

## FMfI2023 Program

Name	Philip Broadbridge
Affiliation	La Trobe University, Australia and IMI-Kyushu University, Japan
Title	<b>Reaction-diffusion models for fish populations with realistic mobility</b>
Abstract	<p>Nonlinear reaction-diffusion equations, with Fisher logistic growth and constant diffusion coefficient, have been used in fisheries research to estimate sustainable harvesting rates and critical domain sizes of no-take areas. However, constant diffusivity in a population density corresponds to standard Brownian motion of individuals, with a normal distribution for displacement over a fixed time interval. For available good data sets on mobile fish populations, the distribution is certainly not normal. The data can be fitted with a long-tailed Lévy distribution that corresponds to diffusion by fractional Laplacian. Optimal foraging theory shows that an order-0.5 Lévy process is optimal for sparse populations.</p> <p>We have developed exact solutions for realistic Fisher-Kolmogorov-Petrovski-Piscounov models with diffusion by fractional Laplacian. These have also been extended to hyperbolic diffusion models with a Cattaneo-type delay between gradient and flux, as an individual will persist with overcrowding for some time before emigrating. It is then shown how to modify critical domain sizes of protected areas.</p>