Ensuring animal health in a zoo

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Clinic of Zoo Animals, Exotic Pets and Wildlife

Zoo Animal Health Approach

The approaches to zoo animal health

proactive

collection plan

collection design

enclosure design

husbandry
nutrition
training

population management

quarantine
entry exam
vaccination

hygiene protocol

pest control

predator control

strategy
communication

Collection plan - example

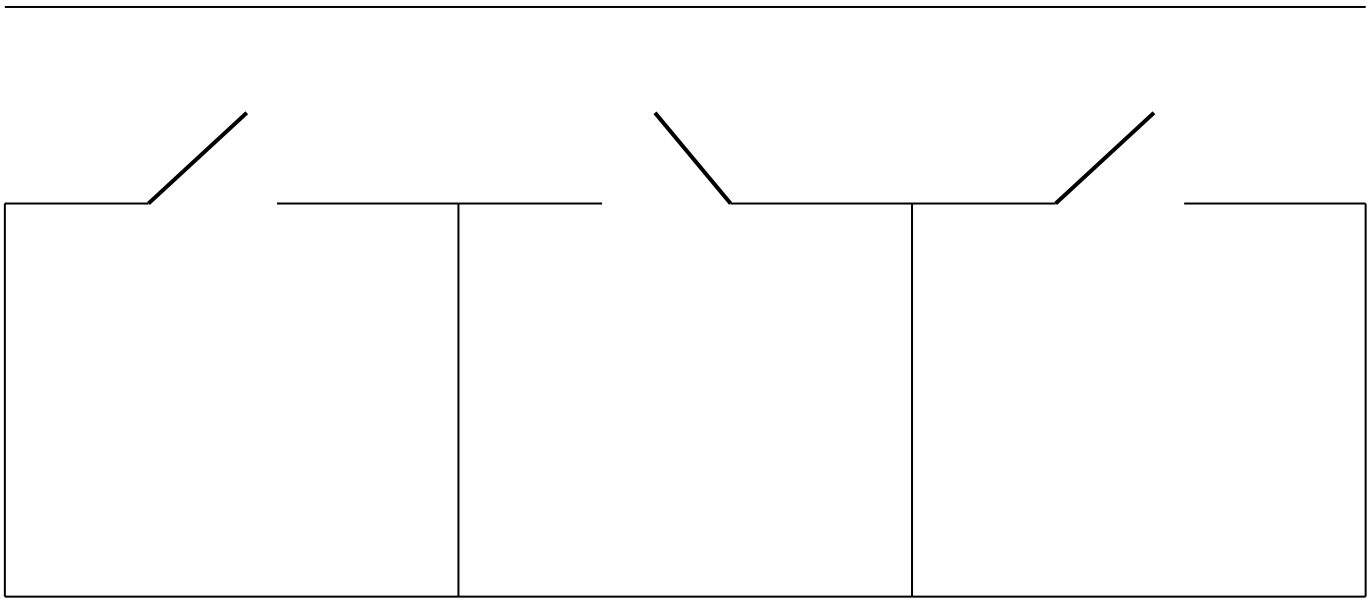
Ovine gammaherpresvirus 2

Alcephaline gammaherpresvirus 1

malignant catarrhal fever

Collection design - example

Enclosure design - example



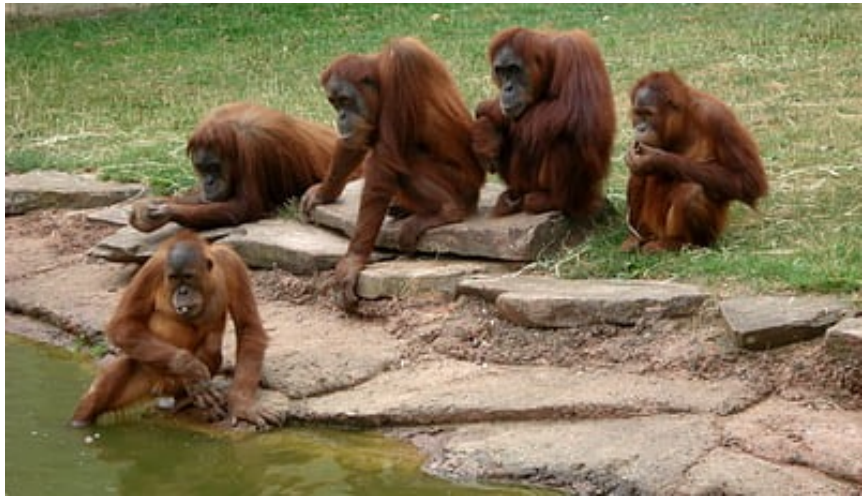
visitors

Enclosure design - example

Enclosure design example

Husbandry - example

Q: Should orangutans be kept in groups or solitary?

