

*This adaptation is designed to modify the Population Education lesson Pop Ecology Files for use with marine education. **Get the full lesson plan for Pop Ecology Files** [here](#).*

PROCEDURE: Student Worksheets

Set-up the challenge for your students:

“Your aunt is a marine biologist who just returned from a long research voyage studying six ocean species across different regions. Unfortunately, her field notebook got mixed up, and she lost the key that matches each data set to its species. Your mission is to graph the data sets and then match the graphs with the species background information. Your aunt can’t do it without you!”

ANSWER KEY:

- Data Set 1: Central Stoneroller
- Data Set 2: Anchovy
- Data Set 3: Phytoplankton A
- Data Set 4: Bluefin Tuna
- Data Set 5: Phytoplankton B
- Data Set 6: Humpback Whale

See completed graphs on pages 9-12.

Species #1 Worksheet

Name: _____

Date: _____

Answer questions #1-4 based on your data. Then plot your graph and use it to help you answer questions #5-6. **Don't forget to title your graph with your Data Set Number.**

Data Set #1	
YEAR	POPULATION
10	100
20	102
30	104
40	106
50	108

1.) What information goes on the dependent axis?

2.) What information goes on the independent axis?

3.) What scale will you use on the dependent axis?

4.) What scale will you use on the independent axis?

5.) What species do you think you are working with? _____

6.) How do you know? Use information from the Species List below as evidence to support your answer. (Write 1-2 full sentences on the back of this page.)

SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Central Stoneroller	The central stoneroller is an abundant, herbivorous fish that is primarily used by humans as fishing bait due to its consistent availability. The fish is currently classified under "least concern" by the International Union of Conservation of Nature, meaning that it is not under threat of extinction.	Northeast Mexico
Anchovy Fish	Over the years, changes in ocean nutrients, fishing patterns, and ecosystem health impact the size of the anchovy population. When nutrients are abundant, their reproduction increases; when nutrients are scarce, the population declines.	Southern Pacific Ocean
Phytoplankton A	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. During this study period, the habitat of Phytoplankton A is initially warm with lots of sunlight. But after several months, temperatures and nutrients plummet.	Gulf of Mexico
Atlantic Bluefin Tuna	The Atlantic bluefin tuna is the largest and most agile tuna, making it a prize highly sought after by fishermen. During the initial study period, the fish was susceptible to tuna ranching and overfishing. After several years, management policies were enforced that allow both harvesting for humans and protections for the fish.	Eastern Atlantic Ocean
Phytoplankton B	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. Phytoplankton B's habitat starts off warm and sunny. Unlike Phytoplankton A, when temperatures and sunlight decline several months into the study period, this population was able to quickly adapt to its changing environment.	Gulf of Mexico
Humpback Whale	Humpback whales can live to be 80-90 years old. In the 1960s, policies were enacted to ban commercial hunting of these whales. Additionally, environmental laws that created cleaner water have ensured humpback whales' healthy habitat in which they can thrive.	Salish Sea

Species #2 Worksheet

Name: _____

Date: _____

Answer questions #1-4 based on your data. Then plot your graph and use it to help you answer questions #5-6. **Don't forget to title your graph with your Data Set Number.**

Data Set #2	
YEAR	POPULATION
5	1000
10	1500
15	800
20	1200
25	700

1.) What information goes on the dependent axis?

2.) What information goes on the independent axis?

3.) What scale will you use on the dependent axis?

4.) What scale will you use on the independent axis?

5.) What species do you think you are working with? _____

6.) How do you know? Use information from the Species List below as evidence to support your answer. (Write 1-2 full sentences on the back of this page.)

SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Central Stoneroller	The central stoneroller is an abundant, herbivorous fish that is primarily used by humans as fishing bait due to its consistent availability. The fish is currently classified under "least concern" by the International Union of Conservation of Nature, meaning that it is not under threat of extinction.	Northeast Mexico
Anchovy Fish	Over the years, changes in ocean nutrients, fishing patterns, and ecosystem health impact the size of the anchovy population. When nutrients are abundant, their reproduction increases; when nutrients are scarce, the population declines.	Southern Pacific Ocean
Phytoplankton A	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. During this study period, the habitat of Phytoplankton A is initially warm with lots of sunlight. But after several months, temperatures and nutrients plummet.	Gulf of Mexico
Atlantic Bluefin Tuna	The Atlantic bluefin tuna is the largest and most agile tuna, making it a prize highly sought after by fishermen. During the initial study period, the fish was susceptible to tuna ranching and overfishing. After several years, management policies were enforced that allow both harvesting for humans and protections for the fish.	Eastern Atlantic Ocean
Phytoplankton B	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. Phytoplankton B's habitat starts off warm and sunny. Unlike Phytoplankton A, when temperatures and sunlight decline several months into the study period, this population was able to quickly adapt to its changing environment.	Gulf of Mexico
Humpback Whale	Humpback whales can live to be 80-90 years old. In the 1960s, policies were enacted to ban commercial hunting of these whales. Additionally, environmental laws that created cleaner water have ensured humpback whales' healthy habitat in which they can thrive.	Salish Sea

