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EP500 - A SYSTEM FOR PROCESSING AND PRESENTATION OF ECHOGRAM DATA PRODUCED BY THE SIMRAD EY500 / EK500 ECHO SOUNDERS.

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ABSTRACT.

Echogram data telegrams from the SIMRAD echo sounders EY-500 and EK-500 can now be processed and analysed on a personal computer. Increased computing speed on PC's has made it possible to handle echogram data which earlier only could be done with UNIX-based workstations like SUN.
In addition to standard echo integration and *in situ* target strength measurements this program will use all information given by the split beam echo sounder. In a separate window traces are drawn for single fish as they are moving through the beam. From selected areas trace data from single fish can be viewed and later transferred to standard ASCII-files, - which can be used by standard spreadsheet programs. GPS-data provided with the echogram makes it possible to draw the actual transect line. A map-window can display several transect lines together,- showing how a survey have covered an area.
Modem and ethernet communications makes it possible to operate echo sounders placed in remote places or onboard offshore buoys.

INTRODUCTION.

SIMRAD introduced the split-beam echo sounder ES380 in 1984 (Foote et al., 1984). It was a major step forward in the development of scientific echo sounders used for fish stock assessment and *in situ* studies of individual fish.

Since then the split-beam technology have developed through the ES400, EK500 and now finally into the EY500 echo sounder. This latest sounder is a small portable version of the EK500, - a worthy successor to the EY-M and EY200P. The data-technology used in these new sounders made it necessary to connect computers with high performance to handle the vast amount of real time data. The EK500 communicates through a LAN (Local Area Network) interface of the TCP/IP/ETHERNET type to external post processing and data logging systems. It was basically designed to co-operate in a network with UNIX based workstations.
This design made it necessary to develop an on-line/real-time program package to analyse and store the huge amount of fish data available on the network. Some users of the EK500 have developed their own fish analysing programs, but most Fisheries Research institutes have adapted the program called the Bergen Integrator, BI.
However, this program running on a SUN workstation have made the whole EK500/BI-concept very costly. It has not made this new technology available to many potential users.

The aim of this project was to develop a new and smaller version of the EY500 to bring the split beam technology into a low-cost LAP-top computer. The on-line program is running under the RMX operating system, but the post processing program EP500 has been developed in C++ under MS-DOS, Microsoft's operating system for personal computers. In the process of developing this post processing program we soon found that new personal computers based on Intel 386 and 486 microcomputers had a formidable computing power. It became apparent that a lot of the facilities found in the BI-program could be implemented on a 486 based PC. Even on-line ethernet communication was not a problem for such systems.
As a result the EP500 was developed to work on-line in real time with EK500 echo sounders and/or as a post processing program for both the EK500 and EY500.

OVERVIEW OF THE EP500 PROGRAM.

A personal computer with standard VGA-graphics is the main platform for the EP500 program. The software is specially developed for logging raw data in the form of "data telegrams" from the EK500 and EY500 sounders. In the case of EK500 these telegrams are read in real time on the Ethernet, - on the EY500 they can be found in data files located on the hard-disk.
These echo sounders, in addition to be self-contained echo integrators and target strength measurement devices, deliver integrated values for small depth intervals in each sounding.

Data stored on hard-disk or received via the communication channels represent the complete dataset for each ping. Each of the 250 vertical pixels used to reproduce the echogram on the screen represent a set of information. With the echo-data presented in "pixel mode" it is easy to define layer limits in accordance with the displayed echogram. Several modules for data analysis are provided, including echo integration and target strength measurements both for pelagic, surface and bottom locked layers. The results from such an analysis are displayed on the screen together with the echogram. See figure 1. They can be printed or saved as an ASCII-file which later easily can be loaded into a "spread-sheet" program like EXCEL or statistical programs like SAS or SPSS

