



## NOAA's West Coast Region

### Middle school Curriculum: Sustainable Halibut Fisheries

Recruiting teachers, Overview, Pre-Visit, Teacher Evaluation and Vocabulary

## Recruiting Teachers

NOAA's 6<sup>th</sup>-8<sup>th</sup> Grade Sustainable Halibut Fisheries Curriculum

Science kits:

- FOSS: Populations and Ecosystems (6-8)
- FOSS: Diversity of Life (6-8)
- STC: Organisms-From macro to Micro (6-8)

Social Studies and Classroom Based Assessment:

- History of fishery, gear, and technology
- Government, Policy, and International Management
- Economics (Stakeholders and how different levels of government regulate impacts)
- Civics (rights and responsibility of citizens)

Designed for **Classroom Based Assessment: Humans and the Environment**

## Curriculum Overview

Lesson	Topic	Activity	Length of Time	Materials Needed	Assessment
1	Life history, Adaptations, and Classification	Ideal fish to fish Fisherman's Next Top Model	50 min. period	Sustainability Poster/website worksheet computer access for research	Group work on classification and compare and contrast Halibut scale model Information card
2	Evidence of human interactions and Technology advancements	3 Threats using adverb clauses, Technology Challenge, and Timeline Cause and Effect	50 min. period	Timeline and Issues worksheet	Research worksheets
3	Fishing regulations and types of fisheries	Scale model awards Halibut derby data collection and lab write up Research type of fishery	50 min. period	worksheets large cookie sheet (for ocean) 1 sm. Dixie cup, 1 per student paper towels, 1 per student uncooked rice (for sand) green lentils (for algae) multicolored goldfish crackers red hots (for crabs) oyster crackers (for bivalves) chart paper to graph	Regulations/Management and Lab report worksheet
4	Government, Policy and Management	Quick write stakeholders Fisherman's Facebook page	50 min. period	Facebook page (1 per student) 4 posters (print off 10 of each per class)	Research worksheets
5	<b>NOAA representative:</b> Science, Management and Stewardship	Given stock assessment data, how do managers make allocations; stewardship	50 min. period	worksheet stock assessment activity they will bring	Datasheet Classroom participation

Classroom based assessment: Humans and the Environment, Checks and Balances, or International Relations  
<http://www.k12.wa.us/socialstudies/Assessments/MiddleSchool/MiddleSchGeo-HumansandTheEnvironment-CBA.pdf>

For a NOAA guest speaker in lesson 5 email: [wcr.education@noaa.gov](mailto:wcr.education@noaa.gov)



**NOAA's West Coast Region**  
 6<sup>th</sup>-8<sup>th</sup> Grade Curriculum: Sustainable Halibut Fisheries  
 Aligned for Social Studies CBA: "Humans and the Environment"

**Pre-Visit Questionnaire**

Your Name:		Teacher's Name:	
School/Groups Name:		Phone number:	
Periods: * * * * * *	Time: * * * * * *	Class size: * * * * * *	
School location:			
Driving Directions:			
Presentation Date:		Check in at office? Yes <input type="checkbox"/> No <input type="checkbox"/>	
		Room #:	
What is the best time to set up:		Resources that you brought:	
		# Distributed:	

**Content background knowledge**

- What background do your students have in policy and marine conservation efforts?
- Are there any vocabulary words or topics that you would like me to specifically address or connect to prior knowledge or concepts?

**Class dynamics**

- Do you have any special needs students?
- How do you involve them in group discussion? (raising hands?)
- What techniques do you use to get their attention? (clap, turn off lights, etc.)

**Equipment and Room Space**

- Computer and LCD projector? Yes  No  Macintosh  or PC
- Recommendations? own laptop  CD or flash drive  TV/VCR Yes  No   
 Make a pdf of your presentation to avoid inconsistencies in formatting/ font etc.
- Blackboard or dry erase board?
- Table if you have hands-on materials (baleen, salmon eggs, etc.)
- Open space if you are going to do an activity on the floor (sitting or able to move around)

**Timing**

- Will I have time to set up before you introduce me?
- What will they be doing before and after my presentation? (lunch or recess?)

← **OVER** →

Summarize your presentation for the teacher:

Notes and observations from your classroom visit:



**West Coast Region**  
 6<sup>th</sup>-8<sup>th</sup> Grade Curriculum: Sustainable Halibut Fisheries  
 Teacher Evaluation

**Classroom Background Information**

Teacher's Name:	NOAA representative:
School:	Visit Date:
Grade level:	# of students:
Subject/class name:	

<b>Teacher Evaluation</b>	Strongly disagree.....Strongly agree				
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>

Lessons 1-5: Was there enough background information?	1	2	3	4	5
Was the information age-appropriate?	1	2	3	4	5
Was the purpose clear?	1	2	3	4	5
Were the instructions for the lessons easy to follow?	1	2	3	4	5
Were the worksheets appropriate?	1	2	3	4	5
Were students successful using the websites?	1	2	3	4	5
Was the time estimated for each lesson accurate?	1	2	3	4	5
Did students enjoy the curriculum?	1	2	3	4	5
Would you teach it again?	1	2	3	4	5
Anything else you would like to tell us?					
NOAA Representative:					
Was the guest timely in preparation, delivery, and cleaning up?	1	2	3	4	5
Was the guest easy to understand/follow?	1	2	3	4	5
Was the guest's time valuable to the success of the curriculum?	1	2	3	4	5
Anything else you would like to tell us?					

**Please send to:** NOAA Fisheries, c/o Peggy Foreman, 7600 Sand Point Way NE, Bld. 1, Seattle, WA 98115

## 6<sup>th</sup>-8<sup>th</sup> Grade Social Studies Vocabulary

<b>Social Studies: History vocabulary</b>			
history ethnic groups racial groups cultural influence social influence conflict war religious motive political motive economic motive immigrant consequences	involuntary servitude federal policy treaty removal reservation allotment contemporary interpret points of view resistance assimilation	scientific invention technological invention social life economic life modes of transportation economic prosperity national unity exploration interaction native people territorial expansion	internal conflict external conflict diverse cultures 17 <sup>th</sup> Century 18 <sup>th</sup> Century European explorers European settlements American Revolution Civil War Reconstruction American Indians Manifest Destiny
<b>Social Studies: Geography vocabulary</b>			
maps globes graphs charts databases models landforms piedmont plateau	basin elevation tributary climate tundra prairie savanna canal urban	suburban rural metropolitan area estuary drought backcountry tidewater earthworks	annex cession province urbanization physical environment political development economic development westward migration
<b>Social Studies: Economics vocabulary</b>			
economics profit risk stock raw materials professional trade company export import debtor budget	inflation commerce supply demand natural resources conservation tariff taxation monopoly barter embargo	depression boycott boom bust capital human resource division of labor consumer good stock market unemployment rationing	interest trade-off opportunity cost entrepreneur free enterprise market economy deficit economic region diverse economy interest rate middle class
<b>Social Studies: Civics and Government vocabulary</b>			
democracy direct democracy democratic republic representative democracy monarchy	parliament congress dictatorship state coup d' etat	junta civil disobedience revolution independence legitimacy	colonialism empire emperor prime minister president

