



Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences

Sötvattenslaboratoriet

*Kerstin Holmgren:
Contribution to "eDNA-seminar",
3 December 2014, in Drottningholm*

Lake fish communities – monitoring today and tomorrow

Havs
och Vatten
myndigheten

NATUR
VÅRDS
VERKET 

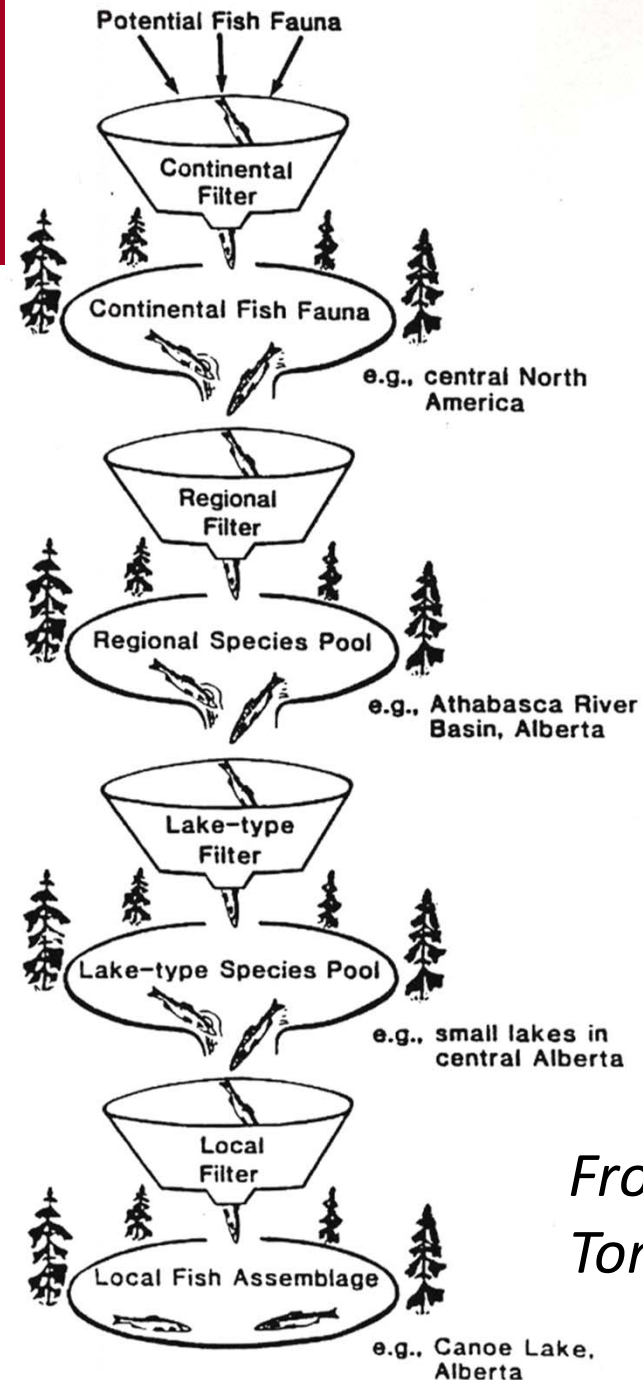


General background

Hierarchical filters

- Continental
- Regional
- Lake type
- Local

Influence the structure, function and dynamics of local fish assemblages (or communities)



From:
Tonn 1990

General background: Fish community characteristics can be measured and/or inferred

Structure

Abundance & biomass
Species composition
Distributions of size, age, sex, etc.

Function

Trophic guild
Feeding habitat preference
Reproductive guild
Tolerance and optima (in abiotic and biotic environmental gradients)

