Effective management of marine ecosystems requires understanding complex species interactions and food web dynamics. We present two artificial intelligence approaches that help tackle this challenge. The first uses generative AI to develop Models of Intermediate Complexity for Ecosystem Assesment (MICE) (Plagányi et al 2014) that can capture key ecological processes while remaining computationally feasible. We demonstrate this through modeling Crown-of-Thorns starfish populations on the Great Barrier Reef, showing the ability to build, parameterise and calibrate numerous, bespoke models in a matter of minutes. Our second framework addresses a common challenge in marine ecology: how to parameterise diet matrices for marine ecosystem models like Ecopath with Ecosim (EwE) (Guesnet et al. 2015) and Atlantis (Pethybridge et al 2019). Testing this approach across three diverse Australian marine ecosystems, we successfully identified key functional groups and their critical feeding relationships, providing new insights into food web structure. These frameworks help bridge the gap between ecological theory and practical management by automating complex analyses while ensuring ecological realism. This enables more widespread adoption of ecosystem-based management approaches across different marine environments, from coral reefs to temperate systems.