Lab: Go Fish

(modified from Life on an Ocean Planet)

PART ONE: Fishing for the Future

Activity: Each student is a fisherperson whose livelihood depends on catching fish. Larger pretzel M&Ms represent the most valuable fish (tuna, swordfish, etc.). Smaller plain M&Ms represent more common, smaller fish (snapper, flounder, etc.). When fishing begins, students must hold their hands behind their backs and use the "fishing rod" (straw) to suck "fish" (M&Ms) from the "ocean" (pan) and deposit them into their "boat" (cup). The fish remaining in the pan will represent the breeding population, with new fish being added periodically. Keep track of your catch in the table below.

Data:

Season	Catch				# Fish Left in Ocean
	# Large Fish (worth $5 each)	# Small Fish (worth $1 each)	Total # Caught (cumulative)	Total $ Value (cumulative)	
1					
2					
Fish Breeding Time!					
3					
4					
Fish Breeding Time!					
5					
6					

Analysis Questions:

1. Describe the status of the fishery before fishing began.
2. Describe the status of the fishery after fishing.
3. How did changes in fishing technology affect the fishery?
4. At what point did you realize there might be a problem with the future of the fishery? Did you discuss this with others in your group? Did you change the methodology or rules to compensate?
5. How could you have made your fishery more sustainable from the start?
6. What happens when a commonly owned resource is overused?
7. Name the principle that relates to the use of commonly owned resources.

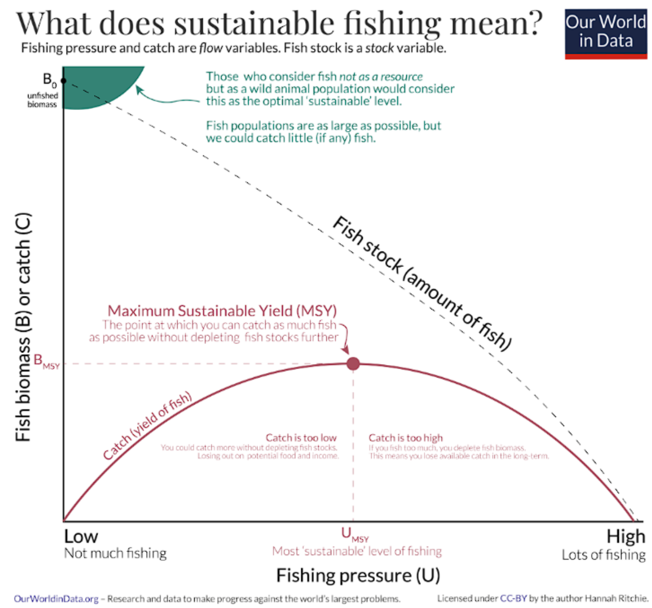
PART TWO: Commercial Catch & Aquaculture

Background: Since the early 1600s, countries have been indiscriminately harvesting ocean resources without thinking ahead to the health of the resource. This led to a *Tragedy of the Commons*, which is defined as the depletion or degradation of a potentially renewable resource to which people have free and unmanaged access. The establishment of resource jurisdictions with the Law of the Sea Treaty (1982) changed the face of ocean management forever. This agreement established an exclusive economic zone and territorial waters for each country with a coastline. It also has limited protections for international waters. Countries now had a vested interest as to what was happening under the waves. They could no longer fish and fish until the resource was wiped out because there would be no other place to go. Countries now had to manage their resources more wisely. Marine resource management programs are set up in coastal areas to guide industry into its new role of ownership. At first, the research community and the fisheries industry did not get along with one another. Industries believed it was the researchers versus business. This attitude makes it difficult to obtain accurate data from the fishing fleets. Good management recommendations came slowly. During the early 1990s this "research versus industry" attitude began to change. The fisheries industry realized that to maintain a productive harvest, they needed the advice of the fisheries scientists. At the same time the scientists realized that they would need to be sensitive to the fishing industry's concerns and interests to obtain the data that was needed to make valid recommendations. Scientists began to interpret data to yield practical applications. In the United States, the Magnuson–Stevens Fishery Conservation and Management Act (2007) regulates the fisheries industry. While there are some concerns with the law, the U.S. is generally considered to have a better-than-average management program. The degree of management around the world varies greatly from country to country. It is therefore very important to know where you seafood comes from in order to sustainably manage the populations of ocean species.

DATA: **from Food and Agriculture Organization of the United Nations (includes rounded totals)*

Table 1: World Aquaculture & Commercial Catches, 2000-2020			
Year	**Total Aquaculture (in metric tons)**	**Total Commercial Catch (in metric tons)**	**Total Seafood Production (in metric tons)**
2000	43,010,000	94,440,000	137,450,000
2001	45,560,000	91,690,000	137,240,000
2002	48,670,000	92,050,000	140,730,000
2003	51,530,000	89,290,000	140,820,000
2004	55,810,000	93,960,000	149,780,000
2005	59,160,000	93,600,000	152,750,000
2006	62,950,000	91,170,000	154,120,000
2007	66,320,000	91,530,000	157,850,000
2008	70,220,000	90,610,000	160,820,000
2009	73,850,000	90,000,000	163,840,000
2010	77,990,000	88,080,000	166,080,000
2011	81,620,000	92,580,000	174,200,000
2012	88,180,000	89,630,000	177,810,000
2013	94,950,000	90,870,000	185,820,000
2014	99,630,000	91,430,000	191,050,000
2015	104,000,000	92,510,000	196,520,000
2016	108,220,000	90,530,000	198,740,000
2017	112,240,000	94,390,000	206,630,000
2018	115,910,000	97,330,000	213,240,000
2019	119,800,000	93,190,000	212,990,000
2020	122,580,000	91,340,000	213,920,000

