Seafood Education kit

A WORKBOOK FOR

STUDENTS LEADING CHANGE

Grades 7-8

http://education.ocean.org
Lesson 1

"I will share awareness of the link between consumer habits and ocean health."

PART 1: The Earth has one big ocean with many features.

1) Use the data and stats provided to answer the attached questions:

a) How has the rate of fish consumption changed over time? What is causing the change in consumption rate?
b) How has the rate of fishing and aquaculture changed over time?

c) Where does fishing and aquaculture contribute to employment the most?

d) What factors contribute to employment being highest there?
Lesson 2

“I will chat with my friends and family about sustainable seafood choices.”

PART 2: The ocean made the earth habitable.
Use the terms below to help facilitate aquaculture charades:

* **Aqua** (water) + **Culture** (to cultivate): The process of farming ocean organisms to keep up with the high demand of seafood from people around the world.

* **Off-Bottom Culture:** Shellfish are reared in a hatchery. When they reach a certain size they are moved to rafts, bags, or suspended ropes until they are large enough to go to market.

* **On-Bottom Culture:** Shellfish reared in a hatchery. When they reach a certain size they are transferred and seeded onto the beach or onshore habitat where they continue their grow-out.

* **Open Net Pens:** Fish are reared in hatcheries. When they reach the right size they are moved to large nets in the ocean or freshwater body until they grow to market size.

* **Raceways:** Raceways are composed of a long channel or basin which has an input and output on either end. Water is diverted from a well or nearby stream and flows through the raceway creating a current that the fish in the tank swim against.

* **Ponds:** An artificial pond or series of ponds is dug or sometimes a natural water body may be used. Water is forced into the pond and maintained at a certain height. Often flow-through systems are used when water flows into and out of the pond from the natural environment.

* **Land Based recirculating tanks:** Fish are reared and grown-out in land based circular tanks. There is no direct interaction between farming with the environment. Filters utilize bacteria to clean the water so no chemicals or antibiotics are used. Filtration allows water to be reused.
Lesson 3

“I will choose Ocean Wise products to support ocean health.”

PART 3: The ocean is a major influence on climate and weather.

Refer to the key terms listed when reviewing the case studies.

Key Terms

- **Overfishing**: Catching fish faster than they can replace themselves. This results in populations declining over time.

- **Ocean Acidification**: A term used to describe significant changes to the chemistry of the ocean. It occurs when carbon dioxide gas (CO2) is absorbed by the ocean and reacts with seawater to produce acid.

- **Habitat Destruction**: When a natural habitat, such as a forest or wetland, is altered so dramatically that it no longer supports the species it originally sustained. Plant and animal populations are destroyed or displaced, leading to a loss of biodiversity.

- **Pollution**: The presence in or introduction into the environment of a substance or thing that has harmful or poisonous effects.
Lesson 3 - Continued...

Candidate #1
- Ca Mau Vietnam black tiger shrimp – silviculture aquaculture.

*The Ca Mau region of Vietnam supplies about a quarter of the country’s shrimp. The farm being considered for recommendation utilizes silviculture as its aquaculture method. Silviculture shrimp fisheries, including this one farm shrimp by raising them within a **mangrove forest**. The natural habitat is left almost completely undisturbed, though some modification (mostly through the removal of some trees and use of nets or other structures to block in an area of mangrove) is needed to make farming possible.

*Shrimp are hatched and grown from larvae in a hatchery facility, and then moved out into an enclosed portion of a mangrove to grow-out. When shrimp reach market size, farmers use the **tides to draw some of the water** and shrimp out of the mangrove and into a small (3-4 metre) net.

*These farms are small-scale, often family run operations. As a result very little data exist about silviculture farmed shrimp. Escapes are possible when this harvesting occurs, though the shrimp being farmed are a native species. Because the shrimp are native species and are not stocked in high abundance, **no chemicals are needed**. Low density of shrimp in the farm also makes disease risk low and antibiotics are not used. Additionally, the mangroves act as natural filters.
Lesson 3 - Continued...

