



# GUIDE THE TIDE: INTRODUCTION TO SUSTAINABLE SEAFOOD

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**Grade Level**

High School

**Subject Area**

Environmental Science

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**Title:** Guide the Tide: Introduction to Sustainable Seafood

**Focus:** Understanding the basics of the science and management of commercial fisheries and how to identify sustainable sources of seafood.

**Grade Level:** Environmental Science (10/11)

**Virginia Standards of Learning:**

- ENV.6 The student will investigate and understand that Earth’s resources are finite and should be conserved. Demonstration of the essential knowledge and practices includes:
  - a) Make, support, and evaluate a claim about how sustainable and unsustainable natural resources affect organisms.
  - b) Compare geologic and chemical processes that are responsible for filtering, cycling, and storing Earth’s freshwater resources.
  - c) Debate advantages and disadvantages of a sustainable practice in a community, in a home, and as an individual.
  - d) Make, support, and evaluate a claim about how human activities affect Earth’s resources.
  - e) Compare environmental effects related to the various energy sources in Virginia.

**Learning Objectives:**

Students will...

- explore the concept of sustainable seafood and the many factors that influence the sustainability of a product
- Examine sustainable seafood guides and discuss what makes them good and/or bad
- Create their own local sustainable seafood guide as a class

**Total length of time required for the lesson:**

50-70 minutes (depending on class size)

**Vocabulary:**

- **Aquaculture:** the process of raising and farming fish for food.
- **Bycatch:** fish that are caught by ships by accident when other types of fish are being caught
- **Commercial fishing:** the activity of catching fish and other seafood for commercial sale and profit, mostly from wild fisheries.

- **Fecundity:** The ability to produce an abundance of offspring
- **Overfished:** A fish population (stock) whose population has dropped too low
- **Overfishing:** the process of taking so many fish from the sea, a river, etc. that the number of fish in it becomes very low
- **Per capita:** for each person
- **Spawning:** to lay eggs
- **Stock:** a supply of something that is available to be used or managed (in this case, fish)
- **Subsistence fishing:** the activity of catching fish and other seafood primarily to feed the family or for local sale
- **Sustainability:** the use of natural products and energy in a way that does not harm the environment

### **Background Information:**

Commercial fisheries have been around since medieval times and have since provided millions with a source of protein and income. They are an extremely important part of global economies and are relied upon by communities worldwide. As fishing gear and technology have advanced, we are able to harvest more and more fish at a time. This brings more food and money to growing populations but has negatively impacted the populations of many seafood species.

A fishery can be considered sustainable when its population can remain relatively stable over the years while still being harvested from. To ensure that these aquatic resources remain available for future generations, it is extremely important to manage our fisheries well. Fish species have many biological characteristics that need to be accounted for when managing fisheries, like growth rates, life span, fecundity, spawning frequency, and more. By accounting for all of these things, scientists can estimate how much biomass can be taken from a population before it becomes too depleted to recover.

Fisheries management is often done by government organizations. These can be at a national, state, or regional level. These organizations implement measures like gear restrictions, size limits, catch limits, and time of year restrictions to ensure that fish populations have ample time to replenish themselves after being harvested for commercial use. A well-managed fishery is considered sustainable and has less of a negative impact on the species overall.

### **Materials & Supplies:**

- Students will need access to the internet to perform the research portion of this lesson

### **Teacher Preparation:**

- Open the seafood guide slide template and create a PowerPoint that students can access and add to. If you do not have access to PowerPoint/Google slides or you would prefer not to do the activity electronically, you can print out the templates to hand out to students.
- Ensure students will have access to at least one electronic device with internet capabilities per group for research purposes
- Review background information and definitions provided in this lesson plan

### **Procedure:**

#### **Lecture portion (~20 minutes)**

*(Slides 1 and 2)* Introduce the topic and scientist to the class

**Hook:** *(slide 3)* Ask the students to raise their hands if they eat seafood and then ask students with their hands raised what their favorite seafood to eat is. If not, do your family/friends eat seafood?

*(Slides 4 and 5)* Introduce statistics on popular seafood in the United States, as well as global fish consumption. Introduce the topic of seafood being a resource that is extremely important to people everywhere

*(Slide 6)* Define commercial fishing and emphasize its importance again, as a food source and to the economy. Distinguish commercial fisheries from subsistence fisheries.

