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Observations On Fishes Associated With Kelp Beds in Southern California

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ABSTRACT

This bulletin is meant to be a guide to the fishes of the west-central coast of North America that commonly occur in kelp beds and adjacent areas. The fishes described are common species, and this report is not meant to include all species that occur in the kelp environment and adjacent zones. In all, 97 species are described; key identification features are given. Colors listed for each species refer to how that specimen would appear in the live and/or recently captured state; underwater behavioral characteristics are given wherever possible to aid the underwater diving enthusiast. Description of the kelp environment is given, which includes a brief explanation pertaining to the three major ecological zones within the kelp ecosystem. A brief explanation and description of the kelp bed flora is included, along with geographical considerations. The kelp environment as a habitat type for fishes is discussed; three habitat regions in the kelp bed are given special attention, these are: 1) the canopy, 2) intermediate regions, and 3) kelp bottom holdfast region. Accounts of each species of fish then follow which include identification, distribution, size, habitat habits, and life history inclusive of food and reproductive biology whenever available. Four appendix tables include listings of the organisms frequently observed by diving in the various kelp bed habitat regions.

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A major portion of the information presented here was extracted from notes and published papers of the late Conrad Limbaugh (1955, 1961a,

1961b, 1962, 1963, 1964) and Limbaugh, Pederson, and Chace (1961). His observations were made during a 10 year period of underwater study along the California coast. As a biologist he was more at home in the water than on land, and the information included represents observations of a scientifically trained diver.

Limbaugh studied kelp beds and related areas as far north as Van Damme State Park in northern California and as far south as the San Benito Islands, Baja California. Diving observations between these extremes were made along the mainland at Monterey Bay, Morro Bay, Goleta, Santa Barbara, Point Dume, Palos Verdes, Newport Bay, Laguna Beach, Dana Point, San Clemente, Solana Beach, Del Mar, La Jolla, Point Loma, Ensenada, Punta San Carlos, Punta Blanca, and Punta Santa Rosalia and off the islands of San Miguel, Santa Rosa, Santa Cruz, Anacapa, Santa Catalina, Coronado, and San Martin. His most intensive investigations were carried out in San Diego and Orange Counties, with special concentration on the La Jolla kelp beds.

Conrad Limbaugh met his death in a diving accident in the Mediterranean on March 20, 1960. At the time of his death, he was Chief Diving officer at Scripps Institution of Oceanography, and one of the world's foremost underwater naturalists. He was responsible for introducing the now internationally used Aqualung (scuba) to the west coast of the United States. He acquired this equipment for research purposes while at the University of California, Los Angeles, in 1949.

Many of his underwater projects were unfinished at the time of his death; however, it has been possible to publish a considerable amount of his information from the very extensive field notes and unfinished manuscripts he left behind.

In 1970 the California Department of Fish and Game sustained the loss of Charles Turner, Senior Marine Biologist. Chuck had worked for the Department since his graduation from the University of California, Los Angeles, in 1956. He was well known as a marine biologist, a diver, and a skilled underwater photographer. He was one of the pioneers in developing man-made reefs and became a major influence in establishing the underwater biological surveys now conducted by the Department.

In addition to supervising the Ocean Fish Habitat Development Program, Turner was in charge of the Department's diver training program for 8 years; and at the time of his death was supervisor of the Pelagic Fish Program and of the Inshore Fisheries Habitat and Monitoring Program. Chuck was a member of the California Underwater Parks Advisory Board and of the California Cooperative Oceanic Fisheries Investigations Committee.

Like Limbaugh, many of Turner's projects were unfinished at the time of his death. Much of this work has since been completed or is being continued by diving biologists trained by him.

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1. INTRODUCTION

Habitats of marine organisms may be divided broadly into open ocean, ocean bottom, rocky shore, sandy beach, and estuary. Each area has its own complement of plants and animals.

Rocky areas along the California coast, from shore to considerable depths, contain enormous numbers of living things, and any rock may be covered with organisms that provide food for numerous fishes. Plants in upper levels of rocky regions may grow profusely. The stipes and fronds of some species extend to the surface, forming great plant masses known as kelp beds which harbor many organisms, and are important for recreational fishing and skin diving. In addition, industries harvest as much as 100,000 tons of kelp annually from California beds (Dawson, Neushul, and Wildman, 1960).

An excellent dicussion on ecology and taxonomy of seaweeds in association with kelp beds is available (Dawson, Neushul, and Wildman, 1960), but except for Limbaugh's specialized report (1955) on fish life in the kelp beds and more recent publications by Quast (1968a, b, c), nothing is available on the general biology of fishes in this region.

This bulletin is designed as a guide to marine fishes of California which are found in kelp beds and the adjacent environment, and should be most useful to the skin and scuba diver—whether a recreational diver or biologist. Fishes included are those most commonly encountered by divers, and represent but a fraction of the total species occurring in the state.

Descriptions of appearance and color refer, in practically all cases, to living individuals observed underwater. Wherever possible, key underwater identification features are included so a diver may rapidly recognize the fish. Behavioral traits shown by certain species are included to facilitate recognition. Structural descriptions, color out of water, and distributional ranges may be found for most of these fishes in Barnhart (1936); Bolin (1944); Tarp (1952); Roedel (1953); Clemens and Wilby (1961); Miller, Gotshall, and Nitsos (1965); Baxter (1966); Fitch (1969); and Miller and Lea (1972). Species from other habitats also are considered to enable the reader to distinguish between causal visitors and true kelp-bed dwellers.

2. THE KELP PLANT AND THE KELP BEDS

Kelp beds are submarine forests of giant marine algae. The beds of southern California are dominated by a single species, the giant kelp, Macrocystis pyrifera, which is found from Sitka, Alaska, to San Hipolito Point, Baja California, and from the intertidal to 100 feet (Dawson, Neushul, and Wildman, 1960). Large offshore beds, occurring from Santa Cruz, California, to central Baja California, vary in size from a few plants, forming several hundred square feet of surface canopy, to hundreds of thousands of plants forming several square miles of canopy.

Individual plants consist of twisted columns of slender, round, stemlike stipes rising from a rootlike, relatively conical holdfast. Holdfasts may vary in diameter from less than 1 inch to more than 4 feet. They consist of rootlike structures known as haptera which arise at the apex of the cone,

below the stipes, and branch downward into older haptera until they reach the bottom. Here they affix to solid objects, usually rough rocky substrate. Sometimes they are attached to water soaked wood, concrete, metal, hard clay or sand, old holdfasts, rhizomes of eelgrass, or stipes of other algae. Inner haptera are always dead in older plants, and the holdfasts are secured only at the periphery of the base of the cone. The stipe diameter varies from # to ½ inch. When a stipe reaches the surface it bends to form a canopy. The number of stipes arising from a single holdfast varies from 1 to 40 or more. Attached alternately to the thin unbranched stipes are leaflike blades, each with a round to egg shaped supporting float.

Plant growth is primarily from the terminal ends of stipes; additional growth seems to occur along the major portion of the stipe. Growth eventually stops on mature stipes, but individual plants may attain a length of 165 feet or more. Plant length is determined in part by the depth from which the plant grows, which in turn is partly dependent upon water clarity since sunlight is needed for energy. Around offshore islands where water is clearest, plants may grow from depths of over 100 feet. In the typically more turbid coastal waters, Macrocystis grows from shallower depths; nevertheless, in areas such as La Jolla where the water is relatively clear, plants may grow at 90 feet. Depth of kelp beds also is determined in part by water temperature. North of Point Conception and in areas of upwelled water in Baja California, the beds grow close to shore—even into the intertidal region.

Since horizontal and vertical wave motions are exaggerated by bottom interference over a rocky substrate, Macrocystis is subjected to sudden and strong changes in currents as well as normal surface turbulence. The plant has a number of adaptions to prevent being torn free. Its holdfast anchors it to the substrate so that it cannot be carried away by normal currents. Stipes are sufficiently elastic to take up shock from sudden surge. Individual stipes grow in a zigzag or sometimes coiled pattern that allows the plant to yield to the drag of currents. The surface canopy has a slight positive buoyancy and may sink 20 feet or more when strong currents are running.

Kelp beds are sometimes destroyed by natural causes. Beds growing on weak substrate, or having holdfasts weakened by the kelp boring isopod, may be torn loose by heavy seas or by their own buoyancy. The free plant may remain tangled in the kelp bed and continue to grow with its holdfast suspended above the bottom, or it may drift, sometimes ashore, and die. Occasionally a plant will reanchor if the holdfast remain in contact with the substrate. Recovery of storm destroyed beds may take more than a year. Kelp beds also may be injured or destroyed by sea urchins, as reported by Dawson, Neushul, and Wildman (1960) and North (1967, 1971). An encrusting bryozoan, Membranipora serrilamella, or the kelp scallop, Leptopecten monotimeris, may cause stipes to sink away from light but usually they do not destroy the entire plant. In the more southerly portion of its range, warm summer waters may damage Macrocystis beds.

Pollution also may result in loss of kelp. Strong evidence indicates that kelp beds off White Point, Los Angeles County, were destroyed by domestic

and industrial wastes. Beds there dwindled in size until they completely disappeared north and south of the Los Angeles County, White Point outfall for a distance of several miles. Similarly sewage from Tijuana, Mexico, apparently was responsible for disappearance of kelp beds off the adjacent coast (Limbaugh, 1955).

Much kelp is cut at the surface by propellers of boats. Commercial abalone divers and their tenders damage or kill an additional, although probably negligible, number of plants each year. The commercial harvest of kelp has long been an area of concern, but recent work has demonstrated that this practice does not have a lasting detrimental effect on the kelp bed as a whole (North and Hubbs, 1968).

An abundant growth of kelp enriches the environment for organisms living in it. The stipes provide substrate, food, or cover for many small invertebrates. A single blade of kelp may be encrusted with hundreds of animals, many of which are the food of fishes living in kelp beds. One fish, the opaleye, feeds directly on the fronds, devouring invertebrates along with the seaweed. Stipes form dense bundles in which certain fishes seek cover from predators (Carlisle, Turner, and Ebert, 1964).

Among the haptera are individual communities with dense populations of animals. A single holdfast may contain 30 to 40 species of crustaceans and 20 to 30 species of mollusks, in addition to hydroids, nemertean worms, round worms, polychaetous annelids, peanut worms, bryozoans, brachiopods, echinoderms, and small fishes.

Most fishes congregate in bottom areas near the rocky substrate or in the region of the canopy with the stipes offering an avenue of protected access between the two. Each species has its own preferred niche. The 125 species known to occur in southern California kelp beds represent almost 23% of the known fishes of California, although many are small and economically unimportant.

A close examination of the morphology and habits of kelp fishes reveals few well established affinities for giant kelp. Specific characters such as color and shape which might appear to be especially adapted for the giant kelp habitat are applicable to other seaweed habitats. Only one species, the tiny kelp clingfish, is thought to be almost wholly restricted to the giant kelp habitat.

Fishes found in kelp beds may be divided into three categories: (i) those depending primarily on kelp beds; (ii) those associated with the bottom below kelp beds; and (iii) those wandering into kelp beds from pelagic and nearshore regions.

Fishes found in kelp beds vary morphologically, but may be grouped into two behavioral categories—schooling and nonschooling species. The former inhabit more open water between plants, blend with the open water in color, and are not specifically modified in shape for protective camouflage. This group is exemplified by the opaleye and the halfmoon. The more numerous nonschooling species blend well with the kelp background because of their bizarre shapes and colors. They range from the spindle shaped, brown and white spotted kelp bass to the yellow-brown stemlike kelp gunnel, and may be subdivided into groups that resemble stipes, fronds, or parts of fronds, or that have the coloration of kelp. One

specific structural character common to two kelp species of quite different families is the small mouth and protruding teeth of the kelp surfperch and the señorita. Both feed directly on external parasites attached to other fishes and on organisms attached to kelp or other substrate. This example of convergent evolution seems to fit diverse groups of fishes all over the world (Limbaugh, 1961b; Feder, 1966).

The kelp bed may be divided into three habitat zones: (i) the canopy, an area of tangled stipes from just below the water line to a depth of 10 feet, which contains a great concentration of kelp per unit of water and is a loosely compact, floating mass anchored by columns of tangled kelp that pass to holdfasts on the bottom; (ii) the mid-kelp region extending from the kelp bed bottom habitat to the canopy, which is similar in some respects to the trunk region of the dense forest (the fauna here is not as rich as it is in the canopy or bottom habitats); and (iii) the kelp bed bottom or holdfast region containing a rich fauna and flora because of the addition of benthic organisms to kelp residents. None of these zones is independent of the others, and many organisms are found in all three, but sufficient differences are observed for these to be convenient groupings.

3. THE KELP CANOPY HABITAT

The lush appearing canopy is a rather unstable environment. During storms, currents may submerge it to depths of 20 feet or more. Wave action may break up the canopy, and extensie temperature changes subject it to desiccation and decay. Occasionally, large canopy areas are lost as a result of these natural processes. Rapid growth and short life of individual stipes do not make them desirable substrates for most sessile organisms.

Life in the canopy is not nearly so complex as in bottom or intertidal habitats. A few organisms feed directly on kelp; others use it as a permanent or temporary platform; a few use it as cover. There are also wanderers and drifters from other habitats; these, though not directly associated with kelp, play important roles in the ecology of the beds. Such forms include pelagic and nearshore fishes and invertebrates, especially larval forms.

The number of invertebrate species and individuals in the canopy region is smaller than in the bottom and intermediate habitats. Plankton is poorer in quantity than in adjacent areas, such as submarine canyons, sandy nearshore bottom, and rocky nearshore bottom. Many canopy inhabitants feed on small planktonic organisms. Invertebrates in this group include hydroids, tube dwelling polychaete worms, bryozoans, barnacles, and kelp scallops. Fishes that feed partly on plankton are the topsmelt, blacksmith, and señorita. Young to half grown blacksmith often aggregate where plankton rich currents enter the kelp bed to pick tiny planktonic organisms from the water. Stomach analyses of these fish reveal squid, larval fishes, and other planktonic forms. Such screens of invertebrates and fish probably are responsible for the dearth of plankton within kelp beds.

Some of the common organisms of the canopy (Table 1), easily observable in the field, are hydroids, a sea anemone, tube dwelling polychaete

worms, bryozoans, a few crustaceans, three large and several small species of snails, a nudibranch, the kelp scallop, sea stars, and several species of fishes. In addition, two species of algae are occasionally observed in southern California kelp canopies. The feather boa kelp grows on the inner edge of kelp beds into the intertidal zone, and elk kelp normally grows in deeper parts of the outer edge of the kelp. Elk kelp does not grow to the surface, but when it becomes detached may float to the surface and tangle with the surface canopy.

At present, no group of organisms in the kelp is more important to man than the fishes. Few of them are of commercial value, but many are important as sport fishes.

The conventional mental picture of the kelp beds is somewhat confused. For many years it was believed that kelp beds, especially the canopy region, represented spawning and nursery grounds of many sport and forage fishes. California barracuda, yellowtail, and even tuna were thought to attach their eggs to kelp. During the summer when California barracuda and yellowtail, heavy with eggs and sperm, are caught by fishermen on the edges of kelp beds, it is easy to associate kelp with the spawning activities of these fishes. California barracuda and yellowtail are observed near kelp beds all year, but like kelp bass, feed heavily only during the warmer months. They are thus more frequently caught during summer. They spawn at this time, and extrude their eggs into the water where currents carry them away. Chances for survival of eggs which enter kelp are diminished by the many plankton feeding animals that live there. The larvae are open water pelagic forms with a better chance of survival outside the kelp.

Fishermen often report fish eggs in surface kelp, but investigation fails to reveal eggs originating from fishes. often reported "eggs" are those of mollusks, or are colonies of bryozoans or tiny annelid worms. However, attached eggs of several fishes have been found while studying the canopy habitat (Limbaugh, 1955). They include eggs of the inch long kelp clingfish, giant kelpfish, tubesnout, Pacific saury, California flyingfish, and topsmelt.

The kelp clingfish, because of its small size, plays no important part as a forage fish. Kelpfish are of no sport or food fish value, and of little value as forage. Kelpfish eggs have been found more often attached to other seaweeds closer to the bottom than in the canopy. The tubesnout, a small slender fish related to the sticklebacks, generally attaches its eggs just below the fast-growing tips of young stipes emerging from the holdfast. The only eggs of this species found in the canopy were on broken stipes, free of the bottom. The eggs of the Pacific saury and the California flyingfish often are found attached to floating objects far at sea. Occasionally these objects drift into the canopy and are held there until the eggs hatch. Eggs of topsmelt are generally attached to red seaweeds covering submerged reefs and on rare occasions to surface fronds of the canopy.

Other fish species found in or near the canopy either give birth to living young, broadcast their eggs for dispersion by watter currents, or lay eggs on the bottom. No evidence is available to support the theory that the canopy is widely used as a spawning area (Limbaugh, 1955).

Nearshore waters contain many larval fishes, and kelp bed areas are no exception. Larvae of a few fishes are found in greater abundance in kelp beds than elsewhere. These include the topsmelt, kelp goby, kelp clingfish, and striped kelpfish. Larvae of the topsmelt and adult opossum shrimps may become extremely abundant in the surface region of kelp, and fishermen observing these tiny creatures conclude that kelp beds are nursery grounds for fishes. often topsmelt are misidentified as a more important forage or sport fish, such as sardine or California barracuda. During spring and summer, larvae of striped kelpfish and the kelp goby occur in extremely large numbers, usually in the lower portion of the canopy or the mid-kelp region. They may serve as forage for some fishes during this larval period.

Many juvenile fishes inhabit the kelp canopy. The more common ones are kelp bass, topsmelt, kelp surfperch, blacksmith, señorita, kelp clingfish, giant kelpfish, olive rockfish, and kelp pipefish. Juvenile kelp bass inhabit all nearshore seaweed and rocky areas, but are frequently more common in Torrey's surfgrass, eelgrass, and among the fronds of feather boa kelp. They occur only sporadically in the kelp canopy. Juvenile topsmelt swim near the surface and inhabit open spaces in kelp beds and areas between the bed and shore. Recently born and juvenile kelp surfperch inhabit the canopy and mid-kelp areas. Although they are more common in mid-kelp regions, they are numerous in the canopy, tending to aggregate under bent stipes. Juvenile blacksmith occur in large dense schools, but are no more common in the canopy than in rocky inshore areas. Juvenile señoritas school throughout shallow water. They prefer rocky areas but are common over beds of surfgrass and eelgrass. They occasionally enter the canopy in search of food. When frightened, they may pierce kelp fronds by swimming through them. Juvenile olive rockfish inhabit inshore rocky areas, kelp beds, and surfgrass and eelgrass beds. Juvenile kelp pipefish are more common in the canopy region than in other areas. Juvenile kelp clingfish adhere to kelp fronds and are probably more numerous in the canopy than elsewhere. Juvenile kelpfish are common in all seaweeds, and blend well with their background. They are less common in the canopy than among shorter seaweeds.

Adult fishes of the canopy include numerous species that wander into the area, others that on some occasions or in some places include the canopy as a portion of their usual habitat, and five species that typically utilize the canopy as habitat: topsmelt, kelp surfperch, kelp pipefish, kelp clingfish, and kelp gunnel. These five species are too small to be considered commercial or sport fishes, but they do have similar food habits, selecting small free swimming crustaceans of the canopy.

Fishermen rely on the surface kelp canopy to locate preferred fishing areas where they seek fishes that live on or orient to a rocky bottom. Usually they fish the edges of kelp beds where the fish fauna is much richer than in other portions of the beds. This is "edge effect," a term indicating that forest-meadow, forest-lake, and lake-meadow boundaries of the terrestrial world, as well as sand-rock, kelp-rock, and land-sea boundaries of the ocean, are richer in fauna than the areas on either side. The inshore canopy boundary yields nearshore pelagic and reef dwelling fishes in

greater abundance than the kelp bed itself, while the offshore canopy boundary may yield pelagic and nearshore pelagic forms in greater abundance than areas of no boundary.

4. THE MID-KELP HABITAT

Arbitrary boundaries of this habitat are 10 feet below the canopy and 10 feet above the bottom. The fauna of this region is composed of forms that prefer the surface canopy (Table 1), a very few that prefer this intermediate area (Table 2), and forms that prefer the bottom (Tables 3 and 4). Almost all organisms that occur in the canopy also are found in the mid-kelp habitat. Relatively few of the truly benthic species enter this region, since most of the bottom forms require specific substrates. Organisms that do enter the mid-kelp area are motile forms that are free to climb or swim, and sessile forms that attach to kelp.

5. THE KELP BED BOTTOM HABITAT

Holdfast habitats are the most complex of the three major kelp bed environments and may be further subdivided into sandy bottom and rocky bottom regions.

5.1. Kelp Bed Sandy Bottom Habitat

This is the least complex of the holdfast bottom habitats. Typical areas are found off the towns of San Clemente and Santa Barbara. Kelp may grow directly on old, partially burried holdfasts or other solid objects such as hardened clay, cobbles, scattered rocks, stems of Torrey's surfgrass, anchors, and discarded tires. In such areas, sand dwelling organisms normally are influenced to a large degree by the presence of kelp and organisms associated with kelp. Compared with the fauna of "desert like" stretches of relatively barren sand bottom, the fauna around these holdfasts seems rich, but when compared with that of rocky regions it is sparse.

The predominantly benthic fauna is qualitatively similar to that of nearby sand areas (Table 3), but is quantitatively different. For example, the sand dollar, Dendraster excentricus, lives in great profusion in sandy areas of similar depth but is quite scarce around holdfasts; the opposite is true of the speckled sanddab.

Apparently no organism prefers the sandy bottom holdfast region to all other habitats, but there is no doubt that the presence of kelp on an otherwise barren sandy bottom tremendously enriches the fauna—especially with fishes. Large numbers of sand dwelling and even some reef dwelling and nearshore pelagic fish species concentrate around kelp. Small invertebrates found in holdfasts are similar to those found in holdfasts of rock areas. It is apparent that by supplying suitable substrate for Macrocystis on barren sand bottoms, man can increase the numbers and distribution of sand, rock, and kelp fishes. Such a substrate for kelp also would permit an increase of abalone and lobster (Carlisle, Turner, and Ebert, 1964).

Sediments in sandy bottom regions of kelp beds are less uniform than in open sandy stretches at similar depths. Ripple marks are confused by

surge interference due to kelp plants. Scouring takes place around the plants, moving aside the finer sediments and leaving the coarser ones. Interference with surge and other bottom currents causes mounds of fine sediment to settle in areas without strong currents. Variations in size of sand grains in different parts of the bottom produce additional habitat sites. However, constant scouring and filling frequently damage sessile organisms living in this region.

5.2. Kelp Bed Rocky Bottom Habitat

Irregular rocky bottoms are richest in quality and quantity of organisms (Table 4). Such bottoms provide vertical, oblique, and under surfaces, as well as crevice bottoms, cave roofs, and horizontal surfaces. They offer niches with varying degrees of turbulence; from calm, deep crevices and caves to accelerated velocities of surge channels and tunnels. Crevices, caves, and holes of varying size are inhabited by a considerable diversity of organisms. Sport fishermen refer to certain contour irregularities of this habitat as "bass holes," "cod holes," or "sculpin holes;" depending on the fishes most commonly caught there. Frequently these irregularities are not holes but submarine hills, mounds, or rock piles.

The term "flat rock bottom" has only a relative meaning, since all exposed rocks are covered with an irregular mass of living organisms, carved by animals, eroded by currents, and full of structural irregularities. Nevertheless, the flora and fauna differ from those of irregular rocky bottoms. The difference is qualitatively slight, but quantitatively great. Flat rock bottoms do not have the large numbers of fishes found associated with irregular rock bottoms but are far richer than sand bottom habitats.

Plants in this rocky habitat add cover to the bottom and make possible the support of a large fish population. Foliage, cover, and additional substrate are provided for many invertebrates that serve as fish food. The brown algae, Eisenia arborea and Pterygophora californica, form "under-stories" 1 to 2 feet above the bottom, and Agarum fimbriatum and Laminaria farlowilie as broad undulating fronds over the bottom. Short red and brown seaweeds form a carpet over the rocks. These additions to the habitat are especially important to fishes on the flat-rock bottom where plants form the only available cover.

Extreme habitat complexity and the many thousands of organisms present make it impossible to tabulate any but the most common and conspicuous species. However, additional ecological and taxonomic information may be found in Johnson and Snook (1927); Dawson, Neushul, and Wildman (1960); Lance (1961); Carlisle, Turner, and Ebert (1964); Turner, Ebert, and Given (1964, 1965, 1968, 1969); MacFarland (1966); MacGinitie and MacGinitie (1968); Rickets and Calvin (1968); McLean (1969); Light et al. (1970); and North (1971).

6. SPECIES ACCOUNTS

Many of the fishes observed in or around the kelp bed habitats are discussed in this section. Items of biological, zoogeographical, and behavioral interest are included to bring together various components of current knowledge concerning each species. In general, these species appear to be more dependent upon bottom type than existence of giant kelp. The giant kelp's main contributions are in allowing fuller utilization of the entire water column by fishes. This results in more fishes per unit of bottom area than is possible with the substrate alone and in the addition of many of organisms to the food chain.

6.1. Horn shark, Heterodontus francisci (Girard)

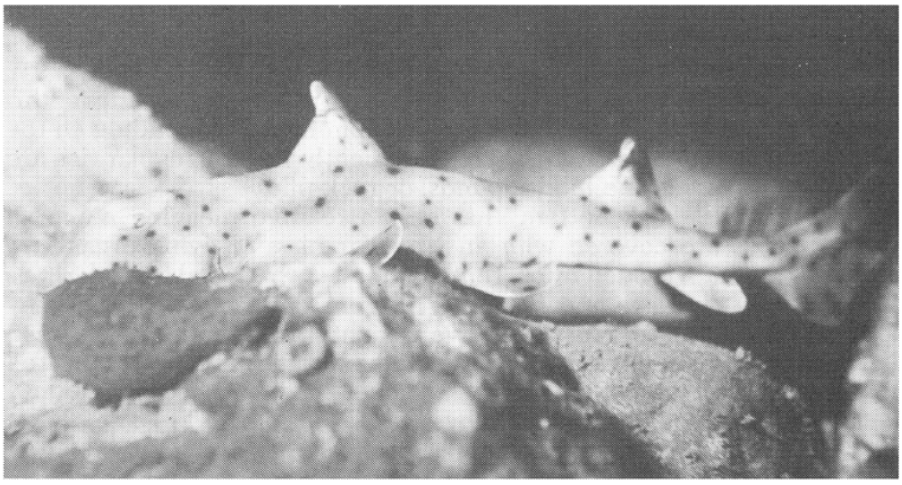

FIGURE 1. Juvenile horn shark, *Heterodontus francisci.* *Photograph by Charles Turner.*

FIGURE 1. Juvenile horn shark, Heterodontus francisci.

Identification: Body chunky, broad anteriorly, tapering to narrow tail. Head broad and blunt with ridge over each eye. Two widely separated dorsal fins, each preceded by blunt horny spine. Tan to dark brown with black spots above, blending to pale yellowish below. Young have light as well as dark spots. Reported to 4 feet long. Largest verified was a 3 foot 2# incher weighing 22 pounds, caught by Homer Moore, a commercial fisherman, at Playa Maria Bay, Baja California. Horn sharks are recorded from Monterey Bay, California, to Cape San Lucas, Baja California, and into the Gulf of California.

Habitat-Habits: Among rocks, ranging from tidepools to depths of at least 80 feet, usually with head in crevice during daytime. Most common in depths of 8 to 35 feet. Resting on bottom of sandy draws in rocky areas. Frequently in deep crevices and small caves. Observed to venture several hundred feet back into large caves. Presumably a nocturnal forager since it is seldom observed swimming during the day.

Life History Notes: Large crustaceans and small fishes are important food items. Spiral egg cases of stiff, dark brown, horny material are scattered

among rocks. Young hatch in 8 to 9 months (Sam Hinton, formerly Scripps Institution of Oceanography, pers. commun.), are 4 to 5 inches long, and do not feed for at least 1 month after hatching.

Remarks: Sluggish, solitary, easily captured by hand. When disturbed swims by lateral undulations of body and tail. Adults may attack humans when provoked, but because of small teeth are relatively harmless. If handled and released, occasionally swims back and bites.

6.2. Swell shark, Cephaloscyllium ventriosum (Garman)

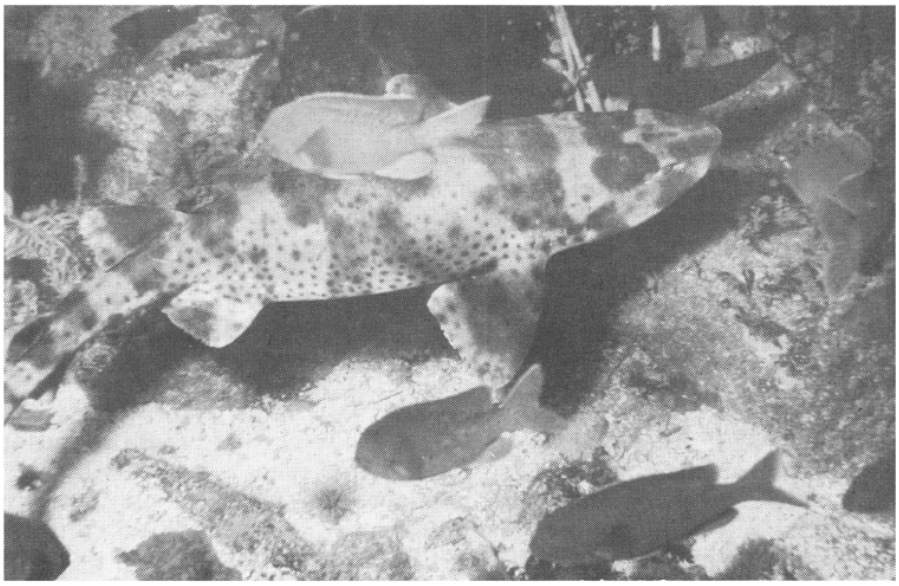

FIGURE 2. Swell shark, *Cephaloscyllium ventriosum*, about 48 inches long off Santa Catalina Island. The other fishes are blacksmith, *Chromis punctipinnis*. *Photograph by Charles Turner.*

FIGURE 2. Swell shark, Cephaloscyllium ventriosum, about 48 inches long off Santa Catalina Island. The other fishes are blacksmith, Chromis punctipinnis.

Identification: Plump body, slim tail. Head blunt, flattened. Dorsal fins far back on body; first dorsal opposite pelvic fins. No spines near dorsals. Skin apprears very rough, flabby. Brown above, with dark saddles and light spots; cream below. Usually less than 3.3 feet long. They are known from Monterey Bay to Chile.

Habitat-Habits: Sluggish, crevice dwelling. Rocky areas at depths of 15 to about 120 feet, recorded from 1500 foot depths (Don Nelson, California State University Long Beach, pers. commun.). In daytime, usually found deep in crevices. When disturbed, greatly inflates abdomen like puffer fish. Nocturnal, feeding on decaying fish and some living organisms. Easily attracted into lobster traps baited with decaying fish. This habit may account for present rarity in areas where lobsters are trapped; common in regions where lobster fishing is prohibited. Generally solitary, occasionally aggregate.

Life History Notes: Purse shaped, horny egg cases, found in same area as adults, held in place by curling tendrils extending from corners of cases.

Four egg cases removed from one female in October 1960. Developmental time for eggs is 7½ to 10 months depending on water temperature. The young upon hatching are 5 to 6 inches long. The young exhibit adult coloration, but have a double row of larger denticles down the back. These denticles are lost by the time the animals are a foot long (Charles A. Grover, formerly Marineland of the Pacific, pers. commun.).

Remarks: Swims away only after rude handling. If disturbed in narrow crevice, cannot be readily extracted if inflated. No known direct relationship to giant kelp, but lives at similar depths and on similar substrates. Most common in kelp bed areas, less common in rocky areas without quantities of algae.

6.3. Leopard shark, Triakis semifasciata Girard

Identification: Body slender with small narrow head. Dark gray above to light gray below. Back marked with black saddles interspaced with black spots. Larger female reaches length of 6 feet, male about 5. Emil Smith, California Department of Fish and Game, observed a pregnant female estimated 6½ to 7 feet long and about 70 pounds in weight. It had been caught in a gill net set in 35 to 50 fathoms (210 to 300 feet) of water. This species ranges from Oregon to Mazatlan, Mexico.

Habitat-Habits: Most frequently observed in shallow water, usually less than 12 feet, occasionally as deep as 40. Prefers flat areas of sand or cobble near rocky reefs. Gregarious. Large schools mixed with gray smoothhound sharks common in shallow water. Nomadic, may occur in area for only a few hours or several days, then disappear. Certain coves and bays more likely than others to have a visiting school. In almost constant motion, swimming snake-like. On rare occasions, rests on bottom, usually on sand among rocks. Young, less than 1 foot long, commonly observed in bays.

Life History Notes: Food items include large crustaceans and small fishes. Easily taken with bits of fish on hook.

Remarks: Although quite wary, usually taking flight when they encounter skindiver, they are frequently speared. Excellent eating, this is not generally recognized. Sold in fish markets. Numbers have declined in recent years, possibly due to added fishing by spearfishermen. Although generally timid, an attack on a diver is recorded (DeWitt, 1955)

6.4. Blue shark, Prionace glauca (Linneaus)

Identification: Relatively large mouth. Commonly observed at sea with dorsal and caudal fins projecting through surface. Gray-blue above, lighter blue sides, white below. Occasionally reaches 10 feet in length, a 12 foot 7 inch specimen recorded. An 8 foot specimen weighted 120 pounds and a 5 foot 9 incher weighed 49 pounds. Found in warm seas worldwide; in eastern Pacific from Gulf of Alaska to Chile, but not in tropics.

Habitat-Habits: Coastal pelagic, infrequently venturing close to shore, except in clear blue water. Occasionally at outer edges of surface kelp, especially around islands. Most individuals at surface are immature. Those at surface dive when approached by boat. Frequently in large numbers, apparently associated, but out of visual contact with each other.

Life History Notes: Vicious, ovoviviparous, carnivores. Feed on squid, pelagic red crabs, Pleuroncodes planipes, and fishes. Young not observed underwater, but half grown individuals common. A 95 pound, 6 foot (1813 mm) female contained 27 "pups" 13 to 15 inches (325 to 375 mm) long. Free living young 17 inches (430 mm) long have been taken off Newport Beach, California (J.E. Fitch, California Department of Fish and Game, pers. commun.).

Remarks: Frequently bite at tin cans and boxes floating on surface, often strike back if molested with oar. On several occasions, skindivers have had to drive them away with spears. Capable of killing a man, they have been implicated in attacks on humans off Los Angeles. Caught on baited hook; flesh considered edible though of poor quality. No known significant relationship to giant kelp, but may feed on kelp dwelling fishes on outer edge of beds. Frequent offshore oil drilling rigs and islands along southern California coast.

6.5. Pacific angel shark, Squatina californica Ayres

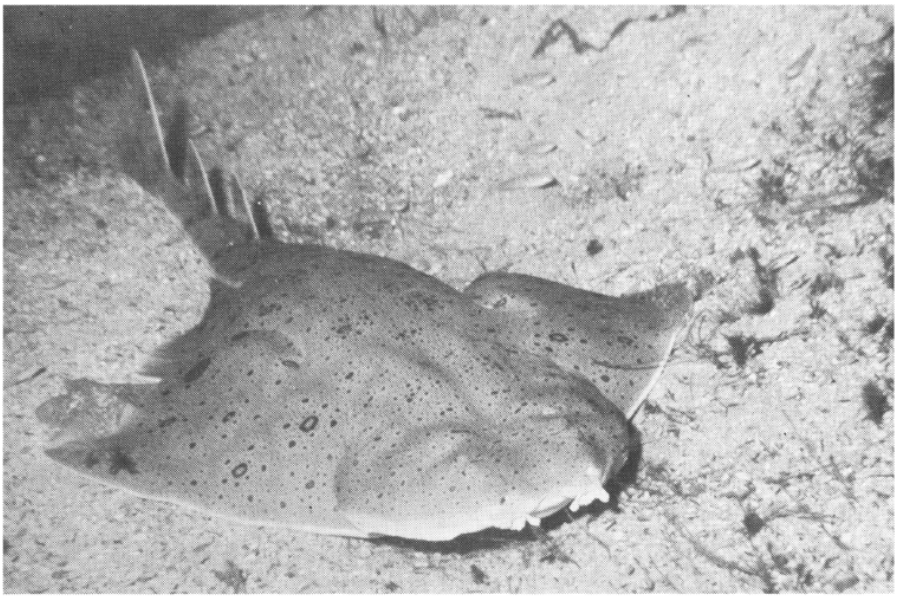

FIGURE 3. Pacific angel shark, *Squatina californica*, at a depth of 120 feet near Ship Rock, Catalina Island. *Photograph by Charles Turner.*

FIGURE 3. Pacific angel shark, Squatina californica, at a depth of 120 feet near Ship Rock, Catalina Island.

Identification: Flat with extremely large pectoral fins. Superficially look more like rays than sharks. Typical sharp shark teeth. Sandy-gray, speckled

with darker spots above; white below. Length to at least 4 feet, some estimated near 5. A 44¼ inch female weighed 31 pounds. From southern Alaska to southern Chile. Extremely abundant around the California Channel Islands.

Habitat-Habits: Typically observed buried in sand or mud especially near rocks or around submarine canyon heads at depths of 10 to 150 feet. Most common at approximately 50 feet. Taken by gill nets at 75 to 100 fathoms off Tiburon Island, Gulf of California. Sluggish. Extremely tough skin. Lies buried in sand with only eyes and upper portions exposed. Blends well with background. Powerful jaws capable of extending forward and quickly grasping objects with surprising vigor.

Life History Notes: Feeds on fast moving fishes such as corbina, queenfish, and California halibut.

Remarks: Occasionally turns on spear and should be considered as potential hazard to skindivers, especially those who swim close to bottom. Caught by baited hook, spear, and occasionally with bare hands by skindivers. Little relationship to giant kelp, but prefers it to barren sandy areas. The numerous Pacific angel sharks around the offshore Channel Islands are seldom associated with algal cover. They usually lie in sandy areas adjacent to rocky outcrops (i.e. Isthmus Reef, Ship Rock, and Long Point at Santa Catalina Island).

6.6. Shovelnose guitarfish, Rhinobatos productus (Ayres)

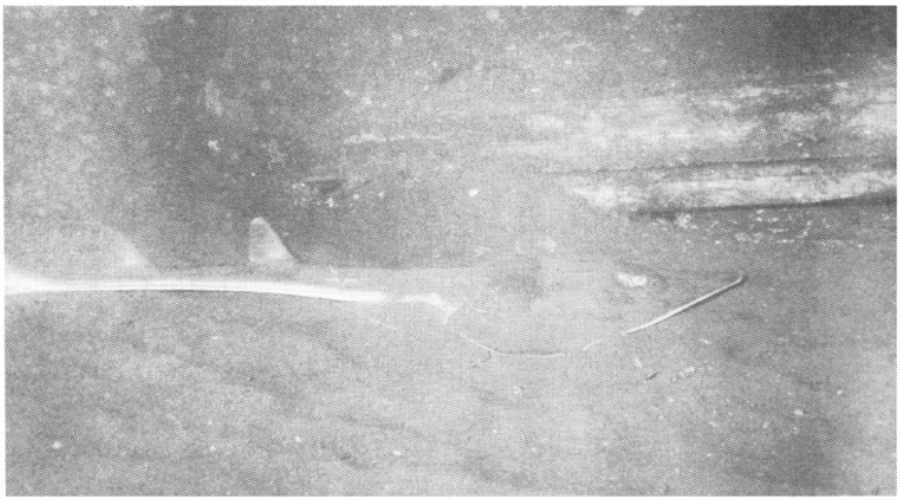

FIGURE 4. Shovelnose guitarfish, *Rhinobatos productus.* *Photograph by Charles Turner.*

FIGURE 4. Shovelnose guitarfish, Rhinobatos productus.

Identification: Body flattened, raylike. Snout sharply pointed. Uniformly gray-brown above and white below. Length to 5 feet. A 51¼ inch female taken at Elkhorn Slough weighed 27 pounds (Herald and Dempster, 1952); another (61½ inches) taken at San Quintin Bay, Baja California, weighed 40½ pounds (Baxter, 1966). This species is recorded from San Francisco to and into the Gulf of California.

Habitat-Habits: Shallow sandy areas from shore to depths of 50 feet, concentrated between 3 and 40 feet. Gregarious. often in tremendous numbers. Prefers to burrow into sand when resting. Does not remain much more than a day in one area. Apparently more common off California in summer.

Life History Notes: Polychaete worms, crabs, and clams are typical food items.

Remarks: Normally harmless. One diver reports unprovoked attack by adult male. Caught by baited hook and spear. Excellent eating, but rarely saved by sportsmen. No known significant relationship to giant kelp, and only enters shallow sandy portion of harvested beds.

6.7. Banded guitarfish, Zapteryx exasperata (Jordan and Gilbert)

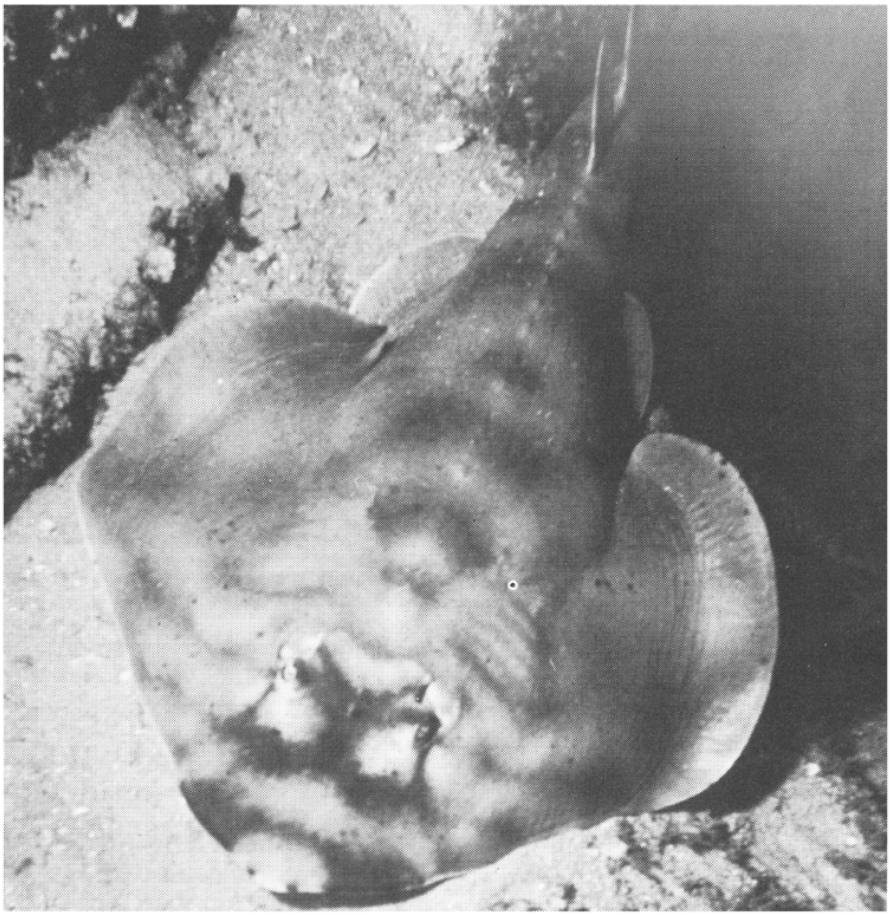

FIGURE 5. Banded guitarfish, *Zapteryx exasperata*, at a depth of 70 feet near Cabo San Lucas, Baja California. *Photograph by Charles Turner.*

FIGURE 5. Banded guitarfish, Zapteryx esasperata, at a depth of 70 feet near Cabo San Lucas, Baia California.

Identification: Shorter, heavier with thicker edged "shovel" than shovelnose guitarfish. Very dark slate-gray; broad (2 to 3 inches), sooty-black banding across snout and body. Readily distinguishable from unbanded

sand color of shovelnose guitarfish. Underside cream splotched with black. Length up to 3 feet. Recorded from La Jolla southward to Panama.

Habitat-Habits: Rocky areas, particularly flat-bottomed crevices and caves, from tide pools to 70 feet. Concentrated 8 to 30 feet; relatively rare off California. Unlike shovelnose guitarfish, seldom burrows but rests among rocks, usually with head in crevice. Found throughout year but less abundant in winter.

Life History Notes: Probably summer mating.

Remarks: Skindivers occasionally collect by hand. No known relationship to giant kelp, but associated with nearshore rocky bottom.

6.8. Thornback, Platyrhinoidis triseriata (Jordan and Gilbert)

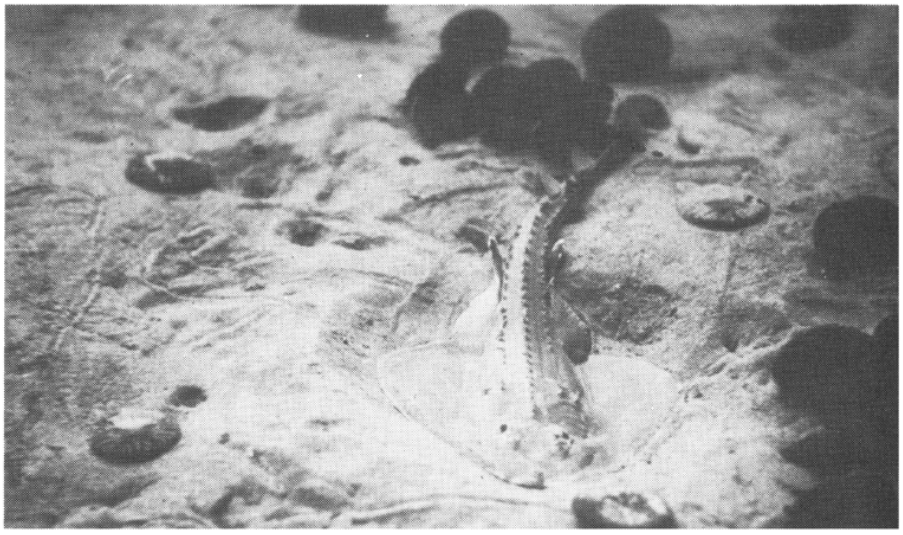

FIGURE 6: Thornback, *Platyrhinoidis triseriata*, on sandy bottom with sand dollars, *Dendroster excentricus*. *Photograph by Conrad Limbaugh.*

FIGURE 6: Thornback, Platyrhinoidis triseriata, on sandy bottom with sand dollars, Dendroster excentricus.

Identification: General outline that of banjo. Three rows of nontoxic spines along back. Gray-brown, brown, or brownish-olive on top, white or buff below. Unreliably reported to 3 feet, but seldom exceed 2 to 2½. Two 29½ inch females taken at Elkhorn Slough weighed 5¾ pounds each. Occurs from San Francisco, California, to Thurloe Head, Baja California.

Habitat-Habits: Fine sand to mud bottoms. Usually remains buried. Found throughout year from shore to 150 feet, concentrated 3 to 100 feet. Somewhat gregarious wanderer, appearing for short periods at certain localities and then moving on.

Life History Notes: Food items are predominantly sand dwelling polychaetous annelids, mollusks, and small crustaceans (i.e., isopods, crabs,

and small shrimp). Embryos found in heavy females in August. Adult males collected in September dripped milt from claspers.

Remarks: Taken by fishermen incidentally, but not eaten. Usually swallows bait, and generally killed by recovery of hook. No known direct relationship to giant kelp but prefers fine sand below kelp to barren sand bottom.

