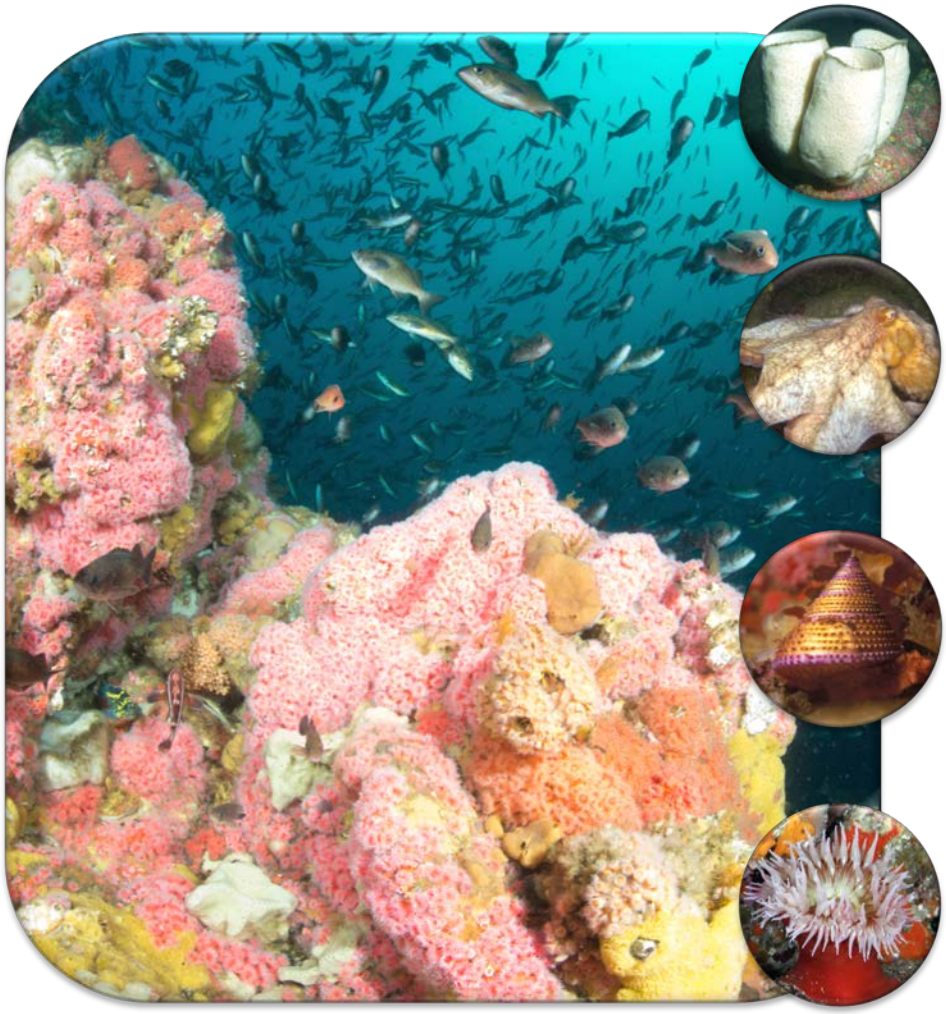
Cordell Bank Taxonomic Guide



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Cordell Bank National Marine Sanctuary 2017

Cover:
Main Photo: Reef habitat at Cordell Bank, C. Bauder/CBNMS
Top circle photo: Unidentified barrel sponge, K. Evans/CBNMS
Top middle circle photo: Giant Pacific octopus (*Enteroctopus dofleini*), K. Evans/CBNMS
Bottom middle circle photo: Purple ring snail (*Calliostoma annulatum*), CBNMS
Bottom circle photo: Fish eating anemone (*Urticina piscivora*), CBNMS

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Table of Contents

About Cordell Bank National Marine Sanctuary

Cordell Bank is an offshore underwater granitic formation, located on the continental shelf approximately 20 nautical miles west of Point Reyes, northern California (Figure 1). George Davidson of the U.S. Coast Survey discovered the bank in 1853 during a mapping expedition on the north coast of California. Not much was known about what life existed on the bank until Cordell Expeditions, a non-profit research association, began exploring the bank using scuba in 1977. These surveys discovered the incredibly rich ecosystem of the bank including dense aggregations of colorful invertebrates on the bank and schools of rockfish above.

The documentation by Cordell Expeditions led to the designation of Cordell Bank National Marine Sanctuary (CBNMS) in 1989, which was established to protect the bank and the surrounding areas, a total of 529 square miles. In 2015, the sanctuary was expanded to 1,286 square miles to provide greater protection, and now includes Bodega Canyon to the north of Cordell Bank and deep slope habitat to the west. Sanctuary designation provides protection through regulations and the sanctuary staff works to enhance conservation and stewardship through education, research, resource protection, and community engagement.

Since the original explorations by the Cordell Expedition divers, 21 surveys have collected data on the benthic habitat in CBNMS as of July 2016. The majority of these surveys focused on the bank but some were conducted on the other habitat types in the sanctuary, including the continental shelf and slope, and head of Bodega Canyon. These surveys documented the abundant and diverse benthic communities, including colorful hydrocorals and anemones covering the reef crests of the bank, sea pen and brittle star fields on the soft sediment on the shelf, and mixed cobble and boulder habitats that provide hard substrate and crevices for species such as crinoids and sea stars. This guide brings together information from these surveys about species that have been observed on or around Cordell Bank to serve as a guide to scientists studying the area and as a reference to students and teachers learning about seafloor habitats in CBNMS.

Methods

This guide provides a baseline taxonomic characterization of the benthic species found on or around Cordell Bank. The initial focus when creating this guide was to include the invertebrates and algae found on Cordell Bank. Some surrounding areas were also included because missions to the bank often included areas adjacent to the bank. Fish species, as well as species in deep-water sanctuary habitats, which are not included here, could be added in future versions of this report.

To determine species found in these habitats we reviewed photos and documents from surveys that occurred on and around Cordell Bank from 1977 to 2014 and developed a list of species that had been observed and reported. In particular, reports from the most recent ROV surveys on Cordell Bank in 2010 and 2014 were extensively referenced. The

list of taxa was checked against a species database maintained by CBNMS that documents all confirmed species observed in the sanctuary.

Images collected during these surveys are archived in the CBNMS multimedia library and were reviewed to identify high quality, representative images of the taxa to include in this guide. Information about the taxa was curated from published references. Sanctuary scientists reviewed images for identification confirmation. Species for which we were not able to confirm identification are marked as unidentified.

