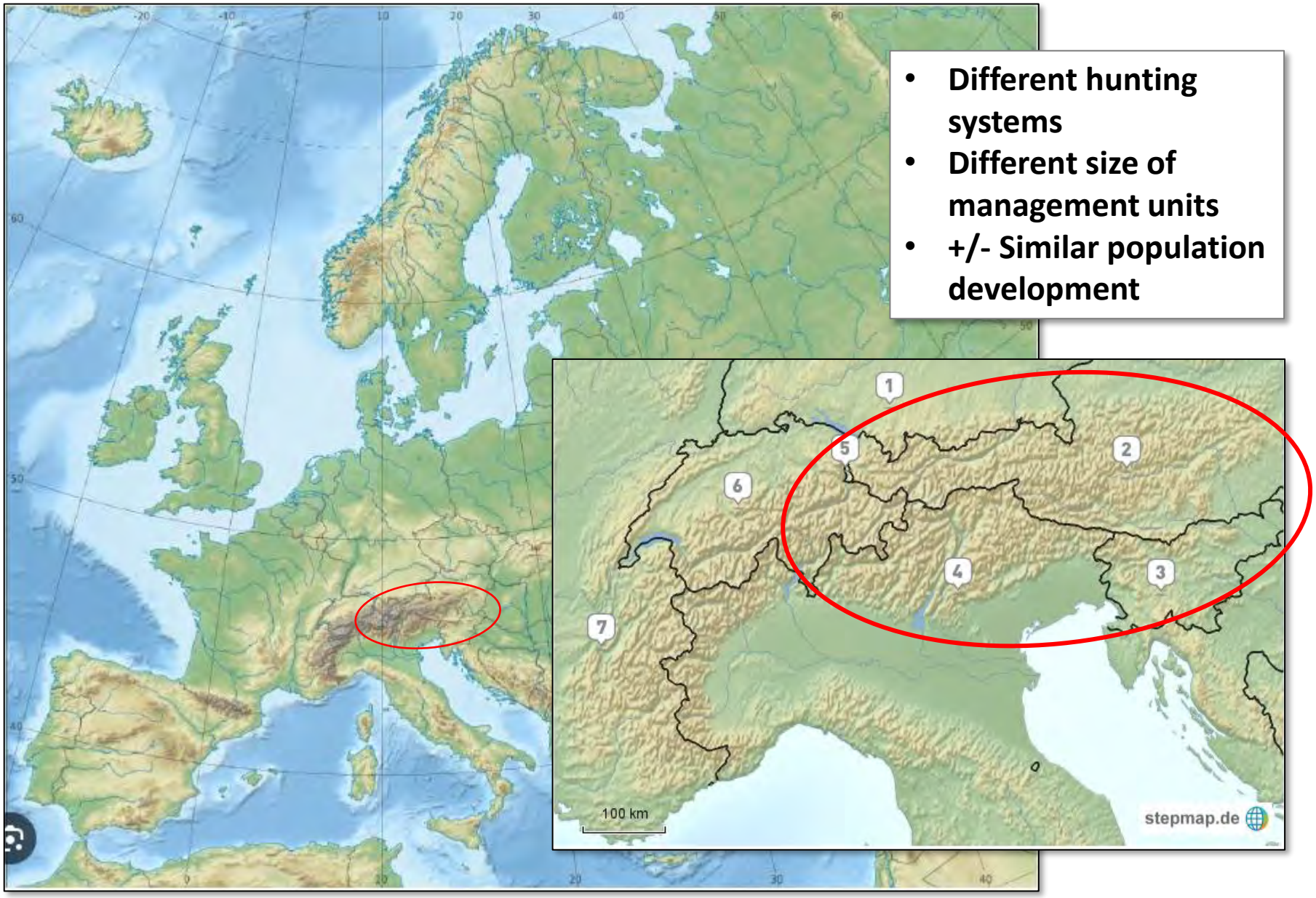
Population dynamics and hunting management of red deer
the perspective shapes the scene

Hubert Zeiler



- Different hunting systems
- Different size of management units
- +/- Similar population development

The perspective shapes the scene

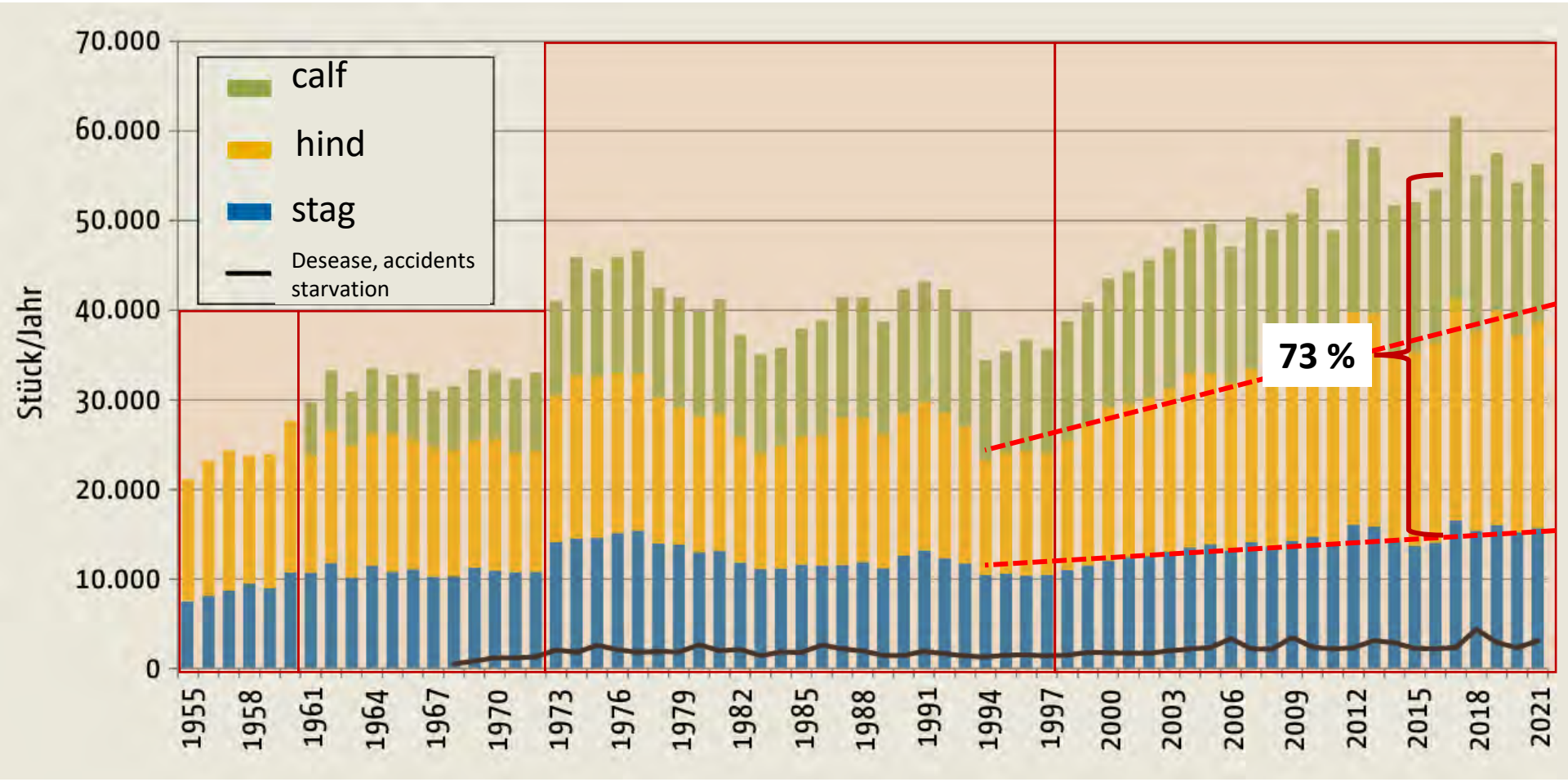
The perspective shapes the scene

Austria

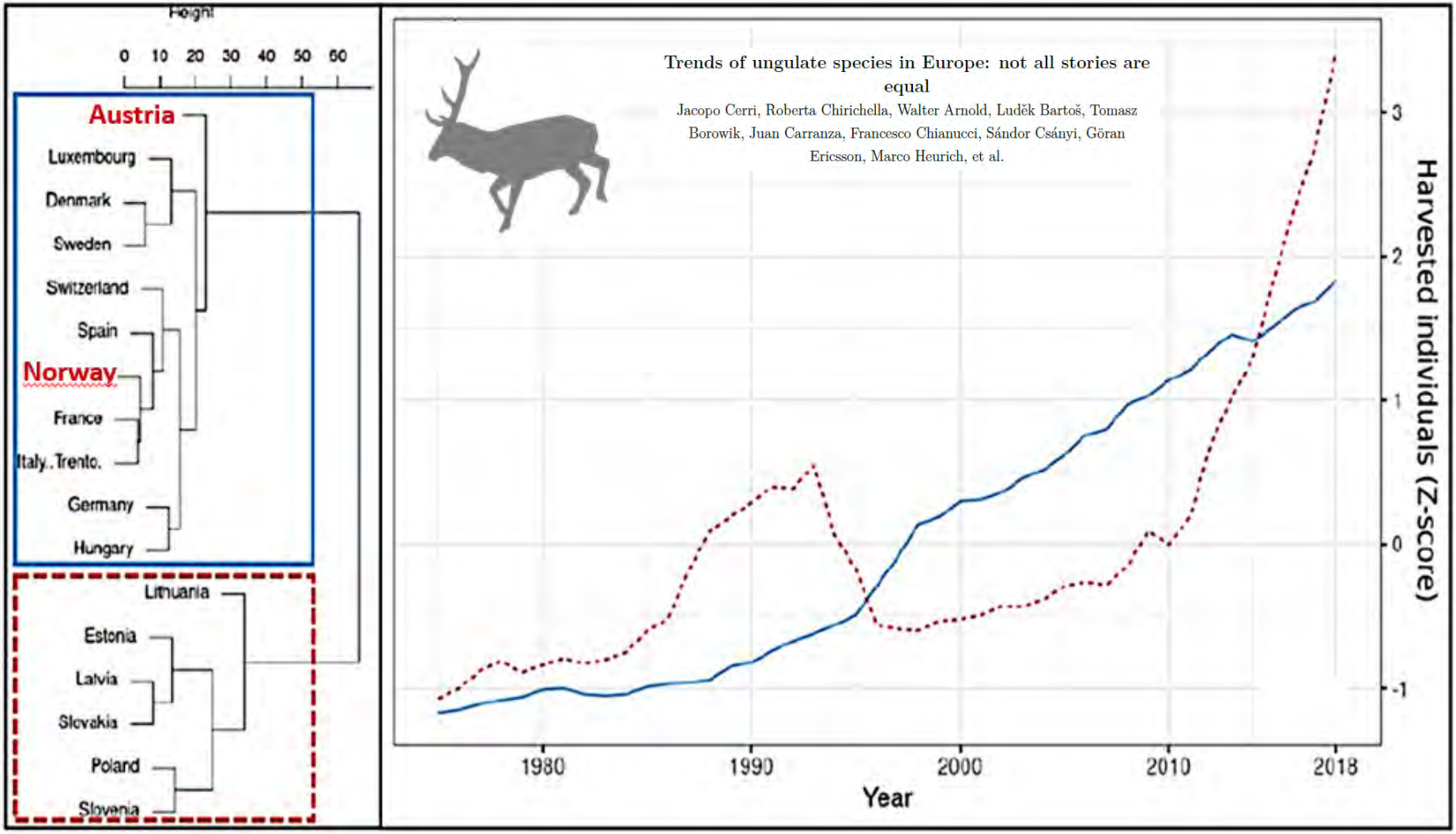
- **Hunting-ground min. area 115 ha**
- **135.000 hunters**
- **480 prof. hunters**