6.9. Diamond stingray, Dasyatis dipterura (Jordan and Gilbert)

Identification: Disk somewhat diamond shaped. One or more large serrated venomous spines part way out on tail. No dorsal or tail fins. Dark brown above, white below. Length to 6 feet. A 69 inch (1760 mm) female taken in the Los Angeles Harbor weighed 113½ pounds. Her disk was 36½ inches (931 mm) long and 38 inches (975 mm) wide. She contained no developing eggs or embryos. Occurs from Kyugot, British Columbia, to Paita, Peru.

Habitat-Habits Sandy areas frequently near rocks or kelp in depths averaging 7 feet, ranging from shore to 20 feet during summer. During late fall and winter in depths averaging 48 feet, concentrated 40 to 55 feet. Common from San Diego south. Burrows and covers back with sand. Found throughout the year. No known relationship to giant kelp. During winter more numerous around kelp than on flat sand bottom.

6.10. Round stingray, Urolophys halleri Cooper

Identification: Disk nearly circular; tail shorter than disk, bears long, venomous spine near mid-length of tail. Color varies with substrate. In general color light to dark gray-brown with small light dots; yellowish below. Length to 22 inches and a weight of about 2 pounds. Found from Humboldt Bay to Panama Bay.

Habitat-Habits: All shallow water, sand or mud bottom. Common off southern California, along sandy beaches, and in bays and sloughs; occasionally in rocky areas. Most common at depths of about 15 feet, ranging from surface to 70 feet. Concentrated 3 to 50 feet. Observed throughout the year.

Life History Notes: Food items are worms, small crustaceans, and mollusks (Babel, 1967). First mating in April, newborn appear June through October.

Remarks: Half grown specimens observed in winter only. Edible but seldom used. Not aggressive but stings when stepped on. Nuisance to bathers; occasional large concentrations make safe wading difficult. Many bathers are stung off southern California each summer month; most require medical attention. Between April and November 1952, there were 474 persons treated for such injuries (Babel, 1967). No known relationship to giant kelp. Babel (1967) found a positive relationship between increased water temperatures in shallow inlets, lagoons, and bays and the occurrence of round stingrays.

6.11. Bat ray, Myliobatis californica Gill

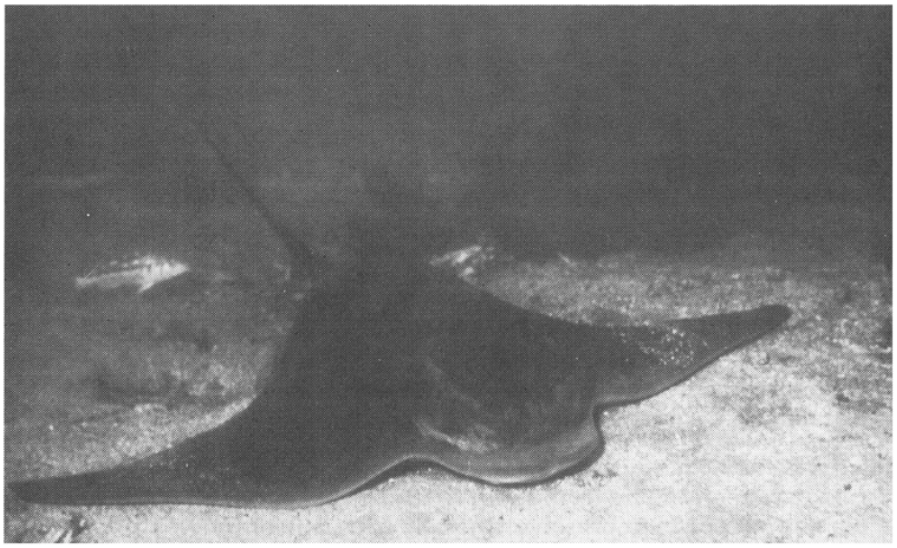

FIGURE 7. Bat ray, *Myliobatis californica*, on sandy bottom. *Photograph by Charles Turner.*

FIGURE 7. Bat ray, Myliobatis californica, on sandy bottom.

Identification: Diamond ray-like form. Pectoral fins form large "wings" which come to blunt points. Heavy, broad head raised above level of "wings" with eyes placed laterally on head. Horizontal depression below forward projection of head like broad smiling mouth. Long, whip-like tail, usually incomplete. One or more sharp venomous spines at base of tail. Uniform dark brown or black above; white below except near tips or disk. Looks like no other ray. Specimens weighing over 200 pounds have been reported; a 240 pounder was taken in Newport Bay in 1957. Recorded from Oregon to and into the Gulf of California.

Habitat-Habits: Flat, rocky bottom or sand patches among rocks. Common inshore and in bays and sloughs. From surface to 150 feet, concentrated 8 to 100 feet. often buries in sand, leaving deep, diamond-shaped depression on bottom. Adults tend to aggregate by size and thus may be found resting on the bottom or swimming far at sea. Solitary adults and young not uncommon, occasionally rest on kelp.

Life History Notes: In rocky environment feeds chiefly on shellfish, including abalones, red and wavy turbans, and top-shells. Shells are crushed with teeth, fragments ejected, soft parts swallowed. Feeds on dead and dying squid during squid spawning season. By using "wings" to form a suction, often dig deep holes in the sand to obtain chaetopterid annelid worms, mantis shrimp and clams. Very common around the offshore islands; particularly abundant at San Clemente, Anacapa, and Santa Rosa. Observed in spring and summer at San Clemente. At Santa Rosa, they are common in the shallows (15 to 40 feet deep water) in March and April. They are common to abundant in waters 15 to 30 feet deep during the summer at Anacapa Island.

Apparent breeding behavior was observed in August at Rocosa Point, Baja California, at a depth of approximately 20 feet along a sandy bottom inside a rocky reef; bat rays were numerous, resting on the bottom and swimming freely a few feet above the bottom. A medium sized female was closely followed by two smaller males. The head of one male was under the female, pushing her in the genital region. Identical behavior was subsequently observed off Scripps Institution of Oceanography in August at a depth of 15 feet, over a sandy bottom. Young appear in late summer and fall. Half grown, subadults or small adults appear throughout the year, but are usually most abundant near shore in summer.

Remarks: Taken occasionally by baited hook; considered good sport. Remote relationship to giant kelp: feeds on seaweed eating mollusks, which include some giant kelp in their diet. Two sets of jaw plates were recorded in the stomach of a sea lion.

6.12. Pacific electric ray, Torpedo californica Ayres

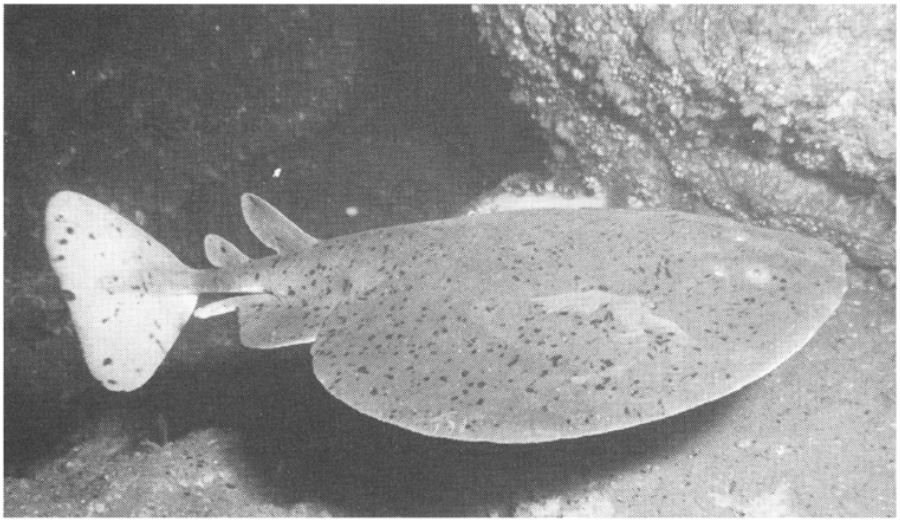

FIGURE 8. A 3 foot Pacific electric ray, *Torpedo californica*, near Redondo Beach, California.
Photograph by Charles Turner.

FIGURE 8. A 3 foot Pacific electric ray, Torpedo californica, near Redondo Beach, California.

Identification: Body heavy, flabby. Skin without spinules, wrinkled. Dark gray, irregularly spotted with black. Length exceeds 3 feet; authentic weight to 90 pounds. Recorded from southern British Columbia to Sebastian Viscaino Bay, Baja California.

Habitat-Habits: Prefers fine sand bottom, but not uncommon around rocks or in kelp beds. Found from 10 to 640 feet deep (Carlisle, 1969) most commonly observed in 60 to 100 feet. Head of the La Jolla Submarine Canyon is a typical habitat. Sluggish, geared to a life protected by powerful electric shock. Burrows in fine sand to rest or feed, or wanders slowly and apparently aimlessly close to bottom. Solitary, but two or three may borrow within 30 to 60 feet of each other.

Life History Notes: Feeds on halibut and other bottom dwelling fishes.

Remarks: May demonstrate aggressive behavior. If diver approaches too close, blocks ray's path, or irritates it with a spear, the ray may turn on him. When "tickled" with a rod or spear the ray turns toward its assailant not away from it as commonly observed with other species. This permits a diver to "lead" the way in any desired direction. Will swim some distance off bottom after a swimmer, approaching with small, ventrally located mouth open as if to bite. No diver has permitted ray to approach close enough to receive bite or shock. Spearfishermen take ray, but none has reported receiving shock. No known relationship to giant kelp, but occasionally enters kelp beds.

6.13. Pacific sardine, Sardinops sagax caeruleus (Jenyns)

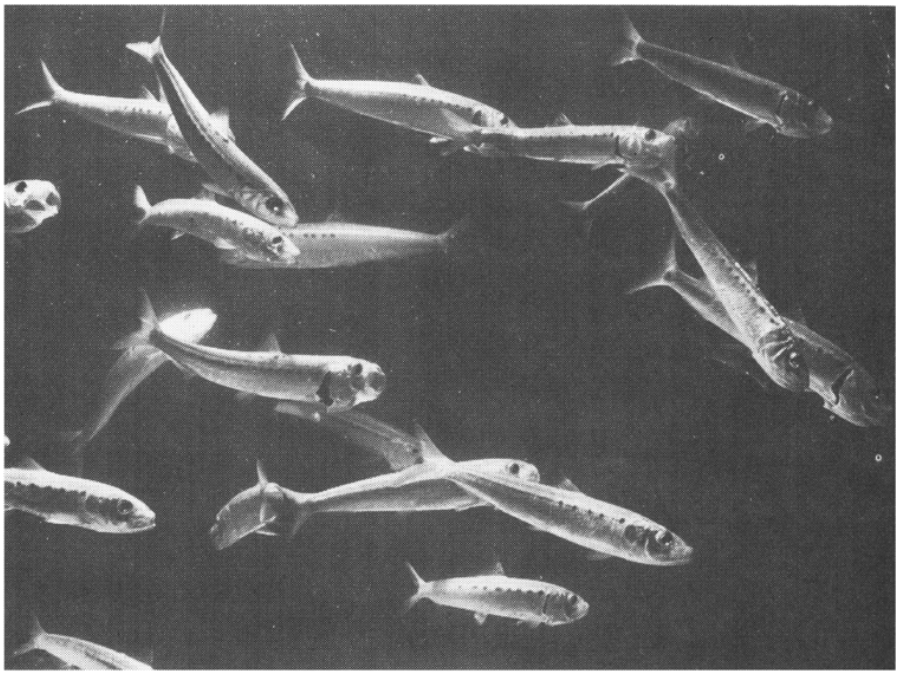

FIGURE 9. A school of Pacific sardines, *Sardinops sagax caeruleus.*
Photograph by George Mattson, National Marine Fisheries Service.

FIGURE 9. A school of Pacific sardines, Sardinops sagax caeruleus.

Identification: Body roughly cigar-shaped. Gill cover with low raised ridges running obliquely downward. Dark green to blue above, silver below; row of dark spots along side. Length to 16 inches. A 14 inch (355 mm TL) sardine weighed 13¼ ounces. Formerly from southeastern Alaska into the Gulf of California as far as Guaymas, Mexico. In 1970 its northern range was limited primarily to central California.

Habitat-Habits: Coastal pelagic. Observed schooling nearshore from surface to at least 80 feet (probably much deeper). Frequently schools with Pacific mackerel, jack mackerel, and northern anchovies.

Life History Notes: Typical food items include small planktonic organisms, strained out by gill rakers; also individual particulate plankton.

Remarks: Eggs and larvae pelagic. Important at all stages as forage for most game fishes. Used as live bait by sportfishermen, particularly young-of-the-year sardines which are called "firecrackers." Once the subject of a heavy commercial fishery along the west coast. In peak years, I billion pounds were taken annually; however present day catches are much lower. In 1971, only 124,000 pounds were landed by the commercial fleet. Caught in roundhaul and purse seine nets. No known direct relationship to giant kelp, but occasionally enter it, especially when driven by California barracuda, yellowtail, Pacific mackerel, or Pacific bonito. More often driven away by kelp bass and other inhabitants of kelp and rocky substrate. Serves in part as forage for many kelp bed fishes.

6.14. Northern anchovy, Engraulis mordax Girard

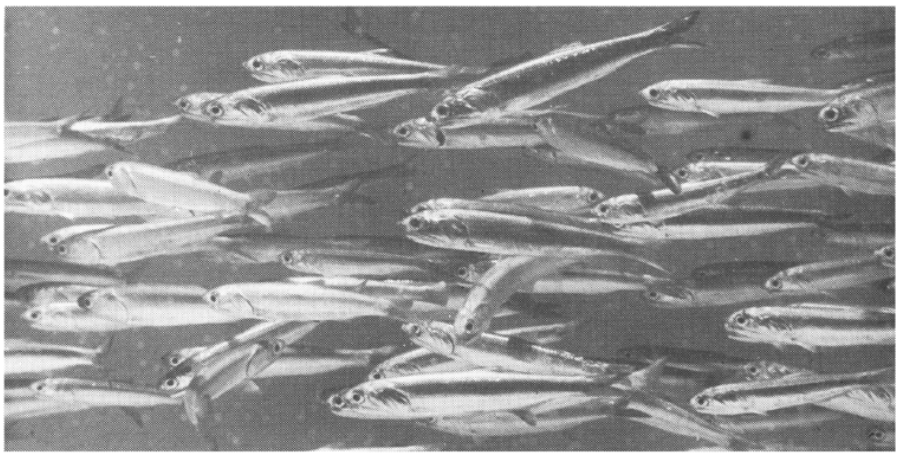

FIGURE 10. A school of northern anchovies, *Engraulis mordax.*
Photograph by George Mattson, National Marine Fisheries Service.

FIGURE 10. A school of northern anchovies, Engraulis mordax.

Identification: Long, cylindrical shape. Single, relatively short dorsal fin midway on body. Scales very thin and not apparent. Pelvic fins below front of dorsal fin. Snout forming blunt point with very large mouth subterminal. Head length greater than body depth. Silvery, schooling. Individuals blue to green-black above; silver on sides and below. Usually small, 3 to 6 inches. British Columbia to Cape San Lucas, Baja California.

Habitat-Habits: Coastal pelagic. Frequently observed from the surface to 50 foot depths. Sonar survey conducted from California Department of Fish and Game research vessels revealed northern anchovy schools near submarine canyons and nearshore escarpments at 60 to 120 fathom depths (360–720 feet). Northern anchovies often form large, tightly packed revolving schools which may enter surf zone, most commonly along sandy shores. Presence frequently marked by predatory fishes, birds, or sea lions. Schools avoid solid objects, remain foot or two below surface and several feet above bottom. Because of continual mouth movement, like yawning, fish twinkle when school is observed on sunny days. Other schooling bait fishes do not "yawn" as commonly and consequently

"flash" rather than "twinkle." Large predators (e.g., white seabass, and sea lions are permitted to pass through tunnels formed by schools at approach of animal; openings close behind animal as it swims. Occur throughout the year, but seem most abundant in summer.

Life History Notes: Feeds on small crustaceans by filtering; also takes individual particulate plankton. Eggs and small larvae pelagic. Larger larvae tend to school near bottom at depths of 35 to 55 feet. Juveniles and subadults school in patterns similar to adults.

Remarks: Many fishes use as forage; man, for bait. No known direct relationship with giant kelp, but kelp fishes use as forage.

6.15. California moray, Gymnothorax mordax (Ayres)

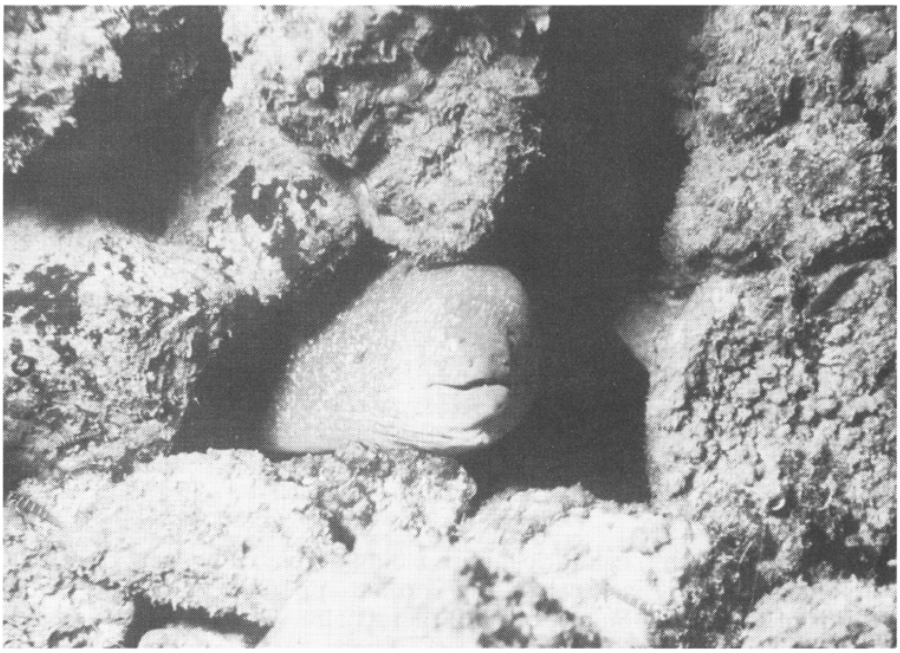

FIGURE 11. A California moray, *Gymnothorax mordax*, peering out from a crevice.
Photograph by Charles Turner.

FIGURE 11. A California moray, Gymnothorax mordax, peering out from a crevice.

Identification: Elongate; eel-, oar-, or snake-like. Large head tapers to nearly pointed tail. No paired fins. No distinct tail fin visible. Dorsal and anal fins fleshy ridges. No scales. Mouth terminal, very conspicuous teeth. Nostrils form small tube. No gill slits or gill cover. Greenish-brown, greenish-yellow, or red-brown. Usually appears gray underwater. A 49 inch (1255 mm TL) specimen weighed 11.2 pounds. Its stomach was empty. A 47 inch (1195 mm TL) weighed 14.58 pounds; it had eaten two California flying fish. Recorded from Point Conception to Magdalena Bay, Baja California.

Habitat-Habits: Rocky crevices, caves, tide pools to 130 feet (concentrated 2 to 65 feet). Respires by taking water in mouth and exhaling it

through hole on side, just behind head. often observed with head protruding from cave, rhythmically opening and closing mouth for respiratory purposes, and giving impression of baring teeth in warning. Half-grown and subadults apparently prefer shallow water. Population relatively small in given area. Experimental removal, for several weeks, of all specimens caught in fish traps in small area off La Jolla drastically reduced population for 2 year period.

Life History Notes: Feeds heavily on crustaceans, and small fishes. Small California spiny lobsters, red rock shrimp, kelp bass, and black surfperch are favorites. Several have eaten flyingfish. Although takes abalones removed by divers, the California moray normally does not eat many because of inaccessibility.

Red rock shrimp actively clean morays, nearly all crevices contain shrimp. Crawling rapidly over entire outside of eel, these shrimp clean away everything removable, including decaying tissue. Moray does not seem bothered by shrimp, although it may occasionally jerk head. In some cases shrimp may enter mouth in search of parasites, but not without risk; stomachs of morays from certain areas yield considerable numbers of these shrimp (Limbaugh, 1961b).

Remarks: Morays occasionally bite skindivers, and although reputation exaggerated, are still a hazard, sometimes striking from hidden crevices without warning and causing serious lacerations. Despised by lobster fishermen, who occasionally are bitten. Enters lobster traps, eating bait, trapped fishes and lobsters. May be killed by lobsters. No known relationship with giant kelp.

6.16. Tubesnout, Aulorhynchus flavidus Gill

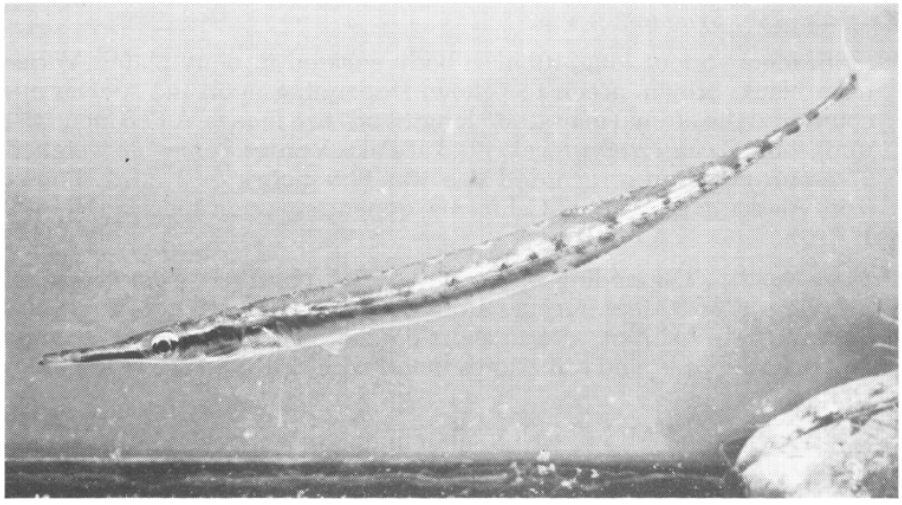

FIGURE 12. A tube snout, *Aulorhynchus flavidus.* *Photograph by Conrad Limbaugh.*

FIGURE 12. A tube snout, Aulorhynchus flavidus.

Identification: Elongate body, elongate tubular snout; 23–26 isolated spines on back preceding the rayed dorsal fin. Light tan with dark cross

bars. Attains a maximum size of at least 7 inces (177 mm). Found from Sitka, Alaska, to Rocosa Point, northwestern Baja California.

Remarks: Not significant to man. Occasionally preserved and sold as curios. They serve, to small extent, as forage for kelp bass and sea gulls, and sometimes found in stomachs of tunas and other high seas species.

Habitat-Habits: Over rocky areas in shallow water in northern California but often deeper in southern California. From surface to 100 feet, averaging about 36 feet. The juveniles are more frequently found from the surface to 40 feet.

Life History Notes: Primarily feeds upon small, free swimming organisms: mysids, amphipods, crab zoea larvae, and fish larvae. Spawns all year. Male binds seaweed (often new growths in lower parts of giant kelp) together with very thin thread secreted from urogenital region. Eggs are deposited by female around seaweed nest but not in it; nest closely guarded by male who drives off all intruders by swimming directly at them. Translucent orange eggs hatch in 2 to 3 weeks. Larvae school near bottom, usually in quiet water close to rocks and seaweeds. Schooling behavior continues throughout life, broken only during spawning when male remains to guard egg masses. Young probably mature in less than 1 year.

Remarks: Extremely abundant in certain regions, serves as forage for at least one commercially important species. Found in stomachs of kelp bass and sand bass. Eggs fed upon by sand bass, sculpin, and cabezon. Not taken by fishermen because of small size and feeding habits. Common in lower parts of giant kelp. For additional information see Limbaugh (1962).

6.17. Kelp pipefish, Syngnathus spp.

Identification: Snout long, tubular; body encased in bony plates. Varies from black, brown, green to yellow. Depending upon the species encountered the animal may attain lengths of 5 to 8 inches. A 17.8 inch (454 mm) long S. californiensis collected at Palos Verdes Peninsula weighed 27 grams. Maximum recorded size was 19.5 inches (495 mm). Found from Alaska to the Gulf of California, depending upon species (Herald, 1940).

Habitat-Habits: Depending upon the species, observed from intertidal into depths of 60 feet. Occurs among seaweeds, frequently in canopy and mid-kelp habitats; also in short coralline algae, Torrey's surfgrass and eelgrass beds, and sometimes found with drifting kelp many miles from shore.

Life History Notes: Mysids and small amphipods make up much of their food. Spawning throughout year. Females lay eggs in pouch in male. Eggs hatch, are retained in pouch for short time, and then released as miniature, thread-sized "adults." Young live among seaweeds, some probably spend life in kelp beds.

6.18. Groupers, Mycteroperca spp.

Identification: Continuous dorsal fin with more soft rays than spines. Caudal fin scalloped between rays at outer edge in the broomtail grouper, M. xenarcha, but not in the Gulf grouper, M. jordani. Various mottled and spotted brown patterns. Normally groupers are taken only south of San Diego, but one, M. xenarcha, was captured in San Francisco Bay (1966) and several M. jordani have been taken in the La Jolla area (Rosenblatt and Zahuranec, 1967).

Habitat-Habits: Prefers irregular rocky bottoms with large crevices and caves. Enters mid-kelp and canopy biotopes occasionally, but majority remain near bottom from 5 to 60 feet. Concentrated 12 to 50 feet. Expatriate dwellers in California since no evidence to indicate that either species is capable of successful reproduction in these waters (Rosenblatt and Zahuranec, 1967).

Life History Notes: Feeds upon small kelp bass and other small fishes. The eggs are pelagic. Most marine fishes of the family Serranidae are hermaphroditic, and various genera show several types of hermaphroditism, (Smith, 1965). The groupers are protogynous hermaphrodites (i.e. the male gonadal tissue develops after the female gonadal tissue is no longer functional), and the fishes probably spend several seasons as females before becoming males.

Remarks: Occasionally caught by gill net, baited hook, and spear off La Jolla. Territorial fishes, living in restricted areas of large boulders or caves. Diver observing one in specific area can generally return to same area and see same grouper next day or even next year. Gregarious. More than one individual of either or both species may be found together. Living in moderately deep water they are not easy targets for average skindiver, but attracted to disturbances such as air bubbles from scuba equipment, are easy targets for scuba divers. Result is drastic reduction of groupers in certain areas. Protection appears desirable.

6.19. Kelp bass, Paralabrax clathratus (Girard)

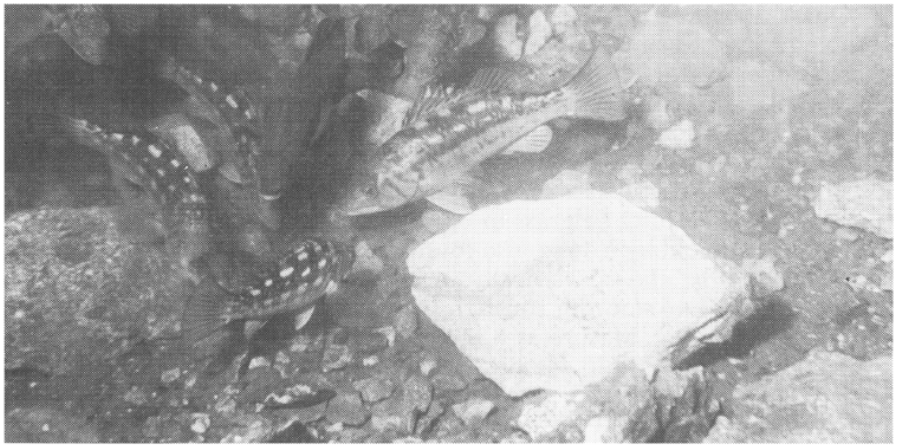

FIGURE 13. A school of kelp bass, *Paralabrax clathratus.* *Photograph by Charles Turner.*

FIGURE 13. A school of kelp bass, Paralabrax clathratus.

Identification: Typical bass shape with pelvic fins under pectorals and long dorsal fin composed of spines in front and rays behind. Dorsal fin deeply notched with two longest spines of equal length; anterior part of dorsal fin forms arch not found in other members of bass family. Mouth terminal and large. Posterior end of upper jaw broad and distinct. No obvious spines on head. Dark brownish-gray or brownish-black on back with many white blotches; pale cream below. Yellowish tinge to fins. Eyes at close range often appear iridescent blue or green. Breeding individuals, particularly maies, have bright yellow snouts. May be confused with olive rockfish, which occupies same ecological niche. Distinguishing characteristics: Kelp bass have more spots (a calico look) on dark dorsal section, and these extend below midline; has distinct break between dark dorsal and light ventral areas; is more robust. Olive rockfish are more even color and have only a few blotches on back, all above midline, and have a more slender head in profile. The calculated maximum length for kelp bass is listed by Young (1963) as 28.4 inches. Five kelp bass taken off the Newport jetty were 27 to 28.4 inches long and weighed from 8 pounds 11 ounces to 10 pounds 3 ounces. The heaviest kelp bass recorded (14 pounds 9 ounces) was 27.4 inches long. Recorded from the Columbia River to Magdalena Bay, Baja California (Hosie and Bond, 1968).

Habitat-Habits: Occurs among seaweeds and rocks. Larger ones tend to live deeper, often in rocky areas with little or no seaweed. Ranges from surface to 130 feet; concentrated between 8 to 70 feet. Occurs throughout the year. Little tendency to move or wander, except during breeding migration; do not display aggressive territorial behavior. In general, solitary, but asssembles to feed on schooling bait fishs. All dart together from different directions at forage fishes. Each seizes a fish, swallows it, then follows bait at some distance; later all rush school again. Sometimes leap clear of water in pursuit of prey.

Life History Notes: Food items vary markedly with size of fish. Diet includes polychaete worms, crustaceans, mollusks, and small fishes (Quast, 1968b). Early May through August spawning. Ripe adults tend to aggregate during spawning activities, often in kelp, usually in relatively deep water. Hundreds of kelp bass and other fishes may aggregate in small area during spawning. Ripe kelp bass, males and females, form such aggregations, as do ripe sand bass and sargo, pile surfperch, kelp surfperch, blacksmith, señorita, and sheephead. Eggs pelagic. Young ranging from slightly less than 1 to 2 inches common throughout inshore seaweeds, including eelgrass in bays. Preferred habitat inshore clumps of feather boa kelp. Young also found in kelp canopy, holdfast regions, at mid-depths, and sporadically in areas below growth of giant kelp. Young occur late summer through December and by following summer are 4 inches long. Mature at 8 inches when 2 years old. Smaller adults begin spawning late in season.

Remarks: A most important sportfish (Young, 1963), taken by trolling spearfishing, and hook baited with live or cut bait. Feeds lightly during

winter; almost impossible to catch then. Excellent eating. Includes but does not require giant kelp in habitat, also inhabits rocky areas without kelp. For example, large numbers of young to adult kelp bass occur off Guadalupe Island, Mexico, where no giant kelp present.

6.20. Barred sand bass, Paralabrax nebulifer (Girard)

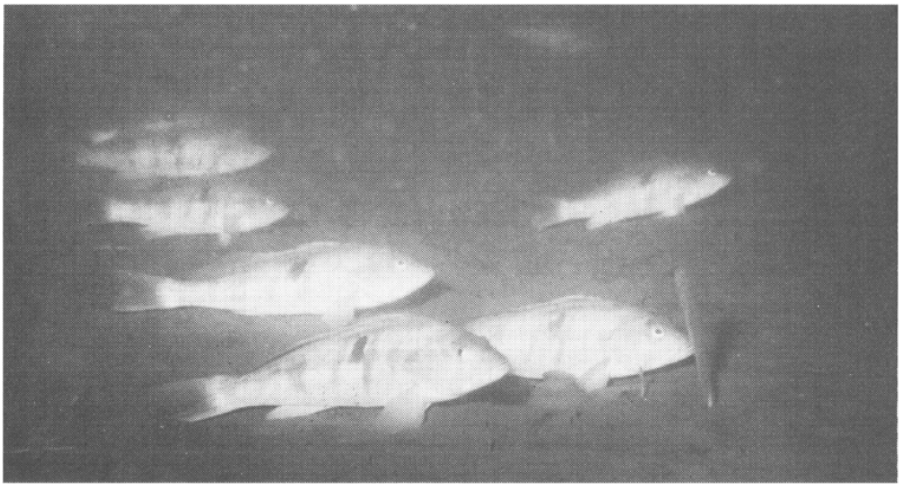

FIGURE 14. A group of barred sand bass, *Paralabrax nebulifer,* on a sandy bottom near Hermosa Beach, California. *Photograph by Charles Turner.*

FIGURE 14. A group of barred sand bass, Paralabrax nebulifer, on a sandy bottom near Hermosa Beach, California.

Identification: General bass form. Pelvic fins directly below pectorals. Dorsal fin long and continuous, with notch between spiny and soft ray portions but not nearly as deep as in kelp bass. Third spine of dorsal fin longest. Posterior end of upper jaw expanded and visible. No spines visible on head or preopercle. Scales small. Color grayish-black above, whitish below. Distinctly mottled with large dark blotches on side, and wide vertical bars on side of body. often confused with kelp and spotted sand bass. Distinguished from former by shape of dorsal fin and from latter by absence of profuse dark spots on body. A 25 inch (650 mm TL) male weighed 8 pounds and # ounces (3647 grams). Its stomach contained an octopus and a plainfin midshipman. A 25 incher (631 mm TL) was determined to be 20 years old. Recorded from Santa Cruz, California, south to Magdalena Bay, Baja California.

Habitat-Habits: Among rocks close to bottom, especially near sand or on sand, from 4 to 120 feet. Concentrated between 17 to 85 feet. Adults primarily bottom fish that remain a few inches to several feet over substrate, seeking cover when necessary in caves and holes. Present throughout year.

Life History Notes: Food items include amphipods, crabs, octopus, squid, ophiuroids, small fishes (such as anchovies and surfperch) and tubesnout eggs. Adults aggregate and spawn during warmer months. Eggs pelagic. Young striped, appearing in entrances to bays (e.g., Newport Bay and Mission Bay) in eelgrass beds during fall and winter.

Remarks: A more southern species frequenting our coast in and subsequent to periods of warmer waters. Because of this it is caught less commonly than kelp bass, but the two often are caught together close to bottom. Recently, 1960 to 1970, barred sand bass have formed an important part of the sport catch. No important relationship to giant kelp, but surface kelp often present above habitat.

6.21. Spotted sand bass, Paralabrax maculatofasciatus (Steindachner)

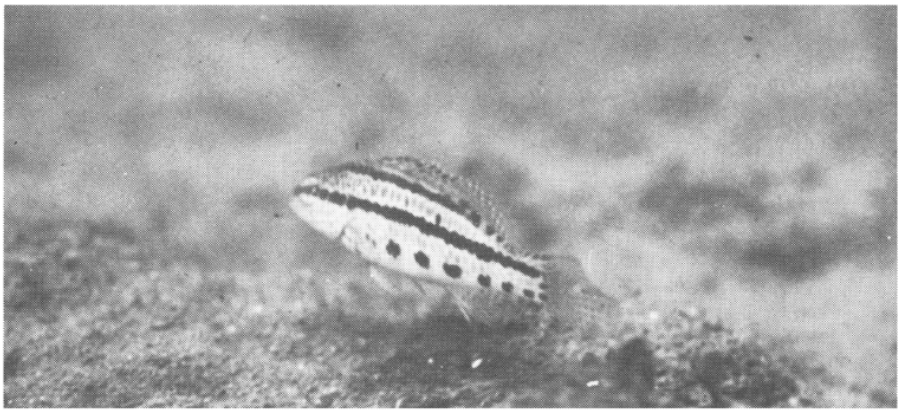

FIGURE 15. A juvenile spotted sand bass. *Photograph by Charles Turner.*

FIGURE 15. A juvenile spotted sand bass.

Identification: Body bass-like, somewhat elongate. Pelvic fins below pectorals. Dorsal fin long and continuous, with third spine longest and very broad notch between spiny and soft ray portions. Posterior end of upper jaw expanded and visible. Body somewhat deeper than in barred sand bass and kelp bass. No spines visible on head or preopercle. Olive above, whitish below; with several dark bars on sides. Numerous small round black spots cover body and head and extend onto caudal fin; both vertical and horizontal barring. Horizontal bars more numerous than on barred sand bass. A 22 incher weighed 5 pounds 10 ounces. A 15 inch spotted sand bass (390 mm TL) was determined to be 5 years old. Recorded from Monterey Bay, California, southward to Mazatlan, Mexico, including the Gulf of California.

Habitat-Habits: Sand bottom close to eelgrass or jetty rocks, from 2 to 30 feet (Newport Bay). Taken in 150 to 200 feet of water in the upper Gulf of California (J.E. Fitch, California Department of Fish and Game, pers. commun.). Closely associated with high relief: during 5 year period never found more than 100 feet away from eelgrass, in Newport Bay. Adults often remain in small clearings, perhaps bass-made, in eelgrass. On several occasions, each observed depression contained a spotted sand bass.

Life History Notes: Crabs; ghost shrimp, Callianassa californiensis; and small fishes, including kelpfish are important food items. Pelagic eggs.

Remarks: often found in patches of surfgrass near edges of La Jolla kelp beds and near rock jetties in San Diego and other harbors. Primarily a more southern species, typically found from Newport Beach southward.

6.22. Giant sea bass, Stereolepis gigas Ayres

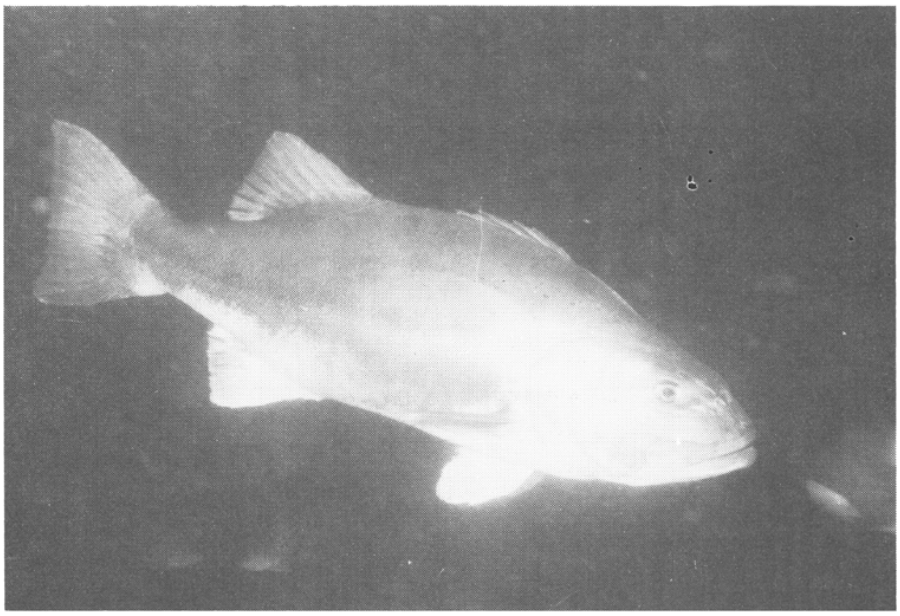

FIGURE 16. A giant sea bass, *Stereolepis gigas,* weighing approximately 200 pounds.
Photograph by Charles Turner.

FIGURE 16. A giant sea bass, Stereolepis gigas, weighing approximately 200 pounds.

Identification: General bass shape. Heavy, robust; often large. Head large. Two dorsal fins; first dorsal low with no high spines. Posterior end of upper jaw expanded and visible. Pelvic fins below pectorals. Anal fin short. Adults black or brown above, pale below. Except for large black spots on body, could be confused with broomtail grouper and gulf grouper. Young perch shaped; black or brick red above, slate-gray below; with black spots on body. A 7 footer (539 pounds) was found beached at San Clemente. This behemoth was about 60 years old, considerably younger than the 72 to 75 years determined for a 435 pounder (Fitch, 1969). Ranges from Humboldt Bay to Gulf of California (Boydstun, 1967).

Habitat-Habits: Rocky areas, kelp. Generally swims 5 to 10 feet over substrate, but will swim at mid-depths or even near surface in kelp beds. From 18 to 100 foot depths. Adults tend to be gregarious, six to eight swimming together over shallow reef is a relatively common sight off central Baja California.

Life History Notes: Spiny lobster, squid, and smaller fishes (including kelp bass, sardines, and bonito) are typical food items. A stingray sting was found in one specimen's air bladder (Fitch, 1969). Eggs pelagic, spawned in summer. Young to about 6 inches are brick red with six irregular rows of black dots on sides. Color similar to that of other lower intertidal zone fishes. Mature at age 11 to 13 at a weight of 50 to 60 pounds.

Remarks: Not numerous off southern California. Taken by baited hook, especially with live bait. Considered prize by spearfishermen. Occurs perodically in kelp beds at lower depths, particularly around the offshore banks and all channel islands except San Miguel and Santa Rosa.

6.23. Ocean whitefish, Caulolatilus princeps (Jenyns)

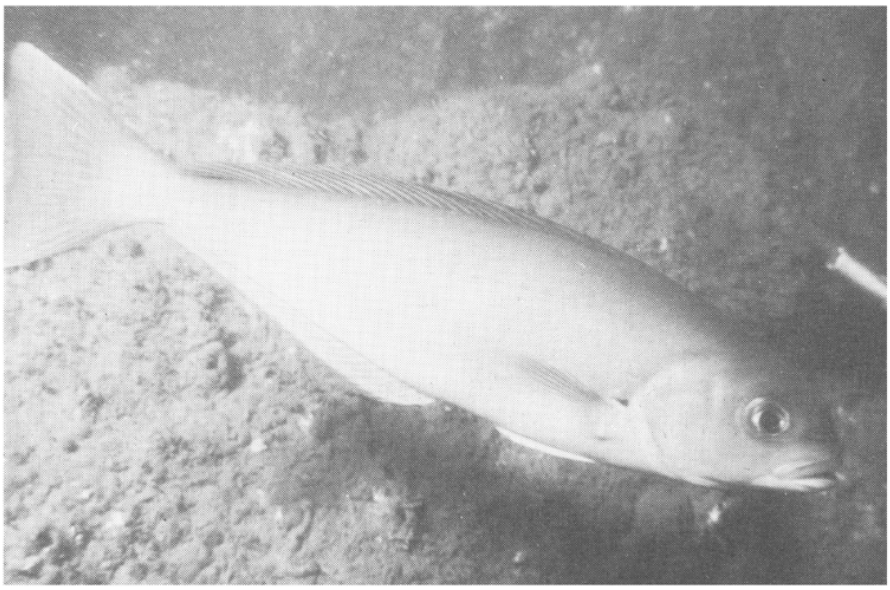

FIGURE 17. An ocean whitefish, *Caulolatilus princeps,* in 60 feet of water near Hermosa Beach, California. *Photograph by Charles Turner.*

FIGURE 17. An ocean whitefish, Caulolatilus princeps, in 60 feet of water near Hermosa Beach, California.

Identification: Body elongate with pelvic fins below pectorals. Upper profile in front of dorsal forms smooth curve to point below mouth. Dorsal very long, running from above pectoral fin almost to tail, with spines and rays of equal length and no notch in fin. Anal similar to dorsal but runs from about mid-body almost to tail. Light tan or gray above, white below; with white chin; fins light yellow with blue trim. Length (unreliable) to about 40 inches. A 27 inch ocean whitefish weighed 7 ¾ pounds. Recorded from Willapa Bay, Washington, to and into the Gulf of California.

Habitat-Habits: Over rocky bottom and in kelp; from surface to at least 300 feet, concentrated 10 to 65 feet. Adults, loosely gregarious, wander almost continuously 4 to 15 feet above substrate, occasionally observed dropping to bottom to feed.

Life History Notes: Crabs, shrimp, other crustaceans, small octopuses, squid, and fishes are main food items. Eggs pelagic; larvae found in albacore stomachs.

Remarks: Excellent food fish, good game fish. Apparently no important relationship to giant kelp. Mid-depths in southern California kelp beds, but over rocks at similar depths in more southerly areas without kelp.

6.24. Yellowtail, Seriola dorsalis (Gill)

Identification: Fusiform. Pelvic fins below pectorals. Posterior end of upper jaw expanded and visible. often bulbous enlargement of head forward of eyes. Two dorsal fins, almost connected; first short, second long, extending almost to tail with anterior rays longest. Anal fin long, similar to second dorsal. Caudal fin crescent-shaped. Blunt low keel on either side of slender caudal peduncle. No shields along lateral line. Metallic blue-green to dark gray above; silver-white below; faint brassy stripe along middle of side from eye to tail; caudal fin bright yellow. Length to nearly 5 feet. The record yellowtail is an 80 pounder caught at Guadalupe Island (Fitch, 1969). Most of those caught locally are 10 to 20 pounders and are 3 to 7 years old. The oldest fish which could be reliably aged during a recent study was 12 years old and weighed 35 pounds. Recorded from southern Washington to Chile, and in the Gulf of California as far north as Los Angeles Bay. In California waters they are rare north of Point Conception.

Habitat-Habits: Nearshore pelagic, schooling. Surface to 80 feet, although occasionally deeper. Yellowtail feed and live along edges of rocky points and kelp beds, usually swimming just below surface. In California seasonally during most years, but most numerous during summer. often observed close to shore on late summer evenings, especially pairs of large adults.

Life History Notes: Food items include squid and small fishes such as sardines, anchovies, jacksmelt, and topsmelt. Sometimes can be heard from skiff as it snaps at bait. Adult sexually ripe during summer. Eggs pelagic. Subadults occur in small schools with barracuda at inner edges of kelp during summer. Rarely spawning in California waters except during warm water years (e.g., 1957–59).

Remarks: Extremely popular game fish. Taken chiefly with live bait or by trolling, also speared by divers. Catch of live-bait fishermen increases in regions of clearest water such as off La Jolla, Coronado Islands, and San Clemente Island. Extends well south of giant kelp range. Yellowtail apparently do not need kelp, but do feed in and around kelp and use it for cover. Not disturbed by kelp harvesters, feeds directly behind these boats, probably on items forced into open by harvesting operations. This circumstance is well recognized, and many sport boats fish recently cut areas. The biology of this species and the history of the yellowtail fishery are well documented (Baxter, 1960).

6.25. Jack mackerel, Trachurus symmetricus (Ayres)

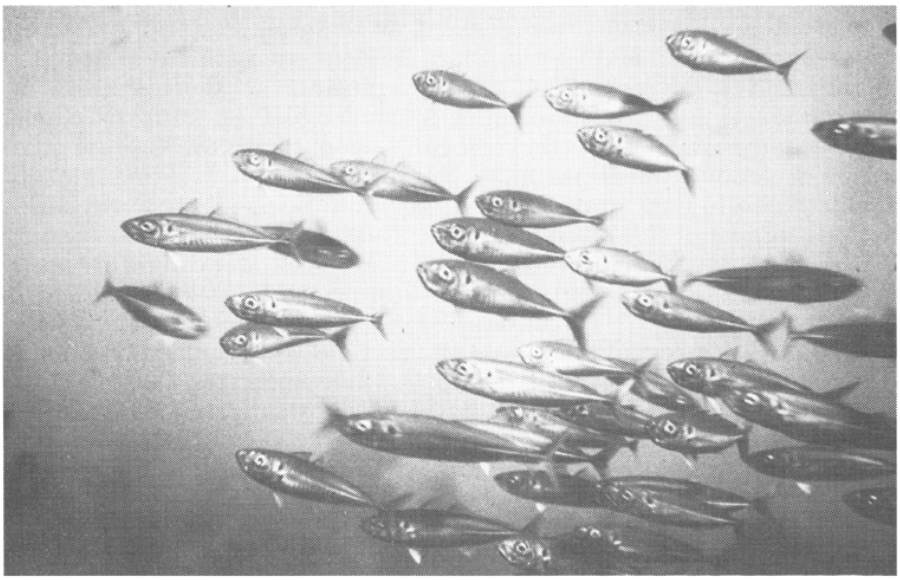

FIGURE 18. A school of jack mackerel, *Trachurus symmetricus.* *Photograph by Conrad Limbaugh.*

FIGURE 18. A school of jack mackerel, Trachurus symmetricus.

