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A2 Biology OCR

Unit F215: Control, genomes and environment

Module 3.2 Populations and sustainability

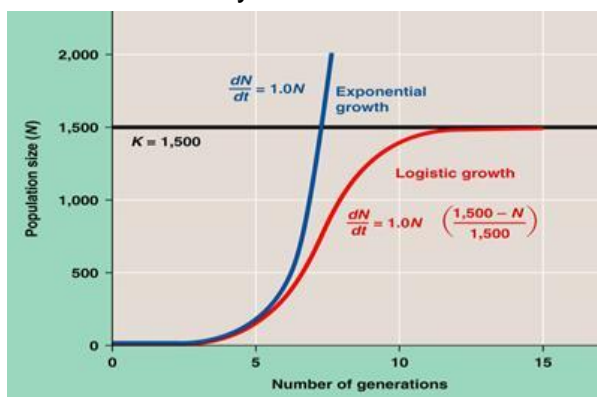
Notes & Questions

Explain the significance of limiting factors in determining the final size of a population.

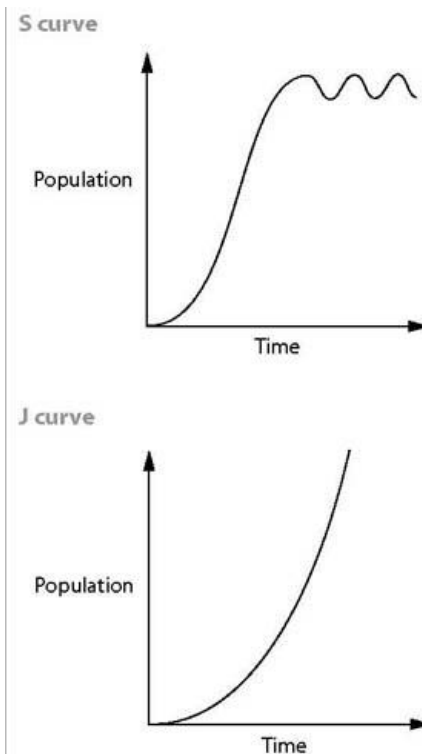
- A variable that limits the rate of a particular process. If the factor is increased then the process will take place at a faster rate. Where the rate of the natural process is affected by a number of factors, the limiting factor is the one whose magnitude limits the rate of the process.
- Limiting factors can be one or more of the following
 - Biotic – Living components of an ecosystem
 - Disease
 - Food (prey/grazing)
 - Competition (Intraspecific or interspecific)
 - trampling
 - Abiotic – Non-living components of an ecosystem
 - Water availability (soil or pools)
 - Mineral availability
 - Space
 - Light
 - Temperature
- Limiting factors generally generate competition either intraspecific or interspecific. Competition generates a selection pressure as there are fewer resources for the current population

- **Population size = rate of reproduction – rate of death**

- **K-Strategists**
 - Display an s-shaped curve.
 - Reach a carrying capacity
- **R-Strategists**
 - Display a j-shaped curve
 - Exceed the carrying capacity – Boom/Bust cycle



Andy Todd



K-Strategists

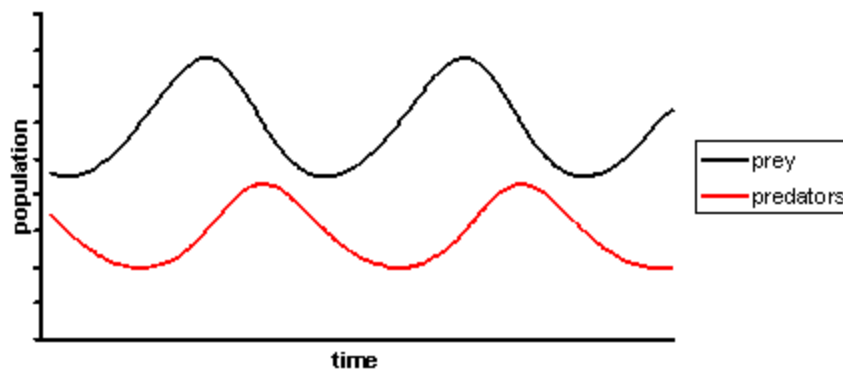
fewer offspring
 High parental investment
 Low infant mortality
 slower to develop
 longer life spans
 delayed reproduction
 larger body sizes
 smaller populations but stable
 E.g Elephants & Oak trees

R-Strategists

many offspring
 low parental investment
 High infant mortality
 rapid development
 short life span
 early reproduction
 small body size
 large population but unstable
 E.g Voles & Weeds

Explain the meaning of the term *carrying capacity*.

