



Aquaculture: Down on the Salmon Farm

Middle Level Lesson Plan

Topic

The environmental impact of fish farming in New England: The impact of science and technology on society

Grade Levels 7-8

Overview

Raising salmon in enclosed ocean pens was originally designed to increase the availability of affordable salmon for human consumption and, at the same time, to preserve native salmon stocks. Today, however, fish farming is threatening both the native salmon and the ecosystems on which they depend. This QUEST episode, *Aquaculture: Down on the Salmon Farm*, looks at the impact of the salmon-farming industry on the New England coast. The film also introduces viewers to some specific problems that people are trying to solve through science and technology. Will aquaculture remain a viable industry for northern New England?

Introduction

This teaching unit introduces students to the complex social, economic, environmental, and technological aspects of aquaculture, particularly salmon farming. Students will learn firsthand, through role-playing as aquaculture "stakeholders," about the connections among the aquaculture industry, northern New England's natural resources, science, technology, and the economy.

At the end of this teaching unit, students will be able to:

- Describe the changing practices of aquaculture, specifically fish farming.
- Describe complex connections among the aquaculture industry, the region's natural resources, science, technology, and the economy.
- Describe both immediate and long-term, intended and unintended, consequences stemming from various solutions (or technological implementations) related to aquacultural practices in northern New England.
- Give examples of the variety of ways in which wild salmon and farmed salmon interact in local ecosystems.

Time Allotment Six to seven 45-minute class periods.

**QUEST: Investigating Our World is a regional public television series
seen on Maine Public Broadcasting Network, Vermont Public Television, and New Hampshire Public Television**



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Accessing Prior Knowledge

New England students will undoubtedly be somewhat familiar with the role of fisheries in their communities. Students living in coastal communities in particular may be much more aware of the prevalence of aquaculture facilities and may be aware of some of the issues raised during the course of this unit. Teachers are encouraged to tap this valuable body of knowledge!

Upper middle school students should also be familiar with the variety of ways in which organisms in ecosystems interact with each another and with their environment. Most students will be aware that all organisms have specific needs in order to survive. Remind students of the relationships among organisms, their environment, and human activity.

Concepts to Clarify

Make explicit the link between technological developments and aquaculture practices. For example, technology has given people the ability to simulate the proper ecological conditions for raising salmon, thus enabling aquaculture to be practiced. Throughout this teaching unit, point out how technology is used to solve some of the practical problems encountered in this industry.

Be aware that some students may be sensitive to issues raised during this unit. Encourage all students to acknowledge and respect alternative viewpoints. Help them learn how to think critically about issues. Model appropriate ways in which to present evidence fairly and use logic to formulate opinions.

CONNECTIONS TO THE STANDARDS

| National Science Education Standards | Benchmarks for Science Literacy | Maine Learning Results | New Hampshire Curriculum Framework | Vermont Learning Standards |
|--|---|---|---|---|
| <p>Science in Personal and Social Perspectives (5-8)</p> <p>Science and Technology in Society</p> <p>3. Technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technology changes are often accompanied by</p> | <p>Chapter 3C: Issues in Technology (6-8)</p> <p>4. Technology has strongly influenced the course of history and continues to do so. It is largely responsible for the great revolutions in agriculture, manufacturing, sanitation, medicine, warfare, transportation, information processing, and communications that have radically changed how people live.</p> | <p>M. Implications of Science and Technology (5-8)</p> <p>_ Research and evaluate the social and environmental impacts of scientific and technological developments.</p> <p>_ Describe the ethical issues surrounding a specific scientific or technological development.</p> <p>_ Give examples of actions which may have expected or</p> | <p>Science, Technology, and Society</p> <p>2e. Curriculum Standard 3 (Gr. 6)</p> <p>_ Describe the possible consequences of various alternative decisions to a science- and/or technology-related issue.</p> <p>Curriculum Standard 1 (Gr. 10)</p> <p>_ Describe immediate and long-term consequences of various alternative</p> | <p>Roles and Responsibilities (5-8)</p> <p>7.5.aa: Analyze the roles and responsibilities of scientists, mathematicians, and technologists in relation to ongoing research and discoveries that impact society (e.g., the dangers and benefits of nuclear energy).</p> <p>The Universe, Earth,</p> |



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CONNECTIONS TO THE STANDARDS cont.