About This Guide

There are 80 taxa presented in this guide. The guide is divided into 9 phyla and each section is color coded for easy reference. In each phylum, species are listed one or two to a page in alphabetical order and include, at most an image and scientific classification, common name, typical habitat, identifying characteristics, and life history facts. Not all items are listed for each taxa. Classification is listed to species when possible, or lowest possible confirmed classification. Taxa identified to genus for which species is unknown are indicated by "sp." following the genus (e.g., *Stomphia sp.*). Taxonomy was confirmed using The World Register of Marine Species (WoRMS).

Well-established common names are provided where appropriate. Descriptive names were also provided where a common name could not be used, such as for sponge morphologies.

The majority of photos were taken during research expeditions in the sanctuary and provided to CBNMS to use for research or education purposes. When a high quality photo was not available in the CBNMS multimedia library, a photo from another California sanctuary was acquired from the Sanctuary Integrated Monitoring Network (SIMoN) online photo library. Photo credit is given next to the photo of the taxa.

The sources used to classify organisms in this guide are cited in the *References.*

Acronyms

CBNMS	Cordell Bank National Marine Sanctuary
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
ROV	Remotely Operated Vehicle
SIMoN	Sanctuary Integrated Monitoring Network
WoRMS	World Register of Marine Species

Map of Cordell Bank

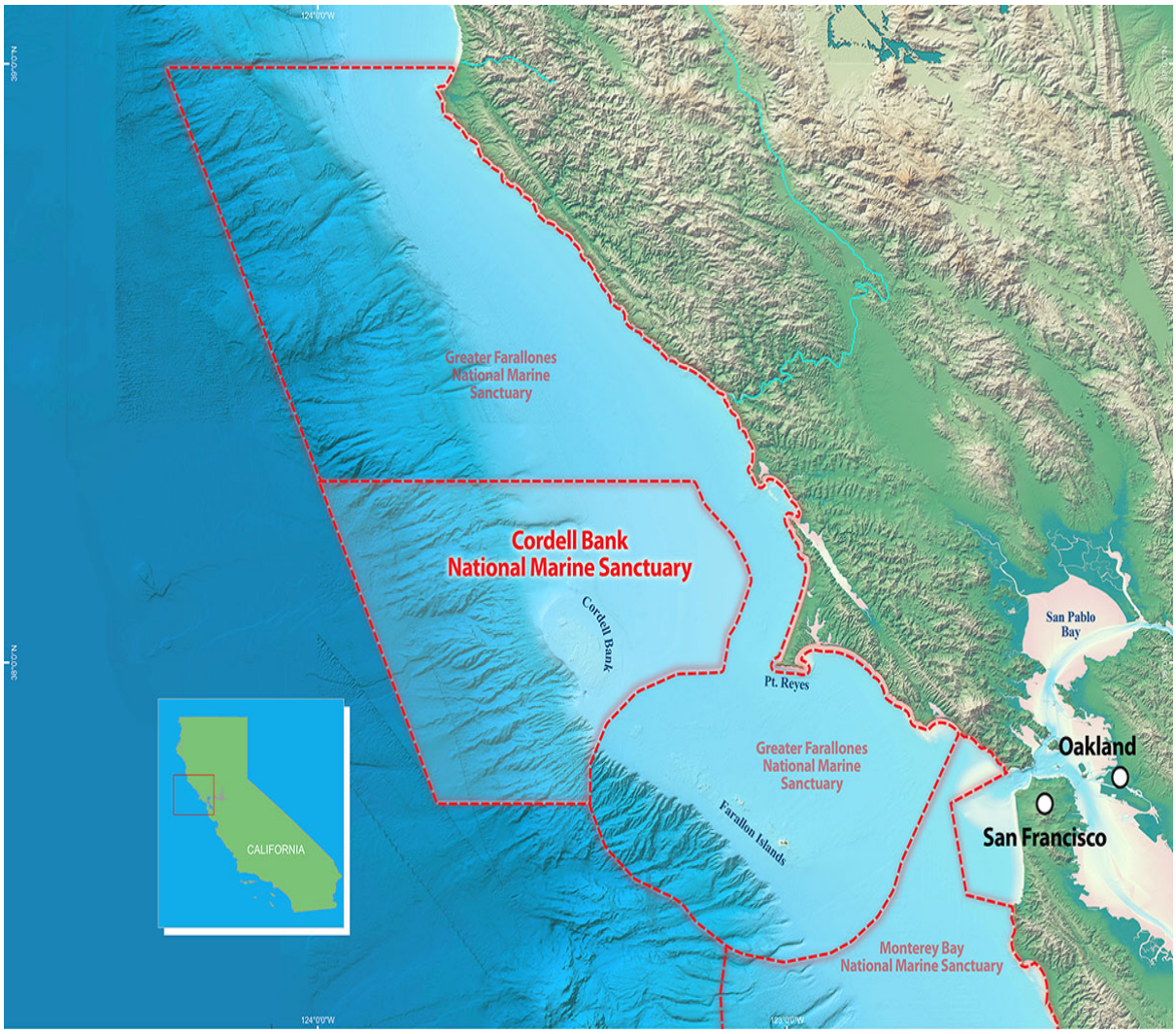

Figure 1. Map of CBNMS

Acknowledgements

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1. Phylum: Porifera

Class: Demospongiae

Order: Halichondrida

Family: Halichondriidae

Scientific Name: *Halichondria panicea*

Common Name: Brown sponge/bread crumb sponge

Identification: This sponge is typically yellow, orange or green, with a very rough surface. The osculas are smooth, circular, and slightly unevenly distributed.

Natural History: This sponge is a food source for the cushion star and several species of nudibranchs.

Habitat: Found in the intertidal to a depth of at least 90 m.

Photo Credit: M.Carver/CBNMS

1. Phylum: Porifera

Class: Demospongiae

Order: Poecilosclerida

Family: Mycalidae

Scientific Name: *Mycale sp.*

Common Name: Yellow vase sponge

Identification: This sponge looks like a yellowish cushion, found under boulders and on rocks.

Photo Credit: N.Puniwai/CBNMS

1. Phylum: Porifera

Class: Demospongiae

Order: Hadromerida

Family: Polymastiidae

Scientific Name: *Polymastia pachymastia*

Common Name: Aggregated nipple sponge

Identification: This sponge has many raised oscula that cover its surface, giving it a somewhat cone shape. Color can vary from pale to dark yellow. Aggregations may cover an area of 1.5m across.

Habitat: Found on rocks with sandy pockets, can be found in very low intertidal to at least 60 m.

Photo Credit: M.Carver/CBNMS

1. Phylum: Porifera

Class: Demospongiae

Order: Hadromerida

Family: Clionaidae

Scientific Name: *Spheciospongia confoederata*

Common Name: Gray moon sponge

Identification: Gray sponge (leathery in texture) with numerous crater-like oscula on the outer ridge. This sponge can grow to a thickness of 3.5 m and may reach 12 m in length.

