Teacher's Edition

Classroom Guide:
Sustainable U.S. Seafood: A Journey from Sea to Market

National Standards:

Unifying Concepts and Processes; Earth and Space; Life Science; History of Nature and Science; Personal and Social Perspectives; Science as Inquiry.

Ocean Literacy Principles:

5 - The ocean supports a great diversity of life and ecosystems;
6 - The ocean and humans are inextricably interconnected.

Grade Levels: 6-12

Website:

Go to afsc.noaa.gov/education to find all the PDFs from the original series printed in November 2011 in The Seattle Times.

Background

Did you know that seafood caught in U.S. waters is considered sustainable?
A Journey from Sea to Market series in The Seattle Times Newspapers in Education, is an introduction into the complex process of how seafood gets to market and the commitment that the U.S. federal government has made to ensure that U.S. seafood is sustainably managed for the enjoyment of future generations. The series introduces key parts of this process: from why is seafood important to how science is used to make management decisions. Within each part of the series there are teaching moments such as: leading questions that will help your students think about key concepts, new vocabulary words, and activities. There is a glossary at the end of this guide.

Day 1 - Introduction

The introduction to this series begins with a "so what" question. What's the big deal about U.S. seafood? The big deal is not only that seafood is a healthy food choice, but it is a very important part of our economy. Key statistics are given, and a link to the report Fisheries of the U.S. 2010 has more economic information about U.S. Fisheries. After this blast of information the chapter illustrates the key parts of the process; science, management, safety and finally getting seafood to market.

More information:
http://www.st.nmfs.noaa.gov/st1/fus/fus10/index.html
Extension Activities:
Video: http://www.nmfs.noaa.gov/stories/2011/10/05_voices_laura_anderson.html
Explore Fishwatch: http://www.fishwatch.gov

Day 2 - Science: What is a healthy fish population?

The first step to ensuring sustainable seafood is to have a good understanding of the population dynamics of a species of fish. Scientists aren't just learning information about these fish because they love science, it is imperative to understand what influences the growth of a fish population. The chapter describes several things a scientist needs to determine if a fish population is healthy: a population estimate and information about the fish's life history.

Extension Activities:
Fish Fetch activity (included in this guide)
Population estimation module – http://www.afsc.noaa.gov/education/activities.htm

Day 3 - Management: How many fish can be harvested?

In this chapter the law governing U.S federal fisheries is introduced as the basis to why our fisheries are the most regulated fisheries in the world. This law mandates the NOAA Fisheries Service to ensure that our fisheries are managed sustainably. Fishery Management Councils serve as a forum for stakeholders in the fishery to discuss how the fisheries are managed and then make recommendations to NOAA Fisheries for final regulatory rule making. Different types of management strategies are presented and can be used in the classroom to discuss why one method may be better for a certain fish species than another.

Extension Activity:
Facehook – a role playing activity that helps students understand the different viewpoints and needs from various stakeholders in the fishery. (included in this guide)

Day 4 - Inspection: Is the seafood safe to eat?

This chapter talks about safe processing of food. When food safety issues are talked about in the news we usually hear about the FDA inspecting the issue, but what about seafood? The FDA is ultimately the food safety regulatory agency, but the FDA partners with NOAA Fisheries Seafood Inspection Program to ensure that domestic and imported seafood is safe and of a high quality. The chapter describes eight sanitation control points that inspectors use when auditing a seafood processing plant. In the classroom you can use these eight points as a way to discuss why good sanitation/hygiene practices are important in general and when handling food. You can also ask the students to go online to Fishwatch.gov to find out a few key things to know when purchasing fresh seafood. These discussions can lead into a discussion about germs, common cold, the flu and diseases related to food borne pathogens such as E.coli bacteria infections.

Extension Activity:
Use your senses! Learn how NOAA, the FDA and the Gulf states joined forces to prevent seafood tainted with oil from Deep Water Horizon oil spill from reaching the marketplace. Watch this video: http://www.youtube.com/noaa#p/a/u/1/pantI8WYynE

Career: Sudents interested in becoming a Consumer Safety Officer should consider college courses of related science coursework (e.g., animal science, chemistry, food science and nutrition, public health science, microbiology, zoology) after earning their high school degree.