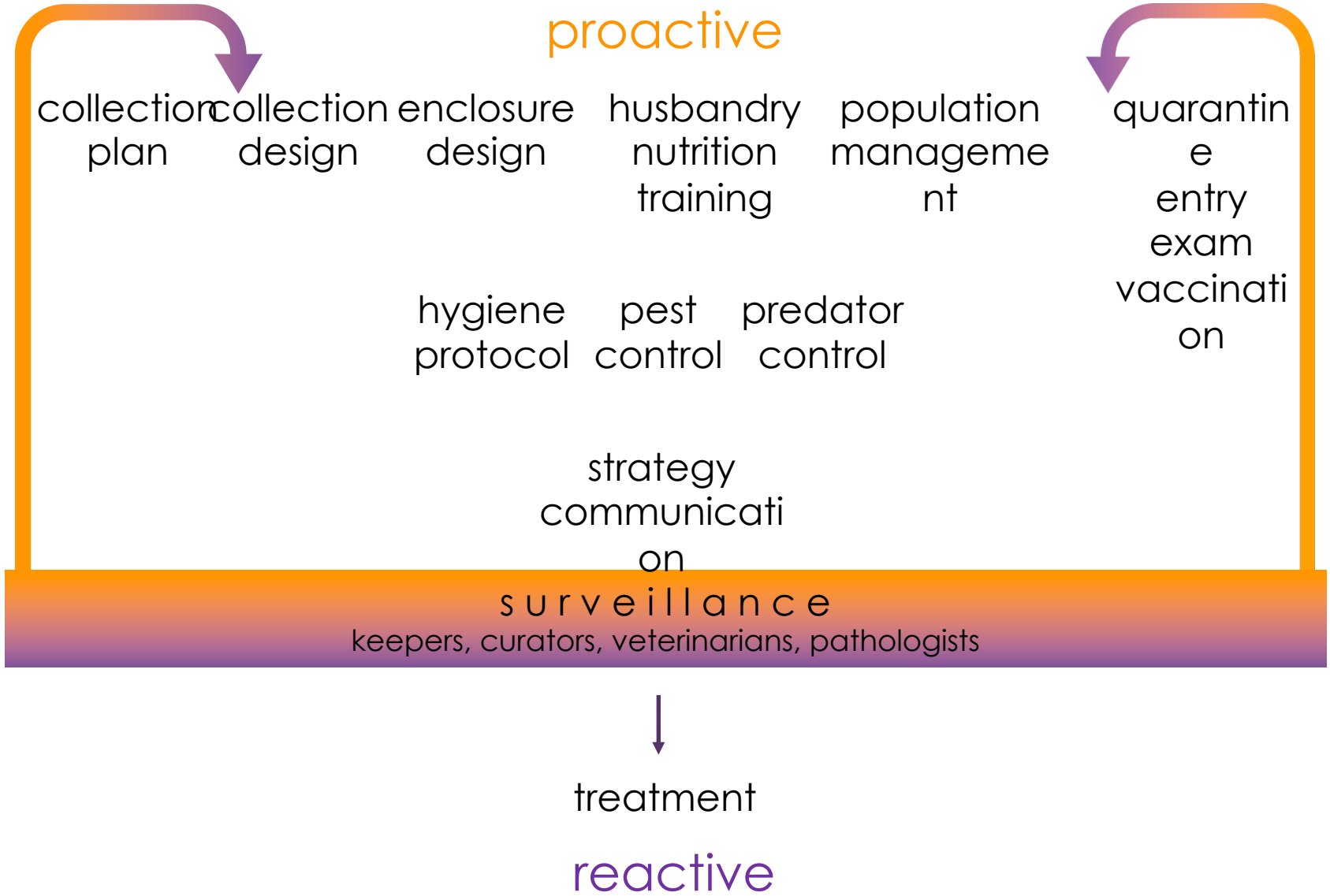


Vaccination routine

Tierart (Revier)	Krankheit (Erreger)	Impfstoff (Hersteller)	Grund-immunisierung	Booster	Bemerkung
Vögel aus Südamerika (Regenwald)	**Pseudotuberkulose** (Yersinia pseudotuberculosis)	Pseudovac (Univ. Utrecht)	2 Impfungen im Abstand von 6 Wo	Jährlich	Impfungen im Herbst
Krallenaffen und Neuweltaffen (Regenwald, Pantanal, Quarantäne, Gibbon)	**Pseudotuberkulose** (Yersinia pseudotuberculosis)	Pseudovac (Univ. Utrecht)	2 Impfungen im Abstand von 6 Wo	Jährlich	Impfungen im Herbst
Marderartige (Fischotter)	**Staupe** (Canines Staupevirus)	Febrivac Dist (IDT) (in CH nicht zugelassen)	3 Impfungen im Abstand von 3 Wo (ab 8 Wo)	Jährlich	
Südamerikanische Nagetiere (Pantanal)	**Pseudotuberkulose** (Yersinia pseudotuberculosis)	Pseudovac (Univ. Utrecht)	2 Impfungen im Abstand von 6 Wo	Jährlich	Impfungen im Herbst
Katzen (Katzen)	**Katzenschnupfen, Panleukopenie** (Felines Calicivirus, Felines Herpesvirus, Felines Parvovirus)	Nobivac TRICAT III (MSD)	Ab 6 Wo, 2 Impfungen im Abstand von 6 Wo	Jährlich oder wenn möglich	Impfung, wenn Narkose aus anderen Gründen gemacht wird
	Staupe (Canines Staupevirus)	Febrivac Dist (IDT)	Ab 6 Wo, 2-3 Impfungen im Abstand von 3 Wo		
Wölfe (Katzen)	**Staupe, HCC, Zwingerhusten, Parvovirose, Leptospirose** (Canines Staupevirus Canines Adenovirus, Canines Parvovirus, Canines Parainfluenzavirus, Leptospira)	Nobivac DHPPi und Nobivac LEPTO 6 (MSD)	ab 8 Wo 2 Impfungen im Abstand von 3-4 Wo	Jährlich oder wenn möglich	Impfung, wenn Narkose aus anderen Gründen gemacht wird
	Parvovirose (Canines Parvovirus)	Nobivac PARVO (MSD)	mit 6 Wo		
Elefanten (Elefanten)	**Tetanus** (Cl. Tetani)	Equilis TE (MSD)	2 Impfungen im Abstand von 4-8 Wo	Alle 2 Jahre	Impfung nach Absetzen
Tapire (Pantanal)	**Tetanus** (Cl. Tetani)	Equilis TE (MSD)	2 Impfungen im Abstand von 4-8 Wo	Alle 2 Jahre	Impfung nach Absetzen
Equiden (Zoolino, Huftiere)	**Tetanus** (Cl. Tetani)	Equilis TE (MSD)	2 Impfungen im Abstand von 4-8 Wo	Alle 2 Jahre	Impfung nach Absetzen
	Equine Influenza (Equines Influenzavirus)	Duvaxyn IE Plus (Zoetis)	3 Impfungen im Abstand von 4-6 Wo und 6 Monaten	Jährlich	Impfung im Frühjahr, bei Absetzen
	Atemwegserkr., Aborte (Equines Herpesvirus 1, 4)	Duvaxyn EHV 1,4 (Zoetis)	2 Impfungen im Abstand von 4-6 Wo	Halbjährlich, trächtige Tiere	Impfung bei Absetzen
Kameliden (Huftiere)	**Tetanus** (Cl. Tetani)	Equilis TE (MSD)	2 Impfungen im Abstand von 4-8 Wo	Alle 2 Jahre	Impfung nach Absetzen
Klippschliefer (Semien)	**Pseudotuberkulose** (Yersinia pseudotuberculosis)	Pseudovac (Univ. Utrecht)	2 Impfungen im Abstand von 6 Wo	Jährlich	Impfungen im Herbst

Hygiene protocol - examples

The approaches to zoo animal health



Parasitological examination and treatment routine

Kotparasitologische Routineuntersuchungen

Die jährlichen kotparasitologischen Untersuchungen und Behandlungen erfolgen gemäss nachfolgendem Plan.

Revier Tierart	**Jan.**	**Feb.**	**März**	**April**	**Mai**	**Juni**	**Juli**	**Aug.**	**Sep.**	**Okt.**	**Nov.**	**Dez.**
Elefantenhaus Säuger & Vögel	Kot nativ & SAF	Geflügelentw. (Flubendazol-Pellets)	Huftierentw. (Ivermectin-Pellets)							Geflügelentw. (Ivermectin-Pellets)	Huftierentw. (Fenbendazol-Pellets)	
Gibbon Menschenaffen, andere Primaten, Säuger & Vögel	Kot nativ & SAF; Primaten incl. Bakt	Geflügelentw. (Flubendazol-Pellets)								Geflügelentw. (Ivermectin-Pellets)		
Gorilla Menschenaffen, andere Primaten		Kot nativ & SAF; Primaten incl. Bakt										
Semien Primaten, Säuger, Vögel, Reptilien		Geflügelentw. (Flubendazol-Pellets)	Kot nativ & SAF; Primaten incl. Bakt							Geflügelentw. (Ivermectin-Pellets)		
Huftiere Säuger & Vögel		Geflügelentw. (Flubendazol-Pellets)	Huftierentw. (Ivermectin-Pellets)	Kot nativ & SAF alle				Kot nativ nur Equiden		Geflügelentw. (Ivermectin-Pellets)	Huftierentw. (Fenbendazol - Pellets)	Kot nativ nur Equiden
Fischotter Säuger & Vögel		Geflügelentw. (Flubendazol-Pellets)	Huftierentw. (Ivermectin-Pellets)		Kot nativ & SAF					Geflügelentw. (Ivermectin-Pellets)	Huftierentw. (Fenbendazol - Pellets)	
Vogelwiese Vögel		Geflügelentw. (Flubendazol-Pellets)				Kot nativ & SAF				Geflügelentw. (Ivermectin-Pellets)		
Katzen Säuger & Vögel		Geflügelentw. (Flubendazol-Pellets)					Kot nativ & SAF			Geflügelentw. (Ivermectin-Pellets)		
Zoolino Säuger (Ponys) & Vögel		Geflügelentw. (Flubendazol-Pellets)	Huftierentw. (Ivermectin-Pellets)	Kot nativ Equiden				Kot nativ & SAF		Geflügelentw. (Ivermectin-Pellets)	Huftierentw. (Fenbendazol - Pellets)	Kot nativ Equiden
Regenwald Säuger (Primaten), Vögel		Geflügelentw. (Flubendazol-Pellets)							Kot nativ & SAF; Primaten incl. Bakt	Geflügelentw. (Ivermectin-Pellets)		
Bären Säuger & Vögel		Geflügelentw. (Flubendazol-Pellets)								Kot nativ & SAF Geflügelentw. (Ivermectin-Pellets)		
Pantanal Säuger & Vögel											Kot nativ & SAF	
Quarantäne Säuger & Vögel		Geflügelentw. (Flubendazol-Pellets)	Huftierentw. (Ivermectin-Pellets)							Geflügelentw. (Ivermectin-Pellets)	Huftierentw. (Fenbendazol - Pellets)	Kot nativ & SAF; Primaten incl. Bakt.
Terrarium Reptilien & Amphibien												Kot nativ & SAF
Masoala Säuger (Primaten), Vögel						Kot nativ & SAF; Primaten incl. Bakt						Kot nativ & SAF; Primaten incl. Bakt

Population ecology

Crowding / Density dependence

Mentioned in the veterinary literature on domestics but hardly ever applied to zoo animals

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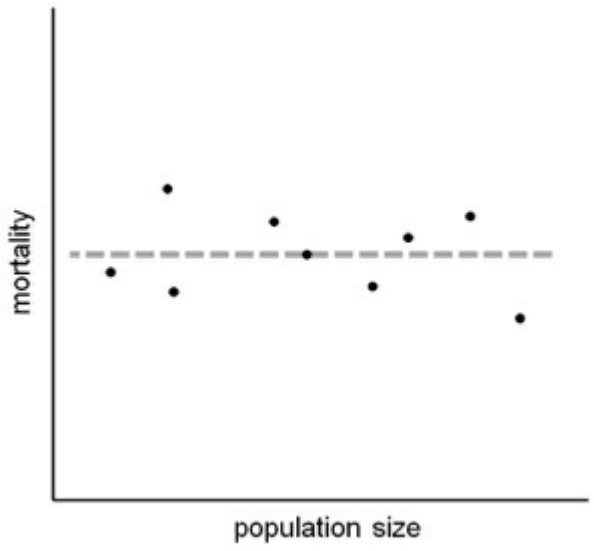
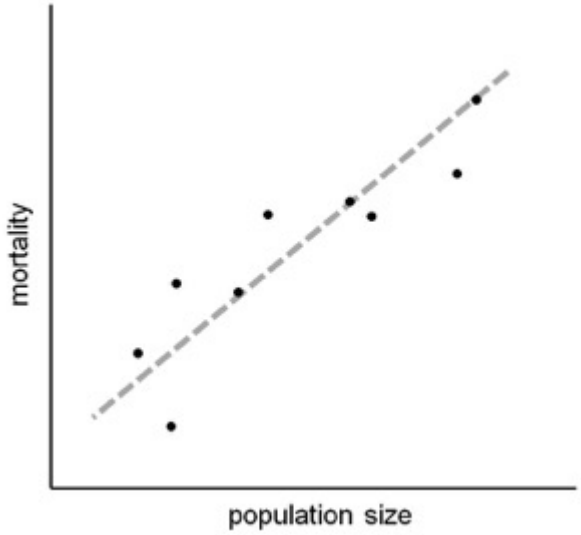
Mentioned in the veterinary literature on domestics but hardly ever applied to zoo animals

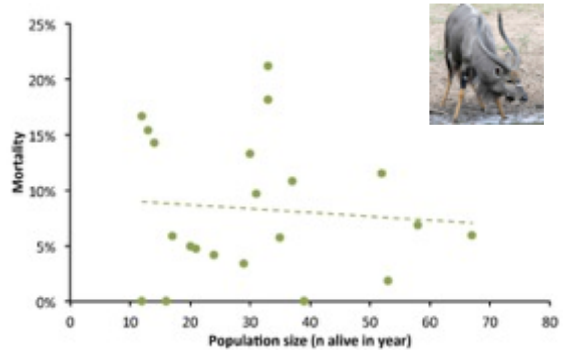
How are density-dependent effects assessed?

