DEVELOPMENT AND OCCURRENCE OF LARVAE AND JUVENILES OF THE ROCKFISHES *SEBASTES FLAVIDUS* AND *SEBASTES MELANOPS* (SCORPAENIDAE) OFF OREGON[1]

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ABSTRACT

Developmental series of larvae and juveniles of two important and very similar species of northeast Pacific rockfishes (Scorpaenidae: *Sebastes*) are described and illustrated: *S. flavidus* (10.1-105.0 mm standard length) and *S. melanops* (10.6-111.6 mm standard length). Descriptions include a literature review, identification, distinguishing features, general development, morphology, fin development, spination, scale formation, pigmentation, and color of fresh specimens. The main differences between *S. flavidus* and *S. melanops* within the size range described are pectoral fin ray number (usually 18 versus 19), lateral line pore number (usually >50 versus <50), and caudal peduncle depth/caudal peduncle length ratio (mean values 0.73, 0.64, 0.64, 0.80 versus 0.88, 0.78, 0.74, 0.92 in postflexion larvae, transforming, pelagic juvenile, and benthic juvenile specimens, respectively). Occurrence of these two species in waters off Oregon is discussed. Small benthic juveniles of *S. flavidus* seem to inhabit deeper waters, >20 m depth, than those of *S. melanops*.
Comparisons are made among known larvae and juveniles of *Sebastes* species. Identification problems within the *S. flavidus*-*S. melanops*/*S. entomelas*-*S. mystinus* groups are discussed.

Rockfishes, *Sebastes* spp., represent an important commercial and recreational resource along the west coast of North America. In 1976, landings of rockfishes (all species) were 14,000 t, constituting 24% of the total trawl catch by the United States and Canada, second only to Pacific cod landings (Pacific Marine Fisheries Commission[3]). Since the decline of Pacific ocean perch, *S. alutus*, landings in the late 1960's, more rockfish species have been subjected to increasing fishing pressure (Verhoeven 1976). This situation, together with concern over managing the resource, has emphasized the need to determine the condition of rockfish stocks particularly in order to avoid overexploitation (Gunderson[4]). Knowledge of the early life stages, especially pelagic juveniles, is important since they provide valuable tools for resource assessment, systematics, evolution, and other emerging research areas.

This paper contributes new information on the early life history of two important rockfish species: yellowtail rockfish, *S. flavidus*, and black rockfish, *S. melanops*. They were among the five principal species in the Oregon trawl landings of "other rockfish" from 1963 to 1971, contributing 33 and 12% of the total landings during those 9 yr (Niska 1976). They are also important in the Oregon sport catch but landing data are not available.

Larval and juvenile development of these two species is described for the first time and occurrence of young off Oregon is discussed. Particular attention is given to problems involved with identification due to the extreme similarity of these two species as larvae and juveniles.

METHODS

Specimens described in this paper came from collections in the School of Oceanography, Oregon State University. The collections were obtained with 70 cm bongo nets, neuston nets, meter nets, Isaacs-Kidd midwater trawls, beam trawls, otter trawls, beach seines, and dip nets off the Oregon coast and in Oregon tidepools and estuaries since 1961. Samples were taken during all months of the

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[3]Pacific Marine Fisheries Commission. 1978. Data series. Bottom or trawl fish section. Pac. Mar. Fish. Comm., Portland, Oreg., p. 1-472, 500-509.

[4]Gunderson, D. 1976. Proceedings of the 1st rockfish survey workshop. Processed rep., 14 p. Northwest Fisheries Center, NMFS, NOAA, 2725 Montlake Boulevard East, Seattle, Wash.

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year and along the entire Oregon coast, but were concentrated along an east-west transect off Newport, Oreg. (lat. 44°39.1′ N). All specimens were preserved in 5 or 10% Formalin[5] and transferred to ≈40% isopropyl alcohol.

Our approach to identification, methods of making counts and measurements, and terminology for development and spination follow Richardson and Laroche (1979). Body parts measured include:

Standard length (SL) = snout tip to notochord tip preceding development of caudal fin, then to posterior margin of hypural plate.

Snout to anus length = distance along body midline from snout tip to vertical through posterior margin of hindgut at anus.

Head length (HL) = snout tip to cleithrum until no longer visible, then to posteriormost margin of opercle.

Snout length = snout tip to anterior margin of orbit of left eye.

Upper jaw length = snout tip to posterior margin of maxillary.

Eye diameter = greatest diameter of left orbit.

Interorbital distance = distance between dorsal margins of orbits.

Body depth at pectoral fin base = vertical distance from dorsal to ventral body margin at base of pectoral fin.

Body depth at anus = vertical distance from dorsal to ventral body margin immediately posterior to anus.

Caudal peduncle depth = shortest vertical distance between dorsal and ventral margins of caudal peduncle.

Caudal peduncle length = horizontal distance from base of posteriormost dorsal ray to posterior margin of hypural elements.

Pectoral fin length = distance from base to tip of longest ray.

Pectoral fin base depth = width of base of pectoral fin.

Pelvic spine length = distance from base to tip of pelvic spine.

Pelvic fin length = distance from base to tip of longest ray.

Snout to origin of pelvic fin = distance along body midline to vertical through insertion of pelvic fin.

Parietal spine length = distance along posterior margin of parietal spine from insertion to tip.

Nuchal spine length = distance along posterior margin of nuchal spine from insertion to tip.

Preopercular spine length (third spine; posterior series) = distance from tip to basal insertion if visible, or to a line connecting the points of deepest indentation between preopercular spines 2 and 3 and spines 3 and 4 (posterior series).

Length of angle gill raker = distance from tip of gill raker to point of articulation with gill arch.

Longest dorsal fin spine = distance from base to tip.

Longest dorsal fin ray = distance from base to tip.

Longest anal fin spine = distance from base to tip.

All body lengths given refer to standard length unless noted otherwise.

When the two posteriormost dorsal and anal fin rays arise from the same pterygiophore, they are counted as one.

A modified descriptive approach is used to minimize repetition which would result due to the extreme similarity in the development of *S. flavidus* and *S. melanops*. Descriptions are combined for both species and differences are noted as they occur. Reference to tabularized development morphology data, including relative body proportions and fin and head spine development, is made wherever practical to condense the description.

SEBASTES FLAVIDUS (AYRES) AND *SEBASTES MELANOPS* GIRARD (Figures 1-6)

Literature.—Pigment patterns of preextrusion larvae of *S. flavidus* were described by Delacy et al. (1964), including a figure, Westrheim (1975), and Moser et al. (1977). Preextrusion larvae (mean total length = 4.5 mm) have a row of usually <16 melanophores ($\bar{x}$ = 10, range 8-12 on 20 specimens) along the ventral body midline which stops short of the anus by at least four myomeres. The gut is pigmented and melanophore(s) are usually present on the ventral body surface near the notochord tip.

Larvae and juveniles of *S. melanops* have not been described.

Identification (Tables 1-3; Appendix Table 1).—Fifty-one specimens of *S. flavidus* (10.1-105.0 mm)

[5]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

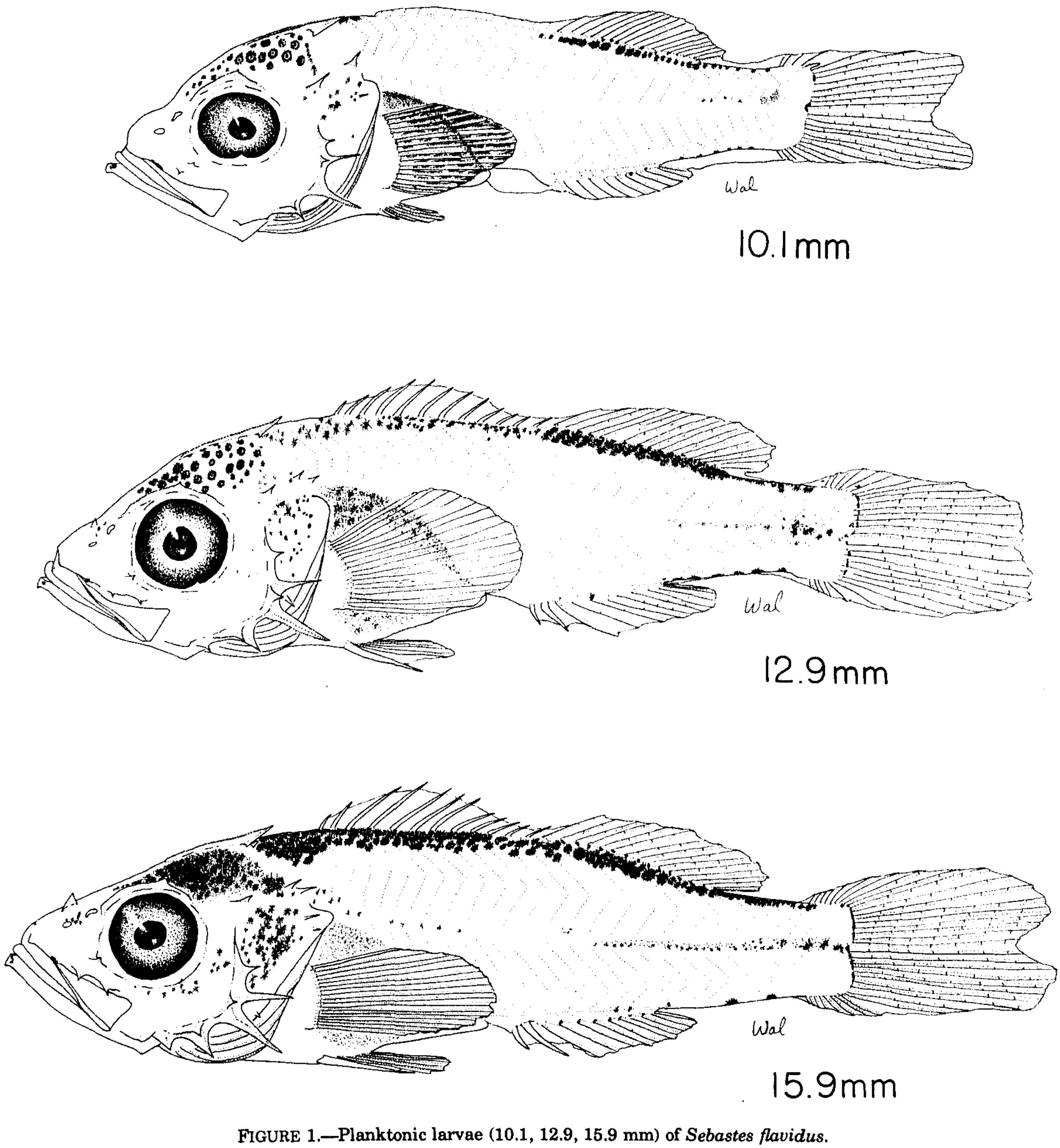

FIGURE 1.—Planktonic larvae (10.1, 12.9, 15.9 mm) of *Sebastes flavidus*.

were selected for the developmental series from 556 specimens identified. Juveniles were identified by the following combination of characters recorded from juvenile and adult specimens:

Gill rakers = 33-39
Lateral line pores = 46-57, usually 50-54
Pectoral fin rays = 17-19, usually 18
Anal fin soft rays = 7-9, usually 8
Dorsal fin soft rays = 14-15
Preocular spine = absent
Supraocular spine = absent
Interorbital space = flat to convex
Black blotch at base of spinous dorsal fin = present.

Fifty-eight specimens of *S. melanops* (10.6-111.6 mm) were selected for the developmental

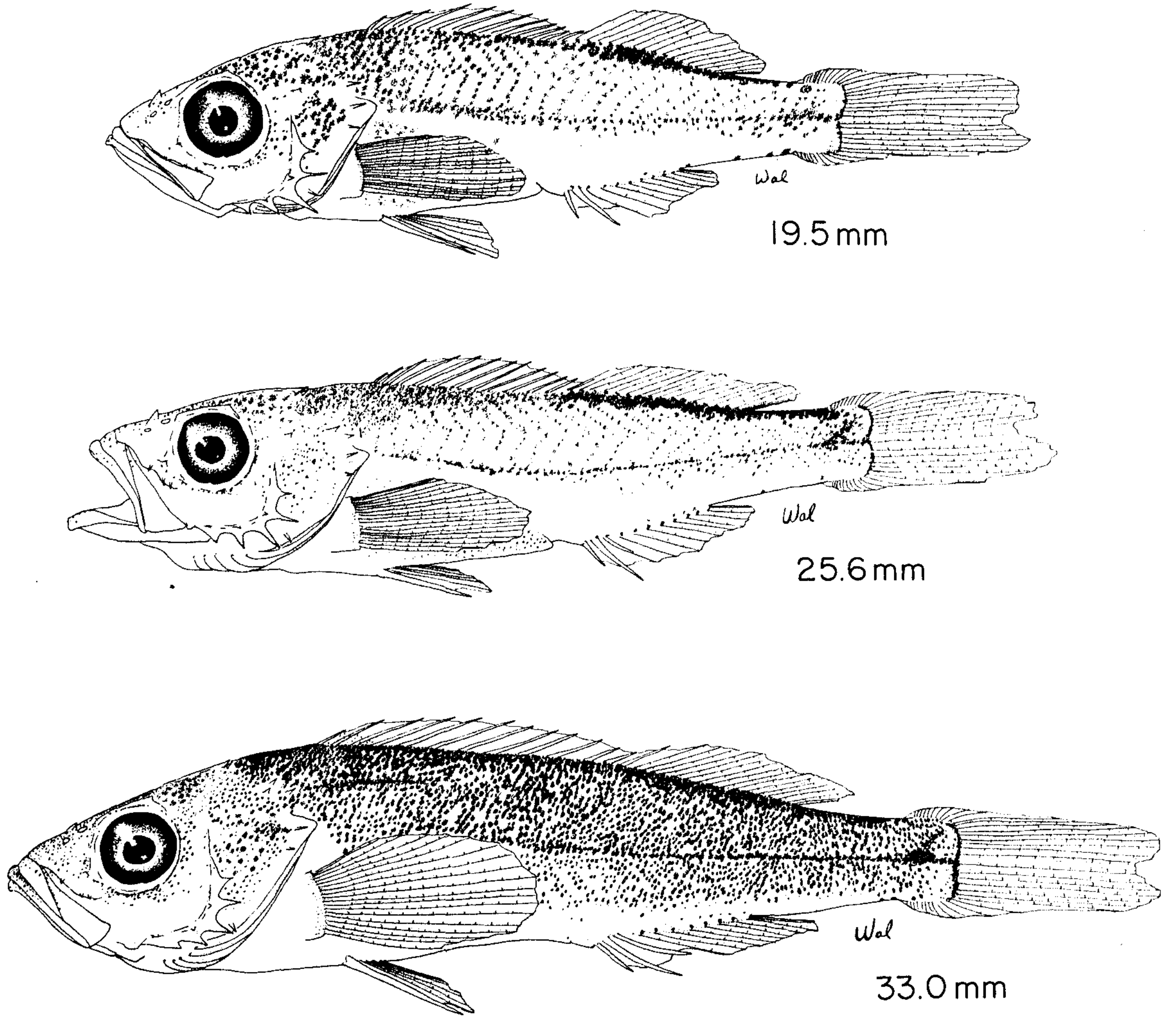

FIGURE 2.—Planktonic larva (19.5 mm), transforming specimen (25.6 mm), and pelagic juvenile (33.0 mm) of *Sebastes flavidus*.

series from 365 specimens in our collections. Juveniles were identified by the following combination of characters recorded from our juvenile and adult specimens:

Gill rakers = 34-40
Lateral line pores = 45-54, usually 47-50
Pectoral fin rays = 18-20, usually 19
Anal fin soft rays = 7-9, usually 8
Dorsal fin soft rays = 14-16, usually 14-15
Preocular spine = absent
Supraocular spine = absent
Interorbital space = flat to convex
Black blotch at base of spinous dorsal fin = present.

