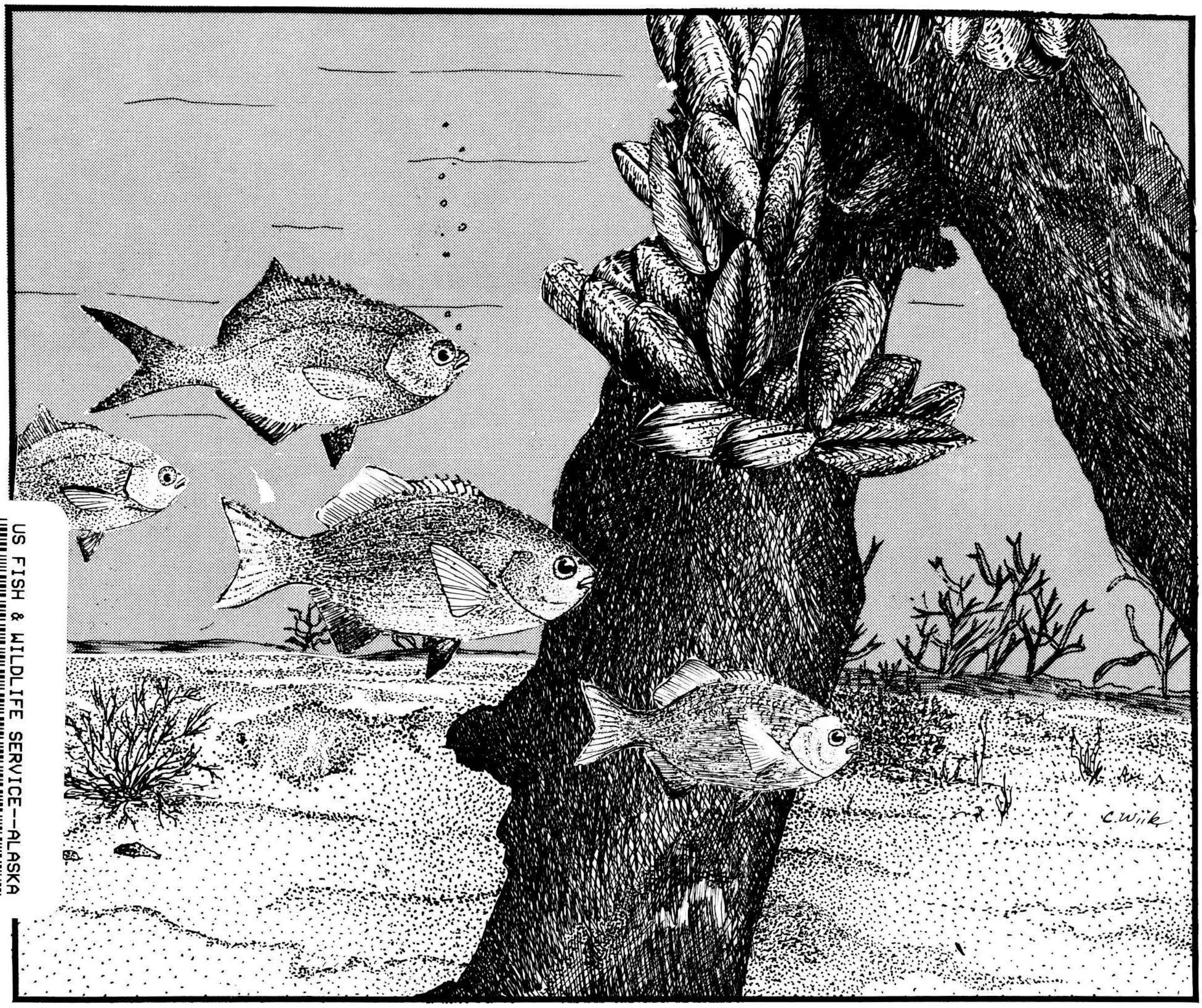
Biological Report 82 (11.103)
July 1989

TR EL-82-4

Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Pacific Southwest)

PILE PERCH, STRIPED SEAPERCH, AND RUBBERLIP SEAPERCH



nd Wildlife Service
epartment of the Interior

Coastal Ecology Group
Waterways Experiment Station
U.S. Army Corps of Engineers

Biological Report 82(11.103)
TR EL-82-4
July 1989

Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Pacific Southwest)

PILE PERCH, STRIPED SEAPERCH, AND RUBBERLIP SEAPERCH

by

Ronald A. Fritzsche
Department of Fisheries
Humboldt State University
Arcata, CA 95521
and
Thomas J. Hassler
California Cooperative Fishery Research Unit
Humboldt State University
Arcata, CA 95521

Project Officer
David Moran
U.S. Fish and Wildlife Service
National Wetlands Research Center
1010 Gause Boulevard
Slidell, LA 70458

Performed for

Coastal Ecology Group
Waterways Experiment Station
U.S. Army Corps of Engineers
Vicksburg, MS 39180

and

U.S. Department of the Interior
Fish and Wildlife Service
Research and Development
National Wetlands Research Center
Washington, DC 20240

This series may be referenced as follows:

U.S. Fish and Wildlife Service. 1983-19__. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates. U.S. Fish Wildl. Serv. Biol. Rep. 82(11). U.S. Army Corps of Engineers, TR EL-82-4.

This profile may be cited as follows:

Fritzsche, R.A., and T.J. Hassler. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest)--pile perch, striped seaperch, and rubberlip seaperch. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.103). U.S. Army Corps of Engineers, TR EL-82-4. 15 pp.

PREFACE

This species profile is one of a series on coastal aquatic organisms, principally fish, of sport, commercial, or ecological importance. The profiles are designed to provide coastal managers, engineers, and biologists with a brief comprehensive sketch of the biological characteristics and environmental requirements of the species and to describe how populations of the species may be expected to react to environmental changes caused by coastal development. Each profile has sections on taxonomy, life history, ecological role, environmental requirements, and economic importance, if applicable. A three-ring binder is used for this series so that new profiles can be added as they are prepared. This project is jointly planned and financed by the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service.

Suggestions or questions regarding this report should be directed to one of the following addresses.

