Pigment Patterns of Juvenile *Sebastes flavidus* and *Sebastes melanops* Useful in Identification

By

Thomas E. Laidig and Wayne M. Samiere[1]

ABSTRACT

Morphology and pigmentation of juvenile *Sebastes flavidus* and *S. melanops* are compared. All *S. flavidus* were found to have from two to five distinct pigment saddles while *S. melanops* rarely had saddles. Other differences were observed in the pigmentation of the peritoneum and head spination.

[1] Present Address: 21 Vernon St., San Francisco, CA 94132

INTRODUCTION

Sebastes flavidus, yellowtail rockfish, and S. melanops, black rockfish, are two co-occurring species of rockfish that inhabit the nearshore waters of the northeastern Pacific Ocean (Eschmeyer et al. 1983). Sebastes spp. are an important component of the Pacific coast groundfish fishery, contributing 45% of the total landings in 1989, with 43,877 mt (Pacific Fishery Management Council 1990). Sebastes flavidus accounted for approximately 10% of the total rockfish landings with a total of 4,217 mt (Pacific Fishery Management Council 1990). Sebastes melanops is not specifically managed, but is incorporated into the management group termed other rockfish. This group accounted for 4,593 mt or slightly more than 10% of the total rockfish landings (Pacific Fishery Management Council 1990).

Rockfishes are characterized by strong and weak year-classes, and much recent research has focused on estimating the numbers of juveniles as a means of forecasting year-classes (Stephens et al. 1986; Wyllie Echeverria et al. 1990; Moser and Boehlert 1991). This research had been impeded by the difficulty in differentiating between various species at the juvenile stage. Juvenile rockfishes are identified to species by use of meristics and pigmentation (Litvinenko 1974; Richardson and Laroche 1979; Laroche and Richardson 1980, 1981; Anderson 1983; Kendall and Lenarz 1987). Any attributes that help distinguish species

faster and with increased accuracy benefits any early life history study.

In this study, we examined pigmentation differences between two species of juvenile rockfish (S. melanops and S. flavidus) which have very similar meristics. We studied both fresh and preserved specimens to note any change due to preservation. This study will aid in identifying those "hard-to-identify" fish. This study is also envisioned as a fast sorting technique while conducting field work, since rapid and accurate identification techniques are often needed to sort large catches of fish.

METHODS

Fishes used in this analysis were taken from the Gulf of the Farallones (central California) during two cruises, May 30 to June 6, 1985, and May 29 to June 3, 1986, aboard the NOAA R/V David Starr Jordan. Samples were taken at night using an 80-ft Stauffer-modified Cobb midwater trawl at a depth of 10 m (Wyllie Echeverria et al. 1990). All rockfish were removed from the net and frozen for later analysis.

In the laboratory, Sebastes flavidus and S. melanops were separated based on meristics, using the key developed by Moreland and Reilly (1991). Pigmentation (overall body patterns, body coloration, chromatophore type and location, fin pigmentation, and peritoneum pigments) was recorded for each species. After the initial observations, specimens were placed in a 10%

Formalin[1] solution and stored for one to three months. After fixation, similar observations were performed and results were compared to the fresh specimens. All illustrations were drawn by the junior author. Lastly, we examined differences in head spination.

RESULTS

A total of 162 S. flavidus (standard length (SL) = 39-53 mm) and 47 S. melanops (SL = 30-49 mm) were examined.

Pigmentation

In S. flavidus, the melanophores were concentrated into blotches, known as saddles, between the dorsal fin and the lateral line (Fig. 1). Clear areas of little or no melanistic pigment separated the saddles. Typically, three saddles were present, but the number ranged from two to five. The common saddle pattern found one occurring beneath the spiny dorsal fin, one below the soft dorsal fin, and one on the caudal peduncle. The two posterior saddles usually had the shape of an inverted triangle and the anterior saddle was highly variable. The shape and intensity of these saddle marks varied with length; larger specimens (over 45 mm) tended to have darker and more variable saddles.

[1] Use of tradename does not imply endorsement by NMFS.