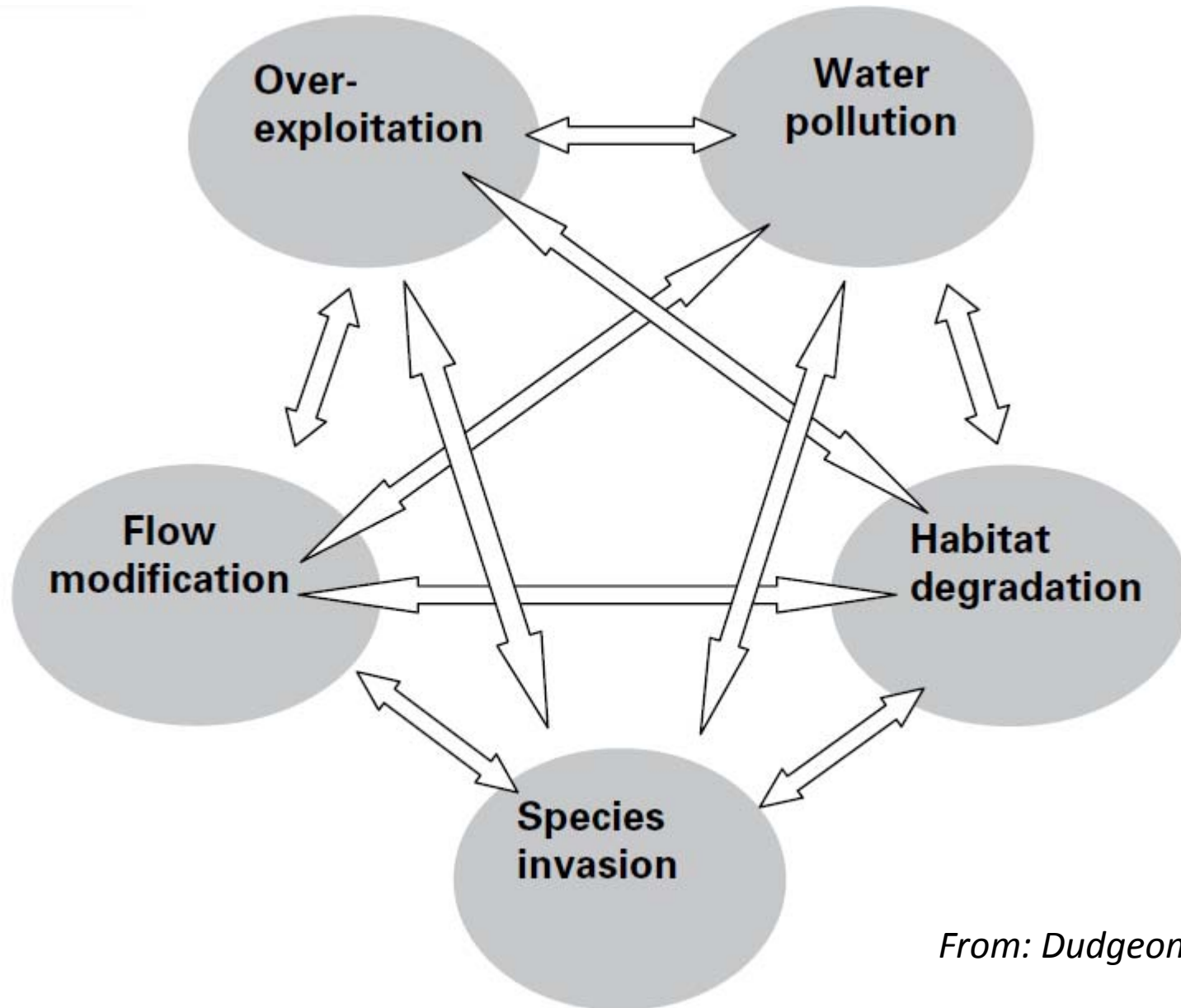
Dynamic processes

Individual growth
Recruitment
Mortality

Objective & challenge:

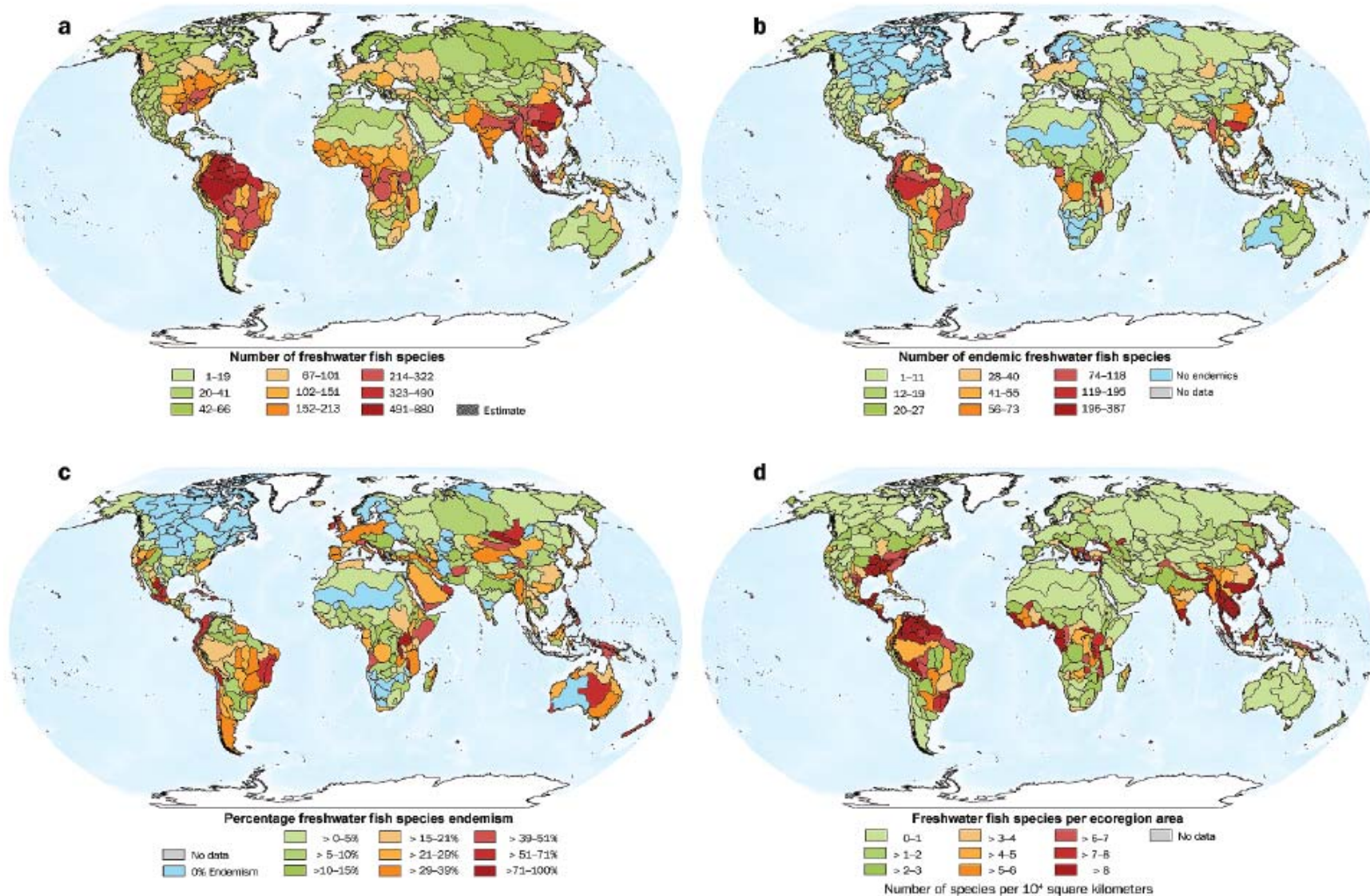
To distinguish effects of anthropogenic pressures from natural variation

Five major threats to freshwater biodiversity



From: Dudgeon et al. 2006

***Abell et al. 2008*: > 13400 described freshwater fish species, 6900 endemic to one ecoregion**



Sampling of fish with multi-mesh gillnets (EN 14757)