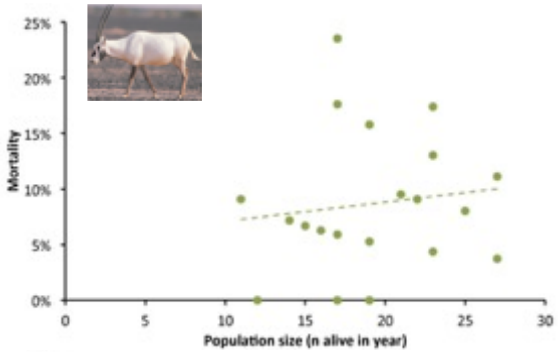


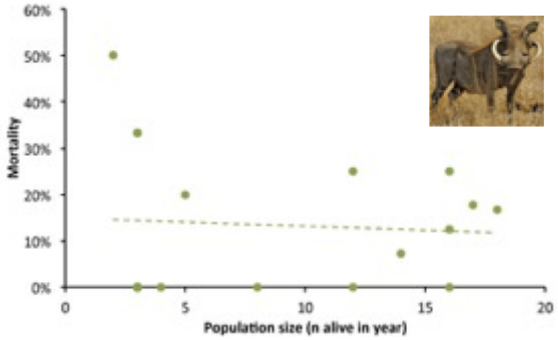


of the same year
of the preceding year

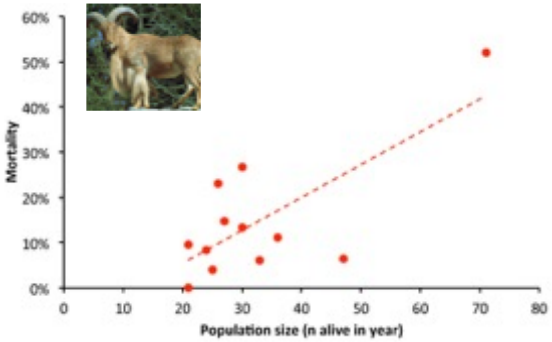
Crowding / Density dependence at a zoo

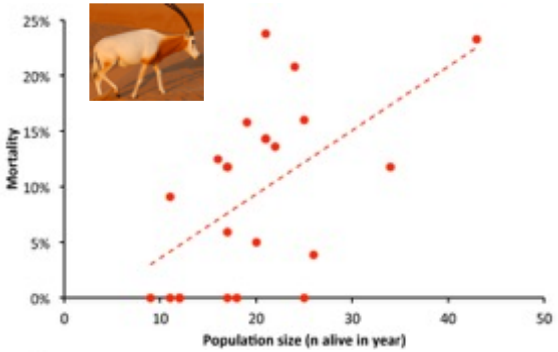


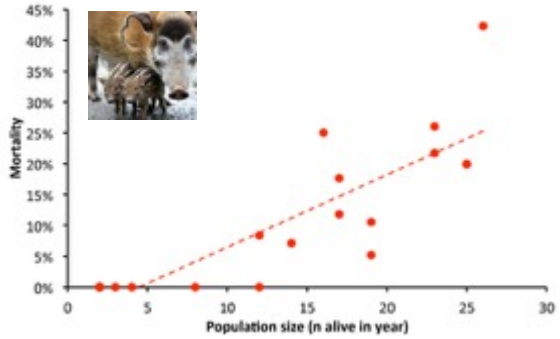




of the same year

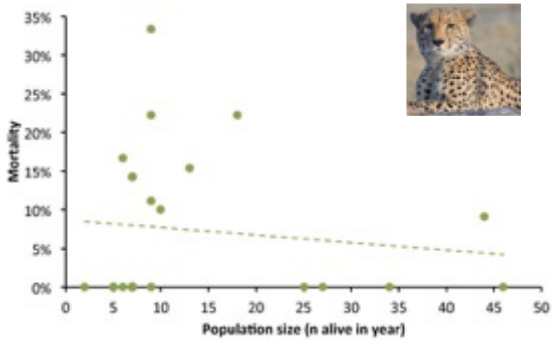


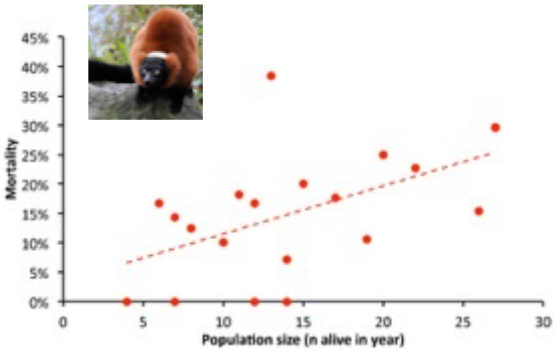


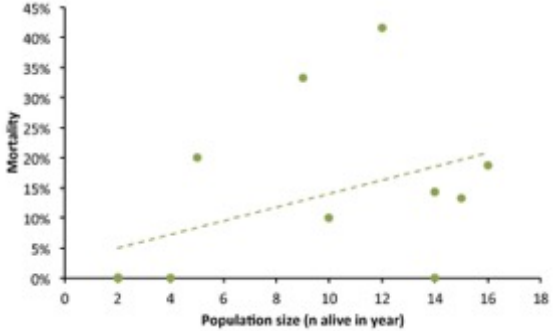


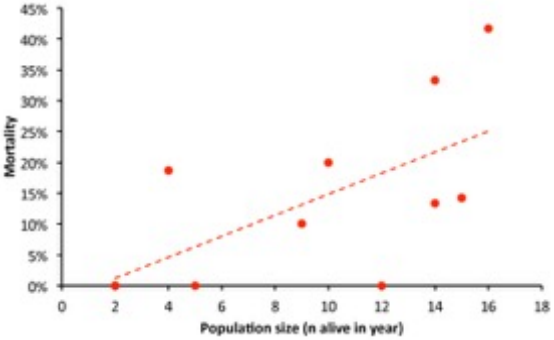
Crowding / Density dependence at a zoo

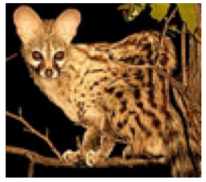
of the preceding year







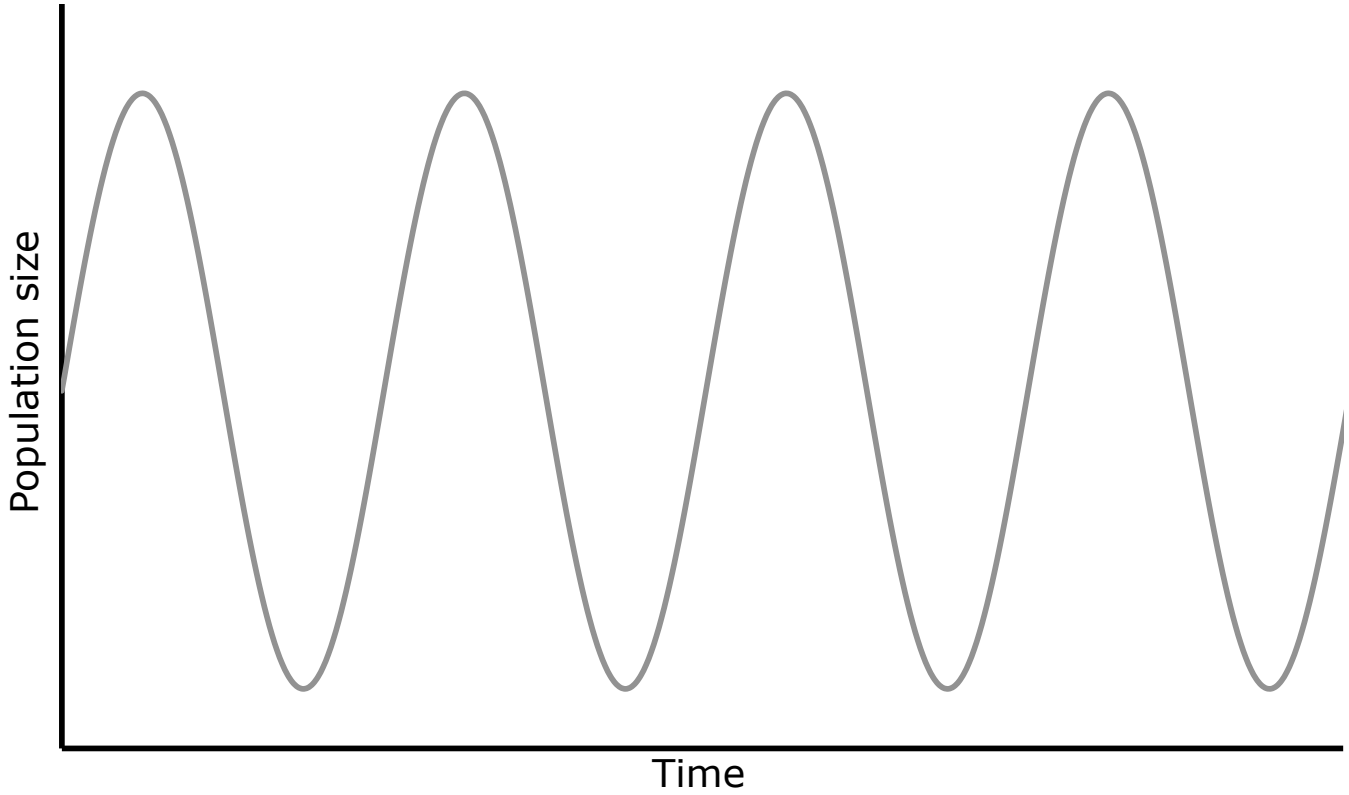




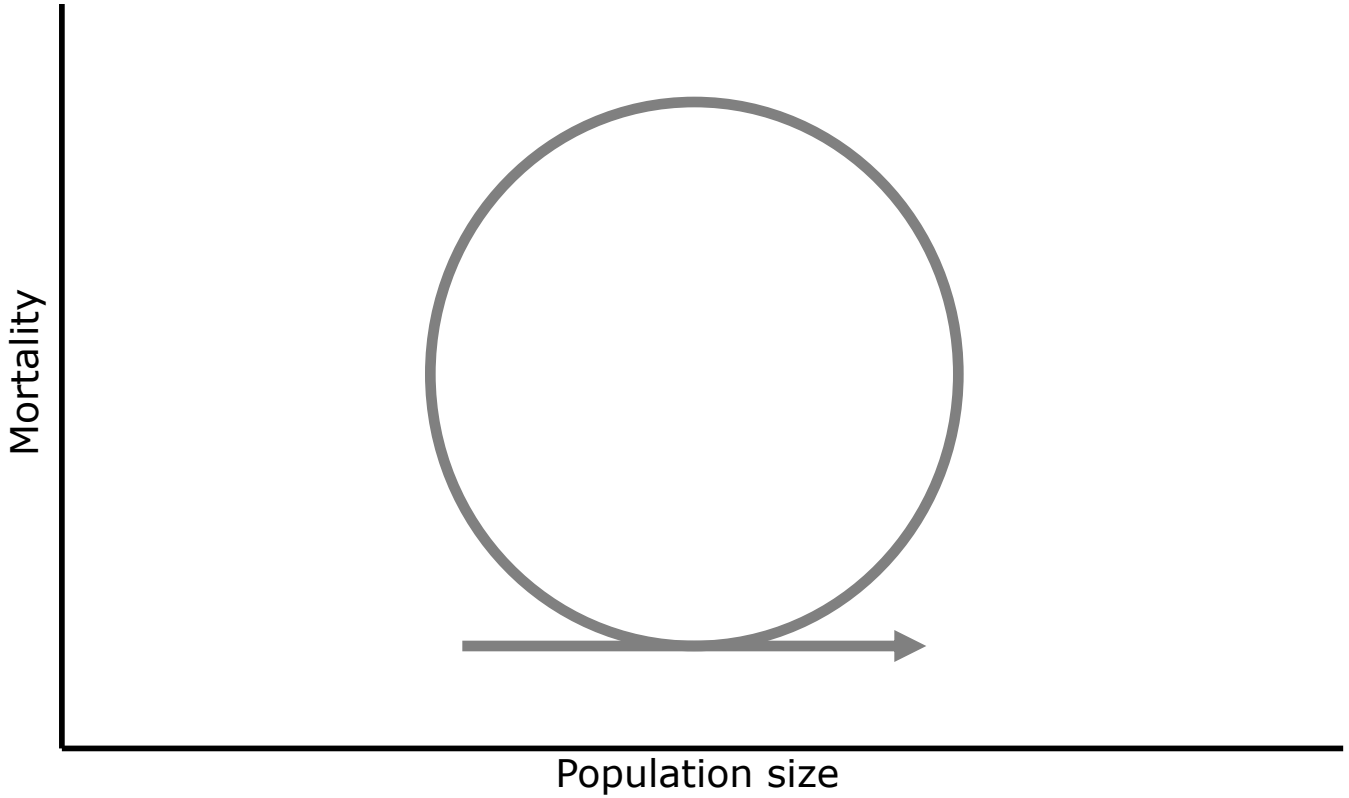
Crowding / Density dependence at a zoo

Species	Overall mortality	Neonate mortality	DD present	Number of species	%
Artiodactyls	7	6	10	24	42
Carnivores	5	5	7	13	54
Primates	2	3	4	4	100
Hyrax	0	0	0	1	0
Total	14	14	21	42	50