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| <p>social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.</p> | <p>6. Rarely are technology issues simple and one-sided. Relevant facts alone, even when known and available, usually do not settle matters entirely in favor of one side or another. That is because the contending groups may have different values and priorities. They may stand to gain or lose in different degrees, or may make very different predictions about what the future consequences of the proposed action will be.</p> <p>7. Societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.</p> <p>Chapter 5D: Interdependence of Life (6-8)</p> <p>1. Organisms with similar needs may compete with one another for resources, including food, space, water, air, and shelter.</p> <p>2. Two types of organisms may interact with one another in several ways....</p> | <p>unexpected consequences that may be positive, negative, or both.</p> <p>– Explain the connections between industry, natural resources, population, and economic development.</p> | <p>solutions for science- and/or technology-related issues, e.g., natural catastrophes, interactions of populations, resources and environment, health and disease.</p> <p>Standard 2 (Gr: 10) – Determine how technology affects their [students'] lives and predict how it might affect their future.</p> | <p>and The Environment (5-8)</p> <p>7.15.ee: Analyze and explain natural resource management and demonstrate an understanding of the ecological interactions and interdependence between humans and their resource demands on environmental systems (e.g., waste disposal, energy resources, recycling, pollution reduction).</p> |
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Materials Needed

- TV with VCR
- QUEST *Aquaculture: Down on the Salmon Farm* video
- Access to the Internet and school/local library for aquaculture print resources
- Chart paper and markers (optional)
- Scissors (1 pair per student pair)
- 30 index cards (3" x 5") – 1 card for each timeline event
- Wall-sized world map
- Smaller world maps (1 per student pair)
- 30 pushpins
- Colored pencils or markers for each student pair (optional)
- Copies of each of the following reproducible handouts:
 - Student Handout 1: Follow-Up Questions for To Market, To Market (1 copy per student)
 - Student Handout 2: Video Viewing Guide (1 copy per student)
 - Student Handout 3: Team Debate Planner (2 copies per team – 2 teams)
 - Student Handout 4: QUEST at Home: Preserving Your Catch (1 copy per student)
 - Teacher Resource 1: Aquaculture Timeline Cards (1 set per student pair)
 - Teacher Resource 2: To Market, To Market Sample Survey Matrix
 - Teacher Resource 3: Summary of Debate Procedure

I. Introducing the Concepts

The purpose of this initial activity is to engage students in the topic of aquaculture, specifically aquaculture aimed at raising salmon. Through a class discussion, students will share their current knowledge; through a timeline activity, they will become familiar with the history of aquaculture practices.

Note: Before introducing this activity to students, preview the QUEST *Aquaculture* video and/or review the transcript found at Maine Public Broadcasting Network's QUEST Web site at <http://www.mpbn.net/quest/index.shtml>. Become familiar with the topic of finfish aquaculture and the sensitive issues associated with this topic. The following Web sites can also offer good teacher background information: <http://www.asf.ca/Issues/index.html>
http://www.maine.gov/dmrl/aquaculture/aqtaskforce/presentations/asc_files/frame.htm
<http://clf.org/programs/cases.asp?id=205>

At this time, it would also be helpful to locate print resources in your school or community library on related aquaculture practices for students to use in Activity 4.

Activity 1: Aquaculture

Step 1

Engage students by finding out what they already know about aquaculture practices, specifically the practice of raising fish. Initiate the discussion by asking students to respond to the following questions:

- What is aquaculture?
- How are aquaculture and agriculture similar? (You may choose to have students investigate the root words: agri = land, aqua = water; culture = to harvest)
- What kinds of organisms are grown in aquaculture?
- Who practices aquaculture, and why?
- Where did the practice of aquaculture come from?
- What scientific understanding would one have to have in order to successfully practice aquaculture?
- How does aquaculture connect to you? Do you know of people practicing aquaculture locally?
- Do you think that there could be any problems or issues with aquaculture? What might those be?

