

# Current movement and sediment build-up within Blue Skin Bay

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## Introduction

Our team investigated the possibility of a gyre (circular current movement) that might be responsible for the existence of a bog hole (a term used in fisherman's folklore) in Blue Skin Bay on the coast of Otago. Observations were made using the ADCP (acoustics Doppler Current Profiler), Sonde (YSI Sonde 6600 V2) and underwater camera with DVR.

## Why?

We chose to study the proposed Blue Skin Bay gyre, as our findings could be useful to the fishing industry. Fishermen are unable to fish at the site, as their nets would become full of sediment, resulting in poor fishing. Blue Skin Bay was presumed to be a bog hole and is generally avoided by fishermen. We believe that this bog hole is the direct result of a gyre.

A gyre is a circular current movement, ranging from small eddies to large bay sized currents. A gyre picks up heavy sediment and dumps it toward its core this leaves a potential bog hole.



The red circle is shows the location of Blue Skin Bay and the mouth of the Blue Skin Bay estuary. This image shows the current movement outside of Blue Skin Bay, where the coastal neritic water mixes with deeper waters from the sub tropical convergence. It is clear from the image that there is a lot of current movement.

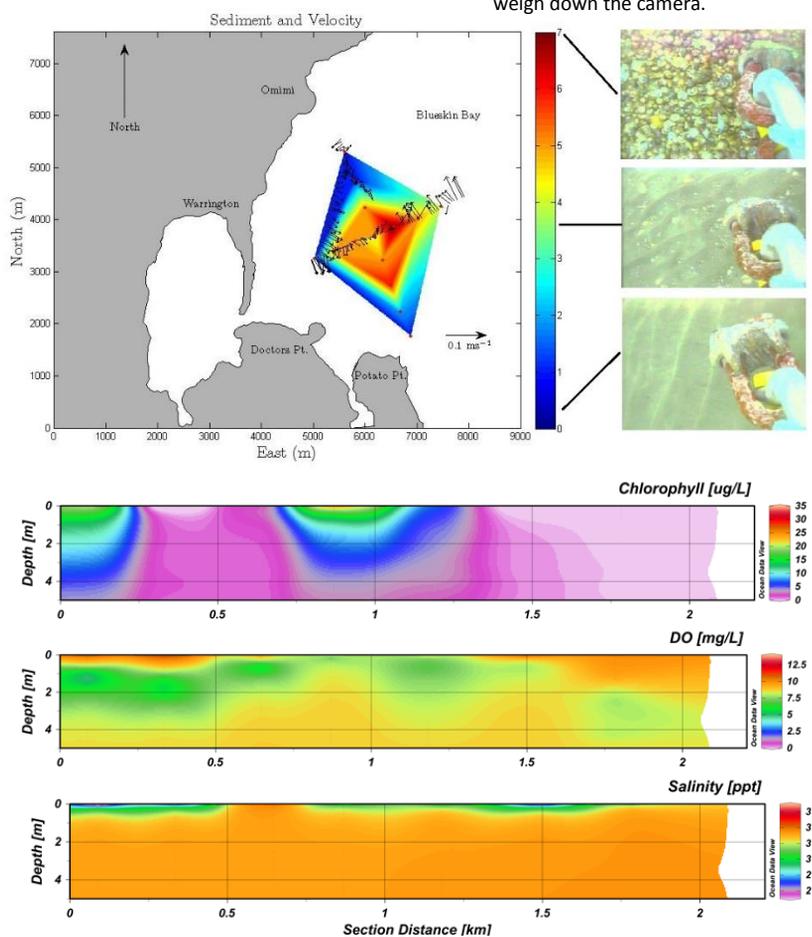
The contour plot below shows sediment types and location. There was a clear variation between some areas, as seen in the images below. The blue and red object in the bottom of the images are the bolt used to weigh down the camera.

## Method

The ADCP (acoustic doppler current profiler) measures the current movement, which we used to create a visual image of the current movement in the area of Blue Skin Bay. We recorded data from the ADCP in the general area of Blue Skin Bay in which we were surveying. Unfortunately, the reliability of the ADCP's data is questionable, as the results were affected by the boats movement when we stopped to do Sonde drops. These periods were averaged out. The Sonde was dropped in an X formation, starting in a North West direction, and then in a North East direction. We also recorded in-between transects. The X formation was executed in order to give a more accurate image of parameter conditions this gives a more accurate chance of getting a possible gyre diameter. The intention for our Sonde drops were to find the temperature, salinity, dissolved oxygen and chlorophyll A levels in that area. This group can be referred to the term parameters. We dropped the camera along with the Sonde, giving a qualitative image of the state of the seafloor.

Later, we graphed the results, averaging the parameters in the area.

The data of the Sonde was transferred to excel, 'cleaned', and then transferred to the programme ODV (Ocean Data View, version 4 2013) and split into systematic cross sections of the two transects so that we could visibly compare the parameters of the Sonde drops to depth and distance. The ADCP data was transferred to the programme Mat Lab and then converted to a systematic satellite view of the Blue Skin Bay area. This gives us a nice triangular shaped image to represent the current movement. The camera videos were viewed and then ranked by the condition the sediment on the sea floor. The videos were viewed analysed and then ranked by a group of six so that the results wouldn't be biased. For example, some videos showed many shells, and some videos showed large ridges made up of different sand densities. This information was qualitative, but very useful nonetheless. These rankings were transferred to a map of the Blue Skin Bay area using the coordinates of where they were filmed. This, with the use of Mat Lab, was transferred to a contour plot.



The graphs above show the chlorophyll, dissolved oxygen and salinity levels in relation to the section distance and depth. They coincide the contour plot.

## Discussion

By comparing the data, it suggests that there is current movement similar to that of a gyre. The contour plots showed a general trend of a circular anticlockwise current flow deep within the bay. Supporting this, the direction of Warrington sand Spit is from North to South, in the direction of the current flow. As another example, the ADCP's analysed data showed that there are some small currents flowing with the bay in a general counter-clockwise direction. The contour plot also suggested that there was some heavy sediment build up in a circular shape towards the centre of the bay.

To be conclusive, we would need to complete further tests, such as ADCP runs, Sonde transects and video sampling. However, it is fair to say that there are current movements within the Blue Skin Bay area that suggest a gyre like movement.

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