

Exercise walk-through

8.3

Population Ecology

AP Biology

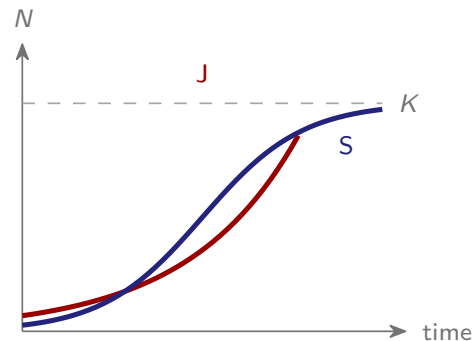
Population growth

Two growth models:

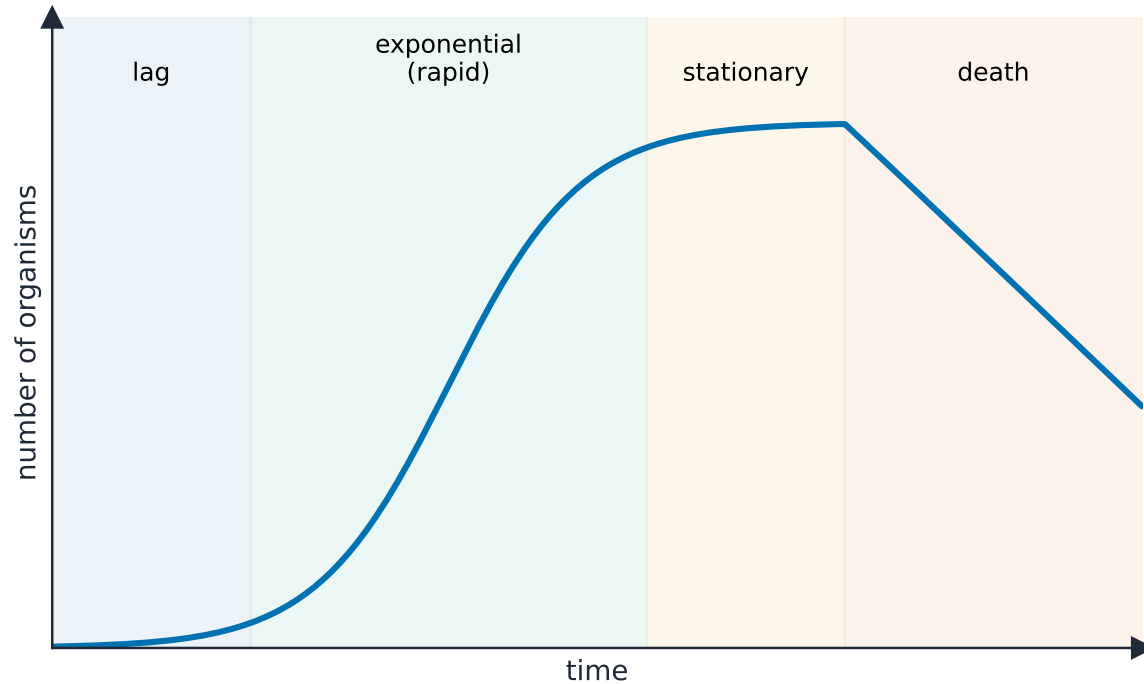
- **exponential** : a J-curve,

$$\frac{dN}{dt} = rN$$
- **logistic** : an S-curve,
 slowed by resources

Growth levels off at the **carrying capacity** K : $\frac{dN}{dt} = rN \frac{K - N}{K}$.



Population growth: lag



Population growth: lag, exponential, then levelling off at the carrying capacity

Worked example – the logistic growth rate

A population has $r_{\max} = 0.5 \text{ yr}^{-1}$, carrying capacity $K = 1000$, and current size $N = 400$. Find dN/dt .

- $\frac{dN}{dt} = r_{\max} N \frac{K - N}{K}$
- $= 0.5(400) \frac{1000 - 400}{1000}$
- $= 200 \times 0.6 = 120 \text{ yr}^{-1}$

Exponential growth

$r_{\max} N$ would give 200. The $(K - N)/K$ term is what makes it **logistic**: it approaches zero as N approaches K .

Exercises 2.1-2.3

2.1 What shape is an exponential growth curve?

[1]

2.2 What does carrying capacity mean?

[1]

2.3 What shape is a logistic growth curve?

[1]

Exercises 2.1-2.3

2.1 What shape is an exponential growth curve? [1]

2.1

- J-shaped
-

2.2 What does carrying capacity mean? [1]

2.2

- The maximum population the environment can support long-term
-

2.3 What shape is a logistic growth curve? [1]

2.3

- S-shaped

Exercise 3.1

3.1 Logistic growth levels off at the

[1]

☐

A origin

B carrying capacity

C exponential phase

D zero point

Exercise 3.1

3.1 Logistic growth levels off at the

[1]

☐

A origin

B carrying capacity

C exponential phase

D zero point

3.1 B

- the carrying capacity

Exercise 3.2 (a)

3.2 A population grows and then levels off at 1200 individuals.

(a) State the carrying capacity.

[1]

Exercise 3.2 (a)

3.2 A population grows and then levels off at 1200 individuals.

(a) State the carrying capacity.

[1]

(a)

- 1200

Exercise 3.2 (b)

3.2 A population grows and then levels off at 1200 individuals.

(b) Explain why growth slows as the population approaches this value.

[2]

Exercise 3.2 (b)

3.2 A population grows and then levels off at 1200 individuals.

(b) Explain why growth slows as the population approaches this value. [2]

(b)

- As the population grows, resources (food, space) become limited and competition rises, so births fall and deaths rise, slowing growth toward K

Exercise 3.3

3.3 Explain the difference between exponential and logistic growth in terms of resources. [2]

Exercise 3.3

3.3 Explain the difference between exponential and logistic growth in terms of resources.[2]

3.3

- Exponential growth assumes unlimited resources, so it keeps accelerating; logistic growth accounts for limited resources, so it slows and levels off at the carrying capacity