MILESTONE 6 REPORT

Water category/GIG/BQE/ horizontal activity:	**Lake / Central-Baltic / Fish /**
Information provided by:	David Ritterbusch (Germany)

1. ORGANISATION

1.1. Responsibilities

Indicate how the work is organized, indicating the lead country/person and **the list of involved experts of every country:**

DE	Germany (CB lead)	David Ritterbusch / Uwe Brämick
FR	France (cross-GIG coord.)	Christine Argillier / Simon Caussé
BE-F	Belgium-Flanders	Jan Breine
CZ	Czech Republic	Marie Prchalova/Jan Kubecka (observational)
DK	Denmark	Torben Lauridsen
EE	Estonia	Teet Krause / Anu Palm
LT	Lithuania	Tomas Virbickas
LV	Latvia	Janis Birzaks
NL	Netherlands	Eddy Lammens / Nico Jaarsma / Bob Brederveld
PL	Poland	Hanna Draszkiewicz-Mioduszewska, Witold Bialokoz
SK	Slovakia	Vladimír Kováč (observational)
UK	United Kingdom	Willie Duncan

1.2. Participation

Indicate which countries are participating in your group. Are there any difficulties with the participation of specific Member States? If yes, please specify:

All MS listed in 1.1 participate, except of Latvia, where contact was lost in early 2011. Czech Republic participates as an observational partner but actively contributes with data and advice. Slovakia is an observational member, too.

1.3. Meetings

List the meetings of the group:

2008: 31.03./01.04. 1st LakeFish meeting (Aix-en-Provence / France)
2008: 30.09./01.10. 2nd LakeFish meeting (Ranco / Italy)
2009: 22.09./23.09. 3rd LakeFish meeting (Drottningholm / Sweden)
2010: 30.11./01.12. 1st CB Lake Fish meeting (Berlin / Germany)

2. OVERVIEW OF METHODS TO BE INTERCALIBRATED

Identify for **each** MS the national classification method that will be intercalibrated and the status of the method (national / intercalibrateable / under development / no method).

MS	status	expected for	sampling gear
NL	national	present	Trawl, seine, electrofishing
DE	intercalibrateable	2011	CEN / CENmod
DK*	intercalibrateable	2011	CEN
LT	intercalibrateable	2011	CENmod
EE	intercalibrateable	2012	CENmod
PL	intercalibrateable u. d./ intercalibrateable	2011 2013	LFI+: Fisheries statistics CEN
BE	under development	2012	fyke + electrofishing
FR	intercalibrateable	2011	CEN
LV	under development	unclear	gillnets, trammel nets, statistics
CZ	no method	unclear	CEN, hydroacoustics, electrofishing
SK	no method	not expected	-
UK*	no method	unclear	

DK: expects a finalized and approved method within 2011. Method is intercalibrateable, but comparison could not be done in due time for Milestone 6. It is suggested to wait with the further intercalibration until the official confirmation is obtained.
UK: England and Wales are part of the CB GIG. The Irish LakeFish system and the CB methods will be checked for applicability. Gillnet fishing is not an option because of public relation issues.

Sampling gear was added to the table, because sampling is essential for comparability.

3. CHECKING COMPLIANCE OF NATIONAL METHODS WITH THE WFD REQUIREMENTS

Compliance criteria	Compliance checking conclusions
1. Ecological status is classified by one of **five classes** (high, good, moderate, poor and bad).	Yes for all MS
2. High, good and moderate ecological status are set in line with the WFD's **normative definitions** (**boundary setting procedure**)	ND: Yes for all MS BSP: No for most MS See comment on pressures, p. 18
3. **All relevant parameters** indicative of the biological quality element are covered. If parameters are missing, Member States need to demonstrate that the method is sufficiently indicative of the status of the QE as a whole.	**Tax. composition**: Yes for all MS **Abundance**: Yes for all MS **Sensitive taxa**: - Yes for BEF, EE, FR, LT, NL, PL - No for DE, DK - unknown for others **Age**: direct - no for all MS indirect - yes for most MS See comment on age, p. 21
4. A **combination rule** of parameters into assessment BQE is defined.	Yes for all MS
5. Assessment is adapted to **intercalibration common types** that are defined in line with the typological requirements of the WFD Annex II and approved by WG ECOSTAT	Yes: FR, NL No: BE WFD but not approved: other MS **CB LakeFish typology is developed and adopted by DE, LT**
6. The water body is assessed against **type-specific near-natural reference conditions**	Yes for most MS. FR uses site specific modelling.
7. Assessment results are expressed as **EQRs**	Yes for all MS.
8. Sampling procedure allows for **representative** information about water body quality/ ecological status **in space and time**	CEN and trawl fishing information is representative in space (whole lake). Temporal representativeness is under discussion/investigation Yes for time / space for Polish LFI+
9. All data relevant for assessing the biological **parameters** specified in the WFD's normative definitions are covered by the **sampling procedure**	Taxonomic composition: Yes Abundance: Yes Sensitive species: No for CEN, Yes for multiple gear (NL, PL) Age: indirectly, see comment p. 21
10. Selected taxonomic level achieves adequate **confidence and precision** in classification	Yes for all MS

Clarify if there are still gaps in the national method descriptions information and summarize the conclusions of the compliance checking:

Comprehensive English descriptions exist for some MS (DE, FR, NL). Short descriptions have been submitted by other MS. The descriptions will be made available at the CIRCA forum of the JRC as soon as they are in a publishable condition (folder Lakes-fish intercalibration/CB GIG/CB method descriptions).

The aim of the LakeFish assessment systems is to provide information on the ecological status of lakes based on a 5-step scale. General WFD compliance is present in the existing systems and will be given for systems to be developed. The aim of intercalibration process is to make the assessment results comparable. Minor deviations from WFD prerequisites do not hinder from intercalibration.

One deviation is the lack of a 'real' age metric in all national systems. In all CB systems, age is substituted by length or weight parameters. Scientific justification was provided by the CB GIG lead (see annex). Based on this, ECOSTAT decided to include national methods in the current intercalibration exercise even if they do not contain age structure metrics (VAN DE BUND et al. 2011).

4. METHODS' INTERCALIBRATION FEASIBILITY CHECK

4.1. Typology

Describe common intercalibration water body types and list the MS sharing each type

Common IC type	Type characteristics	MS sharing IC common type
POLY	Polymictic lakes	Most MS
STRAT	Stratified lakes	Most MS
DEEP	Stratified lakes > 30 m max. depth	Most MS

Conclusion:
A common CB IC typology has been developed (RITTERBUSCH et al. 2010)[1] and was accepted for use in the CB intercalibration process (RITTERBUSCH 2010). IC Typology and national typologies are compatible. The IC typology covers most of the lakes.
Different typologies are used on the national level and FR developed a site-specific approach without typology. However, no difficulties in the comparison have appeared until now, that would have been caused by different typologies.
Only some special lake types can not be intercalibrated (naturally acidified, influenced by humic substances or marine water). The number of lakes assigned to these special types is too small to establish a systematic assessment of status.

[1] Both documents are available on CIRCA/JRC - Lakes -fish intercalibration

4.2. Pressures

Describe the pressures addressed by the MS assessment methods.

MS	pressures addressed
BE-F	biotic integrity (habitat quality, water quality)
DE	general
DK	eutrophication
EE	eutrophication
FR	eutrophication, general degradation
LT	eutrophication
NL	eutrophication, water level regulation
PL	general and eutrophication
CZ, LV, SK, UK	-

Conclusion
Fish in lakes can be used to assess many pressures (eutrophication, acidification, deterioration, water level fluctation). Fish communities reflect the lake status as stipulated by the WFD. However, fish are a BQE that integrates pressures over time and space. They are less useful to describe individual pressure intensities (please see 'Comment on the suitability …' in the Annex). For this reason, intercalibration processes can not rely on good pressure-impact correlations. Therefore, the future harmonization process might differ from the proposals in the IC Guidance. A scientific justification was provided by the leader of the Alpine and CB GIG (see annex). Based on these arguments, ECOSTAT decided to agree that MS will demonstrate a reaction of the total assessment result to the combined intensity of all pressures (if necessary, using expert judgment) and clearly document it in the reports (VAN DE BUND et al. 2011).

4.3. Assessment concept

Do all national methods follow a similar assessment concept?

