AN INTERACTIVE CD-ROM FOR IDENTIFYING FRESHWATER DIATOMS

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Benthic diatoms are already part of the Environment Agency's monitoring toolkit, and this role is likely to increase in the future with the advent of the Water Framework Directive. In anticipation of this, the Environment Agency is funding the development of an interactive CD-ROM to help their staff and others identify diatoms. This follows on from earlier projects in which CD-ROMs were developed to identify blue-green and green algae, and uses the Lucid software, developed by the University of Queensland in Australia.

The project is a collaboration between the Environment Agency and five partners, and draws upon archives of images and data held by these partners. In particular, images collected as part of the EU projects ADIAC and EDDI will be used. No attempt is being made to include all freshwater diatoms recorded from Britain and Ireland; instead, a modular approach has been adopted, with the present project providing a core structure plus comprehensive coverage of riverine habitats. This will enable all genera recorded from freshwaters in Britain and Ireland to be identified, along with about 300 species and infraspecific taxa within these genera. The project has been designed in such a way that additional modules covering freshwater plankton and upland / more acidophilic taxa can be added in the future (Fig. 1).
The project started in Autumn 2002 and will be completed by August 2004.

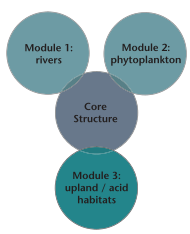

Fig. 1. Diagrammatic representation of structure for CD-ROM project. Present funding allows development of the core structure plus Module 1 ("rivers")

"Traditional" dichotomous keys take the user along a series of steps in an order decided in advance by the author and make an implicit assumption that all features necessary for the correct identification can be discerned in the specimen under consideration (Fig. 2).
By contrast, computer-based keys offer the user the opportunity to describe what characters can be seen, and then use this information to filter out those taxa which do not have all of these features. Advanced features within Lucid allow the software to examine the attributes of those taxa remaining and to "suggest" those attributes that are most likely to lead to unique solutions.

Traditional keys

"Is it warm blooded? .....Yes. Does it have hairy skin? ..... Yes. Does it walk on four legs? .....Yes. Has it got a cloven hoof ...",

Computer-based multiaccess keys

"It's got a trunk ..... it must be an elephant!"

Fig. 2. With traditional keys (left), users seek information in an order preordained by the expert/author. With computer-based multiaccess keys (right), users say what characteristics they can see, and the software then filters out all taxa except those that have this combination of characteristics. In extreme cases, a single characteristic may be all that is required for identification.

An important benefit of such approach is that the set of attributes can be much broader than is the case for a traditional key.
For diatoms, it is possible to include information on the characteristics of "live" diatoms alongside attributes seen only in "cleaned" material (Fig. 3), allowing the key to work in a wider range of situations than was the case in previous keys.

Fig. 3. Live (left) and cleaned (right) valves of *Meridion circulare*. One advantage of a computer-based key to diatoms is that information on characteristics - such as plastid number and organisation, and colony structure, can be integrated seamlessly with information on valve morphology.

The main source of images for the project is the database built up by the Royal Botanic Garden, Edinburgh for the EU-funded project ADIAC (Automated Diatom Identification and Classification). There are approximately 2300 images, representing about 500 taxa. The database is accessible online at www.rbge.org.uk/ADIAC/db/adiacdb.htm and some examples are shown below (Fig. 4).

More images - of diatoms in both cleaned and live states - will be collected during the course of the project.

Paper-based keys and floras typically have a long life-expectancy, with modern phycologists still using works written half a century ago. Developments in hardware and operating systems can render software obsolete unless continually upgraded. This, however, should work to the benefit of users. Alongside any upgrading to reap the benefits of new versions of software, operating system and hardware, there is an opportunity for the geographical coverage of the flora to be expanded and for taxonomic concepts to be refined in the light of new research, such that the CD-ROM remains "state of the art" for the foreseeable future.

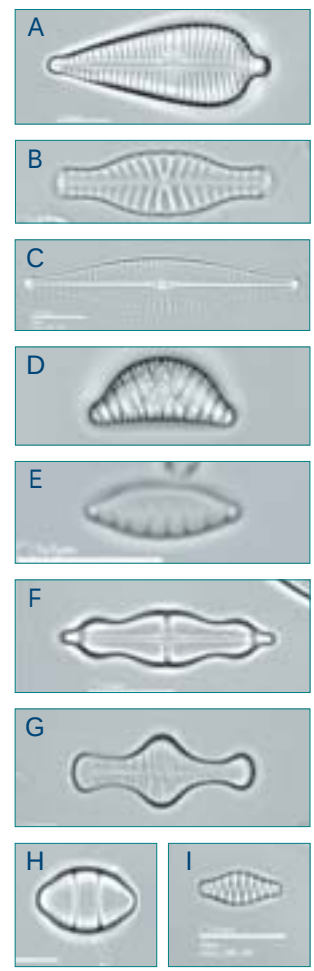

Fig. 4. Some examples of the high quality images included in the ADIAC database
A, *Gomphonema augur;* B, *Navicula capitata* var. *capitata;* C, *Navicula rhynchocephala;* D, *Epithemia sorex;* E, *Nitzschia sinuata;* F, *Stauroneis smithii;* G, *Tabellaria flocculosa;* H, *Diatoma mesodon;* I, *Staurosirella pinnata.* Scale bar, 10 µm.

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