



Island STYLE



How Many Red Snapper Can I Keep?



SUBJECT:

Math

GRADE LEVEL:

6th

TIMEFRAME:

45 - 90 minutes

MATERIALS:

- 1 bag of plain popped popcorn
 - “Adult Fish”
- 1 bag of Chex Mix
 - “Bycatch”
- 1 bag of Goldfish
 - “Juvenile Fish”
- Assorted seashells
- Serving spoon
 - “Large Trawl”
- Dinner spoons
 - “Small Trawl”
- Chopsticks
 - “Hook and Line”
- Pretend Money
 - \$1 and \$5 bills
- Quota tickets



ACTIVITY SUMMARY:

Students will learn about the management of commercial and recreational fisheries using data from the Gulf of Mexico and Texas state waters snapper catch.

LEARNING OBJECTIVES:

- Students will learn about Northern red snapper, a commercially important fish species in the Gulf of Mexico
- Students will learn about the effectiveness of different fishing methods, tools, and techniques
- Students will understand biological, economical, and social impacts of regulations placed on commercial fisheries

ALIGNMENT:

TEKS

- 6.1 (A) – apply math to problems arising in everyday life, society and the workplace.
- 6.1 (B) -use a problem solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem solving process
- 6.1 (C) - select tools, including real objects, manipulatives, paper and pencil, technology as appropriate to solve problems
- 6.3 (D) – add, subtract, multiply and divide integers fluently
- 6.12 (A) – represent numeric data graphically
- 6.13 (A) – interpret numeric data summarized in dot plots

Ocean Literacy Principles: 1, 5, 6

VOCABULARY:

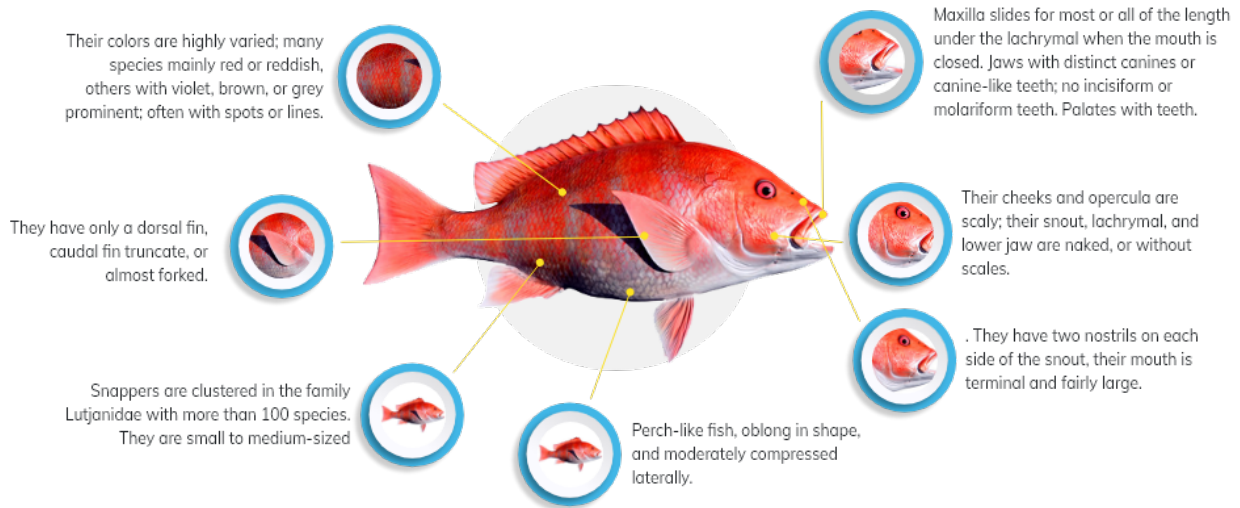
- **Habitat** - The natural home or environment of an animal, plant, or other organism
- **Trawl** - An act of fishing with a trawl net
- **Bycatch** - The unwanted fish and other marine creatures caught during commercial fishing for a different species