- **Carrying capacity** – the maximum population size that can be maintained over a period of time in a particular habitat. It is determined by the limiting factors
- You can increase or decrease the carrying capacity of a population by adjusting the limiting factors. Useful when conducting conservation.

Describe predator–prey relationships and their possible effects on the population sizes of both the predator and the prey.

- This predator-prey graph shows a perfect predator-prey relationship.
- Data like this will have likely come from a lab based study as it is so regular.
- This would not necessarily be the case in nature.
 - Limiting factors affect a population size.
 - Predators usually have multiple prey
 - Prey usually has multiple predators.

Explain, with examples, the terms *interspecific* and *intraspecific* competition.

- **Competition** – Arises when resources availability becomes into short supply
- **Intraspecific Competition**
 - Between individuals of the same species
 - Maintains a stationary phase – however there are small fluctuations
- **Interspecific Competition**
 - Between individuals of different species
 - Can affect population size and population distribution
 - Can bring about competitive exclusion principle
- **Competitive exclusion principle**
 - One species will out compete another leading to its extinction
 - Extinction however is not always inevitable
 - Both species can survive, however one will have a significantly reduced population size
 - It is important to note that if any small adjustment was made to the environment then the outcome of which out competed the other could change dramatically.

Explain how the management of an ecosystem can provide resources in a sustainable way, with reference to timber production in a temperate country.

- **Biological resource**
 - trees are living organisms;
 - renewable;
 - ref to, growth / growing;
 - timber is, of use to human beings / made into products;
- **Sustainability**
 - The long term responsible maintenance of a resource, which provides enough of the resource to meet our needs now and ensure enough for our future needs.
 - In the timber industry this means planting trees to replace the ones felled.
 - Grants are provided for management schemes and/or planting forests
 - Benefits the local people
 - Must maintain biodiversity, nitrogen and carbon cycle, water retention and climates.

- **Sustainable productivity**
 - harvested at levels which leave sufficient organisms;
 - to grow / reproduce, and replenish what has been harvested;
 - ref to, coppicing / replanting / afforestation;
 - can be carried on indefinitely;

- **Planting of trees**
 - trees not planted too closely together;
 - support young trees to prevent damage e.g. from grazing animals;
 - species planted that are suitable for prevailing conditions /native spp;
 - softwood sp. / conifers / named conifer / fast growing sp. planted;
 - deciduous broadleaved species around edges for aesthetic reasons;
 - creates different habitats / named habitat / protected habitats/ some fallen trees left to rot;

- **Small Scale timber production**
 - ref to coppicing / pollarding;
 - tree cut, close to ground/down to its stump/AW; **R** *down to trunk*
 - new growth forms/AW;
 - harvest after a number of years/process repeated;
 - rotational coppicing/AW;
 - standards / large trees not coppiced, as encourages biodiversity;
 - ref to how coppicing increases biodiversity
e.g. increasing light intensity;

- **Large Scale timber production**
 - ref. to clear felling having negative effects e.g. soil erosion;
 - only mature trees removed / selective felling / individual trees;
 - some clearings / rides / glades in woodland / strip felling;
 - control of, pests / diseases / fire preventions

- **Economic Benefits**
 - (standards) large planks/AW; **A** used as *timber*
 - **A** standards *more valuable*/AW
 - (coppice) small diameter wood/fencing/hurdles/garden
 - furniture/charcoal/firewood/matches;
 - (coppice) continuous, source of timber/income;
 - recreational use/nature reserve; **A** ref to tourism

Distinguish between the terms *conservation* and *preservation*.

- **Preservation**
 - Protecting areas that as yet are unused by humans and are in their untouched form.

- **Conservation**
 - Involves the maintenance of Biodiversity, including diversity between species, genetic diversity within species, and the maintenance of a variety of habitats and ecosystems.

Explain that conservation is a dynamic process involving management and reclamation.

- **Conservation is a dynamic process**
 - preservation of, organisms / environments ;
 - that are at risk from human activity ;
 - requires management ;
 - creation of new habitats ;
 - may need reclamation ;
 - conservation requires vigilance ;
 - resolving conflicts ; **A** suitable alternatives

- **Considerations**
 - Social costs
 - Economic costs
 - Providing
 - Education
 - Legal protection
 - Establishing protected areas

- **Management strategies**
 - Increasing food will increase the carrying capacity
 - Control of pests / predators
 - Vaccinations
 - Preservation of habitats

- **Reclamation Strategies**

- Occurs when disruption has gone too far
- Often the best strategy is to replace original species with slightly different species
- This is due to the length of time required to reach climax communities

Discuss the economic, social and ethical reasons for conservation of biological resources.

