West Coast Regional Office

Elementary Curriculum: Sustainable Halibut Fisheries

Recruiting teachers, Overview, Teacher Feedback and Curriculum Evaluation

Recruiting Teachers

NOAA's 4th-5th Grade Sustainable Fishery Curriculum aligns with:

- Science kits:
  - FOSS's Environments
  - FOSS's Living Systems
  - STC's Land and Water
- Science/Environment (Salmon in the Classroom Unit)
- Social Studies
  - History of fishery, gear, and technology
  - Management and Policy (Which laws regulate the fishing?)
  - Economics (Stakeholders and how different levels of government regulate impacts)
  - Government (three branches of government)
  - Civics (rights and responsibility of citizens)
  - Designed for **Civics Classroom Based Assessment: You Decide**

Curriculum Overview

Lesson	Topic	Activity	Length of Time	Materials Needed	Assessment
1	Life history, Anatomy of a halibut, and adaptations	Ideal fish to fish Body Plan and Sustainability Poster	50 min. period	Sustainability Poster/website worksheet computer access for research	Research worksheet
2	Sustainability and Technology Changes and 3 main threats	Fishing gear now and then Fishing gear research (skit, new technology, or PowerPoint) Cause and Effect Relationships	50 min. period	Now and Then posters (3) worksheet fishing gear half sheets off website	Research worksheet Skit, model/prototype, or PowerPoint (2 slide maximum)
3	Sustainable fishing practices, Data collection and analysis	Halibut Derby, data collection, and graphing	50 min. period	worksheet 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	Lab report worksheet
4	Government, Policy and Management	Something's Fishy (doubling activity) Compare IPHC to School organization	50 min. period	worksheet computer access for research	Research worksheet
5	**NOAA representative:** Science, Management and Stewardship	Relate school subjects with NOAA work Science-otoliths, stomach contents, PIT tags, stock assessment, and Ecofinley	50 min. period	worksheet otoliths/microscopes stock assessment activity	Worksheet Classroom participation

Classroom based assessment: You Decide
http://www.k12.wa.us/assessment/WASL/SocialStudies/BridgingDocuments/Elem08/ElemCivics-YouDecide-CBA.pdf

To arrange a NOAA guest speaker email: **nwr.education@noaa.gov**

West Coast Regional Office
Elementary Curriculum: Sustainable Halibut Fisheries
Teacher Evaluation

Classroom Background Information	
Teacher's Name: School: Grade level:	NOAA representative: Visit Date:

Teacher Evaluation	Strongly disagree…….Strongly agree **1**	**2**	**3**	**4**	**5**
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 Pointe Way NE,Bld.1, Seattle, WA 98115

Sustainable Halibut Fisheries

Elementary science: Life history, anatomy of a halibut and adaptations
Lesson 1: Ideal Fish to Fish and Halibut Body Plan

HARVEST	**Subject Area(s):** Life Science, life history of halibut, body plan, adaptations	**Duration:** one 50 minute period
	Key words: counter shading, eye migration, orientation, laterally compressed, dorsal-ventrally compressed, swimming patterns, benthic, pelagic	
Materials:	Worksheet Sustainability poster or website http://www.nmfs.noaa.gov/speciesid/Sustainability.html Computers with internet access	
State Standards: WA, OR, and ID	WA: EALR 4, 4-5 LS1A (sorting and classifying) EALR 4, 4-5 LS1C (respond to changes in environment, camouflage and hide from prey) EALR 4, 4-5 LS3B (inherit many characteristics from parents to better survive in ecosystem) OR: 4.1E.1 (Structure and function: Identify properties, uses, and availability of Earth materials 5.1L.1 (explain that organisms are comprised of parts) ID: 4-5.S.1.5.1 (explain the relationship between shape and use) 4.S.3.1.1 (analyze and communicate the adaptations of animals to their environment) 5.S.3.3.2 (explain the concepts that traits are passed from parent to offspring)	
Focus Questions:	What does a halibut look like? (Color, size, shape, weight, etc.) How is it different than other fish? Why are eyes on one side? Where does this animal live? What adaptations help this animal survive in its ecosystem?	
Learning Objectives:	At the end of this lesson students will be able to: • identify the general body plan of a halibut • describe the adaptations and colorations of a halibut • compare the body plan to a salmon	
Engage and Encounter	Brainstorm with students what the "Ideal fish to fish" would be. Have them think of economic value, cultural perspectives, environmental impacts and other factors that might influence.	
Explore and Investigate	Halibut body plan in comparison to a salmon and research halibut adaptations and how some of these traits are inherited by their parents and show evidence of natural selection and evolution.	
Reflect and Explain	Research benthic life and adaptations of groundfish. Assessment: worksheet and participation	
Apply and Extend	Create a class library focusing on fisheries and ocean life; encourage students to design area. Weird fins website or Sustainability in your hands website.	
Background for teacher	Pacific halibut are large flatfish found on the continental shelf from California to the Bering Sea. Halibut have diamond-shaped bodies, can weigh up to 600-700 pounds, and can grow to nine feet long. Halibut is low in saturated fat and sodium and is a very good source of protein, niacin, phosphorus, and selenium.)	
Contact NOAA	For a NOAA guest speaker in lesson 5 email: **nwr.education@noaa.gov**	

Lesson 1 Procedures

Ideal Fish to Fish and Halibut Body Plan

I. Anticipatory Set (10 minutes)

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

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 describe a halibut. Halibut are a type of flatfish, prized by fishermen (commercial and for sport), and are internationally managed in the Pacific Northwest by representatives from Canada and the United States.