Species #3 Worksheet

Name: _____

Date: _____

Answer questions #1-4 based on your data. Then plot your graph and use it to help you answer questions #5-6. **Don't forget to title your graph with your Data Set Number.**

Data Set #3	
YEAR	POPULATION
1	5000
3	12000
5	30000
7	8000
9	6000

1.) What information goes on the dependent axis?

2.) What information goes on the independent axis?

3.) What scale will you use on the dependent axis?

4.) What scale will you use on the independent axis?

5.) What species do you think you are working with? _____

6.) How do you know? Use information from the Species List below as evidence to support your answer. (Write 1-2 full sentences on the back of this page.)

SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Central Stoneroller	The central stoneroller is an abundant, herbivorous fish that is primarily used by humans as fishing bait due to its consistent availability. The fish is currently classified under "least concern" by the International Union of Conservation of Nature, meaning that it is not under threat of extinction.	Northeast Mexico
Anchovy Fish	Over the years, changes in ocean nutrients, fishing patterns, and ecosystem health impact the size of the anchovy population. When nutrients are abundant, their reproduction increases; when nutrients are scarce, the population declines.	Southern Pacific Ocean
Phytoplankton A	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. During this study period, the habitat of Phytoplankton A is initially warm with lots of sunlight. But after several months, temperatures and nutrients plummet.	Gulf of Mexico
Atlantic Bluefin Tuna	The Atlantic bluefin tuna is the largest and most agile tuna, making it a prize highly sought after by fishermen. During the initial study period, the fish was susceptible to tuna ranching and overfishing. After several years, management policies were enforced that allow both harvesting for humans and protections for the fish.	Eastern Atlantic Ocean
Phytoplankton B	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. Phytoplankton B's habitat starts off warm and sunny. Unlike Phytoplankton A, when temperatures and sunlight decline several months into the study period, this population was able to quickly adapt to its changing environment.	Gulf of Mexico
Humpback Whale	Humpback whales can live to be 80-90 years old. In the 1960s, policies were enacted to ban commercial hunting of these whales. Additionally, environmental laws that created cleaner water have ensured humpback whales' healthy habitat in which they can thrive.	Salish Sea

Species #4 Worksheet

Name: _____

Date: _____

Answer questions #1-4 based on your data. Then plot your graph and use it to help you answer questions #5-6. **Don't forget to title your graph with your Data Set Number.**

Data Set #4	
YEAR	POPULATION
3	700
5	100
7	200
9	300
12	400

1.) What information goes on the dependent axis?

2.) What information goes on the independent axis?

3.) What scale will you use on the dependent axis?

4.) What scale will you use on the independent axis?

5.) What species do you think you are working with? _____

6.) How do you know? Use information from the Species List below as evidence to support your answer. (Write 1-2 full sentences on the back of this page.)

SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Central Stoneroller	The central stoneroller is an abundant, herbivorous fish that is primarily used by humans as fishing bait due to its consistent availability. The fish is currently classified under "least concern" by the International Union of Conservation of Nature, meaning that it is not under threat of extinction.	Northeast Mexico
Anchovy Fish	Over the years, changes in ocean nutrients, fishing patterns, and ecosystem health impact the size of the anchovy population. When nutrients are abundant, their reproduction increases; when nutrients are scarce, the population declines.	Southern Pacific Ocean
Phytoplankton A	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. During this study period, the habitat of Phytoplankton A is initially warm with lots of sunlight. But after several months, temperatures and nutrients plummet.	Gulf of Mexico
Atlantic Bluefin Tuna	The Atlantic bluefin tuna is the largest and most agile tuna, making it a prize highly sought after by fishermen. During the initial study period, the fish was susceptible to tuna ranching and overfishing. After several years, management policies were enforced that allow both harvesting for humans and protections for the fish.	Eastern Atlantic Ocean
Phytoplankton B	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. Phytoplankton B's habitat starts off warm and sunny. Unlike Phytoplankton A, when temperatures and sunlight decline several months into the study period, this population was able to quickly adapt to its changing environment.	Gulf of Mexico
Humpback Whale	Humpback whales can live to be 80-90 years old. In the 1960s, policies were enacted to ban commercial hunting of these whales. Additionally, environmental laws that created cleaner water have ensured humpback whales' healthy habitat in which they can thrive.	Salish Sea

Species #5 Worksheet

Name: _____

Date: _____

Answer questions #1-4 based on your data. Then plot your graph and use it to help you answer questions #5-6. **Don't forget to title your graph with your Data Set Number.**

Data Set #5	
YEAR	POPULATION
1	5000
3	12000
5	18000
7	18000
9	18000

1.) What information goes on the dependent axis?