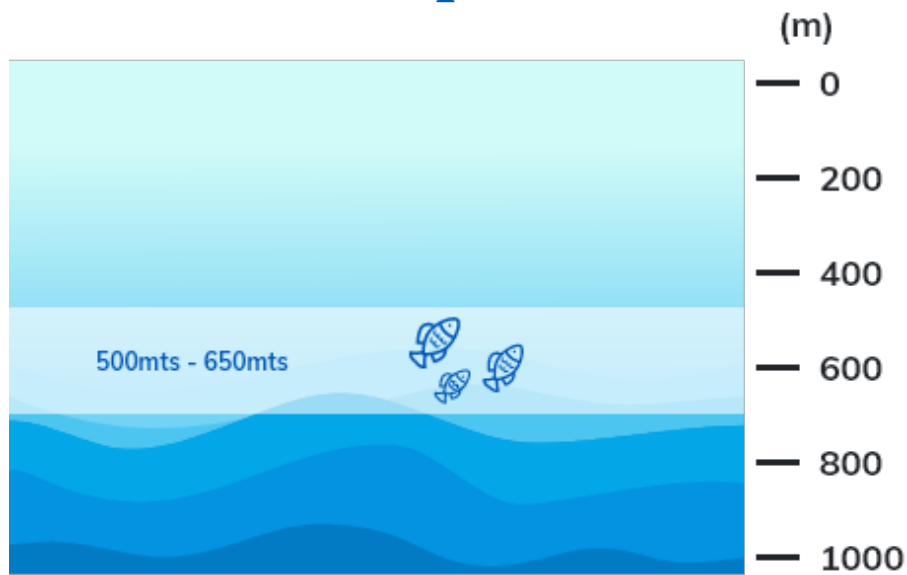
Snapper

Common names: Red snapper, lane snapper, Caribbean red snapper, redfish, southern red, silk snapper

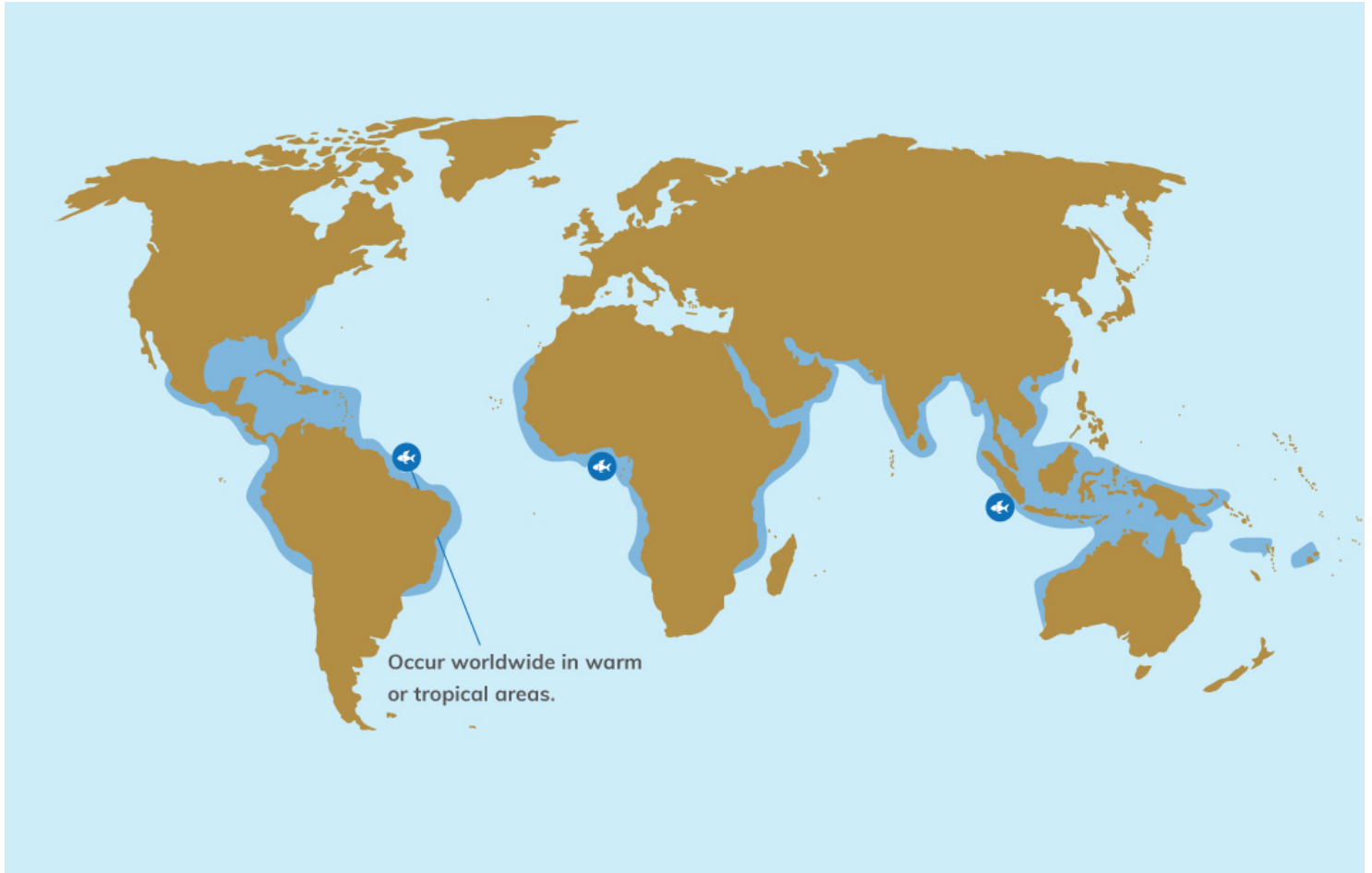
Scientific name (various species): *Lutjanus purpureus*, *Lutjanus synagris*, *Lutjanus vivanus*, *Rhomboplites aurorubens*, *Ocyurus chrysurus*



