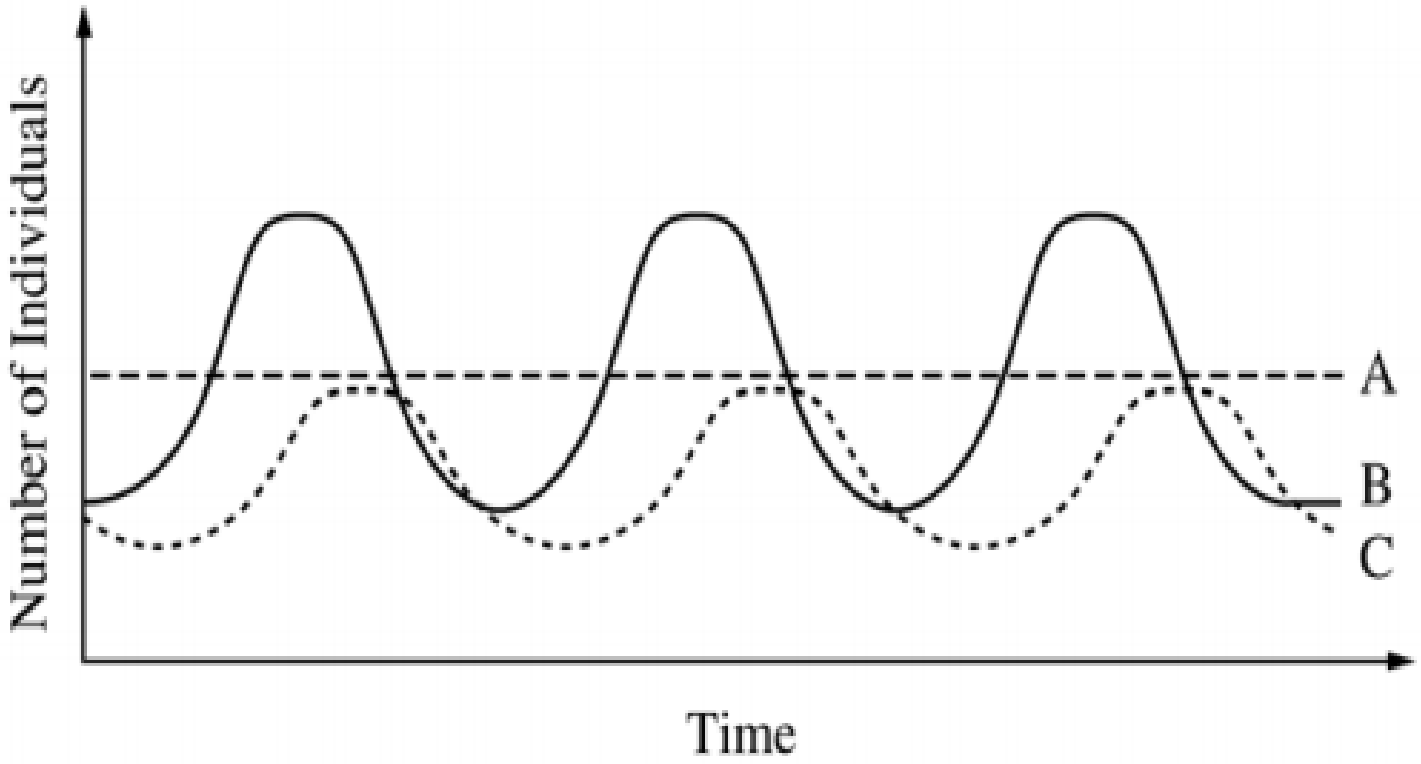
AP Biology Ecology Review and Study Guide

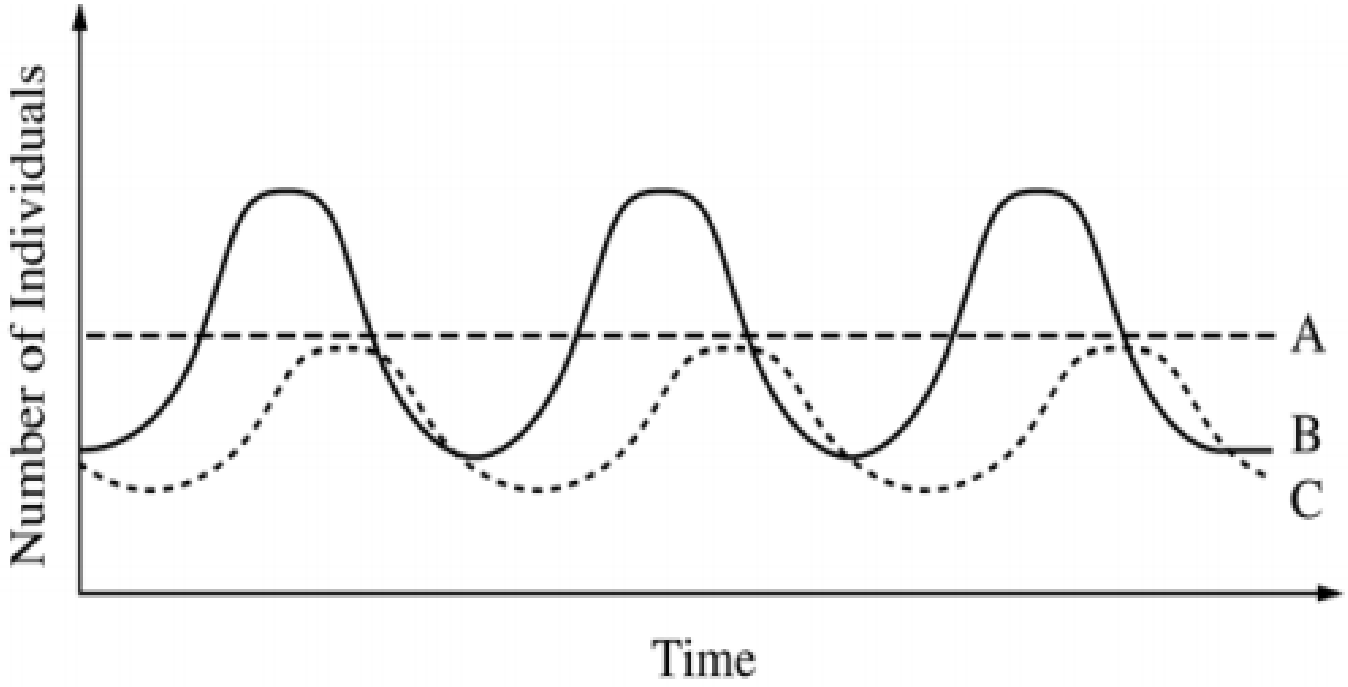
2017 - 2018



1. Which pattern represents the predator, which the prey?

2. Give two justifications for your selection:

3. Describe the population dynamics of A:



1. Which pattern represents the predator, which the prey?

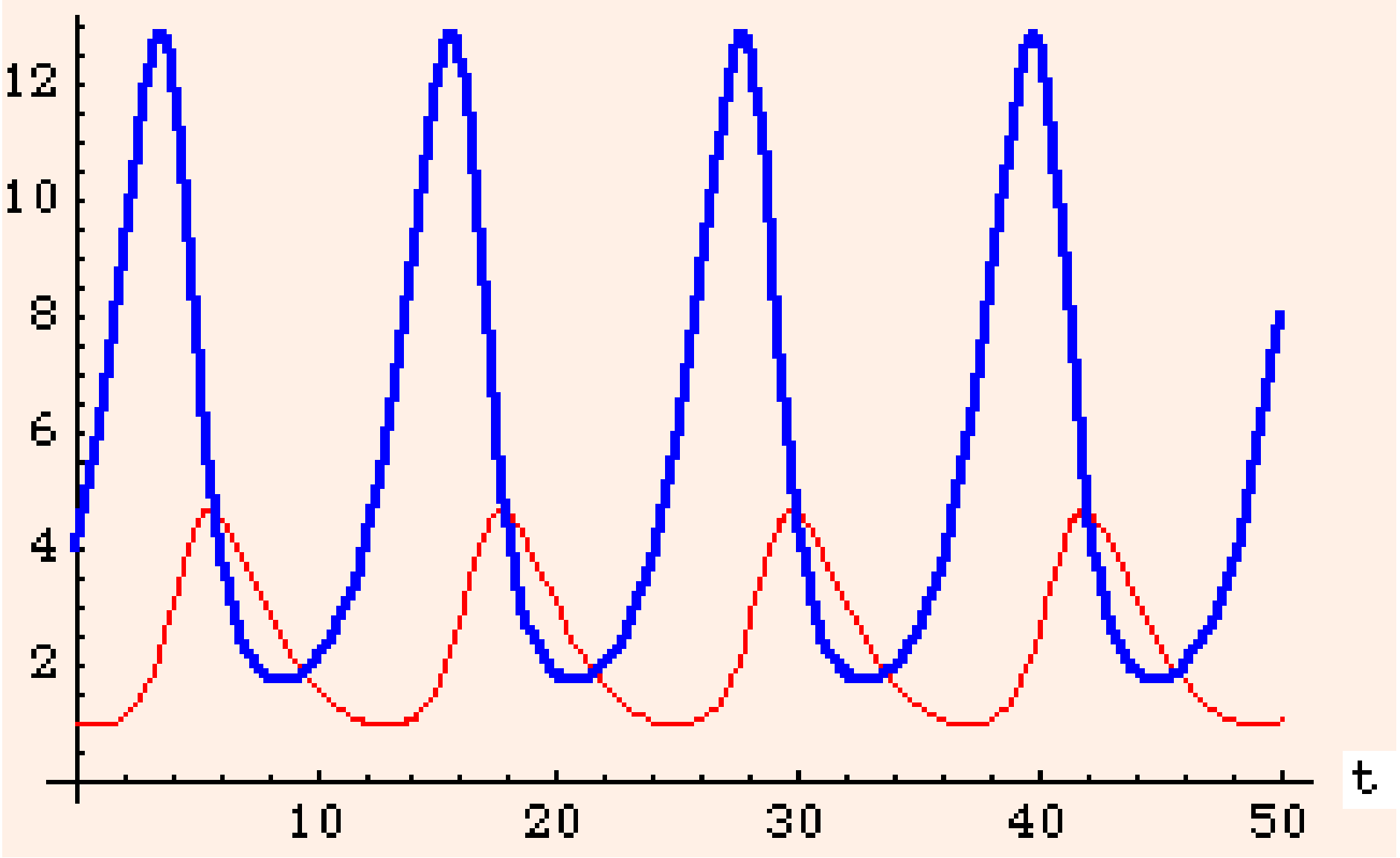
C is predator and B is prey

2. Give two justifications for your selection:

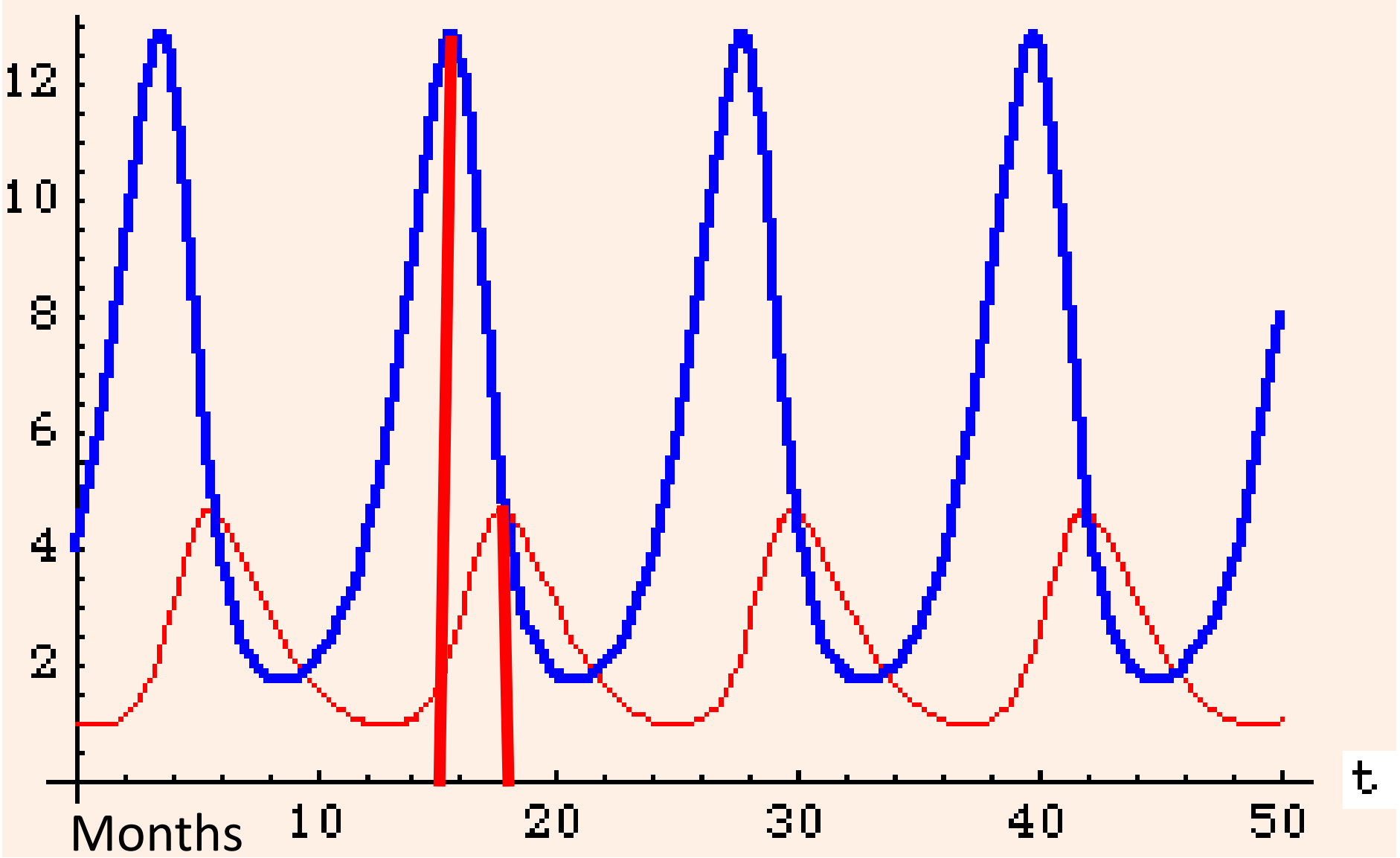
Prey (B) peaks at larger numbers and peaks before the predator (C)

3. Describe the population dynamics of A:

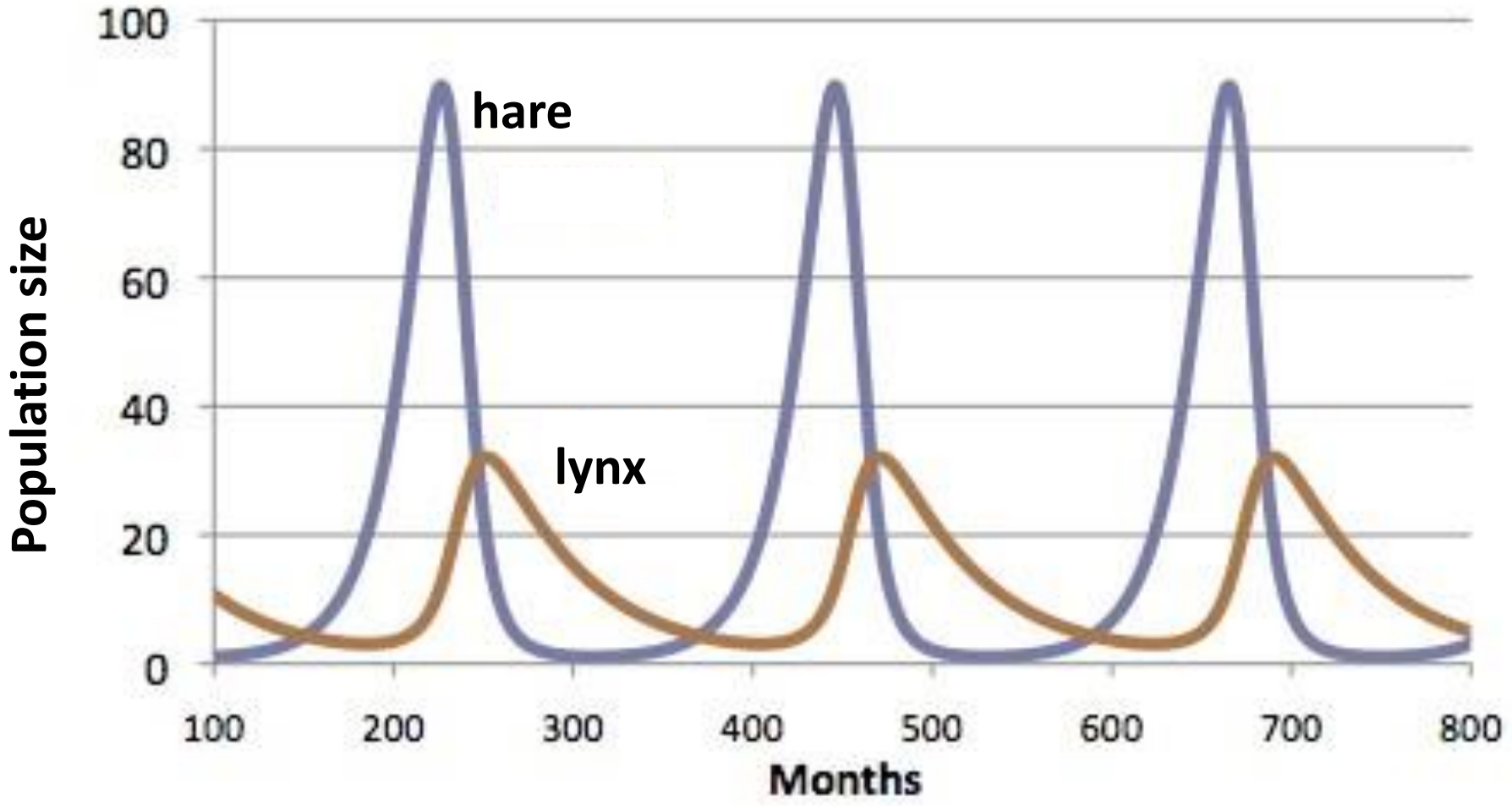
A has a stable population that does not fluctuate.



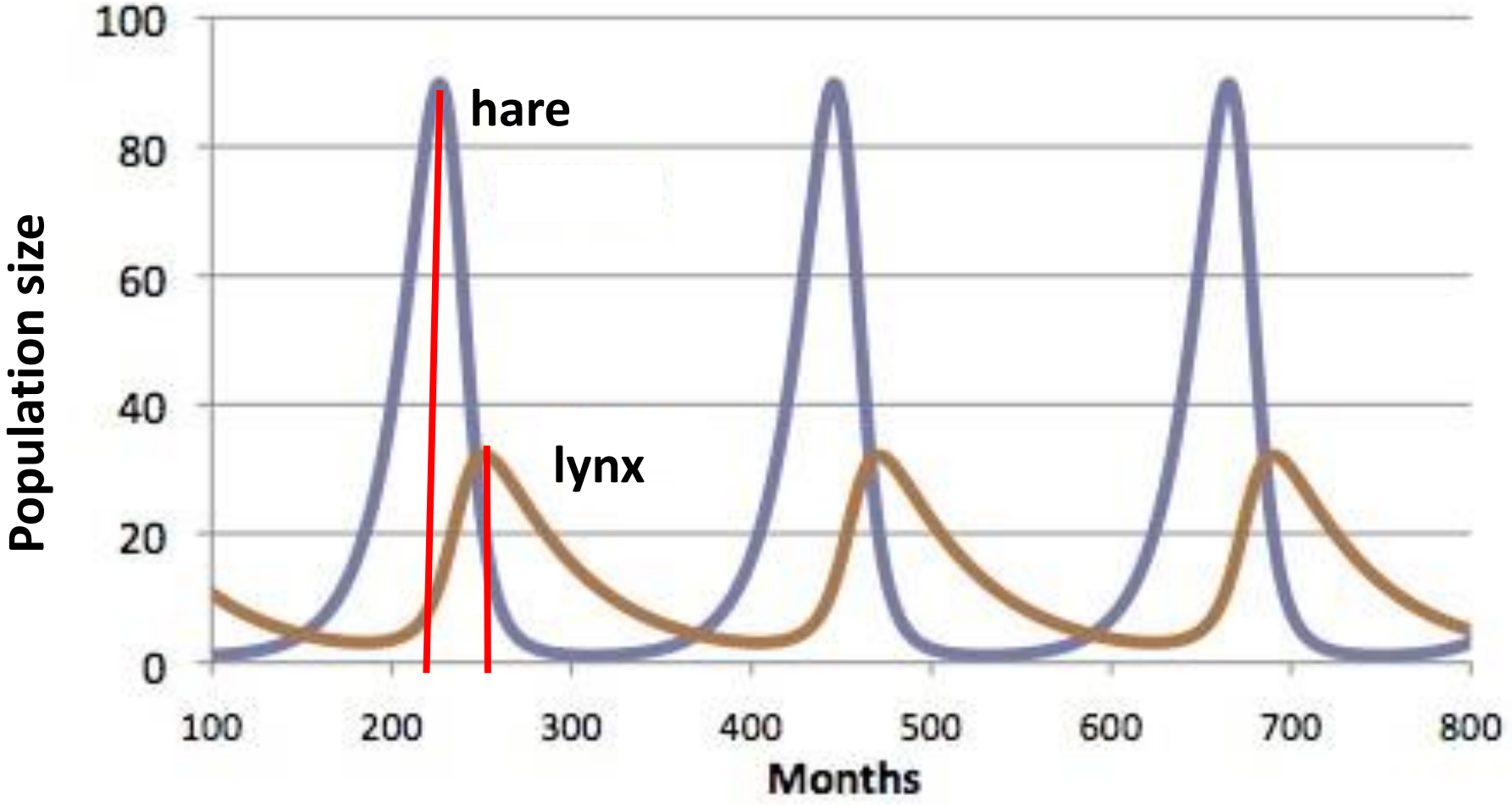
Calculate the lag time between predator and prey peaks. Assume the x-axis is in months. Round your answer to the nearest month.



Calculate the lag time between predator and prey peaks. Assume the x-axis is in months. **18 months – 15 months = 3 months**



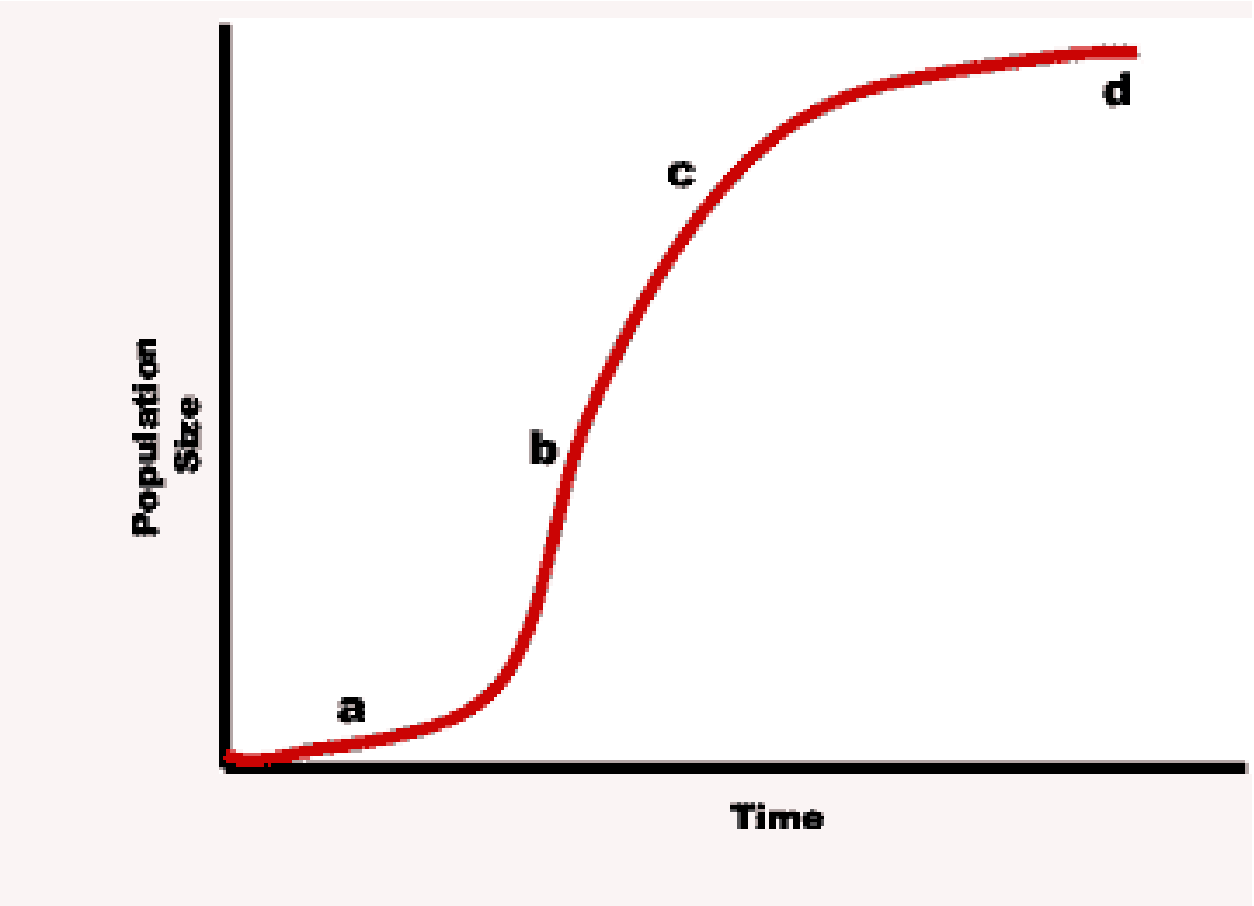
Calculate the lag-time in, round to the nearest month:



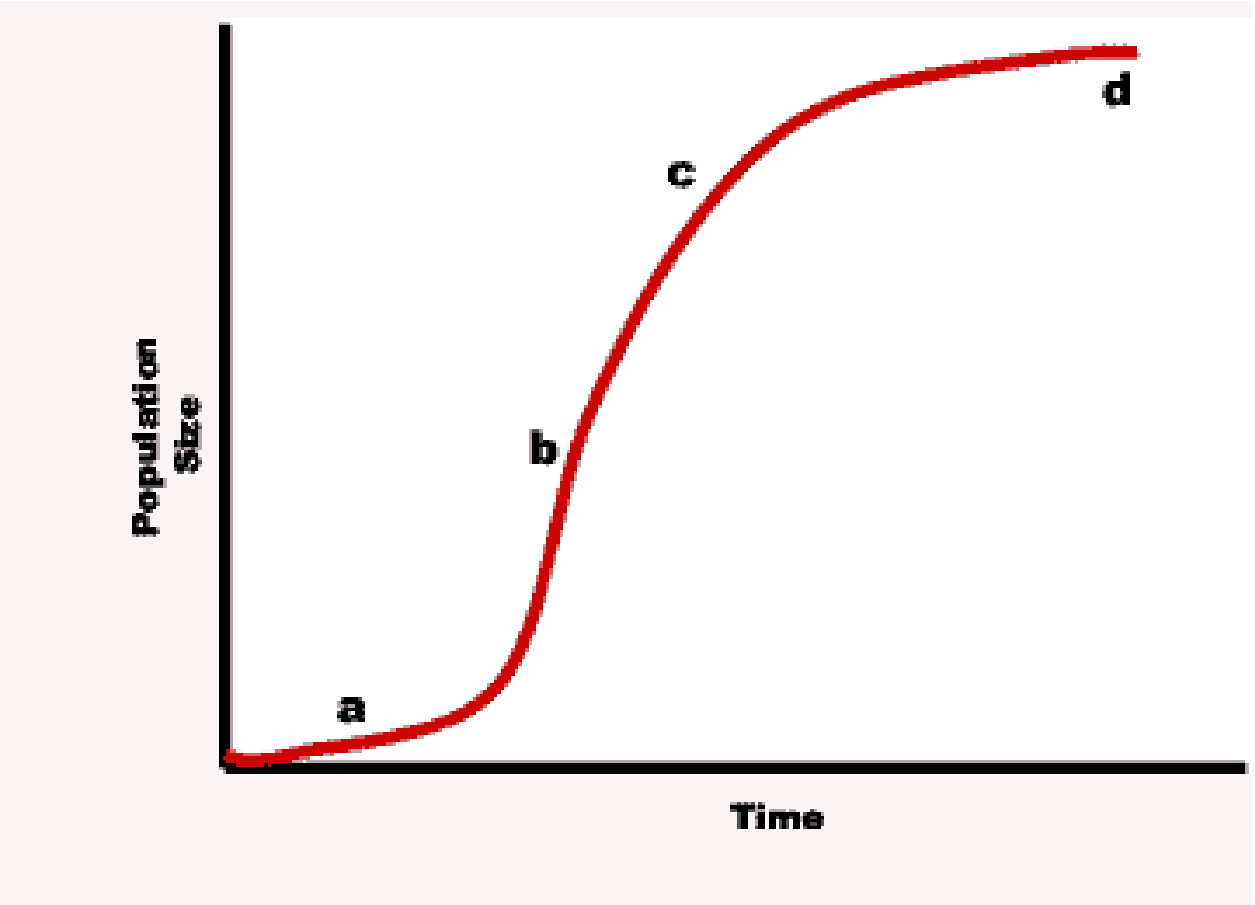
Calculate the lag-time in, round to the nearest month:

250 – 220 = approximately 30 months

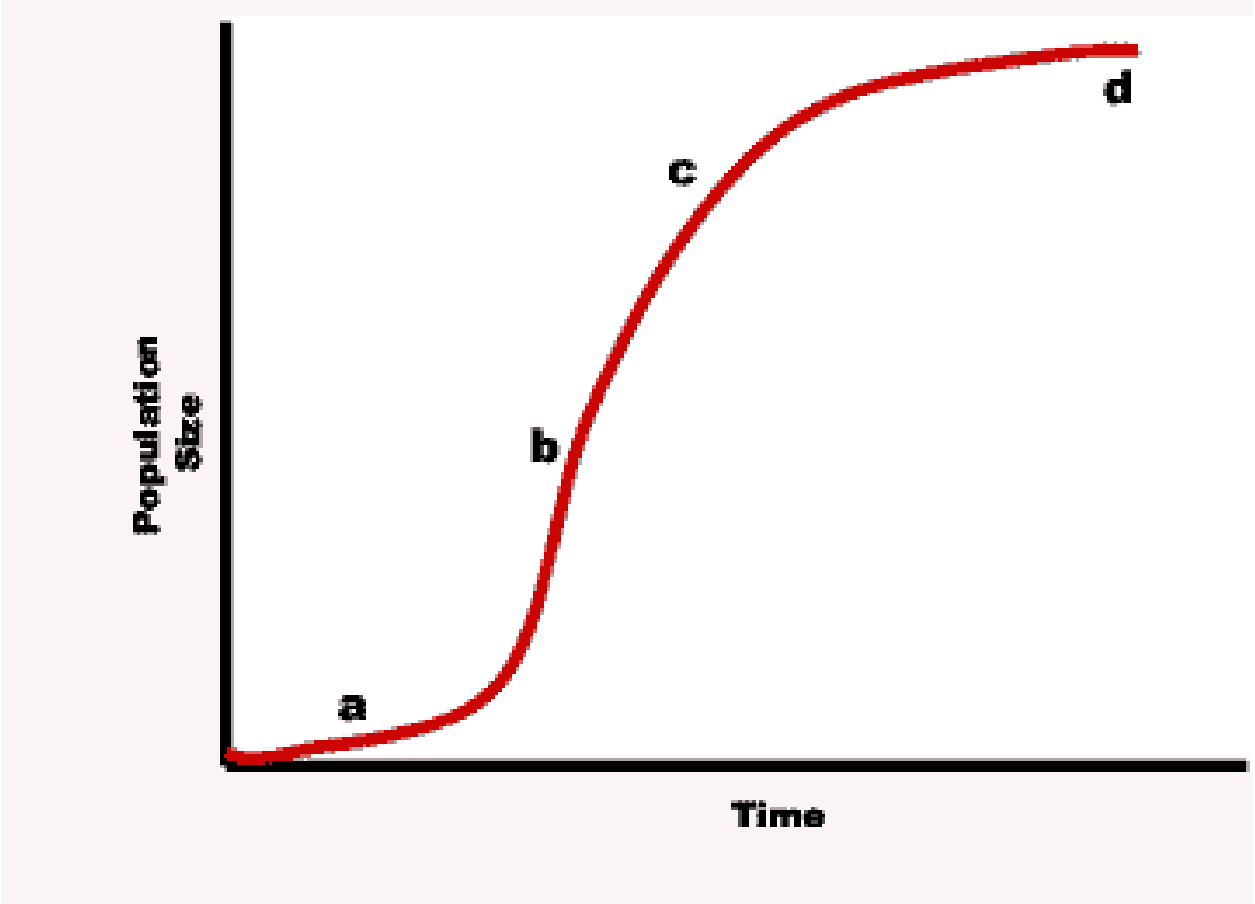
At which labeled point is the population growing at the fastest rate? Justify your selection:



At which labeled point is the population growing at the fastest rate? Justify your selection:



The rate of population growth is related to the steepness of the line. The steeper the line, the faster the rate. Thus the population growth rate is the fastest at point b.



