

Listening to climate change

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Understanding of climate change induced ecological changes is a critical input to future natural marine resource management. However the underwater absorption of visible light, the large spatial and temporal scales involved, and the limitations of conventional evaluation/monitoring techniques are major challenges in underwater ecosystem monitoring. Passive acoustic assessment and monitoring of underwater environments offers a unique ability to obtain quantitative information regarding relative ecological state over large areas, for long periods of time, and in a cost-effective manner. Spectral analysis of these signals provides quantitative insight towards the characteristics of sound producers and may elucidate relative levels of ecosystem health on spatial and temporal scales in the face of climate change induced environmental changes. Here we evaluate the ability of passive acoustic monitoring to detect and characterize spatial gradients of sound-field spectral characteristics over a well-studied gradient of ecological disturbance in the Northern Line Islands archipelago. Existing ecological data obtained through video surveys and fish transects are compared to the spectral qualities of reef noise recorded in November 2010 using a variety of signal processing and statistical tools. Correlation between acoustic and ecological gradients may indicate that our impact upon the marine ecosystem is acoustically quantifiable. It is envisaged that the spatial gradient of ecosystem disturbance may serve as a proxy for temporal gradients of anthropogenic impact brought about by climate change. This is a key step towards the development of passive acoustic monitoring as a means to evaluate anthropogenic impacts on marine ecological states. Mitigation of climate change related impacts on marine resources will become increasingly important to economic stability and conservation efforts in the future. The quantitative nature of passive acoustic monitoring may enable characterization of what will in many cases be subtle yet significant ecological changes over large spatio-temporal scales.