NOAA Technical Memorandum NMFS

JULY 2013

PHOTOGRAPHIC GUIDE OF PELAGIC JUVENILE ROCKFISH (*SEBASTES* SPP.) AND OTHER FISHES IN MID-WATER TRAWL SURVEYS OFF THE COAST OF CALIFORNIA

Keith M. Sakuma[1]
Arnold J. Ammann[1]
Dale A. Roberts[2]

Fisheries Ecology Division[1]
Southwest Fisheries Science Center
National Marine Fisheries Service, NOAA
110 Shaffer Road
Santa Cruz, California 95060

Cordell Bank National Marine Sanctuary[2]
National Oceanic and
Atmospheric Administration
1 Bear Valley Road
Point Reyes Station, California 94956

NOAA-TM-NMFS-SWFSC-515

U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
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Southwest Fisheries Science Center

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U. S. DEPARTMENT OF COMMERCE
Cameron F. Kerry, Acting Secretary
National Oceanic and Atmospheric Administration
Dr. Kathryn D. Sullivan, Acting Administrator
National Marine Fisheries Service
Russell Smith, Acting Assistant Administrator for Fisheries

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ABSTRACT

Photographs were taken of pelagic juvenile rockfish (*Sebastes* spp.) and other fishes collected aboard annual mid-water trawl surveys off the coast of California during late spring. Whenever possible, specimens were photographed shortly after capture at sea to accurately record coloration and pigment patterns prior to preservation. The color images in this guide can be used to assist in the field identification process, particularly for rockfishes (where species identifications of early life history stages is often difficult) and other commercially and recreationally important species.

INTRODUCTION

Rockfishes (*Sebastes* spp.) are an important component of the marine ecosystem along the U.S. west coast with approximately 72 species described in this area (Love *et al.* 2002) where they comprise a substantial fraction of the volume and value in the commercial and recreational fisheries (PFMC 2008). Since 1983 the Groundfish Analysis Team of the Fisheries Ecology Division (FED), Southwest Fisheries Science Center (SWFSC), National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA) has conducted annual rockfish recruitment and ecosystem assessment surveys during late spring (April-June) along the central California coast (36°30'–38°20' N) (Ralston *et al*. 2013). In 2004 the survey area was expanded to encompass nearly the entire coast of California (32°45'–40°00' N) (Sakuma *et al.* 2006). The survey was initially implemented to develop a rockfish recruitment index which could be incorporated into the fisheries management process (Field *et al.* 2010; Ralston *et al.* 2013). However, the survey also collects other species of interest such as juvenile and adult Pacific hake (*Merluccius productus*), juvenile lingcod (*Ophiodon elongatus*), northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), market squid (*Doryteuthis opalescens*), and krill (Euphausiacea). In addition, hydrographic data have been recorded using a Seabird conductivity, temperature, and depth (CTD) profiler starting in 1987 (for details see Baltz *et al.* 2006), which coupled with the biological data, allows for an examination of the general state of the ecosystem. For development of recruitment indices and ecosystem analyses, accurate identifications of fishes collected at sea is essential. However, while some species are easily recognized (e.g. Pacific hake), others are more difficult to identify (e.g. pelagic juvenile rockfish). While there are existing early life history stage identification guides (e.g., Matarese *et al*. 1989; Moser 1996), more general identification guides (e.g., Miller and Lea 1972; Eschmeyer *et al.* 1983), and rockfish specific guides (e.g., Love *et al.* 2002), we wanted to document in photographs the color patterns of fishes and particularly pelagic juvenile rockfishes, prior to preservation to assist in field identifications. Note that this guide is not intended to be a definitive identification source, but rather to provide organized color images that can be used in conjunction with other documents that describe pigmentation, morphology, and meristics (e.g., Miller and Lea 1972; Eschmeyer *et al.* 1983; Matarese *et al*. 1989; Moser 1996; Love *et al.* 2002).

METHODS

Fish photographed in this guide were collected primarily aboard the NOAA research vessel (R/V) *David Starr Jordan* with a few specimens also collected aboard the R/V *Ocean Starr.* A modified Cobb mid-water trawl with a 26 m headrope and 9.5 mm mesh codend liner and a theoretical mouth opening of 12 m x 12 m was fished at night (typically 2100-0600 PDT) for 15 minutes at a target headrope depth of 30 m except at shallow water stations (< 60 m) where the target headrope depth was 10 m (Wyllie-Echeverria *et al*. 1990, Sakuma *et al*. 2006, Ralston *et al*. 2013). In a few instances, deeper trawls were conducted at 100 m (e.g. off Monterey Bay Canyon; Wyllie-Echeverria *et al.* 1990). The majority of specimens were photographed at sea shortly after capture. However, in some instances specimens were frozen and then later photographed back at the laboratory if it was determined that the freezing process would not be detrimental to the color patterns observed. Initial photographs were taken with a film camera mounted to a fixed stage, while later photographs were taken with a handheld digital camera. The first set of photographs with the film camera used two large clear glass bowls with flat bottoms. One bowl was partially filled with white candle wax and the other black candle wax. Pins were inserted into the wax in order to mount specimens to prevent movement at sea while aboard ship. The bowl (either the white or black background) was filled with water and the specimen was then submerged, so that it was entirely covered. Using this

process, the fins were able to be spread out on most specimens and surface glare was diminished. The later photographs taken with the digital camera used a clear plexiglass vertical container filled with seawater and a blue or green background placed vertically behind. This vertical container made it possible to photograph live specimens in their natural orientation (as opposed to lying on their side using the bowl). Two fiber optic microscope lights were used for illumination on most photographs, as the flexible light guides allowed for finer adjustments than with regular lamps. In addition, some specimens were simply photographed on the sorting trays or in the sorting containers immediately after the catch was processed at sea using ambient lighting and the built in flash of the digital camera. Whenever possible, a small ruler or other measuring device marked in millimeters was inserted into the photograph for size reference. The order of specimen photographs presented in this guide is patterned after Miller and Lea (1972) and Eschmeyer *et al.* (1983) with the rockfish and flatfish ordered alphabetically by species name within their respective groups.

ACKNOWLEDGMENTS

We would like to thank the officers and crew of the NOAA R/V *David Starr Jordan*, the captain and crew of the R/V *Ocean Starr*, and all the NOAA NMFS SWFSC FED scientists who participated in the mid-water trawl surveys. In addition to the author's photographs, the picture of the Pacific electric ray was taken by Matthew Birk. Thanks to Tom Laidig and John Field for reviewing this guide.

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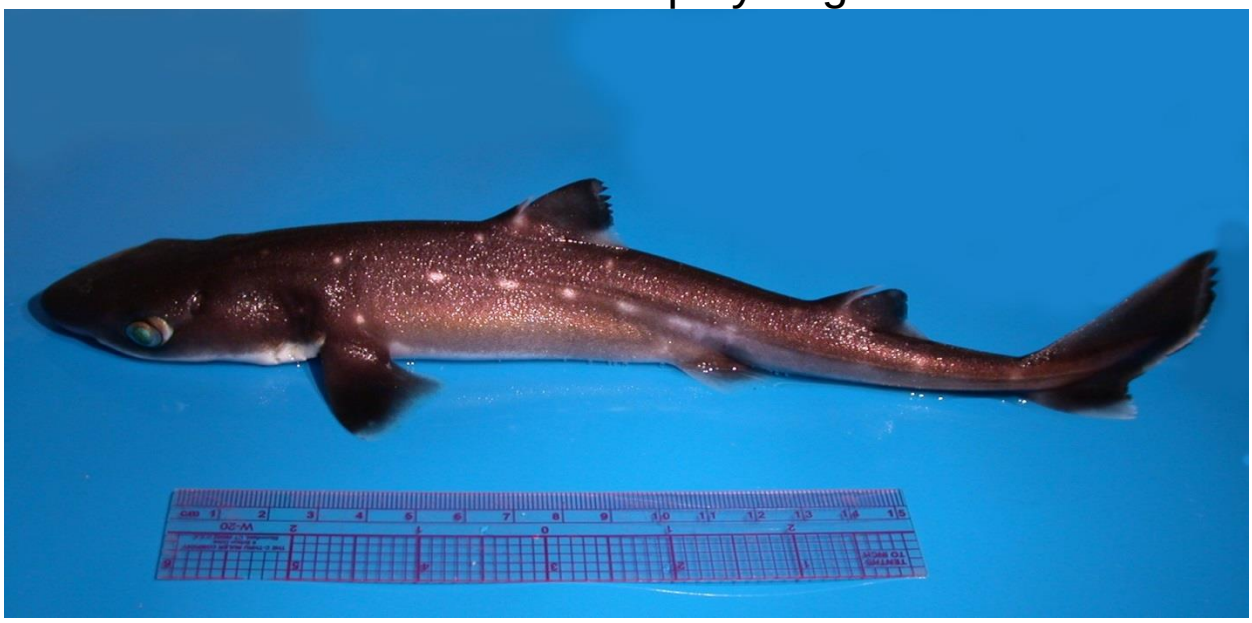
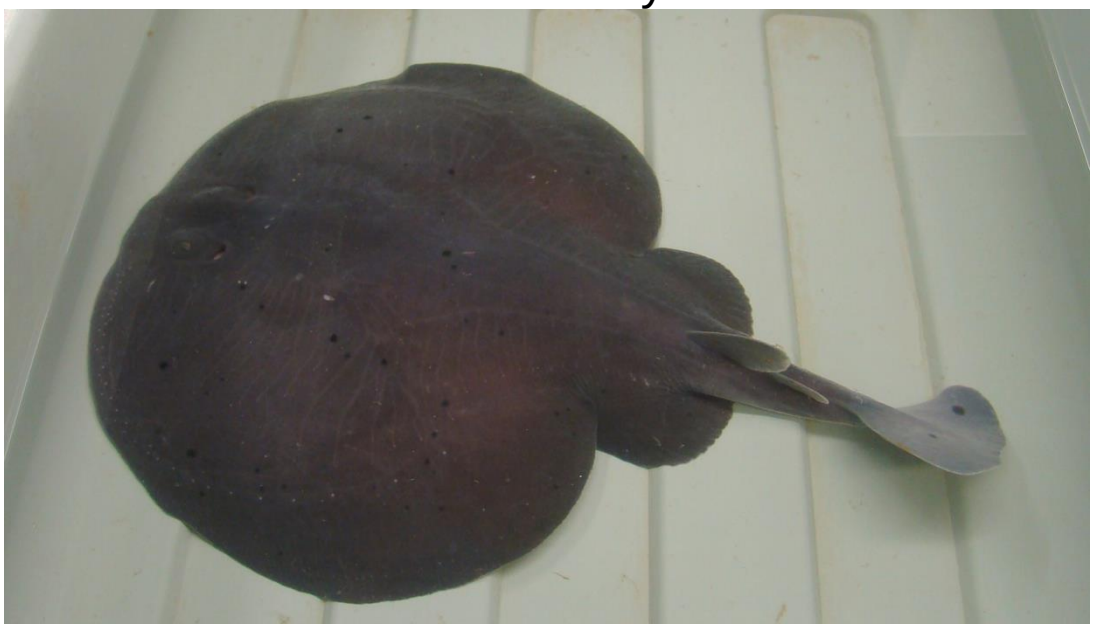
Wyllie-Echeverria, T., W.H. Lenarz, and C.A. Reilly. 1990. Survey of the abundance and distribution of pelagic young-of-the-year rockfish, *Sebastes,* off central California. U.S. Dep. Commer., NOAA Tech. Memo., NOAA-TM-NMFS-SWFSC-147, 125 pp.