Nordic gillnets

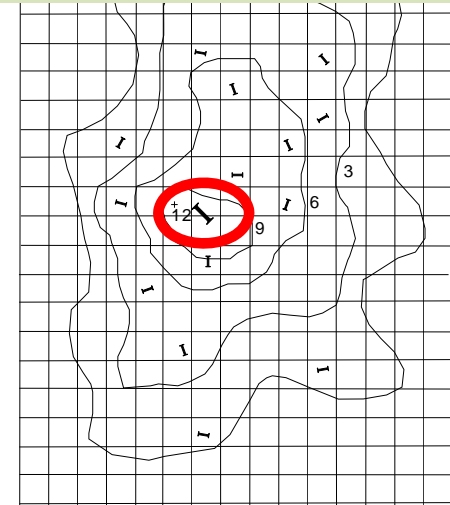
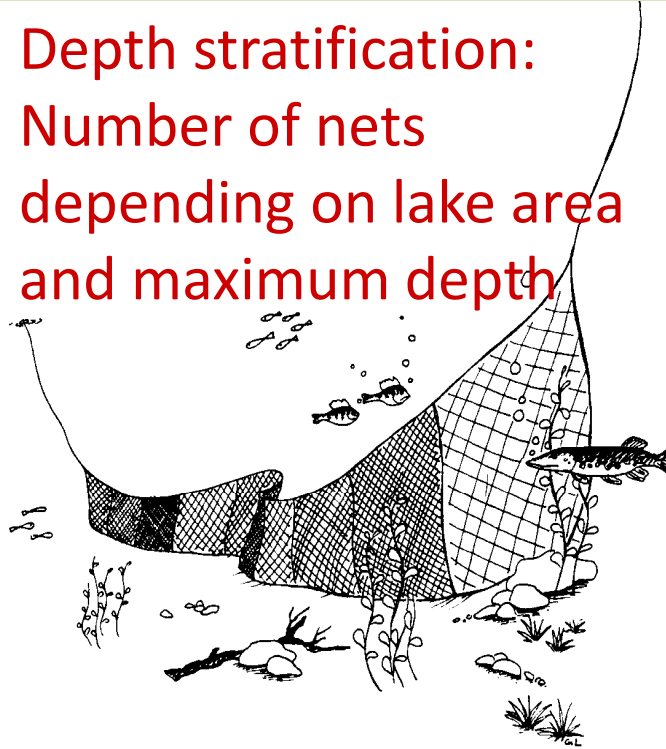
1,5 m deep

12 panels (2.5 m)

Mesh sizes:

5 - 55 mm

Depth stratification:
Number of nets
depending on lake area
and maximum depth



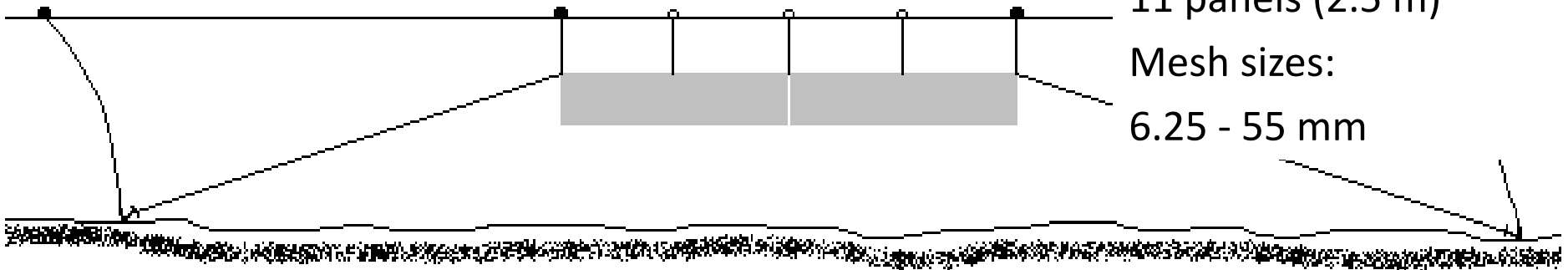
Pelagic nets

6 m deep

11 panels (2.5 m)

Mesh sizes:

6.25 - 55 mm



Fish sampling with gillnets in July or August

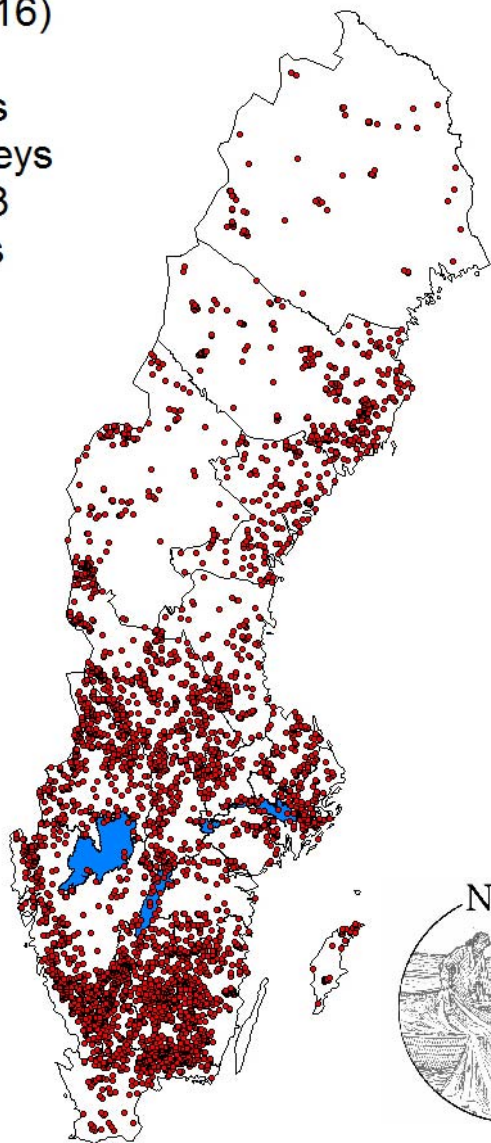


Most field working hours are spent ashore

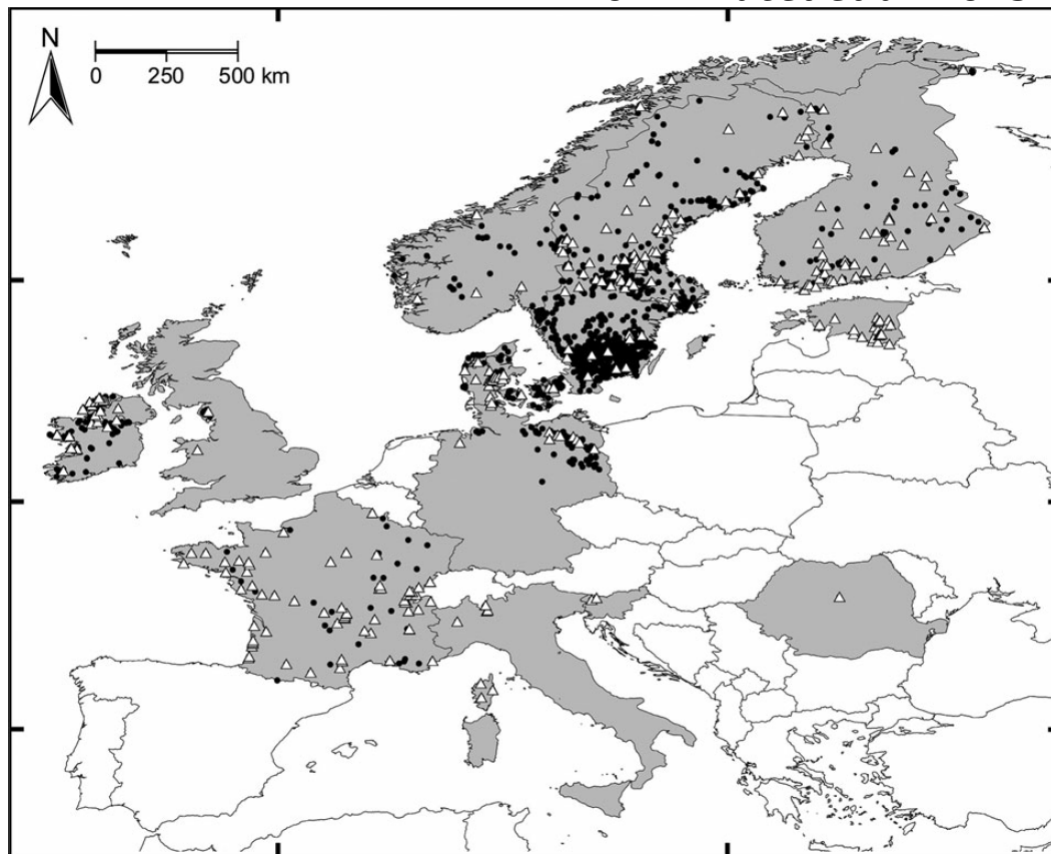


NatiOnal Register of Survey test-fishing - NORS
(2014-06-16)

3495 lakes
7867 surveys
1952-2013
46 species



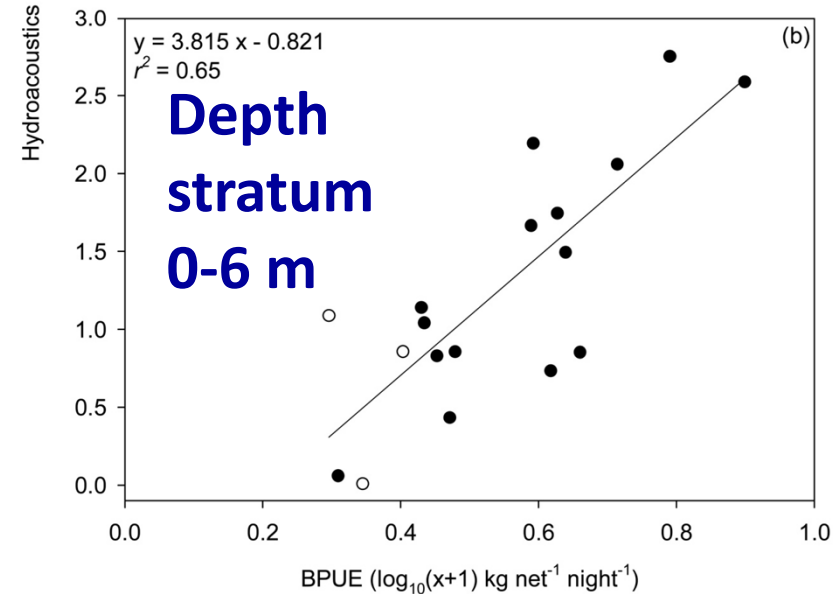
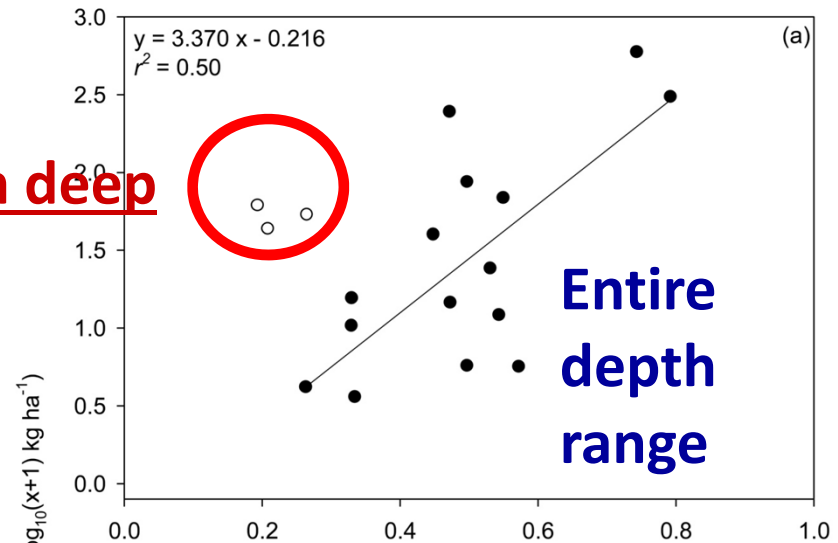
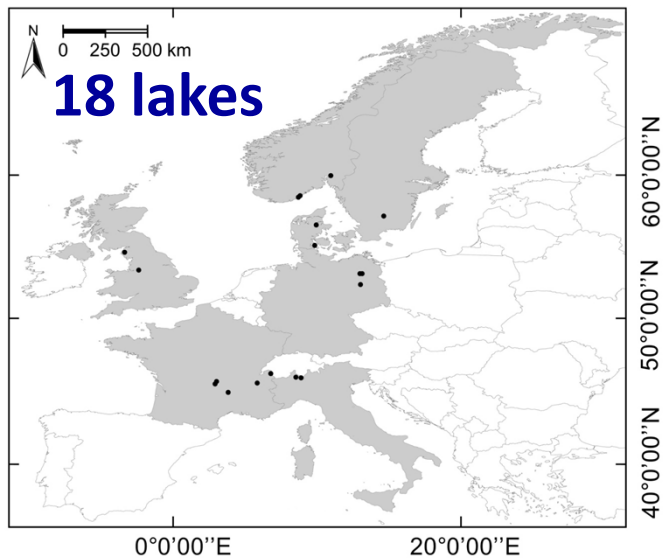
From: Brucet et al. 2013



1632 lakes sampled with Nordic gillnets according to EN 14757, In “the IC/WISER database”

Hydroacoustic fish biomass versus benthic gillnet BPUE

3 lakes > 70 m deep



From: Emmrich et al. 2012

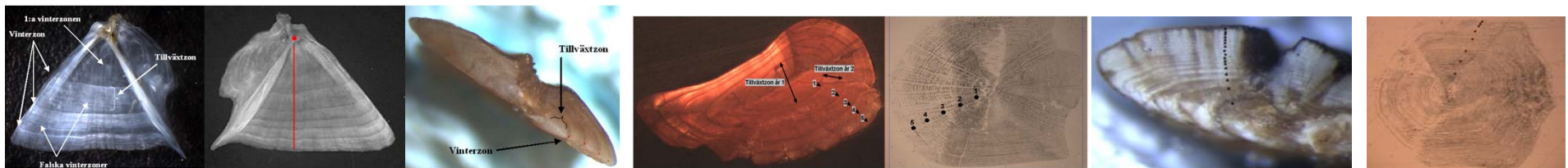
Use of sampling with gillnets (EN 14757)

The fish fauna in lakes – high ecological status according to the Water Framework Directive (WFD);

Species composition och *abundance* (number and/or biomass) correspond totally or nearly totally to undisturbed conditions

All the *type-specific sensitive species* are present.

