

Populations

Chapter 5.1 and 5.2

Why is the study of populations important?

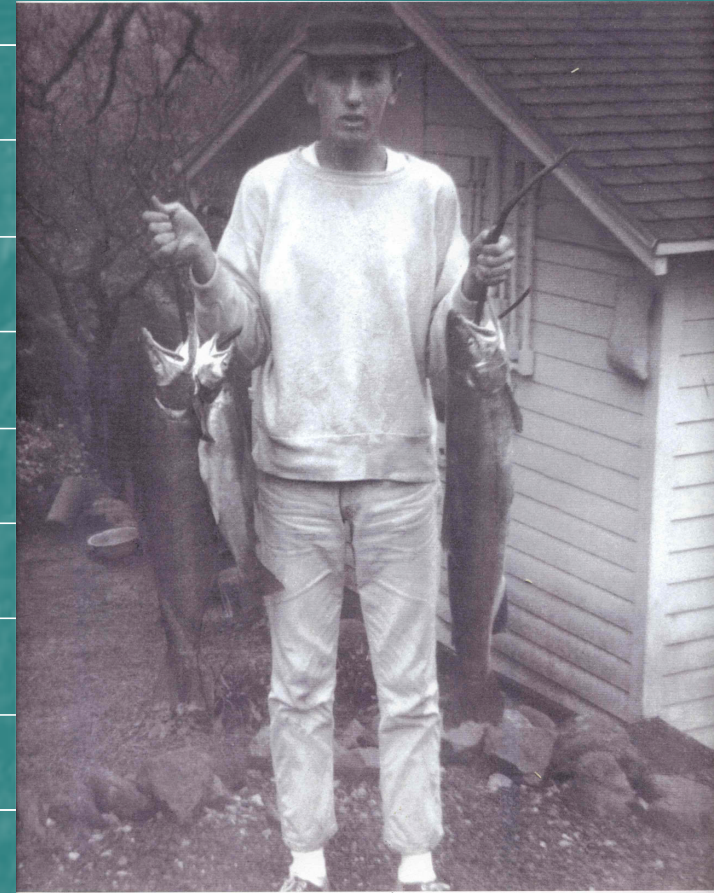
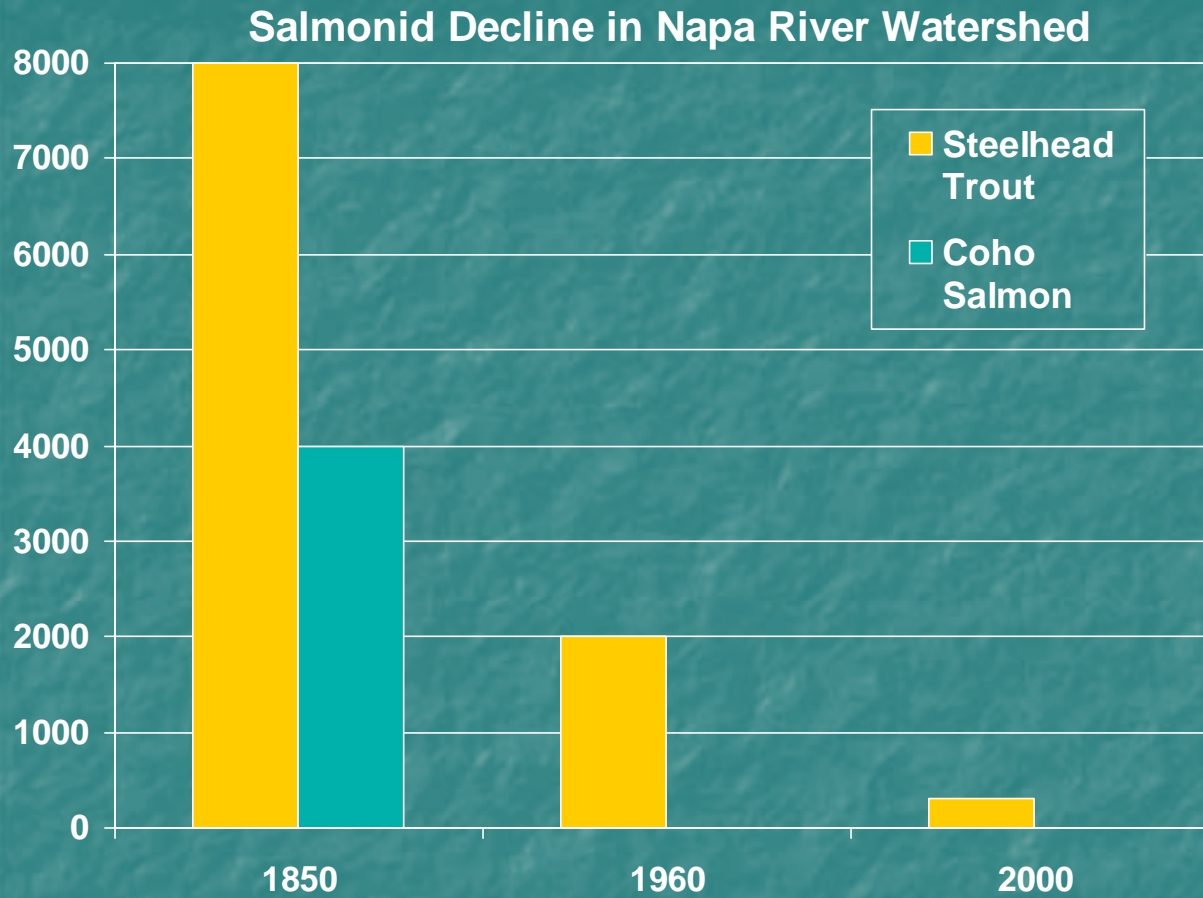
Sea Otters

