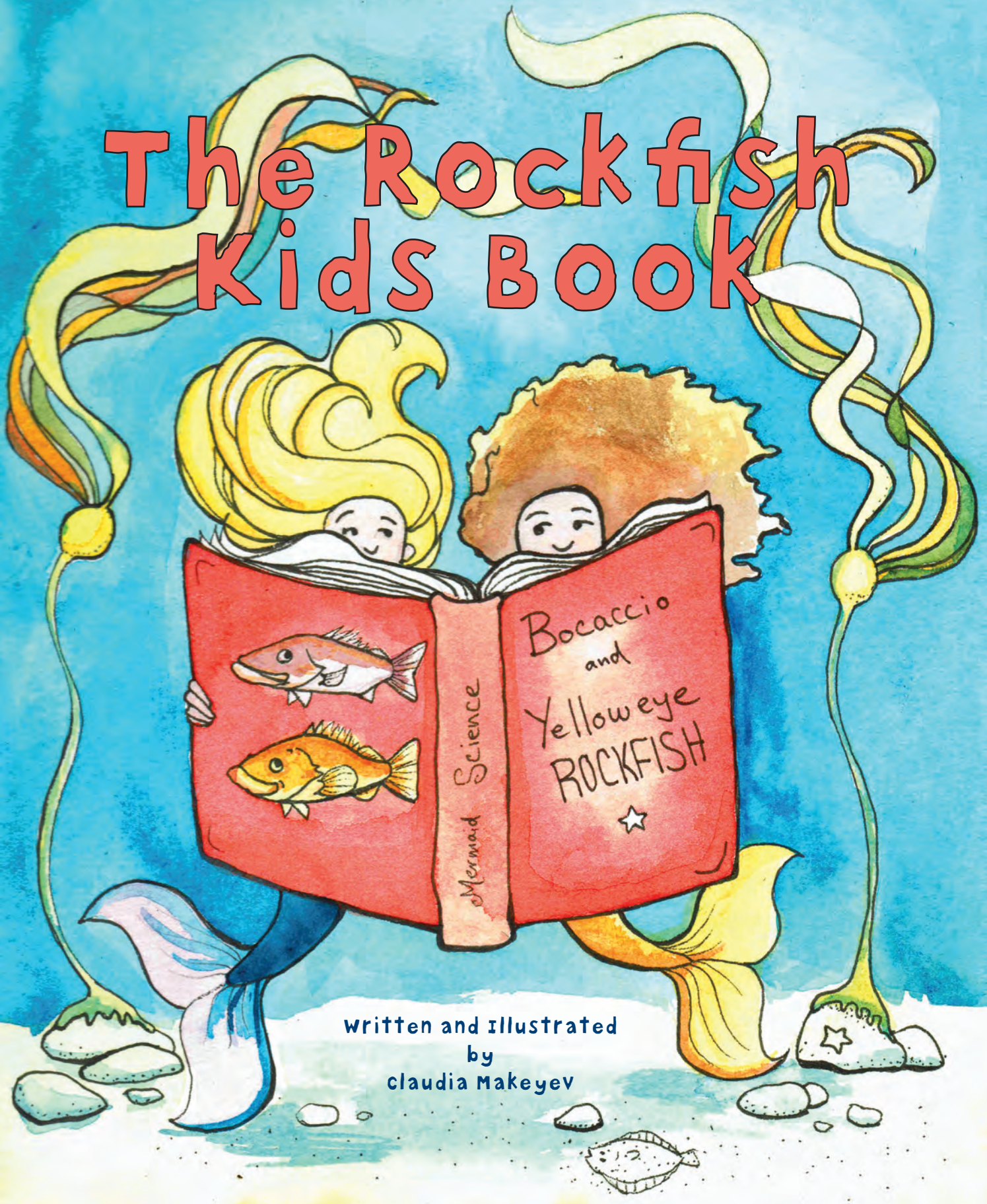
The Rockfish Kids Book



written and Illustrated
by
claudia Makeyev

A NOAA Fisheries Project

The Rockfish Kids Book

The Secret Lives of Bocaccio & Yelloweye Rockfish

Written and Illustrated by Claudia Makeyev

Funded and supported by NOAA Fisheries and the Rockfish Conservation Bottom-up Recovery of Puget Sound

NOAA FISHERIES

ROCKFISH CONSERVATION
Bottom-up Recovery of Puget Sound

MERMAID SCIENTIST

About this book

This science-based educational children's book depicts the unique life history of two rockfish species in Puget Sound listed under the Endangered Species Act (ESA). The Rockfish Recovery Plan of Puget Sound supported this lovely project to teach Washington kids about the interesting life cycle of bocaccio and yelloweye rockfish.

This book swims through the life cycle of these fish. It presents the habitat, prey, predators and morphological changes in each life stage while teaching basic observational skills. Students also learn food chain and ecosystem concepts. Each chapter can be used as a separate lesson or taught all together, depending on teacher needs.

This book is for all the little mermaids in training who love learning about the ocean and those who have yet to discover it.

Corresponding curriculum

The Teacher Resource Guide provides curriculum for Washington State 3rd - 5th grade teachers. It hits several Next Generation Science Standards while teaching about the rockfish life cycle and the Puget Sound ecosystem. It includes several lessons to complement the book.

For a free copy of this book, a corresponding classroom poster and Teacher Resource Guide contact RockfishID@noaa.gov.

For more information about two amazing rockfish:
https://www.fisheries.noaa.gov/species/yelloweye-rockfish
https://www.fisheries.noaa.gov/species/bocaccio-protected

Dedication

This book is dedicated to the bocaccio and yelloweye rockfish of Puget Sound - May you live a long time and may your female fish be fertile and productive.

To the hard working and wonderful scientists at NOAA Fisheries.

To all the little mermaid scientists out there who may be inspired to learn more and/or join the ranks of this important Rockfish Recovery Plan.

Acknowledgments

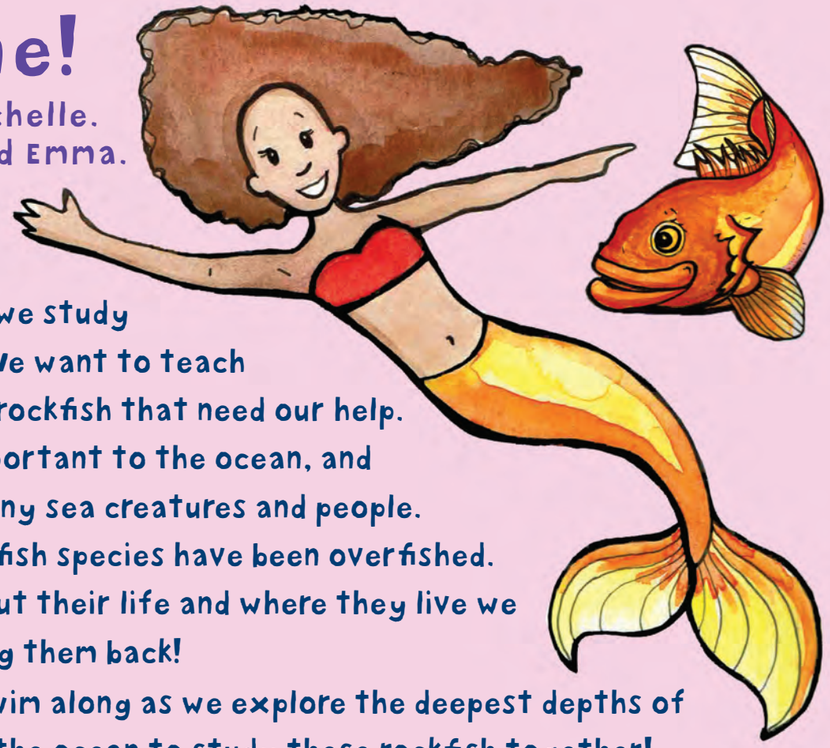
This book was written and illustrated by Claudia Makeyev.

Thanks to the endless support and patience of Dan Tonnes of NOAA Fisheries West Coast Region. Seychelle Tonnes for inspiring the mermaid spirit of this project. Neosha Kasheff and Dave Stafford for providing countless answers to rockfish questions and pretty larval/juvenile rockfish reference photos. Kristina Webster, Jen Thal-Weddle, and Kathy Makeyev for excellent educator perspectives and editing. SLO Bunker artist Irene Flores contributed Photoshop prowess. Thank you Jan Mason and Mary Yoklavich for being amazing rockfish scientists. Milton Love's wonderfully heavy rockfish books. Thank you also to Lynne Barre, Steve Copps, Jennifer Sawchuck, Merlin Alix Smith, and Jamey Selleck.

Table of contents

Welcome!

My name is Seychelle.
This is my friend Emma.



We are marine biologists, and we study sea creatures. We want to teach you about two rockfish that need our help. Rockfish are important to the ocean, and are food for many sea creatures and people. These two rockfish species have been overfished. By learning about their life and where they live we can help to bring them back!

Swim along as we explore the deepest depths of the ocean to study these rockfish together!

Get ready for a ROCKFISH adventure!

Find the sea star to answer a sea star question

Two AMAZING Rockfish

Yelloweye rockfish are brilliant orangey red. They have bright yellow eyes.

Their scientific name "Ruberrimus" means red.

Yelloweye can live 147 years!

Yelloweye Rockfish

Sebastes ruberrimus

They are the size of a medium-sized dog.

Bocaccio

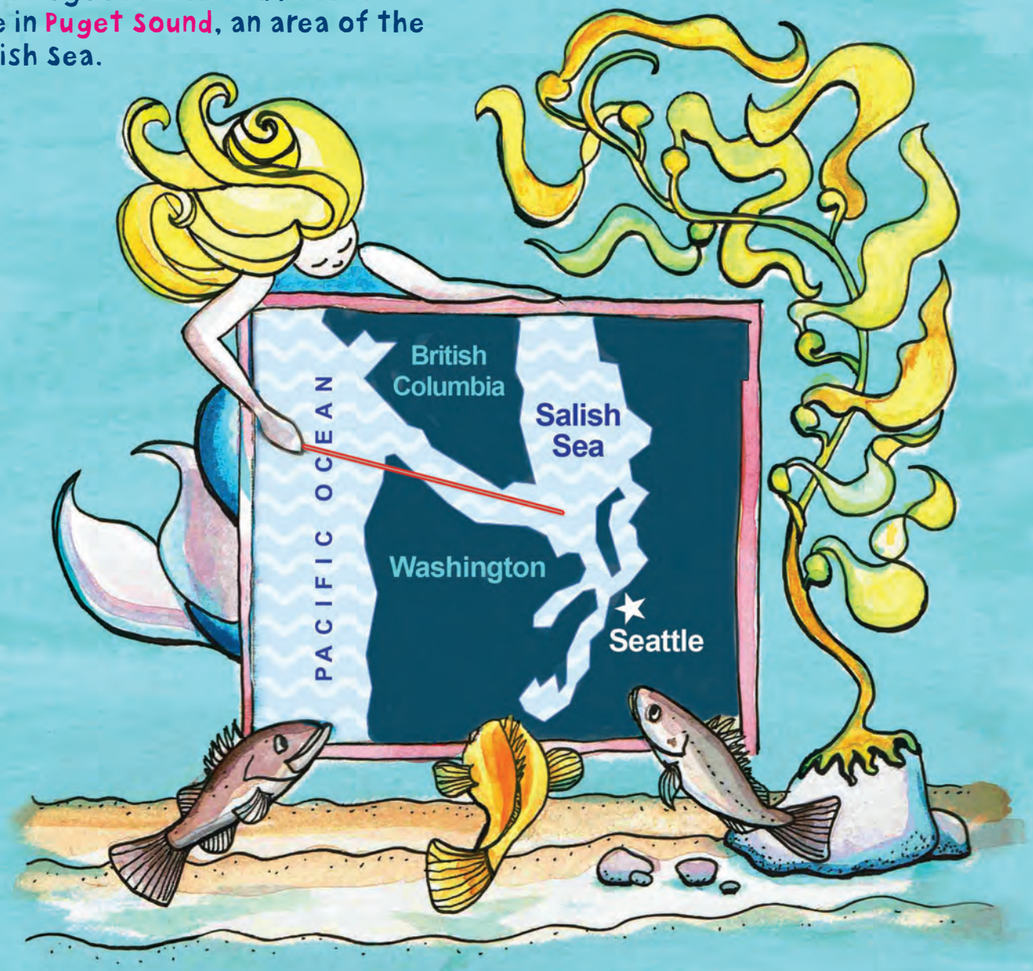
Sebastes paucispinus

Bocaccio are rockfish too.
They are a brown purplish color.
Sometimes they are greyish orange.