Annual harvest RED DEER Austria (1955 – 2021)

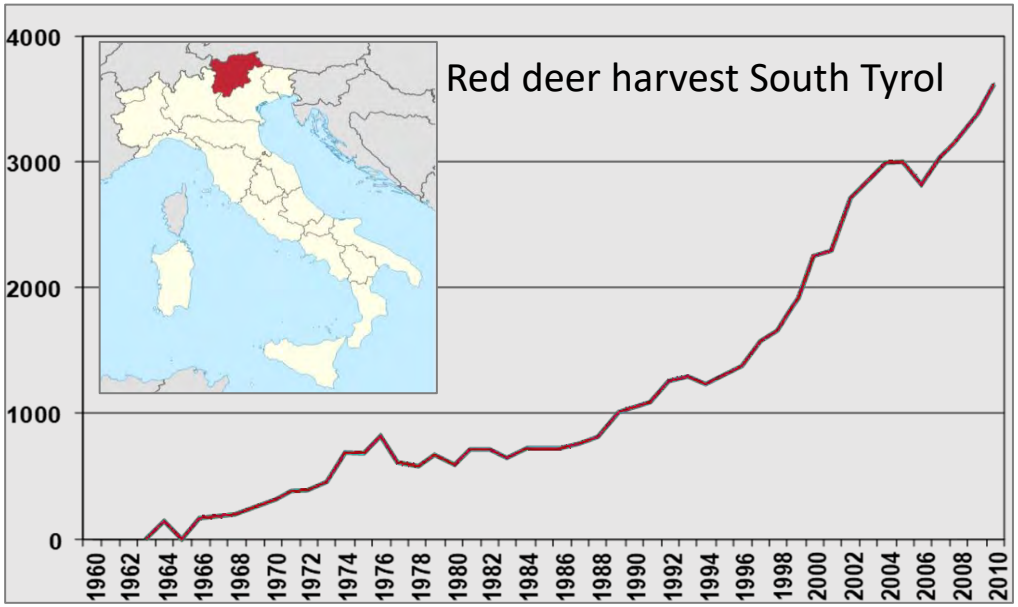
Red deer harvest 2024/25 - Norway 54.216, Austria 57.697



Red deer harvest



Red deer harvest

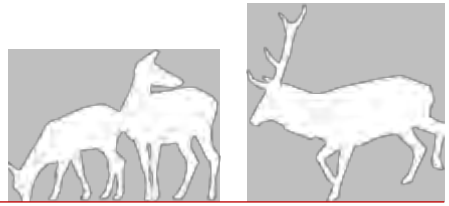


Our most important aim is to controll the red deer population.
The rule for this is: **For one stag you have to shoot a hind and a calf.**

If you hold on this principle you take the same number of males and females.

We hold on this principle very tight – all the same we got more and more red deer.

Food supply



top down

Secundary impact factors are modifying population dynamics.
Sinclair & Krebs (2002)

Wolves, Lynx
Hunters
Traffic
Disturbance
…

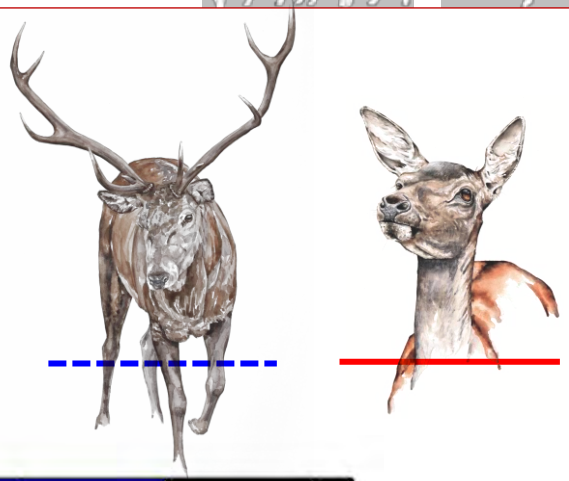
The „top down“ impact becomes stronger in less productive habitats and with harsh winters.

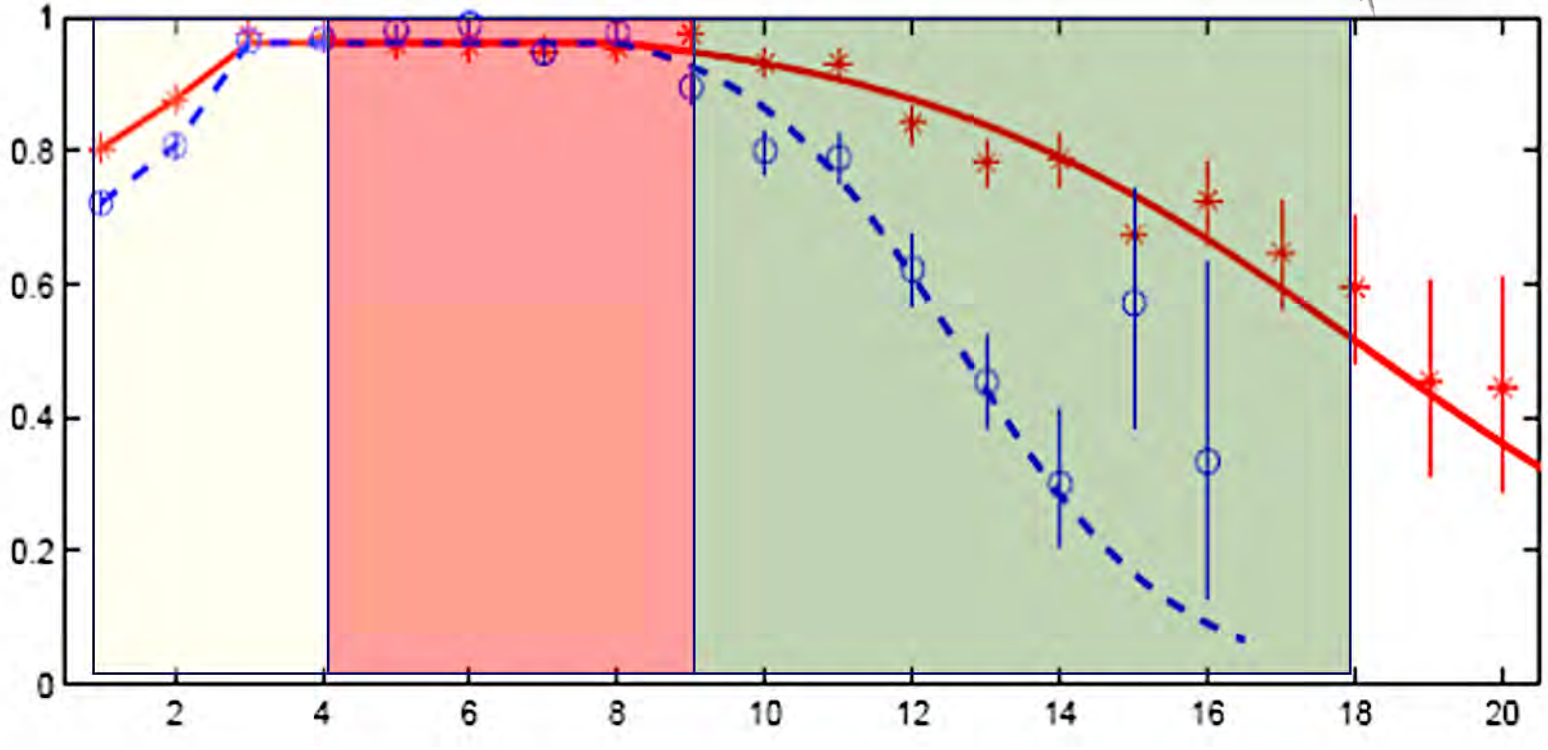
bottom up

For most herbivores is known:
The most important factor affecting population dynamics is
food supply.

