Seabed images: keeping track & making sense

David Bowden[1]*, Brent Wood[1], Jens Greinert[2], and Don Robertson[1] (*d.bowden@niwa.co.nz)
[1] National Institute of Water and Atmospheric Research Ltd (NIWA), Private Bag 14-901 Kilbirnie, Wellington, New Zealand. [2] University of Ghent, Belgium

NIWA Taihoro Nukurangi

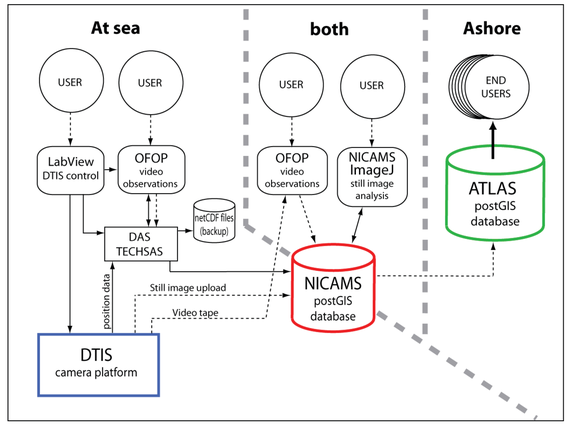
Introduction

Photographic sampling of the seabed affords great potential for developing new insights into the ecology of seabed assemblages and ground-truthing of broad scale acoustic surveys. However, images bring their own problems of data management and analysis.
At NIWA we are developing standardised techniques for keeping track of, and making sense of, seabed images. These include software for logging geo-referenced observations during video transects, databases for long term management of images and metadata, and an image analysis application integrated with an extensive reference database supporting taxon hierarchies, substrata, and anthropogenic features. The goal is routinely to generate managed, audited, data from video and still images in a form that can be used directly in ecological analyses and habitat mapping.

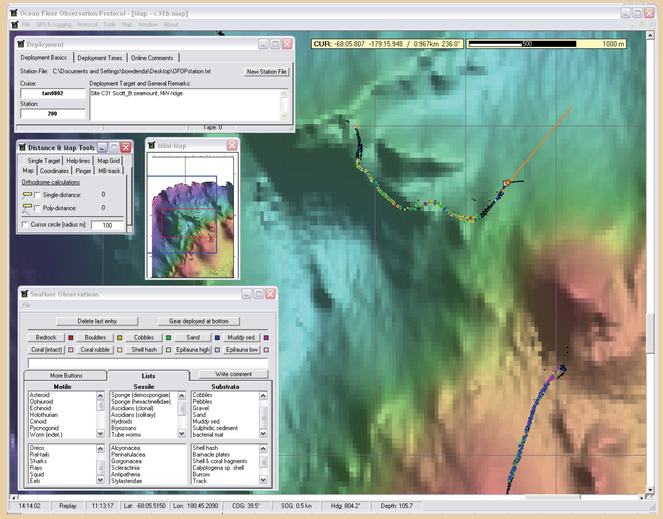
The scheme

Work flow from camera deployment at sea (using OFOP), through data extraction and management (using OFOP & NICAMS), to archiving of images and extracted data ashore (using NICAMS & ATLAS).

NIWA's Deep Towed Imaging System (DTIS)



OFOP (Ocean Floor Observation Protocol)



OFOP in use: logging positions and observations during DTIS camera deployments on seamounts in the Ross Sea.

OFOP at sea: keeping track

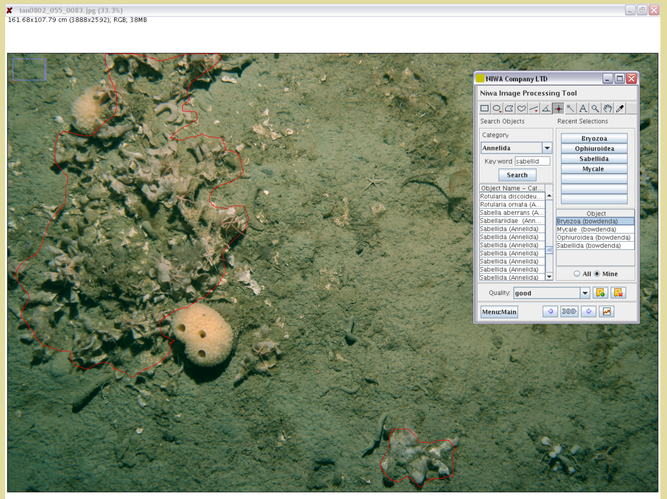
Conceived by Jens Greinert (University of Ghent, Belgium) and further developed in collaboration with NIWA and others, OFOP lets us:

- plan where the camera is going to sample,
- track where it is *actually* sampling,
- keep accurate records of times, positions, observations, and other metadata

OFOP allows real time tracking of ship and camera vehicle against any raster image of the seabed, typically multibeam bathymetry or sidescan sonar. During transects, spatially-referenced logs of all events (e.g. start and stop of video, still image frame capture) and observations (fauna, substrata, technical notes) are recorded in real time and broadcast to the ship's data acquisition system.
Observations from previous camera transects can be displayed against bathymetry to facilitate planning of subsequent deployments; particularly useful when targeting restricted habitats such as methane seeps.

NICAMS

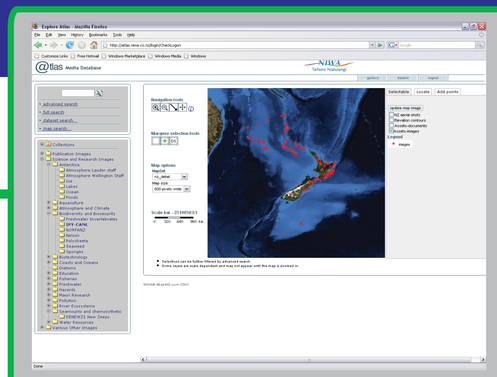
(Niwa Image Capture and Management System)



NICAMS in use: image analysis tools integrated with taxon and substrata identifications in a spatial database.

OFOP in the lab: video analyses

OFOP incorporates tools to smooth and spline acoustic track data, and can synchronise video files (avi, mpeg, mov etc) with splined tracks, enabling us to rerun seabed transects in the lab. This allows detailed analyses of fauna and substrata using video pause, slow-motion, and review facilities. All observations are logged against seabed position at 1 s intervals. Log files are imported into a PostGIS database with scripts which allocate observations to user-defined categories that are either continuous (e.g. substrata) or point observations (e.g. motile megafauna).



@TLAS

Atlas is a commercial Digital Asset Management application (www.atlasmd.com) that NIWA has purchased as its central image library. To support images for which location metadata are critical, such as seabed photographs, NIWA has funded development of a spatial capability in Atlas, which allows stored images to be selected using a map interface.

Why NICAMS?

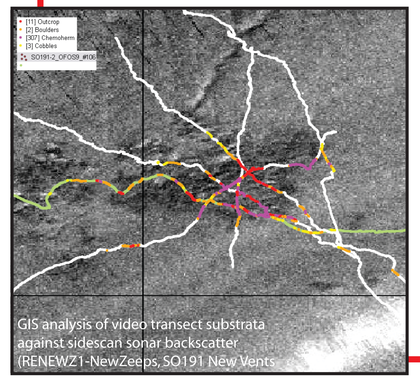
To extract data from images consistently and repeatably we needed

- a uniform data structure
- a means of audit to ensure consistency of descriptions and measurements between analysts and analyses,
- a single source for taxon hierarchies and substrata descriptions.

To meet these needs we adapted the open source image analysis application ImageJ (http://rsbweb.nih.gov/) and linked it to a purpose-built PostGIS database.

Using NICAMS to analyse images

Analysts search and select from the full *Species 2000* taxonomic hierarchy and a table of generic substratum descriptors. Regions of interest (ROI) can be point observations (e.g. motile fauna) or areas (e.g. substrata). These are saved in an ROI file which is associated with the image in the database and referenced to the analyst. Thus, the image is unmodified but all identifications and descriptors, together with the points or polygons they refer to, can be retrieved at any time for comparison or audit. The database can be interrogated by SQL query or directly by many GIS packages (QGIS, JUMP, uDIG, etc) and data can be extracted in a variety of GIS formats (e.g. Mapinfo, ESRI shapefile) for use with applications which cannot access the PostGIS database directly.



GIS analysis of video transect substrata against sidescan sonar backscatter (RENEWZ1-NewZeeps, SO191 New Vents