Grouse and game dynamics

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From 1 January 2015:

Natural Resources Institute Finland

“Luonnonvarakeskus” Luke

Luke
NATURAL RESOURCES INSTITUTE FINLAND

Turnover 140 EUR milj.
Person-years approx.1700
Locations 38
The 2nd largest research institute in Finland

Hares	2 species
Fur-bearing animals	11
Moose and other artiodactylus	7
Large predators and seals	4
Waterfowl	16
Grouse (tetraonid birds)	5
Farmland game birds	3
Coots and waders	2

Hares	254 000	Number of bagged in 2013
Fur-bearing animals	290 000	
Moose and other artiodactylus	83 000	
Large predators and seals	1 400	
Waterfowl	450 000	
Grouse	495 000	
Farmland game birds	240 000	
Coots and waders	5 500	

Value of bagged animals, 1000 € (2013)

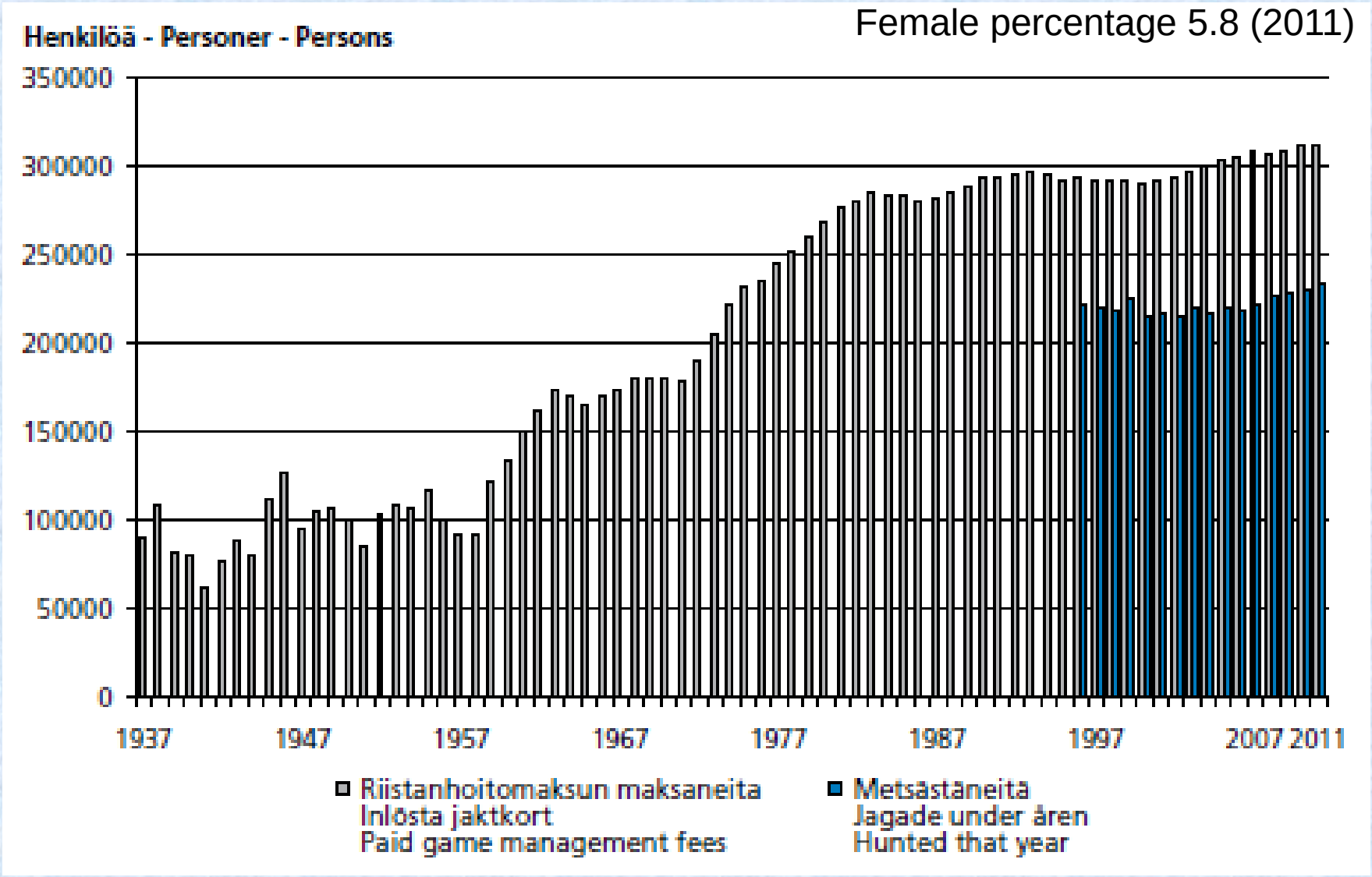
Moose	47 140	(53%)
Other mammals	22 660	
Birds	18 400	
Total	88 200	

(reindeer husbandry 52 500)

Recreational value ?

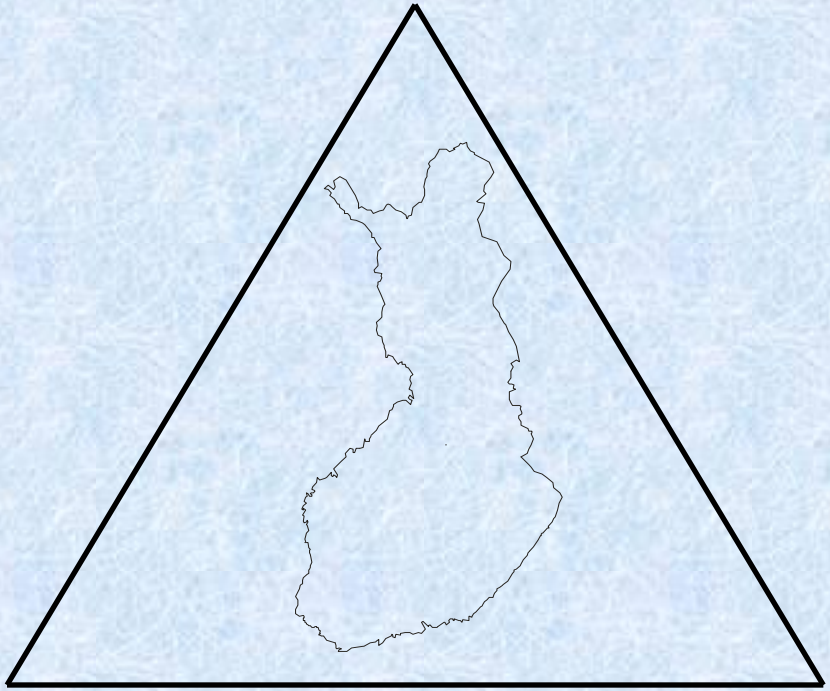
No. of hunters in Finland

Female percentage 5.8 (2011)



Ministry of agriculture & forestry

EU



Luke

Hunters
Finnish Wildlife Agency

Monitoring methods include: line transect counts (ground, aerial), territory mapping, study plot method, voice counts, pellet counts, nest counts, colony counts, DNA-sampling (non-invasive method for some species), capture-recapture method, radio/satellite telemetry, etc.

Statistical principles/tools

- total counts seldom possible
- random sampling if possible
- stratified sampling (random/systematic
  e.g. program DISTANCE for line transect data),
  TRIM (Trends and indices in monitoring data)
  etc.
- Bayes-based methods coming

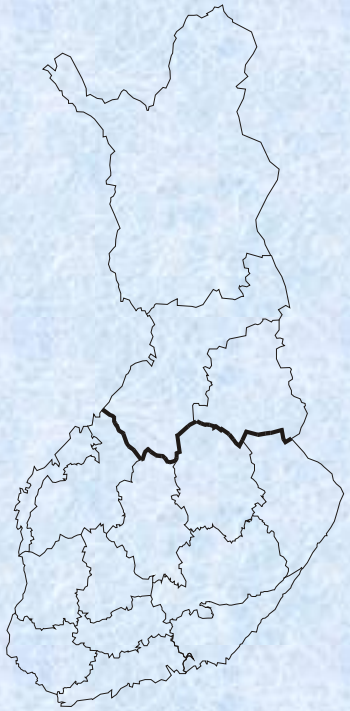
The very problem:

- Voluntary people do the dirty work !
- They cannot be forced too much !

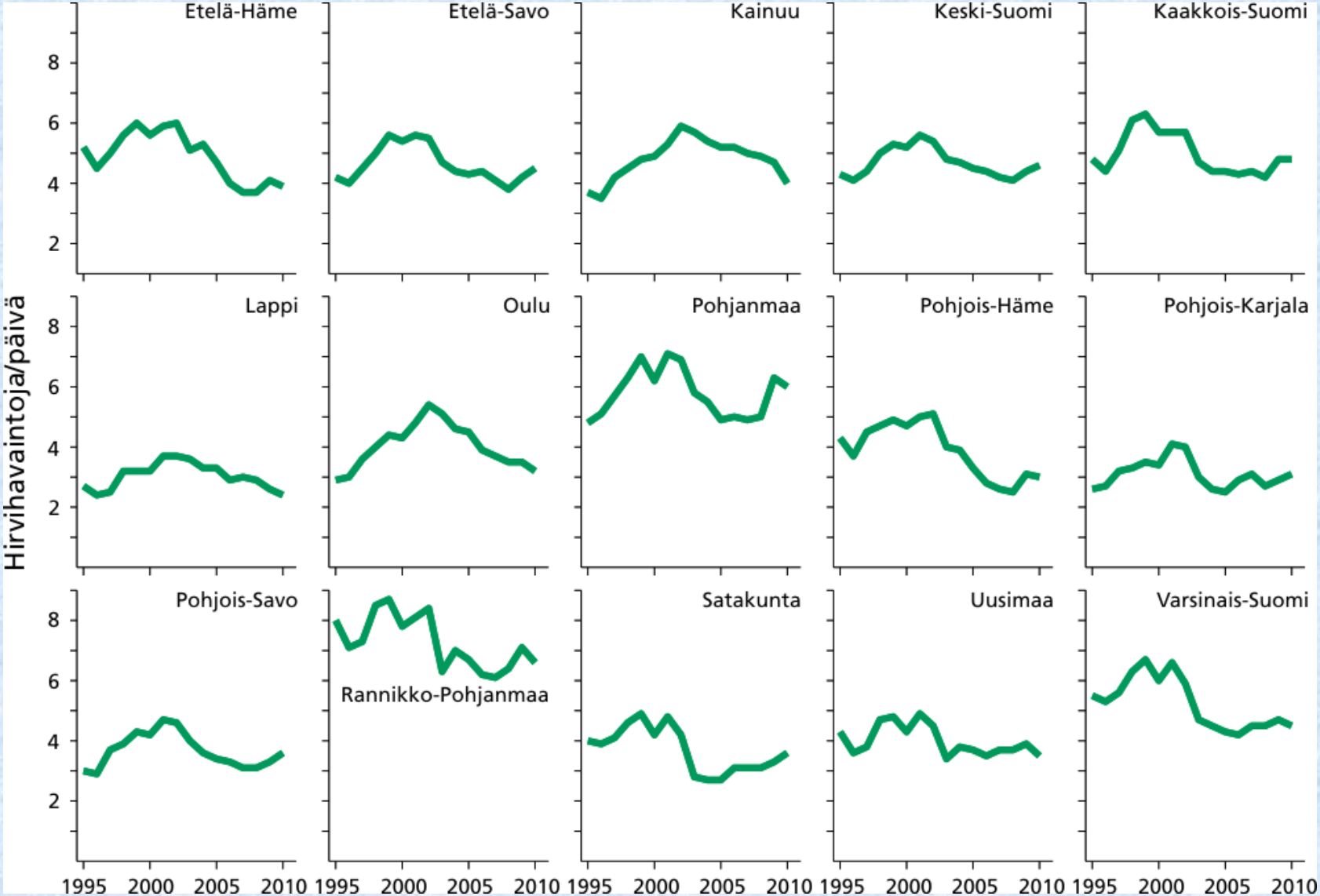
Game – sustainable hunting

- Monitoring of:
  - Moose
  - Wild forest reindeer
  - Baltic seals
  - Large predators
  - Field game
  - Waterfowl
  - Some individual species (e.g. beaver)
  - Forest mammals
  - Grouse