Conclusion:
The methods are aware of the integrating indicating value of the fish community and assess the status of the fish community of the lake as a whole (including littoral, benthic and pelagic fish). All systems are based on the comparison of the current status with a reference condition. By now, the intercalibration seems feasible in terms of assessment concepts.

4.4. Sampling comparability

Conclusion:
Many MS follow the CEN 14757 multimesh gillnetting fishing procedure with randomized stratified setting of nets. The following methods are used
- DE, DK, EE, FR follow the CEN 14757 exactly (more or less)
- LT excluded small mesh sizes
- BE-F, NL and PL use other methods (like trawl, fishers statistics, see section 2.).

Data based on different gear is incomparable because:
a) methods sample different habitats,
b) active (trawl) and passive gears (nets) have different species-specific effectiveness,
c) selectivity of gears to species or size-classes can not be converted to other gear,
d) most systems work with percentages, deviation in one size/species impacts others,
e) the evidence of some species is restricted to certain methods (e.g. littoral species).

4.5. Boundary setting / comparison and harmonization in common IC type

Boundaries were set at national level.
The boundary setting procedure is heterogeneous and differs between MS, lakes, or even metrics of individual systems. Some possibilities are:

- regression lines, discontinuities (NL, DE)
- definition of H/G boundary and consequent equidistant division (NL, FR)
- value distributions, discontinuities (DE)

In most cases, national expert judgment is included in the class boundary setting. There are no common agreements on abiotic parameters and threshold values representing H/G or G/M boundaries. In many cases pressure-impact relationships are of limited use to set class boundaries in LakeFish assessment (see comment).
More detailed descriptions will be provided in a more advanced state of intercalibration.

4.6 Conclusions

Typology, reaction on pressures and system concepts are of minor importance for the intercalibration process. Main problem is the incomparability of results obtained with different fishing gear. This requires the use of intercalibration option 2, i.e. the development of common metrics / pseudo common metrics. Until now, the search for a suitable common metric had no convincing result. The only way to apply a pseudo common metric is parallel sampling. This was done by NL and will be done by PL. However, results are not clear until now.

5. COLLECTION OF IC DATASET

Describe data collection within the GIG.

The common dataset for the LakeFish IC process is hosted at the CEMAGREF (France, cross-GIG coordination). It is used as WISER database and includes data from European Member States that have done fishing according to CEN 14757 in natural lakes. For the CB-Gig the MS are: CZ, DE, DK, EE, FR, LT, LV. New data obtained throughout 2009/2010 is imported into the database. Only CEN 14757 data was summarized, so all data acceptance criteria are fulfilled. Concerning the IC process, a limited part of the dataset is really comparable. Reasons might be the lake type (e.g. the Czech Republic has anthropogenic reservoirs, but no natural lakes), modifications of the CEN procedure (exclusion of smaller mesh sizes by LT, two campaigns with ½ of nets instead of full standard for DE). The database includes physic-chemical and pressure data for the lakes. For detailed information on the data please refer to the host.

Within the GIG, there is a collection of an IC dataset with information on assessment results. It includes EQR values and status classes for both individual metrics and whole systems of the CB common metric, the German assessment method and the national systems. Additionally, expert's estimations of the ecological status of the lakes reflecting the total pressure intensity are collected.

MS	Data provided to the common CEMAGREF-database
Czech Republic	Yes - CEN 14757 (HMWB/AWB)
Denmark	Yes - CEN 14757
Estonia	Yes - CEN 14757
France	Yes - CEN 14757
Germany	Yes - CEN 14757
Latvia	Yes - CEN 14757
Lithuania	Yes - CEN 14757
Poland	CEN 14757 - not yet achievable
Netherlands	Some new CEN 14757, to be included in the DB soon
Belgium (Flan.)	No CEN 14757 data
Slovakia	No data
UK	CEN 14757 (with reduced effort)

6. BENCHMARKING: REFERENCE CONDITIONS OR ALTERNATIVE BENCHMARKING

Clarify if you have defined
- common reference conditions → **No**
- or a common alternative benchmark for intercalibration → **Not yet**

Lakes in true reference condition concerning non biological parameters are absent or nearly absent in the CB GIG. Therefore most MS use other methods then abiotic reference sites to define the fish community in HIGH status (e.g. expert's definition, use of LDC sites, historical data, for France also WISER hindcasting method (CAUSSE et al. 2011)).

There was a huge and enduring disagreement in the cross-GIG LakeFish experts group about the relevance of the REFCOND criteria for defining reference condition. The proposals of the WISER/CEMAGREF team were also discussed controversially. Therefore, an alternative solution was found using a modelling procedure that was not based on reference sites. In summary, both 'true reference' and LDC sites defined with abiotic parameters seem to be unsuitable to benchmark status equivalents for fish in lakes on a CB range because of their strong dependency on lake type and biogeographical location.

Additionally benchmarking with the use of a pressure-impact gradient is not a suitable intercalibration option for fish in lakes. They would be necessary for the 'official' IC spreadsheets, for example. Correlations between pressure intensities and fish community measures are weak. In lakes, Fish are mostly insensitive to individual pressures but react on the sum of different pressures (see comment on the suitability of fish to address specific pressures, p. 18). This makes benchmarking even more difficult.

For future use in the IC process, expert judgments on the total ecological status are collected for use as a benchmarking system.

First experiences have shown that the comparison of assessment results with expert judgments of the ecological status of the corresponding lakes can be used to
1) estimate the reliability of assessment systems and
2) compare, evaluate and synchronize the results of different assessment systems.
This procedure was accepted by ECOSTAT (van de Bund et al. 2011), but the practical use is still under investigation.

7. DESIGN AND APPLICATION OF THE IC PROCEDURE

7.1. Please describe the choice of the appropriate intercalibration option.

Which IC option do you plan to use?

IC Option 1 - same method:
The GIG lead tried to develop a common CB method during 2010. It was designed for MS applying the CEN 14757 multimesh method or slightly modified sampling. However, the results were not satisfying. The huge biogeographical differences within the GIG lead to the fact that individual metrics are not transferable to the whole range of MS, e. g. Bream is a reliably indicator of eutrophication in central CB regions, but naturally absent in the eastern part. The incomparability is even more pronounced for class boundaries (RITTERBUSCH 2010). Option 1 is not applicable.

IC Option 2 - Different data acquisition and numerical evaluation:
Most of the MS use different fishing methods (see section 2). Even modifications of a similar method lead to an incomparability of the results, both for absolute values per unit effort and for percentages (e.g. exclusion of small mesh sizes). Knowledge on the difference of methods is present, but there is no way to translate results of one sampling procedure into another. Ecological relevance and class boundaries of metrics are gear specific.
All MS have different procedures of fish data evaluation.
Principally, option 2 would be the appropriate choice of intercalibration. However, it was not possible to identify a suitable common metric until now.
Option 2 is not applicable.

IC Option 3 - Similar data acquisition, but different numerical evaluation:
A small subset of MS applies the CEN 14757 procedure in the standardized way (CZ, DE[2], DK, EE, FR). First steps in the IC option 3 have been done. A common metric was proposed by Germany and was calculated for these countries. Comparisons of national assessment results with this common metric, the German system and expert's estimations of lakes status show different degrees of correlation. The relationships between national methods and common metric are prevailingly unacceptable. As things stand now, option 3 might be useful for some MS in geographical vicinity.

More recently, the index developed in the WISER project has reached a condition that it's suitability as common metric can now be tested. Unfortunately, this was reached too late to be included in the present Milestone 6 report.

Option 3 can become useful to intercalibrate within the central CB region: DE, DK, FR and later on PL. NL could be added via direct comparison using parallel sampling results of trawl and CEN fishing.
Option 3 could be applicable for a number of neighboured MS. The WISER results may further improve the use of option 3.

[2] Using 2 times ½ CEN efforts is regarded as comparable, although not strictly following the standard.

