

Environmental Studies FACT SHEET



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Zoos and botanic gardens

Definitions:

- **Extinct:** a species for which there has been no confirmed sighting for 50 years.
- **Endangered:** a species whose continued existence is deemed unlikely if the factors that are causing its decline continue e.g. Black rhino
- **Vulnerable:** a species which is likely to become endangered soon if the causes of its decline continue.
- **Rare:** a species with localised distribution but in no immediate danger.
- **Translocation:** the release of animals taken from the wild into a new area in an attempt to re-establish or augment natural populations.
- **Captive Breeding:** the breeding of species in captivity, usually zoos, with the aim of reintroducing the animals back to their original habitat once it is safe to do so.
- **Studbook:** an international register, updated every 3 years, which lists all captive individuals of a taxon which is under threat.
- **In-situ conservation:** conservation of an animal or plant in the habitat it lives in i.e. species conservation through habitat conservation.
- **Ex-situ conservation:** conservation of an animal or plant by removing it from its habitat and keeping and/or breeding it in, for example, a zoo.

The conservation role of zoos

Zoos justify their existence by emphasising their role in conservation, education, research and entertainment. In terms of conservation, zoos point out that some species, such as lions, are disappearing faster than their habitats because of threats such as hunting. Clearly, many species are threatened by habitat degradation, fragmentation and destruction. The complex causes of these are not going to be addressed quickly enough to prevent some animal species becoming endangered or extinct.

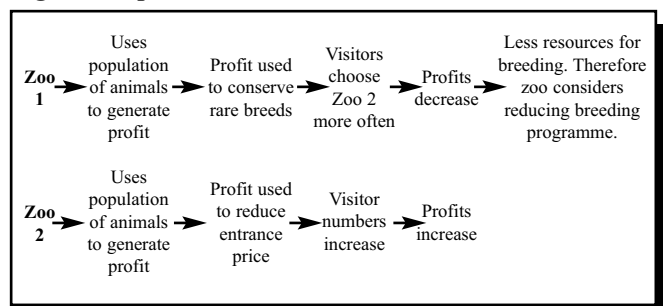
The World Conservation Union (IUCN) estimate that only 3% of the planet is designated as a protected reserve and that, on average, one mammal, bird or reptile species has been lost each year for the last century. Certain groups of species are particularly at risk – those with a restricted distribution, those of high economic value, those at the top of food chains and those in climax habitats.

Thus, the IUCN encourages zoos to capture a proportion of these species and try to establish **captive breeding** populations. There are now more than 3000 captive breeding programmes and **studbooks** are used to monitor the history (diet, health, matings) of many captive individuals, allowing recommendations to be made about which individuals should be allowed (encouraged) to mate. Rare animals are exchanged internationally between co-operating zoos in an effort to increase genetic diversity and prevent inbreeding. **Joint Species Management Programmes** and the **International Species Inventory System (ISIS)** have been established for this purpose.

The problems of captive breeding

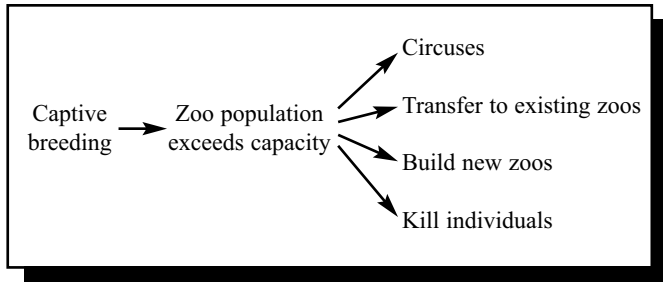
- The species must retain its ability to survive in its original habitat and this becomes more unlikely the longer an individual is kept in captivity.
- Some aspects of behaviour are learned and some are **innate**. As we move from primitive invertebrates to fish to reptiles to mammals, the proportion of learned behaviour increases. Thus, primates such as the golden lion tamarin must be given the opportunity to spend time with and learn from experienced adults when they are young. If they are not given the opportunity to learn that snakes or poisonous figs are dangerous, for example their release into the wild could have negative consequences.
- Captive breeding often only begins when the wild population has fallen to very low levels. The genetic diversity of the captive population is therefore usually very low.
- Captive breeding is very expensive. Leader-Williams (1990) reports that the cost of keeping African elephants and Black rhinos in captivity is 50 times that of maintaining equivalent populations in national parks in Zambia. In addition, he argues, money spent on captive breeding does nothing to help conserve threatened habitats and the many other species that live there.
- One of the reasons that captive breeding is expensive is that zoos may charge other zoos when animals are loaned for breeding. Zoo finance relies heavily on visitors. These visitors usually want to see penguins, chimpanzees and lions etc, none of which are endangered. A zoo that wants to maintain a breeding population of, say, Mountain oryx, cannot just keep two or three animals. It will need to keep 30 – 50 and this is expensive. Unfortunately, the general public are unwilling to pay more to see 30 oryx than they are one or two; they are more excited by seeing lots of species rather than a lot of any one. Zoos that want breeding programmes must raise finance and this is what prompts zoos to charge each other for exchange or loan of animals.
- The problem may be made worse because zoos are in competition. A zoo that uses its visitor profit to maintain captive breeding populations can be harmed if a competitor decides to use its profits in a price war (Fig. 1).