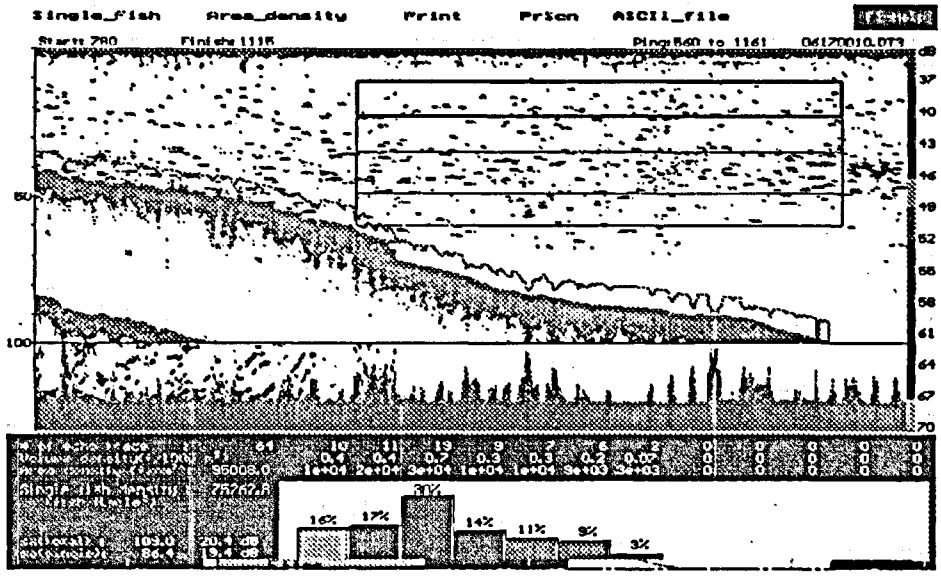

Figure 1. Echogram with selected areas for analysis. Fish data from the upper frame are displayed below the echogram.

ECHOGRAM DATA.

Raw data from the echo sounder are sent to Ethernet or disk as a series of "data telegrams". These telegrams consists of a header with position data, log counter and bottom depth, followed by the Sv values.

The vertical resolution can be selected between 1 m and 10 cm and is set in accordance to the bottom depth. In addition, there are expanded values (for each 10 cm) representing the 15 m bottom layer.

The computer screen allows a display of a maximum of 600 pings horizontally. This means that if a transect contains more than 600 pings, which is often the case, only a fraction of the echogram would be displayed. To display a full picture of a large transect, EP500 displays one in every "n" pings, where "n" depends on the total number of pings in the transect.

A "Zoom" option is provided to select and display any part of the echogram in more details. The log results, originally generated by the sounder and often printed on the echogram paper, are stored within the data file. They can be displayed on the screen under the echogram together with the lines defining the log markers.

TRACE TRACKING.
The SIMRAD split beam echo sounders are able to position single fish in the beam. (Brede *et al.*,1987) This makes it possible to track single fish and plot there movement through the beam. See Figure 2. Three predefined parameters are decisive for the trace tracking algorithm:

- The minimum number of traces to start tracking a fish.
- The allowed depth difference (in cm) between consecutive traces.
- The allowed consecutive missing pings in a series of traces.

All three parameters can be altered to match any specific criteria.

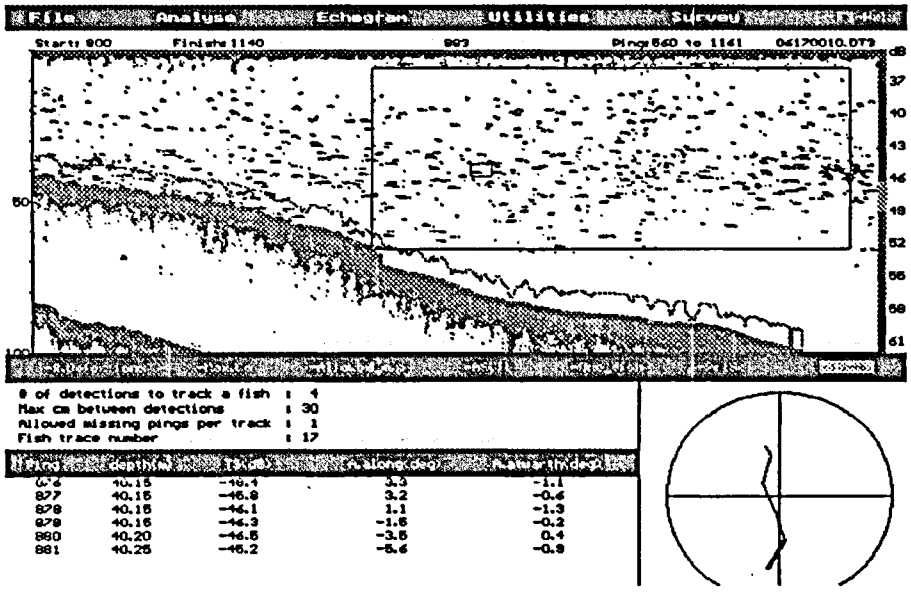

Figure 2. An example of an individual fish traced through the beam of the echo sounder. The actual fish displayed in the "trace window" can be found within the small square box located in the selected area of the echogram.

