NOAA Technical Memorandum NMFS-NWFSC-138

Survey Fishes:

An Illustrated List of the Fishes Captured during the Northwest Fisheries Science Center's Fishery Resource Analysis and Monitoring Division's West Coast Surveys

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Daniel J. Kamikawa

Fishery Resource Analysis and Monitoring Division
Newport Research Station
Northwest Fisheries Science Center
2032 Southeast OSU Drive
Newport, Oregon 97365

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Dedication

To my parents,
Paul and Annamae Kamikawa,
because they took me fishing.

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Key to Fish Families

1	Jaws absent; 1 median nostril; no paired fins or scales 2	
1	Jaws present; paired nostrils; paired fins & scales present or absent 3	
2(1)	Barbels around mouth; mouth a fleshy opening ..... **Myxinidae**	p 5
2	No barbels; mouth a toothed sucking disc ..... **Petromyzontidae**	p 6
3(1)	1–7 gill openings; if 1 opening, opercular cover consists of soft tissue covering 4 internal gill pores; scaleless; no caudal peduncle; first dorsal is high & triangular, preceded by stout, serrated spine; second dorsal is low, strongly indented 4	
3	1 gill opening; opercular cover typically rigid (soft in some spp.), opening into single gill cavity; fins not as described above 23	
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48(47)	Dorsal fin composed of spinous and soft-rayed portions, with shallow to deep notch between them; large, highly branched cirrus over each eye	**Cottidae*** p 250
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* In part.

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* In part.

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[*] In part.

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* In part.

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* In part.

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* In part.

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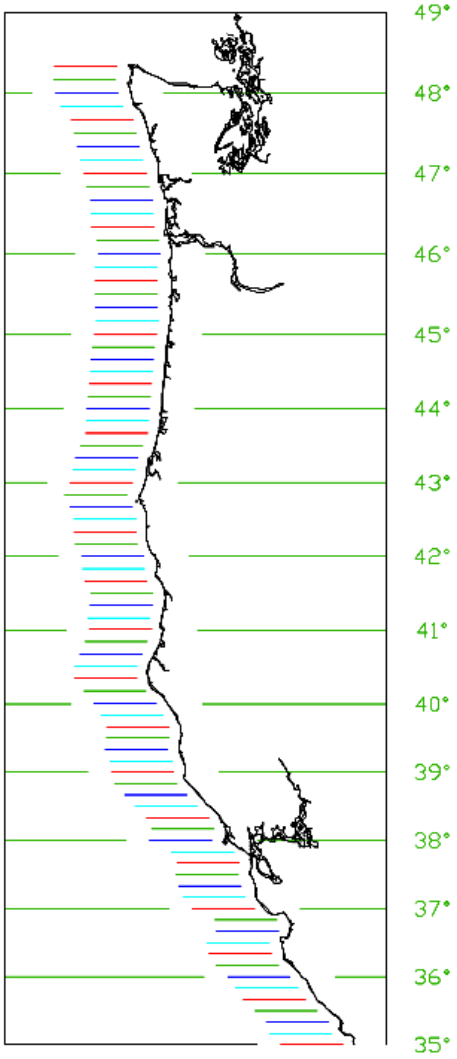
133(130)	Anal fin absent — **Trachipteridae***	p 131
133	Anal fin present	134
134(133)	1–2 anal spines — **Melamphaidae**	p 167
134	No anal spines	135
135(134)	Caudal fin absent; dorsal & anal fin join forming pointed tail — **Macrouridae**	p 141
135	Caudal fin present, may be joined with dorsal and/or anal fins	136
136(135)	Caudal fin present, joined with dorsal fin; head blunt, highly sculptured — **Melanonidae**	p 151
136	Caudal fin separate	137
137(136)	2 anal fins; 3 dorsal fins — **Gadidae**	p 156
137	1 anal fin (may be deeply notched); 2 dorsal fins	138
138(137)	Barbel on lower jaw; filamentous pelvic fins — **Moridae**	p 152
138	No barbels; pelvic fin rays not filamentous — **Merlucciidae**	p 154

* In part.

Introduction

Prior to 1998, the primary source for fishery-independent data from the West Coast of the United States was the Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC). AFSC conducted two surveys off the U.S. West Coast: The West Coast Triennial Bottom Trawl Survey (Triennial) and the West Coast Upper Continental Slope Trawl Survey (WCUCS).

The Triennial Survey was initiated in 1977 and was conducted by AFSC every three years from 1977–2001 aboard chartered commercial and research vessels. Due to changes in sampling emphasis from rockfish (*Sebastes* spp.) to a more general approach that covered a range of demersal species, the latitudinal boundaries varied over time from as far south as Point Conception (lat 34°30'N) to as far north as northern Vancouver Island, British Columbia (lat 50°00'N). The sampling depth varied over time as well, but always fell within the final range of 55–503 m. In 2004, the Fishery Resource Analysis and Monitoring Division (FRAM) at the Northwest Fisheries Science Center (NWFSC) conducted the final Triennial Survey following the protocols establ



Approximate locations of sampling transects, West Coast slope survey

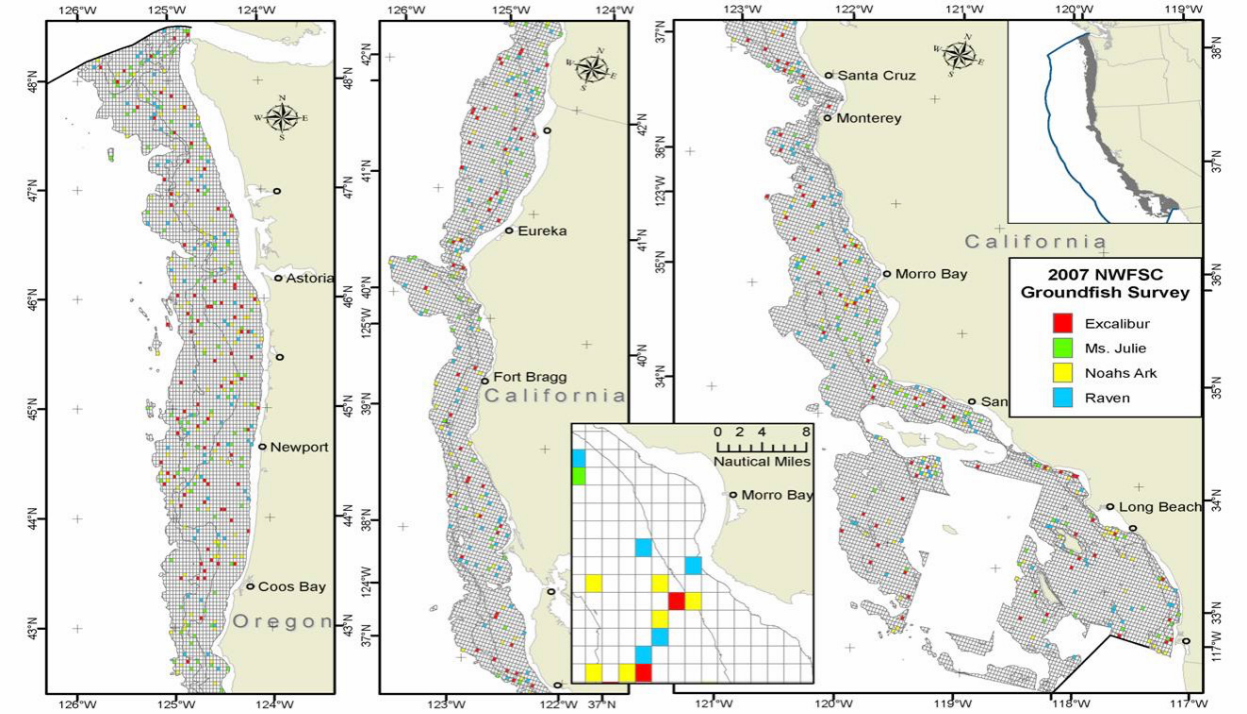
The first WCUCS Trawl Survey was in 1984 aboard the NOAA Ship *Miller Freeman*. The WCUCS Trawl Survey was then conducted annually on the *Miller Freeman* from 1988–2001, with the exception of 1998 when the *Miller Freeman* was in for repairs. The WCUCS covered the habitat from 183–1,280 m from near Nitinat Canyon (lat 48°05'N) on the U.S.–Canada border to Point Conception, California (lat 34°30'N). The five International North Pacific Fisheries Commission (INPFC) statistical areas included in the survey area are U.S. Vancouver, Columbia, Eureka, Monterey, and Conception. From 1984–1996, since the entire survey area could not be sampled each year due to ship-time constraints, a different portion of the survey area was sampled. Sampling was conducted along latitudinal transects spaced 10 nm (nautical miles) apart. In 1997, the spatial coverage was expanded to include all the INPFC statistical areas from Point Conception (lat 34°30'N) to the U.S.–Canada border (lat 48°05'N) and the time frame extended from one month to six weeks, but sampling density was decreased so that the expanded area could be surveyed in the allotted time.

In 1995, NWFSC established FRAM Division. The Division, in partnership with the West Coast commercial fishing industry, then began developing a new survey to increase the amount of fishery-independent data collected along the U.S. West Coast. The survey began in 1998 aboard chartered West Coast trawl vessels. This innovative survey has an electronic (paperless) back deck. From 1998–2003, biological information was collected using a programmable electronic measuring board and detachable data storage unit which was downloaded to a computer after each tow. In 2003, the survey adopted a wireless data collection system. Using an on-board wireless router and a ruggedized laptop computer running data collection software, data collected through the measuring board and electronic scales goes directly to the database. The amounts and types of data have also expanded.

Due to the small size of both the scientific and vessel crew (two persons each), data collection in 1998 was limited in scope. Identification of commercially important fish species such as sablefish (*Anoplopoma fimbria*), Dover sole (*Microstomus pacificus*), and commercially harvested species from groups that contained both commercial and non-commercial species such as the rockfishes (Scorpaenidae) and flatfishes (Pleuronectiformes), was to the lowest level possible. Identification of non-commercial species such as the eelpouts (Zoarcidae) and invertebrates such as the sea stars (Asteroidae) was into broad categories or not taken past the family level. Beginning in 1999, the vessel and scientific crew were increased to three each, and the identification of all species of fish and invertebrates was to be to the lowest taxonomic level possible.

AFSC conducted its last WCUCS and Triennial Surveys in 2001. Without these surveys, the FRAM WCUCS survey became the primary source for fishery-independent data. To increase spatial coverage in 2002, the survey expanded to include the waters south of Point Conception (lat 34°30'N) to the U.S.–Mexico border (lat 32°36'N) and conducted a pilot project to test the feasibility of expanding the FRAM WCUCS survey onto the continental shelf. The 2002 test proved successful and beginning in 2003, the survey expanded onto the continental shelf. Covering the West Coast from Canada to Mexico between 55 and 1,280 m, the FRAM WCUCS survey became the West Coast Groundfish Bottom Trawl Survey (WCGBTS; see Keller et al. 2017).

In 2003, sampling practices were changed. It was determined that the practice of sampling along the same established transect lines each year did not give adequate spatial coverage. As a result, the entire survey area is now a grid consisting of squares of 1.5 × 2 nm, with each survey vessel assigned a randomly selected subset of the squares.



Nautical chart of the West Coast showing the station locations and allocation for the 2007 NWFSC Groundfish Survey.

Survey protocol dictates field identification be to the lowest taxonomic level possible. Each revision and expansion of the WCGBTS, the number of animals taken to species greatly increased. In 1998, 21 of the 33 fish entries and 8 of the 16 invertebrate entries were to the species level. By 2010, 233 of 271 fish entries and 220 of 350 invertebrate entries were to species. While there are many identification manuals on board, none is specific to the scope of the FRAM surveys and, in most cases, are not designed for outdoor use. Since the work conducted on most FRAM surveys is on deck, regardless of weather, the survey team needed a durable, weatherproof guide geared toward species encountered in the survey area. It is to meet those needs that this guide was developed.

Methods

The intention of this guide is to be a field reference to the fishes captured during the various FRAM Division West Coast surveys. Scientific and technical terms have been kept to a minimum and, when used, are defined within the text. Descriptions and distribution are confined to those species within the geographic (U.S.–Canada to U.S.–Mexico borders) and depth (30–1,680 m) parameters of the FRAM West Coast surveys. Many of the fishes described have geographic and/or depth ranges

that extend outside of the survey parameters. Distributions include these areas and are described by political boundaries (e.g., state and/or country borders), bodies of water (i.e., the northeastern Pacific, the Strait of Juan de Fuca, the Columbia River, etc.), islands and/or major geographical features (i.e., the Hawaiian, Farallon, and Channel Islands, Cape Flattery, Point Conception, etc.). Conducted aboard small commercial vessels with limited personnel and space, the majority of the FRAM West Coast surveys do not have access to wet/dry lab facilities for detailed observations. Due to a variety of factors such as body size and specimen damage, internal meristic counts (i.e., vertebrae or pyloric caeca), and others that cannot be made with the naked eye, identification of some groups of fishes included in this text are treated only to the family or generic level. The species accounts are in scientific order as much as possible. The list of common and scientific names are in the List of Species. Photographs are provided when available. The family and species keys are for the families/species within the guide. However, some species not known from within the scope of this work may have been included to complete a couplet.

Taxon Accounts and Keys to Species

Agnatha (Jawless Fishes)

The class Agnatha currently contains two orders: the Myxiniformes, known as hagfishes, and the Petromyzontiformes, or lampreys. These eel-like fishes lack true jaws, but may have noncalcified teeth for grasping objects or prey. Although considered vertebrates, Agnatha have a large, unsegmented notochord without vertebrae. The Agnatha have a long cylindrical body, a single median nostril, and no true fins. Their gills open along the side of the body as a single pore, or an array of 5–16 pores; not slits. The gill pouches and their associated structures are contained within and supported by a cartilaginous basket.

Myxiniformes

Myxinidae (Hagfishes)

Hagfishes are primitive eel-like fishes. The hagfish family worldwide contains about 60 species within five genera in two subfamilies: Eptatretinae, which have 5–15 porelike gill openings and include the two species covered in this guide, and Myxininae, which have a single common gill opening per side. They have no true fins. The caudal finfold extends onto the dorsal surface of the body. Although hagfishes lack jaws, they have a modified tongue with teeth composed of keratin that rasp flesh from dead or moribund organisms. Barbels surround the mouth and nostril. The vestigial eyes are skin-covered and may appear as white eyespots. Each side of the organism has a series of 70–200 slime and thread pores that produce copious amounts of slime as a defense mechanism. Hagfish can tie themselves into a knot to remove slime, to tear off food, or as a means of escape.

Key to the Myxinidae of the FRAM Surveys

1	Usually 6–8 prebranchial slime pores (range 4–10); purple/black to dark brown, may have light spots and blotches; ventral finfold weakly developed or absent ..... ***Eptatretus deani***	p 5
1	Usually 12–14 prebranchial slime pores (range 10–16); brown to tan, may have pale spots and blotches; prominent ventral finfold ..... ***Eptatretus stoutii***	p 6

Black hagfish (*Eptatretus deani*)

Description

Black hagfish are generally a uniform purple/black to dark brown, but can have pale spots and blotches. The ventral finfold is present or absent; if present, weakly developed and uniform in color except in spotted animals, where there is a pale margin. Black hagfish have no visible eyes, but have light-colored eyespots of various size with irregular margins. There are usually 6–8 prebranchial slime pores (range 4–10) and, typically, 11 gill pores per side (range 10–12). There are eight barbels around the mouth and nostril. The distance from the tip of the snout to the first gill pore is 5.4–6.6 into total length (TL). To 63.5 cm TL.

Similar species
Pacific hagfish (*Eptatretus stoutii*) has a prominent ventral finfold with a wide pale margin and small, well defined eyespots. The distance from the snout tip to the first gill opening is 4.5 or less into TL.

Distribution
Black hagfish range from southeastern Alaska to central Baja California, Mexico, at depths of 107–2,743 m.

Pacific hagfish (*Eptatretus stoutii*)

Description
Pacific hagfish are brown to tan, often with pale spots and blotches. The prominent ventral finfold has a pale margin. Pacific hagfish lack eyes but have small, light-colored, well defined eyespots. There are typically 12–14 (10–16) prebranchial slime pores. There are usually 12 (10–14) gill pores per side. There are eight barbels around the mouth and nostril. The distance from the tip of the snout to the first gill pore is 4.5 or less into TL. To 64 cm TL.

Similar species
Black hagfish (*Eptatretus deani*) has a weakly developed or absent ventral finfold, prominent but poorly defined eyespots, and the distance from snout tip to first gill opening is 5.4–6.6 into TL.

Distribution
Pacific hagfish range from British Columbia, Canada, to central Baja California, Mexico, at depths of 16–944 m.

Petromyzontidae (Lampreys)

The lamprey family has at least 40 species in nine genera worldwide. Lampreys are cylindrical eel-like fishes that lack jaws, paired fins, or scales. There are seven gill pores on each side. The two dorsal fins are continuous with the caudal fin. They have a single median nostril above the circular mouth. In parasitic lampreys, the circular mouth forms a sucking disc. The sucking disc and tongue contain teeth made of keratin. Parasitic lampreys feed by attaching to other fish and rasping a hole through the skin using their tongue. Nonparasitic lampreys and lamprey larvae, or ammocoetes, are filter feeders.

Key to the Petromyzontidae of the FRAM Surveys

1 Supraoral bar with 3 (rarely 2) cusps; 4 pairs of lateral teeth: the middle pairs have 3 cusps, the infraoral bar has 4–8 cusps ..... ***Entosphenus tridentatus*** p 7

1 Supraoral bar with 2 (rarely 3) cusps; 3 pairs of lateral teeth, each with 2 or 3 cusps; the infraoral bar has 5–10 cusps (usually 7–8)..... ***Lampetra ayresii*** p 7

Pacific lamprey (*Entosphenus tridentatus*)

Description
Pacific lamprey are dark bluish gray to dark brown dorsally, silvery or whitish ventrally, with dusky dorsal and caudal finfolds. Lacking jaws, there is a toothed sucking disc with three supraoral and four lateral teeth. The seven gill openings are posterior to the eye. There are no true fins. The two dorsal and one anal finfold join with the caudal finfold. To 64 cm TL.

Similar species
River lamprey (*Lampetra ayresii*) have two supraoral and three lateral teeth, and one large tooth on the tongue.

Distribution
Pacific lamprey range from the eastern Chukchi and Bering Seas to northern Baja California, Mexico, at depths to 1,463 m (but usually less than 250 m).

Western river lamprey (*Lampetra ayresii*)

Description
Western river lamprey can be yellow, brown, or metallic blue or blue/back dorsally, and silver or whitish ventrally, with yellow finfolds and a dark gray blotch on the caudal finfold. Lacking jaws, there is a toothed sucking disc with two supraoral and three lateral teeth. There are no true fins. The two dorsal and one anal finfold join with the caudal finfold. To 31 cm TL.

Similar species
Pacific lamprey (*Entosphenus tridentatus*) have three supraoral and four lateral teeth, and no tongue teeth.

Distribution
Western river lamprey range from Juneau, Alaska, to San Francisco, California, at depths to 250 m.

Chondrichthyes (Cartilaginous Fishes)

The Chondrichthyes have a cartilaginous skeleton, possibly calcified but not ossified or true bone. Cartilaginous rods support the fins, not bony spines or soft rays. In most species, the teeth are unconnected to the jaws and replaced serially. There is generally a single nostril divided by a flap on each side of the head.

Elasmobranchii (Elasmobranchs)

The elasmobranchs include the sharks, skates, and rays. These mostly marine organisms rely primarily on scent and electroreception, rather than sight, to find prey. They have a well developed olfactory system, small eyes, and numerous teeth, usually in multiple rows. The teeth are not connected to the jaws and are replaced serially. Other characteristics include 5–7 pairs of gill openings, rigid dorsal fins, and a pair of spiracles. The elasmobranchs are a large group of organisms that have a wide range of body shapes, from the fusiform shape of most sharks to the dorsoventrally flattened skates.

Hexanchidae (Cow Sharks)

The cow shark family contains three genera with at least four species in the boreal to subtropical seas worldwide. Although also found nearshore in bays and estuaries, cow sharks are most common in deep water. Ranging in length from 1.4 to over 5 m, these fish have 6–7 gill slits, with the first slit not extending across the throat. The single dorsal and anal fins are far back on the body, and the caudal fin is elongated. The teeth differ, with long, fanglike upper and multicusped and comblike lower teeth.

Sixgill shark (*Hexanchus griseus*)

Description
Sixgill sharks are dark brown to gray or black dorsally, lighter shades of the same color laterally turning a pale white to dirty gray ventrally. A visible light stripe along the lateral line extends from about the pectoral fin base to near the terminal lobe of the caudal fin, and the eyes are green. There is a single dorsal fin set far back on the body, posterior to the pelvic fins. The caudal fin is elongate and the caudal peduncle lacks keels and precaudal pits. There are six paired gill slits. The teeth in the subterminal mouth are very different, with long, narrow, fanglike teeth in the upper jaw and large, comblike teeth with 8–12 cusplets in the lower jaw. To 482 cm TL.

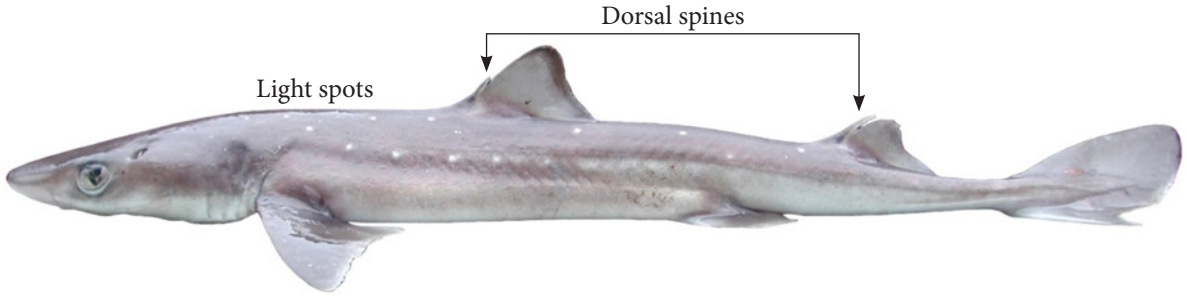
Similar species
Sevengill shark (*Notorynchus cepedianus*) has seven gill slits and a spotted body.

Distribution
Pacific sixgill sharks range from south of the Aleutian Islands to northern Baja California, Mexico, at depths to 2,500 m. In the western North Pacific, from Japan to the South Pacific. Worldwide in deep temperate to tropical waters.

Squalidae (Dogfish Sharks)

The taxonomy of the dogfish is highly problematic. There are two recognized genera, *Cirrhigaleus* with three species, and *Squalus* with at least 24 species in three subgroups, *S. mitsukurii*, *S. megalops*, and *S. acanthias*. *S. suckleyi*, the species covered in this guide, is included in the *S. acanthias* subgroup. These small- to medium-sized sharks are variable in body shape and can range from stout to quite slender. They have five sets of similarly sized gill slits. There are two dorsal fins, with the first closer to the pectoral than the pelvic fin. Both dorsals have a single spine in front, and there is no anal fin.

Pacific spiny dogfish (*Squalus suckleyi*)



Description
Pacific spiny dogfish are slate gray or brown, with 1–2 rows of light spots that fade with age dorsally, with lighter shades of the same color laterally and light ventrally. There are two dorsal fins, the first larger than the second with a single spine at the origin of each; there is no anal fin. There is a dorsal precaudal pit and lateral keels on the caudal peduncle. To 160 cm TL (usually smaller).

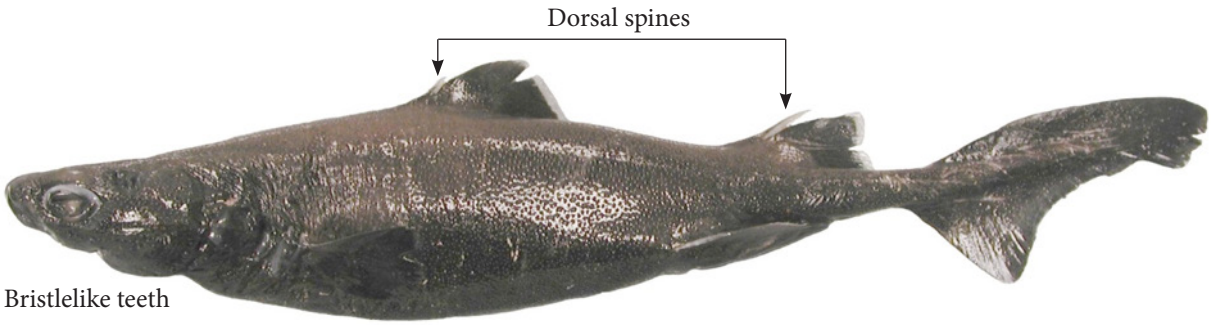
Similar species
Ebert et al. (2010) resurrected *Squalus suckleyi* as the name for the Squalidae population in the North Pacific. The brown smoothhound (*Mustelus henlei*) lacks dorsal spines.

Distribution
Pacific spiny dogfish range throughout the western North Pacific from Korea and Japan northward to Kamchatka, the Sea of Okhotsk, and Sakhalin. Along North America from the Bering Sea, Aleutian Islands, the Gulf of Alaska, and British Columbia, Canada, to southern Baja California, Mexico, at depths to 1,236 m.

Etmopteridae (Lantern Sharks)

The lantern sharks consist of five genera with at least 45 species. Lantern sharks are small, slender to cylindrical deepwater sharks, found along the continental slope as well as in deep waters well offshore. There are five gill openings, the fifth much smaller than the first four. The teeth in both jaws are usually similar in size, but the lower teeth may be longer. There are two dorsal fins. The first originates closer to the pectoral than the pelvic fins. The second may be somewhat larger than the first. A spine proceeds each dorsal. The second dorsal spine is usually longer than the first. There are no keels or precaudal pits on the caudal peduncle or anal fin. Many lantern sharks have photophores.

Pacific black dogfish, combtooth dogfish (*Centroscyllium nigrum*)



Description
Pacific black dogfish are dark brown/black to black. There are two relatively equal-sized dorsal fins with a single spine at the origin of each. The second dorsal fin spine is larger, up to 1.5 times the length of the first. Live specimens of Pacific black dogfish have white-edged fins. The broad snout is short and round. The name "combtooth" derives from the teeth, with 3–5 bristlelike cusps present in both jaws. A small, flabby-bodied shark that can reach 50 cm TL.

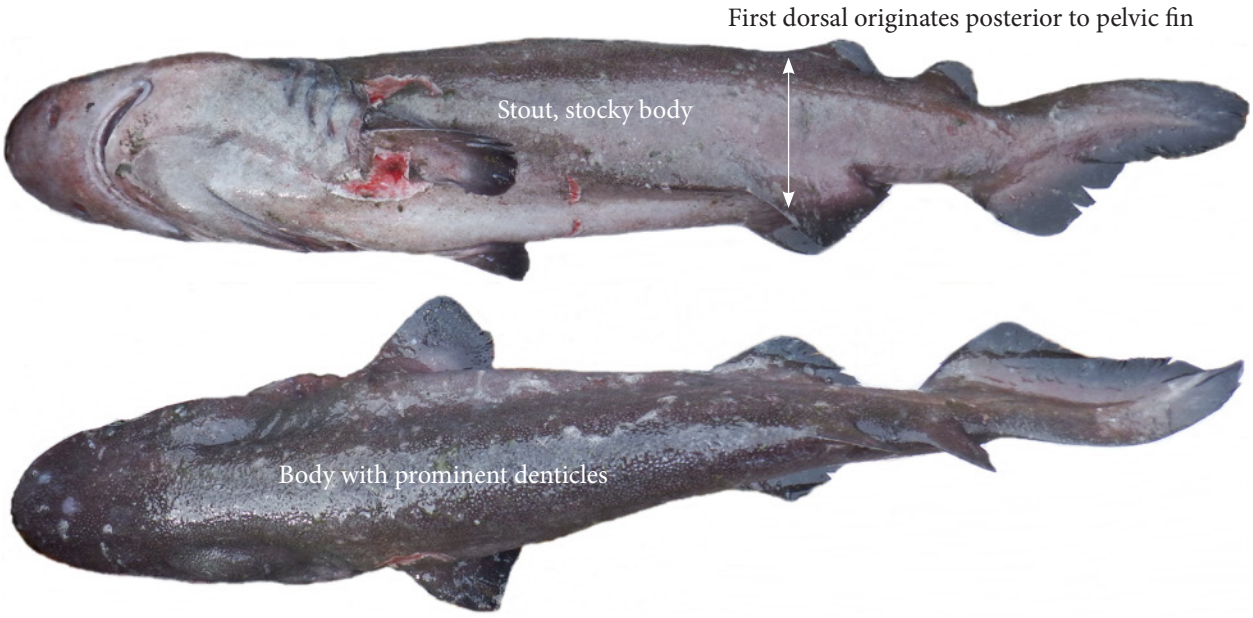
Similar species
Not likely to be confused with other species with dorsal fin spines.

Distribution
Pacific black dogfish range from southern California to Chile at depths of 640–1,097 m.

Echinorhinidae (Bramble Sharks)

The bramble sharks consist of two species in a single genus. These slender to stout-bodied sharks are small, with a maximum length of about 2 m. These are moderately large sharks with cylindrical bodies, a broadly arched mouth, and small spiracles. There are no dorsal fin spines, and the first dorsal fin originates behind the pelvic fins. Large denticles cover the body. Primarily found in the deep water of the outer continental shelf and upper continental slope, they are occasionally in shallow water.

Prickly shark (*Echinorhinus cookei*)



Description
Prickly sharks are a uniform brown to slate gray or black, with lighter coloration around the mouth and the underside of the snout. The moderately large, stout, and flabby body has very large denticles irregularly scattered over the body and fins. The first dorsal fin originates behind the pelvic fins. To 400 cm TL (usually smaller).

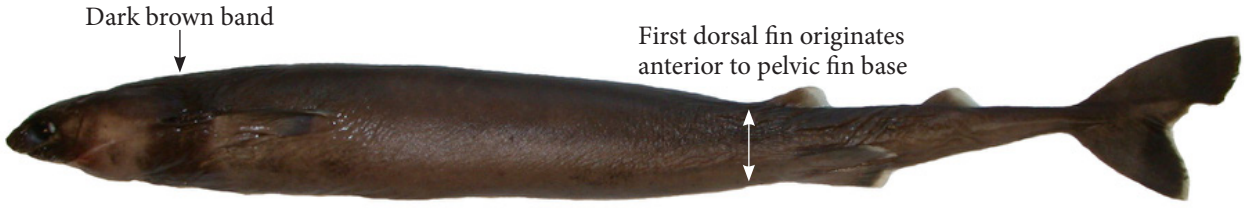
Similar species
The stocky body, large prominent denticles, and the first dorsal originating behind the pelvic fins distinguishes the prickly shark from other similar species.

Distribution
In the western Pacific, prickly sharks range from Japan and Taiwan to the southern Pacific around Palau, Australia, and New Zealand. In the eastern Pacific, from Oregon to Hawaii and south to Baja California and the Gulf of California, Mexico, Costa Rica, Peru, and Chile, at depths of 11–1,100 m.

Dalatiidae (Kitefin Sharks)

The kitefin sharks comprise nine species in seven genera. These slender to stout-bodied sharks are small, usually less than 2 m. The fifth gill opening is smaller than the first four, except for the cookiecutter shark (*Isistius brasiliensis*). Large spiracles are set close behind the eyes. The upper jaw teeth are small with a single narrow cusp. The lower teeth are broad and bladelike with erect to oblique cusps. The adjacent lower teeth are imbricate or overlap along the edges, but not so the upper teeth. Some species have photophores, others have specialized glands on the shoulder or cloaca. The dorsal fins are small to moderate in size, the first usually smaller than the second. The first dorsal originates closer to the pectoral fins than the pelvics, except for the pygmy shark (*Euprotomicrus bispinatus*) and the cookiecutter shark. The second dorsal fin base can be over or posterior to the pelvic fin bases. Lateral keels on the caudal peduncle are present or absent.

Cookiecutter shark (*Isistius brasiliensis*)



Description
Cookiecutter sharks are small, slender, and cigar-shaped, with a bulbous snout and large oval eyes. The body color is brown dorsally, somewhat lighter ventrally, with a dark band around the gills. There are two similar-sized dorsal fins—the first originates just anterior to the pelvic fin bases and the second originates over the free tips of the pelvic fins—and a large, nearly symmetrical caudal fin. The small upper teeth have a single, smooth-edged, nearly erect cusp. The triangular lower teeth are much larger and broader. To 56 cm TL.

Similar species
The dark brown band, size and location of the first dorsal fin in relation to the pelvic fins, and the size of the second dorsal fin distinguish the cookiecutter shark from other similar species.

Distribution
Cookiecutter sharks are an oceanic species that can be found at depths to 3,500 m along the continental slopes and deep, open-ocean waters in tropical and warm, temperate seas worldwide.

Somniosidae (Sleeper Sharks)

The sleeper shark family consists of at least 15 species in four or more genera. Sleeper sharks are some of the world's largest sharks, reaching lengths of 5 m. These sharks have five similar-sized gill openings and two small dorsal fins that may or may not have fin spines. The first dorsal fin can be close to either the pectoral or pelvic fins. The caudal peduncle lacks keels and precaudal pits. A small keel on the caudal fin can be present or absent.

Key to the Somniosidae of the FRAM Surveys

1	Anal fin and dorsal spines absent; long, slender upper teeth with a smooth cusp; short lower teeth with an oblique cusp ..... ***Somniosus pacificus***	p 13
1	Anal fin and dorsal spines present; sharp, needlelike, single-cusped upper teeth; sharp, bladelike, single-cusped cutting lower teeth..... ***Scymnodon squamulosus***	p 13

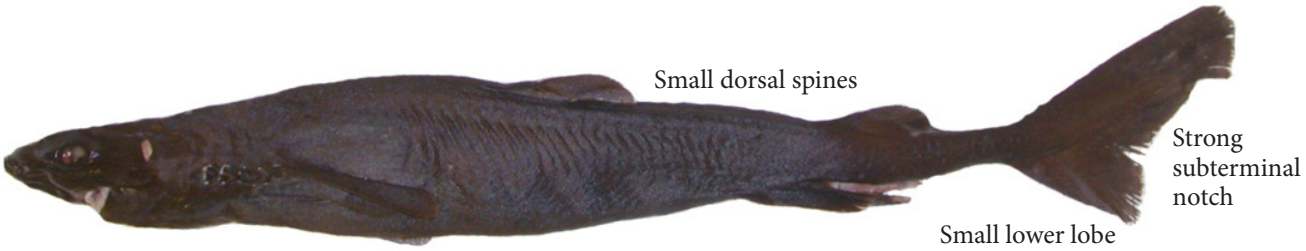
Pacific sleeper shark (*Somniosus pacificus*)

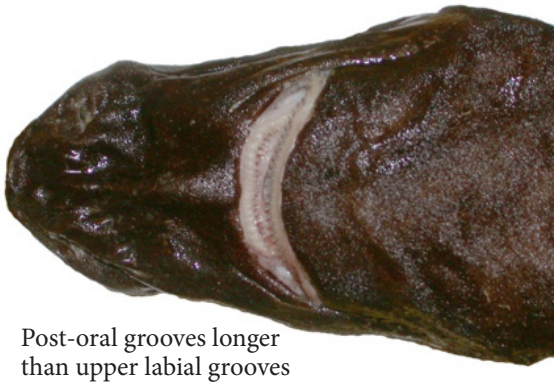
Description
Pacific sleeper sharks are uniformly brown or brown/black. Dorsal fin spines and anal fin absent. Upper teeth have a long, slender, smooth cusp. Lower teeth are short and low with an oblique cusp. To 700 cm TL or more.

Similar species
Most other large sharks have an anal fin.

Distribution
Pacific sleeper sharks range from Japan and the Sea of Okhotsk, the Chukchi and Bering Seas, and possibly the East Siberian and Beaufort Seas to southern Baja California, Mexico, usually on or near the bottom at depths to at least 2,000 m, but can be intertidal or near the surface.

Velvet dogfish (*Scymnodon squamulosus*)





Description
Velvet dogfish are dark brown to black. There are two dorsal fins far back on the body, each with a single spine. The pelvic fins are just anterior to the second dorsal fin. Anal fin, absent. The low, flat head has a long, narrow snout. The post-oral grooves are much longer than the upper labial grooves. The needlelike upper and bladelike lower teeth have a single cusp. The gill slits are short, the longest being less than half the eye length. The posterior edge of the pectoral fins is anterior to the first dorsal spine. The small pelvic fins are nearly equal to the second dorsal fin. The caudal fin has a strong subterminal notch and a short lower lobe. To 84 cm TL.

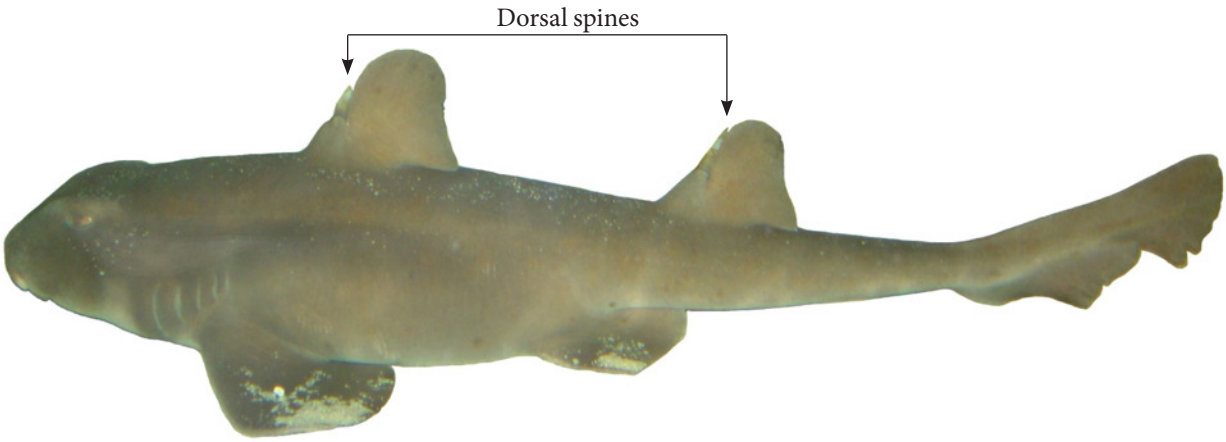
Similar species
Not likely to be confused with other species.

Distribution
Velvet dogfish range from Japan and Taiwan to southeastern Australia and New Zealand. In the central Pacific near Hawaii and Chile in the southeastern Pacific. Usually on or near the bottom at depths of 550–1,450 m and well off the bottom over depths from 2,000–6,000 m.

Heterodontidae (Horn Sharks)

The horn sharks belong to a single genus with eight related species and are the only sharks that have a single spine in front of both dorsal fins and also an anal fin. Horn sharks are small to medium-sized, with a broad, blunt head with broad crests over each eye. The stout body tapers toward the tail. The small mouth has small front teeth and larger crushing teeth in the rear.

Horn shark (*Heterodontus francisci*)



Description
Adult horn sharks are gray to brown or dark tan, with light and dark patches of the same color dorsally, somewhat lighter laterally, and yellowish ventrally. Scattered small black spots on dorsum present or absent. Young horn sharks may also have numerous white spots on the body and fins. The short head has a blunt snout and raised ridges above the eyes. Females tend to grow larger than males, reaching lengths to 96 cm TL.

Similar species
The anal fin is absent in other sharks with dorsal spines.

Distribution
Although rare north of southern California, horn sharks range from central California to Baja California and the Gulf of California, Mexico, at depths to 146 m.

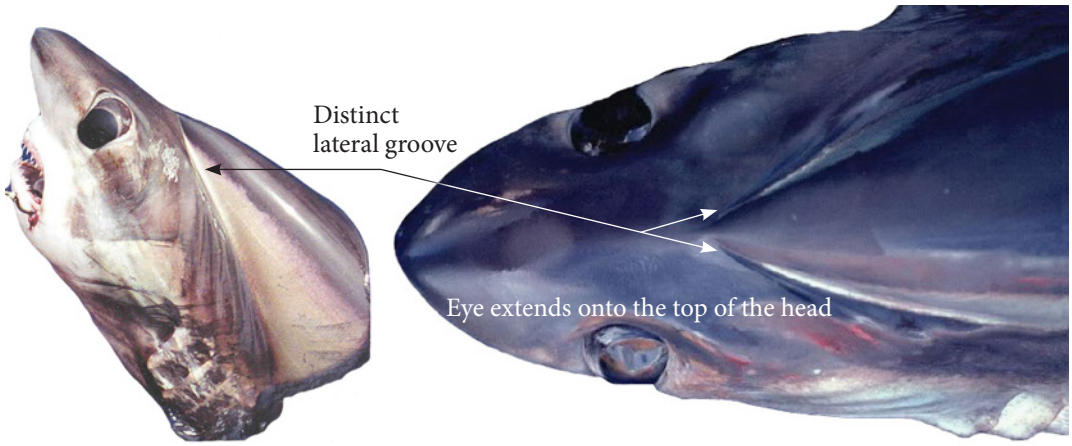
Alopiidae (Thresher Sharks)

Thresher sharks have an upper caudal lobe that can be as long as the body and is used to herd and stun their prey. The family contains a single genus and three species. Common features include the long caudal fin and no precaudal pits or keels on the caudal peduncle. The three species can be broken down into two categories. The first category contains the common and pelagic threshers. These fish have small to moderately sized eyes, a thin tail, and no prominent grooves on the top of the head. The second category contains the bigeye thresher. Bigeye threshers have very large eyes that extend onto the top of the head, prominent grooves that extend from the top of the head to behind the gill slits, and a broad tail.

Key to the Alopiidae of the FRAM Surveys

1	Deep lateral groove around both sides of the head; orbits of the large eyes extend onto the top of the head ..... ***Alopias superciliosus***	p 15
1	No lateral groove around the head; eyes and orbits do not extend onto the top of the head 2	
2(1)	Dark above the pectoral and pelvic fins; narrow head with a long snout; labial furrows present ..... ***Alopias pelagicus***	p 16
2	White above the pectoral and pelvic fins; broad head with a short snout; labial furrows absent ..... ***Alopias vulpinus***	p 17

Bigeye thresher (*Alopias superciliosus*)

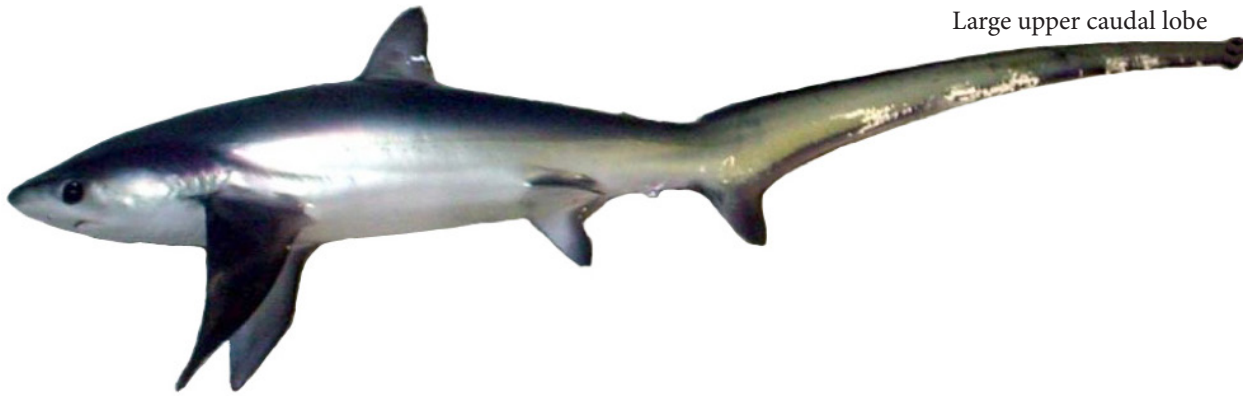


Description
Bigeye threshers are gray to violet or red/brown dorsally, fading to white ventrally. Light patches above the pectoral fin bases absent. The large eyes and orbits extend onto the top of the head. The dorsal profile of the head appears indented, with a weakly convex forehead when viewed laterally. The interorbital space is flat. The moderately long snout is somewhat bulbous. Distinct lateral grooves extend from above the eye to behind the gill slits. A horizontal groove extends to about midbody. Labial grooves are absent. Pectoral fins have curved anterior margins and broad tips. Upper and lower teeth are similar, with a single, somewhat narrow cusp. To 461 cm TL.

Similar species
Eyes that extend onto the top of the head and grooves on the head and body distinguish the bigeye threshers from other thresher species.

Distribution
Bigeye threshers have a circumglobal tropical distribution, mainly near the surface offshore, but also inshore and at depths to 494 m.

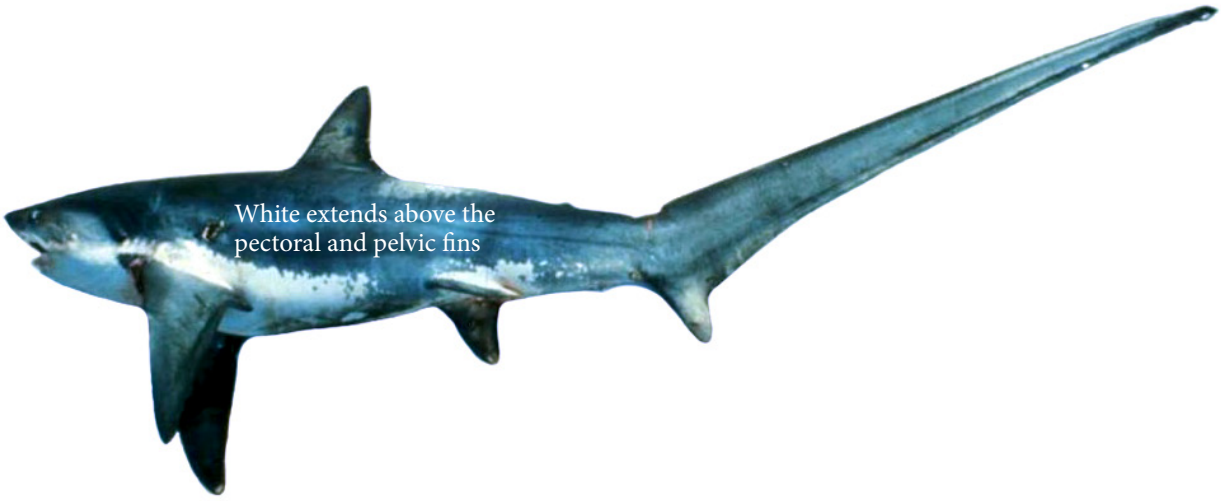
Pelagic thresher (*Alopias pelagicus*)



Description
Pelagic threshers are dark blue dorsally fading to white ventrally. Light patches above pectoral fins absent. Adults have moderately large eyes, but orbits do not extend onto the top of the head. The dorsal profile of the head is convex and the forehead moderately convex in the lateral view. The interorbital space is broadly convex. The conical snout is long with a very indistinct horizontal groove above the gills on each side of the head. Labial grooves are absent. Pectoral fins with a straight anterior margin with broad tips. The upper caudal lobe is nearly as long as the body. The terminal lobe is very small. Except for the first few rows, the upper and lower teeth are small with a single, smooth-edged, oblique cusp, and 1–2 lateral cusplets. To 383 cm TL.

Similar species
The common thresher (*Alopias vulpinus*) has white patches above the pectoral and pelvic fins. The bigeye thresher (*A. superciliosus*) has large eyes that extend onto the top of the head, and prominent horizontal grooves starting above the eye and extending almost half the body length.

Distribution
Known to reach southern California in warm-water years, pelagic threshers range throughout the tropical and warm, temperate waters of the Pacific and Indian oceans, from near the surface to depths of at least 152 m.



Description
Common threshers are blue, brown, or black dorsally, fading to lighter shades of the same color laterally, and white but sometimes becoming silvery, bluish, or golden to white with dark patches ventrally. The white extends as patches above the bases of the pectoral and pelvic fins. The orbits of the moderately large eyes do not extend onto the top of the head. The dorsal profile of the head is convex, with a strongly convex forehead in the lateral view. The pointed conical snout is relatively short. There are no visible grooves on the sides of the head above the gill slits, but labial grooves are present. Pectoral fins have a curved anterior edge and narrow pointed tips. The upper caudal lobe is up to half the TL, with a moderately sized terminal lobe. All teeth have a single, narrow, smooth-edged, obliquely triangular cusp. To 636 cm TL.

Similar species
The pelagic thresher (*Alopias pelagicus*) has differently shaped teeth and does not have the white patches above the pectoral and pelvic fins. The bigeye thresher (*A. superciliosus*) has large eyes that extend onto the top of the head and prominent horizontal grooves starting above the eye and extending almost half the body length.

Distribution
Common thresher sharks have a circumglobal distribution in warm and temperate seas, both over the continental and insular shelves and epipelagic far from land, near the surface to 366 m. In the eastern Pacific they range from the southeastern Gulf of Alaska through British Columbia, Canada, to Baja California, Mexico, Panama, and Chile.

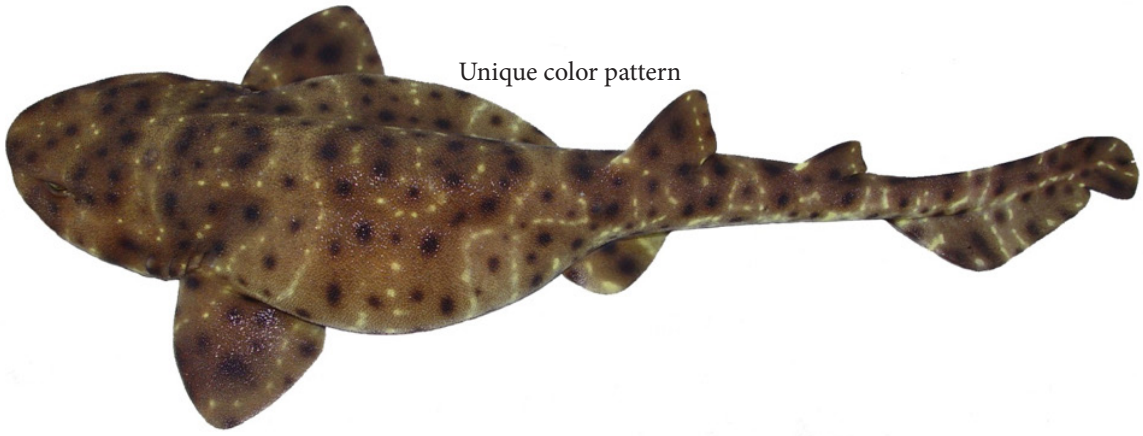
Scyliorhinidae (Cat Sharks)

The cat shark family is a large group comprising 15 genera with at least 106 species. These small sharks have small, slitlike eyes, small multicusped teeth, and a first dorsal fin that originates over or slightly behind the pelvic fin origin.

Key to the Scyliorhinidae of the FRAM Surveys

1	Body is yellowish brown with dark saddles, numerous dark brown and yellow spots, light brown ventrally; short, rounded snout; labial grooves tiny, if present ..... ***Cephaloscyllium ventriosum***	p 18
1	Uniformly colored body; not inflatable 2	
2(1)	Gray/brown to brown/black dorsally, lighter ventrally; inside of mouth light; short labial grooves nearly equal; upper edge of caudal fin with prominent ridge of enlarged denticles ..... ***Parmaturus xaniurus***	p 19
2	Body uniformly dark; snout long; long labial grooves unequal; upper edge of upper caudal fin without a prominent ridge of enlarged denticles 3	
3(2)	Various shades of brown to nearly black; inside of mouth dark; long labial grooves, upper longer than lower; discontinuous supraoral sensory canal; anal fin shallow, long based, nearly reaching caudal fin; 2 small gill openings ..... ***Apristurus brunneus***	p 19
3	Generally black with the posterior edges of the fins white or very light; inside of mouth dark; long labial grooves nearly equal, lower somewhat longer than upper; supraoral sensory canal continuous; anal fin high, somewhat angular and short, not reaching caudal fin; gill openings long ..... ***Apristurus kampae***	p 20

Swell shark (*Cephaloscyllium ventriosum*)



Description

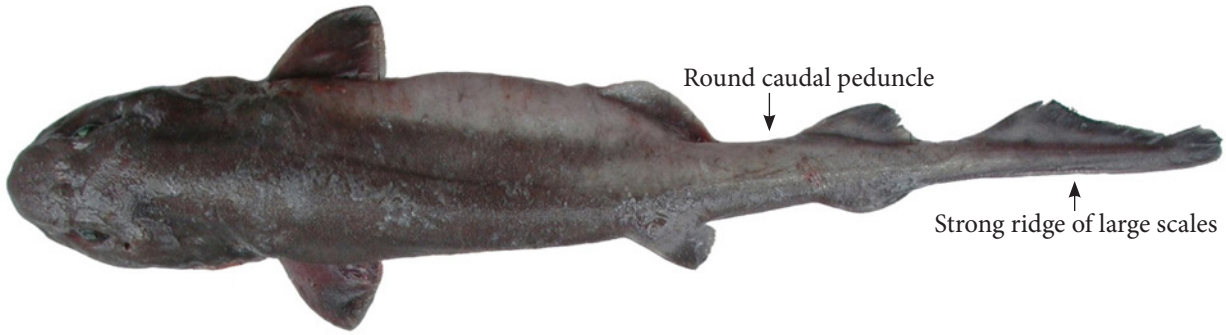
Swell sharks are yellow brown with 7–8 saddlelike bars and numerous dark brown, black, and yellowish-white spots on the body and fins; the ventral surface is light brown. The flattened head has a short, rounded snout. Labial grooves are tiny when present. To 96 cm TL.

Similar species

The unique coloration distinguishes swell sharks from other cat sharks.

Distribution
Swell sharks range from Monterey Bay, California, to Acapulco, Mexico, usually to depths less than 37 m—but have been recorded to depths of 457 m.

Filetail cat shark (*Parmaturus xaniurus*)

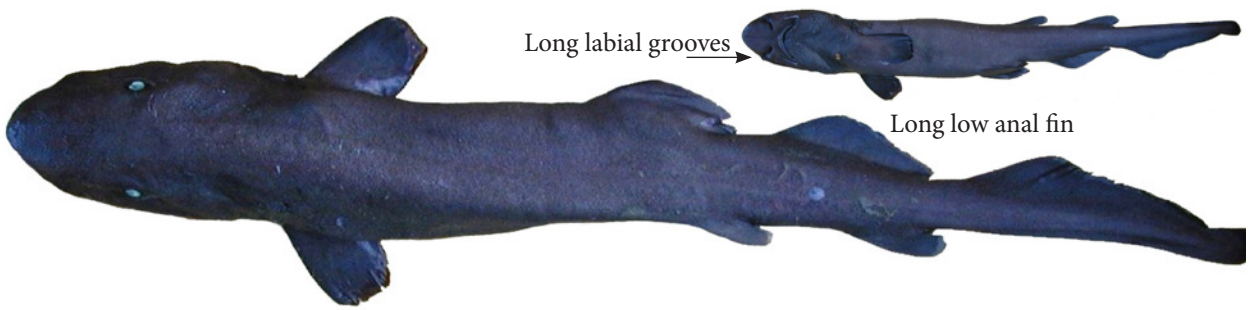


Description
Filetail cat sharks are gray to black/gray or brown. The body and caudal peduncle are nearly round in the cross-section. The broad, blunt, rounded snout has broad, triangular nasal flaps. The short upper and lower labial groves are about equal in length. The inside of the mouth is dusky to light in color. The convex sides of the crescent shaped gill openings point forward. The two dorsal fins are similar in size. The first dorsal originates posterior to the pelvic fin origin, with the insertion anterior to the pelvic fin insertion. The origins of the second dorsal and anal fins are nearly opposite, with the dorsal fin insertion ahead of the anal fin insertion. The anterior edge of the caudal fin has a strong ridge of enlarged scales. To 61 cm TL.

Similar species
Apristurus species are laterally compressed and have a less-pronounced edge on the caudal fin. The inside of the mouth is very dark to black.

Distribution
Filetail cat sharks range from Cape Foulweather, Oregon, to the Gulf of California, Mexico, usually on or near the bottom at depths of 91–1,251 m.

Brown cat shark (*Apristurus brunneus*)



Description
Brown cat sharks are medium to dark brown or black, with darker fin edges. The inside of the mouth is a dark grayish-blue to black. The snout is broad and rounded, and the gill openings small. The supraorbital sensory canal is not continuous. The upper and lower labial grooves are long, with the upper groove somewhat longer than the lower. The two dorsal fins are approximately the same size, the first dorsal origin posterior to the pelvic fin insertion. The long, shallow anal fin extends nearly to the base of the caudal fin. The anal fin insertion is posterior to the second dorsal fin insertion. To 69 cm TL.

Similar species
The longnose cat shark (*Apristurus kampae*) has a longer and more pointed snout, a continuous supraorbital sensory canal, white edged fins, differently shaped dorsal fins with different points of insertion, and a short, deep anal fin. The filetail cat shark (*Parmaturus xaniurus*) has a light lining to the inside of the mouth.

Distribution
Brown cat sharks range from southeastern Alaska to Panama, usually on or near the bottom, at depths of 33–1,306 m, but also high in the water column.

Longnose cat shark (*Apristurus kampae*)

Description
Longnose cat sharks are black to dull brown; the fins all have light or white posterior. The long, somewhat pointed snout has a wide internarial space. The supraorbital sensory canal is continuous. The gill openings are somewhat large. The long upper and lower labial grooves are about equal in length, or the lower groove is somewhat longer than the upper. The two dorsal fins have approximately equal fin base lengths, but the second dorsal is higher and broader than the first and originates over the midpoint of the anal fin. The free rear edge of the short, high, rounded anal fin does not reach the origin of the lower caudal fin. The anal fin insertion is ahead of the second dorsal fin insertion. To 57 cm TL.

Similar species
The brown cat shark (*Apristurus brunneus*) has a narrow internarial space, a discontinuous supraorbital sensory canal, a long, shallow anal fin, dark fin edges, and the upper labial groove is longer than the lower.

Distribution
Longnose cat sharks range from southern Oregon to the Gulf of California at depths of 183–1,829 m.

Triakidae (Houndsharks)

The houndshark family consists of nine genera and at least 39 species. These small to medium-sized sharks have a slender fusiform body, large eyes, small to moderately large spiracles, and two spineless, similar-sized dorsal fins—except for soupfin sharks, which have a smaller second dorsal.

Key to the Triakidae of the FRAM Surveys

1	Distinct dark saddles and spots on the dorsal surface..... ***Triakis semifasciata***	p 21
1	No distinct spots or saddles 2	
2(1)	First dorsal fin large; second dorsal and anal fins about equal; lower caudal fin lobe approximately half the length of upper caudal fin margin..... ***Galeorhinus galeus***	p 22
2	Dorsal fins nearly equal; second dorsal fin larger than anal fin; lower caudal fin lobe less than half the length of upper caudal fin margin..... 3	
3(2)	Rear edge of both dorsal fins frayed..... ***Mustelus henlei***	p 22
3	Dorsal fins not frayed..... 4	
4(3)	First dorsal fin originates behind pectoral fin; rear edge of first dorsal slopes backward; lower lobe of caudal fin is indistinct..... ***Mustelus californicus***	p 23
4	First dorsal fin originates over far rear edge of pectoral fins; rear edge of first dorsal is vertical; lower caudal fin lobe is long and pointed..... ***Mustelus lunulatus***	p 23

Leopard shark (*Triakis semifasciata*)

Distinctive color pattern

Description

Leopard sharks are silver/gray to bronze/gray with very large, well defined black saddles, bars, and spots, with a light, unmarked ventral side. To 210 cm TL.

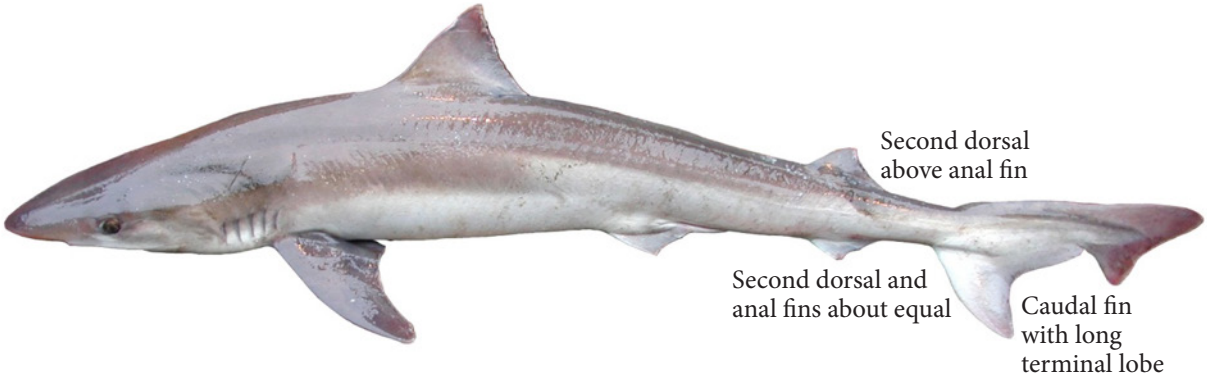
Similar species

The distinct coloration distinguishes the leopard shark from other houndsharks.

Distribution

Leopard sharks range from Oregon to Baja California and the Gulf of California, Mexico, at depths to 91 m but most commonly in waters less than 10 m.

Soupfin shark, tope (*Galeorhinus galeus*)

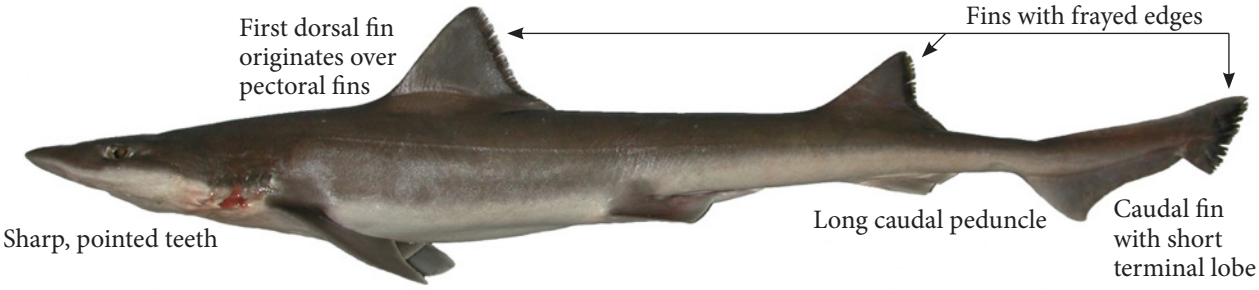


Description
Soupfin sharks are gray to bronze dorsally and white ventrally, with a long, narrow snout and large mouth. The teeth in both jaws are small, triangular, bladelike, and have a single, smooth-edged cusp followed by 4–5 smaller cusplets. The larger first dorsal fin originates over the free posterior edge of the pectoral fins. The second dorsal fin is smaller—about half the size of the first—and is about as large as, and nearly opposite, the anal fin. The caudal fin has a large terminal lobe that is nearly the size of the lower lobe. To 195 cm TL.

Similar species
In the smoothhounds (*Mustelus* spp.) the second dorsal fin is larger and originates forward of the anal fin, and the terminal lobe of the caudal fin is generally small. Requiem sharks (*Carcharhinidae* spp.) have precaudal pits, shorter terminal lobes, and long lower lobes on their caudal fins.

Distribution
Soupfin sharks in the northeastern Pacific range from British Columbia, Canada, to central Baja California and the Gulf of California, Mexico, from close inshore, including shallow bays, to depths of 471 m.

Brown smoothhound (*Mustelus henlei*)



Description
Brown smoothhounds are brown to bronze dorsally, with lighter shades of the same color on the sides, and white ventrally. The short head has a moderately long, bluntly to sharply angular snout. The lower and upper jaw teeth have a strong, sharp primary cusp. The first dorsal fin originates

over the pectoral fin and has a rear edge that slopes down toward the caudal fin. Both dorsal fins, and occasionally the anal and caudal fins, with frayed posterior margins. The caudal peduncle is long, and the caudal fin has a short terminal lobe. To 100 cm TL.

Similar species
Other *Mustelus* species lack the frayed dorsal fins and have blunt teeth. Pacific spiny dogfish (*Squalus suckleyi*) has a prominent spine at the leading edge of both dorsal fins.

Distribution
Brown smoothhounds range from Coos Bay, Oregon, to the Gulf of California, Mexico, and again from Ecuador to Peru, typically near the bottom from the intertidal area to depths of 200 m.

Gray smoothhound (*Mustelus californicus*)

Description
Gray smoothhounds are gray to brown dorsally, with lighter shades of the same color on the sides, and white ventrally. The short head has a moderately long, blunt snout. The teeth are blunt and pebblelike with a single blunt cusp. The broadly triangular first dorsal fin has a slightly sloping to nearly vertical posterior edge, and originates behind the pectoral fins. To 124 cm TL.

Similar species
Other members of the genus also have a first dorsal fin that originates over the pectoral fins.

Distribution
Gray smoothhounds, though rare north of Point Conception, California, and most commonly found at depths less than 12 m, range from Cape Mendocino, California, to Mazatlán and the Gulf of California, Mexico, at depths to 46 m.

Sicklefin smoothhound (*Mustelus lunulatus*)

Description
Sicklefin smoothhounds are gray to olive brown dorsally, with lighter shades of the same color on the sides, and light ventrally. The short, narrow head has a moderately long, bluntly angular snout. The teeth are blunt and pebblelike with a single low, blunt cusp. The first dorsal fin is falcate, with an abruptly vertical posterior edge from the apex. The tip of the terminal lobe is somewhat pointed, while the lower lobe is elongate, pointed, and hooked. To 110 cm TL.

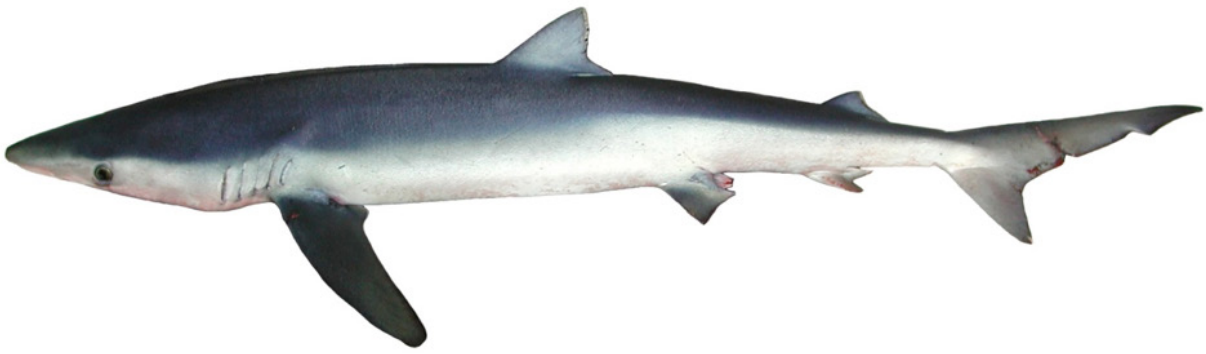
Similar species
Other *Mustelus* species have short lower lobes and an angled rear edge on the first dorsal fin.

Distribution
Sicklefin smoothhounds range from southern California to the Gulf of California and Panama at depths to 94 m. Uncommon in U.S. waters, can be seasonally abundant in warm-water years.

Carcharhinidae (Requiem Sharks)

The requiem shark family has 12 genera and at least 50 species. Requiem sharks have round eyes with a distinct nictitating membrane, and most species do not have spiracles. The five gill slits are similar in size, with the fifth slit over or behind the origin of the pectoral fin. There are two spineless dorsal fins. The first dorsal is placed well ahead of the pelvic fin and is much larger than the second. There is an anal fin, and precaudal pits but no caudal keels. The upper lobe of the caudal fin is roughly twice the length of the lower lobe.

Blue shark (*Prionace glauca*)



Description
Blue sharks are dark blue to blue/black dorsally, brilliant blue on the upper sides, and white ventrally. The body is slender, with a long, narrow snout, large eyes, and long, narrow pectoral fins. The teeth in the upper jaw have a finely serrated, single, narrow, slender cusp. The lower teeth have broader cusps and can have either serrated or smooth edges. To 380 cm TL.

Similar species
Other requiem sharks are extremely rare and not likely to be encountered.

Distribution
Blue sharks can be found worldwide in temperate to tropical waters at depths from the surface to 220 m. Blue sharks in the eastern Pacific range from the Gulf of Alaska to Chile.

Squatinidae (Angel Sharks)

The angel sharks are a small group of approximately 15 species in a single genus, family, and order. The dorsoventrally compressed body is very distinct. The pectoral fins do not attach to the head, and the five gill slits at least partially extend up onto the sides of the head.

Pacific angel shark (*Squatina californica*)

Description
Pacific angel sharks are gray, brown, tan, or reddish, with various dark spots dorsally, and white ventrally. The long terminal mouth is nearly three-fourths the head length. The upper and lower jaw teeth are small, with a single, large, sharply pointed cusp. The gill slits are close together laterally in the notch at the rear of the head anterior to the pectoral fins. The large, winglike pectoral fins of this distinctly flattened raylike shark are not attached to the head. To 152 cm TL.

Similar species
Other flattened species have attached pectoral fins and gill slits on the underside of the head.

Distribution
Pacific angel sharks range from southeastern Alaska to the Gulf of California, Mexico, and again from Ecuador to southern Chile, at depths from 3–183 m, usually on the bottom but also swimming well off the bottom over deep water.

Rajiformes (Skates and Rays)

Skates and rays make up the largest group of elasmobranchs worldwide. There are at least 540 species in 71 genera and 22 families. Skates and rays are flat, disk-shaped fish with large pectoral fins attached to the sides of the head that are continuous with the body.

Rhinobatidae (Guitarfishes)

The guitarfish family consists of at least 50 species in four genera. Guitarfishes have a narrow, angular snout, with large, attached, angular to rounded pectoral fins that form a triangular disc with the head. They have two dorsal fins, with the first originating closer to the pelvic fins than the origin of the caudal fin. The thick tail has a rather large caudal fin with an indistinct lower lobe.

Key to the Rhinobatidae of the FRAM Surveys

1	Disc as long as wide; several distinct dark bands on dorsal side ..... ***Zapteryx exasperata***	p 26
1	Disc longer than wide; dorsal side usually unmarked, may occasionally have dark spots but no prominent dark markings ..... ***Rhinobatos productus***	p 27

Banded guitarfish (*Zapteryx exasperata*)

Description
Banded guitarfish are sandy brown to dark gray, with several prominent dark bands or bars dorsally. The ventral side is lighter, with light spots on the inner portion of the disc and dark spots along the edge. The blunt disc is about as wide as it is long. Variously sized spines cover the dorsal surface, with a single row of strong thorns along the midback. The tail is long, thick, and broad. There are two well formed dorsal fins. The first dorsal is closer to the pelvic fins than to the large caudal fin, which does not have a distinct lower lobe. To 97 cm TL.

Similar species
The shovelnose guitarfish (*Rhinobatos productus*) has a smooth, unmarked back, a narrow snout and disc, and a single row of spines on the back and tail.

Distribution
Banded guitarfish range from southern California to at least Mazatlán, Mexico, the Gulf of California, and possibly Peru, from the intertidal zone to depths of 69 m.

Shovelnose guitarfish (*Rhinobatos productus*)

Description
Shovelnose guitarfish are sandy brown to olive dorsally and white ventrally. The flattened body has pectoral fins attached to the head forming a long, narrow disc. The snout is long and pointed, with the mouth and gill slits on the underside of the head. The tail is long, thick, and broad. There are two well formed dorsal fins. The first dorsal is closer to the pelvic fins than to the large caudal fin, which does not have a distinct lower lobe. The dorsal surface is smooth except for one row of spines around the eyes that extends down the back and tail. To 145 cm TL.

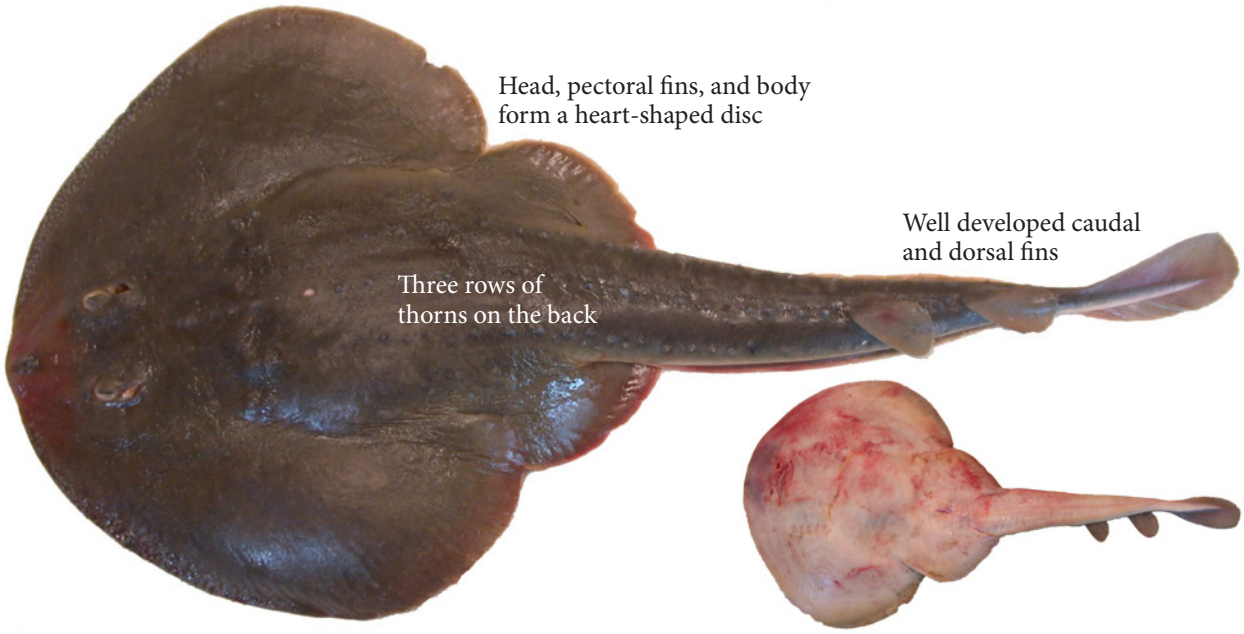
Similar species
The banded guitarfish (*Zapteryx exasperata*) has dark bars on the back, a broader disc, and a rough dorsal surface.

Distribution
The shovelnose guitarfish, though rare north of Monterey, California, ranges from San Francisco, California, to the Gulf of California and southern Mexico, in very shallow water but occasionally to 82 m.

Platyrhinidae (Thornback Guitarfishes)

Thornback guitarfish are endemic to the eastern Pacific and consist of at least three species in two genera. The head, pectoral fins, and trunk of the body form a heart-shaped disc. Depending on the species, they can have 1–3 rows of prominent thorns, varying in size, on the back and extending onto the tail.

Thornback guitarfish (*Platyrhinoidis triseriata*)



Description
The thornback guitarfish are a uniform olive to gray brown dorsally and white ventrally. The broad, rounded head, the pectoral fins, and the trunk form a heart-shaped disc. The short snout is bluntly rounded and there are three rows of thorns on the back and tail. There are two well formed dorsal fins. The first dorsal is closer to the caudal fin than to the tips of the pelvic fins. The thin tail has a well developed caudal fin that does not have a distinct lower lobe. To 91 cm TL.

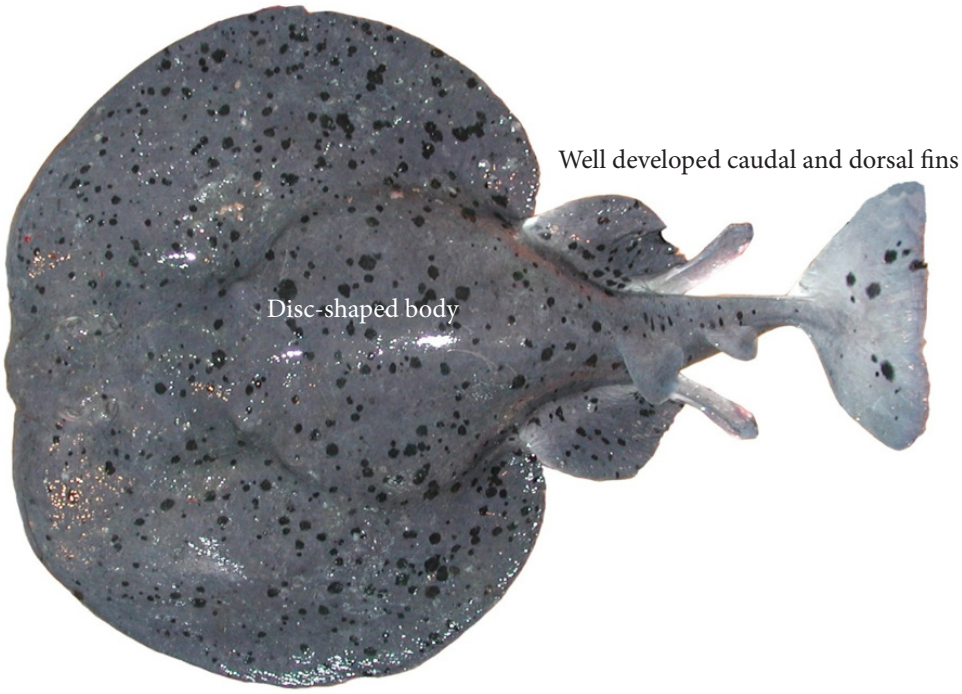
Similar species
Often referred to as the thornback ray, *Platyrhinoidis triseriata* should not be confused with *Raja clavata,* the thornback ray of the eastern Atlantic Ocean.

Distribution
Although uncommon north of Monterey, California, the thornback guitarfish ranges from Tomales Bay, California, to the Gulf of California, Mexico, usually in shallow water but occasionally to 137 m.

Torpedinidae (Electric Rays)

The electric ray family consists of at least 27 species in a single genus. The electric rays have a distinct rounded disc with a short, truncated snout. There are two well formed dorsal fins and a large caudal fin on the short, stout tail.

Pacific electric ray (*Torpedo californica*)



Description
Pacific electric rays are dark blue to blue/gray or brown/gray, with numerous dark spots dorsally, and white ventrally. The smooth body is soft and flabby with a thick, round disk. The short tail has a well developed caudal fin and two well developed dorsal fins. The first dorsal fin is almost twice the size of the second. To 137 cm TL.

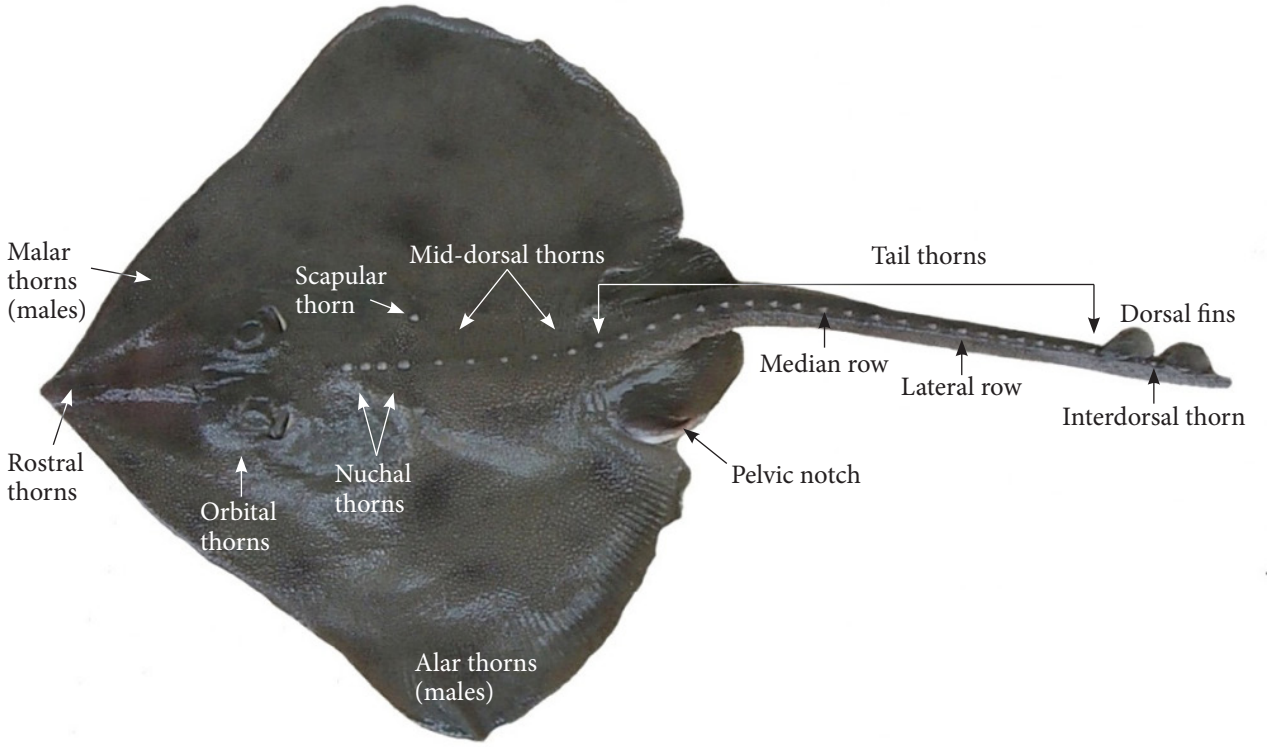
Similar species
The distinct shape, body texture, short stocky tail, and well developed caudal and dorsal fins separate the Pacific electric ray from other flattened species.

Distribution
Pacific electric rays range from northern British Columbia, Canada, to Baja California, Mexico, on or near the bottom at depths to 200 m, but also near the surface over deep water offshore.

Arhynchobatidae (Softnose Skates)

The softnose skates consist of at least 81 species in 11 genera. The short, flexible snout distinguishes the softnose skates.

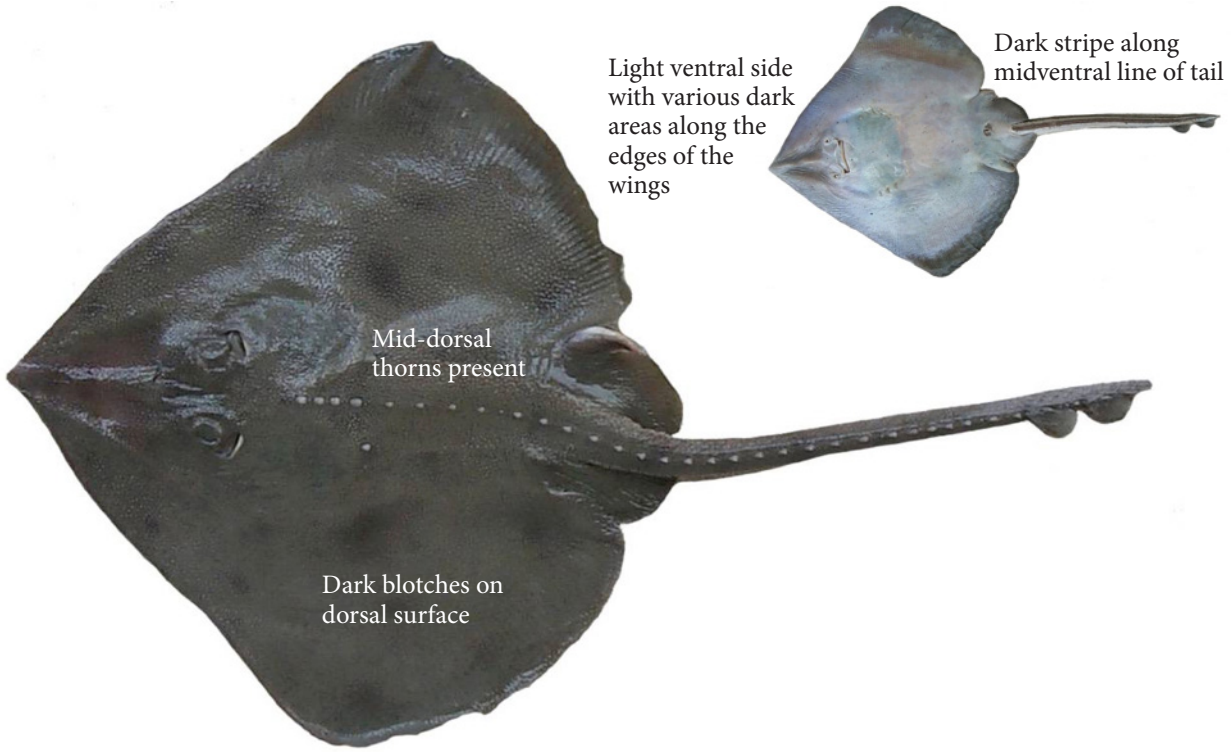
Skate dorsal thorn terminology and location



Key to the Arhynchobatidae of the FRAM Surveys

1	Scapular thorns present	2
1	Scapular thorns absent	3
2(1)	Mid-dorsal thorns present but may be reduced; dorsal side gray to olive w/dark blotches, ventral side light with dark areas ***Bathyraja aleutica***	p 31
2	Mid-dorsal thorns reduced or absent; dorsal color uniform, ventral side without dark areas ***Bathyraja kincaidii***	p 32
3(1)	1–5 prominent nuchal thorns ***Bathyraja abyssicola***	p 33
3	0–3 very weak nuchal thorns	4
4(3)	Prominent denticles and thorns on dorsal surface ***Bathyraja trachura***	p 34
4	Fine denticles and small thorns on dorsal surface	5
5(4)	Dorsal and ventral surfaces evenly covered with fine denticles; dorsal and ventral surfaces uniform gray color ***Bathyraja spinosissima***	p 35
5	Dorsal surface evenly covered with fine denticles, ventral side smooth; dorsal color dark, ventral side mostly white ***Bathyraja microtrachys***	p 35

Aleutian skate (*Bathyraja aleutica*)

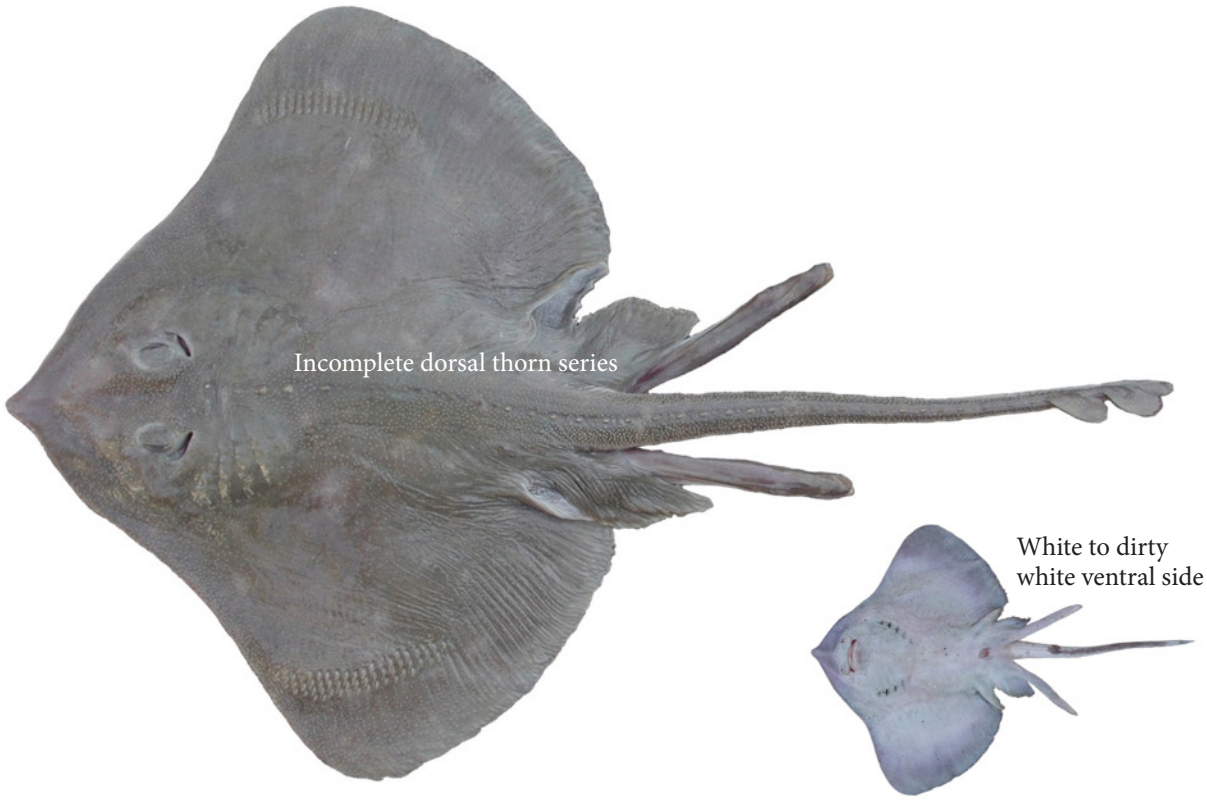


Description
Aleutian skates are olive, olive/gray, gray, or dark brown, with scattered dark mottling dorsally. The ventral side is white to dirty white except on the snout, posterior edges of the wings, and the midventral line on the tail, which are dusky or dark. The mottling on the dorsal side and dark areas on the ventral side are not as pronounced on juveniles. The broad disc has a triangular shape (becoming more pronounced with age), and rounded posterior edges of the pectoral fins. The triangular snout can be up to one-third of the total body length. The interorbital space is deeply concave. There are 1–2 strong scapular thorns per side. Although possibly reduced, the mid-dorsal thorn series is complete. Fine denticles evenly cover the dorsal surface. The ventral surface is smooth, but adults may have patches of denticles along the outside edges of the wings. To 154 cm TL.

Similar species
The sandpaper skate (*Bathyraja kincaidii*) has an incomplete row of mid-dorsal thorns.

Distribution
In the western Pacific, Aleutian skates range from off Hokkaido to the northern Sea of Japan; in the western Bering Sea, to the Sea of Okhotsk; from the eastern Bering Sea to the Aleutian Islands; and from British Columbia, Canada, to Cape Mendocino, California. On or near the bottom at depths of 15–1,602 m, most common on the outer continental shelf and upper continental slope at 100–800 m.

Sandpaper skate (*Bathyraja kincaidii*)

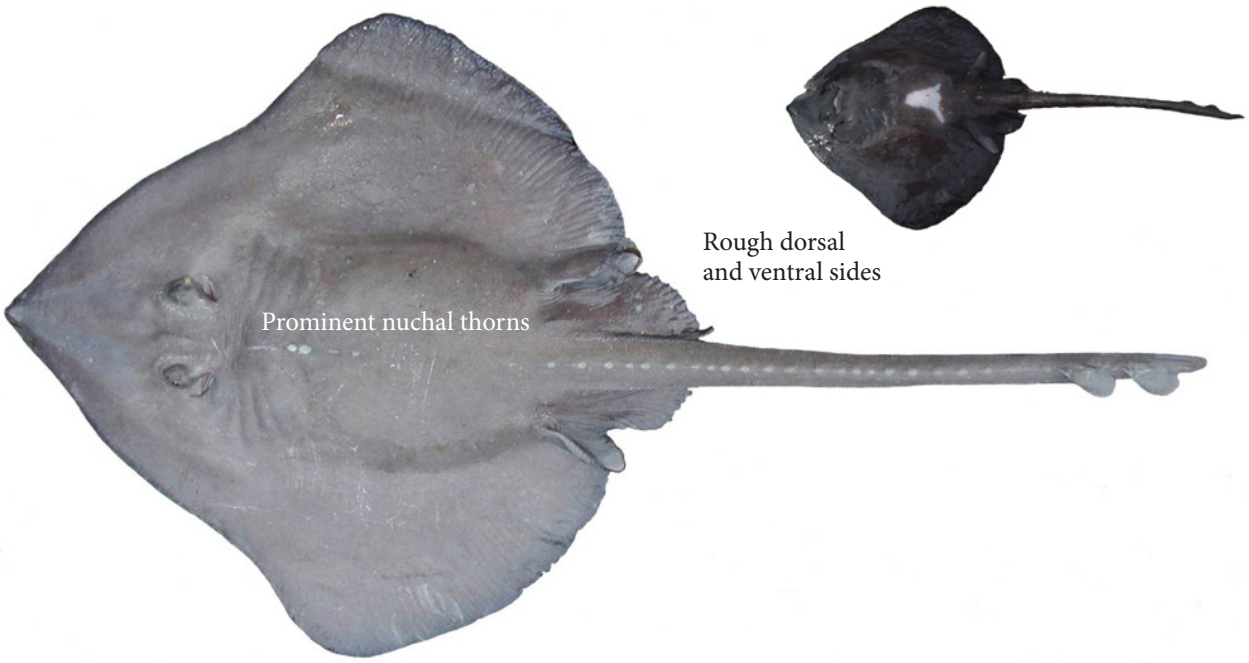


Description
Sandpaper skates are a uniform tan to light brown or gray. Juveniles often have various concentrations of small black dots dorsally. Adults lack the black dots, but may develop irregular light blotches. The ventral side is white to dirty white. In small skates, the dorsal color may be visible through the thinner, more translucent parts of the body such as the snout and posterior edges of the wings. The leading edge of the disc becomes more concave as the animal matures. The dorsal side is evenly covered with rough denticles; the ventral side is smooth. Large adults may have large smooth patches along the mid-dorsal region and/or the central and rear portions of the wings. The smooth ventral side may have small rough patches along the edges of the wings, especially in mature males. There are 1–2 scapular thorns per side. The median row of mid-dorsal thorns is generally incomplete, but can be complete or greatly reduced. To 56 cm TL.

Similar species
In some texts, *Bathyraja kincaidii* is a junior synonym to *B. interrupta,* the sandpaper or Bering skate. However, Ebert (2003) suggests two distinct species, and that *B. kincaidii* may have one or more morphological variants throughout its range. The Aleutian skate (*B. aleutica*) has a complete row of mid-dorsal thorns. The roughtail skate (*B. trachura*) has no thorns on the disc and is dark ventrally.

Distribution
Sandpaper skates range from British Columbia, Canada, to northern Baja California, Mexico, at depths of 32–500 m.

Deepsea skate (*Bathyraja abyssicola*)

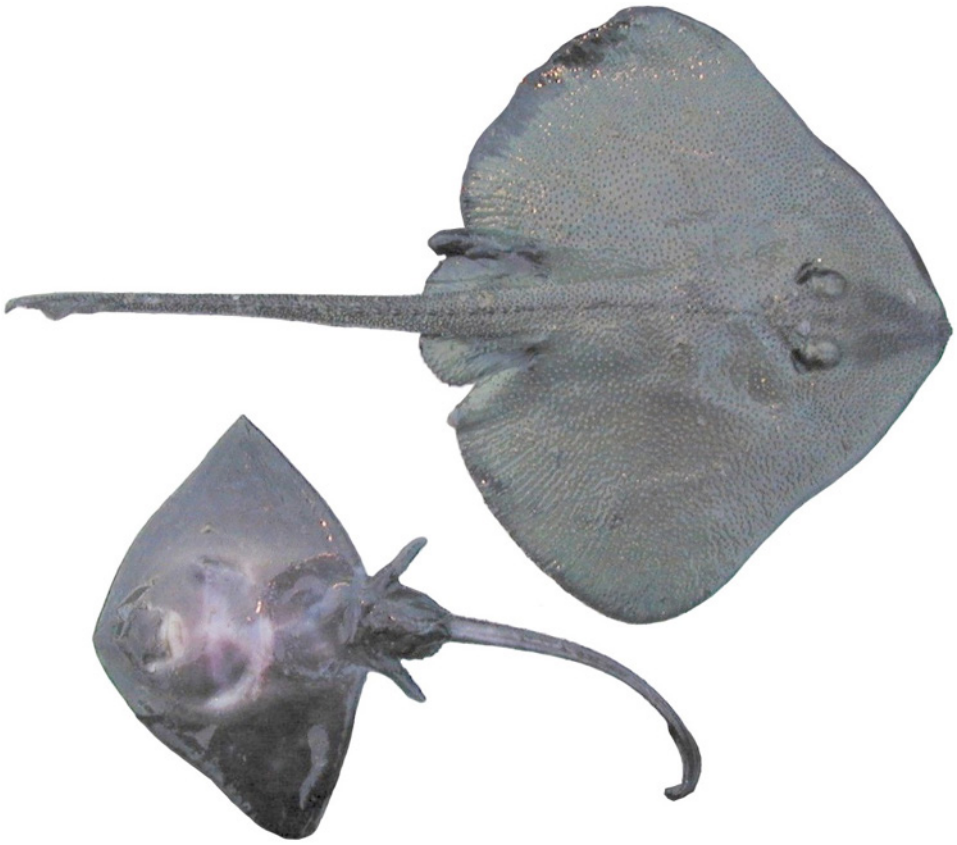


Description
Deepsea skates are gray or purple/gray to dark brown or black dorsally, sometimes with small dark spots. The ventral surface is usually a few shades darker and may have light or whitish areas around the mouth and gill openings. The anterior tips of the pectoral fins may be light or whitish. Large males have irregular light or whitish blotches and dark spots. When present on females, the light blotches are small. Juveniles tend to be uniformly colored. The triangular snout is long and narrow. The posterior margins of the wings are rounded. The long, narrow, tapered tail has two large, closely spaced dorsal fins, generally with one interdorsal thorn. There is a distinct gap between the second dorsal and caudal fins. Small denticles cover both the dorsal and ventral sides. Orbital, scapular, or mid-dorsal thorns are absent. There are 1–5 prominent nuchal thorns and a strong median row of tail thorns. To 157 cm TL.

Similar species
The roughtail skate (*Bathyraja trachura*) has no disc thorns and has a smooth ventral surface. The roughshoulder skate (*Amblyraja badia*) has prominent orbital and scapular spines. The white skate (*B. spinosissima*) has no enlarged thorns on the disc.

Distribution
Deepsea skates range from southern Japan through the western Bering Sea to the Aleutian Islands, southeastern Alaska, and British Columbia, Canada, to northern Baja California, Mexico, at depths of 362–2,904 m.

Roughtail skate (*Bathyraja trachura*)



Description
Roughtail skates are dark gray/black to black on both sides, with light areas around the mouth. Ventral-side gill openings are prominent on small specimens. Usually there are no thorns on the disc; however, the nuchal thorns, if present, are greatly reduced and fewer than three. A median row of strong tail thorns is present. The dorsal surface is covered with rough denticles that may become reduced or absent on larger specimens, especially mature males. To 92 cm TL.

Similar species
The sandpaper skate (*Bathyraja kincaidii*) has prominent scapular thorns and a partial or complete row of mid-dorsal thorns. The deepsea skate (*B. abyssicola*) has prominent nuchal thorns, and denticles on the ventral side.

Distribution
Roughtail skates range from Cape Navarin in the western Bering Sea to the Commander Islands, the northern Kuril Islands and Sea of Okhotsk, the eastern Bering Sea and the Aleutian Islands, then to northern Baja California, Mexico, at depths of 400–2,550 m.

White skate (*Bathyraja spinosissima*)

Description
White skates are white/gray to light gray on both sides, but can appear darker or dusky along the edges of the body. The body is slightly broader than it is long, and the leading edges of the pectoral fins are slightly convex. Small denticles cover both the dorsal and ventral surfaces. Other than the mature male's alar thorns, there are no other enlarged thorns or median thorns on the disc. The two dorsal fins are about equal in size, with no interdorsal thorn. There is a gap between the second dorsal fin and the long, tapering caudal fin, with a filamentous fold along the upper edge. To 150 cm TL.

Similar species
The deepsea skate (*Bathyraja abyssicola*) has prominent nuchal thorns.

Distribution
In the eastern Pacific, white skates range from central Oregon to the Galapagos Islands at depths of 800–2,938 m. There are also reports from the Sea of Okhotsk.

Fine-spined skate (*Bathyraja microtrachys*)

Description
Fine-spined skates are brown, with darker edges dorsally. The ventral side has a white patch that extends from the snout to the pelvic region, bordered by dark wings. The disc is slightly wider than long. The leading edge of the pectoral fins is straight to slightly concave. Small denticles, but no large thorns, cover the dorsal surface. The ventral surface is smooth. The slender tail has one median row of thorns and is slightly longer than the disk. There are two equal-sized dorsal fins with a distinct gap and one small interdorsal thorn. The free rear tip of the second dorsal slightly overlaps the short tapering caudal fin, which has a filamentous fold along the upper surface. To 70 cm TL.

Similar species
Until recently, *Bathyraja microtrachys* was considered a junior synonym of *B. trachura* (the roughtail skate). Roughtail skates are dark dorsally and ventrally, their leading pectoral fin edges convex. The tail is shorter than the disc and covered with numerous denticles, with no interdorsal thorn.

Distribution
Although rare, fine-spined skates range from Washington State to northern Baja California, Mexico, in very deep water (1,995–2,900 m), rarely shallower.

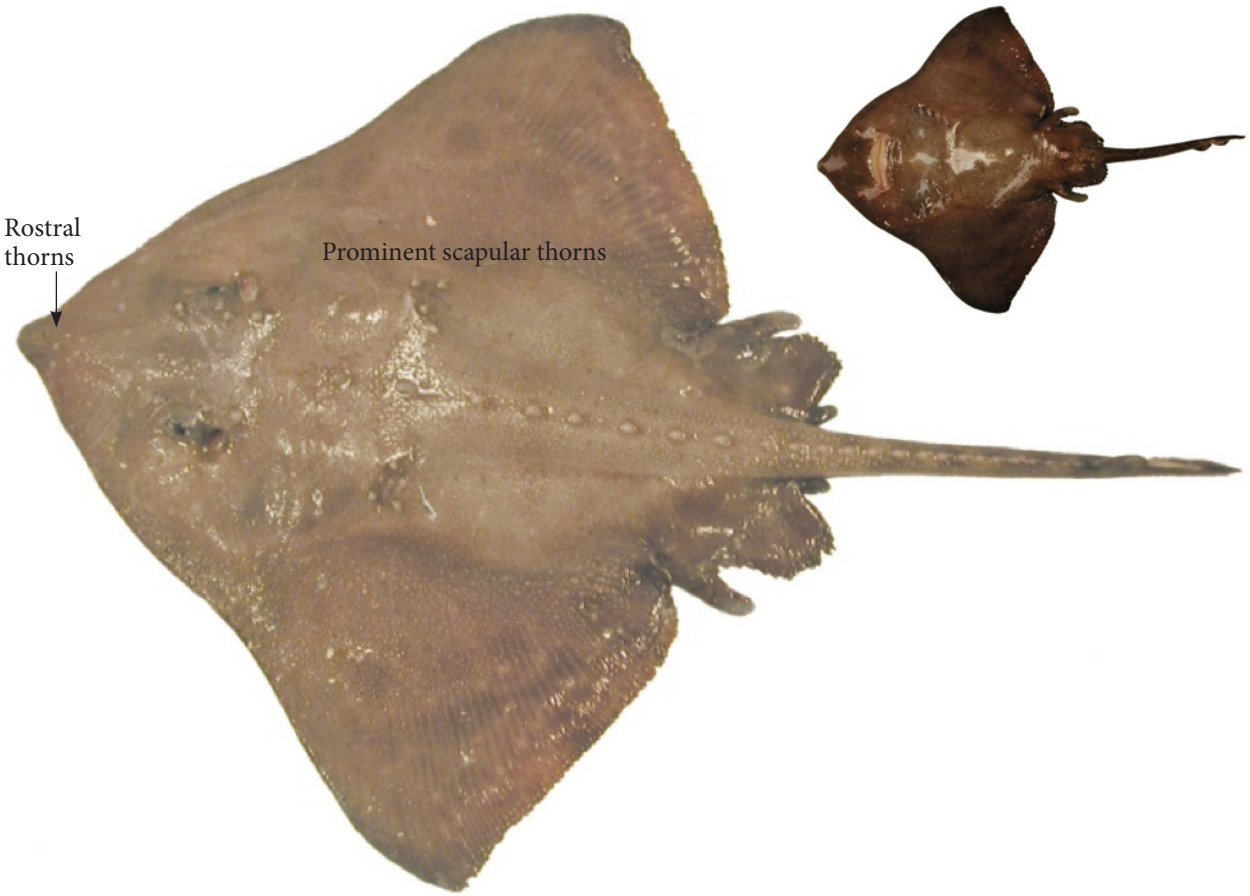
Rajidae (Hardnosed Skates)

The hardnosed skate family consists of at least 133 species in 15 genera. Their stout, stiff, elongated snout distinguishes the hardnosed skates.

Key to the Rajidae of the FRAM Surveys

1	Scapular thorns present	***Amblyraja badia***	p 36
1	Scapular thorns absent		2
2(1)	Pelvic fin with a shallow notch	***Beringraja binoculata***	p 37
2	Pelvic fin deeply notched		3
3(2)	Snout short, blunt	***Raja stellulata***	p 38
3	Snout long, pointed		4
4(3)	Dark ventral side; ventral pores below pelvic arch	***Raja rhina***	p 39
4	Lightly mottled ventral side; no ventral pores on pelvic arch	***Raja inornata***	p 40

Roughshoulder skate, broad skate (*Amblyraja badia*)



Description

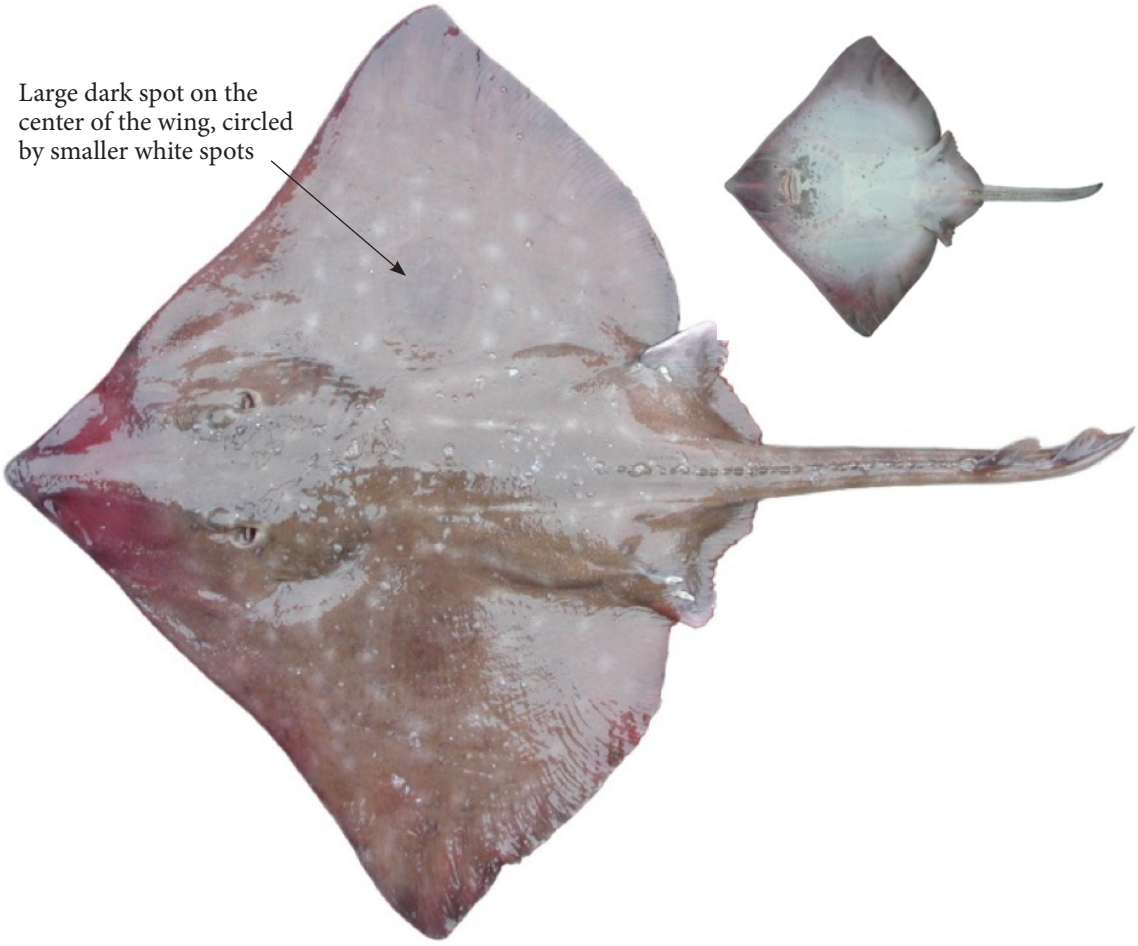
Roughshoulder skates are dark brown to gray/brown, often with faint darker blotches dorsally. The ventral side is the same color, but darker on the pelvic fin lobes and tail, possibly with whitish areas on the snout, upper abdomen, nostrils, mouth, gill slits, and anal opening. The

long, broadly pointed snout has several small rostral spines. The disc is wider than it is long, with a short, narrow, tapering tail that is shorter than the disc. The dorsal side is covered with rough denticles; the ventral side is smooth. The short tail has a single median row of strong thorns flanked by a lateral row of shorter thorns. There are 2–3 pairs of strong scapular thorns per side and a continuous row of mid-dorsal and tail thorns. There are two equal-sized dorsal fins, no interdorsal spine, and a small caudal fin close to the second dorsal. To 99 cm TL, possibly more.

Similar species
Deepsea skates (*Bathyraja abyssicola*) are rough on both sides and lack scapular and orbital thorns.

Distribution
Roughshoulder skates range from the Bering Sea to Panama at depths from 823–2,324 m.

Big skate (*Beringraja binoculata*)



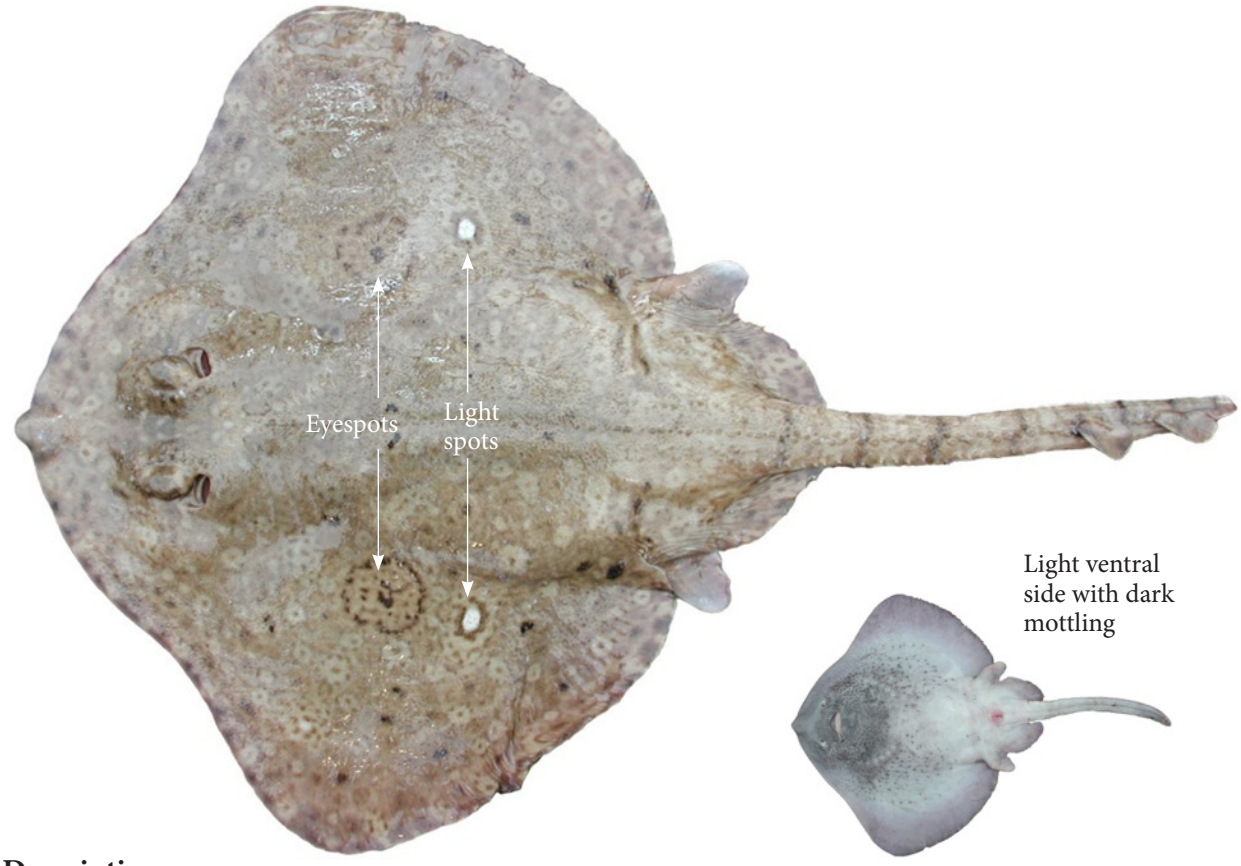
Description
Big skates are light olive to olive/brown, gray, or nearly black, with darker mottling. There is a large dark spot at the base of each wing surrounded by a ring of light spots. The ventral side is white to dirty white with occasional dark patches. The robust body is diamond-shaped, with a broadly pointed snout. Patches of small scales cover the dorsal surface. There are no orbital or

scapular thorns and, when present, the mid-dorsal series consists of only 1–2 thorns. A median row on the tail and a small interdorsal thorn are the only other dorsal thorns. The two dorsal fins are large and the caudal fin is very small. To 244 cm TL.

Similar species
The longnose skate (*Raja rhina*) has a longer snout and a dark ventral side.

Distribution
Big skates range from the Bering Sea to central Baja California, Mexico, inshore to depths over 732 m.

Starry skate (*Raja stellulata*)



Description
Starry skates are brown to gray/brown with numerous dark spots and various mottling. There is a brown eyespot surrounded by a ring of brown spots followed by a prominent yellow to whitish spot on each wing. The ventral side is mostly light with dark mottling and dark brown to gray margins. Numerous small, star-shaped denticles cover the dorsal side. The ventral side is mostly smooth except around the snout. Scapular thorns may or may not be present. There are 2–16 large orbital thorns. The mid-dorsal thorns are usually continuous with the median row of tail thorns. Lateral rows of tail thorns appear as the animal grows and become quite extensive in large individuals. To 76 cm TL.

Similar species
The sandpaper skate (*Bathyraja kincaidii*) has scapular thorns and a smooth ventral side.

Distribution
The northern limit for starry skates is unclear but at least from Cape Flattery, Washington, USA to northern Baja California, Mexico, at depths from 18–732 m.

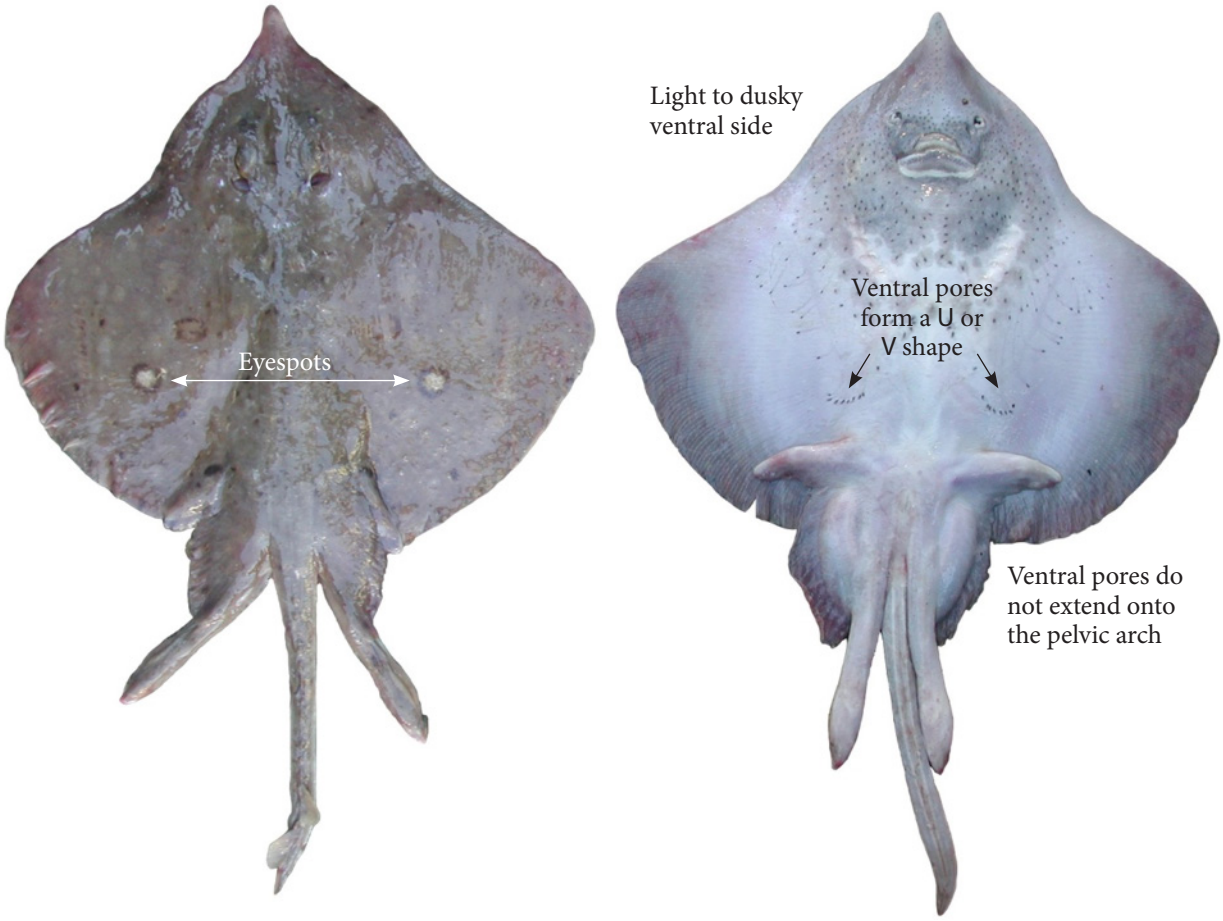
Longnose skate (*Raja rhina*)

Description
Longnose skates are a uniform brown dorsally with a dark spot at the base of each pectoral fin, which may or may not have one or more light spots posterior to the spot or slightly encircling it. The ventral side is blue/black to purple/gray and can have irregularly shaped dark blotches. The prominent ventral pores extend onto the wings and pectoral fins. Longnose skates also have a long, flexible snout, concave anterior margin of pectoral fin, short row of mid-dorsal thorns mostly on the tail, and acutely notched pelvic fins. To 137 cm TL.

Similar species
The California skate (*Raja inornata*) has a light ventral side and the ventral pores do not extend onto the pelvic arch.

Distribution
Longnose skates range from the southeastern Bering Sea to Baja California and the Gulf of California, Mexico, at depths of 20–622 m.

California skate (*Raja inornata*)



Description
California skates are olive brown and variously mottled dorsally, with up to two dark rings or eyespots on the wings. The ventral side is dirty white to tan. The snout is moderately long and highly pointed. There are 0–7 nuchal and scattered small denticles on the dorsal side. There is a median row of tail thorns flanked on each side by a lateral row of smaller thorns and one interdorsal thorn. The ventral side is smooth. Ventral sensory pores do not extend onto the pelvic arch and may form a continuous U or V shape. To 76 cm TL, but generally slightly wider than long.

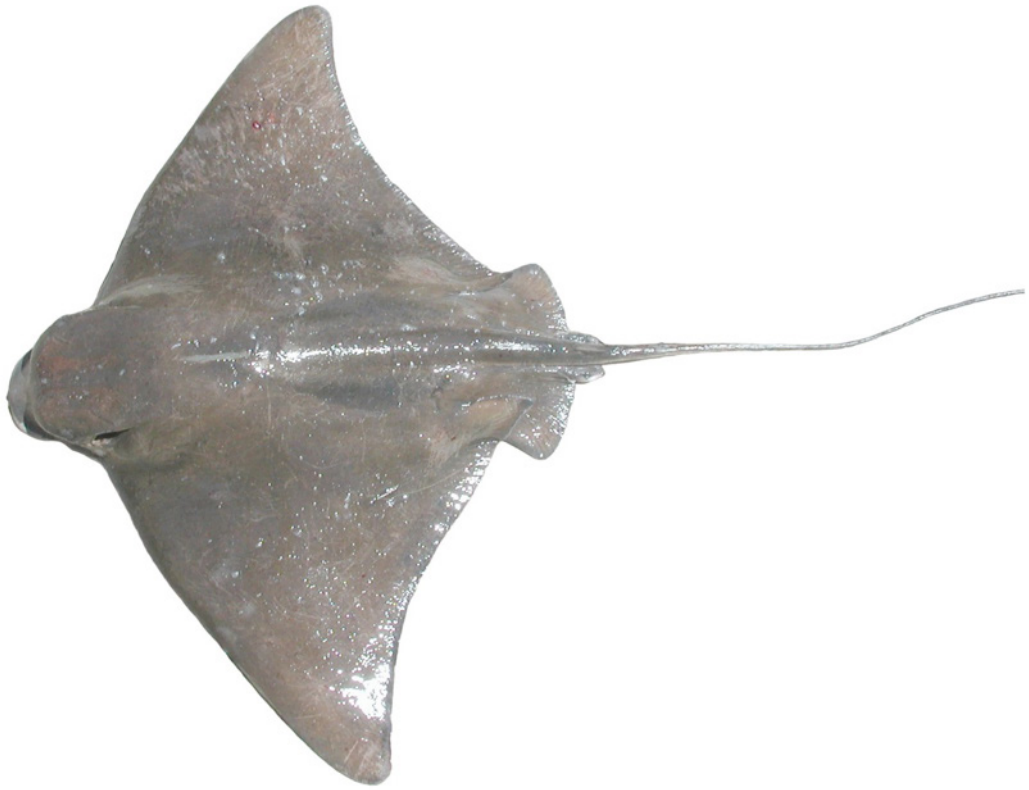
Similar species
The longnose skate (*Raja rhina*) has a dark ventral side, a longer, more acutely pointed snout, and the pores extend onto the pelvic arch.

Distribution
California skates range from the Strait of Juan de Fuca to central Baja California, Mexico, at depths from 5–641 m.

Myliobatidae (Eagle Rays)

The eagle ray family consists of four genera and at least 18 species. The laterally expanded disc of these medium to large rays can be more than 1.5 times the length, with a maximum width of over 2.4 m. Eagle rays have a short, thick, blunt snout. The small, transverse mouth has large, flattened, platelike teeth for crushing prey.

Bat ray (*Myliobatis californicus*)



Description
Bat rays are heavy-bodied rays that have a disc width generally more than 1.5 times the length. Raised above the disk, the large head has a short, thick, bluntly rounded snout. The small, transverse mouth has large, flattened teeth for crushing prey. The whiplike tail has a long, slender, serrated stinging spine. The dorsal side is generally dark brown to olive/brown, olive, or black, with a white ventral side. Maximum length differs between the sexes. Males reach 101 cm disc width (DW), females to 180 cm DW.

Similar species
Other myliobatids (eagle rays) very rarely stray into U.S. waters.

Distribution
Bat rays range from Yaquina Bay, Oregon, to Baja California and the Gulf of California, Mexico. Found in shallow inshore waters including bays and estuaries at depths less than 108 m, but do migrate over the very deep waters of the open ocean.

Chimaeriformes (Chimaeras)

The chimaeras, or ratfishes, consist of three families, six genera, and at least 50 species. The chimaeras have a long, tapered, scaleless body with a thin, whiplike tail. There is a large spine in front of the dorsal fin. The pectoral fins are very large. The open lateral line canals appear as grooves on the head and body.

Chimaeridae (Shortnose Chimaeras)

The shortnose chimaera family consists of two genera with at least 19 species. Shortnose chimaeras have a short, blunt, fleshy snout.

Spotted ratfish (*Hydrolagus colliei*)

Description
The spotted ratfish are silver/gray to brownish with varying hues of gold, copper, green, and brown, with multiple prominent white spots. Ratfish have a large, bulky snout with a spiny, club-shaped appendage on the head of males. Body and head are smooth, with the body tapering to a long tail. The first dorsal fin is nearly triangular with a long, serrated spine. The long second dorsal has a deep notch. Characteristic of this genus, the anal fin is absent. To 97 cm TL.

Similar species
The Eastern Pacific black ghost shark (*Hydrolagus melanophasma*) is a uniform black or blue/black with no spots.

Distribution
Spotted ratfish range from the eastern Gulf of Alaska to Cedros Island, Baja California, to the northern Gulf of California, Mexico, from the intertidal zone to depths of 971 m.

Eastern Pacific black ghost shark (*Hydrolagus melanophasma*)

Description
The Eastern Pacific black ghost shark is uniformly dark, with no distinct markings or mottling. The body and head are smooth with the body tapering to a long tail. The blunt snout slopes very little from the orbit to the tip. The first dorsal fin has a prominent, slightly curved dorsal spine attached for most of its length that extends beyond the tip of the fin. The short-based, triangular first dorsal fin has a concave posterior margin. The second dorsal is long, unnotched, and uniform in height. There is no distinct gap between the second dorsal fin and the dorsal lobe of the caudal fin. The depth of the dorsal lobe of the caudal fin is less than the depth of the second dorsal. The ventral lobe of the caudal fin is about equal in depth to, but longer than, the dorsal lobe. The anterior margins of the large, triangular pectoral fins extend to or beyond the pelvic fin insertion when laid flat against the body; the posterior margin is concave. The anterior margins of the pelvic fins are straight and about half the length of the pectoral fin margin; the posterior margin is convex. Characteristic of this genus, the anal fin is absent. This rarely captured species can reach lengths of 98 cm, possibly more.

Similar species
The spotted ratfish (*Hydrolagus colliei*) is multihued with numerous light spots, and has a deeply notched second dorsal fin.

Distribution
The complete distribution for Eastern Pacific black ghost sharks is unknown. They occur from southern California to Baja California and the Gulf of California, Mexico, at depths ranging from 30.5–1,667 m.

Rhinochimaeridae (Longnose Chimaeras)

The longnose chimaeras are composed of three genera and seven species. The longnose chimaeras have a very elongated, fleshy snout. Longnose chimaeras inhabit all the major oceans of the world at depths ranging from 750–2,800 m.

Longnose chimaera (*Harriotta raleighana*)

Description
Longnose chimaeras are dark brown, but with darker fin edges and brownish-black pelvic fins. The first dorsal fin spine is very prominent, and the second dorsal fin is long and low. The snout is very long and laterally expanded. To 120 cm TL.

Similar species
Due to its very distinct features, it is highly unlikely the longnose chimaera would be confused with other chimaeras.

Distribution
This uncommon, deepwater species has a scattered circumglobal distribution. The few specimens taken in the eastern Pacific were between southern California and the Gulf of California, Mexico, at depths ranging from 530–2,603 m.

Teleostei (Bony Fishes)

Acipenseriformes (Sturgeons and Paddlefishes)

Acipenseriformes are a primitive order of Northern Hemisphere fishes that contain 25 or 26 species in two families, Acipenseridae (sturgeons) and Polyodontidae (paddlefishes). The Polyodontidae are restricted to freshwater and are not included here. Acipenseriformes generally have a mostly cartilaginous skeleton, a flattened snout, and sharklike fins with a heterocercal tail. The spine curves upward into the upper lobe of the tail, which is longer than the lower. The mouth is on the underside of the head.

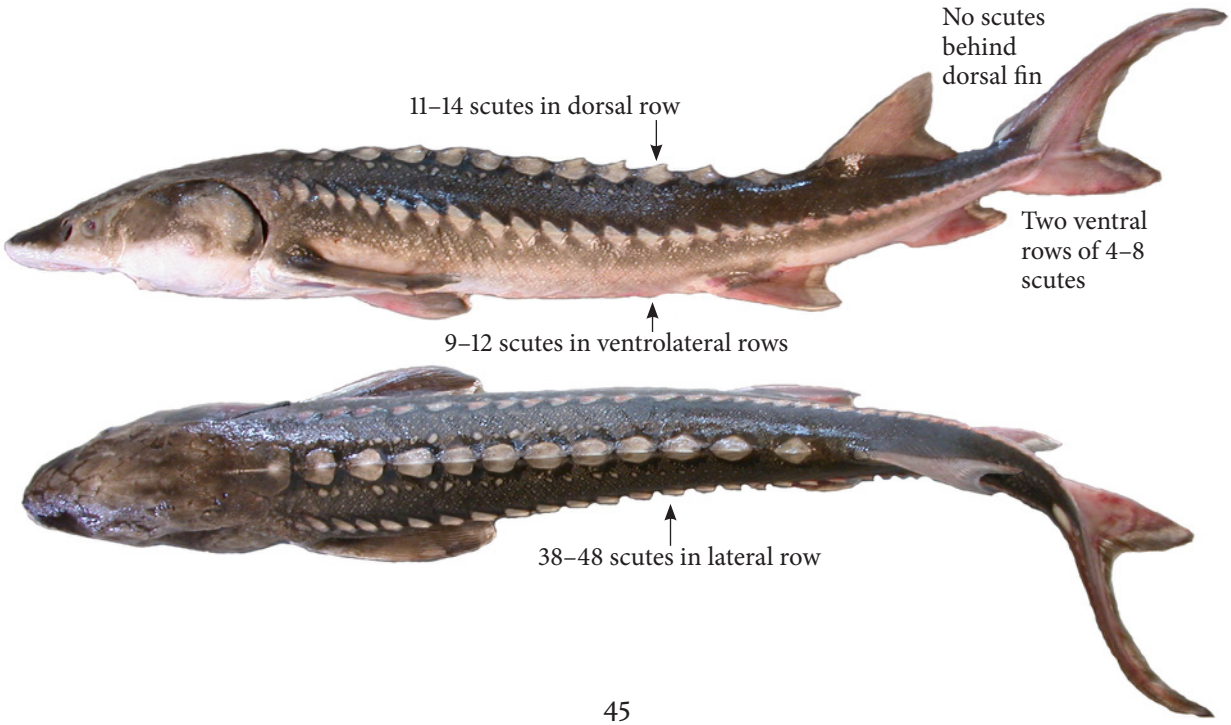
Acipenseridae (Sturgeons)

The sturgeon family is composed of about 25 species. These large, bottom-living fishes have five rows of large, bony plates, or scutes, on their bodies, more pronounced in the young. The scutes wear with age. There is one row of scutes along the dorsal surface, one row on the middle of each side, and one row on each side of the ventral surface. Sturgeons usually have rough skin. The bony head has a long snout. There is a row of four barbels in front of the protractile mouth. There may be a spiracle above and behind the eye. The single dorsal fin is far back on the body. The upper lobe of the sharklike caudal fin is longer than the lower.

Key to the Acipenseridae of the FRAM Surveys

1	2 midventral line rows of 4–8 bony scutes between anus and anal fin; 38–48 scutes in lateral row; no scutes behind dorsal fin ..... ***Acipenser transmontanus***	p 45
1	1 midventral line row of 1–4 bony scutes between anus and anal fin; 23–30 scutes in lateral row; 1–2 scutes behind dorsal fin ..... ***Acipenser medirostris***	p 46

White sturgeon (*Acipenser transmontanus*)

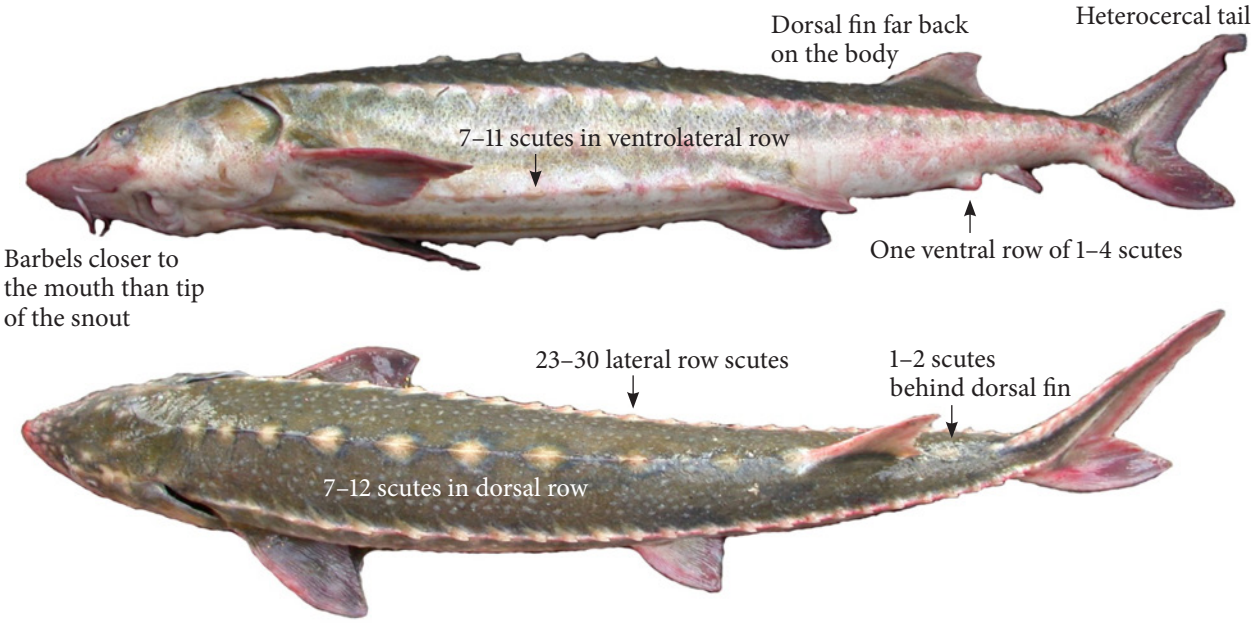


Description
White sturgeon are grayish white dorsally, with lighter shades of the same color laterally, a light ventral side, and dark viscera. There are five body rows of bony scutes, one dorsal row of 11–14 scutes in front of the dorsal fin, a lateral row of 38–48 scutes on each side, one ventrolateral row of 9–12 scutes on each side, and two short rows of 4–8 scutes along the midventral line between the anus and anal fin. The single row of four barbels in front of the protractile mouth is closer to the tip of the snout than the mouth. A large fish, to 600 cm TL.

Similar species
Green sturgeon (*Acipenser medirostris*) have 1–2 scutes after the dorsal fin (0 in white sturgeon), 1 row of 1–4 scutes on the midventral line between the anus and anal fin (2 rows of 4–8 in white sturgeon), 23–30 scutes in the lateral row (38–48 in white sturgeon), and white viscera (dark in white sturgeon).

Distribution
White sturgeon range from the northern Gulf of Alaska to Ensenada, Mexico, at depths from 1–122 m.

Green sturgeon (*Acipenser medirostris*)



Description
Green sturgeons are olive to dark green dorsally shading to a greenish white, occasionally with dark green stripes laterally and light greenish-white to white ventrally, with white viscera. There are five rows of bony scutes: one dorsal row with 7–12 scutes anterior to the dorsal fin and 1–2 scutes between the dorsal and caudal fins, one lateral row of 23–30 scutes, and one ventrolateral row of 7–11 scutes on each side. There is one ventral row of 1–4 scutes between the anus and anal fin. The single row of barbels is closer to the protractile mouth than the tip of the snout. To 200 cm TL, possibly more.

Similar species
The white sturgeon (*Acipenser transmontanus*) has dark viscera (white in green sturgeon), 38–48 lateral row scutes (23–30 in green sturgeon), no dorsal scutes behind the dorsal fin (1–2 in green sturgeon), and two rows of 4–8 ventral scutes between the anus and anal fin (one row of 1–4 in green sturgeon).

Distribution
Green sturgeon range from the Bering Sea to southeastern Alaska to Ensenada, Mexico, at depths from 0–80 m.

Albuliformes (Bonefishes)

Eels and eel-like fishes belong to three orders: Albuliformes, Anguilliformes, and Saccopharyngiformes. The Albuliformes differ by having the mandibular sensory canal in an open groove in the dentary (the bones that form the anterior portion of each half of the lower jaw) and the angular (the small bone at the posterior end of each half of the lower jaw). In the other two orders, the canal has a roof at least in the dentary. Albuliforms vary widely in appearance, having both eel-like (suborder Notacanthidae) and herringlike forms (suborder Albulidae). Although different in appearance, both forms have a distinctive, long-lived larval stage known as a leptocephalus. The leptocephali vary in shape, from long and ribbonlike to deep and leaflike, but all are highly compressed and transparent. The herringlike Albulidae are a single family with ten species in two genera. One genus (*Albula*) occurs outside the survey parameters, in the shallow coastal waters and bays of southern California, and is not included in this guide. The eel-like Notacanthidae consist of two families with 28 species in nine genera. Notacanthidae have pectoral fins located high on the sides and abdominal pelvic fins, and the body tapers to a point with or without a caudal fin (if present, the caudal fin is minute). The dorsal fin has a short base or can be composed of isolated spines. The anal fin is long. There is a prominent, posteriorly directed spine on the on the upper edge of the posterior end of the maxilla. The upper jaw is bordered by both the premaxilla and maxilla. The gill membranes can be separate or joined. There are 5–23 branchiostegal rays, and a swim bladder is present.

Notacanthidae (Deepsea Spiny Eels)

The deepsea spiny eels comprise four genera and 12 species. The long body tapers toward the tail, which is often broken; there is no caudal fin. Like true eels, they have leptocephalus larvae. The leptocephali have pelvic fins and may be as large as, or larger than, the adults.

Key to the Notacanthidae of the FRAM Surveys

1	15 or fewer dorsal spines	***Notacanthus chemnitzii***	p 48
1	30 or more dorsal spines	***Polyacanthonotus challengeri***	p 48

Snubnosed spiny eel (*Notacanthus chemnitzii*)

Description
Snubnosed spiny eels are dirty gray to brown, with black on the edges of the operculum and black fins. The small mouth is on the underside of the head. The dorsal fin has 5–15 (usually 9–10) dorsal spines not connected by a membrane. The anal fin is long and dark, with spinous rays in front. There is one row of curved teeth on the premaxillary and two rows on the palatine and mandibles. To 120 cm TL.

Similar species
The longnose tapirfish (*Polyacanthonotus challengeri*) has a longer, more pointed snout, different teeth, and the dorsal fin has 32–38 spines.

Distribution
Snubnose spiny eels occur in temperate and boreal waters worldwide. In the northeastern Pacific, they range from Oregon to California at depths from 125–3,285 m.

Longnose tapirfish (*Polyacanthonotus challengeri*)

Description
Longnose tapirfish are a dirty to creamy white with pink highlights. The mouth, gill membranes, opercular flap, and the rear margins of the anal and caudal fins are black. The dorsal fin usually has 32–38 spines. There is a single row of recurved, clawlike teeth on the premaxillary, palatine, and mandibles. To 60 cm TL.

Similar species
Snubnosed spiny eels are different in color and have 15 or fewer dorsal spines.

Distribution
Although reported from the Azores, Canary Islands, and Morocco, longnose tapirfish have a mainly antitropical, worldwide distribution. In the northeastern Pacific, longnose tapirfish range from the southern Bering Sea to Oregon at depths from 1,260–3,753 m.

Halosauridae (Sea Lizards)

The sea lizards are composed of three genera and 17 species. Large scales cover the elongate body, which ends in a strongly tapered tail. The small dorsal fin originates close to the pointed head, which is largely scaleless; the slender pectoral fins and the anal fin are long. The mouth is large, with the upper jaw extending beyond the lower jaw.

Sea lizard (*Aldrovandia oleosa*)

A membrane connects the rays of the short-based, triangular first dorsal fin

Description
Aldrovandia oleosa are long and eel-like, with the vertex of the head unscaled. The body is dark brown, darker along and below the lateral line and along the margins of the scale pockets. The black head has blue highlights along the jaws, snout, and operculum. The anal opening is white surrounded by a dark field. The fins are a uniform black. The lateral line is indistinct. There is a single row of black pyloric caeca. The scales along the lateral line are enlarged and there are 16–21 lateral line scales forward of the vent. There are 9–11 soft rays in the pectoral fin. The 9–11 branchiostegal rays are variously developed or absent. The palatine tooth patches are widely separated and the space between the palatine and the adjacent pterygoid tooth patches is equal to 1–4 times the width of the palatine tooth patch. The first dorsal is short and high, and the rays are connected with a dark membrane. To 52 cm TL.

Similar species
Aldrovandia oleosa is the only species with the combination of the white anal opening surrounded by a dark field, the widely spaced palatine tooth patches, and the large space between the palatine and pterygoid tooth patches.

Distribution
The sea lizard has a trans-Atlantic distribution, occurring in the western Atlantic from Canada to Venezuela and Guyana and in the eastern tropical Atlantic in the Gulf of Guinea. Recorded from the Indian Ocean and the east-central Pacific off Chile. In the northeastern Pacific, it ranges from British Columbia, Canada, to at least far southern California, at depths from 819–2,014 m.

Anguilliformes (True eels)

True eels consist of 15 families with approximately 140 genera and 740 species. They are widely distributed in the world's oceans, but mainly in the tropical and subtropical regions. True eels have an elongate, compressed or rounded body. The long-based dorsal and anal fins join with the caudal fin. True eels do not have pelvic fins, and most do not have pectoral fins; when present, the pectoral fins are high on the sides. Most species are scaleless; if present, the scales are cycloid, embedded, and arranged in a basketweave pattern. The head and gill region are elongate, with the gills displaced posteriorly. The small gill openings are slitlike or circular. The gill membranes are united to the isthmus. There are 6–49 branchiostegal rays, and four gill arches that lack gill rakers.

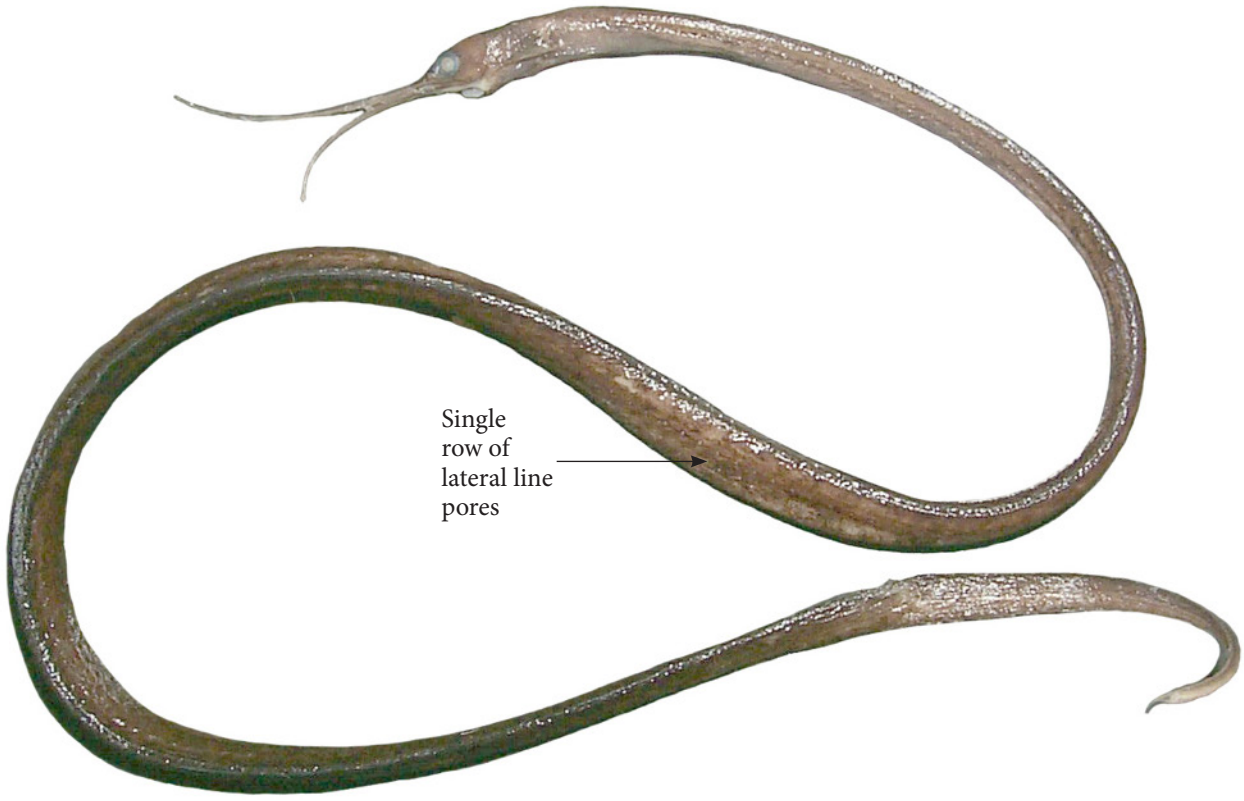
Nemichthyidae (Threadtail Snipe Eels)

The threadtail snipe eels are a small group of fishes consisting of nine species in three genera. The threadtail snipe eels are long, slender fishes that, with the exception of ripe males, have long curved jaws said to resemble the beak of a snipe. In some species, the caudal fin extends out in a long, delicate filament.