Identification: Body elongate, tapered at both ends, cylindrical. Dorsal fin divided into two adjoining portions, the soft-rayed portion being long and running to caudal. Anterior rays much the longest. Anal similar in shape and oppositely placed to rayed portion of dorsal. Tail deeply forked, chevron-like. Snout bluntly pointed. Pelvic fins below pectoral. Lateral line distinct, curving downward abruptly about on line with front of anal fin; characteristic ridged bony plates along straight portion of lateral line. Green, darker above and lighter below. Similar in appearance and habits to unrelated Pacific mackerel, often in same school, but readily distinguished by absence of wavy dark streaks on back and by distinctive lateral line scutes. Nearshore schools are usually small fish, less than 14 inches (FL). offshore the fish grow larger; a 32 inch, 5 pounder appears to be the record. Found throughout the northeast Pacific. Typically found from southeast Alaska to Magdalena Bay, Baja California.

Habitat-Habits: Nearshore and offshore pelagic. Smaller individuals often school under piers or in shade of kelp. Surface to 150 feet and deeper. often schools with Pacific sardine, Pacific mackerel, and blacksmith.

Life History Notes: Food items are mainly large copepods, euphausids, pteropods, squid, and small fishes including silversides (atherinids), anchovies, and lanternfishes (myctophids). Eggs pelagic. Young individuals (# to 1 inch) pelagic and often seek shelter under mantle of purple striped jellyfish, Pelagia sp. In aquarium young appear dusky on top and transparent below. Juveniles and subadults common under piers during summer, forming dense schools.

Remarks: No important relationship to giant kelp. Sometimes seeks cover in kelp beds, but equally common in areas without kelp. Large adults and larvae common several hundred miles from shore.

6.26. Sargo, Anisotremus davidsonii (Steindachner)

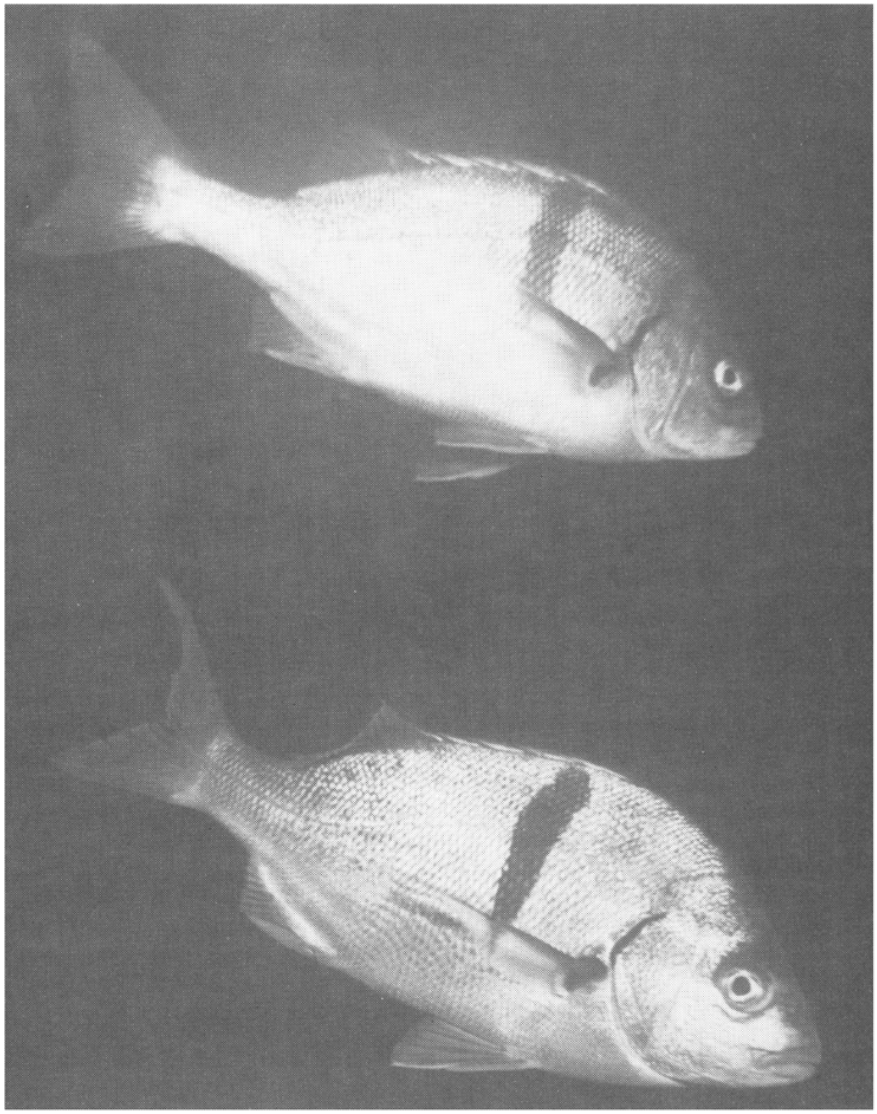

FIGURE 19. Two adult sargo, *Anisotremus davidsonii.* *Photograph by Charles Turner.*

FIGURE 19. Two adult sargo, Anisotremus davidsonii.

Identification: General perch shape. Body deep, compressed, steep between snout and dorsal fin. Dorsal fin long, distinctly notched with spines longer than rays. Anal fin short. Iridescent silver to silvery; with distinct vertical black bar behind pectoral fin, extending from dorsal fin to lower sides. often confused with pile surfperch and occasionally with

rubberlip surfperch. Distinguished from pile surfperch by shorter anal fin and shape of dorsal fin. Lips less fleshy than in rubberlip surfperch. In rubberlip and pile surfperch, the dark bar, when present, is in posterior half body. Several golden and albino sargos have been taken in California. A 17.4 inch normally colored female weighed 3.7 pounds (Baxter, 1966). Occurs from Monterey Bay to Cape San Lucas, Baja California, and into the upper Gulf of California (San Felipe). Since 1951 when they were introduced, they have been very abundant in Salton Sea, California.

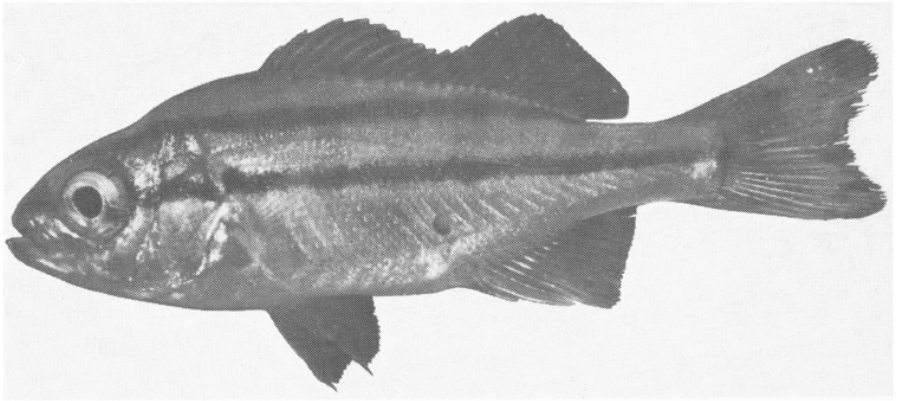

FIGURE 20. Juvenile sargo. Note color pattern. *Photograph by Conrad Limbaugh.*

FIGURE 20. Juvenile sargo. Note color pattern.

Habitat-Habits: Schools over rocky or rock-sand bottom from surface to 130 feet. Concentrated 8 to 25 feet.

Life History Notes: Food items include bryozoans, small crustaceans, and mollusks (i.e., chitons and clams). Late spring and early summer spawning. Eggs pelagic. Young, 1 inch long, appear during late summer and early fall at depths of 4 to 20 feet, and loosely school with various sized young salema, and black croaker, on shoreward side of rocks over sand bottom. Horizontally striped like these two associated species (Limbaugh, 1961a). As winter approaches, stripes are lost, black bar appears, and young sargos become solitary, inhabiting depths from 4 to 50 feet until the following winter. At about 5 inches, join adult schools and probably spawn the following summer at 2 years of age when approximately 7 inches. All through juvenile, half grown, subadult, and adult life, these fish are capable of displaying striped juvenile pattern.

Remarks: Good food fish. Taken by surf, skiff, and spear fishermen. No important direct relationship to giant kelp, but often school in mid-kelp and kelp bottom habitats. Frequently associated with rock substrate at the inner kelp (shallower) edge.

6.27. Salema, Xenistius californiensis (Steindachner)

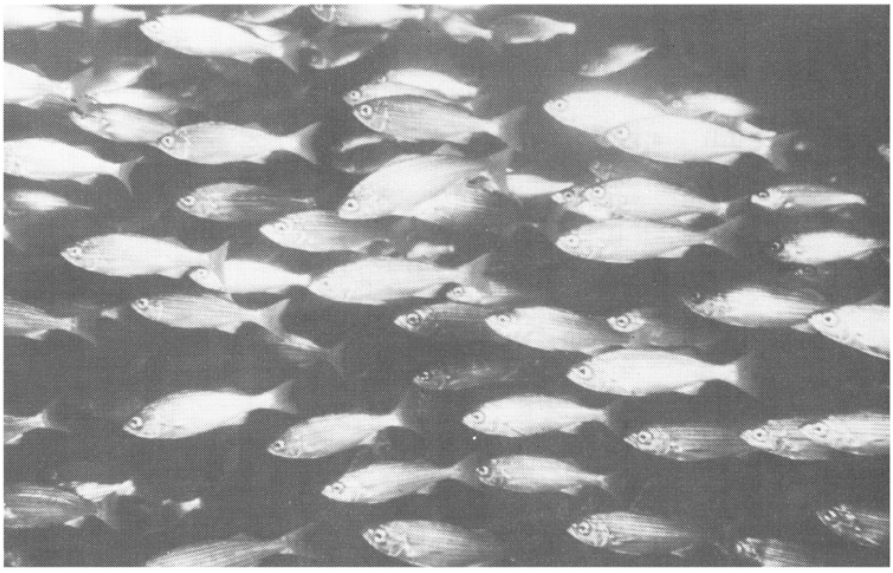

FIGURE 21. A school of 8 to 10 inch long salema, *Xenistius californiensis.*
Photograph by Charles Turner.

FIGURE 21. A school of 8 to 10 inch long salema, Xenistius californiensis.

Identification: Iridescent blue-green to silver with numerous yellow-orange horizontal stripes on body. Large eyes equal to almost one third length of head. Length to 10 inches. Recorded from Monterey Bay, California, southward to Peru and in the Gulf of California.

Habitat-Habits: Over and among rocks in shallow water from 4 to 35 feet. often in kelp beds near canopy. Typically a southern species, commonly observed at Santa Catalina Island and from the Dana Point area southward.

Life History Notes: Juveniles feed upon amphipod crustaceans. Quast (1968b) mentions ophiuroids as a food item. Eggs pelagic. Young frequently mix with young black croaker and sargo; appear in late summer at depths ranging from 6 to 17 feet. Similar juvenile color pattern in the three species. All bear longitudinal black stripes, each much narrower than eye. School 1 to 4 feet off sandy bottoms shoreward of rocks or pilings. In marine tanks at Scripps Institution of Oceanography fed on living brine shrimp; some individuals grew from a length of 1 inch to 3.5 inches in 1 year.

Remarks: Seldom caught by baited hook, but easily taken by spearfishermen. Good eating, but generally too small to make preparation worthwhile.

6.28. Black croaker, Cheilotrema saturnum (Girard)

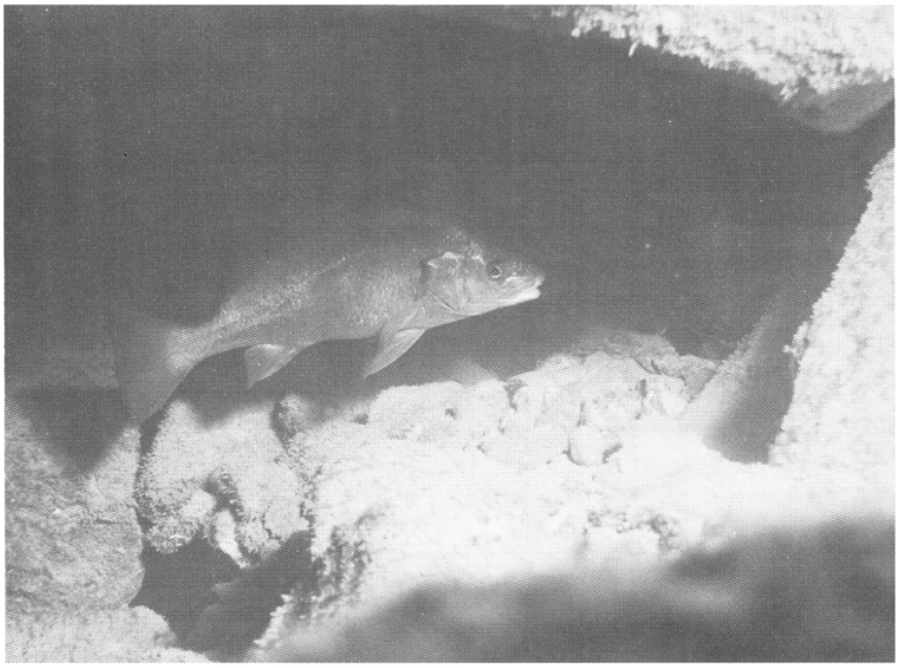

FIGURE 22. An adult black croaker, *Cheilotrema saturnum,* at the mouth of a cave.
Photograph by Charles Turner.

FIGURE 22. An adult black croaker, Cheilotrema saturnum, at the mouth of a cave.

Identification: General croaker like form. Body moderately deep. Pelvic fins below pectorals. One dorsal fin, but deep notch almost separates spiny portion from soft-rayed portion. Soft-rayed portion much longer than spiny. Anal fin short. Snout rounded; mouth subterminal. Purplishblack, somewhat ligher below, with tail fin dark. Edge of gill cover above pectoral fin black. Adults assume several distinctive color patterns. Dark brown in caves. Except for cream colored spots, night pattern is essentially same as displayed in caves during daylight. Light tan may be displayed in clear, open water; striped pattern assumed over sand patches. Young light yellowish-white with stripes. Length to 15 inches. A 14 incher weighed 1 pound 9 ounces, and was 20 to 21 years old. Occurs from Point Conception southward to Magdalena Bay, Baja California, and in the upper Gulf of California.

Habitat-Habits: Along open rocky coasts and in coastal bays. Fish associated with rocks are mostly in fair sized rock caves or dark crevices. In murky water tend to school in thick clumps of seaweeds such as ribbon kelp. Adults displaying juvenile striped color pattern occur over sand patches among shallow reefs. Less restricted to rocky retreats in bays where water is generally more turbid. Concentrated 10 to 50 feet, range from 4 to 150 feet. Young concentrated 8 to 10 feet, range from 4 to 18. Easily approached when found in caves and tunnels, but these fish almost invisible because of dark color. In almost constant motion outside

caves and tunnels, when approached promptly seek shelter among rocks. Become almost invisible at 15 feet by longitudinal stripes when over sand ripples. Striped individuals seldom retreat into caves, darken when speared.

Life History Notes: Food items include crustaceans, mainly rock dwelling crabs such as lumpy crabs, young masking crabs, and red-rock shrimp and various amphipods. Spawn in late spring and early summer. Tiny, pelagic, colorless eggs (0.78 mm in diameter) hatch within 18 to 48 hours. Juveniles, appear in August, September, and October and strikingly resemble young sargo and salema. Along open coast just beyond surf, young of these species school together over a sandy bottom near bases of rocks in water 4 to 18 feet deep. Rocks afford protection from surge. Schooling individuals are 6 to 10 inches apart, all face directly into constantly reversing surge. Schools do not shift position more than 10 feet during entire season. However, within schools, species, sizes, and numbers fluctuate from day to day. Black croakers become larger, break away from these schools and retire to caves and crevices.

Remarks: Infrequently caught by baited hook, but commonly by spear. Not so large as some California croakers, but quite palatable and potentially valuable as food. No important direct relationship to giant kelp, but sometimes seeks cover among stipes and on substrate below. Limbaugh (1961a) provides additional information concerning this species.

6.29. White seabass, Cynoscion nobilis (Ayres)

Identification: Fusiform. Pelvic fins below pectorals. Two dorsal fins, nearly connected; first short and higher than second; second quite long. Caudal fin truncate. Anal fin short. Lower jaw protrudes slightly beyond upper. Posterior end of upper jaw expanded and visible. No barbel on lower jaw. Raised ridge on midline of belly of all ages. Bluish-gray to silver-gray above; silvery-white below with gold highlights. Young, those less than approximately 2 feet in length, have three to six distinct broad black vertical bars and dusky yellow fins; vertical bars fade rapidly out of water. Recorded from Juneau, Alaska, to Magdalena Bay, Baja California, and there is an isolated population in the northern Gulf of California.

Habitat-Habits: Schools over rocky bottoms from 4 to 50 feet, concentrated 10 to 40 feet. Among giant kelp just below canopy.

Life History Notes: Food includes squid and small fishes such as anchovies and sardines. Summer spawning. Eggs pelagic. Young in bays and surf during late summer and fall.

Remarks: Taken commercially with gill nets in kelp. Gill net fishermen frequently follow kelp cutters, fishing for some time in areas where harvesters have cleared away heavy canopy. Occasionally caught in kelp, usually on inner edge by fishermen using live bait. Best fishing usually between kelp beds and shore over rocky bottom. Kelp not necessary but used for cover at lower levels. Trawled specimen taken in 62

fathoms (372 feet) of water off Cedros Island, Baja California (J. E. Fitch, California Department of Fish and Game pers. commun.). Thomas (1968) provides a good description of white seabass fishery and management.

6.30. California corbina, Menticirrhus undulatus (Girard)

Identification: More slender than other croakers; body elongate and cigar shaped. Nearly flat on ventral side. Pelvic fins below pectorals. Dorsal fin appears divided by deep notch but remains connected by low membrane; soft-rayed portion much longer than spiny. Anal short. Caudal fin large, nearly straight in profile. Caudal fin higher on dorsal edge and flattened on ventral edge. Snout blunt and rounded, mouth subterminal with barbel on chin. Sooty-gray above, light below; sometimes marked with heavy distinct dark and light lines. Reportedly attains lengths of 2½ feet and weights of 8 pounds (Roedel, 1953). A 28 inch, 7 pound 4 ounce California corbina was taken at San Onofre (Baxter, 1966). Recorded from Point Conception to Gulf of California.

Habitat-Habits: Usually in sandy surf zone in schools or groups of two or three or in shallow bays, from surface to 45 feet, concentrated 3 to 18 feet. Adults often observed swimming slowly over bottom in aggregations of two to five, occasionally in schools of hundreds. At times move with small waves, and accompany breaking wave high on beach.

Life History Notes: Food items are mainly sand crabs. Polychaete worms, clams, clam siphons, crustaceans, small fishes, and fish eggs also are eaten (Joseph, 1962). Feeds in surf zone, at times in water so shallow that back protrudes. Scoops mouthfuls of sand, separating food by sending sand through gills. Summer spawning. Eggs pelagic. Inch long young are found at depths of 4 to 8 feet outside surf during August. Larger young occur in very shallow water inside surf.

Remarks: Highly prized surf fish; taken by baited hook and spear. No important relationship to giant kelp, but enters shallower sandy portions occasionally.

6.31. Spotfin croaker, Roncador stearnsii (Steindachner)

Identification: Croaker shaped. Body slightly compressed but heavy; moderately deep. Dorsal fin continuous but nearly separated by deep notch; soft-rayed portion much longer than spiny. Anal fin short. Pectoral much longer than pelvic with distinct black spot at base. Caudal fin broad, unnotched; profile straight with lateral line running to end. Snout bluntly rounded with mouth slightly subterminal. Scales large. Metallic gray above, brassy on sides. No barbel on chin. In shape resembles yellowfin croaker, but easily distinguished by dark spot at base of pectoral and lack of brassy streaks on sides. Attains a weight of 10½ pounds and ages of 18 to 19 years. A 26½ inch, 9¼ pounder was 15 years old (Baxter, 1966). Although recorded from Point Conception to Magdalena Bay, Baja California, they are not common north of Los Angeles Harbor.

Habitat-Habits: On sand; almost always in shallow surf zone or bays. From 4 to 50 feet. May swim in small schools up to 50 but generally only two or three individuals are found together just inside surf, especially near rocks, breakwaters, or in entrances to bays.

Life History Notes: Food includes polychaete worms, clams, crabs, and various small crustaceans, crabs, and clams. Due to their heavy, crushing pharyngeal teeth, spotfin croakers are capable of ingesting heavier shelled clams than are California corbina (Joseph, 1962). Summer spawning. Eggs pelagic. Young, 1 inch long, appear in surf during early fall. Subadults also found in surf.

Remarks: Excellent sportfish, caught by surf, pier, and spear fishermen. No known relationship to giant kelp; only rarely ventures into kelp beds. Joseph (1962) provides considerable additional information about this species and California corbina.

6.32. Queenfish, Seriphus politus Ayres

Identification: Body elongate, moderately compressed. Pelvic fins below pectorals. Two distinctly separate dorsal fins, second slightly longer. Tail unnotched, with lateral line running to end. Mouth large, terminal, slanted obliquely upward, parallel to profile of lower jaw. Posterior end of upper jaw expanded and visible. Scales moderately large. Dark tan above, silvery on sides, fins yellowish. An 11 incher (205 mm TL) weighed slightly more than a half pound (295 grams). Recorded from Yaquina Bay, Oregon, to Uncle Sam Bank, Baja California.

Habitat-Habits: Common during summer in shallow water around pier pilings on sand bottom. Schools in tightly packed aggregations over sandy bottom. From 2 to 70 feet, concentrated 4 to 27 feet. Migrates seaward, into deep water, at night (Edmond F. Hobson, National Marine Fisheries Service, pers. commun.).

Life History Notes: Feeds on small free swimming crustacea, small crabs, and fishes. Adults ripe in summer. Eggs pelagic. Tiny young, less than 1 inch long, appear late summer and fall; first at depths of 20 to 30 feet, gradually moving shoreward until they enter surf zone when 1 to 3 inches long.

Remarks: Small quantities taken commercially. Baited hook or jigging by sport fishermen. Probably important forage to fishes such as California halibut. Occasionally a dense school of adults seeks cover in kelp shade usually at mid-depths or near bottom. No other known relationship to giant kelp.

6.33. Yellowfin croaker, Umbrina roncador Jordan and Gilbert

Identification: Body croaker-like, compressed, somewhat elongate, with pelvic fins below pectorals. Dorsal fin long, almost divided by deep notch, with soft-rayed portion much longer than spiny. Pectoral fins about same length as pelvics. Caudal fin concave, yellow. Snout bluntly

rounded, mouth small and subterminal. Single short barbel at tip of lower jaw. Grayish-tan (sand colored) above, belly white; metallic light tan on sides with many irregular dark yellow-brown lines running from near head to tail. Blends extremely well with sand background, but yellow fins help locate it underwater. Reportedly attains length of 16 inches (Roedel, 1953); recorded by Southern California Tuna Club as attaining a 3.9 pound weight. A 10 inch (250 mm TL) male weighed 0.37 pounds (170 grams). Recorded from Point Conception to Gulf of California.

Habitat-Habits: Extremely shallow water close to sand bottom, especially in surf zone, near rocks or in bays. From shore to 25 feet.

Life History Notes: No information.

Remarks: Caught by surf and spear fishermen. Excellent food fish. No known important relationship to giant kelp. Rarely enters shallow sandy portions of kelp beds.

6.34. Halfmoon, Medialuna californiensis (Steindachner)

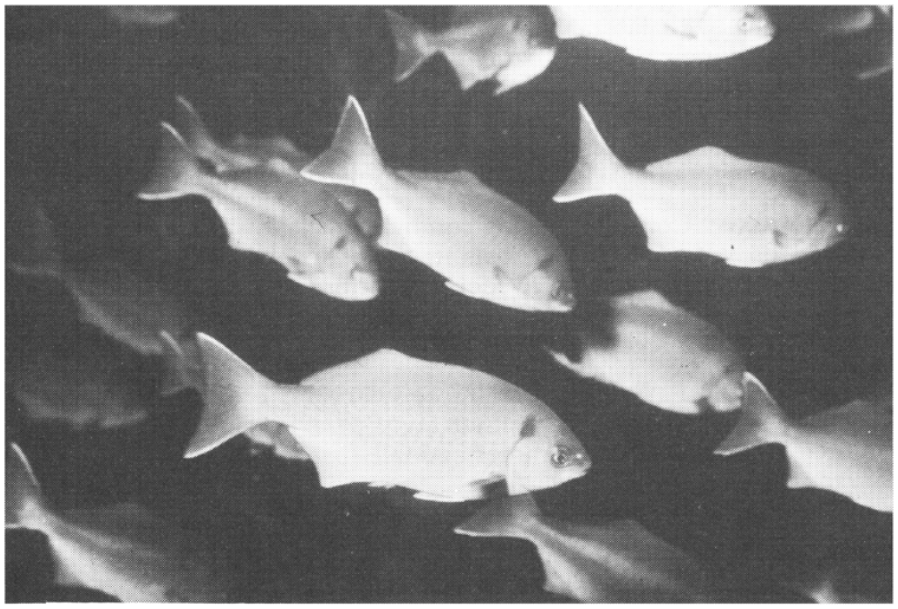

FIGURE 23. A school of halfmoon, *Medialuna californiensis.* *Photograph by Charles Turner.*

FIGURE 23. A school of halfmoon, Medialuna californiensis.

Identification: Body perch-like; moderately deep and compressed. Pelvic fins slightly behind pectorals. Dorsal fin long with short spines and long soft rays; rays shorter posteriorly. Tail profile forms shallow curve with no distinct fork. Anal fin similar in length and appearance to soft-rayed portion of dorsal. Scales small, almost completely cover anal and dorsal soft rays, giving them leathery appearance. Dorsal profile forms smooth curve from dorsal fin to terminal mouth. Bluish-black above, bluish-gray on sides, becoming lighter below. Fins dark. Fish of offshore islands are

more blue. A 19 inch (TL) specimen weighed 4 pounds 12.5 ounces. Occurs from Klamath River, California, to Gulf of California.

Habitat-Habits: Generally high over rocks and at mid-depths in kelp. Occasionally seek cover in crevices and swim close among boulders inshore. From surface to 100 feet. Concentrated 8 to 65 feet. Abundant, but does not aggregate in large compact schools. May school loosely, sometimes with pile surfperch. often solitary.

Life History Notes: Food items include red, green, and brown algae; sponges, bryozoans, and crustaceans. Ripe adults occur in July, August, September, and October. Eggs possibly pelagic. Pelagic young (1 to 2.5 inches long) collected beyond outer edges of kelp beds off Santa Cruz Island in August. Young similar in appearance to pelagic opaleye and have same pelagic habit of curling, looking like wet feathers. Individuals mature at approximately 7.5 inches.

Remarks: Good food fish; taken by baited hook or spear. Extremely abundant everywhere among seaweed, often outside range of giant kelp. Apparently no significant dependence on kelp (Also see Follett, Gotshall, and Smith, 1960).

6.35. Zebraperch, Hermosilla azurea Jenkins and Evermann

FIGURE 24. A school of zebraperch, *Hermosilla azurea,* at Magdalena Bay, Baja California.
Photograph by Jack Ames.

FIGURE 24. A school of zebraperch, Hermosilla azurea, at Magdalena Bay, Baja California.

Identification: Perch-like. Olive to brown, with light azure vertical bars. A very large adult caught near San Onofre was 16 inches long and weighed 3 pounds 2 ounces (J. E. Fitch, California Department of Fish

and Game, pers. commun.). Recorded from Monterey Bay southward into the Gulf of California (Phillips, 1965).

Habitat-Habits: Shallow water off southern California. Occasionally observed in kelp bed canopy. From surface to 25 feet. Common around the discharge pipe from the Pacific Gas and Electric steam generating station at Morro Bay (Earl E. Ebert, California Department of Fish and Game, pers. commun.) an indication of their preference for warmer waters. Common close inshore, often schools with opaleye and halfmoon. Adults usually in fast, constant motion, swimming back and forth over same areas, using same paths around ledges and boulders.

Life History Notes: Feeding habits probably similar to those of opaleye and halfmoon. Eggs and larvae probably pelagic. Young zebraperch school with young opaleye in August when they are relatively common inshore and in tide pools.

Remarks: Occasionally taken by spear. Edible, but not rated high as food fish. Rare in kelp beds.

6.36. Opaleye, Girella nigricans (Ayres)

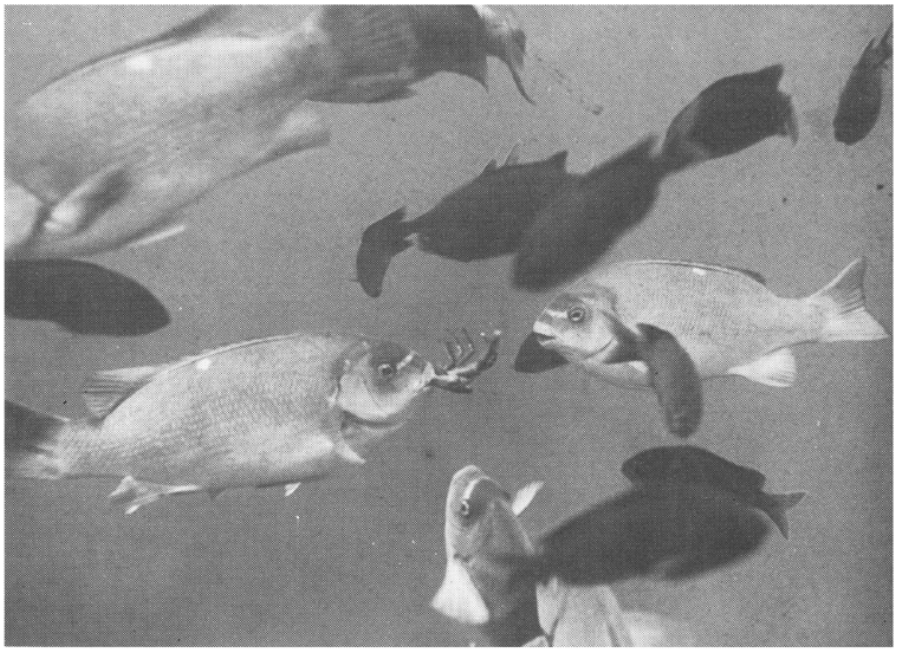

FIGURE 25. A school of opaleye, *Girella nigricans,* feed on pelagic red crabs, *Pleuroncodes planipes.* *Photograph by Ron Church.*

FIGURE 25. A school of opaleye, Girella nigricans, feed on pelagic red crabs, Pleuroncodes planipes.

Identification: Body perch-like, deep, compressed. Dorsal fin long, continuous; soft rays longer than spines. Pelvics below pectorals. Mouth terminal. Tail truncate. Eyes rather large, distinctive opalescent blue. Gray-green to olive-green above, slightly lighter below; occasionally a pale green, almost white individuals have been observed. Sometimes

called button perch from presence of one or two white spots near center of back at base of dorsal fin. Largest fish on record is a 25½ inch (644 mm TL) specimen speared off south Laguna. It weighed 13.46 pounds and was determined to be 10 to 11 years old (Baxter, 1966). Recorded from San Francisco to Cape San Lucas, Baja California. The major portion of the population is south of Point Conception.

Habitat-Habits: Among seaweeds at shallow depths, ranging from tide pools and canopy to 100 feet; near or over rocky areas. Prefers depths averaging about 20 feet, concentrated 5 to 65 feet.

Life History Notes: Food primarily organisms attached to seaweed. often eats seaweed, either with or without encrustations of organisms. Food items include feather boa kelp; giant kelp; sea lettuce, Ulva; Gelidium; coralline algae; small tube dwelling polychaetes, Dexiospira sp.; bryozoans; and pelagic red crabs (Also see Williams and Williams, 1955). Will take hooks baited with animal material, but prefers bits of green marine plants.

Adults ripe in April, May, and June when dense schools of large fish aggregate in shallower parts of kelp beds or inshore among patches of ribbon kelp. Spawning probably occurs much earlier since young appear in tide pools from March into October. Eggs and larvae are pelagic. Post larvae and juveniles nearshore pelagic, but found many miles at sea around bits of drifting seaweed or jellyfishes.

The young are bright green above and silver along sides and below. School in typical anchovy fashion with the whole group turning in synchronized movement. Schools small, usually fewer than two dozen fish. Sometimes school under floating kelp rafts with juvenile halfmoon which have the same coloration. Opaleye almost always under ½ in length, whereas halfmoon often remain under kelp until adult size. Scattered individuals rest in curled position just beneath surface, resembling wet feathers. Pelagic young enter tide pools at length of about 1 inch. Within few days or even overnight, lose pelagic colors and habits, becoming gray below and olive above with white dot at either side of dorsal. Lose synchronized schooling habits and form typical loose aggregation of tide pools.

Juveniles and subadults seek increasingly deeper water. Mature at length of 8 or 9 inches, probably at age of 2 or 3 years. Spawning probably does not occur in Monterey Bay since no young, half grown, or even small adults were observed during one entire summer. Large adults in this area probably stragglers which wandered from successful spawning areas in south or may be result of successful spawnings in Monterey region in warmer water years.

Remarks: Edible; prized by some fishermen who deliberately seek this species, despised by others who discard them. Extremely abundant, might make suitable fishery if better fishing methods could be devised. Browses through seaweeds continually; usually at lower levels and in shallow waters, but occasionally high along kelp columns through mid-kelp habitat and even to canopy.

6.37. Barred surfperch, Amphistichus argenteus Agassiz

Identification: Body perch-like, deep, compressed. Pelvic fins below pectorals. Dorsal fin long, undivided, with soft-rayed portion higher than spiny section. Snout blunt, mouth terminal; both jaws equally projecting. Distinct row of scales along dorsal fin base. Caudal fin notched. Sides silvery, darker above; several irregular rust or bronze vertical bars on sides, with scattered rust colored spots between them. A 17 inch, 4½ pounder is the largest authentic record. It was 9 years old (Baxter, 1966). Range from Bodega Bay, California, to Playa Maria Bay, Baja California.

Habitat-Habits: Aggregations or schools generally found within surf zone, where markings blend with wave churned environment of sea water, air bubbles, and sand. Concentrate near rocks, pilings, or borders of rocky zones where food and cover readily are available. Evidence suggests that a large portion of the population lives in deeper water; some individuals were collected at depths of 78 feet off Oceano, California.

Life History Notes: Feeds on miscellaneous crustaceans, especially sand crabs, Emerita analoga; crabs; bean clams, Donax spp.; and small mussels, Mytilus spp. Breed at least from November through December off La Jolla. Breeding behavior observed in aquarium at Scripps Institution of Oceanography. Mating male and female much darker than nonbreeding individuals in same tank. Female, quite dark below, largest fish in tank. Male especially dark below and on head. During courtship male continually pursued female, anal fin caressing her face and dorsal fin contacting her genital region. Male moved continually in figure eight pattern, bringing anal fin gland in contact with her head as often as possible. Occasionally male attempted to bring tubercles of gland to her urogenital opening by tilting his body as he swam parallel. Actual contact observed in only a few cases. Female seemed passive, occasionally made effort to elude male during courtship, sometimes rotating 180° to avoid genital contact. Male showed no signs of aggressive behavior. Young appear in spring and summer. From 4 to 113 embryos counted in females.

Remarks: Large numbers caught by surf fishermen, infrequently observed by divers though often mistakenly reported when black perch assume a light color phase. Additional information for this and other surfperches is presented by Tarp (1952); Carlisle, Schott, and Abramson (1960); and DeMartini (1969).

6.38. Kelp surfperch, Brachyistius frenatus Gill

Identification: Small, perch-like with elongate caudal peduncle. Spiny portion of dorsal fin usually slightly higher than soft-rayed portion. Long pointed snout with dorsal profile above eyes slightly concave. Brassy or golden-brown, nearly matching stripes of kelp. White horizontal line running through eye and in splotches along body at about midline. An 8½ inch (218 mm TL) specimen weighed 0.3 pounds (130 grams); this

FIGURE 26. A school of kelp surfperch, *Brachyistius trenatus,* in the kelp canopy.
Photograph by Charles Turner.

FIGURE 26. A school of kelp surfperch, Brachyistius trenatus, in the kelp canopy.

is the maximum size recorded. Recorded from Vancouver Island, British Columbia, to Turtle Bay, Baja California.

Habitat-Habits: Prefers giant kelp canopy and region just below. Seldom any distance from growing plants. From surface to 100 feet.

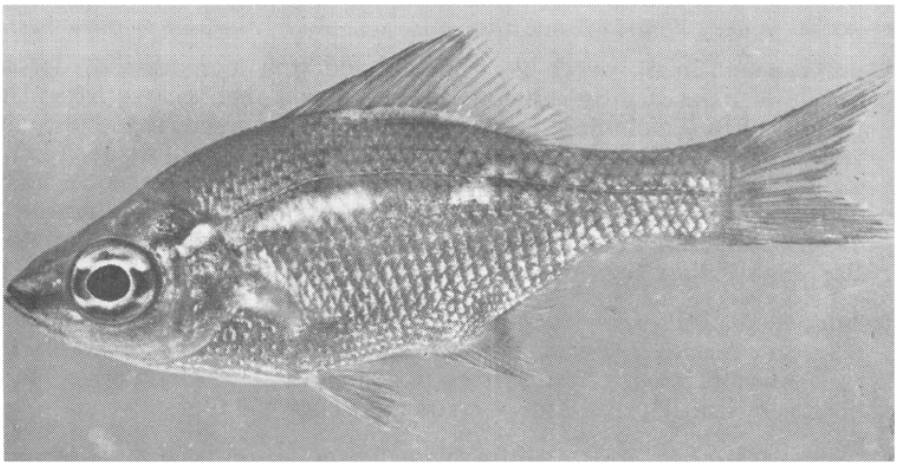

FIGURE 27. A kelp surfperch, *Brachyistius frenatus.* *Photograph by Conrad Limbaugh.*

FIGURE 27. A kelp surfperch, Brachyistius frenatus.

Life History Notes: Food includes small crustaceans, especially those on giant kelp plant, and external parasites on other fishes. Fishes seek out kelp surfperch to remove parasites; blacksmith may surround solitary kelp surfperch until it is completely hidden. Other fishes seeking services

of kelp surfperch include kelp bass, walleye surfperch, garibaldi, opaleye, and halfmoon. Breed in September and October, probably continuing through December. Pregnant individuals observed in April. Young breed the following season. Large aggregations of adults occur in late summer, possibly in preparation for mating.

Remarks: Too small for direct fishery importance, but devouring of ectoparasites may be beneficial to kelp dwelling fishes. Additional information is presented by Limbaugh (1961b).

6.39. Shiner surfperch, Cymatogaster aggregata Gibbons

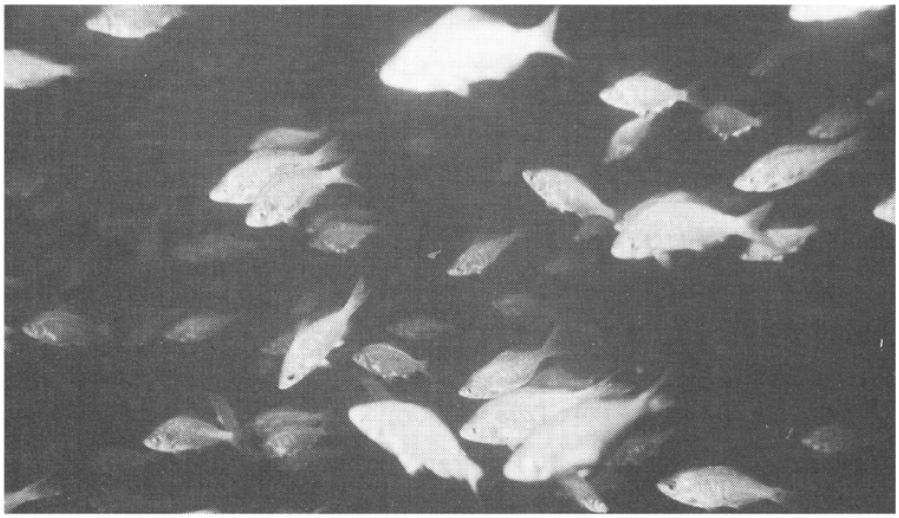

FIGURE 28. A school of shiner surfperch, *Cymatogaster aggregata.* *Photograph by Charles Turner.*

FIGURE 28. A school of shiner surfperch, Cymatogaster aggregata.

Identification: Small, perch-like; body moderately compressed; dorsal profile of head slightly concave. Darker above than below; irregular pattern of fine blotching on sides; yellow predominant; three distinct yellow bars on side behind pectoral fin. Length to 7 inches (J. E. Fitch, California Department of Fish and Game, pers. commun.). A 6½ inch (169 mm) female that weighed 75 grams contained 20 young that were 41 to 43 mm long. Recorded from Port Wrangell, Alaska, to San Quintin Bay, Baja California.

Habitat-Habits: Prefers bays and eelgrass, but fairly common along open coast in calm deeper water, or around patches of feather boa kelp in turbid water. Ranges from surface to 22 feet in bays. Along open coast observed from 4 to 120 feet. Occurs to at least 450 feet.

Life History Notes: Food consists of small crustaceans. Mating pairs and young apparently occur through all seasons. Breeding pairs a common sight in nature, occasionally observed in aquaria. Male turns dark, almost black, and follows female closely, bringing his vent close to hers for 1 or 2 seconds. He frequently leaves her and approaches intruding males aggressively.

Remarks: Extremely abundant in bays, often being the predominant fish. Very small portion of population outside bays. Commonly caught by small hooks. No relationship to giant kelp, but seeks cover at mid-depths and near bottom of kelp growing inside bay entrances.

6.40. Island surfperch, Cymatogaster gracilis Tarp

Identification: Similar in color to shiner surfperch, but brassy-pink on back and sides. Slightly larger but more slender than shiner surfperch, attaining length of slightly over 7½ inches. Found in inshore areas off Santa Cruz, Santa Rosa, and Santa Catalina islands.

Habitat-Habits: Occurs over sand, among rocks, eelgrass, giant kelp, and in bays. From surface to 30 feet.

Life History Notes: Some observed in June, July, and September; but undoubtedly present throughout year.

Remarks: Uses kelp frequently for cover, but equally common in rocky and sandy areas.

6.41. Black surfperch, Embiotoca jacksoni Agassiz

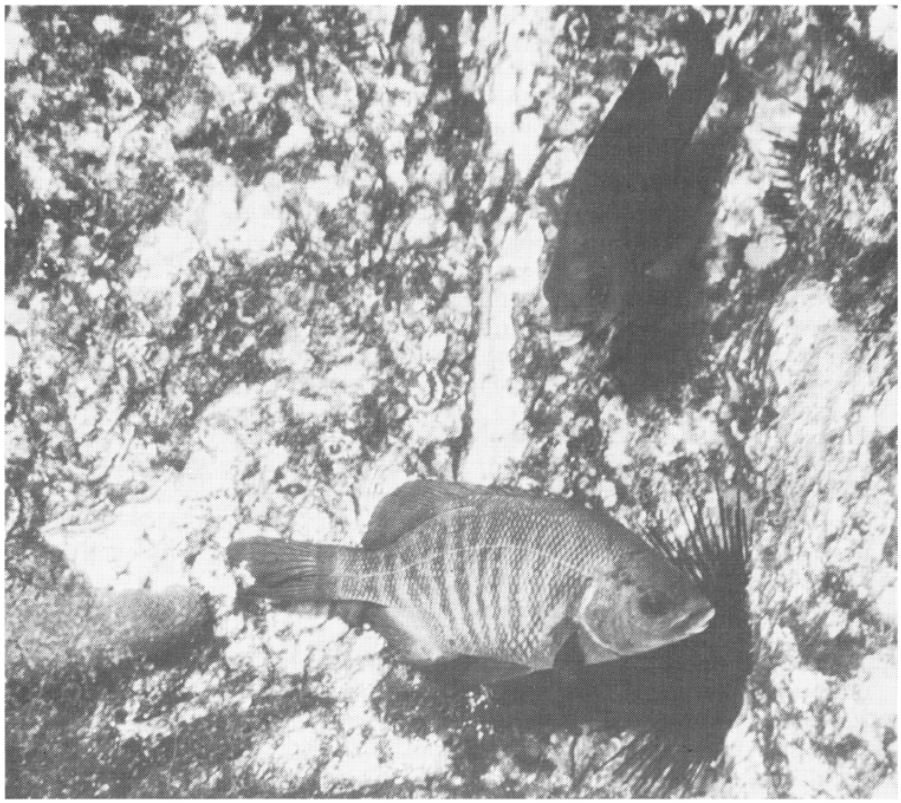

FIGURE 29. Black surfperch, *Embiotoca jacksoni.* *Photograph by Charles Turner.*

FIGURE 29. Black surfperch, Embiotoca jacksoni.

Identification: Body perch-like, deep, compressed. Pelvic fins a little behind pectorals. Dorsal fin moderately long, undivided, with spines shorter than soft rays. All rays same length. Anal fin of moderate length with numerous rays, all same length; row of scales runs along fin base. Snout bluntly rounded, lips thick, often light yellow color. Patch of enlarged scales between pectoral and pelvic fins. Usually uniform dark reddish-brown; often with darker, vertical bars. Anal may have gold and dark blue bars, particularly during breeding. Occasionally observed with pale greenish-white body color, vertical stripes quite faint, making it resemble barred surfperch but still distinguishable by patch of large scales. A 12 incher (301 mm TL) weighed 1.4 pounds (629 grams); maximum recorded length is 14 inches. Ranges from Fort Bragg to Abreojos Point, Baja California.

Habitat-Habits: Eelgrass beds of bays and among seaweeds along coast from the tide pools into depths of 110 feet. Major concentrations occur between 2 and 80 feet. Swims close to bottom between and over rocks, through tunnels and caves, and through seaweeds; usually as solitary individuals or in groups of three or four. Heavy aggregations in kelp beds and inshore among rocks always contain ripe males, easily recognized by peculiar genital structures on anal fin.

Life History Notes: Typical foods include polychaete worms, bryozoans, crustaceans, mollusks, and external parasitic fish crustaceans. Black surfperch remove parasitic organisms from members of own species as well as from other fishes. Large adults formed a major food item of Pacific electric rays taken at Port San Luis in November 1957 (J. E. Fitch, California Department of Fish and Game, pers. commun.). Breeds during summer and probably to a certain extent during balance of year. During mating large numbers aggregate in rather tight schools, and split into pairs with males swimming close beside females. During breeding season, males have a nipple-like structure (intromittent organ connected to tests and carrying sperm) projecting forward from each side of anal fin. Young present throughout year but most numerous in spring.

