

Population Biology

THE YOUNG SCIENTIST PROGRAM

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WASHINGTON UNIVERSITY SCHOOL OF MEDICINE
ECOLOGY/EVOLUTION TEACHING TEAM



Review

- Name 4 characteristics of a living thing.
- Draw a logistic growth curve.
- What is a dichotomous key?
- What is carrying capacity?

Graph our population growth

Generation	Rabbit Population	Environment Amount	Fox Population

Question 1

- What is the independent variable? What is the dependent variable? What are the constants?
- The independent variable is time or generation. The dependent variable is population size. The constants are environment, predators, decomposers.

Question 2

- What is the largest number of rabbits able to survive in the provided environment called?
- Carrying capacity

Question 3

- Explain how the fox affected the carrying capacity of the rabbits once it was introduced.
- The fox decreased the carrying capacity of the rabbits.

Question 4

- Why did the dead rabbits not become an environmental resource in the next generation once the fox was introduced in the game?
- Because the dead rabbit was consumed by the fox and was not left in the environment to decompose.

Question 5 - 7

- What was the rabbit population growth rate from generation 1 to generation 5?
- What was the rabbit population growth rate from generation 6 to generation 8?
- What was the rabbit population growth rate from generation 9 to the last generation?

Interspecific Interactions

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Intra vs Inter



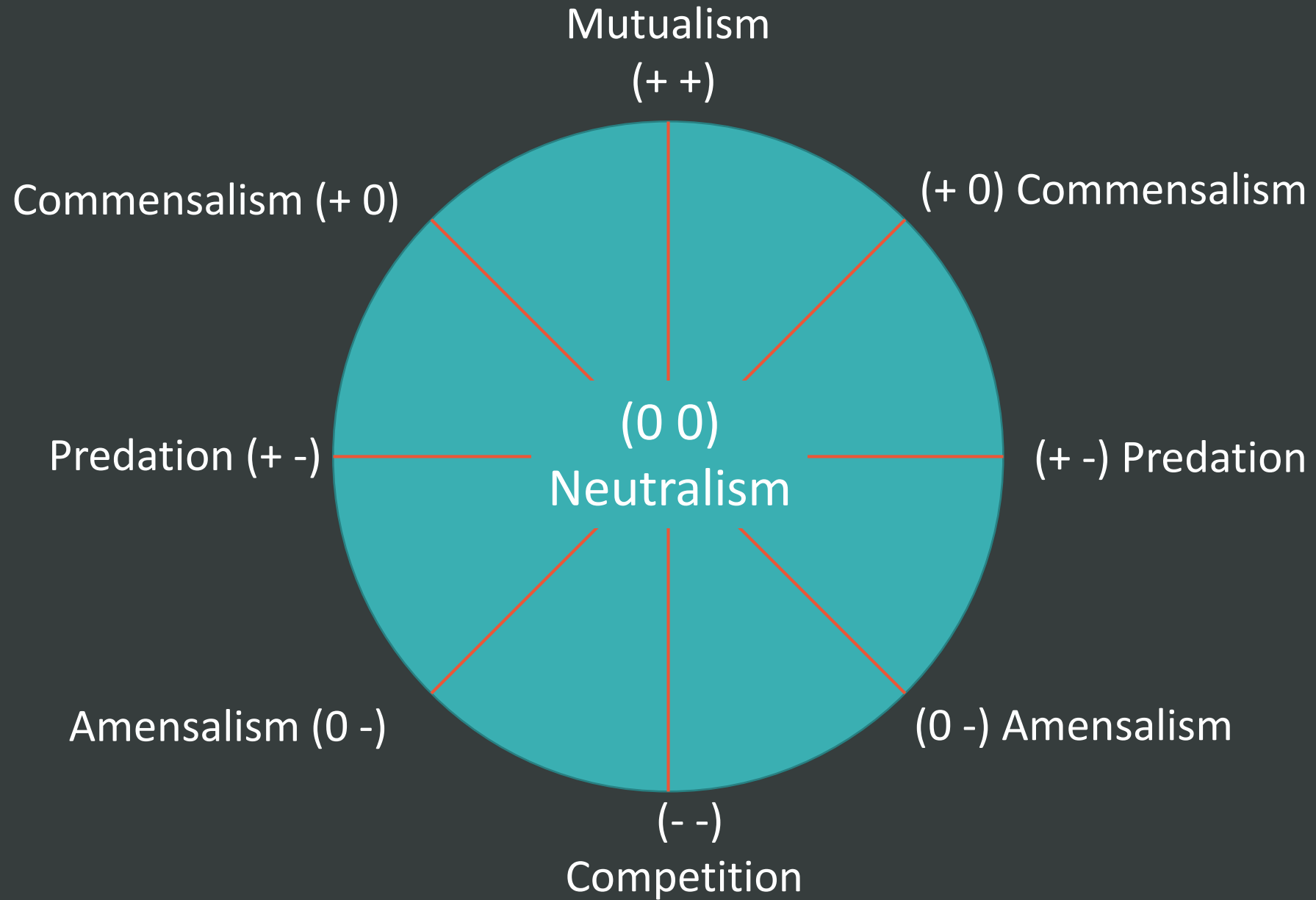
Intraspecific competition



Interspecific competition

What is a niche?

- A niche is the role a species plays in its ecological community (what it eats, where it lives, how it interacts with other species, etc.)
- Today we are going to talk more about species interactions.