Age and hunting

Life expectance dependent on age for male and female red deer





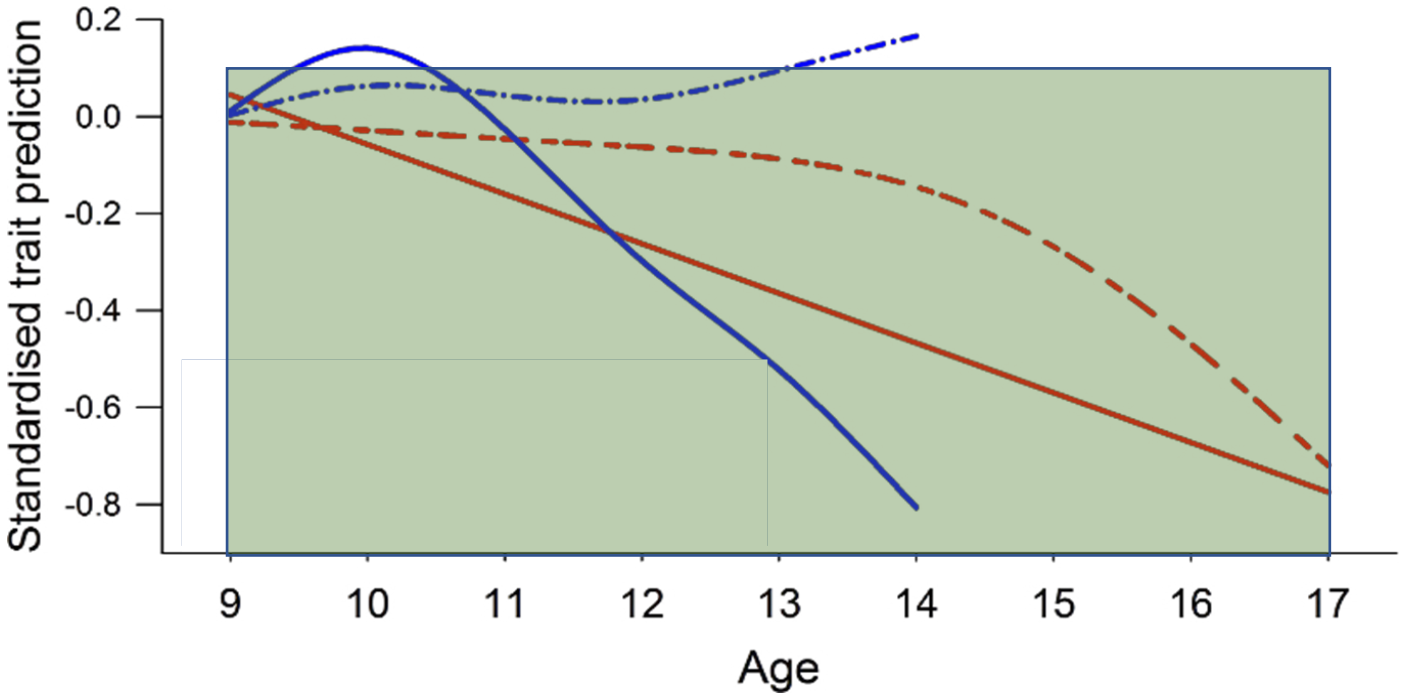
Age and reproduction

Female fecundity

Body mass calves

Breeding success males

Antler length



Hunting practice

Eur J Wildl Res (2011) 57:565–574
DOI 10.1007/s10344-010-0466-x

ORIGINAL PAPER

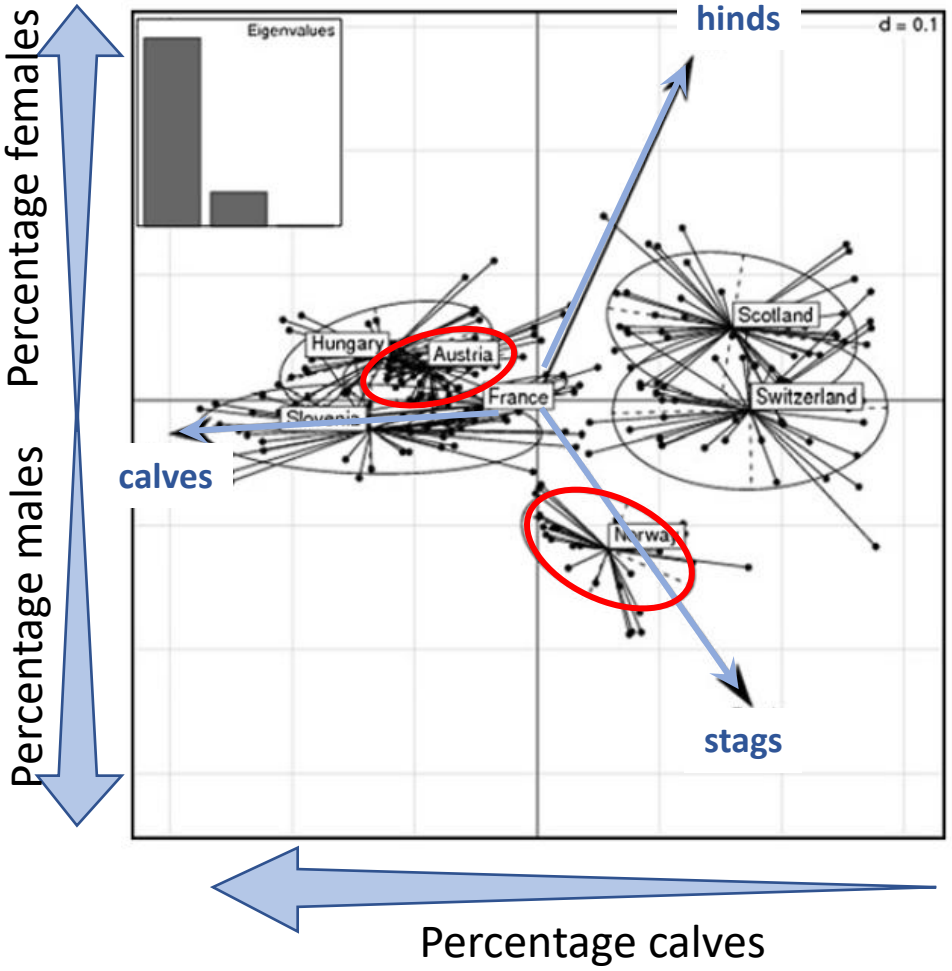
Hunting Bambi—evaluating the basis for selective harvesting of juveniles

Jos M. Milner · Christophe Bonenfant · Atle Mysterud

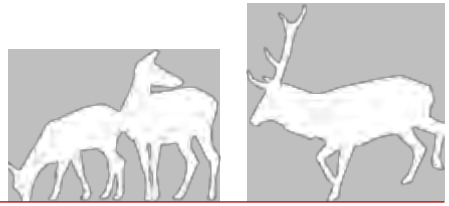
- Hunting males is not very effective if you want to control population dynamics.

- **Hunting grown up females is most effective if you want to control population dynamics**.

Composition of hunting bag statistics in different countries



Practice _ body mass and sexual matureness in female red deer



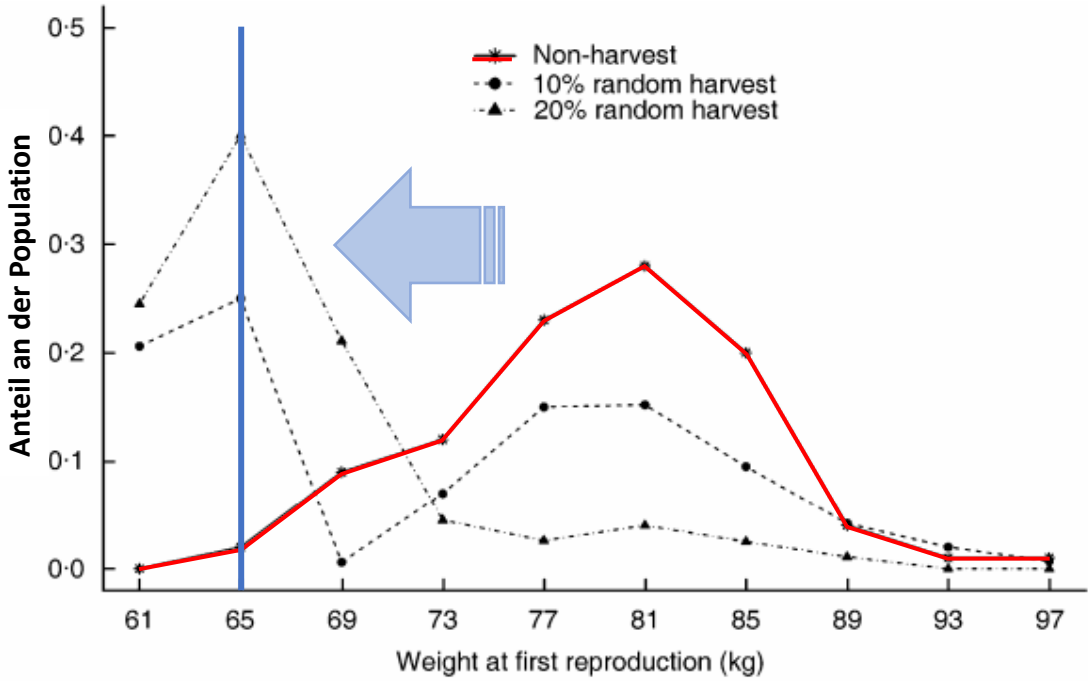
Journal of Animal Ecology 2007
76, 669–678

Evolutionary responses to harvesting in ungulates

G. PROAKTOR, T. COULSON and E. J. MILNER-GULLAND
Division of Biology and Centre for Population Biology, Imperial College, Silwood Park, Ascot, Berkshire, SL5 7PY, UK

If you are hunting a long living game species like red deer, you should idealy take calves and one year old individuals as like as old females – and not females in the middle age classes.

Growth rate is increasing!

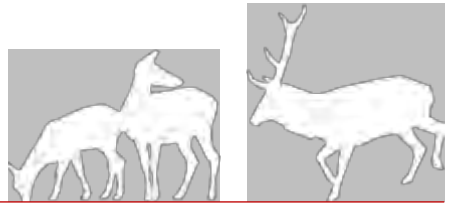


If there is hunting pressure on the middle class, the treshold weight is decreasing.

Consequently one year old females are reproducing.

Animal populations respond to hunting by evolutionary adaption!

Breeding of one year old females



Behav Ecol Sociobiol (2004) 56:1–8
DOI 10.1007/s00265-004-0764-y

ORIGINAL ARTICLE

Tomás Landete-Castillejos · Christian Gortázar · Joaquin Vicente · Yolanda Fierro · Andres Garcia · Laureano Gallego

Age-related foetal sex ratio bias in Iberian red deer (*Cervus elaphus hispanicus*): are male calves too expensive for growing mothers?

Received: 5 February 2003 / Revised: 4 September 2003 / Accepted: 15 January 2004 / Published online: 13 February 2004

… sex of fetus from **221 killed females** in relationship with ageclass (yearling/subadult/adult)

- With growing age probability of giving birth to a male calve is increasing.
- Yearlings with fetus have been smaller than yearlings without fetus.
- There is a „trade off“ between reproduction and body growth.
- **One year old females are giving birth to more female calves.**