Websites: NOAA Seafood Inspection Program at http://www.seafood.nmfs.noaa.gov/
The danger of eating contaminated raw oysters at
http://www.fda.gov/Food/ResourcesForYou/HealthEducators/ucm085368.htm
NOAA's response to the Deepwater Horizon oil spill at
http://www.noaa.gov/deepwaterhorizon/data/seafood_safety.html

Day 5 - To the Market: Faces of Sustainability

The last chapter is a culmination of the previous but with a human face. Six people that represent the "from the sea to the market" seafood process were interviewed and asked 3 basic questions: what does sustainable seafood mean to you? What is your role in the process, and why is your role important. All of their work ends with a child enjoying seafood. And that's what it is all about!

Extension Activity:
Sustainable Seafood Activity (included in this guide)

Video: http://www.nmfs.noaa.gov/stories/2011/10/05_voices_laura_anderson.html

Careers: Want to be a fishery scientist or other type of ocean scientist? Check out our Career website for more information:
http://www.afsc.noaa.gov/Education/Students/careers.htm

Glossary

Abundance: The number of individuals of a species found within a sample.

Annual Catch Limit: The amount of fish or shellfish of a particular species or species group that can be caught in one year. This amount is determined by the Fishery Management Council, which is based on scientific information from a stock assessment.

Aquaculture: the cultivation of aquatic organisms (as fish or shellfish) especially for food.

Biomass: The total weight of a group of living organisms in an area, at a particular time.

Bottom Trawl Gear: A large net that is towed behind a fishing vessel at or very near to the bottom of the ocean. Key parts of a bottom trawl are the trawl doors, the footrope, the head rope and the cod end.

Bycatch: Living creatures that are harvested or harmed unintentionally during fishing operations but are not landed or retained.

Data: Units of information or facts from which conclusions may be drawn.

Density: The number of individuals in a unit of area, such as per square kilometer.

Estimate: To determine roughly the size, extent, or nature of.

Export: To send or transport (a commodity, for example) abroad, especially for trade or sale.

Import: To bring or carry in from an outside source, especially to bring in (goods or materials) from a foreign country for trade or sale.

Insanitary: Dirty or unhygienic and thus likely to cause disease.

Life History: All the changes experienced by a living organism, from its conception to its death.

Overfishing: When a population of fish or shellfish is subject to fishing pressure at a rate that does not allow the population to grow or maintain a healthy level.

Overfished: The description of a population that has reached a low population level that does not support historical fishing pressure. When a population is overfished a rebuilding plan is created that minimizes or eliminates catch, but sometimes a population may remain overfished even with these actions.

Regulatory: To organize and control an activity or process by making it subject to rules or laws.

Sampling: (statistics) the selection of a suitable sample for study.

Senses: Any of the faculties by which stimuli from outside or inside the body are received and felt, as the faculties of hearing, sight, smell, touch, taste, and equilibrium.

Sensory: Involving or derived from the senses.

Stock Assessment: A stock assessment is an analysis that contains biological and ecological information that explains processes that influence the health of fish populations.

Sustainability: a state or condition that can be maintained over an indefinite period of time.

Wholesome: Conducive to sound health or well-being.

Teacher's Edition

Fish Fetch – Fisheries Survey Activity

Objective: *Students will learn how to use sampling to estimate the size of a fish population*

Grade Level: *PreK-8; can be scaled to older students*

Background

Fish Fetch asks the question "How many fish are there?" and answers it using methods based on the surveys that Alaska Fisheries Science Center biologists use to estimate the size of fish populations in the Bering Sea and Gulf of Alaska. The participants take samples of fish and learn how to estimate population size from samples. Fish Fetch is targeted at all age groups, with the capacity to scale up or down given the audience's comprehension of math. The activity has engaged participants as young as 3 years old, with accompanying adults asking questions about details of population estimation. The activity can be used as a math activity or a science activity, and shows how concepts learned in school are used in realworld research.