Family: Petromyzontidae
Species name: *Entosphenus tridentatus*
Common name: Pacific lamprey

Family: Squalidae
Species name: *Squalus suckleyi*
Common name: North Pacific spiny dogfish

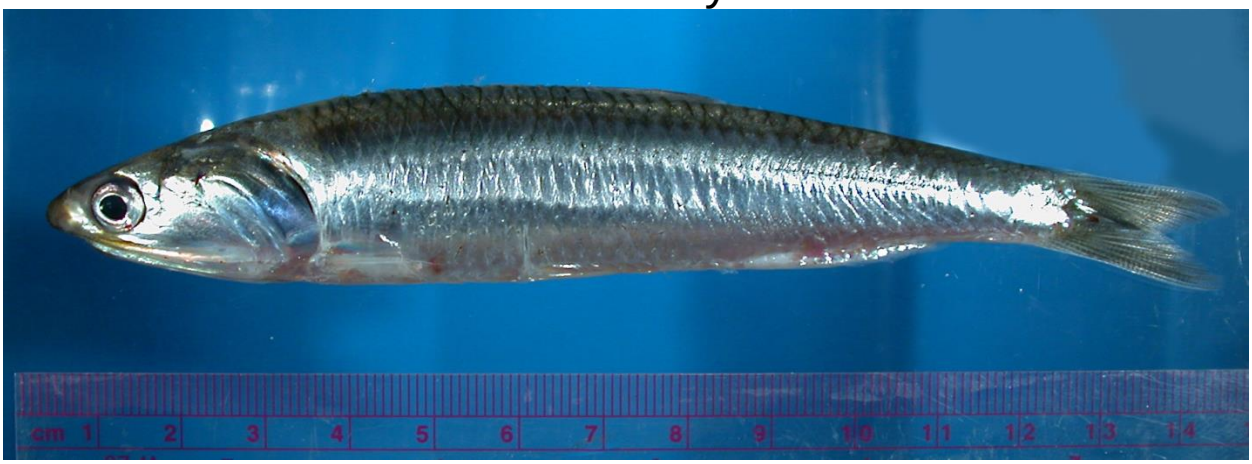


Family: Torpedinidae
Species name: *Torpedo californica*
Common name: Pacific electric ray

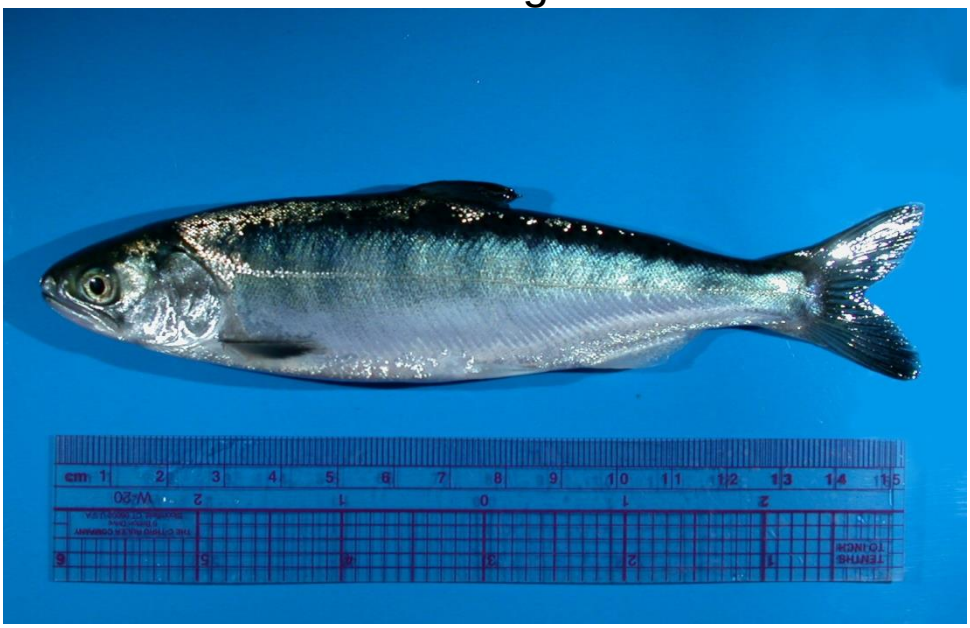


Family: Clupeidae
Species name: *Sardinops sagax*
Common name: Pacific sardine

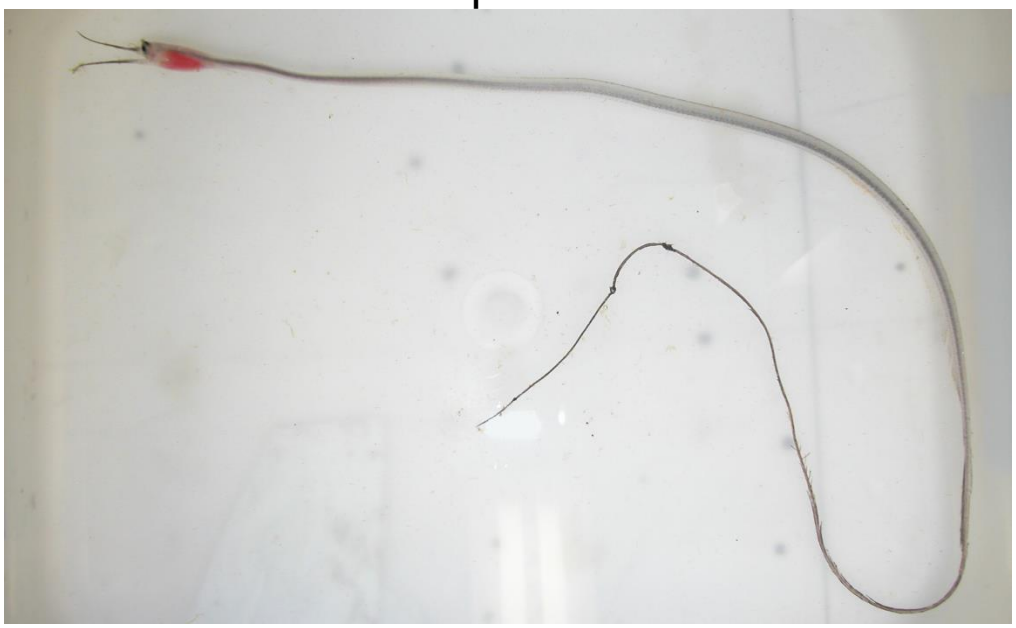
Family: Engraulidae
Species name: *Engraulis mordax*
Common name: northern anchovy



Family: Salmonidae
Species name: *Oncorhynchus tshawytscha*
Common name: Chinook or king salmon



Family: Nemichthyidae
Species name: *Nemichthys scolopaceus*
Common name: slender snipe eel



Family: Osmeridae
Species name: *Allosmerus elongatus*
Common name: whitebait smelt

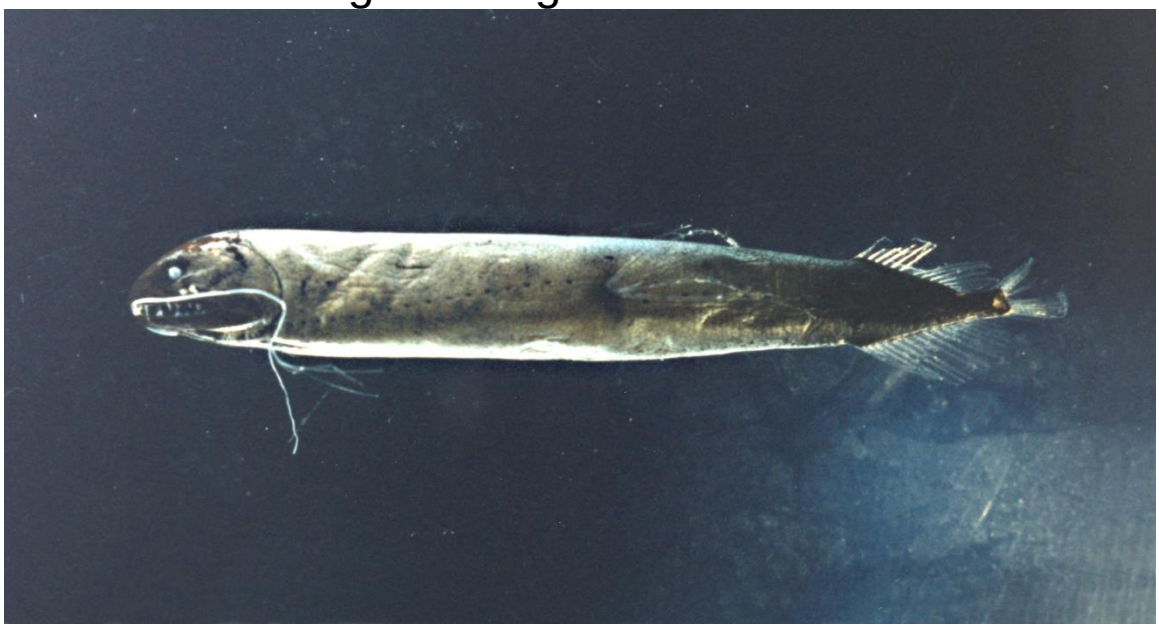
Family: Argentinidae
Species name: *Argentina sialis*
Common name: Pacific argentine (juvenile)

Family: Bathylagidae
Species name: *Leuroglossus stilbius*
Common name: California smoothtongue

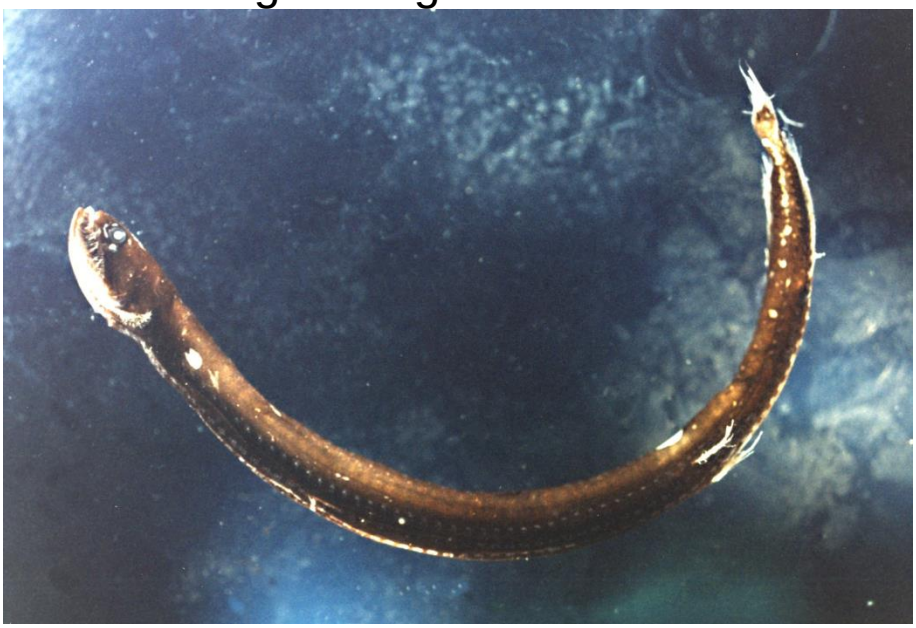
Family: Phosichthyidae
Species name: *Vinciguerria nimbaria*
Common name: oceanic lightfish

Family: Stomiidae
Species name: *Stomias atriventer*
Common name: black-belly dragonfish

Family: Stomiidae
Species name: *Bathophilus flemingi*
Common name: highfin dragonfish



Family: Stomiidae
Species name: *Tactostoma macropus*
Common name: longfin dragonfish



Family: Stomiidae
Species name: *Malacosteus niger*
Common name: stoplight loosejaw

Family: Stomiidae
Species name: *Idiacanthus antrostomus*
Common name: Pacific blackdragon

Family: Paralepididae
Species name: *Lestidiops ringens*
Common name: slender barracudina

Family: Synodontidae
Species name: *Synodus lucioceps*
Common name: California lizardfish (juvenile)

Family: Myctophidae
Species name: *Diaphus theta*
Common name: California headlightfish

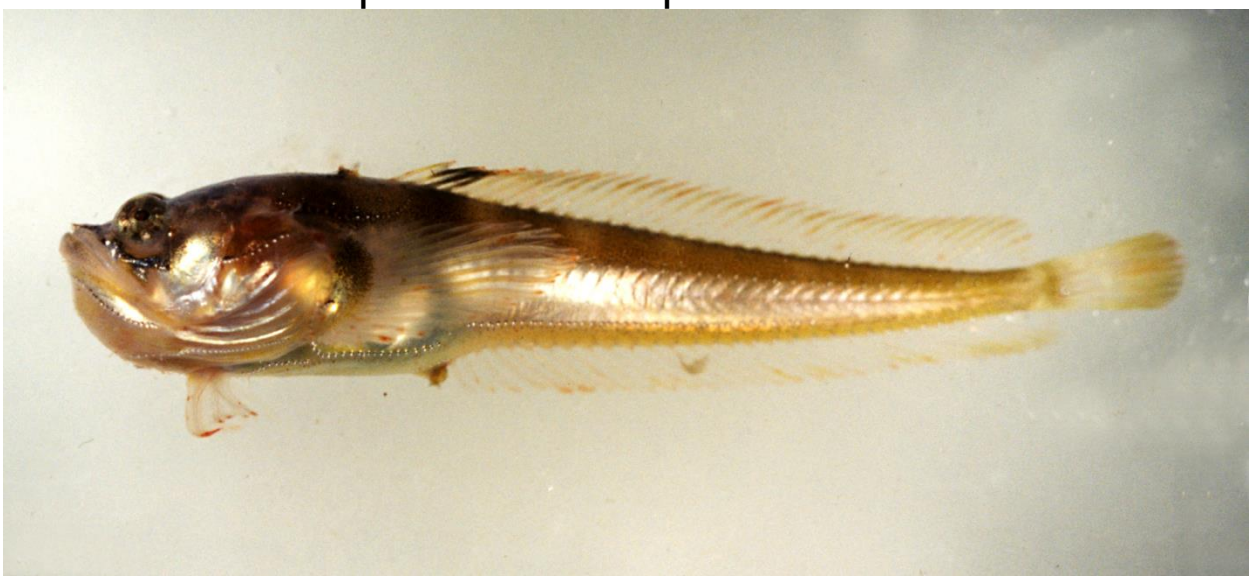
Family: Myctophidae
Species name: *Lampadena urophaos*
Common name: sunbeam lampfish