B. Have students share what they already know about the Pacific Halibut.

II. Direct Instruction: (40 minutes)

A. **Body Plan Activity:** Have the students compare the body plans of these two types of fish. Worksheet provided.

B. Here is a fabulous website/kids book that can help answer these questions. http://www.iphc.washington.edu/halcom/pubs/kc/kids.htm And here is a fact sheet specifically on halibut. http://www.pcouncil.org/facts/halibut.pdf

C. Next, look at Sustainability Poster and see if students can recognize any other fish who might have a similar body plan or who might also be a groundfish. http://www.nmfs.noaa.gov/speciesid/Sustainability.html

III. Assessment:

A. Evaluate the worksheet on completion, accuracy, depth, and details.

B. Encourage them to investigate the above websites to learn more about halibut or other species.

IV. Apply and Extend:

A. Create a class library specifically on fisheries (gather books from library, decorate a bulletin board with halibut and other groundfish, etc.)

B. Weird fins website: http://www.nmfs.noaa.gov/rss/podcasts/weirdfins/edition.htm

Name:

Using this poster and interactive website, you will learn about the Pacific halibut and how sustainability is central to the fishery.
http://www.nmfs.noaa.gov/speciesid/Sustainability.html

Define pelagic=

Define benthic=

Examples of Pelagic fish	Examples of Benthic fish
*	*
*	*
*	*

Explain how the shape of an animal is related to its use or function.

Body plan comparisons between a Pacific halibut and a salmon

Characteristics:		
Size/length		
Weight		
Coloration		
Counter shading		
Compressed		
Swimming patterns		
Diet		
Range		
Other observations		

Name:

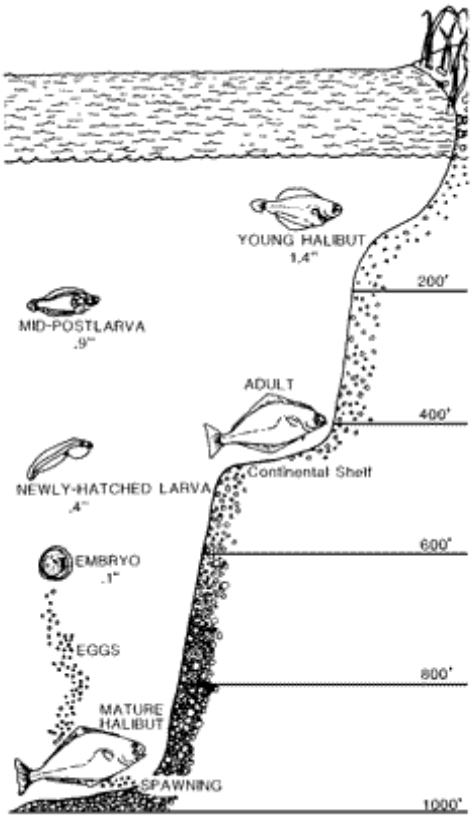
Halibut Adaptations

Using the life cycle of Pacific Halibut, explain the characteristics that halibut inherit to better survive a benthic living or adapt to their environment?

1. Eye migration:

2. Asymmetrical coloration/counter shading:

3. 90° rotation in position:



Graphic Courtsey IPHC

What advantages does a flatfish, like halibut, have for living a benthic life style?

Briefly describe the habitat requirements at 1000 ft.:

1. **Water temperature** compared to surface water (warmer or colder)
   Explain:

2. **Dissolved oxygen** compared to surface water (more or less)
   Why?

3. **Light** compared to the surface water (more or less)
   Influencing what:

4. **Vegetation** compared to the surface waters (more or less)
   Why?

5. **Shelter**/cover/place to hide compared to the surface waters (more, less, equal)
   Explain:

6. **Other biota** (prey and predators) compared to the surface waters (more, less, equal)
   Explain:

KEY

Using this poster and interactive website, you will learn about the Pacific halibut and how sustainability is central to the fishery.
http://www.nmfs.noaa.gov/speciesid/Sustainability.html

Define pelagic=of or pertaining to life at or near the surface of the open sea/ocean; far from land.
Define benthic=of or pertaining to life at the bottom of the ocean.

Examples of Pelagic fish	Examples of Benthic fish
* salmon	* halibut
* tuna	* flounder
* mackeral	* rockfish

Explain how the shape of an animal is related to its use or function. Speed, movement, eating, hiding/camouflaging, etc.

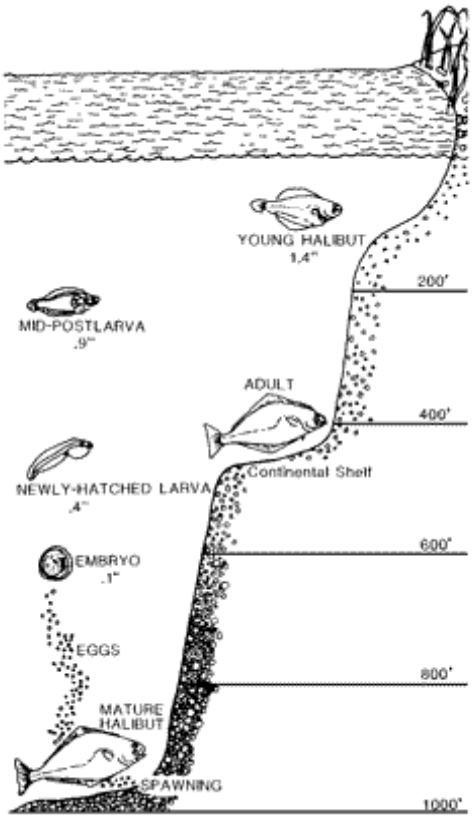
Body plan comparisons between a Pacific halibut and a salmon