- Kelp forests are habitat for many species of fishes along the CA coast.
- Sea Otters help to maintain kelp forests by eating sea urchins that eat the kelp.

Why is the study of populations important?

- Sea otters were hunted to near extinction and kelp forests started to disappear.
- When sea otters were protected from hunting under the Endangered Species Act, their population increased and the kelp forests grew back.

Example



Why have salmon and steelhead declined?

Why is the study of populations important?

Main Idea: The study of how populations grow and decline is important in order to understand how to preserve species and ecosystem stability.

3 Important Characteristics

1. Population Density
2. Geographic Distribution
3. Growth Rate

1. Population Density

Population Density: The number of individuals per unit area. Units may be in in^2 , ft^2 , yd^2 , or mile^2 .

Examples

High Density:

- The bacteria in your mouth
- Trees in a forest

Low Density:

- Mountain Lions
- Cactus in a desert

2. Geographic Distribution: The range or area where a species or population lives.

Importance

Species or populations confined to a small area like an island are more likely to go extinct than a population with a large range.

3. Population Growth

Four factors affect population size:

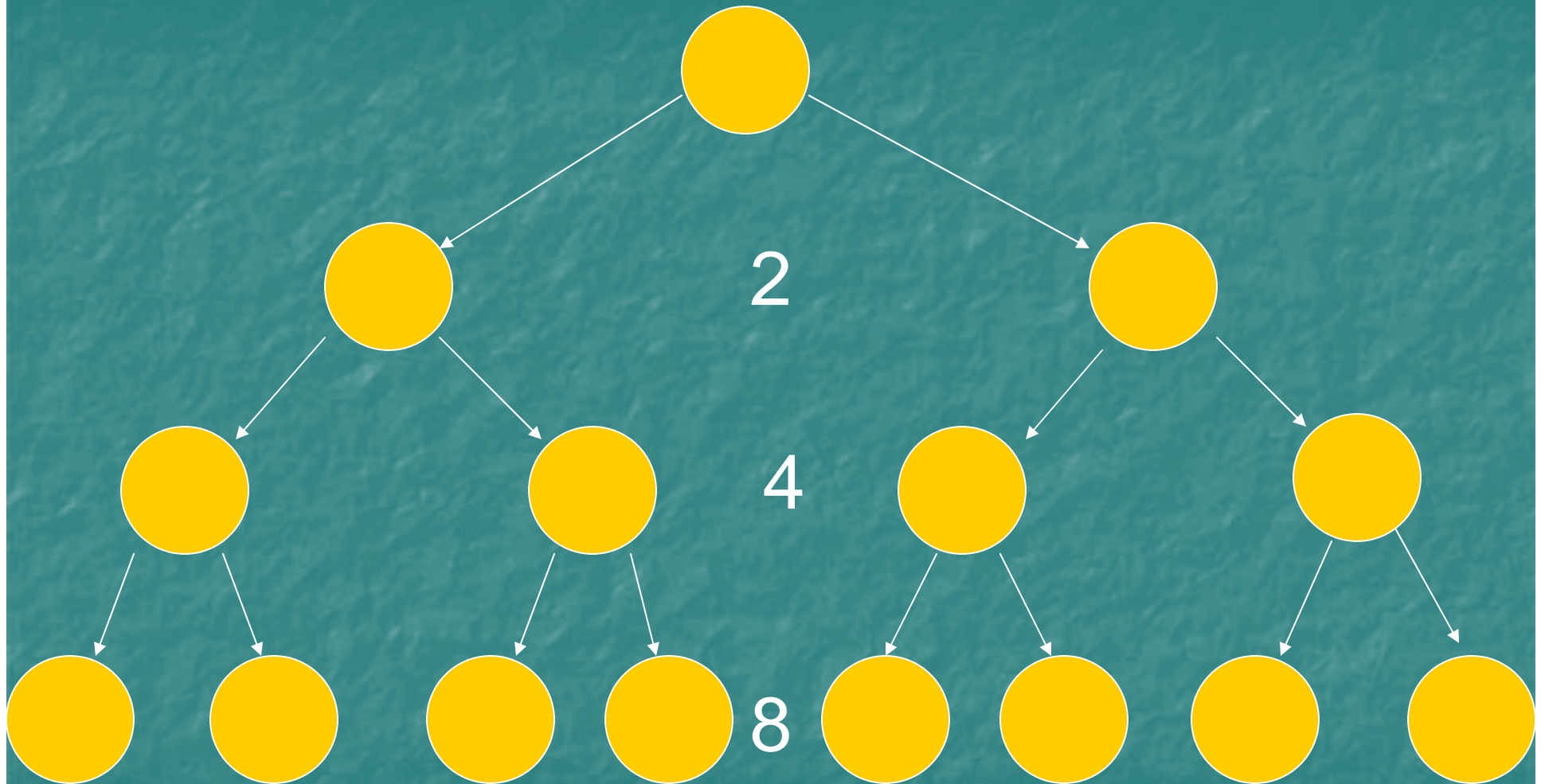
1. Birth Rate
2. Death Rate
3. Immigration: Individuals entering a population/area
4. Emigration: Individuals leaving a population/area

