TECHNISCHE UNIVERSITÄT DRESDEN

Wildlife Ecology and Management, Dresden University of Technology

Principles and methods of abundance assessment and monitoring as a basis of sustainable hunting

Professor Dr. Dr. **Sven Herzog**

Species conservation…

is tied to a sustainable and wise utilization.

It requires primarily that natural resources like wild animals are „harvested scientifically, and not faster as they reproduced“ (LEOPOLD 1933)

Wildlife management requires…

…excellent knowledge on species and populations biology and ecology, such as…

- **habitats**
- **behaviour**
- **nutrition**
- **abundance**
- **reproduction**
- **mortality**
- **interaction with other species**
- **interaction with man**
- **…**

Sustainable hunting …

…takes only the utilizable surplus of an animal population

i.e. mortality by hunting regularly has to be compensatory, not additive

Quota setting has to guarantee that populations are not overexploited.

Quota setting …

…requires especially informations about

- **abundance**
- **reproduction**
- **mortality**

Some methods for abundance assessment

- **hunting bag statistics**
- **direct observation (terrestric or aerial)**
- **observation of signs (snow tracking, pellet counts)**
- **capture-mark-recapture methods (including photo traps)**
- **molecular methods**

TECHNISCHE UNIVERSITÄT DRESDEN

Hunting bag statistics

- **theory: higher abundances will result in a higher hunting success and *vice versa***
- **a simple and cheap method suitable for long-term monitoring of regularly utilized populations**
- **„*ceteris paribus*" situation is required: hunting methods, hunting seasons, number of hunters, legal hunting restrictions, poaching situation etc. must not change during a long period (at least a liftime of the animals in question)**

Hunting bag statistics

- **allows good trend analyses (increasing, decreasing or steady-state)**
- **allows a rough estimation of abundance, if**
  - **a good density estimation exits at the beginning**
  - **good knowledge about reproduction, sex-ratio, and age structure**

Ground based census

- **total or sample population census by direct observation**
  - **Problem: high bias**
  - **distance sampling reduces bias of sampling**

Aerial census

traditional method: direct census from aircraft (total or sample)

census (total or sample) supported by VIS-video and IR-video

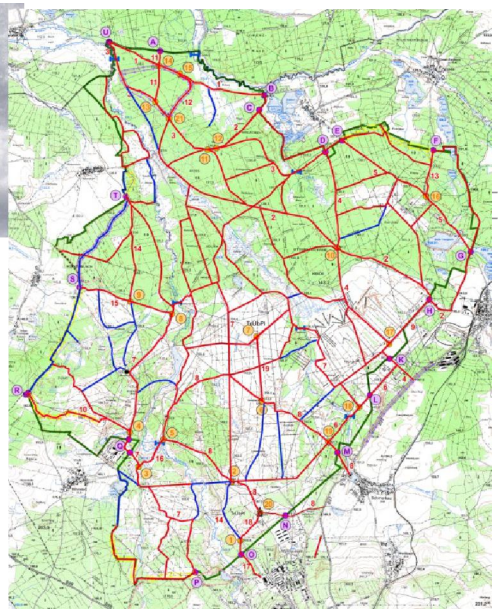
- ***actual:*** **aircraft or microlight (dependent on area to be covered)**
- ***next generation technology:*** **unmanned air vehicle (UAV)**

Aerial census

- **suitable for open landscapes**
- **forest canopy and sometimes even single trees, bushes or shrubs widely inhibit (even IR !) detectability of wildlife, dependent on species and their behaviour**
  - wild boar nearly undetectable even in open landscapes
- **„lean" solution: microlight with one operator and VIS plus IR camera**
- **UAV actually often restricted by legislation: maximum payload and maximum time of flight are limiting factors; UAV often requires two persons: AVO and PO**

Capture-mark-recapture methods

- **well suitable for small animals (fish, birds, rodents, small predators)**
- **relation between marked and unmarked recaptured individuals is a good estimator**
- **actual application: camera traps**
  - **applicable only for species with individual coat colour traits (tiger, leopard, lynx…)**
  - **requires dense grid of IR or motion sensor triggered cameras**
  - **at least in the situation of low densities high bias: JACKSON et al. 2006: 8,49/100 km² 2003, 4.45/100 km² 2004 for snow leopard in India**