Information Transfer Specialist
National Wetlands Research Center
U.S. Fish and Wildlife Service
NASA-Slidell Computer Complex
1010 Gause Boulevard
Slidell, LA 70458

or

U.S. Army Engineer Waterways Experiment Station
Attention: WESER-C
Post Office Box 631
Vicksburg, MS 39180

CONVERSION TABLE

Metric to U.S. Customary

Multiply	By	To Obtain
millimeters (mm)	0.03937	inches
centimeters (cm)	0.3937	inches
meters (m)	3.281	feet
meters (m)	0.5468	fathoms
kilometers (km)	0.6214	statute miles
kilometers (km)	0.5396	nautical miles
square meters (m^2)	10.76	square feet
square kilometers (km^2)	0.3861	square miles
hectares (ha)	2.471	acres
liters (l)	0.2642	gallons
cubic meters (m^3)	35.31	cubic feet
cubic meters (m^3)	0.0008110	acre-feet
milligrams (mg)	0.00003527	ounces
grams (g)	0.03527	ounces
kilograms (kg)	2.205	pounds
metric tons (t)	2205.0	pounds
metric tons (t)	1.102	short tons
kilocalories (kcal)	3.968	British thermal units
Celsius degrees (°C)	1.8(°C) + 32	Fahrenheit degrees

U.S. Customary to Metric

Multiply	By	To Obtain
inches	25.40	millimeters
inches	2.54	centimeters
feet (ft)	0.3048	meters
fathoms	1.829	meters
statute miles (mi)	1.609	kilometers
nautical miles (nmi)	1.852	kilometers
square feet (ft^2)	0.0929	square meters
square miles (mi^2)	2.590	square kilometers
acres	0.4047	hectares
gallons (gal)	3.785	liters
cubic feet (ft^3)	0.02831	cubic meters
acre-feet	1233.0	cubic meters
ounces (oz)	28350.0	milligrams
ounces (oz)	28.35	grams
pounds (lb)	0.4536	kilograms
pounds (lb)	0.00045	metric tons
short tons (ton)	0.9072	metric tons
British thermal units (Btu)	0.2520	kilocalories
Fahrenheit degrees (°F)	0.5556 (°F - 32)	Celsius degrees

CONTENTS

ACKNOWLEDGMENTS

We are grateful for the reviews by Donald Baltz, Louisiana State University, and James Chess, National Marine Fisheries Service. We would also like to thank Neal Moyer and Laree Richard for help in reviewing the literature.

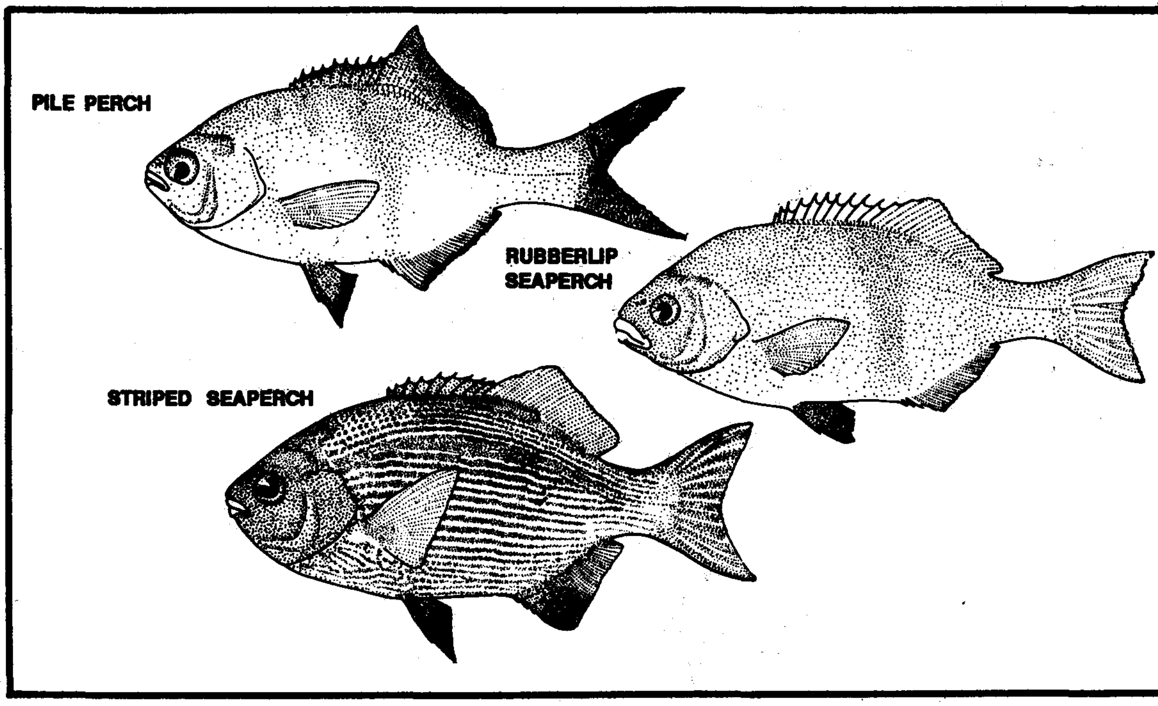


Figure 1. Three species of seaperches.

PILE PERCH, STRIPED SEAPERCH, AND RUBBERLIP SEAPERCH

NOMENCLATURE/TAXONOMY/RANGE

Scientific name . . . . . Rhacochilus vacca (Girard)
Preferred common name. . . pile perch (Figure 1)
Local common names . . pile surfperch, fork-tail perch, porgy
Class . . . . Osteichthyes
Order . . . . Perciformes
Family . . . . Embiotocidae

Geographic range: Port Wrangell, Alaska, to Guadalupe Island off Baja California (Figure 2). Rocky shores and near kelp, pilings, and underwater structures; inshore and to 46 m (Eschmeyer et al. 1983).

Scientific name . . . . . . Embiotoca lateralis Agassiz
Preferred common name . . . . striped seaperch (Figure 1)
Local common names . . . . striped surfperch, blue perch
Class . . . . Osteichthyes
Order . . . . Perciformes
Family . . . . Embiotocidae

Geographic range: Port Wrangell, Alaska, to northern Baja California (Figure 2). Rocky coasts and kelp beds; inshore and to 21 m (Eschmeyer et al. 1983).