Bocaccio means "big mouth."
They have a big under bite (lower lip).
Bocaccio live about 22 years.

Puget Sound

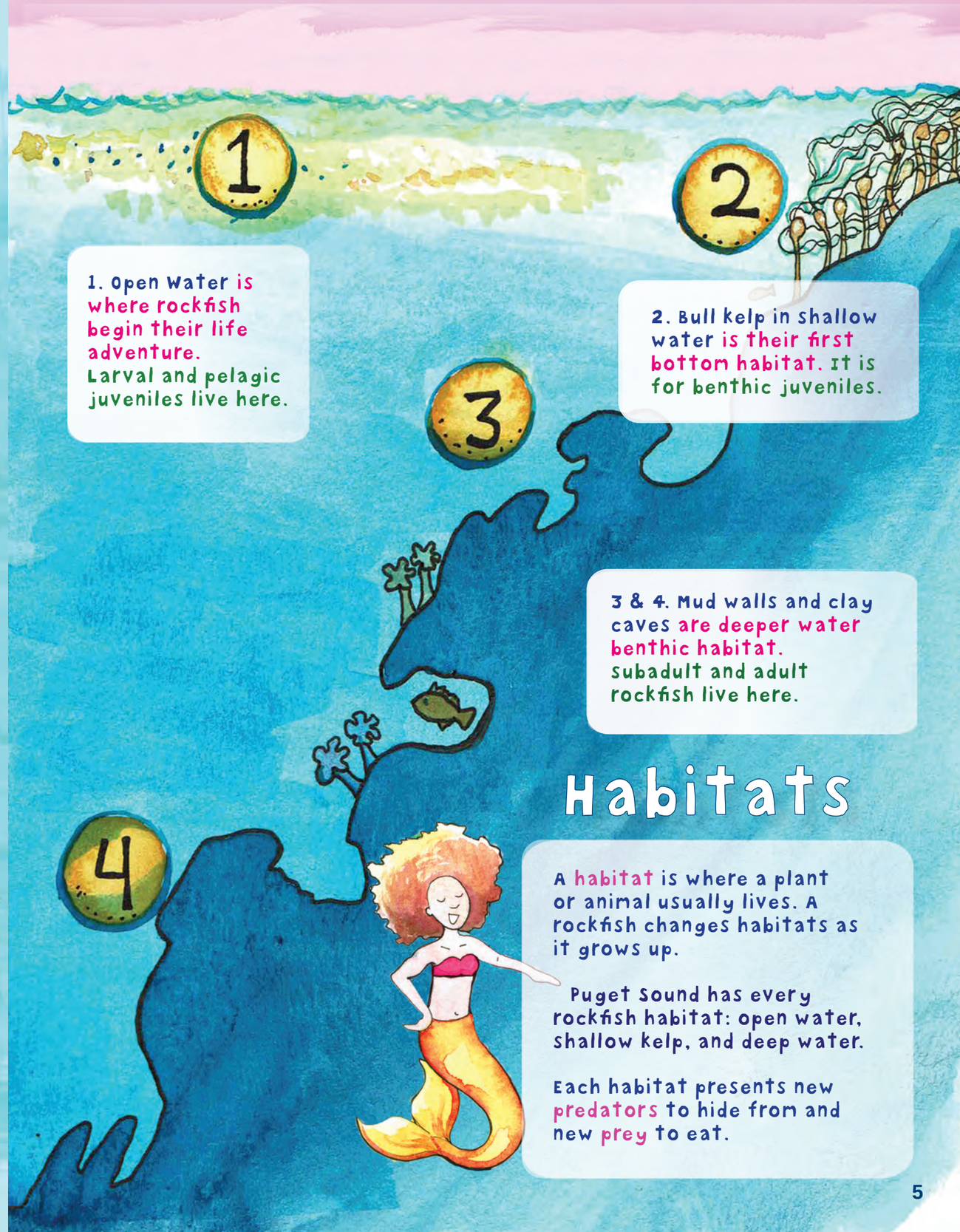
Yelloweye rockfish and bocaccio live in **Puget Sound**, an area of the Salish Sea.



Puget Sound is salt water. **Puget Sound** is in Washington State. It extends from Olympia to Deception Pass. The Strait of Juan de Fuca connects **Puget Sound** to the Pacific Ocean. Yelloweye and bocaccio also live in the Pacific Ocean. They range from Alaska all the way to Mexico.

Puget Sound has everything a rockfish needs for its whole life! It has delicious foods and homes for rockfish of all ages. Some rockfish live their whole lives in **Puget Sound** and never leave.

Why do bocaccio and yelloweye rockfish live in Puget Sound?



1. Open water is where rockfish begin their life adventure. Larval and pelagic juveniles live here.

2. Bull kelp in shallow water is their first bottom habitat. It is for benthic juveniles.

3 & 4. Mud walls and clay caves are deeper water benthic habitat. Subadult and adult rockfish live here.

Habitats

A **habitat** is where a plant or animal usually lives. A rockfish changes habitats as it grows up.

Puget Sound has every rockfish habitat: open water, shallow kelp, and deep water.

Each habitat presents new **predators** to hide from and new **prey** to eat.

Life Stages

1. Larvae are between 5 and 15mm.

2. Pelagic juveniles are between 15 and 60mm.

3. Benthic juveniles (60-350mm)

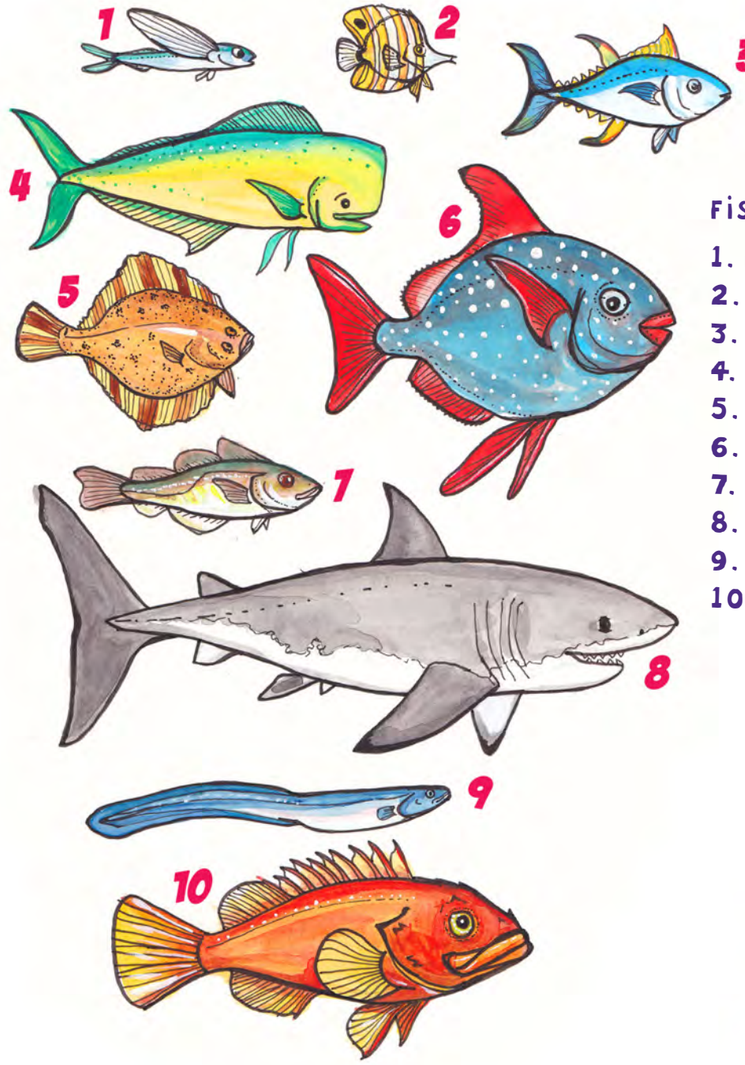
4. Subadults are between 350 and 400mm.

5. Adults are 400mm and longer.

Rockfish change as they grow up.
Observe their color, shape and size transformation.
Use a ruler to measure their length in millimeters (mm).
color, shape and size show us which life stage they are in.

Morphology

This is a fancy word to describe how something looks.
Fishes come in different forms, sizes and colors.
Some have big fins and some have little fins.
Let's compare a rockfish to these ten fishes.

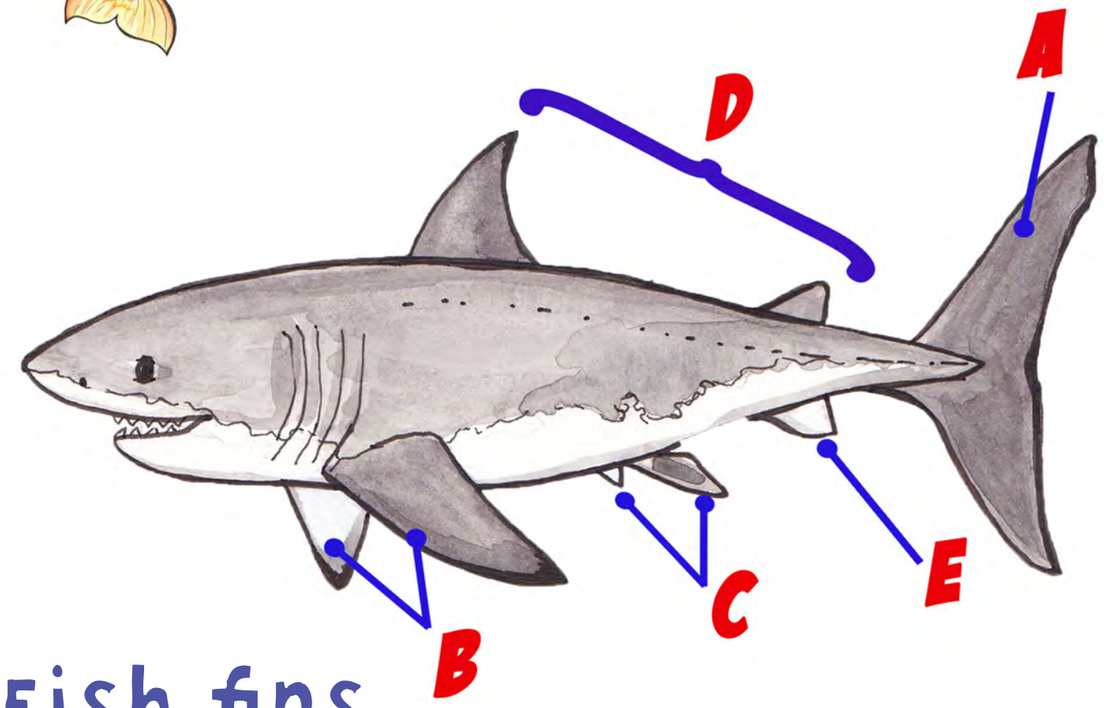


How does a rockfish look different from other fish?