The age structure of the fish community show little sign of anthropogenic disturbance and are not indicative of a failure in the reproduction of a particular species.



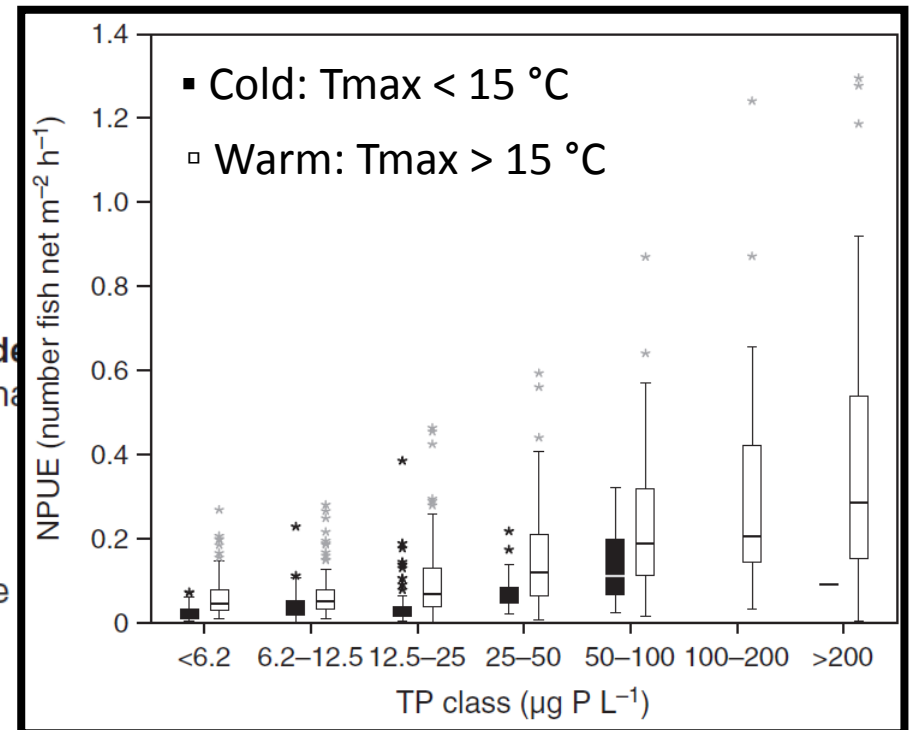
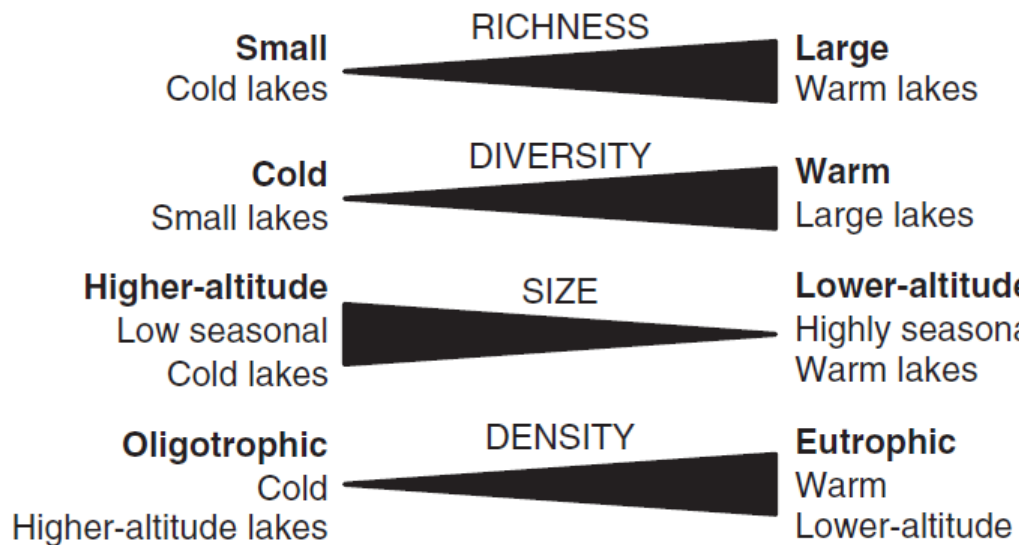
Perch:
Operculum bone and otolith

Roach:
Otolith and scale

Whitefish:
Otolith and scale

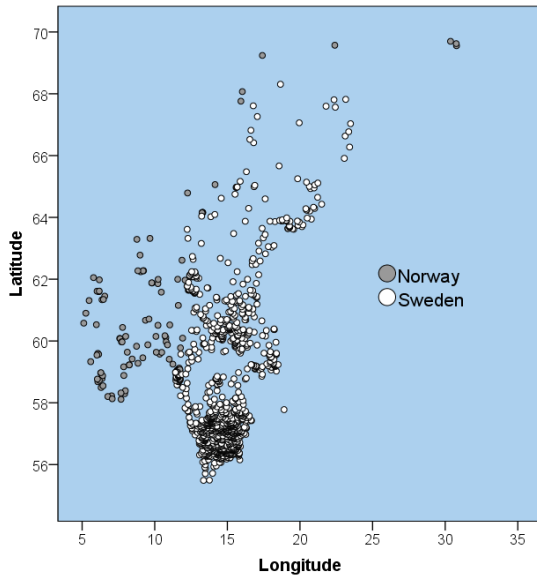
Environmental influence on fish diversity and density (abundance)