2.) What information goes on the independent axis?

3.) What scale will you use on the dependent axis?

4.) What scale will you use on the independent axis?

5.) What species do you think you are working with? _____

6.) How do you know? Use information from the Species List below as evidence to support your answer. (Write 1-2 full sentences on the back of this page.)

SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Central Stoneroller	The central stoneroller is an abundant, herbivorous fish that is primarily used by humans as fishing bait due to its consistent availability. The fish is currently classified under "least concern" by the International Union of Conservation of Nature, meaning that it is not under threat of extinction.	Northeast Mexico
Anchovy Fish	Over the years, changes in ocean nutrients, fishing patterns, and ecosystem health impact the size of the anchovy population. When nutrients are abundant, their reproduction increases; when nutrients are scarce, the population declines.	Southern Pacific Ocean
Phytoplankton A	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. During this study period, the habitat of Phytoplankton A is initially warm with lots of sunlight. But after several months, temperatures and nutrients plummet.	Gulf of Mexico
Atlantic Bluefin Tuna	The Atlantic bluefin tuna is the largest and most agile tuna, making it a prize highly sought after by fishermen. During the initial study period, the fish was susceptible to tuna ranching and overfishing. After several years, management policies were enforced that allow both harvesting for humans and protections for the fish.	Eastern Atlantic Ocean
Phytoplankton B	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. Phytoplankton B's habitat starts off warm and sunny. Unlike Phytoplankton A, when temperatures and sunlight decline several months into the study period, this population was able to quickly adapt to its changing environment.	Gulf of Mexico
Humpback Whale	Humpback whales can live to be 80-90 years old. In the 1960s, policies were enacted to ban commercial hunting of these whales. Additionally, environmental laws that created cleaner water have ensured humpback whales' healthy habitat in which they can thrive.	Salish Sea

Species #6 Worksheet

Name: _____

Date: _____

Answer questions #1-4 based on your data. Then plot your graph and use it to help you answer questions #5-6. **Don't forget to title your graph with your Data Set Number.**

Data Set #6	
YEAR	POPULATION
5	100
10	104
15	110
20	116
25	120

1.) What information goes on the dependent axis?

2.) What information goes on the independent axis?

3.) What scale will you use on the dependent axis?

4.) What scale will you use on your independent axis?

5.) What species do you think you are working with? _____

6.) How do you know? Use information from the Species List below as evidence to support your answer. (Write 1-2 full sentences on the back of this page.)

SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Central Stoneroller	The central stoneroller is an abundant, herbivorous fish that is primarily used by humans as fishing bait due to its consistent availability. The fish is currently classified under "least concern" by the International Union of Conservation of Nature, meaning that it is not under threat of extinction.	Northeast Mexico
Anchovy Fish	Over the years, changes in ocean nutrients, fishing patterns, and ecosystem health impact the size of the anchovy population. When nutrients are abundant, their reproduction increases; when nutrients are scarce, the population declines.	Southern Pacific Ocean
Phytoplankton A	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. During this study period, the habitat of Phytoplankton A is initially warm with lots of sunlight. But after several months, temperatures and nutrients plummet.	Gulf of Mexico
Atlantic Bluefin Tuna	The Atlantic bluefin tuna is the largest and most agile tuna, making it a prize highly sought after by fishermen. During the initial study period, the fish was susceptible to tuna ranching and overfishing. After several years, management policies were enforced that allow both harvesting for humans and protections for the fish.	Eastern Atlantic Ocean
Phytoplankton B	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. Phytoplankton B's habitat starts off warm and sunny. Unlike Phytoplankton A, when temperatures and sunlight decline several months into the study period, this population was able to quickly adapt to its changing environment.	Gulf of Mexico
Humpback Whale	Humpback whales can live to be 80-90 years old. In the 1960s, policies were enacted to ban commercial hunting of these whales. Additionally, environmental laws that created cleaner water have ensured humpback whales' healthy habitat in which they can thrive.	Salish Sea

ALTERNATIVE PROCEDURE: Species Graphs and Descriptions

Set-up the challenge for your students:

“Your aunt is a marine biologist who just returned from a long research voyage studying six ocean species across different regions. Unfortunately, her field notebook got mixed up, and she lost the key that matches each graphed data set to its species! Your mission is to use each population graph and the species background information to determine which graphed data set belongs to which species.”

SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Central Stoneroller	The central stoneroller is an abundant, herbivorous fish that is primarily used by humans as fishing bait due to its consistent availability. The fish is currently classified under “least concern” by the International Union of Conservation of Nature, meaning that it is not under threat of extinction.	Northeast Mexico

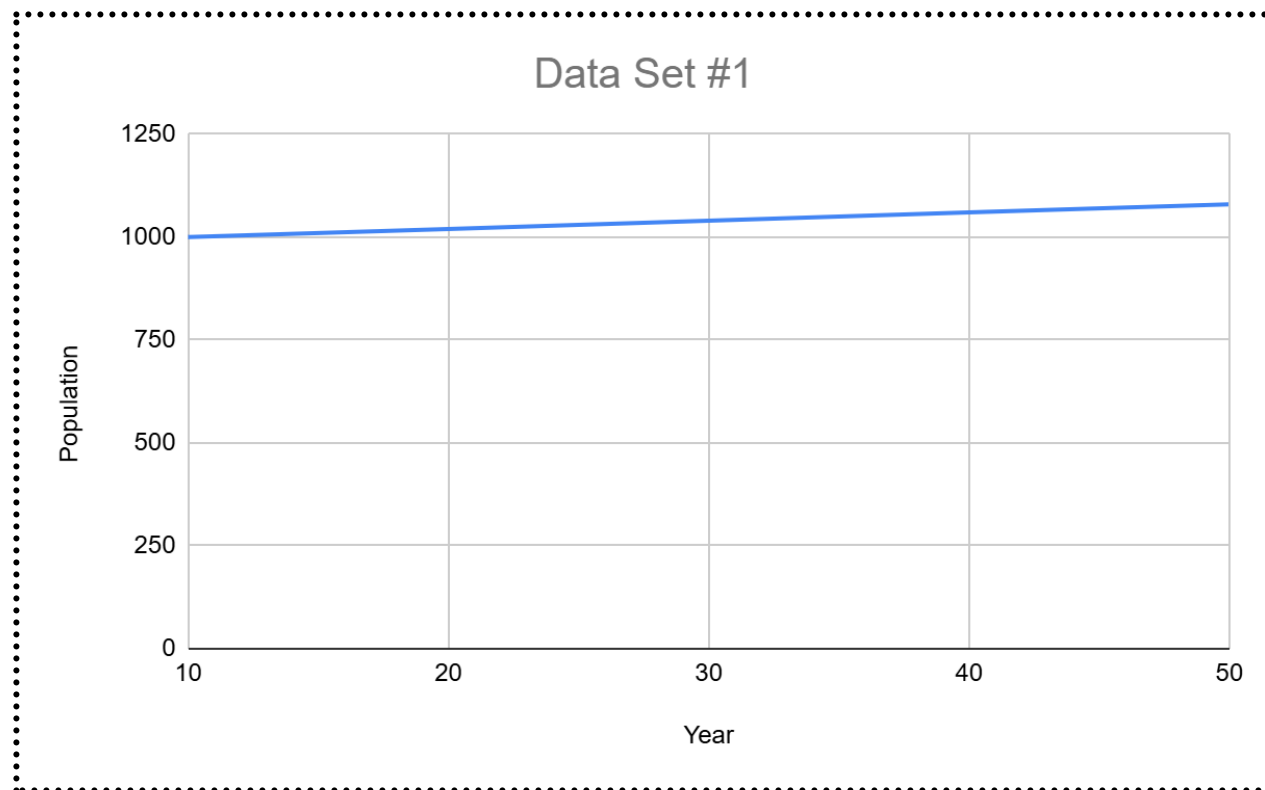
SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Anchovy	Changes over the years in ocean nutrients, ecosystem health, and fishing patterns impact the size of the anchovy population. When nutrients are abundant, this fish’s reproduction increases; when nutrients are scarce, the population declines.	Southern Pacific Ocean