Key to the Nemichthyidae of the FRAM Surveys

1	No caudal filament; anus is behind pectoral fins; single row of lateral line pores; sensory ridges on head, behind eyes ..... ***Avocettina infans***	p 50
1	Caudal filament present; anus below pectoral fins; 3 rows of lateral line pores; no sensory ridges on head 2	
2(1)	Lateral line pores form a rectangular pattern with a pore in the center; uniformly dark..... ***Nemichthys scolopaceus***	p 51
2	Lateral line pores form a square pattern with a pore in the center; pale dorsal side, dark ventral side ..... ***Nemichthys larseni***	p 52

Blackline snipe eel (*Avocettina infans*)



Description

The blackline snipe eel is very long and laterally compressed. The body is brown to black, with the darker pigment along the lateral line. They have one row of large lateral line pores, along with sensory ridges behind the eyes. The small head has recurved jaws that taper to a fine end, tipped by a small bulb. The anus is behind the pectoral fin base. The body tapers to a point, and there is no caudal filament. To 80 cm TL.

Similar species
Avocettina gilli (spaced snipe eel) is a synonym of *A. infans* (blackline snipe eel). The slender snipe eel (*Nemichthys scolopaceus*) and the pale snipe eel (*N. larseni*) have three rows of lateral line pores, a long caudal filament, and lack sensory ridges.

Distribution
Blackline snipe eels occur worldwide in tropical to temperate seas. In the northeastern Pacific, they range from the Aleutian Islands to central Mexico, including the Gulf of California, at depths from the surface to 4,571 m.

Slender snipe eel (*Nemichthys scolopaceus*)

Description
Slender snipe eels are dark brown to gray/black, but can be somewhat darker on the ventral side. The long body has a long, drawn-out tail filament. The dorsal fin begins just posterior to the occipital, and the anal fin originates just behind the gill opening; both extend the length of the body. The jaws on the females are long, very pointed, and may be straight or somewhat curved. The anus is near the head, under the pectoral fins. There are three rows of lateral line pores forming rectangular units of four, with a fifth pore in the center. To 130 cm TL.

Similar species
Blackline snipe eels (*Avocettina infans*) lack the long tail filament and have a single row of lateral line pores. The pale snipe eel (*Nemichthys larseni*) is light-colored and has a square pattern to the lateral line pores.

Distribution
Slender snipe eels occur worldwide in tropical to temperate seas. In the northeastern Pacific, they range from the western Gulf of Alaska to South America, including the Gulf of California, from the surface to 4,337 m.

Pale snipe eel (*Nemichthys larseni*)

Description
Young pale snipe eels are a uniform pale cream to tan in color. The adults are light gray to tan and tend to be darker on the ventral side. The long slender jaws are recurved, with the upper jaw slightly longer than the lower. The body is very long, with the tail drawn out to a long filament. There are three rows of lateral line pores. The pores form square units of four with a fifth pore in the center. The anus is near the head, below the pectoral fins. To 161 cm TL.

Similar species
The blackline snipe eel (*Avocettina infans*) has a single row of lateral line pores. The slender snipe eel (*Nemichthys scolopaceus*) is darker-colored and has a rectangular pattern to the lateral line pores.

Distribution
Pale snipe eels range from Washington State to central Mexico, including the Gulf of California, and west to Hawaii, at depths from 170–1,280 m.

Serrivomeridae (Sawtooth Eels)

The sawtooth eels comprise ten species in 2–3 genera. Three species in the genus *Serrivomer* are known to occur within the survey boundaries: *S. sector* (sawtooth eel), *S. jesperseni* (crossthroat sawpalate), and *S. samoensis* (Samoa sawtooth eel). They are very closely related and difficult to distinguish in the field. Sawtooth eels have long, slender jaws that extend forward to a fine point. The small, acute teeth on the maxillae and dentaries are set in multiple rows. There are two or more rows of large, close-set vomerine teeth. The scaleless skin is loose and friable. The lateral line pores are minute. Connected ventrally, the broad gill openings start high on the sides. Except at the posterior margin, the gill membranes attach to the isthmus. There are 6–7 branchiostegal rays. Pectoral fins can be reduced or absent. The pelvic fins are absent, the dorsal fin originates well behind the origin of the anal fin, and both fins join with the caudal fin. The body color is a uniform black overlaid with silver.

Crossthroat sawpalate (*Serrivomer jesperseni*)

Description
Crossthroat sawpalates are dark black to gray/black or dusky brown, generally overlaid with silver. The mouth, gill cavities, and peritoneum are black. The dorsal fin begins well behind the head and behind the anal fin insertion, the pectoral fins are very small, and there are no pelvic fins. The long jaws have multiple rows of small, sharp teeth. Two rows of large, bladelike teeth form a serrated ridge down the center of the top of the mouth (vomer). To 67 cm TL.

Similar species
Of the several described species of *Serrivomer*, three occur in the survey area: *S. sector* (sawtooth eel), *S. jesperseni* (crossthroat sawpalate), and *S. samoensis* (Samoa sawtooth eel). Differentiation is by differences in vertebral and fin ray counts, and how the branchiostegal rays attach to the skeleton. These differences are slight, making positive identification in the field to the species level highly problematic.

Distribution
The crossthroat sawpalate has the farthest northern range of the three species present. They range from British Columbia, Canada, to the Gulf of Panama, at depths from 0–825 m. There are no records of the other two species north of central California.

Nettastomatidae (Duckbill Eels)

The duckbill eel family consists of 42 species in seven genera. They are highly elongate eels with pointed snouts that can end in a blunt rubbery tip or a distinct fleshy flap. Sometimes they are confused with the sawtooth eels. Duckbill eels differ in the location of the dorsal fin origin. In duckbill eels, the dorsal fin begins over the gill opening, while in the sawtooth eels, the dorsal fin originates behind the origin of the anal fin.

Key to the Nettastomatidae of the FRAM Surveys

1	Snout ends in a distinct fleshy flap		2
1	Snout ends in a blunt, rubbery tip	***Facciolella equatorialis***	p 54
2(1)	Fleshy flap is approximately 20% of snout length	***Venefica procera***	p 55
2	Fleshy flap is 30% or more of snout length		3
3(2)	Fleshy flap is 30% or more, but less than 50%, of snout length	***Venefica tentaculata***	p 56
3	Fleshy flap is 50% or more of snout length	***Venefica ocella***	p 56

Dogfaced witch eel (*Facciolella equatorialis*)

Description

Dogfaced witch eels are brown dorsally, transitioning to tan midbody. There are numerous small black dots dorsally that become very concentrated on the upper snout, below the eyes, and on the gill covers. The jaws of the large mouth extend well past the eye. Small, needlelike teeth line both jaws and the tongue, palatines, and vomer. The upper jaw is longer than the lower and ends with a blunt, rubbery tip. The posterior nostril is a slit opening into the upper lip below the eye. The pectoral and ventral fins are absent. The dorsal fin originates over the gill opening. The anal and dorsal fins are confluent with the caudal fin. The tail is slender, attenuated, very pointed, and makes up more than 50% of the total length. To 90 cm TL.

Similar species
The other genera in this family off the West Coast have a prominent fleshy flap at the end of the upper jaw.

Distribution
Dogfaced witch eels occur at depths of 64–1,000 m and range from Point Conception, California, to Panama, where they may be confused with or replaced by one or more closely related species.

Venefica procera

Description
Venefica procera is a long, eel-like fish that has a large mouth with jaws that extend well past the eye. Small, needlelike teeth line both jaws and the tongue, palatines, and vomer. The upper jaw is longer than the lower jaw and ends in a prominent, but relatively short (approximately 20% of the snout length, or about two times the eye diameter) fleshy flap. The posterior nostril is on or behind the head, and nearly level with the top of the eye. Pectoral and ventral fins are absent. The dorsal fin originates over the gill opening. The anal fin insertion is generally under the 73rd dorsal fin ray. The body is a uniform brown to gray with the vertical fins edged in black, along with a black stomach and intestines. To 110 cm TL.

Similar species
Venefica ocella and *V. tentaculata* have longer fleshy flaps (30% or more of the snout length), and the anal fin insertion is 20 or more dorsal fin rays farther back.

Distribution
Venefica procera are mainly in the west-central Atlantic, the Gulf of Mexico, and the Caribbean Sea, at depths of 326–2,304 m. Scattered records exist for the western Pacific in the Celebs Sea, and the eastern Pacific off southern California.

Venefica tentaculata

Description
Venefica tentaculata is a long, eel-like fish that has a large mouth with jaws that extend well past the eye. Small, needlelike teeth line both jaws and the tongue, palatines, and vomer. The upper jaw is longer than the lower jaw and ends with a prominent fleshy flap. The flap is generally 3–4.1 times the eye diameter (approximately 33–47.5% of the snout length). The posterior nostril is on or behind the head, and nearly level with the top of the eye. The lateral line is prominent, and preservation makes it even more so. Pectoral and ventral fins are absent. The dorsal fin originates over the gill opening. The anal fin generally originates under dorsal fin rays 113–115 (93–115). To 90 cm TL.

Similar species
Venefica procera has a short fleshy flap (approximately 20% of the snout length), and the anal fin insertion is 20 or more dorsal fin rays farther forward. *Venefica ocella* has a longer fleshy flap (50% or more of the snout length), and the anal fin insertion is generally under the 99th dorsal fin ray.

Distribution
Venefica tentaculata range from the northern tip of Vancouver Island, British Columbia, Canada, to Chile at depths of 1,170–1,869 m.

Venefica ocella

Description
Venefica ocella is a long, eel-like fish that has a large mouth with jaws that extend well past the eye. Rows of small, needlelike teeth line most of the tongue, palatines, vomer, and both jaws. The upper jaw is longer than the lower jaw, and ends with a long fleshy flap (50% or more of the snout length). The posterior nostril is on or behind the head, nearly level with the top of the eye. The lateral line is prominent, and preservation makes it even more so. The pectoral and ventral fins are absent. The dorsal fin originates over the gill opening. The anal fin insertion is generally under the 99th dorsal fin ray. To at least 70 cm TL.

Similar species
Venefica procera has a short fleshy flap (about 20% of the snout length), and the anal fin insertion is 20 or more dorsal fin rays farther forward. *Venefica tentaculata* has a short fleshy flap (less than 50% of the snout length), and the anal fin insertion can be 10–15 dorsal fin rays farther back.

Distribution
Venefica ocella range from Moresby Island, British Columbia, Canada, to Colombia, at depths of 1,170–1,814 m.

Saccopharyngiformes (Gulper Eels)

The gulper eels consist of two suborders, the Cyematidae (or bobtail eels) and the Saccopharyngidae (or gulper eels), from which the order takes its common name. The latter have a highly distensible pharynx and can swallow very large prey. The gulper eels are unique among bony fishes due to the presence of connected efferent branchial arteries that form loops around and between the gill clefts. Other features shared by the fishes in this order are small, pouchlike gills with plumelike gill filaments, and projecting sensory papillae on the lateral line. Other modifications include the absence of opercular bones, branchiostegal rays, ribs, pelvic fins, scales, pyloric caeca, and a swim bladder. The long dorsal and anal fins are composed of unsegmented rays. The caudal fin is usually absent, but is rudimentary if present.

Cyematidae (Bobtail Eels)

The bobtail eels consist of two genera, each with a single species. The bobtail eels have short bodies with a dartlike profile from the long pointed snout. The body is thin, with the posteriorly placed dorsal and anal fins having rays that become longer from front to back. Bobtail eels have small eyes and lack branchiostegal rays and opercular bones, but do not have some of the other prominent features of the other Saccopharyngiformes.

Black bobtail eel (*Cyema atrum*)

Description
Black bobtail eels are opaque, dark brown to violet/black. The short, delicate body is highly compressed and bandlike. The eye is small. The snout and jaws form a long, slender beak, with the upper jaw extending slightly beyond the lower. The large mouth extends posteriorly to the end of the head. The dorsal fin originates above the anus. The dorsal and anal fins join the caudal fin. The rays of the dorsal and anal fins become progressively longer posteriorly until just before the tip of the tail, when they become abruptly shorter. The caudal fin rays are short. The pectoral fins are well developed, but the pelvic fins are absent. To 16 cm TL.

Similar species
Not likely to be confused with other fishes in the area due to the dartlike profile.

Distribution
Black bobtail eels are widely distributed in the temperate to tropical regions of all oceans. In the northeastern Pacific, black bobtail eels range from Tillamook Head, Oregon, to Panama, at depths of 330–5,100 m.

Saccopharyngidae (Whiptail Gulpers)

The whiptail gulper family consists of 11 species within a single genus. The mouth is very large and the stomach highly distensible, allowing it to swallow very large prey. The tiny eyes are well forward on the snout. The curved teeth are well developed. The dorsal fin originates well behind the head and there are well developed pectoral fins.

Whiptail gulper (*Saccopharynx lavenbergi*)

Description
Whiptail gulpers are dark gray/black to black. The huge mouth has well developed, curved teeth. The tiny eyes are well forward, almost to the tip of the snout. The dorsal fin originates behind the head. The pectoral fins are well developed. To 78 cm TL, possibly more.

Similar species
In umbrellamouth gulpers (*Eurypharynx pelecanoides*), the dorsal fin originates above the head.

Distribution
Whiptail gulpers range from northern California to Peru, at depths of 2,000–3,000 m.

Eurypharyngidae (Umbrellamouth Gulpers)

This family consists of one genus with a single species.

Umbrellamouth gulper, pelican eel (*Eurypharynx pelecanoides*)

Description
Umbrellamouth gulpers are dark gray/black to black. The most notable characteristic is the large mouth. The loosely hinged, pouchlike lower jaw allows capture of prey items much larger than the animal itself. The small eyes are located nearly on the tip of the snout. The scaleless skin is loose and friable. The small pectoral fins are low on the sides. The origin of the dorsal fin is over the head, well anterior of the anal fin origin; the pelvic fins are absent. The caudal fin is absent; instead, the highly attenuated tail ends in an expanded luminous caudal organ. Also unusual are the segmental muscle fibers, or myomeres: they form a V shape. The lateral line does not have pores; instead, the ampullae appear as elevated tubules. To 99 cm TL.

Similar species
Saccopharynx spp. (whiptail gulpers) have a dorsal fin that originates behind the head.

Distribution
The umbrellamouth gulper is circumglobal in tropical to temperate waters at depths from 500–7,625 m. In the eastern Pacific, they range from northern California to Peru.

Clupeiformes (Herrings and Anchovies)

The herrings and anchovies are a group of pelagic schooling fishes containing more than 350 species. Most are silvery, but body shape varies greatly from highly compressed to round. Other features include fins without spines (soft rays only), a single short dorsal fin usually about midbody, a short anal fin, a forked caudal fin with 19 fin rays, pectoral fins set low on the body, and the pelvic fins below the dorsal fin. There is no lateral line canal with pored scales along the sides. However, there may be 1–2 pores behind the gill opening. Cycloid scales that can be deciduous cover the body. Almost all Clupeiformes have a modified scale or scute immediately in front of the pelvic fins; some have additional scutes in front of and behind the pelvic scute, and a few species have scutes ahead of the dorsal fin. There are one to several modified scales, or axillary processes, above the first ray of the pelvic (and sometimes pectoral) fins. Some species have modified scales on the base of the caudal fin. The maxillae usually has two supramaxillae along the upper edge. There are usually small, conical teeth on the jaws, palatines, and vomer. Most Clupeiformes are plankton feeders and have long, and often numerous, gill rakers. The gill membranes are separate, and most have 6–7 branchiostegal rays.

Clupeidae (Herrings)

The herrings are a large group of fishes containing about 180 species and 56 genera in five subfamilies found worldwide. While there are a number of freshwater and anadromous species, most herrings are marine species. Most herrings are highly compressed, silvery fishes that have a row of modified sawlike scales or scutes along the belly, along with a single dorsal fin, deeply forked caudal fin, and abdominal pelvic fins. Herrings in our area do not have a lateral line, fin spines, or an adipose fin.

Key to the Clupeidae of the FRAM Surveys

1	No enlarged scales at base of caudal fin; radial striations on operculum or dark spots on body ..... ***Clupea pallasii***	p 60
1	Enlarged scale on base of caudal fin; striations on operculum and dark spots on body 2	
2(1)	Deep, laterally compressed body; strong keels on abdominal scutes; strong opercular striations; dark spots not randomly arranged, usually in a single row ..... ***Alosa sapidissima***	p 61
2	Cylindrical tapered body; weak keels on abdominal scutes; fine opercular striations; dark spots usually randomly arranged, not in a single row ..... ***Sardinops sagax***	p 61

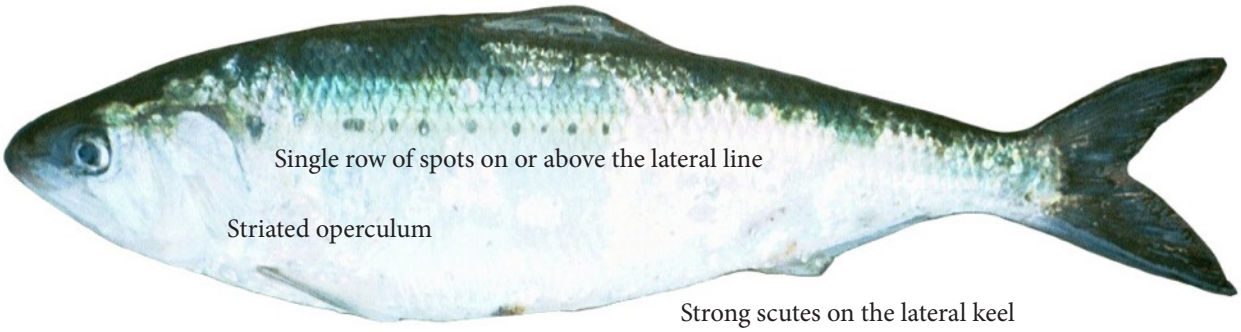
Pacific herring (*Clupea pallasii*)

Description
Pacific herring are dark blue to olive dorsally, shading to silver on the sides, with no distinct spots on the body or fins. The lateral keel is weak to moderate, there is no median notch in the upper jaw, and there are no striations on the operculum. To 46 cm TL.

Similar species
American shad (*Alosa sapidissima*) and Pacific sardine (*Sardinops sagax*) have spots on the body and striations on the operculum.

Distribution
In the Arctic, Pacific herring range from the White Sea eastward to the Ob' Inlet. In the western Pacific from Anadyr Bay to the eastern coasts of Kamchatka, southward to Japan and the west coast of Korea. In the eastern Pacific from the Kent Peninsula at long 107°W and the Beaufort Sea south to northern Baja California, Mexico, at depths from 0–475 m.

American shad (*Alosa sapidissima*)



Description
American shad are metallic blue to tan dorsally, shading to silver/white ventrally. The body has 1–3 (usually 1) rows of one or more dark spots. The operculum has coarse, radiating striations. The highly laterally compressed body has a prominent lateral keel with a row of very strong modified scales, or scutes. To 76 cm TL.

Similar species
Pacific herring (*Clupea pallasii*) lacks spots and striations on the operculum, and has a weak row of scutes on the lateral keel. Pacific sardine (*Sardinops sagax*) has spots that vary widely in size, number, and configuration, and a rounder, shallower body.

Distribution
Native to the Atlantic coast from Newfoundland, Nova Scotia, and the St. Lawrence River to central Florida. Introduced into the Sacramento River drainage in the 1800s, American shad now range from Kamchatka and the Bering Sea to Cook Inlet and Kodiak Island, Alaska, to Baja California, Mexico, at depths from 0–250 m.

Pacific sardine (*Sardinops sagax*)

Description
The spindlelike body of the Pacific sardine has a dark metallic blue or green dorsally and silver ventrally. The variously sized spots can be in one or more rows on the sides, under the scales. The operculum is finely striated. There are enlarged scales on the upper and lower lobes of the caudal fin looking like fleshy flaps or keels. To 41 cm TL.

Similar species
Pacific herring (*Clupea pallasii*) lacks spots, and American shad (*Alosa sapidissima*) usually have a single row of spots, and do not have the flaps on the tail.

Distribution
In the northwestern Pacific, Pacific sardines range from Kamchatka to south of Japan. Populations occur in the eastern and western South Pacific and off South Africa. In the northeastern Pacific, sardines range from southeastern Alaska to southern Baja California, Mexico, and in the Gulf of California, at depths from 0–150 m.

Engraulidae (Anchovies)

The anchovies consist of two subfamilies of 16 genera and 139 species. Most anchovies are coastal marine species, but some enter or are predominantly brackish and/or freshwater species. They are separated from herring and smelt by the pointed snout overhanging the very large mouth with jaws extending well behind the eyes.

Northern anchovy (*Engraulis mordax*)

Jaws extend well back on the operculum

Description
Northern anchovies are metallic blue or green dorsally, shading to silver ventrally. The large cycloid scales are in oblique rows. The short, sharply pointed snout protrudes beyond the lower jaw. The mouth is large. The pointed tip of the maxilla extends well back on the operculum. The anal fin originates below the last dorsal fin ray or slightly posterior to it. To 25 cm TL.

Similar species
Other anchovies are laterally compressed, and the anal fin origin is mid-dorsal.

Distribution
Northern anchovies range from the eastern Gulf of Alaska to Baja California and the Gulf of California, Mexico, at depths from 0–310 m.

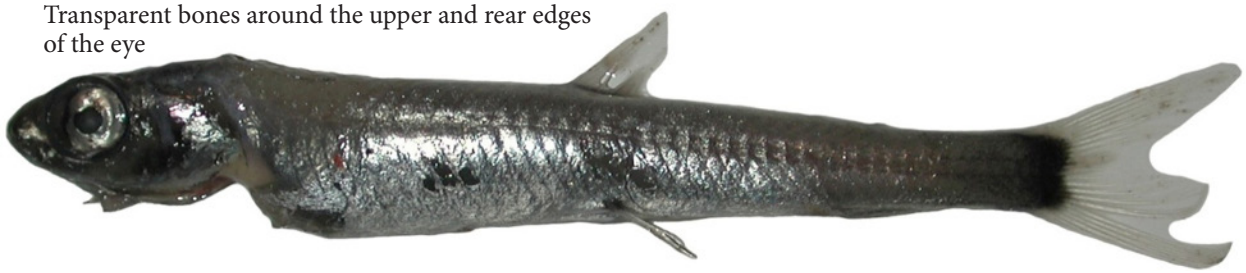
Osmeriformes (Argentines and Smelts)

The Osmeriformes are a group consisting of two suborders, 13 families, about 74 genera, and 235 species. The body shape varies from round to somewhat laterally compressed, and although some are uniformly dark and can exceed 60 cm TL, most are small (≤ 30 cm TL), silvery fishes. Other characteristics include fins consisting of rays only and a dorsal adipose fin that may or may not be present. Nuptial tubercles (small, white, hard protuberances that form on the scales or skin of some fishes in conjunction with breeding) are usually absent. The scales are cycloid, and can be highly deciduous. The orbitosphenoid (the median bone between the orbits that forms the floor and walls of the anterior part of the cranium) and basisphenoid (a small, median, Y-shaped bone in the rear of the orbit) are absent. The first basibranchial (one of three median bones lying end to end on the floor of the gill chamber between the hypobranchials at the lower end of the gill arches) has a ventral cartilaginous vane.

Microstomatidae (Pencil Smelts)

The pencil smelts consist of 16–17 species in three genera distributed from the subpolar to tropical regions of the world's oceans. The long, slender bodies vary from compressed to round. The jaws of the small mouth do not extend past the front of the eye. The dorsal fin originates midbody, above to behind the pelvic fins. The anal fin is farther back on the body and is equal to or slightly shorter than the caudal peduncle. A dorsal adipose fin is present in some species. Pencil smelts and deepsea smelts are closely related, and sometimes combined. However, the pencil smelts have 3–4 branchiostegal and 8–11 anal fin rays, compared to two branchiostegal and 10–28 anal fin rays in the deepsea smelts.

Bluethroat argentine (*Nansenia candida*)



Description
Bluethroat argentines are silver, with a darker back and a bluish tint on the nape, preopercle, and throat. The fins are clear. The mouth is very small, the jaws barely reaching the front of the pupil. There are three branchiostegal rays. Transparent bones border the upper and rear edges of the eye. The dorsal fin is located midbody, above the pelvic fin. The adipose fin is above the anal fin. The anal fin contains 8–11 rays. To 23 cm TL.

Similar species
The silvery Bathylagidae (deepsea smelts) have two branchiostegal and 10 or more anal fin rays.

Distribution
Bluethroat argentines range from the southern Bering Sea west to the Kuril Islands and northern Japan, and to the east to the Gulf of Alaska to Baja California, Mexico, at depths from 0–1,500 m.

Argentinidae (Argentines)

The argentine family contains about 30 species in two genera. Argentines are worldwide in tropical to temperate waters. The slightly compressed body is generally tan on the back with silvery sides and a light belly. The single dorsal is placed midbody. The pectoral fins are low on the sides of the body. The abdominal pelvic fins are generally under the dorsal fin. A dorsal adipose may or may not be present ahead of a deeply forked caudal. While they resemble the smelts, the argentines have much larger eyes, and the terminal mouth is tiny.

Pacific argentine (*Argentina sialis*)

Description
Pacific argentines are tan to tan/brown dorsally, shading to silver sides that can have faint dark bars on live specimens. The scales are large and deciduous. The mouth is very small and ends well before the large eye. The small anal fin is below the adipose fin. To 22 cm TL.

Similar species
The Osmeridae (smelts) have smaller eyes and the jaws extend to at least the front of the eye.

Distribution
Pacific argentines range from the Columbia River to Baja California, Mexico, and in the Gulf of California, at depths from 11–325 m.

Bathylagidae (Deepsea Smelts)

The deepsea smelts comprise 19 species in eight genera distributed in deep ocean waters worldwide. Roughly divided by color. Some species are black while others are light or silvery in color. The light-colored species tend to have longer gill slits that extend up to or above midbody, and a short anal fin base that is roughly equal to the dorsal fin base. The black species tend to have short gill openings that do not extend to the midbody, and a long anal fin base that can be over twice the length of the dorsal fin base.

Key to the Bathylagidae of the FRAM Surveys

1	Long gill slit reaching to or above midbody; anal fin base is as long as, or slightly longer than, dorsal fin base 2	
1	Short gill slit not reaching midbody; anal fin base 2 or more times length of dorsal fin base 4	
2(1)	Snout length > eye diameter; generally 11–14 anal fin rays 3	
2	Snout length < eye diameter; generally 14–15 anal fin rays ..... ***Lipolagus ochotensis***	p 65
3(2)	Captured north of the Strait of Juan de Fuca ..... ***Leuroglossus schmidti***	p 65
3	Captured south of the Strait of Juan de Fuca ..... ***Leuroglossus stilbius***	p 66
4(1)	Pelvic fin is below anterior portion of dorsal fin; usually 22–26 anal fin rays and 11–16 pectoral fin rays; lateral scale row count is 23–27 ..... ***Pseudobathylagus milleri***	p 66
4	Pelvic fin is below posterior portion of dorsal fin; usually 18–20 anal fin rays and 7–11 pectoral fin rays; lateral scale row count is 37–44 ..... ***Bathylagus pacificus***	p 67

Popeye blacksmelt (*Lipolagus ochotensis*)

Description

Popeye blacksmelt are dusky dorsally, sometimes with faint dark blotches, with dirty silver to silver/white sides. The body is slightly compressed. The eye diameter is greater than the snout length. There are slender knobs in the posterior portion of the interorbital space. The jaws are small, reaching to or slightly past the front of the eye, and are about the same size; sometimes the lower jaw is slightly protruding. The striated gill cover has a notched or concave upper rear edge. There is a slender adipose fin. The anal fin has 12–17, but usually 14–15, rays, and is about equal in size to the dorsal fin. To 16 cm TL.

Similar species

Smoothtongues (*Leuroglossus* spp.) have longer snouts and bigger jaws. The bluethroat argentine (*Nansenia candida*) has 3–4 branchiostegal rays (two in popeye blacksmelt), and 8–11 anal fin rays (12–17 in popeye blacksmelt).

Distribution

Popeye blacksmelt range from the Bering Sea and the North Pacific to Baja California, Mexico, and to the Sea of Okhotsk and southern Honshu, Japan, from the surface to 6,100 m.

Northern smoothtongue (*Leuroglossus schmidti*)

Description

Northern smoothtongue are dusky dorsally, shading to a dirty silver or silver/white on the sides. The head tapers to a point. Both jaws have weak teeth, with the lower jaw projecting beyond the upper. The snout is about equal to the eye diameter. The operculum has radial striations and a convex rear edge. The fins are dusky to clear, there is a slim adipose fin, and the base of the anal fin is about the same length as the dorsal fin base. To 20 cm TL.

Similar species
California smoothtongues (*Leuroglossus stilbius*) occur south of the Strait of Juan de Fuca.

Distribution
Northern smoothtongues range from the Bering Sea to southern British Columbia, Canada, and to the Sea of Okhotsk and northern Honshu, Japan, at depths to over 1,800 m.

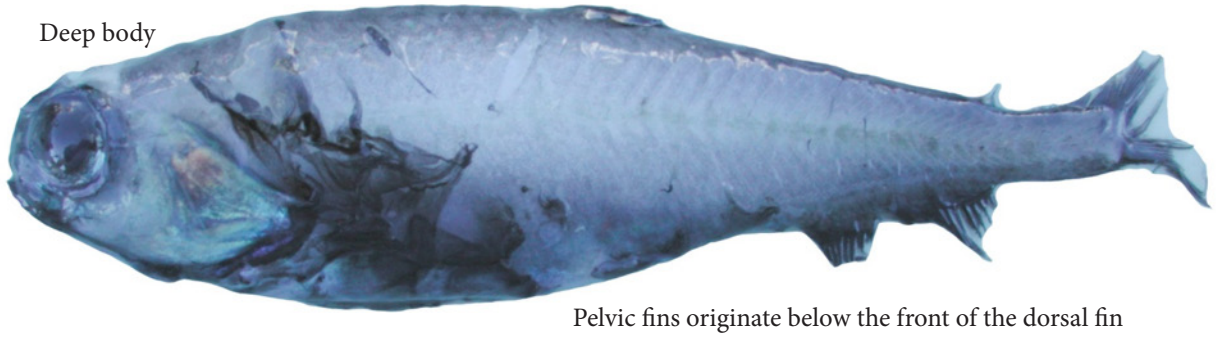
California smoothtongue (*Leuroglossus stilbius*)

Description
California smoothtongues are dusky dorsally, shading to a dirty silver or silver/white on the sides. The head tapers to a point. Both jaws have weak teeth, with the lower jaw projecting beyond the upper. The snout is about equal to the eye diameter. The operculum has radial striations and a convex rear edge. The fins are dusky to clear. The adipose fin is slim. The anal and dorsal fin bases are about the same length. To 20 cm TL.

Similar species
Northern smoothtongues (*Leuroglossus schmidti*) occur north of the Strait of Juan de Fuca.

Distribution
The California smoothtongues range from Washington State to Colombia, and in the Gulf of California, near the surface to depths of over 1,646 m.

Stout blacksmelt (*Pseudobathylagus milleri*)

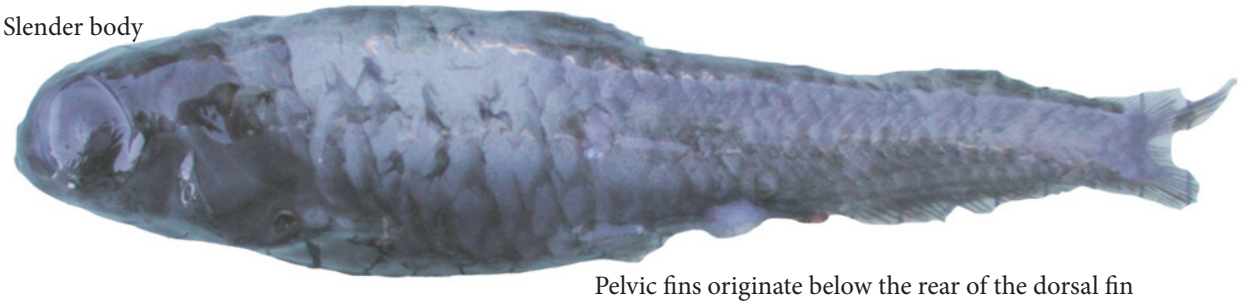


Description
Stout blacksmelt are black/brown to black with a metallic sheen. The gill membranes are blue/black. Robust anteriorly, the soft body tapers posteriorly. The eye diameter is two or more times the snout length. The mouth is small, with the lips and lower jaw protruding slightly. The upper rear edge of the unmarked gill cover is straight. The anal fin base is twice that of the dorsal, and the pelvic fin originates below the front of the dorsal fin. To 22 cm TL.

Similar species
The slender blacksmelt (*Bathylagus pacificus*) has pelvic fins that originate below the rear of the dorsal fin.

Distribution
Stout blacksmelt range from the Bering Sea to southern Honshu, Japan, and the Sea of Okhotsk in the western Pacific, and in the eastern Pacific to southern California, at depths from 60–6,600 m.

Slender blacksmelt (*Bathylagus pacificus*)



Pelvic fins originate below the rear of the dorsal fin

Description
Slender blacksmelt are black/brown to black, with a black to blue/black head and blue/black gill membranes. The soft body is slender and moderately compressed. The eye diameter is two or more times the snout length. The mouth is small, with a slightly projecting lower jaw. The upper rear edge of the unmarked gill cover is straight. The base of the anal fin is twice that of the dorsal, and the pelvic fin originates below the rear of the dorsal fin. To 25 cm TL.

Similar species
The stout blacksmelt (*Pseudobathylagus milleri*) has a more robust body, and the pelvic fins originate below the front of the dorsal fin.

Distribution
Slender blacksmelt range from the southern Bering Sea and North Pacific to the Gulf of California, and to the Sea of Okhotsk and Honshu, Japan, at depths from 150–7,700 m.

Opisthoproctidae (Spookfishes or Barreleyes)

The spookfish family contains about 11 species in six genera that range throughout the tropical to temperate waters of the Atlantic, Indian, and Pacific Oceans. Spookfishes are also known as barreleyes due to their tubular eyes, which, depending on the species, can be directed up, forward, or to the sides. Body shape is variable, from short and stocky to long and cylindrical. The jaws of the tiny mouth do not reach the eye. The snout is moderately pronounced. Possibly well developed and high on the body, the pectoral fins have lateral bases. The dorsal and anal fins are far back on the body, and a dorsal adipose fin may be present. The pelvic fins are generally well developed and can be abdominal to high on the sides.

Key to the Opisthoproctidae of the FRAM Surveys

1	Deep, somewhat laterally compressed body ..... ***Macropinna microstoma***	p 68
1	Long, somewhat cylindrical body 2	
2(1)	Long, dark pectoral and pelvic fins, with pectoral fin extending nearly to or beyond anal fin base; anal fin originates below middle of dorsal fin ..... ***Dolichopteryx parini***	p 69
2	Pectoral and pelvic fins not as described above; anal fin originates behind dorsal fin 3	
3(2)	Pelvic fins set high on body, forward of dorsal fin ..... ***Dolichopteryx longipes***	p 69
3	Pelvic fins set low on body 4	
4(3)	Cylindrical body; dark blotches may appear as bands ..... ***Bathylychnops exilis***	p 70
4	Cylindrical body; fine, dark speckling from back of head to tail ..... ***Opisthoproctidae* sp.**	p 70

Barreleye (*Macropinna microstoma*)

Description
Barreleye are a uniform dark brown or brown/black. Large deciduous scales cover the short, stocky body. The eyes are large, tubular, and directed upward. The snout is broad and bill-shaped. The terminal mouth is tiny. The dorsal and anal fins are far back on the body. The long rays of the pectoral fins nearly reach the anal fin. The long pelvic fin rays nearly reach the caudal fin. To 16 cm TL.

Similar species
Other opisthoproctids have longer, more cylindrical bodies.

Distribution
Barreleye range from the Bering Sea to the eastern South Pacific off Chile and the western North Pacific off the Kuril Islands and southern Japan, at depths of 16–1,015 m.

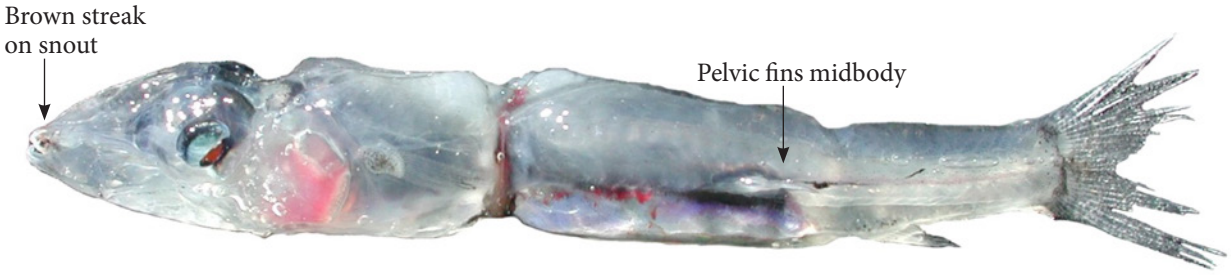
Winged spookfish (*Dolichopteryx parini*)

Description
The long, cylindrical body of the winged spookfish is light with dark scale pockets. The pectoral and pelvic fins are dark, the remaining fins can be light or dark. The dark peritoneum is visible through the body wall. The long pectoral fins extend to or beyond the anal fin. The long pelvic fins extend to or beyond the caudal fin base. The dorsal and anal fins are far back on the body. There is a dorsal adipose fin. The terminal mouth is very small. The eyes are large, tubular, and directed upward. To 22 cm TL.

Similar species
The brownsnout spookfish (*Dolichopteryx longipes*) is mostly transparent, with a dark brown streak across the snout, short pectoral fins, and the dorsal fin ahead of the anal fin.

Distribution
Winged spookfish range from the southern Bering Sea and the North Pacific to southern British Columbia, Canada, and to Honshu, Japan, and the Sea of Okhotsk, but may range throughout the North Pacific at depths of about 200–1,000 m.

Brownsnout spookfish (*Dolichopteryx longipes*)

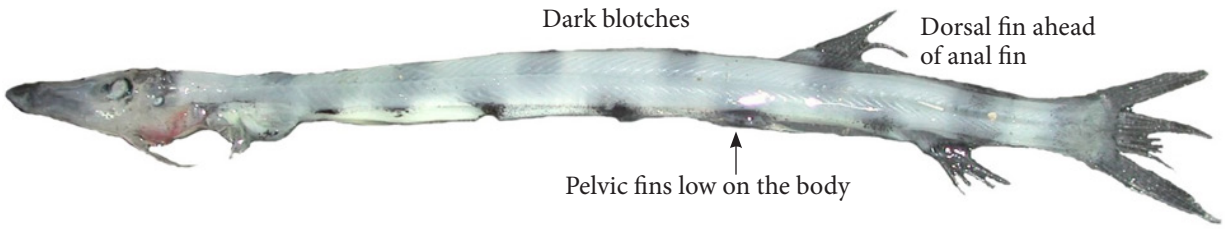


Description
Clear, gelatinous skin covers the nearly transparent body of the brownsnout spookfish. The dark intestinal cavity is partially visible through the silvery peritoneum. The large, tubular eyes are set high on the head. The fins are clear. The pectoral and pelvic fins are midway up the body. The small dorsal fin originates forward of the anal fin, and a small adipose fin may or may not be present. To 18 cm TL.

Similar species
Winged spookfishes (*Dolichopteryx parini*) have long, dark pectoral and pelvic fins.

Distribution
Brownsnout spookfish occur in temperate and tropical waters worldwide at depths of 300–2,000 m.

Javelin spookfish (*Bathylychnops exilis*)



Description
Javelin spookfish are opaque, with dark blotches from the back of the head to the tail and a dark tip on the long snout. The skin is soft and gelatinous. The dorsal fin is far back on the body, forward of the anal fin and just behind the low-set pelvic fins. To 58 cm TL.

Similar species
Brownsnout spookfish (*Dolichopteryx longipes*) and winged spookfish (*D. parini*) have pelvic fins placed high on the sides near midbody.

Distribution
Javelin spookfish range from British Columbia, Canada, to central California, at depths from 400–800 m. Also recorded from the northwestern Pacific and eastern Atlantic.

Opisthoproctidae sp. (unidentified spookfish)

Description
This spookfish has an elongate, cylindrical body. The maxilla of the small terminal mouth is short, falling far forward of the eye. The skin is soft and gelatinous. The dorsal fin originates between the pelvic fin insertion and the anal fin origin. The posterior portion of the body has numerous fine, dark speckles.

Similar species
Several closely related genera in the northeastern Pacific have this body type. The heavy damage precludes identification in the field.

Distribution
This heavily net-damaged specimen was captured in deep water off southern California.

Platytroctidae (Tubeshoulders)

The tubeshoulder family consists of 13 genera with 35 species found in the deep waters of the world's oceans. These dark-colored, deepwater fishes closely resemble the slickheads. However, the presence of a tube (often supported by a modified scale) above the pectoral fin but below the lateral line differentiates the two.

Key to the Platytroctidae of the FRAM Surveys

1	Laterally compressed and sharply tapered both dorsally and ventrally; body has a distinct leaf- or bladelike shape		2
1	Body not as above		3
2(1)	Pelvic fins absent; strongly pointed, barbless cleithral symphysis	***Platytroctes apus***	p 72
2	Pelvic fins present; barbed cleithral symphysis	***Platytroctes mirus****	p 72
3(1)	Large pit just behind upper rear margin of gill cavity	***Maulisia argipalla***	p 72
3	No pit behind upper rear margin of gill cavity		4
4(3)	Photophores and premaxillary tusks absent; small mouth	***Mirorictus taningi***	p 73
4	Photophores present (may be covered by dark tissue) with a bar-shaped jugular organ (JO); premaxillary tusks, when present, are rudimentary	***Sagamichthys abei***	p 74

* Atlantic and Indian Oceans

Legless searsid (*Platytroctes apus*)

Description

Legless searsid are dark black to black/brown. The body is laterally compressed. Dorsal and ventral fleshy keels extending from behind the head to the dorsal and anal fin bases increase the body depth. The dorsal margin is a single scale row wide. The ventral margin is 1–3 scale rows wide. Dorsal and anal fins are nearly opposite and far back on the body. The caudal fin is small. The short, shallow head has a short, truncated snout. The cleithral symphysis ends in a sharp point. Most body scales have a medial lateral keel, which is usually hollow and open on the posterior end. Pelvic fins and photophores are absent. To 18 cm TL.

Similar species

Although not present in the Pacific Ocean, the leaf searsid (*Platytroctes mirus*) has pelvic fins, the cleithral symphysis ending in a barbed point, and, usually, scales without keels.

Distribution

The legless searsid occurs in the temperate and tropical waters of the Atlantic, Indian, and Pacific Oceans, at depths from 384–5,393 m.

Pitted tubeshoulder (*Maulisia argipalla*)

Description
Pitted tubeshoulders are dark black to black/brown with blue highlights. The head is scaleless. The supraorbital bone forms a hood over the top front part of the eye. There are two tusklike teeth present on the premaxillae—the first points forward, the second laterally—followed by 4–8 teeth. A prominent pit is located on the shoulder just behind the upper gill plate. The thoracic photophore is round, and the jugular photophore is absent. To 20 cm TL.

Similar species
Shining tubeshoulders (*Sagamichthys abei*) have scales on the head (absent in other tubeshoulders). The shoulder pit, tusks, and hood over the eye are absent. Other Platytroctidae with scaleless heads lack the pit on the shoulder.

Distribution
Pitted tubeshoulders range from the western and eastern Bering Sea and the Sea of Okhotsk to British Columbia, Canada, to Chile and the Indian and Atlantic Oceans, at depths of 475–1,400 m.

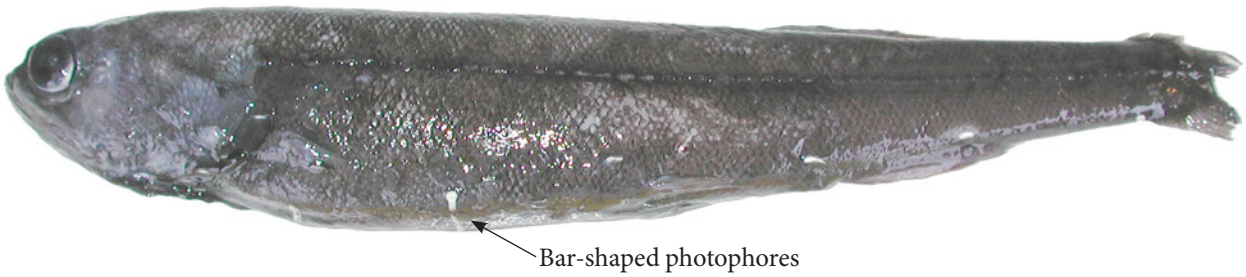
Mirorictus taningi

Description
Mirorictus taningi are dark brown with a dark black/brown to black head. The body is moderately shallow, elongate, and somewhat laterally compressed, with a relatively long caudal peduncle. Photophores are absent. Eyes are below the profile of the head. Small head and short snout. The jaws extend to mideye. The thin, flexible jaws are weakly connected. The teeth are small, loosely attached, and deciduous; no modified premaxillary teeth or tusks. The small, round nasal sac is located near midsnout. The pelvic fin insertion is slightly ahead of midbody. The dorsal fin is far back on the body, origin only a few fin rays ahead of the anal fin. Body scales are relatively large with pores underneath. Lateral line scales are unmodified. The low gill raker count is diagnostic: there are generally 21 or fewer on the first arch. To 14 cm TL.

Similar species
The shining tubeshoulder (*Sagamichthys abei*) has photophores. The pitted tubeshoulder (*Maulisia argipalla*) has a longer snout and jaws, two tusklike premaxillary teeth, and a shoulder pit.

Distribution
Scattered records of *Mirorictus taningi* exist from the eastern and western Pacific, the Gulf of California, the Gulf of Panama, and the Indian Ocean, to depths of 1,750 m.

Shining tubeshoulder (*Sagamichthys abei*)



Description
Shining tubeshoulders are dark gray/blue when young, turning black with age. Black tissue can partially to totally obscure the long, bar-shaped ventral photophores. A small, tubelike projection is present above the pectoral fin. Opposite the body scales, the head scales overlap the scale in front. To 25 cm TL.

Similar species
Other Platytroctidae have tusklike teeth on the premaxillary and no head scales. Alepocephalidae lack scales on the head, photophores, and the tubelike projection.

Distribution
Shining tubeshoulders range from the Bering Sea through the northeastern Pacific, Alaska, and British Columbia, Canada, to South America, at depths of 300–1,000 m.

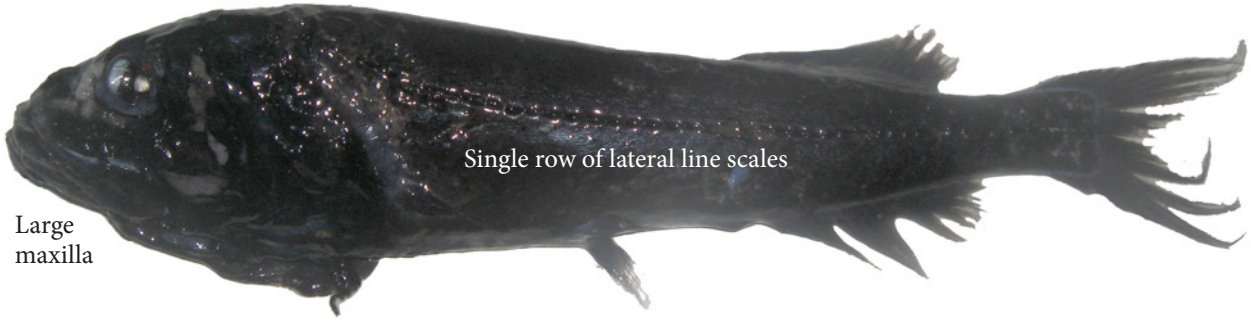
Alepocephalidae (Slickheads)

The slickhead family includes more than 90 species in 20 genera. The adults are deepwater fishes relating closely to the bottom, the juveniles at mid-depths. Generally, the body is slightly compressed, moderately elongate, and deep. Cycloid scales partially to totally cover the body. The eyes and scaleless head are relatively large. The pectoral fins are reduced; the pelvic fins can be reduced and are located at or behind the midpoint of the body. The dorsal and anal fins are far back on the body.

Key to the Alepocephalidae of the FRAM Surveys

1	Scaleless body, except along lateral line ..... ***Rouleina attrita***	p 75
1	Body covered with deciduous scales 2	
2(1)	First pectoral ray, and top & bottom caudal rays long, threadlike ..... ***Talismania bifurcata***	p 75
2	Small pectoral fin, no long fin rays 3	
3(2)	Prominent knob on tip of lower jaw 4	
3	No knob on tip of lower jaw ..... ***Alepocephalus tenebrosus***	p 77
4(3)	Maxilla extends to anterior edge of pupil; gill rakers on first arch 31–38; teeth minute, uniserial ..... ***Bajacalifornia burragei***	p 76
4	Maxilla extends from just short of to posterior edge of eye; gill rakers on first arch 25–29; teeth moderate, uniserial ..... ***Bajacalifornia megalops***	p 76

Softskin slickhead (*Rouleina attrita*)

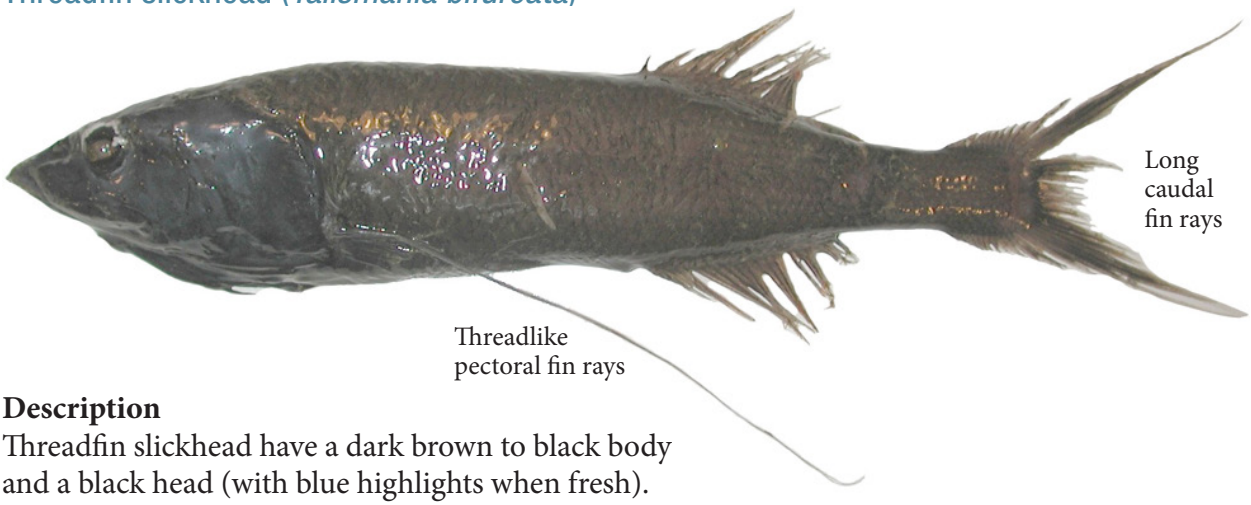


Description
Softskin slickhead are black, possibly with blue highlights on the gill membranes, around the eyes, and the fin bases. Body scales are absent except along the lateral line. The head can be 30% or more of the standard length (SL). The maxilla extends past the eye and expands greatly posteriorly. To 38 cm TL.

Similar species
The lack of scales and greatly expanded maxilla separate this species from the other slickheads.

Distribution
Softskin slickheads are worldwide in temperate to tropical waters, at depths of 800–2,102 m.

Threadfin slickhead (*Talismania bifurcata*)



Description
Threadfin slickhead have a dark brown to black body and a black head (with blue highlights when fresh).
Small deciduous scales cover the soft and mushy body.
The head is scaleless. The jaws extend to the anterior margin of the eye. The first ray of the pectoral fin and the upper and lower rays of the caudal fin are very long and threadlike. To 28 cm TL.

Similar species
California slickhead (*Alepocephalus tenebrosus*) do not have long fin rays.

Distribution
In the eastern Pacific, threadfin slickhead range from British Columbia, Canada, to Peru, and in the southwestern Pacific to New South Wales, Australia, at depths of 300–2,000 m.

Sharpchin slickhead (*Bajacalifornia burragei*)

Description
Sharpchin slickhead are dark gray/black to black. The dorsal and anal fins originate posterior to midbody. The dorsal fin has 14–17 rays and originates just anterior to the anal fin. The anal fin has 12–14 rays. The short pectoral fin has 15–17 rays and the pelvic fins have 7–8. Rows of small cycloid scales cover the elongated, cylindrical body. There are generally 24–25 (rarely 17) transverse rows of scales from the head to the dorsal fin origin. The head is scaleless. The flesh is soft and the skeleton weakly ossified. The mouth is oblique, with the maxillary extending to the anterior edge of the pupil. The upper jaw has a small, bony point. The lower jaw extends slightly beyond the upper. The bony symphyseal knob points down and slightly forward. There are minute uniserial teeth on the premaxillary, maxillary, dentary, and (although rarely) on the vomer. However, it is common for the teeth to appear worn or be lost in older and larger individuals. There are 31–38 gill rakers on the first arch. To 18 cm TL.

Similar species
Bigeye smooth-head (*Bajacalifornia megalops*) has long jaws extending to the back of the eye (anterior edge of pupil in sharpchin slickhead), fewer gill rakers (25–29) on the first arch (31–38 in *B. burragei*), and sharp teeth (minute in sharpchin slickhead).

Distribution
Sharpchin slickhead range from southern California to Chile and the Gulf of California, at depths to 1,080 m.

Bigeye smooth-head (*Bajacalifornia mega*

Description
Bigeye smooth-head are dark brown/black to black. The dorsal and anal fins originate posterior to midbody. The dorsal fin has 15–18 rays and originates just anterior to the anal fin. The anal fin has 13–16 rays. The short pectoral fin has 13–16 rays and the pelvic fins have 7–9. Rows of moderately sized cycloid scales cover the elongated, cylindrical body. There are generally 19–25 transverse rows of scales from the head to the dorsal fin origin. The head is scaleless. The flesh is soft and the skeleton weakly ossified. The mouth is oblique, with the maxillary extending to the anterior edge of the pupil. The upper jaw has a small, bony point. The lower jaw extends slightly beyond the upper. The bony symphyseal knob points down and slightly forward. There are sharp uniserial teeth on the premaxillary, maxillary, and dentary. However, it is common for the teeth to appear worn or be lost in older and larger individuals. There are 25–29 gill rakers on the first arch. To 32 cm TL.

Similar species
Sharpchin slickhead have short jaws that extend to the anterior edge of the pupil (to back of the eye in bigeye smooth-head), more gill rakers (31–38) on the first arch (25–29 in bigeye smooth-head), and minute teeth (moderate and sharp in bigeye smooth-head).

Distribution
Bigeye smooth-head have an antitropical distribution with records from both high and low latitudes worldwide, at depths of 150–3,200 m.

California slickhead (*Alepocephalus tenebrosus*)

Description
California slickhead have a brown to black body and a darker head. The small, cycloid body scales are deciduous. The enlarged lateral line scales form a raised ridge. The head is scaleless. The flesh is soft and the skeleton weakly ossified. The dorsal fin origin is equal to or slightly anterior to the anal fin insertion. The well developed pectoral fins have ten rays. The gill membranes are not united and free from the isthmus. Not joined at the base, the gill rakers are long and free. To 60 cm TL, possibly more.

Similar species
Threadfin slickhead (*Talismania bifurcata*) has long, threadlike rays on the pectoral fin. Platytroctidae have a small tubelike projection just above the operculum.

Distribution
California slickhead range from southern British Columbia, Canada, to central Baja California, Mexico, at depths of 294–1,646 m.

Osmeridae (Smelts)

The smelts are a family of small, slender, generally silver fish consisting of seven genera and 15 or 16 species. Smelts occur in the temperate to cold regions of the Northern Hemisphere in both fresh- and saltwater. Smelts can be distinguished from other similar-looking species by the presence of a dorsal adipose fin, a protruding lower jaw, and the lack of an axillary process (sometimes called an axillary scale), which is a modified or elongated scale or series of scales above the bases of the first rays of the pelvic fins.

Key to the Osmeridae of the FRAM Surveys

1	Small tongue teeth in compact patches; jaws do not extend past middle of eye	2
1	Medium to large conical to caniniform teeth on tongue; jaws extend to or past rear of eye	3
2(1)	Numerous tiny scales; lateral line count 170–220; 16–22 pectoral fin rays; 9th pelvic fin ray much smaller than other rays ***Mallotus villosus***	p 78
2	Large scales, lateral line interrupted or obsolete; midside scale row with 61–73 scales ***Hypomesus pretiosus***	p 79
3(1)	Small pointed teeth in an arc across vomer	4
3	Large canine teeth on vomer	5
4(3)	High dorsal fin; long anal fin rays; long pectoral fin reaches almost to or past pelvic fin origin; blunt, steeply angled (68–90°) snout ***Spirinchus thaleichthys***	p 79
4	Low dorsal fin; short pectoral, anal fins; pointed snout at 54–65° ***Spirinchus starksi***	p 80
5(3)	1 large canine tooth on vomer, may be flanked by 1 smaller canine tooth on one or both sides ***Allosmerus elongatus***	p 80
5	1 or more large canine teeth on each side of vomer	6
6(5)	Concentric striae on operculum; pelvic fin origin ahead of dorsal fin origin; 4–6 upper arch gill rakers ***Thaleichthys pacificus***	p 81
6	No striae on operculum; pelvic fin origin equal to or behind dorsal fin origin; 8–14 upper arch gill rakers ***Osmerus mordax***	p 81

Capelin (*Mallotus villosus*)

Description

Capelin are blue, green, or olive/green dorsally, shading to slivery/white laterally and white ventrally, often with small black spots on the gill cover. The mouth is small, the jaws not extending past the middle of the eye. The long, rectangular adipose fin base is up to 1.5 times the eye diameter. The pectoral fins have 16–22 rays. The pelvic fin origin is directly under or slightly anterior to the dorsal fin origin. The ninth pelvic fin ray is much shorter than the rest. The scales are numerous and tiny. The teeth on the vomer, palatines, and tongue are very small. Adult males have long anal and pectoral fin bases. Males develop a raised ridge of long scales along the lateral line, making it look hairy, and tubercles on the head and fins. To 25 cm TL.

Similar species

Other Osmeridae have 17 or fewer pectoral fin rays, short-based adipose fins, and very prominent teeth on the tongue.

Distribution
Capelin range from the Beaufort Sea to the Strait of Juan de Fuca. In the western Pacific to Japan and Korea and the Sea of Okhotsk. Across southern Arctic Canada to the western Atlantic to Cape Cod, at depths from the surface to 200 m.

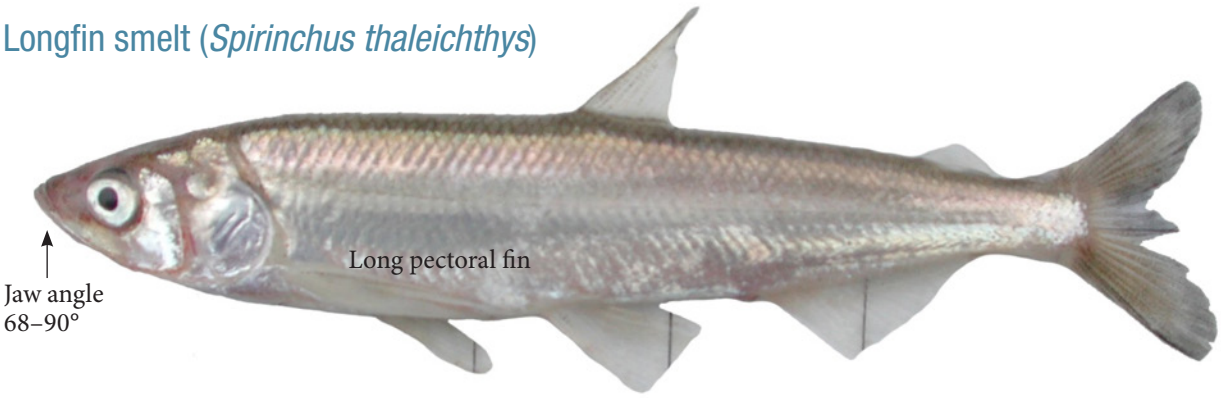
Surf smelt (*Hypomesus pretiosus*)

Description
Surf smelts are light green to tan/green dorsally, with light sides highlighted by a silvery stripe that will darken upon death, and a light ventral side. The adipose eyelid is well developed. The adipose fin base is small, less than the eye diameter. The pectoral fin is short, with 13–16 (usually 15) rays. The pelvic fin origin is below or just posterior to the dorsal fin origin. The incomplete lateral line extends a short way down the body. The small, pointed teeth form an arch across the vomer. To 31 cm TL.

Similar species
Whitebait smelt (*Allosmerus elongatus*) have a single large canine tooth on the roof of the mouth.

Distribution
Surf smelts range from Izembek Bay on the north side of the Alaska Peninsula, Prince William Sound, and the Gulf of Alaska to Long Beach, California, at depths of 0–174 m.

Longfin smelt (*Spirinchus thaleichthys*)



Description
Longfin smelt are brown to olive/brown dorsally, shading to silver laterally and white ventrally. The blunt snout and lower jaw form a 68–90° angle to the top of the head. There is an arc of small teeth across the vomer. The jaws extend to or almost to the rear of the eye. The teeth are small, except for a patch of large canine teeth on the tongue. The pectoral and pelvic fins are large. The pectoral fins reach nearly to or beyond the front of the pelvic fin. The incomplete lateral line extends a short way down the body. To 20 cm TL.

Similar species
Night smelt (*Spirinchus starksi*) have shorter pectoral fins and a more pointed snout.

Distribution
Longfin smelt range from Shelikof Strait and the southwestern Gulf of Alaska to Monterey Bay, California, at depths of 0–137 m.

Night smelt (*Spirinchus starksi*)

Description
Night smelt are brownish-green dorsally shading to silver laterally and ventrally. The pointed snout forms a 54–65° angle. The jaws extend to just short of the rear of the eye. There is an arc of small teeth across the vomer. All teeth are small, except for a patch of large canines on the tongue. Pectoral and pelvic fins are short. The pelvic fin originates just ahead of the dorsal. The short lateral line extends a short way down the body. To 23 cm TL.

Similar species
The pectoral fins of longfin smelt (*Spirinchus thaleichthys*) extend to or beyond the pelvic fin origin.

Distribution
Night smelt range from Shelikof Bay and the southeastern Gulf of Alaska to Point Arguello, California, at depths of 0–128 m.

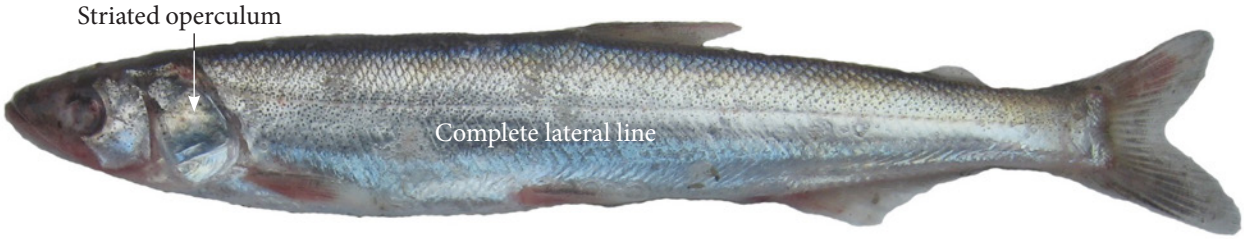
Whitebait smelt (*Allosmerus elongatus*)

Description
Whitebait smelt are greenish-gray dorsally shading to silver/white laterally, with a distinct silver stripe. The snout is long and pointed. The mouth is large, with a single large canine tooth on the vomer sometimes flanked on each side by a smaller tooth. The diameter of the eye is nearly equal to the depth of the caudal peduncle. To 23 cm TL.

Similar species
The other species with canine teeth on the roof of the mouth have one or more canines on each side of the vomer. All other smelt lack enlarged teeth on the roof of the mouth.

Distribution
Whitebait smelt range from Vancouver Island, British Columbia, Canada, to San Francisco and possibly San Pedro in southern California, at depths of 0–103 m.

Eulachon (*Thaleichthys pacificus*)



Description
Eulachon are blue, blue/black, or brown, with fine black speckling dorsally shading to silver white laterally and ventrally. The mouth is large, the jaws extend to or beyond the rear of the eye. The operculum is marked with concentric striations. The pelvic fin originates ahead of the dorsal fin origin. The lateral line is complete. The teeth on the palatines get larger toward the front of the mouth. The teeth on the tongue vary from medium to large and conical to canine, and all teeth tend to be lost during spawning. Gill raker counts on the first arch are diagnostic: 17–23 total, 4–6 upper limb, 13–18 lower limb. To 26 cm TL.

Similar species
Other smelts have 8–14 rakers on the upper limb of the first gill arch and lack the striations on the operculum.

Distribution
Eulachon range from the Bering Sea and the central Aleutian Islands to Monterey Bay, California, at depths of 0–300 m.

Rainbow smelt (*Osmerus mordax*)

Description
Rainbow smelt are olive/green to tan with black speckling dorsally shading to silver with blue, purple, and pink iridescent reflections laterally, giving the fish a rainbow-colored sheen when fresh. The mouth is large, with jaws reaching to or past the back of the eye. The pelvic fin originates below or slightly behind the dorsal fin origin. The lateral line is incomplete, ending just before the pelvic fin insertion. There is a large prominent canine on each side of the vomer, often with several smaller canines. The prominent teeth on the tongue vary from conical to canine. There are 8–14 gill rakers on the upper first arch. To 36 cm TL.

Similar species
Whitebait smelt (*Allosmerus elongatus*) have a single large canine tooth on the vomer and shorter jaws. Eulachon (*Thaleichthys pacificus*) have fewer gill rakers on the upper first gill arch and a striated operculum.

Distribution
The rainbow smelt ranges from the Beaufort Sea south to Heceta Head, Oregon, and across Arctic Canada to Labrador, at depths of 0–150 m. In the western Pacific, rainbow smelt range from the Sea of Okhotsk to North Korea and across Arctic Russia to the White Sea. Landlocked populations exist in all five Great Lakes.

Salmoniformes (Salmon, Trout, Whitefishes, Graylings, and Chars)

The Salmoniformes consist of one family, three subfamilies—Coregoninae (whitefishes), Thymallinae (graylings), and Salmonidae (trout, salmon and char)—11 genera, and about 230 species. With only one family in the order, the characters of the order and family are the same.

Salmonidae (Salmonids)

The salmon family consists of three subfamilies, 11 genera and 228 species. Native to the Northern Hemisphere, the Salmonidae have been widely introduced for sport and aquaculture. Many are anadromous, spending part of their lives at sea then returning to freshwater to spawn; most die after spawning. The body has small cycloid scales. Gill membranes reach far forward and are not attached to the isthmus. Pelvic axillary process and adipose fin are present. Pectoral, pelvic, dorsal, anal, and caudal fins are soft-rayed, without spines.

Key to the Salmonidae of the FRAM Surveys

1	Black spots on back and caudal fin 2	
1	No distinct black spots (fine black speckling may be present) 4	
2(1)	Large (nearly eye-diameter) oval spots on back and caudal fin; numerous small scales, 170 or more in first row above lateral line ..... ***Oncorhynchus gorbuscha***	p 83
2	Small (much less than eye-diameter) spots on back and caudal fin; moderately large scales, 155 or less in first row above lateral line 3	
3(2)	White or pale gums in a black mouth; black spots on back and, if present on caudal fin, generally on upper lobe only ..... ***Oncorhynchus kisutch***	p 83
3	Black gums in a black mouth; black spots on back and both lobes of caudal fin ..... ***Oncorhynchus tshawytscha***	p 84
4(1)	28 or fewer short, stout, smooth, widely spaced gill rakers on first arch ..... ***Oncorhynchus keta***	p 85
4	30–39 long, slender, rough, closely spaced gill rakers on first arch ..... ***Oncorhynchus nerka***	p 86

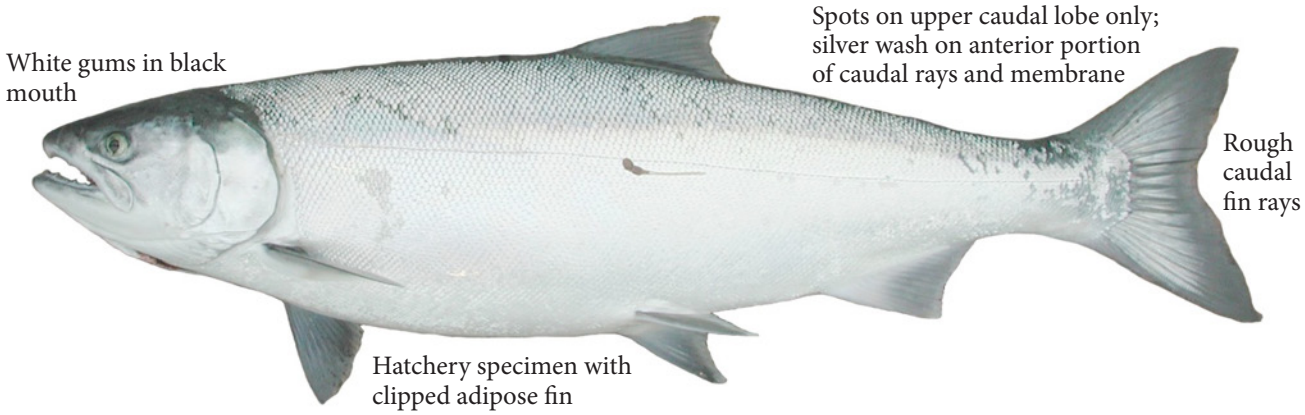
Pink salmon (*Oncorhynchus gorbuscha*)

Description
Pink salmon are metallic blue to green with large, black, oval spots dorsally shading to silver laterally and white ventrally. The gray caudal fin has large, black, oval spots on both lobes, but lacks the silver wash found on other species. The gums are usually light, but can be black at the base of the teeth. The scales are very small, 170 or more along the lateral line. The first gill arch has 24–35 somewhat long, closely spaced gill rakers. The smallest of the Pacific salmon, to about 76 cm TL.

Similar species
Chinook salmon (*Oncorhynchus tshawytscha*) have numerous small, irregular blotches on the back, dorsal, and adipose fins, and both lobes of the caudal. The gums at the base of the teeth are black. The scales are large, 130–165 along the lateral line. The caudal fin rays and membrane have a silver wash on the anterior half to over three-fourths of the fin. Coho salmon (*O. kisutch*) have dorsal spots that extend onto the upper caudal lobe only. The caudal fin has prominent rays and a silver wash on the rays and membrane of the anterior half to two-thirds of the fin. Chum salmon (*O. keta*) and sockeye salmon (*O. nerka*) are not spotted.

Distribution
Pink salmon range from the Mackenzie River of the Northwest Territories, Canada, and the Beaufort Sea coast of Alaska to the Sacramento River in California, and from the Lena River in Siberia to Japan and North Korea, at depths of 0–250 m. Landlocked populations exist in the Great Lakes.

Coho salmon, silver salmon (*Oncorhynchus kisutch*)



Description
Coho salmon are metallic blue to blue/green with irregularly shaped black spots dorsally shading to silver laterally and white ventrally. The irregular-shaped spots extend onto the upper lobe of the caudal fin. The caudal peduncle is thick. The caudal fin rays are rough, and the fin has a silver wash on the anterior half to two-thirds of both the rays and membrane. The jaws are black, but the gums at the base of the teeth are white or gray and may have a light pinkish tint. The short, rough gill rakers are widely spaced. To 108 cm TL.

Similar species
Chinook salmon (*Oncorhynchus tshawytscha*) have numerous irregular spots on the entire caudal fin, and the mouth and gums are black. Pink salmon (*O. gorbuscha*) have large oval spots, but no silver wash, on both lobes of the caudal fin. Chum salmon (*O. keta*) and sockeye salmon (*O. nerka*) are not spotted.

Distribution
Coho salmon range from Point Hope, Alaska, to Monterey Bay, California, and from the Anadyr River, Russia, and Kamchatka to northern Japan and North Korea, at depths of 0–250 m. Widely introduced landlocked populations exist in the Great Lakes and elsewhere.

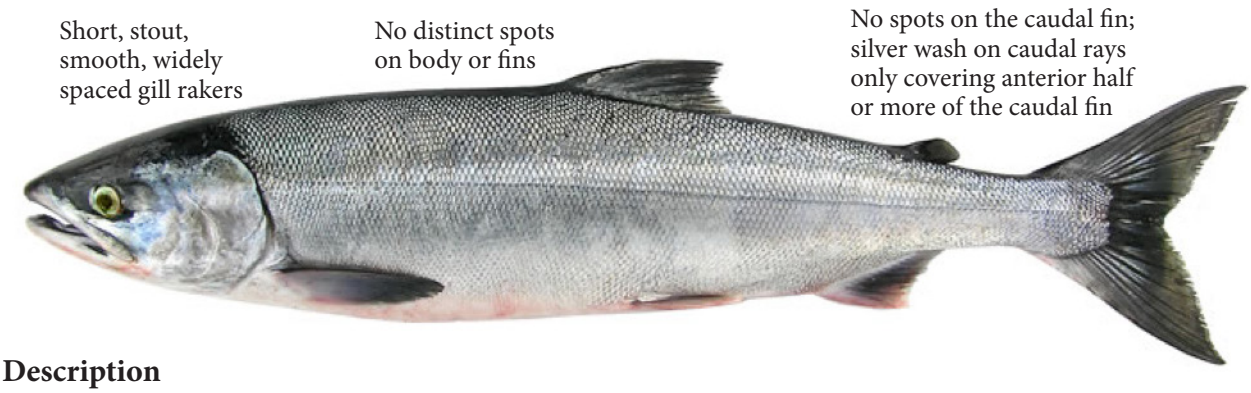
Chinook salmon, king salmon (*Oncorhynchus tshawytscha*)

Description
Chinook salmon are greenish-blue to purple or black dorsally, with numerous irregularly shaped black spots dorsolaterally ending above the lateral line, shading to silver laterally and white ventrally. The black spots occur on both caudal lobes. The caudal fin has a silver wash on both the rays and membrane, extending to or almost to the fin margin. The teeth are set in dark gums within a dark mouth. The scales are somewhat large, with 130–165 along the lateral line. The largest Pacific salmon, to 160 cm TL.

Similar species
Coho salmon (*Oncorhynchus kisutch*) have no spots on the lower lobe of the caudal fin, and white gums set in a black mouth. Pink salmon (*O. gorbuscha*) have 170 or more very small scales along the lateral line, large oval spots on the back and both caudal lobes, and no silver wash on the caudal fin. Chum salmon (*O. keta*) and sockeye salmon (*O. nerka*) are not spotted.

Distribution
Chinook salmon range from Point Hope, Alaska, to the Ventura River in southern California, and from the Anadyr River in Siberia to northern Japan, at depths from 0–250 m. Widely introduced, anadromous populations exist in New Zealand and along the Atlantic and Pacific coasts of South America. Landlocked populations exist in many locations across North America, most notably the Great Lakes.

Chum salmon, dog salmon (*Oncorhynchus keta*)



Description
Chum salmon are metallic blue with occasional fine black speckling but no dark spots dorsally, shading to silver laterally and white ventrally. The caudal peduncle is narrow. The caudal fin has a silver wash on the rays only, and no spots. There are 28 or fewer smooth, short, stout, and widely spaced gill rakers on the first arch. To 109 cm TL.

Similar species
Sockeye salmon (*Oncorhynchus nerka*) have 28–40 long, rough, slender gill rakers on the first arch, and no spots or silver wash on the caudal fin. The other *Oncorhynchus* species have prominent spots on the dorsal surface and fewer gill rakers.

Distribution
Chum salmon range from the Mackenzie and Anderson Rivers in the Northwest Territories, Canada, along the Beaufort Sea coast of Alaska to central California, and from the Lena River in Arctic Siberia to southern Japan and Korea, at depths from 0–250 m.

Sockeye salmon (*Oncorhynchus nerka*)

Description
Sockeye salmon are dark metallic blue or blue/green dorsally, shading to silver laterally and white ventrally. Generally, there are no distinct black spots on the back or fins. If present, the spots tend to be very small and limited to the lobes of the caudal fin, or appear as irregular marks on the dorsal fin. There is no silver wash on the gray to dark gray caudal fin and typically no spots. There are 28–40 (usually more than 30) long, slender, serrated gill rakers on the first arch. To 84 cm TL.

Similar species
Chum salmon (*Oncorhynchus keta*) has a narrow caudal peduncle, silver wash on the caudal fin, and fewer (18–28) gill rakers. The other *Oncorhynchus* species are variously spotted.

Distribution
Sockeye salmon range from Point Hope, Alaska, with occasional strays into Arctic Canadian waters, to the Klamath River in California, at depths from 0–250 m. In the western Pacific from the Anadyr River in Siberia to Hokkaido, Japan.

Stomiiformes (Stomiiforms)

The Stomiiformes are a diverse group of deepsea fishes that include Gonostomatidae (bristlemouths), Sternoptychidae (marine hatchetfishes), Phosichthyidae (lightfish), and Stomiidae (barbeled dragonfish). While body forms within this group vary widely, all Stomiiformes have a large mouth that extends well past the eye, and luminescent organs. Other features found on some members of this order are the presence of chin barbels, premaxillae and maxilla—both with bristle- or fanglike teeth and both included in the mouth's gape—and no spines in the fins. Pectoral, dorsal, and adipose fins may or may not be present. There are generally 4–9 pelvic fin rays and 5–24 branchiostegal rays. The color is a uniform dark brown to black, or silver. The shape, size, number, location, and arrangement of photophores are important for identifying stomiiform families and species.

Gonostomatidae (Bristlemouths)

The bristlemouths include about 33 species in eight genera. Although a few species can obtain lengths up to 36 cm, most are small fishes with mximum langths of less than 7.6 cm. Due to their small size, identification in the field is problematic, so the description of the family is the same for the example given.

Cyclothone sp. (unidentified bristlemouth)

Description
Bristlemouths derive their name from the numerous fine teeth that resemble a long, bristly fringe when the large mouth is closed. The body is elongate and somewhat compressed. Chin barbels are absent. Adipose fins may or may not be present. Anal fin rays range from 16–68. There are 12–16 branchiostegal rays. Photophores are present on the branchiostegals (7–16), present or absent on the isthmus. The serial photophores are separate, not grouped, and the number and configuration vary by species. Teeth are present in the jaws, with larger teeth forward in the mouth and many fine teeth along the sides of the jaws. Teeth may or may not be present on the tongue, vomer, palatines, and pterygoids. Gill openings are large, and gill rakers nearly always well developed. When present, scales are large, thin, cycloid, and deciduous. Pectoral fins are low on the body.

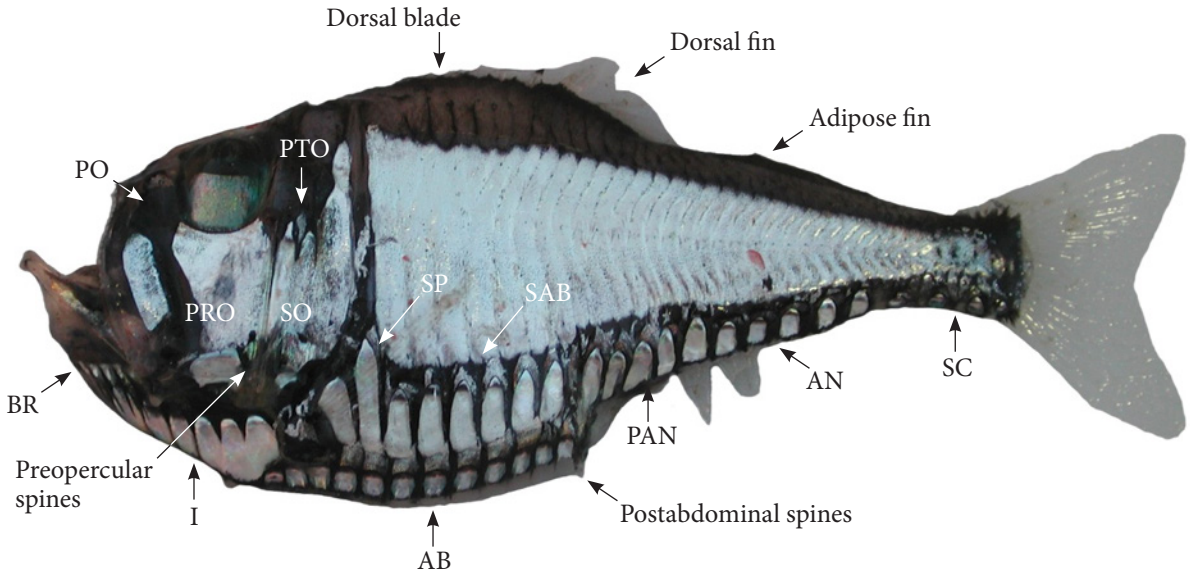
Similar species
The numerous fine teeth on the maxilla, that show as a long, bristly fringe when the mouth is closed, differentiate the bristlemouths from other, similar-looking species.

Distribution
Bristlemouths occur at sub-Arctic to sub-Antarctic latitudes in the Atlantic, Indian, and Pacific Oceans, at depths to 5,304 m.

Sternoptychidae (Marine Hatchetfishes)

The marine hatchetfishes include 57 species in ten genera. Hatchetfishes occur in the tropical to temperate zones of the Atlantic, Indian, and Pacific Oceans. Some species can resemble the bristlemouths, but hatchetfishes have fewer (6–10) branchiostegal rays (12–16 in bristlemouths) and branchiostegal photophores (6 in hatchetfish, 7–16 in bristlemouths), and some hatchetfishes have deep, highly compressed bodies. Hatchetfishes may have some serial photophores grouped into compound light organs that appear as black or silvery bands.

Hatchetfish Photophores and Spines, Particularly *Argyropelecus* spp.

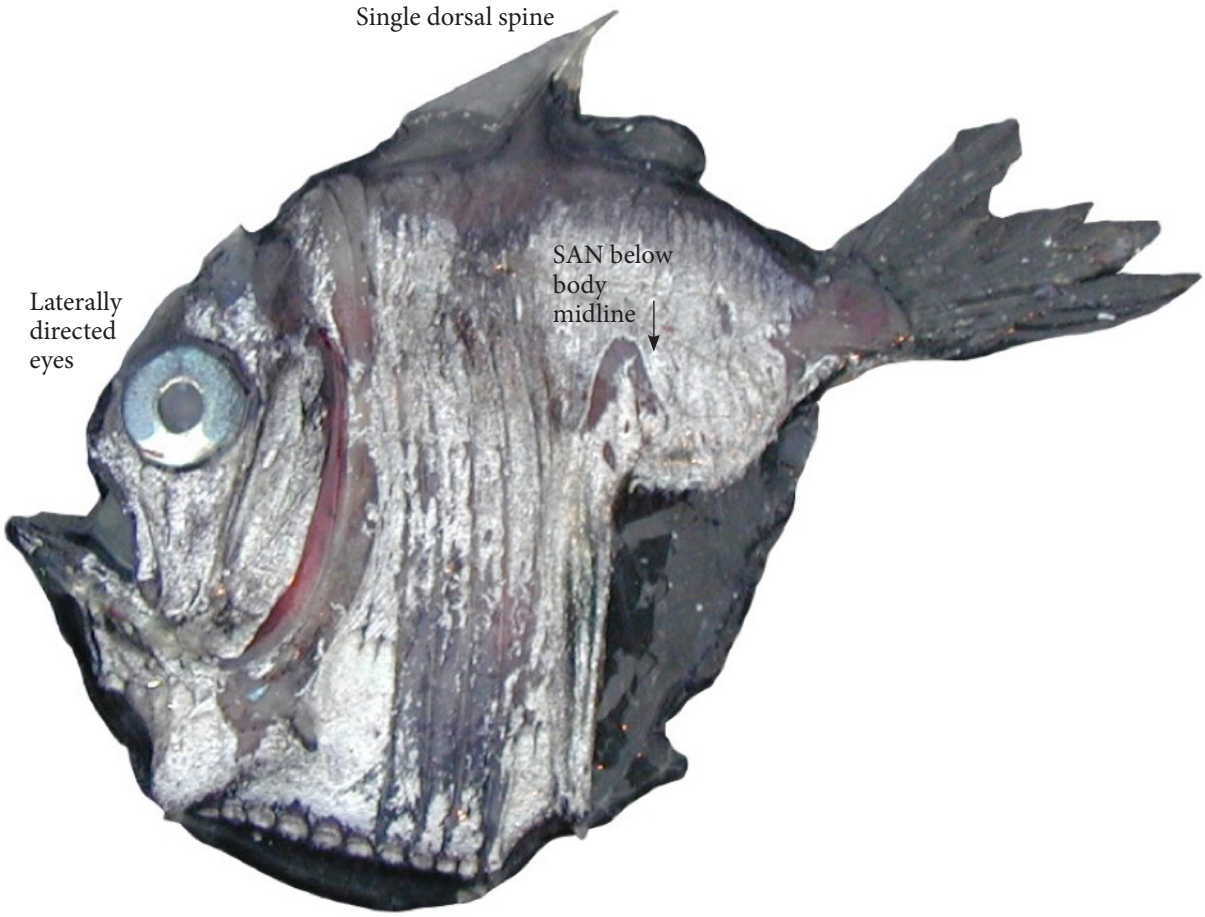


Abbreviation	Definition	Abbreviation	Definition
PO	Preorbital	SP	Suprapectoral
PTO	Postorbital	SAB	Supra-abdominal
PRO	Preopercular	AB	Abdominal
SO	Subopercular	PAN	Pre-anal
I	Isthmus	AN	Anal
BR	Branchiostegal	SC	Subcaudal

Key to the Sternoptychidae of the FRAM Surveys

1	10 abdominal photophores; laterally directed eyes ..... ***Sternoptyx diaphana***	p 89
1	12 abdominal photophores; tubelike eyes directed upward 2	
2(1)	Supra-abdominal, pre-anal, anal, & subcaudal photophores in a nearly continuous straight line..... ***Argyropelecus affinis***	p 90
2	Supra-abdominal, pre-anal, anal, & subcaudal photophores not in a straight line ..... ***Argyropelecus sladeni***	p 91

Longspine hatchetfish, dollar hatchetfish (*Sternoptyx diaphana*)

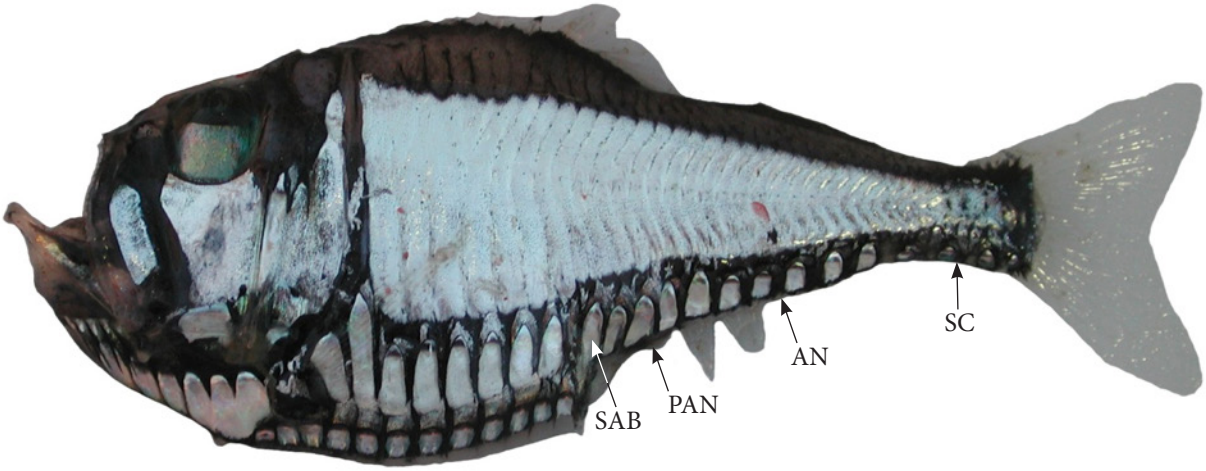


Description
Longspine hatchetfish are highly compressed, and deeper (body depth at end of dorsal less than 2.8 into SL) than long (maximum length about 6 cm TL). The single dorsal spine is as long as or longer than the dorsal fin length. There are ten abdominal, three anal, three branchiostegal, and five isthmus photophores. The supra-anal (SAN) photophore is low, generally not reaching more than half the distance from the ventral margin to the midline. The large, lateral eyes are nontelescopic. There are 7–9 gill rakers with rough, spiny margins. The anteriormost rakers are spiny, toothlike plates that extend into the mouth cavity.

Similar species
Argyropelecus have 12 or more abdominal photophores, six anal photophores, and telescopic eyes.

Distribution
Longspine hatchetfish range from central California and Hawaii, and possibly British Columbia, Canada, through Central and South America, at depths from 400–1,200 m. Also from the Philippine Islands to the coast of Japan. Broadly distributed throughout the Atlantic Ocean, Gulf of Mexico, southern Caribbean Sea, and western Indian Ocean.

Pacific hatchetfish (*Argyropelecus affinis*)

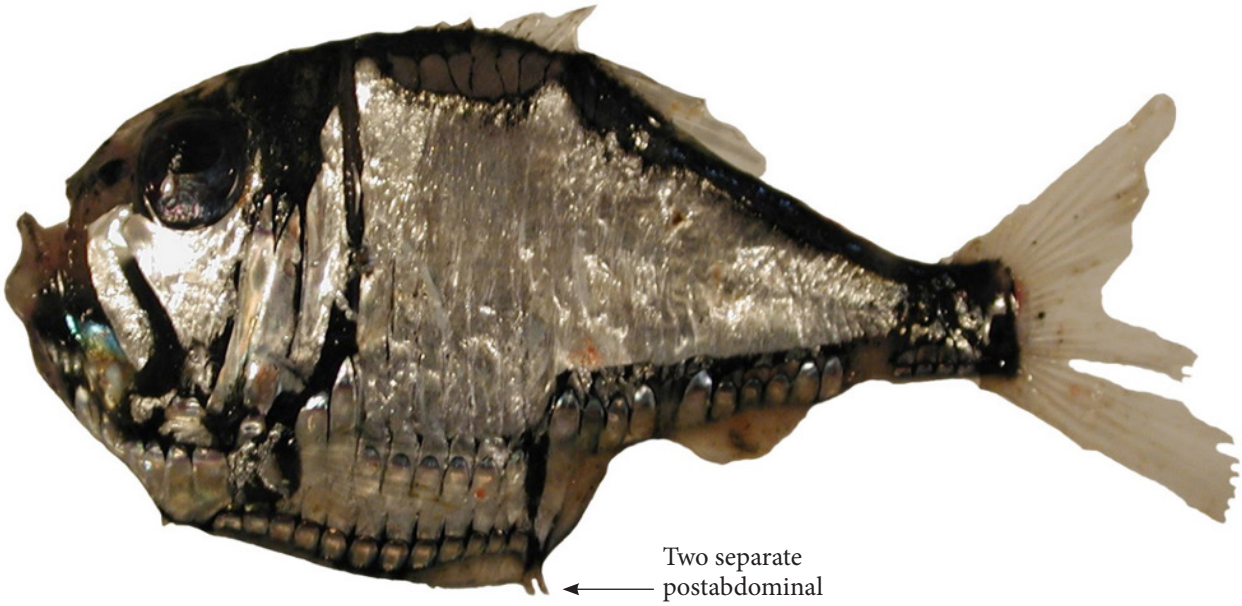


Description
Pacific hatchetfish have a highly compressed, evenly tapered body (body depth at end of dorsal greater than 3.5 into SL). The caudal peduncle is long and narrow. The dorsal spine is short, less than a third the dorsal fin length. The postabdominal spines are equal in length, with no marked curving. The upper preopercle spine points anteriorly, the lower spine is long and curves anteriorly. The gill rakers are long and close-set. The telescopic eyes point up. The color is dark dorsally with silver sides. There are twelve abdominal photophores. The supra-abdominal (SAB), pre-anal (PAN), anal (AN), and subcaudal (SC) photophores are in a nearly continuous straight line. To 7 cm TL.

Similar species
The photophores on other *Argyropelecus* species are not in a straight line.

Distribution
Pacific hatchetfish range from Netarts Bay in Oregon to Chile, including the Gulf of Mexico, at depths from 170–600 m. Broadly distributed in the Atlantic and Indian Oceans. In the western Pacific and the South China Sea.

Lowcrest hatchetfish (*Argyropelecus sladeni*)



Description
The highly compressed head and body of the lowcrest hatchetfish are dark along the dorsal, with silver sides. There are dark spots along the lateral midline that become less prominent in larger individuals. The two small, separate postabdominal spines are about equal in length, but the anterior spine is blunt. The upper preopercular spine extends just beyond the rear of the preopercle and is usually curved upward. The lower preopercular spine points down and often curved back. To 7 cm TL.

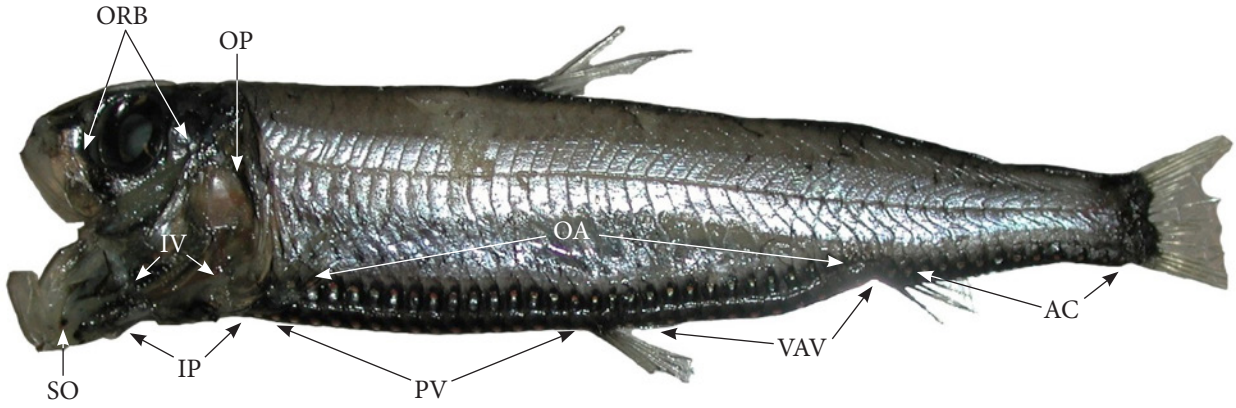
Similar species
The tropical hatchetfish (*Argyropelecus lychnus*) is similar, but the upper preopercular spine curves downward. The lower preopercular spine usually curves forward.

Distribution
Lowcrest hatchetfish range from southern British Columbia, Canada, to Peru at depths of 55–600 m. Broadly distributed in the temperate and tropical waters of the Atlantic, Indian, and Pacific Oceans.

Phosichthyidae (Lightfishes)

The lightfishes consist of about 25 species in seven genera. The Phosichthyidae are generally black, highly compressed, and elongate bathypelagic fishes found in tropical to temperate seas worldwide. The evenly spaced rows of round abdominal photophores separate the Phosichthyidae from similar-looking Gonostomatidae, Sternoptychidae, and Myctophidae.

Lightfish Photophores



Abbrev.	Definition
AC	Ventral series posterior to anal fin origin
BR	On branchiostegal membranes
IP	Ventral series anterior to pectoral fin base
IV	Ventral series anterior to pelvic fin base
OA	Lateral (upper) series

Abbrev.	Definition
OP	Opercular photophores
ORB	Anterior and posterior to eye
PV	Ventral series between pectoral & pelvic fin bases
SO	Paired photophores near symphysis of lower jaw
VAV	Ventral series between pelvic fin base & anal fin origin

Key to the Phosichthyidae of the FRAM Surveys

1 14–16 (usually 15) dorsal rays; 24–26 gill rakers on lower limb of first arch; 31–32 lateral (OA) series photophores; body depth 21–29% of SL ..... ***Ichthyococcus elongatus*** p 93

1 10–13 (usually 11–12) dorsal rays; 15–19 gill rakers on lower limb of first arch; 23–26 lateral (OA) series photophores; body depth 33–39% of SL ..... ***Ichthyococcus irregularis*** p 94

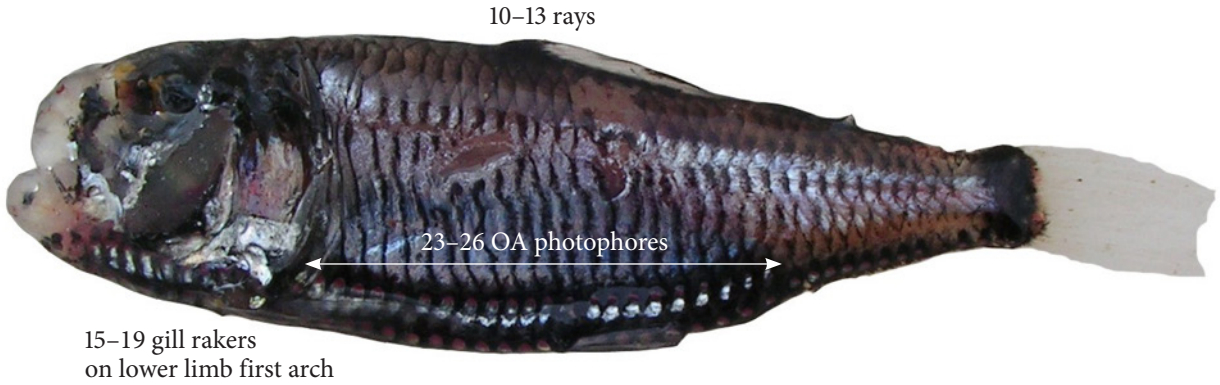
Slim lightfish (*Ichthyococcus elongatus*)

Description
Slim lightfish are generally black dorsally, black to gray with a silver sheen laterally, and black ventrally between the photophores. The body is long but not deep, body depth 21–29% of SL. Generally, 42–44 moderately sized scales along the lateral line. However, scales and skin are usually lost during capture. The premaxillary teeth are uniserial. The large eyes are tubular. There are two orbital photophores (ORB): ORB 1 is anterioventral and ORB 2 is midventral to the eye. Lateral series (OA) with 31–32 photophores. There are 11–22 branchiostegal rays with 11–18 branchiostegal photophores (BR). There are 24–26 gill rakers on the lower limb of the first arch. There are usually 15 (10–16) dorsal fin rays. The anal fin, with 11–22 rays, originates posterior to the last dorsal ray. The long dorsal adipose fin is about as long as the anal fin base. To about 13 cm TL.

Similar species
The bulldog lightfish (*Ichthyococcus irregularis*) has fewer (15–19) gill rakers (24–26 in slim lightfish) on the lower limb of the first gill arch, 10–13 (usually 11-12) dorsal rays (10–16 in slim lightfish), 32–39 lateral line scales (42–44 in slim lightfish), and greater (33–39% of SL) body depth (21–29% in slim lightfish).

Distribution
Slim lightfish are widely distributed in the temperate waters of the North Pacific, at depths of 100–1,948 m, and in the southwestern Pacific to New Zealand.

Bulldog lightfish (*Ichthyococcus irregularis*)



Description
Bulldog lightfish are generally black dorsally, black to gray with a silver sheen laterally, and black ventrally between the photophores. The body is short and moderately deep, body depth 33–39% of SL. Generally, 32–39 moderately sized scales along the lateral line. However, scales and skin are usually lost during capture. The large eyes are tubular. Lateral series (OA) with 23–26 photophores. There are 15–19 gill rakers on the lower limb of the first arch. There are usually 11–12 (10–13) dorsal fin rays. To about 7.6 cm TL.

Similar species
Slim lightfish (*Ichthyococcus elongatus*) have more (24–26) gill rakers (15–19 in *I. irregularis*) on the lower limb of the first gill arch, 10–16 (usually 15) dorsal rays (10–13 in I. *irregularis*), 42–44 lateral line scales (32–39 in *I. irregularis*), and greater body depth (21–29% of SL, 33–39% in *I. irregularis*).

Distribution
Bulldog lightfish are restricted to the eastern Pacific throughout the California Current region from approximately lat 43°50'N southward, at depths of 360–3,658 m.

Stomiidae (Barbeled Dragonfishes)

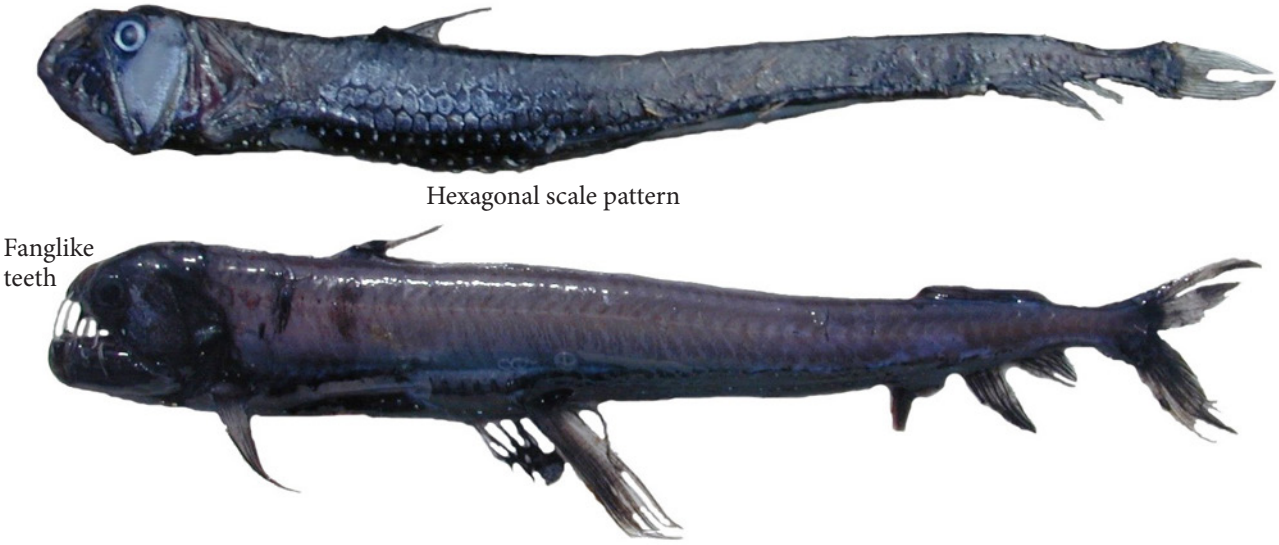
The Stomiidae are a diverse group of deepwater pelagic fishes that have both photophores and a chin barbel. In the past they comprised six separate families: Stomiatidae (scaly dragonfishes), Chauliodontidae (viperfishes), Astronesthidae (snaggletooths), Melanostomiidae (scaleless dragonfishes), Malacosteidae (loosejaws), and Idiacanthidae (blackdragons). Currently there are about 230 species in 26 genera in a single family.

Key to the Stomiidae of the FRAM Surveys

1	Short dorsal fin in front of pelvic fins; long first dorsal fin ray; dorsal and ventral adipose fins..... ***Chauliodus macouni***	p 95
1	Short dorsal fin completely posterior to, or long dorsal fin originating anterior to and continuing posterior of, pelvic fins..... 2	
2(1)	Long dorsal fin originates ahead of pelvic fins ..... ***Idiacanthus antrostomus***	p 96
2	Short dorsal fin originates behind pelvic fins 3	

3(2)	Short dorsal fin originates well in advance of anal fin; dorsal fin between pelvic and anal fins; dorsal adipose fin present ..... ***Borostomias panamensis***	p 97
3	Short dorsal fin originates far back on body and is nearly opposite anal fin 4	
4(3)	Pectoral fin present ..... ***Tactostoma macropus***	p 97
4	Pectoral fin absent 5	
5(4)	Pelvic fins positioned high on body ..... ***Bathophilus flemingi***	p 98
5	Pelvic fins ventral 6	
6(5)	5–6 rows of hexagonal pigmented areas, each covered with a scale, on sides ..... ***Stomias atriventer***	p 98
6	Scaleless, unmarked, uniformly pigmented 7	
7(6)	Large photophore below eye, small photophores in front and behind eye; no fanglike teeth ..... ***Pachystomias microdon***	p 99
7	Large photophore below eye, small photophore behind eye, no photophore in front of eye; some fanglike teeth 8	
8(7)	Chin barbel present; well developed, prominent photophores on body; large orbital photophore below lower front quarter of eye ..... ***Aristostomias scintillans***	p 100
8	Chin barbel absent; poorly developed, inconspicuous photophores on body; large orbital photophore is below lower rear quarter of eye ..... ***Malacosteus niger***	p 101

Pacific viperfish (*Chauliodus macouni*)



Description

Pacific viperfish are black dorsally with hexagonal pigmented areas covered by deciduous scales laterally and black ventrally. The elongate, triangular postorbital (PTO) photophore is located behind the posterior margin of the orbit. The dorsal fin is well anterior of the pelvic fin base, and the first dorsal fin ray is greatly elongated. There are two adipose fins; the dorsal adipose fin is above the anal fin, and the ventral adipose fin in front of the anal fin. The pelvic fins are long and narrow. A minute chin barbel may or may not be present. To 27 cm TL.

Similar species
The blackbelly dragonfish (*Stomias atriventer*) has a long chin barbel, and the short-rayed dorsal is far back on the body over the anal fin.

Distribution
Pacific viperfish range from the Bering Sea to the Gulf of California at depths of 25–4,390 m. In the western Pacific from the Kuril Islands and Japan.

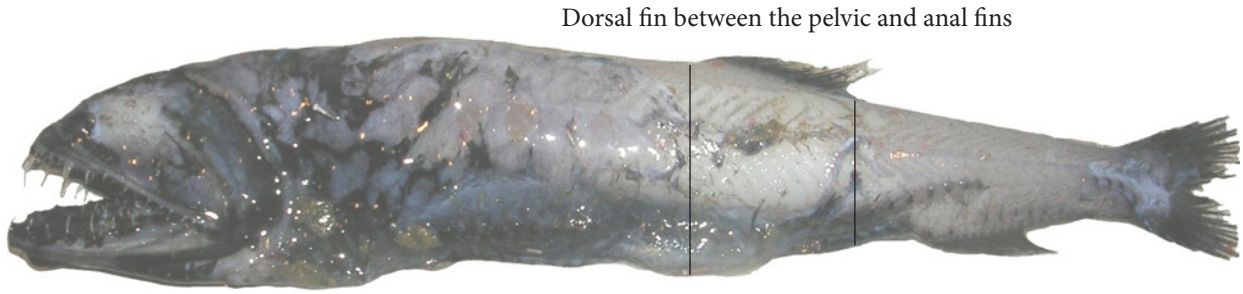
Pacific blackdragon (*Idiacanthus antrostomus*)

Description
Pacific blackdragons show strong sexual dimorphism. Females are highly elongate, reaching lengths of 61 cm. The dorsal and anal fins are long and extend nearly to the caudal fin. There are no pectoral or adipose fins. The pelvic fins are far back on the body. There is a long chin barbel with a bladelike structure at the tip. The males are dark brown, very short—generally less than 8 cm—and have no teeth, chin barbel, or pelvic fins.

Similar species
Longfin dragonfish (*Tactostoma macropus*) have a very short chin barbel and short dorsal and anal fins.

Distribution
Pacific blackdragons range throughout most of the tropic and temperate waters of the North Pacific from northern California through South America, at depths of 0–1,830 m, possibly deeper.

Panama snaggletooth (*Borostomias panamensis*)



Description
Panama snaggletooth are black, scaleless, and laterally compressed. The ventral series of photophores is arranged in regular continuous rows, PV photophores 26 or less, lateral series photophores between the pectoral and pelvic fin bases (OV) 24 or less. Well developed orbital photophore below the anterior margin of the orbit. Pelvic fins are placed midbody, dorsal fin originates well anterior of the anal fin and posterior to the pelvic fin. Dorsal adipose fin is present over the anal fin, and rarely a ventral adipose fin on the anterior end of the anal fin. To 30 cm TL.

Similar species
Other Stomiiforms differ in the shape, size, and location of the dorsal fin and the presence, absence, and shape of photophores on the head.

Distribution
The Panama snaggletooth ranges from Point Conception in California to Panama and possibly Chile, at depths of 91–2,743 m.

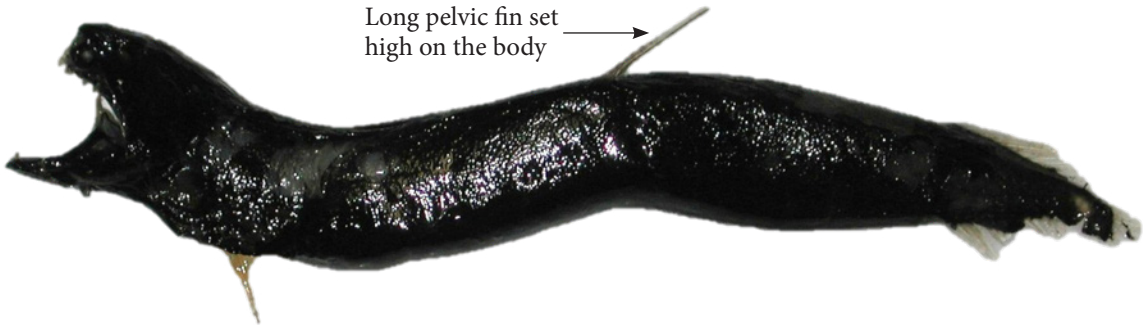
Longfin dragonfish (*Tactostoma macropus*)

Description
Longfin dragonfish are black, scaleless, elongate, and almost cylindrical in cross-section. The lower jaw is longer than the upper and has a strong upward curve. There are parallel lateral and ventral rows of numerous small, serial photophores. The body and fins have small, luminous flecks and patches. The chin barbel is short—less than the diameter of the eye. The dorsal and anal fins are nearly opposite and far back on the body. The pectoral and adipose fins are absent. The long pelvic fins are low on the body. To 41 cm TL.

Similar species
Pacific blackdragons (*Idiacanthus antrostomus*) have a chin barbel and long fins.

Distribution
Longfin dragonfish range from the Bering Sea to southern California at depths of 25–2,000 m, and across the North Pacific to the Sea of Okhotsk and Japan.

Highfin dragonfish (*Bathophilus flemingi*)

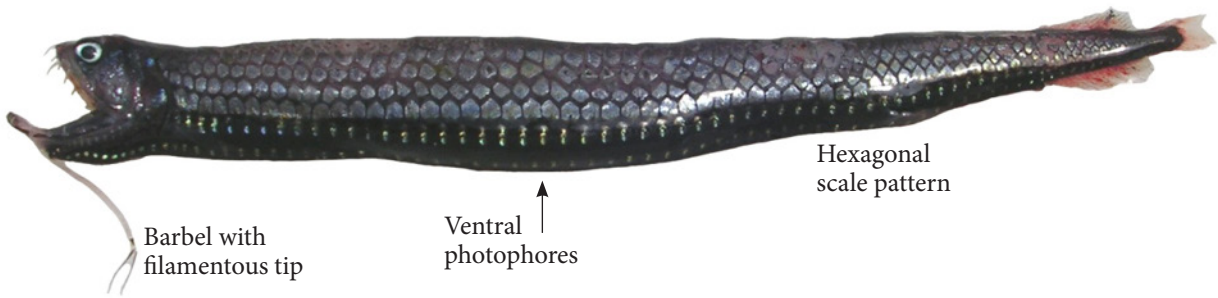


Description
Highfin dragonfish are black to very dark black/brown. There are parallel lateral and ventral rows of numerous small, serial photophores, but counts are difficult due to body damage. The OA photophores are discontinuous, having a gap around the pelvic fin. The anterior portion OV is highly arched to a level above the pelvic fin base. The posterior portion VAL resumes below the pelvic fin base. The long barbel can be up to four times the body length and does not have an enlarged, bulbous tip. The pectoral fins have long rays and are low on the body; the pelvic fins have long rays and are high on the body. Due to their fragile nature, the photophores, chin barbel, and pectoral and pelvic fin rays are often missing. Adipose fins are absent. To 17 cm TL.

Similar species
Other Stomiiformes differ in the presence, absence, size, or location of the pelvic fins.

Distribution
Highfin dragonfish range from the Gulf of Alaska and eastern North Pacific to Baja California, Mexico, at depths of 60–1,372 m.

Blackbelly dragonfish (*Stomias atriventer*)



Description
The blackbelly dragonfish has a black body overlaid with 5–6 rows of pigmented hexagonal areas, each covered by a thin, large, deciduous scale. Tiny photophores cover most of the long, compressed body. There are parallel lateral and ventral rows of numerous small, serial photophores. The small dorsal and anal fins are nearly opposite and far back on the body. There is no adipose fin. The large mouth contains curved, fanglike teeth. The chin barbel has a luminescent lure and a filamentous tip. To 25 cm TL.

Similar species
The Pacific viperfish (*Chauliodus macouni*) has dorsal and ventral adipose fins, a dorsal fin placed well forward on the body, and no chin barbel.

Distribution
Blackbelly dragonfish are uncommon, and range from California through Mexico at depths of 100–1,500 m.

Large-eye dragonfish (*Pachystomias microdon*)

Description
Large-eye dragonfish are black and scaleless. The snout length is equal to or shorter than the eye. There is a fold of skin connecting the anterior end of the lower jaw. Just behind this is a thin, transparent membrane connecting the posterior end of the jaws and forming the mouth's floor. The large, sausage-shaped ORB below the orbit is red to greenish-yellow. The smaller photophore of the same color just anterior to the eye is apparently part of the ORB. The PTO photophore is well behind the eye just above the upper jaw. Spaces divide the lateral and ventral photophore series into groups, and can range from red to violet. The curved teeth are generally in a single row and not very large. The chin barbel tapers to a thin filament. To 22 cm TL, possibly more.

Similar species
The shining loosejaw (*Aristostomias scintillans*) does not have connective tissue to form a floor to the mouth, and the snout length is greater than the eye diameter. The shortnose loosejaw (*Malacosteus niger*) has no chin barbel, a short snout, unpaired nostrils, and the large suborbital photophore is below and behind the eye.

Distribution
Large-eye dragonfish are widespread in the Atlantic and Pacific Oceans, and reportedly from the southern Bering Sea, at depths to over 4,206 m.

Shining loosejaw (*Aristostomias scintillans*)

No floor to the mouth

Description
The shining loosejaw has a black, scaleless, laterally compressed head and body and no lateral line canal. A well developed, red ORB is just below and on the front edge of the eye. The forward edge of a small green PTO is under the rear edge of the eye. Serial photophores form lateral and ventral series, but counts are difficult due to specimen damage and there are numerous minute luminous bodies on the head, body, and fins. There are paired nostrils on the snout, which is longer than the eye diameter. The long chin barbel has a bulbous tip (broken off in pictured specimen). The large jaws extend past the base of the skull and are very low on the head. The mouth has no floor. To 23 cm TL.

Similar species
The large-eye dragonfish (*Pachystomias microdon*) has a threadlike chin barbel, a long, sausage-shaped photophore below the eye, and the mouth has a floor. The shortnose loosejaw (*Malacosteus niger*) has no chin barbel, a short snout, unpaired nostrils, and the large ORB photophore is below and behind the eye.

Distribution
Shining loosejaw range from British Columbia, Canada, to central Baja California, Mexico, at depths of 29–1,008 m.

Shortnose loosejaw (*Malacosteus niger*)

Description
The head and body of the shortnose loosejaw are scaleless, black, and laterally compressed. A well developed, comma shaped, dark red ORB is below and slightly behind the eye. A well developed green PTO is well behind the eye. Other photophores on the body and branchiostegal membranes are small and inconspicuous. The snout is very short, less than half the diameter of the eye. There is a single pair of nostrils, and no barbel. The fanglike teeth in the floorless mouth are much longer in the lower than upper jaw. Total length to about 24 cm.

Similar species
Large-eye dragonfish (*Pachystomias microdon*) have a threadlike chin barbel, a long, sausage-shaped photophore below the eye, and the mouth has a floor. Shining loosejaws (*Aristostomias scintillans*) have a chin barbel, snout length greater than the eye diameter, paired nostrils, and the shape and location of the ORB and PTO are different.

Distribution
Shortnose loosejaw are widely distributed worldwide, from sub-Arctic to tropical waters, at depths from 183 to 3,658 m.

Aulopiformes (Aulopiforms)

The Aulopiforms consist of 13 families and 42 genera with about 220 species. This group of benthic and pelagic predatory fishes varies widely in body shape and size. Most do not have photophores. Taxonomic characteristics of Aulopiforms include internal features, such as specialization of the gill arches, absence of a swim bladder, and fusing of the medial processes of the pelvic girdle. Externally, Aulopiforms have fins composed of soft rays only, and low-set pectoral fins. The dentition is highly variable. The upper jaw has a single row of numerous small teeth. Teeth in the lower jaw are absent in some species, and in 2–4 rows in others. When present, the innermost row of teeth is depressible, and there are 1–2 rows of palatine teeth. There are bony plates with teeth, not normal gill rakers, on the gill arches.

Scopelarchidae (Pearleyes)

The pearleyes consist of about 17 species in four genera. Pearleyes have tubular, upward-directed eyes that have a pearl-like light patch. Cycloid scales cover the laterally compressed body. The pectoral fins are set low on the body and there is a dorsal adipose fin.

Key to the Scopelarchidae of the FRAM Surveys

1	Distinct, equal, or subequal stripes above & below lateral line, extending forward from caudal peduncle; no concentrated pigment on upper caudal lobe; pectoral fins longer than pelvics; pectoral rays 18–22	2
1	Distinct stripes absent, or, if present, very unequal; pigment concentrated either above or below lateral line	5
2(1)	Pigment absent on pectoral fin; anal rays usually 25 or more ***Scopelarchus guentheri***	p 103
2	Pigment present on pectoral fin; anal rays usually 25 or less	3
3(2)	Anal rays 21 or more, usually 22 or more; lateral line scales 44 or fewer; vertebrae 44 or fewer ***Scopelarchus analis***	p 104
3	Anal rays 22 or fewer, usually 21 or fewer; lateral line scales 45 or more, usually 46 or more; vertebrae 44 or more	4
4(3)	Pectoral fin black except for ventralmost 5 rays; pectoral fin reaches to or beyond anal fin origin ***Scopelarchus michaelsarsi***	p 105
4	Pectoral fin pigment a limited patch of melanophores between rays 2–6 or 7 (counting from top) on medial ⅓ of fin length, absent at fin base and distal ⅓ of fin length; pectoral fin reaches to pelvic fin insertion ***Scopelarchus stephensi***	p 105
5(1)	Pelvic fin insertion distinctly anterior of a vertical through base of first dorsal ray	9
5	Pelvic fin insertion distinctly posterior of a vertical through base of first dorsal ray	6
6(5)	Pectoral longer than pelvic; dorsal lobe of caudal fin highly pigmented, pigment on ventral lobe weak, if present; no stripe associated with lateral line; no pigment on pectoral and pelvic fins; anal rays 26 or more, usually 27 or more ***Scopelarchoides signifier****	*n/a*
6	Pectoral fin shorter than pelvic; both lobes of caudal fin equally pigmented, or strong pigment on ventral lobe only; well developed stripe associated with lateral line and/or pigmented pectoral and pelvic fins; anal rays 27 or fewer, usually 26 or fewer	7

* Southern Hemisphere, not known above lat 5°N.

7(6)	Pigment absent on pectoral and pelvic fins; well developed stripe ventral to lateral line, little or no pigment dorsal to lateral line except on caudal peduncle; pectoral fin rays 23 or fewer; lateral line scales 52 or fewer	8
7	Not as above	*n/a*
8(7)	Anal fin rays 20–23; well developed pigment on both lobes of caudal fin; gill filaments very long, extending beyond edge of gill covers to overlap pectoral fin base	***Scopelarchoides nicholsi*** p 106
8	Not as above	*n/a*
9(5)	Lateral line scales 47–53; vertebrae 46–51; lingual teeth over first 2–3 basibranchials and basihyal; no stripes associated with lateral line; anal rays 20–24	10
9	Lateral line scales 54 or more; vertebrae 54 or more; lingual teeth only over basihyal, possibly 1–2 small teeth over anterior end of first basibranchial; stripes associated with lateral line present or absent; 30 or fewer anal rays	11
10(9)	No pigment on pelvic fins, branchiostegal membranes with dense black pigment medially	***Rosenblattichthys volucris*** p 107
10	Not as above	*n/a*
11(10)	Stripes along lateral line present	***Scopelarchoides kreffti**** *n/a*
11	Stripes along lateral line absent	12
12(11)	Anal rays 30 or fewer	13
12	Not as above	*n/a*
13	Adipose fin base posterior to a vertical through base of last anal ray; dorsal rays usually 6–7; anal rays 17–21, usually 20 or fewer	***Benthalbella dentata*** p 107
13	Adipose fin base anterior of a vertical through base of last anal ray; dorsal rays usually 9; pectoral rays, lateral line scales 66; anal rays 28 or more	***Benthalbella linguidens*** p 108

*Range restricted to the Southern Hemisphere.

Staring pearleye (*Scopelarchus guentheri*)

Description

Staring pearleye have a moderately high dorsal fin with 7–8 rays. The pectoral fins have 18–21 rays that extend past the pelvic fin insertion but do not reach the anus. The pelvic fins extend to the anus but not the anal fin origin. The elongate anal fin has 24–29 rays. There are 47–52 large lateral line scales; the remainder of the body scales are moderate in size, with those scales adjacent to the lateral line less than one-fifth the depth of the lateral line scales. Body color is limited to the dark stripes above and below the lateral line. The scale pockets above the lateral line have black edges. The caudal peduncle and the scaly flaps of skin over the bases of the caudal rays are darkly colored. Pigment is absent on the pectoral, pelvic, anal, adipose, and caudal fins. Some dark pigment is present at the base and on the rays and membranes of the dorsal fin. The peritoneum is black. The gill filaments are elongate, extending to or beyond the edge of the gill cover. To 12.7 cm SL.

Similar species
The distinct, although sometimes unequal, stripes above and below the lateral line extending from the caudal peduncle distinguish *Scopelarchus* from the other genera. The lack of pigment on the pectoral fins, and having 25 or more anal rays, separates the staring pearleye from the other *Scopelarchus* species.

Distribution
Staring pearleye are circumglobal in the warm waters of the Atlantic, Indian, and Pacific Oceans. In the eastern North Pacific from the Catalina Basin in southern California to near Cedros Island in Baja California, Mexico, at depths of 0–4,000 m.

Shortfin pearleye (*Scopelarchus analis*)

Description
Shortfin pearleye have a moderately high dorsal fin with 7–9 rays. The pectoral fins have 18–22 rays that extend nearly to or slightly beyond the pelvic fin insertion. The pelvic fins extend nearly to the anus but not the anal fin origin. The elongate anal fin has 21–26 rays. There are 45–50 large lateral line scales; the remainder of the body scales are moderate in size, with those scales adjacent to the lateral line less than one-third the depth of the lateral line scales. Body color is limited to the dark stripes above and below the lateral line. The scale pockets above the lateral line have black edges. The caudal peduncle and the scaly flaps of skin over the bases of the caudal rays are darkly colored. There are 3–4 lines above and below the midcaudal rays on the membrane between the rays. Pigment is absent on the anal and adipose fins. The dorsal fin base is dark, and, except for the last two rays, the whole dorsal fin has pigment. The pectoral fins have pigment at the base and usually on the rays and membranes. If present on the pelvic fins, it is not well developed. The peritoneum is black. To 12.6 cm SL.

Similar species
The distinct, although sometimes unequal, stripes above and below the lateral line extending from the caudal peduncle distinguish *Scopelarchus* from the other genera. The staring pearleye (*S. guentheri*) lacks pigment on the pectoral fin. The bigfin pearleye (*S. michaelsarsi*) has a solid-colored pectoral fin (except the five ventralmost rays), 18–21 anal rays, and 40–44 lateral line scales. *Scopelarchus stephensi* have pigment on the pectoral fin—not on the base of the fin, and limited to a patch between rays 2–6, sometimes 7.

Distribution
Shortfin pearleye are circumglobal in the warm waters of the Atlantic, Indian, and Pacific Oceans. In the eastern North Pacific from southern California to Baja California, Mexico, at depths of 0–4,000 m.

Bigfin pearleye (*Scopelarchus michaelsarsi*)

Description
Bigfin pearleye have a moderately high dorsal fin with 7–9 rays. The pectoral fins have 18–21 rays that extend to or slightly beyond the anal fin insertion. The pelvic fins extend to or slightly beyond the anus but not to the anal fin origin. There are 40–44 large lateral line scales. The body scales are nearly as large as the lateral line scales, and those adjacent to the lateral line overlap the anterior two-thirds of the lateral line. Body color is limited to the dark stripes above and below the lateral line. The scale pockets above the lateral line have black edges. The caudal peduncle and the scaly flaps of skin over the bases of the caudal fin rays are dark. There are 3–4 dark lines directed posteriorly on the membranes above and below the midcaudal rays. The dorsal fin base is dark, and, except for the last two rays, the whole dorsal fin has pigment. Color on the pelvic fin is usually absent but, when present, is on the lateral portions of the fin rays and membranes. The adipose and anal fins lack pigment. The peritoneum is black. To 10.2 cm SL.

Similar species
The distinct, although sometimes unequal, stripes above and below the lateral line extending from the caudal peduncle distinguish *Scopelarchus* from the other genera. The shortfin pearleye (*S. analis*) has pectoral fin pigment limited to the base or individually identifiable melanophores over the whole fin. Anal fin with 21–26 (usually 22–25) rays. The staring pearleye (*S. guentheri*) lacks pigment on the pectoral fin. *Scopelarchus stephensi* has pigment limited to a patch of melanophores between rays 2–6 or 7 on the middle one-third of the pectoral fin, which extends to or just beyond the pelvic fin insertion but does not reach the anus.

Distribution
Bigfin pearleye occur in the warm waters of the western North Atlantic, the central South Atlantic, throughout the Indian Ocean, the South China Sea, the waters of the Indo-Malayan Archipelago, and the central North and South Pacific, at depths of 256–500 m.

Scopelarchus stephensi

Description
Scopelarchus stephensi have a moderately high dorsal fin with eight rays. The pectoral fins have 18–20 rays that extend to or slightly beyond the pelvic fin insertion. The pelvic fins extend barely to the anus. There are 41–44 large lateral line scales. The body scales are nearly as large as the lateral line scales, and those adjacent to the lateral line overlap the anterior two-thirds of the lateral line. Body color is limited to the dark stripes above and below the lateral line, the scale pockets above, not below, the lateral line, and on the caudal peduncle at the bases of the caudal rays. There is limited color on the anterior one-fourth to one-third of the caudal fin above and below the midcaudal rays. Color on the pectoral fin is limited to a patch of melanophores between rays 2–6 or 7 (counting from the top) on the middle one-third of the fin. No pigment is present at the bases of the pectoral rays and does not extend onto the posterior one-third of the fin. Color is absent but, when present, is on the lateral portions of the fin rays and membranes. The adipose, anal, and pelvic fins lack pigment. The peritoneum is black. To 6.2 cm SL.

Similar species
The distinct, although sometimes unequal, stripes above and below the lateral line extending from the caudal peduncle distinguish *Scopelarchus* from the other genera. The shortfin pearleye (*S. analis*) has pectoral fin pigment limited to the fin base or individually identifiable melanophores over the whole fin. Anal fin with 21–26 (usually 22–25) rays. The staring pearleye (*S. guentheri*) lacks pigment on the pectoral fin. The bigfin pearleye (*S. michaelsarsi*) has a black pectoral fin (except for the five ventralmost rays) extending to or beyond the anal fin origin.

Distribution
Scopelarchus stephensi is known only from the North Pacific, from approximately long 178°E to 126°W and lat 25–35°N. The known range forms a band across the north-central portions of the western and eastern North Pacific at depths of 0–1,000 m.

Scopelarchoides nicholsi

Description
Scopelarchoides nicholsi have a moderately high dorsal fin with 6–7 rays. The pectoral fins have 20–23 rays. The pelvic fins extend slightly beyond the anal fin origin. The pelvic fin origin is beneath or posterior to a vertical from the mid-dorsal fin base. The pelvic fin insertion is beneath or slightly posterior to the last dorsal ray in adults. Large cycloid scales cover the head, from just posterior of the orbit, and the entire body. The body scales are moderately large, with the largest behind the pectoral insertion. They are much larger than the adjacent body scales, and slightly larger than the lateral line scales above the pectoral insertion of anal origin. The 46–50 lateral line scares are large. All external surfaces of the head are dark and are especially dark on the occiput, dorsal margins of the eye, snout, lining of the dentigerous surfaces of the jaws and ventrally on the mandible, and the dark streak ahead of the eye. The branchial and oral cavities are unpigmented. The branchiostegal membranes between branchiostegal rays 1–4 are lightly colored. The body pigmentation is especially dense around the scale pockets. The peritoneum is visible through the thin body wall. The dorsal fin is heavily colored. Pigment is limited to the bases of the pectoral, pelvic, and anal fins, with no pigment on the rays or membranes. The caudal peduncle at the base of the caudal rays has a black outline. Both lobes of the caudal fin are dark the whole length. There is a broad dark stripe below the lateral line, with little light colorations above. To 12.7 cm SL.

Similar species
The pelvic fins distinctly longer than the pectorals, both lacking pigment, the broad dark stripe below the lateral line, and long gill filaments that overlap the pectoral fin base distinguish *Scopelarchoides nicholsi* from all other *Scopelarchoides* species.

Distribution
Known only from the eastern Pacific Ocean, *S. nicholsi* has a limited but disjunct range—the northern area from the Catalina Basin in southern California to Cedros Island in Baja California, Mexico, and a southern area off Peru, at depths of 0–3,294 m.

Chubby pearleye (*Rosenblattichthys volucris*)

Description
Chubby pearleye have a moderately high dorsal fin with 9–10 rays. The pectoral fins have 23–26 rays and extend slightly beyond the pelvic fin insertion. The pelvic fins extend slightly beyond the anal fin origin. The pelvic fin insertion is just anterior to the dorsal fin origin. There is a short, fleshy ridge extending anteriorly from the adipose fin. The 48–51 lateral line scales are relatively small. The body color is grayish black to brown, with darker edges on the scale pockets. There are two broad, dark bands: one above the lateral line from the back of the head to the caudal peduncle, the second below the lateral line from just behind the pelvic fins to the caudal peduncle. The two bands join to form a dark bar at the base of the caudal fin rays. All fins have a dark band at the base that extends onto the rays and membranes of the dorsal, pectoral, anterior half of the anal, and the upper- and lowermost rays of the caudal fin. The pelvic fins lack the dark color on the rays and membranes. The peritoneum is dark black. To 6.6 cm SL.

Similar species
The other known species of *Rosenblattichthys* do not occur in the North Pacific.

Distribution
Known only from the eastern Pacific Ocean, chubby pearleye range from approximately San Pedro, California, to Punta San Juanico in Baja California, Mexico, at depths of 0–3,294 m.

Northern pearleye (*Benthalbella dentata*)

Description
Northern pearleye have a moderately high dorsal fin with 6–8 (usually 6–7) rays. The pectoral fins are greatly reduced, with 21–24 short, slender rays. The pelvic fins are longer and extend to about half the distance between the pelvic fin insertion and the anus. The anal fin originates well posterior to midbody, has a short base, and 17–20 rays. The adipose fin base becomes greatly reduced with age, becoming a small fin with the base entirely posterior to a vertical through the last anal fin ray. The 54–58 lateral line scales are moderate in size, approximately twice the size of the adjacent scales. The body is a dirty silver-black to dark brown, with darker color outlining the scale pockets. The fins are dusky to dark and the peritoneum is dark black. To 28 cm TL.

Similar species
The longfin pearleye (*Benthalbella linguidens*) has long pectoral fins, a longer anal fin base, 28–30 anal fin rays, 8–9 dorsal fin rays, 66 lateral line scales, and the adipose fin originates anterior to the midline of the last anal fin ray.

Distribution
Northern pearleye range from the southern Bering Sea and Gulf of Alaska to off Guadalupe Island off Baja California, Mexico, at depths from 90 to 1,340 m. In the western North Pacific from midocean, the Sea of Okhotsk, and the Sea of Japan.

Longfin pearleye (*Benthalbella linguidens*)

Description
Longfin pearleye have a moderately high dorsal fin with 8–9 rays. The pectoral fins have rays and extend short of the pelvic fin insertion. The pelvic fins extend somewhat short of the halfway point between the pelvic fin insertion and anus. The anal fin originates well posterior to midbody, is long-based, and has 28–30 rays. The 66 lateral line scales are relatively small, but the body scales adjacent to the lateral line scales are much smaller. The fins, head, and body are uniformly dark, with somewhat darker outlines to the scale pockets. The peritoneum is a dark black. To 36 cm TL.

Similar species
The northern pearleye (*Benthalbella dentata*) has greatly reduced pectoral fins, a short anal fin base with fewer rays (17–20 vs. 28–30), and fewer and larger lateral line scales (54–58 vs. 66).

Distribution
Longfin pearleye range from the Gulf of Alaska and the North Pacific to Oregon, and northern Japan, at depths from 13 to 3,360 m.

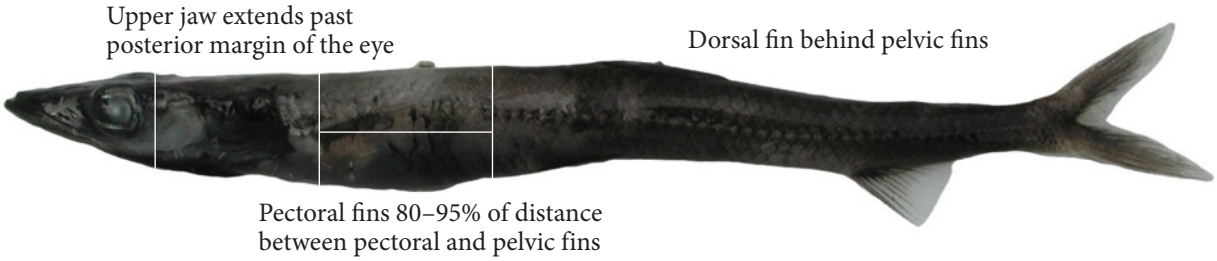
Notosudidae (Waryfishes)

The waryfish, also known as paperbones due to their fragile skeletons, contain 19 species in three genera in the tropical to temperate seas worldwide. In cross-section, the body is round anterior to the anus, and becomes increasingly compressed closer to the caudal. The large, egg-shaped eye has an elliptical pupil on a round lens with a large, lensless space. The color ranges from brown to black, with the darkest coloration on and near the head. The pectoral fins are high on the body. The dorsal fin is about midbody, with the last ray divided to the base. The anal fin is far back, with the last ray divided to the base and under the adipose fin. The cycloid scales are deciduous.

Key to the Notosudidae of the FRAM Surveys

1	Upper jaw extends past posterior margin of eye; pectoral fin length 80–95% of distance between pectoral and pelvic fins ..... ***Scopelosaurus alderi***	p 108
1	Upper jaw does not extend past rear margin of pupil; pectoral fin length 60–75% of distance between pectoral and pelvic fins..... ***Scopelosaurus harryi***	p 109

Longfin waryfish (*Scopelosaurus alderi*)



Description
Longfin waryfish are uniformly dark, with the jaws, head, and fin bases somewhat darker. The upper portions of the fins are lighter than the bases. The mouth cavity, iris, and gill cavity are dark. The body is triangular in cross-section near the head in small fish, and increasingly rounded in cross-section with age and growth. Lateral compression increases progressively posteriorly. Scales are large and deciduous. The large dorsal fin is posterior to the pelvic fins. The long pectoral fins are placed midbody near the edge of the operculum, and extend 80–95% of the distance between the pectoral fin base and the pelvic fin base. The dorsal adipose fin is above the posterior part of the anal fin. The upper jaw extends past the rear margin of the eye. The lower jaw extends slightly beyond the upper and has a distinct symphyseal enlargement. To 31 cm SL.

Similar species
Scaly waryfish (*Scopelosaurus harryi*) have shorter jaws extending to the rear margin of the pupil and shorter pectoral fins (60–75% of the distance between the pectoral fin base and the pelvic fin base, vs. 80–95% in *S. alderi*). Slender barracudina (*Lestidiops ringens*) have a light-colored mouth and gill cavities, a nearly straight lateral line, and up to 17 more rays in the anal fin. Duckbill barracudina (*Magnisudis atlantica*) have pelvic fins below the dorsal fin. The ribbon barracudina (*Arctozenus risso*) is a larger, deeper-bodied fish, with the pelvic fins behind the dorsal and a black area at the base of the forward anal fin spines.

Distribution
Longfin waryfish range from Japan and the Sea of Okhotsk to the Bering Sea and are widespread in the Pacific between lat 20–60°N at depths of 18–1,310 m.

Scaly waryfish (*Scopelosaurus harryi*)

Description
The head, body, and fins of the scaly waryfish are dark-colored and the mouth cavity is black. The body is almost round in cross-section near the head, but becomes progressively more compressed posteriorly. Scales are large and deciduous. The large dorsal fin is posterior to the pelvic fins. The pectoral fins are placed midbody near the edge of the operculum and extend 60–75% of the distance between the pectoral fin base and the pelvic fin base. The dorsal adipose fin is above the posterior part of the anal fin. The upper jaw extends to the rear margin of the pupil. The lower jaw extends slightly beyond the upper, with an indistinct symphyseal enlargement. To 32 cm SL.

Similar species
Longfin waryfish (*Scopelosaurus alderi*) have longer jaws extending beyond the rear margin of the orbit and longer pectoral fins extending 80–95% of the distance between the pectoral fin base and the pelvic fin base (typically 60–75% in scaly waryfish). Slender barracudina (*Lestidiops ringens*) have a light-colored mouth and gill cavities, a nearly straight lateral line, and up to 17 more rays in the anal fin. Duckbill barracudina (*Magnisudis atlantica*) have pelvic fins below the dorsal fin. The ribbon barracudina (*Arctozenus risso*) is a larger, deeper-bodied fish with the pelvic fins behind the dorsal and a black area at the base of the forward anal fin spines.

Distribution
Scaly waryfish occur in the Bering Sea and are widespread in the Pacific between lat 20–60°N, at depths from 20 to over 1,300 m, but most commonly at 200–800 m.

Synodontidae (Lizardfishes)

The lizardfishes are elongated, cylindrical fishes with 55 species in five genera found primarily in marine areas (but occasionally in brackish water) in warm, shallow parts of the Atlantic, Indian, and Pacific Oceans. The large mouth in the lizardlike head has small, needlelike teeth. The spineless dorsal fin is approximately midbody. Most species have a dorsal adipose fin.

California lizardfish (*Synodus lucioceps*)

Description
California lizardfish are brown or tan dorsally, lighter laterally, shading to white ventrally. The body is long and cylindrical. The head is small, the snout triangular, the teeth large, and the long jaws extend well past the eye. Adipose and other fins may have a yellowish tint. To 64 cm TL.

Similar species
Not likely to be confused with other species.

Distribution
Although rare north of San Francisco, California, California lizardfish range from Puget Sound through Mexico at depths of 0–229 m, but are most common at depths of 2–50 m.

Alepisauridae (Lancetfishes)

The lancetfishes are a small family consisting of two species in a single genus. They occur in the warm, shallow waters of the Atlantic and Pacific Oceans. The skeleton is weak and the body soft and covered with pores, with prominent lateral keels on each side and large eyes and snout. The large, sail-like dorsal fin begins behind the head and ends above the anal fin. The dorsal rays can be almost as long as the body.

Longnose lancetfish (*Alepisaurus ferox*)

Description
Longnose lancetfish are blue/black or brown dorsally, shading to pale iridescent silvery gray laterally and ventrally, with dark fins. The sail-like dorsal fin originates above the rear edge of the opercle and extends almost to the adipose fin. A long, dark, prominent lateral keel along the lateral midline is present. There are numerous small teeth in the upper jaw, and a single row of premaxillary teeth. There are 1–2 daggerlike teeth on the palatines, separated from a second similar group and 5–9 moderately sized teeth. The lower jaw has a single row of variously sized canines and 1–2 daggerlike teeth followed by a series of triangular teeth. To 231 cm TL.

Similar species
The sail-like dorsal fin separates *Alepisaurus ferox* from other similarly shaped species.

Distribution
Longnose lancetfish range from the southern Bering Sea and western North Pacific to Japan and the Sea of Okhotsk, and from the Aleutian Islands to Chile, at depths from the surface to 1,830 m.

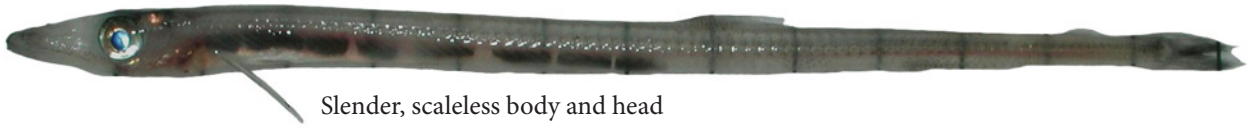
Paralepididae (Barracudinas)

The barracudinas contain about 56 species in 12 genera. They occur in all the world's oceans, but are most common in the tropical zones. These slender, elongate fishes have a small dorsal fin just posterior of midbody, a long dorsal fin that originates well behind the dorsal fin, a dorsal adipose fin and, in some species, a ventral adipose fin. The pectoral and pelvic fins are small, with the pelvic fins far back on the body near the dorsal fin. In the species with scales, the scales are large and deciduous and are lost during capture, except for the embedded scales along the lateral line, which tend to remain attached. The fanglike teeth on the lower jaw and palatines alternate between fixed and depressible. Sawlike caniniform teeth follow the fanglike teeth on premaxillary. Barracudinas can be confused with the waryfishes due to their similar appearance and fragile skeleton. However, body and eye shape differentiate them. Barracudinas are somewhat compressed forward of midbody and increasingly cylindrical toward the caudal. Waryfish are the opposite, being cylindrical forward of midbody and becoming laterally compressed posteriorly. Barracudina eyes and pupils are round, not elliptical like the waryfishes.