# Sustainable Halibut Fisheries

Middle school science: Life History, Adaptations and Classification

Lesson 1: Fisherman's Next Top Model Contest

	<b>Subject Area(s):</b> Life history and factors that influence population growth; adaptations, evolution, and classification	<b>Duration:</b> one 50 minute period
	<b>Key words:</b> halibut, flatfish, groundfish, scale, proportion, size, weight, counter shading, orientation, eye migration, swimming patterns, ontogeny, benthic, metamorphosis, morphological evolution	
<b>Materials:</b>	Sustainability poster or website <a href="http://www.nmfs.noaa.gov/speciesid/Sustainability.html">http://www.nmfs.noaa.gov/speciesid/Sustainability.html</a> Worksheet/rubric Computers with internet access	
<b>State Standards:</b> WA, OR, and ID	WA: EALR 1, 6-8 INQE (model object and explain how it is similar and different to actual) EALR 4, 6-8 LSIE (classify based on internal, external, and behavioral characteristics) EALR 4, 6-8 LS3E (adaptations are physical and behavioral changes that are inherited) OR: 6.2L.2 (explain how individual organisms and populations in an ecosystem interact) 8.1L.1 (explain how genetics and anatomical characteristics are used to classify organisms) ID: 6-7.S.1.2.3 (use models to explain or demonstrate a concept) 6.S.1.3.2 (use U.S. and metric system in data collection) 6.S.1.5.1 (analyze how the shape of an object is frequently related to function)	
<b>Focus Questions:</b>	What does a halibut look like? (Color, size, shape, weight, etc.) What factors can influence the size of an animal, its abundance, and distribution? What evidence of evolution and natural selection are seen in flatfish?	
<b>Learning Objectives:</b>	At the end of this lesson students will be able to: <ul style="list-style-type: none"> <li>• identify the general body plan, swimming orientation, and life cycle of halibut</li> <li>• describe the adaptations and evidence of evolution</li> <li>• explain the factors that influence population growth and how scientists study this</li> </ul>	
<b>Engage and Encounter</b>	Brainstorm with students what the "Ideal fish to fish" would be. Have them think of economic value, cultural perspectives, and environmental impacts.	
<b>Explore and Investigate</b>	Students will create a scale model of a Pacific halibut.	
<b>Reflect and Explain</b>	Students will investigate adaptations and evidence of evolution; classify according to order/suborder and compare and contrast species	
<b>Apply and Extend</b>	Compare halibut to other species of flatfish (arrowtooth flounder, dover sole, petrale sole, Atlantic or California halibut, etc.) Learn more about other types of groundfish and characteristics of fish.	
<b>Background for teacher</b>	Pacific halibut are large flatfish found on the continental shelf from California to the Bering Sea. Halibut have diamond-shaped bodies, can weigh more than 500 pounds, and can grow to nine feet long. The left eye migrates to the right hand side of the animal and there are approximately 80 dorsal soft rays. Halibut is low in saturated fat and sodium and is a very good source of protein, niacin, phosphorus, and selenium. Your students can make a model of the largest caught halibut, average male/female, or whatever category they choose, but encourage them to get multiple resources to verify their facts and be explicit of the size they focused on. A frequently asked question published by the IPHC was: How old is a 40 pound halibut? Quick answer: 12. Actually, there is no simple answer to this question. It all depends on the sex of the fish and from which regulatory area it came. Female halibut tend to grow faster, so a 40 pound female would be younger than a 40 pound male. Also, halibut seem to grow faster the farther northwest you go: a 40 lb fish off the coast of Washington State is likely to be a lot older than a 40 lb fish off of Kodiak Island, AK.	
<b>Contact NOAA</b>	For a NOAA guest speaker in lesson 5 email: <a href="mailto:wcr.education@noaa.gov">wcr.education@noaa.gov</a>	

## Lesson 1 Procedures

### Fisherman's Next Top Model Contest: Life History, Adaptations and Classification

#### I. Whole Class: Anticipatory Set: (15 minutes)

A. **Ideal fish to fish:** Brainstorm with the students the characteristics of a fish that might be valuable to humans.

1. Draw a very generic fish on the board and encourage students to think about the economic characteristics: such as tasty, so people would buy it; large size might be financially profitable; catchable, etc.
2. What are the social or cultural connections that might make a fish valuable to fishing communities: such as spiritual significance or traditional implications, etc.
3. What are the environmental connections that might make a fish valuable to humans and their environment: such as provides food for other animals; preys on other species in the food web, promotes biodiversity etc.
4. Once finished brainstorming, write the word halibut under that fish or change the drawing. Have the students turn to their neighbor and see if they can think of the three changes halibut larvae undergo before settlement. How might this be evidence of evolution? Halibut larvae have eyes on both sides of the head and swim like most pelagic fish; during development the left eye migrates to the right side of the body, making it a right eyed flatfish. They also rotate 90 degrees, so that the left side is on the ground. The last change is the asymmetrical coloration where that left side turns white (counter shading) and the right side's pigment cells allow the fish to camouflage itself.

B. Introduce the Fisherman's Next Top Model Contest. Teams of 1-2 students will research the life history of halibut and make a true scale model.

#### II. Direct Instruction: (35 minutes)

A. **Fisherman's Next Top Model Contest:** Ask the students to turn to their neighbor and describe what a scale model is. Probe them to explain how to create a scale model. Highlight that they are smaller versions of real things that are in correct proportion. Emphasize that there is a mathematical relationship between the model and the object that exists in real life.

B. Hand each student the worksheet/rubric and walk through the example of using ratios/fractions to determine scale. Tell students they are going to make a scale model of either a halibut, sable fish, or a salmon, then make an information card to explain the scale and give a life history of the animal. Emphasize materials should be recycled to even the playing field and brainstorm ways to include weight in their model. Reinforce the due date (Assign on a Friday or Monday and make due on Tuesday or Wednesday works best; you will need it done for the 3<sup>rd</sup> lesson or at least the information card). \*Modify to all students making halibut, or other types of benthic or groundfish; or groups of students could work on this.

#### III. Assessment:

A. Group work on classification and comparing and contrasting, Halibut scale model and life history information card worth 50 points total, see rubric.

#### IV. Apply and Extend:

- A. Students could compare halibut to other species of flatfish (arrowtooth flounder, dover sole, petrale sole, Atlantic or California halibut, etc.)
- B. Great website allowing students to become familiar with some common fish also we have posters that can complement this web-based activity  
<http://www.nmfs.noaa.gov/speciesid/Sustainability.html>
- C. Weird fins website: <http://www.nmfs.noaa.gov/rss/podcasts/weirdfins/edition.htm>



# Fisherman's Next Top Model Contest

Names:

		Grading criteria:	Value	Your Points
1. <b>Group work:</b> Your group will be assigned to research the order or suborder of your type of fish, name some species that are also in that group and if you were to classify them how would they be similar or different? (10 points)		<b>Quality of research:</b> Characteristics of order/suborder Different species within that group What classifying qualities make them different?	5 pts 5 pts	
2. <b>Scale model:</b> Your team will make a scale model of the Pacific halibut, a species of Pacific salmon, or sablefish. Please do not go out and spend money on fancy materials; try your very best to use recycled products from school or home. (20 points)		<b>Accuracy and scale</b> Size/proportion Shape Weight Coloration is realistic, detailed and neat	5 pts 5 pts 5 pts 5 pts	
3. <b>Information card:</b> Investigate its life history and write this either on a large index card or half piece of card stock. This will be used in lesson 3, so please make sure your name is on both the model and this card. Here are some websites that might be useful in your research: <a href="http://www.fishwatch.gov/seafood_profiles/species/halibut/species_pages/pacific_halibut.htm">http://www.fishwatch.gov/seafood_profiles/species/halibut/species_pages/pacific_halibut.htm</a> <a href="http://www.pcouncil.org/wp-content/uploads/halibut_fact_sheet2.pdf">http://www.pcouncil.org/wp-content/uploads/halibut_fact_sheet2.pdf</a> (20 points: 10 points for key characteristics and 10 points for life cycle)		<b>Content accuracy:</b> Size (length and weight) Coloration Counter shading Eye migration Orientation (right or left sided?) Compressed (laterally or dorsal/ventrally?) Swimming patterns Adaptations Habitat Life cycle Cite your sources	10 pts 10 pts	
<b>Comments:</b>		<b>TOTAL:</b>		<b>/50</b>