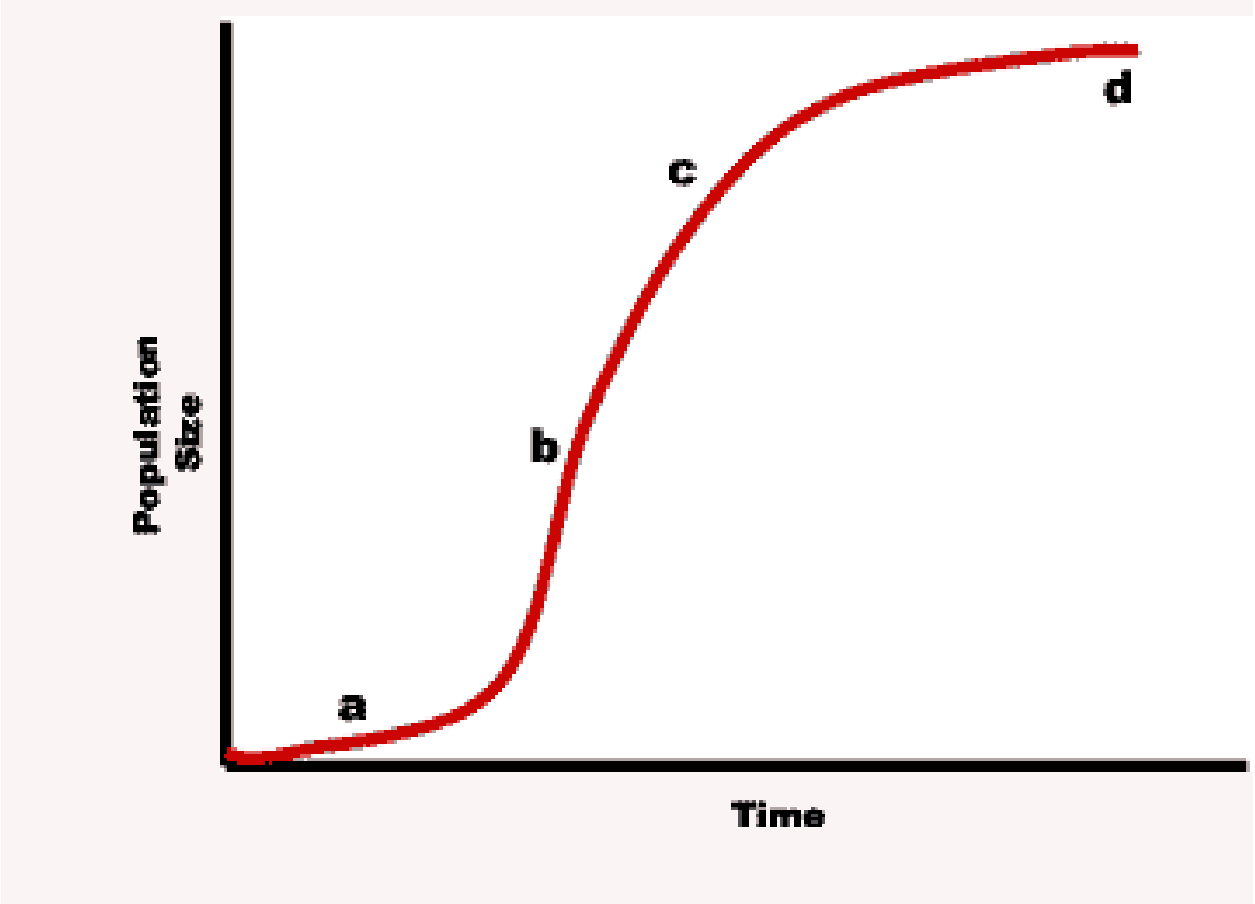
Match the description with a – d above:

_____ = density-dependent factors start to slow growth

_____ = exponential-phase, growth is at its maximal rate

_____ = slow initial growth, lag-phase

_____ = growth levels off at carrying capacity due to density-dependent factors



Match the description with a – d above:

C = density-dependent factors start to slow growth

B = exponential-phase, growth is at its maximal rate

A = slow initial growth, lag-phase

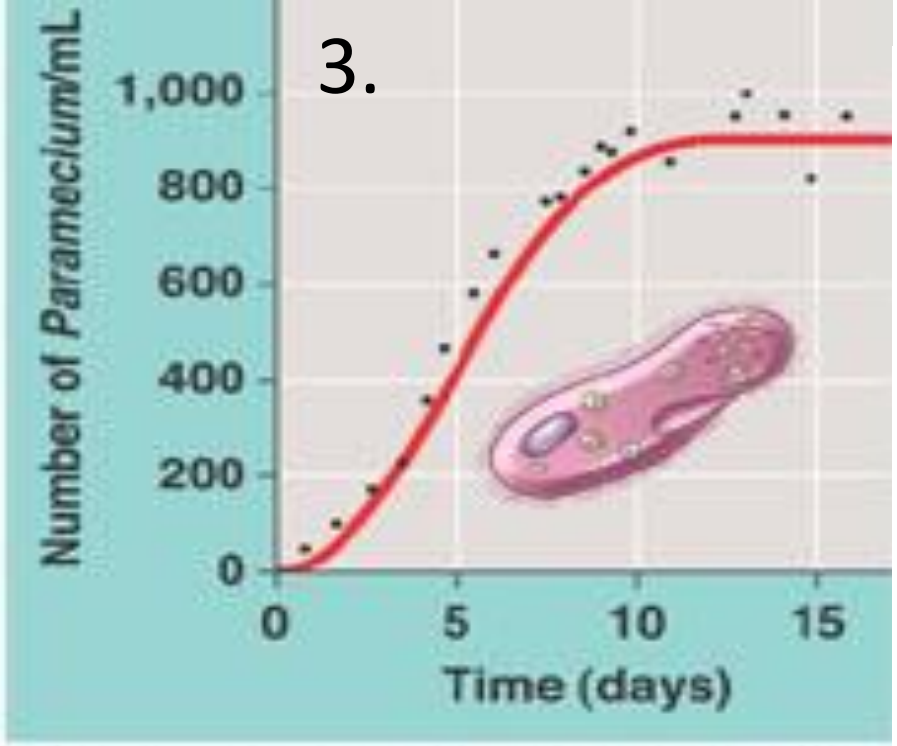
D = growth levels off at carrying capacity due to density-dependent factors

What are some density-dependent factors that can cause a population’s growth to slow and level out at carrying capacity?

What are some density-dependent factors that can cause a population's growth to slow and level out at carrying capacity?

Competition for limited resources (i.e. food)
Territoriality
Predator-prey interactions
Disease
Toxic-waste buildup
Intrinsic factors

3.



(a) A *Paramecium* population in the

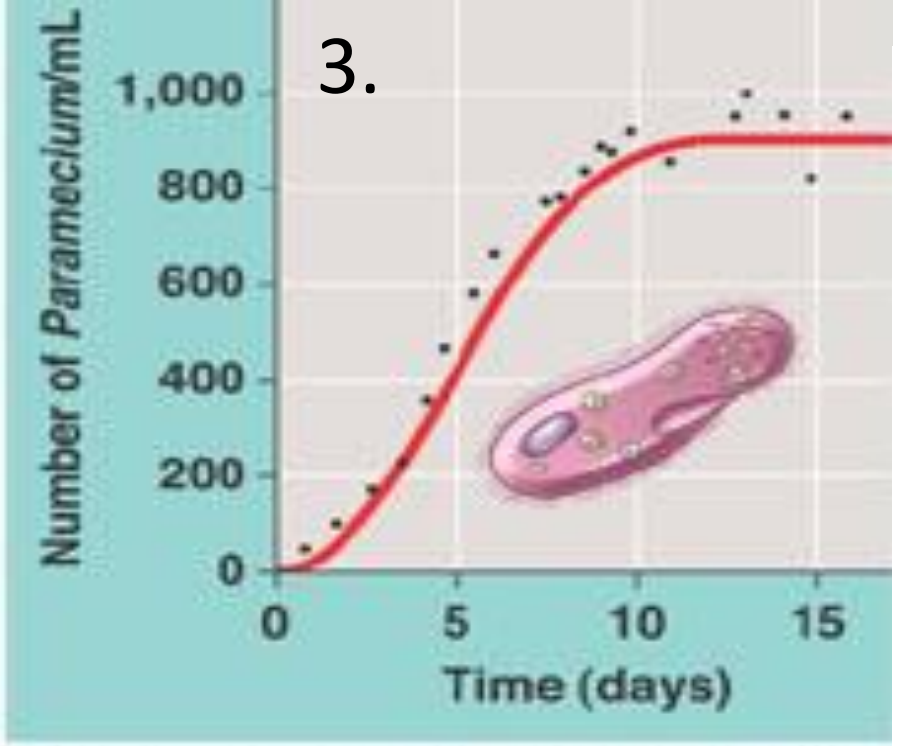
a. Calculate the mean rate of growth from day 5 to 10. Record your answer to the nearest whole #.

b. What is the carrying capacity?

c. How would this species growth curve be affected if it was grown with a second species with which it was in competition with?

d. “” with which it was not in competition with?

3.



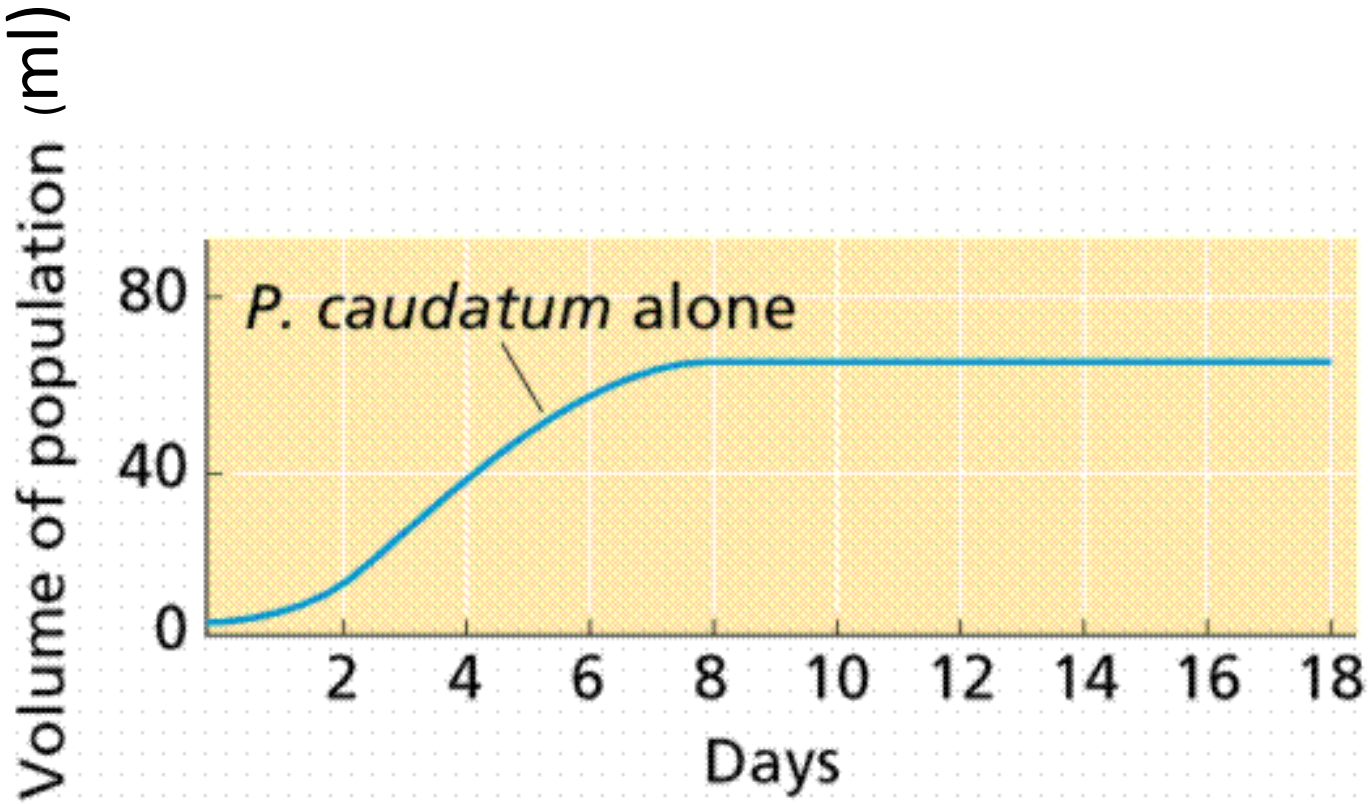
(a) A *Paramecium* population in the

a. Calculate the mean rate of growth from day 5 to 10. Record your answer to the nearest whole #. **Slope, rise/run = approx. 90 ml/day**

b. What is the carrying capacity? **Approx. 900**

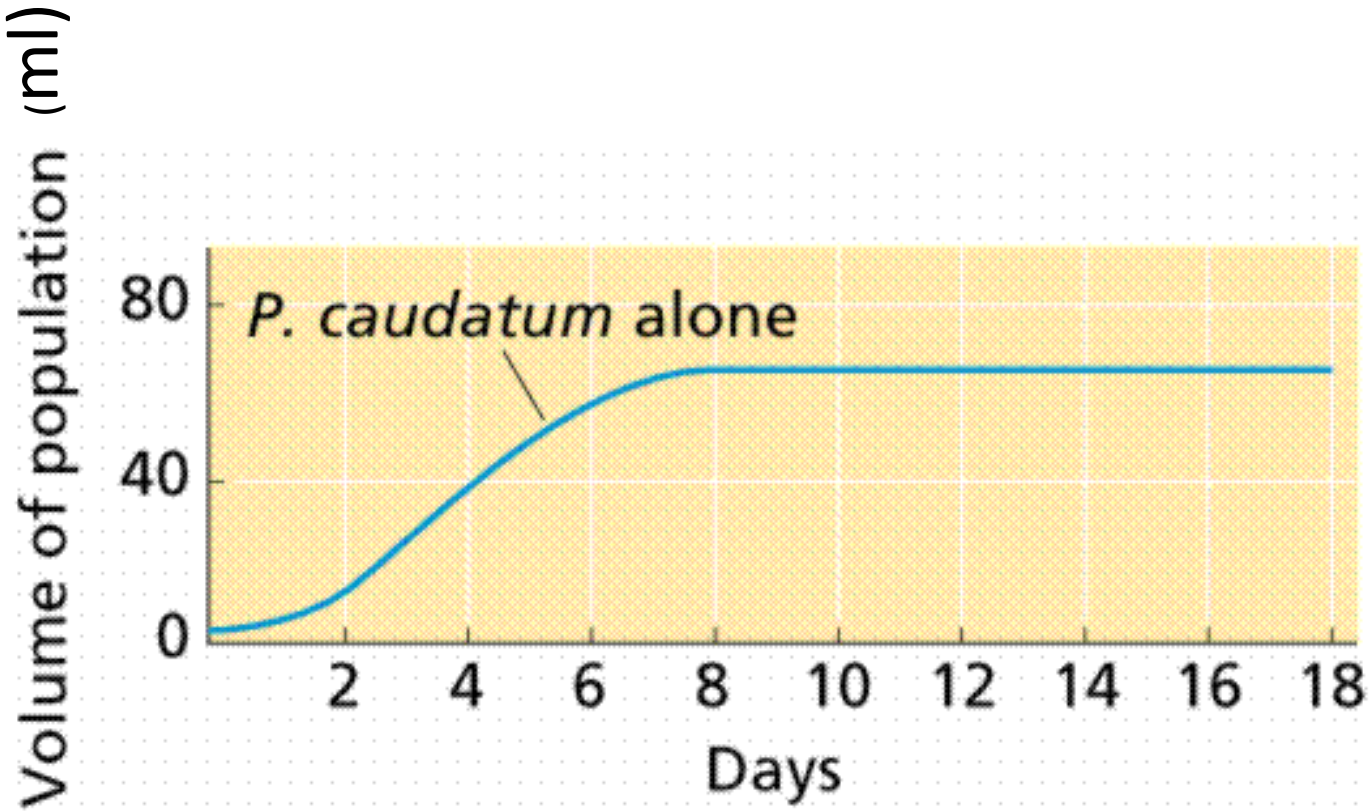
c. How would this species growth curve be affected if it was grown with a second species with which it was in competition with? **Carrying capacity would be lower**

d. “” with which it was not in competition with? **unchanged**



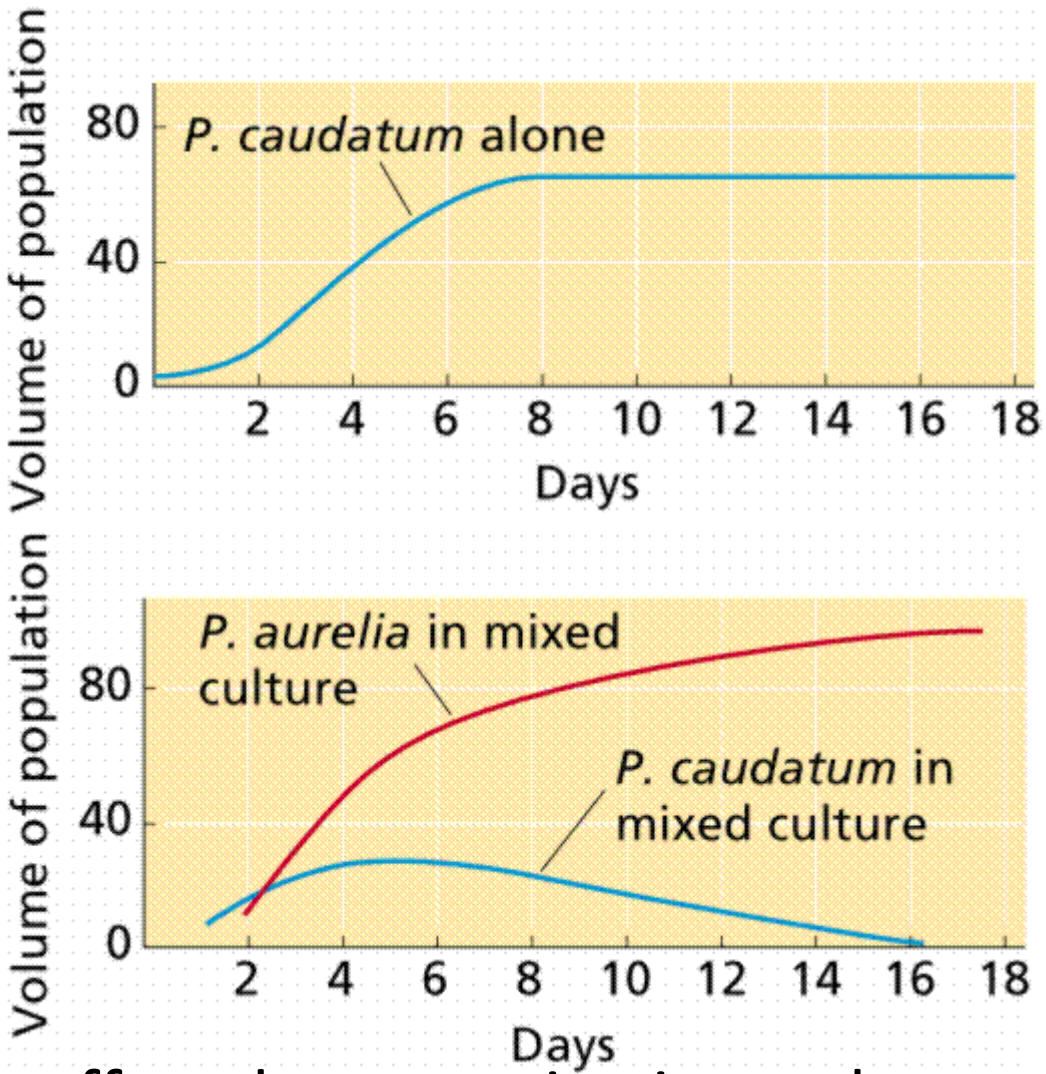
1. What is the mean growth rate of *P. caudatum* from day 2 to 6?

2. What does the carrying capacity of *P. caudatum* appear to be?

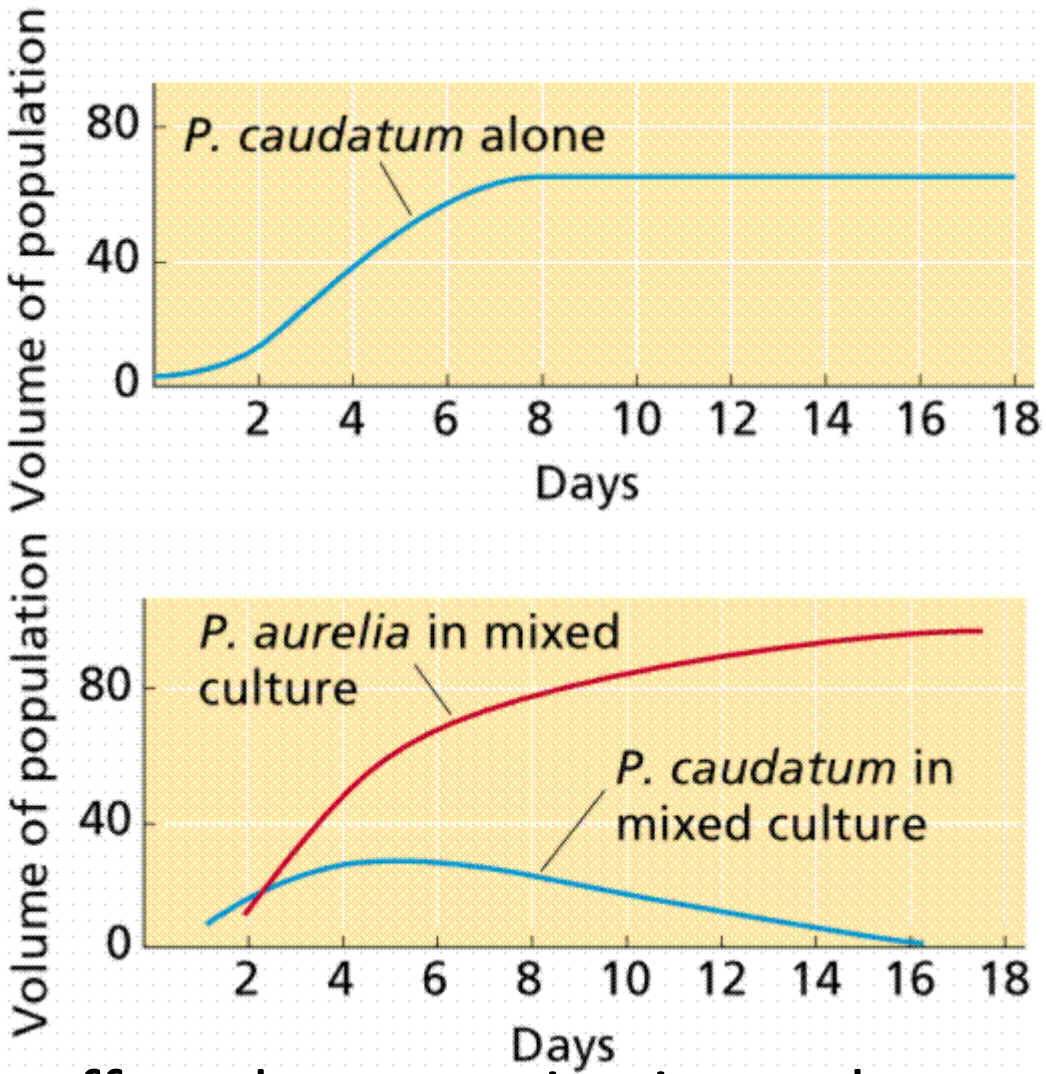


1. What is the mean growth rate of *P. caudatum* from day 2 to 6? Approx. 50/4 = 12.5 ml/day

2. What does the carrying capacity of *P. caudatum* appear to be? Approximately 70 ml

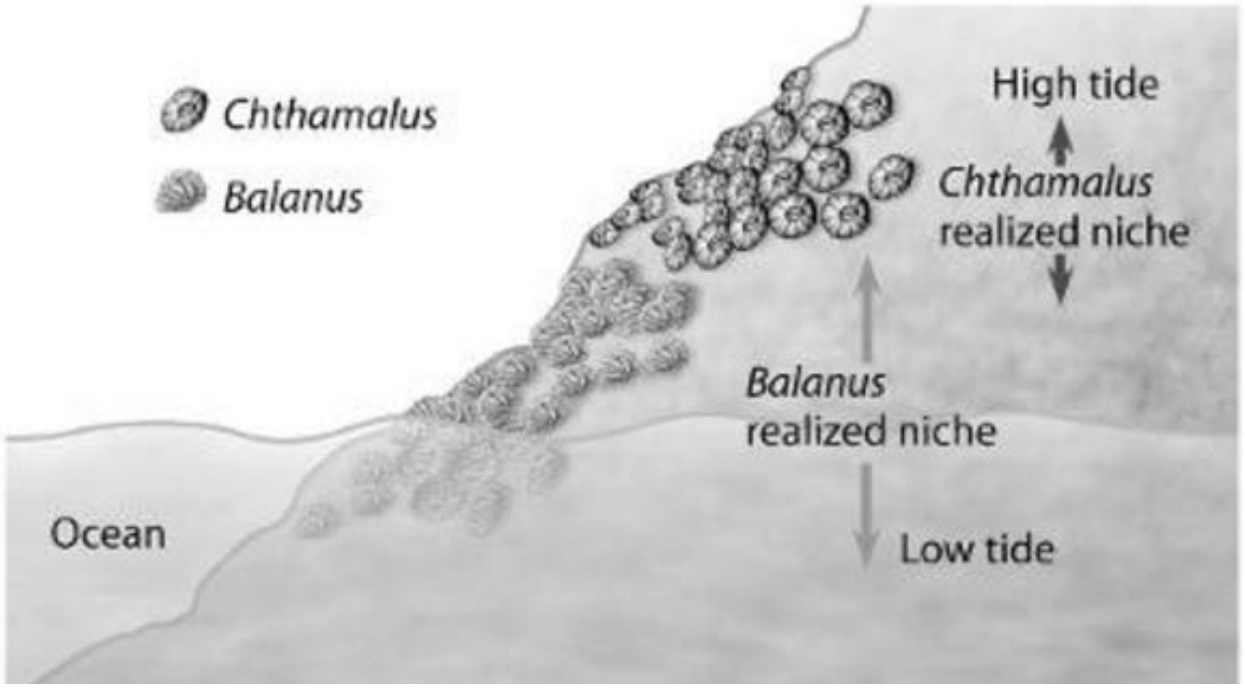


1. What effect does growing in a culture mixed with *P. aurelia* have on the population growth rate of *P. caudatum?*
2. What could be an explanation for this?