1632 lakes from 11 countries
Regression trees & GLMs

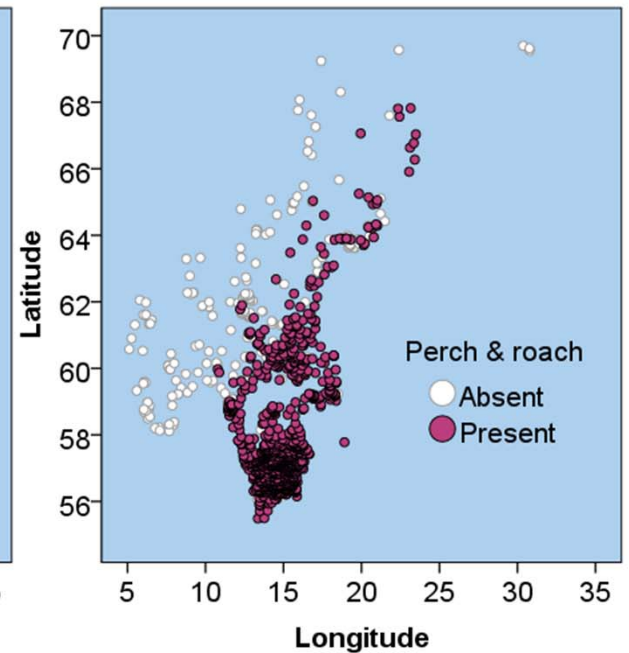
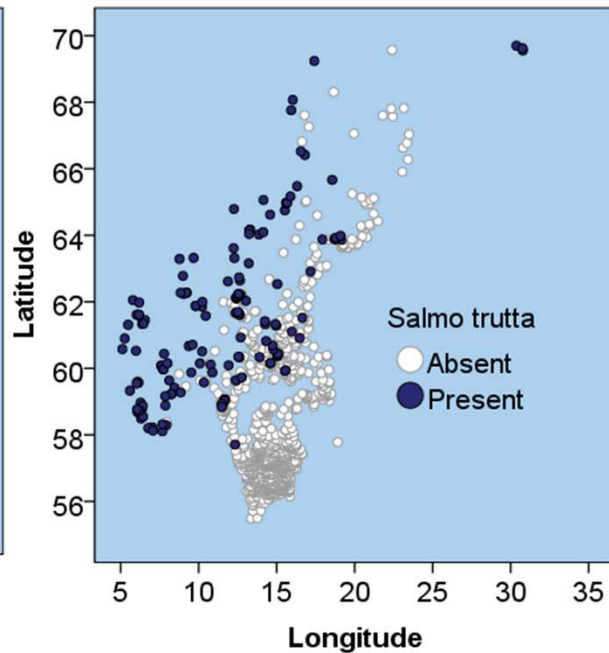
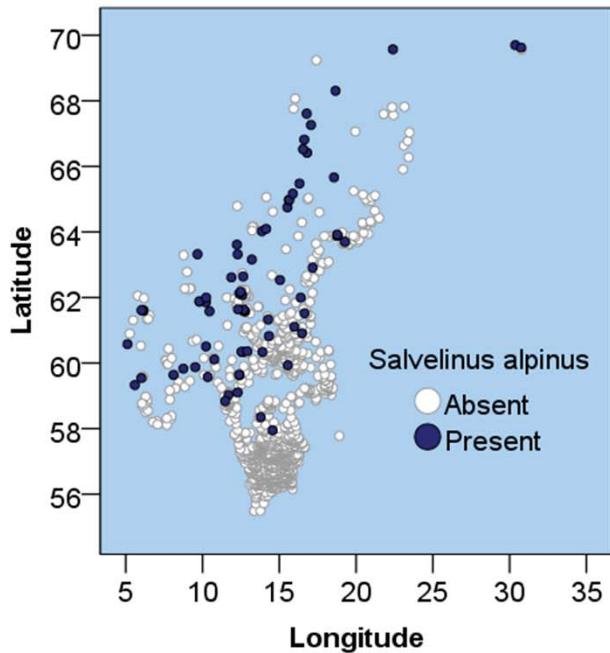
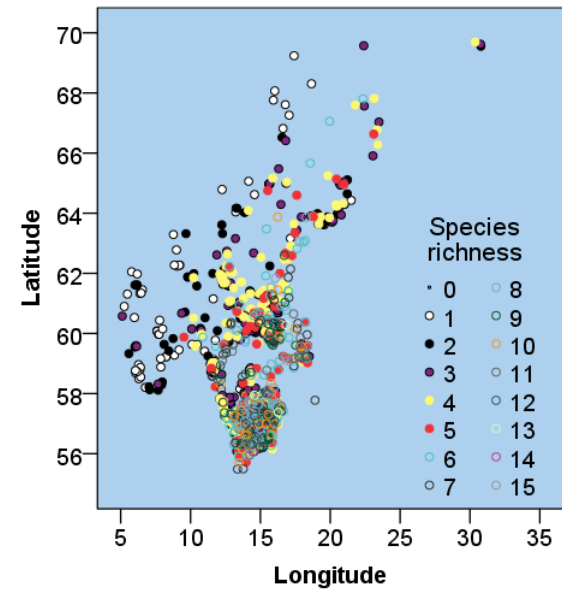