Optional: It may be useful to create a record of students' initial ideas on chart paper or on the board as the initial discussion unfolds. This will help to ensure that their questions and ideas are addressed before the end of the teaching unit.

Step 2

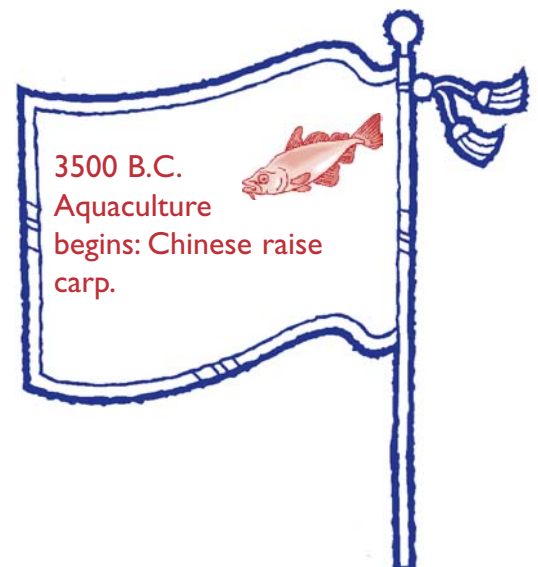
Explain to the class that they will be exploring the history of aquaculture. They will be using timeline cards which contain descriptions of various aquaculture-related events.

Divide students into pairs, and distribute to each pair a set of timeline cards (see Teacher Resource 1: Aquaculture Timeline Cards) and a copy of a world map. Explain that each pair will work together to become familiar with the events on the cards. They should then put their cards in order by date, and locate on a world map where each event occurred.

Circulate among the students, monitoring their progress and providing assistance as needed.

Step 3

Assign each pair of students two or three of the events described on their timeline cards to report on to the class. (The number of events that you assign each pair will depend upon the total class size.) Have student pairs make a creative representation of each assigned event on an index card "flag" (see example below). Instruct students to include on their "flags" a key phrase and picture to represent each event.





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Step 4

As a class, review the entire aquaculture timeline, starting with the oldest event. Have each student pair describe their assigned events, one by one, placing each event flag in the location on the large world map of where the event took place. (Event flags can be attached to the map with pushpins.) Whenever possible, have students add their knowledge of other general world events to the timeline.

Optional: Have students do further research to incorporate local historical events into the timeline.

Step 5

Close the introductory activity by asking students to reflect on the timeline display, either in writing individually or as a full-class discussion. Have students think about and respond to the following questions:

- What patterns or trends in aquaculture practices do you notice in different areas of the world and different time periods?
- Does the timeline indicate any relationships between general world events – in particular, between scientific discoveries or technological developments and aquaculture practices?
- What kinds of cultural beliefs may influence the widespread use of aquaculture in particular areas?
- What predictions can you make about the future of aquaculture?
- After reading about the events on this timeline, what new questions do you have about aquaculture?

2. Exploring the Concepts

In the following activity, students will design a survey to find out the prevalence of farm-raised seafood in local fish markets.

Note: Before introducing this activity to the class, contact a number of local fish markets and/or supermarkets in the area. Let them know that your students will be conducting interviews and asking questions about their stocks of fish and shellfish. As you make these calls, create a master list of local markets, noting the location, contact person, business hours, and phone number for each.

If having students visit local markets is problematic or impractical, you may choose to gather the raw data yourself in advance of this activity. Then you will need to modify the activity that follows accordingly. Another suitable alternative might be to have students conduct individual phone interviews with vendors, or to implement a class phone or e-mail survey, in lieu of face-to-face interviews.

Activity 2: To Market, To Market

Step 1

Discuss the idea of students conducting a fish-market survey to determine the role that aquaculture plays in their local markets. Remind students that they should be focusing particularly on the presence of farm-raised fish in their area stores.