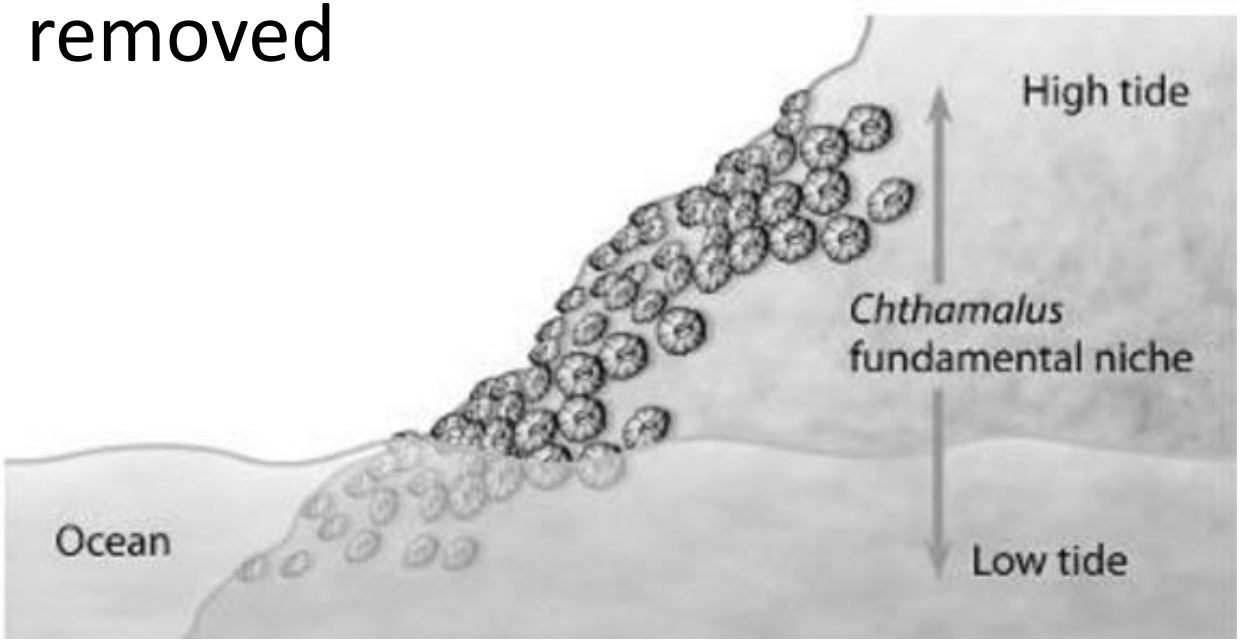


1. What effect does growing in a culture mixed with *P. aurelia* have on the population growth rate of *P. caudatum*? *Eliminates it*
2. What could be an explanation for this? competition

Control:

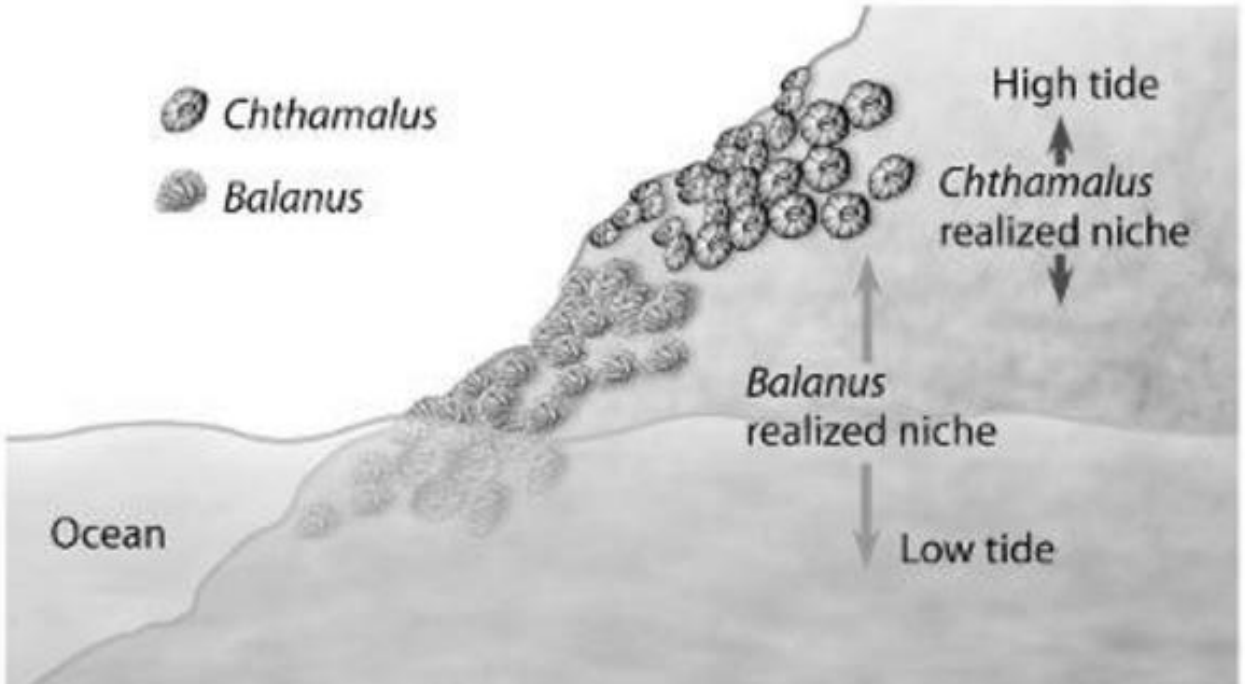


Experimental treatment: *Balanus* removed

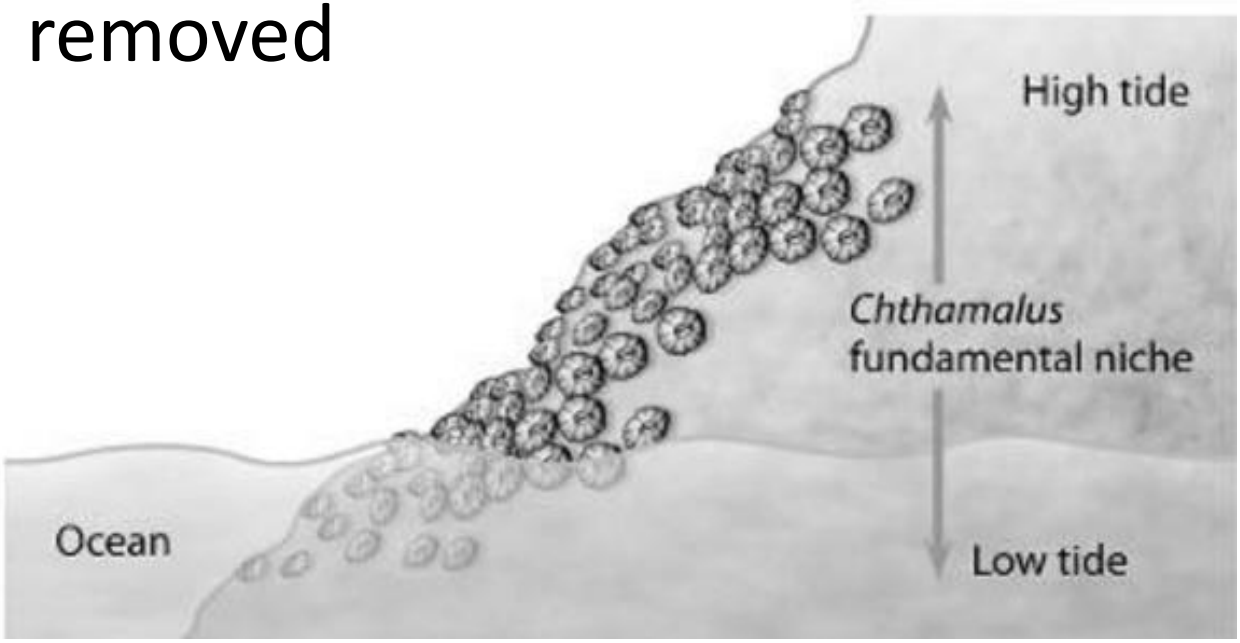


Propose an explanation for the results of the experiment:

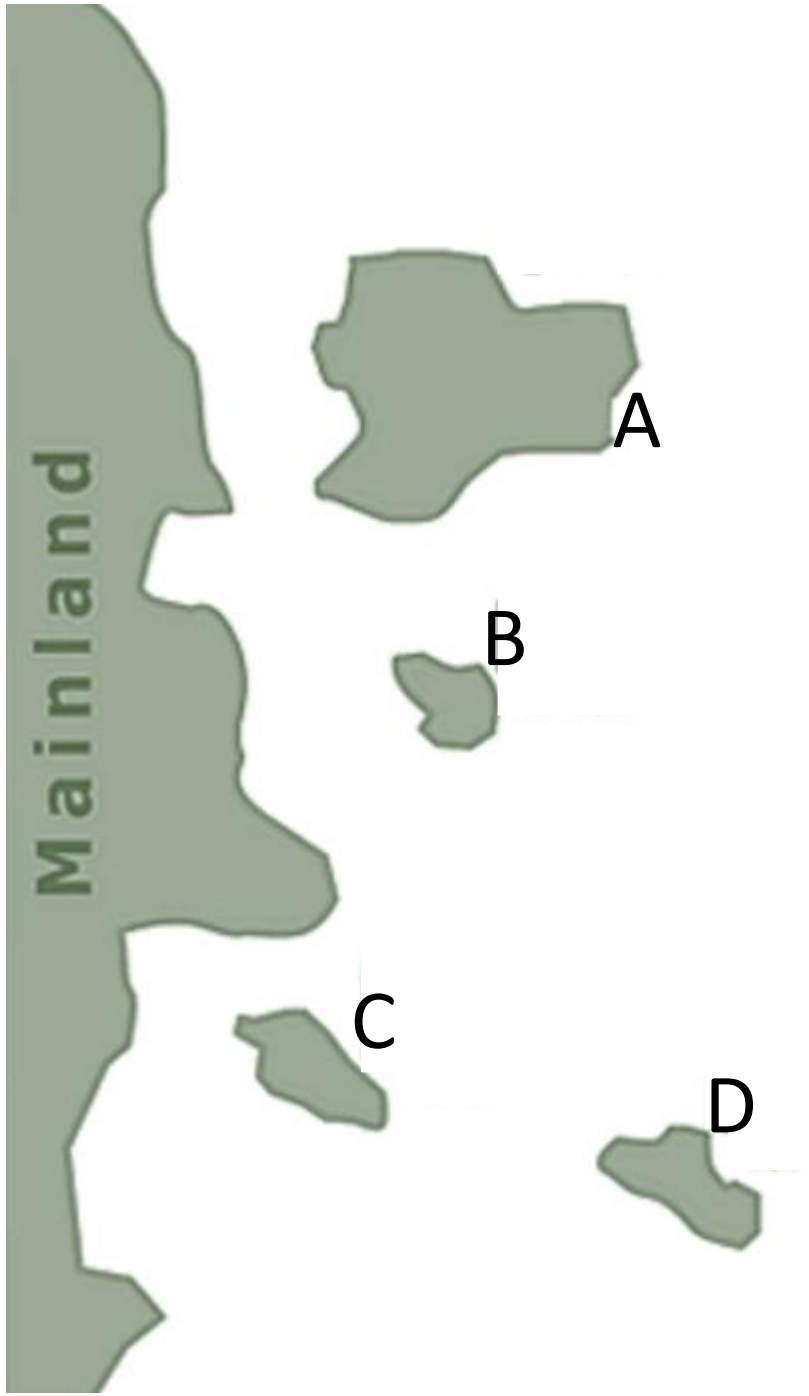
Control:



Experimental treatment: *Balanus* removed

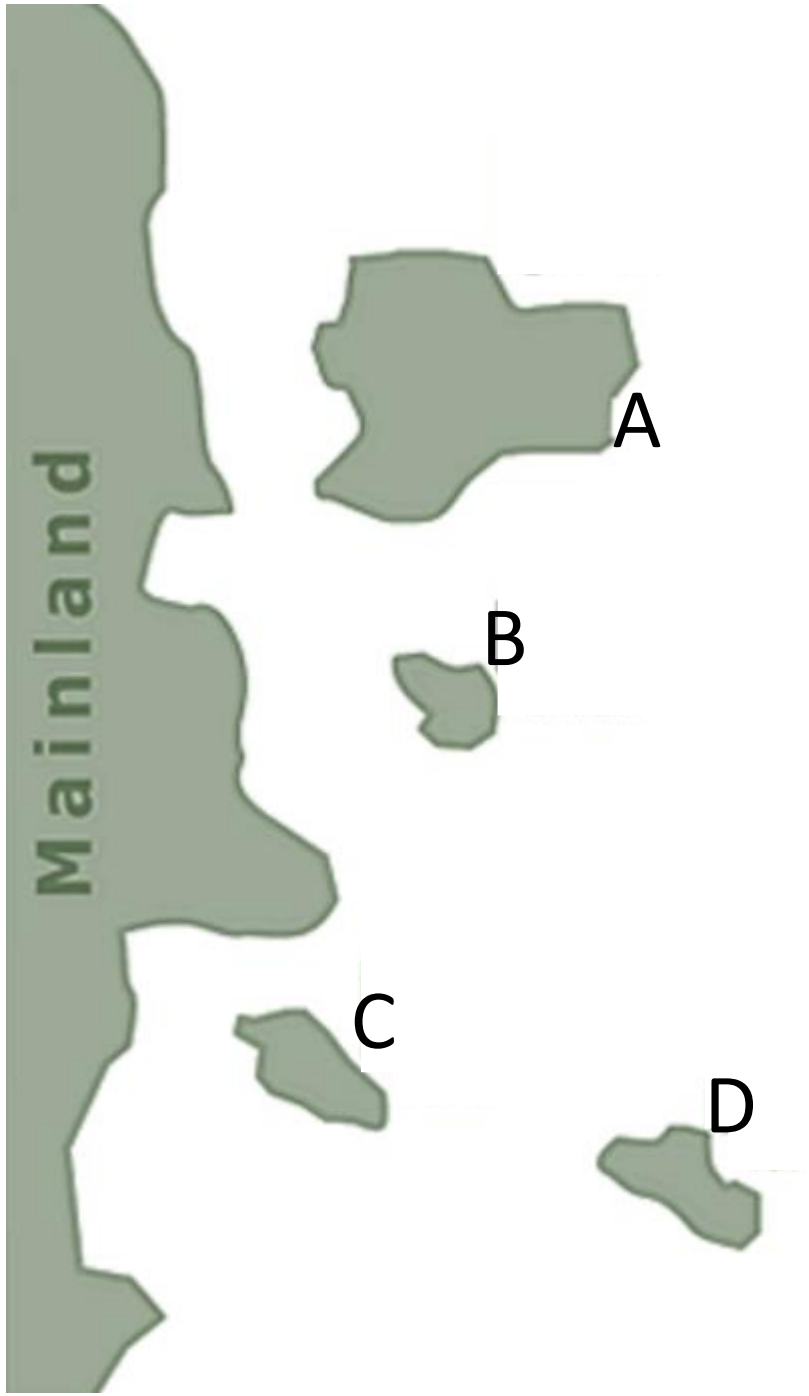


Propose an explanation for the results of the experiment: **Balanus is able to outcompete Chthamalus at the low tide line (this is an example of competitive exclusion).**



1. Rank the islands from highest number to lowest number of expected species.

2. Justify your ranking:



1. Rank the islands from highest number to lowest number of expected species.

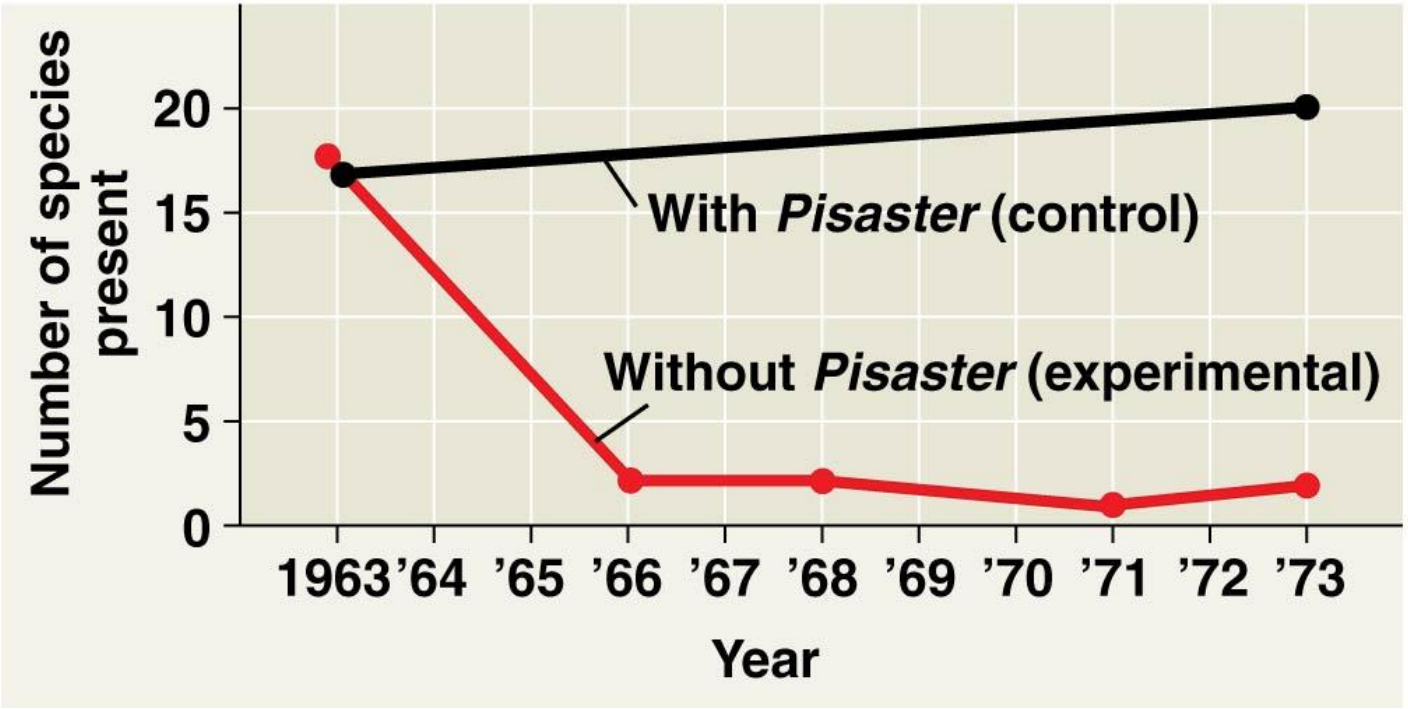
   A, C, B, D

2. Justify your ranking:

Larger and closer islands are expected to have the most species.

Experiment

Results

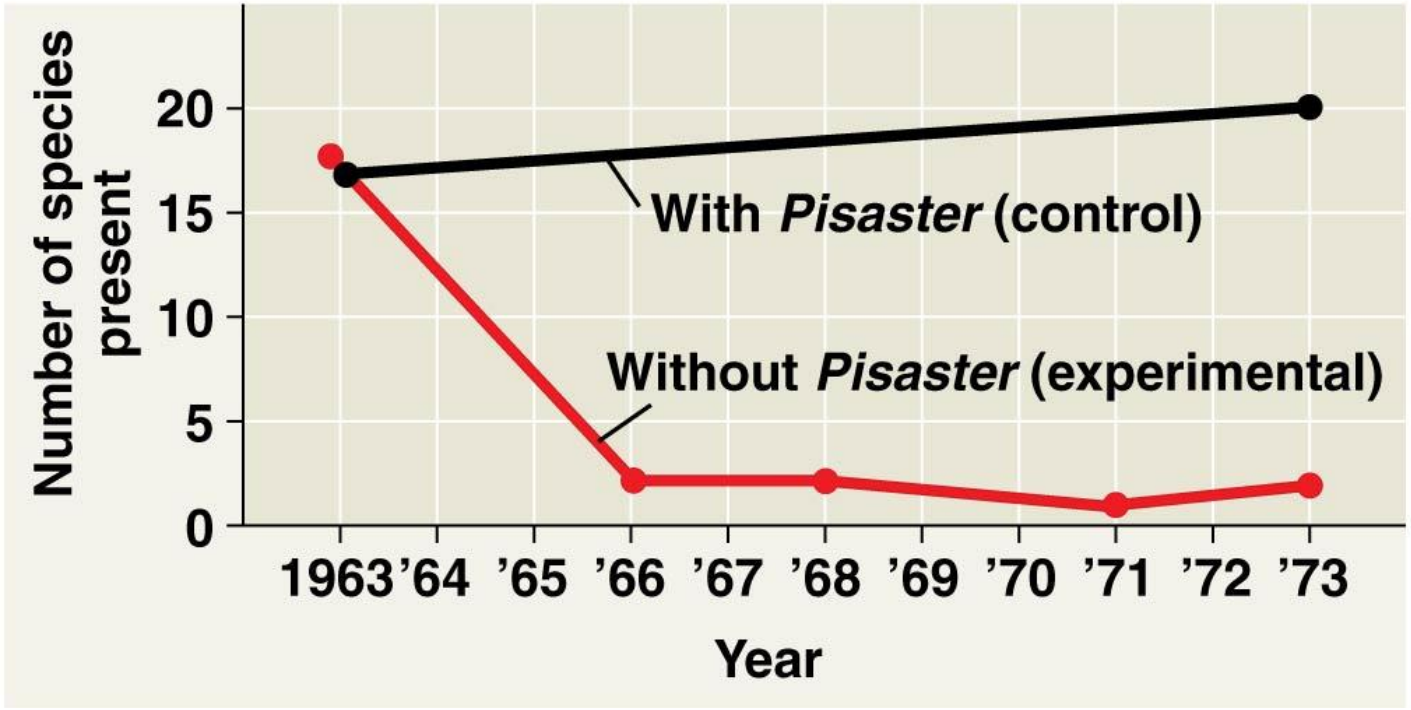


1. What is the effect of removing sea stars?

2. Why is there this effect?

Experiment

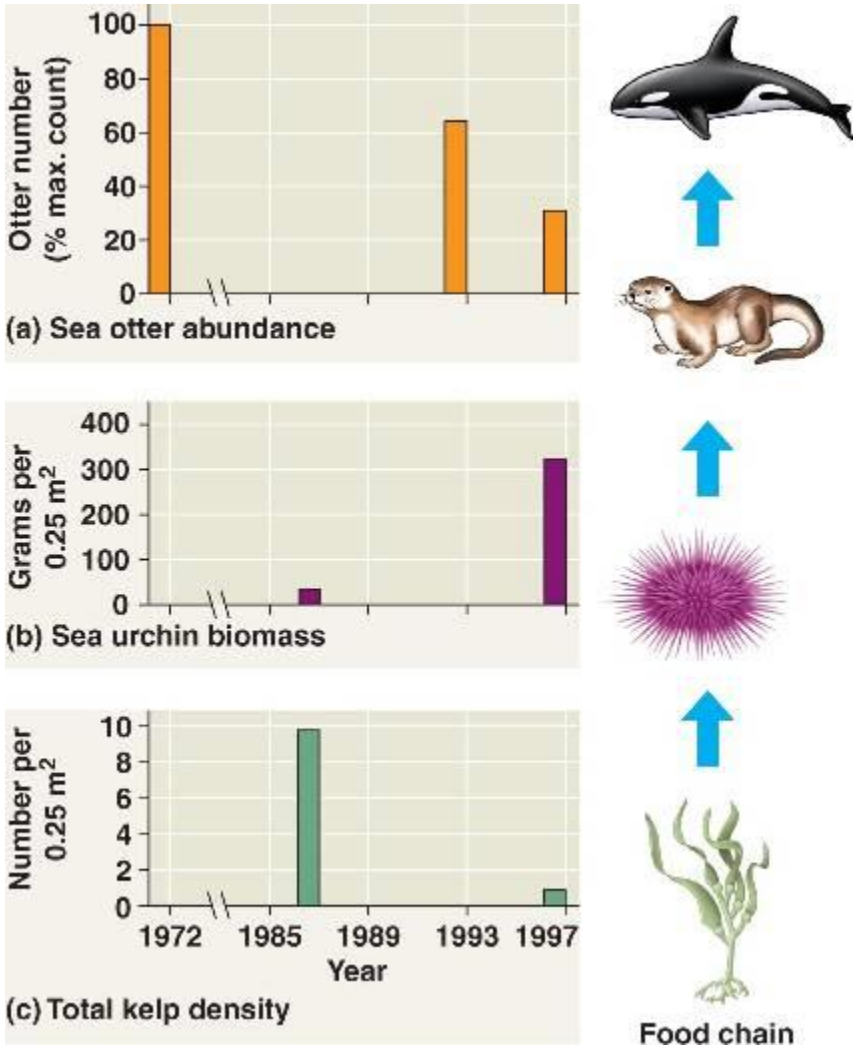
Results



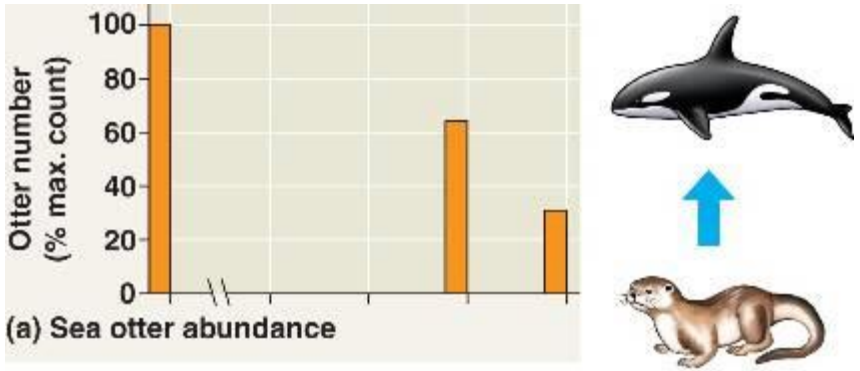
1. What is the effect of removing sea stars? **Biodiversity decreased**

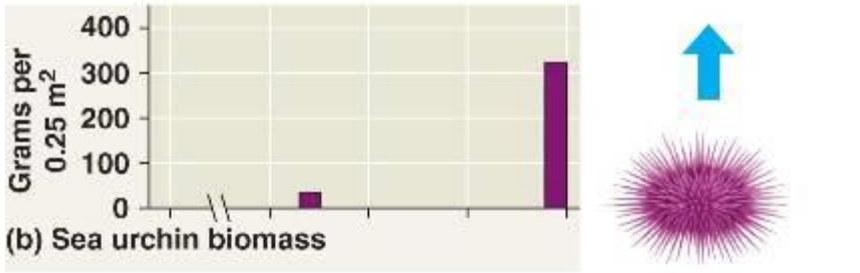
2. Why is there this effect? **Sea stars prey on muscles, removing them from the rocks, thus freeing up space for other species to anchor. It acts as a keystone predator.**

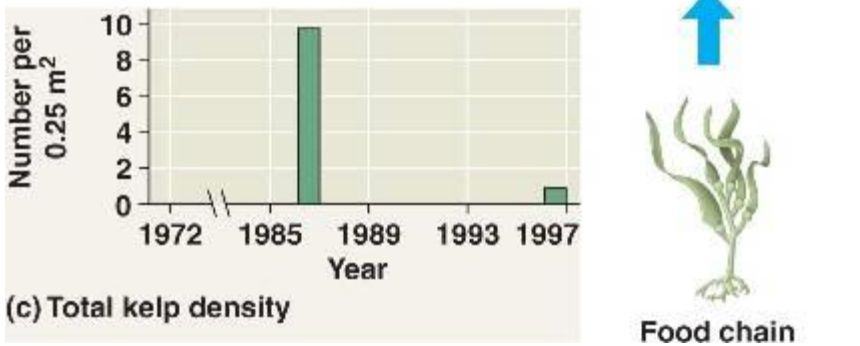
How do ***keystone species*** such as the sea otter affect the biodiversity of their habitats?

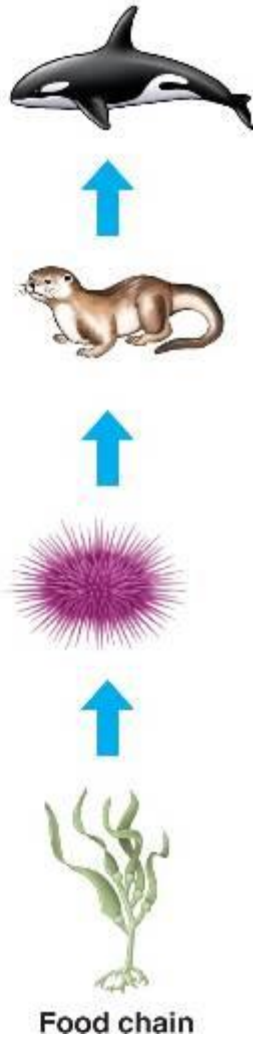


How do ***keystone species*** such as the sea otter affect the biodiversity of their habitats?

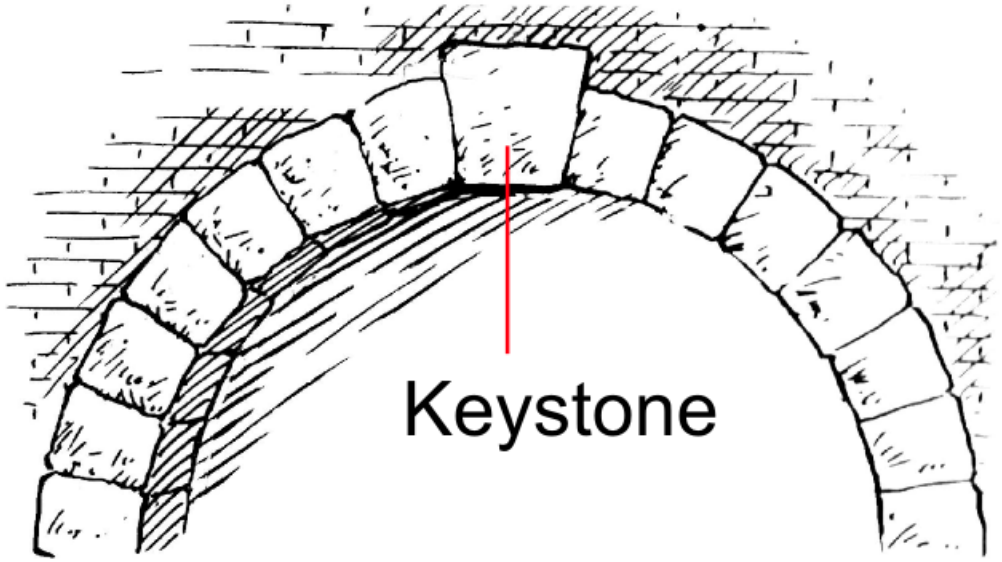






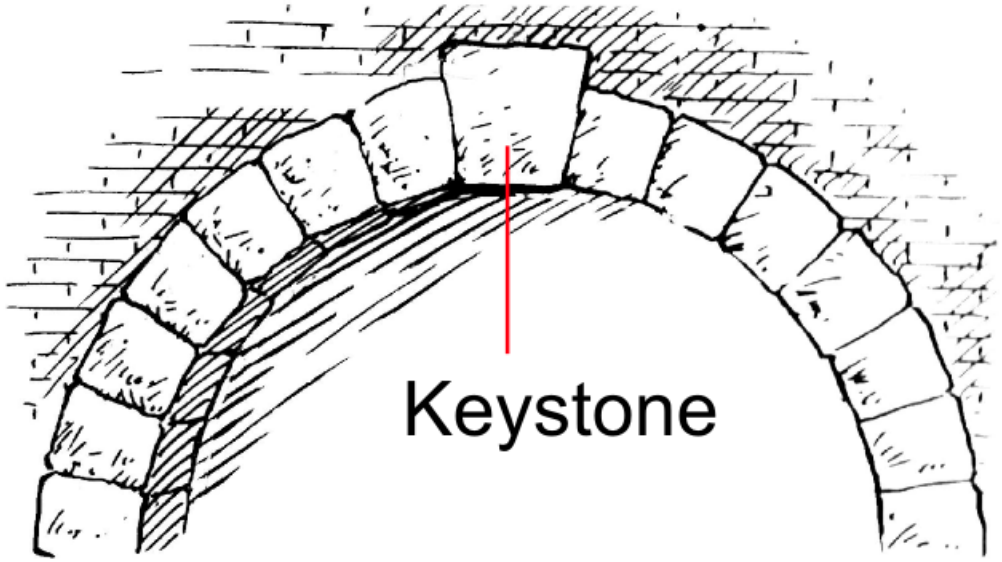


Sea otters prey upon urchins. Urchins feed on kelp. If otter population drops, sea urchin population would increase and kelp would decrease. As a result of the loss of kelp in the kelp-forest habitat, the biodiversity of that habitat would be expected to decrease.



