from the east side of Isla Guadalupe,

Baja California, Mexico (lat. 29°10.5′ N, long. 118°16.0′ W), taken with rotenone in depths of 30–60 ft on a boulder bottom by a Scripps Institution of Oceanography party on January 27, 1960.

PARATYPES: Isla Guadalupe, Baja California, Mexico—SU 48144, 5 (19–44) (paratypes of *Brannerella spinipenis* Al-Uthman); SIO 53-163, 2 (41–42); SIO 57-190, 1 (18); SIO 58-493; 1 (33); SIO 65-51, 2 (26–27).

Starksia hoesei n. sp.

Figs. 5, 9

Description

D. XX–XXII (21.0 ± .408); 9–10 (9.8 ± .250); A. II, 20–21 (20.5 ± .289); total pectoral rays 26–28 (26.5 ± .500); lateral line scales 41–43 (42.3 ± .479).

Proportions of certain body parts are given in Table 2. Nuchal cirri flattened, about one-third as broad as long. Orbital cirri one-third eye diameter; nasal cirri notably long, one-half eye diameter in females, two eye diameters in males. Circumorbital pores uniserial, except that there is a pore in the position of the outer row opposite the last circumorbital pore behind the eye. Most of posterior lateral line scales with tubes. Belly naked. Third pelvic ray not splinted to second but connected to it by a membrane. First anal spine of males strongly curved, extending to base of fourth or fifth anal soft ray when folded back; free from second. Tip of genital papilla extends slightly past tip of spine; both are connected for entire length of anal spine (Fig. 5).

Lips with four dark bars on either side of midline; cheek and opercle with dark blotches; isthmus pale, but chin with transverse bar behind tip, branchiostegal membranes evenly dusky. Pelvic fins clear, bases dusted with melanophores, pectorals pale, bases dusky. Dorsal with dark marks basally above body bars, with a few vague marks distally. Anal with ill-defined bars, or evenly and lightly pigmented. Body with nine bars, usually four to five scales wide dorsally and one to two scales wide ventrally, anteriormost over posterior margin of pectoral base, posteriormost at caudal base. Caudal mostly clear, but with some ill-defined blotches. Moiety of bar below midline continuous with upper portion or slightly offset posteriorly. This variability may be expressed in one individual, as in the holotype in which the bars on the left side of the body are slightly offset and those on the right are nearly continuous. All bars save last two fade out about two to three scale rows from ventral margin of body; last two continue to it.

Remarks

An 18.5-mm-long immature female (SIO 70-163) from Bahia Navidad, Colima, Mexico is referred to this species with some doubt. Its counts of D. XXI, 8; A. II, 19; P 13, 13; LL 40 compare well with the counts of the four Gulf of California types, although the lateral line scales and dorsal and anal soft-ray counts are lower by one than the lowest count in the Gulf material. The well-developed head cirri, the uniserial circumorbital pores and the well-separated third pelvic ray also are consonant with identification as *S. hoesei*. The color pattern of *S. hoesei* is diagnostic, but the small Colima specimen is plain olive-tan with but faint adumbrations of bars and head markings. Because of these uncertainties the counts of this specimen are not included in Table 1, nor is the specimen marked on the range map (Fig. 4).

Range

Species is known from Isla Ildefonso, Gulf of California, and possibly from Bahia Navidad, Colima, Mexico (Fig. 4).

Derivation of Name

Species is named for Douglass F. Hoese, friend and ichthyologist.

Material Examined

HOLOTYPE: SIO 65-329, a 38.5-mm-long male, from Isla Ildefonso (lat. 26°38′ N, long. 111° 26.5′ W). Taken July 19, 1965 at a depth of 80–105 ft (26–34 m), at base of cliff among boulders and broken rocks on coarse sand with many gorgonians and considerable algae, by the Scripps Institution of Oceanography Pescado Expedition.

PARATYPES: SIO 65-329 (same collection and

data as above) one 35.3-mm-long male and two 35.0-mm-long females, one bearing eyed embryos.

Starksia lepidogaster n. sp.

