



# LEADING THE WAVE OF CHANGE

ARATAKINA TE NGARU O TE HURINGA

IANZ 2023 ANNUAL CONFERENCE

17 - 19 October 2023 | Auckland, NZ

Muriwai Beach, Auckland

## PRESENTATION | INTERACTING STRESSORS ERODE ECOLOGICAL INTEGRITY IN THE COASTAL ZONE: IMPLICATIONS FOR MANAGEMENT

### ABSTRACT

The cumulative effects of multiple stressors have the potential to erode ecological resilience making ecosystems prone to threshold responses and tipping points. Demonstrating empirically and at scale how stressors interact to alter biodiversity and ecological functioning in complex systems with high environmental variability is challenging but such evidence is needed to underpin management, including consenting. As part of the National Science Challenge Sustainable Seas we investigated the cumulative effects of two important stressors in the coastal zone (land derived nutrients and sediments) on biodiversity and ecosystem functioning. A large-scale field experiment was conducted manipulating sediment nutrient concentrations (a proxy for enrichment) at 24 sites in 15 estuaries spanning a gradient in turbidity (sediment inputs from land). Results from an ecological interaction network analysis highlight how turbidity diminishes the important role key shellfish species play in processing nutrients, leaving estuarine ecosystems more vulnerable to eutrophication. Moreover, biodiversity-ecosystem functioning relationships changed markedly as turbidity increased. In clear estuaries nutrient stress induced reductions in biodiversity did not result in a loss of ecosystem multifunctionality whereas in more turbid estuaries biodiversity loss was associated with a decreased functional performance and thus ecological integrity. Our results have important implications - maintaining or increasing ecological integrity requires management of multiple stressors and national limit setting for stressors without consideration of interactions may make ecosystems vulnerable to tipping points.

## SPEAKER BIOGRAPHY



### JUDI HEWITT

Judi Hewitt is a professor of statistics at the University of Auckland, previously working for NIWA. She has a wide range of research interests in marine ecology, designing robust monitoring programs, innovative approaches to data analysis and the science-management interface. Dr Shaun Awatere (Ngāti Porou) is based at Manaaki Whenua and his research involves the incorporation of Māori values into economic decision-making, enabling Māori organisations to make more kaupapa Māori attuned decisions. While most of his research has been in the freshwater space he has been involved through the Sustainable Seas NSC in the marine area. Conrad Pilditch is Professor of Marine Science at the University of Waikato. Recently he has focused on determining biodiversity and ecosystem function responses to globally important stressors in our harbours and estuaries. Conrad's bio-physical research interests provide critical links between field-based science and models of ecosystem processes that underpin marine management. Simon Thrush is a Professor at Auckland University and Director of the Institute of Marine Sciences. His ecological research has focused on disturbance-recovery dynamics and understanding human impacts on marine ecosystems. He has worked extensively with social scientists to change management processes for the better of the environment. Dr Paula Blackett is an Environmental Social Scientist working at NIWA. While the major focus of her work lately has been on climate risk and adaptation, she has also heavily researched participatory processes in decision making, including world views and balances of power. Joanne Ellis is an Associate Professor at the University of Waikato, and her research focuses on detecting and understanding the effects of human activities on marine ecosystems. This has led her into methods of estimating ecological risk and uncertainty and the impacts of mismatches in management and ecological scales. Dr Rebecca Gladstone-Gallagher is a research fellow at the University of Auckland. She is a conceptual ecologist and her present research focusses on introducing ecological theory onto management frameworks. Jasmine Lowe is an emerging researcher based at the University of Auckland working across the economic- ecological divide. Supported by senior researchers Jasmine has led a piece of work showing how maps of stressor footprints translate to ecological response footprints and is presently doing a PhD on modelling community-based restoration efforts.