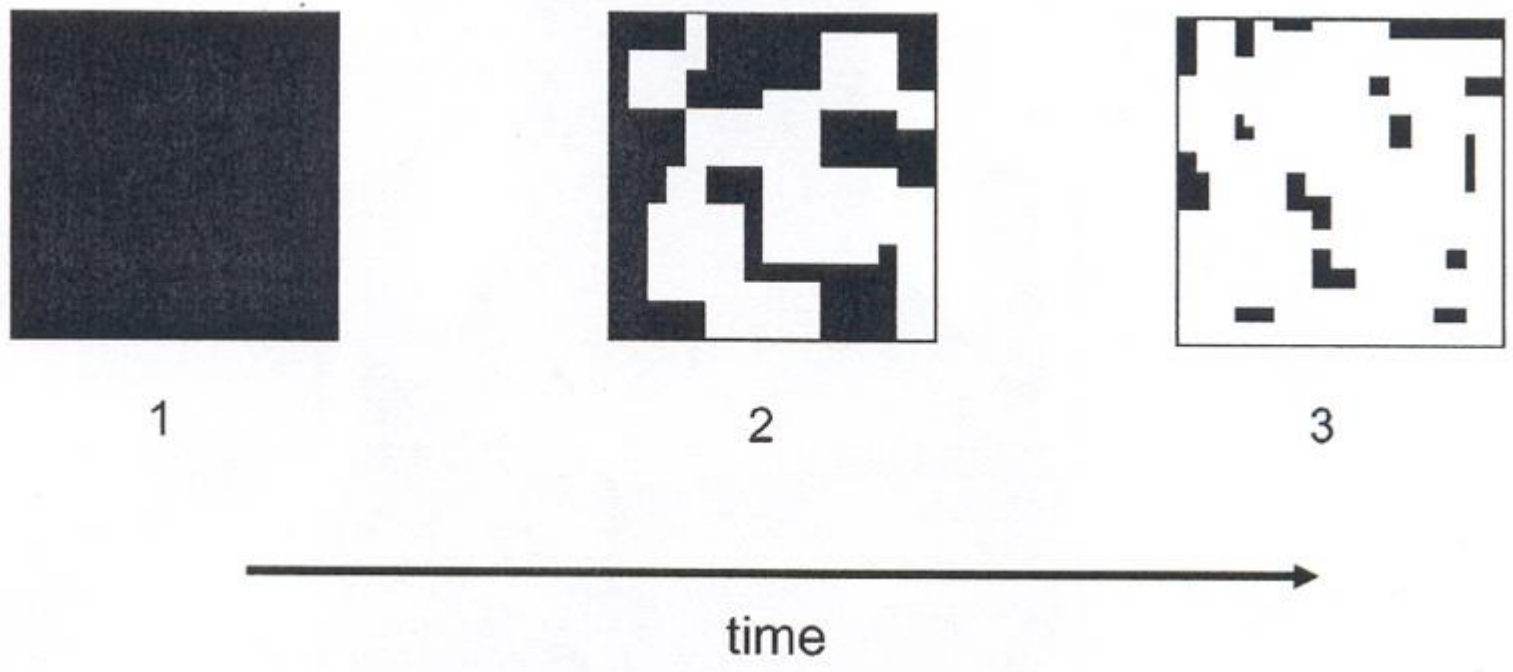
1. Give two examples of marine keystone species:

2. Give an example of a terrestrial keystone species:



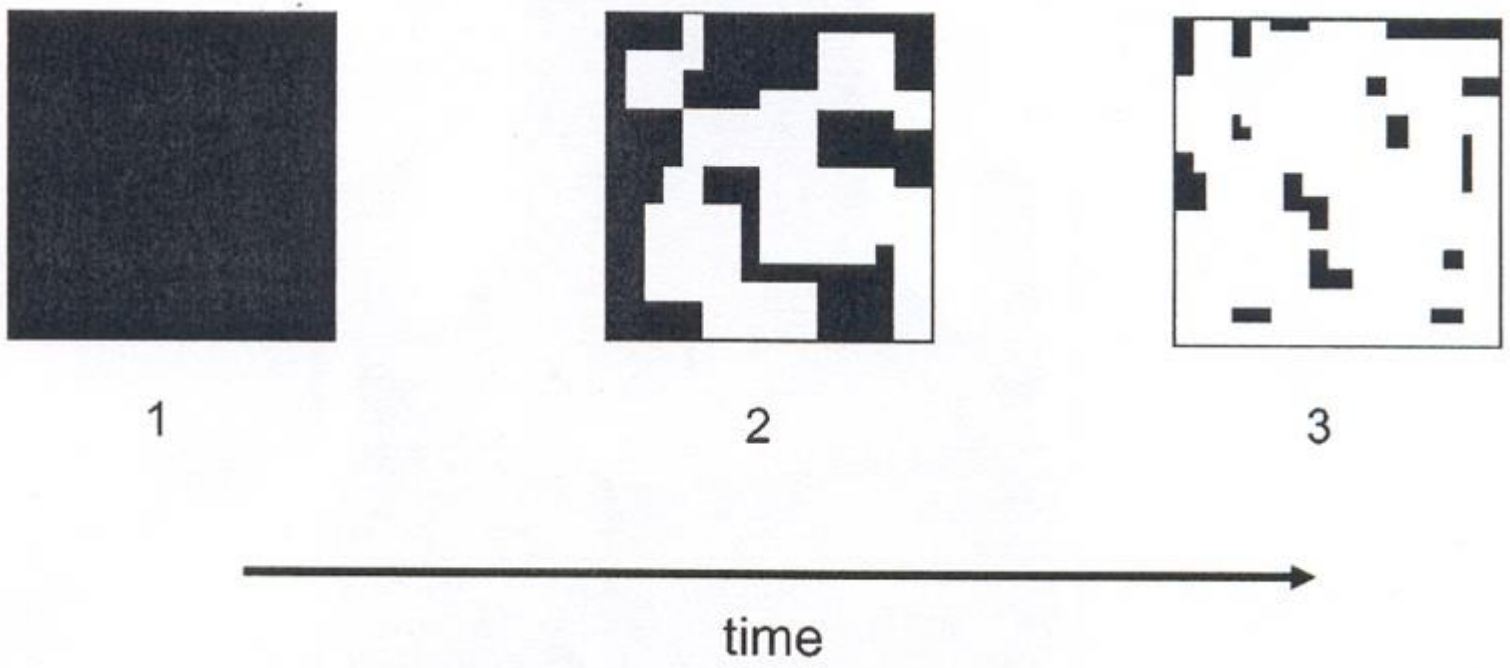
1. Give two examples of marine keystone species: **sea stars and sea otters**

2. Give an example of a terrestrial keystone species: **wolves**



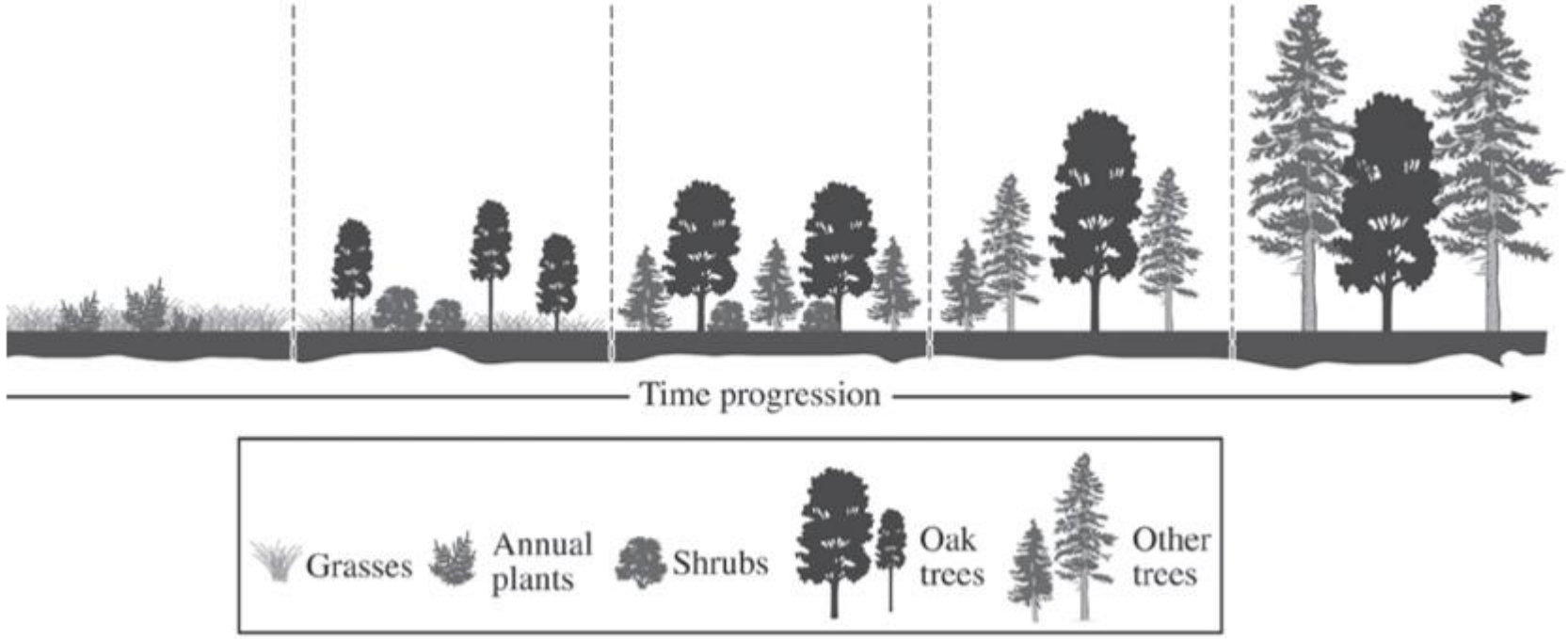
Shading represents rainforest habitat and white represents agricultural fields.

Predict and explain the effect of the changes on biodiversity.

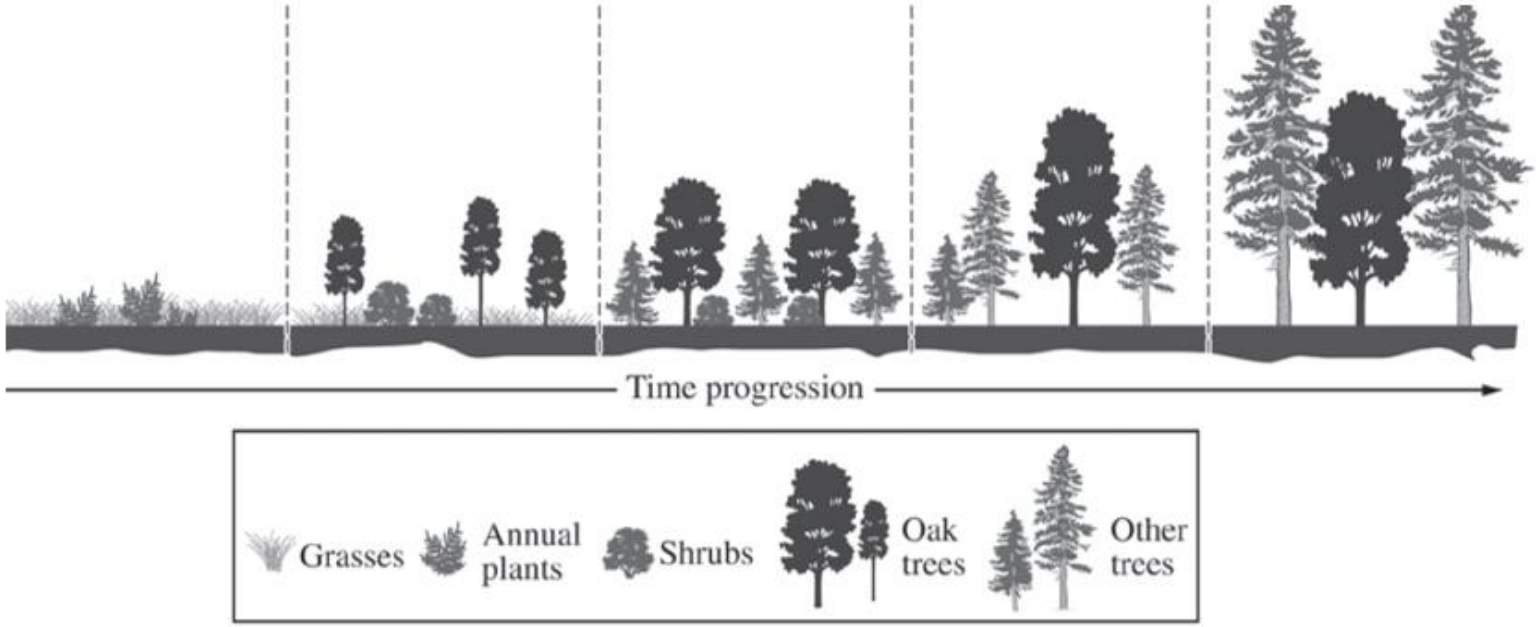


Shading represents rainforest habitat and white represents agricultural fields.

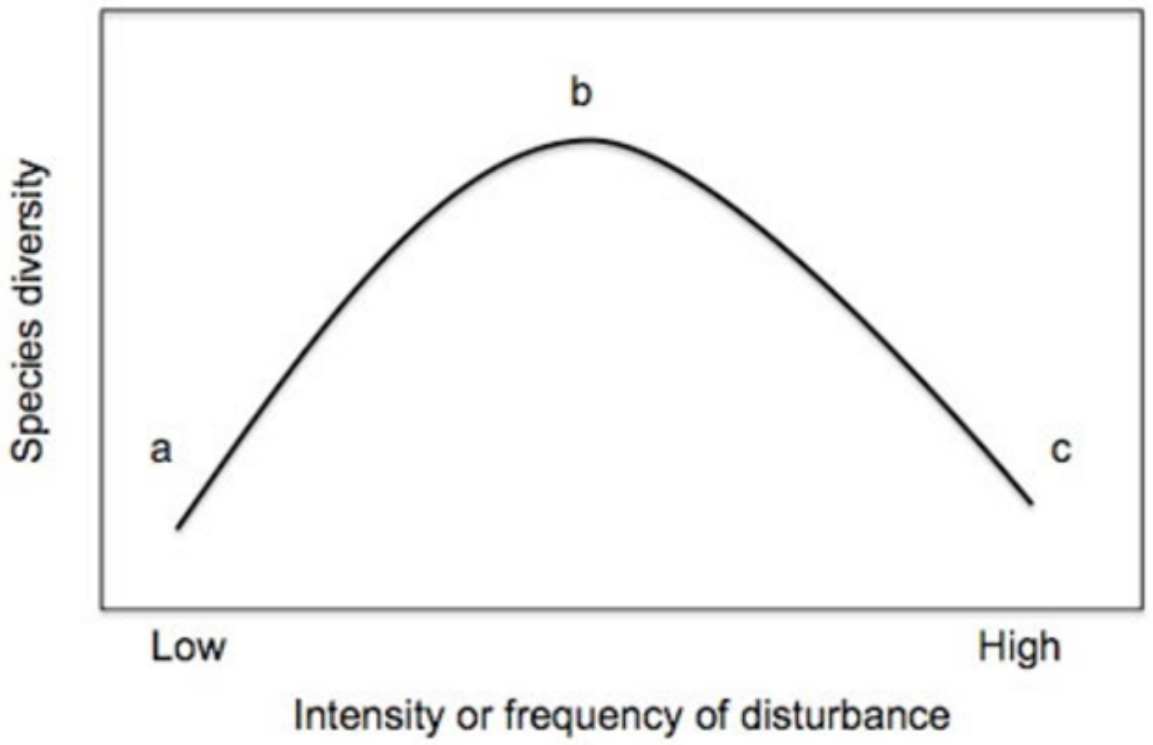
Predict and explain the effect of the changes on biodiversity. **Habitat has been lost and fragmented; as a result less individuals will be supported and biodiversity will be lost.**



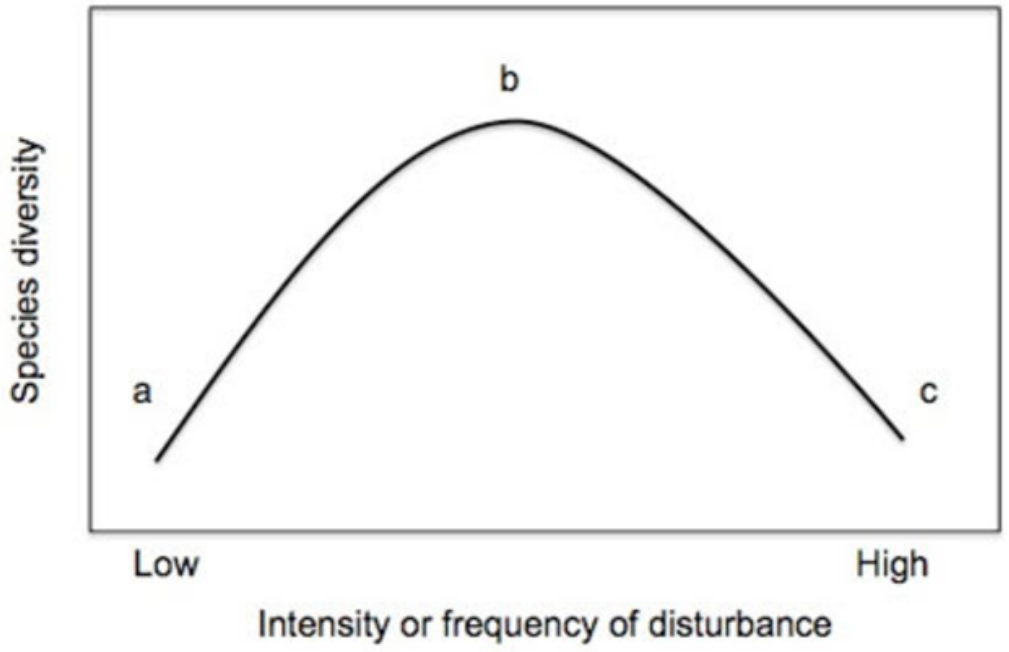
1. Describe the changes in biotic factors that are visible in this model of ecological succession following a fire:
2. Infer the changes in abiotic factors that are likely occur over the time sequence shown:



Following the fire, grasses and annual (living only one year) plants dominate the ecosystem. We can infer that these are sun-loving plants as there is no shade. Later, shrubs start to grow as well as oak trees. These plants provide some shade, which we can infer is necessary for the pine/fir trees that now start to grow in the understory. It appears that the grasses and annual plants are now shaded out. At the end of the time-progression, the pine/fir trees have grown above the oak tree canopy and appear to be shading them out as no new oak seedling appear to grow under the canopy (light now appears to be a limiting factor for oak trees).



1. What can result in an early-successional community?
2. What does a climax community mean? What is an example?
3. According to the graph shown, what is the relationship between the two variables?
4. What could be an explanation?



1. What can result in an early-successional community? A disturbance such as a fire or clear-cut
2. What does a climax community mean? What is an example? A community that has persisted for a long time with low disturbance – temperate rainforest of WA
3. According to the graph shown, what is the relationship between the two variables? The community with an intermediate-level of disturbance has the highest diversity
4. What could be an explanation?

A intermediate-level of disturbance could result in patchy habitats, i.e. windfall in WA temperate rainforest producing a canopy-gap with lots of light

1. What is the relationship between biodiversity and how resistant an ecosystem is to invasion by nonnative species?

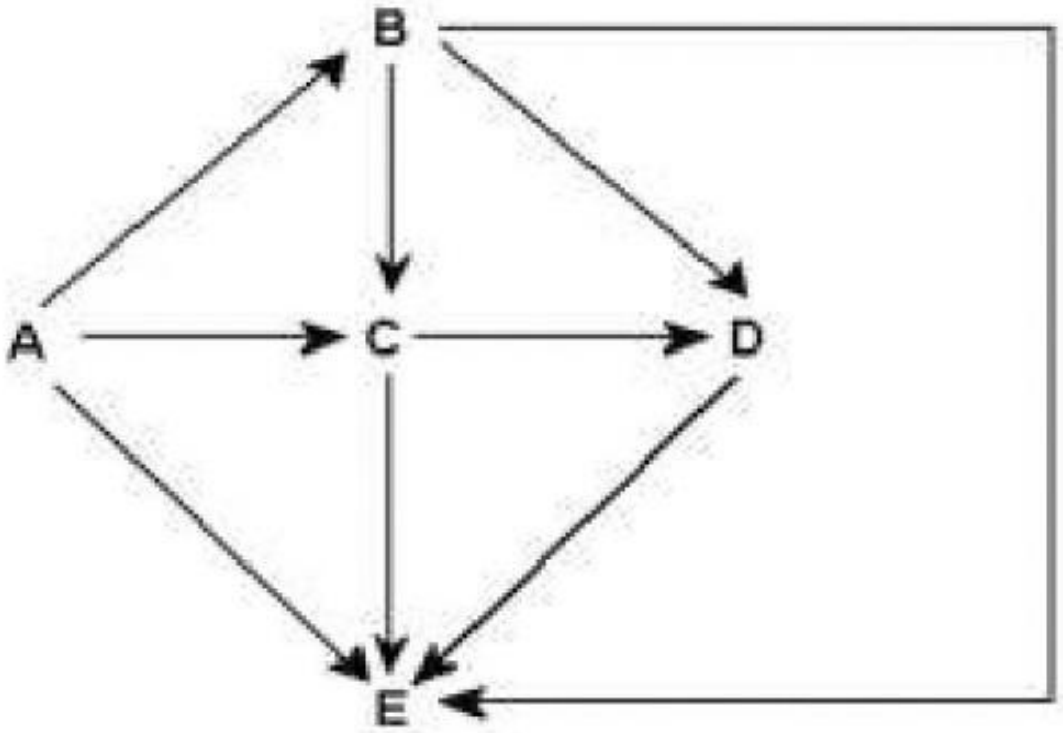
2. What would this relationship look like as a graph?

3. What would be an explanation for this relationship?

1. What is the relationship between biodiversity and how resistant an ecosystem is to invasion by nonnative species? As biodiversity increases, the likelihood of successful invasion decreases

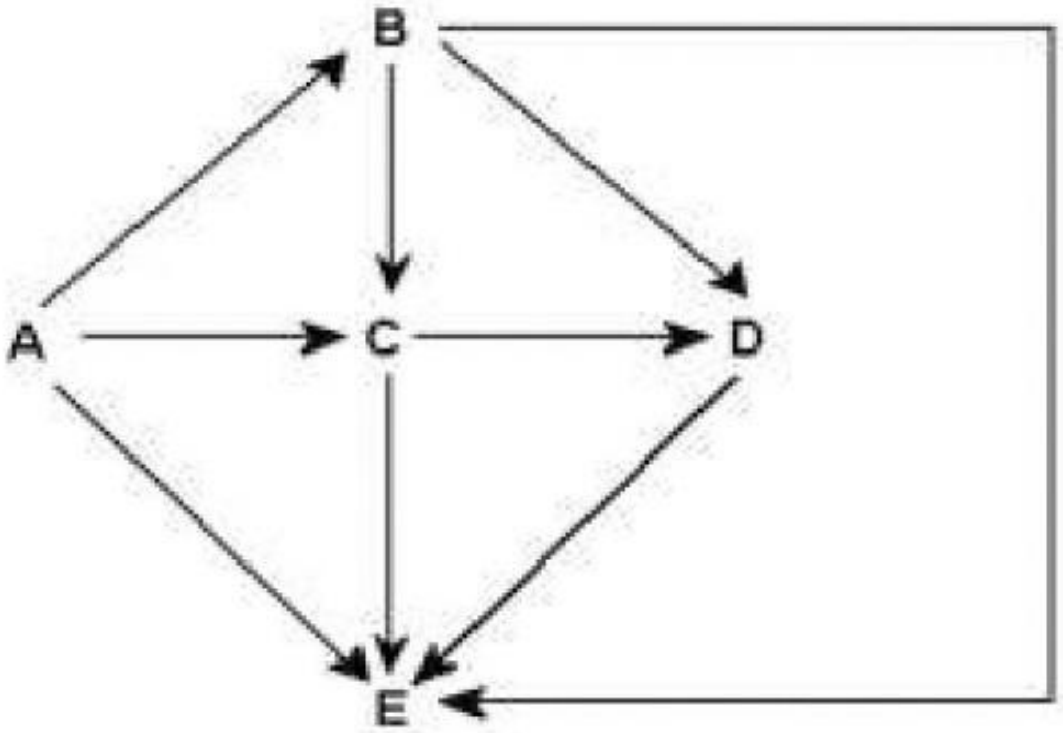
2. What would this relationship look like as a graph? Negative correlation (x-axis would be biodiversity and y-axis would be likelihood of successful invasion)

3. What would be an explanation for this relationship? Ecosystems with higher biodiversity have more of the niches full and there is greater competition, thus allowing less opportunities for a new nonnative species to have success



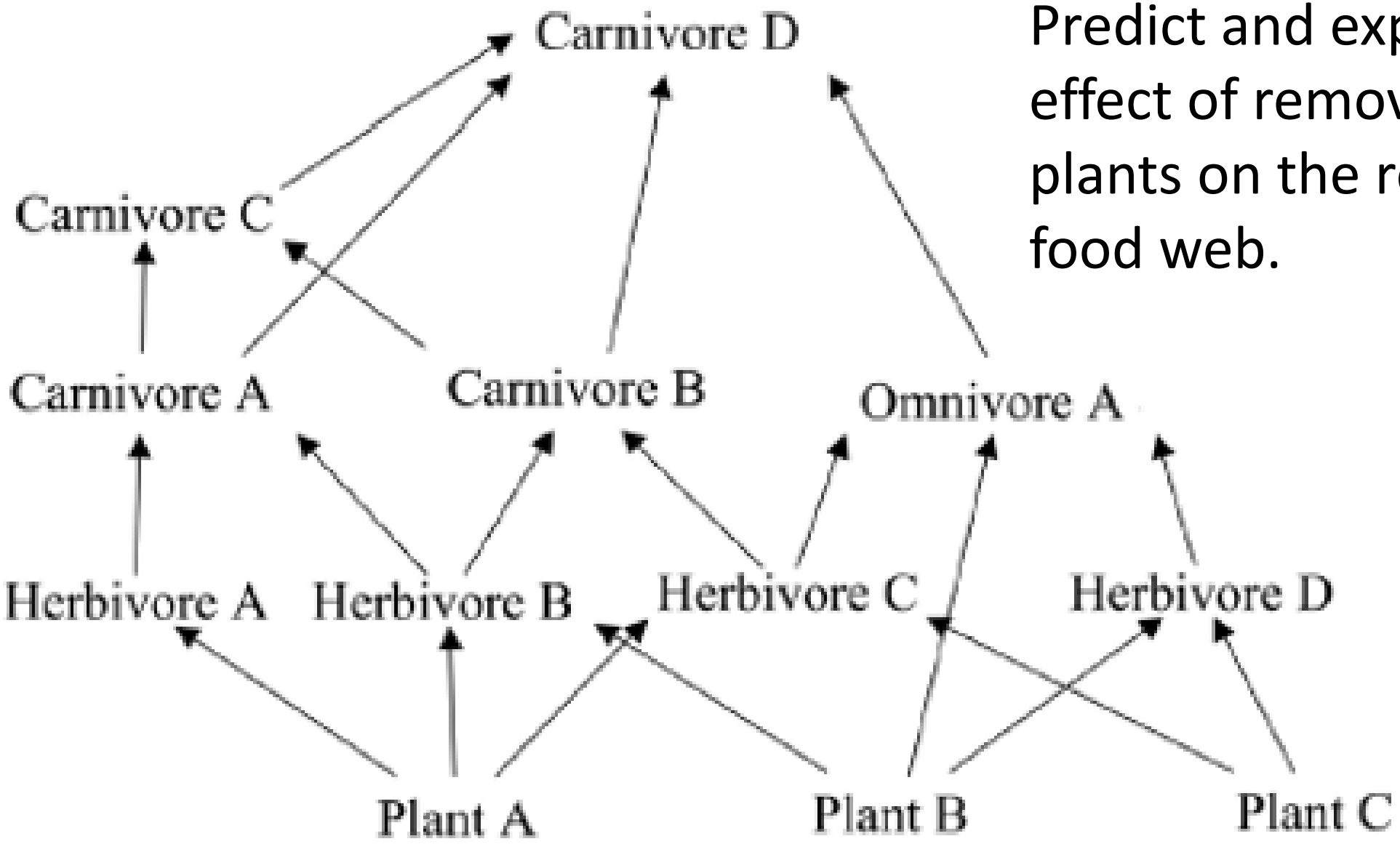
Which organism(s) is/are:

1. The top predator
2. A primary producer
3. A herbivore
4. A decomposer

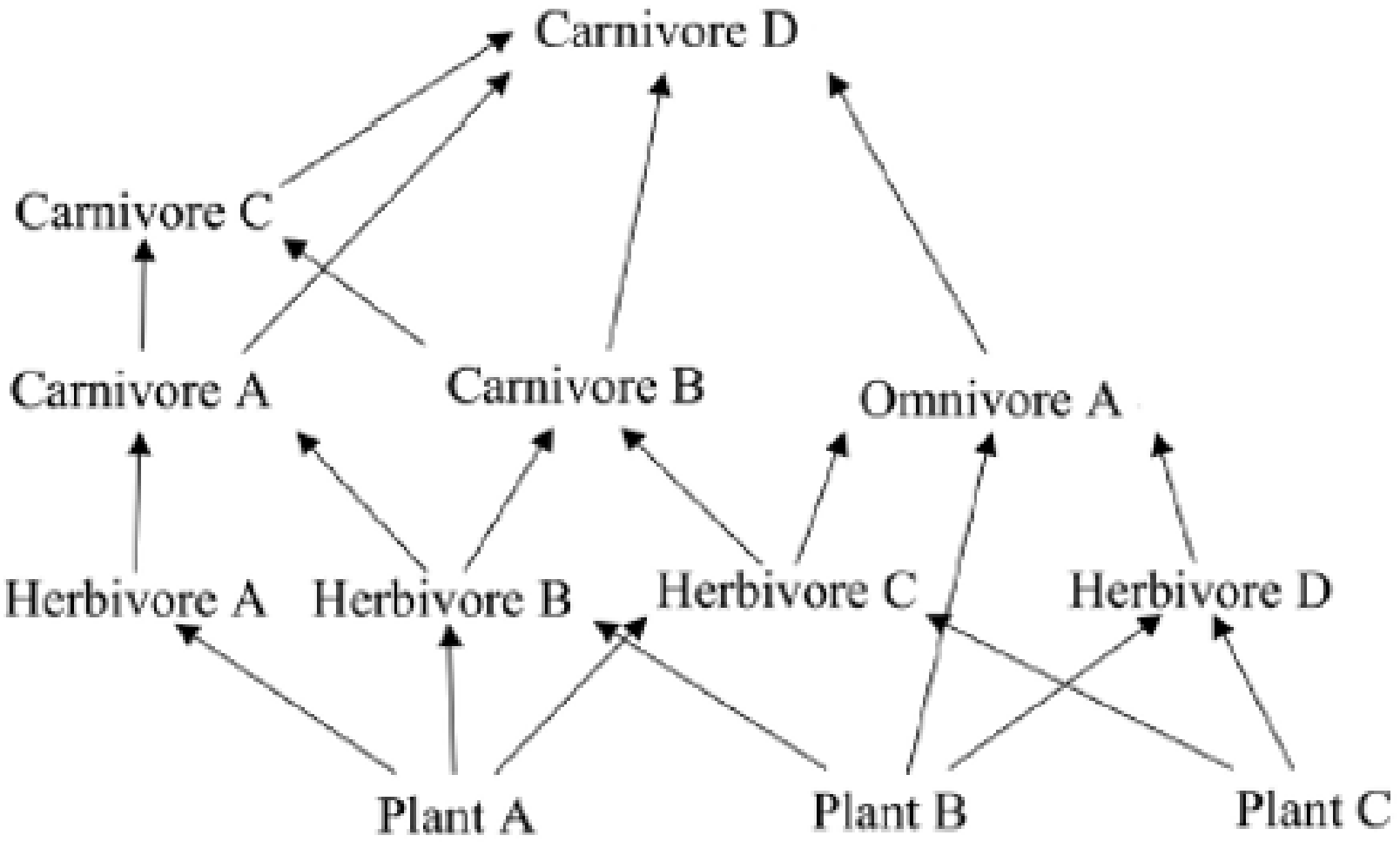


Which organism(s) is/are:

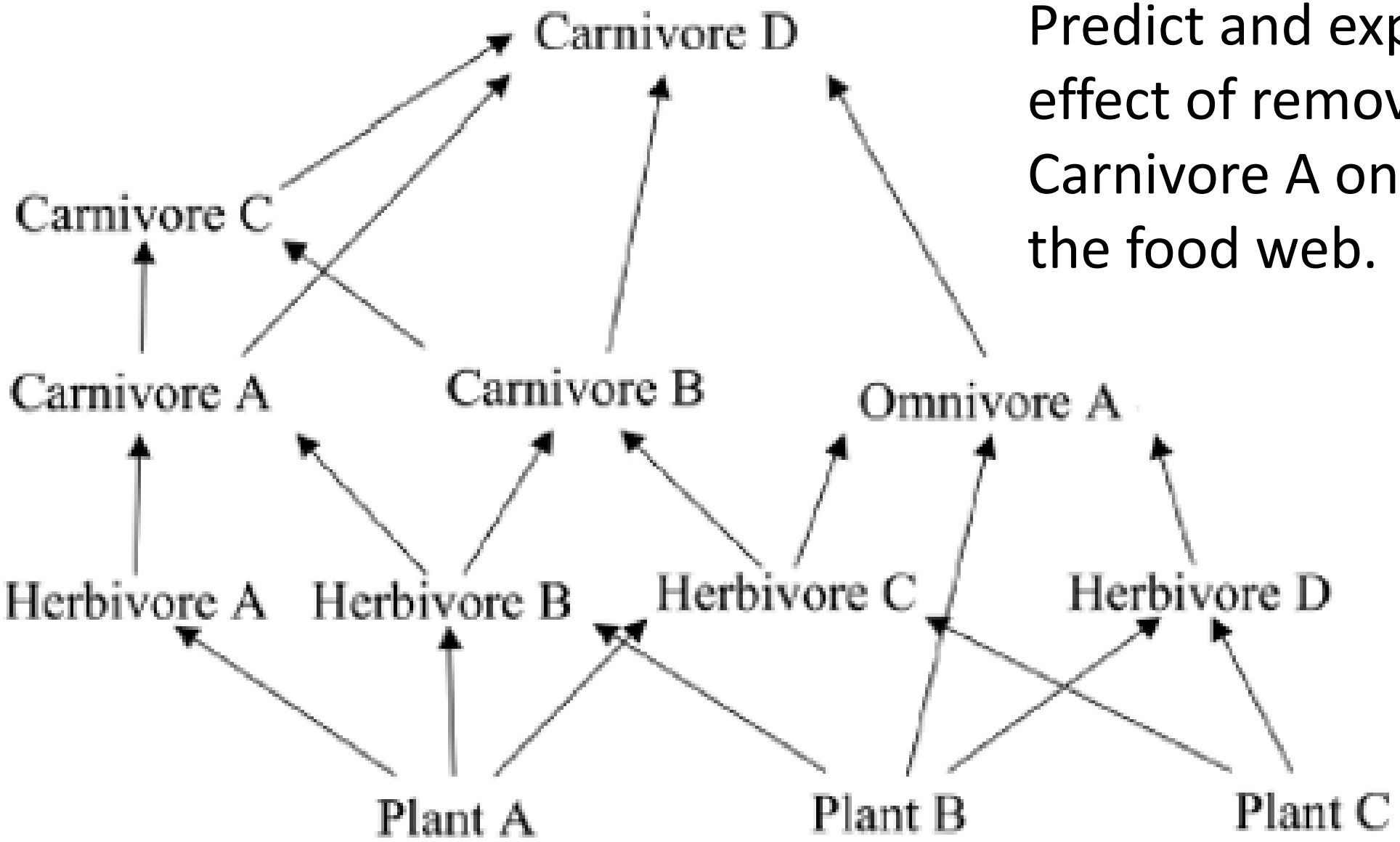
1. The Carnivore **D**
2. A primary producer **A**
3. A herbivore **B**
4. A decomposer **E**



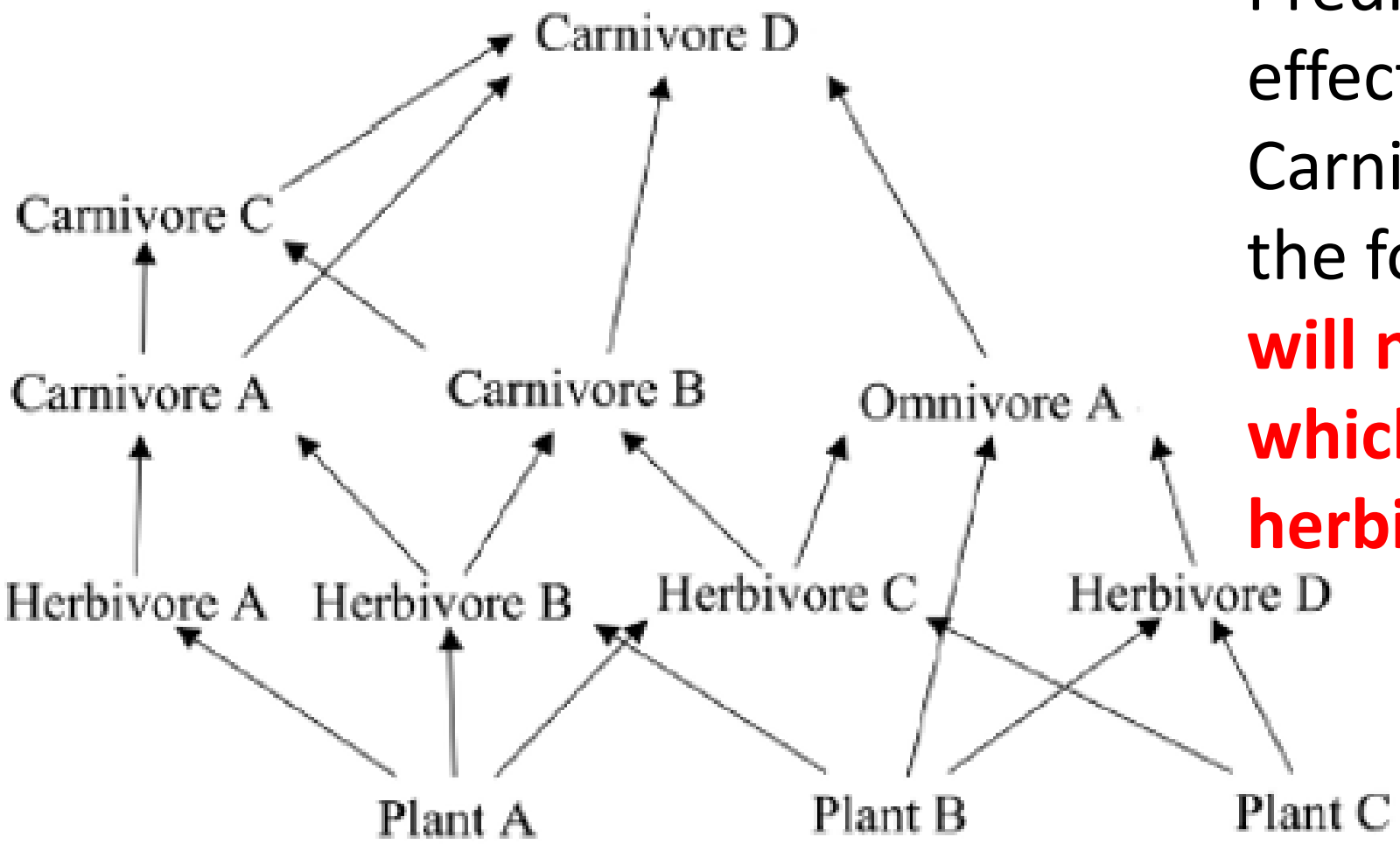
Predict and explain the effect of removal of ½ of all plants on the rest of the food web.



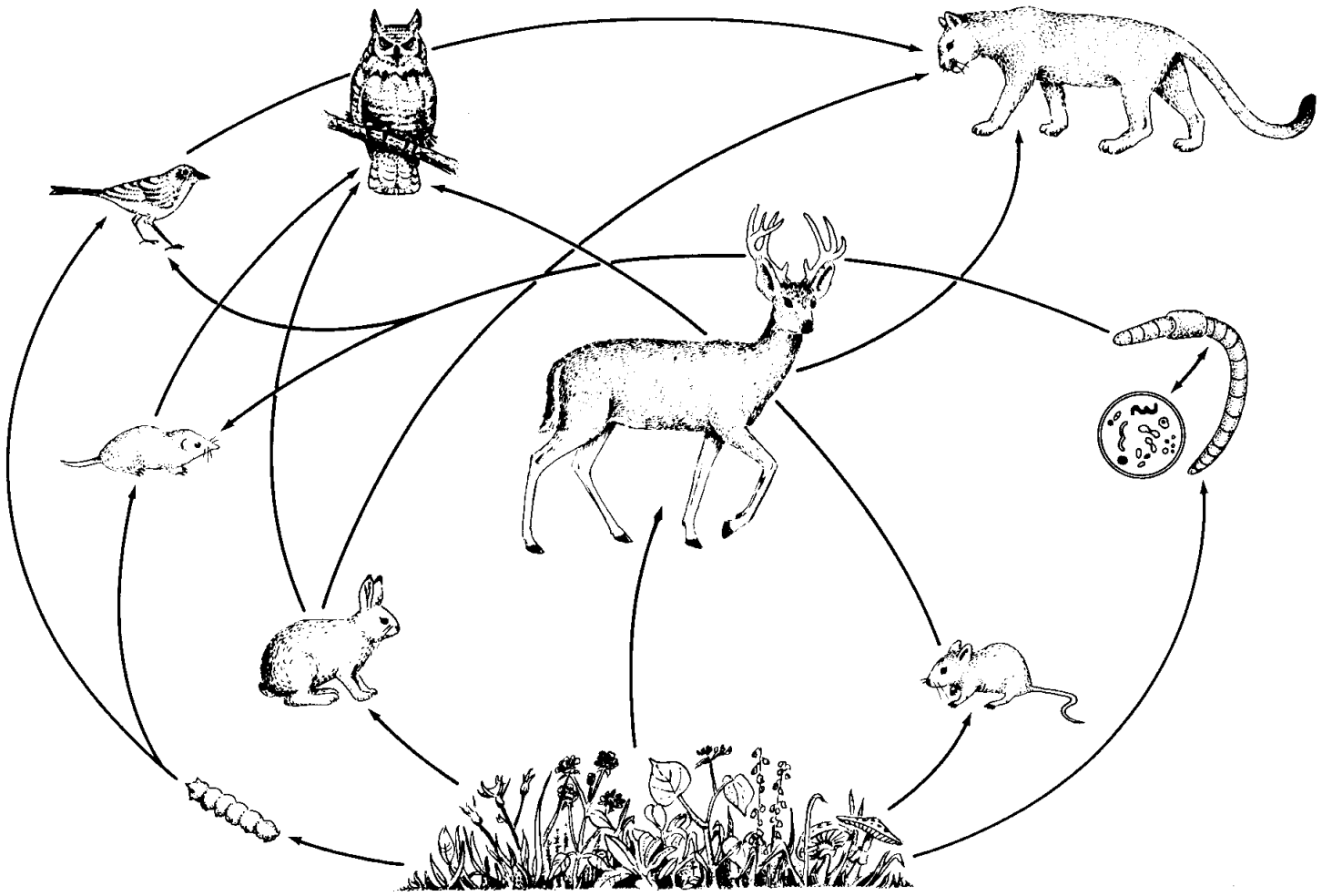
Predict and explain the effect of removal of ½ of all plants on the rest of the food web. **The numbers of individuals of each species will be reduced. Higher order carnivores risk of extinction. Pattern exists because energy flow through system is reduced.**



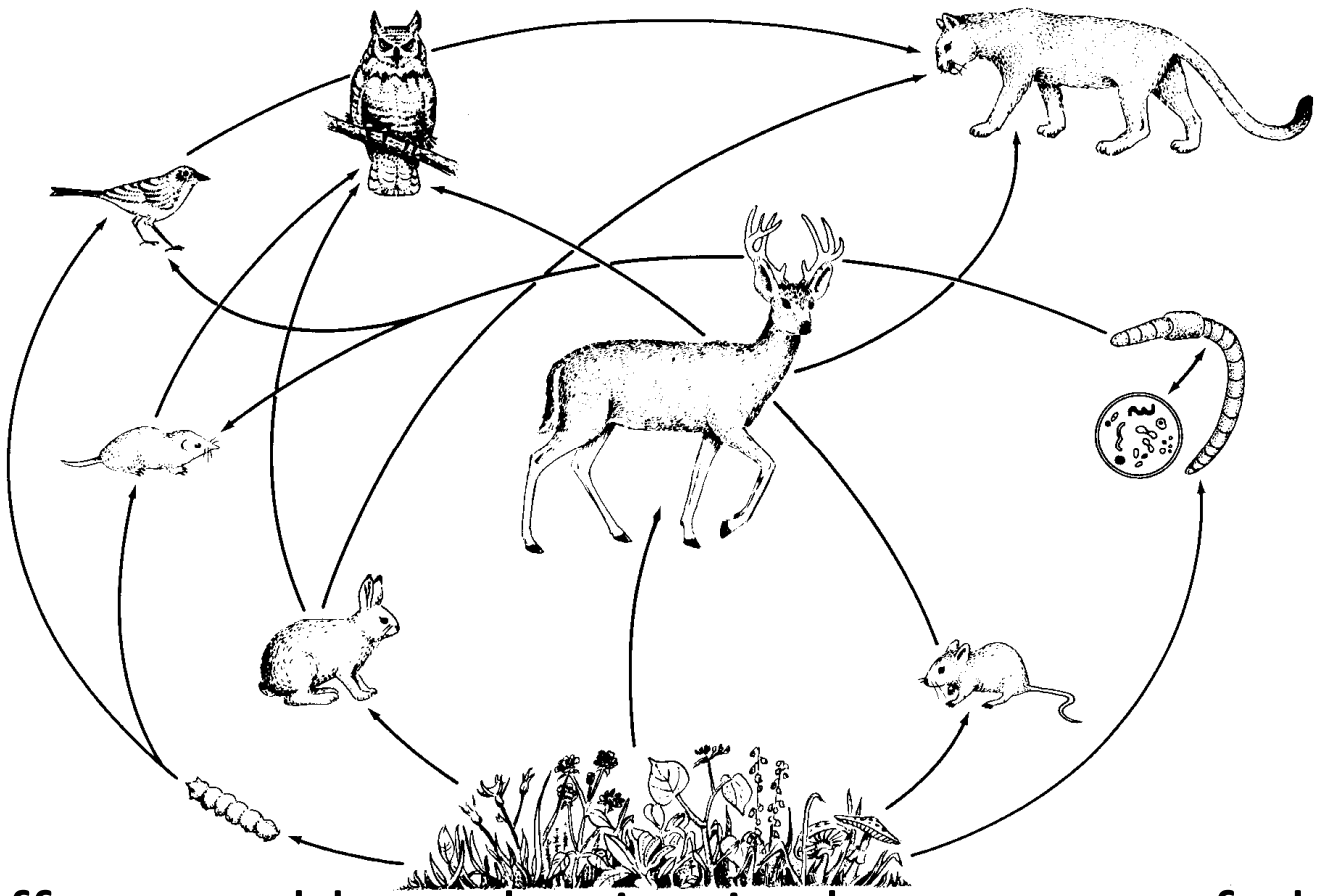
Predict and explain the effect of removal of Carnivore A on the rest of the food web.



Predict and explain the effect of removal of Carnivore A on the rest of the food web. **Herbivore A will not be under control which may result in more herbivory of plant A.**



1. What effect would a reduction in the amount of plants in this ecosystem have on the food web?
2. Explain your answer to #1:



1. What effect would a reduction in the amount of plants in this ecosystem have on the food web? Reduction in abundance of consumers, possible loss of top-predators
2. Explain your answer to #1: Energy flows through the food web from plants through eating relationships, energy-loss at each level, top-predators require the most energy to support

Summarize the nature of the relationships:
(+,+), (+,-), (-,-)

1. Parasitism
2. Predation
3. Mutualism
4. Herbivory
5. Competition

Summarize the nature of the relationships:
(+,+), (+,-), (-,-)

1. Parasitism **(+,-)**
2. Predation **(+,-)**
3. Mutualism **(+,+)**
4. Herbivory **(+,-)**
5. Competition **(-,-)**

Give two reasons why alien species can be so successful in invading native habitats:

Why are Alien Invasive Species so Successful?

They may have ***lost a population controlling factor***: left their predators, pathogens, or parasites behind

They may have a ***novel evolutionary advantage*** (chemical defense, enzyme, competitive edge, etc.)

Define and give some examples of the following:

1. Autotrophs (and list two types):
2. Heterotrophs
3. Detritivores

Autotroph/Primary Producer

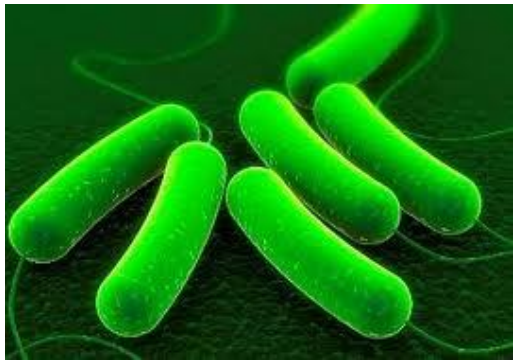
Use a free energy source and CO_2 + H_2O to make their own food

- Photoautotrophs use photosynthesis: plants, algae, cyanobacteria
- Chemoautotrophs use chemosynthesis: bacteria at deep-sea thermal vents

Heterotroph/Consumer

Must consume their food

- Animals
- Fungi
- Most bacteria
- Some Protista



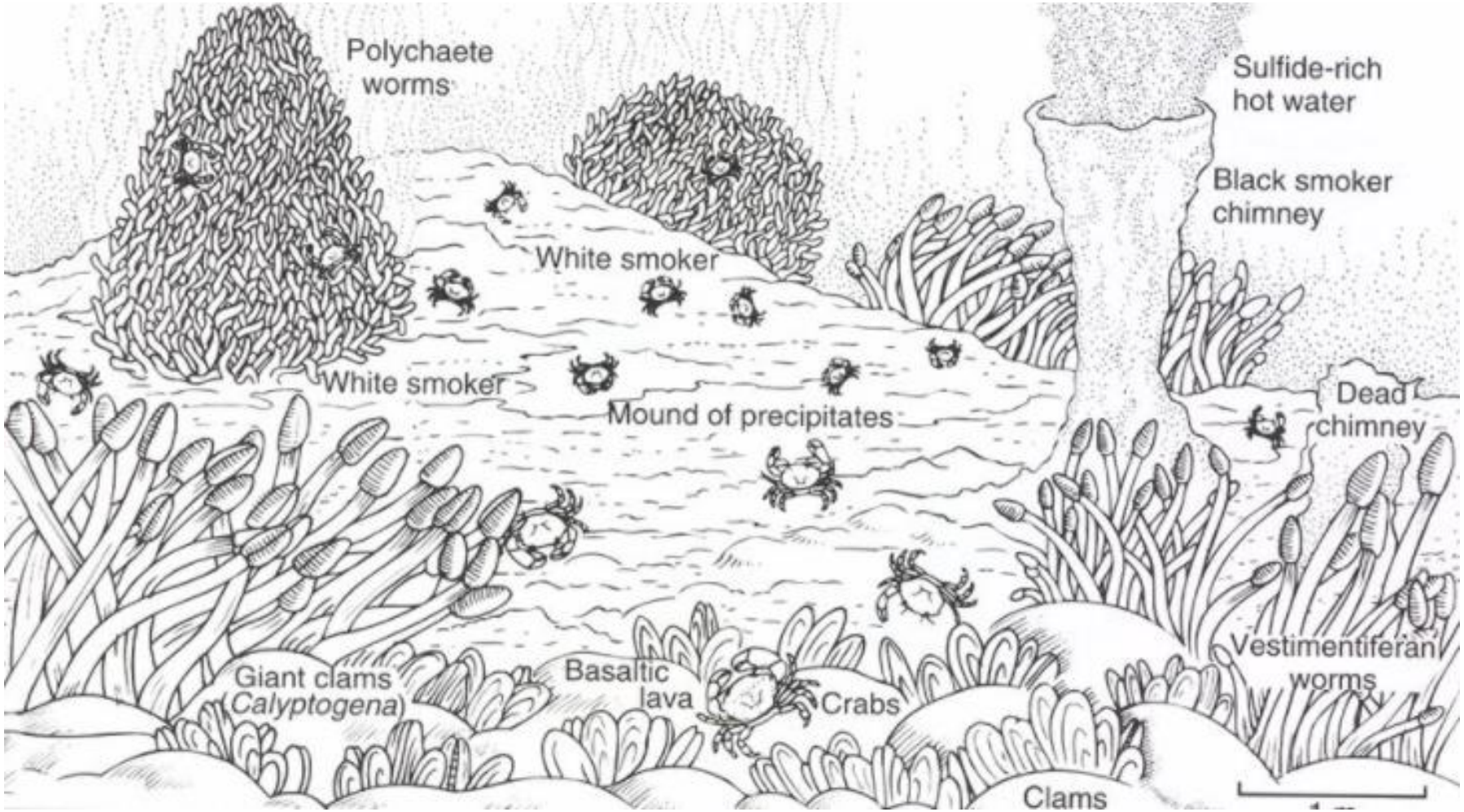
Decomposer/Detritivor

Breaks down detritis: dead organisms, fallen leaves & wood, feces

Returns nutrients to the soil

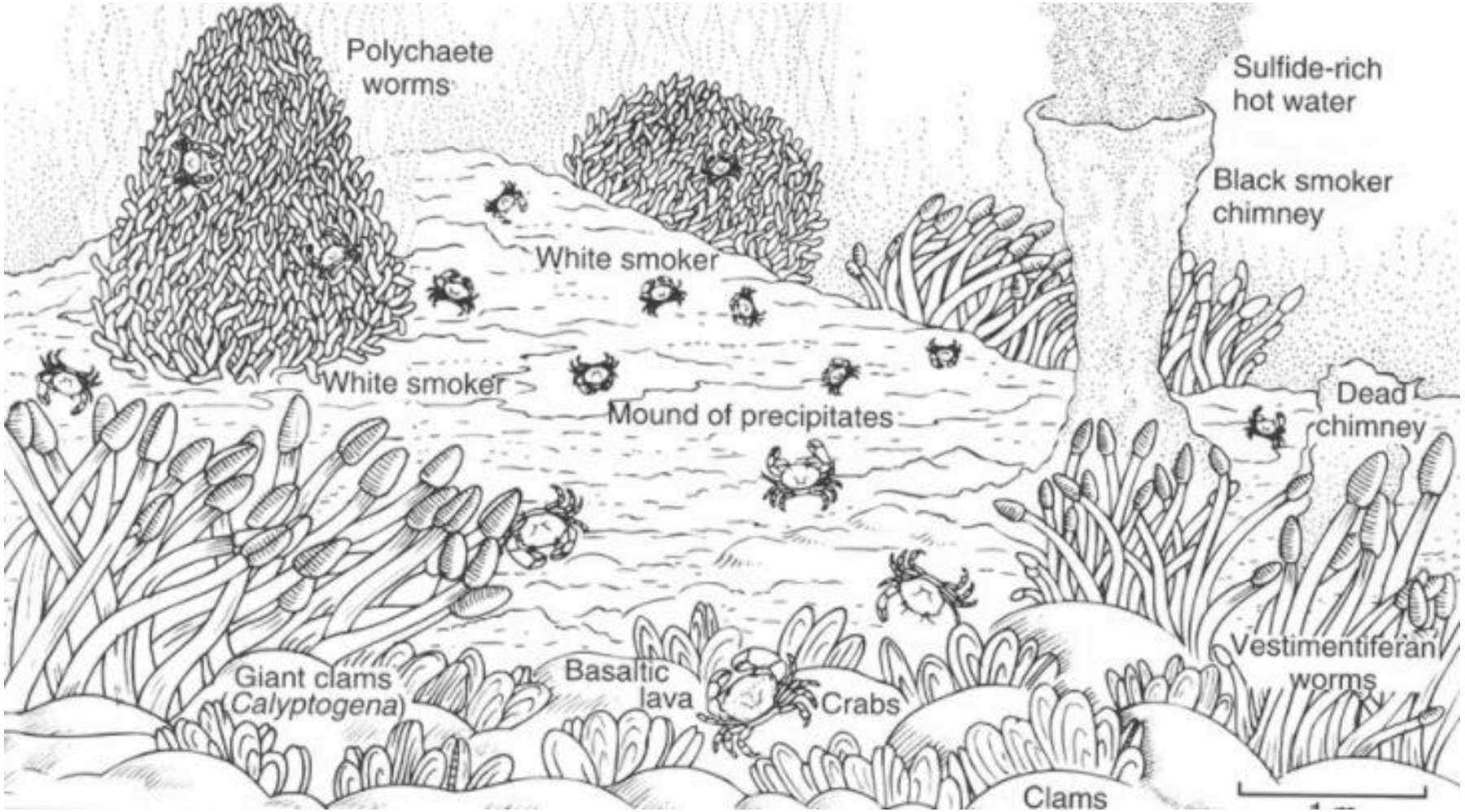
- Fungi
- Bacteria

Shown below is a deep-sea thermal vent community. No sunlight reaches the sea floor here.

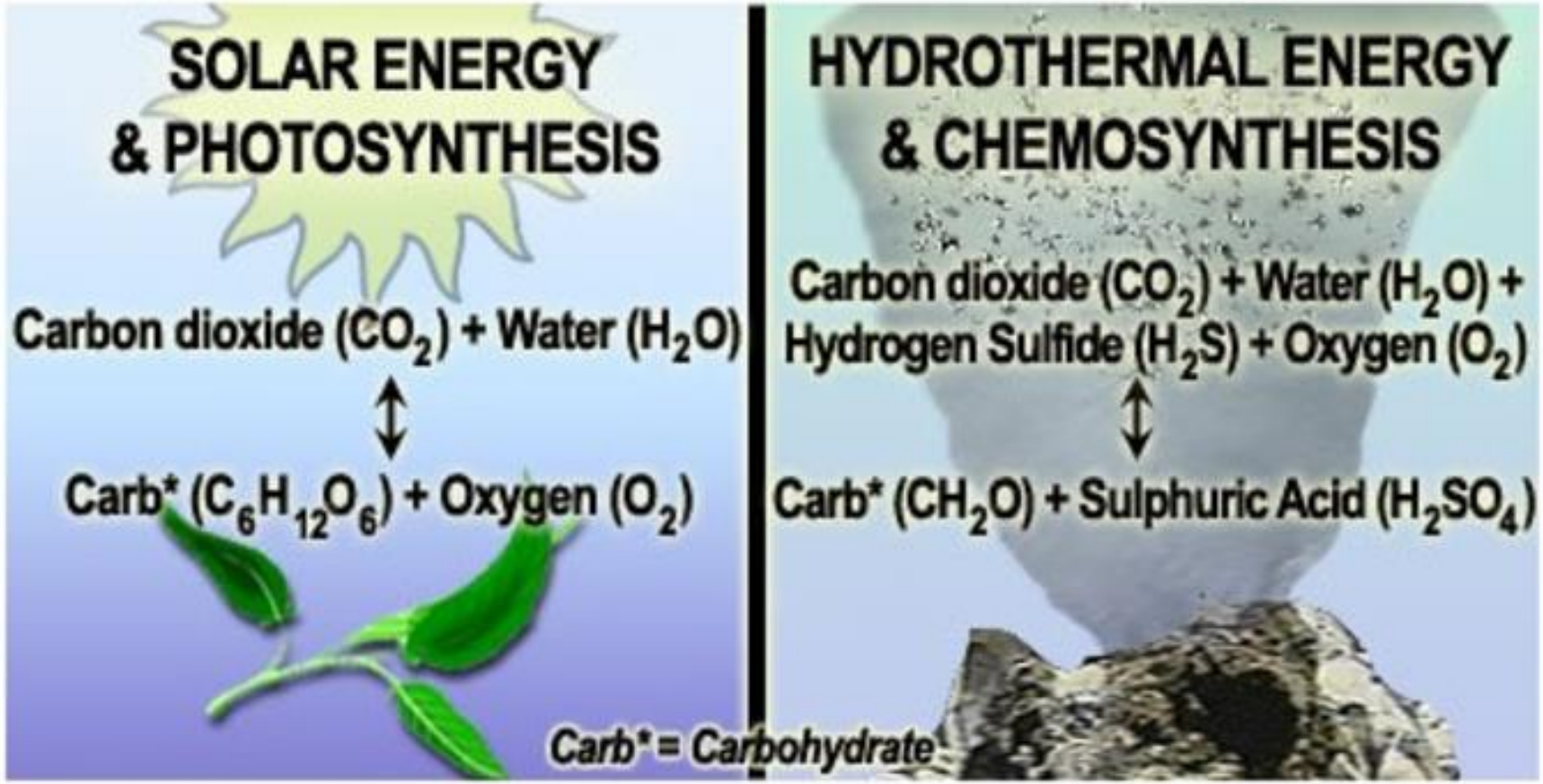


1. What is the source of free energy for this ecosystem?
2. What are the autotrophs/primary producers (hint: they are microscopic)?
3. Name a heterotroph:

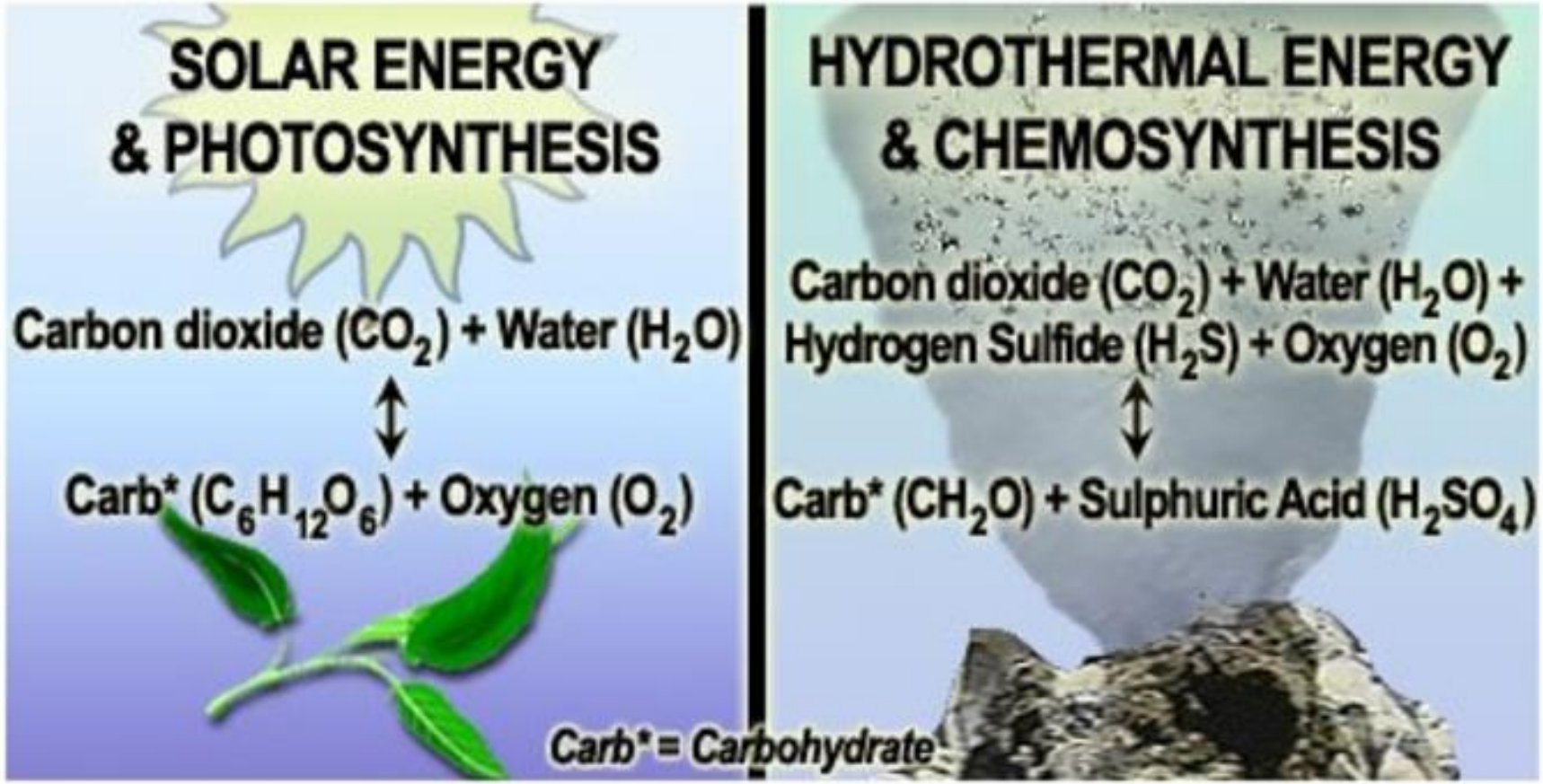
Shown below is a deep-sea thermal vent community. No sunlight reaches the sea floor here.