Habitat: Found in low intertidal zone to at least 65 m.

Photo Credit: CBNMS

1. Phylum: Porifera

Class: Demospongiae
Order: Astrophorida
Family: Ancorinidae

Scientific Name: *Stelletta clarella*

Common Name: Black edge sponge

Habitat: At Cordell Bank, this sponge has been observed at depths less than 100m.

Photo Credit: C. Bauder/CBNMS

1. Phylum: Porifera

Class: Demospongiae

Order: Haplosclerida

Family: Petrosiidae

Scientific Name: *Xestospongia edapha*

Common Name: Locally known as "Cordell sponge"

Habitat: At Cordell Bank, this sponge has been observed at depths less than 100 m.

Photo Credit: R. Lee/CBNMS

1. Phylum: Porifera

Class: Calcarea

Order: Leucosolenida

Family: Amphoriscidae

Scientific Name: *Leucilla nuttingi*

Common Name: Urn sponge

Identification: An urn-shaped creamy white sponge with a single osculum at the free end.

Habitat: Found in groups of 5-10, the individuals are attached to rocks; from low intertidal to at least 70 m.

Photo Credit: CBNMS

1. Phylum: Porifera

Sponge Morphs

Common Name: Porifera - barrel

Identification: This sponge provides habitat for fish and other invertebrates with its barrel shaped morphology, it may be covered in sediment.

Habitat: At Cordell Bank, this has been observed at all depths on rocky substate.

Photo Credit: K.Evans/CBNMS

Common Name: Porifera - branched

Identification: This sponge's branching morphology provides habitat for fish and invertebrates.

Habitat: At Cordell Bank, this has been observed at all depths on rocky substate.

Photo Credit: CBNMS/NMFS

1. Phylum: Porifera

Sponge Morphs

Common Name: Porifera - encrusting

Identification: An encrusting sponge, found in multiple color morphs: red and orange.

Habitat: At Cordell Bank, this has been observed at all depths on rocky substate.

Photo Credit: M.Carver/CBNMS

Common Name: Porifera - mound

Identification: A rounded, ball-like sponge from multiple unknown species.

Habitat: At Cordell Bank, this has been observed at all depths on rocky substate.

Photo Credit: CBNMS

1. Phylum: Porifera

Sponge Morphs

Common Name: Porifera - orange

Identification: Orange sponge with large osculum.

Habitat: At Cordell Bank, this has been observed at shallow depths less than 70 m.

Photo Credit: CBNMS

Common Name: Porifera - shelf

Identification: This sponge grows horizontally and flat.

Habitat: At Cordell Bank, this has been observed at all depths on rocky substrate.

Photo Credit: K.Evans/CBNMS

1. Phylum: Porifera

Sponge Morphs

Common Name: Porifera - vase

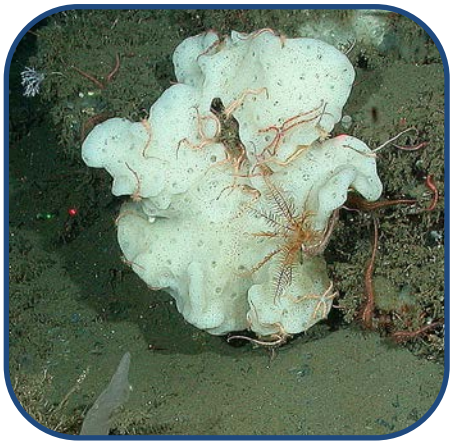
Identification: A vase or goblet shaped sponge

Habitat: At Cordell Bank, this has been observed at all depths on rocky substrate.

Photo Credit: CBNMS/NMFS

1. Phylum: Porifera

Sponge Morphs



Common Name: Porifera - upright

Identification: This sponge grows vertically and can have multiple attachment points.

Habitat: At Cordell Bank, this has been observed at all depths on rocky substrate.

Photo Credit: CBNMS/NMFS

2. Phylum: Cnidaria

Class: Hydrozoa

Order: Anthoathecata

Family: Bougainvilliidae

Scientific Name: *Garveia annulata*

Common Name: Orange hydroid

Identification: This orange hydroid occurs in clusters of 20-30 stems and polyps.

Natural History: Colonies are either female or male. Eggs are fertilized internally by free swimming sperm.

Habitat: Found on low intertidal rocks to depths of at least 60 m.

Photo Credit: M.Vieta/CBNMS

2. Phylum: Cnidaria

Class: Hydrozoa

Order: Anthoathecata

Family: Stylasteridae

Scientific Name: *Stylaster spp.* (*S. californicus* or *S. venustus*)

Common Name: Hydrocoral

Identification: The color of the *Stylaster spp.* colonies range from pink to dark purple, some are also seen with white tips

Natural History: Studies have been shown that it requires 20 or more years for a colony to grow to heights of 30 cm.

Habitat: Found at depths of 12 to 70 m.

Photo Credit: M.Vieta/CBNMS

2. Phylum: Cnidaria

Class: Anthozoa

Order: Actiniaria

Family: Actiniidae

Scientific Name: *Urticina piscivora*

Common Name: Fish eating anemone

Identification: This anemone has a red prominent column, with white tenactles, but can occasionally have red tentacles.

Natural History: This anemone feeds on fish and small invertebrates.

Habitat: Found on the sides of rocks, from the low intertidal to depth of 100 m.

Photo Credit: M.Carver/CBNMS

Scientific Name: *Urticina spp.*

Common Name: White spotted rose anemone

Identification: The column of this anemone is a very distinct red with white spots. The tentacles are a crimson color. The smooth column lacks tubercles.

Habitat: Found buried in sand and mud bottoms, from depths of 12 to 45 m.

Photo Credit: CBNMS

2. Phylum: Cnidaria

Class: Anthozoa

Order: Actiniaria

Family: Metridiidae

Scientific Name: *Metridium farcimen*

Common Name: White-plumed anemone

Identification: This large white anemone has a lobed oral disc. The tentacles are small and appear fluffy.

Natural History: This anemone reproduces both asexually and sexually. Asexual reproduction occurs in a process called pedal laceration. Sexual reproduction is by broadcast spawning.

Habitat: Found on reefs, wrecks, and other structures, from subtidal depths to 200m.

Photo Credit: J.Pirtle/CBNMS

Scientific Name: *Metridium senile*

Common Name: Frilled-anemone

Identification: Unlike *M. farcimen*, this small anemone lacks a lobed oral disc. The tentacles are solitary, short slender, and tapered, with a more delicate appearance. Colors range from white to orange, cream, brown, or tan.