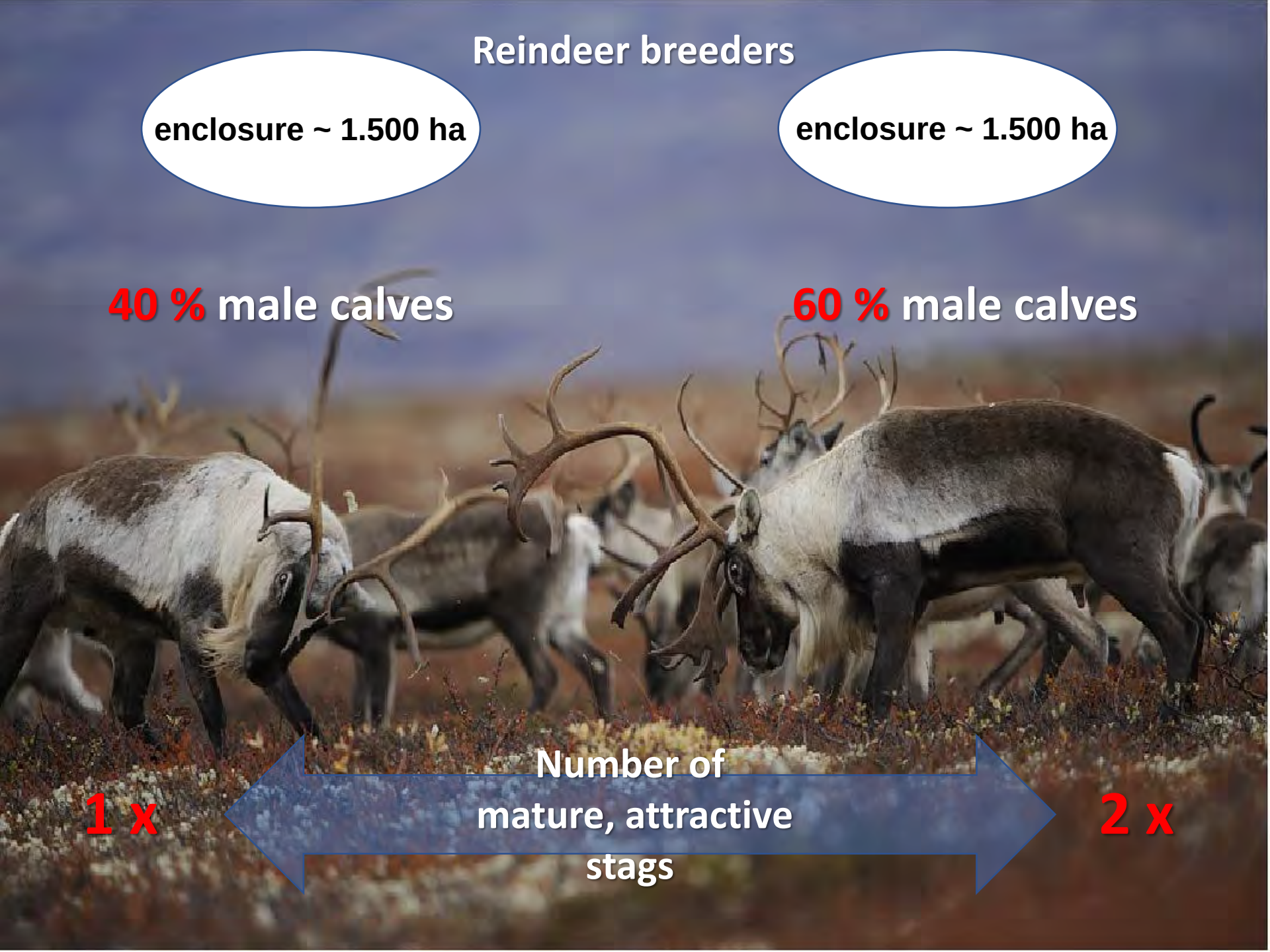
The importane of grown up males

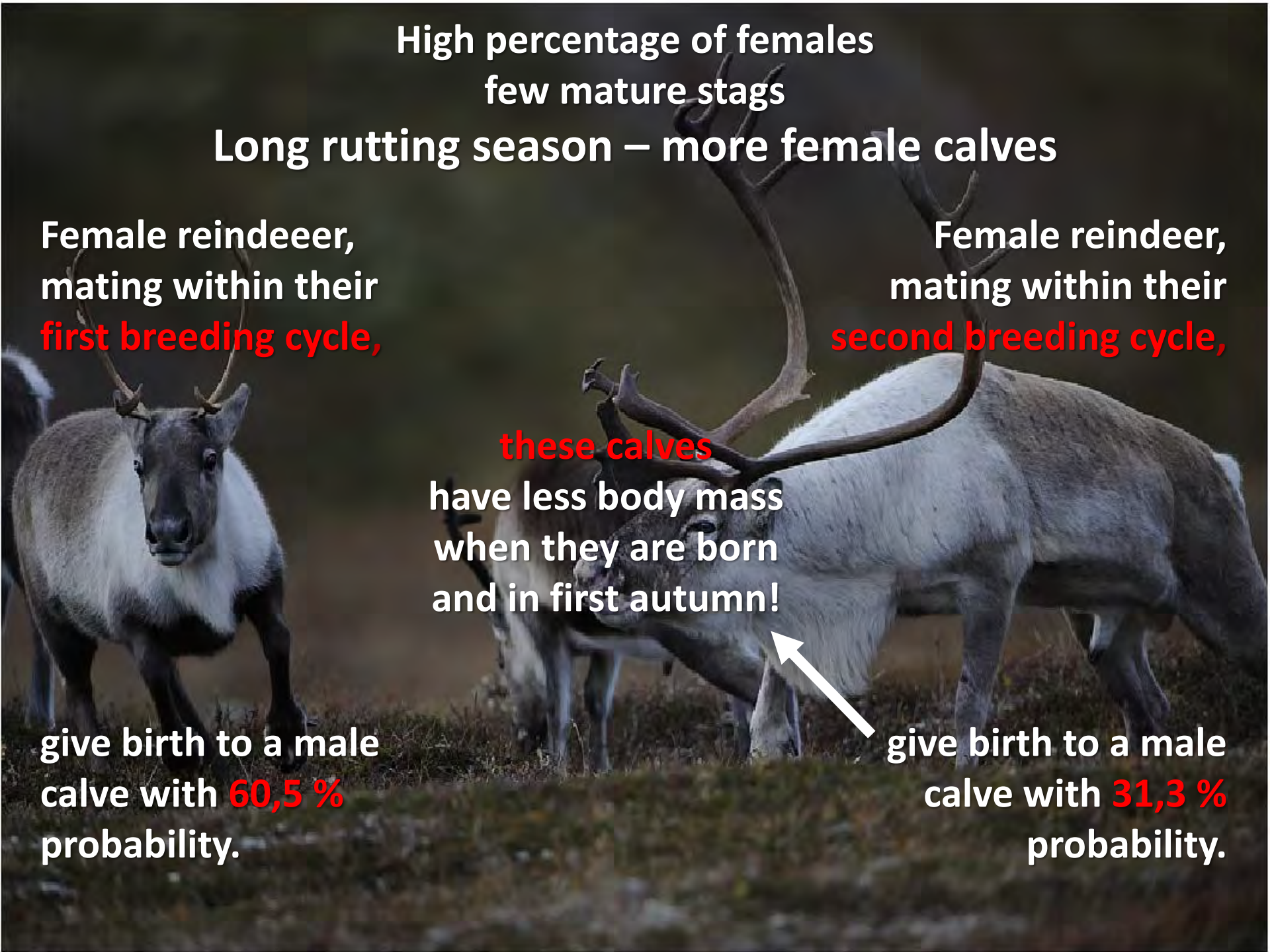
PROCEEDINGS OF THE ROYAL SOCIETY B

Proc. R. Soc. B (2007) 274, 727–733
doi:10.1098/rspb.2006.0214
Published online 12 December 2006

Male phenotypic quality influences offspring sex ratio in a polygynous ungulate

Knut H. Røed[1], Øystein Holand[2], Atle Mysterud[3,*], Aage Tverdal[1], Jouko Kumpula[4] and Mauri Nieminen[4]


Reindeer breeders
enclosure ~ 1.500 ha
enclosure ~ 1.500 ha
40 % male calves
60 % male calves
1 x
Number of mature, attractive stags
2 x



High percentage of females
few mature stags

Long rutting season – more female calves

Female reindeeer,
mating within their
first breeding cycle,

Female reindeer,
mating within their
second breeding cycle,

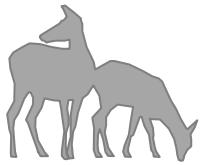
these calves
have less body mass
when they are born
and in first autumn!

give birth to a male
calve with 60,5 %
probability.

give birth to a male
calve with 31,3 %
probability.

Red deer population 600 animals, 1 m : 1,5 f


240 male : 360 female



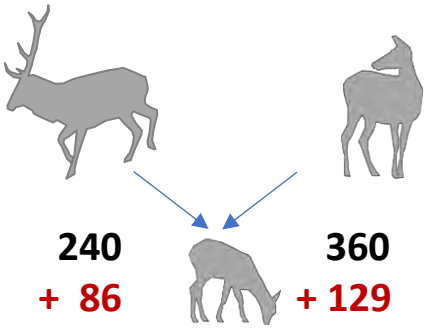
70 % females 2 years and older – 85 % increment