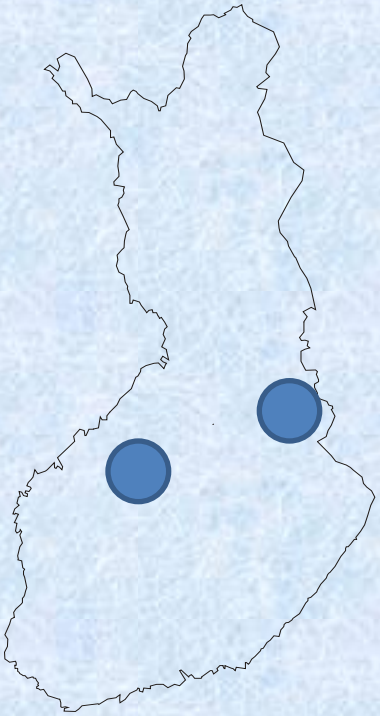
WILDLIFE TRIANGLE SCHEME ca 35 species

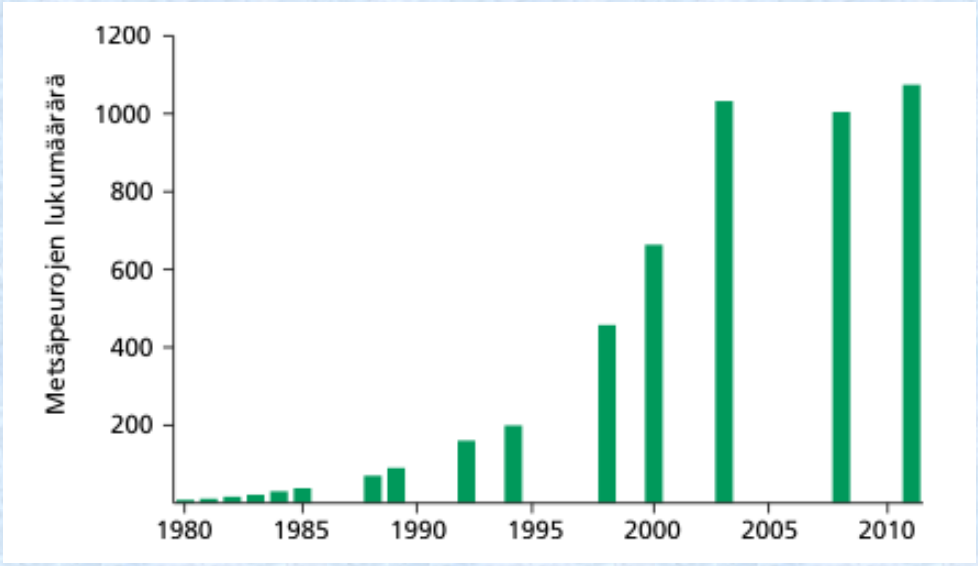


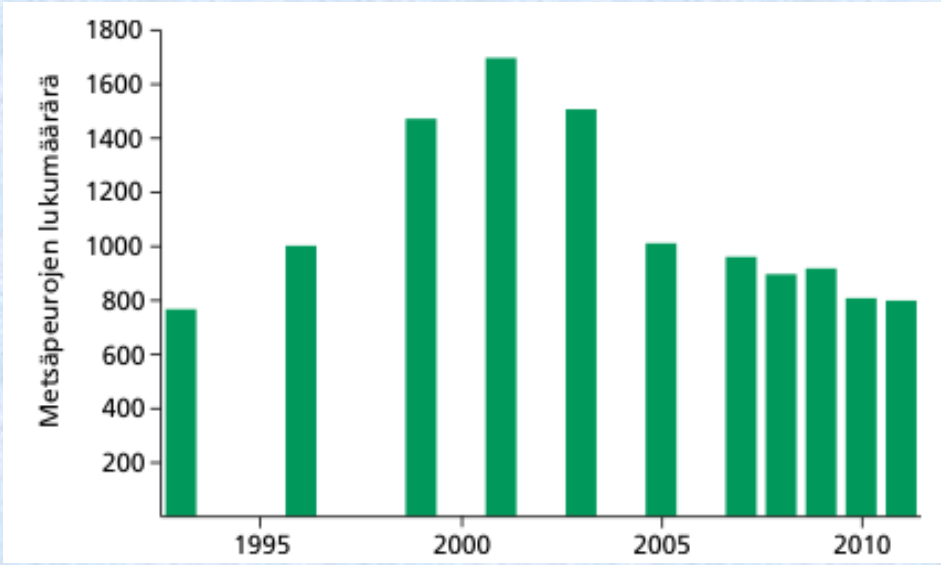
Moose hunting clubs' (6000) reports
No. of moose observations per day



Two sub-populations
Aerial counts with helicopter

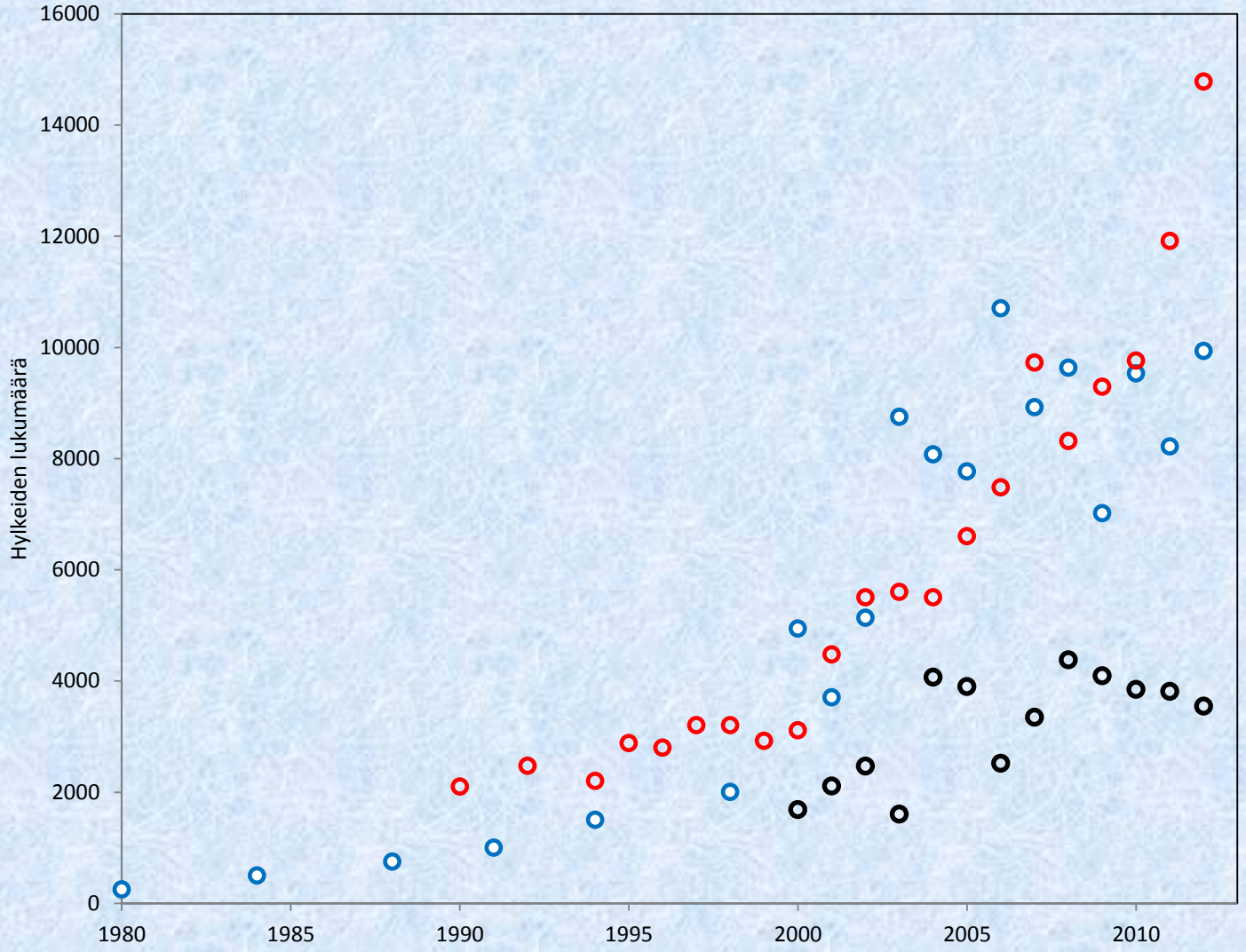






Baltic seals Aerial counts
Two species: ringed seal and grey seal
(international effort)