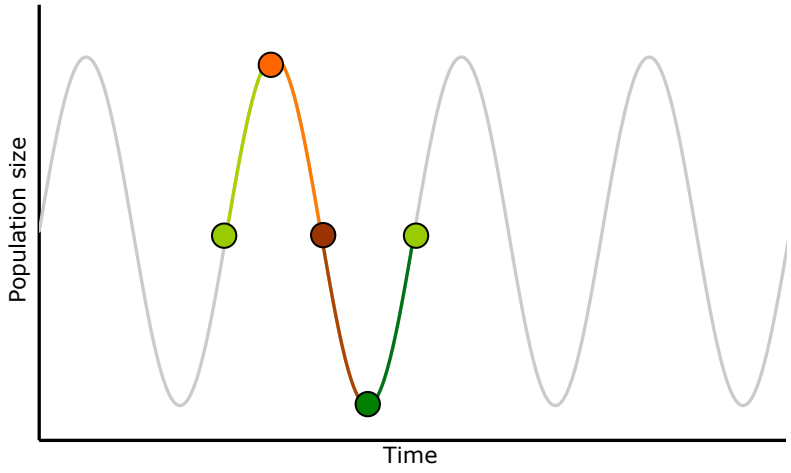
Population ecology

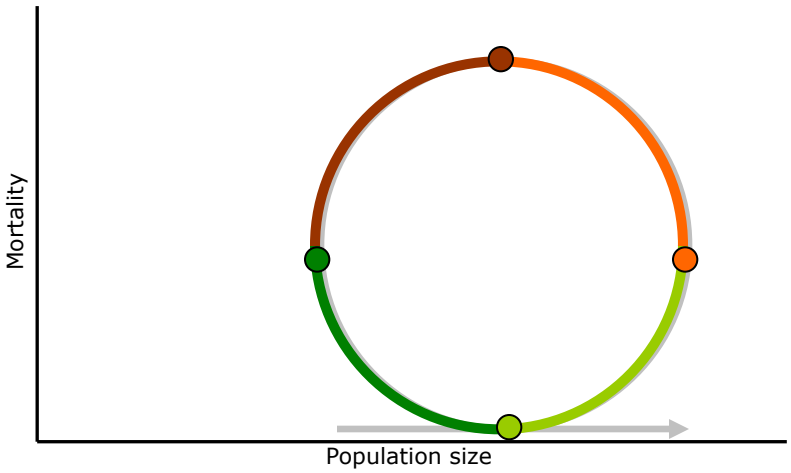


Population ecology

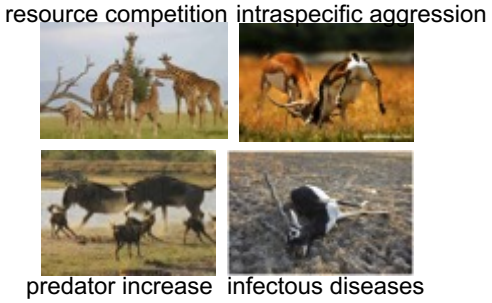


Population ecology

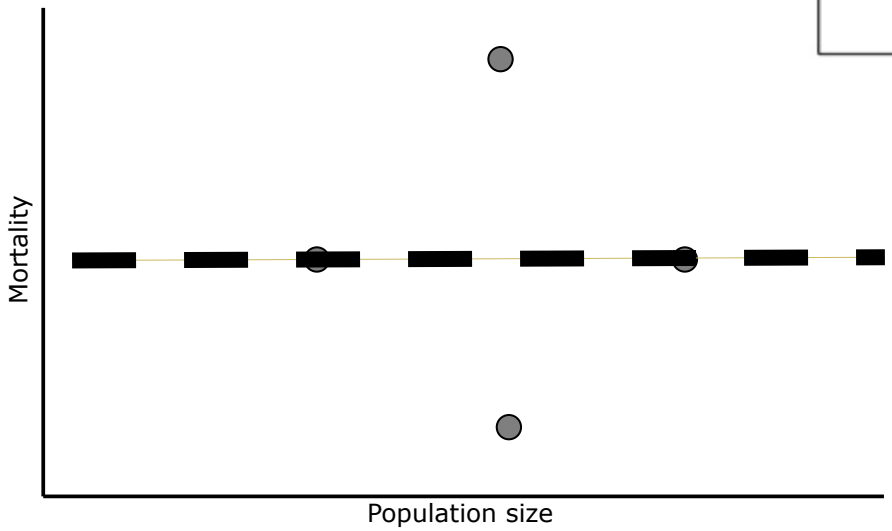


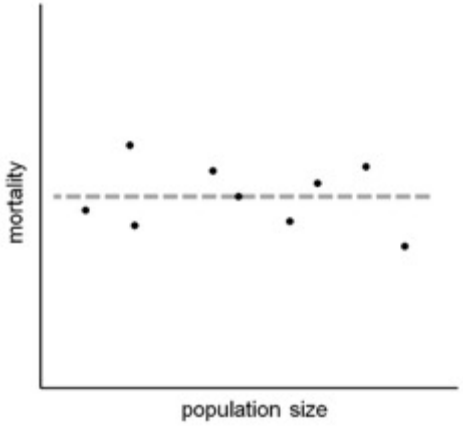


Population growth to the maximum population size
Population decline to the maximum mortality
Mortality decline to the minimum population size
Population growth to the minimum mortality



Population ecology





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DOI:10.1111/izy.12018

A conceptual approach to density-dependent management of zoo animals kept in herds

D. W. H. MÜLLER[1,2], S. HAMMER[3,4], C. HAMMER[3,4], J.-M. HATT[1] & M. CLAUSS[1]

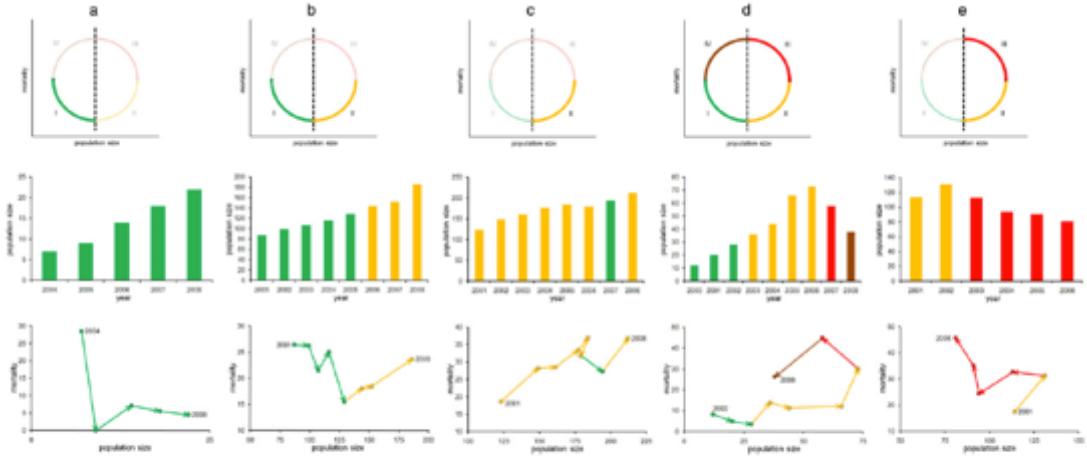
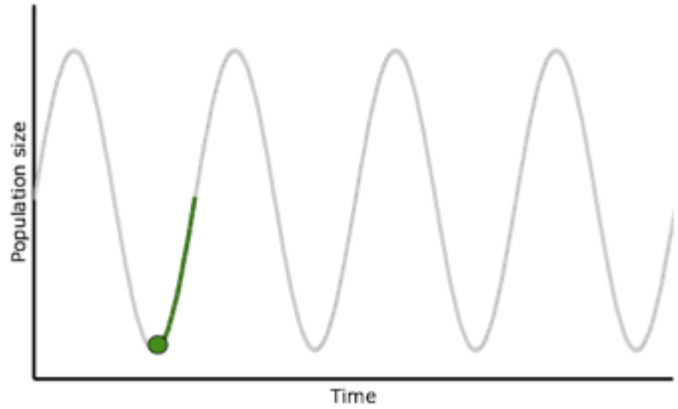
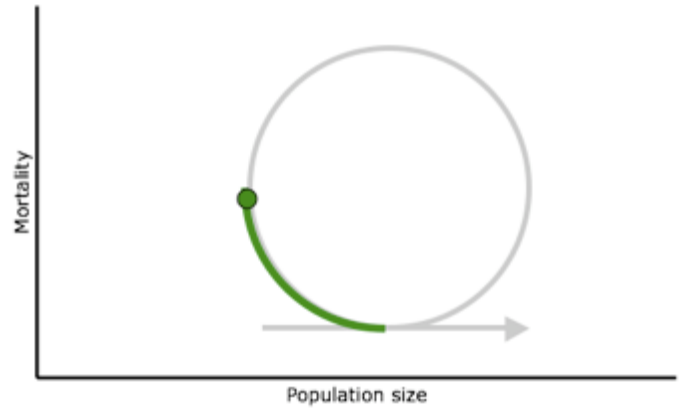
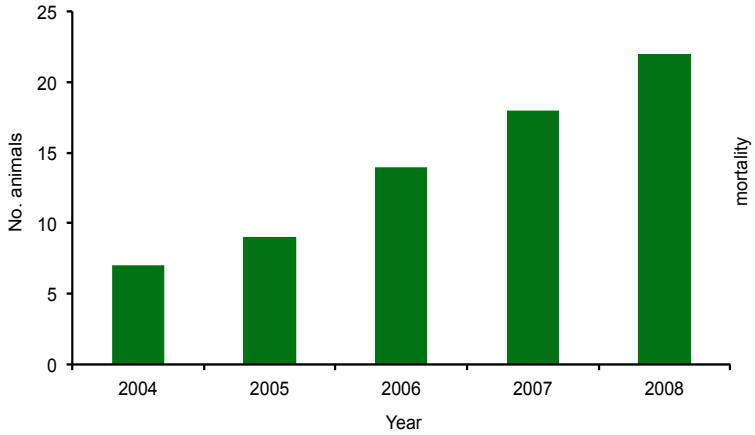


