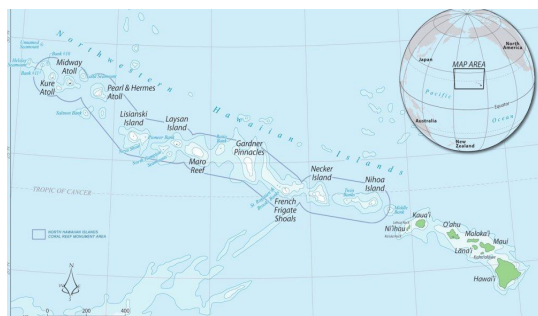


Science

Module 5 Population Changes and Resources

Chapter 1 Population Ecology



Lessons & Objectives

Lesson 1: Introduction to Monk Seal Populations

- ☐ I can... observe and describe changes in a population.

Lesson 2: Limiting Factors to Population Size

- ☐ I can... identify the main limiting factors to population size.

Lesson 3: Density dependent vs. density independent factors

- ☐ I can... determine whether density dependent or independent factors limit a population size.

Packet Completion Rubric

4	3	2	1	0
Nothing in packet is missing. Responses consistently meet ALL of the criteria for high quality work. Exemplary effort is evident throughout the entire packet.	Packet is 75-100% complete/accurate. Work/effort misses the criterion for high quality consistently.	Packet is 50-75% complete/accurate. Work/effort has evidence of quality but not consistently.	More than 50% of the packet is incomplete or incorrect. Work does not meet the expected level of quality.	Packet is entirely incomplete or not turned in.

Grading Breakdown: 0 - 1.9 = F 2 - 2.4 = D 2.5 - 2.9 = C 3 - 3.4 = B 3.5 - 4 = A

LESSON 1: INTRODUCTION TO MONK SEAL POPULATIONS

Objective: I can observe changes in a population

LESSON 1 DO NOW

You are about to watch a video about Hawaiian Monk Seals! As you watch, write down two ideas as to what could be causing a change to the monk seal population:

-
-

LESSON 1 VOCABULARY (REVIEW FROM MODULE 4!)

Population: A group of the _____ type of organisms living in the _____ area.

Ecosystem: All the _____ and _____ organisms interacting in a particular area.

Population Ecology: *the study of* how these _____ interact with the _____.

KEY CONCEPT

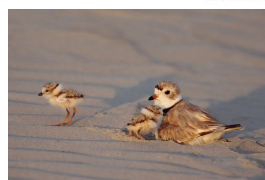
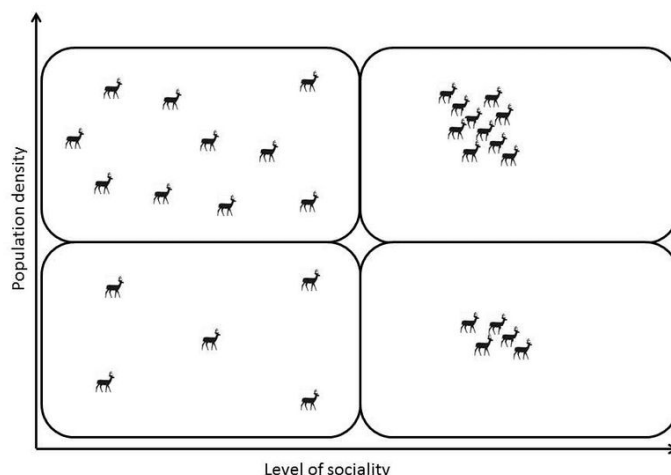
Many factors contribute to _____ of a population.

WHAT IS THE "DENSITY" OF A POPULATION?

Population density is a way to _____ a population per unit of area.

Examples:

1. **Piping Plover** (1st column) - Territorial. Their main defense against predators is camouflage, so they need space from one another!
2. **Tern spp.** (2nd column) - Their main defense is to alert each other to predators and directly attack. Therefore, they remain together to best protect the colony.