Figs. 5, 7

Description

D. XIX–XX (19.9 ± .090) 7–8 (7.9 ± .090); A. II, 17; total pectoral rays 24–27 (25.9 ± .211); lateral line scales 35–36 (35.7 ± .152). Proportions of certain body parts are given in Table 2. Nuchal cirri triangular flaps. Orbital cirri slender, one-third to one-half eye diameter; nasal cirri slender, two to three times as long as nostril tube, much longer than interspace between anterior and posterior nostrils. Circumorbital pores mostly uniserial. Vomerine teeth present, palatine teeth absent, present in one paratype only. Posterior lateral line scales tubed. Belly entirely scaled, with 10–14 rows between pelvic base and vent. Third pelvic ray tightly bound to second for two-thirds its length, distal one-third slightly separated by a membrane. First anal spine free from second and about equal to it in length in largest male. Genital papilla not extending beyond tip of anal spine in largest male (which may not be mature). Body with six bars, first five beneath spinous dorsal, sixth beneath soft dorsal. Last two bars split dorsally to form a Y. A few specimens with a dorsal and ventral dark, oblong mark on caudal peduncle. Body bars encroach on dorsal.

Identification

Starksia lepidogaster can be distinguished from other Pacific starksiins by the completely scaled belly, with 10–14 scale rows between the vent and pelvic base. *S. spinipenis* has a higher number of lateral line scales (39–42) than *S. lepidogaster* (35–36). *S. grammilaga* is distinct from *S. lepidogaster* in bearing a series of horizontal light lines on the posterior half of the body.

Range

Species is known from a single station at Isla Cleopha, Islas Tres Marias, Mexico (Fig. 3).

Derivation of Name

Species is named for its scaled belly—from the Greek *lepidos,* a scale, and *gaster,* the belly.

Material Examined

HOLOTYPE: SIO 62-55. An 18.5-mm-long male (probably immature) from Isla Cleopha, Islas Tres Marias, Mexico (lat. 21°15.0′ N, long. 106°17.3′ W). Taken with rotenone in 0–45 ft (14 m) from sand and boulders on August 22, 1961 by a party from Scripps Institution of Oceanography.

PARATYPES: SIO 62-55 (same collection and data as above), six males (16.0–19.5), and four females (14.5–15.5).

Starksia posthon n. sp.

Figs. 5, 7

Description of Male Holotype

D. XXI, 9; A. II, 19; total pectoral rays 26; lateral line scales 39.

Proportions of certain body parts are given in Table 2. Nuchal cirri absent; orbital cirri small, less than one-tenth eye diameter, flattened and pointed; nasal cirri long and slender, equal to eye diameter when nasal tube is included in length. First three circumorbital pores uniserial, remainder biserial. Vomer and palatines toothed. Posterior lateral line scales tubed. Belly naked. Pelvic spine clearly visible in transmitted light, about one-third length of first pelvic ray; third pelvic ray a rudiment splinted to base of second ray. First anal spine about 1.3 as long as second and separate from it, extending to base of fourth anal soft ray when laid parallel to line of belly. Urogenital papilla attached for full length of anal spine and extending past its tip a distance equal to one-third eye diameter (Fig. 5).

Color in our single specimen pale, probably faded, with hint of duskiness on pectoral bases. Median fins unmarked with the exception of the dorsal, which bears a black splotch between the first and second spines. The pigment extends from the base of the fin halfway up the two spines.

Identification

S. posthon can best be identified by the combination of the dorsal fin spot between the first

and second spines, the long, slender, nasal cirri, and the long intromittent organ with the free tip.

Range

Species is known from one station in Islas Secas, Panama (Fig. 3).

Derivation of Name

Name derived from the Greek *posthon,* "one with a large phallus."

Material Examined

S. posthon is known only from the holotype, a 27.9-mm-long male, USNM 101945, from Isla Secas (Secas group), Panama. Taken in 14 fathoms on a bottom of "shells and millepore" on February 5, 1935 by Waldo L. Schmitt (original number 450-35). This specimen was damaged in collection and is consequently quite distorted and bent; measurements given in Table 2 were made with the body held in a normal posture but are probably not entirely reliable.

Starksia spinipenis Al-Uthman

Figs. 2, 5, 8

Brannerella spinipenis Al-Uthman, 1960, p. 163. Type locality Isla San Pedro Martir.

Description

D. XIX–XXI (20.0 ± .002), 8–10 (8.9 ± .052); A. II, 16–19 (19.0 ± .060); total pectoral rays 27–30 (28.1 ± .045); lateral line scales 38–42 (39.6 ± .106).

