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R E P O R T

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ITALIAN CLASSIFICATION METHOD FOR FISH IN LAKES

METHOD SUMMARY.

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Italian classification method for fish in lakes. Method summary

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Summary

Overview

The present document explains the structure of the Italian classification method used for Fish fauna in Italian lakes.

The Lake Fish Index include 5 metrics which take into consideration community composition, abundances and age structure of key fish species, reproductive success of key fish species and accompanying fish species, presence of invasive alien species.

Reference conditions are derived by:

a. hystorical reconstruction of reference fish community (composed by key- and accompanying-fish species)
b. expert judgment (abundance classes)
c. literature models to assess the age structure from fish length distribution.

The reference fish community has been reconstructed from historical documents (Volta et al. 2011).

A site-specific approach (based on historical data taken from literature) and expert judgment were used to infer reference conditions. For that literature, catch statistics and fish collections in museums were analysed dating back to medieval times. From all the information a historical fish community was reconstructed and checked for plausibility for each lake. The thresholds of 1950 was set in order to divide among pre-impacted and impacted communities mainly by eutrophication, hydromorphological alterations and intensive fishing. The specification was that "historical" lakes were more or less free from the considered pressures (Eutrophication, general degradation, habitat destruction, shore line modification, hydromorphological degradation or biological degradation (alien species)).

Based on historical fish species lake composition (year 1950 as the threshold between not impacted and impacted communities), two lake types were identified by statistical approach (Volta et al. 2011): deep lakes and shallow lakes. Each lake type is characterized by a specific group of Indicator species. Indicator species include key-species and type-specific (accompanying) species.

Alpine deep lakes of north west

Key species: *Alosa agone, Coregonus lavaretus, Lota lota*.

Accompanying species: *Alburnus alborella, Cottus gobio , Cyprinus carpio, Esox* sp., *Perca fluviatilis*, *Padogobius martensii*, *Rutilus aula*, *Salmo trutta lacustris, Scardinius* sp., *Squalius squalus*, *Tinca tinca*.

Alpine deep lakes of north east

Key species: *Esox* sp., *Scardinius* sp., *Tinca tinca.*

Accompanying type specific species:

Chondrostoma soetta, Cyprinus carpio, Salmo trutta lacustris, Squalius squalus.

Alpine high altitude lakes

Key species: Phoxinus phoxinus

Accompanying type specific species: *Cottus gobio*, *Salmo trutta lacustris*, *Salvelinus alpinus*.

Alpine shallow lakes

Key species: *Esox* sp., *Scardinius* sp., *Tinca tinca.*

Accompanying type specific species*: Alburnus alborella, Cyprinus carpio, Padogobius martensii, Perca fluviatilis.*

Mediterranean deep lakes

Key species: *Coregonus lavaretus, Alburnus alburnus alborella, Atherina boyeri.*

Accompanying type specific species*: Cyprinus carpio*, **Esox* sp.*, Perca fluviatilis*, **Scardinius sp.*, *Squalius squalus*, *Tinca tinca.*

Mediterranean shallow lakes

Key species: *Esox* sp., *Tinca tinca*, *Scardinius sp.*

Accompanying type specific species: *Alburnus alburnus alborella*, *Cyprinus carpio*, *Atherina boyeri*, *Perca fluviatilis*, *Rutilus rubilio*.

LAKE FISH INDEX (LFI) - Description

The Lake Fish Index (LFI) is composed by 5 metrics.

Metric 1 – Abundance of key species

It takes into account the number of individuals of each key fish species in the standard catches (CEN gillnetting + point abundance sampling electric fishing). Five classes of abundance. Five score (from 10 to 2).

Tab. 1 - Metric 1

Number of individuals of Key Species	41-99	7-40	1-6/ 100-250	Not captured in standardized sampling but their presence verified in fishery statistics or other qualified statistics. In the last 5 yearsi / 251-400	Neither captured or verified in fishery statistics or other qualified statistics in the last 5 years / >400
Score	10	8	6	4	2

- *If score is equal to 10 for a key species but this species is usually stocked in the lake, the score must be decreased to 8.*
- *The final score of Metric 1 is the average of the score of each key species.*

Metric 2 – Population structure of key species

It takes into account the size structure (as proxy of age structure) of the key species. It is evaluated by means of the length based structural index PSD-Proportional Stock Density Index (Anderson & Neumann 1996; Volta 2010).