Scientific name. . Rhacochilus toxotes Agassiz
Preferred common name . . . rubberlip seaperch (Figure 1)
Local common names . . . . . rubberlip surfperch, porgy

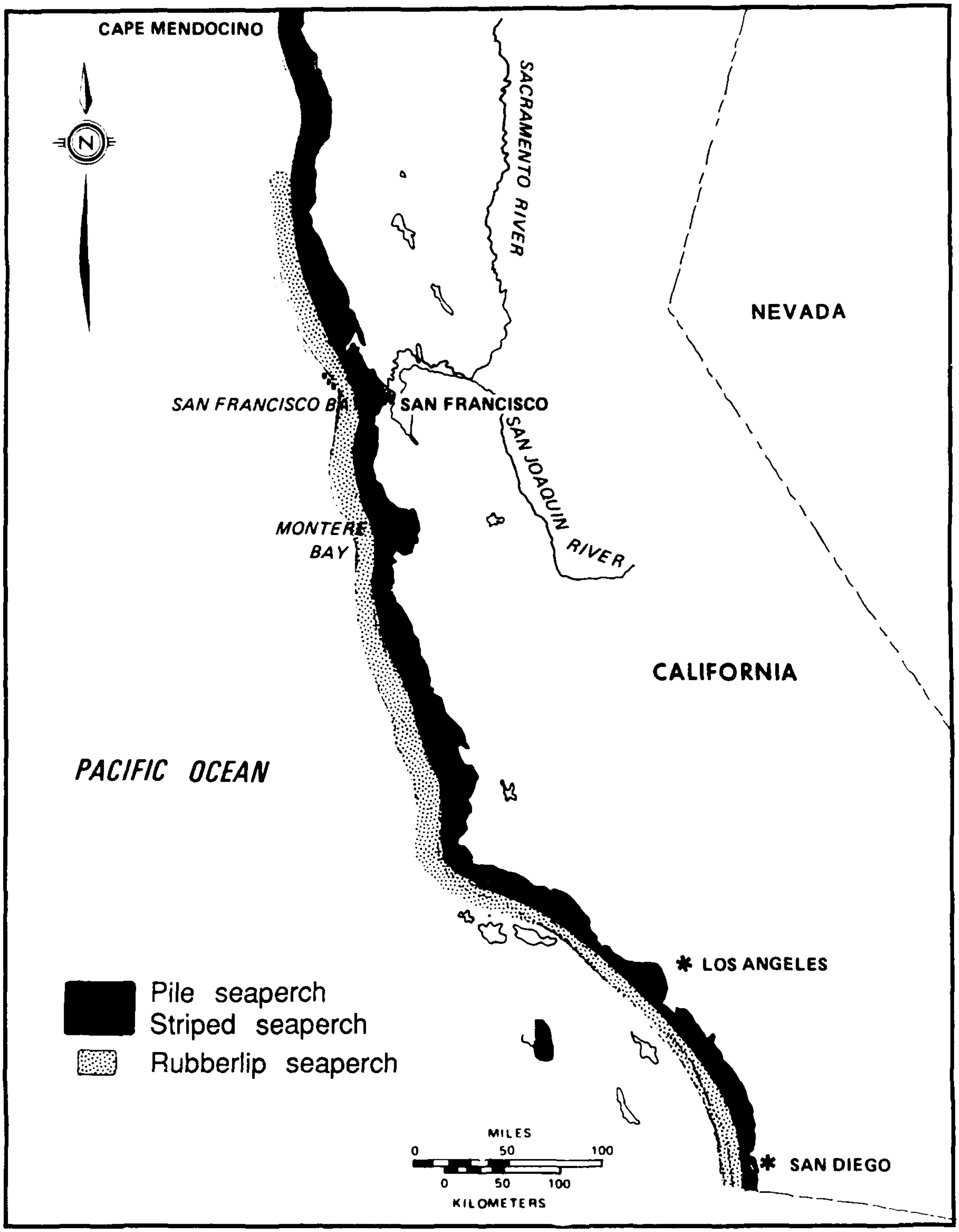


Figure 2. California distribution of pile perch, striped seaperch, and rubberlip seaperch.

Class . . . . Osteichthyes
Order . . . . Perciformes
Family . . . . Embiotocidae

Geographic range: Mendocino County, California, to central Baja California including Guadalupe Island (Figure 2). Usually rocky areas and near jetties, kelp or pilings; inshore and to 46 m (Eschmeyer et al. 1983).

MORPHOLOGY/IDENTIFICATION AIDS

Surfperches are characterized by having cycloid scales covering the body and forming a sheath at the base of the dorsal fin. The dorsal fin is single; the spinous portion gradually increases in height to the point where it joins the soft rayed portion. There are three anal-fin spines. No teeth on vomer or palatines. Branchiostegals 5-6; gill membranes free from the isthmus. All surfperches are viviparous; the male has a distinctive anal gland on the anal fin (Tarp 1952).

Rhacochilus vacca: Rays at front of soft dorsal fin long--about twice as long as dorsal fin spines. Caudal fin deeply forked (Eschmeyer et al. 1983). Dorsal fin spines 9-11; soft rays 21-25. Anal fin rays 25-31; pectoral fin rays 19-22; vertebrae 34-39. Scales along the lateral line 56-69 + 5-8 on tail. Gill rakers 18-22 on the first arch (Miller and Lea 1972). Ground color silvery overlain with brown or sooty tones; most heavily pigmented on dorsal surface. Fins dusky (Tarp 1952). Maximum length 44 cm total length (TL) (Eschmeyer et al. 1983).

Embiotoca lateralis: Body compressed; caudal peduncle short and deep. Spinous portion of dorsal fin low. Dorsal fin spines 10-12; soft rays 23-26. Anal fin rays 29-33; pectoral fin rays 21-24; vertebrae 33-35. Scales along the lateral line 59-65 + 6-8 on the tail. Gill rakers 22-27 on the first arch (Miller and Lea 1972). Ground color coppery, darker brown dorsally; about 15 horizontal blue stripes on the body below the lateral line; several series of blue spots and stripes on head; fins coppery. Maximum length 38 cm TL (Eschmeyer et al. 1983).

Rhacochilus toxotes: A large surfperch with thick lips. Spines slightly shorter than rays in dorsal fin (Eschmeyer et al. 1983). Dorsal fin spines 9-11, soft rays 20-25; anal fin rays 27-30; pectoral fin rays 21-24; vertebrae 35-38. Scales in lateral line 69-76 + 6-9 on the tail. Gill rakers 26-28 on the first arch (Miller and Lea 1972). Ground color silvery with blue to purple coloration on dorsal surface; pectoral fins yellowish and pelvics black; other fins dusky or fringed with black. Lips white or pink (Tarp 1952). The largest of the surfperches, reaching a maximum length of 47 cm TL (Eschmeyer et al. 1983).

REASON FOR INCLUSION IN SERIES

The pile perch, striped seaperch, and rubberlip seaperch all belong to the family Embiotocidae, the surfperches. Of the 23 species in this family, nineteen are widespread along the California coast. Most are inshore species, found in kelp beds, in estuaries, around jetties, and outside the surf zone of beaches. Many are popular sport species, and a few, including the three contained herein, support a small commercial fishery (Fritzsche 1982).