Materials

- Blue tarp with a 10 x 10 grid of 1 square foot cells laid out with yellow duct tape
- 1000 Fish-shaped craft beads, approximately 1" in length and in assorted solid colors, (this is the total fish population)
- 5 plastic sand pails, referred to as "scientifically calibrated sample buckets"
- 5 sample selectors (e.g. soft foam boat, preferably one that bounces erratically rather than rolling)
- Whiteboard or flipchart to write on
- Whisk broom (optional) to redistribute fish after sampling

Procedures

This activity can be done with one participant or several, depending on the situation. If several participants are taking part, each person can take one sample. If one person takes part, he/she can take several samples.

1. Scatter the 1000 fish around on the grid.
2. Ask participants, "How many fish do you think are on the grid?" (This is their initial guess – some will take a wild guess, others will try to figure it out visually in a more systematic way).
3. Ask participants to go "out into the ocean" and throw their squishy boat onto the grid. The square that the ship lands on is the random sample.
4. Tell participants to count all the fish in the blue part of the square and put the fish into their bucket.
5. Write the number of fish in each sample on the whiteboard. Counts of zero are valid observations.
6. Ask participants, "How can you figure out, on average, how many fish were in the squares that you counted?" (Answer: add up the number of fish in the samples, and divide by the number of samples). Participants can do the math themselves on the whiteboard, or the presenter can do it for them.

7. Ask participants, "If this is the average number of fish per square, how can you figure out how many fish there are in all?" (Answer: count the number of squares in the grid – 100 – and multiply the average number by 100).
8. Compare their initial guess of how many fish there were to their estimate using the samples.
9. Throw the fish "back into the sea." The whisk broom can be used to re-distribute the fish around the grid. You can experiment with an even distribution of fish or a clumped distribution (where some squares have a lot of fish in them and others have none). Discussions on how the math works visually are very useful. Depending on the level of engagement from the participants, discussions can range from how to estimate jelly beans in a jar, to how observations of zero and other real-life factors affect the population estimate. In an informal environment, the youngest participants (ages 2-5) can collect fish and then practice counting them and "tossing them back into the sea." There are further applications for more in-depth interactions, like classroom demonstrations, where parameters such as species (color) composition, patchiness, catch efficiency, and depth distribution, are discussed. The effect of survey design can also be discussed (e.g. what effect would including the fish on the yellow border line have? What if we sampled squares in a line instead of randomly?). The activity is highly scalable in this way, and effectively presents the basic components of fisheries science.

   For alternative methods for this activity go to:
   http://www.afsc.noaa.gov/education/Activities/fish_fetch.htm

Created by Jason Conner, AFSC

Teacher's Edition

Fishermen's Facehook Page

Objective: Increase knowledge of Rockfish stakeholders and how they are an integral part of the fisheries management systems with a variety of governmental agencies.

Strategies: Allow students to explore and research rockfish issues and what science and management techniques are used to promote healthy fish populations but also address economic needs of different stakeholders.

Focus Questions: How do two countries manage a fish that lives in an environment that has no boundaries? How do federal, state, local, and tribal governments work together to achieve a common goal? How do stakeholders' voices get heard?

Time frame: This activity is really meant to be one component of understanding stakeholders. Introducing the students to what stakeholders are, the resources to help them better understand where to learn more about the science, government involvement, etc might take one period (50 min). Then assign them homework to gather the information and turn in the next day. Finally having the students share their work and give time to find "friends" who might align with what they feel strongly about. A mock Council meeting might be interesting to have the students act and attempt to negotiate on fisheries issues.

WA State Social Studies Standards:

EALR 1 CIVICS, component 1.2 (understands the purposes of organization and function of governments, laws, and political systems)

EALR 1 CIVICS, component 1.4 Understands civic involvement

EALR 2 ECONOMICS, component 2.1 (understand that people have to make choices between wants and needs)

EALR 3: GEOGRAPHY, component 3.2.1 (understands and analyzes how the environment has affected people and how people have affected the environment)

Supplies needed:

- ☐ Stakeholders page and Facehook page (back to back copied)
- ☐ Website available for students to write down
  http://www.nmfs.noaa.gov/fishwatch/species/pop.htm

Suggestions:

Assign students a stakeholder ahead of time by circling the appropriate position that either suites the students or helps control the dynamics of the groups.

