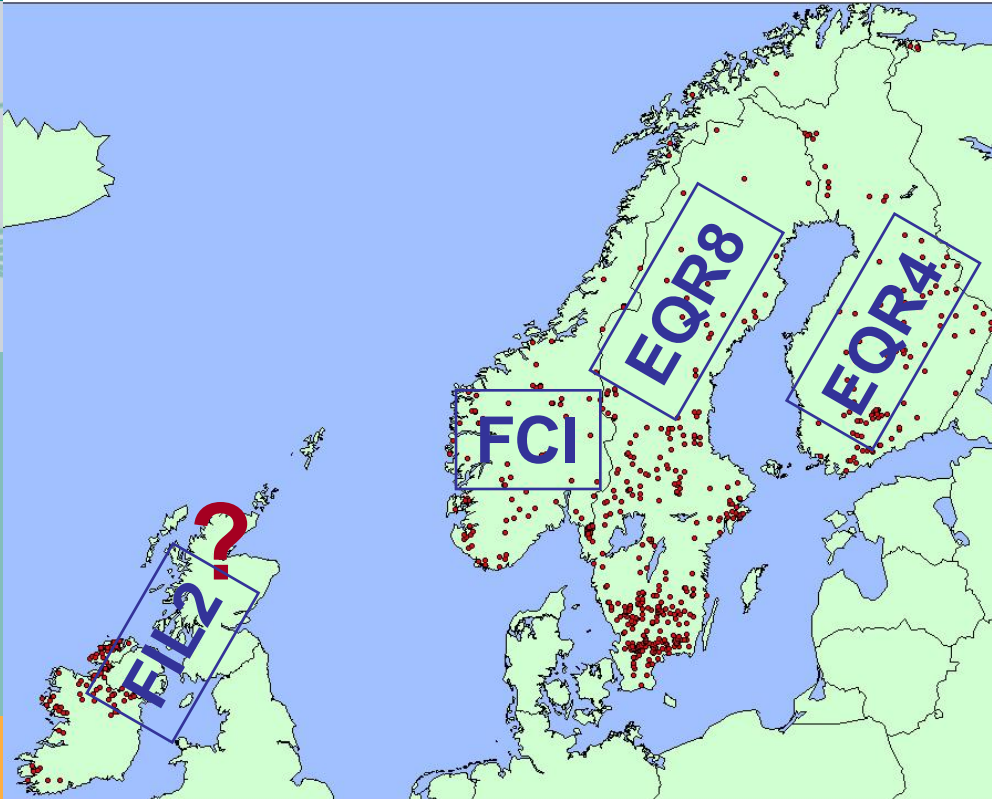


# Intercalibration of lake fish assessment methods: Towards the final steps for the L-N-F group

**IC phase 2  
2008-2011**

**4 (or more) MS  
with fish samples  
using EN 14757!**

**4 lake fish  
assessment  
methods for IC!**



# Partners in IC-group L-N-F

- **Sweden**: Kerstin Holmgren (group leader) & Anders Kinnerbäck
- **Finland**: Martti Rask & Mikko Olin
- **Norway**: Trygve Hesthagen & Randi Saksgård
- **Ireland**: Fiona Kelly & Linda Connor
- **UK (passive partners)**: Willie Duncan/Scotland & Robert Rosell/Northern Ireland

# Outline

- Background for the final steps
- Preliminary benchmarking and comparability calculations 2010 (two methods)
- Common dataset 2011
- Very preliminary recent results

# IC process according to Guidance Document No.14

## Methods descriptions:

- Preconditions (WFD compliance)
- IC feasibility check 1

## Data basis for IC analysis

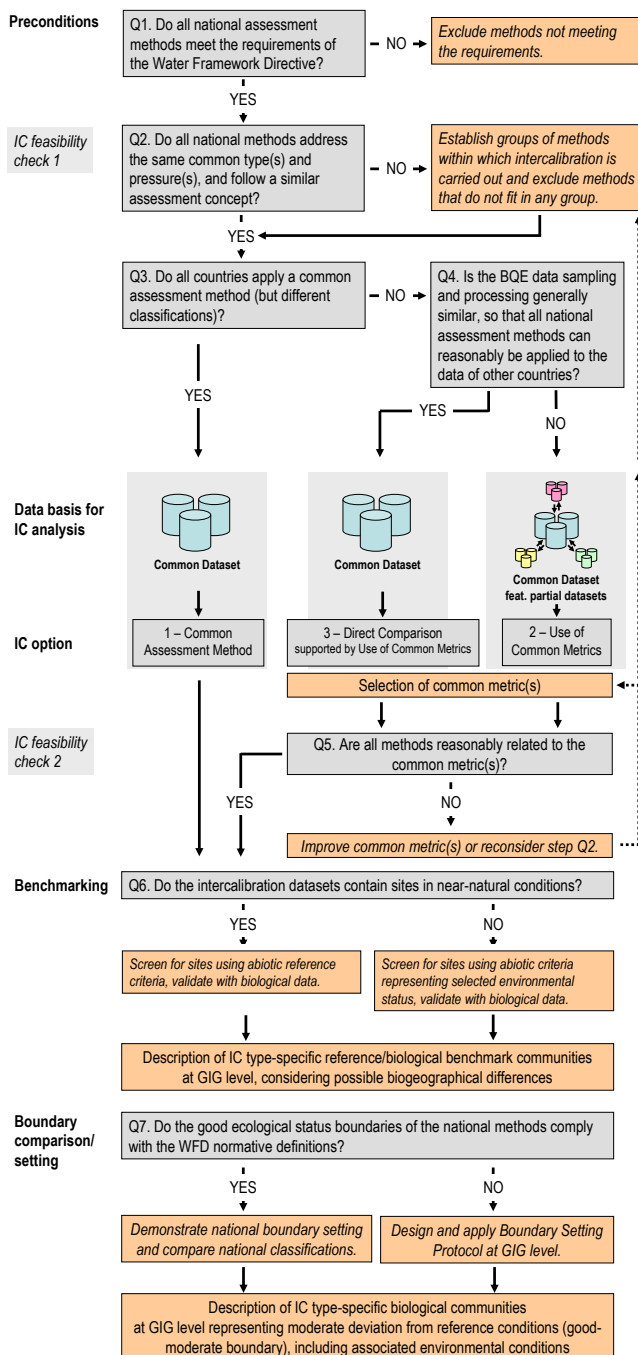
- IC option and common metrics
- IC feasibility check 2

## Benchmarking

- Abiotic reference criteria
- IC type-specific reference/biological benchmark communities

## Boundary comparison/checking

- IC type-specific biological communities at the good-moderate boundary



# Questions in the IC guidance

## Preconditions

Q1. Do all national assessment methods meet the requirements of the Water Framework Directive?

- NO →

*Exclude methods not meeting the requirements.*

YES

**More or less (EQR4, EQR8, FIL2, FCI)**

## IC feasibility check 1

Q2. Do all national methods address the same common type(s) and pressure(s), and follow a similar assessment concept?

- NO →

*Establish groups of methods within which intercalibration is carried out and exclude methods that do not fit in any group.*

YES

**Type-independent? Eutrophication?**

Q3. Do all countries apply a common assessment method (but different classifications)?

- NO →

Q4. Is the BQE data sampling and processing generally similar, so that all national assessment methods can reasonably be applied to the data of other countries?