Habitat: Found on rocks and man made structures, from intertidal to depths of 30 m.

Photo Credit: S. Lonhart/NOAA MBNMS

Note: Although this has been reported as occuring in CBNMS, there is low confidence in the identification. No photos have been found from CBNMS and in other areas they are reported at 30 meters and shallower. Researchers should keep an eye out for this species in CBNMS and collect a specimen if encountered.

2. Phylum: Cnidaria

Class: Anthozoa

Order: Actiniaria

Family: Liponematidae

Scientific Name: *Liponema brevicorne*

Common Name: Pom-pom anemone

Identification: The size of this anemone is about 25 cm across. It takes a variety of shapes, from low and flat to round and puffy.

Natural History: They will roll across the seafloor like living tumbleweeds. Its stinging tentacles capture krill and other crustaceans.

Habitat: Found in the deep sea on soft substrate at depths ranging from 100 to 1,000 m.

Photo Credit: CBNMS/NOAA

2. Phylum: Cnidaria

Class: Anthozoa

Order: Actiniaria

Family: Actinostolidae

Scientific Name: *Stomphia sp.*

Common Name: Orange and white anemone

Identification: This anemone has a column that is as wide as its height. It is usually orange with a white spot at the base of each tentacle.

Habitat: Found in deep waters on rocks, from depths of about 60 to 180 m.

Photo Credit: CBNMS

2. Phylum: Cnidaria

Class: Anthozoa

Order: Alcyonacea

Family: Plexauridae

Scientific Name: *Alcyonacea*

Common Name: Red gorgonian

Identification: A cnidarian related to soft corals and anemones. Individual tiny polyps form colonies that are normally erect, flattened, branching, and reminiscent of a fan.

Habitat: Found in depths of 50 to 200 m.

Photo Credit: CBNMS

2. Phylum: Cnidaria

Class: Anthozoa

Order: Alcyonacea

Family: Alcyoniidae

Scientific Name: *Heteropolypus ritteri*

(formerly*: Anthomastus ritteri)*

Common Name: Mushroom coral

Identification: The size of this octocoral is about 15 cm diameter. This animal takes on two different shapes: with tentacles outstretched to feed, it looks like a flower and with tentacles retracted it looks like a ball.

Natural History: It contains poisonous stinging cells that capture tiny animals drifting by.

Habitat: Found in the deep sea on rocky surfaces, at depths of 213 to 1,243 m.

Photo Credit: CBNMS

2. Phylum: Cnidaria

Class: Anthozoa

Order: Scleractinia

Family: Dendrophylliidae

Scientific Name: *Balanophyllia elegans*

Common Name: Orange cup coral

Identification: This bright orange -yellow hard coral is round and ringed with clear tapered tentacles. It may appear in clusters or aggregations, but it is considered a solitary species.

Habitat: Found attached to rocks, from depths of low intertidal to 120 m.

Photo Credit: Steve Lonhart / NOAA MBNMS

2. Phylum: Cnidaria

Class: Anthozoa

Order: Scleractinia

Family: Caryophylliidae

Scientific Name: *Paracyathus stearnsii*

Common Name: Brown cup coral

Identification: Like the orange cup coral, the brown cup coral is also considered a solitary species. The brown, solitary cups have long, almost clear, tentacles.

Habitat: Found on lower sides of rocky reefs, at depths of 9 to 60 m.

Photo Credit: CBNMS

2. Phylum: Cnidaria

Class: Anthozoa

Order: Corallimorpharia

Family: Corallimorphidae

Scientific Name: *Corynactis californica*

Common Name: Strawberry anemone

Identification: This pink anemone can be found forming colonial aggregates that cover large areas of substrate. They can attain densities of up to 3,000 polyps per square meter.

Natural History: The presence of these anemones increases the density of rock oysters and mussles by protecting them from predatory seastars.

Habitat: Found in abundance on temperate rocky shores and on tropical coral reefs. Found anywhere in the intertidal zone to at least 75 m in depth.

Photo Credit: CBNMS

2. Phylum: Cnidarians

Class: Anthozoa

Order: Ceriantharia

Family: Cerianthidae

Scientific Name: *Cerianthidae*

Common Name: Tube dwelling anemone

Identification: This anemone burrows itself in sand and muddy gravel. It makes a mucus tube into which it can withdraw. Tentacles are usually brown, white, or green.

Habitat: Found living in soft substrates along the coast or in deep waters.

Photo Credit: L.Snook/CBNMS

2. Phylum: Cnidarians

Class: Anthozoa

Order: Zoanthidea

Family: Epizoanthidae

Scientific Name: *Epizoanthus scotinus*

Common Name: Yellow zoanthid

Identification: These zoanthid anemones range from tan to brown to light yellow. The tentacles are a light yellow or white.

Natural History: They can reproduce sexually as well as budding.

Habitat: Found on rocks from low intertidal to 54 m.

Photo Credit: R. Lee/CBNMS

3. Phylum: Mollusca

Class: Bivalvia

Order: Pectinidae

Family: Pectinidae

Scientific Name: *Crassadoma gigantea*

(Formerly: *Hinnites giganteus*)

Common Name: Giant rock scallop

Identification: This scallop has very thick valves with prominent ribs that have short spines. It can grow to a diameter of 12 to 25 cm.

Habitat: Found on rocks, from low intertidal to 45 m.

Photo Credit: CBNMS

3. Phylum: Mollusca

Class: Cephalopoda
Order: Octopoda
Family: Octopodidae

Scientific Name: *Enteroctopus dofleini*

Common Name: Giant Pacific octopus

Identification: This large octopus has arms that can be 3 to 5 times the length of its body. The color will vary depending on the its background or behavior.

Habitat: Found on rocky and soft bottoms near crevices or caves, from low intertidal to 180 m.

Photo Credit: K.Evans/CBNMS

Scientific Name: *Octopus rubescens*

Common Name: Ruby octopus

Identification: This octopus is usually small with a color from dull red to mottled white. The arms are about 4 times the length of the body.

Habitat: Found on rocky and soft bottom, from low intertidal to about 210 m.

Photo Credit: CBNMS/NMFS

3. Phylum: Mollusca

Class: Gastropoda

Family: Calliostomatidae

Scientific Name: *Calliostoma annulatum*

Common Name: Purple ring snail

Identification: This snail's shell is a distinct purple and gold, while the foot is orange-yellow with brown blotches. They feed on hydroids, bryozoans, kelp, and copepods.

Habitat: Found on rocks and kelp, from low intertidal zone to 42 m.

Photo Credit: CBNMS

Scientific Name: *Calliostoma ligatum*

Common Name: Blue ring snail

Identification: The snail's shell has light tan spiral ridges with a brown background, while its foot is orange. This snail feeds on kelp, diatoms, and hydroids.