Exponential Growth

Example: Bacteria reproduce by dividing in half. Under ideal conditions, they can reproduce themselves every 20 minutes.

Assumption: Bacteria growth is not limited by resources (food) or space.

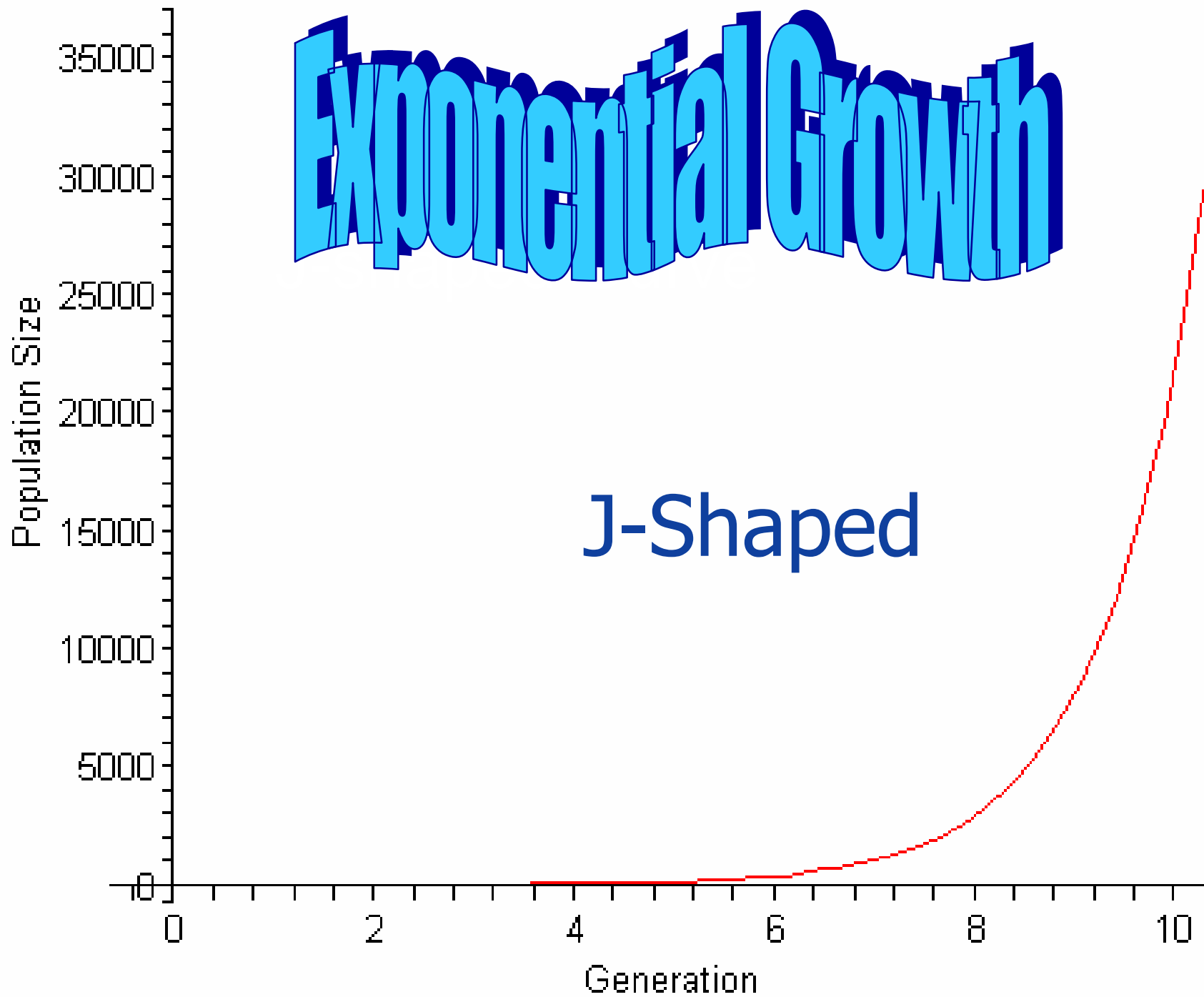
Bacterial Growth Over 1-Hour



Time	Generation	Number of Individuals
0	1	1
20 min	2	2
40 min	3	4
60 min	4	8
80 min	5	16
100 min	6	32
120 min	7	64
1,440 min =1 day	74	