Grey seal



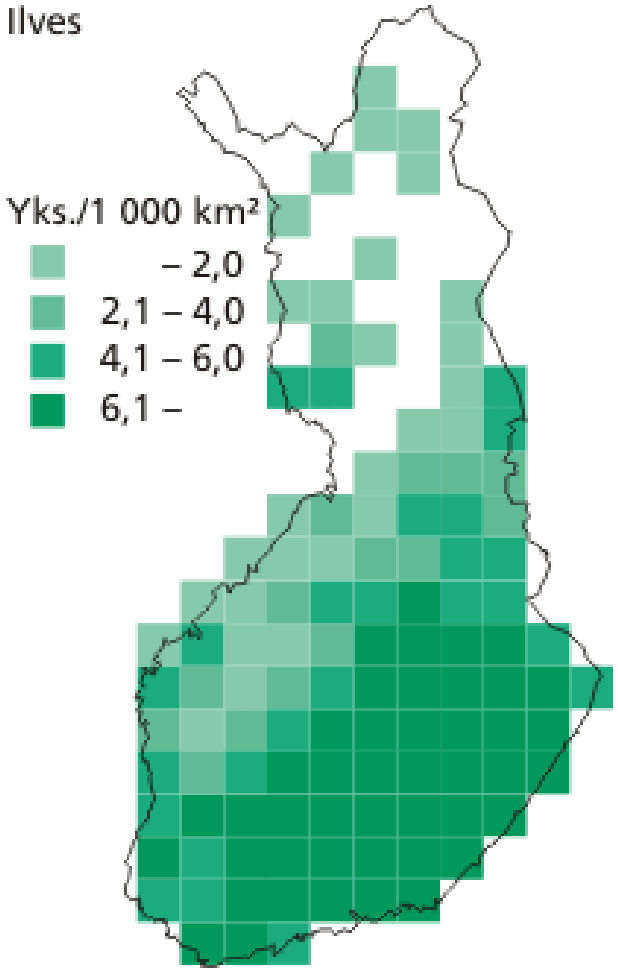
Finland

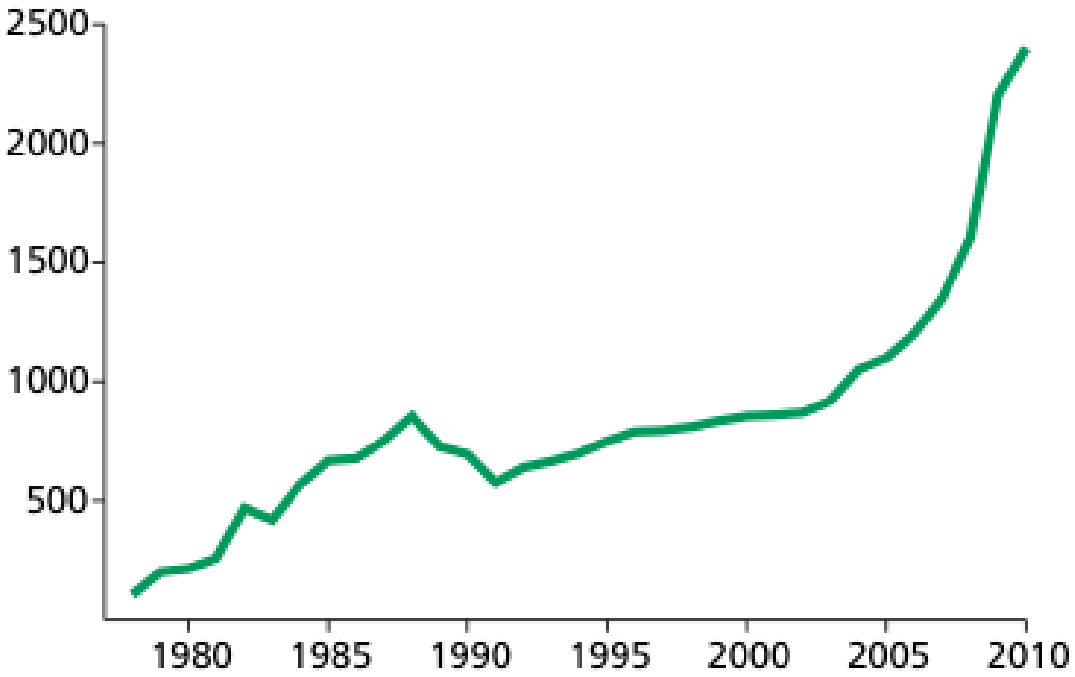
Sweden

Other Balti

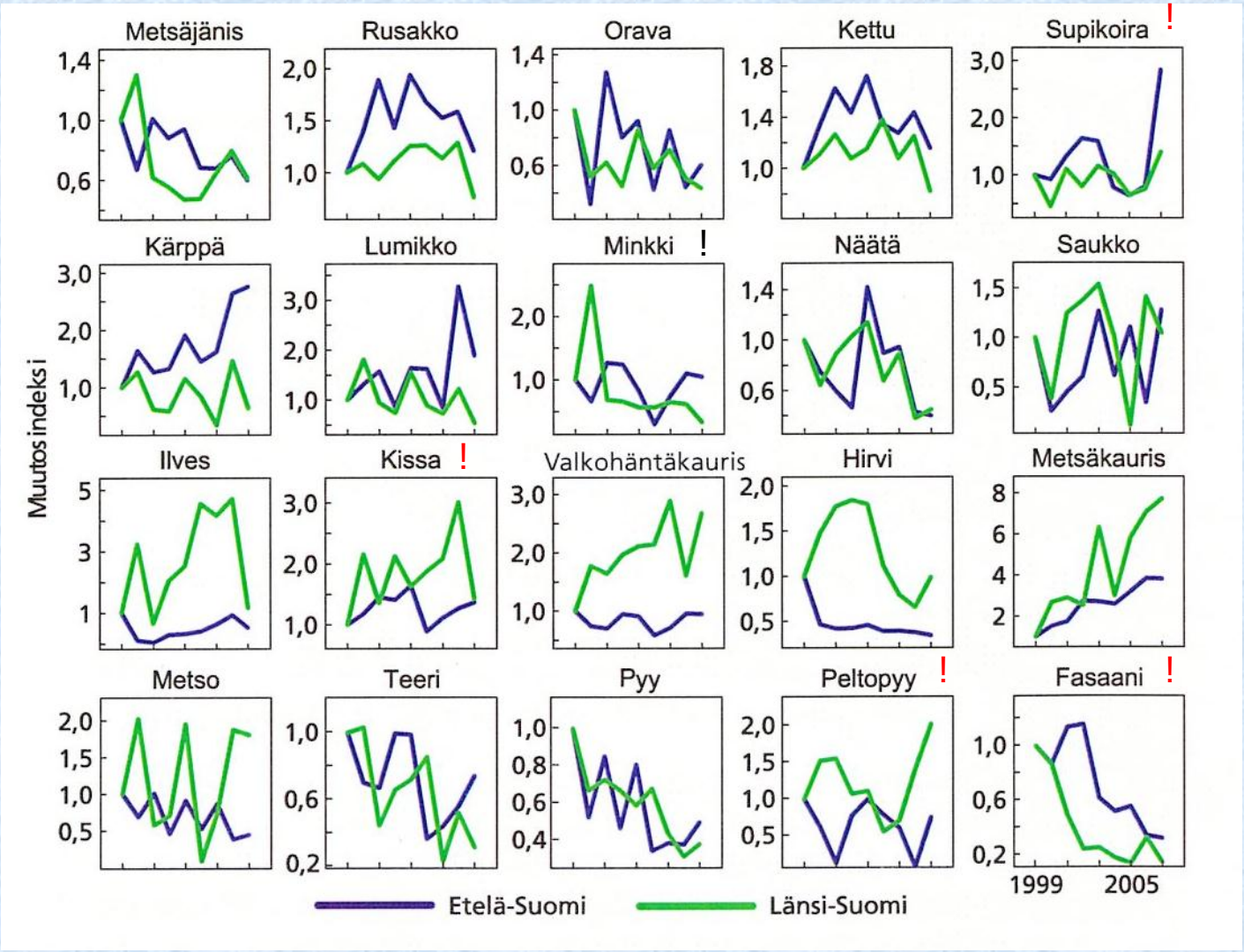
Lynx

Main method for large predators:
Network of trained local (1700)
About 60 000 observations yearly (Tassu)

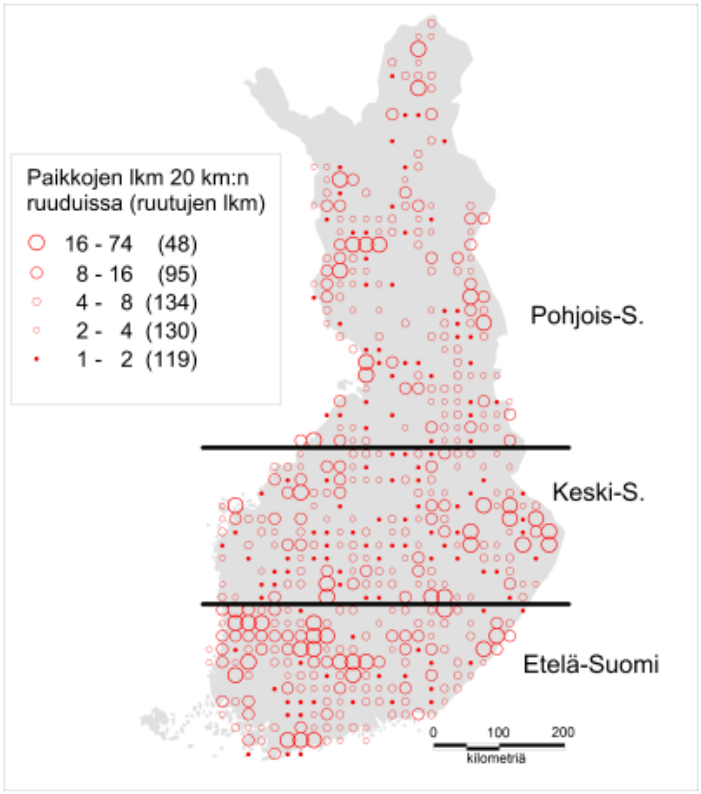


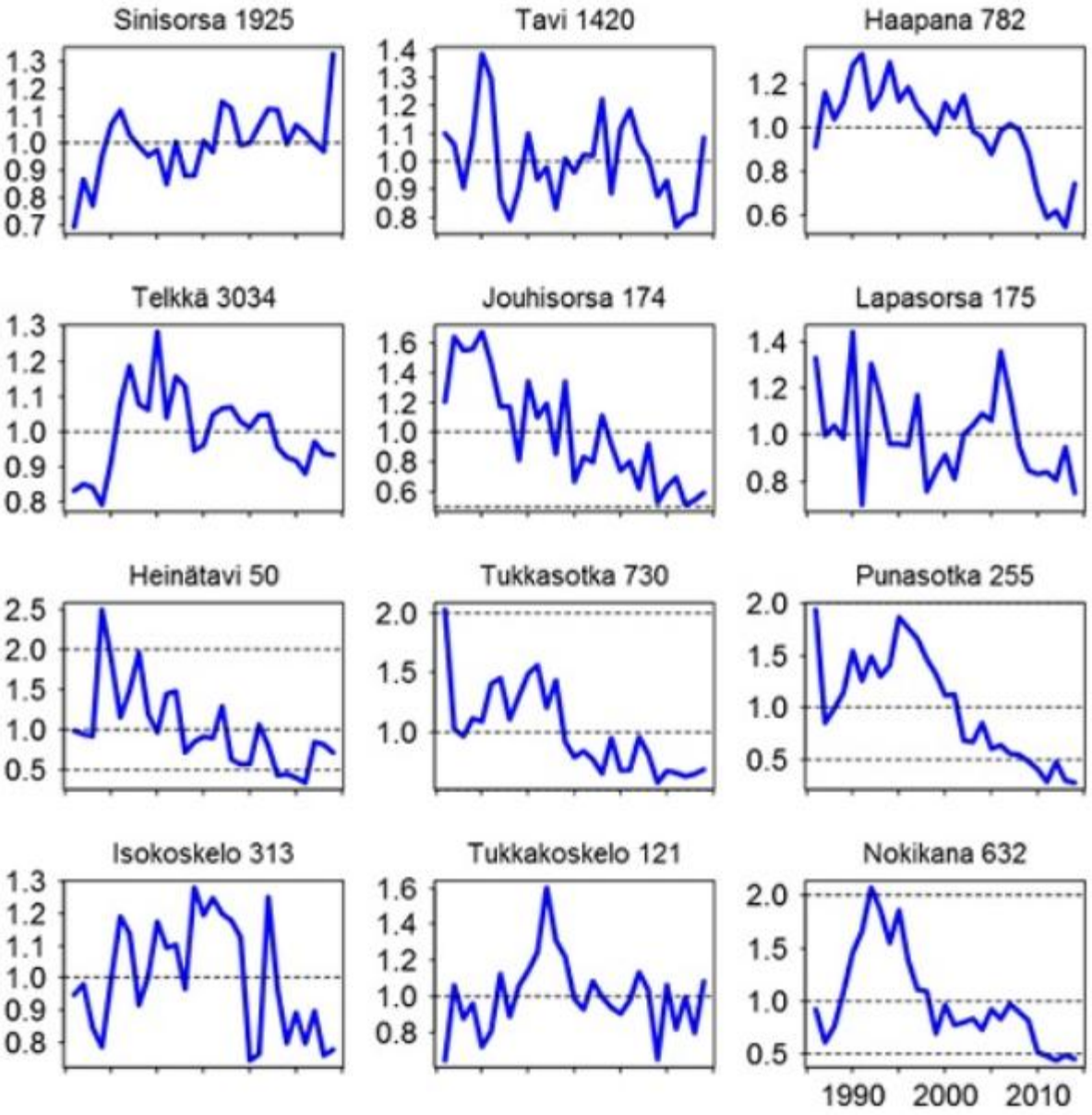


GAME IN AGRICULTURAL AREAS (line transects)
(South and Western coastal areas)




MARCUS WIKMAN

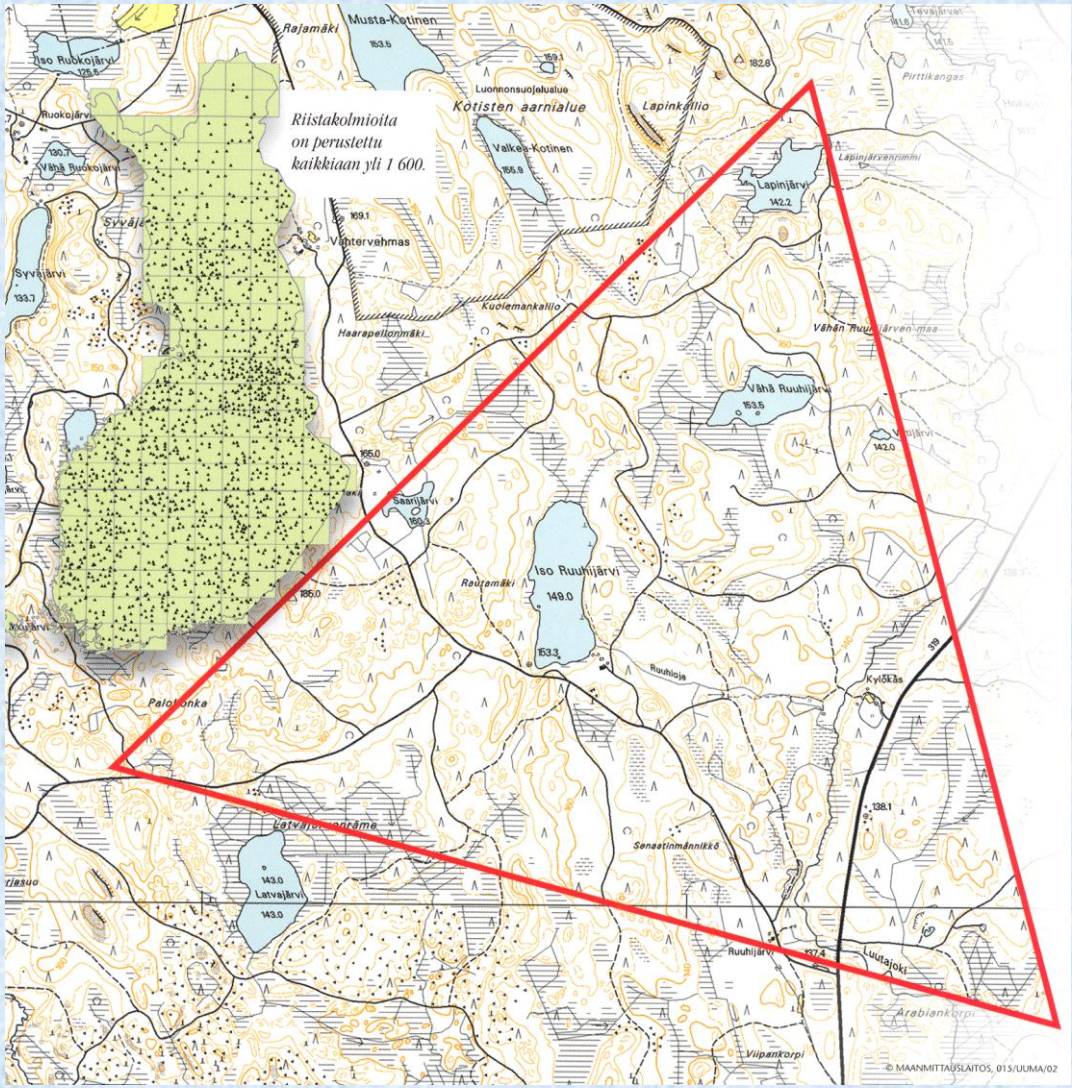

Paikkojen lkm 20 km:n ruuduissa (ruutujen lkm)
16 - 74 (48)
8 - 16 (95)
4 - 8 (134)
2 - 4 (130)
1 - 2 (119)
Pohjois-S.
Keski-S.
Etelä-Suomi
0
100
200
kilometriä


