



Iain M. Parnum, Tyler Ellement and Miles J.G. Parsons
 Centre for Marine Science and Technology, Curtin University, Bentley, Western Australia, AUSTRALIA
 e-mail: i.parnum@curtin.edu.au



Iain Parnum

Introduction

Once focused on the collection and processing of bathymetry data, in recent years multibeam echo-sounders and imaging SONARs have also been used increasingly to map and quantify the spatial and temporal distribution of in-water targets. The authors have used multibeam systems to study fish, marine mammals, zooplankton, epi-benthic structure, seeps and suspended sediment. Some of these studies are highlighted below. All of these applications required the need for exploration and analysis of the raw data. This resulted in the development of new software to read various SONAR data and to summarise large water column datasets. Details of these software tools and how to access them are given below.

Detection of Marine Mega Fauna

- A variety of multibeam SONARs were deployed as part of an investigation into the potential of using SONAR for shark detection.
- The Water Column Viewer (WCV) and SONAR2MAT were used for data exploration, correction and to enable image enhancement in MATLAB.
- At short ranges (< 10 m), it is possible to discern the shape of a shark in images produced from multibeam sonar systems (Fig 1).
- At long ranges (> 20 m), sharks can be detected but are not readily distinguished from other targets (Fig 2).
- Maximum detection and identification ranges are reliant on system source level, beam pattern, bathymetry, and target size.

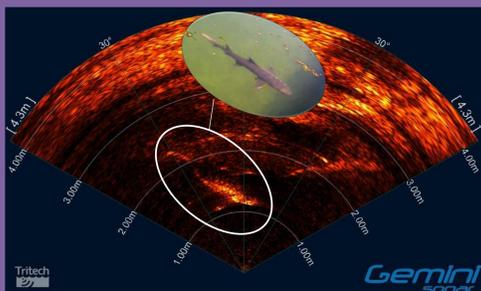


Fig 1. Screen shot from a Tritech Gemini imaging sonar of a Lemon Shark. Photo insert taking from above the water.

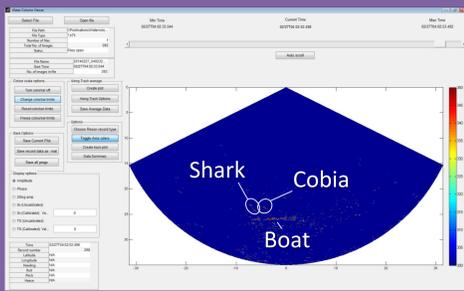


Fig 2. Screen shot of the WCV displaying Reson 7125 deployed horizontally to observe a shark.

Searching for Underwater Seeps

- Water column data from a multibeam survey was used to search for underwater seeps (Fig 3). This resulted in a large number of files, which required disseminating and reviewing.
- The WCV was used to automate the generation of along track and across track average data (Fig 4), which made it easier to review and plot large amounts of data collected.

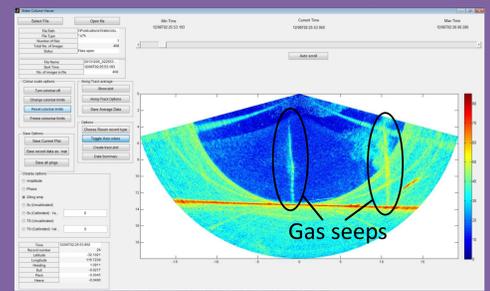


Fig 3. Screen shot of the WCV reviewing Reson 7125 data collected over a gas seep.

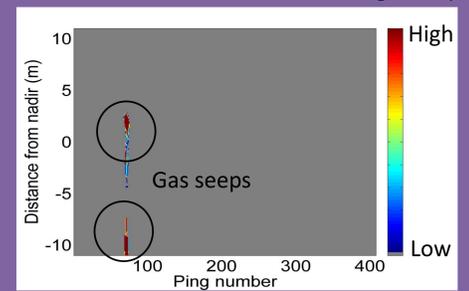
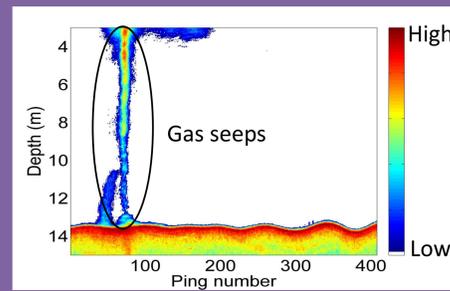


Fig 4. Along track (left) and across track (right) representation of water column data collected over a gas seep with a Reson 7125.