Example of Parasitism

- **Tarantula wasps** lay eggs inside of **tarantulas** while they're still alive. The larvae hatch and eat the tarantula!



Interactions between species

Interaction	Species 1	Species 2	Definition
Parasitism (parasite lives on or inside of a host)			An interaction that benefits one species and harms another.

Interactions between species

Interaction	Species 1	Species 2	Definition
Parasitism (parasite lives on or inside of a host)	+ Wasps		An interaction that <u>benefits one species</u> and harms another.

Interactions between species

Interaction	Species 1	Species 2	Definition
Parasitism (parasite lives on or inside of a host)		- Tarantulas	An interaction that benefits one species <u>and harms another</u> .

Interactions between species

Interaction	Species 1	Species 2	Definition
Parasitism (parasite lives on or inside of a host)	+ Wasps	- Tarantulas	An interaction that benefits one species and harms another.

Interactions between species

Interaction	Species 1	Species 2	Definition
Parasitism (parasite lives on or inside of a host)	<div><div>+</div><div>Wasps</div></div>	<div><div>-</div><div>Tarantulas</div></div>	An interaction that benefits one species and harms another.
Predation (predator eats prey)			

Example of Predation

- **Lions** hunt and eat **zebras**



Interactions between species

Interaction	Species 1	Species 2	Definition
Parasitism (parasite lives on or inside of a host)	+ Wasps	- Tarantulas	An interaction that benefits one species and harms another.
Predation (predator eats prey)	Lions	Zebras	

Interactions between species

Interaction	Species 1	Species 2	Definition
Parasitism (parasite lives on or inside of a host)	+ Wasps	- Tarantulas	An interaction that benefits one species and harms another.
Predation (predator eats prey)	Lions	Zebras	
Herbivory (organism eats a plant species)			