POPULATION CHANGES

Population Increase (two ways):

- More _____ than deaths.
- Immigration _____ OR emigration decrease.

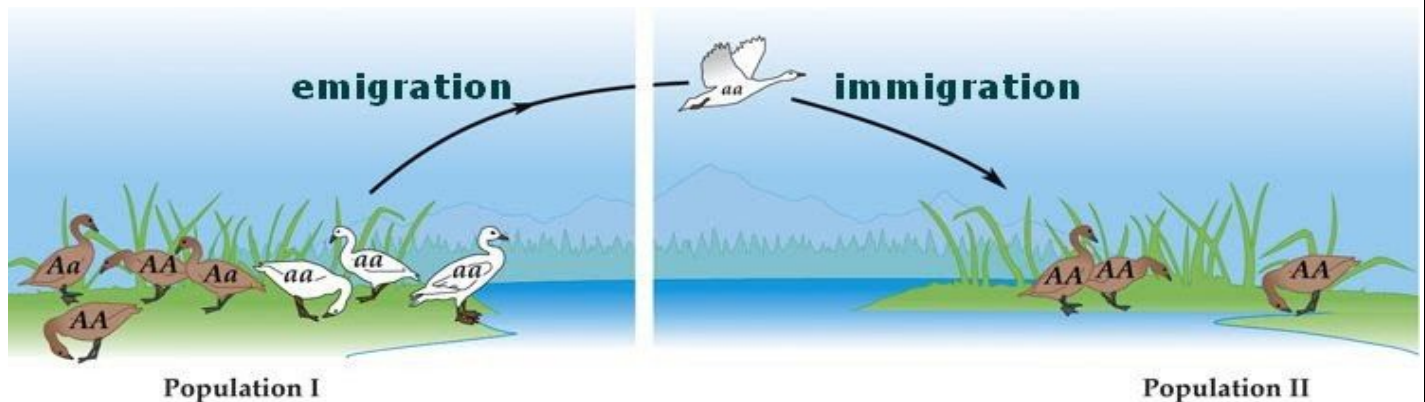
Population Decrease (two ways):

- More _____ than births.
- Immigration _____ OR emigration increase.

IMMIGRATION VS. EMIGRATION

Immigration: members *of the same species* coming _____ an area.

Emigration: members *of the same species* _____ an area.



Concept connection (to 8th grade science!) - What do you notice about the birds in the picture? What do you think it means?

HAWAII NEWS NOW – 2018 MONK SEAL PUP SEASON IS RECORD BREAKING – BUT HOLD THE APPLAUSE

HONOLULU (HawaiiNewsNow) - Scientists say the 2018 pup season has been a record-breaking one on the main Hawaiian islands, with 27 pups born since Rocky gave birth.

"But that doesn't mean we should be shooting off fireworks," said Jon Gelman, president of Hawaii Marine Animal Response. Gelman's organization responds to sightings of monk seals and turtles on Oahu and Molokai.

"Even with record breaking numbers, we're still suffering from loss," he said.

According to Gelman, that loss is mainly stemming from three issues: Fishing interactions, human-caused injuries and

death, and toxoplasmosis, a parasite spread through cat feces.

Gelman said that even with all these pups born, the Hawaiian monk seal population has flat-lined in the past two or three years on the main islands.

"We don't have enough animals surviving to offset this," he said. "Every year we see births, but we continue to have those three threats."

Although, he added, the latest 2017 survey didn't include the recent pup season. It estimated there are 1,400 monk seals throughout Hawaii and the Northwestern Hawaiian Islands. Less than 300 of them are on the main Hawaii islands. Still, three monk seals death have been blamed on toxoplasmosis just in recent months. And National Oceanic and Atmospheric Administration veterinarian Michelle Barbieri said at least six monk seals have been believed to be killed by humans since 2009.

Gelman said though conservation efforts have proven to help the population, monk seals will need to double their numbers before the line crosses from the label of endangered species to threatened.

"This is multi-decade, multi-generational conservation efforts," Gelman said. He added it could take decades.

