

**SeaChoice.org**  
*for healthy oceans*

# Sustainable Seafood

**An Educator's Guide  
for Grades K-6**

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# SeaChoice.org

## Foreword

The oceans have a profound effect on all of us. We also have a profound effect on the health of our oceans and, unfortunately, it is often not positive. As our understanding of the complex systems that support ocean life has improved, we are realizing just how much of an impact we are having on the world beneath the water's surface. Despite these increasing challenges, our oceans are an amazing treasure of biodiversity, healthy food, and awe! Given the right tools and education, everyone has an opportunity to engage in marine conservation and help protect the global treasures of the sea. By learning (and teaching) about the issues affecting the health of our oceans, and by making informed choices, you become part of a larger community of ocean and sustainable seafood ambassadors leading by example: together we can maintain healthy and abundant oceans for future generations.

With appreciation,

## The SeaChoice Team



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CANADIAN PARKS AND WILDERNESS SOCIETY



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# About this Guide

## Setting the Scene for Sustainable Seafood

Fish comprise the world's largest wild food harvest and provide a vital source of protein as well as livelihoods for many families. Globally, more than 120 million people are dependent on fish for all or part of their income, particularly in developing countries. Animals such as whales, dolphins and seabirds also rely on fish for their food. Fish are a vital part of marine ecosystems and are key to the essential services that these environments provide (e.g., global nutrient cycling).

Over the last century, commercial fisheries have drastically reduced fish populations and altered the world's marine ecosystems. On a global level, most fisheries are poorly managed and fish stocks have been fully exploited (52%), over-exploited (16%), or depleted (7%). The world's capture fisheries peaked in the late 1980s and, despite increased fishing efforts, catch rates have dropped. More hours on the water for fishermen have yielded fewer and fewer fish.

Put simply, what we take out of the ocean as seafood or by-catch is greater than what the ocean can sustainably provide. We are not only facing a decline in the capacity of our oceans to provide a sustainable food source but we are destroying the basic ecological processes and food chains that we and marine life depend on. While the overall catch from the world's oceans

appears to be maintained at a high level, this does not mean that catches are sustainable. High levels of catch have been maintained as commercial fleets move to new, previously unexploited species or areas, once their original target stock is depleted. This "sequential depletion" of marine organisms has been masked until recently by improved technology, expansion to different or deeper parts of the ocean, and over-reporting of fish catches for political reasons. All the while, previously undesirable species, often lower on food chains, are marketed to consumers.

The movement towards sustainable seafood is about solutions for our oceans. The ultimate resolution will require governments, industry, retailers and individuals to take responsibility for changing our approach to seafood. Your personal seafood choices are also a big part of the solution.

Choosing sustainable seafood is a simple and effective action that you can take every time you eat at a restaurant or buy seafood at your local grocer. Voting with your wallet also sends a strong signal to government and industry telling them that you support responsible stewardship of our natural marine resources. This, in turn, strengthens the voice of conservation organizations when they advocate for changes to fisheries management to government and industry. (1)

## How to Use this Educators' Guide

This teaching kit is designed to help teachers educate their students about the value of the oceans and marine conservation issues, with a focus on the global fisheries crisis. The teaching kit is appropriate for various age groups; however, activity levels vary.

This guide is broken into five major sections:

### Section 1: Student Introduction

This section provides a broad overview of the material within this guide.

### Section 2: Our Big, Beautiful Oceans

This section provides an introduction to the physical environment of the oceans and the services that it provides to humans.

### Section 3: Oceans in Deep Trouble

This section describes the threats facing our oceans.

### Section 4: Seafood: The Good, The Bad, and the Unsustainable

This section provides an overview of unsustainable fishing practices.

### Section 5: Sustainable Seafood

This section defines sustainable seafood and provides an overview of the criteria used to determine the sustainability of any given species of seafood.

### Section 6: Choosing Sustainable Seafood at the Market

This section offers helpful suggestions to students and parents on how to use their power as consumers to reduce the impact of the seafood industry on the marine environment. It also provides tips for selecting sustainable seafood when shopping.

Each section is thoroughly researched and referenced, and the reference numbers you will find throughout the text correspond to primary sources in the bibliography at the end of this guide.

In order to facilitate teaching, each section also provides a number of teaching resources. These teaching resources include suggestions for

additional discussion topics, class activities, and project ideas that will provide additional opportunities for learning. They also help to drive home the point that many types of seafood are rapidly disappearing, and that making sustainable choices can help to reverse this trend from the bottom up – by affecting demand.

The various teaching resources you will encounter throughout this guide are outlined below:

**Learning Objectives:** Precede each major section and frame the key points that students will learn.

**Did You Know?:** Vignettes giving additional information on selected subjects.

**Discussion Points:** Questions for stimulating thought and discussion.

**Teaching Tips:** Pointers or advice on how to present lesson information.

**Additional Resources:** Web sites, books, and other educational resources where both educators and students can learn more about the subject.

**Activities:** Classroom activities and projects tailored for both younger and older learners that help reinforce concepts covered in each section.

**Handouts:** Featuring paper-based activities such as quizzes, crosswords, puzzles, and crafts, handouts are designed for easy printing and distribution.

By incorporating more activities and projects teachers can tailor the scope of this learning program to suit their needs – be it a one-day lesson or a one-week module.



# Student Introduction

**Teaching Tip:** Use this narrative to introduce the lesson to students.

The last time you ate salmon for dinner or had fish sticks in the school cafeteria, did you stop to think about where that fish came from? The fish and other seafood we eat were once wild animals living in the world's oceans, and they are some of the last wild animals that people still hunt for food. Many people think there are plenty of fish in the sea, and that the oceans are so big that we could never run out of seafood to eat.

What these people might not know is that our oceans are in trouble, mostly because of the way human activities are damaging the environment — polluting, and contributing to global warming, but also because we are taking too much seafood out of the ocean (overfishing). As a result, today, there is less and less seafood to go around. If humans don't become more responsible about the way they treat the oceans and what's in them,

then the day will soon come when fish sticks are no longer on your lunch menu! One important way that people like you can help the oceans is by making sure the seafood you buy and eat is sustainable. This means making sure the kinds of seafood you eat aren't in danger of disappearing and that the way they're caught doesn't damage the ocean environment.

In the coming lessons, you'll learn about the reasons why our oceans are in trouble and why the fish and other seafood that many of us love to eat might disappear if we aren't more careful about how we use them. You'll also learn about one way that you can help, by knowing about and choosing seafood that is sustainable and ocean-friendly. By teaching you about the oceans, fish and seafood, SeaChoice hopes that you can help keep our oceans and our seafood in good shape! (1)

## Discussion Points

1. What does the word "seafood" mean?
2. Why is seafood good for you?
3. Why is seafood important for people around the world?
4. Where does seafood come from and how do we get it?
5. Is there enough seafood around for everybody?



# Learning Objectives



Begin with a brief overview of the subjects you will be covering and a classroom discussion centred around the discussion points on the preceding page. Then, explain to students what they will learn during their upcoming lessons using these learning objectives. Depending on the scope of the program you wish to conduct, you may cover only some of these subjects, or all of them.

## What You'll Learn

- Why the ocean is important: environmental services, recreation, transportation, biodiversity, and nutrition.
- Why the ocean is in trouble: climate change, pollution, habitat destruction, and overfishing.
- How some kinds of fishing can be harmful for the ocean and the marine life it harbours.
- What sustainable seafood is and how it can help to keep global fisheries in good shape.
- How scientists decide which kinds of wild and farmed seafood are sustainable and which ones aren't.
- How to identify some common types of seafood you might find at the grocery store.
- How to find out if the kind of seafood you or your parents want to buy is sustainable.
- The meanings of many new words related to the oceans, fishing, and seafood. These words appear as **bold and blue** type throughout the text and are defined in a Glossary at the end of this guide.

# 1: Our Big, Beautiful Ocean

## Section Learning Objectives

- Learn about the ocean's physical environment
- Understand the ocean's "ecosystem services"
- Understand biodiversity and food webs
- Understand why seafood is an important food source
- Understand why seafood is nutritious and healthy



Photo © NASA

## Our Blue Planet

If you've ever spent time by the beach or on a boat, you might remember thinking that the ocean seemed to go on forever, and from a human point of view, you weren't far off. The ocean covers about 70% of our planet, of which humans have only explored a very tiny part. Most of the ocean is incredibly deep and features vast undersea plains, canyons, and some of the largest mountains in the world (higher even than the Himalayas)! The ocean gets shallower near land, where the sea floor rises up to form a shallow fringe around the world's land masses that is known as the **continental shelf**. Although the continental shelf makes up only 8% of the whole ocean, these shallow, sunny waters are where we can find most of the ocean's plants and animals and also where most human interaction with the oceans takes place. (2)

## Why is the Ocean Important?

Today, over 60% of the world's population lives near a coast and nearly everyone can think of a way they are connected to the ocean. For you, it might be visiting the beach on a hot summer day, seeing colourful coral reef fish at your local aquarium, or having some fresh seafood right off the docks. This close relationship with the ocean began over 125 000 years ago, when our early ancestors collected seafood from the seashore and began using boats to get around. Although a lot has changed since then, humans still rely on the ocean for many important things that are known as ecosystem services. (3)

### Did You Know?

One of the very deepest parts of the ocean is an undersea canyon called Challenger Deep, which bottoms out at 11 000 metres beneath the surface of the Pacific Ocean. Challenger Deep is so deep that you could put Mount Everest inside of it and still have about 2 000 metres or so to spare before reaching the surface! (2)

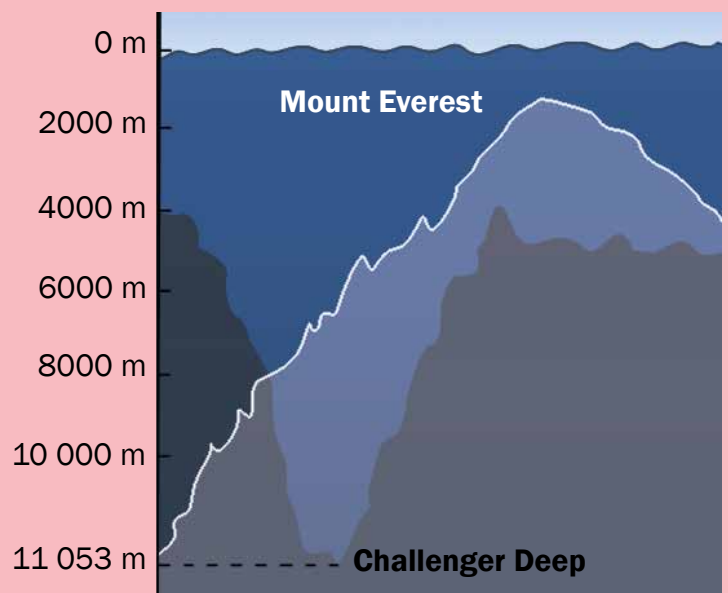


Diagram © Natascia Tamburello



## Environmental Services

Although you might not realize it, the ocean plays a big role in keeping the planet's air and water clean. The many **wetlands**, **mangrove forests**, and **estuaries** found along our coastlines filter waste and pollution out of rain and river water as it flows back to the ocean. In the ocean itself, **algae** use up carbon dioxide through **photosynthesis** and release oxygen that we can breathe, just like plants do on land. By taking carbon dioxide out of the atmosphere, the ocean's algae help to slow climate change. (4) (5)

## Transportation

The ocean has helped people and products get from place to place for thousands of years. While early wooden boats needed many months to cross the ocean, today's modern ships can make the same journey in just a couple of hours and shipping has become the single most important way to move things across the world. Over 90% of clothing, toys, furniture, food and other things you can find in local stores have travelled across the ocean from a faraway country as cargo in the belly of a big ship. Every year, 907, 504 ships from over 150 countries carry 7.4 billion tonnes of cargo all over the world. (6)

## Recreation

No matter where they're from, people love to visit the ocean, whether it's to cool down on a summer day, take a boat ride, explore the underwater world through SCUBA diving, or just play in the sand. Not everybody is lucky enough to live by the ocean, though, and many of us become familiar with the ocean as visiting tourists on vacation. Tourism creates many jobs for people all over the world, especially those living on tropical islands and other places near the ocean. One of the newest kinds of tourism is ecotourism, where tourists visit natural areas like wetlands, mangrove forests, and coral reefs to see and learn more about the environment and the plants and animals that live there. (7)



## Biodiversity

The ocean is home to over 210 000 kinds of plants and animals, including algae, corals, salmon, sharks, seahorses, whales and many, many others that we have yet to discover. We can say that the ocean has high **biodiversity**, because many different kinds of plants and animals live there rather than just a few kinds. (8)

All the plants and animals in the ocean depend on each other for food. Algae and **plankton** are at the bottom of the **food chain**. They are eaten by little fish, little fish are eaten by bigger fish, and bigger fish are eaten by the biggest fish. The complex relationships describing who eats whom in the ocean can be illustrated as a “**food web**.”

All the different plants and animals in the ocean are connected through the food web in a delicate balance. If one kind of animal disappears because of pollution or overfishing, the animals that depend on it might not be able to survive and even more species might disappear – the food web could collapse. If biodiversity is low, then a collapse is more likely, but if biodiversity is high, then one of the many other different kinds of plants or animals in the food chain might be able to take the place of the ones that go missing and prevent a collapse. This is one reason why biodiversity is so important: it helps to protect ocean ecosystems from falling apart, that is, it makes them resilient.

## Did You Know?

Most people think that sharks are at the top of the marine food chain and, in the past, this was certainly true. Sharks and their relatives were already around in the time of the dinosaurs and, today, scientists have identified about 500 kinds of sharks. The biggest of these, the whale shark, can grow over 10 m long and live for more than 100 years! Sharks are very efficient swimmers and very effective hunters. They are able to track down food using their sense of smell and ability to sense the electrical signals given off by living fish and other marine animals, making them excellent hunters. (9) Even though sharks have a bad reputation, it's

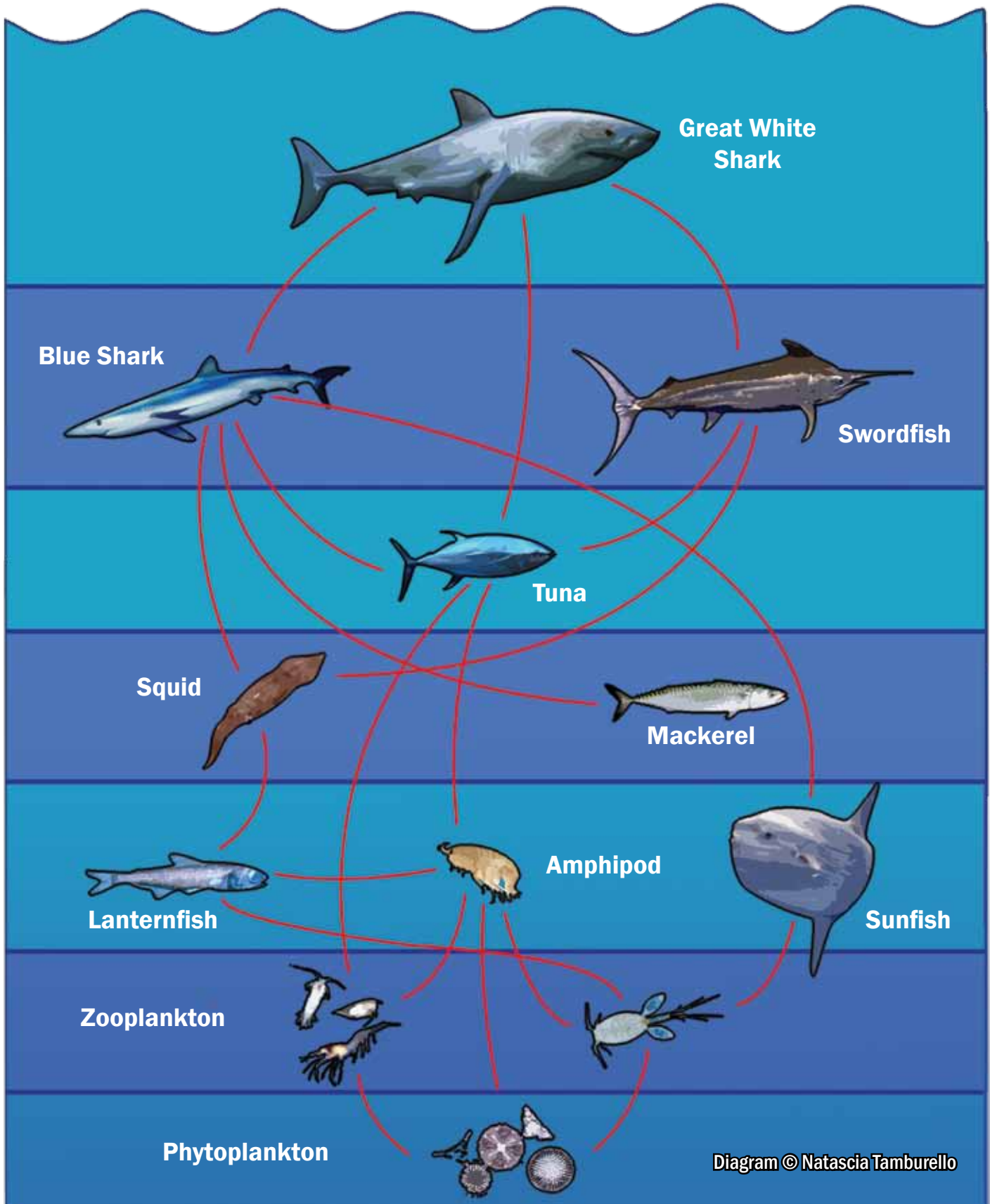
important to remember that most sharks aren't dangerous and would much rather munch on seafood than swimmers. A much more dangerous predator is even higher up on the marine food chain than sharks. Can you guess what it is?

