CRC for Coastal Zone Estuary and Waterway Management

In cooperation with

Centre for Marine Science and Technology
Curtin University of Technology

FIELD REPORT:
Toolkit Version
Data Collection in Cockburn Sound

By:

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REPORT 2004-21 (Toolkit Version)

Table of Contents

Introduction

This report summarises aspects of a field program undertaken by the Coastal CRC in 2004 in Cockburn Sound, Western Australia. The Sound is a relatively sheltered inshore area readily accessible from boat launching sites near Fremantle. The program included geological work undertaken by Geoscience Australia and acoustic surveys undertaken by Curtin University and the University of Western Australia. Fugro Survey provided Starfix position fixing equipment.

Itinerary Summary

Week 23-27 Feb	Geoscience Australia (GA) ship all gear to Perth.
26 or 27 Feb	Starfix differential GPS system secured from from Fugro Survey.
Week 1-5 Mar	GA gear picked up and consolidated, GA hire a ute for week 8-12 Mar.
8 Mar	GA mobilise gear to *FP Response* in Fremantle, Curtin to assist in gear mobilisation.
8-12 Mar	GA run transects and grab sampling in Southern end of Cockburn Sound, any slack time to be made up with swath mapping transects (ie. 5 days committed for vessel).
12 Mar	De- mobilise *FP Response*.
13-14 Mar	GA personnel fly Canberra.
15 Mar	Mobilise sidescan and swath mapper to vessel *FV Sabrina*.
15-19 Mar	Run sidescan and swath mapper in Cockburn Sound.
22-26 Mar	Run sidescan and swath mapper in Cockburn Sound, de-mobilise on Friday 26th Mar.
29 March	Starfix positioning system to Fugro.

Personnel

Three personnel from Geoscience Australia, five from Curtin University, five from the University of Western Australia and two from DAL Science and Engineering were involved at various stages of the work, together with 4 boat crew members.

Vessel

FP Response *FV Sabrina*

Figure 1. Vessels used in the survey.

Data collection took place on *FP Response* and on the fishing boat, *FV Sabrina* (see Figure 1). *FP Response* carried over 500 kg of GA's field gear to collect acoustic sub-bottom data and sediment samples and *FV Sabrina* carried approximately 200 kg of field gear to collect single beam, multibeam, sidescan and underwater video data.

Trip Objectives

GeoScience Australia
Carry out sediment samples along three EW transects at: 1) 32° 09' S; 2) 32° 12' S; and 3) 32° 15' S within Cockburn Sound. Obtain three vibracore samples from along each transect. If possible extend transect 1 to juts NW of Garden Island. Sample selected site for DSTO with grab and vibracore.

University of Western Australia
1. To map seagrass cover and species distribution on Success and Parmelia Banks in water depths < 10m.
2. To complete 90 km of towed video across Success and Parmelia Banks.
3. To map the benthos of Eastern Shelf of Cockburn Sound using a combination of sidescan, towed video and diver surveys.

University of Western Australia/Curtin University of Technology, CRC activities
1. To complete 3 east-west transects in Cockburn Sound using swath, sidescan and single beam sonar, with video groundtruthing.
2. To complete mapping of the western edge of eastern shelf, Cockburn Sound, and the southern and northern edges of Parmelia and Success Banks from the 10 m isobath to the loss of seagrass cover with depth(approx 500m thickness – out to 15m isobath) using a combination of sidescan, towed video and diver surveys.

Curtin University of Technology
1. Obtain simultaneous coverage if possible, with Reson 455 kHz swath mapper, UWA 75/200 kHz sidescan and Simrad 38/200 kHz single beam sounders.
2. Obtain 200-300 m swath sonar coverage along GA EW transects – include coverage to include Five Fathom Bank on transect 1.
3. Sample fixed locations of different seagrass beds with Reson and Simrad at 09:30 and 15:30 each day for consecutive days by following set tracks over designated points.
4. Obtain short sections of Reson data over well defined and distinct substrate/community types with short, long and medium pulse lengths.

Trip Narrative

On 22 March 2004, Rob McCauley, Justy Siwabessy, Yao-Ting Tseng (Tim) and Iain Parnum from CMST, Curtin University of Technology and Andy Bickers from UWA mobilised gear to *FV Sabrina*. We then spent the whole day installing all field gear.