Sinisorsa 1925
Tavi 1420
Haapana 782
Telkkä 3034
Jouhisorsa 174
Lapasorsa 175
Heinätavi 50
Tukkasotka 730
Punasotka 255
Isokoskelo 313
Tukkakoskelo 121
Nokikana 632
1990
2000
2010

FOREST GAME – WILDLIFE TRIANGLE SCHEME

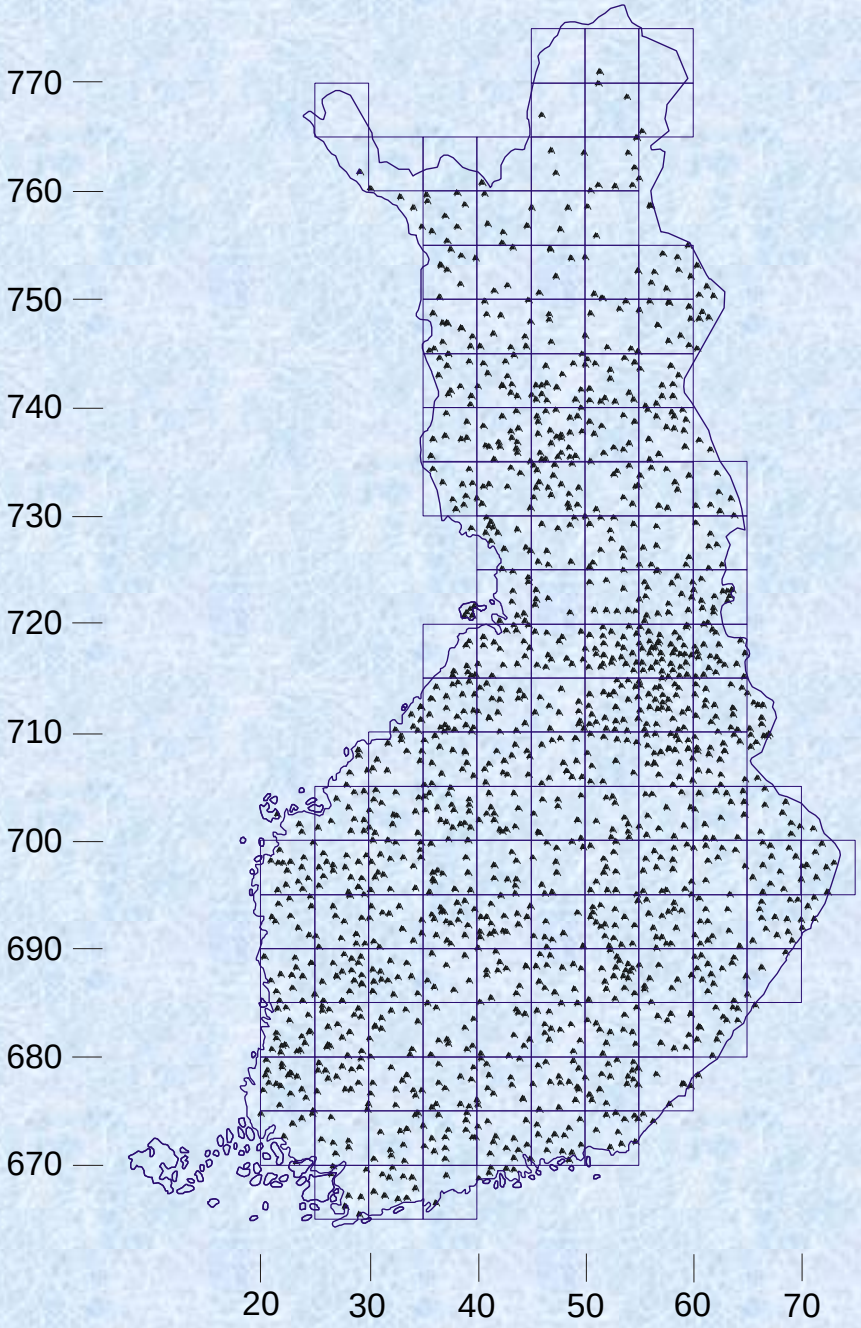
4 + 4 + 4 = 12 km

As randomly as possible in forested areas



1700 wildlife triangles

- Good coverage nation-wide
- Most of them established in Lapland
- Highest density in Kainuu province



Late-summer census

3-man line transect: main belt 60 m in breadth

August prime time for counting grouse, broods still together

Census efficiency high, 80% on average

Winter count in January-March

Usually by skiing

Main target: mammal tracks crossing the line

Standardization: pre-check of the line or count done after a good snow-fall

Species covered in winter:

Mountain hare
European hare
Red squirrel
Flying squirrel
Beaver
Muskrat
Wolf
Red fox
Arctic fox
Raccoon dog
Brown bear
Stoat
Weasel
American mink
Polecat
Pine marten
Wolverine

Badger
Otter
Lynx
Wild boar
White-tailed deer
Moose
Wild forest reindeer
Roe deer

Capercaillie
Black grouse
Hazel grouse
Willow grouse
Partridge
Pheasant
Goshawk
Raven

Parameters

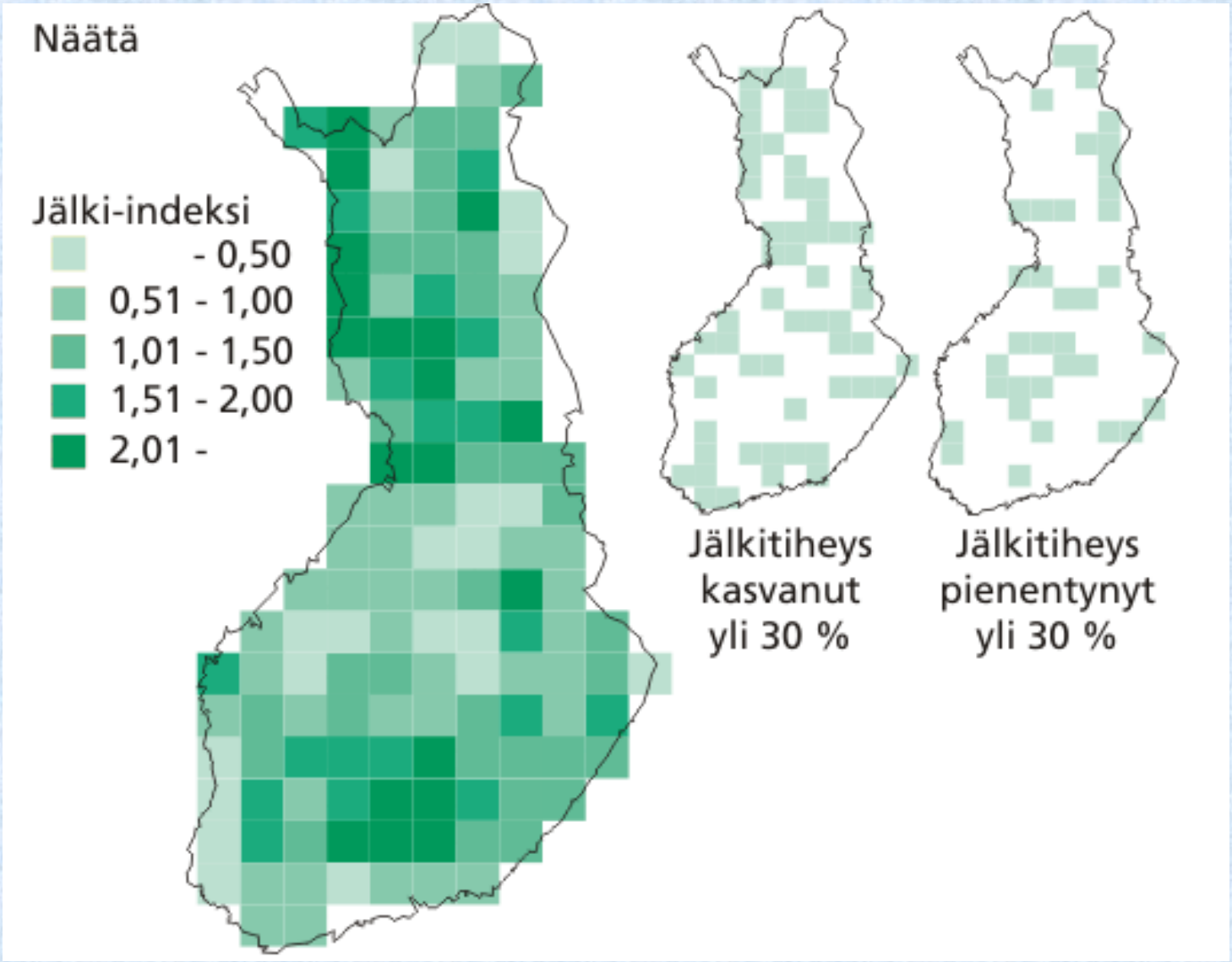
August count:

Grouse, density of individuals
density of adults
density of juveniles
brood size
hen with or without brood
(capercaillie, black grouse)

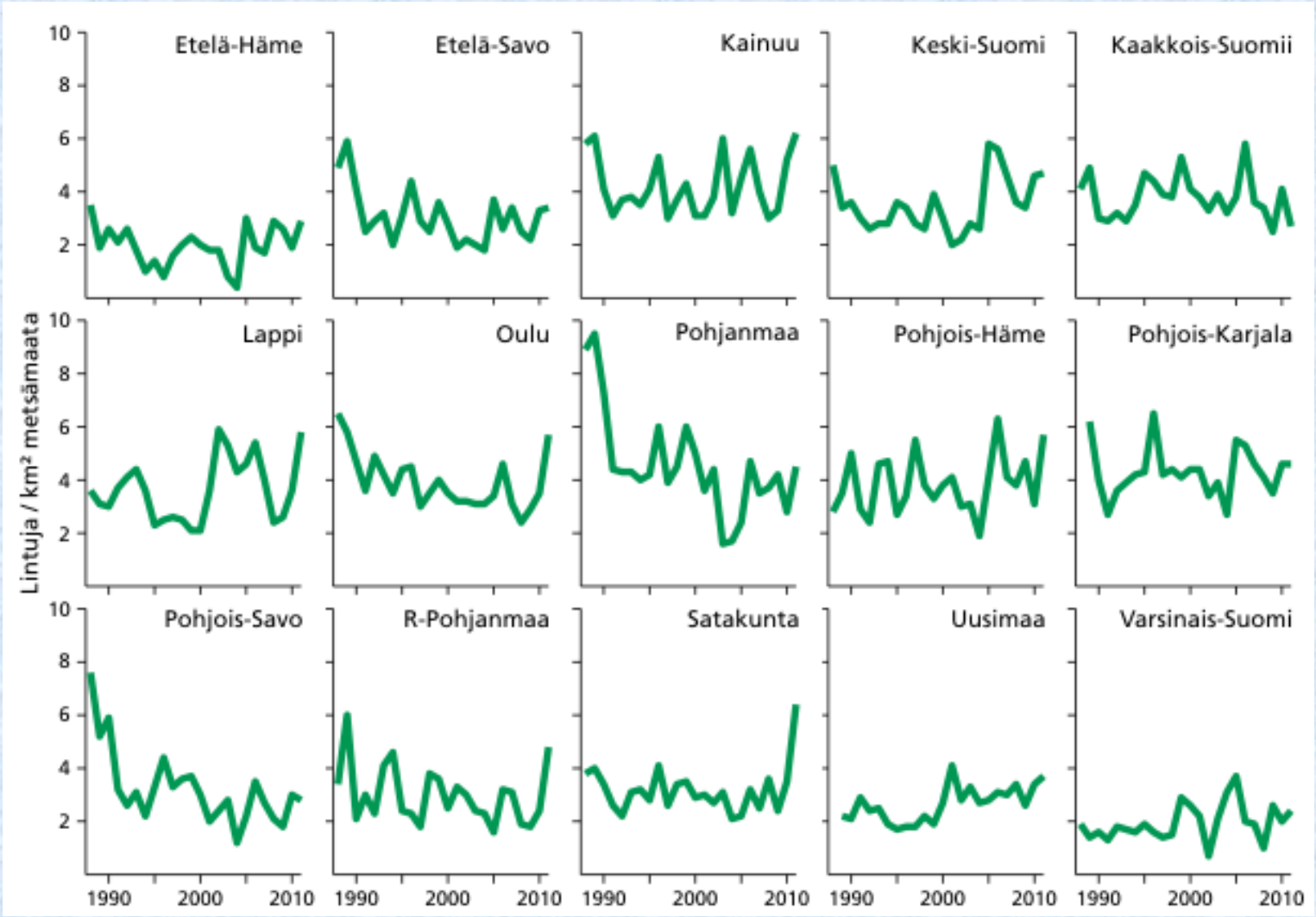
Winter count:

Track density – number of crossings per 24 h per 10 km

Pine marten in 2014



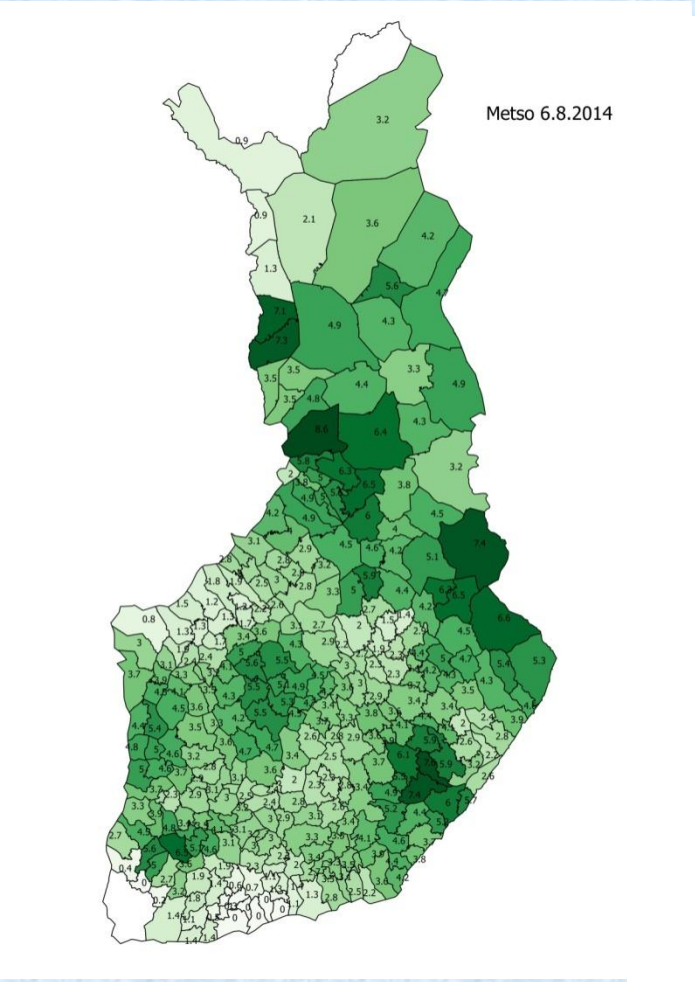
Capercaillie

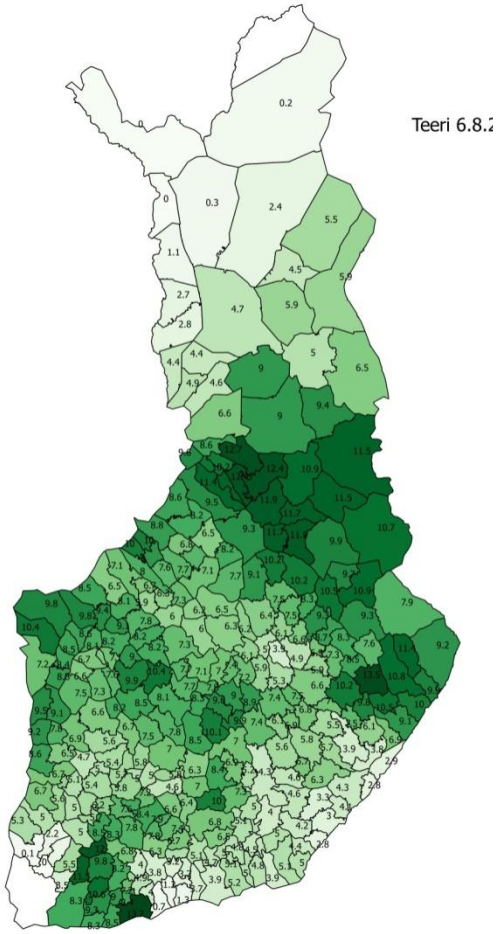


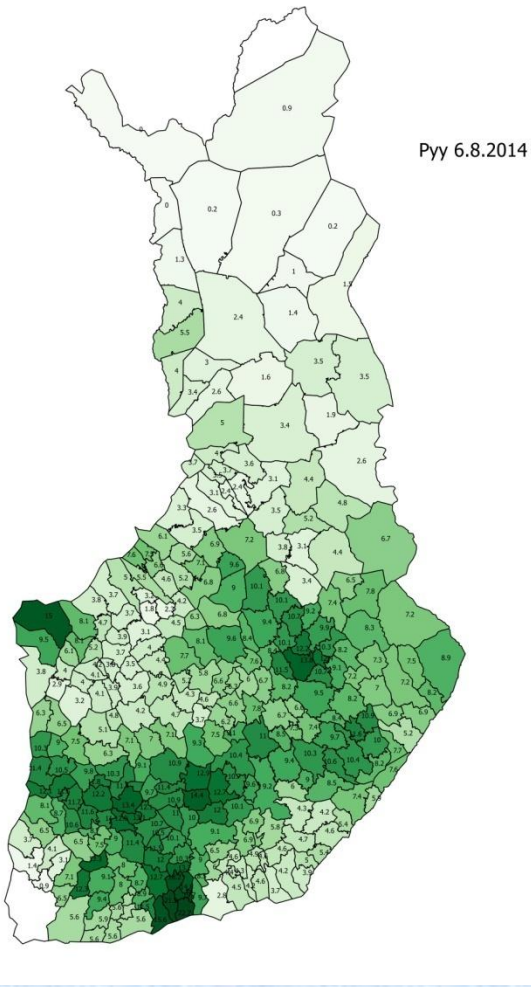
Capercaillie

Black grouse

Hazel grouse



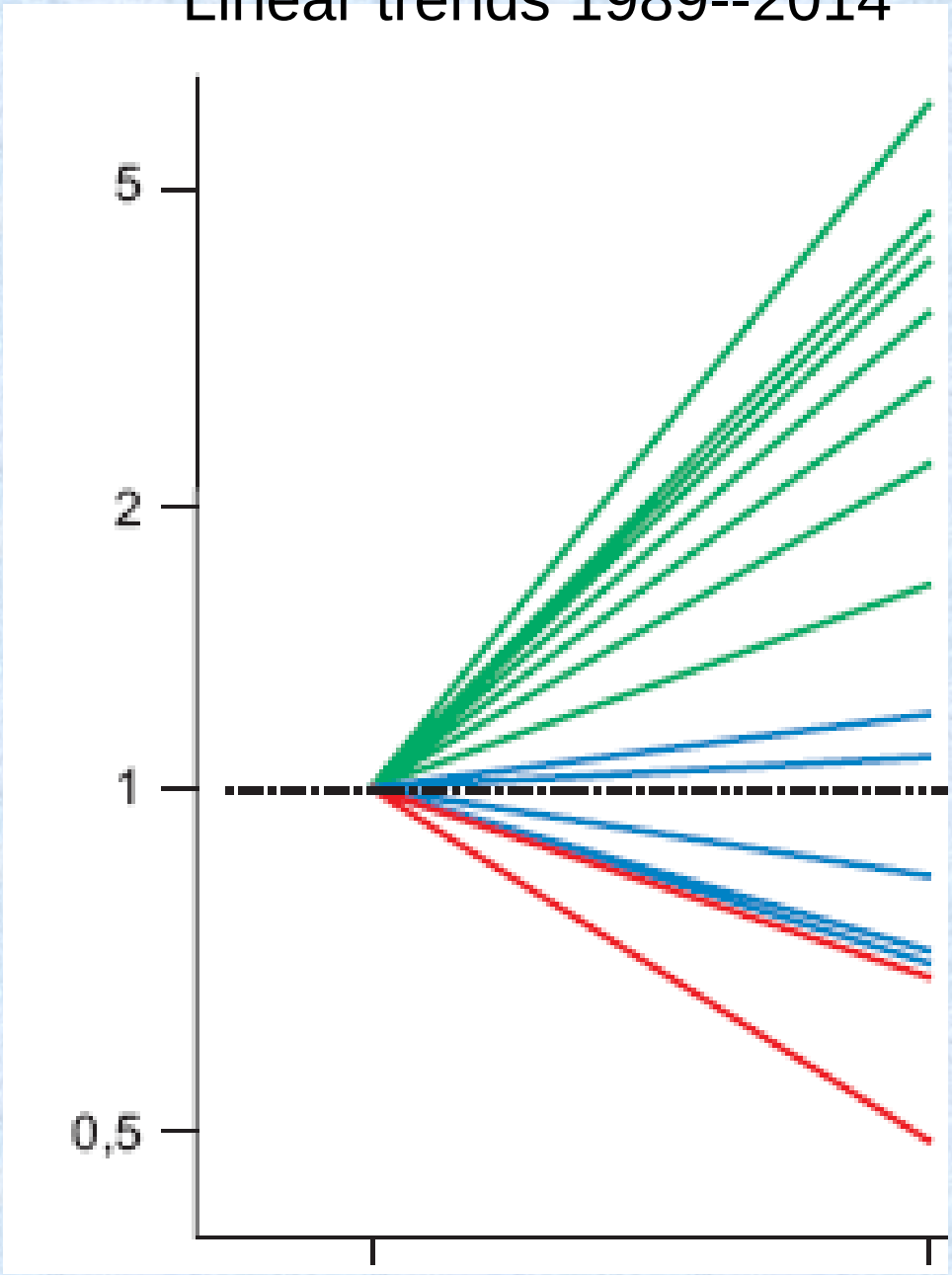




Wildlife triangles: playing with large numbers

- During 1988–2014, about 45 000 counts performed (24 000 in late-summer, 21 000 in winter)
- Total length covered more than 500 000 km
- 850 000 working hours done, roughly 420 person years
- About 330 000 grouse individuals observed
- Snow tracks of mountain hare, moose and red fox most abundant. Their total numbers are 640 000, 190 000 and 170 000, respectively.

Linear trends 1989--2014



Roe deer

Wolf
Wild forest reindeer
Wolverine
Lynx
European hare

White-tailed deer

Otter

Moose
Pine marten

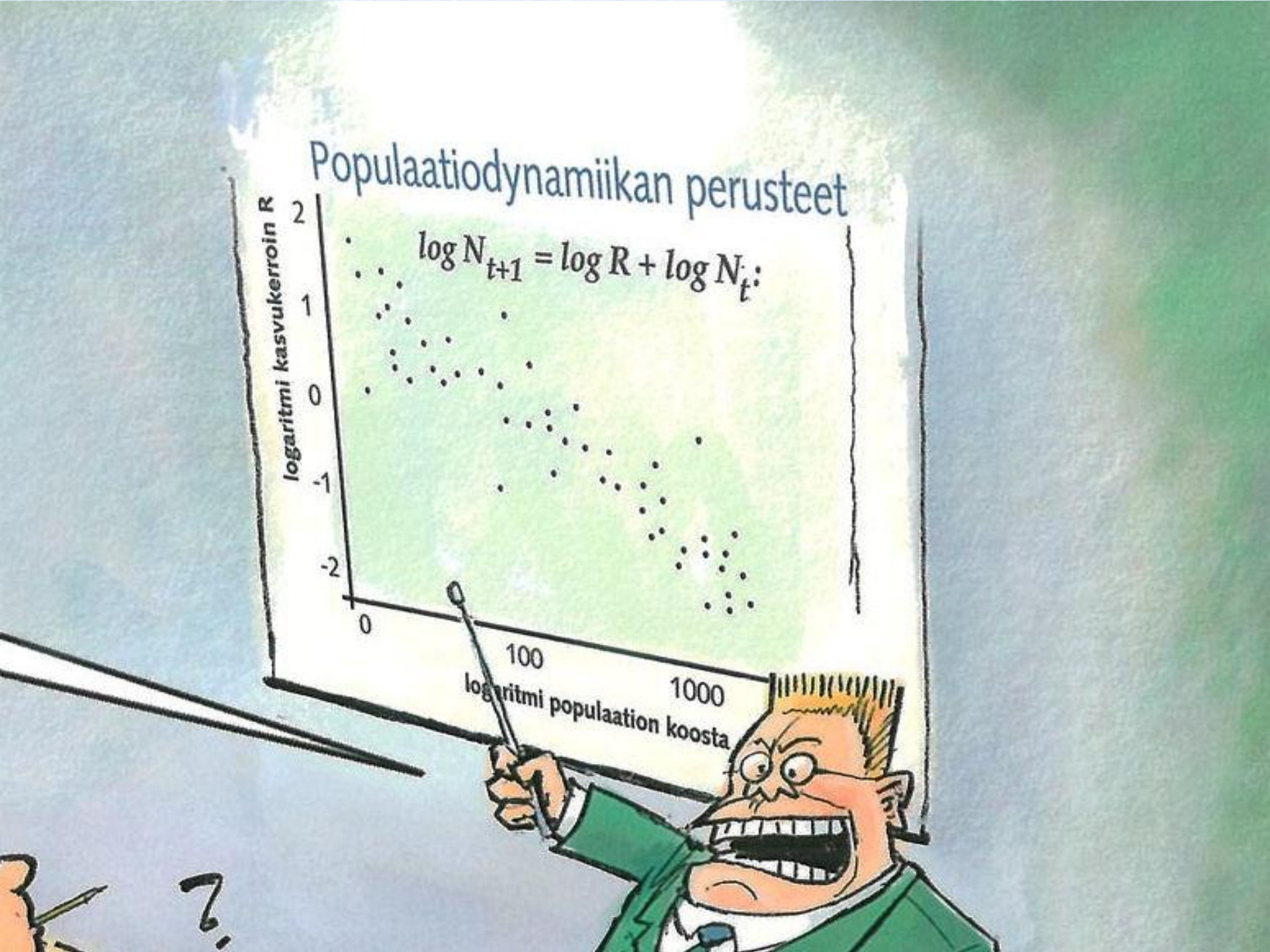
Red fox
Red squirrel
Least weasel
Mountain hare !!!