7.2. IC common metrics (if IC Options 2 or 3 are used)

Describe the IC common metric:

There are three kinds of common metrics:
a) single metrics selected of national methods or generated for the IC process
b) common metric made of combined metrics
c) a pseudo common metric, i.e. the mean assessment result of other methods

a) Was avoided because fish in lakes usually show weak correlations between parameters and pressures. It was expected that single metrics have no acceptable correlation to both national systems and pressure-intensities. LakeFish assessment systems always base on multiple metrics to provide acceptable results.

b) Following the discussion about the CB system, 4 suitable common metrics were selected. With this selection, a common metric mini-assessment system was developed for the CB GIG. The development was based on the WISER database. It was designed for the CEN 14757 sampling and based on the following metrics:
- WPUE
- Bream + Roach
- Benthic species reacting on eutrophication
- Species sensitive to the integrity of the shoreline

The common metric mini-system shows the same problems as the preceding complete system proposal: no reaction on pressures, limited applicability to metrics to the huge biogeographical range of fish communities, no comparability of EQR values and class boundaries between MS.

c) The pseudo common metric is applicable only, if multiple assessment systems can be applied to the same dataset. As already mentioned, the direct comparison is useful only for few MS in close vicinity.

7.3. Strategy

Status quo

The BQE Fishes in Lakes, Central Baltic GIG has achieved great progress during the intercalibration Phase II. Only one system with official status is present in the GIG (NL), but other intercalibrateable systems have been finalized recently (DE, DK, EE, FR, LT). Two additional systems will be ready for intercalibration in 2011 / 2012 (BE-F, PL).

The intercalibration process will not be finished within 2011. All member states have done considerable efforts to develop national assessment methods with the result that most of them expect to finalize their system within 2011/2012 (see section 2). Thus, the situation has greatly improved from only one finalized method at the beginning of the LakeFish IC Process in 2008 (The Netherlands) to currently roundabout six methods that can be compared.

Reasons for delay

Most of the CB methods were not ready to be compared until end of September 2011. Therefore, first comparisons could be done (see Annex 3), but real intercalibration processes in terms of class boundary comparisons and adjustments are still missing. The reasons for the delay are unclear. Despite its suitability to indicate the ecological status of lakes the BQE Fish is far behind in (nearly) all European MS. While other BQE started intercalibration in 2004, the CB LakeFish intercalibration started in 2008 with only one working system. The BQE fish fauna has some inherent properties that add further problems beside the delay of system development.

First of all, there seems to be focus on other Water Bodies/BQE in most MS. Manpower and money invested in LakeFish systems is small compared to other elements. Eventually the difficulties of LakeFish assessment have been foreseen and the initial focus of the WFD compliant system development was set to more easy/obvious biota. The existent datasets of fish are small, long time series are missing.

Methodological reasons are for example, that no agreement on the threshold values of pressures reflecting the reference conditions could be found. Not even the significance of pressures for fish was undisputed and the proposals of the REFCOND guidance were criticized. An important biological reason is the weak pressure-impact reaction of specific fish community traits. Fish are integrating in space and time and can avoid local or limited pressures. Pressure-impact relationships are the basis of most of the IC options proposed in the current guidance. Additionally, the resilience of the fish community is high. Therefore single metrics are unreliable indicators of pressures. To obtain a good performance, multimetric indices are needed, which are more stable if more metrics are used. This makes a single or reduced common metrics unusable. The huge geographical range of the CB GIG leads to very different fish communities, in some cases important indicator species are naturally missing.

We have to highlight that the existing typology are not able to take into account the entire natural variability of the natural environment of the CB lakes. As it is shown on the following figures (principal component analyses), there are large differences among the main environmental characteristics of the lakes in the different countries. As a consequence, the intercalibration process will probably be difficult because of the specificity of each national tool.

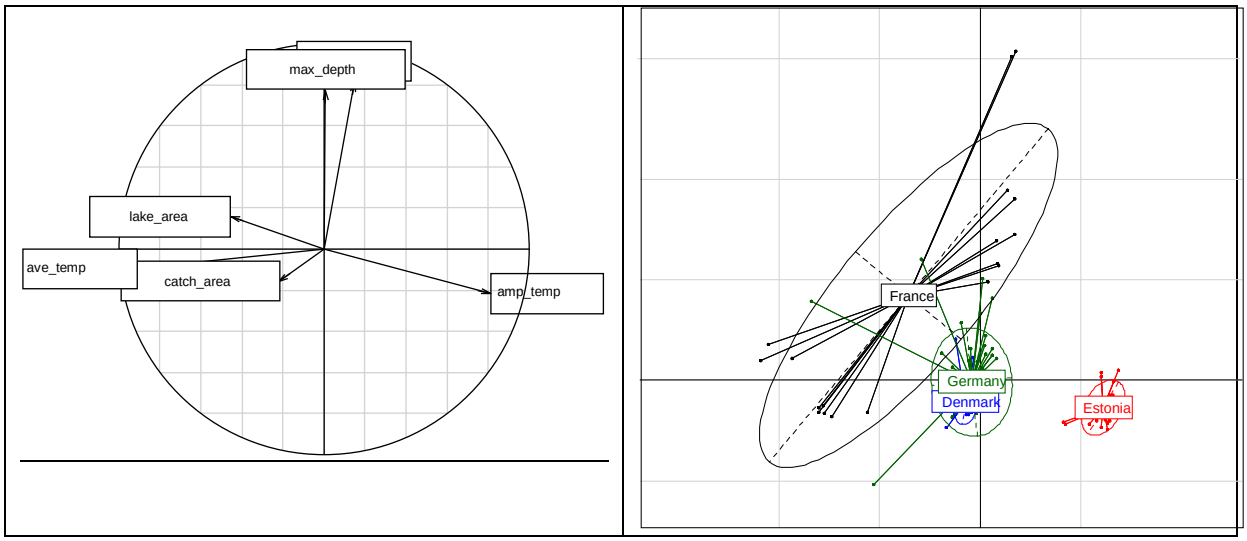

Fig. 1: Principal Component Analyses (PCA) performed on natural parameters of all CB lakes (a) Correlation circle for environmental parameters (amp_temp: temperature amplitude, ave_temp: average temperature, max_depth=maximum depth, altitude, lake_area and catch_area = catchment area); (b) Representation of lakes coordinates on the first factorial plan according to the country. For further explanations see WISER report (CAUSSE et al. 2011).

Strategy up to now

Due to the lack of national systems in the MS of the Central Baltic GIG, the strategy for intercalibration focused on the development of a kind of common assessment.
First, this was done by proposing a common system (2010). The common system was modified and is now used as national German system; some metrics were adopted by other MS. At all, the system turned out to be too specific for use on a whole GIG level.
Afterwards, a mini common system (common metric) was developed.
First bilateral comparisons show, that the common metric has low correlations with the lake status for most MS. The common metric can not be used to assess the ecological status of Central/Baltic MS. The correlations of EQR values with the results of national systems are also weak. Apart from Germany they only correlate with NL expert judgment. However, a CEN-based system will not be used in The Netherlands.

In the following table, the "appl"-columns show if MS national system, CB common metric and DE system are applicable for use as national system (via comparison with expert judgment). The "corr"-columns indicate if there is a correlation to the MS national system (EQR values).

MS	**appl. MS**	**appl. CB**	**appl. DE**	**corr CB**	**corr DE**
CZ	-	ok	Not suitable	-	-
DE	ok	Not suitable	ok	ok	-
DK					
EE	limited	Not suitable	limited	Not suitable	ok
LT	ok	Not suitable	Not suitable	Not suitable	Not suitable
NL	ok	ok	ok	ok	ok (?)
PL	-	Not suitable	Not suitable	-	-

Both common system and common metric are not suitable for
a) Assessment of the ecological status of most CB states or
b) Comparison of the results of assessment systems.

Perspectives

The intercalibration of LakeFish assessment could not be finalized within Phase II/2011. The CB MS stress the importance of fish to assess the ecological status of lakes and great progress has been achieved in recent times. Most MS favour the straightforward continuation of the IC process if the results obtained in 2011 are promising. More systems can be expected in near future and the interruption of a dynamic process can undermine the successes obtained until now. Financing and manpower are estimated to be sufficient for the intercalibration purposes in most cases. However, no explicit decisions on the future of the LakeFish Intercalibration Process after Phase 2 have been made. Decisions will have to be made on the integration of Fish in the national lake assessment of the different MS. And on the future and way of realization of the IC process.