Key to the Paralepididae of the FRAM Surveys

1	Pelvic fins ahead of dorsal fin origin; scales on lateral line only	***Lestidiops ringens***	p 112
1	Pelvic fins below or behind dorsal fin origin; body covered with deciduous scales	2	
2(1)	Pelvic fin mostly behind dorsal; 28 or more anal fin rays	***Arctozenus risso***	p 112
2	Pelvic and dorsal fins about equal; 25 or fewer anal fin rays	***Magnisudis atlantica***	p 113

Slender barracudina (*Lestidiops ringens*)



Slender, scaleless body and head

Description

The slender barracudina is greenish-brown dorsally, shading to silver with a delicate iridescence laterally and ventrally. The body and head are very slender. The pelvic fins are well anterior to the dorsal fin. The dorsal adipose fin is well posterior of the anal fin. The ventral adipose fin extends from the anus to the anal fin, but can be barely discernible on some individuals. There are ridges between the pelvic fins extending to and joining just anterior to the anus. The anus is between the pelvic fins and the dorsal fin origin. Body is scaleless except along the lateral line. To 24 cm SL.

Similar species

The ribbon barracudina (*Arctozenus risso*) is deeper-bodied, scaled, has pelvic fins behind the dorsal fin, and has a black area at the base of the forward anal fin spines. The duckbill barracudina (*Magnisudis atlantica*) has scales, and the pelvic fins are below the dorsal fin. The scaly waryfish (*Scopelosaurus harryi*) and longfin waryfish (*S. alderi*) have 16–18 anal fin rays, pelvic fins just forward of the anus, and a dark head, mouth, and gill cavities.

Distribution

Slender barracudina range from the western Bering Sea and western Pacific off southern Kamchatka to the southern Kuril Islands. In the eastern Pacific midocean, and widely distributed from British Columbia, Canada, to Baja California, Mexico, and the Gulf of California, at depths of 29–3,920 m.

Ribbon barracudina, white barracudina (*Arctozenus risso*)

Dorsal fin in front of the pelvic fin

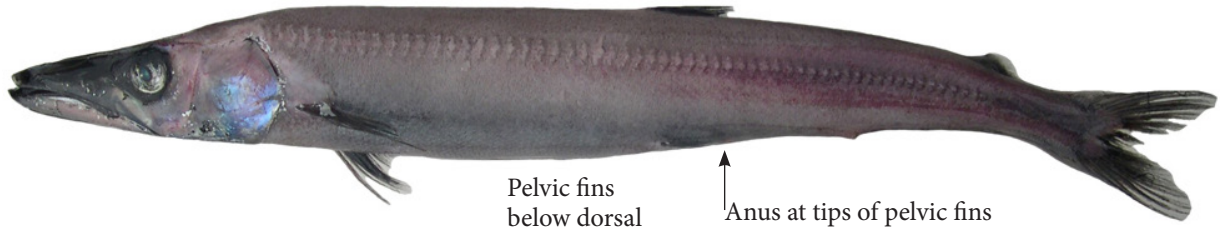
Dark area at base of anterior anal spines

Description
Ribbon barracudina are dark dorsally shading to silver laterally and white ventrally. Deciduous scales cover the body. Pores are present in the lateral line scales. The pelvic fin originates behind or just under the last ray of the dorsal fin. The area at the base of the anterior rays of the anal fin is black. Dorsal adipose fin well posterior to the anal fin, ventral adipose fin absent. To 31 cm SL.

Similar species
Slender barracudina (*Lestidiops ringens*) have no scales except along the lateral line, and the pelvic fins are in front of the dorsal. Duckbill barracudina (*Magnisudis atlantica*) have pelvic fins below the dorsal fin. Scaly waryfish (*Scopelosaurus harryi*) and longfin waryfish (*S. alderi*) are generally dark, not silver, with a dark head, mouth, and gill cavities; have 16–18 anal fin rays compared to 26–33 in other species; and the pelvic fin is in front of the dorsal.

Distribution
Worldwide from Arctic to Antarctic waters (both inshore and offshore), ribbon barracudina occur sporadically throughout the Pacific Ocean north of Mexico at depths of 0–2,195 m.

Duckbill barracudina (*Magnisudis atlantica*)



Description
Duckbill barracudina are dark brown/tan dorsally shading to lighter shades of the same colors laterally and ventrally, with the fins and their bases darker. There is no black area at the base of the anal fin. The pelvic fins are below the dorsal. Deciduous scales cover the body. The lateral line scales do not have pores. The anus is located equal to the tips of the pelvic fins. To 50 cm SL.

Similar species
Ribbon barracudina (*Arctozenus risso*) have pelvic fins behind the dorsal, a black area at the base of the forward anal fin spines, and pores on the lateral line scales. The anus is between the pelvic fins. Slender barracudina (*Lestidiops ringens*) have no scales except along the lateral line, are light in color, and the pelvic fins are in front of the dorsal. Scaly waryfish (*Scopelosaurus harryi*) and longfin waryfish (*S. alderi*) are generally dark, not silver, with a dark head, mouth, and gill cavities; have 16–18 anal fin rays in the anal fin, compared to 26–33 in other species; and the pelvic fin is in front of the dorsal.

Distribution
Worldwide in boreal to tropical waters. In the Pacific, duckbill barracudina range from the Bering Sea and the North Pacific to Baja California, Mexico, at depths of 66–2,160 m.

Anotopteridae (Daggertooths)

The daggertooths currently consist of a single genus and three geographically separated species, with one in the North Pacific, one in the North Atlantic, and one circumglobal in the Southern Ocean. The common name derives from the large, forward-pointing, daggerlike palatine teeth. There is a flexible projection at the tip of the lower jaw. The highly elongate body lacks scales and a rayed dorsal fin, although a dorsal adipose fin is present. The small pectoral fins are with a vertical insertion. The anal fin is small and far back on the body. The large compressed head has long, pointed jaws. The teeth in the jaws are alternately fixed and depressible, and are smaller than the palatine teeth.

North Pacific daggertooth (*Anotopterus nikparini*)

Long, slim, thin-skinned body with no, or only a few, embedded scales

Description
North Pacific daggertooth are dark dorsally, silver laterally and ventrally. The pectoral and pelvic fins are black; the caudal fin is dark. The body is extremely elongate, slim, and covered with a thin skin. Scales are present or absent; if present, only a few embedded scales on older and larger individuals. On large individuals, there is a pair of dermal keels midlaterally on each side. There is no rayed dorsal fin, but dorsal adipose fin is present. The pectoral, pelvic, and anal fins are small. The lower jaw terminates in a pointed, flexible projection. The usual 9–10 (range 5–11) daggerlike palatine teeth often point forward. The premaxillary and dentary teeth are more numerous and much smaller. Vomerine teeth are absent. All teeth can be lost in adults. To 146 cm TL.

Similar species
The forward-pointing daggerlike teeth separate the daggertooth from other similar species.

Distribution
North Pacific daggertooth range from the Bering Sea to Japan and the Gulf of Alaska through the North Pacific and south of Baja California, Mexico, at depths from the surface to 2,750 m, but usually less than 700 m.

Myctophiformes (Myctophiforms)

The Myctophiforms, or lanternfishes, are an order of small, deepsea, pelagic and benthopelagic fishes consisting of two families with 35 genera and about 240 species, most with numerous photophores on the head and body. These small (most ≤20 cm TL) fishes occur in vast numbers, forming a major component of the deep scattering layer of the oceans, and provide a large forage base for larger predators. Many Myctophiforms undertake diurnal migrations of several hundred meters, being in the greatest concentrations at 300–1,200 m during the day and 10–100 m at

night. Other than the presence of photophores in most species, other characteristics include a compressed head and body. The eyes are lateral, and the large, terminal mouth has maxillae extending beyond the eyes and excluded from the gape by the premaxillae. An adipose fin is present; the other fins are composed of soft rays only. The abdominal pelvic fins usually have eight rays and the caudal fin is forked. Most species have cycloid scales and a physoclistic (closed, not connected to the gut) swim bladder is usually present. There are generally 7–11 branchiostegal rays, and the gill rakers are well developed.

Neoscopelidae (Blackchins)

The blackchins comprise six species in three genera. Family characteristics include an anal fin that originates far behind the dorsal fin base and a long, slender supramaxilla along the upper edge of the greatly expanded maxilla. There are bands of teeth present in both jaws, the palatines, and the basibranchials. The lateral line is poorly developed. Of the three genera, *Solivomer* and *Scopelengys* have small eyes and no photophores. *Scopelengys* is the only genus without a swim bladder. *Neoscopelus* have large eyes and well developed photophores.

Key to the Neoscopelidae of the FRAM Surveys

1	No photophores; triangular head; small eye; uniform black 2	
1	Prominent photophores; large eye; dark body with orange/copper highlights 3	
2(1)	Posterior end of maxilla wider than eye diameter; 11–13 dorsal rays; 14–17 pectoral rays; caudal peduncle narrow..... ***Scopelengys tristis***	p 115
2	Posterior end of maxilla equal to or narrower than eye diameter; 13 dorsal rays; 12–13 pectoral rays; caudal peduncle wide ..... ***Scopelengys clarkei***	p 116
3(1)	Lateral series (LO) photophores 36–40 divided into 4 subseries..... ***Neoscopelus porosus***	p 117
3	LO photophores not branched..... 4	
4(3)	LO 12–15 photophores extend to or nearly to anal fin origin; gill rakers usually 11 (10–14); pectoral rays 18–19 ..... ***Neoscopelus macrolepidotus***	p 117
4	LO 20–26 photophores extend well past midpoint of anal fin base; gill rakers usually 14 (14–16); pectoral rays 15–16..... ***Neoscopelus microchir***	p 118

Pacific blackchin (*Scopelengys tristis*)

Description
Pacific blackchin are uniformly black. The body is laterally compressed, moderately slender, and deepest at the nape, tapering to a narrow caudal peduncle. The eyes are small. The skeleton is weakly ossified and the flesh soft. The skin is friable and large scales deciduous; both are usually lost during capture. The head is large (26–30% of SL), strongly triangular, and moderately concave in profile. The jaws and palatines have bands of villiform teeth. The vomer has a small patch of teeth on each side. The lower jaw is projecting. The upper jaw extends well past the back of the eye. The posterior end of the upper jaw is wider than the eye diameter. The dorsal fin has 11–13 rays. The anal fin has 12–14 rays and is well behind the dorsal. The pectoral fin has 14–17 rays and extends past the anal fin insertion. There are teeth on the 7–11 total first arch gill rakers, with the anterior rakers reduced to toothed knobs. No photophores. To 19.4 cm SL.

Similar species
Scopelengys clarkei is deepest at the dorsal fin origin (at nape in Pacific blackchin), with a wide caudal peduncle (narrow in Pacific blackchin), posterior end of maxilla equal to or less than eye diameter (wider than eye diameter in Pacific blackchin), and fewer (12–13) pectoral rays (14–17 in Pacific blackchin).

Distribution
Pacific blackchin are widespread in the tropical and subtropical waters of the Atlantic and Indian Oceans. In the North Pacific from the southern Bering Sea to Japan and Indonesia and from the eastern mid-Pacific to Chile at depths from 400-3,350 m.

Scopelengys clarkei

Description
Scopelengys clarkei are uniformly black. The slender, laterally compressed body is deepest at the dorsal fin origin, tapering to a deep caudal peduncle. The eyes are small. The skeleton is weakly ossified and the flesh soft. The skin is friable and large scales deciduous; both are usually lost during capture. The head is large (24.5–26.4% of SL) and slightly concave in profile. The lower jaw is projecting. The upper jaw extends well past the back of the eye. The posterior end of the upper jaw is equal to or less than the eye diameter. The dorsal fin has 13 rays. The anal fin has 14 rays and is well behind the dorsal. The pectoral fin has 12–13 rays and extends past the anal fin insertion. There are teeth on the 7–10 total first arch gill rakers, with the anterior rakers reduced to toothed knobs. No photophores. To 17.6 cm SL.

Similar species
Pacific blackchin is deepest at the nape, with a narrow caudal peduncle, posterior end of maxilla greater than eye diameter, and more (14–17) pectoral rays (12–13 in *S. clarkei*).

Distribution
The complete range of *S. clarkei* is unknown, but generally defined as the eastern Central Pacific at depths of 0–1,000 m.

Spangleside blackchin (*Neoscopelus porosus*)

Description
Spangleside blackchin are somewhat laterally compressed, with soft flesh and large deciduous scales. The body color is variable, usually silvery on the head and gill covers, dark dorsally shading to light or silvery laterally, and dark ventrally between the photophores. The fin color may not be visible due to damage. There is a single high dorsal fin (12–14 rays, usually 13) just anterior to midbody. A small adipose fin is behind the dorsal. The anal fin (18–20 rays, usually 19) is under the adipose fin. The caudal fin is forked. The pectoral fins (15–16 rays) extend just to or short of the anus. The pelvic fins (8–9 rays) are shorter than, and inserted behind, the pectoral fins and extend about the same distance. The mouth points slightly upward, and the jaws extend to the upper end of the front edge of the gill cover. There is one midventral row and two lateral rows of photophores. The uppermost row has 36–40 photophores, is broken into four subseries, and extends well past the anal fin insertion. Inside the mouth is a row of photophores on each side of the tongue. To 18.3 cm SL.

Similar species
The long lateral photophore series broken into four subseries, and large number of lateral photophores (36–40), separate spangleside blackchins from other *Neoscopelus* species.

Distribution
Spangleside blackchins range from the western North Pacific off Suruga Bay, Japan, to the Indian Ocean, at depths from 400–642 m. Not currently known from the eastern Pacific.

Largescale blackchin, glowingfish (*Neoscopelus macrolepidotus*)

Row of photophores

Description
Largescale blackchin are somewhat laterally compressed, with soft flesh and large deciduous scales. The body color is variable, usually dark dorsally shading to light or silvery laterally, and dark ventrally between the photophores. Fresh specimens have pink, red, or orange highlights on the head, gill cover, and body. The fins are pink, red, or orange, although the color may not be visible due to damage. There is a single high dorsal fin (12–13 rays) just anterior to midbody. A small adipose fin is behind the dorsal. The anal fin (11–12 rays) is under the adipose fin. The caudal fin is forked. The long pectoral fins (18–19 rays) extend to or beyond the anus. The pelvic fins (8–9 rays) are shorter than and inserted behind the pectorals, and do not extend to the anus.

The mouth points slightly upward, and the jaws extend to or just beyond the back of the eye. There is one midventral row and two lateral rows of photophores. The uppermost row has 12–15 photophores and ends just at or just anterior to the anal fin origin. Inside the mouth is a row of photophores on each side of the tongue. To 25 cm TL.

Similar species
The lateral row of photophores in spangleside blackchin (*Neoscopelus porosus*) is branched into four subseries. Shortfin blackchin (*N. microchir*) have fewer (15–16) pectoral fin rays (18–19 in largescale blackchin), more photophores (20–26 vs. 12–15 in largescale blackchin) in the lateral row, and gill rakers (14–16, usually 14 vs. 10–14, usually 11, in largescale blackchin).

Distribution
Largescale blackchin occur throughout the eastern and western Atlantic and Indian Oceans. In the western Pacific from Australia to Japan. In the eastern Pacific from British Columbia, Canada, to Hawaii, at depths of 300–1,180 m.

Shortfin blackchin (*Neoscopelus microchir*)

Description
Shortfin blackchin are somewhat laterally compressed, with soft flesh and large deciduous scales. The body color is usually dark dorsally shading to light or silvery laterally and on the head and gill covers, and dark ventrally between the photophores. It can also be light pink to red dorsally, with lighter shades of the same color laterally and silvery white ventrally. Fresh specimens have pink or red highlights on the head, gill cover, and body. The fins are pink or red, although the color may not be visible due to damage. There is a single high dorsal fin (12–13 rays) just anterior to midbody. A small adipose fin is behind the dorsal. The anal fin (11–13 rays) is under the adipose fin. The caudal fin is forked. The pectoral fins (15–16 rays) extend just to or short of the anus. The pelvic fins (9 rays) are shorter than and inserted behind the pectorals, and extend about the same distance. The mouth points slightly upward, and the jaws extend to or just beyond the back of the eye. There are one midventral and two lateral rows of photophores. The uppermost row has 20–26 photophores and extends well past the midpoint of the anal fin base. Inside the mouth is a row of photophores on each side of the tongue. To 30 cm TL.

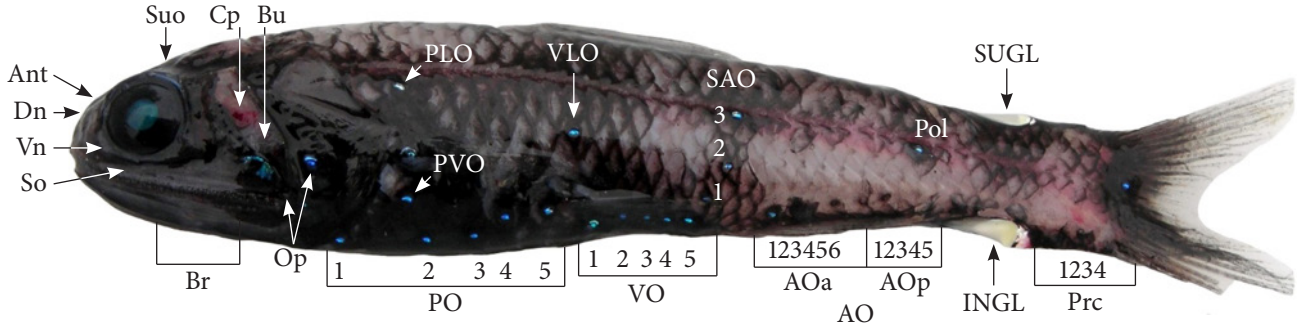
Similar species
The lateral row of photophores in spangleside blackchin (*Neoscopelus porosus*) is branched into four subseries. Largescale blackchin (*N. macrolepidotus*) have more (18–19) pectoral fin rays (15–16 in shortfin blackchin), fewer (12–15) photophores in the lateral row (20–26 in shortfin blackchin), and 10–14 (usually 11) gill rakers (14–16, usually 14 in shortfin blackchin).

Distribution
Shortfin blackchin occur throughout the North Atlantic and Indian Oceans and the East and South China and Arabian Seas. In the western Pacific Ocean from southern Japan to northeastern New Zealand, at depths of 250–1,000 m. Not currently known from the eastern Pacific.

Myctophidae (Lanternfishes)

The lanternfishes are a large group of small fishes with over 30 species in 20 genera. They have compressed bodies, large mouths, small teeth, and, in most cases, laterally directed eyes. All myctophids have photophores in a species-specific limited series below the lateral line, making identification in the field possible. However, due to the delicate nature of the skin and photophores, heavy body damage makes positive identification of trawl-caught specimens to the species level highly problematic. Modified scales form lenses over the photophores. The anal fin is large and placed well back on the body. Lanternfishes also have an adipose fin.

Lanternfish Photophore Terminology and General Location



Abbreviation	Definition
Ant	Antorbital
Dn	Dorsonasal
Vn	Ventronasal
Suo	Supraorbital
So	Suborbital
Br	Branchiostegal
Cp	Cheek
Bu	Buccal
Op	Opercular
PLO	Suprapectoral organ
PVO	Subpectoral organ

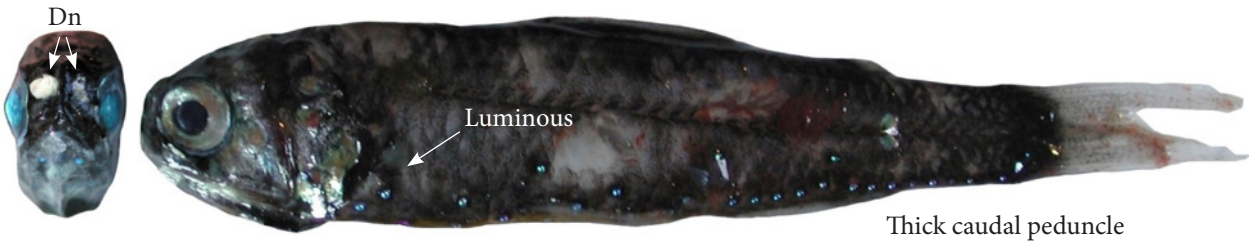
Abbreviation	Definition
PO	Pectoral organs
VLO	Supraventral organ
VO	Ventral organs
SAO	Supra-anal organs
AO	Anal organs
AOa	Anterior anal
AOp	Posterior anal
Pol	Posterolateral
Prc	Precaudal
SUGL	Supracaudal luminous gland
INGL	Infracaudal luminous gland

Key to the Myctophidae of the FRAM Surveys

1	SUGL and INGL always absent; Dn, Vn, So present ..... ***Diaphus theta****	p 121
1	SUGL and/or INGL can be present; Dn, Vn, So can be absent 2	
2(1)	If present, SUGL & INGL a single organ with a dark black border 3	
2	If present, SUGL & INGL overlapping scalelike plates not bordered by black 8	
3(2)	Single SUGL or INGL present ..... ***Protomyctophum thompsoni***	p 121
3	SUGL and/or INGL present or absent 4	
4(3)	SUGL and INGL present 5	
4	SUGL absent; INGL present or absent 7	
5(4)	Body robust; thick caudal peduncle; scales dark with darker edges giving body a honeycomb pattern ..... ***Lampadena urophaos***	p 122
5	Body laterally compressed; thin caudal peduncle; scales silver 6	
6(5)	SUGL and INGL short and bulky ..... ***Tarletonbeania taylori (m)***	p 122
6	SUGL long and slender; INGL short and bulky ..... ***Tarletonbeania crenularis (m)***	p 123
7(4)	SUGL and INGL absent ..... ***Tarletonbeania taylori (f)***	p 122
7	SUGL absent; INGL present or absent ..... ***Tarletonbeania crenularis (f)***	p 123
8(2)	1 Pol 9	
8	2 Pol 11	
9(8)	2 Prc; SAO forming a nearly right angle with SAO 1 over or in advance of VO 3 ..... ***Symbolophorus californiensis***	p 124
9	3–5 Prc; SAO in nearly straight line, nearly in line with last VO 10	
10(9)	Body robust, silvery; caudal peduncle thick; fins light gray, becoming clear at margins; 3–5 (usually 4) VO; VO 1–2 interspace largest; 3–5 (usually 4) Prc, in even curve; SUGL with 5–8 luminous scales; INGL with 7–9 scales filling whole infracaudal space ..... ***Stenobrachius leucopsarus***	p 124
10	Body thin, very dark; caudal peduncle thin; fins black; 4–6 (usually 5) VO; 3–4 (usually 3) Prc; SUGL with 2–4 luminous scales; INGL with 5–6 scales filling ½–¾ of infracaudal space ..... ***Stenobrachius nannochir***	p 125
11(8)	Pectoral fin long, about 80–110% of head length, extends past pelvic fin base; broad pectoral fin base ..... ***Lampanyctus jordani****	p 126
11	Pectoral fin short, not reaching past pelvic fin base; narrow pectoral fin base ..... **Genus *Nannobrachium***	12
12(11)	INGL long, originating below AOp 2–3; body photophores noticeably small; SAO 3 above or anterior to anal fin origin; VLO much closer to lateral line than pelvic fin base; line through VLO and SAO 1 passes far below SAO 3; AOa series often curved ..... ***Nannobrachium regale***	p 126
12	INGL covering ¾ or less of ventral surface of caudal peduncle; body photophores not noticeably small; VLO on line through SAO 1 & 2, slightly below midpoint between lateral line and pelvic fin base; SAO 3 well behind vertical through anal fin origin ..... ***Nannobrachium ritteri***	p 127

* Representative species.

Headlight lanternfish (*Diaphus theta*)



Description
Headlight lanternfish are uniformly dark. The body is robust, and deepest at the pectoral fin origin. The head is somewhat compressed, with a very short, blunt snout, the large mouth directed forward and up. The maxilla extends well beyond the back of the eye. The caudal peduncle is thick and somewhat short. A large suprapectoral luminous scale is present. The Dn are present and well developed. The Vn and So are also present. The PLO and VLO are closer to the pectoral and pelvic fin bases than the lateral line. Rarely to 9, usually less than 7.5, cm SL.

Similar species
Other myctophids lack the large photophores between the eyes.

Distribution
Headlight lanternfish range from the southern Bering Sea throughout the Gulf of Alaska and the North Pacific to Japan and Baja California, Mexico, at depths from 0–800 m.

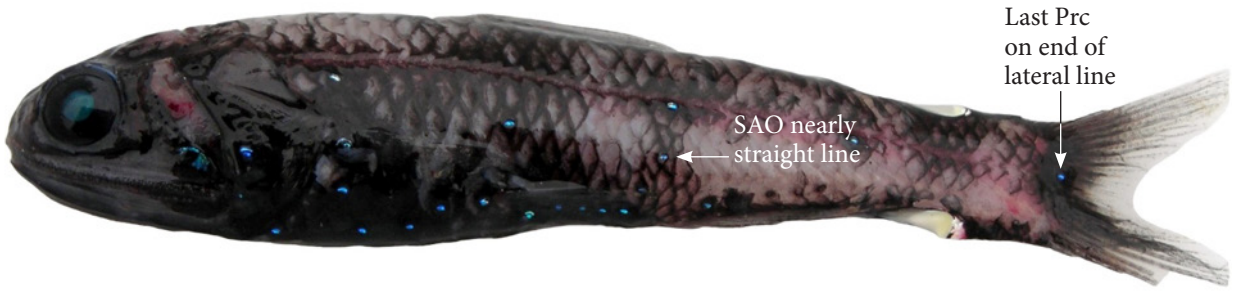
Bigeye lanternfish (*Protomyctophum thompsoni*)

Description
Bigeye lanternfish, when fully scaled, are metallic blue dorsally and bright silver laterally, but can appear black when descaled. The body is short, deep, and somewhat laterally compressed. The snout is small and not projecting. The terminal mouth is large. The maxilla extends to or beyond the rear of the eye, becoming greatly expanded posteriorly. The lower jaw is distinctly projecting. A single SUGL or INGL is present depending on the sex. The PLO is ventral to the pectoral fin base, anterior to PVO 1, and is nearly hidden by the subopercle. SAO 2 is closer to SAO 3 than to SAO 1. AO are continuous, not clearly separated into AOa and AOp. To 7 cm TL.

Similar species
The unbroken string of 14–17 photophores above the anal fin in the AO series and the expanded posterior portion of the maxilla distinguish the bigeye lanternfish from similar species.

Distribution
Bigeye lanternfish range from Hokkaido, Japan, to the southern Bering Sea throughout the sub-Arctic North Pacific to central California, at depths of 200–1,370 m.

Sunbeam lanternfish (*Lampadena urophaos*)



Description
Sunbeam lanternfish are black with darker pigment on the scale margins, giving the body a honeycomb pattern. The coloration extends over most of the caudal fin; the remaining fins have blackish membranes with pale rays. The robust body is deepest just anterior to the pectoral fin insertion, then tapers posteriorly being narrowest at the middle of the photophores on the caudal peduncle. The head is blunt and rounded, with the opercular edge moderately pointed. The gill rakers are well developed, four on the upper limb with two (1–3) additional rudimentary and nine (8–9) on the lower limb with an additional five (4–5) rudimentary, and one raker in the angle of the limbs. Dn absent, Vn small and inconspicuous. PO series linear, none markedly elevated. VO 5 (4–6) linear, none markedly elevated. SAO steep, slightly angular line, usually in line with the last VO. A single Pol. The last of the Prc (3) series on the end of the lateral line. To 14 cm SL.

Similar species
Other Myctophidae differ in the photophore count and arrangement.

Distribution
Sunbeam lanternfish range from Suruga Bay, Japan, and near the Ogasawara and Ryukyu Islands. Also New South Wales, Australia, and New Zealand. In the eastern Pacific from British Columbia, Canada, to Chile at depths of 50–1,000 m.

Taillight lanternfish (*Tarletonbeania* sp.)

Description
Taillight lanternfish, when intact, are dark metallic blue to black dorsally, silver laterally and ventrally, but can be somewhat dark between the ventral photophores. The head and body are highly laterally compressed. The caudal peduncle is long and narrow, less than the eye diameter. The pelvic fins are reduced, the adipose fin is short-based and narrow. There are no photophores

on the body above the angle of the operculum. There is one precaudal photophore and 5–7 (usually 6) ventral photophores. Photophore pattern and development are somewhat sexually dimorphic. SUGL and INGL of males are short and bulky, and are absent in females. To 7 cm TL.

Similar species
Male blue lanternfish (*Tarletonbeania crenularis*) have long, slender SUGL photophores. The INGL photophores are short, sometimes poorly developed, and may be masked by scales. In females, the SUGL is absent, and the INGL is absent or long and slender if present.

Distribution
Taillight lanternfish range from Japan to the southeastern Bering Sea and Pacific Ocean to California, at depths of 0–1,500 m.

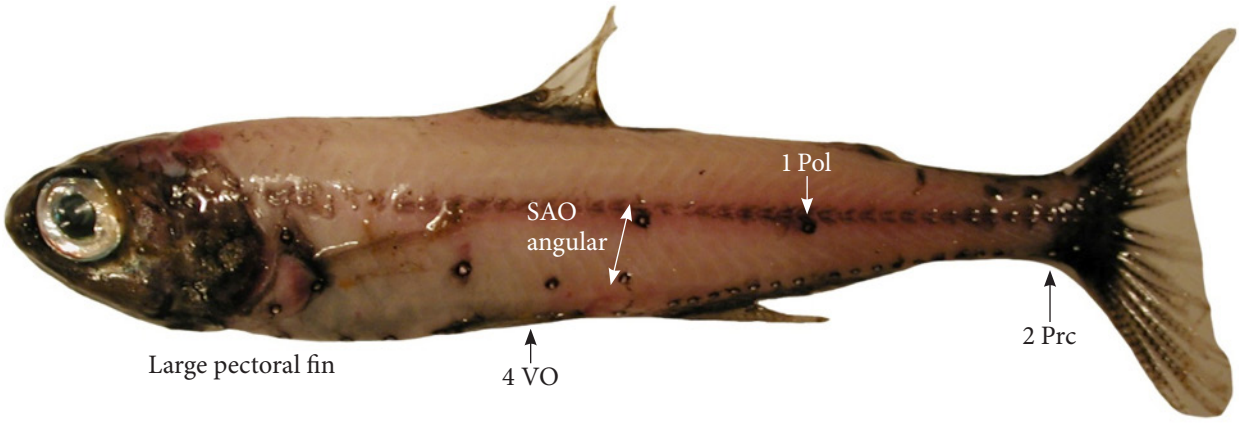
Blue lanternfish (*Tarletonbeania crenularis*)

Description
Blue lanternfish, when intact, are dark metallic blue to black dorsally, silver laterally and ventrally, but can be somewhat dark between the ventral photophores. The snout is slightly projecting and the head and body are highly laterally compressed. The caudal peduncle is long and narrow, less than the eye diameter. The pelvic fins are reduced, the adipose fin is short-based and narrow. There are no photophores on the body above the angle of the operculum. There is one precaudal photophore and 5–7 (usually 6) ventral photophores. Photophore pattern and development are somewhat sexually dimorphic. SUGL of males is long and slender, usually filling the supracaudal space. The INGL of males is present or absent; if present, is short, weakly developed, and may be masked by scales. SUGL is absent in females. The INGL of females is present or absent; if present, is long and slender. To 7 cm TL.

Similar species
Male taillight lanternfish (*Tarletonbeania taylori*) have short and bulky SUGL and INGL photophores. Both the SUGL and INGL are absent in females.

Distribution
Blue lanternfish range from Japan through the sub-Arctic North Pacific south of the Aleutian Islands and the Gulf of Alaska to Mexico, at depths from 0–832 m.

California lanternfish (*Symbolophorus californiensis*)



Description
California lanternfish are black dorsally, silver over a dark background laterally and ventrally, and dusky at the base of the fins. The head and body are laterally compressed, and the caudal peduncle is somewhat shallow. The large, terminal mouth is directed forward and up. The maxilla extends well posterior of the rear margin of the eye. The lower jaw protrudes slightly. The adipose fin is short-based and slender. The long pectoral fins extend beyond the pelvic fin insertion but not to the anus. The SAO forms a sharp angle. One Pol. The two Prc are set close together (the second slightly elevated), and well separated from the AOp series. The AOa and AOp series are separated over the anal fin. To 11 cm TL.

Similar species
The combination of the large pectoral fin, highly angular SAO series, single Pol, and two Prc well separated from the AOp series distinguish the California lanternfish from similar species.

Distribution
California lanternfish range throughout the North Pacific to Japan and from Alaska to Baja California, Mexico, at depths from 557–1,497 m.

Northern lanternfish (*Stenobrachius leucopsarus*)

Description
Northern lanternfish are gray to dark greenish-blue dorsally, somewhat lighter shades of the same color laterally and ventrally, with black on the operculum. The fins are light gray, becoming clear near the margins. The body is fairly robust with a somewhat deep caudal peduncle. There is a single dorsal fin with 12–15 rays. The adipose fin is small and slender. The caudal fin is forked. The anal fin originates below the posterior third of the dorsal fin. The pectoral fins are slender and very short, not reaching the pelvic fin. The photophores glow blue/green. The SUGL is long, consisting of 5–8 luminous scales beginning below the tip of the adipose fin. The INGL consists of 7–9 scales and is as long as the caudal peduncle. The VO has 3–5 (usually 4) photophores, with the VO 1–2 interspace the greatest. SAO, with 2–4 (usually 3) photophores, are in a relatively straight line, in line or nearly in line with the last VO. A single Pol and 3–5 (usually 4) Prc are generally in an even curve. To 11.2 cm SL.

Similar species
The combination of the tiny pectoral fins, long SUGL and INGL, and a single Pol distinguish the northern lanternfish from similar species.

Distribution
Northern lanternfish are widespread throughout the sub-Arctic North Pacific, ranging from Honshu, Japan, through the southern Bering Sea and Gulf of Alaska to Baja California, Mexico, at depths of 200–1,000 m (but make vertical migrations at night to depths as shallow as 30 m).

Garnet lanternfish (*Stenobrachius nannochir*)

Description
Garnet lanternfish are very dark with black fins. The body is slender, with a somewhat narrow caudal peduncle. The photophores glow red. The SUGL is short, consisting of 2–4 luminous scales, and originates well behind the adipose fin. The INGL has 5–6 scales and is about half to three-quarters the length of the caudal peduncle. The VO has 4–6 (usually 5) photophores. SAO are in a relatively straight line, in line or nearly in line with the last VO. A single Pol and 3–4 (usually 3) Prc. To 11.2 cm SL.

Similar species
The slim body and somewhat narrow caudal peduncle, dark body color, black fins, and red photophores distinguish the garnet lanternfish from similar species.

Distribution
Garnet lanternfish are widespread in the sub-Arctic North Pacific, ranging from Japan through the southern Bering Sea and Gulf of Alaska to California, at depths from 500–1,000 m.

Brokenline lanternfish (*Lampanyctus jordani*)

Pectoral fin extends past pelvic fin base

Description
Brokenline lanternfish have dark scales with somewhat darker edges. The fins are dusky. The pectoral fin is broad-based and long, extending past the pelvic fin base. There are luminous scales at the base of the adipose fin. The INGL is short. The body photophores are well developed and not noticeably small, but can be obscured by the body color. There is an extra PLO close above the pectoral fin origin. VLO is close to the lateral line. SAO 3 is above the anal fin origin. AOa 2–3, and often AOa 4, are abruptly elevated. To 14 cm TL.

Similar species
The marked elevation of AOa 2–3 (and often AOa 4) and the well developed second PLO on the dermal flap of the pectoral fin just above and behind the base of the upper pectoral ray distinguish the brokenline lanternfish from similar species.

Distribution
Although more common in the western Pacific, brokenline lanternfish are widespread in the sub-Arctic North Pacific, ranging from Japan and the Sea of Okhotsk, the Bering Sea, and the Gulf of Alaska to southern California, at depths to 1,400 m (but makes vertical migrations to near the surface at night).

Pinpoint lanternfish (*Nannobrachium regale*)

Description
Pinpoint lanternfish are very dark brown to black. The color is darkest dorsally, with somewhat lighter shades of the same color laterally and ventrally. The fins are dusky, with the inner rays of the pelvic fins whitish. The elongate body is deepest anteriorly. The large, terminal mouth is directed forward and up, with the maxilla extending well beyond the posterior margin of the eye. The jaws are about equal, with the lower jaw slightly projecting. There is a single dorsal fin with 14–17 rays. The adipose fin is moderate, rather short and rounded. The caudal fin is forked. The anal fin has 16–19 rays. The short pectoral fins have 11–14 rays and a narrow base, and do not extend past the base of the pelvic fin. There is no luminous gland at the base of the adipose fin. The long INGL originates below AOp 2–3. The SUGL and INGL are present in both sexes. Dn is absent, and Vn is small. The body photophores are small. PVO 1 is well below PVO 2, and PVO 4 is elevated. VO 2 is not elevated. SAO 3 is above or anterior to the anal fin origin. VLO is much closer to the lateral line than to the pelvic fin base. A line through VLO and SAO 1 passes far below SAO 3. The AOa series is often slightly curved. To 21 cm TL.

Similar species
Broadfin lanternfish (*Nannobrachium ritteri*) has larger photophores (noticeably smaller in pinpoint lanternfish), VLO in line with SAO 1–2 midway between the lateral line and the pelvic fin base (VLO not in line with SAO 2, and closer to lateral line than pelvic fin base in pinpoint lanternfish).

Distribution
Pinpoint lanternfish are widespread in the sub-Arctic North Pacific. They range from Japan to the Bering Sea, the Gulf of Alaska, and the North Pacific to Bahía Magdalena, Baja California, Mexico. Found at depths to 1,500 m during the day, making vertical migrations to near the surface at night.

Broadfin lanternfish (*Nannobrachium ritteri*)

Description
Broadfin lanternfish are nearly black to metallic blue dorsally, somewhat lighter laterally and ventrally. The mouth and gill cavity are black. The fins are dusky and marked with fine wavy lines. The elongate body is somewhat laterally compressed. The terminal mouth is very large; the maxilla extends for more than half its length behind the posterior margin of the eye. The jaws are nearly equal, with the lower jaw projecting slightly anterior to the upper. There is a single dorsal fin with 13–16 rays. The small adipose fin is slender and narrow-based, and originates anterior to the last anal ray. The caudal fin is forked. The anal fin has 17–19 rays and originates below the middle of the dorsal fin base. The short pectoral fins have 11–13 rays and a narrow base, and do not extend past the pelvic fin base. The INGL covers three-fourths or less of the caudal peduncle. A SUGL and INGL are present in both sexes. The Dn is absent and the Vn is small. The body photophores are not noticeably small. PVO 1 is well below PVO 2, and PVO 4 is elevated. VO 2 is not elevated. VLO is in line with SAO 1–2, slightly below midway between the lateral line and the pelvic fin base. SAO 3 is well behind a vertical from the anal fin origin. Prc 4 is slightly behind Prc 3. To 12 cm SL.

Similar species
Pinpoint lanternfish (*Nannobrachium regale*) have noticeably small photophores (not noticeably small in broadfin lanternfish), VLO not in line with SAO 1–2 and closer to the lateral line than the pelvic fin base (VLO in line with SAO 1–2 and midway between lateral line and pelvic fin base in broadfin lanternfish).

Distribution
Broadfin lanternfish range throughout the northeastern Pacific south of the Aleutian Islands and the Gulf of Alaska to Mexico. Found at depths to 1,100 m during the day, and make vertical migrations toward the surface at night.

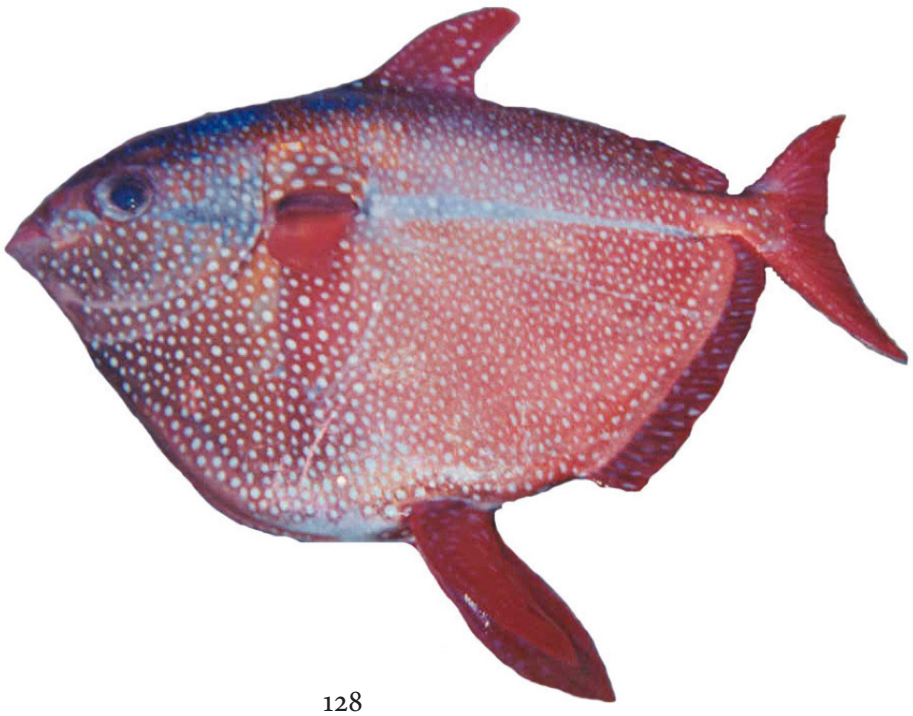
Lampridiformes (Lampridiforms)

The Lampridiforms consist of seven families, 12 genera, and about 19 species. This diverse group of oceanic fishes are in all seas worldwide. The body varies in shape, but most fall into one of two forms, the Bathysomes (with deep bodies, symmetrical caudal fins, and well developed skeletons) and the Taeniosomes (with long, ribbonlike bodies, asymmetrical caudal fins, and weak skeletons). Many species are very colorful, with silver bodies and bright red fins. Other characteristics include fins composed of soft rays only. The dorsal fin is long, and the anterior part is often much higher than the rest of the fin. The anal fin can be long or greatly reduced. The pelvic fins are usually thoracic, or they can be absent. The unique protractile upper jaw has a posteriorly placed mesethmoid (a median anterior skull bone above the vomer and between the olfactory capsules), and lacks a ligament attachment between the palatines and maxillae, allowing the maxillae to carry the premaxillae forward into a feeding configuration.

Lamprididae (Opahs)

Widespread throughout the tropical and temperate seas of the world, opahs are a small group of fishes consisting of two species in a single genus easily identified by their highly compressed oval shape, silvery blue and red body with silver spots, and bright red fins. The anterior portion of the long dorsal fin is high, the posterior portion low. The low anal fin has a shorter base than the dorsal. The long, horizontal pectoral fins are on the upper third of the body. The long pelvic fins connect to the pectoral girdle. The forward portion of the lateral line is highly arched.

Spotted opah, moonfish (*Lampris guttatus*)



Description
Spotted opah are iridescent blue or red dorsally shading to silver with red, green, or blue overtones of varying intensity laterally and silvery ventrally, with opaque whitish spots over the whole body that may also appear on the dorsal, pelvic, and anal fins. The eye is large and often with gold highlights. The fins and mouth are bright red or crimson. The body is very deep, highly compressed, and oval-shaped. The protractile mouth is small and toothless, with a slightly protruding lower jaw. The first rays of the dorsal fin (48–55 rays) are elongate, with a falcate profile similar to the pelvic fins. The long falcate pectoral fins (21–25 rays) are nearly horizontal. The caudal fin is broadly lunate, forked and emarginated. The pelvic fins (13–17 rays) are similar to but somewhat longer than the pectoral fins. The anal fin (33–42 rays) is about as high and as long as the short-rayed portion of the dorsal fin; both have corresponding grooves into which they can be depressed. To 200 cm TL.

Similar species
The unique shape and coloration make confusion with other species unlikely.

Distribution
Spotted opah occur in tropical to temperate seas around the world. In the western Atlantic from the Grand Banks and Nova Scotia, Canada, to Florida and the Gulf of Mexico, and the West Indies to Argentina. In the eastern Atlantic from Greenland and Norway to Senegal and Angola. Also in the Mediterranean Sea. In the eastern Pacific from the Gulf of Alaska to at least southern California, at depths from about 100–500 m.

Lophotidae (Crestfishes and Unicornfishes)

The crestfishes are a family of highly elongate, ribbonlike fishes. Also known as unicornfish, they have crimson fins and a protruding forehead. Although rare, they occur in temperate seas around the world. As a group, they are either naked or have small, highly deciduous cycloid scales. There is a short anal fin far back on the body. The long dorsal fin has 220–392 rays and begins above or before the tip of the snout.

Key to the Lophotidae of the FRAM Surveys

1	Elongate body very shallow (19–30 into SL); hornlike, nearly horizontal crest extends far forward of jaws ..... ***Eumecichthys fiski***	p 129
1	Elongate body moderately deep (5–8 into SL); angular, nearly vertical crest extends to or beyond jaws 2	
2(1)	Crest to tip of jaws; body with multiple white or silver spots..... ***Lophotus lacepede***	p 130
2	Crest to or beyond tip of jaws; body without white or silver spots ..... ***Lophotus capellei***	p 131

Unicorn crestfish (*Eumecichthys fiski*)

Description
The body and head of the unicorn crestfish are silver, with 24–60 dark, subvertical bars. The dorsal portions of the dark bars are prominent; the ventral portions can be dark or so faint as to appear absent. The long dorsal (310–393 rays) and caudal fins (12–13 rays) are red or crimson. The anteriormost 3–5 dorsal rays are highly elongate, forming the pennant. The light pectoral fin has

13–15 rays. Greatly reduced and divided into two sections, there are 5–9 anal fin rays. Pelvic fins are absent in adults. The body is very shallow (body depth 19–30 into SL). The crest is hornlike, nearly horizontal, and extends well beyond the tips of the jaws. To 150 cm TL.

Similar species
The unique shape of the unicorn crestfish differentiates it from all other related species.

Distribution
Unicorn crestfish have a probable worldwide distribution. In the western Atlantic from southeastern Florida, also from central and southern Brazil. In the southeastern Atlantic at False Bay, South Africa, and the Gulf of Guinea. In the northwestern Pacific from around Japan to the east-central Pacific off Hawaii, to Mexico. In the Indian Ocean from India. Found at depths of around 1,000 m.

Crested oarfish (*Lophotus lacepede*)

Description
Crested oarfish are usually blue dorsally shading to silver laterally and white ventrally, with numerous light or silvery spots. Some populations are dark tan or bronze dorsally shading to lighter shades of the same color laterally and ventrally, with numerous light or silvery spots. The long dorsal (206–263 rays) and caudal fins (12–13 rays) are red or crimson. The anteriormost 3–5 dorsal rays are highly elongate, forming the pennant. The light, horizontal pectoral fin has 13–15 rays. The anal fin is short (5–20 rays) and close to the caudal fin. Greatly reduced pelvic fins are present. The body is moderately deep (body depth 5–8 into SL). The crest is tall, the anterior edge nearly vertical to slightly forward, and extends from short of to just beyond the tips of the jaws. To 200 cm TL, but most commonly around 100 cm TL.

Similar species
The numerous white to silvery spots differentiate the crested oarfish from all other related species.

Distribution
Crested oarfish are nearly worldwide in warmer seas. In the western Atlantic from Florida to Brazil. In the eastern Atlantic and western Mediterranean off Portugal, Madeira, the Canary Islands, and South Africa. In the western Indian Ocean. In the eastern Pacific from Hawaii and California. Also from Australia. Usually found at depths of 100–1,000 m.

North Pacific crestfish (*Lophotus capellei*)

Description
North Pacific crestfish are usually blue dorsally shading to silver laterally and white ventrally, usually without any spots or bars. The long dorsal (210–262 rays) and caudal fins (12–13 rays) are red or crimson. The anteriormost 3–5 dorsal rays are highly elongate, forming the pennant. The light, horizontal pectoral fin has 15–19 rays. The anal fin is short (19–21 rays) and near the caudal fin. The greatly reduced pelvic fins have five rays. The body is moderately deep (body depth 5–8 into SL). The crest is tall; the anterior edge can be close to vertical, but is usually angled forward from 15° to more than 45° from vertical and extends from just to, to well beyond the tips of, the jaws. To 200 cm SL.

Similar species
The highly angled crest and lack of light spots on the body differentiate the North Pacific crestfish from other related species.

Distribution
North Pacific crestfish are widely distributed in the warm waters of the Atlantic Ocean. In the northwestern Pacific, they occur from Japan, and in the southwestern Pacific from New Zealand and Australia. Recorded in the east-central Pacific from Hawaii and California. Probably from deep water, 0–200 m or more.

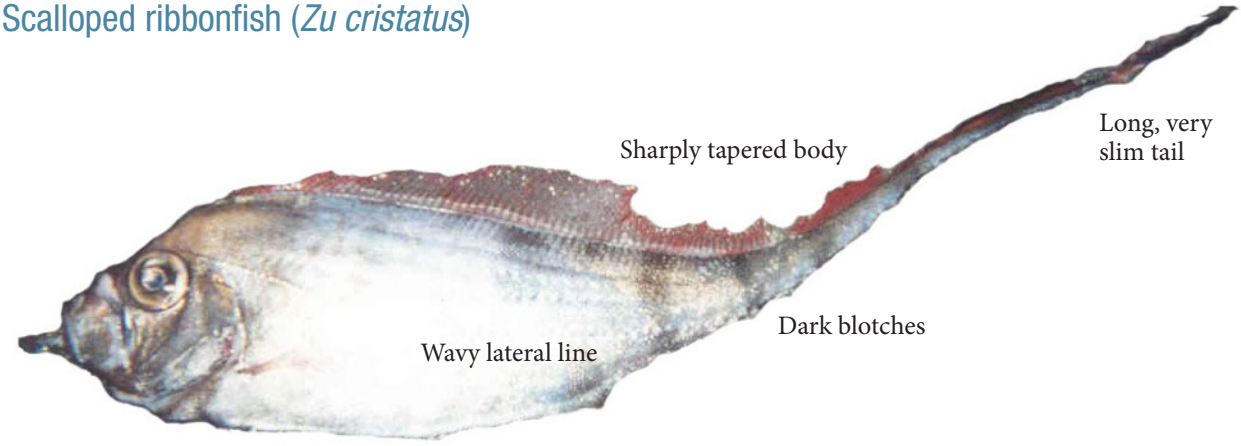
Trachipteridae (Ribbonfishes)

Ribbonfishes are greatly elongated and highly compressed fishes. The body of a ribbonfish is silver with red fins. As they grow, the body goes through drastic changes. The pelvic fins become rudimentary, the lower lobe of the caudal fin becomes only a few short spines, the upper lobe becomes long, the ctenoid scales along the ventral midline modify into tubercles, and the dark blotches on the body disappear. The adults have a long dorsal fin that originates above the head, small, horizontally inserted pectoral fins, rudimentary or absent pelvic fins, no anal fin, and a caudal fin that consists mostly of just an upper lobe. Scales, when present, are cycloid and highly deciduous or ctenoid, modified into tubercles along the ventral midline.

Key to the Trachipteridae of the FRAM Surveys

1	Wavy lateral line at rear of body	***Zu cristatus***	p 132
1	Lateral line not as above	2	
2(1)	Extremely long, tapered body with a long, filamentous tail	***Desmodema lorum***	p 133
2	Body and tail not as above	3	
3(2)	Body has a smooth, continuous taper	***Trachipterus altivelis***	p 133
3	Body with a smooth taper to or behind the midbody, then a sharp, abrupt taper; posterior ⅓ of body narrow, straplike	***Trachipterus fukuzakii***	p 134

Scalloped ribbonfish (*Zu cristatus*)



Description

Scalloped ribbonfish change appearance with growth and age. The young are silvery, with about ten dark, vertical bars on the body and about six on the tail. They have a scalloped ventral margin between the pelvic fin and anus. The first few rays of the long dorsal (120–150 rays) and the pelvic fin rays are extremely elongate. The dorsal fin is red with dark patches. The caudal fin is large, with a pale base becoming black distally. The body has an abrupt, pronounced taper at midbody. Adults are silvery, but the dark bars fade. The elongate dorsal and pelvic fin rays become greatly reduced or rudimentary. The ventral margin becomes nearly straight, with a low, fleshy keel from the rudimentary pelvic fins to the anus. The reduced caudal fin is red/black, becoming darker distally. The abrupt midbody taper becomes less pronounced. The caudal fin is unique in that it has two distinct lobes. The upper lobe has 6–12 rays and is upturned; the lower, 1–5 rays. The lateral line becomes wavy posteriorly. Anal fin is absent at all stages. To 118 cm SL, possibly more.

Similar species

The abrupt midbody taper and wavy lateral line distinguish the scalloped ribbonfish from other closely related species.

Distribution

Scalloped ribbonfish are probably circumglobal in the tropical waters of the Mediterranean Sea and the Atlantic, Indian, and Pacific Oceans. In the east-central Pacific, scalloped ribbonfish range from Hawaii and southern California to Peru, at depths from 0–950 m.

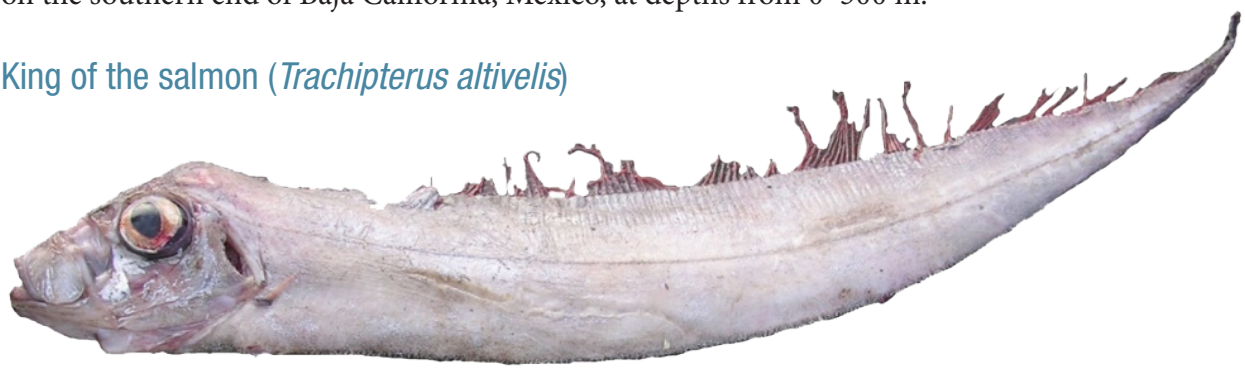
Whiptail ribbonfish (*Desmodema lorum*)

Description
Whiptail ribbonfish are silvery, with numerous dark, round spots that fade with age. The body is strongly laterally compressed. The area posterior to the anus narrows to a long, whiplike tail. The anterior 5–6 dorsal fin rays form a greatly elongated pennant when young, but are completely lost in adults. The pelvic fin rays are long and fanlike in juveniles, but are very rudimentary to absent in adults. The caudal fin is a single, well developed lobe consisting of 4–10 unbranched rays parallel to the axis of the tail. The fin rays have a lateral row of small spines that may be weak or absent on the posterior pelvic, middle caudal, and pectoral rays. On each side of the base of the dorsal rays anterior to the tail is a single, laterally directed, stout spine. To 114 cm TL, possibly more.

Similar species
The caudal fin with a single lobe in line with the tail and the long, whiplike tail distinguish the whiptail ribbonfish from other species.

Distribution
Whiptail ribbonfish appear to be restricted to the northern Pacific. Scattered records from the western Pacific near Japan to the east-central Pacific from southern California to Cabo San Lucas on the southern end of Baja California, Mexico, at depths from 0–500 m.

King of the salmon (*Trachipterus altivelis*)



Description
King of the salmon are silver with red fins. Juveniles have evenly spaced dark spots, usually 4–5 above and 1–2 below the lateral line; these fade with age. Adults are dusky silver, black above the eyes, with red fins. The deep head and elongate body are laterally compressed. The body tapers to a fine caudal peduncle. Body depth at the deepest point is about 10 into SL. The first 3–6 rays of the long dorsal fin (163–191 rays) are long, but become reduced with age. The pectoral fins are small. The pelvic fin rays are long and fanlike in juveniles, becoming rudimentary in adults. There is no anal fin. The small, fan-shaped caudal fin consists of a single upward-pointing lobe. The rays of the lower lobe are reduced to rudimentary stumps. The modified scales appear as sharp tubercles covering the body, enlarged along the ventral surface, but appear as small prickles on the fin rays and are inconspicuous small prickles along the lateral line. To 245 cm TL or more.

Similar species
The areas of occurrence and meristic characteristics of species in the genus *Trachipterus* in the northern Pacific overlap widely, making identification problematic. Tapertail ribbonfish (*T. fukuzakii*) has the fewest vertebrae at 69–72 (90–94 for *T. altivelis*).

Distribution
King of the salmon range from the southeastern Bering Sea to the Gulf of Alaska and south to central Chile, at depths from 0–640 m.

Tapertail ribbonfish (*Trachipterus fukuzakii*)

Description
Tapertail ribbonfish are silvery, with dark blotches on the sides that fade with age, and red fins. The moderately deep head and elongate body are laterally compressed. The body taper is uniform, then sharply tapers posterior to midbody with the posterior one-third of the body becoming thin and straplike. The long dorsal fin (153–172 rays) extends the length of the body. The pectoral fins are small. The pelvic fins are rudimentary. The anal fin is absent or, if present, extremely rudimentary. The upward-pointing, small upper caudal lobe has 7–9 rays; the lower lobe is absent or, if present, extremely rudimentary. To 165 cm SL.

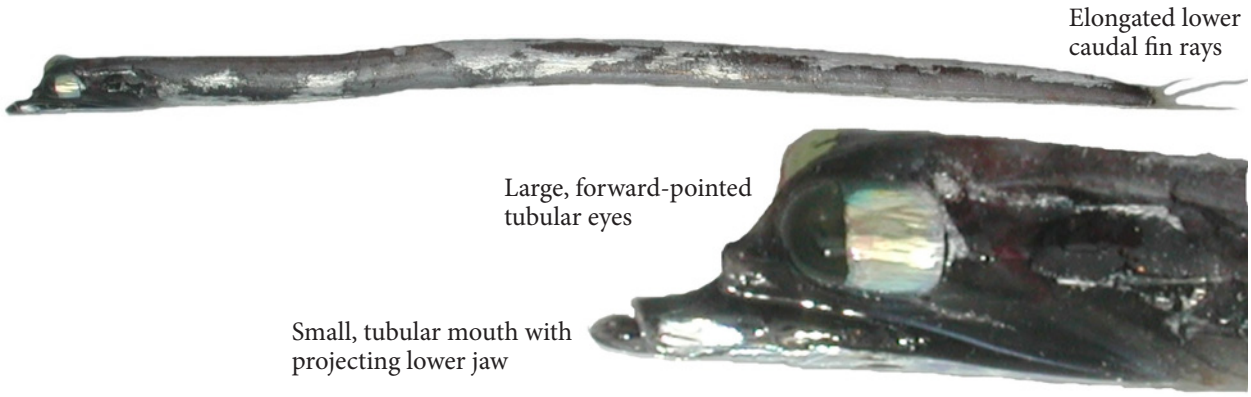
Similar species
King of the salmon (*Trachipterus altivelis*) has 90–94 vertebrae (69–72 for *T. fukuzakii*).

Distribution
Tapertail ribbonfish have poorly defined geographic and depth ranges. Confined to the east-central Pacific from just north of San Francisco, California, to Hawaii, and south to Chile. Apparently makes diurnal vertical migrations: found near the surface at night and in deeper waters during daylight.

Stylephoridae (Tube-eyes or Thread-tails)

The tube-eyes or thread-tails are silvery, ribbonlike fishes that are widely distributed in most oceans of the world, but may be only a single species. The fish feed by sucking plankton through the small protractile mouth at the end of the tubular snout. The large telescopic eyes point forward or upward. The long dorsal fin originates on the nape and extends to the caudal peduncle. The upper lobe of the caudal fin has five rays while the lower lobe has two extremely long, threadlike rays. The anal fin is short. The reduced pelvic fin is a single ray.

Tube-eye, thread-tail (*Stylephorus chordatus*)



Description
Tube-eyes have a silver body and a black head. The long body is cylindrical at the anterior end, then increasingly laterally compressed posteriorly. The lower rays of the caudal fin are greatly elongated and can be several times the body length. The large tubular eyes point forward or upward. The mouth is small, with a short upper jaw and projecting lower jaw. To 32 cm SL.

Similar species
The tube-eye is not likely to be confused with other species.

Distribution
Tube-eyes are very rare, apparently in tropical to temperate seas worldwide at depths of 300–800 m.

Ophidiiformes (Ophidiiforms)

The Ophidiiforms are a large group of elongate, tapering fishes containing about 367 species in 93 genera, four families, and two suborders which are defined by the presence or absence of viviparity. The Bythitidae are live-bearing fishes, and the Ophidiidae are oviparous (eggs that develop and hatch outside the body of the female). While many species inhabit deepwater benthic habitats, a few occur in brackish water and in tropical freshwater caves. In Ophidiiforms, the long dorsal and anal fins join with the caudal fin (which is absent in some species). There are more dorsal and anal pterygiophores (the structures that articulate the rays of the median fins in most teleosts) than adjacent vertebrae. If present, the pelvic fins have 1–2 close-set soft rays inserted about level with or anterior to the preopercle. Some species have a short, well hidden pelvic fin spine that is not generally included in the meristic counts. There are a pair of nostrils on each side, and most genera have one or more patches of basibranchial teeth. There are 7–9 branchiostegal rays that may be obscured by darkly pigmented or thick skin. Most species have short tubercles along with well developed gill rakers on the first arch.

Ophidiidae (Cusk Eels)

The cusk eels are a large group consisting of about 209 species in 46 genera, found in diverse habitats ranging from shallow tide pools to the deep abyssal plain in the Atlantic, Indian, and Pacific Oceans. Most cusk eels taper posteriorly. The long dorsal and anal fins join with the caudal fin, forming a pointed tail, but in some species, the caudal fin rays can be very long. The rays of the dorsal fin are generally as long as or somewhat longer than the corresponding anal fin ray. The anus and anal fin origin are posterior to the tip of the pectoral fin. Rarely absent, the pelvic fins are far forward on the underside of the head, located approximately below the eye.

Key to the Ophidiidae of the FRAM Surveys

1	Well defined spots on body	***Chilara taylori***	p 136
1	No spots on body		2
2(1)	Body scales in a crisscross pattern	***Ophidion scrippsae***	p 136
2	Body without crisscross pattern of scales		3

3(2)	Large pectoral fin extends to or beyond anus, lower rays of pectoral fin free, long, and threadlike ..... ***Dicrolene filamentosa***	p 137
3	Short pectoral fin without long rays 4	
4(3)	Highly sculptured head with weakly ossified bony ridges & crests ..... ***Lamprogrammus niger***	p 138
4	Head not sculptured; short lateral line only on front of body 5	
5(3)	135–148 dorsal fin rays; 101–112 anal fin rays; 77–88 total vertebrae; maximum SL less than 130 cm ..... ***Spectrunculus grandis***	p 138
5	121–139 dorsal fin rays; 91–102 anal fin rays; 71–78 total vertebrae; maximum SL less than 60 cm ..... ***Spectrunculus crassus***	p 139

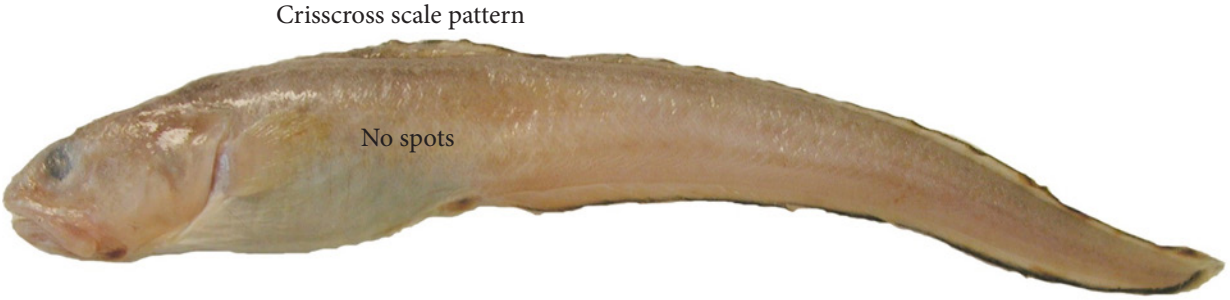
Spotted cusk eel (*Chilara taylori*)

Description
Spotted cusk eels are brown to yellow/brown dorsally fading to lighter shades of the same color laterally, and dirty white to creamy yellow ventrally. The mottled body has irregular-sized dark blotches and spots, with a vertical row of light spots behind the eye and along the upper jaw. The separate barbel-like pelvic fins are located below the eyes. To 40.4 cm TL.

Similar species
The basketweave cusk eel (*Ophidion scrippsae*) is not spotted. Eelpouts (Zoarcidae) have gill membranes joined at isthmus, and, when present, the small jugular pelvic fins have 2–3 rays. Brotulas (Bythitidae) have joined pelvic fins attached farther back on the body (under the gill cavity), lack basibranchial teeth, and have prominent pores on the snout and lower jaw.

Distribution
Spotted cusk eels range from Oregon to Baja California, Mexico, at depths to 366 m.

Basketweave cusk eel (*Ophidion scrippsae*)

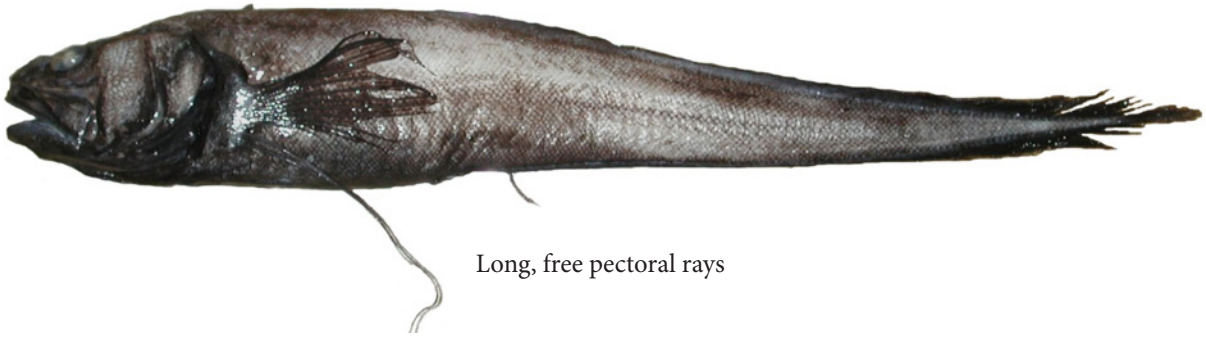


Description
Basketweave cusk eels are brown to olive/brown dorsally fading to lighter shades of the same color laterally and light ventrally. Body scales form a strong crisscross or basketweave pattern. To 28 cm TL.

Similar species
Spotted cusk eels (*Chilara taylori*) have spots on the body and head. Eelpouts (Zoarcidae) have gill membranes joined at isthmus; when present, the small jugular pelvic fins have 2–3 rays. Brotulas (Bythitidae) have joined pelvic fins attached farther back on the body (under the gill cavity), lack basibranchial teeth, and have prominent pores on the snout and lower jaw.

Distribution
Basketweave cusk eels range from Point Arguello, California, to Baja California, Mexico, at depths to 110 m.

Threadfin cusk eel (*Dicrolene filamentosa*)



Description
Threadfin cusk eel are a uniform dusky black to black/brown. The snout is rather blunt and about equal to the eye diameter. Usually a single, strong, straight opercular spine. Usually three spines on the rear margin of the preopercle. Anterior arch gill rakers (7–15) are well developed. The pelvic fins consist of two rays nearly completely fused together and farther back under the gill cavity. The long pectoral fins (22–33 total rays) extend nearly to the anal fin origin. The lower 5–11 rays are very long, free, and threadlike. The lower portion of the dorsal fin is flesh-covered. The dorsal and anal fins join with a pointed caudal fin. To 58 cm SL.

Similar species
Other genera of cusk eels lack the long, free pectoral fin rays, and the pelvic fins are on the throat, below the eye.

Distribution
Threadfin cusk eels are apparently restricted to the eastern Pacific at depths from 935–1,867 m.

Paperbone cusk eel (*Lamprogrammus niger*)

Description
Paperbone cusk eels are black to dark blue/black on the head, dorsally, and on the anterior portion of the body, becoming lighter posteriorly. The head is highly sculptured, with weakly ossified bony ridges and crests. The mouth terminal, usually eight branchiostegal rays, median basibranchial tooth patch absent. The lateral line scales cover vertically oriented, spindle-shaped neuromasts, each of which are on a large, vertically elongate scale. Pelvic fins are absent in adults. The long lateral and anal fins join with the caudal fin. To 61 cm SL.

Similar species
Arrowtails (*Melanonus zugmayeri*) have pelvic fins and separate dorsal, anal, and caudal fins.

Distribution
Paperbone cusk eels have a circumtropical distribution, occasionally occurring in subtropical waters as well, at depths of 741–1,500 m (rarely to 2,000 m).

Giant cusk eel (*Spectrunculus grandis*)

Description
The body color of giant cusk eels varies widely; pale pinkish-orange or light to dark shades of brown/dark brown rings may or may not be present. The elongate body is laterally compressed and tapers toward the tail. The short, robust head has a rounded, fleshy snout. The orbits are circular and shorter than the snout. The upper jaw of the large subterminal mouth extends well past the eye. The upper jaw expands posteriorly, with the midpoint sheathed by a skin flap. The anterior nostril has a thick, fleshy, raised rim and is relatively high on the snout. The posterior nostril is larger but without the rim, and is closer to the eye than the lip. There is a strong opercular spine. The anterior gill arch has 5–11 short rakers and 7–10 elongated rakers on the lower branch, with 3–5 short rakers on the upper branch. Pseudobranchial filaments 0–3. The long dorsal fin (135–148 rays) originates well anterior of the distal tip of the pectoral fin. The pectoral fins (25–31 rays) are short and low on the body. The pelvic fins have two rays, are close together, are located below the preopercle, and extend about one-third the distance between the preopercular base and the anal fin origin. The small, thin scales that cover the head and body extend onto the dorsal, anal, and pectoral fins. The lateral line is short, extending to or slightly beyond the origin of the dorsal fin. To 130 cm SL.

Similar species
Spectrunculus crassus has fewer (121–139) dorsal rays (135–148 in *S. grandis*), anal rays (91–102 vs. 101–112 in *S. grandis*), and total vertebrae (71–78 vs. 77–88 in *S. grandis*).

Distribution
Giant cusk eels range from lat 57°N and 59°S in all oceans, at depths of 800–4,255 m (but most commonly at 2,000–3,000 m.

Spectrunculus crassus

Description
Spectrunculus crassus can be very pale, but are generally various shades of brown, possibly with numerous dark speckles. The elongate body is laterally compressed and tapers toward the tail. The short, robust head has a rounded, fleshy snout. The orbits are circular and shorter than the snout. The upper jaw of the large, subterminal mouth extends well past the eye. The upper jaw expands posteriorly, with the midpoint sheathed by a skin flap. The anterior nostril has a thick, fleshy, raised rim and is relatively high on the snout. The posterior nostril is larger but without the rim, and is closer to the eye than the lip. There is a strong opercular spine. The anterior gill arch has 5–7 short rakers and 8–10 elongated rakers on the lower branch, with 3–5 short rakers on the upper branch. Two pseudobranchial filaments. The long dorsal fin (121–139 rays) originates well anterior of the distal tip of the pectoral fin. The pectoral fins (25–31 rays) are short and low on the body. The pelvic fins have two rays, are close together, are located below the preopercle, and extend about one-half the distance between the preopercular base and the anal fin origin. The small, thin scales that cover the head and body extend onto the dorsal, anal, and pectoral fins. The lateral line consists of four rows of small, tube-shaped, widely separated neuromasts: one short row in front of the dorsal fin, one row below the entire dorsal fin to the caudal fin origin, one median row from behind the pectoral fin to the caudal fin origin, and one ventral row from a vertical through the anal fin origin to the caudal fin origin. To about 60 cm SL.

Similar species
The giant cusk eel (*Spectrunculus grandis*) has more (135–148) dorsal rays (121–139 in *S. crassus*), anal rays (101–112 vs. 91–102 in *S. crassus*), and total vertebrae (77–88 vs. 71–78 in *S. crassus*).

Distribution
Spectrunculus crassus range from about lat 56°N and 32°S, at depths of 1,772–3,677 m.

Bythitidae (Viviparous Brotulas)

The brotulas are a large group consisting of about 96 species in 32 genera. They are similar in appearance to the cusk eels, but fertilization is internal, and the males have an external intromittent organ. The thoracic pelvic fins are under the gill opening. The dorsal and anal fins may or may not join with the caudal fin, and scales may or may not be present.

Key to the Bythitidae of the FRAM Surveys

1	Separate caudal fin; 2 pelvic fin rays	***Brosmophycis marginata***	p 140
1	Dorsal and anal fin join to form caudal fin; 1 pelvic fin ray.....	***Cataetyx rubrirostris***	p 140

Red brotula (*Brosmophycis marginata*)

Description

Red brotula are bright red to brown dorsally with lighter shades of the same color laterally. The ventral side of the body is a lighter shade of the dorsal color, to nearly white. The ventral side of the head is pale red or brown and the lips are pink. The pectoral, dorsal, and anal fin margins and the caudal fin are bright red. The caudal fin is separate from the dorsal and anal fins. The anal fin origin is about midbody. The long pelvic fins consist of two rays and extend past the pectoral fin base. Thick, red mucus obscures the regular rows of small scales that cover the body. There are small, embedded scales on the head, but the snout is naked. The lateral line has two parts; one begins at the operculum and arches to about midbody, the other runs along the midline from the anus to the caudal fin. To 46 cm TL, possibly more.

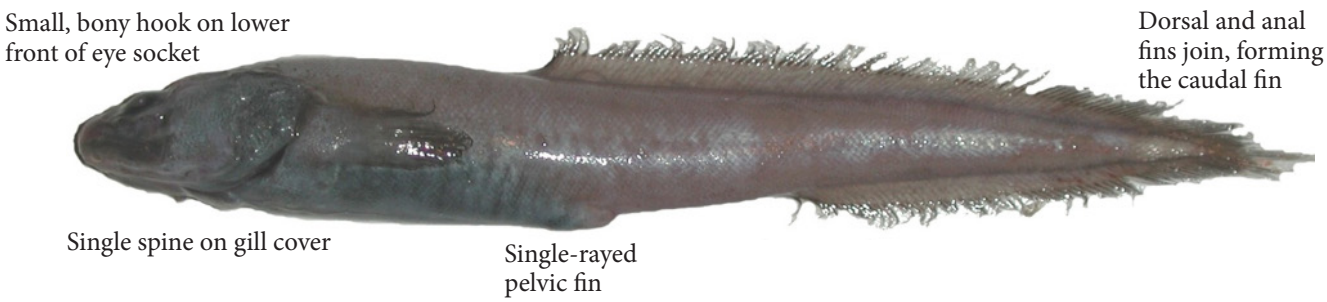
Similar species

The cusk eels (Ophidiidae) have basibranchial teeth and inconspicuous pores on the snout and lower jaw. The eelpouts (Zoarcidae) have gill membranes that join at the isthmus and, if present, the small pelvic fins have 2–3 rays and are located under the gill slit or eye.

Distribution

Red brotulas range from the Gulf of Alaska to northern Baja California, Mexico, and Japan, at depths from 3–256 m.

Rubynose brotula (*Cataetyx rubrirostris*)



Description
Rubynose brotula are gray/purple with faint red or pink undertones. The dorsal fin originates at or slightly ahead of the anus. The anal fin is short, originating well behind the anus. Both join with the caudal fin. The single-rayed pelvic fin is located near the throat. There is a single spine on the gill cover, and a hooklike bone on the lower front edge of the eye socket. To 15.7 cm TL.

Similar species
Cusk eels (Ophidiidae) have basibranchial teeth and inconspicuous pores on the snout and lower jaw. Eelpouts (Zoarcidae) have gill membranes joined at the isthmus. If pelvic fins are present, they are small, consisting of two to three rays, and are located under the gill slit or eye.

Distribution
Rubynose brotula range from Oregon to Baja California, Mexico, and the Gulf of California, at depths of 300–1,000 m.

Gadiformes (Gadiforms)

The Gadiforms are a complex, highly polymorphic order that consists of 12 families with 85 genera and about 482 species. The Gadiforms include the cods. Their close relatives are primarily benthopelagic fishes in the cool waters of the mid to upper latitudes, though they can be also be found in deep tropical waters and one species (*Lota lota*) is confined to fresh water. Although no set external or internal characteristics uniquely define the Gadiforms, many species share similar features. There are 6–7 branchiostegal rays. Their fins are composed of soft rays only, although some rays may be spinelike. The long-based dorsal and anal fins are often divided into 2–3 fins. The thoracic pelvic fins are reduced and filamentlike in some species, and in rare cases, absent. The scales are cycloid in most cases, but in rare cases can be ctenoid. Many species have a chin barbel. The premaxilla forms the whole margin of the upper jaw and is protractile in some species.

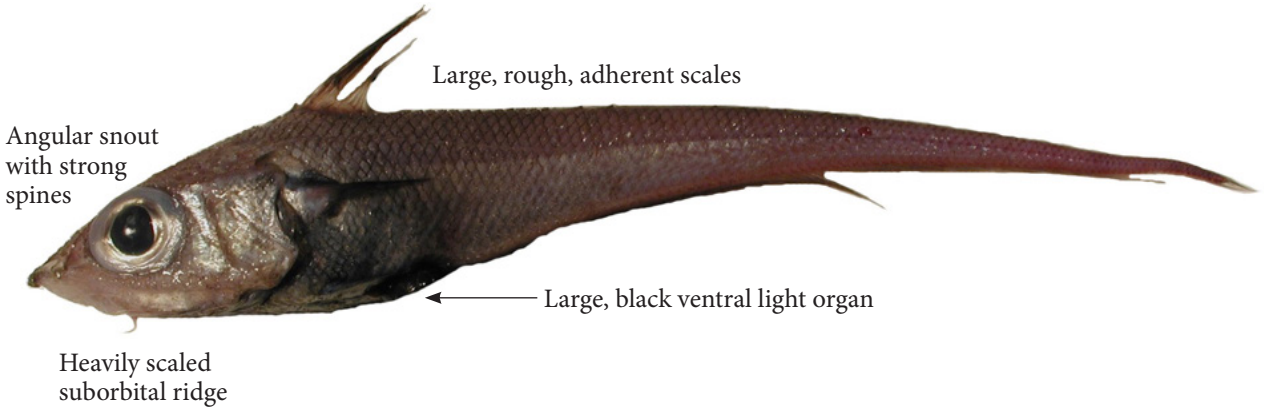
Macrouridae (Grenadiers)

The grenadiers, also called rattails, are a large family that consists of four subfamilies and about 285 species and occurs in all the oceans of the world except the high Arctic. Grenadiers have a short body with a very long, highly tapered tail. The eyes are large above a pronounced ridge. There is usually a pronounced rostrum over an inferior mouth, along with a chin barbel. Most species have two dorsal fins, and all have a single anal fin and no caudal fin. The second dorsal and anal fins are long and join at the tip of the tail. The two anteriormost rays of the first dorsal are spinous: the first is minute and very close to the base of the second ray, which is long, somewhat stout, and often serrated on the leading edge. Grenadier scales are cycloid, often with ridgelike rows of sharp spinules covering the exposed areas of the scale. Scale structure differs between species and is useful in identification, but the spinules become reduced with age and growth.

Key to the Macrouridae of the FRAM Surveys

1	6 branchiostegal rays	2
1	7–8 branchiostegal rays	9
2(1)	Large light organ between pelvic fin bases; leading edge of second dorsal spine rounded with smooth edge ***Coelorinchus scaphopsis***	p 143
2	No light organ; leading edge of second dorsal spine variously serrated	3
3(2)	6–8 (usually 7) pelvic fin rays; large deciduous scales, 10–11 scale rows between lateral line and middle of first dorsal fin base; suborbital ridge naked or with few scales ***Albatrossia pectoralis***	p 143
3	7–14 pelvic fin rays; usually less than 10 scale rows between lateral line and middle of first dorsal fin	4
4(3)	No enlarged scutes on tip of snout	5
4	Enlarged scutes present on tip of snout	7
5(4)	Isthmus to anus, 65–88% of HL; scales highly deciduous; body brown, fins dusky, lips, mouth, gill membranes and peritoneum black; scaleless specimens whitish ***Coryphaenoides leptolepis***	p 144
5	Isthmus to anus, 89–135% of HL; color ranges from dark brown, dark gray, or blueish gray to blackish	6
6(5)	Deciduous scales with 3–10 rows of small spinules that diminish with age; 4–5 rows of small scales on suborbital shelf; usually 2 distinct rows of premaxillary teeth: smaller inner row can become lost in large specimens; 1 distinct row of mandibular teeth ***Coryphaenoides armatus***	p 144
6	Somewhat adherent scales with 3–7 strong, sharp ridges of close-set spinules; usually 2 rows of scales on suborbital shelf; usually 2 or more irregular rows of premaxillary teeth: outer row is greatly enlarged; mandibular teeth are a small patch or in 2 irregular rows anteriorly and 1 distinct row posteriorly ***Coryphaenoides yaquinae***	p 145
7(4)	Strong, stout scutes on snout and suborbital ridge ***Coryphaenoides acrolepis***	p 146
7	Prominent spines on snout	8
8(7)	Suborbital ridge scales thin, deciduous ***Coryphaenoides cinereus***	p 146
8	Suborbital ridge covered with stout scales ***Coryphaenoides filifer***	p 147
9(1)	Blunt snout; fully scaled head; small, highly deciduous scales	10
9	Snout, scales and teeth not as above	11
10(9)	Orbit more than 2× snout length; chin barbel present ***Malacocephalus laevis***	p 148
10	Orbit equal to or shorter than snout length; chin barbel absent ***Mesobius berryi***	p 148
11(9)	Leading edge of second dorsal spine strongly serrated; moderately developed, strongly scaled suborbital ridge; 3–5 scales at bases of branchiostegal rays; snout scales strong, scutelike; pelvic fin rays 9–10 ***Nezumia stelgidolepis***	p 149
11	Leading edge of second dorsal spine moderately serrated to smooth; weakly developed, lightly scaled to naked suborbital ridge; snout scales absent or weak; pelvic fin rays 10–12	12
12(11)	Leading edge of second dorsal spine smooth; weak, deciduous suborbital ridge scales; pelvic fin rays 10–11 (rarely 12); gill rakers on first arch 9–12 ***Nezumia liolepis***	p 150
12	Leading edge of second dorsal spine with very small serrations; pelvic fin rays 11–12; gill rakers on first arch 7–9 ***Nezumia kensmithi***	p 150

Shoulderspot grenadier (*Coelorinchus scaphopsis*)

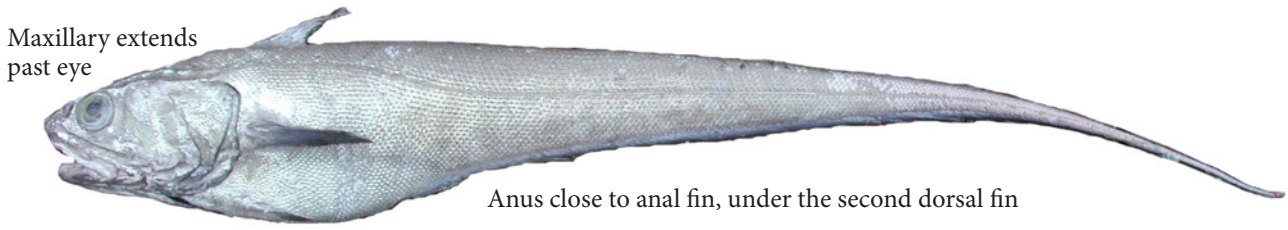


Description
Shoulderspot grenadier are various shades of tan to gray dorsally, lighter laterally; the peritoneum can show through the body wall, making the ventral surface appear black. The fins are dusky to blacking. Large, adherent, and rough scales cover the body. The highly angular and distinctly pointed snout has prominent spines. The long, prominent suborbital ridges that extend from the tip of the snout to the preopercular angle are strongly scaled. The leading edge of the second dorsal spine is smooth. There is a large, black light organ between the pelvic fin bases. To 34 cm TL.

Similar species
The genus *Coryphaenoides* lacks the large light organ and the distinctly shaped snout. The head shape and configuration also differentiate the shoulderspot grenadier from the genus *Nezumia*.

Distribution
The shoulderspot grenadier ranges from southern California to southern Baja California, Mexico, the Gulf of California, and mainland Mexico, at depths from 165 to 274 m.

Giant grenadier (*Albatrossia pectoralis*)



Description
Giant grenadier are gray/silver to tan when the scales are present, and white to light gray when not. The flaccid, watery, elongate body tapers to a very narrow tail. Deciduous scales cover the body. The jaws are long, extending beyond the eye. There are 6–8, but usually seven, pelvic fin rays, with the first ray not much longer than the other rays. The anus is under the second dorsal and close to the anal fin. To 210 cm TL.

Similar species
Coryphaenoides have tighter scales, and the jaws do not extend past the eye.

Distribution
Giant grenadiers range from northern Japan to the Okhotsk and Bering Seas, to the Gulf of Alaska, and south to northern Baja California, Mexico, at depths of 140–3,500 m.

Ghostly grenadier (*Coryphaenoides leptolepis*)

Description
When scaled, ghostly grenadier are brown with blackish lips, mouth, gill membranes, and peritoneum. Scaleless specimens are whitish. The fins are dusky. The thin deciduous scales are smooth or can have 5–7 low, divergent rows of weak spinules. The area from behind the leading edge of the snout on either side of the median ridge is scaleless. There are large, prominent sensory pores on the head, and a distinct lateral line. The short, broadly rounded snout barely protrudes beyond the mouth, but can appear pointed in desiccated specimens. The tiny, slender premaxillary teeth are in densely packed bands or compact patches with a distinctly enlarged and spaced outer series. The chin barbel is long (25% of the head length) and well developed. The outer pelvic fin ray is thick and elongate, reaching well past the anal fin origin. To 62 cm TL.

Similar species
The short, blunt snout, scaleless suborbital ridge and shelf, long chin barbel, long, thick first pelvic ray that reaches well past the anal fin origin, and the whitish color of denuded specimens separate the ghostly grenadier from other closely related species.

Distribution
Ghostly grenadiers range from the Gulf of Alaska westward of Prince of Wales Island, and in the northeastern Pacific from central British Columbia, Canada, to Baja California, Mexico, at depths of 640–4,100 m. They also occur in the western Pacific off Japan as well as the North Atlantic.

Smooth abyssal grenadier (*Coryphaenoides armatus*)

Description
The smooth abyssal grenadier is dark brown to black with blackish fins, lower part of the head, gill cavities, and peritoneum. The small deciduous scales have 3–10 rows of small spinules that diminish with age. The suborbital ridge has 4–5 rows of small scales. The sensory pores on the head are prominent, and the lateral line is conspicuous. In small specimens, the snout is strongly protruding, but becomes less so as the fish grows. The premaxillary teeth are usually in two distinct rows with an enlarged outer row; the inner row can be absent in larger specimens. The mandibular teeth are usually in one distinct row. The long, well developed chin barbel is about 11–19% of the head length. The outer pelvic fin ray is somewhat long but usually does not reach the anus. To 102 cm TL.

Similar species
The lack of strong scutes on the snout, large sensory pores on the head, the 4–5 rows of scales on the suborbital shelf, and the two rows of premaxillary teeth and single row of mandibular teeth separate the smooth abyssal grenadier from other closely related species.

Distribution
Smooth abyssal grenadiers range from the southeastern Bering Sea and south of the Aleutian Islands to the northeastern Pacific from northern British Columbia, Canada, to South America. They occur in the western Pacific off Japan and in all oceans other than the Arctic. Although limited to depths of 2,000–4,300 m on the deeper portions of the continental slope and upper rise in the North Pacific, they co-occur with rough abyssal grenadiers (*Coryphaenoides yaquinae*) at depths of 3,400–4,300 m. In the Atlantic Ocean, smooth abyssal grenadiers occur at depths to 4,700 m.

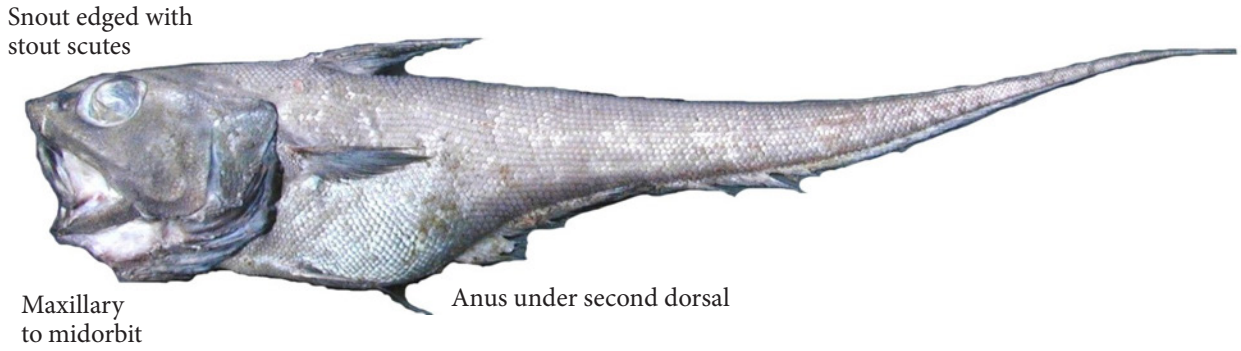
Rough abyssal grenadier (*Coryphaenoides yaquinae*)

Description
The rough abyssal grenadier is a dark gray to bluish gray with the lips, orbit, barbel, opercle, and posterior margins of the gill membranes blackish, a black peritoneum, and dusky fins. The somewhat adherent scales have 3–7 strong, sharp ridges of close-set spinules, usually with only two rows of scales on the suborbital shelf. There is a broad, scaleless area dorsally on the snout on either side of the median ridges. The snout strongly protrudes and the maxilla extends to or beyond the posterior edge of the eye. The premaxillary teeth are usually in two or more irregular rows, with the outer row much enlarged. The mandibular teeth occur in a small patch or two irregular rows anteriorly and one row posteriorly. The outer ray of the pelvic fin is somewhat long, extending just posterior to the anal fin origin. To 77 cm TL.

Similar species
The strongly protruding snout, spiny adherent scales, two rows of scales on the suborbital ridge, pelvic fin ray that reaches slightly beyond the anal fin origin, and the great depth of occurrence separate the rough abyssal grenadier from other closely related species.

Distribution
The rough abyssal grenadier occurs at depths from 3,400–6,450 m along the ocean floor and lower continental rise in the eastern, western, and mid-North Pacific at latitudes equal to Oregon south to the equator. In the Pacific, they co-occur with smooth abyssal grenadiers (*Coryphaenoides armatus*) at depths of 3,400–4,300 m.

Pacific grenadier (*Coryphaenoides acrolepis*)

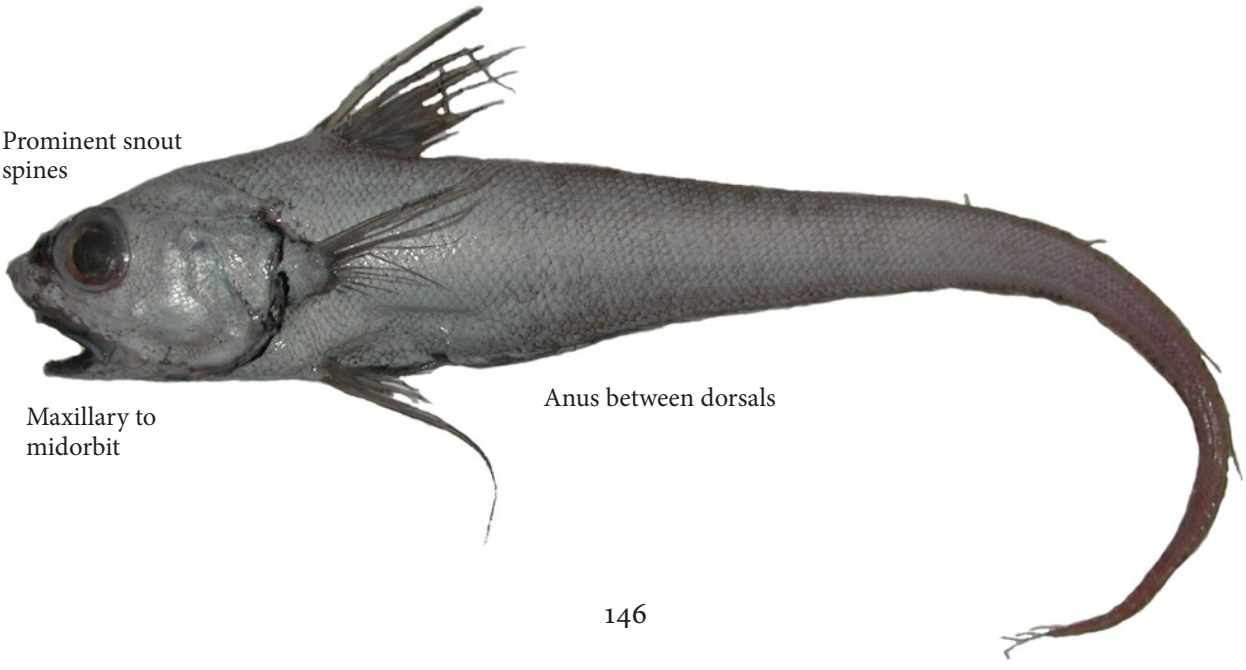


Description
When scaled, Pacific grenadier are light gray/silver to black, gray to whitish when not. The fins are dark. The peritoneum, orbit, mouth, and gill cavities are black. Stout scutes completely cover the leading edge of the snout. Strong, stout, adherent scales cover the body. The suborbital ridge has strong scales. The teeth in both jaws are in two irregular rows or a narrow band; the lower teeth are somewhat smaller than the upper. The anus is located under the second dorsal close to the anal fin. To 104 cm TL.

Similar species
Popeye grenadier (*Coryphaenoides cinereus*) and filamented grenadier (*C. filifer*) have prominent snout spines.

Distribution
Pacific grenadiers range from northern Japan to the Okhotsk and Bering Seas, to the Gulf of Alaska and south to Baja California, Mexico, and northern Mexico, at depths of 300–3,700 m, but most commonly at 900–1,300 m.

Popeye grenadier (*Coryphaenoides cinereus*)



Description
When fully scaled, popeye grenadier are gray to tan, and whitish when not. The mouth and gill cavities are black. The body scales are deciduous. The scales on the suborbital ridge are thin and deciduous, except for a few on the far forward end. Broad spinous scutes tip the snout. The jaws are short. The maxillary extends to midorbit. The first dorsal fin has two spinous, and 10–12 (but usually 10–11) soft, rays. The anus is below the space between the dorsal fins. To 56 cm TL.

Similar species
Filamented grenadiers (*Coryphaenoides filifer*) have longer jaws, a heavily scaled suborbital ridge, and a tubular snout spine.

Distribution
Popeye grenadiers range from northern Japan to the Okhotsk and Bering Seas south to Oregon at depths from 225-2,832 m.

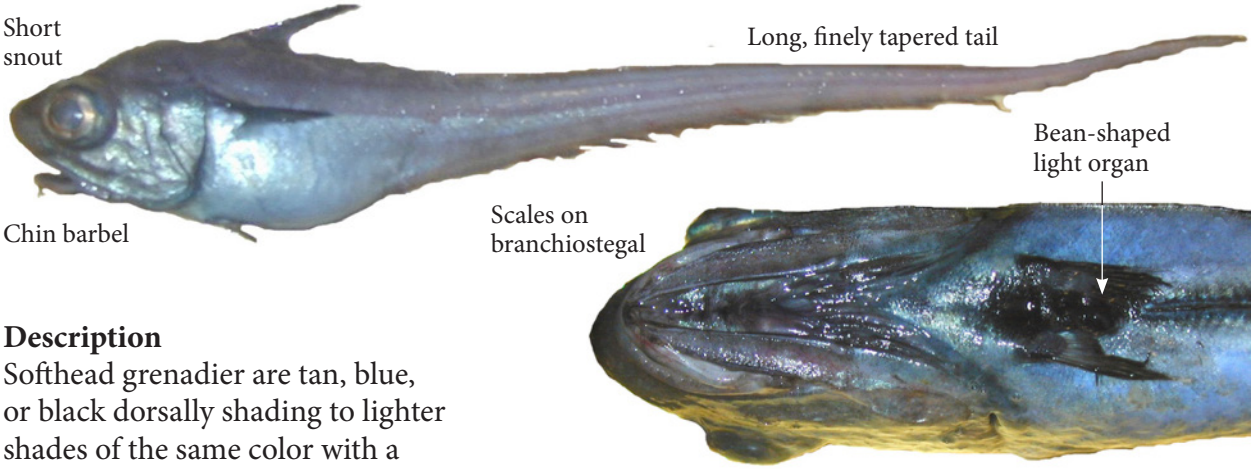
Filamented grenadier (*Coryphaenoides filifer*)

Description
Filamented grenadier are light gray when scaled, white when not. The body scales are deciduous. The fins, lips, underside of the snout, and gill membranes are black. The jaws are moderately long, extending to the rear of the orbit. The suborbital ridge scales are stout and well embedded. Heavy, spinelike scutes and a tubular spine tip the snout. The first dorsal fin has two spinous, and 8–14 (but usually 12–13) soft, rays. The anus is under the origin of the second dorsal fin. To 66 cm TL.

Similar species
The popeye grenadier (*Coryphaenoides cinereus*) has a shorter maxillary and a lightly scaled suborbital ridge.

Distribution
Filamented grenadier range from the Sea of Okhotsk and the southeastern Bering Sea to southern California, at depths from 1,829 to 2,904 m.

Softhead grenadier (*Malacocephalus laevis*)



Description
Softhead grenadier are tan, blue, or black dorsally shading to lighter shades of the same color with a silvery sheen laterally and light ventrally. The lateral compression increases posteriorly, and the body sharply tapers, forming a long, finely tapered tail. The short, blunt, round, scaleless snout does not have spines or scutes, and is about half the diameter of the orbit. Small deciduous scales cover the body. There may be scales on the branchiostegal rays. There is a bean-shaped light organ at the base of and between the pelvic fins. The anus is between the pelvic fins, well forward of the anal fin origin. There are two rows of teeth in the upper jaw; the outside row is widely spaced, enlarged canines, and the inner row teeth are small and closely spaced. There is a single row of widely spaced, large teeth in the lower jaw. A small chin barbel is present. To 52 cm TL.

Similar species
Two closely related species, *Malacocephalus nipponensis* and *M. hawaiiensis*, co-occur in the eastern Pacific. However, the differences are nominal and could represent disjunct populations of *M. laevis*. Berry's grenadier (*Mesobius berryi*) have a smaller orbit, about the same length as the snout, and the chin barbel is absent.

Distribution
The softhead grenadier ranges from central California to Baja California, Mexico, at depths of 200–1,000 m, but usually 300–750 m.

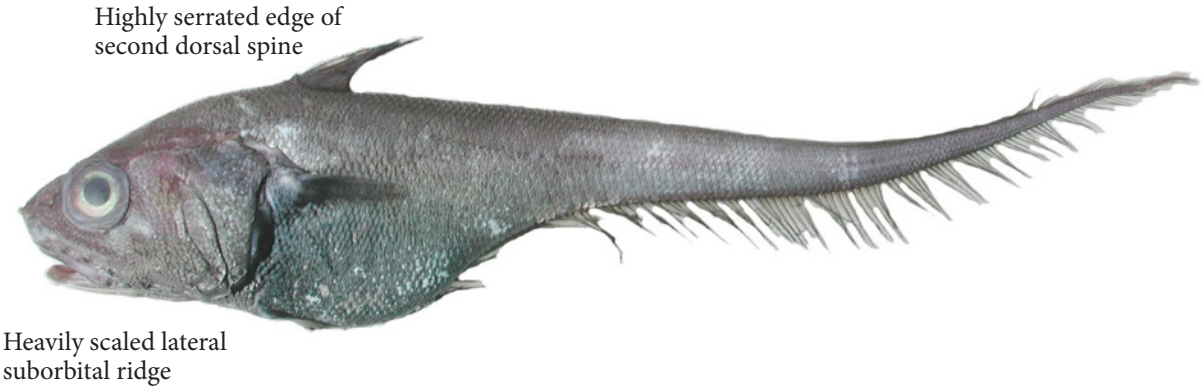
Berry's grenadier (*Mesobius berryi*)

Description
Berry's grenadiers are black over the head and black with purple highlights midbody. The head and body are compressed, the widest portion of the head being about half the greatest body depth. The fin rays are slender and fragile. The skeleton and the dermal bones in the head are thin and weakly ossified. The high supraoccipital crest forms a distinctly arched dorsal profile. The anus, pelvic fins, and anal fin origin are much farther forward than in most other grenadiers. The posterior margin of the opercular bones is finely scalloped. The large lower jaw has a pronounced knob at the symphysis and a small tubercle below, but no barbel. To 39.7 cm TL.

Similar species
Two closely related species, *Malacocephalus nipponensis* and *M. hawaiiensis*, co-occur in the eastern Pacific; however, the differences are nominal and they could represent disjunct populations of *M. laevis*.

Distribution
Berry's grenadiers range from the central North Pacific to the Hawaiian Islands to central California to Baja California, Mexico, and to the equatorial mid-Pacific off Christmas Island, at depths from 0–2,700 m—but most captures occur at 650–1,000 m.

California grenadier (*Nezumia stelgidolepis*)



Description
California grenadier are dark gray/black to black, often with a blue tint especially on the head and abdominal region. The gill and mouth cavities are pale with black areas. The fins are dusky to black. The body scales are rough and strongly adherent. The snout has moderately developed scutelike scales. The heavily scaled suborbital ridge extends from the snout to the back of the eye. The underside of the snout, anterior portion of the lower jaw, and most of the area below the eye are scaleless. There are scales on the lowermost portions of the branchiostegal rays. There are distinct bands of teeth in both jaws, with the outer teeth somewhat enlarged. The dorsal fin consists of two spines; the first is minute, the leading edge of the second is highly serrated. There are 9–10 (rarely 8) segmented dorsal fin rays. There is a small light organ between the bases of the pectoral fins. The anus has a small light organ on the anterior edge and is well forward of the anal fin origin. To 45 cm TL.

Similar species
Smooth grenadier (*Nezumia liolepis*) have weakly adherent scales, few if any serrations on the dorsal fin, and a scaleless suborbital ridge. Blunt-nosed grenadier (*N. kensmithi*) have a weakly developed and lightly scaled suborbital ridge (moderately developed and heavily scaled in California grenadier), 7–9 gill rakers on the first arch (10–11 in California grenadier), and 11–12 pelvic fin rays (9-10 in California grenadier).

Distribution
Although rare north of California, California grenadier range from Vancouver Island, British Columbia, Canada, to Peru, at depths of 277–909 m.

Smooth grenadier (*Nezumia liolepis*)

Description
Smooth grenadiers are gray/brown to blue. The gill cover, gill membranes, and belly are blackish. The fins are dusky to black. Small deciduous scales cover the body. The somewhat pointed snout has a weak terminal scute. The snout, suborbital ridge, and the area below the eye are almost scaleless. There is a narrow band of small teeth in the upper jaw, and a moderate band of small teeth in the lower jaw. The outer teeth are somewhat enlarged. The leading edge of the second dorsal ray is smooth, but may have weak serrations on the lower quarter of the spine. There is a small light organ between the pelvic fins. The anus is slightly ahead of the anal fin origin. To 30 cm TL.

Similar species
California grenadier (*Nezumia stelgidolepis*) have a highly serrated dorsal fin and a heavily scaled suborbital ridge.

Distribution
Although rare north of central California, smooth grenadiers range from Washington State to Baja California, Mexico, and the Gulf of California and Mexico, at depths of 768–1,660 m.

Blunt-nosed grenadier (*Nezumia kensmithi*)

Description
Blunt-nosed grenadiers are brown anteriorly with a gray suborbital area, bluish-black midbody beneath the first dorsal fin, and bluish along the side of the abdomen and ventrally. The lips, gill membranes, upper-rear corner of opercle, and area surrounding the anus are black. The paired fins are black. The first dorsal fin is dusky with some gray, and the anal fin is dusky. The head is somewhat compressed, without pronounced ridges. The suborbital region is nearly flat, with a weakly developed suborbital ridge extending from just anterior of the nostrils to just posterior of the orbit. The area below the ridge has scales but becomes naked along a narrow strip along the ventral margin of the lacrimal. The snout is very blunt, nearly vertical in profile, does not protrude much beyond the mouth, and is scaleless below the dorsal tip. The barbel is small to moderate, not very thick, and tapers to a fine tip. The 7–9 gill rakers on the first arch are much

reduced, often barely visible. The dorsal fin consists of two spines—the first greatly reduced and barely visible, the second long with a long filamentous tip and a series of very small serrations along the anterior edge—and 9-11 soft rays. The pectoral fin consists of 19–25 rays. The pelvic fin consists of 11–12 rays. To 40 cm TL.

Similar species
California grenadier (*Nezumia stelgidolepis*) have a highly serrated second dorsal fin, a heavily scaled suborbital ridge, 9–10 pelvic fin rays, and 10–11 gill rakers on the first arch.

Distribution
Blunt-nosed grenadiers occur on Fieberling Guyot of the Fieberling–Guadalupe seamount chain in the eastern North Pacific Ocean, at depths to 555 m.

Melanonidae (Arrowtails)

Arrowtails are a small group consisting of two species in a single genus. They are dark-colored and delicate. The first dorsal and anal fins are long. The second dorsal and anal fins join with the caudal fin and form a pointed fin at the end of the tail, giving them their common name.

Arrowtail (*Melanonus zugmayeri*)

Description
Arrowtails are uniform black to black/gray. The elongate body tapers to a narrow caudal peduncle. Small fleshy ridges cover the blunt head. The long, single dorsal fin may appear as two, and the long anal fin extends far back on the narrow caudal peduncle but is separate from the small caudal fin. To 28 cm TL.

Similar species
The paperbone brotula (*Lamprogrammus niger*) does not have a separate caudal fin.

Distribution
Scattered records of arrowtail exist between lat 60°N–49°S and long 81–153°W, at depths of 991–3,000 m.

Moridae (Codlings)

The codlings are a large group with about 100 species found in all seas, mostly in deep water. They are a diverse group having one, two, or sometimes three dorsal fins, one or two anal fins, and many have a chin barbel.

Key to the Moridae of the FRAM Surveys

1	Snout flattened into a broad, V-shaped plate	***Antimora microlepis***	p 152
1	Snout not as above		2
2(1)	Chin barbel present	***Physiculus rastrelliger***	p 153
2	Chin barbel absent	***Halargyreus johnsonii***	p 153

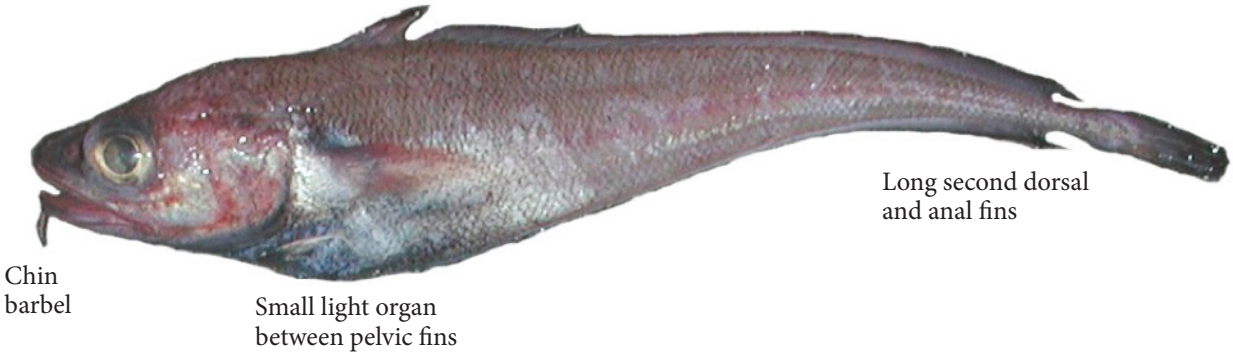
Pacific flatnose (*Antimora microlepis*)

Description
Pacific flatnose are pale brown, blue/gray, black to light gray, or whitish. The pectoral, pelvic, and caudal fins are blackish. There are two dorsal fins, the first with five or more rays with the first ray highly elongate. The relatively short pectoral fin falls far short of the anal fin origin. There are six pelvic fin rays, the first being somewhat elongate. The deeply indented anal fin originates posterior to the body's midpoint. The flattened snout has a broad, V-shaped plate. Chin barbel present. To 66 cm TL.

Similar species
The V-shaped snout separates the Pacific flatnose from the other Moridae.

Distribution
Pacific flatnose range throughout the North Pacific Ocean north of lat 10°N, including the tropical mid-Pacific, the Bering, Okhotsk, and Kamchatka Seas, and the Pacific off southern Japan, at depths of 175–3,408 m, usually at 500–950 m.

Hundred fathom mora (*Physiculus rastrelliger*)

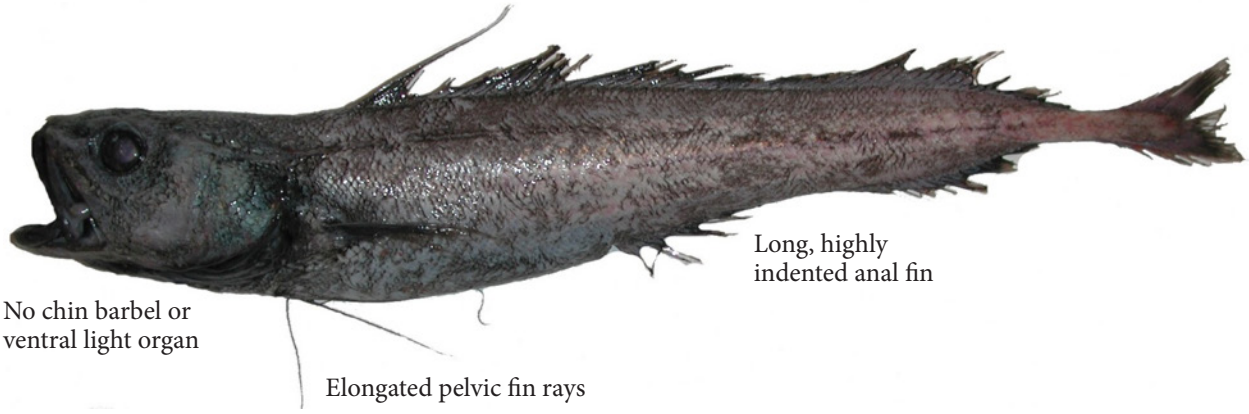


Description
Hundred fathom mora are tan to dark brown or black and may have pink or red highlights. There is a single band of brushlike teeth on the jaws, with no teeth on the vomer or palatines. There are two dorsal fins, the first ray of the first dorsal somewhat elongate. The second dorsal and anal fins elongate, extending onto the caudal peduncle. The caudal fin is separate. The narrow pelvic fins have 4–7 rays and are ahead of the pectorals. A ventral light organ between the bases of the pelvic fins appears as a dark, scaleless patch. Chin barbel present. To 20 cm TL.

Similar species
Slender codlings (*Halargyreus johnsonii*) do not have a chin barbel or ventral light organ.

Distribution
Hundred fathom mora range from southern Oregon to the Gulf of Panama at depths of 128–549 m.

Slender codling (*Halargyreus johnsonii*)



Description
Slender codlings are dirty gray/silver. The jaws, fins, inside of the mouth, and gill cavities are dark. The diameter of the eye and the snout length are about equal. There are fine, granular teeth in both jaws, but not on the vomer or palatines. There are two separate dorsal fins; the first is short, with 6–8 rays, the second elongate, extending to the caudal peduncle. The slender pelvic fins have 5–6 rays and are ahead of the pectorals. The highly indented anal fin originates near midbody. Ventral light organ and chin barbel absent. To 56 cm TL.

Similar species
The hundred fathom mora (*Physiculus rastrelliger*) has a chin barbel and light organ. Pacific whiting (*Merluccius productus*) have a V-shaped ridge on the top of the head, strong pointed teeth in both jaws and on the vomer, and lack the elongated pelvic fin rays.

Distribution
Slender codling are pelagic to benthopelagic over the continental slope, at depths from 500–1,500 m. Scattered records exist from the northwestern Bering Sea, the Pacific south of the Gulf of Alaska to California, and to Japan and the Sea of Okhotsk. Records also exist from the sub-Arctic and sub-Antarctic waters of both the Atlantic and Pacific Oceans.

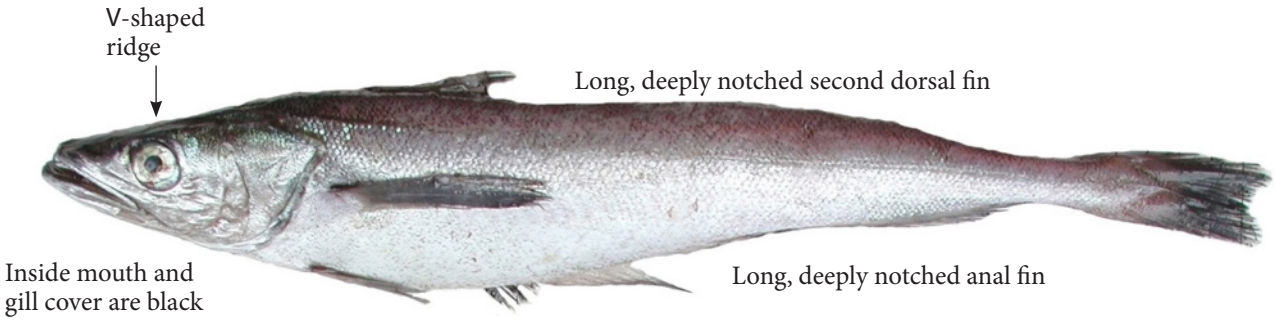
Merlucciidae (Merlucciids, Merluccid Hakes, and Hakes)

The hakes comprise three subfamilies (Merlucciidae, Macruroninae, and Steindachneriinae), five genera, and 24 species. Hakes occur throughout the Atlantic, Indian, and Pacific Oceans, and the Mediterranean and Red Seas. The distinct caudal peduncle and the separate dorsal, anal, and caudal fins distinguish the Merlucciidae from the other two subfamilies. The Macruroninae and Steindachneriinae have long, tapering bodies with no distinct caudal peduncle, and the dorsal and anal fins are continuous with the caudal fin. The presence of a striated light organ on the ventral half of the body and the sides of the head differentiates the Steindachneriinae from the Macruroninae.

Key to the Merlucciidae of the FRAM Surveys

1	Head short, 3.4–4.0 into SL; usually 22 (18–23) gill rakers on first gill arch ..... ***Merluccius productus***	p 154
1	Head long, 3.3 or less into SL; usually 16–17 (13–20) gill rakers on first gill arch	2
2 (1)	Caudal fin clearly emarginate (slightly indented); pectoral fin rays extend to or just beyond anus ..... ***Merluccius angustimanus***	p 155
2	Caudal fin lobed; pectoral fin rays extend well beyond anus ..... ***Merluccius hernandezi***	p 156

Pacific whiting, Pacific hake (*Merluccius productus*)



Description
Pacific hake are dark silver/gray with black speckling on the dorsal surface, fading to light silver on the sides and white on the belly. The mouth and gill cavities are black. There is a V-shaped ridge on the top of the head. The head is short, 3.4 to 4.0 times into SL. There are a total of 18–23 (usually 22) long, slender, pointed gill rakers on the first gill arch (3–6 on the upper arch and

14–17 on the lower). The mouth is relatively large, with a protruding lower jaw and no chin barbel. There are bands of strong, pointed teeth in both jaws and on the vomer. There are two separate dorsal fins; the first dorsal fin has one spine and 10–13 (usually 11) rays, the second has 37–44 (usually 40–42) rays. The second dorsal and anal fins are both long and deeply notched toward the rear. The small cycloid scales are deciduous. To 91 cm TL.

Similar species
The Panama hake (*Merluccius angustimanus*) and Cortez hake (*M. hernandezi*) have longer heads (3.3 times or less into SL vs. 3.4 or more times for Pacific hake) and fewer gill rakers on the first arch (usually 16–17 for Panama and Cortez hake and 22 for Pacific hake). Slender codling (*Halargyreus johnsonii*) has fine, granular teeth in both jaws (strong and pointed in the hakes) and elongated pelvic fin rays.

Distribution
Pacific hake range (although very rarely) from Casco Cove, Attu Island—more commonly from the Gulf of Alaska—to Baja California, Mexico, and the Gulf of California, to the Gulf of Tehuantepec, southern Mexico, at depths of 0–1,000 m.

Panama hake (*Merluccius angustimanus*)

Description
Panama hake are dark silver/gray on the dorsal surface, fading to light silver on the sides and white on the belly. The long head is 2.9–3.3 times into SL. There are a total of 13–18 (usually 16–17) long, slender, pointed gill rakers on the first gill arch: 2–5 on the upper arch and 11–14 on the lower. There are two separate dorsal fins; the first has one spine and 10–13 (usually 12) rays, the second has 36–40 (usually 37) rays. Both the second dorsal and anal fins are long and deeply notched toward the rear. When depressed, the pectoral fin rays extend to or just beyond the anus. The caudal fin is emarginate (slightly notched or forked). To 39 cm TL, possibly more.

Similar species
The Cortez hake (*Merluccius hernandezi*) has a truncate tail, usually with a central lobe extending distally along the axis of the fish, especially in smaller specimens (emarginate caudal fin in Panama hake), and pectoral fins that extend well past the anus (to or slightly beyond in Panama hake). Pacific hake (*M. productus*) have shorter heads (3.4 times or more into SL vs. 3.3 or less for Panama hake). Slender codling (*Halargyreus johnsonii*) have fine, granular teeth in both jaws (strong and pointed in the hakes), and elongated pelvic fin rays.

Distribution
Panama hake range from Turtle Island in the Gulf of California to Ensenada de Tumaco in Colombia, at depths of 80–500 m.

Cortez hake (*Merluccius hernandezi*)

Description
Cortez hake are dark silver/gray on the dorsal surface, fading to light silver on the sides and white on the belly. There are 14–20 long, slender, pointed gill rakers on the first gill arch. There are two separate dorsal fins; the first has a single spine and 10–13 rays, the second 36–42 rays. The second dorsal and anal fins are both long and deeply notched toward the rear. When depressed, the pectoral fin rays extend well beyond the anus. The caudal fin is usually truncate in large fish. However, a central lobe projecting distally along the axis of the fish may be present, especially in fish smaller than 25 cm. To 107 cm TL.

Similar species
Although considered a valid species, the taxonomy of Cortez hake—due to a lack of biological and population information, and the high variability and considerable overlap in meristic characteristics with Panama hake (*Merluccius angustimanus*)—is uncertain.

Distribution
Limited distribution data exist for Cortez hake. Apparently confined to the northern portion of the Gulf of California south to Isla Tiburón. Also south of the Bay of Yavaros, Sonora, Mexico, on the Mexican mainland (east side of the Gulf of California) and on the west side to Isla Carmen, Baja California, possibly farther south. At depths of 0–300 m.

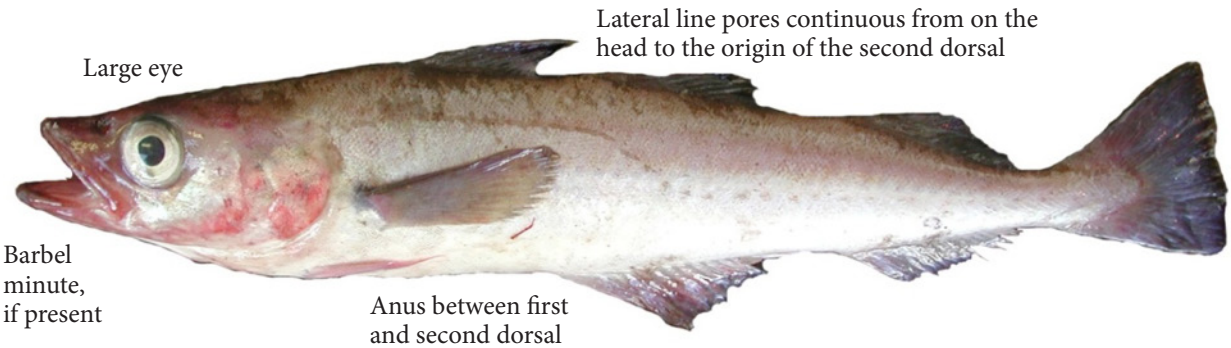
Gadidae (Cods)

The cods are a group containing about 30 species in 12 genera. Most cod are marine species and found along the continental shelves in the northern latitudes of the Atlantic and Pacific Oceans, and circumglobal in the Arctic.

Key to the Gadidae of the FRAM Surveys

1	Protruding lower jaw; chin barbel tiny, if present; lateral line extends to second dorsal ..... ***Gadus chalcogrammus***	p 156
1	Protruding upper jaw; chin barbel present; lateral line extends past second dorsal 2	
2(1)	Lateral line extends to end of third dorsal; fins dusky ..... ***Microgadus proximus***	p 157
2	Lateral line to or beyond middle of third dorsal; unpaired fins have white edges ..... ***Gadus macrocephalus***	p 158

Walleye pollock (*Gadus chalcogrammus*)

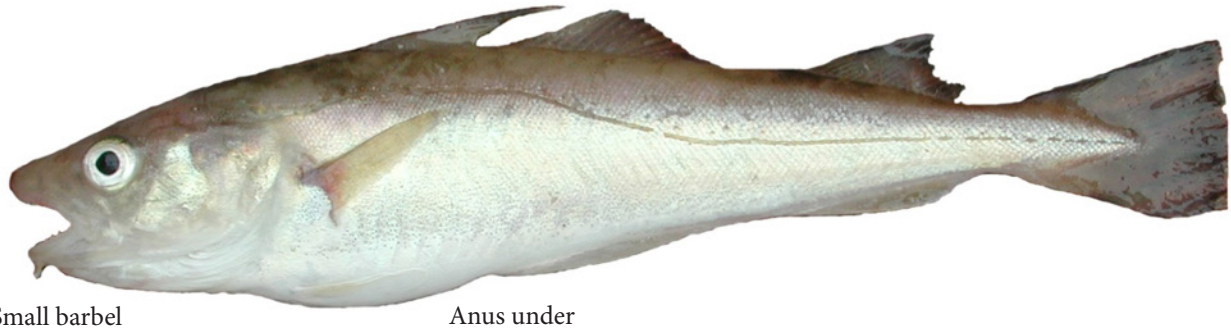


Description
Walleye pollock are olive/green to brown with a mottled pattern dorsally, shading to a dark, brassy olive with blotches laterally and white ventrally. The fins are brown, dusky gray, or black. There are three separate dorsal fins and two anal fins. The first anal fin is equal to the second dorsal. The moderately large mouth has a slightly protruding lower jaw. If present, the chin barbel is minute. The lateral line pores are continuous from on the head to the origin of the second dorsal fin. The anus is below the space between the first and second dorsal. To 91 cm TL.

Similar species
In related species, the lateral line is continuous to or beyond the middle of the third dorsal fin.

Distribution
Walleye pollock range from the Beaufort and Chukchi Seas, through the Bering Sea and the Aleutian Islands to Carmel in central California, and west from the Commander Islands through the Okhotsk and Japan Seas, at depths of 30–300 m, but occasionally much deeper.

Pacific tomcod (*Microgadus proximus*)



Small barbel

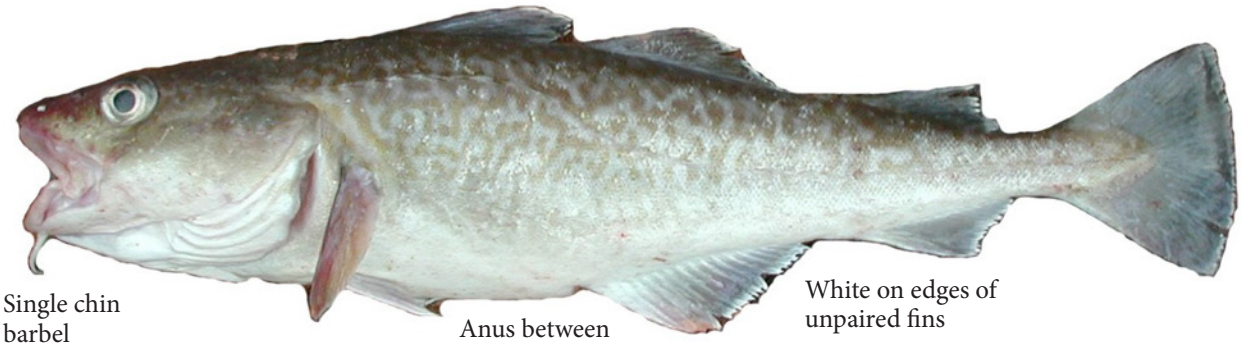
Anus under first dorsal

Description
Pacific tomcod are olive/green to brown or tan with yellow or gray overtones on the dorsal surface, with light sides and a white belly. The fins are brown to gray with dusky tips. The chin barbel is small, about equal to the diameter of the pupil. The jaws extend to or beyond the center of the eye, with a slightly protruding upper jaw. There are no lateral line pores on the head. The body lateral line extends continuously to the end of the third dorsal fin, and then broken to the caudal peduncle. The anus is located under the rear quarter of the first dorsal. To 37 cm TL.

Similar species
In Pacific cod (*Gadus macrocephalus*), the barbel is longer, about equal to the diameter of the eye, and the anus is located under the gap between the first and second dorsal fins.

Distribution
Pacific tomcod range from the Bering Sea to central California, at depths of 25–250 m.

Pacific cod (*Gadus macrocephalus*)



Description
Pacific cod are gray/brown or olive to gray with olive tones on the dorsal surface, brown to yellow spots and blotches on the back and sides, and a white ventral surface. The fins are dusky, with white edges on the unpaired fins. The chin barbel is relatively long, about equal to the diameter of the eye. There are lateral line pores present on the head. The lateral line arches over the pectoral fin and is continuous nearly to the caudal peduncle. The anus is under the origin of the second dorsal fin. To 120 cm TL.

Similar species
In Pacific tomcod (*Microgadus proximus*), the barbel is shorter, about equal to the diameter of the pupil, and the anus is located under the rear of the first dorsal fin.

Distribution
Pacific cod range from the Chukchi and Bering Seas through the North Pacific to Alaska and California, and to the Yellow Sea off Manchuria, China, at depths of 0–875 m.

Batrachoidiformes (Batrachoidiforms)

The Batrachoidiforms are a group of mostly plain-colored fishes with large, depressed heads on anteriorly stout bodies. Other characteristics that define the order include: protruding eyes that are more dorsal than lateral; the premaxilla and maxilla that form the border of the large mouth; and the presence or absence of photophores. In some species, there is a pore in the axis of the pectoral fin. The jugular pelvic fins have 1 spine and 2–3 rays. Batrachoidiforms are usually scaleless; scales are small and cycloid, if present. There are three pairs of gills with small gill openings. The separate gill membranes are broadly joined to the isthmus. There are six branchiostegal rays. There are no pyloric caeca. A swim bladder is present, and some species can use it to produce sounds.

Batrachoididae (Toadfishes)

The toadfishes consist of about 69 species in 19 genera. These bottom-dwelling fishes are located primarily in the shallow coastal waters of the Atlantic, Indian, and Pacific Oceans. Most toadfishes have a small, spinous dorsal fin that has two to four rays, long-rayed dorsal and anal fins that extend almost to the caudal fin, and a prominent opercular spine.

Key to the Batrachoididae of the FRAM Surveys

1	Spots and blotches on pectoral and soft dorsal fins; photophores on underside of lower jaw form U shape ..... ***Porichthys myriaster***	p 159
1	Dusky fins; photophores on underside of lower jaw form V shape ..... ***Porichthys notatus***	p 159

Specklefin midshipman (*Porichthys myriaster*)

Description
Specklefin midshipmen are purple/gray to brown dorsally, paler laterally, and yellow ventrally. There are rows of luminous organs and cirri on the ventral side. The photophores on the underside of the head form a U-shaped pattern. There are two dorsal fins. The spinous dorsal is very small, with two spines. The second dorsal and anal fins are long. The pelvic fins are under the head. The pectoral and soft dorsal fins are spotted. To 51 cm TL.

Similar species
The photophores on the underside of the head on the plainfin midshipman (*Porichthys notatus*) are arranged in a V shape, and it has unmarked fins.

Distribution
Specklefin midshipmen range from Point Arguello, California, to Bahia Almejas, Baja California, Mexico, at depths from 0–126 m.

Plainfin midshipman (*Porichthys notatus*)

Description
Plainfin midshipmen are olive brown to bronze or dark iridescent purple dorsally, lighter laterally and yellow ventrally. There is a white space over a black crescent under the protractile eyes. There are rows of luminous organs and cirri on the ventral side. The photophores on the underside of the head form a V pattern. There are two large canine teeth on the vomer. There are two dorsal fins, with the spinous dorsal very small. To 38 cm TL.

Similar species
The specklefin midshipman (*Porichthys myriaster*) has spotted dorsal and pectoral fins. The photophores on the underside of the head form a U pattern.

Distribution
Plainfin midshipmen range from southern Smith Sound, British Columbia, Canada, to Magdalena Bay, Baja California, Mexico, at depths from 0–366 m.

Lophiiformes (Anglerfishes)

The anglerfishes have a fishing apparatus on the head called the illicium, which is a modified dorsal fin spine. The base, or "pole," is a pterygiophore that can be quite long in some families, and moves in and out of the head to draw prey toward the mouth. In some species, when retracted, it will stick out of the dorsal surface encased in skin; it is then referred to as a tentacle, papilla, or spine. The "line," or illicial bone, has a modified tip called the esca, or "lure," used for attracting prey. Inhabiting marine waters, anglerfish fall into two groups: the first is found in shallow water, either on the bottom or attached to drifting vegetation; the second is in the water column at deep depths. The body shape varies among the families. Most are globular, some are highly flattened, and the whipnose anglers are highly streamlined. The jaws are large, well developed, and usually equal or with a slightly projecting lower jaw. There may be a well developed symphyseal spine. There are generally 4–8 dorsal fin rays, 4–7 anal fin rays, and six branchiostegal rays. There are no spines on the skin, but some have fine dermal prickles.

Ceratiidae (Seadevils)

Key to the Ceratiidae of the FRAM Surveys

1	2 dorsal caruncles; no subopercle spine; 9 caudal fin rays ..... ***Ceratias holboelli***	p 160
1	3 dorsal caruncles; subopercle with a spine on anterodorsal edge; 8 caudal fin rays ..... ***Cryptopsaras couesii***	p 161

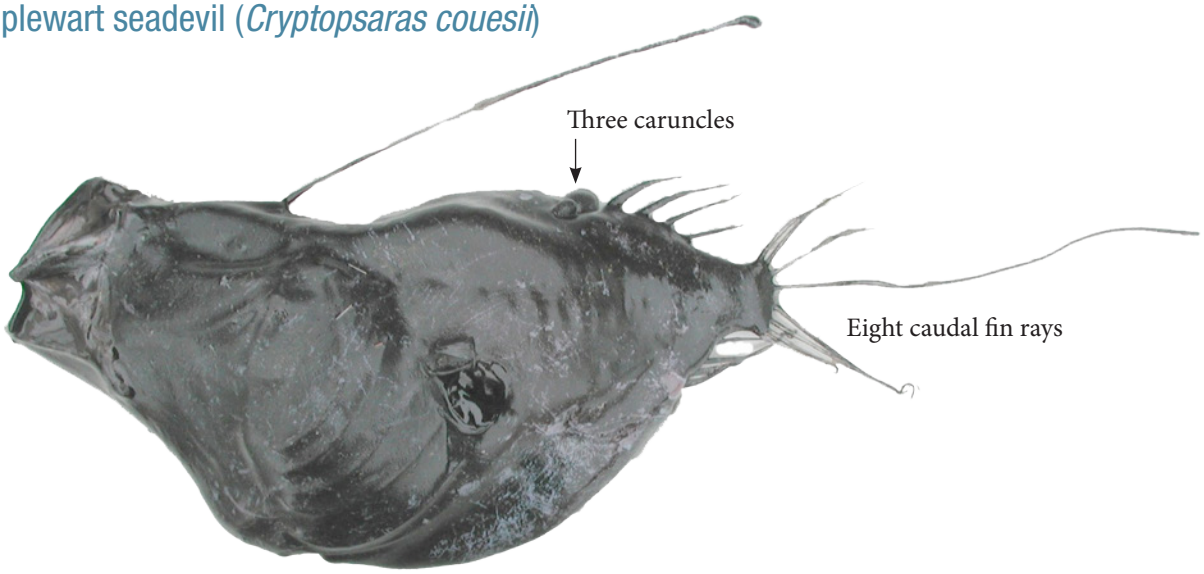
Northern seadevil (*Ceratias holboelli*)

Description
Northern seadevils are uniformly black. There are two fleshy lobes (caruncles) just anterior of the dorsal fin (absent or greatly reduced in adults). The skin, with close-set spinules, covers the body. The caudal fin has nine rays, with the lowest ray greatly reduced and totally encased in skin. The illicium, or "pole," is long and jointed. The esca, or "lure," at the end of the illicium has a single filament at the tip, with 0–3 short filaments on each side. To 152.4 cm TL.

Similar species
The triplewart seadevil (*Cryptopsaras couesii*) has three prominent caruncles, eight caudal fin rays, an unjointed illicium, and the esca with one or more pairs of filaments on each side.

Distribution
Northern seadevils range from the Bering Sea through the North Pacific to California, Hawaii, and Japan, at depths from 120–3,400 m.

Triplewart seadevil (*Cryptopsaras couesii*)



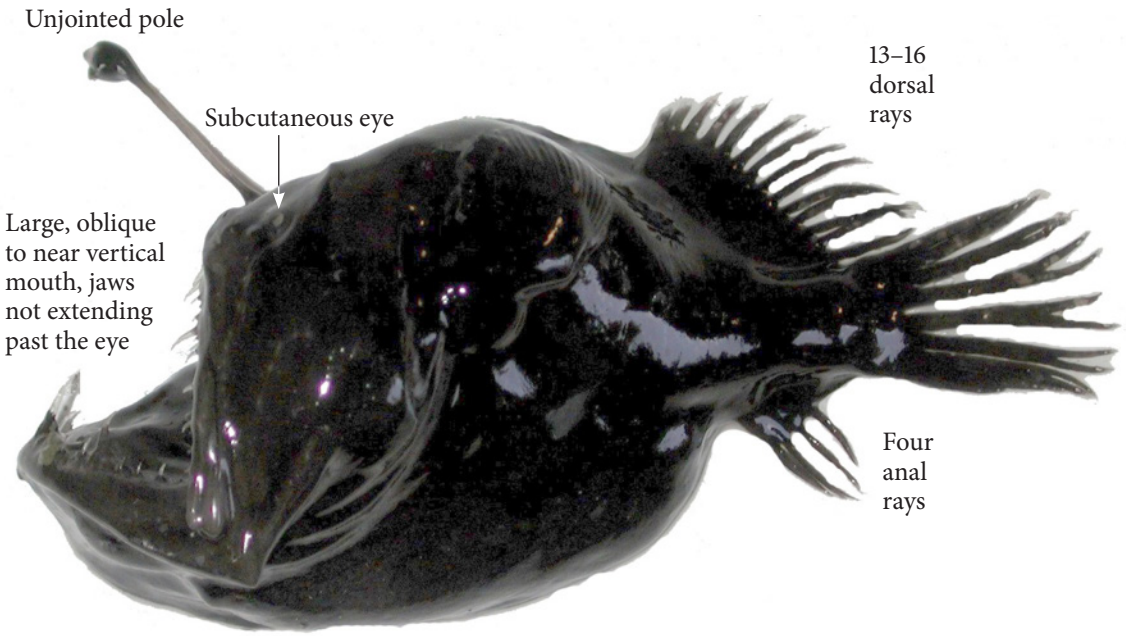
Description
Triplewart seadevils are uniformly black. There are three fleshy lobes (caruncles) located just anterior of the dorsal fin. A single spine on the anterodorsal margin of the subopercle. The caudal fin has eight rays. The illicium, or "pole," is long and unjointed. The esca, or "lure," at the tip of the illicium has a single filament at the tip, and one or more pairs of filaments at the base. Fine, close-set spinules cover the skin. To 44 cm TL.

Similar species
The northern seadevil (*Ceratias holboelli*) has two caruncles, nine caudal fin rays, a jointed illicium, and the esca with up to three filaments on each side.

Distribution
Triplewart seadevils occur in all the major oceans, from lat 63°N to 43°S, at depths from 0–3,085 m, but usually 500–1,250 m.

Melanocetidae (Black Seadevils)

Common blackdevil (*Melanocetus johnsonii*)



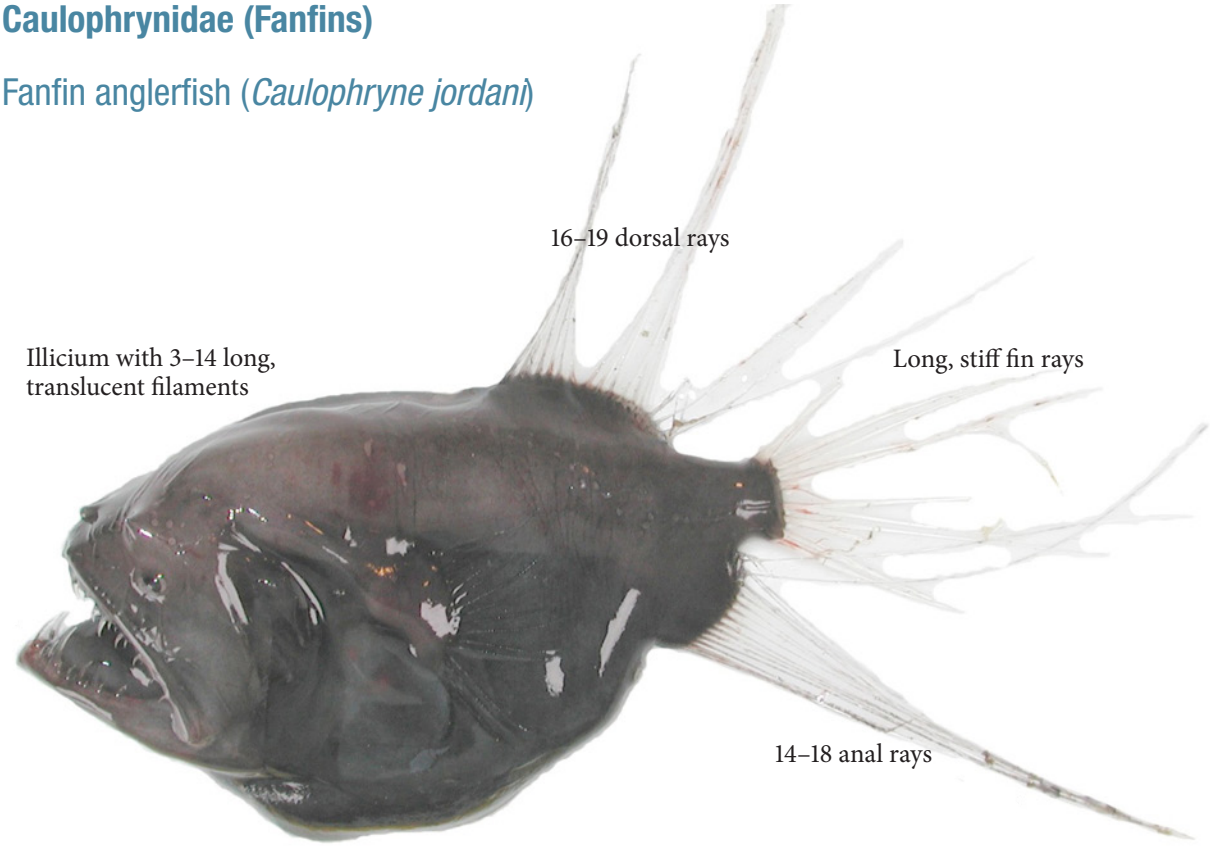
Description
Common blackdevil are small, black, scaleless, and somewhat flabby anglerfishes. The body is short, deep, and globular, body depth 60–75% of SL. The head is short. The mouth is large, the opening oblique to near vertical, with the cleft not extending past the eye. The eye is small and subcutaneous, appearing through a circular, translucent area of the integument. The illicium is short and non-jointed. Dorsal fin is usually with 13–16 (rarely with 12 or 17) rays. Anal fin with four (rarely three or five) rays. The well developed, underslung lower jaw and moderate-sized upper jaws have well developed teeth. To 18 cm TL.

Similar species:
The combination of 13–16 dorsal and four anal rays distinguish the common blackdevil from all other ceratoid families.

Distribution
Common blackdevil are nearly circumglobal in the Atlantic, Indian, and Pacific Oceans, between lat 66°N and 53°S, at depths of 100–4,500 m, most commonly 100–2,100 m.

Caulophrynidae (Fanfins)

Fanfin anglerfish (*Caulophryne jordani*)



Description
The relatively stout body of the fanfin anglerfish is dark black/brown. Dorsal fin with 16–18 (rarely 19) long, stiff rays. Anal fin with 14–17 (rarely 18) long, stiff rays. The illicium is somewhat short, 16.8–36.8% of SL, and pigmented except near the esca. The stem of the illicium has 3–14 long, translucent filaments along its length. To 15.5 cm SL.

Similar species
The long, stiff, 16–19 dorsal and 14–18 anal rays, and the illicium with 3–14 filaments, distinguish the fanfin anglerfish from other related species.

Distribution
Fanfins occur throughout the North Atlantic from Greenland and Iceland south to about lat 5°N. In the Pacific from New South Wales to Peru and southern California, at depths of 275–3,000 m.

Oneirodidae (Dreamers)

Oneirodidae includes approximately 60 species in 16 genera. Generally, they have a soft, globular body with loose black or black/brown skin. The fishing apparatus on the head, the illicium, is a modified dorsal fin spine. The base, or "pole," is a pterygiophore that varies in length depending on the family, and moves in and out to draw in prey. In some species, when retracted, the pterygiophore sticks out of the dorsal surface encased in skin, and is then referred to as a tentacle, papilla, or spine. The modified tip of the illicium, or esca, acts as a "lure" for attracting prey. The

enlarged bones of the skull form the prominent concave forehead. The large and well developed jaws are usually equal, or the lower jaw is slightly projecting. There are generally 4–8 dorsal fin rays, 4–7 anal fin rays, and six branchiostegal rays. There are no spines on the skin, but some species have fine dermal prickles.