Step 2

Have students work in pairs to brainstorm the types of information they feel are most important to elicit with the survey. Explain that you will collect their individual survey drafts and compile their ideas into a master survey that the class will then use to conduct their interviews. (**Note:** A sample survey has been included at the end of this teaching guide; see Teacher Resource 2. Allow sufficient time for students to create their survey drafts and for you to compile these into one master survey for the class to use.)

Step 3

Distribute the master survey that you have compiled for the class. Clarify any questions that students may have about conducting the survey, and work out the logistics of students visiting various markets. (If possible, have different students survey different markets for comparison.) Remind the class of proper “etiquette” when conducting their interviews. Set a due date for completion of the entire survey.

Step 4

Have students share and compile their survey findings. Then distribute copies of Student Handout I (Follow-Up Questions for To Market, To Market). Have students complete the questions on the handout based on their survey findings.

Step 5

Wrap up this activity by having the class consider the following questions about their survey:

- What role does aquaculture play in local fish markets?
- Do you think that your findings are representative of fish markets across the state? Across New England? Why?
- How might we improve our survey or get more information that would allow us to get a more complete picture of the impact of aquaculture in the marketplace and beyond?
- Based on our findings, what role do you see farm-raised fish and other cultured seafoods playing in the marketplace in the future?

Inform students that, in the next activity, they will be viewing a video on the topic of finfish aquaculture which will present them with another piece of this complex picture.

Step 6

Have students write thank-you notes to the individuals whom they surveyed. In their letters, you may wish to have them include a summary of the class findings. (**Note:** Alternatively, you may want to have students write at a slightly later time, so that they can include copies of the articles they will be writing later in this teaching unit.)

3. Developing the Concepts

In the following activity, students will view the QUEST *Aquaculture* episode to become familiar with the evolution of issues associated with the practice of fish farming. With the help of a video viewing guide,



students will identify the stakeholders involved and track developments (positive, negative, neutral, expected, and unexpected) of this type of aquaculture. Students will then use the information they have gathered in a debate during Activity 4.

Activity 3: QUEST Aquaculture Video

Step 1

Distribute a copy of Student Handout 2 (Video Viewing Guide) to each student. Introduce the video and video guide, and set the stage for the upcoming debate so that students can begin to prepare. Students should be beginning to recognize that the practice of aquaculture is a significant part of the current fisheries industry. They should also be gaining awareness that aquaculture involves a number of different community players, each of whom brings a unique perspective and set of interests to the table.

Explain to students that as they watch the video, their task will be twofold: (1) to make a list of the “stakeholders” involved in the issue of fish farming, and (2) to keep a record of how events unfolded in the finfish aquaculture stories highlighted in the film. Model for students how to use the video viewing guide to help them capture and organize the salient details in the video. Use an example or two to illustrate how to complete the middle section of the guide. For instance, in the Event column, students could list “Introduction of salmon fish farming,” followed by “Farmed salmon will relieve the stresses on wild salmon, giving depleted wild stocks time to recover” in the Intent/Expected Consequences column. They could then list “Escaped farm-raised salmon out-competing wild salmon, driving wild salmon to near extinction” in the Unexpected Consequences column.

Remind students that they will be using information from the video in an upcoming debate involving the practice of fish farming. Point out that one of the main purposes of this activity is help them see both the expected and unexpected results (consequences) of the implementation of various practices, and to understand the role of science and technology in these situations.

Step 2

Show the QUEST *Aquaculture* episode to the class. Viewing may take two class periods, depending on the schedule at your school. It may be helpful to pause the video occasionally to ensure that students have adequate time to record pertinent information and make full use of the viewing guide.

Step 3

As a class, compile a list of “stakeholders,” either on chart paper or on the board. A typical list might include the following:

- aquaculturist/fish farmer
- environmentalists/ecologists
- property owners
- fisheries biologist
- retail/wholesale fish marketers
- restaurateurs
- commercial fisherman

Using this master list, assign specific stakeholder roles to small groups of students. Ideally, there should be two to three students assigned for each role. Have students save their video notes for use in the next activity.



4. Synthesizing and Applying the Concepts

In the next activity, students will assume the roles of particular stakeholders. Working in groups, they will prepare for and participate in a debate over aquaculture practices that are impacting a fictitious coastal community.