Characteristics:

Size/length	Up to 9 feet and females are larger than males	Up to 2 feet
Weight	More than 500 lbs.	Up to 36 lbs. and an average weight of 8 lbs.
Coloration	Ability to change color according to substrate: camouflage	Dark metallic blue/greenish backs with silver sides and a light belly. There are small black spots on the back and upper lobe of the tail while in the ocean. Spawning: dark reddish-maroon coloration on the sides.
Counter shading	Left side (side that faces the bottom substrate)	Ventral side (belly)
Compressed	Laterally (side to side; as opposed to dorsally ventrally like a skate/ray)	Laterally (side to side)
Swimming patterns	Due to rotation, it looks like this fish is undulating up and down	Undulating from side to side
Diet	Small juveniles consume small crustaceans and other benthic organisms. As adults they consume cod, Pollock, sablefish, rockfish, turbot, sculpins, other flatfish, sand lance, herring, octopus, crabs, and clams	They prey on small fishes such as herring, sand lance, anchovies, sardines, and juvenile salmon or other fishes.
Range	Coastal waters of Northeast Pacific from Northern California to the Bering Sea.	North Pacific ocean, coastal streams and rivers from Central California to Alaska.
Other observations	Is a flatfish/groundfish that has 80 dorsal soft rays.	Dorsal fin, caudal fin, adipose fin, pectoral fins, pelvic fins

Halibut Adaptations

Using the life cycle of Pacific Halibut, explain the characteristics that halibut inherit to better survive a benthic living or adapt to their environment?



Graphic Courtsey IPHC

1. Eye migration: so the left eye is not looking into the substrate and getting scratched or irritated.

2. Asymmetrical coloration/counter shading: When the animal settles and begins its benthic lifestyle, it adapts to counter shade its underside, which in the halibut is now the left side.
3. 90° rotation in position: This allows them to be parallel to the substrate in order to blend in and not stick out like a sore thumb.

What advantages does a flatfish, like halibut, have for living a benthic life style?
Like above, it can hide from predators and sneak up on prey if a low profile is available. Everything also falls to bottom of the ocean, so there is a need for detritovores, and other animals that thrive under limited light conditions.

Briefly describe the habitat requirements at 1000 ft.:

1. **Water temperature** compared to surface water (warmer or colder)
   Explain: The deeper you go in the ocean, less light penetrates, pressure increases, and temperature decreases.

2. **Dissolved oxygen** compared to surface water (more or less)
   Why? Dissolved oxygen enters at the surface of the water (increased when wind blows) or is produced by photosynthetic plankton (phytoplankton) or algae (seaweed).

3. **Light** compared to the surface water (more or less)
   Influencing what: photosynthetic biota or the food web

4. **Vegetation** compared to the surface waters (more or less)
   Why? Less light, means less primary production. Only certain wavelengths of light (blues and greens) penetrate down to 200 meters.

5. **Shelter**/cover/place to hide compared to the surface waters (more, less, equal)
   Explain: In a 3-D ocean, benthic life has advantages if you can look up into the water and not have to worry what is below you.

6. **Other biota** (prey and predators) compared to the surface waters (more, less, equal)
   Explain: Probably relative or less, animals adapt to live where they can survive.

Sustainable Halilbut Fishery- Rubric for worksheets

Rate on a scale of 1-4 4=Above standard 3=Right at standard 2=Needs improvement 1=Does not meet standard	Lesson 1 Worksheet: Halibut body plan, life cycle, and adaptations **20 points**	Lesson 2 Worksheet: Fishing gear now and then and three threats **20 points**	Lesson 3 Worksheet: Halibut derby lab report **20 points**	Lesson 4 Worksheet: Something's fishy **20 points**	Lesson 5 worksheets: Science, management, and stewardship **20 points**
Content Accuracy: Did students correctly answer the questions and complete their research?					
Ideas: Ideas were expressed in a clear and organized fashion. It was clear that you understood the concepts.					
Completeness: Did student answer all of the questions in full detail?					
Objectives from each lesson addressed					
Neatness: Did student take pride in this work? Was it clean, not wrinkled, and easy to read with no distracting error corrections?					
Add up the total point for each worksheet					

Total score:

Comments:

Sustainable Halibut Fisheries

Elementary science: Sustainability, Technology changes, and Issues

Lesson 2: Fishing Gear Now and Then

	Subject Area(s): Sustainable fishing practices, human impacts on an environment (overfishing, bycatch, and habitat destruction)	**Duration:** one 50 minute period
	Key words: dredging, gillnetting, harpooning, hook and line, longlining, purse seining; traps and pots; trawling and dragging; trolling, sustainable (seafood and fishery), bycatch, threatened species, and endangered species	
Materials:	Now and Then posters (3) worksheet Fishing gear half sheets off website and computers with internet access	
State Standards: WA, OR, and ID	WA: EALR 3: 4-5 APPA (technology changing natural world) EALR 3, 4-5 APPD (generate different ideas for solving a problem) Social Studies EALR 4.1.1 (understands historical chronology) OR: 4.4D.2 (engineering design, construct, and test prototype) 5.4D.1 (using science principles describe a solution to a need or problem given criteria) ID: 5.S.5.1.1 (Identify issues for environmental studies) 5.S.5.2.2 (list examples of science and technology)	
Focus Questions:	What are the different types of fishing gear? What are the human impacts on fisheries? What is a sustainable fishery?	
Learning Objectives:	At the end of this lesson students will be able to: • Explain how biota, habitat, and people make up the fishery • List the top three main threats to fisheries • Describe at least 4 types of fishing practices and explain their impacts on the environment	
Engage and Encounter	How long have people been harvesting halibut? What makes up the fishery (biota, ecosystem, and people (fishermen, scientists, managers, conservationists, chefs, etc=stakeholders)	
Explore and Investigate	Students will look at how the technology (vessels, gear, etc.) has impacted the environment.	
Reflect and Explain	They will research one type of vessel or type of fishery that targets halibut or catches halibut as bycatch. Students will also explore what cause and effect relationships have influenced the fishery over time.	
Apply and Extend	Game of life Make a timeline of the history of the fishery and what major events influenced changes.	
Background for teacher	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.	
Contact NOAA	For a NOAA guest speaker in lesson 5 email: **nwr.education@noaa.gov**	

