# Team 4 Cruise Report

Charlie Bishop
Ashley Robar
Susanne Brandstaetter

October 27, 2008

## 1 Introduction

The collection of field oceanography data within Conception Bay required the use of the Anne S. Pierce, a marine vessel employed by Memorial University and the Marine Institute, during the time period from 1:00pm on October $7^{th}$ to 5:00pm on October $8^{th}$.

In total, six students (Charlie Bishop, Susanne Brandstatter, Kathryn Denommee, Sheilagh O'Leary, Ashley Robar, and Graig Sutherland), three scientists (Dr. Sam Bentley, Jack Foley, and Dr. Paul Snelgrove) and the crew of the Anne S. Pierce deployed several oceanographic instruments into Conception Bay. These instruments were lowered over the sides and rear of the ship to collect information about biotic and abiotic features present within Conception Bay. Figure 1 shows the cruise track and sampling locations. Prior to sampling, we were made aware of the safety procedures and were given a brief introduction to the scientific equipment. All group members were expected to participate with the data collection.

### 1.1 Work Accomplished

#### 1.1.1 Day 1

On the first day (Oct. $7^{th}$) we arrived and began our field cruise at 1pm. The crew was informed about our cruise plan and we proceeded to the two fixed CTD stations in the open bay (CTD 4 and CTD 6). We tested the ADCP/Biosonics and Sub-bottom profiles but did not collect data due to communication problems.

#### 1.1.2 Day 2

The second day (Oct. $8^{th}$) we began at 8am with a fixed station (S1) inside the Tickle. A cross-tickle transect was conducted followed by a second fixed station inside the tickle (S2). A second transect, along the tickle, was conducted, followed by our final fixed station (S3). We finished the days sampling with a sonar survey that was cut short due to high winds.

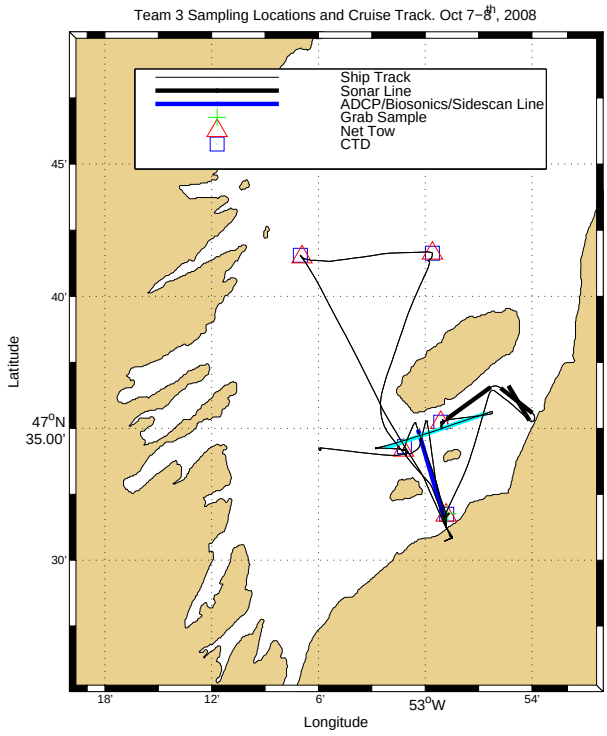


Figure 1: Cruise track for Oct. 7-$8^{th}$. 5 CTD samples, 5 vertical net tows, 1 grab sample, 2 ADCP lines, and a sonar survey were completed.

## 1.2 Problems

On the first day aboard the ship we encountered a problem with the GPS signal for most of our equipment (ADCP, Biosonics and Multi-beam). With this system down we could not gather information about the relative speed of the ship and therefore no data was collected with these instruments.

Another issue became apparent due to the Anne Pierce's minimum cruising speed of 4knots - horizontal net tows could not be completed at this speed, and thus we were forced to do stationary, vertical, net tows. Another issue was due to not enough vertical line to reach the bottom on our grab samples, only 1 grab sample was done successfully.

During the second day on board, the winds picked up late in the afternoon making it too dangerous to hang instruments off the ship. For this reason, we only completed part of our planned multi-beam transects within the tickle region of Conception Bay.

The finial issue we could not resolve occurred with the glider deployment. Technical difficulties with the internal communication device were discovered prior to its

flight within Conception Bay, therefore the glider did not get deployed. Data from a previous 2006 flight within the same region was provided for comparisons to the data we collected.

# 2 Data

Data collected on this cruise covered three main areas of science: physical, geological, and biological oceanography.

At each sampling site (see table 1 for coordinates), we deployed the ring net for plankton sampling within the water column, a Secchi disk measurement was taken, and the CTD was lowered through the water column. For each transect, we deployed the Multi-beam sonar, side-scan sonar, the towed ADCP and the Biosonics echo-sounder. These same instruments were also deployed during the area mapped with the sonar equipment. Moored ADCP and thermistor instruments were set up at specific sites as well.

| Sample site | Longitude (decimal degrees) | Latitude (decimal degrees) |
|---|---|---|
| CTD 4 | -53.1169 | 47.6926 |
| CTD 6 | -52.9933 | 47.6938 |
| S1 | -52.9799 | 47.5290 |
| S2 | -53.0194 | 47.5718 |
| S3 | -52.9854 | 47.5872 |
| ADCP Line 1 | start: -52.9827, end: -53.0068 | start: 47.5277, end: 47.5825 |
| ADCP Line 2 | start: -53.0372, end: -52.9429 | start: 47.5711, end: 47.5928 |
| Sonar Line 1 | start:-52.9797, end:-52.9386 | start: 47.5893, end: 47.6094 |
| Sonar Line 2 | start: -52.9293, end: -52.8997 | start: 47.6088, end: 47.5931 |
| Sonar Line 3 | start: -52.9025, end: -52.9220 | start: 47.5883, end: 47.6103 |

Table 1: Team 4 Sampling Locations

## 2.1 Physics

The instruments used to collect the physics data are a SeaBird Electronics 19+ (with attached dissolved oxygen, PAR, and fluorescence sensors) CTD, RD Instruments 600 khz and 400 khz Acoustic Doppler Current Profiler (ADCP), BioSonics multi-frequency backscatter system, and a thermistor chain.

The data for our two day portion of the cruise consists of 5 CTD casts ($\approx$ 2 MB of data), 8 separate lines of towed ADCP data ($\approx$ 12 MB), and 10 lines of Biosonics data ($\approx$ 80 MB). A moored ADCP and thermistor chain were also collecting data for the full extent of the sampling program.

Typical examples of the CTD data, the thermistor chain, moored ADCP, Biosonics, and towed ADCP can be found in figures 2, 3, 4, 5, 6, 8, and 7 respectively.

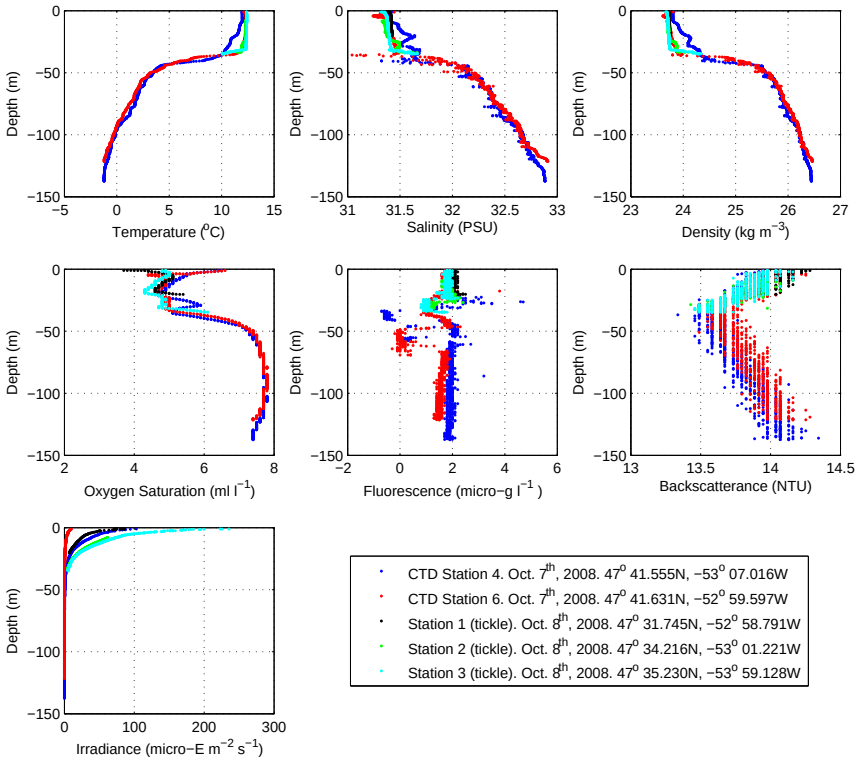


Figure 2: CTD data collected at our five different sample sites are typical of Conception Bay. There is minimal variation between the different sampling sites. Temperature, Salinity, Density and Backscatterance are approximately the same at our 5 sampling locations. Oxygen Saturation, Fluorescence, and Irradiance show small variation in the upper mixed layer between our sampling sites.

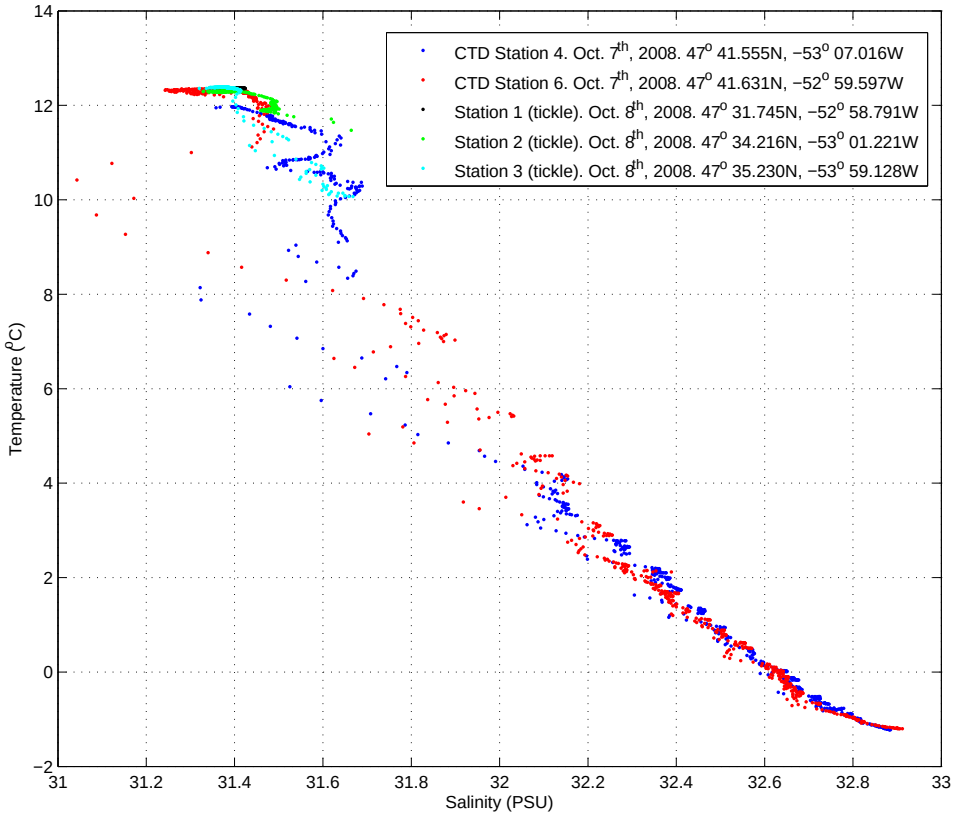


Figure 3: The temperature-salinity data collected inside the tickle show minimal deviation but vary from those collected in the open bay.

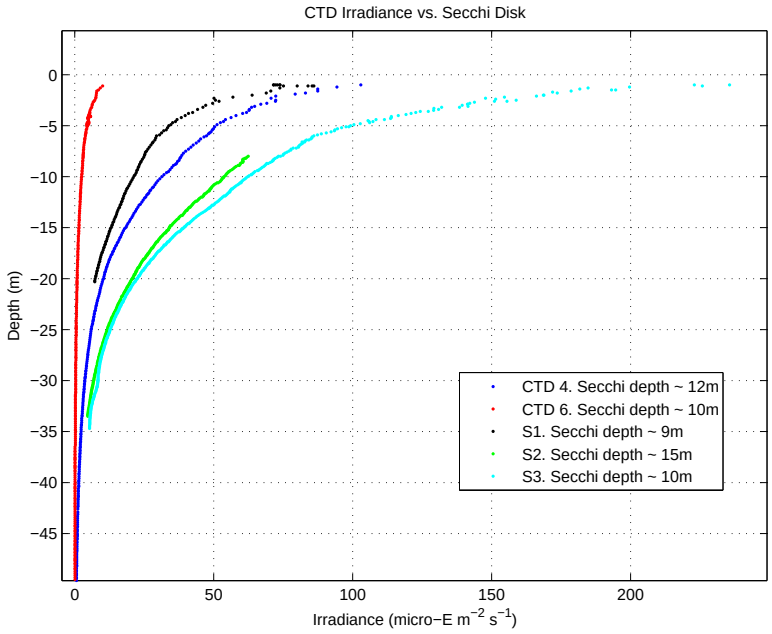


Figure 4: A comparison of the Irradiance measured by the CTD PAR sensor and the data we collected with the secchi disk shows that the secchi disk measurements correspond to a PAR reading of ≈25-45 % and are unreliable at best.

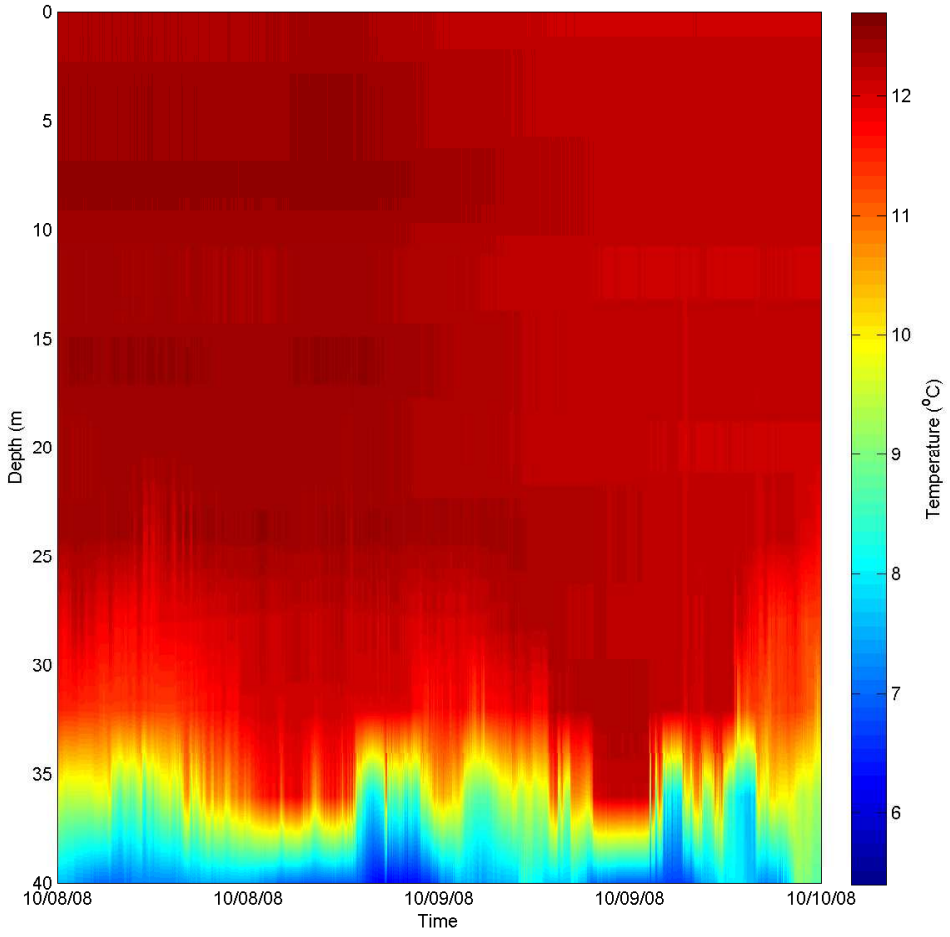


Figure 5: The thermistor chain was moored such that the first thermistor was directly below the surface with each subsequent thermistor at 4m intervals. Only the last thermistor (closest to the bottom) showed variation in temperature.

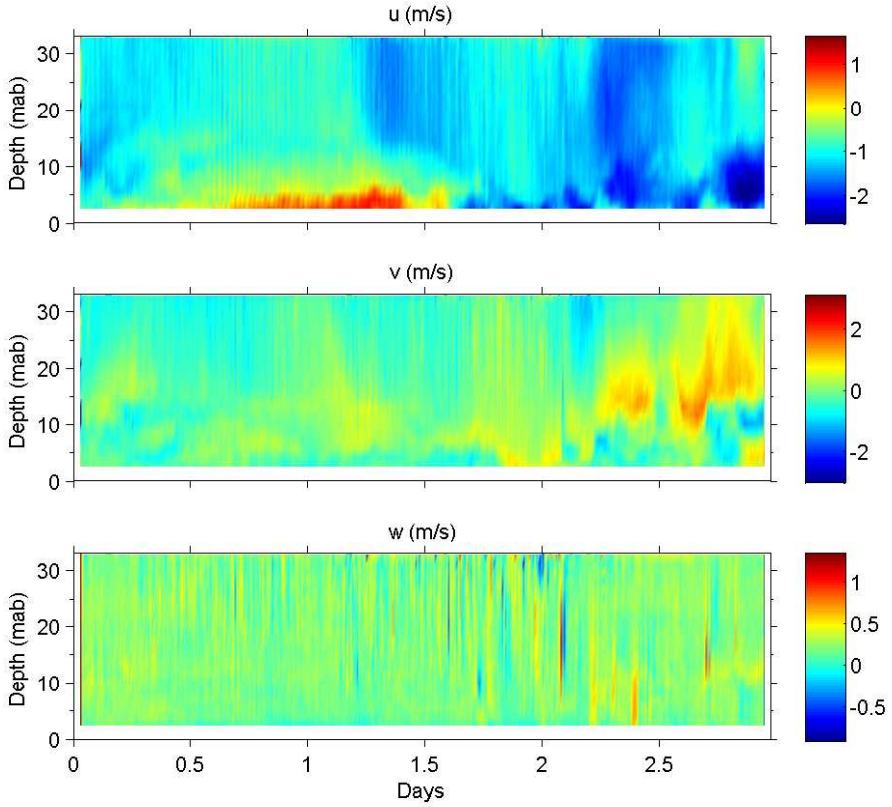


Figure 6: The moored-ADCP shows typical current measurements of Conception Bay. Vertical banding present shows the reversal of currents with the tide. Filtering of this data must occur before any spectral analysis takes place.

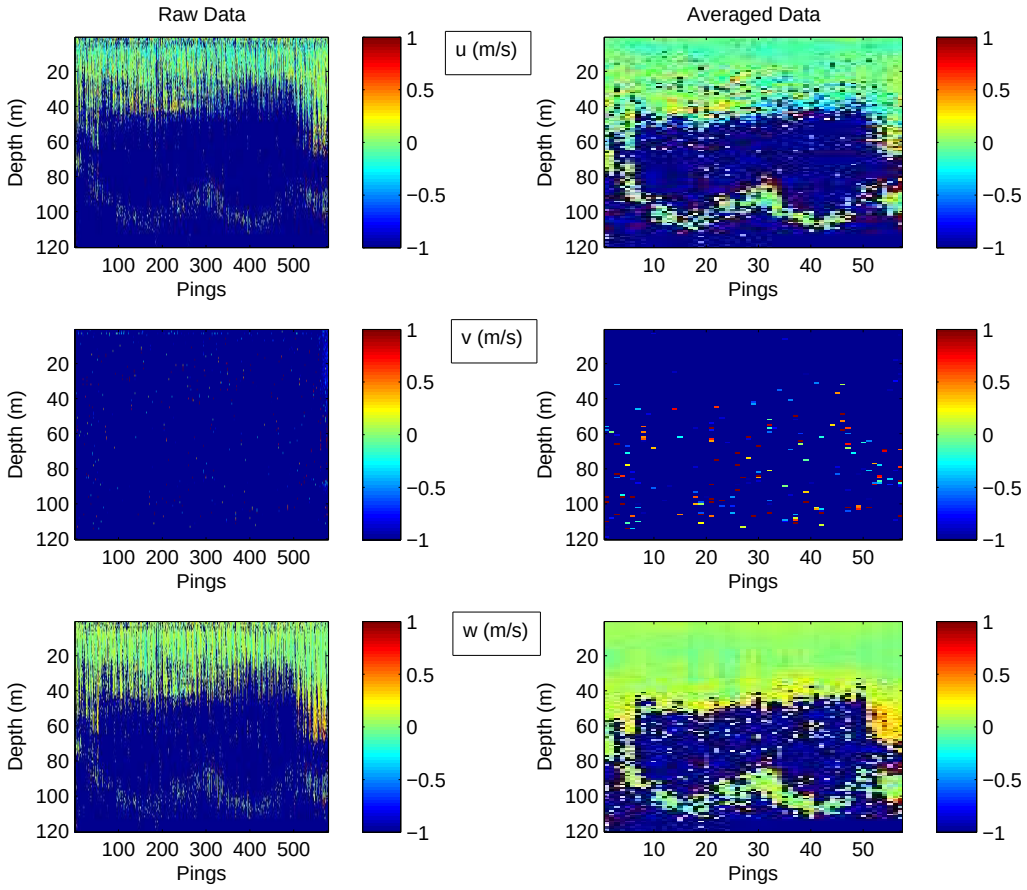


Figure 7: Towed-ADCP data shows considerable noise. Left) Raw data. Right) Velocity data is averaged every 10 measurements still shows considerable noise.

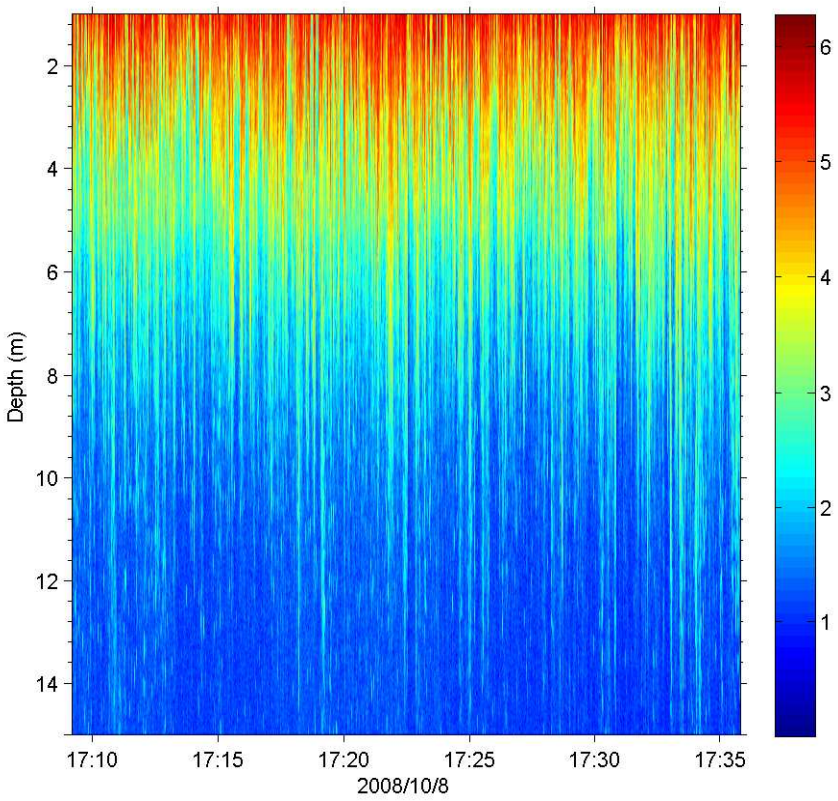


Figure 8: Biosonics data obtained during our 2 day voyage shows considerable noise. This section (25mins) is the best example and shows little particulate matter in the water column.

## 2.2 Geology

The systems used to collect the data are an EdgeTech sub-bottom profiling system with 2 - 15 kHz, an EdgeTech side-scan profiling system, and an IMAGENEX DELTA T profiling system for the multi-beam data.

The collected sonar data include seven sub-bottom sonar files ($\approx$ 260 MB data), nine side-scan sonar files ($\approx$ 1.04 GB data), and seven multi-beam sonar data files ($\approx$ 504 MB data), which were all collected on the third day of the cruise in the area of the Bell Island Tickle.

The sub-bottom profiler was towed on the starboard side of the ship in about 2.5 m water depth, as was the side-scan for the first two lines (together with the towed ADCP lines). During the sonar survey the side-scan profiler was towed at the stern of the ship in about 4 m water depth. The multi-beam profiler was towed at the port-side of the ship in about 1.5 m water depth. The records for the sub-bottom profiler and the side-scan profiler were both stopped and started again for each line and each turn of the ship. The multi-beam profiler on the other side was recording continuously while in the water.

The collected data can be used to get a better idea of how the sea floor looks like. This information can help to understand processes of sediment transport, currents, or where hazardous dumping can complicate moorings. Figures 10, 9, and 11 show a typical example of data collected from the multi-beam, side-scan sonar, and sub-bottom profiler respectively.

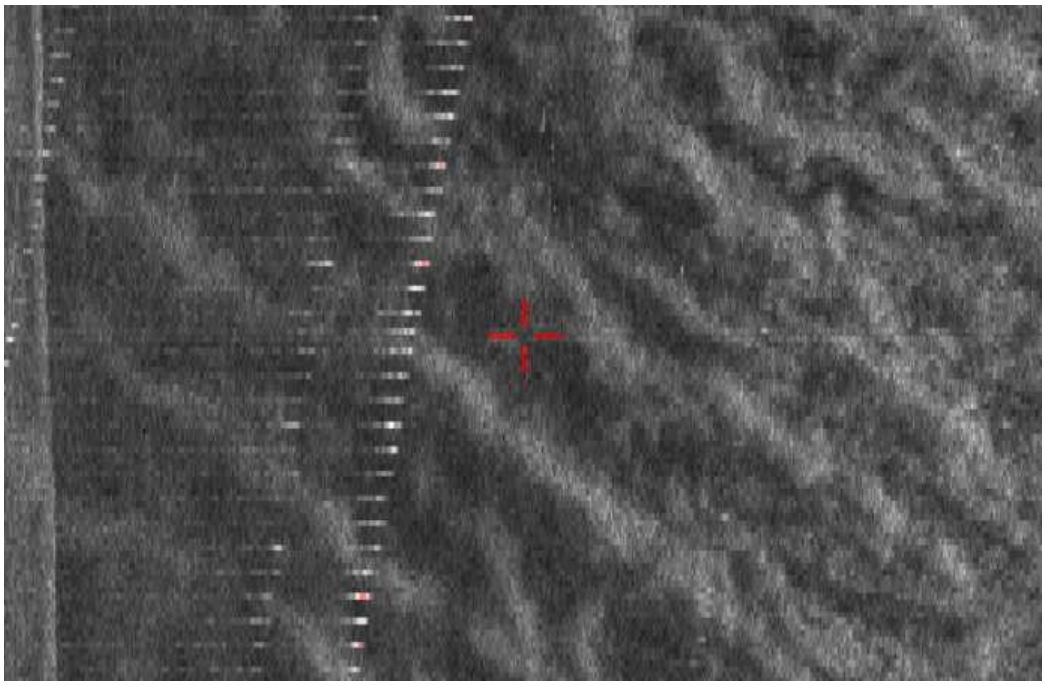

Figure 9: This typical example of a side-scan sonar shows features on the sea-floor which resemble sand ripples due to bottom currents.

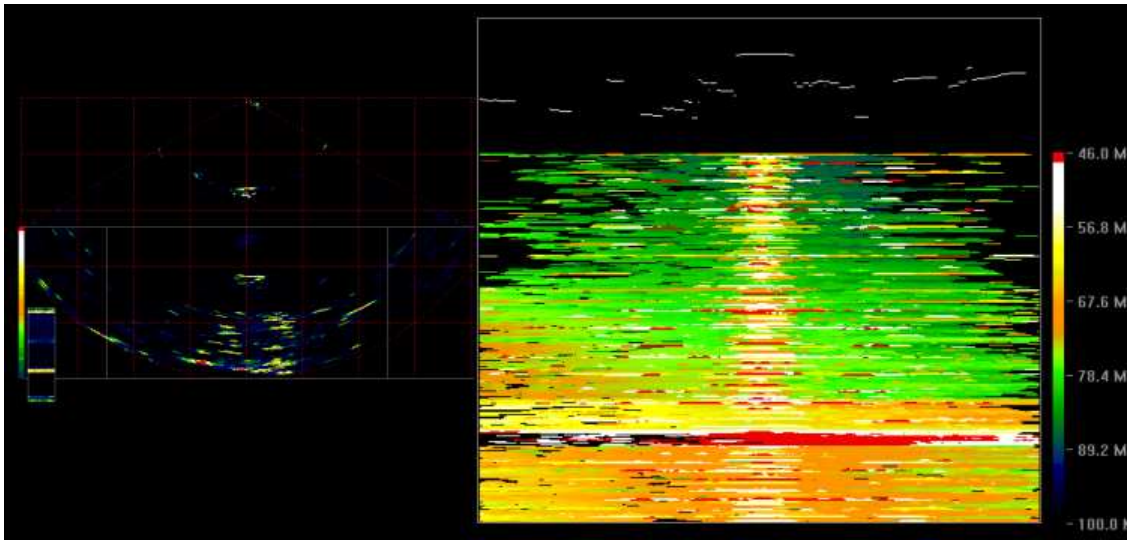


Figure 10: Raw data from the multi-beam shows bathymetry of Conception Bay.

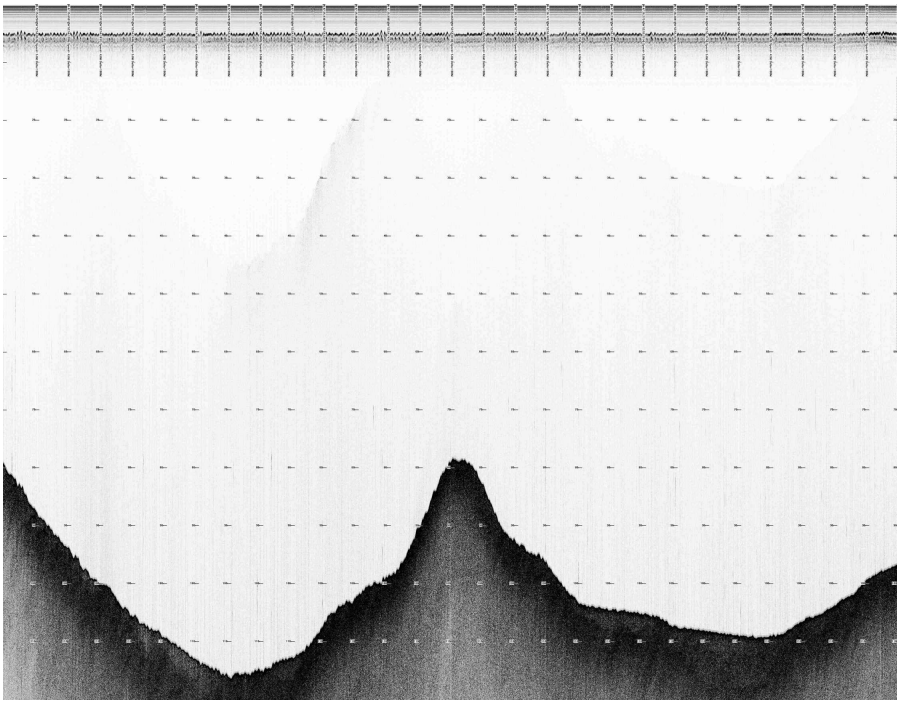

Figure 11: The sub-bottom ”chirp” system shows geomorphological cross-section of the sea floor of Conception Bay.

## 2.3 Biology

To assess the biological composition within Conception Bay, vertical plankton ring toes were conducted at five separate sample sites.

The procedure required a winch to lower the net into the water close to the benthic substrate and haul the net vertically through the water column. As the net was hauled on board, a fire hose was required to wash plankton residue off the sides of the net and into the collection chamber at the bottom. The contents of the collection chamber was emptied into a jar and preserved in formalin until the sample could be processed at a later date.

Returning to the lab, samples were split using a standard sample splitting procedure where the sample was poured into a Plexiglas box and reduced by half until approximately 300 organisms were remaining. The sub-sample was observed under light microscopes where individual organisms could be counted and identified. Assessment of the abundance of organisms present at the different sampling sites required taking the product of the sample split factor and the total count of organisms in the sub-sample. This gives an approximate estimate of the total number of organisms present at the different sites displayed in table 2.

The different species can be observed in figure 12. Copepods were by far the most abundant class of organisms found in all sites. From table 2 it is clear that sites CTD4 and CTD6 had higher abundances of organisms when compared to the other 3 sites. These two separations also represent the two different sampling days.

| Site | Split | Sample Size | Estimated Total |
|---|---|---|---|
| CTD 4 | 1/128 | 1311 | 167808 |
| CTD 6 | 1/256 | 604 | 154624 |
| S1 | 1/128 | 413 | 52864 |
| S2 | 1/128 | 674 | 86272 |
| S3 | 1/128 | 505 | 64640 |

Table 2: Biological Counts

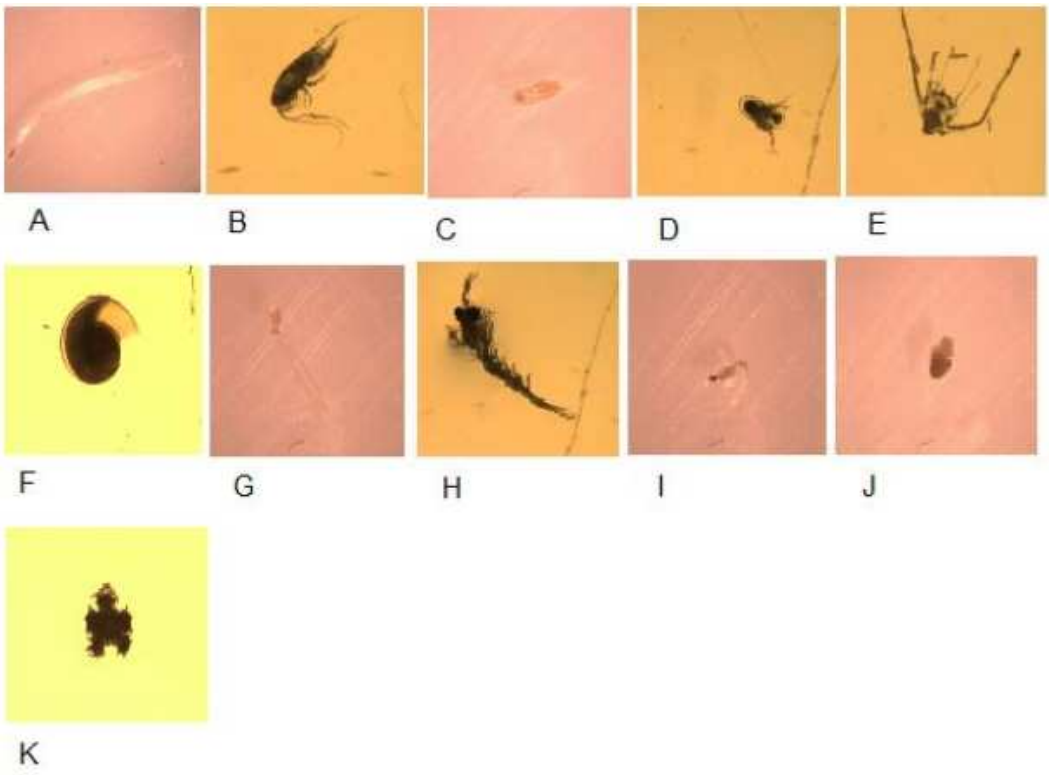


Figure 12: Examples of plankton within the water column of Conception Bay found through vertical ring net tows. A= Chaetognath, B= Copepod -1, C= Copepod -2, D= Cladoceran, E= Echinoderm Larvae, F= Gastropod Larvae, G= Larvacean, H= Mysid, I= Shrimp Larvae, J= Pteropod, K= Starfish Larvae.

# 3 Future Scientific Analysis

## 3.1 Physics

**Moored ADCP** Filtering of data to remove noise. Spectral analysis to reveal tidal signal. Examination of back-scatter to look for interesting phenomena (i.e. internal waves.)

**Towed ADCP** Filtering of data to remove noise. Comparison of cross channel ADCP line to along-channel ADCP line.

**Biosonics** Filtering to remove noise. Comparison of Biosonics with CTD data.

**Thermistor** Examination of thermistor time-series data to reveal possible tidal forcing of temperature.

**CTD** Comparison of collected CTD data with previous 2006 glider data.

## 3.2 Geology

**Side-scan** Creation of a bottom surface map aligned with sub-bottom sonar.

**Multi-Beam** Filter out the noise, and creation of a bathymetry file.

## 3.3 Biology

**Biological Data** Look at the abundance of each species. Compare the abundances between different net tows to establish if there is a statistical significance between the data.