Stoat

Value of voluntary work done by hunters and bird-watchers in game monitoring programs estimated in 2008 based on an questionnaire

- Large predator observer network – 40 person work years
- moose (observation cards) – 28 pwy
- wildlife triangle counts – 20 pwy
- counts of waterfowl and species of agricultural land less work intensive

Value of work – about 1 200 000 € annually
Voluntary helpers also drive about 900 000 km per year without compensation!


Populaatiodynamiikan perusteet
$\log N_{t+1} = \log R + \log N_t$:
logaritmi kasvukerroin R
2
1
0
-1
-2
0
100
1000
logaritmi populaation koosta
?

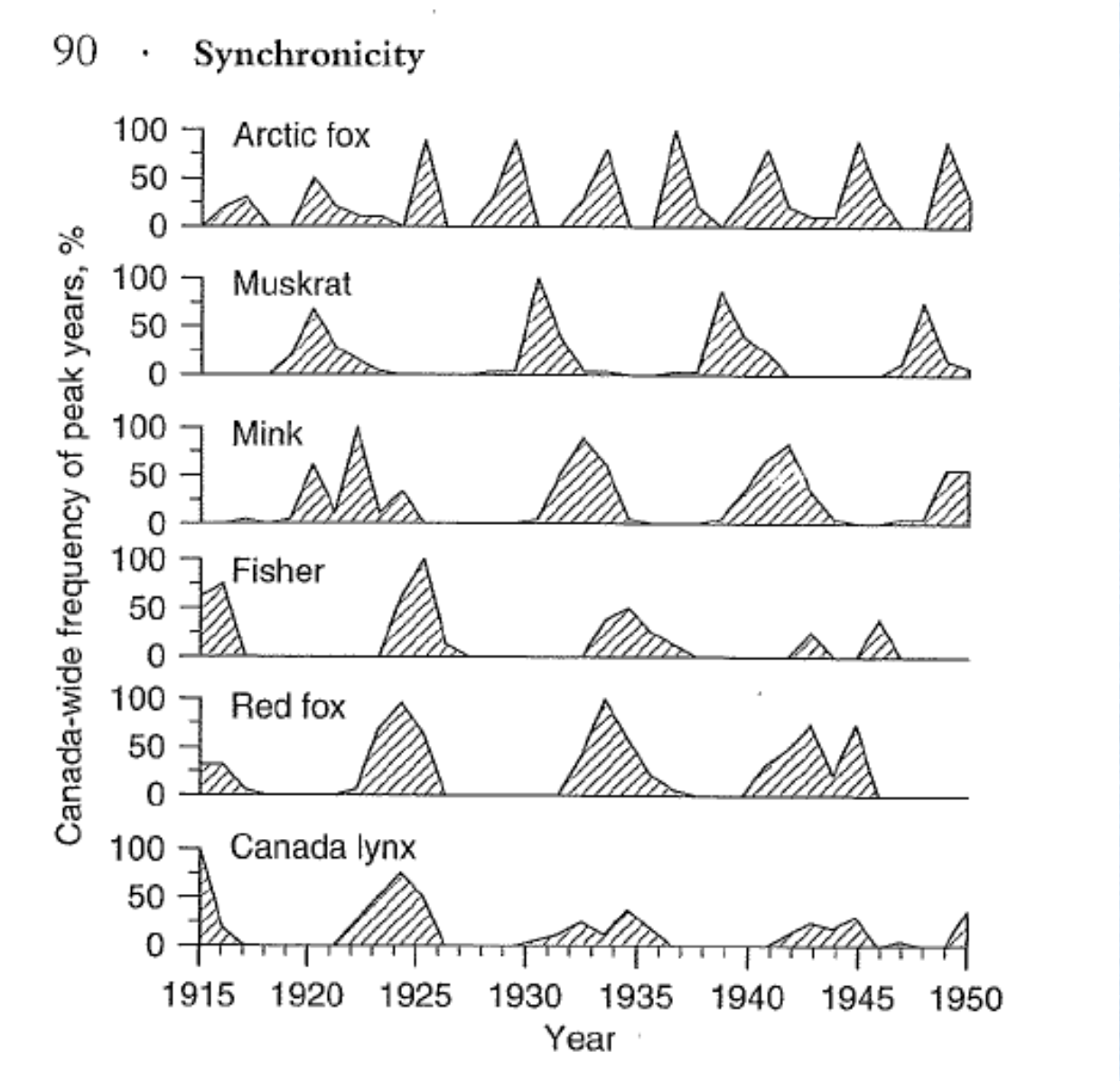
Black grouse

Hazel grouse

Rock ptarmigan Willow grouse

Capercaillie

Hudson Bay Company's records (redrawn from Butler 1953)



- Population growth model (in its simplest form)

  New population size = old size + births - deaths + immigrated – emigrated

$$N(t+1) = N(t)e^{r[1 - N(t)/K]}$$

N = population size

t = time

r = growth rate

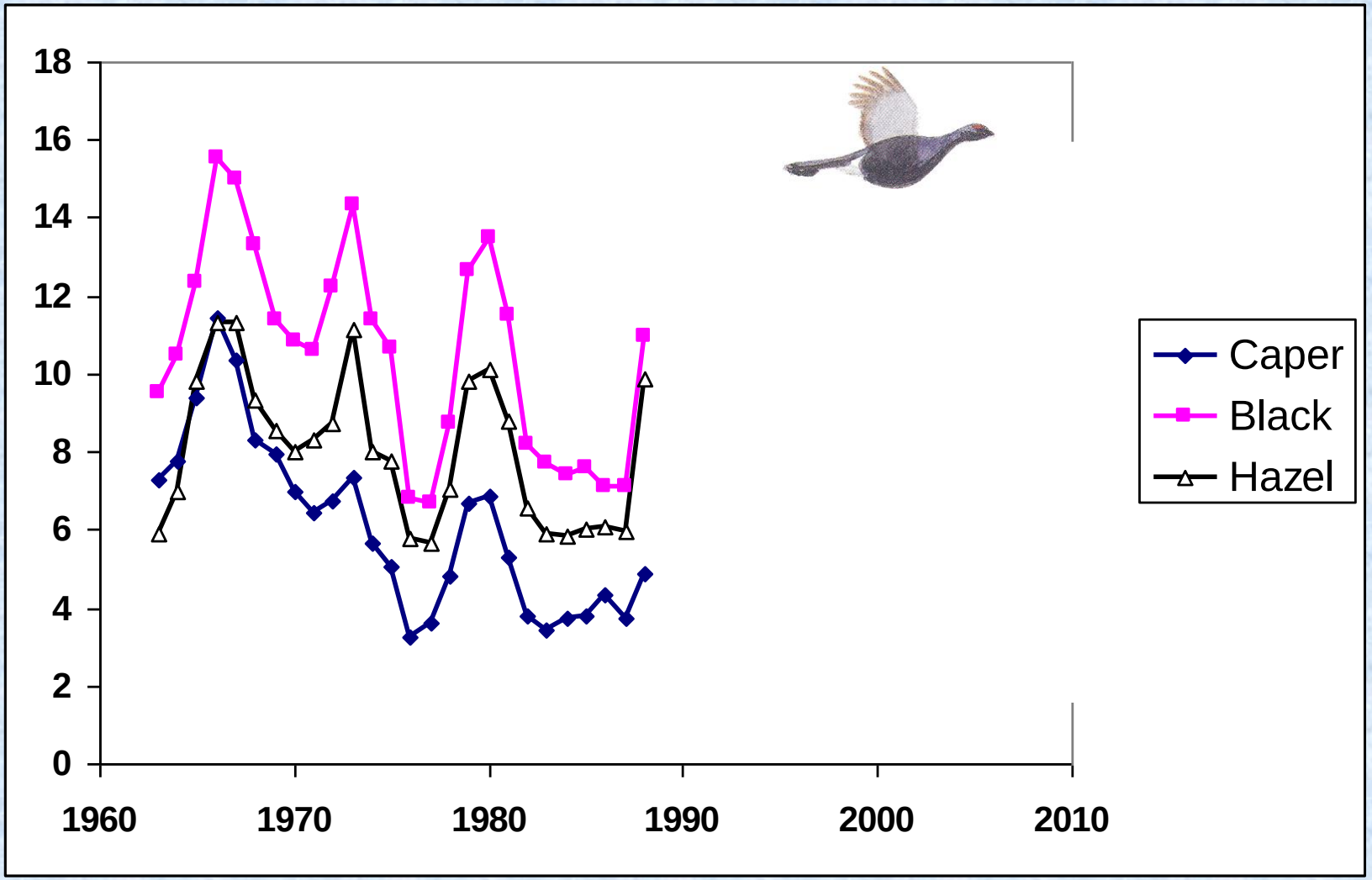
K = carrying capacity

”There are three kinds of mathematicians:
Those who can count and those who cant.”

Anon.

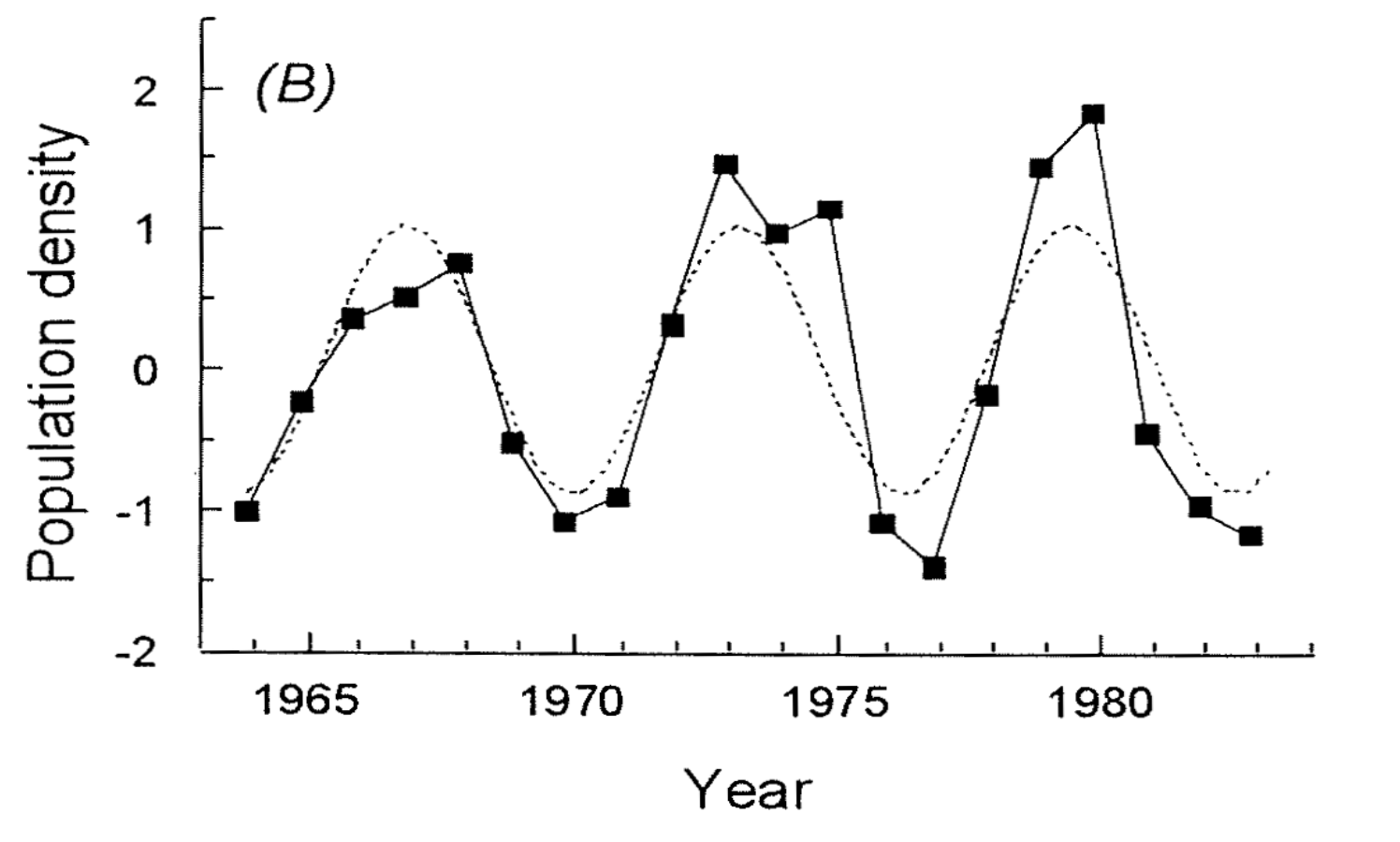
During 1960s-80s: 6-7 years cycles prevailed

Lindström, Jan 1994: Modelling grouse population dynamics. PhD thesis, Univ. Helsinki.