Fishermen's Facehook Procedure:

A. Stakeholder introduction using a Quick Write:

1. This brainstorming strategy known as a Quick Write will allow students to answer: Who are the stakeholders involved in the Rockfish Fishery? This might be done in a notebook or on scratch paper; a quick write challenges students to write down their ideas that first pop into their minds. Have them generate details, topics, or tap into past experiences and not focus on spelling, punctuation, or grammar. Give the students 1.5 minutes only. Topics: fishermen, marinas, boat captains, biologists, managers, federal, state, international representatives, anyone who profits from the season influx of fishermen into their community (like hotels, restaurants, etc.)
2. Group activity: Have students share and add to their list.

B. Briefly discuss the threats facing Rockfish populations.

1. Overfishing: http://www.nmfs.noaa.gov/ http://www.nmfs.noaa.gov/fishwatch/species/pop.htm
2. Bycatch: http://www.nmfs.noaa.gov/by_catch/docs/ bycatchplanonline.pdf
3. Habitat degradation: http://www.mpa.gov/pdf/helpful-resources/nmfs_mpa_snapshot_aug2011.pdf and http:// www.gc.noaa.gov/gcil_derelict_gear.html

C. Stakeholder Involvement:

1. Hand the students the worksheet with the Stakeholder side up first.
2. Tell the students that you want to get all of the stakeholders together to discuss the three main threats (overfishing, bycatch, and habitat destruction). Ask them to imagine what that would be like? Who would lead? What is the hierarchy in the management system and who would be present? Split the class into six groups (see backside of worksheet).
3. Research their stakeholder and their role in that group, then fill in a "mock" Facehook page focusing on what that person does and their role in the rockfish fishery. The first blank box is where the students can draw a picture of their stakeholder and encourage the students to choose a fictional name appropriate for their job.
4. Share with the class either at the end of the period, or the next day.

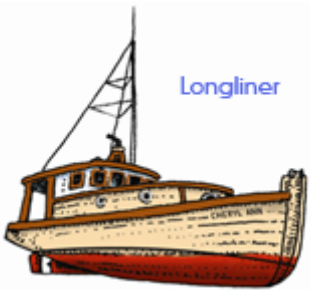
D. Apply and Extend:

1. Have the students' research or interview a real stakeholder.
2. Conduct a mock Council and have the students help contribute to the Fisheries Management Plan.
3. Research one of the issues and submit a testimony to the Council, see attached example and template or go to website: http://www.pcouncil.org/facts/sample.pdf

Student Activity

Stakeholder's Profile: Yelloweye Rockfish (*Sebastes rubberimus*)

You will be assigned one of these roles. Please research and find out more information on Rockfish Recovery.




Sport Fishing Boat


NOAA Ocean Science Vessel

1. NOAA Fisheries manager working on the Puget Sound Rockfish Recovery Plan
2. Washington Department of Fish and Wildlife manager
3. NOAA Fisheries manager in Alaska
4. Pacific Fisheries Management Council member
5. NOAA fisheries marine debris coordinator, removing marine debris
6. NOAA fisheries biologist (studying population dynamics)
7. Washington Department of Fish and Wildlife biologist
8. Alaska Department of Fish and Game stock assessment biologist
9. Washington commercial fisherman ()
10. Oregon commercial fisherman (set nets)
11. California commercial fisherman (trawl)
12. Native American fisherman (ceremonial and subsistence)
13. Washington sports fisherman (hook and line)
14. Oregon sports fisherman (hook and line)
15. California sports fisherman (set nets)
16. Alaskan Halibut long-line fisherman (catch yelloweye as bycatch)
17. NOAA Observer on commercial fishing boat
18. Scientist leading the Sea Floor Mapping Project using a multi-beam eco-sounder
19. Graduate student studying effects of fishing gear on benthic habitat
20. Scientist using non-lethal methods to survey rockfish with ROV
21. NOAA National Marine Sanctuary educator
22. Pacific Northwest fish buyer who processes and sells fish
23. Scuba diver involved in protecting rocky habitat for bottom fish
24. Illustrator who is developing a rockfish field guide for fisherman
25. NGO concerned with overfishing
26. NGO concerned with ocean habitat and effects of trawl gear
27. Conservation group- Concerned with derelict fishing gear
28. Seafood chef concerned with Mercury levels in fish
29. Hotel owner on coast interested in lengthening the season
30. 7th grader in Seattle who wants to grow up and protect these fish

