Genetic fingerprinting for environmental quality

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Craticula

Diatoma tenue

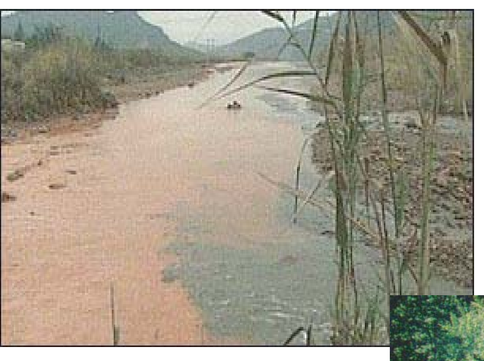
Water management in Europe is undergoing a period of rapid and radical change including the adoption of the EU Water Framework Directive (WFD) in October 2006. This aims to ensure all aquatic ecosystems, terrestrial ecosystems and wetlands (with regard to their water needs) meet 'good status' by 2015

Biological indices are increasingly used to measure environmental quality and rely on skilled taxonomists to accurately identify species, using visual markers. Unfortunately, there is insufficient provision within Europe for biological testing of indicator species (abundance/ taxa) to meet the imminent requirements of the WFD in terms of extended specification demand.

Bacillaria paradoxa

These indices are varied but many include groups of species. For example, the freshwater diatom index relies on visual identification of diatoms such as those shown in the images on this presentation (in particular their skeletons).

Caloneis lewisii

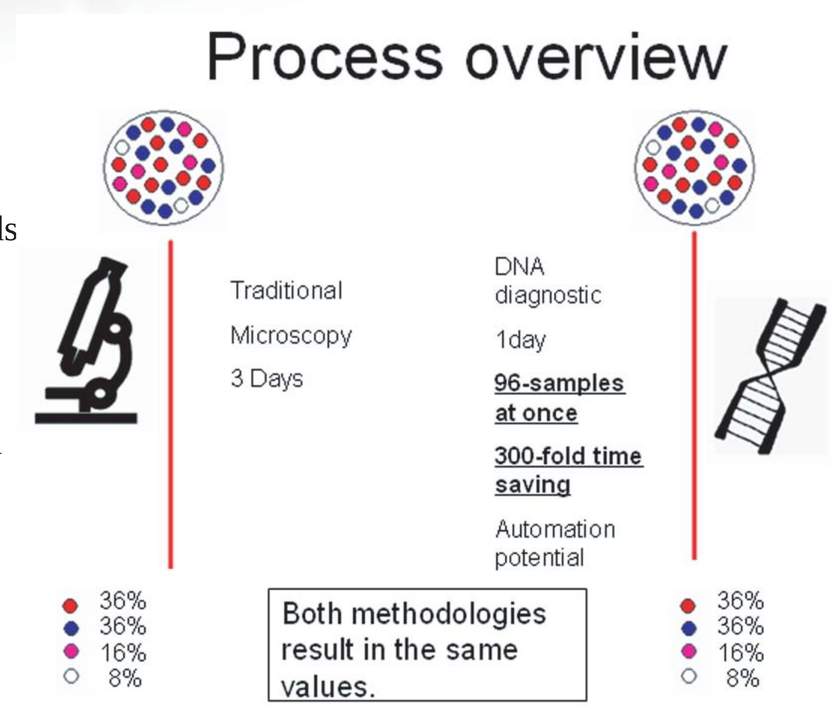


At SCRI we have developed a suite of state-of-the-art molecular biological methods. We have applied these to the accurate and rapid identification of groups that are both difficult to identify by traditional taxonomy and used as common environmental indicators. The technique, now under optimisation and calibration, allows simple accurate measurement of relative abundance of the target organisms.

Cymbella aspera

Advantages:

1. Throughput.
Our molecular methods are designed to allow a high throughput of samples, allowing economies of scale, greater replication and sample collection (and thus accuracy of monitoring). The assay is significantly quicker than the traditional approach.



2. Removal of subjectivity. A number of target organisms are taxonomically difficult to process. The use of molecular tools removes the inevitable errors associated with mis-classification.

Other applications.

A significant application for the same approach is the marine environmental water testing market. The first stage of testing for marine samples is clear separation into the major phytoplanktonic groups (see Figure1). Use of the methodology developed for freshwater at SCRI, and currently under development for the marine environment, would allow Environment Agencies to process sufficient samples to meet the requirements of the WFD.

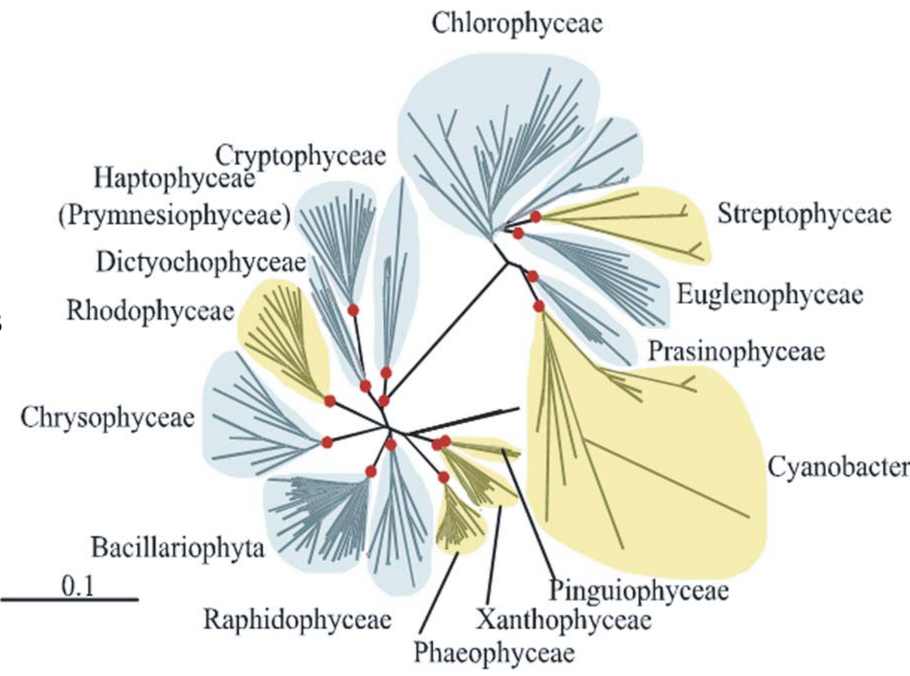


Figure 1. Phylogenetic tree of phytoplanktonic groups based on a chloroplastic gene. The groups shaded in blue are the ones targeted for marine monitoring. The red dots indicate branches with >95% bootstrap support

PROJECT PART-FINANCED BY THE EUROPEAN UNION
Europe and Scotland Making it work together

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Photographs: Dr David Roberts

Scottish Enterprise