A semi-automatic method to quantify and identify zooplankton

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Abstract

The use of a microfiche reader in counting and identifying zooplankton samples was investigated. The data from the system were logged onto a microcomputer and saved on diskette. The system was found to increase the number of samples analysed per unit of time and to increase the time the operator could spend on analysing the samples, because of less eye strain. The costs were kept to a minimum and existing equipment was used.

Introduction

The introduction of an intensive monitoring programme by the Hydrological Research Institute in 1986 and the subsequent increase in samples collected, caused a backlog to develop in the zooplankton laboratory.

The traditional method of identifying and counting zooplankton populations is to use a low-powered microscope in conjunction with a counting chamber. This method is, however, time-consuming and is a strain on the operator.

An alternative method of counting and identifying zooplankton was investigated to reduce the time taken in analysing each sample and to ease the strain on the operator.

Restrictions on the system were that as much existing equipment as possible be used and that the cost should be kept to a minimum.

Method

General

Mills and Confer (1986) described a method to improve their zooplankton studies using a projector and a viewing screen. Whiteside (in Mills and Confer, 1986) suggested the possibility of using a microfiche reader. It was decided to investigate the feasibility of this approach.

A Xidex model 780 microfiche with 48 × magnification and 60 × magnification was purchased for this study.

The trays which normally hold the microfiche film were not suitable for wet samples, but were retained because they could hold a microscope slide and cover slip. This was used in the identification of uncommon species and for the production of drawings.

To analyse "wet" samples (i.e. 1 mℓ of sample) a special tray was constructed by CSIR. A reference grid was etched onto the tray so that the relative position of the tray and area under investigation could be known.

A sample which is collected from an impoundment is washed through a 80 μm mesh sieve to remove algae and other fine material. A representative subsample (1 mℓ) is placed into the special tray. The zooplankton are then identified and counted, using the grid as a reference to make sure that the individuals are counted only once.

A 1 mℓ sample was chosen as larger volumes cause the plankton to drift, making an accurate count impossible.

Fig. 1 shows a schematic of this process.

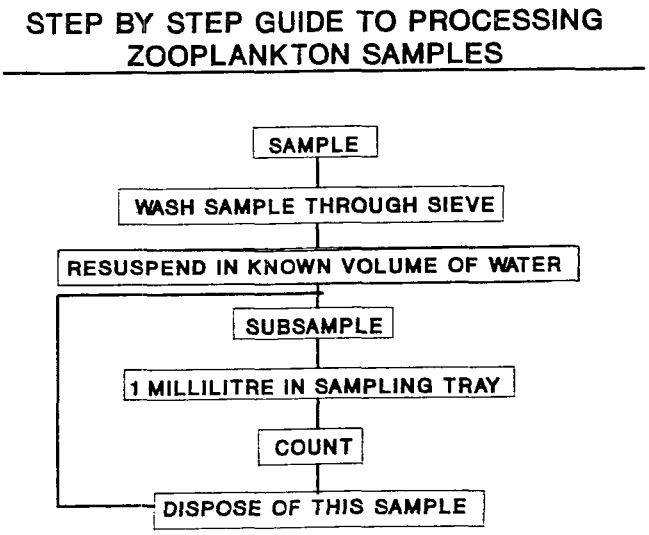

Figure 1
A schematic of the preparation process.

It was decided, once the method was operational, that the information be stored in a format that would also ease the analysis of results.

An Apple II microcomputer was available for this part of the investigation and software was written specifically for the system. The Apple II was also equipped with a simple digitising table. This particular digitiser operates with two potentiometers working on the x-y axes, and plugs into the paddle port inside the Apple. Software was written so that this system could be used to measure size, area and volume of zooplankton specimens.

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Software

The program which runs on the Apple microcomputer is written in BASIC and is designed to call different subroutines depending on the dam sample being analysed. These subroutines are all used via menus on the screen from which the operator selects his choice.

The primary options are data input or retrieval. If data input is chosen, the menu displays the names of the dams available and the operator then selects the appropriate one.

The operator is also required to enter information regarding the date and time of sample collection, the point on the dam where the sample was collected and the depth and volume of sample collected. When counting zooplankton the operator watches the microfiche screen and enters a single digit code on the computer each time a species is identified.