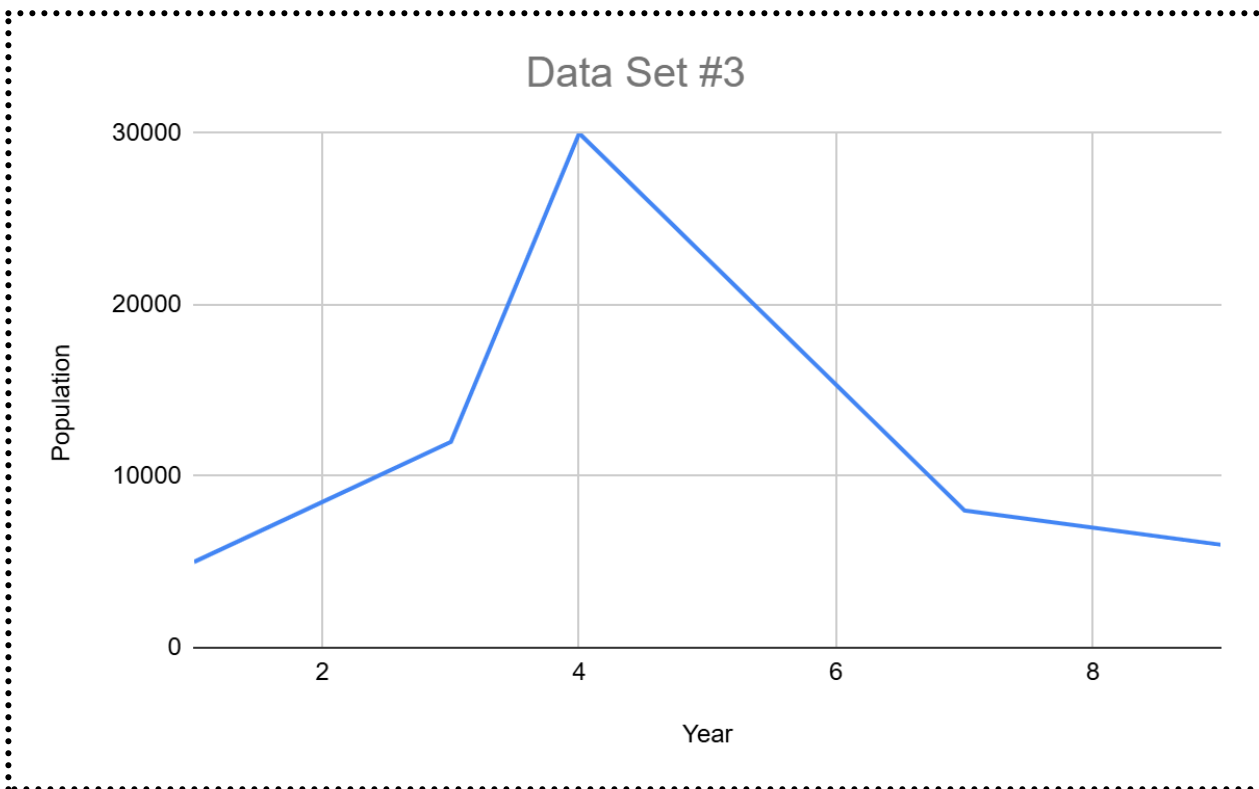
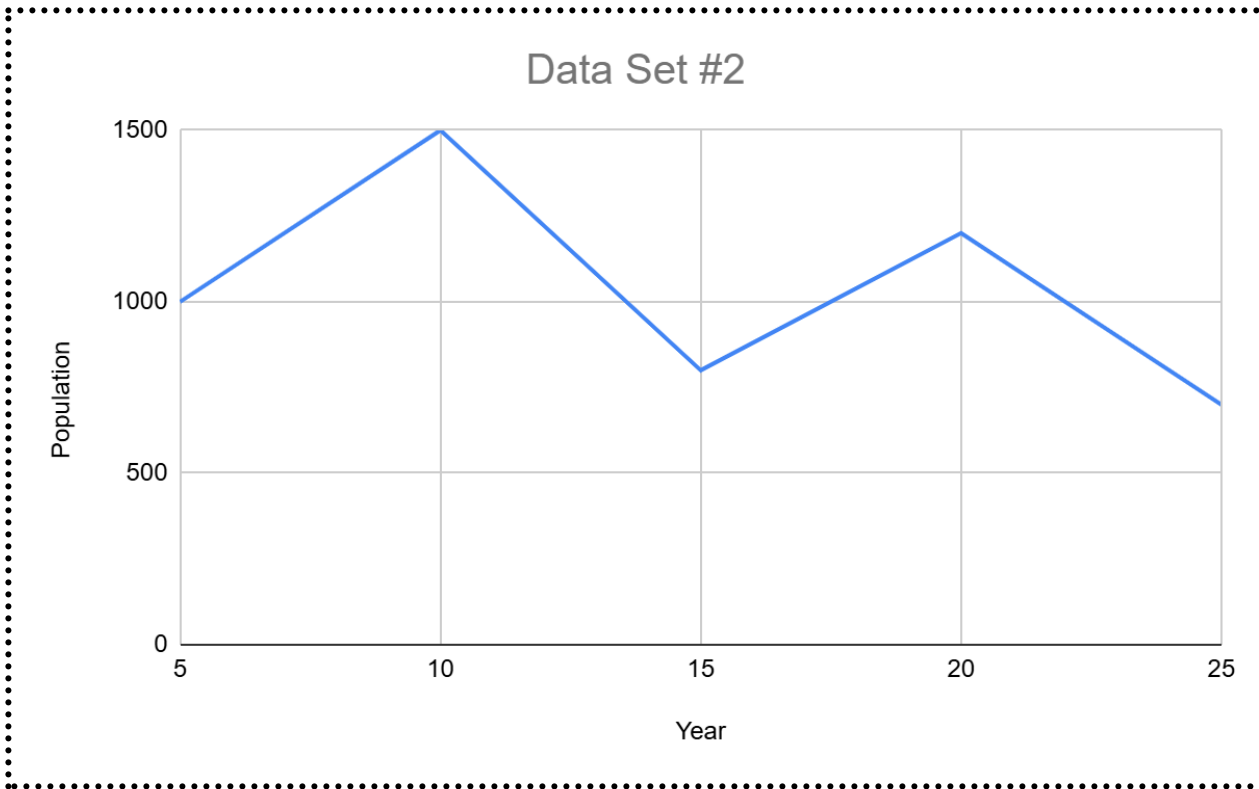
SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Phytoplankton A	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. During this study period, the habitat of Phytoplankton A is initially warm with lots of sunlight. But after several months, temperatures and nutrients plummet.	Gulf of Mexico