Oneirodidae spp. (unidentified dreamers)

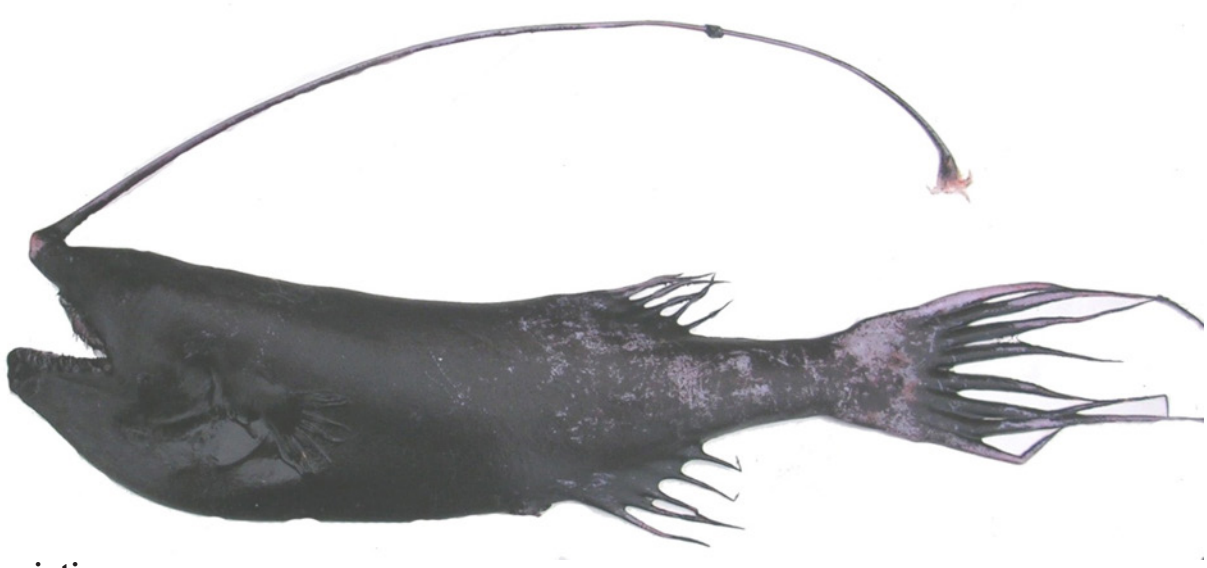
Similar species
Positive identification to species requires microscopic examination of the filamentous ornamentation on the esca, making positive identification in the field problematic.

Distribution
Members of this family occur over a variety of habitats in the deep waters of the Atlantic, Indian, and Pacific Oceans.

Gigantactinidae (Whipnoses)

The whipnose anglerfishes consist of two genera and 23 species. The females have elongate streamlined bodies, a relatively small head, a long and slender caudal peduncle, and an extremely long illicium, or "pole," which can be 1–5 into SL. There are 3–10 dorsal fin rays, 14–22 (but usually 17–19) pectoral fin rays, no pelvic fins, and 3–8 anal fin rays. There are nine unbranched rays in the caudal fin. The greatly reduced ninth, or ventralmost, caudal fin ray is skin-covered. The granulose skin is black. The eyes are very small and covered with a layer of transparent skin.

Gigantactis vanhoeffeni



Description
Gigantactis vanhoeffeni are uniformly black. There are 5–7 dorsal fin rays, 17–18 (rarely 19) pectoral fin rays, no pelvic fins, and 5–6 (rarely 7) anal fin rays. The caudal fin has nine unbranched rays (rays 45% or less of SL), the ninth or ventralmost often reduced and covered with skin. The illicium, or "pole," is relatively short, less than 120% (71–112%) of SL. The escal bulb and distal prolongation have distally flattened papillae and short distal and proximal filaments. The illicium has a posterior pair of papillae below the escal bulb. The teeth in the lower jaw are relatively long (longest 2.6–5.0% of SL), and in three longitudinal rows. The skin is granulose. A layer of transparent skin covers the very small eyes. To 62 cm TL.

Similar species
The combination of a relatively short illicium, distinct shape and arrangement of filaments on the illicium, escal bulb and prolongation, and dentition in the lower jaw distinguish *G. vanhoeffeni* from the other species in the genus.

Distribution
Gigantactis vanhoeffeni has a nearly cosmopolitan distribution between approximately lat 64°N and 43°S. In the northeastern Pacific from Oregon to the Gulf of Panama and Ecuador, at depths of 300–5,300 m, but most commonly 700–1,463 m.

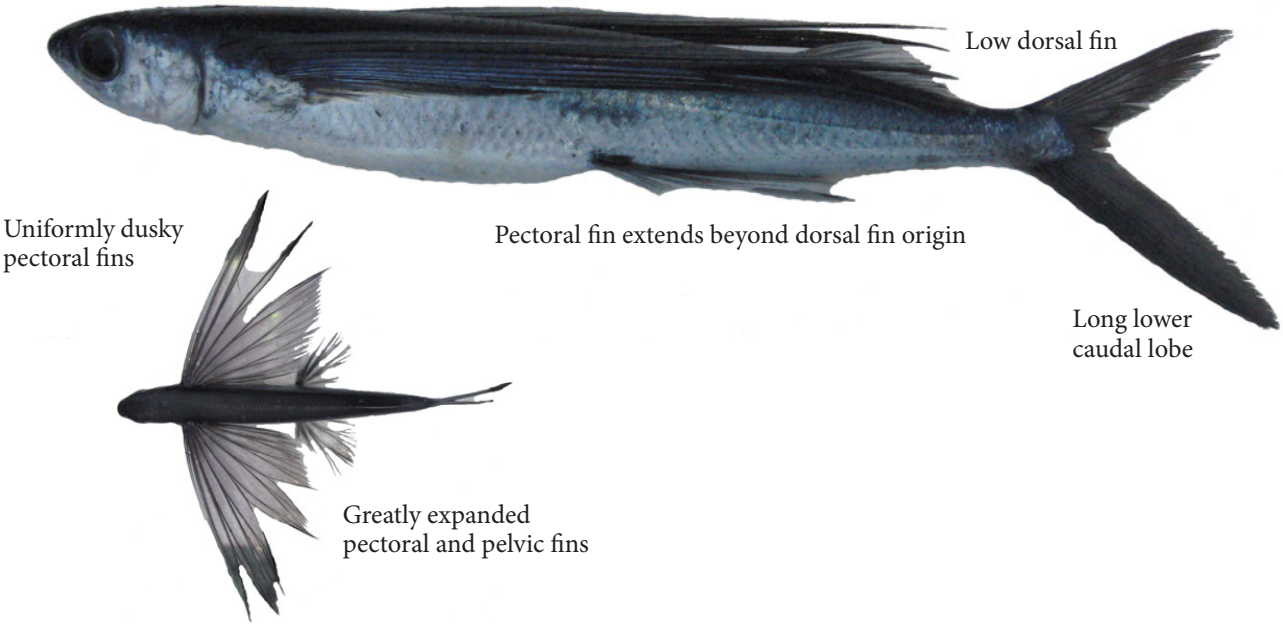
Beloniformes (Flyingfishes)

The flyingfishes are a group of epipelagic fishes consisting of two suborders and five families with about 200 species found primarily in warm seas, although a few species inhabit temperate seas and brackish and freshwater. The characteristics that define the flyingfishes include a long slender body, a nonprotractile upper jaw, and fins composed of soft rays only. The dorsal and anal fins are placed far back on the body. The majority of the 13 caudal fin rays are in the lower lobe. The pectoral fins are placed high on the body. The abdominal pelvic fins have six rays. The swim bladder is physoclistic (closed, no connection to the gut). The maxillae are not included in the gape. The lower pharyngeal bones are fused. The orbitosphenoid (median bone between the orbits) and mesocoracoid (a bone of the pelvic girdle) are absent.

Exocoetidae (Flyingfishes)

The flyingfishes consist of approximately eight genera with 52 species, readily distinguished by the large, winglike pectoral fins and, in some species, the greatly expanded pelvic fins. There is a single dorsal fin far back on the body opposite the anal fin. The lower lobe of the deeply forked caudal fin is much longer than the upper. There are no fin spines. The mouth is small, and the short jaws are about equal length. Flyingfishes occur in the warm surface waters of the Atlantic, Indian, and Pacific Oceans, generally offshore.

California flyingfish (*Cheilopogon pinnatibarbatus*)



Description
California flyingfish are blue to blue/gray dorsally, silvery laterally, and white ventrally. The snout is short, less than the diameter of the eye. The jaws are about equal in length but short, reaching to or just beyond the front of the eye. The large, uniformly dusky pectoral fins extend well beyond the dorsal fin insertion. To 38 cm SL.

Similar species
In sharpchin flyingfish (*Fodiator acutus*), the pectoral fins do not extend past the dorsal fin insertion, the lower jaw extends past the upper jaw, and the high dorsal fin is rounded. Blackwing flyingfish (*Hirundichthys rondeletii*) have an unbranched second pectoral fin ray. Blotchwing flyingfish (*Cheilopogon heterurus*) have fewer predorsal scales (28–41 compared to 47–50 for California flyingfish), and the posterior portion of the pectoral fin is black.

Distribution
Although rare north of Point Conception, California flyingfish range from Astoria, Oregon, to southern Baja California, Mexico, usually on or near the surface.

Scomberesocidae (Sauries)

The sauries consist of four monotypic genera. All the sauries are marine species. Sauries have long, slender bodies. The jaws range from long, slender beaks with both jaws projecting to short beaks with only the lower jaw projecting. The mouth has a small opening, small teeth, and does not extend to the eye. The dorsal and anal finlets are modified posterior portions of the dorsal and anal fins.

Pacific saury (*Cololabis saira*)

Description
Pacific saury are dark green to olive/green or blue dorsally shading to bright silver laterally and ventrally. The head is pointed. The body is long, slender, and laterally compressed. The jaws moderately project into a short beak, with the lower jaw projecting slightly beyond the upper. The mouth is small, with the maxilla not nearly reaching the eye. The dorsal is about equal to and originates over the anal fin origin. There are 5–6 dorsal finlets and 5–7 anal finlets. The lateral line is very low on the body, almost on the ventral surface, and extends over the base of the anal fin. To 44 cm TL.

Similar species
The small, beaklike mouth with slightly projecting lower jaw, low lateral line, and the dorsal and anal finlets distinguish the Pacific saury from other similar fishes.

Distribution
Pacific saury range from Japan to the Sea of Okhotsk and the Kuril Islands through the Bering Sea to the North Pacific from south of the Aleutian Islands and the Gulf of Alaska to Mexico, at depths of 0–229 m.

Atheriniformes (Silversides)

Atheriniformes has one suborder, the Atherinoidei, that consists of 5 families, 39 genera, and about 246 species inhabiting tropical to temperate marine, brackish, and freshwater habitats. The Atherinopsidae, or New World silversides, are a family of Atheriniform fishes separate from the Atherinoidei and consisting of two subfamilies, 13 genera, and about 108 species. The Atherinopsidae occur in freshwater and the temperate marine waters of North America and in freshwater and the tropical and subtropical waters of Central America. They are present only in the temperate freshwaters of South America, but are present in all (tropical, subtropical, and temperate) marine waters.

Silversides are small fishes that vary in length from 2–44 cm SL (but most are less than 15 cm). They usually have a somewhat compressed body with a small terminal mouth. The premaxilla is not protractile; the distal end is not expanded and usually has a postmaxillary process. There are small teeth present in both jaws and sometimes on the vomer. The gill rakers are generally large. The opercular bones around the medium to large eyes do not have spines. The lateral line is absent or very weak. There are usually two separated dorsal fins; the first, if present, is composed of 2–5 spines, and the second has a single anterior spine followed by soft rays. The pectoral fins are high on the body in most species. The pelvic fins have one spine and five soft rays, and can be abdominal, subabdominal, or thoracic. The anal fin has a single anterior spine followed by soft rays. Most species are translucent green to yellow/green on the dorsal surface, with a dark mid-dorsal stripe, light laterally, with a bright silvery stripe and light to slightly yellowish ventrally. However, some species are brightly colored and are popular aquarium fishes.

Atherinopsidae (New World Silversides)

The New World silversides are mostly small fishes, usually less than 15 cm SL, but some eastern Pacific species can exceed 1 m. The premaxillary is protractile (usually highly protractile), with an expanded distal end (slightly reduced in some species), and lacks a postmaxillary process. There are small teeth on both jaws and sometimes on the vomer and mesopterygoid (a thin bony plate that fits against the upper edge of the pterygoid bone). There are two well separated dorsal fins: the first has 2–9 flexible spines, the second a single anterior spine followed by soft rays. The pectoral fins are inserted high (above mideye) on the body. The abdominal pelvic fins have one anterior spine and five soft rays. The long anal fin has a single anterior spine, and the caudal fin is forked. The body color is usually translucent green to yellow/green on the dorsal surface, with a dark mid-dorsal stripe, light laterally with a narrow or wide silver stripe, and pale to slightly yellowish ventrally.

Key to the Atherinopsidae of the NWFSC Surveys

1	Anal fin originates below the first dorsal fin; 5-8 scales between the dorsal fins; a single row of tiny forked teeth in both jaws ..... ***Atherinops affinis***	p 168
1	Anal fin originates behind the first dorsal fin; 10-12 scales between dorsal fins; multiple rows of tiny conical teeth in both jaws..... ***Atherinopsis californiensis***	p 169

Topsmelt (*Atherinops affinis*)

Description

Topsmelt are elongate fish that are blue/gray to green dorsally, whitish with a silver band laterally, and white ventrally. The compressed head is pointed. The snout extends slightly beyond the mouth and has a broadly rounded tip. The small, protractile mouth opens at the front, with

the top lip folded down. There is a single row of tiny, forked teeth in both jaws. There are 5–6 branchiostegal rays. There are 20–25 rounded, unserrated gill rakers on the first gill arch. The small eye is about half the snout length. There are two dorsal fins 5–9 scales apart; the first has 5–9 spines, the second has a single anterior spine and 8–14 soft rays. There is no adipose fin. The pectoral fins originate high on the body. The abdominal pelvic fins have a single spine and five soft rays. The long anal fin originates below the rear of the first dorsal and has a single anterior spine and 19–25 soft rays. There is no lateral line. To 37 cm TL.

Similar species
Jacksmelt have an anal fin that originates behind the first dorsal, 10–12 interdorsal scales, and multiple rows of conical teeth in both jaws.

Distribution
From Vancouver Island, Canada, to southern Baja California, Mexico, and the upper Gulf of California, usually near the surface to 26 m.

Jacksmelt (*Atherinopsis californiensis*)

Description
Jacksmelt have a bright yellow patch on the operculum. The body color is green/blue to olive/tan dorsally, light laterally with a slivery stripe, and silver/white ventrally. The head and body are compressed and the snout pointed. The small, protractile mouth opens at the front, with the edge of the top lip folded down. There are 2–3 rows of conical teeth in both jaws. There are 5–6 branchiostegal rays. There are 30–40 rounded, unserrated gill rakers on the lower limb of the first gill arch. The small eye is less than half the snout length. There are two dorsal fins 10–12 scales apart; the first has 6–10 flexible spines, the second has a single anterior spine and 10–14 soft rays. There is no adipose fin. The pectoral fins originate high on the body. The abdominal pelvic fins have a single spine and five soft rays. The long anal fin originates behind the first dorsal and has a single anterior spine and 21–26 soft rays. There is no lateral line. To 45 cm TL.

Similar species
Topsmelt have an anal fin originating below the posterior portion of the first dorsal, 5–9 interdorsal scales, and a single row of forked teeth in both jaws.

Distribution
Yaquina Bay, Oregon, to Bahía Magdalena, Baja California, Mexico, usually near shore, near the surface to 29 m.

Stephanoberyciformes (Stephanoberyciforms)

The Stephanoberyciforms consist of nine families with about 86 species. The typical Stephanoberyciform has a rounded body, a single dorsal fin well back on the body, a toothless palate, and very thin skull bones. They have a modified extrascapular and lack an orbitosphenoid. Some species have weak dorsal spines and a few lack pelvic fins.

Melamphaidae (Bigscales)

The bigscales consist of 33 species in five genera. They are small, dark brown to black deepsea fishes found in all oceans except the Arctic and the Mediterranean Sea. The bodies are moderately compressed. The heads are highly sculpted with numerous ridges and crests.

Key to the Melamphaidae of the FRAM Surveys

1	Serrated, crestlike frontal ridges; prominent spine between nostrils; lower margin, angle, and most of posterior margin of preopercle serrated ..... ***Poromitra rugosa***	p 170
1	Smooth frontal ridges may or may not be crestlike; damaged ridges may appear serrated; spine between nostrils, small if present; smooth preopercular margins, no spines on angle 2	
2(1)	Total dorsal fin spines and rays, 17 or more ..... ***Melamphaes lugubris***	p 171
2	Total dorsal fin spines and rays, 15 or less ..... ***Scopeloberyx robustus***	p 172

Poromitra rugosa

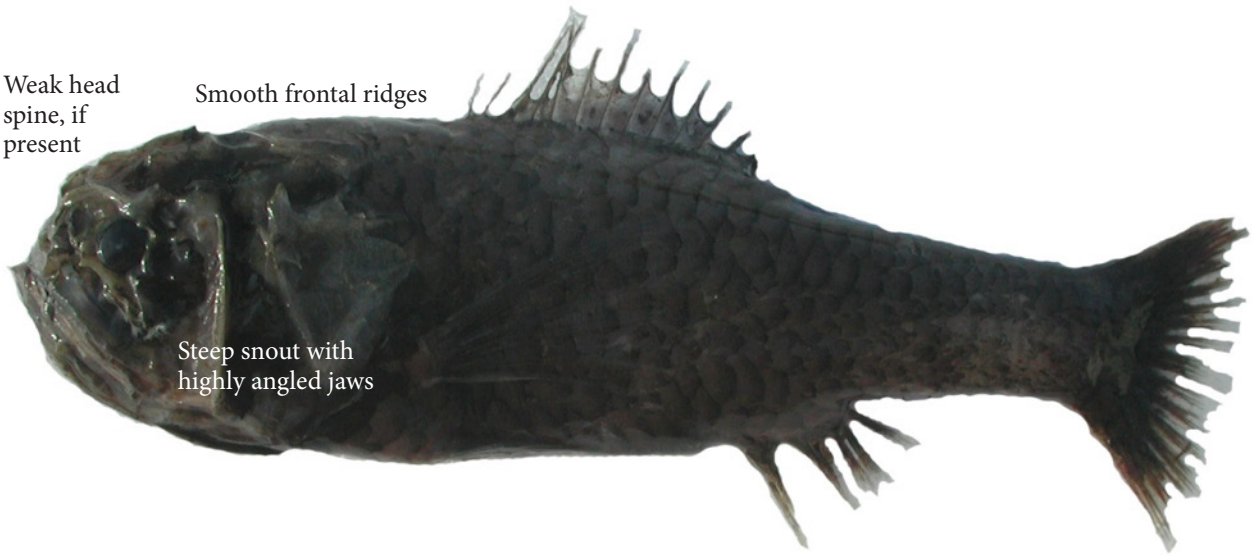
Description

Poromitra rugosa are black. The highly sculptured head has serrated frontal ridges, crests over the eyes, a prominent spine between the nostrils, and spines on the forehead and preoperculum. The preopercular spine series on the posterior and ventral edges is continuous, no gaps or indentations. The maxilla extends to the rear edge of the eye. The pelvic fins are just posterior to a vertical through the posterior edge of the pectoral fin base. To 9.4 cm SL.

Similar species
Revisions to the genus *Poromitra* (Kotlyar 2008a, 2008b) restricted the crested melamphid (*P. crassiceps*) to the tropical Atlantic Ocean, and resurrected *P. rugosa* in the northeastern Pacific. The longjaw bigscale (*Scopeloberyx robustus*) and the highsnout melamphid (*Melamphaes lugubris*) have smooth frontal ridges and no preopercular spines.

Distribution
Poromitra rugosa occur in the northeastern Pacific between lat 52–55°N, at depths of 708–886 m.

Highsnout melamphid (*Melamphaes lugubris*)



Description
Highsnout melamphids are dark brown to brown/black with black on the branchiostegal and throat. The sculptured head has smooth frontal ridges and crests over the eyes. The preoperculum is smooth. A spine between the nostrils is present or absent and, if present, is very weak. The short snout is very steep. The jaws are short and extend to the rear of the eye. There are 17 or more spines and rays in the dorsal fin. To 9.1 cm SL.

Similar species
Longjaw bigscale (*Scopeloberyx robustus*) have 15 or fewer spines and rays in the dorsal fin, and the jaw extends past the eye. *Poromitra rugosa* have preopercular spines, highly serrated frontal ridges, and the jaw reaches the rear of the eye.

Distribution
Highsnout melamphids range from the sub-Arctic North Pacific Ocean, the Bering Sea and the Sea of Okhotsk, to Japan and northern Baja California, Mexico, at depths of 150–1,500 m.

Longjaw bigscale (*Scopeloberyx robustus*)

Description
Longjaw bigscales are black to dark brown/black. The head is highly sculpted, with smooth edges on the frontal ridges and crests over the eyes. The spine on the forehead is present, but small and inconspicuous. There are no spines along the angle of the preopercle. The jaw extends well past the back of the eye. There are 15 or fewer spines and rays in the dorsal fin. To 10 cm TL.

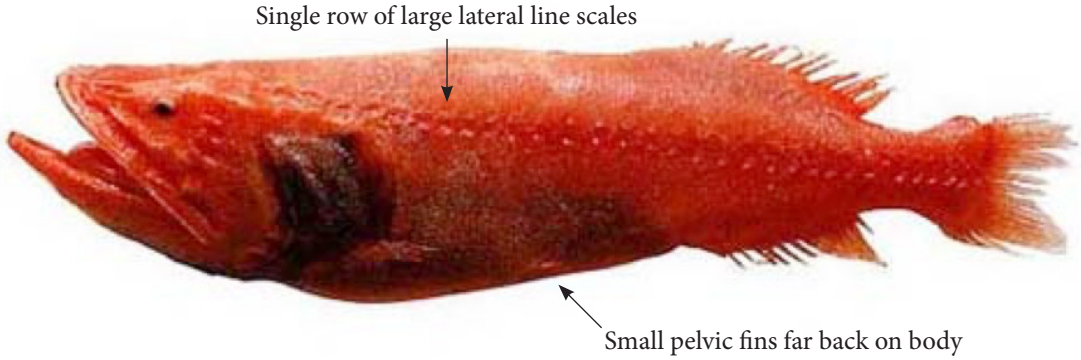
Similar species
Poromitra rugosa have prominent preopercular and forehead spines, highly serrated frontal ridges, and the jaw reaches the rear or slightly beyond the eye. Highsnout melamphids (*Melamphaes lugubris*) have a highly angled mouth, short jaws that barely reach the rear edge of the eye, and 17 or more spines and rays in the dorsal fin.

Distribution
Longjaw bigscales range the tropical and temperate waters, except the Arctic Ocean and the Mediterranean Sea, at depths of 500–3,384 m.

Barbourisiidae (Velvet Whalefish)

The velvet whalefish, also known as the red whalefish, is the only recognized species in this family. Although rare, velvet whalefish are widespread, mostly in the lower latitudes of the world's oceans. The densely packed, tiny spines that give the skin a furry appearance separate the velvet whalefish from the other whalefishes.

Velvet whalefish (*Barbourisia rufa*)



Description
Velvet whalefish are a uniform red to red/orange. The dorsal and anal fins are opposite and far back on the body; both lack spines, but the rays are thick. The pectoral fins are small but well developed. The small, well developed pelvic fins are located far back on the body. The mouth is very large. The weakly ossified jaws extend well behind the eye, with a slightly projecting lower jaw. The teeth are broad, villiform bands extending the length of each jaw. The vomerine teeth

are present or absent; if present, a round patch of villiform teeth. The lateral line is a single continuous row of pores set in large scales. The tough, loose skin is covered with densely packed minute spinules, giving the surface a velvety feel. To 39 cm TL.

Similar species
The bright red color and the densely packed spinules that give the skin a velvety feel distinguish the velvet whalefish from other similar-looking fishes.

Distribution
Velvet whalefish range from the Bering Sea and the Pacific Ocean south to California, the Hawaiian Islands, and Japan, and worldwide at lower latitudes, at depths of 120–2,000 m.

Rondeletiidae (Redmouth Whalefishes)

The redmouth whalefishes are a small group of fishes containing two recognized species. Although rare, they occur worldwide in all the temperate and tropical seas. The skin is smooth, and the lateral line is a series of pores in short vertical rows.

Redmouth whalefish (*Rondeletia loricata*)

The lateral line pores are in short, vertical rows

Description
Redmouth whalefish are black, with red or orange overtones, to dark brown/orange. The inside of the mouth is orange/red in color. Skin encases the dorsal and anal fin bases. The rayed portions of the dorsal, anal, and caudal fins are red or orange; the color fades with preservation. The dorsal and anal fins are nearly opposite and well posterior. The pectoral and pelvic fins are small but well developed. The pectoral fins are low on the body. The pelvic fin originates far posterior to the pectoral fin tips and extend beyond the whitish area around the vent, just reaching the anal fin origin. The body is blocky, laterally compressed posteriorly, and scaleless, with very soft skin. The head is large, about 50% of SL. The mouth is large. The lower jaw is slightly projecting, with a small symphyseal knob. The maxilla extends to the rear of the eye. The lateral line is a series of pores in short, vertical rows. To 11 cm SL.

Similar species
The lateral line pores arranged in short, vertical rows, lack of scales, and presence of pelvic fins distinguish the redmouth whalefish from other whalefishes.

Distribution
Redmouth whalefish occur in tropical to temperate seas worldwide, in the Pacific Ocean reported from between lat 45°N and 42°S, at depths of 100–3,500 m.

Beryciformes (Beryciforms)

The Beryciforms consist of seven families, 28 genera, and 123 species. Some species inhabit shallow tropical waters, and others are deepsea fishes with more cosmopolitan distributions. Most Beryciform fishes have short, deep, and compressed bodies, and typically have spines in one or more fins. Other characteristics of the order include having an orbitosphenoid and lacking the mesocoracoid. The pelvic fins are thoracic to subthoracic and usually have five or more rays. The caudal fin has 18–19 primary rays and a few procurrent rays dorsally and ventrally (small rays on the upper and lower edges of the caudal fin base). A somewhat protractile maxillae is usually partially included in the gape of the mouth.

Anoplogastridae (Fangtooths)

The fangtooths, also called ogrefishes, consist of two species in a single genus. These deepsea fishes occur in the temperate and tropical seas worldwide. The head and body are laterally compressed. The sculptured head is large, about one-third of SL. The body is deep anteriorly, tapering sharply to a narrow caudal peduncle. The eyes are small, eye diameter less than snout length. The mouth is large, the maxilla nearly as long as the head. The long, fanglike teeth are widely spaced and are depressible in juveniles. The fins are composed of soft rays only, no spines. The thin embedded scales give the skin a granular texture. The lateral line canal is an open groove bridged intermittently by scales.

Common fangtooth, longhorn fangtooth, ogrefish (*Anoplogaster cornuta*)

Description
The common fangtooth is uniformly black. The body and head are laterally compressed. The deep body tapers sharply to a narrow caudal peduncle. The large, sculptured head is about one-third of SL. The mouth is large, the maxilla almost as long as the head. The long, fanglike teeth are widely spaced, three pairs on the upper jaw and four pairs on the lower. The small ctenoid

scales are embedded, nonoverlapping, and elevated on short, stout pedicels, giving the skin a granular texture. The fins are spineless. Juveniles differ greatly in appearance: they are silvery, have depressible, not fixed, teeth, and very long temporal and preopercular spines. To 16 cm SL.

Similar species
Not likely to be confused with other species.

Distribution
Common fangtooth occur nearly worldwide in tropical to cold temperate seas. In the western Pacific from New Zealand to Hokkaido, Japan, and the Sea of Okhotsk, and in the mid-Pacific to British Columbia, Canada, to the Gulf of Panama and northern Chile. Adult fangtooth occur at depths of 75–4,992 m, most commonly 500–2,000 m.

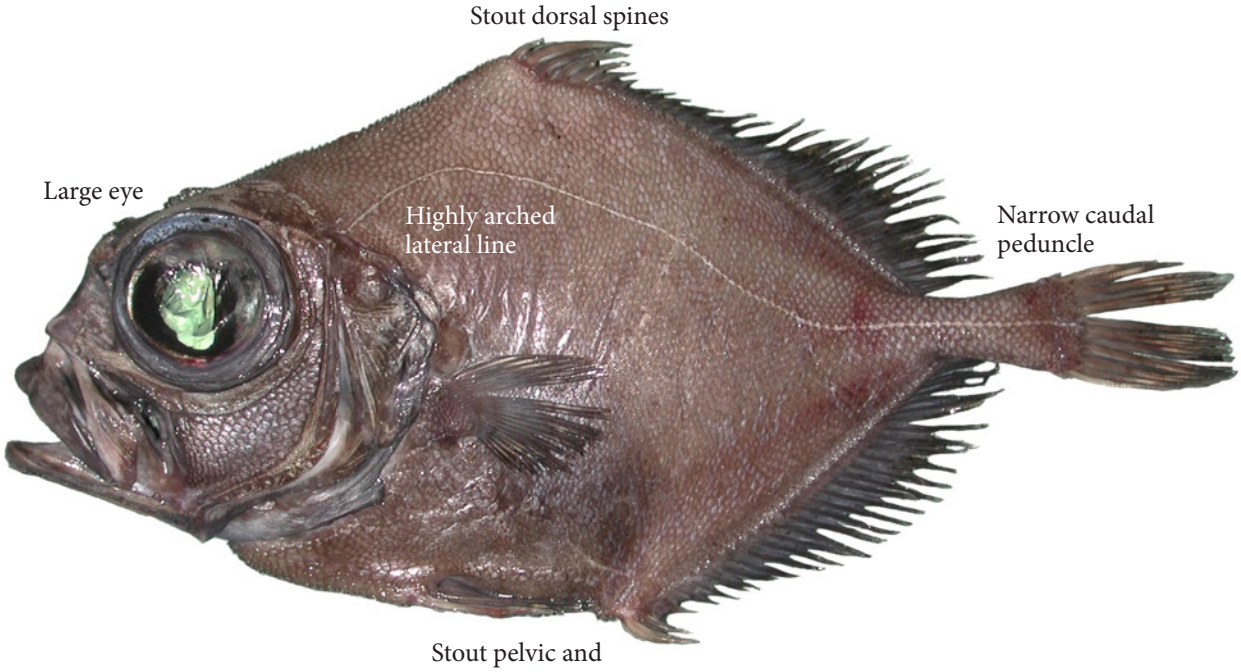
Zeiformes (Boarfishes, Dories, John Dories, and Oreos)

Zeiformes are a group of primarily deepsea fishes consisting of six families, with about 20 genera and 39 species. Zeiformes generally have deep, compressed bodies, large eyes, and oblique mouths with protractile jaws. The anterior portion of the dorsal fin has 5–10 spines separated from the soft-rayed portion by a notch. The anal fin has 0–4 spines ahead of the soft rays. The pelvic fins have one spine and 5–9 rays. The orbitosphenoid is absent. There are 5–8 branchiostegal rays, and a swim bladder is present.

Oreosomatidae (Oreos)

The oreo family consists of nine species in five genera distributed nearly worldwide, with most found in the Southern Hemisphere. The oreos have an extra life stage between the larval and juvenile stages known as the prejuvenile stage. The prejuveniles have expanded abdomens and leathery skin covered by minute tubercles. There are two rows of large tubercles on the lower sides between the pectoral and pelvic fins. During development, the abdomen shrinks and the large tubercles are lost or become greatly reduced. The body scales develop, the eyes become very large, and the color changes from light with dark spots to uniformly dark. Adult oreos have deep, compressed bodies with upturned mouths and large eyes. The small scales may be cycloid or ctenoid. There are rays and spines in the dorsal, anal, and pelvic fins. Because of the vast differences in appearance, prejuveniles and adults were once thought of as separate species.

Oxeye oreo (*Allocyttus folletti*)



Description
Adult oxeye oreos are a uniform dark brown. Juveniles are somewhat lighter, with dark spots. The deep, highly compressed body tapers sharply to a narrow caudal peduncle. The upturned mouth is protractile. The eye is very large. The dorsal and anal spines are very stout and become smaller posteriorly. Prejuveniles have two rows of large scutes between the pectoral and pelvic fins. The 3–5 scutes in the upper row are larger and more conelike than the nine or more scutes in the lower row. Both rows are reduced or absent in adults. The adults have rough, spiny scales on the belly, between the eyes, on the nape, and in rows at the bases of the dorsal and anal fins, with cycloid scales on the cheeks, sides, lateral line, and the caudal peduncle. To 42 cm TL.

Similar species
The large eye and stout dorsal and anal spines distinguish adult oxeye oreos from similarly shaped fish.

Distribution
Oxeye oreo range from Japan to the Bering Sea and the Pacific Ocean to southern California. Adults are generally on or near the bottom, at depths of 360–860 m; prejuveniles can be near the surface.

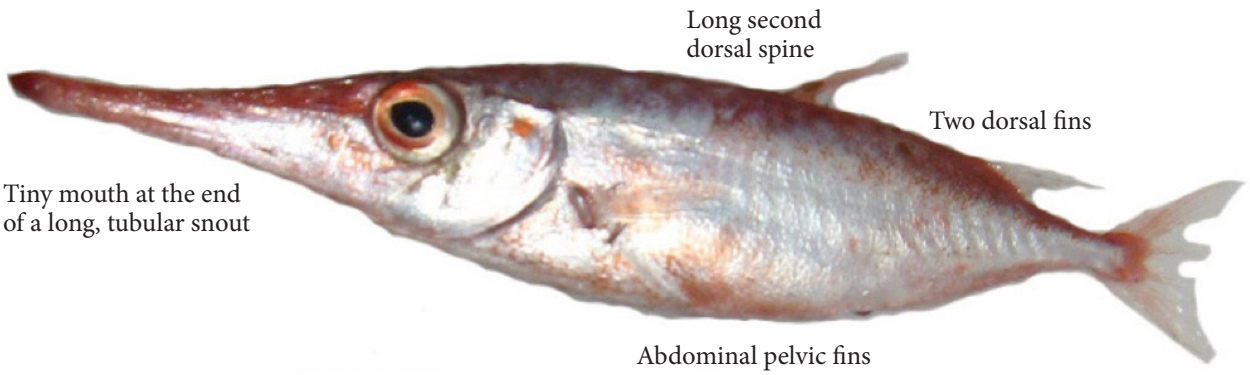
Gasterosteiformes (Pipefishes and Sticklebacks)

The Gasterosteiformes are a group of nearshore marine, brackish, and freshwater fishes consisting of two suborders, 11 families, 21 genera, and about 260 species. Many species have dermal plates, small mouths, and long snouts, and most have elongate bodies. Other characteristics include the lack of a supramaxilla, orbitosphenoid, and basisphenoid. The pelvic girdle is unattached from the cleithra, and, if present, the postcleithrum is a single bone.

Centriscidae (Snipefishes)

The snipefishes comprise approximately 12 species in five genera that occur in tropical to warm, temperate seas. Most are small and highly laterally compressed, with a very narrow (sharp) ventral edge. Thin bony plates cover most of the body. The first dorsal spine is long, sharp, and located at the extreme end of the body, and usually followed by two shorter spines.

Slender snipefish (*Macroramphosus gracilis*)



Description
Slender snipefish are dark pink/red dorsally shading to silvery with pink, orange, or green highlights laterally. The highly laterally compressed, elongate body has a sharp ventral edge. There are two dorsal fins; the spinous dorsal is short, except for a greatly elongated second spine. The pelvic fins are abdominal. To 22.8 cm TL.

Similar species
Two species are generally recognized: the longspine snipefish (*Macroramphosus scolopax*) and the slender snipefish (*M. gracilis*). Taxonomic studies (Clarke 1984, Assis 1993) indicate that body shape, growth, and feeding patterns separate the species, but individuals showing intermediate characteristics exist in all cases, so species definition remains inconclusive.

Distribution
Slender snipefish occur throughout the tropical to warm, temperate seas worldwide, at depths of 50–500 m, but most commonly 50–150 m.

Scorpaeniformes (Mailcheeked Fishes)

The Scorpaeniformes are a large group consisting of seven suborders, 26 families, about 262 genera with about 1,275 species. Most are marine, except for a few species that are freshwater. This order takes its common name, mailcheeked fishes, from the elongate third suborbital bone that extends across the cheek to the preopercle, also referred to as the suborbital stay. It is the only characteristic common to all the fishes in the order.

Scorpaenidae (Scorpionfishes and Rockfishes)

Rockfish within the geographic boundaries of the Northwest Fisheries Science Center's West Coast surveys consist of three of the five genera that comprise the family Scorpaenidae in the northeastern Pacific: *Sebastolobus*, *Sebastes*, and *Scorpaena*. Identification to species is most difficult in the genus *Sebastes* due to the high level of overlap in their morphological characteristics. The species recognized here are grouped according to the work by Hitz (1965) and Orr et al. (2000).

First, sort the fishes into the following five color groups: red, red/black, black, banded, and white-spotted red. Within the color groups, sort the species by relative head-spine strength: weak or strong. Finally, group the species according to external similarities. Because they are sorted first by color and then by head spine strength, some similar-looking species may not be grouped together.

Definitions used to determine color groups

Red: Rockfishes in this group generally have a light background color that ranges from orange and yellow to predominantly red. Often there are dark blotches on the back that can extend from the base of the dorsal fin to or below the lateral line. The blotches can be indistinct.

Red/Black: Rockfishes in this group are generally equally light and dark colored, which makes sorting into either of the previous categories difficult.

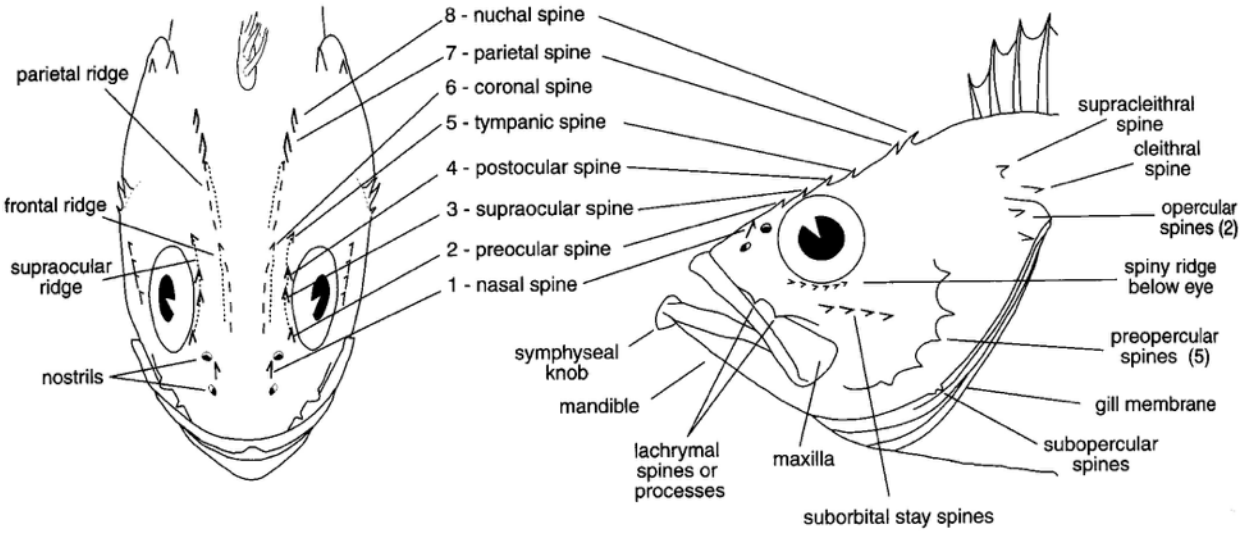
Black: Rockfishes in this group have a dark background color. Most are uniformly dark, mostly blacks and browns, and can have dark blotching and/or spots, light areas on the dark back lightening to white, gray, or pink on the ventral side, or both. Some species may also display a highly contrasting color scheme.

Banded: Rockfishes in this group have 4–6 distinct, dark vertical bands on a light background.

White-Spotted Red: Rockfishes in this group generally have a light-colored body with 2–5 pale spots above the lateral line and/or numerous small white spots on the body.

Determining head-spine strength

If the spines are easily visible, especially those nearest the orbit, they are strong. If they are not easily visible, the spines are weak. Count the head spines to see which of the eight possible pairs are present:



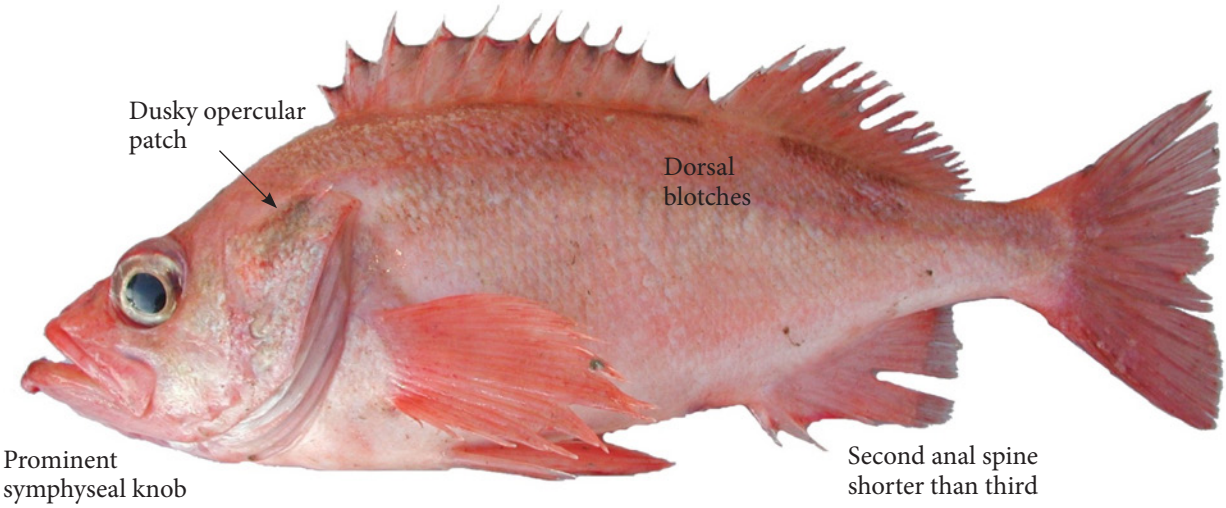
Rockfish head spines and structures

Rockfish Species by Group

Rockfish Species by Group (continued)

Weak Head Spines, Red

Pacific ocean perch, POP (*Sebastes alutus*)

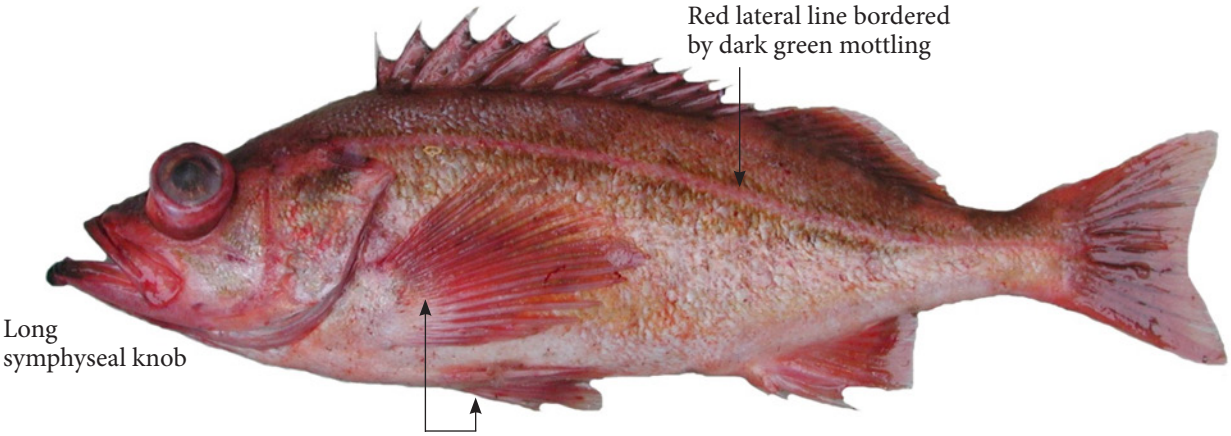


Description
Pacific ocean perch generally have head spines 1, 2, 4, 5, and 7; head spine 3 may or may not be present. The color is bright to light red dorsally, with lighter shades of the same color laterally and light ventrally. There is a dusky patch on the upper operculum, dark blotches at the dorsal fin base that do not extend below the lateral line, dark stippling on the sides, and a dark blotch on the caudal peduncle. However, these markings can fade with age and growth. The lower jaw has a very large, forward-directed symphyseal knob. To 55 cm TL.

Similar species
The redstripe rockfish (*Sebastes proriger*) has a lateral line with dark borders. The yellowmouth rockfish (*S. reedi*) has a weak and rounded symphyseal knob, yellow, red, and black blotches inside the mouth, a discrete dark opercular blotch, and diffuse dorsal blotches. The sharpchin rockfish (*S. zacentrus*) has strong head spines, dorsal blotches extending below the lateral line, a forked bar radiating from the eye, and a highly developed second anal spine that is longer than the third. The darkblotched rockfish (*S. crameri*) has dark blotches extending across the lateral line, a weak symphyseal knob, and strong head spines with a different count. The pygmy rockfish (*S. wilsoni*) has stronger head spines, usually with a different count, and a longer second anal spine than third. The Puget Sound rockfish (*S. emphaeus*) has a weak symphyseal knob, if present, stronger head spines—usually with a different configuration—and a longer second anal spine than third.

Distribution
Pacific ocean perch range from the Bering Sea to Baja California, Mexico, at depths of 100–825 m (usually 100–350 m).

Redstripe rockfish (*Sebastes proriger*)



Description
Redstripe rockfish generally have head spines 1, 2, 4, 5, and 7. The color is light red, with olive mottling dorsally shading to lighter shades of the same color pattern with a yellow wash laterally and light ventrally. The pink to red lateral line has a dark border of green mottling on each side. The lips are dark. The paired fins are generally red, but can be touched with some green and/or a yellow or yellow/red wash. The second and third anal spines are about equal in length. To 52 cm TL.

Similar species
The yellowmouth rockfish (*Sebastes reedi*) has a weak, rounded symphyseal knob, yellow, red, and black blotches inside the mouth, a discrete dark opercular blotch, and diffuse dorsal blotches. The sharpchin rockfish (*S. zacentrus*) has large dorsal blotches that extend across the lateral line, a forked bar on the operculum, different head spine configuration, and a longer second anal spine than third. The Pacific ocean perch (*S. alutus*) has a lateral line without dark borders, and the head spine count can differ. The greenstriped rockfish (*S. elongatus*) has 4–5 rows of broken dark patches, and does not have a pink to red lateral line with dark borders.

Distribution
Redstripe rockfish range from the Bering Sea to Baja California, Mexico, at depths of 100–425 m (usually 100–300 m).

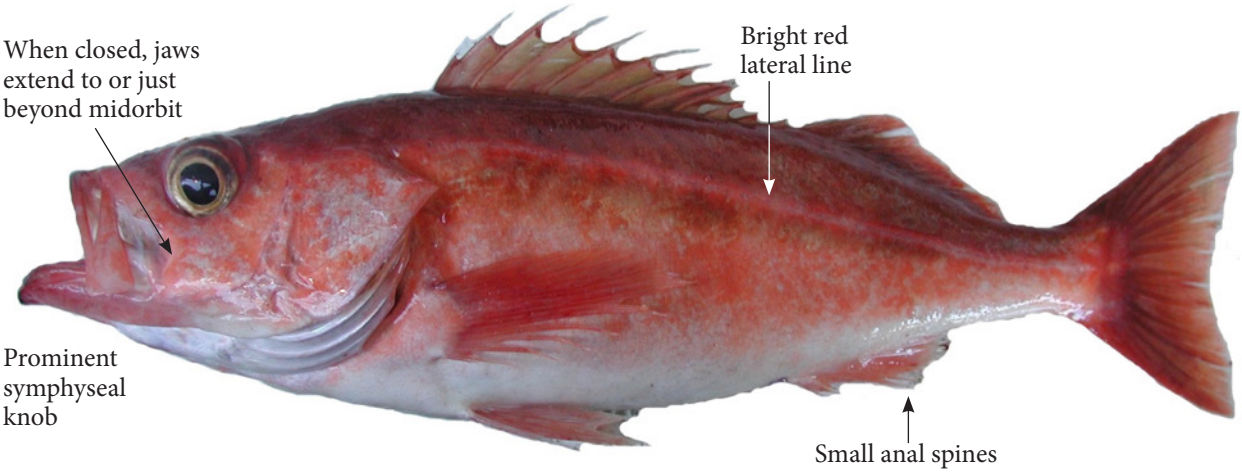
Yellowmouth rockfish (*Sebastes reedi*)

Description
Yellowmouth rockfish generally have head spines 1, 2, 3, 4, 5, and 7. The color is red mixed with yellow and orange with some diffuse darker blotches dorsally, shading to lighter shades of the same color laterally and light ventrally. Often with three vague dark bands across the head, a distinct and roughly square-shaped dark opercular blotch, a pinkish-white mouth with yellow, black, and red blotches, and a pinkish lateral line. To 58 cm TL.

Similar species
The Pacific ocean perch (*Sebastes alutus*) has a long, sharp symphyseal knob, no blotches in the mouth, discrete dorsal blotches, and a diffuse opercular blotch. The redstripe rockfish (*S. proriger*) has a light lateral line bordered top and bottom by dark mottling. The sharpchin rockfish (*S. zacentrus*) has large dorsal blotches that extend across the lateral line, a forked bar on the operculum, different head spine configuration, and a longer second anal spine than third. The rougheye rockfish (*S. aleutianus*), the shortraker rockfish (*S. borealis*), and the blackgill rockfish (*S. melanostomus*) all have stronger head spines in different configurations.

Distribution
Yellowmouth rockfish range from the Gulf of Alaska to central California, at depths to about 366 m.

Chilipepper (*Sebastes goodei*)

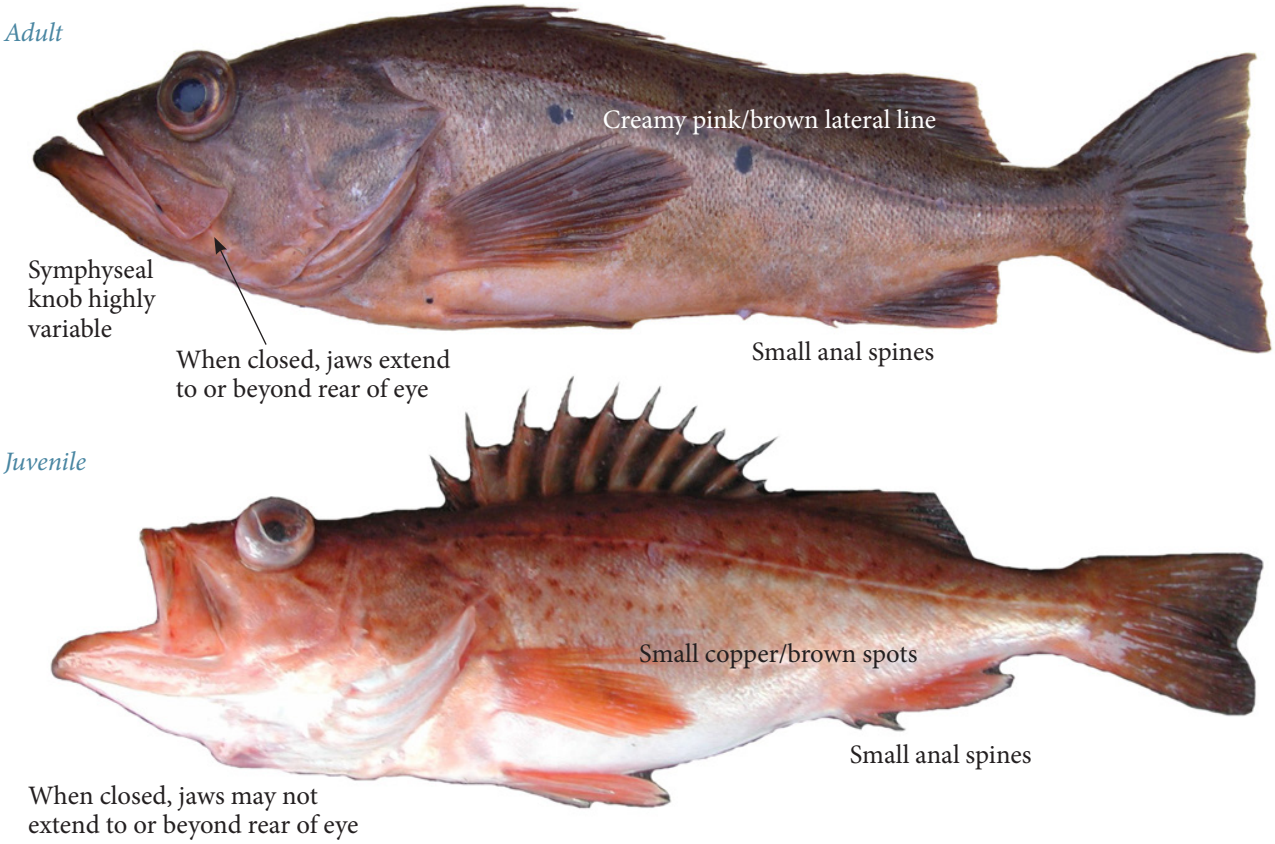


Description
Chilipepper generally have head spines 1, 3, and 7. The color is a pink/red to pink/brown dorsally that shades to lighter shades of the same color laterally and white ventrally. The paired fins are pink to red. The lateral line is bright pink to red. The anal fin has small spines and usually eight soft rays. There are generally no spines below the eye. The mouth is moderate, with jaws that extend to the middle of the eye. To 56 cm TL.

Similar species
Bocaccio (*Sebastes paucispinis*) have a larger, more massive, projecting lower jaw, a mouth that extends to the back of the eye or beyond, and a different head spine configuration. Shortbelly rockfish (*S. jordani*) have the anus well forward of the anal fin, a dark peritoneum, and a different head spine configuration.

Distribution
Chilipepper range from the eastern Gulf of Alaska to Baja California, Mexico, at depths of 50–425 m (usually 50–250 m).

Bocaccio (*Sebastes paucispinis*)

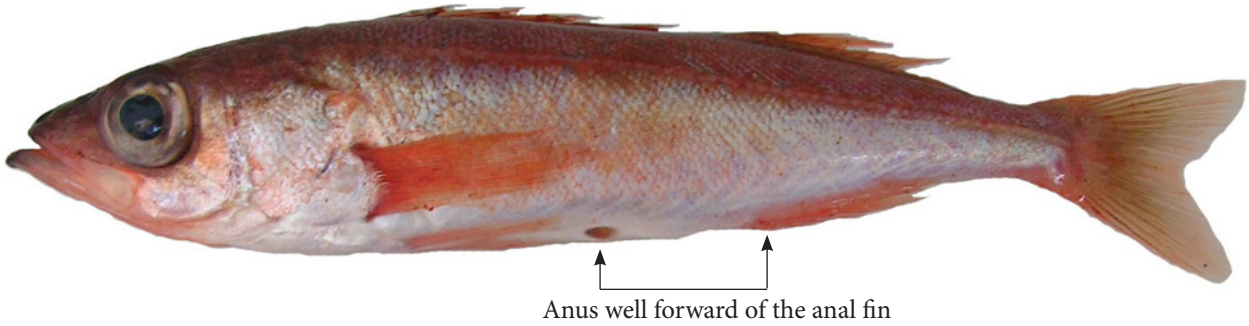


Description
Bocaccio generally only have head spines 1 and 7. The color is generally olive/brown dorsally becoming pink ventrally, with a creamy or light pink/brown lateral line. Juveniles are red/brown to olive/brown dorsally, lighter shades of the same color laterally—often with various brown or copper spotting both dorsally and laterally—and light ventrally. The lower jaw is massive, with the maxilla extending past the eye. To over 91 cm TL.

Similar species
The silvergray rockfish (*Sebastes brevispinis*) is dark gray dorsally and light ventrally, has different gill rakers and dorsal ray counts, and has large anal spines. Chilipepper (*S. goodei*) have jaws that do not extend past midorbit and a different head spine configuration.

Distribution
Bocaccio range from the western Gulf of Alaska to Baja California, Mexico, at depths of 50–475 m (usually less than 250 m).

Shortbelly rockfish (*Sebastes jordani*)

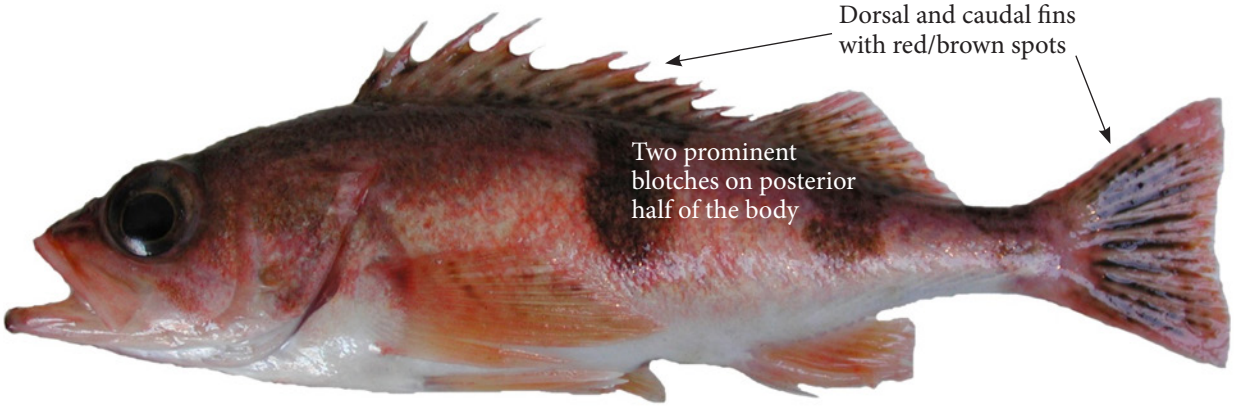


Description
Shortbelly rockfish generally have head spines 1, 2, 4, 5, and 7. The color is generally an olive/pink dorsally becoming lighter laterally and white ventrally. The fins are the same color as adjacent body parts, to reddish. The anus is located midway between the pelvic fin and the origin of the anal fin. To 32 cm TL.

Similar species
The location of the anus midway between the pelvic and anal fins distinguishes the shortbelly rockfish from the other species of *Sebastes*.

Distribution
Shortbelly rockfish range from British Columbia, Canada, to Baja California, Mexico, at depths of 50–350 m (usually less than 250 m).

Halfbanded rockfish (*Sebastes semicinctus*)



Description
Halfbanded rockfish generally have head spines 1, 2, 4, 5, and 7. The color is brown to dusky tan/pink dorsally, lighter shades of the same color laterally—with two conspicuous, dark red/brown blotches on the posterior half of the body—and white ventrally. The dorsal and caudal fin membranes have brown streaks and spots. To 25 cm TL.

Similar species
The stripetail rockfish (*Sebastes saxicola*) has strong head spines and, when present, the dark blotches are on both halves of the body. The calico rockfish (*S. dalli*) has strong head spines and is yellow/green with brown bars, splotches, and spots on the whole body.

Distribution
Halfbanded rockfish range from Oregon to Baja California, Mexico, at depths of 58–402 m.

Dwarf-red rockfish (*Sebastes rufinanus*)

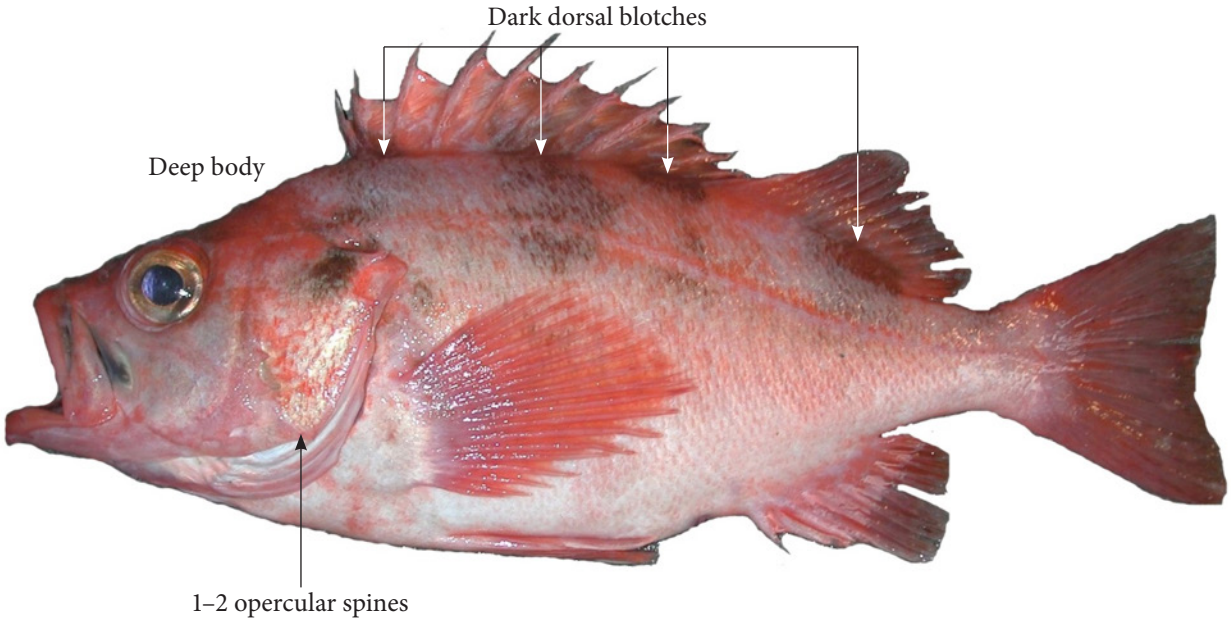
Description
Dwarf-red rockfish generally have head spines 1, 2, 4, 5, and 7. The body is dusky red dorsally, losing the dusky overtones and appearing redder laterally and bright red ventrally, with a pale lateral line. The fins are a dusky red except for the light red anal fin, which has eight rays. To 17 cm TL, possibly more.

Similar species
The aurora rockfish (*Sebastes aurora*) has fewer (24–28) gill rakers (37–48 in dwarf-red rockfish) and anal rays (5–6 vs. 8 in dwarf-red rockfish), and strong head spines.

Distribution
Dwarf-red rockfish are very rare, known from two specimens taken off San Clemente Island at an approximate depth of 183 m.

Strong Head Spines, Red

Darkblotched rockfish (*Sebastes crameri*)

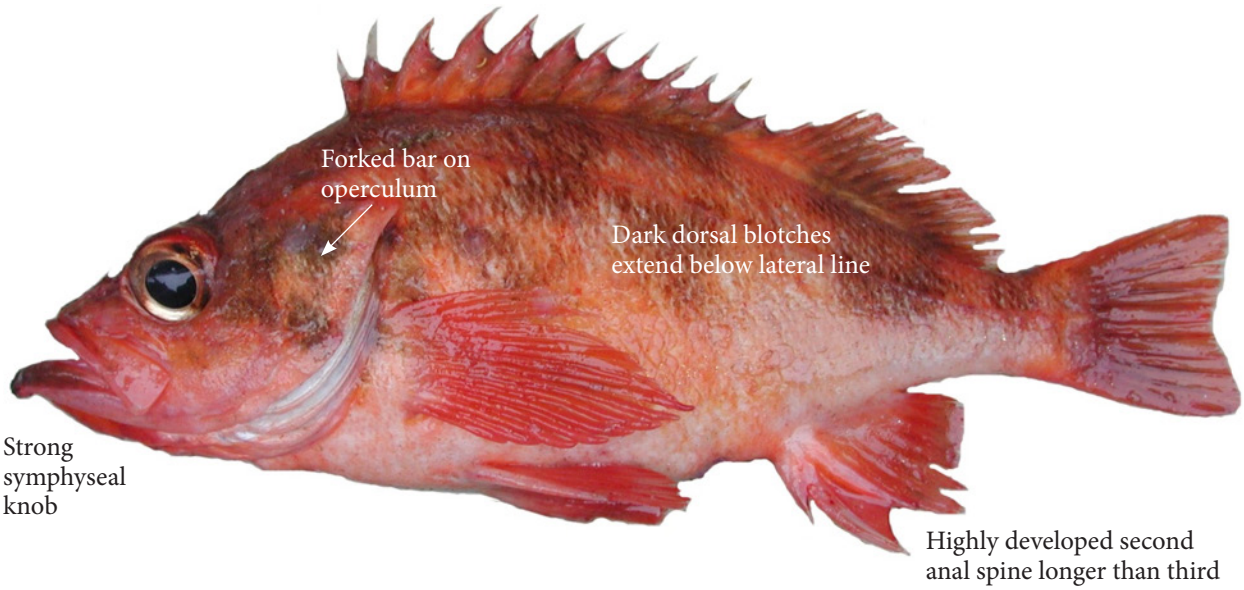


Description
Darkblotched rockfish generally have head spines 1, 2, 3, 4, 5, and 7. Head spine 8 may or may not be present. Orbital spines are usually absent. However, a single orbital spine may be present. The body is red dorsally, lighter shades of the same color laterally, and light ventrally. Five discrete black blotches extend across the lateral line. The upper branchiostegal membranes may or may not be black. The body depth at the pelvic fin insertion is greater than the head length. To 58 cm TL.

Similar species
The sharpchin rockfish (*Sebastes zacentrus*) has a highly developed second anal spine, strong symphyseal knob, smooth-edged operculum (1–2 spines in darkblotched rockfish), and a different head spine configuration. The Pacific ocean perch (*S. alutus*) has dorsal blotches that do not extend below the lateral line, a long, sharp symphyseal knob, and weak head spines that usually differ in count.

Distribution
Darkblotched rockfish range from the southeastern Bering Sea and the Aleutian Islands to southern California, at depths of 25–904 m (commonly 100–350 m).

Sharpchin rockfish (*Sebastes zacentrus*)

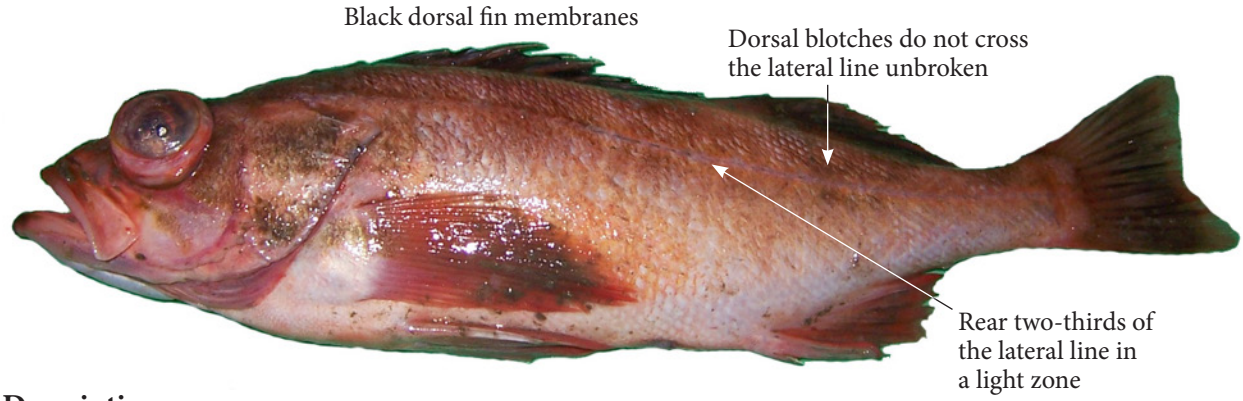


Description
Sharpchin rockfish generally have head spines 1, 2, 4, 5, and 7. The color is various shades of light red to red/orange dorsally, lighter shades of the same color laterally, and light ventrally. There are usually several vague dark blotches dorsally, with at least one extending below the lateral line, and a dark forked bar on the operculum. The second anal spine is overdeveloped, heavy, and longer than the third. The suborbital bone just below the nostril forms a prominent ridge. To 45 cm TL.

Similar species
The darkblotched rockfish (*Sebastes crameri*) has a deeper body, weak symphyseal knob, shorter second anal spine than third, and a different head spine configuration. The Pacific ocean perch (*S. alutus*) has weak head spines, usually with a different count, dorsal blotches that do not extend below the lateral line, a blotch on the operculum, and spines on the operculum. Redstripe rockfish (*S. proriger*) have a pink to red lateral line bordered on both sides by dark mottling, dorsal blotches present or absent—if present, not extending below the lateral line—no forked bar radiating from the eye, weak head spines with a different count, and the second anal spine about equal to the third. The harlequin rockfish (*S. variegatus*) has dark dorsal fin membranes, a dark caudal fin edged in red on the posterior margin, and the posterior two-thirds of the lateral line in a light zone. Puget Sound rockfish (*S. emphaeus*) have dorsal blotches that do not extend below the lateral line, the symphyseal knob is absent or, if present, very weakly developed, and no distinct dark bars radiate from the eye.

Distribution
Sharpchin rockfish range from the Aleutian Islands to southern California, at depths of 150–444 m (usually 150–300 m).

Harlequin rockfish (*Sebastes variegatus*)

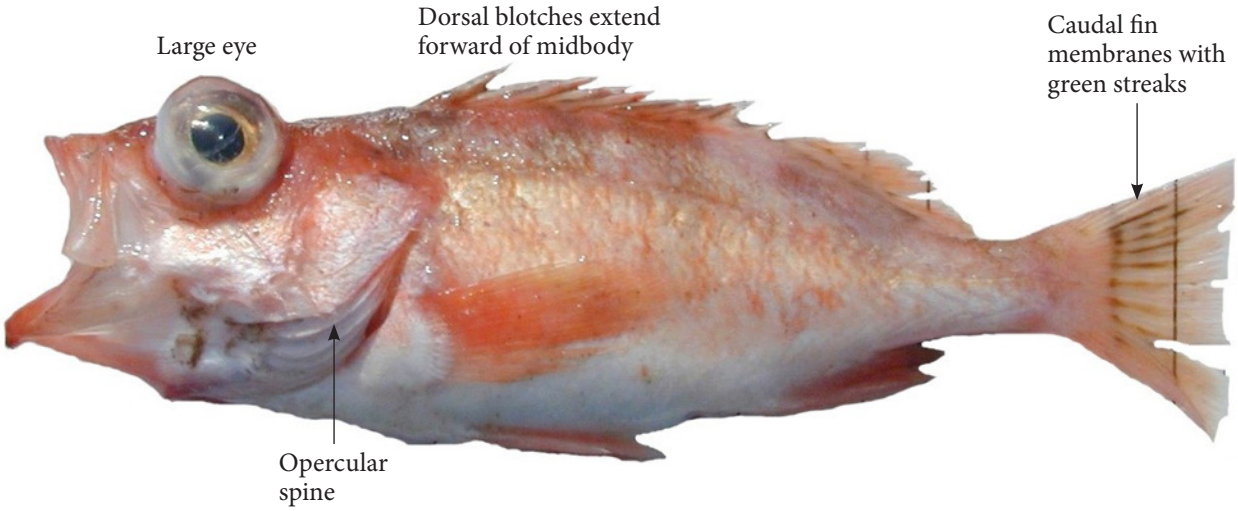


Description
Harlequin rockfish generally have head spines 1, 2, 4, 5, and 7. The color is dark red to red/pink, with dark saddles dorsally that may extend across but are broken by the lateral line, lighter shades of the same color laterally, and light ventrally. A dark, forked bar radiates from the eye. The posterior two-thirds of the lateral line are in a light zone. The spinous dorsal fin is mostly black, and the rayed dorsal and caudal fins are blackish, generally with a red edge. The anal fin is reddish with some black on the membranes. To 37 cm TL.

Similar species
In the sharpchin rockfish (*Sebastes zacentrus*), the lateral line is pigmented, the dorsal blotches cross the lateral line unbroken, the symphyseal knob is strong, and the dorsal and caudal fin membranes are red to orange.

Distribution
Harlequin rockfish range from the Bering Sea to central Oregon at depths from 6–558 m (commonly 100–300 m).

Stripetail rockfish (*Sebastes saxicola*)

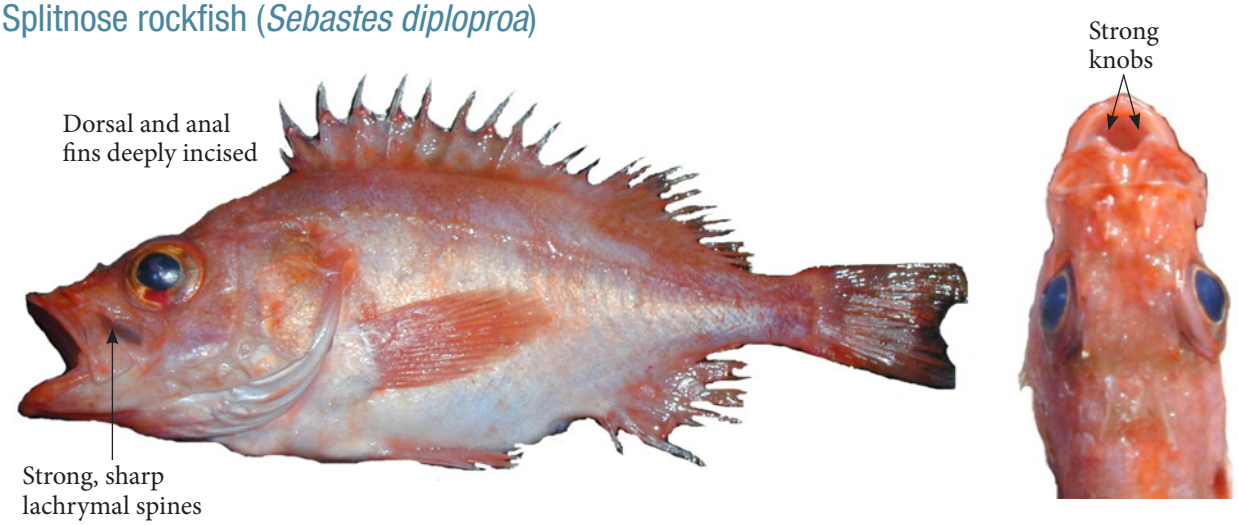


Description
Stripetail rockfish generally have head spines 1, 2, 4, 5, and 7. Adult stripetail rockfish are various shades of red mixed with pink, orange, or yellow dorsally, lighter shades of the same color laterally, sometimes with a silvery sheen, and white ventrally. The 4–5 dark dorsal bars are most prominent in juveniles, and fade with growth. The dark streaks on the caudal fin vary widely, appearing as full streaks, a series of dots and dashes, a single row of dots at the bases of the rays, or only on the upper half of the caudal fin. The eyes are large: 2.9–3.2 into the head length. There is a single spine on the lower third of the operculum. To 41 cm TL.

Similar species
Halfbanded rockfish (*Sebastes semicinctus*) have weak head spines and two diamond-shaped dark blotches, the first at midbody and the second between the first blotch and the caudal fin. Calico rockfish (*S. dalli*) have strong head spines and are yellow/green with brown bars, splotches, and spots on the whole body.

Distribution
Stripetail rockfish range from the Gulf of Alaska to Baja California, Mexico, at depths of 100–547 m.

Splitnose rockfish (*Sebastes diploproa*)



Description
Splitnose rockfish generally have head spines 1, 2, 4, 5, and 7. Spines below the eye are usually absent, but very weak if present. Rosy red dorsally, lighter shades of the same color laterally, and white ventrally, but can have strong black coloration on the body and fins. There are prominent knobs bordering a notch in the upper jaw. The strong lachrymal spines are long, come to a single, needlelike point, and often point in different directions. The dorsal and anal fins are deeply incised. To 45 cm TL.

Similar species
The aurora rockfish (*Sebastes aurora*) has a different head spine configuration and the lachrymal spines are stout and triangular. The chameleon rockfish (*S. phillipsi*) has spines below the eye, lachrymal spines with multiple points and a different head spine count.

Distribution
Splitnose rockfish range from the Gulf of Alaska to Baja California, Mexico, at depths of 94–274 m (commonly 171–274 m).

Aurora rockfish (*Sebastes aurora*)

Description
Aurora rockfish generally have head spines 1, 2, 3, 4, 5, 7, and 8; head spine 6 may or may not be present, and a single orbital spine may be present as well. The color is a uniform, creamy light red to pink dorsally, lighter shades of the same color laterally, and light ventrally. The dentigerous knobs are small. The second anal spine is longer than the third. The lachrymal spines are broad-based and triangular. To 41 cm TL.

Similar species
The splitnose rockfish (*Sebastes diploproa*) has strong lachrymal spines and a different head spine configuration. Chameleon rockfish (*S. phillipsi*) have multipointed lachrymal spines (a single point in aurora rockfish), 2–4 orbital spines, and 36–39 gill rakers (24–28 in aurora rockfish).

Distribution
Aurora rockfish range from the Gulf of Alaska to southern California, at depths of 164–768 m.

Chameleon rockfish (*Sebastes phillipsi*)

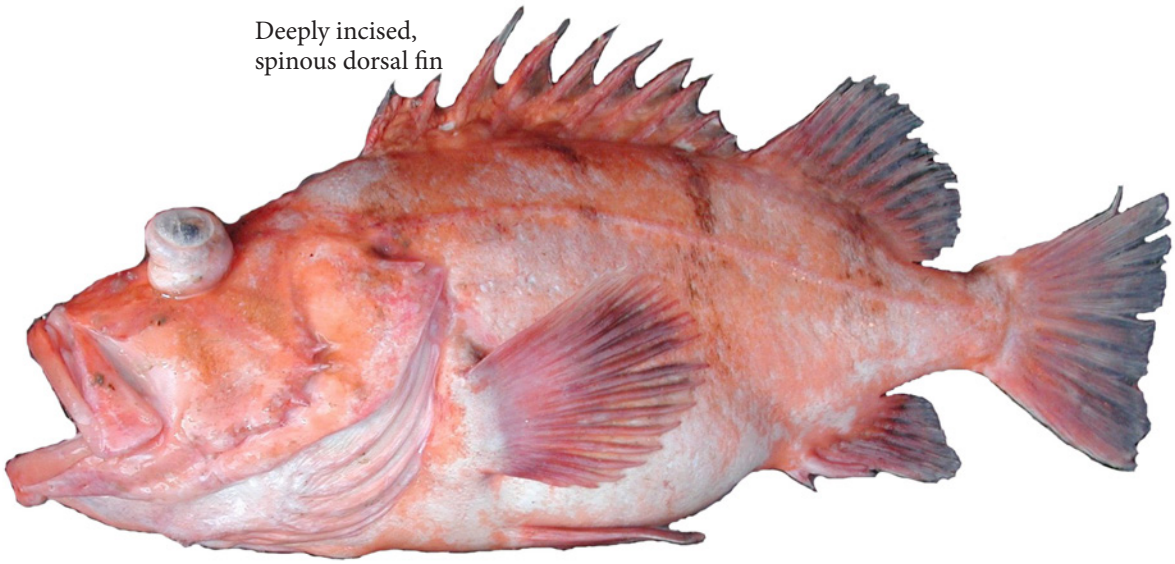
Description
Chameleon rockfish generally have head spines 1, 2, 3, 4, 5, 7, and 8, with head spine 6 present or absent. The strong lachrymal spines have multiple points, and there are 2–4 orbital spines. The color is whitish-pink, changing to golden crimson upon death and exposure to air. Usually vague dusky streaks dorsally from the rear margin of the eye to the second dorsal fin origin. To 43 cm TL.

Similar species
Splitnose rockfish (*Sebastes diploproa*) do not have head spines 3, 6, and 8. Their lachrymal spines are single-pointed (multipointed in chameleon rockfish), and they have no orbital spines (2–4 in chameleon rockfish). Aurora rockfish (*S. aurora*) have stout, triangular, single-pointed lachrymal spines (multipointed in chameleon rockfish), 0–1 orbital spines (2–4 in chameleon rockfish), and 24–28 gill rakers (36–39 in chameleon rockfish).

Distribution
Chameleon rockfish range from Point St. George, northern California, to Nine Mile Bank, southern California, at depths of 174–300 m.

Cowcod (*Sebastes levis*)

Adult



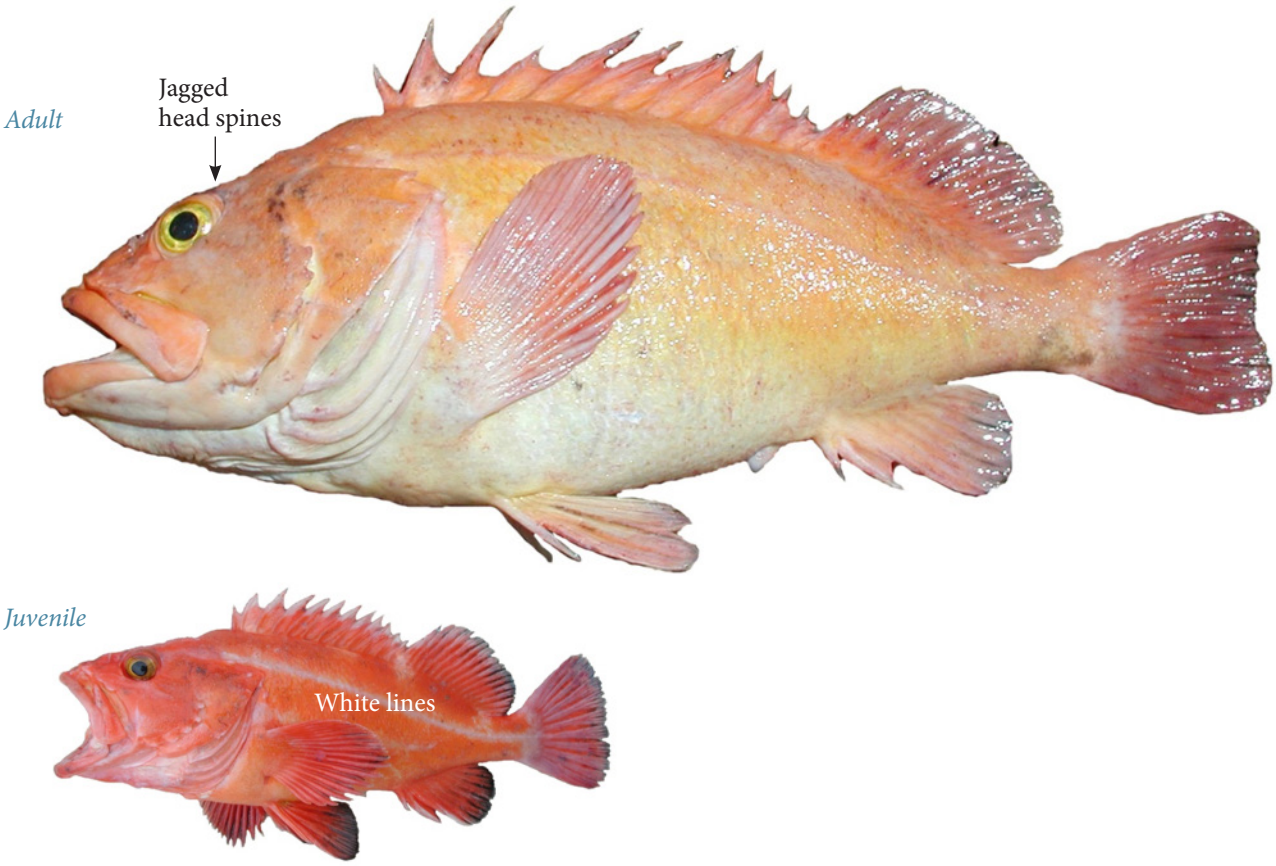
Juvenile

Description
Cowcod generally have head spines 1, 2, 3, 4, 5, and 7. The color ranges from pink to orange/pink dorsally, lighter shades of the same color laterally, and light ventrally. The 4–5 narrow, somewhat irregular bars fade with age. The membranes on the spinous dorsal are deeply incised. The second anal spine is longer than the third. To 94 cm TL or more.

Similar species
The tiger rockfish (*Sebastes nigrocinctus*) has head spines 6 and 8.

Distribution
Cowcod range from to Oregon to Baja California, Mexico, at depths of 152–366 m, but usually less than 244 m.

Yelloweye rockfish (*Sebastes ruberrimus*)

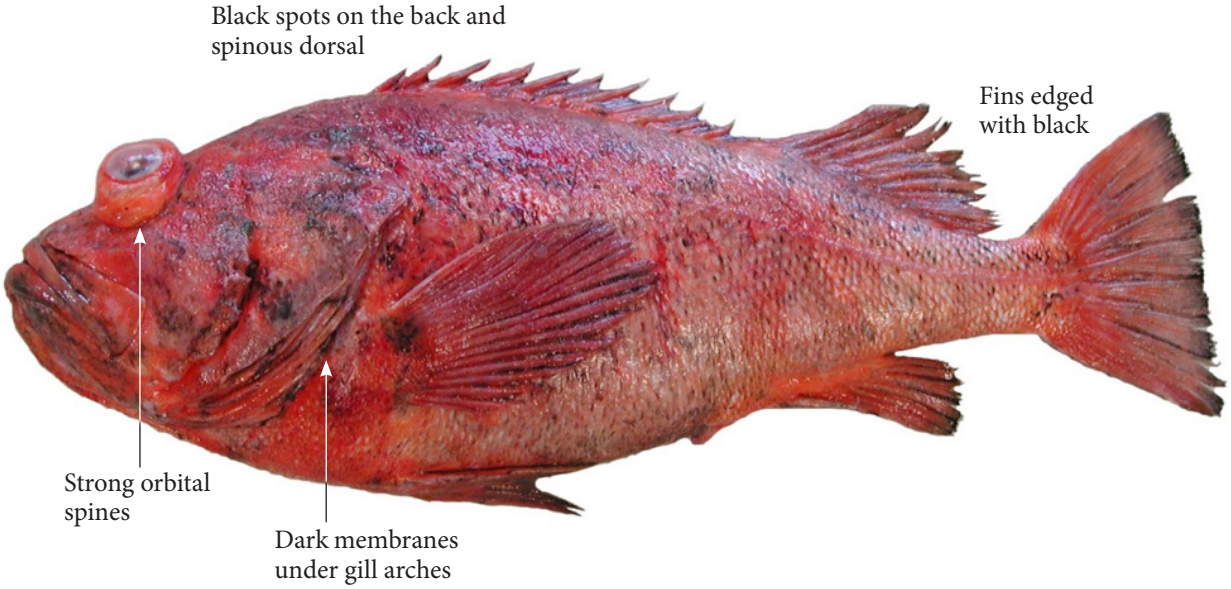


Description
Yelloweye rockfish head spines are very strong, appearing jagged—almost serrated or rugose. They generally have head spines 1, 2, 3, 4, 5, and 7. Body color varies with age. Adults are orange/red to orange/yellow dorsally with lighter shades of the same color laterally and light ventrally. The fins are orange/red to orange/yellow and may have black borders. Juveniles are generally dark orange or orange/yellow dorsally, somewhat lighter shades of the same color laterally, and light ventrally. Juveniles also have two prominent lateral white lines: the long upper line is on or just above the lateral line, and the shorter second line is just above the pectoral fin. Both lines fade with age, but can persist well into adulthood. The spinous dorsal can have a white border, with the rayed dorsal having white or light margins and a black edge. The caudal, anal, pelvic, and pectoral fins may also have black edges. Both adults and juveniles have yellow eyes. To 91 cm TL.

Similar species
Rougheye rockfish (*Sebastes aleutianus*), blackspotted rockfish (*S. melanostictus*), shortraker rockfish (*S. borealis*), and blackgill rockfish (*S. melanostomus*) are red with various dark mottling and have head spine 8 (not present in yelloweye).

Distribution
Yelloweye rockfish range from the Aleutian Islands to Baja California, Mexico, at depths of 15–549 m (commonly 91–180 m).

Blackspotted rockfish (*Sebastes melanostictus*)

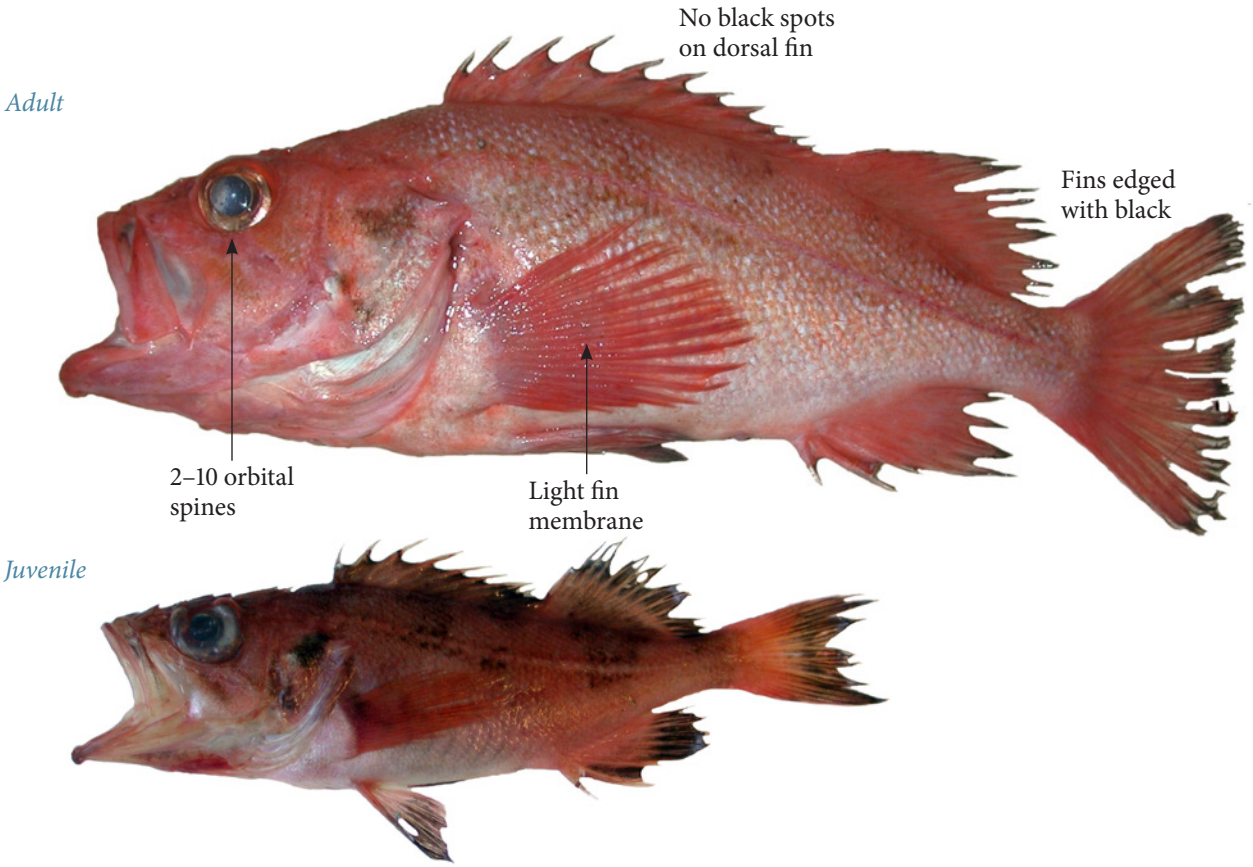


Description
Blackspotted rockfish generally have head spines 1–8. The body has a dark red or red/orange background with dark or black overtones and various black spots and blotches. These black spots and blotches extend onto the membrane of the spinous dorsal fin. The fins have black edges. The membranes of the pectoral, pelvic, anal, and caudal fins can be dusky or black. The membrane under the gill arches is dark or black. A series of 2–10 orbital spines form a prominent, raspy ridge just below the front of the eye. There are 2–10 spines on the lower edge of the orbit. The gill rakers are moderately long and stout. To 97 cm TL.

Similar species
Due to its overlapping morphological characteristics with rougheye rockfish (*Sebastes aleutianus*), *S. melanostictus* is identified by the dark coloration. Rougheye rockfish are a light red to orange/red without dark spots on the dorsal surface or the dorsal fin membranes, and have light to dusky gill membranes. Blackgill rockfish (*S. melanostomus*) have a black mouth, gill cavity, and branchiostegal membranes, only one orbital spine (if present), and are usually missing the sixth head spine. Yelloweye rockfish (*S. ruberrimus*) are orange/red to yellow/red, and lack orbital spines and head spine 8.

Distribution
Blackspotted rockfish have been collected in the western Pacific off the coast of Japan, north through the Kuril and Aleutian Islands and the Bering Sea, then south to Coronado Bank in southern California, at depths of 84–490 m.

Rougheye rockfish (*Sebastes aleutianus*)

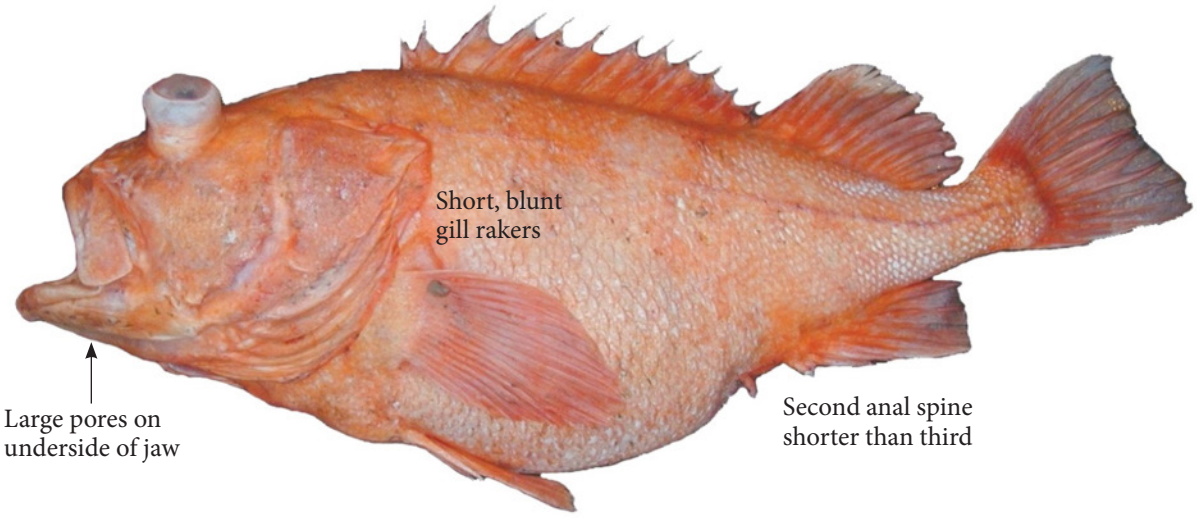


Description
Rougheye rockfish generally have head spines 1–8. The color is red dorsally shading to light red or pink laterally, often with vague spotting and faint bars, and light ventrally. The dorsal, ventral, anal, and caudal fins may be edged with black; the edging is more prominent in juveniles. The inside of the mouth is red/black or red/white. The posterior portion of the lateral line is often light. There are 2–10 spines on the lower edge of the orbit. The gill rakers are long and stout. To 97 cm TL.

Similar species
Blackspotted rockfish (*Sebastes melanostictus*) are darker red, with various black spots and blotches on the body extending onto the dorsal surface and the dorsal fin membranes. The gill membranes are dark or black. Blackgill rockfish (*S. melanostomus*) have a black mouth, gill cavity, and branchiostegal membranes, only one orbital spine (if present), and are usually missing the sixth head spine. The shortraker rockfish (*S. borealis*) has short, blunt gill rakers, orange coloration, and generally lacks spines below the eye. The yelloweye rockfish (*S. ruberrimus*) is red/orange to yellow/orange, has rugose head spines, and is missing head spine 8.

Distribution
Rougheye rockfish range across the North Pacific from Japan and the Kamchatka Peninsula to the Bering Sea, and the Aleutian Islands to southern California (although they become increasingly rare south of about central Oregon), at depths of 55–875 m.

Shortraker rockfish (*Sebastes borealis*)



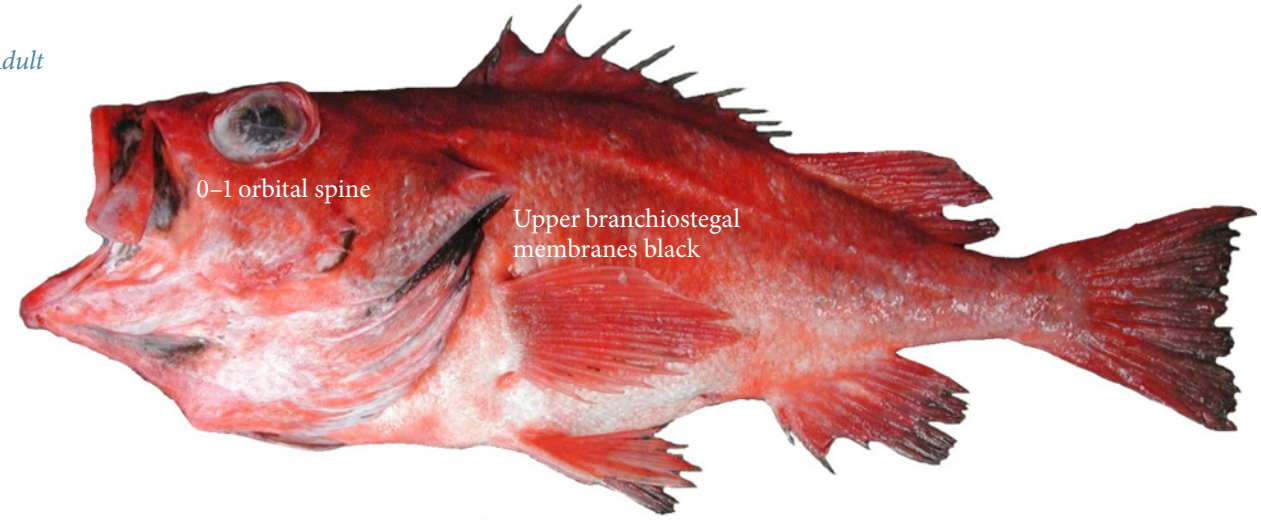
Description
Shortraker rockfish generally have head spines 1, 2, 3, 4, 5, 7, and 8; head spine 6 may or may not be present. Orbital spines are usually absent; however, some specimens can have a single orbital spine. The color ranges from pink to orange/pink with reddish fins sometimes edged with black. Faint, dusky red bars may be present dorsally; if present, they are more prominent in young specimens. The mouth and gill cavities are red with dark blotches. The underside of the lower jaw has large and prominent pores. The gill rakers are short, stout, and blunt. The second anal spine is shorter than the third. To 120 cm TL.

Similar species
Rougheye rockfish (*Sebastes aleutianus*) and blackspotted rockfish (*S. melanostictus*) have long and pointed gill rakers and 2–10 spines below the eye. The blackgill rockfish (*S. melanostomus*) has a black mouth, gill cavity, and upper branchiostegal membranes. Yelloweye rockfish (*S. ruberrimus*) have rugose head spines, and head spine 8 is absent. Large redbanded rockfish (*S. babcocki*) can have a similar color pattern, but lack head spines 3, 6, and 8, and the second anal spine is longer than the third.

Distribution
Shortraker rockfish range across the North Pacific from Japan and the Okhotsk and Bering Seas to the Aleutian Islands and south to southern California, at depths of 55–875 m.

Blackgill rockfish (*Sebastes melanostomus*)

Adult



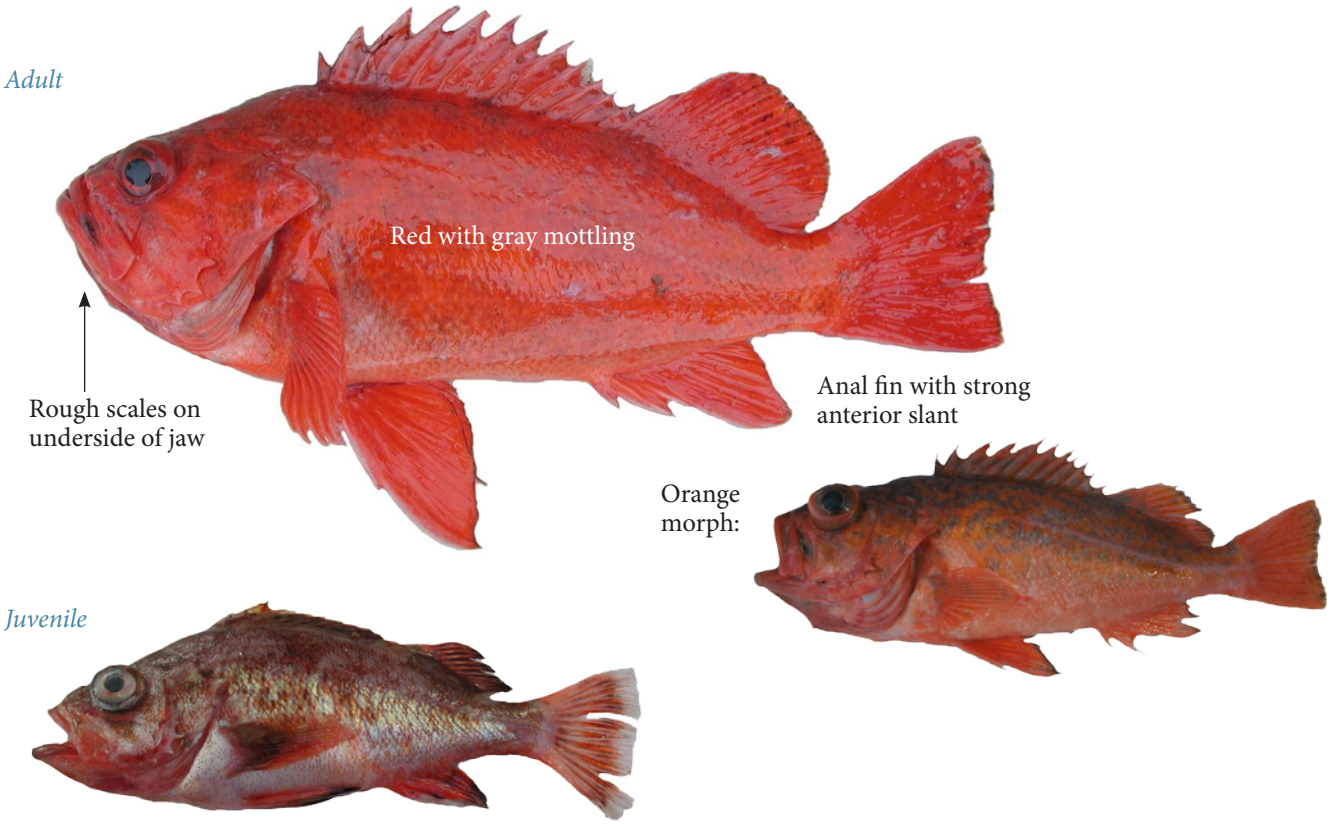
Juvenile

Description
Blackgill rockfish generally have head spines 1, 2, 3, 4, 5, 7, and 8. In adults, the color is red, dark dorsally and somewhat lighter laterally, with a light red to pink or pink/white ventral side. There may be dusky bars dorsally. The upper edge of the gill cover, upper branchiostegal membranes, and the inside of the mouth are black. In juveniles, the body is light red to pink with distinct dark bars dorsally that extend below the lateral line. To 61 cm TL.

Similar species
Blackspotted rockfish (*Sebastes melanostictus*) and rougheye rockfish (*S. aleutianus*) have 2–10 orbital spines and head spine 6. Shortraker rockfish (*S. borealis*) are pink to pink/orange with a red or red/black mouth, branchiostegal membranes, and gill cavity. Yelloweye rockfish (*S. ruberrimus*) is red/orange or orange/yellow, and has rugose head spines with a different count.

Distribution
Blackgill rockfish range from central Vancouver Island, British Columbia, Canada, to central Baja California, Mexico, at depths of 87–768 m (commonly 250–600 m).

Vermilion rockfish (*Sebastes miniatus*)



Description
Vermilion rockfish generally have head spines 1, 2, 3, 4, 5, and 7. The color is a dark red to orange/red or orange/yellow, with gray or gray/blue mottling dorsally and laterally. The mottling can become pronounced and obscure the red. The eye in adults, especially in the northern part of their range, can be red. The red to orange fins are often edged in black. In lighter specimens, three obscure orange stripes radiating from each eye may be visible. The mouth is red and has rough scales on the underside of the lower jaw. The rear edge of the anal fin has a strong anterior slant. Generally, there are 38 (35–43) or fewer gill rakers on the first gill arch. To 76 cm TL.

Similar species
The canary rockfish (*Sebastes pinniger*) has a smooth lower jaw and orange fins, and the rear two-thirds of the lateral line is highlighted in gray. The sunset rockfish (*S. crocotulus*) is orange, has 39 or more gill rakers on the first arch (usually 38 or less in vermilion rockfish), and is generally found deeper than 100 m.

Distribution
Vermilion rockfish range from the Gulf of Alaska to Punta Baja, Mexico, at depths up to 100 m.

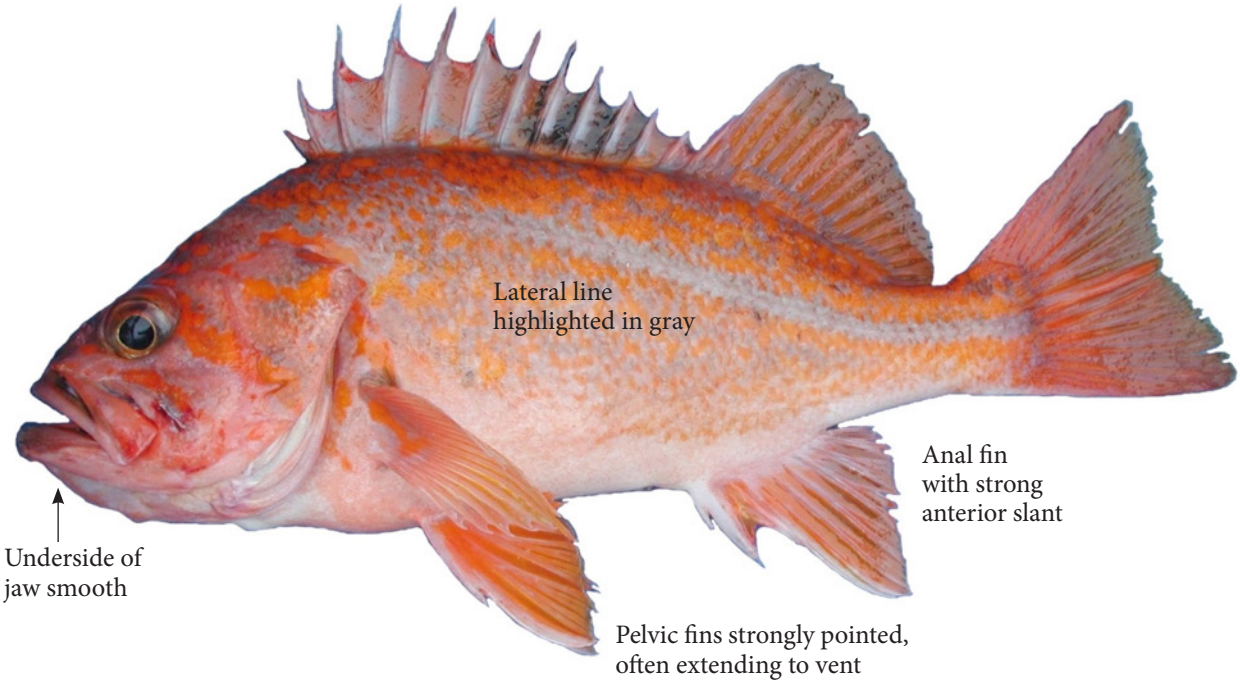
Sunset rockfish (*Sebastes crocotulus*)

Description
Sunset rockfish are orange/yellow to orange/red dorsally and lighter shades of the same color laterally, with various darker mottling that can become very pronounced and obscure the body coloring. The fins range from orange/yellow to orange/red. In lighter specimens, three obscure orange stripes radiating from each eye may be visible. The mouth is orange or orange/yellow and has rough scales on the underside of the lower jaw. There are generally 39 or more gill rakers on the first arch. To approximately 76 cm TL.

Similar species
The vermilion rockfish (*Sebastes miniatus*) is usually dark red, generally has 38 or fewer gill rakers on the first arch, a deeper caudal peduncle, and occurs at somewhat shallower depths. Canary rockfish (*S. pinniger*) have a smooth lower jaw and a highlighted lateral line.

Distribution
Sunset rockfish occur from Monterey, California, to Punta Colonet, Mexico, but are most common in the Southern California Bight deeper than 100 m.

Canary rockfish (*Sebastes pinniger*)

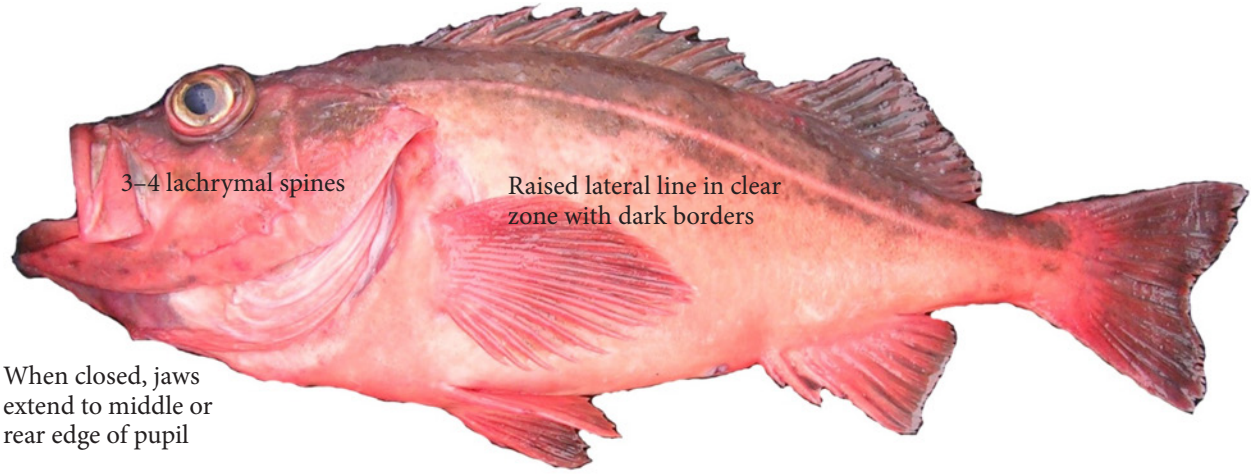


Description
Canary rockfish generally have head spines 1, 2, 3, 4, 5, and 7. The body is bright orange or orange/yellow mottling on a gray or gray/blue background, giving an orange appearance. There are three vague orange stripes across the head. The fins are bright orange. The pelvic and anal fins can have a white leading edge, with the anal fin having a strong anterior slant. The posterior two-thirds to three-fourths of the lateral line are highlighted in gray. The scales on the lower jaw are smooth. To 76 cm TL.

Similar species
The vermilion rockfish (*Sebastes miniatus*) and sunset rockfish (*S. crocotulus*) have rough scales on the underside of the lower jaw.

Distribution
Canary rockfish range from the western Gulf of Alaska to Punta Colonet, northern Baja California, Mexico, at depths from the surface to 838 m (commonly 50–250 m).

Mexican rockfish (*Sebastes macdonaldi*)

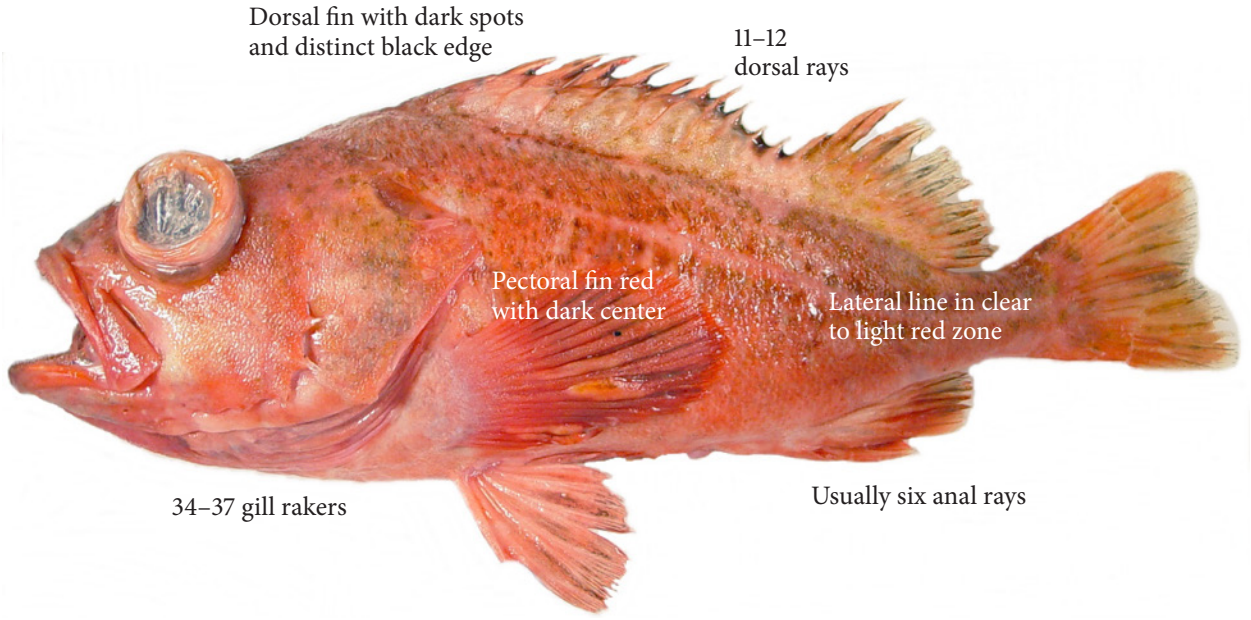


Description
Mexican rockfish generally have head spines 1, 2, 3, 4, 5, and 7; head spine 8 may or may not be present. The color is dark black to black/red or brown/red, with some light-colored, irregularly shaped patches dorsally. Their head and sides are red with various dark blotches. At times, there are two dark bars on the side of the head. The first bar starts below the eye and radiates back, and the second radiates from the eye to the jaw. The raised pink/red lateral line is in a clear zone bordered by the darker color of the back and sides. The dorsal and caudal fins are dark. The pectoral fin is red and can have black membranes, and generally 19 rays. The pelvic and anal fins are reddish with some black. The mouth is large. The jaws extend to the middle or rear edge of the pupil, and there are 3–4 lachrymal spines. The lower jaw projects slightly beyond the upper, and has a strong symphyseal knob. To 66 cm TL.

Similar species
Bocaccio (*Sebastes paucispinis*) have a different head spine count, and the jaws extend to or beyond the back of the eye.

Distribution
Mexican rockfish range from Point Sur in central California to southern Baja California, Mexico, and the central Gulf of California to Guaymas on mainland Mexico, at depths of 76–238 m.

Semaphore rockfish (*Sebastes melanosema*)

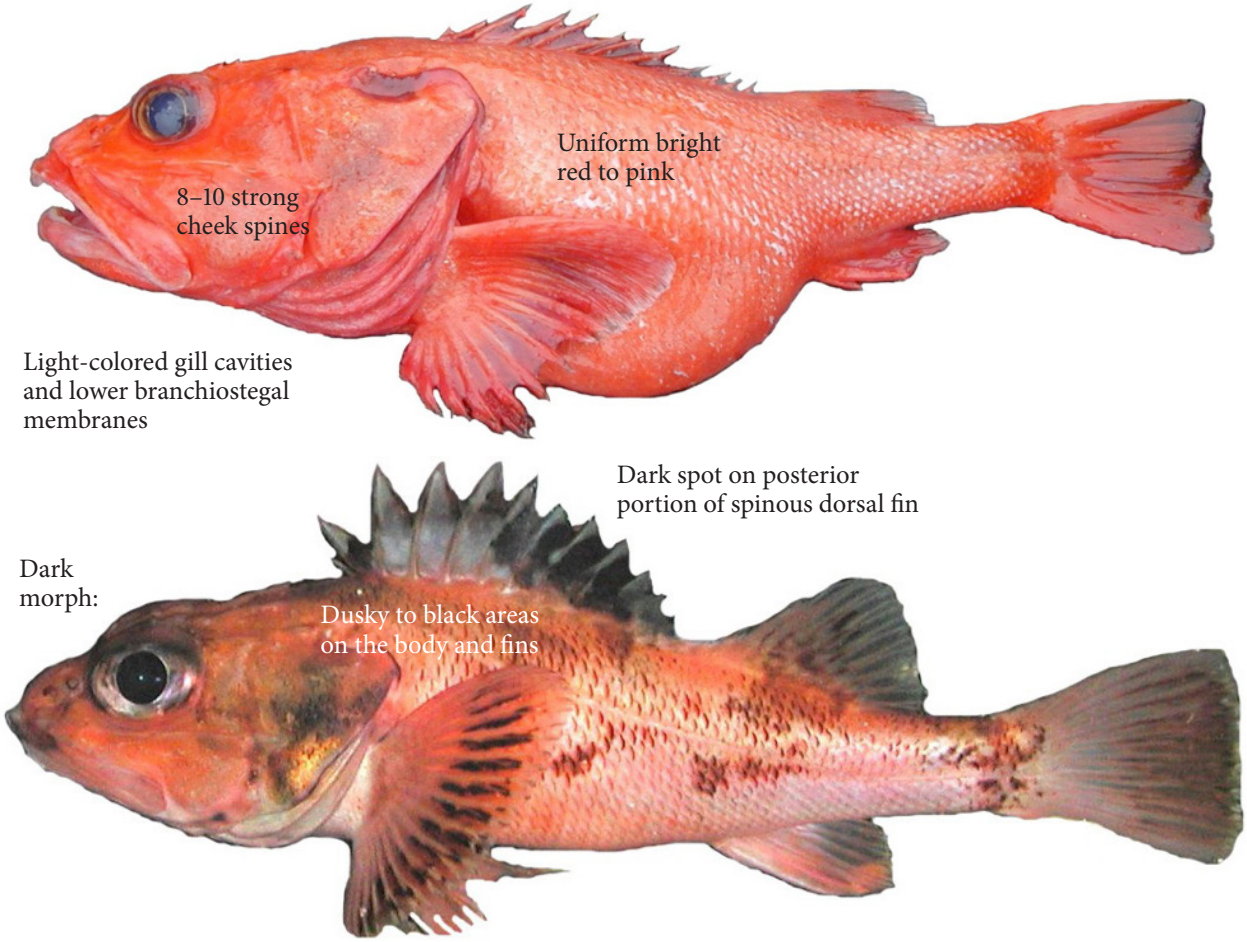


Description
Semaphore rockfish generally have head spines 1, 2, 4, 5, and 7. This is a small red to dusky red fish with variously shaped light blotches dorsally. The red coloration on the back gradually lightens down the sides and ventrally. There are 30–33 pores in the lateral line, which is in a clear or light red zone. The dorsal and anal fins are red with distinct black dots and a prominent black edge. The caudal fin is red. The pectoral fin color can be light, but is generally reddish on the front and rear portions with a dark center. The mouth has a dusky-colored lining and sometimes a dark blotch on the underside of the opercle. To 15.5 cm TL.

Similar species
The combination of six soft anal fin rays, 11–12 dorsal rays, and 34–37 gill rakers on the first arch separate the semaphore rockfish from most other *Sebastes* species.

Distribution
Semaphore rockfish range from central Oregon to southern Baja California, Mexico, at depths of 137–490 m.

Shortspine thornyhead, SST (*Sebastolobus alascanus*)

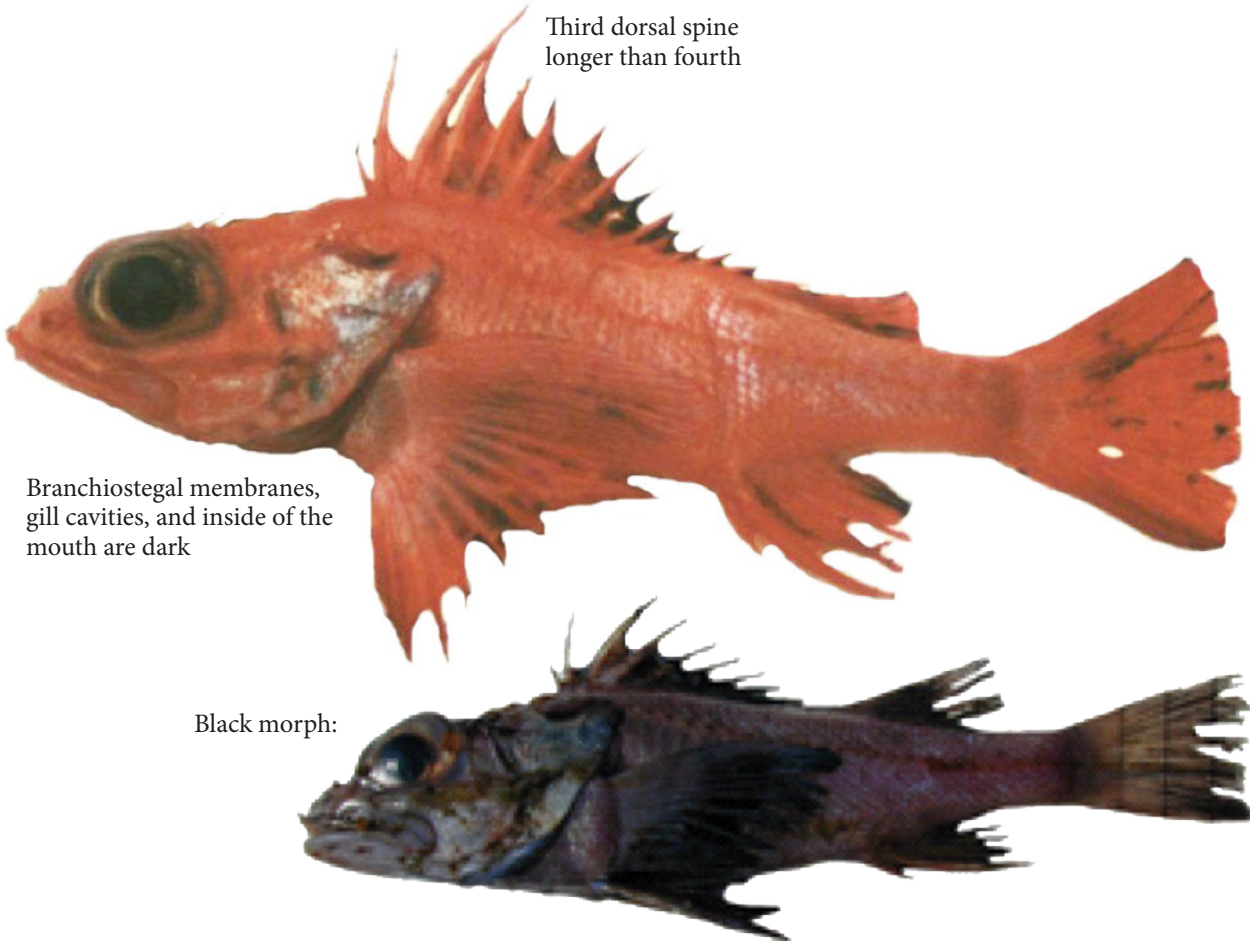


Description
The shortspine thornyhead generally has head spines 1, 2, 3, 4, 5, 7, and 8. A series of 8–10 strong cheek spines form a prominent ridge below the eye. There are 15–17 dorsal spines; the third spine is shorter than the fourth. The color ranges from bright red to pink, often with dusky to black areas on the fins and body. There can be a dark spot on the posterior part of the spinous dorsal fin. Small specimens can have a series of small white spots on the pectoral fin rays arranged so they appear to form vertical rows. The back of the mouth, gill cavities, and lower branchiostegal membranes are light-colored. The maxilla extends to or past the rear of the eye. To 75 cm TL.

Similar species
Longspine thornyhead (*Sebastolobus altivelis*) have a long third dorsal spine, a dark mouth, gill cavities, and branchiostegal membranes, and a maxilla that extends to the rear of the pupil.

Distribution
Shortspine thornyhead range from the Seas of Okhotsk and Japan to the northern Bering Sea and the Aleutian Islands to Isla Cedros in central Baja California, Mexico, at depths of 20–1,524 m (commonly 150–450 m).

Longspine thornyhead, LST (*Sebastolobus altivelis*)



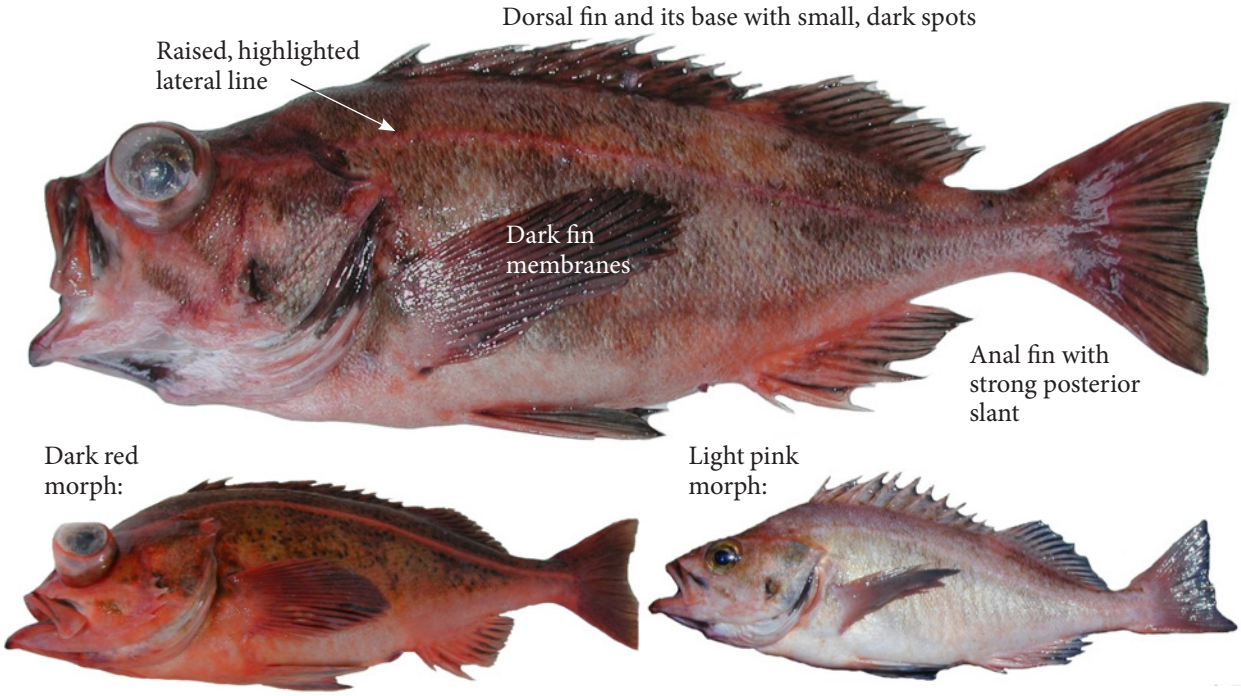
Description
The longspine thornyhead generally has head spines 1, 2, 3, 4, 5, 7, and 8. There are 8–12 strong cheek spines forming a prominent ridge below the eye. There are 15–16 dorsal spines; the third spine is the longest, longer than the fourth spine. The body color is bright red with black areas on the fins and body and a dark spot on the posterior part of the spinous dorsal fin. The entire animal may also be completely black. The back of the mouth and gill cavities are dark, with the maxilla extending to the rear of the pupil. To 39 cm TL.

Similar species
Shortspine thornyhead (*Sebastolobus alascanus*) have a short third dorsal spine, a light-colored mouth, gill cavities, and branchiostegal membranes, and a maxilla that extends to or past the rear of the eye.

Distribution
Longspine thornyhead range from the western Gulf of Alaska to Cabo San Lucas, southern Baja California, Mexico, at depths of 201–1,756 m (commonly 500–1,300 m).

Weak Head Spines, Red/Black

Bank rockfish (*Sebastes rufus*)



Description
Bank rockfish generally have head spines 1, 2, 3, 4, 5, and 7. The color varies from gray to red or pink with various levels of black overlay and spotting, sometimes with small dark spots laterally and on the dorsal fin base and dorsal membranes. The membranes of the soft dorsal, pectoral, pelvic, and anal fins are blackish. The anal fin has a strong posterior slant. The slightly raised, pink to dark red lateral line is generally in a clear zone. To 55.2 cm TL.

Similar species
The combination of a strong posterior slant to the anal fin, black fin membranes, and red coloration on the body distinguish the bank rockfish from other closely related rockfish species.

Distribution
Bank rockfish range from British Columbia, Canada, to central Baja California, Mexico, at depths of 31–454 m (commonly 90–360 m).

Strong Head Spines, Red/Black

Greenstriped rockfish (*Sebastes elongatus*)

Description
Greenstriped rockfish generally have head spines 1, 2, 4, 5, and 7. There are 4–5 irregular, broken olive stripes dorsally and laterally on a pink background. Usually pale red or pink to white ventrally. The lateral line is in a distinct pink zone. The dorsal, anal, and caudal fins are dusky with greenish areas. The pectoral and pelvic fins are pale pink or red. The mouth and gill cavities are mostly white with some pink. The second anal spine is longer than the third, and the rear edge of the anal fin is nearly vertical or with a slight anterior slant. To 43 cm TL.

Similar species
The redstripe rockfish (*Sebastes proriger*) has a lateral line bordered with mottled green stripes, the second anal spine is shorter than the third, and its head spines are weak.

Distribution
Greenstriped rockfish range from the Gulf of Alaska to Baja California, Mexico, at depths of 25–425 m.

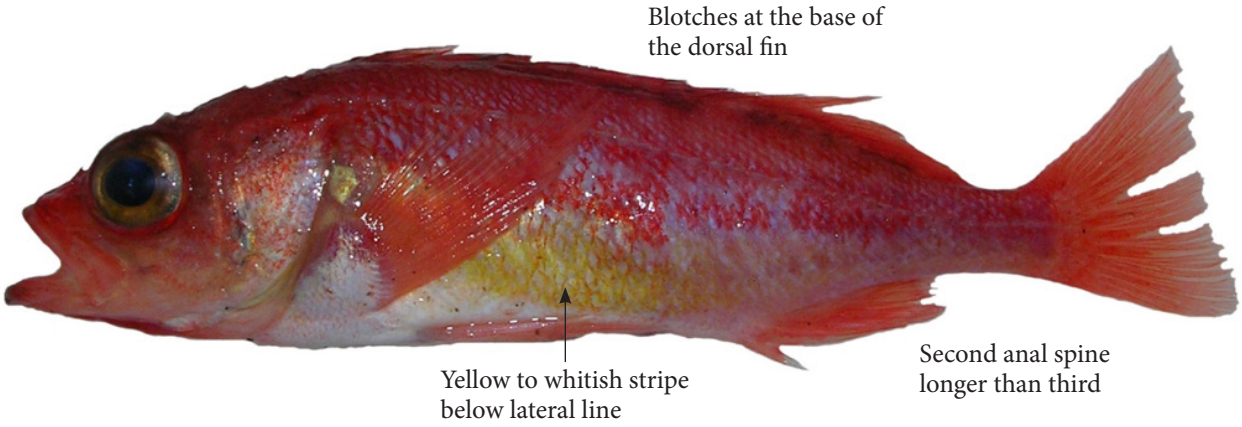
Copper rockfish (*Sebastes caurinus*)

Description
Copper rockfish generally have head spines 1, 2, 4, 5, and 7. The color pattern exhibits a wide range of blotchy colors, usually dark brown and olive washed with copper/pink and often splashed with dull yellow dorsally, becoming white laterally and ventrally that may turn copper/pink with prolonged exposure to the air. Two or more brown, copper/orange, or yellowish bars radiate back from the eye. The posterior two-thirds of the lateral line are in a light area. To 66 cm TL.

Similar species
Brown rockfish (*Sebastes auriculatus*) have a dark blotch on the operculum, a light brown body with darker brown mottling, and a different head spine configuration. Gopher rockfish (*S. carnatus*) generally have six gray or pink blotches on the body (none on copper rockfish) and a dark lateral line broken by blotches. Quillback rockfish (*S. maliger*) have deeply incised dorsal fin membranes, orange/brown spots on the anterior portion of the body, and a different head spine configuration.

Distribution
Copper rockfish range from the western Gulf of Alaska to central Baja California, Mexico, at depths from shallow intertidal areas to 183 m.

Pygmy rockfish (*Sebastes wilsoni*)



Description
Pygmy rockfish generally have head spines 1, 2, 4, 5, and 7. The color is light brown to red tinged with red or orange, darker dorsally, with lighter sides and white ventrally. Generally, up to four dark blotches along the dorsal fin base can extend onto the fin, but can be vague. The stripe on or below the lateral line appears yellow to whitish; underwater, it appears dark brown. To 23 cm TL.

Similar species
Puget Sound rockfish (*Sebastes emphaeus*) have a different body color, no stripe below the lateral line, and seven anal fin rays. Pacific ocean perch (*S. alutus*) have a strong symphyseal knob, the second anal spine shorter than the third, and weak head spines in a different configuration.

Distribution
Pygmy rockfish range from the northern Gulf of Alaska to Cortez Bank in southern California and possibly Baja California, Mexico, at depths of 29–383 m.

Puget Sound rockfish (*Sebastes emphaeus*)

Description
Puget Sound rockfish generally have head spines 1, 2, 4, 5, and 7. The color is a copper red with indefinite, faint olive blotches and green bands radiating from the eye. The spinous dorsal is green/red to red with bright red at the tips of the spines. The outer soft dorsal is bright red with a dark base. The paired anal fins are clear, or sometimes brilliant red. To 18 cm TL.

Similar species
The pygmy rockfish (*Sebastes wilsoni*) has a yellow to whitish stripe at or below the lateral line (which appears brownish-red underwater) on fresh specimens out of the water. The sharpchin rockfish (*S. zacentrus*) has dorsal blotches that extend below the lateral line, a prominent symphyseal knob, and dark stripes behind the eye. Pacific ocean perch (*S. alutus*) have a prominent symphyseal knob, weak head spines typically with a different count, and the second anal spine shorter than the third.

Distribution
Puget Sound rockfish range from Prince William Sound and the Gulf of Alaska to northern California, at depths from 3–366 m.

Calico rockfish (*Sebastes dalli*)

Description
Calico rockfish generally have head spines 1, 2, 4, 5, and 7. The color pattern is very distinct, with dark brown bars on the sides that slant back toward the tail (especially on adults), and dark spots and mottling that may fade on adults over a lighter brown to yellow/green color. The caudal fin has brown membranes between the rays, making it looked striped. To 20 cm TL.

Similar species
Stripetail rockfish (*Sebastes saxicola*) are red, with diffuse dark bars that do not slant backward and an opercular spine. Halfbanded rockfish (*S. semicinctus*) are red, have weak head spines, and do not have dark bars forward of midbody.

Distribution
Calico rockfish range from San Francisco, California, to central Baja California, Mexico, at depths from intertidal to 256 m (usually 20 m and deeper).

California scorpionfish (*Scorpaena guttata*)

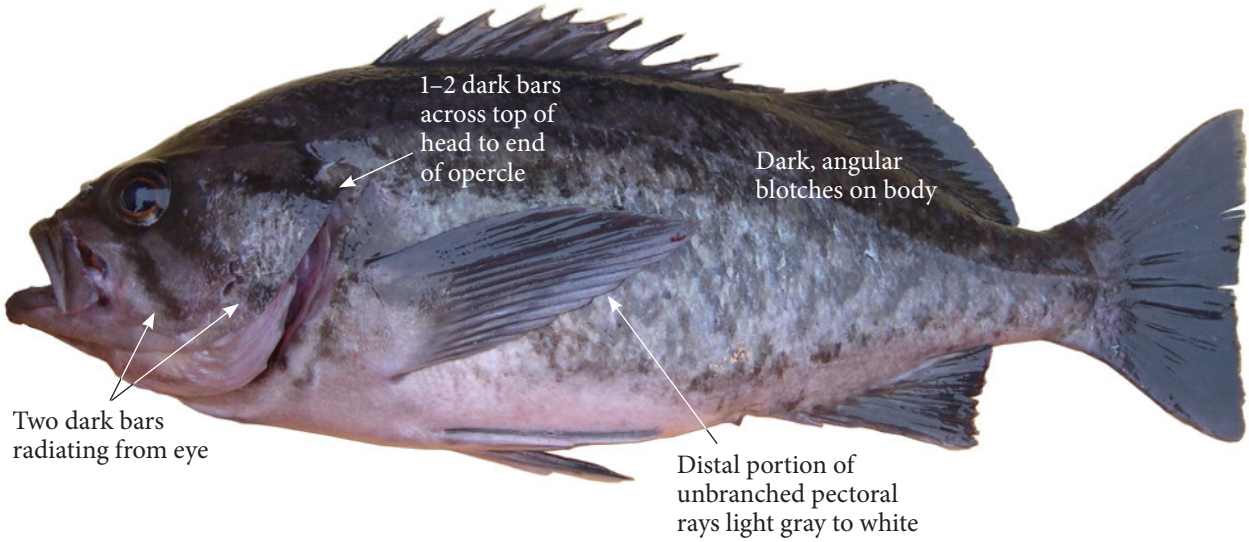
Description
California scorpionfish are various shades of orange, red, or brown, with light and dark mottling and numerous spots that vary in size and color. Scales cover the short, stocky body. The head spines are strong, with a prominent row of cheek spines. The jaws are large, extending to or past the rear of the eye. There are teeth on the palatines (a pair of bones on the roof of the mouth). The dorsal fin has 12 spines and 9–10 soft rays. To 43 cm TL.

Similar species
Cottidae (sculpins) have bodies not completely scale-covered, and lack the prominent row of cheek spines. Rainbow scorpionfish (*Scorpaenodes xyris*) are small, with 13 dorsal spines, a dark spot on the gill cover, and no palatine teeth.

Distribution
Although very rare north of Point Conception, California, California scorpionfish range from Santa Cruz in central California to Baja California, Mexico, and the Gulf of California, at depths to 183 m (but most commonly inside 55 m).

Weak Head Spines, Black

Blue rockfish (*Sebastes mystinus*)



Description

Blue rockfish generally have head spines 1 and 2; head spines 3, 4, and 5, singularly or in any combination, may or may not be present. When closed, the jaws form a 30° angle with the anterior tip of the lower jaw, equal to or just slightly anterior to the tip of the upper jaw. The flat to slightly rounded posterior tip of the maxilla usually extends to midorbit, but can extend to the rear of the pupil. A small symphyseal knob may or may not be present. The color varies from gray/blue to green/blue, with large, dark, angular blotches that become more pronounced with age and growth and no speckling on the sides, and white ventrally. There are two distinct dark bars on the head radiating from and/or through the orbit to the ventral margin of the opercle. There are 1–2 additional dark bars across the dorsal surface of the head behind the orbit terminating on the opercular flap. The pectoral fins, usually with 18 (16–19) rays, are mostly dark blue/black with the distal half of the unbranched fin rays light gray to white. The pelvic fins are light gray with blue tips and a white to light gray pelvic fin spine. The uniformly dark and unspotted dorsal fin is usually with 13 (12–15) spines and 15 (13–17) soft rays. The gray/blue to dark gray anal fin has three spines and usually nine (8–10) soft rays. The uniformly dark caudal fin has a thin, unpigmented posterior margin. To 53 cm TL.

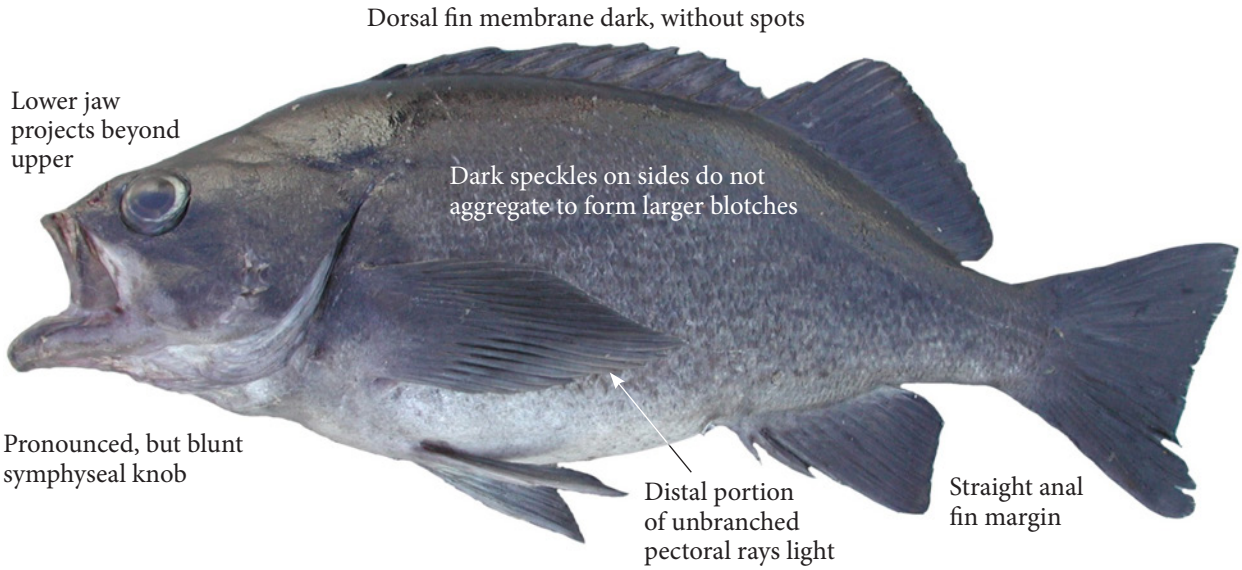
Similar species

The deacon rockfish (*Sebastes diaconus*) is generally a solid color pattern with a distinct speckling pattern on the sides (angular blotches in blue rockfish). When its mouth is closed, the lower jaw projects beyond the upper (jaws are equal or with the lower jaw slightly beyond the upper in blue rockfish), with a prominent symphyseal knob. Black rockfish (*S. melanops*) have a rounded anal fin, larger mouth, typically fewer dorsal and anal rays, no head spine 2, and spots on the dorsal fin membranes.

Distribution

Blue rockfish range from central Oregon to northern Baja California, Mexico, at depths to 30 m.

Deacon rockfish (*Sebastes diaconus*)



Description

Deacon rockfish head spines are generally absent, with the exception of moderately weak head spine 1. When closed, the upper and lower jaws of the terminal mouth form a 30–35° angle, with the slightly rounded posterior edge of the maxilla extending to midpupil. With growth, the projecting lower jaw becomes more pronounced. The symphyseal knob is pronounced, but blunt. Body coloration varies from dark brown to shades of blue/gray, becoming somewhat lighter posteriorly and white to light gray ventrally. Small dark speckles, which do not form larger blotches, cover the sides. The pronounced adult speckling pattern tends to be darker in juveniles, making the speckling appear indistinct or absent. There are two dark, oblique bars radiating posteriorly below the orbit, and 1–2 dark bars over the cranium and opercular flap. The pectoral fins, usually with 18 (16–19) rays, are dark dorsally, with the distal half of the unbranched fin rays light gray to white. The pelvic fins have one (usually white) spine and five light rays with blue tips. The uniformly dark dorsal fin usually has 13 (12–13) spines and 16 (14–17) rays. The uniformly dark anal fin has three spines and 8–9 (usually nine) rays. The caudal fin is blue/black, with a thin light or unpigmented posterior margin. To 53 cm TL.