Fisherman's Facehook

Home | Profile | Friends | Inbox

Information

My Name:

Location:

My occupation:

What % of my income relies on rockfish?

Friends

My Wall

6 facts about my role in the Rockfish Fishery (gear, type of boat, season, etc.)

What can I do to help protect this fishery?

Teacher's Edition

Going Green? Evaluating "Sustainable" Seafood

Overview: *In this activity, students learn about the concept of sustainable seafood. They use information about common commercial species from NOAA's FishWatch program to evaluate the sustainability of selections on restaurant menus. Using criteria from NOAA's National Marine Fisheries Service FishWatch program, they will decide whether they think the restaurants live up to their claims to be sustainable. Then students will write a short newspaper article explaining their findings to interested consumers.*

Background

Do you like seafood?

If you are like the average American, you eat around 16lbs of fish and shellfish per year[2]! That is good news for the many fishing and marine aquaculture operations that sell to markets and restaurants in the United States. However, factors such as overfishing and bycatch threaten the sustainability of some fisheries.

Commercial fisheries are managed at the stock level. A fish **stock** is a group of individuals of the same species that inhabit the same geographic region and interbreed when mature. The **Maximum Sustainable Yield (MSY)** is the greatest number of fish that can be caught each year without impacting the long-term productivity of the stock. **Overfishing** occurs when fishing mortality exceeds a specific threshold, usually set at a level to achieve MSY. **Bycatch** refers to organisms other than the primary target species that are caught incidentally. Bycatch may include other fish species or endangered and threatened species like sea turtles, whales and dolphins.

Fortunately, there has been a lot of attention to increasing sustainability of fisheries overthe past several years. In general **sustainability** represents the ability of a fish stock to persist in the long term. If a fish stock remains at a constant level (or even grows) despite fishing pressure over a long time period, it is considered sustainable. The Sustainable Fisheries Act of 1996 (a set of amendments to the 1976 Magnuson-Stevens Fishery Conservation and Management Act, which authorizes NOAA to manage U.S. commercial and sport fisheries) gave fishery managers new mandates and tools to promote sustainable fisheries. The Magnuson-Stevens Reauthorization Act of 2006 included items designed to end overfishing, expand programs to promote sustainable fisheries management and improve the science used to monitor and manage fisheries. As the concept of sustainability has gained visibility in fisheries management and policy, commercial vendors like markets and restaurants are increasingly interested in offering sustainable seafood to their customers. This is a promising development, but can consumers be sure that restaurants are living up to their claims of sustainability?

[2] NOAA FishNews July 2008

Materials Fishing Methods Facts (File: Fisheries Gear.pdf)

- Also found online at http://www.nmfs.noaa.gov/fishwatch/fishinggears.htm; Accessed: April 2011 Restaurant Menus (included in this document) Menu Data Sheets, four per group (included in this document) FishWatch species information (File: FishWatch.pdf)

- Also found online at http://www.nmfs.noaa.gov/fishwatch/; Accessed: April 2011 (Click species names in left-hand panel.)