Proportions of certain body parts are given in Table 2. Nuchal cirri slender, orbital and nasal cirri slender, slightly less than one-third orbit diameter. Circumorbital pores biserial, but inner row absent anteriorly. Vomer and palatines toothed. Scales of posterior portion of lateral line tubed, posterior margins notched. Belly naked. Third pelvic ray a rudiment at base of second ray. First anal spine of males 1.7 times length of second and free from it; genital papilla extending beyond fleshy tip of second anal spine (Fig. 5).

Body with numerous subquadrate to polygonal dark blotches that tend to line up in a series of bars on the sides extending slightly below the midline. The barring is well developed in material from the Gulf of California, although usually there are pigment aggregations interpolated between the body bars on the lower sides. In the Gulf material the markings were blue-black in life. Material from the areas to the south of the Gulf of California has a different appearance. The body blotches are olive-tan and separated, so that the fish seldom has a barred appearance. Lips dusky laterally, but darkest on either side of the medial pale area. In some specimens, notably those from southern Mexico, the dark lateral areas on the lips are developed as strong bars running from the eye down and forward to the chin, where they meet. Opercles and cheeks dusky or speckled, a dark spot behind eye, isthmus dusky. Median fins pale, dorsal base sometimes with extensions of body bars.

Identification

S. spinipenis can be distinguished from the sympatric *Xenomedea rhodopyga* and *Starksia hoesei* on the basis of color pattern. In the latter two species the body bars are even and not broken up into blotches. In addition there are differences in the structure of the intromittent organ. In the allopatric *S. fulva* the color is plain tan, and the tip of the genital papilla extends but little beyond the fleshy tip of the first anal spine.

Range

Range is from Isla Angel de la Guarda, Gulf of California to Acapulco, Guerrero, Mexico (Figs. 3, 4).

Material Examined

Meristic and morphometric data were taken from the following lots: Punta Pulpito—SIO 65-318, 27 (23–29); Isla Carmen—SIO 65-324, 1 (29); Punta Nopolo—SIO 65-270 (27–34); Isla Espiritu Santo—SIO 61-265, 4 (28–34); Los Frailes—SIO 61-239, 2 (27–29); SIO 61-241, 1 (31); SIO 61-248, 1 (29); SIO 61-250, 3 (21–29); Cabo San Lucas—SIO 59-210, 1 (35); SIO 59-215, 1 (19); UCLA 61-225, 2 (31–34); SIO 69-217, 1 (30); Ensenada Chacala, Nayarit—UCLA 58-2, 2 (34–35); Islas Tres Marias—SIO 62-20, 17 (11–30); Bahia

Banderas, Nayarit—SIO 62-29, 17 (15–38); Manzanillo, Colima—UCLA 56-231, 7 (15–29). An additional 304 specimens from the following localities (all Baja California) were utilized for comparative purposes: Isla Ildefonso, 24; Punta Pulpito, 29; Punta Mangles, 3; Isla Carmen, 11; Isla Santa Catalina, 16; Bahia Agua Verde, 1; Isla Santa Cruz, 6; Punta San Telmo, 2; Punta Nopolo, 1; Isla San Jose, 7; Isla San Francisco, 6; Cabeza de Mechudo, 5; Isla Espiritu Santo, 3; Isla Ceralbo, 4; Punta Pescadero, 12; Bahia de Palmas, 5; Cabo Pulmo, 2; Punta Los Frailes, 5; San Jose del Cabo, 21; Cabo San Lucas, 33. Isla San Pedro Nolasco, Sonora, 3; Isla San Ignacio Farallon, Sonora, 4; Isla Isabel, Nayarit, 11; Ensenada Chacala, Nayarit, 3; Islas Tres Marias, 86; Bahia Banderas, Nayarit, 18; Manzanillo, Colima, 7; Zihuatanejo, Guerrero, 5; Puerto Marquez (near Acapulco), Guerrero, 2.

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ADDENDUM

After this paper had been accepted for publication, we obtained a collection containing five additional specimens of *Starksia guadalupae* from Rocas Alijos, Baja California (lat. 24°57′ N, long. 115°45′ W) about 250 miles south of Isla Guadalupe. Their counts are as follows: D. spines XX (3), XXI, XXII; D. soft rays 8, 9 (3), 10; total D. rays 29 (2), 30 (3); A. rays II, 18 (3), 19 (2); pect. rays 26; LL. scales 38, 39, 40 (3). They fit the description well, except that the nuchal cirri are longer (ca. one-half of orbit) and broader with a few slender fingerlike projections, and one individual has extensions of the body markings below the midline. One of the females contains eyed embryos.

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