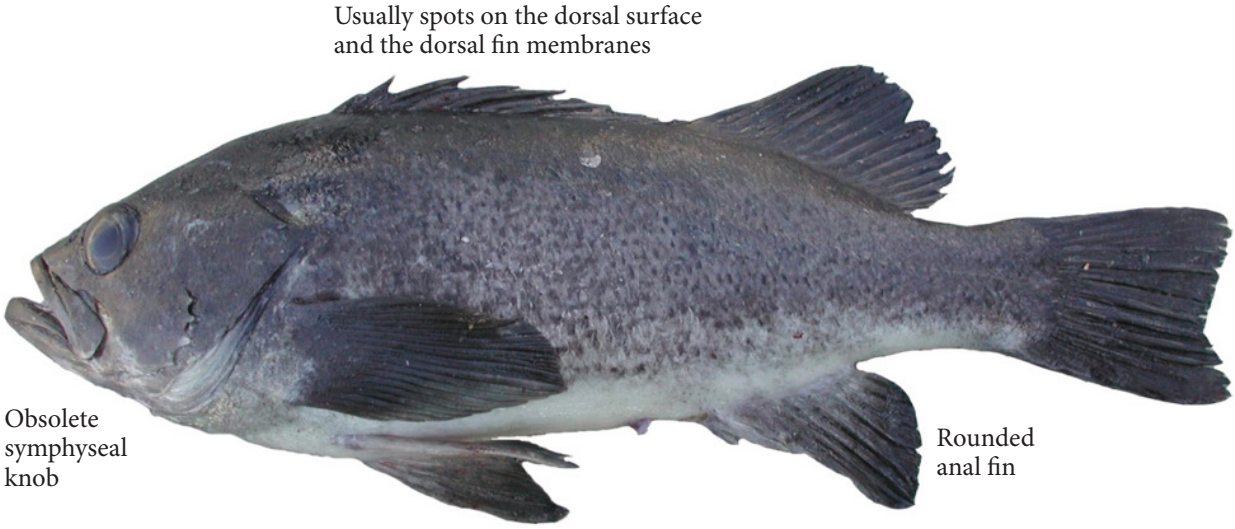
Similar species

Blue rockfish (*Sebastes mystinus*) have a blotchy color pattern, the lower jaw is equal to the upper or slightly protruding, and the symphyseal knob is very weak to absent. Black rockfish (*S. melanops*) have a rounded anal fin, a larger mouth, spots on the dorsal fin membranes, and typically fewer dorsal and anal fin rays.

Distribution

Deacon rockfish range from Vancouver Island, British Columbia, Canada, to Morro Bay, California, at depths of 8–50 m. However, due to the limited amount of material available for examination from British Columbia and Alaska, the northern edge of their range is unclear.

Black rockfish (*Sebastes melanops*)

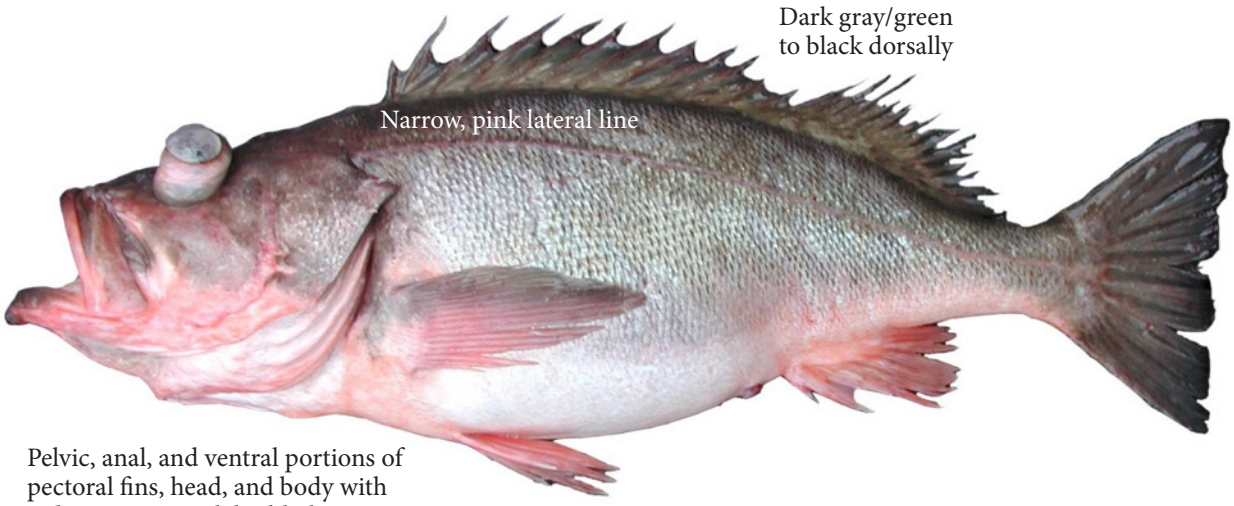


Description
Black rockfish generally have head spine 1; head spine 4 may or may not be present, but all spines present are weak. They are dark gray to black with light gray mottling dorsally that extends onto the dorsal fin membranes, lighter shades of the same colors with some mottling laterally, and light gray or gray/white ventrally. The fins are dark gray to black. The anal fin has a rounded posterior margin. The mouth is moderately large, with the maxilla extending to anywhere from the rear of the pupil to the rear edge of the eye. If present, the symphyseal knob is very weak. To 65 cm TL.

Similar species
Deacon rockfish (*Sebastes diaconus*) and blue rockfish (*S. mystinus*) have smaller mouths, with jaws that extend to midorbit, a straight posterior edge to the anal fin, no spots on the dorsal surface or dorsal fin membranes, and different head spine counts.

Distribution
Black rockfish range from the Aleutian Islands and Gulf of Alaska to southern California, at depths from the surface to 366 m.

Silvergray rockfish (*Sebastes brevispinis*)

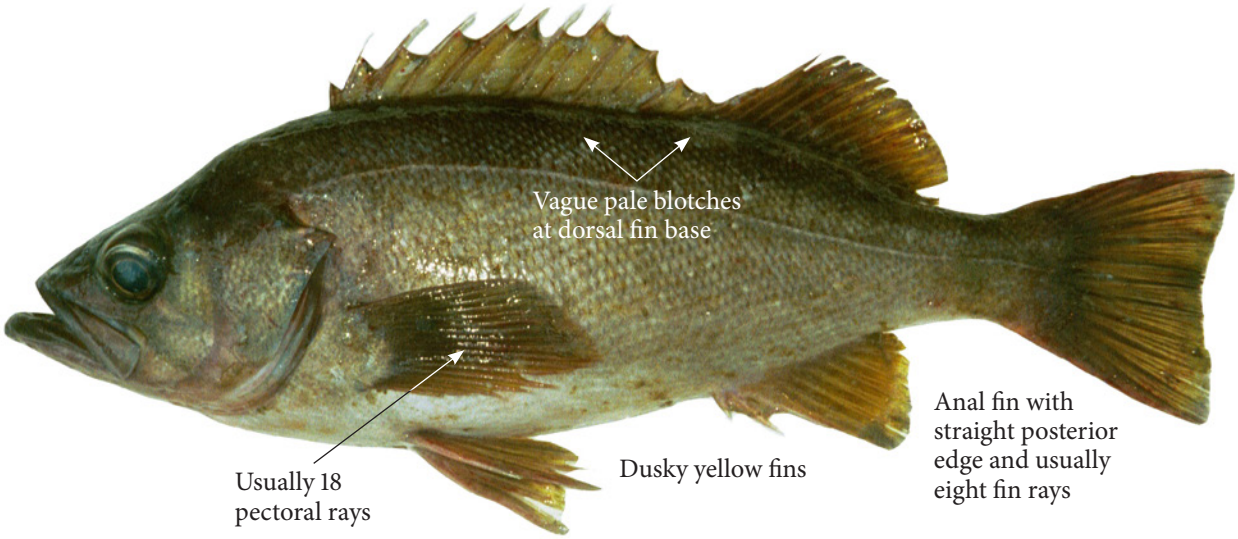


Description
Silvergray rockfish generally have head spines 1, 2, and 7. The color is dark gray/green to black dorsally becoming silver/gray laterally to white tinted with red/orange or pink to solid red/orange or pink ventrally. The lateral line is a narrow pink stripe, and the lips are dark. The lower portions of the pectoral, anal, and pelvic fins are washed with red/orange to pink. The mouth is large, with a strongly projecting lower jaw, strong symphyseal knob, and maxilla that extends to anywhere from the rear edge of the pupil to the rear edge of the eye. Anal spine two is slightly shorter than or about equal to three. The posterior margin of the anal fin is nearly vertical to slightly anteriorly slanted. To 71 cm TL.

Similar species
Bocaccio (*Sebastes paucispinis*) are red to red/brown in color, with fewer (27–32) gill rakers (33–36 in silvergray rockfish) and more anal fin rays (8 vs. 7 in silvergray rockfish), small anal spines, a different head spine configuration, and no symphyseal knob (or, if present, very weakly developed).

Distribution
Silvergray rockfish range from the southeastern Bering Sea to central Baja California, Mexico, at depths from the surface to 375 m, but most commonly 100–300 m.

Yellowtail rockfish (*Sebastes flavidus*)

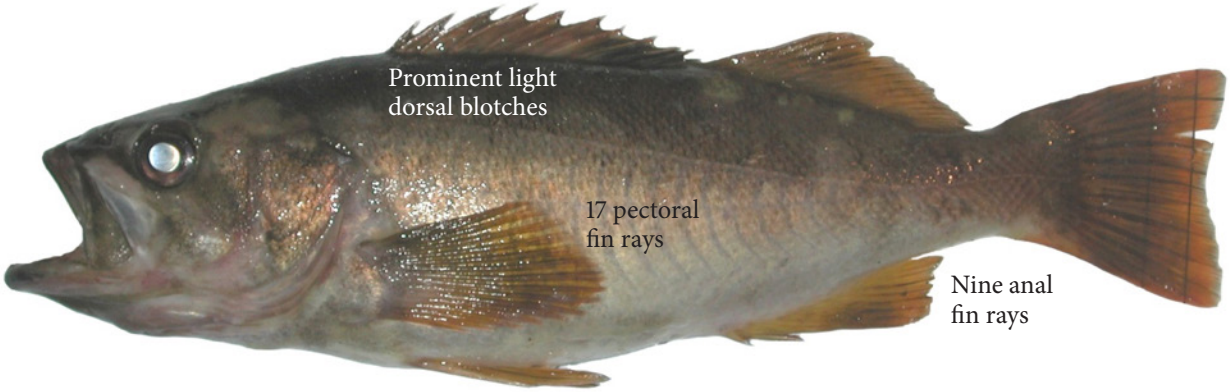


Description
Yellowtail rockfish generally only have head spine 1; head spines 2 and/or 7 may or may not be present. The color is olive/green to greenish-brown, usually with a brassy yellow wash. The color is darker dorsally, with lighter shades of the same color laterally and light ventrally. There are vague pale blotches at the base of the dorsal fin, and fine brown to reddish-brown specks or flecking on the posterior margins of the scales. The fins are a dusky yellow. The pectoral fin generally has 17–19 (usually 18) rays, sometimes edged with pink. The anal fin has 7–8 (usually eight) rays and a straight posterior edge. To 66 cm TL.

Similar species
Olive rockfish (*Sebastes serranoides*) have very prominent pale areas dorsally, often with completely dark pectoral fins and dark fin membranes (dusky yellow in yellowtail rockfish), a pectoral fin without a pink edge (sometimes present in yellowtail rockfish), 17 pectoral rays (18 in yellowtail rockfish), nine anal fin rays (eight in yellowtail rockfish), and usually only head spine 1 (2 and/or 7 may be present or absent in yellowtail rockfish).

Distribution
Yellowtail rockfish range from Unalaska Island to La Jolla in southern California, from the surface to depths of 549 m.

Olive rockfish (*Sebastes serranoides*)

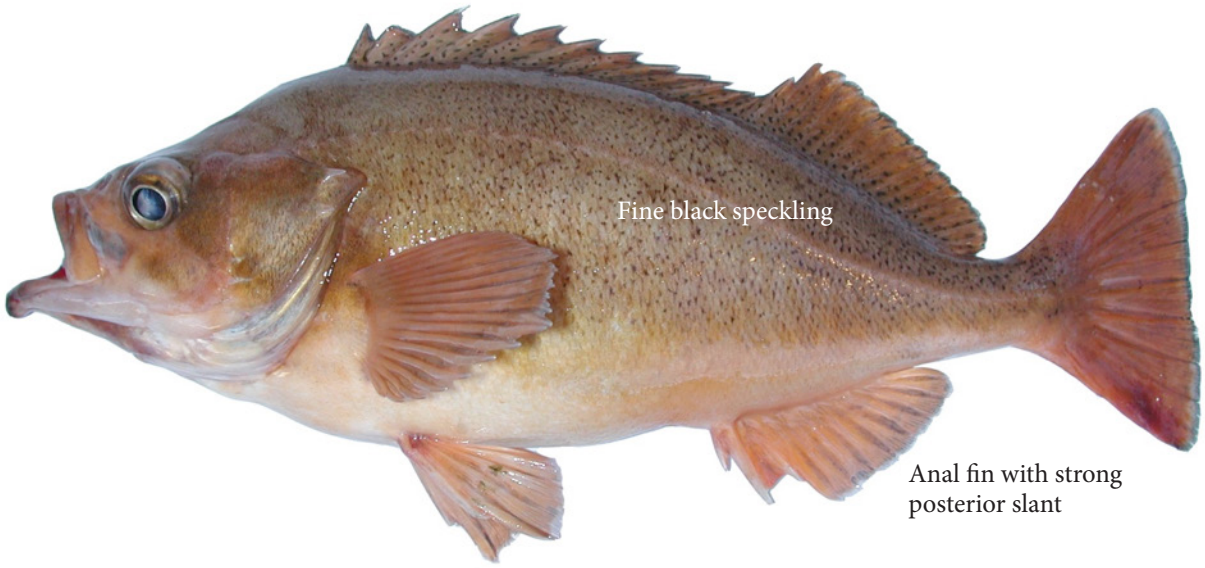


Description
Olive rockfish generally only have head spine 1. The color is dark olive gray with several clear splotches dorsally, becoming lighter gray with fine dark gray speckles laterally, and whitish gray to white ventrally. The fins are a dark olive washed with yellow. However, the pectoral fins can be completely dark. The pectoral fins have 17–19 (usually 17) rays. The anal fin has 8–10 (usually nine) rays. To 61 cm TL.

Similar species
Yellowtail rockfish (*Sebastes flavidus*) typically have eight anal rays (nine in olive rockfish), 18 pectoral fin rays (17 in olive rockfish), and less prominent pale areas on the back. The fins are generally a dusky yellow. The pectoral fins often have a pink edge (not present in olive rockfish). The head spine configuration can differ in that spines 2 and/or 7 may or may not be present.

Distribution
Olive rockfish range from southern Oregon to central Baja California, Mexico, at depths from near the surface to 172 m.

Speckled rockfish (*Sebastes ovalis*)



Description
Speckled rockfish generally have head spines 1, 2, 3, 4, 5, and 7. The color is brown to tan, somewhat darker dorsally with lighter shades of the same color laterally and whitish ventrally, often with yellow or pinkish overtones over the whole body. Fine dark brown or black speckling occurs laterally, dorsally, and on the dorsal fin; the amount of speckling can vary with the individual. Vague dusky saddles may also be present on the dorsum. The pectoral, pelvic, and anal fins are often a creamy orange. The tips of the jaws, as well as the lower fins, can have black tips. The anal fin has a strong posterior slant. To 56 cm TL.

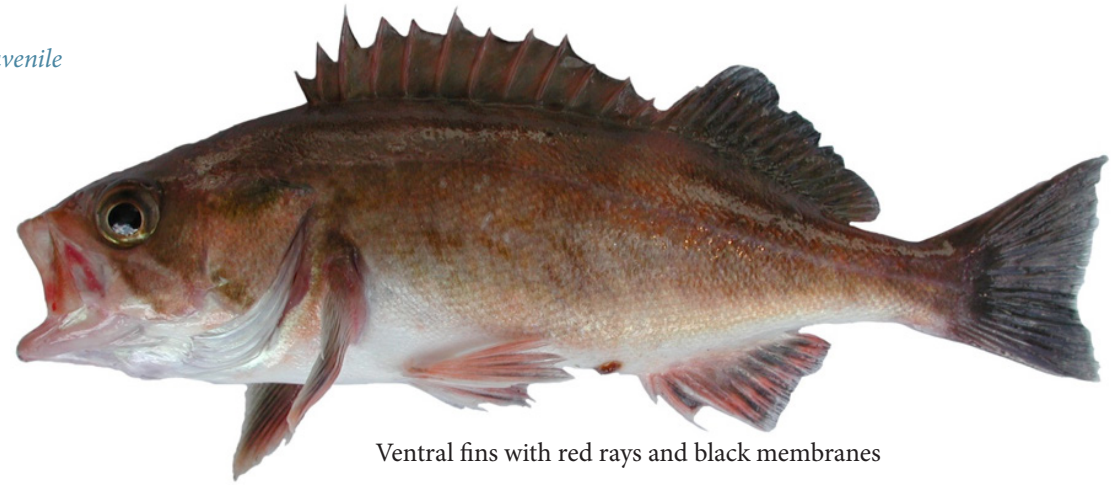
Similar species
The widow rockfish (*Sebastes entomelas*) lacks the speckling and has black pelvic and anal fin membranes (dusky in speckled rockfish). The bank rockfish (*S. rufus*) is generally pink to red or dusky gray, with black pelvic and anal fin membranes. The lateral line is in a clear zone, and it typically has 34–35 gill rakers (31–33 in speckled rockfish).

Distribution
Although rare north of central California, speckled rockfish range from northern Washington State to central Baja California, Mexico, at depths of 30–366 m (commonly 60–150 m).

Widow rockfish (*Sebastes entomelas*)

Adult

Juvenile

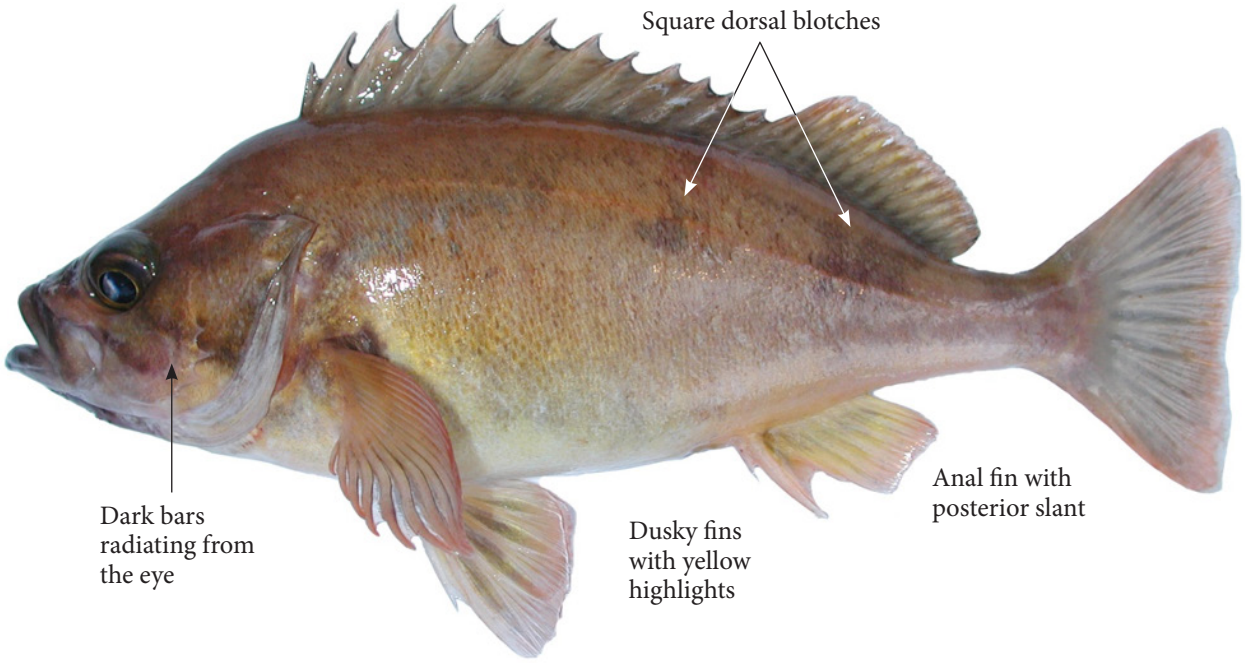


Description
Widow rockfish generally have head spines 1 and 2. Head spines 3, 4, 5, and 7, singularly or in combination, may or may not be present. The color is a dusky brown to olive/ brown dorsally, with lighter shades of the same color laterally and light or white ventrally. Juveniles generally have vague dark saddles dorsally that can cross the lateral line, and vague dark bars may radiate from the eye. The caudal, anal, pectoral, and pelvic fin membranes are dark. The ventral fins on juveniles may also have traces of red, especially along the margin. The rear edge of the anal fin has a strong posterior slant. To 59 cm TL.

Similar species
The combination of an anal fin with a strong posterior slant, pectoral and often pelvic and anal fins with black membranes, and the predominantly dark body color distinguishes the widow rockfish from other species of rockfish.

Distribution
Widow rockfish range from east of Kodiak Island in the western Gulf of Alaska to northern Baja California, Mexico, at depths of 24–549 m (usually 140–210 m).

Squarespot rockfish (*Sebastes hopkinsi*)



Description
Squarespot rockfish generally have head spines 1, 2, 3, 4, 5, and 7. The color is a dusky tan or brown to yellow/brown dorsally with lighter shades of the same color laterally and a light or whitish ventral side. The fins have dusky membranes with yellow highlights, especially the anal fin. The rear margin of the anal fin has a posterior slant. There are several square-shaped dark brown to dusky blotches at the base of the dorsal fin that extend to just below the lateral line. The blotches can fade with age and growth and be quite faint. Generally, there are dark bars radiating from the eye. The mouth is very small. The maxilla extends to or just beyond the front edge of the pupil. To 29 cm TL.

Similar species
Widow rockfish (*Sebastes entomelas*) have black pectoral, pelvic, and anal fin membranes. Speckled rockfish (*S. ovalis*) have distinct small black speckling on the body and dorsal fin.

Distribution
Squarespot rockfish range from southern Oregon to central Baja California, Mexico, at depths of 18–224 m, but tend to be more common at 30–150 m in the southern portion of their range.

Strong Head Spines, Black

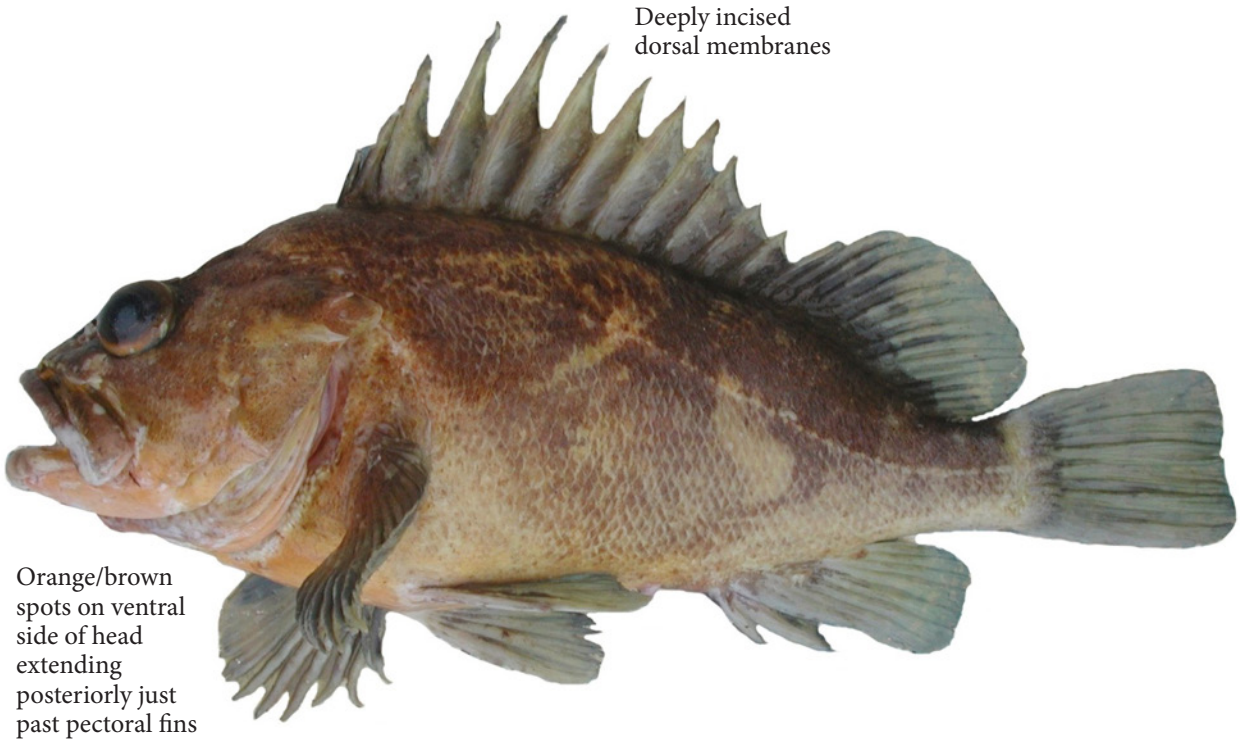
Brown rockfish (*Sebastes auriculatus*)

Description
Brown rockfish generally have head spines 1, 2, 4, 5, and 7. Head spines 6 and/or 8 may or may not be present. The color is tan to light brown overlaid with dark brown, red/brown, and black mottling. The dark blotch on the upper portion of the opercle may become faint with age. Brown, red/brown, or orange bars radiate back from the eye and upper jaw. The fins are dusky pink, and the top of the head is flat. To 56 cm TL.

Similar species
The copper rockfish (*Sebastes caurinus*) has a body mottled with white and yellow, the posterior two-thirds of the lateral line in a clear zone, and a different head spine configuration. The quillback rockfish (*S. maliger*) has deeply incised dorsal fin membranes, orange/brown spots on the anterior portion of the body, and a different head spine configuration. The kelp rockfish (*S. atrovirens*) usually has a different head spine configuration.

Distribution
Brown rockfish range from Prince William Sound and the northern Gulf of Alaska to southern Baja California, Mexico, from shallow inshore waters to depths of 128 m.

Quillback rockfish (*Sebastes maliger*)

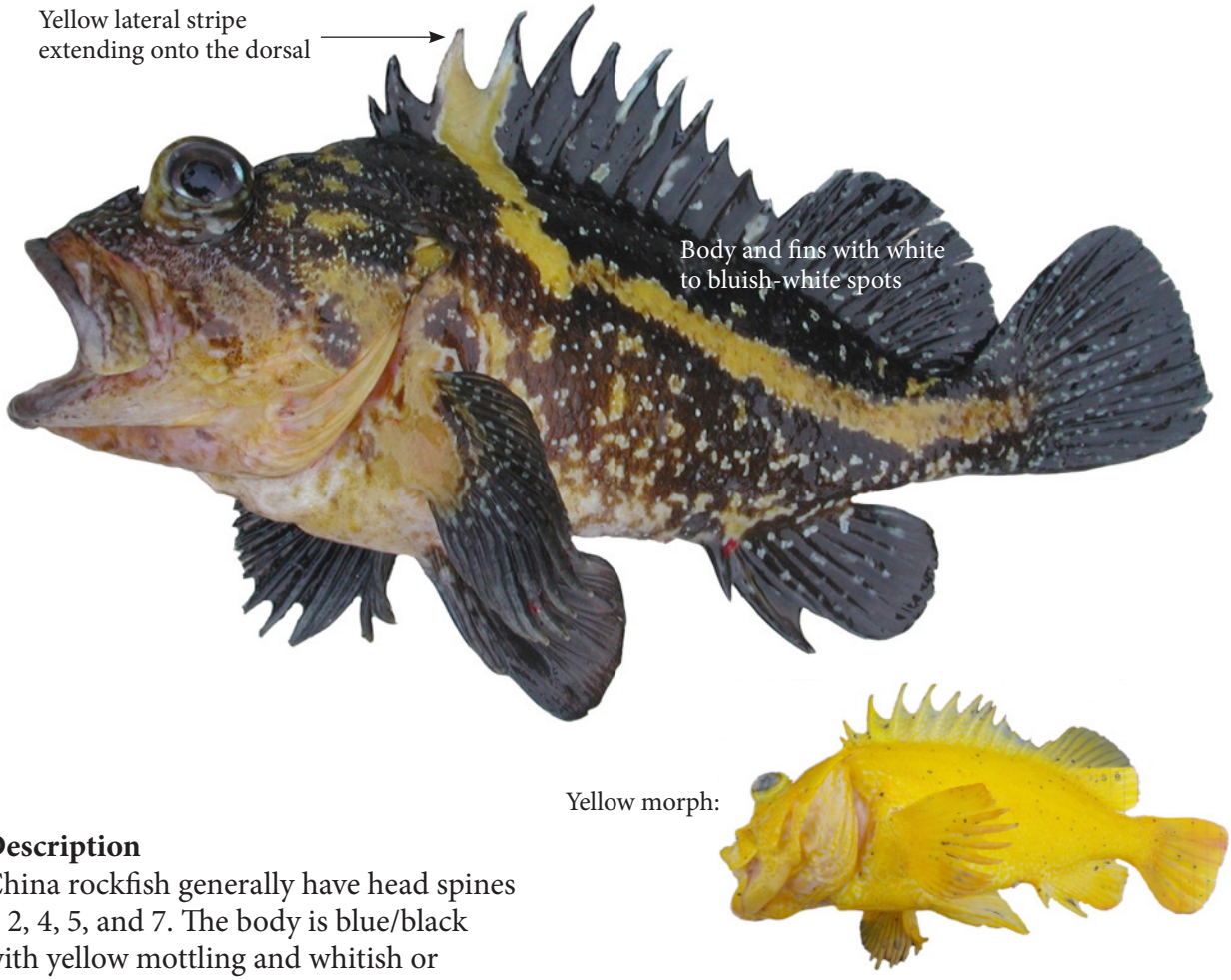


Description
Quillback rockfish generally have head spines 1, 2, 4, 5, and 7. The color is brown with yellow and/or orange blotches. There are light-colored dorsal blotches on the anterior portion of the body that can extend in vague bands over the head and onto the spinous dorsal fin. Orange or orange/brown spots may appear on the ventral side of the head and extend posteriorly to just past the pectoral fins. All fins are dark, except the anterior portion of the spinous dorsal, which can be yellow. The dorsal fin spines are long and the membranes deeply incised. To 61 cm TL.

Similar species
The brown rockfish (*Sebastes auriculatus*) lacks the yellow area on the dorsal, the spots on the body, and the deeply incised dorsal membranes, and has a different head spine configuration. The copper rockfish (*S. caurinus*) lacks the spotting, and the posterior two-thirds of the lateral line are in a clear zone. The China rockfish (*S. nebulosus*) is black, with a yellow stripe on the side that extends onto the dorsal fin.

Distribution
Quillback rockfish range from the Kenai Peninsula, Alaska, to southern California, at depths of 24–274 m.

China rockfish (*Sebastes nebulosus*)

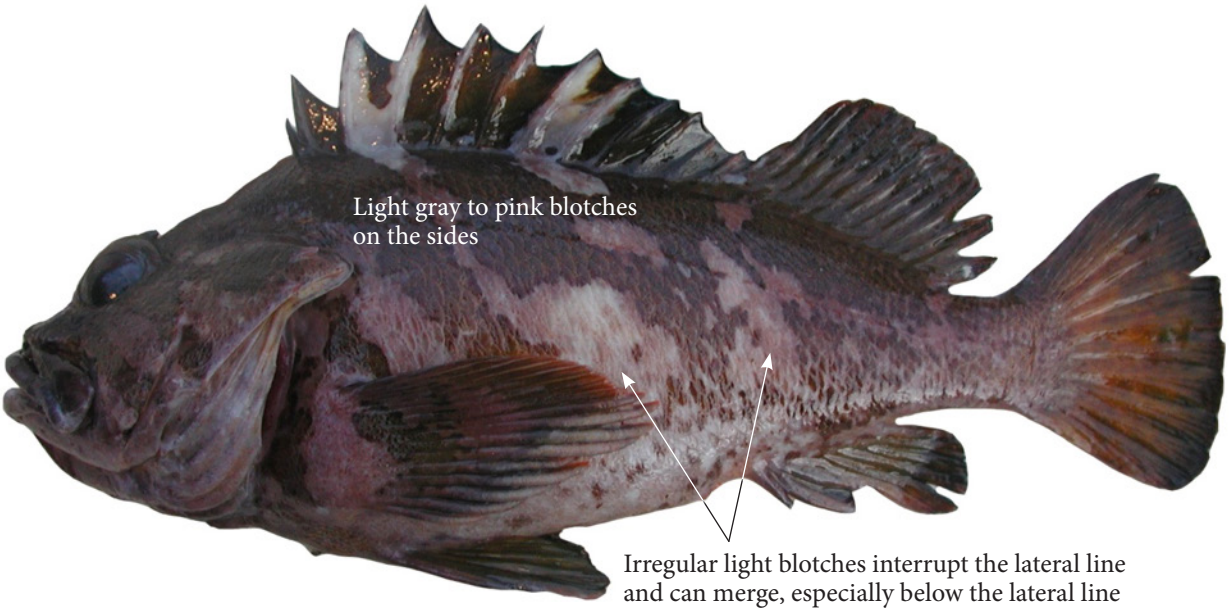


Description
China rockfish generally have head spines 1, 2, 4, 5, and 7. The body is blue/black with yellow mottling and whitish or whitish-blue spots, especially below the lateral line and extending onto the fins. An irregular yellow stripe starts at about the third dorsal spine and extends to and along the lateral line. Occasionally the stripe, especially in juveniles, can be discontinuous. To 45 cm TL.

Similar species
Black and yellow rockfish (*Sebastes chrysomelas*) have irregular yellow blotches (a distinct yellow line in China rockfish) and 5–7, but usually six, anal rays (6–8, but usually seven, in China rockfish).

Distribution
China rockfish range from Kachemak Bay and the northern Gulf of Alaska to Redondo Beach and San Nicolas Island in southern California, at depths of 3–128 m.

Gopher rockfish (*Sebastes carnatus*)

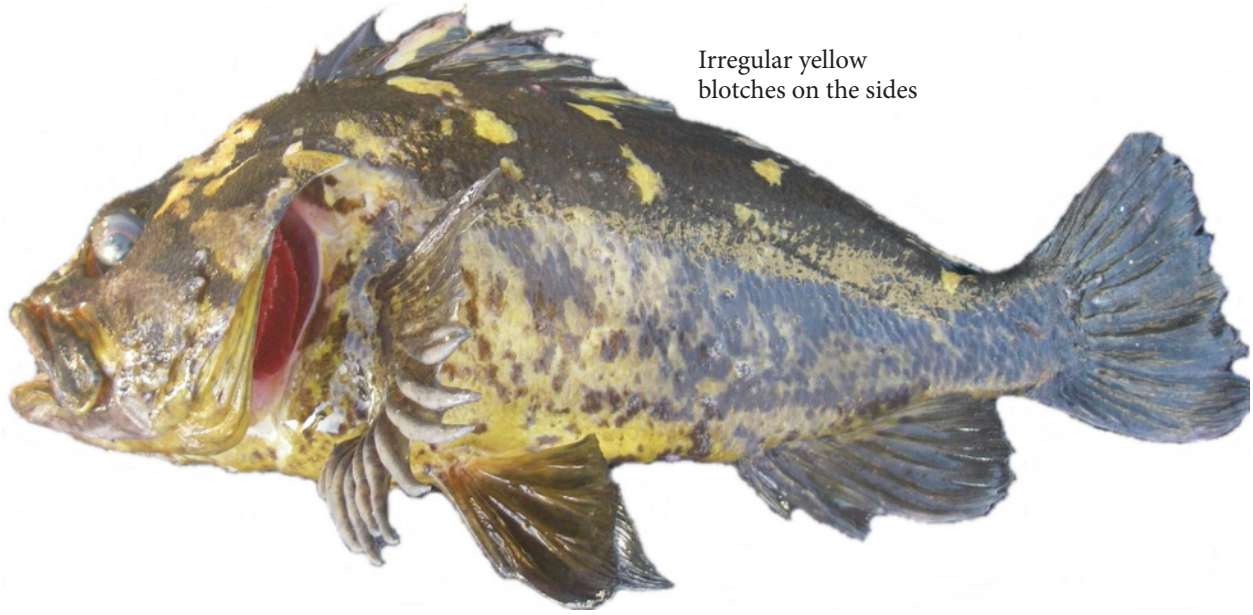


Description
Gopher rockfish have head spines 1, 2, 4, 5, and 7. The color is dark olive/brown dorsally, with lighter shades of the same color laterally. There are usually three or more irregular, clear, light gray or pink blotches dorsally and laterally that can extend onto the dorsal fin, interrupt the dark lateral line, and tend to run together on the lower sides. To 43 cm TL.

Similar species
The copper rockfish (*Sebastes caurinus*) lacks the light blotches, and the posterior two-thirds of the lateral line are in a clear zone. The black and yellow rockfish (*S. chrysomelas*) is black with irregular yellow blotches (brown with light gray to pink blotches in gopher rockfish); gill raker counts are 25–30, usually 27–28 (26–30, usually 28–30, in gopher rockfish). The kelp rockfish (*S. atrovirens*) has a light body with dark mottling (dark body with light mottling in gopher rockfish), and the gill raker count is 28–34, usually 31–34 (usually 26-30 in gopher rockfish)

Distribution
Although rare north of Sonoma County in northern California, gopher rockfish range from Cape Blanco, Oregon, to Punta San Roque in southern Baja California, Mexico, from the shallow intertidal waters to 80 m (but are most common at depths greater than 12 m).

Black and yellow rockfish (*Sebastes chrysomelas*)



Description
Black and yellow rockfish generally have head spines 1, 2, 4, 5, and 7. The color ranges from black to dark olive/black dorsally with lighter shades of the same color laterally. There are usually three or more irregular, clear, yellow blotches dorsally and laterally that can extend onto the dorsal fin, interrupt the dark lateral line, and tend to run together on the lower sides. To 38 cm TL.

Similar species
The gopher rockfish (*Sebastes carnatus*) is dark olive to olive/brown with light gray or pinkish blotches (black to olive/black with yellow blotches in black and yellow rockfish); the gill raker count is 26–30, usually 28–30 (25–30, usually 27–28, in black and yellow rockfish). The China rockfish (*S. nebulosus*) has a distinct yellow lateral line stripe extending onto the dorsal fin, bluish-white spots on the body, and 6–8 (usually seven) anal rays (5–7, usually six, in black and yellow rockfish).

Distribution
Although uncommon north of Sonoma County, northern California, and south of Point Conception, California, black and yellow rockfish range from Cape Blanco, Oregon, to Isla Natividad, central Baja California, Mexico, at depths from shallow intertidal waters to 37 m, but most commonly shallower than 18 m.

Grass rockfish (*Sebastes rastrelliger*)

Description
Grass rockfish generally have head spines 1, 2, 4, 5, and 7. The color ranges from dark green, olive/green, or brown to nearly black. Small dark spots and larger dark mottling covers the body, but can be obscured by the dark body color. Occasionally there will be a dark blotch on the posterior edge of the gill cover. The caudal peduncle is very thick. There are 17–25 thick, stubby gill rakers on the first gill arch. To 56 cm TL.

Similar species
The brown rockfish (*Sebastes auriculatus*) has a dark blotch on the operculum and 25–29 long gill rakers. The gopher rockfish (*S. carnatus*) has 26–30 long gill rakers.

Distribution
Although rare north of southern Oregon, grass rockfish range from Boiler Bay in central Oregon to Bahía Playa María, central Baja California, Mexico. One of the shallowest-occurring rockfishes, often found in the intertidal to just subtidal waters to 46 m.

Kelp rockfish (*Sebastes atrovirens*)

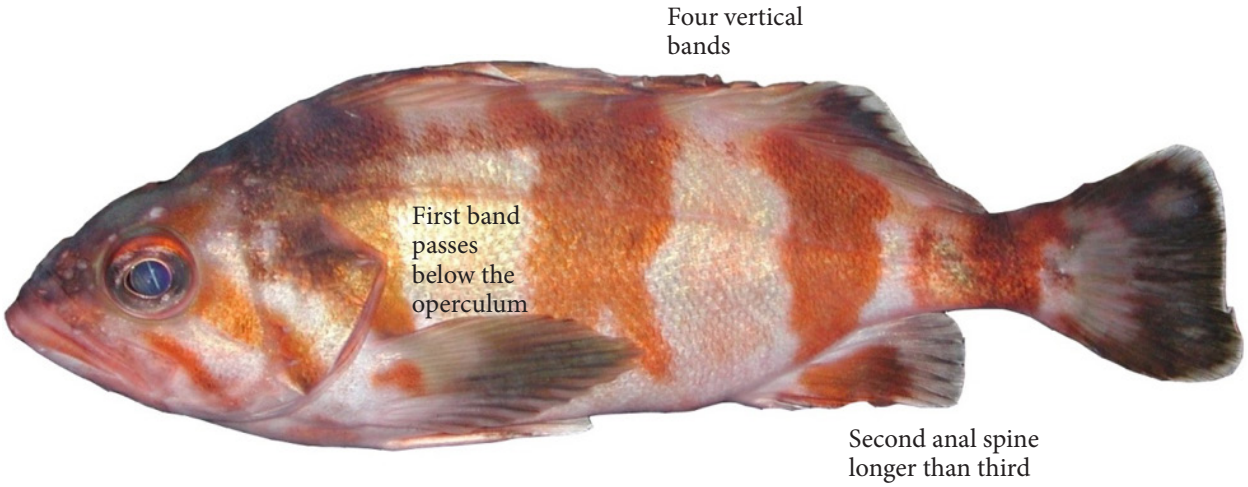
Description
Kelp rockfish generally have head spines 1, 2, 4, 5, and 7. The color is darker on the head and dorsally, with lighter shades of the same color laterally and light ventrally. However, the color can vary widely, from almost white to mottled brown, green, dark olive/gray, olive/brown to nearly black, and occasionally reddish, mimicking the color of the local kelp. A faint blotch on the gill cover and several faint bars radiating posteriorly from the eye and jaw may be visible. The fins are generally the same color as the body. The gill rakers on the first arch are long and slender. To 43 cm TL.

Similar species
The brown rockfish (*Sebastes auriculatus*) has a dark blotch on the operculum, and usually has a different head spine configuration. The gopher rockfish (*S. carnatus*) has fewer gill rakers, which are thick and stubby, and a thick caudal peduncle.

Distribution
Kelp rockfish range from Albion in northern California to Bahía San Carlos and Islas San Benito in central Baja California, Mexico, at depths of 18–54 m.

Strong Head Spines, Banded

Redbanded rockfish (*Sebastes babcocki*)

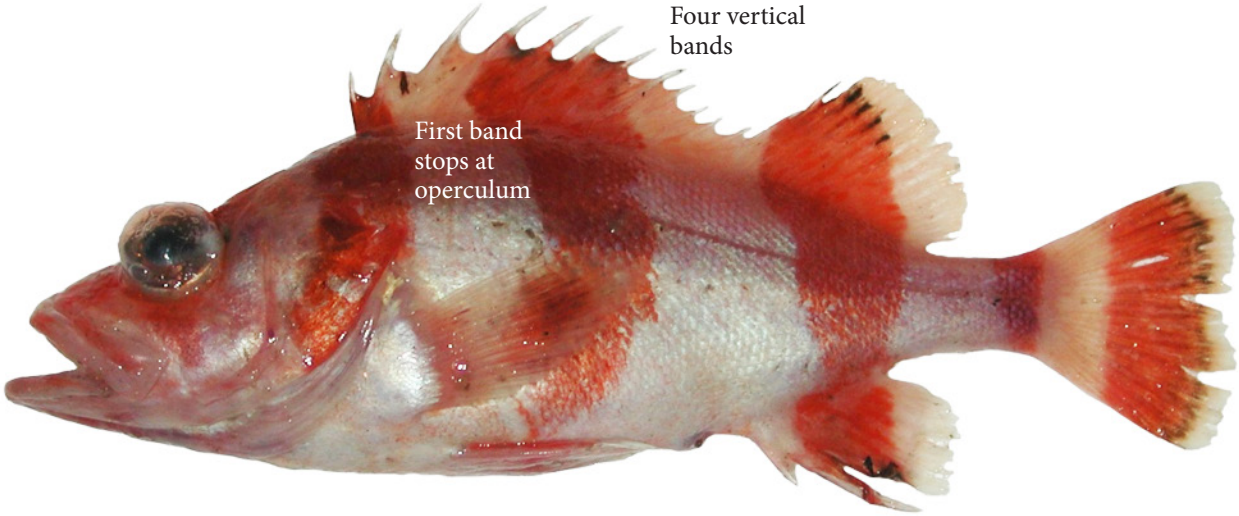


Description
Redbanded rockfish generally have head spines 1, 2, 4, 5, and 7. The color varies from light pink to light red, with four dark, orange to red bands that may fade with age. The first band passes below the operculum and the upper portion of the pectoral fin. There are two oblique bands, one extending back from the eye, the second from near the upper jaw. The dorsal, anal, and pectoral fins can have extensive dusky or black coloration, especially on the outer margins. The second anal spine is longer than the third. To 66 cm TL.

Similar species
In the flag rockfish (*Sebastes rubrivinctus*), the first red band stops at the operculum, there are 16–18 (usually 17) pectoral rays (17–20, usually 19, in redbanded rockfish). The tiger rockfish (*S. nigrocinctus*) has all eight head spines and the second anal spine is as long as or shorter than the third. The treefish (*S. serriceps*) is dark olive dorsally, light yellow ventrally, with 5–6 dark olive bars, and has a different head spine configuration. The shortraker rockfish (*S. borealis*) has a different head spine count, and the third anal spine is as long as or longer than the second.

Distribution
Redbanded rockfish range from the Bering Sea and the Aleutian Islands to San Diego, southern California, at depths of 49–625 m.

Flag rockfish (*Sebastes rubrivinctus*)

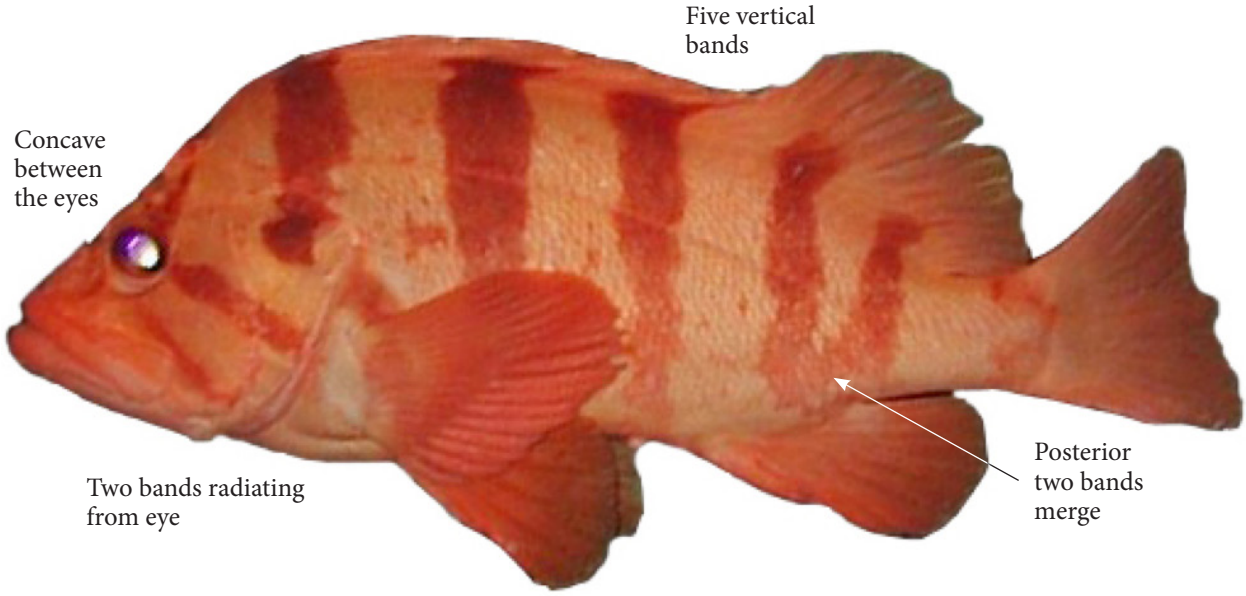


Description
Flag rockfish generally have head spines 1, 2, 4, 5, and 7; head spine 3 may or may not be present. The body color is white to light pink with several, usually four, broad, vertical, dark orange to red bands that may fade with age. The first band stops at the operculum. There are two bands on the head, the first extending down from the eye, the second running toward the upper jaw. The caudal fin is red with a white border. To 44 cm TL.

Similar species
In redbanded rockfish (*Sebastes babcocki*), the first red band extends past the upper margin of the pectoral fin. The tiger rockfish (*S. nigrocinctus*) has several dark red bands on a pink to orange body, and a different head spine configuration. Treefish (*S. serriceps*) are dark olive dorsally, light yellow ventrally, with 5–6 dark olive bars, and have a different head spine configuration.

Distribution
Flag rockfish range from Heceta Bank, Oregon, to Cape San Quintín, Baja California, Mexico, at depths of 30–418 m.

Tiger rockfish (*Sebastes nigrocinctus*)

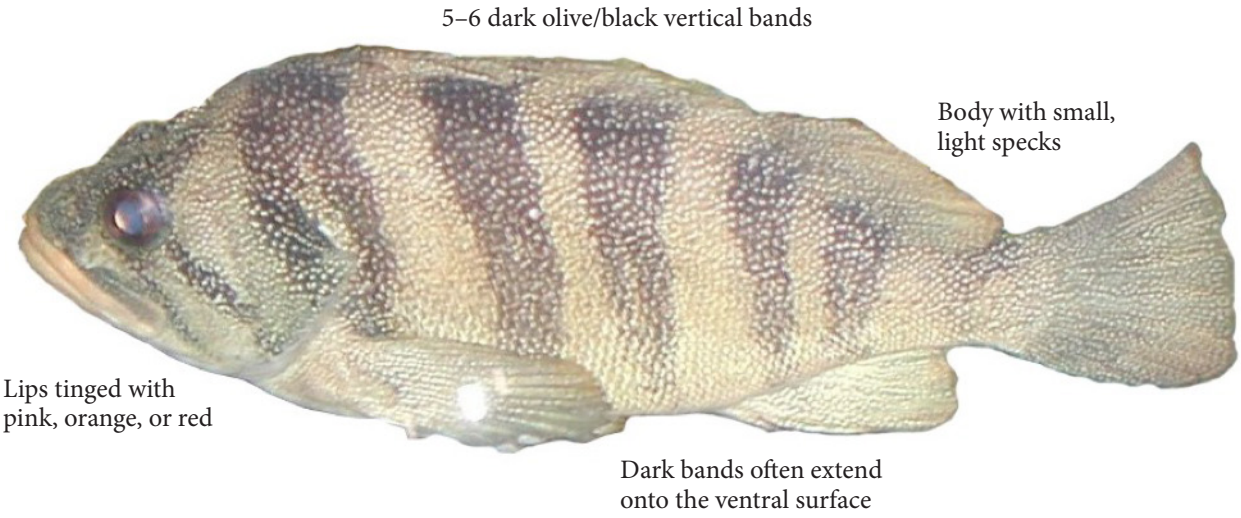


Description
Tiger rockfish generally have head spines 1–8. The body color varies from white or light pink to orange or red, with five narrow, dark red, purple, brown, or black vertical stripes. Occasionally, the two posterior bands merge ventrally. There are two dark bars radiating from each eye. The head is strongly concave between the eyes. To 61 cm TL.

Similar species
The redbanded rockfish (*Sebastes babcocki*) has four wide, red to orange vertical stripes on a white to light pink background, and a different head spine configuration. The flag rockfish (*S. rubrivinctus*) has four wide, red to orange vertical bands on a white to light pink body, and different head spine configurations. Treefish (*S. serriceps*) have black bands on an olive/yellow body.

Distribution
Tiger rockfish range from Marmot Bay (northeast of Kodiak Island in the Gulf of Alaska) to Tanner and Cortez Banks in southern California, at depths of 55–274 m.

Treefish (*Sebastes serriceps*)



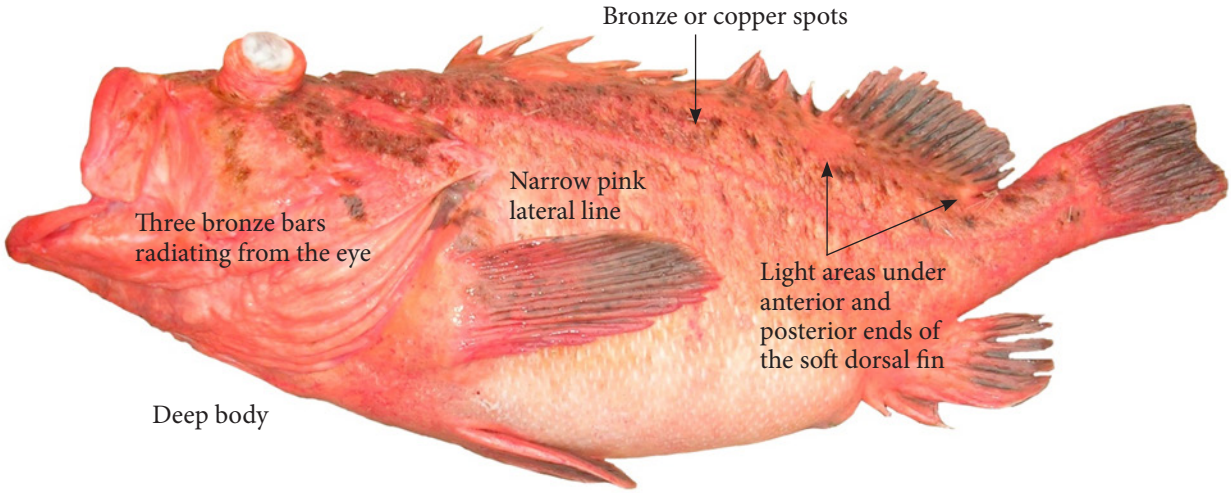
Description
Treefish generally have head spines 1, 2, 4, 5, 7, and 8. The body, often covered with small, light-colored specks, is dark olive dorsally, olive/yellow laterally, with 5–6 distinct vertical black bands that often extend onto the ventral surface, and two oblique bars on the head radiating from the eye. Juveniles have double dark bands that fill in with age. The large lips are tinged with pink, orange, or red. To 40 cm TL.

Similar species
Redbanded rockfish (*Sebastes babcocki*) and flag rockfish (*S. rubrivinctus*) have four wide, red to orange bands on a white to light pink body, and lack head spine 8. Tiger rockfish (*S. nigrocinctus*) have red to black bands on a pink to orange body, and all eight head spines.

Distribution
Treefish range from San Francisco, California, to Isla Cedros in central Baja California, Mexico, from the shallow intertidal waters to 97 m, but are most common shallower than 60 m.

Strong Head Spines, White-Spotted Red

Bronzespotted rockfish (*Sebastes gilli*)

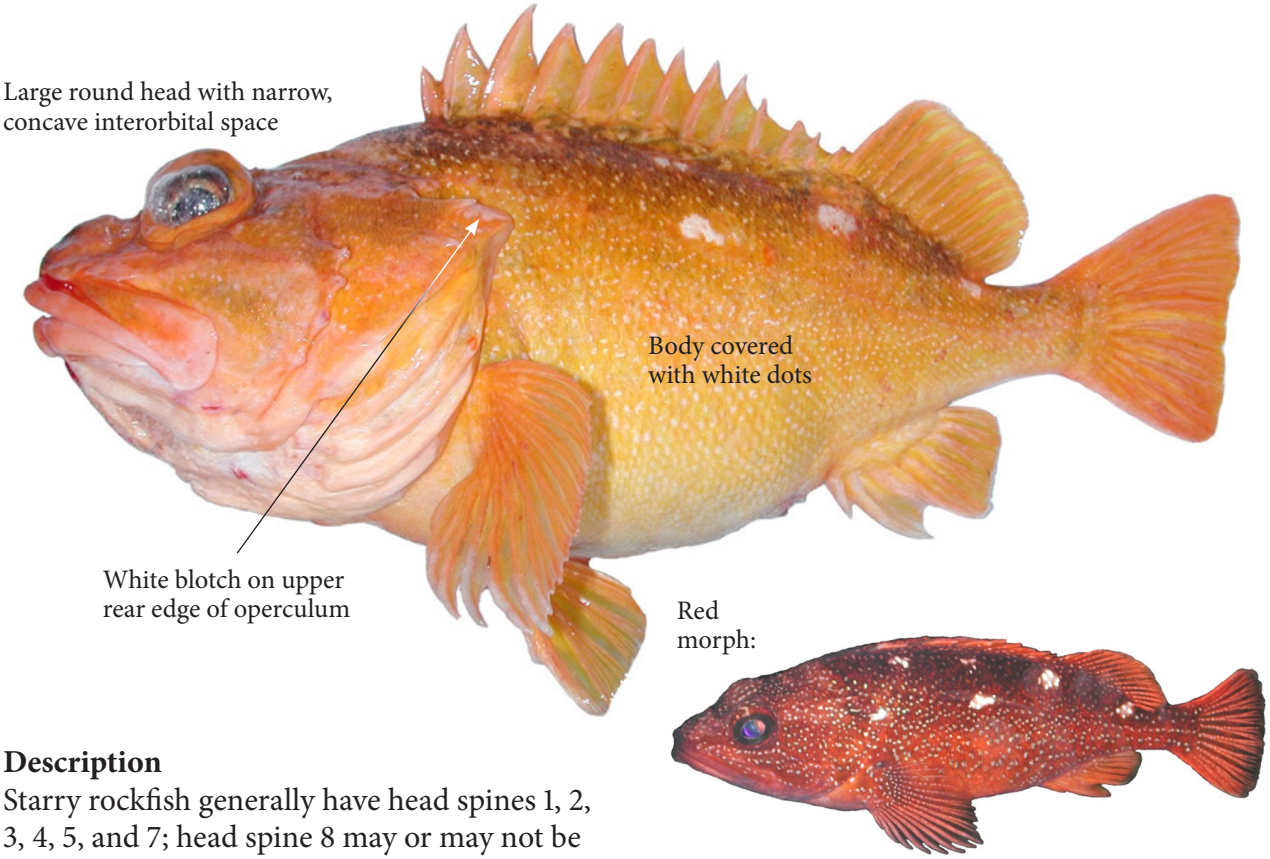


Description
Bronzespotted rockfish generally have head spines 1, 2, 3, 4, 5, 7, and 8. The robust body is deep, and the jaws are sharply upturned. The color is orange or orange/red with lighter shades of the same color laterally and ventrally. There are numerous copper or bronze spots, blotches, and vermiculations, and possibly light blotches, on the dorsum, along the base of the dorsal fin, and on the sides. Juveniles may be very light to nearly white, with dark spotting. There are three bronze bars radiating from the eye, two posteriorly, one ventrally. After capture, light orange areas appear under the anterior and posterior ends of the soft dorsal, and the lateral line appears light pink to red. To 71 cm TL.

Similar species
The lack of any distinct white spots above the lateral line, the bronze- or copper-colored spots, blotches, and vermiculations, and the sharply upturned mouth distinguish the bronzespotted rockfish from the other species in the White-Spotted Red category.

Distribution
Bronzespotted rockfish range from Monterey Bay, California, to Punta Colonet, northern Baja California, Mexico, at depths of 75–413 m.

Starry rockfish (*Sebastes constellatus*)



Description
Starry rockfish generally have head spines 1, 2, 3, 4, 5, and 7; head spine 8 may or may not be present. The body color varies. Newly settled juveniles are bright yellow. Older juveniles and adults range from bright orange/red to nearly brown. The color is darker dorsally, with lighter shades of the same color laterally and lighter or nearly white ventrally. There are generally 3–5 distinct white spots just on or above the lateral line. Some may have a white blotch below the lateral line just posterior to or on the upper rear edge of the operculum. Numerous small white to bluish-white spots cover the bodies of older juveniles and adults. To 46 cm TL.

Similar species
Whitespeckled rockfish (*Sebastes moseri*) have no light blotches above the lateral line (3–5 in starry rockfish) and a slender body and head (head distinctly broad and rounded in starry rockfish). There is a broad, flat interorbital space (narrow and concave in starry rockfish), and the weak head spines are in a different configuration. The mouth is small, maxilla extending to midorbit (to or beyond the orbit in starry rockfish).

Distribution
Starry rockfish range from Cordell Bank, northern California, to Banco Thetis, southern Baja California, Mexico, at depths of 24–274 m.

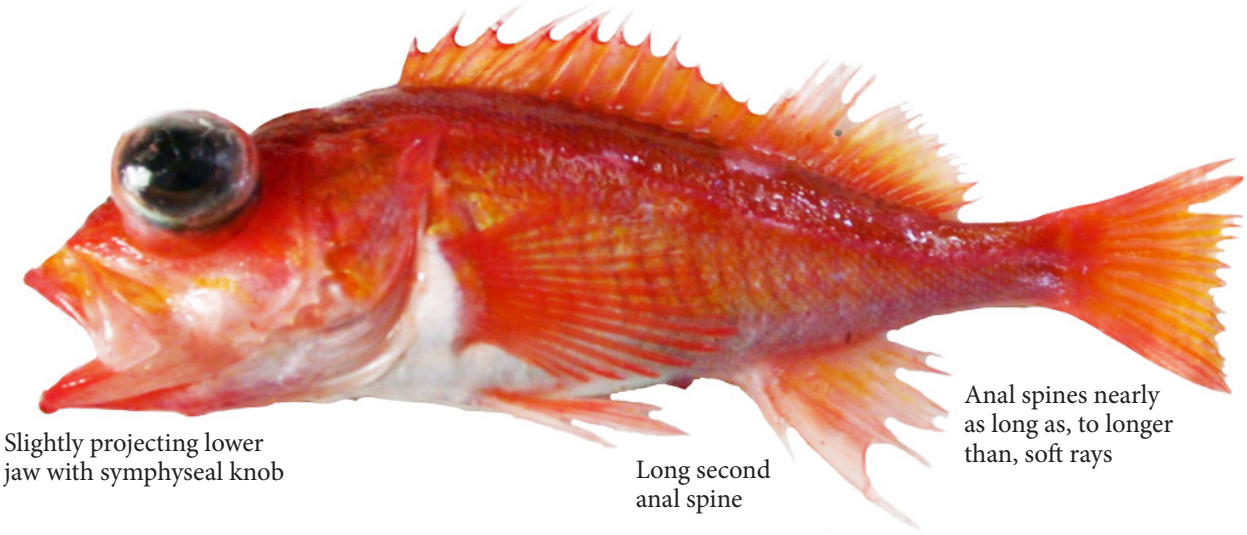
Whitespeckled rockfish (*Sebastes moseri*)

Description
Whitespeckled rockfish generally have head spines 1, 2, 4, 5, and 7; head spine 3 may or may not be present. This small, streamlined rockfish is dark red dorsally with lighter shades of the same color laterally, with a darker red lateral line and light or whitish ventrally. The 3–5 distinct white blotches above the lateral line are absent. Numerous fine white to bluish-white spots cover the body, possibly with fine dark brown spots below the lateral line and on the operculum and 1–2 dark or dusky bars radiating from the eye. The fins appear red with dark or dusky membranes. The slender head has a broad, flat interorbital space and a small mouth with jaws extending to or just short of the middle of the eye. To 21 cm TL.

Similar species
The starry rockfish (*Sebastes constellatus*) has 3–5 prominent white blotches above the lateral line (absent in whitespeckled rockfish), a narrow and concave interorbital space (broad and flat in starry rockfish), and a broad, rounded head (narrow in starry rockfish).

Distribution
Whitespeckled rockfish are a rarely captured, semi-pelagic fish that range from Point Arguello, central California, to Punta Colonet, northern Baja California, Mexico, at depths of 50–220 m.

Swordspine rockfish (*Sebastes ensifer*)

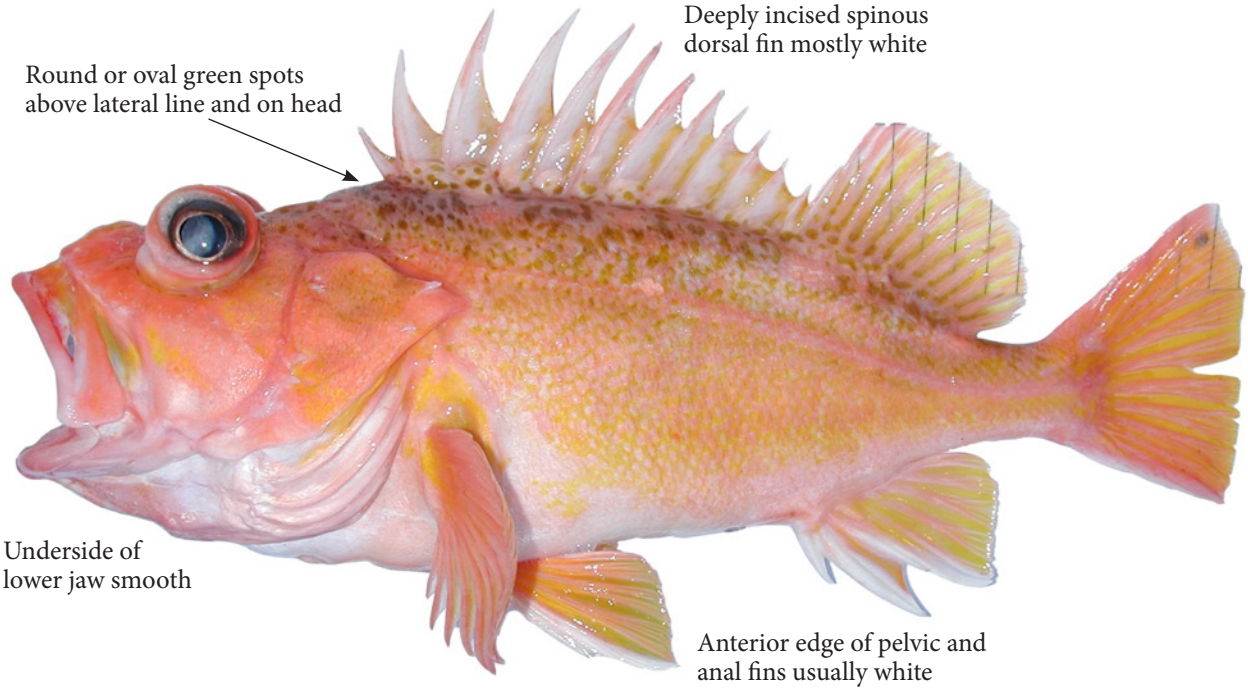


Description
Swordspine rockfish generally have head spines 1, 2, 3, 4, 5, and 7; head spine 8 may or may not be present. The color is red or red/orange dorsally with lighter shades of the same color laterally, with green highlights above and yellow highlights below the lateral line, and whitish ventrally. The 3–5 white blotches on the back have light green borders. Generally, the fins are red with yellow/green membranes. The slightly projecting lower jaw has a prominent symphyseal knob. The long, highly developed second anal spine extends from just short of, to beyond the end of, the soft rays. To 25 cm TL.

Similar species
The projecting lower jaw, prominent symphyseal knob, and highly developed second anal spine distinguish the swordspine rockfish from all other species in the White-Spotted Red category.

Distribution
Swordspine rockfish range from Heceta Bank, Oregon, to Isla Guadalupe, central Baja California, Mexico, at depths of 90–150 m.

Greenspotted rockfish (*Sebastes chlorostictus*)

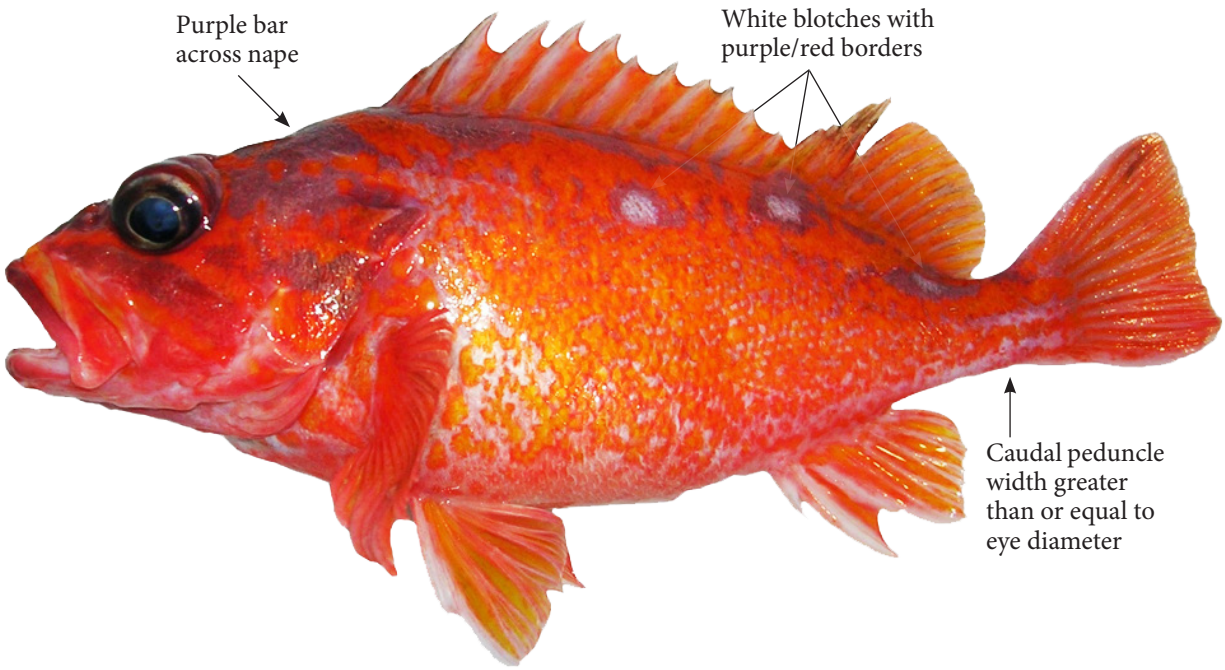


Description
Greenspotted rockfish generally have head spines 1, 2, 3, 4, 5, and 7; head spine 8 may or may not be present. The red/orange to yellow background color is somewhat darker dorsally and lighter laterally, darkening and becoming infused with pink after death. There are 3–5 white to whitish-pink blotches above the lateral line. The top of the head and the area above the lateral line are marked with numerous sharply defined bright green spots and vermiculations. There are numerous faint alternating pink and yellow bars radiating posteriorly from the eye that fade after death. The deeply incised spinous dorsal fin and the anterior edge of the pelvic and anal fins are white. Usually 17 (16–18) pectoral fin rays. Scales on the ventral side of the lower jaw are absent or small and deeply embedded, giving the lower jaw a smooth finish. To 51 cm TL.

Similar species
Pink rockfish (*Sebastes eos*) and greenblotched rockfish (*S. rosenblatti*) have rudimentary upper gill rakers (well developed in greenspotted rockfish), a rough-to-the-touch, fully scaled lower jaw (scales present or absent and smooth to the touch in greenspotted rockfish), and irregular green blotches and wavy lines dorsally (distinct spots in greenspotted rockfish).

Distribution
Greenspotted rockfish range from Washington State to Baja California, Mexico, at depths of 30–363 m.

Rosy rockfish (*Sebastes rosaceus*)



Description
Rosy rockfish generally have head spines 1, 2, 3, 4, 5, and 7; head spine 8 may or may not be present. The color ranges from orange/red to orange/purple dorsally, somewhat lighter shades of the same color with a yellow wash laterally, and light ventrally. The usually 3–6 (rarely 0) clear, whitish to whitish-purple blotches bordered with purple/red at or above the lateral line may turn purple, especially after freezing. The fins are orange/red to pink with yellow highlights. There are generally 17 (16–18) pectoral fin rays. The caudal peduncle is as deep as or slightly deeper than the eye diameter. To 36 cm TL.

Similar species
In rosethorn rockfish (*Sebastes helvomaculatus*), the caudal peduncle is less than the eye diameter (equal to or greater in rosy rockfish), the purple/red borders on the dorsal white spots and the purple bar across the nape are absent (present in rosy rockfish), and there are generally 16 (16–18) pectoral fin rays (generally 17 in rosy rockfish). Pinkrose rockfish (*S. simulator*) have a uniform pink to red body (spots and streaks in rosy rockfish), and the caudal peduncle is less than the eye diameter (equal to or greater in rosy rockfish). Freckled rockfish (*S. lentiginosus*) have prominent knobs bordering a cleft in the upper jaw (absent in rosy rockfish). Greenspotted rockfish (*S. chlorostictus*), greenblotched rockfish (*S. rosenblatti*), and pink rockfish (*S. eos*) have irregular green blotches and/or spots on the body (absent in rosy rockfish).

Distribution
Rosy rockfish range from the Cobb Seamount in Washington State south to Baja California, Mexico, at depths of 7–262 m.

Rosethorn rockfish (*Sebastes helvomaculatus*)

Description
Rosethorn rockfish generally have head spines 1, 2, 3, 4, 5, and 7; head spine 8 may or may not be present. The body color is red/orange, orange, orange/yellow, or pink, with yellow or red highlights, sometimes with a green or olive/green wash and light olive mottling dorsally and a small dusky patch on the operculum, and lighter shades of the same color laterally and light to white ventrally. The 4–5 clear white blotches bordered with light pink or orange at or above the lateral line may turn pink, especially after freezing. The fins are various shades of red or pink and washed with yellow or yellow/green. The pectoral fin usually has 16 (16–18) rays. The caudal peduncle depth is less than the diameter of the orbit. To 41 cm TL.

Similar species
The 16 pectoral fin rays distinguish the rosethorn rockfish from the other species of White-Spotted Red rockfish, which usually have 17 pectoral rays.

Distribution
Rosethorn rockfish range east of Sitkinak Island, western Gulf of Alaska, to Banco Ranger, central Baja California, Mexico, at depths of 25–549 m.

Pinkrose rockfish (*Sebastes simulator*)

Description
Pinkrose rockfish generally have head spines 1, 2, 3, 4, 5, and 7; head spine 8 may or may not be present. The body color is a uniform red, red/orange, or red/yellow that intensifies after death. There are 4–5 white to pink blotches at or above the lateral line, an occasional dusky tint along the back, and usually a dusky or green blotch on the gill cover. The symphyseal knob is absent, and the jaws are of equal length. The caudal peduncle is narrower than the orbital depth. To 42 cm TL.

Similar species
Rosethorn rockfish (*Sebastes helvomaculatus*), greenspotted rockfish (*S. chlorostictus*), pink rockfish (*S. eos*), and greenblotched rockfish (*S. rosenblatti*) have green blotches, streaks, and/or spots on the back. Rosy rockfish (*S. rosaceus*) are purple/red, and the width of the caudal peduncle is greater than the orbital depth. Swordspine rockfish (*S. ensifer*) have a prominent symphyseal knob and protruding lower jaw. Freckled rockfish (*S. lentiginosus*) have prominent knobs bordering a notch in the upper jaw.

Distribution
Pinkrose rockfish range from the Carmel Submarine Canyon, central California, to Punta Colonet and Isla Guadalupe, central Baja California, Mexico, at depths of 99–360 m.

Freckled rockfish (*Sebastes lentiginosus*)

Description
Freckled rockfish generally have head spines 1, 2, 3, 4, 5, and 7; head spine 8 may or may not be present. The body color is orange/brown, brassy, or greenish, with 5–6 whitish to light pink blotches above the lateral line. They are covered with prominent dark brown to green vermiculations, particularly on the back and top of the head, and dark green to brown freckles, especially above the lateral line and on the back of the head. There are very prominent pointed, toothed knobs bordering a notch in the upper jaw. To 23 cm TL.

Similar species
In honeycomb rockfish (*Sebastes umbrosus*), the knobs on the upper jaw are absent or small and rounded if present (prominent and pointed in freckled rockfish), dorsal freckling and vermiculations are absent (present in freckled rockfish), and the scales have darkly pigmented margins (absent in freckled rockfish).

Distribution
Freckled rockfish range from Point Conception, central California, to Punta San Roque, southern Baja California, Mexico, at depths of 36–290 m.

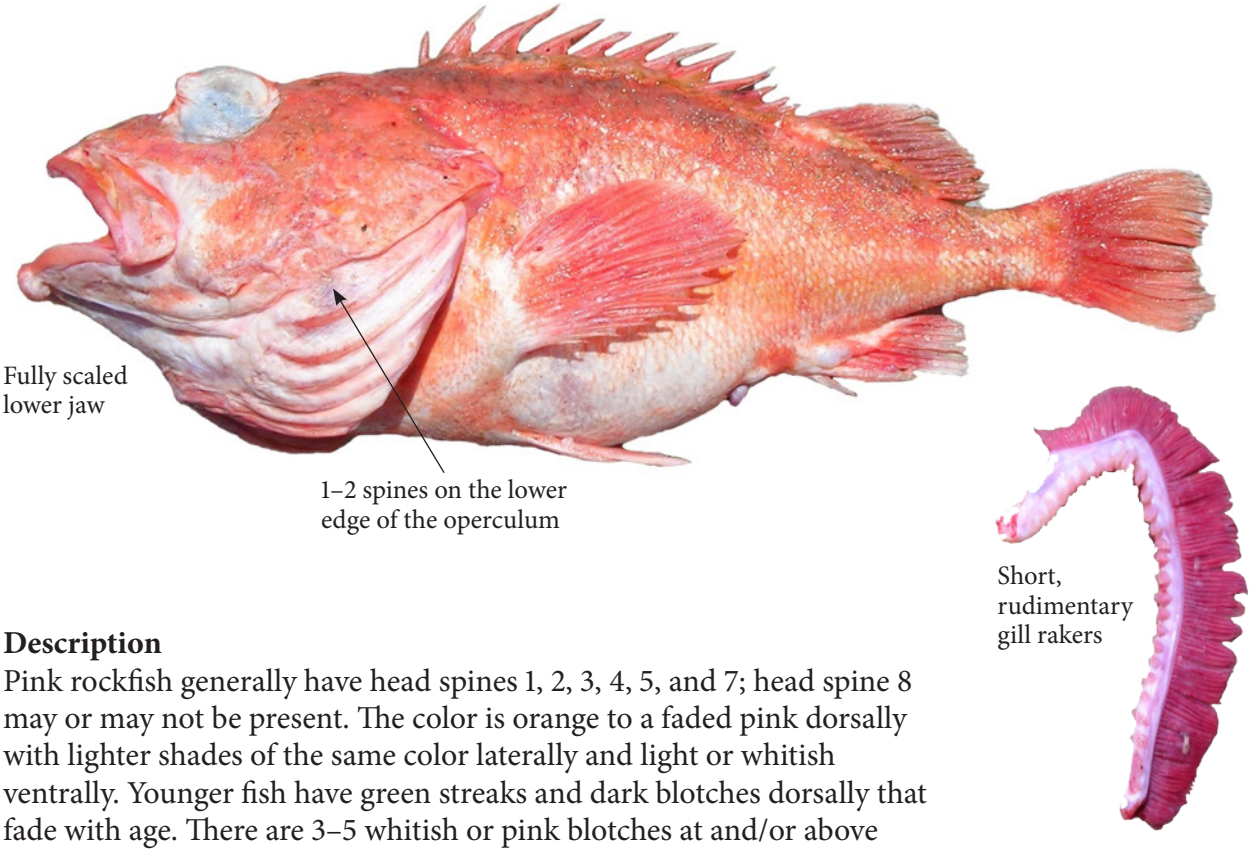
Honeycomb rockfish (*Sebastes umbrosus*)

Description
Honeycomb rockfish generally have head spines 1, 2, 3, 4, 5, and 7; head spine 8 may or may not be present. The color is orange/brown, light orange, or pink/yellow. The fine black dots around the margins of the scales, primarily below the lateral line, give the body a honeycombed appearance. There are large dark areas between the lateral line and the dorsal fins. The 3–5 whitish blotches on the back can turn light brown, light orange, or light pink after death. The fins are generally orange with dusky membranes. To 29 cm TL, possibly more.

Similar species
In freckled rockfish (*Sebastes lentiginosus*), the dentigerous knobs are prominent and pointed (absent, or small and rounded if present, in honeycomb rockfish), there are prominent dark freckling and vermiculations above the lateral line and on the head (absent in honeycomb rockfish), and the dark pigment around the scale margins is absent.

Distribution
Honeycomb rockfish range from Point Pinos, central California, to Bahía San Juanico, southern Baja California, Mexico, at depths of 30–270 m.

Pink rockfish (*Sebastes eos*)



Description

Pink rockfish generally have head spines 1, 2, 3, 4, 5, and 7; head spine 8 may or may not be present. The color is orange to a faded pink dorsally with lighter shades of the same color laterally and light or whitish ventrally. Younger fish have green streaks and dark blotches dorsally that fade with age. There are 3–5 whitish or pink blotches at and/or above the lateral line. The fins are a yellow/pink with the soft dorsal, caudal, and anal fins edged with white. The head and body are robust. There are generally 18 pectoral fin rays and 1–2 spines on the lower edge of the operculum. The 30 or fewer gill rakers, especially on the upper first arch, are short, rudimentary, and have spiny, club-shaped tips. To 56 cm TL.

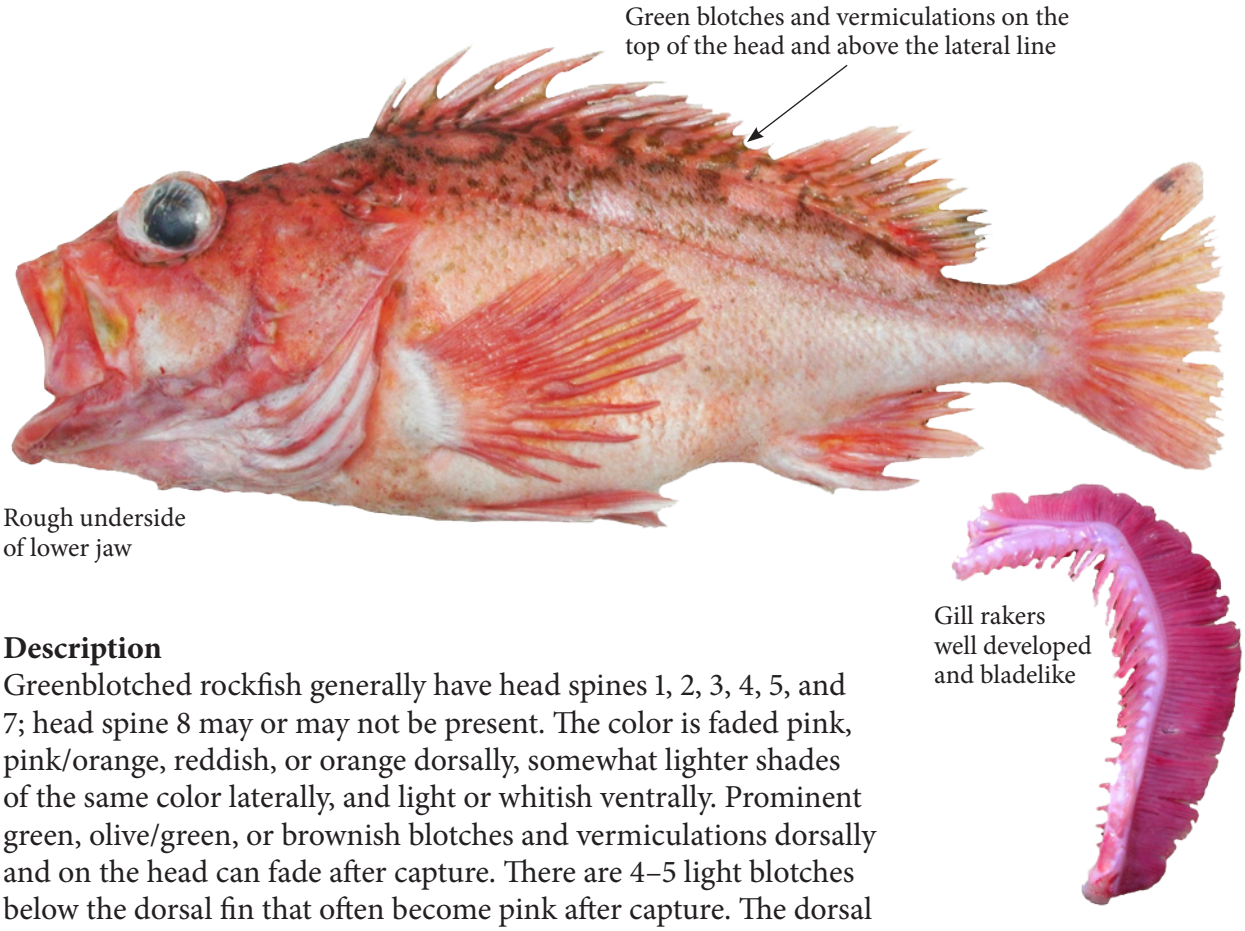
Similar species

The greenblotched rockfish (*Sebastes rosenblatti*) has 17 pectoral fin rays (18 in pink rockfish), the spines on the lower operculum are absent (1–2 in pink rockfish), and the gill rakers on the first gill arch are well developed.

Distribution

Pink rockfish range from central Oregon to southern Baja California, Mexico, at depths of 45–366 m.

Greenblotched rockfish (*Sebastes rosenblatti*)



Description
Greenblotched rockfish generally have head spines 1, 2, 3, 4, 5, and 7; head spine 8 may or may not be present. The color is faded pink, pink/orange, reddish, or orange dorsally, somewhat lighter shades of the same color laterally, and light or whitish ventrally. Prominent green, olive/green, or brownish blotches and vermiculations dorsally and on the head can fade after capture. There are 4–5 light blotches below the dorsal fin that often become pink after capture. The dorsal fin is pinkish and tipped with white. Scales cover the ventral side of the lower jaw. To 48 cm TL.

Similar species
The pink rockfish (*Sebastes eos*) has spines on the lower operculum (absent on greenblotched rockfish), rudimentary gill rakers on the upper arch, and typically 18 pectoral fin rays (17 in greenblotched rockfish). The greenspotted rockfish (*S. chlorostictus*) has prominent green spots (blotches and vermiculations in greenblotched rockfish), and the scales on the lower jaw are absent.

Distribution
Greenblotched rockfish range from Point Delgada, northern California, to Banco Ranger and Isla Cedros, central Baja California, Mexico, at depths of 55–491 m.

Anoplopomatidae (Sablefishes)

The sablefishes, also known as coalfishes, consist of two monotypic genera. Both genera occur in the waters of the North Pacific, where they range from California to Alaska and west to Japan.

Key to the Anoplopomatidae of the FRAM Surveys

1	2 well-separated dorsal fins, second nearly equal to and opposite anal fin..... ***Anoplopoma fimbria***	p 241
1	2 very close-set dorsal fins, second longer than and originating well anterior to anal fin..... ***Erilepis zonifer***	p 242

Sablefish, blackcod (*Anoplopoma fimbria*)

Description
Sablefish vary widely in color. When found in shallow water, the color can range from a greenish-gray to black with reticulated markings dorsally, lighter shades of gray or black/gray with reticulated markings that fade below the lateral line laterally, and light gray to white ventrally. When in deep water, sablefish are a dark, dusky black that may lighten slightly or not at all, with the reticulated markings obscured by the dark body color. To 114 cm TL, possibly more.

Similar species
The skilfish (*Erilepis zonifer*) has a deeper body, close-set dorsal fins, and 12–14 dorsal fin rays (17–30 in sablefish), and its scales extend onto the second dorsal and anal fins. The interorbital space is less than the eye diameter (two or more times the eye diameter in sablefish).

Distribution
Sablefish range from Japan and the Commander Islands through the Bering Sea south of Saint Lawrence Island and the Aleutian Islands to Cedros Island, central Baja California, Mexico. Adult sablefish are generally on or near the bottom at depths of 175–2,740 m; juveniles are often in shallow waters and near the surface.

Skilfish (*Erilepis zonifer*)

Description
Adult skilfish are robust and generally a uniform dark gray to black dorsally, somewhat lighter laterally and ventrally. Juveniles can be black, dark blue/gray, or green dorsally, with somewhat lighter shades of the same color laterally and ventrally. Young adults and juveniles have large, light-colored blotches on the sides that fade with growth. The two dorsal fins are close-set, the interdorsal space less than the eye diameter. The first dorsal is set in a shallow groove; the second dorsal fin base is longer than the first dorsal. The anal fin origin is posterior to the origin of the second dorsal fin. The ctenoid scales extend onto the second dorsal and anal fins. The conical teeth are in two rows in the lower jaw and in a band along the upper jaw. To 183 cm TL.

Similar species
Sablefish (*Anoplopoma fimbria*) are narrower, with dorsal fins equal in size and set wide apart, the first dorsal with 17–30 rays (12–14 in skilfish) not set in a groove, and scales that do not extend onto the fins.

Distribution
Skilfish are found in deep offshore waters from south of the Aleutian Islands and the southern Gulf of Alaska to Monterey Bay, California, at depths of 200–439 m.

Triglidae (Searobins)

The searobins are a large group of 14 genera with over 100 species occurring on the bottom in all the temperate and tropical seas at shallow to moderate depths. The large, bony head is boxlike and can be highly sculptured with spines and ridges. The spinous first dorsal fin is higher, shorter-based, and usually separate from the soft-rayed second dorsal fin. The pectoral fins are broad and winglike with the three lower rays long, free, and separate.

Key to the Triglidae of the FRAM Surveys

Lumptail searobin (*Prionotus stephanophrys*)

Description
The body of the lumptail searobin is silver/gray to purple/brown, darker on the back and lighter on the sides, with numerous brown, rust, and black spots on the back, sides, and soft dorsal, caudal, and pectoral fins. The white belly can have orange or red highlights. The large, winglike pectoral fin extends to or just past the midpoint of the anal fin. The lower three pectoral rays are separate and leglike. To 43 cm TL.

Similar species
The splitnose searobin (*Bellator xenisma*) has a shorter pectoral fin that does not reach the anal fin, and two bony projections on the snout.

Distribution
Although rare north of Baja California, Mexico, lumptail searobins range from Washington State to Chile at depths of 15–110 m.

Splitnose searobin (*Bellator xenisma*)

Description
When fresh, the body color is generally light brown mottled with darker brown or black, with a light or white ventral surface. There may also be a distinct spot on the posterior edge of the spinous dorsal. The spinous dorsal fin is higher, shorter-based, and separate from the soft dorsal. The lower three rays of the pectoral fin are free and leglike. The pectoral fin is broad but short, and does not reach or barely reaches the anal fin. To 11 cm TL, possibly slightly more.

Similar species
The lumptail searobin (*Prionotus stephanophrys*) has a long pectoral fin extending well beyond the anal fin origin, and no bony projections on the snout.

Distribution
Although extremely rare north of Baja California, splitnose searobins range from Santa Barbara, southern California, to Baja California and the Gulf of California, Mexico, to Colombia, at depths of 60–94 m.

Hexagrammidae (Greenlings)

The greenlings are a small group of fishes inhabiting the temperate to sub-Arctic waters of the North Pacific, with one species found as far north as the Chukchi and Beaufort Seas. Depending on the classification used, the number of species ranges from 9–12, and the number of genera from 4–5. For example, some researchers place the following into their own genera: the lingcod (*Ophiodon elongatus*) into Ophiodontidae, and the combfishes (*Zaniolepis* spp.) into Zaniolepididae.

Key to the Hexagrammidae of the FRAM Surveys

1	Single lateral line per side	2
1	Multiple lateral lines per side	5
2(1)	Jaws extend to or beyond rear of eye; large canine teeth; dorsal spines not elongate, connected for most of their length ***Ophiodon elongatus***	p 244
2	Jaws barely reaching or falling short of forward margin of eye; small teeth	3
3(2)	Dorsal spines not elongate, barely incised, with connective membrane for nearly entire length ***Oxylebius pictus***	p 245
3	First dorsal spines elongate, moderately to deeply incised, without connective membrane for most of their length	4
4(3)	First 3 dorsal rays long, second longer than third; cirri above eye absent or very small ***Zaniolepis latipinnis***	p 246
4	Second dorsal ray not much longer than third; large cirrus above eyes ***Zaniolepis frenata***	p 247
5(1)	Complex cirrus above each eye; pair of small cirri in slightly depressed area between eyes and origin to dorsal fin ***Hexagrammos decagrammus***	p 248
5	Complex cirrus above each eye; no other cirri between eyes and origin of dorsal fin ***Hexagrammos lagocephalus***	p 249

Lingcod (*Ophiodon elongatus*)

Blue/green morph:

When closed, jaws extend to or beyond the rear of the eye

Description

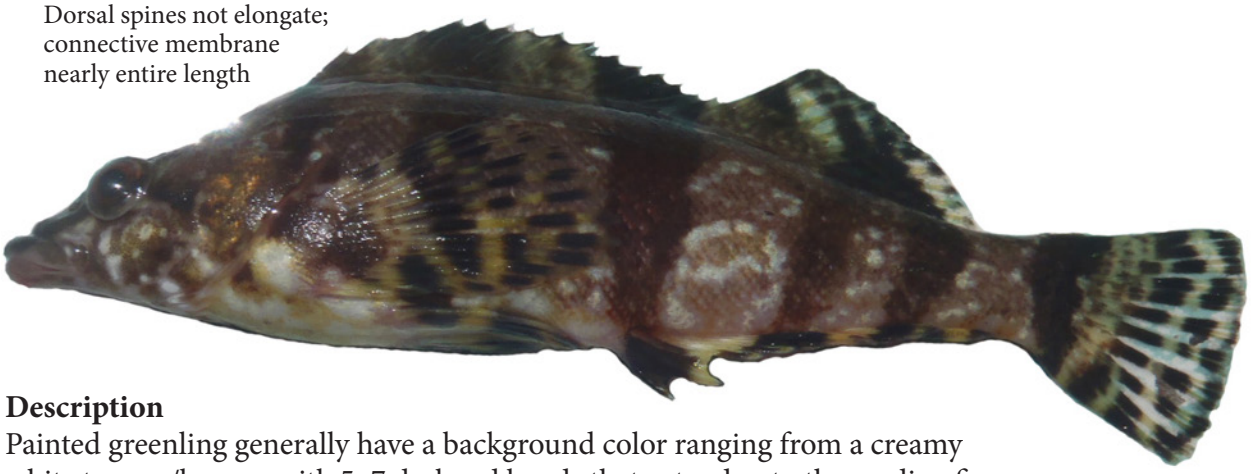
The body color—black, gray, or brown, with shades of blue or green—is somewhat darker dorsally, with dark mottling and yellow, orange, or copper spots dorsally and laterally, and light ventrally. The amount of mottling is highly variable, ranging from little or none to very dense. Occasionally the body color will be a distinct blue/green, with the associated mottling, but unlike the other body colors, the blue/green will permeate the flesh. There is a single lateral line. A deep

notch divides the long dorsal fin between the spinous and soft-rayed portions. The mouth is large, with tooth-filled jaws extending to or past the rear of the eye. There are large, variously shaped cirri (fleshy flaps) above each eye. To 152 cm TL.

Similar species
The combination of the large mouth, sharp teeth, and single lateral line differentiates the lingcod from the other Hexagrammidae.

Distribution
Lingcod range from the Shumagin Islands and the southwestern Gulf of Alaska to Punta San Carlos in northern Baja California, Mexico. Generally on or near the bottom in areas of strong tidal flow, usually near rocky areas, reefs, kelp, or other structures, from shallow inshore waters to 475 m.

Painted greenling, convict fish (*Oxylebius pictus*)

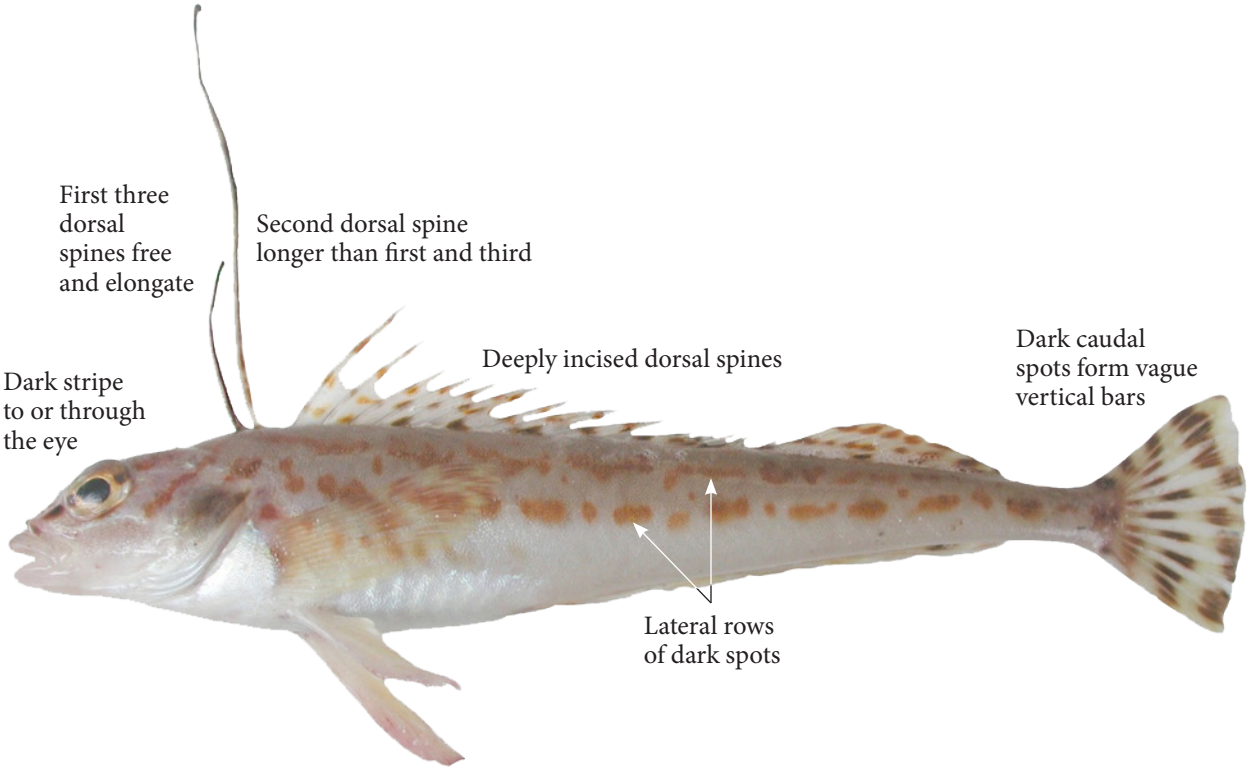


Description
Painted greenling generally have a background color ranging from a creamy white to gray/brown, with 5–7 dark red bands that extend onto the median fins. There are three dark bars radiating from the eye, one anteriorly, two posteriorly. During breeding season, the color can be sexually dimorphic, with the males becoming nearly black and the bars on the females turning brown. The head is long with a pointed snout. The mouth is small, the jaws barely reaching the front of the eye. There are two pairs of cirri on top of the head, the first above the eye, the second in the space between the eye and the dorsal fin. There is a single lateral line. A moderate to shallow notch divides the spinous and soft-rayed dorsal fins. The spines of the dorsal fin are not elongate and have connective membranes almost their entire length. The anal fin usually has three spines, the second being the longest. The caudal fin is rounded. To 25 cm TL.

Similar species
Combfish (*Zaniolepis* spp.) have elongate, moderately to deeply incised dorsal spines mostly free of connective membrane and divided by a deep notch between the spines and rays.

Distribution
Painted greenling range from Snug Harbor in Prince William Sound, Alaska, to the San Benito Islands in central Baja California, Mexico. Usually on the bottom in rocky areas from the shallow intertidal waters to 49 m.

Longspine combfish (*Zaniolepis latipinnis*)



Description

The color is very light tan, brown, or yellow/brown to green, with long lateral rows of dark spots or blotches above the pectoral fin base extending onto the dorsal fin, and a short row behind the pectoral fin. The caudal fin has irregular dark spots on the rays that form vague vertical bars. A dark stripe extends from the tip of the snout to the eye, sometimes continuing beyond the eye. A second dark stripe on the cheek begins below the posterior margin of the eye and extends diagonally to or just beyond the upper edge of the operculum. The first three dorsal spines are very elongate, with the second spine being much longer than the first and third. Cirri above the eyes are usually absent, or very small if present. The single lateral line high on the body follows the dorsal contour throughout its length. The very small ctenoid scales give the skin a rough texture. To 30 cm TL.

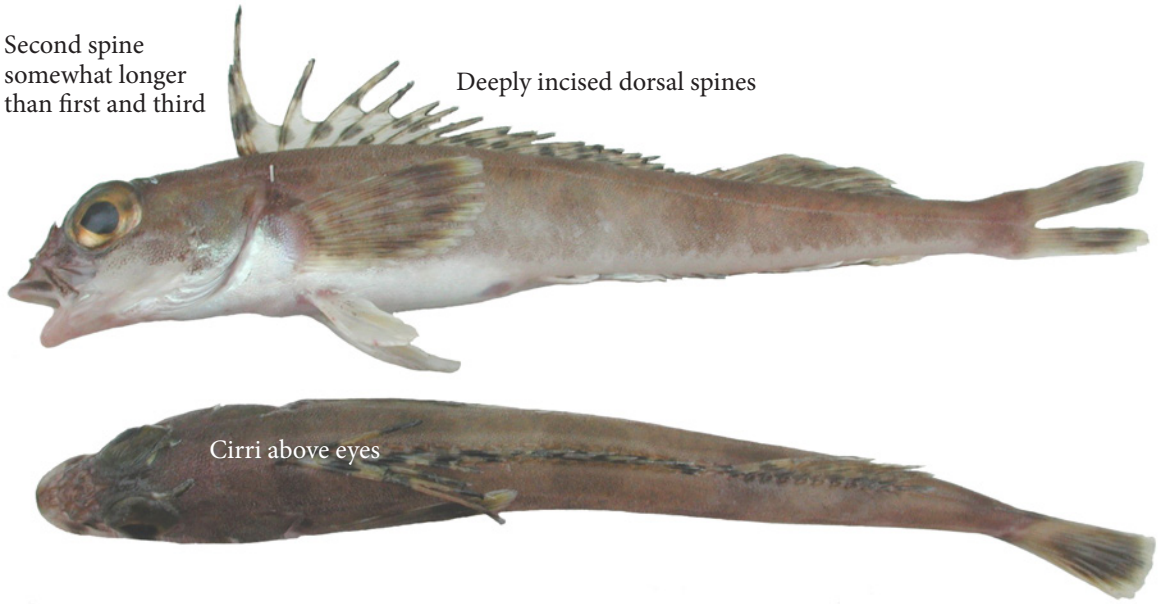
Similar species

In the shortspine combfish (*Zaniolepis frenata*), the first three dorsal spines are somewhat elongate and not free (highly elongate and free in longspine combfish), and there are prominent cirri above each eye (absent or very small in longspine combfish).

Distribution

Longspine combfish range from Vancouver Island, British Columbia, Canada, to central Baja California, Mexico, at depths of 37–201 m.

Shortspine combfish (*Zaniolepis frenata*)



Description
The color is very light tan, brown, or yellow/brown to green, with dark blotches and streaks. The amount and intensity of the blotches and streaks is highly variable, ranging from little or none to forming a short lateral row behind the pectoral fin base and several long vague lateral rows above the pectoral fin and extending onto the dorsal fin. The dorsal fin is generally somewhat dusky to light yellow and, when present, the dark spots can form oblique rows. The caudal fin may be dusky to dark or have rows of dark spots that form vague vertical bars. The second dorsal ray is somewhat longer than the third. There is a cirrus, or fleshy flap, above each eye. The single lateral line high on the body follows the dorsal contour throughout its length. The very small ctenoid scales give the skin a rough texture. To 25 cm TL, possibly more.

Similar species
The longspine combfish (*Zaniolepis latipinnis*) has a highly elongated second dorsal spine and lacks the cirri (fleshy flaps) above the eyes.

Distribution
Shortspine combfish range from southern Oregon to central Baja California, Mexico, usually on the bottom at depths of 4–450 m.

Kelp greenling (*Hexagrammos decagrammus*)

Female

Male

Description

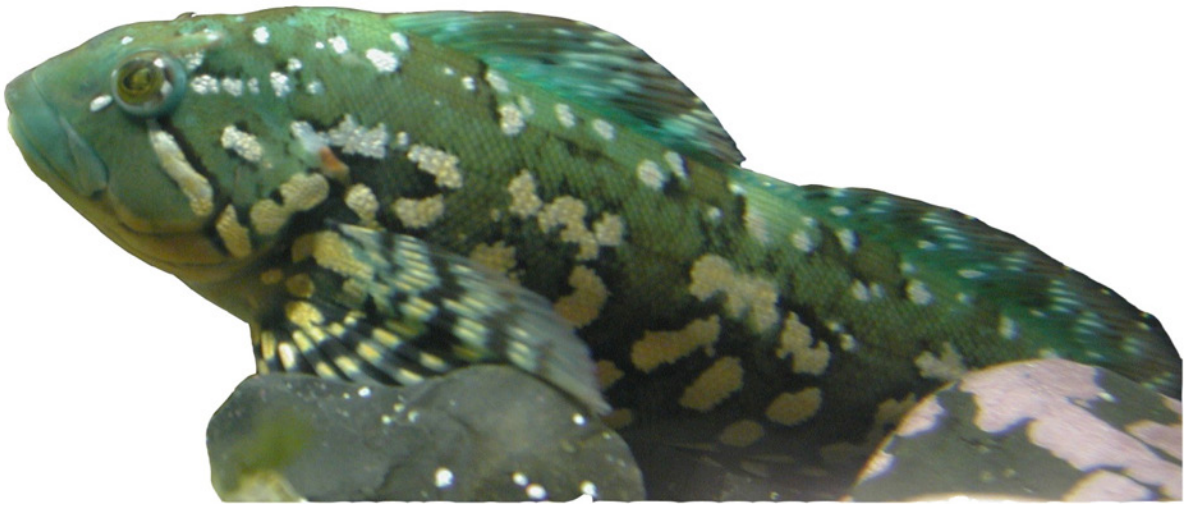
Kelp greenlings are sexually dimorphic in regards to their color. Females range from light brown with small reddish spots to light blue with rows of round orange spots, red to orange on the dorsal fin, clouded with blue, orange, or pale yellow on the pectoral fins without markings. Males are brownish-olive to blue tinged with copper and have blue spots surrounded by small reddish-brown spots on the head and anterior part of the body, brown mottling on the dorsal fin, dusky blue pelvic and anal fins, and brown or black pectoral fins with white spots giving the appearance of transverse bars. Both sexes may have a round dark ocellus (eyespot) with a light border on the posterior end of the rayed portion of the dorsal fin. To 53 cm TL.

Similar species

The painted greenling (*Oxylebius pictus*) has 5–7 red bands, two pairs of cirri (one above the eye and one midway between the eye and the dorsal fin), and a single lateral line. The rock greenling (*Hexagrammos lagocephalus*) has large cirri above each red eye, a blue mouth, and long first and fourth lateral lines.

Distribution
Kelp greenling range from the Aleutian Islands to La Jolla in southern California, usually near rocky areas, reefs, and kelp beds, from the shallow inshore waters to 46 m.

Rock greenling (*Hexagrammos lagocephalus*)



Description
Rock greenling can vary in color, color pattern, and hue. Fish of both sexes are generally dark green to brown dorsally, with dark mottling dorsally and laterally and a light ventral side. The fins have dark bars and blotches and typically a dark spot above the pectoral fin base. The eye is red and the inside of the mouth usually blue. Occasionally the fish will have a highly mottled pattern over a dark blue/green color that will color the entire fish, including the flesh. The males typically have large red and/or orange blotches laterally, while females have long light blue or other light-colored spots on the body. The large cirrus (fleshy flap) above the eye is the only one on the top of the head, and there are small cirri on the tips of the dorsal fin spines. There are five lateral lines, the first extending beyond the middle of the second dorsal. The long fourth extends above the rear half of the anal fin, but the length of the extension can vary. To 61 cm TL.

Similar species
The painted greenling (*Oxylebius pictus*) has a long, pointed head, 5–7 red bands (absent in rock greenling), two pairs of cirri on the head (1 in rock greenling), and a single lateral line (five in rock greenling). The kelp greenling (*Hexagrammos decagrammus*) has dark eyes (red in rock greenling) and two pairs of cirri on the head (one in rock greenling).

Distribution
Rock greenling range from the Aleutian Islands and the eastern Bering Sea and the Gulf of Alaska to Point Conception in southern California, usually on or near the bottom around rocky areas, reefs, and kelp beds, from shallow inshore waters to 73 m.

Rhamphocottidae (Grunt Sculpins)

The only known species in Rhamphocottidae has a distinct appearance. It has a large head with prominent bony ridges with a strongly concave space between them, a long snout, and free lower pectoral fin rays.

Grunt sculpin (*Rhamphocottus richardsonii*)

Description
The grunt sculpin is yellow or yellow/orange on the body, with irregular dark streaks on the sides and around the eyes. The head is large, with a distinct profile, large bony ridges, and a concave forehead. The fin color ranges from red to orange to yellow. The lower rays of the pectoral fin are free. Small spiny plates cover the head and body. To about 9 cm TL.

Similar species
Not likely to be confused with other species.

Distribution
In the northeastern Pacific, grunt sculpins range from the Gulf of Alaska and possibly the Bering Sea to Santa Monica Bay in southern California, from the shallow intertidal waters to 165 m.

Cottidae (Sculpins)

The Cottidae are the largest family of sculpins. Primarily bottom-dwelling fishes, they range throughout the North Pacific. While they are highly variable in body shape, most sculpins generally have a stout, round to boxlike body with a large head that often has various arrays of

spines, knobs, and cirri, with large, fan-shaped pectoral fins. There are 0–4 spines in front of the gill cover. While some species are fully scaled or unscaled, most are partially scaled. The scales can be modified bony plates, prickles, or spines, and can be in distinct rows or scattered over the body. A notch usually separates the spinous and rayed dorsal fins. There are no spines in the long anal fin. The pectoral fin has one small spine, usually covered with skin and closely attached to the first of the five or fewer soft rays. The body color is highly variable.

Key to the Cottidae of the FRAM Surveys

1	9–13 dorsal spines, 21–32 soft rays; 3 pelvic fin rays; 18–21 pectoral rays; 4–11 dermal folds across breast; forked caudal fin; no cirri above eyes or on top of head ..... ***Trigalops macellus***	p 252
1	Not as above 2	
2(1)	Single row of hooked scutes on each side below dorsal fins ..... ***Paricelinus hopliticus***	p 253
2	No row of scutes along dorsal fins 3	
3(2)	Scales deeply embedded, skin appears smooth and scaleless; cirrus on snout ..... ***Scorpaenichthys marmoratus***	p 253
3	Not as above 4	
4(3)	Scales always in 3 distinct, rough bands 5	
4	Not as above 6	
5(4)	Dorsal scale band 4–5 rows; ventral scale band 6–9 rows; gill membranes united and attached along isthmus, forming a free rear margin ..... ***Hemilepidotus hemilepidotus***	p 254
5	Dorsal scale band 6–8 rows; ventral scale band 4–5 rows; gill membranes united and joined to isthmus without a free rear margin ..... ***Hemilepidotus spinosus***	p 255
6(4)	Spinous dorsal fin deeply notched between spines 3 and 4; 3 pelvic fin rays ..... ***Chitonotus pugetensis***	p 256
6	Spinous dorsal fin unnotched; 2 pelvic fin rays 7	
7(6)	2 scale rows just below dorsal fin: row number does not increase anteriorly, rows do not extend onto or across nape; lateral line scales platelike; 2 pelvic fin rays 8	
7	Not as above 11	
8(7)	First 1–2 dorsal spines very long 9	
8	First 1–2 dorsal spines about equal length 10	
9(8)	2 distinct pairs of postocular spines; no cirri on nasal spines; dorsal scale band extends to between rays 5–11 of soft dorsal ..... ***Icelinus tenuis***	p 256
9	No postocular spines; long cirrus at base of nasal spine; dorsal scale band extends to below last 2 soft dorsal rays ..... ***Icelinus filamentosus***	p 257
10 (8)	1 pore on tip of chin; dorsal scale band extends onto caudal peduncle ..... ***Icelinus borealis***	p 258
10	2 pores on tip of chin; dorsal scale band does not extend beyond insertion of soft dorsal ..... ***Icelinus fimbriatus***	p 258
11(7)	Double row of scales begins under dorsal spine 5–6, ends under rear of second dorsal fin ..... ***Icelinus burchami***	p 258
11	1–4 rows of scales immediately below dorsal fin separated by a naked area from large lateral line scales; lateral line high on body, no spines on top of head 12	

12(11)	Snout less than or equal to eye diameter; long pointed nasal spines; pelvic fins long, about equal to or greater than width of pectoral fin base ..... ***Radulinus asprellus***	p 259
12	Not as above	13
13(12)	No scales on body; bony plates on head, cirri, or nasal spines; upper preopercular spine very long	14
13	Large bony lateral line plates; very long upper preopercular spine	15
14(13)	Long, robust upper preopercular spine with 2–6 spinules ..... ***Leptocottus armatus***	p 260
14	Long, lightly upwardly curved preopercular spines; enlarged mandibular pores; more than 20 lateral line pores ..... ***Zesticelus profundorum***	p 261
15(13)	9–13 (usually 12) rays in second dorsal; 8–10 (usually 9) anal fin rays; bony head with prominent ridges ..... ***Enophrys bison***	p 261
15	8–10 (usually 9) rays in second dorsal; 6–7 (usually 7) anal rays ..... ***Enophrys taurina***	p 262

Roughspine sculpin (*Trigalops macellus*)

Description

The head of the roughspine sculpin has a pointed snout and the body is very long and narrow. The color varies from dark brown to olive green with several dark bands (saddles) on the back, fading to a cream color on the belly. The fin membranes are clear with dark narrow bars on the rays of the dorsal, caudal and the upper pectoral fins. The rays of the lower pectoral fin are longer than the upper rays and are generally free from the membrane. Fine prickly scales cover the area above the lateral line without any prominent scale rows or bands. The lateral line scales are large and plate-like. The scales below the lateral line are on numerous folds (dermal folds) giving the area a wrinkled look. To about 30 cm TL.

Similar species

The slim sculpin (*Radulinus asprellus*) has prominent nasal and preopercular spines and a single row of large scales above the lateral line to the middle of the second dorsal fin.

Distribution

Roughspine sculpin range from the Bering Sea through the Aleutian Islands to Washington State, at depths of 18–275 m.

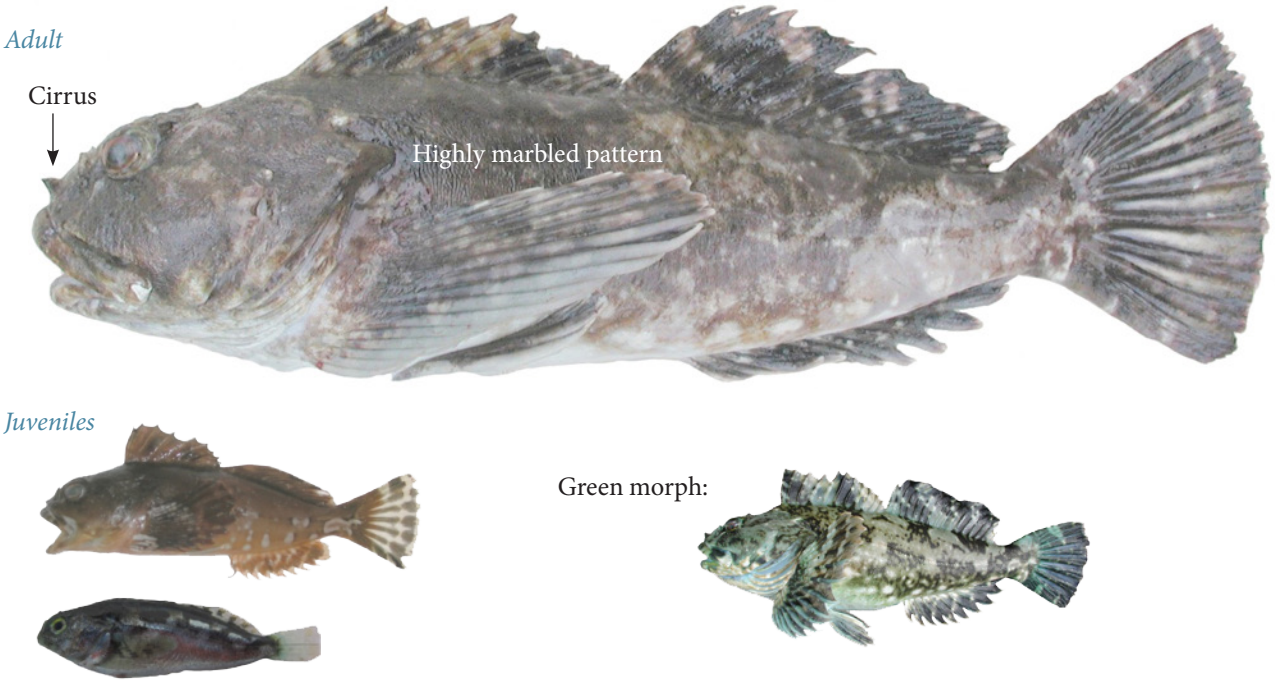
Thornback sculpin (*Paricelinus hopliticus*)

Description
This fish is a slender, elongate sculpin with a row of scales, each with a prominent hooked spine, on either side at the base of the dorsal fins. The body is mostly scale-covered; each scale has a small spine. There are short, slightly curved preopercular spines, and hooked spines below the eye. To about 20 cm TL.

Similar species
The Agonidae have a similar body shape and structure, but the scales are modified bony plates that cover the body.

Distribution
Thornback sculpin range from British Columbia, Canada, to San Diego, California, at depths to 183 m.

Cabezon (*Scorpaenichthys marmoratus*)

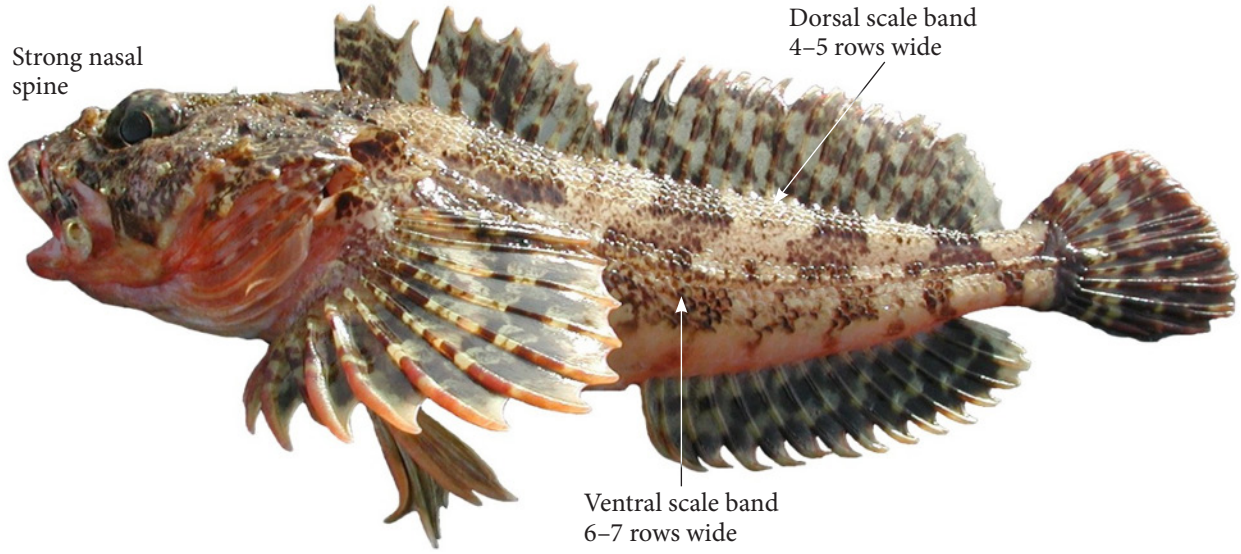


Description
Cabezon vary in color. The brown to red/brown body is highly mottled, with an array of irregular brown to yellow/brown and light-colored blotches and bars. The body can also be green to blue/green, highly mottled, with irregular dark- and light-colored blotches and bars. The dark blue/green color can color the entire fish, including the flesh, that will turn white when cooked. The nasal spines are blunt and covered with skin. The three preopercular spines are covered with skin: the ventral is reduced, the upper two are stout and point backward. The lateral line slopes downward from the anterior end, becoming straight along the sides to the caudal peduncle. Scales are present, but they are so highly embedded that the body appears unscaled. A large triangular cirrus (fleshy flap) folds down on the premaxillaries, and there is a small fleshy cirrus on the end of the maxillaries, a large, lance-shaped, branched cirrus behind the posterior margin of the orbits, and a flap of skin on the snout. The dorsal fin is highly indented, the pelvic fin has five soft rays, and the pectoral fins are very large. To 99 cm TL.

Similar species
Other sculpins generally have fewer soft rays in the pelvic fins and/or have scales.

Distribution
Cabezon range from Sitka, Alaska, to central Baja California, Mexico, at depths from the shallow intertidal waters to 76 m.

Red Irish lord (*Hemilepidotus hemilepidotus*)



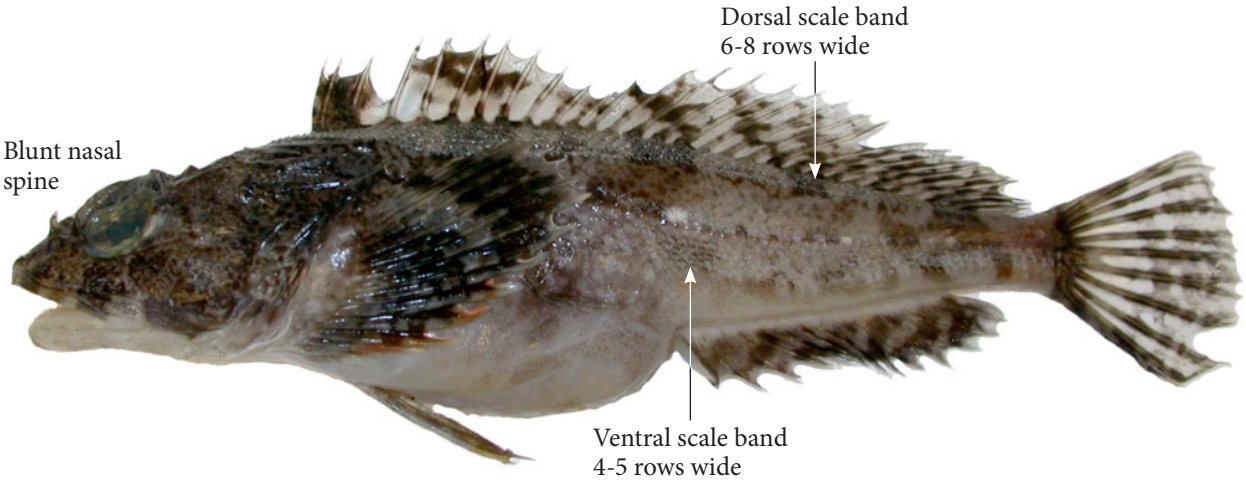
Description
The red Irish lord is red to red/brown with four dark saddles on the back, and white, brown, and black mottling on the back and sides that fades to white or reddish white on the belly. This fish has a strong, prominent nasal spine and ridges on the head that may become rough and wrinkled with age. There are four preopercular spines. The upper two spines are long and sharp, with the first being longest. The two lower spines are small and blunt. The dorsal fin is continuous with the first three spines, shorter than the fourth, with the deeply incised membrane between the third and fourth spines forming a notch, and the posterior dorsal fin rays are branched. There are three

bands of scales. There are 4–5 scale rows in the dorsal band, a shorter row of 7–27 scales above the lateral line, and 6–7 scale rows in the ventral band. The gill membranes are united, attached along the isthmus leaving a free, but narrow, rear margin. To 51, but rarely over 38, cm TL.

Similar species
The brown Irish lord (*Hemilepidotus spinosus*) has a blunt, skin-covered nasal spine, 6–8 dorsal band scale rows, 4–5 ventral band scale rows. Joined at the isthmus, the gill membranes have no free rear margin.

Distribution
Red Irish lords range from the southeastern Bering Sea through the Aleutian Islands to Monterey Bay, California, and can be found in tidepools and out to depths of 48 m, possibly more.

Brown Irish lord (*Hemilepidotus spinosus*)

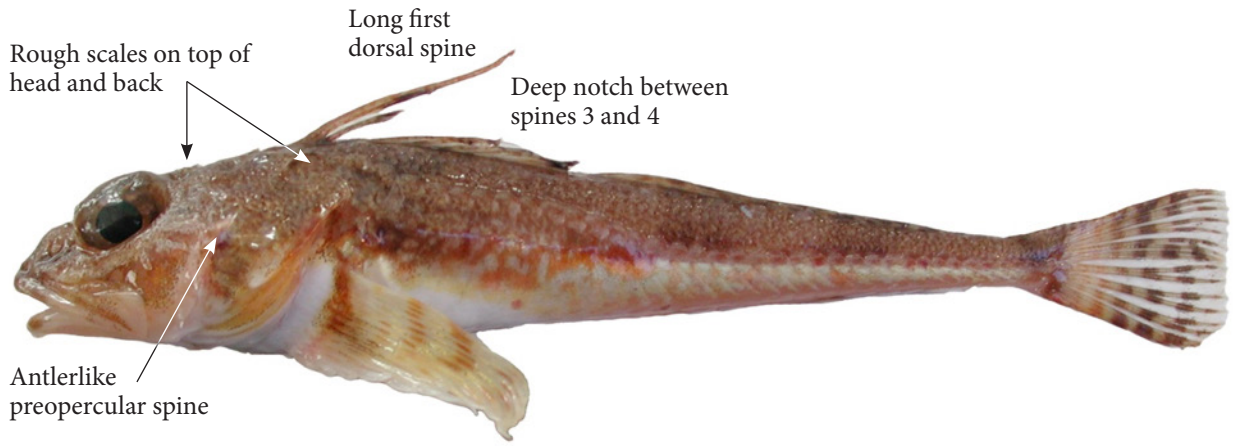


Description
Brown Irish lords are usually various shades of brown with dark mottling and saddles dorsally and a whitish ventral surface. The top of the head can be brownish-red. The fins generally have black and red mottling. The large, blunt nasal spine is skin-covered, and there are ridges on the head that may become rough and wrinkled with age. There are four preopercular spines; the upper two to three are blunt, and longer than the fourth, which is small and sharp. The second dorsal spine of the continuous dorsal fin is longer than the third, and there is a notch between the third and fourth spines. There are three bands of scales, the anal row being absent. There are 6–8 scale rows in the dorsal band, a shorter row of 18–37 scales above the lateral line, and 4–5 scale rows in the ventral band. Joined at the isthmus, the gill membranes have no free rear margin. To 29 cm TL.

Similar species
The red Irish lord (*Hemilepidotus hemilepidotus*) has a sharp, prominent nasal spine, 4–5 dorsal band scale rows, 6–7 ventral band scale rows, and gill membranes that are united and attached along the isthmus with a narrow free rear margin.

Distribution
Brown Irish lords range from the northern Gulf of Alaska to the Santa Barbara Islands in southern California, and can be found in tidepools and out to depths of 97 m.

Roughback sculpin (*Chitonotus pugetensis*)

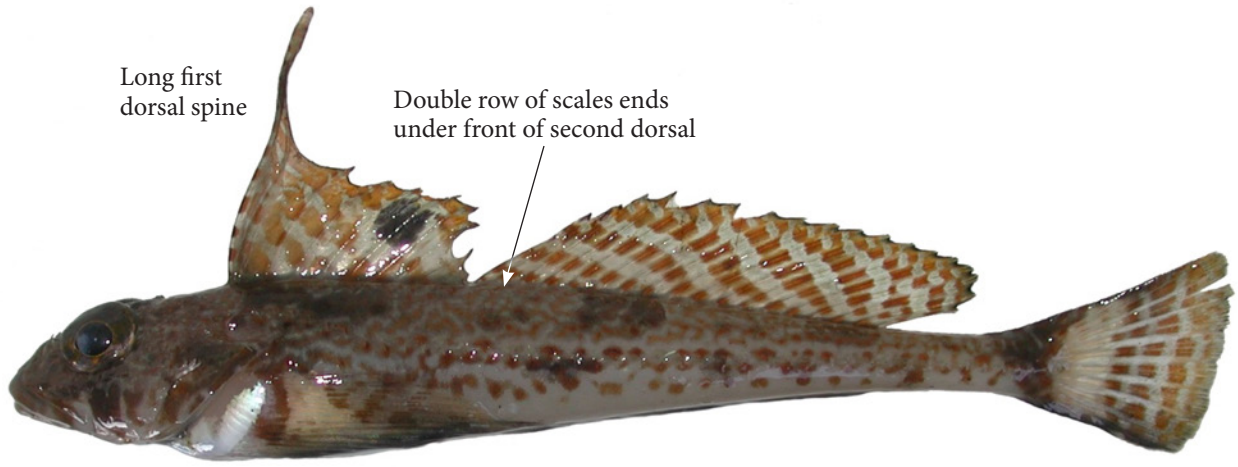


Description
The roughback sculpin is gray/green to red/brown, with dark saddles and blotches on the back that fade to a white to gray/white on the ventral surface. The first dorsal spine is very long, and there is a deep notch between the third and fourth spines. The pelvic fin generally has three (rarely two) soft rays. The scales on the top of the head and along the back are rough. The preopercular spine is prominent and antlerlike. To 23 cm TL.

Similar species
Species of *Icelinus* have two pelvic fin rays, no notch between third and fourth dorsal spines, and no scales on the back. Other similar genera have no scales on the back and/or head.

Distribution
Roughback sculpin range from southeastern Alaska to southern Baja California, Mexico, at depths from the shallow intertidal waters to 142 m.

Spotfin sculpin (*Icelinus tenuis*)

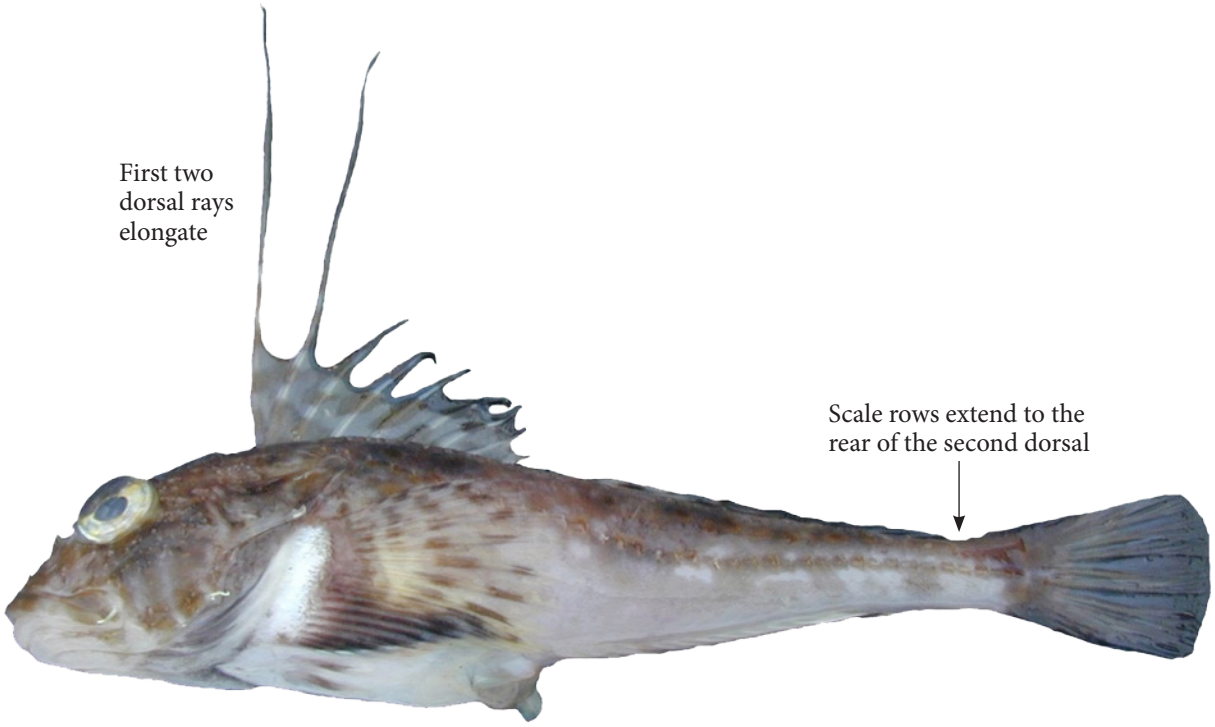


Description
The spotfin sculpin has rows of large, thornlike spines from head to tail, a short-based, high, spinous dorsal with a distinct dark spot, and a blunt protuberance between the two nasal spines. There are two distinct spines behind the upper edge of the eye. The top of the head is concave, and the double row of scales begins under the middle of the first dorsal and ends under the front of the second. To about 16 cm TL.

Similar species
Threadfin sculpin (*Icelinus filamentosus*) have no spines behind the eye and a longer double row of scales.

Distribution
Spotfin sculpin range from Alaska to Baja California, Mexico, at depths of 33–366 m.

Threadfin sculpin (*Icelinus filamentosus*)



Description
The threadfin sculpin is olive green to light brown dorsally, somewhat lighter shades of the same color laterally—especially above the lateral line—with darker mottling and light blotches dorsally and laterally, to a creamy white or yellow to brown ventrally. Usually with four dark saddles across the back and bars of dark blotches on the dorsal, caudal, and pectoral fins. The first two dorsal rays are elongate, with the second being equal to or longer than the first, and scale rows that extend to the last dorsal soft ray. To 27 cm TL, possibly more.

Similar species
Spotfin sculpin (*Icelinus tenuis*) have a concave head, two distinct spines behind the upper edge of the eye, and a short double scale row from the middle of the first dorsal to the front of the second.

Distribution
Threadfin sculpin range from the Gulf of Alaska to southern California, at depths of 18–373 m.

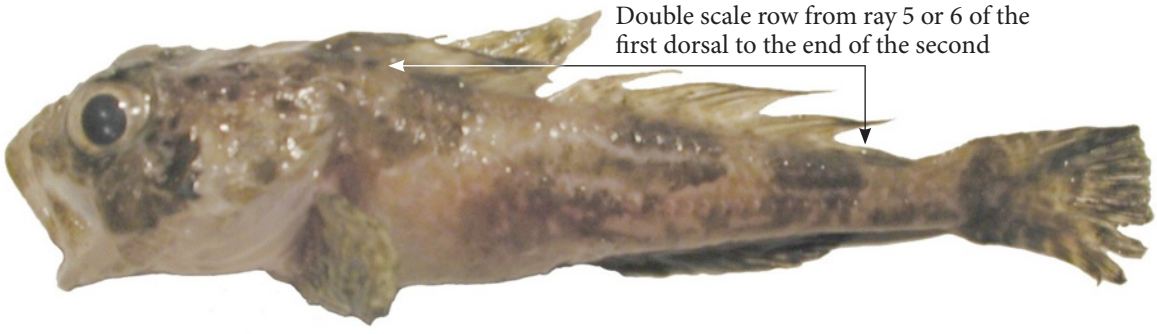
Fringed sculpin (*Icelinus fimbriatus*)

Description
The fringed sculpin is olive/brown with small irregular olive/yellow spots and a white belly. The dorsal, caudal, and pectoral fins are yellowish-green with dark bars. The double row of scales extends onto the caudal peduncle. There are several small cirri at the rear of the upper jaw, and a cirrus with expanded fringed tips at the nasal spine. There are two chin pores. To 19 cm TL.

Similar species
The dusky sculpin (*Icelinus burchami*) has a short double row of scales not extending onto the caudal peduncle. The northern sculpin (*I. borealis*) has a single chin pore.

Distribution
Fringed sculpin range from British Columbia, Canada, to San Diego, California, at depths to 247 m.

Dusky sculpin (*Icelinus burchami*)

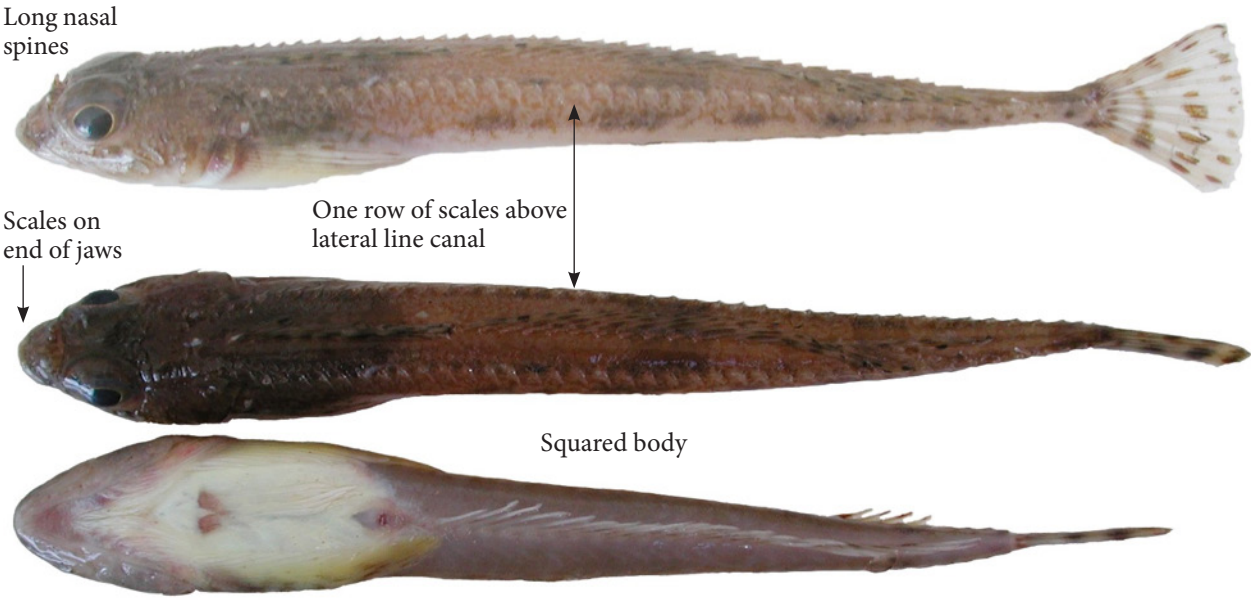


Description
The dusky sculpin does not have spines on the upper rear quarter of the orbit, the post-temporal, or the subopercle, but it does have very large pores on its head. An incomplete double band of scales begins under the fifth or sixth dorsal spine and ends at the last dorsal soft ray. There are no scales beyond the end of the second dorsal. To 13 cm TL.

Similar species
Northern sculpin (*Icelinus borealis*) and fringed sculpin (*I. fimbriatus*) have a double row of scales extending onto the caudal peduncle.

Distribution
Dusky sculpin range from Alaska to southern California, from shallow waters to over 549 m.

Slim sculpin (*Radulinus asprellus*)



Description
The slim sculpin ranges in color among various shades of brown and tan or olive green on the back, with three or four indistinct saddles and orange and brown mottling, lighter on the sides with diffuse dark spots along the lateral line canal. There are brown bars on the dorsal, caudal, and pectoral fins. The pelvic fins are long. The soft dorsal and anal fins have more than 19 rays, and the anal fin has a distinct white edge. The males have a dark spot on the back edge of the spinous dorsal fin. The snout is shorter than the eye diameter. The body is slender, with a straight dorsal profile. The nasal spines are slender, long, and sharp. There are four preopercular spines; the first is long and sharp, the second is triangular, sharp, and stout, and the third and fourth are blunt. There are scales across the ends of the jaws, one row of large spiny lateral line scales, and a single row of small scales above the lateral line canal extending from inside of the orbit to the middle of the second dorsal fin. To 15 cm TL.

Similar species
The darter sculpin (*Radulinus boleoides*) has short nasal spines, two preopercular spines that appear as very small points, and short pelvic fins, and the snout length is greater than the diameter of the eye. The other *Radulinus* species are found in shallow water and have short nasal spines and one or more rows of scales above the lateral line. The Agonidae have a similar body shape and structure, but the scales are modified bony plates that cover the body.

Distribution
Slim sculpin range from the Aleutian Islands and the Gulf of Alaska to northern Baja California, Mexico, at depths of 18–284 m.

Pacific staghorn sculpin (*Leptocottus armatus*)

Description
The Pacific staghorn sculpin ranges in color from greenish-brown to tan to gray, with some yellow dorsally becoming lighter laterally and fading to a light yellow/orange to white ventrally. The color of the dorsal, caudal, and pectoral fins ranges from creamy white to yellow/white with green or dusky bars. There are three preopercular spines. The long, well developed first preopercular spine has 2–6 spinules on the dorsal surface. The two less-prominent lower preopercular spines are simple. To 48 cm TL.

Similar species
Other sculpin species may have similar preopercular spines, but they generally will have 2–3 soft rays in the pelvic fin and variously arranged scales.

Distribution
Pacific staghorn sculpin range from the Bering Sea to central Baja California, Mexico, from the lower brackish and freshwater sections of rivers and streams out to depths of 91 m.

Flabby sculpin (*Zesticelus profundorum*)

Description
Flabby sculpins are small and rare deepwater fish. Fresh specimens have a dark black body, with metallic blue overtones that fade over time and upon preservation. The long, pointed upper preopercular spine has a slight upward curve at the tip. The head is large and has prominent pores below the eye and on the preoperculum. There are no scales, cirri, or papillae on the head or body. There are no lateral line scales, but a series of less than 20 pores. To about 6.5 cm TL.

Similar species
The other sculpin species lack the prominent pores on the head.

Distribution
In the northeastern Pacific, flabby sculpin range from the Bering Sea to northern Baja California, Mexico, at depths of 730–2,580 m.

Buffalo sculpin (*Enophrys bison*)

Description
Buffalo sculpin vary in color from dark brown to green/black or white with dark mottling and 3–4 dark bands dorsally and laterally, often with purplish plates on the head, and white or ivory ventrally. The dorsal, pectoral, and caudal fins have an array of dark blotches, bars, and spots. The pelvic fins are clear. Te pectoral, pelvic, anal, and caudal fins may have an orange edge. The head is

large, bony, and has prominent ridges. The first preopercular spine is extremely long, unbranched, and upward-pointed. The lowest preopercular spine is large, flattened, and points down. The body is scaleless except for a row of large, platelike, raised ctenoid scales high on the back along the lateral line. To 37 cm TL, possibly more.