As shown in this Milestone report, it is unlikely that the options proposed by the IC guidance will fit the special requirements of Fishes in Lakes. Modifications of existing options or alternative pathways of intercalibration have to be found. Some approaches are:

"Normative" solutions

a) **Agreement of expert's judgment**: Fish in lakes have low reactions on the intensity of individual pressures but react on the total level of lakewide degradation. A common CB definition of relevant pressures, their combination to total pressure intensity and thresholds values for the status classes could be defined. Afterwards, the fish assessment could be calibrated against the total pressure intensity parameter. However, the experiences show that it is unlikely to find such a common agreement (see section 6.).
b) **Precise normative definition of the status classes:** This would be a specification of the WFD normative definitions leading to a detailed description of a set of fish community parameters and unequivocal class boundary equivalents. Such an agreement is possible, but unlikely (see a).

Decrease of demands

c) **The introduction of CB-subgroups**: The division of the CB GIG into geographical subgroups could lead to a higher similarity of fish communities and thus to a better fit of common metrics. However, the aim of the IC process should be to assure comparability in the largest geographical range possible.
d) **Reduced common system and other combination of metrics**: As both common system and common metric failed to be reliable, I thought about mistakes in the combination of individual metrics and the scoring procedure. As a consequence, I checked all the metrics of both approaches individually for correlations to the expert's judgment of the lakes. The aim was to identify the metrics, which can be used for the whole GIG. A first analysis showed that the value distributions make the successful development of a 5 class system unlikely. Therefore, I focused on the most essential requirement - separating the good from the bad lakes (i.e. identifying the M/P/B lakes). Preliminary results are promising, but for further investigations some important data needs to be included that was missing until termination of this milestone (DK assessment results, WISER results).

Others

e) **WISER results**: The LakeFish team of the WISER project aims at developing a common European assessment system. The suitability of this system for the Central/Baltic subgroup has to be evaluated.

The future strategy of the CB intercalibration process is to continue the work without interruption beyond Phase II. Within 2011, more information can be gathered (DK and

WISER). The WISER proposal will be tested for suitability on a GIG level. It will be tested, if approach d) can provide a common benchmark for the G/M-boundary.
The MS will be asked for their suggestions for the future IC process and a decision on the future of CB LakeFish intercalibration will be made.

ANNEX 1 - METHODS AND DESCRIPTIONS

Detailed descriptions of the national assessment systems will be made available at the CIRCA forum of the JRC as soon as they are in a publishable condition (folder Lakes-fish intercalibration/CB GIG/CB method descriptions).

Overview of national metrics and assignment to WFD normative definition

Tab. 1: Metrics of national LakeFish assessment systems in the CB GIG. N: number, NPUE: number per unit of effort, W: weight, WPUE: weight per unit of effort, spn: species' number. Rows in italics are systems which undergo changes, so metrics might be modified (last update October, 2011).

MS	Species composition	Abundance	Age structure	Combination rule of metrics
BE	*- number of species* *- Mean tolerance value* *- % type species (for Bream, Roach and Rudd)* *- W piscivores /non-pisciv.*	*- Total biomass* *- Pike biomass* *- Tench biomass*	*- Pike recruitment* *- Tench recruitment*	*Average and equidistant classes*
EE	- Perch %N - non-piscivorous % W - Simpson Dw	- NPUE - WPUE	Number of length classes	Average
DE	- Presence obligatory species - Bream % W or N - White bream % W - Ruffe % W or N - Pikeperch % W - Perch % W - Benthic net species % W - Benthivorous % W	- WPUE	- median ind. W Bream, Perch, Roach - reprod. of stocked species is tested	EQR of metric status classes
DK	*- Perch % N* *- Bream + Roach % W* *- Bream + Roach % N* *- piscivorous % W*	*- NPUE*	*- avg. ind. W total*	*EQR based on a combined metric*
FR	- Omnivorous %N	- NPUE - WPUE		Average of metrics EQR

LT	- White bream % W - Perch % N - Benthivorous % W - tolerant % N - perch+stenoterm. %W - stenotermic NPUE - stenotermic spn	←	- avg. ind. W Roach	Average of metrics EQR
NL	- Number of species - bream (%W) - perch+roach/eurytopic W - phytophilic species (%W) - low oxygen tolerant (%W)	←	- % of eel > legal length limit - % pikeperch > legal length limit	Average or weighted average
PL	**Polish method LFI+:** Total cyprinids %W Small cyprinids %W Big cyprinids %W Predators (pikeperch+pike+ perch) %W Littoral (pike+tench) %W Species choices depends on type of lake **CEN method (first attempt):** Perch %W Rudd %W Bream %W Pike-perch %W	LFI - total commercial catches CEN - % of weight in total catch is the best. Weak relationship pressure ↔ WPUE / NPUE		EQR from mathematic models

ANNEX 2 - COMMENTS

Comments on the suitability of the BQE fish to address specific pressures in lake assessment systems

This document was drafted at the 2nd Alpine GIG meeting, March 10, 2011 in Scharfling, Austria.
It represents the point of view of the following MS:
Alpine: Austria (alpine lead), Germany, Italy, Slovenia
CB: Germany (GIG lead), MS were informed and asked for their opinion. Generally support: BE, critical view: EE,

Some MS criticized contents of the following position (EE) or principally disagree (FR).

Last update: October 2011

Fish as bioindicators in lakes

The WFD has included the fish fauna as an inevitable quality element to asses the ecological status of lakes. In addition to phytoplankton, macrophytes and makrozoobenthos the fish fauna completes an integrated assessment as the upmost trophic level in the ecosystem. Fish are long living and mobile and thus have an integrating value to indicate changes in the ecological status over a wider range of place and time. It is well known, that fish communities are suitable to assess the ecological status and/or the biological integrity of lakes. The show reactions on:

- Eutrophication (BELPAIRE et al. 2000; GARCIA et al. 2006; HELMINEN et al. 2000; JEPPESEN et al. 2005b; LAUNOIS et al. 2011; MEHNER et al. 2004; PEDRON et al. 2010; PERSSON et al. 1991; SONDERGAARD et al. 2005; WHITTIER 1999)
- habitat destruction, shoreline degradation, lake use intensity (BELPAIRE et al. 2000; JENNINGS et al. 1999; WHITTIER 1999)
- HYMO degradation, connectivity (DEGERMAN et al. 2001)
- Acidification (APPELBERG et al. 2000)
- Combined degradation (WHITTIER 1999)

A summary can be found in (BECK & HATCH 2009).
Based on this knowledge many European countries investigated the suitability of the fish communities in Lakes to indicate anthropogenic deterioration (MED and EC GIG not included):

- Austria (GASSNER & WANZENBÖCK 2005; GASSNER et al. 2003; GASSNER et al. 2005; ZICK et al. 2006)
- Belgium (BELPAIRE et al. 2000)
- Denmark (ANDERSON et al. 2005; JEPPESEN et al. 2005a; JEPPESEN et al. 2000; JEPPESEN et al. 2007; JEPPESEN et al. 2005b;

SONDERGAARD et al. 2005)
- Finland and Sweden (APPELBERG 2000; APPELBERG et al. 2000; HOLMGREN & APPELBERG 2000; TAMMI et al. 2001; TAMMI et al. 2003)
- France (LAUNOIS et al. 2011; PEDRON et al. 2010)
- Germany (BRÄMICK et al. 2008; DIEKMANN et al. 2005; GARCIA et al. 2006; MEHNER et al. 2005a; MEHNER et al. 2004; MEHNER et al. 2005b)
- Netherlands (JAARSMA 2007)
- international (JEPPESEN et al. 2005b; MEHNER et al. 2007)

A huge additional amount of scientific knowledge gained in the process of WFD-compliant LakeFish assessment methods is unpublished or hidden in grey literature. In both the Alpine and the Central/Baltic GIG working LakeFish assessment systems have been developed or will soon be finalized in Austria, Belgium, Denmark, Estonia, France, Germany, Italy, Lithuania, and Netherlands. In summary, fish are a suitable and well chosen BQE to assess human impacts on lakes.