Remarks: Caught by baited hook, especially over eelgrass in shallow-water bays and from breakwaters and docks. Important in rocky shore fisherman's catch; largest portion of average novice spearfisherman's catch. No important relationship to giant kelp, but uses lower levels of giant kelp as well as rocks and caves for cover during breeding activities.

6.42. Striped surfperch, Embiotoca lateralis Agassiz

Identification: Body perch-like, deep, compressed. Dorsal fin moderately long, undivided; soft rays decreasing in length to rear, spines shorter than soft rays. Row of scales runs along base of dorsal. Anal fin about equal in length and height to rayed portion of dorsal. Pelvic fins slightly behind pectorals. Mouth terminal. Brilliant red and blue horizontal stripes on body; parallel to dorsal profile above lateral line, but horizontal below it. Metallic copper, silver, or brown above; lighter below. Tail

orange. Maximum recorded size is 15 inches. Recorded from Port Wrangell, Alaska, to Point Cabras, Baja California. Not common south of Point Dume.

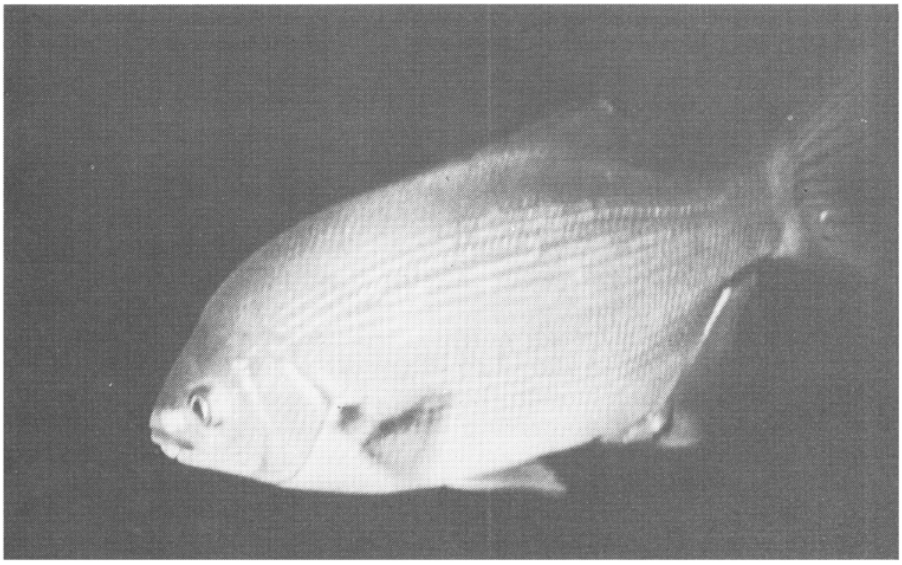

FIGURE 30. Striped surfperch, *Embiotoca lateralis.* *Photograph by Charles Turner.*

FIGURE 30. Striped surfperch, Embiotoca lateralis.

Habitat-Habits: Cold water rocky bottoms. off southern California depth range 15 to 55 feet; northern California from surface to 35 feet.

Life History Notes: Adults somewhat solitary, but probably aggregate during breeding season. Young were observed in May, June, August, and September north of Port Dume. Young not observed south of this point.

Remarks: Commonly caught by baited hook; easily taken by spear. No apparent relationship to giant kelp, but occasionally seeks cover in lower levels.

6.43. Walleye surfperch, Hyperprosopon argenteum Gibbons

Identification: Body perch-like, deep, compressed. Sharp angle to front profile. Pelvic fins below pectorals. Dorsal fin long, continuous, without notch, and with shortest spines at anterior edge. Anal fin long with all soft rays about same length. Caudal fin forked. Eye large in relation to head. Mouth terminal with lower jaw jutting beyond upper. Lateral line parallels dorsal curve of body. Silver, darker above; dark irregular bars extending from the back down the sides; black border on caudal and anal fins, distinctive black tips on pelvic fins. A 10 inch (266 mm TL) female weighed 0.9 pounds (397 grams). Found from Vancouver Island, British Columbia, to Point San Rosarito, Baja California.

Habitat-Habits: Occurs over sand patches among rocks or in surf. Aggregates in dense schools 6 to 8 feet thick, reaching to within 2 feet of surface, and comprised of several hundred or even several thousand

fish. From surface to 40 feet, concentrated 5 to 22 feet. Usually around piers.

Life History Notes: Food items include small crustaceans. Breeding takes place during October, November and December in southern California. Individuals pair briefly during courtship. Males become aggressive, dividing time about equally between fighting or chasing other males and courting females. Females appear passive; those displaying dark anal fin and rapid changes of bar color receive most attention from males. Breeding males darker, usually with lower half of pelvics very black, bars on sides prominent, and other fins dark. Male's anal fin considerably lighter than that of breeding female. During courtship male usually moves in series of figure-eight patterns directly in front of female with his head slightly up and all fins extended except the pelvic closest to female. Occasionally quickly moves in tight circle in front of female with inside pelvic fin folded and all other fins extended. If female is moving, male will try either to swim beside her with back tilted away or to undulate below her, contacting her with his dorsal fin. Occasionally male in front of female quivers with fins extended and with head and body tilted about 30° from horizontal. Posterior half of anal fin is curved away from the female during this display. To make genital contact, male swims beside female, tilts away from her about 20°, curves anal fin toward her, and makes contact with small anal gland tubercles, transferring spermatozoa to oviduct. Gestation period approximately 5 to 6 months. Young born about mid-April. Number of young, commonly five to 12, varies with age of female. Length averages slightly over 1 ½ inches at birth.

Remarks: Serve as forage for kelp bass, sculpin, halibut. Probably most abundant surfperch in southern California. Commonly caught by surf fishermen. Excellent food fish. Disregarded by spearfishermen because of small size. No significant relationship to giant kelp, but tends to enter inshore edges of the kelp beds along sand patches.

6.44. Silver surfperch, Hyperprosopon ellipticum (Gibbons)

Identification: Olive above, silver along sides and below. Sides may have darker bars of pink. Thinner than other surfperch. Recorded from Schooner Cove, British Columbia, to Rio San Vicente, Baja California (Peden, 1966).

Habitat-Habits: Found inshore over sand, usually 2 to 8 feet above bottom; from surface to 16 feet. Generally tends to aggregate near attached or free seaweeds. Schools in loose aggregations, usually inshore from seaweeds or rocks.

Life History Notes: Mating during October at Point Arguello at depths of 4 to 10 feet over bottom 10 to 25 feet deep. Male approaches female from below, both swim with vents close for 2 or 3 seconds, then separate and repeat process. Young probably born in spring and summer.

Remarks: Too small to be of much significance to sportfishermen. Probably serve as forage for other fishes. No significant relationship to giant

kelp. Lives in area of more northerly kelp beds but rarely enters beds, except on extreme inshore edge.

6.45. Rainbow surfperch, Hypsurus caryi (Agassiz)

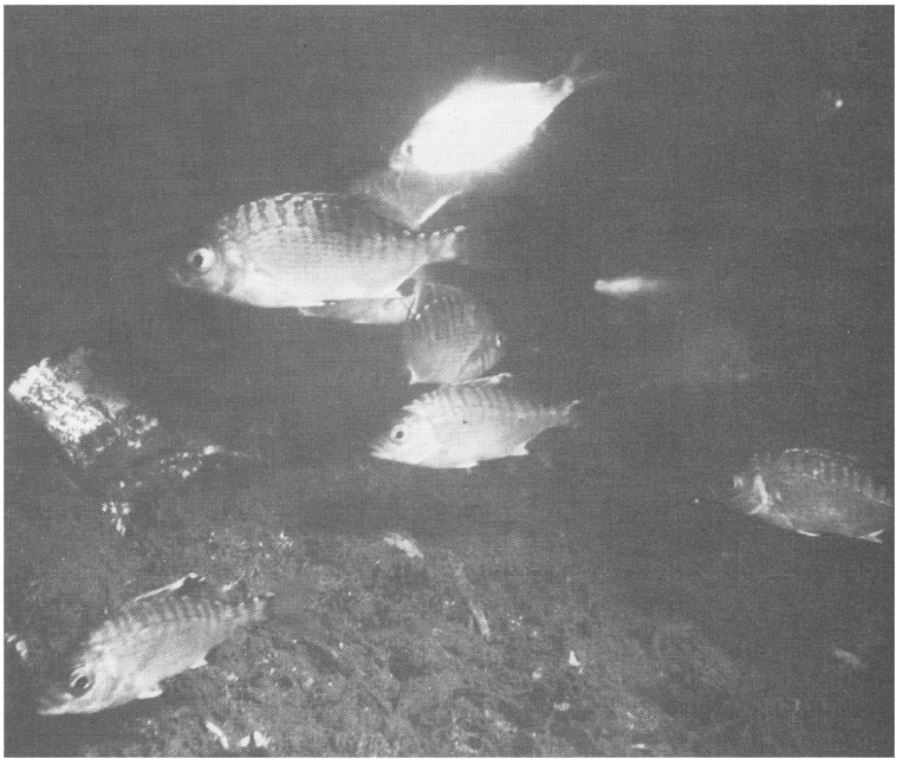

FIGURE 31. A school of rainbow surfperch, *Hypsurus caryi.* *Photograph by Charles Turner.*

FIGURE 31. A school of rainbow surfperch, Hypsurus caryi.

Identification: Body perch-like, deep, compressed. Pelvic fins slightly behind pectorals. Dorsal fin long, undivided, with soft rays higher than spines. No distinct notch in dorsal. Anal rather short and far back, beginning about on line with end of dorsal and giving fish characteristic appearance: ventral profile almost flat to origin of anal; from there it curves sharply upward. Snout bluntly pointed, mouth terminal, upper jaw jutting sightly over lower. Body striped horizontally with bars of orange and bright blue; shorter and irregularly arranged orange and blue bars below pectoral fin and on head. Fins orange with iridescent blue margins. Strikingly colored, even in deep water, with iridescent blue most apparent. Ranges from Cape Mendocino, California to Rio Santo Tomas, Baja California, but not common south of Point Dume.

Habitat-Habits: Schools below thermocline in summer. From tide pools to over 100 feet, usually over rocky substrate. Concentrated below 10 feet.

Life History Notes: Clusters in fall, possibly for breeding; solitary remainder of year, occasionally in groups of two or three. Young born throughout

summer. Recorded by Gotshall (1967) as cleaner fish in Monterey Bay.

Remarks: Occasionally taken by baited hook in deep water in kelp beds off southern California. Good food fish. No significant relationship to giant kelp. Small number occasionally seen on barren sandy bottom.

6.46. Dwarf surfperch, Micrometrus minimus (Gibbons)

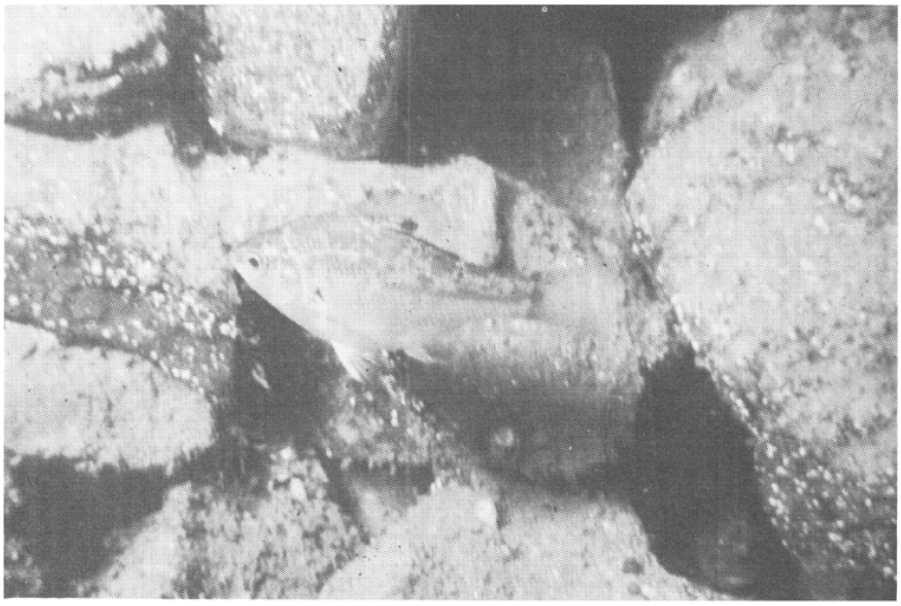

FIGURE 32. A dwarf surfperch, *Micrometrus minimus,* at 15 feet in King Harbor, Redondo Beach, California. *Photograph by Charles Turner.*

FIGURE 32. A dwarf surfperch, Micrometrus minimus, at 15 feet in King Harbor, Redondo Beach, California.

Identification: Small, similar in shape to kelp surfperch. Dorsal spines and soft rays about equal height. Back mottled brownish-olive, lighter on sides and bottom; dark black or brown blotches on back and sides. Irregular longitudinal stripe down side and darker irregular bar extending down from spines dorsally. Record length of 6 ¼ inches (161 mm TL) and 0.16 pounds (76 grams); maximum age (determined by otoliths) to 3 years. Recorded from Bodega Lagoon to Cedros Island, Baja California.

Habitat-Habits: Occurs in shallow eelgrass and surfgrass beds, swimming over these for food and into them for cover, also around shallow rock reefs and jetties (i.e., in marinas and bays). From tide pools to 30 feet. Concentrated 3 to 20 feet. Noted throughout the year, never in heavy schools.

Life History Notes: Food items include mainly small crustaceans, especially amphipods, and mollusks. Young appear in April and May.

Remarks: Only rarely observed in canopy of kelp, but occasionally enters shallower parts of beds.

6.47. White surfperch, Phanerodon furcatus Girard

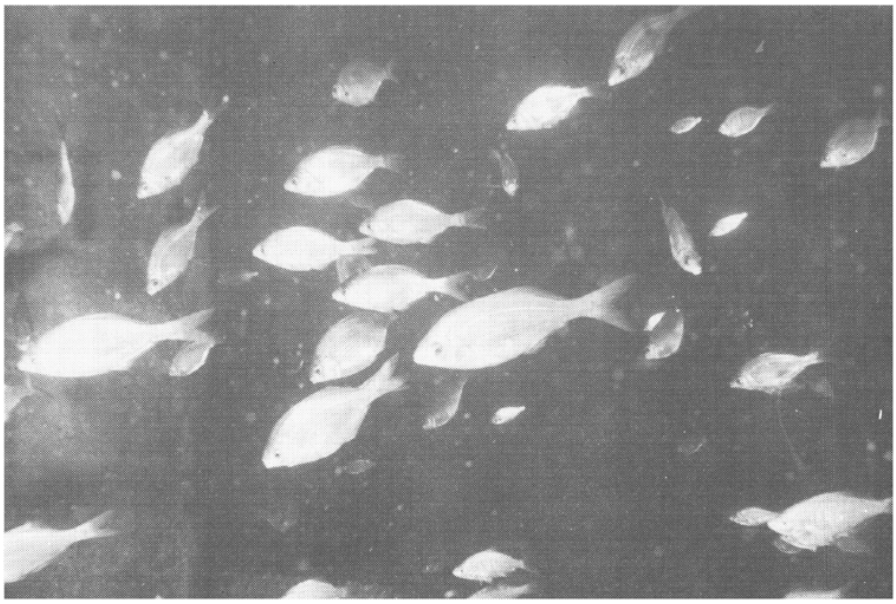

FIGURE 33. A school of white surfperch, *Phanerodon furcatus,* (center) and a school shiner surfperch, *Cymatogaster aggregata* (below and to the right). *Photograph by Charles Turner.*

FIGURE 33. A school of white surfperch, Phanerodon furcatus, (center) and a school shiner surfperch, Cymatogaster aggregata (below and to the right).

Identification: Olive above to white below; often dusky with a rosy-orange cast. Soft dorsal with black line along base. Tail deeply forked. A 9 inch (242 mm TL) specimen weighed 0.8 pounds (376 grams). Ranges from Vancouver Island, British Columbia, to Point Cabras, Baja California.

Habitat-Habits: Quiet waters, preferring bays and deeper water, especially around combinations of rocks and fine sand. From 1 to 120 feet, concentrated 8 to 110 feet. Tend to form loose schools.

Life History Notes: Bryozoans abundant in stomachs. No information on reproductive biology, but probably similar to other surfperches. Young observed in September.

Remarks: Taken commercially off northern California. Generally disregarded by spearfishermen because of small size. No important direct relationship with giant kelp, but uses regions near holdfasts as cover.

6.48. Rubberlip surfperch, Rhacochilus toxotes Agassiz

Identification: Body perch-like. Pelvic fins slightly behind pectorals. Dorsal fin long, undivided, with spines shorter than soft rays. Large, thick, whitish lips. Olive above, fading to brassy below. Pectoral fins yellowish. One or two vertical dusky bars on adult. Brassy color, thick lips, and soft dorsal not sharply elevated (without high spire) help distinguish it from pile surfperch. Lengths of 16 inches (414 mm TL) and weights of nearly

3 pounds (1265 grams) recorded. Found from Russian Gulch State Beach, California, to Thurlock Head, Baja California.

FIGURE 34. Rubberlip surfperch, *Rhacochilus toxotes,* in kelp on the man-made reef at Paradise Cove, California. *Photograph by Charles Turner.*

FIGURE 34. Rubberlip surfperch, Rhacochilus toxotes, in kelp on the man-made reef at Paradise Cove, California.

Habitat-Habits: Among giant kelp at mid-depth, and near bottom in submarine canyons and other rocky areas. From 6 to 150 feet, concentrated 10 to 100 feet.

Life History Notes: Adults feed upon crabs, shrimps and octopuses. Juveniles feed on typical perch food; polychaete worms, bryozoans, gamma-rid and caprellid amphipods, small crabs, mussels, and tiny snails. Actual breeding has not been observed, but seasonally developed intromittent organs on anal fin still present in late December. Small embryos observed

in females in June and September. Life history pattern apparently almost identical with that of pile surfperch.

Remarks: Excellent food fish, abundant sportfish. Primarily taken with small spears in kelp beds; also by hook along rocky coasts, from jetties, and in bays. often concentrates in dense schools throughout year. One of few fish in southern California that prefers mid-kelp region.

6.49. Pile surfperch, Damalichthys vacca (Girard)

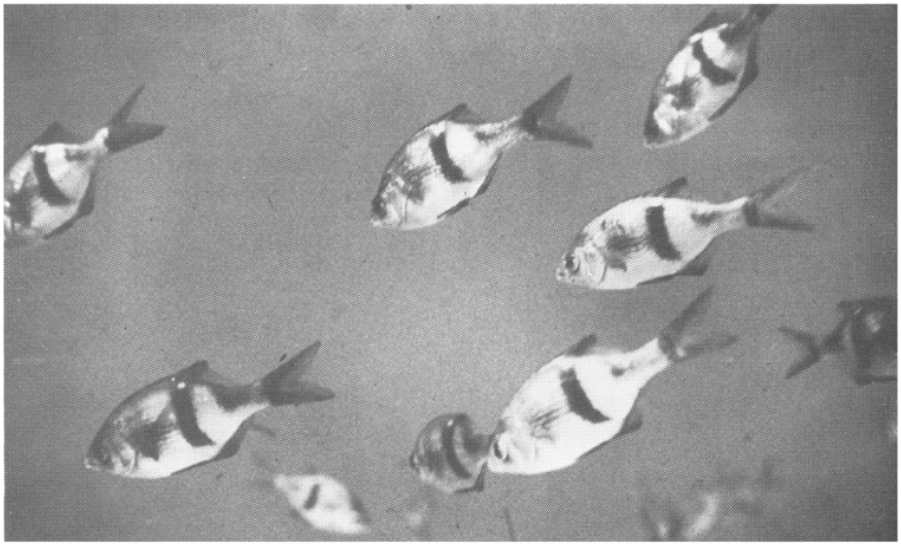

FIGURE 35. A school of pile surfperch, *Damalichthys vacca.* *Photograph by Conrad Limbaugh.*

FIGURE 35. A school of pile surfperch, Damalichthys vacca.

Identification: Body perch-like. Deep forked tail and high spired second dorsal distinguish it from rubberlip surfperch with which it schools. Dark brassy-brown fading to silver on sides and belly. One dusky vertical bar across side at about high point of soft dorsal. Posterior position of bar helps distinguish it from sargo. A large 17 inch (433 mm TL) female weighed 2.7 pounds (1223 grams). Known from Port Wrangell, Alaska, to Guadalupe Island, Mexico.

Habitat-Habits: often schools in kelp stipes just below canopy, and above rocks near sand, from surface to 150 feet. Concentrated 5 to 115 feet. Adults school throughout year; subadults solitary.

Life History Notes: Food items include crabs and other small crustaceans, brittle stars, sand dollars, bean clams, mussels, limpets, dove shells, California cones, Norris' top shells, and chitons. Common around pilings pulling small crabs and mussels free, and crushing them in throats. Adults off Guadalupe Island carry flattened pebbles in mouths, presumably to aid in crushing shellfish. Half grown individuals may be forced into eating external parasites by group of blacksmith. The blacksmiths crowd in front and around pile surfperch until it is unable to proceed. It then picks at a parasite, and moves on until blocked by other blacksmiths.

October and November breeding. Mating pairs in large schools occur at depths from 4 to 30 feet. Male displays himself to female and then rotates to his side or even turns upside down. Both then press ventral surfaces together and swim slowly on their sides (or raise heads toward surface). Entire procedure, taking approximately 10 second, repeated many times. Schools of breeding adults remained at pier at Scripps Institution of Oceanography for several days. Young appear June through October.

Remarks: Commonly taken by pier fishermen and spear. Good food fish. No important association with giant kelp. Occurs frequently in kelp bed at mid-depths and near bottom.

6.50. Blacksmith, Chromis punctipinnis (Cooper)

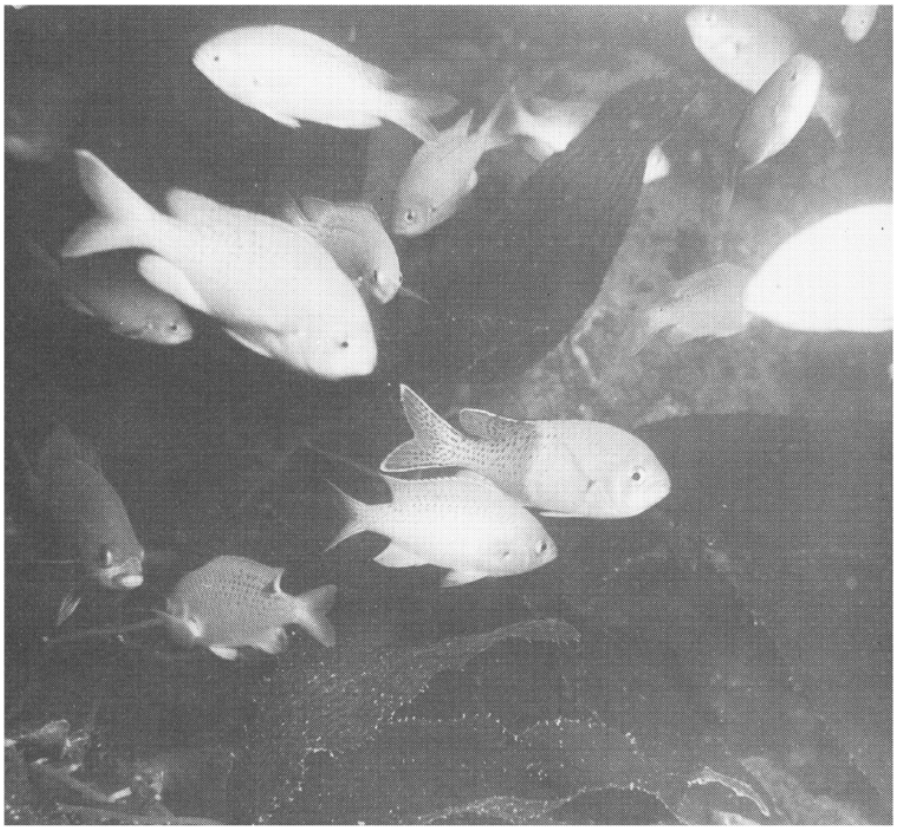

FIGURE 36. A school of blacksmith, *Chromis punctipinnis,* in kelp canopy.

Photograph by Charles Turner.

FIGURE 36. A school of blacksmith, Chromis punctipinnis, in kelp canopy.

Identification: Body somewhat perch-shaped but not so deep; compressed and somewhat elongate; depth about equal to distance between rear of eye and beginning of anal fin. Dorsal fin long, undivided, more spines than soft rays; soft-rayed portion somewhat higher. Pelvics below

pectorals. Head blunt. Mouth terminal, moderately oblique. Tail slightly forked; scales large, prominent underwater. Adults dark blue with series of dark spots over body; somewhat lighter below. Yellow tone in fins. During breeding period male has masked appearance with bars over eyes; turns almost white while in cave guarding eggs. An 11 inch (277 mm TL) specimen collected at San Jose Beach, Carmel Bay, in January 1962 was 7 years old (J. E. Fitch, California Department of Fish and Game, pers. commun.). Maximum recorded size is 12 inches (TL). Their range is from Monterey Bay southward to Point San Pablo, Bajo California.

Habitat-Habits: Occurs over steep, rocky banks and among tall seaweeds as well as around rocks; generally faces incoming currents. Surface to deeper than 150 feet; probably visits depths of 300 feet or more. Young from surface to at least 100 feet. Extremely abundant throughout year in southern California. Young and adult blacksmiths school or aggregate according to size; in general, smaller fish in shallower water, although large adults live in shallow water in northern portion of range. In loosely oriented schools or, when molested or pursued, in large well oriented compact schools.

Life History Notes: Young feed on small crustaceans (mysids and amphipods) and juvenile squid when abundant. Large schools of blacksmith, señoritas, and topsmelt often intercept and filter out small organisms from currents moving into kelp bed.

Ripe adults throughout range in June and July. Breeding fish off Santa Catalina Island deposited eggs in holes and small caverns formed by 15 to 30 pound rocks in a tumbled slide extending offshore. Nesting takes place from 12 to 80 feet beneath surface and probably deeper. Male first clears area, then herds female into "den" by biting and other aggressive actions. Egg masses salmon pink when laid; eggs oblong and adhere by filaments at one end of egg to rock. Male guards nest pugnaciously during brooding period. If male driven off, hordes of fishes devour eggs (Turner and Ebert, 1962). Juveniles, ½ to 1 inch long, appear in large semipelagic schools in August, September, and October. By November only a few 1 inch specimens remain in central portion of range. However, off Guadalupe Island, ½ inch young occur in November. By following June, length between 2 and 3 inches.

Young of the year gray-blue anteriorly and yellow-orange posteriorly, with iridescent blue margin around dorsal, caudal, and anal fins. Juveniles school densely in open ocean, sometimes entering kelp beds. Growing larger, settle down in shallow sandy areas protected by large rocks. Yearlings somewhat more solitary, seeking refuge in small caves and crevices. Subadults seek out cleaning fishes (juvenile pile surfperch and señoritas) and place themselves in positions that make it almost mandatory for cleaners to feed on their external parasites. Groups of blacksmith completely obscuring cleaning fishes are a common sight over shallow reefs. During cleaning blacksmiths assume many positions: on side, head up, head down, or even on back. If cleaner tries to leave, blacksmiths follow, crowd in front, and prevent escape.

Remarks: Excellent food, seldom caught on hook because of small mouths and general feeding habits. Activities of subadults may materially affect amount of plankton entering kelp beds.

6.51. Garibaldi, Hypsypops rubicunda (Girard)

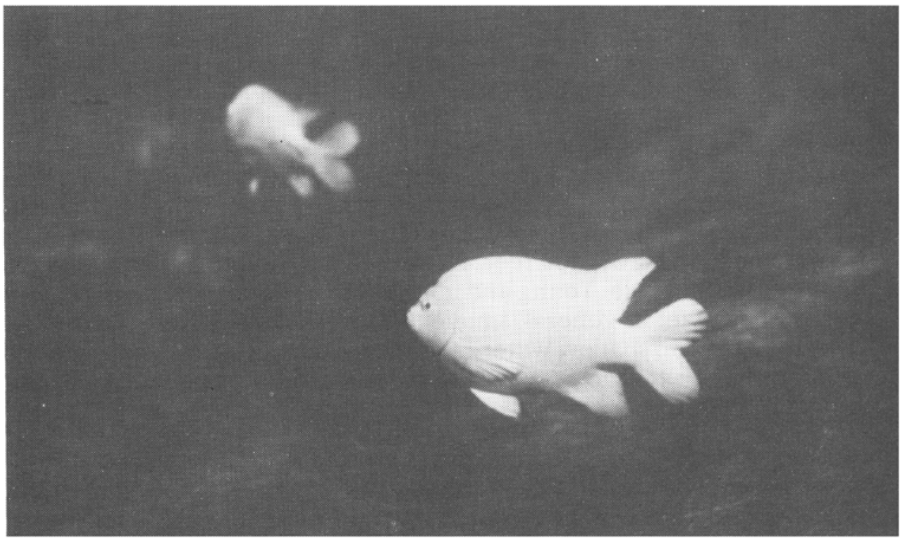

FIGURE 37. An adult male garibaldi, *Hypsypops rubicunda.* Note typical lump on forehead.

Photograph by Conrad Limbaugh.

FIGURE 37. An adult male garibaldi, Hypsypops rubicunda. Note typical lump on forehead.

Identification: Body perch-like, deep, compressed. Dorsal fin long, continuous, more spines than soft rays, but soft rays higher than spines. Pelvics below pectorals; pectorals broad. Tail deeply notched, but lobes rounded. Scales large. Mouth terminal, lips large; dorsal profile of head irregular; large males have lump on forehead. Fish bright orange or yellow-orange; in deep water appears brownish. Eyes green in adults. Young bright orange with iridescent blue spots and blotches persisting until about 6 inches long. Tiny individuals have somewhat similar appearance of the bluebanded goby, when they retreat into dark crevices; difficult to differentiate unless observed entering crevice. Recorded range from Monterey Bay to Magdalena Bay, Baja California.

Habitat-Habits: Occurs over rocky bottoms on exposed or semiprotected coasts having clear water, on rocky reefs with crevices and small caves for cover, and on rare occasions high on column of giant kelp, apparently searching for food. Garibaldi are found in tide pools and at depths of 90 feet, depending upon clarity of water and depth of thermocline. Generally remain above thermocline, where concentrated 4 to 42 feet. When water is dirty, remain closer to rocky retreat. Juveniles in tide pools and to depths of 40 feet. Probably remains in restricted territory most of life. Individual roams rather large territory, but definite concentrations of individuals exist in certain areas, possibly depending upon favorable environment. Groups may use same crevices for cover. Individuals

in a group never observed fighting, but tagged fish introduced from other regions quickly driven away. Defend territory vigorously, reluctantly retreating from diver to rock holes when approached directly. Generally wait at entrance if not pursued. If further molested enters hole and either leaves by another opening or wedges into crevice. Actually may be caught by hand at this time but at risk of lacerated hands and arms. Disturbed garibaldi generally emits thumping sounds easily heard by diver. Characteristic swimming motion involves "sculling" with pectorals.

Life History Notes: Prefers sessile animals such as sponges, coelenterates (e.g. sea anemones), and bryozoans for food; also takes algae, worms, small crabs, amphipods, gooseneck barnacles, clams, snail eggs, and own eggs. Clarke (1970) gives additional details concerning diet and life history.

Breeding apparently continuous throughout spring and summer, beginning as early as March and persisting through July, longer in warm years and in southern portions of range. Spawning may not occur in extreme northern part of recorded range. We have observed juveniles only as far north as Santa Cruz Island and Santa Barbara.

Male prepares nest by cleaning rocky surface of all but strongly adherent calcareous organisms. In center of cleared area, he cultivates elliptical patch, usually 11 to 12 inches along major axis, of velvety red algae of at least four different species. Nest site always shaded, generally on vertical surface in shallow water; in deeper water, in the open in horizontal plane. Nest kept clean and algae cropped to about ½ inch; surrounding rocks for 4 to 14 inches (10 to 35 cm) kept completely bare by male's continual activity. Nest guarded constantly and other fishes, including male garibaldi, driven off. Spawning begins shortly after a female wanders to within 4 to 15 feet of nest, where male challenges her by making thumping sounds and rushing her. Unlike invading males, she does not swim swiftly away; instead she evades male by darting past him toward nest. After several challenges during which the male may bite her, she arrives inside an area, about 1 food in diameter, where he ceases to challenge. Once inside protected area, female moves slowly back and forth over nest, maintaining genital area against plants. Male usually joins her unless disturbed by presence of other fishes. During spawning he is in a highly excited state characterized by rapid darting motions, frequent challenges of other fish, and quick returns to the nest. If he joins female, he may keep his genital area next to hers. At this time, quivering violently, he emits sperm on eggs as they are laid. After female departs, he may go over eggs again, still in a highly excited state.

One end of the orange-yellow capsule shaped egg is attached to the red algae by short threads. Developing eggs gradually turn greenish-gray. Male guards nest while it contains developing eggs. Pugnacious, he challenges fishes up to 3½ times his own length, biting and making thumping noises which ultimately drive them away. An unguarded nest is attacked quickly by other male garibaldi and eggs devoured. Resident male on returning drives out encroaching male. Foreign objects such as shells, stones, crabs, and starfish are removed if they settle or are placed

on nest. If summer waves raise sand level until it endangers nest, male cleans sand away. Some dig holes as deep as 8 inches around nest.

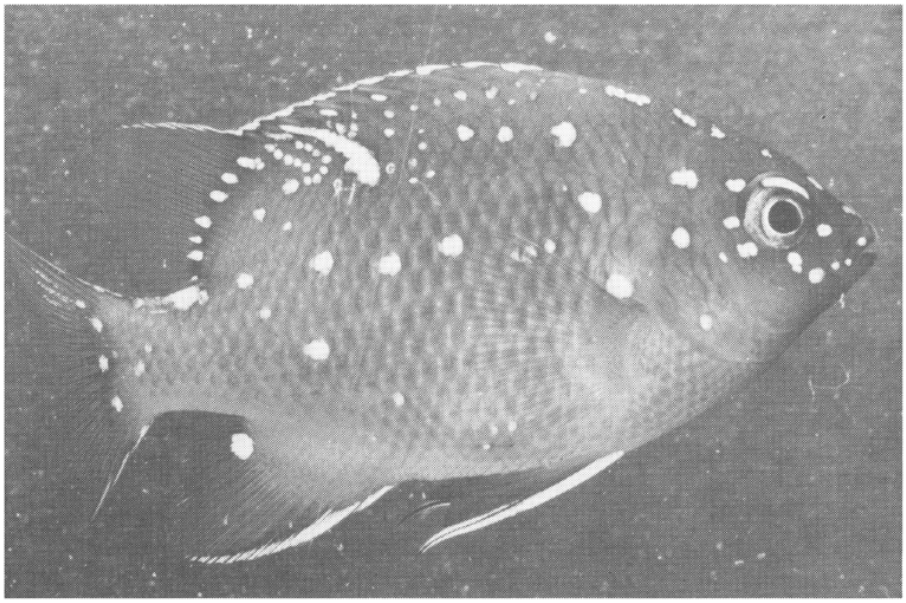

FIGURE 38. A young garibaldi exhibiting a pattern of iridescent blue spots.

Photograph by Conrad Limbaugh.

FIGURE 38. A young garibaldi exhibiting a pattern of iridescent blue spots.

Half inch young, appearing from July through November, are brilliantly colored with iridescent butterfly blue markings over an otherwise translucent orange body, heads are striped with blue. As the fish grow older, the orange color deepens and blue markings gradually are lost. Faintest trace of blue is indication of immaturity. As young enter shade of crevice, where they commonly shelter, bright blue turns black (blue is a reflected color) and they disappear from sight. Young frequently found with large red sea urchin. Half grown fish pass through dull orange stage and are much less conspicuous than either young or adults. At maturity the last bright blue markings, those on the edges of fins, disappear.

External parasitic organisms such as bacteria, fungi, copepods, and isopods are removed from garibaldi by the señorita. During this process, a garibaldi frequently opens operculum so señorita can remove gill parasites.

Remarks: Quite common, although perhaps less abundant than before spearfishing since very easy to spear or capture; however, they are protected by law. Population probably is recovering its former abundance. Little relation to giant kelp. Occasionally bites off chunk with bryozoan colony. often seeks shelter in rocks below kelp bed; observed high on columns in search of food (Limbaugh, 1964).

6.52. California sheephead, Pimelometopon pulchrum (Ayres)

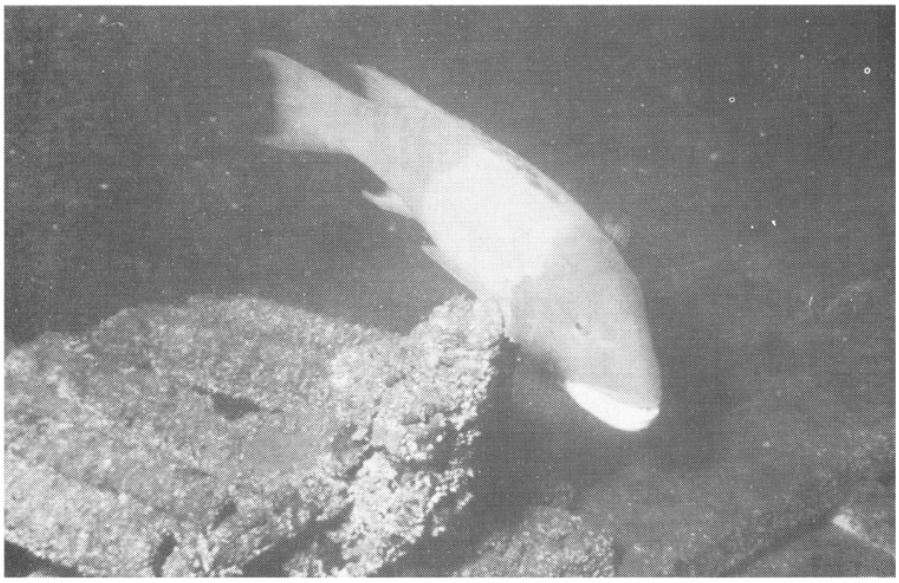

FIGURE 39. A male California sheephead, *Pimelometopon pulchrum.* *Photograph by Charles Turner.*

FIGURE 39. A male California sheephead, Pimelometopon pulchrum.

Identification: Juveniles, males, and females quite different in appearance. All sheephead start life as females, then change to males. Mature male has large, fleshy hump on top of head which increases in size with age. Males usually brilliantly colored, bluish-black with brilliant red or pink band on central portion of body and white chin. The crimson or pink often appears white in deeper water since water absorbs red light. Over light sand in shallow water, male may assume a less conspicuous, uniform, very light pink color. Females, less conspicuously colored, change color with background, and may vary from almost black to light pink, sometimes with irregular bars. A 29 pound male was 32 inches long and 53 years old judged by the age rings on its opercle (Fitch, 1969). Reported to attain 36 pounds. California sheephead range from Monterey Bay south to Cape San Lucas, California, and are common at Guadalupe Island. An isolated population occurs in the northern portion of the Gulf of California.

Habitat-Habits: California sheephead frequent rocky areas from surface to 150 feet and deeper; females usually in shallowest depths, large males in deepest. Concentrated below 10 feet. Generally occur solitary, although often with schools of other fish to which they probably are attracted by activity. Move almost constantly by employing pectoral fins, but use powerful tail for speed. Apparently aimless movement over familiar path provides crevices for hiding. Usually sleeps at night resting on bottom, but sometimes naps during day, lying on side in crevices and caves. In shallow water difficult to approach, seeks shelter in rock crevices. Below 20 feet not so easily frightened. Curious; congregate around

commercial abalone divers, nipping abalone removed from rocks or even entering divers' bags of abalone. Become further nuisance by

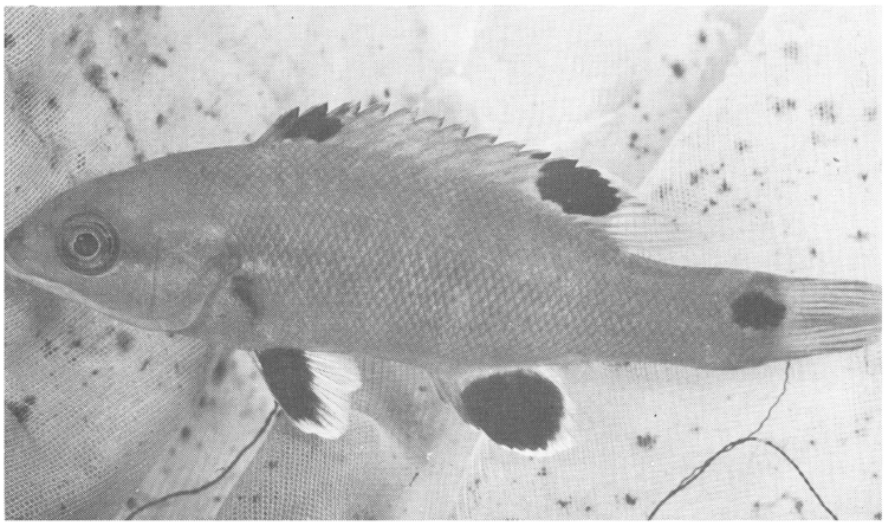

FIGURE 40. A young California sheephead. Photograph by Conrad Limbaugh.

FIGURE 40. A young California sheephead.

causing abalone to clamp against rocks before diver can get iron under them.

Life History Notes: Bryozoans, crabs, mussels, large and small snails, squid, sea urchins, sand dollars, and sea cucumbers are typical food items. Their large canine-like teeth pry food from rocks. Special plate in throat crushes shells into small pieces for easy digestion. Occasionally, large adults have been observed hanging onto mussels above water after wave has receded.

The California sheephead is a protogynous hermaphrodite (i.e. the male gonadal tissue develops after the female gonadal tissue is no longer functional). Females mature when they are about 8 inches (200 mm SL) long and are 4 to 5 years old at this time. Most females transform to functional males at a length of about 12 inches (300 mm SL) which corresponds to an age of 7 or 8 years. Transformation appears to take place between breeding seasons. The sex ratio at Catalina Island is about nine or ten females for each male (all data on hermaphroditism in California sheephead from unpublished notes of R. Warner, Scripps Institution of Oceanography).

Early spring and summer spawning. Eggs pelagic. Young, ½ inch long, are present in late May through late December, and do not resemble adults. They are brilliant red-orange with two black spots on dorsal fin, a black spot at base of tail fin. Pelvic and anal fins black, trimmed in white. Occasional lemon-yellow young are seen. Young live close to rocks at depths from 10 to well below 100 feet, particularly around beds of gorgonian corals (sea fans). When disturbed, seek shelter in sea fans or among red seaweed. Following summer, juveniles are 3 to 4 inches

long and have faded to dull pink. At 2 years they are 6 to 8 inches long, have lost all spots, and have typical female color pattern.

Remarks: Equipped with protruding canine-like teeth, this harmless heavy bodied fish has terrified skin divers unfamiliar with its habits. Some consider flesh of poor quality, but cooked while still fresh will compare in flavor with best of fish. Commonly lives on rocky bottom below giant kelp, and goes greater distance above bottom where kelp present. Apparently no important relationship with kelp.

6.53. Rock Wrasse, Halichoeres semicinctus (Ayres)

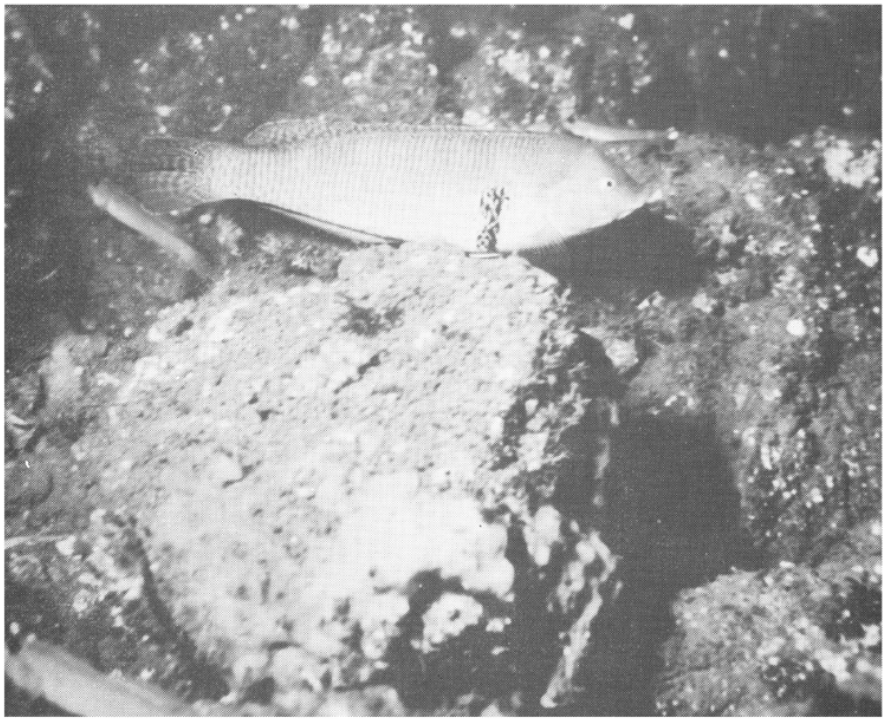

FIGURE 41. Male rock wrasse, *Halichoeres semicinctus,* with blackeye gobys, *Coryphopterus nicholsii,* around it. *Photograph by Charles Turner.*

FIGURE 41. Male rock wrasse, Halichoeres semicinctus, with blackeye gobys, Coryphopterus nicholsii, around it.

Identification: General shape of laterally flattened cigar; similar to señorita but more robust. Single dorsal fin. Teeth small and project forward. Conspicuous large scales. Male greenish-brown above with blue-black band behind yellow pectoral fin. Occasional female is barred. Individuals over 4 to 5 inches long have dark spot on each scale of posterior two-thirds of body. Lacks the large black spot at base of tail fin found in señorita. Blue-gray wavy lines radiate from red eye. Young are brassy orange-brown with two white streaks running horizontally through eye from snout to tail. One streak arches upward toward dorsal and the other runs just below midline. White streaks lost when fish are about 4 to 6 inches long. A 12 inch (300 mm TL) male weighed 1 pound (450

grams) and was about 7 years old (J. E. Fitch, California Department of Fish and Game, pers. commun.). Recorded from Point Conception to and into the Gulf of California.

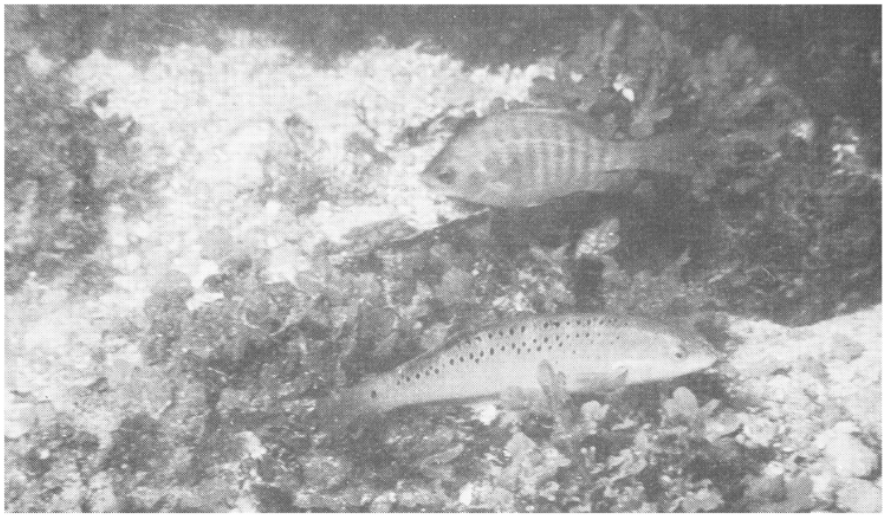

FIGURE 42. A female rock wrasse, *Halichoeres semicinctus,* and a black surfperch, *Embiotoca jacksoni,* at Santa Catalina Island. *Photograph by Charles Turner.*

FIGURE 42. A female rock wrasse, Halichoeres semicinctus, and a black surfperch, Embiotoca jacksoni, at Santa Catalina Island.