Fish list:

1. Flying fish
2. Butterfly Fish
3. Yellowfin tuna
4. Mahi-Mahi
5. Starry flounder
6. Opah
7. Pollock
8. Great white shark
9. European eel
10. Yelloweye rockfish

How many fins does a great white shark have?
1+2+2+2+1 = ?



Fish fins

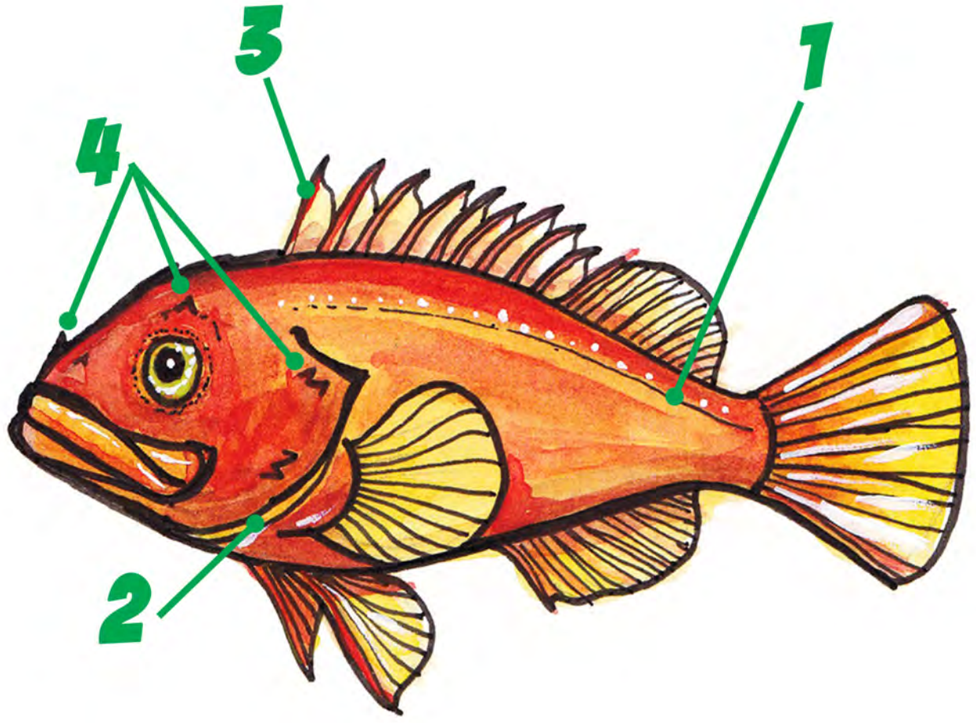
Swimming through water is a lot like flying. Fish need fins to act like wings and rudders. Here are the names of fish fins and what they do:

A. The caudal fin (the tail) is used for powerful movement forward.
B. Two pectoral fins, one on each side of the body, are used to steer.
C. Two pelvic fins (on the ventral side) balance the fish so they don't roll.
D. Dorsal fins are used for balance and sudden turns.
E. The anal fin is located on the bottom behind the anus (aka the fish butt). Anal fins also help with stability and balance.

Dorsal is a fancy scientific word for the top of an animal.
Ventral relates to the bottom of an animal.

Other Fish Body Parts

(1) A lateral line feels movement in the water around them.
(2) Gills breathe oxygen from the water (like lungs breathe oxygen from air).
(3) Pointy protective dorsal spines are the long spikey part on the fin.
(4) Sharp head spines are on the gill cover, nose and above the eyes.



Rockfish are recognized for their big heavy heads.
Rockfish are also known for their spines.

Spines are hard and sharp.
Spines painfully poke predators.
Spines protect rockfish from being swallowed.

Different fish have different numbers of spines. counting dorsal spines can help identify a type of fish.

Which body part does a rockfish breathe with?

Name: _____ Date:_____

Pick a fish and draw it. Label all of the fins.

Bonus: Label their body parts too.

chapter 2

Life in the Plankton

Rockfish Life Stage 1 and 2

Larval crab

copepod

Larval rockfish

Pelagic Nursery

Pelagic is a scientific word for open water.

Baby rockfish begin life in the **plankton**. **Plankton** is a word for the tiny plants and animals floating together in the open sea. **Plankton** is **pelagic**.

Rockfish spend their first two life stages in the **plankton**. The first stage is larval rockfish. Larval rockfish are 5 mm long.

A penny is about 19mm long. Baby rockfish are smaller than a penny.

5 mm

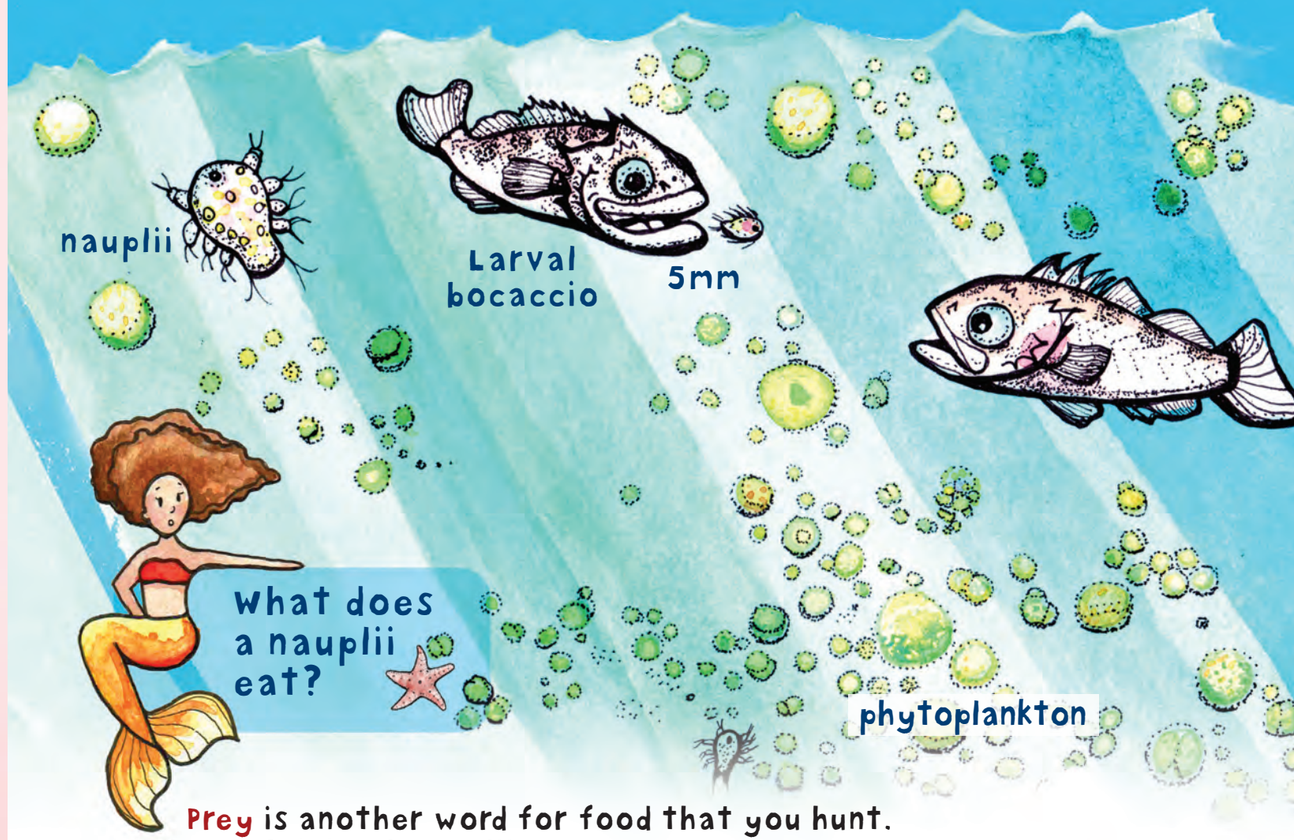
15 mm

pelagic juvenile yelloweye rockfish

19.5 mm

What does pelagic mean?

Pelagic Prey

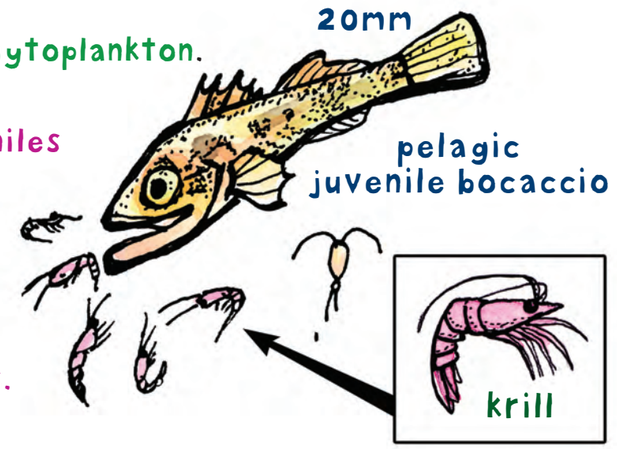


Prey is another word for food that you hunt.
Larval rockfish hunt nauplii.
Nauplii are baby copepods.
Nauplii eat tiny green plants called **phytoplankton**.
Phytoplankton float in the water.

Rockfish eat and grow. Pelagic juveniles become the size of a paperclip.

In the plankton, they grow to 60mm long.

Juveniles are big enough to eat krill and copepods.
Krill are tiny, shrimp-like crustaceans.
A krill eats phytoplankton.

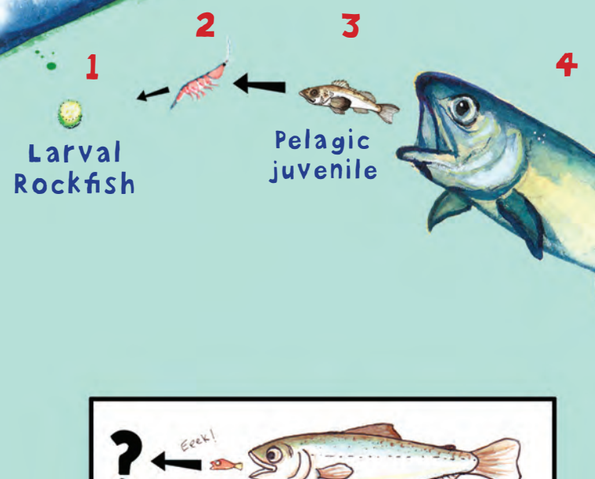


Pelagic Predators

A predator is a creature that eats another animal.

Pelagic juvenile rockfish make tasty snacks for young chinook salmon (aka King salmon). Salmon are rockfish predators.

Salmon eat pelagic juvenile rockfish, rockfish eat krill, and krill eat phytoplankton. Eating gives you energy. This transfer of energy is called a food chain. This food chain has four levels.



can you draw the four things in this food chain?