Problems using pressure-impact relationships for fish in lakes

For the development of assessment systems, the accompanying guidance demands well established relationships between human pressures and reaction of the metrics. This is regarded as essential for system development, class boundary setting and intercalibration. In spite of the well known impacts of certain pressures, such highly significant correlations are not present in most pressure-impact-analyses for fish in lakes. The reasons are manifold:

- A lake is an individual water body but is comparably huge and usually consists of sub-habitats, which occur several times. Fish are mobile and can avoid local pressures. Therefore, the whole fish community will not show reactions (a difference to the assessment of river sections).
- Lakes are complex ecosystems containing a diversified network of interacting trophic levels. Pressures affecting the ecological status of lakes are highly interdependent, e.g. lakes in urban regions are often influenced by lake use, shoreline degradation, eutrophication and water level regulation. Lakes influenced by single pressures are rare or absent[3]. Many pressures impact the fish community in similar ways, e.g. via destruction of submersed macrophytes. Furthermore, natural variation can hide the effect of anthropogenic impacts in all trophic levels. Fish as the topmost level of the trophic cascade are indirectly integrating effects of

[3] This is not valid for acidification which occurs in lakes not impacted by other pressures. Acidification is not relevant for the alpine GIG and of limited relevance for the CB GIG.

pressures acting on any level below (bottom up-hypothesis). Thus linear relationships between individual pressures and fish-metrics may be lacking and it make it impossible to identify pressure specific effects (a difference to pressure specific BQE like phytoplankton for eutrophication)

- Fish represent the upmost trophic level in a lake and are a BQE integrating space and time. Fish are resilient to pressures. Fish should be used for an integrated assessment of pressure intensity while other BQE can be used to address specific pressures.
- Using highly correlated relationships leads to the result, that direct pressure measurements are replaced by imprecise and ineffective BQE metric measurements. The fish experts feel that this is not the intention of the WFD. The aim of the fish assessment should be to compare fish communities in reference condition with the current status. This can be done effectively with the present approaches.

The conclusion for fish in lakes is that highly correlated pressure-impact relationships can not be expected. Additionally, they are not necessary for effective assessment of ecological status. For fish in lakes, a reaction of the total assessment result (EQR or status class) to the combined intensity of all pressures is a suitable measure of assessment quality. This has successfully been tested, e.g. using expert's judgment.

Recommendations

We strongly recommend recognizing fish as a valuable BQE to assess the ecological status of lakes. Effective and WFD compliant lake assessment methods based on the fish communities are developed. However, some of the recommendations in the IC guidance are specific to certain BQE or water bodies and can not be transferred to the LakeFish assessment. We suggest leaving this freedom to the fish experts.

Comments on the WFD metric "age structure"

Mainly based on the following arguments, ECOSTAT decided at a meeting in March 2011 that 'it is agreed to include national methods even if they do not contain age structure metrics for the current intercalibration exercise' (VAN DE BUND et al. 2011).

This following section represents 'the German' (my personal) opinion concerning the traits 'age structure' and 'sensitive species'. Both are part of the normative status definitions of the WFD for LakeFish, but their national application is very problematic. Many or most of the problems also occur in other MS of the CB GIG. However, this document is not harmonized throughout the GIG. MS were asked for their opinion, but little feedback was obtained.
David Ritterbusch, March 2011, last update: October 2011

Age structure
Normative definition WFD for HIGH status: **The age structures of the fish communities show little sign of anthropogenic disturbance and are not indicative of a failure in the reproduction or development of a particular species.**

The description of this trait is in the WFD is imprecise. Strictly speaking, it is impossible to assess the age structure of a fish community. It would be possible to identify the age structure of selected species but some fundamental problems exist with this indicator:

- Age structure can only be assessed for a few very frequent species (e.g. Bream, Roach, and Perch). For other fish species, the number of individuals caught usually is too low to identify structural deficits, even if methods are combined. Frequent species are mostly insensitive. A reaction to pressures by changes in age structure or failure of reproduction is not expected except for very high levels of pressures.
- Fish are mobile and can avoid local pressures. They will successfully reproduce as long as any suitable habitat remains within the whole lake. The natural over-production of offspring will hide pressure effects.
- The natural variability of reproductive success is very high. Single depressions of natural reproduction should not lead to a downgrade of ecological status class, as they might well be of natural origin. A reproductive failure caused by human impacts can be distinguished from natural variation by the fact, that it should exceed the natural resilience, i.e. the potential to counterbalance natural oscillations. Such an enduring anthropogenic influence will be shown in species abundance, not age structure.
- The catch data is unreliable and strongly depends on small difference of date and place. Chance or unknown factors might also

play a major role (catch a shoal of juveniles or not). Gear specific age/length sampling makes the results incomparable (e.g. CEN net catches underestimate YOY and 1+ as well as old/big individuals).

- 'Real' age data, i.e. age reading on scales or otolithes is highly time consuming, expensive and uncertain. The gain of knowledge usually is low. It is doubtful that size proxies of age are applicable and represent the intention of the WFD.

Summarized, age structure is of minor suitability to assess the ecological status of lakes in the CB GIG. Some MS tested the metric age structure but no clear reaction to human impacts was found (DE, BE, unpublished results). Our experiences show, that all major age classes (YOY, juvenile, adult) of the more common species are always present in lakes.
Size can to some degree replace direct measures and indicate certain pressures. The absence of large individuals can show intensive fisheries (as done in NL). In EE the absence of large individuals directly shows the allowed mesh sizes. Additionally large individuals indicate a good quality of deeper waters, which is their main habitat (A. Palm, pers. comm). Mean or median individual weight can be used as growth parameter and indicator for eutrophication (DK, DE).
Summarized, size parameters can be used as metrics and serve as proxies for 'real' age measurement. At all, they seem to be of minor validity and of limited applicability, e.g. type-specific within a smaller geographical range. In the WISER project, reliable relationships between size metrics and pressures were not found (CAUSSE et al. 2011).
However, the German interpretation of the WFD's intention of the 'age' parameter is that resident fish species should reproduce naturally and sufficiently for the maintenance of the standing stock. A similar interpretation is found in the Belgic system, which uses reproductive success of tench and pike.
In lakes, the successful natural reproduction of fish species is usually shown be the mere presence in the catches. This might not apply for stocked species. This limits the need to investigate age structure to some species that are or might be stocked. Relevant species are (for Germany): Carp, Pike, Pikeperch, Whitefish. If stocking takes place, the species' presence and abundance might be influenced by human activities. However, many investigations show that stocking rarely increases the natural species abundance (Literature to be added). Germany has implemented a metric 'reproduction of stocked species'. In this metric it must be proved, that stocked species also reproduce naturally. Otherwise the species will be rated as absent, which might impair the assessment result.

The comment on age structure is generally supported by BE, FR, but seen critical by EE
Comments of the following MS were included: BE, FR, EE

ANNEX 3 - FIRST STEPS IN INTERCALIBRATION SHORT DESCRIPTION/KEYWORDS

Data compilation

- Development of a common metric (metric selected by expert judgment at the GIG meeting) - CB_LaFi
- Elaboration of an Excel-template which provides the corresponding assessment results for CB_LaFi and DE_LaFi
- Request for the assessment results of the corresponding national assessment system MS_LaFi and an expert judgement of the total ecological status of the lake (not of the fish fauna) MS_exp

Dataset

- CZ: Data for 16 reservoirs. CB_LaFi and DE_LaFi suitability is tested. No national method present and water bodies are anthropogenic therefore CZ is not included in intercalibration.
- DE: Data for 84 fishing campaigns at 78 lakes (6 lakes were sampled twice)
- EE: Data for 11 natural lakes (CEN 14757 but nets are not strictly set in random stratified procedure)
- LT: Data for 38 natural lakes. Data based on special fishing procedure without mesh sizes < 14 mm. CB_LaFi and DE_LaFi suitability is tested and correlations are checked with the provision that the mesh sizes will influence the results.
- NL: Data for 8 natural lakes in Netherland. Lakes were sampled with CEN 14757 multimesh-nets and electrofishing to be assessable with CEN-based methods. Simultaneously, lakes were sampled with the Dutch Trawl fishing procedure and assessed with the Dutch system to make the results comparable. Additionally, 2 Danish and 2 German lakes were sampled with both methods simultaneously.
- PL: Data for 10 natural lakes, suitability and correlations checked

System validation - methods

<u>Suitability check</u>

Is the method useful to assess the lakes of the specific MS?