Habitat-Habits: Found close to rocky bottoms, preferring areas with small patches of coarse sand. From tide pools to 60 feet, concentrated 10 to 50 feet. Present throughout year but never abundant. Solitary nomads

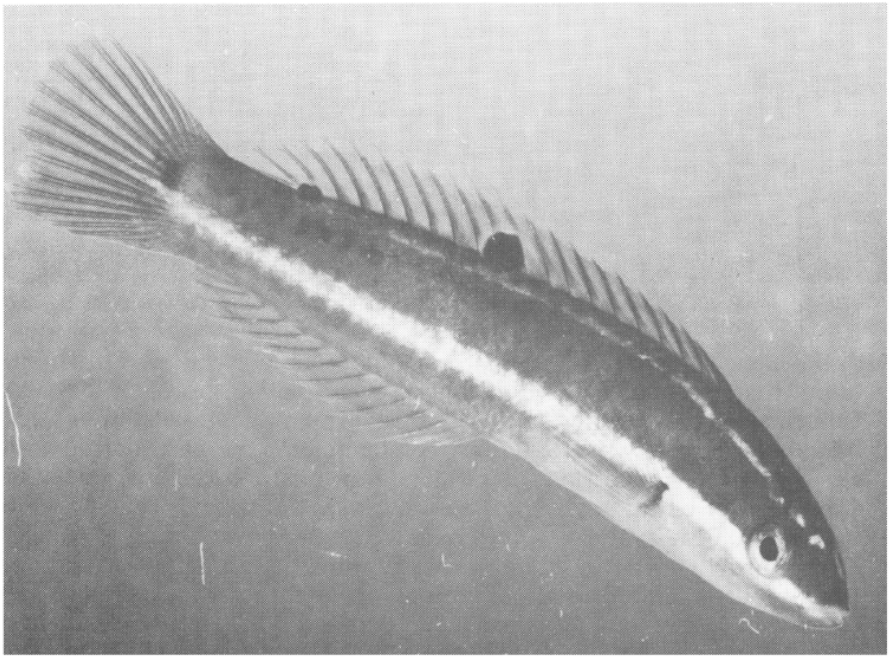

FIGURE 43. A young rock wrasse, *Halichoeres semicinctus.* *Photograph by Conrad Limbaugh.*

FIGURE 43. A young rock wrasse, Halichoeres semicinctus.

wandering over reefs, foraging by day, and burrowing between or under rocks to escape predators or to sleep.

Life History Notes: Amphipods, small crabs, dove shells, and slipper shells are typical food items. This species has a small mouth with protruding, sharp canine teeth suitable for picking small organisms from the substrate. The rock wrasse also is protogynous hermaphrodite (R. Warner, Scripps Institution of Oceanography, unpublished notes; see discussion under California sheephead). Adults ripe in summer. Eggs probably pelagic. Inch-long young, brown with cream stripes and black spots on fins, observed from September through November over flat rocky areas interspersed with sand, at depth of about 8 to 20 feet. When frightened or disturbed, a rock wrasse darts into sand. At night sleeps buried with head protruding. Juveniles and half grown fish present throughout year. Probably mature at age 2 or 3.

Remarks: Occasionally taken by baited hook or by spear. Colors attract considerable attention. No relationship to giant kelp other than utilizing, in part, same rocky substrate.

6.54. Señorita, Oxyjulis californica (Günther)

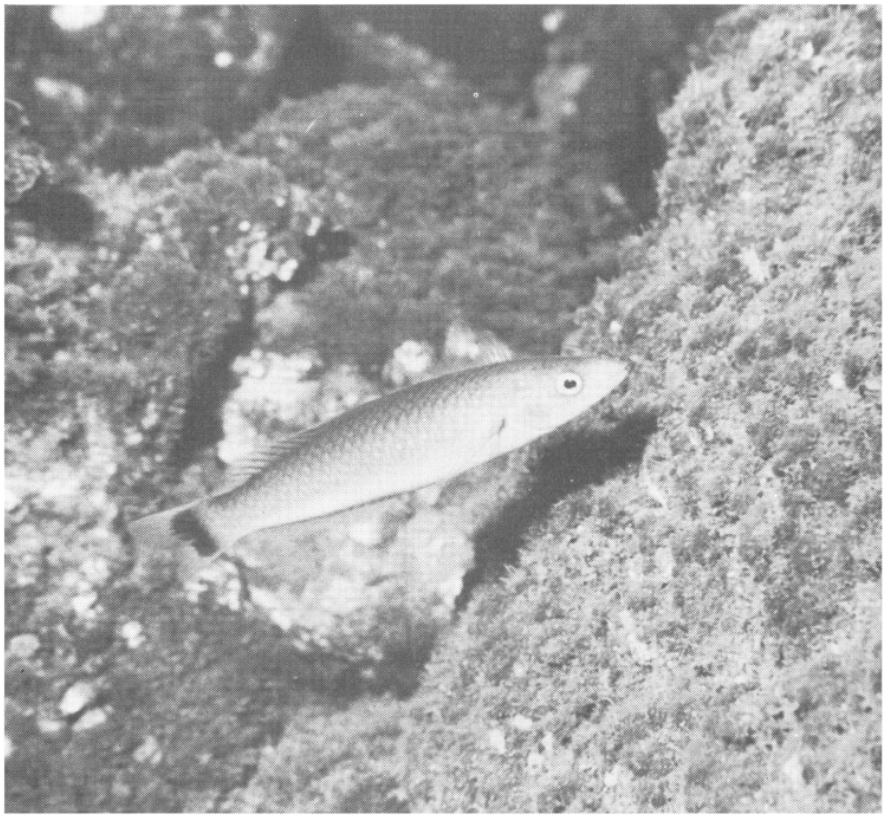

FIGURE 44. Señorita, *Oxyjulis californica,* browsing on algae. *Photograph by Charles Turner.*

FIGURE 44. Señorita, Oxyjulis californica, browsing on algae.

Identification: Cigar-like in general size and shape. Single dorsal fin. Teeth small and project forward. Large scales. Brown above, orange on sides, lighter below; large black spot at base of caudal fin. A 9 inch (210 mm TL) specimen weighed about 3 ounces (80 grams) and had a fourth winter ring on margin of otolith (J. E. Fitch, California Department of Fish and Game, pers. commun.). Recorded from Sausalito, California, to Cedros Island, Baja California.

Habitat-Habits: Occurs among seaweeds and over rocks. From tide pools to depths of 140 feet. Concentrated 5 to 75 feet. Average depth where observed 27 feet. Occurs throughout the year, either in more or less dense schools, sometimes large, or scattered and solitary. Blends well with kelp and uses it for cover, often piercing fronds in flight as it dives into clump of kelp. often burrows in sand to escape predators, and often sleeps there with only head projecting.

Life History Notes: Carnivores, continually feeding on almost any small animal whether on bottom, on plants, on other fishes, or in water. Specific organisms used for food include worms, bryozoans, various crustaceans, dove snails, and limpets. When plankton is heavy with larval fishes, squid, or small crustaceans, large schools of señoritas, with blacksmiths, often intercept inflowing current in kelp bed or in bay entrance.

Pelagic eggs spawned from May through summer. Postlarval young less than 1 inch long, appearing from June to early November, are transparent with single black spots in soft dorsal and anal fins. Postlarval

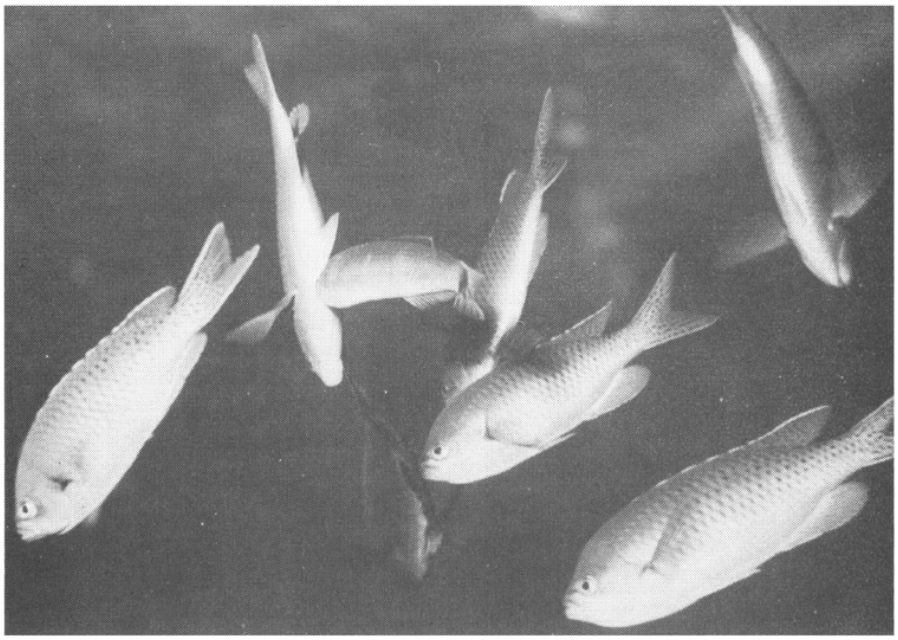

FIGURE 45. A señorita, *Oxyjulis californica,* (center) picking parasites from a blacksmith, *Chromis punctipinnis.* This is a good example of cleaning symbiosis.

Photograph by Charles Turner.

FIGURE 45. A señorita, Oxyjulis californica, (center) picking parasites from a blacksmith, Chromis punctipinnis. This is a good example of cleaning symbiosis.

young school with slightly larger young which have attained color pattern of adult. These schools occur among seaweeds of inshore region, including eelgrass of bays, and in kelp beds occasionally as high as canopy region. When frightened young make no attempt to go around seaweeds, but go through them piercing leaflike fronds with sharp snouts. Like rock wrasse, they often burrow into bottom when disturbed. Half grown young and subadults present from August through April. Maturity achieved at length of 5½ inches, probably at 1 year.

Remarks: Characteristic habit of picking parasites from other fishes. Sought out for this by bat ray, giant sea bass, kelp bass, jacksmelt, tops-melt, sargo, walleye surfperch, pile surfperch, blacksmith, garibaldi, opaleye, halfmoon, and mola. often fishes maintain awkward positions in order to place parasite in front of señorita. Garibaldi hold gill slits open for removal of parasites in gill chamber. Blacksmith crowd around señorita so tightly as to obscure cleaner completely. If señorita tries to leave, blacksmith blocks path. Opaleye, wary fish in almost constant motion, will stop to allow removal of parasites. Kelp bass, which normally feeds on señorita-sized fish, remains motionless while parasites removed from lips. Many señoritas will tend single giant sea bass or mola. Ectoparasites removed are bacteria, copepods, and isopods, (see Feder, 1966; Hobson, 1971; and Limbaugh, 1961b, for further discussion on cleaning symbiosis).

Entire kelp bed used as part of extensive habitat. Disliked by hook-and-line fishermen for its bait stealing habit. Not good food fish; seldom used as forage by other fishes. Found occasionally in stomachs of cormorants.

6.55. Pacific mackerel, Scomber japonicus Houttuyn

Identification: Body elongate, tapering at both ends. Tail deeply notched, chevron-like. Pelvic fins below pectorals. Snout forms blunted point, mouth terminal. Two dorsal fins widely separated; soft-rayed portion followed by four or five finlets which run onto caudal peduncle. Anal fin identical in appearance and opposite posterior dorsal fin. Lateral line slightly irregular, rather indistinct, without trace of bony plates. Dark greenish or blue above, metallic silver on sides and below. Back has many dark wavy lines. Usually less than 15 inches long, a record 25 incher weighed 6# pounds. Occurs in eastern Pacific from the Gulf of Alaska to Chile and in the Gulf of California.

Habitat-Habits: Nearshore pelagic from surface to below 100 feet.

Life History Notes: Euphausids, squid, and young fishes are typical food items. Eggs pelagic. Juveniles and halfgrown school commonly with sardines and jack mackerel.

Remarks: No important relationship to giant kelp. Caught commercially with roundhaul nets, by dipnet under lights, and to a lesser extent by hook and line.

6.56. Pacific bonito, Sarda chiliensis (Cuvier)

FIGURE 46. A school of Pacific bonito, *Sarda chiliensis.* *Photograph by Charles Turner.*

FIGURE 46. A school of Pacific bonito, Sarda chiliensis.

Identification: Mackerel shaped; body elongate, tapering at both ends. Dorsal fin long and continuous but almost divided between spiny and soft-rayed portions. First dorsal spines longest, gradually decreasing posteriorly. Spiny portion of dorsal fin much longer than soft-rayed portion, usually hidden in groove along back when fish swims. Dorsal and anal fins followed by six to eight finlets which extend onto caudal peduncle. Caudal peduncle slender; caudal fin deeply forked, crescentic. Snout pointed, mouth terminal. Scales small and thin. Pectoral fin slightly longer than pelvic. Bluish-purple above, silvery below; above lateral line six to eight oblique dark lines slope forward and downward from back toward head. Reportedly attains 40 inches (Roedel, 1953), a 740 mm TL specimen weighed 10½ pounds and was 6 years old (J.E. Fitch, California Department of Fish and Game, pers. commun.). Recorded from Cordova, Alaska, south to Chile.

Habitat-Habits: Pelagic, schooling. Surface to below depths attainable by scuba diver.

Life History Notes: Feeds on small fishes such as anchovies and sardines, and occasionally on squid. At times leaps high into air while feeding. Eggs pelagic.

Remarks: Rarely enters kelp beds but often runs along outer edge. Large schools observed occasionally. Taken with live bait or by trolling.

6.57. Blackeye goby, Coryphopterus nicholsii (Bean)

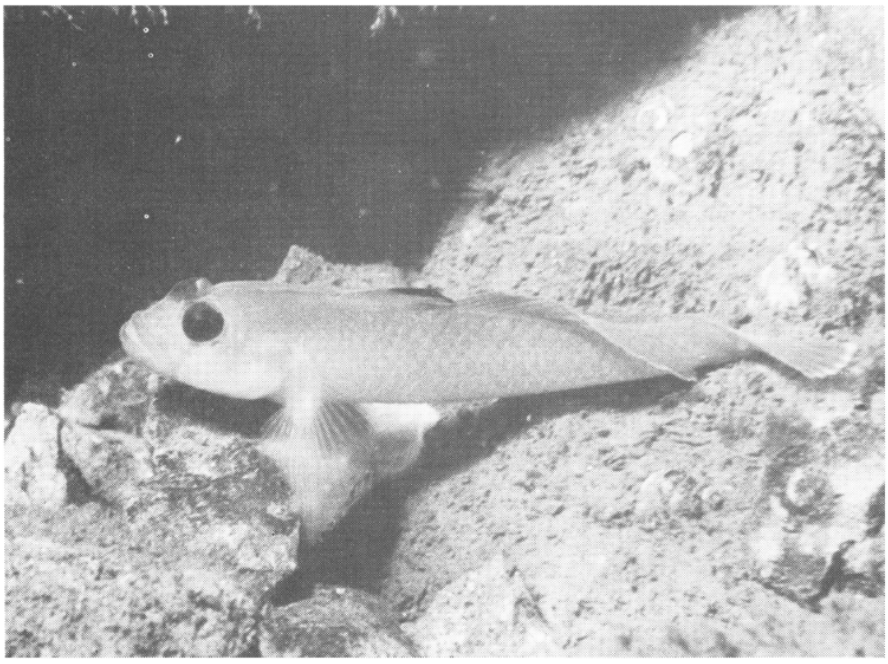

FIGURE 47. Blackeye goby, *Coryphopterus nicholsii.* *Photograph by Charles Turner.*

FIGURE 47. Blackeye goby, Coryphopterus nicholsii.

Identification: Body elongate, cylindrical, with almost no taper to posterior region. Two dorsal fins, close together. Pectoral fins above ventrals; ventrals united forming disk on which fish normally rests on bottom. Caudal fin rounded in outline. Mouth terminal, slightly oblique. Large dark eyes close together project or bulge above top of head. Body color cream to white, changing to mottled brown when driven away by other fish or collected by diver. First dorsal fin with black tip. Pelvic fins dusky, jet black in breeding male. Females and young lack black ventrals. Blue spot under eye brilliant when lighted by flashlight at night. Recorded from Point Rompiente, Baja California, to Queen Charlotte Islands, Canada.

Habitat-Habits: Deep quiet waters along the bottom, entering intertidal regions of bays and penetrating into waters more than 200 feet deep in open sea. often not noticed because tends to remain motionless on bottom until approached too closely, but extremely abundant, especially on fine sand among or near rocks. When disturbed seeks shelter in crevices or burrows in sand or mud. Always on bottom. Most common on sand. often on clay-mud where holes exist in vertical bank face, also common on sand near rocks or in flat bedrock areas where larger rocks provide shelter. Half-grown and subadults common throughout year.

Life History Notes: Black ventrals of male used in courtship and territorial display. Male rises off bottom in horizontal position all fins extended and

ventrals fanned out, for 2 feet or more and sinks down again. If female is present, he may dash at and strike her very rapidly. Both sexes dig nest in sand or mud beneath any solid object resting on bottom such as rocks, boards, or debris accumulated from passing boats (Ebert and Turner, 1962).

Remarks: Penetrates kelp beds only along substrate; no direct relationship to kelp.

6.58. Bluebanded goby, Lythrypnus dalli (Gilbert)

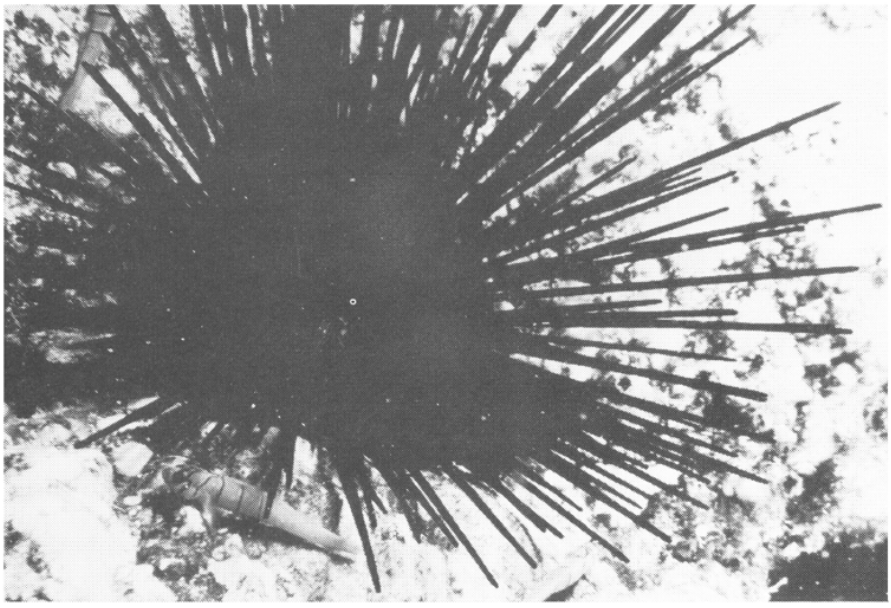

FIGURE 48. Bluebanded goby, *Lythrypnus dalli,* under a large red sea urchin, *Strongylocentrotus franciscanus.* Photograph by Ron Church.

FIGURE 48. Bluebanded goby, Lythrypnus dalli, under a large red sea urchin, Strongylocentrotus franciscanus.

Identification: Body elongate, cylindrical. Two dorsal fins, second much longer than first with exception of long filamentous rays on anterior part of first dorsal of male; spines of first dorsal elongate with enlarged black tips. Pelvic fins below pectorals, united into circular disk by which fish props itself on bottom or adheres to vertical substrate faces. Caudal fin rounded. Large males develop noticeably "pug-nosed" appearance. Mouth small, terminal, directed upward. Eyes dark. Color distinctive; brilliant crimson or orange-red with about six iridescent blue vertical stripes on anterior two-thirds of body. Appearance changes noticeably with increasing depth. In shallow water orange-red obvious, but below 50 feet this coloration disappears and fish appears iridescent blue. Small fish, 2¼ to 2½ inches long. Considerable size differences among populations from different areas; some coves off Catalina Island have only small gobies, but sometimes there are pockets of large fish within an area inhabited by small gobies. Common in shallow rocky areas from Morro Bay along length of Baja California to Guaymas, Mexico, but those to south extremely tiny and may not be identical.

Habitat-Habits: On rocks from surface to over 200 feet. Around La Jolla usually from 50 to 60 feet down on submarine canyon walls; individuals hide in crevices or under large red sea urchins when frightened. Especially abundant and obvious at offshore Channel Islands. Territorial. Pugnacious.

Life History Notes: Omnivorous, but heavily dependent on plankton. Food consists of small crustaceans, especially amphipods. Habit of sitting on rocks next to hole and darting forth to gulp some barely visible morsel indicates selective plankton feeder (David Powell, Sea World, San Diego, pers. commun.). To begin courtship, an adult male with dorsal fin fully extended and body at right angles to another bluebanded goby (presumably a female) make a series of rapid darts, each dart forward about one-half own body length (David Powell, pers. commun.). Eggs are spawned in empty shells, especially those of attached mollusks such as the scaled worm shell, and rock scallop. They are attached at base by threads to inner surfaces of shells. Male protects eggs until they hatch. Young postlarvae may be found in March. Eggs have been found in August, and some spawning has been noted in laboratory aquaria in May.

Remarks: Almost all specimens collected on mainland are infected with isopod crustacean, but none of those collected on islands are so infected. Small, economically insignificant.

6.59. Zebra goby, Lythrypnus zebra (Gilbert)

Identification: Similar to bluebanded goby but coloration less striking. Brick red to red-brown with numerous fine vertical blue bars on entire body. Red not visible at 50 feet, but there is not enough blue to make goby appear blue. In deep water looks brown with dirty blue lines, lacking iridescent quality of lines on bluebanded goby. Equally as common as bluebanded goby on subtidal rocks, but often overlooked because of more subtle coloration. Small, about 2½ inches long. Ranges from about Morro Bay to Clarion Island, Mexico, including Guadalupe Island.

Habitat-Habits: Rocky areas with heavy encrustation of shelled animal life. More retiring than bluebanded goby; usually inside crevices or caves where light is weak. From tide pools to at least 110 feet. Generally more commonly observed around islands than off mainland.

Life History Notes: No information, probably quite similar to bluebanded goby.

Remarks: Extremely abundant in southern California, but seldom observed because of living in dark crevices or caves. Almost always found when intensive collections are made in rocky environments. of no economic significance.

6.60. Sculpin, Scorpaena guttata Girard

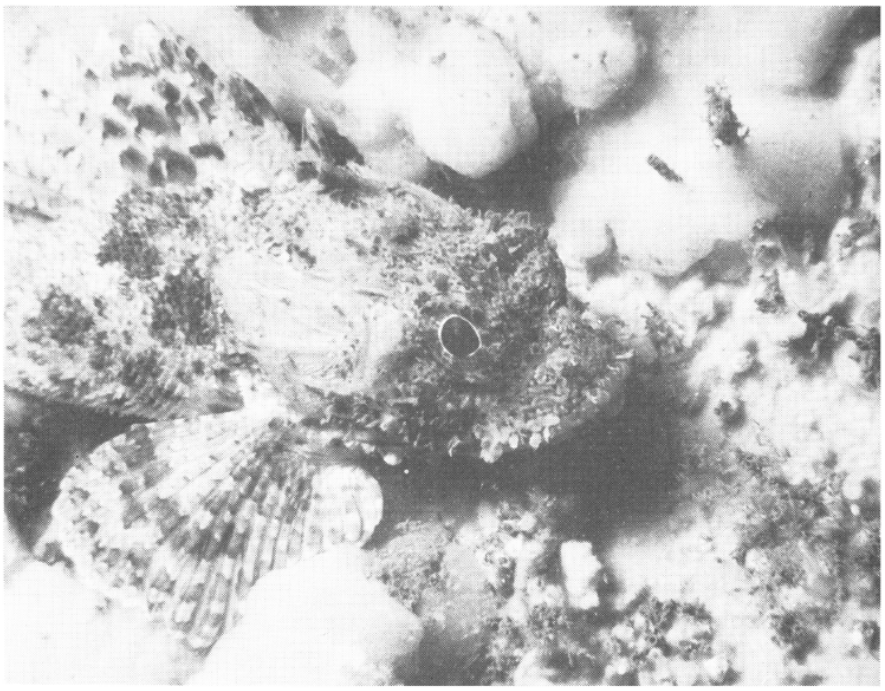

FIGURE 49. A closeup of the head of a sculpin, *Scorpaena guttata,* exhibiting the cryptic appearance of this fish. *Photograph by Charles Turner.*

FIGURE 49. A closeup of the head of a sculpin, Scorpaena guttata, exhibiting the cryptic appearance of this fish.

Identification: Body elongate, nearly cylindrical, pelvic fins below pectorals. Head large (bulbous) with numerous strong spines. Dorsal fin long, undivided, and deeply notched between spiny and soft-rayed portions; strong venomous spines stand erect and longer than rays, with notch behind each spine. Anal fin short, venomous spines very apparent; first two spines followed by distinct notch. Caudal fin profile vertical. Snout blunt, mouth terminal. Eye large. Scales tend to lie away from body giving roughened appearance rather than smooth look of most fishes. Generally reddish-brown above, becoming lighter below with reddish mottling. Numerous dark or cream colored round spots on body, head, and fins, except pelvics which are a uniform rose. Individuals from deep water tend toward red; those from shallow water more brownish. Young have very pronounced and distinct black spots. Some fishermen may confuse this species with the cabezon, but sculpins lack a fleshy flap on the middle of their snout and large flaps just back of the eyes. Reported from Santa Cruz to Point San Juanico, Baja California.

Habitat-Habits: Rocky bottoms. Frequently seek caves and crevices. In areas deeper than 20 feet, remains in open. Small (less than 10 inches) sculpins become residents in rocky areas inundated with sand and remain in one area for several months. From tide pools to 600 feet, but most common in less than 100 feet. Usually solitary, but four or five may

seek shelter in same cave or on same ledge. Generally sluggish, not easily disturbed. May only raise spines when prodded. often in great numbers on open sand bottoms in depression, especially smaller individuals.

Life History Notes: Crabs, shrimp, octopus, squid, and fishes are typical dietary items. The transparent almost invisible eggs released in summer and fall become floating bilobed masses which are seen occasionally just below the surface in nearshore open water. Inch long young are found in tide pools during winter. Half-grown and subadults are found in slightly deeper waters. This species matures at 7½ inches.

Remarks: All spines venomous. Reactions to scratches by spines mild to violent, but not fatal. Divers scratched by spines during deep dives in cold water reported no poisonous effects until they neared surface. Excellent food fish, taken by baited hook and spear. No important relationship to giant kelp, but use same type of substrate where depth range overlaps that of giant kelp.

6.61. Bocaccio, Sebastes paucispinis Ayres

FIGURE 50. Bocaccio, *Sebastes paucispinis,* beside rock crevice. *Photograph by Charles Turner.*

FIGURE 50. Bocaccio, Sebastes paucispinis, beside rock crevice.

Identification: Typical rockfish shape. Bony support from lower part of eye across cheek under skin. Dorsal fin deeply notched with 13 spines.

Lower jaw greatly projecting. General color tan, mottled with brown; sometimes pink along sides. Everywhere blushed with red; sometimes with black blotches on body; juveniles speckled. Size 36 inches. Found from Kodiak Island and Kruzol Island, Alaska, to Point Blanca, Baja California. Phillips (1957) provides additional information on all species of Sebastes.

Habitat-Habits: Normally associated with rocky substrate such as submarine canyon walls at La Jolla. Large specimens at depths of 90 to 1,050 feet.

Life History Notes: Feeds mainly on fishes, but crabs, squid, and octopus also form part of the diet. Larvae born from October through April (H.G. Moser, National Marine Fisheries Service, pers. commun.). Young begin to school in spring usually mixing with schools of olive rockfish. Growth rate rapid in laboratory tanks, sometimes attaining 5 inches during first year. Young abundant from April through September in shallow water. Feeds on small crustaceans and fish, sometimes on smaller members of own species. Dense schools of 1 to 3 inch young commonly enter kelp beds. Usually seeks shallower water in entrances to bays or behind protecting points. With increasing age young seek deeper water.

Remarks: Commonly taken from deep water by baited hook. Appearance of young in kelp beds incidental. Juveniles often taken by pier fishermen along the central California coast.

6.62. Blue rockfish, Sebastes mystinus (Jordan and Gilbert)

Identification: Rockfish-like but without obvious heavy head or spination. Bony support from lower part of eye across cheek under skin. Dorsal fin deeply notched, with 13 spines. Smaller mouth than other rockfish. Blue-black above, lighter below. often with black flecks. Sometimes with "masked" look of blacksmith. Easily confused with black rockfish which has a much larger eye on size for size basis. Size 21 inches. Range from Todos Santos Bay, Baja California, to Bering Sea.

Habitat-Habits: Rocky cold water areas, deep in southern California and shallower in central California. Common in mid-kelp and canopy of Monterey County coastline kelp beds. From tide pools off Pacific Grove (Monterey Bay) to 130 feet off La Jolla. Deepest record 300 feet. They form loose aggregations in the inshore kelp bed areas or can often be found as solitary wandering individuals moving in and about the kelp bed or swimming along with other rockfish such as olive rockfish and kelp rockfish. Juveniles found in the kelp canopy. Blue rockfish form dense aggregates in deeper waters from surface to bottom but usually in mid-depth levels around 60 to 120 feet.

Life History Notes: Feeding habits vary. Deeper water individuals feed almost entirely on macroplankton consisting of scyphozoan jellyfishes (gonadal material), crustaceans, and tunicates (salps). In shallow areas

and in kelp beds they also feed on several species of algae, hydroids, crabs, shrimps, amphipods (occasionally), and small fishes (Gotshall, Smith, and Holbert, 1965). A relatively slow growing fish.

Remarks: One of the most important sport species of central and northern California. Taken by all fishing methods. Some evidence of overutilization in recent years (Miller and Gotshall, 1965).

6.63. Olive rockfish, Sebastes serranoides (Eigenmann and Eigenmann)

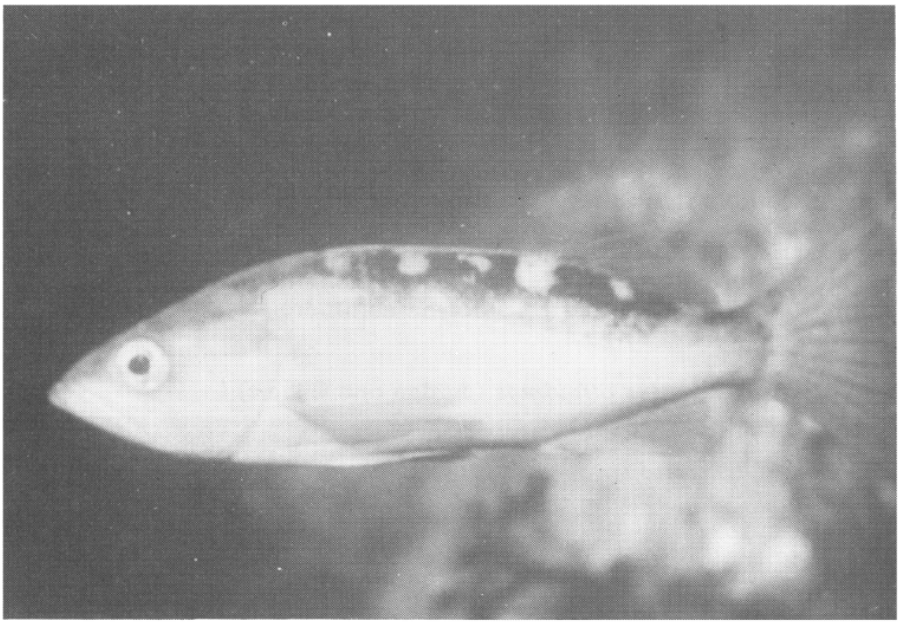

FIGURE 51. Olive rockfish, *Sebastes serranoides.* *Photograph by Charles Turner.*

FIGURE 51. Olive rockfish, Sebastes serranoides.

Identification In general shape and color resembles kelp bass. Body somewhat elongate, only slightly compressed. Bony support from lower part of eye across cheek under skin. Dorsal fin long, nearly separated by deep notch between spiny and soft-rayed portions. Soft rays longer than spines, shorter to rear. Anal short, its profile forming right angle. Caudal fin slightly concave. Lower jaw extends forward distinctly beyond upper. Spines distinct at angle of preopercle but absent on head. Color olive-gray on back, mottled with light blotches. Caudal fin distinctly yellow, other fins with yellow tones. Easy to confuse with unrelated kelp bass which is often found in same areas. Most readily distinguished from kelp bass by yellow tail, spines on preopercle, and profile of spiny portion of dorsal fin (much more peaked in kelp bass). Blotching below dorsal similar to kelp bass but not so profuse and not extending to mid-line. Replaces kelp bass in northern part of range, above Point Conception, and tends to dominate population in Santa Barbara region; constitutes small proportion of joint population in rest of southern California. Size 21 inches. Ranges from Redding Rock, Humboldt County, to San Benito Islands, Baja California.

Habitat-Habits: Common in kelp and rocky bottom regions. From surface to 100 feet. Deepest 480 feet. Usually solitary but occasionally aggregates around favorable reefs or kelp clumps. Less easily frightened than kelp bass and makes a slow descent toward cover in rocks when disturbed. Similarity in shape and color pattern to kelp bass may be of mutual benefit to both species. Distinctly different evasive movements of these two species may confuse predators. Kelp bass makes horizontal path when startled; olive rockfish follows vertical pattern. Both species compete for same food and cover.

Life History Notes: Food items include crustaceans and smaller fishes. Larvae born in winter and early spring. Young appear in large schools from May through September. Schools form behind protective reefs, in bay entrances, and in lee of islands. Young enter increasingly deeper levels as they age. Possibly mature between 7 and 8½ inches, although some workers think they mature at a larger size.

Remarks: Excellent food fish. Common in sport catch of Santa Barbara region where they are often mistakenly identified as kelp bass; also important in the southern California commercial catch. Common in kelp beds.

6.64. Kelp rockfish, Sebastes atrovirens (Jordan and Gilbert)

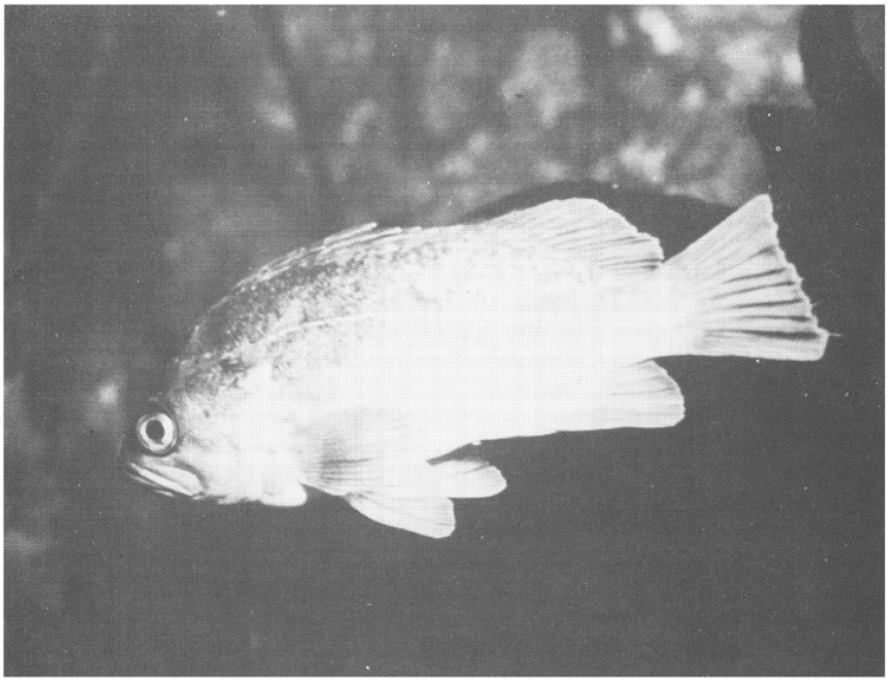

FIGURE 52. Kelp rockfish, *Sebastes atrovirens.* *Photograph by Charles Turner.*

FIGURE 52. Kelp rockfish, Sebastes atrovirens.

Identification: Typical rockfish shape. Bony support from lower part of eye across cheek under skin. Dorsal fin with 13 spines. Large pectoral

fins. Large eye. Color variable; usually with blotches of dark brown or black on white or cream background. Blending of color pattern with kelp and habit of remaining motionless renders it inconspicuous in kelp. Size 15 inches. Range from Timber Cove, Sonoma County, to San Pablo Point, Baja California.

Habitat-Habits: Lower levels of kelp and among rocks from surface to 150 feet. Not schooling but aggregations of several hundred occasionally found, sometimes far beyond limits of kelp beds. Hangs upside down around rocks or in kelp. Food primarily small crustaceans such as crabs and shrimp, some squid, and occasionally small fishes. Apparently spawns in winter since ripe adults are taken in December and females ready to give birth are taken in March. Large numbers of 1 inch long young occur along scattered rocks on open sand bottom in April through August. Fish 2 to 3 inches long are found in August and September.

Remarks: Commonly caught in kelp beds by baited hook and spear. Good food fish; should be handled carefully since spines are mildly toxic.

6.65. Vermilion rockfish, Sebastes miniatus (Jordan and Gilbert)

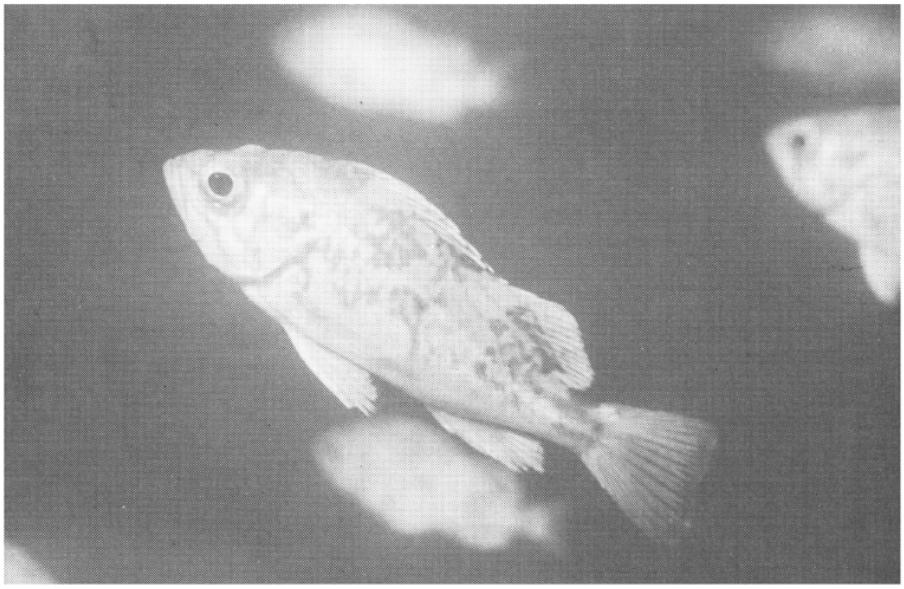

FIGURE 53. A juvenile vermilion rockfish, *Sebastes miniatus.* *Photograph by Charles Turner.*

FIGURE 53. A juvenile vermilion rockfish, Sebastes miniatus.

Identification: Rockfish-like. Bony support from lower part of eye across cheek under skin. Dorsal fin deeply notched, with 13 spines. Lower jaw projects slightly, with knob at tip. This is the only rockfish tending toward dark red with reddish fins and gray or blackish mottlings on back and sides. Margins of fins, especially the caudal, have narrow melanistic borders, never apparent in juveniles (H.G. Moser, National Marine Fisheries Service, pers. commun.). Pigmentation varies somewhat with depth, tending to be reddish-brown at approximately 85 feet, brick-red at 150 feet, and vermilion at greater depths. Size 30 inches. Report range

from Vancouver Island, British Columbia, to San Benito Islands, Baja California.

Habitat-Habits: Found over and among rocks where cover (caves or crevices) available. Abundant in deep rocky areas. Occurs from 85 to 170 feet, but as deep as 650 feet. Typically taken in shallower waters north of Point Conception.

Life History Notes: Food items are squid, octopuses, and fishes. The larvae are born during winter and early spring. Young, less than 1 inch long, appear at depths of 40 to 90 feet in March and April, and occasionally at surface. Later during June and July, when 2 to 3 inches long, live at depths of 25 to 100 feet, and begin to turn dark brown or blackish to rusty-brown.

Remarks: An excellent food fish, taken with heavy lines in deep water or occasionally speared by scuba divers. Should be handled carefully since its spines are extremely sharp. Occasionally found among rocks along outer edges of kelp beds. Rarely observed in water less than 80 feet deep in southern California.

6.66. Brown rockfish, Sebastes auriculatus Girard

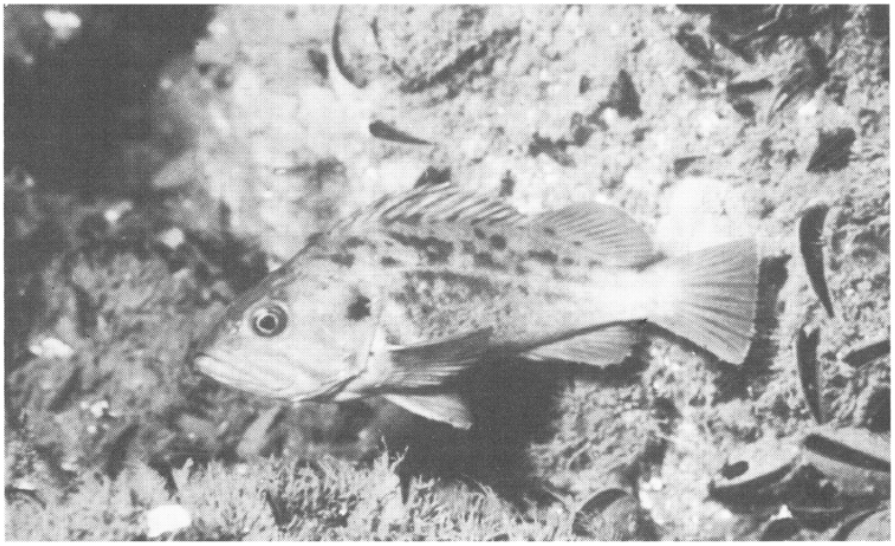

FIGURE 54. Brown rockfish, *Sebastes auriculatus.* *Photograph by Charles Turner.*

FIGURE 54. Brown rockfish, Sebastes auriculatus.

Identification: Rockfish-like. Bony support from lower part of eye across cheek under skin. Dorsal fin deeply notched with 13 spines. Color varies considerably. In general, dark brown, mottled with light brown; dark "ear" spot on the posterior region of the opercle. the only brownish colored shallow water rockfish with a black opercular blotch and coronal spines. Size to 21½ inches (TL). Occurs from southeast Alaska to Hipolito Bay, Baja California.

Habitat-Habits: Rocky crevices at depths of 15 to 60 feet. Shallow water species, also caught in deeper waters (30 fathoms). Common, but never abundant.

Life History Notes: Food items include crabs and small fishes.

Remarks: Infrequently seen. Caught most frequently in lobster traps, but a few are taken by baited hook or spear.

6.67. Grass rockfish, Sebastes rastrelliger (Jordan and Gilbert)

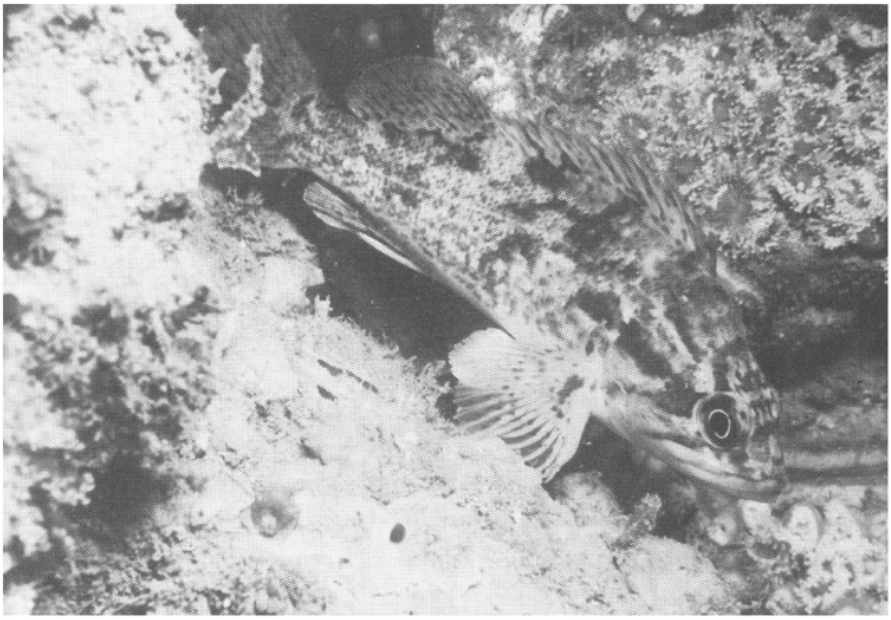

FIGURE 55. Grass rockfish, *Sebastes rastrelliger.* *Photograph by Ronald McPeak.*

FIGURE 55. Grass rockfish, Sebastes rastrelliger.

Identification: Rockfish-like. Bony support from lower part of eye across cheek under skin. Dorsal fin deeply notched with 13 spines. Distinguished by short stubby gill rakers, and thick caudal peduncle. Bulbous head. Blackish-brown to dark green with lighter blotching on body. Pectoral fins usually have pink edge. Size 16 inches. Range from Yaquina Bay, Oregon, to Playa Maria Bay, Baja California.

Habitat-Habits: Among marine plants especially of shallower depths, eelgrass. From surface to 150 feet (rarely). Concentrated in waters less than 30 feet deep.

Life History Notes: Crabs and small fishes make up major portion of their food. Winter spawning with young being found from March to September in same areas as adults.

Remarks: Taken along rocky shore by baited hook and spear. Very good food fish. Enters only rocky bottom inshore edges of kelp beds; no direct relationship to giant kelp.