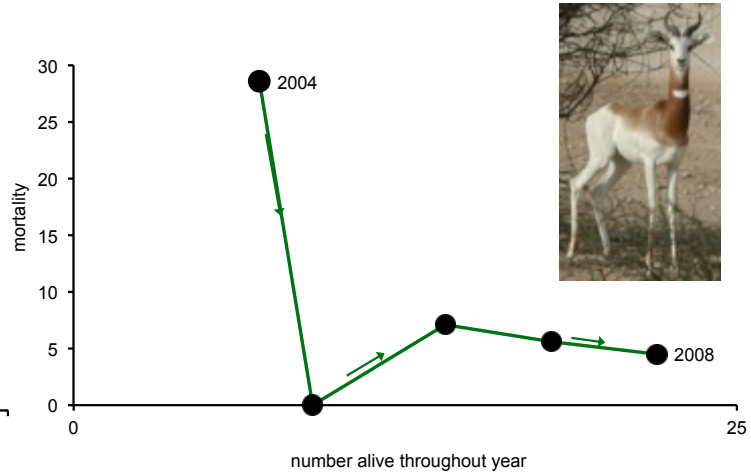
Fig. 4. Observed patterns in the relation between herd size and mortality in herds of gazelles in a closed collection in captivity. Four different phases of this relationship were recognized: I. herd size increases, mortality decreases; II. herd size and mortality increase; III. herd size decreases, still mortality increases; IV. herd size and mortality rate decrease (first row), and observed in varying combinations within the collection's herds (bottom row). The stock number as on 31 December in the respective year is given (middle row). Note that if just the usual annual stock count is used to evaluate the development of the herds of (a) Dama gazelle *Nanger dama ruficollis*, (b) Mountain gazelle *Gazella gazella* and (c) Pelzeln's gazelle *Gazella dorcas pelzelni*, a similar, positive state for all three herds is observed. However, when the plots of mortality vs herd size are considered, the three examples differ in quality, indicating that in some (b,c) mortality is on the rise. The herd development of the (d) Beira antelope *Dorcatragus megalotis* demonstrated a 'full cycle', whereas the development of the (e) Speke's gazelle *Gazella spekei* herd demonstrated a threatening ongoing increase in mortality and decline.

‘Complete success’ – population increase & mortality decrease (*Nanger dama*)

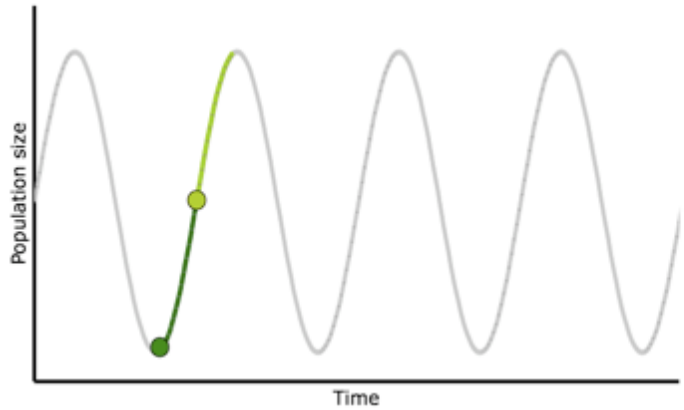


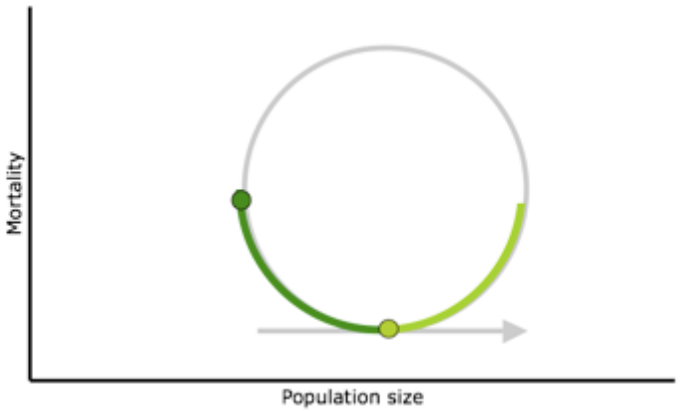


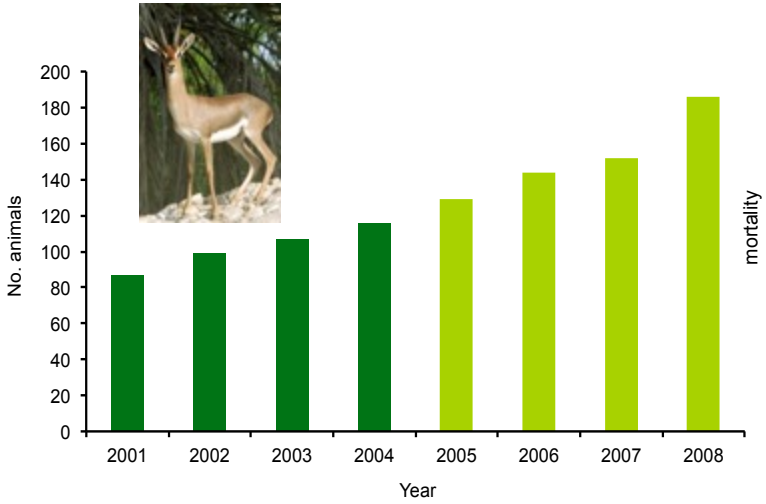


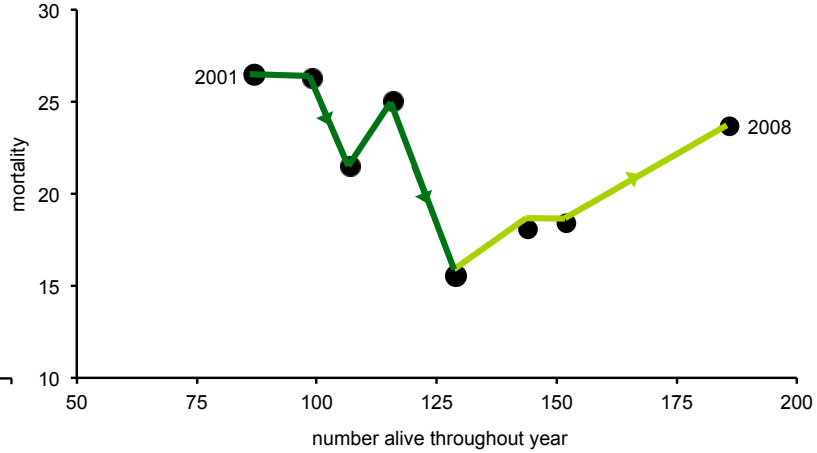


‘Good success’ – population increase & mortality stagnation (*Gazella gazella*)

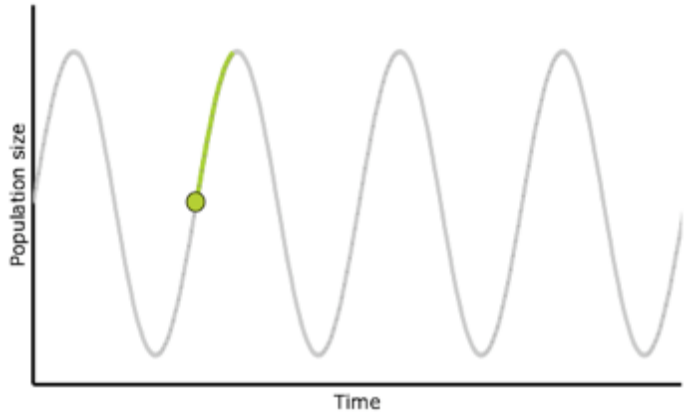


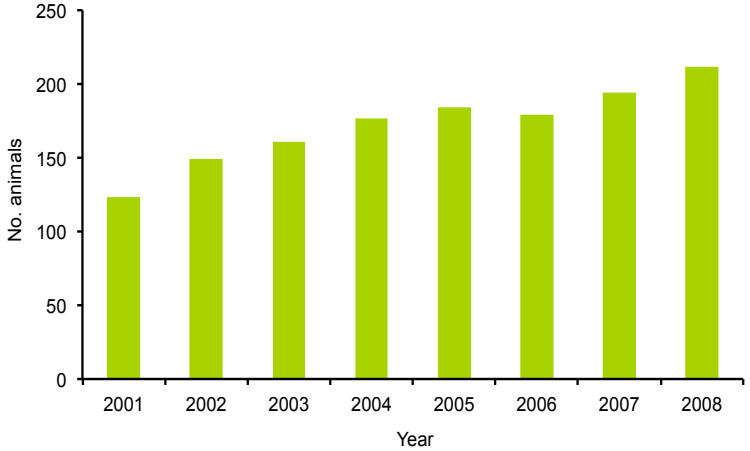


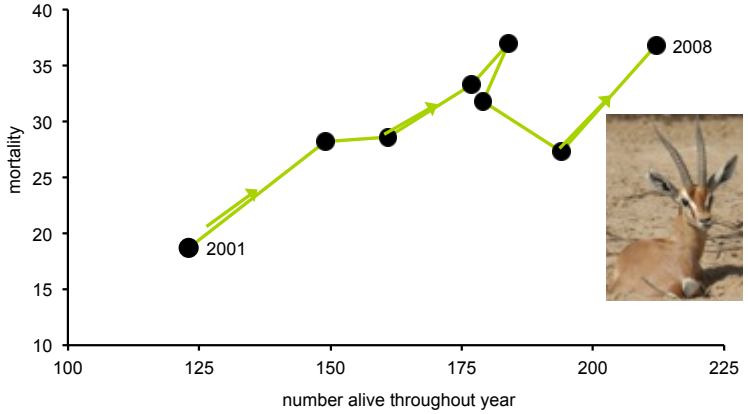




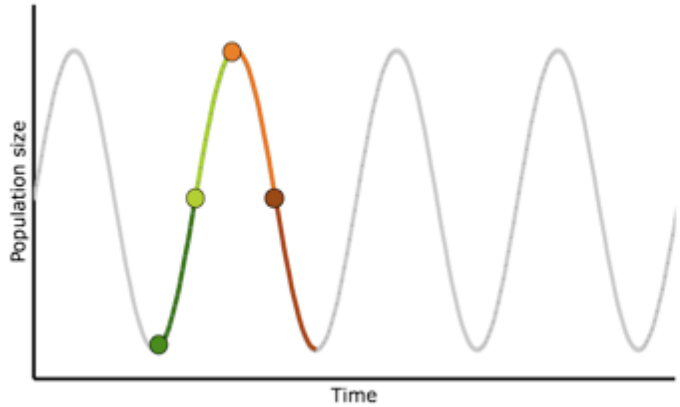
‘Moderate success’ – population increase & mortality increase (*Gazella Dorcas pelzelnii*)