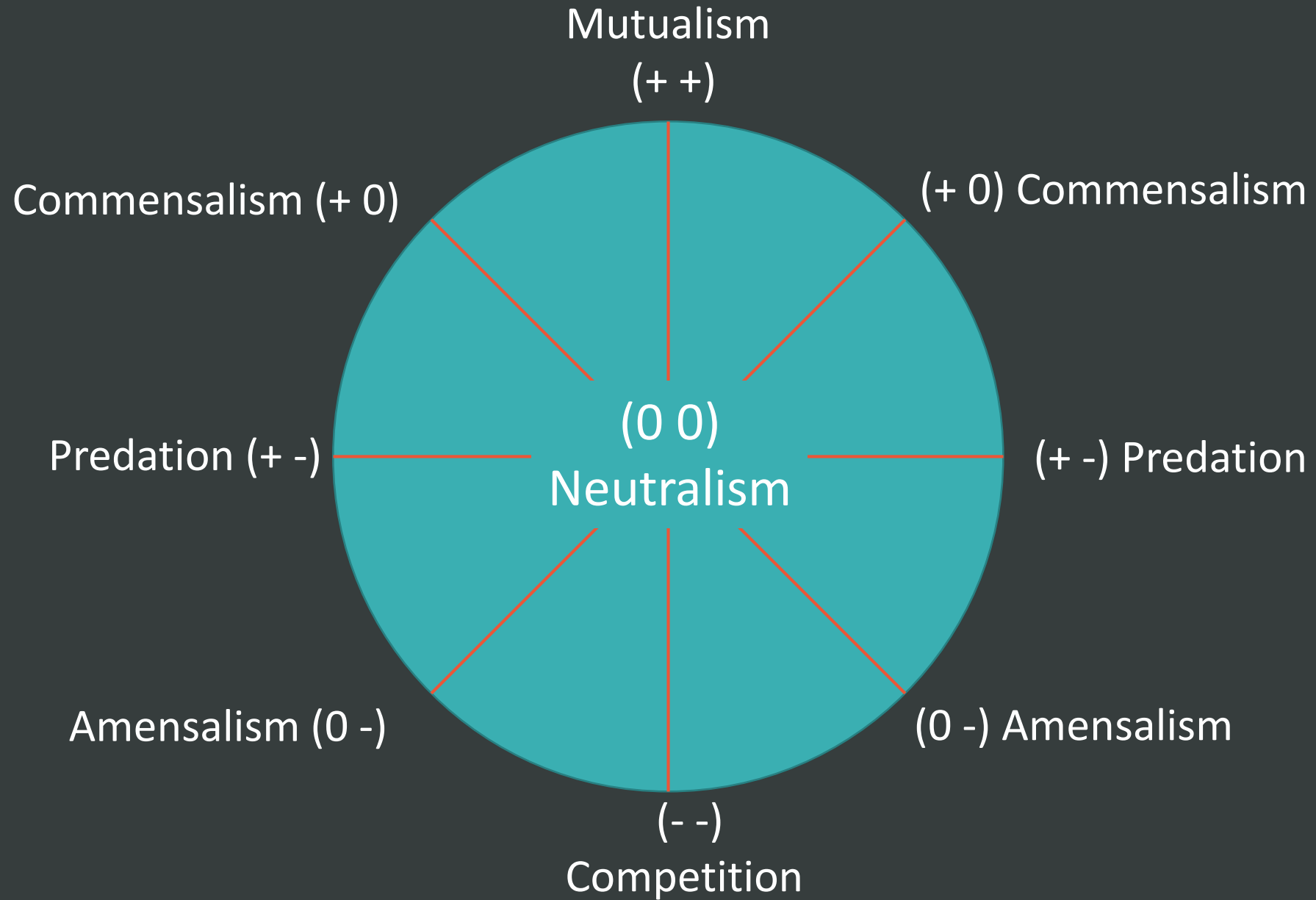
Example of Herbivory

- **Cows** eat **grass** and other plant species



Interactions between species

Interaction	Species 1	Species 2	Definition
Parasitism (parasite lives on or inside of a host)	+ Wasps	- Tarantulas	An interaction that benefits one species and harms another.
Predation (predator eats prey)	Lions	Zebras	
Herbivory (organism eats a plant species)	Cows	Grass	