Habitat Depths



Location



Fishing Season



Fishing Methods



Bottom Trawl



Bottom Long Lines

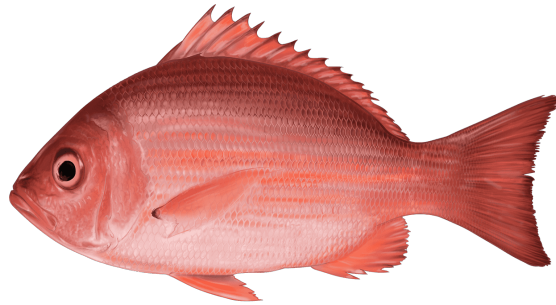


Gill Nets / Trammel



Hand Lines

BACKGROUND INFORMATION:



- **Species name:**
 - *Northern red snapper*
- **Native:**
 - to the Western Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico
- **Habitat:**
 - Inhabits rocky seafloors and artificial reefs such as oil rigs and shipwrecks
- **Characteristics:**
 - Ray-finned fish with a sloped profile, medium-to-large scales, a spiny dorsal fin, and a laterally compressed body. Northern red snappers have short, sharp, needle-like teeth but lack upper canine teeth. Large and red in color. Can be up to 39 inches long, weigh up to 50 lbs, and can live to be over 50 years old!
- **Commercial use:**
 - Northern red snapper (*Lutjanus campechanus*) is perhaps the most economically valuable and culturally relevant fishery in the U.S. Gulf of Mexico. The trends in fishing activity over the past 150 years have led to a depleted stock, which is now under a rebuilding plan. As the stock continues to show signs of recovery, fishermen are seeing more (and larger) red snapper in the population; however, the spawning potential of the population (the number of eggs produced by reproductively active females) is still lower than the rebuilding target. The conundrum caused by a population that is rapidly rebuilding, but has not yet met its rebuilding target (the biomass needed for long-term sustainable yield), has led to discontent among some user groups. Hearing the frustration from their constituents, lawmakers took action.
- **The Great Red Snapper Count:**
 - In 2016, Congress made funding available to independently estimate the population size of U.S. Gulf of Mexico red snapper. A total of \$10 million was awarded by Mississippi-Alabama Sea Grant for a two-year project, which will run from 2017 – 2019. The project, officially titled 'Estimating the absolute abundance of red snapper in the U.S. Gulf of Mexico,' but better known as the Great Red Snapper Count, aimed to estimate the population size of red snapper in U.S. waters of the Gulf of Mexico. This evaluation was conducted separately from the assessment process employed by the Gulf of Mexico Fishery Management Council through the SEDAR process. The project was led by a well-integrated, multidisciplinary team of 21 investigators, which was comprised of leading fisheries experts from the Gulf region and beyond. A suite of methods, including habitat classification, direct visual counts, depletion surveys, and a high-reward tagging study, was used across the entire U.S. Gulf of Mexico

BACKGROUND INFORMATION:

Fishing Methods

- Some fishing methods, such as purse seining and dredging, catch a significant amount of bycatch because they use nets in the water column, which sometimes capture unintended animals. Additionally, some methods, such as trawling, cyanide fishing and explosives also wreak havoc on the seafloor, uprooting long standing corals and kelp beds.
- More environmentally friendly methods include trolling, a hook-and-line method that tows fishing lines behind or alongside a boat. Fishermen use various baits to "troll" for specific fish at different depths. This method catches fish that will follow a moving lure or bait, such as salmon, mahi mahi and albacore tuna. Trolling is an environmentally responsible fishing method. Fishermen can quickly release unwanted catch from their hooks since lines are reeled in soon after a fish takes the bait.

Conservation & Sustainability Methods

- There are many potential solutions regulating fisheries so that they are more sustainable, which means that it meets the needs of the present without compromising the ability of future generations to meet their own needs. Students will be asked to come up with their ideas for ways to be more sustainable. This will help them build critical thinking skills. However, if they struggle, you can introduce some of these ideas.
- Catch Limits: the maximum number of fish that an angler may catch from a specified waterbody or a portion of a waterbody in one day.
- Catch Share: a fishery management system that allocates a secure privilege to harvest a specific percentage of a fishery's total catch to individuals, communities and/or associations throughout the season. This often creates an increase in fish available over time.
- Marine Sanctuary: is a federally designated area within United States waters that protects areas of the marine environment with special conservation, recreational, ecological, historical, cultural, archeological, scientific, educational, or aesthetic qualities.
- Outlawing certain fishing methods: Many places are now outlawing trawling, explosives, and cyanide fishing in order to prevent bycatch, and environmental problems.
- Responsible Consumerism: If people refuse to buy certain fish because there is too much impact on the animal populations then they are practicing "responsible consumerism." Sometimes this means buying "good alternatives," or choosing not to consume fish at all.

PREPARATION:

Players

- 1 Fisheries manager (the teacher)
- Pairs of fishermen

Game set up

- Scatter shells across the tray playing surface
- Disperse all the adult fish, juvenile fish and bycatch across the habitat
- Distribute \$10 to each pair of fishermen
- Distribute gear based on fisherman choice
- Large Trawls \$10, small trawl \$8, hook and line \$5

Rules of the game

- All gear must be used properly!
- Trawls must have contact with the table at all times and collect everything in the path.
- Hook and line can grab just two at a time.
- New or additional gear can **only** be purchased at the beginning of a new season.
- Each target adult fish landed is worth \$1
- Fisheries manager will monitor the season fishing time
- Fines for rule violation -\$2 for improper gear use, -\$4 for fishing outside the season
- All Fishing statistics must be reported at the end of the season.
- Fisheries manager will record the statistics and set the next season catch based on spawning rules.

Spawning rules

- Adult fish: add ½ the number of juvenile fish remaining back to the habitat.
- Juvenile fish: add 1x the number of adult fish that are left.
- Bycatch: add ½ of the number of bycatches that are left.

INTRODUCTION:

You are a local fisherman in the Galveston area targeting red snapper, the delicious fish that is on every menu at every restaurant in town. Fisherman from far and wide are meeting the demand by investing the time and money needed to bring these fish to market through many different harvest methods. A fisheries manager is responsible for ensuring a healthy and sustainable stock of all of our game fish in the state and federal water off our coastline. The Gulf of Mexico Fishery Management Council through NOAA has the authority to develop and enforce management measures and participating fisherman must comply with those rules. The rules for amount of time you can fish, how big the fish must be to keep them and how many fish you can catch change from year to year based on data from the previous fishing season.

GUIDED PRACTICE:

Season 1 - No regulations

- No catch limits, play for 15 seconds.

Season 2 - Catch limits

- Due to impacts from overfishing last season, there is now a limit of half the adult fish biomass. Fishing stops when statistics reach the catch limit.

Season 3 - Early season closure

- The catch limit from last year is still in place, but due to declining adult populations, there will also be a shortened fishing season of five seconds. If the catch limit is reached before the five seconds, fishing will stop.

Season 4 - Catch share or quotas

- Catch limit of half the adult fish biomass still in place. Each fisherman also now receives a quota which guarantees each fisherman a share of the catch limit.
- Allocating quota shares - divide the catch limit by the number of fisherman teams.
- Teams can buy or sell their quota shares.
- If a fisherman team goes over their quota, they must purchase a quota share from another fisherman or borrow against next year's quota.
- There is no time limit. Each fisherman has as much time as needed to land their allotted quota.