*(Slide 7)* Introduce the figure showing different types of fishing gear used by commercial fishermen without going into major detail but mentioning that fishing technology has been optimized to bring in as much food and economic value as possible for growing populations.

*(Slide 8)* Introducing the environmental impacts that commercial fisheries have on the environment, mentioning that subsistence fisheries often do not have as many environmental impacts because they are being practiced at a smaller scale.

- **Overfishing** occurs when more fish are being harvested at a faster speed than they can reproduce and replace the fish that are being removed
- **Bycatch** is the harvest of fish or shellfish other than the species for which the fishing gear is intended to catch. Oftentimes, larger marine animals will get stuck in fishing nets and are accidentally brought onto fishing boats. These animals are thrown back into the water but are often already injured or dead.
- **Destructive fishing gear** damages many ocean habitats across the globe. [Play video on slideshow about bottom trawl net](#)
- **Food web disruptions:** harvesting too many individuals at a certain level in the food web can have impacts on other parts of the food web. If too many prey animals are harvested, then predators have no food. If too many predators are harvested, the prey species population becomes way too big and faces increased competition for resources.
- **Genetic changes** occur when fishermen target all the largest fish of a species (because that is the most valuable for consumption). This leaves only the smallest individuals to remain in the ocean and reproduce with each other, producing smaller offspring.

*(Slide 9)* Aquaculture is an alternative way that we can harvest fish for consumption. Also known as “fish farming”, fish or shellfish are raised under human control in a variety of different settings. They can have a variety of different impacts on the environment and health that can be both positive and negative. In the image on the top right, fish are being raised in pens in the open ocean. On the bottom right, shellfish are being grown in cages on the coast.

*(Slide 10)* Oyster aquaculture is a cool way to farm seafood while still having a positive environmental impact. Oysters are filter feeding organisms, meaning that they get their food by filtering water through their bodies and extracting small bits of food and nutrients. This results in cleaner water due to removal of many nutrients by the oyster. (Emphasize graphic top right to help students understand the full cycle) This is possible with many other types of shellfish, which make them a sustainable seafood choice in many places

*(Slide 11)* First, ask students what they think makes a fishery sustainable, or to define sustainable fisheries.

- A **sustainable fishery** is a fishery that is harvested at a rate that will meet the needs of the present without harming the environment or preventing future generations from having the same access to the fishery.
- Populations in the wild will remain relatively stable or grow to larger numbers while still being harvested by humans

*(Slide 12)* Some species have traits that make them more “sustainable” than others and by looking at these characteristics, scientists can manage species more efficiently.

- **Size/growth rate**- organisms that grow quickly reach maturity faster and replace themselves faster in the environment
- **Spawning frequency**- organisms that lay eggs more often are adding more individuals to a population, allowing the population to increase
- **High fecundity**- fecundity refers to the amount of offspring an individual can produce. Higher fecundity means they are laying more eggs, allowing for faster population growth.
- **Short lifespan**- often means that individuals reach maturity very fast. It takes less time for new organisms to be added to the population
- **Low on the food chain**- organisms that are lower on the food chain usually have higher population sizes and are more resilient to pressure from predators, including fishermen

*(Slide 13)* Play video about the orange roughy - a case study on poor fisheries management and biological characteristics that can lead to the downfall of a fishery

*(Slide 14 and 15)* Ask students why it was so easy for the orange roughy populations to be depleted by fishing pressures?

- Review characteristics talked about on slide 11 that apply to orange roughy

*(Slide 16 and 17)* Ask students how they think you could manage the orange roughy fishery to be more sustainable? Let them brainstorm ideas

- Provide some examples after they brainstorm on common fishery management techniques

*(Slide 18)* Brief overview on how fisheries management is related to sustainability and who makes the decisions. Scientists are constantly working alongside governmental organizations to make decisions on how to best manage fisheries and decide what is sustainable and what is not. NOAA Fisheries manages many of the fisheries we have in the United States, and is where we will get all of the data for our activity today!

*(Slide 19)* Science communication is a skill that is extremely important for scientists to learn, because it helps them inform the public about the work that they do. If science communication is done properly, society has a better understanding of the world around them and the impacts that they have. If fisheries scientists communicate their findings about the health of seafood species, the public can be more informed when making decisions about buying or eating seafood

*(Slide 20)* Science communication is when scientists teach the public about the results of their research and experiments. Talk about some of the tips introduced on the page to effectively communicate scientific findings, and let the students know that they are about to practice their science communication skills!