YES

**FIL2:  
RoI &  
UK**

YES

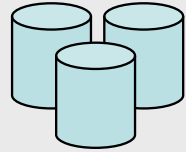
**EQR4, EQR8  
& FIL2**

NO

**FCI?**



Data basis for IC analysis

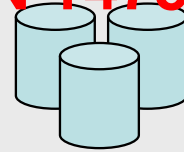


Common Dataset

**RoI & UK**

1 – Common Assessment Method

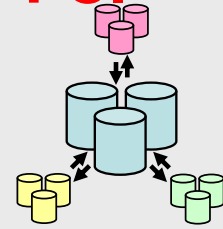
**All MS have gillnet data (EN 14757)**



Common Dataset

3 – Direct Comparison supported by Use of Common Metrics

**Additional information for FCI**



Common Dataset feat. partial datasets

2 – Use of Common Metrics

IC option

Selection of common metric(s)

**NPUE & Cyprinid%, or WISER FAML?**

IC feasibility check 2

Q5. Are all methods reasonably related to the common metric(s)?

YES

NO

**!?!?!**

*Improve common metric(s) or reconsider step Q2.*

Benchmarking

Q6. Do the intercalibration datasets contain sites in near-natural conditions?

YES, **but too few?**

NO



*Screen for sites using abiotic reference criteria, validate with biological data.*

*Screen for sites using abiotic criteria representing selected environmental status, validate with biological data.*

Description of IC type-specific reference/biological benchmark communities at GIG level, considering possible biogeographical differences

**Boundary comparison/  
setting**

Q7. Do the good ecological status boundaries of the national methods comply with the WFD normative definitions?

YES

**More or less**

NO

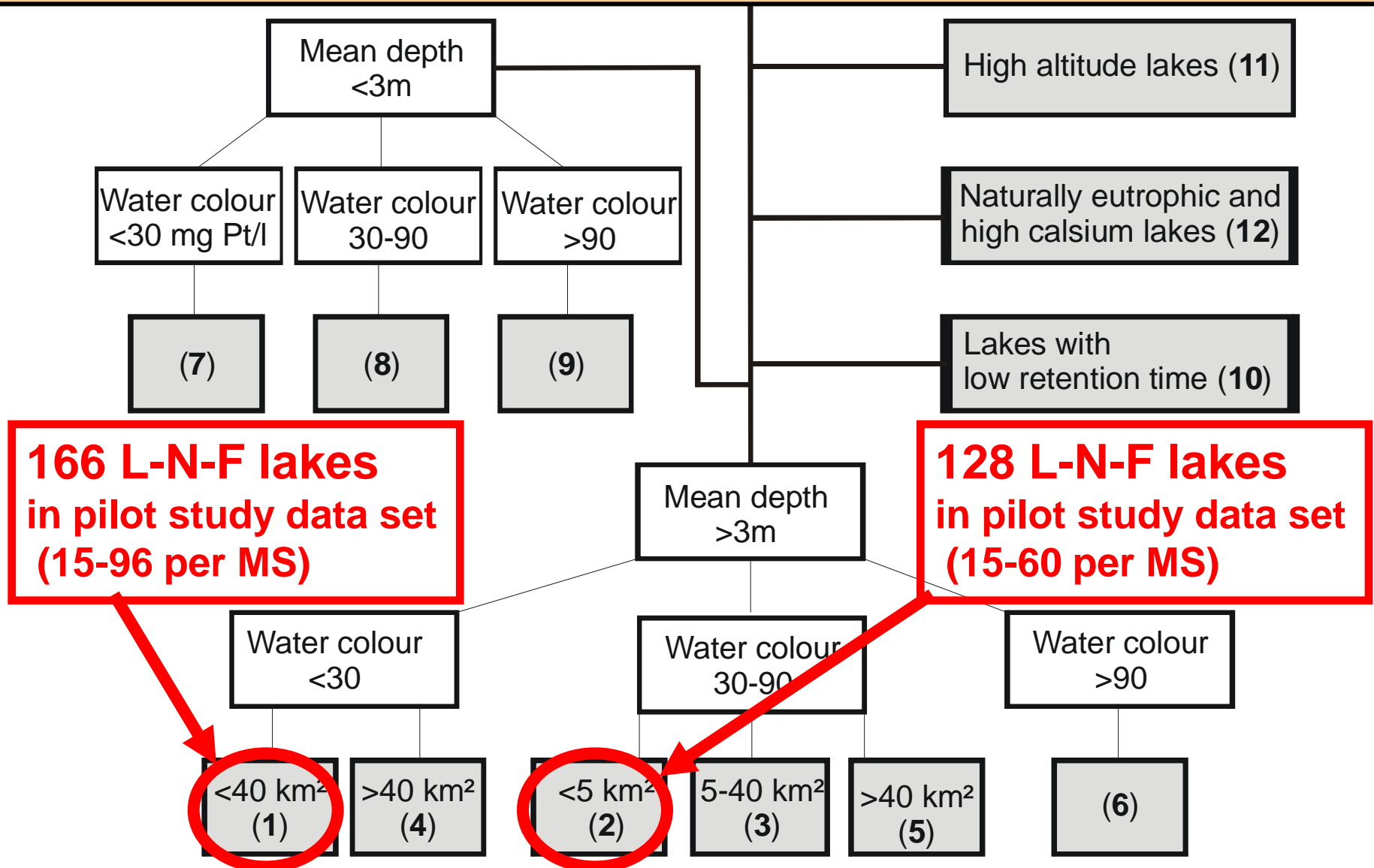
*Demonstrate national boundary setting and compare national classifications.*

*Design and apply Boundary Setting Protocol at GIG level.*

Description of IC type-specific biological communities at GIG level representing moderate deviation from reference conditions (good-moderate boundary), including associated environmental conditions