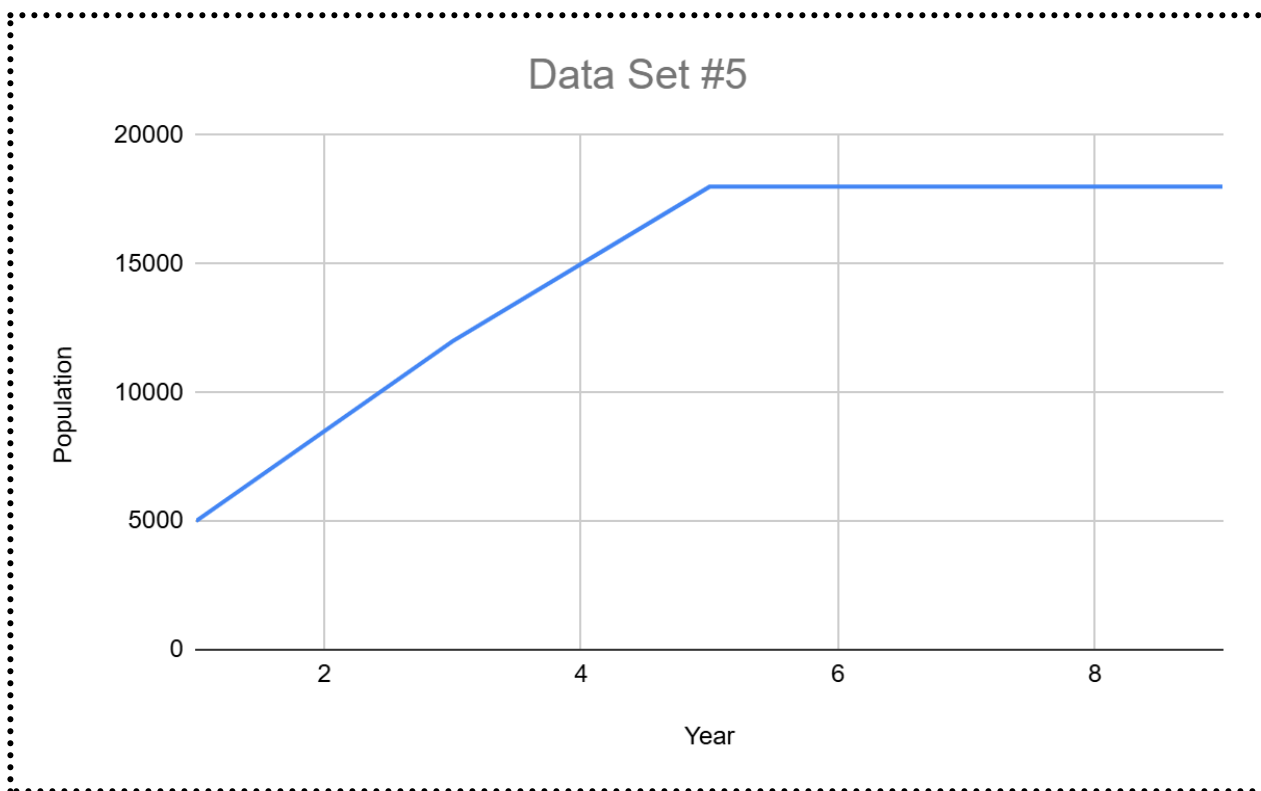
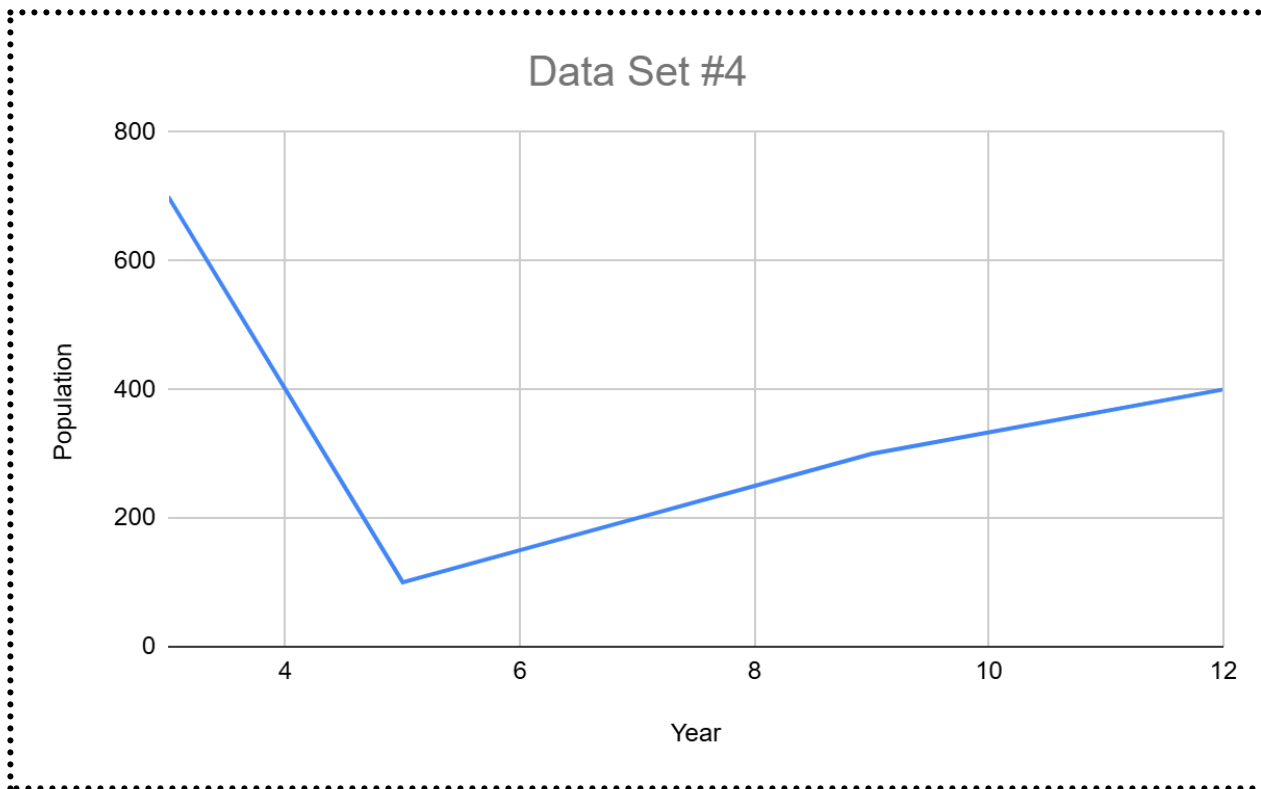
SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Humpback Whale	Humpback whales can live to be 80-90 years old. In the 1960s, policies were enacted to ban commercial hunting of these whales. Additionally, environmental laws that created cleaner water have ensured humpback whales' healthy habitat in which they can thrive.	Salish Sea