Family: Myctophidae
Species name: *Stenobrachius leucopsarus*
Common name: northern lampfish

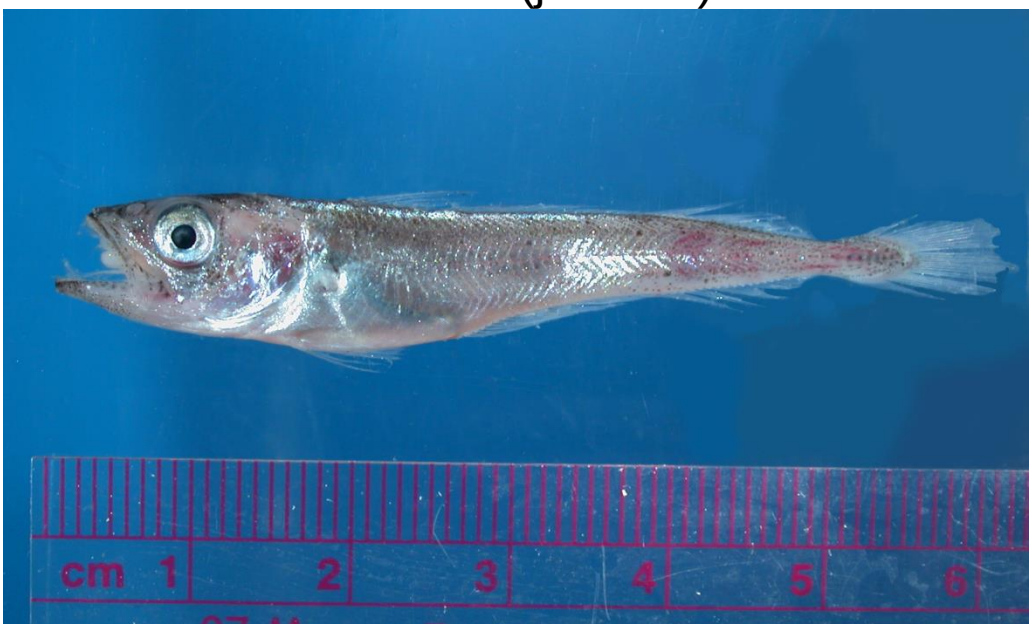
Family: Myctophidae
Species name: *Tarletonbeania crenularis*
Common name: blue lanternfish

Family: Myctophidae
Species name: *Nannobrachium ritteri*
Common name: broadfin lampfish

Family: Batrachoididae
Species name: *Porichthys notatus*
Common name: plainfin midshipman

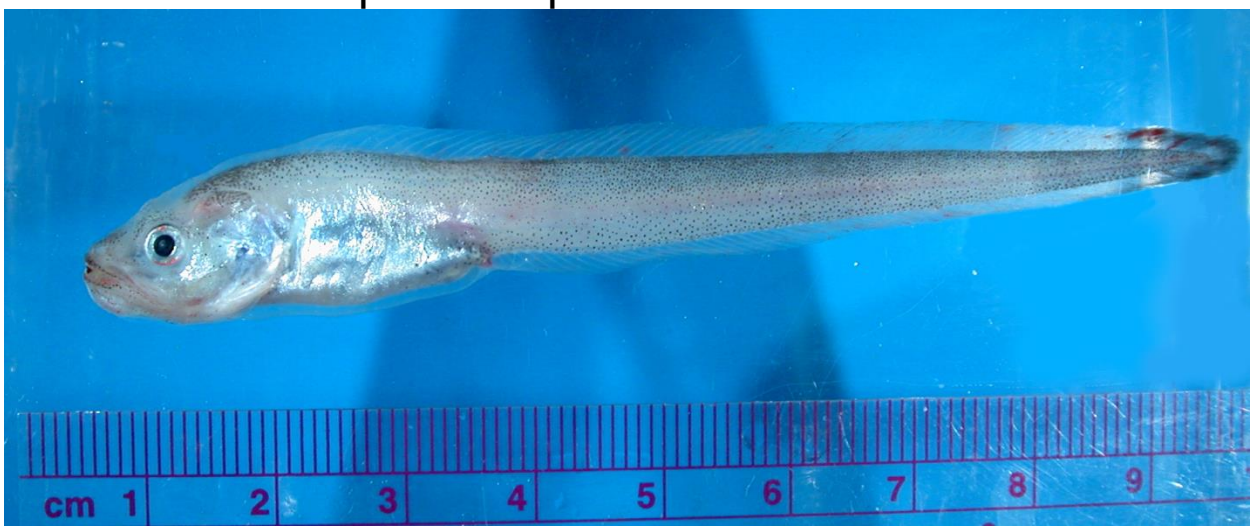


Family: Merlucciidae
Species name: *Merluccius productus*
Common name: Pacific hake (juvenile)

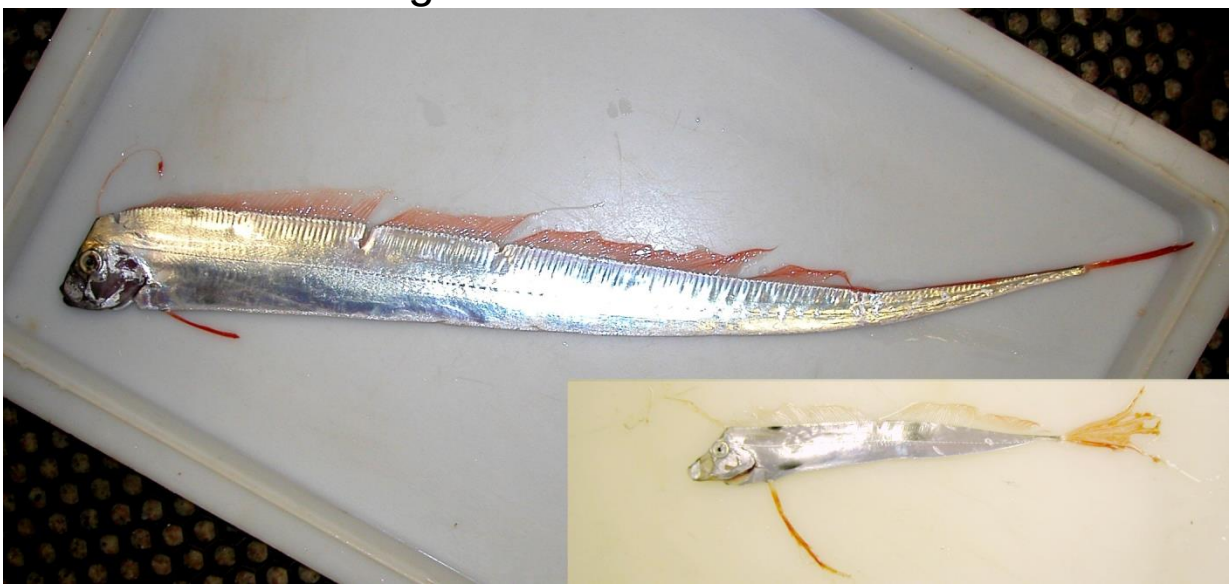


Family: Merlucciidae
Species name: *Merluccius productus*
Common name: Pacific hake (adult)

Family: Zoarcidae
Species name: *Lycodapus mandibularis*
Common name: pallid eelpout



Family: Trachipteridae
Species name: *Trachipterus altivelis*
Common name: king-of-the-salmon



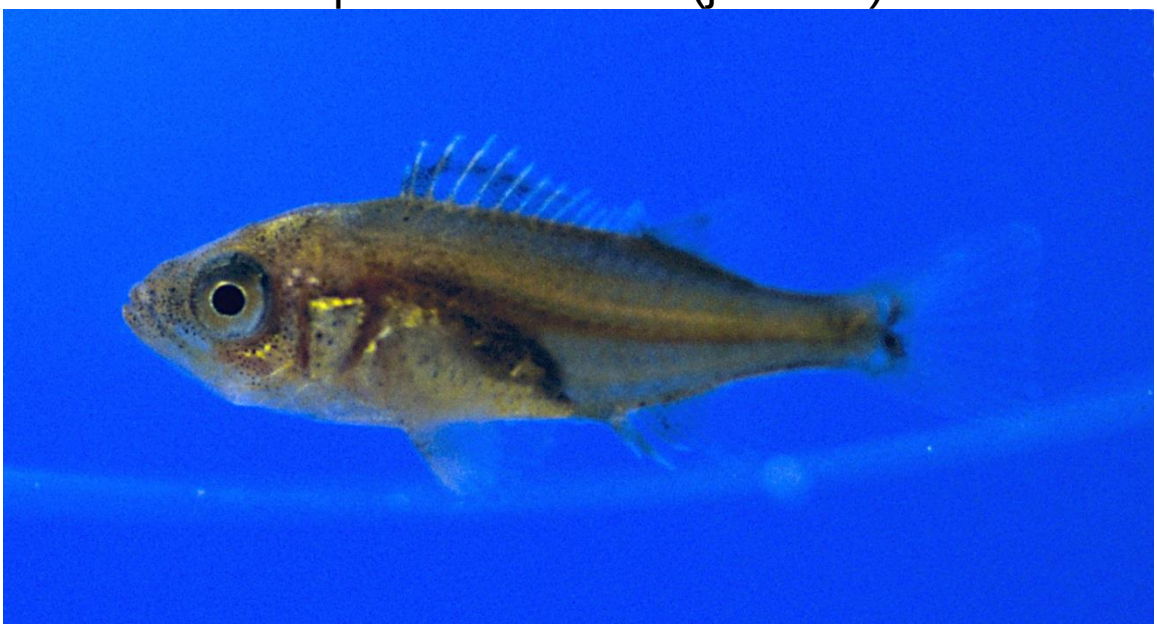
Family: Gasterosteidae
Species name: *Gasterosteus aculeatus*
Common name: three-spined stickleback

Family: Scorpaenidae
Species name: *Sebastes auriculatus*
Common name: brown rockfish (juvenile)

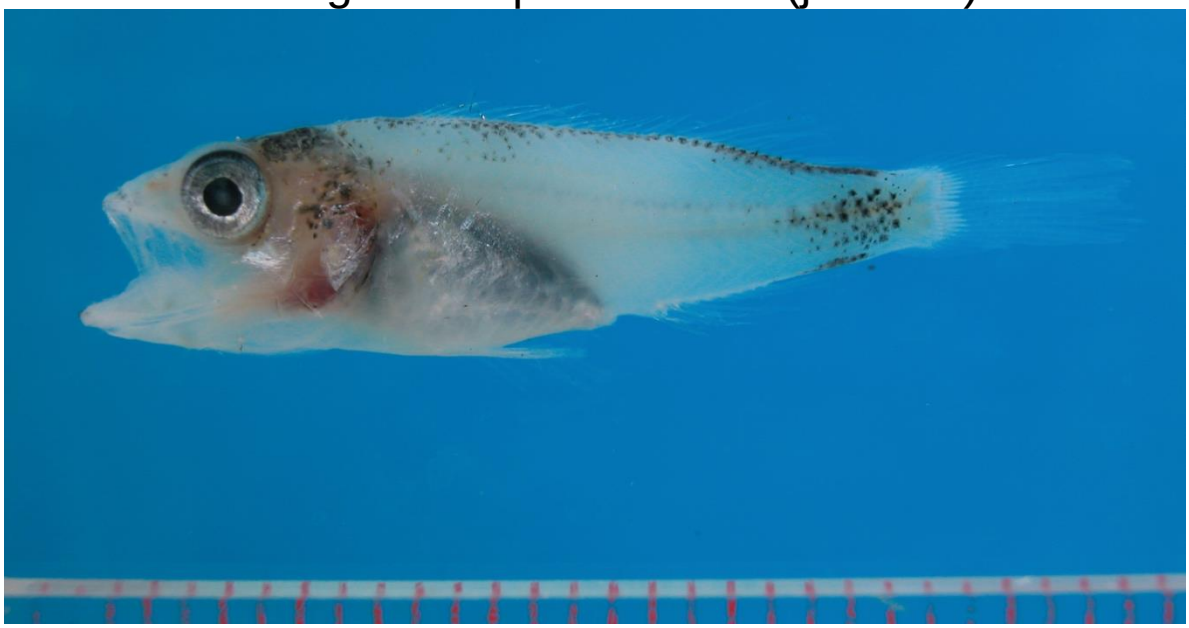
Family: Scorpaenidae
Species name: *Sebastes caurinus - carnatus/chrysomelas*
Common name: copper - gopher/black and yellow rockfish (juvenile)