Similar species
The bull sculpin (*Enophrys taurina*) has nine rays in the second dorsal and seven anal fin rays.

Distribution
Buffalo sculpin range from Kodiak Island to Monterey, California, at depths to 20 m or more.

Bull sculpin (*Enophrys taurina*)

Description
Bull sculpins are dark olive/brown and heavily mottled and spotted with various shades of brown, gray, pink, and white, often with three dark bars alternating with light bars dorsally and laterally, and light ventrally. The pectoral, dorsal, and caudal fins have various brown bands, spots, or marbling. The pelvic fins are clear, and the anal fin is dark or dusky. There are 8–10 rays in the second dorsal and 6–7 rays in the anal fin. The head is large, bony, and has prominent ridges. The first preopercular spine is extremely long, unbranched, and upward-pointed. To 17 cm TL.

Similar species
The buffalo sculpin (*Enophrys bison*) has 12 rays in the second dorsal and nine anal fin rays.

Distribution
Bull sculpin range from San Francisco to Santa Catalina Island, California, at depths from 11–256 m.

Hemitripteridae (Sailfin Sculpins)

The sailfin sculpins consist of eight species in three genera. They take their name from the tall dorsal fin that can be exceptionally long in some species. Numerous prickles or papillae cover the head and body of sailfin sculpins. The prickles are modified platelike scales that have a single

skin-covered spine. There are 3–4 preopercular spines, which tend to be blunt and skin-covered. There are two dorsal fins, the first generally with 6–19 spines and the second with 11–30 soft rays. The anal fin has 11–12 soft rays. The pelvic fins have one spine and three soft rays.

Sailfin sculpin (*Nautichthys oculofasciatus*)

Description
The color of the sailfin sculpin varies from yellow or orange/brown to almost white, with black blotches. A solid black bar crosses the eye and cheek. The nape is short, and the base of the first dorsal is enlarged, forming a deep, prominent notch at the back of the head. The first 3–5 rays of the spinous dorsal fin are very long and separated from the soft dorsal, which generally has more than 26 rays by a deep notch. To about 20 cm TL.

Similar species
The shortmast sculpin (*Nautichthys robustus*) has very sharp, pointed head spines and a short, spinous dorsal fin that is equal to or just higher than the soft dorsal fin, which has 21 or fewer rays.

Distribution
Sailfin sculpin range from the Gulf of Alaska to San Miguel Island, southern California, sometimes in tidepools and out to depths of 110 m.

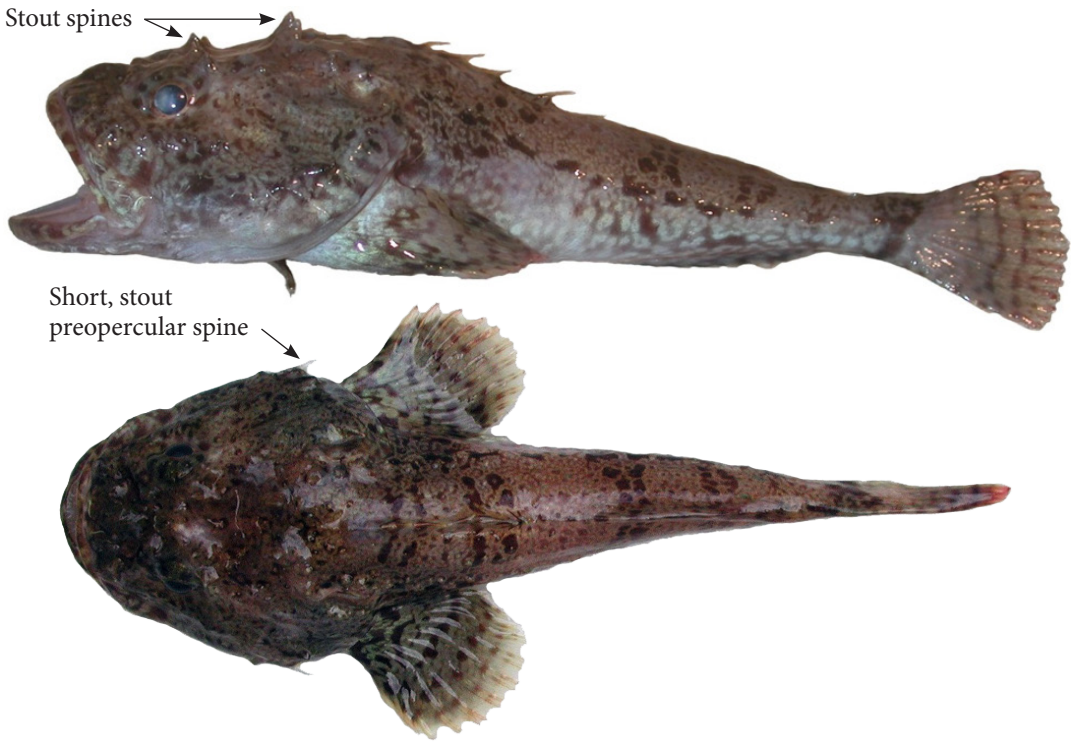
Psychrolutidae (Fathead Sculpins)

The fathead sculpins include about 30 species. Fathead sculpins are tadpole-shaped fishes with loose, movable skin over a clear gelatinous layer. The base of the continuous dorsal, especially the spinous portion, is skin-covered. The pelvic fins have one spine with three soft rays whose bases are skin-covered.

Key to the Psychrolutidae of the FRAM Surveys

1	Spines on head and/or preopercle; may have cirri on lower jaw; space between eyes less than 2× diameter of eye	2
1	No spines on head or preopercle; no cirri on lower jaw; space between eyes more than 2× diameter of eye	3
2(1)	Gill membranes attached to each other and free from isthmus; spines on head and preopercle; dorsal fins separate or barely connected — ***Dasycottus setiger***	p 264
2	Gill membranes attached to isthmus with no free rear edge; if noticeable, head spines very weak; preopercular spines long & sharp; no secondary preopercular spine; dorsal fins separate or barely connected — ***Malacocottus kincaidi***	p 265
3(1)	Head large, more than 40% of SL; thick, tough skin without bands or other color patterns — ***Psychrolutes phrictus***	p 266
3	Not as above	*n/a*

Spinyhead sculpin (*Dasycottus setiger*)



Description
The spinyhead sculpin is tan to gray/tan with brown spots and/or patches and dark saddles dorsally and on the lateral sides. The ventral surface is light with gray/blue mottling. The dorsal, caudal, and pectoral fins have dark specks and/or bars. This species has a stout spine above the eye and one between the eye and the dorsal fin. The upper preopercular spine is short and stout. Cirri cover the body and head. There are one to two broken rows of prickly papillae below the dorsal fin. The pelvic fin has three soft rays. To 45 cm TL.

Similar species
Bigmouth sculpin (*Hemitripterus bolini*) are papillae-covered, with free dorsal fin ray tips.

Distribution
In the northeastern Pacific, spinyhead sculpin range from Navarin Canyon and the Aleutian Islands to Washington State, at depths of 15–850 m.

Blackfin sculpin (*Malacocottus kincaidi*)

Description
The color of the blackfin sculpin varies from gray to light brown with dark brown blotches and light spots. Except for the pelvic fins, the fins have a white edge and one or more dark bars and irregular blue/gray blotches and/or bars. The white edge turns golden on breeding males. A deep notch separates the dorsal fins. The joined gill membranes attach to the isthmus. The loose, flabby skin has a few scattered prickles. Skin covers most of the short, blunt nasal spines. There are four preopercular spines, the first two slender and diverging on the upper angle of the preopercle, the third below and ahead of the first two and directed forward and down, the fourth small and obscured. Generally, there is no accessory spine at the base of the second preopercular spine. To about 20 cm TL, possibly more.

Similar species
The darkfin sculpin (*Malacocottus zonurus*) has a more robust body, four strong preopercular spines, and a prominent accessory spine in front of the second preopercular spine.

Distribution
Blackfin sculpin range throughout the Bering Sea and the Aleutian Islands to Washington State and Puget Sound, at depths of 27–1,205 m.

Blob sculpin (*Psychrolutes phrictus*)

Description
Blob sculpin range from gray to black dorsally, sometimes with vague white mottling but with no other distinct bands or patterns. The face of large adults may be white. The tapering light gray to purple/gray body is naked except for a few plates bearing prickles. The prickles are more noticeable on small specimens. Thick, tough skin covers the large head and globular body. The head and body have scattered small cirri. The spinous and soft-rayed portions of the dorsal fin are continuous, but the spinous dorsal is low and mostly covered with skin. The lateral line has twenty pores or fewer. To 70 cm TL.

Similar species
The tadpole sculpin (*Psychrolutes paradoxus*) is a small animal with two rows of prickles on the ventral side, no cirri, and fewer (19–23, but generally 20–21) pectoral fin rays. In the soft sculpin (*P. sigalutes*), the spinous and soft-rayed portions of the dorsal fin are continuous and of equal height, and the dorsal and anal fins extend onto the base of the caudal fin. They have fewer (14–18, usually 17) pectoral fin rays (22–26 in blob sculpin).

Distribution
Blob sculpin range from Japan and the Bering Sea to San Diego, California, at depths of 480–2,800 m.

Agonidae (Poachers)

The poachers are a group of bottom-dwelling fishes with bodies completely covered in bony plates, giving them an armored appearance. Primarily found in the North Pacific Ocean, poachers range from the Arctic Ocean to Mexico over a variety of habitats ranging from tidepools to the continental slope. In addition to the bony plates, poachers usually have a long body, unbranched fin rays, and lack a swim bladder. Poachers usually have two dorsal fins. If present, the first dorsal fin has 2–21 spines, and the second dorsal fin has 4–14 rays. The anal fin has 4–28 rays. The lower rays of the pectoral fins may be thick and extend beyond the fin membrane. The thoracic pelvic fins have one spine and two rays, but are longer in adult males than females.

Key to the Agonidae of the FRAM Surveys

1	United gill membranes free from isthmus	2
1	Gill membranes united, attached to isthmus with or without a free rear margin or fold	7
2(1)	No plates, but numerous prickles on breast; 7–9 anal fin rays; 16–19 pectoral fin rays — ***Stellerina xyosterna***	p 268
2	Breast plates present; 10–16 anal fin rays (rarely 7–9); 13–16 pectoral fin rays	3
3(2)	7–13, but usually 10–12, anal fin rays — ***Chesnonia verrucosa***	p 268
3	Not as above	4
4(3)	Cirri or barbels on gill membranes, greater than or equal to 1 on each branchiostegal ray; barbels on cheeks, snout and around mouth sometimes on underside of snout; occipital pit present	5
4	Not as above	6
5(4)	Pectoral fins dark brown with white tips; cirri may or may not be on underside of snout — ***Agonopsis vulsa***	p 269
5	Pectoral fins white; no cirri on underside of snout — ***Agonopsis sterletus***	p 270
6(4)	No heart-shaped pair of pits at rear of head; patch of 13–19 barbels on underside of snout; upper preopercular spine not laterally expanded — ***Podothecus accipenserinus***	p 270
6	Distinct heart-shaped pair of pits at rear of head; vertical spine at tip of rostral plate; long body — ***Odontopyxis trispinosa***	p 271
7(1)	Starlike arrangement of spines with 5 or more points, with 3 pointed up, on rostral plate	8
7	1 dorsally directed spine on rostral plate	11
8(7)	Uniform black fins; projecting lower jaw — ***Bathyagonus nigripinnis***	p 271
8	Fins not black; lower jaw not projecting	9
9(8)	2 median pairs of plates immediately in front of pelvic fins; 40 or more supralateral plates; 39 or more infralateral plates — ***Bathyagonus pentacanthus***	p 272
9	1 median pair of plates immediately in front of pelvic fins; less than 40 supralateral plates; less than 39 infralateral plates	10
10(9)	Free lachrymal margin smooth; 2 spines on infraorbital ridge; anal fin origin below space between 2 dorsal fins — ***Bathyagonus alascanus***	p 273
10	Serrated free lachrymal margin; 3 spines on infraorbital ridge; anal fin origin below first dorsal fin insertion — ***Bathyagonus infraspinatus***	p 273

11(7)	No spines on eye ..... ***Xeneretmus leiops***	p 273
11	2–6 spines in a row on top of eye	12
12(11)	1 large barbel at rear of upper jaw, occasionally with 2 or 3 small barbels ..... ***Xeneretmus latifrons***	p 274
12	2 large barbels at rear of upper jaw ..... ***Xeneretmus triacanthus***	p 274

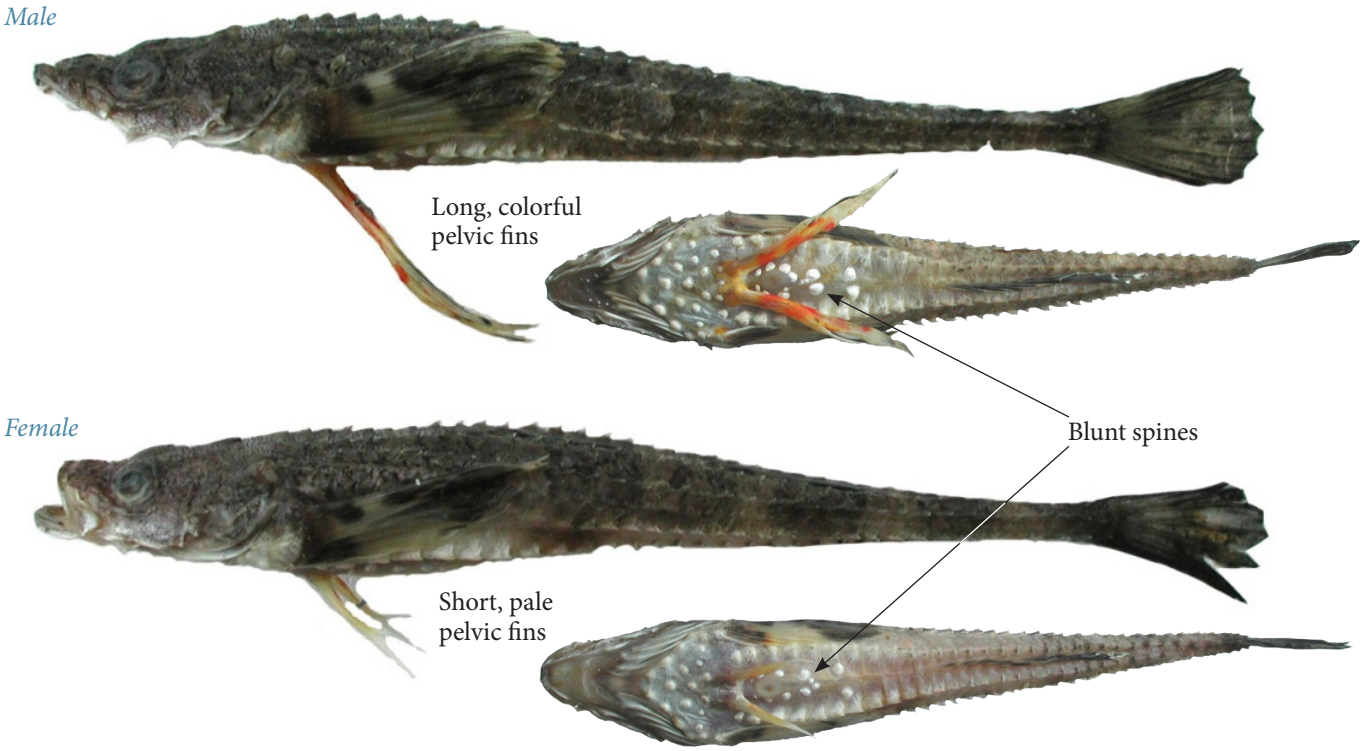
Pricklebreast poacher (*Stellerina xyosterna*)

Description
Pricklebreast poachers are light olive to olive/brown with spots dorsally and light ventrally. The rear half of the pectoral fin has a dark band followed by a clear tip. The dorsal fins have black edges. The rear of the anal fin has a black mark and the caudal fin is black. There is a long barbel on the end of the jaw. There are no plates, but numerous prickles cover the breast. To 16 cm TL.

Similar species
The fins of the blackfin poacher (*Bathyagonus nigripinnis*) are all black.

Distribution
Pricklebreast poachers range from the northern Gulf of Alaska to northern Baja California, Mexico, at depths of 5–75 m.

Warty poacher (*Chesnonia verrucosa*)

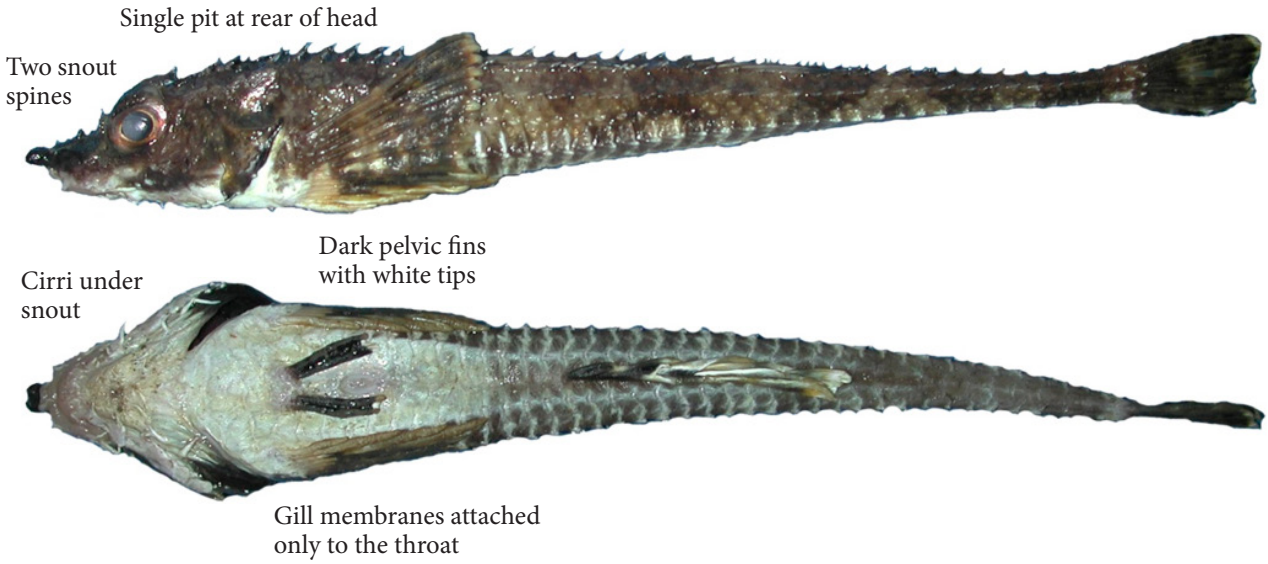


Description
The body of the warty poacher is gray to brown on the back with a light belly. The body and dorsal fin have dark bands. The pelvic fin's shape and color are sexually dimorphic: the male pelvic fin is long (reaching the anal fin), expanded, and is black and orange. The female pelvic fin is short, unexpanded, and pale. The anal fin is long and has ten to twelve rays. The scales on the belly form blunt spines. To 20 cm TL.

Similar species
Other similar Agonidae have nine or fewer rays on the anal fin.

Distribution
Warty poachers range from the Gulf of Alaska to central California, at depths of 21–330 m.

Northern spearnose poacher (*Agonopsis vulsa*)



Description
The northern spearnose poacher has a dark brown back with six or more dark bars on the sides. Its belly is light. It has two forward-pointing spines on the tip of a pointed snout, and a prominent pit at the rear of the head. Gill membranes attach to the throat, but not to each other. The pelvic fins are dark brown with white tips. Barbels and cirri are present on the gill plate and membranes, jaws, lips, and chin, and they may or may not be present on the underside of the snout. To 20 cm TL.

Similar species
Southern spearnose poachers (*Agonopsis sterletus*) are similar in appearance, but lack the cirri (fleshy flaps) under the snout, and the pelvic fins are white. The pygmy poacher (*Odontopyxis trispinosa*) has barbels on the end of the upper jaw, not at the corner of the mouth, a single prominent spine on the tip of the snout, and a heart-shaped pair of pits at the rear of the head.

Distribution
Northern spearnose poachers range from southeastern Alaska to Point Loma, California, at depths of 0–180 m.

Southern spearnose poacher (*Agonopsis sterletus*)

Description
Southern spearnose poachers are dark brown to black on the back, usually with seven dark bars, and slightly lighter on the sides, with a light belly. The fins can have bands or be clear, except for the pelvic fins, which are white. There are two forward-pointing spines on the tip of the snout, but there are no cirri (fleshy flaps) on the underside of the snout. To 15 cm TL.

Similar species
The northern spearnose poacher (*Agonopsis vulsa*) has brown pelvic fins with white tips.

Distribution
Southern spearnose poachers range from San Simeon, California, to central Baja California, Mexico, at depths of 42–91 m.

Sturgeon poacher (*Podothecus accipenserinus*)

Description
The body color of the sturgeon poacher ranges from yellow/brown or olive/brown to gray/brown. This species has dark bands on the back and lighter sides. The belly varies from orange or yellow to white. The dorsal and caudal fins have a dark edge. The anal fin has a dark blotch on the rear edge. The pectoral fins have faint bands on the clear upper and dark lower halves. The densely packed patches of barbels under the snout, numbering 13 to 19, are yellow. The barbels around the mouth are white. The inferior mouth has a gap when closed. To about 31 cm TL.

Similar species
The inferior mouth separates the sturgeon poacher from most other Agonidae.

Distribution
Sturgeon poachers range from the northern Kuril Islands and the Sea of Okhotsk through the northwestern Pacific Ocean and the Bering Sea to the Aleutian Islands, from Attu Island to Point Reyes, California, at depths of 2–300 m.

Pygmy poacher (*Odontopyxis trispinosa*)

Description
The body is olive green or olive brown to gray, with lighter shades of the same color laterally and light or whitish ventrally. There are generally 6–7 dark blotches or bands across the back and down the upper sides. Sometimes with dusky or dark spots, blotches, and streaks on the dorsal, pectoral, and caudal fins that form vague vertical bars. The anal and pelvic fins are pale. There is a single vertical spine on the end of the snout, in front of the nasal spines. There is a single barbel at the end of the jaws. On the back of the head there is a moderately large pit, divided by a long, noticeable longitudinal ridge, resembling the shape of a heart. To about 10 cm TL.

Similar species
The heart-shaped pit on the back of the head distinguishes the pygmy poacher from other closely related species.

Distribution
Pygmy poachers range from the Gulf of Alaska, Prince William Sound, and possibly the southeastern Bering Sea, to Cedros Island, Baja California, Mexico, at depths of 5–373 m.

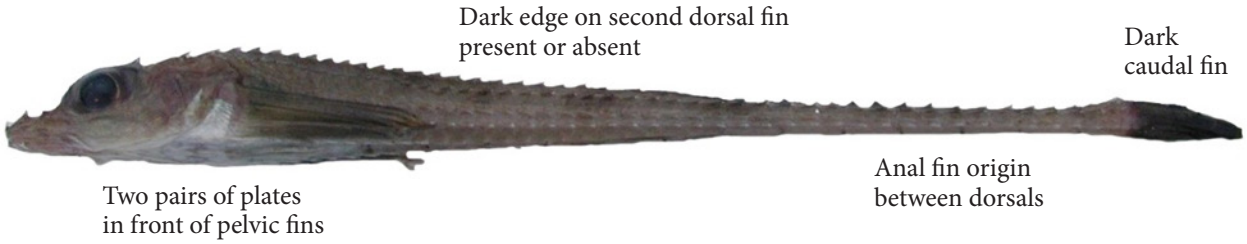
Blackfin poacher (*Bathyagonus nigripinnis*)

Description
Blackfin poachers are light to dark brown dorsally and laterally with light dusky brown on the posterior portion of the ventral surface. The ventral side of the head and anterior portion of the ventral surface are dark blue or blue/black. The dorsal, anal, caudal, and pelvic fins are black. The pectoral fins are black, but can have blue highlights on the ventral edge. The eyes are large, with a ridge of poorly developed suborbital spines. The terminal mouth has a protruding lower jaw. To 24 cm TL.

Similar species
The all-black fins distinguish the blackfin poacher from other related species.

Distribution
Blackfin poachers range from the northern Kuril Islands and Kamchatka to the Commander Islands, through the Bering Sea and the Aleutian Islands to Eureka, California, at depths of 90–800 m.

Bigeye poacher (*Bathyagonus pentacanthus*)



Description
Bigeye poachers are olive brown dorsally and laterally and the same or somewhat paler ventrally, usually with 4–6 indistinct dark bands across the back and down the sides. There are dusky areas on the dorsal and pectoral fins. The posterior edge of the second dorsal can be dark. The anal and pelvic fins are mostly pale, and the caudal fin is very dusky to black. There is a narrow concave gap between the large eyes. There is a row of 4–6 blunt, spinous projections on the upper edge of the eye. There are five or more spines in a star-shaped pattern on the movable rostral plate. There is a well developed but weakly serrated ridge with three spines below the eye, and three spinous plates below the ridge. There are two pairs of bony plates in front of the pelvic fins. The anal fin originates under the interdorsal space. To about 26 cm TL.

Similar species
The gray starsnout (*Bathyagonus alascanus*) has one pair of plates ahead of the pelvic fins and two spines below the eye. The smootheye poacher (*Xeneretmus leiops*) has no spines on the eye.

Distribution
Bigeye poachers range from the western Gulf of Alaska to Cortez Bank, southern California, at depths of 75–910 m.

Gray starsnout (*Bathyagonus alascanus*)

Description
Gray starsnout are gray/green to light brown dorsally and laterally and the same or lighter ventrally. Usually with 4–6 dark blotches or bands across the back and on the sides. The fins are pale, with bars on the dorsal, caudal, and pectoral fins. There are 5–10 spines on the eye and two spines on the infraorbital ridge, one on the lachrymal and one on the second infraorbital. There are 2–3 tightly joined, spineless plates below the ridge. This species has a single plate or a single pair of bony plates directly in front of the pelvic fins in the median row of plates. To 14 cm TL.

Similar species
The bigeye poacher (*Bathyagonus pentacanthus*) has two pairs of plates ahead of the pelvic fins, fewer spines on the eye, three spines on and three spines below the infraorbital ridge, and darker fins. The smootheye poacher (*Xeneretmus leiops*) has no spines on the eye.

Distribution
Gray starsnout range from west of the Pribilof Islands to northern California, at depths of 18–252 m.

Spinycheek starsnout (*Bathyagonus infraspinatus*)

Description
Spinycheek starsnout are olive green to brown dorsally and laterally and whitish ventrally. There are 5–6 dark bars or blotches on the body. The fins are pale, with bars on the dorsal, caudal, and pectoral fins. There are 6–10 spines on the eye, three spines on the serrated ridge below the eye, with three spinous plates below the ridge. There is a single plate or single pair of plates directly in front of the pelvic fins in the median row of plates. To 14 cm TL.

Similar species
Gray starsnouts (*Bathyagonus alascanus*) have two spines on the smooth ridge below the eye and 2–3 spines below the ridge under the eye.

Distribution
Spinycheek starsnout range from the Pribilof Islands to Eureka, California, at depths of 6–183 m.

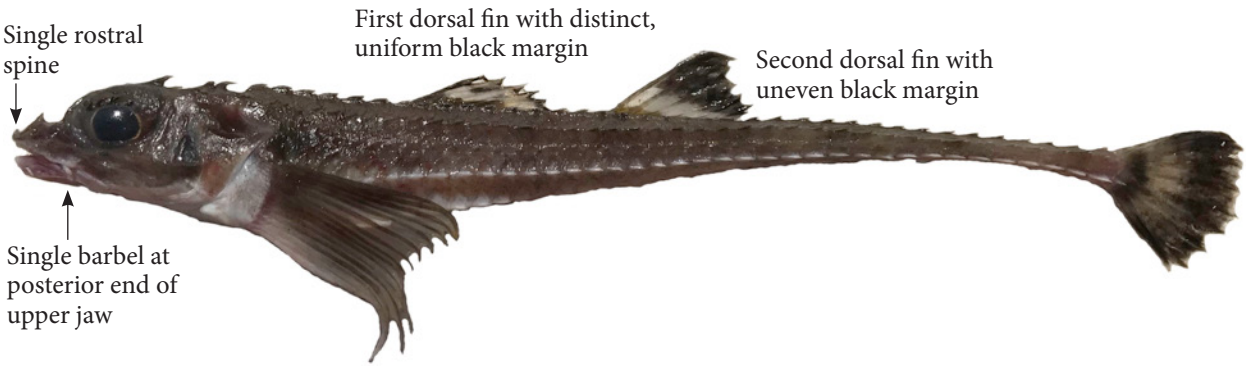
Smootheye poacher (*Xeneretmus leiops*)

Description
Smootheye poachers are olive/green dorsally and laterally and whitish ventrally, usually with six or more dark blotches on the sides. The tip of the snout is black and has one dorsally directed rostral spine and, often, one tiny, laterally directed spine on each side. The margin of the first dorsal fin is black, with the black color extending down the anterior edge. The margin of the second dorsal is dusky, with the dusky color extending down the anterior edge. The fins are clear. The anal fin originates under the second dorsal origin. There are no plates below the ridge under the eye and no spines on the eye. To 27 cm TL.

Similar species
The lack of spines on the eye distinguishes the smootheye poacher from other similar species.

Distribution
Smootheye poachers range from southeastern Alaska to Santa Catalina Island, southern California, at depths of 37–399 m.

Blacktip poacher (*Xeneretmus latifrons*)



Description
Blacktip poachers are brown, tan, or olive dorsally, somewhat lighter shades of the same color laterally, and light brown to cream ventrally, usually with 5–8 faint dark bars on the body. The first dorsal fin has a distinct, uniform black margin. The second dorsal fin has a dark, unevenly edged margin. The dark coloration on the margins of the dorsal fins does not extend onto the fins' leading edges. The caudal fin is dusky to dark and may have a dark posterior margin. The remaining fins are dusky. The anal fin originates below the gap between the dorsal fins. The single rostral spine may or may not have a single smaller spine on each side. Plates below the infraorbital ridge are absent (though rarely there is one). There are 3–6 spines on the eye. There is a single barbel at the posterior end of the maxilla. To 19 cm TL.

Similar species
Smootheye poachers (*Xeneretmus leiops*) have no spines on the eye. Bluespotted poachers (*X. triacanthus*) have bright blue spots on the head, no black dorsal fin margins, 2–3 barbels on the posterior end of the maxilla, and 1–4 plates below the infraorbital ridge.

Distribution
Blacktip poachers range from Rennell Sound and Skidgate Channel, British Columbia, Canada, to Punta Colonet, northern Baja California, Mexico, at depths of 18–400 m.

Bluespotted poacher (*Xeneretmus triacanthus*)

Description
Bluespotted poachers are olive brown dorsally, lighter shades of the same color laterally and ventrally, and usually with bright blue spots on and behind the head. The fin rays and membranes are dusky. The anal fin originates under the second dorsal fin origin. There are 1–4 plates below

the infraorbital ridge, and 2–6 spines on the eye. There are 2–3 barbels on the posterior end of the maxilla, three small barbels on the mandible, and one each at the posterior margins of the first three mandibular pores. To 18 cm TL.

Similar species
The blue spots on and behind the head distinguish the bluespotted poacher from other related species.

Distribution
Bluespotted poachers range from Kwatna Inlet, northern British Columbia, Canada, to Punta Baja, northern Baja California, Mexico, at depths of 73–373 m.

Liparidae (Snailfishes)

Snailfishes are a group of tadpole-shaped, soft-bodied fishes that are generally covered with a layer of gelatinous tissue. The body cavity is shorter than the caudal region. Snailfishes usually have a single, long dorsal fin and anal fin. Many species have a ventral sucking disc derived from the pelvic fins. In other species, it is absent or greatly reduced. The snailfishes range throughout the cold and temperate marine waters in a variety of habitats from tidepools to the abyssal plain. They are generally bottom-dwelling fishes, but a few are pelagic or benthopelagic.

Key to the Liparidae of the FRAM Surveys

1	2 nostrils per side; well developed sucking disc; pseudobranchs present	2
1	1 nostril per side; variously developed sucking disc may or may not be present; no pseudobranchs	3
2(1)	Dorsal and anal fins join with caudal fin for most of its length; pectoral fin ray count less than anal fin ray count; 45 or more dorsal fin rays and 39–42 anal fin rays	***Liparis pulchellus*** p 276
2	Dorsal and anal fins join with caudal fin, anal farther than dorsal; 37–40 dorsal fin rays; 30–33 anal fin rays	***Liparis dennyi*** p 277
3(1)	Disc present, but variable in development	4
3	No disc	6
4(3)	Rudimentary disc	5
4	Well developed disc	13
5(4)	Long lower pectoral fin rays nearly completely free; strongly arched anterior dorsal profile decreasing gradually to caudal fin	***Elassodiscus caudatus*** p 278
5	Not as above	6
6(3)	Barbels on snout	7
6(5)	No barbels on snout	8
7(6)	2 transparent or lightly speckled barbels on snout; strongly lobed teeth	***Rhinoliparis barbulifer*** p 278
7	9 black barbels on snout; simple teeth	***Rhinoliparis attenuatus*** p 279
8(6)	28–32 pectoral fin rays	9
8	12–25 pectoral fin rays	10

9(8)	Lobed teeth ..... ***Paraliparis dactylosus***	p 280
9	Simple teeth ..... ***Paraliparis pectoralis***	p 281
10(8)	6 branchiostegal rays	11
10	5 branchiostegal rays	12
11(10)	Oblique mouth with knob on mandibular symphysis that fits into a notch at junction of premaxillae; head and anterior part of body very swollen, then tapering sharply to a narrow tail ..... ***Paraliparis cephalus***	p 281
11	Horizontal mouth without knob; head and anterior part of body not swollen; deepest part of body just behind pectoral fin; body shades of red, pink, or blue ..... ***Paraliparis rosaceus***	p 282
12(10)	Gill opening entirely in front of divided pectoral fin; 19–25 pectoral rays ..... ***Nectoliparis pelagicus***	p 283
12	Not as above	10
13(4)	Anus in posterior position; distance from anus to sucking disc equal to or greater than diameter of sucking disc	14
13	Anus close to or immediately behind sucking disc	15
14(13)	Narrow rows of stout, sharp, simple recurved teeth in both jaws ..... ***Careproctus ovigerum***	p 284
14	Broad bands of trilobed teeth in both jaws ..... ***Careproctus kamikawai***	p 285
15(13)	Sucking disc triangular	16
15	Sucking disc oval or round	17
16(15)	Lower pectoral fin rays mostly free, greatly elongate, equal to or greater than head length; gill opening above pectoral fin small ..... ***Careproctus colletti***	p 285
16	Lower pectoral fin rays short, less than head length; gill opening above pectoral fin large ..... ***Careproctus cypselurus***	p 286
17(16)	Oval disc about size of orbit; horizontal pectoral fin base; inside of mouth, gill cavities, caudal fin, rear of dorsal and anal fins, and peritoneum black ..... ***Careproctus melanurus***	p 287
17	Round disc much smaller than orbit; inside of mouth & gill cavities light ..... ***Careproctus gilberti***	p 287

Showy snailfish (*Liparis pulchellus*)

Description

The body color of the showy snailfish is highly variable, with various shades of brown that get lighter ventrally. The body may be plain or may have variably sized spots and wavy lines. The dorsal fin has at least 45 rays and is unnotched. There are fewer rays on the pectoral fin than the anal fin. The dorsal fin, along with the anal fin, joins with the caudal fin for nearly its entire

length. There are two nostrils on each side of the head. The pseudobranchs are small, gill-like organs on the inner surface of the operculum. They have five filaments. The sucking disc is large and well developed. The gill opening extends to just above the pectoral fin or just in front of rays 1–7, but usually only to the fourth ray. To 25 cm TL.

Similar species
Marbled snailfish (*Liparis dennyi*) have 40 or fewer dorsal fin rays, the dorsal and anal fins do not extend very far onto the caudal fin, and the color pattern is different.

Distribution
Showy snailfish range from the southeastern Bering Sea to Monterey, California, at depths of 9–183 m (but usually shallower than 90 m).

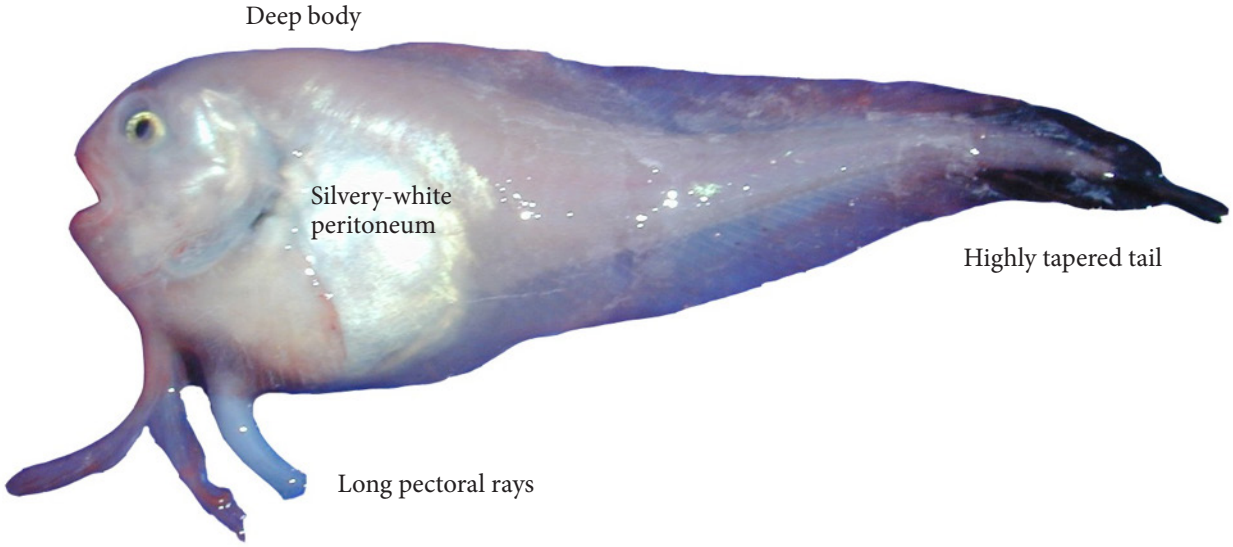
Marbled snailfish (*Liparis dennyi*)

Description
Marbled snailfish have a variable body color. They can be pink with black-tipped fins or mottled, striped, or brown with small white spots. The dorsal fin has 37–40 rays and may or may not be slightly notched on the anterior edge. The anal fin has 30–33 rays. The dorsal and anal fins join with the caudal fin for about the first one-third of its length, with the anal fin extending farther than the dorsal. The gill opening extends down in front of the first 9–20 rays. To 31 cm TL.

Similar species
Showy snailfish (*Liparis pulchellus*) are colored differently, have 45 dorsal fin rays, and the gill opening does not extend as far down the pectoral fin as in marbled snailfish.

Distribution
Marbled snailfish range from the eastern Aleutian Islands to Puget Sound, Washington State, usually at shallow depths and occasionally in tidepools to 225 m.

Humpback snailfish (*Elassodiscus caudatus*)



Description
The color of the humpback snailfish ranges from light pink to orange/pink. The margins on the posterior half of the fish and the posterior portions of the dorsal and anal fins are black. The peritoneum is a silvery white. The large head tapers to an extremely slender tail. A rudimentary disc is present well forward on the underside of the head. The rays on the lower lobe of the pectoral fin are very long. To 18 cm TL.

Similar species
Blacktail snailfish (*Careproctus melanurus*) have a more highly developed disc, and short pectoral fin rays. Smalldisk snailfish (*C. gilberti*) have a much less tapered tail; shorter, more filamentous pectoral fin rays; and lack the dark pigment on the posterior portions of the dorsal, anal, and caudal fins.

Distribution
Humpback snailfish range from the eastern Bering Sea through Monterey Bay, California, at depths of 335–1,040 m.

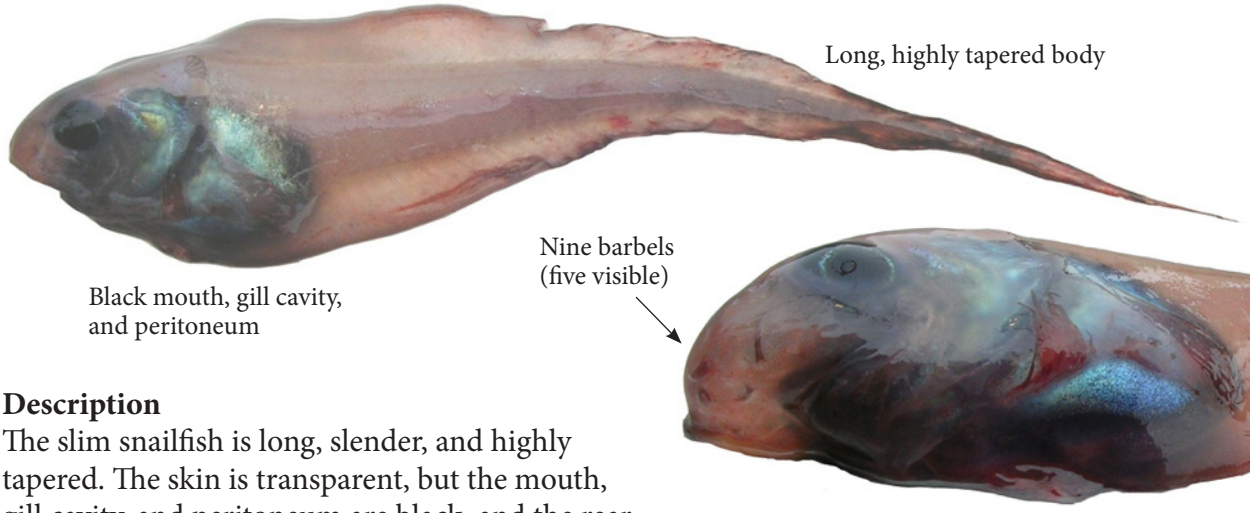
Longnose snailfish (*Rhinoliparis barbulifer*)

Description
Longnose snailfish have a long, slender, highly tapered body. The head is heavy. It is wider than deep, and the back of the head before the nape (occiput) is slightly swollen. The snout is low and projecting, with two small, transparent barbels. The teeth have strong lobes. The skin is transparent, with the black mouth, gill cavity, and peritoneum showing through. To 11 cm TL.

Similar species
The slim snailfish (*Rhinoliparis attenuatus*) has nine dark barbels and more dorsal, anal, and pectoral fin rays and vertebrae.

Distribution
Slim snailfish range from Honshu, Japan, through the Sea of Okhotsk and the Commander Islands, through the Bering Sea to southern California, at depths of 252–1,500 m.

Slim snailfish (*Rhinoliparis attenuatus*)

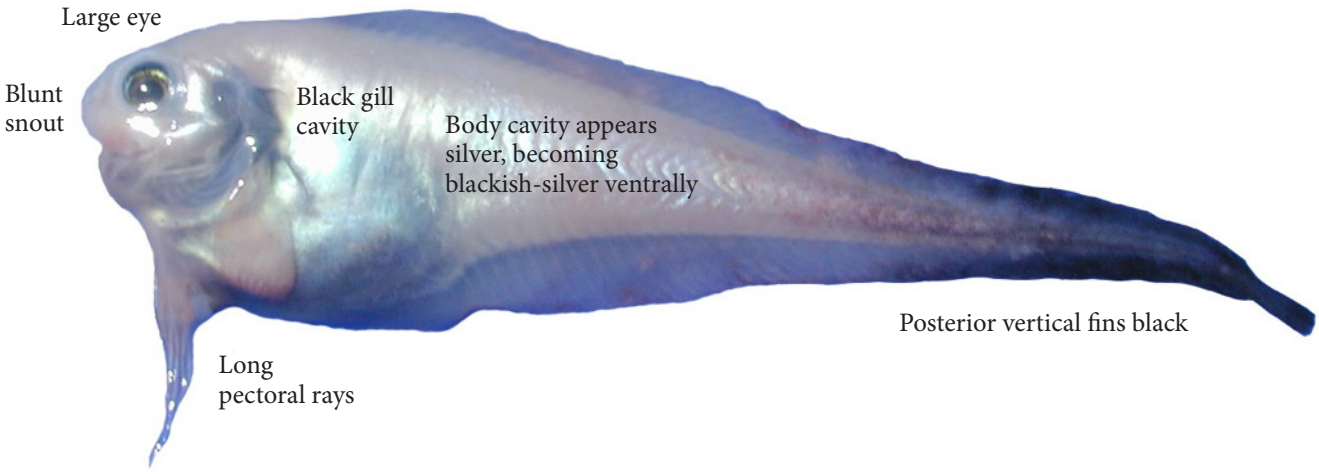


Description
The slim snailfish is long, slender, and highly tapered. The skin is transparent, but the mouth, gill cavity, and peritoneum are black, and the rear portion of the body is a dusky color. The broad, slightly depressed, projecting snout has nine small, dark barbels, some or all of which are often missing due to damage during capture. The teeth are simple. To 11 cm TL.

Similar species
The longnose snailfish (*Rhinoliparis barbulifer*) has two barbels and fewer dorsal, anal, and pectoral fin rays and vertebrae.

Distribution
Although confirmed from the eastern Bering Sea, the next closest records come from southern British Columbia, Canada. The center of abundance for slim snailfish is from southern British Columbia, Canada, to Monterey Bay, California, at depths of 362–2,189 m.

Polydactyl snailfish (*Paraliparis dactylosus*)



Description
Polydactyl snailfish are light pink to red with pearlescent highlights along the myomeres. The black gill cavity shows through the somewhat translucent operculum. The body cavity appears mostly silver dorsally becoming more blackish ventrally. The anterior portions of the dorsal and anal fins are translucent, becoming black especially along the margins posteriorly, and join with the black caudal fin. The pectoral fins are a light translucent pink to orange. The deeply notched pectoral fin has 28–30 rays. The median rays are widely spaced. The long, delicate lower rays are partially free at the tips. This is the only *Paraliparis* species with trilobed teeth. The eyes are large, 28–33% of the head length. The snout is short and blunt. The sucking disc is absent. To 12.1 cm TL.

Similar species
A common name for *Paraliparis dactylosus* was "red snailfish." However, since many snailfish are red, this led to misidentification. "Polydactyl" refers to the relatively large number of pectoral rays, an important diagnostic characteristic. Blacktail snailfish (*Careproctus melanurus*) have a sucking disc and short pectoral rays. Humpback snailfish (*Elassodiscus caudatus*) have a small eye, highly elongate pectoral rays, and a light gill cavity.

Distribution
Polydactyl snailfish have a scattered distribution, with records from the Commander Islands, the eastern Bering Sea, the northeastern Pacific, Oregon, and central California, at depths of 541–960 m.

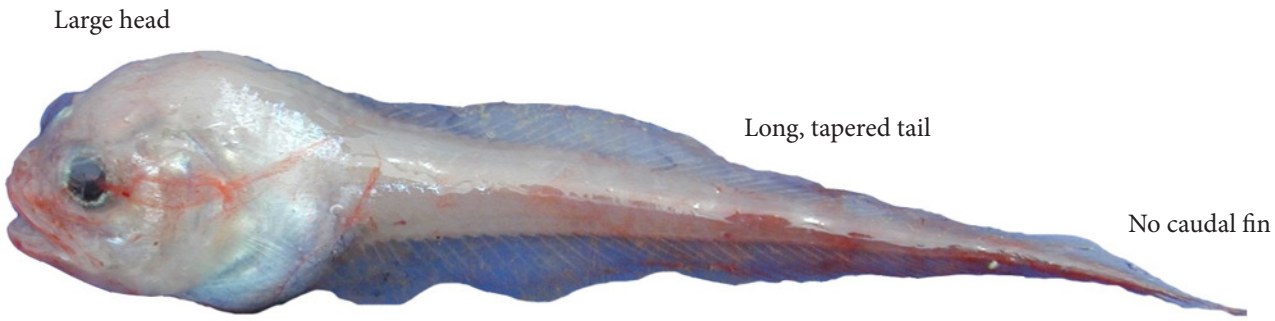
Pectoral snailfish (*Paraliparis pectoralis*)

Description
Pectoral snailfish are dark brown, dark brown/red, or dark red/purple, becoming darker anteriorly to nearly black on the head. The head and body have a fine, light speckling that can extend onto the dorsal and anal fins. The mouth, gill cavity, and peritoneum are black. The pores on the head are evident on intact specimens. There are two closely spaced pores above the gills, and a line of pores form the lateral line to the caudal fin. The pectoral fin has 28–32 rays set low on the body, with the upper edge at or just above the rear of the upper jaw. The sucking disc is absent. To 22 cm SL.

Similar species
Falcate snailfish (*Careproctus cypselurus*) have a sucking disc.

Distribution
Pectoral snailfish range from Hokkaido, Japan, through the Sea of Okhotsk, the central Bering Sea, and the northeastern Pacific Ocean off British Columbia, Canada, to Oregon, at depths of 681–1,636 m.

Swellhead snailfish (*Paraliparis cephalus*)

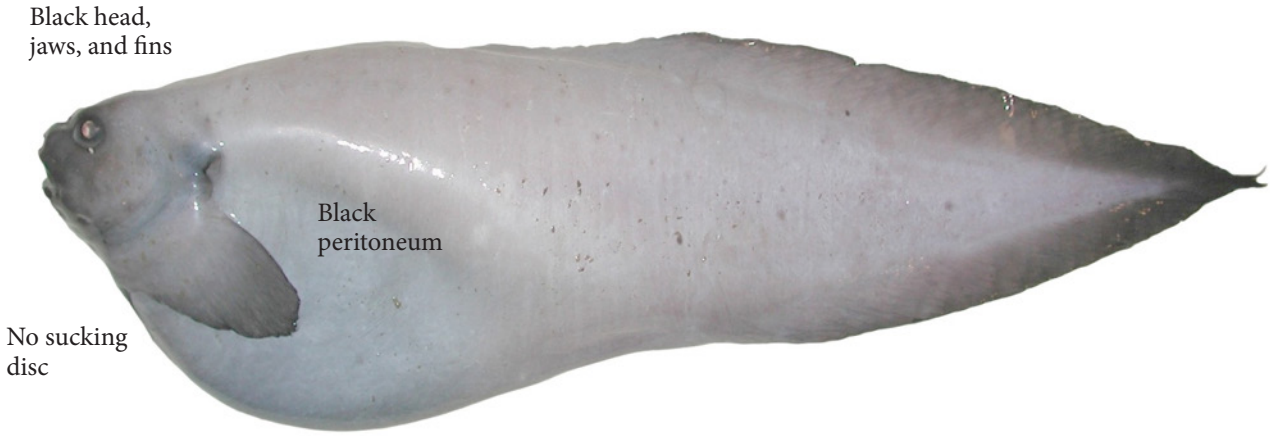


Description
Swellhead snailfish vary in color from a light red/pink to pink/orange. The mouth and gill cavities are white to dusky-colored. The head and occiput (the area behind the head) are very swollen, with the body tapering rapidly to a threadlike tail. There is no caudal fin or sucking disc. The maxilla of the large, oblique mouth extends to the rear of the pupil. The snout retreats from the upper jaw. The large eyes have large black pupils. To 8.2 cm SL, possibly more.

Similar species
The large, swollen head, highly tapered body, and lack of a sucking disc distinguish the swellhead snailfish from other similar species.

Distribution
Swellhead snailfish range from the vicinity of the Commander Islands, with scattered records from the Bering Sea, the western Gulf of Alaska, and Shelikof Strait, to northern British Columbia, Canada, to Monterey, California, at depths of 294–1,799 m.

Rosy snailfish (*Paraliparis rosaceus*)

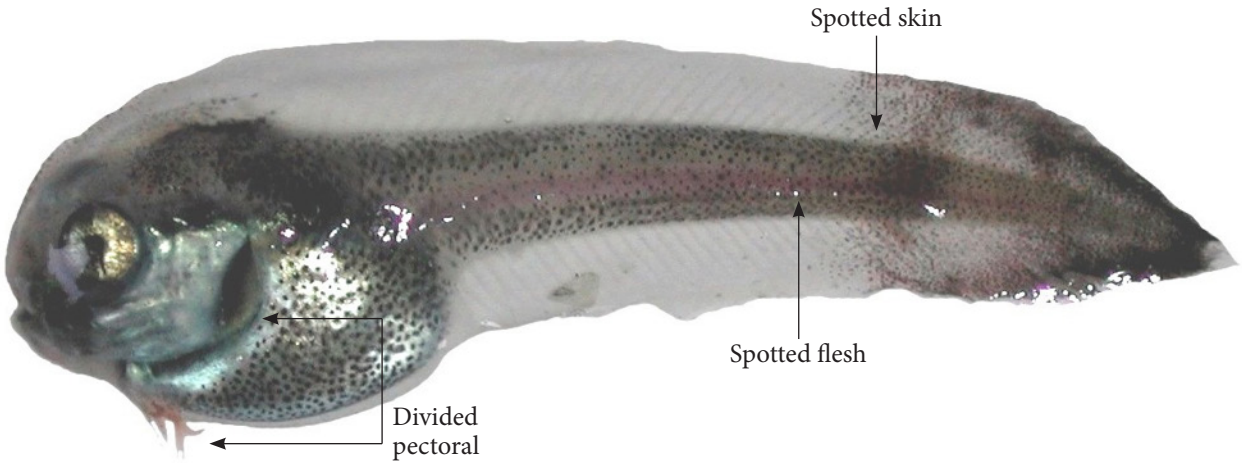


Description
The rosy snailfish is dusky pink, pinkish-purple, pinkish-blue, or rose red, with a black head and black fin margins. The mouth is dusky to dark. The body is moderately deep, compressed, and tapers gradually to the tail. For about half its length, the caudal fin joins with the anal fin. The rays at the base of the deep notch in the pectoral fin often become rudimentary in adults. The head width and depth are nearly equal. The deep snout rises steeply but is nonprojecting. The small gill opening is almost entirely above the pectoral fin. The maxilla extends to just beneath the pupil. The single row of short, blunt teeth forms a cutting edge in the lower jaw. The upper teeth are nearly absent. The sucking disc is absent. To 40 cm SL.

Similar species
The lack of a sucking disc separates the rosy snailfish from other similar species.

Distribution
Rosy snailfish range from the Sea of Okhotsk off Hokkaido, Japan. The next records are from northern British Columbia, Canada, to Baja California, Mexico, and the Gulf of California, at depths of 1,050–3,358 m.

Tadpole snailfish (*Nectoliparis pelagicus*)



Description
The tadpole snailfish is a very small fish with transparent skin. The pigment appears as small black spots on the top of the head and the flesh and skin on the posterior portion of the body. The pigmented and heavily spotted flesh sometimes appears very dark. The abdomen and cheeks have a silvery appearance. The mouth, gill cavity, and peritoneum are black. The eye is large, with a prominent pupil. The pectoral fins are highly divided, consisting of an upper lobe separated by 3–5 widely spaced rudimentary rays from the lower lobe, giving the impression that there are pelvic fins. The upper lobe has 13–14 rays and extends nearly to the anal fin. The lower lobe has four rays very low on the body that can be fairly long and semifree. The gill opening is entirely anterior to the pectoral fin. No sucking disc is present. On fish greater than or equal to 2.5 cm SL, the anus is located on a forward-pointing papilla anterior to the pectoral symphysis. On fish less than 2.5 cm SL, the anus is normal, posterior to the pectoral symphysis. To 6.5 cm TL.

Similar species
Similar to the genus *Paraliparis*, but differs in that *Nectoliparis* has a low gill slit that is anterior to the pectoral fin and five branchiostegal rays, compared to a high gill slit and six branchiostegal rays for *Paraliparis*.

Distribution
Tadpole snailfish range from the Sea of Okhotsk and the Bering Sea to Santa Barbara in southern California, at depths to 3,383 m.

Abyssal snailfish (*Careproctus ovigerum*)

Description
Abyssal snailfish are pink to light red and may have very faint fine brown dots. The fins may have blackish margins. The mouth, gill cavities, and pyloric caeca are pale. The peritoneum may be dark or mottled. The large mouth has narrow rows of sharp, simple, recurved teeth in both jaws. The dorsal fin is generally unnotched or slightly notched. There are generally 33 rays in the deeply notched pectoral fin, and usually 11 caudal fin rays. The anus is at least the diameter of the sucking disc, set far behind the disc. The head is blunt and rounded. The round sucking disc is well developed and located well forward on the underside of the head. To 43.1 cm SL.

Similar species
Arbiter snailfish (*Careproctus kamikawai*) have broad bands of strongly trilobed teeth in both jaws.

Distribution
This rare deepwater animal ranges from the Queen Charlotte Islands, Canada, to Oregon, usually deeper than 1,829 m.

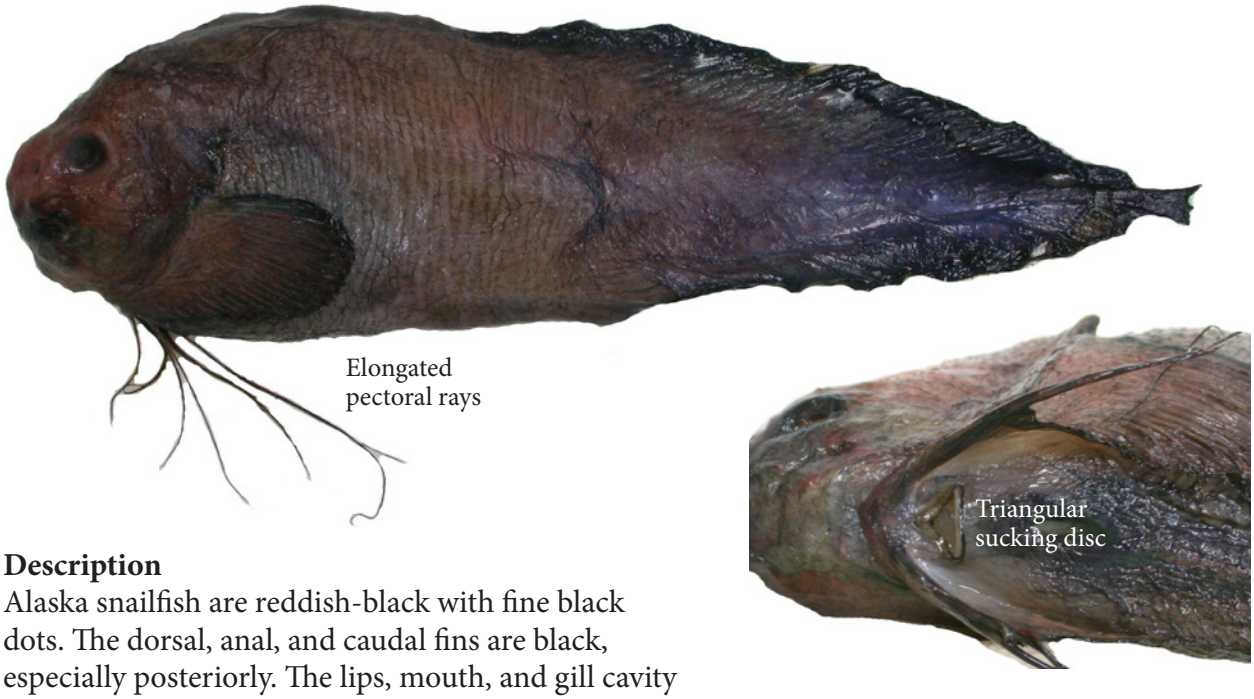
Arbiter snailfish (*Careproctus kamikawai*)

Description
Arbiter snailfish are dark pink to red. The moderately compressed and robust body tapers strongly posteriorly. The large head slopes gently from the nape to the blunt snout, which projects slightly anterior to the lower jaw. The subterminal mouth has a large upper jaw that extends to midorbit or to the posterior rim of the orbit, and a somewhat inferior lower jaw. The mouth, gill cavities, and pyloric caeca are pale. The peritoneum is black. The numerous strongly trilobed teeth form broad bands in both jaws. The first 4–5 rays of the dorsal fin are slightly longer than the rest, forming a slight lobe. The tips of all the dorsal fin rays project slightly beyond the dorsal membrane. To 17.5 cm TL, possibly more.

Similar species
Abyssal snailfish (*Careproctus ovigerum*) have narrow bands of simple teeth in both jaws.

Distribution
The complete distribution is unknown. The few specimens collected have been from Monterey Bay and the southern California coast, at depths of 468–1,397 m.

Alaska snailfish (*Careproctus colletti*)



Description
Alaska snailfish are reddish-black with fine black dots. The dorsal, anal, and caudal fins are black, especially posteriorly. The lips, mouth, and gill cavity are dusky. The stomach is pale, but the peritoneum is black. The deep, slightly projecting snout is bluntly rounded. The teeth are long, recurved, and lanceolate. The lower pectoral rays are greatly elongated (equal to or greater than the head length) and mostly free. The anus is positioned close behind the triangular sucking disc. The small gill opening is entirely above the pectoral fin. To 40 cm SL.

Similar species
Falcate snailfish (*Careproctus cypselurus*) have a moderate-sized gill opening (small in Alaska snailfish) and short—less than or equal to the head length—lower pectoral fin rays (greater than or equal to head length in Alaska snailfish).

Distribution
Alaska snailfish range from Japan and the Sea of Okhotsk to the Bering Sea and the Gulf of Alaska, to southern California, at depths of 64–1,350 m.

Falcate snailfish (*Careproctus cypselurus*)

Description
Falcate snailfish are variable in color, ranging from a dark dusky pink to a dark purple/pink with dark red highlights, turning black posteriorly. The dorsal, anal, and forked caudal fins are black. The shallowly notched pectoral fins are dark. The gill cavity is black, the mouth is dusky, and the eye is dark. The sucking disc is roughly triangular. To 54 cm TL.

Similar species
Blacktail snailfish (*Careproctus melanurus*) have a light eye and an unnotched caudal fin.

Distribution
Falcate snailfish range from Honshu, Japan, the Kuril Islands, the Sea of Okhotsk, and the Bering Sea through Oregon, at depths of 214–1,993 m.

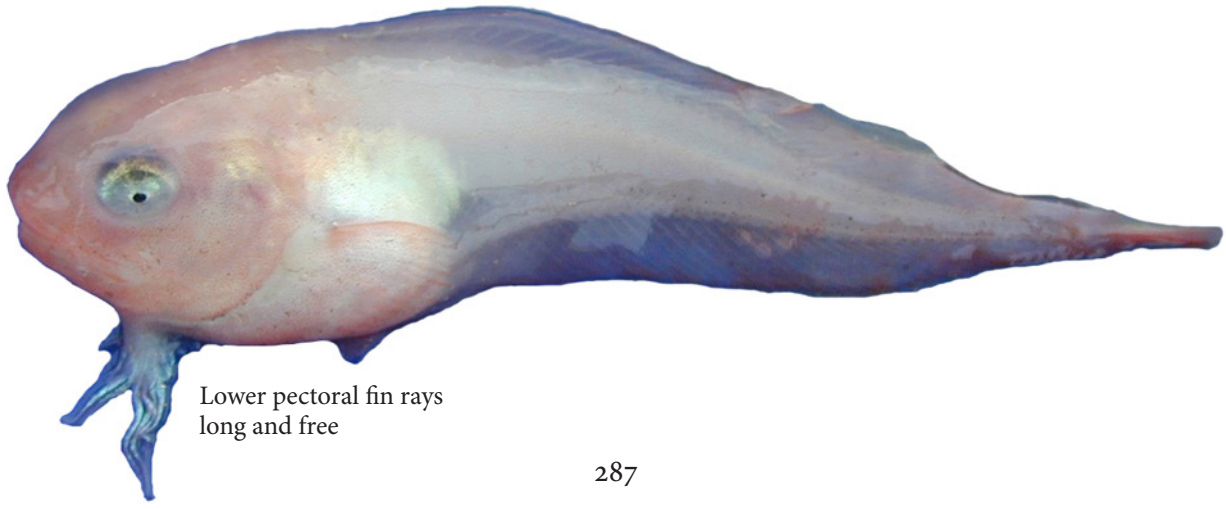
Blacktailed snailfish (*Careproctus melanurus*)

Description
Blacktailed snailfish are whitish-pink or pink to rose red. The caudal fin, posterior portions of the dorsal and anal fins, and the medial side of the pectoral fin are black. The lips, front of the snout, and chin can be blackish. The mouth, gill cavity, and peritoneum are black. The stomach and pyloric caeca are pale. The eye is light. The robust body tapers sharply to a stout caudal region. The head is blunt and rounded. The snout is blunt and not projecting. The unnotched dorsal and anal fins gradually extend onto the caudal, forming a bluntly pointed tail. The pectoral fins are set low on the body and may have a slight notch, with the anterior rays partially free. The oval sucking disc is longer than wide and small, usually smaller than the eye, and located well forward on the underside of the head. To 35 cm SL.

Similar species
Falcate snailfish (*Careproctus cypselurus*) have a dark eye and a forked caudal fin.

Distribution
Blacktail snailfish have been recorded from the Pacific Ocean off northern Honshu, Japan, the southern Bering Sea, and the Pacific Ocean from south of the Aleutian Islands to Baja California, Mexico, at depths of 89–2,286 m.

Smalldisk snailfish (*Careproctus gilberti*)



Description
Smalldisk snailfish are pink, sometimes with light orange highlights. The mouth and gill cavity are slightly darker shades of the body color. The peritoneum is silvery with small black specks. The stomach is black and the pyloric caeca are pale. The fins are translucent. The head is robust, the eye large, and the body tapers sharply to the caudal fin. The disk is very small, about 6–14% of the head length, but completely developed. To 12.7 cm SL.

Similar species
Humpback snailfish (*Elassodiscus caudatus*) have a deeper body, an extremely slender tail, and longer rays on the pectoral fins.

Distribution
Smalldisk snailfish range from the western Aleutian Islands to Morro Bay, California, at depths of 172–886 m, possibly much shallower.

Perciformes (Perchlike Fishes)

Containing about 41% of all bony fishes, the Perciformes consist of about 18 suborders, 150 families, and 1,500 genera with about 10,000 species. Characteristics that separate the perchlike fishes from other teleosts include the absence of an adipose fin. Most have spines in their fins. There are usually two separate dorsal fins; less common is a single fin consisting of both spines and soft rays. When present, the pelvic fins are thoracic, and the scales, when present, are ctenoid rather than cycloid. The premaxilla borders the upper jaw, as opposed to both the premaxilla and the maxilla. The orbitosphenoid, mesocoracoid, and intermuscular bones, and the suborbital stay, are absent.

Howellidae (Oceanic Basses)

The classification of the genus *Howella* varies due to the poorly defined the morphology of this group. Generally, the basslets have 7–10 spines in the first dorsal fin and 0–1 spines and 8–10 soft rays in the second dorsal fin. The anal fin has three spines and 7–9 soft rays. The long pectoral fins extend from just past the anal fin origin to the entire length of the anal fin. There are scales on the snout; the skin-covered operculum lacks scales and has spines along the margin. The body scales are large and very tight. The arrangement and complexity of the opercular spines and the number of scale rows between the base of the second dorsal fin and the lateral line are key diagnostic features.

Key to the Howellidae of the FRAM Surveys

1	Upper operculum angle has 2 simple or split spines separated by a shallow notch; 3 or fewer scale rows between origin of second dorsal fin and lateral line ..... ***Howella brodiei***	p 289
1	Upper operculum angle has a simple or split upper and complex lower spine separated by a shallow notch; 4–5 scale rows between second dorsal origin and lateral line ..... ***Howella sherborni***	p 289

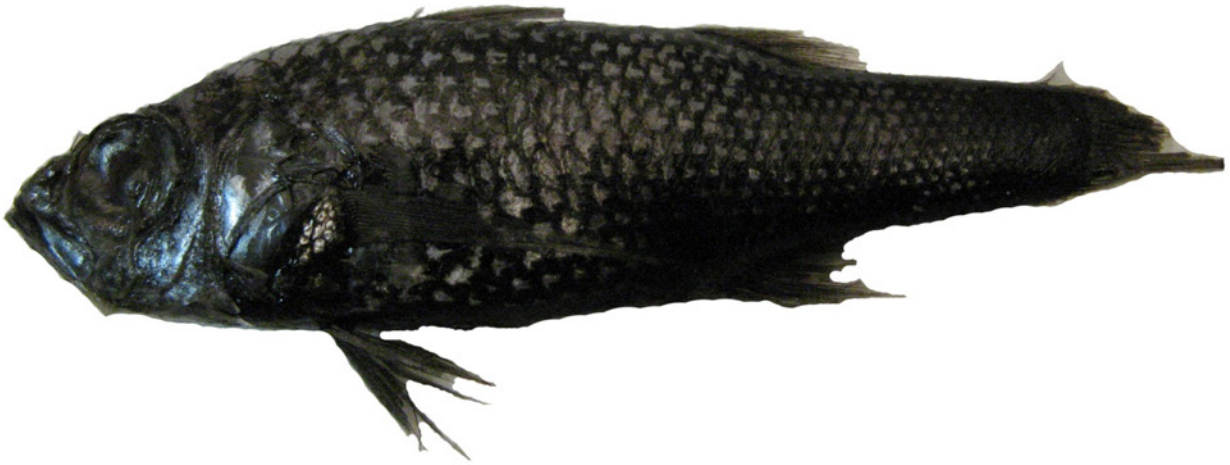
Pelagic basslet (*Howella brodiei*)

Description
The pelagic basslet is a small, black fish with two dorsal fins and long pectoral fin rays. The upper opercle has two simple spines, either single-pointed or split, separated by a shallow notch. There are 1–3 scale rows between the origin of the second dorsal fin and the lateral line. To 7.6 cm TL.

Similar species
The shortspine basslet (*Howella sherborni*) has a complex lower opercular spine and 4–5 scale rows between the base of the second dorsal fin and the lateral line.

Distribution
The pelagic basslet is a southern species that ranges from central California to Chile. Known to make vertical migrations, they range from near the surface to depths of 1,800 m.

Shortspine basslet (*Howella sherborni*)



Description
The shortspine basslet is a small, black fish with two separate dorsal fins and long pectoral fins. The upper opercle has two spines separated by a shallow notch; the upper spine is simple or split, the lower is complex. There are 4–5 scale rows between the base of the second dorsal fin and the lateral line. To 8.0 cm TL.

Similar species
The pelagic basslet (*Howella brodiei*) has two simple spines on the upper opercle and 1–3 scale rows between the base of the second dorsal fin and the lateral line.

Distribution
Shortspine basslets range from the Krenitzin Islands, Alaska, to Chile, from near the surface to depths in excess of 2,000 m.

Polyprionidae (Wreckfishes)

The wreckfishes are a small family with four species in two genera. These are large, oblong, moderately compressed, deep-bodied fishes. The head is scaly and spiny between the eyes and on the nape, especially rough in young fish. The snout is smooth. The terminal mouth has a strongly projecting lower jaw. The maxilla is broad-tipped and completely exposed. The jaw teeth are small, and there are patches of small teeth on the roof of the mouth and on the tongue. The opercle has a distinct horizontal ridge that ends in a short, flat, blunt spine with a smaller flat spine above, but none below the principal spine. The dorsal fin has 11–12 strong spines and 11–12 soft rays. The caudal fin varies from rounded to truncate. The pectoral fins are nearly symmetrical but shorter than the pelvic fins. The pelvic fin insertion is below or slightly behind the pectoral fin base. The anal fin has three strong spines and 9–10 soft rays. The small, strongly ctenoid scales are rough. The lateral line does not extend onto the caudal fin.

Giant sea bass (*Stereolepis gigas*)

Juvenile

Description
Giant sea bass are bright orange with large dark spots as juveniles. As the fish grows, the spots fade, losing the orange coloration and becoming bronzy-purple. Adults appear solid black to gray with a light ventral surface. However, adult giant sea bass are capable of rapid color changes. Large fish retain the ability to display large black spots, take on a bicolor appearance (dark above and light below), assume white mottling, or change from dark black to slate gray. The robust oblong body is deep (body depth approximately 40% of SL). Small, rough scales cover the body and head except for the snout, jaws, and the interorbital space. The mouth is large, with a projecting lower jaw. The teeth are small. The preopercle is weakly serrated. There are two flat, blunt spines at the angle of the operculum, with a small spine above the primary but none below. There are 9–12 gill rakers on the first arch. There is one strongly notched dorsal fin with 11–12 strong spines and 9–10 soft rays; it folds down into a groove on the back. The base of the low, spinous part is longer than the base of the high, soft part. The anal fin has three strong spines and 8–9 soft rays. The caudal fin is truncate with rounded tips. To 250 cm TL.

Similar species
Sebastes spp. have a series of head spines not present in giant sea bass. Serranidae have three opercular spines, a primary spine with a smaller spine above and below; giant sea bass have two, a primary spine with a small spine above.

Distribution
Although rare north of Point Conception, California, giant sea bass range from Humboldt Bay, California to Baja California, Mexico, and the northern portion of the Gulf of California, at depths of 5–50 m.

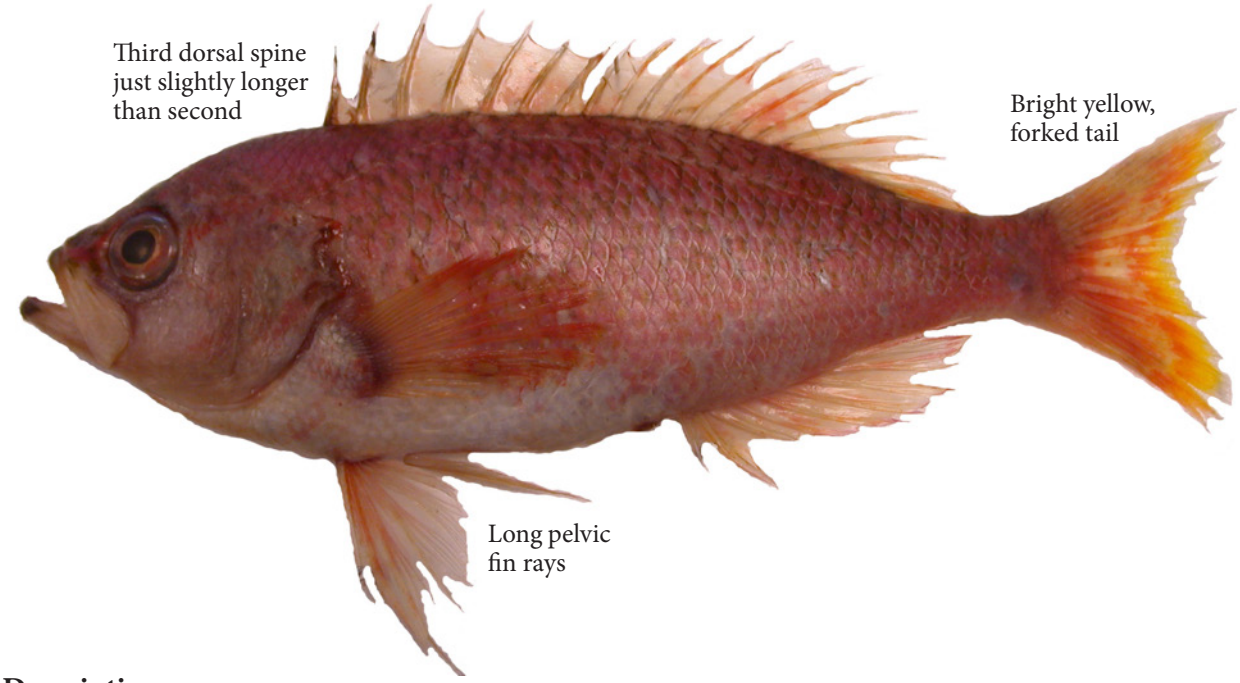
Serranidae (Sea Basses and Groupers)

The sea basses are a large family with over 400 species in 62 genera distributed mainly in the tropical seas, with fewer species in the temperate waters. Some characteristics include the familiar bass shape. There may not be a notch in the continuous dorsal fin between the 7–10 spines and 9–25 soft rays. There is a single spine and five soft rays in the pelvic fin. There are three spines in the anal fin. The caudal fin is usually rounded, but can vary from truncate to lunate; it is rarely forked. The mouth is generally large, often with the lower jaw projecting beyond the upper. The rear of the upper jaw is fully exposed, not under a shelf or covered with skin even when the mouth is closed. There are scales on the cheek and gill cover. The gill cover sports three spines, a main spine with one above and below.

Key to the Serranidae of the FRAM Surveys

1	Body red/orange with dark reticulations; caudal fin bright yellow	***Pronotogrammus multifasciatus***	p 292
1	Not as above		2
2(1)	Third dorsal spine equal to or slightly longer than fourth	***Paralabrax clathratus***	p 293
2	Not as above	***Paralabrax nebulifer***	p 293

Threadfin bass (*Pronotogrammus multifasciatus*)



Description
Threadfin bass are red to red/orange with dark vermiculations dorsally, with lighter shades of the same color and the dark vermiculations laterally and a light ventral surface. The rays of the pelvic fins are very long, and the forked caudal fin is bright yellow. The dorsal fin spines are nearly uniform in length, with the third spine just slightly longer than the second. The maxilla has scales on the posterior end and extends to or somewhat beyond the pupil. To 26 cm TL.

Similar species
The somewhat short third dorsal spine, long pelvic fin, scales on the rear of the upper jaw, and bright yellow color separate the threadfin bass from other related species.

Distribution
Threadfin bass range from Los Angeles County in southern California to northern Peru, at depths of 40–300 m.

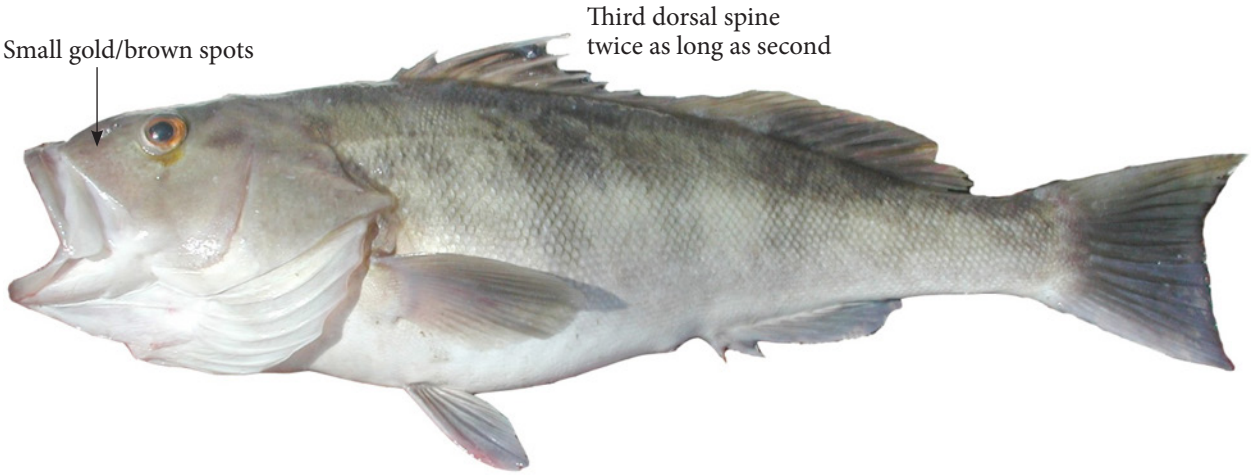
Kelp bass (*Paralabrax clathratus*)

Description
Kelp bass are olive to brown with pale blotches dorsally and laterally shading to a cream color ventrally. There are 10–11 dorsal spines; the first two are shorter than the third, which is as long as or just slightly longer than the fourth. To 72 cm TL.

Similar species
The third spine is about twice as long as the second spine in other species of *Paralabrax*.

Distribution
Although rare north of Point Conception, California, kelp bass have been reported as far north as the Columbia River and south to Bahía Magdalena, Baja California, Mexico, usually in very shallow water to depths of 61 m.

Barred sand bass (*Paralabrax nebulifer*)



Description
Barred sand bass are gray to olive brown dorsally, somewhat lighter shades of the same color laterally, and pale ventrally. There are multiple bars of variable intensity dorsally and laterally. While there may be small, gold/brown spots on the head, there are no spots on the body. The caudal fin is square, and the anal fin has a rounded edge. The first two dorsal spines are shorter than the third, which is roughly twice the length of the second. To 67 cm TL.

Similar species
Other *Paralabrax* species have spots on the body and/or a relatively short third dorsal spine.

Distribution
Barred sand bass range from Santa Cruz in central California to Cabo San Lucas, southern Baja California, Mexico, in the Gulf of California to Loreto, and from near Acapulco on the Mexican coast, at depths of 1–183 m (but usually at depths less than 30 m).

Malacanthidae (Tilefishes)

The tilefishes consist of about 31 species in five genera distributed throughout the Atlantic, Indian, and Pacific Oceans at depths of 10–500 m. These elongate fishes have one relatively long dorsal fin that generally has 6–9 spines and 22–64 soft rays. The long anal fin has 1–2 weak spines followed by 14–56 soft rays. They may or may not have ridges on the top of the head. There is generally one opercular spine that can be sharp or blunt, and usually six branchiostegal rays. The caudal fin may be truncate, emarginate, double emarginate, or forked.

Key to the Malacanthidae of the FRAM Surveys

1	Prominent dark spot above pectoral fin axil; dorsal spines generally 8 (7–9); broad yellow band from under eye to end of snout ..... ***Caulolatilus affinis***	p 294
1	Dark spot above pectoral fin absent; dorsal spines generally 9 (7–10); yellow band under eye absent	2
2(1)	Jaws extend to middle of eye; scales absent behind eye ..... ***Caulolatilus hubbsi***	p 295
2	Jaws extend nearly to anterior edge of orbit; scales present behind eye ..... ***Caulolatilus princeps***	p 295

Pacific golden-eyed tilefish (*Caulolatilus affinis*)

Description
The Pacific golden-eyed tilefish is a uniform light to dark brown dorsally and laterally, often with a metallic bluish sheen, and light ventrally. There is a dark spot above the pectoral fin axil, a broad yellow band extending from under the eye to the end of the snout, and eyes with a gold-colored iris. The long, dusky dorsal fin has 7–9 (usually 8) spines. The first and second spines are joined at the base; the first spine is about three-fourths as long as the second, followed by 22–25 (usually 24) soft rays. The long anal fin is dusky. There are 1–2 (usually 2) spines—the first is short, stout, and often well hidden, the second thin and flexible—followed by 21–24 (usually 23) soft rays. The broad and pointed pectoral fins are dusky and have 18–19 rays. The dusky pelvic fins are narrow and pointed. The truncate caudal fin is dusky. The body is elongate and somewhat deep, the body depth 23–32% (usually 29%) of SL. To 45 cm TL, possibly more.

Similar species
The dark spot above the pectoral fin, the yellow band under the eye, the golden iris, and the generally eight dorsal spines differentiate the Pacific golden-eyed tilefish from the other Pacific species of *Caulolatilus*.

Distribution
Pacific golden-eyed tilefish range from the Gulf of California to Cape San Lucas, Baja California, Mexico, and along the Pacific coasts of Costa Rica to Peru and the Galápagos Islands, at depths of 20–239 m.

Enigmatic tilefish (*Caulolatilus hubbsi*)

Description
Not having been documented, the color in life of enigmatic tilefish is unknown. The long dorsal fin has 8–10 (usually 8) spines; the first and second spines are joined at the base, with the first spine about three-fourths to just about as long as the second, followed by 23–27 (usually 26) soft rays. The long anal fin has two spines, the first reduced and the second followed by 23–26 (usually 25) soft rays. The broad and pointed pectoral fins have 18–19 (usually 19) rays. The caudal fin is nearly truncate. The body is elongate and somewhat deep, the body depth to 31% (usually 24–29%) of SL. The rounded head has a moderately sized mouth with thick lips and jaws extending to under the middle of the pupil. To 36 cm SL, possibly more.

Similar species
Reexamination of original materials of *Caulolatilus hubbsi* (Lea and Feeney 2013) concluded that the three characteristics (thick fleshy lips, the caudal fin shape, and the relationship of the position of the maxilla to the orbit) used to distinguish it as a species (Dooley 1978) are subjective and highly variable, or can be attributed to variation within a single species. Therefore, some researchers consider *C. hubbsi* a junior synonym of *C. princeps*.

Distribution
Enigmatic tilefish range from southern California south through Baja California, Mexico, and the Gulf of California to the Galápagos Islands and Peru, at depths of 18–41 m. The northern edge of the distribution is from a single record from California.

Ocean whitefish (*Caulolatilus princeps*)

Description
The ocean whitefish is yellow/brown dorsally with somewhat lighter shades of the same color laterally and white ventrally. The long dorsal fin is dusky to dusky yellow, with a light blue band running the length of the fin. There are 7–10 (usually 9) spines—the first and second are joined at the base, with the first spine about half as long as the second—followed by 24–27 soft rays. The long anal fin is dusky with a light blue band running the length of the fin, and two spines. The first is short, stout, and often well hidden, the second is thin and flexible. They are followed by 20–26 (usually 24–25) soft rays. The pectoral fins, with 18–20 (usually 19) rays, are bluish with a yellow streak near the center. The emarginate caudal fin is yellowish. The pelvic fins have a yellow edge. The body is elongate and somewhat slender, the body depth 23–28% (usually 25%) of SL. The rounded head has a small mouth, the small jaws extending to just short of the front of the eye. Fine ctenoid scales cover the body. Cycloid scales are on the top and sides of the head up to the eyes. To 102 cm TL.

Similar species
Enigmatic tilefish (*Caulolatilus hubbsi*) is a closely related species found from the Gulf of California to Peru. It has a rounder head and longer jaws that reach the area below the pupil.

Distribution
Although rare north of central California, ocean whitefish range from Vancouver Island, British Columbia, Canada, south to the Galápagos Islands and Peru, at depths of 10–91 m.

Carangidae (Jacks, Amberjacks, and Pompanos)

The approximately 140 species of jacks, amberjacks, trevallies, and pompanos are collectively referred to as jacks. The jacks are a very morphologically diverse group, but do share certain characteristics. Generally, the jacks have a deeply forked caudal fin, narrow caudal peduncle, and two free spines separate from and preceding the anal fin. These spines become skin-covered with size and age. They also have two dorsal fins: a short, spinous first dorsal followed by a long second dorsal composed mainly of soft rays and, in some species, finlets. Jacks have small, very adherent cycloid scales and, in some species, modified scales or scutes along the lateral line.

Key to the Carangidae of the FRAM Surveys

1	Scutes on lateral line present	2
1	Scutes on lateral line absent ... ***Seriola dorsalis***	p 297
2(1)	Lateral line dorsal accessory branch extends to or beyond origin of second dorsal fin; main lateral line arched steeply downward below origin of second dorsal fin, continuing straight onto caudal peduncle; no finlets posterior to last dorsal and anal fins ... ***Trachurus symmetricus***	p 297
2	Lateral line dorsal accessory branch terminates before second dorsal fin origin; main lateral line with slight to moderate arch under second dorsal fin base, continuing straight onto caudal peduncle; independent 2-rayed finlet (dorsal and ventral) on caudal peduncle ... ***Decapterus muroadsi***	p 298

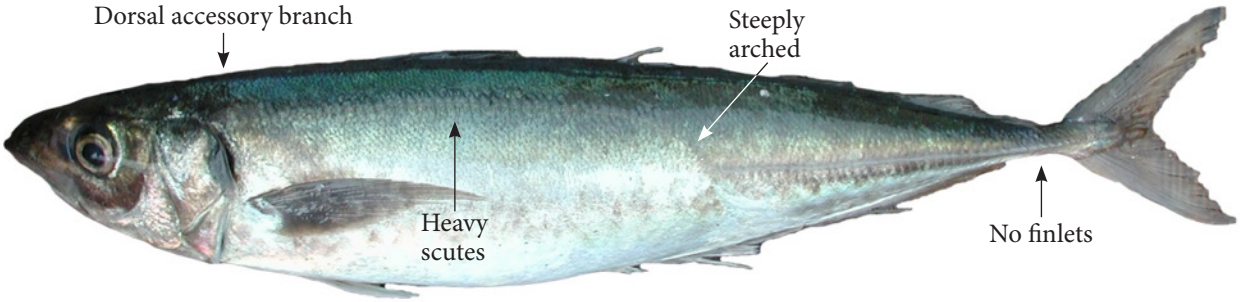
Yellowtail jack (*Seriola dorsalis*)

Description
Yellowtail jacks are metallic blue to green dorsally, with a brassy to yellow stripe along the side from eye to tail, and silvery ventrally. The dorsal and anal fins are dusky to nearly black. The pectoral and pelvic fins are dusky yellow/green. The caudal fin is a dull yellow. There are two dorsal fins: the first, with 4–7 spines, is much lower than the second, which has one spine and 31–39 soft rays. The anal fin has 0–2 spines followed by one spine and 19–23 soft rays. The pectoral fin does not extend beyond the first dorsal fin and is shorter than the pelvic fin. This is the only jack without scutes along the lateral line. To 250 cm TL.

Similar species
Genetic studies of the genus *Seriola* (Martinez-Takeshita et al. 2015) indicate the population in the northeastern Pacific to be distinct from those in the northwestern Pacific and Southern Hemisphere, and resurrect the name *Seriola dorsalis* for the northeastern Pacific population. The lack of scutes along the lateral line and the distinct demarcation line between the dorsal and ventral colors distinguish the yellowtail jack from similar species.

Distribution
Yellowtail jack have a disjunct circumglobal distribution in subtropical waters. In the northeastern Pacific, although rare north of California, yellowtail jack range from British Columbia, Canada, to Chile, from the surface to 69 m.

Jack mackerel (*Trachurus symmetricus*)



Description
Jack mackerel are metallic blue to olive green with some faint mottling possible dorsally, with lighter shades of the same color laterally fading to silver/white ventrally. There is usually a dark spot on the upper-rear edge of the operculum. The fins are generally clear to dusky, but the caudal fin may have a yellow or red tint. The first dorsal fin has eight spines and is slightly higher or equal in height to the second dorsal, which has 0–1 spines and 28–40 soft rays. The last rays of the second dorsal and anal fins are usually separate, especially in large individuals. A small, forward-pointing spine is located at the base of the first dorsal, noticeable in small specimens but becoming embedded as the fish grows. The narrow pectoral fin has 22–26 soft rays and is longer than the pelvic fins. The pelvic fins have one spine and five soft rays and extend to or just beyond

the origin of the second dorsal. The lateral line has a row of heavy scutes and slopes sharply downward below the front of the second dorsal, then straightens out to the base of the caudal fin. There is an accessory lateral line high on the body, from the head to below the spinous dorsal. An adipose eyelid is present and is noticeable in fresh specimens. To 81 cm TL.

Similar species
The Pacific mackerel (*Scomber japonicus*) has 5–6 finlets on the dorsal and ventral sides of the caudal peduncle, irregular diagonal stripes, a short pectoral fin, and does not have scutes along the lateral line. Amberstripe scad (*Decapterus muroadsi*) have a short dorsal accessory branch and one finlet at the end of the anal and second dorsal fins.

Distribution
Jack mackerel range from the Aleutian Islands and the Gulf of Alaska to southern Baja California, Mexico, and the Gulf of California, and reportedly off Acapulco, Mexico and the Galápagos Islands, at depths from 0–400 m.

Amberstripe scad (*Decapterus muroadsi*)

Description
Amberstripe scad are metallic blue to olive dorsally, yellowish-silver laterally and ventrally. There is a yellow stripe down the side, bordered both above and below with blue stripes. The pelvic, pectoral, dorsal, and anal fins are various shades of lime green. The caudal fin has a dark lower lobe and a greenish-yellow upper lobe. There is a small, sometimes indistinguishable dark spot on the upper angle of the operculum. The elongate slender body is cylindrical. The eye is covered with an adipose eyelid. At the front of the shoulder where it meets the gill cavity are two moderately sized papillae. The first dorsal fin has eight spines and is as tall as or taller than the second dorsal, which has one spine and 28–32 rays (including the finlet). The anal fin has two detached spines followed by a single spine and 24–27 soft rays (including the finlet). The main lateral line has a long, low arch. The 10–20 scales on the straight anterior portion are unmodified, followed by 28–41 scutes. The scales on the top of the head extend forward to above the anterior margin of the pupil. The lateral line dorsal accessory branch terminates on the nape before the dorsal fin origin. To 55 cm TL.

Similar species
Jack mackerel have a long dorsal accessory branch extending to or beyond the second dorsal (terminates before the dorsal on amberstripe scad), a highly arched main lateral line (low arch in amberstripe scad), and no dorsal or ventral finlets (single dorsal and ventral in amberstripe scad).

Distribution
In the northeastern Pacific, amberstripe scad range from southern California to the tip of Baja California, Mexico, Ecuador, and Chile, usually at or near the surface to 30 m.

Bramidae (Pomfrets)

The pomfrets are a widespread family consisting of 20 species in seven genera inhabiting the tropical and temperate waters of the Atlantic, Indian, and Pacific Oceans. Most pomfrets have very laterally compressed, deep bodies and a blunt snout. There is a single long dorsal fin and a single shorter anal fin. In adults, both the dorsal and anal fins are high in the front and have a few thick unbranched rays that are included with the branched rays. The pectoral fins are long and the caudal fin is deeply forked. The scales are strongly adherent and have spines or keels.

Key to the Bramidae of the NWFSC Surveys

1	Head blunt; profile of head distinctly arched; interorbital space strongly convex; 65–75 small to moderate scales from upper end of gill opening to base of midcaudal rays ..... ***Brama japonica***	p 299
1	Head not blunt; profile of head not distinctly arched; interorbital space concave to slightly convex; 40–50 relatively large scales from upper end of gill opening to base of midcaudal rays ..... ***Taractes asper***	p 300

Pacific pomfret (*Brama japonica*)

Description

Pacific pomfret are dark dorsally and silvery-white laterally and ventrally, but rapidly turn black after death. The head is blunt and distinctly rounded in profile. The interorbital space is strongly convex. The single long dorsal fin has 33–36 rays. The single long anal fin has 27–30 rays. In adults, the dorsal and anal fin rays are higher anteriorly. The long pectoral fin has 21–23 rays. The pelvic fin has one spine and five rays. The small to moderate scales are very adherent and arranged in longitudinal rows on the body and the bases of the fins, nape, cheeks, operculum, and upper jaw, but the snout is scaleless. There are 65–75 scales from the upper end of the gill opening to the base of the midcaudal rays. The dorsal and anal fins are not fully depressible and are partially scaled, but without a distinct scaly sheath along the base. To 61 cm TL.

Similar species
The blunt head with the distinct round profile and convex interorbital space, along with the overall silvery-white coloration, distinguish the Pacific pomfret from similar looking species.

Distribution
Pacific pomfret are an oceanic species rarely found nearshore that range from Japan through the Pacific Ocean south of the Aleutian and Commander Islands and the Gulf of Alaska to Peru, at depths of 261–620 m.

Rough pomfret (*Taractes asper*)

Description
Rough pomfret are a uniform dark brown, but the fins can be either lighter or darker than the body. The head is somewhat pointed and not distinctly arched in profile. The interorbital space is concave to slightly convex. The single long dorsal fin has 26–34 rays. The single long anal fin has 27–30 rays. In adults, the dorsal and anal fin rays are higher anteriorly. The long pectoral fin has 16–20 rays. The pelvic fin has one spine and five rays. The rough, relatively large scales have median ridges that form spines, are very adherent, and are arranged in longitudinal rows on the body, nape, cheeks, operculum, and upper jaw. The snout, interorbital space, and lower jaw are scaleless. There are 40–50 scales from the upper end of the gill opening to the base of the midcaudal rays. The bases and anterior portions of the dorsal, anal, and caudal fins have scales. To 50 cm TL.

Similar species
Other closely related species of the east-central and western Pacific have not been confirmed from the northeastern Pacific.

Distribution
Rough pomfret are an oceanic species known from scattered records ranging from Japan through the Gulf of Alaska and in the Pacific Ocean from British Columbia, Canada, to southern California, at depths from the surface to 550 m.

Caristiidae (Manefishes)

The manefishes consist of four genera and about 16 species of mesopelagic, oceanic fishes found throughout the major ocean basins of the world. Although rarely captured, manefishes are easily recognized. Manefishes are highly compressed, with a high, steep forehead, high, long dorsal and anal fins, and pelvic fins with one spine and five long rays.

Key to the Caristiidae of the FRAM Surveys

1	Expanded suborbital series overlaps bones of upper jaw, creating a broad space between orbit and mouth; short upper jaw extending to about midorbit; interorbital space wide; dorsal fin originates above orbit; lateral line absent ..... ***Paracaristius nudarcus***	p 301
1	Suborbital stays not expanded; space between orbit and mouth narrow; long upper jaw extending to or just beyond posterior margin of orbit; interorbital space narrow; lateral line present 2	
2(1)	Conspicuous lateral line with large scales ..... ***Platyberyx andriashevi***	p 302
2	Inconspicuous lateral line with small scales ..... ***Caristius macropus***	p 303

Paracaristius nudarcus

Description

Paracaristius nudarcus are uniformly dark. The dorsal, pectoral, pelvic, and anal fins are black. Soft tissue covers the dorsal and anal fin bases. The dorsal fin consists of 27–31 elongate rays. The anal fin consists of 17–20 elongate rays. The pectoral fins have 16–18 rays and are posterior to the pelvic fins. The pelvic fins consist of one spine and five elongate rays. The lightly pigmented caudal fin has scales covering the proximal one-third or more of the rays. The blunt head has a rounded profile. The large eyes are one-third to one-half of head length (HL). The highly expanded suborbital series overlaps the bones of the upper jaw, creating a broad, fully scaled suborbital space. The anterior extent of the jaws is equal. The short upper jaw is about one-half of HL and extends to or just short of midorbit. Dentary and premaxillary teeth are in 1–3 distinct rows anterior to, and a single row posterior to, the symphyses. Vomerine and palatine teeth are absent. The gill rakers on the first arch are in two series. The lateral series are elongate, pointed, and well separated in small specimens, becoming shorter and more closely spaced with growth. The sparsely pigmented rakers have 10–15 bristles in two rows along the medial margin. The medial series are stouter, rounded, with long bristles covering the lateral surfaces and tips. The body is ovate, with the deepest point near a vertical placed between the pectoral and pelvic fin bases. Irregularly shaped scales not arranged in distinct rows cover the body including the isthmus, predorsal region, and the pectoral and caudal fin bases. A small patch of enlarged scales occurs just posterior to the pectoral fin base. To 22.3 cm SL.

Similar species

The broad suborbital space, short jaws extending to about midorbit, lack of teeth on the vomer and palatines, and lack of a lateral line distinguish *P. nudarcus* from other related species.

Distribution

In the eastern Pacific, *P. nudarcus* range from California and Baja California and the Gulf of California, Mexico; in the western Pacific, off Honshu, Japan; as well as in the Atlantic and Indian Oceans, at depths of 1–1,800 m.

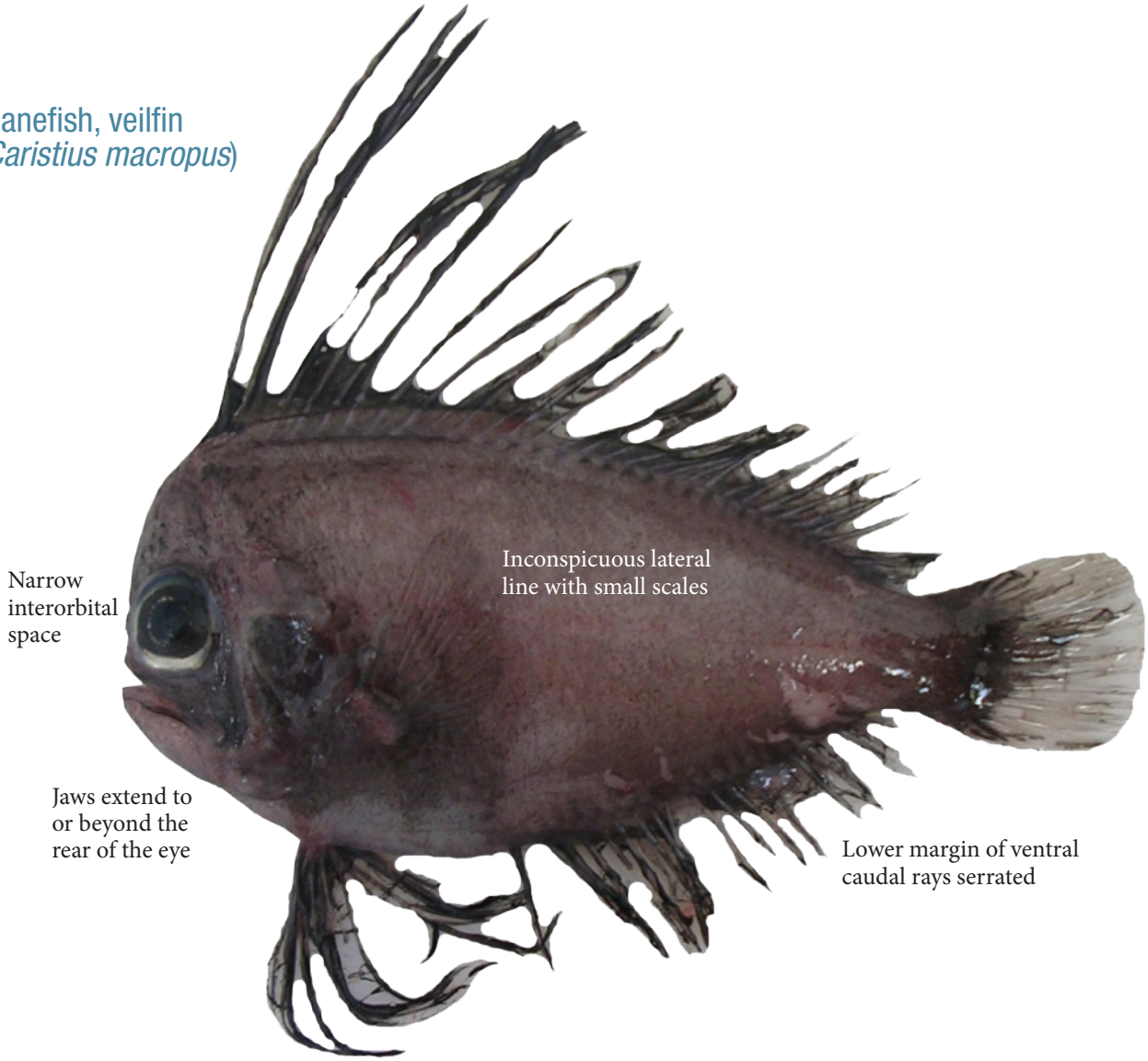
Platyberyx andriashevi

Description
Platyberyx andriashevi are uniformly dark. The dorsal, pectoral, pelvic, and anal fins are black. Soft tissue covers the bases of the dorsal and anal fins. The dorsal fin consists of 31–35 elongate rays. The anal fin consists of 20–22 elongate rays. The pectoral fins consist of 17–18 rays and are posterior to the pelvic fins. The pelvic fins consist of one spine and five elongate rays. The lightly pigmented caudal fin has scales covering the proximal one-third or more of the rays. The blunt head has a rounded profile. The diameter of the large eyes is one-third to one-half of the head length (HL). The mouth is large, with the anterior edge of the upper jaw extending beyond the lower. The long upper jaw extends to or just beyond the rear of the orbit. The dentary and premaxillary teeth are in a single row. The anterior teeth are moderate in size but decrease in size posteriorly. Vomerine and palatine teeth are present, somewhat smaller than but similar in shape to the jaw teeth. There are two series of gill rakers on the first arch separated by a heavily pigmented fold of tissue. The lateral series are elongate, with rounded tips, and closely spaced. The moderately pigmented rakers have 1–3 bristles at the tips and 1–2 small nodules along the dorsomedial margin that have 1 or more bristles. The medial series are short, stout, and rounded, with the tips covered in small bristles. The body is somewhat elongate and deepest at or near the base of the pectoral fin. The caudal peduncle is somewhat elongate, approximately twice as long as deep. Small scales cover the body including the isthmus and predorsal region along with the caudal and pectoral fin bases. A small patch of enlarged scales occurs just posterior to the pectoral fin base. The lateral line, consisting of 40 or more enlarged, elongate, and pore-bearing scales, originates at the upper-rear margin of the opercle, arches posteriorly toward the dorsal fin base, and extends onto the caudal fin. To 18.5 cm SL.

Similar species
The conspicuous lateral line with large scales and simple lower caudal rays distinguish *P. andriashevi* from other related species.

Distribution
Platyberyx andriashevi occur throughout the Gulf of Mexico and the Atlantic, Indian, and Pacific Oceans, at depths of 48–2,200 m.

Manefish, veilfin (*Caristius macropus*)



Description

Manefish are highly compressed, and uniformly dark as adults. Juveniles are light with distinct dark bars. The fins are black. Soft tissue covers the bases of the dorsal and anal fins. The dorsal fin consists of 32–36 elongate rays. The anal fin consists of 21–23 elongate rays. The pectoral fins consist of 16–19 rays and are posterior to the pelvic fins. The pelvic fins consist of one spine and five elongate rays. The heavily pigmented, truncate to slightly emarginated caudal fin has scales covering the proximal one-third or more of the rays. The lower margin of the ventral caudal rays is serrated. The eye is somewhat small, approximately one-third of HL. The jaws of the large mouth are about equal anteriorly in smaller specimens, with the upper jaw extending anteriorly to the lower jaw in larger specimens. The upper jaw extends posteriorly to the rear, or slightly beyond the rear, of the eye. The small dentary and premaxillary teeth are in single rows, except for small patches at the premaxillary and dentary symphyses. The slightly recurved vomerine and palatine teeth are about the same size as the largest jaw teeth. The gill rakers on the first arch are in two series separated by a fold of tissue. The lateral series have sparse pigment and are long with pointed tips (rounded tips in larger specimens). Each has several short bristles arranged along the distal half of the dorsomedial surface. Some have a small bristle at the tip. The medial series

are short, stout, and have 2–3 bristles at the tip. The body is triangular to ovate and deepest at or near a vertical through the pectoral fin base. The head is blunt with a steep forehead. The caudal peduncle is somewhat narrow, about as long as deep. The lateral line is inconspicuous or not visible to the naked eye. To 32 cm TL.

Similar species
Other species of the genus *Caristius* have either not been confirmed from the northeastern Pacific, or are considered synonyms of *C. macropus*. The indistinct lateral line and small lateral line scales distinguish the manefish from species of the genus *Platyberyx*. The narrow suborbital space and long jaw that extends to or beyond midorbit distinguish the manefish from species of the genera *Neocaristius* and *Paracaristius*.

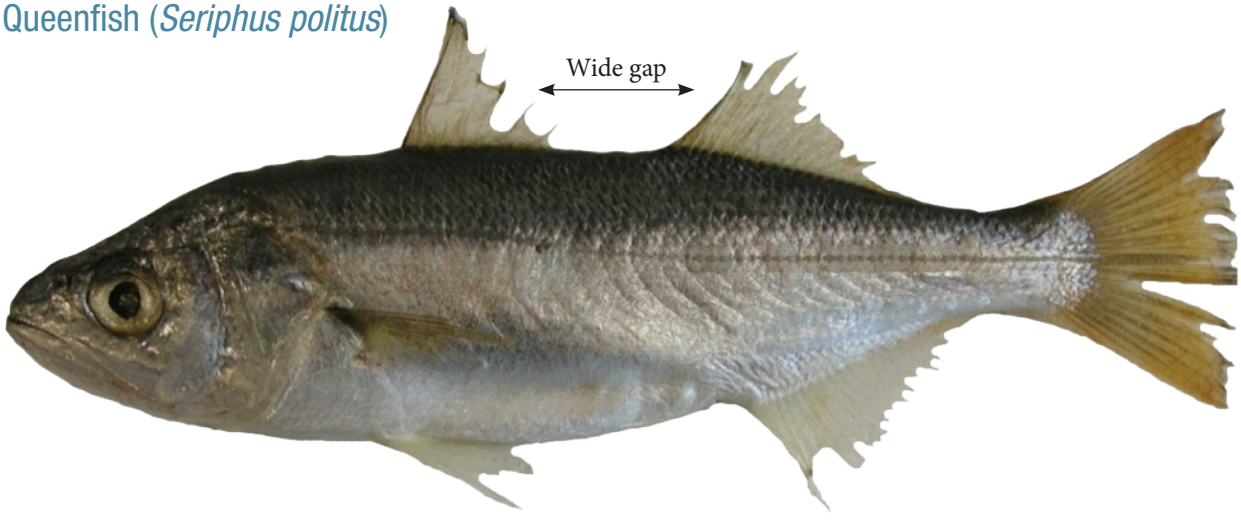
Distribution
Manefish occur in the northwestern Pacific from Japan to the Bering Sea, the Aleutian Islands, the Gulf of Alaska, and the northeastern Pacific to central Baja California, Mexico, at depths of 200–1,450 m.

Sciaenidae (Drums or Croakers)

The drums get their name from the loud noises they produce using their multibranched swim bladder and large otoliths. Drums are bottom-dwelling fishes distributed in the Atlantic, Indian, and Pacific Oceans. The long dorsal fin has a deep notch between the spinous and soft-rayed portions, or can be separate. The spinous portion has 6–13 spines. The soft-rayed portion has up to one spine followed by 20–35 soft rays. The anal fin has 1–2 weak spines followed by 6–13 soft rays. The caudal fin varies from slightly rounded to emarginate. The lateral line extends to the end of the caudal fin. The opercle has a forked, bony upper edge, and there is a bony flap above the gill opening. Some species have a single or small patch of chin barbels. There are large canals in the head, and the snout and lower jaw have conspicuous pores.

Key to the Sciaenidae of the FRAM Surveys

Queenfish (*Seriphus politus*)

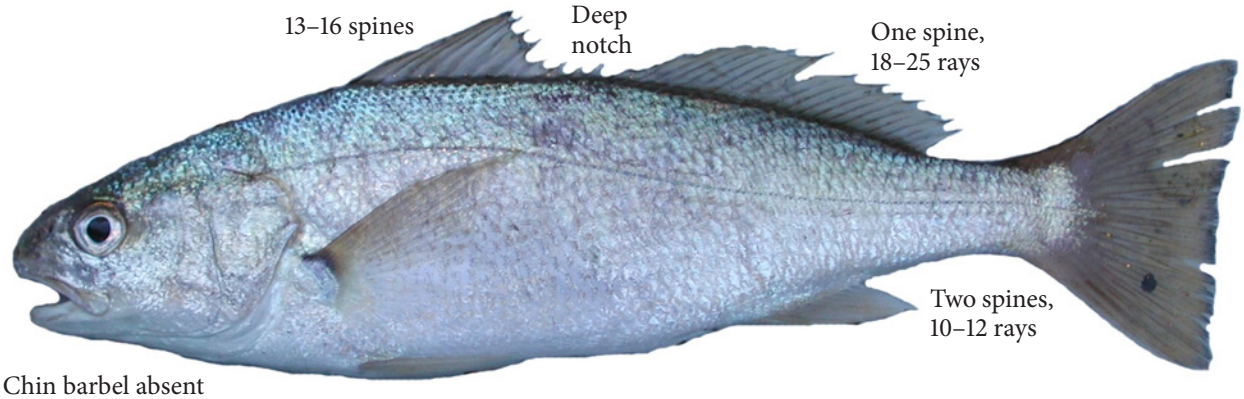


Description
Queenfish are dark gray, gray/blue, or tan dorsally, becoming silver laterally and silver to silvery white ventrally. The dorsal, caudal, anal, and pelvic fins are generally yellow. The pectoral fins are dusky at the base, becoming yellow posteriorly. A wide gap separates the two dorsal fins. The spinous dorsal consists of 8–9 (usually 8) spines. Dorsal spines 1 and 2 are shorter than 3, with the remaining spines decreasing in length posteriorly. The second dorsal fin consists of one spine and 18–21 (usually 20) soft rays. The bases of both dorsal fins have scales. The pectoral fins consist of one spine and 15–17 (usually 16) rays. The long anal fin is similar in size to the second dorsal and consists of two short, thin spines followed by 21–23 (usually 22) rays. The body is somewhat elongate, being deepest between the anterior end and middle of the first dorsal. The interorbital space is slightly concave. The snout is moderately long: 3.4–3.7 into HL. The large mouth is slightly upturned, with the lower jaw projecting slightly beyond the upper to nearly equal. The upper jaw is somewhat long, extending to or beyond the middle of the eye to the posterior margin of the eye. To about 30 cm TL.

Similar species
The wide gap between the dorsal fins distinguishes the queenfish from other closely related species.

Distribution
Although rare north of Point Conception, California, queenfish range from British Columbia, Canada, to Uncle Sam Bank, southern Baja California, Mexico, at depths to 55 m.

White croaker (*Genyonemus lineatus*)



Chin barbel absent

Description
White croakers have elongated, oblong, compressed bodies. They are most often a metallic blue or blue/green dorsally fading to silver laterally with yellow highlights to white ventrally. Fresh specimens may exhibit faint wavy lines along the scale rows, but these fade rapidly upon death. Some specimens have an overall brassy coloration that is dark dorsally with lighter shades of the same color with various dark spotting laterally and light ventrally. The upper jaw of the slightly elongated snout extends just beyond the lower. The fins may have a yellowish tint but are generally white. The first dorsal fin has 12–16 (usually 13) spines. The second dorsal has one spine and 18–25 rays. The anal fin consists of two spines and 10–12 soft rays. The pelvic fins have a

fleshy appendage at the base and a free, threadlike tip to the first ray. Often with a small dark spot at the base, the long pectoral fin rays extend past the pelvic fin tips. The straight margin of the caudal fin often has a dark edge. Chin barbels are usually absent but, if present, are very small and inconspicuous. To 41 cm TL.

Similar species
The 12 or more dorsal spines (similar species generally with 11 or fewer), lack of a chin barbel, dark lines on the body, and prominent black area at the pectoral fin base (one or more of these characteristics are present in similar species) distinguish the white croaker from other similar species.

Distribution
Rare north of California, white croakers range from Barkley Sound, British Columbia, Canada, to Magdalena Bay in southern Baja California, Mexico, at depths of 0–183 m.

Embiotocidae (Surfperches)

The surfperches are a group of laterally compressed, deep-bodied, small-mouthed fishes distributed throughout the temperate coastal waters of the North Pacific. The single dorsal fin is composed of both spines and soft rays, and has a sheath of scales along the base separated by a groove from the cycloid body scales. The anal fin has three spines ahead of the soft rays. The pelvic fins have one spine and five rays. They have wide gill openings—the gill membranes are free from or very weakly connected to the isthmus—and 5-6 branchiostegal rays.

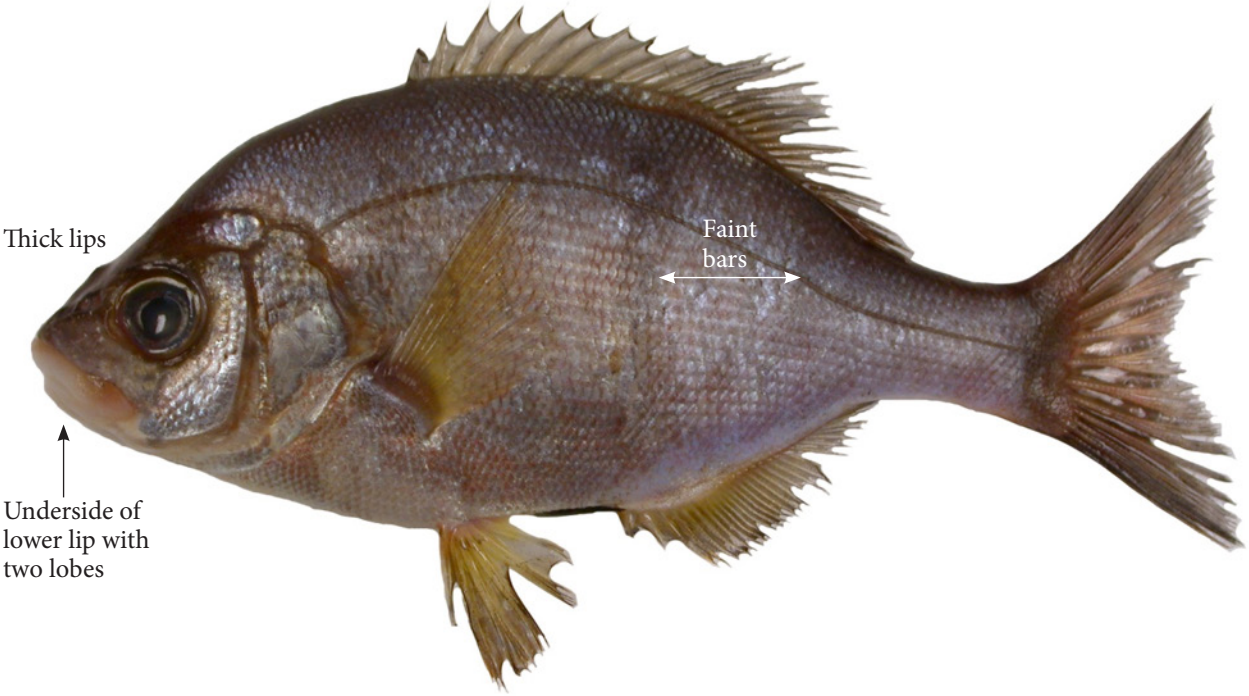
Key to the Embiotocidae of the FRAM Surveys

1	Lower lip large, with 2 central ventral lobes ..... ***Rhacochilus toxotes***	p 308
1	Lower lip without central ventral lobes 2	
2(1)	Patch of enlarged scales between pectoral and pelvic fins ..... ***Embiotoca jacksoni***	p 309
2	Not as above 3	
3(2)	Anal fin base has a row of scales extending over base of soft rays; 6 or more yellow to olive yellow vertical bars on sides 4	
3	Anal fin base not as above; 0–3 yellow to olive yellow vertical bars on sides 6	
4(3)	Upper jaw extends slightly beyond lower; caudal fin not red; spinous dorsal shorter than longest soft dorsal ray; lower lip has a fold or membrane that connects lip to ventral side of lower jaw ..... ***Amphistichus argenteus***	p 309
4	Jaws are equal, or projecting lower jaw; light pink to dark red caudal fin; longest dorsal spines longer than or equal to longest dorsal soft ray; 14–18 gill rakers on lower limb; usually no connective tissue from lower lip to lower jaw 5	
5(4)	Longest dorsal spine about equal to longest dorsal soft ray; 14–18 gill rakers on lower limb; usually no connective tissue from lower lip to lower jaw ..... ***Amphistichus koelzi***	p 310
5	Longest dorsal spine longer than longest dorsal soft rays; 10–14 gill rakers on lower limb; no connective tissue from lower lip to lower jaw ..... ***Amphistichus rhodoterus***	p 311
6(3)	No connective tissue from lower lip to lower jaw 7	
6	Lower lip with connective tissue to lower jaw 11	

7(6)	Black spot on spinous dorsal and anal fins ..... ***Hyperprosopon anale***	p 312
7	Not as above 8	
8(7)	Total length more than 3 times greatest body depth; 5–6 scale rows between dorsal fin insertion and lateral line; 55 or more lateral line scales 9	
8	Total length 3 or more times greatest body depth; 3 scale rows between dorsal fin insertion and lateral line; 46 or fewer lateral line scales 10	
9(8)	Pelvic fin has black tips; white tail with black edge; 20–23 gill rakers on lower limb of first arch ..... ***Hyperprosopon argenteum***	p 313
9	Pelvic fins without black tips; pink, pink/orange, or light red tail; 15–19 gill rakers on lower limb of first arch ..... ***Hyperprosopon ellipticum***	p 314
10(8)	Least depth of caudal peduncle 7.9 (7.2–8.6) into SL; distance from upper end of pectoral fin base to first dorsal spine 3.74 (3.3–3.9) into SL ..... ***Cymatogaster aggregata***	p 315
10	Least depth of caudal peduncle 9.15 (8.4–9.9) into SL; distance from upper end of pectoral fin base to first dorsal spine 4.24 (3.9–4.7) into SL ..... ***Cymatogaster gracilis***[*]	p 315
11(6)	Pink with 2 dark brown spots at base of dorsal fin; last anal fin rays long and threadlike ..... ***Zalembius rosaceus***	p 316
11	Body color and anal fin not as above 12	
12(11)	Red, yellow, and/or blue body stripes 13	
12	No red, yellow, or blue body stripes 14	
13(12)	Upper jaw and snout extend beyond lower jaw; anal fin base shorter than distance from pelvic fin base to anal fin origin; straight abdominal profile ..... ***Hypsurus caryi***	p 316
13	Jaws equal or slightly extended upper jaw and snout; anal fin base longer than distance from pelvic fin to anal fin origin ..... ***Embiotoca lateralis***	p 317
14(12)	Anal fin base shorter than distance from base of last anal soft ray to end of scales on midcaudal ray; shallowly forked tail; midcaudal ray goes less than 2× into upper caudal lobe 15	
14	Anal fin base longer than distance from base of last anal soft ray to end of scales on midcaudal ray; deeply forked tale; midcaudal ray goes 2 or more times into upper caudal lobe 17	
15(14)	No black area under or behind pectoral fin base ..... ***Brachyistius frenatus***	p 317
15	Black area under or behind pectoral fin base 16	
16(15)	12–16 dorsal soft rays; body depth 2–2.4 into SL ..... ***Micrometrus minimus***	p 318
16	15–19 dorsal soft rays; body depth 2.4–2.8 into SL ..... ***Micrometrus aurora***	p 318
17(14)	Longest dorsal soft ray 1.6–3× length of longest dorsal spine; 8–9 scale rows between first dorsal spine and lateral line ..... ***Rhacochilus vacca***	p 319
17	Longest dorsal soft ray as long as or slightly longer than longest dorsal spine; 4–7 scale rows between first dorsal spine and lateral line 18	
18(17)	Whitish to clear pelvic fins may or may not have faint dusky speckling at tips; body has no speckling on dorsal surface; dark line at dorsal fin base extends from rear end of spinous dorsal to end of soft dorsal ..... ***Phanerodon furcatus***	p 320
18	Pelvic fins black-tipped; reddish speckling on dorsal scales ..... ***Phanerodon atripes***	p 321

[*] Invalid. Synonym for *Cymatogaster aggregata*.

Rubberlip surfperch (*Rhacochilus toxotes*)

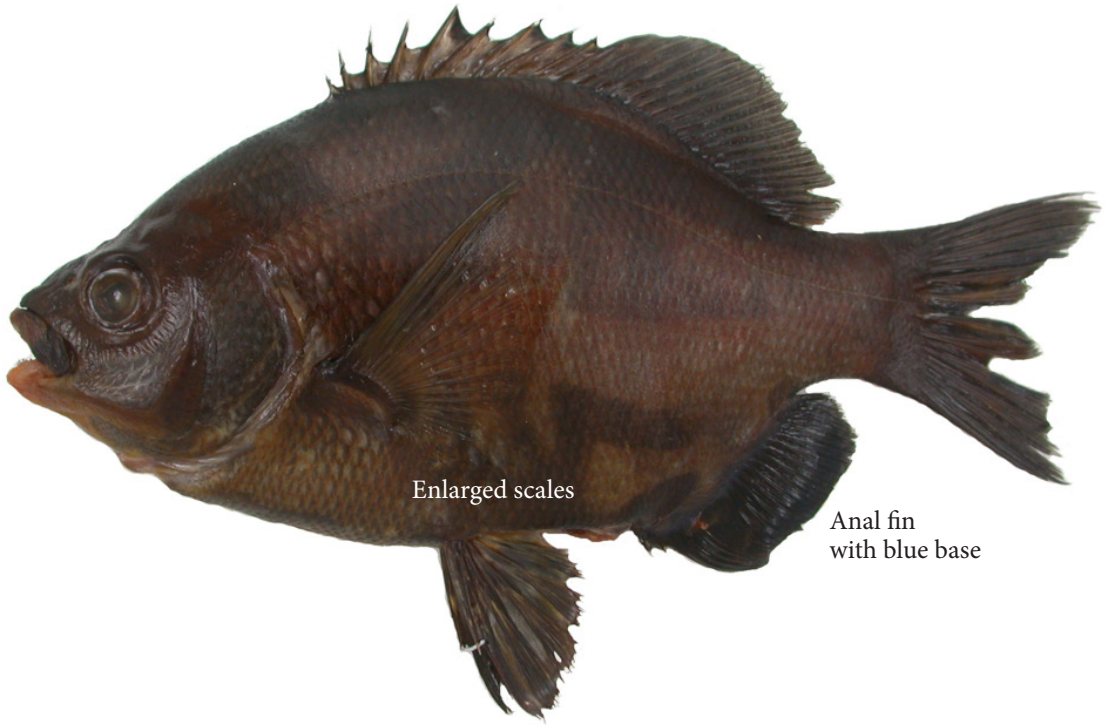


Description
Rubberlip surfperch are usually silver with an olive, black, dark blue, or dark purple tint dorsally, becoming brassy with 1–2 faint dusky bars laterally and somewhat lighter ventrally. The dorsal fin consists of 9–11 (usually 10) spines, the longest of which are just shorter than the 20–25 (usually 23) soft rays. The usually dark anal fin consists of three spines and 27–30 (usually 29) soft rays. The yellow or yellow/orange pectoral fin has 21–24 (usually 23) rays. The pelvic fins are generally dark. Juvenile rubberlip surfperch are generally light with an overall pink tint and a dark bar at midbody. The lips of both adults and juveniles are very large and are white to light pink. The lower lip has two central lobes on the underside. To 47 cm TL.

Similar species
The pile surfperch (*Rhacochilus vacca*) has narrow lips and dorsal soft rays nearly twice as long as the dorsal spines (thick lips, the underside of the lower lip with two lobes; and dorsal soft rays not much longer than dorsal spines, in rubberlip surfperch).

Distribution
Rubberlip surfperch range from Mendocino County, California, to central Baja California, Mexico, at depths to over 55 m.

Black surfperch (*Embiotoca jacksoni*)



Description
The color ranges from black/gray to black dorsally and varies laterally from black to orange/brown to orange/red, generally with nine dark bars and commonly with blue specks on the scales. The dorsal fin has 9–11 (usually 10) spines, the longest of which are shorter than the 18–22 soft rays. The pectoral fin consists of 20–22 (usually 20) rays. The pelvic fins are often red or orange. The anal fin generally has a blue or gold stripe at the base, and consists of three spines and 24–27 (usually 26) soft rays. There is a patch of greatly enlarged scales between the pelvic and pectoral fins. To 39 cm TL.

Similar species
All other surfperch lack the patch of enlarged scales.

Distribution
Black surfperch range from Fort Bragg, California, to central Baja California, Mexico, including Guadalupe Island, to depths of 55 m.

Barred surfperch (*Amphistichus argenteus*)

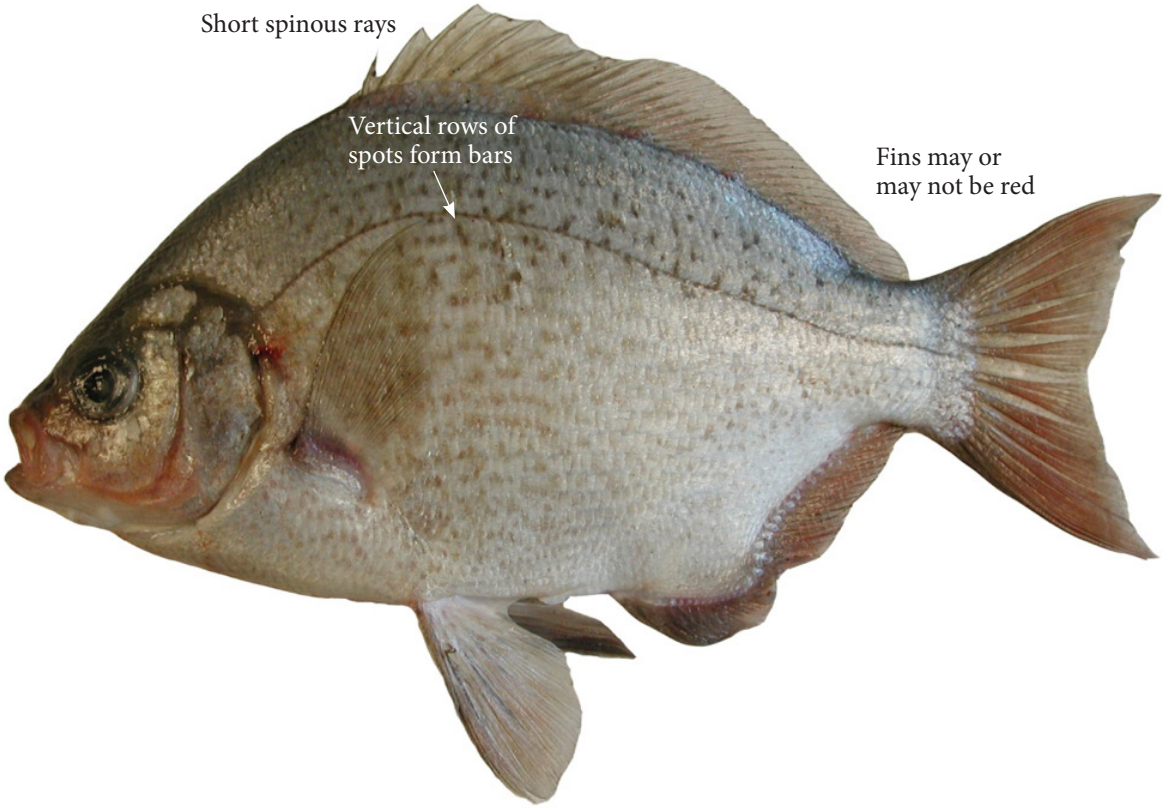
Description
Barred surfperch are generally olive green to yellow/green with blue or gray highlights dorsally, becoming silvery but can appear whitish or brassy olive laterally. There are generally 8–10 bronze, brassy, or yellow-colored bars on the sides. However, the bars can appear irregular and often have spots between them, or the color can be uniform without any bars or spots. Mature adults tend to be darker. The fins are clear to dusky, with darker edges. The dorsal fin consists of 9–12 (usually 10) spines, the longest of which are about three-quarters the length of the 21–27 (usually 24) soft

rays. The anal fin consists of 3–4 (usually 3) spines and 24–29 (usually 26) soft rays. The body is oval and compressed. The head is blunt and the mouth is comparatively large, with the maxillary extending to the anterior edge of the pupil and anteriorly just past the lower jaw. To 43 cm TL.

Similar species
The clear to dusky fins (usually pink to red in other *Amphistichus* species), dorsal spines much shorter than the dorsal rays (nearly equal to much longer in other *Amphistichus* species), and a lower jaw slightly shorter than the upper, distinguish the barred surfperch from its closely related species.

Distribution
Barred surfperch range from Bodega Bay, California, but are more abundant from Cayucos, California, to Plaza Maria Bay in central Baja California, Mexico, from the surf to 73 m.

Calico surfperch (*Amphistichus koelzi*)



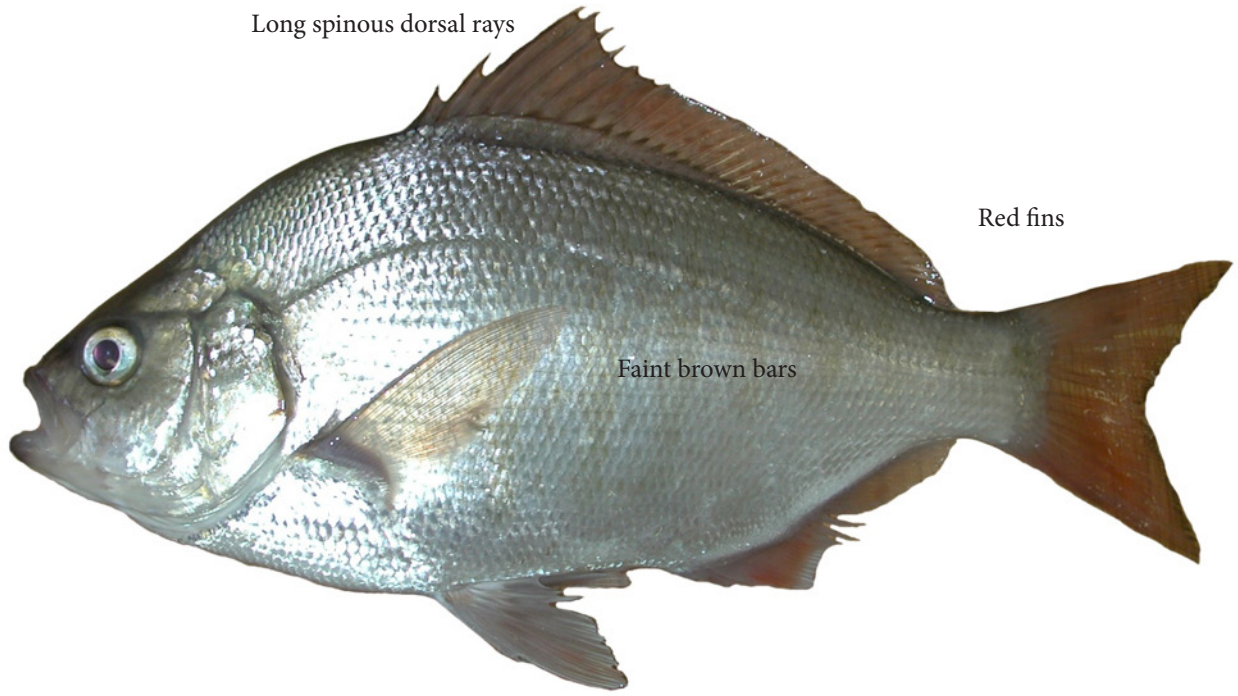
Description
Calico surfperch are generally silvery with brassy overtones. Dorsally, the color varies from silver/blue, olive, or brassy, usually lighter shades of the same color laterally, sometimes with a red tint. Vertical bars made up of red to reddish-brown spots on the sides are offset below the lateral line. The pectoral fins are dusky to clear. The dorsal, anal, and pelvic fins have a red or pink tint that fades upon death. The caudal fin may also have the red or pink tint, but is just as often a dusky color. The dorsal fin consists of 9–11 (usually 10) spines, the longest of which are nearly as long as the 24–28 (usually 26) soft rays. The body is moderately large and deep. The sharp curve

of the dorsal contour contrasts the gentle arch of the ventral surface. The dorsal contour of the head is very abrupt at the snout, then curves gently to the dorsal fin origin, occasionally slightly concave around the nape. The mouth is somewhat large. The maxillary extends to or just beyond the anterior edge of the orbit. The lower jaw projects slightly beyond the upper. To 31 cm TL.

Similar species
The barred surfperch (*Amphistichus argenteus*) has a slightly projecting upper jaw (slightly projecting lower jaw in calico surfperch), dorsal spines much shorter than soft rays (nearly equal in calico surfperch), and dusky or clear fins (most fins with pink or red tint in calico surfperch). The redtail surfperch (*A. rhodoterus*) has dorsal spines much longer than soft rays (nearly equal in calico surfperch).

Distribution
Although becoming increasingly uncommon the farther north of California one travels, calico surfperch have been recorded from Cape Flattery, Washington, to Santo Tomas Point, northern Baja California, Mexico, from the surf line to depths over 55 m.

Redtail surfperch (*Amphistichus rhodoterus*)



Description
Redtail surfperch are generally light olive dorsally becoming silvery with a brassy tint laterally, with 8–11 faint brown vertical bars. The dorsal, anal, and pelvic fins generally have a red tint. The pectoral fins are dusky to clear. The caudal fin is red to dark purple. Fin color does fade upon death. The dorsal fin consists of 9–10 (usually 9) spines, the longest of which are much longer than the 25–28 (usually 27) soft rays. The body is fairly large and deep. The dorsal contour of the body is very sharp in contrast with the gentle curve of the ventral profile. The head tapers sharply

from the snout, then curves gently to the dorsal fin origin, occasionally slightly concave at the nape. The mouth is moderately large. The maxillary extends to the anterior edge of the orbit and the lower jaw projects slightly beyond the upper. To 38 cm TL.

Similar species
The dorsal spines being much longer than the soft rays (dorsal spines much shorter than to about equal with the soft rays in other *Amphistichus* species) distinguish redtail surfperch from all other similarly colored *Amphistichus* species.

Distribution
Redtail surfperch have been recorded from Vancouver Island, British Columbia, Canada, to Avila Beach, California, from the surf line to depths over 55 m.

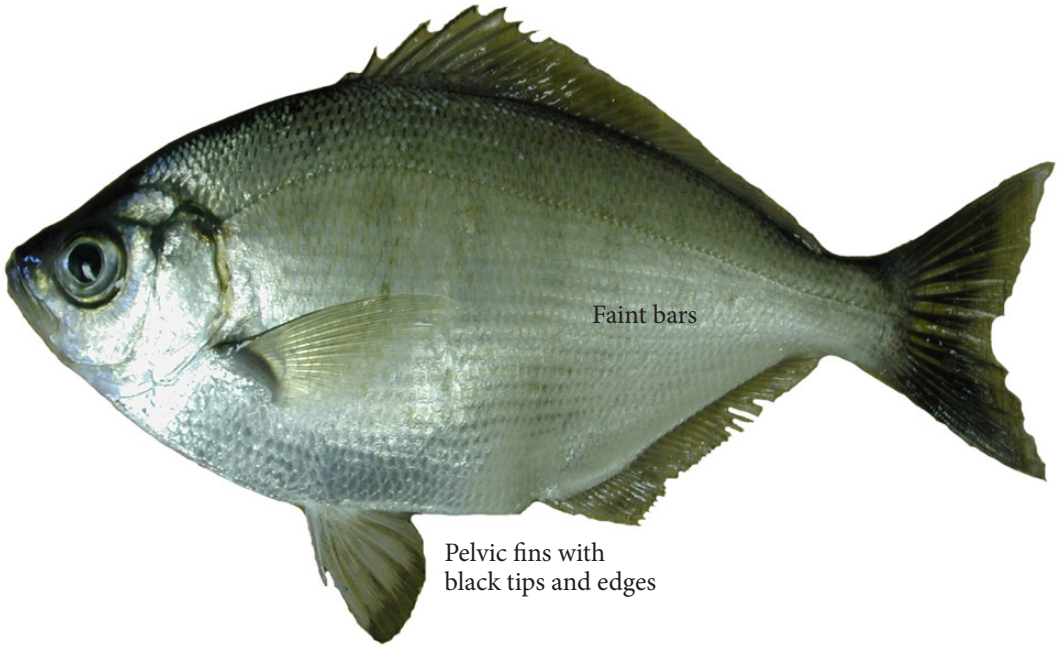
Spotfin surfperch (*Hyperprosopon anale*)

Description
Spotfin surfperch are generally dark dorsally, silvery laterally, and silvery white ventrally. There is a dark spot on the spinous dorsal and anterior portion of the anal fin; the rest of the fins are clear or slightly dusky. The dorsal fin has 7–9 (usually 8) spines; the longest of these are slightly higher than the 22–25 (usually 23) soft rays. The anal fin has three spines and 23–26 (usually 25) soft rays. The body is narrow and not sharply contoured in profile. The dorsal contour of the head is straight. The mouth is somewhat small and the maxillary does not reach the anterior edge of the orbit. To 20 cm TL.

Similar species
The shiner perch (*Cymatogaster aggregata*) has dark pigment on the scales forming lateral stripes that are crossed with about three vertical yellow bars (stripes and bars absent in spotfin surfperch), dusky dorsal and anal fins, and a plain, possibly yellow spot on the anal fin (dorsal and anal fins with distinct dark spots in spotfin surfperch).

Distribution
Spotfin surfperch range from Seal Rock, Oregon, to central Baja California, Mexico, from the surf to 92 m.

Walleye surfperch (*Hyperprosopon argenteum*)

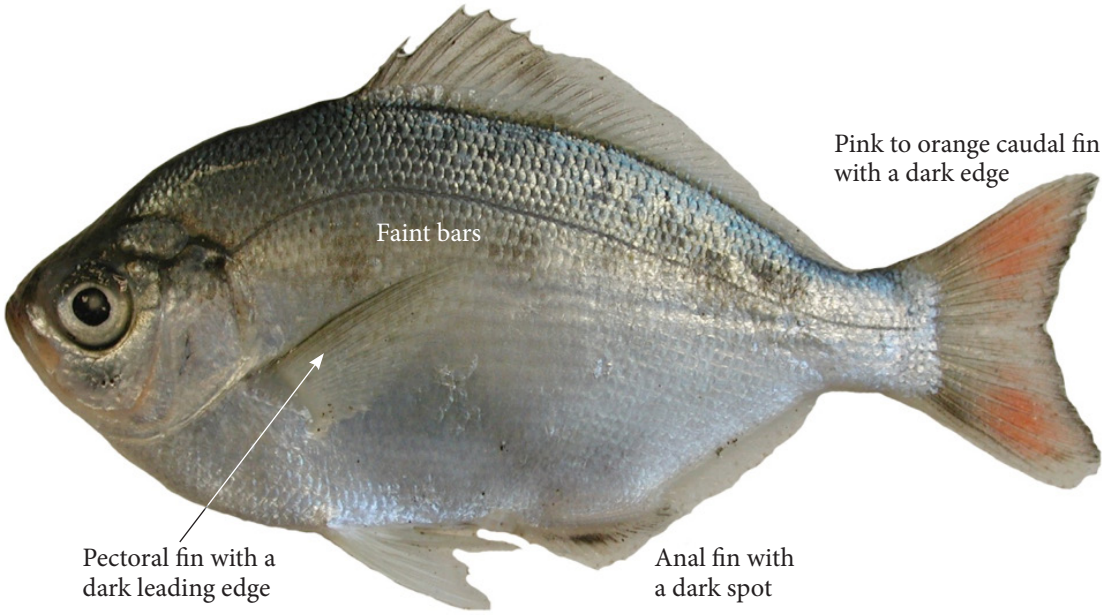


Description
Walleye surfperch are dark gray to blue/gray dorsally, silvery with faint vertical bars that fade upon death laterally, and light ventrally. The fins are clear to dusky. The pelvic fins have a prominent black edge. The dorsal fin has 8–10 (usually 9) spines, the longest longer than the 25–28 (usually 27) soft rays. The anal fin has three spines and 30–35 (usually 32) soft rays. The body is deep and, along with the head, with a gentle dorsal contour. To 30 cm TL.

Similar species
The prominent black edges and tips of the pelvic fins distinguish walleye surfperch from other *Hyperprosopon* species.

Distribution
Walleye surfperch range from Vancouver Island, British Columbia, Canada, to Point San Rosarito, central Baja California, Mexico, from the surf line to depths of 18 m.

Silver surfperch (*Hyperprosopon ellipticum*)



Description
Silver surfperch are silver/gray to green dorsally, silvery or silvery/white (often with faint, dark bars that fade upon death) laterally, and silvery to silvery/white ventrally. The dorsal fin has 8–10 (usually 9) spines, the longest of these longer than the 25–28 (usually 26) soft rays. The dorsal fin ranges from clear to slightly dusky, with a dark edge. The caudal fin has a pink tinge with a dark edge, the anal fin may have a dark red or black spot, the pelvic fins are clear, and the pectoral fin may be clear or dusky, with a darker leading edge. The body is deep. The dorsal contour of the snout and head are straight to a point slightly beyond the eye, then arching gently to the base of the dorsal fin. The mouth is moderate, with the maxillary extending to or just short of the anterior edge of the orbit. To 27 cm TL.