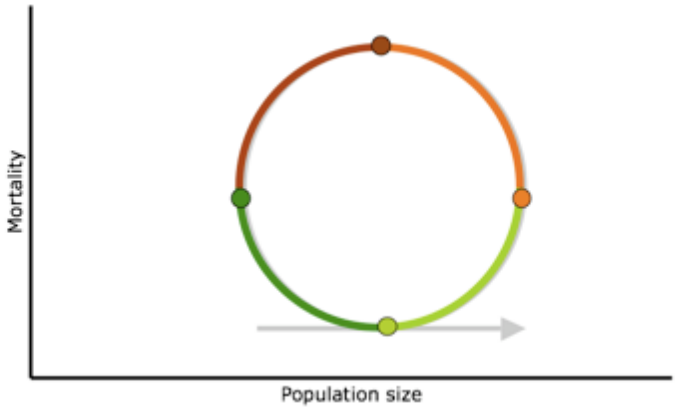


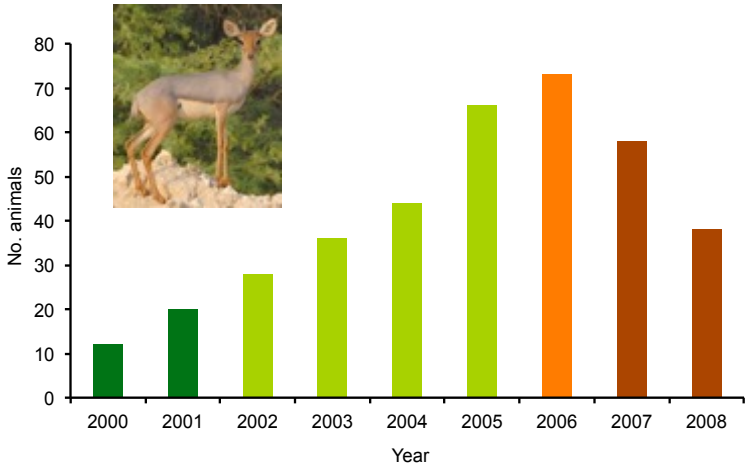


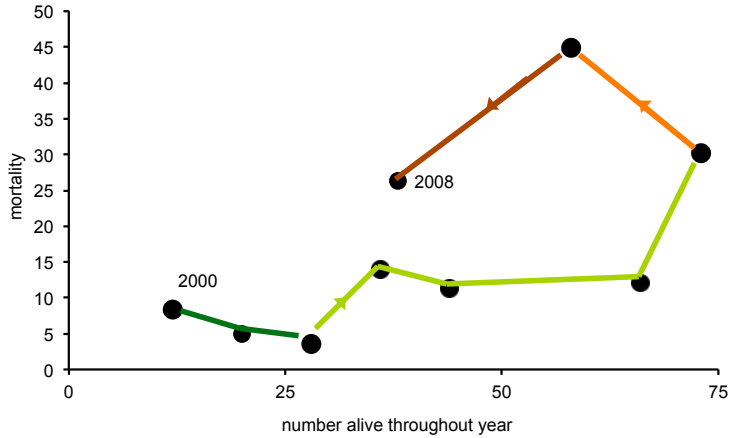


‘Over the top’ – after population peak & mortality decreasing (*Dorcotragus megalotis*)

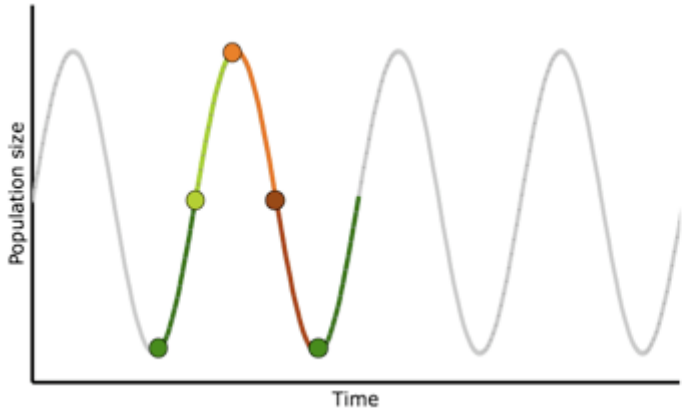


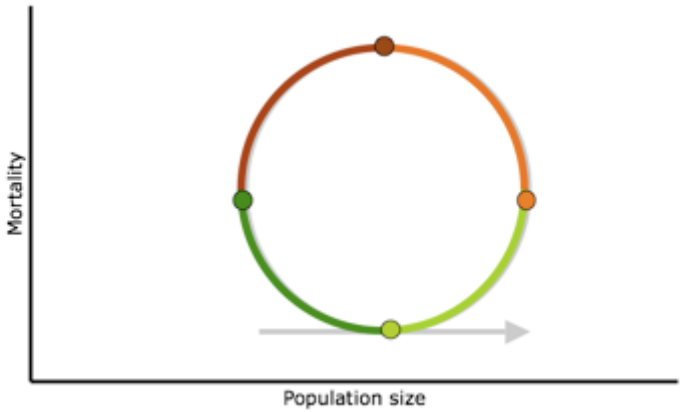


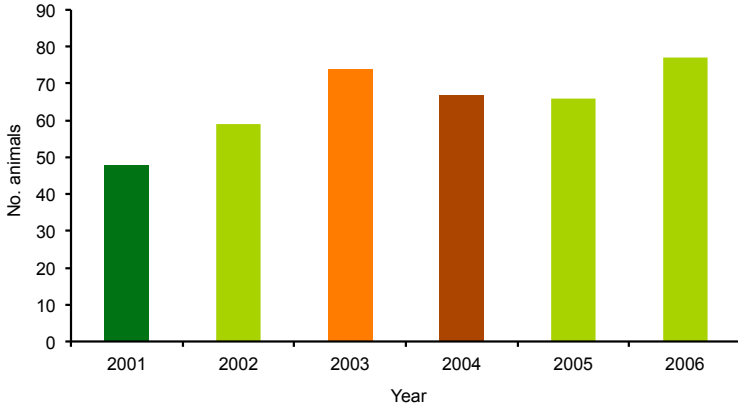


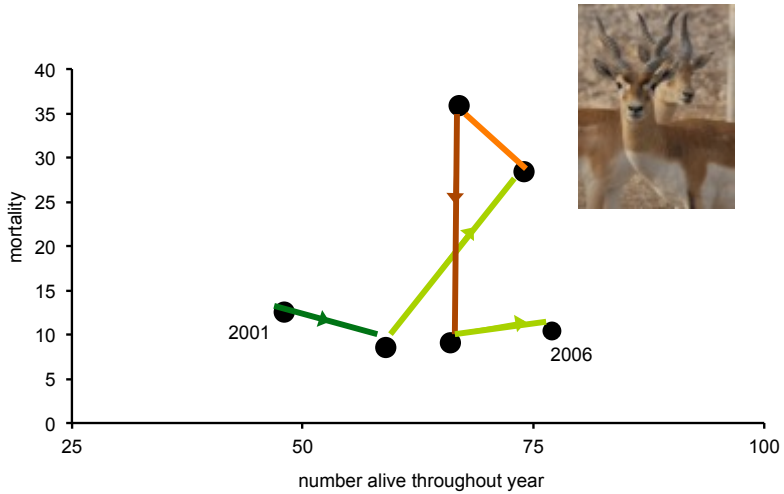


‘Over the top’ – after population peak & mortality decreasing (*Antelope cervicapra*)