LIFE HISTORY

Spawning

Embryos are nurtured in the female before birth and may be fairly large as newborn young (Eschmeyer et al. 1983).

The testis index for male pile perch from Yaquina Bay, Oregon, peaked in September and October; the highest index in late September was ten times that in midsummer (Wares 1971).

Fecundity (brood size) is positively correlated with size and age in female pile perch (Baltz 1984; Wares 1971), and weight in pile perch and striped seaperch (Webb and Brett 1972a). Female striped seaperch also display an age-specific increase in fecundity, while no data are available for rubberlip seaperch (Baltz 1984). Fecundity of pile perch at the age of first reproduction (IV) averages 11.7 and sometimes exceeds 60 in older fish (ages VII-X). Average fecundity of striped seaperch is 18 at the age of first reproduction (III) and increases to 32 at age VII (Baltz 1984).

Breeding behavior has been observed only in pile perch and striped seaperch. A pair of pile perch swimming in the same direction suddenly turn on their sides or upside down and bring their urogenital openings into contact for an instant (Randolph 1928; Wales 1929). The behavior is somewhat different in striped seaperch. One member of a pair maintains a normal (vertical) swimming position while the other orients in a horizontal plane. The anal fins are situated opposite one another. They maintain this position for 2 or 3 seconds while the horizontally oriented individual (male?) vibrates or shudders and fertilization occurs (Edwards 1970).

Development

Since surfperches are viviparous, the eggs and embryos develop within the maternal ovaries. The embryos obtain nourishment for growth by absorbing the rich ovarian fluid. The dorsal and anal fins of the embryo are large and vascular and have spatulate extensions (Moyle 1976; Webb and Brett 1972a) that lie in close contact with the well-vascularized ovarian wall. Respiration also takes place between these spatulate fins and the ovarian wall (Webb and Brett 1972a). The oxygen capacity of the ovarian fluid of striped seaperch and pile perch is about the same as that of 10 ppt seawater. This fluid apparently lacks respiratory pigments (Webb and Brett 1972b). In striped seaperch, the oxygen affinity of fetal hemoglobin is higher than that of the adult hemoglobin at all physiological pH's. This difference is apparently due to two mechanisms: (1) structurally different hemoglobin, and (2) differences in intra-erythrocytic organic phosphate concentrations (Ingermann and Terwilliger 1981). The embryo may show adaptations to hypoxia, such as having lower mean corpuscular hemoglobin concentrations, since the oxygen tensions it is exposed to may be lower than those available to the adult. This difference may facilitate oxygen transfer between the embryo and the adult (Ingermann and Terwilliger 1982; Ingermann et al. 1984).

During gestation the fins change little in surface area, while the body area does change. The spatulate fin extensions are absorbed before birth (Webb and Brett 1972a).

In British Columbia young pile perch are born in mid to late August (Webb and Brett 1972a). Rubberlip seaperch containing nearly mature embryos have been taken from April to June (Fitch and Lavenberg 1971). In British Columbia waters striped seaperch liberate their young in June and July (Fraser 1923).

Movement, Seasonality, and Longevity

Studies in and near the kelp forests off Santa Barbara, California, have indicated that the three species of surfperches considered here generally remain in the mid-water and suprabenthic zones both day and night, and pile perch are often seen scattered in the water column at night (Table 1). Ebeling and Bray (1976) reported that the relative abundance

Table 1. Vertical-zone variation in numbers of fish compared between day and night (26 species represented) (from Ebeling and Bray 1976).

	Day				Night			
Species	* M	Sb	B	Sh	M	Sb	B	Sh
Pile perch	32	76	2	2	10	10	2	0
Striped seaperch	26	108	0	0	10	15	10	2
Rubberlip seaperch	8	19	4	0	16	20	4	1

*M, mid-water; Sb, suprabenthic; B, bottom; Sh, shelter

of each of the three species in the kelp forest varied seasonally and diurnally. Although the seasonal data is not conclusive, it appears that these species were most abundant in December to February. Pile perch and striped seaperch were most abundant during the day while rubberlip seaperch were slightly more abundant at night. Ebeling et al. (1980) compared the annual variability in abundance and distribution of pile perch and rubberlip seaperch between two study sites, located on either side of the Santa Barbara Channel. Fish at the two sites were censused each September for 4 years. Pile perch were relatively more abundant at the mainland site.

Anderson and Chew (1972) who made monthly fish collections at Big Beef Harbor in Hood Canal, Washington, reported that pile perch ranked third in abundance there. However, they disappeared by November and did not reappear until the following July. The hypothesis was that pile perch enter shallow water in summer and move to deep water in winter. Terry and Stephens (1976), however, noted that adult pile perch were most abundant during winter and spring months at a Redondo Beach, California, breakwater. Juveniles first appeared in May and abundance peaked in June. Adults commonly traveled in schools of 50 to 100 during winter months; they lived in shallow water during winter and spring, seemingly because of a preference for water temperatures of 16 °C or lower.

All three species of surfperch treated here have a life span of 7 to 10 years (Baltz 1984).

GROWTH CHARACTERISTICS

Wares (1971), who used the scale method of analysis to back-calculate length at age for pile perch, reported that males and females grew at about the same rate for the first 3 to 4 years. Thereafter, the growth rate of males declined more rapidly than that of females. Webb and Brett (1972a) calculated a daily growth rate for pile perch embryos of nearly 5% (wet weight).

Baltz (1984), who stated that the growth of striped seaperch is indeterminate, observed the following average standard lengths (mm) for different ages (roman numerals): I, 130; II, 173; III, 216; IV, 233; V, 262; VI, 277; and VII, 297. The growth rate of embryos was slightly over 2% per day (Webb and Brett 1972a).

FISHERY

All three of the surfperches treated herein are among the eight to ten species of the family that are important in the commercial "perch" fishery. The annual commercial catch of surfperches has varied substantially ($\bar{x} \pm$ S.D. = 176.8 $\pm$ 49.6 in thousands of pounds) over time (Table 2). The market for fresh "perch" fillets is relatively small.

All three species of surfperches are taken by sport fishermen, mostly from piers, jetties, skiffs, or the shore. From 1958 to 1961, sport fishermen caught an estimated 5,000 rubberlip seaperch per year in the area between Point Arguello and the Oregon border. The annual catch south of Point Arguello was believed to be double this number (Fitch and Lavenberg 1971).

Table 2. Commercial "perch" landings and ex-vessel value in California 1967-1976 (from California Department of Fish and Game 1968-79).