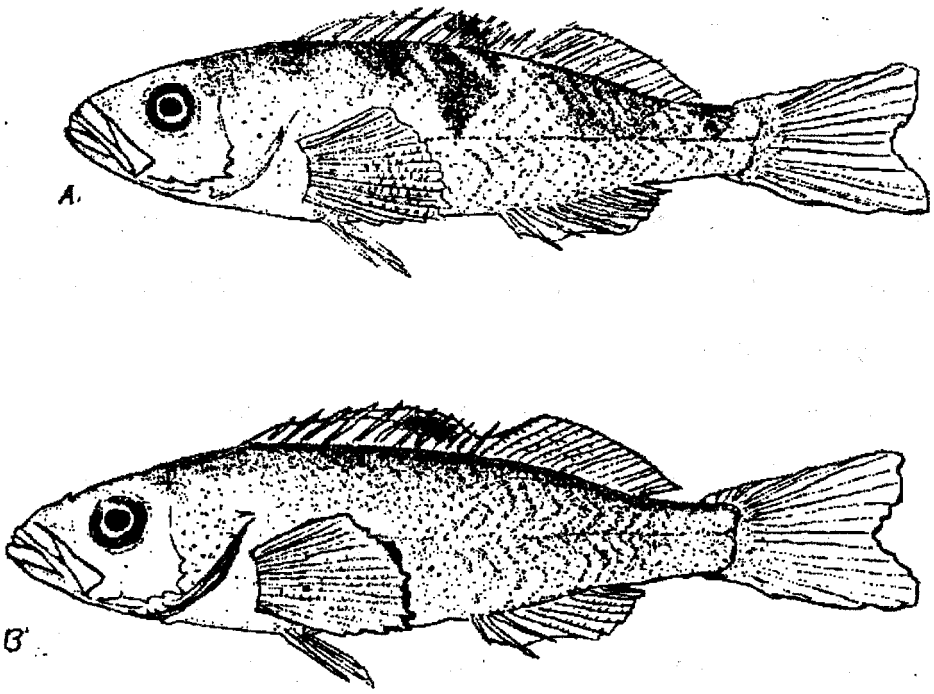

Figure 1. Pelagic juveniles collected off the coast of central California of Sebastes flavidus (A., 45 mm) and Sebastes melanops (B., 45 mm).

The melanophores on S. melanops were uniformly distributed over the sides of the body except where they tended to concentrate between muscle segments (Fig. 1). Only 6 of the 47 S. melanops had one very faint saddle mark below the soft rays of the dorsal fin, extending from the fin base to the lateral line. On the body surface, a dark stripe of pigment ran along the base of the dorsal fin from the nape to the caudal fin.

Fresh specimens of S. melanops were transparent, pale green, while specimens of S. flavidus were beige to light yellow. Dark melanophores covering the body surface of both species were concentrated in the dorsal half. Both species had orange and yellow chromatophores interspersed with the melanophores, with the largest concentrations at the base of the caudal and anal fin and between myomeres.

The intensity of the black spot located in the spinous dorsal fin varied between the two species. In S. melanops, the spot was small and faint. In S. flavidus, the spot was large and intense. This difference was noted in all specimens.

Both species had pigment at the base of each anal spine. Sebastes flavidus had numerous large spots that covered the base of each spine, while S. melanops had much smaller pigment spots, typically, only one tiny chromatophore per spine. These characteristics remained constant throughout the size ranges studied.

Sebastes melanops had pigment on both pectoral fins. There was at least one melanophore per ray, occurring over the entire proximal portion of the fin. In S. flavidus, 40% had no pectoral fin pigment and these fish ranged from 40-44 mm. When pigment was observed, there were only a few melanophores observed (mostly one spot on one fin only), and these were located in the middle of the proximal side of the fin. Fin pigment increased with specimen size.

The color of the peritoneum, as viewed externally, varies somewhat between both species. For S. melanops, the peritoneum typically had scattered black spots with a dark shade between spots. There was also a concentration of pigment around the anus. For S. flavidus, the peritoneum also had scattered black spots, but little or no dark shading was observed between them. No concentration of pigment around the anal vent was found. Each pattern was exclusive to each species, and both patterns persisted for all size ranges examined.

After preservation, the color of each species turned to an opaque white, with S. melanops appearing darker in overall color than S. flavidus because of the many melanophores spread uniformly over the body surface. The chromatophores disappeared, but the melanistic pigments remained, although they faded in intensity. The patterns evident in the fresh specimens were still visible in S. flavidus, but the pigment became much more faint. There wasn't a noticeable difference in pigmentation between specimens stored for one month or three months. However, when samples were stored for a year, the pigment pattern in S. flavidus became hard to distinguish in some specimens.

Head Spination

The only noticeable difference among the head spines of the two species was with the nasal spines. The nasal spines of S. melanops were short and stubby in all individuals, while those of S. flavidus were about twice as long as those of S. melanops.

The spines of S. flavidus were also pointed to a sharp tip (in 86% of the examined fish). This difference persisted for all sizes examined.

DISCUSSION

The presence of the saddle pattern offers the greatest opportunity for rapid and accurate discrimination between S. flavidus and S. melanops. Other differences which may be used to differentiate between these two species are the amount and pattern of the pigmentation of the peritoneum, the differences in the shape and size of the nasal spine, and the intensity of the dorsal spot. The pigmentation on the anal fin ray bases and pectoral fin were less pronounced between the species.

Our observations of saddle pigment patterns of juvenile S. flavidus (also observed by Anderson (1983)) differed from those of Laroche and Richardson (1980), who did not describe the saddle patterns. Since the patterns tend to fade with increased time after preservation, this could account for the difference. There also may be a geographical difference, since Laroche and Richardson (1980) studied fish from off the Oregon coast and we studied fish from off central California.

Differences in meristics still remain the main method for distinguishing rockfish species, but other characteristics are finding increasing use in identifications. As early life history stages of more species are described, pigment will probably

become more important in identifying species. By using the differences in pigmentation described above, the accurate identification between S. flavidus and S. melanops will increase. These differences in pigment will become more important in identification due to the ambiguity of meristics caused by damage of the fins or overlapping counts.