The answer is YOU! Humans eat almost all of the animals found in the ocean, including its biggest predators like tuna and even sharks. In fact, hunting sharks for their fins - which are used as food and traditional medicine in some Asian countries - now represents one of the greatest global threats to shark conservation.





# A Marine Food Web



## Nutrition

One of the most important reasons that humans need the oceans is because oceans help to feed the world with seafood! Each person on the planet consumes an average of 14 kg of seafood out of the 158 million tonnes of seafood that fishermen catch every year. (8) That's enough to fill over 61 000 Olympic-sized swimming pools with seafood! (12) People in some areas may eat more seafood than others. This is especially true for some developing countries, where other kinds of food may be hard to find, grow, or buy. All in all, about 2 billion people, or 30% of the world's population, rely on seafood as a major source of food. (13)

Seafood isn't just a good way to fill a hungry belly, it's also one of the healthiest, and most nutritious kinds of food around. It is an excellent source of protein and contains many vitamins, like vitamins B and D, as well as many minerals, like calcium, iron, zinc, magnesium, potassium, copper and iodine. Seafood is also very low in saturated fats

which can be bad for your heart. Instead, it is rich in healthy fats like omega-3s. Omega-3 fats are very important for the growth and development of the brain and nervous system and can help to keep the heart healthy throughout life. Because seafood is so good for you, Canada's Food Guide recommends you eat seafood at least twice per week to help keep you healthy and strong. (14) Later on in this guide, we'll learn what kinds of seafood are also healthy choices for our oceans.

Now, when most people think of seafood, they naturally think of fish. While fish are a very important type of seafood, the word seafood can refer to pretty much any animal that lives in the ocean and that people catch and eat somewhere in the world! In addition to fish, seafood can mean fish eggs (called "**roe**"), shrimp, crabs, lobsters, snails, clams, squid, octopus, sea urchins, sea cucumbers, sea turtles, seaweeds and even jellyfish, which are considered a treat in some Asian countries. (15)





## Did You Know?



Another reason that biodiversity is important is that scientists have discovered many new medicines by studying sponges, starfish, anemones, snails, and other ocean life.

Searching for useful medicines or other chemicals in the natural world is called “**bioprospecting**”. (8) (10) Some examples of marine medicines already discovered include these:

- The chemical trabectedin is isolated from a jellyfish relative called a tunicate and is now being tested as a cancer treatment.
- The chemical contignasterol is isolated from a Pacific sponge and is developing as a promising new therapy for asthma.
- Drugs based on the venom from snails known as cone shells are being tested as a new type of pain medication 1,000 times more powerful than morphine. (11)

The more plants and animals there are to study, the greater the chances that we might find new cures for many of the world’s diseases, so it’s important for us to protect as many as we can!

Tunicates



Photo ©Nick Hobgood

Sea Sponges



Photo ©Nick Hobgood

Cone Shell



Photo © Dave Burdick / NOAA

## Discussion Points

**Teaching Tip:** As you go through each of the major subject headings in this learning program, take the time to pause and initiate discussions with your students based on questions they might have or based on the discussion points provided here:

1. Can you think of a few ways, other than those listed, in which you are connected to the ocean? What would you miss about the ocean if it were gone?
2. When is the last time you went to the ocean? What did you do there?
3. Do any of you practice water sports like swimming, sailing, or snorkelling?
4. Discuss terrestrial examples of biodiversity to conceptualize this term in a form more familiar to most students. Ask them how many different kinds of wild animals they can think about that live in cities. Ask them if they think biodiversity is higher in the city or in a forest or other wild habitat than the ocean and discuss why this might be.
5. How is a food chain different from a food web? What is at the bottom of a typical marine food web? What about at the top?
6. How many of you like fish? What is your favourite seafood to eat? How do you like it to be cooked?
7. Can you describe what your favourite kinds of seafood look, feel, smell, and taste like? Try to evoke the five senses in this discussion topic! **NOTE:** This discussion could be tied into a seafood cooking and tasting activity (see suggestion in following pages).



# Classroom Activities

## Food Chain Activity

Break the class into groups of 5 or 6 students. Write out the following plant and animal names on cue cards and distribute them within each group:

- Plankton
- Sardines
- Cod
- Tuna
- Blue shark (a small species of shark)
- Great white shark

Have kids try to arrange themselves in the correct order from the bottom of the food chain to the top. Go over each group's answer and discuss why they decided to arrange themselves in that way. Get them to act out what they think their species would look like and, for younger students, have fun by letting them pretend to eat their counterparts lower on the food chain.

## Fish Chowder: Choosing Ingredients BEFORE

Cut out a number of fish shapes from construction paper and label them with the names of many popular food fish (try the ones found in a later section, Get to Know Your Seafood!).

- Ask one student to be a seafood seller and another to be a customer who wants to make a seafood chowder for dinner.
- Tell the students that they can pick whatever they think would taste best in their chowder, and have the class watch the interaction.
- When the students are done, talk about the types of fish they chose and introduce how some of them are overfished, come from polluting farms, or are otherwise unsustainable.

Try this activity again AFTER the module is over and ask students to ask the salesman questions and use a seafood guide to choose their fish. Compare the difference in their "consumer behaviour" before and after completing the learning module!

## Seafood Dishes

Try to tie this activity in with a discussion on kids' favourite seafood dishes.

- Discuss the nutritional value of fish.
- Have each student pick a seafood dish from a different country, ask them to cook some at home and write a little report on the country it came from, the type of fish in it, how it was prepared, what it was like cooking this fish, and what the dish looked, smelled, tasted and felt like.
- Ask them to bring some in for the class to taste! Have the students try and use their seafood guides when picking fish for their recipes. As the students try their food, have them describe the way it smells, tastes, or feels as they eat it.

**ALLERGY ALERT:** Make sure none of your students are allergic to fish, shellfish, peanuts, or any other ingredients that might go into these recipes!

# More Resources

- The Harvard Center for Health and the Global Environment has produced a great short film for younger kids that explains how everyone depends on the ocean. It can be viewed for free online at:

[http://chge.med.harvard.edu/programs/healthyoceans/once\\_upon\\_a\\_tide/index.html](http://chge.med.harvard.edu/programs/healthyoceans/once_upon_a_tide/index.html)

- Disney had produced a great, media-rich webpage to accompany it's Disney Oceans documentary; teachers can explore the site for photos, videos, and educational resources on the marine environment and it's diverse creatures.

<http://disney.go.com/disneynature/oceans/>

- The UN Atlas of the Oceans is a great online resource for students to learn more about the ocean environment and the ways in which humans use it.

<http://www.oceansatlas.org/index.jsp>

- MarineBio.org and OceanWorld provide information on the ocean, marine life, and marine conservation.

<http://marinebio.org/>

<http://oceanworld.tamu.edu/>

- Oceana is an organization that campaigns for marine conservation and its web site offers many resources on the ocean environment, its creatures, and ways to help protect them.

<http://na.oceana.org/>

- Google Earth can be used to dive below the surface and take a virtual tour of the ocean bottom and its many trenches and seamounts, and it can also be used to display data about currents, temperature, and climate change. Download Google Earth for free and explore the ocean without leaving the computer lab!

<http://earth.google.com/tour.html#v=4>

- The Woods Hole Oceanographic Institute (WHOI) runs a fascinating educational webpage dedicated to exploration of the deepest parts of the world's oceans.

<http://divediscover.whoi.edu/>

- OceanLink is a marine education outreach program affiliated with the Bamfield Marine Science Center on Vancouver Island, and it's website is filled with useful educational materials on the marine life of Canada's West Coast. They also offer a LiveLab and LiveDive educational service, where classrooms can watch streaming live videos of educators presenting a lab lesson or narrating a dive underwater along the coastline! (fees may apply for some programs)

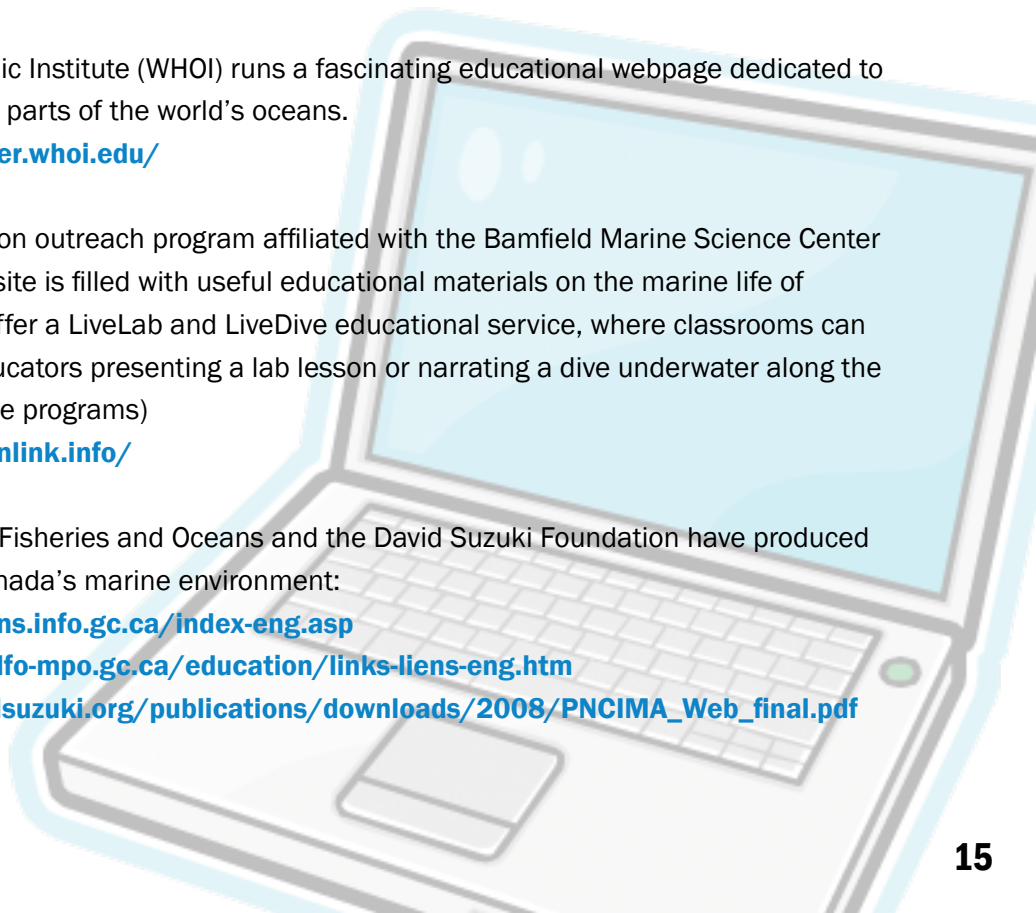
<http://www.oceanlink.info/>

- Both Canada's Department of Fisheries and Oceans and the David Suzuki Foundation have produced great guides specifically about Canada's marine environment:

<http://www.oceans.info.gc.ca/index-eng.asp>

<http://www.pac.dfo-mpo.gc.ca/education/links-liens-eng.htm>

[http://www.davidsuzuki.org/publications/downloads/2008/PNCIMA\\_Web\\_final.pdf](http://www.davidsuzuki.org/publications/downloads/2008/PNCIMA_Web_final.pdf)



# 2: Oceans in Deep Trouble

## Section Learning Objectives

- Recognizing major marine conservation issues like pollution, climate change, and overfishing.
- Understanding that even pollution from land can end up in the ocean.
- Understanding that marine pollution which seems local can spread all over the world through the ocean's currents.
- Understanding that climate change is causing global warming, sea level rise, ocean acidification, and changes in weather patterns that can negatively affect marine life.
- Explaining how overfishing is depleting fish populations and can disrupt marine food webs.

## The Vast, yet Vulnerable Sea

Many people still think that the ocean is so big that our actions don't affect it at all. People have treated the ocean this way for many years, without a thought to how our actions might impact the ocean. Today, because of our many years of careless action, we've come to realize that the ocean is more fragile than we thought and that human activity has landed the world's oceans in deep trouble. (16) If we don't begin to understand and change the way they treat the ocean and its resources, then we may not be able to rely on the ocean for very much longer. Three of the biggest problems facing the world's oceans today are pollution, climate change, and unsustainable fishing and aquaculture practices.

## Marine Pollution

You might not know it, and you might not like it, but the ocean is fast becoming one of the world's biggest garbage dumps. About 80% of all the waste we create on land eventually ends up in the ocean. This includes untreated water and sewage from cities, fertilizer and pesticides from farms, plastic, oil, industrial toxins, and even radioactive waste. (16)

Because all of the world's oceans are connected through ocean currents, pollution can spread far and wide. Evidence of marine pollution can now be found on even the most remote and beautiful tropical islands.

Everywhere pollution spreads, marine life pays a price. Marine life can be poisoned by toxic chemicals and animals can choke on pieces of plastic they mistake for food, or die out when pollutants affect their environment and the food sources they depend on to survive. (16) Not only that, but most marine pollution is also dangerous for people who live close to the ocean or might come into contact with it.



## Global Warming

It's getting hot in here, and as the planet warms up through the insulating action of **greenhouse gases**, about 80% of this heat is eventually transferred to the ocean. (16) (17) Global warming is causing dramatic shifts in the marine environment: polar ice is melting, sea level is rising, and currents are changing. Many organisms are having a hard time adapting to the consequences of rising temperatures. (16) (17) For example, mobile animals like fish may prefer cooler temperatures and migrate into new regions, disturbing local ecosystem structure. On the other hand, organisms that can't move like corals may become sick and even die due to unusually warm water temperatures. (17) This is the phenomenon known as 'coral bleaching' which is currently a hot-button issue in environmental news.

The accumulation of carbon dioxide that contributes to climate change also causes changes in the ocean's chemical composition. Absorption of carbon dioxide into the oceans is causing them to become more and more acidic. Ocean acidification can negatively impact chemical processes in the bodies of marine organisms. This is especially true of coral, molluscs, and other marine organisms that build their shells or skeletons using calcium, which can dissolve in water that is too acidic. (17)

Climate change is thought to be affecting the oceans in still more ways that scientists do not yet fully understand. Because it can impact so many aspects of the marine environment, countering climate change is now an integral part of marine conservation initiatives.

### Did You Know?

Each tiny coral animal, or polyp, that lives within a colony contains symbiotic algae called zooxanthellae. These zooxanthellae are capable of producing energy from sunlight through **photosynthesis**, just like plants on land, and they share some of this energy with their host corals. As temperatures heat up with climate change, these zooxanthellae are expelled from coral polyps as part of the coral's stress response. Once the zooxanthellae are expelled, the bright white skeleton of corals becomes visible through their now unpigmented tissues and they appear 'bleached'. Without their zooxanthellae, corals have access to less energy and may fall victim to disease or death if temperatures do not return to normal within a few weeks or months. Today, most of the world's coral reefs experience bleaching during at least some parts of the year, and coral bleaching has become a major concern in coral reef conservation. (18)

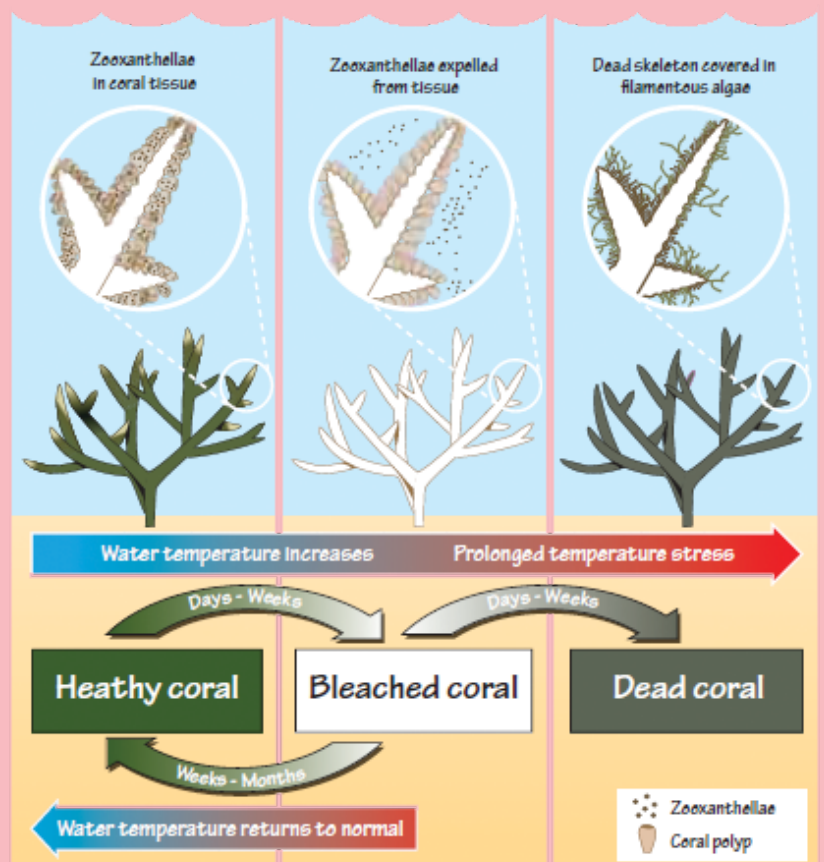


Diagram © Great Barrier Reef Marine Park Authority



## Unsustainable Fishing & Aquaculture Practices

The ever-growing demand for seafood is having a major impact on the oceans.