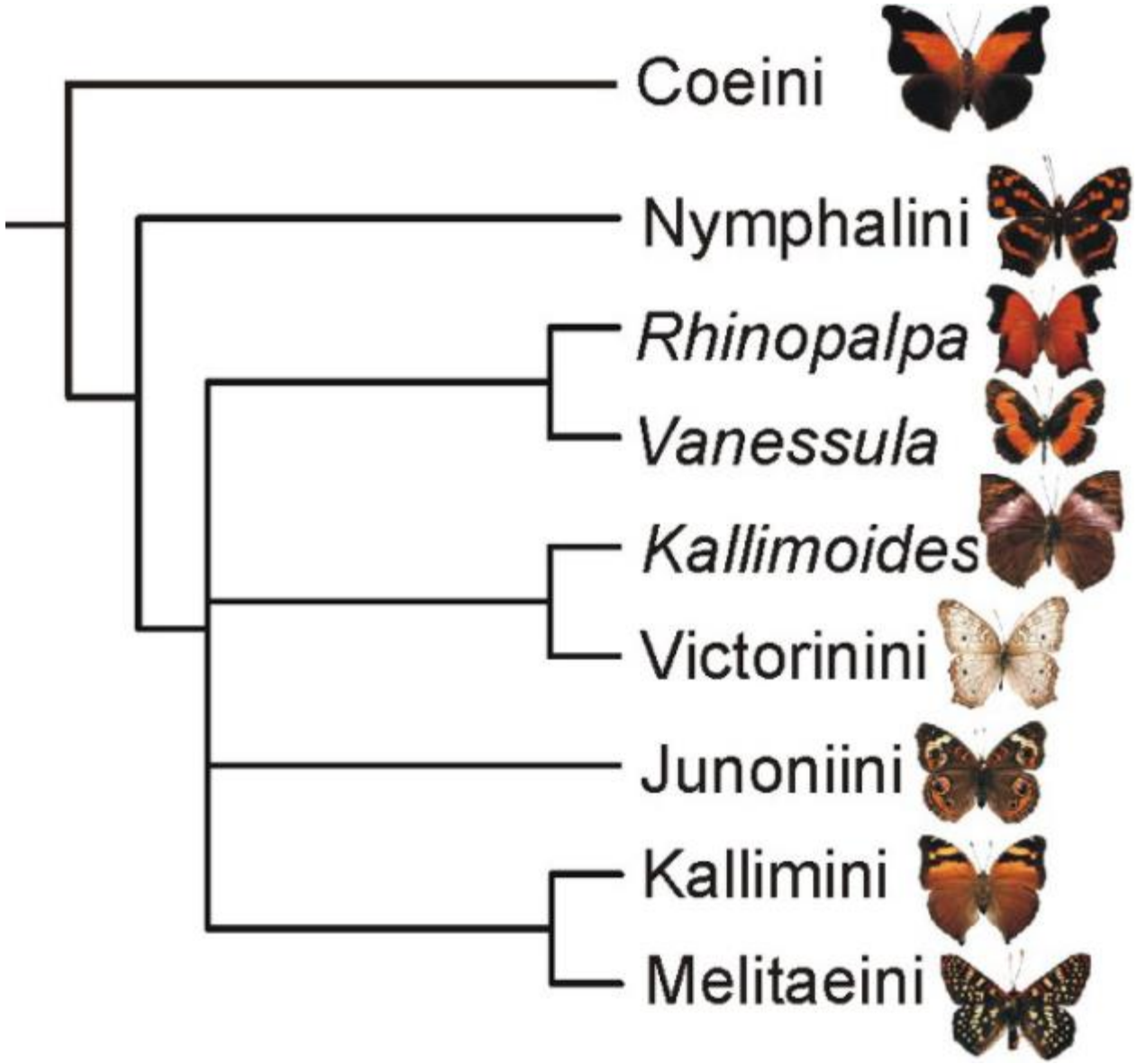
1. What is the source of free energy for this ecosystem? Chemical energy found in hydrogen sulfide
2. What are the autotrophs/primary producers (hint: they are microscopic)? Bacteria both free-living and living symbiotically within giant tubeworms, shrimp and mussles
3. Name a heterotroph: all of the organisms shown in the diagram above are heterotrophs



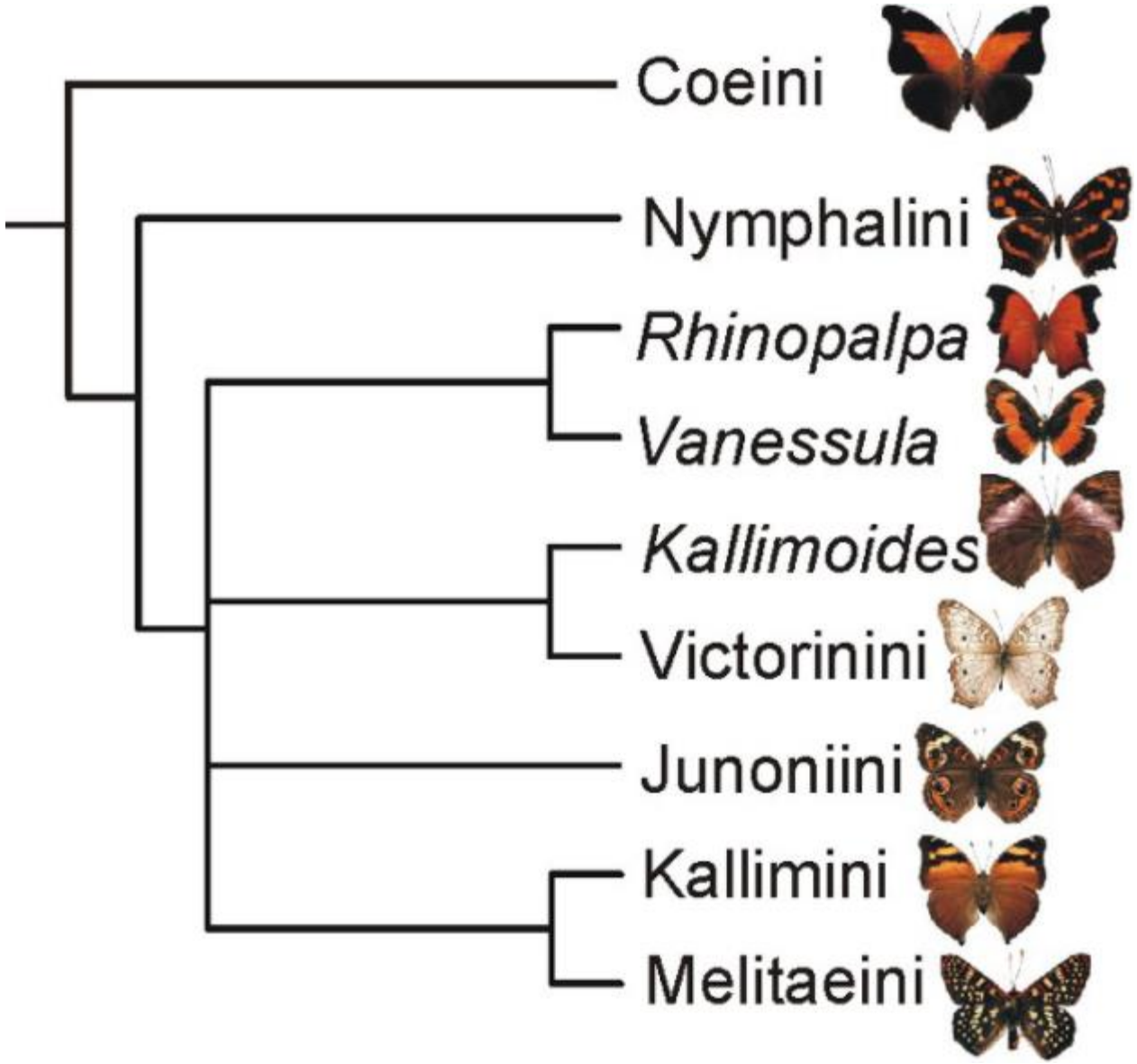
1. Where would you find the primary production shown in the diagram on the L.?
2. Where would you find the primary production shown in the diagram on the R.?
3. What is the energy source for primary production in both ecosystems?
4. What is the carbon source for the production of carbohydrate in each ecosystem?



1. Where would you find the primary production shown in the diagram on the L.? Terrestrial ecosystems and marine and freshwater in the light-zone
2. Where would you find the primary production shown in the diagram on the R.? Deep sea hydrothermal vents
3. What is the energy source for primary production in both ecosystems? L. = sunlight R. = energy found in inorganic (lacking carbon) compounds such as hydrogen sulfide (H_2S)
4. What is the carbon source for the production of carbohydrate in each ecosystem? Carbon dioxide (CO_2)



Biologists interested in classifying organisms, create models called phylogenetic trees (see left) that show the evolutionary relationships between organisms. What type of data are researchers increasingly using to "build" these kind of trees?



Biologists interested in classifying organisms, create models called phylogenetic trees (see left) that show the evolutionary relationships between organisms. What type of data are researchers increasingly using to "build" these kind of trees? Genetic data, i.e. a comparison of the DNA sequence of genes.

Nitrogen (N) and Phosphorous (P)

N and P are the most important nutrients that plants take up via the soil. In most environments one or both limit plant growth.

List 2 biological molecules that plants need N for:

List 2 biological molecules that plants need P for:

Nitrogen (N) and Phosphorous (P)

N and P are the most important nutrients that plants take up via the soil. In most environments one or both limit plant growth.

List 2 biological molecules that plants need N for:

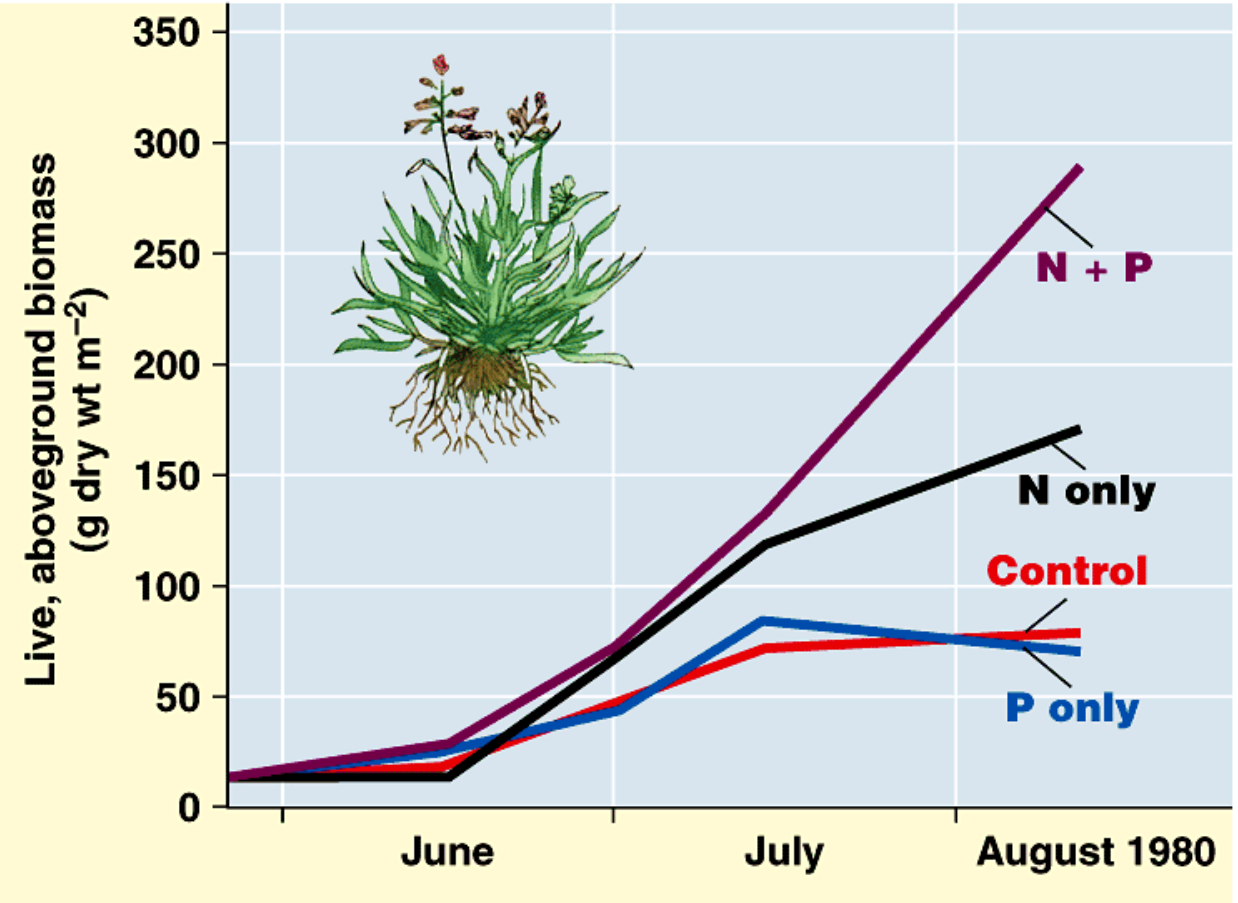
- **DNA & RNA (nitrogenous bases: A, T, C & G)**
- **Protein (amino group of each amino acid)**

List 2 biological molecules that plants need P for:

- **Phospholipids that make up membranes**
- **DNA and RNA (sugar-phosphate backbone)**
- **ATP (adenosine triphosphate – cell energy)**

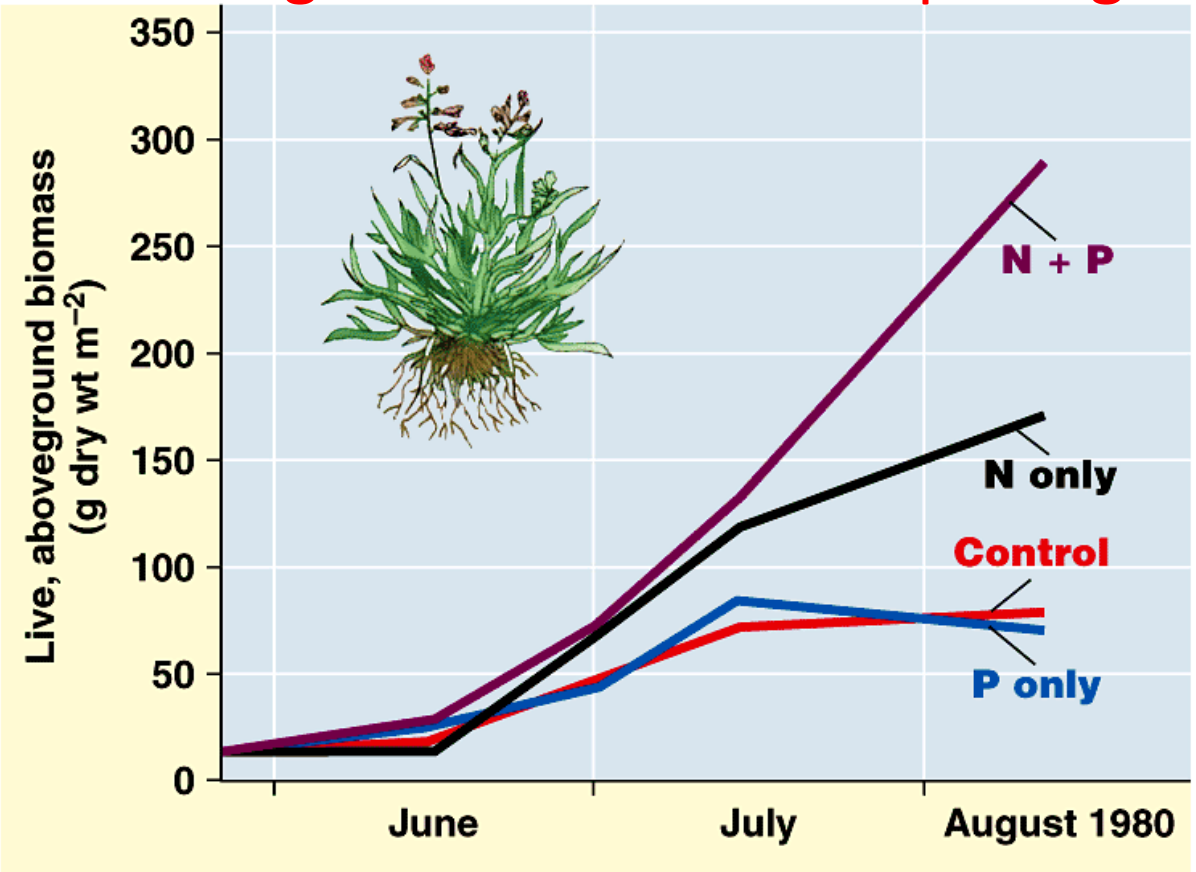
Nutrient Addition Experiment in a Salt Marsh

1. Describe the effect of adding Phosphorus (P) only:
2. Describe the effect of adding Nitrogen (N) only:
3. Which nutrient most limits growth in this ecosystem?
4. Which treatment boosted growth the most?

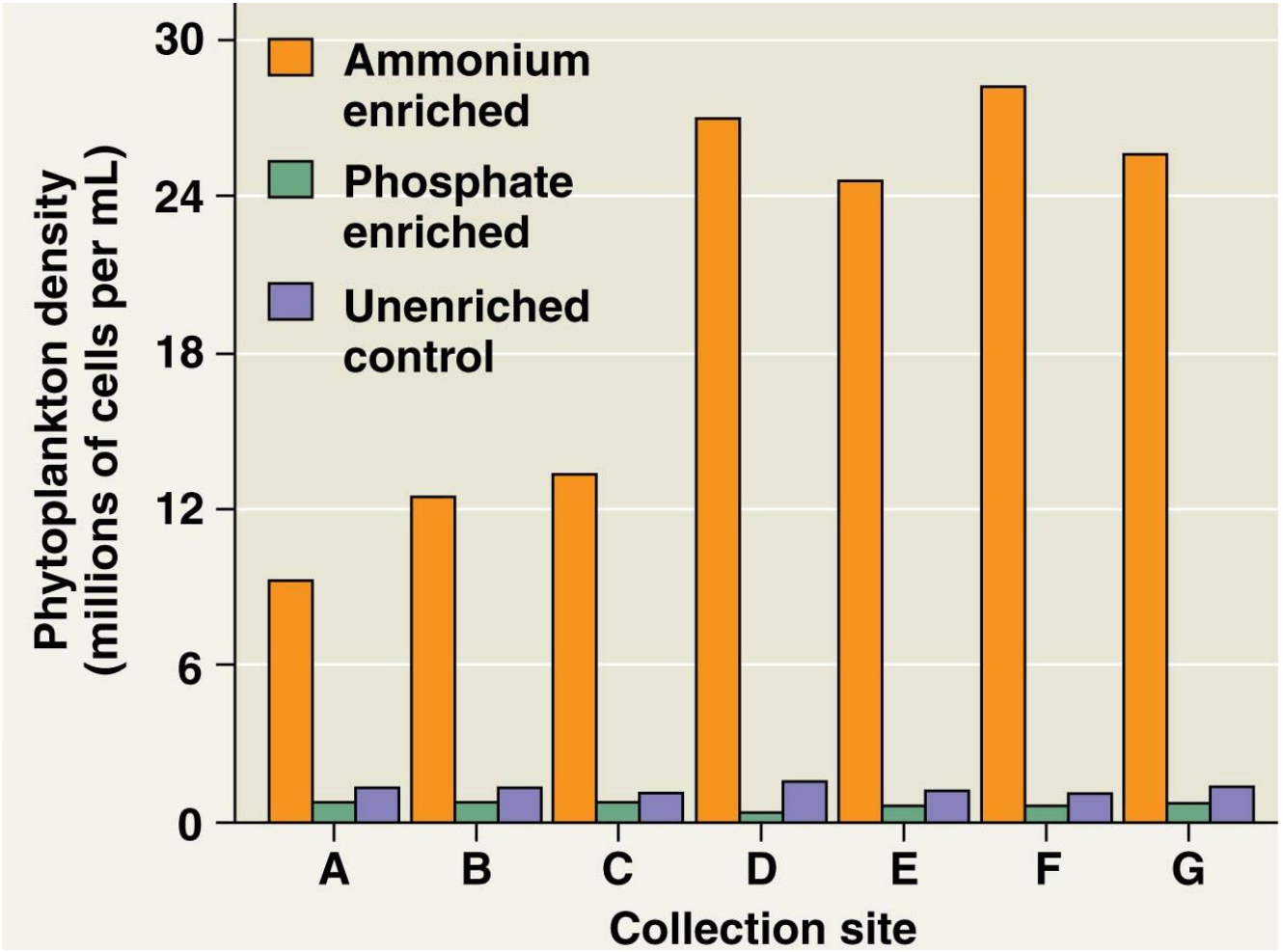


Nutrient Addition Experiment in a Salt Marsh

1. Describe the effect of adding Phosphorus (P) only: similar to control
2. Describe the effect of adding Nitrogen (N) only: increased plant growth
3. Which nutrient most limits growth in this ecosystem? nitrogen
4. Which treatment boosted growth the most? Nitrogen + phosphorus because first N was limiting but with increased plant growth, P became limiting as well



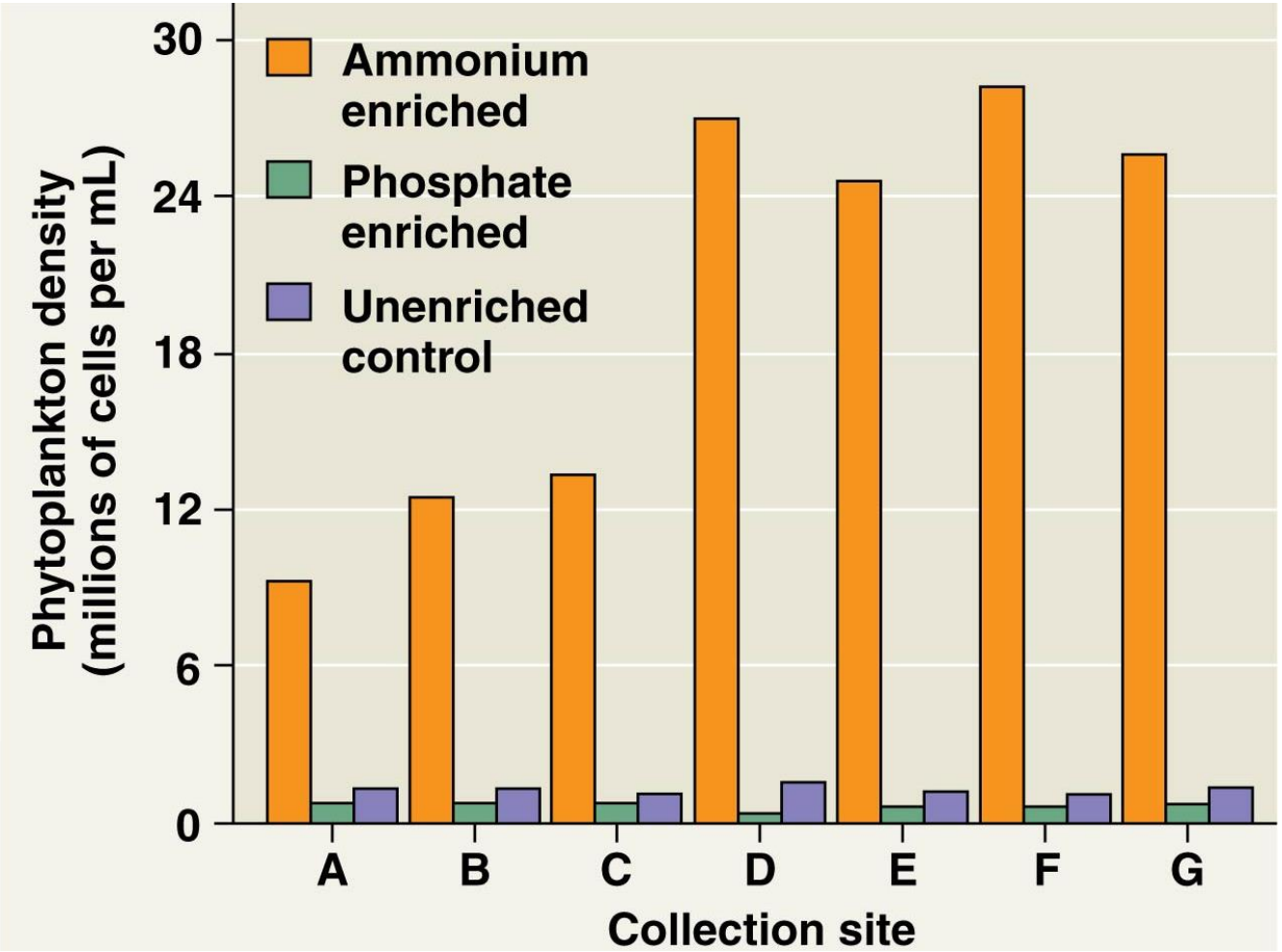
Nutrient Addition Experiment in the Ocean



Which nutrient limits marine phytoplankton production? Cite evidence from the graph to justify your answer:

Nutrient Addition Experiment in the Ocean

Which nutrient limits marine phytoplankton production? Cite evidence from the graph to justify your answer: Nitrogen (found in ammonium) was most limiting because when it was added, phytoplankton density increased. When phosphate (P) was added, on the other hand, there was no increase in phytoplankton density.

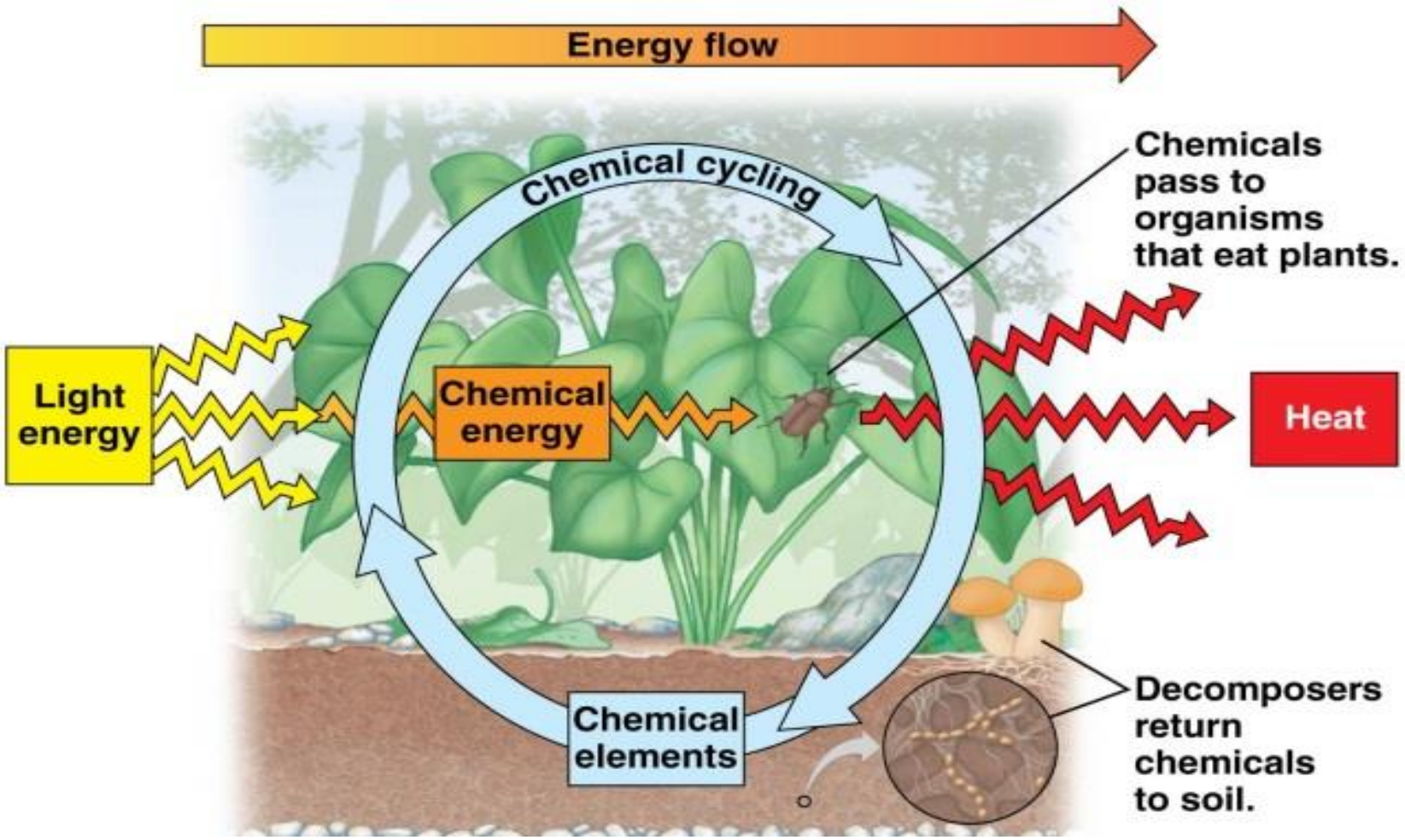


1. Which nutrient appears limiting for fresh-water algae?

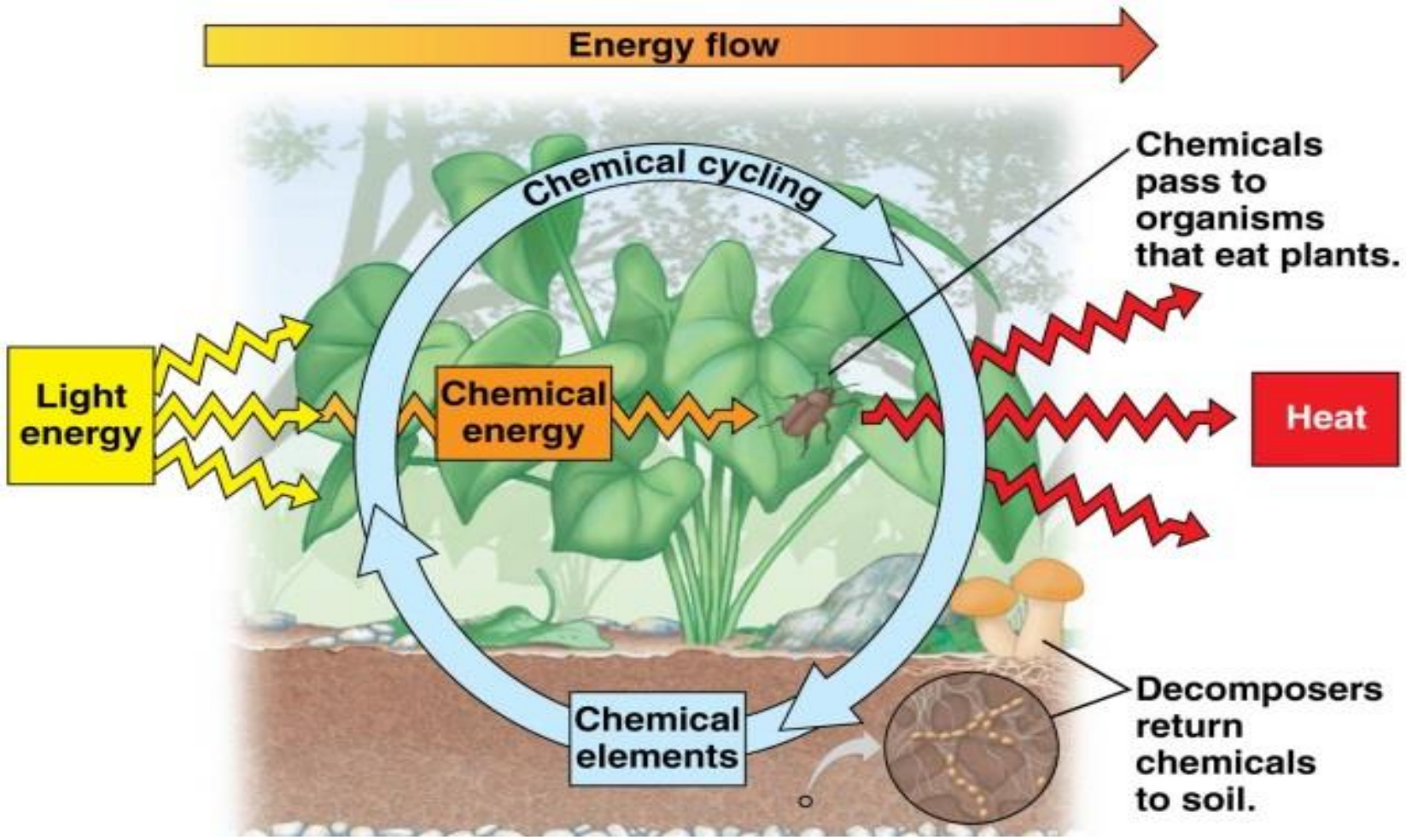
2. How does this relate to the use of phosphate-based detergents?

