Shark Bay World Heritage site – seagrass recovery and restoration challenges in a changing ecosystem

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Understanding how organisms respond to environmental change and how rapidly new adaptations can evolve is key for predicting how ecosystems will respond to global environmental change, and thus help in prioritizing sites for restoration. Shark Bay is a World Heritage site in the north west of Western Australia. The complicated coastline creates a unique and complex series of environmental gradients for those species inhabiting the marine environment. Shark Bay sits at the interface of tropical and temperate waters, and this is reflected in the high biodiversity. Two temperate seagrass species dominate the meadows - Amphibolis antarctica and Posidonia australis – 'forests of the ocean' creating habitat, controlling sediment movement and blue carbon stores. Both species were both impacted by the extreme (+5ºC) and prolonged (3-4 months) marine heat wave in the summer of 2011. Five years on and these species have had quite different responses: A. Antarctica initially suffered from leaf loss and longer term reductions in below ground biomass, but is now showing signs of recovery through strong recruitment, while P. australis shows a continuous decline in leaf density, and ongoing widespread failure to produce many viable seeds. Restoration trials based on locally-sourced, transplanted rhizome are showing signs of success and the recent identification of a viable seed-producing meadow has allowed pilot-scale seed-based approaches to get underway. These range edge meadows for P. australis are under threat from tropicalisation of these waters as the meadows are at their thermal and salinity tolerance limits, with limited opportunity for recruitment from seeds without active translocation from viable sites. How much effort should be put into restoration of P. australis in this system? Should we be restoring meadows in sites that may no longer be able to support temperate ecosystems into the future?