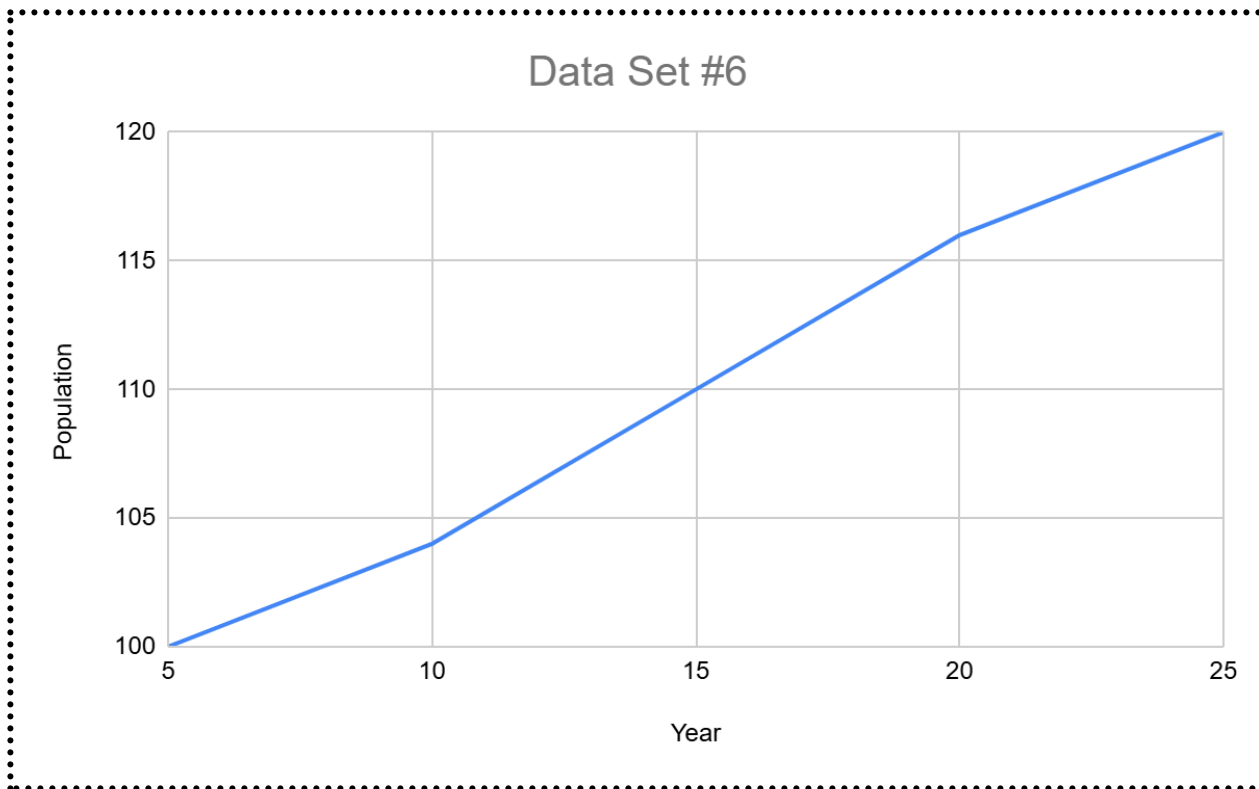
SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Atlantic Bluefin Tuna	The Atlantic bluefin tuna is the largest and most agile tuna, making it a prize highly sought after by fishermen. During the initial study period, the fish was susceptible to tuna ranching and overfishing. After several years, management policies were enforced that allow both harvesting for humans and protections for the fish.	Eastern Atlantic Ocean