(Remember to label every one).

Microscope

Plankton is small.
It is too small to see
with the naked eye.
It looks like cloudy water.

We want to see what larval and pelagic juvenile rockfish look like. They are smaller than a penny. Some are just the size of a paperclip!

How do we measure a fish this small? We use a microscope to see creatures this small. To see far away we use a telescope. To see close up we use a microscope.

A microscope shines light up through a glass lens. This magnifies tiny rockfish. The knobs are used to focus the image.

The fish is no longer just a speck. Now we see it close up.

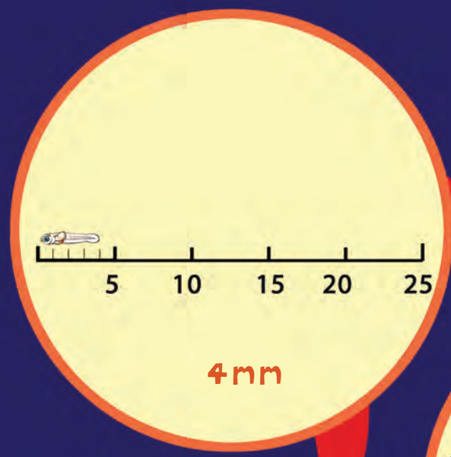
We can see if it is a fish or a krill.

Now we can measure it.

What is the difference between a microscope and a telescope?

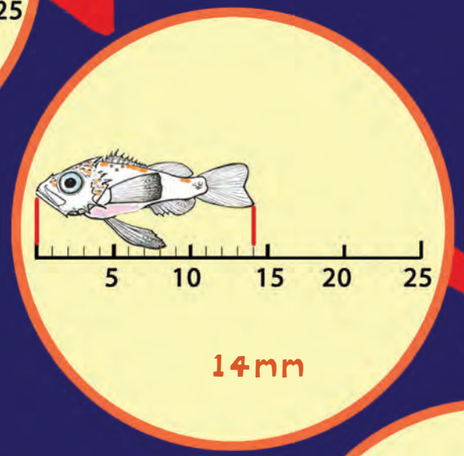
Measuring

This microscope shows a tiny yelloweye growing from a larva into a juvenile. In the first scope it is 4mm long. It grows longer. It changes shape and color.

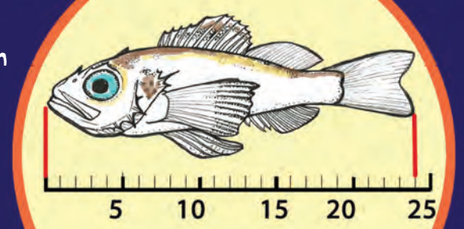


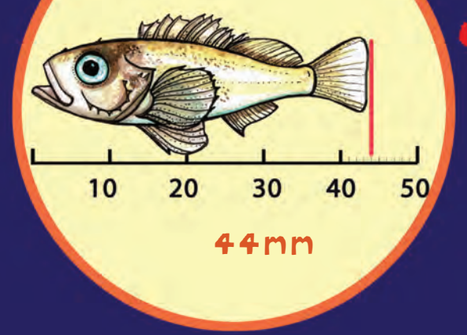
How much does it grow on this page?
Measure from the tip of the nose to the tip of the tail. This is its **length.**
Each tick mark on the ruler is 1 millimeter (mm).

When it grows more than 15mm it is considered a pelagic juvenile.



To find out how much it grew **subtract.**





How much did it grow?

After - Before = ?

44mm - 4 mm = ? mm

Observer: _____ Date: _____

Imagine you are a marine biologist. This is your rockfish datasheet. Draw and describe 2 fish from this chapter. First draw a larval rockfish. In the second box draw a pelagic juvenile rockfish. Pick either a bocaccio or a yelloweye rockfish. Fill in the length, color, name, etc.

How are they similar?

How are they different?

Location: open water
Puget Sound

Length:

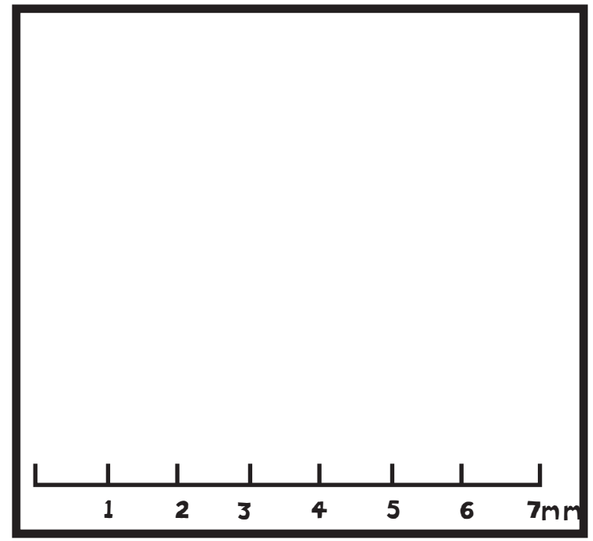
color(s):

Dorsal spines present: Yes/no

common name:

Scientific name:

Life stage: Larval rockfish



Location: open water
Puget Sound

Length:

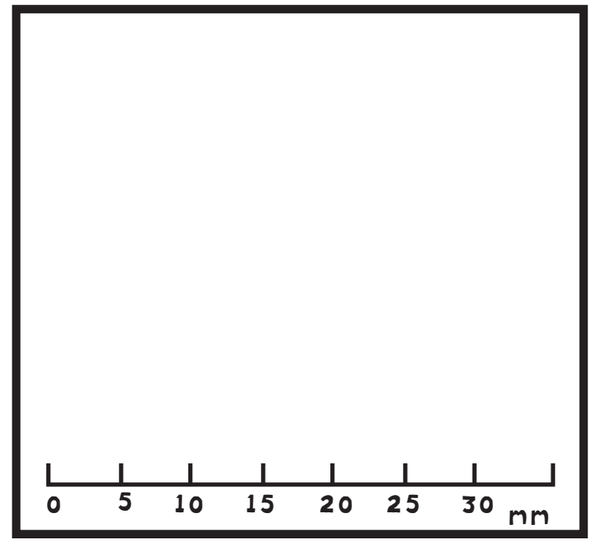
color(s):

Dorsal spines present: Yes/no

common name:

Scientific name:

Life stage: Pelagic juvenile



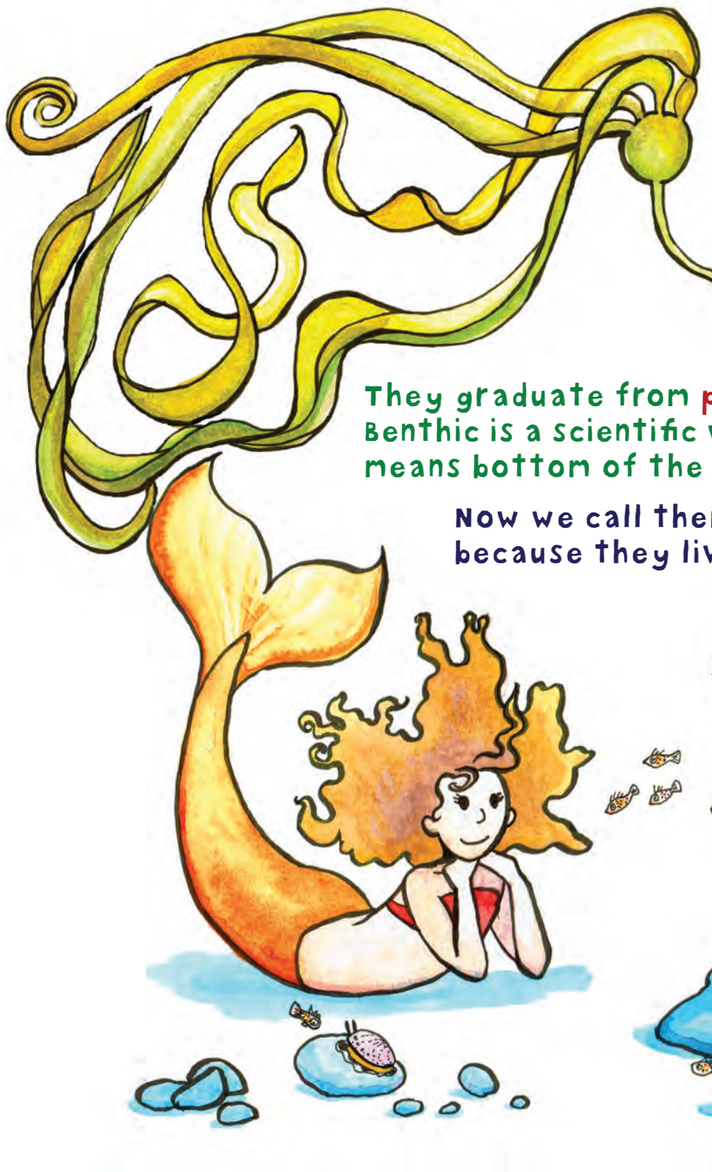
chapter 3

Benthic Juveniles

Rockfish Life Stage 3

Life On The Bottom

There comes a time when rockfish grow too big for the plankton.
It is time to change **habitats**.
They bravely swim down to the ocean bottom.
This becomes their new home.



There are places to hide.
There are also new
things to eat.

They graduate from pelagic to benthic.
Benthic is a scientific word that
means bottom of the ocean.

Now we call them "benthic" juveniles
because they live on the bottom.

True
or False

"Benthic"
means
"Bottom"

Bull Kelp

The second rockfish habitat is **bull kelp**.
Bull kelp is a large **algae** living in Puget Sound.
It attaches firmly to the bottom.

The sun shines through shallow water. Bull kelp
gets **energy** from the sun. It uses this energy
to grow quickly. It grows 10 inches in one day!

Bull kelp
Nereocystis
luetkeana

"**Nereocystis**" is
the fancy scientific
name for **bull kelp**.
It means "mermaid's
bladder" in Greek.

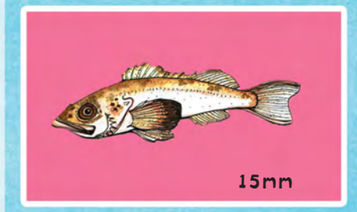
Is bull kelp an algae
or an animal?

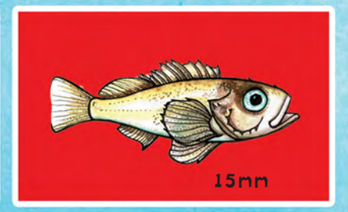
Morphology

Only at 60 mm do we call them true benthic juveniles. 60 mm is a bit longer than a house key.

Yelloweye grow to 250 mm before getting their signature yellow eyes. 250mm is about the size of a football.

In this life stage they grow to 350 mm.





Juveniles start exploring the bottom around 15mm. They will grow and change color a lot on the bottom (see below).

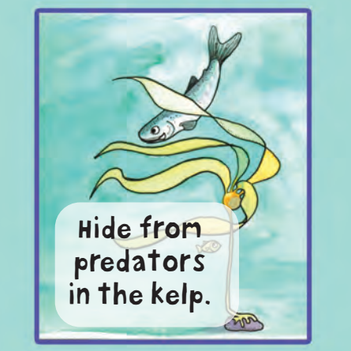
Boccacio get darker and sometimes get red-brown spots.

Yelloweye develop a dark red color and two white stripes.

Name the juvenile rockfish with stripes.