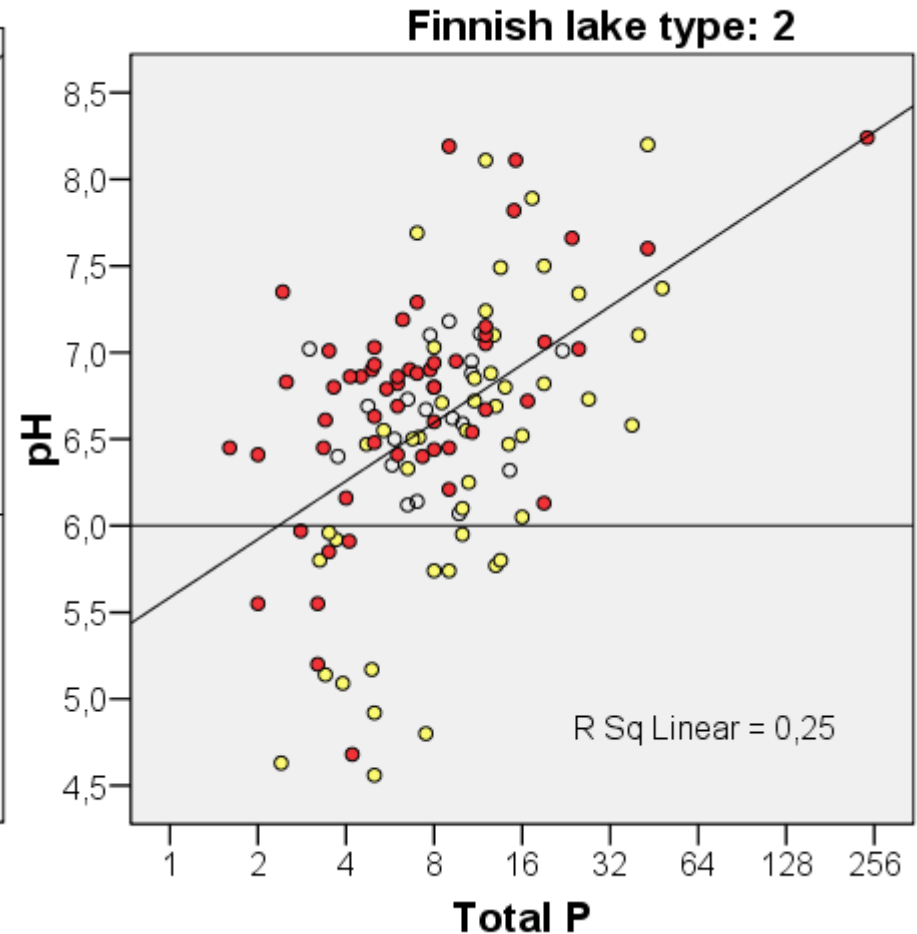
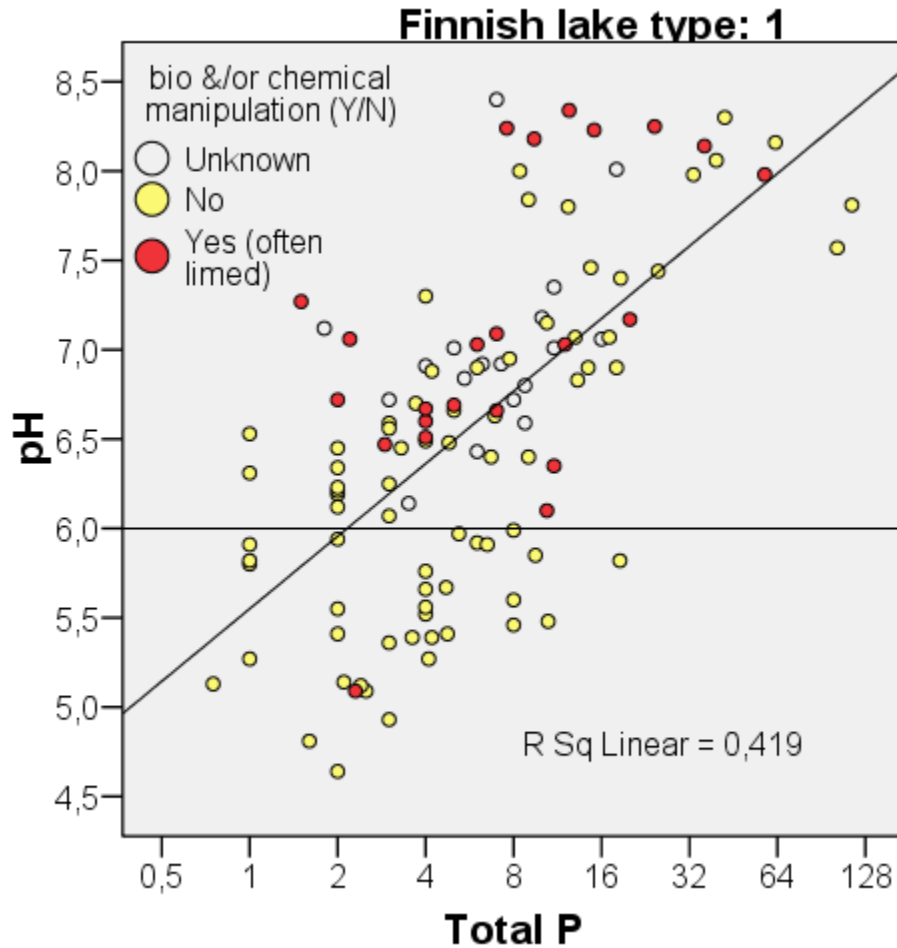
**Fish communities at benchmark sites, and at moderate ecological status, must be described for each common IC type!**

# Finnish lake types





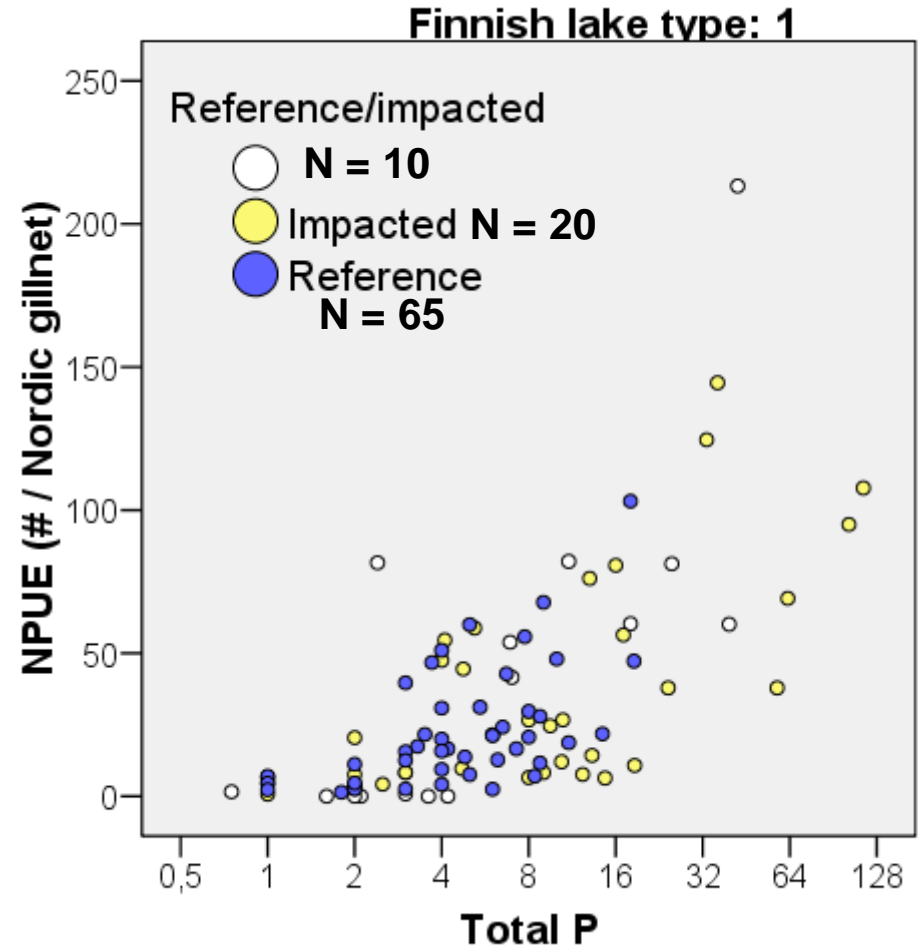
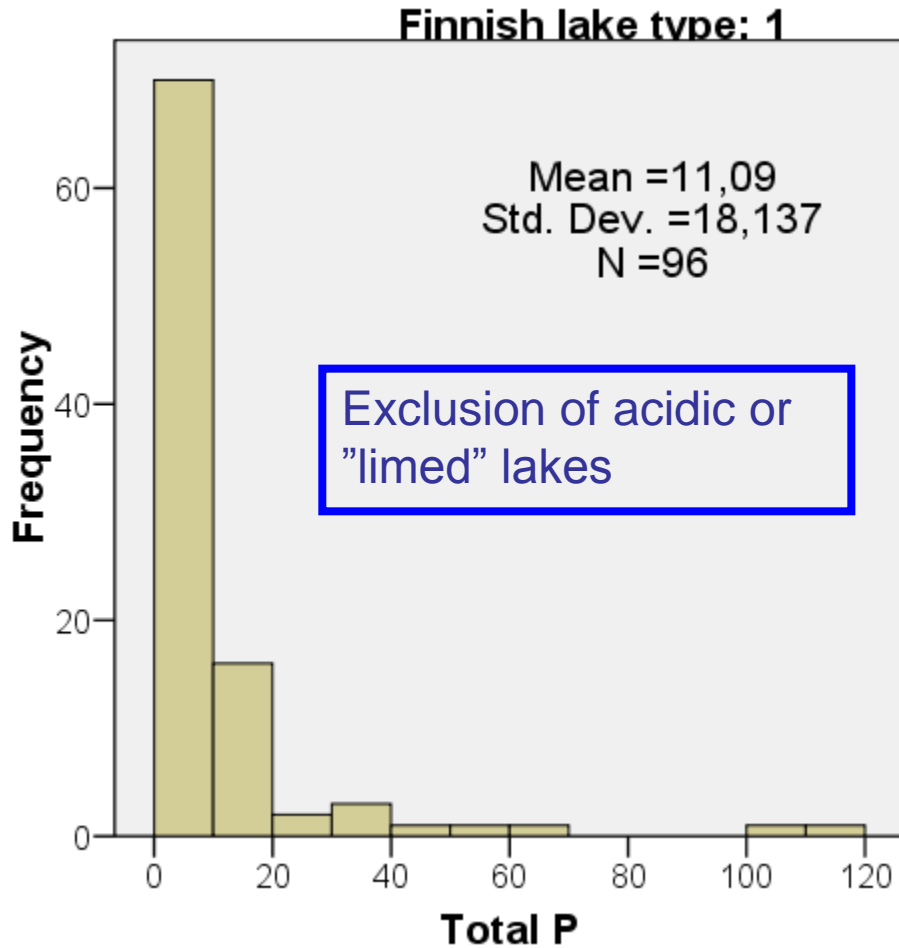
# Variation in pressures (pH and Total P):