Family: Scorpaenidae
Species name: *Sebastes crameri*
Common name: darkblotched rockfish (juvenile)

Family: Scorpaenidae
Species name: *Sebastes diploproa*
Common name: splitnose rockfish (juvenile)



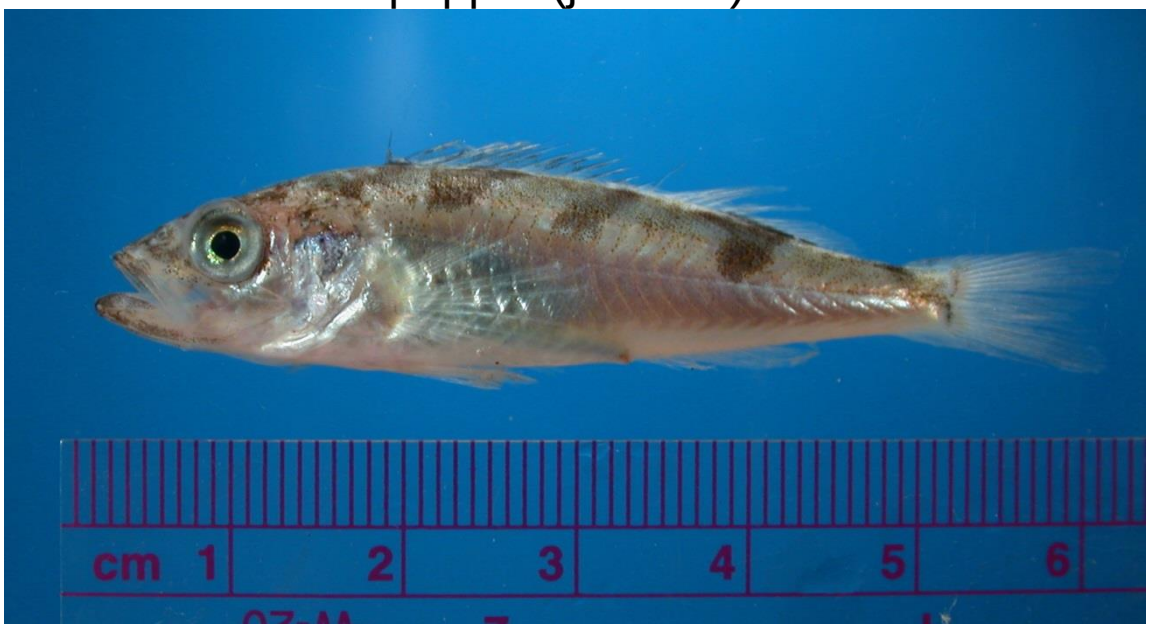
Family: Scorpaenidae
Species name: *Sebastes elongatus*
Common name: greenstriped rockfish (juvenile)



Family: Scorpaenidae
Species name: *Sebastes entomelas*
Common name: widow rockfish (juvenile)

Family: Scorpaenidae
Species name: *Sebastes flavidus*
Common name: yellowtail rockfish (juvenile)

Family: Scorpaenidae
Species name: *Sebastes goodei*
Common name: chilipepper (juvenile)



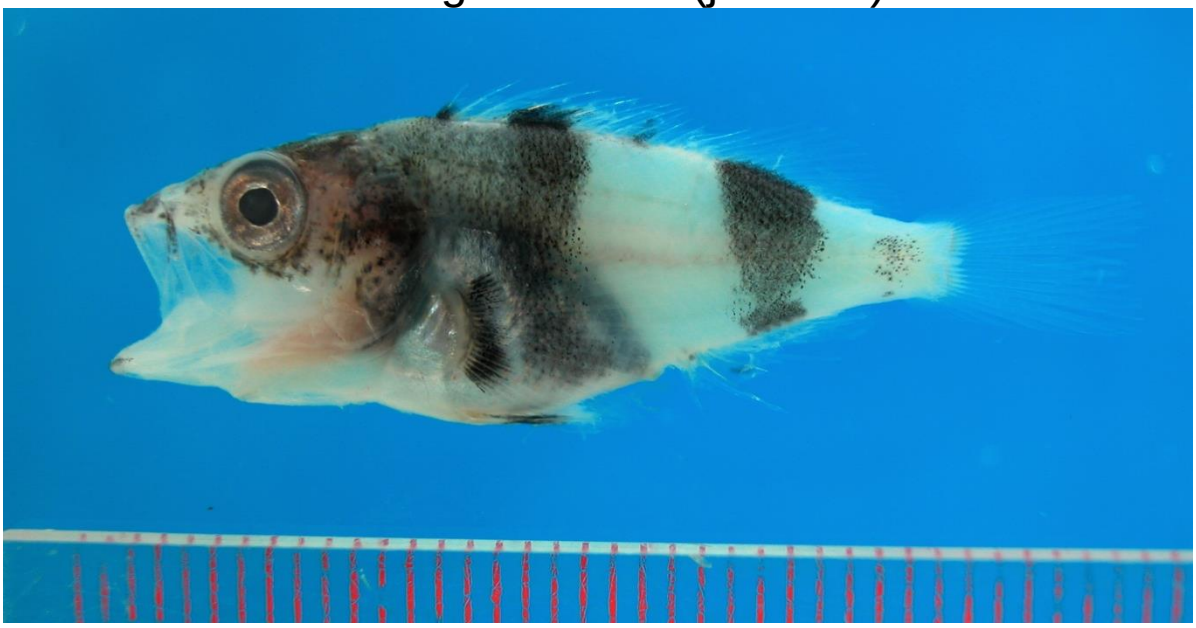
Family: Scorpaenidae
Species name: *Sebastes hopkinsi*
Common name: squarespot rockfish (juvenile)

Family: Scorpaenidae
Species name: *Sebastes jordani*
Common name: shortbelly rockfish (juvenile)

Family: Scorpaenidae
Species name: *Sebastes levis*
Common name: cowcod (juvenile)

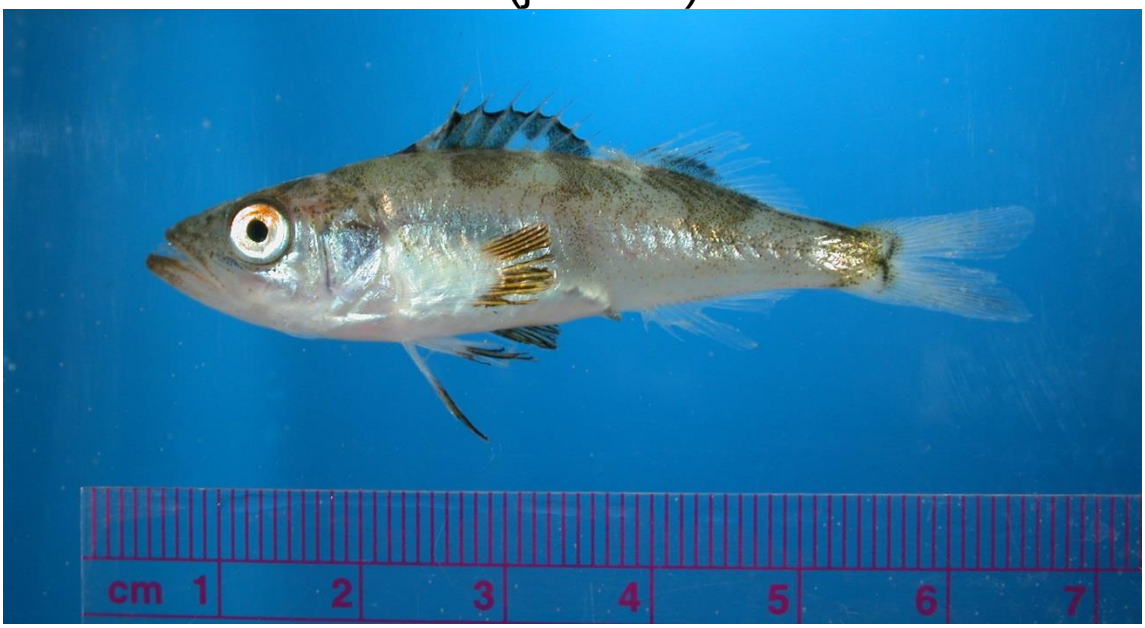
Family: Scorpaenidae
Species name: *Sebastes melanops*
Common name: black rockfish (juvenile)

Family: Scorpaenidae
Species name: *Sebastes melanostomus*
Common name: blackgill rockfish (juvenile)

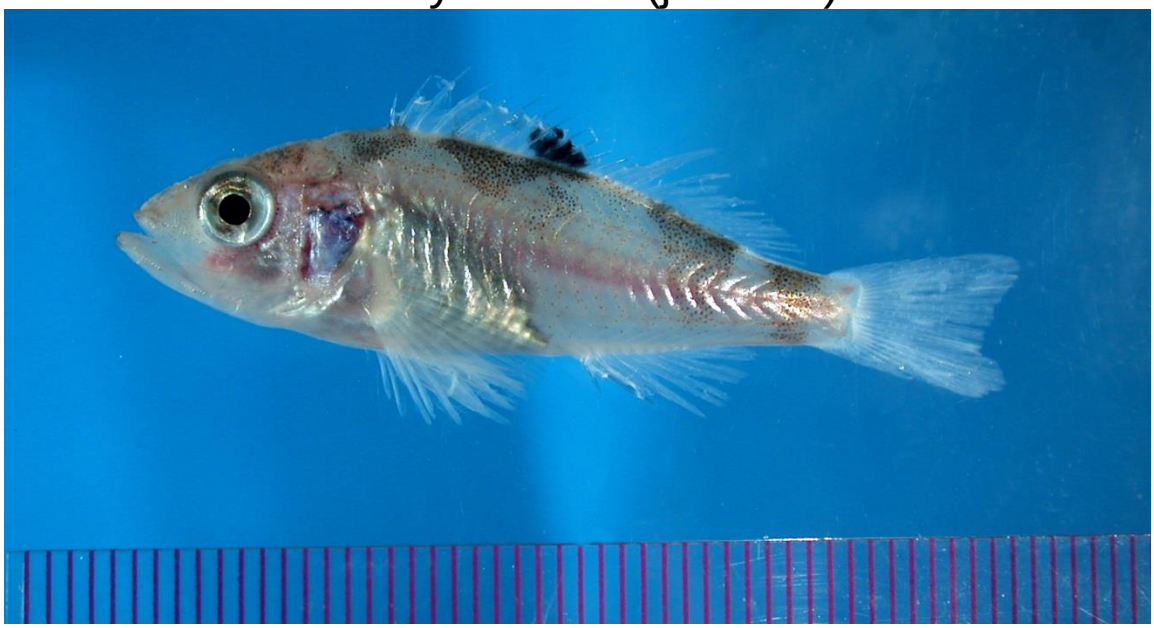


Family: Scorpaenidae
Species name: *Sebastes mystinus*
Common name: blue rockfish (juvenile)

Family: Scorpaenidae
Species name: *Sebastes paucispinis*
Common name: bocaccio (juvenile)