- national methods: MS_LaFi ↔ MS_exp (status class),
- CB common metric: CB_LaFi ↔ MS_exp (status class),
- German method: DE_LaFi ↔ MS_exp (status class),

The suitability check is used to assess if the method provides reliable results for assessment of the lakes of a MS.
National method assessment results should correlate with national expert judgment of lake status. Otherwise the national method might be of limited suitability. This might eventually be the case for systems under development. Methods that do not fulfil this criterion should be improved.
For the CB common metric and the German system it is just a test, if they could be used for assessment. In terms of status classification, neither CB nor German systems need to be very useful for the direct assessment of lakes of different MS. But missing or contradictory correlations indicate a stronger level of disharmony which could be caused by biogeographical incomparability of metrics, differences of the system concept or other reasons.
The German system has to be intercalibrated like other MS systems. The direct comparison of national systems with the German system is kept, because the German approach was originally developed for use as a common CB assessment system. The applicability of a common system was rejected at the CB meeting in Berlin. However, the comparisons are done to substantiate the decision.

Correlation check

Are the methods sufficiently correlated?

- between MS_LaFi and CB_LaFi (EQR)
- between MS_LaFi and DE_LaFi (EQR)

This is the most important prerequisite for intercalibration. A correlation indicates similarity of the concepts, metrics and systems.

Acceptance criteria

- for status class measures
  - Spearman rho $\geq$ 0.5, - roughly following IC Guidance, Annex V (CIS 2009)
  - mean absolute class difference < 1 - following IC Guidance, Annex V (CIS 2009)
  - critical misclassification (H/G $\leftrightarrow$ M/P/B) < 20 % of all classifications - my assignment
  - no systematic misclassification: 25 - 75 % of mis-classifications are false-positive - - my assignment
- for EQR measures
  - correlations with rho $\geq$ 0.5 - following IC Guidance, Annex V (CIS 2009)

System validation: results for MS

CZ

Notes: The Czech Republic has no natural lakes, but exclusively anthropogenic reservoirs. For this reason, no official participation in the intercalibration process takes place. No national method has been developed until now. The application of the common metric and the German LaFi is a test to ease the future national system development with the knowledge gained in the IC process. I decided to modify the DE_LaFi assessment a little bit (this is an allowed option of the German system). I excluded the size metrics for DEEP reservoirs (Flaje, Klicava, Nýrsko, Orlik, Rimov, Sec, Vranov, Zelivka). Czech and German experiences have shown, that individual growth is misleading in this kind of water body (median of fish sizes are usually bigger in deep reservoirs then in deep natural lakes). I deselected the Bream and Ruffe metrics where the species are naturally absent (Flaje, Nýrsko, Zlutice). A Czech national method is not present; the corresponding suitability check and the check of correlations are cancelled.

Suitability check: The CB_LaFi system would be a suitable method to assess the ecological status of Czech reservoirs. Only 2 of 16 water bodies are misclassified, both of them by one class, but critical. The deviation is not in the same direction (one is too good, the other one too bad). The suitability criteria shown in Tab. 2 have excellent values. The system concept, metrics and class boundaries can be useful in the future for the national system development. The German assessment method is not applicable to Czech reservoirs. There is no correlation of assessment result to expert's status estimation, the percentage of critical misclassifications is app. 1/5 and close to the acceptability limit, all misclassifications are false-positive (i.e. the German system systematically scores too badly).

Tab. 2: Comparison of ecological status classes assigned by CB_LaFi and De_LaFi results with expert's judgment of the ecological status/potential of Czech reservoirs (experts: Marie Prchalova, Jan Kubecka, number of lakes: 16). Check is ok, if acceptance criteria are fulfilled (p. 24).

criterion	CB_LaFi value	CB check	DE_LaFi value	DE check
rho ESC ↔ ESC	0.75, $p < 0.002$	ok	0.35, n. s.	X
macd	0.13	ok	0.5	ok
% critdev	13	ok	19	ok
% falsepos	50	ok	100	X

Conclusions: The results were sent to the Czech representative Marie Prchalova and it was taken note of. Conclusions will be drawn when a national system and an official participation of the Czech Republic in the IC process is given.

DE

Notes: Anthropogenic lakes were removed from the dataset for the system validation check. Special lakes were removed also (flushed lakes, saline lakes, heavily stocked lakes). For lakes which were fished in two different, non-consecutive years, I always took the first (earlier) campaign for the validation check. For the six lakes with two assessment results, all status classes were similar for the German system, but differed in three cases for the common metric.

Suitability check and correlation: The German assessment method is suitable to assess the German lakes, i. e. the status-classes correlate with the expert's expectations. The suitability criteria shown in Tab. 3 have good values except the low percentage of false-positive classifications. The German system scores too positive. *Favouring false-negative in comparison to false-positive assessments was intended in the German system development considering the one-out-all-out principle of four BQE proposed by the WFD.*
The CB common metric shows a correlation close to the limit of acceptance. The class deviation is in a good range, but approximately 1/3 of all lakes are critically misclassified. The CB system is not applicable to assess the German lakes without modifications.

Tab. 3: Ecological status classes: comparison of CB_LaFi and De_LaFi results with expert's judgment of the ecological status of German lakes (experts depend od federal country, number of lakes: 77). Check is ok, if acceptance criteria are fulfilled (p. 24).

criterion	**DE_LaFi value**	**DE check**	**CB_LaFi value**	**CB check**
rho ESC ↔ ESC	0.753, $p < 0.001$	ok	0.476, $p < 0.001$	X
macd	0.29	ok	0.55	ok
% critdev	14	ok	31	X
% falsepos	21	X	27	ok

The correlation between both systems is good; the common metric seems useful for calibration:
EQR DE_LaFi ↔ EQR CB common metric: rho = 0.710, $p < 0.001$.

Conclusions: The German system reliably assesses the ecological status of German lakes. It can be included in the intercalibration process.

EE

Notes: For some lakes, I modified the German assessment system, which is an allowed option in the German approach. I excluded the Pikeperch metric, which is part of the German assessment of polymictic lakes. Pikeperch is naturally absent in some of the Estonian lakes; a low percentage is not indicating a good status, but directly the lack of stocking of that specific species.

Suitability check and correlations: The suitability checks of all three methods tested are not convincing (Tab. 4). The suitability values for Estonia are close to the acceptability limit of correlation between system and experts opinion. However, approximately 30 % of critical misclassifications do not seem reliable enough. Additionally, there is a strong tendency to assign too bad status classes. The application of the German system shows equal limitations.
The common metric does not correlate with the expert's judgment of the lake ecology and thus is not suitable for Estonian lakes.

Tab. 4: Ecological status classes: comparison of EE_LaFi (current version 2), CB_LaFi and De_LaFi results with expert's judgment of the ecological status of Estonian lakes (experts: Anu Palm, Teet Krause, number of lakes: 21). A comparison for an outdated version of the Estonian system is added at the right in grey cells (EE_LaFi_old). Check is ok, if acceptance criteria are fulfilled (p. 24).

criterion	**EE_LaFi_2 value**	**EE check**	**CB_LaFi value**	**CB check**	**DE_LaFi value**	**DE check**	**EE_LaFi old value**	**EE old check**
rho	0.478, $p < 0.05$	X	0.24, n. s.	X	0.57, $p < 0.01$	ok	0.32, n. s.	X
macd	0.62	ok	0.52	ok	0.52	ok	0.76	ok
% critdev	28	X	28	X	28	X	33	X
% falsepos	90	X	44	ok	82	X	23	X

The correlations between the Estonian system and the common metric EQR values are weak for both the outdated and the current version. The correlation between the current Estonian and the German system is above the acceptability limit.

New version of Estonian LAFi system
Est2 - EQR ↔ CB EQR: rho = 0.269, n. s.
Est2 - EQR ↔ DE EQR: rho = 0.585, p < 0.01

Old version of Estonian LaFi system
Est1 - EQR ↔ CB EQR: rho = 0.062, n. s.
Est1 - EQR ↔ DE EQR: Spearman rho = 0.368, n. s.

Conclusion: The results show, that the continuous development of the Estonian LaFi system has led to better results in terms of identity of assessment of fish and expert's judgment of lake ecology. The common metric is unsuitable for intercalibration purposes. This is shown by low correlations with both lake status and the Estonian fish system. The German system shows a higher correlation and might be a basis for future comparisons.
At the present stage, it is suggested to wait with the inclusion of the Estonian system into the IC process until the continuous national system improvement leads to more plausible assessment results.

