Using low-cost sidescan sonar to map sediment type & in-channel habitats in Glen Canyon.

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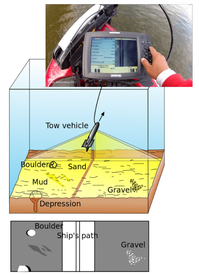
We imaged the riverbed in Glen Canyon before & after the 2013 HFE using low-cost sidescan sonar.

- We're using cheap sidescan sonar unit for rapid assessment of shoreline & in-channel habitats. The instrument provides georeferenced soundings for depth & bed texture.
- We are developing software for processing sidescan sonar data & working on methods to automatically classify sediments using sonar data (in conjunction with underwater video images of various substrates).
- There is a need for mapping bed substrate & texture as it relates to the production of invertebrates & vegetation on the channel bed. This work is supporting biological monitoring & research projects, namely, Natal Origins of Rainbow Trout & Aquatic Foodbase.
- This poster presents data from opportunistic sampling in Glen Canyon in October & December 2013, & details our research directions.

The Humminbird is a low-cost commericial fishfinder with downward & sidescan sonars.

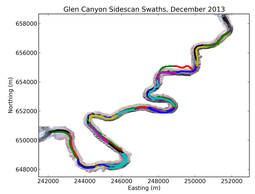
- Can be deployed rapidly in very shallow water from virtually any boat.
- Rugged, water proof, low power consumption. $1500 with GPS & computer included.
- 455 kHz sidescan sonar, 83 & 200 kHz downward looking sonars.
- We're developing a set of software tools for the extraction of data from the unit, rectification of the scans, & automated classification of bed textures. The software (Beta) can be found at https://github.com/dbuscombe-usgs/PyHum



Sidescans provide 1D traces several times a second to image the water column & riverbed. The Humminbird is a cheap, easy to use & durable sidescan sonar. The complete channel can be mapped using 3 passes (center, & both shorelines).

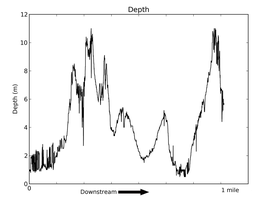
We're investigating whether the sidescan unit can provide information at the resolution required for change detection analysis pre- & post-HFE..

- This will require that the imagery is rectifiable, that adjacent swaths can be merged to provide detailed pictures of the bed, & that the imagery is of sufficient resolution to capture the finer sediments.

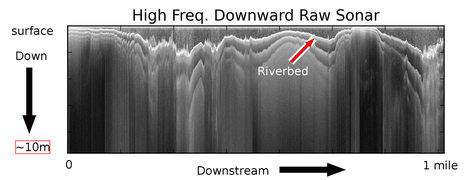


All sidescan traces collected in a couple of days in December 2013 following the November HFE.

The downward sonar provides depth & can tell you about the hardness of the sediment under the boat.

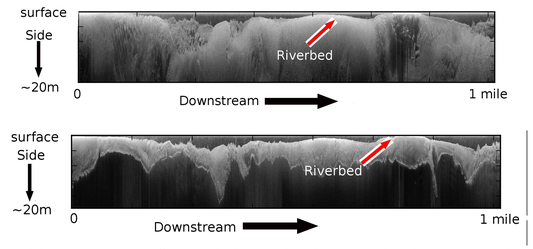


The depth estimate comes from the 200kHz downward looking sonar (singlebeam echosounder).



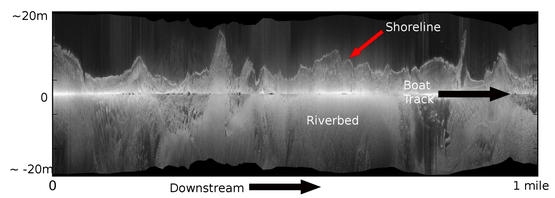
The nature of echoes received tells us about the hardness of the bed. More echoes closely spaced indicates hard substrates.

The 2 sideways-looking sonars image the bed up to 120 ft from the boat in deep water.

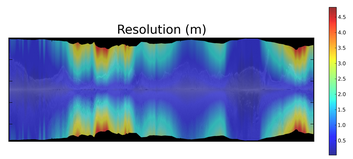


Starboard & port side scans are collected independently & need to be merged & rectified to give an overhead view of the river bed (below).

The bed is found & the two sidescans are merged. Different textures correspond to different sediments.

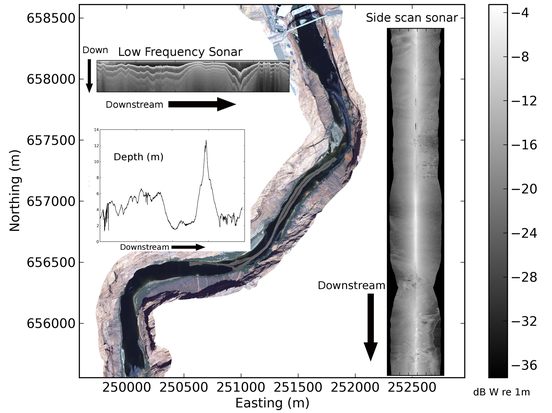


The bed is picked & water column removed. The port & starboard scans are then merged.

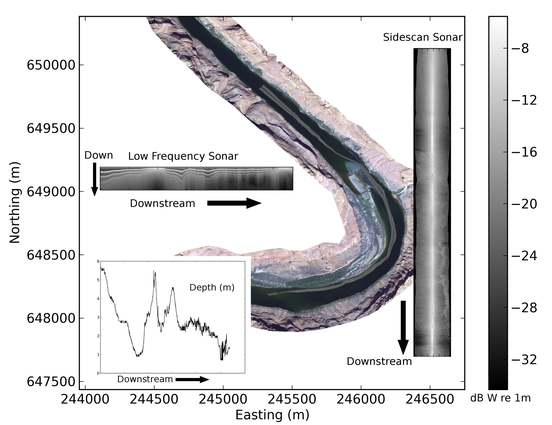


It's possible to estimate the footprint (resolution) of each sidescan 'pixel', which depends on depth & bed slope.

It's possible to rectify the scans using GPS coordinates of the boat & some knowledge of (& assumptions about) the sonar geometry



Composite of data at Fourteen Mile Bar (-14.5 to -14 mile) in December 2013 including rectified sidescans.



Composite of data at Four Mile Bar (-4.1 to -3.1 mile) in December 2013 including rectified sidescans.

Summary & ongoing work.

- We've made progress towards our goal of bed sediment classification in Glen Canyon using low-cost sidescan imagery.
- Ongoing work includes an analysis of the precision of the unit's GPS, & image rectification procedures.
- Future work will consist of developing supervised bed texture classification algorithms based on concurrent video observations of the bed.

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