1. Which nutrient appears limiting for fresh-water algae? Phosphorus

2. How does this relate to the use of phosphate-based detergents? Phosphate-based detergents can result in algal blooms

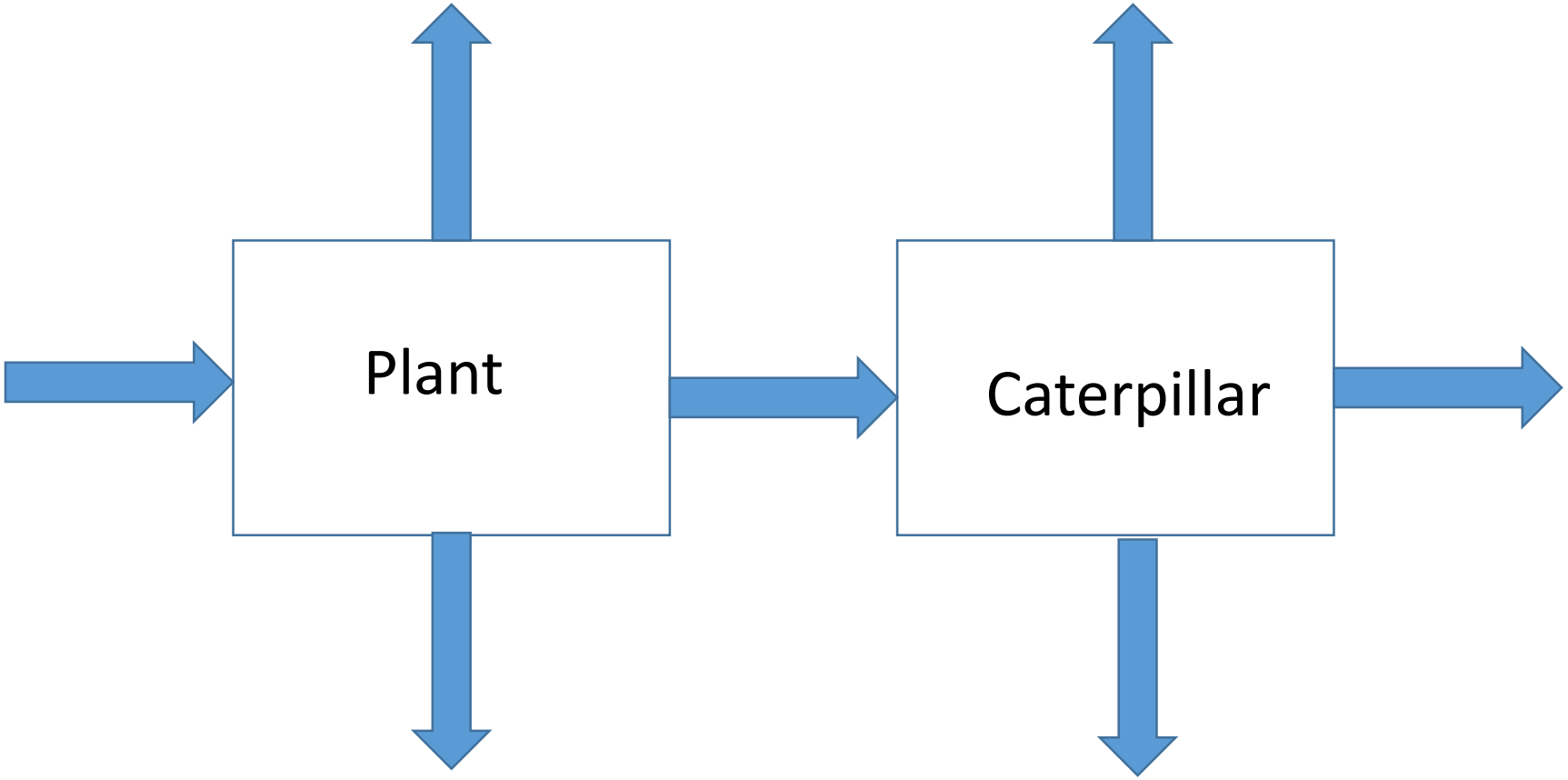


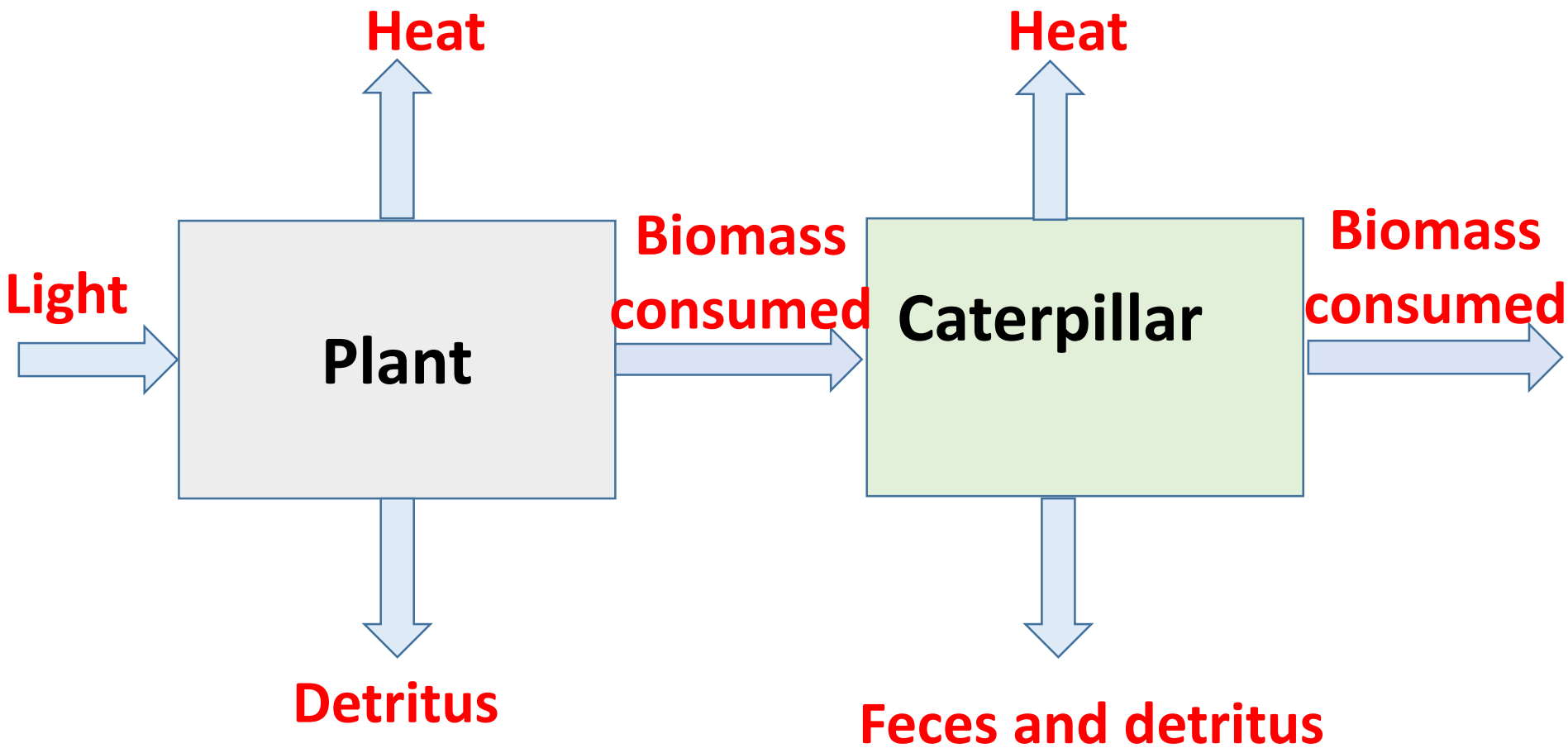
1. Energy enters Earth's ecosystems as _____ and exits as _____.
2. Energy _____ through Earth's ecosystems.
3. Matter _____ through Earth's ecosystems aided by the action of organisms called _____.

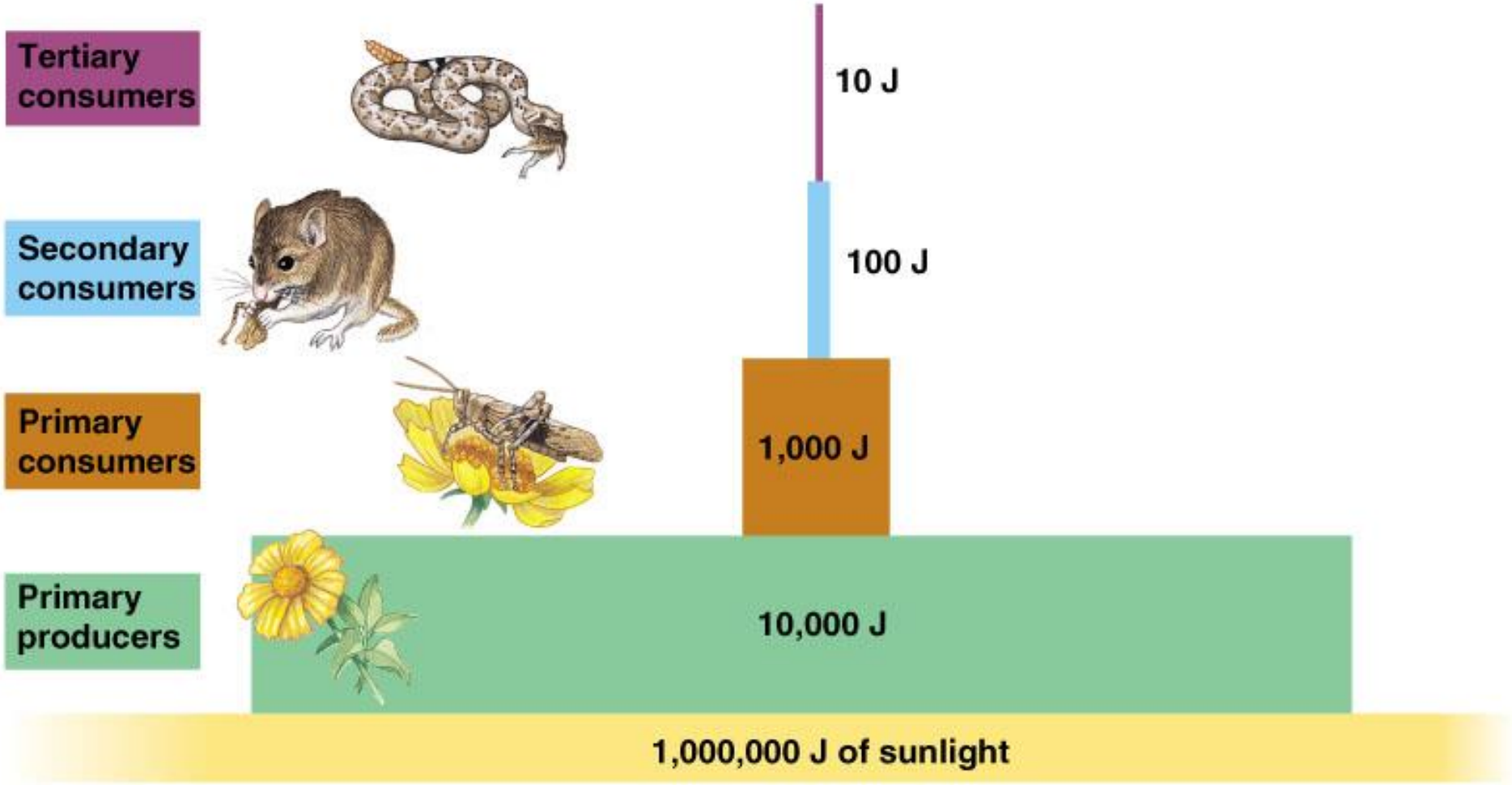


1. Energy enters Earth's ecosystems as **sunlight** and exits as **heat**.
2. Energy **flows** through Earth's ecosystems.
3. Matter **cycles** through Earth's ecosystems aided by the action of organisms called **decomposers/detritivores**.

Describe the energy-flow through the model system below, by labeling the arrows:




Heat
Heat
Light
Plant
Biomass consumed
Caterpillar
Biomass consumed
Detritus
Feces and detritus

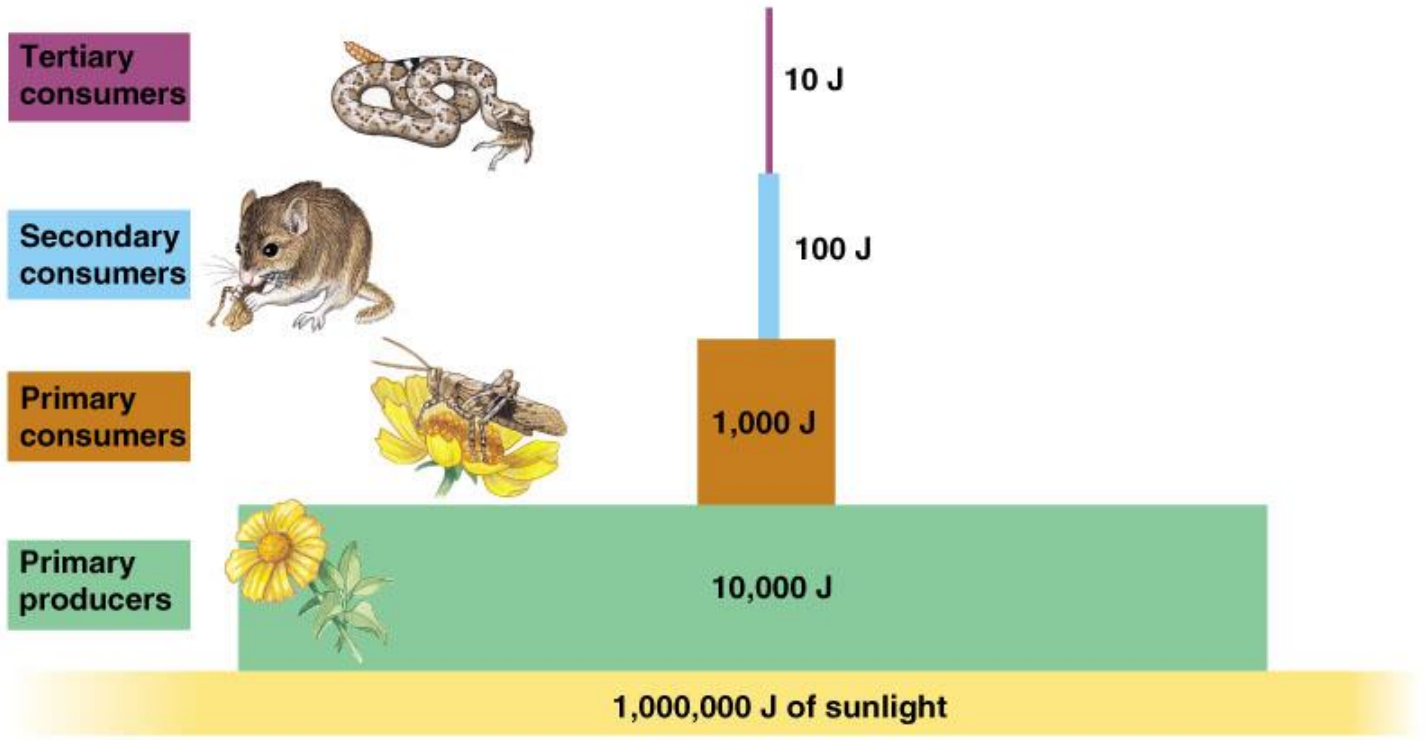


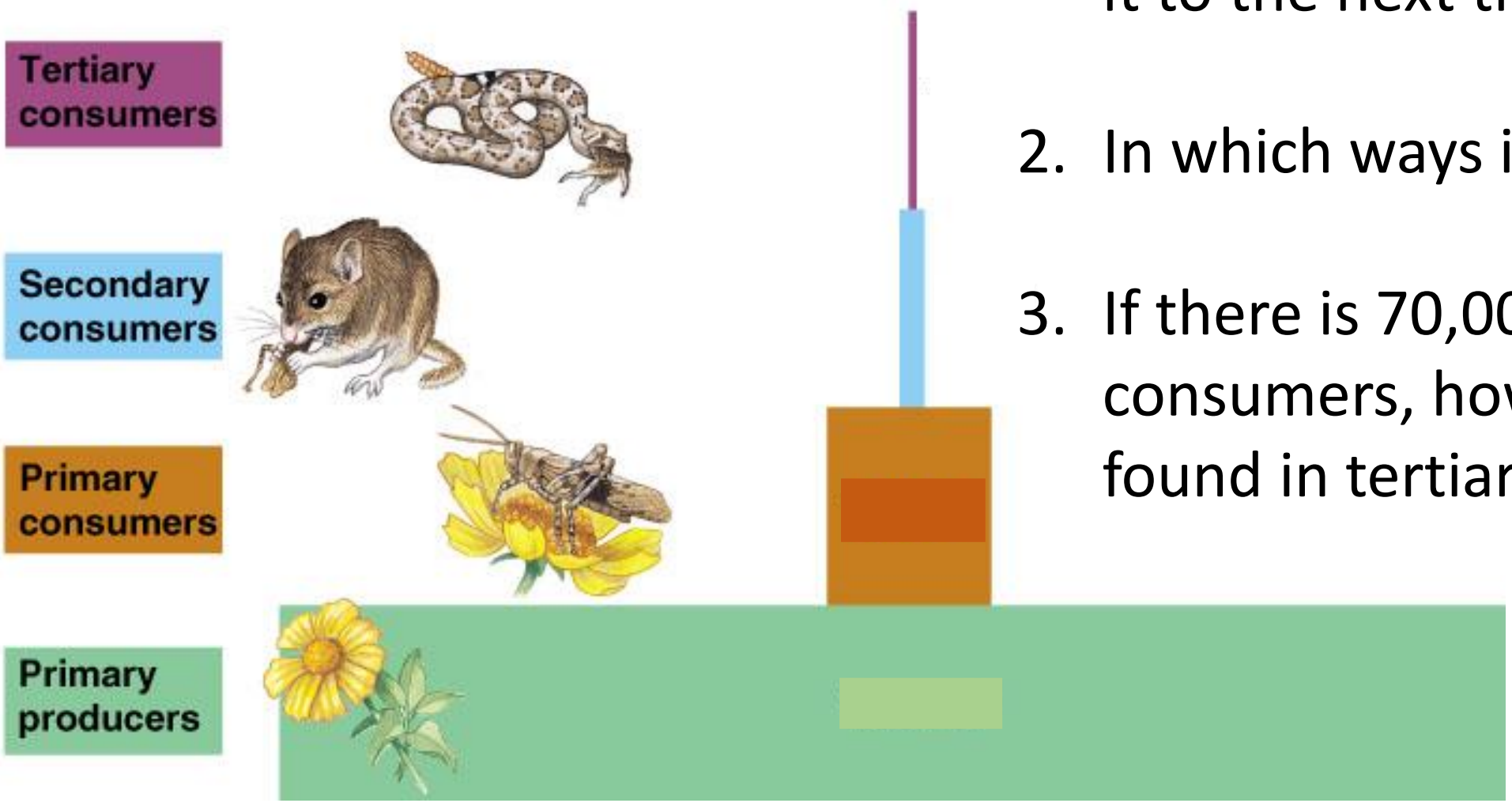
What percentage of the energy in plants makes it into the bodies of (show set-up and circle the final answer):

a. Primary consumers
b. Secondary consumers
c. Tertiary consumers

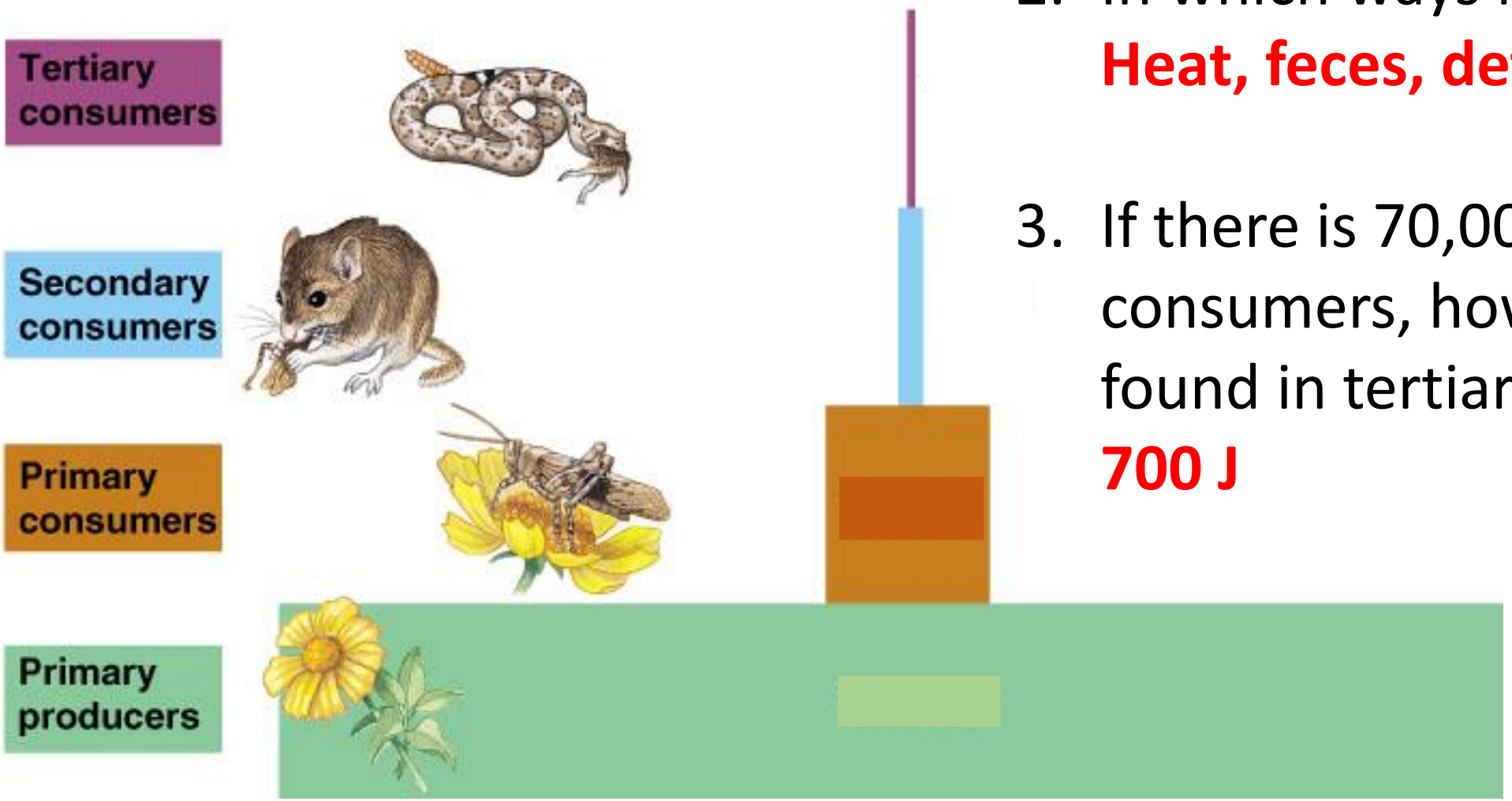
Pyramid of Net Production

a. What % of energy in plants makes it to primary consumers? **1,000/10,000 = 1/10 = 10 %**
b. What % of energy in plants makes it to secondary consumers? **100/10,000 = 1/100 = 1 %**
c. What % of energy in plants makes it to tertiary consumers? **10/10,000 = 1/1000 = 0.1%**





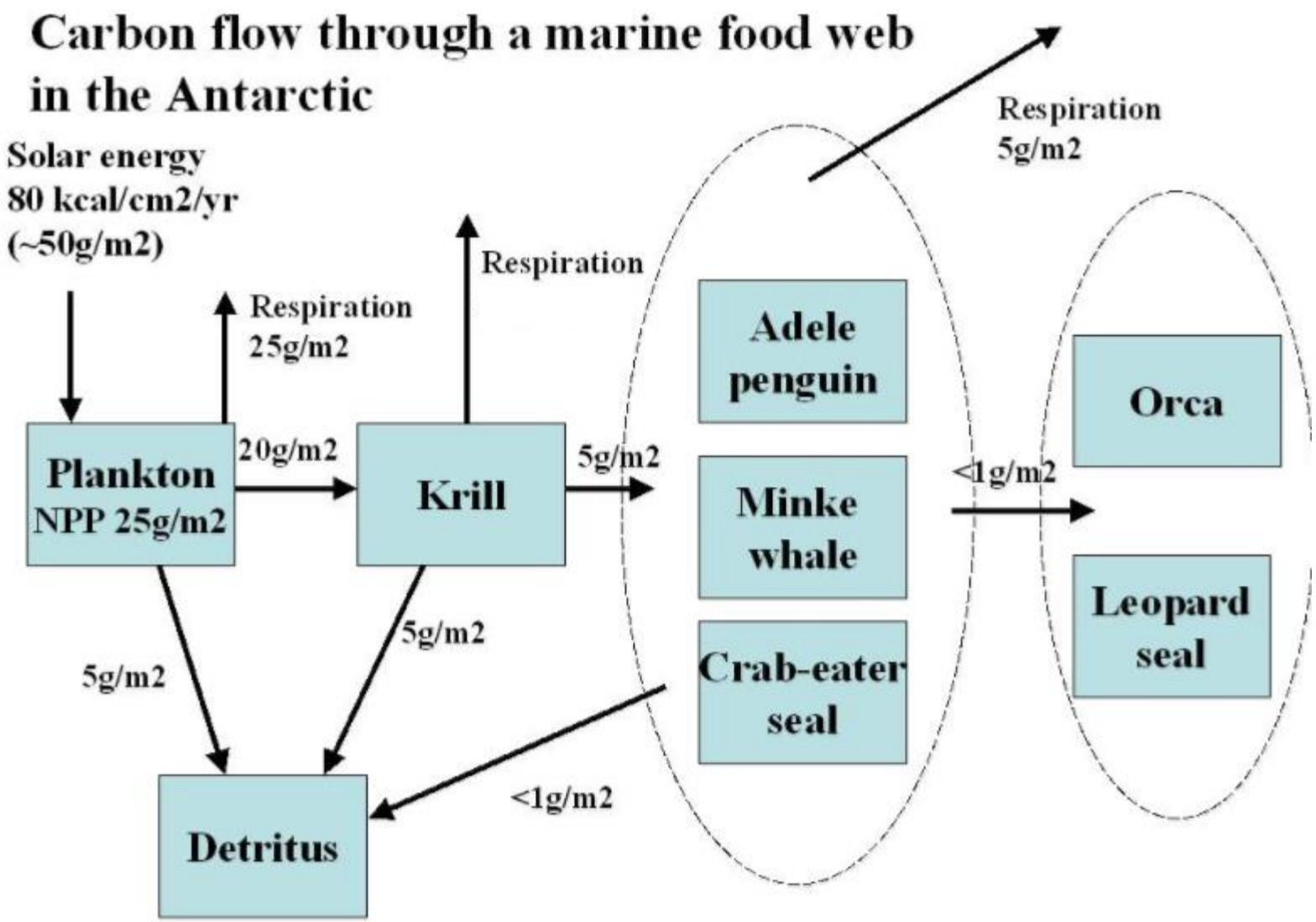
1. About what % of energy makes it to the next trophic level?
2. In which ways is energy lost?
3. If there is 70,000 J in primary consumers, how much will be found in tertiary consumers?