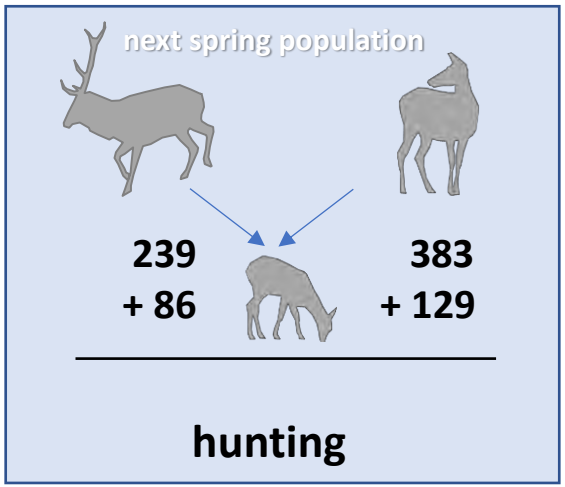
>> 252 hinds x 0,85 = **214 calves**

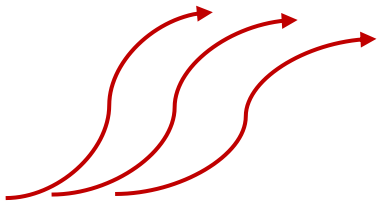
hunting

32 % stags 34 % hinds 34 % calves

Fulfillment/performance 90 %

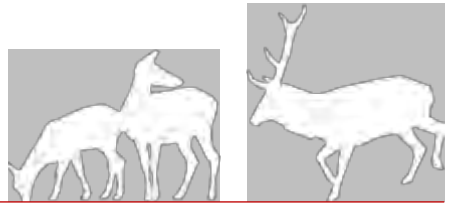






5 years

Red deer population 600 animals, 1 m : 1,5 f



after 5 years

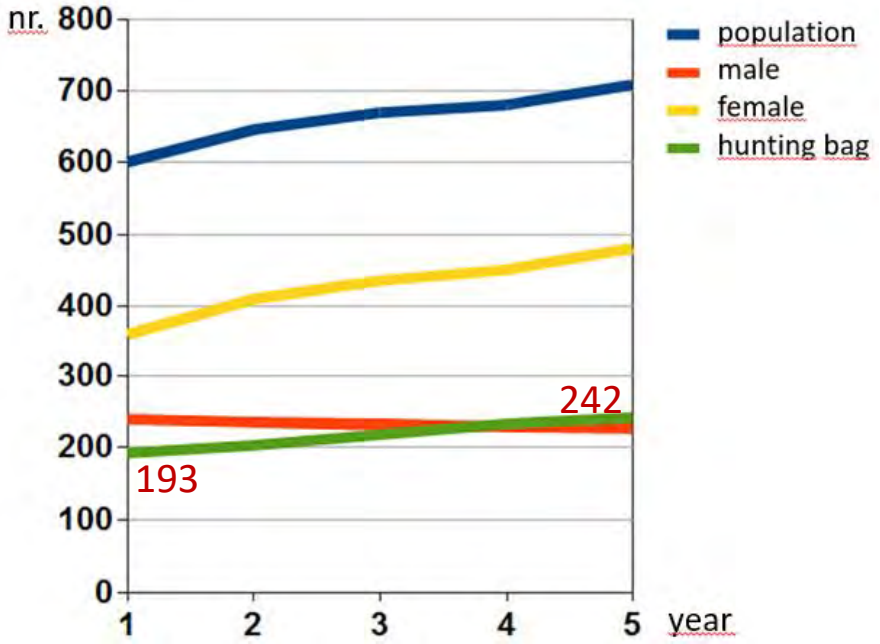
spring population

707 animals

227

480

1 m : 2 f

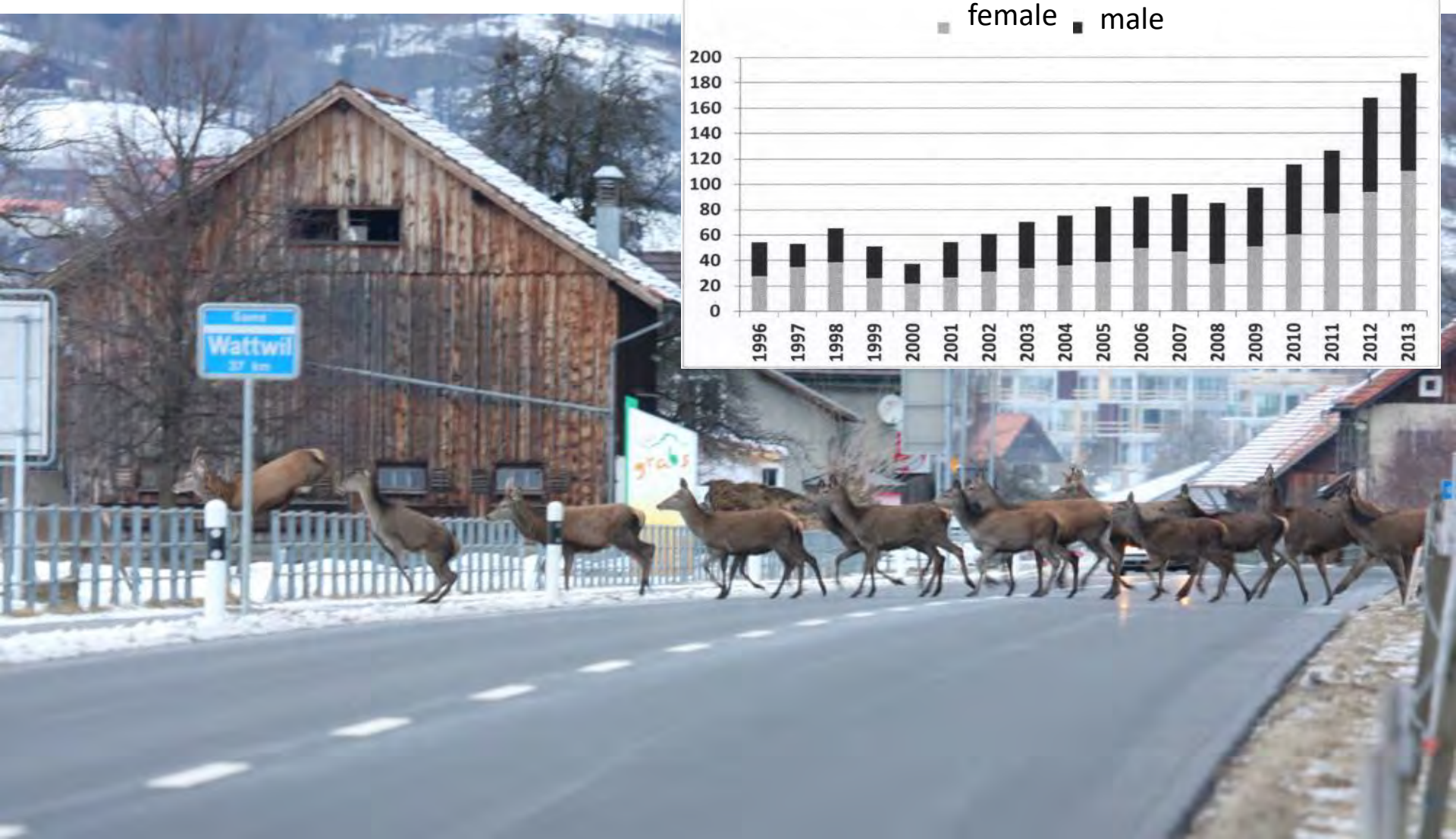


municipality
Kastelbell
South Tyrol

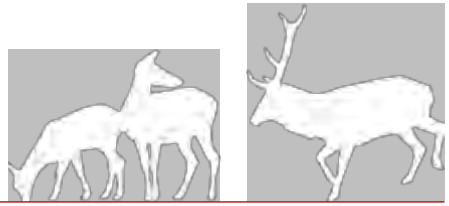
Year	calves m : f
1990	1 : 1
1991	1 : 2
1992	1 : 1
1993	1 : 1,4
1994	1 : 1,9
1995	1 : 1,3
1996	1 : 2
1997	1 : 1
1998	1 : 2,3
1999	1 : 1
2000	1 : 1,5
2001	1 : 1,6
2002	1 : 1
2003	1 : 1,9
2004	1 : 1
2005	1 : 1,7
2006	1 : 1,4
2007	1,2 : 1
2008	1 : 1,2
2009	1 : 2,3
2010	1 : 1,5
2011	1 : 1
2012	1 : 1,2
2013	1,1 : 1
2014	1,5 : 1

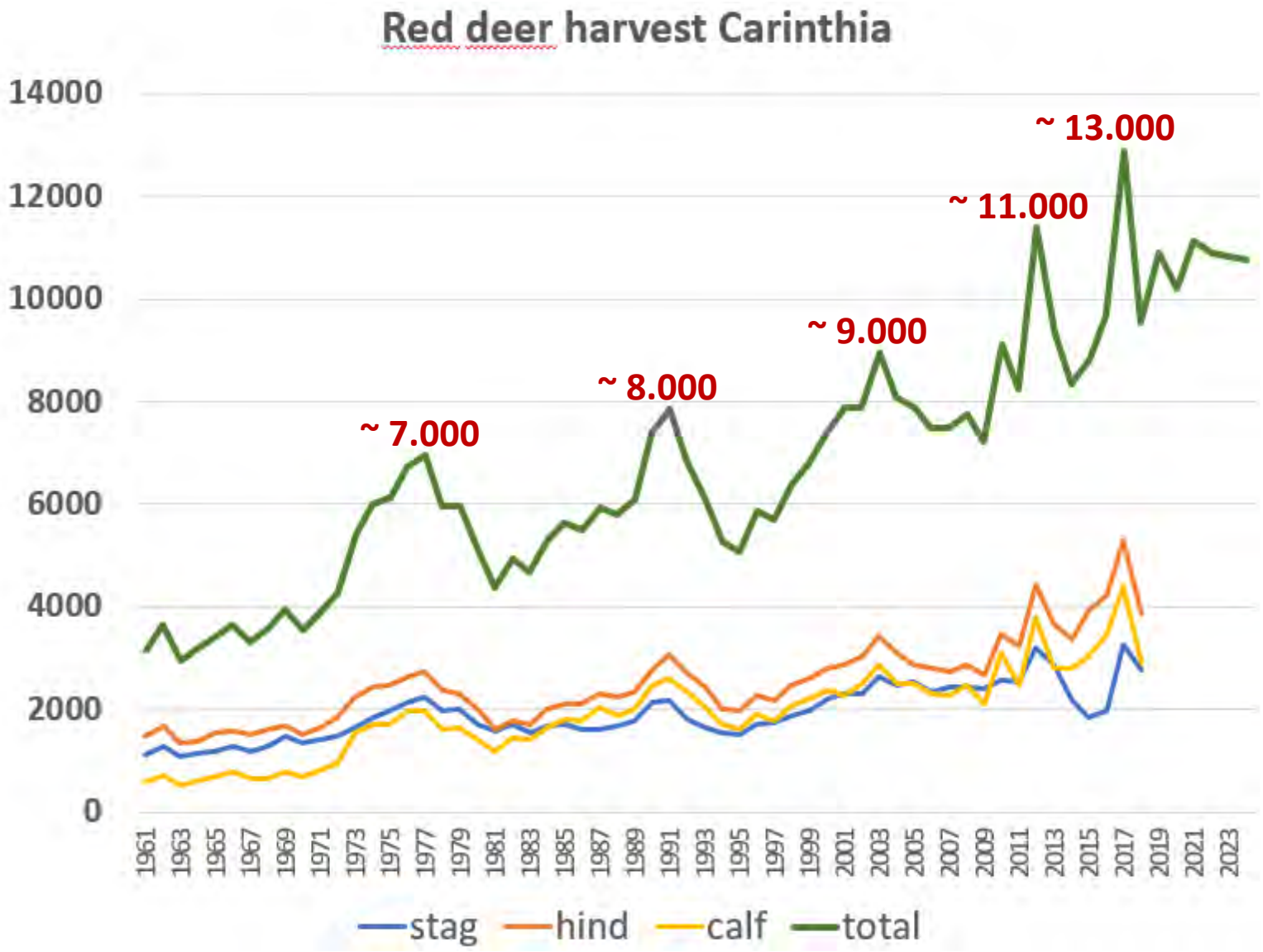
Sex ratio – calves

Switzerland canton St. Gallen



Harvest rate





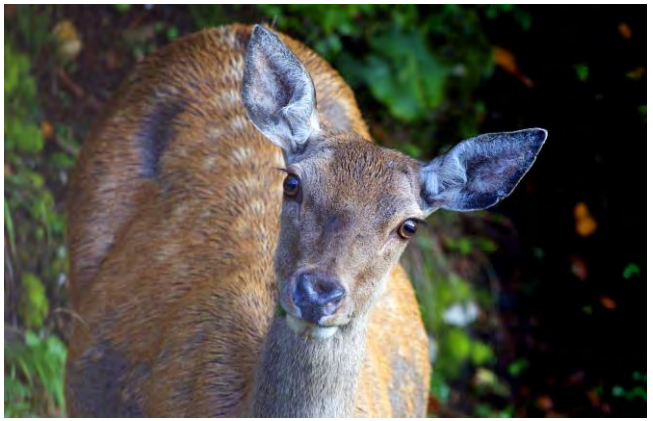
Population density and sex ratio - Norway

Journal of Animal Ecology 2000, **69**, 959–974

Relationships between sex ratio, climate and density in red deer: the importance of spatial scale

ATLE MYSTERUD*, NIGEL G. YOCCOZ*†, NILS CHR. STENSETH* and ROLF LANGVATN‡

*Department of Biology, Division of Zoology, University of Oslo, PO Box 1050 Blindern, N-0316 Oslo, Norway, (atle.mysterud@bio.uio.no); †Department of Arctic Ecology, Norwegian Institute for Nature Research (NINA), Polar Environmental Centre, N-9296 Tromsø, Norway; and ‡University Studies at Svalbard (UNIS), N-9170 Longyearbyen, Spitsbergen, Norway



3. The **proportion of male calves** shot each autumn **declined markedly as density increased** in all four populations. The proportion of male calves shot each autumn increased signicantly with an increasing NAO index in one of the four populations, but there was no residual effect of the NAO once the effect of snow depth (at low elevation) was controlled for (decreasingly male biased harvest with increasing snow depth).