On 23 March 2004, installation continued. All offsets required for the multibeam sonar were measured. Yao-Ting Tseng (Tim), Iain Parnum and Justy Siwabessy operated the system and collected the patch test data. During data collection for the patch test, they found faulty on the RESON SeaBat 8125. Justy Siwabessy reported the faulty to Rob McCauley. After a discussion with Rob McCauley and John Penrose, survey continued and data were collected along GA northernmost transect line.

Mal Perry from CMST, Curtin University of Technology met with Yao-Ting Tseng (Tim), Iain Parnum and Justy Siwabessy on 24 March 2004 to demobilise the sonar head and 81-P sonar processor from the boat. The sonar head and 81-P sonar processor were transferred to Curtin University of Technology for tank testing. Alec Duncan, Rob McCauley, Mal Perry and Justy Siwabessy conducted a tank testing.

With Andy Bickers operating the sidescan sonar, and Yao-Ting Tseng (Tim), Iain Parnum and Justy Siwabessy operating the single beam SIMRAD EQ60 echosounder, sidescan and single beam data were collected on 25 March 2004.

Sidescan and single beam data collection continued on 26 March 2004 with Andy Bickers and Yao-Ting Tseng (Tim) operating the system. Sidescan data collection completed on 26 March 2004.

On 29 March 2004, Yao-Ting Tseng (Tim) and Justy Siwabessy continued collecting acoustic data using single beam SIMRAD EQ60 echosounder. Yao-Ting Tseng (Tim) also operated the drop video camera in few stations of different bottom habitat types. Rob McCauley met with Yao-Ting Tseng (Tim) and Justy Siwabessy at 15:00, demobilised all field gear from the boat and loaded to the ute.

Methods

Multibeam sonar (RESON SeaBat 8125)

RESON SeaBat 8125 Sonar Specifications

Sonar Operating Frequency:	455 kHz
Swath Coverage:	120º (3.5 X Water Depth)
Beam Width, Along Track:	1.0º
Beam Width, Across Track:	0.5º (at Nadir)
Number of Horizontal Beams:	240
Range Resolution:	1.0 cm
Maximum Ping (update) rate:	40

Mounting

The sonar head was side-mounted in the starboard side of the boat. As recommended, the motion sensor was placed very close to the centre of gravity of the boat whereas the gyrocompass was installed parallel to the centre line of the boat. The motion sensor and the gyrocompass were placed in the accommodation room right below the wheelhouse. The GPS antenna was fitted in a selected location with a full 360 field of view at the roof of the wheelhouse. Using the software provided, the motion sensor was calibrated while the vessel was anchored at the jetty. All sensor offsets were measured relative to the centre of gravity of the boat using a metal tape. A spirit level and a plumb bob were also used to allow for accurate measurements. All the measured offsets are presented in Table 1.

Survey planning

The survey took place in Cockburn Sound area. Transect lines were created using the Navisoft Planning and Presentation software (Figure 2). Each set of transect lines was divided into grids/bins using the Navisoft Planning and Presentation software. This was prepared for each sub-area that allowed for a quality control.

Table 1. Sensor offsets.

Sensor	Sensor Offsets (m)		
	X	Y	Z
Sonar Head	2.66	0	-1.76
DGPS	0.43	-0.64	3.74
Motion Sensor	0	1.56	0.33

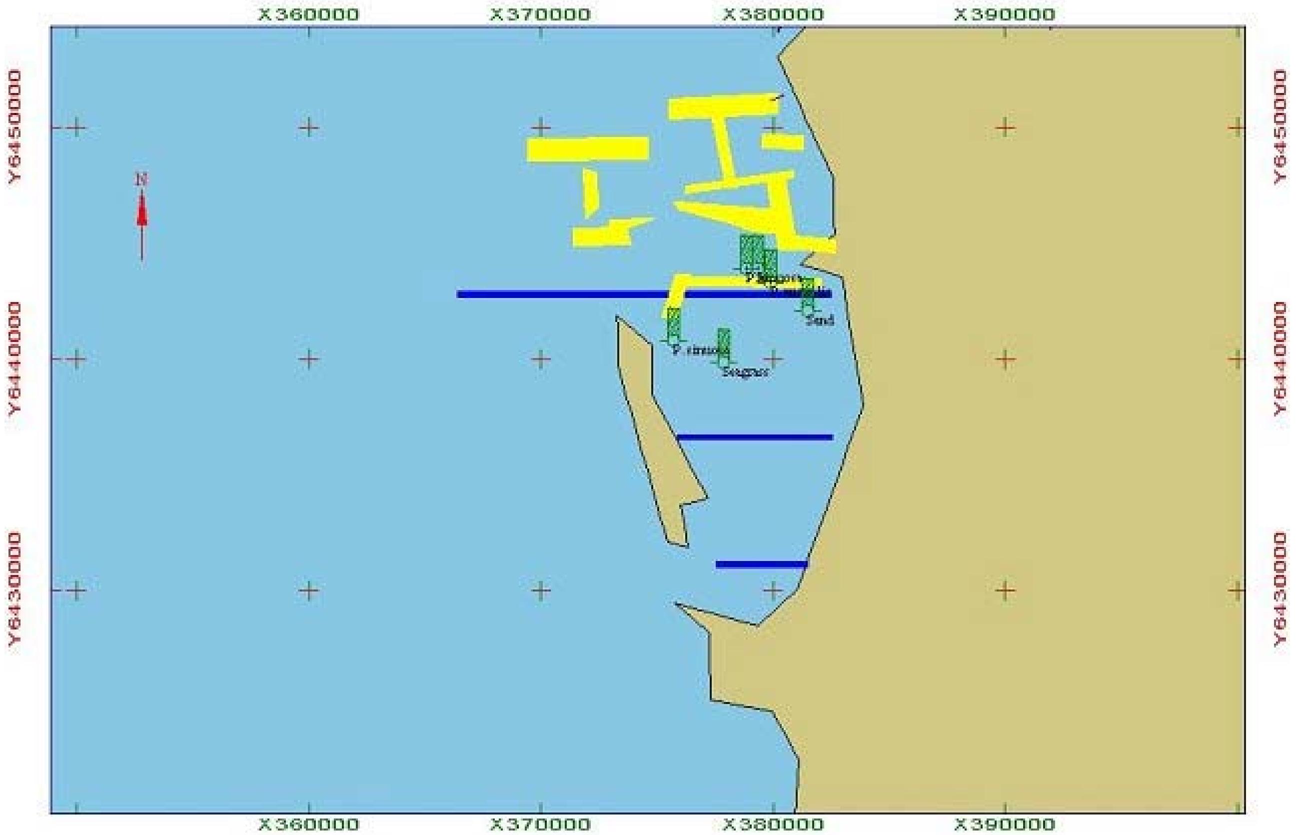

Figure 2. Transect lines (blue and yellow lines) and stations (green rectangles) produced by using the Navisoft Planning and Presentation software. Blue lines are GA transect lines; Yellow lines are CRC transect lines; Green rectangles are stations for Yao-Ting Tseng's work.

<u>Initial setup and data collection</u>

The software used for data collection was Navisoft Survey. Using this software, the project file created using the Navisoft Planning and Presentation software was loaded and all available offsets were entered. Communication lines between PC and all sensors were checked. Data logging configuration was also checked, making sure that the folder and the filename were correctly specified and the GRD file (grid file) was selected.

Single beam echosounder (SIMRAD EQ60)

<u>SIMRAD EQ60 Echosounder Specifications</u>

Operating frequency:	38, 200 kHz
Transmit power:	Max 1 kW RMS for each channel
Beam width:	15.20º (38 kHz), 7.20º (200 kHz)
Two-way beam angle:	-14.00 dB (38 kHz), -20.50 dB (200 kHz)
Gain function:	20 log TVG, 40 log TVG
Colour scale:	12 colours (3 dB per colour)
Start depth and range:	5 to 15,000 meters
Ping rate:	Adjustable, maximum 10 pings per second

<u>Mounting</u>

The transducer was side-mounted in the starboard side of the boat approximately 3 meters behind the sonar head of the multibeam system. Vertically, it was 2.14 meters below the sea surface.

Data collection
Data were collected continuously while steaming and also while the boat was kept stationary in each station given as green rectangles in Figure 2.

Drop Camera

Deck box, camera, cable, weights, 30-50 m line suitable for handling, VCR's. Video footages and acoustic data were taken simultaneously while the vessel was kept as stationary as possible for 5 minutes at each station given as green rectangles in Figure 2.

Results

RESON SeaBat 8125

On 23 March 2004 during the patch test data collection, it was found that the noise increased with the speed. While collecting the patch test data for the latency at the slow speed (half the survey speed), this problem was not noticeable. However, it was very obvious when the speed increased to the survey speed while collecting the other set of patch test data for the latency at a higher speed. Data collection was continued after a short discussion with Rob McCauley and John Penrose. The multibeam data were collected at the optimum speed, around 4 knots, in which the noise was kept minimum. Later, it was found that the noise increased with depth, too.

On 24 March 2004, the sonarhead was removed from the boat and together with the 81-P sonar processor was taken back to Curtin University of Technology for a tank testing. Alec Duncan from Curtin University of Technology conducted a tank testing checking for the source level of the system. He found that the source level at the maximum power dropped by approximately 50 dB. In addition, the signal amplitude remained unchanged regardless of power change. We were also able to replicate the intermittent faulty on the DOWNLINK which first occurred while the system was on lease by Fremantle Port Authority. This intermittent faulty was due to a damage found in the main cable around the cable clamp.

SIMRAD EQ60

On 25 and 26 March 2004, single beam data were collected using SIMRAD EQ60 simultaneously with the sidescan data collection. A complete trackplot of the single data collection is shown in Figure 3 as blue tracks. Video footages were not taken during those days when sidescan data were collected. Andy Bickers of the Western Australia University later took video footages after the acoustic data collection had completed. A complete trackplot of video footages is given as red tracks in Figure 3. Sites for video footages were decided from the sidescan. Sidescan works and video footages using UWA's gear are not included in this report.

On 29 March 2004, single beam data collection was continued. Acoustic data were collected in several locations of different bottom habitat types, given as red triangles in Figure 3. Acoustic data were collected for 5 minutes in each station while simultaneously taking video footages with Curtin's gear. Acoustic data were also collected while moving from one station to another.

During the survey, areas with and without dense seagrass were easily recognised visually from the echograms of the two operated frequencies. In areas without dense seagrass, the sounder-detected bottom produced form the SIMRAD EQ60 built-in algorithm is similar for both frequencies. In areas with dense seagrass however, the sounder-detected bottom of the two frequencies is very different (Figure 4). As shown in Figure 4, the sounder-detected bottom (the light green line) observed on the 38 kHz echogram shifted by few pixels up from that on the 200 kHz echogram. In addition, a spikelooking detected bottom was also observed on the 38 kHz echogram depending on how dense the seagrass was.

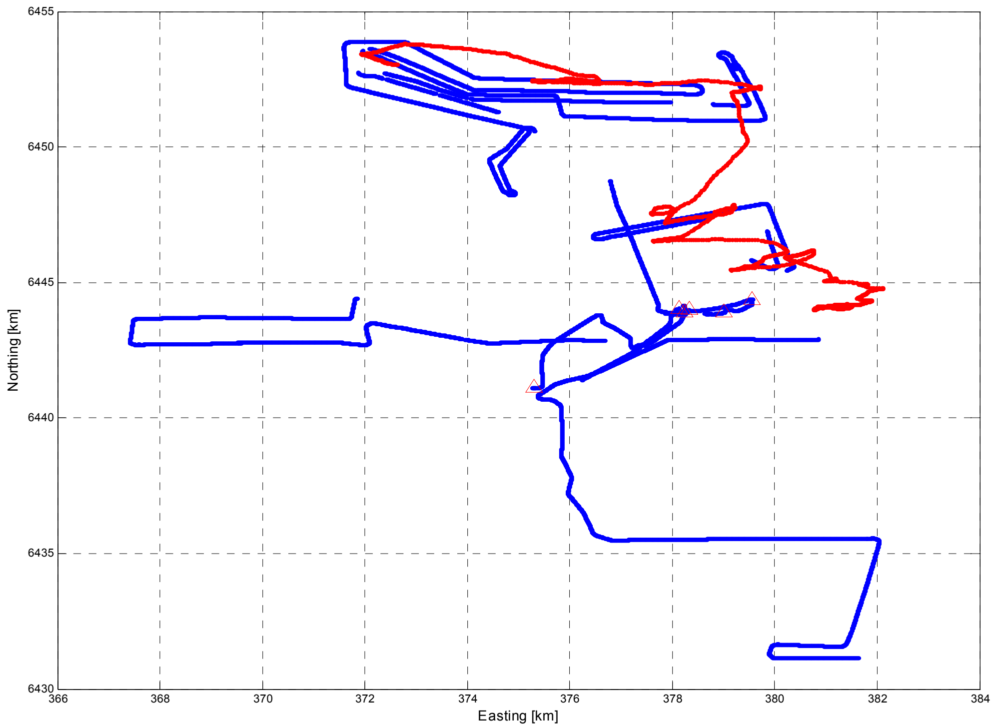

Figure 3. A complete trackplot of the single beam data collection (blue tracks) and video footages (red tracks). Red triangles are stations for Tim's PhD study.

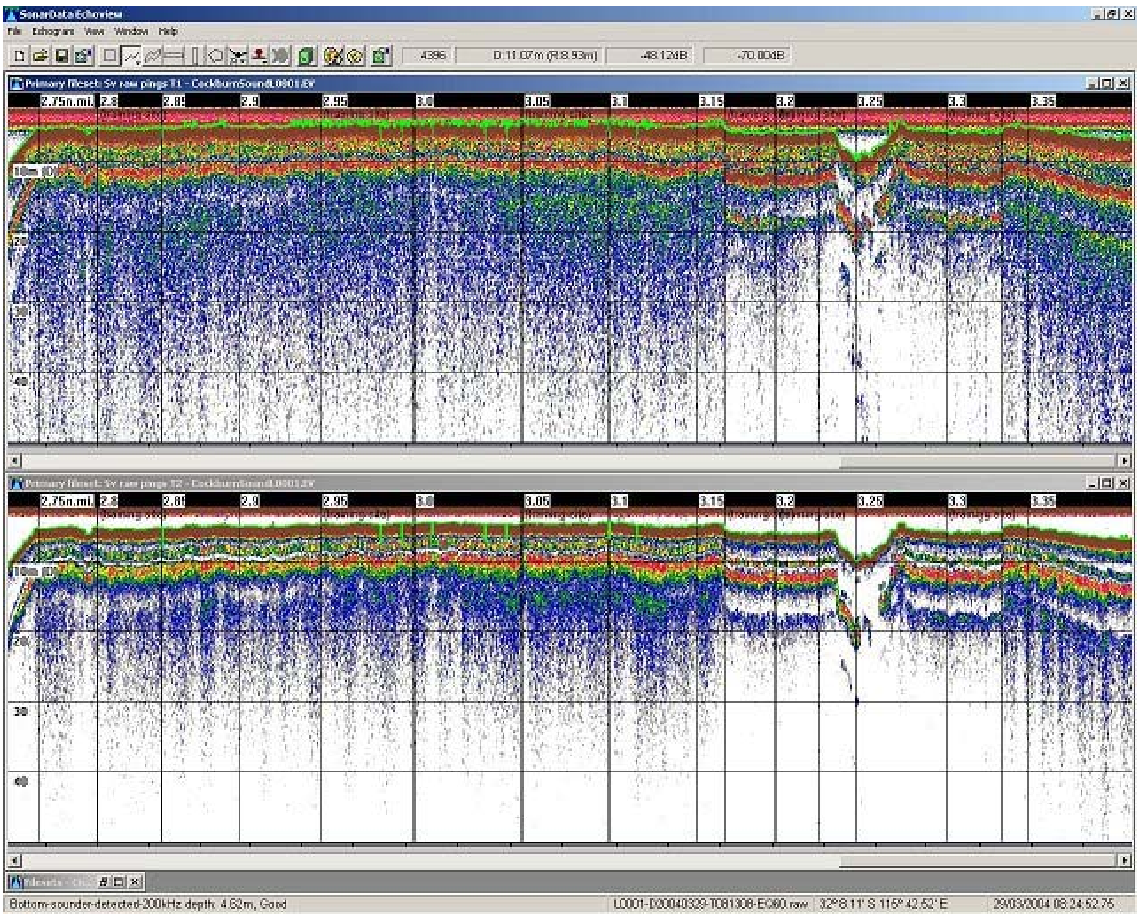

Figure 4. An example of the echograms indicating acoustic return from seagrass.

Different bottom habitat types produce different characteristics of the acoustic return on the echogram (Figure 5). As shown in Figure 5, different characteristics of the acoustic return on the echogram are obvious, due to different bottom habitat types. In addition, both echograms agree well. While different characteristics of the acoustic return on the echogram in Figure 5 are obvious in both frequencies, it’s not the case in Figure 6. In Figure 6, different characteristics of the acoustic return on the 200 kHz echogram are obvious whereas those on the 38 kHz echogram are barely observed. Although, this may relate to different bottom habitat types, it also shows a frequency dependence.

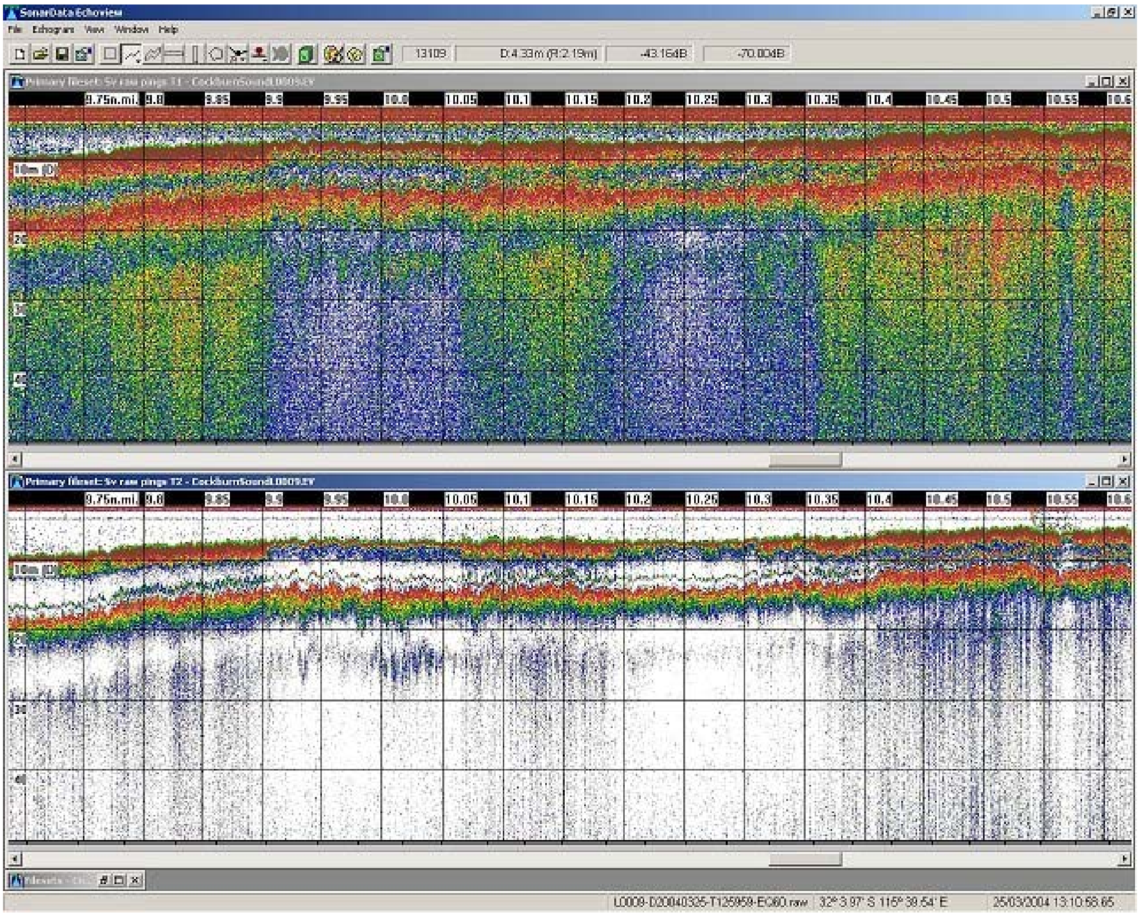

Figure 5. An example of the echogram showing different characteristics of the acoustic return of both 38 and 200 kHz data due to different bottom habitat types.

Video

Video footages were taken in predefined locations shown as red triangles in Figure 3 using Curtin’s gear. Total of 6 sequences of the video footage was obtained.

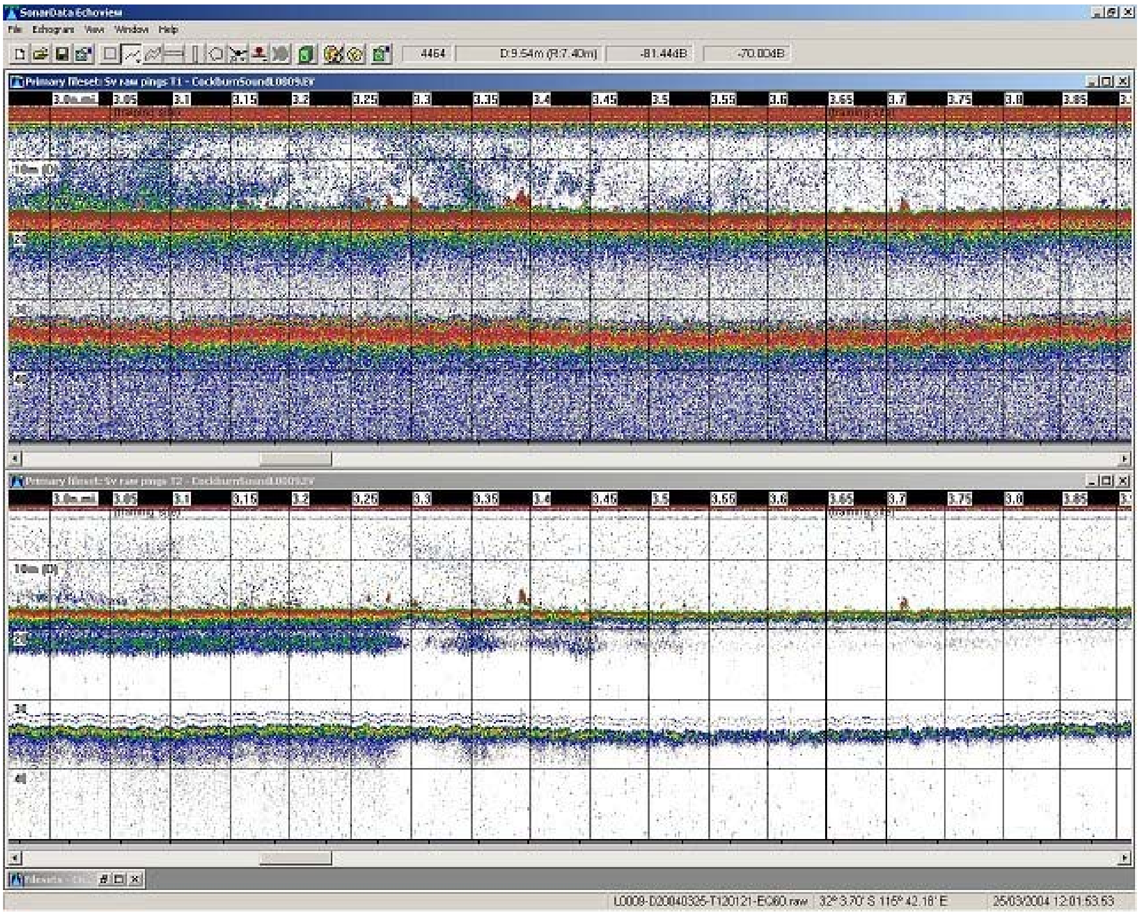

Figure 6. An example of the echogram showing frequency dependence and different characteristics of the acoustic return due to different bottom habitat types.