Lesson 2 Procedures

Fishing Gear Now and Then: Sustainability, Technology, Issues

I. Anticipatory Set (10 minutes)

A. How long do you think humans have been fishing for halibut? Centuries. What evidence do we have of this practice? Midden deposits which often contain a variety of archaeological material, including animal bone, feces, shell, and other artifacts associated with past human occupation. These features, therefore, provide a useful resource for archaeologists who wish to study the diet and habits of past societies. Oral, written, and photographic histories as well.

B. Who makes up the fishery? The fish (biota), the habitat or ecosystem, and people (fishermen, scientists, managers, and other stakeholders who are impacted by the fishery).

C. Why might it be important to know the history of halibut fishing if you were a fisheries biologist or manager? Cause and effect relationships about overfishing, bycatch, and habitat destruction are useful in improving sustainability, not only for halibut, but for the whole ecosystem as a whole.

II. Direct Instruction: (40 minutes)

A. **Fishing Gear Now and Then:** Show the three "Now and Then" posters and have the students write on their worksheets what they notice, what they wonder about and how they think the technology has changed the industry.

B. **Fishing Gear Research:** Now assign 9 groups the different types of fishing gear. Have them learn about that type of fishing gear and have them choose one of the following:
http://www.nmfs.noaa.gov/fishwatch/fishinggears.htm
http://www.montereybayaquarium.org/cr/cr_seafoodwatch/sfw_gear.aspx#dredging

1. Skit involving the gear, target species and issues they face. What are the pros and cons of a certain type of net.
2. Make a smaller version of the fishing gear and come up with three ways that you could change it to minimize overfishing, bycatch or habitat destruction.
3. Make a two slide PowerPoint explaining that type of fishery and the pros and cons of that type of gear.

C. **Cause and Effect Relationships:** Using adverb clauses with expressions of cause and effect. How have technology, science, and policy/management influenced or played a role in sustainability? Have the students work in partners to address the cause and effect relationships that influence a fishery.

III. Assessment:

A. Finish the worksheet and encourage them to investigate the above websites to learn more about fishing gear and sustainable practices.

IV. Apply and Extend:

A. Play the game of life:
http://sanctuaries.noaa.gov/education/teachers/pdfs/sustain_seafood_lesson1.pdf

B. Make a timeline of the halibut fishery using the different vessels, gear and other technological advances seen over the years.

Fishing Now and Then

What do you notice? What do you wonder about? How has technology changed this industry?

Vessels	Distance and Time
Gear	How to preserve the fish

Visit these two websites and explore one of the types of fishing vessels used today.

http://www.nmfs.noaa.gov/speciesid/Sustainability.html (click on the vessels)

http://www.montereybayaquarium.org/cr/cr_seafoodwatch/sfw_gear.aspx#dredging

Fishing Now and Then: Explore some cause and effect relationships

What does sustainable mean=

Why is sustainability important to the fish?

Why is sustainability important to the habitat or ecosystem?

Why is sustainability important to people (fishermen, scientists, and managers)?

Overfishing:
-The main cause of overfishing was probably…
-The effects of overfishing were…
-Due to the fact that overfishing occurred, today…

Bycatch:
-I think that bycatch is caused by…
-The reason for halibut bycatch in a salmon fishery or sablefish fishery is because…
-The pros and cons of bycatch are…

Habitat desctruction:
-Due to habitat destruction to our benthic communities…
-The effects of habitat destruction to future populations are…

What else do you wonder?

Sustainable Halibut Fisheries

Elementary science: Sustainable Fishing Practices and Data Analysis
Lesson 3: Halibut Derby

	Subject Area(s): Sustainable fishing practices, environmental or human impacts on an environment (overfishing, bycatch, habitat)	**Duration:** one 50 minute period
	Key words: allocation, Catch Sharing Plan, exploitable biomass, revenue, constituents or stakeholders	
Materials:	Worksheet Large cookie sheet for the ocean Uncooked rice for sand Green lentils for vegetation Multi-colored goldfish crackers Red hots for crabs 1 small Dixie cup for each student Paper towels for each student Oyster crackers for bivalves Chart paper for graph/dry erase board/Excel	
State Standards: WA, OR, and ID	WA: EALR 2, 4-5 INQD (data collection and record) EALR 2, 4-5 INQH (communicate the results of investigation) *math connection *b 5.5.C communicates verbally and in writing EALR 2, 4-5 INQI (Intellectual honesty) OR: 5.3S.1 (scientific inquiry: identify questions) 5.3S.2 (scientific inquiry: identify patterns in data that support a reasonable explanation) ID: 5.S.5.1.1 (identify issues for environmental issues)	
Focus Questions:	Why are there different fishing areas in our oceans? Who manages this resource? How do federal, state, local, and tribal governments manage one resource? How do policy and management ensure sustainability within a fishery?	
Learning Objectives:	At the end of this lesson students will be able to: • Describe at least three perspectives that exist among halibut fisheries stakeholders. • Explain how resource managers divide the quota into allocations for each type of fishery. • Identify the conservation strategies that promote conservation and sustainable practices.	
Engage and Encounter	How would you catch a halibut? More than one at a time? Introduce what bycatch is and how regulations help ensure sustainability	
Explore and Investigate	Halibut Derby: students will “fish” for halibut, count their catch, determine their landings and use data or evidence to support the activity.	
Reflect and Explain	Write up a lab report from the activity, explaining the results and quantifying the numbers from the catch data.	
Apply and Extend	Modify the halibut derby and have them explore other regulations Food for thought lesson plan http://www.prb.org/Educators/LessonPlans/2000/FoodforThought.aspx	
Background for teacher	Pacific halibut is managed by the United States and Canada in a bilateral commission known as the International Pacific Halibut Commission. 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 International Pacific Halibut Commission refers to U.S. waters off the states of Washington, Oregon and California collectively as "Area 2A." Regulations for Area 2A are set by NOAA Fisheries Service's Northwest Regional Office in Seattle. Halibut in Area 2A is 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 Fisheries Management Council that each year writes a catch-sharing plan describing these allocations.	
Contact NOAA	For a NOAA guest speaker in lesson 5 email: **nwr.education@noaa.gov**	