Benthic Predators

Little juveniles meet new predators. Salmon, lingcod and adult rockfish eat benthic juvenile rockfish.



chinook salmon
Oncorhynchus tshawytscha

Lingcod eat little juveniles.

What do juveniles eat?

Blue rockfish
Sebastes mystinus

Lingcod
Ophiodon elongatus

Juvenile rockfish are in the middle of the food chain. A food chain shows the transfer of food energy from one organism to another.

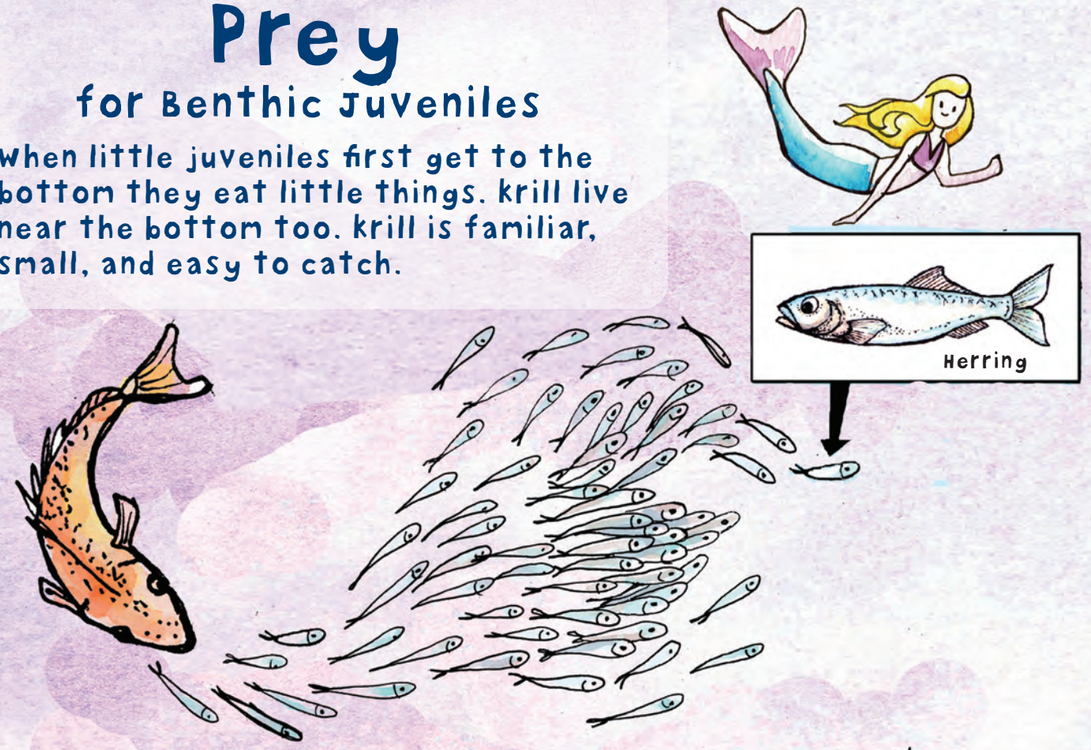
Phytoplankton > krill > juvenile rockfish > lingcod

Juveniles must outgrow these predators to move up the food chain. They must grow as large as a lingcod.

Prey

for Benthic Juveniles

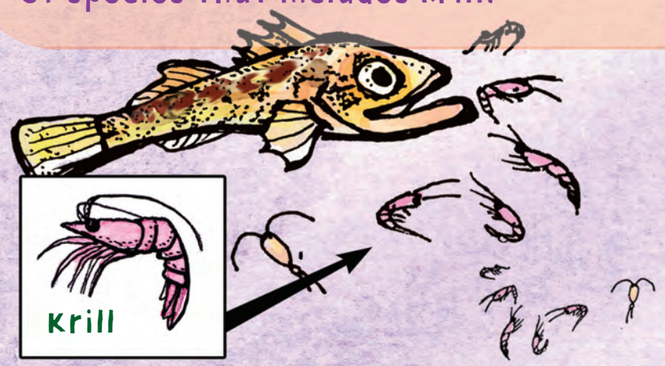
When little juveniles first get to the bottom they eat little things. krill live near the bottom too. krill is familiar, small, and easy to catch.



Juveniles eat more and get energy to grow.
As they get bigger, they move higher up the food chain.

Big benthic juveniles hunt prey like herring.
Herring are a silver fish with one dorsal fin.
Big benthic juveniles also eat anchovies, smelt and flatfish.
Eating fish gives juveniles energy to grow even bigger.

Scientists also refer to krill as "Euphausiids," for the group of species that includes krill.



What does a krill eat?

observer: _____ Date: _____

Using what you know about benthic juveniles, draw and describe a benthic juvenile bocaccio and yelloweye rockfish.
How are they similar?
How are they different?

Location: kelp forest
Puget sound

Length:

color(s):

Dorsal spines present:
Yes/no

common name:

scientific name:

Life stage:

mm
20 40 60 80 100

Location: kelp forest
Puget sound

Length:

color(s):

Dorsal spines present:
Yes/no

common name:

scientific name:

Life stage:

mm
20 40 60 80 100

observer: _____ Date: _____

As a rockfish grows, it changes size, color and shape.
These two fish were caught in Puget Sound. Use length, color and habitat to determine the species and lifestage.
Record your observations on this data sheet.

Location: open water
Puget Sound

Length:

color(s):

Dorsal spines present:
Yes/no

common name:

scientific name:

Life stage:

Location: kelp forest
Puget Sound

Length:

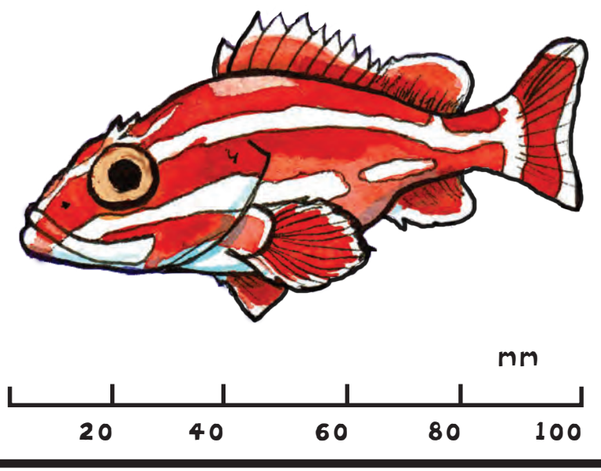
color(s):

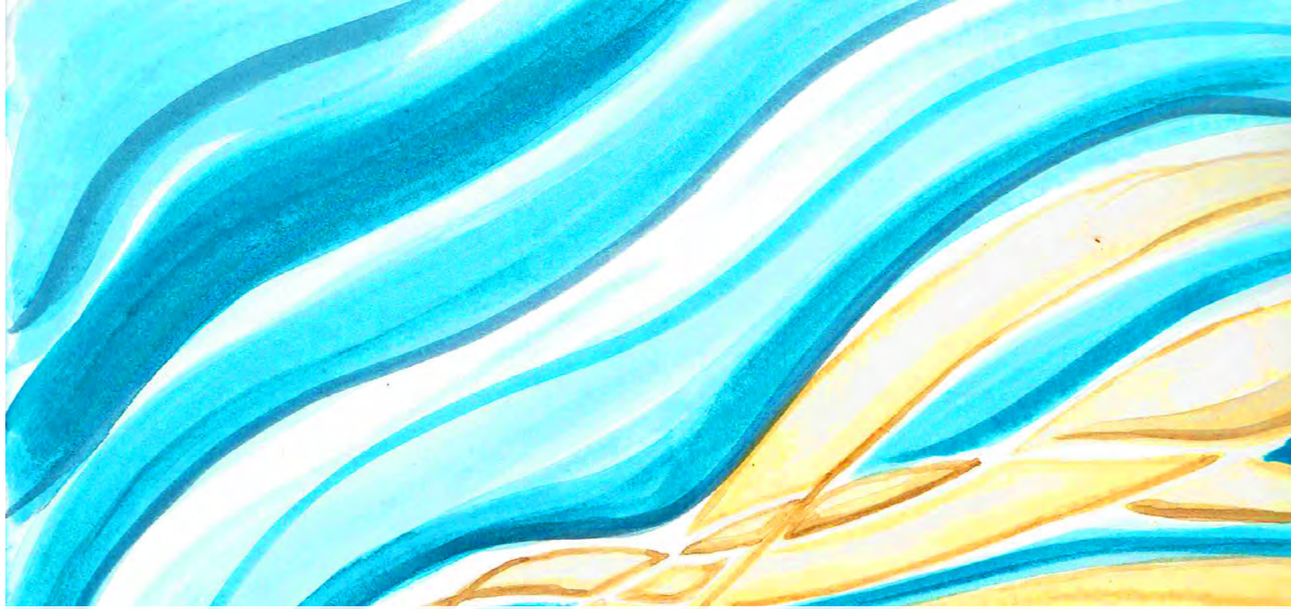
Dorsal spines present:
Yes/no

common name:

scientific name:

Life stage:



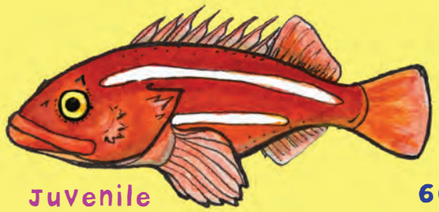


chapter 4
Subadults

Rockfish Life Stage
4

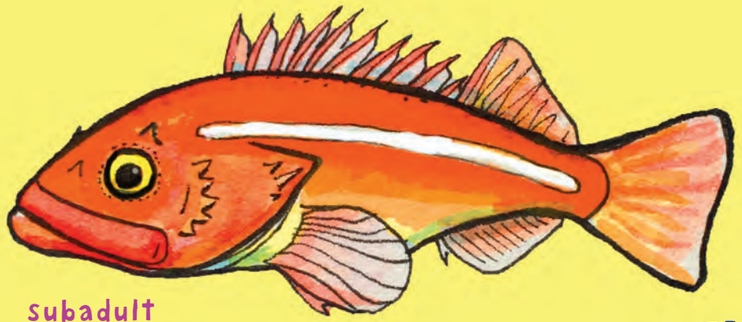
Morphology

Subadults are almost all grown up. They begin to eat what adults eat. They have the same predators too. Their bodies are still changing in size and color. Yelloweye have two white stripes that disappear as they mature. Their change is so dramatic! Juveniles, subadults and adults look like different species of fish but they are not.



Juvenile

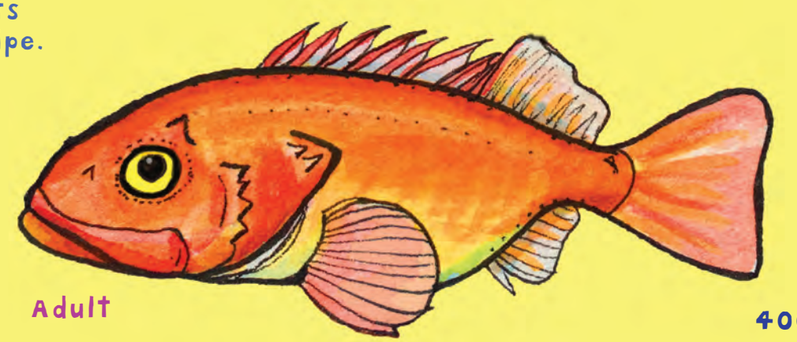
60 mm +



Subadult

350 mm +

Subadults lose a stripe.