Of the 36 *Sebastes* species off Oregon (Richardson and Laroche 1979), *S. flavidus* and *S. melanops*, respectively, have the best fit to the above characters. *Sebastes melanops* usually has 19 rather than 18 pectoral rays and a lower number (<50 rather than >50) of lateral line pores than *S. flavidus* based on counts made on juveniles and adults collected from Yaquina Bay, Oreg., and the Pacific Ocean nearby (Appendix Table 1). Juvenile specimens were identified by us as *S. flavidus* and *S. melanops* using the above characters together with color pattern (intensity of melanistic pigment on caudal fin) and location of capture (*S. flavidus* from depths >25 m and *S. melanops* from depths <15 m). Of 52 *S. flavidus*

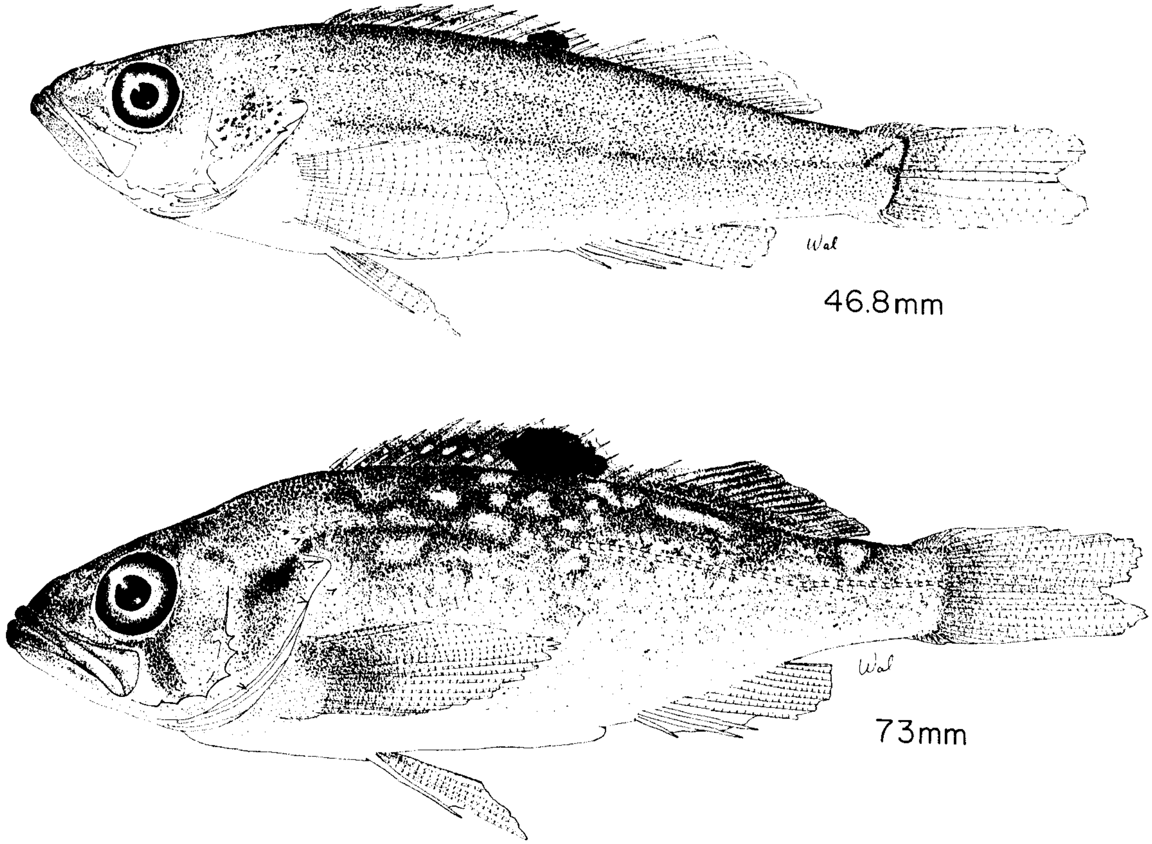

FIGURE 3.—Pelagic juvenile (46.8 mm) and benthic juvenile (73 mm) of *Sebastes flavidus*.

taken off Yaquina Bay (the area offshore of which most larval and pelagic juvenile *S. flavidus* were collected), 96% had a pectoral fin ray count of 18 on one or both sides. Of 66 *S. melanops* taken in Yaquina Bay and adjacent tidepool and shallow subtidal locations (the area offshore of which most larval and pelagic juvenile *S. melanops* were collected), 95% had a pectoral fin ray count of 19 on one or both sides. Mean numbers of lateral line pores were 52.33 ±0.52 (95% confidence) (N = 48) and 49.20 ±0.42 (95% confidence) (N = 66) on the left side of *S. flavidus* and *S. melanops*, respectively. No significant difference was found between counts made on the left and right sides for either species. Two specimens of *S. flavidus* had 19 pectoral fin rays on both sides but lateral line pores numbered >50 on both sides. Three specimens of *S. melanops* had 18 pectoral fin rays on both sides but lateral line pores numbered <51 on both sides. Thus the number of pectoral fin rays and lateral line pores allow positive identification of *S. flavidus* in most cases. Although diagonal scale rows below the lateral line were not used in making the initial identifications, they are useful when they can be counted and can help verify identifications when other characters are not conclusive (see Appendix Table 1).

Specimens of *S. flavidus* and *S. melanops* were selected for the developmental series only if pectoral fin ray counts on both sides were ≤18 and ≥19, respectively, to minimize possible confusion. The presence of discrete melanophores at the articulation of dorsal and anal fin soft rays and melanophores along the posterior margin of the hypural plate together with counts helped link the developmental series and distinguish the specimens from all other Oregon species. The more slender and longer caudal peduncle of *S. flavidus* and the deeper, shorter caudal peduncle of *S. melanops* (Table 2) helped tie each series together, confirm identifications, and eliminate confusion between the two species.

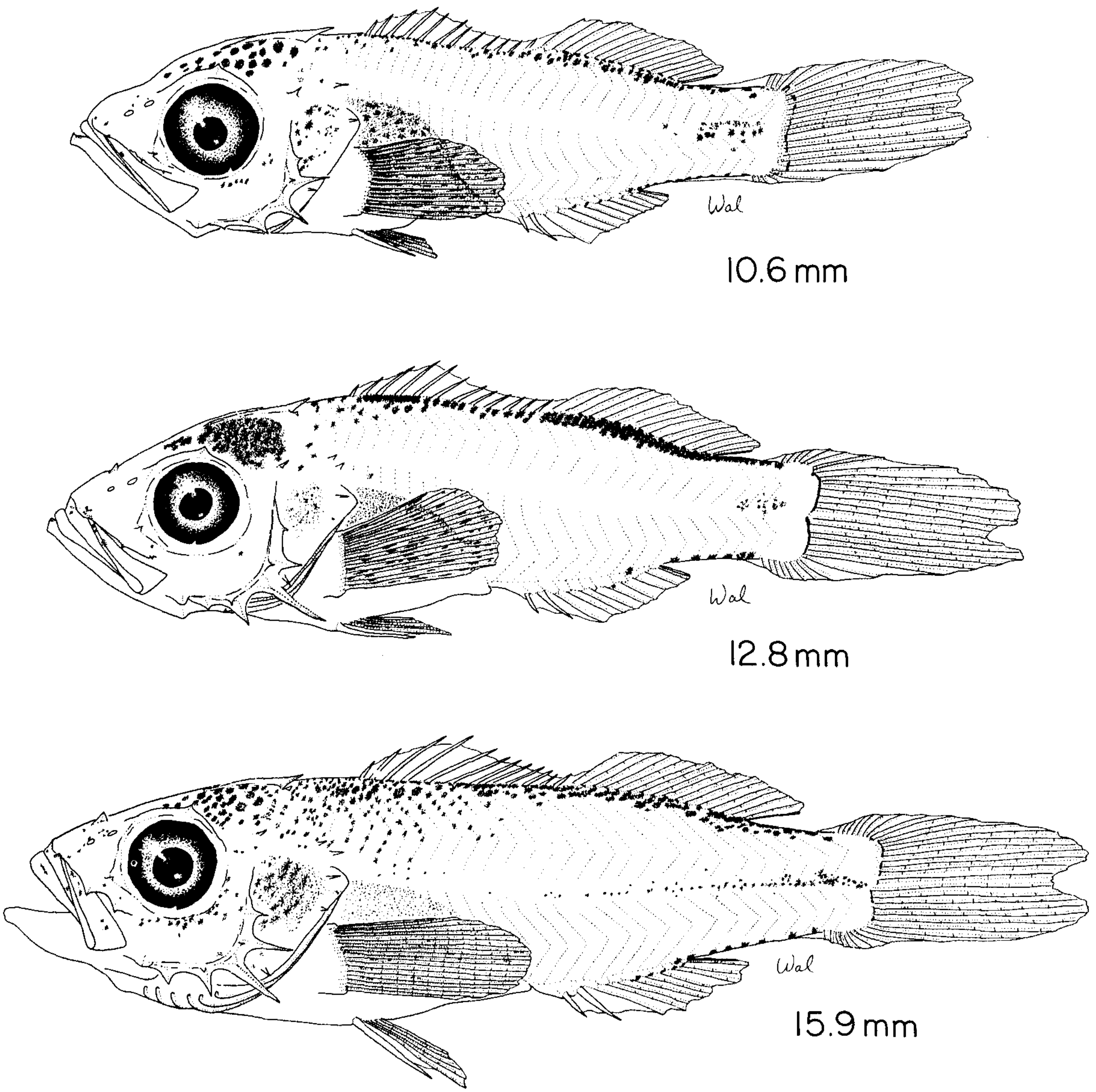

FIGURE 4.—Planktonic larvae (10.6, 12.8, 15.9 mm) of *Sebastes melanops*.

Distinguishing Features.—Characters useful to distinguish the smallest identified larvae (10-11 mm) of *S. flavidus* and *S. melanops* from those of other *Sebastes* species are the moderately pigmented pectoral and pelvic fins, presence of pigment along the dorsal body surface under the dorsal fin, internal and external melanophores above the notochord at and anterior to the point of notochord flexion, melanophores along the dorsal and ventral margins of the caudal peduncle, and melanophores at the articulation of some dorsal and anal rays. The relatively long and narrow caudal peduncle and presence of 18 pectoral rays distinguishes *S. flavidus,* and the relatively deep and short caudal peduncle and presence of 19 pectoral rays distinguish *S. melanops*. Meristics,[6] lack of preocular and supraocular spines, flat to

[6]The term "meristics" is used to refer to all countable characters which are usually arranged in series.

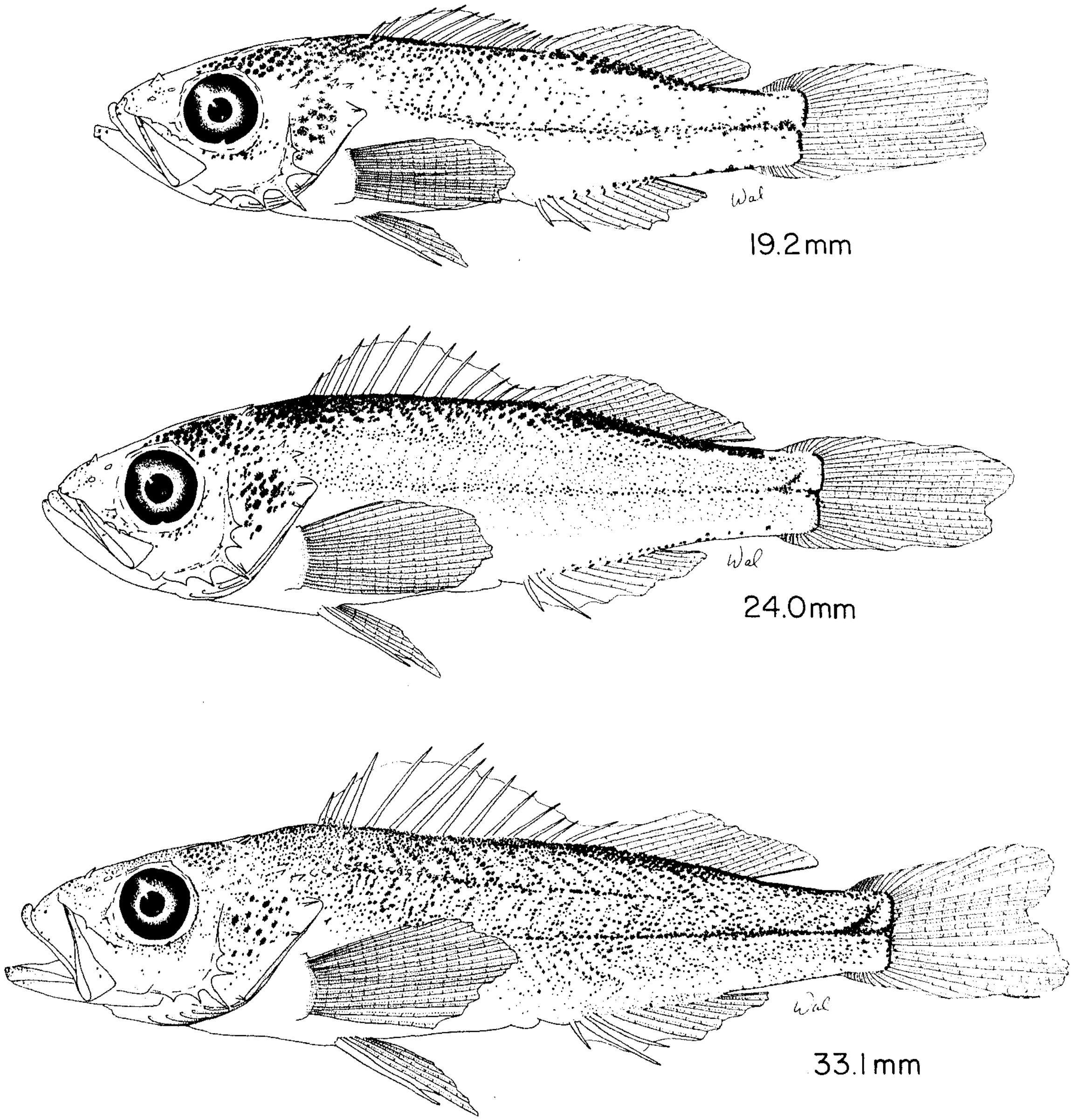

FIGURE 5.—Pelagic larvae (19.2, 24.0, 33.1 mm) of *Sebastes melanops*.

convex interorbital space, body and fin pigmentation, and body morphometry together serve to distinguish larger larvae and juveniles from those of other Oregon species.

General Development.—Notochord flexion is complete on the smallest larva of *S. flavidus* (10.1 mm) and *S. melanops* (10.6 mm) identified. Transformation from postflexion larvae to pelagic juveniles occurs between 23 and 27 mm in *S. flavidus* and between ≈24 and 33 mm in *S. melanops* as indicated by the structural change of the "prespines" in the dorsal and anal fins to sharp, hard spines. Melanistic pigmentation gradually increases over the body through the larval and transformation periods and shows no marked change during transformation. Transition from pelagic to benthic habitat usually occurs when

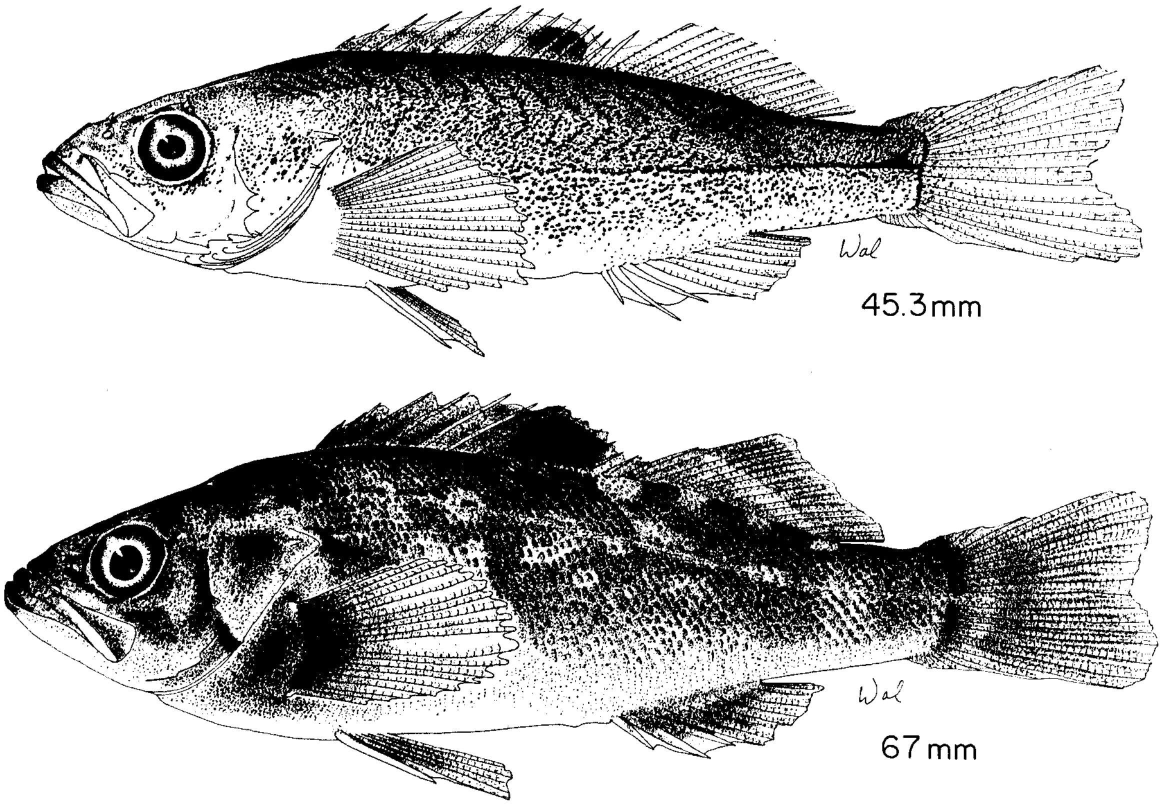

FIGURE 6.—Pelagic juvenile (45.3 mm) and benthic juvenile (67 mm) of *Sebastes melanops*.

fish are between 40 and 50 mm in both species. The largest pelagic juvenile and the smallest benthic juvenile observed were 45 mm and 42 mm for *S. flavidus* and 47 mm and 38 mm for *S. melanops* (see Figures 7-10).

Morphology (Tables 2, 4, 5).—Various body parts were measured on 51 selected specimens of *S. flavidus* (10.1-105.0 mm) and 58 specimens of *S. melanops* (10.6-111.6 mm). Relative growth trends are summarized in Table 2.

The most important morphometric character which will separate most *S. flavidus* from *S. melanops* is the caudal peduncle depth/length ratio. While the depth and length of the caudal peduncle change only slightly during development, their ratio changes notably. In *S. flavidus* it decreases from 73 to 64 or 65% in pelagic stages, increasing again to 80% in benthic juveniles. In *S. melanops* it decreases from 88 to 74-77% in pelagic stages and then increases to 89% in benthic juveniles. This ratio is usually smaller in *S. flavidus* than in *S. melanops* for all specimens of similar size. Caudal peduncle depth is generally less and caudal peduncle length is generally greater in *S. flavidus* than in *S. melanops.*

Fin Development (Tables 1-4).—Pectoral fins are formed and have the adult complement of 17-19 (usually 18 in *S. flavidus* and 19 in *S. melanops*) fin rays in the smallest specimens (10 or 11 mm) in the series. The fins in both species are moderate in length, reaching 24 or 25% SL in juveniles.

