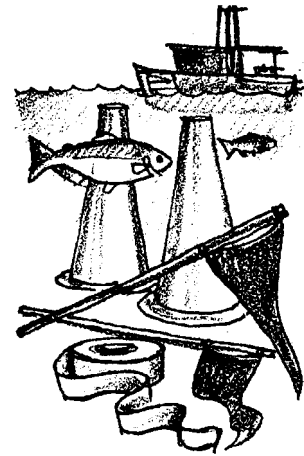


Harvest Race

Key Concepts

1. Raising salmon in aquaculture programs is done in three different ways: hatchery released, sea ranching, sea farming.
2. Much of the populations of wild salmon and aquaculture-raised salmon are caught by fishers in the ocean, near shore or in rivers.
3. Different governments create rules to regulate the harvesting of their fish..



Background

For thousands of years, fish have been a significant part of the human diet. People harvested fish with slight regard for the ability of the fish populations to reproduce and maintain their numbers. As long as the human population was relatively small and the fishing gear relatively unsophisticated, this arrangement worked well. It is clear that the arrangement is not working so well now. Changes in the numbers of salmon serve as a painful example.

Several techniques are now being employed to raise salmon in aquaculture programs that strive to maintain a constant, uniform supply of high quality fish. In a sense, these programs resemble sustainable agriculture while the traditional fishing model resembles mining. The three principal types of aquaculture programs for salmon are: hatchery released, sea ranching, sea farming. They are discussed in detail in the preceding activity, “Raising Salmon”.

For aquaculturists who release salmon smolts into the ocean, many possibilities exist for the population of the return run. Presently, the rates of return of adult aquaculture salmon are the same or greater than the rates of return for wild salmon. Hatcheries expect a 1% to 2% return of their salmon. Sea ranchers expect a 1% to 6% return, averaging about 2% to 4%. Many aquaculturists fear that overfishing and high rates of “incidental by-catches” by fishing vessels in the open ocean harm the population of salmon stock they have released. International problems and solutions are discussed in more detail in the “Ocean Address” activity in this guide.

In an effort to address the questions of overfishing and accidental catching of salmon, governments have created rules to regulate the harvesting of their fish crops. One such rule is called the Exclusive Economic Zone (EEZ). The

EEZ extends 200 miles offshore into the Pacific Ocean. It helps in the solutions of political problems over territorial fishing rights. A nation has jurisdiction over fishing only within its EEZ. Foreign vessels may fish there under some conditions but the zone is politically controlled by its nation and national fishers are given the first chance to fish there. (See the “Background” section in the following activity, “Ocean Address”, for more information.)

State governments control fishing seasons and quotas within state coastal waters. Regulating salmon fishing can be quite complex. Salmon fishing openings near shore are determined by the river systems and the fish species. A “test fishery” determines when a salmon run is approaching its home river and estimates how many fish are likely to be in the run. From this data it is determined how many days the area near the river mouth will be open for fishing and how many fish can be caught in the quota.

What is more, a federal regulation, the Bolt Decision, assigns half the catch quota to Native American fishers in Washington State and half to non-Native American fishers. Fishery regulators must keep data and know how many fish from each river system have been caught by which people. According to the Bolt Decision, Native tribes have the exclusive right to fish in their “usual and accustomed” fishing areas. Some tribal fishing areas overlap with those of other tribes. The area is usually close to the river system where the tribe resides. Members of other Native American tribes are not allowed to fish in the area. So the salmon fishery is regulated by river systems. Coho salmon, for example, that enter the Strait of Juan de Fuca in Washington, and are returning to a river in Puget Sound can not be fished by fishers in the Strait. The salmon run must be allowed to pass through the Strait to its home river. Once near the home river, it might be fished. Another problem comes up when the waters are a boundary between nations, as is the Strait of Juan de Fuca between Canada and the U.S.. Canadian and U.S. regulations and fishing techniques differ. A nation has jurisdiction only over its nationals and in its own Exclusive Economic Zone. In the unregulated ocean, whose salmon are they? Do they belong to the nation of their home river or to the nations who catch them?

Once in the rivers, the fish are further regulated for commercial and sports fishing. Enough salmon must be allowed to return to hatcheries or spawn in the wild to continue the stock of salmon. Consider the sockeye salmon from streams and lakes in Idaho. It must navigate dams and other river hazards while it passes through the state of Idaho and between Washington and Oregon states in the Columbia River. Once in the ocean it spends some of its life cycle in estuaries and near shore, regulated by state, county, city, federal, and tribal governments. Outside the EEZ of the U.S. it is open to fishing by any nation in the Pacific Ocean. Then on its return route to its home river, it passes through the same zones of regulation and critical habitat. The difficulty in managing these fish has contributed to it being classified as an endangered species.

Materials

For the class:

- large playing area - gym or field
- colored ribbons or flags - 4 or 5 colors
- 5 cones or markers for destinations/safe zones
- optional - long rope or tape to mark Exclusive Economic Zone
- chart paper/butcher paper and markers/pens

Teaching Hints

In “Harvest Race”, students role play salmon from aquaculture programs trying to avoid capture by fishers in the ocean. This simulation tag game has been designed to follow the previous activity “Raising Salmon” in which students learn about growing salmon in captivity as they solve problems related to aquaculture and fish resources. Additional background information for “Harvest Race” is found in the student reading material and questions of “Raising Salmon”.

Regulating salmon fishing can be quite complex. In “Harvest Race” we recommend that you keep it simple. Introduce only as much regulation as necessary, letting your students determine what and when regulation is needed.