Habitat: Found on kelp and rocks, from low intertidal to about 30 m.

Photo Credit: CBNMS

3. Phylum: Mollusca

Class: Gastropoda

Order: Notaspidea

Family: Pleurobranchidae

Scientific Name: *Pleurobranchaea californica*

Common Name: California sea slug

Identification: This slug is mottled brown with large irregular translucent white patches, with no shell. It can travel about 1 m per minute.

Natural History: The California sea slug is a very active predator that feeds on prey such as sea anemone, dead squid, and even members of its own species.

Habitat: Found usually on fine sand from 10 to 366 m.

Photo Credit: CBNMS/NMFS

3. Phylum: Mollusca

Class: Gastropoda

Scientific Name: *Prosobranchia*

Common Name: Unidentified sea snail

Identification: The prosobranchia subclass refers to forward gills, meaning the gills are located anterior to the heart. Most have well developed shells.

Natural History: Typically sexes are seperated, however some undergo a sex change from male to female during their life span.

Habitat: Found living on the seafloor at all depths in all oceans of the world.

Photo Credit: CBNMS/NMFS

3. Phylum: Mollusca

Class: Gastropoda

Order: Nudibranchia

Family: Dorididae

Scientific Name: *Doris odhneri*

(Formerly: *Archidoris odhneri*)

Common Name: White-night nudibranch

Identification: This nudibranch is a pure white. Rhinophores have 20 to 24 lamellae and the gill is composed of seven fluffy plumes. Average size is 10 to 20 cm.

Natural History: They feed on sponges: *Halichondria* and *Myxilla.*

Habitat: Found in subtidal to 70 m.

Photo Credit: J.Pirtle/CBNMS

4. Phylum: Annelida

Class: Polychaeta

Order: Sabellida

Family: Sabellidae

Scientific Name: *Sabellida*

Common Name: Feather duster worms

Identification: This family includes many species of worms, some of which reach up to 50 cm long. They have membranous tubes, usually greenish or yellowish in color. The gills look like feather dusters, but withdraw inside tubes when the worm is alarmed.

Habitat: Found attached to rocks and dock pilings, from low intertidal to 120 m.

Photo Credit: CBNMS

4. Phylum: Annelida

Class: Polychaeta

Order: Sabellida

Family: Serpulidae

Scientific Name: *Serpulidae*

Common Name: Tube worms

Identification: These worms construct white calcareous tubes that are often coiled. The white crown of gills consists of 40 pairs of plumes. It also has a funnel shaped operculum.

Habitat: Found on shallow rock ridges and pinnacles.

Photo Credit: CBNMS/NMFS

Scientific Name: *Spirobranchus sp.*

Common Name: Christmas tree worm

Identification: The branchial plume consists of three concentric whirls in a variety of colors.

Natural History: Christmas tree worms will pull into their tube instantly when threatened. The operculum covers the opening to their tube, protecting them inside.

Habitat: The tubes are found attached to rocks, from intertidal to 30 m.

Photo Credit: CBNMS/NOAA

5. Phylum: Arthropoda

Class: Malacostraca

Order: Decapoda

Family: Lithodidae

Scientific Name: *Lopholithodes foraminatus*

Common Name: Box crab

Identification: This crab's typical coloration is drab reddish- brown or tan and often covered in sediment.

Habitat: Found mainly on muddy bottoms.

Photo Credit: CBNMS/NOAA

Scientific Name: *Paralithodes californiensis*

Common Name: California king crab

Identification: The crab's carapace, legs and claws are covered with spines and it's coloration is orange-yellow.

Habitat: Found on soft bottoms in depths of 3 to 180 m.

Photo Credit: CBNMS

5. Phylum: Arthropoda

Class: Malacostraca

Order: Decapoda

Family: Pisidae

Scientific Name: *Loxorhynchus crispatus*

Common Name: Moss/decorator crab

Identification: This crab decorates itself with tiny seaweeds and animals like anemones, sponges, and bryozoans.

Natural History: When its shell becomes too small, it molts and grows a new one. It then transfers all the decorations from the old shell onto its new one.

Habitat: Found on rocky and soft bottoms, from low intertidal to 180 m.

Photo Credit: K.Evans/CBNMS

5. Phylum: Arthropoda

Class: Malacostraca

Order: Decapoda

Family: Hapalogastridae

Scientific Name: *Acantholithodes hispsidus*

Common Name: Spiny crab

Identification: This crab has short spines on its legs and triangular shaped carapace.

Habitat: Found on rocky bottoms, from shallow subtidal to 150 m.

Photo Credit: CBNMS

5. Phylum: Arthropoda

Class: Malacostraca

Order: Decapoda

Family: Galatheidae

Scientific Name: *Munida quadrispina*

Common Name: Squat lobster

Identification: This crab has a similar appearacne as the pelagic red crab, however it is orange rather than red.

Habitat: Found on soft bottoms, from subtidal depths of 60 to 1,463 m.

Photo Credit: CBNMS/NMFS

5. Phylum: Arthropoda

Class: Malacostraca

Order: Decapoda

Family: Pandalidae

Scientific Name: *Pandalus platyceros*

Common Name: Spot prawn

Identification: This prawn is usually about 26 cm in size. The color is a light to dark translucent orange, with a pair of distinctive white spots on the abdomen.

Natural History: Spot prawns change sex from male to female as they grow.

Habitat: Found on soft bottoms or rocky areas, hidding in deep rocky cayons, reefs, or pilings. Found at depths of 30 to 500 m.

Photo Credit: CBNMS//NOAA

5. Phylum: Arthropoda

Class: Malacostraca

Order: Decapoda

Family: Paguridae

Scientific Name: *Pagurus*

Common Name: Hermit crab

Identification: Hermit crabs are found throughout the world's oceans. They move into increasingly larger shells as they grow.

Habitat: Found on rocks and soft bottoms, from depths of 80 to 200 m.

Photo Credit: CBNMS/NMFS

5. Phylum: Arthropoda

Class: Hexanapulia

Order: Sessilia

Family: Balanidae

Scientific Name: *Balanus nubilus*

Common Name: Giant acorn barnacle

Identification: This sessile barnacle is very large. It has a large aperture and lacks longitudinal striations on any of the large body plates.

Habitat: Found on shallow reef tops.

Photo Credit: CBNMS

6. Phylum: Echinodermata

Class: Asteroidea

Order: Valvatida

Family: Goniasteridae

Scientific Name: *Ceramaster spp.*

Common Name: Cookie star

Identification: The color of this sea star is light orange to reddish, with large plates on the outer edge of each arm. The shape is nearly pentagonal and the body is flat and rigid or occasionally swollen.

