

### 3.1 An overview of Ecosim

Ecosim provides a dynamic simulation capability at the ecosystem level, with key initial parameters inherited from the base Ecopath model. See [Ecosim Inputs?](#) and [Ecosim Outputs?](#) for links to instructions for using Ecosim.

The key computational aspects are in summary form:

- Use of mass-balance results (from Ecopath) for parameter estimation;
- Variable speed splitting enables efficient modelling of the dynamics of both 'fast' (phytoplankton) and 'slow' groups (whales);
- Effects of micro-scale behaviours on macro-scale rates: top-down vs. bottom-up control incorporated explicitly.
- Includes biomass and size structure dynamics for key ecosystem groups, using a mix of differential and difference equations. As part of this EwE incorporates:
- Multi-stanza life stage structure by monthly cohorts, density- and risk-dependent growth;
- Stock-recruitment relationship as 'emergent' property of competition/predation interactions of juveniles.

Ecosim uses a system of differential equations that express biomass flux rates among pools as a function of time varying biomass and harvest rates, (for equations see Walters et al., 1997; Walters et al., 2000; Christensen and Walters, 2004). Predator prey interactions are moderated by prey behaviour to limit exposure to predation, such that biomass flux patterns can show either bottom-up or top down (trophic cascade) control (Walters et al., 2000). By doing repeated simulations Ecosim allows for the fitting of predicted biomasses to time series data.