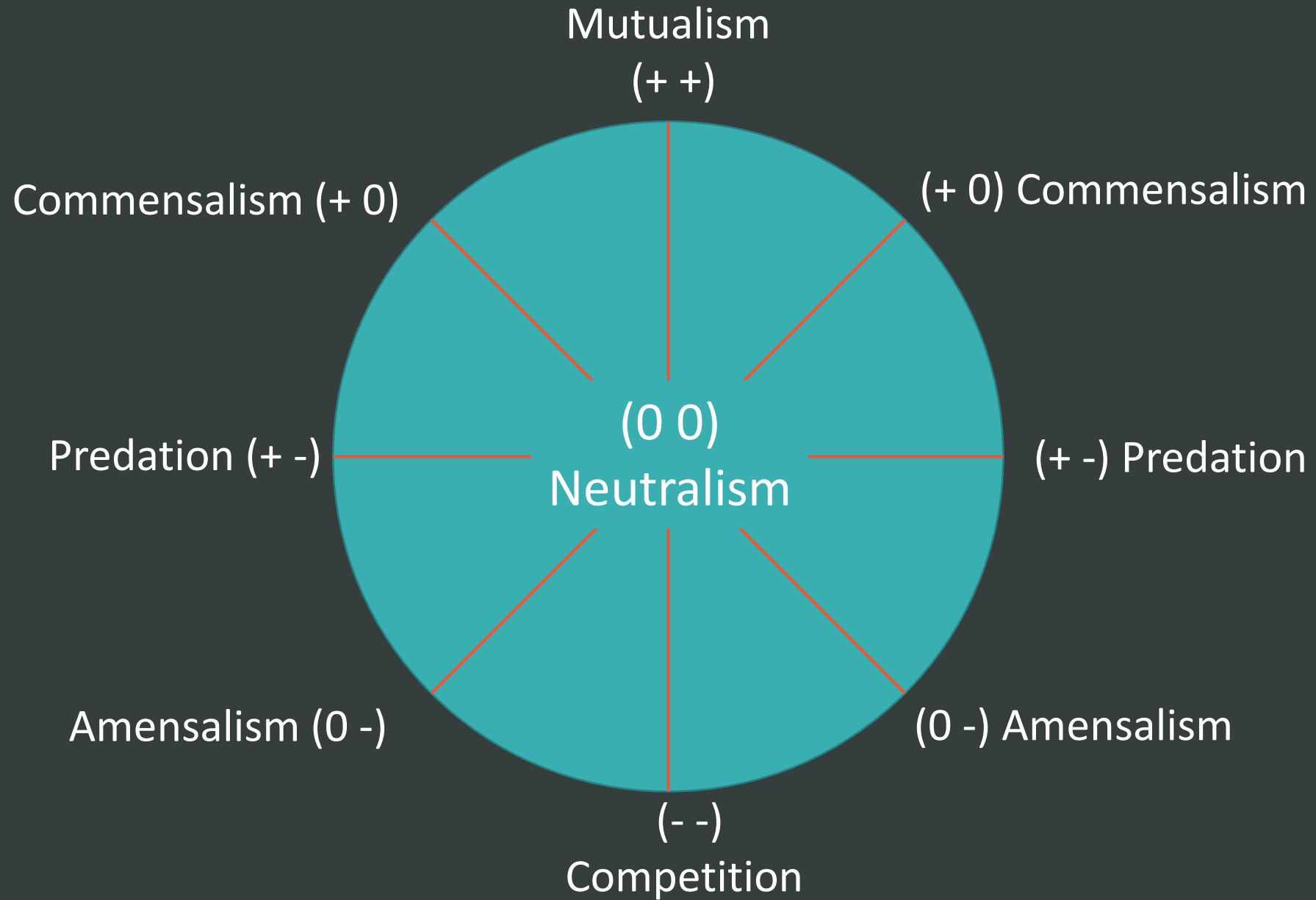
Example of Mutualism

- Bees pollinate the flowers of plants



Interactions between species

Interaction	Species 1	Species 2	Definition
Mutualism	<div><div>+</div><div>Bees</div></div>	<div><div>+</div><div>Plants</div></div>	An interaction where both species benefit