PSD is calculated as:

PSD= $(Ni \geq L_m)/(Ni \geq L_{stock})*100$
Ni = number of individuals
L_{stock} = minimum stock length = $L_m-(L_{Trophy}-L_m)/3$
L_m = minimum quality length = mean length at maturity.
$L_{trophy} = L_{tot} \geq 0.8*(L_{inf})$
Linf is the site-specific maximum length reached by the species in that environment.

The score of Metric 2 is calculated as :

Table 2 - Metric 2 and its score

PSD	35-65	25-34/66-75	<25/>75
Score	10	6	2

- *The minimum number of individuals use for PSD calculation is: 40 for Scardinius and Coregonus lavaretus, 20 for Esox sp. and Tinca tinca. In the case the number of individuals of key species is lower than the threshold for PSD calculation, the score of the metric is 0.*

Metric 3 – Reproductive success of the key and accompanying fish species

The reproductive success is verified if 0^+ or 1^+ individuals of each key and accompanying species in the standard catches are captured. The score is based on the percentage of key and accompanying species on the total of key and accompanying species for each lake type, whose reproductive success was verified.

Tab. 3- Metric 3

Reproductive success	>80%	80%-66%	65%-51%	50%-25%	<25%
Score	10	8	6	4	2

Metric 4 – Decrease (%) of the number of indicator species

It takes into account tte decrease of the number of indicator species in each lake (as % on the total indicator species for each lake type).

Tab. 4 - Metric 4

Decrease (%)	<20%	20%-40%	41%-60%	61%-80%	>80%
Score	10	8	6	4	2

Metric 5 – % Ratio among the number of invasive alien species and the total number of species in the catches.

Are considered as invasive alien species those not included in the following list or introduced in the Alpine Ecoregion after the 1950**:**
Acipenser sturio, Acipenser naccarii, Alburnus alburnus alborella, Alosa agone, Alosa fallax, Anguilla Anguilla, Barbus plebejus, Barbus meridionalis, Chodrostoma soetta, Chondrostoma genei, Cobitis taenia, Coregonus lavaretus, Coregonus macrophthtalmus, Cottus gobio, Cyprinus carpio, Gasterosteus aculeatus, Gobio gobio, Leuciscus lapacinus, Leuciscus souffia, Padogobius martensii, Salaria fluviatilis, Squalius squalus, Sebanejewia larvata, Esox sp. Perca fluviatilis, Rutilus aula, Scardinius sp., Salmo trutta lacustris, Salmo marmoratus, Tinca tinca.

Are considered as invasive alien species those not included in the following list or introduced in the Mediterranean Ecoregion after the 1950**:**

Alburnus alburnus alborella, Alburnus albidus, *Alosa agone*, *Alosa fallax*, *Anguilla anguilla*, *Atherina boyeri*, *Barbus meridionalis*, *Barbus plebejus*, *Chodrostoma genei*, *Cobitis taenia*, *Coregonus lavaretus*, *Cottus gobio*, *Cyprinus carpio*, *Gasterosteus aculeatus*, *Leuciscus souffia*, *Padogobius nigricans*, *Salaria fluviatilis*, *Squalius squalus*, *Sebanejewia larvata*, *Knipowitschia panizzai*, *Esox* sp. *Perca fluviatilis*, *Rutilus rubilio*, *Scardinius* sp. *Rutilus erythrophthtalmus*, *Salmo trutta lacustris*, *Salmo fibreni*, *Tinca tinca*.

Tab. 5 - Metric 5

Ratio IAS/total	<20%	20%-40%	41%-60%	61%-80%	>80%
Score	10	8	6	4	2

EQR calculation

Sum of metric scores/50.

Boundaries

0,64 Moderate/Good, 0,82 Good/High.

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