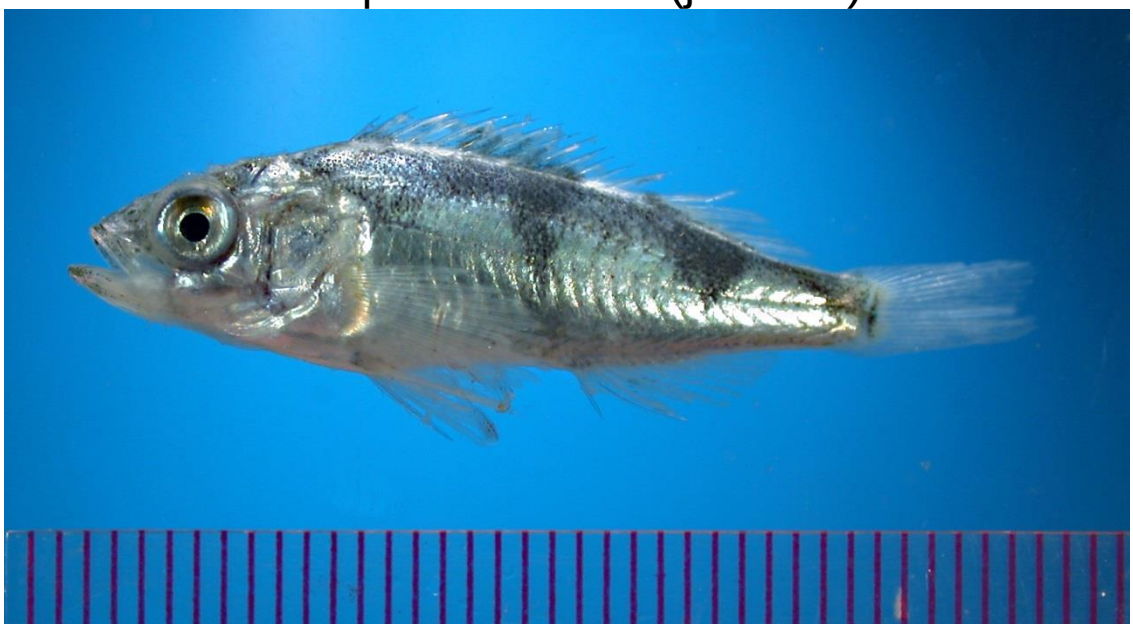
Family: Scorpaenidae
Species name: *Sebastes pinniger*
Common name: canary rockfish (juvenile)



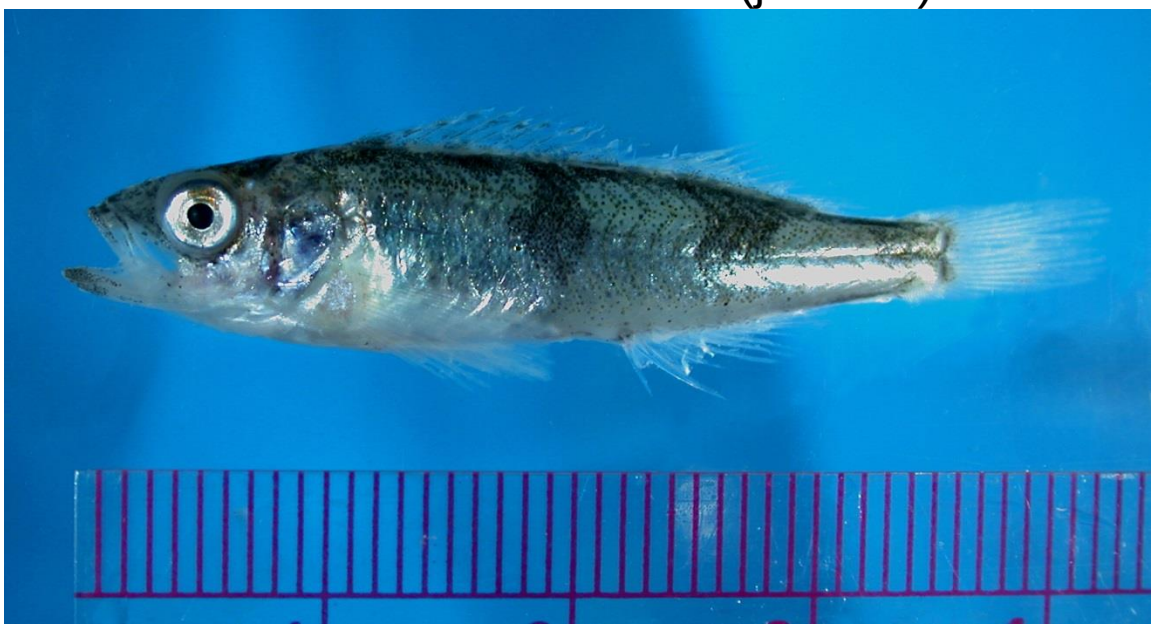
Family: Scorpaenidae
Species name: *Sebastes rastrelliger*
Common name: grass rockfish (juvenile)

Family: Scorpaenidae
Species name: *Sebastes rufus*
Common name: bank rockfish (juvenile)

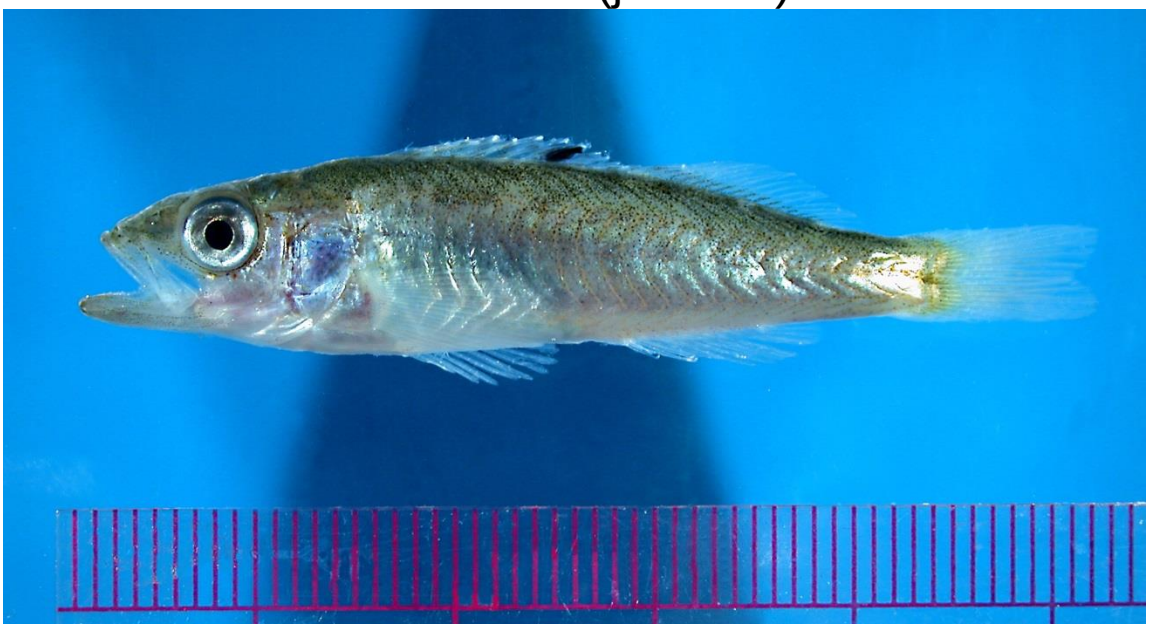
Family: Scorpaenidae
Species name: *Sebastes saxicola*
Common name: stripetail rockfish (juvenile)



Family: Scorpaenidae
Species name: *Sebastes semicinctus*
Common name: halfbanded rockfish (juvenile)



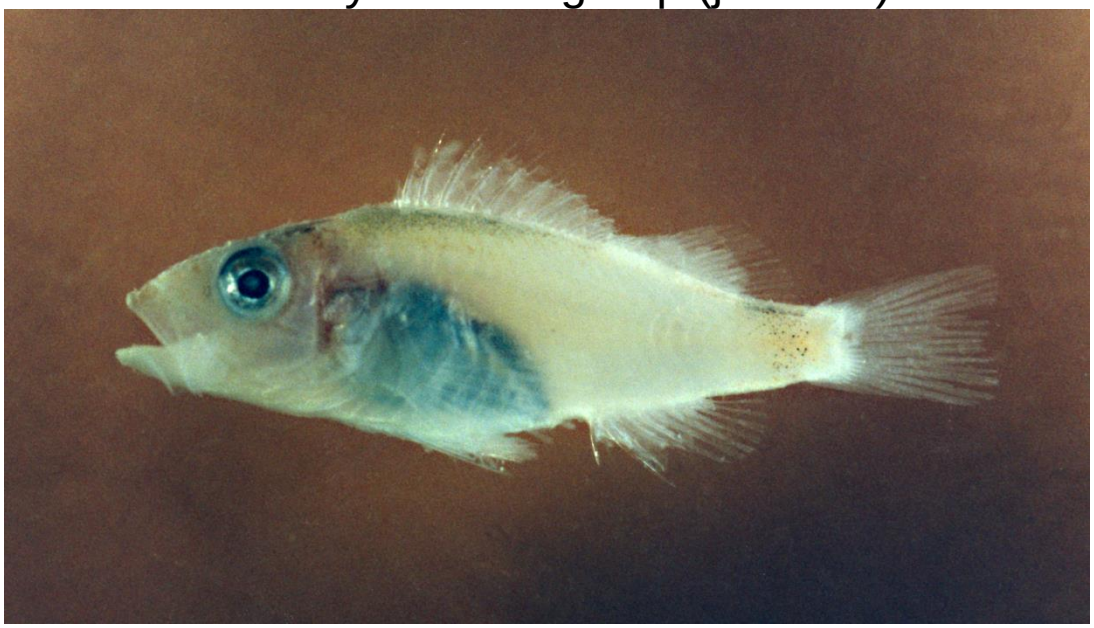
Family: Scorpaenidae
Species name: *Sebastes serranoides*
Common name: olive rockfish (juvenile)



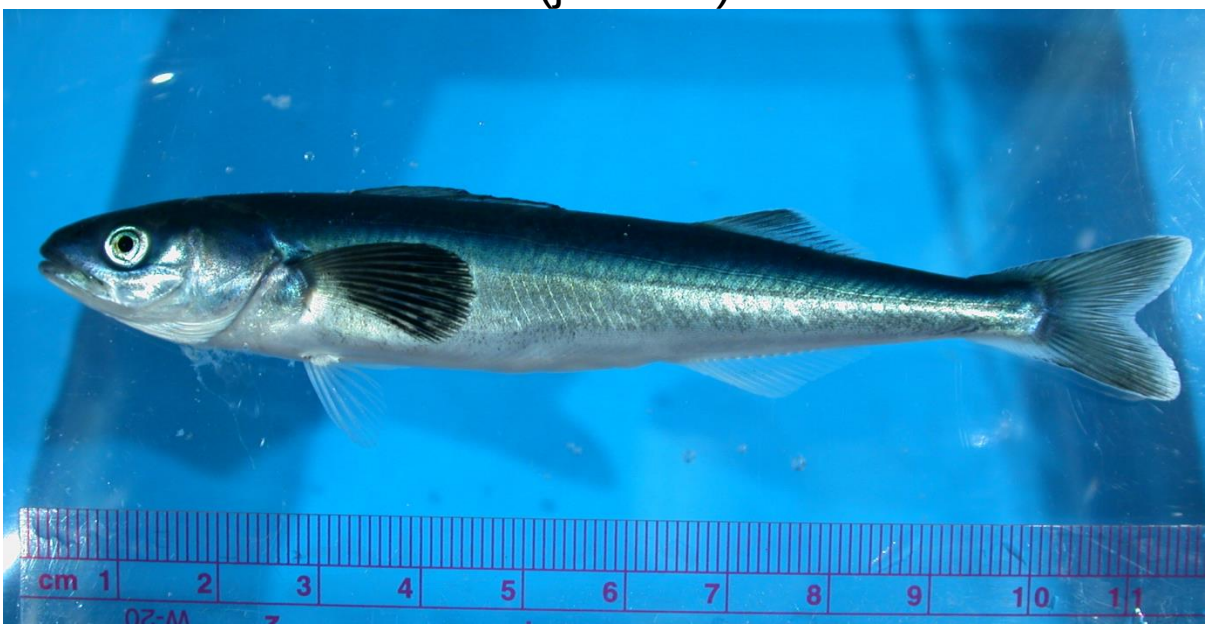
Family: Scorpaenidae
Species name: *Sebastes wilsoni*
Common name: pygmy rockfish (juvenile)

Family: Scorpaenidae
Species name: *Sebastes zacentrus*
Common name: sharpchin rockfish (juvenile)

Family: Scorpaenidae
Species name: *Sebastomus* subgenera
Common name: rosy rockfish group (juvenile)