LT

Notes: The Lithuanian fishing procedure is deviating from the CEN 14757 in the fact, that small mesh sizes < 14 mm are not included in the nets. In addition to bio-geographical constraints, methodological differences might prevent applicability of assessment systems developed for a CEN 14757 procedure to Lithuanian data. Anyhow, Tomas and I decided to perform the tests and include the differences in the interpretation of results.
The consequences of changed mesh sizes on the metrics are not obvious or inevitably, except for the German size metrics. Excluding small mesh sizes will increase the median of species-specific sizes and make the selected class boundaries obsolete. Therefore, I excluded the size metrics from the calculations of DE_LaFi. Additionally I excluded the Pikeperch metric, which is part of the German assessment of polymictic lakes. Pikeperch is naturally absent in the Lithuanian lakes; a low percentage is not indicating a good status, but directly the lack of stocking of that specific species.

Suitability check and correlations: The Lithuanian LaFi system is a suitable tool to assess the ecological status of Lithuanian lakes. The values shown in Tab. 5 indicate a good correlation of system result and expert judgment and a small class deviation. The Lithuanian system has a tendency to score too badly, although the values are within the acceptability limit set. The percentage of critical misclassification seems to be too high.
Neither the status classes given by the common metric nor the German system significantly correlate with the expert's judgment of the lake. Main reason might be a displacement of the relative metrics (percentages) used in both systems due to the exclusion of small mesh sizes. Thus, wrong status classes might have been assigned.

Tab. 5: Ecological status classes: comparison of LT_LaFi, CB_LaFi and De_LaFi results with expert's judgment of the ecological status of Lithuanian lakes (expert: Tomas Virbickas, number of lakes: 38). Check is ok, if acceptance criteria are fulfilled (p. 24).

criterion	LT_LaFi value	LT check	CB_LaFi value	CB check	DE_LaFi value	DE check
rho	0.702, $p < 0.001$	ok	0.217, n. s.	X	0.304, n. s.	X
macd	0.37	ok	0.61	ok	0.68	ok
% critdev	24	X	33	X	33	X
% falsepos	71	ok	44	ok	73	ok

The presence/absence of small mesh sizes is a systematic difference in the methodology. Thus, a correlation between the EQR values can be given even if status classes deviate. The coefficients of correlation between the Lithuanian and the common metric / German method are significant, but rho is below the given threshold value:

LT EQR ↔ CB EQR: rho = 0.388, $p < 0.05$, LT EQR ↔ DE EQR: rho = 0.408, $p < 0.05$

Conclusion: The correlations between the Lithuanian system and the common metric / German system are too weak to be used for an intercalibration based on direct comparison. One possibility for the future is to adjust the class boundaries for each metric of the calibration system (CB or DE). This could be done based on catch data with known mesh sizes by comparing the metric values with and without the small meshes. Alternatively, another IC option has to be found.
The results are confirmed by the Lithuanian representative Tomas Virbickas.

NL

Notes: Eight shallow lakes in the Netherlands, two shallow lakes in Germany and two in Denmark have been sampled in 2009 with both CEN (gillnets) and trawling method. Data for eight Dutch lakes could be used for the following comparisons. Almost all lakes sampled are quite eutrophic and disturbed (POOR or MODERATE status of lakes according to expert judgment). The limited number of lakes investigated and the narrow range of expectable status classes has to taken into account. Only the Dutch lakes are taken into account for the suitability check.

Suitability check and correlations: Due to the low number of lakes, the values given in Tab. 6 are not really representative. The Dutch system is a suitable tool to assess Dutch lakes. The assessment results highly correspond with the expert's expectations. In terms of status classes, only one out of eight lakes differs by one class within the poor/moderate range.
Both the CB common metric and the German system would be usable to assess the Dutch lakes, though with a lower performance. The correlation with the Dutch expertise on lake status is present, but the status classes assigned by both methods are too high.

Tab. 6: Ecological status classes: comparison of NL_LaFi, CB_LaFi and De_LaFi results with expert's judgment of the ecological status of Dutch lakes (experts: Bob Bredervald, Nico Jaarsma, Eddy Lammens, number of lakes: 8). Check is ok, if acceptance criteria are fulfilled (p. 24).

criterion	NL_LaFi value	NL check	CB_LaFi value	CB check	DE_LaFi value	DE check
rho	0.774, $p < 0.05$	ok	0.715, $p < 0.05$	ok	0.677, n.s.	ok
macd	0.13	ok	0.75	ok	0.38	ok
% critdev	0	ok	25	-	12,5	-
% falsepos	-	-	0	X	0	X

The coefficients of correlation between both the common metric and the German system indicate comparability (although the significance is absent for the German LAFi due to the low number of lakes):

NL EQR ↔ CB EQR: rho = 0.756, $p < 0.05$ NL EQR ↔ DE EQR: rho = 0.551, n. s.

Conclusions: The comparisons show that the Dutch system can be intercalibrated thanks to the investigations with simultaneous application of different fishing methods. The intercalibration can be done by direct comparison with methods based on CEN 14757 (common metric, pseudo common metric, DE_LaFi, DK_LaFi and others). However, a low number of lakes covering only two degraded status classes might lead to problems with the analytical methodology.

PL

Notes: The results of the Polish assessment method are available for three lakes only. The suitability check of the national method and the EQR correlation checks are cancelled.

Suitability check: As can be seen from the results in Tab. 7, the suitability criteria indicate that both common metric and the German system are (completely) unsuitable to assess the ecological status of Polish lakes. The correlations of system results and expert judgments of the lake status are negative, indicating an assessment working in opposite directions. The other criteria are above the acceptability limits.

Tab. 7: Ecological status classes: comparison of CB_LaFi and De_LaFi results with expert's judgment of the ecological status of Polish lakes (expert: Witold Bialokoz, number of lakes: 10). Check is ok, if acceptance criteria are fulfilled (p. 24).

criterion	CB_LaFi value	CB check	DE_LaFi value	DE check
rho	- 0.72, $p < 0.05$	X	- 0.16, n. s.	X
macd	1.3	X	1.1	X
% critdev	80	X	50	X
% falsepos	44	ok	57	ok

Conclusions: It has to be kept in mind, that the most important suitability measure is the correlation between the Polish system and the common metric or German system. The comparisons should be repeated with a higher number of lakes and the Polish EQR values included. However, the values in Tab. 7 indicate, that common metric and German LaFi are unsuitable for direct comparison. Further decisions can be made when the Polish methods are established, what will be in 2012 for LFI+ and 2013 for a CEN 14757-based method. Rather then using direct comparison, it is likely that another solution for intercalibration will have to be found

LITERATURE

ANDERSON, J. N., JEPPESEN, E. & SONDERGAARD, M. (2005): Ecological effects of reduced nutrient loading (oligotrophication) on lakes: an introduction. Freshwater Biology 50: 1589-1593.

APPELBERG, M. (2000): Swedish standard methods for sampling freshwater fish with multi.mesh gillnets. Institute of Freshwater Research, Drottningholm.

APPELBERG, M., BERGQUIST, B. C. & DEGERMAN, E. (2000): Using fish to assess environmental disturbance of Swedish lakes and streams-a preliminary approach. Verhandlungen der Internationalen Vereinigung für Limnologie 27: 311-315.

BECK, M. W. & HATCH, L. K. (2009): A review of research on the development of lake indices of biotic integrity. Environmental Reviews 17: 21-44.

BELPAIRE, C., SMOLDERS, R., AUWEELE, I. V., ERCKEN, D., BREINE, J., VAN THUYNE, G. & OLLEVIER, F. (2000): An index of biotic integrity characterizing fish populations and the ecological quality of Flandrian water bodies. Hydrobiologia 434: 17-33.

BRÄMICK, U., DIEKMANN, M., LEMCKE, R. & MEHNER, T. (2008): Assessing shifts in fish assemblages of German large lakes by literature data and commercial catch statistics. Fundamental and Applied Limnology 171: 87-103.

CAUSSE, S., GEVREY, M., ARGILLIER, C. & PEDRON, S. (2011): Fish indicators for ecological status assessment of lakes affected by eutrophication and hydromorphological pressures - final report under revision. CEMAGREF, WISER deliverable 3.4-4, Aix-en-Provence.