The adult pelvic fin complement (I, 5) is present by 10 or 11 mm in both species. The pelvic fins are of moderate length, averaging 13-18% SL during the pelagic period. Pelvic spine length is always less than pelvic fin length.

The adult complement of 8 + 7 principal caudal rays is present on the larvae of both species along with six superior and five inferior secondary caudal rays. Counts of superior and inferior secondary rays made on three stained juvenile *S.*

TABLE 1.—Meristics from larvae and juveniles of *Sebastes flavidus* off Oregon, based on unstained specimens. Counts of left and right pelvic fin rays (I,5;I,5), superior and inferior principal caudal rays (8,7), and left and right branchiostegal rays (7;7) were constant from the smallest to largest specimen listed.

Standard length (mm)	Dorsal fin spines and rays	Anal fin spines and rays	Pectoral fin rays		Gill rakers (first arch)		Lateral line pores		Diagonal scale rows	
			Left	Right	Left	Right	Left	Right	Left	Right
10.1	([1]),15	III[2],8	18	18	—	—	—	—	—	—
10.3	XIII[2],14	III[2],8	18	18	—	—	—	—	—	—
10.7	XIII[2],14	III[2],8	18	18	—	—	—	—	—	—
11.4	XIII[2],15	III[2],8	18	18	—	—	—	—	—	—
11.8	XIII[2],14	III[2],8	18	18	—	—	—	—	—	—
11.8	XIII[2],15	III[2],8	18	18	—	—	—	—	—	—
11.9	XIII[2],15	III[2],8	18	18	—	—	—	—	—	—
12.0	XIII[2],15	III[2],8	18	18	—	—	—	—	—	—
12.2	XIII[2],15	III[2],8	18	18	—	—	—	—	—	—
12.7	XIII[2],15	III[2],8	18	18	23+ 8=31	23+ 9=32	—	—	—	—
12.8	XIII[2],15	III[2],8	18	18	23+ 9=32	24+ 9=33	—	—	—	—
12.9	XIII[2],15	III[2],8	18	18	23+ 9=32	23+ 9=32	—	—	—	—
13.1	XIII[2],15	III[2],7	17	18	22+ 8=30	23+ 9=32	—	—	—	—
13.7	XIII[2],15	III[2],7	18	18	23+ 9=32	23+ 9=32	—	—	—	—
14.4	XIII[2],15	III[2],8	18	18	24+ 9=33	23+ 9=32	—	—	—	—
14.8	XIII[2],14	III[2],8	18	18	24+ 9=33	23+ 9=32	—	—	—	—
15.8	XIII[2],15	III[2],9	18	18	24+ 9=33	24+ 9=33	—	—	—	—
15.9	XIII[2],14	III[2],7	17	18	24+10=33	23+ 9=32	—	—	—	—
16.4	XIII[2],15	III[2],8	18	18	24+10=34	24+10=34	—	—	—	—
16.8	XIII[2],15	III[2],7	18	18	24+10=34	25+10=35	—	—	—	—
18.9	XIII[2],15	III[2],8	18	18	24+10=34	24+10=34	—	—	—	—
19.5	XIII[2],15	III[2],8	18	18	25+10=35	24+10=34	—	—	—	—
19.8	XIII[2],15	III[2],8	18	18	25+10=35	25+10=35	—	—	—	—
20.5	XIII[2],15	III[2],9	18	18	25+10=35	24+11=35	—	—	—	—
21.3	XIII[2],15	III[2],8	18	18	25+10=35	25+10=35	—	—	—	—
22.3	XIII[2],15	III[2],8	18	18	24+10=34	25+10=35	—	—	—	—
[3]23.6	XIII[2],15	III[2],8	18	18	25+11=36	26+10=36	—	—	—	—
[3]23.7	XIII[2],15	III ,8	18	18	25+11=36	26+11=37	—	—	—	—
[3]24.2	XIII[2],15	III ,8	18	18	26+11=37	26+11=37	—	—	—	—
[3]24.8	XIII[2],15	III[2],8	18	18	25+10=35	25+11=36	—	—	—	—
[3]25.6	XIII[2],15	III ,8	17	17	25+10=35	25+11=36	—	—	—	—
[3]26.6	XIV[2],15	III[2],8	18	18	24+10=34	24+10=34	—	—	—	—
[3]26.7	XIII[2],15	III ,8	18	18	27+10=37	26+11=37	—	—	—	—
[4]28.6	XIII ,15	III ,8	18	18	25+10=35	26+11=37	—	—	—	—
[4]29.2	XIII ,15	III ,8	18	18	26+10=36	26+10=36	—	—	—	—
[4]29.6	XIII ,15	III ,8	18	18	26+10=36	27+11=38	—	—	—	—
[4]30.4	XIII ,15	III ,8	18	18	25+11=36	26+11=37	—	—	—	—
[4]33.0	XIII ,14	III ,8	18	18	26+11=37	27+11=38	—	—	—	—
[4]33.1	XIII ,15	III ,8	18	18	25+10=35	25+10=35	—	—	—	—
[4]35.2	XIII ,14	III ,8	18	18	26+11=37	26+11=37	—	—	—	—
[4]36.4	XIII ,14	III ,8	18	18	26+11=37	27+11=38	—	—	—	—
[4]37.6	XIII ,15	III ,8	18	18	25+11=36	25+10=35	—	—	—	—
[4]41.9	XIII ,15	III ,8	18	18	28+11=39	28+11=39	—	—	—	—
[4]43.6	XIII ,15	III ,8	18	18	25+10=35	25+11=36	—	—	—	—
[4]45.2	XIII ,15	III ,8	18	18	27+11=38	28+11=39	—	—	—	—
[5]67.6	XIII ,14	III ,8	18	18	26+11=37	26+11=37	54	54	56	56
[5]71.5	XIII ,15	III ,8	18	18	27+11=38	26+11=37	46	53	—	55
[5]72.5	XIII ,14	III ,8	18	18	26+11=37	27+10=37	52	53	54	54
[5]77.5	XIII ,14	III ,8	18	18	26+11=37	25+10=35	50	53	55	56
[5]81.0	XIII ,14	III ,7	18	18	26+11=37	26+11=37	52	53	—	—
[5]105.0	XIII ,14	III ,8	18	18	27+11=38	26+11=37	55	56	57	—

[1]Forming.
[2]Posteriormost dorsal and anal spine appears as a soft ray.
[3]Transforming.
[4]Pelagic juvenile.
[5]Benthic juvenile.

flavidus (49, 50, and 52 mm long) were 12/13, 12/13, and 12/12, respectively. Counts on four stained juvenile *S. melanops* (42, 43, 47, and 48 mm long) were 12/13, 12/12, 12/12, and 12/13, respectively. Adult complements of the dorsal and anal fin spines and rays can be counted by ≈11 or 12 mm. The transition of the 13th dorsal and 3d anal fin "prespines" to spines is complete by ≈27 mm in *S. flavidus* and ≈33 mm in *S. melanops*.

Spination (Tables 2, 4-7).—Spines present on the left side of the head of the smallest (10.1 mm) larval *S. flavidus* include the parietal; first, second, third, and fourth posterior preopercular; first and third anterior preopercular; postocular; pterotic; superior opercular; first inferior infraorbital; first superior infraorbital; inferior posttemporal; and the developing interopercular (indicated by a small blunt projection). The smallest

TABLE 2.—Body proportions of larvae and juveniles of *Sebastes flavidus* and *S. melanops*. Values given are percent of standard length (SL) or head length (HL) including mean, standard deviation, and range in parentheses. Number of specimens measured may be derived from measurements listed by developmental stage (as indicated by footnotes) in Tables 4 and 5.

Item	*Sebastes flavidus*	*Sebastes melanops*
Body depth at pectoral fin base/SL:		
Postflexion	28.2±1.72(25.3-30.8)	29.6±1.77(26.3-32.8)
Transforming	24.5±0.62(23.6-25.6)	26.1±0.79(25.2-27.5)
Pelagic juvenile	24.8±1.08(23.3-26.9)	25.9±0.72(24.7-26.7)
Benthic juvenile	30.0±1.00(28.4-31.0)	30.9±1.94(27.0-33.0)
Body depth at anus/SL:		
Postflexion	22.3±1.01(20.6-24.2)	24.3±1.24(21.8-26.1)
Transforming	20.0±0.51(19.2-20.7)	21.9±0.89(20.9-23.3)
Pelagic juvenile	21.3±0.99(19.9-23.4)	22.2±0.71(20.9-23.6)
Benthic juvenile	25.6±1.11(23.5-26.3)	26.4±0.75(25.3-27.4)
Snout to anus length/SL:		
Postflexion	57.3±1.77(53.5-61.2)	58.0±2.15(54.0-62.2)
Transforming	60.0±1.23(57.5-60.5)	58.9±3.02(55.8-62.6)
Pelagic juvenile	60.3±1.02(58.8-62.3)	61.3±1.65(59.4-65.3)
Benthic juvenile	63.2±1.22(62.2-65.6)	63.0±3.43(59.4-70.7)
Snout to pelvic fin origin/SL:		
Postflexion	37.9±1.86(34.4-42.7)	38.8±1.86(35.8-42.9)
Transforming	35.9±0.49(35.3-36.7)	37.3±1.94(34.8-39.3)
Pelagic juvenile	36.2±0.73(35.3-37.7)	36.8±1.63(35.2-40.1)
Benthic juvenile	39.7±2.37(37.2-43.0)	38.2±2.38(35.4-41.8)
Head length/SL:		
Postflexion	38.6±1.78(35.4-42.7)	38.5±1.95(34.8-42.9)
Transforming	35.0±0.91(33.7-36.0)	35.0±2.19(31.9-37.8)
Pelagic juvenile	33.4±1.34(31.9-36.0)	33.3±1.45(31.1-35.3)
Benthic juvenile	35.2±2.52(33.4-40.0)	34.8±1.83(32.3-37.3)
Eye diameter/HL:		
Postflexion	32.0±2.06(27.1-35.4)	30.8±1.61(26.9-34.1)
Transforming	28.9±0.72(27.8-29.8)	28.6±1.90(26.0-30.6)
Pelagic juvenile	27.2±1.29(25.7-29.1)	26.3±1.49(24.0-28.9)
Benthic juvenile	26.8±1.78(24.1-29.5)	25.6±1.70(23.4-28.7)
Upper jaw length/HL:		
Postflexion	42.6±1.84(39.0-45.9)	42.1±2.21(37.3-45.7)
Transforming	40.5±2.35(37.5-44.0)	41.2±2.02(37.6-42.7)
Pelagic juvenile	42.1±1.33(39.2-44.4)	41.4±1.71(39.3-44.2)
Benthic juvenile	42.5±2.89(39.3-46.5)	44.2±4.16(35.3-48.4)
Snout length/HL:		
Postflexion	27.4±1.74(23.9-30.6)	27.6±1.65(25.0-31.4)
Transforming	26.3±0.38(25.6-26.7)	26.7±1.13(25.8-28.0)
Pelagic juvenile	25.6±1.75(23.1-29.1)	27.0±2.12(23.9-30.0)
Benthic juvenile	28.8±3.56(22.9-32.7)	23.1±1.98(19.9-26.5)
Interorbital distance/HL:		
Postflexion	28.8±1.78(25.0-31.9)	29.0±2.11(24.0-32.7)
Transforming	24.8±0.71(24.1-26.2)	25.9±1.01(24.7-27.0)
Pelagic juvenile	24.7±1.67(21.6-28.0)	24.2±1.25(22.2-26.2)
Benthic juvenile	22.2±0.98(21.4-24.1)	23.6±1.97(21.1-26.2)
Angle gill raker length/HL:		
Postflexion	12.1±1.46(9.0-14.5)	10.9±1.36(7.3-13.5)
Transforming	14.7±0.84(13.9-16.1)	12.2±1.92(10.6-15.0)
Pelagic juvenile	14.4±1.13(11.7-16.2)	14.1±1.04(13.1-16.1)
Benthic juvenile	15.0±0.66(14.4-16.1)	14.9±0.71(14.1-15.8)
Longest dorsal spine length[1]/HL:		
Postflexion	19.4±6.84(5.0-32.4)	24.0±5.11(15.2-31.9)
Transforming	32.8±1.53(31.0-34.5)	—
Pelagic juvenile	35.3±1.68(33.7-39.3)	36.9±2.46(33.3-39.5)
Benthic juvenile	34.6±1.81(31.7-36.7)	35.4±1.35(33.9-37.8)
Longest dorsal ray length[2]/HL:		
Postflexion	30.5±4.39(19.0-38.1)	32.6±3.70(25.0-38.3)
Transforming	36.7±1.59(35.2-39.3)	36.9±3.07(34.9-40.4)
Pelagic juvenile	40.5±3.00(37.1-45.8)	40.1±1.62(38.5-43.0)
Benthic juvenile	43.4±2.34(40.3-46.1)	46.1±2.34(45.2-48.5)
Longest anal spine length[3]/HL:		
Postflexion	16.5±4.96(10.8-26.3)	19.2±3.99(11.3-25.6)
Transforming	26.2±2.25(22.2-28.7)	30.4±2.95(27.1-32.7)
Pelagic juvenile	30.6±2.41(26.2-33.6)	32.3±2.44(28.7-37.7)
Benthic juvenile	33.8±1.36(31.9-35.4)	34.7±1.97(31.2-37.1)
Pectoral fin length/SL:		
Postflexion	20.1±1.91(15.8-22.7)	21.7±1.41(18.5-24.5)
Transforming	22.5±1.01(21.4-24.3)	24.0±1.08(22.8-25.5)
Pelagic juvenile	24.6±0.35(24.1-25.1)	24.2±0.90(22.4-25.2)
Benthic juvenile	24.1±1.30(21.8-25.7)	24.7±1.57(22.9-27.2)
Pectoral fin base depth/SL:		
Postflexion	8.5±0.90(7.2-10.9)	8.8±0.69(7.7-10.1)
Transforming	7.0±0.22(6.7-7.3)	7.7±0.18(7.5-7.9)
Pelagic juvenile	7.0±0.45(6.1-7.6)	7.8±0.12(7.6-8.0)
Benthic juvenile	8.4±0.34(7.8-8.7)	9.4±0.39(8.5-9.8)
Pelvic fin length/SL:		
Postflexion	13.4±1.83(8.9-16.7)	15.4±1.17(12.6-17.4)
Transforming	15.5±0.59(14.6-16.1)	16.4±0.30(16.1-16.7)
Pelagic juvenile	16.3±0.89(14.8-17.8)	17.5±0.64(16.8-18.8)
Benthic juvenile	19.5±0.51(19.0-20.4)	20.7±1.44(18.2-23.0)
Pelvic spine length/SL:		
Postflexion	10.4±2.46(6.3-15.7)	12.6±1.57(9.2-14.9)
Transforming	13.7±0.92(12.7-15.3)	11.4±0.92(10.8-12.1)
Pelagic juvenile	13.6±0.88(12.6-15.4)	14.0±0.56(12.8-14.5)
Benthic juvenile	12.1±0.72(11.3-13.2)	13.3±2.04(10.7-13.9)
Parietal spine length/HL:		
Postflexion	8.8±2.17(4.2-11.8)	7.9±2.00(4.2-11.4)
Transforming	4.0±0.67(3.4-4.7)	5.6±0.35(5.3-5.8)
Pelagic juvenile	1.0±0.45(0.7-1.7)	1.2±0.64(0.7-1.6)
Benthic juvenile	—	—
Nuchal spine length/HL:		
Postflexion	2.1±1.15(0.1-3.9)	1.6±0.87(0.4-3.2)
Transforming	2.1±0.31(1.8-2.6)	2.6±0.35(2.4-2.9)
Pelagic juvenile	1.9±0.72(1.1-2.4)	1.4±0.24(1.2-1.7)
Benthic juvenile	—	—
Preopercular spine length/HL:		
Postflexion	20.1±3.30(12.8-27.0)	19.5±3.31(14.5-26.9)
Transforming	12.8±2.16(10.0-16.0)	13.3±1.11(11.8-14.4)
Pelagic juvenile	10.2±1.60(7.8-13.0)	9.6±0.81(8.4-10.9)
Benthic juvenile	3.2±0.86(2.4-4.8)	2.3±1.15(0.4-4.5)
Caudal peduncle depth/SL:		
Postflexion	11.3±0.71(10.0-12.6)	12.8±0.89(11.4-14.3)
Transforming	9.7±0.43(9.0-10.2)	11.1±0.54(10.5-11.7)
Pelagic juvenile	9.7±0.29(9.3-10.4)	10.3±0.27(9.7-10.5)
Benthic juvenile	10.5±0.38(9.9-11.0)	11.3±0.23(11.0-11.6)
Caudal peduncle length/SL:		
Postflexion	15.5±0.89(13.4-16.8)	14.6±0.70(13.0-16.2)
Transforming	15.1±0.54(14.3-15.7)	14.3±0.17(14.2-14.6)
Pelagic juvenile	15.1±1.06(14.1-17.8)	13.9±0.66(12.8-14.9)
Benthic juvenile	13.2±0.88(12.0-14.5)	12.6±0.69(11.6-13.4)
Caudal peduncle depth/caudal peduncle length:		
Postflexion	.73±0.060(0.65-0.83)	.88±0.069(0.74-1.06)
Transforming	.64±0.029(0.60-0.69)	.78±0.042(0.73-0.84)
Pelagic juvenile	.64±0.046(0.56-0.74)	.74±0.034(0.70-0.81)
Benthic juvenile	.80±0.072(0.70-0.90)	.92±0.021(0.91-0.94)

[1]Usually fourth or fifth in larvae, fifth or sixth in juveniles.
[2]Usually in anterior one-fourth of fin.
[3]The second spine in larvae and transforming larvae, the third spine in juveniles.