Officials say the best thing the public can do is to report any sightings to the NOAA marine animal hotline at 888-256-9840 and give the animals space.

"We need information on these animals before they get too sick," Gelman said.

Gelman recalls an incident earlier in the year with a monk seal who eventually died from toxoplasmosis.

Scientists learned after-the-fact that there people spotted signs of the same seal exhibiting "off" behavior, but it was never reported.

"Protecting every animal is critical," he said.

Take Rocky for example. She's had 11 pups. And every death of a seal takes away any possibility that the animal had of reproducing and sustaining the endangered population.

"For over three million years, they have called Hawaii home," Gelman said. "They are truly a Hawaiian treasure."

Copyright 2018 Hawaii News Now. All rights reserved.

LESSON 1 EXIT SLIP/HOMEWORK - "SAVING JUVENILE HAWAIIAN MONK SEALS- STATUS AND CHALLENGES"

Read and annotate the article provided by your teacher to prepare for lesson 2. Do you think the population is increasing or decreasing? What do you think is contributing to this change?

LESSON 2: LIMITING FACTORS TO POPULATION SIZE

Objective: I can... identify the main limiting factors to population size.

LESSON 2 DO NOW

So far, we have looked at how births/deaths and immigration/emigration could change a population. Look back to your article from yesterday, *what are the three main threats to the Monk Seal Population?*

1. _____
2. _____
3. _____

THINK - PAIR - SHARE

What else do we have to consider for population growth? *So far, we have discussed population increase/decrease due to members coming in or leaving (immigration and emigration), as well as due to the birth and death rate.*

What could make a population increase or decrease? What could *limit* a population from increasing forever? Write your thoughts below and be prepared to share with a partner!

WHAT ELSE DO WE HAVE TO CONSIDER FOR POPULATION GROWTH?

Fecundity: how many _____ an individual can have in a lifetime.

Female Hawaiian Monk Seals give birth to _____ on land in the spring or summer, and the pups stay with their mothers for five to seven weeks.

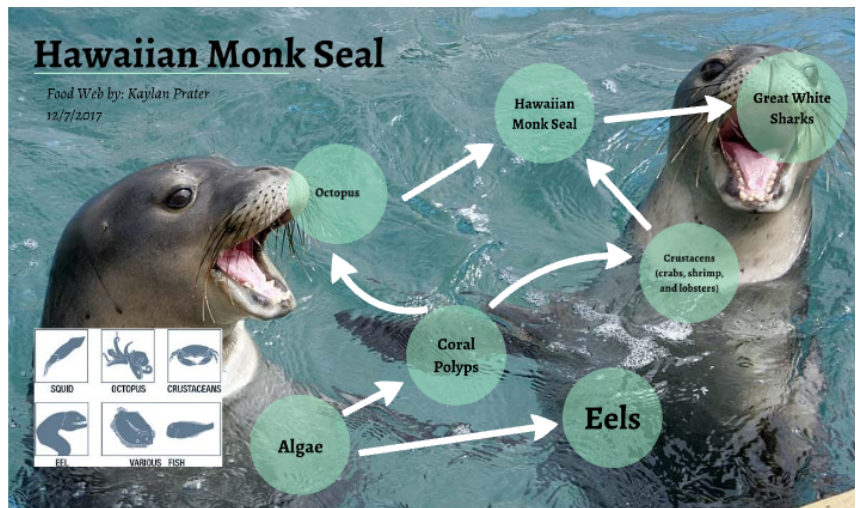
How does this compare to rabbits which can have large litters in only 30 days?

LIMITING FACTORS

Limiting factors: What keeps growth in check.

1. _____
2. _____
3. _____
4. _____

LIMITING FACTOR #1



LIMITING FACTOR #2

“Most seals live in cold water”.

“Hawaiian Monk Seals are a rare breed of warm-water seals, and so they cannot migrate over cold oceans to repopulate elsewhere.” They need the warm water around the islands to survive.