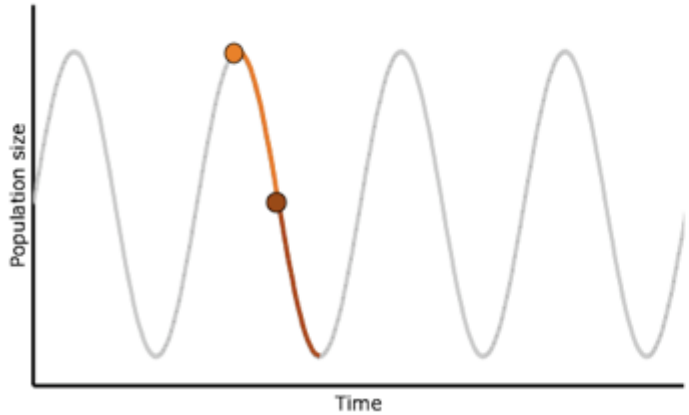


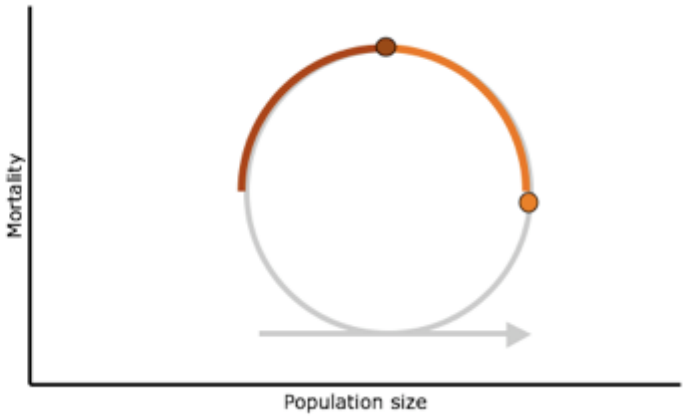


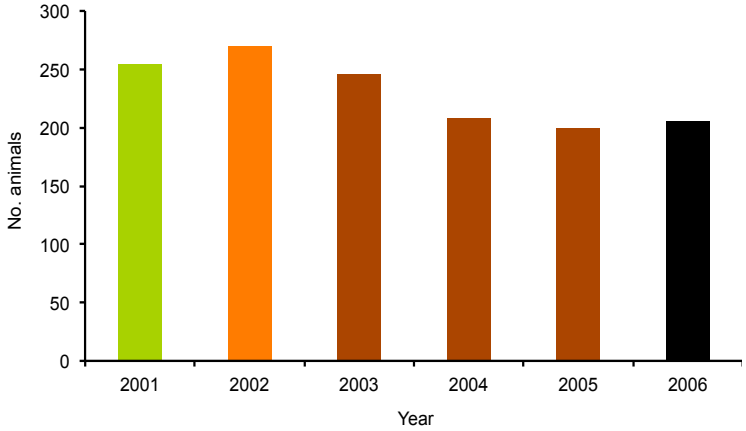


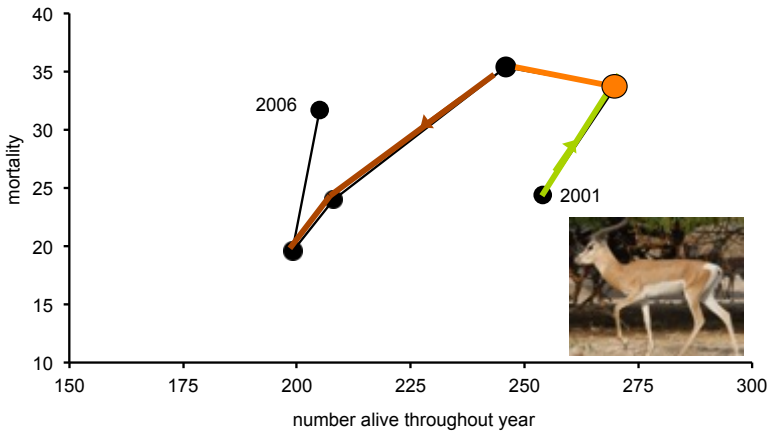


‘Deterioration’ –population decrease & mortality increase/decrease (*Nanger soemmerringii*)

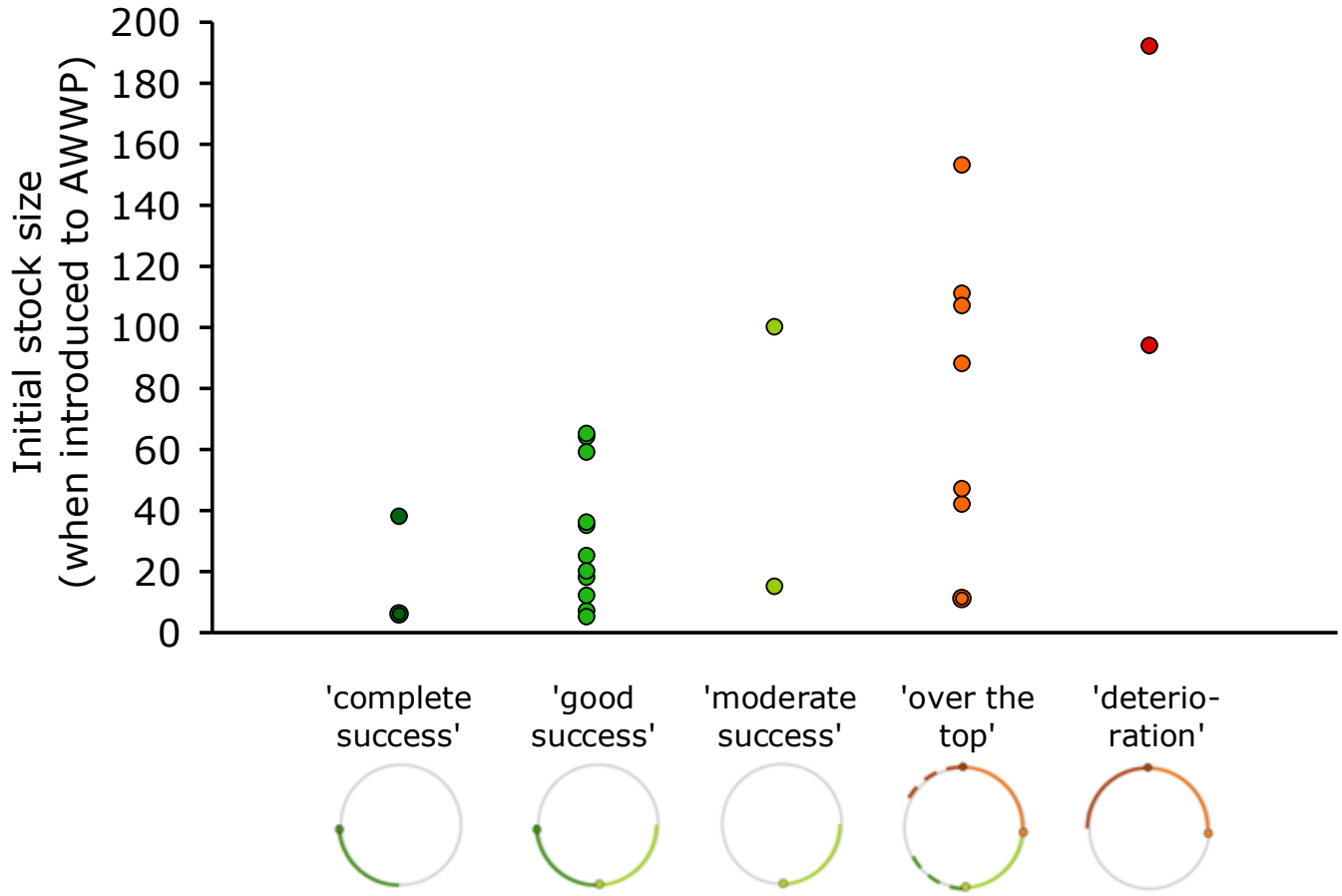




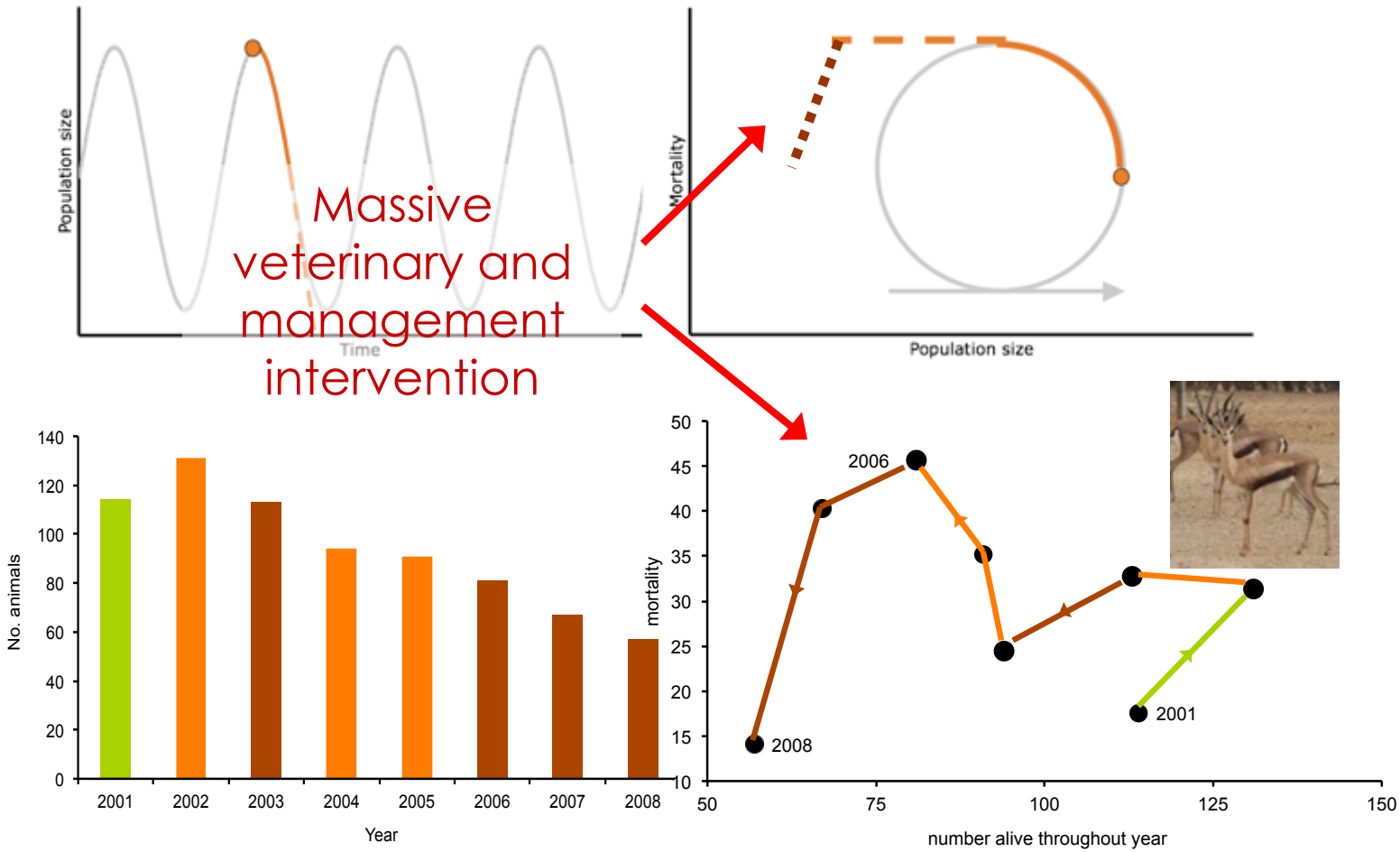




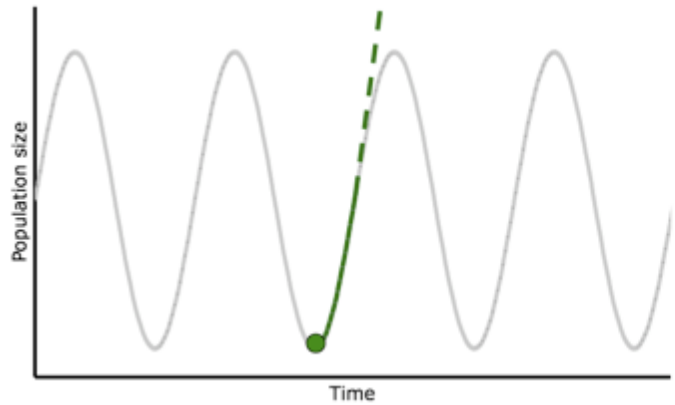
Overstocking right from the start?