Once the sample has been analysed, the operator enters the end code and the information is stored on diskette and the program returns to the main menu where the primary options are available.

The data retrieval software allows the operator to list the data from previous analyses, either on the screen or on the printer.

Another program will convert this data from random access files to DIF format for use with most software packages.

Fig. 2 shows a schematic of the processes within the software.

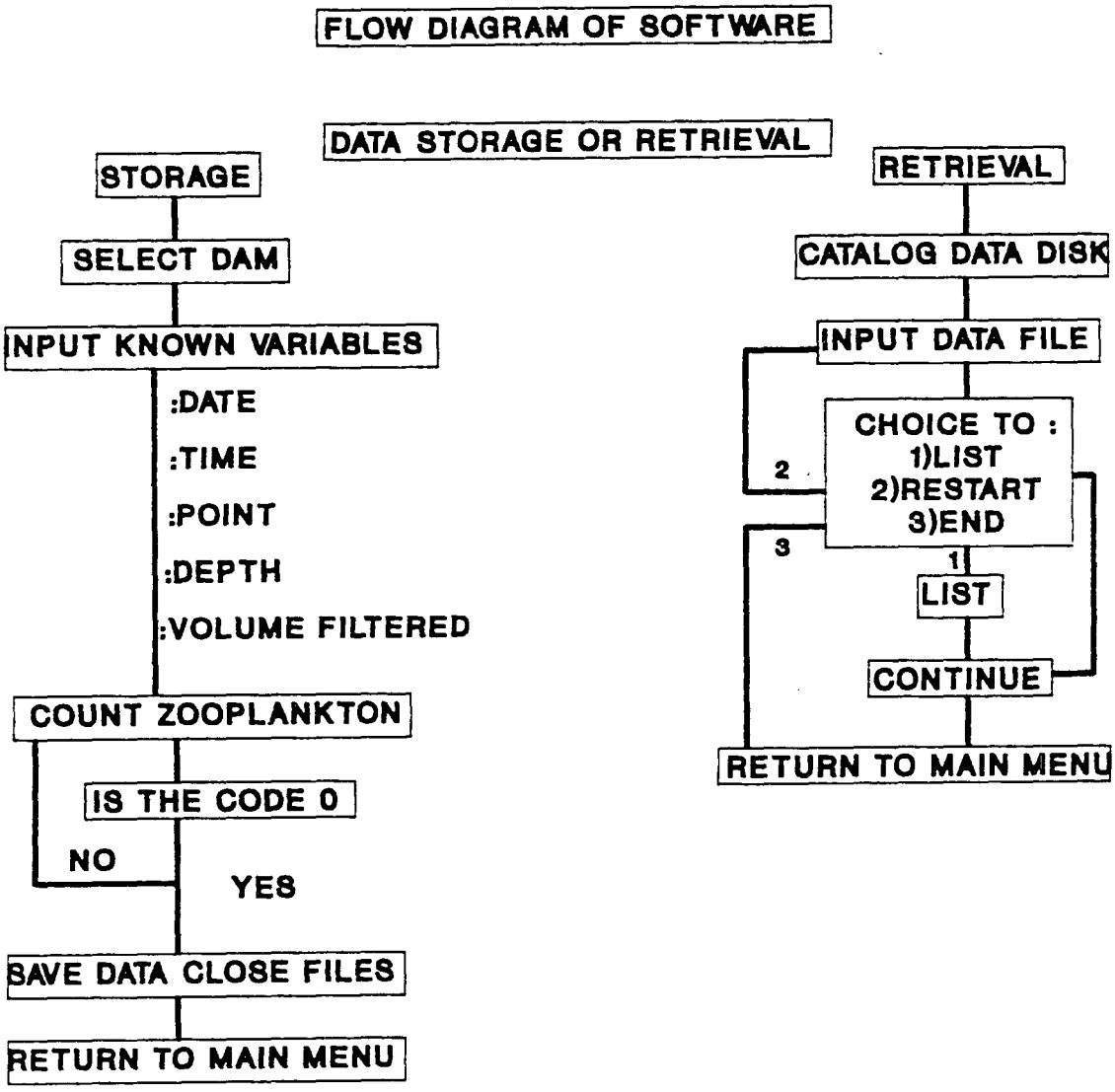

Figure 2
Schematic of software.