INDEPENDENT / GROUP PRACTICE:

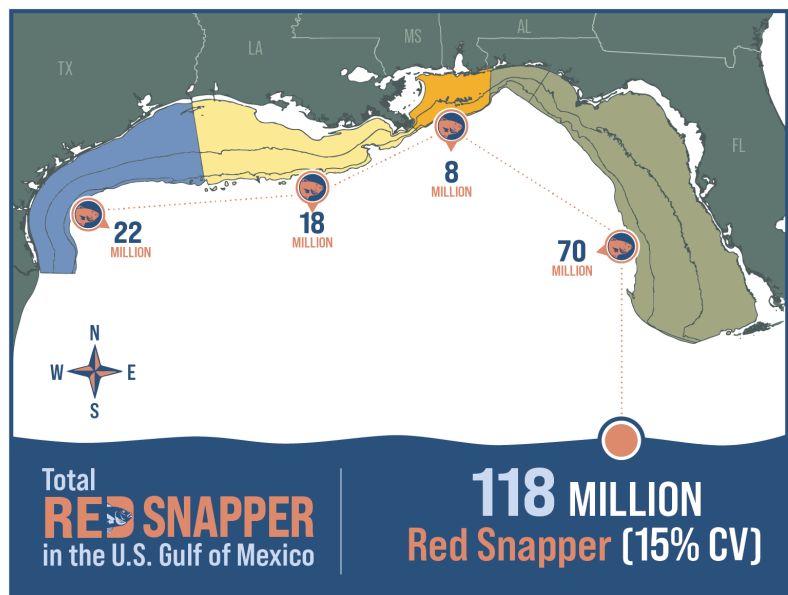
Have the students work in small groups to graph their data from the activity. See graphing worksheet attached below.

THE GREAT RED SNAPPER COUNT

EXECUTIVE SUMMARY TABLE

State /Region	Habitat Type	Estimated Abundance
Texas	Natural	7,000,000
	Artificial	<1,000,000
	Uncharacterized Bottom	14,000,000
	State Total	22,000,000
Louisiana	Natural	4,000,000
	Artificial	4,000,000
	Uncharacterized Bottom	10,000,000
	State Total	18,000,000
Mississippi & Alabama	Natural	4,000,000
	Artificial	1,000,000
	Uncharacterized Bottom	3,000,000
	State Total	8,000,000
Florida	Natural & Uncharacterized Bottom	70,000,000
	Artificial	<1,000,000
	State Total	70,000,000

Total
RED SNAPPER
in the U.S. Gulf of Mexico | **118 MILLION** (15% CV)



ASSESSMENT OF LEARNING:

Discussion -

Hold a discussion to help students process what they have learned during each season. Give real world statistics and stories about our snapper fishery that might illustrate the situation they were simulating.

- What happened **BIOLOGICALLY** after each season? Look at the graphs they created to see how the numbers of fish fluctuated.
 - Were there some areas of habitat that had more fish than others?
 - When you have been fishing, do you throw the small fish back?
 - Do they always live when you throw them back in?
- What happened **ECONOMICALLY** after each season?
 - Were there seasons when it was easier to make money?
 - Harder?
 - More stability for the long term?
- What happened **SOCIALLY** among the fisherman teams?
 - Why did they make the decisions they did about gear choice or quota selling?
 - Did they work together?
 - Fight over good fishing habitat?

Season 1 - Expect to see habitat destruction, aggression among fisherman, and high catch numbers.

Season 2 - Expect to see a shorter fishing season, landings exceeding the catch limit, fines, and a shift in gear type from trawl to hook and line.

Season 3 - Expect to see landings exceeding catch limits, fines, and a shift from trawl to hook and line.

Season 4 - Expect to see the pace of the game slow significantly. Fisherman may plan more efficiently to stay within their quota and avoid juvenile fish, bycatch and habitat destruction. Some fishermen may choose not to fish at all, but to sell their quota instead.