S. melanops (10.6 mm) has a nuchal and supracleithral (as blunt bumps) and a fourth superior infraorbital in addition to the spines listed above.

In both species the parietal spine and ridge are finely serrated on all specimens <34 mm long. Parietal spine length decreases with development becoming overgrown in benthic juveniles. The nuchal spine, always shorter than the parietal, is usually present in larvae and pelagic juveniles and is overgrown by scales and tissue in benthic juveniles. (Table 2 lists the mean nuchal spine/HL value for pelagic juveniles as greater than the

TABLE 3.—Meristics from larvae and juveniles of *Sebastes melanops* off Oregon, based on unstained specimens. Counts of left and right pelvic fin rays (I,5;I,5), superior and inferior principal caudal rays (8,7), and left and right branchiostegal rays (7;7) were constant from the smallest to the largest specimen listed.

Standard Length (mm)	Dorsal fin spines and rays	Anal fin spines and rays	Pectoral fin rays		Gill rakers (first arch)		Lateral line pores		Diagonal scale rows	
			Left	Right	Left	Right	Left	Right	Left	Right
10.6	XIII[1],15	III[1],8	19	19	—	—				
11.7	XIII[1],15	III[1],9	19	19	—	—				
11.9	XIII[1],15	III[1],8	19	19	—	23+ 8=31	—	—	—	—
11.9	XIII[1],15	III[1],8	19	19	21+ 8=29	21+ 8=29	—	—	—	—
12.4	XIII[1],15	III[1],8	19	19	22+ 9=31	24+ 8=32	—	—	—	—
12.8	XIII[1],14	III[1],8	19	19	23+ 9=32	22+ 8=30	—	—	—	—
12.8	XIII[1],15	III[1],8	19	19	23+ 8=31	23+ 8=31	—	—	—	—
12.8	XIII[1],14	III[1],8	19	19	21+ 8=29	22+ 9=31	—	—	—	—
13.5	XIII[1],15	III[1],8	19	19	23+ 9=32	23+ 9=32	—	—	—	—
13.6	XIII[1],14	III[1],8	19	19	22+ 8=30	23+ 9=32	—	—	—	—
13.9	XIII[1],15	III[1],8	19	19	22+10=32	22+ 9=31	—	—	—	—
14.0	XIII[1],15	III[1],8	19	19	23+ 9=32	23+10=33	—	—	—	—
14.9	XIII[1],14	III[1],8	19	19	23+ 9=32	22+ 8=30	—	—	—	—
15.4	XIII[1],13	III[1],8	19	19	21+ 9=30	23+ 9=32	—	—	—	—
15.4	XIII[1],15	III[1],8	19	19	23+ 9=32	23+10=33	—	—	—	—
15.7	XIII[1],15	III[1],8	19	19	24+ 9=33	24+ 9=33	—	—	—	—
15.9	XIII[1],15	III[1],8	19	19	23+ 9=32	23+10=33	—	—	—	—
16.4	XIII[1],14	III[1],8	19	19	23+ 9=32	23+10=33	—	—	—	—
16.5	XIII[1],15	III[1],8	19	19	23+10=33	23+ 9=32	—	—	—	—
17.2	XIII[1],14	III[1],8	19	19	24+ 9=33	23+10=33	—	—	—	—
17.4	XIII[1],15	III[1],8	19	19	25+10=35	25+10=35	—	—	—	—
17.4	XIII[1],14	III[1],8	19	19	23+10=33	23+ 9=32	—	—	—	—
17.7	XIII[1],15	III[1],8	19	19	24+ 9=33	24+10=34	—	—	—	—
17.7	XIII[1],15	III[1],8	19	19	24+10=34	24+11=35	—	—	—	—
18.5	XIII[1],14	III[1],8	19	19	23+10=33	24+ 9=33	—	—	—	—
19.0	XIII[1],15	III[1],8	19	19	24+10=34	23+10=33	—	—	—	—
19.2	XIII[1],14	III[1],8	19	19	24+10=34	25+10=35	—	—	—	—
19.2	XIII[1],14	III[1],8	19	19	23+10=33	23+10=33	—	—	—	—
20.7	XIII[1],14	III[1],8	19	19	25+10=35	25+10=35	—	—	—	—
20.7	XIII[1],14	III[1],8	19	19	23+10=33	23+10=33	—	—	—	—
21.0	XIII[1],14	III[1],7	19	19	24+10=34	24+10=34	—	—	—	—
22.9	XIII[1],14	III[1],8	19	19	25+10=35	24+10=34	—	—	—	—
[2]23.2	XIII[1],15	III[1],8	19	19	24+10=34	23+10=33	—	—	—	—
[2]24.0	XIII[1],14	III[1],8	19	19	26+11=37	26+11=37	—	—	—	—
[2]24.0	XIII[1],15	III[1],8	19	19	26+10=36	25+10=35	—	—	—	—
[2]24.6	XIII[1],15	III[1],8	19	19	26+10=36	26+10=36	—	—	—	—
[2]27.9	XIII[1],15	III ,8	19	19	26+11=37	27+11=38	—	—	—	—
[2]30.6	XIII[1],14	III ,7	19	19	25+10=35	25+10=35	—	—	—	—
[3]33.1	XIII ,15	III ,8	19	19	28+11=39	27+11=38	—	—	—	—
[3]33.9	XIII ,16	III ,8	19	19	26+12=38	26+11=37	—	—	—	—
[3]35.2	XIII ,15	III ,8	19	19	25+10=35	26+11=37	—	—	—	—
[3]35.8	XIII ,15	III ,8	19	19	25+11=36	25+11=36	—	—	—	—
[3]38.2	XIII ,15	III ,8	19	19	25+11=36	25+11=36	—	—	—	—
[3]39.2	XIII ,15	III ,8	19	19	26+11=37	26+10=36	—	—	—	—
[3]40.0	XIII ,14	III ,8	19	19	27+12=39	26+11=37	—	—	—	—
[3]41.0	XIII ,14	III ,8	19	19	25+10=35	25+10=35	—	—	—	—
[3]43.8	XIII ,15	III ,8	19	19	26+12=38	27+12=39	—	—	—	—
[3]45.3	XIII ,15	III ,8	19	19	26+11=37	26+11=37	—	—	—	—
[3]48.4	XIII ,14	III ,7	19	19	25+10=35	24+11=35	—	—	—	—
[4]52.5	XIII ,14	III ,8	19	19	26+11=37	26+11=37	50	51	54	53
[4]62.5	XIII ,15	III ,8	19	19	27+11=38	28+11=39	48	49	54	57
[4]67.0	XIII ,15	III ,8	19	19	26+11=37	26+11=37	49	46	55	58
[4]76.1	XIII ,14	III ,7	19	19	25+11=36	24+11=35	46	49	49	55
[4]89.4	XIII ,15	III ,8	19	19	26+11=37	26+11=37	51	51	56	56
[4]97.7	XIII ,14	III ,7	19	19	25+11=36	25+10=35	49	51	57	52
[4]100.9	XIII ,15	III ,8	19	19	26+11=37	26+11=37	50	50	53	52
[4]111.6	XIII ,14	III ,8	19	19	24+10=34	24+10=34	49	53	58	55

[1]Posteriormost dorsal or anal spine appears as a soft ray.
[2]Transforming.
[3]Pelagic juvenile.
[4]Benthic juvenile.

mean parietal spine/HL value. This results from many broken parietal spines on pelagic juveniles as indicated in Tables 4, 5.)

The five spines of the posterior preopercular series are present on specimens of both species by ≈11 or 12 mm. The first spine becomes reduced to a small blunt projection by ≈70 mm. The third spine is always longest but decreases in length from 20 to 2 or 3% HL during development. The second, third, and fourth posterior preopercular spines and the anterior edge of the first spine of the anterior preopercular series are weakly serrated on specimens of *S. flavidus* <17 mm and *S. melanops* <16 mm. Serrations persist on the third posterior preopercular spine of both species to ≈32 mm. The second spine of the anterior series is present occasionally (rarely in *S. melanops*) on one side of the head, particularly on specimens <13 mm. The first and third anterior preopercular spines are visible on specimens <27 and 25 mm (*S. flavidus* and *S. melanops*, respectively), become reduced to small bumps, and are no longer visible on specimens >31 and 29 mm.

The inferior opercular spine forms by ≈11 or 12 mm and is sharp tipped by ≈15 or 16 mm. (Two inferior opercular spines were observed on one

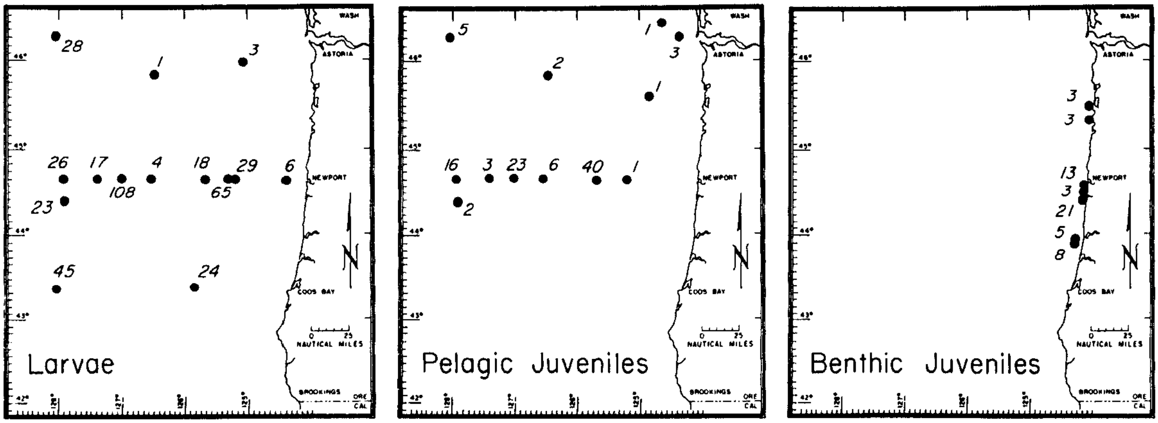

FIGURE 7.—Number of specimens and location of capture of larvae and juveniles of *Sebastes flavidus* off Oregon (1961-78) described in this paper.

side of two specimens of *S. melanops*, 36 and 39 mm long.) The interopercular spine is present on specimens >10 mm and persists as a sharp spine to ≈71 mm on *S. flavidus* and ≈52 mm on *S. melanops*. This spine becomes skin covered and appears as a bump on large specimens.

The ridge anterior to the postocular spine is usually finely serrated on specimens <16 mm in *S. flavidus* and <22 mm in *S. melanops*. Preocular and supraocular spines never develop on either species. The second inferior infraorbital spine is visible as a bump at 10.3 and 11.7 mm on *S. flavidus* and *S. melanops*, respectively, and as a sharp spine by ≈12 mm on both species. A third inferior infraorbital spine appears on both species between 13.5 and 14.5 mm. The second and third inferior spines are reduced to a pair of rounded bony lobes on *S. flavidus* ≈36-67 mm and *S. melanops* 33-50 mm long. *Sebastes flavidus* >67 mm and *S. melanops* >50 mm have a single fleshy lobe which encases the bony lobes. The first superior infraorbital spine is present through the larval periods of both species and becomes reduced and then absent on *S. flavidus* >45 mm and *S. melanops* >38 mm long. The fourth superior infraorbital spine develops by ≈10 mm, is present to ≈45-48 mm, and then is absent in both species. The third superior infraorbital spine appears on *S. flavidus* 15-35 mm and on *S. melanops* 19-33 mm long. A second superior infraorbital spine never develops. The nasal spine appears as a bump between 11 and 12 mm and becomes a sharp spine, between 12 and 13 mm, which persists on all larger specimens of both species.

The tympanic spine never becomes well developed, appearing as a small bump on ≈24-63 mm *S. flavidus* and 30 to ≈40 mm *S. melanops* and as a small spine on larger specimens. The pterotic spine is present on all larvae <24 mm; is usually a bump on specimens 24-41 mm; and is absent on larger specimens. The inferior posttemporal spine is reduced to a bump and then absent on *S. flavidus* >67 mm and *S. melanops* >45 mm. The supracleithral spine and superior posttemporal spine first appear at ≈11 or 12 and ≈19 or 20 mm, respectively, and persist in benthic juveniles. These spines are scale covered on benthic juvenile *S. melanops* >67 mm. The cleithral spine usually appears as a bump at ≈24 mm in *S. flavidus* and at ≈30 mm in *S. melanops*. Specimens >33 mm have a sharp spine which is scale covered in larger juvenile and adult *S. flavidus* and *S. melanops* >67 mm long.

Scale Formation.—Lateral line organs are visible on transforming specimens >14.8 mm in *S. flavidus* and >17.2 mm in *S. melanops*, indicated by a row of light colored spots on the flesh. Developing scales are first visible on unstained specimens ≈23 or 24 mm long in the region above the pectoral fin, near the posttemporal and supracleithral spines, and over the upper two-thirds of the body in the postanal region. The body is scale covered by ≈28 mm.

Pigmentation.—The smallest larvae (10.1 and 10.6 mm) of both *S. flavidus* and *S. melanops* have melanistic pigment on the head over the brain. Melanophores are usually present on the

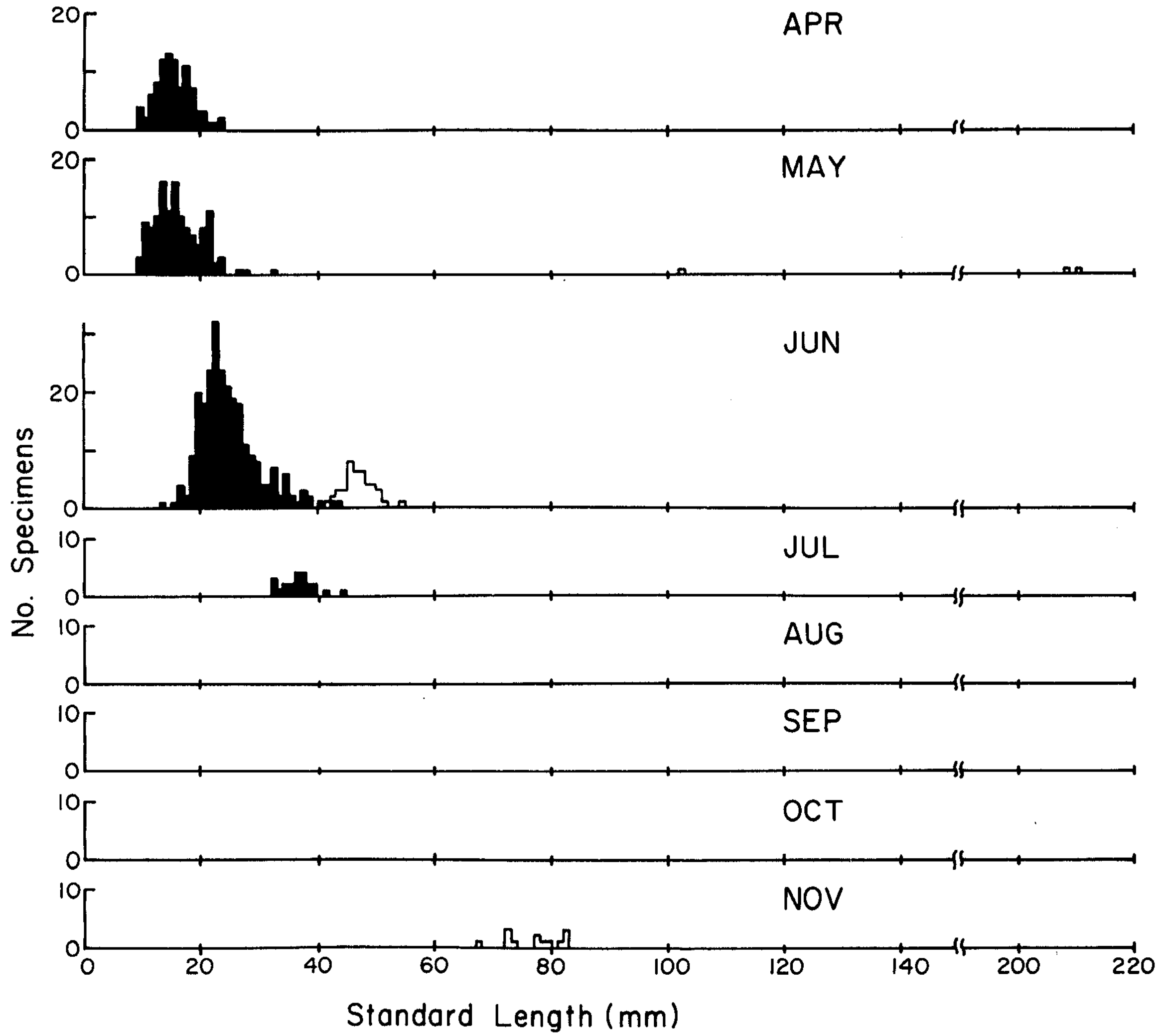

FIGURE 8.—Seasonal occurrence of larvae and juveniles of *Sebastes flavidus* off Oregon. Data from 1961 to 1978 combined. Solid bars indicate pelagic stages, open bars indicate benthic stages.

inside tip of the lower jaw, along the anterior margin of the maxillary, around the pterotic spines, and on the operculum. The 10.6 mm larva of *S. melanops* also has pigment on the snout, along the posteroventral margin of the orbit, on the cheek, and around the posttemporal spine. An internal melanistic shield covers the gut in both species appearing darkest on the dorsal surface. In *S. flavidus* melanophores are present dorsally on the nape, beneath the second dorsal fin, and on the caudal peduncle. In addition to these, *S. melanops* has melanophores beneath the first dorsal fin, possibly due to a more advanced state of development for this specimen. Several melanophores also occur along the posterior portion of the anal fin base and the ventral margin of the caudal peduncle in both species. Internal and external melanophores are present near the midline of the caudal peduncle and several melanophores are at the margin of the hypural elements. The pectoral and pelvic fin blades are moderately pigmented with expanded, elongated melanophores. The inner side of the pectoral base is also pigmented. A discrete melanophore is pres-

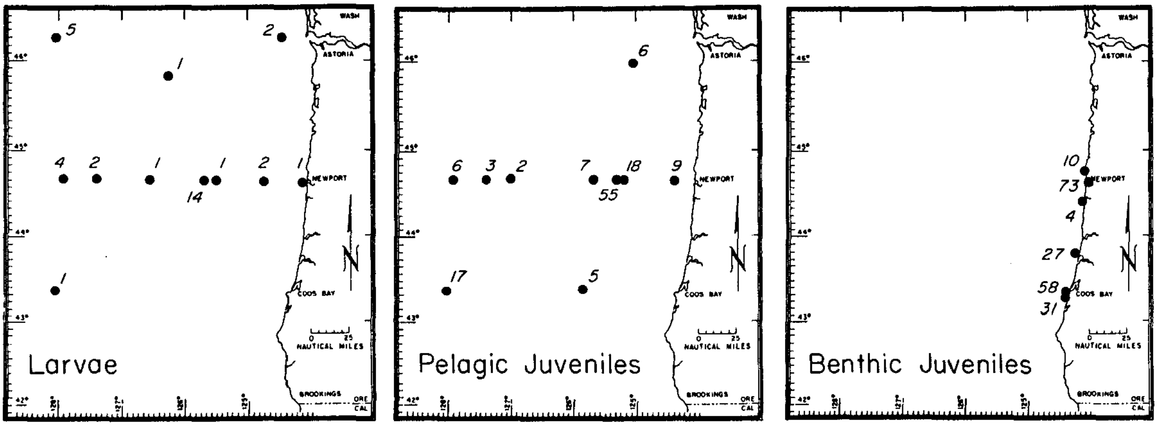

FIGURE 9.—Number of specimens and location of capture of larvae and juveniles of *Sebastes melanops* off Oregon (1961-78) described in this paper.