## Determining scale:

### Real car

length: 17 ft.  
width: 5 ft.  
weight: 3,200 lbs

### Model/match car

length: 2.5 inches  
width: 1.5 inches  
weight: 20 grams

### Real fish

length:  
width:  
weight\*:

### Model fish

length:  
width:  
weight\*:

**\*Note:** you might want to use two ratios; one for size (length and width) and one for weight.

**\*\*Don't forget to site your sources on your information card.**

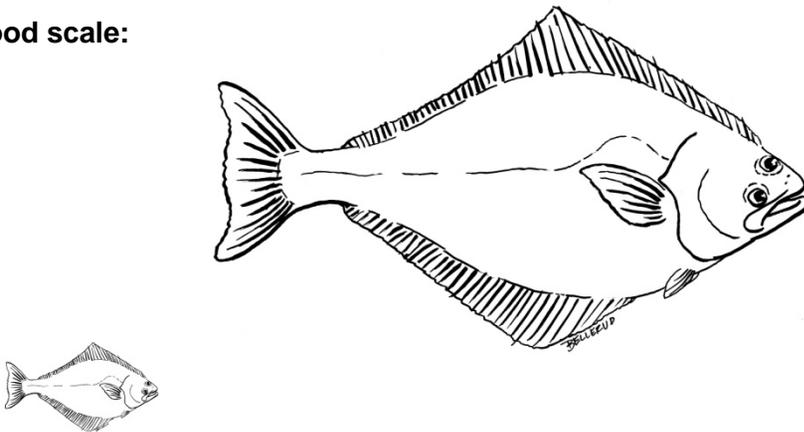
**Step 1: Convert the units** of the real item to the units you will use in the model. (Change 17 feet into inches, like your model. How many inches in a foot? So the real car is 204 inches)

**Step 2: Set up a ratio** where the numerator (top number) is the model item and the denominator is the real life item. Your goal is to get the numerator to 1. So divide the top and bottom by the numerator and that will give you the scale or ratio.

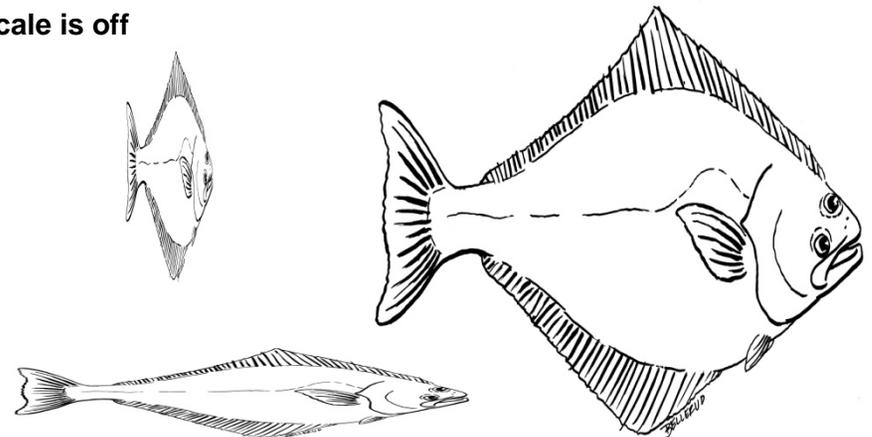
$$\frac{2.5 \text{ inches}}{204 \text{ inches}} \div 2.5 \text{ inches} = \frac{1}{81.6} \quad \text{or} \quad \frac{1}{82}$$

**Step 3: Interpret:** for every inch of your model it represents 82 inches in real life.

### Good scale:



### Scale is off



# Sustainable Halibut Fisheries

Middle school science: Evidence of Human Interactions and technology advancement  
Lesson 2: Technology Challenge, History of Halibut Fishery, and Top 3 issues

	<b>Subject Area(s):</b> Sustainable fishing practices, environmental or human impacts on an environment (overfishing, bycatch, habitat)	<b>Duration:</b> one 50 minute period
<b>Key words:</b> sustainable fishery, seine nets, trawls, troll, long-line, treaty, International Pacific Halibut Commission, Pacific Fisheries Management Council		
<b>Materials:</b>	Worksheet Computers with internet access	
<b>State Standards:</b> WA, OR, and ID	WA: EALR1, 6-8 SYSF (highlight how changes in one part of the system are likely to influence other parts of the system) EALR3, 6-8 APPA, B, C, D, and E (using technology to solve a problem, interdependent with science, generate solutions) EALR 4, 6-8 LS2E (environmental issues, human interactions and threats) OR: 7.2E.3 (evaluate natural processes and human activities) 7.4D.3 (engineering design: explain how new scientific knowledge develops solutions) ID: 6.S.5.2.1 (describe how science and technology are part of our society) 7.S.5.2.1 (explain how science and technology are interrelated)	
<b>Focus Questions:</b>	How has halibut fishing changed over the years? Are the practices used today like the past? How have technology, science, & policy/management influenced or played a role in sustainability?	
<b>Learning Objectives:</b>	At the end of this lesson students will be able to: <ul style="list-style-type: none"> <li>• Develop critical thinking skills by defining and identifying cause and effect and generating examples of cause and effect statements</li> <li>• Draw conclusions based on evidence of past events</li> <li>• Apply their knowledge of cause and effect to explain what a sustainable fishery is</li> </ul>	
<b>Engage and Encounter</b>	Discuss how technology/science are interrelated and how the fishing industry has changed over time. Look at cause and effect relationships using timeline.	
<b>Explore and Investigate</b>	Discuss overfishing, bycatch, and habitat destruction and what cause and effect relationships have influenced the fishery over time.	
<b>Reflect and Explain</b>	Technology challenge: address one of the threats and attempt to solve one of the issues.	
<b>Apply and Extend</b>	Make Now and Then posters focusing on gear, technology, and advancements. Interview an elder to learn more about the fishery, science or technology.	
<b>Background for teacher</b>	Native Americans have fished halibut both on the East and West coast for many centuries. The groundfish fishery however first started on the East coast and started around 1888 on the West Coast. The groundfish managed under the Pacific Coast groundfish Fishery Management Plan (FMP) include more than 90 different species that, with a few exceptions, live on or near the bottom of the ocean. Students will investigate when certain events happened in history to shape this industry (technology advancement in nets, vessels, and navigational equipment) and emphasize the cause and effect relationships. Exploring these cause and effect relationships will help students think logically and draw conclusions based on evidence. By exploring how change has occurred over time in this fishing industry, students will see firsthand the trial and error of methods, which is key to the scientific method.	
<b>Contact NOAA</b>	For a NOAA guest speaker in lesson 5 email: <a href="mailto:wcr.education@noaa.gov">wcr.education@noaa.gov</a>	

## Lesson 2 Procedures

### Technology Challenge, History of Halibut Fishery, and Top 3 issues

#### I. Anticipatory Set: (10 minutes)

- A. Do you think the halibut fishery today is like it was 400 years ago? No. How has the technology changed? Vessels have advanced with engines, navigation devices, better knowledge of bathymetry, refrigerated containers for holding fish, are a few to start a discussion.
- B. Hand out the worksheet, History of Halibut Fishery Timeline, and have them use the following two sites to help guide students on the history of Pacific Halibut Fisheries: [http://www.fishwatch.gov/seafood\\_profiles/species/halibut/species\\_pages/pacific\\_halibut.htm](http://www.fishwatch.gov/seafood_profiles/species/halibut/species_pages/pacific_halibut.htm) and [http://www.pcouncil.org/wp-content/uploads/halibut\\_fact\\_sheet2.pdf](http://www.pcouncil.org/wp-content/uploads/halibut_fact_sheet2.pdf)

#### II. Direct Instruction: (40 minutes)

- A. **Top Three Issues:** Turn the worksheet over and ask the following questions: How has technology, science, and policy/management influenced or played a role in sustainability? Split the class into three groups and have them come up with cause and effect statements using one of the following themes.
  1. **Overfishing,**
  2. **bycatch, and**
  3. **habitat destruction**
- B. While students are brainstorming or defining what their term means, write on the board example adverb clauses phrases that can help frame their statements.
  1. I think...was caused by...
  2. The effects of...were...
  3. The main cause of...was probably...
  4. The reason for...was...
  5. Due to the fact that...
  6. ...occurred, and consequently...
  7. That wasn't caused by...because...