*(Slide 21)* One way that this can be done is through the use of seafood guides- this example is from the Virginia Aquarium. State the importance of communicating the science in a way that is easy to read, understand, and use for day-to-day decision-making.

**Activity: Classroom Seafood Guide (Slide 22) (~30 minutes)**

- Students will split into groups of 2-3 (either self-assigned or teacher assigned) with at least one laptop/tablet with internet access per group
- Instructor will open the classroom seafood guide template and share access with student groups so that they can edit the slides
- Students will follow the instructions given in the slides to select a species in their region. If instructor would prefer, they can pre-select species and assign them to student groups.
  - Navigate to [NOAA Fisheries Sustainable Seafood Species Directory](#)
  - Under region, select the region that you are in/are closest to
  - Students may then select their species from this list (with approval from teacher so that no species are repeated)
- Students must navigate through the species page to fill in required information on the seafood card
- While students are completing this activity, instructor can walk around or watch collaborative slides to check on student progress and answer questions
- Once all information is filled in, students will decide if they think the species is sustainable or not based on the information they found by selecting Best Choice, Alternative, or Avoid
- Students will add a picture of their species to the full seafood guide at beginning of template in the correct category
- If time allows, students may research multiple species (dependent on class size/speed) or research the current management agencies in their state. If students do not finish

within the allotted time, it can be finished as homework and reviewed at the beginning of next class.

- After all groups have finished, the seafood guide is complete! Feel free to upload completed seafood guide here ([drive link](#)) and look through other seafood guides completed by classrooms
- If there is time, have students/groups share their most important or interesting findings with the class

### **Conclusion/Wrap Up (~10 minutes)**

(Slide 23) Review major themes from the lesson, ask students what they learned that surprised them. Encourage students to practice science communication and use/share their sustainable seafood guides!

(Slide 24) This wrap up discussion can be either just a verbal discussion or an exit ticket that students turn in – have students reflect not just on what they learned today but how they will use it.

### **Assessment:**

- Observe students through discussion points and during the activity to gauge understanding of topics.
- Students will have completed research and translated these findings into a tangible science communication product that they can use. Completion of this activity can be graded for participation and engagement.

### **References:**

- City of Virginia Beach Web Development Team. (n.d.). *Sensible seafood program*. Sensible Seafood Program | Virginia Aquarium & Marine Science Center. <https://virginiaaquarium.com/sensible-seafood-program>
- *Home: Food and agriculture organization of the united nations*. FAOHome. (n.d.). <https://www.fao.org/home/en>
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- *MSC in the USA and Canada*. United States. (n.d.). <https://www.msc.org/en-us>
- “Science Communication Skills for Middle and High School Students.” *Activate Learning*, 30 May 2024, [activatelearning.com/science-communication-skills-for-middle-and-high-school-students/](https://activatelearning.com/science-communication-skills-for-middle-and-high-school-students/).
- *Sustainable seafood*. FoodPrint. (2024, February 28). <https://foodprint.org/issues/sustainable-seafood/>

### **Appendices:**

**Link to Seafood Guide Template for download: [Seafood Guide TEMPLATE](#)**

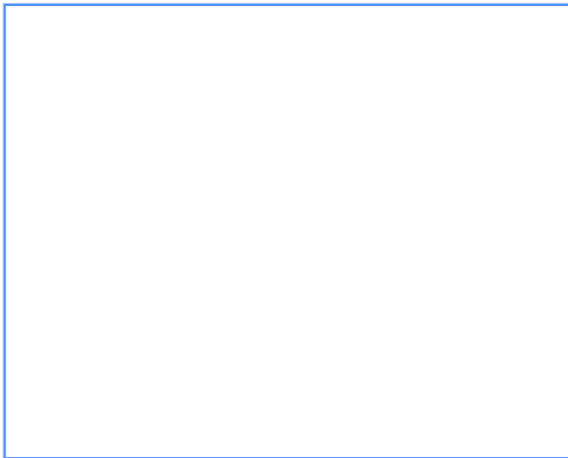
**(Teacher name) (Class period) Seafood Guide**

School:

City/State:

**Best Choice****Alternative****Avoid**

Student names:

**Status:****Regions and Habitat:****Gear types:****Life span:****Size:****Species Name:**Category: **Best Choice**, **Alternative**, or **Avoid****Fun Fact:**