Activity 4: Debate

Step 1

Set the stage for students by introducing the following scenario:

Fintastically Fresh, a reputable salmon-farming business, has purchased a large parcel of waterfront property in a small town. The company is seeking the town's permission to begin building and operating its fish-farming facility. Fintastically Fresh has run a successful business for a number of years in neighboring New England states. Several local fish markets even carry fish that have been raised at the out-of-state farms in addition to fish caught locally by commercial fishermen.

Word has spread through town about Fintastically Fresh's intentions of bringing their business to this small town. Many residents are in favor of the business coming to town, while others are against disrupting the serene beauty and impacting the fragile ecosystems found in their coastal community. Before the town council makes a final decision, they wish to hear from all of the stakeholders in the community. So, they decide it would be wise to hold a public forum on the matter. As a stakeholder living in this seaside community, you plan on attending the forum to share your opinion!

Step 2

Explain to the class the informal debate procedure described below. If your students are already familiar with an alternative debate style, it may be more appropriate to follow existing guidelines. A number of alternative debate structures, rubrics, preparation guidelines, protocols, and creative debate formats can be found at: http://www.educationworld.com/a_lesson/lesson/lesson304b.shtml (Education World's "More Resources for Classroom Debate").

Suggested Debate Procedure (See Teacher Resource 3: Summary of Debate Procedure)

Note: Hold as many rounds as time will permit. Each round should take approximately 20 minutes.

1. Students will first work in small groups to pool facts, formulate arguments, and conduct further research. These small groups will eventually reconfigure to form two debate groups: one group made up of stakeholders who are in favor of Fintastically Fresh's starting their business in the community, and one group made up of stakeholders who are against Fintastically Fresh's starting their business in the community.



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2. After the small groups merge into two debate teams, each team will receive at least two copies of Student Handout 3 (Team Debate Planner). This handout will help them organize the order in which team members present information to make their best case. The handout will also help students determine the role each member will play for each debate round.
3. The debate begins with the affirming team presenting their opening statement (3 minutes). Next, the opposing team presents their opening statement (3 minutes).
4. The first rebuttal presenter for the affirming team has 2 minutes to present their first response in detail. The first rebuttal presenter of the opposing team then has 2 minutes to present their first response, using specific supporting details.
5. Each side has 2 minutes in turn to elaborate upon the initial ideas and evidence they presented earlier. Statements are presented by the designated second statement presenters (2 minutes each side).
6. The debate on the first issue concludes with each side presenting their closing statements.
7. The debate should continue for at least one more round, focusing on a different issue, and starting with the opposing team.

Step 3

Before beginning the debate, have students with the same stakeholder roles meet in small groups to compare notes from the video. Be sure that they discuss the issues raised in the film from the perspective of their assumed roles and the introduced scenario. Allow time for students to do follow-up research using the Internet and/or other available resources to gather additional facts to use in the debate.

Step 4

Merge smaller stakeholder groups into two teams – the affirming team and the opposing team. Give each team at least two copies (one for each round) of Student Handout 3 (Team Debate Planner). Explain the importance of each team being sure to consider the most effective way to present its arguments and supporting facts. Also, encourage teams to prepare thoroughly for the opposing team's anticipated rebuttal statements.

Step 5

Hold the debate following the format described in Step 2 above.

Step 6

As a class, discuss the positions taken by each side during the debate. Discussion points might include:

- What were some of the issues that were raised, and how were they resolved?
- Which side presented the most convincing case? Why?



- How do you think the issue for this town will be resolved?
- In what ways does this local issue reflect what has been occurring across the state, region, and country as a whole?
- What role has science and technology played in this dilemma? Give specific examples to support your thinking.
- Given what you have learned over the past few days, what do you think the role of aquaculture will be in the future?

Step 6 (Optional)

As a follow-up, consider having students take on one of the following assignments:

- Assume the role of a newspaper reporter writing a story about the town meeting debate.
- Write a newspaper article or editorial letter that presents the viewpoint of a particular person who is role-played during the debate. This kind of writing should attempt to convince readers to take a particular position on the aquaculture issue.