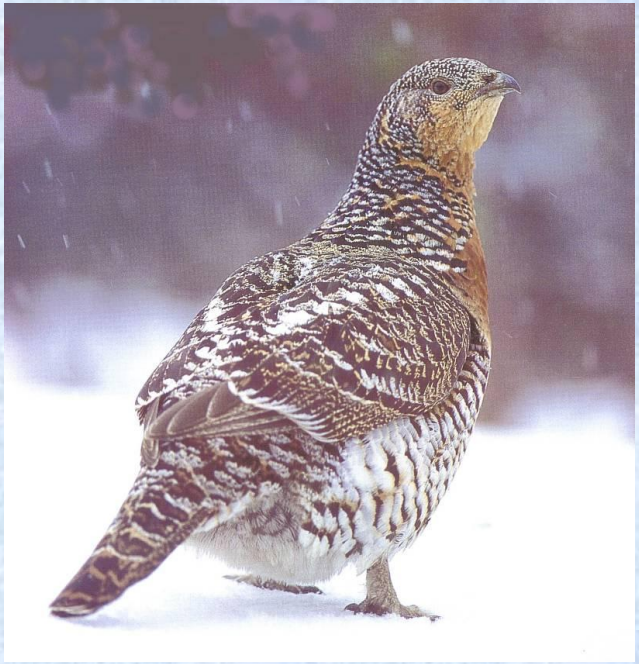


$$N_t = a + b_1(t) + b_2 \cos(t) + b_3 \sin(t),$$

where a – constant, b_1 – captures the trend, b_2 and b_3 together with the trigonometric functions allow for the part of population fluctuation

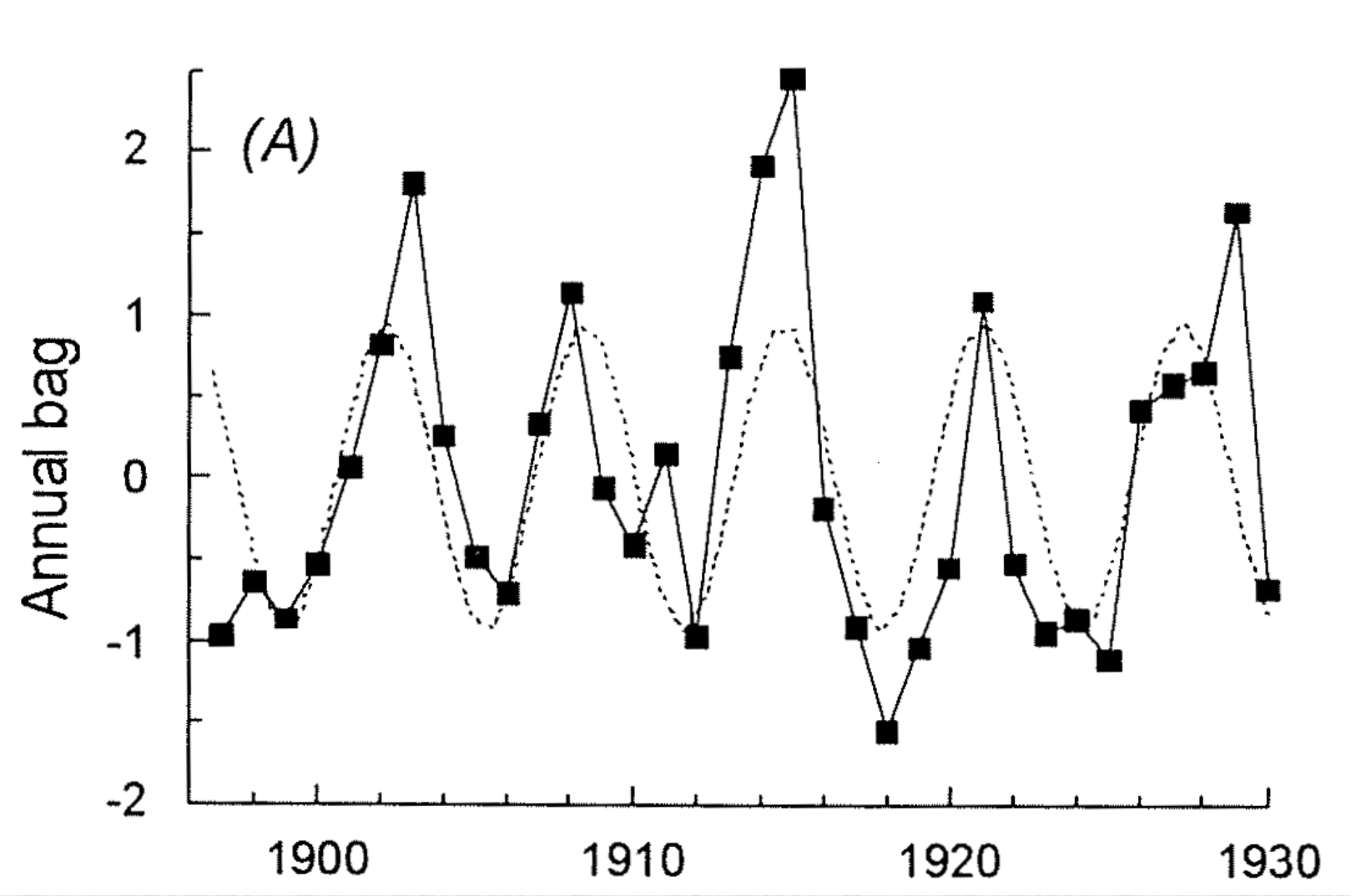


Cycles can be modelled nicely in 1960s-1980s by a combination of sin and cosine functions



What is the population ecological explanation of sin and cosine functions? Of course, none!

Annual bag of black grouse in SW Finland during 1897–1930



Elements needed in Finnish grouse cycles:

- delayed density dependence
- dampening dynamics: random hits are needed
- spatial synchrony of populations

Reasons:

- intrinsic factors; age structure of population
- weather effects (did)
- predation (dd)
- parasites, diseases (dd)
- etc.
- most probably a combination of several factors

During increasing phase:

- females older than average, producing more offspring
- females lay more eggs
- females (also/especially old) probably in better physical condition (why is that? spring food, weather, 'history' (year of birth?), better incubators, better in guarding a brood, selecting habitats with less predators), other behavioural responses to predation?

During decreasing phase:

- factors opposite

What could 'a random hit' be?

Weather conditions during egg-laying period and (especially) during early brood season

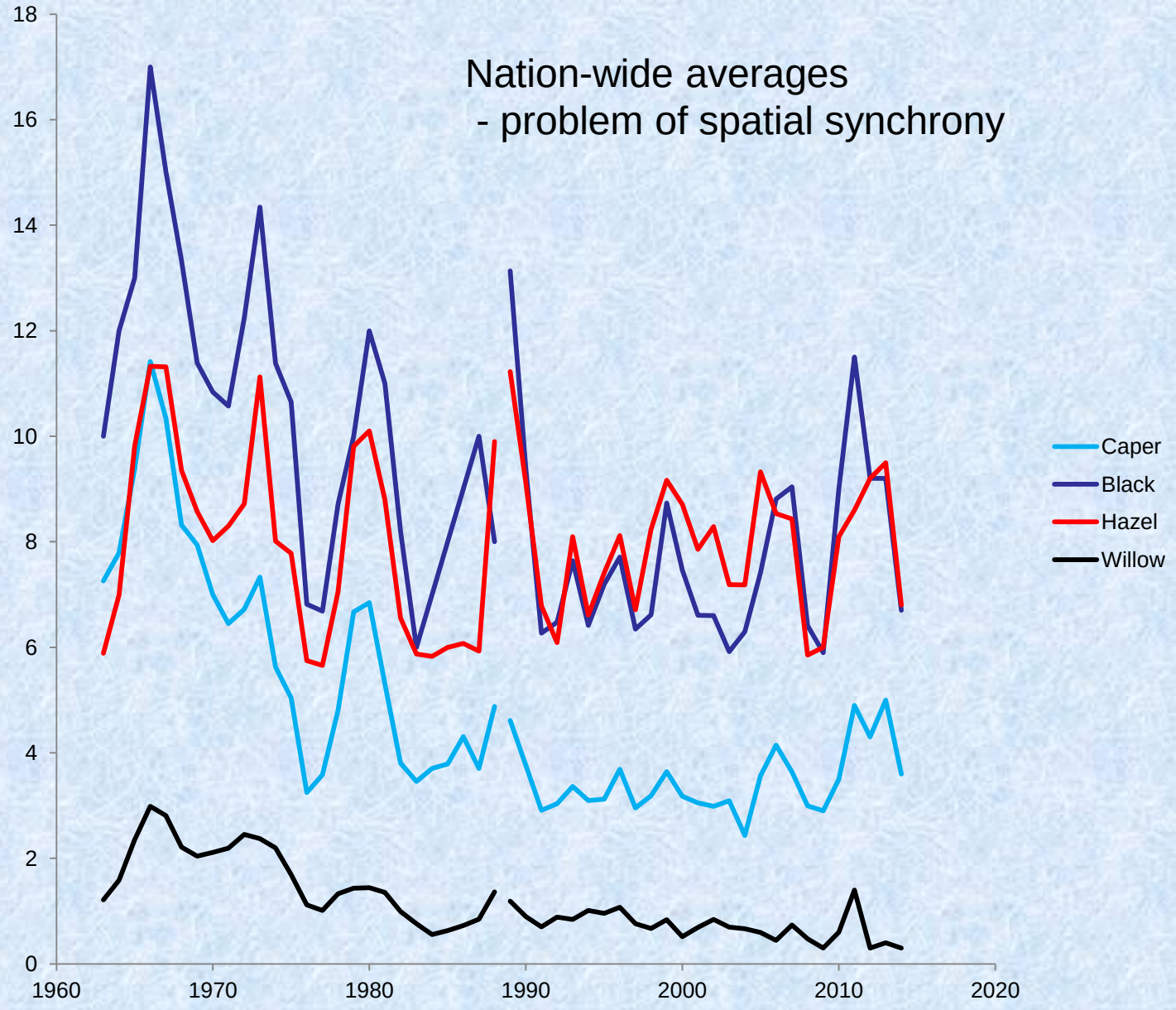
Predation – especially during vole population low