Have students share their statements and ground truth any ideas/facts.

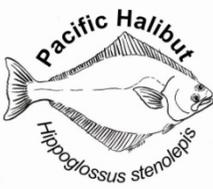
- C. **Optional: Technology Challenge:** Introduce this project and have them write the due date (3-4 days) on their worksheet or planner. They can work in partners or on their own to come up with a new technology idea to improve groundfish fishing or scientific research. They will create a model/prototype and write a one page summary of how the device works, what it is made of, estimated cost, and purpose. Have students emphasize how this new technology addresses sustainability, overfishing, bycatch, or habitat destruction.

#### III. Assessment:

- A. Finish the worksheet and encourage them to investigate the above websites to learn more about halibut, salmon, or sablefish.
- B. Optional: technology challenge, see above.

#### IV. Apply and extend:

- A. Students could make Now and Then posters of contemporary halibut fishing gear, boats, or other technology in comparison to past practices.
- B. Have students interview an elder of any sort and ask them what they think of fishing practices today. How has the fishing industry changed over time? (Interviewing an elder fisherman would be ideal, but not realistic. Elders in your family or community should still have an opinion on the subject.)



# History of Halibut Fishery: Timeline

Visit the following website to help you:

[http://www.fishwatch.gov/seafood\\_profiles/species/halibut/species\\_pages/pacific\\_halibut.htm](http://www.fishwatch.gov/seafood_profiles/species/halibut/species_pages/pacific_halibut.htm) and

[http://www.pcouncil.org/wp-content/uploads/halibut\\_fact\\_sheet2.pdf](http://www.pcouncil.org/wp-content/uploads/halibut_fact_sheet2.pdf)

Time	Events	Cause	Effect
>400ya	<b>Aboriginal Fishing</b> ~ many centuries ago fished the waters of the northwestern coastline of North America. These indigenous people took what they needed and the fish were abundant.		
17 <sup>th</sup> century	<b>Groundfish Fishery on East Coast</b> ~400ya Groundfishing, the catching of fishes that swim in close proximity to the bottom, was the first colonial industry in America. Cod, Haddock, Redfish, Yellowtailed flounder, ocean perch...to name a few.		
18 <sup>th</sup> century	<b>Halibut Fishery Began:</b> Cod fishermen on the New England banks regarded halibut as a pest which drove cod from their lines. When the exceptional merits of the halibut as a food fish were discovered, the sons of these fishermen were willing to go as far as the Grand Banks of Newfoundland to bring back halibut for the eastern markets.		
19 <sup>th</sup> century	<b>Collapse:</b> By 1850 the Atlantic halibut had become so scarce on the nearer banks that it commanded a luxury price. ~1883: The completion of the Northern Pacific <b>Railway</b> opened the way for tapping the virtually untouched stocks of Pacific halibut from the West coast. -1888: <b>Pacific Halibut Fishery started</b> -1910: Expanded from Washington to Alaska ~700 miles Shortly after extended from CA up to Bering Sea		
20 <sup>th</sup> century	<b>1923 Treaty</b> with Canada and U.S.A. was established to study and conserve the fishery. 3 other conventions occurred in 1930, 1937, 1953, and 1979. -1982: Northern Pacific Halibut Act		
21 <sup>st</sup> century	Today: Future:		



# How has the Halibut Fishery changed over time?

How has halibut fishing changed over the years? Are the practices used today, like the past? How has technology, science, and policy/management influenced or played a role in sustainability?

Cause and effect statements:

Overfishing:	
Bycatch:	
Habitat destruction:	

## Define sustainable=

What testable experiments could scientists do to help better understand overfishing, bycatch, or habitat destruction?

If it were up to you, how would you regulate or limit fishing in order to create a sustainable fishery?

**Technology Challenge:** Work in partners or on your own to address one of the threats above by changing the technology to improve fishing techniques or scientific research. Create a prototype and 1 page summary of your idea. Make sure you include estimated cost, materials, how it works, and what issue it addresses. How does your technology improve sustainability?



# History of Halibut Fishery: Timeline **KEY**

Visit the following website to help you:

[http://www.fishwatch.gov/seafood\\_profiles/species/halibut/species\\_pages/pacific\\_halibut.htm](http://www.fishwatch.gov/seafood_profiles/species/halibut/species_pages/pacific_halibut.htm) and  
[http://www.pcouncil.org/wp-content/uploads/halibut\\_fact\\_sheet2.pdf](http://www.pcouncil.org/wp-content/uploads/halibut_fact_sheet2.pdf)

Time	Events	Cause	Effect
>400ya	<b>Aboriginal Fishing</b> ~ many centuries ago fished the waters of the northwestern coastline of North America. These indigenous people took what they needed and the fish were abundant.	Sustainable fishery	Abundant resource
17 <sup>th</sup> century	<b>Groundfish Fishery on East Coast</b> ~400ya Groundfishing, the catching of fishes that swim in close proximity to the bottom, was the first colonial industry in America. Cod, Haddock, Redfish, Yellowtailed flounder, ocean perch...to name a few.	Abundant resource	Once fed millions of Americans
18 <sup>th</sup> century	<b>Halibut Fishery Began:</b> Cod fishermen on the New England banks regarded halibut as a pest which drove cod from their lines. When the exceptional merits of the halibut as a food fish were discovered, the sons of these fishermen were willing to go as far as the Grand Banks of Newfoundland to bring back halibut for the eastern markets.	Realized halibut could be a food fish; some changed from cod to halibut \$\$\$	Halibut fishery began
19 <sup>th</sup> century	<b>Collapse:</b> By 1850 the Atlantic halibut had become so scarce on the nearer banks that it commanded a luxury price. ~1883: The completion of the Northern Pacific Railway opened the way for tapping the virtually untouched stocks of Pacific halibut from the West coast. -1888: <b>Pacific Halibut Fishery started</b> -1910: Expanded from Washington to Alaska Shortly after extended from CA up to Bering Sea	Classic supply and demand Hard to catch, Signs of overfishing, Changing equipment & technology	Fishermen could get GOOD \$ for them; Reduced Atlantic stocks; Sail boats changed to steamboat & equipment/gear developed
20 <sup>th</sup> century	<b>1923 Treaty</b> with Canada and U.S.A. was established to study and conserve the fishery. 3 other conventions occurred in 1930, 1937, 1953, and 1979. -1982: Northern Pacific Halibut Act	1 <sup>st</sup> International Management/regulatory efforts; vessel changes from steam to diesel; mechanically hauling gear changed the fishery.	Establishing ways to study natural history, populations/ and effects of fishery
21 <sup>st</sup> century	<b>Today:</b> <b>Future:</b>	Constantly working to assess the <b>population...</b>	Still working to create a sustainable <b>fishery</b>



# How has the Halibut Fishery changed over time?

How has halibut fishing changed over the years? Are the practices used today, like the past? How has technology, science, and policy/management influenced or played a role in sustainability?