The Software Tools Developed

Water Column Viewer

The Water Column Viewer (WCV) allows the user to review water column data collected from Reson (s7k – 7008, 7011 and 7018 records), Kongsberg (.wcd) and Odom/Imagenex (.83b) multibeam systems. Data can be saved as a MATLAB data file. Along and across track summary data files can be created to help disseminate data. This is especially useful to summarise and plot large datasets.

SONAR2MAT data convertor

SONAR2MAT is a program that converts selected SONAR files to MATLAB (.mat) data format to allow advanced data analysis and algorithm development. The convertor supports Reson (s7k), Kongsberg (.all, .wcd), Odom/Imagenex (.83b), Generic Sensor Format (GSF), eXtended Triton Format (XTF) and Biosonics (.dt4).

These tools are available from the authors and the CMST website: <http://cmst.curtin.edu.au/>

Monitoring Suspended Sediment Plumes

- Acoustic devices have long been used to monitor suspended sediment, but there are no readily available tools for this to be carried out with multibeam systems, which was the focus of one such study by the authors.
- The WCV and SONAR2MAT convertor were used for data exploration, correcting for system settings and to import data into MATLAB.
- In MATLAB, the acoustic backscatter was compared with data from a turbidity (NTU) sensor (Fig 5), and was used to generate a 3D representation of a small sediment plume (Fig 6).

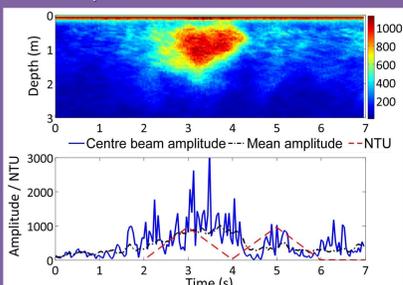


Fig 5. A sediment plume detected in multibeam backscatter (top) and the beam responses at 1 m (along track) compared to a turbidity (NTU) sensor at the same depth (bottom).

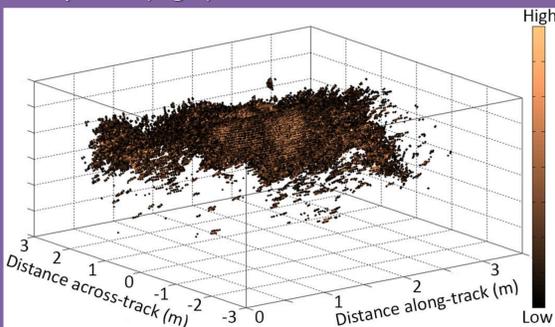


Fig 6. 3D representation of the backscatter data from a sediment plume.

Mapping the Water Column with Sidescan Data Recorded by Multibeam Systems

- Full beam time series water records are not always recorded, but some multibeam systems can record a sidescan record, which contains water column backscatter (BS) from directly below the vessel.
- The SONAR2MAT convertor was used to bring the sidescan data recorded by multibeam systems in to MATLAB to enable appropriate geometric and radiometric corrections to be applied, but the BS values are used relatively.
- Sidescan backscatter data was used by the authors to investigate seagrass canopy height (Fig 7) and for preliminary biomass investigations (Fig 8).

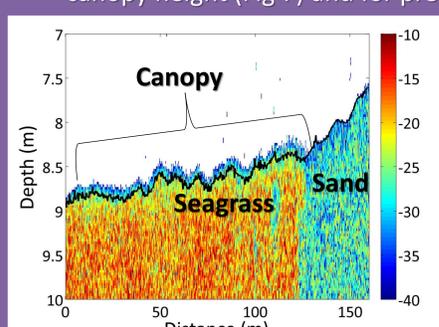


Fig 7. Sidescan data from the port side of a Reson 8125 used to detect seagrass canopy. Black line is the depth pick.

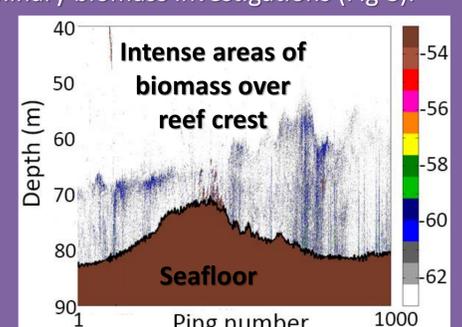


Fig 8. Sidescan data from the port side of a Reson 8101 used to identify areas of in-water biomass. Black line is the depth pick.

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