LIMITING FACTOR #3

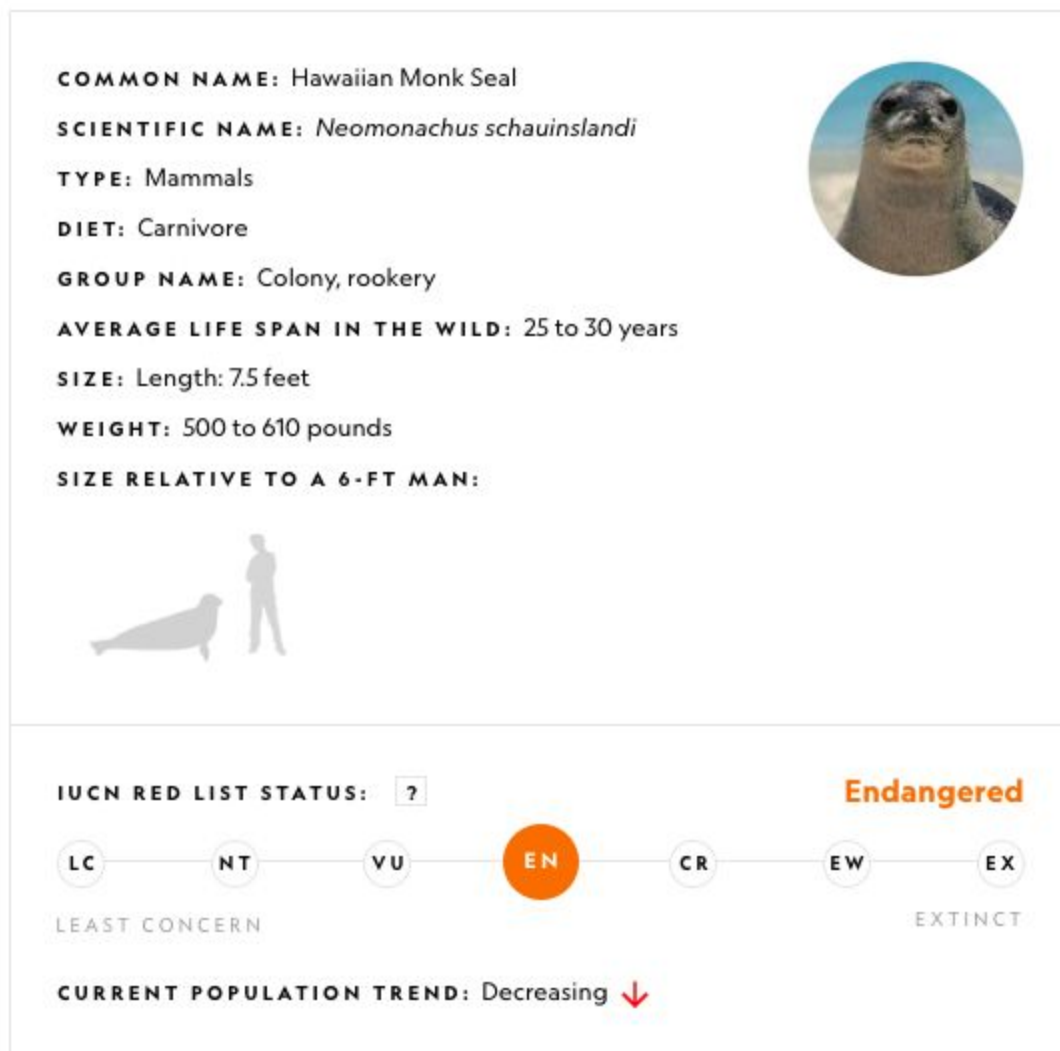
“Adult males have been seen “mobbing”, an aggressive behavior where one or more males attempt to mate with immature seals of both sexes, often injuring or killing them. This behavior is likely due to the disparity between the number of males to females in Hawaiian monk seal populations as it seems to occur where there are more males than females.”