Traces within any selected area are plotted on the echogram showing their target strength, location on the echogram and trajectory within the transducer beam. The results are stored in an ASCII-file for further analysis by other programs.

GPS CHART PLOTTING.

If the echo sounder is connected to a GPS (satellite navigation) system, the EP500 can organise several transect-files into a "survey-file" . The transect files linked together into this "survey-file" can be displayed in an interactive chart.(See Figure 3.) On this chart every single transect can be accessed and displayed as an individual echogram. In this way it is easy to get a picture on how fish are distributed within an area.

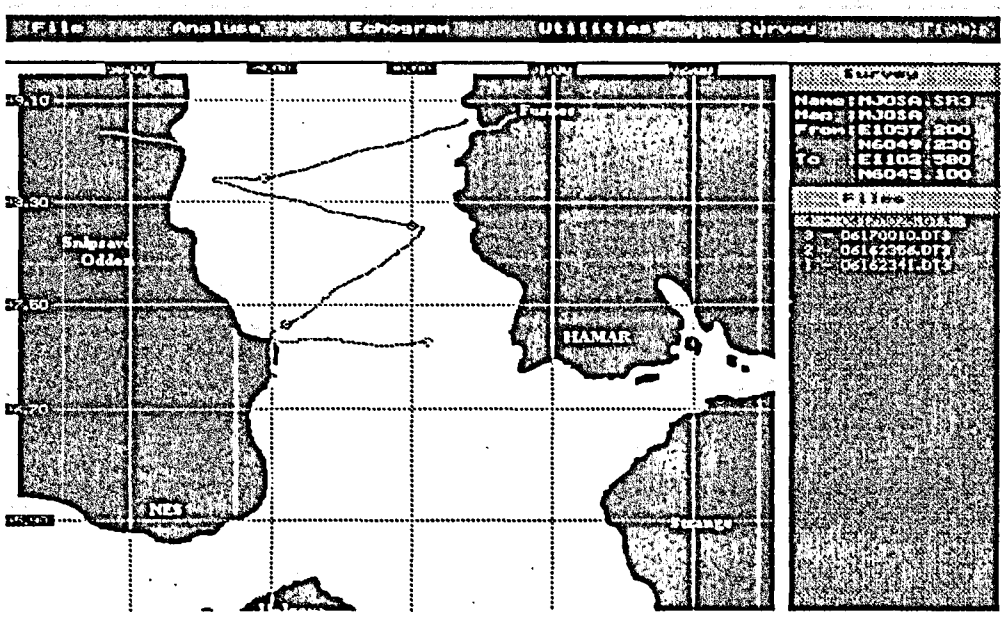

Figure 3. EP500 can link together navigation data from several transects and display them together. This interactive chart map show how the survey area has been covered with 4 transect lines.

COMMUNICATION.

Communication represents a central part in the EP500. In addition to the ethernet communication with the EK500 sounder, it is able to communicate with the EY500 and EK500 echo sounders through their serial port. The EP500 program and EY500 can communicate directly via modem. In this way EP500 can log into remote echo sounders, like on offshore buoys, and plot the echogram in real time or transfer stored data files.

SUMMARY.

The EP500 program does not only brings many post processing features into a personal computer, it is also able to run on-line with the EK500 and EY500 echo

sounders. In the case of EK500 this is done via ethernet, on the EY500 via modem.
We have found the program easy to operate and the analysis provided covers many research areas. One of the most important features with the program is the ability to provide ASCII-files for almost any available data. These ASCII-files are in a CSV-format which can be imported into most third party programs. Users with special interests will find these ASCII-files very useful for further studies.

REFERENCES

Brede, R., Kristensen, F.H., Solli, H., Ona, E. 1987. Target tracking with split beam echo sounder. International Symposium on Fisheries Acoustics, Seattle, Washington, 22-26 June 1987. 22pp.

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