ID-GENE
ecodiagnostics

ID-Gene

DIATOM MOLECULAR INDEX

A new genetic tool for rapid and cost-effective assessment of the biological quality of watercourses

Why diatoms are important for biomonitoring?

Benthic diatoms are widely used as bioindicators in rivers and streams because of their high sensitivity to environmental changes and well-established taxon-specific ecological tolerances and preferences. The diatoms grow rapidly and respond quickly to changes in chemical, physical, or biological factors. Hence, analyzing the composition of their communities provides an easy method to detect environmental changes due to natural or anthropogenic causes.

Various diatom-based biotic indices have been developed all over the world in order to follow the recommendations of public authorities to protect aquatic ecosystems. In Europe, the Member States shall implement measures decided by Water Framework Directive, which recommends using diatoms for the assessment of ecological status of water bodies. In Switzerland, diatoms, along with macro-invertebrates, macrophytes and fish, form a part of the Modular Stepwise Procedure for the assessment of watercourses published by the Federal Office for the Environment.

What is the ID-Gene Diatom Molecular Index?

Based on sequencing of environmental DNA (eDNA) targeting the diatom community, **ID-Gene** has developed a **Diatom Molecular Index** as a tool to determine the ecological status of rivers and streams. The diatom DNA is specifically amplified from total eDNA extracted from epilithic biofilm samples and sequenced using the high-throughput sequencing technologies. Thousands of diatom DNA sequences are obtained per sample. The analysis of these samples using specifically tailored computer algorithms allows to predict with high accuracy a **Diatom Molecular Index**, as well as to provide a list of referenced diatom species present in the sample.

What are the advantages of using the ID-Gene Diatom Molecular Index?

Current biodiversity assessment and monitoring are largely based on morphological identification of bioindicator taxa. However, in the case of diatoms, the microscopic identification of tiny and highly variable diatom frustules is time consuming and requires very good taxonomic expertise, which is not always available. These limiting factors contrast with the need of a fast routine assessment for the management of water quality. To overcome these issues, we propose the **ID-Gene Diatom Molecular Index** to assess water quality directly from diatom high-throughput DNA sequence data. This method allows processing a large number of samples over a short period of time.

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HOW DOES THE DIATOM MOLECULAR INDEX WORK?

STEP 1

Biofilm DNA extraction

STEP 2

Diatom PCR amplification

STEP 3

High-throughput sequencing

STEP 4

Data analysis

OUTPUT

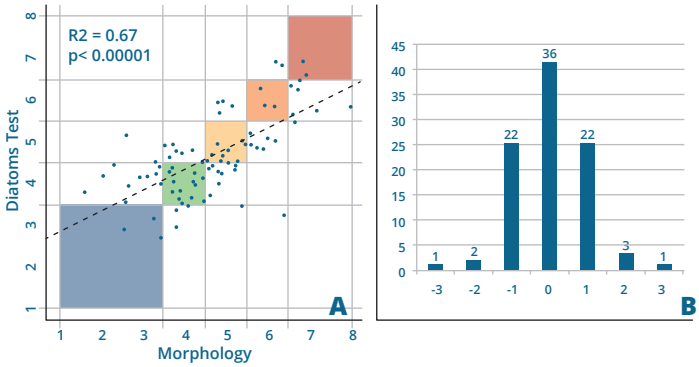
Index Value

Species list

HOW DOES OUR INDEX PERFORM IN COMPARISON TO CONVENTIONAL MICROSCOPIC APPROACH?

The **ID-Gene Diatom Molecular Index** has been calibrated using the Swiss Diatom Index (DI-CH) that is currently available in Switzerland and recognized by the Swiss Federal Office for the Environment as one of the tools to assess the biological quality of Swiss watercourses. The index involves an autoecological value and a weighting factor, which are calculated from the relative abundance and the repartition of each DNA sequence across the entire dataset.

The cross-validation study conducted on 87 samples from Swiss rivers and streams show good congruence between the values of diatom index inferred from morphology-based and eDNA-based taxonomy free approaches (Fig A). The difference with the index value given by the traditional method is calculated for each sample and for the majority of samples (80/87) the ecological status differs by less than 1.5 from the original microscopic assessment (Fig B).



WHERE ID-GENE DIATOM MOLECULAR INDEX CAN BE APPLIED?

The index has been developed for rivers and streams in Switzerland. However, it is possible to develop its customized versions that can be adapted to other habitats and geographic regions. Such development of customized tests might require an additional step of calibration for local conditions.

HOW TO START?

If you are interested in applying the **ID-Gene Diatom Molecular Index** to evaluate the biological quality of watercourses in your area, please contact us and we will provide you with protocols and material for samples preservation.

WHAT DO WE OFFER?

- **rapid service (processing time max 2 weeks for 20-50 biofilm samples)**
- **high quality control**
- **competitive prices**
- **final report comprising diatom index value and a list of species for each sample**

References

- *Swiss Federal Office for the Environment (FOEN/BAFU) Méthodes d'analyse et d'appréciation des cours d'eau. Diatomées Niveau R / Methoden zur Untersuchung und Beurteilung der Fliessgewässer*
- *Visco J, Apothéloz-Perret-Gentil L, Cordonier A et al. (2015) Environmental Monitoring: Inferring the Diatom Index from Next-Generation Sequencing Data. Environmental Science & Technology, 49, 7597–7605*
- *Apothéloz-Perret-Gentil L, Cordonier A, Straub F, Esling P, Pawlowski J (2017) Taxonomy-free molecular diatom index for high-throughput eDNA biomonitoring, Molecular Ecology Resources (in press)*

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