Procedure

1. Divide students into groups of 4.
2. Distribute a copy of the Student Activity to each student.
3. Distribute Fishing Methods Facts (1 per group), Restaurant Menus (1 of each per group) and Menu Data Sheets (1 per student) to student groups.
4. Tell students to read through the Student Activity worksheet and follow the instructions.
5. Students can start with some background research by visiting the FishWatch homepage found at the link below. Note that if you do not have internet access, you must distribute the hard copy of the FishWatch species information (File: FishWatch.pdf).
   http://www.nmfs.noaa.gov/fishwatch/
6. Divide the four restaurant menus among each group, assigning one or two students to one menu. These are selections based on actual restaurant menus with the names removed!
7. Each student should fill out a menu data sheet using information provided by FishWatch for each species. If you have internet access, you will see a list of species on the right hand side of the page. Click on species names to access information about each. If you do not have internet access, use the printed materials.
8. For each menu item, describe the current level of biomass (a measure of the quantity of the item, usually by weight), whether overfishing has occurred or is occurring and whether there is bycatch associated with the item. If the restaurant menu does not provide you enough information to decide how to fill out the data sheet, make sure to write that in your notes!
9. If a menu item contains more than one type of seafood, make sure students consider all types in the data sheet.
10. After each member is done evaluating a restaurant, groups should discuss their findings.
11. Finally, groups should write a short article for a local newspaper. The article should evaluate whether local "sustainable" seafood restaurants really live up to their claims. Students should answer all the following questions somewhere in the article:
    a. Why should a consumer care about the sustainability of seafood?
    b. How did you decide whether a restaurant is sustainable or not? (Hint: How does FishWatch define sustainability?)
    c. What were your findings: are most of the restaurants truly sustainable according to your determination or are most really not?
        i. How would you respond to the claim of restaurant A to be the "most sustainable restaurant in your city?"
        ii. How would you respond to the assertion that Restaurant D uses "only sustainable seafood?"
    d. Were all the menus clear about what type of fish the restaurant was offering?
    e. Was it possible in every case to determine if the fish were sustainable?
    f. What would you recommend to consumers who want to make sure that they are eating the most sustainable possible seafood? (Hint: Let consumers know what types of questions they should ask the restaurant to make sure they are getting a sustainably harvested item.)

Answer key

Answer keys for the menu data sheets are included here. Be aware that the stock status for different fish populations may change over time. If you see discrepancies between your students' answers and the answer key, you may want to look online to double-check the answers:

http://www.nmfs.noaa.gov/sfa/statusoffisheries/SOSmain.htm

The groups' articles will vary, but they should touch on some of the following key points: They should explain the concepts of sustainability and briefly touch on the problems of overfishing and bycatch They should explain how they decided if each restaurant was sustainable None of the restaurants offers entirely sustainable seafood (except perhaps restaurant B but it isn't possible to tell) In most cases, restaurants offer at least one item that should be avoided

In many cases, restaurants aren't clear about the origin or type of fish they offer, which makes it impossible to determine whether the item is sustainably harvested Consumers should ask the restaurants about the origin of the fish they want (if unclear) and, when the fishing method makes a difference, ask the restaurants if they are aware of the harvesting method of their products

NOTE: If you are short on time, you can have your groups answer the questions for the article rather than writing the actual article. However, time permitting, it is a valuable exercise in communication.

Restaurant A				
Menu item	**Biomass**	**Overfishing?**	**Bycatch?**	**Additional notes**
Mahi Mahi	No current estimates	No	Regulations in place to reduce bycatch	Menu did not specify the origin of the fish
Seafood Combination	Most of the choices have high biomass levels are rebuilding, but the origin of the crab is unspecified	Yes for some populations of American lobster, no for most types of crab	Some bycatch found in lobster traps	Did not specify the species of crab or the origin of the seafood
Pacific Halibut	High biomass	No	Some bycatch, regulations in effect	
Atlantic Salmon	Wild salmon are at very low levels	Yes, overfishing has occurred in the past. There are no current wild Atlantic salmon fisheries in the U.S.	No, as long as they are commercially farmed	Does not specify that the salmon is farmed