Fig. 1 Competition between zoos.



Critics of captive breeding in zoos also claim that, even if the breeding programme is a success, this may lead to more problems (Fig. 2).

Fig. 2 Problems associated with captive breeding.



The main stages and problems involved in captive breeding are shown in Fig. 3 below.

Captive breeding successes

- Pere David’s deer
- American or European bison
- Przewalski’s horse
- Arabian scimitar-horned oryx
- Mauritius kestrel

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The population of several species have derived from a small number of founding parents: every Arabian oryx alive today is descended from a single herd of just nine.

In the 1970s the Brazilian government provided zoos with Golden lion tamarins which were successfully bred and disseminated to zoos around the world. Over the next 10 years the government succeeded in establishing forest reserves in Brazil that allowed reintroduction of the tamarins. In this case then, the captive breeding programme effectively bought the time needed for the original habitat to be conserved. There are now an estimated 1000 wild tamarins and 600 in captivity.

Fig. 3 Stages and problems in captive breeding.

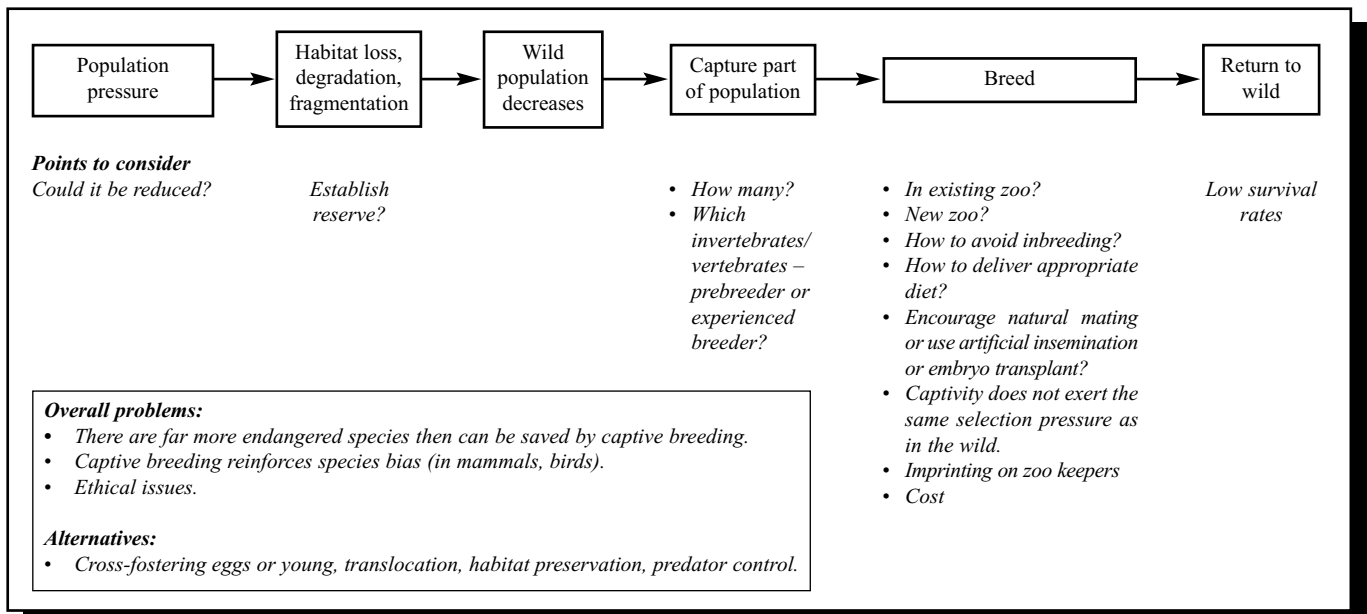