Cause and effect statements:

Overfishing:	I think <b>overfishing</b> was caused by <b>harvesting fish without knowing exact population sizes</b> . The effects of <b>overfishing</b> were <b>impacting populations, other groundfish, and people</b> . Due to the fact that <b>overfishing</b> of certain species occurred, <b>regime shifts probably occurred making the ecosystem more vulnerable for other species to thrive (maybe even non-edible species)</b>
Bycatch:	The main cause of <b>bycatch</b> is <b>the equipment is not species specific (openings in nets can catch many different species)</b> . The reason for reducing <b>bycatch</b> in other fisheries is <b>to not be wasteful and make a profit if you catch a non-target species</b> .
Habitat destruction:	I think that <b>habitat destruction</b> effects <b>not only the target species, but the whole food web and benthic environments if trawled</b> . That was not caused by <b>habitat destruction from fishing gear</b> because <b>that area is closed to fishing</b> .

**Define sustainable=** Capable of being continued with minimal long-term effect on the environment. 3 components: economics, environment, and society.

What testable experiments could scientists do to help better understand overfishing, bycatch, or habitat destruction?

How many fish are out there? (stock assessments and population structures) How many can we catch and still leave enough reproductively viable animals? How much is too much to catch? How does overfishing affect the rest of the food web? What pressures from overfishing affect the biota, the ecosystem, and the stakeholders? When bycatch is not allowed, what is the success rate of throwing fish back in? What physiological effects do fish have when brought up too fast? Or up from the deep? Are certain types of fisheries catching halibut by accident and what might influence that? What technology can be used to reduce bycatch? How are different age classes using the habitat? How is recruitment effected by trawling? (target species and others) How does fishing gear or fishing strategies effect benthic ecosystems? What are the short term and long term effects of habitat destruction? Trawling? How do we mitigate habitat destruction and what are the time frames?

If it were up to you, how would you regulate or limit fishing in order to create a sustainable fishery? Closing certain areas, fishing periods/seasons, fishing periods with limits, gear restrictions, recreational bag limits, size limits of fish, and vessel size (length of vessels or how much they can hold).

**Technology Challenge:** Work in partners or on your own to address one of the threats above by changing the technology to improve fishing techniques or scientific research. Create a prototype and

1 page summary of your idea. Make sure you include estimated cost, materials, how it works, and what issue it addresses. How does your technology improve sustainability?

# Sustainable Halibut Fisheries

Middle school science: Fisheries Science, Regulations, and Types of Fisheries  
Lesson 3: Halibut Derby

	<b>Subject Area(s):</b> Science: Sustainable fisheries/ ecosystems/ economics	<b>Duration:</b> one-two 50 minute period(s)
	<b>Key words:</b> halibut, conservationist, sablefish, commercial fishery, sport fishery, tribal fishery, resource management, usual and accustomed fishing grounds, troll fishery, and incidental catch or bycatch, exclusive economic zones	
<b>Materials:</b>  <b>**Prep</b> beforehand. Recipe for 1 cookie sheet for 4-8 students.	Worksheet IPHC poster and map of 2A Computers with internet access 2-4 Large cookie sheets for oceans Paper towels for each student 1 small Dixie cup for each student Uncooked rice for sand (1 cup/ocean)	Green lentils for vegetation (1/2 cup/ocean) Regular goldfish crackers (1 cup/ocean) Multi-colored goldfish crackers (1 cup/ocean) Baby goldfish crackers (1/2 cup/ocean) Oyster crackers for bivalves (1/2 cup/ocean) Red hots for crabs (handful/ocean) Chart paper/dry erase board/Excel for graph
<b>State Standards:</b> WA, OR, and ID	WA: EALR 2, 6-8INQC (collecting, analyzing, displaying data and interpreting patterns) EALR 2, 6-8 INQF (Lab write up differentiating results and conclusion) *math connection (*a 7.4E evaluate data for bias and explain reasons) EALR 2, 6-8 INQH (Intellectual honesty) OR: 6.3S.1 (based on observation and science principles propose question/hypothesis) 7.3S.2 (organize, display, analyze relevant data) 8.3S.2 (construct an evidence based explanation from results of data) ID: 6.S.5.1.1 (Identify issues for an environmental study) 7.S.1.2.1 (describe how observation and data are evidence of scientific explanation) 7.S.1.6.3 (evaluate data in order to form a conclusion)	
<b>Focus Questions:</b>	Why are there different fishing areas in our oceans? Who manages this resource? How do federal, state, local, and tribal governments manage and work together? How do policy and management ensure sustainability within a fishery?	
<b>Learning Objectives:</b>	At the end of this lesson students will be able to: <ul style="list-style-type: none"> <li>explain the differences in the five fisheries in the 2A region;</li> <li>list at least five ways a fishery is managed</li> <li>describe what allocations are and how they were established</li> </ul>	
<b>Engage and Encounter:</b>	Fisherman's next top model awards	
<b>Explore and Investigate:</b>	Halibut derby: Have students visualize how the regulatory regions are divided and why. Collect data, analyze results and draw conclusions.	
<b>Reflect and Explain:</b>	Students will research one of the types of fisheries and then analyze allocations to better understand how different types of equipment/fisheries impact issues	
<b>Apply and Extend:</b>	Have students research different types of fisheries doing queries (see link below) Facing Our Futures Lesson Plans <a href="http://www.facingthefuture.org/Home/FTFMembershipLogin/tabid/62/default.aspx?returnurl=%2fDesktopModules%2fFTFModules%2fwfLogDownload.aspx%3fFileToDownload%3d2712#.Unlx1Pmko9Y">http://www.facingthefuture.org/Home/FTFMembershipLogin/tabid/62/default.aspx?returnurl=%2fDesktopModules%2fFTFModules%2fwfLogDownload.aspx%3fFileToDownload%3d2712#.Unlx1Pmko9Y</a>	
<b>Background for teacher:</b>	Pacific halibut is managed by the United States and Canada in a bilateral commission known as the International Pacific Halibut Commission (IPHC). Each year, the Commission sets total allowable catch levels for halibut that will be caught in the U.S. and Canadian exclusive economic zones in the northeastern Pacific Ocean. The IPHC refers to U.S. waters off the states of Washington, Oregon and California collectively as "Area 2A." Regulations for Area 2A are set by the Commission and divided between tribal and non-tribal fisheries, between commercial and recreational fisheries, and between recreational fisheries in different states (Washington, Oregon, and California). There is also another group known as the Pacific Fishery Management Council that each year writes a catch-sharing plan describing these allocations and the Commission signs off on them.	
<b>Contact NOAA:</b>	For a NOAA guest speaker in lesson 5 email: <a href="mailto:wcr.education@noaa.gov">wcr.education@noaa.gov</a>	

# Lesson 3 Procedures

## Halibut Derby: Fisheries Science, Regulations, and Types of Fisheries

### I. Anticipatory Set: (15 minutes)

A. **Fisherman's next top model awards:** Gather students around the models and make sure they have their information card (names on both the card and model).

1. Hand out awards according to your own criteria, could be overall or each of these categories per type of fish (halibut, sablefish, and salmon):
  - a. Largest fish (this might be largest model or it could be by the ratio)
  - b. Heaviest fish
  - c. Prettiest fish
  - d. Most realistic fish or accurately depicted

B. Now have students get ready for the Halibut Derby. Have students get a paper towel, worksheet, a Dixie cup and make sure there is a mark about 1 inch from the bottom (their limit). Placing a tea light in the cup to trace around makes an efficient way to get a line.