Adult

400 mm

These yelloweye are different ages but all the same species.

How many stripes does a subadult have?

Bocaccio have a much less dramatic change.
Sometimes they lose all their brown speckles. Sometimes they don't.
Bocaccio do get heavier and more full bodied.
Subadults are shorter and sleek. Adults are fatter and longer.
They keep their big lower lip.

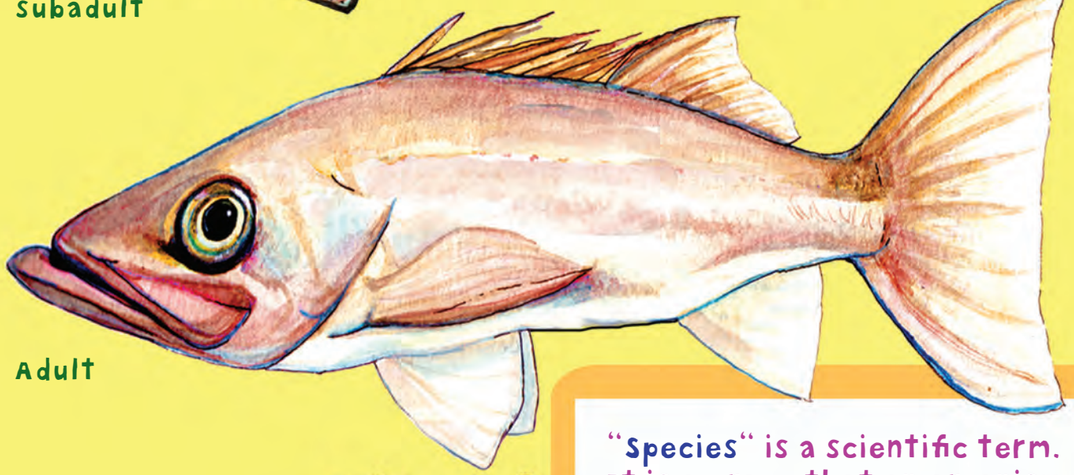
60 mm+

Juvenile

350 mm+

Subadult

420 mm



Adult

"Species" is a scientific term. It is a group that an organism belongs to.

These bocaccio are different ages but the same species.

Bocaccio and yelloweye are different species.

How long is an adult bocaccio?

1

larvae and pelagic juveniles

2

benthic juveniles

subadults

3

A long time ago, glaciers left mud and rocks on the bottom of Puget Sound. This made caves and ledges for rockfish.

adults

4

Habitat #3
Mud Walls and Caves

In deep water there are caves and rocks to explore. There are slanted walls made of clay and mud. Anemone and coral grow on these structures.

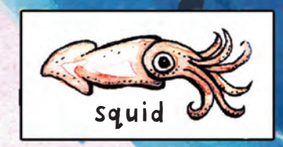
Habitat #3 is deep water.
Habitat #4 is the deepest water.
Subadults live in #3.
Other rockfish live down here too.

Adult rockfish are big enough to compete in the deepest water with the other big fishes.

Prey in Deep Water

Tasty squid swim in deep water. Subadults and adults eat squid. They also catch fishes like Pacific cod and walleye pollock. Subadults need this food energy to grow into adults.

Loligo opalescens



Anemone
Metridium giganteum

Predators

Subadults and adults have few predators. They grew too big for most creatures to eat. Orca, steller sea lions and humans are the exceptions.

Orca and sea lions are marine mammals. Humans are land mammals. All three of these mammals breathe air and have a taste for rockfish.

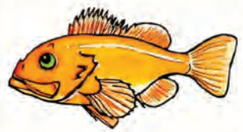
Puget Sound is home to an orca population. Bocaccio and yelloweye also call Puget Sound their home.

Is an orca
a fish
or
a mammal?

observer: Date: _____

Rockfish grow throughout their life. They change habitats, find new prey, and encounter new predators.

List the habitat, prey, and predators for each life stage.

	Habitat	Prey	Predator
 larvae			
 pelagic juvenile			
 benthic juvenile			
 subadult			

chapter 5

Adulthood

Rockfish Life Stage 5

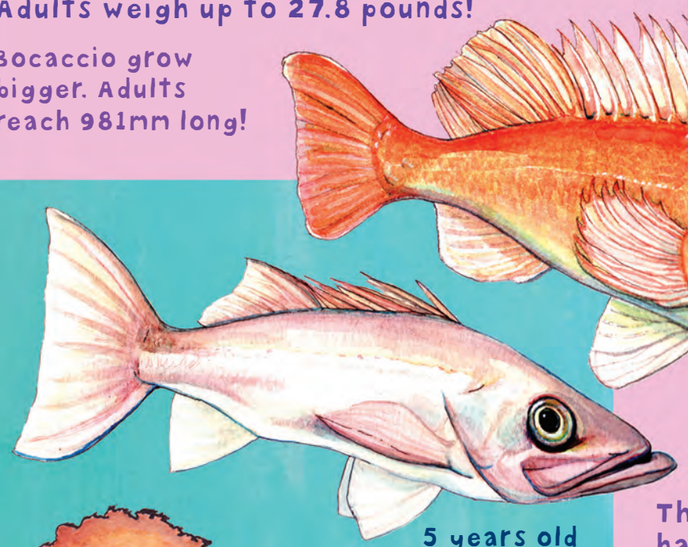
Adulthood

Adult yelloweye grow up to 914 mm. That is 200 times taller than a newborn. The statue of liberty is 200 x taller than a human. Imagine a person growing that tall!

Yelloweye are heavyweight champions too. Adults weigh up to 27.8 pounds!

Bocaccio grow bigger. Adults reach 981mm long!

20 years old



They are all grown up. They swim at the top of the food chain.

They lived in every habitat. They escaped every predator. Adult rockfish eat of lot of different prey.

5 years old

which rockfish lives the longest?

Rockfish stats	Yelloweye rockfish	Bocaccio
Max size	91.4 cm	98.1 cm
Max depth	549 meters	478 meters
Max weight	27.8 pounds	23.6 pounds
Max age	147 years	22 years
Years to Maturity	20 years	5 years
Size at Maturity	40-54 cm	42 cm

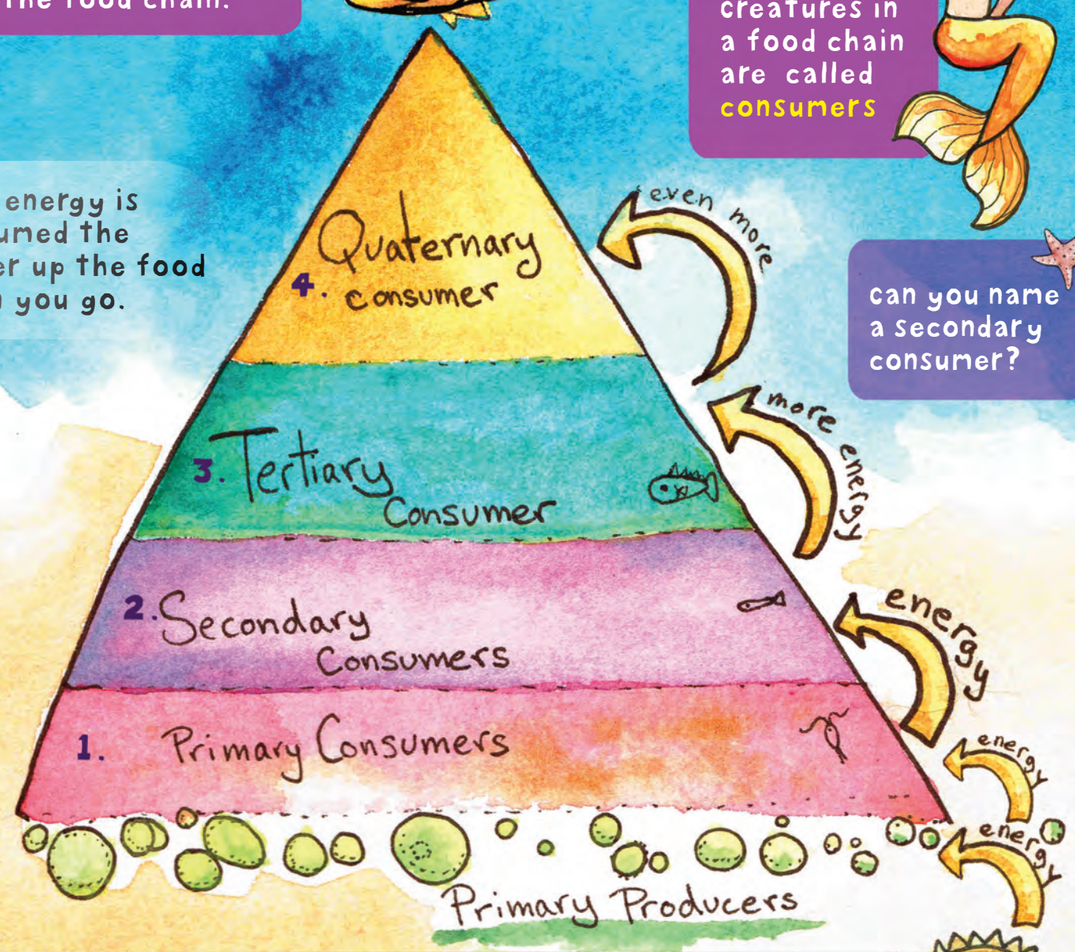
The Trophic Levels

A trophic level is an energy step in the food chain.

creatures in a food chain are called consumers

More energy is consumed the higher up the food chain you go.

can you name a secondary consumer?



The first step from the sun is primary producer.
This includes: plants, phytoplankton and algae.

Everyone else in the food chain is a consumer.
1. Primary consumers eat primary producers. Eg: krill eat phytoplankton.
2. Small fish eat krill. They are secondary consumers.
3. Bigger fish eat the small fish. They are tertiary consumers.
4. Quaternary consumers are 4 steps up a food chain.

The Puget Sound Ecosystem
Arrows show energy moving through all the food chains.

Pink arrows show who eats yellowey and bocaccio.

An Ecosystem for Rockfish

An ecosystem is all the food chains PLUS the environment.
For Puget Sound this includes plants and animals PLUS the sun, the water, and the habitats.

A rockfish needs things throughout its life. They live in many habitats. They eat their way up the trophic levels.

WHAT DOES A ROCKFISH NEED?

1. Clean open water
2. Bull kelp
3. Deep water nooks and cranies
4. Nauplii and krill
5. Small baitfish
6. Squid, pacific walleye and cod
7. Time: 5 years to mature for bocaccio
8. Time: 20 years to mature for yelloweye
9. Other rockfish to breed with. (*see next 2 pages)

Page 38 ECOSYSTEM KEY
a. Humans b. Orca c. Adult yelloweye & bocaccio
d. Salmon e. Young lingcod f. Subadults g. Walleye & cod
h. Squid i. Benthic juveniles j. Herring & Smelt
k. Salmon smolt l. Seabirds m. Pelagic juveniles n. Krill
o. Copepods p. Phytoplankton q. Bull kelp r. Sun energy

Are humans in this ecosystem?

Adult rockfish have come a long way. Let's review their life stages.

Life cycle

LARVAE

Pelagic Juvenile

Benthic Juvenile

Sub Adult

Adult

Reproduction

Adults must find another fish to mate with. This final step completes their life cycle.

When does reproduction start?