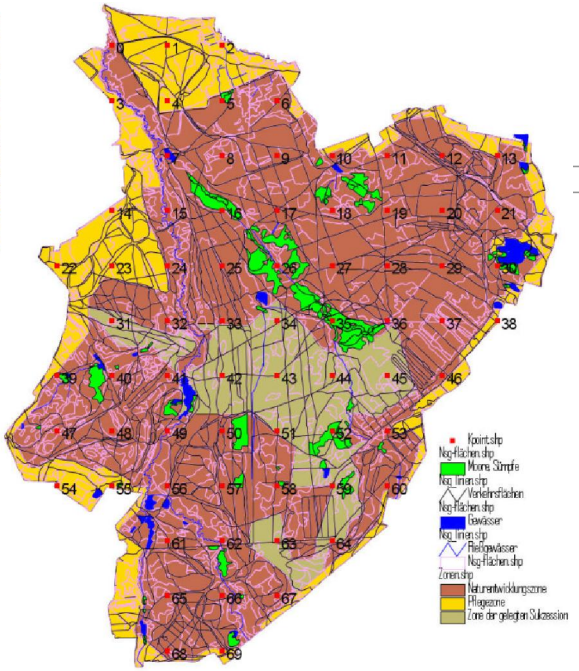


Snow tracking

- **simple, robust method**
- **tends to a slight underestimation**

- **problems**
  - **need of good knowledge of species behaviour**
  - **need of a trail system**
  - **personnel-intensive**
  - **dependent on climate and weather conditions**

TECHNISCHE UNIVERSITÄT DRESDEN



Pellet counts

- **simple method**
- **theory: ammount of faeces is an estimator for abundance**

- **Problems**
  - **need of good knowledge of species intestinal physiology and food supply**
  - **needs preparation of the monitoring area**
  - **dependent on vegetation situation**

Molecular methods

- **DNA analysis from faeces**
- **molecular marker system distingushing between individuals**
- **samples of a certain region investigated**

- **Problems**
  - **Relatively hogh costs per sample**
  - **artefacts**
  - **sampling bias or total population screening**

„Distance sampling“

- **Applicable to several previosly mentioned methods**

- **More precise results of sampling methods by underlying detection models dependent on distance (and angle) of individual animal (or even sign) obeservations**

- **For a first look:**

Buckland, S.T., Anderson, D.R., Burnham, K.P. and Laake, J.L. 1993. Distance Sampling: Estimating Abundance of Biological Populations. Chapman and Hall, London. 446pp

http://www.colostate.edu/Dept/coopunit/download.html

How to find out the most suitable method?

- **there is not one single „best" method**
- **what informations do we need? E.g.**
  - species in question, focus on one or several species?
  - landscape situation (coast, mountains, plains, wood covered or not)?
  - need for actual density estimates, e.g. for a contractor?
  - need for long-term population trends?
  - what level of accuracy is needed?
  - are there informations existing about the tendency of population development?
  - single effort or long-term monitoring program?
  - resources (manpower, financial, technical, legal restrictions...)?

What do we need ?

- **is a long-term monitoring necessary ?**
  - **relation between quota and estimated total population size ?**
- **are trend estimations sufficing?**
  - **e.g. Germany: a lot of species managed without a census, but applying more or less intensive trend estimations**
- **do we need a single census at a starting point?**
- **do we need an intensive monitoring ?**
  - **typical example: species decreasing or near extinction**

From population census to monitoring…

- **„monitoring“ means a systematic, long-term observation of the state of a system**
- **for abundance or density monitoring methods can be applied in different ways, e.g.**
  - applying one and the same method routinely
  - Assesment every year necessary?
  - maybe longer intervals, e.g. every five or ten years
  - initial census, followed by trend estimations or more simple density estimations
  - only trend estimators, census only in certain situations calling for more precise data
  - combining methods if necessary

Quota setting…

- **based on informations about abundance, nreproduction and mortality**
- **„natural growth rate" is a suitable estimator integrating data on reproduction and mortality**
- **quota should be -using a rough approach- e.g.**
  - slightly less than growth rate for cropping (wildlife pruducts such as meat)
  - far less than growth rate (at least during the first years) for trophy hunting
  - higher than growth rate for population reduction (e.g. to reduce crop or forest damages)