SPECIES NAME	POPULATION PATTERN	STUDY LOCATION
Phytoplankton B	Phytoplankton are dependent on sunlight and warm water temperatures to thrive. Phytoplankton B's habitat starts off warm and sunny. Unlike Phytoplankton A, when temperatures and sunlight decline several months into the study period, this population was able to quickly adapt to its changing environment.	Gulf of Mexico









ANSWER KEY:

- Data Set 1: Central Stoneroller
- Data Set 2: Anchovy
- Data Set 3: Phytoplankton A
- Data Set 4: Bluefin Tuna
- Data Set 5: Phytoplankton B
- Data Set 6: Humpback Whale

Sources:

- Central Stoneroller. (2020, June 17). Mexican Fish.com. <https://mexican-fish.com/central-stoneroller/>
- The Story of Atlantic Bluefin. (2017, October 3). The Story of Atlantic Bluefin. Pew.org; The Pew Charitable Trusts. <https://www.pew.org/en/research-and-analysis/issue-briefs/2017/10/the-story-of-atlantic-bluefin>
- How the humpback whale made a massive comeback in the Salish Sea. (2023, September 10). The Seattle Times. <https://www.seattletimes.com/seattle-news/environment/how-the-humpback-whale-made-a-massive-comeback-in-the-salish-sea/>
- Marine Species Report Card (2016). Northern Anchovy. Aquariumofpacific.org. https://www.aquariumofpacific.org/reportcard/info/northern_anchovy
- Part 1: What Causes a Bloom? (2016, November 8). Predicting Phytoplankton Bloom in the Gulf of Maine. <https://serc.carleton.edu/eet/phytoplankton/primer.html>