Candidate #2
- Indonesian black tiger shrimp – pond aquaculture

*Tiger shrimp are one of the main shrimp species farmed in Indonesia. In 2014, 126.6mt of tiger shrimp were produced. Pond aquaculture in Indonesian consists of man dug ponds. Creation of ponds requires mangrove forests to be removed, dramatically altering the natural habitat of the region.

*Data available to assess ponds is scarce. Broodstock (group of mature individuals used in aquaculture for breeding purposes) for the farm are often wild caught, from populations that are overfished. New shrimp hatch offsite and brought to farms to grow-out.

*Ponds are open exchange, meaning water from the surrounding environment flows into and out of ponds with out being treated. Farms also use a variety of chemicals and antibiotics as shrimp are stocked in high abundance. Antibiotics that are banned in both Indonesia and the United States continue to be used.

*Tiger shrimp are not fed commercial feed but farmers do use fertilizers to encourage algal growth, which are used as a source of food. Escapes from the farm are possible due to frequent water exchanges.
Lesson 4
“I evaluate where my seafood comes from and share my findings with friends.”

PART 4: The ocean and humans are interconnected.

Write your thoughts to address the three statements before the class discussion:

All wild caught fish are good

Farmed fish is always bad

Sustainable seafood is always expensive
Students must create pros/cons list for each form of seafood harvesting. Thereafter have class discussion to share findings. Have students update.

### AQUACULTURE:

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
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### WILD FISHING:

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
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Lesson 5
“\textit{I will be an active consumer and investigate the systems in place that brings seafood to my plate.}”

PART 5: The ocean supports a great diversity of life and ecosystems.

Review the guidelines of recirculating aquaculture systems (RAS) then match the image of the Rainbow Trout life cycle to the correct description of the RAS production on the next page. All information provided is sourced from the Fisheries and Aquaculture Organization of the United Nations. You can learn more at www.fao.org.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{rainbow_trout_life_cycle.png}
\caption{Some of the parameters affecting the growth and well-being of a fish.}
\end{figure}
In a recirculation system it is necessary to treat the water continuously to remove the waste products excreted by the fish, and to add oxygen to keep the fish alive and well. A recirculation system is in fact quite simple. From the outlet of the fish tanks the water flows to a mechanical filter and further on to a biological filter before it is aerated and stripped of carbon dioxide and returned to the fish tanks. This is the basic principle of recirculation.
Fill in the blank circle of the life cycle stage to match the description of the RAS production stage. Use the attached info as a guide.

<table>
<thead>
<tr>
<th>Lifecycle Stage</th>
<th>RAS Production Stage</th>
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<tbody>
<tr>
<td></td>
<td>Raceways</td>
</tr>
<tr>
<td></td>
<td>Selection of sperm or egg for fertilisation</td>
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<tr>
<td></td>
<td>Hatching</td>
</tr>
<tr>
<td></td>
<td>Release in rivers or sale</td>
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<tr>
<td></td>
<td>Hatching Tray</td>
</tr>
<tr>
<td></td>
<td>Rearing Tanks</td>
</tr>
</tbody>
</table>
Lesson 6

“I will be an active consumer and investigate the systems in place that brings seafood to my plate.”

PART 6: The ocean, and the life in the ocean shapes the earth.

Discuss what would happen to all of the people mentioned in response to the scenarios listed in the next page of your workbook.

**Fish Farmers:** For generations, the production of blue mussels has sustained smaller communities along the northern and eastern coastlines of Prince Edward Island. The industry provides a year-round source of income and employment to local residents, and generates wealth across the region with its strong export market. In 2010, the Prince Edward Island aquaculture industry paid approximately $38.7 million in salaries, wages, and employer contributions to the 1,200 people who worked directly and indirectly in aquaculture operations. Mussel production accounted for most of this total. Mussels on the island are farmed using the longline system in 19 coastal areas, such as Malpeque Bay, St. Mary’s Bay, Hillsborough Bay, and Broughton River.