From: Bruce et al. 2013

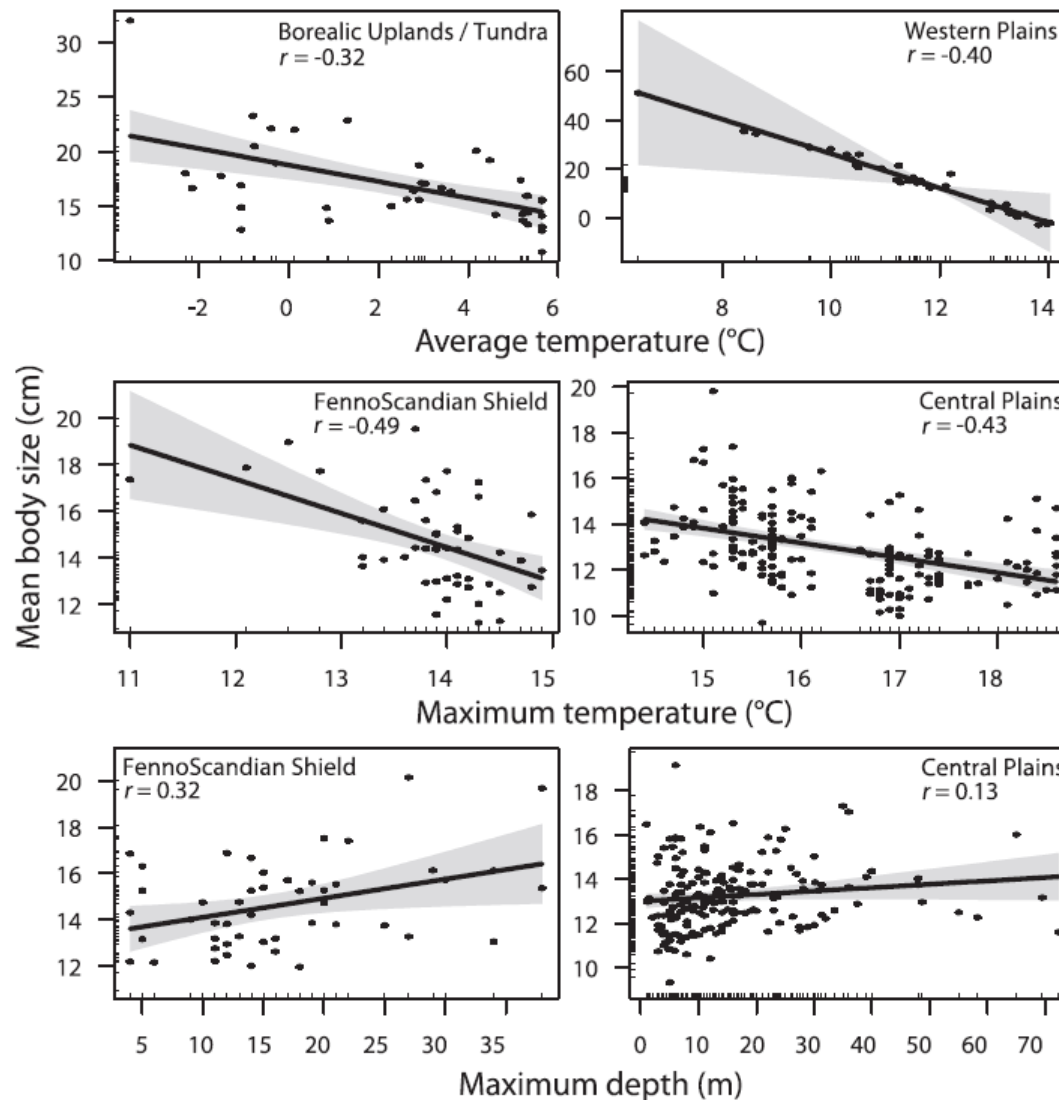
Fish species richness and composition



153 Norwegian and
1162 Swedish lakes
in "the IC/WISER database"

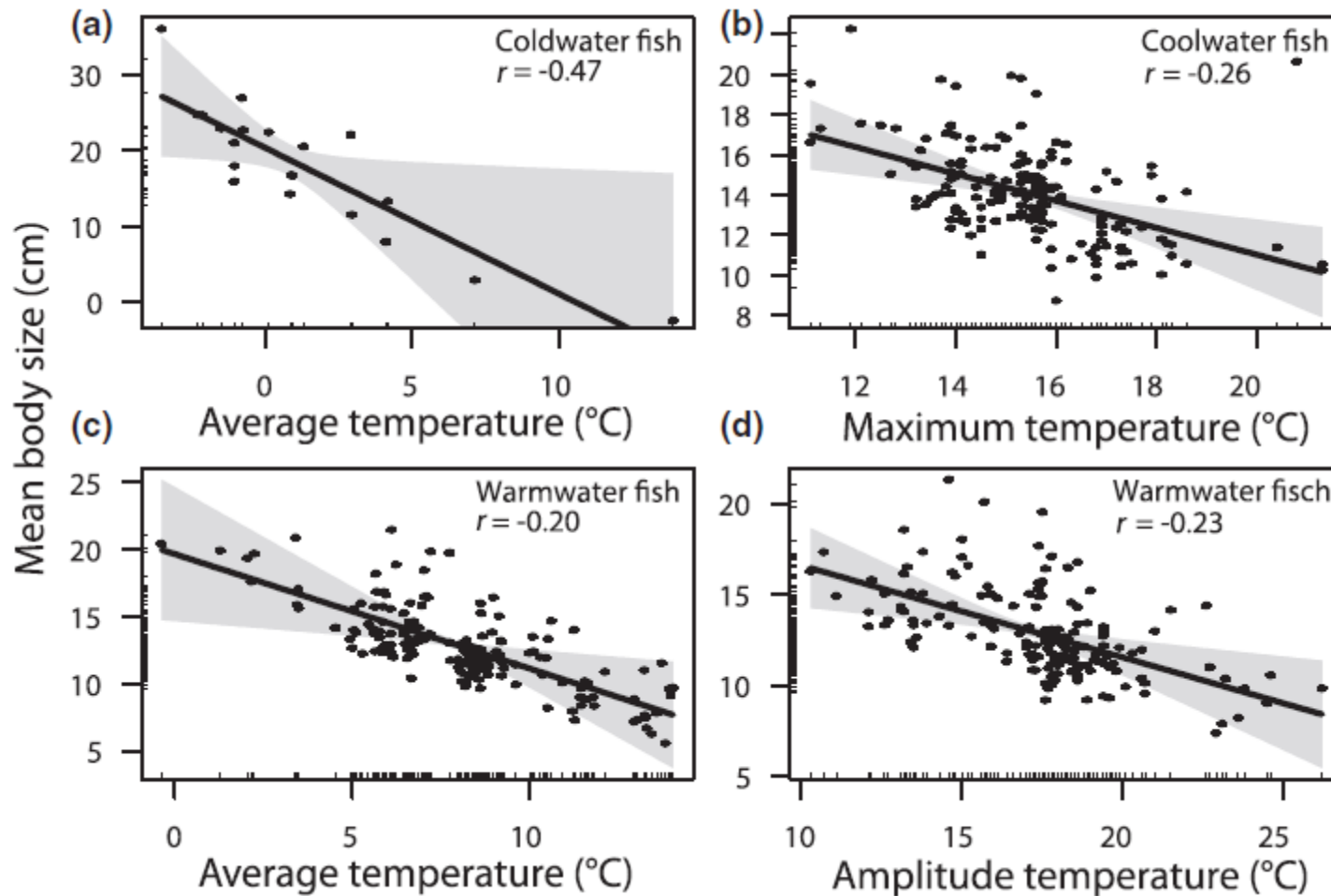


Climate factors influence fish size



From: Emmrich et al. 2014

Climate factors influence fish size

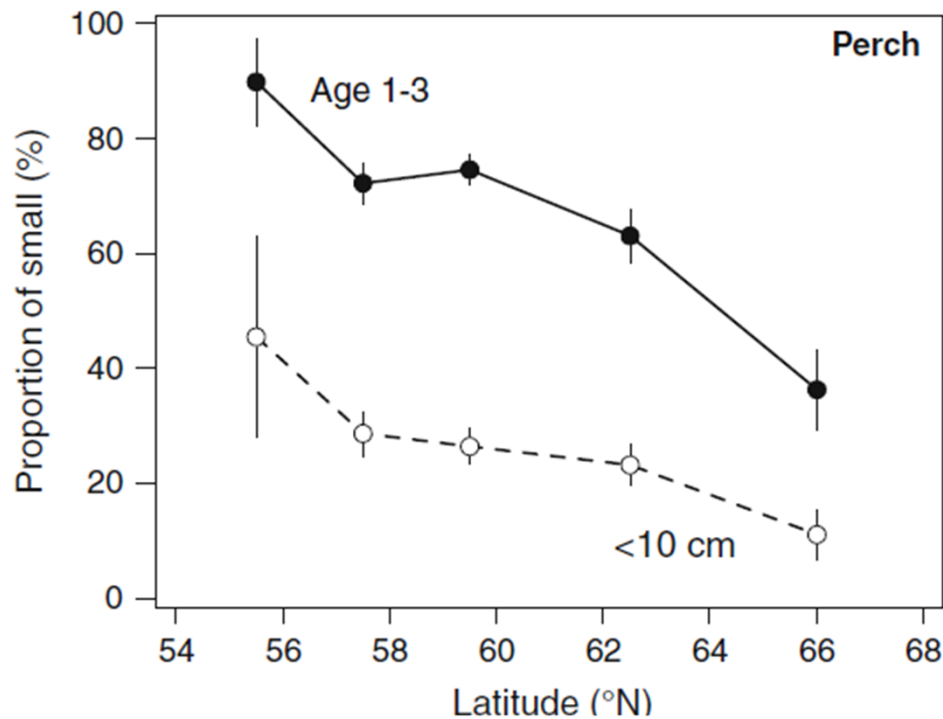


Data from 356
European lakes

Cold, **Cool** and **Warm** refers to lakes with fish communities dominated by different thermal guilds

From: Emmrich et al. 2014

Climate-related factors influence intra-specific size and age structure

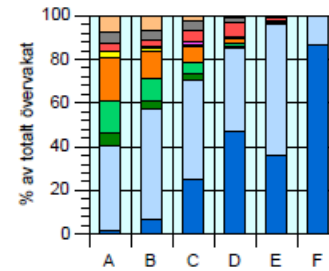
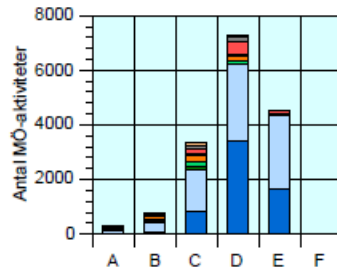
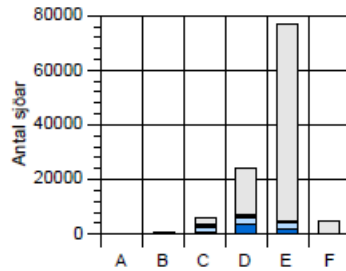


Perch from 50
Swedish lakes

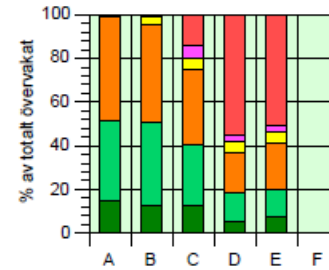
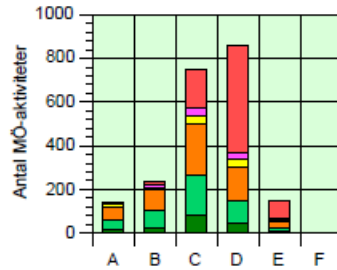
Modified from: Jeppesen et al. 2010

Environmental monitoring of Swedish lakes

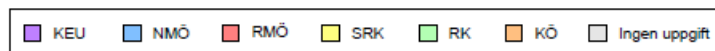
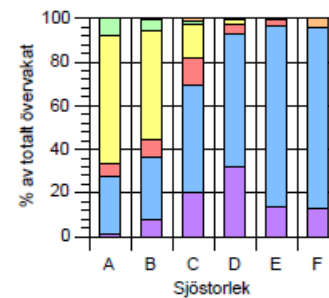
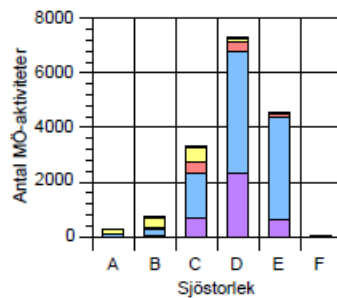
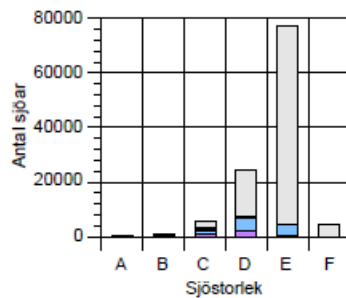
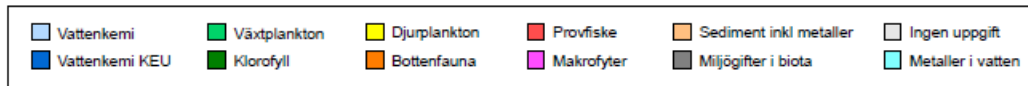
Hela Sverige



Figurema visar miljöövervakningsaktiviteter som undersökningstyper (samtliga ovan och enbart biologiska typer till höger), samt som typ av övervakningsprogram (nedan). Informationen visas i relation till det totala antalet sjöar i området (figurema längst till vänster), enbart antal registrerade aktiviteter (mitten-figurema), samt andelarna av de olika aktiviteterna av det totala antalet. Sjöstorlekarna är enligt SMHI:s klasser A >100 km², B 10-100, C 1-10, D 0,1-1, E 0,01-0,1, samt F <0,01.



Fish sampling (red) is the biological method most often used in area class D (10-100 ha)!



From: Sonesten 2013

Can Sweden increase biological monitoring by sampling more lakes with helicopter?



*From:
http://www.tyreso.se/Boende_miljo/Naturmiljo-och-halsa/Natur-och-naturvard/Vatten-i-Tyreso/Helikopterprovtagning/*

Can fish species composition and relative abundance be estimated by e-DNA in e.g. 1L samples of surface water?

If Yes, then fish samples might be taken from e.g. the 4800 lakes currently sampled for water chemistry once every 6-years



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Thank you!

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