### II. Direct Instruction: (35 minutes)

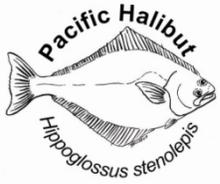
- A. **Halibut Derby:** Pacific Halibut are not targeted with trawl gear, but trawl gear is being used to demonstrate the derby and gear selectivity. This activity will depict a bottom trawl which is a cone shaped net that drags along the seafloor. If you want to show them pictures of different types of vessels, trawl in particular, try this websites: <http://www.nmfs.noaa.gov/speciesid/Sustainability.html>
- B. Set a cookie sheet at a table for 4-8 students to fish out of. Lay a piece of yarn about 2 inches from one end and tell students there is a "no fish zone" where sensitive habitat is protected and off limits.
- C. Ask students to describe their ocean in front of them. Encourage them to describe the habitat and diversity of fish species. Inform students that their target species is a benthic fish, the Pacific halibut, the normal gold fish cracker.
- D. For the derby they will drag a trawl (Dixie cup) on the bottom of the ocean (cookie sheets) in search of halibut for 30 seconds, only on 80% of the cookie sheet, and they can only fill their trawl up to the 1" line in their cups. When the derby is done, they will haul up their nets, empty contents on deck (their paper towel), sort by species. First have them make a regular goldfish pile (big and small), colored fish pile, oyster cracker pile, crustacean pile (crabs, shrimp, or other), finally set the lentils and sand aside. Fill out the worksheet and compare with the other students at their table.
- E. Did they experience any of the threats? Were there any fish left in the ocean, why is this important? Discuss the regulations (time restriction/openings, geographical locations and relieving pressure on other areas; and lastly quotas.) Brainstorm other ways to manage.
- F. Emphasize that 80% was fictional, but in order to have enough crackers for everyone it was appropriate for this lesson. Ask them what other ways were unrealistic.
- G. Lastly explain that NOAA scientists collect data directly from fishermen (catch data, size, weight, sex, age and other statistics; they call this data fishery dependent. What biases are there? Fishermen target areas of highest fish densities and they prefer/take the largest fish. Now compare to fishery independent research on population studies. How would they do it? Use their own boat, go to statistically random collection sites, and use other types of collecting methods.
- H. When done the students can eat the consumable goodies but place the uncooked/inedible items (rice, lentils, etc.) back on cookie sheet. Then direct them to their homework/research project and emphasize when it is due.
  - I. Share with them that off the coast of Washington, Oregon, and California there are 5 different halibut fisheries. Split the class into 6 groups: Tribal fisheries; Sport fishery in Washington; Sports fisheries in Oregon and California; Halibut commercial fishery; Salmon commercial troll fishery with incidental halibut retention; and Sablefish commercial longline fishery with incidental halibut retention.

### III. Assessment:

- A. Fishing Derby and allocations worksheet to be finished either individually or in teams.
- B. Research one of the five fisheries.

### IV. Apply and extend:

- A. Have students do queries on landing data and better understand fisheries:  
<http://www.research.noaa.gov/k12/index.html>



# Lab Report:

Title: Halibut Derby	Purpose (target species?)
Hypothesize what will happen:	
Materials:	
Procedures:	
<b>CATCH DATA:</b>	
<p><b>Type A</b> catch are TARGET fish brought back to the dock. (Halibut, large regular goldfish crackers)</p>	
<p><b>Type B1</b> catch are UNSELLABLE target or non-target fish or other organisms that may have DIED on the haul up. These fish are often used for bait or released dead. (green goldfish crackers)</p>	
<p><b>Type B2</b> catch are SMALL target fish or ALIVE non-target species that are released back into the ocean. (baby goldfish crackers, all other colors of goldfish crackers, any other species like bivalves(clams, mussels, oysters, scallops, etc. which are represented by the oyster crackers) or crabs (red hots).</p> <p style="text-align: right;"><b>QUANTITY</b></p>	
TOTAL CATCH= Type A + B1 + B2	
<p>HARVEST = Type A + B1 Animals removed from the population or ocean</p>	
<p>LANDINGS = Type A only Animals that you will sell or eat</p>	
RELEASED ALIVE = Type B2 only	
What percentage of target species did you get from your total catch? (Type A/Total catch)	

Results and graphs:

Conclusions:

What did this fishing derby teach you and explain ways it was realistic and not. Put into context of the real world and the three threats you learned about yesterday. What questions arose for you?



## Halibut Derby

What stipulations were put on you for the derby? These regulations control what?

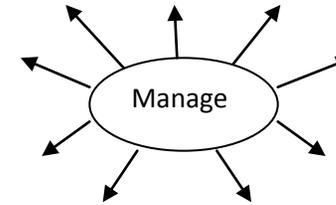
The three main threats you learned about in lesson 2, how does policy, regulation, and management work towards sustainability?

Scientific data collected by fishermen like catch data with information like length, weight, sex, age and other statistics is called **fishery dependent**.

**What biases come from this data?**

- 
- 
- 
- 

**Sustainability:** What are some other ways a fishery is managed to ensure sustainability? [http://www.pcouncil.org/wp-content/uploads/groundfish\\_fact\\_sheet1.pdf](http://www.pcouncil.org/wp-content/uploads/groundfish_fact_sheet1.pdf)



**Fishery independent data** might be collected how?

Location:

Method:

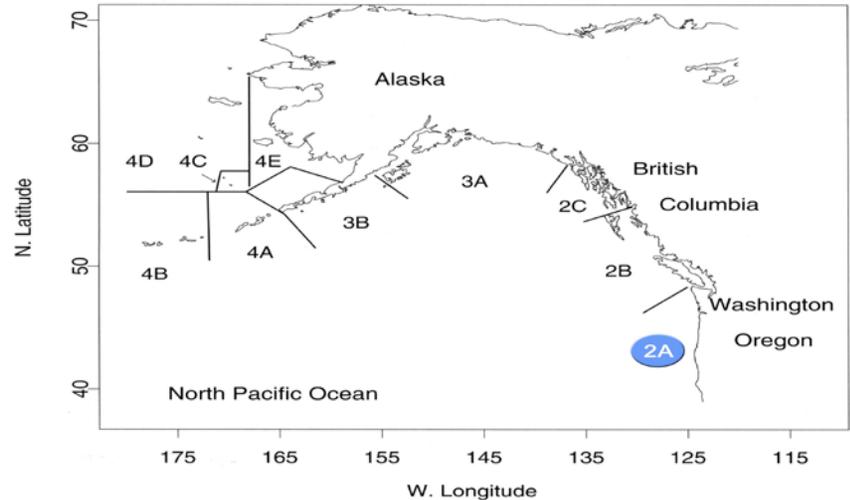
What driving questions are the scientists asking?



## Regulations and Management

Looking at the map, what are the advantages of dividing the regulatory areas into these regions?

How do two countries manage a fish that lives in an environment that has no boundaries?



**IPHC Regulatory Areas**

**Research:** Choose one of the five types of halibut fisheries in the 2A region and investigate the following:  
[http://www.westcoast.fisheries.noaa.gov/fisheries/management/pacific\\_halibut\\_management.html](http://www.westcoast.fisheries.noaa.gov/fisheries/management/pacific_halibut_management.html)

**Fishery type:** tribal, sport, commercial or incidental catch in the sablefish longline fishery or salmon troll fishery.