DEGERMAN, E., HAMMAR, J., NYBERG, P. & SVARDSON, G. (2001): Human impact on the fish diversity in the four largest lakes of Sweden. Ambio 30: 522-528.

DIEKMANN, M., BRÄMICK, U., LEMCKE, R. & MEHNER, T. (2005): Habitat-specific fishing revealed distinct indicator species in German lowland lake fish communities. Journal of Applied Ecology 42: 901-909.

GARCIA, X.-F., DIEKMANN, M., BRAMICK, U., LEMCKE, R. & MEHNER, T. (2006): Correlations between type indicator fish species and lake productivity in German lowland lakes. Journal of Fish Biology 68: 1144-1157.

GASSNER, H. & WANZENBÖCK, J. (2005): Application of population size structure indices to Austrian whitefish (Coregonus sp.) stocks. Advances in Limnology 60: 377-384.

GASSNER, H., TISCHLER, G. & WANZENBÖCK, J. (2003): Ecological integrity assessment of lakes using fish communities - Suggestions of new metrics developed in two austrian prealpine lakes. International Review of Hydrobiology 88: 635-652.

GASSNER, H., WANZENBÖCK, J., ZICK, D., TISCHLER, G. & PAMMINGER-LAHNSTEINER, B. (2005): Development of a fish based lake typology for natural Austrian lakes >50 ha based on the reconstructed historical fish communities. International Review of Hydrobiology 90: 422-432.

HELMINEN, H., KARJALAINEN, J., KURKILAHTI, M., RASK, M. & SARVALA, J. (2000): Eutrophication and fish biodiversity in Finnish lakes. Verhandlungen der Internationalen Vereinigung für Limnologie 27: 194-199.

HOLMGREN, K. & APPELBERG, M. (2000): Size structure of benthic freshwater fish communities in relation to environmental gradients. Journal of Fish Biology 57: 1312-1330.

JAARSMA, N. (2007): Description of references and metrics for fish in lakes in the netherlands (unpublished). Witteveen & Bos consulting engineers.

JENNINGS, M. J., LYONS, J., EMMONS, E. E., HATZENBELER, G. R., BOZEK, M. A., SIMONSON, T. D., BEARD, T. D. & FAGO, D. (1999): Toward the development of an index of biotic integrity for inland lakes in Wisconsin. In: T.P. Simon (Ed.) Assessing the sustainability and biological integrity of water resources using fish communities, pp. 541-562. CRC Press LLC, Boca Raton.

JEPPESEN, E., JENSEN, J. P., SONDERGAARD, M. & LAURIDSEN, T. L. (2005a): Response of fish and plankton to nutrient loading reduction in eight shallow Danish lakes with special emphasis on seasonal dynamics. Freshwater Biology 50: 1616-1627.

JEPPESEN, E., JENSEN, J. P., SONDERGAARD, M., LAURIDSEN, T. & LANDKILDEHUS, F. (2000): Trophic structure, species richness, and biodiversity in Danish lakes: changes along phosphorus gradient. Freshwater Biology 45: 201-218.

JEPPESEN, E., MEERHOFF, M., JACOBSEN, B. A., HANSEN, R. S., SØNDERGAARD, M., JENSEN, J. P., LAURIDSEN, T. L., MAZZEO, N. & BRANCO, C. W. C. (2007): Restoration of shallow lakes by nutrient control and biomanipulation—the successful strategy varies with lake size and climate. Hydrobiologia 581: 269-285.

JEPPESEN, E., SONDERGAARD, M., JENSEN, J. P., HAVENS, K. E., ANNEVILLE, O., CARVALHO, L., COVENEY, M. F., DENEKE, R., DOKULIL, M. T., FOY, B., GERDEAUX, D., HAMPTON, S. E., HILT, S., KANGUR, K., KÖHLER, J., LAMMENS, E., LAURIDSEN, T. L., MANCA, M., MIRACLE, M. R., MOSS, B., NOGES, P., PERSSON, G., PHILLIPS, G., PORTIELJE, R., ROMO, S., SCHELSKE, C. L., STRAILE, D., TATRAI, I., WILLEN, E. & WINDER, M. (2005b): Lake responses to reduced nutrient loading - an analysis of contemporary long-term data from 35 case studies. Freshwater Biology 50: 1747-1771.

LAUNOIS, L., VESLOT, J., IRZ, P. & ARGILLIER, C. (2011): Selecting fish-based metrics responding to human pressures in French natural lakes and reservoirs: towards the development of a fish-based index (FBI) for French lakes. Ecology of Freshwater Fish 20: 120-132.

MEHNER, T., DIEKMANN, M., BRÄMICK, U. & LEMCKE, R. (2005a): Composition of fish communities in German lakes as related to lake morphology, trophic state, shore structure and human-use intensity. Freshwater Biology 50: 70-85.

MEHNER, T., DIEKMANN, M., GARCIA, X.-F., BRÄMICK, U. & LEMCKE, R. (2004): Ökologische Bewertung von Seen anhand der Fischfauna. Berichte des IGB 21: 202.

MEHNER, T., DIEKMANN, M., GARCIA, X.-F., BRÄMICK, U. & LEMCKE, R. (2005b): Möglichkeiten und Grenzen der Bewertung der ökologischen Qualität von Seen anhand der Fischfauna. In: C.K. Feld, S. Rödiger, M. Sommerhäuser & G. Friedrich (Eds.), Typologie, Bewertung, Management von Oberflächengewässern, pp. 137-150. E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart.

MEHNER, T., HOLMGREN, K., LAURIDSEN, T. L., JEPPESEN, E. & DIEKMANN, M. (2007): Lake depth and geographical position modify lake fish assemblages of the European 'Central Plains' ecoregion. Freshwater Biology 52: 2285-2297.

PEDRON, S., DE BORTOLI, J. & ARGILLIER, C. (2010): Fish indicators for ecological status assessment of lakes affected by eutrophication and hydromorphological pressures - provisional report. CEMAGREF, WISER deliverable 3.4-4, Aix-en-Provence.

PERSSON, L., DIEHL, S., JOHANSSON, L., ANDERSSON, G. & HAMRIN, S. F. (1991): Shifts in fish communities along the productivity gradient of temperate lakes - patterns and the importance of size-structured interactions. Journal of Fish Biology 38: 281-293.

RITTERBUSCH, D. (2010): First LakeFish Intercalibration Meeting. Minutes 30.11.-01.12.2010, Berlin. http://circa.europa.eu/Members/irc/jrc/jrc_eewai/library?l=/intercalibration_4/cb_gig&vm=detailed&sb=Title.

RITTERBUSCH, D., BRÄMICK, U. & MEHNER, T. (2010): Development of a German lake typology for fish-based assessments of ecological status/integrity. Institut für Binnenfischerei e.V., Potsdam-Sacrow.

SONDERGAARD, M., JEPPESEN, E., JENSEN, J. P. & AMSINCK, S. L. (2005): Water Framework Directive: ecological classification of Danish lakes. Journal of Applied Ecology 42: 616-629.

TAMMI, J., LAPPALAINEN, A. & RASK, M. (2001): Using Swedish fish index FIX in assessing degradation of Finnish eutrophic lakes - what does fish community data tell about them? Nordic Council of Ministers, Copenhagen.

TAMMI, J., APPELBERG, M., BEIER, U., HESTHAGEN, T., LAPPALAINEN, A. & RASK, M. (2003): Fish status survey of Nordic lakes: Effects of acidification, eutrophication and stocking activity on present fish species composition. Ambio 32: 98-105.

VAN DE BUND, W., BONNE, W., POIKANE, S. & ZAMPOUKAS, N. (2011): Method compliance checking: which methods can be included in the intercalibration exercise? Joint Research Center, V 2.0.

WHITTIER, T. R. (1999): Development of IBI metrics for lakes in southern New England. In: T.P. Simon (Ed.) Assessing the sustainability and biological integrity of water resources using fish communities, pp. 563-582. CRC-Press.

ZICK, D., GASSNER, H., FILZMOSER, P., WANZENBÖCK, J., PAMMINGER-LAHNSTEINER, B. & TISCHLER, G. (2006): Changes in the fish species composition of all Austrian lakes >50 ha during the last 150 years. Fisheries Management and Ecology 13: 103-111.