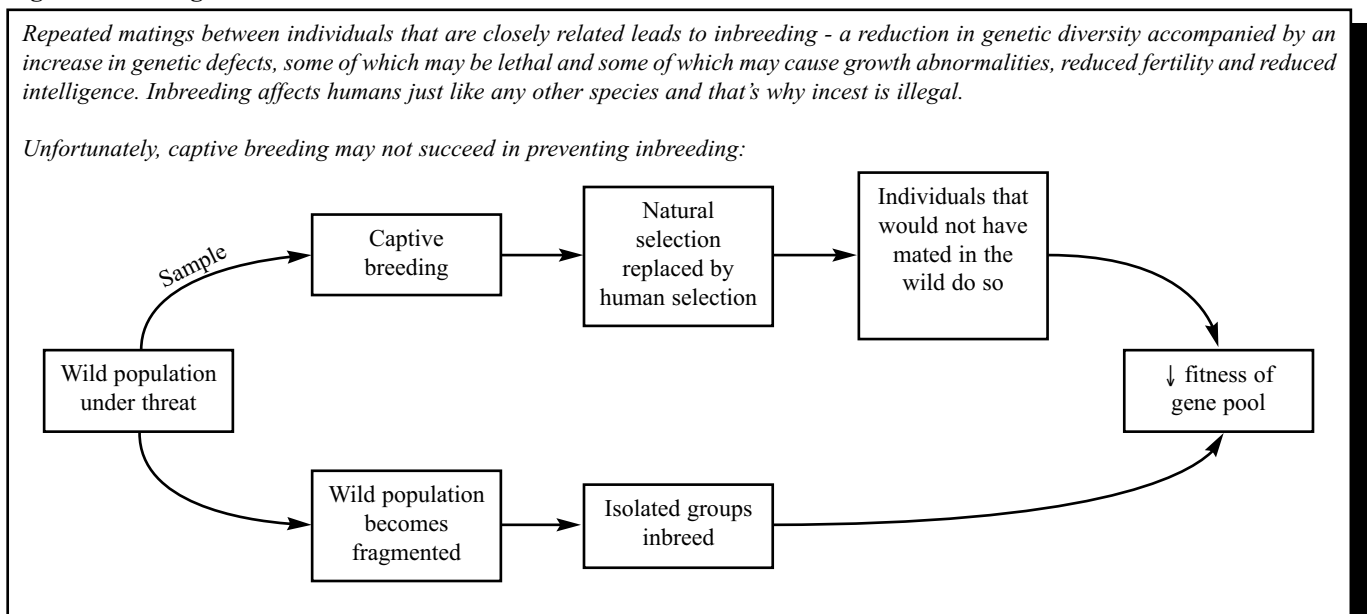
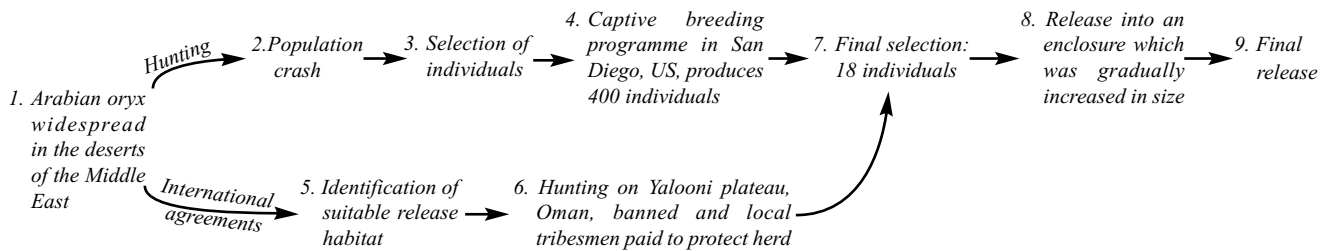


Fig. 4 Inbreeding.



Typical Exam Question

The diagram below shows the captive breeding programme for the Arabian Oryx.



Suggest:

- the factors which should be considered at Stage 3 – selection of individuals for the captive breeding programme. (3)
- why not all of the 400 bred individuals were released. (2)
- why the 18 oryx were released into enclosures for two years before complete release. (1)

Answers

- health; size; sex; genetic diversity
- carrying capacity; need to maintain programme; unsuitable because of over-familiarity with humans etc.
- allow bonding; identify unsuccessful individuals

If original habitat is degraded or destroyed, captive populations can be thought of as refugees in stationary arks, awaiting the time when their habitat will allow their return. Captive breeding is seen as a support rather than as a replacement for the wild population. Often, it is anticipated that it will be the descendants of the captive animals that will be returned to the wild. Such descendants may be conceived naturally or breeders may turn to techniques such as artificial insemination or embryo transfer (see Factsheet 006).