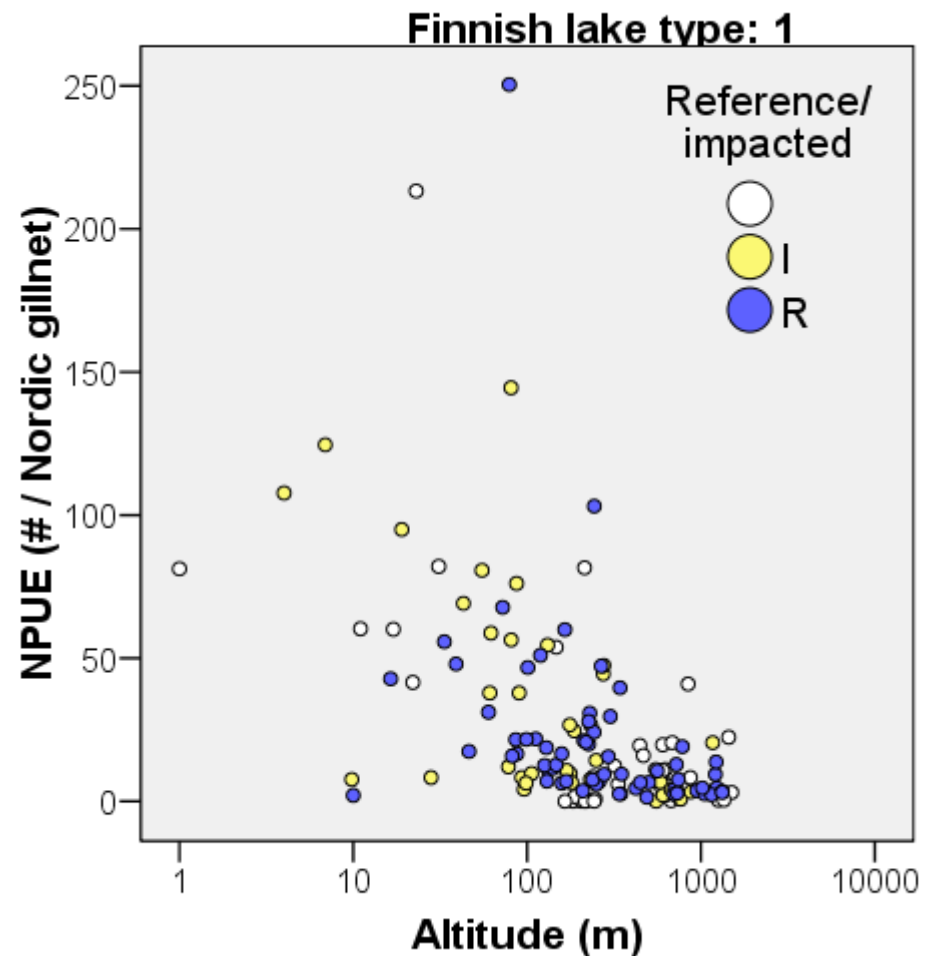
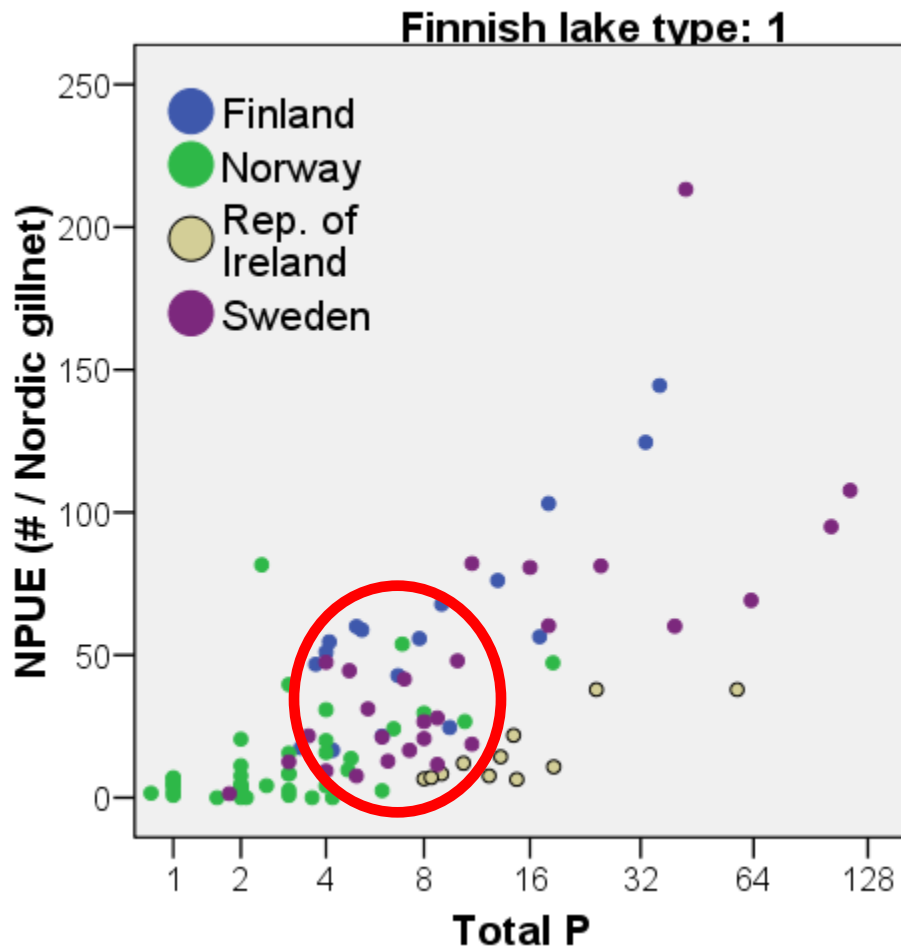
**In tests of metric or index response to Total-P:  
Exclude acidic and limed lakes!**