Restaurant B				
Menu item	**Biomass**	**Overfishing?**	**Bycatch?**	**Additional notes**
Sea Scallops	Very high	No	Some bycatch of sea turtles, finfish and other scallops possible	
Seafood Volcano (Crab, Shrimp, Lobster)	Population levels of most items are high or rebuilding, but in some cases, this depends on the species	Yes for some populations of American lobster, no for most types of crab and shrimp	Some bycatch found in lobster traps. For shrimp, bycatch depends on the area they are caught and the species, but bycatch can be a serious problem (in the Gulf of Mexico for example)	Menu did not specify origin or species of seafood
Fish and Chips	Cannot determine			Type of fish unclear
Red Snapper	Very low biomass	Yes	Bycatch thought to be minimal	

Restaurant C				
Menu item	**Biomass**	**Overfishing?**	**Bycatch?**	**Additional notes**
Fried Atlantic Clams	High biomass	No	Significantly reduced bycatch	
Fisherman's Linguini (clams, Longfin squid & Pacific sardines)	Clams, squid and sardines all have high biomass	No	Marine mammal bycatch for squid, little bycatch for sardines	
Whole Fish	Cannot determine	Type of fish unclear		
Black Sea Bass	Biomass very low in the South Atlantic but high in the Mid-Atlantic	Yes in the South Atlantic, uncertain in the mid-Atlantic	Some bycatch possible, it depends on the mesh size	Origin of fish unclear

Restaurant D				
Menu item	**Biomass?**	**Overfishing?**	**Bycatch?**	**Additional notes**
North Atlantic Albacore Tuna	Low	Yes	Longlines can take marine mammals, sea turtles and seabirds	
Stuffed Yellowfin Sole	High	No	Bycatch includes halibut, crab and other types of sole	
North Atlantic Swordfish	High biomass	No	Pelagic long-lines can inter-fere with marine mammals, sea turtles and seabirds	
Red King Crab	Most popula-tions of this type of crab are high	No, but there are some regions where overfishing is unknown	Some bycatch, methods to reduce bycatch in place	

Student Activity

Going Green? Evaluating "Sustainable" Seafood

Walleye pollock is a commercial species iused in McDonald's fish fillet sandwiches. Photo: NOAA

Do you like seafood?

If you are like the average American, you eat around 16lbs of fish and shellfish per year[3]! That is good news for the many fishing and marine aquaculture operations that sell to markets and restaurants in the United States. However, factors such as overfishing and bycatch threaten the sustainability of some fisheries.

Commercial fisheries are managed at the **stock** level. A fish stock is a group of individuals of the same species that inhabit the same geographic region and interbreed when mature. The **Maximum Sustainable Yield (MSY)** is the greatest number of fish that can be caught each year without impacting the long-term productivity of the stock. **Overfishing** occurs when fishing mortality exceeds a specific threshold, usually set at a level to achieve MSY. **Bycatch** refers to organisms other than the primary target species that are caught incidentally. Bycatch may include other fish species or endangered and threatened species like sea turtles, whales and dolphins.

Fortunately, there has been a lot of attention to increasing **sustainability** of fisheries over the past several years. In general sustainability represents the ability of a fish stock to persist in the long term. If a fish stock remains at a constant level (or even grows) despite fishing pressure over a long time period, it is considered sustainable. The Sustainable Fisheries Act of 1996 (a set of amendments to the 1976 Magnuson-Stevens Fishery Conservation and Management Act, which authorizes NOAA to manage U.S. commercial and sport fisheries) gave fishery managers new mandates and tools to promote sustainable fisheries. The Magnuson-Stevens Reauthorization Act of 2006 included items designed to end overfishing, expand programs to promote sustainable fisheries management and improve the science used to monitor and manage fisheries.

As the concept of sustainability has gained visibility in fisheries management and policy, commercial vendors like markets and restaurants are increasingly interested in offering sustainable seafood to their customers. This is a promising development, but can consumers be sure that restaurants are living up to their claims of sustainability?

Today, you and your team members are going to rate seafood restaurants that claim to be highly sustainable. You will evaluate a sample of menu options using NOAA's National Marine Fisheries Service (also referred to as NOAA Fisheries Service) FishWatch program.