Lesson 3 Procedures

Halibut Derby: Sustainable Fishing Practices and Data Analysis

I. Anticipatory Set (5 minutes)

A. If your halibut from lesson 1 were living at the bottom of the ocean (center of your classroom), how would you:

1. catch one? (sports fisherman using hook and line or harpooning)
2. catch a lot? (commercial fisherman using longlining, trawl, or dredge)
3. Do you think every single time you would catch ONLY halibut? No, sometimes fishermen collect non-target species, called bycatch. If their permit doesn't allow for that type of fish, then they have to throw it back.
4. What do you need to know if you were to go fishing? Location, time of year, type of gear, do's and don'ts (regulations)

II. Direct Instruction: 40 minutes (30 min. to make and 15 min. to debrief)

A. **Halibut Derby:** Review the types of fishing gear they studied yesterday, remind them that flatfish are benthic fish who live on or near the ocean floor. For their derby, they will drag a trawl net on the bottom of the ocean in search of halibut, haul it up, empty contents on deck, sort by species, then tally up their catch data and graph results.

B. Hand each student the Halibut Derby worksheet, then measure and mark one inch from the bottom on their cups. Tell them that the derby will only last 1.5 minutes, they can only fish this portion of the tray (block off 40% of the tray for no-fishing) and they can only use one hand. Let them go.

C. When stopped, ask them to dump their trawl (Dixie cup) onto the deck of their fishing boat (paper towel). Sort and count the fish using tally marks. Remind them that the halibut were our target species. What percentage was that from your total catch?

D. Lastly, have them construct meaning from this activity. What rules or regulations were in place to prevent overfishing? Fishing periods, quotas, and geographic location. Were there any fish left? Yes, emphasize that this cookie tray is not proportionate to the real ocean obviously. What other guidelines could have been used to restrict or change the fishing derby? Size limits (hard to do with crackers that are the same size), # of vessels, type of gear, etc.

E. Finish filling out their lab report and graph your results.

III. Homework/ Assessment:

A. Worksheet provided: Halibut derby lab report and class/individual graph.

B. Participation

IV. Apply/Extend:

A. Students could modify the derby adjusting the different types of regulations (time, quotas, types of vessels, have them experience overfishing and problem solve on their own.

B. Food for thought lesson plan http://www.prb.org/Educators/LessonPlans/2000/FoodforThought.aspx

Halibut Derby Lab Report:

Title:
Purpose (target species?)
Hypothesis: (write a possible solution using if ___ then___ statements, make it testable)
Materials:
Procedures:

CATCH DATA:	**QUANTITY:**
Type A catch are fish brought back to the dock in a form that can be identified by trained interviewers. (Halibut)	
Type B1 catch are fish that are used for bait, released dead, or filleted -- i.e. they are killed but identification is by individual anglers. (this is a discard: dead target fish or non-target fish)	
Type B2 catch is fish that are released alive - again, identification is by individual anglers. (Released alive: not correct size of halibut or non-target species)	
TOTAL CATCH= Type A + B1 + B2	
HARVEST = Type A + B1	
LANDINGS = Type A only	
LANDINGS = Type A only	
RELEASED ALIVE = Type B2 only	
What percentage of target species did you get from your total catch?	

Graph your results:

Conclusions:

What did this Fishing Derby teach you? Accept or reject your hypothesis. Explain.
Was the Halibut Derby realistic? Explain. Put into context of the real world and the three threats we learned about yesterday. What questions arose for you?

Sustainable Halibut Fisheries

Elementary science: Governments, Policy, and Management

Lesson 4: Something Fishy

HARVEST	**Subject Area(s):** Governments, Policy, and Management	**Duration:** one 50 minute period
	Key words: 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)	
Materials:	Worksheet Computers with internet access	
State Standards: WA, OR, and ID	WA: EALR 4, 4-5 LS2F (people affect ecosystems both positively and negatively) Social Studies EALR 1.2.1 (understands government organization) Social Studies EALR 1.4.1 (civic participation in public issues) OR: SS.05.CG.02 (identify the primary function of federal, state, and local governments) ID: 4.S.1.3.1 (describe how changes occur and can be measured) 5.SS.3.1.2 (describe how conservation of natural resources is important)	
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 is conflict resolution addressed?	
Learning Objectives:	At the end of this lesson students will be able to: • Explain how regions of the ocean are split up for management purposes • Give 5 examples of how fisheries are managed • Compare the management structure of schools to the halibut fishery	
Engage and Encounter	Ask them how a fish without borders can be managed? What issues surround international management and how do they align their goals?	
Explore and Investigate	Students will learn how the halibut fishery in the NE Pacific is managed on international, federal, state, and local levels.	
Reflect and Explain	Students will research how agencies, non-governmental organizations, and workplaces actually work on problems.	
Apply and Extend	Continue with the derby and address conflict resolution as it arises. Make up a card game with some of the “Fishy” issues in the industry.	
Background for teacher	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.	
Contact NOAA	For a NOAA guest speaker in lesson 5 email: **nwr.education@noaa.gov**	

