On the dynamics of coral reef fishes:
Growth, senescence and mortality

Submitted by Shay O’Farrell to the University of Exeter
as a thesis for the degree of
Doctor of Philosophy in Biological Sciences
in September 2011

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Abstract

The present thesis deals with the related themes of mortality and growth in coral reef fishes. In the first chapter, a nine-year dataset from Bermuda is used to quantify how reef fish populations respond to the introduction of a trap-fishing ban, finding that herbivores exhibit extremely strong recovery, but that stock-recruitment relationships may be decoupled by a numerical response in a meso-predator. In the second chapter, a dataset from Bonaire is used to test the efficacy of the widely-used coefficient of natural mortality, $M$, in modelling a population of stoplight parrotfish (*Sparisoma viride*). As determined from simulation models, this statistical coefficient performs considerably less well than a novel mechanistic function that partitions mortality into size- and age-based processes and achieves extremely good fits to the field data. The third chapter presents a new approach to estimating growth parameters of reef fish from tagging data that exploits the disproportionate response of certain parameters to misestimates in the true age of the tagged individuals. The method works considerably better than the most widely used method when sample sizes are small, as is commonly the case in reef fish tagging studies where recapture rates tend to be low. The fourth and final chapter uses non-lethal stable isotope techniques to tease apart the invasion dynamics of Indo Pacific lionfish (*Pterois* spp.) that are currently colonising the wider Caribbean. The results show that lionfish exhibit habitat-specific ontogenetic shifts in prey selection, inflicting elevated mortality on small, bommie-dwelling fishes on forereefs but switching to seagrass-foraging invertivores as they grow. Lionfish also display ontogenetically shifting competition with native Nassau grouper (*Epinephelus striatus*), which may provide a greater barrier to invasion success on patch reefs than on fore reefs, where competitive overlap is diminished. The thesis concludes with a discussion of some lines of enquiry that could not be undertaken owing to time or data limitations, but which may hold as much interest for the reader as they do for the author.
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