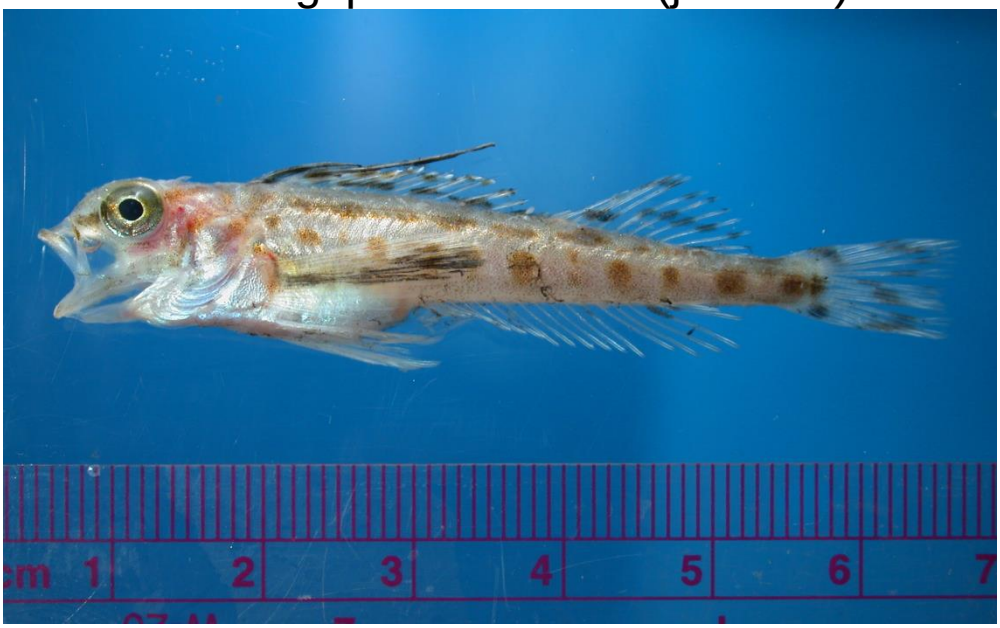


Family: Anoplopomatidae
Species name: *Anoplopoma fimbria*
Common name: sablefish (juvenile)



Family: Hexagrammidae
Species name: *Zaniolepis frenata*
Common name: shortspine combfish (juvenile)

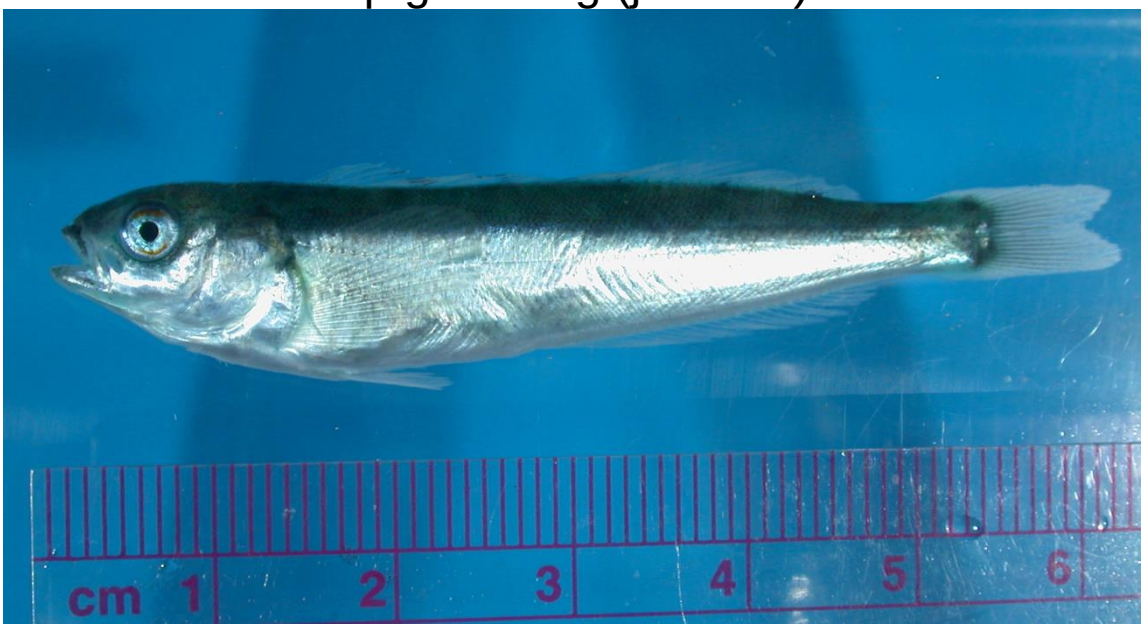
Family: Hexagrammidae
Species name: *Zaniolepis latipinnis*
Common name: longspine combfish (juvenile)



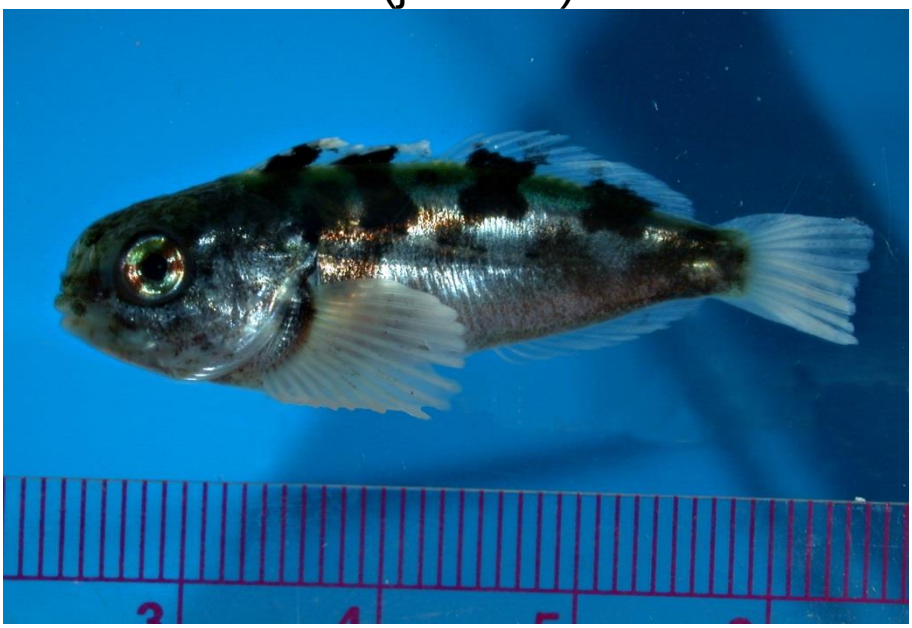
Family: Hexagrammidae
Species name: *Oxylebius pictus*
Common name: painted greenling (juvenile)

Family: Hexagrammidae
Species name: *Ophiodon elongatus*
Common name: lingcod (juvenile)

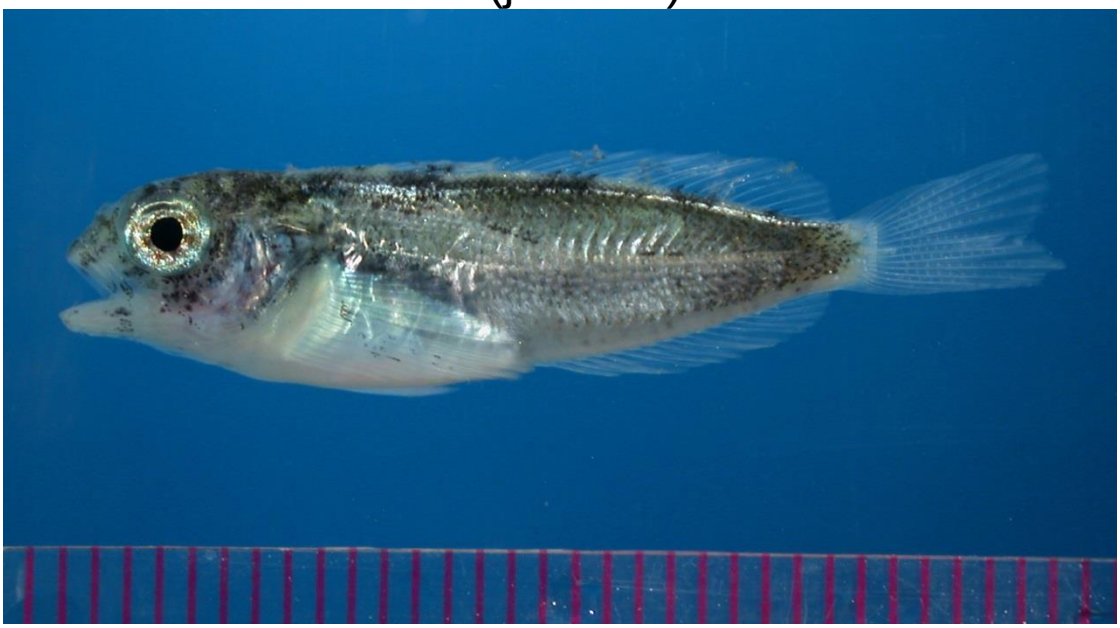
Family: Hexagrammidae
Species name: *Hexagrammos decagrammus*
Common name: kelp greenling (juvenile)



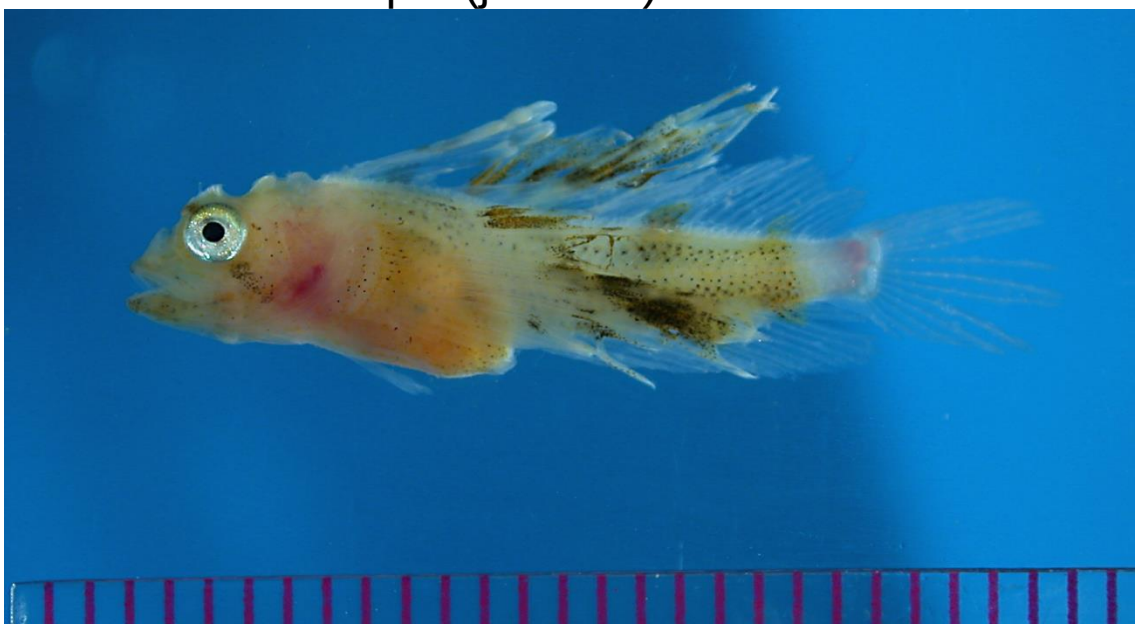
Family: Cottidae
Species name: *Scorpaenichthys marmoratus*
Common name: cabezon (juvenile)



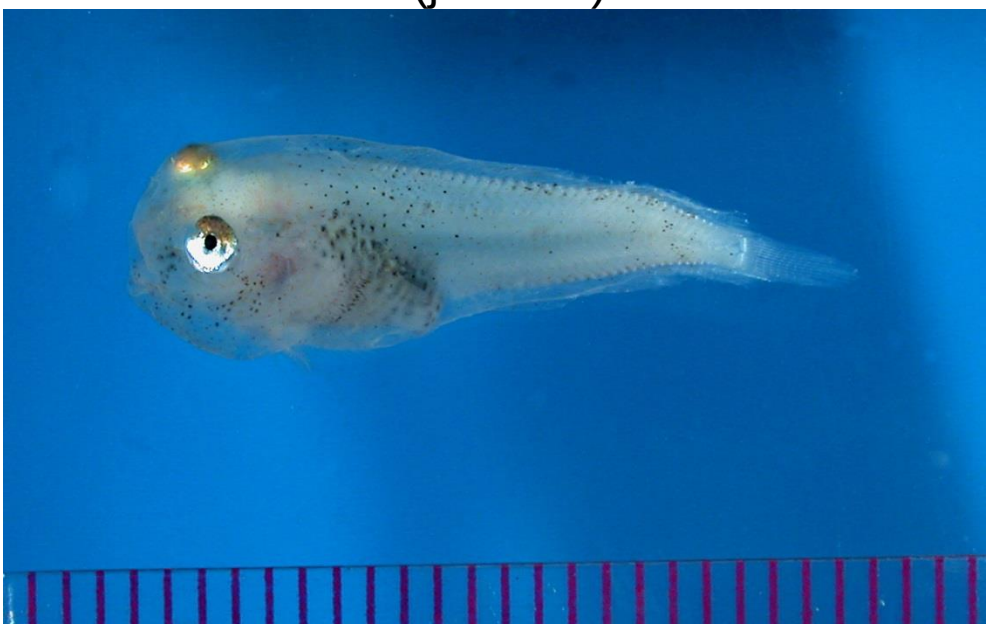
Family: Cottidae
Species name: *Hemilepidotus* spp.
Common name: Irish lord (juvenile)