Lesson 4 Procedures

Something Fishy: Governments, Policy, and Management

I. Anticipatory Set (10 minutes)

A. Brainstorm how the United States and Canada manage a fish that lives in an environment that has no boundaries? Have students think about how the International Pacific Halibut Commission came about. Ask them what issues might come up with different jurisdictions or different stakeholders?

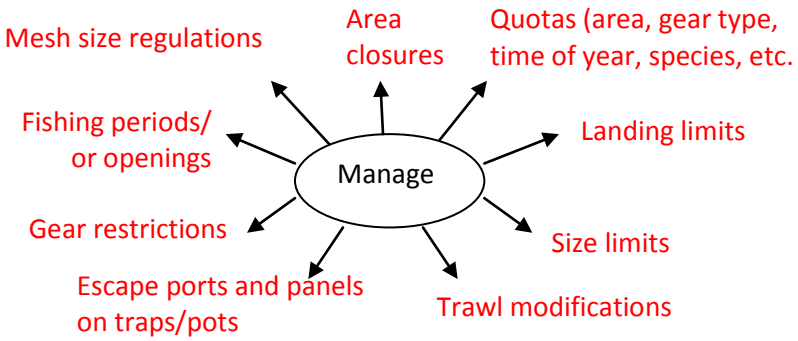
II. Direct Instruction: (40 minutes)

A. Remind students of what happened yesterday at the Halibut Derby, did it go smoothly? What do you think your goal was? To get as much of the fish as possible. Do you think that real fisherman are that competitive? Yes, definitely.

B. Ask students to find a partner and start on the top half of the paper. (you will progressively double the size of their group and see if they can all work together).

C. Make a team of 4, and start on the lower left box. Share ideas and work cooperatively. (In about 5 minutes, have them join another group)

D. Make a team of 8, finish the last box on page 1. When they are done, emphasize that when a group, especially a decision making group gets large it can be hard to listen to everyone's ideas. Go over that Sustainability and how to manage box with everyone.



E. What they don't finish in class will be homework. Tomorrow they will compare and contrast the two different groups.

III. Assessment:

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

IV. Apply/Extend:

A. Students could continue trying the derby and problem solving on their own; this is good conflict resolution practice if they try to negotiate and address the issues.

B. Make a card game involving some of the "Fishy" issues that come up when fishing, based on Candy Land or other game.

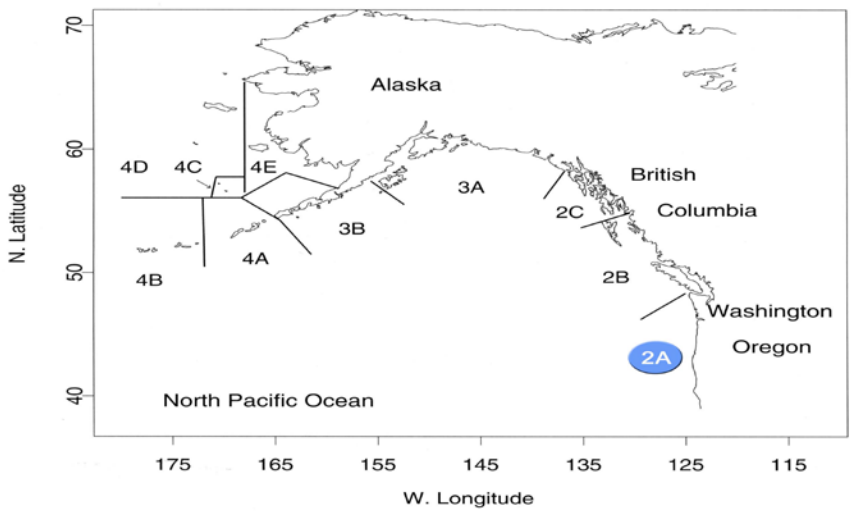
Something's Fishy

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

Now that you know what regulatory region you would fish in, how would you know where to fish in that area?

-
-

How would you find the fish?



IPHC Regulatory Areas

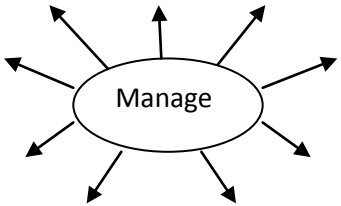
How do two countries manage a fish that lives in an environment that has no boundaries?