- **Ethical**

- All species have right to live
- Religious beliefs

- **Social / Economic**

- Genetic diversity
- Genetic traits including disease, drought, pest resistance
- Future medicines
- Biological pest controls
- Pollinators
- Eco-tourism
- Aesthetic reasons

Outline, with examples, the effects of human activities on the animal and plant populations in the Galapagos Islands.

- **Overexploitation**

- Whaling
- Fur traders
- Giant tortoises where taken as a food source on ships
- Fishing for exotic species
- Fishing for sharks

- **Habitat destruction**

- Increase in human population
 - Increase in demand for water, energy and sanitation
 - Increases pollution and waste
 - Increases in building and agriculture = ***Scalesia*** trees almost extinct

- **Introduction of Species**

- Red quinine tree
 - Out competes the **scalesia** tree
 - Creates a closed canopy eradicating **cacaotillo shrub**
- Goat
 - Eats **rock purslane**
 - Out competes the **giant tortoise** for grazing
 - Tramples food sources and nesting sites of the **giant tortoise**
- Cat
 - Hunts **lava lizards**
 - Hunts **young iguanas.**

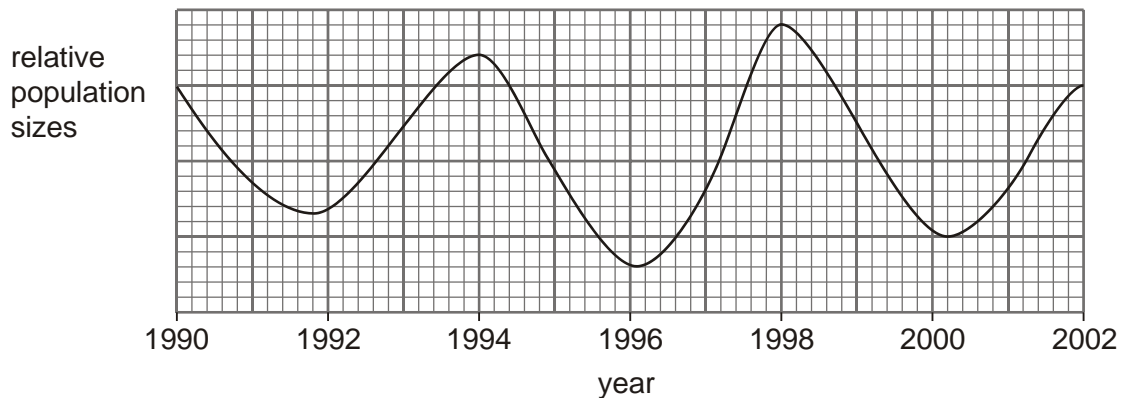
Questions

1

Lemmings are small mammals that live near the Arctic circle. Their populations show regular patterns of increase and decrease. In 2003, scientists published results based on a long-term project in East Greenland. They made the following observations.

- Population peaks occurred in regular four year cycles.
- Four main predators feed on the lemmings: Arctic owls, Arctic foxes, long-tailed skuas and stoats.
- Stoats feed only on lemmings; the other predators feed on a range of prey species.
- Stoats reproduce more slowly than lemmings.

- (a) The figure below shows the changes in the population of lemmings in the East Greenland project area from 1990 to 2002.



- (i) Sketch **on the figure** the likely changes in the population size of stoats.

[2]

(ii) Suggest three environmental conditions, **other than climatic**, that are required for a population explosion of lemmings.

1

2

3

[3]

(b) With reference to the species studied in the East Greenland project, distinguish between interspecific and intraspecific competition.

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[3]

(c) The carrying capacities for lemmings and for the various predators in this area are all different.

Explain the term *carrying capacity*.

.....
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[2]

[Total 10 marks]

5.3.2

2

In woodlands that are managed, a conflict exists between the economic yield and the maintenance of biodiversity.

Below is a photograph of an area of coppice and standard woodland.



- (i) Describe the process of coppicing **and** explain how it is used in the sustainable management of a woodland.

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.....

[3]

- (ii) State **two** ways in which managing woodland as a mix of standard and coppiced trees can be of **economic** benefit to the owner.

1

2

3

[2]

[Total 5 marks]