As a result of this demand and its interplay with international politics, the fishing industry now uses bigger, faster ships equipped with wider nets, sonar fish finders, and other advanced technology to catch enough of the seafood we demand. (8) We are now fishing so much and so quickly that we are taking fish out of the oceans before they have a chance to mature, mate, and produce young fish to help the population grow and recover. (19) Some commonly used fishing methods also destroy marine habitat that fish and other sea creatures need for food and shelter, further reducing survival and population size. (8) (20) Because fishing alone can no longer meet our demand for seafood, many fish are now raised in farms in a practice known as aquaculture. When not carried out properly, aquaculture can also damage the marine environment through pollution, disease, and other impacts.

These are some of the biggest problems facing the ocean right now, and they are problems that you can do something about! Before we can understand how to help, however, we'll need to learn a little more about fishing.



Photo © HoseCort / NOAA

### Did You Know?

Swirling around in the middle of our oceans are giant areas of floating plastic. These regions, called **gyres**, may be the world's largest garbage dumps! If you can imagine a giant toilet bowl swirling plastic around and around, you'll have a pretty good idea of what is happening in these gyres. Almost all of the trash making up this garbage patch is plastic: bags, food packaging, toothbrushes, pens, shoes, and even toys. Once in the ocean, plastic does not disappear for thousands of years, and just keeps breaking up into smaller and smaller pieces. These pieces of plastic can be mistaken as food by sea creatures, like fish, birds, whales, and turtles, harming them. (21) To help stop plastics from building up in the ocean, use as little plastic as you can and always recycle whatever you do use!

### Marine Pollution



Photo ©Hoshana / Wikimedia Commons



# Discussion Points

**Teaching Tip:** As you go through each of the major subject headings in this learning program, take the time to pause and initiate discussions with your students based on questions they might have or based on the discussion points provided here:

1. What are some ways in which humans are harming the ocean environment?
2. What are some ways that we can help to reduce marine pollution? (e.g., don't litter and please do recycle. Never throw toxic chemicals like paint, batteries, or cleaning supplies into the regular trash, since these chemicals can be washed into the ocean.)
3. Climate change is affecting our oceans in many ways; what are some ways we can help to reduce climate change? (e.g., Walk, cycle, or use public transport instead of a car, reduce reuse and recycle.)
4. Why are fishermen trying to catch more and more fish? What kinds of strategies do you think they are using to catch more fish than before?
5. Discuss how fishing methods have changed through time: from simple fishing lines, nets, and small boats all built by hand to large-scale industrial fishing operations that use giant nets, sonar fish finders, and even spotter planes to target fish.

## Classroom Activities

### Calculating your Carbon Footprint

Having kids calculate their carbon footprint is a great way to help them understand the demands they are placing on the earth's natural resources and their contribution to climate change. Zero Footprint is an organization campaigning for individuals to help counter climate change by knowing and then reducing their own personal footprint. The Zero Footprint web site has a kid-friendly carbon footprint calculator that kids can use to calculate their personal carbon footprint as well as resources that will help your students understand how to reduce their contribution to climate change. The calculator provides numbers in terms of carbon dioxide, water, trees, and land. For example, the average Canadian creates nearly 9 tonnes of carbon dioxide each year, while using 1,630,000 litres of water, 3.5 trees, and 3.3 hectares of land.

- Over the course of a week, have students think about and record in a journal what they eat, what kinds of things they buy or use, what they throw into the garbage, what kinds of activities they do at home and at school, and how they get from place to place.
- Ask students to visit the Zero Footprint kids' web site and use their diary to answer the questions in the online carbon footprint calculator.  
<http://www.zerofootprintkids.com/>
- The Zero Footprint site also has an accompanying web site with resources for parents and teachers who wish to know more about climate change and carbon footprints.  
[http://www.zerofootprintkids.com/kids\\_teacher.aspx?cat\\_id=wel](http://www.zerofootprintkids.com/kids_teacher.aspx?cat_id=wel)

Translating a carbon footprint into understandable terms can help kids to better understand the direct impact of their way of life on the environment.

## Climate Change and Sea Level Rise

In this activity students will find out what happens to various coastal towns and cities in the event of continuing sea level rise, providing a little food for thought on the impacts that climate change can have on them and the people they care about.

The Sierra Club of British Columbia has produced detailed maps for the Greater Vancouver Regional District showing the urban regions that will be flooded if the sea level rose 6 m.

<http://www.sierraclub.bc.ca/quick-links/publications/sierra-club-bc-maps-1>

The following web site provides a sea level rise simulator that gives students a rough idea of how coastlines will change elsewhere in the world if sea levels continue to rise:

<http://flood.firetree.net/>

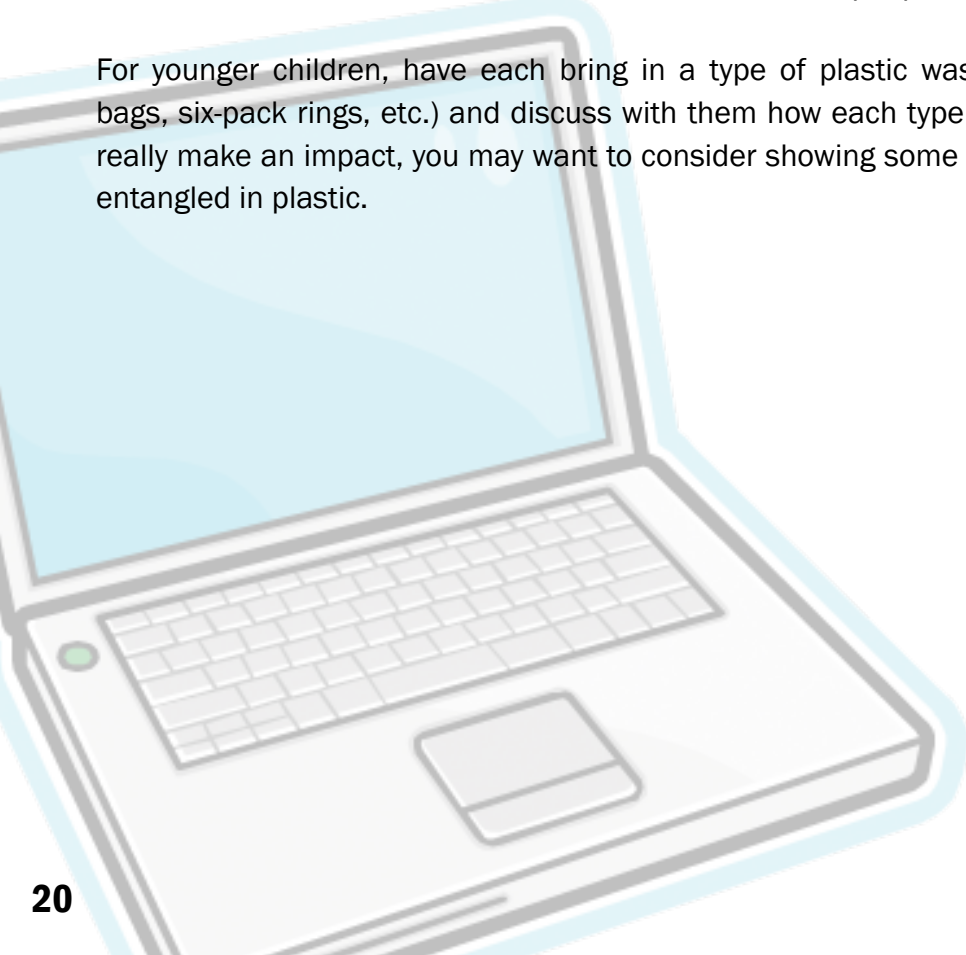
Using this (or another) online sea level rise simulator, have students answer the following questions:

- List 5 major cities that would be underwater if sea level rose 6 m, and if it rose 12 m.
- List 3 cities that would be on the coast if sea level rose 7 m, and if it rose 14 m.
- What would happen to your hometown if the sea level rose 7 m? If it rose 10 m?

## Pollution Profiling

Break the class into groups and have each group pick one type of marine pollution, such as fertilizer from farms, human sewage, plastics, radioactive waste, or oil spills. Have each group do some research and report on the sources of their chosen form of pollution and describe how it can alter and/or damage the ocean environment, the animals that live there, and the people that depend on them.

For younger children, have each bring in a type of plastic waste item from their home (e.g. plastic bags, six-pack rings, etc.) and discuss with them how each type of garbage could harm marine life. To really make an impact, you may want to consider showing some images of sea life swimming in and/or entangled in plastic.



# More Resources

- The Sierra Club of British Columbia has produced a great short animated film that describes issues in ocean health for Canada's West Coast and and the world. This would be a great video to play to introduce this module.

<http://www.sierraclub.bc.ca/seafood-and-oceans/threats/global-warming>

- NASA's ClimateKids web site is a great kid-friendly resource for learning about climate change and its various impacts on our environment, and the educator's part of this web site also provides suggestions for a number of climate change related classroom activities:

<http://climate.nasa.gov/kids/>

- The David Suzuki Foundation has produced a handy set of cliff notes on ways to combat climate change, as well as a guide to sources of water pollution on Canada's West Coast (better suited to older audiences):

<http://www.davidsuzuki.org/publications/downloads/2011/Top-10-climate-fridge-list.pdf>

[http://www.davidsuzuki.org/publications/downloads/2009/pollution\\_report\\_web.pdf](http://www.davidsuzuki.org/publications/downloads/2009/pollution_report_web.pdf)

- The Stewardship Center for British Columbia (SCBC) has produced a great guide to water stewardship in Canada for teachers, students, and communities which can be found at:

[http://www.stewardshipcentre.bc.ca/files/scn/waterstewardship\\_2.pdf](http://www.stewardshipcentre.bc.ca/files/scn/waterstewardship_2.pdf)

- Fisheries and Oceans Canada has put together educational resources at three levels (primary, intermediate, secondary) to educate students about the sources and impacts of water pollution and how they and their families can be better water stewards. These include lesson plans, brochures and handouts, and information on sponsored activity programs:

<http://www.pac.dfo-mpo.gc.ca/education/index-eng.htm>

- The interactive animations "Don't Mess the Sea!" and "Oil and Water Don't Mix", by the Australian Maritime Safety Authority, demonstrate the effects of garbage and oil marine pollution with engaging animated stories kids can relate to:

[http://www.amsa.gov.au/marine\\_environment\\_protection/educational\\_resources\\_and\\_information/kids/dont\\_mess\\_the\\_sea/index.asp](http://www.amsa.gov.au/marine_environment_protection/educational_resources_and_information/kids/dont_mess_the_sea/index.asp)

[http://www.amsa.gov.au/marine\\_environment\\_protection/educational\\_resources\\_and\\_information/kids/oil\\_and\\_water\\_dont\\_mix/index.asp](http://www.amsa.gov.au/marine_environment_protection/educational_resources_and_information/kids/oil_and_water_dont_mix/index.asp)





# 3: Seafood: The Good, The Bad, The Unsustainable

## Section Learning Objectives

- Understand why many fishing practices may be unsustainable.
- Explain the concept behind overfishing and knowing how much fishing is too much.
- Describe how overfishing leads to fishing down the food chain as the biggest species become sequentially depleted.
- Define by-catch and describe the magnitude of global fisheries by-catch.
- Describe how some fishing practices can damage ocean habitats and identify some of these.
- Understand why many aquaculture operations may be unsustainable.

## Where Does Seafood Come From? Overfishing

Everybody loves seafood, but many of us forget that much of our seafood was once wild and that it must be caught at sea in enormous quantities in order to satisfy our hungry planet. In 2006 alone, fishermen caught almost 92 million tonnes of wild fish, and the size of the global catch continues to increase. (22) Increasing catches are not necessarily a good thing, however, since many fishing methods used today are having a negative impact on the ocean's health. Besides the capture of wild fish, you might be surprised to find out that almost half of our seafood is now farmed in aquaculture operations, which are associated with their own environmental impacts. (22) Keep reading to find out some of the problems with fishing and seafood farming, which will help you to understand how you can do your part to help solve these problems.

Overfishing means taking fish out of the ocean faster than they can reproduce to replace themselves and keep the population at a stable size. (19) Today, at least 80% of all the fish humans catch for food are either being fished to the limit, are overfished, or have collapsed to the point where there are no fish left to catch. (8)

Some of the species that are declining the fastest are large, carnivorous fish that also make a popular meal — tuna, cod, and salmon. If their populations continue to shrink, there may not be any more tuna sandwiches, cod fish sticks, or salmon sushi for us to enjoy! (8) If we want our seafood stocks to last into the future, we need to begin fishing more responsibly.

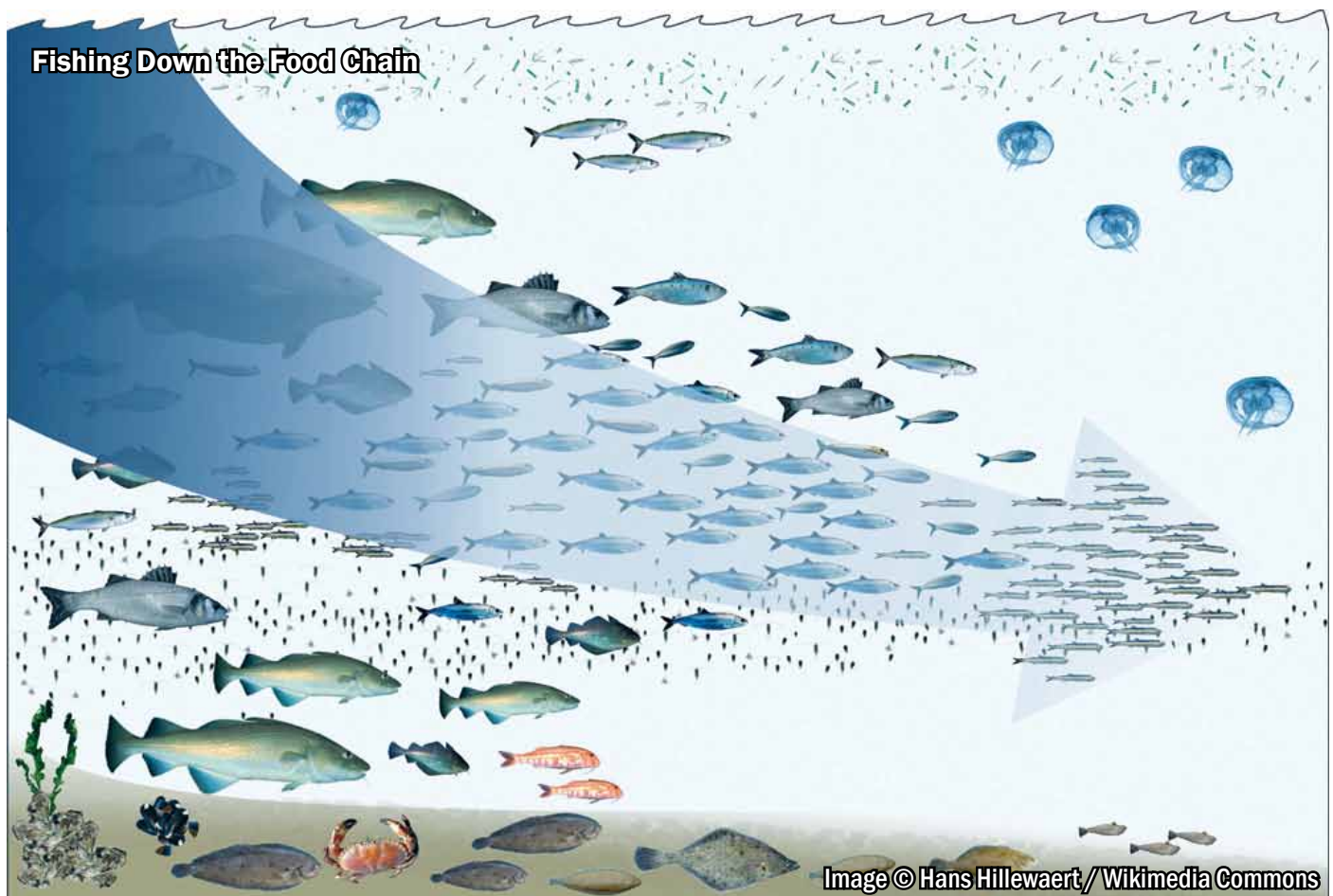
## Fishing Down the Food Chain

Fishermen are always trying to catch the biggest fish for your dinner plate. The big fish that we ourselves like to eat are usually at the top of their food web. Bigger fish eat smaller fish, smaller fish eat even smaller fish, and the smallest fish usually eat tiny plants and animals like those in plankton. Once all the big fish are caught, fishermen must move on to the next biggest fish. When that species of fish is all gone, they move on to even smaller species of fish, and so on. This reductionist process is called “fishing down the food web.” (8)

As the different species that are part of the food web begin to disappear, the biodiversity of the oceans declines and the food web itself becomes less stable. Disappearance of predator species can result in runaway increases of prey species, while disappearance of prey species can leave predatory species with fewer or no food options. Most often, predator and prey species

are fished at the same time, causing widespread reductions of species across the food web. (8)