Family: Cottidae
Species name: Unidentified
Common name: sculpin (juvenile)

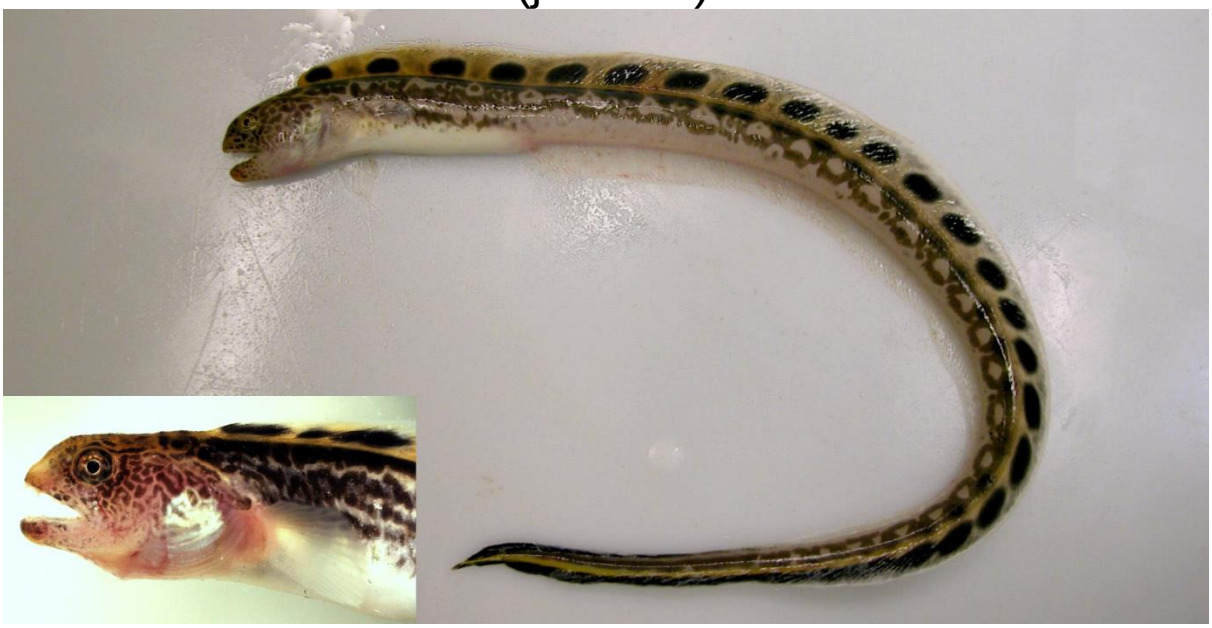


Family: Liparidae
Species name: *Liparis* spp.
Common name: snailfish (juvenile)



Family: Carangidae
Species name: *Trachurus symmetricus*
Common name: jack mackerel (juvenile)

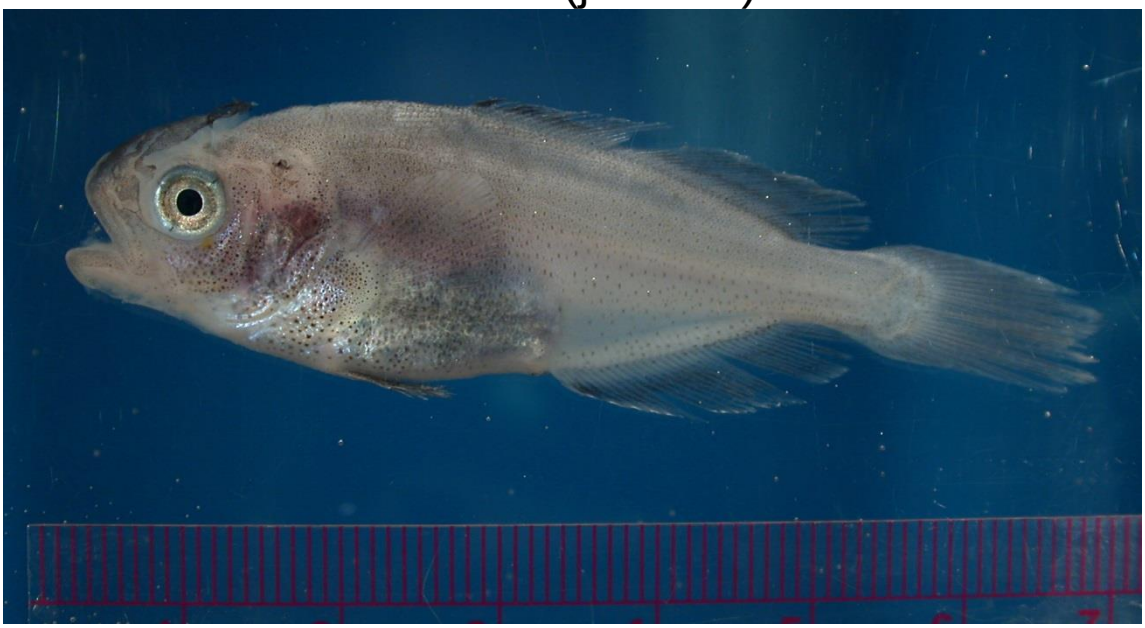
Family: Anarhichadidae
Species name: *Anarrhichthys ocellatus*
Common name: wolf-eel (juvenile)



Family: Icosteidae
Species name: *Icosteus aenigmaticus*
Common name: ragfish (juvenile)

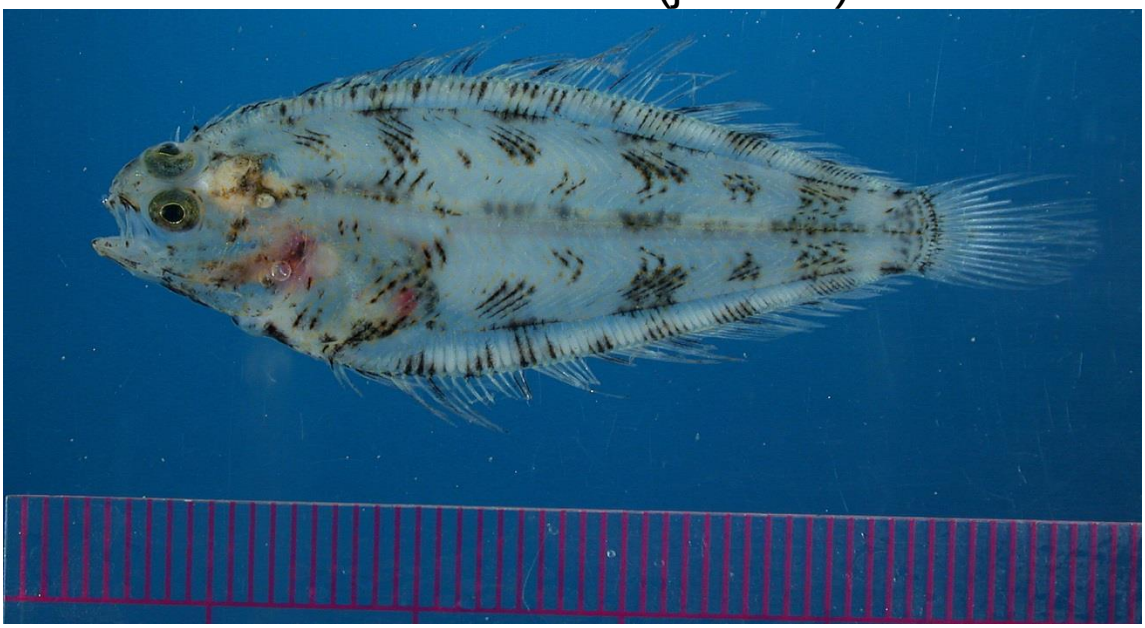
Family: Gobiidae
Species name: *Rhinogobiops nicholsii*
Common name: blackeye goby (juvenile)

Family: Centrolophidae
Species name: *Icichthys lockingtoni*
Common name: medusafish (juvenile)

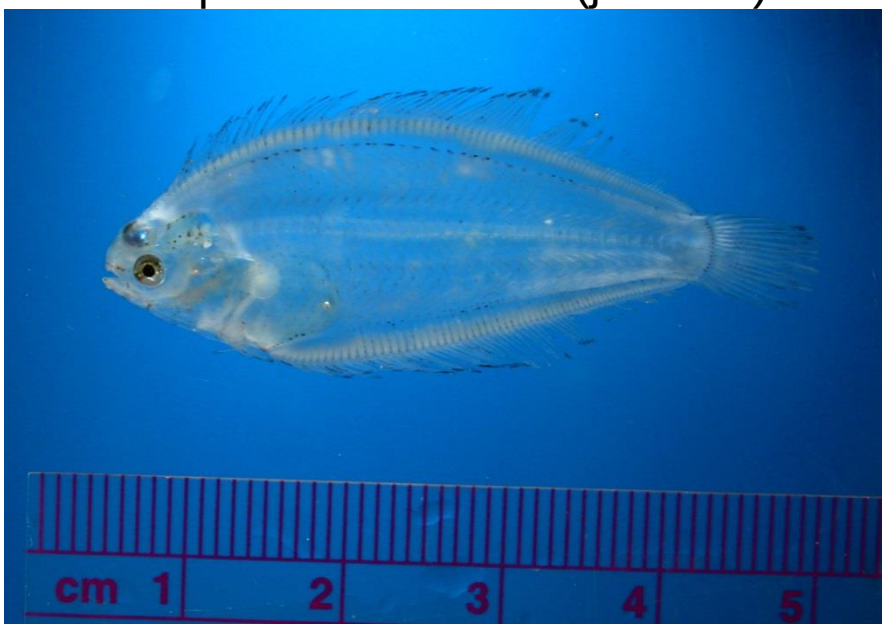


Family: Stromateidae
Species name: *Peprilus simillimus*
Common name: Pacific pompano (juvenile and adult)

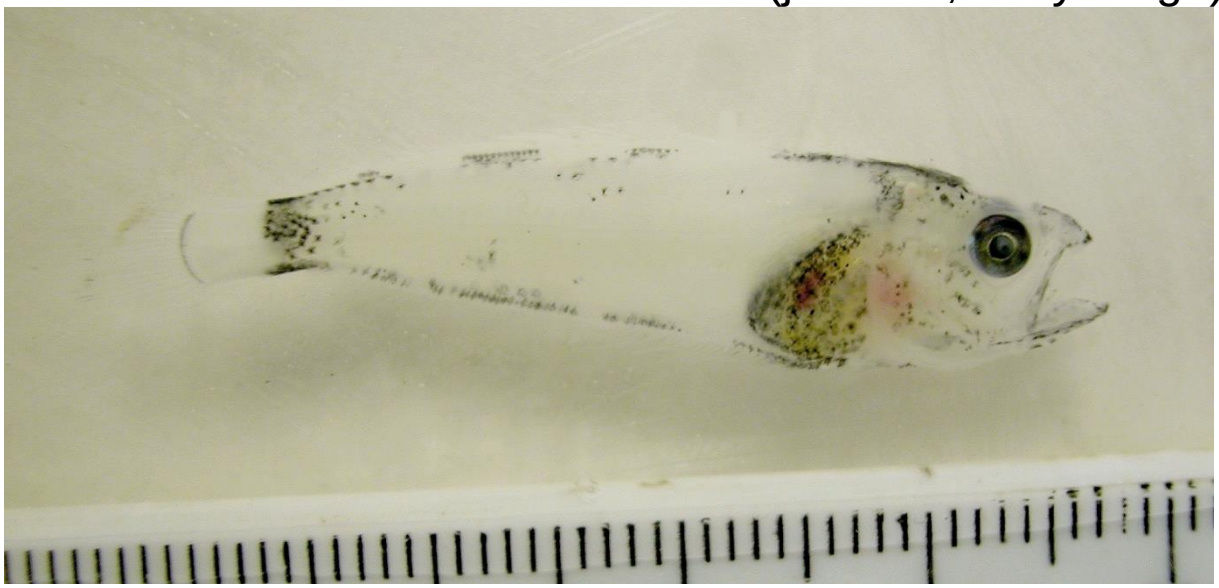
Family: Paralichthyidae
Species name: *Citharichthys sordidus*
Common name: Pacific sanddab (juvenile)