ACKNOWLEDGEMENTS

We would like to thank the crew of the David Starr Jordan and the scientific personnel who aided in the collection of juveniles for this study. We would also like to thank Carol Reilly for helping in identifications of the two species.

CITATIONS

Anderson, T. W.

1983 Identification and development of nearshore juvenile rockfishes (genus Sebastes) in central California kelp forests. M. A. thesis, California State Univ., Fresno, California, 216 p.

Eschmeyer, W. N., E. S. Herald, and H. Hammann

1983 A field guide to the Pacific coast fishes of North America. Houghton Mifflin Co., Boston, 366 p.

Kendall, A. W., and W. H. Lenarz

1987 Status of early life history studies of northeast Pacific rockfishes. In Proc. Int. Rockfish. Symp. Oct. 1986. Anchorage, Alaska, p. 99-128. Univ. Alaska, Alaska Sea Grant Rep. 87-2.

Laroche, W. A., and S. L. Richardson

1980 Development and occurrence of larvae and juveniles of the rockfishes Sebastes flavidus and Sebastes melanops (Scorpaenidae) off Oregon. Fish. Bull., U. S. 77:901-923.

1981 Development and occurrence of larvae and juveniles of the rockfishes Sebastes entomelas and S. zacentrus (family Scorpaenidae) and occurrence off Oregon, with notes on head spines of S. mystinus, S. flavidus, and S. melanops. Fish. Bull., U. S. 79:231-258.

Litvinenko, N. N.

1974 Coloration and other morphological characters distinguishing juvenile Sebastes fasciatus from juvenile Sebastes menitella (Scorpaenidae). J. Ichthyol. 14:591-595.

Moreland, S. L., and C. A. Reilly

1991 Key to the Juvenile Rockfishes of Central California. In Laidig, T. E., and P. B. Adams (eds.), Methods used to identify pelagic juvenile and larval rockfish (Genus Sebastes) occurring along the coast of central California. U. S. Dep. Commer., NOAA Tech Memo. In Prep.

Moser, G. H., and G. W. Boehlert

1991 Ecology of pelagic larvae and juveniles of the genus Sebastes. Environ. Biol. Fishes 30:203-224.

PFMC (Pacific Fisheries Management Council)

1990 Status of the Pacific coast groundfish fishery through 1990 and recommended acceptable biological catches for 1991. Pacific Fishery Management Council, Metro Center, Suite 420, 2000 S. W. First Avenue, Portland, Oregon 97201, 58 p.

Richardson, S. L., and W. A. Laroche

1979 Development and occurrence of larvae and juveniles of the rockfishes Sebastes crameri, Sebastes pinniger, and Sebastes helvomaculatus (family Scorpaenidae) off Oregon. Fish. Bull., U. S. 77:1-41.

Stephens, J. S., Jr., G. A. Jordan, P. A. Morris, M. M. Singer, and G. E. McGowan

1986 Can we relate larval fish abundance to recruitment or population stability? A preliminary analysis of recruitment to a temperate reef. Calif. Coop. Oceanic Fish. Invest. Rep. 27:65-83.

Wyllie Echeverria, T., W. H. Lenarz, and C. Reilly

1990 Survey of the abundances and distribution of pelagic young-of-the-year rockfishes, Sebastes, off central California. U. S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFC-147, 125 p.

NOAA Technical Memorandum NMFS

This TM series is used for documentation and timely communication of preliminary results, interim reports, or special purpose information; ~~and~~ have not received complete formal review, editorial control, or detailed editing.

the TMs

NOVEMBER 1991

METHODS USED TO IDENTIFY PELAGIC JUVENILE ROCKFISH (GENUS *SEBASTES*) OCCURRING ALONG THE COAST OF CENTRAL CALIFORNIA

Edited by

Thomas E. Laidig
and
Peter B. Adams

National Marine Fisheries Service, NOAA
Southwest Fisheries Science Center
Tiburon Laboratory
3150 Paradise Drive
Tiburon, CA 94920

NOAA-TM-NMFS-SWFSC-166

U.S. DEPARTMENT OF COMMERCE
Robert A. Mosbacher, Secretary
National Oceanic and Atmospheric Administration
William E. Evans, Under Secretary for Oceans and Atmosphere
National Marine Fisheries Service
James W. Brennan, Assistant Administrator for Fisheries

NOAA Technical Memorandum NMFS

The National Oceanic and Atmospheric Administration (NOAA), organized in 1970, has evolved into an agency which establishes national policies and manages and conserves our oceanic, coastal, and atmospheric resources. An organizational element within NOAA, the Office of Fisheries is responsible for fisheries policy and the direction of the National Marine Fisheries Service (NMFS).

In addition to its formal publications, the NMFS uses the NOAA Technical Memorandum series to issue informal scientific and technical publications when complete formal review and editorial processing are not appropriate or feasible. Documents within this series, however, reflect sound professional work and may be referenced in the formal scientific and technical literature.