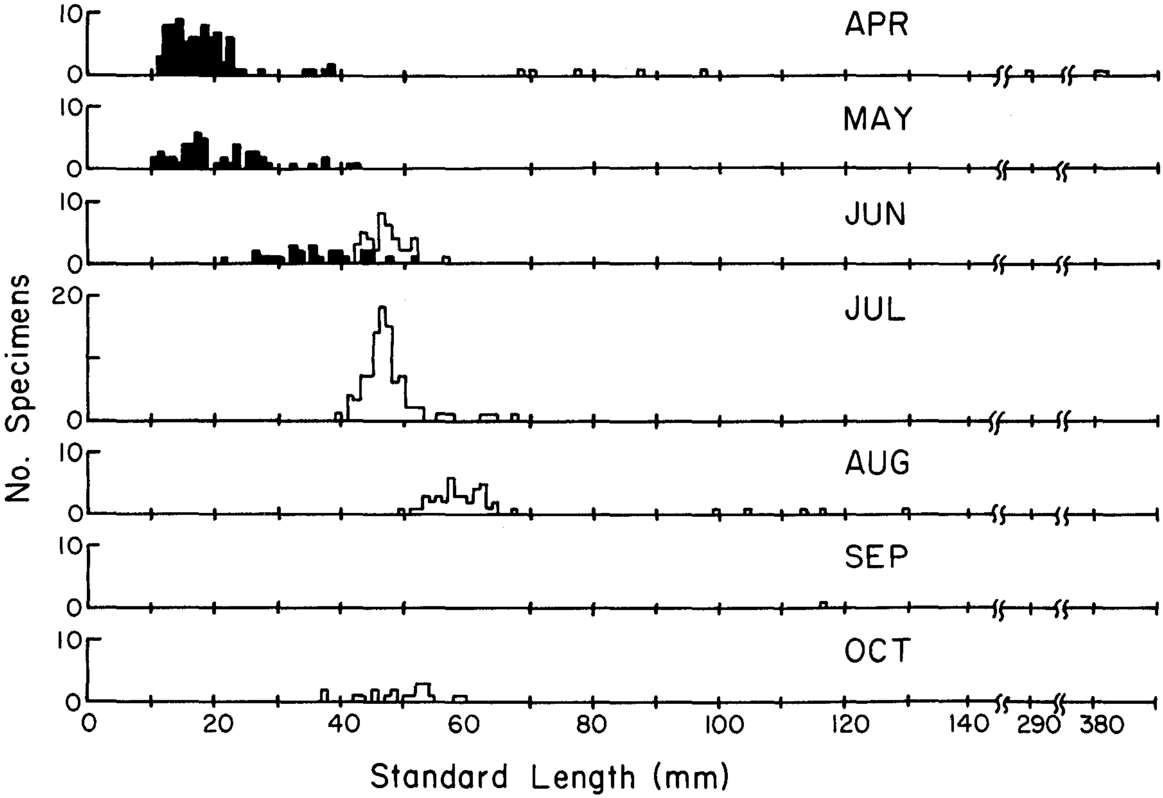

FIGURE 10.—Seasonal occurrence of larvae and juveniles of *Sebastes melanops* off Oregon. Data from 1961 to 1978 combined. Solid bars indicate pelagic stages, open bars indicate benthic stages.

ent at the articulation of each of several dorsal and anal fin rays (more in the 10.6 mm *S. melanops* than in the 10.1 mm *S. flavidus*).

As larvae develop, pigment increases over the brain. Melanophores are added on the snout, interorbital region, tips of the upper and lower lips,

TABLE 4.—Measurements (millimeters) of larvae and juveniles of *Sebastes flavidus* from waters off Oregon.

Standard length	Total length	Snout to anus length	Head length	Snout length	Upper jaw length	Eye diameter	Interorbital distance	Body depth at pectoral fin base	Body depth at anus	Caudal peduncle depth	Dorsal to hypural distance	Pectoral fin length	Pectoral fin base depth	Pelvic spine length	Pelvic fin length	Snout to pelvic fin origin	Parietal spine length	Nuchal spine length	Preopercular spine length	Angle gill raker length	Longest dorsal spine length[1]	Longest dorsal ray length[2]	Longest anal spine length[3]
10.1	12.5	5.5	4.0	1.2	1.7	—	1.1	3.0	2.2	1.1	1.7	1.6	1.1	0.64	0.90	3.9	0.44	—	1.08	—	0.20	0.76	([4])
10.3	13.3	6.3	4.4	1.3	1.9	1.5	1.3	3.1	2.3	1.3	1.6	2.1	1.0	0.83	1.2	4.4	0.50	0.02	—	—	0.57	1.2	0.52
10.7	13.7	5.9	4.3	1.2	1.9	1.4	1.3	3.2	2.4	1.2	1.8	2.0	1.0	0.78	1.1	4.2	0.34	0.04	0.96	—	0.56	1.3	0.48
11.4	14.6	6.6	4.6	1.2	2.0	1.6	1.4	3.4	2.7	1.4	1.8	2.4	1.1	1.1	1.4	4.6	0.44	0.04	0.96	—	0.68	1.2	0.64
11.8	15.0	6.8	4.7	1.2	2.0	1.6	1.4	3.5	2.6	1.4	1.7	1.9	1.1	1.1	1.5	4.7	0.49	—	1.00	—	0.70	1.2	1.00
11.8	15.2	7.1	4.8	1.4	2.1	1.7	1.4	3.5	2.8	1.4	1.7	2.3	1.1	1.3	1.8	4.8	0.53	0.06	—	—	—	—	—
11.9	15.1	6.6	4.7	1.3	1.9	1.5	1.5	3.5	2.5	1.4	1.8	2.2	1.1	0.98	1.4	4.3	0.54	0.04	—	—	0.64	1.3	0.52
12.0	15.0	6.7	4.9	1.3	2.0	1.5	1.5	3.7	2.9	1.5	2.0	2.4	1.0	1.2	1.6	4.6	0.43	0.14	0.98	—	0.76	1.4	0.66
12.2	15.8	6.9	4.8	1.3	2.0	1.7	1.5	3.6	2.8	1.5	1.8	2.4	1.1	1.2	1.6	4.6	0.49	0.05	0.92	—	0.90	1.4	0.92
12.7	—	6.8	5.1	1.4	—	1.7	1.5	3.4	2.8	1.4	1.7	2.4	1.1	1.3	1.6	5.1	0.43	0.07	—	0.54	0.86	1.4	—
12.8	16.3	7.2	5.0	1.3	2.1	1.7	1.5	3.7	2.8	1.5	1.9	2.4	1.1	1.2	1.6	4.8	0.43	0.06	1.04	0.64	0.84	1.3	1.04
12.9	16.6	7.3	4.9	1.5	2.2	1.6	1.5	3.8	3.0	1.5	2.1	2.7	1.1	1.2	1.7	4.9	0.58	0.06	1.17	0.53	0.88	1.5	1.17
13.1	16.7	7.6	4.9	1.4	2.1	1.6	1.5	3.8	3.0	1.5	2.0	2.5	1.1	1.3	1.7	5.0	—	([5])	1.00	0.44	0.83	1.5	1.00
13.7	17.5	7.8	5.3	1.6	2.1	1.6	1.6	4.0	3.2	1.6	2.1	2.8	1.2	1.4	1.9	5.0	0.46	0.17	1.10	0.68	0.96	1.6	1.10
14.4	18.1	8.4	5.3	1.5	—	1.7	1.5	4.0	3.2	1.5	2.0	2.6	1.2	1.4	1.6	5.6	0.53	0.16	1.15	0.58	0.96	1.6	1.15
14.8	—	8.8	5.9	1.5	2.3	1.8	1.7	4.0	3.2	1.6	2.3	3.2	1.2	—	2.1	5.6	—	0.18	—	0.68	1.2	1.8	—
15.8	20.0	8.8	5.9	1.7	2.4	1.6	1.6	4.0	3.3	1.7	2.6	3.0	1.2	1.2	1.9	5.8	—	—	—	0.70	0.96	1.8	0.64
15.9	20.0	9.2	6.1	1.7	2.6	1.8	1.7	4.6	3.8	1.9	2.6	3.4	1.3	1.9	2.5	6.0	0.60	0.20	1.22	0.66	1.4	2.0	1.2
16.4	20.7	9.6	6.1	1.7	2.8	2.0	1.7	4.2	3.6	1.8	2.7	3.4	1.3	2.2	2.4	5.9	0.50	0.18	—	0.78	1.6	1.8	1.3
16.8	21.7	9.8	6.3	1.7	2.7	2.0	1.7	4.8	3.9	1.9	2.6	3.8	1.4	—	2.5	6.3	0.54	—	—	0.80	1.8	2.4	—
18.9	24.0	10.7	6.7	1.8	2.8	2.0	1.9	4.8	3.9	2.1	2.9	3.7	1.4	—	2.6	6.5	0.49	0.18	—	0.80	—	2.2	—
19.5	25.1	11.5	7.2	1.8	3.1	2.3	2.0	5.1	4.2	2.0	3.0	4.4	1.4	2.8	3.1	7.3	0.38	—	1.16	1.00	2.1	2.7	1.6
19.8	25.6	11.5	7.1	1.7	3.2	2.3	1.9	5.4	4.2	2.1	3.2	4.5	1.6	3.1	3.3	7.6	0.40	0.28	1.26	1.00	2.3	2.6	1.8
20.5	26.1	11.5	7.6	1.9	3.4	2.3	2.0	5.4	4.4	2.2	3.2	4.6	1.5	3.0	3.2	7.3	0.32	0.22	1.23	0.90	2.3	2.7	2.0
21.3	26.3	12.5	8.0	2.1	3.2	2.4	2.0	5.6	4.5	2.2	3.3	4.8	1.6	2.7	3.1	7.8	—	0.16	—	1.16	—	2.7	—
22.3	28.3	12.9	8.1	2.2	3.6	2.4	2.1	5.8	4.9	2.3	3.4	5.0	1.6	—	3.1	7.9	0.44	0.26	1.04	1.10	2.3	3.0	2.0
[6]23.6	—	14.1	8.4	2.2	3.5	2.5	2.2	5.7	4.8	2.4	3.7	5.4	1.6	3.4	3.8	8.5	—	0.22	1.34	1.17	2.7	3.3	2.3
[6]23.7	—	13.7	8.4	2.2	3.7	2.5	2.1	5.6	4.9	2.3	3.6	5.1	1.7	3.2	3.7	8.5	—	—	1.18	1.18	2.6	3.0	2.2
[6]24.2	30.7	14.0	8.7	2.3	3.5	2.5	2.1	6.2	4.9	2.4	3.7	5.6	1.7	3.7	3.8	8.6	0.30	0.16	1.20	1.24	3.0	3.3	2.5
[6]24.8	31.4	15.0	8.8	2.3	3.3	2.5	2.2	6.1	5.0	2.5	3.6	5.5	1.8	3.4	4.0	9.0	—	0.20	1.02	1.42	3.0	3.1	2.4
[6]25.6	31.5	15.4	9.0	2.3	3.6	2.6	2.2	6.3	5.1	2.4	4.0	5.7	1.8	3.4	3.8	9.4	0.42	—	1.04	1.3	3.1	—	2.3
[6]26.6	31.7	15.3	9.0	2.4	3.8	2.5	2.2	6.4	5.1	2.4	3.8	5.7	1.8	3.4	4.1	9.4	0.34	0.18	0.90	1.4	2.8	3.3	2.0
[6]26.7	32.9	15.8	9.0	2.4	3.4	2.6	2.2	6.6	5.2	2.5	4.1	6.5	1.8	3.4	3.9	9.5	—	0.18	—	1.3	2.9	3.2	—
[7]28.5	36.2	17.4	10.3	3.0	4.3	2.9	2.6	6.9	6.0	2.8	4.2	—	2.0	4.4	4.9	10.6	0.18	—	1.34	1.2	3.5	4.0	2.7
[7]29.2	36.0	17.4	10.2	2.8	4.0	2.7	2.6	7.1	5.9	2.8	4.2	—	1.9	3.8	—	10.4	—	0.24	—	1.4	—	—	2.8
[7]29.6	37.0	17.5	9.8	2.6	4.2	2.8	2.5	6.9	5.9	2.9	4.4	—	1.8	—	4.8	10.5	—	—	—	1.4	3.3	3.9	3.1
[7]30.4	—	18.4	10.5	2.6	4.4	2.7	2.6	7.6	6.5	3.0	5.4	7.6	2.3	—	5.4	11.0	—	0.24	—	1.7	3.8	—	3.2
[7]33.0	41.3	19.8	10.6	2.7	4.4	2.9	2.8	7.8	6.6	3.1	5.0	8.1	2.3	4.7	5.1	12.1	—	0.12	1.24	1.6	3.8	4.7	3.3
[7]33.1	—	19.7	10.7	2.6	4.5	3.1	3.0	7.9	7.3	3.2	5.0	—	2.3	4.6	5.5	12.0	—	—	1.18	1.6	4.2	—	3.6
[7]35.2	44.3	21.4	11.7	2.7	5.1	3.4	3.0	9.0	7.5	3.3	5.2	8.6	2.6	4.9	5.3	12.5	—	—	1.24	1.6	4.2	4.7	—
[7]36.4	45.5	21.4	12.4	3.0	5.1	3.2	2.9	9.1	7.6	3.5	6.0	8.9	2.5	4.9	6.2	13.2	0.10	([5])	1.08	1.8	4.3	4.6	3.9
[7]37.6	45.9	22.4	12.0	3.1	5.1	3.2	2.8	10.1	8.8	3.9	5.3	9.3	2.8	—	6.1	13.4	([5])	—	1.16	1.7	4.2	4.6	—
[7]41.9	51.8	26.1	14.4	3.9	6.0	3.7	3.4	10.9	8.9	3.9	6.0	10.5	2.7	5.7	6.2	15.8	0.10	—	1.12	2.2	4.9	5.7	4.6
[7]43.6	—	26.6	14.2	3.7	6.3	3.7	3.5	11.2	9.5	4.2	6.3	10.5	3.2	5.5	7.1	15.4	0.10	—	1.30	2.0	—	—	4.7
[7]45.2	55.6	27.7	14.4	3.4	6.2	3.9	3.5	11.0	9.9	4.4	6.7	11.0	3.2	5.7	7.6	16.4	([5])	—	1.40	2.2	4.9	6.6	4.1
[8]67.6	79.3	42.4	22.7	7.2	9.7	6.7	5.0	19.2	15.9	6.9	9.8	16.0	5.9	—	13.4	27.8	0.14	—	1.08	3.5	8.2	9.3	7.9
[8]71.5	85.7	44.5	24.9	5.7	10.2	6.5	5.4	22.1	18.5	7.5	9.0	18.4	6.0	8.4	13.7	26.9	([5])	—	0.72	4.0	8.8	10.8	8.5
[8]72.5	88.9	45.4	25.4	8.3	11.5	6.7	5.5	22.0	18.2	8.0	9.5	17.5	6.3	8.2	14.0	27.0	([5])	—	0.60	3.7	8.7	11.7	9.1
[8]77.5	94.5	48.8	25.9	7.0	10.4	7.0	5.8	22.7	20.4	8.1	10.7	18.2	6.4	9.5	15.0	29.5	([5])	—	0.96	3.9	9.5	11.5	8.4
[8]81.0	98.9	53.1	29.0	8.7	11.4	7.0	6.2	25.1	21.4	8.7	9.7	19.9	6.3	10.7	16.5	33.3	([5])	—	1.00	4.2	9.2	11.7	9.9
[8]105.0	125.8	66.1	35.3	10.0	16.4	9.7	8.5	31.8	27.4	10.4	13.7	22.9	9.0	12.7	20.0	45.1	—	—	0.92	5.1	11.9	16.0	12.5

[1]Usually fourth or fifth in larvae, fifth or sixth in juveniles.
[2]Usually in anterior one-fourth of fin.
[3]The second spine in larvae, the third spine in juveniles.
[4]Forming.
[5]Bump.
[6]Transforming.
[7]Pelagic juvenile.
[8]Benthic juvenile.

along the maxillary, and on the cheek and operculum. Pigment increases around the orbit (eventually lining it), and around the posttemporal spine, extending anteriorly over the head. Melanophores line the anterior margin of the cleithrum beneath the operculum.