Norway

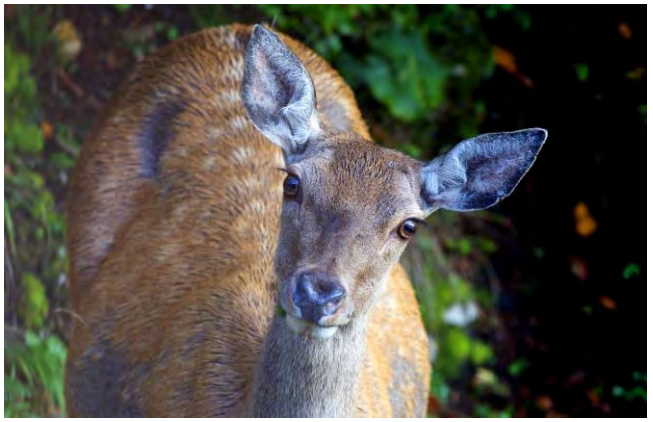
Female red deer is giving birth to less male calves, when food supply is decreasing, population density is increasing and wheather is becoming harsh.

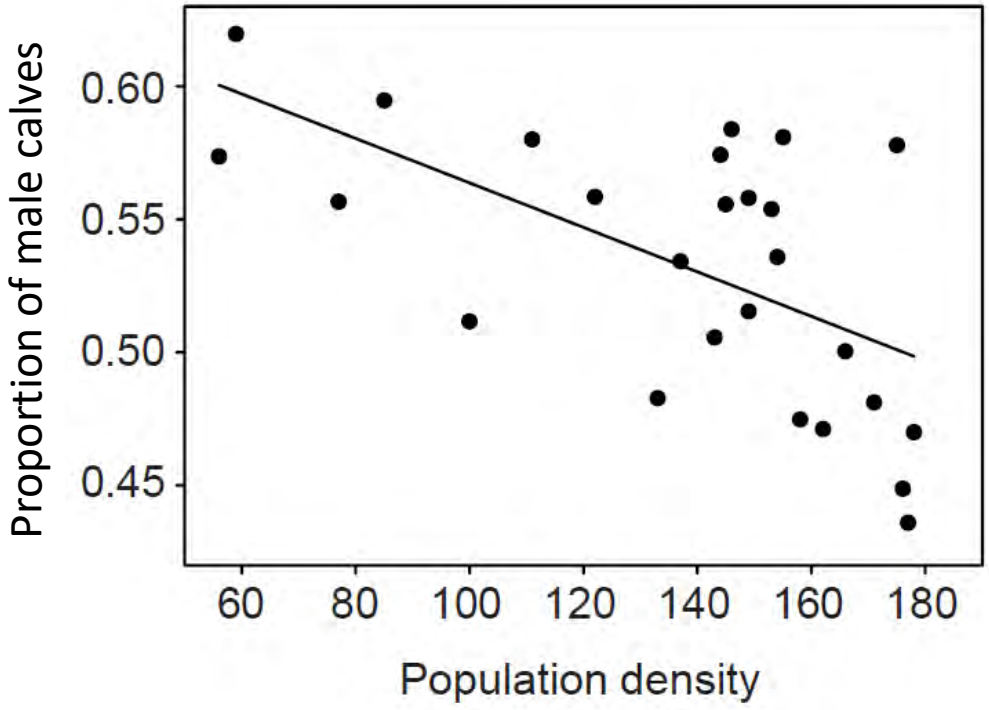
Population density and sex ratio – Isle of Rum

Population density affects sex ratio variation in red deer

Loeske E. B. Kruuk*†, Tim H. Clutton-Brock*, Steve D. Albon‡, Josephine M. Pemberton† & Fiona E. Guinness*

* *Department of Zoology, University of Cambridge, Cambridge CB2 3EJ, UK*
† *Institute of Cell, Animal and Population Biology, University of Edinburgh, Edinburgh EH9 3JT, UK*
‡ *Institute of Terrestrial Ecology, Hill of Brathens, Banchory, Kincardineshire AB31 4BY, UK*





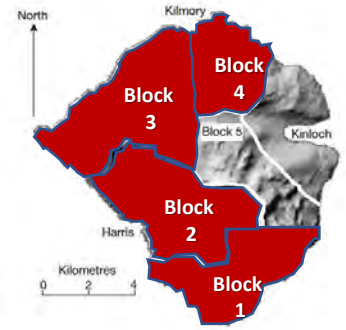
Population density and sex ratio – Isle of Rum

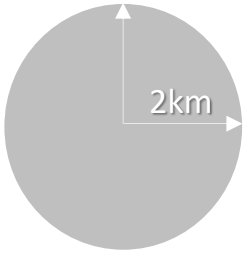
Sex differences in emigration and mortality affect optimal management of deer populations

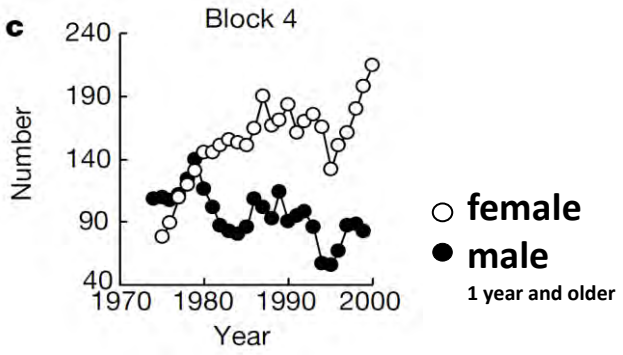
T. H. Clutton-Brock*, T. N. Coulson*, E. J. Milner-Gulland†, D. Thomson* & H. M. Armstrong‡

NATURE | VOL 415 | 7 FEBRUARY 2002 | www.nature.com

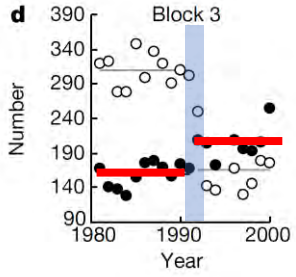
Population density and sex ratio – Isle of Rum



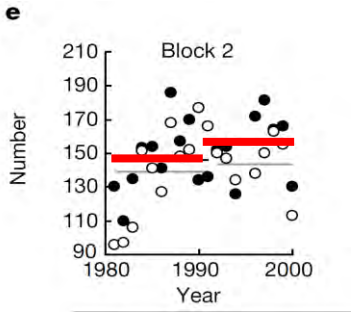




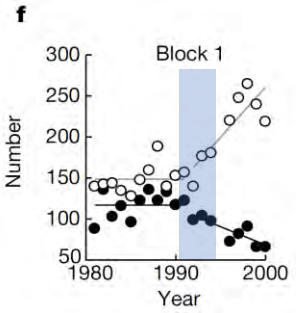
Stop hunting in Block 4 (1200 ha)



1991/92 striking reduction of females



hunting continues in the same way



1991 - 95 hunting stags

50 % males less hunting on females continues in the same way

Management units

Sex differences in emigration and mortality affect optimal management of deer populations

T. H. Clutton-Brock*, T. N. Coulson*, E. J. Milner-Gulland†, D. Thomson* & H. M. Armstrong‡

PROCEEDINGS OF THE ROYAL SOCIETY B

Proc. R. Soc. B (2009) **276**, 2581–2587
doi:10.1098/rspb.2009.0224
Published online 8 April 2009

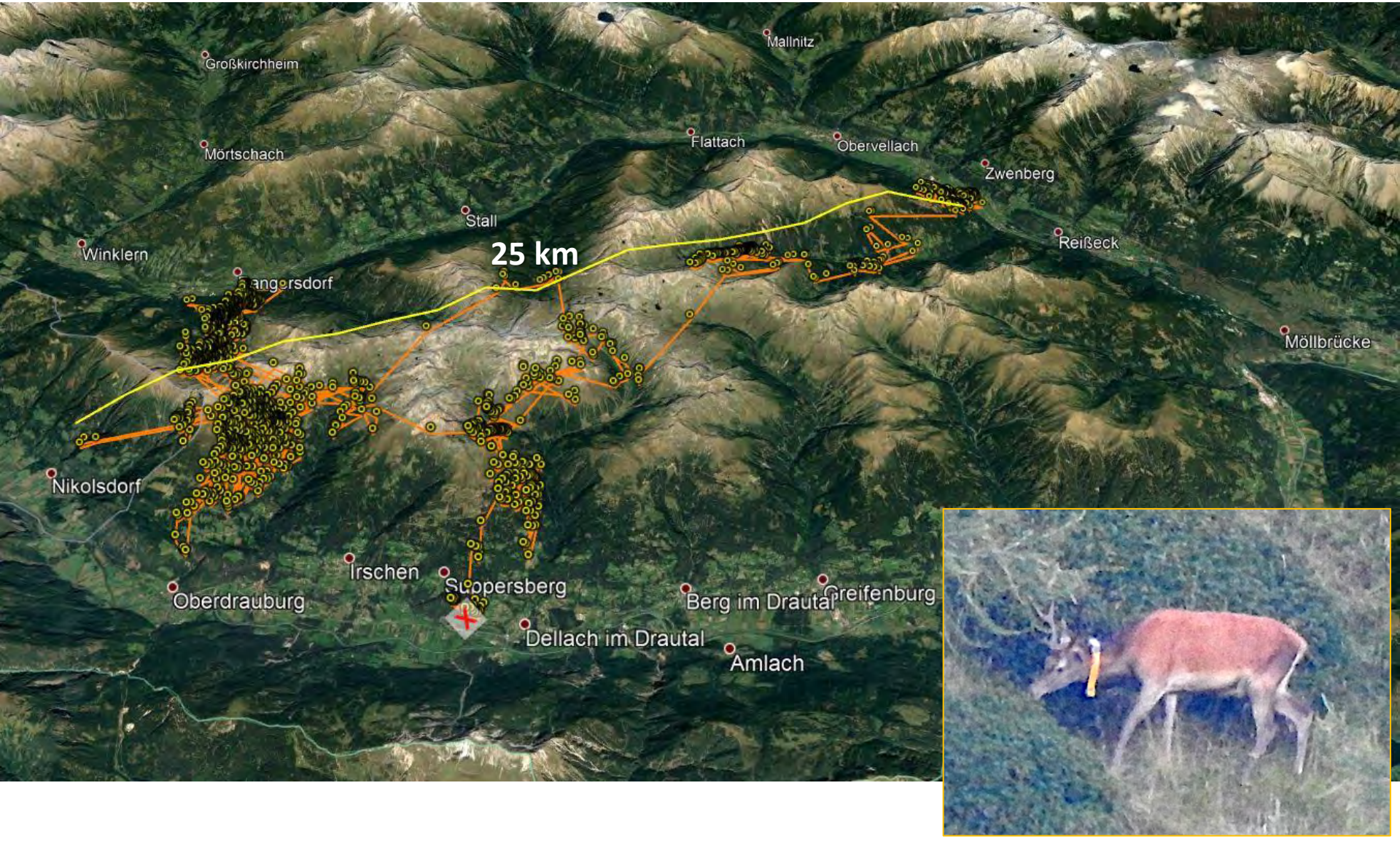
Negative density-dependent emigration of males in an increasing red deer population

Leif Egil Loe[1], Atle Mysterud[1,*], Vebjørn Veiberg[1,2] and Rolf Langvatn[2]