Similar species
The pink caudal fin with a dark margin and the dark spot on the anal fin distinguish the silver surfperch from similar species.

Distribution
Silver surfperch range from Schooner Cove near Tofino, Vancouver Island, British Columbia, Canada, to Río San Vicente, central Baja California, Mexico, at depths from the surf line to 55 m.

Shiner surfperch (*Cymatogaster aggregata*)

Description
Shiner surfperch are dark tan to dusky to greenish dorsally, silvery laterally; the scales below the lateral line and posterior to the head have groups of fine black dots that form about eight dark, broken stripes. The stripes (especially in females) are usually crossed with three vertical yellow bars. The pectoral and pelvic fins are usually clear. The dorsal and caudal fins are plain to dusky. The anal fin is usually colorless, but may have a yellow blotch on the anterior end. Breeding males may be nearly black. The dorsal fin has 8–10 (usually 9) spines, the longest of which are longer than the 19–22 (usually 20) soft rays. To 20.3 cm TL.

Similar species
The island surfperch (*Cymatogaster gracilis*) is believed to be an isolated population of, and are now considered a synonym of, *C. aggregata* (shiner surfperch). Reef surfperch (*Micrometrus aurora*) and dwarf surfperch (*M. minimus*) have black, triangular blotches at the base of the pectoral fins (absent in shiner surfperch) and different spots and bars on the sides and/or fins. Dark breeding males may also look like black surfperch (*Embiotoca jacksoni*), which has a patch of enlarged scales between the pectoral and pelvic fins (absent in shiner surfperch).

Distribution
This is a common species found from Port Wrangell in southeastern Alaska to Bahía San Quintín, north-central Baja California, Mexico, at depths from the surf line to 146 m.

Pink surfperch (*Zalembius rosaceus*)

Description
Pink surfperch are a somewhat dark pink to rose color dorsally, with two black or dark brown spots under the dorsal fin usually beginning at or just posterior to midbody. They are silvery pink laterally, and light ventrally. The fins are clear to slightly dusky. The dorsal fin has 9–11 (usually 10) spines, the longest of which are nearly equal to or shorter than the 16–19 (usually 18) soft rays. To 20 cm TL.

Similar species
The overall pink or rosy hue and the two dark spots below the dorsal fin distinguish the pink surfperch from similar species.

Distribution
Pink surfperch range from Point Delgada, California, to Bahía San Cristóbal, southern Baja California, Mexico, and the Gulf of California, at depths of 8–229 m.

Rainbow surfperch (*Hypsurus caryi*)

Description
The entire body of the rainbow surfperch is marked with horizontal red, red/orange, orange, and blue stripes. There are orange bars on the dorsum. The head has orange streaks and blue bars and spots. There is usually a dark spot at the end of the upper jaw. The fins often have an orange tint. There is a black blotch on the rayed portion of the dorsal and anal fins. The soft-rayed portion of the dorsal fin has a series of small, creamy spots. There is a similar black blotch on the anterior portion of the anal fin. The pelvic fins may or may not be striped. The dorsal fin has 9–11 (usually 10) spines, which are shorter than the 21–24 (usually 22) soft rays. The small anal fin has three spines and 21–23 (usually 22) soft rays. The ventral profile is long and flat, and angles up sharply at the anal fin. To 31 cm TL.

Similar species
Striped surfperch (*Embiotoca lateralis*) have 29–33 anal fin rays (21–23 in rainbow surfperch), dark fins (orange tint in rainbow surfperch), and the ventral profile is round (long and flat in rainbow surfperch).

Distribution
Rainbow surfperch range from Cape Mendocino, California, to northern Baja California, Mexico, at depths of 1–55 m.

Striped surfperch (*Embiotoca lateralis*)

Description
Striped surfperch are dark coppery-brown dorsally, becoming lighter with a small series of curved blue stripes above, and about 15 straight horizontal blue stripes below, the lateral line. The head has several series of blue spots and stripes. The fins are coppery, with dark areas on the anterior part of the rayed dorsal, base of the caudal fin, anterior portion of the anal fin, and distal portion of the pelvic fins. The dorsal fin has 10–11 (usually 10) spines, which are shorter than the 23–25 (usually 24) soft rays. The anal fin has three spines and 29–33 (usually 30) soft rays. The profile of the ventral surface is round. To 38 cm TL.

Similar species
Rainbow surfperch (*Hypsurus caryi*) have orange-tinted fins (dark in striped surfperch), a long, straight ventral profile (rounded in striped surfperch), and 21–23 soft rays in the anal fin (29–33 in striped surfperch).

Distribution
Striped surfperch range from Wrangell, southeastern Alaska, to Punta Cabras, Baja California, Mexico, at depths of 1–21 m.

Kelp surfperch (*Brachyistius frenatus*)

Description
Kelp surfperch are generally rose to copper/brown dorsally, with dark pigment under each scale to the lateral line, and light coppery tan, often with blue spots and whitish areas below the lateral line, or they can be a uniform rosy color without other markings. The fins are plain or rosy. The caudal fin may be dusky anteriorly, then plain or rosy posteriorly. The dorsal fin has 7–9 (usually 8) spines, the longest of which is (nearly) as long as the 13–16 (usually 14) soft rays. A narrow fold of skin or membrane connects the lower lip to the lower jaw. The mouth is very small, with the jaws falling well short of the eye. To 22 cm TL.

Similar species
Shiner surfperch (*Cymatogaster aggregata*) are silvery with three yellow bars and eight broken dark bands (rosy to coppery, possibly with blue spots and whitish areas, in kelp surfperch). Dwarf surfperch (*Micrometrus minimus*) have dark blotches on the dorsal, anal, pelvic, and caudal fins, and an irregular dark stripe on the side crossed by dark, barlike blotches (all absent in kelp surfperch).

Distribution
Kelp surfperch range from northern British Columbia, Canada, to central Baja California, Mexico, at depths to 30 m.

Dwarf surfperch (*Micrometrus minimus*)

Description
Dwarf surfperch are generally silvery with green or yellow overtones, darker green with blue highlights dorsally, and yellow or yellow/orange laterally, with an irregular dark line along the longitudinal axis. There are two distinct dark green or brown blotches at the base of the dorsal fin, the first at about the junction of the spinous and soft dorsals, the second at or near the posterior end of the fin. Two ill-defined vertical bars extend downward from the blotches, and there is a series of continuous stripes below the lateral line. There is a black triangular blotch at the base of the pectoral fin, and black blotches on the anal and pelvic fins. The dorsal fin has 8–11 (usually 9) spines, the longest of which are somewhat longer than the 13–16 (usually 14) soft rays. To 16 cm TL.

Similar species
Shiner surfperch (*Cymatogaster aggregata*) have plain fins (dark blotches on the fins and a triangular blotch at the base of the pectoral fin in dwarf surfperch). Reef surfperch (*Micrometrus aurora*) have black-edged scales between the pectoral and anal fins (absent in dwarf surfperch).

Distribution
Dwarf surfperch range from Bodega Bay, California, to central Baja California, Mexico, at depths to 9 m.

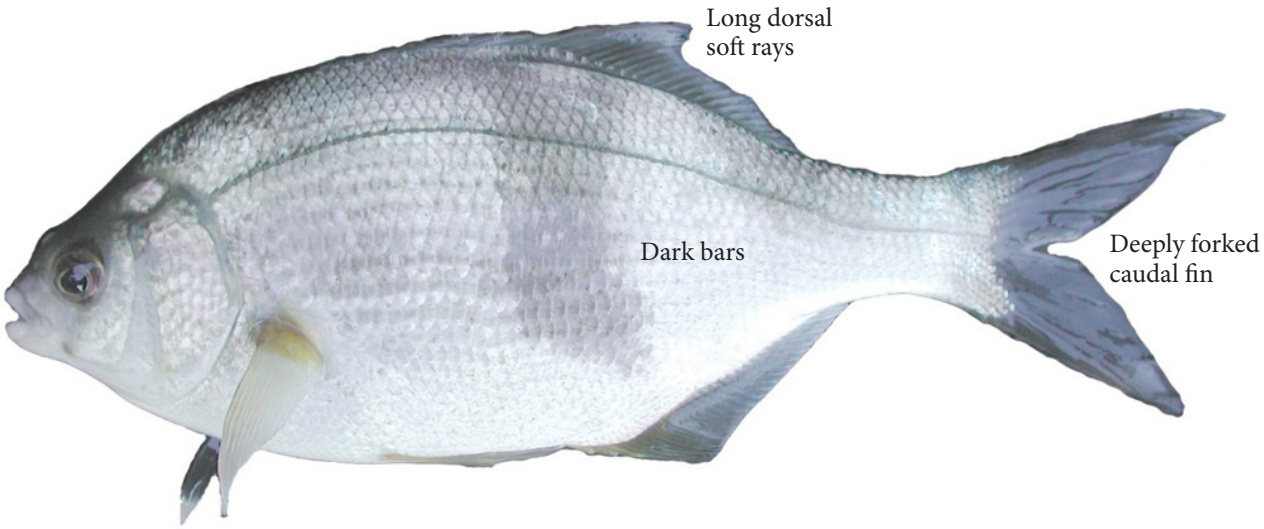
Reef surfperch (*Micrometrus aurora*)

Description
Adult reef surfperch are generally silvery overlaid with black, green, and/or orange, darker blue or green dorsally, becoming lighter laterally and silvery ventrally. The opercle and lower sides are peppered with black specks, and a triangular black blotch is at the pectoral fin base. An orange/gold stripe extends from the pectoral fin nearly to the caudal fin. The scales on the lower body, from just posterior to the pectoral fin to the anal fin, have crescent-shaped black edges that form a series of oblique narrow bars. Juveniles can be uniformly silvery, absent of all markings. To 18 cm TL.

Similar species
Shiner surfperch (*Cymatogaster aggregata*) have dark pigment on the scales that forms a series of broken dark bands, and a series of three yellow stripes (dark blotches, dark, crescent-shaped scale edges, and an orange/gold stripe in reef surfperch). Dwarf surfperch (*Micrometrus minimus*) have dark blotches on the dorsal, anal, pelvic, and caudal fins, and an irregular dark stripe on the side, crossed by barlike blotches (absent in reef surfperch).

Distribution
Reef surfperch range in shallow rocky areas from Tomales Bay, California, to central Baja California, Mexico, at depths to 6.1 m.

Pile perch (*Rhacochilus vacca*)

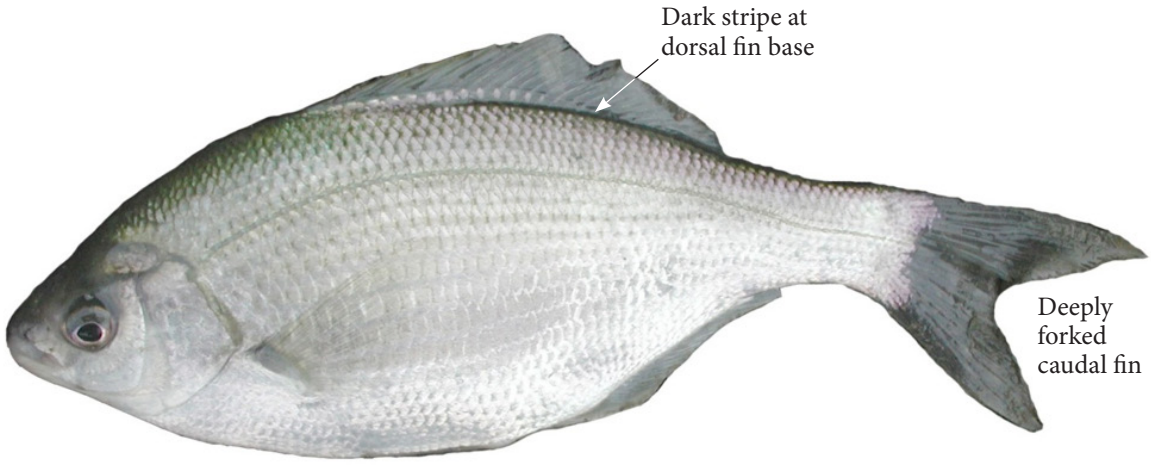


Description
Pile perch are black to black/gray dorsally becoming silvery with dark or sooty overtones laterally and silvery white ventrally. A dark bar that fades with age is present under the junction of the spinous and soft dorsal fins. A second shorter, fainter bar may be present, usually under the posterior portion of the dorsal fin. The dorsal, caudal, and pectoral fins are plain to dusky. On a fresh specimen, the pelvic fins and the anterior portion of the anal fin are yellow, and there is a small yellow patch at the base of the pectoral fin. Occasionally uniform dark pigmentation totally masks the body markings and color. The dorsal fin has 9–11 (usually 10) spines, the longest of which are about half the length of the 21–25 (usually 22) soft rays. To 44.2 cm SL.

Similar species
Rubberlip surfperch (*Rhacochilus toxotes*) have yellow pectoral fins (plain to dusky in pile perch), dorsal soft rays not much longer than spines (soft rays twice the length of spines in pile perch), and thick lips with the underside of the lower lip having two prominent lobes (narrow lips without prominent lobes in pile perch).

Distribution
Pile perch range from Wrangell, southeastern Alaska, to Guadalupe Island and north-central Baja California, Mexico, at depths to 46 m.

White surfperch (*Phanerodon furcatus*)

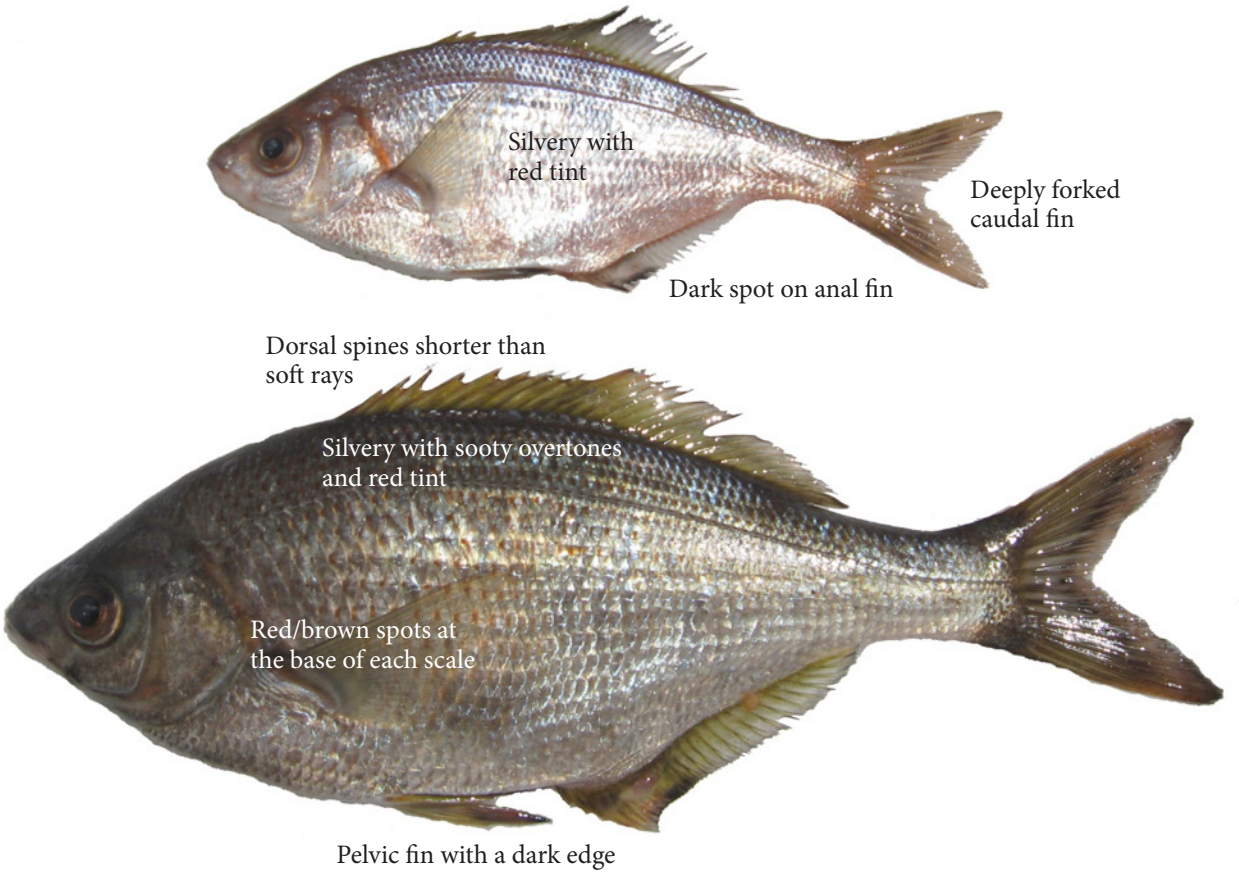


Description
White surfperch are dark silver/gray to blue or pale olive green dorsally and silvery white laterally and ventrally. Sometimes the body may have an overall yellow or pink tinge. There is a prominent dark stripe at the base of the soft dorsal fin. The fins usually have a yellowish tint and are mostly plain, except for black edging on the caudal fin and an occasional black spot on the anterior portion of the anal fin. The caudal fin is highly forked. The dorsal fin has 9–11 (usually 10) spines, the longest of which are (nearly) as long as the 20–26 (usually 23) soft rays. To 32 cm TL.

Similar species
Sharpnose surfperch (*Phanerodon atripes*) have a red tint to the body (usually silvery white in white surfperch), dark anal and pelvic fins (yellowish in white surfperch), and lack the dark stripe at the base of the dorsal fin (present in white surfperch).

Distribution
White surfperch range from Tofino on the west coast of Vancouver Island, British Columbia, Canada, to Punta Cabras, Baja California, Mexico, at depths to 43 m, possibly deeper.

Sharpnose surfperch (*Phanerodon atripes*)



Description
Sharpnose surfperch are silvery overlaid with olive green dorsally. Laterally, the fish are generally silver, possibly with sooty overtones, but have a red tint from the red/brown spot at the base of each scale. These spots form light red streaks. The scales may also have blue edges. The dorsal and pectoral fins are plain or dusky. The pelvic fins have a dark edge, or may be black. The anal fin has a dark patch on the anterior portion. The deeply forked caudal fin is usually clear. The dorsal fin has 10–11 (usually 10) spines that increase in size posteriorly, but the longest spines are shorter than the 22–24 (usually 23) soft rays. To 23 cm TL.

Similar species
White surfperch (*Phanerodon furcatus*) are a uniform silvery white laterally (red tint from red/brown spots at the base of the scales in sharpnose surfperch), with a dark stripe at the base of the dorsal fin (absent in sharpnose surfperch).

Distribution
Sharpnose surfperch range from Bodega Bay, California, to central Baja California, Mexico, from the surf line to 229 m.

Pomacentridae (Damselfishes)

The damselfishes are a group of chiefly marine fishes distributed throughout the tropical and subtropical seas. However, a few do occur in temperate waters. These fishes are round to oval-shaped with a deep, compressed body. The mouth and teeth are small. Most species have a single nostril on each side and two anal fin spines. The lateral line is interrupted and incomplete, usually ending under the soft dorsal. The ctenoid scales are large and usually extend onto the dorsal and anal fins.

Blacksmith (*Chromis punctipinnis*)

Description
Fresh blacksmith specimens are very dark or nearly black dorsally with a gray/blue to slate gray tinge. They are lighter shades of the same colors laterally and ventrally. The scales from midbody to the tail have black spots. Mature males may have a black bar through the eye. The plain pectoral and pelvic fins are dark. The dorsal and caudal fins have dark spots. The dorsal, caudal, and anal fins often have a blue border. Juveniles are purple anteriorly and yellow/orange posteriorly, with blue edges on the dorsal, anal, and caudal fins. The mouth is small. The lateral line ends under the soft dorsal. To 30 cm TL.

Similar species
Blacksmith are not likely to be confused with other species.

Distribution
Although rare north of Point Conception, California, blacksmith range from Monterey Bay, California, to Punta San Pablo, central Baja California, Mexico, most commonly from 0–45 m (but as deep as 82 m).

Sphyraenidae (Barracudas)

The 27 species of barracudas belong to a single genus and occur in the tropical and subtropical portions of the Atlantic, Indian, and Pacific Oceans. Barracudas have an elongate body and a large mouth with a projecting lower jaw and nonprotractile upper jaw, both bearing strong, fanglike teeth. The lateral line is well developed. The gill rakers are vestigial. There are two widely spaced dorsal fins; the first consists of five spines, the second of one spine and nine soft rays.

California barracuda, Pacific barracuda (*Sphyraena argentea*)

Description
California barracuda are generally brownish or bluish dorsally, silvery or silvery blue ventrally, and may have faint oblique bars on the back; the caudal fin is usually yellowish. There are two widely spaced dorsal fins: the first has five spines, the second has one spine and 9–10 soft rays. The anal fin has one spine and 8–9 soft rays. To 145 cm FL.

Similar species
Several related species occur in the waters around the Hawaiian Islands, the east-central Pacific, and the Gulf of California.

Distribution
Although very rare north of Point Conception, California, California barracuda have been recorded from Kodiak Island, Alaska, to Magdalena Bay, Baja California, Mexico. California barracuda are usually found near the surface in shallow inshore waters, as well as offshore and at depths to 20 m.

Labridae (Wrasses)

The wrasses are a large family, and vary widely in shape and coloration. Most common in the tropical seas, a few wrasses range into the warmer temperate waters. Some species have a protractile mouth. The canine teeth are generally large, curved, or forward-pointing, which gives the fish a bucktoothed appearance. The cycloid scales can be quite large. The long, single dorsal fin has 8–21 spines and 6–21 soft rays. The anal fin has 4–6 spines and 7–18 soft rays. Most species change color and sex as they grow.

California sheephead (*Semicossyphus pulcher*)

Male

Female

Description
Adult California sheephead are sexually dimorphic. Male California sheephead have a white chin on a blackish head, often with large prominent forehead, and a red eye. The midsection of the body is red to pink/red, and the posterior portion of the body is blackish. Females do not have the prominent forehead. They have a white chin and a red/brown to light red body with a white ventral surface. Females can also be very dark and can have dark irregular bars. Juveniles are bright red/orange, with black spots on the caudal peduncle and blue spots on the dorsal, pelvic, and anal fins. There are one or more white stripes at midbody, one of which will run from the eye to the caudal fin. To 91 cm TL.

Similar species
The white chin, sexually dimorphic color pattern, and strong protruding teeth distinguish California sheephead from other species.

Distribution
Although rare north of Point Conception, California, California sheephead range from Monterey Bay, California, to Cabo San Lucas, Baja California, Mexico, and the Gulf of California, at depths of 6–30 m.

Bathymasteridae (Ronquils)

The ronquils are a group of fishes confined to the cold and temperate waters of the North Pacific Ocean. These relatively small, elongate fishes have long dorsal and anal fins. The dorsal fin has 43–49 branched and unbranched rays, while the anal fin has 31–36. The counts also include 1–6 weak dorsal spines and 1–2 weak anal spines. The pectoral fins are large and rounded. The thoracic pelvic fins consist of one spine and five rays. The scales are highly variable and range from nearly smooth and weakly ctenoid to strongly cycloid. There is generally a single pair of nostrils. There are usually distinct sensory pores on the top of the head and cheeks. The nearly straight lateral line is high on the body and extends to the end of the dorsal fin.

Key to the Bathymasteridae of the FRAM Surveys

1	Scaleless head; first 3–5 dorsal fin rays unbranched; lateral line scales small; 15–18 gill rakers on lower limb; black blotch on forward end of dorsal fin ..... ***Bathymaster signatus***	p 325
1	Scaled cheeks; first 20-30 dorsal fin rays unbranched; enlarged lateral line scales 2	
2(1)	Pectoral fin does not reach anal fin 3	
2	Pectoral fin extends past front of anal fin ..... ***Ronquilus jordani***	p 326
3(2)	White blotches forming no distinct pattern; scales rough, not extending onto dorsal fin base; blue blotch on anterior portion of dorsal fin ..... ***Rathbunella alleni***	p 327
3	Regularly spaced ventral white blotches form alternating light and dark rows; scales not noticeably rough, extending onto dorsal fin base; blue blotch on dorsal fin absent ..... ***Rathbunella hypoplecta***	p 327

Searcher (*Bathymaster signatus*)

Description

Searchers are generally light olive to dark green or brown with dark markings dorsally, becoming lighter with light vertical bars laterally and light, possibly with yellow to orange streaks, ventrally. The preopercular pores and the area posterior to the upper jaw are bright orange. The dorsal fin is dusky to yellowish, with a prominent black blotch on the first 3–5 unbranched dorsal fin rays. The pectoral and caudal fins are dusky with various yellow mottling. The anal and pelvic fins are dark, with various darker markings. The eyes are bright blue when alive. The pectoral fin is short, and does not reach or barely reaches the anal fin. Rough ctenoid scales cover the body, but the head and cheeks are scaleless. To 38 cm TL.

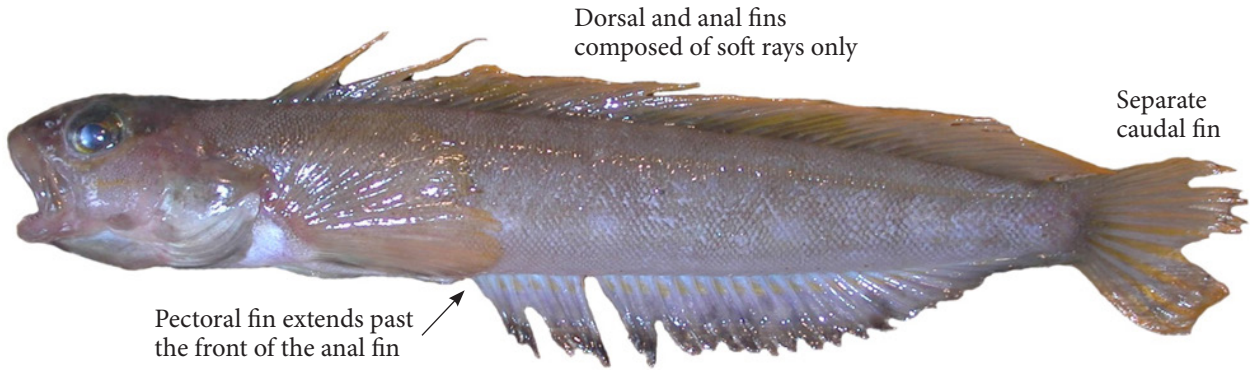
Similar species

The pectoral fin of the northern ronquil (*Ronquilus jordani*) reaches to or past the front of the anal fin (does not reach the anal fin in searcher), and it has scaled cheeks (scaleless in searcher).

Distribution

Searchers range from Hokkaido, Japan, through the sea of Okhotsk, the East Siberian and Bering Seas, and the North Pacific Ocean to Washington State, at depths to 300 m (although most common at depths less than 100 m).

Northern ronquil (*Ronquilus jordani*)



Description
The color of northern ronquils is highly variable and somewhat sexually dimorphic. Males are orange dorsally becoming dull olive with vague darker vertical bars and fine yellow lines below the lateral line laterally. The back of the head, across the occiput, and behind the eye are black, with gold bars below the eye and across the cheek. The upper portion of the pectoral fin is yellow, and usually black on the lower portion. There is a dusky patch on the anterior end of the dorsal fin. The dorsal and caudal fins are yellowish with a dark margin. The pelvic fins are black. The anal fin is blue, with golden spots at the base and a black margin. Females are olive green dorsally, becoming lighter with vague darker vertical bars and yellow lines laterally. The back of the head is dark, but reddish across the occiput. The dorsal and caudal fins have bright orange to yellow/orange edges. The anal fin has a brown margin and there is white on the pelvic fins. The long dorsal fin consists of 41–48 soft rays, the first 20–30 unbranched. The anal fin consists of 31–34 soft rays. The pectoral fin extends past the front of the anal fin. The body scales are small and almost smooth to the touch. There are small, embedded scales on the cheek. The rest of the head is scaleless. To 20 cm TL.

Similar species
Bluebanded ronquil (*Rathbunella hypoplecta*) and rough ronquil (*R. alleni*) have short pectoral fins that do not reach the front of the anal fin (extends past the front of the anal fin in northern ronquil). Searcher (*Bathymaster signatus*) have scaleless cheeks (scaled in northern ronquil).

Distribution
Northern ronquils range from the Bering Sea and the Aleutian Islands to Monterey, California, at depths of 3–275 m.

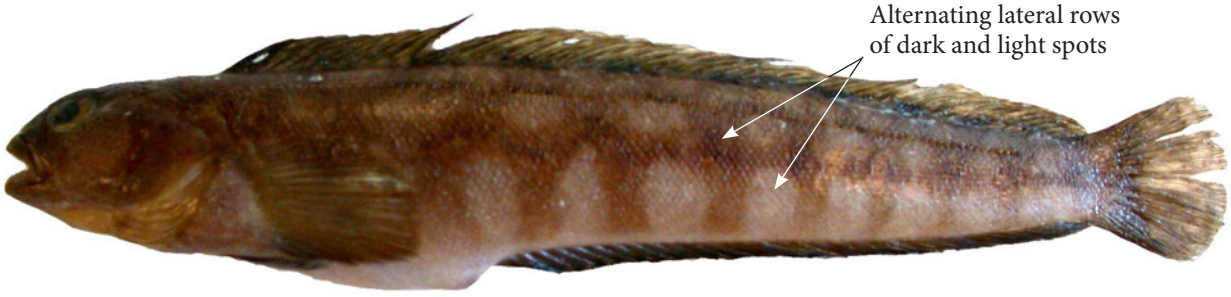
Rough ronquil, stripefin ronquil (*Rathbunella alleni*)

Description
Rough ronquil vary widely in color with sex and age. Generally they are shades of gray to brown or pinkish, with multiple light patches and spots and blotches laterally that form no distinct pattern, and moderately sized dark blotches that form vague lateral rows usually above midbody and along the base of the dorsal fin. Others can be very pale and nearly uniform in color, with scattered dark speckles. All color variants have a blue blotch on the anterior dorsal fin and a yellowish stripe bordered by a bright to dark blue stripe on the anal fin. The edge of the anal fin is dark for males and light to whitish for females. The short, rounded pectoral fin does not extend to the front of the anal fin. The scales are very rough and do not extend onto the dorsal fin. There are seven preopercular pores. Canine teeth are present in males only. To 16 cm TL.

Similar species
Bluebanded ronquil (*Rathbunella hypoplecta*) have regularly spaced light blotches ventrally, alternating with light and dark blotches dorsally (light blotches form no distinguishable pattern in rough ronquil), no blue blotch on the dorsal fin (present in rough ronquil), and scales that are not especially rough and extend onto the dorsal fin (rough and do not extend onto the dorsal fin in rough ronquil). Canine teeth are absent in both sexes (present in male rough ronquil).

Distribution
Rough ronquils range from Marin County, California, to northern Baja California, Mexico, at depths of 2–92 m.

Bluebanded ronquil, smooth ronquil (*Rathbunella hypoplecta*)



Pectoral fin does not extend to the anal fin

Description
The color of bluebanded ronquils varies with sex and age. Generally they are shades of gray to brown or pinkish (males tend to be dark brown to purplish dorsally), with regularly spaced, large, oblong whitish blotches ventrally, then alternating dark brown to black and whitish blotches dorsally. Others are nearly uniformly pale and nearly unmarked. All color variants have a yellowish stripe bordered by a blue band on the anal fin membrane. The edge of the anal fin is dark for males and light to whitish for females. The short, rounded pectoral fin does not extend to the front of the anal fin. The scales are not especially rough and extend onto the dorsal fin base. There are 7–8 preopercular pores. Canine teeth are absent in both sexes. To 16 cm TL.

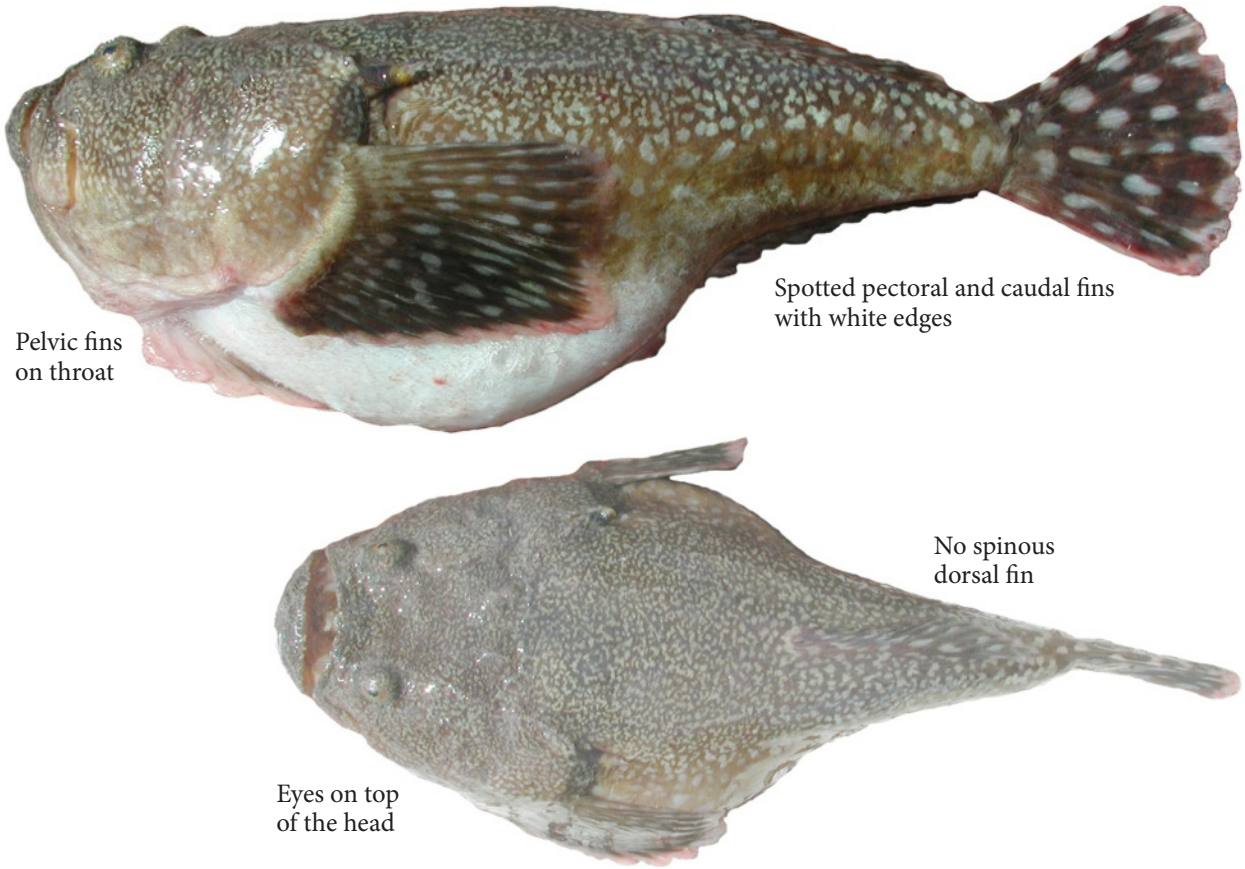
Similar species
Rough ronquil (*Rathbunella alleni*) have irregularly spaced light blotches of various shapes that form no distinct pattern (white blotches are regularly spaced, forming alternating rows of light and dark blotches, in bluebanded ronquil), a blue blotch on the dorsal fin (absent in bluebanded ronquil), and rough scales that do not extend onto the dorsal fin base (not rough and extending onto the dorsal fin base in bluebanded ronquil). Canine teeth are present in males (absent in both sexes for bluebanded ronquil).

Distribution
Bluebanded ronquils range from Point Conception, California, to central Baja California, Mexico, at depths of 3–92 m.

Uranoscopidae (Stargazers)

The stargazer family consists of about 53 species in eight genera. Their name derives from the placement of the eyes on the top of the head. The body is moderately elongate and depressed anteriorly or compressed. The head is large, flat, and cube-shaped. The eyes point dorsally or dorsolaterally. The interorbital space is broad, and the anterodorsal part of the skull deeply scooped backward. The large, protractile mouth is almost vertical, with teeth on the jaws, prevomer, and palatines. There are generally six branchiostegal rays. The first gill arch has gill teeth instead of the typical gill rakers. The anal, pelvic, and pectoral fin membranes are thick and fleshy. The single dorsal fin consists of 0–5 rudimentary spines and 12–20 soft rays, or is divided with 4–5 weak spines and 13–14 (rarely 12) soft rays. The caudal fin is somewhat truncate, with 10–12 branched rays. The pectoral fins are broad and nearly square to knife-shaped, with 13–25 rays. The close-set pelvic fins have one nonvisible spine, and five segmented rays are on the throat ahead of the pectoral fins. The body is scaled or scaleless; if scaled, the scales are cycloid, adherent, and nearly embedded under the skin. The lateral line is complete and extends to or nearly to the end of the caudal fin.

Smooth stargazer (*Kathetostoma averruncus*)



Description
Smooth stargazers are black to gray often mixed with olive, with numerous light spots both dorsally and laterally and plain white ventrally. The dorsal, caudal, and pectoral fins have numerous white spots. The caudal and pectoral fins have white edges. The pelvic fin is light and located on the throat ahead of the pectoral fins. The single low dorsal fin has no spines and 12–15 soft rays; it is far back on the body. The jaws are almost vertical, with short papillae on the lips. The eyes are on the top of the large head. There is a single prominent spine above the pectoral fin on the stocky, scaleless body. To 32 cm TL.

Similar species
The eyes on top of the large, nearly square head and the near-vertical mouth distinguish the smooth stargazer from other similar species.

Distribution
Although rare north of central Baja California, Mexico, smooth stargazers range from Piedras Blancas in central California to Isla Lobos de Tierra, Peru, and the Galápagos Islands, at depths of 13–384 m.

Clinidae (Kelpfishes)

The kelpfishes are a large group consisting of approximately 300 species. These small, long, and laterally compressed fishes occur in the inshore waters of all the temperate and tropical seas. Generally, the fin rays are unbranched. The long dorsal fin usually has more spines than soft rays, can be higher at the front or both ends, and extends from the back of the head almost to the caudal fin. The thoracic pelvic fins have less than five soft rays, usually one hidden spine, and three soft rays.

Key to the Clinidae of the FRAM Surveys

1	Mouth large, upper jaw massive	***Neoclinus blanchardi***	p 330
1	Not as above		2
2(1)	Caudal fin forked	***Heterostichus rostratus***	p 331
2	Caudal fin not forked	***Gibbonsia elegans***	p 331

Sarcastic fringehead (*Neoclinus blanchardi*)

Description
The diagnostic feature that separates the fringeheads from the other Clinidae is the large jaw that extends well past the eye. Sarcastic fringeheads have the largest jaw of them all, especially the males. On fresh specimens, the body color varies from brown to gray, often with a reddish tint, and there may be green or pale blotches. However, males can be nearly all black. There may also be a pale patch or spots on the operculum. The posterior end of the male's jaw can be yellow. There are two metallic blue, ringed ocelli (eyespots) on the spinous dorsal fin. The first is between the first and second spine and the second is between the fifth and ninth spine. The dorsal fin is uniform in height with more spines than soft rays. There are small (less than eye diameter), unbranched cirri above the eye. To 30 cm TL.

Similar species
Yellowfin fringeheads (*Neoclinus stephensae*) vary in color to match the habitat, but generally are a dark mottled gray to olive, or sometimes red/orange. Often with purplish bars on the sides, sometimes blue spots ventrally, and many specimens exhibit a yellow caudal fin and purplish head. There are three pairs of branched ocelli above the eye and no ocelli on the dorsal fin. The onespot fringehead (*N. uninotatus*) is usually light to dark brown with black specks and mottling or sometimes with red specks. There is a single large ocellus between the first and second dorsal spine. There are a few cirri above the eye; the anterior one is large (greater than eye diameter) and has a forked tip.

Distribution
Sarcastic fringeheads range from central California to southern Baja California, Mexico, at depths to over 55 m.

Giant kelpfish (*Heterostichus rostratus*)

Description
The body color of the giant kelpfish varies to match the environment. This species may have lighter blotches, silver streaks, and/or irregular bars. The snout is long and pointed. The dorsal fin is higher at both the front and rear. The pectoral fins are very short and end well before the anal fin. The anal fin has 32 or more spines and rays in combination. This is the only kelpfish with a forked caudal fin. To 61 cm TL.

Similar species
The forked caudal fin distinguishes the giant kelpfish from other similar species.

Distribution
Giant kelpfish range from central California to southern Baja California, Mexico, at depths to over 55 m.

Spotted kelpfish (*Gibbonsia elegans*)

Description
Spotted kelpfish have a highly variable body color, usually to match the environment, and may have blotches or streaks. There are 1–3 (usually 2) ocelli, or eyespots, on the back. If there are two eyespots, one will normally be near the front of the body and one will be near the rear. The dorsal fin is higher at the front and rear. The soft rays at the rear of the dorsal fin are more widely spaced. The small scales extend well back on the caudal fin. To 16 cm TL.

Similar species
Striped kelpfish (*Gibbonsia metzi*) generally have no ocelli on the body and the dorsal rays are equally spaced throughout. Crevice kelpfish (*G. montereyensis*) have short pectoral fins that end well short of the anal fin and have no scales on the base of the caudal fin. Scarlet kelpfish (*G. erythra*), considered an invalid junior synonym of *G. montereyensis*, generally have multiple ocelli on the back, and there are scales present on the base of the caudal fin that do not extend onto the caudal fin.

Distribution
Spotted kelpfish range from central California to southern Baja California, Mexico, generally in vegetation on rocky substrates at depths to over 55 m.

Zoarcidae (Eelpouts)

The eelpouts are a large family consisting of about 240 species in 48 genera (Anderson and Federov 2004) primarily in the North Atlantic, North Pacific, and Arctic Oceans, with records from the Southern Hemisphere as well as the Southern Ocean. Most often found on the bottom, over or partially buried in soft substrates, from the shallow waters of the continental shelf to the abyss, with some species found midwater. These elongate fishes generally have long dorsal and anal fins that lack spines and are continuous with the caudal fin. When present, the pelvic fins are generally small and far forward. However, the cuskpout has pelvic fins that consist of three joined rays with a common base located far forward under the eyes. When present, the scales are cycloid, small, and usually embedded.

Key to the Zoarcidae of the FRAM Surveys

1	Rose/red color ..... ***Maynea californica***	p 334
1	Not as above 2	
2(1)	Cirri on underside of lower jaw ..... ***Lyconema barbatum***	p 334
2	Not as above 3	
3(2)	Gill membrane attached to isthmus; pelvic fins and scales present or absent 4	
3	Posterior margin of gill membranes free from isthmus, anterior portion of gill membranes attached; no pelvic fins or scales 18	
4(3)	Chin crests absent 5	
4	Chin crests present 10	
5(4)	Pelvic fins tiny or absent; lateral line double or absent; head pores inconspicuous 6	
5	Pelvic fins tiny; one lateral line; head pores strong 7	
6(5)	Round, porelike gill opening above pectoral fin ..... ***Melanostigma pammelas***	p 335
6	Gill opening extends down to or below second pectoral fin ray 14	
7(5)	Filamentous pelvic fins with common base placed far forward under eye ..... ***Derepodichthys alepidotus***	p 335
7	Pelvic fins with 3 rays (rarely 2) placed under throat 8	
8(7)	No teeth on vomer ..... ***Lycenchelys crotalinus***	p 336
8	Teeth present on vomer 9	

9(8)	Scales on nape not extending onto head ..... ***Lycenchelys jordani***	p 336
9	Scales absent from nape or, if present, extending onto head ..... ***Lycenchelys camchatica***	p 337
10(4)	No teeth on vomer; mediolateral lateral line; no bands on body; dark blotch on anterior end of dorsal fin (can be absent in adults) 11	
10	Teeth present on vomer; lateral line placement highly variable and may be double; body with or without vertical bands; dark blotch absent on anterior rays of dorsal fin or, if present, then lateral line not mediolateral 12	
11(10)	No teeth on vomer or palatines ..... ***Lycodes pacificus***	p 337
11	No teeth on vomer, teeth on palatines ..... ***Lycodes cortezianus***	p 338
12(10)	Posterior margin of pectoral fin slightly to deeply notched ..... ***Lycodes diapterus***	p 338
12	Pectoral fin rounded 13	
13(12)	Chin crests low, not united anteriorly; dorsal and anal fins with dark margins ..... ***Lycodes brevipes***	p 339
13	Chin crests high, projecting anteriorly but not united, labial lobe usually well developed; black blotch on anterior margin of dorsal fin, can disappear with growth ..... ***Lycodes palearis***	p 339
14(6)	0–6 pseudobranchial filaments; pelvic fins usually present 15	
14	7–8 pseudobranchial filaments; no pelvic fins 17	
15(14)	Pelvic fins absent ..... ***Pachycara bulbiceps***	p 340
15	Pelvic fins present 16	
16(15)	Scales either absent from nape or not extending forward to a line connecting gill openings; pectoral fin rays 17–18 ..... ***Pachycara gymninium***	p 340
16	Scales on nape extending onto interorbital region; pectoral fin rays 15–16 ..... ***Pachycara lepinium***	p 341
17(14)	Gill rakers short & blunt; short pectoral fin not extending to anus ..... ***Bothrocara brunneum***	p 341
17	Gill rakers long & pointed; long pectoral fin extending to or beyond anus ..... ***Bothrocara molle***	p 342
18(3)	Gill rakers blunt, stout, may or may not be pointed; when compressed against arch, gill raker tip does not extend beyond base of next gill raker; 1 median interorbital, 4 mandibular, and 4 preopercular pores 19	
18	Gill rakers long, slender, pointed; when compressed against arch, gill raker tip is closest to base of second raker down, extending past base of adjacent raker; 1 median or paired interorbital, 3–4 mandibular, 3–4 preopercular pores 20	
19(18)	Vomer teeth 0–5; palatine teeth 3–13 (usually less than 3 per side); upper rim of eye level with dorsal profile of head ..... ***Lycodapus mandibularis***	p 342
19	Vomer teeth 16–21 (may be reduced to 4 in mature males); palatine teeth 8–28; upper rim of eye below dorsal profile of head . ***Lycodapus endemoscotus***	p 343
20(18)	Interorbital pore usually paired, 4 mandibular pores, 3 preopercular pores ..... ***Lycodapus fierasfer***	p 344
20	Interorbital pore single, 3–4 (usually 3) mandibular pores, 3–4 (usually 4) preopercular pores ..... ***Lycodapus dermatinus***	p 344

Persimmon eelpout (*Maynea californica*)

Description
The persimmon eelpout has a rose- or persimmon-colored body. The large, rounded pectoral fins are bright orange. The dorsal and anal fins have pale edges, and there are no pelvic fins. To 22 cm TL.

Similar species
The dwarf wrymouth (*Cryptacanthodes aleutensis*) has small pectoral fins, tubelike projections from each nostril, a broad, flat head, a nearly vertical mouth, and a distinct caudal fin.

Distribution
Persimmon eelpouts range from Monterey Bay to San Diego, California, at depths of 110–550 m (but most commonly inside 201 m).

Bearded eelpout (*Lyconema barbatum*)

Description
Bearded eelpouts are light with many dark brown or dusky spots on the body and the dorsal and anal fins. The pectoral fin is generally rounded, but can have a somewhat straight edge. The lower pectoral rays are longer, with tips that may be free of the membrane. Pelvic fins are present, but they are small and located anterior to the pectoral fin insertion. The lower jaw has a fringe of cirri (tiny barbels or minute, hairlike projections). To 17 cm TL.

Similar species
The spotted cusk eel (*Chilara taylori*) does not have cirri on the lower jaw, and the pelvic fins are long and filamentous. Other Zoarcidae do not have prominent dark spots on the body and fins, nor cirri on the lower jaw.

Distribution
Bearded eelpouts range from southern Oregon to Baja California, Mexico, at depths of 82–366 m or more.

Midwater eelpout (*Melanostigma pammelas*)

Description
Midwater eelpout are very dark brown/black on the head and ventral surface with somewhat lighter shades of the same color dorsally and laterally, or uniformly black. Others can be nearly translucent. The peritoneum and viscera, including the intestines, are black. Juveniles have a silver/blue tone. The rounded head is very blunt, the eye large and round, and the gill opening a round pore above the pectoral fins. This species has no pelvic fins, scales, or lateral line. The flesh is soft and gelatinous, and the skin is very thin and loose. To 11 cm TL.

Similar species
The small, round gill opening separates the midwater eelpout from the other Zoarcidae.

Distribution
Midwater eelpout range from the Queen Charlotte Islands, British Columbia, Canada, to central Mexico, at depths of 91–1,829 m.

Cuskpout (*Derepodichthys alepidotus*)

Description
Cuskpout vary in color from light to dark brown, becoming darker posteriorly. The dorsal and anal fins are gray, and the pectoral and pelvic fins are white with dark margins. Each pelvic fin consists of three rays joined below the eye. The body is long and thin, with gelatinous flesh and loose, transparent skin. The head is blunt, with prominent sensory pores. The jaws contain long, recurved teeth. To 16 cm TL.

Similar species
The unique pelvic fin structure, base, and location distinguish the cuskpout from other Zoarcidae.

Distribution
Cuskpout range from the Queen Charlotte Islands, British Columbia, Canada, to the Gulf of California, at depths of 914 m to over 2,743 m.

Snakehead eelpout (*Lycenchelys crotalinus*)

Description
Snakehead eelpout are dark olive brown to brown/black, with light-colored scales that make the body appear spotted. This species has pelvic fins and round pectoral fins. The head shape varies with sex and stage of maturity. Turquoise and sometimes white mottling covers the head and pectoral fins. The mouth has a row of large pores surrounding it, large fleshy lips, and no teeth on the palatines or vomer. Scales are present on the cheek and operculum. To 42.2 cm SL.

Similar species
The Kamchatka eelpout (*Lycenchelys camchatica*) has teeth on the vomer. The shortjaw eelpout (*L. jordani*) has no scales on the cheek, operculum, pectoral fin, or nape.

Distribution
Snakehead eelpout range from the Bering Sea to Baja California, Mexico, at depths of 228–2,816 m.

Shortjaw eelpout (*Lycenchelys jordani*)

Description
The dark brown/olive body of the shortjaw eelpout has light-colored scales that make it appear finely spotted. There are no scales on the cheeks, nape, or pectoral fins. The pectoral fins are rounded, and there are small pelvic fins present. The short upper jaw blends with the rounded head contours. There is no lateral line canal. To 33 cm SL.

Similar species
The other species of *Lycenchelys* encountered in the survey area have scales on the nape, cheek, operculum, and the base of the pectoral fins.

Distribution
Shortjaw eelpout range from Alaska to California at depths of 1,500–2,570 m.

Kamchatka eelpout (*Lycenchelys camchatica*)

Description
Kamchatka eelpout are a dark olive brown to brown/black, with light-colored scales that make the body appear spotted. Pelvic fins are present, and the pectoral fins are rounded. The head shape varies with sex and stage of maturity. The head and pectoral fins have a turquoise and white mottling. The mouth has a row of large pores surrounding it, large fleshy lips, and teeth on the palatines and vomer. Scales are present on the cheek and operculum. To 25 cm TL.

Similar species
The shortjaw eelpout (*Lycenchelys jordani*) has a terminal mouth and no scales on the cheeks, nape, or pectoral fins. The snakehead eelpout (*L. crotalinus*) has no teeth on the roof of the mouth.

Distribution
Kamchatka eelpout range from the Bering Sea to Baja California, Mexico, commonly at depths of 549–1,646 m (but rarely as shallow as 183 m).

Blackbelly eelpout (*Lycodes pacificus*)

Description
The blackbelly eelpout has a long, cylindrical body that ranges in color from light gray to pale reddish-brown or tan. The young can have several pale, white bands with faint black edges on the body, as well as a long, black blotch at the leading edge of the dorsal fin. The bars and black spot fade with age and are absent in some. In adults, the dorsal and the posterior part of the anal fins may or may not have black edges. The pectoral fin is small and rounded, with the color ranging from light to dusky. The black peritoneum may show lightly through the body wall, most notably along the midventral line. The head is long and tapered, especially in mature males. The chin crests are very small and not united anteriorly. There are no teeth on the vomer or palatines. To 46 cm TL.

Similar species
The shortfin eelpout (*Lycodes brevipes*) and the wattled eelpout (*L. palearis*) have teeth on both the vomer and palatines. The bigfin eelpout (*L. cortezianus*) has palatine teeth and a larger, more robust body.

Distribution
Blackbelly eelpout range from the Aleutian Islands to Baja California, Mexico, at depths of 9–399 m.

Bigfin eelpout (*Lycodes cortezianus*)

Description
The thick body of the bigfin eelpout ranges from brown to olive/brown to blue/black dorsally with lighter shades of the same color laterally and light ventrally. The white, embedded scales can give this species a spotted appearance. There is a dark blotch on the leading edge of the dorsal fin, but this may fade with both age and growth, and can be absent in some fish. The dorsal fin has a black border that can be discontinuous. It is present along the anterior and posterior margin, but may fade in the middle or show only on the posterior portion. There is a black border on the caudal and posterior margin of the anal fins. The large pectoral fins are generally rounded, but can have a straight edge, and are usually dark with a light (or sometimes a pale yellow) edge. The large head is broad and the chin crests are low and not united. While there are teeth on the palatines, they are absent from the vomer. To 50 cm TL.

Similar species
The wattled eelpout (*Lycodes palearis*) has teeth on the vomer and prominent chin crests along the lower jaw. The blackbelly eelpout (*L. pacificus*) has no teeth on the vomer or palatines, a narrow body, and a long and tapered head.

Distribution
Bigfin eelpout range from the eastern Gulf of Alaska to San Diego, California, at depths of 73–620 m.

Black eelpout (*Lycodes diapterus*)

Description
Black eelpouts range in color from dusky brown to black, somewhat darker dorsally, lighter on the lateral and ventral sides. The body appears spotted due to the prominent white scales. The 3–9 light, vertical bars on the sides can extend onto the dorsal fin and spread or divide on the lower body, and may become faint or disappear on adults. The pelvic and anal fins are blue/black. The pectoral fins are blue/black but can have a turquoise sheen. The dorsal fin is dark, and commonly has a black blotch on the anterior rays. The mouth and gill cavities are dark, and the peritoneum is black. The posterior edge of the pectoral fin can be straight or notched; the depth of the notch generally increases with age and depth. The weak chin crests join anteriorly under the lower jaw. To 33 cm TL.

Similar species
The shortfin eelpout (*Lycodes brevipes*) has rounded pectoral fins.

Distribution
Black eelpout range from Vancouver Island, British Columbia, Canada, to San Diego, California, at depths of 146–844 m.

Shortfin eelpout (*Lycodes brevipes*)

Description
Shortfin eelpout are brown or tan to gray/brown dorsally with lighter shades of the same color laterally and light ventrally. The underside of the head is light cream to tan, with the demarcation line very prominent in some specimens. There are 9–13 white, vertical bars on the body, but only one is in front of the dorsal fin insertion. These bars may not be present in all specimens. The dorsal and anal fins have dark edges. The upper rays of the pectoral fin are long, while the lower rays are usually thicker and may have tips free of the membrane. This gives the fin a round shape, but it can also appear slightly indented. There are no chin crests on the underside of the head. To 30 cm TL.

Similar species
The black eelpout (*Lycodes diapterus*) has a notched or straight edge to the pectoral fin. The wattled eelpout (*L. palearis*) has white bars on the body (the first two in front of the dorsal fin insertion) and highly developed chin crests.

Distribution
Shortfin eelpout range from the Bering Sea to Fort Bragg, California, at depths of 23–973 m.

Wattled eelpout (*Lycodes palearis*)

Description
Wattled eelpout are light brown to blue/black dorsally with lighter shades of the same color laterally and light ventrally. The young have numerous white bars on the body that extend onto the dorsal fin. The first two bars are in front of the dorsal fin, which has a dark blotch on the anterior rays. Both the bars and the blotch fade with age and length, and are completely absent in

some fish. The dorsal and anal fins have a narrow, dark margin. The pale pelvic fins are smaller than the diameter of the eye. The rather long and unnotched pectoral fin has a rounded edge. The tips of the lower fin rays may be free of the membrane. There is a prominent, lobed flap below the lower jaw. The nonjoined, highly developed chin crests extend out anteriorly beyond the lower jaw. There are teeth on the vomer and palatine. To 54 cm TL.

Similar species
The bigfin eelpout (*Lycodes cortezianus*) has no vomer teeth or chin crests on the lower jaw. The shortfin eelpout (*L. brevipes*) has only one white bar in front of the dorsal fin and no chin crests on the ventral side of the head.

Distribution
Wattled eelpout range from the Okhotsk, Chukchi, and Bering Seas to Oregon, at depths of 25–200 m (rarely to 925 m).

Snubnose eelpout (*Pachycara bulbiceps*)

Description
Snubnose eelpout have a uniformly tan/brown body with a slightly darker head. The area in front of the origin of the dorsal fin, or nape, lacks scales. The body has light-colored scales, making it appear finely spotted. The round pectoral fins are dark brown or black in color, and have 16–19 (usually 17–18) rays. There are no pelvic fins. There are two lateral lines. The upper or mediolateral branch begins well behind the posterior margin of the pectoral fin. To 52.5 cm TL.

Similar species
Scalynape eelpout (*Pachycara lepinium*) and nakednape eelpout (*P. gymninium*) have pelvic fins.

Distribution
In the eastern North Pacific Ocean, snubnose eelpout range from the Queen Charlotte Islands, British Columbia, Canada, to Guadalupe Island, Mexico, and the Gulf of Panama, at depths of 2,195 m to over 4,389 m.

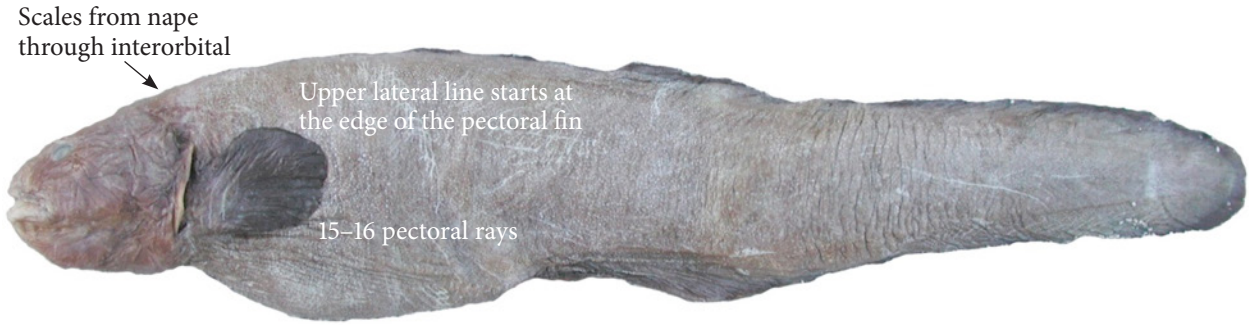
Nakednape eelpout (*Pachycara gymninium*)

Description
Nakednape eelpout have a uniformly tan/brown body with a slightly darker head. The nape lacks scales. The body has light-colored scales which make it appear finely spotted. The dark brown/black pectoral fins are round and have 14-18 (usually 17-18) rays. Though present, the pelvic fins are very small. There are two lateral lines. The upper, or mediolateral, branch begins behind the base of the pectoral fin. To 42.2 cm TL.

Similar species
Scalynape eelpout (*Pachycara lepinium*) have scales on the nape and fewer pectoral fin rays (usually 15–17 vs. 17–18 in nakednape eelpout). Snubnose eelpout (*P. bulbiceps*) do not have pelvic fins.

Distribution
Nakednape eelpout range from the Queen Charlotte Islands, British Columbia, Canada, to Guadalupe Island, Mexico, at depths of 1,646 m to over 3,109 m.

Scalynape eelpout (*Pachycara lepinium*)

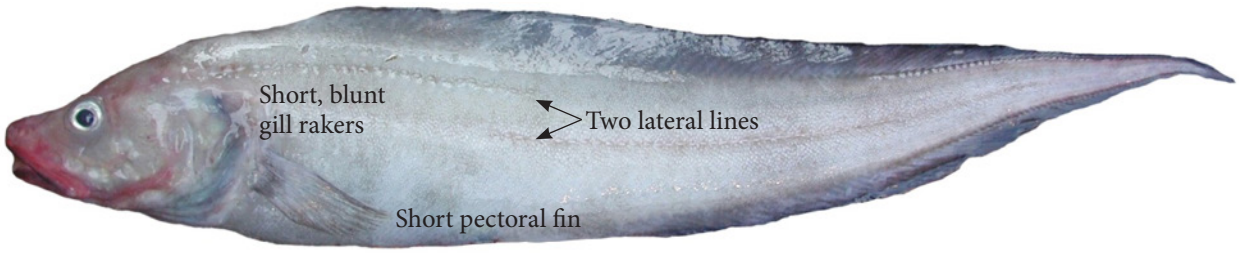


Description
Scalynape eelpout have a uniformly tan/brown body with a slightly darker head. Scales cover the whole nape and extend to the interorbital space. The body has light-colored scales that make it appear finely spotted. The dark brown/black, round pectoral fins have 15–18 (usually 15–16) rays. The pelvic fins are tiny. The dorsal and anal fins have dark edges and join the caudal fin. There are two lateral lines. The upper, or mediolateral, branch begins at or just behind the posterior edge of the pectoral fin. To 59.7 cm TL.

Similar species
Nakednape eelpout (*Pachycara gymninium*) and snubnose eelpout (*P. bulbiceps*) have scaleless napes, more pectoral rays (usually 17–18 vs. 15–16 in scalynape eelpout), and different origins for the upper lateral line.

Distribution
Scalynape eelpout range from the Queen Charlotte Islands, British Columbia, Canada, to Guadalupe Island, Mexico, at depths of 1,646–2,743 m.

Twoline eelpout (*Bothrocara brunneum*)

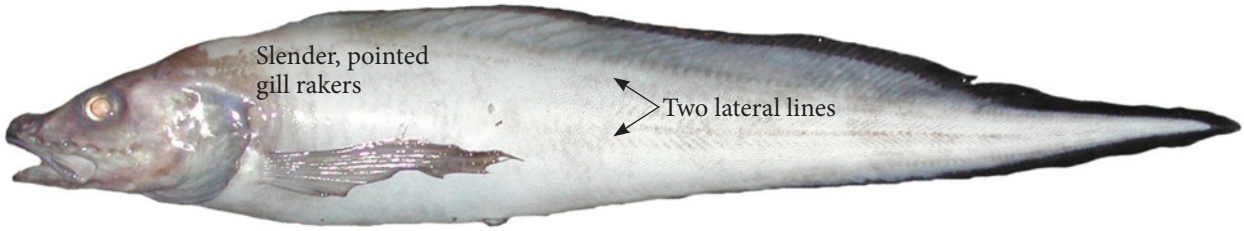


Description
Twoline eelpout are semitranslucent fish with a light gray/white to tan body. The dorsal and anal fin margins are blue or black. The colored margins broaden posteriorly to eventually include all of the fin membrane, especially in large adults. The short pectoral fins do not reach the anus, and there are no pelvic fins. The mouth lining is light, but may get somewhat dusky in large adults. The peritoneum is black. There are two lateral lines; the dorsal branch arches slightly and extends to or just beyond the anus, and the mediolateral branch begins at or just anterior to the anus. To 72 cm TL.

Similar species
The soft eelpout (*Bothrocara molle*) has pectoral fins that extend to or slightly beyond the anus.

Distribution
Twoline eelpout range from the western Bering Sea to southern California, at depths of 199–1,829 m.

Soft eelpout (*Bothrocara molle*)



Pectoral fin extends to or beyond anus

Description
Soft eelpout are semitranslucent fish with a brown or tan body. The dorsal and anal fin margins are black. The colored margins broaden posteriorly to eventually include the entire fin membrane. The mouth and gill chambers are dark, and the peritoneum is black. The tip on the projecting upper jaw is upturned. The eye is smaller than the length of the snout. The long pectoral fin extends to or beyond the anal fin. There are no pelvic fins. There are 19–20 slender, pointed gill rakers on the first arch. There are two lateral lines; the prominent dorsal branch begins above the operculum and extends to or just past the anus, the mediolateral branch is often not visible and begins just ahead of or equal to the anus. To 58.7 cm TL.

Similar species
The twoline eelpout (*Bothrocara brunneum*) has short pectoral fins that do not extend beyond the anus and short, broad gill rakers.

Distribution
Soft eelpout range from Alaska to California, at depths of 400–2,688 m (rarely to 60 m).

Pallid eelpout (*Lycodapus mandibularis*)

Description
Pallid eelpout are translucent gray, white, or silver. There is faint black speckling on the dorsal surface that increases posteriorly. The gill rakers are short and bluntly pointed. The lower jaw extends anteriorly slightly past the upper jaw. When the operculum and jaws are fully closed, the profile of the angle of the lower jaw can be very prominent. The upper orbital rim is high and interrupts the concave dorsal profile of the head. The inside of the mouth, the gill cavities, and the peritoneum are dark. The external surface of the body cavity is silver in life, but the silver color disappears upon preservation, allowing the dark peritoneum to show. The large gill opening extends from above the upper pectoral fin base to below the posterior half of the eye. There is one interorbital pore, and four mandibular and four preopercular pores. There are 0–5 (rarely absent) vomerine teeth and 2–12 palatine teeth on each side. To 20 cm TL.

Similar species
The blackmouth eelpout (*Lycodapus fierasfer*) has long, slender gill rakers and two interorbital, three mandibular, and three preopercular pores. The deepwater slipskin (*L. endemoscotus*) has short, bluntly rounded gill rakers with about 12 small teeth on the tips and more teeth on the vomer. The orbital rim does not interrupt the concave dorsal profile of the head. Other species of *Lycodapus* differ in the shape and ratio of the gill rakers, dentition (teeth), and head pore counts.

Distribution
Pallid eelpout range from Prince William Sound and the Gulf of Alaska to the La Jolla Canyon, central California. A pelagic species, they are captured at depths of 700 m (rarely to 800 m).

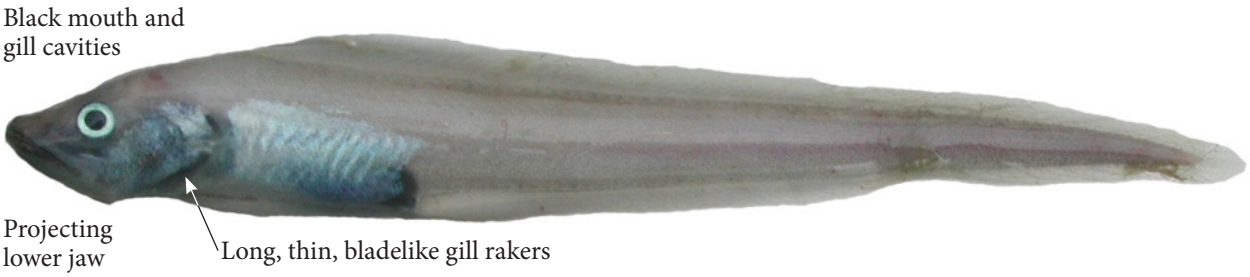
Deepwater slipskin (*Lycodapus endemoscotus*)

Description
Deepwater slipskin are a translucent, creamy white to silver/white. The exterior surface of the body cavity and operculum appear silvery, which fades upon preservation to show a black peritoneum. Small, black speckles on the back, head, and ventral surfaces increase posteriorly on the body. The gill opening is large, extending from well above the pectoral fin to far forward under the jaw, to a point below the middle of the eye. The gill rakers are short, blunt, and tipped with about 12 small teeth. There are is one interorbital pore, and four mandibular and four preopercular pores. The medium-sized eye does not enter the dorsal head profile. There are 4–21 vomerine teeth (becoming fewer and larger in mature males) and 5–28 palatine teeth on each side. To 13 cm TL.

Similar species
The looseskin eelpout (*Lycodapus dermatinus*) has long, pointed gill rakers, fewer preopercular and mandibular pores, and a smaller eye. The pallid eelpout (*L. mandibularis*) has short, bluntly pointed gill rakers. Other species of *Lycodapus* differ in the shape and ratio of the gill rakers, dentition (teeth), and head pore counts.

Distribution
Deepwater slipskin range from the Bering Sea to northern Mexico, the Gulf of California, and Peru, at depths of 439–2,225 m.

Blackmouth eelpout (*Lycodapus fierasfer*)



Description
Blackmouth eelpout have a pearly body that is lightly speckled with small black dots. The mouth, gill cavities, and peritoneum are black. The oblique mouth has a projecting lower jaw. There are numerous small teeth on the upper and lower jaws. There are 1–13 vomerine teeth and 0–16 palatine teeth on each side. The gill rakers are long, slender, and bladelike. There are two (rarely one or obscure) interorbital, three mandibular, and three preopercular pores. To 15 cm TL.

Similar species
The pallid eelpout (*Lycodapus mandibularis*) has short, somewhat stout, triangular gill rakers, a single median interorbital pore, and four mandibular and four preopercular pores. Other *Lycodapus* species differ in the shape and ratio of the gill rakers, dentition (teeth), and head pore counts.

Distribution
Blackmouth eelpout range from Unimak Island, Alaska, to the Gulf of Panama, at depths of 102–2,189 m.

Looseskin eelpout (*Lycodapus dermatinus*)

Description
Looseskin eelpouts have long, bluntly pointed gill rakers. The large gill opening extends from above the pectoral fin to below the rear of the eye. The dorsal profile of the robust head is nearly straight to slightly concave. The small eye does not enter the profile of the head or fill the orbit. When fully closed, the prominent jaw angle hides most of the branchiostegal rays and membranes. There is one interorbital pore and 3–4 mandibular and 3–4 preopercular pores. The vomerine (3–19) and palatine (2–26 on each side) teeth are usually numerous and small. To 9 cm TL.

Similar species
The blackmouth eelpout (*Lycodapus fierasfer*) has pointed, bladelike gill rakers and three mandibular and three preopercular pores. The pallid eelpout (*L. mandibularis*) has a larger eye that interrupts the profile of the head, and short, blunt, rounded gill rakers. Other *Lycodapus* species differ in the shape and ratio of the gill rakers, dentition (teeth), and head pore counts.

Distribution
Looseskin eelpout range from the Gulf of Alaska to northern Mexico, the Gulf of California, and Peru, at depths of 450–1,370 m.

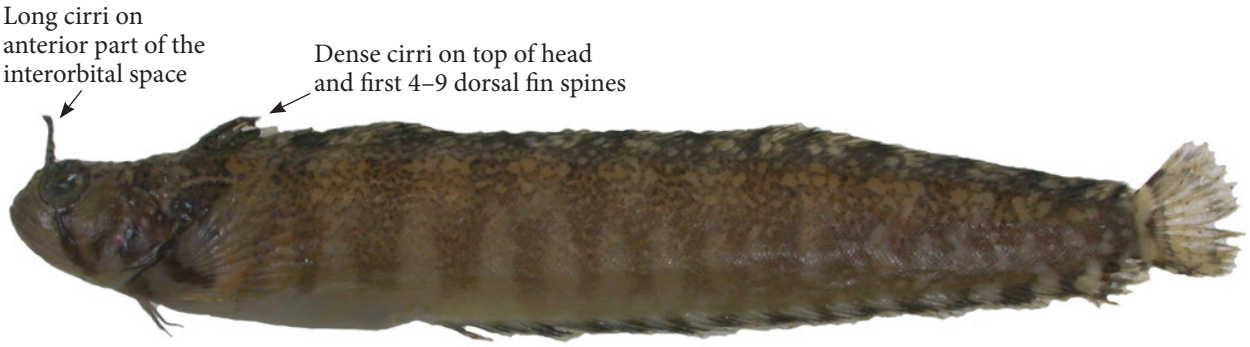
Stichaeidae (Pricklebacks)

The pricklebacks are a family of relatively small, highly elongate fishes that occur primarily in the North Pacific, with a few species found in the Arctic and North Atlantic Oceans. They get their name from the long, spinous dorsal fin that extends down most of the back. Some species have a few soft rays on the posterior end of the dorsal fin. The length of the anal fin is as long as or slightly longer than the distance from the very tip of the snout to the origin of the anal fin, and usually has one or two spines on the anterior end. A few species also have spines on the posterior end. The dorsal and anal fins may extend and join the caudal fin. When present, the pelvic fins are small and thoracic. Scales cover the body, but are absent on the head. Several species have fleshy cirri on their heads and/or the anterior dorsal fin spines.

Key to the Stichaeidae of the FRAM Surveys

1	Dense cirri on top of head 2	
1	Not as above 3	
2(1)	Pair of long cirri on anterior part of interorbital space; first 4–9 dorsal spines with multifid cirri; dorsal fin without ocelli ..... ***Chirolophis decoratus***	p 346
2	Cirri on top of head about equal in height; dorsal spines without cirri; dorsal fin with 12–13 dark ocelli ..... ***Chirolophis nugator***	p 346
3(1)	Dorsal fin plain or with a few dark smudges posteriorly; caudal and pectoral fins with dark markings ..... ***Poroclinus rothrocki***	p 347
3	Dorsal fin with oblique dark bars, often with dark blotches posteriorly; caudal & pectoral fins with dark bars, pale margins ..... ***Plectobranchus evides***	p 347

Decorated warbonnet (*Chirolophis decoratus*)



Description
The overall color pattern of decorated warbonnets is generally multiple shades of brown with some orange and white to cream markings. The color is darker dorsally becoming lighter laterally and pale ventrally. There are numerous pale spots dorsally and irregular vertical light bars laterally. There are dark bars that run down from the eyes and dark bars on the dorsal, caudal, and anal fins. There is one pair of long, multifid cirri, joined at the base on the anterior part of the interorbital space, that is twice as long as the eye diameter. There are many simple cirri on the top of the head, but few on the sides of the head and cheeks. There are also cirri on the first 4–9 dorsal fin spines. The dorsal fin consists of 61–62 spines, and the anal fin consists of one spine and 44–51 soft rays. To 15 cm TL.

Similar species
The mosshead warbonnet (*Chirolophis nugator*) lacks the long cirri on the anterior part of the head, the numerous cirri on the head are about the same size, and it has a series of 12–13 dark ocelli on the dorsal fin and fewer dorsal spines (55–57 vs. 61-62 in decorator warbonnet).

Distribution
Decorated warbonnets range from the eastern Bering Sea and the Aleutian Islands to Humboldt Bay, California, at depths to 91 m.

Mosshead warbonnet (*Chirolophis nugator*)

Description
Male mosshead warbonnets are generally multiple shades of brown, sometimes with a reddish tinge. There are numerous pale spots with dark borders laterally that become smaller and more numerous dorsally. The lower part of the head is light with several dark streaks. The anterior portion of the anal fin and the pelvic fins are white. The pectoral, dorsal, and caudal fins have bands of brown spots forming faint bars. Females are nearly plain brown. The dorsal fins of both sexes have a series of 12–13 dark spots with clear borders forming prominent ocelli. The dorsal fin consists of 53–55 spines. The anal fin consists of one spine and 37–42 soft rays. To 15 cm TL.

Similar species
The decorated warbonnet (*Chirolophis decoratus*) has long cirri on the anterior part of the head (absent in mosshead warbonnet), more dorsal spines (61–62 vs. 53–55 in mosshead warbonnet), and no dorsal ocelli.

Distribution
Mosshead warbonnets range from the Aleutian Islands to San Miguel Island, southern California, at depths to 20 m (rarely to 80 m).

Whitebarred prickleback (*Poroclinus rothrocki*)

Description
The long, somewhat laterally compressed, eel-like body of the whitebarred prickleback is light brown to tan dorsally, with lighter shades of the same color laterally and light ventrally. There are 10–12 narrow white bands bordered on each side by a dark line on the sides. The dorsal, pectoral, and caudal fins may be unmarked or have dusky smudges on the rear portions. The dorsal fin consists of 57–67 spines the anal fin has three spines and 40–44 soft rays. The caudal fin ranges from round to nearly pointed. The pectoral fins are somewhat rounded with long center rays. The lateral line is more visible near the head. To 25 cm TL.

Similar species
The bluebarred prickleback (*Plectobranchus evides*) has dark bars on the dorsal fin, two anal spines (three in whitebarred prickleback), and fewer (34–35) anal fin rays (40–44 in whitebarred prickleback).

Distribution
Whitebarred prickleback range from the southeastern Bering Sea and the Aleutian Islands to San Diego, California, at depths of 46–128 m.

Bluebarred prickleback (*Plectobranchus evides*)

Description
The long, somewhat laterally compressed, eel-like body of the bluebarred prickleback is dusky olive brown dorsally, with lighter shades of the same color laterally and light ventrally. There are about 25 narrow, vertical, light bars with thin dark borders, and about three vague dark blotches laterally. The dorsal fin has a series of oblique dark bars, some becoming dark blotches, on the posterior portion. The caudal, anal, and pectoral fins have dark bars parallel to the pale margins. The caudal fin may have a dark spot on the inner dorsal margin. The pelvic fins are plain. The dorsal fin consists of 55–57 spines. The anal fin consists of two spines and 34–35 soft rays. To 13 cm TL.

Similar species
The whitebarred prickleback (*Poroclinus rothrocki*) has more (40–44) spines (34–35 in bluebarred prickleback) in a plain dorsal fin (with dark bars in bluebarred prickleback).

Distribution
Bluebarred prickleback range from British Columbia, Canada, to San Diego, California, at depths of 84–368 m.

Cryptacanthodidae (Wrymouths)

The wrymouths are a small family consisting of four species in a single genus. They occur throughout the cold and temperate waters of the northwestern Atlantic and the North Pacific Oceans. These elongate fishes are round anteriorly and become compressed posteriorly. The eyes are set high on the broad, depressed heads. The oblique to nearly vertical mouth has a somewhat projecting lower jaw. The long dorsal fin is composed of stiff spines. The dorsal fin, along with the long anal fin, joins the caudal fin. The pelvic fins are absent. Two species occur within the survey area. Of the two species, only the giant wrymouth has scales, which are small, scattered, and cycloid.

Key to the Cryptacanthodidae of the FRAM Surveys

1	No scales; no palatine teeth; red- or pink-colored; small body size ..... ***Cryptacanthodes aleutensis***	p 348
1	Scales on rear portion of body; palatine teeth present; tan or light brown; large body size ..... ***Cryptacanthodes giganteus***	p 349

Dwarf wrymouth (*Cryptacanthodes aleutensis*)

Description
The dwarf wrymouth is a small, scaleless fish. The pink or red color comes from the blood showing through the loose, transparent skin. The dorsal and anal fins extend to or onto the caudal fin, and there are no pelvic fins. The mouth is nearly vertical, with the jaws reaching to the front of the eye, and there is a nostril tube projecting over the maxilla. The lateral line is indistinct. There are bristlelike teeth in both jaws and on the vomer, but not on the palatines. To 31 cm TL.

Similar species
The pink to red color and nearly vertical mouth distinguish the dwarf wrymouth from similar species.

Distribution
Dwarf wrymouth range from the southeastern Bering Sea and Unalaska Island to Eureka, California, at depths of 28–350 m.

Giant wrymouth (*Cryptacanthodes giganteus*)

Description
The long, muscular, eel-like body of the giant wrymouth can be shades of tan or light brown with a yellow or violet tinge. There is a dark brown stripe along the upper portion of the back near the dorsal fin and along the lateral line. There is sometimes a faint stripe at the base of the caudal fin. There are dark spots on the head and along the sides. The lower portion of the head may be white. The fish may also be a uniform tan with a dark stripe along the lateral line. The oblique mouth is large, and the strong jaws extend beyond the back of the eye. The long dorsal fin is composed of stiff spines. The dorsal and anal fins join the caudal fin. There are no pelvic fins. The head is broad and flat on top, with high-set eyes. The scales are rough and exposed only on the rear of the body and along the front portion of the lateral line. The teeth are bristlelike and present in both jaws, as well as on the vomer and palatines. To 123 cm TL.

Similar species
The flattened head without a head crest or cirri and its large size distinguish the giant wrymouth from similar species.

Distribution
Giant wrymouth range from the southeastern Bering Sea to Humboldt Bay in northern California, at depths from 6–128 m.

Anarhichadidae (Wolffishes)

The wolffishes are a small family containing five species in two genera that range throughout the North Atlantic and North Pacific Oceans. Of the five species, only the wolf eel frequents the caves and crevices within the geographic and depth boundaries of the survey.

Wolf eel (*Anarrhichthys ocellatus*)

Description
The jaws of the wolf eel have heavy, spikelike canine teeth at the front and molars in the rear. The color of the fish varies from green/gray to gray or blue/gray. Dark eyespots (ocelli) and various reticulations cover the long, eel-like body and dorsal fins. Adult males typically have lighter-colored heads. Juveniles are generally an orange/brown color with more spots and reticulations, which are larger and more sharply defined. There are no pelvic fins or lateral line. The long dorsal fin is composed of 218–250 flexible spines. The long anal fin has 0–1 spines ahead of 180–233 soft rays. The dorsal and anal fins join with the caudal fin and taper to a point. To 240 cm TL.

Similar species
Anguilliformes have soft rays in the dorsal fin and smaller gill openings. They are easily distinguished from the Anarhichadidae, which are not as elongate and have separate caudal fins.

Distribution
Wolf eels range from the southeastern Bering Sea along the Aleutian Islands and the Gulf of Alaska to southern California, at depths of 0–225 m.

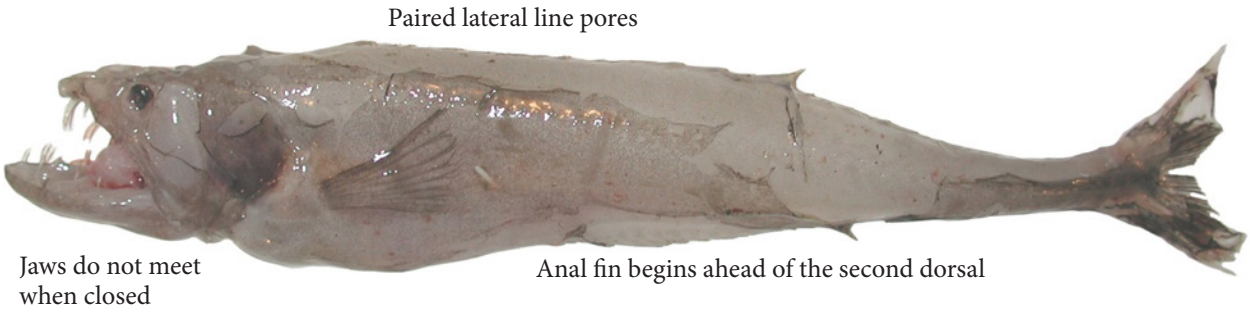
Chiasmodontidae (Swallowers)

The swallowers are a group of fishes consisting of about 15 meso- to bathypelagic species in four genera. The swallowers get their name from the adaptations they have that enable them to swallow large prey. These somewhat elongate, scaleless fish have large mouths with numerous long, sharp teeth (some of which are movable), and highly distensible jaws and stomachs. There are two dorsal fins. The short first dorsal has seven or eight flexible spines. The second dorsal, which is long and soft, has 18–29 segmented rays. The long anal fin has one flexible spine and 17–29 segmented rays. Photophores may or may not be present.

Key to the Chiasmodontidae of the FRAM Surveys

1	6 branchiostegal rays; teeth in mesial series of dentary & premaxilla recurved; tooth attachment to dentary & premaxilla allows rotation up to 270° on own axis	2
1	7 branchiostegal rays; teeth in mesial series of dentary & premaxilla straight to slightly curved; tooth attachment to dentary & premaxilla solid or with ventral attachment that allows deflection, but not rotation	3
2(1)	Tooth 1 in lateral series of premaxilla slightly curved, not projecting anteriorly, 15.2–16.4% of premaxillary length; tooth 1 in mesial series of premaxilla anterior to level of anterior nostril and tooth 2 in lateral series; tooth 1 in mesial series beside tooth 2 of lateral; eye enlarged, orbit width 15.4–22.7% & height 12.5–18.0% of HL; basihyal not reduced and curved, tip of basihyal pointing forward	***Kali indica*** p 351
2	Tooth 1 in lateral series of premaxilla moderately arched, sickle-shaped, projecting anteriorly, 17.2–20.5% of premaxillary length; tooth 1 in mesial series of premaxilla below level of anterior nostril; tooth 1 in mesial series between teeth 2 and 3 in lateral series; orbit width 11.2–16.0% & height 9.7–12.4% of HL; basihyal much reduced and strongly curved, tip of basihyal pointing ventrally	***Kali falx*** p 352
3(1)	15–16 pectoral fin rays; 2 fangs on premaxillary head; adults with tiny dermal spinules; 9 supraorbital pores; lower jaw projects beyond upper jaw	***Chiasmodon asper*** p 353
3	12–14 pectoral fin rays; 1 fang on premaxillary head; dermal spinules absent in adults; 7 supraorbital pores; lower jaw equal to or does not project beyond upper jaw	***Chiasmodon subniger*** p 353

Shortnose swallower (*Kali indica*)



Description

Shortnose swallowers have very friable black skin, which is commonly lost during capture or limited to a few scattered small patches. The transparent dermis is thin with widely scattered melanophores and can also be heavily damaged or lost during capture. There are moderate concentrations of melanophores on the peritoneum. The inside of the mouth and gill chamber are pale. The sides of the mouth, the opercle, and the branchiostegal membranes are pale, with a few widely scattered melanophores. The four pale gill arches have poorly developed, pale filaments. Gill rakers are absent. There are six branchiostegal rays. There are two dorsal fins: the first contains 9–14 spines, the last often embedded in the skin, while the second has 21–25 soft rays. The anal fin has 22–26 rays and originates opposite the second dorsal. The pectoral fin has 12–13 rays, and the pelvic fins have one spine and five soft rays. The fin spines and rays are fragile and often broken. The body is moderately elongate and somewhat compressed. The greatest body depth is at or near the spinous dorsal fin origin. The anterior profile of the broad head is elongate, concave in the lateral view, with a pointed or slightly concave snout. The eyes are moderately large, orbit width 15.4–22.7% of head length. Moderately arched, the lower jaw projects beyond the upper. The large jaws have two series of long teeth. The premaxilla lateral series consists of 7–11 long, highly curved teeth. The premaxilla mesial series has three shorter, less-curved teeth. The dentary lateral series has 6–8 teeth. The dentary mesial series has 3–4 teeth. There is a single series of 3–7 palatine teeth. The well developed pharyngeal teeth extend far forward in the mouth. The 1–2 rows of slender, conical dorsal pharyngeal teeth extend to or beyond the posterior end of the palatine tooth row. The single row of needlelike ventral pharyngeal teeth extends to or beyond the angle of the upper and lower jaws. The larger teeth in both jaws are depressible. The basihyal bone or tongue is long, straight, and points forward. The lateral line is well marked, extending from the head to the fork in the caudal fin, with sensory palps distributed over the entire canal. The lateral line consists of paired pores (~40 pairs) alternating with five or more palps between each pair. To 26.2 cm SL.

Similar species

Kali falx has an enlarged, sickle-shaped, anterior-pointing first tooth in the premaxilla lateral series (first tooth in premaxilla lateral series somewhat enlarged, slightly curved, and not pointing anteriorly in shortnose swallower), a smaller eye with an orbit width 11.2–16.0% of head length (larger eye, orbit width 15.4–22.7% of head length in shortnose swallower), and the reduced, strongly curved basihyal points ventrally (basihyal long, straight and points forward in shortnose swallower).

Distribution
Shortnose swallowers range from the Bay of Bengal in the northeastern Indian Ocean to the Pacific Ocean off Japan, and through the central Pacific Ocean to Baja California, Mexico, at depths of 935–3,300 m (most frequently 1,400–2,500 m).

Kali falx

Description
Kali falx has very friable black skin which is commonly lost during capture or limited to a few scattered small patches. The whitish or clear gray dermis is thick and gelatinous. There are moderate concentrations of melanophores on the transparent peritoneum. The inside of the mouth and gill chamber are pale. The sides of the mouth, opercle, branchiostegal membranes, basihyal, basibranchial, gill arches, and gill filaments are pale, with a few widely scattered melanophores. The four pale gill arches have poorly developed, pale filaments. Gill rakers are absent. There are six branchiostegal rays. There are two dorsal fins; the first contains 10–13 spines, the last often embedded in the skin, while the second has 22–24 soft rays. The anal fin has 23–26 rays and originates opposite the second dorsal. The pectoral fin has 11–13 rays, and the pelvic fins have one spine and five soft rays. The fin spines and rays are fragile and often broken. The body is moderately elongate and somewhat compressed. The greatest body depth is at or near the spinous dorsal fin origin. The anterior profile of the broad head is elongate, concave in the lateral view, with a pointed or slightly concave snout. The eye is somewhat small, orbit width 11.2–16% of head length. Moderately arched, the lower jaw projects beyond the upper. The large jaws have two series of long teeth. The premaxilla lateral series consists of 6–9 long, highly curved teeth. The premaxilla mesial series has three shorter, less-curved teeth. The dentary lateral series has 5–7 teeth. The dentary mesial series has 2–3 teeth. There is a single series of 4–7 palatine teeth. The well developed pharyngeal teeth extend far forward in the mouth. The small patches of needlelike upper pharyngeal teeth extend to or beyond the posterior end of the palatine tooth row. The single row of needlelike ventral pharyngeal teeth extend to or beyond the angle of the upper and lower jaws. The larger teeth in both jaws are depressible. The basihyal bone or tongue is reduced, strongly curved, and points ventrally. To 16.3 cm SL.

Similar species
The shortnose swallower (*Kali indica*) has the first tooth in premaxilla lateral series somewhat enlarged, slightly curved, and not pointing anteriorly (greatly enlarged, sickle-shaped, and pointing anteriorly in *K. falx*), a large eye, the orbit width 15.4–22.7% of head length (smaller eye, orbit width 11.2–16.0% of head length in *K. falx*), and the long, straight basihyal points forward (a reduced, strongly curved and ventral-pointing basihyal in *K. falx*).

Distribution
Kali falx occur in the equatorial and tropical regions of the Northern Hemisphere. In the eastern Pacific, scattered records exist from between lat 10–29°N, at depths of 1,300–2,870 m.

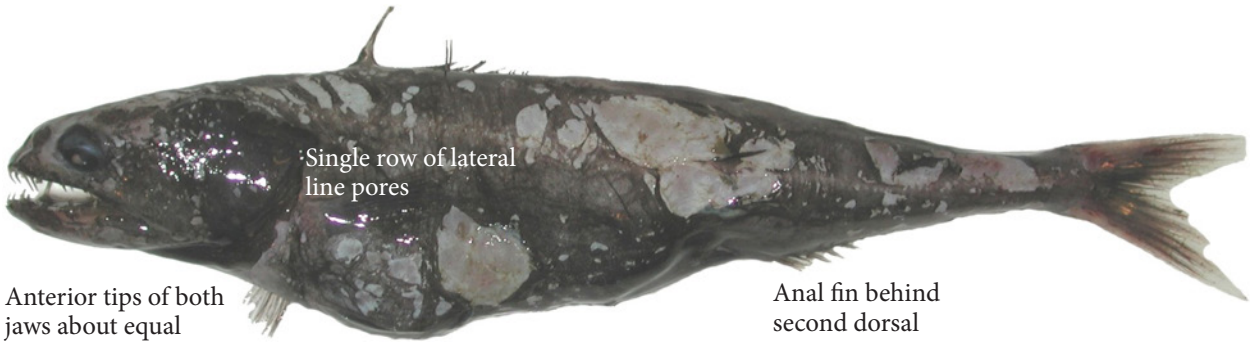
Chiasmodon asper

Description
Juvenile *Chiasmodon* spp. all have tiny dermal spinules along the body and head. They are pale with dark spots both dorsally and ventrally. The spots disappear at approximately 3.52 cm SL and the color becomes dusky, but not as dark as on the adults. By 5.0 cm SL, *Chiasmodon* spp. have the adult color pattern. The head and body are dark brown/black dorsally, a somewhat lighter shade of the same color ventrally. The body is elongate and laterally compressed. The greatest body depth is at the origin of the first dorsal fin. The body is scaleless except for the embedded scales along the lateral line. The lateral line is complete, with pores between each scale. Adult *C. asper* retain the dermal spinules. There are two dorsal fins; the first consists of 10–12 spines, the second of 3–5 spines and 23–25 soft rays. The anal fin consists of 3–5 spines and 22–26 soft rays and originates posterior to the origin of the second dorsal fin. The well developed pectoral fin has 15 rays. The pelvic fins have one spine and five rays and originate just posterior to the pectoral fin base. The lower lobe of the forked caudal fin has two pores. The long upper jaw extends well beyond the posterior edge of the orbit, and extends beyond the anterior tip of the lower jaw. There are two canine teeth at the anterior tip of the premaxilla, a single accessory anterior tooth, and two fangs at the ventral part. Total infraorbital pores 13–14. To 17.86 cm SL.

Similar species
Chiasmodon asper can be distinguished from all closely related species by having 9 (not 6–8) supraorbital pores, dermal spinules on the adults (absent or, if present, species not confirmed from the North Pacific Ocean), and 15–16 (not 12–14) pectoral fin rays.

Distribution
In the Pacific Ocean, *C. asper* occur from lat 19°30'N to 31°S and long 135°W to 178°E. Juveniles occur at depths from 180–450 m, while adults occur at greater depths, 5,154–5,691 m.

Chiasmodon subniger



Description
Juvenile *Chiasmodon* spp. all have tiny dermal spinules along the body and head and are pale with dark spots both dorsally and ventrally. The spots disappear at approximately 3.52 cm SL and the color becomes dusky, but not as dark as on the adults. By 5.0 cm SL, all *Chiasmodon* spp. have their adult color pattern. The head and body are dark brown/black dorsally and a somewhat lighter shade of the same color ventrally. The body is elongate and laterally compressed. The greatest body depth is at the origin of the first dorsal fin. The body is scaleless except for the embedded scales along the lateral line. The lateral line is complete, with pores between each scale. Dermal spinules are absent in adult *C. subniger*. There are two dorsal fins; the first consists of 10–12 spines, the second of 2–4 spines and 21–23 soft rays. The anal fin consists of 4–5 spines and 20–23 soft rays and originates posterior to the origin of the second dorsal fin. The well developed pectoral fin has 12–13 rays. The pelvic fins have one spine and five rays and originate just posterior to the pectoral fin base. The lower lobe of the forked caudal fin has two pores. The upper jaw is long, extending well beyond the posterior edge of the orbit, but does not extend beyond the anterior tip of the lower jaw. There is a single canine tooth at the anterior tip of the premaxilla. Total infraorbital pores 11–13. To 23.48 cm SL, possibly more.

Similar species
The 11–13 infraorbital pores and the upper jaw not extending beyond the lower distinguish *C. subniger* from all closely related species.

Distribution
Chiasmodon subniger are found in the eastern Pacific from Hawaii to the west coasts of North, Central, and South America, from lat 48°N to 29°S, at depths of 245–4,568 m.

Trichodontidae (Sandfishes)

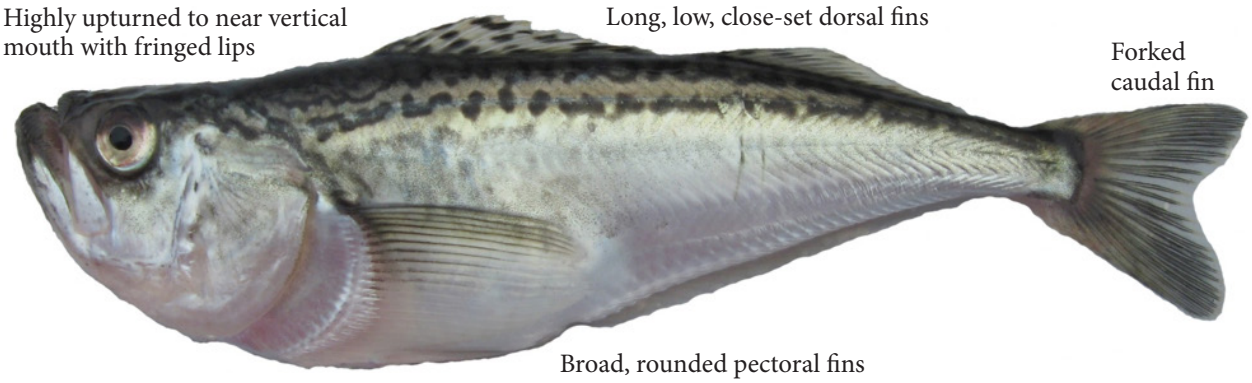
The sandfishes are a small family consisting of two species in one genus. They occur throughout the coastal waters of the North Pacific. The highly compressed, scaleless body is deeper in the front. The large mouth is highly upturned to near vertical and has fringed lips. There are two separate dorsals: a spinous first dorsal and a soft-rayed second. The gill membranes join anteriorly, but are free of the isthmus and supported by 5–6 branchiostegal rays.

Key to the Trichodontidae of the FRAM Surveys

1 Dorsal fins low and fairly close together; pectoral fins broadly rounded with upper-middle rays longest; caudal fin forked ..... ***Trichodon trichodon*** p 355

1 Dorsal fins high, triangular, far apart; pectoral fins truncate, uppermost rays longest; caudal fin truncate or slightly emarginate..... ***Arctoscopus japonicus*** p 355

Pacific sandfish (*Trichodon trichodon*)



Description
Pacific sandfish are brown or greenish dorsally and silvery ventrally. The top of the head has a dark or dusky coloration that extends down to the base of the long, low, close-set dorsal fins as wide, irregular bars. The dark patches also extend down the lateral line as a broken or continuous streak. Dark streaks or patches also appear on the spinous dorsal fin and may extend onto the soft dorsal. There may be a dark or dusky patch on the pectoral and caudal fins. The pelvic and anal fins are not usually marked. The dorsal fins are low, long-based, and close together. The caudal fin is strongly indented or forked. When expanded, the pectoral fins are broadly rounded. The upper middle rays are the longest, extending to the middle of the first dorsal fin. The mouth is strongly oblique to nearly vertical, with fringed lips. The maxilla extends to mideye. To 30.5 cm TL.

Similar species
The sailfin sandfish (*Arctoscopus japonicus*) is native to the Seas of Okhotsk and Japan to Korea, but ranges as far east as the Aleutian Islands. The body shape is similar, and it has the large, upturned mouth with fringed lips, but the two dorsal fins are triangular and widely spaced. The pectoral fins are truncate, and the caudal fin is truncate to slightly emarginate.

Distribution
Pacific sandfish range from the Bering Sea and the Aleutian Islands to central California, at depths of 0–375 m.

Sailfin sandfish (*Arctoscopus japonicus*)

Description
Sailfin sandfish are brown dorsally and silvery ventrally with dark brown mottling on the top of the head and on the dorsum to slightly below the lateral line. There are dark, dusky streaks on both dorsal fins. The posterior half of the caudal fin is dark and dusky. The posterodorsal area of the pectoral fin is dusky. The pelvic and anal fins are not marked. The first dorsal fin is triangular. Both dorsal fins are high, short-based, and set far apart. The caudal fin is truncate or slightly emarginate. The pectoral fin is truncate when spread. The uppermost rays are longest, extending to or beyond the first dorsal fin insertion. The mouth is strongly oblique to nearly vertical, with fringed lips. The maxilla extends to anywhere from mideye to the rear margin of the pupil. To 17 cm TL.

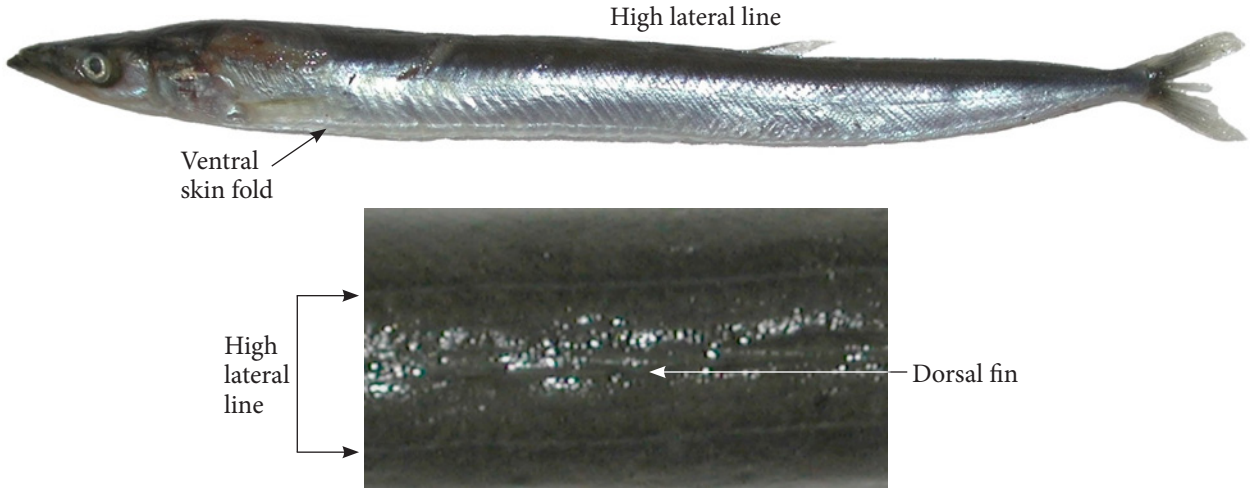
Similar species
Pacific sandfish (*Trichodon trichodon*) have low, long-based, close-set dorsal fins (first dorsal fin triangular, both high, short-based, and spaced far apart in sailfin sandfish), rounded pectoral fins (truncate in sailfin sandfish), and a strongly indented or forked caudal fin (truncate to slightly emarginate in sailfin sandfish).

Distribution
Sailfin sandfish range from Korea, the Sea of Japan, and the Sea of Okhotsk to the Aleutian Islands, from intertidal to depths of 200–400 m.

Ammodytidae (Sand Lances)

The sand lances consist of 18 species in 5–6 genera that occur through the Arctic, Atlantic, Indian, and Pacific Oceans. These elongate fishes have diagonal skin folds visible on the sides. There is a long ventral skin fold extending the length of the body on each side of the ventral midline. The single dorsal fin folds back into a groove. The dorsal and anal fins are composed of only soft rays. Most species lack pelvic fins. The lateral line runs high on the body on each side of the dorsal midline.

Pacific sand lance (*Ammodytes hexapterus*)



Description
When freshly captured, the Pacific sand lance ranges in color from metallic blue or green to gray/green or tan on the back with silver sides and a silver/white belly. The long body is slightly compressed. The head is very long and pointed, with long jaws and a strong, forward-pointing symphyseal knob. The long dorsal fin folds into a narrow slot. The lateral lines are very high on the body, near the base of the dorsal fin. The sides are marked with numerous close-set diagonal skin folds, as well as a long fold of skin along each side of the midventral line. To 28 cm TL.

Similar species
Osmeridae (smelts) are similar in body shape but have shorter dorsal fins, lateral lines low on the body, and an adipose fin.

Distribution
Pacific sand lances range from arctic western Canada through the Pacific Ocean to Balboa Island in southern California, at depths from the intertidal zone to 100 m.

Trichiuridae (Cutlassfishes and Scabbardfishes)

The cutlassfishes consist of about 32 species in nine genera. They occur primarily in the deep waters of the Atlantic, Indian, and Pacific Oceans. Cutlassfishes are very elongate, highly compressed, ribbonlike fishes. Most species have a pointed snout, large mouth with numerous large teeth and a projecting lower jaw. The long dorsal fin may or may not have a notch between the highly flexible spinous and soft-rayed portions. The spines and the soft rays are nearly equal in height. When present, the pelvic fins consist of one scalelike spine and a single rudimentary ray. The prominent lateral line is visible on the scaleless body, and the rear of the body tapers sharply to a point or a small caudal fin.

Key to the Trichiuridae of the FRAM Surveys

1	Caudal fin present	2
1	Caudal fin absent ***Trichiurus lepturus***	p 357
2(1)	Dorsal crest present	3
2	Dorsal crest absent	4
3(2)	Bony crest from tip of snout to front of dorsal fin; area between eyes flat to convex; body depth 25–28 into SL ***Assurger anzac***	p 358
3	Bony crest low and just in front of dorsal fin; area between eyes concave; body depth ~15 into SL ***Lepidopus fitchi***	p 359
4(2)	Single lateral line at or above midbody; anus well behind midpoint of body, generally very close to dorsal fin notch; body color ranges from silver to black with no lines; inside of mouth & gill cavities dark	5
4	Single lateral line drops well below midbody posteriorly; anus midway between tip of snout and tip of caudal fin; silver body has narrow, dark dotted lines on sides; gill membranes black ***Diplospinus multistriatus***	p 359
5(4)	Copper/black to black body; pelvic fins, when present, originate forward of pectoral fin insertion; strong, daggerlike second anal spine ***Aphanopus intermedius***	p 360
5	Silvery body; blackish jaws and opercles; pelvic fins originate behind pectoral fin insertion; delicate second anal spine well separated from anal fin ***Benthodesmus pacificus***	p 360

Pacific cutlassfish, largehead hairtail (*Trichiurus lepturus*)

Description
The Pacific cutlassfish has a long, slender, laterally compressed body that tapers to a hairlike point. This species has no caudal fin. In life, the fish is silvery blue with semitransparent pectoral fins, while the other fins frequently have a yellow tint. After death, the color changes to a dusky brown dorsally becoming dirty silver laterally. The long dorsal fin has three spines and 130–135 soft rays and does not have a notch between the spinous and rayed portions. The anal fin is a row of 100–105 reduced and buried (or nearly buried) spinules. The pectoral fin has a smooth leading edge, one spine, and 11–13 rays. Pelvic and caudal fins are absent. The lateral line begins at the upper

margin of the gill cover and then slants downward to behind the tip of the pectoral fins, then as a straight line near the ventral contour. The large mouth has a small, conical projection at the tip of the upper and lower jaws. There are two sets of long, barbed, fanglike teeth at the anterior end of the upper jaw, and a single similar set at the anterior end of the lower jaw. Both jaws have a single row of compressed, sometimes fanglike, lateral teeth. The diameter of the large eye goes 5–7 times into the head length. Commonly to 100 cm TL, rarely to 234 cm TL.

Similar species
The lack of a caudal fin distinguishes the Pacific cutlassfish from the other Trichiuridae.

Distribution
Pacific cutlassfish range throughout the tropical and temperate waters of the world. In the eastern Pacific from California to Peru at depths of 91–732 m.

Razorback scabbardfish (*Assurger anzac*)

Description
Razorback scabbardfish are very long, slender, and laterally compressed. The maximum body depth goes 25–28 times into the body length. In life, the animal is silver with black on the dorsal fin membrane forward of the third or fourth dorsal soft ray. The dorsal crest runs from the tip of the snout to the origin of the dorsal fin. The nape and the area between the eyes are convex. The long, low dorsal fin has 116–123 elements, including a few weak spines at the anterior end that are difficult to differentiate from the soft rays. The anal fin begins with two spines (the first rudimentary, the second reduced and scalelike) inserted under dorsal soft rays 42–44. Most of the 74–88 anal fin rays/spines are buried with only the last 12–14 external. The mouth is large. The lower jaw projects beyond the upper and there is a conical projection at the tip of both jaws. The mouth contains three sets of fanglike canine teeth with a smaller set of fangs at the tip of the lower jaw. To 250 cm TL.

Similar species
Young Fitch's scabbardfish (*Lepidopus fitchi*) are silver, but are concave on the top of the head and the dorsal crest is low and just in front of the dorsal fin. Lined cutlassfish (*Diplospinus multistriatus*) have a high, deeply notched dorsal fin, and do not have the dorsal crest.

Distribution
Razorback scabbardfish range from Puerto Rico and Uruguay and at Walvis Ridge in the Atlantic Ocean, and off Western Australia in the Indian Ocean. In the Pacific Ocean, off New Guinea, southern Japan through Midway and the Hawaiian Islands, and southern California to Chile, at depths of 150–400 m.

Fitch's scabbardfish (*Lepidopus fitchi*)

Description
The very long, highly laterally compressed body tapers to a very narrow caudal peduncle and ends with a small, forked caudal fin. The upper profile of the head is slightly convex and rises gently from snout to dorsal fin origin. The posterior confluence of the frontal crests is just posterior to the rear margin of the orbit. The sagittal crest is absent. The interorbital space is slightly concave. The orbit just touches the dorsal profile. There are 20–27 lateral teeth in the long maxillary, 18–30 in dentary, and a few teeth on the palatines. There are 12–17 gill rakers. The dorsal fin has 78–87 elements. The anal fin has two spines (the second is flat, triangular, and much shorter than the distance from its origin to the anus) and 41–50 soft rays (the posterior 23–27 connected by a membrane). The small pelvic fin insertion is below dorsal ray 8–9, less than an eye diameter behind the posterior end of the pectoral fin base. The body color changes from a silvery white in the juveniles to a dark black to brown/black in the adults, but appears white when skinless. To 210 cm SL.

Similar species
Other Trichiuridae encountered during the survey are flat to convex between the eyes.

Distribution
In the eastern Pacific, Fitch's scabbardfish are found from lat 45°N, or roughly Cape Kiwanda, Oregon, through the Gulf of California, and then again from lat 5°N south to southern Peru, at depths of 175–500 m.

Lined cutlassfish, striped escolar (*Diplospinus multistriatus*)

Description
The long, slender, laterally compressed, silver body has several narrow dark lines of dots along the sides, and jet-black gill membranes. There are 30–34 spines and 35–44 soft rays in the high, deeply notched dorsal fin. The spinous dorsal is about twice the length of the soft dorsal. There are 11–13 pectoral fin rays. In adults, the pelvic fins are a minute spine, and originate in front of the pectoral fin. The anal fin has two small, free spines ahead of 28–35 soft rays. The anterior rays of the anal fin are small and nearly membrane-free. The single, faint lateral line originates at the upper-rear of the gill cover, slopes sharply down to the tips of the pectoral fins, and then is nearly straight along the ventral profile. The anus is midway between the tip of the snout and the tip of the caudal fin, well ahead of the notch in the dorsal fin. The distance from the anus to the anal fin origin is (nearly) equal to the head length. To 33 cm SL.

Similar species
This species is not easily confused with other Trichiuridae, based on the position of the anus at midbody and the low anterior portion of the nearly membrane-free anal fin.

Distribution
Although rare, lined cutlassfish occur in the central water masses of the Atlantic, Indian, and Pacific Oceans, at depths of 100–200 m at night and to 1,000 m during the day.

Intermediate scabbardfish, black scabbardfish (*Aphanopus intermedius*)

Description
The long, slender, laterally compressed body of the intermediate scabbardfish is dark copper/black with metallic highlights that turn dull and black upon death. The long dorsal fins have 40–44 (rarely 39) spines and 54–59 soft rays, and generally 96–102 (rarely 95) total fin elements. The spinous and rayed dorsal fins are separated by a notch and are about equal-sized. The long anal fin has two close-set spines under the dorsal soft ray 3–6, well separated from the 46–50 soft rays. There are two anal fin spines; the first is greatly reduced and not visible in adults, the second is very strong and sharp. The pelvic fins are a single spine inserted ahead of the pectoral fin base in juveniles, and are absent in adults. The lower jaw extends anteriorly past the upper jaw, and both jaws have a small conical projection at the tip. The top of the head is flat with no ridges. To 148 cm TL.

Similar species
Fitch's scabbardfish (*Lepidopus fitchi*) have a concave head and an unnotched dorsal fin.

Distribution
Intermediate scabbardfish are widespread in the tropical and subtropical Atlantic Ocean. In the North Pacific from Japan and the Kuril Islands to British Columbia, Canada, to California, and in the South Pacific off Australia and Peru, at depths of 300–1,350 m.

North Pacific frostfish (*Benthodesmus pacificus*)

Description
North Pacific frostfish have a long, slender, tapering, and laterally compressed body that is silver with dark jaws and opercles. The gill cavities and the inside of the mouth are black. The long dorsal fin has 44–46 spines and 99–104 soft rays separated by a shallow notch. The spinous dorsal is roughly half the length of the soft dorsal. The anal fin originates below dorsal soft ray 3–6. There are two anal fin spines. The first spine is minute and completely covered, in adults. The second is delicate and well separated from the rest of the anal fin. There are 90–94 rays in the anal fin, but only the rear one-third of the rays are well developed. The pelvic fin insertion is behind the pectoral fin base. The tips of both jaws have a conical projection. There are fanglike teeth on the anterior end of the jaws. The lateral jaw teeth are somewhat compressed. There are lateral teeth on the palatines and no teeth on the vomer. The head has a smooth, gently rising profile from the tip of the snout to the dorsal fin, without crests or ridges, and the nape is generally flat. To 112 cm SL.

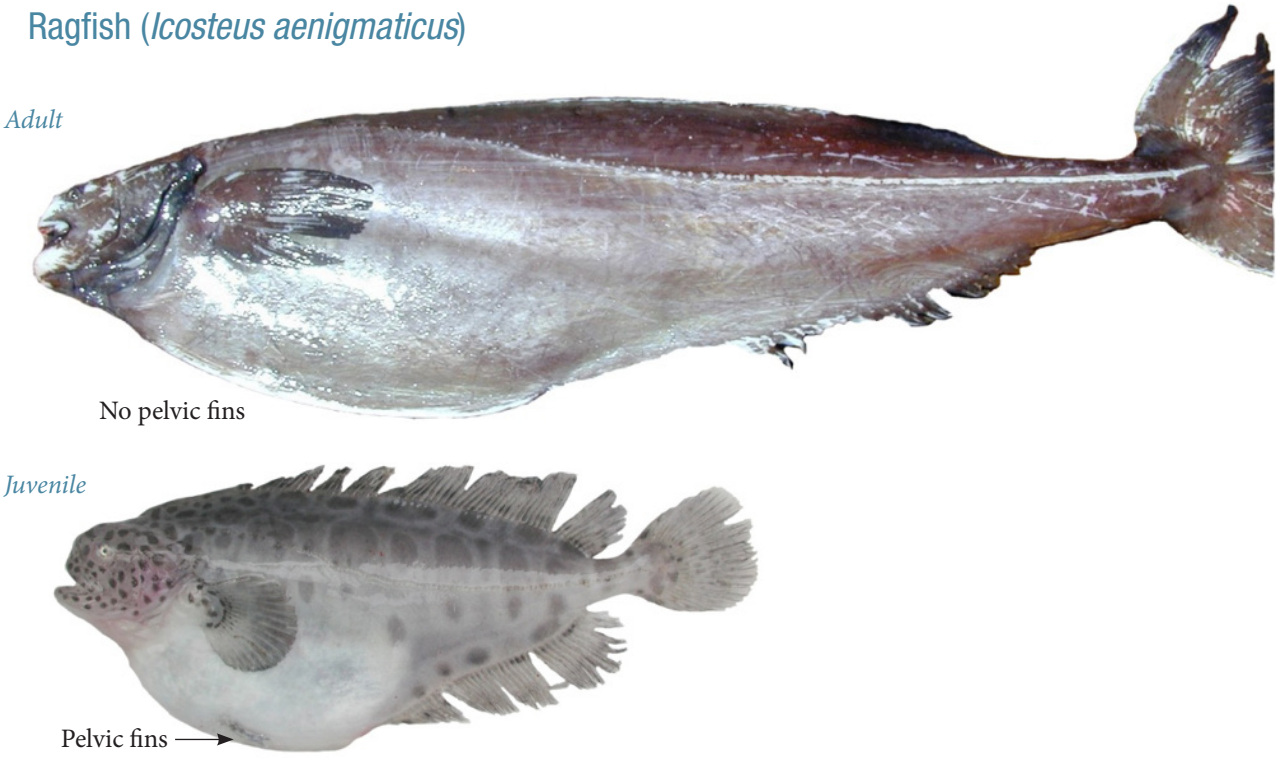
Similar species
Revision of the Trichiuridae (Nakamura and Parin 1993) restricts *Benthodesmus elongatus* to the Southern Hemisphere and *B. pacificus* to the North Pacific.

Distribution
North Pacific frostfish range from Japan, the Ryukyu Islands, and the Kyushu–Palau Ridge to British Columbia, Canada, to California, at depths of 100–1,000 m.

Icosteidae (Ragfishes)

The ragfish is a large meso- to bathypelagic fish that occurs throughout the North Pacific Ocean. The fish derive their common name from the soft, limp body. Juvenile and adult ragfish differ greatly, and in the past were treated as separate species.

Ragfish (*Icosteus aenigmaticus*)



Description
Adult ragfish are dark brown to purple/brown when the fragile skin is intact, and white or cream-colored when skinless. The long, limp body has a cartilaginous appearance, especially around the head, the raised, keel-like lateral line, and the caudal peduncle and fin. The long dorsal and anal fins are composed entirely of flexible, soft rays. The caudal fin is slightly indented, the pectoral fins are round, and there are no pelvic fins. Juveniles have a shorter, deeper, and highly compressed, light brown to light gray or gray/purple body, with dark spots and blotches on the head and sides, and may have a yellow or purple tint that extends onto the dorsal, caudal, and the base of the anal fins. The caudal and pectoral fins are round, and small pelvic fins are present. The lateral line is a series of small, spinelike projections. To 213 cm TL.

Similar species
Medusafish (*Icichthys lockingtoni*) have pelvic fins as adults, and three dorsal spines.

Distribution
Ragfish range from Hokkaido, Japan, in the western Pacific, and the Bering Sea to Point Loma, California, at depths of 0–1,420 m.

Scombridae (Mackerels and Tunas)

The Scombridae are a family of about 51 species in 15 genera. Scombridae include mackerels, bonitos, and tunas. They occur in tropical and subtropical waters. A common feature of this group is the two dorsal fins that fold into grooves. The first dorsal has 9–27 rays and originates well behind the head. There are 5–12 finlets behind the second dorsal and the anal fins. There is a pair of small keels present on each side of the tail at the base of the forked caudal fin. On some species, there is a large median keel on the thin caudal peduncle ahead of the small keels on the tail. The pectoral fins are high on the body. The small to moderate pelvic fins consist of six rays and are located below the pectoral fins. The size of the body scales is generally small to moderate. Some species have enlarged scales in the corselet (the area behind the head and around the pectoral fins), while the rest of the body is covered with small scales or can be scaleless.

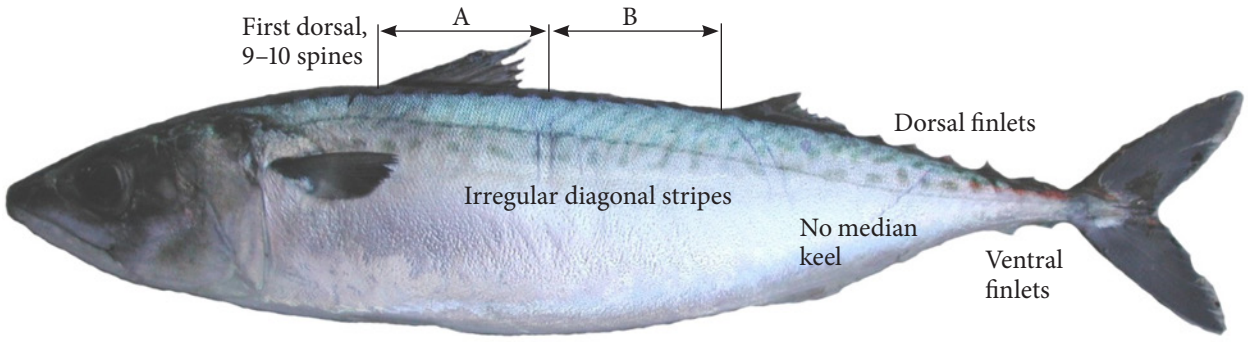
Key to the Scombridae of the FRAM Surveys

1	Caudal peduncle without median keel	2
1	Caudal peduncle with median keel	3
2(1)	First dorsal fin 9–10 spines; distance from last dorsal spine to origin of second dorsal fin less than distance between dorsal spines 1–10 ***Scomber japonicus***	p 363
2	First dorsal fin 10–13 spines; distance from dorsal spine 10 to origin of second dorsal fin greater than distance between dorsal spines 1–10 ***Scomber australasicus***	p 364
3(1)	Scales absent posterior to densely scaled area posterior to pectoral fin, except on lateral line ***Katsuwonus pelamis***	p 364
3	Totally scaled; densely scaled area posterior to pectoral fin and on lateral line	4
4(3)	Oblique dark stripes on back; large, widely spaced teeth; 17 or more dorsal spines	5
4	No dark stripes on back; small teeth; usually 16 or fewer dorsal spines	6
5(4)	23–27 gill rakers on first arch; upper jaw teeth 18–30; lower jaw teeth 14–25 ***Sarda chiliensis***	p 365
5	8–13 gill rakers on first arch; upper jaw teeth 12–20; lower jaw teeth 10–17 ***Sarda orientalis***	p 366
6(4)	Ventral surface of liver with prominent striations; central lobe of liver equal to or longer than left or right lobes	7
6	Ventral surface of liver without prominent striations; right lobe of liver much longer than center or left lobes ***Thunnus albacares***	p 367
7(6)	23–31 gill rakers on first arch; long pectoral fin 30% or more of FL	8
7	31–43 gill rakers on first arch; short pectoral fin 16.8–21.7% of FL ***Thunnus orientalis***	p 368

8(7) Caudal fin with white posterior margin; pectoral fin very long, extending well beyond second dorsal fin often to second dorsal finlet; greatest body depth at or slightly anterior to second dorsal fin origin ..... ***Thunnus alalunga*** p 369

8 Caudal fin without white posterior margin; pectoral fin short or moderate in length, not reaching posterior end of second dorsal fin; greatest body depth near middle of body at or near middle of first dorsal fin ..... ***Thunnus obesus*** p 370

Pacific mackerel, chub mackerel (*Scomber japonicus*)



Description

Pacific mackerel are metallic green or blue dorsally, with dark wavy lines that break up and disappear below the lateral line. The sides are silver, and occasionally marked with faint, small, black specks below the lateral line. The unmarked ventral surface is silvery white. There may be three or more dark lines radiating from the back of the eye. There are two separate dorsal fins of unequal height. The first dorsal has 9–10 spines, the second has 12 soft rays. The distance from the first to the last dorsal fin spine (A) is greater than or about equal to the distance between the last dorsal fin spine and the origin of the second dorsal fin (B). The one conspicuous spine of the short anal fin is set apart from, but joined to, the 12–14 soft rays by a membrane. The anal fin originates opposite to just posterior to the second dorsal fin origin. The pectoral fin is short and set high on the body. There are 4–6 dorsal and anal finlets. The completely scaled body is without any overdeveloped scales or scutes. To 50 cm fork length (FL).

Similar species

Blue mackerel (*Scomber australasicus*) have 10–13 dorsal spines (9–10 in Pacific mackerel), the distance from the first to tenth dorsal spine is less than the distance from the tenth dorsal spine to the origin of the second dorsal fin (distance from first to last dorsal spine about equal to distance from last dorsal spine to second dorsal fin origin in Pacific mackerel), the anal spine is independent from the anal soft rays (anal spine separate from, but joined to, the anal soft rays in Pacific mackerel), and the anal fin originates well posterior to second dorsal fin origin (opposite to just posterior of second dorsal fin origin in Pacific mackerel).

Distribution

Pacific mackerel are most common from central California to Baja California, Mexico, the Gulf of California, and Chile, at depths of 0–300 m. However, in warm-water years, Pacific mackerel have ranged as far north as the western Gulf of Alaska.

Blue mackerel, spotted chub mackerel (*Scomber australasicus*)

Description
Blue mackerel are metallic green or blue dorsally, with narrow diagonal zigzag and reticulated lines on the upper sides, spots along the midside, and fine, wavy, broken lines ventrally. This dark reticulated pattern becomes less distinct with age. The two separate dorsal fins are unequal in height and placed far apart. The first dorsal fin has 10–13 spines and the second has 12 soft rays. The distance from the first to tenth dorsal spine is less than the distance from dorsal spine 10 to the second dorsal fin origin. The anal fin has one spine independent from the 12 soft rays. The anal fin origin is well posterior to the second dorsal fin origin. The short pectoral fin is set high on the body and has 18–21 rays. There are 5–6 dorsal and anal finlets. The completely scaled body has no overdeveloped scales or scutes. To 40 cm FL.

Similar species
Pacific mackerel (*Scomber japonicus*) have 9–10 dorsal spines (10–13 in blue mackerel) and the distance from the first to last dorsal spine is about equal to the distance from the last dorsal spine to the second dorsal fin origin (distance from first to last dorsal spine less than from last dorsal spine to second dorsal fin origin in blue mackerel).

Distribution
Blue mackerel, although rare in tropical waters, range throughout the temperate and tropical waters of the Indian Ocean. In the western Pacific Ocean from Australia and New Zealand to China and Japan and east to the Hawaiian Islands, at depths from 1–200 m. Blue mackerel occur off Socorro Island, Mexico, with no confirmed reports elsewhere in the eastern Pacific Ocean.

Skipjack tuna (*Katsuwonus pelamis*)

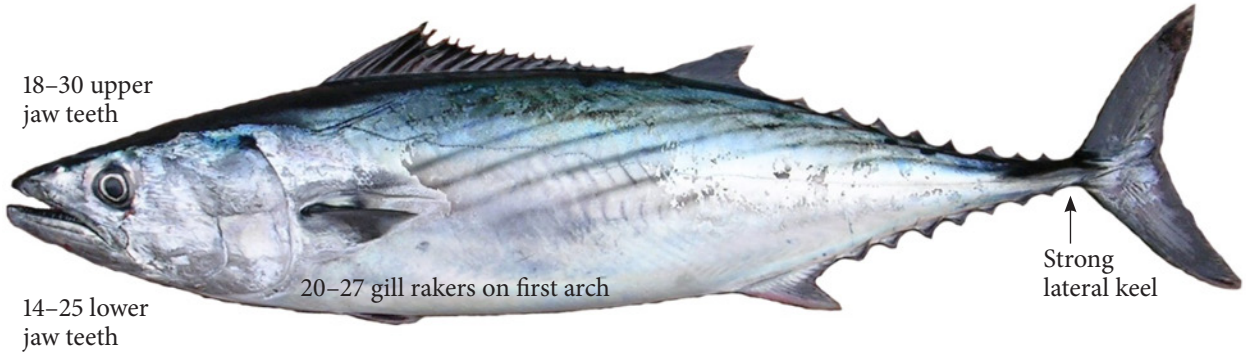
Description
Skipjack tuna are blue to violet dorsally and silver/white laterally and ventrally. There are 4–6 dark longitudinal stripes, sometimes appearing as discontinuous lines of dark blotches. The body is fusiform, elongate, and rounded. There are two dorsal fins separated by a space not much larger than the diameter of the eye; the first dorsal has 14–16 spines, the anteriormost spines the longest,

the second has 14–15 soft rays followed by 7–9 finlets. The short pectoral fins have 26–27 rays. The interpelvic process is small and bifid. The anal fin has 14–15 soft rays followed by 7–8 finlets. The body is scaleless except for a densely scaled area posterior to the pectoral fin base called the corselet. There are no scales posterior of the corselet except along the lateral line. The short jaws extend to the middle of the eye. There are numerous gill rakers (53–63) on the first arch. A well developed median keel occurs on the caudal peduncle. To 110 cm FL.

Similar species
Pacific bonito (*Sarda chiliensis*) have jaws extending to or beyond the back of the eye, slightly oblique stripes dorsally and laterally above and slightly below the lateral line, a long first dorsal fin with 17 or more spines with a straight profile, fewer (20–27) gill rakers (53–63 in skipjack tuna), and a fully scaled body (scales in corselet only in skipjack tuna).

Distribution
Although absent from the Black Sea, skipjack tuna are found throughout the tropical and warm, temperate waters of the world's oceans. In the eastern Pacific, although rare north of southern California, skipjack tuna range from southeastern Alaska to Chile at depths to 260 m during daylight (but limited to the near surface waters at night).

Pacific bonito (*Sarda chiliensis*)

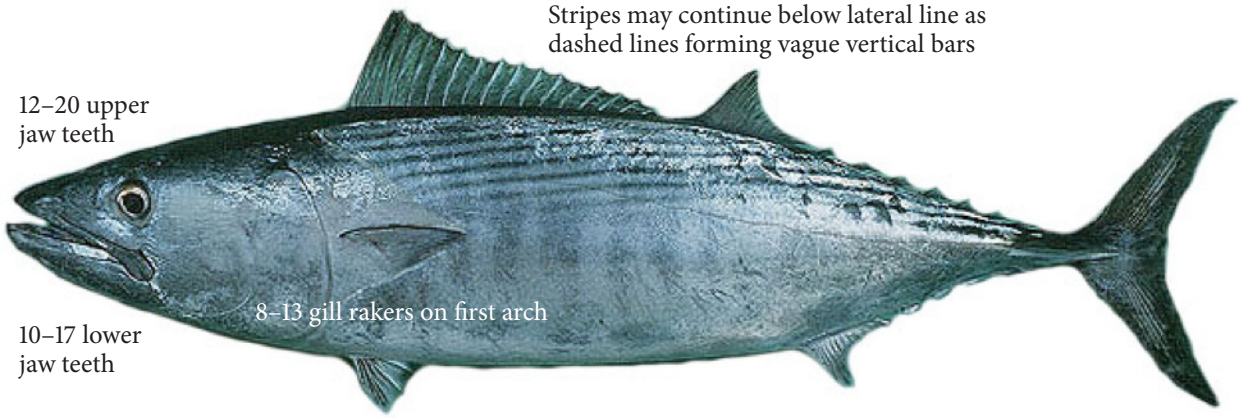


Description
Pacific bonito are dark metallic blue dorsally, silver to silver/white laterally, and white ventrally. There are dark oblique stripes on the dorsum and upper sides. The fully scaled body has enlarged scales in the corselet and along the lateral line. The long first dorsal fin has 17–19 spines, the second dorsal has 12–16 rays, and there are 6–8 (usually eight) dorsal finlets. The anal fin generally has 12–15 soft rays followed by 6–7 anal finlets. The short pectoral fin has 22–26 (usually 24–25) rays. The jaws extend to or beyond the rear of the eye. There are 18–30 large and widely spaced teeth in the upper jaw and 14–25 teeth in the lower jaw, but no teeth on the vomer. There are 20–27 gill rakers on the first arch. A well developed median keel occurs on the caudal peduncle. To 102 cm TL.

Similar species
Skipjack tuna (*Katsuwonus pelamis*) have many more (53–63) gill rakers than Pacific bonito (20–27). Striped bonito (*Sarda orientalis*) generally have fewer teeth in both jaws (12–20 upper and 10–17 lower for striped bonito, 18–30 upper and 14–25 lower for Pacific bonito) and fewer gill rakers on the first arch (8–13 vs. 20–27 for Pacific bonito).

Distribution
Pacific bonito are an epipelagic coastal species that is restricted to the eastern Pacific Ocean, usually at depths of 0–100 m. Its geographical range includes a northern and a southern population, leading some researchers to classify them as separate subspecies (*Sarda chiliensis lineolata* in the north and *Sarda chiliensis chiliensis* in the south). Although rare north of California, the northern population has been reported as far north as the Gulf of Alaska and as far south as Cabo de San Lucas in southern Baja California, Mexico, and the Revillagigedo Islands. The southern population ranges from Mancora, Peru, to Talcahuano, Chile.

Striped bonito (*Sarda orientalis*)

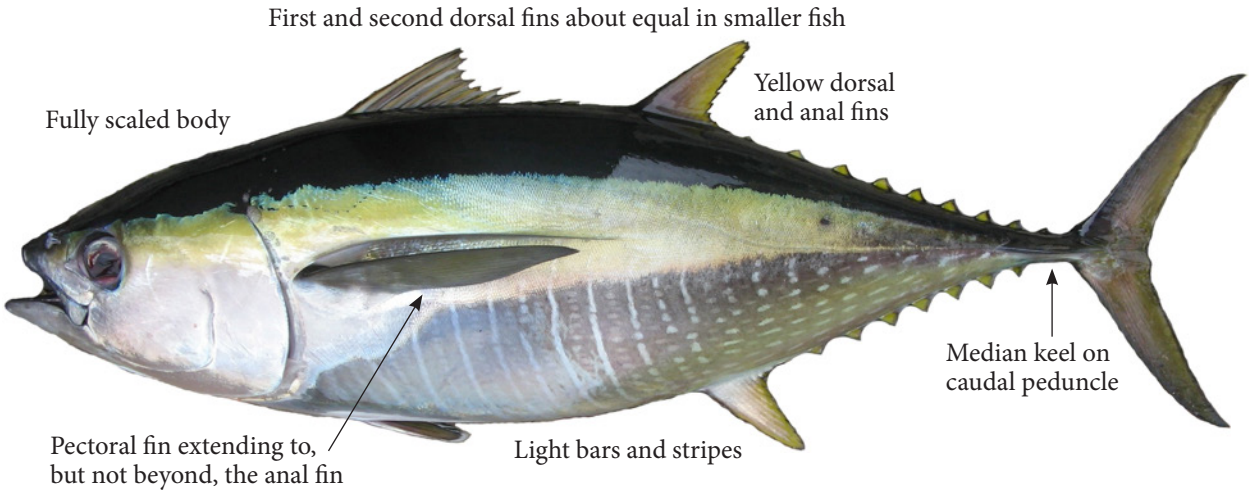


Description
Striped bonito are dark metallic blue dorsally, silver to silver/white laterally, and white ventrally. There are dark, oblique stripes on the dorsum and upper sides. The stripes may continue ventrally below the lateral line, but tend to appear as a series of dashed lines that may appear as a series of vertical bars. The long first dorsal fin has 17–19 spines, the second has 12–16 soft rays and usually eight finlets. The anal fin generally has 14–16 soft rays followed by 6–7 (usually six) finlets. The short pectoral fin has 23–26 (usually 24–25) rays. The jaws extend to or beyond the rear of the eye. There are 12–20 large, widely spaced teeth in the upper jaw and 10–17 teeth in the lower jaw, but no teeth on the vomer. There are 8–13 gill rakers on the first arch. A well developed median keel occurs on the caudal peduncle. To 102 cm FL.

Similar species
Pacific bonito (*Sarda chiliensis*) generally have more teeth in both jaws (18–30 upper and 14–25 lower for Pacific bonito, 12–20 upper and 10–17 lower for striped bonito) and more gill rakers on the first arch (20–27 vs. 8–13 for striped bonito).

Distribution
Striped bonito are an epipelagic coastal species that is widespread in the tropical and subtropical waters of the Indo-Pacific, usually at depths of 0–167 m, but has many gaps within its known distribution. In the western Pacific, it occurs northward to the northern end of Honshu, Japan, but is rare in the Indo-Australian Archipelago; it does occur in northwestern and southwestern Australia. In the eastern Pacific, it occurs around the Hawaiian Islands and the U.S. Pacific coast to Cabo San Lucas in southern Baja California, Mexico, and the Tres Marías Islands south to the Galápagos Islands and the Gulf of Guayaquil.

Yellowfin tuna (*Thunnus albacares*)

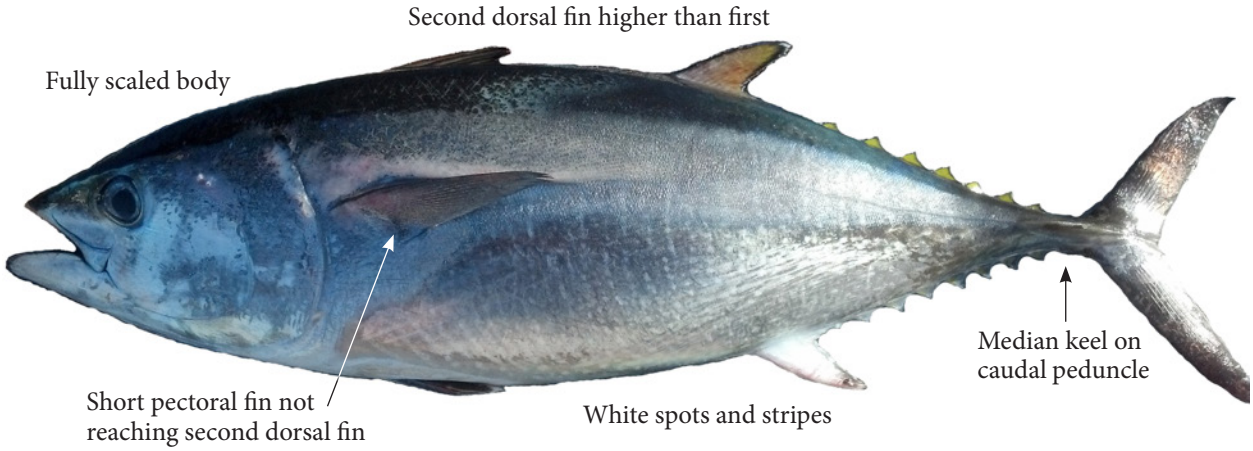


Description
Yellowfin tuna are dark blue dorsally, yellow laterally, and silver or silver/gray ventrally. The dorsal and anal fins are yellow, and the dorsal and anal finlets are yellow with black edges. The caudal fin is dusky yellow to dark. Juveniles have a series of light bars and spots on the ventral half of the body that disappear with age. There are two dorsal fins: the first has 11–14 spines, the second 11–16 soft rays. The pectoral fin has 32–35 rays and reaches to or beyond the second dorsal fin origin, though not beyond the base. The pelvic fins have one spine and five soft rays, with a bifid interpelvic process. The anal fin has 11–16 soft rays. In juveniles, the anal and two dorsal fins are relatively short, with the two dorsal fins about equal in height. The second dorsal and anal fins can become very long, up to 20% of FL in adults. A corselet of slightly enlarged scales is present but not very distinct on the fully scaled body. The body is fusiform and slightly compressed, with body depth greatest at or near the middle of the first dorsal fin. The short jaws extend to the front of but not past the middle of the eye. A well developed median keel occurs on the caudal peduncle. There are 26–34 gill rakers on the first arch. The trilobed liver is not striated, and the right lobe is the largest. Commonly to 150 cm FL, maximum recorded length 239 cm FL.

Similar species
Pacific bluefin tuna (*Thunnus orientalis*) have short pectoral fins (not reaching the second dorsal fin), a dark first dorsal fin, a reddish-brown second dorsal fin, and striations on the ventral side of the trilobed liver (whose central lobe is the largest).

Distribution
Yellowfin tuna are epipelagic oceanic species found in tropical and subtropical waters worldwide (except the Mediterranean Sea). Although rare in the northeastern Pacific north of Point Conception, California, yellowfin tuna range from lat 50°N to Peru, at depths from the surface to 250 m.

Pacific bluefin tuna (*Thunnus orientalis*)

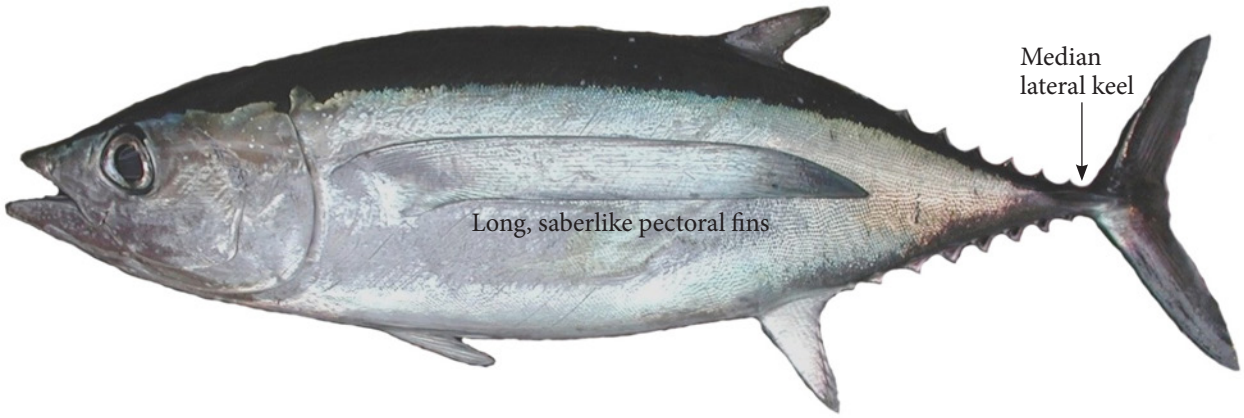


Description
Pacific bluefin tuna are generally dark blue to black dorsally and silver/white to silver/gray, usually with white stripes and spots, laterally and ventrally. There are two dorsal fins; the first has 12–15 spines and is blueish or yellow, while the second is higher than the first, has 0–1 spines and 13–18 soft rays, is reddish-brown, and is followed by 7–10 black-edged, dusky yellow finlets. The short pectoral fin has 31–38 rays and does not extend to the second dorsal fin. The pelvic fins have one spine and five soft rays with a bifid interpelvic process. The anal fin has 0–2 spines and 12–15 soft rays followed by 7–9 black-edged, dusky yellow finlets. The well developed median keel on the caudal peduncle is black on adults. The fusiform and slightly compressed body is deepest at or near the middle of the first dorsal fin. The body is fully scaled; a corselet of moderately enlarged scales is present but not very distinct. There are 32–43 gill rakers on the first arch. The ventral surface of the trilobed liver is striated, and the central lobe is the largest. Commonly 200 cm FL or less, but can reach lengths of 300 cm FL, possibly more.

Similar species
Yellowfin tuna (*Thunnus albacares*) have longer pectoral fins that can reach to or beyond the origin of the second dorsal fin but not beyond the base, and yellow dorsal fins, anal fin, and finlets. The ventral side of the trilobed liver is not striated, and the right lobe is the largest.

Distribution
Pacific bluefin tuna are an epipelagic species found mainly in the North Pacific. Although rare north of California, in the eastern Pacific they range from the Gulf of Alaska at Shelikof Strait to southern Baja California, Mexico, at depths from the surface to 200 m. In the western Pacific, they range from Sakhalin Island in the southern Sea of Okhotsk to the northern Philippines. Although rare, they occur in the Southern Hemisphere off Western Australia, in the southeastern Pacific Ocean, and the Gulf of Papua.

Albacore tuna (*Thunnus alalunga*)



Description
Albacore tuna are dark metallic blue dorsally, silver/white with a faint iridescent blue band laterally, and white ventrally. When freshly captured, the first dorsal fin can be a dark yellow with the second dorsal and anal fins a lighter yellow. The caudal fin is dark with a white posterior margin. However, upon death, the iridescent blue stripe fades and the fins quickly lose the yellow color, taking on a metallic sheen with a white posterior margin. There are two dorsal fins; the first has 11–14 spines (anterior spines much longer than posterior, giving the fin a strong concave outline), the second is lower than the first and has 11–16 soft rays followed by 7–9 finlets. The pectoral fins have 30–36 rays (more than any other genus of Scombridae) and are very long (up to 30% or more of FL in fish greater than 50 cm), reaching well beyond the second dorsal fin up to the second finlet. However, fish under 50 cm will have proportionately smaller pectoral fins than other tunas. The pelvic fins have one spine, five soft rays, and a bifid interpelvic process. The anal fin has 11–16 soft rays followed by 7–8 dark finlets. The body is fusiform, elongate, and slightly compressed. The body depth is deepest at a point farther posterior than other tuna (at or just anterior to the second dorsal fin). The fully scaled body has an indistinct corselet of moderately enlarged scales. The caudal peduncle is very slender, with a strong lateral keel between two smaller keels on each side. The short jaws extend to below the front of the eye. There is a single series of small, conical teeth in both jaws. There are 25–31 gill rakers on the first arch. The ventral side of the trilobed liver is striated, and the central lobe is the largest. To 140 cm FL.