CLOSING:

As you teach lessons linked to the Galveston Bay Watershed and the Gulf of Mexico, you can use the “I Wonder” Board as a closure assignment. You might ask what else the students want to learn about fisheries management. Students may ask about other species, the difference between commercial fishing rules and recreational fishing rules, game wardens, or even how turtle excluder devices work on a shrimp boat. All of their questions (even the ones asked multiple times) will go on the “I Wonder” Board. If a question was answered in the lesson, it can still be placed on the board.

Students may even have follow-up questions after these lessons that could be added to the board. The goal is to have a place for all questions about the Galveston Bay and the Gulf of Mexico in one place.



EXTENSION:

Play Season 1 several times in a row to show the effects of no regulation on the habitat and fishery numbers.

NOTES:

<https://www.hartheresearch.org/snappercount>

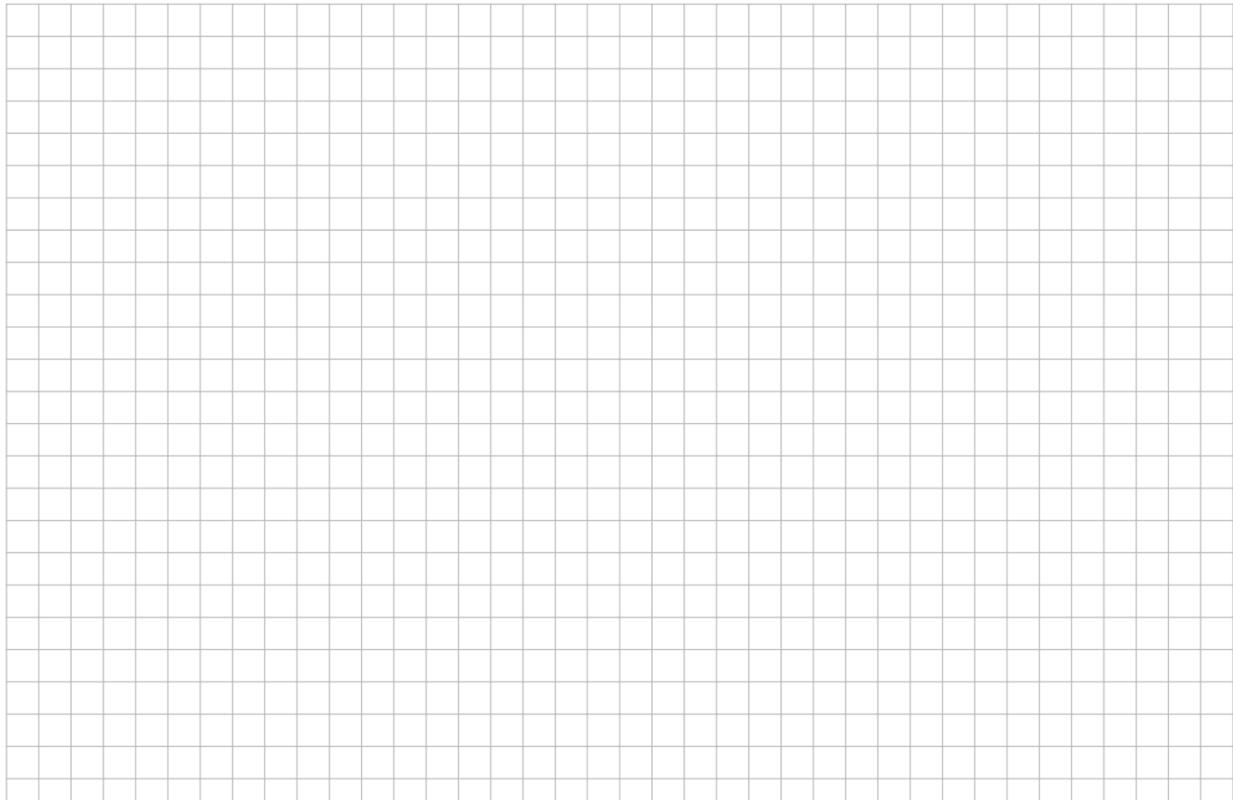
<https://storymaps.arcgis.com/stories/d03212c07af94ac79a98c9c3a210270e>