LIMITING FACTOR #4

“Hawaiian monk seals live in the remote Northwestern Hawaiian Islands. These small islands and atolls are either uninhabited or little-used by humans. They are also surrounded with teeming coral reefs, which serve as great foraging grounds for skilled seals to swim and dive for fish, spiny lobsters, octopuses, and eels. Monk seals spend most of their time at sea, but come ashore to rest on beaches and even utilize fringe vegetation as shelter from storms.”

LESSON 2 EXIT SLIP – NATIONAL GEOGRAPHIC ARTICLE

Read and annotate the following article from National Geographic. Then, answer the question that follows.



ABOUT THE HAWAIIAN MONK SEAL

Most seals are at home in frigid waters, but the Hawaiian monk seal is a rare tropical exception.

Habitat

Hawaiian monk seals live in the remote Northwestern Hawaiian Islands. These small islands and atolls are either uninhabited or little-used by humans. They are also surrounded with teeming coral reefs, which serve as great foraging grounds for skilled seals to swim and dive for fish, spiny lobsters, octopuses, and eels. Monk seals spend most of their time at sea, but come ashore to rest on beaches and even utilize fringe vegetation as shelter from storms.

Etymology

The monk seal is named for its folds of skin that somewhat resemble a monk's cowl, and because it is usually seen alone or in small groups. Hawaiians call the seal *`Ilio holo I ka uua*, which means, “dog that runs in rough water.”

Parenting

Mother monk seals are dedicated and remain with their pups constantly for the first five or six weeks of their lives. They don't eat during this challenging time and may lose hundreds of pounds.

Threats to Survival

Like the other species of warm-water monk seals, the Mediterranean and Caribbean monk seals, the Hawaiian monk seal has a tenuous grasp on survival. The Caribbean monk seal, in fact, is believed to have been extinct since the 1970s.

Humans have moved into many of the desirable coastal habitats that these animals once frequented, so open coastline is at a premium. Monk seals have also been victims of fisheries, though they are usually accidental bycatch and not a targeted species. Sharks also prey on these seals, and males sometimes kill females of their own species in group attacks called “mobbing.”

Today, Hawaiian monk seals are threatened and, although many protection efforts are in place, their numbers have continually dwindled over the years.

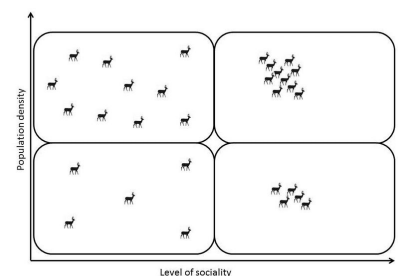
What limiting factors are affecting monk seals in Hawai'i?

LESSON 3: DENSITY DEPENDENT VS. DENSITY INDEPENDENT FACTORS

Objective: I can... determine whether density dependent or independent factors limit a population size.

LESSON 3 DO NOW

Look back at your list from lesson 2 and the figure from lesson 1. Are any of these factors dependent on how close the members of the population are to each other?



LIMITING FACTORS AND DENSITY VIDEO NOTES

LIMITING FACTORS AND DENSITY VIDEO NOTES (CONT'D)

KEY CONCEPT - CARRYING CAPACITY

Limiting factors affect the population's:

Carrying capacity: the number of _____ that a habitat can sustain with the resources it has available.

DENSITY DEPENDENT VS. INDEPENDENT

Limiting factors can be either:

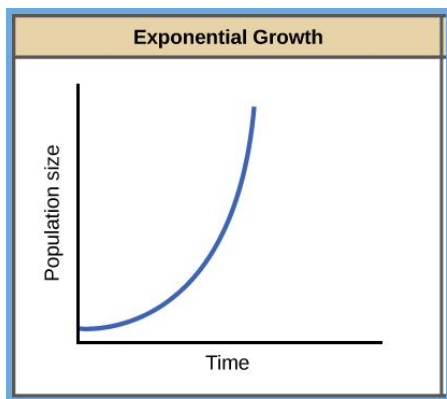
- **Density-**_____ : factors that inhibit growth because of the environmental stress caused by a population size.
 - There may not be enough food, water, and space to accommodate everyone.
 - A nearby predator population increases and keeps the nearby prey population in check.