6.68. Black-and-yellow rockfish, Sebastes chrysomelas (Jordan and Gilbert)

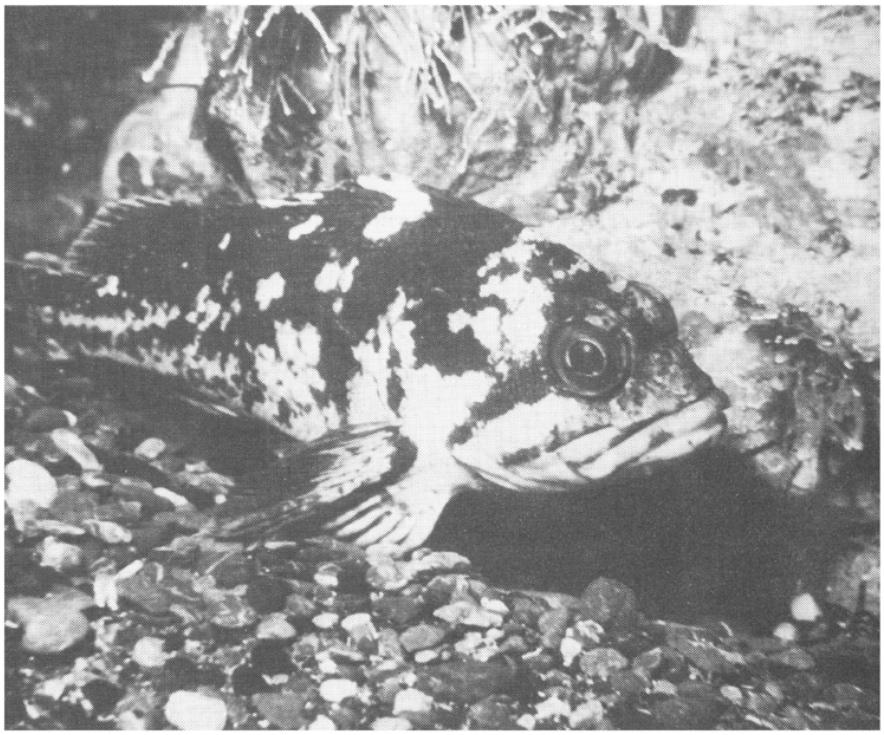

FIGURE 56. Black-and-yellow rockfish, *Sebastes chrysomelas.* *Photograph by Charles Turner.*

FIGURE 56. Black-and-yellow rockfish, Sebastes chrysomelas.

Identification: Rockfish-like. Bony support from lower part of eye across cheek under skin. Dorsal fin deeply notched, with 13 spines. Lower jaw not projecting. Dark brown or black above, spotted with orange or yellow. Similar to gopher rockfish except for color. Occurs from Eureka to Natividad Island, Baja California.

Habitat-Habits: Rocky areas in shallow water, especially around large red urchin. From surface to 120 feet. At Diablo Cove (near Morro Bay) black-and-yellow rockfish were found intertidally and to depths of 30 feet, while gopher rockfish occurred only deeper (50 to 70 feet).

Life History Notes: No information.

Remarks: An important sport fish in central and northern California. A shallow cold water species; those in more northerly areas enter rocky bottom habitats in or below kelp bed areas.

6.69. Gopher rockfish, Sebastes carnatus (Jordan and Gilbert)

Identification: Rockfish-like; body chunky, only slightly compressed. Bony support from lower part of eye across cheek under skin. Dorsal fin long, continuous, with deep notch between spiny and soft portions, 13 spines. Deep notch behind first spines, but not subsequent ones. Caudal

fin slightly convex in posterior profile. Eye large in relation to head. Spines on head only weakly developed. Olive-brown with flesh colored or whitish spotting or blotches. Indistinguishable underwater from black-and-yellow-rockfish, but may be distinguished out of water by flesh colored blotching. Size 15 inches. Range from Eureka, California, to Natividad Island, Baja California.

Habitat-Habits: Rocks in kelp bed and deeper. From 5 to 180 feet. At Diablo Cove (near Morro Bay) never collected shallower than 50 feet, rarely in presence of black-and-yellow rockfish. Usually most abundant rockfish at depths of 65 to 100 feet. Lives in areas with considerable rocky substrate, especially boulders covered with sea urchins.

Life History Notes: Food items include crabs, squid and small fishes. Young are seen in July.

Remarks: Taken commonly in kelp beds by baited hook, occasionally by spear.

6.70. Treefish, Sebastes serriceps (Jordan and Gilbert)

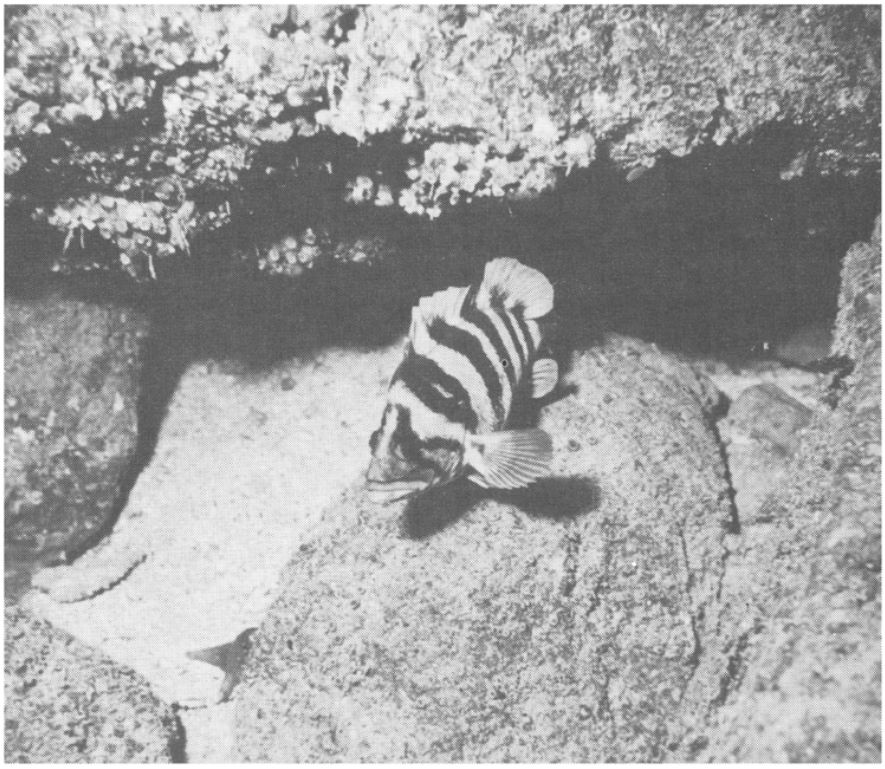

FIGURE 57. Treefish, *Sebastes serriceps,* near rocky crevice. *Photograph by Charles Turner.*

FIGURE 57. Treefish, Sebastes serriceps, near rocky crevice.

Identification: Rockfish-like; body deep, slightly compressed. Bony support from lower part of eye across cheek under skin. Dorsal fin long and

continuous with slight notch separating spiny from soft-rayed portion, 13 spines. Middle dorsal fin spines longest, about equal to soft rays in length. Caudal fin unnotched, slightly convex. Dorsal profile from dorsal fin to snout forms a straight sloping line. Spines very apparent above eyes and on preopercle. Lips rather thickened and light reddish color, chin red. Posterior end of upper jaw broad and expanded. Snout somewhat pointed. Olive, fading to yellow on sides; six or seven broad vertical black bars on sides. Spines longer, red on chin much more pronounced, and color less olive, tending toward a brighter yellow, on fish from deeper water. Young usually bright yellow with distinct black vertical bars with white edging on fins; lack red chin of adults. Yellow ground color of adult distinguishes it readily from other banded rockfishes. Attains length of 16 inches. Range from San Francisco, California, to Cedros Island, Baja California.

Habitat-Habits: Rocky crevices, especially those with sea urchins, in shallow waters. Occurs from 8 to 150 feet, and seldom seen off bottom. Adults and young very aggressive and territorial.

Life History Notes: Young are found in late summer and early fall seeking shelter among urchin filled crevices at depths of 35 to 130 feet.

Remarks: Common, but nowhere abundant. Occasionally taken by baited hook and spear.

6.71. Kelp greenling, Hexagrammos decagrammus (Pallas)

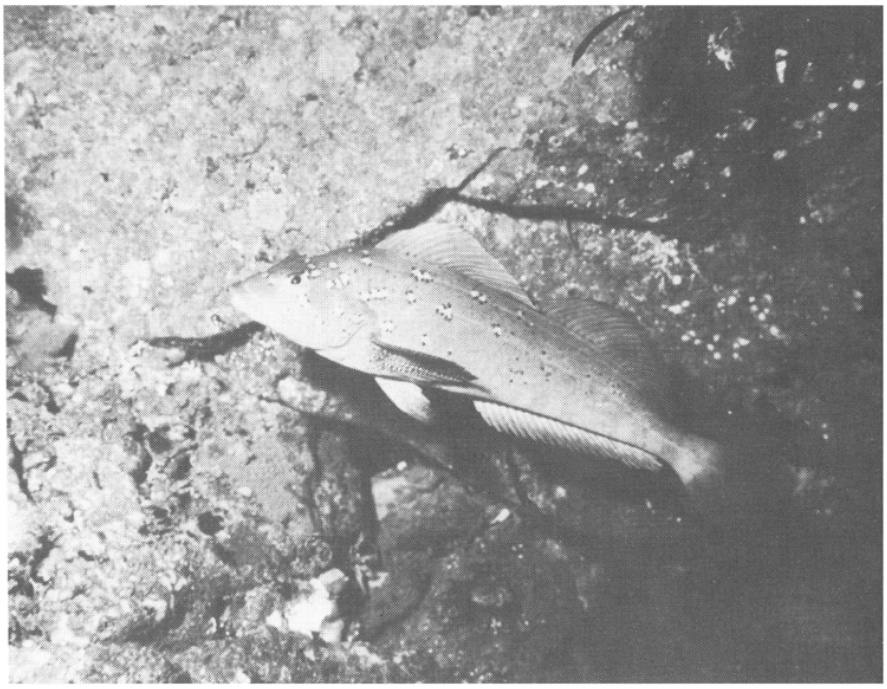

FIGURE 58. A male kelp greenling, *Hexagrammos decagrammus.* *Photograph by Charles Turner.*

FIGURE 58. A male kelp greenling, Hexagrammos decagrammus.

Identification: Body elongate, rather cylindrical. Pelvic fins slightly behind very broad pectorals. Dorsal fin long, nearly divided by deep notch between spiny and soft-rayed parts which are equal in height and length, giving appearance of having two nearly identical dorsal fins. Anal fin about same length and opposite rayed portion of dorsal, with small notch behind each spine and ray. Caudal fin fairly broad. Fleshy flaps over eyes. Marked sexual dimorphism. Male: Dorsal profile from dorsal fin to snout forms sloping straight line. Ventral profile of head and body nearly horizontal. Brownish-black with pale blue spots on anterior portion, particularly head; light below. Female: Dorsal and ventral profiles of head and body symmetrical. Color brownish to grayish with numerous fine brown spots on head and body. Length to 21 inches (52 cm); a female 38 cm TL weighed 645 g (J. E. Fitch, California Department of Fish and Game, pers. commun.). Range from Kodiak Island, Alaska, to La Jolla, California.

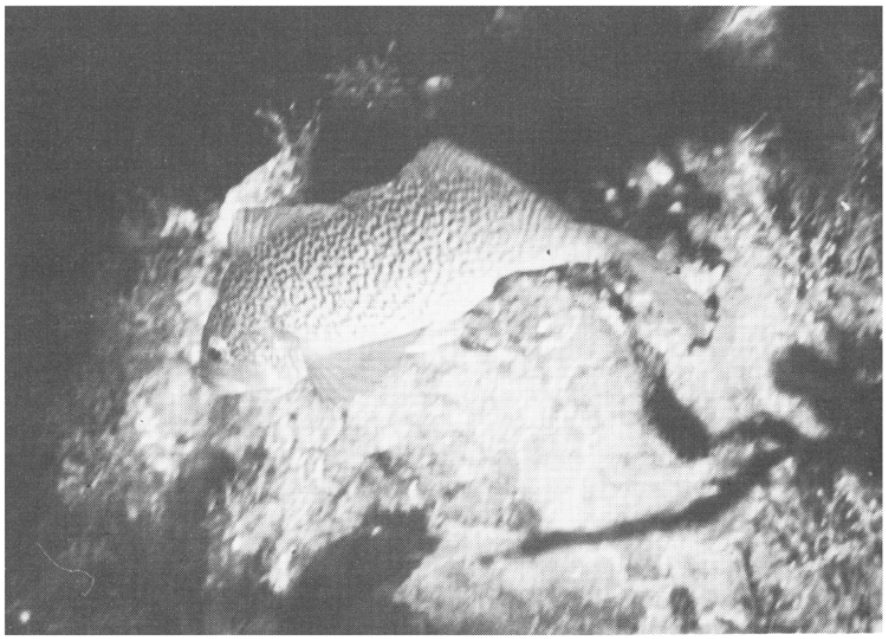

FIGURE 59. A female kelp greenling, *Hexagrammos decagrammus.* *Photograph by Charles Turner.*

FIGURE 59. A female kelp greenling, Hexagrammos decagrammus.

Habitat-Habits: Occurs in relatively shallow water along rocky coasts and around jetties; from 4 to 75 feet in southern California and from surface to 20 feet in northern California. Bottom dwellers, seldom leaving except when disturbed or feeding.

Life History Notes: Polychaetous annelid worms, crustaceans, and small fishes are among major food items. off British Columbia it lays its pale blue eggs in large masses on the rocks in October and November. off California the larvae and young are found in March, suggesting that winter spawning occurs throughout its range.

Remarks: Scarce in southern localities, but abundant off central and northern California. Prized as sportfish off central and northern California. of no direct relationship to giant kelp in southern California waters, but sometimes found among the rocks supporting holdfasts. Usually in waters deeper than 60 feet south of Point Conception.

6.72. Lingcod, Ophiodon elongatus Girard

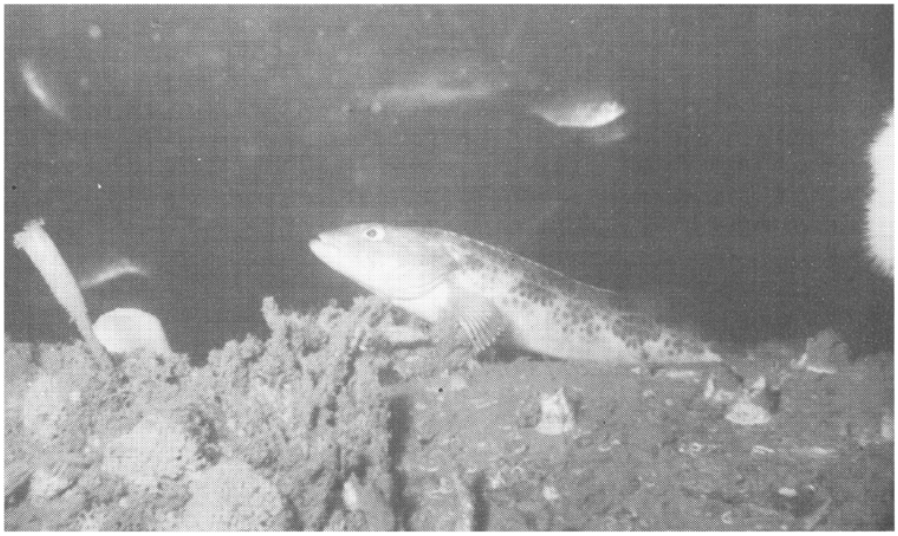

FIGURE 60. Lingcod, *Ophiodon elongatus,* on bottom near Santa Barbara, California.
Photograph by Charles Turner.

FIGURE 60. Lingcod, Ophiodon elongatus, on bottom near Santa Barbara, California.

Identification: Body elongate, tapering. Pelvic fins below pectorals. Dorsal fin very long, running from head almost to tail, with longer spiny portion almost separated from shorter soft-rayed portion by deep notch. Both spines and rays taper smoothly to rear. Anal almost identical in length and appearance to soft-rayed portion of dorsal. Caudal fin unnotched. Head massive, elongate. Eye large. Lower jaw juts beyond upper. Teeth large, numerous, sharp. Color variable, from gray through brown to dark greenish black; fades to white below, often covered with yellowish polka-dots. Heavy blotches dorsally with smaller spotting almost forming bands ventrally. Length to 45 inches. Female off San Nicolas Island age 12 years was 920 mm TL and weighed 17.3 pounds (J. E. Fitch, California Department of Fish and Game, pers. commun.). A maximum reported weight (Canada) exceeds 100 pounds, but few fish reach 70 pounds. Occurs from northwestern Alaska to Point San Carlos, Baja California.

Habitat-Habits: Deep water (below 65 feet) off southern California, but shallower water (even tide pools) off northern California. At or near rock bottom.

Life History Notes: The young feed on shrimp or other crustaceans, the adults on fishes. Eggs from December through March. Larvae in March.

Eggs attached in large masses to rocky crevices generally on subtidal reefs. Male guards eggs until hatched.

Remarks: Good food fish, sought by anglers and skindivers. No apparent relationship to giant kelp other than to live in and among rocks below kelp. Additional information may be found in Phillips (1959).

6.73. Painted greenling, Oxylebius pictus Gill

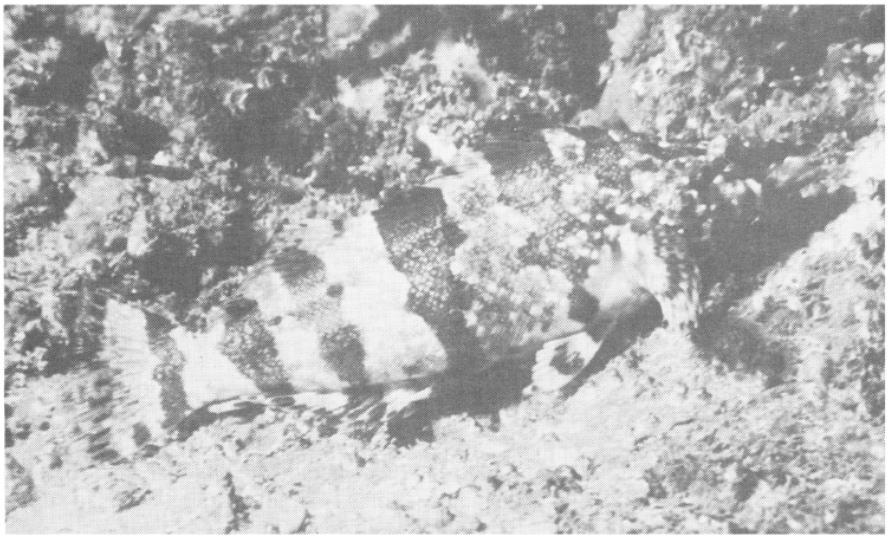

FIGURE 61. Painted greenling, *Oxylebius pictus.* *Photograph by Charles Mitchell.*

FIGURE 61. Painted greenling, Oxylebius pictus.

Identification: Elongate body, conically pointed snout. Flaps (cirri) over eyes. Light brown to gray with dark or red bars vertically crossing body in "convict" pattern. Occasionally body nearly black with even darker bars. Numerous cream colored spots scattered over body. Length to 10 inches but rarely over 6. Recorded from Queen Charlotte Island, British Columbia, to Point San Carlos, Baja California.

Habitat-Habits: Rocky areas, preferring those with little growth. From surface to 160 feet. Concentrated 4 to 120 feet. Not gregarious, but often concentrates in favorable habitat. Commonly motionless on bottom near rocks and crevices.

Life History Notes: off southern California, courtship observed in February. Egg masses attached to rocks in March, August, and November; juveniles to 2 inches common in fall and winter. off La Jolla in December, at depth of 50 feet, individual observed to attack sheephead almost 100 times its own weight, possibly as territorial display in defense of nest. Young seek cover among gorgonian corals (sea fans).

Remarks: No direct relationship with giant kelp, but sometimes lives on and among rocks below kelp beds. Not common in southernmost California.

6.74. Cabezon, Scorpaenichthys marmoratus (Ayres)

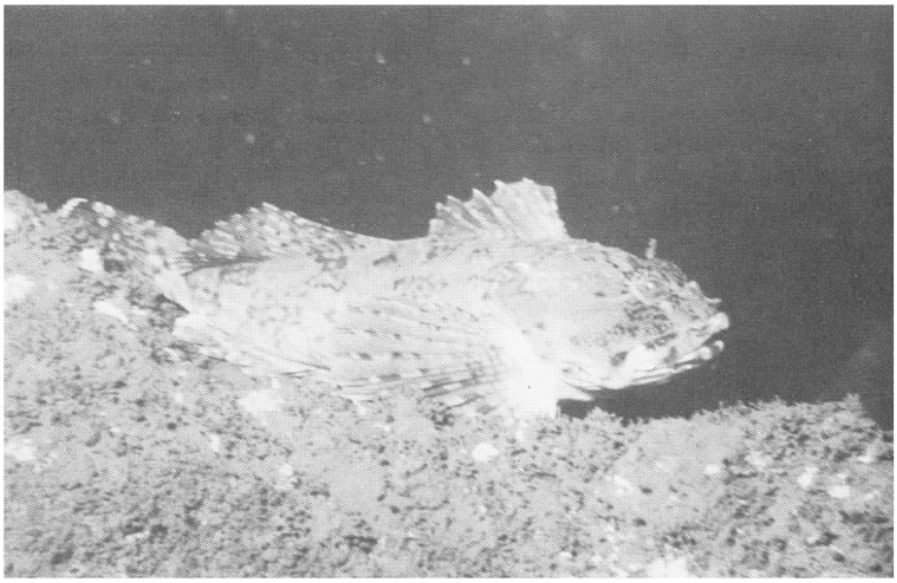

FIGURE 62. Cabazon, *Scorpaenichthys marmoratus,* resting on rock. Note prominent flap on middle of snout. *Photograph by Charles Turner.*

FIGURE 62. Cabazon, Scorpaenichthys marmoratus, resting on rock. Note prominent flap on middle of snout.

Identification: Body elongate, rather cylindrical; head massive, broad. Pelvic fins slightly behind pectorals. Dorsal fin long, nearly divided by deep notch, with soft-rayed portion longer than spiny. Soft rays and spines of about equal length. Anal fin similar in form to soft-rayed portion of dorsal, but with small notch behind each ray. Pectoral fin large and conspicuous, with rays large, fleshy, free at tips. Eyes large, close together. Two pairs of conspicuous fleshy flaps on head; prominent flap on middle of snout. Body smooth, lacks scales; may have "wrinkled skin" appearance. May be greenish, olive, or dark tan with irregular mottling of brown or brownish-red; light green ventrally. Lining of mouth blue-green. Young may be confused with the sculpin, but readily distinguished by lack of scales. Maximum reported size is 39 inches and "at least 25 pounds." A 9 year old specimen was 62 cm TL, 8¼ pounds (J. E. Fitch, California Department of Fish and Game, pers. commun.). Ranges from Sitka, Alaska to Point Abreojos, Baja California.

Habitat-Habits: Most rocky bottoms from tide pools to depths somewhat more than 250 feet.

Life History Notes: Food items include crabs, small lobsters, abalone, squid, octopus, fish eggs, own eggs, and small fishes (O'Connell, 1953). Abalone are swallowed whole, and shells regurgitated after some digestion occurs. Shells often polished by stomach acids. Spawning occurs from November through March. Eggs laid in large masses on cleared usually steeply slanting rocks at depths ranging from tide pools to 55 feet. Egg masses (to 18 inches in diameter and 2 to 4 inches thick) in

tide pools, under rocks, or in deep crevices. Nesting sites close together (within 8 to 10 feet) in restricted areas are used each year. Male remains at each nest site to drive away intruders and to fertilize further spawnings. While protecting nest, adult may occasionally be lifted with bare hands. Eggs may be either white, pink, or blue-green, becoming olive as they mature. Larvae and young pelagic. Young have silversides with typical pelagic color pattern, and enter tide pools and lower levels in spring when they are about 1.5 inches long. Soon lose pelagic color patterns, and developing mottled patterns suitable to habitat heavy with plant and animal growth. Isolated objects at depths of 30 to 90 feet attract young cabezon to otherwise bare bottom.

Remarks: Excellent food fish, highly prized by anglers and spearfishermen. Roe found to be poisonous. With increased use of scuba equipment, nesting adults may be seriously threatened. Lives primarily on bottom but occasionally enters kelp canopy.

6.75. Manacled sculpin, Synchirus gilli

Identification: A narrow, thin fish in body form. Unique among sculpins (Cottidae) with pectoral fins joined under thoracic region. Like other cottids it has no anal spines and is only partly scaled. Nose pointed. Usually kelp colored, mostly yellowish to reddish tan, occasionally with green on back. Small, reaching a maximum length of 2.5 inches. Ranges from Sitka, Alaska, to San Miguel Island, California.

Habitat-Habits: In shallow rocky areas, around pilings and in tide pools in British Columbia. Nearly all individuals in the kelp canopy in California.

Life History Notes: No information currently is available on food habits or reproductive biology.

Remarks: For many years this species was considered rare in California; the first specimen was recorded here in 1949 but during the last few years large numbers have been taken in the Macrocystis canopy between Monterey and Point Conception, an area seldom frequented by marine specimen collectors until the onset of commercial kelp cutting operations in 1970.

6.76. Giant kelpfish, Heterostichus rostratus Girard

Identification: Body elongate, compressed. Dorsal fin very long and continuous with many more spines than soft rays. First spines much longer, giving fin definite peak in front. Anal fin long. Pelvic fins small, in front of pectorals. Caudal fin deeply forked, caudal peduncle slender. Snout distinctly pointed, with lower jaw projecting beyond upper. Color varies with habitat, generally matching background, from bright green with silver stripes in eelgrass and surf grass to yellow-brown in giant kelp; often with blotchy lighter band along sides of body. Difficult to see as result of camouflage. May at first be confused with kelpfish, which have a comparatively blunt nose and slightly rounded caudal fin. Up to 24

inches long; a specimen 412 mm TL weighing 555 grams was 5 years old (J. E. Fitch, California Department of Fish and Game, pers. commun.). Ranges from British Columbia to Cape San Lucas, Baja California.

FIGURE 63. Giant kelpfish, *Heterostichus rostratus,* in giant kelp. *Photograph by Charles Turner.*

FIGURE 63. Giant kelpfish, Heterostichus rostratus, in giant kelp.

Habitat-Habits: Among seaweeds from low tide to 100 feet. Concentrated inshore.

Life History Notes: Food predominantly small crustaceans, mollusks, and small fishes. Spawning occurs during March through July. During spawning, which occurs in territory established by male, female places eggs on seaweed while she quivers with male next to her, sometimes head to tail. Activity often occurs in strong surges. Pink to greenish eggs attached to seaweed (Cystoseira spp., feather boa kelp, giant kelp, or surf grass) by entangling threads that extend from egg coverings. Male remains to guard eggs. Transparent postlarvae appear from April through August, usually in shallow water from 5 to 30 feet. Kelpfish school until approximately 2.5 inches long when they begin to assume adult colors and become solitary, living close among seaweeds.

Remarks: Moderately good eating although not considered desirable by most fishermen.

6.77. Spotted kelpfish, Gibbonsia elegans (Cooper)

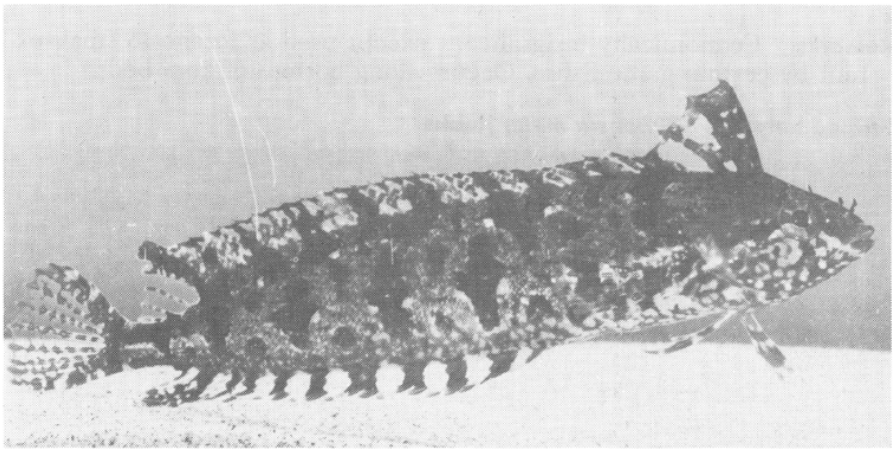

FIGURE 64. Spotted kelpfish, *Gibbonsia elegans.* *Photograph by Conrad Limbaugh.*

FIGURE 64. Spotted kelpfish, Gibbonsia elegans.

Identification: Kelpfish-like. Body elongate, compressed, tapering. Dorsal fin very long, undivided, with first spines much longer, giving fin characteristic front peak. Anal very long. Pelvic fins placed slightly in front of pectorals; pectorals have only few rays. Caudal fin not forked. Snout ending in point, mouth terminal. Lips rather fleshy. Fleshy flap above eye, smaller flap in front of eye. Color extremely variable, usually matching background: gray-brown to yellow-brown to red or red-purple or greenish. often barred or mottled. Against dark background, usually mottled with dark brown on reddish-brown blotches and lighter areas, with lighter irregular band above lateral line running from head to about end of dorsal. May have one to three ocelli (spots) on body; characteristically two ocelli present; one above pectoral fin, second far back on body. About 6 diamond shaped blotches along lateral line. Usually distinguished from other members of the genus, Gibbonsia, by smaller scales and dark spots, but these characters are unreliable without microscope and comparative material. Differentiated from giant kelpfish by rounded tail (forked in giant kelpfish). Length to over 6 inches. Ranges from Point Piedras Blancas, California, to Magdalena Bay, Baja California. Additional information in Hubbs (1952).

Habitat-Habits: Among seaweeds from shore to 70 feet. Extremely abundant close among short seaweeds. Not easily observed because of ability to blend with background.

Life History Notes: Food items include small crustaceans and mollusks. January through June spawning. Eggs laid among short seaweeds. Female lays eggs periodically, mounts egg mass, and undulates body stiffly as she adds to mass. Occasionally swims off egg mass and pushes seaweed into it with head. During spawning process, male brings vent

as close to female as possible without pushing her. Then he quivers, becomes rigid, and eventually falls back. Male interrupts spawning to drive away intruders, including larger fishes. Egg mass white, diameter under 1 inch. Male remains to guard nest.

Remarks: Economically insignificant except used as forage to small extent by certain game fishes. Occurs along bottom of kelp beds.

6.78. Striped kelpfish, Gibbonsia metzi Hubbs

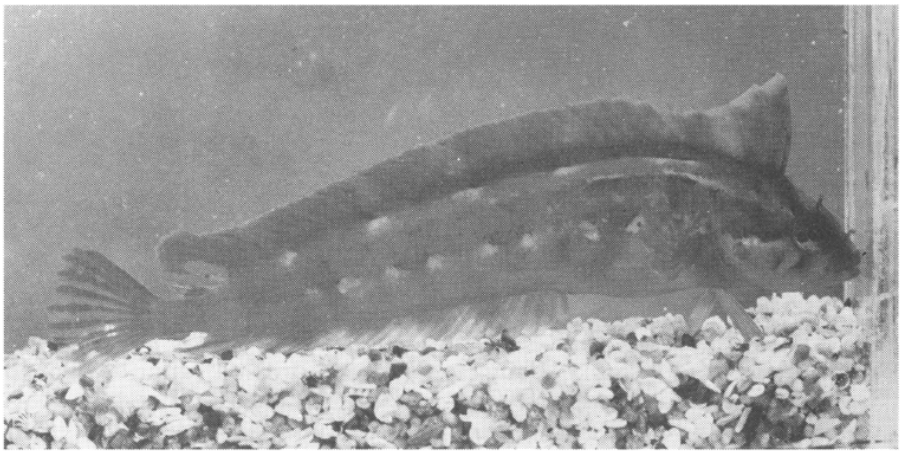

FIGURE 65. Striped kelpfish, *Gibbonsia metzi.* *Photograph by Conrad Limbaugh.*

FIGURE 65. Striped kelpfish, Gibbonsia metzi.

Identification: Similar to spotted kelpfish. Color varies with background, but less variable than that of spotted kelpfish. In kelp are kelp colored, sometimes barred with brown. No dark spots on body. Length to 9¼ inches. Occurs from Vancouver Island, British Columbia, to Point Rompiente, Baja California.

Habitat-Habits: Among seaweeds of shallow waters and in canopy and mid-depths of kelp beds. From surface to 30 feet.

Life History Notes: Food organisms mainly small crustaceans. Schooling young from April through July. Transparent young appear under kelp and inshore. They become opaque and move into seaweeds.

Remarks: No significant economic importance, but probably used incidentally as forage by game fishes.

6.79. Onespot fringehead, Neoclinus uninotatus Hubbs

Identification: Long, slender body, laterally compressed. Long continuous dorsal fin. Moderate to large mouth. Pronounced fringe of cirri on top of head, cirri multifid at tips. Light brown with darker speckling to very dark brown with touch of often bright red speckling. Sides of all fringeheads generally mottled and spotted with darker markings, but varying from complete absence to pronounced marks. Spots (ocelli) dark with yellowish border. Onespot fringehead reaches length of 9 inches. Recorded from Bodega Bay, California, to San Diego Bay.

Habitat-Habits: Occurs on relatively barren bottom of bays and along coastline from 10 to 90 feet deep, in areas such as Santa Monica Bay and off Zuma Beach. Occupies empty soda, beer, or other bottles; old automobile

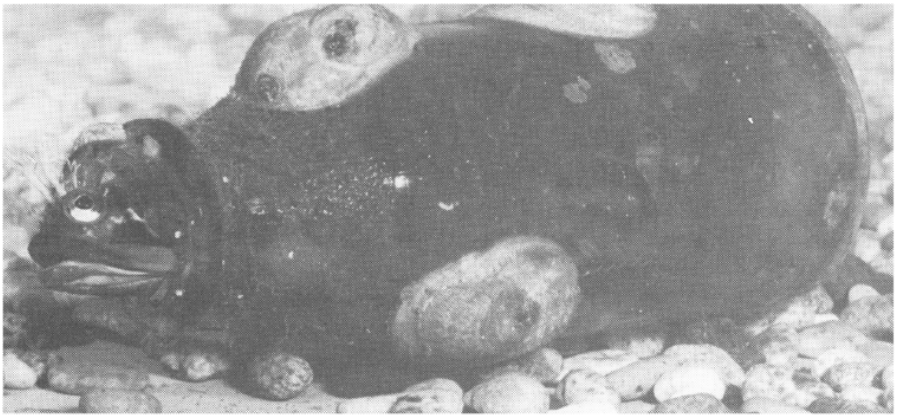

FIGURE 66. Onespot fringehead, *Neoclinus uninotatus,* peering out of a bottle. Slipper shells, *Crepidula* sp., are attached to the bottle. *Photograph by Conrad Limbaugh.*

FIGURE 66. Onespot fringehead, Neoclinus uninotatus, peering out of a bottle. Slipper shells, Crepidula sp., are attached to the bottle.

tires; cans (particularly punched beer cans); pipe coupling; shoes, and depressions scooped out beneath miscellaneous debris thrown overboard from vessels. More abundant around piers with many suitable "homes" on bottom. No "homeless" fringehead found in vicinity of piers in San Diego Bay, although individuals occasionally wander in open areas away from piers. Only one fish occupies a "home," resting at mouth of it with portion of head exposed. Aggressive and strongly territorial. Intruders into fringehead territory (man or fish) are greated by a large gaping mouth or forceful lunge accompanied by vigorous snapping. Fringeheads generally spotted by observing slight movement as fish pulls head back in "home." When at rest, sits with front half of head exposed showing elongate cirri on top of head.

Life History Notes: Spawns in April and May at depths near 30 feet. Eggs cemented to upper inside surfaces of containers. Each egg has dense patch of very fine fibrous strands that tangle eggs into mass. Orange pigment is concentrated entirely in oil globule, and diffusion of light through multitude of eggs produces mass of uniform orange. Each egg bearing container guarded by belligerent male. Parental care appears essential to survival and hatching of eggs in enclosed nesting sites. Males responsible for water circulation and removal of light debris from water by undulating entire body and by limited amount of pectoral fin motion. Both sexes move large pieces of gravel and detrital bits from interior of container and from area immediately adjacent to entrance. Pieces are picked up, carried, and forcefully expelled. Latter behavior exhibited regardless of presence or absence of eggs.

6.80. Sarcastic fringehead, Neoclinus blanchardi Girard

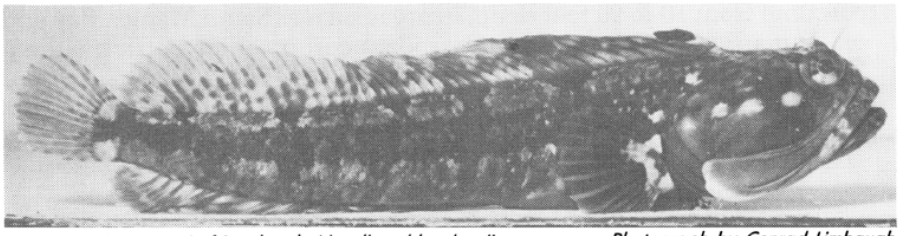

FIGURE 67. Sarcastic fringehead, *Neoclinus blanchardi.* *Photograph by Conrad Limbaugh.*

FIGURE 67. Sarcastic fringehead, Neoclinus blanchardi.

Identification: Shows typical fringehead characteristics. Largest species of the genus; adult males may be 12 inches long. Head large with exaggerated jaw membranes brightly marked posteriorly with yellow, extremely large jaws in males. Cirri usually simple. Body in mottled warm brown to gray. Ranges from San Francisco, California, to Cedros Island, Baja California.

Habitat-Habits: Principally found along open coast on sand or hard mud bottom beyond breaker zone to depths of at least 200 feet. Occasionally observed in bays. Sometimes resides in several types of empty mollusk shells, excavations beneath water-soaked wood, vacated geoduck, Panope generosa, and horse clam, Tresus nuttalli, burrows, or seen wandering over extensive sand dollar beds. In La Jolla submarine canyon, uses abandoned pholad clam burrows, clam shells, and cracks in hard clay. Small octopuses regularly inhabit canyon walls which makes it difficult to differentiate between eyes of sarcastic fringehead and octopus when in dark recesses of canyon walls. Most aggressive of the three fringeheads. When viewed from head-on in fully extended position, only formidable mouth seen; remainder of body hidden. Effectiveness of large mouth exemplified by reports of divers who describe "fights" with this fish, upon winning are surprised to find that the dead fish they remove from a pholad burrow measure only 6 to 10 inches.

Life History Notes: January through August spawning at depths of 45 to 90 feet. Eggs deposited primarily in pholad holes, and occasionally under rocks. Almost clear eggs attached tightly by threads protruding from base of each egg. Male guards eggs, fans them in manner similar to that shown by onespot fringehead.

6.81. Yellowfin fringehead, Neoclinus stephensae Hubbs

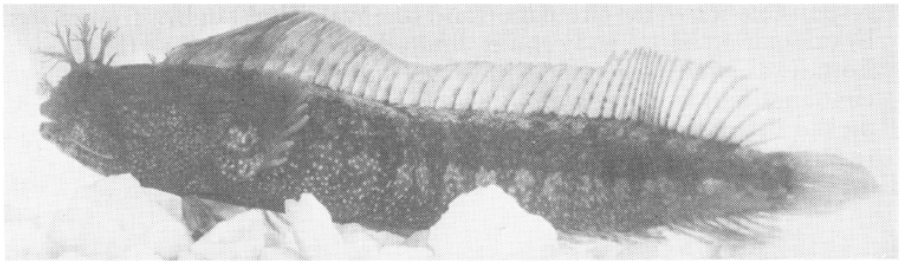

FIGURE 68. Yellowfin fringehead, *Neoclinus stephensae.* *Photograph by Conrad Limbaugh.*

FIGURE 68. Yellowfin fringehead, Neoclinus stephensae.

Identification: Typical fringehead characteristics. Yellowfin fringehead has shortest jaws of the three fringeheads. Cirri branched at the base. Dark mottled color pattern simulates pattern of home rock. Normally light mottled olive spotted with green. Tail often bright yellow, head may appear purple. Occasional bright red-orange specimens are seen. Smallest species of the genus, attaining length of about 4 inches. Occurs from Monterey, California, to Point San Hipolito, Baja California.

Habitat-Habits: Found in empty shells, holes in rocks, and abandoned borings interstices beneath encrusting organisms on large boulders. Occur from 10 to 90 feet, preferring upper sloping surface or sides of rocks. Rests with head protruding from rocky recess. Mainly in rocky areas, but found in bays associated with jetties. Small size, color variation, and similarity of branched cirri to adjacent encrusting growth make fish difficult to locate. Not easy to distinguish small orange solitary coral, from fish in orange color phase. In empty shell of rock scallop, a bright orange fish oriented near lip of shell effectively mimicks scallop's orange mantle.

Life History Notes: Eggs not located. Young in August, a single juvenile was observed in September.

6.82. Mussel blenny, Hypsoblennius jenkinsi Jordan and Evermann

Identification: A small relatively robust blenny-like fish with a prominent branched cirrus over eye and with the head profile not notched (depressed) just behind the eye. Body brown often with a reddish hue; a prominent half-moon mark on cheek behind eye and a series of seven to nine dark bands along base of dorsal fin; fins mottled. The maximum recorded size of this species is 4.4 inches. A mussel blenny 3.1 inches long was in its sixth year, and probably close to maximum age. Reported from Santa Barbara, California, to Puerta Marquis, Mexico, including the Gulf of California.

Habitat-Habits: Found subtidally in holes or small crevices and frequently inhabits boring clam (Family Pholadidea) burrows, scaled worm shell masses, mussel beds, fouling masses on floats and boat bottoms, and kelp holdfasts. Occurs from the sublittoral fringe to depths of 66 feet but is not common below 33 feet. Sedentary and highly territorial for long periods of time; defends territory against intrusion.

Life History Notes: Food consists mainly of planktonic and benthic crustacea. It feeds by darting from or partially extending out of hole. Mass breeding of mussel blennies occurs between May and August. Males guard nests of eggs and will even defend them against females. Egg deposition may occur over a period of several weeks with females spawning three or four times. Occasionally several females in turn spawn with a single male. Mass inshore larval settling occurs between August and October. Larvae are probably in plankton for 2 to 3 months and are widely dispersed by currents. The highly territorial nature of the adults indicates that recruitment is typically the result of larval

dispersal and settlement. This fish is secretive and is rarely exposed to predation during normal activity. Predation on larger mussel blennies occurs seasonally, primarily during summer and fall, when growth is rapid and fish are forced to compete for a limited number of large protective spaces. Only a few achieve success in occupying spaces, and the remainder, unprotected on the surface of the habitat, are removed by predation. The major predators are kelp bass and cabezon. At least eight species of fishes inhabit the same area as the mussel blenny (i.e., yellowfin fringehead, spotted kelpfish, blackeye goby, bluebanded goby, zebra goby, painted greenling, coralline sculpin, snubnose sculpin, but there is little evidence of direct competition for food or space between these species and the mussel blenny with the exception of the yellowfin fringehead which competes to a limited degree for pholad tubes (Stephens et al., 1970).

6.83. Smooth ronquil, Rathbunella hypoplecta (Gilbert)

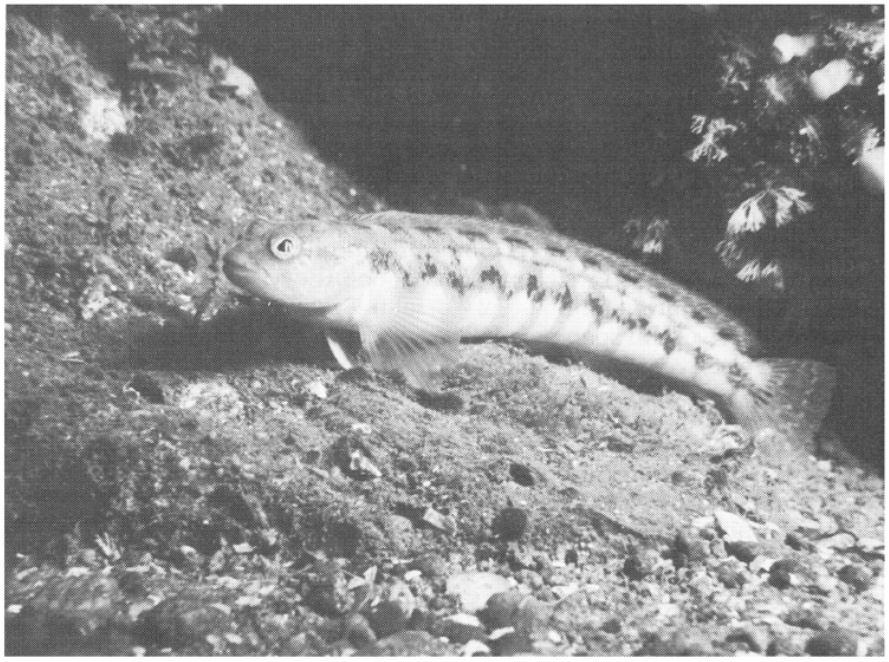

FIGURE 69. Smooth ronquil, *Rathbunella hypoplecta,* taken at 80 feet. *Photograph by Charles Turner.*

FIGURE 69. Smooth ronquil, Rathbunella hypoplecta, taken at 80 feet.

Identification: Body smooth in appearance, but with ctenoid scales. Light brown to olive-brown above, gray below. Generally blotched with darker brown that may form several vague vertical bars on upper half of back. Males with dark edged fins, readily distinguishable from females. Apparently one or more undescribed species inhabit our waters, and intermingle with the smooth ronquil. Maximum length may exceed 10 inches. Reported from Pacific northwest to northern Baja California.

Habitat-Habits: Found in deeper water combinations of sand and rock. From 20 to 175 feet, concentrated 130 to 150 feet. A bottom fish that seeks shelter in rocky crevices. Apparently selects no special territory as do most rock dwelling fishes, but tends to wander somewhat. Becomes immobile when disturbed.

Life History Notes: Individuals from Monterey Bay deposited eggs in aquarium February 5; others observed pairing in ocean at that time (D. Powell, Sea World, San Diego, pers. commun.); some from Diablo Cove spawned several times over a 6 month period. Young do not wander, observed to remain in one area (6 inches by 6 inches) for several months.

6.84. Rockweed gunnel, Xererpes fucorum (Jordan and Gilbert)

Identification: Eel-shaped, body compressed; scales small; dorsal fin composed of spines only, pelvic fins present, ventrals reduced. Color variable: in giant kelp, yellow-brown; others red or green. Blends well into habitat, difficult to distinguish. Attains a length to 9 inches. Ranges from Vancouver Island, British Columbia, to Point Escarpada, Baja California.

Habitat-Habits: Found in inshore seaweed, probably only in shallow water. From surface to 30 feet. Those living among red and green seaweeds assume colors of plants. Yellowish-brown individuals living in kelp canopy often entwine with stipes.

Life History Notes: Young observed in March in southern California, during August and September north of Point Conception.

6.85. Kelp gunnel, Ulvicola sanctaerosae Gilbert and Starks

Identification: Eel-shaped; body compressed; scales small; dorsal fin composed of spines only; pelvic and ventral fins absent. Blends with blackground in color, texture, shape, and diameter. Attains a length of 11¼ inches. Geographically this species ranges from Government Cove (Santa Barbara County), California to Guadalupe Island (offshore) and Point Banda, Baja California (mainland coast).

Habitat-Habits: Entwined in kelp canopy at shallow depths; occur from surface to depths of 40 feet. Concentrated in canopy.

Life History Notes: Typical food items include mysids and amphipods of canopy. Ripe females in January. Young, March through June. Remarks: Common in kelp, but probably not important forage fishes. No economic significance.

6.86. California barracuda, Sphyraena argentea (Girard)

Identification: Body long, cylindrical, roughly cigar-shaped. Pelvic fins about midway on body. Two widely separated dorsal fins, the first above the pelvics. Head long. Sharply pointed snout with lower jaw protruding beyond upper. Teeth obvious when mouth open. Scales small. Bluish-black

above, sides silvery. Tail yellow. They attain weights of 18 pounds and lengths in excess of 40 inches, although a typical barracuda is less than 11 pounds. Range from Kodiak Island, Alaska, to Cape San Lucas, Baja California.