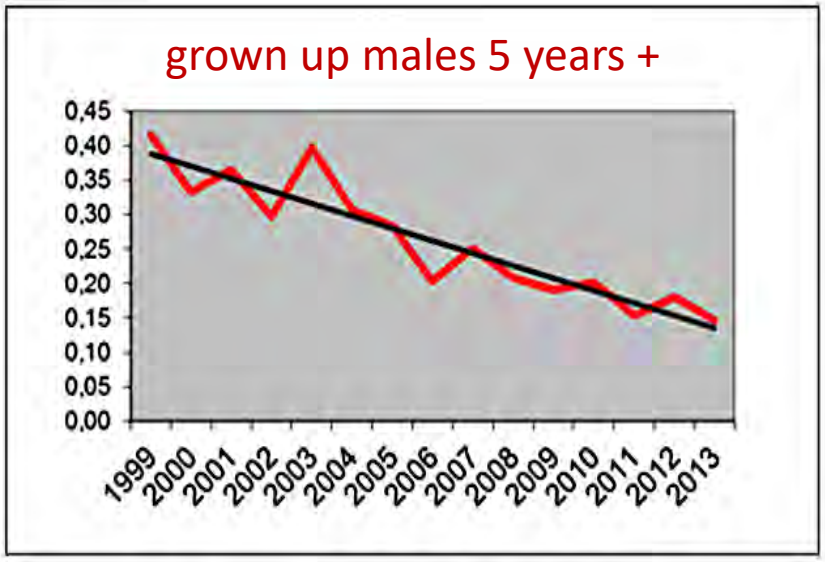
[1]*Centre for Ecological and Evolutionary Synthesis, Department of Biology, University of Oslo, PO Box 1066, Blindern, NO-0316 Oslo, Norway*
[2]*Norwegian Institute for Nature Research, NO-7485 Trondheim, Norway*

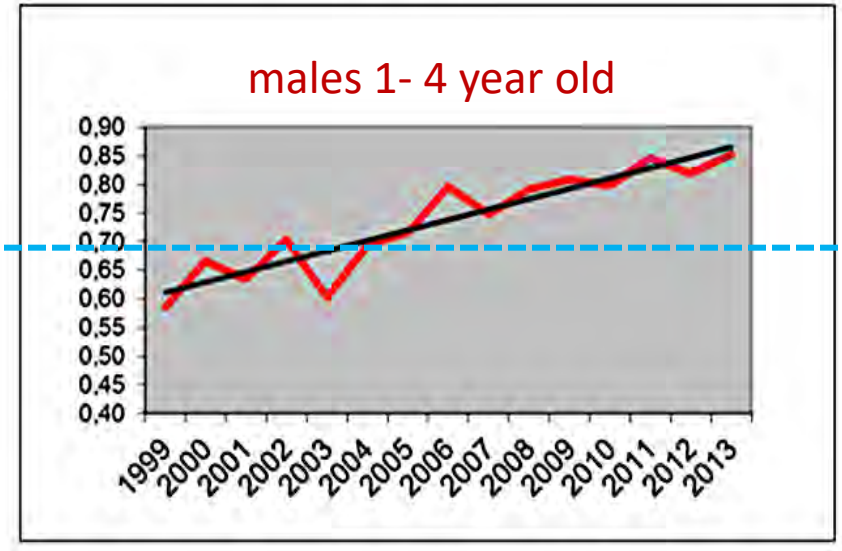
We demonstrate a **strong negative density-dependent emigration rate in males**, **while female emigration rates were lower and independent of density**. Emigrating males leaving the natal range settled in areas with lower density than expected by chance. Dispersing males moved 42 per cent longer at high density in 1997 (**37 km**) than at low density in 1977 (**26 km**).

Red deer on the way – stags in hunting territories



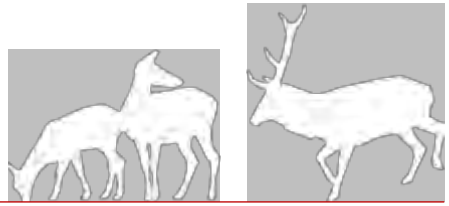
Reference points in red deer management

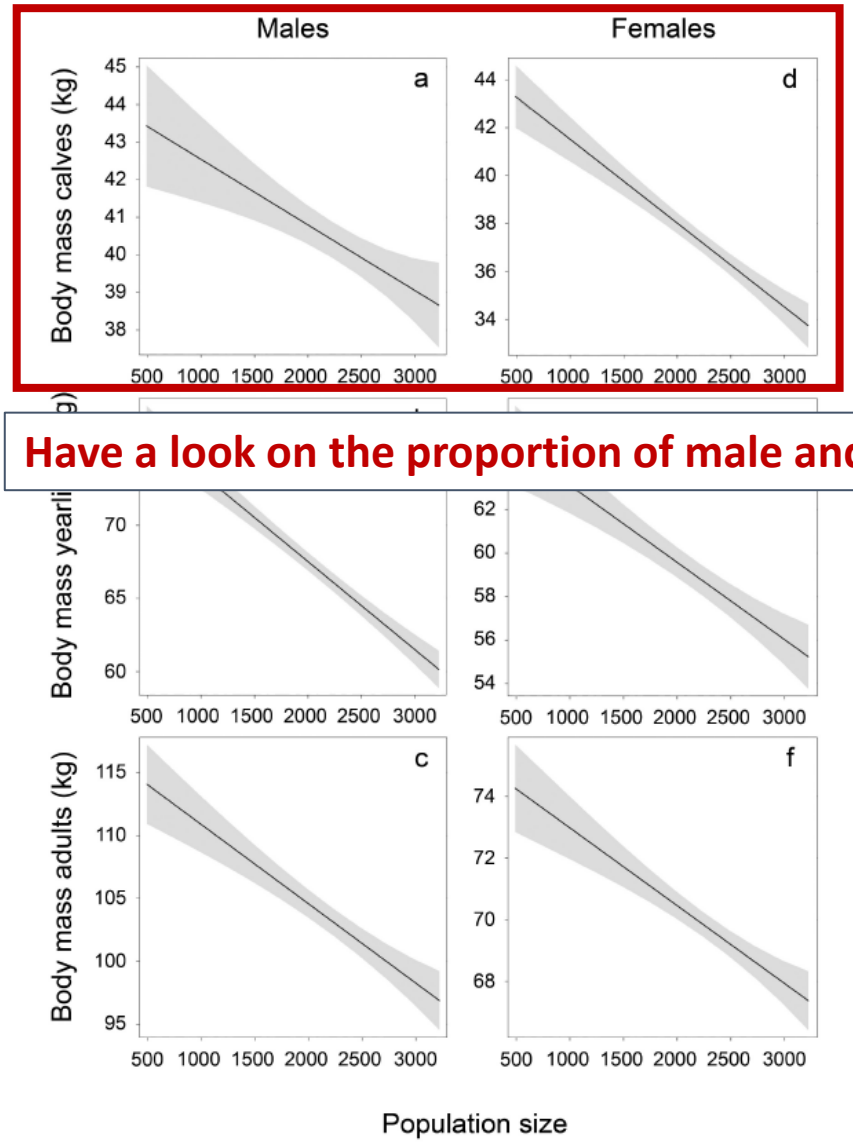




If there are more than 70 % young males in your harvest rate of males you will never get enough old males in the population!

Reference points in red deer management





body mass calves

Have a look on the proportion of male and female calves!

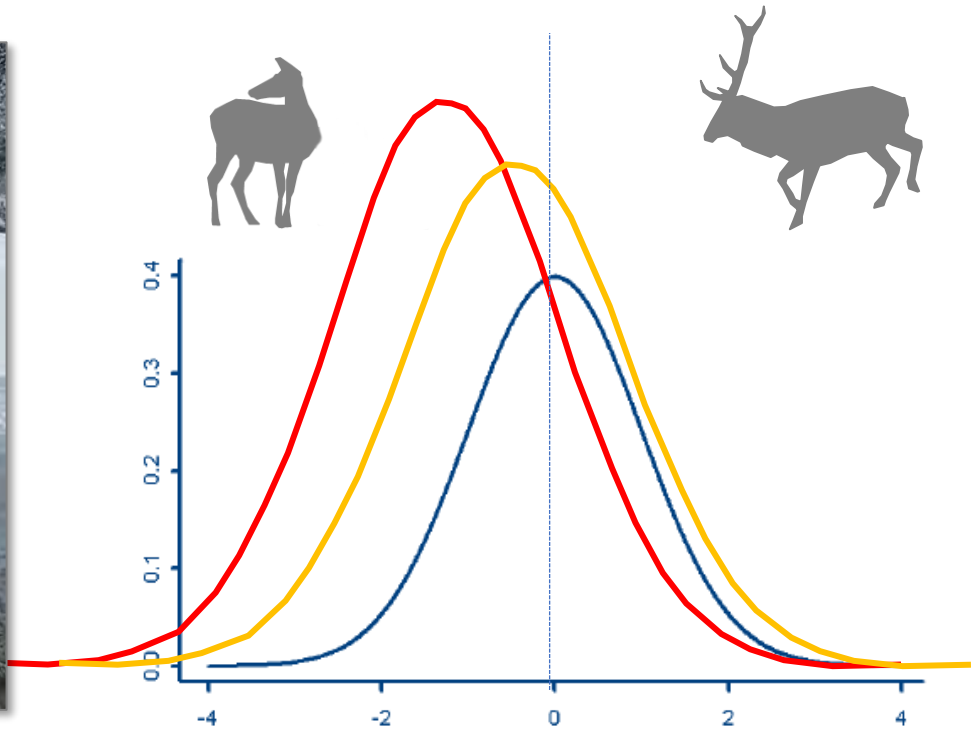
NP Stilfser Joch (1986 – 2014)

- Body mass decreases in all age groups (males and females), when density is increasing.
- **Density and winter harshness** have been the main impact factors shaping the structure of the red deer population.
- Hunters did not controll the red deer population.