Disruption of the food web can make it very difficult for some fish species to survive. As a result, their numbers may drop to levels too low to sustain commercial harvest or the species may disappear altogether from a given area. A scientist would say that such a species has become commercially or locally **extinct**. (8) As more species are lost, the food web becomes increasingly fragile and the loss of additional species becomes more likely until the food web collapses entirely, leaving just a few resilient species in an area that was once rich in species. Because many species take years to grow to adulthood and reproduce, population recovery following a collapse can in some cases take over 15 years! (17)





## By-catch

When fishermen are trying to catch a certain kind of fish, called the “target species”, they often catch many other kinds of fish and marine life by mistake. The marine life caught by mistake is called “by-catch.” By-catch can include fish too small to keep or animals that are not directly fished for, such as other fish species, sharks, rays, dolphins, whales, sea turtles, and sea birds. (8) Fishermen often end up with much more by-catch than target fish, and up to 40% (that’s almost half!) of all the fish caught every year are considered to be by-catch. Because most by-catch can’t be sold as food, most of it is thrown back into the ocean, often dead or dying, making

fishing industry one of the world’s most wasteful industries. (23) Most by-catch is the result of unselective fishing techniques: they are not designed specifically to catch only the desired species. One example of an unselective fishing method is “longlining” – fishing with very long lines and many hooks, catching not only fish but also sea turtles, whales, dolphins, and sea birds. (20) While some fishermen are now using new, more specific fishing equipment in order to help cut down on by-catch, millions of tonnes of by-catch are still caught and wasted every year. (24)

### Sorting Shrimp out of By-catch



### Sea Turtle Drowned in Fishing Net

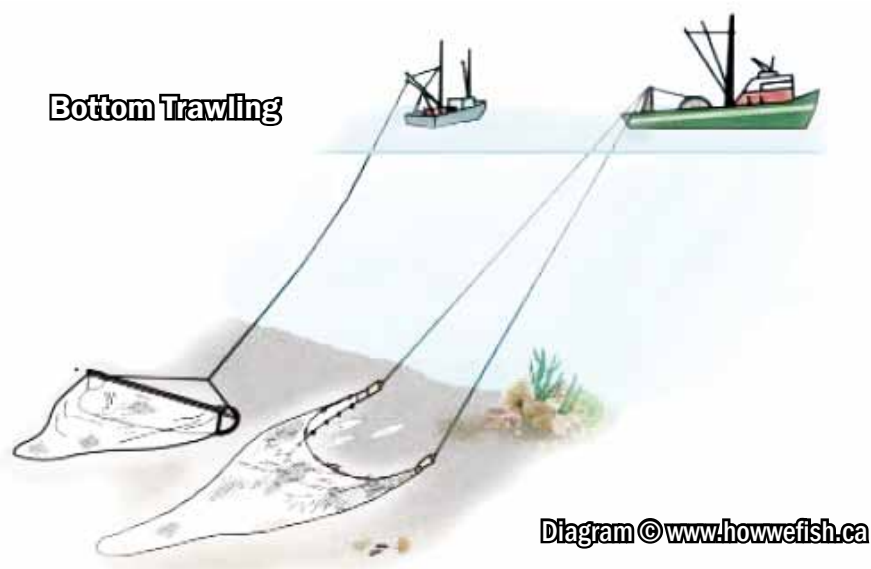




## Destructive Fishing Practices

Some kinds of fishing can destroy the ocean habitats that fish need for food and shelter. (8) (20) Bottom-trawling or dredging, for example, are kinds of fishing where nets with heavy weights tied to the bottom are dragged across the ocean floor to catch fish living on the bottom. As they are dragged, these nets act like a bulldozer, destroying sea plants, corals, rock formations, and other bottom features that fish use for food and shelter. (8) Just imagine trying to catch a cow from a field by dragging a giant net over the entire farm! Think about all the other things that would end up broken or caught in the net: the fence,

the barn, and maybe even the farmer! For this reason, bottom-trawling is widely considered to be the most destructive fishing method. (17) In some developing countries, fishermen may even use poisons or dynamite to stun or kill fish first so that they are easier to catch. Like bottom-trawling, these practices can kill or destroy surrounding organisms and habitats including coral and sponges. (25) When fishing methods damage the surrounding habitat that fish use for food and shelter, this also makes it harder for the fish and other sea creatures that don't get caught to survive and reproduce. (8) (20)



## Aquaculture

Because it's getting harder and harder to catch enough seafood in the ocean to meet the world's demand, much of our seafood is now raised on farms in much the same way we raise chickens, pigs or cows. Seafood farming is called 'aquaculture', and although it has been around for over 4 000 years, it is only recently starting to become more widespread and intensive. Aquaculture can be a good thing if seafood farms are kept clean and environmentally friendly, but

many types of aquaculture are unsustainable because they can have negative effects on the environment, including pollution, habitat loss, and escape of farmed fish. Although there are many ways that aquaculture could harm the environment, remember that aquaculture can also be environmentally friendly if it is done right. (8) (20) We'll learn more about the ways in which aquaculture can be damaging to the environment later on.

### Salmon Aquaculture



Photo © Erik Christensen / Wikimedia Commons

## How Can You Help?

Fishermen all over the world are trying to catch more and more fish in any way they can because many people eat seafood without thinking of how their eating habits affect the fish and the ocean. You, your family, your friends and your students can play a big role by consuming seafood responsibly.

One of the best things you can do to make sure your seafood dinner isn't hurting the oceans is

choosing to eat only seafood that was caught or raised in an environmentally friendly way, that is, by eating only '**sustainable seafood**'. This tells fishermen that you care about the marine environment and it encourages them to become more environmentally friendly. (20)

But what exactly IS sustainable seafood? And how do we know what kinds of seafood are sustainable? Keep on reading to find out!



# Discussion Points

**Teaching Tip:** As you go through each of the major subject headings in this learning program, take the time to pause and initiate discussions with your students based on questions they might have or based on the discussion points provided here:

1. Discuss the concepts of population and population growth. How do new members get added to a population? (e.g. Birth, migration) How do members get removed from a population? (e.g. Migration, natural death, predation) How does overfishing affect the number of individuals in the population?
2. What kind of fish do you think are being overfished the most right now? (e.g. Large predatory species that are popular food fish, like salmon, tuna, and swordfish).
3. Remind students about the food chain and ask them what happens if fishermen take away all the biggest fish at the top. What fish will people eat then? They'll want to eat the next biggest fish. In this manner, talk about fishing down the food chain. Discuss how students will feel if, in the future, the only seafoods around are little fish like sardines, small shrimp, jellyfish, and other animals at the bottom of the food chain.
4. Discuss how loss of species can disrupt the food web. For example, if fishermen remove the biggest predator, like sharks, what happens to the big fish like tuna that sharks used to prey upon? They become more plentiful because fewer animals are eating them! But, remind students that an increase in tuna would also have impacts further down the food chain. For example, if tuna eat mackerel, more tuna would mean fewer mackerel.
5. Discuss by-catch and fishing gear selectivity. What does it mean for fishing gear to be selective? Is selective fishing gear more sustainable or less?
6. Discuss bottom-trawling and how it changes the marine environment. Discuss how destruction of marine habitats can make it hard for fish and other creatures to live in an area after it has been trawled – it would be like trying to live in your neighbourhood after it had been bull-dozed!

## Classroom Activities

### Selective Fishing Gear

Many different technologies have been developed in an effort to make unselective fisheries more selective. Two great examples are the tuna fishery and the shrimp fishery.

- The tuna fishery often uses seine netting that can be associated with a high by-catch of dolphins. In many areas, however, new techniques and types of netting were implemented to allow their release, leading to “dolphin-safe” seals on many brands of tuna found in a typical supermarket.

For more information, visit this web site at the U.S. National Oceanic and Atmospheric Administration (NOAA):

<http://swfsc.noaa.gov/textblock.aspx?Division=PRD&ParentMenuId=228&id=1408>

- The shrimp fishery, on the other hand, often uses trawling and is associated with a high by catch of sea turtles. Similar to the tuna fishery, an invention known as a Turtle Exclusion Device (TED) has been installed in many nets that helps release turtles unharmed.

For more information, visit this web site at the U.S. National Oceanic and Atmospheric Administration (NOAA):

<http://www.nmfs.noaa.gov/pr/species/turtles/teds.htm>

Discuss how the reduction of dolphin and turtle by-catch is the result of a once unselective fishery that is using new types of gear and techniques to be more selective. Have students do some research and report on how tuna and shrimp fishermen changed their fishing practices to reduce by-catch.

**Note:** These fishing methods still produce by-catch of many other species, even if dolphins and turtles are excluded, but exclusion initiatives represent a step in the right direction.

## Different Fishing Gear, Different Impacts

Introduce kids to different types of commercial fishing gear as described in the SeaChoice's recent publication: "Canada's In-Depth Guide to Sustainable Seafood" which can be found in PDF format on the Resources page of the SeaChoice web site at the following web address:

[http://fish.gshaw.ca/files/asset/file/156/Canada\\_s\\_In-depth\\_Guide\\_to\\_Sustainable\\_Seafood.pdf](http://fish.gshaw.ca/files/asset/file/156/Canada_s_In-depth_Guide_to_Sustainable_Seafood.pdf)

- Make some cut-outs of fish, lobster, or other marine species and scatter them over the floor.
- Have kids bring in paper towel and toilet paper rolls and stand these upright in between the fish cut-outs – these will serve as an analogue for kelp, coral, sponges, rocky outcrops and other habitat features.
- Assign each student one of the following fishing methods: hand collection by SCUBA diving, hook-and-line fishing, and bottom-trawling.
- Have kids try and collect the cut-outs of fish from the floor using analogues to the different fishing techniques – hand for divers, a fishing line with some of sticky putty or glue on the end for hook and line, and a broom for bottom-trawling. What happens to the marine environment around the fish for each of these methods?
- Ask students what kinds of seafood they think might be caught using these methods.
- For more information, also visit the web site for **How We Fish Matters**, a Canadian organization that raises awareness about the impacts that our fishing practices have on the environment:

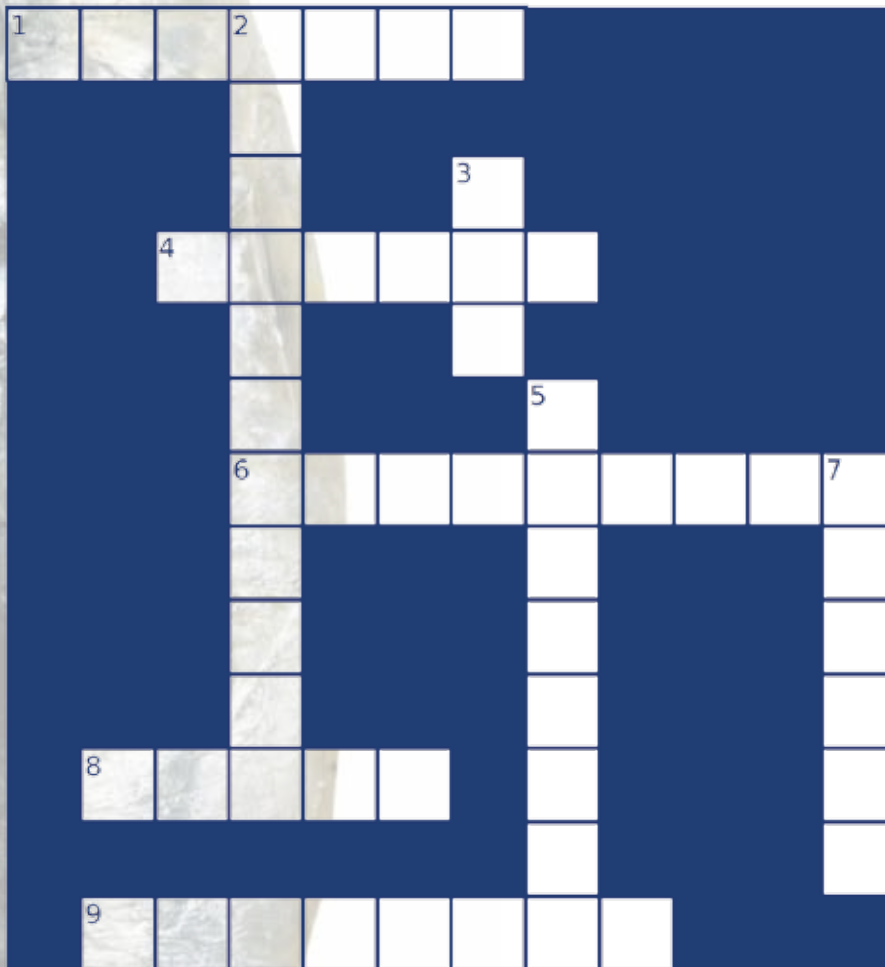
<http://www.howwefish.ca/>

[http://www.mcabi.org/what/what\\_pdfs/HowWeFish.pdf](http://www.mcabi.org/what/what_pdfs/HowWeFish.pdf)

- More information on fishing gear can be found on the SeaChoice web site, which features animations of different methods that can help to better understand how each type of gear impacts the marine environment.

[www.seachoice.org](http://www.seachoice.org)

# Seafood Crossword



## Across Clues

- All of the fish and other animals caught by fishermen other than the fish they are trying to catch.
- A popular food fish that is born in rivers, grows up in the ocean, and returns to rivers to mate.
- The name for a group of fishing gear that uses a very long fishing line with many hooks on it.
- Most of the fish that we eat are caught over the shallow area near the coast, called the continental \_\_\_\_\_.
- A type of fishing method where nets are dragged across the bottom of the ocean.

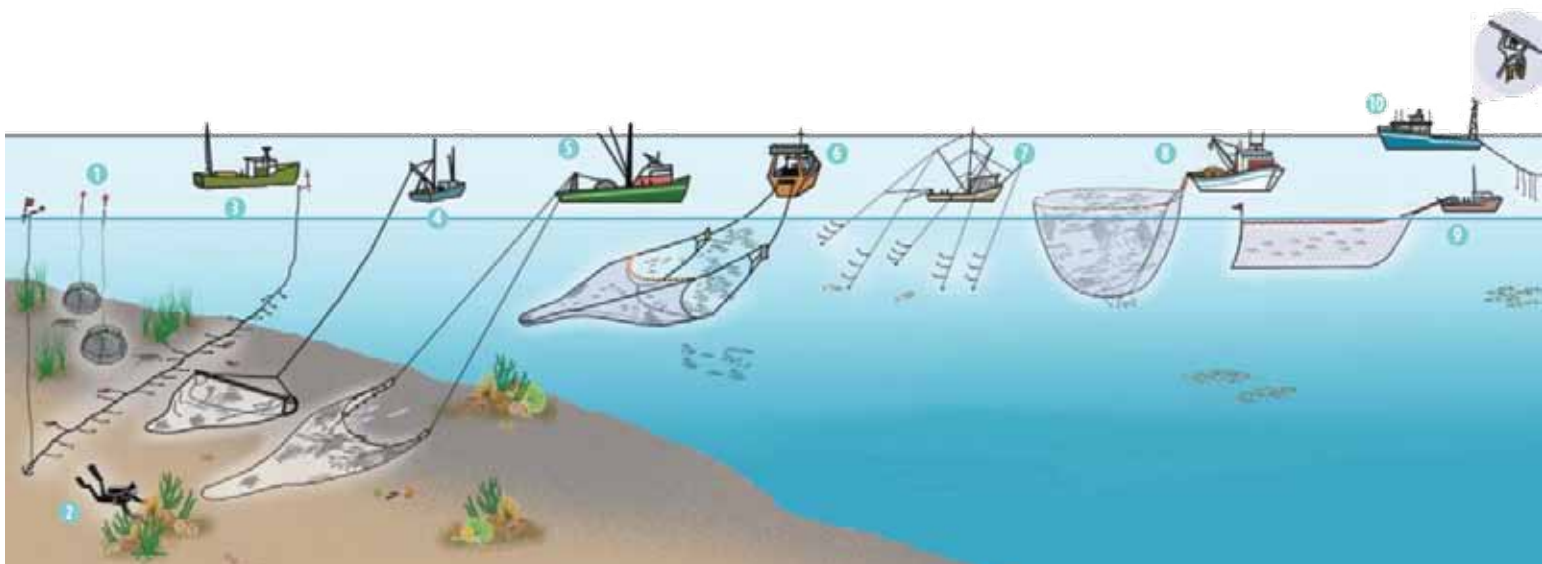
## Down Clues

- Another name for seafood farming.
- Another word for the eggs of fish or other marine creatures.
- Tiny plants or animals that float around in the ocean currents.
- Seafood farmers in tropical countries often cut down mangrove forests to build ponds for farming this kind of seafood.