To reproduce means to make babies. Reproduction is important. It creates the next generation.

Rockfish need to reproduce to keep up the population, or there won't be enough rockfish for food either.

A lot of creatures in Puget Sound depend on little rockfish for food. Humans like to eat rockfish too.

Rockfish should reproduce BEFORE humans catch them for dinner.

Reproduction

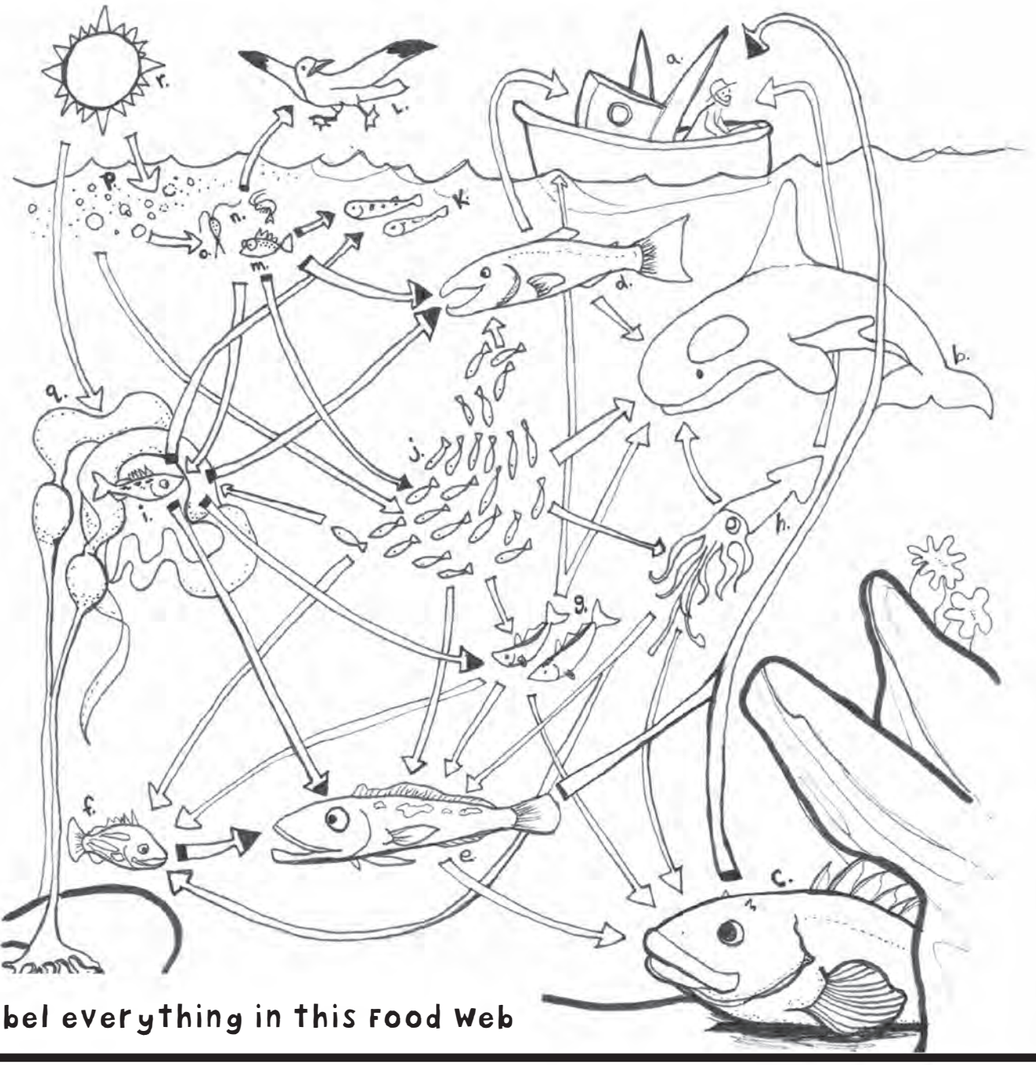
Female yelloweye and bocaccio give birth to live babies (NOT eggs).

Rockfish continue to grow in size as they age. The bigger the female rockfish, the healthier her baby fish are. Large, old females are the BEST!

She can produce anywhere from hundreds of thousands to two million babies each year!

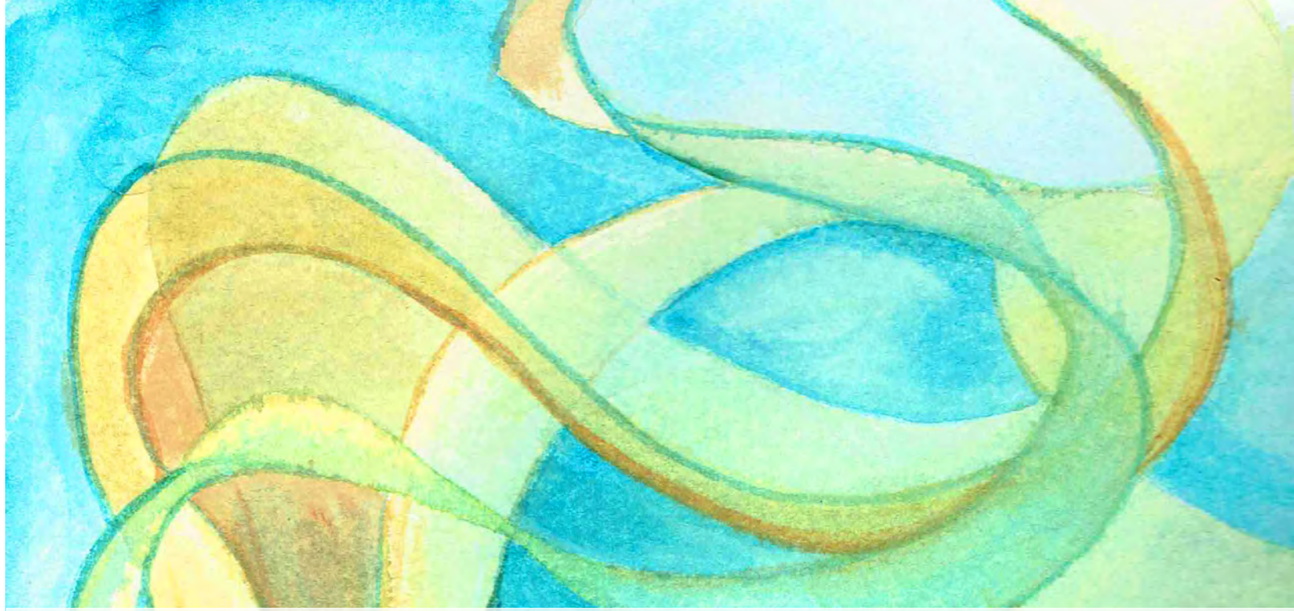
Is 2,000,000 a lot of babies?

Name: _____ Date: _____



Label everything in this Food Web

a. _____	j. _____
b. _____	k. _____
c. _____	l. _____
d. _____	m. _____
e. _____	n. _____
f. _____	o. _____
g. _____	p. _____
h. _____	q. _____
i. _____	r. _____

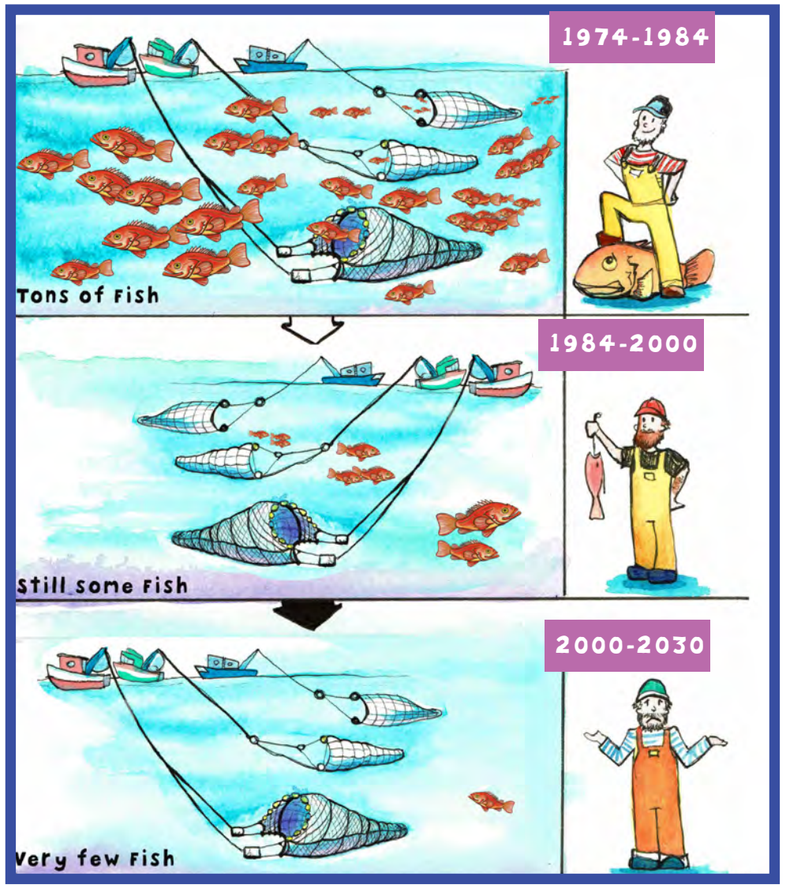


chapter 6
Fishing

Rockfish and Humans Living Together

Fishing History

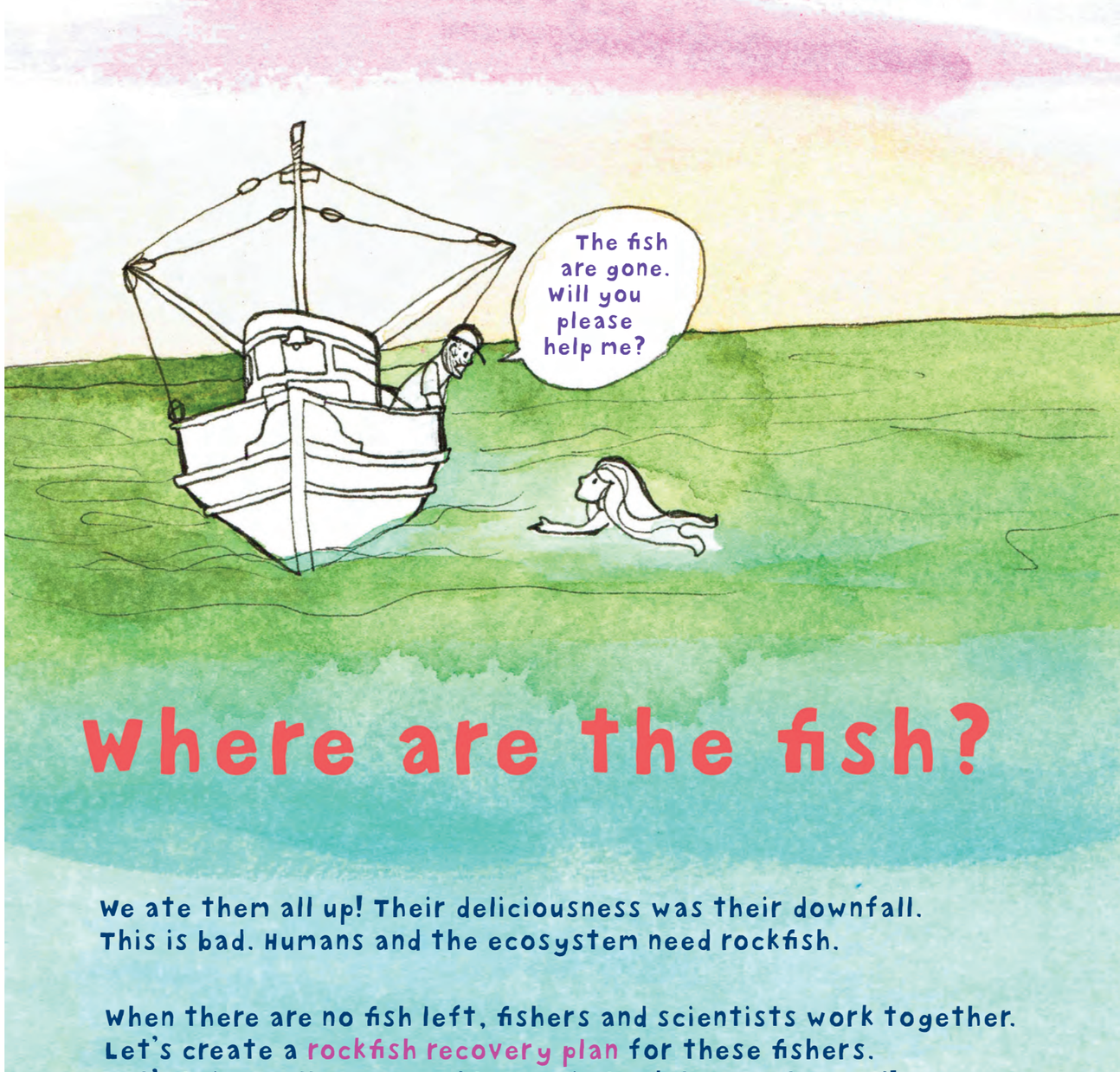
Fishing means to catch fish. Fishing is a way humans get food. Humans are rockfish predators. To catch rockfish, they drag trawl nets behind their boat. Over the years human fishers fished A LOT. Today there are few bocaccio and yelloweye left in Puget Sound.