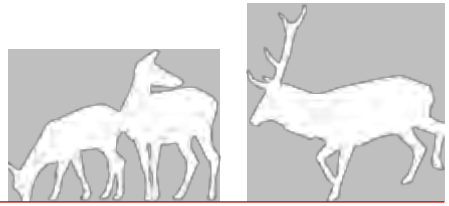
Red deer management

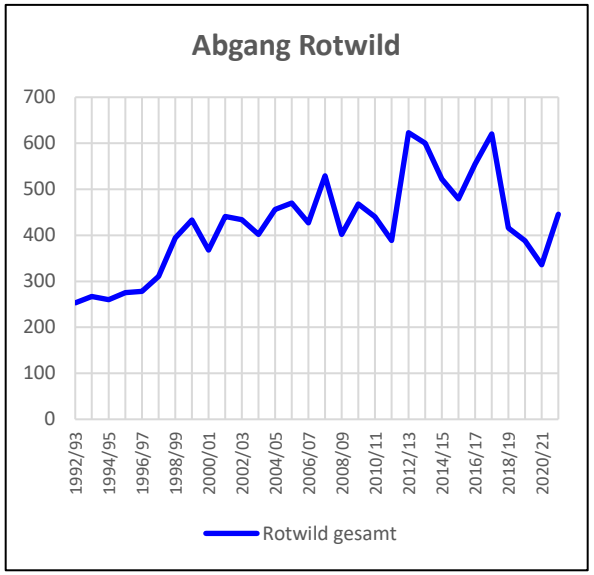
- The number of deer is often underestimated
  Stilfser Joch NP **35 %**

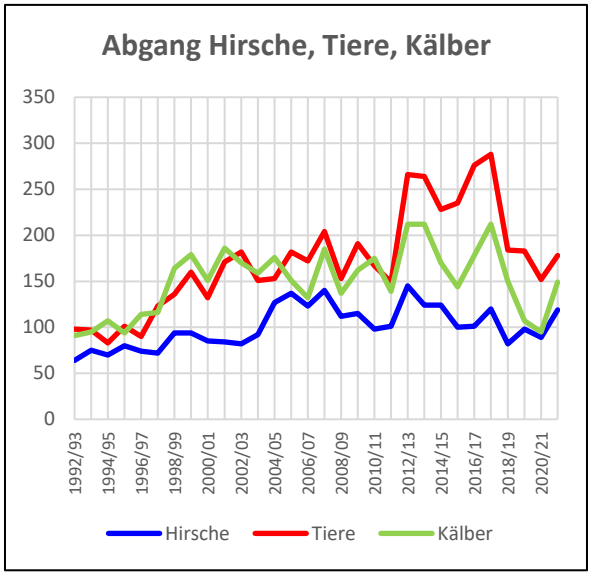
Population density, climate and hunting have impact on the proportion of males to females.

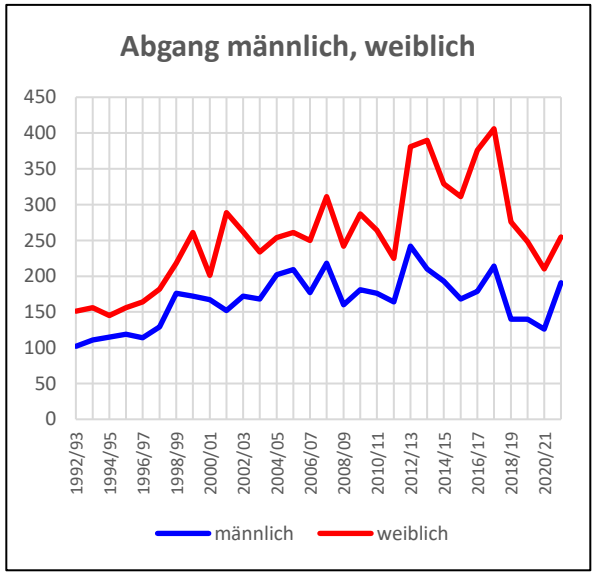


Red deer management - WIS Wildlife Information System

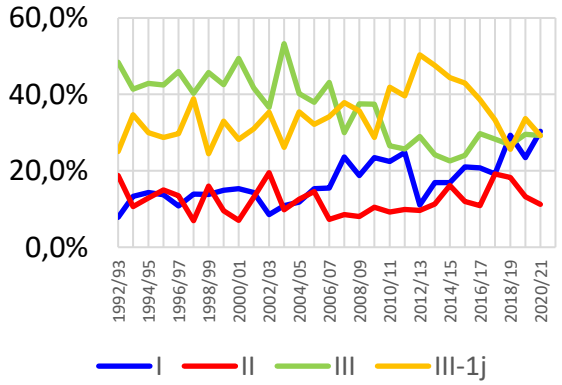




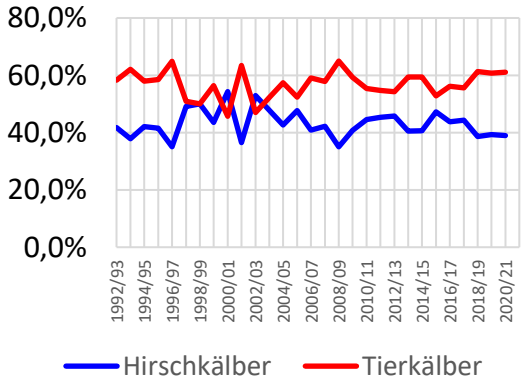




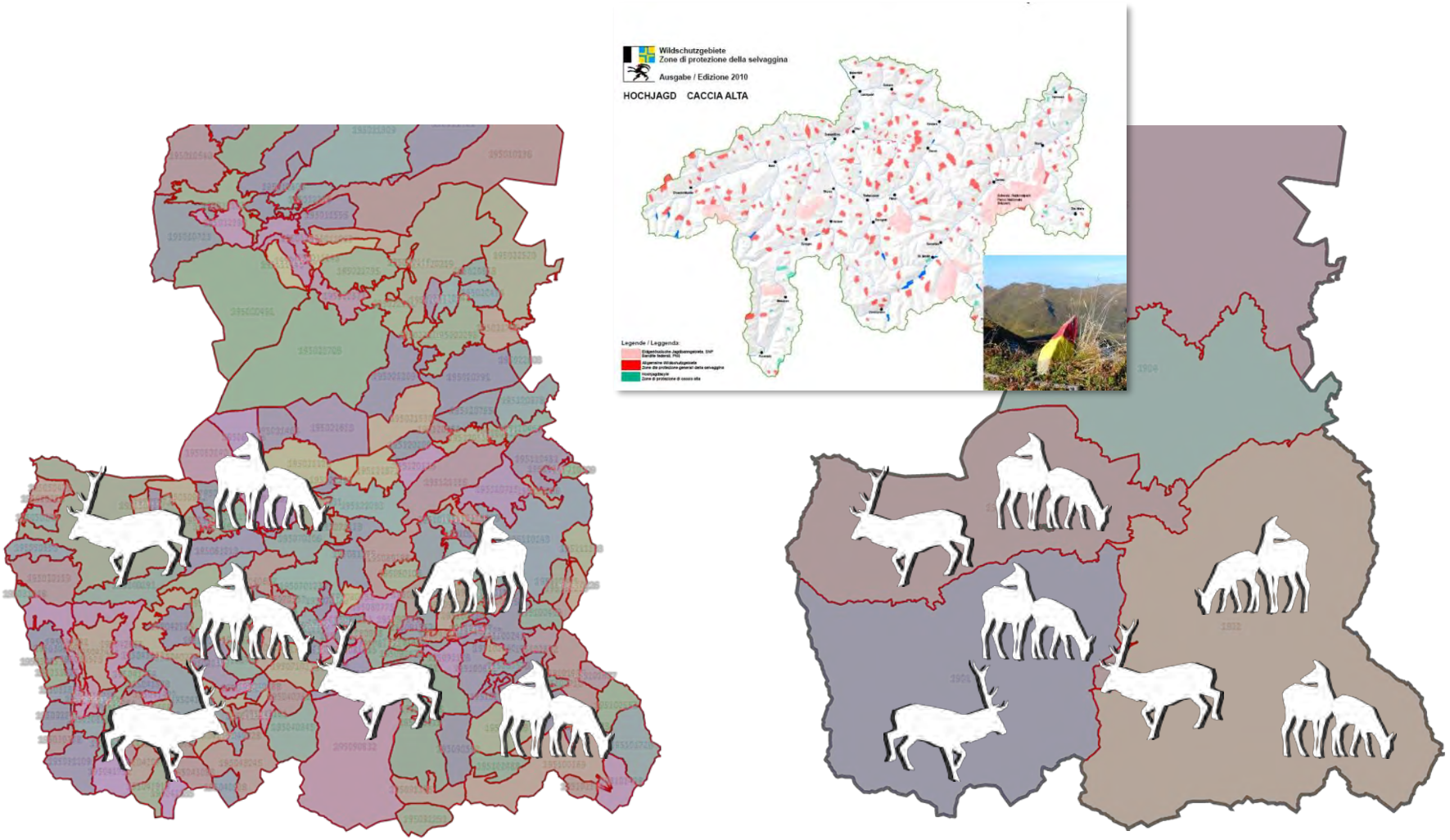
Anteil I, II, III, III-1j
am Abgang Hirsche



Anteil Hirsch-, Tierkälber
am Abgang Kälber



Red deer management units



Creating management units of 10.000 to 25.000 ha
You have to look on females & males!

Red deer management

- Very often the aim is to reduce the population by increasing the number of shot deer. It´s not the only solution – just **the number is not enough**.

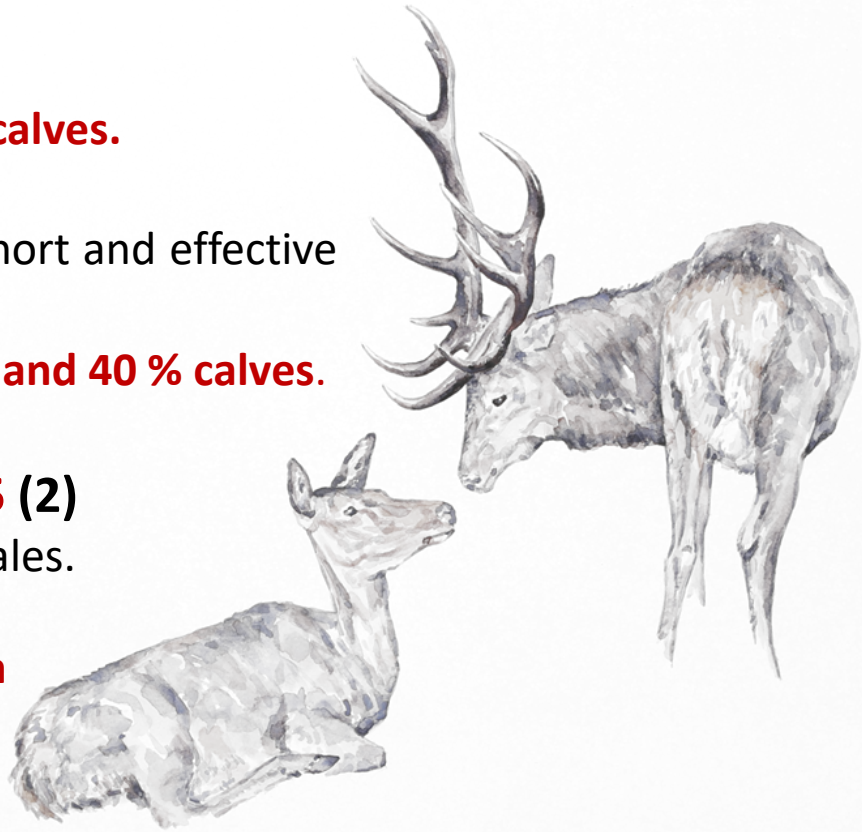
- You can reduce the growth rate by regulating the **proportion of males and females**.

- Have a look on your **males (age)**,
  watch the weigth and the sex proportion of **calves.**

- If you want to reduce the number make it short and effective
  >> **2 - 4 years**
  with a proportion of **20 % stags, 40 % hinds and 40 % calves**.

- Earn always more females **m : f - 1 : 1,5 (2)**
  red deer populations tend to have more females.

- Establish a good **Wildlife Information System**
  it´s your management tool.



Thank you for your attention.

Hubert Zeiler