For either assignment, students should be certain to include enough facts to make their points. When they have completed their writing, the class can compile and “publish” the articles and letters to share with others.

5. Extending the Concepts

In the following take-home activity, students will examine the science of preservation methods to keep foods, including seafood products, fresh for consumers.

Activity 5: *QUEST at Home: Preserving Your Catch*

Step 1

Distribute Student Handout 4 (*QUEST at Home – Preserving Your Catch*). Go over the instructions on the handout and set a due date. (**Note:** You may prefer to divide up the preservation methods and assign them to specific students, making sure that all methods are being researched by equal numbers of students.) Help students brainstorm where they might locate resources for this exercise. When assignment is due, lead a classroom discussion on students’ findings.

Step 2

Have students share their findings with classmates and families.

Community Connections

- Are there individuals or businesses practicing aquaculture in your community? Arrange a visit to one of these facilities, or arrange for a guest speaker to share his or her knowledge with the class.



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- _ Many state and local agencies have publicly accessible fish farms that operate tours, hold demonstrations, and give informational talks. Several links to such agencies can be found in the Additional Resources section that follows.
- _ Get involved in raising salmon or other fisheries stock in your classroom. There are a number of programs designed to bring this practice into classrooms, such as <http://www.fishfriends.net>. This offers information on one program sponsored by the Atlantic Salmon Federation.

Career Opportunities

There are many fields related to the practice of aquaculture. While students may have become familiar with several of these occupations as they role-played for the debate, they may wish to find out more about some of the fisheries-related fields listed below.

- Aquaculturist/fish farmer
- Aquaculture products designer
- Biotechnologist
- Manufacturer
- Marketer
- Commercial fisherman
- Environmental scientist/ecologist
- Fish market retailer/wholesaler
- Fisheries/wildlife biologist
- Policy shapers (e.g., employees of the Environmental Protection Agency, state department of marine resources, legislature, etc.)



Resources

Timeline

Maine Department of Education. 1996. Aquaculture in Maine: A Curriculum Guide for Secondary School Teachers. Aquaculture Education Coalition. pp 13-16, 33-34

Aquaculture Timeline

<http://walton.ifas.ufl.edu/4h%20Aquaculture/..%5C4h%20Aquaculture/Timeline.htm>

SeaWeb Aquaculture Clearinghouse: Salmon Aquaculture Timeline

<http://www.seaweb.org/resources/sac/timelines.shtml>

Maine Aquaculture Innovation Center: History

<http://www.maineaquaculture.org/history/maine.html>

Debate

http://www.educationworld.com/a_lesson/lesson/lesson304b.shtml

Education Worlds "More Resources for Classroom Debate"

Varying levels of structure, rubrics, preparation guidelines, protocols, creative debate formats

Additional Resources

<http://www.nfi.org>

The National Fisheries Institute site contains a wealth of information, including a Species Guide, Top Ten Seafoods, Recipes & Nutrition, Glossary, and Industry Links.

Links to State and National Agencies and Associations

<http://mainesalmonrivers.org>

This is the official site of the Downeast Salmon Federation.

<http://www.asf.ca>

This is the site of the Atlantic Salmon Federation.

<http://www.state.me.us/dep/blwq/docmonitoring/salmon/index.htm>

This is the Maine Department of Environmental Protection's page on Atlantic Salmon monitoring.

<http://www.maine.gov/dmr/aquaculture/index.htm>

This site presents the Maine Department of Marine Resources' collection of Aquaculture links.



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http://www.wildlife.state.nh.us/Fishing/atlantic_salmon.htm

This is the site of the New Hampshire Fish and Game Department.

<http://www.vermontagriculture.com/vaa/species.htm>

This is the site of the Vermont Aquaculture Association.

<http://northeast.fws.gov/newsrel/asalmon2.html>

A press release from the U.S. Fish and Wildlife Service, placing Atlantic salmon on the Endangered Species list, is posted here.

<http://www.asf.ca/Overall/atlsalm.html>

Biological information about the Atlantic salmon, from the Atlantic Salmon Federation, can be found here. The ASF is an international nonprofit organization that promotes the conservation and wise management of the wild Atlantic salmon and its environment.