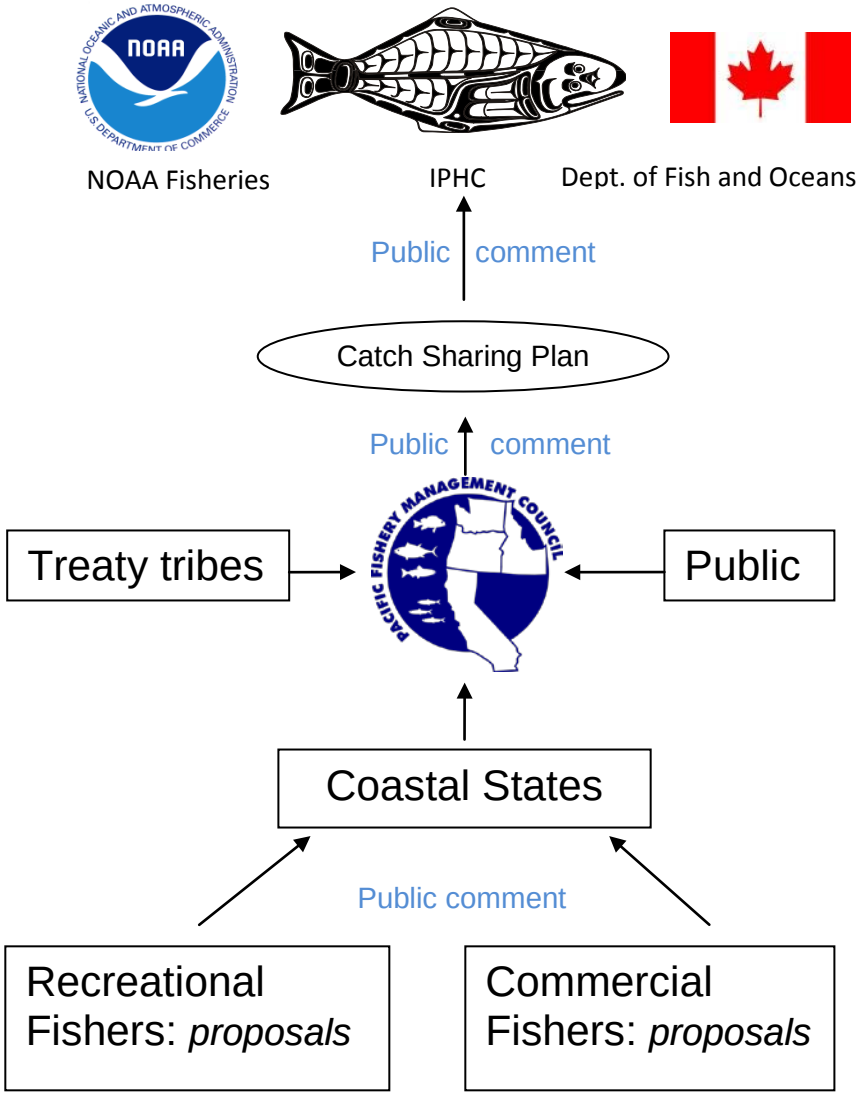
When something is fishy at school who do you turn to?

How can problem solving be used in Fishery Management?

On the back side of this sheet, you will be asked to find the hierarchy of decision making both in school and with halibut. Enjoy!

Sustainability: What are all the ways the fishery is managed to ensure sustainability?
http://www.pcouncil.org/facts/groundfish.pdf



Schools in America	International Pacific Halibut Commission
	

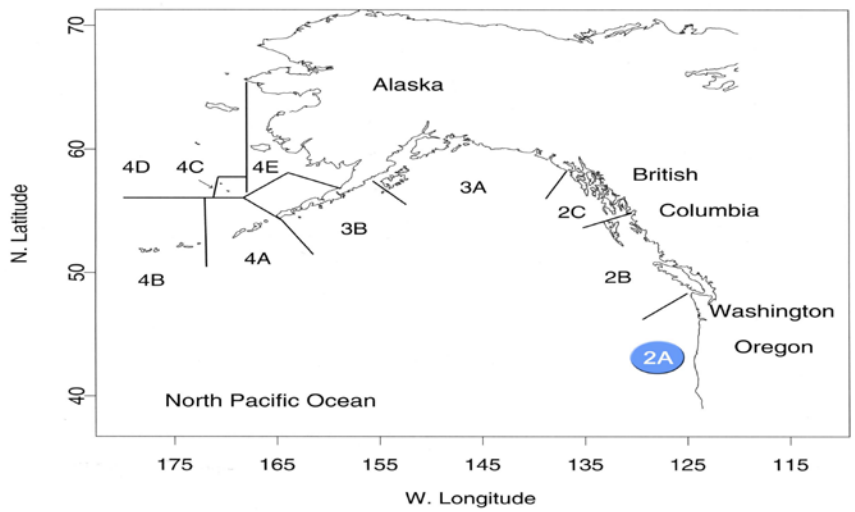
Something's Fishy KEY

Looking at the map, what are the advantages of dividing the regulatory areas into these regions?
Jurisdictional boundaries, quantity, recruitment, accessability

Now that you know what regulatory region you would fish in, how would you know where to fish in that area?

- Depth
- Oral tradition, word of mouth

How would you find the fish? Echo-sounder/ fish finder



IPHC Regulatory Areas

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

They are equally represented as commissioners with the International Pacific Halibut Commission.

When something is fishy at school who do you turn to?

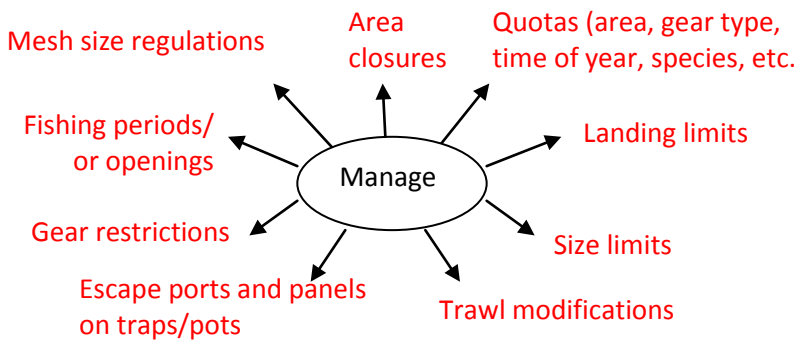
Maybe a trusted friend or an adult (teacher, nurse, counselor, recess attendant, or principal, etc.)

