9-12 GRADE BAND

EDUCATION
GEORGIA AQUARIUM

Sustainable Seafood Project Based Lesson

Georgia Standards of Excellence:

- **SO7.** Obtain, evaluate, and communicate information about how humans use the ocean as a resource and the need for responsible stewardship.

  a. Construct an argument based on evidence about the impact that extraction of physical, geological, chemical, and biological resources from the oceans has on marine systems.

Next Generation Science Standards:

- **HS-ESS3-1.** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

Learning Objective:

- Students will construct a menu that will help ensure fish populations for generations to come.
- Students will analyze resource availability and cost of obtaining fish.

Essential Question:

- What are the impacts of different fishing methods and aquaculture?

Key Vocabulary:

- Maximum Sustainable Yield
- Habitat Degradation
- Overfishing
- Bycatch
- Aquaponics
- Aquaculture

Materials:

- Internet access
- Construction paper
- Card stock
- Crafting supplies

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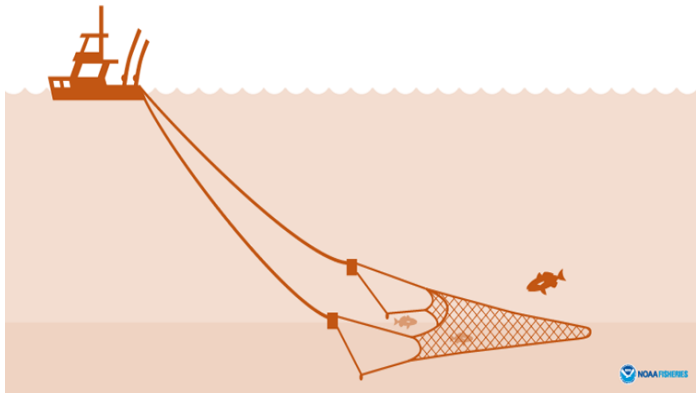
Background Information:

Many people love to eat fish and it's important part of some cultures and religions. However, fish are not an endlessly supplied food source. In fact, researchers have found that many economically important organisms are well below the maximum sustainable yield for the survival of their species. The maximum sustainable yield is the number of organisms that can be fished yet still sustain a healthy population level to produce future generations. Scientists, researchers and institutions are now looking to practice sustainably sourced fishing techniques and methods.

Sustainable seafood means that the seafood comes from sources, either fished or farmed, that are able to maintain or increase production in the long term without negatively impacting the affected ecosystems. Due to the limitations of wild fish populations, and our global population growth, we will not be able to continue to fish our oceans at the same large scale moving forward. Worldwide catches on average over the past 20 years have been flat or declining in terms of number of fish brought in. This large decrease in the catch means that we are looking to aquaculture, or the farming of fish, mollusks, crustaceans, aquatic plants, and other aquatic organisms.

Many current fishing practices has overtly negative affects:

- Habitat degradation: Several types of fishing mechanisms can damage benthic (seafloor) habitats. If trawl nets (pictured on the right) are dragged along the seafloor, coral, rocks and marine plants can be ripped up or badly damaged by the nets. These benthic habitats are important for the protection of many marine species and loss of habitat can leave them vulnerable to predators or other fishing gear. Trawl nets are affective at capturing target species such as flounder, shrimp and crabs.



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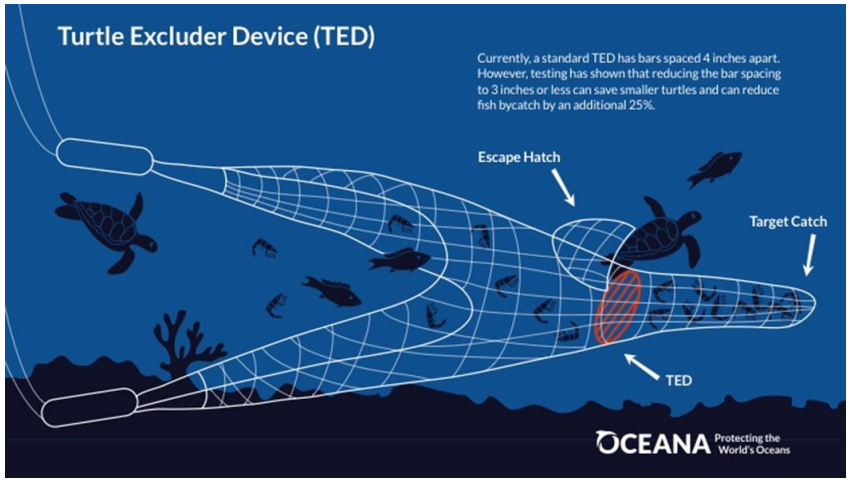
Background Information:

- Overfishing: Aquatic species are being fished at rates faster than they can make up for with reproduction. Fish are often caught prior to reaching reproductive age or prior to giving birth. This means that the populations are being reduced at dangerously high rates and unless we suspend certain fisheries for a long enough time to allow wild populations to recover, we may fish many species into extinction.
- Bycatch: Refers to capturing unintended species along with your target species. Certain fishing methods have worse reputations for bycatch than others - shrimp fishing in particular has had a very negative impact.
- FAD: Fish Aggregating Device. Artificial or man-made object used in conjunction with the purse-seine fishing method targeting pelagic (open ocean) species such as tuna. In the open ocean, pelagic species like to congregate around floating pieces of logs or debris because they attract small marine organisms and marine plant growth. The deeper the water, the more likely it is to find pelagic species hanging around these floating objects. FADs were developed to encourage prized fish species like tuna to be drawn to certain (i.e. tracked) regions and to remain in the center around the FAD while the purse seine nets are drawn around and up.