Year	Weight (Thousands of pounds)	Value (Thousands of dollars)
1967	202	42
1968	168	35
1969	156	36
1970	241	43
1971	185	43
1972	273	44
1973	138	38
1974	148	52
1975	114	40
1976	142	57

The standing crop of pile perch was estimated by Quast (1968b) to be about 16.4 kg/ha in Del Mar, California, and 8.5 kg/ha at Papalote Bay, Baja California. Comparable figures for rubberlip seaperch were about 4.7 and 3.8.

ECOLOGICAL ROLE

Feeding Habits

Surfperches are mainly benthic grazing carnivores that have relatively small mouths and feed on invertebrates -- chiefly crustaceans (DeMartini 1969).

Pile perch have well developed, fused pharyngeal tooth plates that enable the fish to crush hard-shelled invertebrates (DeMartini 1969; Alevizon 1975a). This specialization has led some authors to place pile perch in a separate genus *Damalichthys* (Tarp 1952). Pile perch feed on whole mussels (about 2.5 cm long) in the laboratory (Brett 1979), and field studies have shown that a wide variety of hard-bodied prey are taken. Ellison et al. (1979) listed 27 prey taxa in the diet of pile perch at Redondo Beach, California (Table 3). Hueckel and Stayton (1982) found that prey in the diet of pile perch off Edmonds, Washington, came from seven phyla. In their study, an artificial reef did not attract medium-sized or large pile perch because it supported few barnacles and no mussels. Wares (1971) listed six phyla in the diet at Yaquina Bay, Oregon; however, mollusks and crustaceans made up 99% of the prey volume. McCormack (1982) indicated that pile perch were consistent predators on intertidal snails in British Columbia; they also ate barnacles, small crabs, and mussels.

Table 3. Prey items found in pile perch from King Harbor, Redondo Beach, California, (summer 1976), given as percent of total number of items eaten (adapted from Ellison et al. 1979).

Food group	Pile perch
Arthropoda	
Crustacea	
Decapoda	
miscellaneous	0.22
Brachyura	
miscellaneous	0.89
Canceridae	0.22
Majidae	0.22
Anomura	
Pagurus spp.	8.72
Caridea	
Bataeus spp.	0.22
Isopoda	
Cirolana harfordi	0.45
Ianiropsis spp.	0.45
Jaeropsis spp.	0.45
Amphipoda	
Gammaridea	2.91
Tanaidacea	
Anatanais normani	--[a]
Tanais spp.	0.89
Cirripedia	
miscellaneous	7.83
Mollusca	
Gastropoda	
Miscellaneous	10.29
Acmaeidae	2.46
Barleeia spp.	33.33
Crepipatella lingulata	3.14
Mitrella spp.	6.04
Bivalvia	
miscellaneous	6.49
Hiatella artica	5.59
Lithophaga plumula kelseyi	0.22
Mytilus spp.	0.89
Echinodermata	
Ophiuroidea	3.80
Echinoidea	0.45
Ectoprocta	
miscellaneous	2.24
Bugula neritina	0.22
Membranipora spp.	1.12
Annelida	
Polychaeta	
Miscellaneous	0.22

[a]Found only in intestine.

Haldorson and Moser (1979) compared the diets of pile perch and striped seaperch from Puget Sound south to Baja California (Figure 3). Striped seaperch have a relatively larger mouth and consequently have a diverse diet (Haldorson and Moser 1979). They feed throughout the day (Schmitt and Holbrook 1984). They select prey visually (Schmitt and Holbrook 1984) and eat relatively large, heavy prey when available (Alevizon 1975b). The striped seaperch is mainly a benthic grazing carnivore (DeMartini 1969; Hixon 1980) but feeds throughout the water column in the apparent absence of competitors. DeMartini (1969) listed large isopods and gastropod mollusks as the preferred prey, and noted some amphipods, macruran shrimps, and pelecypods in the diet. A comparative study by Haldorson and Moser (1979) showed a constant diet throughout the year, dominated by gammarid and caprellid amphipods. Hixon (1980) also found polychaete worms and ophiuroid brittle stars in the diet of striped seaperch, and Schmitt and Coyer (1982) found 55% gammarids and 30% isopods, shrimps, and crabs.

Rubberlip seaperch are "oral winnowers" as juveniles and adults (Laur and Ebeling 1983): when food is mouthed, the unwanted items are expelled. They feed both diurnally and nocturnally (Ebeling and Bray 1976; Laur and Ebeling 1983; Stouder 1987) and feed principally on smaller thin-shelled invertebrates (Alevizon 1975a). Stomach contents indicated a diet of almost exclusively crustaceans, including shrimp, amphipods, small crabs, and stomatopods (Fitch and Lavenberg 1971). DeMartini (1969) demonstrated that the diet also sometimes contains a few mollusks and algae.

Laur and Ebeling (1983), in a comparative study of the availability and forage ratios of prey of pile perch and rubberlip seaperch near Santa Barbara, demonstrated the dissimilarity of the diets of these two species. Pile perch fed primarily on brittle stars, crabs and amphipods while rubberlip perch consumed shrimp, amphipods and crabs.

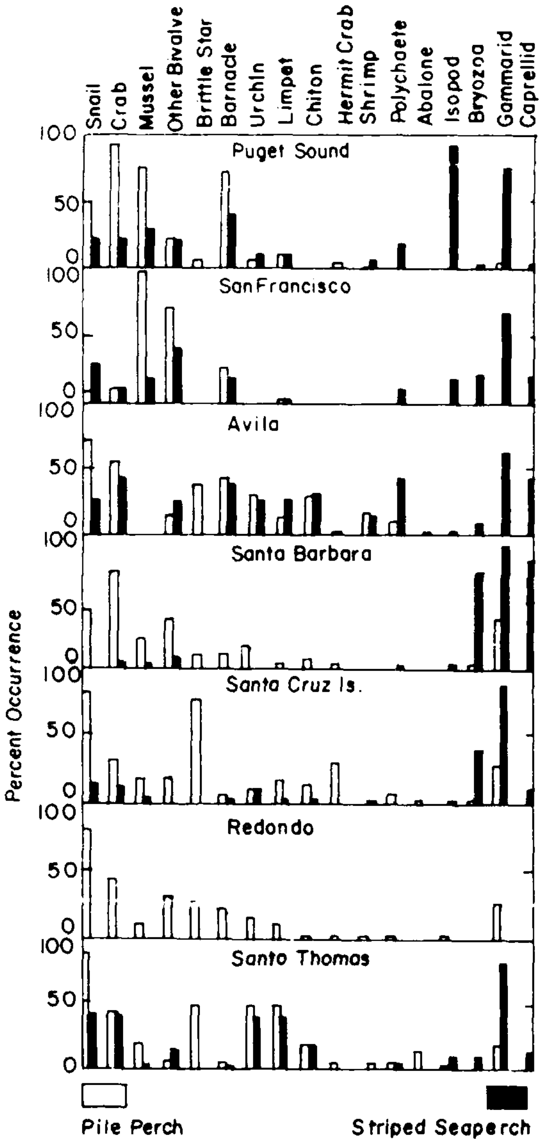


Figure 3. Frequency of occurrence (percent) of all prey categories in stomachs of pile perch and striped seaperch from various locations (from Haldorson and Moser 1979).