# Common Fishing Methods

#	Impact	Fishing Method	Description
1	Yellow	<b>Shrimp Traps</b>	Cage-like traps that shrimp can get into, but not out of. Traps have some bycatch but don't cause much damage to the environment.
2	Green	<b>Dive Collection</b>	A very selective method of fishing where divers collect seafood like shellfish or lobster by hand.
3	Yellow	<b>Bottom Longlining</b>	A fishing line as long as 150 km with many baited hooks on it is weighted to rest on the ocean floor. Longlining is associated with a lot of bycatch and may damage the environment when it is hauled in.
4	Red	<b>Beam Trawling</b>	A type of bottom trawling where the bottom of the net is stabilized with a beam that damages the sea floor as the net is dragged.
5	Red	<b>Trawling</b>	Another type of bottom trawling where the net is held open by floats rather than a beam.
6	Yellow	<b>Midwater Trawling</b>	Similar to bottom trawling except that the net is dragged in midwater away from the bottom. Although this avoids damaging the ocean floor, these nets still associated with a lot of bycatch.
7	Green	<b>Hook and Line Fishing</b>	Similar to traditional fishing methods, boats set out short fishing lines with one or just a few baited hooks. This fishing method doesn't damage the environment and is relatively selective.
8	Green	<b>Purse Seining (Salmon)</b>	Involves a net that can be closed around a school of fish like a bag. Purse seining is quite selective and does not damage the environment.
9	Green	<b>Gillnetting</b>	Involves a wide rectangular net towed at the surface which fish swim into and become tangled in. Gillnetting has little impact on the environment and generally produces little bycatch.
10	Yellow	<b>Surface Longlining</b>	Involves a very long fishing line with many baited hooks. Although not destructive, longlining has very high rates of bycatch and poses a major threat to sharks and sea turtles.
11	Green	<b>Harpooning</b>	A very selective fishing method where fishermen target and spear individual fish.



# Common Fishing Methods

## # Impact Fishing Method

12	<b>Purse Seining (Herring)</b>	Similar to salmon purse seining; involves a net that can be closed around a school of fish like a bag. Purse seining is quite selective and does not damage the marine environment.
13	<b>“Otter” Trawling</b>	Another type of bottom trawling where the net is held open by rectangular boards rather than a beam.
14	<b>Hydraulic Dredging (Clam)</b>	Hydraulic dredges inject high-pressure water into the seafloor to expose buried shellfish. Like regular dredging, this has a high impact on the environment and produces a lot of bycatch.
15	<b>Dredging (Scallops)</b>	Scallop dredges are dragged along the seafloor and pick up everything in their path. Once again, this has a high impact on the environment and produces a lot of bycatch.
16	<b>Lobster Traps</b>	Cage-like traps that lobster can get into, but not out of. Traps have some bycatch but don't cause much damage to the environment.
17	<b>Bottom Gillnetting</b>	Involves a wide rectangular net set along the bottom that fish swim into and become tangled in. Gillnetting has little impact on the environment and produces little bycatch.
18	<b>Bottom Longlining</b>	A fishing line as long as 150 km with many baited hooks on it is weighted to rest on the ocean floor. Longlining is associated with a lot of bycatch and may damage the environment when it is hauled in.
19	<b>Crab Pots</b>	Cage-like traps that shrimp can get into, but not out of. Traps have some bycatch but don't cause much damage to the environment.
20	<b>Dive Collection</b>	A very selective method of fishing where divers collect seafood like shellfish or lobster by hand.

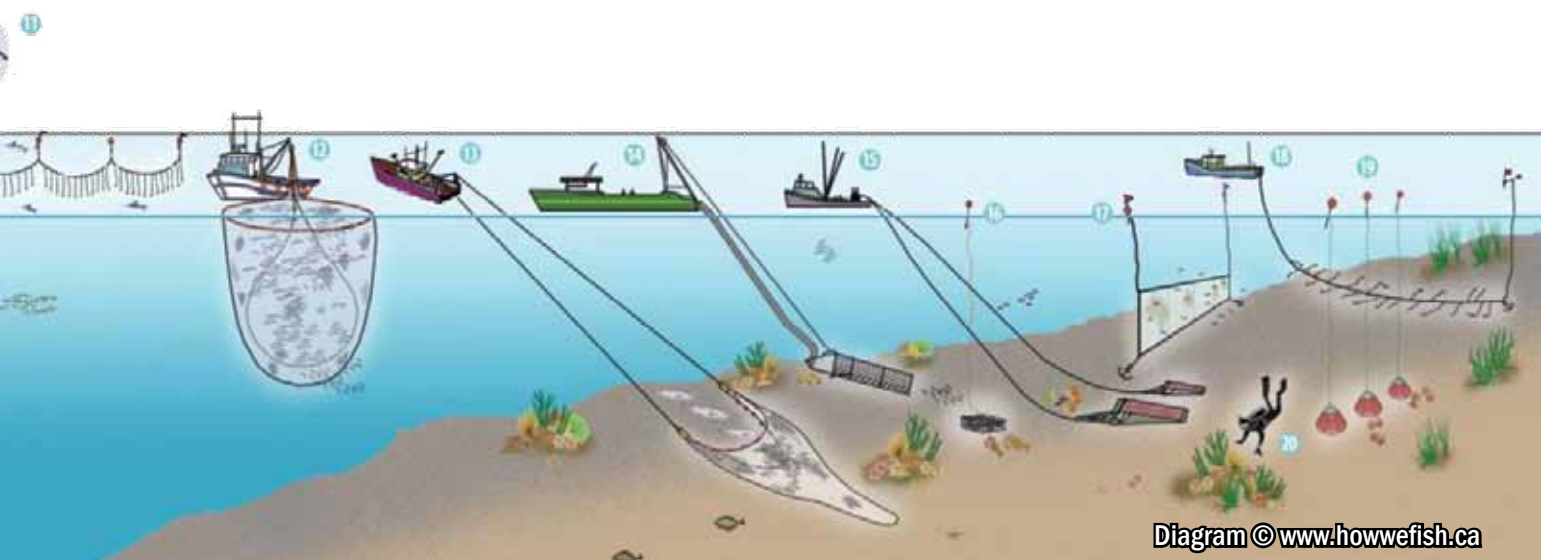


Diagram © [www.howwefish.ca](http://www.howwefish.ca)

# 4: Sustainable Seafood

## Section Learning Objectives

- Be able to define sustainability and what it means in the context of seafood.
- Understand the criteria that make wild-caught seafood sustainable.
- Understand the criteria that make farmed seafood sustainable.

## What is Sustainable Seafood?

Sustainable seafood is fish, shellfish or other types of seafood caught or farmed in ways that don't damage their ocean environment and that leave enough of these animals behind to keep the population healthy and growing far into the future. When conservation organizations are trying to decide if a certain kind of seafood is more, or less,

sustainable, they need to consider many different types of information including the way the animal lives, the size of its population, and how it is caught or farmed. Keep reading to learn more about the different kinds of information that scientists need to think about when deciding whether a certain kind of seafood is sustainable. (20)

## What Makes WILD Seafood Sustainable?

### Do populations grow quickly?

A population is all of the individual members of a certain type of plant or animal put together, like all of the individual people living in a city. The number of animals in the population is always changing.

- When fish mate and have young, they **add** more individuals to the population and make it bigger.
- When fishermen take seafood out of the oceans, they **subtract** from the population and make it smaller.

For a population to stay healthy, fishermen must make sure that they don't subtract fish faster than the population can add more young fish; otherwise the population will get smaller and smaller until there are no fish left! Some fish grow very fast and have many young, so fishermen can catch many

of these fish without worrying too much about making the population smaller, which helps to make the fishery more sustainable. Fish falling into this category are usually small ones which eat plankton and are low on the food chain, like sardines and anchovies.

Some fish grow very slowly and don't have as many young or don't have them very often, which can make a fishery less sustainable, so fishermen have to be very careful not to take too many. These fish are usually big ones, like tuna, swordfish, grouper, salmon and sharks that eat other fish and are high up in the food chain. Remember that big fish like these are the ones most people like to eat and, because of this, fishermen often take too many even though they shouldn't. (20)



## Are wild populations big and healthy?

How much seafood it is safe for fishermen to catch depends on how big the population is to begin with. If the population is already very small, just a few fishing boats can catch all the fish that are left, even if these are small fish that have lots of young and quick population growth!

## Does the fishery have much by-catch?

If a fisherman catches too many other animals by accident while fishing for a certain target species, then the fishery has a lot of by-catch. When fishermen waste seafood by throwing by-catch away, they are hurting many more populations of sea creatures than just the ones they are fishing for, and the seafood they keep is considered to be much less sustainable, even if it comes from a big and healthy population.

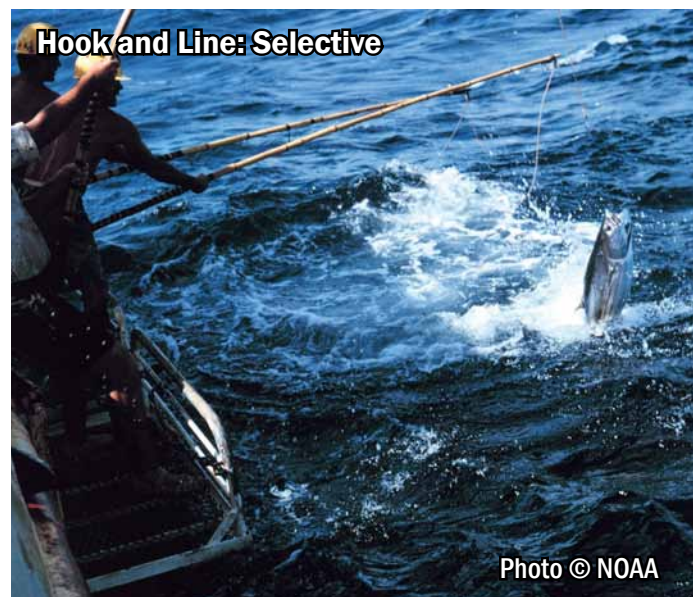
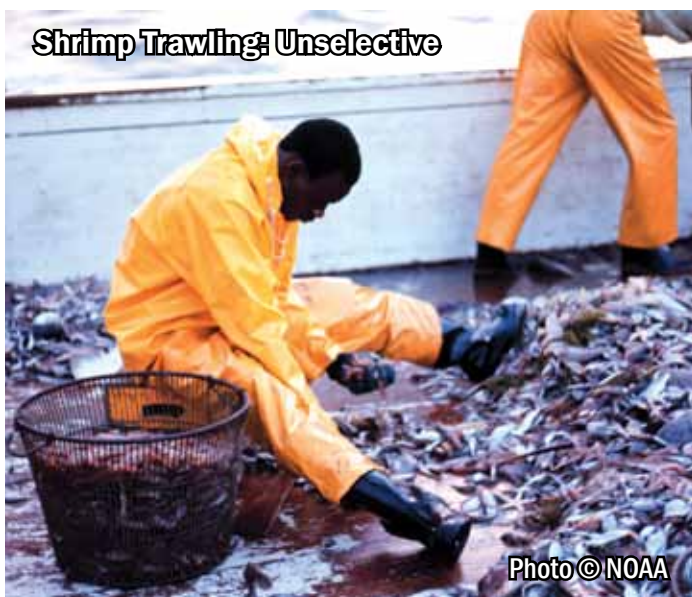
The amount of by-catch from a particular gear type depends largely on the fishing region and target species. Fishing methods that produce a lot of by-catch include drift nets (long nets stretched out across the water surface that trap and kill any animals swimming into them), and longlines (very long fishing lines with many baited hooks). Drift nets and longlines are meant to catch fish, but often also catch and kill sea turtles, sharks, dolphins, whales and sea birds, many of which are already

Big populations have more fish to spare, and responsible fishing is less likely to make the population collapse. Collapse happens when so many fish are caught that not enough are left to mate, produce young, and help the population grow. (20)

**endangered species.** Purse seines, which are big nets that boats can pull and close around a school of fish like a bag, are used in tuna fisheries, for example, and are also associated with large amounts of by-catch of sharks, turtles, dolphins, and other fish. (20)

Fishing methods that produce less by-catch include hook and line fisheries, where only a limited number of hooks are used unlike longlining fisheries; traps, which animals can get into but not out of; and harpoons, where fishermen can spear one big fish at a time.

When fishermen use special techniques or fishing gear that is more selective, they can help to make sure they only catch what they want to keep. If a fisherman keeps everything he catches then nothing goes to waste and the fishery is considered to be much more sustainable. (20)



## Does the fishing method damage marine habitats?

You might remember that some fishing methods, like bottom trawling and dredging, damage the ocean floor and destroy fish habitat. Fishing methods that destroy marine habitats are much less sustainable, because they take away

the food and shelter that many species need to survive, grow, and reproduce there. Without food and shelter, fewer fish and other marine creatures will be able to survive there in the future. (20)

## How well is the fishery regulated?

In many places, including Canada and the United States, governments issue fishing laws that help protect seafood populations and ensure their health and well-being far into the future. Fisheries officials supervise fishermen and make sure they respect these laws while fisheries scientists check up on seafood populations to make sure they stay in good shape. Laws, supervision, and scientific checkups help to make sure that fishermen

don't take more than they need and helps to keep seafood populations healthy.

In places where there are no fishing laws, or where nobody supervises fishermen to make sure they respect the laws, fishermen often take more seafood than they should. This causes seafood populations to shrink, sometimes until there are no fish left. (20)

### Did You Know?

Cod has been an incredibly popular food fish for centuries. Years ago, there used to be plenty of cod in the sea and it was such a popular fish to eat that fishermen were catching them in huge numbers, sometimes even breaking fishing laws so that they could keep on fishing. As fishermen kept fishing more and more, cod populations became smaller and smaller, and many scientists warned that pretty soon there might not be any more cod left. Even though many people knew that the Atlantic cod were in trouble, fishermen kept fishing until the population became so small that hardly anybody was still catching fish – by about 1990, the fishery had collapsed. A lot of fishermen lost their jobs and, even after many years, cod populations are still in bad shape. The best way to prevent the same thing from happening with other kinds of fish and seafood is for people, fishermen, scientists, and governments to remember that fishing needs to be sustainable if we want it to last! (1)



Alaskan Cod Catch: 1920s

Photo © W.B. Miller//US Library of Congress



## What Makes FARMED Seafood Sustainable?

### Do farmers use wild seafood to feed farmed seafood?

Many fish raised in aquaculture are carnivores, like salmon, which means that they eat other fish or animals. Most of the time, seafood farmers must buy wild fish to feed the farmed fish and in many cases more fish goes into the farm as fish food than there is fish coming out as food for people. If you think about it, this means that we end up with less fish than we started with. Because aquaculture of carnivorous fish requires a lot of resources to produce few fish by comparison, these

types of fish are considered to be less sustainable. (8) (20)

Other types of farmed fish are herbivores, like tilapia, meaning that they eat plants. In these types of seafood farms, we end up with more fish than we started with. These kinds of seafood are considered to be more sustainable because farmers use up less resources and energy to produce them. (1)

### Do many farmed animals escape?

Fish or other types of seafood often escape from seafood farms, especially those that use nets, cages, or other enclosures floating in a lake or the open ocean. Escaped animals can compete with wild animals for food or might carry diseases that could make wild animals sick. Because of the potential for damage to wild populations and the

environment, aquaculture that sees a lot of escapes is considered less sustainable. (8)

In some situations, fish or other types of seafood cannot escape because they are raised in ponds, pools, or other closed containers that don't connect with a natural body of water, making them more sustainable. (20)

### Do farmed animals spread disease to wild animals?

As we just read, farmed fish can carry diseases that could make wild fish sick. Fish escaping from a farm could carry diseases to distant locations, or farmed fish could spread the sickness to wild fish that come close to the farm. Some types of seafood farms have more problems with sickness than others. For example, farmed salmon can carry sea lice, a kind of fish flea, while farmed shrimp can get a virus called whitespot. (20) (8)

Diseases like these are more common when too many animals are kept close together in a small space, because parasites and germs can spread from fish to fish more quickly. (17) These diseases are not usually dangerous for people, but they can kill many farmed and wild fish if they spread. Because of this, types of aquaculture that have many problems with diseases are considered to be less sustainable. (8) (20)





## Does the seafood farm damage the environment?

Some types of aquaculture can contribute to water pollution, such as salmon farms that raise fish in mesh cages floating in the ocean. This is because chemicals, leftover fish food, and fish droppings can go straight through the mesh and pollute the surrounding ocean, river, or lake environment. This is especially a concern when seafood farms are built in environments that are sensitive to pollution or that are home to rare or

threatened species. Other types of aquaculture can contribute to habitat loss, such as shrimp farms. This is because shrimp farmers often destroy important coastal habitats, like wetlands and mangrove forests, to build their shrimp ponds in coastal waters. Types of aquaculture that damage the environment in these ways are considered to be less sustainable. (8) (20)