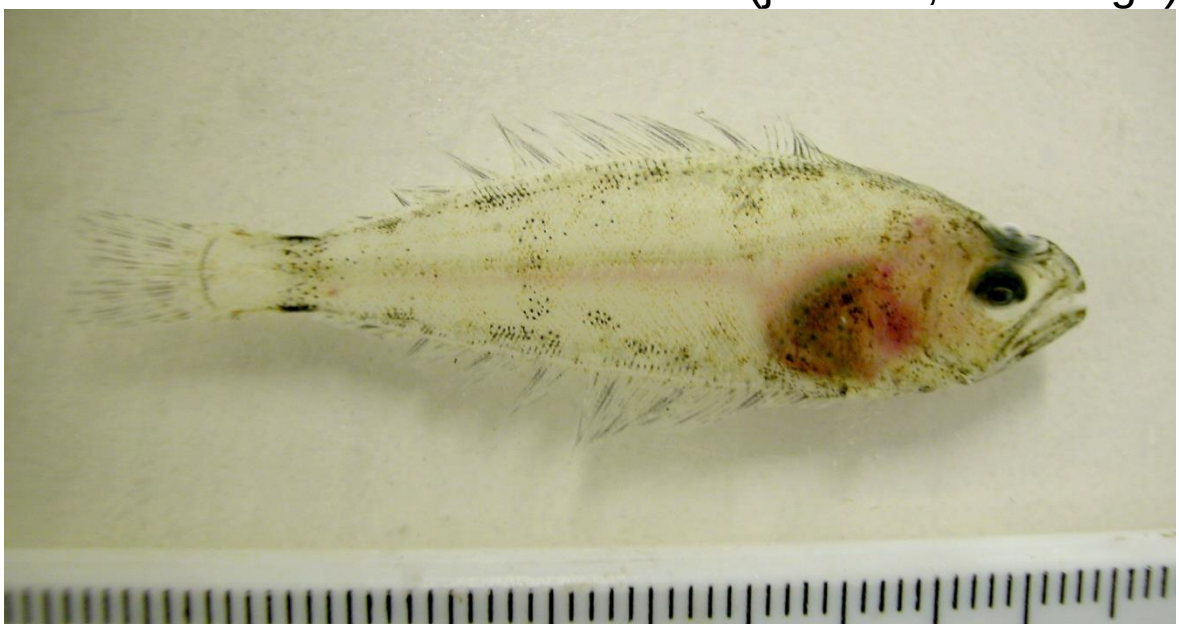
Family: Paralichthyidae
Species name: *Citharichthys stigmaeus*
Common name: speckled sanddab (juvenile)



Family: Pleuronectidae
Species name: *Atheresthes stomias*
Common name: arrowtooth flounder (juvenile, early-stage)

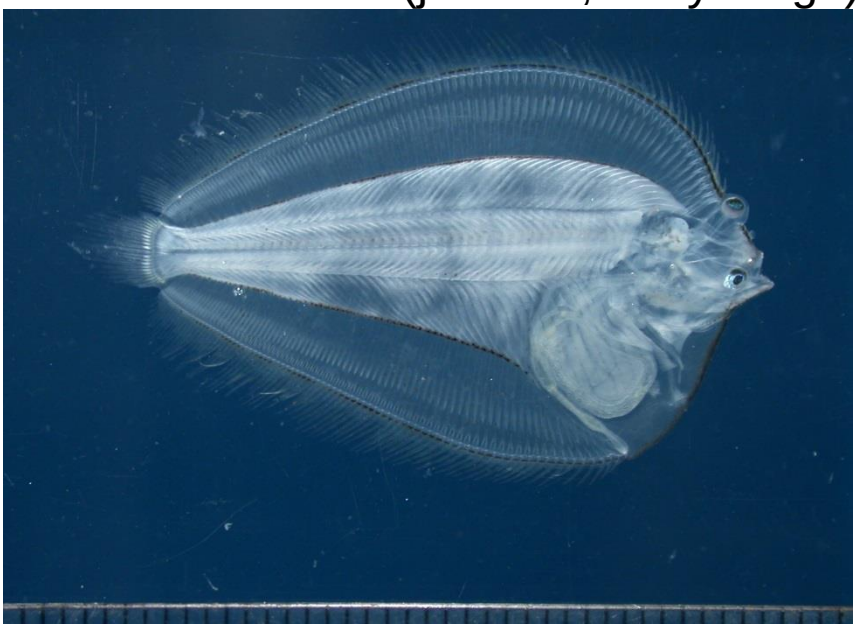


Family: Pleuronectidae
Species name: *Atheresthes stomias*
Common name: arrowtooth flounder (juvenile, late-stage)

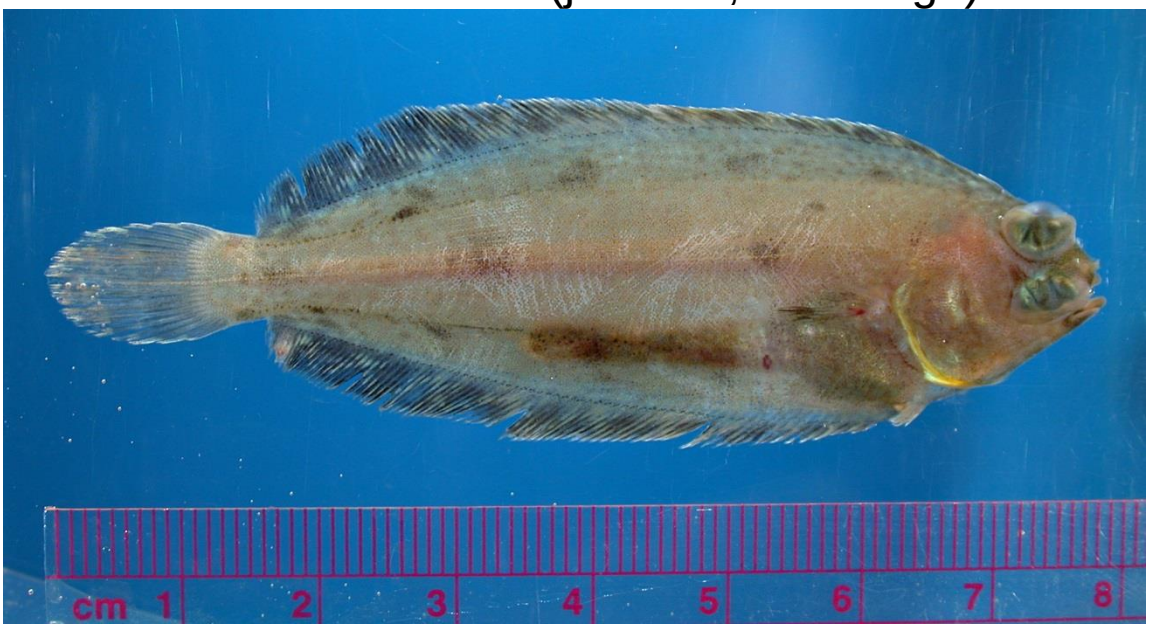


Family: Pleuronectidae
Species name: *Glyptocephalus zachirus*
Common name: rex sole (juvenile, early-stage)

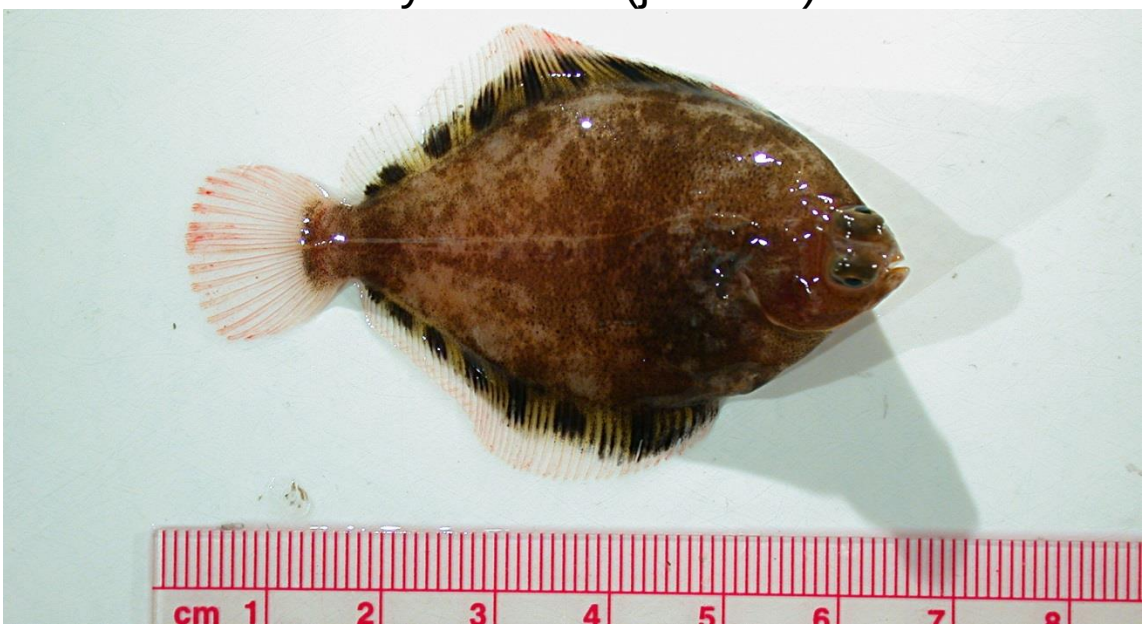
Family: Pleuronectidae
Species name: *Microstomus pacificus*
Common name: Dover sole (juvenile, early-stage)



Family: Pleuronectidae
Species name: *Microstomus pacificus*
Common name: Dover sole (juvenile, late-stage)

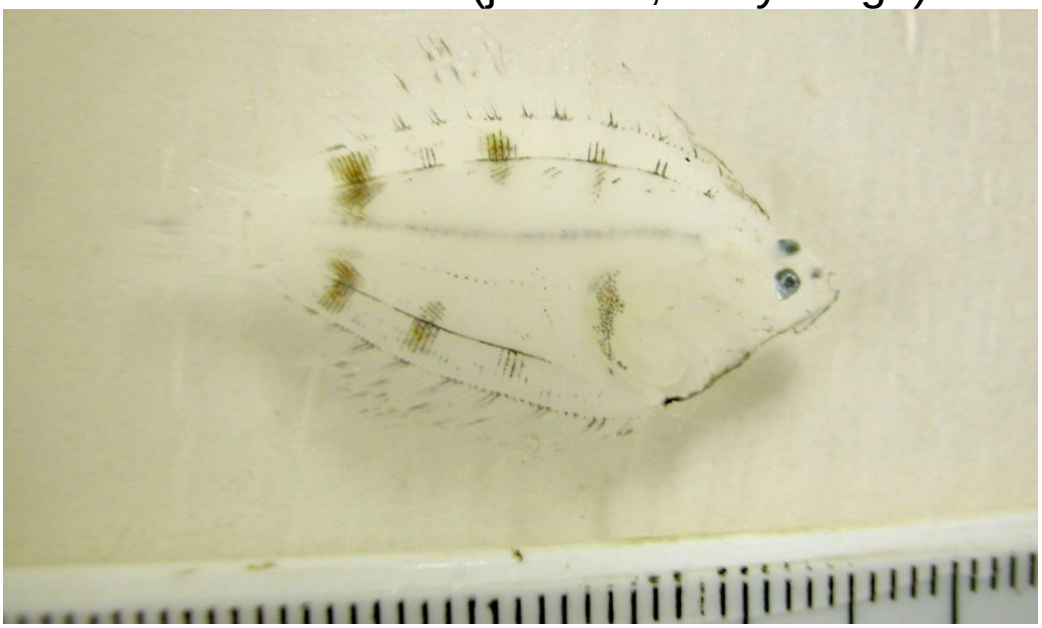


Family: Pleuronectidae
Species name: *Platichthys stellatus*
Common name: starry flounder (juvenile)



Family: Pleuronectidae
Species name: *Pleuronichthys decurrens*
Common name: curlfin sole (juvenile)

Family: Pleuronectidae
Species name: *Psettichthys melanostictus*
Common name: sand sole (juvenile, early-stage)



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