Pilbara Marine Conservation Partnership
Fish and Sharks – Uncovering Fish-Habitat Relationships

The Pilbara region in Western Australia is known for its rich marine biodiversity, recreational and commercial fishing and its contribution to the Australian economy. The region is home to an array of fish and shark communities, which are described as highly diverse and play an important ecological role in the regions marine environment. Given the need to balance the goals of natural resource conservation alongside developments such as offshore gas and petroleum production, a baseline understanding of habitats, fish diversity and distribution is needed. To help achieve this outcome, the Pilbara Marine Conservation Partnership have worked closely with the state's statutory agencies to deliver a broad scale understanding of the patterns of fish and shark abundance distribution in relation to habitat, and developed novel methods for future work.

Background

The Pilbara region (in Australia's north-west) hosts a highly diverse fish assemblages which are also noted for their and economic importance to both commercial and/or recreational fishers.

Fish assemblages are known to be particularly vulnerable to fishing pressure, climate change and activities that affect habitat quality. Those responsible for the management of natural resources are challenged with finding a balance between the economic benefits of extractive industries such as fisheries and oil and gas development with the maintenance of biodiversity and ecosystem services.

To help inform these decisions, researchers from The University of Western Australia (UWA) and CSIRO, through the Pilbara Marine Conservation Partnership (PMCP) have undertaken the first regional-scale assessment of the conditions of, and threats to, finfish and shark biodiversity assets.

The Approach

The key objectives of the fish and shark research included gathering a baseline and quantifying the condition of fish and shark assemblages across the Pilbara; and investigating human-induced changes by assessing and comparing composition, abundance, size-structure and biomass of fishes across gradients in fishing pressure (including inside and outside closed fishing areas).

To achieve these objectives the team surveyed ~340 km of coastline between Coral Bay and Dampier (2013 to 2016), deploying almost 2000 Stereo Baited Remote Underwater Video systems (BRUVs) and conducting over 1200 Diver Operated stereo-video (DOVs) transects.

Data on size, distribution and abundance for over 550 fish and shark species were collected and their relationship with a range of nearshore habitat, environmental and geographical variables assessed.

As part of the research, the team has also developed new light-weight and cost effective techniques for the rapid assessment of fish-habitat associations.

Figure 1: BRUVS showing Bass, cod and sea snake.
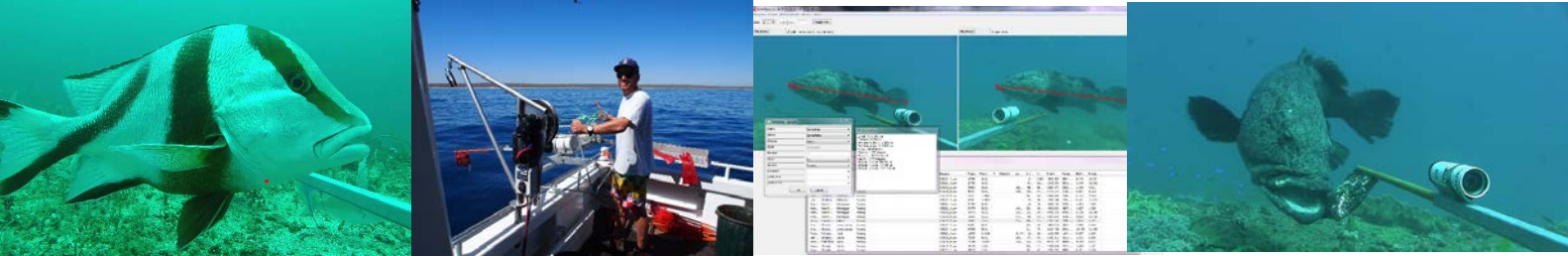
Pilbara Marine Conservation Partnership
Fish and Sharks – Uncovering Fish-Habitat Relationships

What did we uncover?

The research team investigated fish and habitat associations by analysing fish assemblages of four dominant habitat types (Fig 2). The results show that islands in the southern part of the Pilbara, including North and South Muiron, Serrurier, Bessieres, Thevenard and Airlie Islands possessed species-rich assemblages with high abundances of fish, including important species targeted by fishers and protected species. These islands have structurally complex reef systems with a high coverage of hard corals, macroalgae and soft corals.
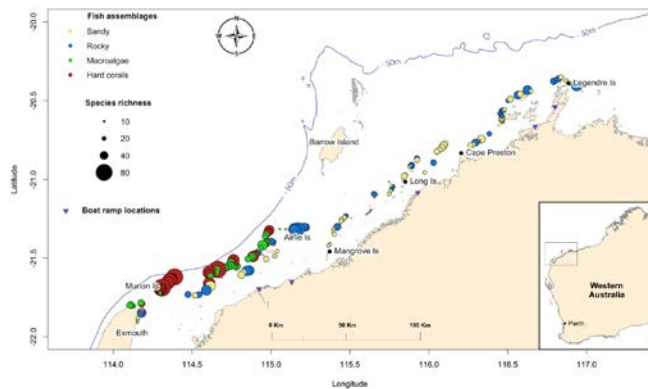

Figure 2: Spatial distribution of species richness as sampled by stereo-BRUV and the associations of particular fish assemblage types with particular types of dominant benthos as indicated by multivariate regression trees. Courtesy of Laura Pittino.

Data collected near Dampier Archipelago on the short-lived commercially important target species the blue spotted emperor (*Lethrinus punctulatus*) revealed strong associations with depth, with small juveniles showing a strong preference for shallow macroalgal beds. Individuals were found to shift from shallow to deep water as they grow to avoid predators. This observation highlights the importance of shallow water habitats for maintaining stock levels and the need for these areas to be considered in decisions which are aimed at enhancing sustainable fisheries management practices in the region.

As part of this work, a novel, cost-effective, standardised method for rapidly quantifying habitat cover and relief was derived for data collected using forward-facing stereo BRUVS. The technique developed uses CATAMI (the Australian standard for habitat classification) and has been made freely available on Github.
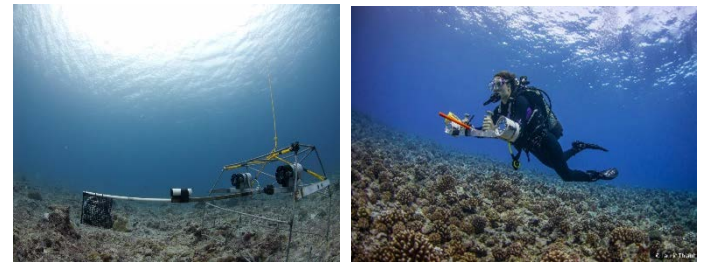

Figure 3: Stereo-BRUVs set-up (left) and Stereo-DOVs transect being completed (right).

Who is this information useful to?

Substantial datasets from this work are now available (online at GlobalArchive) for reporting on the condition of fish and shark assemblages across fishing pressure and environmental gradients. Understanding where juvenile fish and shark are associated with benthic habitat is critical for conservation planning, characterising habitat and sustainable management of the fisheries in the Pilbara. The data from this research also form the much needed baseline for researchers to study impacts, and are invaluable to industry for impact assessment and oil spill planning and response purposes.

The powerful analytical approach developed as part of this research for gathering knowledge is now available for broader application in biogeography studies.

Lead contact details

Tim Langlois, UWA: Timothy.langlois@uwa.edu.au

Dianne McLean, UWA: Dianne.mclean@uwa.edu.au