Similar species
Bigeye tuna (*Thunnus obesus*) have a caudal fin without a white posterior margin (white in albacore), the short to moderate pectoral fins do not reach the posterior end of the second dorsal (well beyond second dorsal in albacore over 50 cm FL), and their body depth is greatest at or near the center of the first dorsal (at or slightly anterior to second dorsal fin origin in albacore).

Distribution
Albacore tuna are an epi- to mesopelagic oceanic species found in the tropical and temperate waters of all oceans and the Mediterranean Sea. In the eastern Pacific, they range from the entrance of Prince William Sound and the Gulf of Alaska to Chile, at depths from the surface to 380 m.

Bigeye tuna (*Thunnus obesus*)

Description
Bigeye tuna are dark metallic blue dorsally, silver/white with a faint iridescent blue band laterally, and white ventrally. Fish less than approximately 110 cm FL have continuous white bars on the rear half of the body; these are absent on larger fish. There are two dorsal fins; the first has 13–15 spines and, when freshly captured, is dark yellow; the second has 14-15 soft rays, is light yellow, and is followed by 8–9 bright yellow finlets with dark edges. The pectoral fin has 30–36 rays. The fin is long (22–31% of FL), points down at the tip, and reaches past the second dorsal fin in fish approximately 110 cm FL and larger. The pelvic fins have one spine and five soft rays, with a short bifid interpelvic process. The light yellow anal fin usually has 14 soft rays followed by 8–9 bright yellow finlets with dark edges. The caudal fin is dark gray. The body is fusiform, elongate, and moderately compressed, deepest at or near the middle of the first dorsal fin. The fully scaled body has a well developed corselet of moderately enlarged scales. The caudal peduncle has a strong lateral keel between two smaller keels on each side. The jaws extend to below the middle of the large eye. There is a single series of small, conical teeth in both jaws. There are 23–31 gill rakers on the first arch. The ventral side of the trilobed liver is striated, and the central lobe is the largest. To 250 cm FL.

Similar species
In albacore tuna (*Thunnus alalunga*), the caudal fin has a white posterior margin (white margin absent in bigeye tuna), the long pectoral fin reaches well beyond the second dorsal in fish over 50 cm FL (pectoral fin does not reach posterior end of second dorsal for bigeye tuna less than ~110 cm FL), and the body depth is greatest at or just anterior to the second dorsal fin origin (at or near center of first dorsal in bigeye tuna).

Distribution
Bigeye tuna are a highly migratory epi- to mesopelagic species found in the tropical and subtropical waters of the Atlantic, Indian, and Pacific Oceans, but are absent from the Mediterranean Sea. Juveniles and small adults tend to school near the surface, with the adults preferring deeper depths, to 250 m, possibly more. In the eastern Pacific, they range from about lat 40°N near Point Delgada, California, to about lat 30°S near Coquimbo, Chile.

Centrolophidae (Medusafishes)

The medusafishes comprise 27 species in seven genera. These pelagic fish occur in tropical and temperate seas. Adults aggregate around floating objects. The young often associate under jellyfish. The adults have pelvic fins. The continuous dorsal fin has 0–5 weak spines anterior to the soft rays, or 5–9 small, stout spines without soft rays. The anal fin has 0–3 spines anterior to the 15–41 soft rays.

Medusafish (*Icichthys lockingtoni*)

Juvenile

Description
Adults are bluish-gray to dark brown with fine, dark, minute dots on the head and dorsum, and dusky to black fins. Small juveniles tend to be nearly a transparent pink or blue. The laterally compressed, limp body is very spongy in the area around the top of the head, the eyes, and the blunt snout. The long dorsal fin has three weak spines, 39–46 soft rays, originates well behind the base of the pectoral fin, and is fleshy at the base. The short pelvic fin has 18–21 rays. The pelvic fins have one spine and five soft rays. The anal fin has three weak spines, 27–32 soft rays, and is fleshy at the base. Adults have small deciduous cycloid scales. Juveniles are scaleless. To about 46 cm TL.

Similar species
Adult ragfish (*Icosteus aenigmaticus*) have no pelvic fins or dorsal spines.

Distribution
Medusafish range from Japan to the Aleutian Islands and to central Baja California, Mexico, sometimes well off shore and usually in the top 91 m of the water column (but occasionally at depths to 485 m).

Tetragonuridae (Squaretails)

The squaretails are a family of oceanic fishes of the tropical and temperate seas consisting of three species in a single genus. Tetragonurids are called squaretails because of two converging keels on each side of the caudal peduncle that make the fish look squarish in cross-section.

Key to the Tetragonuridae of the FRAM Surveys

1	12 or fewer dorsal spines; <80 (73–78) lateral line scales; 34–43 vertebrae ..... ***Tetragonurus pacificus***	p 372
1	12 or more dorsal spines; >80 lateral line scales; 44 or more vertebrae 2	
2(1)	14–17 dorsal spines; 83–95 lateral line scales; 44–51 vertebrae ..... ***Tetragonurus atlanticus***	p 372
2	15–21 dorsal spines; 97–114 lateral line scales; 51–58 vertebrae ..... ***Tetragonurus cuvieri***	p 372

Smalleye squaretail (*Tetragonurus cuvieri*)

Description
Smalleye squaretails are dark brown to black when fresh, often with violet or yellow reflections. The elongate body is cylindrical. The sharp, knifelike teeth in the deep, scooplike lower jaw form a continuous cutting edge. There are two dorsal fins: the first is composed of 15–21 short spines and is depressible into a groove when folded, the second has 0–2 spines followed by 10–17 soft rays. The pectoral fin has 14–17 rays. The pelvic fin has one spine and five rays and folds into an abdominal groove. The anal fin has 0–2 (usually 1) spine followed by 9–15 soft rays There are two convergent keels on each side of the caudal peduncle. Multiple ridged, strongly adherent scales that form precise curved rows cover the body and head. To 70 cm TL.

Similar species
The bigeye squaretail (*Tetragonurus atlanticus*) has fewer dorsal spines (14–17), fewer lateral line scales (83–95), and fewer vertebrae (44–46). The Pacific squaretail (*T. pacificus*) also has fewer dorsal spines (10–12), fewer lateral line scales (73–78), and fewer vertebrae (34–43).

Distribution
In the Pacific Ocean, smalleye squaretail range from Australia and New Zealand to Japan; in the eastern North Pacific, from the Aleutian Islands to Cedros Island in central Baja California, Mexico, at depths of 1–800 m.

Stromateidae (Butterfishes)

The butterfishes consist of about 13 species in three genera distributed through the tropical to warm, temperate coastal waters of North and South America, western Africa, and the Indo-Pacific. These silvery fish have a deep body and rounded heads. The long pectoral fins are falcate or sickle-shaped. The tail is highly forked, and there are no pelvic fins in the adults. The dorsal and anal fins are long, generally higher at the front, and opposite each other.

Pacific butterfish, Pacific pompano (*Peprilus simillimus*)

Description
Pacific butterfish are a bright, iridescent blue or green dorsally and pearlescent silver laterally. The fins are dusky and may have a yellow tint. The body is highly compressed, with a blunt, round head and tiny mouth. The long dorsal fin has 2–4 (usually 3) dorsal spines and 41–48 soft rays. The long anal fin has 2–3 spines and 35–44 soft rays, and is opposite the dorsal fin. The dorsal and anal fins have a low profile, with the anteriormost portion of the fins somewhat higher than the rest of the fin. The pectoral fins are long and have 19–23 rays. Pelvic fins are absent. The caudal fin is deeply forked. The arched lateral line is high on the body, follows the curve of the body, and ends before the base of the caudal fin. To 28 cm TL.

Similar species
The true pompanos (family Carangidae) and the surfperches (family Embiotocidae) have pelvic fins (absent in Pacific butterfish).

Distribution
Although rare north of central California, Pacific butterfish range from Queen Charlotte Sound, British Columbia, Canada, to Cedros Island, central Baja California, Mexico, and the Gulf of California, at depths of 9–91 m.

Pleuronectiformes (Flatfishes)

The flatfishes are a diverse group consisting of 14 families, 133 genera, and 792 species. Four families—the tonguefishes (Cynoglossidae), the left-eyed flounders (Bothidae), the sand flounders/bastard halibut (Paralichthyidae), and the right-eyed flounders (Pleuronectidae)—are included in this guide. Flatfishes are bilaterally asymmetrical in that, as they grow, one eye migrates to the other side of the head so that both eyes are on the same side of the head. As the fish grows and settles to the bottom, the body becomes highly compressed and slightly rounded

on the eyed side, and flat on the blind side. Color is most often limited to the eyed side, while the blind side is generally white to off-white. The size of the mouth varies. The lateral line is variable, from nearly straight to highly arched over the pelvic fin. Some species have an accessory branch along the base of the dorsal fin and an anterior branch that extends over the upper eye. The long dorsal and anal fins do not have spines. The anal spine, which can be somewhat enlarged and stiff, is the tip of a curved bone along the rear of the body cavity.

Key to the Flatfishes of the FRAM Surveys

1	Dorsal and anal fins continuous with caudal fin; pectoral fin and lateral line absent (Cynoglossidae)	***Symphurus atricauda*** p 377
1	Has caudal peduncle and regular caudal fin; pectoral fin and lateral line present	2
2(1)	Eyes typically on left side; pelvic fins usually not same size, placed asymmetrically around abdominal ridge—1 fin often on abdominal ridge	3
2	Eyes typically on right side; pelvic fins symmetrically placed around abdominal ridge (Pleuronectidae)	9
3(2)	Lateral line straight or with a low arch (Paralichthyidae)	4
3	Lateral line with a high arch (Bothidae)	7
4(3)	Pectoral fin longer than head; 47–57 scales along lateral line; lower gill raker count 10–12	***Citharichthys xanthostigma*** p 378
4	Pectoral fin equal to or less than head length	5
5(4)	60 or more lateral line scales; bony ridge above lower eye; tip of pectoral fin reaching mideye when bent over; lower gill raker count 12–16	***Citharichthys sordidus*** p 379
5	<60 scales along lateral line	6
6(5)	Small (<15 cm); scales large; eyed side yellow/brown; slight ridge between eyes; 46–51 lateral line scales; lower gill raker count 16–21	***Citharichthys fragilis*** p 379
6	Eyed side olive brown to brown with fine black speckling; no ridge between eyes; tip of pectoral fin does not reach eye when bent over; 52–58 lateral line scales; lower gill raker count 8–10	***Citharichthys stigmaeus*** p 380
7(3)	Anal spine present; narrow ridge between eyes; caudal fin rounded; mouth large (to or beyond rear orbit); no noticeable teeth; 15–21 gill rakers	***Hippoglossina stomata*** p 381
7	Anal spine absent	8
8(7)	Pectoral fin length equal to or greater than head length; jaws extend to midorbit; typically has 2 spots along lateral line (1 just behind pectoral fin, 1 about two-thirds back on body); often right-eyed	***Xystreurys liolepis*** p 382
8	Caudal fin doubly truncate; jaws extend to or beyond the rear edge of midorbit; flat between eyes; gill raker count 25–32; often right-eyed	***Paralichthys californicus*** p 383
9(2)	Large tuberculate scales appearing as star-shaped or round, bony knobs on the eyed side	10
9	Large tuberculate scales absent, but may be present on anterior portion of eyed side	11

10(9) Dorsal, anal, caudal fins with bold black & white or yellow stripes; scattered, star-shaped tuberculate scales on both eyed and blind sides; often left-eyed ..... ***Platichthys stellatus*** p 384

10 All fins uniformly brown; eyed side completely covered with rounded tuberculate scales, largest in six vague rows; blind side smooth and dark; uncommon, deepwater sp. ..... ***Clidoderma asperrimum*** p 385

11(9) Dorsal accessory branch (DAB) absent 12

11 Dorsal accessory branch (DAB) present 20

12(11) Anal spine absent 13

12 Anal spine present 16

13(12) Mouth large, jaws extend to or beyond midorbit; teeth large; eye visible from blind side 14

13 Mouth small, jaws do not extend past midorbit; teeth small 15

14(13) Preopercle L-shaped; dorsal fin origin behind orbit; small, smooth scales; short, blunt gill rakers; blind side dark gray, light speckling ..... ***Reinhardtius hippoglossoides*** p 386

14 Preopercle rounded; dorsal fin origin anterior to orbit or at midorbit; long, thin gill rakers; scales large, deciduous; blind side off-white ..... ***Atheresthes stomias*** p 386

15(13) Rear edge of moderately sized caudal fin straight or slightly rounded; caudal peduncle length greater than orbit length; brown body with dark spots; bulging eyes; mouth small, lips puckered; slimy when fresh ..... ***Microstomus pacificus*** p 387

15 Small, circular caudal fin; short (less than orbit length), slender caudal peduncle; body mottled; very slimy when fresh ..... ***Embassichthys bathybius*** p 388

16(12) Mouth small (to anterior of eye); snout blunt; long, slender body; lateral line flat or slightly arched; long (greater than head length), dark pectoral fin; caudal fin in broad V shape; slimy ..... ***Glyptocephalus zachirus*** p 389

16 Mouth moderate to large (maxilla to midorbit or posterior) 17

17(16) Lateral line with high arch; caudal fin crescent, often doubly truncate; mouth extends to or slightly beyond midorbit; blind side bright white; small scales; smooth on both sides ..... ***Hippoglossus stenolepis*** p 390

17 Lateral line flat or with slight arch 18

18(17) Large (>3 mm) deciduous scales; <20 scale rows between lateral line and dorsal fin at widest point; slender body; lateral line with slight arch; strong ridge between eyes ..... ***Lyopsetta exilis*** p 391

18 Not as above 19

19(18) Mouth moderate to large; flat interorbital space 4–5 scale rows wide; caudal fin doubly truncate; mandibular articulation rounded; no pores visible behind lower eye; caudal membranes mostly pigmented; 2 rows of teeth in upper jaw on dorsal side ..... ***Eopsetta jordani*** p 391

19 Mouth moderate to large; ridge between eyes 0–3 scale rows wide; mostly unpigmented, angular caudal fin, pointed at center; mandibular articulation angular; pores visible behind lower eye; 1 row of teeth in upper jaw on dorsal side ..... ***Hippoglossoides elassodon*** p 392

20(11) DAB of lateral line extends 50% of SL or more 21

20 DAB of lateral line less than 50% of SL 25

21(20) Front of dorsal fin straight, nearly all on dorsal ridge (only 1–2 rays inserted on blind side); deep, diamond-shaped body..... ***Hypsopsetta guttulata*** p 393

21 First 4–12 dorsal fin rays inserted on blind side 22

22(21) First 9–12 dorsal fin rays inserted on blind side; dorsal fin origin directly posterior to end of maxilla; eyed side, caudal fin uniformly brown; prominent ridge between eyes, blunt knobs at either end; 2–3 knobs behind upper eye..... ***Pleuronichthys decurrens*** p 394

22 First 4–6 dorsal fin rays inserted on blind side; dorsal fin origin directly posterior to upper lip 23

23(22) 4–6 dorsal fin rays inserted on blind side; prominent interorbital ridge ending in a sharp spine; only blind side of lower jaw has teeth ..... ***Pleuronichthys verticalis*** p 395

23 5–6 dorsal fin rays inserted on blind side; ridge not ending in knobs or spines..... 24

24(23) Typically has distinct dark spot at center of body on eyed side; caudal fin with dark, reverse C at base & large, dark spot forming an O; prominent ridge between eyes without any knobs or spines at ends..... ***Pleuronichthys coenosus*** p 396

24 No distinct pigment pattern on caudal fin; 2 distinct dark spots on lateral line at midbody, 1 each at posterior bases of anal and dorsal fins; flat, low ridge between eyes lacks any knobs or spines ..... ***Pleuronichthys ritteri*** p 397

25(20) Lateral line with a high arch..... 26

25 Lateral line with slight to low arch 27

26(25) 10 or fewer total gill rakers, 3 or fewer on upper arch, typically broad and blunt; blind side typically with glossy white highlights corresponding to muscle bands, especially on anterior portion of body; more than 4 supraorbital pores ..... ***Lepidopsetta bilineata*** p 398

26 10 or more gill rakers, 3 or more on upper arch, typically slender and pointed; blind side uniform creamy white, no glossy white highlights; less than 4 supraorbital pores..... ***Lepidopsetta polyxystra*** p 399

27(25) DAB not extending beyond preopercle; prominent ridge between eyes, extending behind upper eye; lateral line extends onto caudal fin; rough scales on both eyed and blind sides; rare outside of Puget Sound ..... **Hybrid sole** p 399

27 DAB extends to or beyond opercle; postocular ridge inconspicuous 28

28(27) Eye visible from blind side; mouth strongly asymmetrical; head slender, pointed; scales not extending onto dorsal or anal fin rays; cycloid scales give body a smooth, shiny appearance..... ***Parophrys vetulus*** p 400

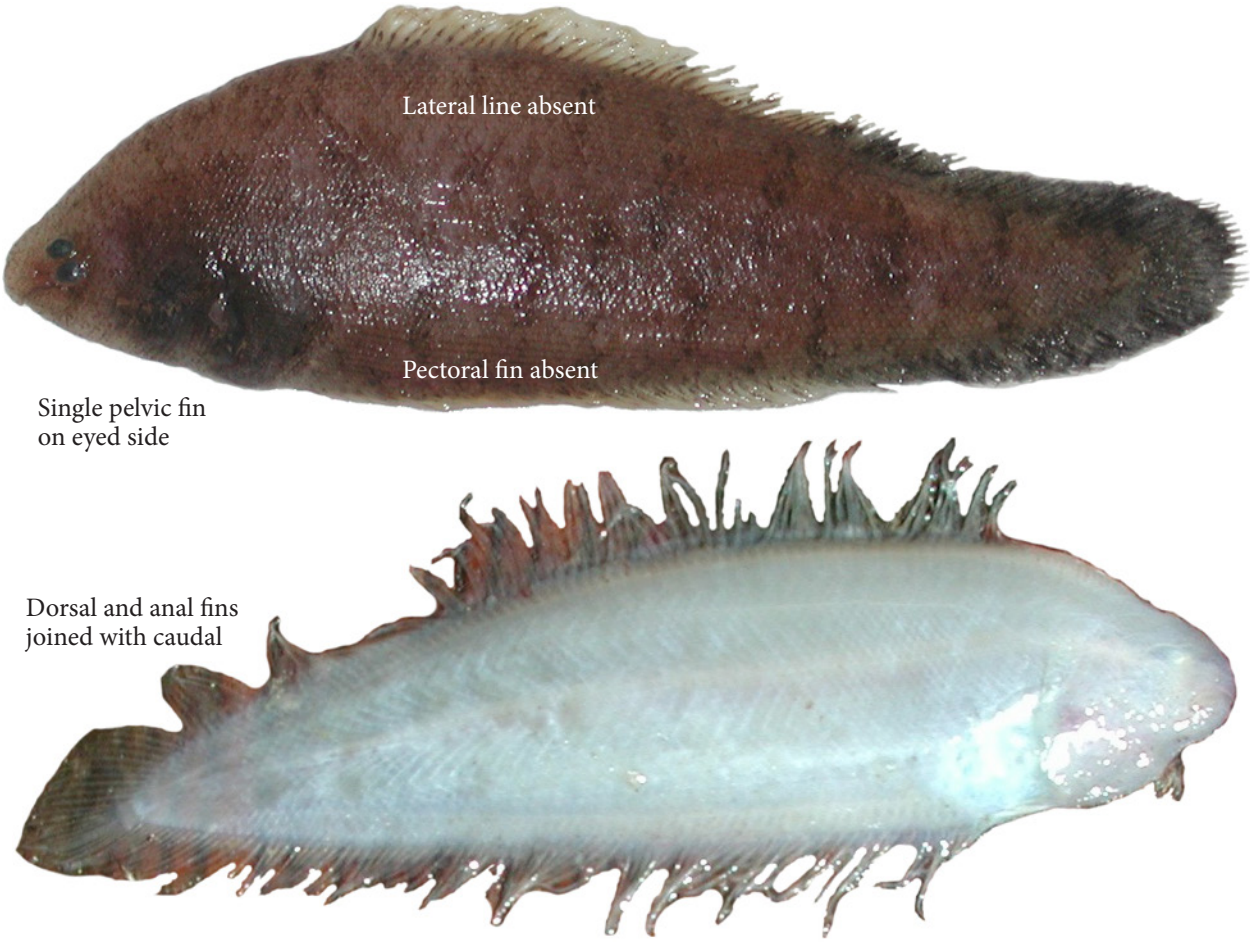
28 Eye not visible from blind side; mouth slightly asymmetrical; scales extend onto dorsal and anal fin rays; ctenoid scales give body a rough appearance 29

29(28) First 4–8 dorsal rays long, mostly free of membrane; mouth moderate to large with large teeth; lateral line with slight arch; skin rough to touch; wide, flat space between eyes ..... ***Psettichthys melanostictus*** p 401

29 First 4–8 dorsal rays short, mostly attached to membrane; mouth small with blunt teeth; typically, a hump above snout; flat and broad between eyes; fins often edged in yellow; lateral line with low arch ..... ***Isopsetta isolepis*** p 402

Cynoglossidae (Tonguefishes)

California tonguefish (*Symphurus atricauda*)



Description
California tonguefish are brown to gray, with dark bars and/or mottling dorsally and white ventrally. The dorsal, anal, and caudal fins are dusky, with various darker mottling. California tonguefish are left-eyed, with the eyes tiny and close-set. The long dorsal fin has 95–106 rays. The anal fin has 77–90 soft rays. The dorsal and anal fins join with the caudal fin. The pectoral fin develops in the larval stage, then quickly degenerates in early juveniles and is absent in adults. There is a single pelvic fin on the eyed side. The inferior mouth is small and twisted. The lateral line is absent from the eyed side. To 21 cm TL.

Similar species
Several species of the family Soleidae occur in the waters off Baja California, Mexico, and may stray into the waters off southern California during warm-water events. Although the Soleidae have a similar body shape, small close-set eyes, and a small, twisted, inferior mouth, they are right-eyed (left-eyed in California tonguefish), with pectoral fins present or absent (always absent in California tonguefish) and dorsal and anal fins free from or united with the caudal fin (always joined with the caudal fin in California tonguefish).

Distribution
Although very rare north of Point Conception, California, California tonguefish range from Yaquina Bay, Oregon, to Panama, at depths of 0–201 m.

Paralichthyidae (Sand Flounders)

Longfin sanddab (*Citharichthys xanthostigma*)

Description
Longfin sanddabs are generally uniform brown dorsally, but can have a combination of speckling and spots which can be white or mixed with red or orange. The space between the eyes is narrow, with a sharp ridge above the lower eye. The pectoral fin on the eyed side is long and reaches to or beyond the forward edge of the eye when folded forward, and from just short of to slightly past the dorsal base of the dorsal fin. There are 10–12 gill rakers on the lower limb of the first arch, and 47–57 lateral line scales. To 25 cm TL.

Similar species
The Pacific sanddab (*Citharichthys sordidus*) has a shorter pelvic fin on the dorsal side that reaches midway up the eye when folded forward, 12–16 gill rakers on the lower limb of the first gill arch, and 61–70 lateral line scales. The speckled sanddab (*C. stigmaeus*) has a short pectoral fin that does not reach or just reaches the eye when folded forward, 8–10 gill rakers on the lower limb of the first arch, and 52–58 lateral line scales.

Distribution
Although rare north of Santa Barbara, California, longfin sanddabs range from Monterey Bay, California, and the Gulf of California, to Costa Rica, at depths of 0–201 m.

Pacific sanddab (*Citharichthys sordidus*)

Description
Pacific sanddabs are dull brown dorsally but can have various spots and streaks of brown and black, as well as yellow, blue, or orange. The ventral side is off-white to tan. There is a sharp, bony ridge over the lower eye and forward of the upper eye. There are 12–16 gill rakers on the lower limb of the first arch and 61–70 lateral line scales. To 41 cm TL.

Similar species
The pelvic fin on the dorsal side of the speckled sanddab (*Citharichthys stigmaeus*) does not reach or just reaches the eye when folded forward. There are 8–10 gill rakers on the lower limb of the first gill arch and 52–58 lateral line scales. The longfin sanddab (*C. xanthostigma*) has a long pectoral fin, 10–12 gill rakers on the lower limb of the first arch, and 47–57 lateral line scales.

Distribution
Pacific sanddab range from the Aleutian Islands and the Bering Sea to Baja California, at depths of 0–549 m (but most commonly at depths less than 91 m).

Gulf sanddab (*Citharichthys fragilis*)

Description
Gulf sanddab are brown dorsally and generally off-white to tan ventrally. They are narrow between the eyes and there is a ridge above the lower eye. Large scales cover the body. The dorsal-side pectoral fin is moderate and extends just beyond the midpoint of the body. The snout and jaws have an angular profile with a distinct angular projection. There are 16–21 gill rakers on the lower limb of the first arch and 46–51 lateral line scales. To 22 cm TL.

Similar species
The pelvic fin on the dorsal side of the Pacific sanddab (*Citharichthys sordidus*) reaches midway up the eye. This species has 12–16 gill rakers on the lower limb of the first gill arch and 61–70 lateral line scales. The speckled sanddab (*C. stigmaeus*) has a pectoral fin that falls short of the eye, 8–10 gill rakers on the lower limb of the first arch, and 52–58 lateral line scales. The longfin sanddab (*C. xanthostigma*) has a long pectoral fin, 10–12 gill rakers on the lower limb of the first arch, and 47–57 lateral line scales.

Distribution
Although reported from Manhattan Beach in southern California, gulf sanddabs are rare outside the Gulf of California, at depths of 18–347 m.

Speckled sanddab (*Citharichthys stigmaeus*)

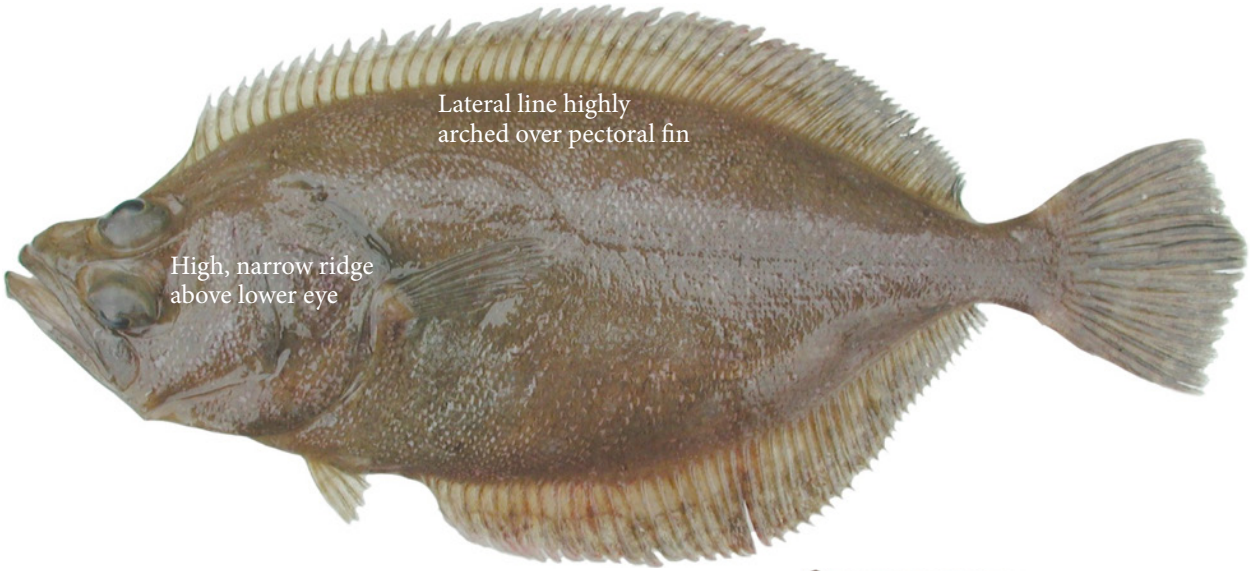
Description
Speckled sanddabs are brown or tan with fine black speckling and sometimes light spots or mottling dorsally. This species is smooth and narrow between the eyes, and lacks a ridge above the lower eye. The pectoral fin on the dorsal side falls short of or barely reaches the eye when folded forward. The eye diameter is equal to or slightly less than the snout length. There are 8–10 gill rakers on the lower limb of the first arch and 52–58 lateral line scales. To 17 cm TL.

Similar species
The pelvic fin on the dorsal side of the Pacific sanddab (*Citharichthys sordidus*) reaches midway up the eye (fall short in speckled sanddab). There are 12–16 gill rakers on the first arch's lower limb (8–10 in speckled sanddab), and 61–70 lateral line scales (52–58 in speckled sanddab). The longfin sanddab (*C. xanthostigma*) has a pectoral fin that reaches well beyond the eye, 10–12 gill rakers on the first arch's lower limb, and 47–57 lateral line scales.

Distribution
Speckled sanddabs range from Montague Island, Alaska, to Bahía Magdalena, southern Baja California, Mexico, from near shore to 366 m (but usually less than 91 m).

Bothidae (Left-eyed Flounders)

Bigmouth sole (*Hippoglossina stomata*)

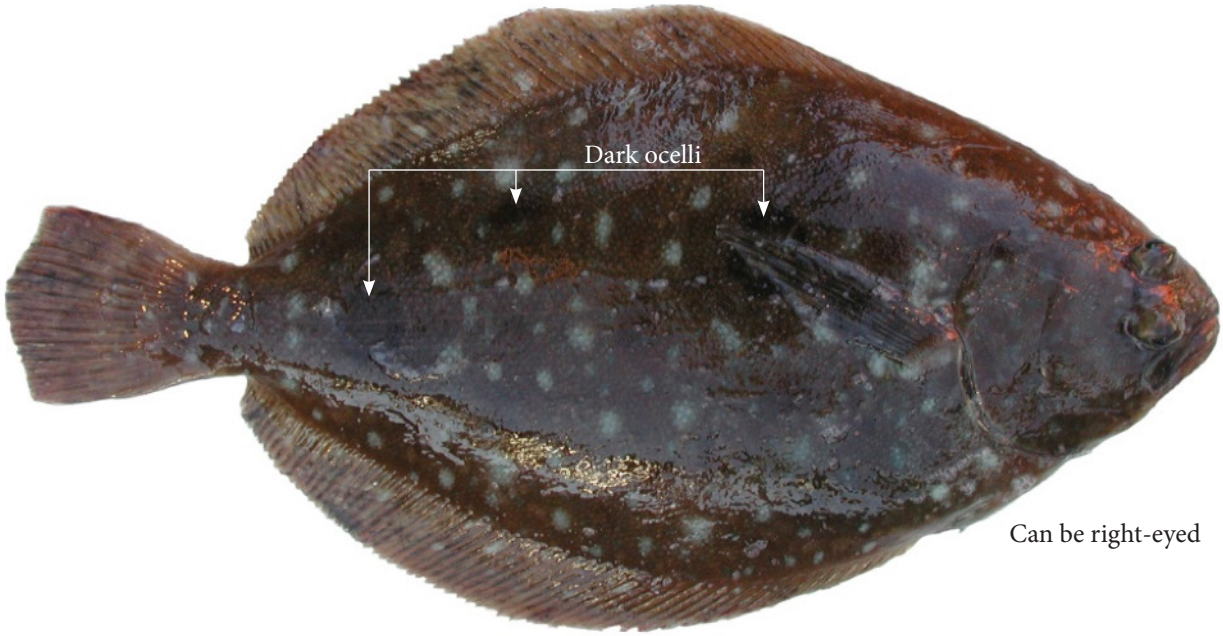


Description
Bigmouth sole are generally a uniform olive brown to dark brown that can have dark blotches and blue specks dorsally, and off-white ventrally. The lateral line has a high arch over the pectoral fin. The large jaws have small teeth and extend to or beyond the rear of the eye. The area between the eyes has a high, narrow, bony ridge. There is an anal spine. The caudal fin is rounded. To 40 cm TL.

Similar species
California halibut (*Paralichthys californicus*) do not have an anal spine (present in bigmouth sole).

Distribution
Bigmouth sole range from Monterey Bay, California, to Baja California, Mexico, and the Gulf of California, at depths of 27–137 m.

Fantail sole (*Xystreurys liolepis*)



Description
Most often fantail sole are left-eyed, but can also be right-eyed. The dorsal side is olive brown to brown, with various light and dark mottling, and possibly gray, gray/blue, or red/brown blotches. There are generally two or more dark round eyespots (ocelli). The first eyespot is behind the head, the second near the rear of the body. The dorsal fin has 73–80 rays, originates over the front half of the upper eye, and has various dark and light spots. The anal fin has 57–62 soft rays and has various dark and light spots. The caudal fin has various dark and light spots. The pectoral fins can have dark bars. The ventral side is off-white. The mouth is small, extending to the middle of the lower eye. There is a single row of small, conical teeth in each jaw, those on the blind side being better developed. The lateral line arches over the pectoral fin, extending onto the rear of the head. There is no anal spine. The body is fully scaled and smooth to the touch. To 63.5 cm TL, but usually much smaller.

Similar species
California halibut (*Paralichthys californicus*) have large jaws extending beyond the eye (middle of eye in fantail sole) with longer, more noticeable teeth (small conical teeth in fantail sole), scales rough to the touch (smooth in fantail sole), and the pectoral fin length is less than the head length (longer than head length in fantail sole).

Distribution
Fantail sole range from Monterey Bay, California, to Baja California, Mexico, and the Gulf of California, at depths of 27–137 m.

California halibut (*Paralichthys californicus*)

Description

Left-eyed California halibut can just as often be right-eyed. The dorsal side is generally gray or green/brown to black, and may have light and/or dark mottling. The ventral side is white. The body is somewhat elongate. California halibut lack an anal spine. The large jaws have strong teeth, and extend to or just beyond the rear of the lower eye. The small eyes are set far apart. The wide interorbital space is flat. There are 25–32 gill rakers on the first arch. Not deeply embedded, the scales make the surface rough to the touch. To 153 cm TL, but usually much less.

Similar species

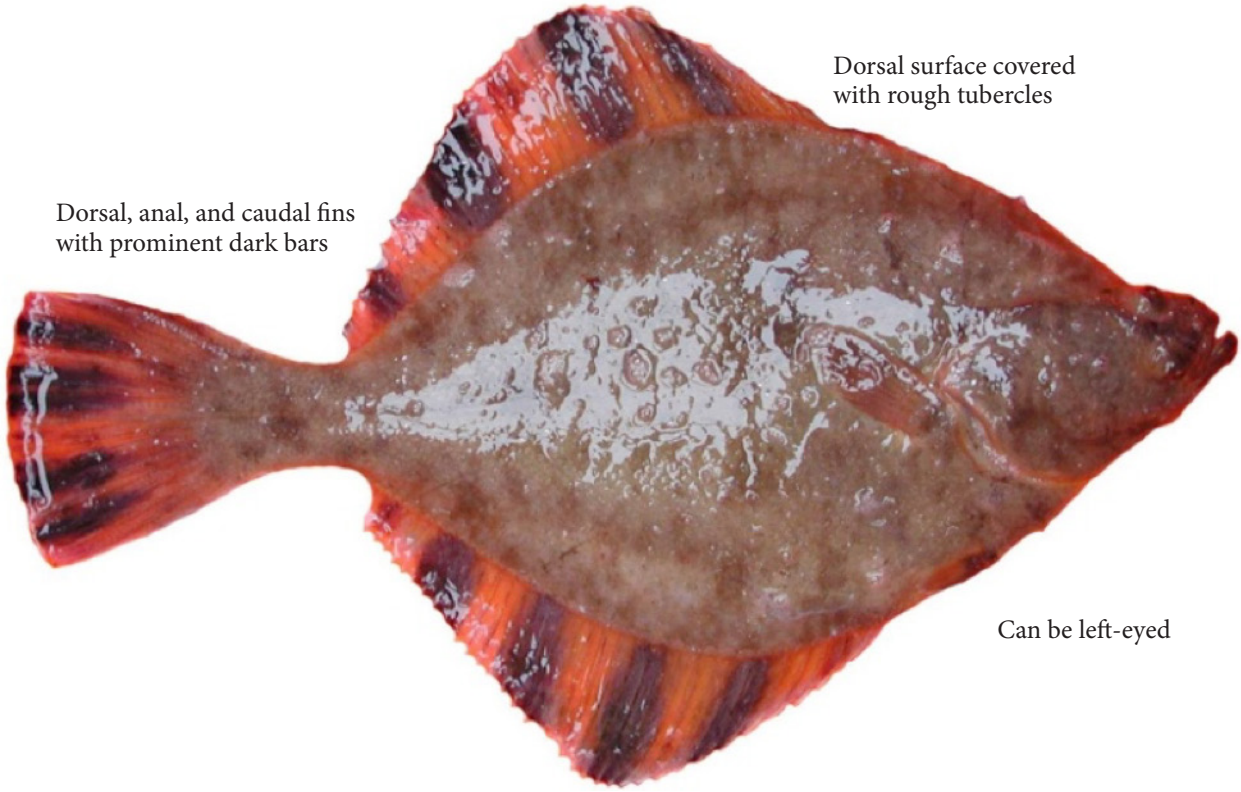
Pacific halibut (*Hippoglossus stenolepis*) are right-eyed (left or right in California halibut). They have an anal spine (absent in California halibut), 8–12 gill rakers on the first arch (25–32 in California halibut), large, close-set eyes (small, wide-set eyes in California halibut), and their jaws reach the anterior edge to the middle of the lower eye (to or beyond the rear of the eye in California halibut).

Distribution

Although rare north of Point Arena, California, California halibut range from the Quillayute River in northern Washington State to Magdalena Bay, Baja California, Mexico, at depths of 0–183 m.

Pleuronectidae (Right-eyed Flounders)

Starry flounder (*Platichthys stellatus*)

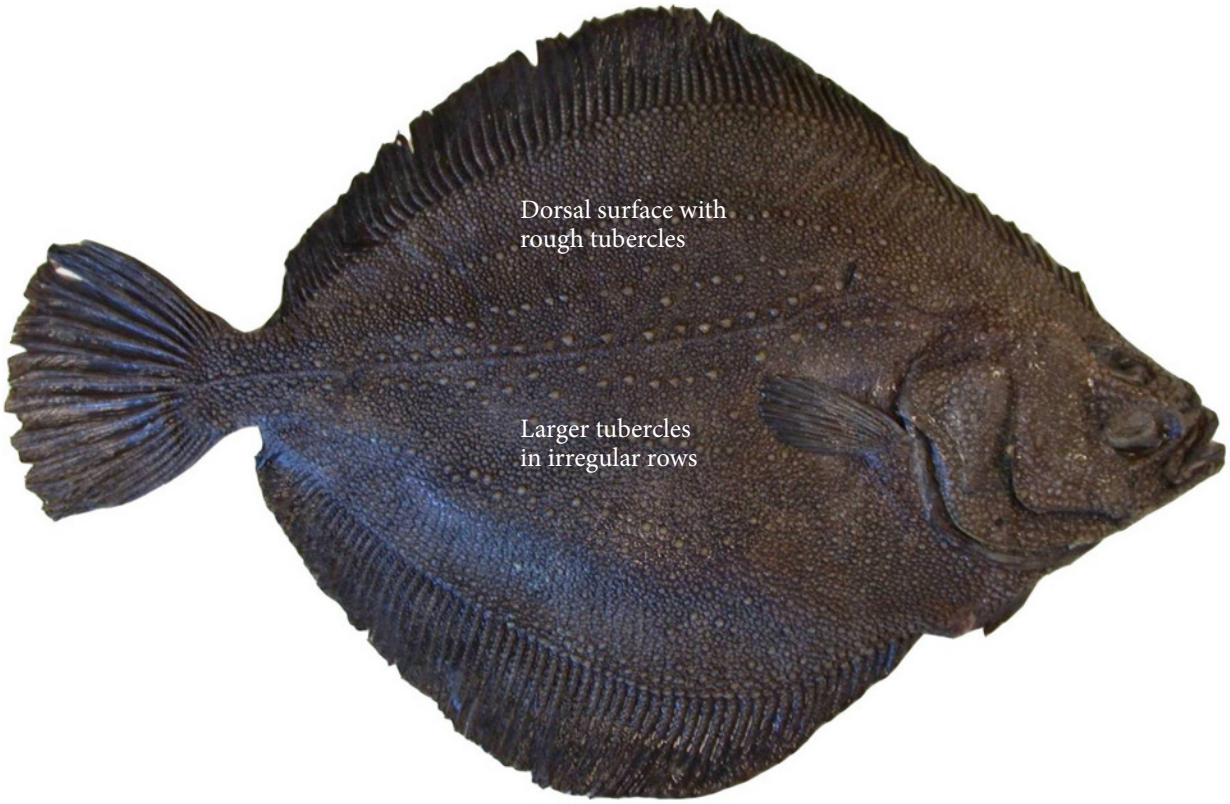


Description
Predominantly right-eyed, starry flounder can be left-eyed. They have an oval body shape and a slender, pointed head. The dorsal side is olive gray to brown or almost black, with darker mottling in some cases. The dorsal, anal, and caudal fins are marked with prominent dark bars, alternating with light white/yellow to white/orange bars. The ventral side is generally white but can have dark blotches. The unbranched lateral line has a slight curve over the pectoral fin. The mouth is small, the maxillary extending to below the anterior portion of the lower eye. The eyes are small, with the lower eye anterior to the upper, and the interorbital is flat. Rough, star-shaped scales or tubercles cover the eyed side. There is a strong anal spine. To 91 cm TL.

Similar species
Starry flounder can hybridize with English sole (*Parophrys vetulus*), and the resulting cross differs from starry flounder in that the bars on the dorsal and anal fins are paler and less well defined, there are no bars on the caudal fin, the dorsal side lacks tubercles, and there is a short, forked dorsal branch to the lateral line.

Distribution
Starry flounder range from the Seas of Japan and Okhotsk to the Chukchi and Bering Seas through Arctic Alaska to Los Angeles Harbor in southern California, usually found near shore and often entering brackish or fresh water, to depths of 375 m.

Roughscale sole (*Clidoderma asperrimum*)



Description
Roughscale sole are dark brown with some indefinite darker blotches dorsally, and gray to gray/brown ventrally. The dorsal side is covered with rough, bony tubercles. The larger tubercles are in irregular rows. The scaleless blind side is smooth. The lateral line has a short branch over the upper eye, and the main branch has a low arch over the pectoral fin. The mouth is small. The jaws extend to below the front edge of the lower eye, and a low ridge runs between the eyes. The anal spine is inconspicuous. To 62 cm TL.

Similar species
This species is not easily confused with other species.

Distribution
Although not very abundant, roughscale sole range from the Yellow and East China Seas through the Bering Sea to northern California, at depths of 15–1,900 m.

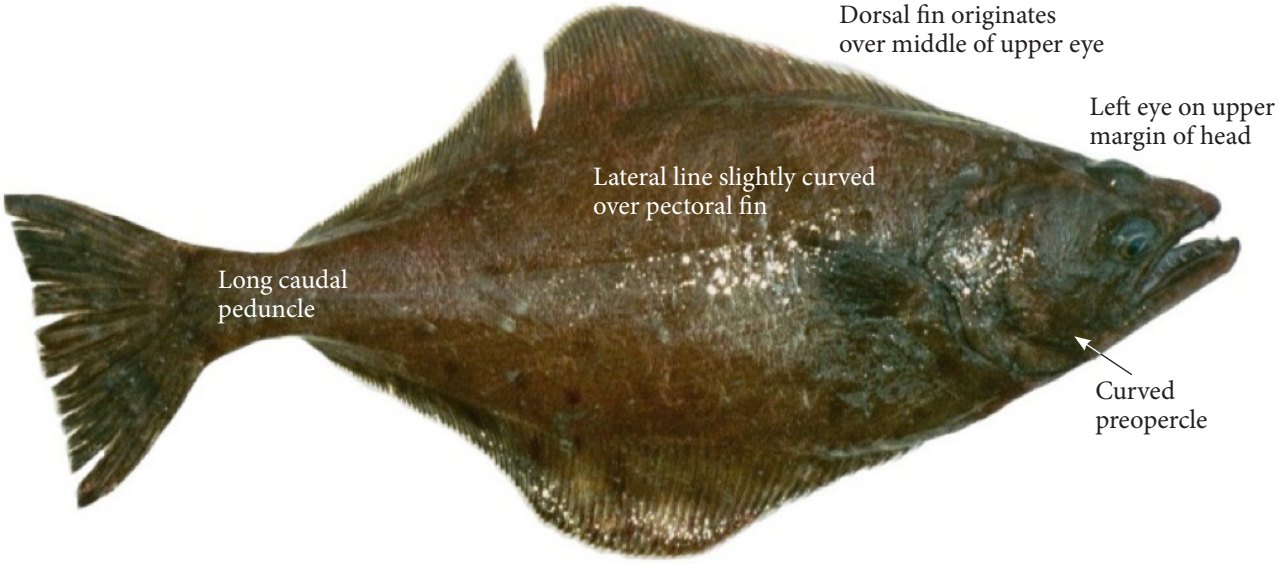
Greenland turbot, Greenland halibut (*Reinhardtius hippoglossoides*)

Description
Greenland turbot are dark olive brown to brown and purple/black and may have some sparse, dark mottling dorsally and dark gray ventrally. The body is elongate. The mouth is large, the maxilla extending to or beyond the posterior margin of the eye. The lower jaw projects just beyond the anterior end of the upper jaw. The eyes are small, with a wide, flat interorbital space. The upper eye is on the head's upper margin and visible from the blind side. The preopercle has a right angle at the posterior margin, giving it an L shape, and 4–5 pores along the edge. There are 12–22 short, blunt gill rakers on the first arch. The anal spine is absent. The dorsal fin originates at the rear of or beyond the upper eye. The lateral line is nearly straight, slightly sloping above the pectoral fin. The small cycloid scales are tight to the body and smooth to the touch. To 130 cm TL.

Similar species
Arrowtooth flounder (*Atheresthes stomias*) have a curved preopercle without pores (L-shaped with 4–5 pores in Greenland turbot) and 13–21 long, slender gill rakers on the first arch (gill rakers short and blunt in Greenland turbot).

Distribution
In the Atlantic Ocean, Greenland turbot range from Ireland through the Barents Sea to Spitsbergen in the Svalbard Islands to New Jersey. In the Pacific from Sagami Bay in the Sea of Japan to the Okhotsk, Bering, Chukchi, and Beaufort Seas, to the Coronado Islands, northern Baja California, Mexico, at depths of 14–2,000 m.

Arrowtooth flounder (*Atheresthes stomias*)



Description
Arrowtooth flounder are dark olive brown to brown/black, and may have some sparse dark mottling dorsally and dirty white ventrally. The body is somewhat elongate. The mouth is large, with two rows of arrow-shaped teeth in the jaws that extend to or just beyond the rear of the lower eye. The upper eye is on the head's upper margin and is visible from the blind side. The curved preopercle lacks pores. The dorsal fin originates at or just ahead of the middle of the eye. There are 13–21 long, slender gill rakers on the first arch, and two gill rakers on the upper limb of the second arch. There are flat, spiny plates at each end of the row of gill rakers and between some of the gill rakers. There is no anal spine. The lateral line is nearly straight, with a slight curve over the pectoral fin. The scales are large and deciduous. To 86 cm TL.

Similar species
The Greenland turbot (*Reinhardtius hippoglossoides*) has an L-shaped preopercle with 4–5 pores along the edge (curved and without pores in arrowtooth flounder), and the gill rakers are short and blunt (long and slender in arrowtooth flounder).

Distribution
Arrowtooth flounder range from the Bering Sea and possibly the Chukchi Sea through the Gulf of Alaska and the northeastern Pacific to San Pedro in southern California, at depths of 18–731 m.

Dover sole (*Microstomus pacificus*)

Description
Dover sole are brown to brownish-gray, and may have dark mottling dorsally and dirty white to dark brownish-gray ventrally. The fins are blackish along the edge. The elongate body is soft, limp, and very slimy. The caudal peduncle is thick and the caudal fin has a rounded posterior margin. A small interorbital ridge is present, the postocular ridge is barely noticeable. The mouth is small, the maxilla extending to below the anterior part of the eye. There are well developed teeth on the blind side, only 0–3 teeth in either jaw on the eyed side. There is no anal spine. The lateral line is nearly straight with a low curve above the pectoral fin and a short anterior branch. To 76 cm TL.

Similar species
Deepsea sole (*Embassichthys bathybius*) have a distinct ridge between the eyes, a narrow caudal peduncle, a round caudal fin, and well developed teeth in both jaws (indistinct interorbital ridge, thick caudal peduncle, caudal fin not round, well developed teeth blind side only in Dover sole).

Distribution
Dover sole range from the southeastern Bering Sea and Stalemate Bank in the Aleutian Islands to Punta San Juanico, southern Baja California, Mexico, at depths of 9–1,372 m.

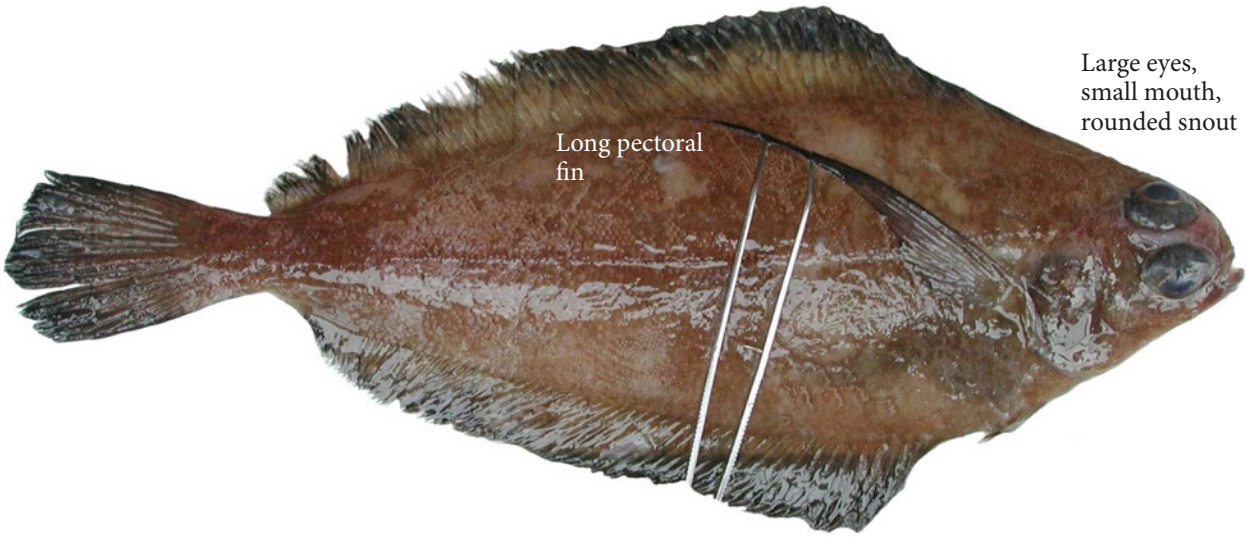
Deepsea sole (*Embassichthys bathybius*)

Description
When young, deepsea sole are dark black to blue/black, with prominent white and blue mottling and bands dorsally and nearly black ventrally. In older, larger specimens, the color fades to brown or brown/red, and the bands and mottling become faint. The ventral side becomes a dirty brown/white to black. The deep body is thicker in the center and becomes increasingly compressed toward the margins. The caudal peduncle is narrow and the caudal fin is round. A high, narrow ridge runs between the eyes. The small mouth has well developed teeth in both jaws. There is no anal spine. The lateral line is nearly straight, with a low arch anteriorly. To 47 cm TL.

Similar species
Dover sole (*Microstomus pacificus*) have a thick caudal peduncle and a curved caudal fin, and well developed teeth on the blind side only (narrow caudal peduncle, round caudal fin, and well developed teeth in both jaws in deepsea sole).

Distribution
Deepsea sole range from Hokkaido, Japan, through the Bering Sea and the Aleutian Islands to the Gulf of Alaska, to the U.S.–Mexico border, at depths of 320–1,433 m.

Rex sole (*Glyptocephalus zachirus*)



Description

Rex sole are light brown to gray with black speckles dorsally and off-white to dusky with black speckles ventrally. The pectoral fin on the eyed side is highly elongate and nearly black. The dorsal, anal, and caudal fins have black edges. The elongate body is slender, highly compressed, and very slimy, with large mucus cavities in the skull that are most evident on the blind side. The small mouth has well developed teeth in both jaws and the snout is rounded. The anal spine is present and conspicuous. The lateral line is nearly straight, with a slight rise or low curve anteriorly with no anterior branch. There are scales on the snout and interorbital ridge, but not the eyes. The caudal fin is scaled; the other fins are not, or are only lightly scaled. To 61 cm TL.

Similar species

The slender profile, rounded snout, small mouth, small, tight scales, and long pectoral fin separate the rex sole from other similarly shaped flatfishes.

Distribution

Rex sole range from the southern tip of the Kamchatka peninsula through the Bering Sea and Stalemate Bank in the Aleutian Islands to off Cedros Island, central Baja California, Mexico, at depths of 0–850 m (but commonly 50–450 m).

Pacific halibut (*Hippoglossus stenolepis*)

Anal spine present

Description
Although classified as right-eyed, on rare occasions Pacific halibut can be left-eyed. Pacific halibut are grayish, green, or greenish-brown to nearly black, with dark and light mottling dorsally and white ventrally. The fins tend to mimic the body color. The body is elongate. The mouth is somewhat small, with the maxilla extending to or beyond mideye. There are two rows of teeth in the upper jaw and one row in the lower jaw. The eyes are somewhat large and close-set. The interorbital space is flat to slightly concave and somewhat narrow. There are 8–12 gill rakers on the first arch. The lateral line has a high arch over the pectoral fin. The anal spine is present. The small, deeply embedded scales make the surface of Pacific halibut smooth to the touch. To 267 cm TL.

Similar species
The California halibut (*Paralichthys californicus*) has 25–32 gill rakers (8–12 in Pacific halibut) and jaws reaching to or beyond the rear of the eye (not beyond mideye in Pacific halibut), but lacks an anal spine (present in Pacific halibut).

Distribution
Pacific halibut range from Hokkaido, Japan, to the Okhotsk, Bering, and Chukchi Seas, to the Aleutian Islands and the Gulf of Alaska to Punta Chamalú, northern Baja California, Mexico, at depths of 6–1,100 m (but usually shallower than 300 m).

Slender sole (*Lyopsetta exilis*)

Description
Slender sole are pale olive brown to reddish-brown dorsally and whitish to pale orange ventrally. The fins are dusky, sometimes with black speckling along the edges. The scales on the flat, elongate, slender body are large, thin, and deciduous. A high ridge runs between the eyes to a nearly straight lateral line that has no dorsal accessory branch. The maxilla of the large mouth extends (almost) to mideye. There are two rows of teeth in the upper jaw that are somewhat enlarged anteriorly but not distinctly caniniform. The anal spine is strong. To 35 cm TL (but commonly less than 25 cm).

Similar species
The arrowtooth flounder (*Atheresthes stomias*) has no ridge between the eyes or anal spine (present in slender sole), and caniniform teeth.

Distribution
Slender sole range from the Gulf of Alaska east of Kodiak Island to west of Punta Pequeña and Punta San Juanico, southern Baja California, Mexico, at depths of 10–800 m.

Petrale sole (*Eopsetta jordani*)

Description
Petrale sole are various shades of brown, sometimes with faint darker blotches dorsally and white ventrally. The fins are mostly brown, often with dark mottling on the dorsal and anal fins. The caudal fin is longest in the middle, with slight indentations near the edges and a brown or dusky pigment to the membranes. The mouth is large, the maxilla extending to or slightly beyond mideye. There are two rows of small teeth on the upper jaw and one row in the lower jaw. The lower jaw or mandibular articulation is rounded. The interorbital space is 4–5 scale rows wide and usually flat. The anal spine is pronounced. The lateral line gently slopes anteriorly. To 75 cm TL, but generally smaller.

Similar species
The flathead sole (*Hippoglossoides elassodon*) has one row of teeth in both jaws (two rows in upper jaw in petrale sole), an angular mandibular articulation (rounded in petrale sole), a prominent ridge between the eyes, and a row of pores behind the lower eye (absent in petrale sole).

Distribution
Petrale sole range from the Bering Sea coast of Alaska and the Aleutian Islands and Gulf of Alaska to Islas Los Coronados, northern Baja California, Mexico, at depths of 0–550 m.

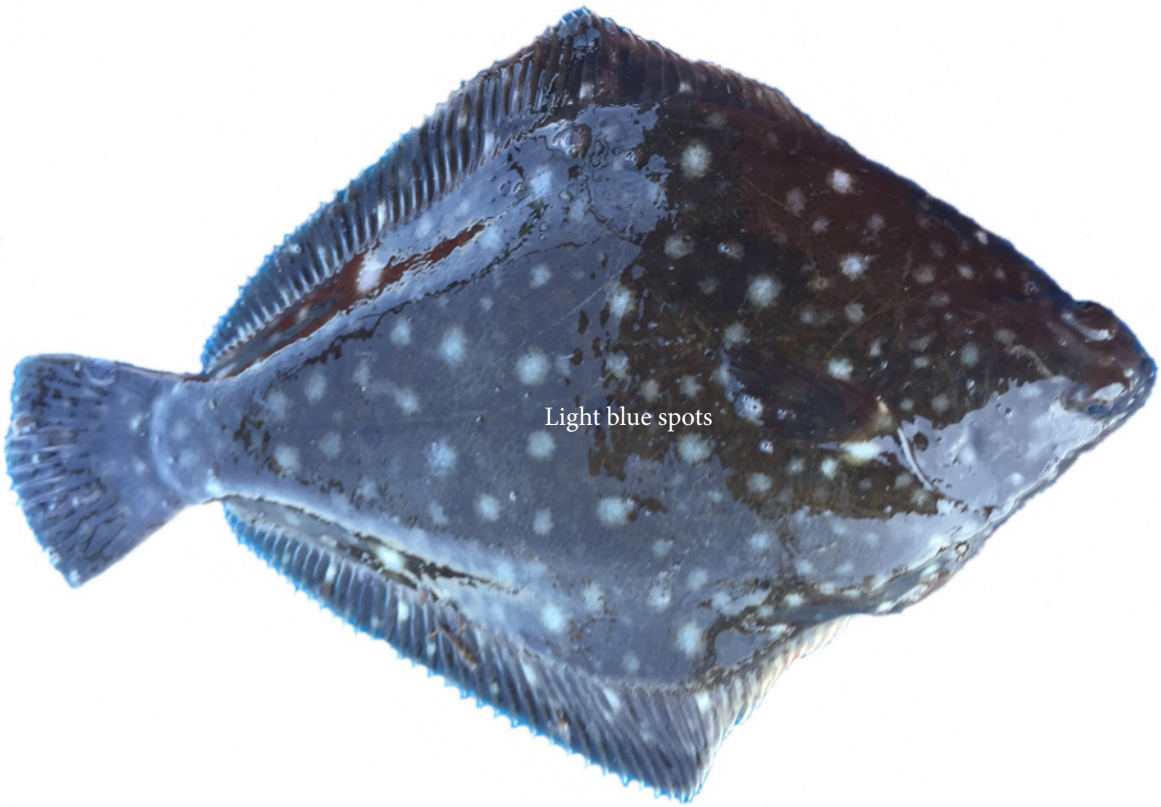
Flathead sole (*Hippoglossoides elassodon*)

Description
Flathead sole are dark olive brown to red/brown, sometimes with darker blotches dorsally. The dorsal and anal fins have dark blotches. The ventral side is translucent, with white areas in the center and extending above the lateral line. The caudal fin is angular and pointed at the center, with clear membranes. The mouth is somewhat large, the maxilla extending to or beyond mideye. There is a single row of teeth in both jaws. The mandibular articulation is angular. There is a sharp ridge in the narrow interorbital space and a prominent curved row of pores behind and below the lower eye. The anal spine is prominent. The nearly straight lateral line arches slightly over the pectoral fin. To 56 cm TL.

Similar species
Petrale sole (*Eopsetta jordani*) have two rows of teeth in the upper jaw (one in flathead sole), no ridge between the eyes, and no pores behind the lower eye (present in flathead sole).

Distribution
Flathead sole range from the northern Sea of Japan and the southern Sea of Okhotsk, to the Bering Sea and the Aleutian Islands, to Monterey, California, at depths of 0–1,050 m (but usually less than 366 m).

Diamond turbot (*Hypsopsetta guttulata*)

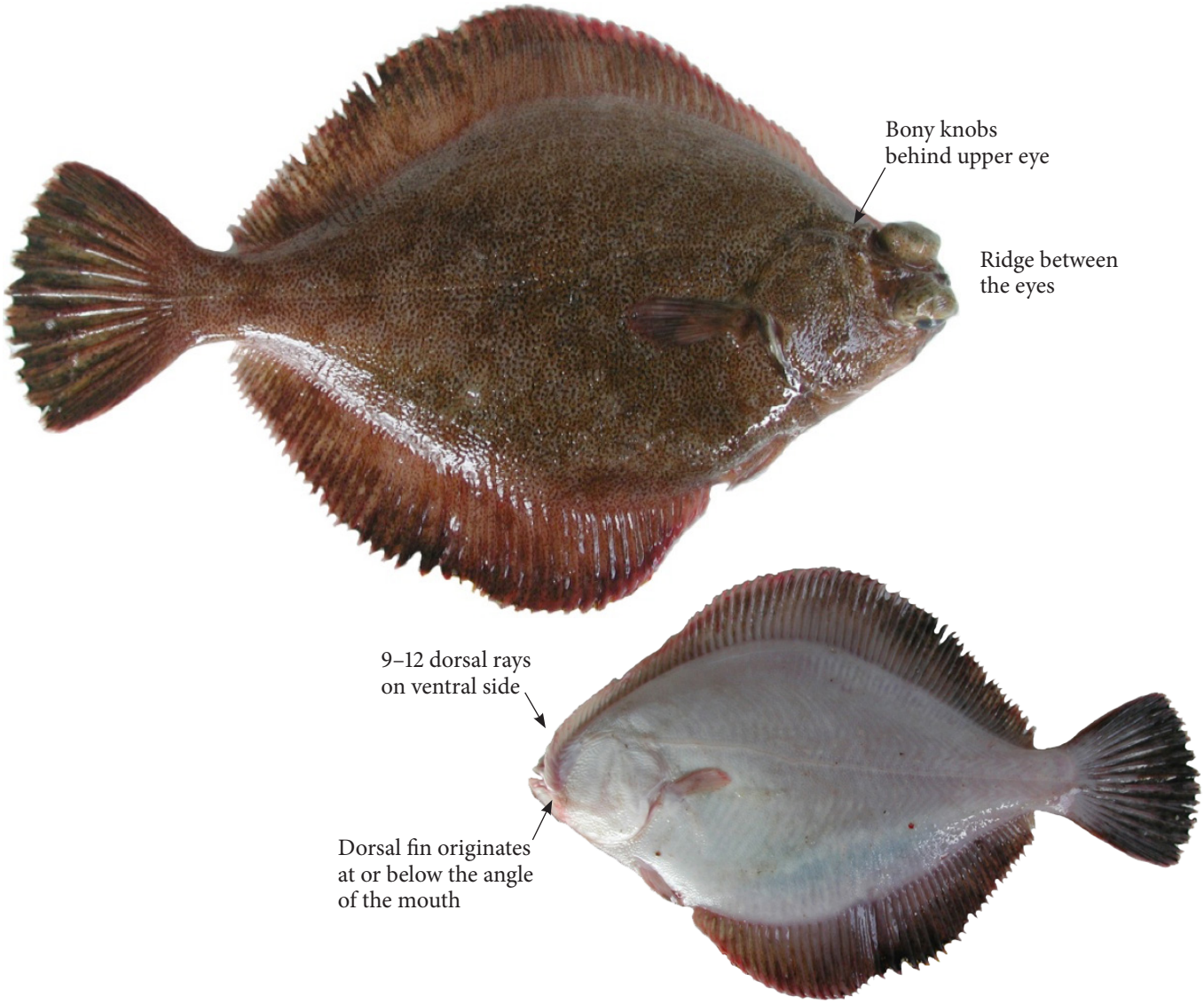


Description
Diamond turbot are dark green/brown to gray/brown, with light blue spots dorsally. The ventral side is bright white, with bright yellow around the mouth and the leading edges of the head. The fins are dusky to light tan. The deep body has a diamond shape. The primary lateral line is nearly straight, with a slight curve over the pectoral fin. The long dorsal accessory branch extends more than halfway to the rounded caudal fin. The dorsal and anal fins are widest in the center, giving strength to the diamond shape. The anterior portion of the dorsal fin is nearly straight and almost completely on the dorsal profile, with only 1–2 rays inserted on the blind side. There is a low ridge between the eyes. The mouth is small, with the jaws extending to or just short of the anterior edge of the eye. The teeth are small and few in number on the eyed side. The anal spine is present. To 46 cm TL.

Similar species
The 1–2 anterior dorsal fin rays extending down the blind side (four or more in other turbots), the light blue spots on the eyed side, and the bright yellow around the mouth and edge of the head on the blind side (absent from other turbots), distinguish the diamond turbot from other similar species.

Distribution
Diamond turbot range from Cape Mendocino, California, to Cape San Lucas, Baja California, Mexico, with an isolated population in the Gulf of California, at depths of 0–50 m (but most commonly 1–10 m).

Curlfin sole, curlfin turbot (*Pleuronichthys decurrens*)

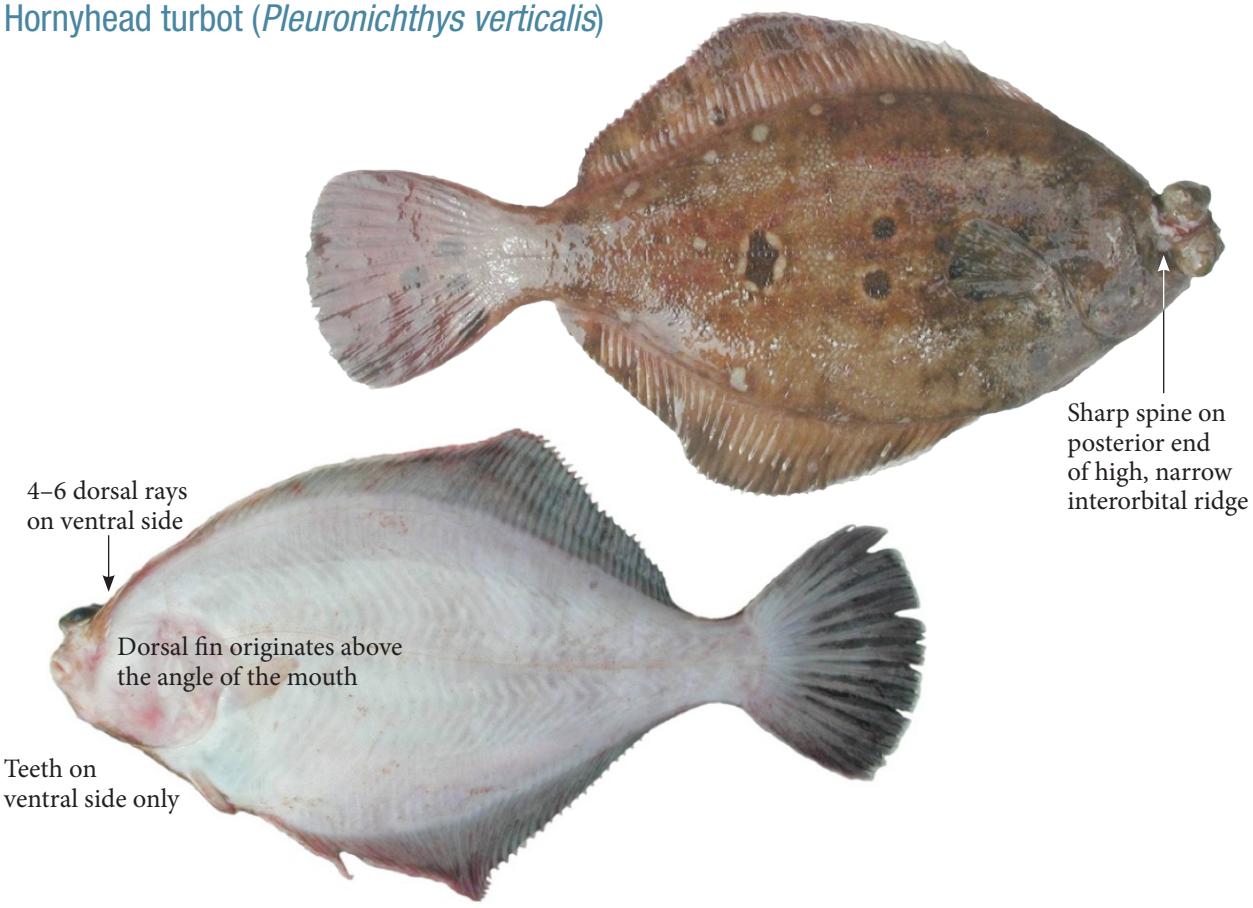


Description
Curlfin sole are greenish-, yellowish-, or reddish-brown to dark brown or black, usually with darker mottling dorsally and white to brown ventrally. The dorsal and anal fins are high. The dorsal fin originates at or below the angle of the mouth, with the first 9–12 rays on the ventral side. The caudal fin is rounded. The lateral line is nearly straight, and the dorsal accessory branch extends to or beyond midbody. There is a prominent ridge between the eyes with a blunt spine on each end. There are 2–3 bony knobs behind the upper eye. The anal spine is present. To 37 cm TL.

Similar species
The 9–12 anterior dorsal fin rays extending down the ventral side (6 or less in other turbots) and the dorsal fin originating at or below the angle of the mouth (above the angle of the mouth in other turbots) distinguish the curlfin sole from similar species.

Distribution
Curlfin sole range from the southeastern Bering Sea and the Gulf of Alaska to Punta San Juanico, southern Baja California, Mexico, at depths of 8–533 m (but usually less than 20 m).

Hornyhead turbot (*Pleuronichthys verticalis*)



Description
Hornyhead turbot are yellowish-brown to dark brown or nearly black with gray, dark brown, or black mottling and possibly pale blotches and light gray or yellow spots dorsally and white ventrally. The lateral line is nearly straight, with a long dorsal accessory branch that extends beyond midbody. The mouth is small and has teeth on the ventral side only. There is a high and narrow bony ridge between the eyes with a sharp spine on the back end. The dorsal and anal fins are high. The origin of the dorsal fin is above the angle of the mouth, with the first 4–6 anterior dorsal rays on the ventral side. The anal spine is present. To 37 cm TL.

Similar species
The curlfin sole (*Pleuronichthys decurrens*) has 9–12 dorsal rays on the ventral side and bony tubercles behind the upper eye. The C-O sole (*P. coenosus*) has a longer, more prominent ridge between the eyes, without spines. The spotted turbot (*P. ritteri*) has teeth in the lower jaw on the eyed side.

Distribution
Hornyhead turbot range from Oregon to Magdalena Bay, southern Baja California, Mexico, and the Gulf of California, at depths of 9–200 m.

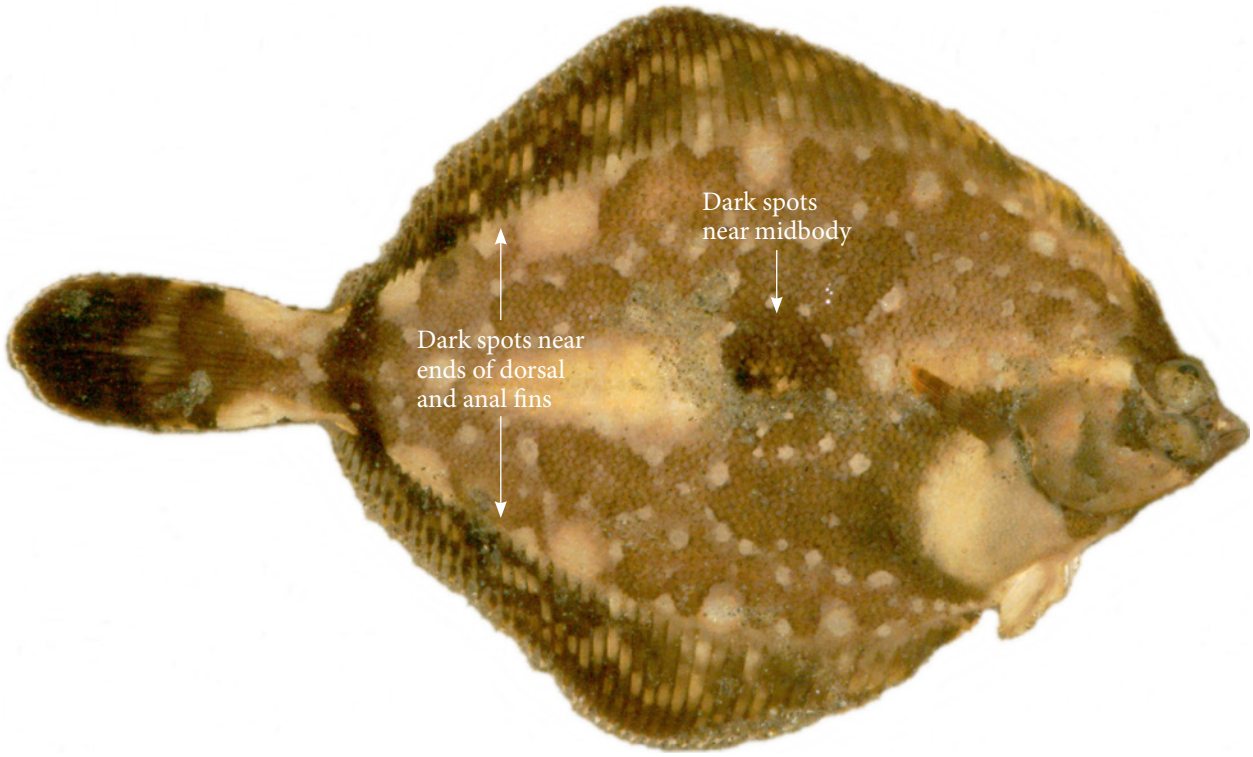
C-O sole, C-O turbot (*Pleuronichthys coenosus*)

Description
C-O sole are light brown to black, with light and dark mottling and generally a dark spot in the center of the body. The dorsal and anal fins mimic the body coloration. Usually there is a dark crescent on the anterior end of the caudal fin surrounding a dark circular spot in the center, looking like an inverted C and an O. The ventral side is white. The first 5–6 anterior rays of the high dorsal fin are on the blind side, with the first ray above the angle of the mouth. There is a long, spineless ridge between the eyes. The nearly straight lateral line has a long dorsal accessory branch that extends beyond midbody. There is a long, prominent ridge between the large, protruding eyes. A small anal spine is present. To 36 cm TL.

Similar species
The curlfin sole (*Pleuronichthys decurrens*) has 9–12 dorsal rays on the ventral side and bony tubercles behind the upper eye. The hornyhead turbot (*P. verticalis*) has no teeth in the lower jaw on the eyed side and no dark spots on the body or tail. The spotted turbot (*P. ritteri*) has a low, flat, spineless ridge between eyes, two prominent black spots midbody along the lateral line, and two dark spots at the ends of the dorsal and anal fins.

Distribution
C-O sole range from Sitka in southeastern Alaska to Bahía San Quintín, northern Baja California, Mexico, at depths of 0–350 m (but most commonly near shore at depths less than 15 m).

Spotted turbot (*Pleuronichthys ritteri*)

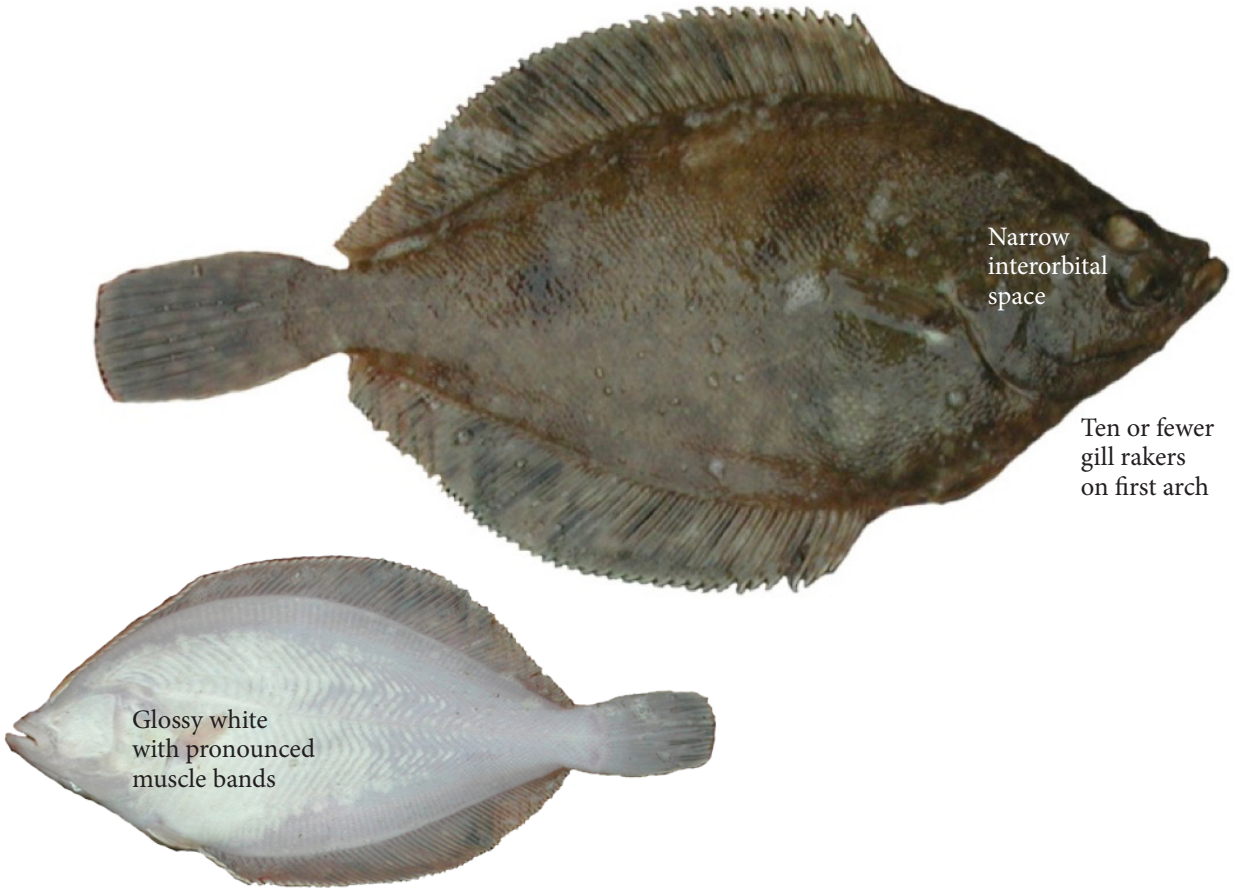


Description
Spotted turbot are brown to gray with lighter speckling. There are two dark spots along the lateral line about midbody. The first is most prominent, the second is posterior to the first and can be smaller and less visible. There are two dark spots on the body near the posterior ends of the dorsal and anal fins. The ridge between the eyes is low and flat. The lateral line is nearly straight, with a long dorsal accessory branch that extends to or beyond midbody. The dorsal and anal fins are high, with the first 5–6 anterior dorsal rays on the ventral side and the first ray above the angle of the mouth. The anal spine is present. To 30 cm TL.

Similar species
The curlfin sole (*Pleuronichthys decurrens*) has 9–12 dorsal rays on the ventral side and bony tubercles behind the upper eye. The hornyhead turbot (*P. verticalis*) has no teeth in the lower jaw on the dorsal side and no dark spots on the body or tail. The C-O sole (*P. coenosus*) has a long, prominent, spineless ridge between the eyes.

Distribution
Spotted turbot range from Morro Bay, California, to Magdalena Bay, southern Baja California, Mexico, at depths of 0–50 m.

Southern rock sole (*Lepidopsetta bilineata*)



Description
Southern rock sole are yellowish- to greenish- or olive brown to dark brown, with scattered dark brown blotches and light spots dorsally. The dorsal and anal fins mimic the body coloration. The ventral side is bright white, with the muscle bands—especially anteriorly—highlighted with a pronounced, glossy white. The interorbital space is narrow. There can be three, but most commonly 4–9, supraorbital pores. The lateral line arches strongly above the pectoral fin. The dorsal accessory branch extends to below dorsal fin ray 13–18. The scales on the eyed side are nearly always rough. There are generally ten or fewer broad, robust gill rakers on the first arch, and usually three or fewer on the upper limb. To 58 cm TL.

Similar species
The northern rock sole (*Lepidopsetta polyxystra*) has ten or more gill rakers on the first gill arch (ten or less in southern rock sole), three or more on the upper arch (three or less in southern rock sole), a uniformly creamy white blind side, and four or fewer supraorbital pores.

Distribution
Southern rock sole range from the southeastern Bering Sea and the Aleutian Islands to Cortez Banks, Baja California, Mexico, at depths of 0–575 m (but usually less than 183 m).

Northern rock sole (*Lepidopsetta polyxystra*)

Description
Northern rock sole are yellowish- or greenish-brown with scattered dark brown blotches and white spots dorsally and creamy white ventrally. The dorsal, anal, and caudal fins have brown blotches. The interorbital space is wide, and there are usually 1–3 (rarely 4–7) supraorbital pores. There are generally 10 or more long, slender, pointed gill rakers on the first arch, and usually three or more on the upper limb. The lateral line arches strongly above the pectoral fin. The long dorsal accessory branch extends to below dorsal fin ray 13–18. The scales on the eyed side are nearly always rough. There is a pronounced anal spine. To 69 cm TL.

Similar species
The southern rock sole (*Lepidopsetta bilineata*) has 10 or fewer thick, blunt gill rakers on the first gill arch, with three or fewer on the upper arch and usually more than four pores below the eye.

Distribution
Northern rock sole range from the northern coast of Hokkaido, Japan, through the Kuril Islands and the Okhotsk Sea, through the Gulf of Anadyr and the Bering Sea, through the Aleutian Islands to Washington State and Puget Sound, at depths of 0–246 m.

Hybrid sole

Description
This description refers to the flatfish formerly known as *Inopsetta ischyra* (forkline or bastard sole). However, other hybrids do exist, and are not included in this text. The markings and characteristics of hybrid sole can be quite variable, but generally, the hybrid sole has a diamond-shaped body that is brown to olive brown with faint light and dark mottling dorsally and creamy white ventrally. The dorsal and anal fins have faint dark bars. The lateral line extends onto the caudal fin and has a low arch over the pectoral fins. The short, forked dorsal accessory branch does not extend past the gill cover. The mouth is small. The jaws reach below the front edge of the lower eye. A prominent, rough ridge runs between the eyes to the back of the upper eye. Rough scales cover both sides of the body and extend onto the dorsal and anal fins. To 46 cm TL.

Similar species
The English sole (*Parophrys vetulus*) has no bars on the fins and the dorsal accessory branch is long and unforked. The starry flounder (*Platichthys stellatus*) has darker, better defined bars on the dorsal, anal, and caudal fins, prominent tubercles on the dorsal side, and no dorsal accessory branch.

Distribution
Although rare outside of Puget Sound, hybrid sole range from the Bering Sea to San Francisco, California, at depths of 0–591 m.

English sole (*Parophrys vetulus*)

Description
English sole are generally olive brown, reddish-brown, or brown, possibly with some vague blotching that usually fades with age dorsally. However, small and young specimens can exhibit varying degrees of light speckling and dark mottling. The ventral side is white to pale yellow, sometimes with a reddish-brown tinge. The dorsal and anal fins usually mimic the color of the eyed side, sometimes with dark edges. The smooth body is long and diamond-shaped. The slender, pointed head has a small mouth and a high, narrow ridge between the eyes. The lateral line has a low curve above the pectoral fin, and the long dorsal accessory branch extends to under the first 21–37 dorsal fin rays. There is a pronounced anal spine. To 61 cm TL, but usually much less.

Similar species
Southern rock sole (*Lepidopsetta bilineata*) have rough scales on the eyed side (smooth scales in English sole).

Distribution
English sole range from Nunivak Island in the Bering Sea and Agattu in the Aleutian Islands to the Alaska Peninsula and the Gulf of Alaska to San Cristobal Bay, Baja California, Mexico, at depths of 0–550 m (but commonly less than 250 m).

Sand sole (*Psettichthys melanostictus*)

Description

Sand sole are gray, gray/green, or brown, with fine black speckling dorsally and white to a translucent gray/white ventrally. The first 4–9 rays of the dorsal fin are long, threadlike, and mostly free of the membrane. The mouth is large, the maxilla extending (nearly) to mideye. Both jaws have a single series of large teeth with a few needlelike canine teeth anteriorly. The lateral line curves slightly above the pectoral fin. The long dorsal accessory branch extends to below the first 18–22 anterior dorsal fin rays. The anal spine is prominent. To 63 cm TL.

Similar species

The free anterior dorsal fin rays and distinct canine teeth in both jaws distinguish the sand sole from similar species.

Distribution

Sand sole range from the southeastern Bering Sea at Unalaska Island and the Gulf of Alaska to Redondo Beach in southern California, at depths of 0–325 m (but usually less than 150 m).

Butter sole (*Isopsetta isolepis*)

Description
Butter sole are grayish-brown, olive brown, or various shades of brown, sometimes with yellow or green mottling dorsally and white ventrally. The dorsal and anal fins have a bright yellow edge. The interorbital space is flat and the upper eye is not visible from the blind side. The anterior dorsal fin rays are partially free but not elongate. The caudal fin has a broad, rounded V shape. The lateral line has a low arch above the pectoral fin. The dorsal accessory branch extends beyond the operculum to under the first 21–28 anterior dorsal fin rays. The scales on the eyed side are rough and extend onto the dorsal and anal fins. Rough scales cover the body and fins. To 55 cm TL.

Similar species
The southern rock sole (*Lepidopsetta bilineata*) has tuberculate scales on the dorsal side and a short dorsal accessory branch. The sand sole (*Psettichthys melanostictus*) has a larger mouth, wide-spaced eyes, and a short dorsal accessory branch.

Distribution
Butter sole range from the southeastern Bering Sea and Amchitka Island in the Aleutian Islands to Ventura, California, at depths of 0–425 m (but usually less than 150 m).

Tetraodontiformes (Tetraodontiforms)

The tetraodontiforms consist of nine families, about 101 genera, and 357 species, most of which inhabit shallow tropical and subtropical nearshore waters. Members of this order vary greatly in form, ranging from relatively normal configurations to very unconventional, specialized forms. However, with 16–30 vertebrae, they are generally round or oval instead of elongate. Most species range in size from 8–60 cm, but the ocean sunfish (*Mola mola*) can grow to over 3 m. Body color and color pattern varies, but species often have very intricate color patterns or are highly colored. Some species are able to enlarge their bodies by inflating their stomach, while others can slightly enlarge their bodies by expanding a ventral flap supported by a large, movable pelvic bone. Characteristics that distinguish the tetraodontiforms include a small gill opening restricted to a short slit on the side of the head. The mouth is small. Most species have teeth that are fused into a beaklike plate, fused maxilla and premaxilla, and modified scales that form overlapping and even sutured bony plates or sharp, projecting spines or prickles. Some species lack scales, but the skin itself can be thickened and hardened by deep layers of connective tissue. There are no anal fin spines. The dorsal fin spines are either absent or, if present, never more than six. The pelvic fins are absent or, if present, consist of one spine and two small soft rays.

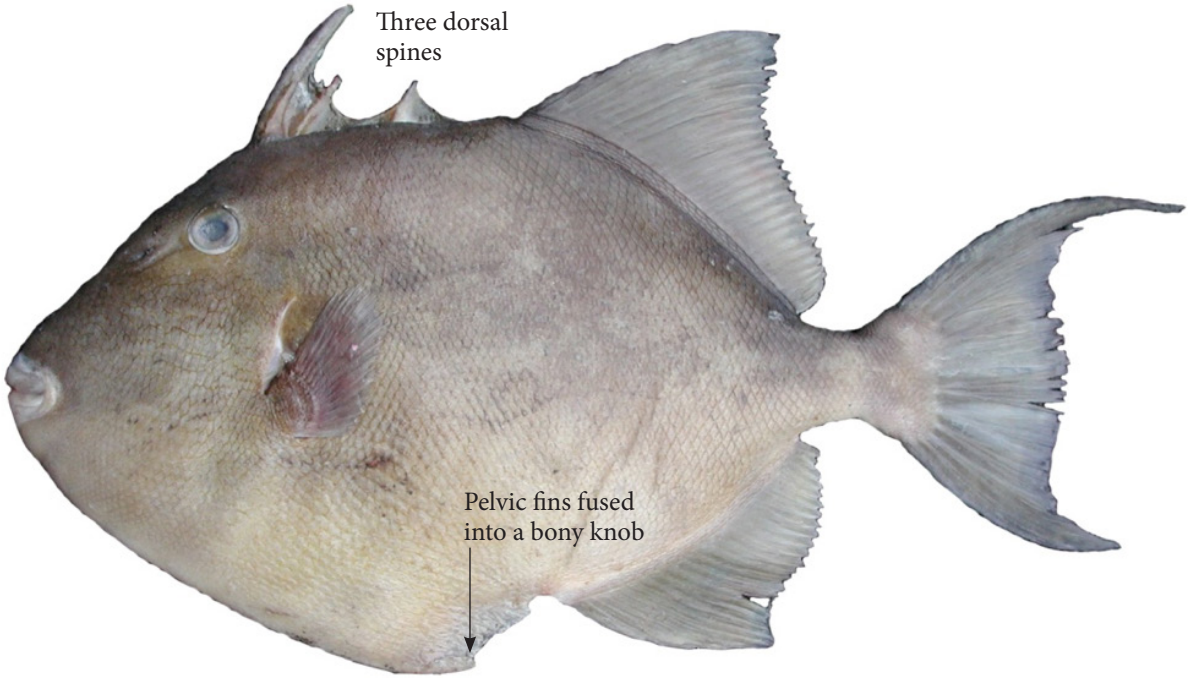
Balistidae (Triggerfishes and Filefishes)

The triggerfishes, also known as leatherjackets because of their thick skin, get their name from the specialized first dorsal spine that locks in place. The family consists of over 120 species that inhabit the warm coastal waters of the Atlantic, Indian, and Pacific Oceans. Only a few species wander into the temperate waters. In general, the triggerfish have a highly compressed body. The first dorsal fin has 2–3 spines. The first spine has a specialized locking mechanism and is far forward, the second is reduced, the third is reduced or absent and followed by a long, soft dorsal. The long anal fin is opposite the dorsal. The pelvic fins (when present) are fused together to form a small spine or tubercle. The caudal fin consists of 12 rays. In the small mouth, there are two rows of protruding teeth in the upper jaw.

Key to the Balistidae of the FRAM Surveys

1	3 completely visible dorsal fin spines	***Balistes polylepis***	p 404
1	2 completely visible dorsal fin spines, third spine tiny or absent		2
2(1)	Black	***Melichthys niger***	p 404
2	Not black	***Xanthichthys mento***	p 405

Finescale triggerfish (*Balistes polylepis*)



Description
Finescale triggerfish are light brown to tan or olive, often with blue spots or speckles on the head. This highly compressed fish has dusky to dark fins. The first dorsal has three stiff and clearly visible spines. The long upper and lower caudal fin rays give the tail its unique shape. Fused together when present, the pelvic fins form a small, tuberclelike spine. The small, slitlike gill opening is just anterior to pectoral fin. There are two rows of incisorlike teeth in the upper jaw. To 76 cm TL.

Similar species
The three visible dorsal spines (two in other species) distinguish the finescale triggerfish from similar species.

Distribution
Finescale triggerfish range from Point St. George, Del Norte County, California, to Baja California, Mexico, the Gulf of California, and the coast of mainland Mexico to Chile, at depths of 0–512 m. Although very rare north of southern California, individual records of finescale triggerfish have been recorded from Metlakatla, southeastern Alaska; Kyuquot Sound, British Columbia, Canada; Willipa Bay, Washington; and Yaquina Bay, Oregon.

Black durgon (*Melichthys niger*)

Description
Black durgon are blackish to dark greenish-black with purple overtones. There is a pale blue to blue/white line at the base of the rayed portions of the black dorsal and anal fins. There may be a faint yellowish hue on the head, and usually thin blue lines radiating dorsally and anteriorly from the eye. The body is highly compressed. The first dorsal is composed of two stiff, clearly visible

spines; the third spine, when present, is greatly reduced and usually only marginally visible in small specimens. The small, slitlike gill opening is just anterior to pectoral fin. The upper and lower rays on the caudal fin are very long, which gives the tail a unique shape. Fused together, the pelvic fins form a small, tuberclelike spine. There is a deep groove in front of the eye. The small, slitlike gill opening is just anterior to the pectoral fin. The scales on the posterior portion of the body have prominent keels that form longitudinal ridges. To 50 cm TL.

Similar species
The finescale triggerfish (*Balistes polylepis*) has three visible dorsal spines and is not black. The redtail triggerfish (*Xanthichthys mento*) has a series of grooves in the cheek and is not black.

Distribution
Black durgon have a circumtropical distribution. Extremely rare north of Mexico, black durgon range from San Diego, California, to Malpelo Island, Colombia, at depths of 0–75 m.

Redtail triggerfish (*Xanthichthys mento*)

Description
Redtail triggerfish body coloration varies and is somewhat sexually dimorphic. Females are brown, sometimes with a bluish cast. The narrow grooves separating the scales are darker brown with a small, even darker brown spot within the groove at the corner of each scale. The head has a bluish cast due to the blue coloration in the narrow spaces between the scales. The 5–8 prominent grooves on the cheek are bright blue with a narrow dark line down the middle. The first dorsal fin membrane is dark brown mostly along the margins and bright orange/red toward the base. The margins of the second dorsal and anal fins are maroon. The caudal fin margin is bright orange/yellow with a blue submarginal line. The pectoral fin rays are yellowish. Males tend to have a yellow tint, especially ventrally on the body, and a blue spot on each scale. The margins of the second dorsal and anal fins are bright yellow and the caudal fin margin is bright red, with a well developed blue submarginal band. The central region of the caudal fin is reddish-brown. The head is bluish, with an irregular light blue line from the upper end of the gill opening to the base of the first dorsal fin, and then posteriorly along the back just below the base of the second dorsal fin, and joining the submarginal blue band in the caudal fin. A second blue line may extend forward from the lower submarginal blue band along the base of the anal fin and along the lower abdomen, breaking up into a row of dots anteriorly. The ventral edge of the abdomen is dark brown. There is a small blue spot at the base of each ray of the second dorsal and anal fins. The first dorsal fin is composed of two stiff and clearly visible spines. The long, high anal and second dorsal fins are nearly opposite and well posterior on the body. The upper and lower rays on the caudal fin are very long, giving the tail a unique shape. The pelvic fins are fused together forming a small, tuberclelike spine. The small, slitlike gill opening is just anterior to the pectoral fin. To 30 cm TL.

Similar species
The finescale triggerfish (*Balistes polylepis*) has three visible dorsal spines and no grooves on the cheeks. The black durgon (*Melichthys niger*) is black and does not have grooves on the cheeks.

Distribution
Redtail triggerfish range from southern Japan and the Ryukyu, Izu, Marcus, Wake, and Hawaiian Islands to Ventura in southern California, and the Pitcairn, Easter, Revillagigedo, Clipperton, and Galápagos Islands, at depths of 6–130 m. Redtail triggerfish are very rare in U.S. waters, with only a few records from Hawaii and Ventura, California.

Molidae (Molas)

The molas are highly compressed fishes found worldwide in the warm seas. Greatly truncated behind the dorsal fin, the body appears as if cut off. The posteriorly placed, tall, stiff, and single dorsal and anal fins are nearly opposite and used for propulsion. Most molas have a thick, scalloped posterior edge (or clavus) which is used like a rudder instead of a true caudal fin. There are no pelvic fins. Molas have two fused, beaklike teeth in each jaw. There are two small nostrils on each side of the head with a porelike gill opening. There is no lateral line or swim bladder.

Key to the Molidae of the FRAM Surveys

1	Body nearly twice as long as it is deep ..... ***Ranzania laevis***	p 406
1	Body nearly as long as it is deep 2	
2(1)	Caudal area blunt ..... ***Mola mola***	p 406
2	Caudal area modified, tapering to a short, pointed caudal fin ..... ***Masturus lanceolatus***	p 407

Slender mola (*Ranzania laevis*)

Description
The slender mola is over twice as long as it is deep. The body color is dark or dusky dorsally with a silver/gray base laterally that may be overlaid with dark copper, and light ventrally. There are bluish-white streaks and spots on the body and a series of bluish-white streaks with dark margins on the snout and under the eye. The ventral portions of the streaks that occur from just below the eye can have a series of dark spots. The skin is leathery. The tiny mouth appears as a vertical slit. The small gill opening is located just ahead of the pectoral fin. To 100 cm TL.

Similar species
Other Molidae are nearly oval (about as deep as long).

Distribution
Slender molas occur in the tropical and temperate seas of the world. Although very rare north of Mexico, slender mola range from central California to Chile, at depths of 0–140 m.

Ocean sunfish (*Mola mola*)

Description
Ocean sunfish are nearly oval and are generally gray to grayish-tan. The tall, stiff, and single dorsal and anal fins are well posterior, nearly opposite, and used for propulsion. The skin is leathery. The mouth is tiny and has two fused, beaklike teeth in each jaw. The gill opening is small and is located just ahead of the slightly rounded pectoral fin. To 330 cm TL.

Similar species
Ocean sunfish are not easily confused with other species.

Distribution
Mola mola occur in tropical and temperate waters worldwide, at depths of 0–480 m.

Sharptail mola (*Masturus lanceolatus*)

Description
Sharptail mola are dark gray/brown to black dorsally to various shades of gray to silver/gray laterally, which may or may not have dark and/or light spots. The dorsal and anal fins are dark, and the caudal fin can sometimes have light spots. The modified caudal area tapers to a short, pointed caudal fin of approximately 18–20 soft rays. The caudal fin extends around from close behind the dorsal fin to close behind the anal fin, with a triangular, blunt-tipped projection a little above the midlevel of the body. The small scales on the leathery skin give the body a smooth appearance. To 337 cm TL.

Similar species
The pointed caudal fin distinguishes the sharptail mola from all other related species.

Distribution
Sharptail mola occur in tropical and warm, temperate seas worldwide, at depths of 0–670 m.

References

Anderson, M. E., and V. V. Federov. 2004. Family Zoarcidae Swainson 1839: Eelpouts. California Academy of Sciences Annotated Checklists of Fishes 34:1–58.

Assis, C. A. 1993. On the Systematics of *Macrorhamphosus scolopax* (Linnaeus, 1758) and *Macrorhamphosus gracilis* (Lowe, 1839). II – Multivariate Morphometric Analysis. Arquiva Histórico Museu Bocage 2:384–402

Clarke, T. A. 1984. Diet and Morphological Variation in Snipefishes, Presently Recognized as *Macrorhamphosus scolopax*, from Southeast Australia: Evidence for Two Sexually Dimorphic Species. Copeia 1984(3):595–608.

Dooley, J. K. 1978. Systematics and Biology of the Tilefishes (Perciformes: Branchiostegidae and Malacanthidae), with Descriptions of Two New Species. U.S. Department of Commerce, NOAA Technical Report NMFS-CIRC-411411.

Ebert, D. A. 2003. Sharks, Rays, and Chimaeras of California. California Natural History Guides No. 71. University of California Press, Berkeley.

Ebert, D. A., W. T. White, K. J. Goldman, L. J. V. Compagno, T. S. Daly-Engel, and R. D. Ward. 2010. Resurrection and Redescription of *Squalus suckleyi* (Girard, 1854) from the North Pacific, with Comment on the *Squalus acanthias* Subgroup (Squaliformes: Squalidae). Zootaxa 2612:22–40.

Hitz, C. R. 1965. Field identification of the northeastern Pacific rockfish (*Sebastodes*). U.S. Fish and Wildlife Service Circular 203.

Keller, A. A., J. R. Wallace, and R. D. Methot. 2017. The Northwest Fisheries Science Center's West Coast Groundfish Bottom Trawl Survey: History, Design, and Description. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-136. DOI: 10.7289/V5/TM-NWFSC-136

Kotlyar, A. N. 2008a. Revision of the Genus *Poromitra* (Melamphaidae), part 1: Species of Group *P. crassiceps*. Journal of Ichthyology 48(4):437–450.

Kotlyar, A. N. 2008b. Revision of the Genus *Poromitra* (Melamphaidae), part 2: New Species of the Group *P. crassiceps*. Journal of Ichthyology 48(8):553–564.

Lea, R. N., and R. F. Feeney. 2013. Status of Two Species of Tilefish *Caulolatilus princeps* (Jenyns) and *C. hubbsi* Dooley, Originally Described from the Galapagos Islands. Galapagos Research 68:10–12. Available: aquaticcommons.org/21548/. (September 2017).

Martinez-Takeshita, N., C. M. Purcell, C. L. Chabot, M. T. Craig, C. N. Paterson, J. R. Hyde, and L. G. Allen. 2015. A Tale of Three Tails: Cryptic Speciation in a Globally Distributed Marine Fish of the Genus *Seriola*. Copeia 2015(2):357–368.

Nakamura, I., and N. V. Parin. 1993. FAO Species Catalogue, volume 15: Snake Mackerels and Cutlassfishes of the World (Families Gempylidae and Trichiuridae), An Annotated and Illustrated Catalogue of the Snake Mackerels, Snoeks, Escolars, Gemfishes, Sackfishes, Domine, Oilfish, Cutlassfishes, Scabbardfishes, Hairtails, and Frostfishes Known to Date. FAO Fisheries Synopsis 125(15).

Orr, J. W., M. A. Brown, and D. C. Baker. 2000. Guide to Rockfishes (Scorpaenidae) of the Genera *Sebastes*, *Sebastolobus*, and *Adelosebastes* of the Northeast Pacific Ocean, 2nd edition. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-117.

Supplemental Data Sources

Abe, T. and H. Hotta. 1963. Description of a New Deep-Sea Fish of the Genus *Rondeletia* from Japan. Japanese Journal of Ichthyology X(2/6):43–48.

Ahlstrom, E. H., J. L. Butler, and B. Y. Sumida. 1976. Pelagic Stromateoid Fishes (Pisces, Perciformes) of the Eastern Pacific: Kinds, Distributions, and Early Life Histories and Observations on Five of These from the Northwest Atlantic. Bulletin of Marine Science 26(3): 323–334.

Airame, S. 2000. Species of Interest in the Channel Islands. Channel Islands National Marine Sanctuary, Santa Barbara, California.

Allen, L. G., T. E. Hovey, M. S. Love, and J. T. Smith. 1995. The Life History of the Spotted Sand Bass (*Paralabrax maculatofasciatus*) within the Southern California Bight. California Cooperative Oceanic Fisheries Investigations (CalCOFI) Reports 36:193–203.

Ambrose, D. A. 1996. Moridae: Codlings. Pages 500–507 *in* H. G. Moser, editor. The Early Stages of Fishes in the California Current Region. California Cooperative Oceanic Fisheries Investigations (CalCOFI) Atlas 33.

Arai, R. 1969. A New Iniomous Fish of the Genus *Neoscopelus* from Suruga Bay, Japan. Bulletin of the National Science Museum, Tokyo 12(3):465–470.

Ayling, T., and G. F. Cox. 1982. Collins Guide to the Sea Fishes of New Zealand. William Collins, Auckland, New Zealand.

Baird, R. C. 1971. The Systematics, Distribution, and Zoogeography of the Marine Hatchetfishes (Family Sternoptychidae). Bulletin of the Museum of Comparative Zoology 142(1):1–128.

Balanov, A. A. and V. F. Savinykh. 1999. Redescriptions of *Scopelosaurus harryi* and *S. alderi* (Notosudidae): Two Valid Mesopelagic Species Inhabiting the Northern Part of the Pacific Ocean. Journal of Ichthyology 39(8):616–625.

Balart, E. F., J. L. Castro-Aguirre, and E. Amador-Silva. 2000. The First Eastern Pacific Report of the Sharptail Mola, *Mola lanceolata* (Tetraodontiformes: Molidae). California Fish and Game 86(2):156–158.

Bañón, R., J. L. del Río, C. Piñeiro, and J. M. Casas. 2002. Occurrence of tropical affinity fish in Galician waters, north-west Spain. Journal of the Marine Biological Association of the United Kingdom 82:877–880.

Barroso-Soto, I., E. Castillo-Gallardo, C. Quiñonez-Velázquez, and R. E. Morán-Angulo. 2007. Age and Growth of the Finescale Triggerfish, *Balistes polylepis* (Teleostei: Balistidae), on the Coast of Mazatlán, Sinaloa, Mexico. Pacific Science 61(1):121–127.

Baxter, R. 1991. Annotated Keys to the Fishes of Alaska, Containing Descriptions, Meristics, and Counts of all Adult Fishes Reported from Alaska and Those That Might Be Found in the State. Arctic-Bio, Red Mountain, Alaska.

Borges, L. 2000. Age and growth of the snipefish, *Macrorhamphosus* spp., in the Portuguese continental waters. Journal of the Marine Biological Association of the United Kingdom 80:147–153.

Brooks, A., G. Hanke, C. Foote, G. Gillespie, and J. Bedard. 2016. First Records of Finescale Triggerfish (*Balistes polylepis*) and Louvar (*Luvarus imperialis*) in British Columbia, Canada. Northwestern Naturalist 97(1):7–12.

Busby, M. S., and J. W. Orr. 1999. A Pelagic Basslet *Howella sherborni* (Family Acropomatidae) off of the Aleutian Islands. Alaska Fishery Research Bulletin 6(1):49–53.

Butler, J. L., and E. H. Ahlstrom. 1976. Review of the Deep-Sea Fish Genus *Scopelengys* (Neoscopelidae) with a Description of a New Species, *Scopelengys clarkei*, from the Central Pacific. Fishery Bulletin 74(1):142–150.

Carpenter, K. E., and V. H. Niem, editors. 1999a. FAO Species Identification Guide for Fishery Purposes: The Living Marine Resources of the Western Central Pacific, volume 3. Batoid fishes, chimaeras and bony fishes part 1 (Elopidae to Linophrynidae). Food and Agriculture Organization of the United Nations, Rome.

Carpenter, K. E., and V. H. Niem, editors. 1999b. FAO Species Identification Guide for Fishery Purposes: The Living Marine Resources of the Western Central Pacific, volume 4. Bony fishes part 2 (Mugilidae to Carangidae). Food and Agriculture Organization of the United Nations, Rome.

Carpenter, K. E., and V. H. Niem, editors. 2001a. FAO Species Identification Guide for Fishery Purposes: The Living Marine Resources of the Western Central Pacific, volume 5. Bony fishes part 3 (Menidae to Pomacentridae). Food and Agriculture Organization of the United Nations, Rome.

Carpenter, K. E., and V. H. Niem, editors. 2001b. FAO Species Identification Guide for Fishery Purposes: The Living Marine Resources of the Western Central Pacific, volume 6. Bony fishes part 4 (Labridae to Latimeriidae), estuarine crocodiles, sea turtles, sea snakes and marine mammals. Food and Agriculture Organization of the United Nations, Rome.

Cohen, D. M., T. Inada, T. Iwamoto, and N. Scialabba. 1990. FAO Species Catalogue, volume 10. Gadiform Fishes of the World (Order Gadiformes): An Annotated and Illustrated Catalogue of Cods, Hakes, Grenadiers and Other Gadiform Fishes Known to Date. FAO Fisheries Synopsis 125(10).

Collette, B., A. Acero, R. Betancur, A. Cotto, and P. Rojas. 2010. *Porichthys myriaster.* The IUCN Red List of Threatened Species 2010: e.T183301A8089925. Available: www.iucnredlist.org/details/183301/0. (September 2017). DOI: 10.2305/IUCN.UK.2010-3.RLTS.T183301A8089925.en

Collette, B. B., and C. E. Nauen. 1983. FAO Species Catalogue, volume 2. Scombrids of the World: An Annotated and Illustrated Catalogue of Tunas, Mackerels, Bonitos and Related Species Known to Date. FAO Fisheries Synopsis 125(2).

Compagno, L. J. V. 1984a. FAO Species Catalogue, volume 4. Sharks of the World: An Annotated and Illustrated Catalogue of Shark Species Known to Date, part 1—Hexanchiformes to Lamniformes. FAO Fisheries Synopsis 125(4/1).

Compagno, L. J. V. 1984b. FAO Species Catalogue, volume 4. Sharks of the World: An Annotated and Illustrated Catalogue of Shark Species Known to Date, part 2—Carcharhiniformess. FAO Fisheries Synopsis 125(4/2).

Compagno, L. J. V. 2002. Sharks of the World: An Annotated and Illustrated Catalogue of Shark Species Known to Date, volume 2. Bullhead, mackerel and carpet sharks (Heterodontiformes, Lamniformes and Orectolobiformes). FAO Species Catalogue for Fishery Purposes 1/2.

Cooper, J. A., and F. Chapleau. 1998. Monophyly and Intrarelationships of the Family Pleuronectidae (Pleuronectiformes), with a Revised Classification. Fishery Bulletin 96(4):686–726.

Craig, M. T., P. A. Hastings, and D. J. Pondella, II. 2004. Notes on the Systematics of the Crestfish Genus *Lophotus* (Lampridiformes: Lophotidae), with a New Record from California. Bulletin of the Southern California Academy of Sciences 103(2):57–65.

Ebert, D. A., J. D. S. Knuckey, and D. J. Kamikawa. 2014. First eastern North Pacific record of the velvet dogfish, *Zameus squamulosus* (Chondrichthyes: Squaliformes: Somniosidae). Marine Biodiversity Records 7. DOI: 10.1017/S1755267214000499

Ebert, D. A., C. Pien, and D. J. Kamikawa. 2015. Confirmation of the cookiecutter shark, *Isistius brasiliensis*, from the eastern North Pacific Ocean (Squaliformes: Dalatiidae). Marine Biodiversity Records 8. DOI: 10.1017/S1755267215000962

Edwards, J. C., and A. E. Peden. 1976. Northernmost known record of the Eel genus *Venefica* (Nettastomatidae) along the North American West Coast. Syesis 9:371–372.

Elbaraasi, H., and O. Elsalini. 2010. Occurrence of Slender Sunfish *Ranzania laevis* Pennant, 1776, (Molidae) in the Eastern Part of the Libyan Coast (Southern Mediterranean). Turkish Journal of Fisheries and Aquatic Sciences 10:549–550.

Eschmeyer, W. N., and E. S. Herald. 1983. A Field Guide to Pacific Coast Fishes of North America: From the Gulf of Alaska to Baja California. Peterson Field Guide volume 28. Houghton Mifflin, Boston.

Fahay, M. P. 2007. Early Stages of Fishes in the Western North Atlantic Ocean (Davis Strait, Southern Greenland and Flemish Cap to Cape Hatteras), volume 1: Acipenseriformes through Syngnathiformes. Northwest Atlantic Fisheries Organization, Dartmouth, Nova Scotia, Canada.

FishBase. Available: www.fishbase.org. (September 2017).

Fitch, J. E., and R. J. Lavenberg. 1968. Deep-Water Teleostean Fishes of California. California Natural History Guides, volume 25. University of California Press, Berkeley.

Frable, B. W., D. W. Wagman, T. N. Frierson, A. Aguilar, and B. L. Sidlauskas. 2015. A new species of *Sebastes* (Scorpaeniformes: Sebastidae) from the northeastern Pacific, with a redescription of the blue rockfish, *S. mystinus* (Jordan and Gilbert, 1881). Fishery Bulletin 113(4):355–377.

Garman, S. 1899. Reports on an Exploration off the West Coasts of Mexico, Central and South America, and off the Galapagos Islands, in Charge of Alexander Agassiz, by the U.S. Fish Commission Steamer "Albatross," during 1891, Lieut. Commander Z. L. Tanner, U.S.N., Commanding. Memoirs of the Museum of Comparative Zoology 24(1):1–431.

Garret, D. L. 2005. A New Intergeneric Hybrid Flatfish (Pleuronectiformes: Pleuronectidae) from Puget Sound and Adjacent Waters. Copeia 2005(3):673–677.

Gilbert, C. H. 1915. Fishes Collected by the United States Fisheries Steamer "Albatross" in Southern California in 1904. DOI: 10.5479/si.00963801.48-2075.305

Gilbert, C. H. and D. S. Jordan. 1880. Description of a New Species of Deep-Water Fish (*Icichthys lockingtoni*), from the Coast of California. DOI: 10.5479/si.00963801.3-154.305

Glubokov, A. I. 2009. New Data on the Blue-Eyed Searcher *Bathymaster signatus* (Bathymasteridae, Perciformes) from the Northwestern Part of the Bering Sea. Journal of Ichthyology 49(2):154–161.

Goin, C. J., and D. S. Erdman. 1951. The Crested Oarfish, *Lophotus lacepedei*, from Florida; First Record for the Western North Atlantic. Copeia 1951(4):285–288.

Gomon, M. F., J. C. M. Glover, and R. H. Kuiter. 1994. The Fishes of Australia's South Coast. State Print, Adelaide, Australia.

Goode, G. B., and T. H. Bean. 1883. Reports on the Results of Dredging under the Supervision of Alexander Agassiz, on the East Coast of the United States, during the Summer of 1880, by the U.S. Coast Survey Steamer "Blake," Commander J. R. Bartlett, U.S.N., commanding. Bulletin of the Museum of Comparative Zoology 10(5):183–226.

Goode, G. B., and T. H. Bean. 1895. Oceanic Ichthyology, a Treatise on the Deep-Sea and Pelagic Fishes of the World, Based Chiefly upon the Collections Made by the Steamers Blake, Albatross, and Fish Hawk in the Northwestern Atlantic, with an Atlas Containing 417 Figures. DOI: 10.5962/bhl.title.2164

Gotshall, D. W. 2001. Pacific Coast Inshore Fishes, 4th edition. Sea Challengers, Monterey, California.

Günther, A. 1877. Report on the Deep-Sea Fishes collected by H.M.S. Challenger during the Years 1873–76. Pages i-329 *in* Report on the Scientific Results of the Voyage of H.M.S. Challenger under the Command of Captain George S. Nares, R.N., F.R.S. and the Late Captain Frank Tourle Thomson, R.N., volume XXII. Eyre and Spottiswoode, London.

Hagerman, F. B. 1952. The Biology of the Dover Sole, *Microstomus pacificus* (Lockington). State of California Department of Fish and Game, Bureau of Marine Fisheries Fish Bulletin 85.

Hanke, G., G. Gillespie, K. Fong, J. Boutillier, J. Nielsen, P. Møller, J. Bedard, and J. Riley. 2015. New Records of Seven Cusk-eels (Ophidiidae) and Brotulas (Bythitidae) in Coastal Waters of British Columbia, Canada. Northwest Naturalist 96(1):71–80. DOI: 10.1898/NWN14-17.1

Hanke, G. F., and S. M. Roias. 2012. First Specimens of the Marine Eels *Venefica ocella* and *V. tentaculata* (Nettastomatidae) from British Columbia. Canadian Field-Naturalist 126(3):210–216.

Hart, J. L. 1973. Pacific Fishes of Canada. Fisheries Research Board of Canada, Ottawa.

Hubbs, C. L., and T. Iwamoto. 1977. A New Genus (*Mesobius*), and Three New Bathypelagic Species of Macrouridae (Pisces, Gadiformes) from the Pacific Ocean. Proceedings of the California Academy of Sciences 41(7):233–251.

Hyde, J. R., C. A. Kimbrell, J. E. Budrick, E. A. Lynn, and R. D. Vetter. 2008. Cryptic speciation in vermilion rockfish (*Sebastes miniatus*) and the role of bathymetry in the speciation process. Molecular Ecology 17:1122–1136.

Ivankova, Z. G. 2007. The First Capture of Roughscale Sole *Clidoderma asperrimum* in the Northwestern Part of the Sea of Japan. Journal of Ichthyology 47(5):410–412.

Iwamoto, T. 1979. Eastern Pacific Macrourine Grenadiers with Seven Branchiostegal Rays (Pisces: Macrouridae). Proceedings of the California Academy of Sciences 42(5):135–179.

Iwamoto, T., and M. Okamoto. 2015. A New Grenadier Fish of the Genus *Lucigadus* (Macrouridae, Gadiformes, Teleostei) from the Emperor Seamounts, Northwestern Pacific. Proceedings of the California Academy of Sciences 62(13):369–380.

Iwamoto, T., and D. L. Stein. 1974. A Systematic Review of the Rattail Fishes (Macrouridae: Gadiformes) from Oregon and Adjacent Waters. Occasional Papers of the California Academy of Sciences 111.

Iwamoto, T., and A. Williams. 1999. Grenadiers (Pisces, Gadiformes) from the Continental Slope of Western and Northwestern Australia. Proceedings of the California Academy of Sciences 51(3):105–243.

James, K. C., D. A. Ebert, D. J. Long, and D. A. Didier. 2009. A new species of chimaera, *Hydrolagus melanophasma* sp. nov. (Chondrichthyes: Chimaeriformes: Chimaeridae), from the eastern North Pacific. Zootaxa 2218:59-68.

Johnson, R. K. 1969. A Review of the Fish Genus *Kali* (Perciformes: Chiasmodontidae). Copeia 1969(2):386–391.

Johnson, R. K. 1974a. Five New Species and a New Genus of Alepisauroid Fishes of the Scopelarchidae (Pisces: Myctophiformes). Copeia 1974(2):449–457.

Johnson, R. K. 1974b. A Revision of the Alepisauroid Family Scopelarchidae (Pisces: Myctophiformes). Fieldiana: Zoology, volume 66. Field Museum of Natural History, Chicago.

Johnson, S. W., A. D. Neff, and M. R. Lindeberg. 2015. A Handy Field Guide to the Nearshore Marine Fishes of Alaska. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-293. Available: www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-293.pdf (September 2017).

Jordan, D. S., and E. C. Starks. 1906. A Review of the Flounders and Soles of Japan. Proceedings of the United States National Museum 31:161–246.

Kamikawa, D. J., and D. E. Stevenson. 2010. New Records of *Aldrovandia oleosa* (Notacanthiformes: Halosauridae) from the Eastern North Pacific Ocean. California Fish and Game 96(3):216–220.

Kawaguchi, K. 1971. Gonostomatid Fishes of the Western North Pacific. Japanese Journal of Ichthyology 18(1).

Kells, V., L. A. Rocha, and L. G. Allen. 2016. A Field Guide to Coastal Fishes from Alaska to California. Johns Hopkins University Press, Baltimore, Maryland.

Kotlyar, A. N. 2009a. Revision of the Genus *Poromitra* (Melamphaidae), part 3: Species of Group *P. cristiceps*: *P. cristiceps*, *P. nigrofulva*, *P. frontosa*, *P. nigriceps*. Journal of Ichthyology 49(6):421–434.

Kotlyar, A. N. 2009b. Revision of the Genus *Poromitra* (Melamphaidae), part 4: Species of *P. cristiceps* Group: *P. atlantica*, *P. oscitans*, and *P. agofonovae* Kotlyar, Species Nova. Journal of Ichthyology 49(8):563–574.

Kotlyar, A. N. 2011. Revision of Genus *Melamphaes* (Melamphaidae). I. Multi-Raker Species: *M. lugubris*, *M. xestoachidus* sp. nova, *M. microps*, *M. manifestus* sp. nova. Journal of Ichthyology 51(8):557–568.

Kramer, D. E., W. H. Barss, B. C. Paust, and B. E. Bracken. 1995. Guide to Northeast Pacific Flatfishes: Families Bothidae, Cynoglossidae, and Pleuronectidae. Marine Advisory Bulletin 47. University of Alaska Sea Grant, Fairbanks.

Kramer, D. E., and V. M. O'Connell. 1988. Guide to Northeast Pacific Rockfishes: Genera *Sebastes* and *Sebastolobus*. Marine Advisory Bulletin 25. University of Alaska Sea Grant, Fairbanks.

Kukuev, E. I. 1998. Systematics and Distribution in the World Ocean of Daggertooth Fishes of the Genus *Anotopterus* (Anotopteridae, Aulopiformes). Journal of Ichthyology 38(9):716–729.

Kukuev, E. I., N. V. Parin, and I. A. Trunov. 2013. Materials for the Revision of the Family Caristiidae (Perciformes): 3. Manefishes (Genus *Caristius*) from Moderate Warm Waters of the Pacific and Atlantic Oceans with a Description of Three New Species from the Southeast Atlantic (*C. barsukovi* sp.n., *C. litvinovi* sp.n., *C. walvisensis* sp.n.). Journal of Ichthyology 53(8):541–561.

Laman, E. A., and J. W. Orr. 2012. First Record of an Aurora Rockfish, *Sebastes aurora*, from Alaskan Waters. Northwestern Naturalist 92(3):230–232.

Lamb, A., and P. Edgell. 1986. Coastal Fishes of the Pacific Northwest. Harbour Publishing, Madeira Park, British Columbia, Canada.

Lane, D. E., and C. W. Hill, editors. 1975. The Marine Resources of Anaheim Bay. State of California Department of Fish and Game, Fish Bulletin 165.

Lloris, D., J. Matallanas, and P. Oliver. 2005. Hakes of the World (Family Merlucciidae): An Annotated and Illustrated Catalogue of Hake Species Known to Date. FAO Species Catalogue for Fishery Purposes 2.

Long, D. F., J. E. McCosker, S. Blum, and A. Klapfer. 2011. Tropical Eastern Pacific Records of the Prickly Shark *Echinorhinus cookei* (Chondrichthyes: Echinorhinidae). Pacific Science 65(4):433–440.

Love, M. S., A. Brooks, D. Busatto, J. Stephens, and P. A. Gregory. 1996. Aspects of the life histories of the kelp bass, *Paralabrax clathratus*, and barred sand bass, *P. nebulifer*, from the southern California Bight. Fishery Bulletin 94(3):472–481.

Love, M. S., C. W. Mecklenburg, T. A. Mecklenburg, and L. K. Thorsteinson. 2005. Resource Inventory of Marine and Estuarine Fishes of the West Coast and Alaska: A Checklist of North Pacific and Arctic Ocean Species from Baja California to the Alaska–Yukon Border. U.S. Department of the Interior, U.S. Geological Survey, Biological Resources Division, Seattle.

Love, M. S., J. K. Passarelli, C. Okamoto, and D. W. Diehl. 2016. The Bigeye Scad, *Selar crumenophthalmus* (Bloch, 1793) (Family Carangidae), New to the California Marine Fauna, with a List to and Keys for All California Carangids. Bulletin of the Southern California Academy of Sciences 114(3):141–148.

Love, M. S., M. Yoklavich, and L. Thorsteinson. 2002. The Rockfishes of the Northeast Pacific. University of California Press, Berkeley.

Makushok, V. M. 1958. [The Morphology and Classification of the Northern Blennioid Fishes (Stichaeoidae, Blennioidei, Pisces)]. Proceedings of the Zoological Institute, Academy of Sciences of the USSR 25:3–129. (In Russian.)

Makushok, V. M. 1961. [Additional Information on the Morphology and Systematics of Wrymouths (Cryptacanthodidae, Blennioidei, Pisces)]. Transactions of the P. P. Shirshov Institute of Oceanography, Academy of Sciences of the USSR 43:184–197. (In Russian.)

Markle, D. F., and G. Krefft. 1985. A New Species and Review of *Bajacalifornia* (Pisces: Alepocephalidae) with Comments on the Hook Jaw of *Narcetes stomias*. Copeia 1985(2):345–356.

Masaki, M., and D. F. Markle. 1993. *Bajacalifornia aequatoris*, New Species of Alepocephalid Fish (Pisces: Salmoniformes) from the Central Equatorial Pacific. Copeia 1993(3):743–747.

Masuda, H., K. Amaoka, C. Araga, T. Uyeno, and T. Yoshino. 1984. Fishes of the Japanese Archipelago, volume 1. Tokai University Press, Tokyo.

Matarese, A. C., A. W. Kendall, Jr., D. M. Blood, and B. M. Vinter. 1989. Laboratory Guide to Early Life History Stages of Northeast Pacific Fishes. U.S. Department of Commerce, NOAA Technical Report NMFS 80.

Matsui, T., and R. H. Rosenblatt. 1987. Review of the Deep-Sea Fish Family Platytroctidae (Pisces: Salmoniformes). Bulletin of the Scripps Institution of Oceanography, volume 26.

Matthews, C. P. 1985. Meristic studies of the Gulf of California species of *Merluccius*, with a description of a new species. Journal of Natural History 19(4):697–718. DOI: 10.1080/00222938500770421

Matthiessen, B., H. O. Fock, and H. von Westernhagen. 2002. Seamounts, hotspots for high speciation rates in bentho-pelagic fishes? A case study on *Macroramphosus* spp. (Sygnathidae) from Great Meteor Seamount. International Council for the Exploration of the Sea CM 2002/M:07. Available: www.ices.dk/sites/pub/CM%20Doccuments/2002/M/M0702.pdf. (September 2017).

McAllister, D. E. 1990. A list of the fishes of Canada: Syllogeus 64. National Museum of Natural Sciences, Ottawa.

Mead, G. W., and J. Böhlke. 1953. *Scopelarchus linguidens*, a New Bathypelagic Fish from off Northern Japan. Japanese Journal of Ichthyology II(6):241–245.

Mecklenburg, C. W. 2003. Family Bathymasteridae Jordan & Gilbert 1883—ronquils. California Academy of Sciences Annotated Checklists of Fishes 7:1–4.

Mecklenburg, C. W., T. A. Mecklenburg, and L. K. Thorsteinson. 2002. Fishes of Alaska. American Fisheries Society, Bethesda, Maryland.

Melo, M. R. S. 2008. The genus *Kali* Lloyd (Chiasmodontidae: Teleostei) with description of new two species, and the revalidation of *K. kerberti* Weber. Zootaxa 1747:1–33.

Melo, M. R. S. 2009. Revision of the Genus *Chiasmodon* (Acanthomorpha: Chiasmodontidae), with the Description of Two New Species. Copeia 2009(3):583–608.

Miller, D. J., and R. N. Lea. 1976. Guide to the Coastal Marine Fishes of California. State of California Department of Fish and Game, Fish Bulletin 157.

Miller, M. J. 2009. Ecology of Anguilliform Leptocephali: Remarkable Transparent Fish Larvae of the Ocean Surface Layer. Aqua-BioScience Monographs 2(4):1–94. DOI: 10.5047/absm.2009.00204.0001

Moser, H. G., editor. 1996. The Early Stages of Fishes in the California Current Region. California Cooperative Oceanic Fisheries Investigations (CalCOFI) Atlas 33.

Nelson, J. S. 2006. Fishes of the World, 4th edition. John Wiley & Sons, Hoboken, New Jersey.

Nichols, J. T. 1936. On *Decapterus scombrinus* (Valenciennes). American Museum Novitates 835.

Nielsen, J. G., and E. Bertelsen. 1985. The gulper-eel family Saccopharyngidae (Pisces, Anguilliformes). Steenstrupia 11(6):157–206.

Nielsen, J. G., D. M. Cohen, D. F. Markle, and C. R. Robins. 1999. FAO Species Catalogue, volume 18. Ophidiiform Fishes of the World (Order Ophidiiformes): An annotated and illustrated catalogue of pearlfishes, cusk-eels, brotulas and other ophidiiform fishes known to date. FAO Fisheries Synopsis 125(18).

Olney, J. E., D. G. Johnson, and C. C. Baldwin. 1993. Phylogeny of Lampridiform Fishes. Bulletin of Marine Science 52(1):137–169.

Orlov, A. M., and A. A. Abramov. 2002. New Data on Flat-Nosed Hake *Antimora microlepis* (Moridae) from the Northwestern Pacific Ocean. Journal of Ichthyology 42(1):65–73.

Orlov, A. M., and A. M. Tokranov. 2011. Some Rare and Insufficiently Studied Snailfish (Liparidae, Scorpaeniformes, Pisces) in the Pacific Waters off the Northern Kuril Islands and Southeastern Kamchatka, Russia. ISRN Zoology 2011, Article 341640. DOI: 10.5402/2011/341640

Orr, J. W. 1991. A New Species of Ceratioid Anglerfish, Genus *Oneirodes* (Oneirodidae), from the Western North Atlantic, with a Revised Key to the Genus. Copeia 1991(4):1024–1031.

Orr, J. W. 2012. Two New Species of Snailfishes of the Genus *Careproctus* (Scorpaeniformes: Liparidae) from the Bering Sea and Eastern North Pacific Ocean, with a Redescription of *Careproctus ovigerus*. Copeia 2012(2):252–265.

Orr, J. W., D. C. Baker, and M. A. Brown. 1997. Field Key to the Flatfishes from Point Conception to the Arctic. [Manuscript available from J. W. Orr, National Marine Fisheries Service, Alaska Fisheries Science Center, 7600 Sand Point Way Northeast, Seattle, WA 98115-0070.]

Orr, J. W., and S. Hawkins. 2008. Species of the rougheye rockfish complex: resurrection of *Sebastes melanostictus* (Matsubara, 1934) and a redescription of *Sebastes aleutianus* (Jordan and Evermann, 1898) (Teleostei: Scorpaeniformes). Fishery Bulletin 106(2):111–134.

Orr, J. W. and A. C. Matarese. 2000. Revision of the genus *Lepidopsetta* Gill, 1862 (Teleostei: Pleuronectidae) based on larval and adult morphology, with a description of a new species from the North Pacific Ocean and Bering Sea. Fishery Bulletin 98(3):539–582.

Page, L. M., H. Espinosa-Pérez, L. T. Findley, C. R. Gilbert, R. N. Lea, N. E. Mandrak, R. L. Mayden, and J. S. Nelson. 2013. Common and scientific names of fishes from the United States, Canada, and Mexico, 7th edition. American Fisheries Society, Special Publication 34, Bethesda, Maryland.

Pallas, P. S. 1814. Zoographia Rosso-Asiatica, sistens omnium animalium in extenso Imperio Rossico et adjacentibus maribus observatorum recensionem, domicilia, mores et descriptiones, anatomen atque icones plurimorum. Petropoli. DOI: 10.5962/bhl.title.42222

Parin, N. V., T. N. Belyanina, and S. A. Evseenko. 2009. Materials to the Revision of the Genus *Dolichopteryx* and Closely Related Taxa (*Ioichthys*, *Bathylychnops*) with the Separation of a New Genus *Dolichopteroides* and Description of Three New Species (Fam. Opisthoproctidae). Journal of Ichthyology 49(10):839–851.

Parr, C. S., N. Wilson, P. Leary, K. S. Schulz, K. Lans, L. Walley, J. A. Hammock, A. Goddard, J. Rice, M. Studer, J. T. G. Holmes, and R. J. Corrigan, Jr. 2014. The Encyclopedia of Life, volume 2: Providing Global Access to Knowledge About Life on Earth. Biodiversity Data Journal 2:e1079. DOI: 10.3897/BDJ.2.e1079

Paxton, J. R. 1963. A New Lanternfish (Family Myctophidae) of the Genus *Lampadena* from the Eastern Pacific Ocean. Copeia 1963(1):29–33. DOI: 10.2307/1441271

Pearcy, W. G., D. L. Stein, and R. S. Carney. 1982. The deep-sea benthic fish fauna of the northeastern Pacific Ocean on Cascadia and Tufts abyssal plains and adjoining continental slopes. Biological Oceanographer 1(4):375–428.

Peden, A. E., and M. E. Anderson. 1978. A systematic review of the fish genus *Lycodapus* (Zoarcidae) with descriptions of two new species. Canadian Journal of Zoology 56(9):1925–1961. DOI: 10.1139/z78-262

Pietsch, T. W. 2009. Oceanic Anglerfishes: Extraordinary Diversity in the Deep Sea. University of California Press, Berkeley.

Pietsch, T. W., and J. W. Orr. 2015. Fishes of the Salish Sea: a compilation and distributional analysis. NOAA Professional Paper NMFS 18.

Prokofiev, A. M., and E. I. Kukuev. 2009. Systematics and Distribution of Black Swallowers of the Genus *Chiasmodon* (Perciformes: Chiasmodontidae). Journal of Ichthyology 49(10):899–939.

Purushottama, G., B. Anulekshmi, C. Ramkumar, S. Thakurdas, and B. Mhadgut. 2014. A rare occurrence and biology of the Slender sunfish, *Ranzania laevis* (Actinopterygii: Tetraodontiformes: Molidae), in the coastal waters of Mumbai, North-West Coast of India. Indian Journal of Geo-Marine Sciences 43(8):1554–1559.

Randall, J. E., K. Matsuura, and A. Zama. 1978. A Revision of the Triggerfish Genus *Xanthichthys*, with Description of a New Species. Bulletin of Marine Science 28(4):688–706.

Rechnitzer, A. B., and J. Böhlke. 1958. *Ichthyococcus irregularis*, a New Gonostomatine Fish from the Eastern Pacific. Copeia 1958(1):10–15.

Renaud, C. B. 2011. Lampreys of the World: An Annotated and Illustrated Catalogue of Lamprey Species Known to Date. FAO Species Catalogue for Fishery Purposes 5.

Rosenblatt, R. H., and J. L. Butler. 1977. The Ribbonfish Genus *Desmodema*, with the Description of a New Species (Pisces, Trachipteridae). Fishery Bulletin 75(4):843–855.

Saruwatari, T., J. A. López, and T. W. Pietsch. 1997. A Revision of the Osmerid Genus *Hypomesus* Gill (Teleostei: Salmoniformes), with the Description of a New Species from the Southern Kuril Islands. Species Diversity 2(1):59–82.

Sato, S., and T. Ueno. 1953. On a Rare Fish, *Bathymaster signatus* Cope, Taken from the Northern Pacific, and Notes on Allied Species. Bulletin of the Faculty of Fisheries Hokkaido University 4(3):203–211.

Savinykh, V. F., and A. A. Baitalyuk. 2011. Taxonomic Status of Ribbonfishes of the Genus *Trachipterus* (Trachipteridae) from the Northern Part of the Pacific Ocean. Journal of Ichthyology 51(8):581–589.

Schultz, L. P., and R. T. Smith. 1936. Is *Inopsetta ischyra* (Jordan and Gilbert), from Puget Sound, Washington, a Hybrid Flatfish? Copeia 1936(4):199–203.

Shao, K. T. 2016. The Fish Database of Taiwan. Available: fishdb.sinica.edu.tw. (February 2016).

Shomura, R. S., J. Majkowski, and S. Langi, editors. 1993. Interactions of Pacific tuna fisheries, volume 2. Papers on Biology and Fisheries. FAO Fisheries Technical Paper 336/2.

Skogsberg, T. 1939. The Fishes of the Family Sciaenidae (Croakers) of California. Division of Fish and Game of California, Bureau of Marine Fisheries, Fish Bulletin 54.

Small, G. J. 1981. A Review of the Bathyal Fish Genus *Antimora* (Moridae: Gadiformes). Proceedings of the California Academy of Sciences 42(13):341–348.

Smith, M. M., and P. C. Heemstra, editors. 2012. Smiths' Sea Fishes. Springer-Verlag, Berlin.

Sommer, C. 1995. Pleuronectidae: Platijas, sollas. [Pleuronectidae: Flounders, plaice.] Pages 1381–1385 *in* W. Fischer, F. Krupp, W. Schneider, C. Sommer, K. E. Carpenter, and V. H. Niem, editors. Guia FAO para la Identificacion de Especies para los Fines de la Pesca Pacifico Centro-Oriental, volumen 3: Vertebrados, parte 2. [FAO Guide for Species Identification in Central-Eastern Pacific Fisheries, volume 3: Vertebrates, part 2.] Food and Agriculture Organization of the United Nations, Rome.

Stein, D. L. 1978. A Review of the Deepwater Liparidae (Pisces) from the Coast of Oregon and Adjacent Waters. Occasional Papers of the California Academy of Sciences 127.

Stein, D. L., J. C. Drazen, K. L. Schlining, J. P. Barry, and L. Kuhnz. 2006. Snailfishes of the central California coast: video, photographic and morphological observations. Journal of Fish Biology 69:970–986. DOI: 10.1111/j.1095-8649.2006.01167.x

Stevenson, D. E., and C. P. Kenaley. 2011. Revision of the Manefish Genus *Paracaristius* (Teleostei: Percomorpha: Caristiidae), with Description of a New Genus and Three New Species. Copeia 2011(3):385–399.

Stevenson, D. E., and C. P. Kenaley. 2013. Revision of the Manefish Genera *Caristius* and *Platyberyx* (Teleostei: Percomorpha: Caristiidae), with Descriptions of Five New Species. Copeia 2013(3):415–434.

Stevenson, D. E., J. W. Orr, G. R. Hoff, and J. D. McEachran. 2007. Field Guide to Sharks, Skates, and Ratfish of Alaska. University of Alaska Sea Grant, Fairbanks.

Stevenson, D. E., and B. A. Sheiko. 2009. Clarification of the *Lycodes diapterus* Species Complex (Perciformes: Zoarcidae), with Comments on the Subgenus *Furcimanus*. Copeia 2009(1):125–137.

Sulak, K. J. 1977. *Aldrovandia oleosa*, a New Species of the Halosauridae, with Observations on Several Other Species of the Family. Copeia 1977(1):11–20.

Tarp, F. H. 1952. A Revision of the Family Embiotocidae (The Surfperches). State of California Department of Fish and Game, Fish Bulletin 88.

Tighe, K. A. and J. G. Nielsen. 2000. *Saccopharynx berteli*, a new gulper eel from the Pacific Ocean (Teleostei, Saccopharyngidae). Ichthyological Research 47(1):39–41. DOI: 10.1007/BF02674311

Uiblein, F., J. G. Nielsen, and P. R. Møller. 2008. Systematics of the Ophidiid Genus *Spectrunculus* (Teleostei: Ophidiiformes) with Resurrection of *Spectrunculus crassus*. Copeia 2008(3):542–551.

Watson, W. 1996. Phosichthyidae: Lightfishes. Pages 284–293 *in* H. G. Moser, editor. The Early Stages of Fishes in the California Current Region. California Cooperative Oceanic Fisheries Investigation (CalCOFI) Atlas 33.

Whitehead, P. J. P. 1985. FAO Species Catalogue, volume 7. Clupeoid Fishes of the World (Suborder Clupeoidei): An Annotated and Illustrated Catalogue of the Herrings, Sardines, Pilchards, Sprats, Shads, Anchovies and Wolf-herrings, part 1—Chirocentridae, Clupeidae and Pristigasteridae. FAO Fisheries Synopsis 125(7/1).

Whitehead, P. J. P., G. J. Nelson, and T. Wongratana. 1988. FAO Species Catalogue, volume 7. Clupeoid Fishes of the World (Suborder Clupeoidei): An Annotated and Illustrated Catalogue of the Herrings, Sardines, Pilchards, Sprats, Shads, Anchovies and Wolf-herrings, part 2—Engraulididae. FAO Fisheries Synopsis 125(7/2).

Wilson, R. R., Jr. 2001. A New Species of *Nezumia* (Gadiformes: Macrouridae) from Fieberling Guyot, Eastern North Pacific Ocean. Revista De Biologia Tropical 49(Suppl. 1):29–37.

Wisner, R. L. 1970. Distribution and Characters of the North Pacific Myctophid Fish *Lampanyctus jordani* Gilbert. Copeia 1970(3):420–429.

Wisner, R. L. 1974. The Taxonomy and Distribution of Lanternfishes (Family Myctophidae) of the Eastern Pacific Ocean. NORDA Report 3.

Wisner, R. L. 1999. Descriptions of Two New Subfamilies and a New Genus of Hagfishes (Cyclostomata: Myxinidae). Zoological Studies 38(3):307–313.

Young, P. H. 1963. The Kelp Bass (*Paralabrax clathratus*) and its Fishery, 1947–1958. State of California Department of Fish and Game, Fish Bulletin 122.

Zahuranec, B. J. 2000. Zoogeography and Systematics of the Lanternfishes of the Genus *Nannobrachium* (Myctophidae: Lampanyctini). Smithsonian Contributions to Zoology 607. DOI: 10.5479/si.00810282.607

List of Species

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NOAA Technical Memorandum NMFS-NWFSC-

137 **Beechie, T. J., O. Stefankiv, B. Timpane-Padgham, J. E. Hall, G. R. Pess, M. Rowse, M. Liermann, K. Fresh, and M. J. Ford. 2017.** Monitoring Salmon Habitat Status and Trends in Puget Sound: Development of Sample Designs, Monitoring Metrics, and Sampling Protocols for Large River, Floodplain, Delta, and Nearshore Environments. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-137. NTIS number PB2017-102556. https://doi.org/10.7289/V5/TM-NWFSC-137

136 **Keller, A. A., J. R. Wallace, and R. D. Methot. 2017.** The Northwest Fisheries Science Center's West Coast Groundfish Bottom Trawl Survey: History, Design, and Description. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-136. NTIS number PB2017-101432. https://doi.org/10.7289/V5/TM-NWFSC-136

135 **Mongillo, T. M., G. M. Ylitalo, L. D. Rhodes, S. M. O'Neill, D. P. Noren, and M. B. Hanson. 2016.** Exposure to a Mixture of Toxic Chemicals: Implications for the Health of Endangered Southern Resident Killer Whales. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-135. NTIS number PB2017-101431. https://doi.org/10.7289/V5/TM-NWFSC-135

134 **Leonard, J. 2016.** Washington and Oregon Charter Vessel Survey: Methodology and Results. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-134. NTIS number PB2017-100472. https://doi.org/10.7289/V5/TM-NWFSC-134

133 **Duffield, D., J. K. Gaydos, S. Raverty, K. Wilkinson, B. Norberg, L. Barre, M. B. Hanson, P. Foreman, A. Traxler, D. Lambourn, J. Huggins, J. Calambokidis, T. McKlveen, S. Dennison, and H. Brubaker. 2016.** Wild Animal Mortality Investigation: Southern Resident Killer Whale L-112 Final Report. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-133. NTIS number PB2017-100471. https://doi.org/10.7289/V5/TM-NWFSC-133

132 **Anderson, L. E., and M. Plummer. 2016.** Puget Sound Recreational Shellfishing Survey: Methodology and Results. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-132. NTIS number PB2017-100470. https://doi.org/10.7289/V5/TM-NWFSC-132

131 **Waples, R. S. 2016.** Small Investments with Big Payoffs: A Decade of the Internal Grants Program at the Northwest Fisheries Science Center. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-131. NTIS number PB2017-100469. https://doi.org/10.7289/V5/TM-NWFSC-131

130 **Puget Sound Recovery Implementation Technical Team. 2015.** Puget Sound Chinook Salmon Recovery: A Framework for the Development of Monitoring and Adaptive Management Plans. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-130. NTIS number PB2016-100691. https://doi.org/10.7289/V5/TM-NWFSC-130

129 **Hard, J. J., J. M. Myers, E. J. Connor, R. A. Hayman, R. G. Kope, G. Lucchetti, A. R. Marshall, G. R. Pess, and B. E. Thompson. 2015.** Viability Criteria for Steelhead within the Puget Sound Distinct Population Segment. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-129. NTIS number PB2015-105188. https://doi.org/10.7289/V5/TM-NWFSC-129

NOAA Technical Memorandums NMFS-NWFSC are available at the Northwest Fisheries Science Center website, https://www.nwfsc.noaa.gov/index.cfm.