Habitat: Found on rocks and soft bottoms, from subtidal depths to about 235 m.

Photo Credit: CBNMS

Scientific Name: *Mediaster aequalis*

Common Name: Vermillion sea star

Identification: This red star is covered with tightly packed flat-topped plates bearing tiny granules, and is about 20 cm across. It feeds on sponges, bryozoans, sea pens, and also scavenges on dead animals.

Habitat: Found on rocks and soft bottoms, from subtidal depths to 900 m.

Photo Credit: CBNMS

6. Phylum: Echinodermata

Class: Asteroidea

Order: Forcipulatida

Family: Asteriidae

Scientific Name: *Leptasterias spp.*

Common Name: Six armed seastar

Identification: This 6 armed, small sea star is only about 5 cm in width. Its color is black, brown, red, or greenish.

Habitat: Commonly found on rocks from the intertidal to shallow subtidal, but has also been seen on Cordell Bank reef crests.

Photo Credit: Steve Lonhart/NOAA MBNMS

Scientific Name: *Pisaster giganteus*

Common Name: Giant spined star

Identification: This star has long spines surrounded by a circle of blue. The giant spined sea star can grow to 55cm in diameter. It eats mussels, other molluscs, and barnacles.

Habitat: Found on rocky and sand bottoms, from very low intertidal to about 90 m.

Photo Credit: Steve Lonhart/NOAA MBNMS

6. Phylum: Echinodermata

Class: Asteroidea

Order: Forcipulatida

Family: Asteriidae

Scientific Name: *Orthasterias koehleri*

Common Name: Rainbow star

Identification: The color of this star varies from rose-pink mottled with gray to red mottled with yellow, and it mainly feeds on molluscs.

Habitat: Found on rocky and soft substrate, from low intertidal to 240 m.

Photo Credit: CBNMS

Scientific Name: *Stylasterias forreri*

Common Name: Fish eating star

Identification: This star has sharp spines and clusters of pedicellariae which are used to capture small fish.

Habitat: Found on rocky and soft bottoms, from subtidal depths to 540 m.

Photo Credit: J.Pirtle/CBNMS

6. Phylum: Echinodermata

Class: Asteroidea

Order: Forcipulatida

Family: Pycnopodiidae

Scientific Name: *Pycnopodia helianthoides*

Common Name: Sunflower star

Identification: This large star can have 20 to 24 arms, ranging in color from purple, brown, orange, or yellow.

Natural History: The star feeds on clams, dead squid, sea urchins, and other small invertebrates. Like most sea stars, tt eats its prey by protruding its stomach, engulfs the entire prey, and digests it.

Habitat: Found on rocky and soft bottoms, from low intertidal to about 435 m.

Photo Credit: CBNMS

6. Phylum: Echinodermata

Class: Asteroidea

Order: Forcipulatida

Family: Labidiasteridae

Scientific Name: *Rathbunaster californicus*

Common Name: Deep-sea sun star

Identification: Like the sunflower star, this very large sea star has about 20 to 24 arms. Its outer surface and arms are covered in spines and its color varies from purple, red, orange and yellow. The deep-sea sun star has a much smaller central disk, compared to the sunflower star.

Habitat: Found in muddy deep habitats, from depths of 99 to 768 m.

Photo Credit: N. Puniwai/CBNMS

6. Phylum: Echinodermata

Class: Asteroidea

Order: Spinulosida

Family: Echinasteridae

Scientific Name: *Henricia spp.*

Common Name: Blood star

Identification: This star typically has 5 arms, but is sometimes seen with 4 or 6. It lacks pedicellariae, and its color varies from orange to red.

Habitat: Found on rocks, from low intertidal to 400 m.

Photo Credit: M.Carver/CBNMS

Scientific Name: *Poraniopsis inflata*

Common Name: Spiny colorful star

Identification: This star has distinct white spines on the upper surface and edges of its arms. Its color can range from cream to orange, and its diameter is about 15 cm.

Habitat: Found on rocks, from subtidal depths to 366 m.

Photo Credit: M.Carver/CBNMS

6. Phylum: Echinodermata

Class: Asteroidea

Order: Valvatida

Family: Asterinidae

Scientific Name: *Patiria miniata*

Common Name: Bat star

Identification: The color of this star can vary greatly from red, orange, yellow, brown, green and purple. It has webbing between its short, triangular arms, which gives it a batlike look. Typically 5 armed, it can have as many as 9 arms. This star feeds on alive or dead animal matter.

Habitat: Found on rocks and sandy bottoms, from low intertidal to about 285 m.

Photo Credit: CBNMS

6. Phylum: Echinodermata

Class: Asteroidea

Order: Velatida

Family: Pterasteridae

Scientific Name: *Pteraster tesselatus*

Common Name: Cushion star

Identification: This star has stubby, broad, thick arms and lacks spines. It gets its common name from its inflated pillow-like appearance.

Natural History: Juveniles look like typical sea stars, but as the cushion star grows, it becomes more inflated and the arms grow together, eventually reaching a point where they are almost no longer discernible. They feed mainly on sponges.

Habitat: Found on rock, from subtidal depths to 435 m.

Photo Credit: CBNMS

6. Phylum: Echinodermata

Class: Asteroidea

Order: Euryalida

Family: Gorgonocephalidae

Scientific Name: *Gorgonocephalus eucnemis*

Common Name: Basket star

Identification: This star has arms with many branches. Its color varies from almost white to orange-red, pink, tan, and beige.

Natural History: The arms are covered with tiny hooks and spines which can be used to grip and manipulate food. The basket star eats animals that get trapped in its branch like arms, such as krill, copepods, and jellyfish.

Habitat: Found on rocks, from subtidal depths to about 1,850 m.

Photo Credit: M.Carver/CBNMS

6. Phylum: Echinodermata

Class: Asteroidea

Order: Paxillosida

Family: Luidiidae

Scientific Name: *Luidia foliolata*

Common Name: Sand star

Identification: This star has 5 long smooth arms. Color can be gray or brown. It feeds on bivalves, sea urchins, sea cucumbers, brittle stars, worms, and small crustaceans.

Habitat: Found on soft bottoms, from subtidal depths to 612 m.

Photo Credit: D.Howard/CBNMS

6. Phylum: Echinodermata

Class: Ophiuroidea

Order: Ophiurida

Family:Ophiocomidae

Scientific Name: Unidentified brittle star I

(Possibly: *Ophiopsila californica*)

Common Name: Brittle Star

Identification: Brittle stars' long slender arms are covered with sharp spines. It often buries in sand, with only its arms exposed.

Habitat: Found on soft bottoms, to at least 300 m.