FIGURE 70. A school of California barracuda, *Sphyraena argentea,* with a male garibaldi, *Hypsypops rubicundus,* below. *Photograph by Donald Morrison.*

FIGURE 70. A school of California barracuda, Sphyraena argentea, with a male garibaldi, Hypsypops rubicundus, below.

Habitat-Habits: Nearshore pelagic from surface to deep water. A schooling fish. Enters kelp beds rarely, although common along the outer edge. California barracuda will frequently chase schools of bait fishes into the kelp. They often leap clear of the water when feeding.

Life History Notes: Food includes squid and nearshore pelagic fishes such as sardines and anchovies. Eggs pelagic. Ripe adults taken through summer. Spawn at about age two. Young in shallow (4 to 15 feet deep) water over sandy areas near rocks, and in protected bays, harbors, and marinas.

Half-grown and subdaults are numerous during late summer along edges of kelp. The species seem to prefer schooling in inshore areas. A 6 year old female, about 37 inches long, weighed slightly more than 7 pounds (Fitch, 1969).

Remarks: Barracudas have a worldwide bad reputation. California divers have no real worry from the relatively small California barracuda which feeds only on small animals, and does not tear or cut food but swallows it whole. Excellent food fishes, but cannot be netted in California waters by commercial fishermen. Sportsmen take them along outer edges of kelp by trolling, live-bait fishing, and spearfishing. Only relationship to giant kelp is that kelp forms boundary along which they concentrate. Abundant off mainland and islands of Mexico in regions with and without giant kelp. Pinkas (1966) discusses management of the species in some detail.

6.87. Jacksmelt, Atherinopsis californiensis Girard

Identification: Body long. Scales large and conspicuous. Two widely separately dorsal fins. Mouth high on head; teeth small, unforked. Grayish-green to green above, with bluish tinge; sides and belly silvery; metallic band tinged with blue extends length of body. Reportedly attains lengths of 22 inches, but a 17½ inch jacksmelt is the largest for which a definite record is available. Eight and 9 year old jacksmelt are 13 to 15 inches long and weigh slightly less than a pound. A 1 pound male was 11 years old. Jacksmelt range from Yaquina, Oregon, to Santa Maria Bay, Baja California.

Habitat-Habits: These fish school in murky water, preferably over sand, from surface to 95 feet, and tend to concentrate between 5 and 50 feet. Jacksmelt spawn when 2 years old (6 inches long).

Life History Notes: Eggs are laid throughout year off southern California with peak during winter. Eggs are the size of small BB's, and are attached in large masses by long filaments to floating objects, especially seaweed. Larvae abundant inshore, common in surface canopy.

Remarks: Fished commercially with gill nets, and sold as smelt on fresh fish market. No important relationship to giant kelp, but at all ages occasionally seek cover there. Used as forage by fishes such as kelp bass and yellowtail.

6.88. Topsmelt, Atherinops affinis (Ayres)

Identification: Body long. Pelvic fins midway between pectoral and anal. Scales large and conspicuous. Two widely separated short dorsal fins. Snout forms blunt point; mouth terminal; teeth small, forked. Pectoral fin large and generally points upward. Seen from above, pectoral fins look like little "wings". Translucent green above, silver below. Distinct bluish-silver streak along side. Easily confused with jacksmelt and often with surf smelt, Hypomesus pretiosus, despite a adipose fin on the latter.

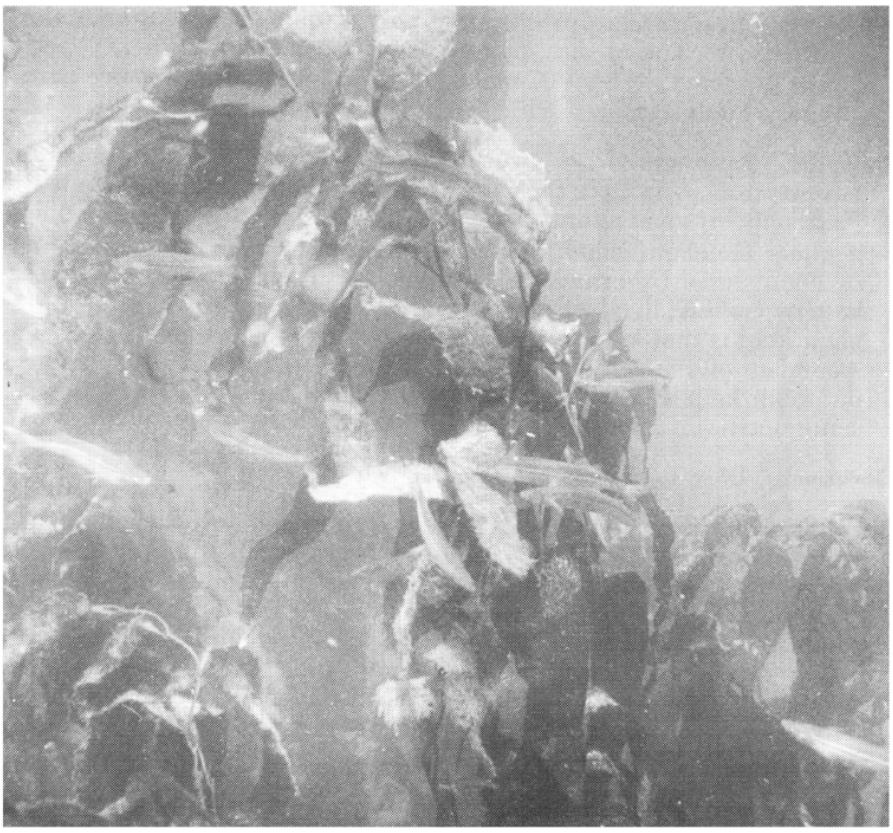

FIGURE 71. Topsmelt, *Atherinops affinis,* feeding on bryozoans attached to kelp.

Photograph by Charles Turner.

FIGURE 71. Topsmelt, Atherinops affinis, feeding on bryozoans attached to kelp.

In California, four subspecies are recognized. These are the San Francisco topsmelt, Atherinops affinis affinis; bay topsmelt, Atherinops affinis littoralis; kelp topsmelt, Atherinops affinis cedroscensis; and the island topsmelt, Atherinops affinis insularum. They can be generally separated by the habitat they occupy.

The maximum size of the topsmelt is 14# inches. These fish are reported to grow between 2½ and 4 inches during their first year. Another 2 inches is added the second year, and 1½ inches and ¾ inches during the third and fourth year. The largest fish have been determined to be 7 or 8 years old. Females tend to grow slightly larger and to outnumber the males. Larger fish usually occur in the northern extremities of the range. Most of the commercial catch is composed of 5¾ to 7 inch fish. Only occasionally are fish over 9 inches observed in these catches. Topsmelt are recorded from Vancouver Island, British Columbia, to Magdalena Bay, Baja California, and from the Gulf of California.

Habitat-Habits: Topsmelt are surface schooling, and depending upon the particular subspecies, they are found along sandy beaches, in and

around bays and kelp beds, inshore over rocky reefs, and around piers. They occur throughout the year ranging from the surface to 30 feet but at an average depth of 4 feet. They are found outside bays mainly in summer, usually along sand beaches.

Life History Notes: Spawning habits similar in all subspecies. Kelp topsmelt eggs laid during spring, summer, and early fall and larvae and young are found in bays. Spawning observed over a shallow reef consisted of a female followed by several males making repeated passes through a clump of red algae containing many eggs. The relatively large eggs have short adhesive filaments that tangle on bits of seaweed and, rarely, on giant kelp. Larvae numerous in upper few inches of kelp, especially during late spring and early summer. Juveniles predominant from summer through fall. In kelp, juveniles occur chiefly in small open spaces of canopy, 1 foot or more below surface. Young particularly common in and near intertidal area of rocky reefs. Larvae and young live in surface canopy and feed on small crustaceans living in canopy as well as planktonic forms that drift into kelp.

Remarks: Some larger fishes, such as yellowtail, forage on topsmelt which often jumps from water to avoid the predators. Schools of topsmelt frequently wander great distances from kelp, usually following patches of green water. Inhabits interspace and edges of kelp beds, spending most of its life just below surface. Although eggs are laid on seaweed, rarely uses giant kelp for substrate. Abundance and feeding habits of topsmelt probably have great effect on reducing numbers of small organisms living in kelp or carried into kelp by currents.

6.89. Pacific sanddab, Citharichthys sordidus (Girard)

Identification: General flatfish form; both eyes on left side of head. Body moderately elongate. Dorsal fin very long, running from level of eye almost to tail. Pelvic fin slightly before pectoral. Lateral line straight, conspicuous, paralleling axis of fish. Scales large and conspicuous. Eyes large in relation to head. Back usually grayish-brown or tan, may be spotted with yellow-orange or black; underside white. Reportedly attains weights of 2 pounds and age of 10 years; however, an 11 ½ inch female weighed just over ½ pound and was determined to be 9 years old. Occurs from Bering Sea to tip of Baja California.

Habitat-Habits: On fine sand to mud bottoms from 45 (rarely) to 600 feet throughout year, and are most abundant from 120 to 300 feet. Pacific sanddabs are the dominant fish in certain deep sand or mud areas.

Life History Notes: Typical sanddab food items include worms, shrimps, octopuses, squid, various eggs and small fishes. Females grow faster and larger than males. They mature during their third year at a length of about 7 ½ inches. Spawning peaks occur during summer. Early life stages are pelagic, and the nearly transparent young often are found miles from shore where they are fed upon by tunas and other pelagic fishes. Adults are preyed upon by many fishes.

Remarks: of commercial importance in central and northern California, they are taken with trawling gear. of recreational value and actively sought by many sport fishermen. Divers swimming close to bottom are frequently surprised by these fish which are well concealed by coloration; fish scurry away as soon as closely approached. They are excellent eating. They often are found concentrated near kelp bed areas; however, there is no relationship to giant kelp. For additional information, see Arora (1951).

6.90. Speckled sanddab, Citharichthys stigmaeus Jordan and Gilbert

Identification: General flatfish form; both eyes on left side of head. Eyes smaller (size-for-size) than with other sanddabs. Dorsal and anal fins long and undivided, slightly peaked behind center. Lateral line nearly straight. Usually yellowish-tan with numerous white and black specks; white below. Changes color pattern to match color and texture of sand; thus becomes nearly invisible on sand bottom. Swims with characteristic skipping motion. Most readily identified by small size and speckled sand-like color. Small, usually under 5 inches, although a 171 mm (6.7 inches) specimen was recorded from Bodega Bay (Ford, 1965). Ranges from Montague Island, Alaska, to Magdalena Bay, Baja California.

Habitat-Habits: Speckled sanddabs are found on all nearshore sandy areas, even in tiny patches between rocks at depths averaging 45 feet. Occurs from surface to 180 feet, but concentrated between 1 and 160 feet. Extremely abundant; close inspection of sand bottom in almost any region reveals some individuals. Prefers irregularities and foreign objects in habitat, resulting in higher densities at the heads of submarine canyons and new rocky areas and pier pilings than on open sand bottom. Sometimes dozens of adults will follow diver. Well adapted to environment; almost invisible once settled on sand.

Life History Notes: A short lived fish (36–42 months) that feeds upon worms, small crustaceans, and fishes, especially larval and postlarval northern anchovies. Spawning occurs during spring, summer, and fall, usually commencing during the animal's second year. The eggs and larvae are pelagic. Postlarvae, young juveniles, and subadults occupy the same habitat as adults.

Remarks: Too small to be of commercial or sport value, although it readily takes a tiny hook.

6.91. Fantail sole, Xystreurys liolepis Jordan and Gilbert

Identification: General flatfish form. Both eyes on either left or right side of head as with California halibut, but long pectoral fin extended straight up sail-like when swimming helps identify. Brown back marked with two large darker brown ocelli (eye-like spots). Reaches a length of 20 inches. A 19 inch female weighed 3 # pounds and was 8 years old (J. E. Fitch, California Department of Fish and Game, pers. commun.). Fantail sole range from Monterey Bay, California to Gulf of California.

Habitat-Habits: Occurs on sandy mud bottoms at depths averaging 55 feet, with range of 30 to at least 110 feet. Generally is buried.

Life History Notes: Giant sand crabs, Blepharipoda occidentalis; stomato-pods, Hemisquilla stylifera; and numerous other crustaceans have been

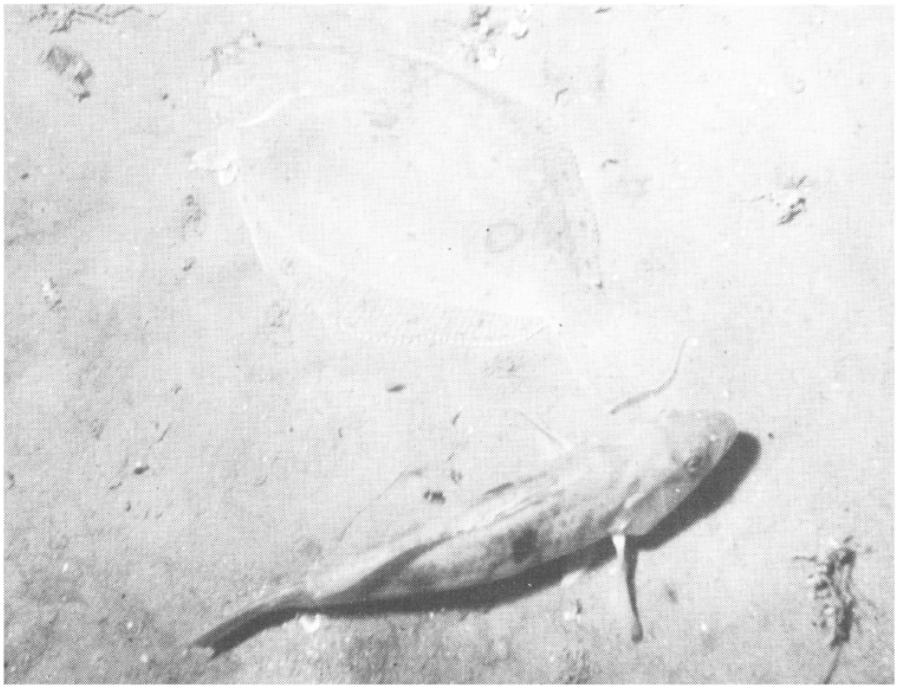

FIGURE 72. Fantail sole, *Xystreurys liolepis,* (above) and barred sand bass, *Paralabrax nebulifer,* (below). *Photograph by Charles Turner.*

FIGURE 72. Fantail sole, Xystreurys liolepis, (above) and barred sand bass, Paralabrax nebulifer, (below).

found in their stomachs; as well as an occasional clam and mud dwelling brachiopod.

Remarks: Not extremely abundant. Remains buried, not easily disturbed by divers. Excellent eating but rarely taken by sport fishermen.

6.92. California halibut, Paralichthys californicus (Ayres)

Identification: General flatfish form. Body rather elongate. Robust for flatfish. Eyes rather small in relation to head, both on left side of head in 52% of fish examined, on right side in remainder. Dorsal and anal fins without any distinct peaks or notches. Large caudal fin with straight margin or slightly double emarginate. Distinctive strong arch (high arch) of lateral line just above and behind pectoral fin. Mouth large, posterior end of maxilla expanded and visible. Lower jaw juts beyond upper. Large teeth visible when mouth open. Greenish or grayish-brown with mottlings of light and dark and often with small black spots. Nearly invisible on sand bottom, but usually detected by darker eyes. When startled, swims with strong sweeps of large tail, moving rapidly.

FIGURE 73. California halibut, *Paralichthys californicus.* *Photograph by Charles Turner.*

FIGURE 73. California halibut, Paralichthys californicus.

Reported to 72 pounds (Skin Diver, 1958) although a 61 ½ pound fish is the largest verified record. This fish was about 5 feet long. Ranges from Quillayute River, British Columbia, to Magdalena Bay, Baja California. An isolated population also occurs in the Gulf of California.

Habitat-Habits: Found buried in sand near rocks, seaweeds, and sand dollar beds, from low tide line to at least 100 feet. Concentrated from 4 to 65 feet. On flat sandy bottom generally seeks irregularity or object such as rock, tin can, or tire near which to burrow with only its eyes and mouth above sand.

Life History Notes: California halibut feed on squid, small fishes including their own species, other flatfishes, Pacific sardines, California grunion, jacksmelt, queenfish, California corbina, walleye surfperch, tubesnout, and kelpfish. They frequent shallower water during periods of grunion runs. They in turn are fed upon by several predaceous animals including Pacific angel sharks, Pacific electric rays, sea lions, and Pacific bottlenose dolphins (Fitch, 1969). Spawning occurs from April through August. Young and juveniles are more common than adults and subadults.

Males mature when 2 or 3 years old, females when 4 or 5. These fish at 5 years of age are about 17 inches long.

Remarks: An excellent food fish sought by anglers, spearfishermen, and commercial fishermen. For additional information see Ginsberg (1952) and Snow and Breuser (1960).

6.93. Diamond turbot, Hypsopsetta guttulata (Girard)

Identification: General flatfish form. Body deep. Mouth, head small. Both eyes on right side of head. Eyes relatively flat without bony ridge between them. Dorsal and anal fins continuous, with longest rays in middle giving fish distinct diamond-shaped outline. Dusky greenish with lighter blotches; lighter and darker areas on dorsal and anal fins. Underside procelain-white with lemon-yellow near mouth. May reach a length of 18 inches. A 375 mm TL female weighted 820 g. Range from Cape Mendocino to Magdalena Bay, Baja, California. An isolated population occurs in the Gulf of California.

Habitat-Habits: Found on or buried in sand, preferably near solid objects, from surface to over 150 feet, concentrated between 4 and 60 feet. Food items are primarily large sand dwelling polychaetous annelids; also isopods; ghost shrimp, Callianassa spp.; barnacles; scaled worm shells; and clam siphon tips. Summer and fall spawning. Eggs pelagic.

Remarks: Common but not abundant. In back bays and sloughs commonly taken on baited hook. Somewhat difficult to prepare but excellent eating. No known relationship to giant kelp.

6.94. C-O turbot, Pleuronichthys coenosus Girard

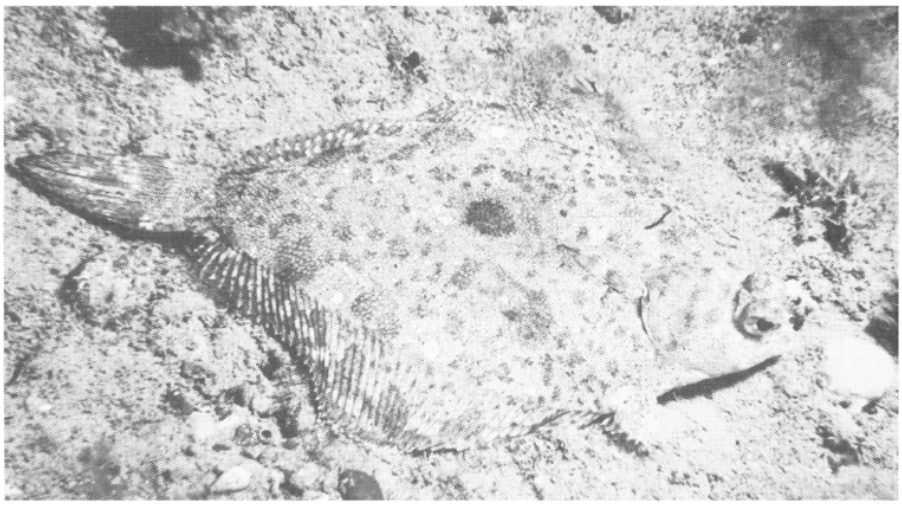

FIGURE 74. C-O turbot, *Pleuronichthys coenosus.* *Photograph by Charles Turner.*

FIGURE 74. C-O turbot, Pleuronichthys coenosus.

Identification: Typical flatfish form. Markedly diamond shaped. Has teeth in lower jaw on eyed side (separating it from its look-alike relative

hornyhead turbot, P. verticalis; lacks a sharp projecting spine on the posterior end of the interorbital ridge. Has an anterior branch to the dorsal accessory lateral line separating it from the curlfin turbot, P. decurrens, another look-alike. A third look-alike, the spotted turbot, P. ritteri, has a narrower caudal peduncle but can best be separated by counting vertebrae. Dark brown, but occasional specimens from bottoms bearing coralline algae are vividly mottled with pink, purple, and yellow as well as brown. Named for dusky crescent partially surrounding circular dark spot on caudal fin. Largest reported was 13 inches (333 mm) and heaviest weighed about 1 pound (431 g). Range from southeast Alaska to Cape Colnett, Baja California.

Habitat-Habits: Occurs on all flat bottoms, but may be in areas with irregular rocky bottoms. Found from surface to 100 feet, but concentrated from 6 to 90 feet. Seldom less than 5 fathoms or deeper than 30, on record at 35 fathoms (Fitch, 1963). Can blend with sandy or rocky substrate.

Life History Notes: Recorded food items include polychaete worms, small crustaceans, clam parts, nudibranch and other opisthobranch mollusks, and small fishes. Eggs pelagic. Young, 1 to 3 inches long, appear throughout year and are often brightly marked with pink, yellow, cream, white, and brown. often assume color of objects in environment rather than color of immediate substrate. For example, a 3 inch fish becomes white or cream if shells of similar size exist within a few feet, although bottom may be dark gray.

Remarks: Commonly taken by spearfishermen. Excellent eating. Occur frequently in kelp beds.

6.95. Kelp clingfish, Rimicola muscarum (Meek and Pierson)

Identification: Body slender, only a little depressed anteriorly; head well depressed. Suction disk on under side. Color generally that of kelp; some banded with light orange. Small, usually measures under 1.5 inches. Recorded from Goose Island, British Columbia, to Point Banda, Baja California. For additional information see Briggs (1955).

Habitat-Habits: Clings tenaciously to kelp with sucker composed chiefly of pelvic fins. Most common in canopy, but occurs at lower levels, even to region of holdfasts. Clings to kelp, moving occasionally to feed or seek cover. Almost invisible because of color.

Life History Notes: Food items primarily small crustaceans. Its relatively large eggs are laid in groups of two dozen or more on fronds of giant kelp, usually between the corrugations on each frond. These eggs are found all year. Young similar in appearance to adults. Kelp clingfish probably spend entire life in kelp beds. They serve, in a small way, as forage for kelp bass, kelp rockfish, and olive rockfish.

6.96. Common mola, Mola mola (Linnaeus)

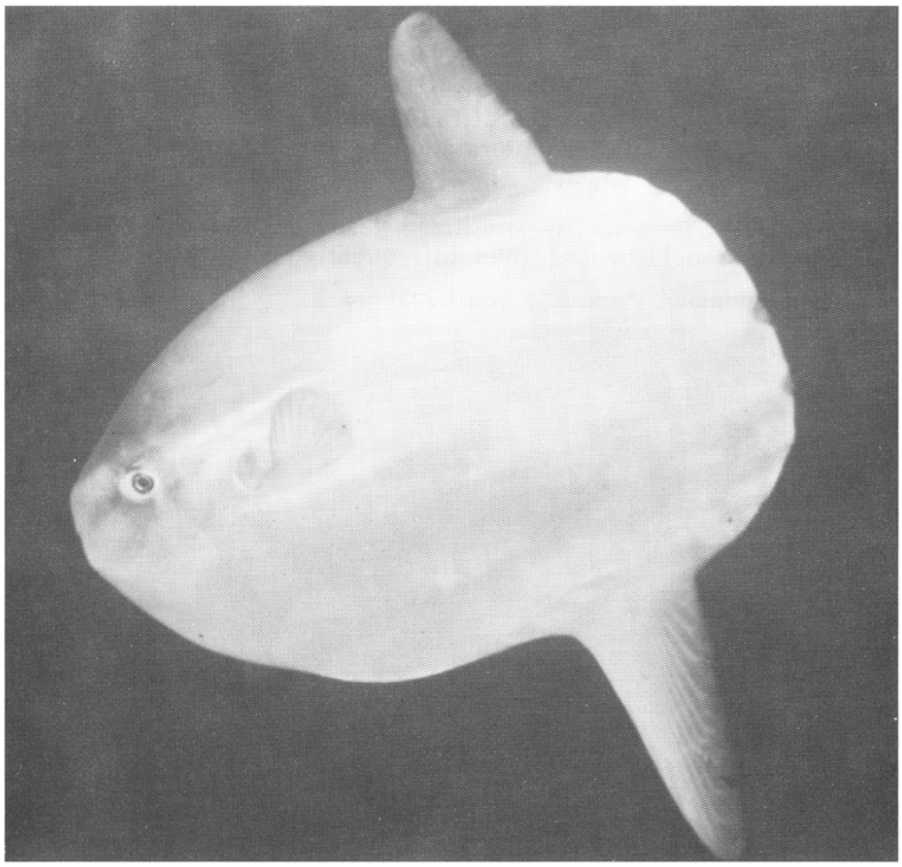

FIGURE 75. Common mola, *Mola mola.* *Photograph by Charles Turner.*

FIGURE 75. Common mola, Mola mola.

Identification: Body unmistakable, unusual shape: nearly round in profile, compressed, with no tail or caudal peduncle. Single narrow high dorsal fin near caudal end. Anal fin similar to dorsal and opposite to it. No pelvic fins. No gill slit; circular opening in front of pectoral fin. Eyes large. Mouth small. No scales, skin appears leathery. Dark gray or blue-gray to pale blue above, silvery on sides and below. Reported to attain 13 feet and 3,300 pounds. Found in warm and tropical seas of the world; in eastern Pacific occurs at least as far north as British Columbia.

Habitat-Habits: Pelagic, but at times (late summer and fall) common along the edges of kelp beds, especially at surface. Recorded by us from the surface to 90 foot depths. Enters kelp beds and allows señoritas to flock around and eat external parasites. Apparently purposely congregate at edges of kelp beds where jellyfishes abound and señoritas are available to eat the parasites. Pelagic individuals permit sea gulls to remove ectoparasites. Leaps clear of water at times, leaving water on side and at angle, and falling back into water on side. Sometimes lies on side at surface.

Life History Notes: Food items include jellyfish; by-the-wind-sailors, Velella lata; salps; and various other plankters. Seasonal population increases coincide with salp populations, presumably one of their major food items. Compared to other pelagic species they are weak swimmers, and are usually observed at or near the surface. When migrating they swim rapidly in small groups of 10 to 15 individuals, 15 to 30 feet beneath the surface. For additional information see Fraser-Brunner (1951) and Gotshall (1961).

Remarks: Flesh very heavily parasitized, gelatinous until cooked. Edible, but seldom sought by fishermen. Infrequently taken by hook and line.

6.97. Plainfin midshipman, Porichthys notatus Girard

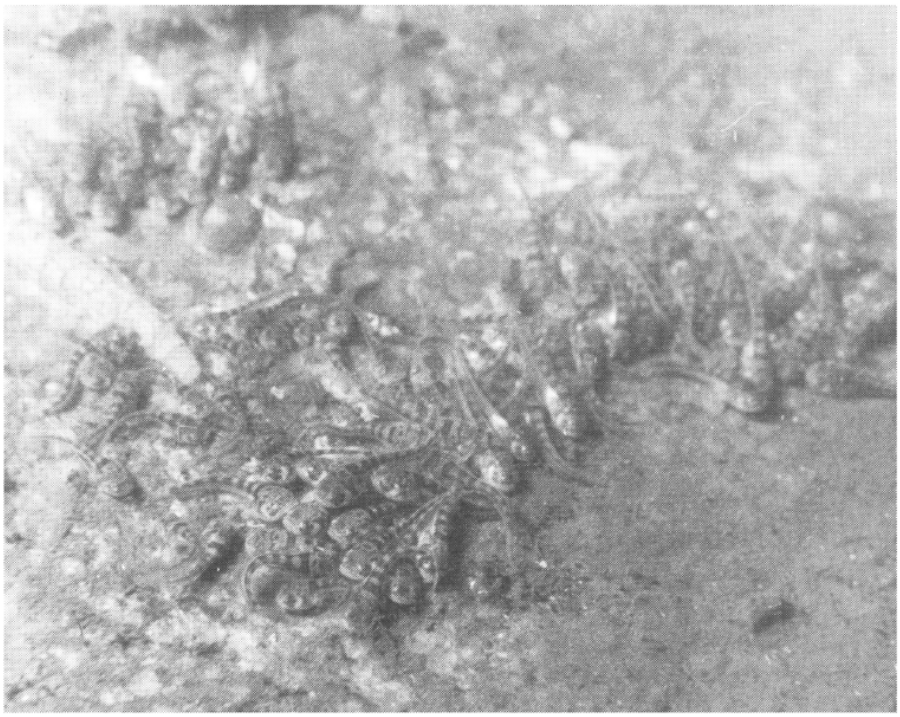

FIGURE 76. A large group of young plainfin midshipman, *Porichthys notatus,* on a rockpile at 60 feet.
Photograph by Charles Turner.

FIGURE 76. A large group of young plainfin midshipman, Porichthys notatus, on a rockpile at 60 feet.

Identification: Scaleless body elongate, cylindrical, deepest over pectorals, tapering smoothly to rather slender caudal peduncle. First dorsal separate, with two small sharp spines. Second dorsal and anal approximately equal in length and extending to base of caudal fin. Pelvic fins in front of pectorals. Caudal fin small, rounded. Head large, broad. Sharp projecting spines on sides of head. Lower jaw jutting beyond upper, mouth directed upward. Teeth well developed. Eyes directed upward. Several rows of pearly-appearing light organs (photophores) on head and body. Usually grayish underwater becoming darker bluish-gray above. Dorsal fin dark; anal fin without dark margin. Lacks speckling on

membranes of dorsal and pectoral fins, which easily separate it from the specklefin midshipman. Further distinguished by absence of dark margin on anal; by photophores under chin forming broad, forward directed [^]; by nearly plain dorsal fin; and by whitish underside. May reach a length of 15 inches. A 13½ inch (340 mm TL) specimen weighed 363 grams (J. E. Fitch, California Department of Fish and Game, pers. commun.). Reported from Sitka, Alaska, to Magdalena Bay, Baja California, and from Gulf of California.

Habitat-Habits: off southern Caifornia, usually found on open sand bottoms 60 feet or more. Enters low intertidal area off northern and central California to spawn. Recorded from low tide to 1,200 foot depths. When annoyed they emit a sharp humming sound or grunts.

Life History Notes: Spawns during late spring and summer at depths ranging from low intertidal to at least 265 feet. The large yellowish eggs (0.5 to 0.75 cm) are attached to the undersides of rocks previously cleaned by the males. The male remains at the nest site, caring for the eggs. Young, recently freed from the nest, seek cover by burrowing in mud or sand. They typically rest on the substrate, either on open sand or in the rocky areas, and are seldom observed swimming in the mid-or surface waters. Characteristically they are found burrowing into the bottom. Male midshipmen, tending eggs, become progressively emaciated directly correlated with egg-larval development. As the larvae approach "term" the adult male becomes progressively more emaciated in appearance, portions of fins often have disappeared and patches necrotic tissue are apparent, possibly the result of having been attacked by Cancer crabs (J. Crane, Cerritos College, pers. commun.). In one instance a dead adult male was found with larvae. These fully developed larvae were in the process of freeing themselves from their yolk sac attachment on the rock. Mortality appears quite extensive among egg tending males, and may account for some of the mass die-offs reported for the species.

Remarks: Plainfin midshipman are occasionally caught by bottom fishermen, but their ugly appearance probably prevents most of them from being eaten. Rarely found in kelp beds.

6.98. Specklefin midshipman, Porichthys myriaster Hubbs and Schultz

Identification: Description same as plainfin midshipman except for following features: membranes on dorsal and pectoral fins speckled; anal fin with distinct dark margin; usually darker colored underwater; and belly quite yellow. Ordinarily in shallow water and in bays, whereas plainfin midshipman is usually in deep water on open bottoms off southern California. Photophores under chin form a forward directed centrally. May attain a length of 19 inches. Recorded from Point Conception, California, to Magdalena Bay, Baja California, and from Bahia de Los Angeles, Gulf of California.

Habitat-Habits: Occurs on sandy mud near rocks from intertidal to 387

feet or deeper. When disturbed, emits characteristic humming or grunting sound.

Life History Notes: Young observed in September off Santa Catalina and Santa Rosa islands from 6 to 20 feet. Breeding habits similar to plainfin midshipman. Eggs slightly smaller and lighter in color. Breeding pairs observed in Anaheim Bay in mid-May.

Remarks: Relatively common, but only sporadically observed. Rarely occurs in kelp beds.

TABLE 1

Some Organisms Observed by Diving in Kelp Canopy Habitat

Scientific name	*Common name*	*Occurrence*		
		typical	*occasional*	*rare*
INVERTEBRATES				
Coelenterata				
Campanularia spp.	hydroid	x		
Sertularella spp.	hydroid	x		
Epiactis prolifera Verrill	prolific anemone	x		
Annelida				
Dexiospira spirillum (Linnaeus)	tube dwelling polychaete worm	x		
Dexiospira rugatus (Bush)	tube dwelling polychaete worm	x		
Spirorbis spp.	tube dwelling polychaete worm	x		
Bryozoa				
Bugula californica Robertson	erect bryozoan		x	
Bugula neritina (Linnaeus)	erect bryozoan	x		
Membranipora membranacea (Linnaeus)	encrusting bryozoan	x		
Membranipora serrilamella Osburn	encrusting bryozoan	x		
Membranipora tuberculata (Bosc)	encrusting bryozoan	x		
Arthropoda				
Balanus pacificus Pilsbry	acorn barnacle		x	
Balanus glandula Darwin	acorn barnacle		x	
Balanus tintinnabulum (Linnaeus)	acorn barnacle	x		
Balanus sp.	acorn barnacle			
Ampithoe humeralis (Stimpson)	gammarid amphipod	x		
Hyale nigra (Haswell)	gammarid amphipod	x		
Pentidotea resecata (Stimpson)	kelp isopod	x		
Mysidopsis californica Tattersall	oppossum shrimp	x		
Taliepus nuttallii (Randall)	southern kelp crab	x		
Pugettia producta (Randall)	common kelp crab	x		
Mollusca				
Aplysia californica Cooper	sea hare	x		
Calliostoma annulatum (Lightfoot)	purple ringed top snail	x		
Lacuna unifasciata Carpenter	one banded lacuna		x	
Chioraera (=Melibe) leonina (Gould)	lion nudibranch	x		
Mitrella carinata (Hinds)	carinate dove snail	x		
Norrisia norrisi (Sowerby)	Norris' top shell	x		
Tegula aureotincta (Forbes)	guilded tegula	x		
Leptopecten monotimeris (Conrad)	kelp scallop	x		
Echinodermata				
Leptasterias hexactis (Stimpson)	six rayed star	x		
VERTEBRATES				
Fishes				
Triakis semifasciata Girard	leopard shark			x
Prionace glauca (Linnaeus)	blue shark			x
Myliobatis californica Gill	bat ray			x
Sardinops sagax caeruleus (Jenyns)	Pacific sardine			x
Anchoa delicatissima (Girard)	slough anchovy			x

TABLE 1
Some Organisms Observed by Diving in Kelp Canopy Habitat

Scientific name	Common name	Occurrence: typical	Occurrence: occasional	Occurrence: rare
Engraulis mordax Girard	northern anchovy			x
Cololabis saira (Brevoort)	Pacific saury			x
Cypselurus californicus (Cooper)	California flyingfish			x
Fundulus parvipinnis Girard	California killifish			x
Aulorhynchus flavidus Gill	tubesnout			x
Syngnathus californiensis Storer	kelp pipefish	x		
Syngnathus sp.	pipefish			x
Mycteroperca jordani (Jenkins & Evermann)	Gulf grouper		x	
Mycteroperca xenarcha Jordan	broomtail grouper		x	
Paralabrax clathratus (Girard)	kelp bass		x	
Paralabrax nebulifer (Girard)	barred sand bass			x
Stereolepis gigas Ayres	giant sea bass		x	
Atherinops affinis (Ayres)	topsmelt	x		
Atherinopsis californiensis Girard	jacksmelt			x
Leuresthes tenuis (Ayres)	California grunion			x
Caulolatilus princeps (Jenyns)	ocean whitefish			x
Sphyraena argentea Girard	California barracuda		x	
Seriola dorsalis (Gill)	yellowtail		x	
Trachurus symmetricus (Ayres)	jack mackerel			x
Scomber japonicus Houttuyn	Pacific mackerel		x	
Anisotremus davidsonii (Steindachner)	sargo			x
Sarda chiliensis (Cuvier)	Pacific bonito			x
Xenistius californiensis (Steindachner)	salema			x
Cynoscion nobilis (Ayres)	white seabass		x	
Brachyistius frenatus Gill	kelp surfperch	x		
Cymatogaster aggregata Gibbons	shiner surfperch			x
Cymatogaster gracilis Tarp	island surfperch			x
Embiotoca jacksoni Agassiz	black surfperch			x
Embiotoca lateralis Agassiz	striped surfperch			x
Hyperprosopon ellipticum (Gibbons)	silver surfperch			x
Hyperprosopon argenteum Gibbons	walleye surfperch			x
Hypsurus caryi (Agassiz)	rainbow surfperch			x
Phanerodon furcatus Girard	white surfperch			x
Rhacochilus toxotes Agassiz	rubberlip surfperch			x
Damalichthys vacca (Girard)	pile surfperch			x
Chromis punctipinnis (Cooper)	blacksmith		x	
Hypsypops rubicunda (Girard)	garibaldi			x
Pimelometopon pulchrum (Ayres)	California sheephead			x
Oxyjulis californica (Günther)	señorita		x	
Girella nigricans (Ayres)	opaleye		x	
Hermosilla azurea Jenkins & Evermann	zebra perch			x
Medialuna californiensis (Steindachner)	halfmoon		x	
Sebastes atrovirens (Jordan & Gilbert)	kelp rockfish		x	
Sebastes mystinus (Jordan & Gilbert)	blue rockfish		x	
Sebastes rastrelliger (Jordan & Gilbert)	grass rockfish			x

TABLE 1—Cont'd.

Scientific name	Common name	Occurrence: typical	Occurrence: occasional	Occurrence: rare
Sebastes serranoides (Eigenmann & Eigenmann)	olive rockfish		x	
Scorpaenichthys marmoratus (Ayres)	cabezon			x
Synchirus gilli Bean	manacled sculpin	x		
Heterostichus rostratus Girard	giant kelpfish		x	
Gibbonsia metzi Hubbs	striped kelpfish		x	
Ulvicola sanctaerosae Gilbert & Starks	kelp gunnel	x		
Xererpes fucorum (Jordan & Gilbert)	rockweed gunnel		x	
Rimicola muscarum (Meek & Pierson)	kelp clingfish	x		
Mola mola (Linnaeus)	common mola			x

TABLE 1—Cont'd.

TABLE 2

Some Organisms Observed by Diving in Mid-Kelp Habitat

Scientific name	*Common name*	*Occurrence*		
		Characteristic	*Frequent*	*Occasional*
PLANTS				
Algae				
Cystoseira osmundacea (Turner) C. Argardh	brown alga			x
Egregia laevigata Setchell	feather boa		x	
Pelagophycus porra (Leman) Setchell	elk kelp		x	
INVERTEBRATES				
Coelenterata				
Campanularia spp.	hydroid		x	
Obelia spp.	hydroid		x	
Sertularella sp.	hydroid		x	
Epiactis prolifera Verrill	prolific anemone			x
Ctenophora				
Beroe sp.	—	(planktonic)		x
Pleurobrachia sp.	sea walnut	(planktonic)		x
Annelida				
Spirorbis sp.	tube dwelling polychaete worm		x	
Bryozoa				
Bugula neritina (Linnaeus)	erect bryozoan		x	
Membranipora membranacea (Linnaeus)	encrusting bryozoan	x		
Membranipora serrilamella Osburn	encrusting bryozoan	x		
Arthropoda				
Balanus tintinnabulum (Linnaeus)	acorn barnacle			x
Ampithoe humeralis (Stimpson)	gammarid amphipod		x	
Hyale nigra (Haswell)	gammarid amphipod		x	
Caprellidae (family)	skeleton shrimp			x
Pentidotea resecata (Stimpson)	kelp isopod		x	
Paracerceis sp.	isopod	x		
Mysidopsis californica Tattersall	oposum shrimp			x
Spirontocaris sp.	broken back shrimp			x
Taliepus nuttallii Randall	southern kelp crab			x
Pugettia producta (Randall)	common kelp crab		x	
Loxorhynchus grandis Stimpson	sheep crab			x
Mollusca				
Chioraera (=Melibe) leonina (Gould)	lion nudibranch			x
Aplysia californica Cooper	sea hare			x
Norrisia norrisi (Sowerby)	Norris' top snail		x	
Tegula aureotincta (Forbes)	gilded tegula			x
Calliostoma annulatum (Lightfoot)	purple ringed top snail		x	
Lacuna unifasciata Carpenter	one banded lacuna		x	
Mitrella carinata (Hinds)	carinate dove snail	x		
Leptopecten monotimeris (Conrad)	kelp scallop	x		
Echinodermata				
Leptasterias hexactis (Stimpson)	six rayed star			x
VERTEBRATES				
Fishes				
Triakis semifasciata Girard	leopard shark			x
Myliobatis californica Gill	bat ray			x

TABLE 2
Some Organisms Observed by Diving in Mid-Kelp Habitat

Scientific name	Common name	Occurrence: Characteristic	Occurrence: Frequent	Occurrence: Occasional
Sardinops sagax caeruleus (Jenyns)	Pacific sardine			x
Engraulis mordax Girard	northern anchovy		x	
Aulorhynchus flavidus Gill	tubesnout			x
Syngnathus californiensis Storer	kelp pipefish			x
Cololabis saira (Brevoort)	Pacific saury			x
Mycteroperca jordani (Jenkins and Evermann)	Gulf grouper			
Mycteroperca xenarcha Jordan	broomtail grouper			
Paralabrax clathratus (Girard)	kelp bass	x		
Paralabrax nebulifer (Girard)	barred sand bass			
Stereolepis gigas Ayres	giant sea bass			
Sphyraena argentea Girard	Pacific barracuda		x	
Seriola dorsalis (Gill)	yellowtail		x	
Trachurus symmetricus (Ayres)	jack mackerel			
Scomber japonicus Houttuyn	Pacific mackerel			
Anisotremus davidsonii (Steindachner)	sargo		x	
Xenistius californiensis (Steindachner)	salema			
Cheilotrema saturnum (Girard)	black croaker			
Cynoscion nobilis (Ayres)	white seabass			
Seriphus politus Ayres	queenfish			
Caulolatilus princeps (Jenyns)	ocean whitefish			
Brachyistius frenatus Gill	kelp surfperch	x		
Cymatogaster aggregata Gibbons	shiner surfperch		x	
Cymatogaster gracilis Tarp	island surfperch			
Embiotoca jacksoni Agassiz	black surfperch			
Embiotoca lateralis (Agassiz)	striped surfperch			
Hyperprosopon argenteum Gibbons	walleye surfperch			
Hyperprosopon ellipticum (Gibbons)	silver surfperch			
Hypsurus caryi (Agassiz)	rainbow surfperch			
Micrometrus minimum (Gibbons)	dwarf surfperch			
Phanerodon furcatus Girard	white surfperch	x		
Rhacochilus toxotes Agassiz	rubberlip surfperch	x		
Damalichthys vacca (Girard)	pile surfperch			
Chromis punctipinnis (Cooper)	blacksmith	x		
Hypsypops rubicunda (Girard)	garibaldi		x	
Halichoeres semicinctus (Ayres)	rock wrasse		x	
Oxyjulis californica (Günther)	señorita	x		
Pimelometopon pulchrum (Ayres)	California sheephead		x	
Girella nigricans (Ayres)	opaleye	x		
Medialuna californiensis (Stendachner)	halfmoon	x		
Sebastes atrovirens (Jordan and Gilbert)	kelp rockfish			
Sebastes mystinus (Jordan and Gilbert)	blue rockfish			
Sebastes rastrelliger (Jordan and Gilbert)	grass rockfish			
Sebastes serranoides (Eigenmann and Eigenmann)	olive rockfish			

TABLE 2—Cont'd.

Scientific name	Common name	Occurrence: Characteristic	Occurrence: Frequent	Occurrence: Occasional
Scorpaenichthys marmoratus (Ayres)	cabezon			x
Lethops connectens Hubbs	kelp goby			
Gibbonsia metzi Hubbs	striped kelpfish		x	
Heterostichus rostratus Girard	giant kelpfish	x		
Ulvicola sanctaerosae Gilbert and Starks	kelp gunnel		x	
Xererpes fucorum (Jordan and Gilbert)	rockweed gunnel	x		
Atherinops affinis (Ayres)	topsmelt	x		
Atherinopsis californiensis Girard	jacksmelt		x	
Leuresthes tenuis (Ayres)	California grunion			x
Rimicola muscarum (Meek & Pierson)	kelp clingfish	x		
Mola mola (Linnaeus)	common mola	Occasional to rare		

TABLE 2—Cont'd.

TABLE 3

Organisms Frequently Seen by Scuba Divers in Kelp Bed Sand Bottom Habitat

Scientific name	*Common name*	*Typical habitat*
INVERTEBRATES		
Coelenterata		
Pelagia panopyra (Peron and Leseur)	purple striped jellyfish	Nearshore pelagic.
Renilla köllikeri Pfeffer	sea pansy	Fine to medium sand bottom, slightly turbulent water, 0–100 feet.
Polyorchis sp.	jellyfish	Nearshore, surface to 150 feet (planktonic).
cerianthid anemones	tube anemone	Sand over solid substrate, 8 to at least 100 feet.
Edwardsiella californica McMurrich	sand anemone	Sand bottom, intertidal to 45 feet.
Ctenophora		
Pleurobrachia sp.	sea walnut	Plantonic, at thermocline.
Annelida		
Diopatra ornata Moore	tubeworm	Sand-mud bottom, 20–150 feet.
Chaetopterus variopedatus (Renier)	parchment tubeworm	Sand-mud to rock bottom, 10–150 feet.
Terebellidae (family)	polychaete worm	Sand-mud bottom, intertidal to 150 feet.
Eudistylia polymorpha (Johnson)	featherduster worm	Rocky substrate, intertidal to 210 feet.
Serpulidae (family)	polychaete worm	On solid surfaces, intertidal to 180 feet.
Bryozoa		
Diaperoecia californica (d'Orbigny)	erect bryozoan	Rocks and holdfasts, 1–100 feet.
Membranipora serrilamella Osburn	encrusting bryozoan	Blades of seaweeds, intertidal to 90 feet.
Phidolopora pacifica (Robertson)	erect bryozoan	Rocks and holdfasts, intertidal to 100 feet.
Arthropoda		
Holopagurus pilosus Holmes	sand burrowing hermit crab	Intertidal to 35 feet.
Pagurus ochotensis Brandt	hermit crab	Sand, 18–65 feet.
Blepharipoda occidentalis Randall	spiny mole crab	Fine-medium sand, 8–45 feet.
Cancer gracilis Dana	slender crab	Mud, medium sand, 8–65 feet.
Heterocrypta occidentalis Dana	elbow crab	Medium sand, 10–45 feet.
Loxorhynchus crispatus Stimpson	masking crab	Sand and rocks, 15–165 feet.
Loxorhynchus grandis Stimpson	sheep crab	Sand and rocks, 10 feet–70 feet.
Randallia ornata (Randall)	purple globe crab	Medium sand, 15–45 feet.