"limed" if "bio &/or chemical manipulation" = Y and  $\text{pH} < 7.5$  and/or  $\text{Total-P} < 20$

# "Common metric" response to **Total P**, within Finnish lake type 1



# "Common metric" response to **Total P**, within Finnish lake type 1



# Lake fish cross-GIG reference criteria:

- at least 81% natural or semi-natural land in the catchment,
- not more than 10 inhabitants / km<sup>2</sup> catchment,
- annual mean of not more than 12 µg Total P/ L,
- annual mean pH between 6-9,
- no upstream barriers,
- no lack of connectivity,
- no significant water level fluctuation,
- 0-10% shoreline (bank) modified,
- no urban/industrial discharge,
- no stocking,
- no biological &/or chemical manipulation (e.g. liming to counteract acidification),
- low exploitation of fish population by fishing

**Cemagref applied the cross-GIG criteria to the L-N-F lakes,**  
although missing data occur, especially for many Swedish lakes!

# Swedish and Finnish fish methods

## Swedish EQR8

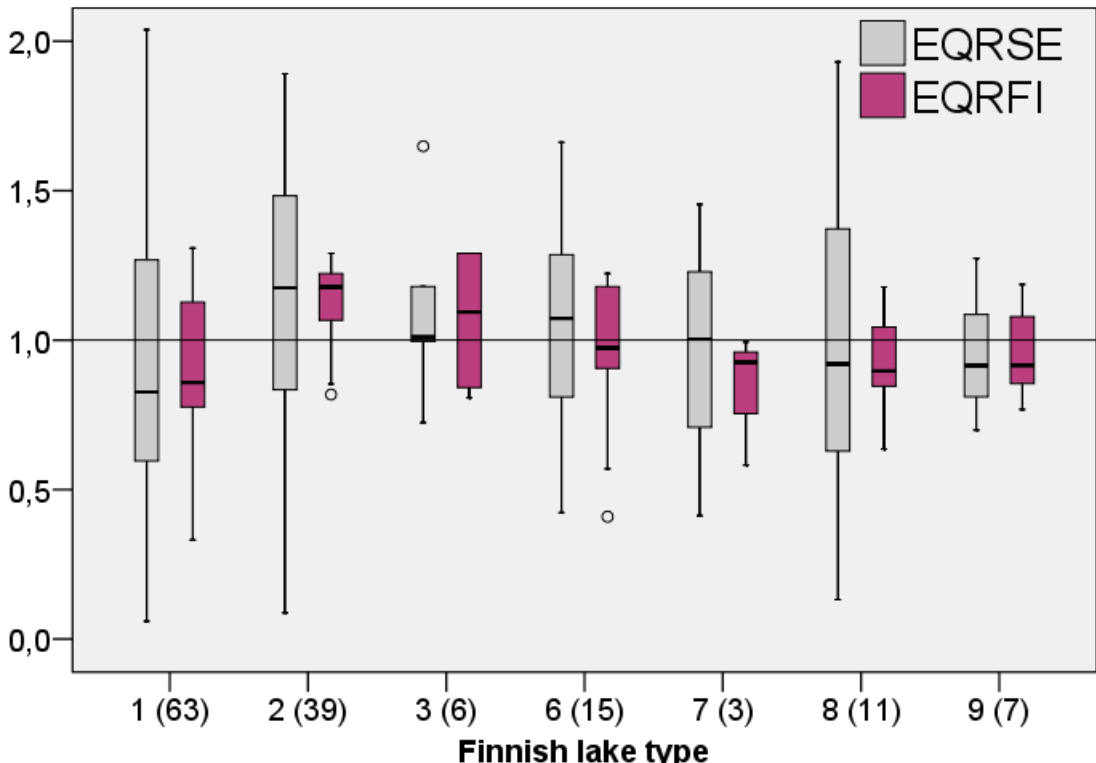
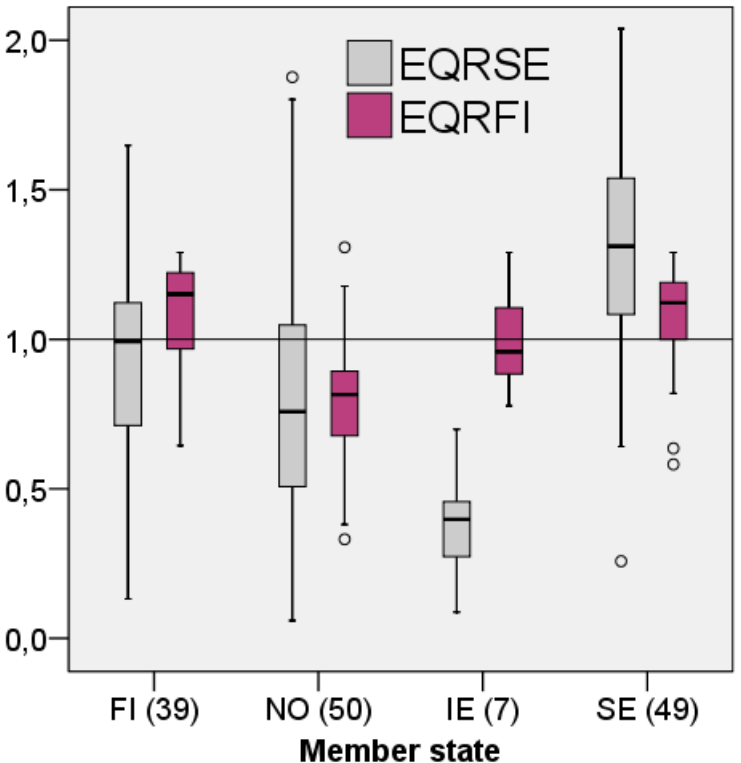
- 1) # of native species
- 2) Simpson's D (abundance)
- 3) Simpson's D (biomass)
- 4) Relative biomass
- 5) Relative abundance
- 6) Mean mass
- 7) "Piscivorous percids (% of biomass)
- 8) Perch / Cyprinids (biomass ratio)

## Finnish EQR4

- 1) Biomass +/-
- 2) # of individuals +/-
- 3) Proportion of Cyprinids +
- 4) Indicator species -