Source: Department of Fisheries and Oceans Canada

**Seafood Chef:** Ned Bell is a chef advocate, keynote speaker, educator and founder of Chefs for Oceans. Bell's interests and talents have led him to his current roles as Ocean Wise Executive Chef, Culinary Director of The Vancouver Club, Chef Ambassador for International Year of the Salmon and author of bestseller - Lure: Sustainable Seafood Recipes from the West Coast. He continues to earn recognition for his ability to influence consumers, industry, media and government through clear, and often deliciously illustrated, education that supports the long-term health of the world's oceans, lakes and rivers. There’s nothing he loves more than uniting and collaborating with chefs, fishermen, farmers and influencers across the globe.

Source: nedbell.com

**Commercial Fishers:** Tiare Boyes has been a commercial fisherman since the age of 12. She has recently completed her Master’s degree at the University of Akureyri in Iceland specializing in Marine Resource Management. Her thesis focused on the spatio-temporal shifts in skipper’s behaviour within the B.C. commercial Halibut fishery. Tiare has represented her family’s small fishing company at the Committee on World Food Security at the FAO in Rome since 2016 and presented on the UN’s Sustainable Development Goals (Goal 14: Life Below Water) at the High Level Political Forum at the UN in New York 2017.

Source: B.C Tuna Fishermen’s Association Board of Directors webpage
1) If you were a member of the community your group was assigned to review, discuss how you would navigate the following scenarios.

a) There’s a growing demand for you to provide seafood; how will you meet this demand while preserving the seafood population for future generations?

b) What laws or regulations could be put in place to ensure the longevity of your seafood industry?

c) What factors could impact your seafood in a negative way? (example: pollution, climate change etc.)

d) Who relies on your seafood and how would they be impacted by the factors listed above?
LESSON 7
"I will share ideas to learn and explore options for sustainable seafood."

Part 7: The ocean is largely unexplored.

In designing your aquaculture business, answer the questions below to showcase the reasoning behind its sustainable.

1) What species will you farm? Why?

___________________________________________________________________________

2) What system of aquaculture will you use? Why?

___________________________________________________________________________

3) Who are your target consumers?

___________________________________________________________________________

4) What regulations will you put in place to limit negative impacts on the environment (ex. Frequent reviews of systems, limit antibiotic use etc.)

___________________________________________________________________________

5) What is the name of your aquaculture business? Explain the meaning behind it.

___________________________________________________________________________
Rubric: Unit Evaluation

The rubric can be used as a guide to help you understand how you might be evaluated in the three main categories noted below.

<table>
<thead>
<tr>
<th>Criteria Category</th>
<th>Extending</th>
<th>Proficient</th>
<th>Developing</th>
<th>Emerging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questioning</td>
<td>- Supplies a thorough analysis of data to shape in depth inquiries</td>
<td>- Student can pose questions based on prior records of qualitative and quantitative observations</td>
<td>- Asks questions from some of the information provided</td>
<td>- Reviews concepts to shape inquiries, with adult guidance</td>
</tr>
<tr>
<td>Procedures and Evidence</td>
<td>- Evaluates evidence to compare and contrast findings to further understanding</td>
<td>- Accurately collects and applies data using a variety of tools from reliable sources</td>
<td>- Records some reliable information to plan investigation</td>
<td>- Records information and applies appropriately, with adult guidance</td>
</tr>
<tr>
<td>Perspectives and Ethics</td>
<td>- Analyzes multiple perspectives to cultivate an independent judgment and/or opinion</td>
<td>- Evaluates social, ethical, and environmental implications in investigation</td>
<td>- Provides evidence to support the presence of multiple factors that shape the ethics of a concept</td>
<td>- Lists several perspectives and explores them accordingly, with adult guidance</td>
</tr>
<tr>
<td>Communicating</td>
<td>- Elaborates on ideas in class discussions to independently form innovative ideas (ex. solutions, arguments etc.)</td>
<td>- Clearly and concisely communicates ideas and information both in independent and collaborative reflections</td>
<td>- Shares opinions and ideas that include some relevant information</td>
<td>- Contributes ideas and opinions, with adult guidance</td>
</tr>
</tbody>
</table>