A GENERALIZED PREDATOR-IMPACT MODEL TO OPTIMIZE STOCKING OF ESTUARINE FINFISH

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Mulloway, *Argyrosomus japonicus*, stocking began in New South Wales in 1997, and currently over 250,000 fish have been released into various estuaries with variable success. Some monitoring of survival was undertaken, but the potential environmental impacts of pilot releases of top-level predators in estuaries is unknown. The authors present a novel numerical model to estimate optimal stocking density and associated predatory impact of stocked finfish, and propose a new approach to stocking estuarine finfish.

The Predatory Impact Model draws on readily available data, including life history parameters (K, L_∞ and W_∞), diet, and habitat information (Figure 1). The model is non-species and non-habitat specific, and may be applied to fish in freshwater or estuarine habitats. Instantaneous measurements of the standing stock key forage species are taken directly before stocking to estimate stocking density (Figure 1). The model uses these estimates of stocking density, and various mortality- and consumption-related component models to estimate predatory impact.

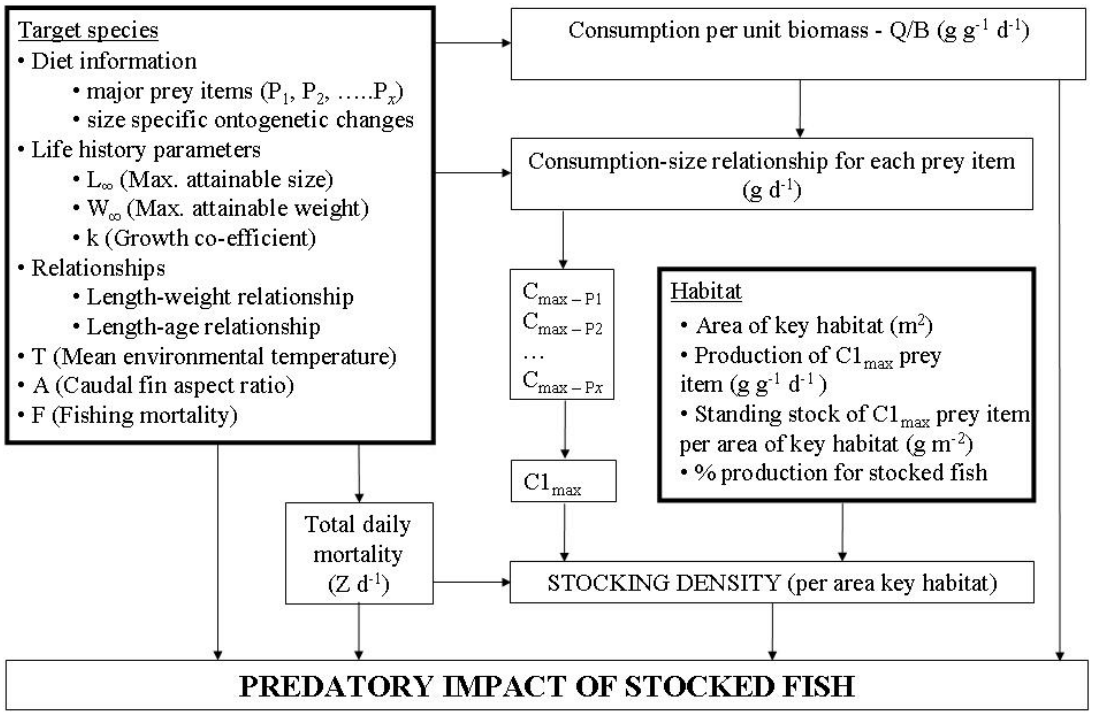

Figure 1: Conceptual Predatory Impact Model.

Model simulations were run for 15 km of the Georges River Recreational Fishing Haven, Sydney, to evaluate appropriate stocking density and associated predatory impact. The 15 km stretch of the Georges River contained 361,486 m^2 of key mulloway nursery habitat, and 10% of mysid shrimp production within this habitat was assigned to support stocked fish, as mysids represent the immediate forage requirements of stocked mulloway.

Modelled stocking density for the 15 km section of river was 4,033 8 cm mulloway. Mulloway are estuarine residents for 4 y before undertaking coastal migrations to other estuaries. Over this time, the predatory impact will reach a maximum rate of 0.3 $t \cdot y^{-1}$ mysid shrimp, 6.7 $t \cdot y^{-1}$ forage fish, 1.8 $t \cdot y^{-1}$ school prawns, 1.2 $t \cdot y^{-1}$ miscellaneous invertebrates and 2.2 $t \cdot y^{-1}$ cephalopods. For comparison, this maximum predatory impact represents 48%, 17% and 127% of former commercial fishery in Botany Bay/Georges River for forage fish, prawns and cephalopods respectively. These estimates demonstrate that relatively small releases of fish can have significant impacts of the environment and other fisheries.

Estimates of stocking density are consistent with recaptures of 2003 verses 2004 stocked fish in the Georges River. A fishery independent recapture rate of 0.1% was obtained from 32,000 fish (8 cm) stocked in the Georges River in 2003, while a recapture rate of 0.2% was achieved from only 5,200 fish (8 cm) stocked in 2004. Given these values, stocking at appropriate densities estimated using the Predatory Impact Model contributed to a doubling in the recapture rate of stocked fish and a saving of around $AU 30,000. Estimates of predatory impact will allow the costs and benefits of stocking scenarios to be evaluated in terms of resource allocation and ecosystem impacts.