Pigment on the gut becomes less intense as body musculature increases. The dorsal body surface is pigmented from nape to caudal peduncle in both species by 11 mm. Large stellate melanophores beneath the soft dorsal fin increase in number and are aligned along the muscles surrounding the dorsal pterygiophores, sometimes appearing as lines of pigment. This is the densest pigmentation on larvae. Internal and external melanophores are added along the body midline anteriorly from the caudal peduncle forming a line along the notochord which extends to the head by ≈14 or 15 mm. Melanophores extend ventrolaterally from the nape to the lateral midline by ≈14-16 mm and are added posteriorly along the dorsolateral body surface with development. Initially these melanophores appear along the myosepta, but this pattern becomes obscured as

TABLE 5.—Measurements (millimeters) of larvae and juveniles of *Sebastes melanops* from waters off Oregon.

Standard length	Total length	Snout to anus length	Head length	Snout length	Upper jaw length	Eye diameter	Interorbital distance	Body depth at pectoral fin base	Body depth at anus	Caudal peduncle depth	Dorsal to hypural distance	Pectoral fin length	Pectoral fin base depth	Pelvic spine length	Pelvic fin length	Snout to pelvic fin origin	Parietal spine length	Nuchal spine length	Preopercular spine length	Angle gill raker length	Longest dorsal spine length[1]	Longest dorsal ray length[2]	Longest anal spine length[3]
10.6	13.7	6.1	4.4	1.2	1.9	1.5	1.2	3.2	2.5	1.4	1.7	2.0	1.0	1.0	1.5	4.2	0.50	[4]	—	—	0.69	1.10	0.58
11.7	15.0	6.8	4.8	1.2	—	1.5	1.4	3.6	3.0	1.6	1.9	2.3	1.1	1.2	1.5	4.7	0.50	[4]	1.02	0.35	0.74	1.34	0.70
11.9	15.4	7.4	5.1	1.3	2.1	1.6	1.5	3.8	3.1	1.7	1.8	2.4	1.2	1.3	1.6	4.9	—	[4]	—	0.48	0.86	1.28	0.64
11.9	15.2	6.9	4.6	1.3	2.1	1.5	1.4	3.7	2.9	1.6	1.8	2.2	1.2	1.1	1.5	4.7	0.44	[4]	—	0.42	0.70	1.30	0.52
12.4	16.4	7.3	4.9	1.3	2.1	1.5	1.6	4.0	3.2	1.7	1.9	2.8	1.2	1.5	1.8	4.6	—	0.04	—	0.48	0.96	1.56	0.78
12.8	16.9	7.7	5.2	1.3	2.3	1.7	1.5	4.0	3.3	1.8	1.7	2.9	1.2	1.5	1.9	4.9	0.58	0.04	1.40	0.50	1.20	1.68	0.90
12.8	16.7	7.6	5.1	1.4	2.1	1.6	1.5	4.2	3.3	1.8	1.8	2.7	1.2	1.4	1.9	4.9	0.46	0.03	1.20	0.46	0.94	1.60	0.84
12.8	16.8	7.6	5.1	1.6	2.2	1.6	1.6	4.1	3.2	1.8	1.8	2.8	1.2	1.4	1.8	4.9	0.52	0.04	1.24	0.49	0.90	1.80	0.78
13.5	—	7.8	5.4	1.4	2.4	1.6	1.7	4.4	3.5	1.9	1.9	2.9	1.3	1.5	2.1	4.9	0.40	0.04	1.14	0.56	—	1.40	0.98
13.6	17.4	8.4	5.4	1.4	2.3	1.7	1.7	4.2	3.4	1.8	2.2	3.0	1.3	1.8	2.3	4.9	—	0.02	1.26	0.58	1.22	1.60	1.00
13.9	17.7	8.2	5.6	1.7	2.4	1.8	1.7	4.2	3.5	1.8	2.1	2.8	1.2	1.7	2.0	5.3	0.54	0.06	1.30	0.58	1.08	1.66	0.84
14.0	18.6	8.4	5.6	1.7	2.5	1.8	1.7	4.3	3.6	2.0	2.1	3.1	1.3	1.8	2.1	6.0	0.52	0.06	1.24	0.57	1.24	2.02	1.00
14.9	19.9	8.8	6.1	1.7	2.6	1.8	1.8	4.5	3.8	1.8	2.2	3.1	1.4	2.0	2.4	5.9	0.52	0.08	1.36	0.70	1.46	2.10	1.06
15.4	19.5	9.5	6.0	1.7	2.5	1.8	1.7	4.6	3.7	2.0	2.2	3.0	1.4	1.9	2.4	6.3	0.44	0.08	1.20	0.68	1.24	2.16	1.08
15.4	—	9.2	6.0	1.7	2.4	1.8	1.7	4.6	3.6	2.0	2.4	3.3	1.4	2.0	2.3	6.3	0.34	0.10	1.18	0.67	—	1.92	—
15.7	20.6	9.4	5.8	1.7	2.5	1.9	1.8	4.5	3.7	1.9	2.3	3.3	1.3	2.0	2.4	6.1	—	[4]	1.20	0.56	1.14	1.80	1.12
15.9	20.5	9.6	6.0	1.7	2.4	1.8	1.9	4.7	3.8	2.0	2.2	3.4	1.4	—	2.4	6.4	—	[4]	1.16	0.64	1.52	—	—
16.4	21.1	9.5	6.5	1.7	2.7	2.0	1.7	4.6	3.8	2.0	2.3	—	1.4	2.3	2.6	6.1	0.48	0.20	1.03	0.78	1.76	—	1.28
16.5	21.6	9.2	6.0	1.7	2.9	2.0	1.8	4.9	4.2	2.1	2.5	3.6	1.4	2.3	2.5	6.1	0.38	0.08	1.34	0.74	1.70	2.30	1.48
17.2	22.1	9.6	6.6	1.9	2.7	2.0	1.8	4.9	4.0	2.2	2.5	3.7	1.4	2.3	2.5	6.9	0.46	[4]	1.17	0.76	1.68	2.20	1.38
17.4	22.4	9.4	6.3	1.7	2.4	2.0	1.9	5.2	4.3	2.2	2.5	4.0	1.6	2.6	2.8	7.0	—	[4]	1.20	0.80	1.86	2.20	1.46
17.4	22.0	10.0	6.6	1.8	2.8	1.9	2.0	4.9	4.1	2.1	2.6	4.1	1.5	2.5	2.8	6.5	—	0.08	1.20	0.89	—	2.32	1.40
17.7	23.1	9.9	6.3	1.7	2.5	2.1	2.0	5.2	4.6	2.3	2.6	4.2	1.6	2.1	2.8	6.6	0.46	0.10	—	0.78	1.60	2.30	1.30
17.7	22.0	10.2	6.6	1.9	2.8	2.1	1.9	5.1	4.0	2.1	2.4	3.9	1.5	2.5	2.8	6.6	0.56	[4]	1.10	0.70	1.76	2.16	1.46
18.5	23.4	10.6	7.0	1.9	3.0	2.1	2.0	5.1	4.2	2.3	2.4	4.2	1.6	2.4	3.0	7.0	—	—	1.30	0.94	1.98	2.50	1.64
19.0	—	10.6	6.9	2.0	2.8	2.1	2.0	5.5	4.5	2.2	2.7	4.5	1.5	2.5	3.2	6.8	—	0.22	1.12	0.72	1.90	—	1.56
19.2	24.7	10.9	7.2	1.9	3.0	2.2	2.0	5.2	4.5	2.3	2.7	4.7	1.6	2.8	3.3	7.6	0.53	0.20	1.27	0.86	2.10	2.40	—
19.2	24.4	10.8	7.5	1.9	3.0	2.2	1.8	5.1	4.5	2.2	2.4	4.3	1.5	2.6	3.0	7.0	0.44	0.22	1.10	0.76	1.84	2.38	1.66
20.7	25.8	11.4	7.6	2.1	3.2	2.2	2.0	5.8	5.0	2.5	3.0	4.7	1.6	3.0	3.4	8.4	0.32	0.16	1.10	0.90	2.26	2.68	—
20.7	25.9	12.0	7.2	2.1	3.1	2.2	2.0	5.8	4.7	2.5	2.8	4.7	1.7	2.8	3.6	8.3	0.36	0.18	1.26	0.80	2.30	—	—
21.0	25.9	12.3	7.8	2.3	3.1	2.1	2.0	6.1	4.9	2.5	2.9	4.4	1.7	3.1	3.4	8.8	—	—	1.22	0.90	2.40	—	2.0
22.9	27.8	12.3	8.3	2.3	3.1	2.3	2.1	6.1	5.0	2.6	3.5	4.8	1.8	2.9	3.8	8.9	—	—	1.21	1.02	2.60	3.00	2.1
[5]23.2	—	12.9	8.3	2.1	3.4	2.5	2.2	6.1	5.2	2.7	3.2	5.2	1.8	2.4	3.8	8.3	0.50	0.17	—	0.90	2.28	3.10	2.0
[5]24.0	—	13.4	8.6	2.4	3.6	2.4	2.3	6.1	5.2	2.8	3.4	5.9	1.8	2.9	4.0	8.6	0.46	—	1.24	0.96	—	3.00	—
[5]24.0	30.6	13.4	8.5	2.2	3.6	2.6	2.2	6.6	5.6	2.8	3.5	5.6	1.9	2.6	4.0	9.0	—	0.20	1.06	0.90	—	3.00	2.3
[5]24.6	—	15.4	9.3	2.6	3.5	2.6	2.3	6.6	5.4	2.7	3.5	5.6	1.9	—	—	10.2	—	[4]	1.10	1.01	—	—	—
[5]27.9	—	16.7	8.9	2.3	3.7	2.7	2.4	7.2	6.0	3.0	4.0	6.6	2.1	—	4.5	9.7	0.52	—	1.26	1.20	—	—	2.8
[5]30.6	39.4	18.5	10.4	2.7	4.4	2.7	2.6	7.7	6.4	3.2	4.4	7.8	2.4	—	5.0	11.9	—	0.30	1.40	1.56	—	4.2	3.4
[6]33.1	—	20.2	11.7	3.1	4.6	2.9	2.7	8.6	7.3	3.4	4.8	8.3	2.6	4.8	5.6	12.1	—	—	1.28	1.64	4.1	4.5	3.5
[6]33.9	42.1	21.0	11.9	3.5	4.9	3.1	2.8	9.0	7.5	3.5	4.8	8.3	2.6	5.0	5.8	13.4	[4]	—	—	1.56	4.2	—	3.8
[6]35.2	43.8	20.9	11.7	2.8	4.9	3.2	2.9	8.7	7.5	3.6	4.8	8.4	2.7	4.9	5.9	12.4	[4]	—	—	1.64	4.6	4.6	4.0
[6]35.8	44.3	21.7	11.4	2.8	5.0	3.3	2.9	9.3	7.9	3.6	4.7	8.9	2.8	5.1	6.3	12.6	0.08	—	1.24	1.68	4.5	4.9	3.7
[6]38.2	48.2	23.4	12.8	3.2	5.1	3.2	3.1	10.1	8.4	4.0	5.2	9.4	2.9	5.3	6.6	14.0	0.20	—	1.24	1.72	4.6	4.9	4.2
[6]39.2	49.0	23.3	12.2	3.2	4.9	3.3	3.2	9.8	8.2	3.8	5.3	9.3	3.0	5.6	7.1	14.0	[4]	—	—	1.96	4.8	5.0	4.1
[6]40.0	—	24.0	12.9	3.5	5.7	3.4	3.2	10.3	9.0	4.2	5.8	9.5	3.2	5.8	7.3	14.3	0.16	—	1.30	1.76	—	—	3.9
[6]41.0	—	25.4	13.0	3.4	5.3	3.6	3.3	10.9	9.2	4.3	6.1	9.2	3.2	5.7	7.3	14.9	[4]	—	—	2.06	—	—	4.9
[6]43.8	53.9	27.2	15.0	4.5	6.3	3.6	3.4	11.7	10.0	4.6	6.3	10.1	3.4	5.6	7.4	16.0	0.20	—	1.26	2.00	5.0	—	4.3
[6]45.3	55.7	27.9	15.4	4.3	6.6	4.2	3.7	11.9	10.7	4.7	5.8	11.4	3.6	6.1	8.4	17.0	0.18	—	1.48	2.12	5.5	6.2	4.8
[6]48.4	59.6	31.6	16.7	5.0	6.6	4.2	3.7	12.2	10.9	4.8	6.9	12.1	3.8	6.5	8.5	19.4	0.28	—	1.48	2.18	—	6.7	5.5
[7]52.5	64.1	37.1	17.2	4.2	7.3	4.6	4.5	15.4	13.3	6.1	7.0	13.2	4.9	6.5	10.5	20.0	—	—	0.78	2.72	6.5	8.3	6.1
[7]62.5	75.6	37.5	20.2	4.8	8.9	5.0	5.3	16.9	16.0	7.0	8.4	14.5	5.9	6.7	12.0	23.0	—	—	0.32	3.20	7.4	8.3	6.5
[7]67.0	80.8	41.6	22.4	5.2	10.4	5.4	5.4	21.2	18.2	7.8	8.9	15.7	6.5	7.8	12.5	23.7	—	—	0.10	3.28	7.6	10.3	7.0
[7]76.1	93.3	48.0	27.9	6.3	13.4	7.3	5.9	23.7	20.0	8.4	9.5	20.7	7.2	9.5	15.9	31.8	—	—	0.52	3.92	9.8	12.9	9.9
[7]89.4	110.3	56.5	31.0	8.2	15.0	8.9	7.5	28.1	24.0	9.9	10.4	22.9	8.4	12.0	19.7	37.1	—	—	0.83	4.81	11.0	14.0	11.0
[7]97.7	118.5	58.0	36.4	8.5	15.9	9.0	7.7	30.4	25.5	10.9	12.4	22.4	8.3	12.5	19.9	37.2	—	—	0.88	5.15	12.4	16.7	12.9
[7]100.9	123.0	63.0	36.1	7.2	16.4	9.5	8.4	33.3	27.6	11.4	12.5	26.4	9.5	14.0	23.2	38.0	—	—	0.80	5.31	13.0	17.5	13.4
[7]111.6	135.5	70.0	39.4	8.4	17.0	9.2	8.9	36.5	30.0	12.4	13.2	26.7	10.9	15.5	24.0	39.9	—	—	1.00	5.73	13.5	18.7	14.0

[1]Usually fourth of fifth in larvae, fifth or sixth in juveniles.
[2]Usually in anterior one-fourth of fin.
[3]The second spine in larvae, the third spine in juveniles.
[4]Bump.
[5]Transforming.
[6]Pelagic juvenile.
[7]Benthic juvenile.

melanophores are added between myosepta, particularly along the dorsal one-fourth of the body. Some melanophores remain visible along the ventral margin of the caudal peduncle although they eventually become internal and obscured by tissues. Melanophores are added along the base of the anal fin. Discrete melanophores are added at the articulation of dorsal and anal fin rays and spines until most of them have a melanophore. Melanophores are added along the caudal fin base, often appearing as a line, and onto the fin membrane. Pigment decreases on the pectoral and pelvic fins and is usually absent on larvae by ≈16-20 mm.

During the transformation period, ≈23-27 mm in *S. flavidus* and ≈23-31 mm in *S. melanops,* pigment gradually increases over the head and body. Melanophores are added on the lips, lower jaw, snout, and dorsolateral areas of the head. Pigment becomes continuous around the orbit. Melanophores are added ventrolaterally beneath the midline band and increase along the ventral body surface above the anal fin.

Pelagic juveniles, ≈28-56 mm in *S. flavidus* and ≈33-52 mm in *S. melanops,* undergo a general increase in pigment with development. The upper head, snout, lips, lower jaw, maxillary, cheek, and gular region become increasingly pigmented with small melanophores. Opercular pigmentation appears less distinct due to scale covering at ≈33 mm. On the side of the body, melanophores are added ventrolaterally until all but the ventral one-eighth is pigmented. Small melanophores increase in number along the ventral surface of the caudal peduncle. Melanophores are added anteriorly and proximally on the first dorsal fin and are eventually scattered over it. A dark blotch develops in the posterior portion of the spinous dorsal fin by ≈35 mm and persists on all larger pelagic juveniles. Melanophores are added to the proximal half of the soft dorsal fin. A few scattered melanophores are added to the pectoral fin and proximal half of the caudal fin. Pigment distinctly lines the caudal fin base.