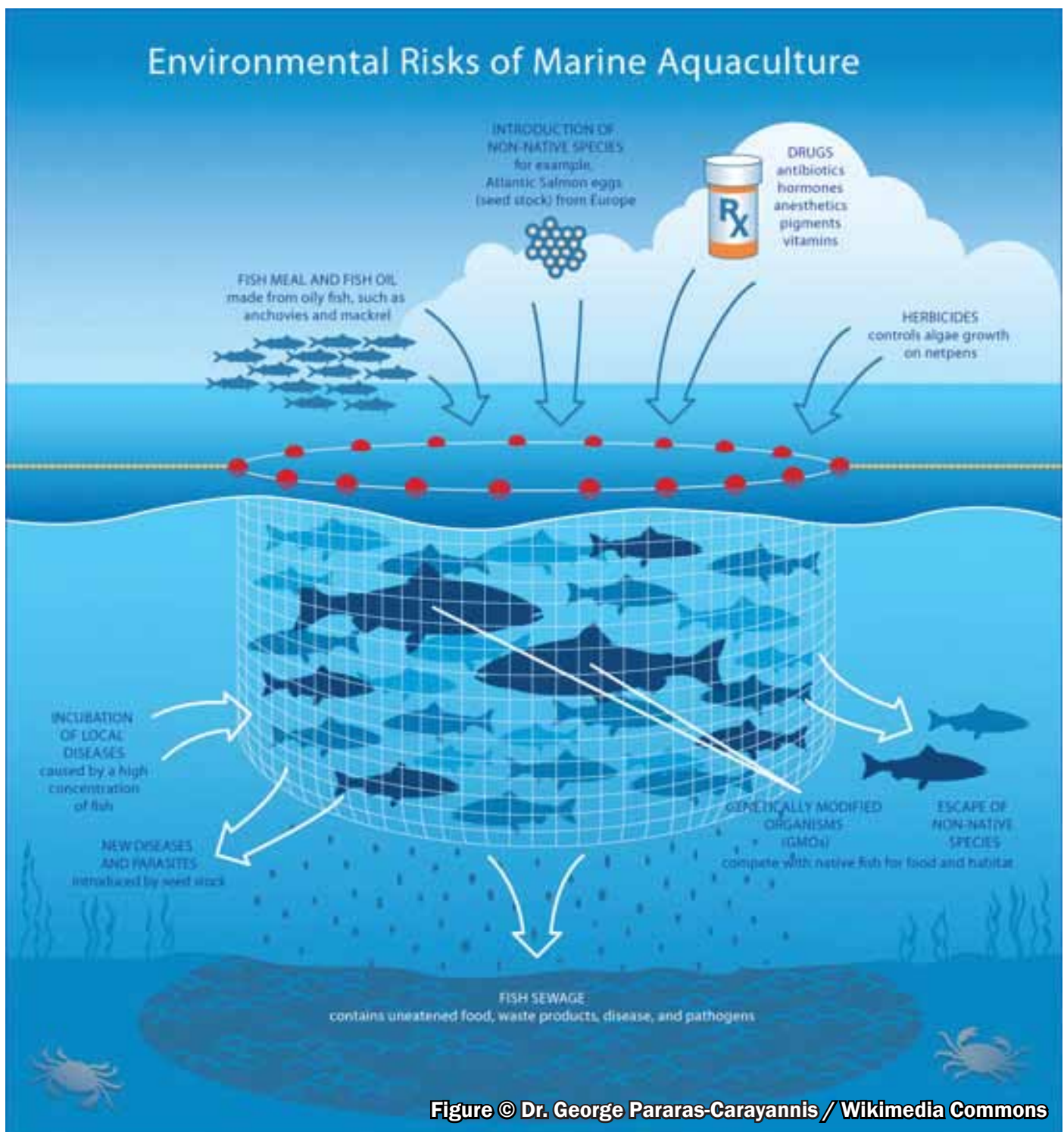


Figure © Dr. George Pararas-Carayannis / Wikimedia Commons

## How well is the seafood farm regulated?

Just as with wild fisheries, many governments have created special laws that seafood farmers need to follow to make sure that their farms aren't damaging the environment and government inspectors visit farms to make sure farmers

respect the law. In places where farmers respect the law, farms are generally more environmentally friendly and are considered more sustainable than in places where there are no laws or where laws exist but are not respected. (20)

## Discussion Points

**Teaching Tip:** As you go through each of the major subject headings in this learning program, take the time to pause and initiate discussions with your students based on questions they might have or based on the discussion points provided here:

1. What is sustainability? Why is sustainability in general important for the human race?
2. How can the biology and rate of reproduction of a seafood species influence the sustainability of its fisheries?
3. Discuss different types of fishing gears and whether they are more or less sustainable, again using supplementary information from SeaChoice's "Canada's In-Depth Guide to Sustainable Seafood".
4. Discuss fisheries regulation and the concept of fishing seasons, quotas, size restrictions, and fishing gear restrictions. Who makes the rules? What information are these rules based on? Why is it important that fishermen follow the rules?
5. How do the sustainability considerations for farmed seafood differ from those for wild-caught seafood?

## Classroom Activities

### The Overfishing Game

Split students into groups of two: some will be fishing for sardines, some for salmon, and some for tuna. Each group will have one biologist, who will check on the fish population size and also add fish to the population to simulate reproduction, and one fisherman, who will take fish out of the population and keep them for human consumption. There will be three games, and each game will have a few rounds (no more than 3 or 4). In each game, fishermen will fish below, at, or above the population rate, and students will be able to see how fishing pressure affects population size and how this depends on the biology and population dynamics of the fish.

Have each group make about 40 fish cut-outs, or simply use slips of paper, marbles, or an other placeholder item. Place 20 in the population open to fishing and give 20 to the biologist to be added into the population. Provide groups with the following rules:

#### For biologists:

- Sardines are small and reproduce **quickly**; add **10** fish each round.
- Salmon reproduce at an **intermediate** rate; add **6** fish each round.
- Big tuna reproduce very **slowly**; add **2** fish each round.

### For fishermen:

In the first game, take **less than 10** sardines, **6** salmon, or **2** tuna each round.

In the second game, take **exactly 10** sardines, **6** salmon, or **2** tuna each round.

In the first game, take **more than 10** sardines, **6** salmon, or **2** tuna each round.

Discuss the results of this experiment with the group. Did any groups completely deplete their fish population? Can they explain why this happened?

## The Great Debate: Fishermen vs. Biologists vs. Regulatory Officials

Organize a classroom debate.

- One third of students will play **biologists**, who want to limit unsustainable fishing and farming activities to maintain fish populations and ensure no seafood species go extinct.
- One third of students will play **fishermen**, who want to catch as much fish as they can so they can earn a living, take care of their families, and grow their business.
- One third of students will play **government officials**, who try to compromise between fishermen and biologists to help fisheries stay healthy while maximizing the livelihoods of the many people that have jobs in the seafood industry.
- Have students break off into groups of three, with each group containing a biologist, a fisherman, and a government official.
- Have the biologist and the fisherman take turns trying to convince the government official why there should be **MORE** fishing or **LESS** fishing allowed.
- At the end of the debate, the government official will make a decision on whether to maintain, increase, or decrease fishing allowances.

Find out each government official's ruling and discuss the exercise with the students. What were some of the difficulties or challenges encountered when making their arguments? What kind of perspective did this activity provide into the difficulties of balancing conservation against human wants and needs?

## Aquaculture Field Trip

- Organize a classroom field trip to a hatchery or aquaculture farm for fish, shellfish, or other marine creatures. Although this may seem easier for those who live near the coast, there are also many inland aquaculture operations in lakes, ponds, and artificial basins.
- For younger students, have them draw a step-by-step comic strip of how young marine creatures are raised from eggs or larvae until they are released or until they are harvested as adults.
- For older students, discuss with students the difference between hatcheries, which release young aquatic creatures to grow up in the wild, and full-fledged aquaculture, which raise these creatures to adulthood.
- Hatcheries and full-fledged aquaculture impact the environment in different ways and in different degrees.
- In addition, different varieties of hatcheries and aquaculture operations have different levels of impact. For example, systems that are open to the ocean are more polluting, whereas closed circulation systems that function more like aquariums are less polluting. Have students present a talk on one type of aquaculture and how sustainable it is in comparison to others.



## The Big Fish Scramble

Lana is a fisheries biologist inspecting the day's catch. By regularly inspecting the catch, fisheries biologists can find out if seafood populations are healthy, how populations change over time, and how fishing might be impacting other marine creatures and the environment they live in. This information helps government organizations decide how to manage the fishery.

Can you help identify the species in the net and count how many of each the fishermen have caught?



**How many flounder?** \_\_\_\_\_



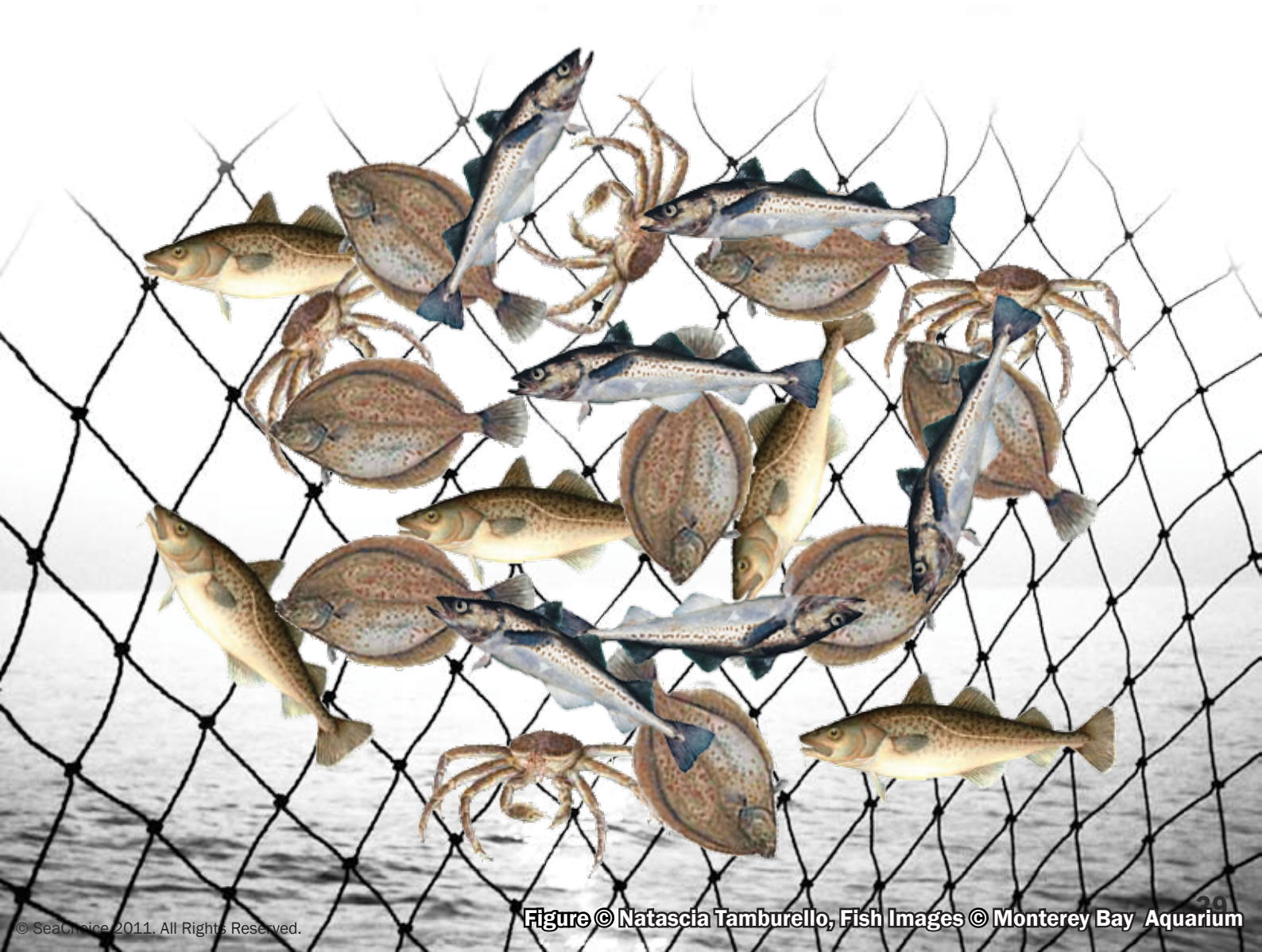
**How many crabs?** \_\_\_\_\_



**How many cod?** \_\_\_\_\_



**How many pollock?** \_\_\_\_\_



# 5: Choosing Sustainable Seafood

## Section Learning Objectives

- Understand how selecting sustainable seafood has an impact on reducing fishing pressure.
- Learn how you can find out if the seafood you want to buy is sustainable.
- Learn how a seafood guide works and how it can help you make sustainable choices.

## How Does it Make a Difference?

### **Shows Businesses Sustainability Matters to Customers**

Businessmen want you to shop in their grocery stores or buy dinner in their restaurants and they aim to keep you happy so that you'll keep coming back. If grocery stores and restaurants know that sustainable seafood is what their customers want, then that is what they'll try to sell. (20)

### **Encourages Sustainable Fisheries and Discourages Unsustainable Fisheries**

When you choose sustainable seafood over other kinds of seafood, unsustainable fisheries and seafood farms whose practices damage seafood populations and the marine environment sell less fish and earn less money. To stay in business, they need to become more sustainable so that environmentally responsible consumers like you will want to buy their seafood. This helps to create more sustainable fisheries and also encourages the fishermen and seafood farms that are already environmentally friendly. (20)

## How Do You Know What Seafood is Sustainable?

### **Read the Label!**

When buying prepackaged seafood, it's important to always read the label. This helps you to learn more about the seafood you're about to buy and find out if it's sustainable. While you're reading the label on packaged seafood, try to answer these questions:

### **Is it Farmed or Wild?**

Not many companies will admit that their seafood was farmed on the label, but many will point out if it's wild. Here's a tip – if a package says Atlantic salmon on it, you can assume it's been farmed, since this species is no longer commercially fished in the wild.

### **If it's Wild, How Was it Caught?**

Remember that some fish are caught in ways that damage the environment. For example, flounder, sole, monkfish and cod living near the ocean floor are often caught with bottom trawlers that damage ocean habitats.

### **Where Does it Come From?**

Different parts of the world have different fishing regulations. In some countries, regulations are lacking or not enforced. To be sure seafood is sustainable, choose fish and shellfish that was caught or farmed in your region. Eating regionally is an important part of sustainability, for two reasons. It's usually easier to find out what regulations exist in your own region or country, and whether they are respected. Also, seafood that comes from local sources doesn't require large amounts of energy to transport, and causes much less car, truck or airplane pollution.



**NOTE:** Because the conservation issues associated with seafood and fisheries are only just beginning to come to the attention of the general public, the information described above might be hard to come by. When dealing with prepackaged seafood, for example, catch method is seldom indicated and a common catch-all name such as “snapper” might stand for any number of individual species. You’ll often have better luck finding out this information when buying fish from a knowledgeable fish market where the produce and its suppliers are typically better known.

## Ask Questions!

When there’s no label to read, like when you buy fresh fish at a grocery store seafood counter or at a restaurant, then you need to ask the salesperson, waiter or waitress for the same information you’d get from a label.

Always ask if it is farmed or wild, how it was caught, and where it comes from, because these are the most important questions to help you decide if the fish you’re eating is sustainable. If the person you ask doesn’t know, ask if they can check with the manager or head chef. Even if nobody knows the answers, asking them shows that you care and gives them a reason to find out for next time!

You can download and print seafood guides for FREE on the SeaChoice web site!

[www.seachoice.org](http://www.seachoice.org)

## Use a Sustainable Seafood Guide!

Once you know if a certain type of seafood is farmed or wild, how it was caught, and where it came from, you still need more information about the biology of that fish and the condition of its fishery to decide if it’s sustainable – this could take a lot of work. Luckily, organizations like SeaChoice have done your homework for you!

SeaChoice is a Canadian organization dedicated to the promotion of sustainable seafood and it has produced a sustainable seafood guide that helps people choose sustainable seafood wherever they go. This guide tells you which fish are very sustainable (**GREEN**), which are not as sustainable but still all right to eat (**YELLOW**), and which should be avoided because they are unsustainable (**RED**). SeaChoice also works with businesses, grocery stores and restaurants to encourage their use of sustainable seafood.





# Discussion Points

**Teaching Tip:** As you go through each of the major subject headings in this learning program, take the time to pause and initiate discussions with your students based on questions they might have or based on the discussion points provided here:

1. How does making sustainable seafood choices help to make fisheries and aquaculture more environmentally friendly?
2. What are the most important questions to ask when looking for sustainable seafood?
3. How can a seafood guide make it easier for you to decide what's sustainable seafood and what isn't?

## Classroom Activities

### Fish Chowder: Choosing Ingredients AFTER

- Cut out a number of fish shapes from construction paper and label them with the names of many popular food fish (try the ones found in the next section, Get to Know Your Seafood!).
- Ask one student to be a seafood salesman and another to be a customer who wants to make a seafood chowder for dinner.
- Tell the students that they can pick whatever they think would taste best in their chowder, and have the class watch the interaction.
- When the students are done, talk about the types of fish they chose and how some of them are overfished, come from polluting farms, or are otherwise unsustainable.
- Compare the difference in their “consumer behaviour” before and after completing the learning module!

### Secret Seafood Shoppers

- Provide each student with a sustainable seafood guide from SeaChoice, which can be downloaded and printed from the SeaChoice Web site.
- Make a class field trip to a local supermarket (or tell the students to visit one with their parents). Tell the students to use the SeaChoice guide to survey the different kinds of seafood found in the store, and take notes.
- They can read the label and/or ask salespeople whether it is caught or wild, how it was caught, and where it was caught.
- Students can also hand out seafood guides to staff to help raise awareness.
- Have students discuss the results of this survey; did most supermarkets have many sustainable choices? Many unsustainable choices? Did most salespeople know how to answer?
- Have students write letters to their local supermarket with the results of their survey – they can provide supermarkets with an idea of how sustainable their seafood counter is – ask for them to make efforts to be more sustainable, and point them towards helpful resources.
- At the end of this activity, students can forward their surveys by mail or email to SeaChoice to build up our local sustainable seafood availability database!