Photo Credit: N.Puniwai/CBNMS

6. Phylum: Echinodermata

Class: Ophiuroidea

Common Name: Unidentified brittle star II

Identification: These stars occur in large numbers, sometimes aggregating a million indivivuals.

Habitat: On rocky and soft bottoms from low intertidal to 2,000 m.

Photo Credit: M.Carver/CBNMS

6. Phylum: Echinodermata

Class: Holothuroidea

Order: Aspidochirotida

Family: Stichopodidae

Scientific Name: *Apostichopus californicus* (Formly: *Parastichopus californicus*)

Common Name: California sea cucumber

Identification: The color of this sea cucumber can vary from dark red, brown or yellow. It feeds on detritus and small organisms. This is the largest cucumber found offshore of California.

Habitat: Found on rocks and soft bottoms, from low intertidal to 90 m.

Photo Credit: J.Pirtle/CBNMS

6. Phylum: Echinodermata

Class: Holothuroidea

Order: Dendrochirotida

Family: Psolidae

Scientific Name: *Psolus squamatus*

Common Name: Sessile sea cucumber

Identification: This sea cucumber has white, branched tentacles with red/pink around its mouth. It tends to bury in the side of deep, muddy canyon walls.

Habitat: Found in deep, muddy canyon walls, to depths of 1,087 m.

Photo Credit: CBNMS/NMFS

6. Phylum: Echinodermata

Class: Echinodea

Order: Camarodonta

Family: Strongylocentrotidae

Scientific Name: *Mesocentrotus franciscanus*
(Formly: *Strongylocentrotus franciscanus*)

Common Name: Red sea urchin

Identification: The color of this urchin ranges from red, red brown, to dark purple. Occasional specimens appear to be hybrids between the red and purple uchins.

Habitat: Found on rocks, from low intertidal to 90 m.

Photo Credit: CBNMS

Scientific Name: *Strongylocentrotus purpuratus*

Common Name: Purple sea urchin

Identification: This urchin has short purple spines. It can create circular holes in rocks by using it's sharp spines and teeth. It mainly feed on algae. Broken spines are regenerated.

Habitat: Found on rocks, from low intertidal to 160 m.

Photo Credit: K. Evans/NOAA

6. Phylum: Echinodermata

Class: Echinoidea

Order: Camarodonta

Family: Strongylocentrotus

Scientific Name: *Strongylocentrotus fragilis*

Common Name: Fragile pink sea urchin

Identification: This sea urchin is about 10 cm across. This pink urchin feeds on plants and animal scraps. Like other urchins, its mouth is on the bottom of its body.

Habitat: Found in the deep sea on the seafloor, from depths of about 91 to 488 m.

Photo Credit: CBNMS/NOAA

6. Phylum: Echinodermata

Class: Crinoidea

Order: Comatulida

Family: Antedonidae

Scientific Name: *Florometra serratissima*

Common Name: Feather star/crinoids

Identification: Crinoids have 10 mobile flexible arms, and their color can vary from purple to orange. They are sometimes found in very large numbers, on rocks and sessile animals.

Habitat: Found attached to rock or other hard substrate, from depths of 10 to 1,000 m.

Photo Credit: M.Carver/CBNMS

7. Phylum: Chordata

Class: Ascidiacea

Order: Aplousobranchia

Family: Polycitoridae

Scientific Name: *Cystodytes lobatus*

Common Name: Lobed tunicate

Identification: This tunicate's color varies from gray, whitish, orange-pink, or lavendar.

Habitat: Found on rock, from low intertidal to about 200 m.

Photo Credit: CBNMS

7. Phylum: Chordata

Class: Ascidiacea

Order: Phlebobranchia

Family: Ascidiidae

Scientific Name: *Ascidia paratropa*

Common Name: Solitary glass tunicate

Identification: This tunicate has a prominent tubercle on the sides and two siphons at the tip, of unequal sizes. Its body is roughly cylindrical, 5 to 15 cm long and is almost transparent

Habitat: Found on rocky substrate, from low intertidal to 100 m.

Photo Credit: J.Pirtle/CBNMS

Unidentified-Tunicate

Common Name: Encrusting tunicate
Photo Credit: CBNMS/NMFS

7. Phylum: Chordata

Class: Ascidiacea

Order: Phlebobranchia

Family: Octracnemidae

Scientific Name: *Megalodicopia hians*

Common Name: Predatory tunicate

Identification: This tunicate waits on the seafloor, waiting for tiny animals to drift or swim into its cavernous hood. The hood closes quickly when a small animal drifts inside.

Habitat: Found anchored along the deep seafloor, at depths of 183 to 1,000 m.

Photo Credit: CBNMS/NMFS

8. Phylum: Brachiopoda

Class: Articulata

Order: Terebratulida

Family: Laqueidae

Scientific Name: Unidentified-brachiopod

(Possibly: *Laqueus californianus*)

Common Name: Brachiopod, possibly lampshell

Identification: The lip of the shell is bent, rather then straight like most bivalves.

Natural History: This lampshell is known to have existed as a species for at least 20 million years.

Habitat: Found attached to rocks, from low intertidal to about 1,800 m.

Photo Credit: CBNMS/NMFS

9. Phylum: Rhodophyta

Class: Petrosiidae

Order: Corallinales

Family: Corallinaceae

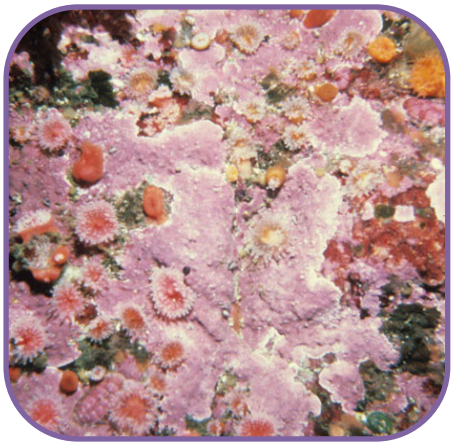
Scientific Name: Articulated Corallinaceae

Common Name: Articulated coralline algae

Identification: This algae contains calcerous deposits in its cell wall that make a hard structure. The algae can vary in color, from reddish-pink to reddish purple.

Habitat: Found on rocks at Cordell Bank to 70 m.

Photo Credit: CBNMS



Scientific Name: Encrusting Corallinaceae

Common Name: Encrusting coralline algae

Identification: A large and very difficult to identify group of pink or purple crusts. It can vary in size from tiny patches to vast sheets on heavily grazed bedrock.

Habitat: Found on hard material, at depths that light can still reach.