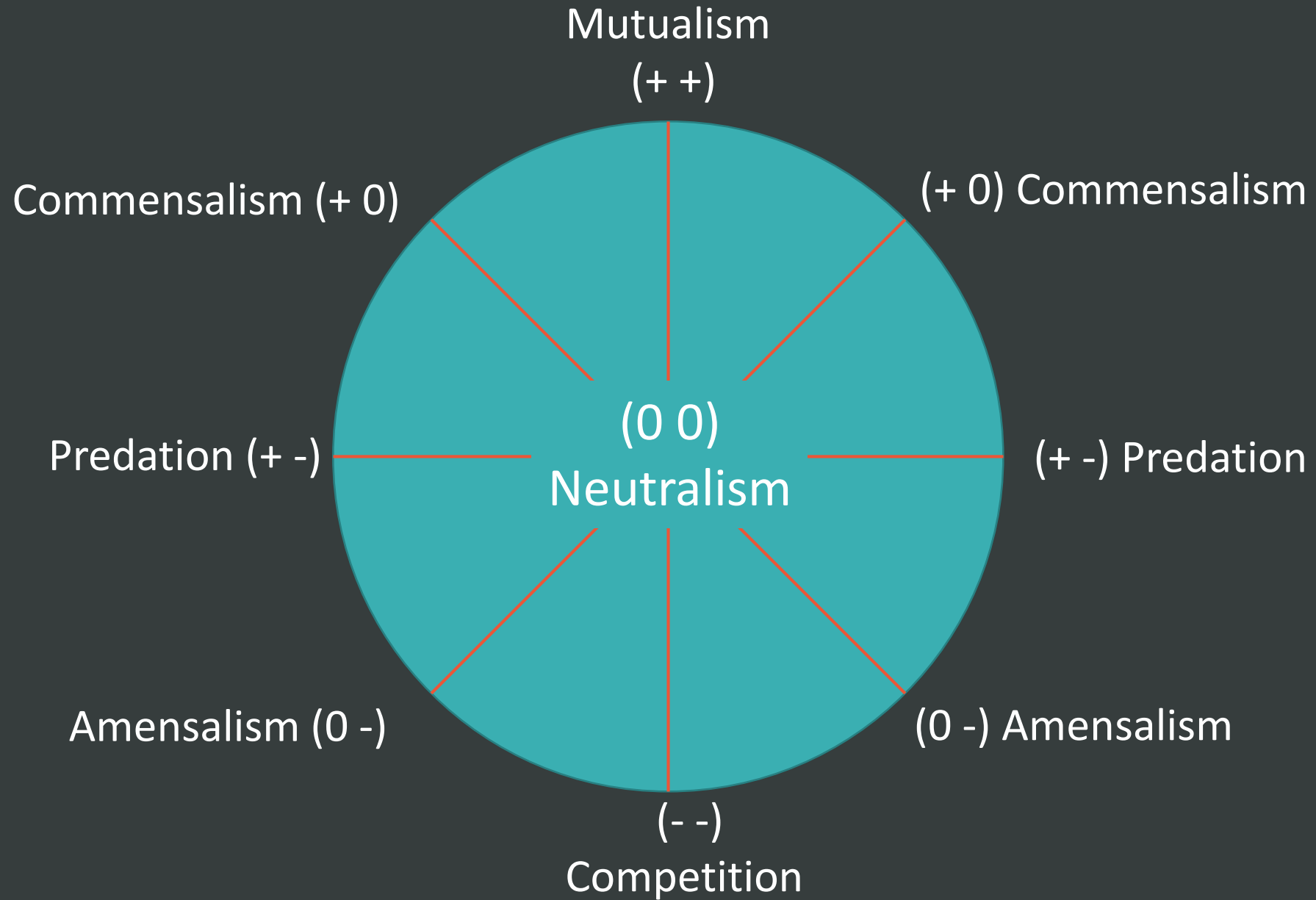
Example of Competition

- **Hyenas** and **lions** compete for the same prey



Interactions between species

Interaction	Species 1	Species 2	Definition
Competition	- Lions	- Hyenas	An interaction that harms both species.



Example of Commensalism

- **Cattle egret birds** eat insects that **horses** accidentally disturb



Interactions between species

Interaction	Species 1	Species 2	Definition
Commensalism	<div><div>+</div><div>Birds</div></div>	<div><div>0</div><div>Horses</div></div>	An interaction that benefits one species and doesn't affect the other species.