Exponential Growth

J-Shaped



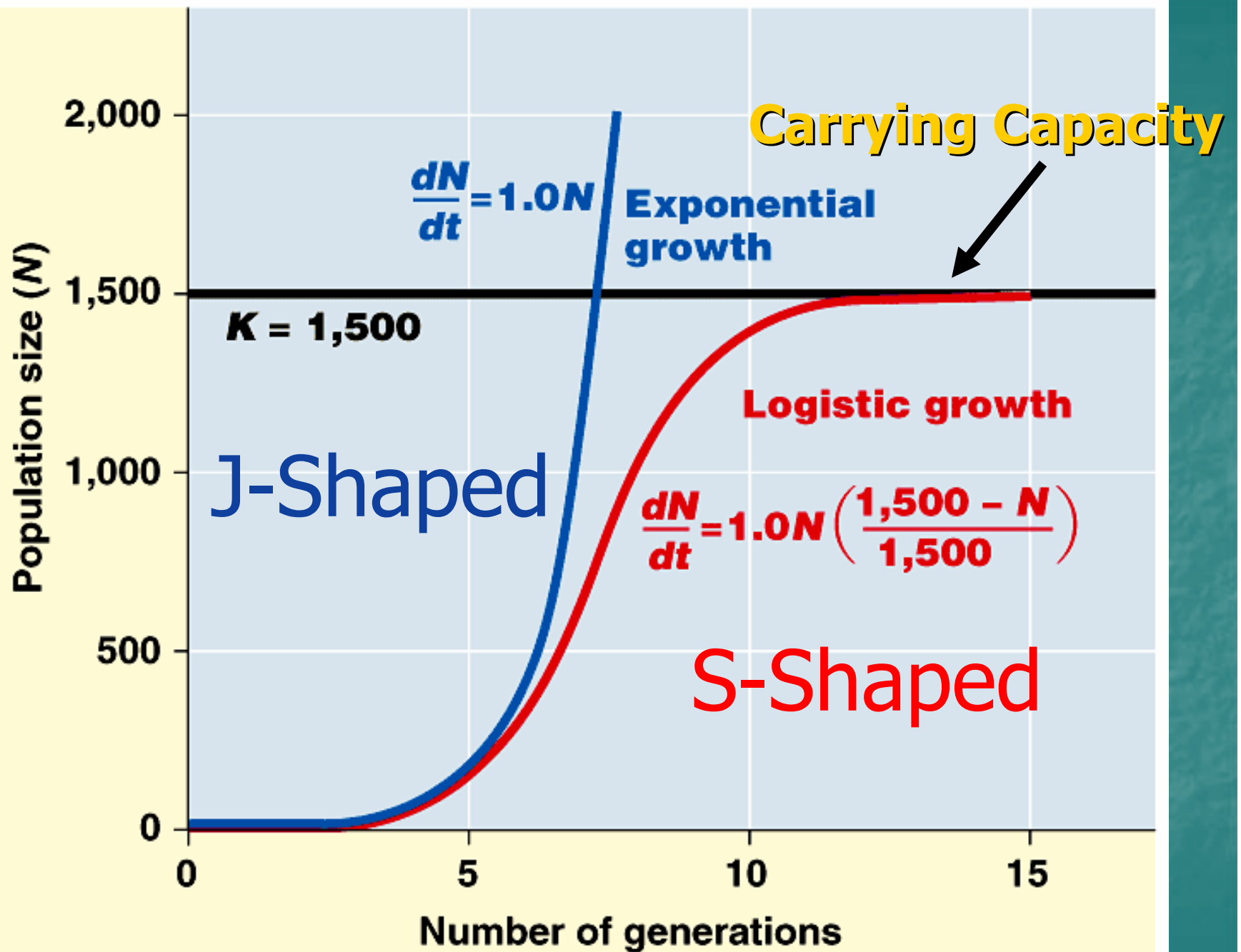
Main Ideas

Exponential population growth only occurs when conditions (temperature) are ideal and resources (food, water, shelter) are unlimited.

As long as resources are plentiful, populations of most species will grow exponentially.

Logistic Growth

As resources become less and less available, the growth of a population slows or stops.



Main Ideas

The population growth of most species is **logistic (S-shaped)**.

Growth increases rapidly at first, then as resources become limited, the growth rate declines and levels off.

Carrying Capacity: The largest number of individuals within a species that can be supported by its environment.

Self-Check

