Human Ecosystem Game

Teacher Edition

Overview:

This game introduces the concept of resource availability and resource scarcity to students. The groups will likely consist of a different number of students each turn, which showcases the variability of populations with variations in ecosystem resources. This can be used to explain the importance of lower trophic levels for the survival of sea stars, and sea stars for the survival of higher trophic levels.

Background:

Resource availability is one one of the main factors in determining population dynamics. Resources include food, space, shelter, oxygen, and more. More available resources, or a high resource availability, results in a higher population growth. As resources become scarce and less available, competition increases. Competition can be between individuals within the same species, which is intraspecific competition, and competition can be between individuals of different species, which is interspecific competition. An abundance of resources is able to sustain a large population with low levels of competition. This allows all organisms to flourish and increases the growth rate.

Population sizes can also be affected by many other external factors, such as a heat wave or pollution. In the example of a heatwave, organisms may not be adapted survive at increased temperatures. Increased temperature can cause water shortages, which lowers resource availability for both plants and animals and leads to a decrease in population sizes. In the example of pollution, pollution can be accidentally ingested by animals, leading to increased mortality, which lowers population size.

As the population decreases and sea stars die, there are less sea stars competing for available resources. A decrease in competition often leads to increase in resource availability means the population will then start to grow again. This is how ecosystems stay balanced.

Materials:

- Cards with pictorials for organisms and ecosystem components
 - Optional, use yarn and a hole punch to make into necklaces.
- ~15 students
- Student pack

Teacher Prep

- 1. Print out a student packet for each student.
- 2. Print and cut pictorial cards (included at end of teacher edition).
 - a. Optional: use yarn to turn pictorials into necklaces

Directions

- 1. Divide players into three groups. Group 1 will signify sea stars. players in group 1 should have a sea star card. Groups 2 and 3 will signify ecosystem components. These components are food, space, shelter and oxygen.
- 2. Before the round begins, each group should gather into positions in which they cannot see the other groups. Each member of group 1 will choose which resource they want to look for this round. They will show this by using hands signals:
 - a. One finger for food
 - b. Two fingers for shelter
 - c. Three fingers for space
 - d. Four fingers for oxygen
- 3. Groups 2 and 3 will simultaneously choose which ecosystem components they will be for this round. They will use the same hand signals.
- 4. Begin the round. All of the players will turn to face each other at the same time, showing their hand signals.
- 5. Group 1 searches for resources that match the one they are looking for and brings them back to the sea star area. The player that is brought back by a sea star will be a sea star now in the next round. They should be given a sea star card at the end of this round.
- 6. Any sea star that doesn't find their desired resource "dies," and is turned into an ecosystem resource for the next round. This is the end of the first round.
- 7. Play 10-15 rounds. Be sure to record the number of sea stars at the beginning of each round.
- 8. Optional: To complicate the game, other factors can be introduced, such as pollution or harmful temperatures. To incorporate these disturbances, limit the types of ecosystem resources available without telling the sea star group. Do this by turning some of the "resources" into disturbances.
- 9. Have players complete worksheets or discuss with players.

Questions with answers

- 1. What patterns did you see in the sea star population? Did it increase, decrease, or both? Answers vary depending on game play outcome
- 2. How did the disturbances affect the populations? Answers vary depending on game play outcome. Disturbances should have a negative impact on sea star numbers as they lower the available resources.
- 3. Based on what you saw in the game, what effect does resource availability have on the survival of species and population growth? Resource availability is a limiting factor in population growth. When more resources are available, populations will grow faster. When less resources are available, the population is not able to grow, and may even decline.
- 4. Why is it important to have multiple trophic levels in order to maintain a healthy ecosystem? Each trophic level plays a different role. Primary producers are the base and provide the energy for the levels above. The levels above all work to keep each other balanced. If there is no secondary consumer to eat the primary consumer, then the primary consumers will eat the producers faster than they can grow and there will be no food source.





TinySea Extention Activity Human Ecosystem Game





References

Overview." Wasteless,

https://wastelessindia.org/garbology-lite/garbology-lite/?doing_wp_cron=1675382985.53 77728939056396484375.

Starfish - 1 Free Stock Photo - Public Domain Pictures.

https://www.publicdomainpictures.net/en/view-image.php?image=297881&picture=starfis h-1.

Vedran. "OpenClipart." Free SVG, https://freesvg.org/1430751900.

Human Ecosystem Game

Student Worksheet

Overview:

This game introduces the concept of resource availability and resource scarcity. The groups will likely consist of a different number of students each turn, which showcases the variability of populations with variations in ecosystem resources. This can be used to explain the importance of lower trophic levels for the survival of sea stars, and sea stars for the survival of higher trophic levels.

Background:

Resource availability is one one of the main factors in determining population dynamics. Resources include food, space, shelter, oxygen, and more. More available resources, or a high resource availability, results in a higher population growth. As resources become scarce and less available, competition increases. Competition can be between individuals within the same species, which is intraspecific competition, and competition can be between individuals of different species, which is interspecific competition. An abundance of resources is able to sustain a large population with low levels of competition. This allows all organisms to flourish and increases the growth rate.

Population sizes can also be affected by many other external factors, such as a heat wave or pollution. In the example of a heatwave, organisms may not be adapted survive at increased temperatures. Increased temperature can cause water shortages, which lowers resource availability for both plants and animals and leads to a decrease in population sizes. In the example of pollution, pollution can be accidentally ingested by animals, leading to increased mortality, which lowers population size.

As the population decreases and sea stars die, there are less sea stars competing for available resources. A decrease in competition often leads to increase in resource availability means the population will then start to grow again. This is how ecosystems stay balanced.

Name: _____

Date: _____

Sea Star Counts

| Round # | Sea stars at beginning of round: | Observations: | |
|---------|----------------------------------|---------------|--|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| Name: | | | |
|-------|--|--|--|
| - | | | |

Date: _____

Questions

- 1. What patterns did you see in the sea star population? Did it increase, decrease, or both?
- 2. How did the disturbances affect the populations?
- 3. Based on what you saw in the game, what effect does resource availability have on the survival of species and population growth?
- 4. Why is it important to have multiple trophic levels in order to maintain a healthy ecosystem?