## Make your Cafeteria Sustainable!

- If your school has a cafeteria that serves fish, have the kids interview the cafeteria staff to find out what kind of seafood is on the menu. Commonly found items might include cod fish sticks or fish burgers, tuna sandwiches, and farmed salmon or shrimp.
- Have students figure out if the types of seafood being offered by the cafeteria are sustainable or not; this might include some detective work like looking at the boxes the seafood was shipped in or calling the supplier company to ask where and how it was caught.
- If there are unsustainable items on the menu, have students try and find sustainable alternatives that could be available to the school. For example, good alternatives for yellowfin tuna might be the smaller skipjack tuna, and good alternative for farmed Atlantic salmon might be wild pink salmon or farmed trout.
- Get students to work together on a proposal presentation to be given to the school director or whoever is in charge of the cafeteria program explaining why the seafood they offer is unsustainable and the benefits of switching to sustainable seafood.
- Try and have students fill out a petition to “lobby” for this change.
- This exercise can help to show students how just a few people can make a difference in environmental causes if they are passionate and dedicated!

## More Resources

- About sustainable seafood and fishing practices:

[www.seachoice.org](http://www.seachoice.org)

[www.montereybayaquarium.org/cr/seafoodwatch.aspx](http://www.montereybayaquarium.org/cr/seafoodwatch.aspx)

[www.biodiversity911.org/swf/fish.html](http://www.biodiversity911.org/swf/fish.html)

[www.habitatmedia.org](http://www.habitatmedia.org)

- About the ecology of Salmonids and other marine resources on Canada’s West Coast:

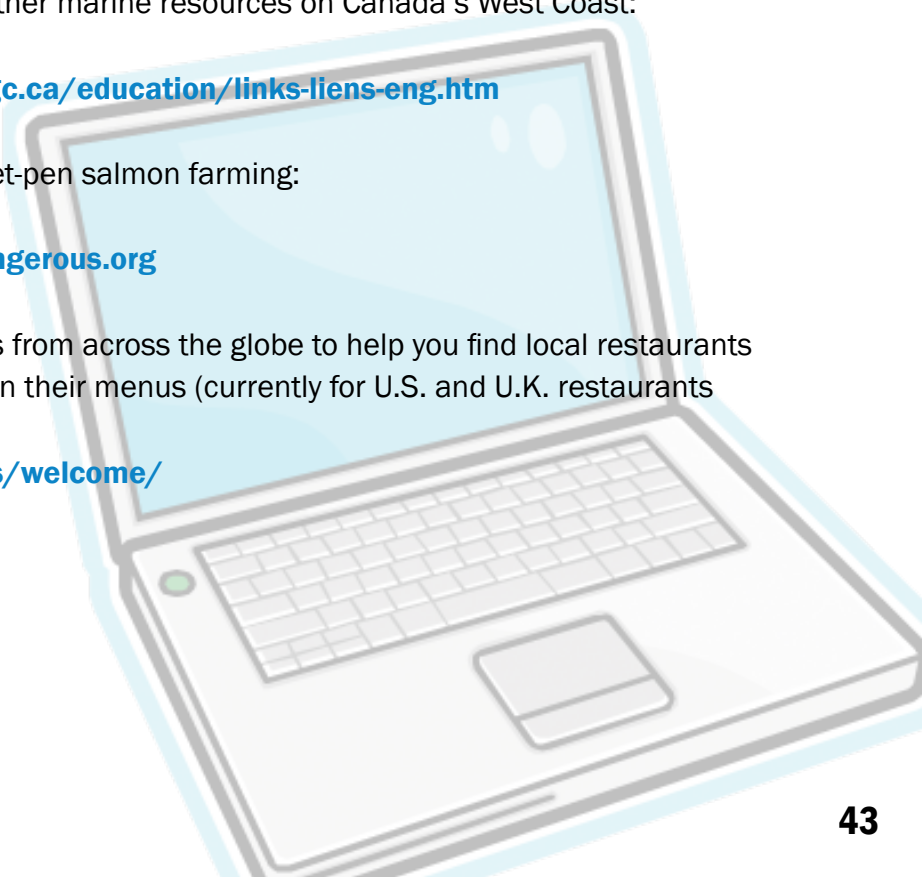
<http://www.pac.dfo-mpo.gc.ca/education/links-liens-eng.htm>

- About the negative aspects of open net-pen salmon farming:

<http://www.farmedanddangerous.org>

- Fish2Fork compiles restaurant profiles from across the globe to help you find local restaurants which offer sustainable seafood choices on their menus (currently for U.S. and U.K. restaurants only).

<http://fish2fork.com/apps/welcome/>



# 6: Get to Know Your Seafood

## American Lobster



Photo © Wikimedia Commons



This is a **YELLOW** species. Although it is very well regulated and is caught using traps, which are selective and not damaging to the environment, lobster grow and reproduce slowly and are vulnerable to overfishing.

**Did you know?** Lobster need to moult a few times a year, meaning that they shed their old shell, like a snake sheds its skin, and then make a bigger shell as they grow.

## Atlantic Cod



Photo © Monterey Bay Aquarium



When harvested from Canada or the US, this is a **RED** species because those populations are very small and usually fished using bottom-trawling, which damages the ocean floor and has a lot of by-catch.

**Did you know?** One female cod can produce up to 9 million eggs!

## Flounder / Sole



Photo © Wikimedia Commons



When from the Atlantic, this is a **RED** species for similar reasons as Atlantic cod, poor population status and harvest through bottom-trawling. When from the Pacific, these are considered **YELLOW** species.

**Did you know?** Storebought flounder could belong to one of up to 60 different fished species.

## King Crab



Photo © Wikimedia Commons



This is a **YELLOW** species when crabs are caught around America. Crab populations there are healthy and they are caught using traps that cause little damage to the seabed.

When caught near Russia, this is a **RED** species because fisheries there are not as well regulated.

**Did you know?** Some king crabs are thought to live as long as 30 years!

## Farmed Shellfish



Photo © Wikimedia Commons



These are **GREEN** species.

Many shellfish (like mussels, oysters, clams, and scallops) are cleanly farmed, they grow quickly, and they be harvested in ways that don't damage the environment.

**Did you know?** Shellfish are filter feeders, meaning they suck in water and eat the tiny plants, animals, and bacteria floating through the water.

## Pacific Sardines



Photo © Monterey Bay Aquarium



This is a **GREEN** species. Sardines are low on the food chain and reproduce very quickly, making for big populations resilient to fishing. On top of that, sardines are caught near the surface using specific gear like purse seines that make for little by-catch and don't damage habitat.

**Did you know?** Pacific sardines are sold as food, often canned, but are also used as bait and for their oil.

## Pollock



Photo © Archipelago Marine Research



This is a **YELLOW** species when from Alaska, the most common source for pollock in grocery stores. Populations have declined and the methods used can damage the sea floor. This is also an important food fish for other species, like sea lions, and depletion can damage the food web.

**Did you know?** Pollock is related to cod and is used to make imitation crab meat.

## Rainbow Trout



Photo © Duane Raver US Fish and Wildlife



This is a **GREEN** species when raised on land. Most rainbow trout sold in America are farmed in big pools on land, so there is less risk of escape and pollution, and farms are well regulated. When raised in ocean pens, this is a **YELLOW** species.

**Did you know?** Rainbow trout are freshwater fish but have a cousin, the Steelhead Trout, that can also live in salt water.



## Atlantic Salmon



Photo © Bernard Yau / efishalbum.com

Atlantic salmon is a **RED** species because most are farmed in open ocean net pens that pollute, allow fish to escape, and help spread disease. Wild salmon is generally better ranked than farmed salmon, but can be **RED**, **YELLOW**, or **GREEN** depending on fishing methods and origin. For the most up-to-date rankings on different salmon stocks, visit [seachoice.org](http://seachoice.org).

**Did you know?** Salmon are born in rivers, swim out to the ocean to grow up, and return to the same rivers where they were born to mate.



## Sharks



Photo © Bernard Yau / efishalbum.com

ALL sharks are **RED** species.

Sharks grow very slowly and have few young, so their populations shrink quickly when overfished, and most shark populations are in trouble. Sharks should also be avoided because their meat contains mercury, a chemical that can be toxic if we eat too much of it. **Did you know?** Many sharks are caught just for their fins, which are a delicacy in Asian countries. Often, fishermen just cut off the fins and throw the rest of the shark back in the ocean where it sinks to the bottom and dies.



## Shrimp



Photo © Wikimedia Commons

Shrimp are ranked very differently as depending on fishing or farming methods and place of origin. BC Spot prawns are sustainably trap-caught with little damage to the environment and are ranked **GREEN**. Wild coldwater shrimp reproduce quickly but are caught using bottom-trawling, and generally rank **YELLOW**. Asian farmed shrimp come from farms often associated with pollution and damage to the environment, and are typically rank **RED**.

**Did you know?** Most of the shrimp we eat are farmed and come from tropical parts of the world.



## Arctic Char



Photo © Monterey Bay Aquarium

Most arctic char is grown in tanks on land that minimize the potential for pollution and escapes that are a problem in open ocean net-pen farming. It carries a solid **GREEN** ranking from Iceland, Norway, Canada, and the U.S.

**Did you know?** Arctic char, a close relative to salmon, is typically found in the polar regions of North America and Europe.



## Tilapia



Photo © Duane Raver / US Fish and Wildlife

Tilapia is an example of a farmed fish that can be produced very sustainably, but that depends on where it comes from. This is generally a **GREEN** species if it comes from the United States (including tilapia sold live), a **YELLOW** species if it comes from Mexico, and a **RED** species if it comes from China. The difference comes mostly from how well the farms are regulated, and because of the vast distances of transported.

**Did you know?** Because male fish grow bigger faster than female fish, many farms raise only males.



## Pacific Albacore Tuna



Photo © efishalbum.com

Most fresh or frozen tuna sold in Canada and the US is ranked **GREEN** because it is caught in a hook-and-line fishery that produces little bycatch or environmental damage. Careful though, the same isn't usually true for canned tuna, which usually comes from other countries! **Did you know?** This is one kind of tuna found in the little cans we buy in grocery stores. Most yellowfin tuna caught by fishermen weigh about 20 kg, but one record-breaking yellowfin tuna weighed 760 kg!



# Discussion Points

**Teaching Tip:** As you go through each of the major subject headings in this learning program, take the time to pause and initiate discussions with your students based on questions they might have or based on the discussion points provided here:

1. Ask students which of these species they eat regularly and where they eat them; at home or in restaurants?
2. How does it make you feel that some of the seafood you probably eat a lot of could be unsustainable?
3. Discuss how sustainability varies with the location the fish comes from and with the way it was caught or produced. How might this vary country to country and why? (e.g., Different regulations, different population status for individual species, etc.)
4. Ask students if they will be trying to choose sustainable seafood from now on, discuss why or why not.

## Classroom Activities

### Exploring Marine Diversity

The idea of biodiversity is sometimes best understood when it is seen. If your city or town has an aquarium or a natural history museum, it can be a great place to visit to learn about the marine environment and witness what a healthy marine habitat looks like.

Here are some ideas for exercises and activities to be completed while visiting an aquarium:

- Before the trip, have each student come up with one question they have about the ocean or its creatures. Ask them to try and answer that question as they look through the exhibits and speak with curating staff.
- Have each student choose a favourite species seen during their visit and find out as much about it as possible by watching it, reading the displays, and talking with aquarium or museum staff. They may want to find out where the species lives, how long it lives, what it eats, and what eats it. This might include information on whether or not it is eaten by people and, if so, how and where it is caught. After the visit, students can complete a short report on their chosen species to present to the class. You might even ask students to try and draw a picture of the fish or other marine creature to use in their report.
- Many museums and aquariums feature different marine environments, like the seashore, tide pools, coral reefs, or the open ocean. Have students choose an environment and report on the types of species that live there and how they interact. You might even ask students to build a simple food web for this environment based on their research.
- If there is no aquarium or museum in your town, students can carry out this project using the internet. Two excellent resources for exploring fish and marine diversity online are [www.fishbase.org](http://www.fishbase.org), an online database of every fish species, and [www.marinebio.org](http://www.marinebio.org), an online encyclopaedia about the ocean and marine life.

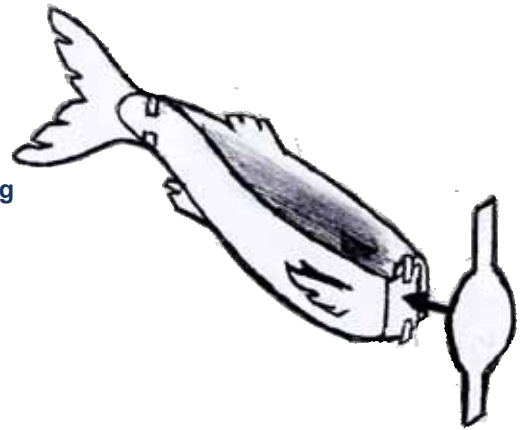
# Build-A-Fish!

- This is a paper cut-out project to that lets students make a 3D model of a fish:  
Materials needed: Tracing patterns; 2 x letter sized sheets of Bristol board (or bigger!); scissors; colouring pencils or crayons; adhesive tape; fishing line or string
- Photocopy the cut-out shape stencils, cut them out, and trace to scale onto bristol board.
- Once panels are traced, students might want to colour or draw patterns on the sides of the fish and on the panels that will make up the head, to give their fish a little colour. Students might even want to try colouring their fish like a seafood fish they know – like rainbow trout.
- Assemble as shown below:

1

## Building the Body

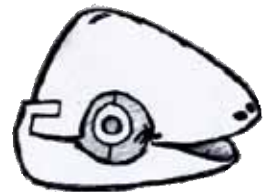
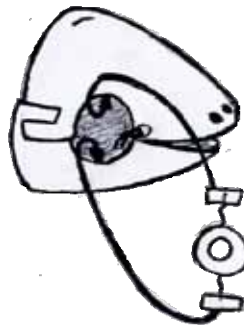
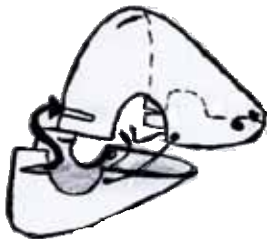
- Put the two body pieces together and tape them at the tail.
- Fold the flaps at the front of each piece along the dotted line, overlap them, and tape them together and overlap them.
- Tape the oval with the two long strips to the front of the body.



2

## Building the Head

- Slot the tabs on each side of the head together.
- Tie the holes at the corner of each eye socket together with a string.
- Attach two strings to the eye with tape and then tape the strings to the inside of the eye socket.



3

## Attaching the Head to the Body

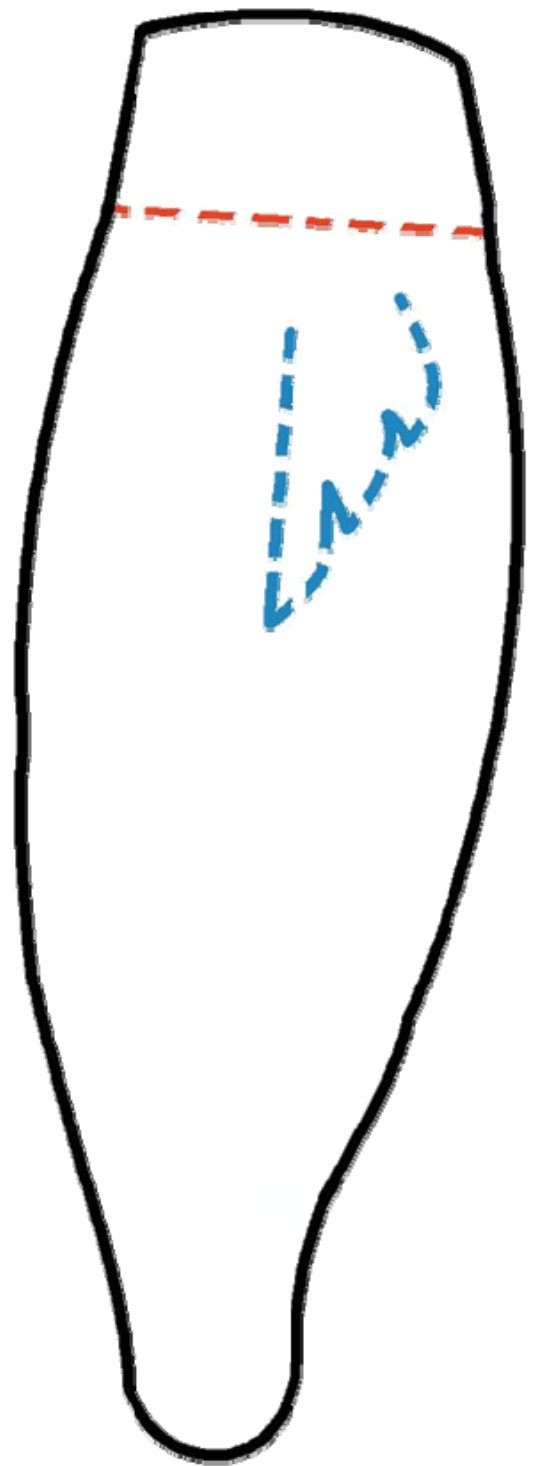
- Place the head against the body.
- Slot each tab down through the slits on the top and bottom of the head.
- Reach through the space behind the head and tape the tabs against the cardboard oval.