**Area allowed to fish:**

**Season:**

**Who manages:**

What gear is used to fish for halibut and explain the pros and cons.  
[http://www.pcouncil.org/wp-content/uploads/halibut\\_fact\\_sheet2.pdf](http://www.pcouncil.org/wp-content/uploads/halibut_fact_sheet2.pdf)

Pros

Cons

# Sustainable Halibut Fisheries

Middle school science: Government, Policy, and Management

Lesson 4: Fisherman's Facebook stakeholder's profile

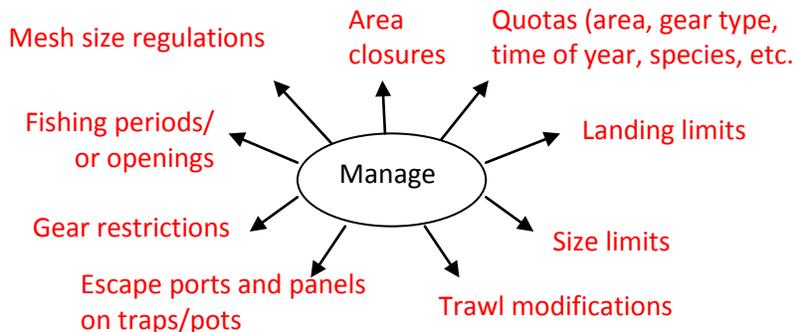
	<b>Subject Area(s):</b> Government, Policy and Management	<b>Duration:</b> one 50 minute period
	<b>Key words:</b> Department of Fisheries and Ocean (DFO), National Marine Fisheries Service (NMFS) also known as NOAA Fisheries, International Pacific Halibut Commission (IPHC), Pacific Fisheries Management Council (PFMC), allocate, and public comments. conflict resolution, checks and balances, testimonies	
<b>Materials:</b>	Facebook worksheet 4 posters (print off about 10 of each, per class) Computers with internet access	
<b>State Standards:</b> WA, OR, and ID	WA: EALR 4, 6-8 LS2E Social Studies EALR 1.2 (organization of governments, laws, and political systems) Social Studies EALR 3.2.1 (understands human interactions with environment) Social Studies EALR 5.1.1 and 5.1.2 (understands a position on an issue/evaluates significance) OR: SS.6-8.CG.03.01 (understand the basic idea of checks and balance of government) ID: 7.S.5.2.1 (explain how science and technology are interrelated)	
<b>Focus Questions:</b>	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?	
<b>Learning Objectives:</b>	At the end of this lesson students will be able to: <ul style="list-style-type: none"> <li>Describe the international management of halibut in the Pacific Northwest.</li> <li>Explain the representations of different stakeholders on the IPHC or on the Pacific Fisheries Management Council and how they work together to create a sustainable fishery.</li> <li>Explain the checks and balance in the management of the halibut fishery.</li> </ul>	
<b>Engage and Encounter:</b>	Review ways to manage a fishery Quick write on who the stakeholders are	
<b>Explore and Investigate:</b>	Students will learn how the halibut fishery in the NE Pacific is managed on international, federal, state, and local levels.	
<b>Reflect and Explain:</b>	Students will also understand how agencies, non-governmental organizations, and workplaces actually work on problems.	
<b>Apply and Extend:</b>	Have the students research or interview a real stakeholder. Write a testimony (template provided)	
<b>Background for teacher:</b>	In 1923 the U.S. and Canada signed a convention on halibut, leading to the eventual creation of the International Pacific Halibut Commission (IPHC). This international management example explores an ecosystem approach to management. Understanding who makes the decisions and how one gets involved is vital to establishing interconnections between humans and the environment. Resource Management issues regarding how fisheries promote sustainable practices and problem solving with diverse constituent groups can be difficult for students if they don't research what factors influence their beliefs and values. Allowing students to familiarize themselves with the different types of fisheries, the closures and other regulations, will help them analyze and evaluate the different stakeholders in this lesson. Emphasize to the students that sustainable practices today define future opportunities for generations to come.	
<b>Contact NOAA:</b>	For a NOAA guest speaker in lesson 5 email: <a href="mailto:wcr.education@noaa.gov">wcr.education@noaa.gov</a>	

# Lesson 4 Procedures

## Fisherman's Facebook stakeholder's profile

### I. Anticipatory Set: (15 minutes)

- A. **Review:** Have students take out their worksheet from yesterday and review the lower right hand box from page 1 that asks the students what are the ways to manage the fishery.



- B. **Quick write:** Have the students do a brainstorming strategy known as a quick write to generate: **Who are the stakeholders involved in Halibut Fisheries?** 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.)
- C. Once done, ask the students to share their lists with a neighbor. Encourage them to develop their list (add new ones, add specificity, etc.) Share one or two groups with the whole class and write this brainstorm list on the board.

### II. Research on computers time: (35 minutes)

- A. 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).
- B. Research their stakeholder and their role in that group, then fill in a "mock" Facebook page focusing on what that person does and their role in the halibut fishery.
- C. Share with the class either at the end of the period, or the next day.

### III. Assessment:

- A. Worksheet provided: Have students finish their research and be prepared to share with the class the next time they meet.

### IV. Apply/Extend:

- A. Have the students research or interview a real stakeholder.
- B. 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/council-operations/council-guide/part-v-why-get-involved-in-management/sample-letter/>

## Information

My Name:

Location:

My occupation:

What % of my income relies on halibut?

## Friends

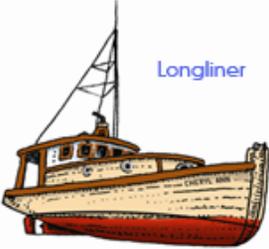
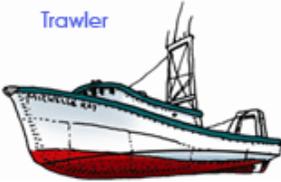
## My Wall

6 facts about my role in Halibut Fisheries  
(gear, type of boat, season, etc.)

What can I do to help protect this fishery?

**STAKEHOLDERS:** You will be assigned one of these roles.

\*These titles are fictional to simplify the process.

<p><b>US Government:</b> National Oceanic &amp; Atmospheric Administration (NOAA)</p> <ol style="list-style-type: none"> <li>1. NOAA fisheries manager</li> <li>2. NOAA fisheries biologist (studying population dynamics)</li> <li>3. International Pacific Halibut Commissioner</li> <li>4. Washington Department of Fish and Wildlife biologist</li> <li>5. Pacific Fisheries Management Council member</li> </ol>	<p><b>Canadian Government:</b> Department of Fisheries and Oceans (DFO)</p> <ol style="list-style-type: none"> <li>6. Canada’s DFO manager</li> <li>7. Canada’s DFO biologist (studying population dynamics)</li> <li>8. Canada’s DFO habitat specialist</li> <li>9. Provincial Fish and Wildlife biologist</li> <li>10. Provincial fisheries manager</li> </ol>		
<p><b>Commercial Fishermen:</b></p> <ol style="list-style-type: none"> <li>11. Alaska commercial fisherman for halibut (longline)</li> <li>12. Washington commercial fisherman for halibut (trawl)</li> <li>13. Canadian commercial fisherman for halibut (longline)</li> <li>14. WA, OR, CA commercial fisherman for sablefish (bycatch halibut)</li> <li>15. Washington commercial fisherman for salmon (bycatch halibut)</li> <li>16. Canadian commercial fisherman for salmon (bycatch halibut)</li> </ol>	<p><b>Sports Fishermen:</b></p> <ol style="list-style-type: none"> <li>17. Alaska sports fisherman (hook and line)</li> <li>18. Washington sports fisherman (hook and line)</li> <li>19. Oregon sports fisherman (hook and line)</li> <li>20. California sports fisherman (hook and line)</li> <li>21. Canadian sports fisherman from Vancouver Island (hook and line)</li> <li>22. Canadian sports fisherman from the mainland (hook and line)</li> </ol>		
<p><b>Tribal Fishermen:</b></p> <ol style="list-style-type: none"> <li>23. WA Native American fisherman (ceremonial and subsistence)</li> <li>24. Canadian First Nation’s fisherman (ceremonial and subsistence)</li> <li>25. Alaska Native American fisherman (commercial halibut)</li> <li>26. Washington Native American fisherman (commercial halibut)</li> <li>27. Canadian First Nation’s fisherman (commercial halibut)</li> </ol>	<p><b>Environmental groups:</b> Non-governmental organization (NGO)</p> <ol style="list-style-type: none"> <li>28. NGO concerned with overfishing</li> <li>29. NGO concerned with ocean habitat</li> <li>30. Conservation group- Concerned with derelict fishing gear</li> <li>31. Seafood chef concerned with Mercury levels in fish</li> <li>32. Hotel owner on coast interested in lengthening the season</li> </ol>		
 <p>Longliner</p>	 <p>Trawler</p>	 <p>Gillnetter</p>	 <p>Sport Fishing Boat</p>