Photo Credit: CBNMS

9. Phylum: Rhodophyta

Class: Florideophyceae

Order: Rhodymeniales

Family: Rhodymeniaceae

Scientific Name: *Maripelta rotata*

Common Name: Purple circular shaped algae

Identification: The algae has a thallus (shoot) consisting of a stipe up to 5 cm tall, ending with a peltate blade 3 to 12 cm in diameter. The algae color is a rose-red to purple.

Habitat: Found at depths less than 70 m. This species is found in CBNMS at depths greater than reported from other locations because of the good water clarity.

Photo Credit: CBNMS

9. Phylum: Rhodophyta

Class: Florideophyceae

Order: Ceramiales

Family: Delesseriaceae

Scientific Name: *Polyneura latissima*

Identification: This red seaweed has a net-like system of veins on the thallus, giving it a crinkly appearance. The color ranges from pale red to pink. Usually it is about 12 to 30 cm long.

Habitat: Found in rocky semi-exposed habitats in mid to low intertidal, at a depth of about 70 m. This is the most common red algae on Cordell Bank

Photo Credit: CBNMS

References

Animal Diversity Web Retrieved 19 June 2017. http://animaldiversity.org.

Behrens, David W. 1993. *Pacific Coast Nudibranchs*. Monterey, CA: Sea Challengers.

Brown, Vinson, and Ernest Braun. 1966. *Exploring Pacific Coast Tide Pools*. Healdsburg, Calif.: Naturgraph.

Cookie Star. Sea Stars of the Pacific Northwest. Cookie Star *Ceramaster patagonicus.* Retrieved 10 July 2017. http://www.seastarsofthepacificnorthwest.info/species/cookie_star.html.

Cordell Bank. *Cordell Bank National Marine Sanctuary*. Retrieved 20 June 2017. http://cordellbank.noaa.gov.

Sanctuary Integrated Monitoring Network. Retrieved 20 June 2017. http://www.sanctuarysimon.org/cordell/index.php

Crisscross Network: Polyneura Latissima. *Biodiversity of the Central Coast*. Retrieved 20 June 2017. http://www.centralcoastbiodiversity.org/.

Cushion Star. Oceana. Retrieved 10 July 2017. http://oceana.org/marine-life/corals-and-other-invertebrates/cushion-star.

Data Catalog. *National Oceanic and Atmospheric Administration*. Retrieved 5 July 2017. https://data.noaa.gov/dataset.

Erwin, David, and Bernard Picton. 1995. *Guide to Inshore Marine Life*. London: Immel Publishing.

Explore the Exotic. *Monterey Bay Aquarium.* Retrieved 20 June 2017. https://www.montereybayaquarium.org/.

Fishery Basics – California Fisheries. *Spot Prawn (Pandalus platyceros) - NOAA National Marine Fisheries Service*. Retrieved 5 July 2017. http://sanctuaries.noaa.gov/education/voicesofthebay.

Giant Spined Seastar Monterey Bay. *NOAA - Encyclopedia of the Sanctuaries*. Retrieved 10 July 2017. http://www8.nos.noaa.gov/onms/park/.

Gotshall, Daniel. 2005. *Guide to Marine Invertebrates: Alaska to Baja California*. Monterey, CA: Sea Challenger.

Graiff, K., and D. Lipski, 2016, *Benthic Community Characterization of the Upper Reefs of Cordell Bank*, Cordell Bank National Marine Sanctuary. http://cordellbank.noaa.gov/science/cb-benthic-community.pdf.

Graiff, K., D. Roberts, D. Howard, P. Etnoyer, G. Cochrane, J. Hyland, and J. Roletto. 2011. A characterization of deep-sea coral and sponge communities on the continental slope west of Cordell Bank, Northern California using a remotely operated vehicle. Final report to NOAA Deep Sea Coral Research and Technology Program. 21pp. http://cordellbank.noaa.gov/science/cb_2010dsc_leg2_2011.pdf

Haderlie, Eugene C., Robert H. Morris, and Donald P. Abbott. 1980. *Intertidal Invertebrates of California*. Stanford CA: Stanford University Press.

Introduction to the Bryozoa, www.ucmp.berkeley.edu/bryozoa/bryozoa.html. Retrieved 20 June 2017.

Langstroth, Lovell, and Libby Langstroth. 2000. A Living Bay: The Underwater World of Monterey Bay. Berkeley: University of California.

Orange Cup Coral *Balanophyllia elegans*. *Biodiversity of the Central Coast*. Retrieved 10 July 2017. http://www.centralcoastbiodiversity.org/.

Schmieder, Robert W. 1991. *Ecology of an Underwater Island*. Walnut Creek, CA: Cordell Expeditions.

Smith, Gilbert Morgan, Isabella Aiona Abbott, and George Jacob Hollenberg. 1973. *Marine Algae of the Monterey Peninsula California*. Stanford, CA: Stanford University Press.

The World Porifera Database. *World Porifera Database*. Retrieved 19 June 2017. http://www.marinespecies.org/porifera/.

WoRMS – World Register of Marine Species. *WoRMS – World Register of Marine Species*. Retrieved 19 June 2017. http://www.marinespecies.org/index.php.

Glossary

Asexually: Reproduce without sex by fragmentation or budding

Bryozoans: Also known as "moss animals," are aquatic organisms, living for the most part in colonies of interconnected individuals

Budding: Reproduction by the development of an outgrowth or budding

Calcareous: Containing calcium carbonate

Carapace: A single plate covering the fused head and thorax of some arthropods

Concentric: Denoting circles, arcs, or other shapes that share the same center, the larger often completely surrounding the smaller

Copepod: Any member of the taxonomic group (Subclass Copepoda) of crustaceans, some free-living, others parasitic

Diatom: A microscopic alga with a silicon-dioxide skeleton

Granules: A small compact particle of a substance

Lamellae: A thin layer, membrane, scale, or plate like tissue or part, especially in bone issue

Nodules: A small lump, swelling or collection of tissue

Operculum: A horny lid like structure attached to the foot of some gastropods that closes the shell opening when the foot is withdrawn

Osculum: A large opening in a sponge, through which water is expelled

Pedal Laceration: A type of asexual reproduction in some sea anemones in which parts of the pedal disc break off and are left behind as the anemone moves

Pedicellariae: Pincer like structures on the backs of some echinoderms

Polyp: In cnidarians, an individual having a tubular body with a mouth-anus opening surrounded by a ring or rings of tentacles; a zooid or individual of colonial animals

Rhinophores: The sensory tentacles on the head of many nudibranchs; thought to have olfactory functions

Sessile: Attached or stationary, as opposed to free-living or mobile

Striations: A series of ridges, furrows or linear marks

Thallus: The body of an alga

Tubercle: A small knoblike process in the skin of an animal