Digitiser

The digitiser is mounted onto the microfiche screen. The two potentiometers allow full movement across the screen and the operator can use this to measure and calculate area and volume of specimens projected onto the microfiche screen.

The software for this part of the system is interactive. In other words, the operator is always told what is going on and is given the opportunity to make changes whenever required.

The scale is determined using a micrometer slide. The operator places this slide in the sample tray alongside the specimens and then enters the start and end points of a known length. The computer is then set up for that length and all measurements are related to that scale.

Fig. 3 shows a schematic of the whole system.

decided to transfer the system to a portable IBM microcomputer. The software will remain the same and the paddle input potentiometers will also be retained.

The average time taken per sample has been reduced by up to 30 per cent and the time spent on analysing has been increased by 50 per cent. This means that more samples can be analysed for a longer period. The backlog of samples (150) was analysed within 21 days, whereas previously the time required was 30 days.

The system described here has also shown its cost-effectiveness. The only additional purchase was a microfiche reader at approximately R600,00, considerably less than a competant microscope. The tray was modified at a minimal charge. Most institutions have microcomputers available, so this cost should not be included. The total cost, therefore, was under R1 000 for everything required.

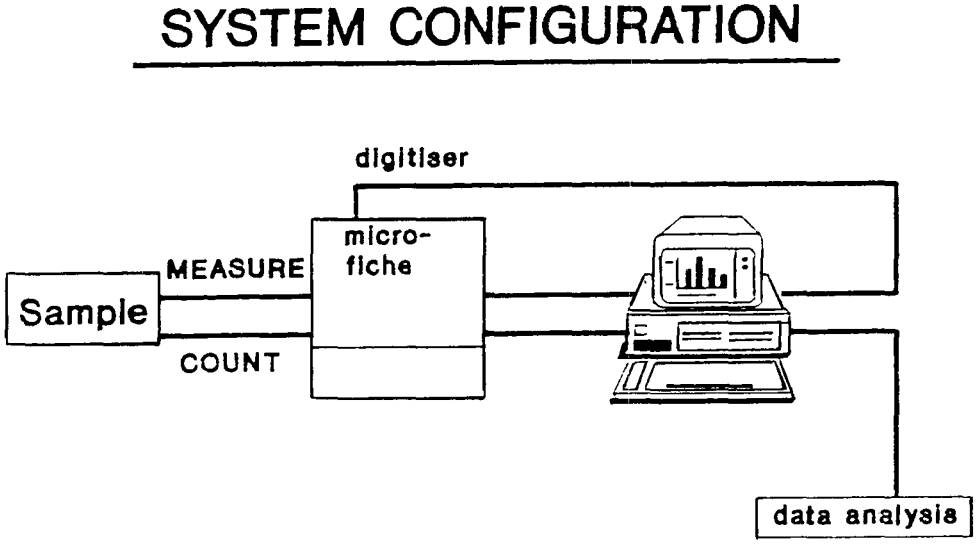

Figure 3
A schematic of the whole system.

Discussion

A number of minor problems were encountered with the development of this system:

- The plastic wheels on the microfiche which are used to focus on the sampling tray showed signs of wear after the system had been used for only a few months, which made focusing difficult.
- The resolution of the screen meant that certain species could not be identified. This was primarily due to the specimens lying awkwardly in the tray.
- The quality of the screen is not good enough for photographs to be taken.
- Large sample volumes allowed the species to move about, causing problems for identification and counting.

Due to the gradual phasing out of Apple II computers from the market in favour of IBM-compatible machines, it has now been

Conclusions

The system as described is now in everyday use. It has superceded the old method because of the increase in the number of samples analysed and the time the operator can spend analysing the samples by reducing strain on the operator.

Acknowledgements

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References

MILLS, EL and CONFER, JL (1986) Computer processing of zooplankton— Application in fisheries study. *Fisheries* 11 24-27.