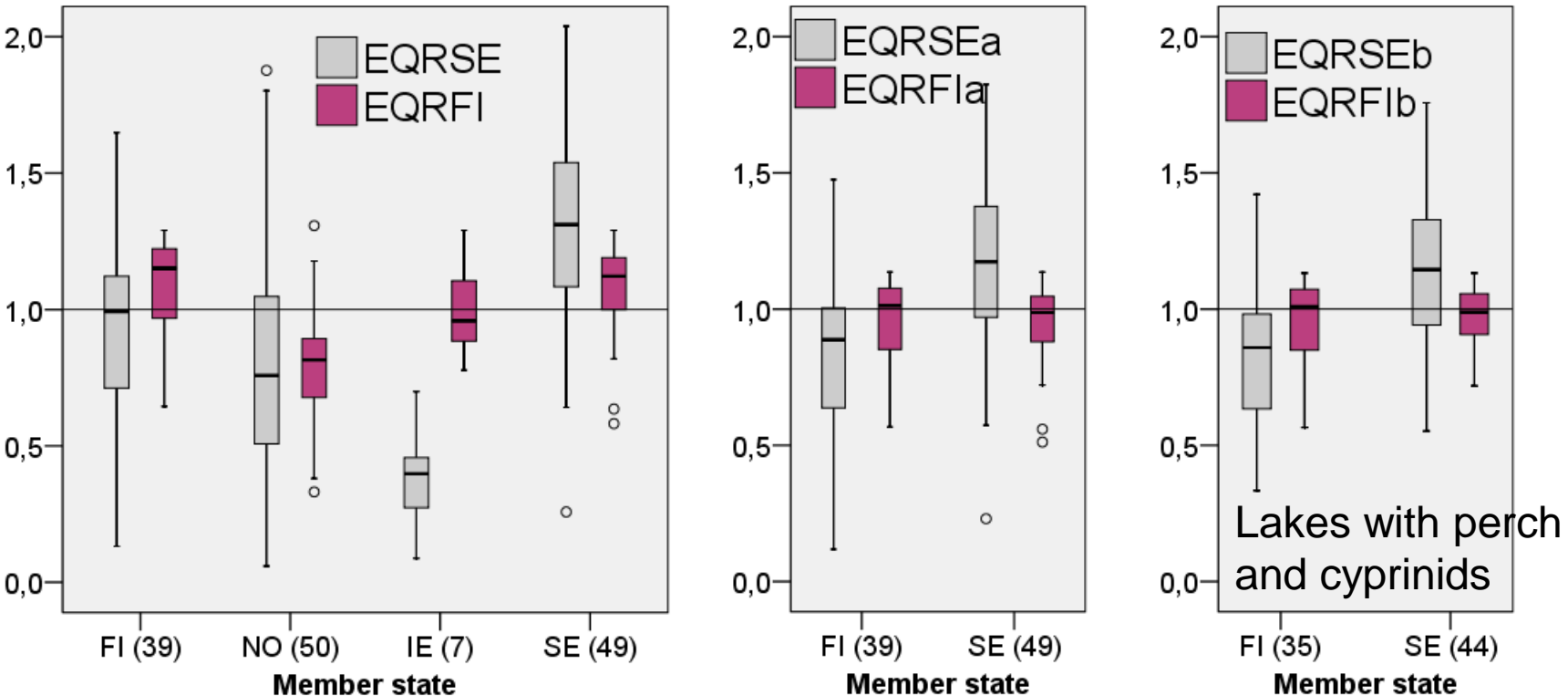
**+/- for all Swedish metrics**

# Standardised EQRs at benchmark sites



Standardised EQR values of both methods still differ between "subtypes"

# Standardised EQRs at benchmark sites



Better agreement between methods and member states after reduction of some of the biogeographic differences!

# Correlation between Finnish EQR4 and Swedish EQR8 (data from pilot study 2008-2009)

Finnish lake type	All MS			FI & SE			All MS, excluding acid and limed lakes			FI & SE, excluding acid and limed lakes		
	N	P's r	S's rho	N	P's r	S's rho	N	P's r	S's rho	N	P's r	S's rho
1	165	0,318	0,306	55	0,161	0,204	145	0,330	0,323	44	0,169	0,217
2	128	0,456	0,498	75	0,278	0,211	74	0,415	0,428	43	0,132	0,136
3	27	0,586	0,607	22	0,516	0,476	13	0,637	0,575	13	0,637	0,575
6	76	0,544	0,463	54	0,403	0,345	43	0,553	0,426	26	0,197	0,135
7	21	0,410	0,338	14	0,694	0,572	16	0,494	0,434	12	0,720	0,648
8	71	0,420	0,414	52	0,361	0,302	42	0,340	0,351	32	0,368	0,299
9	81	0,476	0,458	73	0,448	0,412	40	0,551	0,520	33	0,504	0,396
12	22	-0,309	-0,348	14	-0,176	-0,222	12	-0,638	-0,720	6	-0,866	-0,657
All	639	0,421	0,409	364	0,387	0,344	391	0,401	0,382	238	0,358	0,291

IC is feasible if r or rho  $\geq$  0.5!



# Average absolute class difference (EQR4-EQR8)

absclassdiff

		MS							
		Finland		Norway		Rep. of Ireland		Sweden	
		Mean	Count	Mean	Count	Mean	Count	Mean	Count
Finnish lake type	1	1,24	17	1,29	91	2,09	11	,93	27
	2	1,47	15	,94	16	2,60	15	1,11	28
	3	1,18	11	.	0	.	0	1,00	2
	4	,00	1	.	0	.	0	2,00	1
	5	2,33	3	.	0	.	0	.	0
	6	1,07	15	,64	14	2,33	3	,91	11
	7	1,50	2	.	0	2,00	4	,50	10
	8	1,13	8	.	0	1,50	10	,63	24
	9	1,09	11	.	0	1,57	7	,86	22
	12	1,50	4	,00	1	1,33	6	2,50	2

Pilot study data set after exclusion of acidic and limed lakes!

Mean of average absolute class difference: 1.21

Mean of average difference: 0.97

**Mean average absolute class difference should be < 1 after harmonisation!**

# Norwegian FCI

www.nina.no

Cooperation and expertise for a sustainable future

Weights used for species richness, reference value, losses and changes

Species abundance category	Reference value	Weights for reference value	Weights for lost stocks	Weights for reduced stocks
Dominant species ( <i>D</i> )	1.0	1.0	1.00	0.75
Subdominant species ( <i>S</i> )	1.0	0.75	0.75	0.50
Rare species <i>R</i>	1.0	0.50	0.50	0.25

$$FCI = \frac{RC - CS}{RC}$$



*Input from Trygve Hesthagen*

# Irish (and partly UK) FIL2

## Typology for fish in lakes

1. Optimum cut-point for ALK was 67 with 36 of the 43 lakes being correctly classified into Low and High ALK
2. The optimum cut-point for depth was 17 with 35 of the 43 lakes being correctly classified into Shallow and Deep depth

<b>Alkalinity</b>	<b>mg/l CaCO<sub>3</sub></b>	<b>Max Depth</b>	<b>(m)</b>
Low	<67	Shallow	<17
Low	<67	Deep	>17
High	>67	Shallow	<17
High	>67	Deep	>17

*Input from Fiona Kelly*

# Irish (and partly UK) FIL2 *Input from Fiona Kelly*

## 13 fish metrics used for the DA classification

### CORE METRICS

- TOT\_BPUE: Sum of mean biomass per unit effort (excl. eels and adult salmon)
- NAT\_BPUE: Sum of mean biomass per unit effort of native (group 1) fish species
- PERCH\_BIO: Mean perch biomass per unit effort