<http://www.aquanet.com/news/aquanews.htm>

Seacoast Information Services Aquatic Network has links to current world aquaculture happenings. The site often includes information about the culturing of exotic species and innovative techniques.

Food Preservation

http://www.foodscience.psu.edu/Outreach/Fun_Food_Science.html

Penn State's collection of "Food Science Experiments and Learning Opportunities for Students of All Ages" includes teacher resources and pages appropriate for students.



Follow-Up Questions for To Market, To Market

Directions: Answer the following questions based on the findings of the class survey of local fish markets.

Due: _____

1. How many species were caught in the wild?
2. How many species were produced by aquaculture?
3. What is the proportion of wild caught species to cultured species?
4. How many species were raised locally in this state?
5. Why does one species of fish cost more than another?
6. Are cultured products more or less expensive than products that are caught in the wild?
7. Are there species that are only available at certain times of the year? How and why do prices change at different times of the year?



Video Viewing Guide

Directions: Use this guide to help you collect and organize information from the QUEST *Aquaculture* video. You will use these notes later as you form your arguments for a debate on the practice of aquaculture in a seaside community.

Part 1: Identify the Stakeholders

| | | |
|-------|-------|-------|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

Part 2: Changing Events

| Event | Intent/Expected Result | Unexpected Consequences |
|-------|------------------------|-------------------------|
| | | |
| | | |
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| | | |



Team Debate Planner

Directions: Use this template to help organize your team's roles for the debate. **Your team will need to complete one template for each issue it wishes to present.** Remember to alternate roles after each issue is debated. Also, be sure to involve all of your team members in at least one round.

1. Opening Statement Presenter (3 minutes at the beginning)

Name of team member:

This person begins by presenting the opening statement. The opening statement introduces the team's position on a particular issue and gives the specific details that prove the team's point.

2. Rebuttal Presenter (2 minutes)

Name of team member:

This team member responds to the opponent's argument, using specific information to disprove the opposing team's claims.

3. Second Statement Presenter (2 minutes)

Name of team member:

This person presents more information to support the team's earlier argument. He or she repeats the main idea and adds additional points.

4. Closing Statement Presenter (2 minutes)

Name of team member:

This person presents the closing argument for the team. He or she repeats the main idea and summarizes all main points.



Preserving Your Catch You're on a Quest!

Modern technology allows humans to gather and store foods – whether the food has been gathered in the wild or harvested from a farm – much longer, and with far better results, than ever before. Modern preservation methods help foods retain fresher colors, flavors, textures, and nutrients.

Directions: In this activity, you will explore the science behind food preservation techniques.

1. First, select three preservation methods from the list below that you want to learn more about.
2. Use the resources available at your local library, on the Internet (see links below), and perhaps in your own kitchen (cookbooks, parents, etc.) to find out the following details about the three methods you've chosen:
 - Describe the science involved in the preservation method: What is done to the food? Why?
 - List the kinds of foods are typically preserved this way. Is this a method that is used to preserve fish market products? If so, which ones? Why do you think this method is used for these products?

Preservation Methods:

- Vacuum packed
- Frozen
- Freeze dried
- “Flash” frozen
- Pickled
- Salted
- Canned
- Refrigerated/Iced
- Irradiated
- Smoked



Internet Resources:

<http://home.howstuffworks.com/food-preservation.htm>

http://news2.news.wisc.edu/whyfiles/find_it/index.html?get=t&w=18

<http://www.uga.edu/nchfp/index.html> - choose from the menu on the left-hand side of this page “How Do I?”

Follow the links in the center of the page for the science of each method.

