



## Unit: Oceans of Energy

### Lesson 4: Sustainable Fisheries

**Summary:** Sustainable harvesting of marine resources is a complicated topic, but resources exist that distill the science to help consumers make wise choices. This lesson introduces students to the factors of sustainability through an engaging “fishing” game and encourages them to teach their parents how to make the sustainable choice.

**Lesson type:** Hands on learning and exploration

**Grade level:** Presented to grade 4; appropriate for grades 2 – 12 with age appropriate modifications

**Duration of lesson:** 50 min

**Developed by:** Jonathan Kellogg (Scientist); Catherine Barber and Carel Wilkin (Teachers)

**Developed for:** Sir William Van Horne

**School Year:** 2015-2016

**Notes:**

- For this lesson, I used two sizes of Goldfish crackers, but two sizes of bean, or paper, or just about anything could work.
- If you have lead time before the lesson, Seafood Watch will send you class sets of the current pocket guide to distribute to students.

#### Objectives

- Students will develop a better sense of what sustainability means
- Students will understand some history behind global fisheries
- Students will grasp the basics of fisheries science and that making sustainable choices requires knowledge of fish biology, habitat, and fishing practice.
- Students will know that they can be an informed consumer who can make sustainable choices

#### Materials

- Seafood Watch cards for the class (order ahead at: <https://www.seafoodwatch.org/seafood-recommendations/consumer-guides/consumer-guide-order-form>)
- Goldfish crackers (~1 bag per class of ~25 students, additional box of giant Goldfish if conducting ‘fishing’ with different species)
- Straw for each student
- Bowls, plates, or napkins for each student and each grouping
- Spoons/forks for each student



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## Background Information for the Teacher

Managing the sustainable harvest of marine fisheries is an evolving science that has undergone much growth in the last 30 years. Technological advances, in the form of larger vessels which in turn allow for larger and more efficient nets, sonar, and precision navigation, were put into practice between the 1950s and 1970s. These technologies allowed for fishing areas to be expanded and fishing depths to be increased. A classic story of resulting overfishing comes from the North Atlantic Cod fishery which was one of the first fisheries to collapse with these developments. Many resources for this story are available online (ie. [https://en.wikipedia.org/wiki/Collapse\\_of\\_the\\_Atlantic\\_northwest\\_cod\\_fishery](https://en.wikipedia.org/wiki/Collapse_of_the_Atlantic_northwest_cod_fishery)), but it is a telling story of how care needs to be taken to ensure that sustainable practices are followed to preserve fisheries for future generations.

For a fishery to be considered sustainable, there needs to be an evaluation of **how** a fish is caught, **what** species of fish is caught, and **where** the fish is caught. How is an evaluation of the fishing method that is used and its effect on the environment and how much bycatch is likely for a given level of fishing effort. Current estimates of bycatch are between 8-25% of the total catch which quickly adds up for a commercial trawler that may haul a 60,000 kg net every ~6 hours and may be at sea for 4-6 weeks at a time. What species of fish are caught is of great importance because science has learned much about the different reproductive ages and rate of egg production for the females of various commercial species. An example of a species that is considered sustainable is Walleye Pollock while a species that is not sustainable is the Tiger Rockfish. While both fish are about the same size, Pollock reach reproductive age much younger and produce millions more eggs than Rockfish. Last, where the fish is caught is of great importance because some species have been overfished in certain areas, but not in others where they are still abundant. This is true on both the global and regional scale.

All of these factors are taken into account to have a sustainable fishery where the goal, according to the Bruntland Report (1987) is “meeting the needs of the present generation without compromising the ability of future generations to meet their needs.”

## Vocabulary

- Bycatch – Any organism caught unintentionally while fishing for another species
- Sustainable – Meeting the needs of the present generation without compromising the ability of future generations to meet their needs

## Lesson Detail

### Introduction

Remind students of the human role in the marine food web and probe their understanding of what it means to be sustainable. An idea for this is to show images of a sport fisher, small scale commercial fishing, and a factory processing ship fishing. Ask students if they would consider each method to be sustainable.



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## Activity

1. Have the students sit in groups around their 'ocean' of Goldfish. The 'ocean' or plate/bowl/napkin should start with ~10 smaller Goldfish and ~5 larger Goldfish crackers in it. Have the students conduct 3-6 25 second long 'fishing seasons.' (Repeat seasons if time and crackers allow to have more striking results.)
  - Seasons 1-2: Students are only allowed to use their straw, but no hands, to catch the fish via suction from the ocean. (Ask students to put hands behind backs if necessary.)
  - Seasons 3-4: Technology has improved and students are now allowed to use their hands to steady the straw.
  - Seasons 5-6: Technology has improved and students are now allowed to use a spoon.
2. Between each fishing season, the fish reproduce. Larger fish reproduce slower and so only one additional large fish is added to the ocean for each large fish remaining. Smaller fish reproduce more quickly and so three small fish are added for each small fish remaining. Before reproduction happens, each group should report the catch from their ocean to the authorities (teacher). If a team of fishers overfishes their ocean, they are out of work and must wait out the rest of the seasons patiently.
3. This activity was used early in the lesson before going on to explain that how, what, and where fish are caught contribute to the determination of whether or not a fishery is sustainable and the introduction of OceanWise, Seafood Watch, and the Marine Stewardship Council.

## Closure Discussion

Examples of questions to help students share their results and observations...

1. Revisit the definition of sustainability. Did their initial definition have elements of the 'accepted' definition from the Bruntland Report? Would they change their definition after the fishing game and learning more about sustainable fisheries?
2. Discuss the process of Seafood Watch and how behind every recommendation in the consumer guide is a 80+ page report about the science used in making each recommendation
3. Empower students by encouraging them to make sustainable choices and, in turn, the open market will respond since demand will fall for less sustainable options. Encourage students to teach their families about what they have learned and to ask how and where their fish was caught when at restaurants.

## Extensions of Lesson

1. The activity can be extended by adding more varieties of fish to the 'ocean' or by placing value on the catch. Similar lessons online (search 'Tragedy of the Commons') have examples.



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## References

This lesson was created using the following resources:

<<http://www.seafoodwatch.org/seafood-recommendations/our-standards>> Seafood Watch. (Accessed 20 April 2016).

<<http://www.oceanwise.ca/>> Ocean Wise. (Accessed 20 April 2016).

<<https://www.msc.org/>> Marine Stewardship Council. (Accessed 20 April 2016).

<<http://www.pbs.org/emptyoceans/educators/activities/fishing-for-the-Future.html>> Fishing for the Future, *Marine Fisheries & Aquaculture Series*. Website hosted by PBS. (Accessed 20 April 2016).

<[https://en.wikipedia.org/wiki/Collapse\\_of\\_the\\_Atlantic\\_northwest\\_cod\\_fishery](https://en.wikipedia.org/wiki/Collapse_of_the_Atlantic_northwest_cod_fishery)> Collapse of the Atlantic northwest cod fishery. Website hosted on Wikipedia. (Accessed 20 April 2016).