Zoocheck: Campaigning group who lobby government to strengthen the 1981 UK Zoo Licensing Act. The Act presently emphasises safety of public and zoo workers; Zoocheck want emphasis on animal welfare. Zoocheck would like most zoos to close and for the monies to be used to conserve habitats. They argue that zoos are an expensive waste of money, that most zoos do not contain endangered species and that most endangered species are not represented in breeding programmes.

Case Study: Mauritius Kestrel (*Falco punctatus*)

- Once widely distributed over the island, the kestrel hunts in closed canopy forest, feeding on geckos, large insects and small birds.
- Population decimated by forest destruction for construction timber, fuelwood, food crops and, in the 1950s and 1960s, by the use of organo-chloride pesticides. The spread of non-native plant species, introduced as seeds by other birds, also contributed to the decline of the native forests.
- By 1974 only 6 birds remained, 2 of these were in captivity.
- Cooperation of Mauritius government, Jersey Wildlife Preservation Trust, Mauritian Wildlife Foundation and the Peregrine Fund. Captive breeding successfully carried out at Gerald Durrell Endemic Wildlife Sanctuary.
- Eggs taken from wild nests stimulated wild kestrels to lay second clutch. The eggs that were removed were hatched in incubators and hand reared.
- Some young kestrels were returned to the wild nest and adult birds reared them.
- Others were placed in artificial nest boxes and fed by humans until they were old enough to hunt and avoid predators. This allowed the breeders to exploit new, safe areas of forest.
- Over 400 kestrels have now been bred and released and the wild-population now exceeds 800.
- Ironically, in 1994, a Mauritian kestrel ate a newly hatched chick of a recently reintroduced pair of Mauritian pink pigeons, the world's rarest pigeon.
- The Mauritian kestrel is listed in Appendix 1 of CITES. Mauritian Kestrels can be seen at the Zoological gardens, Upton-By-Chester, Durrell Wildlife Preservation Trust, Jersey and Paignton Zoo.
- Websites: www.mauritian-wildlife.org and www.maurinet.com

Plant conservation

- Plant species are very often closely adapted to soil conditions, insect populations etc so in-situ conservation is preferred. However, in many ways, captive breeding of plants is easier than animals because not all of a plant has to be conserved – individual cells, tissue cultures and seeds can all be used to maintain a species for decades.
- Botanic gardens** are the most important type of institution involved in ex-situ plant conservation. There is, however, an imbalance in global coverage; over half of the 900 Botanic gardens are in Europe and correcting this imbalance is one of the aims of Botanic Gardens Conservation International (BGCI).
- The International Board for Plant Genetic Resources (IBPGR) is a leading force in the establishment of **Field gene banks**, areas of land in which collections of growing plants have been assembled. Field gene banks have now been established for most important temperate and tropical crops and trees.
- Since seeds are small and so take up little space, **seed banks** are the most effective method of ex-situ conservation for sexually reproducing plants whose seeds are suitable for long-term storage. However, an estimated 50,000 species produce seeds that cannot tolerate the low temperatures or dehydration that is involved. One approach with these species is to conserve **germplasm** by culturing and storing tissue at temperatures of -3°C to -12°C in laboratories. Theoretically such **cryogenic** techniques could be used to store such material indefinitely.
- As with animals, the ultimate goal of ex-situ plant conservation is reintroduction but so far relatively little research has been done on the survival prospects of reintroduced plant species, especially that which has been kept as seed or germplasm for years beforehand.

Useful sources of information

- Captive species breeding group of World Conservation Union (IUCN) www.cbsg.org Under "Reports" you can download summaries of management action plans for species and habitats
- www.iucn.org for news, campaigns and management plans for habitats and species such as the black rhino
- World Zoo Conservation strategy
- International Zoo News www.zoonews.ws Lots of interesting articles
- Reintroduction of Californian Condors www.sandiegozoo.org
- Leader-Williams N et al (1990) Illegal exploitation of black rhinoceros and elephant populations. J. Appl. Ecol 27:1055-1087

Acknowledgements

This Factsheet was written and researched by Kevin Byrne.
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