Benthic juveniles, >60 mm, have essentially the same melanistic pigment pattern as the largest pelagic juveniles. Pigmentation at the anterior tips of the lips and along the ventral edge of the maxillary intensifies and a dark bar extends from the posteroventral margin of the eye across the cheek. In *S. melanops* a second dark bar forms dorsal to the first and extends from the eye across the opercle becoming distinct by 76 mm. Melanophores appear on patches of scales covering the dorsal half of the body in both species. These patches overlie the pigment described for pelagic juveniles creating darker patches with lighter areas interspersed where pigmentless scales overlie pigmented areas. The dorsal half of the body has a mottled appearance as a result of this. Melanophores first appear on the pectoral fin base of *S. flavidus* in a patch which extends onto the fin membrane and on the underside of the fin base. Later, additional small melanophores lightly cover the pectoral, anal, and caudal fins while only a few small melanophores appear on the pelvic fin. Benthic juvenile *S. melanops* have melanophores covering all fins, however, the distal margins of those in smaller specimens are usually pigmentless. Although already covered by melanophores, the pectoral fin in small benthic (<63 mm) *S. melanops* has a patch of large melanophores which spread over the dorsal half of the pectoral ray bases and adjacent fin base in the same area which first appears pigmented on the pectoral fin of *S. flavidus*. The spinous dorsal fin, anterior to the black blotch, appears mottled in *S. melanops*. On the soft dorsal fin a more lightly pigmented bar runs through the proximal third of the fin. This bar becomes faint or indistinguishable on specimens >67 mm long. Previously described pelagic juvenile body pigment along the anal fin base, at the articulation of the anal fin rays, and on the caudal peduncle becomes completely obscured by scales and tissues on both species, and small melanophores on the scales are alone visible. In general benthic juvenile *S. flavidus* are more lightly pigmented than *S. melanops* taken over similar substrate, however, the pigment patterns are very similar.

Color of Fresh Specimens.—Yellow chromatophores are visible interspersed with melanophores over all body surfaces on pelagic and benthic juveniles of both *S. flavidus* and *S. melanops*. In *S. melanops* they are not numerous enough to give the fish a distinctly yellow cast. The concentration of yellow chromatophores is generally greatest in the areas where melanistic pigment is densest, e.g., the base of the caudal fin, the pigment bar radiating from the posteroventral margin of the eye, darker areas on fins. Yellow pigment is not concentrated around the dorsal fin black blotch. Juveniles generally appear darkly mottled with faintly yellow fins, yellowish areas on the head and body, and cream colored ventrally. However, considerable variation in the intensity of the melanistic pigment of benthic juveniles may occur seemingly dependent upon bottom substrate. When melanistic pigment is less intense, yellow pigment is more outstanding. The yellow tail,

TABLE 6.—Development of spines in the head region of *Sebastes flavidus* larvae and juveniles. + denotes spine present and − denotes spine absent.

Standard length (mm)	Parietal	Nuchal	Preopercular (anterior series)			Preopercular (posterior series)					Opercular		Inter-oper-cular	Sub-oper-cular	Pre-ocular	Supra-ocular	Post-ocular
			1st	2d	3d	1st	2d	3d	4th	5th	Superior	Inferior					
10.1	+	+	+	−	+	+	+	+	+	−	+	−	(1)	−	−	−	+
10.3	+	+	+	−	+	+	+	+	+	+	+	−	+	−	−	−	+
10.7	+	+	+	+	+	+	+	+	+	−	+	−	+	−	−	−	+
11.4	+	+	+	+	+	+	+	+	+	(1)	+	−	+	−	−	−	+
11.8	+	−	+	−	+	+	+	+	+	+	+	−	+	−	−	−	+
11.8	+	+	+	−	+	+	+	+	+	(1)	+	−	+	−	−	−	+
11.9	+	+	+	+	+	+	+	+	+	+	+	(1)	+	−	−	−	+
12.0	+	+	+	+	+	+	+	+	+	+	+	(1)	+	−	−	−	+
12.2	+	+	+	−	+	+	+	+	+	+	+	(1)	+	−	−	−	+
12.7	+	+	+	−	+	+	+	+	+	+	+	−	+	−	−	−	+
12.8	+	+	+	+	+	+	+	+	+	+	+	(1)	+	−	−	−	+
12.9	+	+	+	−	+	+	+	+	+	+	+	−	+	−	−	−	+
13.1	+	(1)	+	−	+	+	+	+	+	+	+	(1)	+	−	−	−	+
13.7	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
14.4	+	+	+	−	+	+	+	+	+	+	+	−	+	−	−	−	+
14.8	+	+	+	−	+	+	+	+	+	+	+	(1)	+	−	−	−	+
15.8	+	+	+	−	+	+	+	+	+	+	+	(1)	+	−	−	−	+
15.9	+	−	+	−	+	+	+	+	+	+	+	(1)	+	−	−	−	+
16.4	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
16.8	+	+	+	−	+	+	+	+	+	+	+	(1)	+	−	−	−	+
18.9	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
19.5	+	−	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
19.8	+	+	+	+	+	+	+	+	+	+	+	+	+	−	−	−	+
20.5	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
21.3	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
22.3	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
[2]23.6	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
[2]23.7	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
[2]24.2	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
[2]24.8	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
[2]25.6	+	−	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
[2]26.6	+	+	+	−	(1)	+	+	+	+	+	+	+	+	−	−	−	+
[2]26.7	+	+	(1)	−	(1)	+	+	+	+	+	+	+	+	−	−	−	+
[3]28.6	+	−	(1)	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[3]29.2	+	+	(1)	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[3]29.6	+	+	(1)	−	(1)	+	+	+	+	+	+	+	+	−	−	−	+
[3]30.4	+	+	(1)	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[3]33.0	+	+	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[3]33.1	+	−	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[3]35.2	+	(1)	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[3]36.4	+	(1)	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[3]37.6	(1,4)	(1,4)	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[3]41.9	+[4]	(1,4)	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[3]43.6	+[4]	(1,4)	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[3]45.2	+[4]	(1,4)	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[5]67.6	(1,4)	(1,4)	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[5]71.5	(1,4)	(1,4)	−	−	−	(1)	+	+	+	+	+	+	+	−	−	−	+
[5]72.5	(1,4)	(1,4)	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[5]77.5	(1,4)	(1,4)	−	−	−	(1)	+	+	+	+	+	+	+	−	−	−	+
[5]81.0	(1,4)	(1,4)	−	−	−	(1)	+	+	+	+	+	+	(6)	−	−	−	+
[5]105.0	(1,4)	(1,4)	−	−	−	(1)	+	+	+	+	+	+	(6)	−	−	−	+

[1]Bump, indicates beginning of spine formation or bony overgrowth of spine.
[2]Transforming.
[3]Pelagic juvenile
[4]Parietal and nuchal spines fused.
[5]Benthic juvenile.
[6]Spine covered by fleshy lobe.
[7]Adjacent spines fused.
[8]Spine has become scale-covered.

characteristic of adults of *S. flavidus*, usually becomes distinct on juveniles >100 mm long.

Occurrence (Figures 7-10).—Adults of *S. flavidus* occur from San Diego, Calif., to Kodiak Island, Alaska (Miller and Lea 1972). Off Oregon they are most common on the continental shelf between 100 and 200 m (Snytko and Fadeev[7]). Data from Niska (1976) showed that 92% of the total Oregon trawl catch of *S. flavidus* from 1963 to 1971, was taken from depths of 54 to 218 m. Concentrations of adult *S. flavidus* have been found along Astoria Canyon, between lat. 46°10′ N and 46°20′ N, and also between lat. 44°30′ N and 45°

[7]Snytko, V. A., and N. S. Fadeev. 1974. Data on distribution of some species of sea perches along the Pacific coast of North America during the summer-autumn seasons. Document submitted to the Canada-USSR Meeting on Fisheries in Moscow-Batumi, USSR, November 1974, 14 p. (Transl. 3436, Can. Transl. Ser.)

TABLE 6.—Continued.

Standard length (mm)	Infraorbital Inferior 1st	Infraorbital Inferior 2d	Infraorbital Inferior 3d	Infraorbital Superior 1st	Infraorbital Superior 2d	Infraorbital Superior 3d	Infraorbital Superior 4th	Nasal	Coronal	Tympanic	Pterotic	Posttemporal Superior	Posttemporal Inferior	Supra-cleithral	Cleithral
10.1	+	–	–	+	–	–	–	–	–	–	+	–	+	–	–
10.3	+	(1)	–	+	–	–	+	–	–	–	+	–	+	(1)	–
10.7	+	(1)	–	+	–	–	+	–	–	–	+	–	+	–	–
11.4	+	+	–	+	–	–	+	(1)	–	–	+	–	+	–	–
11.8	+	+	–	+	–	–	–	–	–	–	+	–	+	+	–
11.8	+	+	–	+	–	–	–	–	–	–	+	–	+	(1)	–
11.9	+	+	–	+	–	–	+	–	–	–	+	–	+	–	–
12.0	+	+	–	+	–	–	+	–	–	–	+	–	+	–	–
12.2	+	+	–	+	–	–	+	(1)	–	–	+	–	+	+	–
12.7	+	+	–	+	–	–	+	(1)	–	–	+	–	+	(1)	–
12.8	+	+	–	+	–	–	+	(1)	–	–	+	–	+	+	–
12.9	+	+	(1)	+	–	–	+	+	–	–	+	–	+	+	–
13.1	+	+	–	+	–	–	+	+	–	–	+	–	+	+	–
13.7	+	+	–	+	–	(1)	+	+	–	–	+	–	+	+	–
14.4	+	+	–	+	–	–	+	+	–	–	+	–	+	+	–
14.8	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
15.8	+	+	(1)	+	–	–	+	+	–	–	+	–	+	+	–
15.9	+	+	(1)	+	–	+	+	+	–	–	+	–	+	+	–
16.4	+	+	+	+	–	(1)	+	+	–	–	+	–	+	+	–
16.8	+	+	+	+	–	+	+	+	–	–	+	–	+	+	–
18.9	+	+	+	+	–	+	+	+	–	–	+	–	+	+	–
19.5	+	+	+	+	–	+	+	+	–	–	+	–	+	+	–
19.8	+	+	+	+	–	+	+	+	–	–	+	–	+	+	–
20.5	+	+	+	+	–	+	+	+	–	–	+	(1)	+	+	–
21.3	+	+	+	+	–	+	+	+	–	–	+	–	+	+	–
22.3	+	+	+	+	–	+	+	+	–	–	+	+	+	+	–
[2]23.6	+	+	+	+	–	+	+	+	–	–	+	(1)	+	+	–
[2]23.7	+	+	+	+	–	+	+	+	–	–	+	(1)	+	+	(1)
[2]24.2	+	+	+	+	–	+	+	+	–	–	+	+	+	+	(1)
[2]24.8	+	+	+	+	–	+	+	+	–	–	+	(1)	+	+	(1)
[2]25.6	+	+	+	+	–	+	+	+	–	–	(1)	–	+	+	+
[2]26.6	+	+	+	+	–	+	+	+	–	–	(1)	+	+	+	–
[2]26.7	+	+	+	+	–	+	+	+	–	–	(1)	+	+	+	–
[3]23.6	+	+	+	+	–	+	+	+	–	–	+	+	+	+	(1)
[3]29.2	+	+	+	+	–	+	+	+	–	–	(1)	+	+	+	(1)
[3]29.6	+	+	+	+	–	+	+	+	–	–	+	+	+	+	(1)
[3]30.4	+	+	+	+	–	(1)	+	+	–	(1)	(1)	+	+	+	+
[3]33.0	+	+	+	+	–	+	+	+	–	(1)	(1)	+	+	+	(1)
[3]33.1	+	+	+	+	–	+	+	+	–	(1)	+	+	+	+	(1)
[3]35.2	+	+	+	+	–	–	+	+	–	(1)	(1)	+	+	+	+
[3]36.4	+	(1)	(1)	(1)	–	–	(1)	+	–	(1)	(1)	+	+	+	+
[3]37.6	+	(1)	(1)	(1)	–	–	(1)	+	–	(1)	(1)	+	+	+	+
[3]41.9	+	(1)	(1)	(1)	–	–	+	+	–	+	–	+	+	+	+
[3]43.6	+	(1)	(1)	(1)	–	–	+	+	–	+	–	+	+	+	+
[3]45.2	+	(1)	(1)	–	–	–	–	+	–	(1)	(1)	+	+	+	+
[5]67.6	(6)	(6,7)	(6,7)	–	–	–	–	+	–	+	–	+	–	+	+[8]
[5]71.5	(6)	(6,7)	(6,7)	–	–	–	–	+	–	+	–	+	–	+	+[8]
[5]72.5	(6)	(6,7)	(6,7)	–	–	–	–	+	–	+	–	+	(1)	+	+[8]
[5]77.5	(6)	(6,7)	(6,7)	–	–	–	–	+	–	+	–	+	–	+	+[8]
[5]81.0	(6)	(6,7)	(6,7)	–	–	–	–	+	–	+	–	+	–	+	+[8]
[5]105.0	(6)	(6,7)	(6,7)	–	–	–	–	+	–	+	–	+	–	+	+[8]

N (see footnote 7). Larvae, including transforming specimens, of *S. flavidus* in our collections were captured at stations ranging from 24 to 266 km offshore. Larvae apparently range widely and the limit observed are probably most indicative of sampling effort. Within the size range of identified larvae, there was no apparent distribution pattern relative to specimen size. Pelagic juveniles were similarly distributed. Benthic juveniles were taken close to the coast at depths of 20-37 m.

Adult *S. melanops* reportedly occur from Paradise Cove, Baja California, to Amchitka Island, Alaska (Miller and Lea 1972), although Quast and Hall (1972) noted that records from the Aleutian Islands may have resulted from misidentified *S. ciliatus*. *Sebastes melanops* is most common on the continental shelf at depths <200 m (Dunn and Hitz 1969; Niska 1976). Data tabulated by Niska (1976) for Oregon trawl catches show that 82% of the total *S. melanops* landings, from 1963 to 1971, were taken in depths <54 m while 93% were taken at depths <109 m. Larvae, including transforming specimens, of *S. melanops* in our collections were captured at stations ranging from 5 to 266 km offshore. Pelagic juveniles have a similar distribution. Larvae seem to range widely. However, sampling effort was not uniform over the area and relatively little sampling occurred nearshore, <40 km from

TABLE 7.—Development of spines in the head region of *Sebastes melanops* larvae and juveniles. + denotes spine present and − denotes spine absent.

Standard length (mm)	Parietal	Nuchal	Preopercular (anterior series) 1st	2d	3d	Preopercular (posterior series) 1st	2d	3d	4th	5th	Opercular Superior	Inferior	Inter-oper-cular	Sub-oper-cular	Pre-ocular	Supra-ocular	Post-ocular
10.6	+	([1])	+	−	+	+	+	+	+	−	([1])	−	([1])	−	−	−	+
11.7	+	([1])	+	−	+	+	+	+	+	([1])	([1])	−	([1])	−	−	−	+
11.9	+	([1])	+	+	+	+	+	+	+	+	([1])	−	([1])	−	−	−	+
11.9	+	([1])	+	+	+	+	+	+	+	([1])	([1])	−	([1])	−	−	−	+
12.4	+	+	+	−	+	+	+	+	+	+	([1])	−	([1])	−	−	−	+
12.8	+	+	+	−	+	+	+	+	+	+	([1])	−	([1])	−	−	−	+
12.8	+	+	+	−	+	+	+	+	+	+	([1])	−	+	−	−	−	+
12.8	+	+	+	−	+	+	+	+	+	+	+	([1])	+	−	−	−	+
13.5	+	+	+	−	+	+	+	+	+	+	+	−	+	−	−	−	+
13.6	+	+	+	−	+	+	+	+	+	+	+	−	+	−	−	−	+
13.9	+	+	+	−	+	+	+	+	+	+	+	([1])	+	−	−	−	+
14.0	+	+	+	−	+	+	+	+	+	+	+	([1])	+	−	−	−	+
14.9	+	+	+	−	+	+	+	+	+	+	+	−	+	−	−	−	+
15.4	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
15.4	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
15.7	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
15.9	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
16.4	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
16.5	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
17.2	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
17.4	+	+	+	+	+	+	+	+	+	+	+	+	+	−	−	−	+
17.4	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
17.7	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
17.7	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
18.5	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
19.0	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
19.2	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
19.2	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
20.7	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
20.7	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
21.0	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
22.9	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
[2]23.2	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
[2]24.0	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
[2]24.0	+	+	+	−	+	+	+	+	+	+	+	+	+	−	−	−	+
[2]24.6	+	([1])	+	−	([1])	+	+	+	+	+	+	+	+	−	−	−	+
[2]27.9	+[3]	([1,3])	([1])	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[2]30.6	+[3]	([1,3])	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[4]33.1	+[3]	([1,3])	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[4]33.9	([1,3])	([1,3])	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[4]35.2	([1,3])	([1,3])	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[4]35.8	([1,3])	([1,3])	−	−	−	+	+	+	+	+	+	+[5]	+	−	−	−	+
[4]38.2	+[3]	([1,3])	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[4]39.2	([1,3])	([1,3])	−	−	−	+	+	+	+	+	+	+[5]	+	−	−	−	+
[4]40.0	([1,3])	([1,3])	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[4]41.0	([1,3])	([1,3])	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[4]43.8	([1,3])	([1,3])	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[4]45.3	([1,3])	([1,3])	−	−	−	+	+	+	+	+	+	+	+	−	−	−	+
[4]48.4	([1,3])	([1,3])	−	−	−	+	+	+	+	+	+	+	([1,6])	−	−	−	+
[7]52.5	([1,3])	([1,3])	−	−	−	+	+	+	+	+	+	+	([1,6])	−	−	−	+
[7]62.5	([1,3])	([1,3])	−	−	−	([1])	+	+	+	+	+	+	([1,6])	−	−	−	+
[7]67.0	([1,3])	([1,3])	−	−	−	([1])	+	+	+	+	+	+	([1,6])	−	−	−	+
[7]76.1	([1,3])	([1,3])	−	−	−	−	([1])	+	+	+	+	+	([1,6])	−	−	−	+
[7]89.4	—	—	−	−	−	−	([1])	+	+	+	+	+	([1,6])	−	−	−	+
[7]97.7	([1,3])	([1,3])	−	−	−	7	([1])	+	+	+	+	+	([1,6])	−	−	−	+
[7]100.9	−	−	−	−	−	−	([1])	+	+	+	+	+	([1,6])	−	−	−	+
[7]111.6	−	−	−	−	−	−	([1])	+	+	+	+	+	([1,6])	−	−	−	+

[1]Bump, indicates beginning of spine formation or bony overgrowth of spine.
[2]Transforming.
[3]Parietal and nuchal spines fused.
[4]Pelagic juvenile.
[5]Spine is bifid.
[6]Spine covered by fleshy lobe.
[7]Benthic juvenile.
[8]Spine has become scale-covered.
[9]Adjacent spines fused.

the coast. Benthic juveniles have been taken in estuaries, tidepools, and near the coast at depths <20 m.