How can problem solving be used in Fishery Management?

Very necessary to honor all of the perspectives and make it fair and equitable for all.

On the back side of this sheet, you will be asked to find the hierarchy of decision making both in school and with halibut.

Sustainability: What are all the ways the fishery is managed to ensure sustainability?
http://www.pcouncil.org/facts/groundfish.pdf



Schools in America

President

Cabinet: Department of Education

State Departments of Education

Educational Service Districts for whole state
Your school district-Superintendent
Your school-Principal
Your class-Teacher
You and your family

International Pacific Halibut Commission

NOAA Fisheries

IPHC

Dept. of Fish and Oceans

Public comment

Catch Sharing Plan

Public comment

Treaty tribes

Public

Coastal States

Public comment

Recreational Fishers: *proposals*

Commercial Fishers: *proposals*

Sustainable Halibut Fisheries

Elementary science: Compare science in classroom to NOAA's work

Lesson 5: You can make a difference!

	Subject Area(s): Interdisciplinary sciences, civics/stewardship	**Duration:** one 50 minute period
	Key words: stock assessments, PIT tags (passive integrated transponders), otoliths, acoustic technology, marine debris, derelict fishing gear	
Materials:	Worksheet Computers with internet access	
State Standards: WA, OR, and ID	WA: EALR 2, 4-5INQA (asking questions) EALR 4, 4-5 LS2F (people affect ecosystems both positively and negatively) EALR 4, 4-5 PS3 (sound waves, acoustic tools to locate fish and use in bathymetry work) EALR 4, 4-5 LS2 (food web interactions) OR: 5.3S.1 (scientific inquiry: identifying questions) 6.2P.1 (describe and compare types and properties of waves) SS.05.CG.06 (identify and give examples of how individuals can influence the actions of government). ID: 5.S.1.3.1 (analyze changes that occur in and among systems) 5.S.5.1.1 (identify issues for environmental studies) 5.SS.3.1.2 (describe how conservation of natural resources is important)	
Focus Questions:	How do we know the quantity of fish in our oceans? How does one measure that? What are some ways that fishermen can prevent overfishing on the first day? How can we make a difference for halibut, our oceans, and our community?	
Learning Objectives:	At the end of this lesson students will be able to: • Explain how scientists and ecosystem managers work together, with public input along the way • Explain how fishing regulations/policy/ and management are needed to ensure viable, reproductive and sustainable populations • Share their knowledge about marine debris, seafood watch and how individuals can help make a difference	
Engage and Encounter	A NOAA scientist or manager will introduce themselves and highlight how science, management, and stewardship are all interconnected	
Explore and Investigate	Students will explore in more detail about how scientists study fish populations, and how governments, management and policy work	
Reflect and Explain	Students can explore on their own, what marine debris is/derelict fishing gear and Seafood watch. Then highlight ways humans can impact oceans	
Apply and Extend	Enter Ecofinly contest and learn more about marine debris Have students make a top 10 list of actions they could do at home, school, or in their community to help protect fish and their habitat.	
Background for teacher	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. Students can ask the NOAA representative how he or she got involved in policy and management and what paths lead them to this career.	
Contact NOAA	For a NOAA guest speaker in lesson 5 email: **nwr.education@noaa.gov**	

Lesson 5 Procedures

You can make a difference: Science, Management, and Stewardship

I. Guest speaker from NOAA: (40 minutes)

A. Have the NOAA representative introduce themselves and share what role they play in the sustainable groundfish fishery.

B. Bridge school subjects and how NOAA uses science, technology, engineering, mathematics, writing, and social sciences in their work

C. Explain how Science is used to answer questions about populations of fish

1. Explain fish finders/echo sounders,
2. how to study age/growth=otoliths,
3. diet=stomach content,
4. range/distribution=PIT tags, stock assessments)
5. Stock assessments

D. Explain how Policy/Management help protect fish stocks (split class in fours and have them brainstorm these categories.

1. Magnuson/Stevens Act- You'll be with this group explaining what this Act is and why it is important.
2. Why permits are necessary:
3. Why regulations are needed:
4. How do different levels of government work together? (local, state, federal, internation?)

E. Introduce other places to learn more: (they can do this on their own, just introduce)

1. **Ecofinley**- Tell the students that there is a NOAA program that educates people about marine debris (plastics) and derelict fishing gear issues. There is also a marine debris contest for grades 1-6. http://marinedebris.noaa.gov/outreach/contest.html
2. If they want to help make a difference, being knowledgeable about what fish to buy at a grocery store or restaurant is important. Called Fish watch or Seafood Watch. http://www.nmfs.noaa.gov/fishwatch/
3. Lastly, have them fill out ways that humans impact the marine environment.

II. Question and Answer time (5 minutes)

A. Answer any questions they might have come across in this unit

B. 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 and Extend:

A. Enter Ecofinly contest and learn more about marine debris

B. Have students make a top 10 list of actions they could do at home, school, or in their community to help protect fish and their habitat.

You can make a difference!

Ocean Principle: The ocean and humans are inextricably interconnected

Science	Policy/Management
Fish finders/Echo sounders: Age and growth: Diet: Range/Distribution: Stock assessments:	Magnuson/Stevens Fisheries Conservation and Management Act Permits: Regulations: Local: State: Federal: International:
Marine debris/derelict fishing gear: Seafood Watch: **Stewardship**	**"+"** **"-"** **People affect ecosystems in positive and negative ways…**