# Sustainable Halibut Fisheries

Middle school science: Science, Management, and Stewardship

Lesson 5: Invite a NOAA Representative to your classroom: Divvying up the Fish

	<b>Subject Area(s):</b> Science, Management, or Stewardship	<b>Duration:</b> one 50 minute period
	<b>Key words:</b> consensus, stock assessments, total allowable catch (TAC), catch sharing plan, stewardship, marine debris, derelict fishing gear, NOAA's fish watch program, stock assessments, PIT tags (passive integrated transponders)	
<b>Materials:</b>	Map 2A Goldfish crackers (regular)	2 bowls (1 large and one to set aside) Nametags of representatives
<b>State Standards:</b> WA, OR, and ID	WA: EALR 1, 6-8 SYSB (boundaries can be drawn to fit the purpose of the study) EALR 2, 6-8 INQA (asking questions) EALR 4, 6-8 LS2A and D (ecosystem defined, population of organisms and nonliving factors and what factors influence change) OR: 6.2L.2 (explain how changes in populations are related to resources and impacts) 7.2E.3 (evaluate natural processes and human activities) SS.08.CG.06 (identify and give examples of how groups and organizations can influence the actions of government) ID: 7.S.3.2.2 (describe how the availability of resources limits the distribution and abundance of organisms) SS.6-9.GWH.5.1.4 (discuss present conflicts between cultural groups and nation/states in Western hemisphere).	
<b>Focus Questions:</b>	How do we know the quantity of fish in our oceans? How does one measure that? What are some safe guards that can ensure that fishermen don't overfish on the first day? What is consensus decision making? How can we make a difference for halibut, our oceans, or our community?	
<b>Learning Objectives:</b>	At the end of this lesson students will be able to: <ul style="list-style-type: none"> <li>Describe how scientists study populations of fish</li> <li>Explain how policy or rules are needed to ensure viable, reproductive and sustainable populations</li> <li>Understand the importance of civic involvement and how citizens can influence government actions</li> </ul>	
<b>Engage and Encounter:</b>	A NOAA scientist or manager will highlight how scientists assess fish populations, share how that knowledge influences the Catch Sharing Plan and the role of governments and stakeholders in the decision making process.	
<b>Explore and Investigate:</b>	Divvying up the fish activity	
<b>Reflect and Explain:</b>	Create a pie chart of final allocations and summarize the mock IPHC meeting	
<b>Apply and Extend:</b>	Fish population simulators (see websites)	
<b>Background for teacher:</b>	The oceans and humans are inextricably interconnected; humans affect the ocean in a variety of ways. Laws, regulations, and resource management affect what is taken out and put into the ocean. This lesson is intended to empower the community to participate in the decision making process and having a voice is vital to the success of conservation and recovery of endangered and threatened species. We believe that people of any age and in any geographic region can make a positive impact on the marine environment. We hope to strengthen the link between scientific knowledge, resource management and being active stewards in their environment.	
<b>Evaluations</b>	We greatly appreciate you piloting this curriculum, please fill out the evaluation and send it to the address at the bottom of the evaluation page.	

## Lesson 5 Procedures

### Divvying up the Fish: Science, Management, and Stewardship

#### I. Anticipatory Set (15 minutes)

- A. Review: Talk about the Fisherman's Facebook pages from lesson 4.
- B. Overview/remind of Pacific halibut fishery, key information on the species, characteristics of the fishery (primarily longline, tribal/commercial/sport), how it's managed (treaty, science, TAC, annual meetings), who's involved in the management.
- C. Have the NOAA representative introduce themselves, introduce NOAA's mission, what you do, and what education/interests got them their job.
- D. Ask the students: How do we know how many fish are in the ocean? How does one study a population of fish? Think back to your first lesson when you were first studying about all the different types of groundfish, how do scientists know the range and life history of these animals?

#### II. Divvying up the Fish Activity: (35 minutes)

- A. Now that they've learned about the Pacific halibut fishery and how it is managed, ask them to work through a real life example and come to a consensus decision among the stakeholders (can use the facebook page examples). **Scenario:** The IPHC is holding their annual meeting to decide how much halibut each stakeholder group will get. In 2013, Area 2A Catch limit was 950,000lb. Total N. Pacific was 54,080,000 lb.
- B. Split the class in to the following groups:
  1. U.S. government
  2. Canadian government
  3. Tribal fishermen
  4. Commercial fishermen
  5. Sport fishermen
  6. Environmental group (NGO's)Each group will elect a spoke's person to represent that group at the decision maker's table; the other folks in each group not at the table will be advisors to that decision maker and can pass notes or whisper advice to them. Give them name tags so that it's clear who represents which seat.
- C. Answer any questions they might have come across in this unit
- D. If there is any time left, show them the "Sustainability: It's in our hands" Poster
  1. Discuss regime shifts and a changing world
  2. What you can do to make a difference and Opportunities for them

#### III. Assessment:

- A. Worksheet provided

#### IV. Apply/Extend:

- A. Fish population simulators  
<http://www.otherwise.com/population/exponent.html>  
<http://www.otherwise.com/population/logistic.html>
- B. Have students apply their knowledge of marine debris to their service learning requirements, if apply.



**Stewardship:** You can make a difference!

Ocean Literacy Principle: The oceans and humans are inextricably interconnected

- A. Be a responsible consumer; know sustainable fish to buy either at a restaurant or grocery store. Check out NOAA's Fishwatch or Seafood watch <http://www.fishwatch.gov/>
- B. Learn more about marine debris: derelict fishing gear -plastics (larval stages/invasive species) <http://marinedebris.noaa.gov/marinedebris101/sources.html>
- C. If you were to make a top 10 list of actions you could do at home, school, or in your community what would it be?
  - 1.
  - 2.
  - 3.
  - 4.
  - 5.
  - 6.
  - 7.
  - 8.
  - 9.
  - 10.

**Opportunities**

NOAA Science Camp for middle school students: <http://www.wsg.washington.edu/education/events/noaa.html>

Ocean Career Day at the Seattle Aquarium <http://www.seattleaquarium.org>

When you are in high school look into National Ocean Science Bowl Competitions: <http://nosb.org/>

NOAA interns for high school sophomores, Jr. and Sr.  
American Fisheries Society Hutton Intern Program (\$3,000 scholarship)  
[http://fisheries.org/hutton\\_informationforstudents](http://fisheries.org/hutton_informationforstudents)

Learn more about NOAA's Education program... <http://www.education.noaa.gov/>  
Or our West Coast Region Education program...<http://www.westcoast.fisheries.noaa.gov/education/index.html>