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Marine Ecosystem Assessment of the Southern Ocean

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Rowan Trebilco is a marine ecologist with the Antarctic Climate & Ecosystems CRC (ACE CRC) in Hobart, where his research focuses on developing models, methods and analyses to facilitate assessment of Southern Ocean ecosystem status and trends, and to advance fundamental understanding of ecosystem structure and function. Broadly, he is interested in understanding the processes that shape marine ecosystems at scales ranging from local assemblages to global biomes, with the goal of informing conservation and management. He holds a long-standing interest and engagement in the interface between science, decision-making and environmental stewardship.

Rowan joined the ACE CRC in 2014, and from 2015—2017 he held a RJL Hawke Fellowship through the Australian Antarctic Program to lead development of size spectra models to improve representation of mesopelagic fishes and squids in Southern Ocean ecosystem models. Before joining the ACE CRC in 2014, Rowan completed his PhD in Canada as Vanier Scholar at Simon Fraser University, studying how trophodynamics, habitat effects and anthropogenic pressures combine to shape the structure and function of fish communities on temperate and tropical reefs. Prior to his PhD he completed an MSc in Biodiversity Conservation and Management as a Rhodes Scholar at Oxford (2007-2008). Before that, he spent a few years bouncing between Hobart and the sub-Antarctic working for the Tasmanian state government and the Australian Antarctic Division on seabird and marine mammal conservation and monitoring projects.

Big questions, next steps and future for science on modelling habitats, species and ecosystems in the Southern Ocean

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Statistical and dynamical models are central to assessments of the status and trends of habitats, species and ecosystems. Diverse different types of models, focused on different parts of the system, fit into the tool-box for assessments; spanning from earth systems models, through biogeochemical models, habitat models, species population (autecological) models, models of food webs (and parts thereof), end-to-end (physics to predators) ecosystem models, to socioeconomic models. These models form an inter-related and overlapping hierarchy (and some models encompass multiple components) that may be used for developing assessment methods, predicting future states, integrating and contextualising observations and results from process studies, and optimising observation and management strategies. This can help address the over-arching questions: how can we best manage ecosystems to sustain provision of ecosystem services, maintain amenity, avoid surprises and avoid prejudicing future options; and what should we measure to help help us do it?

In this talk, I'll discuss progress toward these outcomes in the Southern Ocean modelling community, and consider the big questions/challenges and promising directions for achieving them. Historically, both in the Southern Ocean and globally, different parts of the hierarchy of models described above have mostly been modelled independently. In addition to improving individual models and addressing key uncertainties, a major goal moving forward will be to

develop integrated ensemble approaches - at organisational, national and international levels ("integrated modelling"). Doing so will build capacity for comprehensive, internally consistent, system-level assessments, help address structural uncertainty, and improve capacity to capture higher-level feedbacks and predict tipping point. Other big questions, next steps and future directions for modelling habitats, species and ecosystems in the Southern Ocean that I will consider in this talk include: the importance of building consensus on the questions (scenarios) that models are used to address - as is currently happening through IMBeR ICED; integrating models with observations to improve both (i.e. using observations in ecosystem model development, and using ecosystem models to optimise observing system design); and how model representation of data signatures could help us better assess ecosystem models.

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