1. What is the difference between exponential and logistic growth?
2. What factors might cause the carrying capacity for a population to decrease?
3. What factors might cause the carrying capacity to increase?

Limits to Growth

Four factors determine growth of a population:

1. Birth Rate
2. Death Rate
3. Immigration
4. Emigration

Limiting Factors

Any factor (food supply, predators) that may cause a population to *decline* (decrease).

Limiting Factors for Salmon:

- ✓ Shade, water temperature, oxygen
- ✓ Amount of good spawning gravels
- ✓ Food in ocean and streams
- ✓ Competition or predation by other animals

Density-Dependent Factors

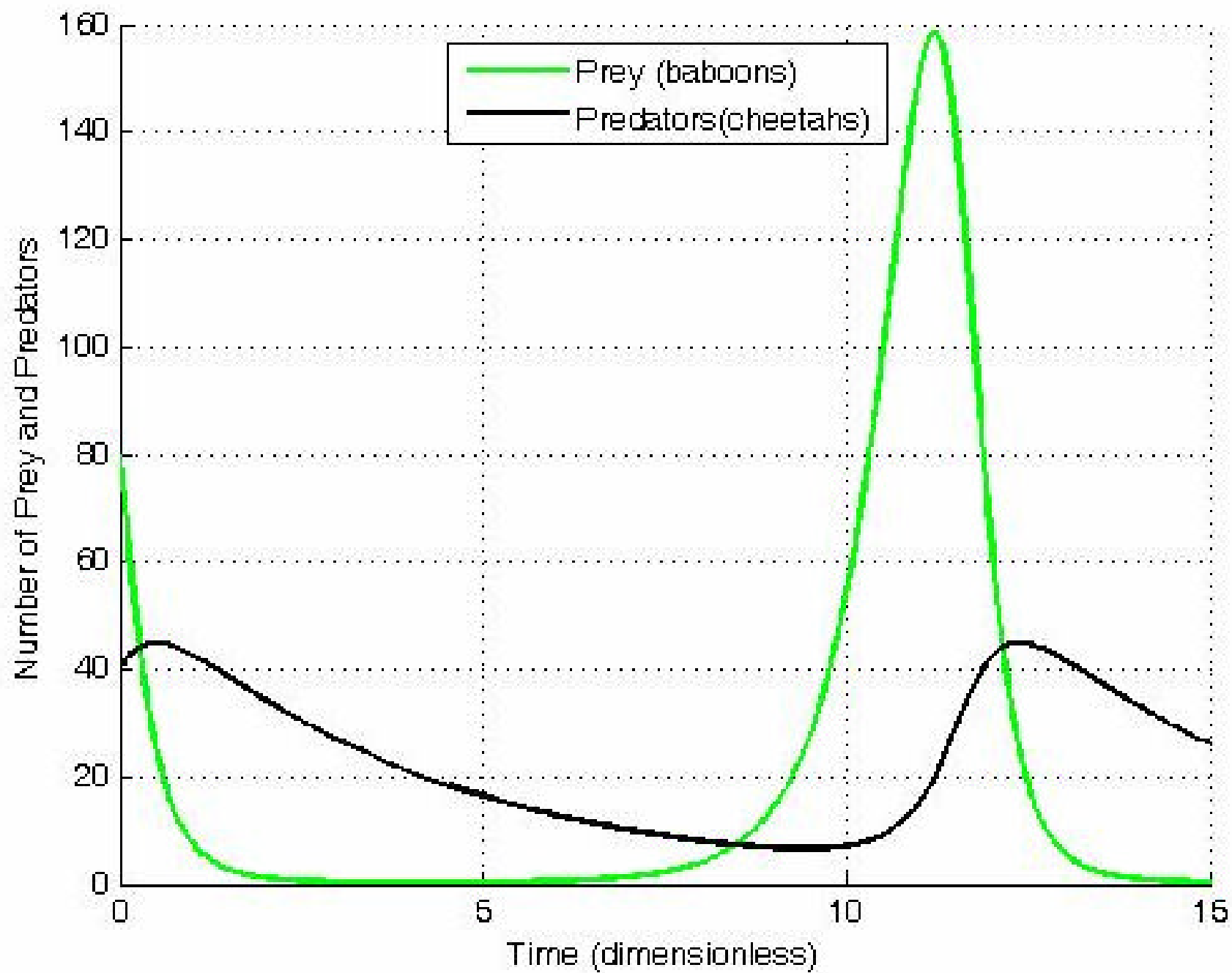
A limiting factor that depends on population size.