Predators

Adult pile perch, striped seaperch and rubberlip seaperch are generally too large for most predators but the young are vulnerable to predation by many piscivores. Ebeling and Laur (1985) listed kelp bass (Paralabrax clathratus) as a predator of young surfperch near Santa Barbara, California. Hixon (1980) listed electric rays, sharks, large serranid basses and pinnipeds as potential surfperch predators. The birth of young surfperches in late spring and early summer coincides with maximum refuge protection in the kelp (Ebeling and Laur 1985).

Competitors

Because of their overlapping ranges and similarity of life style, the pile perch, striped seaperch, and rubberlip seaperch have been the subject of comparative studies (Alevizon 1975a; Ebeling and Bray 1976; Laur and Ebeling 1983). The comparison has sometimes been between similar-sized surfperches, such as the pile perch and striped seaperch (Haldorson and Moser 1979) or congeneric pairs, such as the striped seaperch and black perch, Embiotoca jacksoni (Alevizon 1975a; Hixon 1979, 1980; Schmitt and Coyer 1982, 1983; Schmitt and Holbrook 1984).

In general, pile perch, striped seaperch, and rubberlip seaperch have a similar general form and distribution. However, they have distinctive differences in feeding morphology and feeding behavior and divide the reef habitats among them, thus perhaps reducing interspecific competition. Alevizon (1975a) found that the congeners pile perch and rubberlip seaperch occur in wide overlapping zones from the bottom and up to 15 m above the bottom. They also occasionally form mixed schools. The differences in feeding habits and morphology may account for the ability of different species of the genus

Rhacochilus to share the same habitat (Alevizon 1975a; Laur and Ebeling 1983; Schmitt and Coyer 1983). In addition, the rubberlip seaperch feeds at night, whereas the other surfperches feed diurnally (Ebeling and Bray 1976).

Evidence is available to show that th. Embiotoca species (black perch and striped seaperch) compete interspecifically. Both have similar size, morphology, dentition, and feeding behavior (Alevizon 1975a; Hixon 1979). Striped seaperch exclude some but not all black perch at depths of about 6 m or less when the two species occur in the same area. Striped seaperch prefer shallow water (< 6 m) even when black perch are removed from deeper water. Both species are substrate feeders and exhibit similar and significant patterns of intraspecific and interspecific aggressive interactions (Schmitt and Holbrook 1986). The two species segregate spatially and use different feeding substrates (Hixon 1979; Schmitt and Holbrook 1986).

When prey size and taxon are both considered, diet is significantly distinct among the following four groups: Age I-II striped seaperch, Age I-II black perch, Age III-IV striped seaperch, and Age III-IV black perch. The niches of the four groups may have separated to alleviate intense intraspecific and interspecific competition in the past (Holbrook et al. 1985).

Parasites

Moser and Haldorson (1982) summarized the parasites recorded from pile perch and striped seaperch from Washington to Baja California (Table 4). The list of parasites for the two species correspond almost exactly. Arai (1967) suggested that ecological rather than phylogenetic factors may be responsible for particular parasites being found in a given host species. Dojiri (1981) described the copepod Clavella embiotocae, found on gill filaments of pile perch collected near the sewage outfall off Orange County, California. Noble et al. (1969) described Colobomatus embiotocae as a new copepod species infecting pile perch and rubberlip seaperch in southern California.

Hobson (1971) observed pile perch and rubberlip seaperch being cleaned by the senorita (Oxyjulis californica). He also noted that rubberlip seaperch are occasionally cleaned by sharpnose surf perch, Phanerodon atripes. Hobson (1971) suggested that the copepod Caligus hobsoni was the parasite being removed by these cleaners.

ENVIRONMENTAL REQUIREMENTS

Juvenile black perch and striped seaperch are frequently found together in shallow reef areas but exhibit no detectable competition with each other. In the southern end of its range (south of Santa Barbara), the population density of striped seaperch is low, even though it appears to be the dominant competitor (Hixon 1980).

Pile perch, striped seaperch, and rubberlip seaperch prefer areas of high-relief substrate and dense algal growth that harbor abundant invertebrate prey (Alevizon 1975a; Hixon 1980; Quast 1968a). Harsh storms may scour reef habitat and remove kelp. When the kelp canopy is removed it no longer traps free kelp, a favorite food of sea urchins. The sea urchins then switch to consumption of plant cover elsewhere on the reef, eliminating food habitat (Stouder 1987). After a harsh storm reduces food abundance, pile perch and rubberlip seaperch move but striped seaperch do not (Stouder 1987).

Young of all three species are found in the kelp understory or areas with abundant cover (Hixon 1980; Ebeling and Laur 1985). Adults are typically in areas with little cover (Ebeling and Laur 1985).

Table 4. Parasites of pile perch and striped seaperch (adapted from Moser and Haldorson 1982) (+ = positive record).

Parasite	Site of infection	Host: Pile perch	Host: Striped seaperch
Protozoa, Myxosporida			
Zschokkella embiotocidis	Gall bladder	+	+
Z. ilishae	Gall bladder	+	+
Sphaerospora divergens	Urinary bladder	+	+
Henneguya zschokkei	Gill	+	+
Davisia reginae	Urinary bladder	+	+
Myxosoma squalamis	Gill	+	
Trematoda, Digena			
Lepidophyllum pleuronectini	Intestine	+	+
Neozoogonus californicus	Intestine		+
Sterrhurus exodicus	Intestine	+	+
Telolecithus pugetensis	Intestine	+	+
Genitocotyle acirrus	Intestine		+
Diplangus macrovitellus	Intestine		+
D. mexicanus	Intestine		+
Lopastoma sp.	Intestine		+
Trematoda, Monogenea			
Neobenedenia girellae	Exterior	+	+
Allencotyla pricei	Gill	+	+
Crustacea, Copepoda			
Clavella sp.	Gill	+	+
Bomolochus cuneatus	Gill	+	+
Peniculus sp.	Fin	+	+
Lepeophtheirus oblitus	Gill	+	+
Crustacea, Brachiura			
Argulus pugettensis	Exterior	+	+
Crustacea, Isopoda			
Cymothoidea sp.	Gill	+	+
Acanthocephala			
Corynosoma sp.	Intestine	+	+
Nematoda			
Philometra americana	Muscle	+	
Cucullanellus kanabus	Intestine	+	+
Cystidicolidae	Coelom		+
Phocanema sp.	Intestine	+	+
Cestoda			
Trypanorhyncha	Intestine	+	+