In 2002, the Puget Sound population was declared "**overfished.**" **overfishing** is catching too many fish too fast. Mature fish must be left behind to make babies.

No more fish means unhappy fishers and no adult fish to produce baby fish. Sometimes it's hard to know how much is too much.

Is overfishing good or bad?



Where are the fish?

We ate them all up! Their deliciousness was their downfall. This is bad. Humans and the ecosystem need rockfish.

When there are no fish left, fishers and scientists work together. Let's create a **rockfish recovery plan** for these fishers. Let's bring yelloweye and bocaccio back to Puget Sound!

Which other animals will be hungry without bocaccio and yelloweye?

Rockfish Recovery To Do List

A healthy ecosystem means a healthy fish population.
A healthy fish population means great fishing!

What is the answer to this overfishing problem?
Understand the rockfish life cycle and ecosystem:

1. Learn what rockfish eat.
2. Learn which habitats a rockfish lives in.
3. Find out if their habitats are polluted or healthy.
4. Learn how long it takes a rockfish to mature.
5. collect data on how many fish are left in Puget Sound.
6. Protect any remaining fish and habitat.
7. Wait for the remaining fish to reproduce.
8. Wait for this new crop of babies to mature.
9. Find a healthy number to fish each year.
10. Share the magic number with fishers.

What does a rockfish need to survive and thrive?

Rockfish Needs

Let's review what rockfish need to complete their life cycle.

1. clean open water
2. Bull kelp
3. Deep water rocks and caves
4. Nauplii and krill
5. Small baitfish
6. Squid, pacific walleye and cod
7. Other bocaccio and yelloweye to breed with
8. Five years to mature for bocaccio
9. Twenty years to mature for yelloweye
10. Protection from being overfished (no more disappearing fish!)

Good news!
Puget sound has all of these things!
The rockfish just need time to recover.

How long do we wait for the first mature crop of bocaccio?

Protection

Protection under the Endangered Species Act (ESA) helps rockfish recover.
On April 28, 2010, yelloweye rockfish was listed as "threatened."
Bocaccio was listed as "endangered" (in Puget Sound).

Endangered means a species that is in danger of becoming extinct.
Extinct means a species that has died out completely. Threatened is when a species is almost endangered. We use these terms to help create protections, to keep them from completely disappearing.

How do we protect overfished creatures?

Scientists and fisherman work together to find a healthy number to fish (Maximum Sustainable Yield). This creates a sustainable fishery.

A sustainable fishery leaves fish behind to produce the next generation.

sustainability also means a good ecosystem supports the fishery.

Sustainable Fishing

Let's travel in time five years.
The new crop of bocaccio are now adults.
They are big enough to catch and eat.
There are a lot of fish so we take away their species protection. This time fishers want to be mindful about how much they take.

There are two types of fishing:
#1 Sustainable fishing
#2 overfishing

Which type of fishing leaves some bocaccio for the future?

congratulations!

You made it through the whole rockfish book!
Now you know about the bocaccio
and yelloweye rockfish of Puget Sound.

You traveled through all their habitats.
You learned about all their prey and predators.
You know their place in the ecosystem.
You also learned about sustainable fishing.

You are on your way
to becoming a marine biologist!

To learn more, visit:
www.fisheries.noaa.gov/species/yelloweye-rockfish
www.fisheries.noaa.gov/species/bocaccio-protected

ROCKFISH
CONSERVATION
Bottom-up Recovery
of Puget Sound

Supporting Vocabulary

Adult: A fully developed individual that has reached reproductive age.

Algae: A simple plant that lacks true stems, roots, leaves, and vascular tissue; often the first level in the aquatic food chain.

Anal fin: The fin located to the bottom rear side of the fish.

Benthic: Living on or in close association with the sea floor.

Camouflage: The avoidance of observation that allows otherwise visible organisms to remain unnoticed by other organisms such as predators or prey.

Catch limit: A weight limit of fish that fishers can catch in a fishing season.

Caudal fin: The tail fin.

Consumer: An organism that feeds on other organisms in a food chain.

Copepod: A crustacean, often found in huge swarms in the water column (0.5 to 2mm).

Crustacean: A group of marine animals with a hard, outer shell.

Dorsal: Relating to the upper side of an animal.

Dorsal fin: The fin that sits on the back of fishes. Different species have one, two, or three.

Ecosystem: A community of organisms and the non-living environment in which they interact.

Energy: Power derived from resources. Within an ecosystem, energy is measured in calories or joules. Energy flow is the amount of energy that moves through a food chain.

Euphausiid: Also called krill. Small crustaceans found all over the world.

Fecundity: The number of eggs or young that a female fish produces in a season.

Food chain: The sequence of the transfer of food energy from one organism to another in an ecological community.

Food web: The interconnected feeding relationships in an ecosystem that usually begins with photosynthesis. All the interactions of predator and prey, along with the flow of nutrients into and out of the ecosystem.

Gills: A respiratory organ by which oxygen is extracted from water flowing through them.

Glacial-mud: The geology of Puget Sound came from a receding glacier. The glacier deposited large amounts of glacial till. Now there remain silty clay and mud walls that make good rockfish habitat.

Supporting Vocabulary

Habitat: The natural home or environment of an animal or plant.

Herring: A silvery fish that is most abundant in coastal waters and is of great commercial importance as a food fish in many parts of the world.

Juvenile: Young of a species; usually a miniature version of the adult, but not yet sexually mature.

Kelp: A large brown algae that typically has a long, tough stalk with a broad frond divided into strips. Some kinds grow to a very large size and form underwater "forests" that support a large population of animals.

Krill: A small shrimplike planktonic crustacean of the open seas. It is eaten by a number of larger animals.

Larva (pl. Larvae): A young fish that, at birth or hatching, is unlike its parents and must pass through metamorphosis before assuming adult characteristics.

Lateral line: A series of pores along the sides of a fish. Each pore contains a hair-like structure that bends as water hits it. This allows fish to feel movement in the water around it.

Length: The measurement or extent of something from end to end.

Life stage: The different phases of life that all individuals pass through in a normal lifetime.

Mammal: A warm-blooded vertebrate animal of a class that is distinguished by the possession of hair or fur, the secretion of milk by females for the nourishment of the young, and (typically) the birth of live young.

Marine biology: The scientific study of organisms that live in salt water.

Marine mammal: Aquatic mammals that rely on the ocean and other marine ecosystems for their existence.

Measure: To ascertain the size, amount, or degree of (something) by using an instrument.

Mermaid scientist: A happy individual who loves, draws, studies, protects and eats all manner of sea creatures.

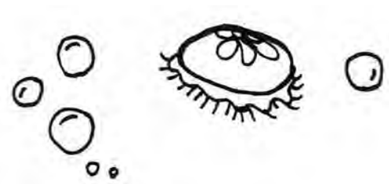
Microscope: An optical instrument with a magnifying lens that typically magnifies several hundred times.

Nauplii: A baby/larval copepod. Lives in the plankton and is food for larval rockfish.

Pectoral fin: A paired fin located behind the head.

Pelagic: Refers to open water; living in the upper layers of the open sea. Comes from the Greek term for "open sea."

Pelagic juvenile: A juvenile that lives in open water.



Supporting Vocabulary

Pelvic fin: A paired fin located on the underside of a fish's body.

Phytoplankton: Tiny, floating aquatic plants that use photosynthesis; often the first level in the aquatic food chain. Found in oceans, rivers, lakes, and Puget Sound.

Plankton: The small and microscopic organisms drifting or floating in the sea or fresh water, consisting chiefly of diatoms, protozoans, small crustaceans, and the eggs and larval stages of larger animals.

Predator: An animal that lives by hunting other animals for food. Killer whales, seals, sharks, humans and rockfish are good examples of predators that hunt small fish.

Prey: An animal that is hunted by another animal for food.

Primary production: Energy (transformed to material) formed by autotrophs, typically through photosynthesis of green plants, in a specific time period.

Quaternary consumer: An animal that meets its nutritional requirements from complex organisms.

Secondary production: Energy (transformed to material) by herbivores, carnivores, or detritus feeders in a specific amount of time.

Species: One of the groups into which animals or plants are divided according to their shared characteristics.

Spine: A body projection on the head or in the dorsal fins and rays.

Stock: A breeding population of a species; a group of individuals regarded as a single unit for fishery management or assessment purposes.

Subadult: An animal that is not fully adult.

Subtract: To take away a number or amount from another number or amount to calculate the difference.

Telescope: An optical instrument designed to make distant objects appear nearer, containing an arrangement of lenses, or of curved mirrors and lenses, by which rays of light are collected and focused and the resulting image magnified.

Trophic level: Each of several hierarchical levels in an ecosystem, composed of organisms that share the same function in the food chain and the same nutritional relationship to the primary sources of energy.

Ventral: Relating to the underside of an animal.

Young-of-the-year: A juvenile fish, from the time it settles out of the plankton until its first birthday.

About the artist

Claudia Makeyev

is an Author and Illustrator of books for kids and teens as well as a marine scientist on the central coast of california.

She created Mermaid Scientist to teach kids marine biology.

This is a

Marine Biology Book for kids

Kids learn all about two special rockfish in this book.
They learn how they grow and change. They learn about what they eat
and who eats them. They get to explore the different places in the ocean
and learn where these rockfish live throughout their lives. All this,
as explained by a couple of intelligent ~~mermaids~~ marine biologists.

Learn, explore and enjoy this tale of two rockfish!