- TED: Turtle Excluding Device. This is a bycatch reduction mechanism developed in the 70s that is inserted into the skinniest part of the trawling net, or the "neck" of the net. The TED is a circular grid of bars that has an opening at the bottom or top of the trawl net. The TED grid allows the smaller target species (such as shrimp) to pass through the bars of the grid and into the back of the net, but larger animals such as endangered sea turtles will put enough pressure on the bars to open a latch at the top of the net and swim to freedom.

9-12 GRADE BAND

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Background Information:

- Monterey Bay Aquarium's Seafood Watch program formed in 1999 and focuses on both individual consumers and businesses to educate and spread awareness about sustainable seafood issues and options. Their recommendations are updated regularly to reflect current species populations and developments in new and sustainable technologies. Consumer guides are available by regions or nationally and have species broken down into three categories:
    - Green: "Best choice: Buy first, they're well managed and caught or farmed in ways that cause little harm to habitats or other wildlife."
    - Yellow: "Good alternative: Buy, but be aware there are concerns with how they're caught or farmed."
    - Red: "Avoid: Don't buy, they're overfished or caught or farmed in ways that harm other marine life or the environment."

BEST CHOICES	
Barramundi (US & Vietnam farmed)	Mussels (farmed)
Bass (US farmed)	Oysters (farmed & Canada)
Catfish (US)	Pompano (US)
Clams (farmed)	Salmon (New Zealand)
Cockles	Shrimp (US farmed)
Cod: Pacific (AK)	Snapper: Mutton (US diving, handlines)
Crab: Blue (MD trotline)	Squid (US)
Crab: King, Snow & Tanner (AK)	Sturgeon (US farmed)
Crawfish (US farmed)	Tilapia (Canada, Ecuador, Peru & US)
Lionfish (US)	Tuna: Albacore (trolls, pole and lines)
Mahi Mahi (US handlines)	Tuna: Skipjack (Pacific trolls, pole and lines)
Mullet: Striped (US)	Wahoo (US Atlantic)
	Wreckfish

GOOD ALTERNATIVES	
Branzino (Mediterranean farmed)	Shrimp (Canada & US wild, Ecuador & Honduras farmed)
Clams (US & Canada wild)	Snapper (US)
Cod: Atlantic (handlines, pole and lines)	Squid (Chile, Mexico & Peru)
Conch (Belize, Nicaragua & US)	Swordfish (US)
Crawfish (LA wild)	Tilapia (Colombia, Honduras,
Crab: Blue (AL, DE, MD & NJ pots)	Indonesia, Mexico & Taiwan) Trout (Canada & Chile farmed)
Grouper: Red (US)	Tuna: Albacore (US longlines)
Lobster: Spiny (Bahamas & US)	Tuna: Skipjack (free school, imported trolls, pole and lines,
Mahi Mahi (Ecuador & US longlines)	US longlines) Tuna: Yellowfin (free school, trolls, pole and
Oysters (US wild)	lines, US longlines)
Salmon: Atlantic (BC & ME farmed)	
Salmon (CA, OR & WA)	

AVOID	
Bass: Striped (US gillnet, pound net)	Salmon (Canada Atlantic, Chile, Norway & Scotland)
Cod: Atlantic (gillnet, longline, trawl)	Sardines: Atlantic (Mediterranean)
Conch (imported)	Sharks
Crab (Argentina, Asia & Russia)	Shrimp (other imported sources)
Crab: Blue (FL, GA, LA, MS, NC, SC, TX & VA)	Squid (Argentina, China, India & Thailand)
Crab: Stone (FL)	Swordfish (imported longlines)
Crawfish (China)	Tilapia (China)
Lobster: Spiny (Belize, Brazil,	Tuna: Albacore (imported except trolls, pole and lines)
Honduras & Nicaragua)	Tuna: Atlantic Bluefin (imported longlines)
Mahi Mahi (imported)	Tuna: Pacific & Southern Bluefin
Orange Roughy	Tuna: Skipjack (imported purse seines) Tuna: Yellowfin (imported longlines except US)

Sustainable Seafood Project Based Lesson

Activity Instructions:

- Cover the background information with the students.
- This project can be done individually or in groups of 2 to 4.
- Students will create a restaurant and a menu for that restaurant that has a sustainable seafood selection. In order to do this, students will need to develop:
    - A visually pleasing menu with at least two appetizers, and two main courses consisting of two different aquatic species on the menu.
        - Students must include prices of their dishes on the menu, remember to account for profit making for the restaurant.
    - A written report where students will have to research desired species market prices, fishing/farming methods for that species, and the location of fisheries that they will be sourcing their food from, in order to run their sustainable restaurant.
        - NOTE: To make more of a challenge, give students budgets for the menu. Ex. cost of ordering one of everything is not more than $300.00.
- A suggested first step for students would be to begin their research at Monterey Bay Aquarium's Seafood Watch homepage: https://www.seafoodwatch.org/

Sustainable Seafood Project Based Lesson

Evaluate:

Have students present their restaurant's and menus. Assure that the students have made sustainable choices for their project.

Inquire with students:

1. Was it is easy to find food costs, would prices be reasonable for customers?
2. Is it realistic for all restaurants to follow these practices?
3. What are some potential solutions?

NOTE: There are no right answers to these questions.

Extensions:

Seafood watch has more information and resources to discuss all the fishing methods and ways students can help. Seafood watch also has an app and this video to summarize.

References:

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