You might choose to do the activities “Raising Salmon” and “Harvest Race” at the same time rather than in sequence. If so, you might choose to use the student questions from “Raising Salmon” for group discussion. You could assign the thinking skills questions to small groups. The groups can prepare a response to present to the class for discussion.

Harvest Race Simulation

In the Harvest Race Simulation, salmon race home to their hatcheries, wild rivers, or net pens. At the same time, fishers race to “harvest” salmon. The object of the game is to avoid being “harvested” by fishers in the ocean.

Procedure:

1. Set up the playing area. Across one end of a gym or field place 4 or 5 cones, at equal distances from each other. The cones represent return destinations for the salmon:
 - one river for wild salmon only (no hatchery released salmon in this river)
 - one river for hatchery salmon only (the native run is extinct here)
 - a sea ranch for salmon released into the ocean only

- a sea farm for one or two salmon who “escaped” from these net pens
- optional: one river for both native wild and hatchery salmon

Mark each return destination with a ribbon or flag of a different color. Since only one or two salmon might return to the sea farm, if at all, you could skip a ribbon for this one if needed. Decide if you want to name the rivers for real ones that are adjacent to each other in one state or nation or name them fictitious rivers.

The center of the playing area will be the “ocean”. Set outside boundaries.

2. How to play. Fishers will start in the ocean. Salmon will start from the end of the playing area opposite the destinations. Salmon must pass by the fishers without being caught (tagged) on their return migration to the river or net pen of their destination. Salmon are “safe” when they have passed the cone representing their return destination. They must line up behind the correct destination cone. “Caught” salmon will stand at the side boundaries until the end of play. They will group themselves according to who tagged them. At the end of each round, data will be collected and recorded. After a few rounds the data will be analyzed and students will create regulations. Then they will try out their rules in more rounds of play.

The first round starts at a signal from you. It ends when all the salmon are safe at their return destination or caught by fishers.

3. For a class of 25, choose 4 fishers, 1 or 2 escaped salmon from a sea farm net pen (optional), and 3 - 4 salmon for each of the other return destinations. You may use the sea farm fish optionally. In the beginning, have the fishers be all from the same nation or river system. You might also want to assign observers/regulators to help referee the play, record catch and return data, and recommend regulations and variations.

Attach a ribbon or flag to each salmon corresponding to the color of that at his or her return destination. This will help students remember to where they are returning, assure that they are in the proper place at the end of the game, and assist in data collection.

4. At the end of each round collect and record data. Count the number of fish that were to return to each destination, the actual number that did return, the number that were caught from each destination, and the name of the vessel that caught them. Also have each fishing vessel count the total number of fish it caught and note from which destinations. You might stimulate competition and cooperation by awarding points each round for the success of the fishing vessels and of the returning salmon stocks.

5. Analyze the data after a few rounds and have the students create fishing regulations and variations. Discuss the results of the data and brainstorm how you can change the results through making or changing rules. Here are some suggestions:
- Close one destination and add more salmon to another population.
 - Create a marine sanctuary (safety zone).
 - Divide the fishers to represent different nations of the Pacific Rim.
 - Have all the fishing vessels be from one tribe or nation. They are to work together to catch more fish for the overall benefit of the tribe, while each vessel strives to catch many fish for its own benefit.
 - Divide the fishers into groups of native and non-native fishers. Monitor catch and return data carefully to be sure the catch quota is 50/50. This means that in some rounds only native fishers would fish, in some rounds only non-native fishers would fish, and in some rounds “all citizens” (native and non-native) would fish.
 - Name the rivers for those in different nations of the north Pacific Rim. Move them to other locations, perhaps on the sidelines, to more realistically represent true geographic locations. Make different regulations for each nation. Since nations and states regulate themselves, not all the rules are the same for everyone.
 - Add an Exclusive Economic Zone. Put some national fishers inside the zone and have some national and foreign fishers outside the zone.
 - Set a limit for how close to a return destination (river mouth) fishers may fish.
 - Define and limit areas that can be fished.
 - Change the total number of fishers allowed.
 - Set limits on a season, or how long the fishers have in a round to catch the fish.
 - Set and change quotas.
 - Have a natural event change a habitat. For example, the warm waters of El Nino force salmon to stay in colder waters to avoid the warm current or an earthquake closes a river to the fish from there.
 - Penalize a vessel or fleet due to bad sea conditions, financial setbacks, loss or damage to equipment, or penalties for illegal fishing.
6. Close and debrief the simulation with a class discussion. Have students list the pros and cons of the game. Ask them to talk about how hatcheries increase or restore fish populations. Ask them to come up with some

solutions to the problem of meeting the demand for salmon with enough supply. Can everyone be happy with regulations? Can people of one government system regulate people of another?

Key Words

analyze - arrange information and make conclusions

aquaculture-raised salmon - fish grown in a controlled environment

Exclusive Economic Zone (EEZ) - an area off a coast that reaches 200 miles offshore where a nation has the rights to fish and to regulate its fishers

life cycle - the natural cycle of animals and plants from fertilization to death and decay

migration - the seasonal or periodic movement of animals from one place to another

natural fish populations - a group of fish that live in a natural environment and that were not raised by humans.

Pacific Rim - land and nations that are on the edge of the Pacific Ocean

sea farming - a way of raising salmon so that they spend all of their life cycle in floating net pens instead of going to the ocean

sea ranching - a way of raising salmon in floating net pens until releasing them into the ocean

Extensions

1. Supplement the concepts in this activity with media, guest speakers, and field trips about aquaculture programs.
2. Investigate programs to raise salmon or other fish species in your classroom.