Parturition times reported for *S. flavidus* are December to February off California (Phillips 1958) and March off Oregon (Westrheim 1975). Larvae 10-20 mm long were taken April through June, although most were taken in April and May. Larvae and pelagic juveniles 20-40 mm long were taken April through July, indicating some

TABLE 7.—Continued.

Standard length (mm)	Infraorbital: Inferior 1st	Infraorbital: Inferior 2d	Infraorbital: Inferior 3d	Infraorbital: Superior 1st	Infraorbital: Superior 2d	Infraorbital: Superior 3d	Infraorbital: Superior 4th	Nasal	Coronal	Tympanic	Pterotic	Posttemporal: Superior	Posttemporal: Inferior	Supra-cleithral	Cleithral
10.6	+	–	–	+	–	–	+	–	–	–	+	–	+	([1])	–
11.7	+	([1])	–	+	–	–	+	([1])	–	–	+	–	+	+	–
11.9	+	+	–	+	–	–	+	([1])	–	–	+	–	+	+	–
11.9	+	+	–	+	–	–	+	([1])	–	–	+	–	+	+	–
12.4	+	+	–	+	–	–	+	+	–	–	+	–	+	+	–
12.8	+	+	–	+	–	–	+	+	–	–	+	–	+	+	–
12.8	+	+	–	+	–	–	+	+	–	–	+	–	+	+	–
12.8	+	+	–	+	–	–	+	+	–	–	+	–	+	+	–
13.5	+	+	–	+	–	–	+	+	–	–	+	–	+	+	–
13.6	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
13.9	+	+	–	+	–	–	+	+	–	–	+	–	+	+	–
14.0	+	+	([1])	+	–	–	+	+	–	–	+	–	+	+	–
14.9	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
15.4	+	+	–	+	–	–	+	+	–	–	+	–	+	+	–
15.4	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
15.7	+	+	([1])	+	–	–	+	+	–	–	+	–	+	+	–
15.9	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
16.4	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
16.5	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
17.2	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
17.4	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
17.4	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
17.7	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
17.7	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
18.5	+	+	+	+	–	–	+	+	–	–	+	–	+	+	–
19.0	+	+	+	+	–	–	+	+	–	–	+	+	+	+	–
19.2	+	+	+	+	–	+	+	+	–	–	+	+	+	+	–
19.2	+	+	+	+	–	–	+	+	–	–	+	+	+	+	–
20.7	+	+	+	+	–	([1])	+	+	–	–	+	+	+	+	–
20.7	+	+	+	+	–	+	+	+	–	–	+	+	+	+	–
21.0	+	+	+	+	–	+	+	+	–	–	+	+	+	+	–
22.9	+	+	+	+	–	+	+	+	–	–	+	+	+	+	–
[2]23.2	+	+	+	+	–	+	+	+	–	–	+	+	+	+	–
[2]24.0	+	+	+	+	–	+	+	+	–	([1])	([1])	+	+	+	–
[2]24.0	+	+	+	+	–	+	+	+	–	([1])	([1])	+	+	+	–
[2]24.6	+	+	+	+	–	+	+	+	–	([1])	([1])	+	+	+	–
[2]27.9	+	+	+	+	–	–	+	+	–	([1])	([1])	+	+	+	–
[2]30.6	+	+	+	+	–	–	+	+	–	([1])	+	+	+	+	([1])
[4]33.1	+	+	+	+	–	([1])	+	+	–	+	([1])	+	+	+	+
[4]33.9	+	([1])	([1])	+	–	–	+	+	–	([1])	([1])	+	+	+	+
[4]35.2	+	([1])	([1])	([1])	–	–	([1])	+	–	([1])	–	+	+	+	+
[4]35.8	+	([1])	([1])	([1])	–	–	+	+	–	+	–	+	+	+	+
[4]38.2	+	([1])	([1])	–	–	–	([1])	+	–	([1])	([1])	+	([1])	+	+
[4]39.2	+	([1])	([1])	–	–	–	([1])	+	–	([1])	–	+	+	+	+
[4]40.0	+	([1])	([1])	–	–	–	([1])	+	–	([1])	–	+	+	+	+
[4]41.0	+	([1])	([1])	–	–	–	([1])	+	–	([1])	([1])	+	+	+	+
[4]43.8	+	([1])	([1])	–	–	–	([1])	+	–	–	–	+	([1])	+	+
[4]45.3	+	([1])	([1])	–	–	–	–	+	–	+	–	+	–	+	+
[4]48.4	+	([1])	([1])	–	–	–	([1])	+	–	–	–	+	–	+	+
[7]52.5	([6])	([1])	([1])	–	–	–	–	+	–	–	–	+	–	+	+[8]
[7]62.5	([6])	([6,9])	([6,9])	–	–	–	–	+	–	–	–	+	–	+	+[8]
[7]67.0	([6])	([6,9])	([6,9])	–	–	–	–	+	–	([1])	–	+[8]	–	+[8]	+[8]
[7]76.1	([6])	([6,9])	([6,9])	–	–	–	–	+	–	–	–	+[8]	–	+[8]	+[8]
[7]89.4	([6])	([6,9])	([6,9])	–	–	–	–	+	–	–	–	+[8]	–	+[8]	+[8]
[7]97.0	([6])	([6,9])	([6,9])	–	–	–	–	+	–	–	–	+[8]	–	+[8]	+[8]
[7]100.9	([6])	([6,9])	([6,9])	–	–	–	–	+	–	–	–	+[8]	–	+[8]	+[8]
[7]111.6	([6])	([6,9])	([6,9])	–	–	–	–	+	–	–	–	+[8]	–	+[8]	+[8]

variability and protraction of parturition time. Benthic juveniles were taken only in June and October due to limited samples.

Parturition times reported for *S. melanops* are February to April (Hart 1973) and January off Oregon (Westrheim 1975). Larvae 10-20 mm long were taken April through May. Larvae and pelagic juveniles 20-40 mm long were taken April through June, indicating some variability in spawning time and duration. Benthic juveniles first appeared in June samples.

Comparisons.—Prior to this paper, developmental series of 10 of the 69 northeast Pacific (including Gulf of California) species of *Sebastes* had been described: *S. cortezi*, *S. crameri*, *S.* Gulf Type A, *S. helvomaculatus*, *S. jordani*, *S. levis*, *S. macdonaldi*, *S. melanostomus*, *S. paucispinis*, and *S. pinniger* (Moser 1967, 1972; Moser et al. 1977; Moser and Ahlstrom 1978; Richardson and Laroche 1979). While exhibiting some similarities to larval and juvenile *S. flavidus* and *S. melanops*, the previously described developmental series differ in many characters. Most apparent is the early lack of pigment and the later development of distinct pigment saddles under the dorsal fins of postflexion and pelagic juvenile *S. crameri*, *S. helvomaculatus*, *S. levis*, *S. melanostomus*, *S. paucispinis*, and *S. pinniger*. The only species described to date which has pigment along the dorsal surface under the dorsal fins in postflexion larvae and pelagic juveniles, similar to that of *S. flavidus* and *S. melanops*, is *S. jordani*. However, *S. jordani* has a very short snout to anus distance/SL ratio, 36 to 53% SL, compared with 57 to 60.3% SL and 58.0 to 61.3% SL for postflexion larvae and pelagic juveniles of *S. flavidus* and *S. melanops*, respectively. *Sebastes cortezi*, *S.* Gulf Type A, and *S. macdonaldi* are all deeper bodied than *S. flavidus* and *S. melanops*, and both *S.* Gulf Type A and *S. macdonaldi* have much longer parietal spines.

Other Oregon species which are easily confused with *S. flavidus* and *S. melanops* during larval and juvenile development are the widow rockfish, *S. entomelas*, and the blue rockfish, *S. mystinus*. However, pelagic and benthic juveniles of these species are separable based on the presence of preocular and supraocular spines, usually >15 dorsal soft rays, and usually >8 anal soft rays (see Appendix Table 1).

Sebastes mystinus is separable from the other three species at all sizes after fin formation has occurred, ≈9.0 mm, since it is the only species which usually has 16 dorsal soft rays and 9 anal soft rays. *Sebastes entomelas* and *S. mystinus* both usually have 18 pectoral rays which distinguish them from *S. melanops*, which usually has 19 rays. *Sebastes flavidus* and *S. entomelas* are the only pair of species which are not readily separated by fin counts. However, both *S. entomelas* and *S. mystinus* develop supraocular spines, which appear on specimens larger than ≈17 mm, while *S. flavidus* and *S. melanops* rarely develop supraocular spines. In addition to these characters, larvae and pelagic juveniles of *S. entomelas* and *S. mystinus* either lack or have a reduced number of melanophores at the articulations of the anal fin rays and on the ventral surface of the caudal peduncle. We have a description of the development of *S. entomelas* in preparation.

Sebastes ciliatus (from British Columbia and Alaska) and *S. serranoides* (from California) are other similar species which should be carefully considered when identifying specimens from areas where they also occur. We have not had the opportunity to observe specimens of *S. ciliatus* and cannot assess its potential for causing confusion. We have examined 20 benthic juvenile *S. serranoides*. Although the head spine pattern in *S. serranoides* is the same as in *S. flavidus* and *S. melanops*, *S. serranoides* usually has <18 pectoral rays and >8 anal soft rays which will usually separate them from *S. flavidus* and *S. melanops* (see Appendix Table 1). All of the species discussed, excluding *S. ciliatus* for which we have no information, have to some extent a concentration of melanistic pigmentation on the posterior portion of the spinous dorsal fin occurring on juveniles. *Sebastes flavidus* and *S. melanops* have the most intensely pigmented "black blotch." *Sebastes mystinus* has a more darkly pigmented spinous dorsal fin which presents little contrast from the pigment in the area of the black blotch. *Sebastes entomelas* and *S. serranoides* usually have a less distinct "blotch" with most of the pigment concentrated in a fringe along the posterior distal edge of the spinous dorsal fin membrane.

The most important characters useful in separating larval and juvenile *S. flavidus* and *S. melanops* from each other are pectoral ray number (usually 18 versus 19), lateral line pore number (usually >50 versus <50), and caudal peduncle depth/length ratio (mean values 0.73, 0.64, 0.64, 0.80 versus 0.88, 0.78, 0.74, 0.92 in postflexion larvae, transforming, pelagic juvenile, and benthic juvenile specimens, respectively). *Sebastes flavidus* taken at the same location as *S. melanops* appear to have less dense melanistic pigment. Benthic juveniles of *S. flavidus* seem to inhabit deeper waters, >20 m, while *S. melanops* inhabits estuaries, tidepools, and offshore waters <20 m. Landing data tabulated by Niska (1976) indicates a corresponding difference in "preferred" depth for adults with *S. flavidus* taken chiefly between 54 and 218 m and *S. melanops* taken mainly in water <54 m.

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APPENDIX TABLE 1.—Frequency distributions of soft fin rays, lateral line pores, diagonal scale rows below the lateral line, and gill rakers for juvenile and adult *Sebastes entomelas, S. flavidus, S. melanops, S. mystinus,* and *S. serranoides.*

		Pectoral fin rays				Dorsal fin soft rays					Anal fin soft rays			
Species	Side	17	18	19	20	13	14	15	16	17	7	8	9	10
Sebastes entomelas[1]	Left	1	37	2	—	—	4	31	5	—	3	35	2	—
	Right	1	37	2	—									
Sebastes flavidus[2]	Left	2	47	3	—	—	30	22	—	—	5	47	—	—
	Right	1	48	3	—									
Sebastes melanops[3]	Left	—	11	55	—	2	26	37	1	—	13	53	—	—
	Right	—	3	61	1									
Sebastes mystinus[4]	Left	3	55	3	—	—	—	5	49	8	—	6	52	4
	Right	3	55	4	—									
Sebastes serranoides[5]	Left	16	4	—	—	—	1	11	8	—	—	3	16	1
	Right	15	5	—	—									

		Lateral line pores												
Species	Side	45	46	47	48	49	50	51	52	53	54	55	56	59
Sebastes entomelas[1]	Left	—	—	—	—	—	—	—	4	6	16	13	1	—
	Right	—	—	—	—	—	—	—	4	4	19	12	1	—
Sebastes flavidus[2]	Left	—	1	—	—	1	4	6	15	10	5	5	1	—
	Right	—	—	—	—	—	3	11	12	15	3	3	2	1
Sebastes melanops[3]	Left	2	2	4	13	16	15	11	1	1	1	—	—	—
	Right	1	3	5	9	17	13	13	2	3	—	—	—	—
Sebastes mystinus[4]	Left	—	—	—	1	6	16	18	12	9	—	—	—	—
	Right	—	—	—	—	4	10	15	22	8	2	—	—	—
Sebastes serranoides[5]	Left	—	—	—	—	—	1	—	5	9	3	1	—	—
	Right	—	—	—	—	—	—	1	3	12	2	2	—	—

		Diagonal scale rows below lateral line																			Gill rakers on lower bar of 1st gill arch						
Species	Side	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	23	24	25	26	27	28	29
S. entomelas	Left	—	—	—	—	—	—	—	—	—	—	1	2	4	6	12	7	5	2	1	—	—	11	21	7	1	—
	Right	—	—	—	—	—	—	—	—	—	—	1	1	6	5	13	4	7	2	1	—	—	13	22	5	—	—
S. flavidus	Left	—	—	—	—	—	—	—	—	3	12	8	10	6	1	3	—	1	—	—	—	5	14	30	3	—	—
	Right	—	—	—	—	—	—	1	—	1	6	16	9	4	2	4	—	1	—	—	—	1	15	31	4	—	—
S. melanops	Left	1	3	2	6	8	11	19	13	2	1	—	—	—	—	—	—	—	—	—	—	7	13	27	17	2	—
	Right	—	1	1	8	9	12	17	13	4	1	—	—	—	—	—	—	—	—	—	1	6	10	27	18	4	—
S. mystinus	Left	—	—	—	1	9	11	5	14	7	3	3	—	1	—	—	—	—	—	—	2	7	28	19	6	—	—
	Right	—	—	1	—	4	8	7	11	13	4	3	2	1	—	—	—	—	—	—	2	9	21	21	7	1	1
S. serranoides	Left	—	—	—	—	—	—	—	—	—	2	2	3	2	1	—	—	—	—	—	1	8	11	—	—	—	—
	Right	—	—	—	—	—	—	—	—	—	1	2	3	2	2	—	—	—	—	—	1	6	10	3	—	—	—

		Gill rakers on upper bar of 1st gill arch					Total gill rakers on 1st gill arch								
Species	Side	8	9	10	11	12	32	33	34	35	36	37	38	39	40
S. entomelas	Left	—	4	36	—	—	—	—	2	10	21	6	1	—	—
	Right	—	5	33	2	—	—	—	2	14	17	7	—	—	—
S. flavidus	Left	—	—	21	30	1	—	—	4	6	21	18	3	—	—
	Right	1	—	20	30	1	—	1	—	10	17	21	3	—	—
S. melanops	Left	—	1	13	46	6	—	—	4	10	9	21	17	5	—
	Right	—	—	20	41	5	—	—	5	10	8	21	16	5	1
S. mystinus	Left	—	3	43	15	1	1	1	7	25	15	9	3	1	—
	Right	—	2	47	11	2	1	1	8	20	17	9	4	2	—
S. serranoides	Left	—	4	16	—	—	1	3	5	11	—	—	—	—	—
	Right	—	7	13	—	—	—	4	5	10	1	—	—	—	—

[1]All *S. entomelas* were collected at lat. 44°39′ N, long. 124°44′ W off Oregon.
[2]All *S. flavidus* were collected at two locations (lat. 44°05′ N, long. 124°55′ W and lat. 45°33′N, long. 124°07′ W) off Oregon.
[3]All *S. melanops* were collected from Yaquina Bay, Oreg. (lat. 44°37′ N, long. 124°03′ W), or open coast tide pools nearby.
[4]*Sebastes mystinus* from a number of locations between Soberanes Point, Calif. (lat. 36°26′54″ N, long. 121°55′41″ W), and the mouth of the Columbia River, Oreg. (lat. 46°15′ N, long. 124°07′ W) were examined.
[5]All *S. serranoides* were collected in California between Newport Beach (lat. 33°35′ N) and San Francisco (lat. 37°50′ N).