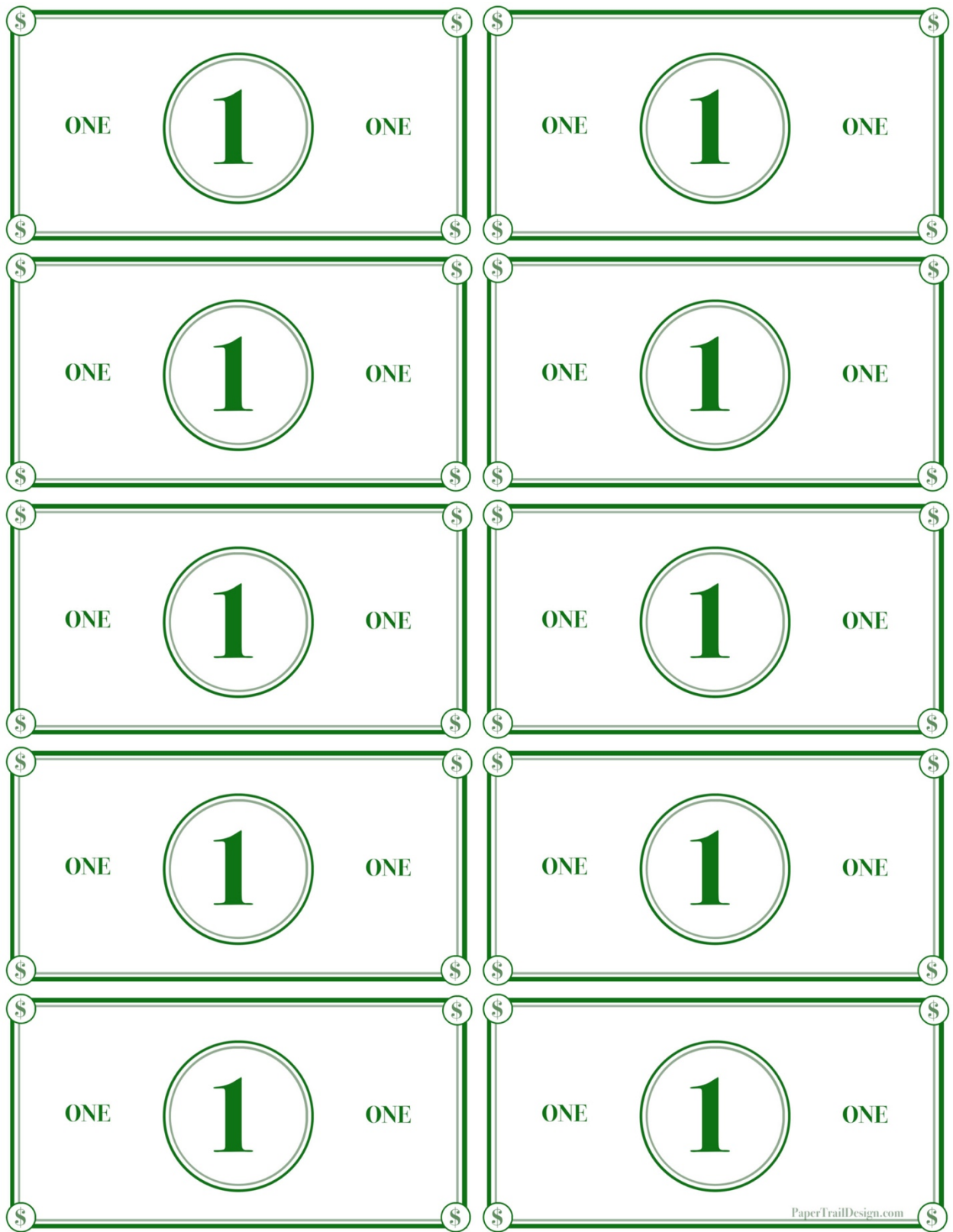
Graphing Exercise

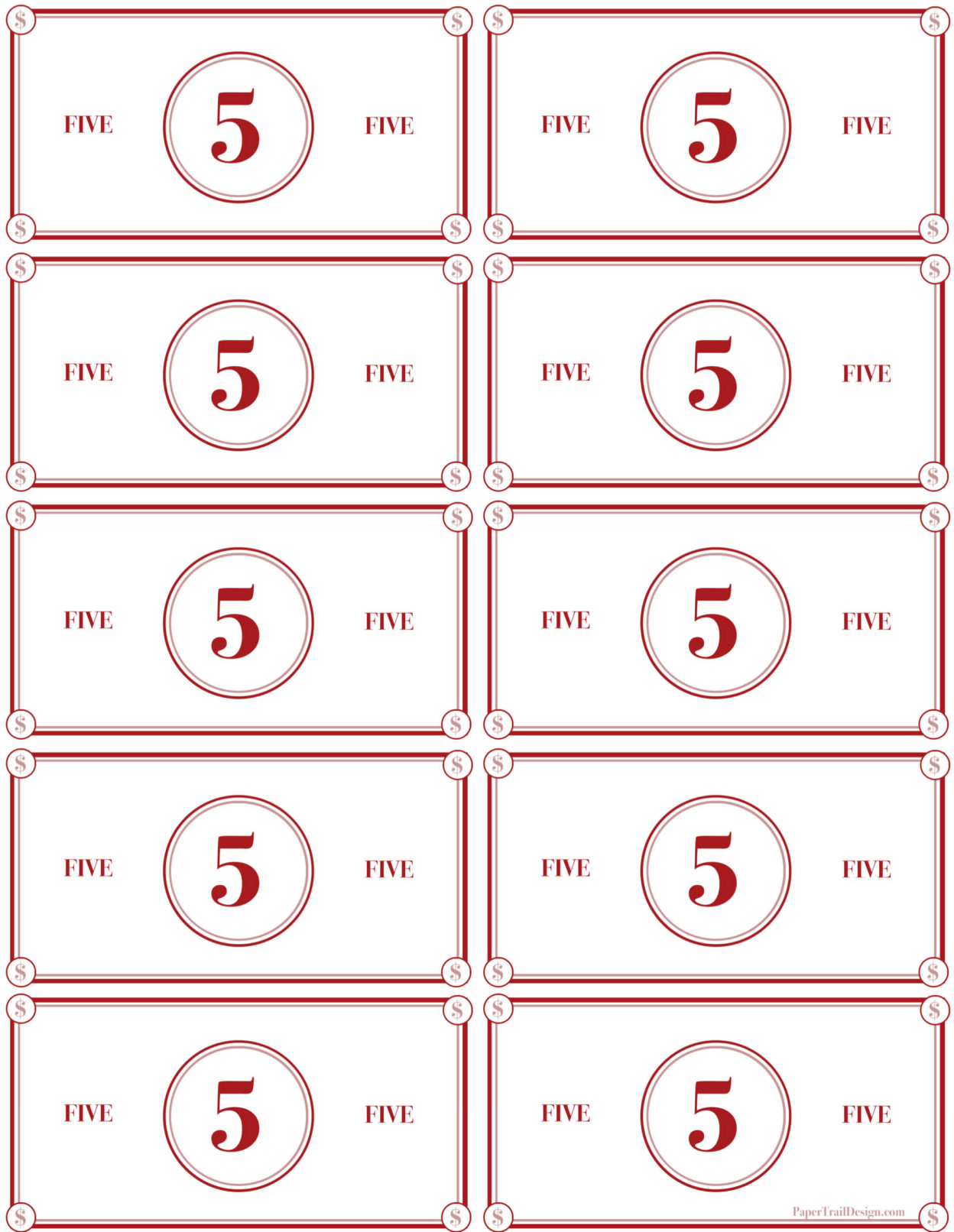
Create a bar graph using your fisheries statistics.

Use a separate color for each season.

Remember to include a descriptive title, x and y axis labels, and a numbering scheme that does NOT label every line!







<p>Fishing Quota Holder of this certificate has the rights to ONE fishing share</p> 	<p>Fishing Quota Holder of this certificate has the rights to THREE fishing shares</p> 
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My Fishing Statistics Log

Name of fisherman team:

Season 1

Adult fish caught	Juvenile fish caught	Bycatch caught	Revenue adult fish x \$1	Gear costs	Fines costs	Profit Revenue - gear - fines

Season 2

Adult fish caught	Juvenile fish caught	Bycatch caught	Revenue adult fish x \$1	Gear costs	Fines costs	Profit Season 1 profit + revenue - gear - fines

Season 3

Adult fish caught	Juvenile fish caught	Bycatch caught	Revenue adult fish x \$1	Gear costs	Fines costs	Profit Season 2 profit + revenue - gear - fines

Season 4

Adult fish caught	Juvenile fish caught	Bycatch caught	Revenue adult fish x \$1	Gear costs	Fines costs	Profit Season 3 profit + revenue - gear - fines