Integrating multibeam echosounder water-column data into benthic habitat mapping

Peter Porskamp¹, Alexandre Schime¹²³, Mary Young¹, Alex Rattray¹, Yoann Ladroit³ and Daniel Ierodiaconou¹

¹Centre for Integrative Ecology, School of Life and Environmental Sciences, Deakin University, P.O. Box 423, Warrnambool, VIC 3280, Australia
²NGU. Leiv Eirikssons vei 39, 7040 Trondheim, Norway
³NIWA. 301 Evans Bay Parade, Hataitai, Wellington 6021, New Zealand

Kelp forests worldwide are under ever increasing pressure from anthropogenic impacts including kelp harvesting, pollution, and higher sea surface temperatures due to climate change. Marine spatial planning requires accurate mapping of these habitat types to inform effective policy. Key data needed for benthic habitat maps to inform policy are acquired by multibeam echosounders, which collect high resolution bathymetry and backscatter of the seafloor. An additional and previously little used product of high resolution MBES are mid-water backscatter data, termed water-column data, that have been used to identify and map kelp species that extended above the seafloor. We show that incorporating water-column data as a variable for modeling benthic marine habitat distributions can significantly improve the accuracy of benthic habitat maps, specifically where habitat categories include large species of macroalgae on shallow (2-34m) subtidal reefs. The study site has full coverage multibeam bathymetry, backscatter and water-column data, alongside comprehensive observation surveys of benthic habitats using towed video. All towed video observations were classified using a hierarchal marine biotope classification scheme. Water-column data were processed into a mosaic-like product representing the acoustic energy in a layer 0-1m above the seabed. This processing included filtering of the sidelobe artefact. The volumetric water-column mosaic along with bathymetric and backscatter derivatives combined with towed video observations were used as input variables in a supervised random forest classification algorithm to create habitat maps for the study site. Variable importance was assessed for all variables and water-column performed well as it was retained in all models. Including water-column data increased overall map accuracy up to 1.18% and improved producer class accuracies that contained macroalgae up to 2.95%. With increasing pressure on temperate macroalgal communities due to a synergy of pressures arising from warming oceans, our work provides a timely advance for mapping and monitoring changes.