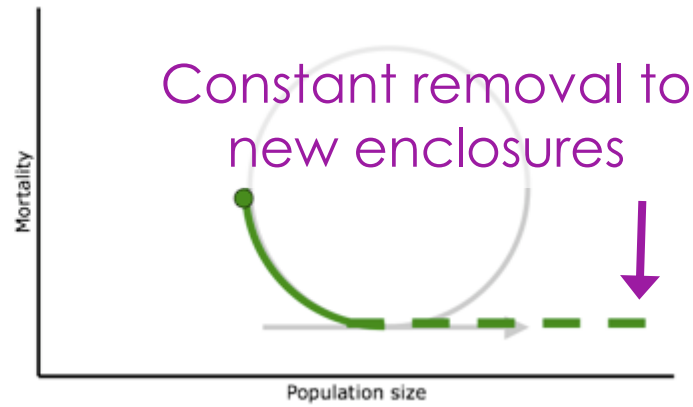


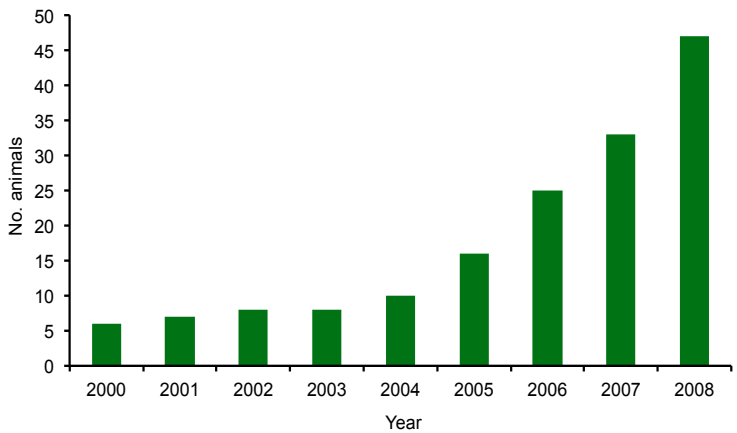
Catastrophe: population decrease without mortality decrease (*Gazella spekeii*)

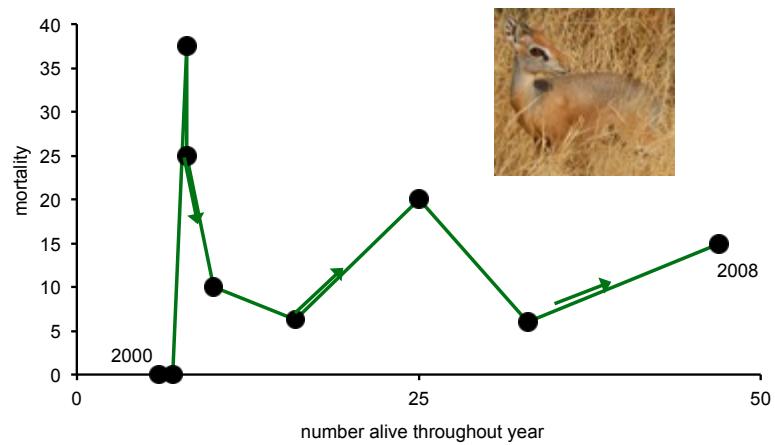


Perfect world: population increase at minimum mortality (*Madoqua saltiana*)



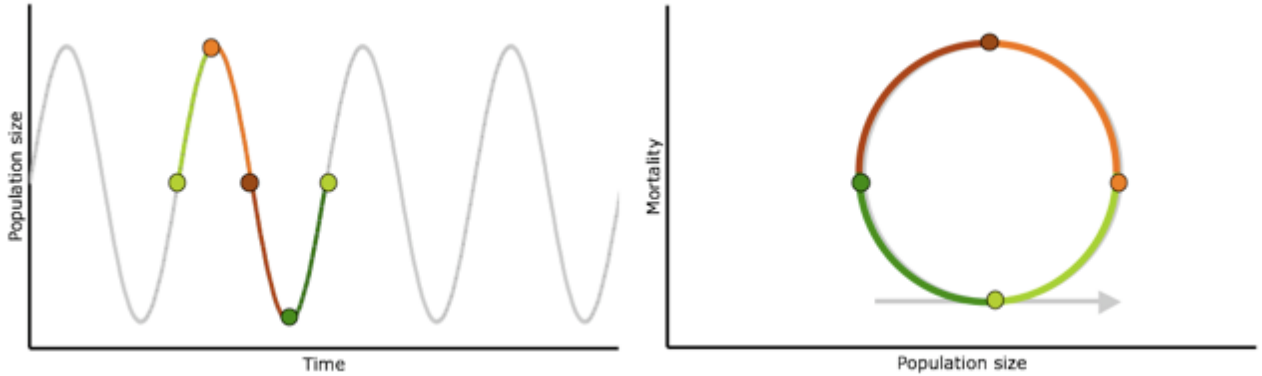






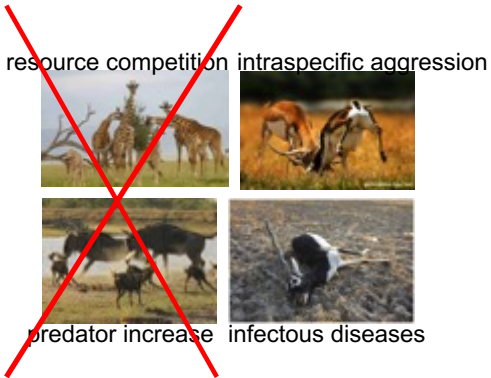
Conclusions

Principal population biology derived from free-ranging populations adequately describes the situation of closed captive situations ...

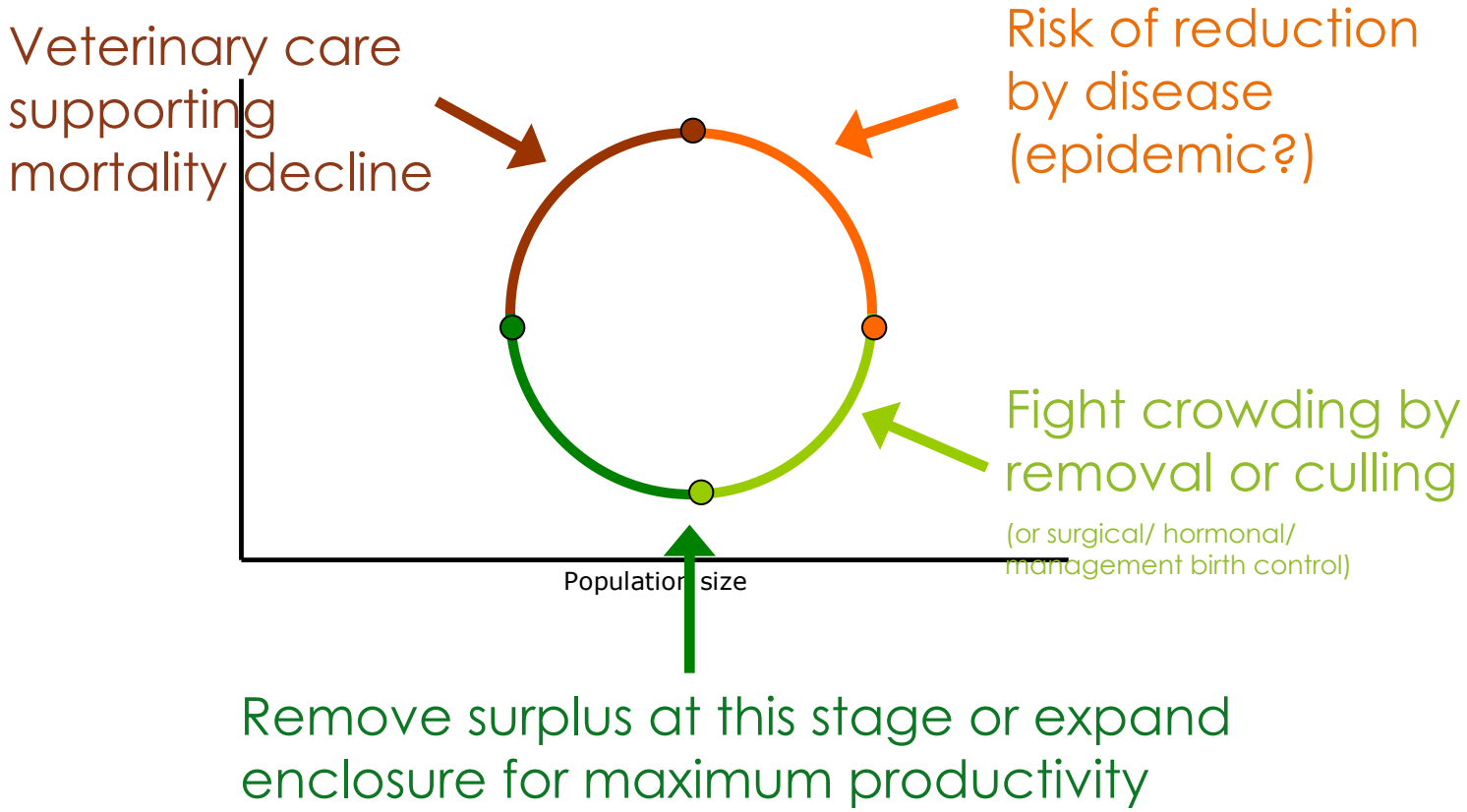


... in the absence of nutritional constraints and predation

=> crowding/social stress and infectious diseases



How to manage captive populations



Thank you for your attention