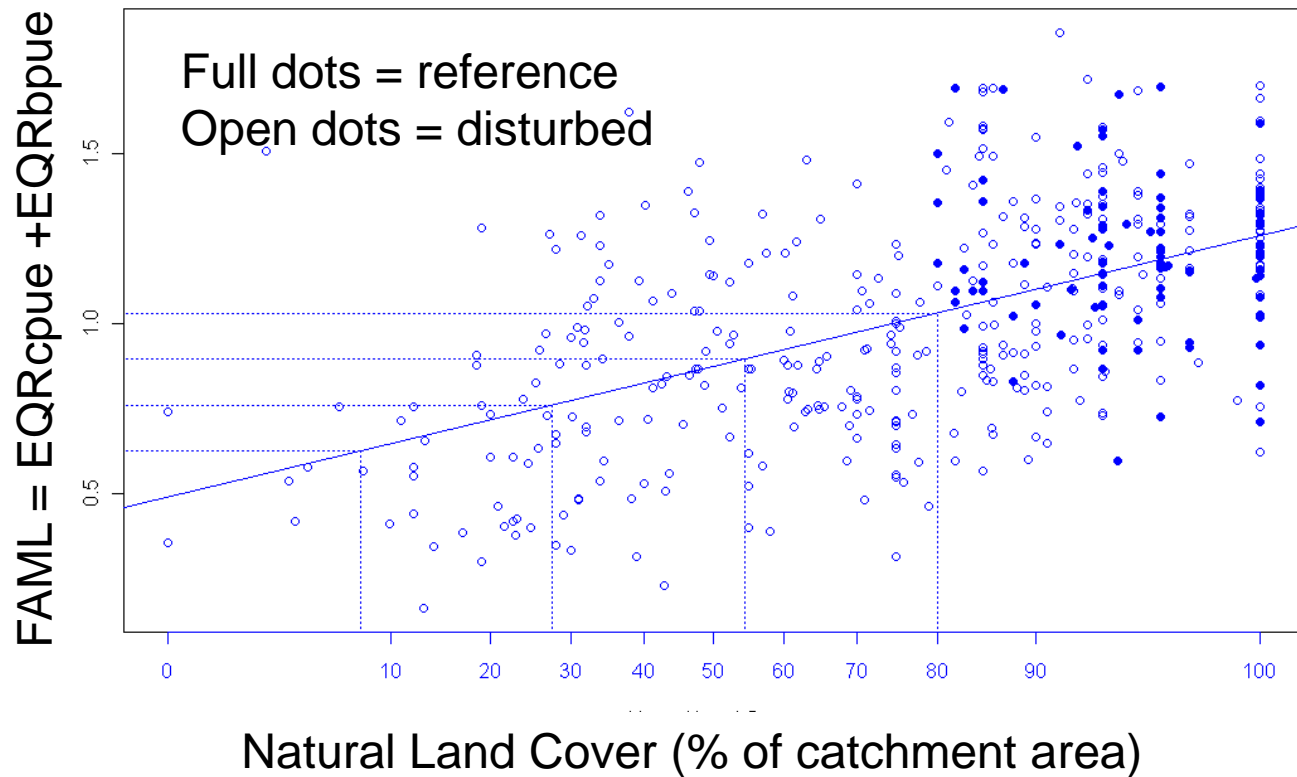
### OPTIMAL METRICS

- RHEO\_BIO: % individuals (based on BPUE excl. eels & adult salmon) that are rheophilic
- SPE\_EVEN: Species evenness/dominance ( $1/D=1/(N_{max}/N_{tot})$ ) ( $N_{max}$ = no. inds represented by the most abundant species,  $N_{tot}$ =total number of individuals in the sample (eels captured in fyke nets excluded) (Based on total number of fish captured)
- ROACH\_BPUE: Mean biomass per unit effort ((g) of fish per linear metre of net - gill nets and fyke nets)
- BREAM\_%\_IND: % composition of bream based on CPUE ( $BREAM\_CPUE/TOTAL\_CPUE*100$ )
- PHYT\_%\_BIO: % individuals (based on BPUE excl. eels and adult salmon) that are phytophilic
- 2\_%\_BIO: % biomass of Group 2 species (based on BPUE excl. eels and adult salmon), inc hybrids
- CYP\_BIO: % biomass (based on BPUE excl. eels and adult salmon) of cyprinid species, inc hybrids
- RUDD\_%\_IND: % composition of rudd based on CPUE ( $RUDD\_CPUE/TOTAL\_CPUE*100$ )
- MAX\_L\_DOM\_BIO: Maximum length of dominant species (based on BPUE excl. eels and adult salmon)
- LITH\_IND: % individuals (based on CPUE excl. eels and adult salmon) that are lithophilic

(per linear metre of net used – gill nets and fykes)

# WISER Fish Abundance Metric for Lakes FAML

Reference values of metrics **CPUE** and **BPUE**, are estimated from lake characteristics, using a hindcasting model



*From WISER Deliverable 3.4-4 (provisional version)*

# Common dataset 2011

**February 23:** Online access to the combined cross-GIG IC and WISER database

## Unique ID-codes for communication of aggregated data

"lake\_code\_europa" – common denominator for lake characteristics and pressures

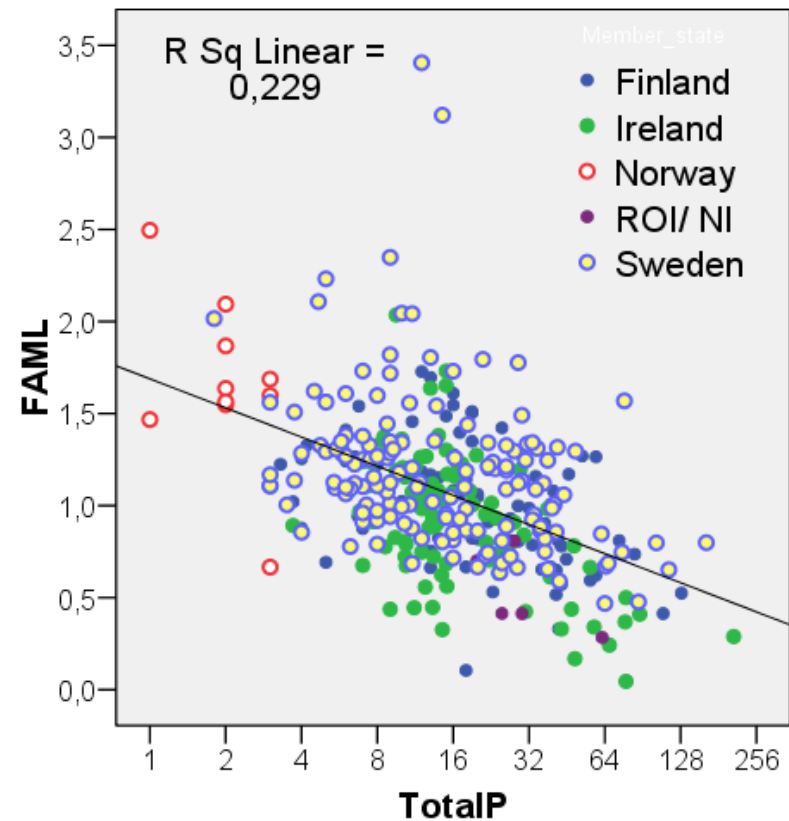
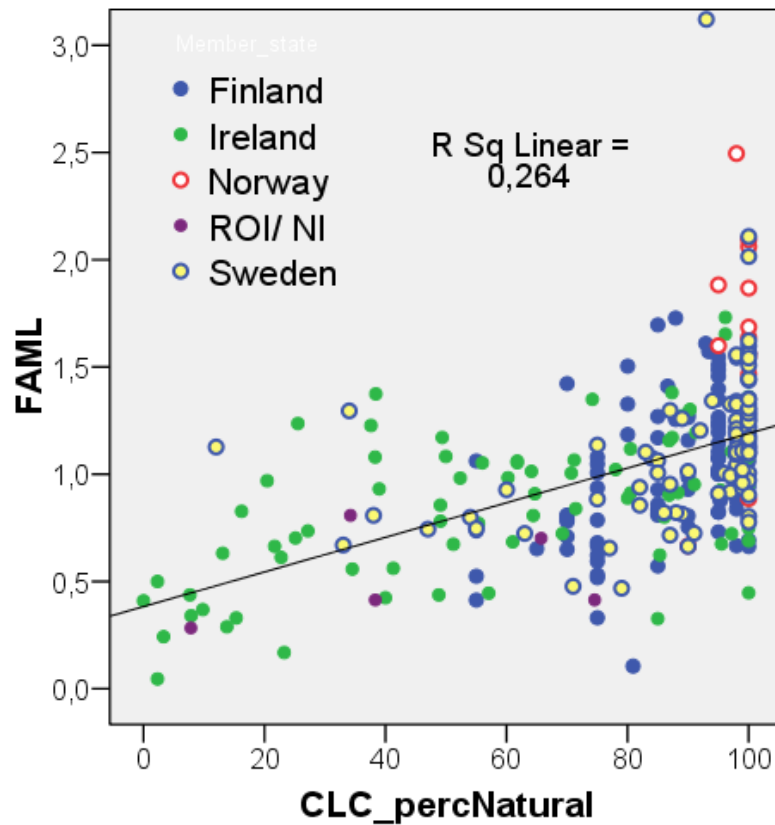
"id\_campaign" – common denominator for fish sampling campaigns