Examples of density-dependent factors:

- ✓ Competition
- ✓ Predation
- ✓ Parasitism
- ✓ Disease

Competition is a density-dependent limiting factor because as populations grow there are less resources available to each individual.

Predation, Parasitism, and Disease are also density dependent because more prey = more predators.



Density-Independent Factors

Density-Independent limiting factors have nothing to do with the size of the population. **Examples:**

- ✓ Hurricanes
- ✓ Droughts
- ✓ Damming rivers
- ✓ Clear-cutting forests

Population Growth

LIMITING FACTORS

Density-
Dependent

Density
Independent

Predation

Parasitism/
Disease

Dams

Competition

Droughts

Hurricanes

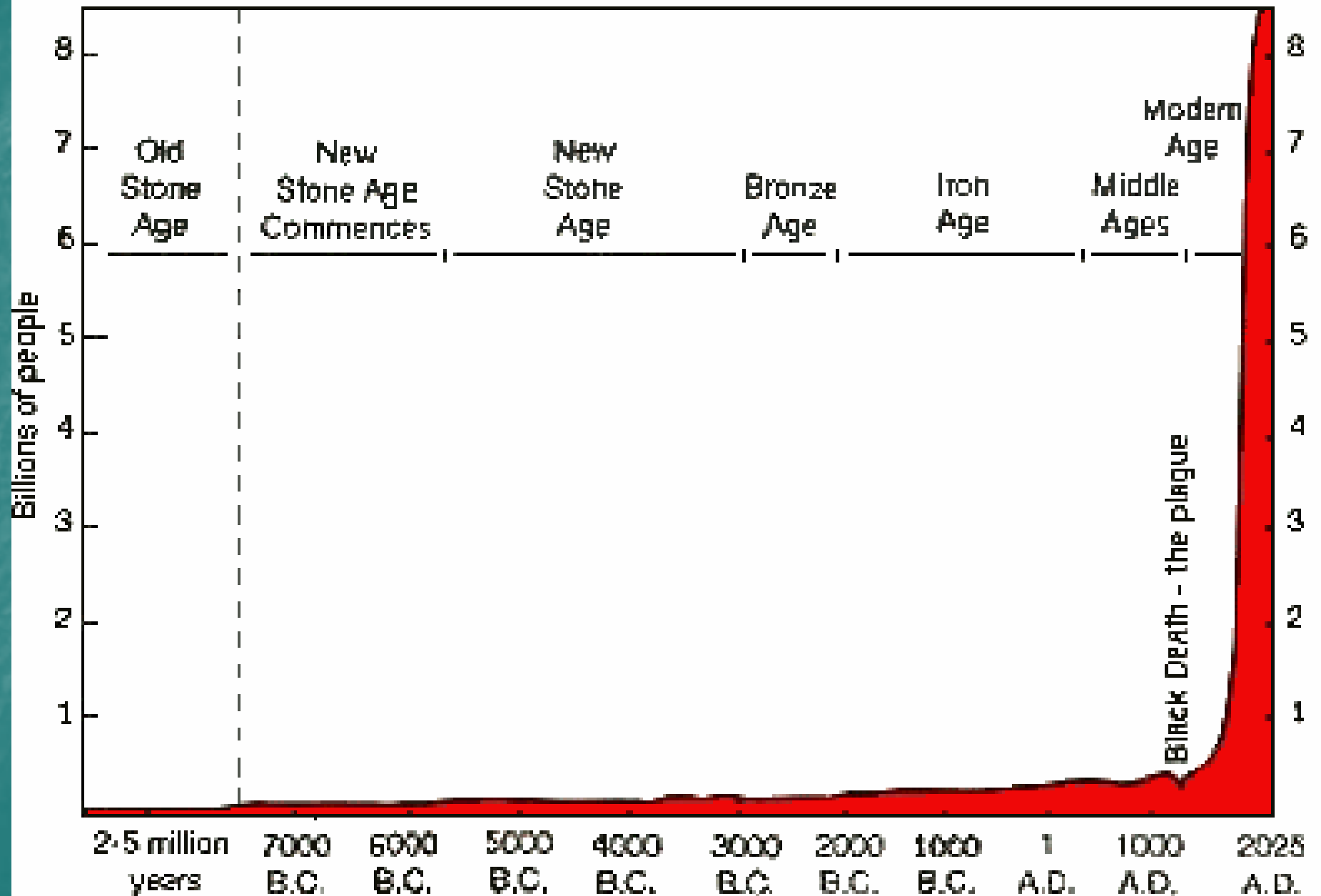
Self Check

1. What is the relationship between competition and population size?
2. If ladybugs (predator) disappear from your garden, what is likely to happen to the aphid population on which it preys?
3. Are density-**dependent** limiting factors biotic or abiotic factors?
4. Are density-**independent** limiting factors biotic or abiotic factors?