**When finished, your fish should look something like this!**

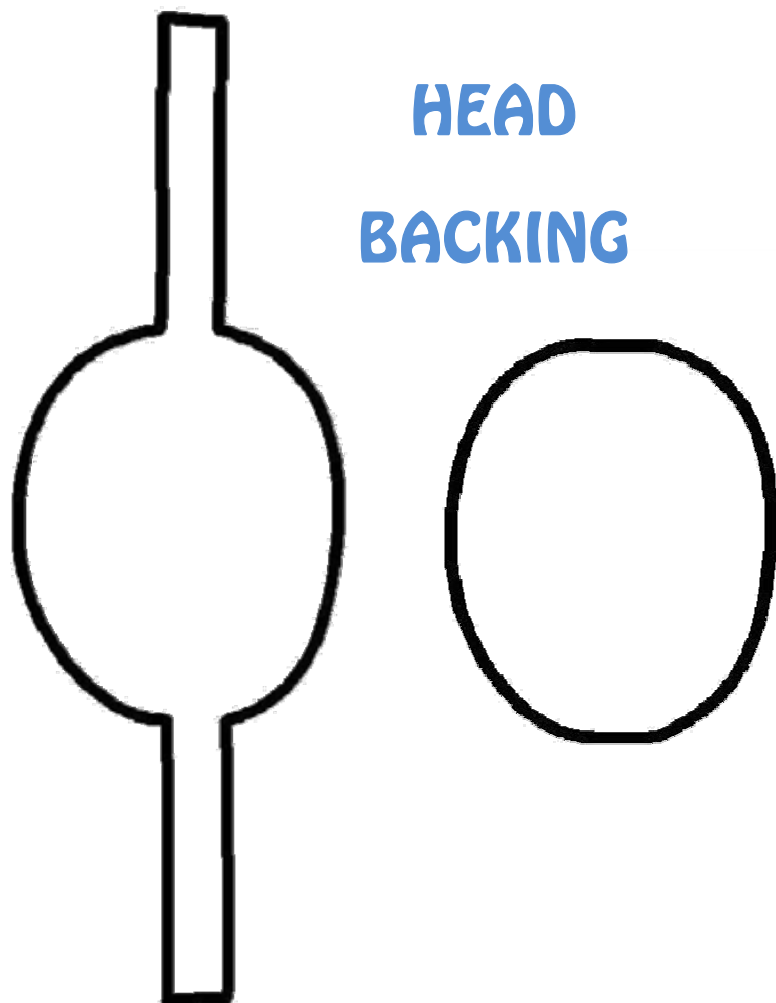


# Build A Fish Stencils: Body



**BODY**

# Build A Fish Stencils: Head

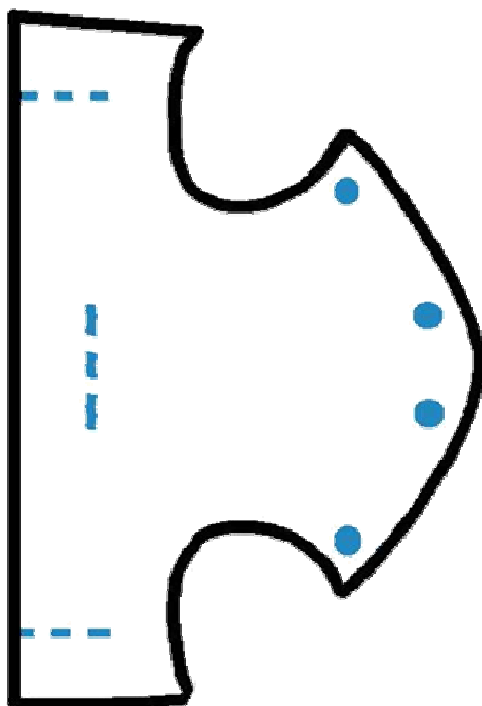
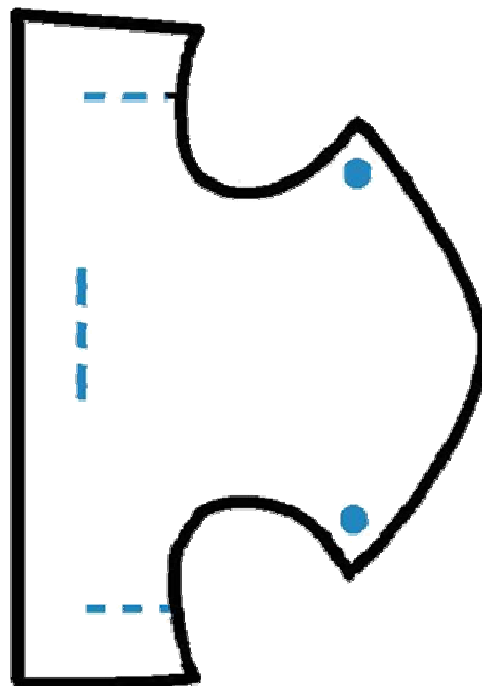


HEAD  
BACKING



EYES

HEAD TOP



HEAD BOTTOM

## Seafood Meet and Greet

- Have each student choose a type of seafood from the seafood guide and do some research on their chosen species.
- Once students know their chosen species well, have them mingle in a seafood “meet and greet”, where they will each pose as the type of fish or other animal that they researched and talk about themselves, but without revealing the name of their species.
- From the information given and by asking questions (e.g., How big are you? What colour are you? Do you have fins or claws? How are you farmed or fished? Are you sustainable seafood?) the students will have to guess who the other students are posing as.
- Ask that each student talks to 5 others and writes down on a piece of paper the student’s real name and then their guess at what kind of species that student is pretending to be. After the activity, have everybody reveal their chosen species as the others check their answers.
- To make this more like a real party, offer snacks or party games that kids can play while talking with each other, like fish or seafood themed charades!

# What We’ve Learned

- **Oceans, lakes and rivers are beautiful ecosystems that help feed the world.**
- **But, seafood is so popular that fishermen are taking too much.**
- **If we want to have fish and other kinds of seafood far into the future, we need to take care of the fish that we have right now.**
- **One way to help is to choose only sustainable seafood, which is farmed or caught in ways that don’t hurt seafood populations or aquatic environments.**
- **Your choices can help to make a big difference in the kinds of seafood that fishermen catch and the way they catch it.**





## Top 10 Tips to Protect Our Oceans

- 1.** Remember to always check the label, ask questions, and make sustainable seafood choices whenever you can. Help spread the word about sustainable seafood by visiting the SeaChoice website ([www.seachoice.org](http://www.seachoice.org)) to get free seafood guides and hand them out to friends, family, and local businesses to help them make sustainable seafood choices too.
- 2.** Reduce your contribution to climate change by walking and using public transit instead of taking the car, by turning down the heater or air conditioner at home, and by turning off lights and appliances when not in use. By reducing our greenhouse emissions, we help the ocean maintain its chemical balance so it can continue to support a rich array of species and ecosystems.
- 3.** Reduce your use of plastics and recycle what you can to help keep garbage out of our oceans. A great place to start is replacing disposable plastic bags and water bottles with reusable ones.
- 4.** Conserve water by turning off the tap when not in use, taking shorter showers, and trying to make sure you wash only full loads of laundry or dishes.
- 5.** Consider switching to a biodegradable laundry detergents and other household cleaning supplies; many options are now available and using biodegradable products helps reduce marine pollution.
- 6.** Never pour chemicals like paint, paint thinner, gasoline, cleaning fluids, or other toxic substances down the drain, as they will eventually end up in the ocean and contribute to marine pollution. Most communities have a place where you can take these products to be disposed of safely.
- 7.** Never buy jewellery or souvenirs made from marine animals.
- 8.** If you have an aquarium, try to make sure the fish, plants and corals you put in it were bred in captivity, since many of the ways in which aquarium fish are caught damages the environment.
- 9.** Volunteer in marine conservation initiatives, like a beach or river cleanup day, to help keep the ocean clean and healthy for fish and seafood.
- 10.** Keep on learning about the marine environment and its creatures by reading books, watching documentaries, visiting museums or aquariums, and even visiting the ocean itself!

# Test Your Sustainable Seafood Smarts!

1. Can you name five important services which the ocean provides us?

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_
- 4 \_\_\_\_\_
- 5 \_\_\_\_\_

2. Overfishing means fishing too much, but how much is too much?

(Hint: Think about overfishing in relationship to how fast fish populations grow)

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3. Fishermen try to catch all the biggest fish first, but when these fish are gone, they try to catch fish that are smaller, and when those are gone, they try to catch fish that are even smaller! What is this process called?

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4. Fill in the blanks in this sentence:

“\_\_\_\_\_ is what we call all the sea creatures fishermen catch besides the fish they actually wanted to catch. Some scientists think that almost \_\_\_\_\_ of all the sea creatures fishermen catch are caught by accident in this way.”

5. What is bottom-trawling and why is damaging to the ocean environment?

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6. Can you name an example of one species that is caught by bottom-trawling?

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7. What is “sustainable seafood”?








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8. True or false? While there are many ways in which aquaculture can damage the environment, aquaculture can also be sustainable if it is done right.

9. Can you **name** these four popular seafood species? Once you’ve written down their names, **draw a line** from each species to the symbol telling if these are red, yellow or green species according to the SeaChoice sustainable seafood guide.

 <b>Name:</b> _____	
 <b>Name:</b> _____	
 <b>Name:</b> _____	
 <b>Name:</b> _____	

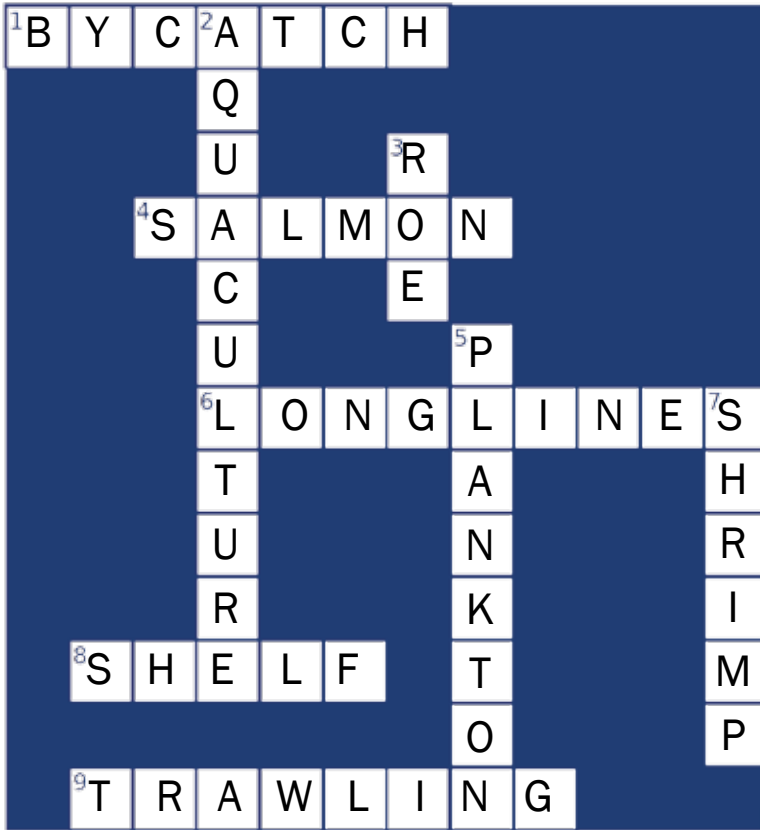
10. What are the three most important things you can do while shopping for seafood that will help you make sustainable choices?

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_



# Activity Answer Key

## Seafood Crossword



## Fish Scramble



How many flounder? 8



How many cod? 5



How many crabs? 4



How many pollock? 6

## Seafood Smarts Quiz

- Can you name five ways in which humans need the ocean?
  - Clean air and water
  - Transportation
  - Recreation
  - Biodiversity
  - Nutrition
- Overfishing means fishing too much, but how much is too much?
 

**A: Overfishing is fishing faster than fish can make young to replace themselves and keep the population stable.**
- Fishermen try to catch all the biggest fish first, but when these fish are gone, they try to catch fish that are smaller, and when those are gone, they try to catch fish that are even smaller! What is this process called?
 

**A: Fishing down the food chain**

4. Fill in the blanks in this sentence:  
 “**By-catch** is what we call all the sea creatures fishermen catch besides the fish they actually wanted to catch. Some scientists think that almost **half** of all the sea creatures fishermen catch are caught by accident in this way.”








5. What is bottom-trawling and why is damaging to the ocean environment?  
**A: Bottom trawling is a way of fishing that drags a heavy net across the bottom of the ocean to catch fish that live there, but it also acts like a bulldozer, destroying marine habitat.**

6. Can you name an example of one species that is caught by bottom-trawling?  
**A: Cod, shrimp, or flounder, for example.**

7. What is “sustainable seafood”?  
**A: Sustainable seafood is fish, shellfish or other types of seafood caught or farmed in ways that don’t damage their ocean environment and that leave enough of these animals behind to keep the population healthy and growing far into the future.**

8. True or false? While there are many ways in which aquaculture can damage the environment, aquaculture can also be sustainable if it is done right. **A: True**

9.

	
<b>Name: <u>Atlantic Cod</u></b>	
	
<b>Name: <u>Salmon</u></b>	
	
<b>Name: <u>American Lobster</u></b>	
	
<b>Name: <u>Arctic Char</u></b>	

10. What are the three most important things you can do while shopping for seafood that will help you make sustainable choices?

- 1) Check the label!                      2) Ask questions!                      3) Use a seafood guide!**

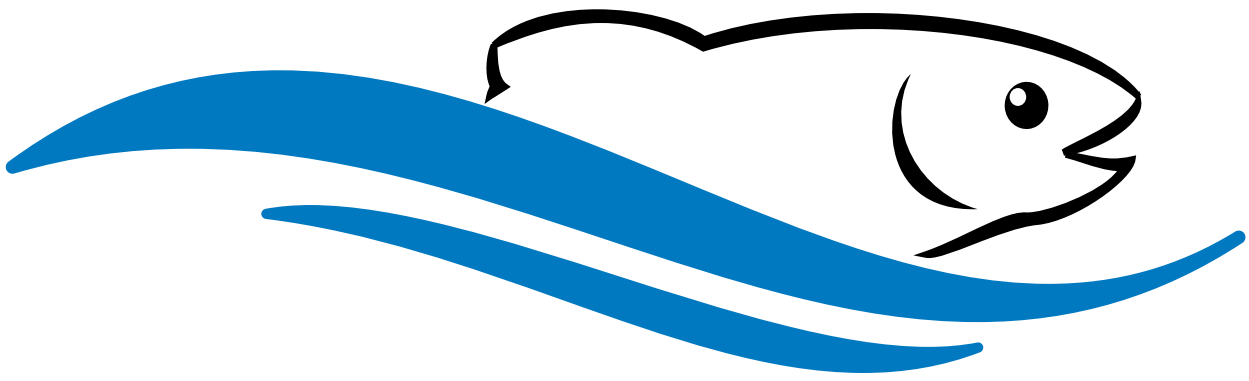
# Seafood Vocabulary

<b>Algae</b>	Very simple plants that live in fresh or salt water; they can be as tiny as a single cell like phytoplankton or as big as a tree like brown kelp.
<b>Biodiversity</b>	The total variety of genes, species and ecosystems in a given region. The higher these values, the greater the biodiversity. Biodiversity is a measure of the health of ecosystems.
<b>Bioprospecting</b>	When scientists look for new kinds of medicines or other chemicals in plants and animals they find in nature. Many medicines come from the natural world, like aspirin, which comes from the bark of the willow tree.
<b>Continental Shelf</b>	The strip of shallow seabed close to land that drop off very quickly into deep water as you move towards the open ocean.
<b>Endangered Species</b>	Species of plants or animals that are rare and in danger of disappearing forever.
<b>Estuaries</b>	Places where a river flows into the ocean and fresh water mixes with saltwater.
<b>Extinct</b>	Plants or animals that have all died off and disappeared from the planet forever.
<b>Food Chain</b>	A chain of species that describes who eats who in the ecosystem; only one possible path out of the more complicated food web.
<b>Food Web</b>	A network that describes all the possible who eats who connections between all of the plants and animals in an entire ecosystem.
<b>Greenhouse Gases</b>	Gases like carbon dioxide that enter the atmosphere and trap heat from the sun like a greenhouse would, contributing to climate change. In the right proportion, these gases trap just enough heat to make the Earth livable. If the right proportion is exceeded, these gases contribute to dangerous global warming.
<b>Gyre</b>	A circular or spiral motion, especially a giant circular oceanic surface current.
<b>Mangrove Forests</b>	Forests of mangrove trees, tropical trees that grow on the shoreline with their roots sticking straight out of the water. These forests help to filter water flowing off the land and are home to many other plants and animals.
<b>Photosynthesis</b>	The process through which plants use sunlight to make sugars they use as food.
<b>Plankton</b>	Tiny plants and animals that float through the oceans.
<b>Roe</b>	The eggs of fish, crab, shrimp, and other marine animals.
<b>Sustainable</b>	Practices that use the environment in ways that are not damaging and that leave enough natural resources behind for the future.
<b>Wetlands</b>	Shallow land that is covered in water and where many grasses, reeds, and aquatic plants grow.



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## About the Author



Natascia Tamburello is a marine scientist and freelance science writer specializing in biology, health science, and science education. She supports the promotion of sustainable fisheries and sustainable seafood in the broader context of global marine conservation initiatives, and continues to pursue these interests through outreach. Natascia is also an avid SCUBA diver, climber, and photographer, and is currently based in Vancouver.

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