Generalist vs. Specialist Species

- **Generalist** species can eat many different types of food.
 - Example: racoons
- Can you think of others?



Generalist vs Specialist Species

- **Specialist** species only eat one or very few types of foods.
 - Example: Koala bears
- Can you think of others?



Activity Instructions

1. Split into groups of 3. Face each other.
2. Have ONE member from each group come grab a baggie from the front.
3. Put the M&Ms into the bowl in the middle of your group. **Don't eat them – they're dirty!**
4. Each member gets: 1 spoon, 1 cup, 1 stack of cards. **Keep your cards a secret!**

Activity Instructions

- We will play 4 rounds, one card per round
- Each round will last ~ 30 seconds to 1 minute
- During the round, you will be collecting M&Ms in your cup (according to card instructions).

Rules

- Use your spoon only, not your hands!
- Only collect one M&M at a time!
- Keep your cup on the table in front of you. NO cup guarding!

Read your **ROUND 1** card

GO!

STOP!

Instructions

1. Count your M&Ms
2. Fill out the table for Round 1 with your group.
3. Put the M&Ms back in the bowl.
4. Answer questions 1-4 with your group.

Question 1

- Which two species occupied the same niche in this community? How do you know?
- Species A and Species B. They both eat ONLY green M&Ms.

Question 2

- Which ecological relationship does.....
 - Species A and Species B have?
Competition (both eat green)
 - Species A and Species C have?
None (eat different colors)
 - Species B and Species C have?
None (eat different colors)

Question 3

- Why will two species not be able to occupy the same niche in a community for very long?
- One species will outcompete the other and eventually drive it to extinction.

Question 4

- Was your species a generalist or a specialist? Why?
- Species A, B and C were all specialists! They can each eat only one color of M&M.

Read your **ROUND 2** card

GO!

STOP!

Instructions

1. Count your M&Ms.
2. Fill out Round 2 table.
3. Put the M&Ms back in the bowl.
4. Answer questions 5 & 6 with your group.

Question 5

- Which ecological relationship does...

...Species A and Species B have?

None (eat different colors)

...Species A and Species C have?

Parasitism (C takes A's food)

...Species B and Species C have?

Parasitism (C takes B's food)

Question 6

- Was your species a generalist or a specialist? Why?
- Species C is a generalist (eats any color M&M).
- Species A & B are each specialists and can each eat only 2 colors of M&Ms.

Read your **ROUND 3** card

GO!

STOP!

Instructions

1. Count your M&Ms.
2. Fill out Round 3 table.
3. Put the M&Ms back in the bowl.
4. Answer question 7 with your group

Question 7

- Which ecological relationship does...

...Species A and Species B have?

Mutualism (A donated blue, B donated red)

...Species A and Species C have?

Mutualism (A donated blue, C donated orange)

...Species B and Species C have?

Mutualism (B donated red, C donated orange)

Read your **ROUND 4** card

GO!

STOP!

Instructions

1. Count your M&Ms.
2. Fill out the Round 4 table.
3. Neatly put all the supplies back into the baggy.
4. Answer question 8 with your group.

Question 8

- Which ecological relationship does...

...Species A and Species B have?

Commensalism (B helps A)

...Species A and Species C have?

Commensalism (C helps A)

...Species B and Species C have?

Competition (eat same 2 colors)

Answer the elaboration questions
with your group members

Question 9

- If the environment changed suddenly, for example because of global warming, do you think generalist or specialist species would be better able to adapt and avoid going extinct? Why?
- Generalist species. They are more likely to have food sources remaining after a big change.

Question 10

- What would happen if a new invasive species came into your ecosystem that ate blue, red, and orange M&Ms and was better at collecting food than all three of your species?
- The three species would eventually go extinct (or would need to adapt to a new food source).

Question 11

- Using what you have learned about ecological interactions, think an example of each interaction in which humans are involved:
 - Competition
 - Parasitism
 - Mutualism
 - Commensalism

Question 12

- *“All populations living together within a community interact with one another and with their environment in order to survive and maintain a balanced ecosystem.”* Do you agree with this statement? Why or why not?