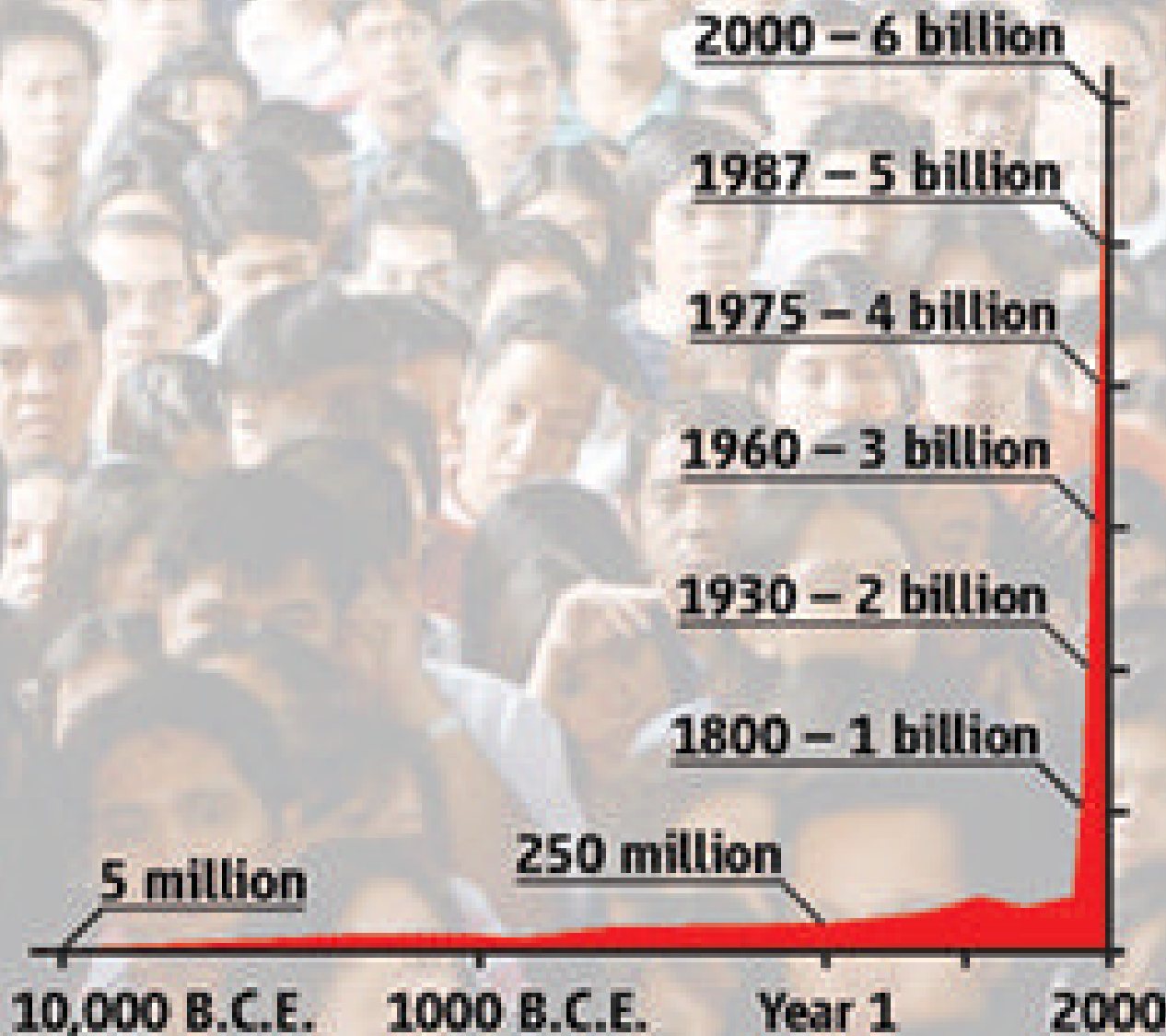
Human Population Growth

1. What does ecology tell us about our own growth as a species?
2. Are there limits to our growth?

World Population Growth Through History



WORLD POPULATION GROWTH



13 years

12 years

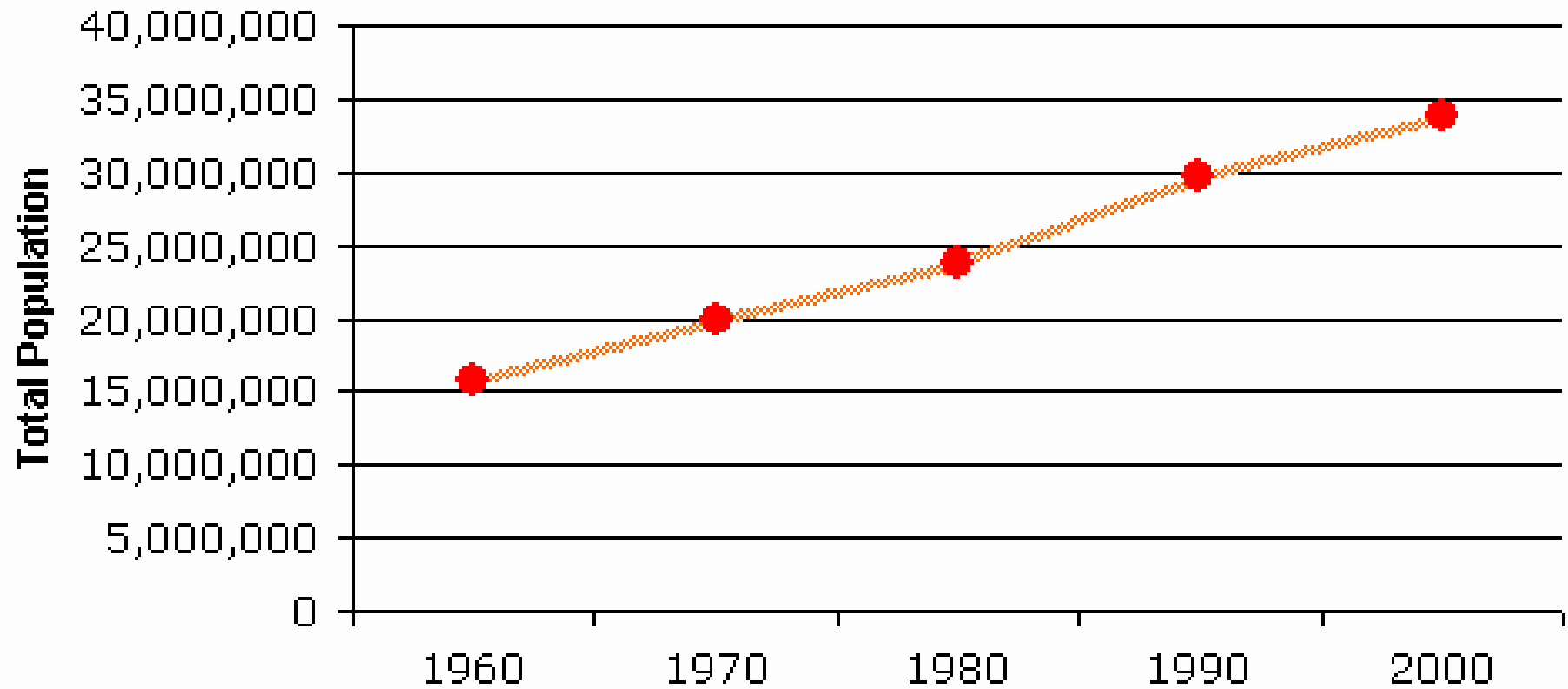
15 years

30 years

130 years

California

Population, 1960-2000



Self Check

1. Does human population growth over the past 10,000 years follow the exponential or logistic growth curve?
2. At some point, the global human population, like other species, will reach its carrying capacity. Describe density-dependent and density-independent factors that could affect the carrying capacity of humans.