- **Density-**_____ : **Any factor** limiting the size of a population whose effect is not dependent on the number of individuals in the population.
 - Example: earthquake, or fire that kills members of a population regardless of how many of them there are.

TYPES OF POPULATION GROWTH

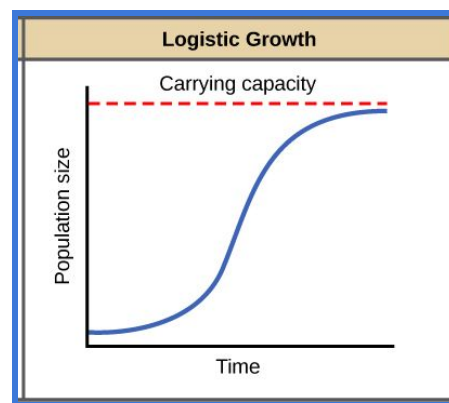
Exponential **growth** - occurs when individuals of a population reproduce at a constant rate.

- J-shaped curve
- ONLY happens when there are no limiting factors present (very rare in nature).
- Ex- bacteria growth



Logistic **growth** - occurs as resources become less available, population growth slows, stops, or fluctuates at the carrying capacity.

- s-shaped curve
- Most commonly seen in ecosystems



GROWTH RATE

Growth rate:

(The number of births)-(number of deaths)= the amount of individuals that are added to a population.

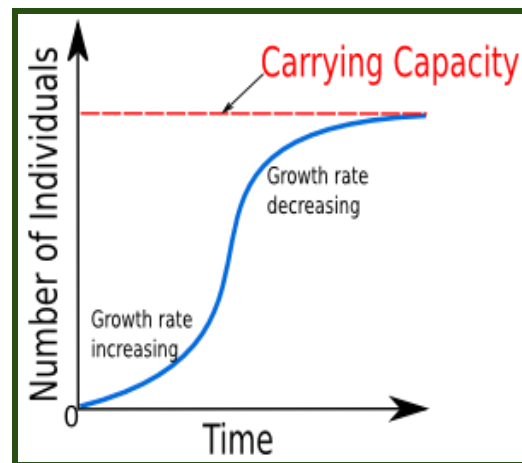
You can calculate the growth rate as how many individuals were *added* to a population **PER** individual in the *original population*.

You try!

What is the growth rate of the following scenario?

Every year, wedge-tailed shearwaters will nest in shallow burrows throughout the Hawaiian islands. For every 2,000 births, there are 1,400 deaths of both chicks and adults due to a variety of limiting factors, such as food availability.

Growth rate: _____



POPULATION GROWTH RATE

Population growth rate can be calculated using the following equation:

$$R = \frac{(B - D)}{N}$$

R	
B	
D	
N	

You try!

What is the population growth rate?

Every year, 7,000 wedge-tailed shearwaters will nest in shallow burrows throughout the Hawaiian islands. For every 2,000 births, there are 1,400 deaths of both chicks and adults due to a variety of limiting factors, such as food availability.

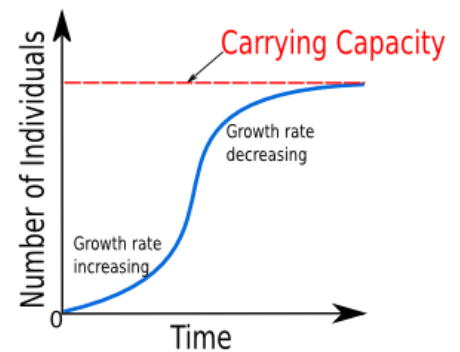
Population growth rate: _____

LESSON 3 EXIT SLIP

Using what you know about limiting factors and growth rate, explain why the growth rate must decrease as a population approaches its carrying capacity?

Limiting factors: what keeps growth in check

- Food
- Temperature
- Mates
- Space



EXTRA TIME?

Draw a group of monk seals experiencing different limiting factors: