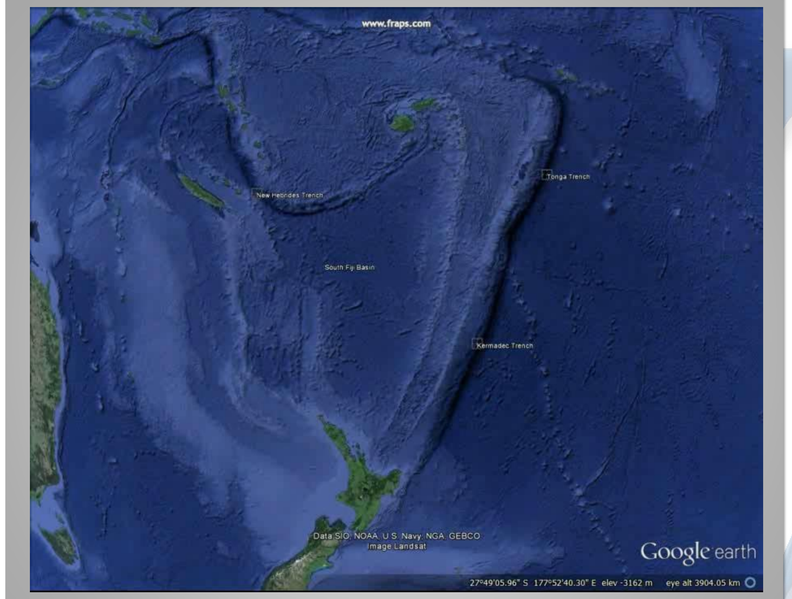
Current Projects: The Deep-Sea Fish of the Pacific Rim

Linley, T[1], Stewart, A[2], Clarke, M[3] and Jamieson, A [1]

1. *Oceanlab, University of Aberdeen – T.Linley@abdn.ac.uk*
2. *Te Papa Museum, Wellington*
3. *NIWA, Wellington*

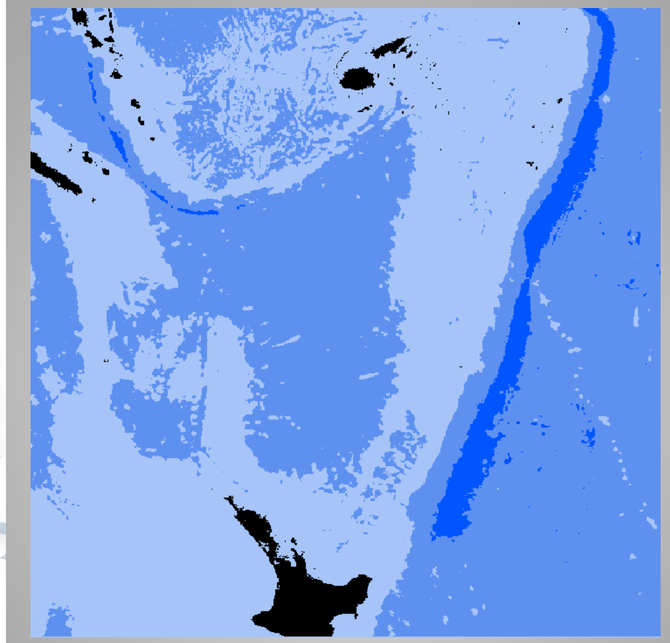
The deep-sea has been shown to exhibit strong depth zonation in species composition and abundance[4;6;12]. Depth has become a dominant factor when we discuss where a fish is found.

The abyssal plains beyond the continental slope; often categorized as 3500 - 6500m[1] depth, posses relatively uniform environmental conditions[8;9;2;7]. This generally homogeneous environment allows many abyssal fish species to have a near circumglobal distribution[3]. The deepest oceanic zone: the hadal zone, exists only as isolated trenches within the abyssal plane. Extending to full ocean depth, this zone accounts for 45% of the vertical depth gradient but makes up just 1-2% of the benthic area[5].



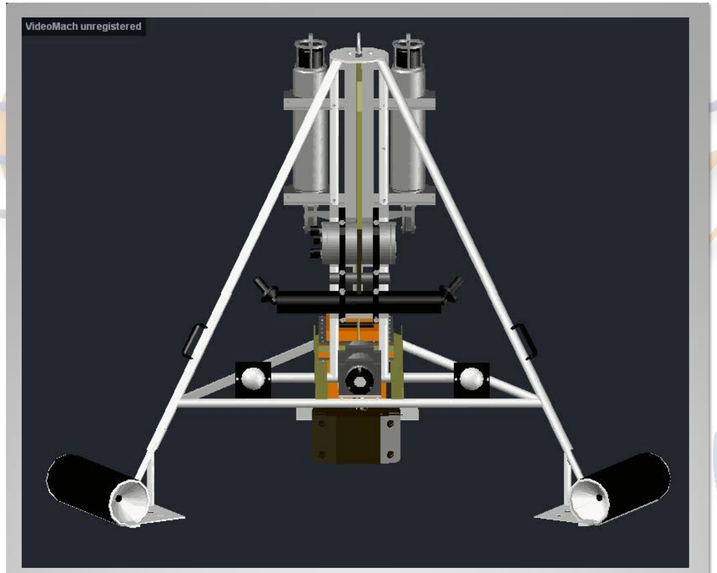
The New Hebrides, Tonga and Kermadec trenches surrounding the South Fiji Basin

The changes between abyssal and hadal fauna appear to take place gradually between 6,000 and 7,000m and was thought to primarily be caused by changes in hydrostatic pressure and favourable feeding conditions[10;11]. Jamieson *et al.* (2010) warns that separation of environment strictly by depth may hamper our understanding of the hadal environment as there are additional unique conditions in the hadal trenches; the extreme and isolated nature of these areas result in a specific ecological character.



Map of the South Fiji Basin highlighting hadal trenches, abyssal planes and shallower regions

Few systematic studies of the hadal trenches and their relationship to the surrounding abyssal planes have been conducted. The South Fiji Basin offers a great opportunity as it contains a large abyssal plane surrounded by three hadal trenches of varying isolation.



The now completed Hadal Lander rated to 11,000m

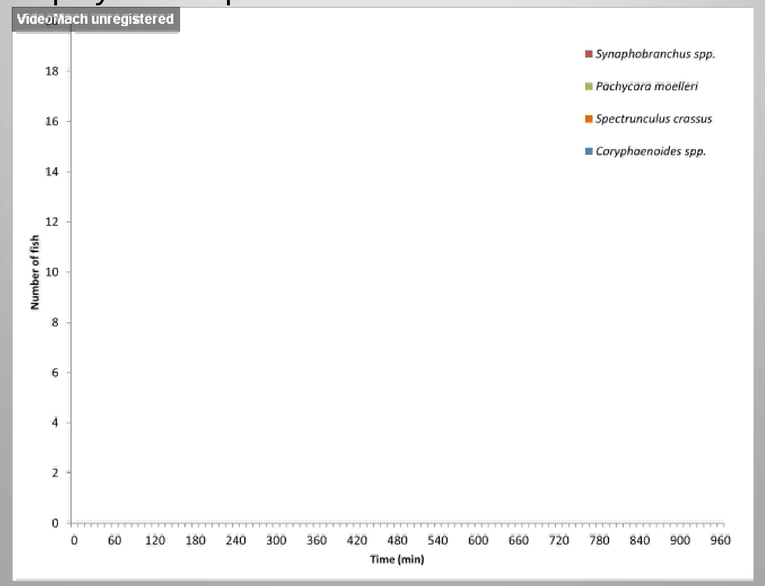
Gear deployment aboard the *RV Kaharoa*

The hadal zone has been unlocked to new forms of analysis with developing technologies but much of the work as been unstructured[5]. Due to the extreme depths being studied; cabled devices are expensive, time consuming and potentially dangerous. The use of pop-up vehicles negates the need for large vessels and expense. Upon release from the vessel the vehicles are equipped with flotation and ballast. While the ballast is attached the equipment is negatively buoyant and sinks to the study area. Upon acoustic command from the surface the vehicle releases its ballast and returns to the surface. This methodology requires only a small vessel and minimal crew.

The use of bait, to lure scavenging animals in view of the camera or into a trap, congregates the low density animals of the deep-sea. This allows a static mooring to collect a large amount of data on the organisms in the surrounding area. It is possible to infer elements of their ecology through the rate of their arrive and the time they remain at the bait.

The project will collect digital and physical data by employing photographic and HD video vehicles and traps.

Progression of fish at the bait over time. The counter is in the form HH:MM:SS. The same deployment is plotted below



An expedition to the Kermadec trench has already been conducted and another to the New Hebrides trench is planned for later this year. Two further expeditions are planned for the following year.

Of the data collected so far; the physical samples provide us with accurate length and weight measurements as well as the opportunity for traditional taxonomy and tissue samples. Physical samples also provides us with voucher specimens for the validation of our *in situ* imaging.

Processing of fish specimens caught via trap and taxonomic illustrations based upon them

Behavioural observations of *Simenchelys parasitica* “drilling” into bait and *Coryphaenoides armatus* following an odour plume and intercepting bait

The photographic lander takes still images from above the bait and due to the fixed field of view allows for animal counts, density and size estimates.

The videos allow for behavioural observations such as foraging behaviour when following the bait odour plume and methods of feeding that have not been observed previously.

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