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Aquaculture Timeline Cards

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| <p>3500 B.C. Aquaculture begins in China. The Chinese raise carp, a hardy fresh-water species, in ponds on silk-worm farms.</p> | <p>2000 B. C. Egyptian tomb paintings show fish, probably Tilapia, kept in artificial ponds. This warm-water species is still cultured in many countries today.</p> | <p>800 B. C. Archaeological evidence shows the Maya Indians of Central America culturing fish in their extensive irrigation systems.</p> |
| <p>100 B.C. Romans practice both fresh and saltwater aquaculture. They import carp from the Danube River to grow in artificial enclosures called "piscinae."</p> | <p>400 Hawaiian Natives develop organized pond systems for growing several species of freshwater and marine fish for food. These systems also include plants.</p> | <p>1100 Aquaculture begins in central Europe with pond culturing of carp.</p> |
| <p>1400 Dom Pinchon, a French monk, develops the technique of collecting fertilized eggs from spawning fish. He is believed to be the first person to successfully propagate fish artificially.</p> | <p>1834 Shaw and Young artificially propagate salmon in Scotland.</p> | <p>1852 First commercial trout hatchery is established in France.</p> |
| <p>1853 First artificial propagation of trout in the United States.</p> | <p>1877 Domestic carp is introduced into United States waters by U.S. Commission of Fish and Fisheries to help restock depleted fishery resources. These fish have been bred in the Reflecting Pool at the Washington Monument.</p> | <p>1934 The first marine shrimp are spawned and raised in Fuginaga, Japan.</p> |
| <p>1879 Landmark study on the composition of fish to determine their food and nutritive values is conducted.</p> | <p>1882 Methods for freezing fish involving new technology enter the field.</p> | <p>Late 1960's First commercial salmon farming operations begin in Scotland and Norway.</p> |



INVESTIGATING OUR WORLD

| | | |
|---|--|--|
| <p>Early 1970's Commercial salmon farming begins in Maine, Washington, and British Columbia.</p> | <p>1975 A parasite spreads from hatcheries to wild salmon in Norway causing widespread devastation of some wild salmon populations.</p> | <p>Late 1970's Commercial salmon farms are established in New Zealand, New Brunswick, and Chile.</p> |
| <p>1985 Atlantic salmon aquaculture is introduced to Australia.</p> | <p>1987 Pacific salmon commercial fisheries first report "escaped" Atlantic salmon among their catch.</p> | <p>1988 Storm hits the Faroes Island, destroying many salmon cages and releasing millions of Atlantic salmon into the ocean.</p> |
| <p>1996 Canadian researchers patent transgenic salmon.</p> | <p>1997 The state of Washington classifies escaped Atlantic salmon as a "living pollutant."</p> | <p>Early 1990's A bacterial disease infects nearly 200 salmon farms and wild salmon populations in Norway.</p> |
| <p>2000 Atlantic salmon are listed as a federal endangered species in Maine.</p> | <p>2001 Widespread viral infection spreads to farmed salmon, causing farmers to sacrifice over 1 million fish to control the outbreak.</p> | <p>2002 "Eco-salmon" – salmon farmed in land-based tanks -- are sold in British Columbia.</p> |
| <p>1850 Trout and salmon are cultured in the United States for the purpose of restocking lakes and streams for anglers.</p> | <p>(local event)</p> | <p>(local event)</p> |
| <p>(local event)</p> | <p>(local event)</p> | <p>(local event)</p> |



To Market, To Market Sample Survey Matrix

Name and location of fish market: _____

Person interviewed/title: _____

by (student name) _____ on (date) _____

| Name of product (species) | Caught in wild? | Aquacultured or farm-raised? | Price per pound | Origin | Fresh or saltwater species? | How packaged? |
|---------------------------|-----------------|------------------------------|-----------------|---------------|-----------------------------|---------------|
| Haddock | X | | | Gulf of Maine | Salt | Flash-frozen |
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SAMPLE

Summary of Debate Procedure

■ For Round 1 of Debate:

- Opening statement by affirmative team (3 minutes)
- Opening statement by opposing team (3 minutes)
- Rebuttal by affirmative team (2 minutes)
- Rebuttal by opposing team (2 minutes)
- Second statement by affirmative team (2 minutes)
- Second statement by opposing team (2 minutes)
- Closing statement by affirmative team (2 minutes)
- Closing statement by opposing team (2 minutes)



■ For Round 2 of Debate:

- Repeat the procedure described above, using different issues. In round 2, the opposing team presents first.