The NOAA Fisheries Service is the U.S. Government's primary agency responsible for the stewardship of the nation's living marine resources and their habitats. The FishWatch program provides scientific information about different commercial marine species including population status, overfishing status and bycatch. This information is designed to help you make informed decisions about the seafood you eat.

Using FishWatch information, you will assess menus based on actual seafood restaurants that claim to serve sustainable fish. Using your results, you will write a short article to inform residents whether or not their favorite sustainable seafood restaurants are keeping their promises.

Procedure

1. Start with some background research. As a group, familiarize yourself with the information on the FishWatch homepage found at the link below. Note that if you do not have internet access, your teacher will provide you with printed materials to review.
   http://www.nmfs.noaa.gov/fishwatch/
2. Divide the four restaurant menus among your group, assigning one or two students to one menu. These are selections based on actual restaurant menus with the names removed!
3. In your small groups, fill out a menu data sheet using information provided by FishWatch for each species. If you have internet access, you will see a list of species on the right hand side of the page. Click on species names to access information about each. If you do not have internet access, use the printed materials provided by your teacher.
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5. If a menu item contains more than one type of seafood, make sure you consider all types in your data sheet.
6. After each member is done evaluating a restaurant, discuss your findings as a group.
7. Finally, write a short article for a local newspaper. The article should evaluate whether local "sustainable" seafood restaurants really live up to their claims. Remember that the story is for a general audience, so make sure that you explain any scientific terms in non-technical language. Make sure you answer all the following questions somewhere in the article:
   a. Why should a consumer care about the sustainability of seafood?
   b. How did you decide whether a restaurant is sustainable or not? (Hint: How does FishWatch define sustainability?)
   c. What were your findings: are most of the restaurants truly sustainable according to your determination or are most really not?
      i. How would you respond to the claim of restaurant A to be the "most sustainable restaurant in your city?"
      ii. How would you respond to the assertion that Restaurant D uses "only sustainable seafood?"
   d. Were all the menus clear about what type of fish the restaurant was offering?
   e. Was it possible in every case to determine if the fish were sustainable?
   f. What would you recommend to consumers who want to make sure that they are eating the most sustainable possible seafood? (Hint: Let consumers know what types of questions they should ask the restaurant to make sure they are getting a sustainably harvested item.)

Menu

First course	
Mahi Mahi	$8
Seafood Combination (American lobster, clams, crabs)	$42
Second course	
Pacific Halibut	$24
Atlantic Salmon	$28

Menu item	Biomass	Overfishing?	Bycatch?	Additional notes
Mahi Mahi				
Seafood Combination				
Pacific Halibut				
Atlantic Salmon				

Newspaper Article

Menu

Appetizers	
Sea Scallops	*$10*
Seafood Volcano (crab, shrimp, lobster)	*$38*
Entrees	
Pub Fish and Chips	*$12*
Red Snapper	*Market price*

Menu item	Biomass	Overfishing?	Bycatch?	Additional notes
Sea Scallops				
Seafood Volcano (Crab, Shrimp, Lobster)				
Fish and Chips				
Red Snapper				

Newspaper Article

Menu

Appetizers	
Fried Atlantic Clams	*$12*
Entrees	
Fisherman's Linguini (clams, Longfin squid, Pacific sardines)	*$23*
Whole Fish	*Market price*
Black Sea Bass	*$28*

Menu item	Biomass	Overfishing?	Bycatch?	Additional notes
Fried Atlantic Clams				
Fisherman's Linguini (clams, Longfin squid & Pacific sardines)				
Whole Fish				
Black Sea Bass				

Newspaper Article

Menu

Appetizers	
Red King Crab Legs	*$8*
Entrees	
Stuffed Yellowfin Sole	*Market price*
North Atlantic Swordfish	*Market price*
North Atlantic Albacore Tuna	*Market price*

Menu item	Biomass	Overfishing?	Bycatch?	Additional notes
Red King Crab				
Stuffed Yellowfin Sole				
North Atlantic Swordfish				
North Atlantic Albacore Tuna				

Newspaper Article