Diseases

Parasites

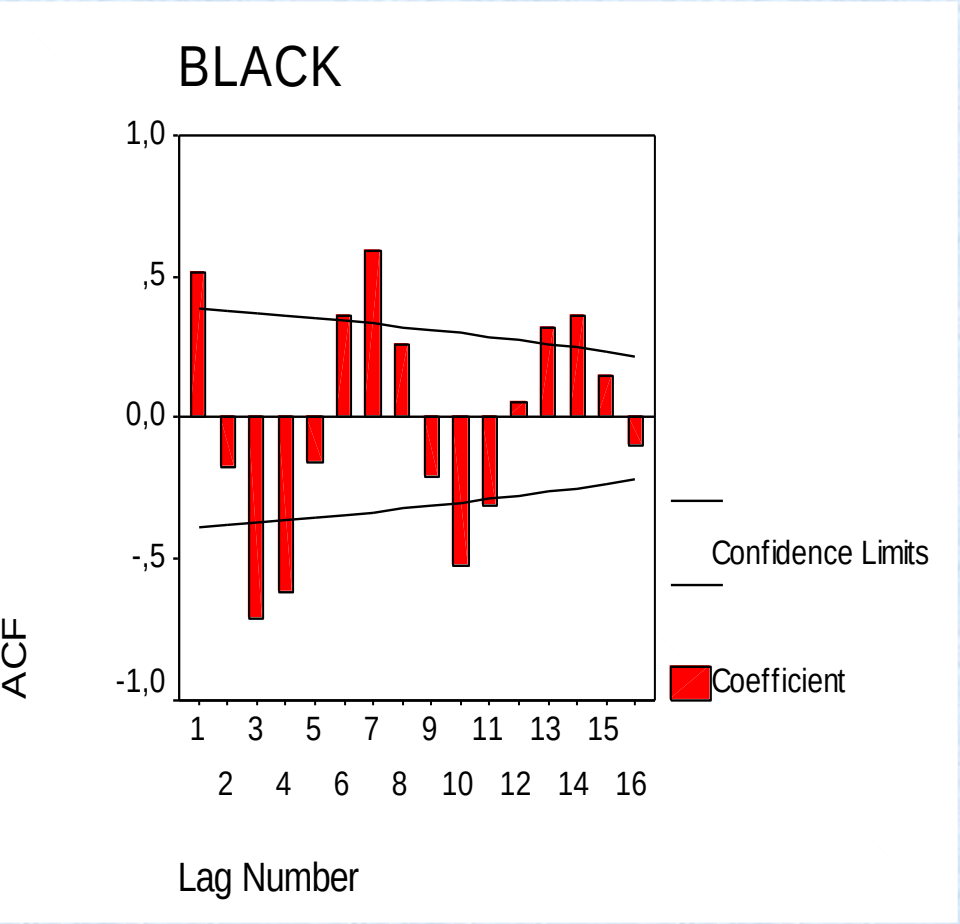
A combination of these (and unknown) factors

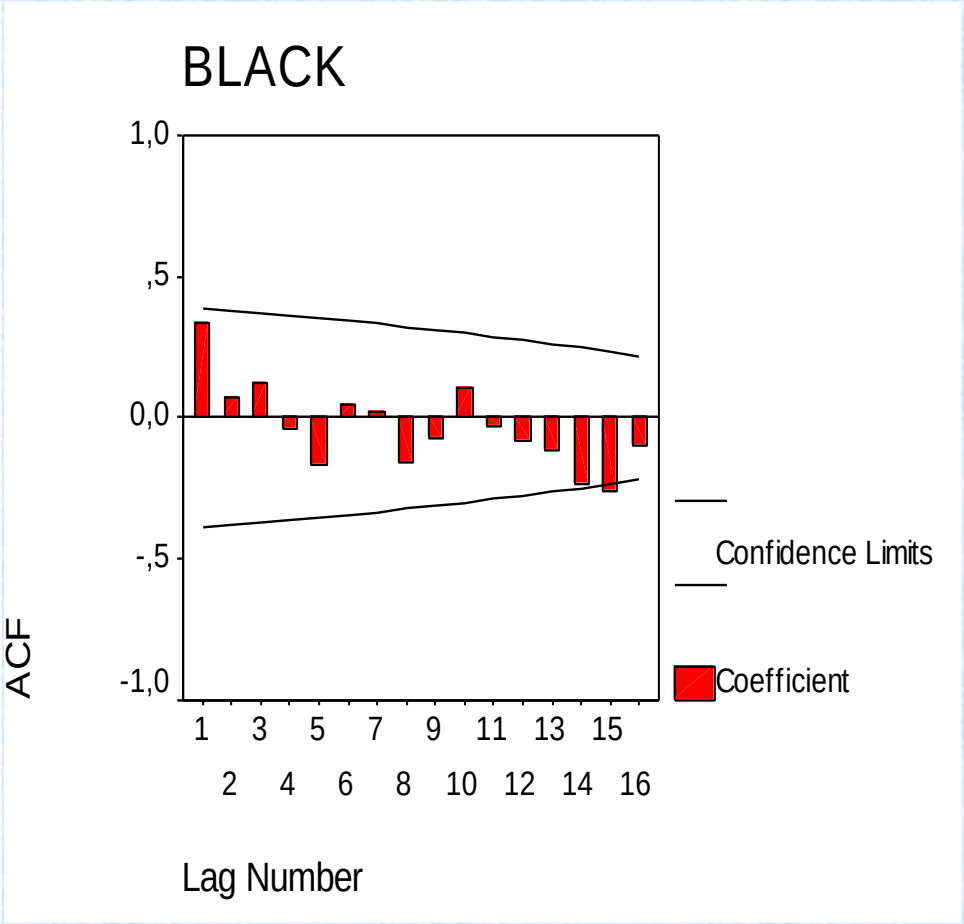
(In addition, population age structure is playing at least some role in cyclic fluctuations)


Nation-wide averages
- problem of spatial synchrony
18
16
14
12
10
8
6
4
2
0
1960
1970
1980
1990
2000
2010
2020
Caper
Black
Hazel
Willow

1963–1985

1986–2008





Why did the cycles disappear (hypotheses only):

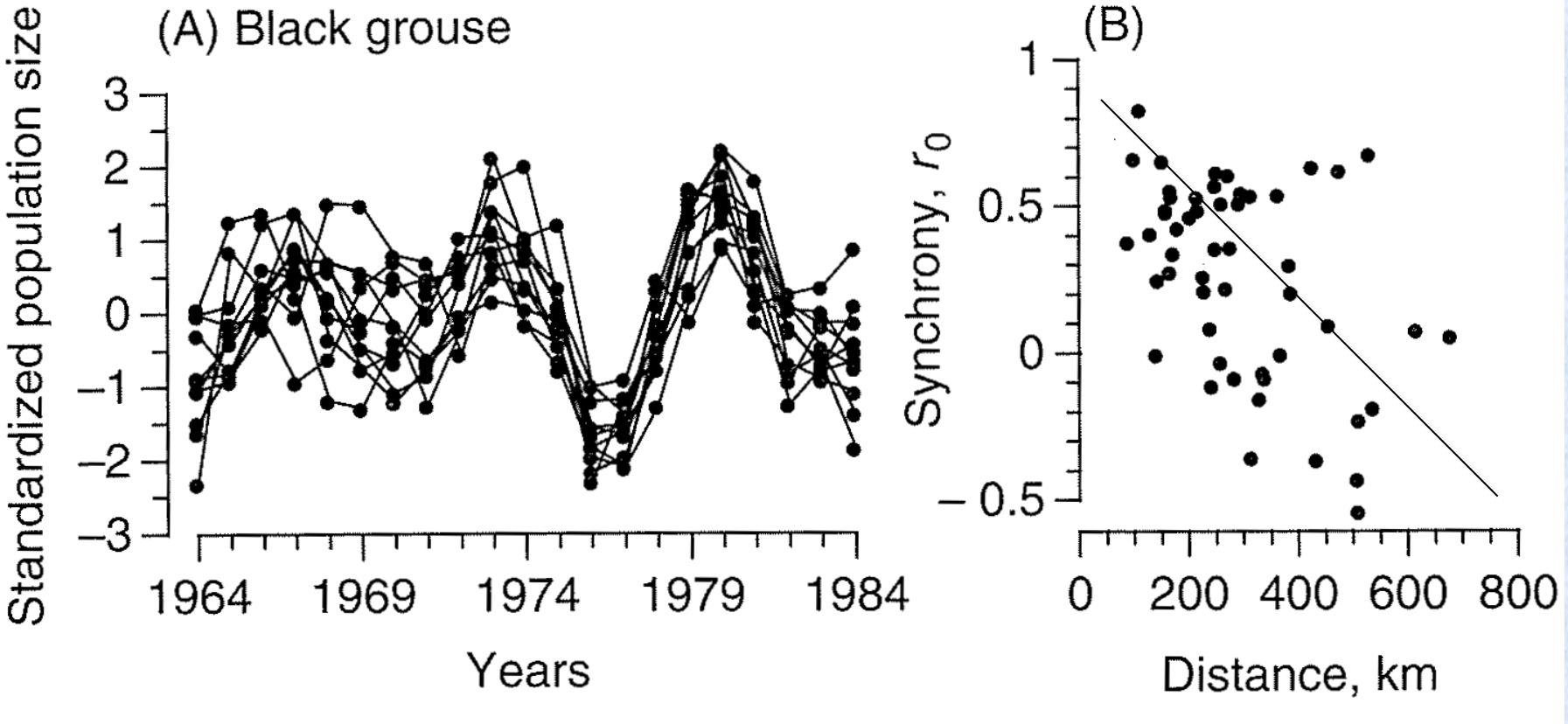
- Species densities decreased below a critical threshold due to various reasons (increased predation, lowered habitat quality etc.)

- Decreased densities: fewer observations produce more noise to the data

- Simulations suggest that minor changes in parameters may alter dynamics: either shortening or lengthening cycles; they may easily disappear – and come back as well

- If dispersal is needed to maintain spatial synchrony, it may have become weaker due to e.g. habitat fragmentation

SPATIAL ASPECTS



One example:

Spatial synchrony in grouse populations1964-2008

15 game management districts

All pair-wise correlations calculated (105)

Mean value is used to describe average regional synchronism

Sliding time window technique

Synchrony in 20 years periods

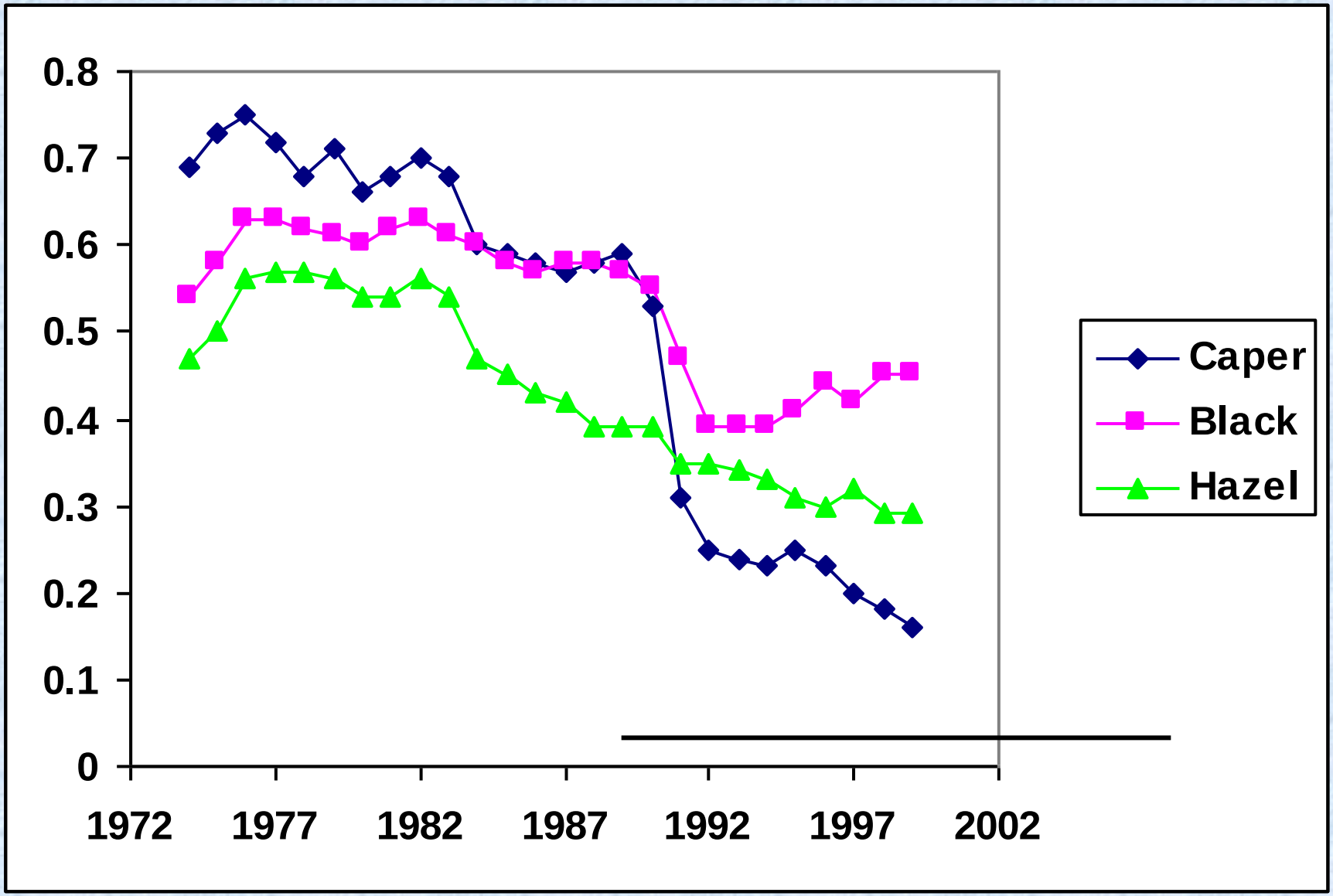
1. 1964-1983
2. 1965-1984

..

..

26. 1989-2008

Ranta et al. 1995, updated



Thank You for your attention!