Finnish lake type	Finland		Ireland		Norway		ROI/ NI	Sweden		Sum	reference_MS = 1
	reference_MS = 0	reference_MS = 1	reference_MS = 0	reference_MS = 1	reference_MS = 0	reference_MS = 1	reference_MS = 0	reference_MS = 0	reference_MS = 1		
	0	0	1	0	1	0	0	805	8	815	8
1	35	11	20	0	27	21	0	32	13	159	45
11_1	0	0	0	0	17	40	0	0	4	61	44
11_2	0	0	0	0	4	3	0	6	3	16	6
11_3	0	0	0	0	0	0	0	0	2	2	2
11_6	0	0	0	0	0	1	0	2	0	3	1
11_7	0	0	0	0	0	0	0	5	1	6	1
11_8	0	0	0	0	0	0	0	2	3	5	3
11_9	0	0	0	0	0	0	0	1	1	2	1
12	9	1	8	0	1	0	0	5	0	24	1
2	11	9	21	3	24	3	1	47	26	145	41
3	6	5	3	0	1	0	2	11	0	28	5
4	1	0	2	0	0	0	0	0	1	4	1
5	0	3	1	0	0	0	0	0	0	4	3
6	5	11	4	1	12	7	0	43	5	88	24
7	1	1	10	0	0	0	0	9	0	21	1
8	7	4	22	2	0	0	2	41	5	83	11
9	6	6	9	1	0	0	0	80	2	104	9
Sum	81	51	101	7	87	75	5	1089	74	1570	207

Ref. sites  
(common ref. cond. criteria)  
are needed for benchmarking

# Preliminary IC results 2011

## Common metric response to pressure

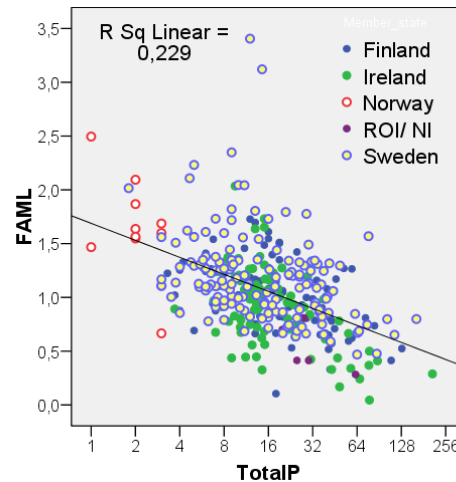
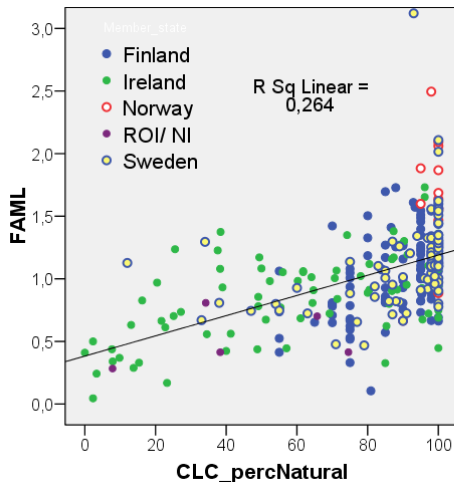


**Acidic and limed lakes excluded!**

"limed" if "bio &/or chemical manipulation" = Y and pH < 7.5 and/or Total-P < 20

# Preliminary IC results 2011

Common metric and national method response to pressure  
**Acidic and limed lakes excluded!**



Common metric & national methods		CLC_perc Natural	TotalP
FAML	Pearson's r P (2-tailed) N	0.51 <0.001 289	-0.41 <0.001 346
EQR FIL2	Pearson's r P (2-tailed) N	0.56 <0.001 95	-0.48 <0.001 95
EQR4	Pearson's r P (2-tailed) N	0.44 <0.001 365	-0.50 <0.001 394
EQR8	Pearson's r P (2-tailed) N	0.32 <0.001 379	-0.12 0.010 453
FCI	Pearson's r P (2-tailed) N	0.15 NS 31	-0.37 0.043 31



# Preliminary IC results 2011

## Correlations with Common Metric FAML

L-N-F indices	All MS & Types (N=994)		FI lakes (N=97)		IE lakes (N=110)		NO lakes (N=29)		SE lakes (N=753)		FI type 1 (N=98)		FI type 2 (N=108)		Non acid or limed (N=702)	
	P's r	N	P's r	N	P's r	N	P's r	N	P's r	N	P's r	N	P's r	N	P's r	N
EQR FIL2	0.51	113		0	0.47	108		0		0	0.53	21	0.52	25	0.55	97
EQR8	-0.00	994	0.24	97	-0.35	110	0.09	29	-0.29	753	0.06	98	0.24	108	0.09	610
EQR4	0.27	553	0.67	97	0.24	110	0.14	29	0.06	312	0.57	98	0.65	108	0.49	321
FCI	-0.35	71	-0.12	14		0		0	-0.40	57	0.06	11	-0.05	10	0.10	25

	Acceptable (Pearson's $r \geq 0.5$ ) = <b>Pass IC Feasibility check 2</b>
	Significant ( $P < 0.001$ , 2-tailed)
	Significant ( $P < 0.05$ , 2-tailed)
	Not significant ( $P \geq 0.05$ )
	No possible comparisons

## Correlation between national methods: Pearson's r (N)

	EQR4	EQR8	FCI
EQRFIL2	0.56 (97)	-0.18 (97)	--- (0)
EQR4		0.15 (409)	0.28 (31)
EQR8			0.00 (31)

Compared to  $r = 0.40$ , when using 391 lakes in the pilot study data

**Acidic and limed lakes excluded!**

# Preliminary IC results 2011

## Reasons for lowered agreement between EQR4 and EQR8?

- Method-specific data templates versus common dataset?
- More errors in the common dataset?
- Mean values within lakes instead of latest sample?
- Other reasons?



# Concluding remarks

- **Common metric**: expected response to pressure
- **National methods**: expected (but sometimes weak) response to pressure
- **FIL2 and EQR4 pass feasibility check 2**, when
  - 1) applied to their own MS data
  - 2) applied to Finnish lake types 1 and 2
  - 3) pair-wise compared within Irish lakes
- **EQR8**: lower correlation with EQR4 than previously found for pilot study data!**?!?!**
- Messy dataset with (many ?) errors to be corrected
- **FCI**: insignificant (or negative) correlation with other methods, but also too few lakes for comparison