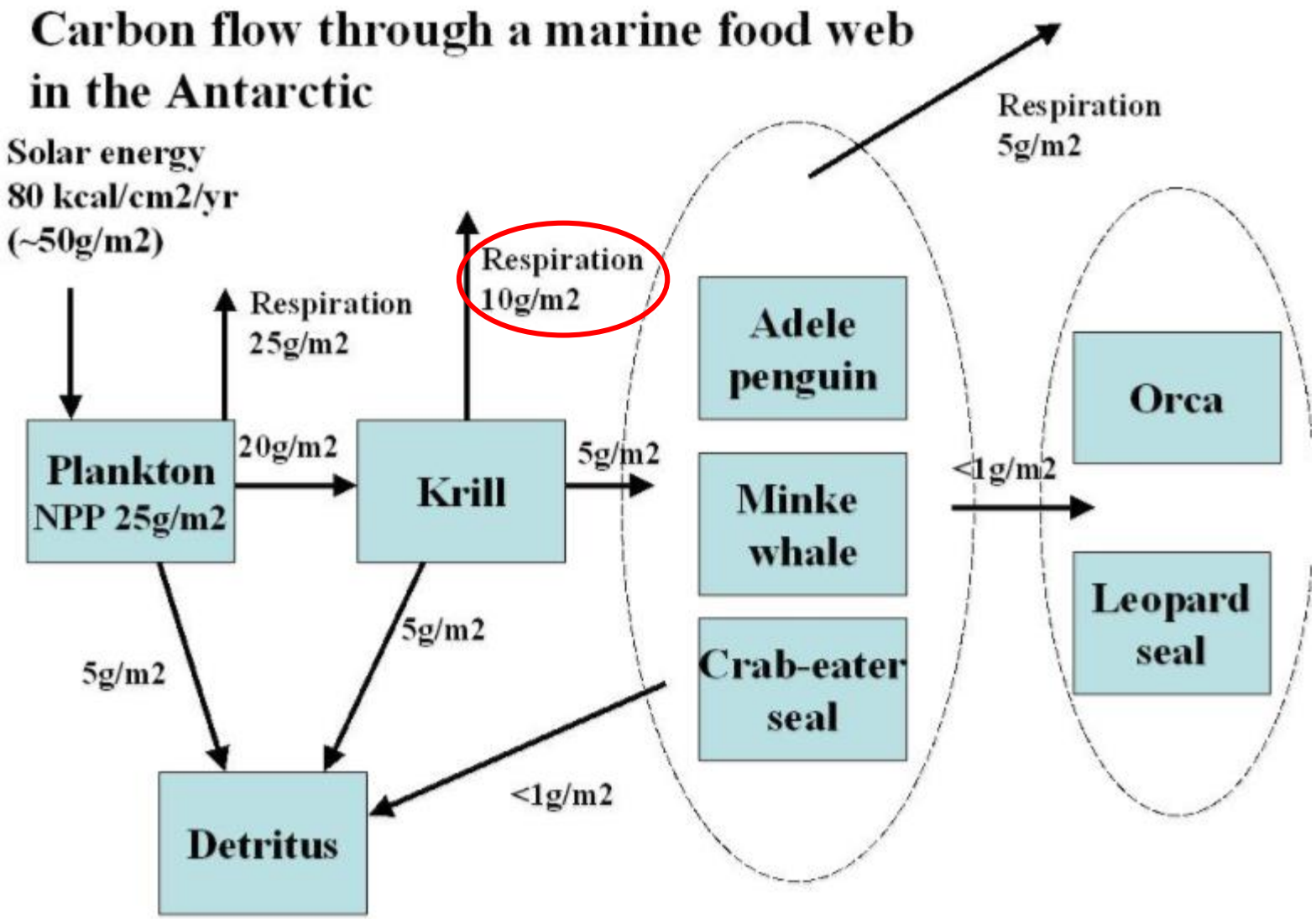
1. About what % of energy makes it to the next trophic level? **10%**

2. In which ways is energy lost?
   Heat, feces, detritus

3. If there is 70,000 J in primary consumers, how much will be found in tertiary consumers?
   700 J

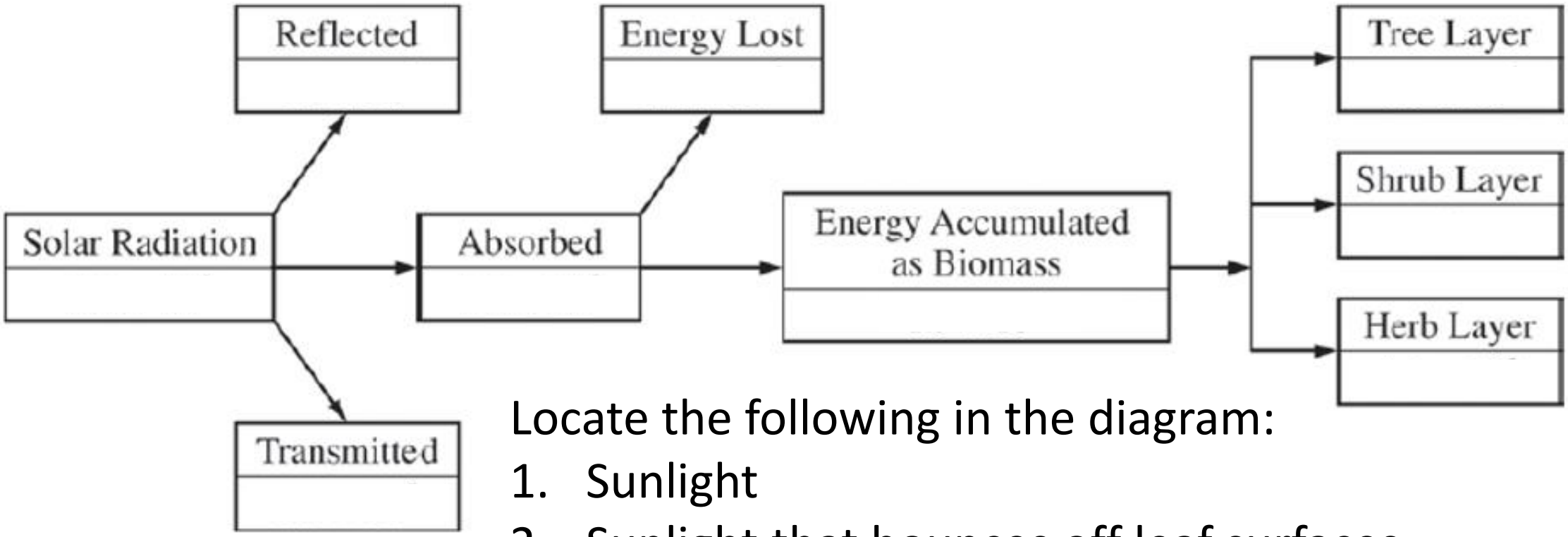


According to the carbon flow diagram above, calculate how much carbon (g/m^2) is released from Krill through cellular respiration.



According to the carbon flow diagram above, calculate how much carbon (g/m^2) is released from Krill through cellular respiration.

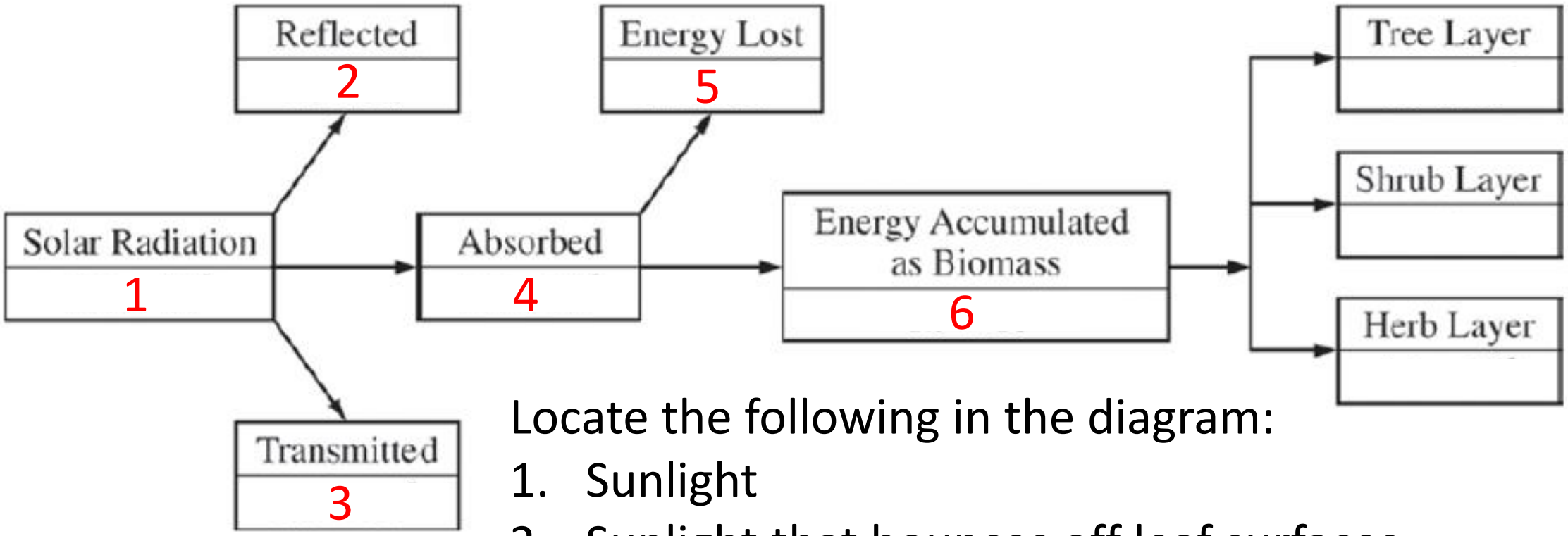
Energy Flow Through a Ponderosa Forest Diagram



Locate the following in the diagram:

1. Sunlight
2. Sunlight that bounces off leaf surfaces
3. Sunlight that passes through leaf surfaces
4. Sunlight used in photosynthesis
5. Cellular respiration by plants
6. Plant growth

Energy Flow Through a Ponderosa Forest Diagram



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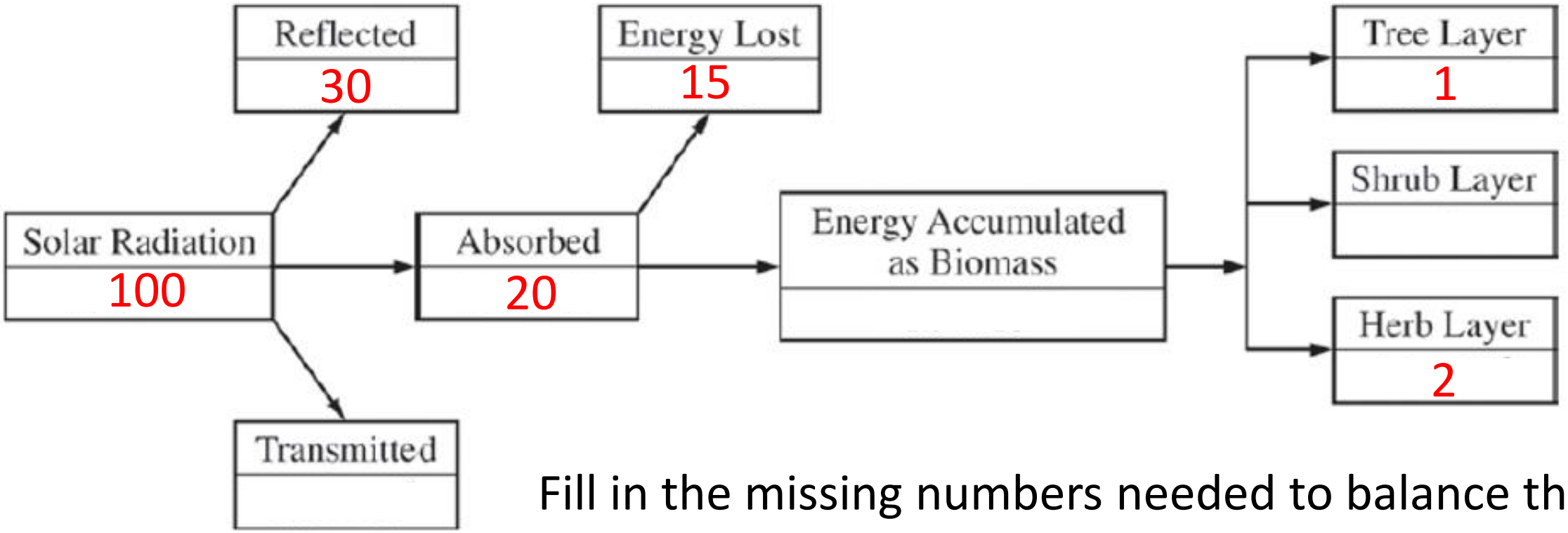
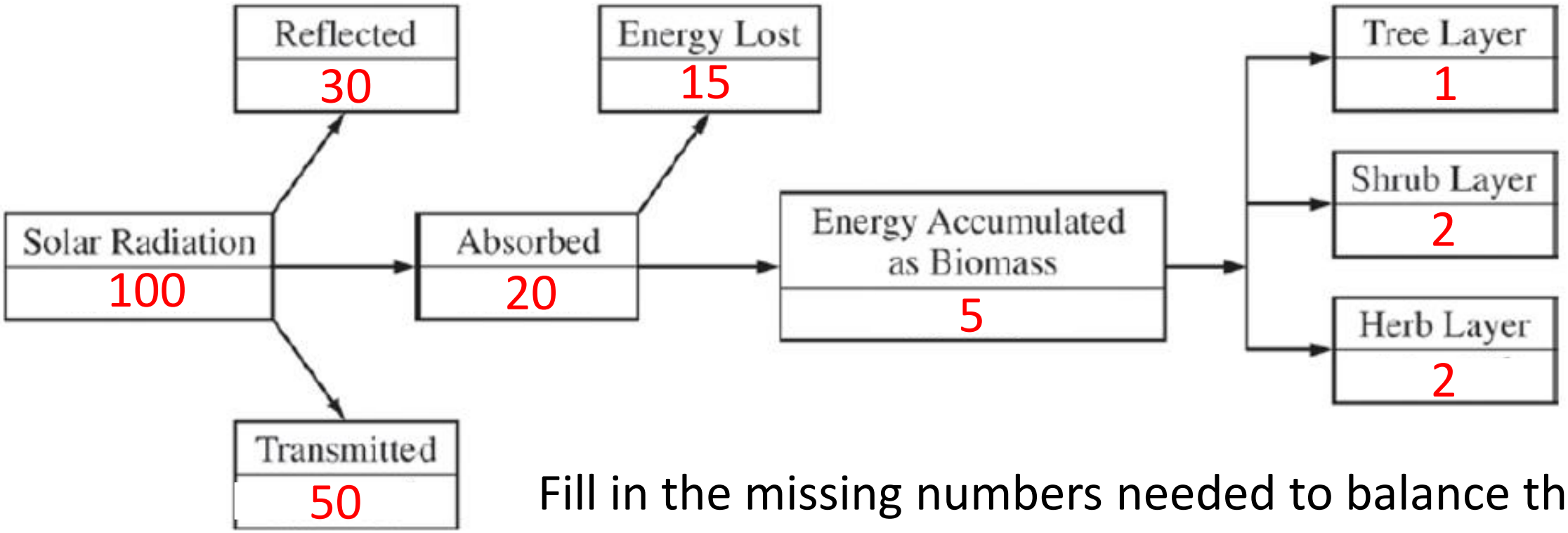
Energy Flow Through a Ponderosa Forest Diagram



Fill in the missing numbers needed to balance the energy flow through a Ponderosa forest

Energy Flow Through a Ponderosa Forest Diagram



Fill in the missing numbers needed to balance the energy flow through a Ponderosa forest

1. What is the ultimate (underlying) cause of animal behavior?

2. Use your answer above, to explain why birds in the Northern hemisphere exhibit breeding behavior in the spring, not in the fall:

3. What is an example of an altruistic behavior?

4. How can we explain such behavior?

The Ultimate (Underlying) Cause of Behavior

- Addresses evolutionary significance
- Developed due to natural selection
- Increases survival to reproduction in some way

Unique among gull species, kittiwakes show an innate aversion to cliff edges; they turn away from the edge. Kittiwake chicks in earlier generations that did not show the edge-aversion response failed to become ancestors to modern kittiwakes.

When do animals exhibit certain behaviors?

- Why territory defense, mate-attraction and nest-building in the Spring? Because: ↑plant growth and thus ↑ insect biomass.
- Therefore, chicks born when food resources are peaking (Spring) will have a better chance of survival than when food ↓ (Fall).

Altruistic Behavior: Predator-warning

- Predator-warning (through calling) is a risk because it draws attention to the caller
- Being warned of a predator is a benefit, it gives those that hear the call advanced warning
- Predator-warning is an example of ***reciprocal altruism***
- The biological explanation of this is that individuals that live together in these social networks are usually related to one another. Thus, by helping others survive (since they share genes) they are helping their own genes survive

1. What is the ultimate cause (underlying reason) for animal behavior?

2. How does your answer to #1 relate to the behavior observed in isopods, of rolling up into a ball?

3. How does your answer to #1 relate to the behavior observed in isopods, of preferring to stay under cover?

1. What is the ultimate cause (underlying reason) for animal behavior?

Evolutionary significance, adaptation through natural selection, aids in the animal's survival to reproduction

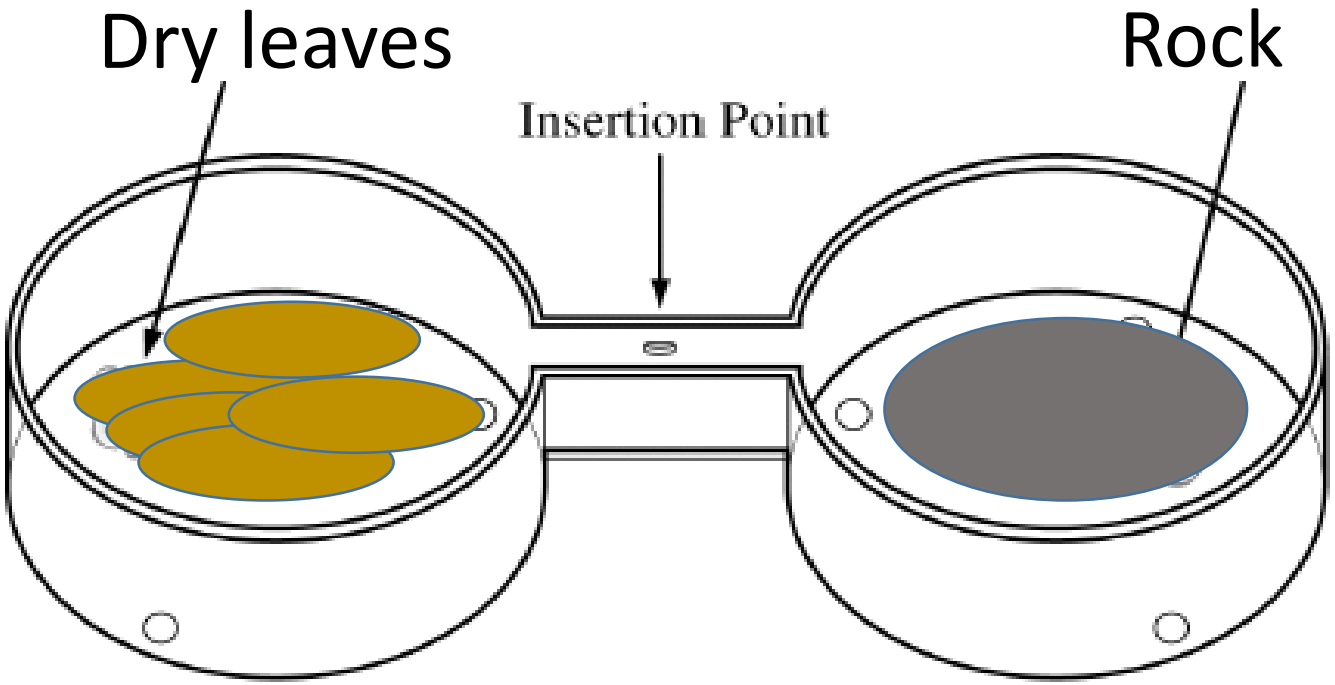
2. How does your answer to #1 relate to the behavior observed in isopods, of rolling up into a ball?

Rolling up is a behavior to escape predation, thus increasing survival to reproduction

3 How does your answer to #1 relate to the behavior observed in isopods, of preferring to stay under cover?

Staying under cover both helps avoid detection by predators and will help keep gills moist both will increase likelihood of survival to reproduction

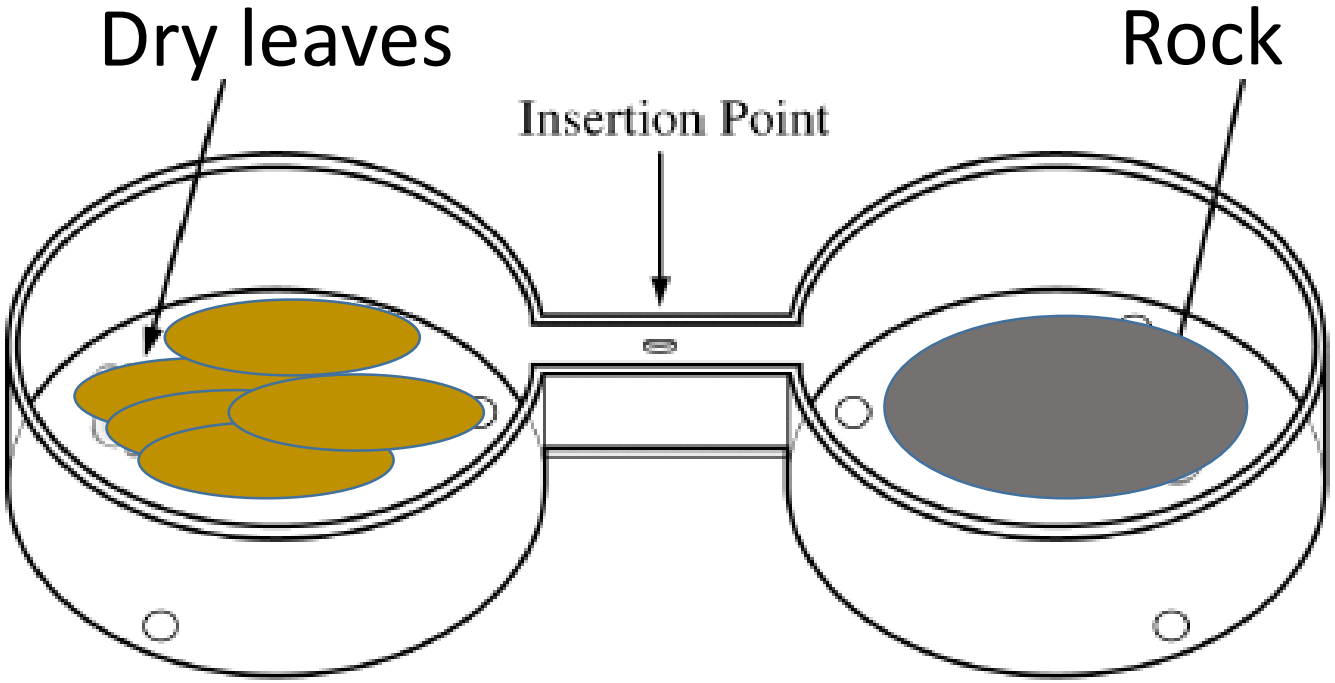
Do isopods prefer dry leaves or rock as cover?



20 isopods are placed into a choice-chamber at the insertion point.

Predict how the isopods will be distributed across the choice-chamber after 10 minutes, and ***justify*** your prediction.

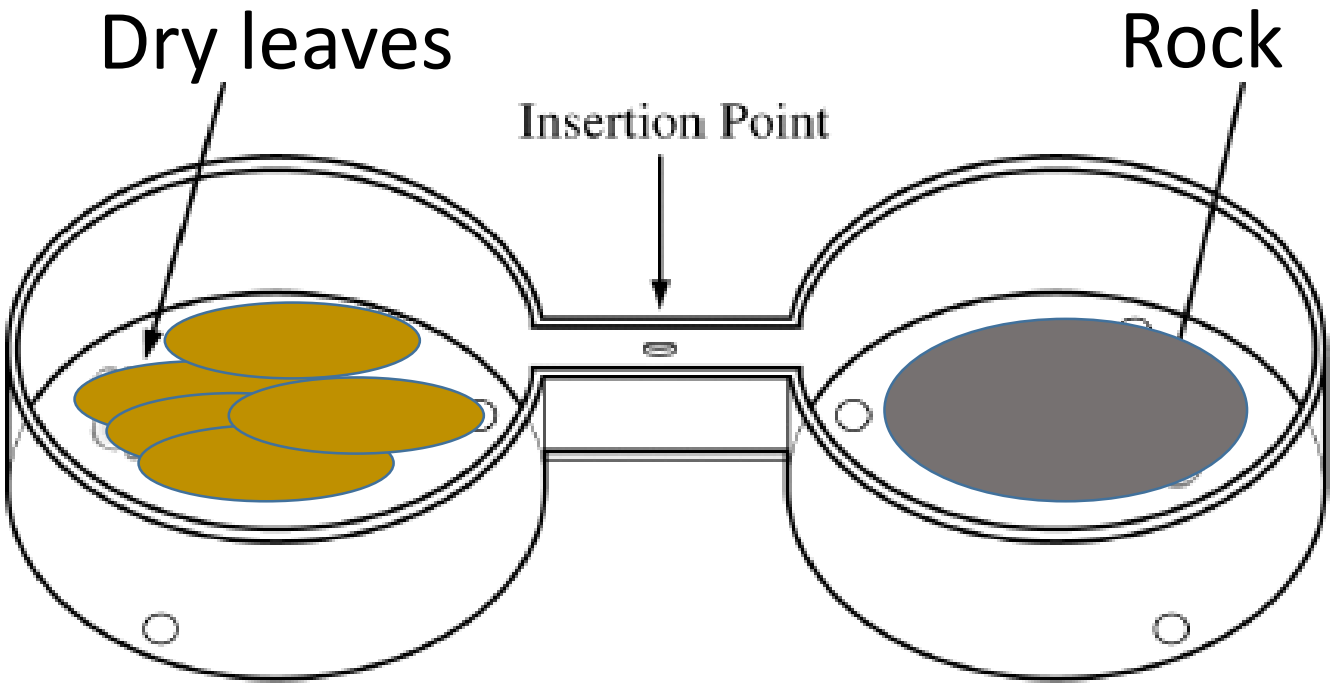
Do isopods prefer dry leaves or rock as cover?



20 isopods are placed into a choice-chamber at the insertion point.

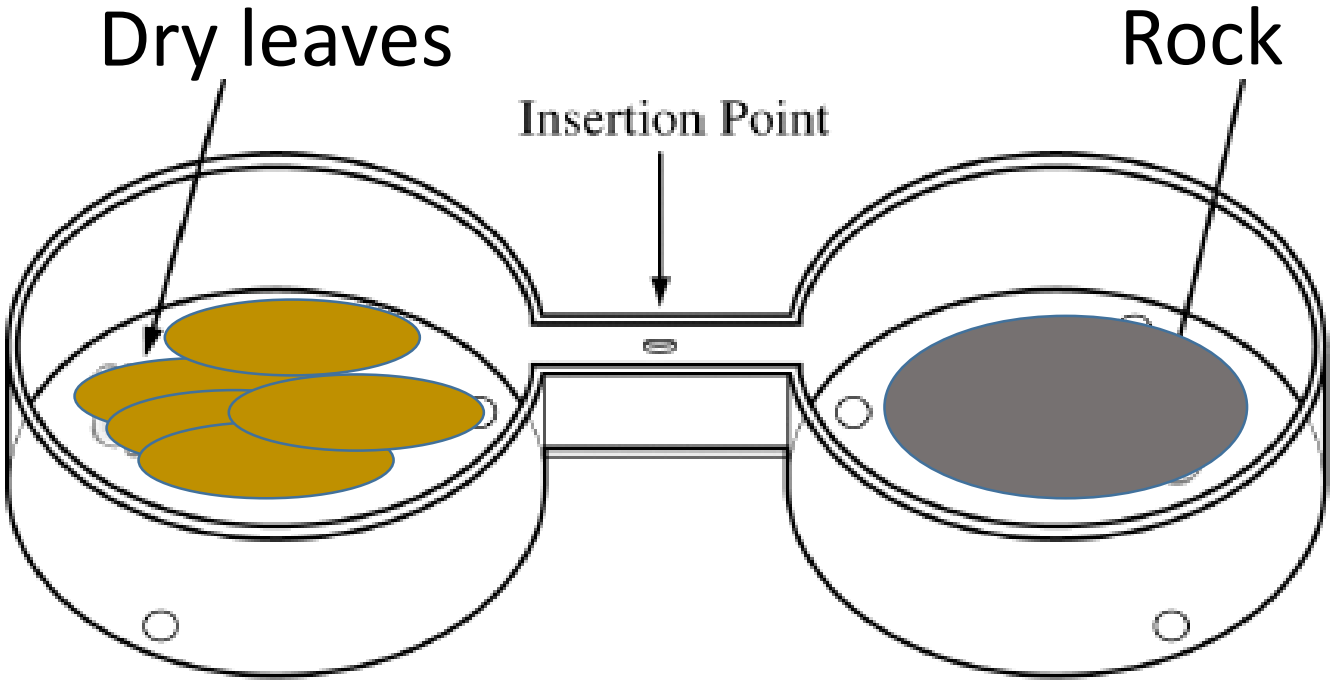
Predict how the isopods will be distributed across the choice-chamber after 10 minutes, and ***justify*** your prediction. Options: more will be found on the dry leaf side, more on the rock side, or they will be evenly distributed. Your justification should fit your specific prediction.

Do isopods prefer dry leaves or rock as cover?



Propose ONE specific improvement to the experimental design and **explain** why the modification is an improvement on the original design.

Do isopods prefer dry leaves or rock as cover?



Propose ONE specific improvement to the experimental design and **explain** why the modification is an improvement on the original design.

Replace the dry leaves with artificial leaves, because both leaves and the rock provide cover, but the leaves also provide a source of food. Isopods may be attracted to the food-value instead of the cover-value of leaves.

The experiment described above is repeated with decomposing apple at one end and fresh apple at the other end. Once again the positions of the isopods are observed and recorded every minute for 10 minutes. The position of isopods after 1 minute and after 10 minutes are shown in the table below.

Time (minutes)	Position in the Chamber	
	End with decomposing apple	End with fresh apple
1	8	12
10	17	3

Time (minutes)	Position in the Chamber	
	End with decomposing apple	End with fresh apple
1	8	12
10	17	3

State the null hypothesis that is being tested in the apple experiment.

Time (minutes)	Position in the Chamber	
	End with decomposing apple	End with fresh apple
1	8	12
10	17	3

State the null hypothesis that is being tested in the apple experiment.

There will be an equal number of isopods on both sides of the choice-chamber. OR There will be no preference for either the decomposing or fresh apple.

Time (minutes)	Position in the Chamber	
	End with decomposing apple	End with fresh apple
1	8	12
10	17	3

Perform a chi-square test on the data for the 10-minute point and p = 0.05 in the apple experiment. Enter the values from your calculations in the table.

	Observed (o)	Expected (e)	(o – e)	$(o - e)^2$	$(o-e)^2/e$
End with decomposed apple					
End with fresh apple					
Total	Sum of $(o-e)^2/e$ = Chi-squared value =				

Time (minutes)	Position in the Chamber	
	End with decomposing apple	End with fresh apple
1	8	12
10	17	3

Perform a chi-square test on the data for the 10-minute point and p = 0.05 in the apple experiment. Enter the values from your calculations in the table.

	Observed (o)	Expected (e)	(o – e)	$(o - e)^2$	$(o-e)^2/e$
End with decomposed apple	17	10	7	49	4.9
End with fresh apple	3	10	-7	49	4.9
Total	Sum of $(o-e)^2/e$ = Chi-squared value =				9.8

Explain whether the null hypothesis is supported by the chi-square test and **justify** your explanation.

Percentage Points of the Chi-Square Distribution

Degrees of Freedom	Probability of a larger value of x^2								
	0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.000	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.020	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21

I _____ the null hypothesis because the chi-squared value of _____ is _____ than the critical value of _____ for _____ degree(s) of freedom and p = _____.

Explain whether the null hypothesis is supported by the chi-square test and **justify** your explanation.

Percentage Points of the Chi-Square Distribution

Degrees of Freedom	Probability of a larger value of x^2								
	0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.000	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.020	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21

I reject the null hypothesis because the chi-squared value of 9.8 is greater than than the critical value of 3.84 for one degree(s) of freedom and p = 0.05.