TABLE 3
Organisms Frequently Seen by Scuba Divers in Kelp Bed Sand Bottom Habitat

Scientific name	*Common name*	*Typical habitat*
Mollusca		
Acteon punctocaelatus (Carpenter)	barrel shell	Fine to coarse sand, intertidal to 60 feet.
Armina californica (Cooper)	nudibranch	Fine to medium sand, intertidal to 290 feet.
Bursa californica (Hinds)	California frog shell	Fine sand-gravel, 35–200 feet.
Conus californicus Hinds	California cone	Sand-rocks, intertidal to 180 feet.
Kelletia kelletii (Forbes)	Kellet's whelk	Fine sand-rock, intertidal to 100 feet.
Megasurcula carpenteriana (Gabb)	Carpenter's turrid	Fine sand-gravel, 45–130 feet.
Nassarius fossatus (Gould)	channeled nassa	Fine medium sand, intertidal to 45 feet.
Norrisia norrisi (Sowerby)	Norris' top snail	Brown algae, 1–100 feet.
Olivella biplicata (Sowerby)	purple olivella	Fine-medium sand, intertidal to 50 feet.
Olivella baetica Carpenter	beatic olivella	Mud-medium sand, intertidal to 110 feet.
Polinices draconis (Dall)	Drake's moon snail	Fine sand-medium sand, intertidal to 45 feet.
Echinodermata		
Astropecten basiliensis armatus Gray	sand star	Mud-medium sand bottom, intertidal to 600 feet.
Luidia foliolata (Grube)	sand star	Mud-fine sand, 50 feet to at least 550 feet.
Unidentified brittle stars (Class Ophiuroidea)	—	Mud-medium sand, intertidal to at least 210 feet.
Dendraster excentricus (Eschscholtz)	sand dollar	Medium sand, surface to 65 feet.
Molpadia arenicola (Stimpson)	"sweet potato" cucumber	Medium sand or mud, intertidal to 100 feet.
Leptosynapta albicans (Selenka)	sea cucumber	Fine-coarse sand, intertidal to 100 feet.
Parastichopus californicus (Stimpson)	California sea cucumber	Sand or rock, 30–190 feet.
Lytechinus anamesus Agassiz and Clark	white sea urchin	Sand bottom, 20 feet–100 feet.
Cephalochordata		
Branchiostoma californiense (Cooper)	lancelet	Mud-sand bottom.
VERTEBRATES		
Fishes		
Triakis semifasciata Girard	leopard shark	Shallow flat bottom.
Squatina californica Ayres	Pacific angel shark	Sand bottom.
Platyrhinoidis triseriata (Jordan and Gilbert)	thornback	Sand bottom.
Rhinobatos productus (Ayres)	shovelnose guitarfish	Shallow sand bottom.

TABLE 3—Cont'd.

Scientific name	*Common name*	*Typical habitat*
Dasyatis dipterurus (Jordan and Gilbert)	diamond stingray	Sand bottom.
Torpedo californica Ayres	Pacific electric ray	Mud and sand.
Urolophus halleri Cooper	round stingray	Sand or mud bottom.
Myliobatis californica Gill	bat ray	Mud, sand, or rock bottom.
Sardinops sagax caeruleus (Jenyns)	Pacific sardine	Nearshore pelagic.
Engraulis mordax Girard	northern anchovy	Nearshore pelagic.
Aulorhynchus flavidus Gill	tubesnout	Seaweeds.
Syngnathus spp.	kelp pipefish	Seaweeds.
Synodus lucioceps (Ayres)	California lizardfish	Sand-mud bottom.
Paralabrax clathratus (Girard)	kelp bass	Rocky bottom.
Paralabrax maculatofasciatus (Steindachner)	spotted sand bass	Eelgrass beds.
Paralabrax nebulifer (Girard)	barred sand bass	Rocks near sand.
Anisotremus davidsonii (Steindachner)	sargo	Rocky bottom.
Menticirrhus undulatus (Girard)	California corbina	Shallow sand bottom.
Roncador stearnsii (Steindachner)	spotfin croaker	Sand bottom.
Seriphus politus Ayres	queenfish	Fine sand bottom.
Umbrina roncador Jordan and Gilbert	yellowfin croaker	Sand bottom.
Medialuna californiensis (Steindachner)	halfmoon	Rocks and seaweeds.
Girella nigricans (Ayres)	opaleye	Seaweeds and rocks.
Brachyistius frenatus (Gill)	kelp surfperch	Kelp beds.
Embiotoca jacksoni Agassiz	black surfperch	Seaweeds in bays and along coast.
Embiotoca lateralis Agassiz	striped surfperch	Rocky bottom.
Hyperprosopon argenteum Gibbons	walleye surfperch	Shallow rock and sand areas.
Hyperprosopon ellipticum (Gibbons)	silver surfperch	Shallow rock and sand areas.
Hypsurus caryi (Agassiz)	rainbow surfperch	Rocky bottom.
Phanerodon furcatus Girard	white surfperch	Rocky bottom.
Rhacochilus toxotes Agassiz	rubberlip surfperch	Seaweeds.
Damalichthys vacca (Girard)	pile surfperch	Rocky bottom.
Chromis punctipinnis (Cooper)	blacksmith	Rocks.
Oxyjulis californica (Günther)	señorita	Rocks and seaweeds.
Pimelometopon pulchrum (Ayres)	California sheephead	Rocks.
Scomber japonicus (Houttuyn)	Pacific mackerel	Pelagic.
Coryphopterus nicholsi (Bean)	blackeye goby	Sand near rocks.
Sebastes atrovirens (Jordan and Gilbert)	kelp rockfish	Rocky bottom.
Sebastes paucispinis (Ayres)	bocaccio	Deep rock bottom.
Sebastes serranoides (Eigenmann and Eigenmann)	olive rockfish	Rocky bottom.
Leiocottus hirundo Girard	lavender sculpin	Sand near rocks.
Scorpaenichthys marmoratus (Ayres)	cabezon	Rocky bottom.
Heterostichus rostratus Girard	giant kelpfish	Seaweeds.
Neoclinus blanchardi Girard	sarcastic fringehead	Sand-mud bottom.
Xererpes fucorum (Jordan and Gilbert)	rockweed gunnel	Shallow water, seaweeds.
Atherinops affinis (Ayres)	topsmelt	Kelp canopy.
Atherinopsis californiensis Girard	jacksmelt	Nearshore pelagic.

TABLE 3—Cont'd.

Scientific name	*Common name*	*Typical habitat*
Citharichthys sordidus (Girard)	Pacific sanddab	Deep sand-mud bottom.
Citharichthys stigmaeus Jordan and Gilbert	speckled sanddab	Sand-mud bottom.
Hypsopsetta guttulata (Girard)	diamond turbot	Sand bottom.
Paralichthys californicus (Ayres)	California halibut	Sand-mud bottom.
Pleuronichthys coenosus Girard	C-O turbot	Rocky and sandy bottom.
Xystreurys liolepis Jordan & Gilbert	fantail sole	Sandy-mud bottom.
Rimicola muscarum (Meek & Pierson)	kelp clingfish	Kelp canopy.

TABLE 3—Cont'd.

TABLE 4

Some Organisms Observed by Diving in Kelp Bed Rock Bottom Habitat

Scientific name	*Common name*	*Preferred habitats with approximated depth distributions*
PLANTS		
Algae		
Chaetomorpha torta (Collins) Yendo	green alga	Epiphytic; entwined around other algae, intertidal to 30 feet.
Codium cuneatum Setchell & Gardner	green alga	Nearshore irregular rocky bottom, 5–60 feet.
Codium fragile (Suringar) Hariot	green alga	Rocky bottom, intertidal to 10 feet.
Codium setchellii Gardner	green alga	On rocks, commonly under kelp canopy in areas of encrusting coralline bottom, 30–75 feet.
Agarum fimbriatum Harvey	brown alga	On rocks, 40–100 feet.
Alaria marginata Postels and Ruprecht	brown alga	Intertidal to 50 feet.
Cystoserira osmundacea (Turner) C. Agardh	brown alga	Rock bottom, intertidal to 100 feet.
Desmarestia munda Setchell and Gardner	brown alga	Rocky bottom, moderate surge 20–60 feet.
Dictyota spp.	brown alga	Intertidal to 115 feet.
Dictyopteris zonarioides Farlow	brown alga	Intertidal to 115 feet.
Eisenia arborea Areschoug	brown alga	Rough rock bottom, intertidal to 115 feet.
Halidrys dioica Gardner	brown alga	Rock bottom, intertidal to 100 feet.
Laminaria farlowii Setchell	brown alga	Flat rock bottom, 30–100 feet.
Macrocystis pyrifera (Linnaeus) C. Agardh	giant kelp	Rock bottom, sand bottom, intertidal—100 feet.
Nereocystis leutkeana (Mertens) Postels and Ruprecht	bull kelp	Rock bottom, sand bottom, 10–60 feet.
Pachydictyon coriaceum (Holmes)	brown	Intertidal to 65 feet.
Pelagophycus porra (Leman) Setchell	elk kelp	Rock bottom, 40–100 feet.
Egregia laevigata Setchell	feather boa	Flat rocks, intertidal to 30 feet.
Pterygophora californica Ruprecht	brown alga	Rough rock bottom, 30–100 feet.
Zonaria farlowii Setchell and Gardner	brown alga	Intertidal to 50 feet.

TABLE 4
Some Organisms Observed by Diving in Kelp Bed Rock Bottom Habitat

Scientific name	*Common name*	*Preferred habitats with approximated depth distributions*
Calliarthron spp., *Bossiella* spp. and *Corallina* spp.	articulated corralline algae	Irregular rocks, intertidal to 100 feet.
Gelidium spp.	red algae	Rocky, well circulated areas, intertidal to 75 feet.
Gigartina spp.	red algae	Rock bottom, intertidal to 45 feet.
Lithothamnion spp.	encrusting coralline algae	Rocky bottom, 20–75 feet.
Lithophyllum imitans Foslie	red alga	Rocks and shells 10–75 feet.
Rhodymenia pacifica Kylin and *Rhodymenia* spp.	red alga	Rock bottom, intertidal 115 feet.
Flowering Plants		
Phyllospadix torreyi S. Watson	Torrey's surfgrass	On rocks, intertidal 50 feet.
Zostera marina Linnaeus	eelgrass	Sand & mud, to 75 feet.
INVERTEBRATES		
Porifera		
Cliona celata Grant	burrowing sponge	Shells, 60–130 feet.
Geodia mesotriaena Lendenfeld	sponge	Flat rock bottom, 60–100 feet.
Rhabdodermella nuttingi Urban	urn sponge	Rocks, surface to 90 feet.
Spheciospongia confoederata de Laubenfels	sponge	In tunnels and crevices, intertidal to 40 feet.
Hemectyon hyle de Laubenfels	sponge	Sides of rocks, 85–225+ feet.
Verongia aurea (Lamouroux)	sulphur sponge	Sides of rocks, intertidal to 200+ feet.
Coelenterata		
Aglaophenia struthionides (Murray)	ostrich plume hydroid	Irregular rocky bottom, 20–130 feet.
Polyorchis sp.	jellyfish	Planktonic, nearshore intertidal to 150 feet.
Pelagia panopyra (Peron & Leseur)	purple striped jellyfish	Planktonic, nearshore, intertidal to 100 feet.
Eugorgia rubens Verrill	purple fan gorgonian	Deep rocks, 60–570 feet.
Lophogorgia chilensis (Verrill)	pink sea whip	Cold water, rocks, 35–570 feet.
Muricea californica Verrill	California rust gorgonian	Rocks, intertidal to 570 feet.
Muricea fruticosa Verrill	bushy rust gorgonian	Rocks, intertidal to 570 feet.
Astrangia sp.	colonial cup coral	Rocks, intertidal to 70 feet.
Balanophyllia elegans Verrill	solitary coral	Rocks, intertidal to 200+ feet.
Cerianthid anemones	tube anemone	Sand near rocks, 8–200+ feet.

TABLE 4—Cont'd.

Scientific name	*Common name*	*Preferred habitats with approximated depth distributions*
Epiactis prolifera Verrill	prolific anemone	Rocks and seaweeds, intertidal to 90 feet.
Tealia lofotensis (Danielssen)	anemone	Rocks.
Platyhelminthes		
Unidentified flatworms (Class Turbellaria)	—	Small dark crevices, under rocks, intertidal to 200+ feet.
Annelida		
Eudistylia polymorpha (Johnson)	featherduster worm	Rocky, intertidal to 210 feet.
Sabellaria cementarium Moore	honeycomb worm	Rocks near sand, surge, intertidal to 35 feet.
Serpula vermicularis Linnaeus	tube dwelling polychaete worm	Rock surfaces, intertidal to 65 feet.
Spirorbis sp.	tube dwelling polychaete worm	Solid surfaces, intertidal to 180 feet.
Sipunculoidea		
Unidentified sipunculids	peanut worms	Sand among rocks, intertidal to 40 feet.
Bryozoa		
Diaperoecia sp.	erect bryozoan	Rock crevices, intertidal to 100 feet.
Membranipora serrilamella Osburn	encrusting bryozoan	Blades of seaweeds, intertidal to 90 feet.
Phidolopora pacifica (Robertson)	erect bryozoan	Rock crevices, intertidal to 100 feet.
Tubulipora sp.	erect bryozoan	Rock crevices, intertidal to 100 feet.
Brachiopoda		
Terebratalia transversa (Sowerby)	lamp shell	Sides of rocks, cold water, 40–110 feet.
Terebratulina unguicula (Carpenter)	lamp shell	Sides of rocks, 30–190 feet.
Arthropoda		
Balanus spp.	acorn barnacles	Solid substrate, intertidal to 250+ feet.
Amphipoda (several families)	—	Particular seaweeds, intertidal to 150+ feet.
Amphipoda (Caprellidae)	skeleton shrimp	Seaweeds, hydroids, gorgonians, intertidal to 50 feet.
Pentidotea resecata (Stimpson)	kelp isopod	Seaweeds, intertidal to 50 feet.
Limnoria algarum Menzies	kelp burrowing isopod	Seaweed holdfasts, 35–110 feet.
Betaeus harfordi (Kingsley)	abalone shrimp	Intertidal to 130 feet.
Alpheus (=Crangon) sp.	pistol shrimp	Rocks, intertidal to 100 feet.
Hippolysmata californica Stimpson	red-rock shrimp	Crevices, intertidal to 130 feet.
Spirontocaris sp.	broken back shrimp	Seaweeds, rocks, intertidal to 30 feet.

TABLE 4—Cont'd.

Scientific name	*Common name*	*Preferred habitats with approximated depth distributions*
Panulirus interruptus (Randall)	California spiny lobster	Rock crevices, intertidal to 200+ feet.
Cancer antennarius Stimpson	rock crab	Rocks and sand, intertidal to 65 feet.
Cancer productus (Randall)	red crab	Rocks and sand, to 65 feet.
Taliepus nuttallii Randall	southern kelp crab	Rock crevices, intertidal to 90 feet.
Pugettia producta (Randall)	common kelp crab	Mid-kelp and canopy, intertidal to 130 feet.
Loxorhynchus crispatus Stimpson	masking crab	Sand and rock, 15–165 feet.
Loxorhynchus grandis Stimpson	sheep crab	Rocks, 10–70 feet.
Paguristes turgidus (Stimpson)	hairy hermit crab	Flat rocks, 25–100 feet.
Paraxanthias taylori (Stimpson)	lumpy crab	rocks, intertidal to 150 feet.
Petrolisthes spp.	porcelain crabs	Crevices, intertidal to 150 feet.
Mollusca		
Adula falcata (Gould)	falcate date mussel	In rocks, intertidal to 40 feet.
Hinnites multirugosus (Gale)	rock scallop	Protected crevices, intertidal to 160 feet.
Leptopecten monotimeris (Conrad)	kelp scallop	Seaweed, intertidal to 120 feet.
Lima hemphilli Hertlein & Strong	file shell	Holdfasts, intertidal to 150 feet.
Lithophaga plumula (Hanley)	date mussel	In rocks and shells, intertidal to 250+ feet.
Penitella penita (Conrad)	flap tipped piddock	Rocks, intertidal to 60 feet.
Pododesmus cepio (Gray)	abalone jingle	Rocks, 10–90 feet.
Semele decisa (Conrad)	clipped semele	Sand between rocks, 15–60 feet.
Aplysia californica Cooper	sea hare	Seaweeds and rocks, intertidal to 45 feet.
Cadlina marginata MacFarland	nudibranch	Rocks, 20–110 feet.
Chiroraera (=Melibe) leonina Gould	lion nudibranch	Kelp, intertidal to 35 feet.
Chromodoris californiensis Bergh	nudibranch	Rocks, intertidal to 40 feet.
Dendrodoris fulva (MacFarland)	nudibranch	rocks, 10–50 feet.
Diaulula sandiegensis (Cooper)	circle spotted nudibranch	Rocks, intertidal to 100 feet.
Flabellionsis iodinea (Cooper)	nudibranch	Rocks, intertidal to 40 feet.
Acmaea mitra Rathke	white cap limpet	*Lithothamnion,* cold water, 40–100 feet.
Serpulorbis squamigerus (Carpenter)	scaled worm shell	Flat rock, intertidal to 90 feet.
Astraea gibberosa (Dillwyn)	red turban	Rocks, cold water, 45–75 feet.

TABLE 4—Cont'd.

Scientific name	*Common name*	*Preferred habitats with approximated depth distributions*
Astraea undosa (Wood)	wavy turban	Rocks, intertidal to 45 feet.
Bursa californica (Hinds)	California frog shell	Fine sand, 35–200 feet.
Calliostoma canaliculatum (Lightfoot)	channeled top snail	Seaweeds and rocks, 40–90 feet.
Haliotis kamschatkana assimilis (Dall) McLean	threaded abalone	Rocks, 30–90 feet.
Haliotis corrugata Wood	pink abalone	Rocks, 15–65 feet.
Haliotis fulgens Philippi	green abalone	Rocks, intertidal to 35 feet.
Haliotis rufescens Swainson	red abalone	Rocks, 30–100 feet.
Kelletia kelletii (Forbes)	Kellet's whelk	Rocks, intertidal to 100 feet.
Megathura crenulata (Sowerby)	ginat keyhole limpet	Rocks, intertidal to 100 feet.
Mitra idae Melville	Ida's miter	Rocks, intertidal to 200 feet.
Mitrella carinata Hinds	carinate dove snail	Rocks and seaweeds, intertidal to 110 feet.
Norrisia norrisi (Sowerby)	Norris' top shell	Brown algae, intertidal to 100 feet.
Dendropoma lituella (Morch)	snail	Flat rocks, intertidal to 90 feet.
Tegula aureotincta (Forbes)	gilded tegula	Seaweeds, intertidal to 40 feet.
Cypraea spadicea Swainson	chestnut cowry	Rock crevices, intertidal to 90 feet.
Unidentified octopus	—	Various habitats, intertidal to 250 feet.
Echinodermata		
Astrometis sertulifera Xantus	sea star	Rock crevices, intertidal to 200 feet.
Dermasterias imbricata (Grube)	leather star	Rocks, cold water, 25–300 feet.
Evasterias troschelii (Stimpson)	sea star	65–240 feet.
Henricia spp.	sea star	Rocks, 35–110 feet.
Leptasterias hexactis (Stimpson)	six rayed star	Kelp fronds, intertidal to 65 feet.
Linckia columbiae Gray	sea star	Flat rocks, intertidal to 240 feet.
Mediaster aequalis Stimpson	vermilion star	Rocks, cold water, 65–140 feet.
Patiria minata (Brandt)	sea bat (sea star)	Rocks and sand, intertidal to 60+ feet.
Pisaster giganteus (Stimpson)	sea star	Rocks, intertidal to 285 feet.
Pycnopodia helianthoides (Brandt)	sunflower star	Rock, 60–200+ feet.
Ophiothrix spiculata LeConte	spiny brittlestar	Rocky bottom, holdfasts, intertidal to 150 feet.
Lytechinus anamesus Agassiz and Clark	white sea urchin	Sand bottom, 20–100 feet.
Strongylocentrotus franciscanus (A. Agassiz)	giant red sea urchin	Irregular rocks, intertidal to 110 feet.

TABLE 4—Cont'd.

Scientific name	*Common name*	*Preferred habitats with approximated depth distributions*
Strongylocentrotus purpuratus (Stimpson)	purple sea urchin	Irregular rocks, intertidal to 110 feet.
Cucumaria sp.	sea cucumber	Seaweeds, rocks, 20–90 feet.
Parastichopus californicus (Stimpson)	California sea cucumber	Rocks, sand 60–190 feet.
Parastichopus parvimensis (Clark)	southern sea cucumber	Rocks, intertidal to 65 feet.
Urochordata		
Metandrocarpa dura (Ritter)	social ascidian (tunicate)	Seaweed, 25–75 feet.
Styela montereyensis (Dall)	solitary ascidian (tunicate)	Rocks, intertidal to 50 feet.
Cephalochordata		
Branchiostoma californiense (Cooper)	lancelet	Sand, mud, intertidal to 100 feet.
VETEBRATES		
Fishes		
Heterodontus francisci (Girard)	horn shark	Rock, 8–35 feet.
Cephaloscyllium ventriosum (Garman)	swell shark	Rock, 40–75 feet.
Triakis semifasciata Girard	Leopard shark	Cobble, 4–25 feet.
Squatina californica Ayres	Pacific angel shark	Sand, 40–100 feet.
Platyrhinoidis triseriata (Jordan and Gilbert)	thornback	Sand, 3–98 feet.
Rhinobatos productus (Ayres)	shovelnose guitarfish	Sand, 3–45 feet.
Zapteryx exasperata (Jordan and Gilbert)	banded guitarfish	Rocks, 8–30 feet.
Torpedo californica Ayres	Pacific electric ray	Sand, 40–100 feet.
Dasyatis dipterurus (Jordan and Gilbert)	diamond stingray	Sand near rocks, 5–11 feet.
Urolophus halleri Cooper	round stingray	Sand, mud, 3–50 feet.
Myliobatis californica Gill	bat ray	Sand patches in rocks, 8–100 feet.
Sardinops sagax caeruleus (Jenyns)	Pacific sardine	Nearshore, pelagic, intertidal to 90 feet.
Engraulis mordax Girard	northern anchovy	Nearshore, pelagic intertidal to 600 feet.
Gymnothorax mordax (Ayres)	California moray	Rock crevices, 2–65 feet.
Aulorhynchus flavidus Gill	tubesnout	Seaweeds, 8–80 feet.
Syngnathus arctus (Jenkins & Evermann)	snubnose pipefish	Coralline algae, 10–45 feet.
Syngnathus californiensis Storer	kelp pipefish	*Macrocystis,* intertidal to 30 feet.
Mycteroperca jordani (Jenkins & Evermann)	Gulf grouper	Rocks, kelp, 32–50 feet.
Mycteroperca xenarcha Jordan	broomtail grouper	Rocks, kelp, 12–50 feet.
Paralabrax clathratus (Girard)	kelp bass	Rocks, kelp, 2–150 feet.

TABLE 4—Cont'd.

Scientific name	*Common name*	*Preferred habitats with approximated depth distributions*
Paralabrax maculatofasciatus (Steindachner)	spotted sand bass	Eelgrass; bays, 8–18 feet; open ocean 35–60 feet.
Paralabrax nebulifer (Girard)	barred sand bass	Rocks, kelp, 17–150 feet.
Stereolepis gigas Ayres	giant sea bass	Rocks, 18–150 feet.
Cauloolatilus princeps (Jenyns)	ocean whitefish	Rocks, kelp, 10–150 feet.
Seriola dorsalis (Gill)	yellowtail	Nearshore pelagic, 10–25 feet.
Trachurus symmetricus (Ayres)	jack mackerel	Nearshore pelagic, 4–140 feet.
Anisotremus davidsonii (Steindachner)	sargo	Rocks, 8–75 feet.
Xenistius californiensis (Steindachner)	salema	Rocks, seaweed, 4–35 feet.
Cheilotrema saturnum (Girard)	black croaker	Rocks, caves, 8–40 feet.
Cynoscion nobilis (Ayres)	white seabass	Rocks, kelp, 10–150 feet.
Menticirrhus undulatus (Girard)	California corbina	Sand, 3–18 feet.
Roncador stearnsi (Steindachner)	spotfin croaker	Sand, 8–12 feet.
Seriphus politus Ayres	queenfish	Sand, 9–25 feet.
Medialuna californiensis (Steindachner)	halfmoon	Rocks, kelp, 6–68 feet.
Hermosilla azurea Jenkins & Evermann	zebraperch	Rocks, 4–12 feet.
Girella nigricans (Ayres)	opaleye	Seaweeds, rocks, 5–75 feet.
Brachyistius frenatus Gill	kelp surfperch	*Macrocystis,* 2–80 feet.
Cymatogaster aggregata Gibbons	shiner surfperch	Eelgrass, 4–20 feet.
Cymatogaster gracilis Tarp	island surfperch	Kelp, rocks, 5–17 feet.
Embiotoca jacksoni Agassiz	black surfperch	Bay, eelgrass, 4–20 feet; seaweeds, rocks, 2–80 feet.
Embiotoca lateralis Agassiz	striped surfperch	Cold water, rocky areas, seaweeds, 4–45 feet.
Hyperprosopon argenteum Gibbons	walleye surfperch	Sand inshore from submerged reefs, 5–22 feet.
Hyperprosopon ellipticum (Gibbons)	silver surfperch	Sand near rocks, cold water, 3–10 feet.
Hypsurus caryi (Agassiz)	rainbow surfperch	Rocky areas, cold water, 10–95 feet.
Micrometrus minimum (Gibbons)	dwarf surfperch	Surf/grass and eelgrass, 3–20 feet.
Phanerodon atripes (Jordan & Gilbert)	sharpnose surfperch	Rocks to deep water.
Phanerodon furcatus Girard	white surfperch	Rocky bottom, 10–140 feet.
Rhacochilus toxotes Agassiz	rubberlip surfperch	Kelp, rocks, 6–140 feet.
Damalichthys vacca (Girard)	pile surfperch	Rocks 5–115 feet.
Chromis punctipinnis (Cooper)	blacksmith	Rocky bottom, 7–140 feet.

TABLE 4—Cont'd.

Scientific name	*Common name*	*Preferred habitats with approximated depth distributions*
Hypsypops rubicunda (Girard)	garibaldi	Rocky bottom, 2–42 feet.
Halichoeres semicinctus (Ayres)	rock wrasse	Rocky bottom, 10–52 feet.
Oxyjulis californica (Günther)	señorita	Seaweeds, rocks, 5–75 feet.
Pimelometopon pulchrum (Ayres)	California sheephead	Rocky bottom, 2–140 feet.
Scomber japonicus Houttuyn	Pacific mackerel	Nearshore pelagic, 4–140 feet.
Coryphopterus nicholsi Bean	blackeye goby	Sand near rock, 1–180 feet.
Lethops connectens Hubbs	kelp goby	Gravel among rocks, intertidal to 50 feet.
Lythrypnus dalli (Gilbert)	bluebanded goby	Rocks, 11–80 feet.
Lythrypnus zebra (Gilbert)	zebra goby	Rock crevices, 9–52 feet.
Typhlogobius californiensis Steindachner	blind goby	Sand, among rocks, intertidal to deep water.
Sebastes atrovirens (Jordan & Gilbert)	kelp rockfish	Rocks, kelp, 2–130 feet.
Sebastes auriculatus Girard	brown rockfish	Rocks, seaweeds, 15–180 feet.
Sebastes carnatus (Jordan & Gilbert)	gopher rockfish	Rock holes, 40–110 feet.
Sebastes chrysomelas (Jordan & Gilbert)	black-and-yellow rockfish	Rocks, 10–120 feet.
Sebastes miniatus (Jordan & Gilbert)	vermilion rockfish	Rocks, 85 feet to deep water.
Sebastes mystinus (Jordan & Gilbert)	blue rockfish	Kelp, rocky reefs, intertidal to 300 feet.
Sebastes paucispinis Ayres	bocaccio	Rocks, 85–1300 feet.
Sebastes rastrelliger (Jordan & Gilbert)	grass rockfish	Rocks, seaweeds, 3–120 feet.
Sebastes saxicola (Gilbert)	stripetail rockfish	Rocks, deep water.
Sebastes semicinctus (Gilbert)	halfbanded rockfish	Rocks, 90 feet to deep water.
Sebastes serranoides (Eigenmann & Eigenmann)	olive rockfish	Kelp, rocks, cool water, 10–480 feet.
Sebastes serriceps (Jordan & Gilbert)	treefish	Rocks, 38–125 feet.
Scorpaena guttata Girard	sculpin	Rocks, 2–160 feet.
Hexagrammos decagrammus (Pallas)	kelp greenling	Rocks, intertidal to 150 feet.
Ophiodon elongatus Girard	lingcod	Rocks, 38–2700 feet.
Oxylebius pictus Gill	painted greenling	Rocks, 4–120 feet.
Artedius creaseri (Hubbs)	roughcheek sculpin	Rocks, 100 feet to deep water.

TABLE 4—Cont'd.

Scientific name	*Common name*	*Preferred habitats with approximated depth distributions*
Artedius corallinus (Hubbs)	coralline sculpin	Rocks, 3–70 feet.
Artedius lateralis (Girard)	smoothhead sculpin	Rocks, 1–25 feet.
Clinocottus analis (Girard)	wooly sculpin	rocks, intertidal to 12 feet.
Icelinus cavifrons Gilbert	pit-head sculpin	Rocks, 100 feet to deep water.
Leiocottus hirundo Girard	lavender sculpin	Sand patches in rocky areas, 8–55 feet.
Orthonopias triacis Starks & Mann	snubnose sculpin	Rocks, short seaweeds, 10–100 feet.
Odontopysix trispinosa Lockington	pygmy poacher	Rocks, 40 feet to deep water.
Liparis mucosus Ayres	slimy snailfish	Seaweeds, 10–22 feet.
Rathbunella alleni Gilbert	rough ronquil	Rocks, 22–140 feet.
Alloclinus holderi (Lauderbach)	island kelpfish	rocks, 10–60 feet.
Gibbonsia elegans (Cooper)	spotted kelpfish	Bottom seaweeds, 6–65 feet.
Gibbonsia erythra Hubbs	scarlet kelpfish	Rocks, 48–60 feet.
Gibbonsia metzi Hubbs	striped kelpfish	Seaweeds, 2–18 feet.
Heterostichus rostratus Girard	giant kelpfish	Seaweeds, 1–50 feet.
Neoclinus blanchardi Girard	sarcastic fringehead	Rocks, 10–200 feet.
Neoclinus uninotatus Hubbs	onespot fringehead	Rocks, 10–90 feet.
Hypsoblennius jenkinsi	mussel blenny	Holdfast, just below tide mark to 60 feet.
Ulvicola sanctaerosae	kelp gunnel	Seaweeds, intertidal to 25 feet.
Xererpes fucorum (Jordan & Gilbert)	rockweed gunnel	Seaweeds, 2–25 feet.
Sphyraena argentea Girard	California barracuda	Nearshore pelagic, 10–50 feet.
Atherinops affinis (Ayres)	topsmelt	Mainland kelp, intertidal to 85 feet; island kelp, to 30 feet; bays, surface to 10 feet.
Atherinopsis californiensis Girard	jacksmelt	Sandy areas, 5–48 feet.
Leuresthes tenuis (Ayres)	California grunion	Sandy areas, 4–25 feet.
Citharichthys sordidus Girard	Pacific sanddab	Sand, 45 feet to deep water.
Citharichthys stigmaeus Jordan & Gilbert	speckled sanddab	Sand, 1–160 feet.
Paralichthys californicus (Ayres)	California halibut	Sand, 4–100 feet.
Xystreurys liolepis Jordan & Gilbert	fantail sole	Sand, 15–82 feet.
Hypsopsetta guttulata (Girard)	diamond turbot	Sand, 4–60 feet.
Pleuronichthys coenosus Girard	C-O turbot	Rocks, sand, 6–90 feet.
Giobiesox rhessodon Smith	California clingfish	Rocks, intertidal to 35 feet.
Rimicola muscarum (Meek & Pierson)	kelp clingfish	Kelp canopy, intertidal to 10 feet.
Mola mola (Linaeus)	common mola	Pelagic.
Porichthys myriaster Hubbs & Schultz	specklefin midshipman	Mud, near rock, intertidal to 130 feet.
Porichthys notatus Girard	plainfin midshipman	Solid substrate and sand or mud, intertidal to deep water.

TABLE 4—Cont'd.

7. REFERENCES

Ahlstrom, Elbert H. 1965. Kinds and abundance of fishes in the California current region based on egg and larval surveys. Calif. Mar. Res. Com., Calif. Coop. Ocean. Fish. Invest., Rept., 10:31–37.

American Fisheries Society, Committee on Names of Fishes (Reeve M. Bailey, Chairman). 1970. A list of common and scientific names of fishes from the United States and Canada. (3rd. ed.). Amer. Fish. Soc., Spec. Publ., (6):1–150.

Arora, Harbens L. 1951. An investigation of the California sand dab, Citharichthys sordidus (Girard). Calif. Fish and Game, 37 (1):3–42.

Babel, John S. 1967. Reproduction, life history, and ecology of the round stingray, Urolophus halleri Cooper. Calif. Dept. Fish and Game, Fish Bull., (137):1–104.

Barnhart, Percy Spencer. 1936. Marine fishes of southern California. Univ. Calif. Press, Berkeley. 209 p.

Baxter, John. 1960. A study of the yellowtail Seriola dorsalis (Gill). Calif. Dept. Fish and Game, Fish Bull., (110):1–91.

Baxter, John. 1966. Inshore fishes of California. (3rd. rev.). Calif. Dept. Fish and Game, Sacramento, 80 p.

Bigelow, Henry B., and William C. Schroeder. 1948. Sharks, p. 59–546. *In* Fishes of the Western North Atlantic, pt. 1. Sears Found. Mar. Res., Memoir, (1):1–576.

Bolin, Rolf L. 1944. A review of the marine cottid fishes of California. Stanford ichthyol. Bull., 3 (1):1–135.

Boydstun, L.B. 1967. Northern range extension of the giant sea bass, Stereolepis gigas Ayres. Calif. Fish and Game, 53 (4):296–297.

Briggs, John C. 1955. A monograph of the clingfishes (Order Xenopterygii). Stanford Ichthyol. Bull., 6:1–224.

Carlisle, John G., Jr. 1969. Results of a six-year trawl study in an area of heavy waste discharge: Santa Monica Bay, California. Calif. Fish and Game, 55 (1):26–46.

Carlisle, John G., Jr., Jack W. Schott, and Norman J. Abramson. 1960. The barred surfperch (Amphistichus argenteus Agassiz) in southern California. Calif. Dept. Fish and Game, Fish Bull., (109):1–79.

Carlisle, John G., Jr., Charles H. Turner and Earl E. Ebert. 1964. Artificial habitat in the marine environment. Calif. Dept. Fish and Game, Fish Bull., (124):1–93.

Clarke, Thomas A. 1970. Territorial behavior and population dynamics of a pomacentrid fish, the garibaldi, Hypsypops rubicunda. Ecol. Monogr., 40:189–212.

Clemens, W.A., and G.V. Wilby. 1961. Fishes of the Pacific Coast of Canada. [2nd ed.] Fish. Res. Bd. Can., Bull., (68):1–443.

Collier, Ralph S. 1964. Report on a recent shark attack off San Francisco, California. Calif. Fish and Game, 50 (4):261–264.

Dawson, E. Yale, Michael Neushul, and Robert D. Wildman. 1960. Seaweeds associated with kelp beds along southern California and northwestern Mexico. Pac. Naturalist, 1 (14):1–81.

De Martini, Edward 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.

Dewitt, S. W. 1955. A record of an attack by a leopard shark (Triakis semifasciata Girard). Calif. Fish and Game, 41 (4):348.

Ebert, Earl E., and Charles H. Turner. 1962. The nesting behavior, eggs and larvae of the bluespot goby. Calif. Fish and Game, 48 (4):249–252.

Feder, Howard M. 1966. Cleaning symbiosis in the marine environment, p. 327–380. *In* S. Mark Henry (ed.) Symbiosis: Its physiological and biochemical significance. Academic Press Inc., New York, 2 Vol.

Fitch, John E. 1952. Distributional notes on some Pacific coast marine fishes. Calif. Fish and Game, 30(4):557–564.

Fitch, John E. 1963. A review of the fishes of the genus Pleuronichthys. Los Angeles Co. Mus., Contrib. in Sci., 76:3–33.

Fitch, John E. 1969. offshore fishes of California. (4th rev.) Calif. Dept. Fish and Game, Sacramento. 80 p.

Follett, W. I., Dan Gotshall, and J. Gary Smith. 1960. Northerly occurrence of the scorpid fish Medialuna californiensis (Steindachner), with meristic data, life history notes, and discussion of the fishery. Calif. Fish and Game, 46(2):165–175.

Ford, Richard F. 1965. Distribution, population dynamics and behavior or a bothid flatfish. Citharichthys stigmaeus. Ph.D. Dissertation, Univ. Calif., San Diego. 243 p.

Fraser-Brunner, A. 1951. The ocean sunfishes (family Molidae). Brit. Mus. (Nat. Hist.) Zool., Bull., 1(6):87–121.

Ginsburg, Isaac. 1952. Flounders of the genus Paralichthys and related genera in American waters. U.S. Fish Wild. Serv., Fish. Bull., 71:265–351.

Gotshall, Daniel W. 1961. Observations on a die-off of molas *(* Mola mola *)* in Monterey Bay. Calif. Fish and Game, 47(4):339–341.

Gotshall, Daniel W. 1967. Cleaning symbiosis in Monterey Bay, California. Calif. Fish and Game, 53(2):125–126.

Gotshall, Daniel W., J. Gary Smith, and Allen Holbert. 1965. Food of the blue rockfish Sebastodes mystinus. Calif. Fish and Games, 51(3):147–162.

Herald, Earl S. 1940. A key to the pipefishes of the Pacific American coasts with descriptions of new genera and species. Allan Hancock Pac. Exped., 9(3):51–64.

Herald, Earl S., and Robert P. Dempster. 1952. The 1951 shark derby at Elkhorn Slough, California. Calif. Fish and Game, 38(1):133–134.

Herald, Earl S., Walter Schneebeli, Norval Green, and Kenneth Innes. 1960. Catch records for seventeen shark derbies held at Elkhorn Slough, Monterey Bay, California. Calif. Fish and Game, 46(1):59–67.

Hobson, E. S. 1971. Cleaning symbiosis among California inshore fishes. Fish. Bull., 69:491–523.

Hosie, Michael J., and Carl E. Bond. 1968. Northern range extension for the kelp bass, Paralabrax clathratus (Girard). Calif. Fish and Game, 54(3):216–217.

Hubbs, Clark. 1952. A contribution to the classification of the blennoid fishes of the family Clinidae, with a partial revision of the eastern Pacific forms. Stanford Ichthyol. Bull., 4(2):41–165.

Johnson, Myrtle E. and Harry J. Snook. 1927. Seashore animals of the Pacific coast. Macmillan Co., New York. 659 p.

Joseph, David C. 1962. Growth characteristics of two southern California surf-fishes, the California corbina and spotfin croaker, family Sciaenidae. Calif. Dept. Fish and Game, Fish Bull., (119):1–54.

Kato, Susumu. 1965. White shark Carcharodon carcharias from the gulf of California with a list of sharks seen in Mazatlan, Mexico, 1964. Copeia, (3):384.

Lance, James R. 1961. A distributional list of southern California opisthobranchs. Veliger, 4(2):64–69.

Light, S. F., Ralph I. Smith, Frank A. Petelka, Donald P. Abbott, and Frances M. Weesner. 1970. Intertidal invertebrates of the central California coast. Univ. of Calif. Press, Berkeley. 446 p.

Limbaugh, Conrad. 1955. Fish life in the kelp beds and the effects of kelp harvesting. Univ. Calif., Inst. Mar. Res., IMR Ref. 55–9:1–158.

Limbaugh, Conrad. 1961a. Life-history and ecologic notes on the black croaker. Calif. Fish and Game, 47(2):163–174.

Limbaugh, Conrad. 1961b. Cleaning symbiosis. Sci. Amer., 205:42–49.

Limbaugh, Conrad. 1962. Life history and ecological notes on the tubenose, Aulorhynchus flavidus, a hemibranch fish of western North America. Copeia, (3):549–555.

Limbaugh, Conrad. 1963. Field notes on sharks, p. 63–94. *In* P. W. Gilbert [ed.]. Sharks and survival. D.C. Heath, Co., Boston 578 p.

Limbaugh, Conrad. 1964. Notes on the life history of two Californian pomacentrids: garibaldis, Hypsypops rubicunda (Girard), and blacksmiths, Chromis punctipinnis (Cooper). Pac. Sci., 18(1):41–50.

Limbaugh, Conrad, Harry Pederson, and Fenner A. Chace. 1961. Shrimps that clean fishes. Bull. Mar. Sci. Gulf and Caribbean, 11(2):237–257.

MacGinitie, G.E., and N. MacGinitie. 1968. Natural history of marine animals. [2nd ed.]. McGraw-Hill, New York. 523 p.

MacFarland, Franck M. 1966. Studies of opisthobranchiate mollusks of the Pacific coast of North America. Calif. Acad. Sci., Mem., 6:1–546.

McLean, James H. 1969. Marine shells of southern California. Los Angeles Co., Mus., Sci. Ser. 24, Zool. (11):1–104.

Miller, Daniel S., and Daniel W. Gotshall. 1965. Ocean sportfish catch and effort from Oregon to Point Arguello, California, July 1, 1957-June 30, 1961. Calif. Dept. Fish and Game, Fish Bull., (130):1–135.

Miller, Daniel S., Daniel W. Gotshall, and Richard Nitsos. 1965. A field guide to some common ocean sport fishes of California. Calif. Dept. Fish and Game, Sacramento. 87 p.

Miller, Daniel S., and Robert N. Lea. 1972. Guide to the coastal marine fishes of California. Calif. Dept. Fish and Game, Fish Bull., (157):1-

North, Wheeler J. 1967. Kelp habitat improvement project: Annual report, 1 April, 1966–30 June, 1967. Calif. Inst. Tech., Los Angeles. 105 p.

North, Wheeler J. 1971. The biology of giant kelp beds *(* Macrocystis *)* in California. Beihefte zur Nova Hedwigia, (32):1–600.

North, Wheeler J., and C.L. Hubbs [eds.]. 1968. Utilization of kelp-bed resources in southern California. Calif. Dept. Fish and Game, Fish Bull., (139):1–264.

O'Connell, Charles P. 1953. The life history of the cabezon Scorpaenichthys marmoratus (Ayres). Calif. Dept. Fish and Game, Fish Bull., (93):1–76.

Peden, Alex E. 1966. Rare marine fishes from British Columbia with first records of silver perch, Hyperprosopon ellipticum, and shanny, Leptoclinus maculatus. Fish. Res. Bd. Can., J., 23(8):1277–1279.

Phillips, Juliuis B. 1957. A review of the rockfishes of California (family Scorpaenidae). Calif. Dept. Fish and Game, Fish Bull., (104):1–158.

Phillips, Juliuis B. 1959. A review of the lingcod, Ophiodon elogatus. Calif. Fish and Game, 45(1):19–27.

Phillips, Juliuis B. 1961. Range extensions for two California fishes, with a note on a rare fish. Calif. Fish and Game, 47(4):418.

Phillips, Juliuis B. 1965. Northern range extension for the zebraperch, Hermosilla azurea Jenkins and Evermann. Calif. Fish and Game, 51(1):55–56.

Pinkas, Leo G. 1966. A management study of the California barracude Sphyraena argentea Girard. Calif. Dept. Fish and Game, Fish Bull., (134):1–58.

Pinkas, Leo, Malcolm S. Oliphant, and Charles W. Haugen. 1968. Southern Claifornia marine sportfishing survey: private boats, 1964; shoreline, 1965–66. Calif. Dept. Fish and Game, Fish Bull., (143):1–42.

Quast, Jay C. 1968a. Some physical aspects of the inshore environment, particularly as it affects kelp-bed fishes. p. 25–34. *In* W. J. North and C. L. Hubbs, [ed.]. Utilization of kelp-bed resources in southern California. Calif. Dept. Fish and Game, Fish Bull., (139):1–264.

Quast, Jay C. 1968b. Observation on the food of the kelp-bed fishes. p. 109–142. *In* W. J. North and C. L. Hubbs [ed.]. Utilization of kelp-bed resources in southern California. Calif. Dept. Fish and Game, Fish Bull., (139):1–264.

Quast, Jay C. 1968c. Effects of kelp harvesting on the fishes of the kelp beds. p. 143–149. *In* W. J. North, and C. L. Hubbs [ed.]. Utilization of kelp-bed resources in sourthern California. Calif. Dept. Fish and Game, Fish Bull., (139):1–264.

Ricketts, Edward F., and Jack Calvin. 1968. Between Pacific tides. 4th ed. rev. by Joel W. Hedgpeth. Stanford Univ. Press, Stanford, Calif. 614 p.

Roedel, Phil. 1953. Common ocean fishes of the California coast. Calif. Dept. Fish and Game, Fish Bull., (91):1–184.

Rosenblatt, Richard H., and B. J. Zahuranec. 1967. The eastern Pacific groupers of the genus Mycteroperca, including a new species. Calif. Fish and Game, 53(4):228–245.

Skin Diver. 1958. Photograph by John Lockwood of a 75 lb. halibut. Skin Diver Magazine, 7(11):2–3.

Smith, C. Lavett. 1965. The patterns of sexuality and the classification of serranid fishes. Amer. Mus. Novitates, (2207):1–20.

Snow, Charles D., and Raymond N. Breuser. 1960. Occurrence of the California halibut in Oregon waters. Oregon Res. Briefs, 8(1):74–75.

Stephens, John S., Jr., Robert K. Johnson, Gerald S. Key, and John E. McCosker. 1970. The comparative ecology of three sympatric species of California blennies in the genus Hypsoblennius Gill (Teleostomi, Blenniidae). Ecol. Monogr., 40(2):213–233.

Tarp, Fred H. 1952. A revision of the family Embiotocidae (the surfperches). Calif. Dept. Fish and Game, Fish Bull., (88):1–99.

Thomas, James C. 1968. Management of the white seabass *(* cynoscion nobilis *)* in California waters. Calif. Dept. Fish and Game, Fish Bull., (142):1–34.

Turner, Charles H. 1960. Smelt (Atherinidae), p. 54–55. *In* California ocean fisheries resources to the year 1960. Calif. Dept. Fish and Game, Sacramento. 79 p.

Turner, Charles H., and Earl E. Ebert. 1962. The nesting of Chromis punctipinnis (Cooper) and a description of their eggs and larvae. Calif. Fish and Game, 48(4):243–248.

Turner, Charles H., Earl E. Ebert, and Robert R. Given. 1964. An ecological survey of a marine environment prior to installation of a submarine outfall. Calif. Fish and Game, 50(3):176–188.

Turner, Charles H., Earl E. Ebert, and Robert R. Given. 1965. Survey of the marine environment offshore of Sal Elijo Lagoon, San Diego County. Calif. Fish and Game, 51(2):81–112.

Turner, Charles H., Earl E. Ebert, and Robert R. Given. 1968. The marine environment offshore from Point Loma, San Diego County. Calif. Dept. Fish and Game, Fish Bull., (140):1–79.

Turner, Charles H., Earl E. Ebert, and Robert R. Given. 1969. Man-made reef ecology. Calif. Dept. Fish and Game, Fish Bull., (146):1–221.

Williams, George C., and Doris C. Williams. 1955. Observations on the feeding habits of the opaleye, Girella nigricans. Calif. Fish and Game, 41(3):203–208.

Young, Parke H. 1963. The kelp bass *(* Paralabrax clathratus *)* and its fishery, 1947–1958. Calif. Dept. Fish and Game, Fish Bull., (122):1–67.

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