Table 2: Total Seafood Production by Country, 2020	
Country	**Total Catch & Aquaculture (in metric tons)**
China	62,240,000
Indonesia	13,430,000
India	13,250,000
United States	5,350,000
Peru	4,970,000



Analysis Questions

8. From the background information, what happened in the 1980s that significantly impacted ocean exploitation?
9. Regulation of the fisheries industry varies greatly from country to country, but is relatively strong in the U.S. due to what law?
10. Why is it important to sustainably manage commercial catch of ocean species?
11. Based on TABLE 1, describe the trends in aquaculture harvests from 2000-2020.
12. Describe the trends in commercial catch from 2000-2020.
13. Propose an explanation for the changes in commercial catch that happen from year to year.
14. The size of the global fishing fleet has decreased slightly since 2000 while commercial catch has remained relatively stable. Why?
15. Based on TABLE 2, what country produces the greatest amount of seafood?
16. Calculate the total seafood production per capita of China (2020 population: 1.4 billion) and the United States (2020 population: 330 million).
17. Based on the IMAGE above right, describe the relationship between fishing pressure and fish biomass.
18. Assess the statement from the upper left corner: "Those who consider fish not as a resource but as a wild animal population would consider this as the optimal sustainable level." Is this a reasonable point of view? Why or why not?
19. Define Maximum Sustainable Yield.
20. The CHART to the right shows sustainable and unsustainable seafood options for the southeast U.S., including North Carolina. Identify a species you eat and which column it's in. (If you do not eat seafood, you may record the answer of a friend)
21. Why should consumers know whether the seafood they are considering eating was caught sustainably?
22. Notice that Albacore Tuna shows up in all three columns. What is the difference between the three examples?
23. How should consumers find out where their seafood is coming from or how it is caught? Who's responsible for that info?
24. Are your answers to #21 and #23 reasonable? Why or why not?
25. The Marine Stewardship Council is an international non-profit that certifies seafood caught sustainably. If you see this label, you know you have made a good choice. Will you make good choices now?

BEST CHOICES

Bass (US farmed)
Catfish (US)
Clams (farmed)
Cockles
Cod: Pacific (Alaska)
Crab: Blue (Maryland trotline)
Crawfish (US farmed)
Lionfish (US)
Mullet: Striped (US)
Mussels (farmed)
Oysters (farmed)
Salmon (New Zealand)
Shrimp (US farmed)
Snapper: Mutton (US diving, handlines)
Squid (California)
Sturgeon (US farmed)
Swordfish (handlines, harpoons; US buoy gear)
Tilapia (Canada, Ecuador, Peru, US)
Tilefish: Blue (Atlantic)
Trout (US farmed)
Tuna: Albacore (trolls, pole & lines)
Tuna: Skipjack (Pacific trolls, pole & lines)
Wahoo (US Atlantic pole & lines)
Wreckfish

GOOD ALTERNATIVES

Clams (US, Canada wild)
Cod: Atlantic (handlines, pole & lines)
Conch (US)
Crawfish (Louisiana wild)
Crab: Blue (Alabama, Delaware, Maryland, New Jersey pots)
Grouper: Red (US)
Lobster: Spiny (US)
Mahi-mahi (US)
Oysters (US wild)
Pompano (US)
Salmon: Atlantic (Faroe Islands, Maine farmed)
Shrimp (Canada & US wild; Ecuador, Honduras & Thailand farmed)
Snapper (US)
Squid: Jumbo (Chile, China, Peru)
Swordfish (US, trolls)
Tilapia (Colombia, Honduras, Indonesia, Mexico, Taiwan)
Tilefish: Blue (Gulf of Mexico)
Trout (Canada farmed)
Tuna: Albacore (US longlines)
Tuna: Skipjack (free school, imported trolls, pole & lines, US longlines)
Tuna: Yellowfin (free school, trolls, pole & lines, US longlines)

AVOID

Branzino (Mediterranean farmed)
Cod: Atlantic (gillnet, longline, trawl)
Conch (imported)
Crab (Asia)
Crab: Blue (other US sources)
Crab: Snow (Canada)
Crab: Stone (Florida)
Crawfish (China)
Lobster: American (Canada, US)
Lobster: Spiny (Belize, Brazil, Honduras, Nicaragua)
Mahi-mahi (imported)
Orange roughy
Salmon (Canada, Chile, Norway, Scotland)
Shrimp (other imported sources)
Squid (Argentina, China, India, Indonesia, Japan, Thailand)
Swordfish (imported longlines)
Tilapia (China)
Tuna: Albacore (imported except trolls, pole & lines)
Tuna: Bluefin
Tuna: Skipjack (imported purse seines, Indian Ocean)
Tuna: Yellowfin (imported longlines, purse seines, Indian Ocean)