Adult pile perch have been shown to move seasonally near Redondo Beach, California. They prefer colder water so that during the summer and fall they are in deeper water, around 8 m. In the winter and spring they are at about 4-5 m. Adults are found in water cooler than 16 ^{o}C and tend to avoid warmer water (Terry and Stephens 1976). This is in contrast with the findings of Allen et al. (1970), who noted pile perch in the warm water near a power plant in Humboldt Bay. Hose et al. (1983), who studied the behavioral response of pile perch to water discharged from a steam generating plant in Redondo Beach, found an average total avoidance threshold to concentrations of hypochlorite of 0.028 mg/l total residual oxidants.

Striped seaperch studied in Humboldt Bay by Allen et al. (1970) are attracted to the warm water discharge of a nuclear power plant and also prefer rocky subtidal areas.

LITERATURE CITED

Alevizon, W.S. 1975a. Spatial overlap and competition in congeneric surfperches (Embiotocidae) off Santa Barbara, California. Copeia 1975(2):352-356.

Alevizon, W.S. 1975b. Comparative feeding ecology of a kelp-bed Embiotoca (Embiotoca lateralis). Copeia 1975(4):608-615.

Allen, G.H., L.B. Boydstun, and F.G. Garcia. 1970. Reaction of marine fishes around warmwater discharge from an atomic steam-generating plant. Prog. Fish Cult. 32(1):9-16.

Anderson, R.D., and K.K. Chew. 1972. Preliminary study on the transient species of fish in Big Beef Harbor. Trans. Am. Fish. Soc. 101(4):726-729.

Arai, H.P. 1967. Ecological specificity of parasites of some embiotocid fishes. J. Fish. Res. Board Can. 24(10):2161-2168.

Baltz, D.M. 1984. Life history variation among female surfperches (Perciformes: Embiotocidae). Environ. Biol. Fishes 10(3):159-171.

Brett, J.R. 1979. Some morphological and behavioral adaptations of pile perch (Rhacochilus vacca) feeding on mussels (Mytilus edulis). Can. J. Zool. 57:658-664.

California Department of Fish and Game. 1968-79. The California marine fish catch (landings). Calif. Dep. Fish Game Fish Bull. Nos. 144, 149, 153, 154, 159, 161, 163, 166, 168, 170.

DeMartini, E.E. 1969. A correlative study of the ecology and comparative feeding mechanism morphology of the Embiotocidae (surf-fishes) as evidence of the family's adaptive radiation into available ecological niches. Wasmann J. Biol. 27(2):177-247.

Dojiri, M. 1981. Copepods of the families Lernaeopodidae and Naobranchiidae parasitic on fishes from southern California inshore waters. J. Crustacean Biol. 1(2):251-264.

Ebeling, A.W., and R.N. Bray. 1976. Day versus night activity of reef fishes in a kelp forest off Santa Barbara, California. U.S. Natl. Mar. Fish. Serv. Fish. Bull. 74(4):703-717.

Ebeling, A.W., and D.R. Laur. 1985. The influence of plant cover on surfperch abundance at an offshore temperate reef. Environ. Biol. Fishes 12(3):169-179.

Ebeling, A.W., R.J. Larson, W.S. Alevizon, and R.N. Bray. 1980. Annual variability on reef-fish assemblages in kelp forests off Santa Barbara, California. U.S. Natl. Mar. Fish. Serv. Fish. Bull. 78(2):361-377.

Edwards, G.D. 1970. Observations of mating behavior of the striped perch and notes on possible reproductive activity of the rainbow perch. Calif. Fish Game 56:205-206.

Ellison, J.P., C. Terry, and J.S. Stephens, Jr. 1979. Food resource utilization among five species of embiotocids at King Harbor, California, with preliminary estimates of caloric intake. Mar. Biol. (Berl.) 52:161-169.

Eschmeyer, W.N., E.S. Herald, and H. Hammann. 1983. A field guide to Pacific Coast fishes of North America. Houghton Mifflin Co., Boston. 336 pp.

Fitch, J.E., and R.J. Lavanberg. 1971. Marine food and game fishes of California. University of California Press, Berkeley. 179 pp.

Fraser, C.M. 1923. Ichthyological notes. Contrib. Can. Biol. N.S. 1(14):285-296.

Fritzsche, R.A. 1982. Osteichthyes. Pages 858-944 in Sybil P. Parker, ed. Synopsis and classification of living organisms. Vol. 2. McGraw-Hill Book Company, New York. 1232 pp.

Haldorson, L., and M. Moser. 1979. Geographic patterns of prey utilization in two species of surfperch (Embiotocidae). Copeia 1979(4):567-572.

Hixon, M.A. 1979. Competition between California reef fishes (niche inclusion of co-extension?) pages 170-178 in S.J. Lipovsky and C.A. Simenstadt, eds. Gutshop '78: fish food habits studies. Proceedings of the second Pacific Northwest Technical Workshop, held at Maple Valley, WA. (USA). 10-13 October 1978. Washington Sea Grant, Seattle.

Hixon, M.A. 1980. Competitive interactions between reef fishes of the genus Embiotoca. Ecology 61(4):918-931.

Hobson, E.S. 1971. Cleaning symbiosis among California inshore fishes. U.S. Natl. Mar. Fish. Serv. Fish. Bull. 69(3):491-523.

Holbrook, S.J., R.J. Schmitt, and J.A. Coyer. 1985. Age-related dietary patterns of sympatric adult surf perch. Copeia 1985:986-994.

Hose, J.E., R.J. Stoffel, and K.E. Zerba. 1983. Behavioral responses of selected marine fishes to chlorinated seawater. Mar. Environ. Res. 9:37-59.

Hueckel, G.J., and R.L. Stayton. 1982. Fish foraging on an artificial reef in Puget Sound, Washington. Mar. Fish. Rev. 44(6-7):38-44.

Ingermann, R.L., and R.C. Terwilliger. 1981. Intraerythrocytic organic phosphates of fetal and adult seaperch (Embiotoca lateralis): Their role in maternal-fetal oxygen transport. J. Comp. Physiol. 144:253-259.

Ingermann, R.L., and R.C. Terwilliger. 1982. Blood parameters and facilitation of maternal-fetal oxygen transfer in a viviparous seaperch (Embiotoca lateralis). Comparative Biochem. Physiol. 73A(3):497-501.

Ingermann, R.L., R.C. Terwilliger, and M.S. Roberts. 1984. Fetal and adult blood oxygen affinities of the viviparous seaperch, Embiotoca lateralis. J. Exp. Biol. 108:453-457.

Laur, D.R., and A.W. Ebeling. 1983. Predator-prey relationships in surfperches. Environ. Biol. Fishes 8(3-4):217-229.

McCormack, S.M.D. 1982. The maintenance of shore-level size gradients in an intertidal snail (Littorina sitkana). Oecologia 54:177-183.

Miller, D.J., and R.N. Lea. 1972. Guide to the coastal and marine fishes of California. Calif. Fish Game Fish Bull. No. 157.

Moser, M., and L. Haldorson. 1982. Parasites of two species of surfperch (Embiotocidae) from seven Pacific coast locales. J. Parasitology 68(4):773-755.

Moyle, P.B. 1976. Inland fishes of California. University of California Press, Berkeley. 405 pp.

Noble, E.R., S.B. Collard, and S.N. Wilkes. 1969. A new philichthyid copepod parasitic in the mucous canals of surfperches (Embiotocidae). J. Parasitol. 55(2):435-442.

Quast, J.C. 1968a. Fish fauna of the rocky inshore zone. Pages 35-55 in W.J. North and C.L. Hubbs, eds. Utilization of kelp-bed resources in southern California. Calif. Fish Game Fish Bull. No. 139.

Quast, J.C. 1968b. Estimates of the populations and the standing crop of fishes. Pages 57-79 in W.J. North and C.L. Hubbs, eds. Utilization of kelp-bed resources in southern California. Calif. Fish Game Fish Bull. No. 139.

Randolph, P.B. 1928. The mating habits of viviparous fishes. Am. Nat. 32:305.

Schmitt, R.J., and J.A. Coyer. 1982. The foraging ecology of sympatric marine fish in the genus Embiotoca (Embiotocidae): importance of foraging behavior in prey size selection. Oecologia 55:368-378.

Schmitt, R.J., and J.A. Coyer. 1983. Variation in surfperch diets between allopatry and sympatry: circumstantial evidence for competition. Oecologia 58(3):402-410.

Schmitt, R.J., and R.J. Holbrook. 1984. Gape-limitation, foraging tactics and prey selectivity of two microcarnivorous species of fish. Oecologia 63(1):6-12.

Schmitt, R.J., and S.J. Holbrook. 1986. Seasonally fluctuating resources and temporal variability of interspecific competition. Oecologia 69:1-11.

Stouder, D.J. 1987. Effects of a severe-weather disturbance on foraging patterns within a California USA surfperch guild. J. Exp. Mar. Biol. Ecol. 114:73-84.

Tarp, F.H. 1952. A revision of the family Embiotocidae (the surfperches). Calif. Fish Game Fish Bull. 88:1-99.

Terry, C.B., and J.S. Stephens, Jr. 1976. A study of the orientation of selected Embiotocid fishes to depth and shifting seasonal vertical temperature gradients. Bull. South. Calif. Acad. Sci. 75(2):170-183.

Wales, J.H. 1929. A note on the breeding habits of the viviparous perch Damalichthys. Copeia (172): 57-58.

Wares, P.G. 1971. Biology of the pile perch, Rhacochilus vacca, in Yaquina Bay, Oregon. U.S. Bur. Sport Fish. Wildl. Tech. Paper 57:3-21.

Webb, P.W., and J.R. Brett. 1972a. Respiratory adaptations of prenatal young in the ovary of two species of viviparous seaperch, Rhacochilus vacca and Embiotoca lateralis. J. Fish. Res. Board Can. 29:1525-1542.

Webb, P.W., and J.R. Brett. 1972b. Oxygen consumption of embryos and parents, and oxygen transfer characteristics within the ovary of two species of viviparous seaperch, Rhacochilus vacca and Embiotoca lateralis. J. Fish. Res. Board Can. 29:1543-1553.

50272-101

REPORT DOCUMENTATION PAGE

1. Report No. Biological Report 82(11.103)*

2.

3. Recipient's Accession No.

4. Title and Subtitle
Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Pacific Southwest)--Pile Perch, Striped Seaperch and Rubberlip Seaperch.

5. Report Date July 1989

6.

7. Author(s)
Ronald A. Fritzsche and Thomas J. Hassler

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
Department of Fisheries
Humboldt State University
Arcata, CA 95521

Calif. Coop. Fishery Research Unit
Humboldt State University
Arcata, CA 95521

10. Project/Task/Work Unit No.

11. Contract(C) or Grant(G) No.
(C)
(G)

12. Sponsoring Organization Name and Address
National Wetlands Research Center
Fish and Wildlife Service
U.S. Department of the Interior
Washington, DC 20240

Coastal Ecology Group
Waterways Experiment Station
U.S. Army Corps of Engineers
Vicksburg, MS 39180

13. Type of Report & Period Covered

14.

15. Supplementary Notes
*U.S. Army Corps of Engineers report No. TR EL-82-4

16. Abstract (Limit: 200 words)
Species profiles are literature summaries of the taxonomy, morphology, range, life history, and environmental requirements of coastal aquatic species. They are designed to assist in environmental impact assessment. Pile perch, striped seaperch, and rubberlip seaperch are popular sport fishes along the entire California coast. They are relatively common near wharves, pilings, jetties, and other nearshore structures. All members of this family are viviparous. Fecundity is positively correlated with size and age of the female. The young are released as miniature adults. All three species are relatively large for the family and may live 7 to 10 years. The primary prey items of all three species are various invertebrates; however, pile perch tend to prefer hard-shelled prey. The habitats of the three species overlap considerably. Little is known of their environmental tolerances.

17. Document Analysis a. Descriptors
Fishes
Growth
Feeding
Parasites
Growth
Life cycles
Competition
Temperature

b. Identifiers/Open-Ended Terms
Pile perch
Striped seaperch
Rubberlip seaperch
Rhacochilus vacca
Embiotoca lateralis
Rhacochilus toxotes
Predation

c. COSATI Field/Group

18. Availability Statement
Unlimited release

19. Security Class (This Report) Unclassified

20. Security Class (This Page) Unclassified

21. No. of Pages 15

22. Price

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

TAKE PRIDE *in America*

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
National Wetlands Research Center
NASA-Slidell Computer Complex
1010 Gause Boulevard
Slidell, LA 70458

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF THE INTERIOR
INT-423