

**Population biology and ecology of the greenback flounder  
(*Rhombosolea tapirina*) in the Coorong estuary, South Australia**



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## Summary

The greenback flounder, *Rhombosolea tapirina*, occurs in estuaries and coastal waters throughout south-eastern Australia and New Zealand where it supports commercial and recreational fisheries. The aim of this study was to inform on the population biology of the species in the Coorong estuary, South Australia, and the processes that contribute to variation in population structure and abundance. In particular, this thesis considered aspects of the adult biology of the species in context of the significant environmental changes that occurred in mid-2010, associated with the delivery of drought-breaking freshwater flows to the system.

Analysis of the long-term chronology of fishery production of *R. tapirina* in the Coorong estuary indicated extreme inter-annual variation in population abundance and dispersion. This variation was driven partly by fluctuations in the magnitude of freshwater inflow, because large areas of high quality, sheltered and food-rich estuarine habitat are only available during and immediately after years of increased freshwater inflow.

A direct fish ageing protocol, based on interpreting the macrostructure of otoliths of *R. tapirina*, was developed and provided estimates of age-based data. Males and females grew rapidly, particularly during the first 12 months of life. There were no differences in growth between the sexes, despite the strong bias in numbers toward female fish. Spatial differences in growth were marginal. The population was truncated in age, consisting of only a few young age classes. This likely related to ontogenetic migration to the marine environment and the removal of larger individuals by the commercial fishery.

Assessment of the reproductive biology of *R. tapirina* indicated that it is a multiple batch spawner, with asynchronous oocyte development, indeterminate fecundity, and early maturation. Spawning occurred from March to October in each year, and was most frequent from May to August, i.e. when water temperature was lowest. Comparison of the reproductive biology between areas of contrasting salinity regimes showed strong similarities in spawning activity.

Assessment of the feeding ecology of *R. tapirina* using a combination of gut contents analysis and stable isotope analysis indicated that the species is a carnivorous, generalist feeder that exploited food resources from a wide array of taxonomic groups. The main

components of the diet were polychaetes, gammarid amphipods, and bivalve siphons. The species exhibited a distinct ontogenetic trophic shift that likely related to changes in feeding morphology. There were distinct differences in diet before and after the commencement of drought-breaking freshwater inflows which likely related to changes in prey availability.

Analysis of the movement patterns of adult *R. tapirina*, based on acoustic telemetry, demonstrated the individualistic and often highly transient nature of the movement behaviour of individuals. This included its ability to undertake regular movements over 10s of kilometres between the estuary and the sea. Tagged fish were detected over a large part of the system, i.e. from near the Murray Mouth to approximately 45 km away in the inner estuary, but they showed a strong preference for 'estuarine habitat' in the inner estuary. Furthermore, they exhibited a distinct diurnal shift in fine-scale habitat use, with individuals occupying deeper habitats during the day and shallower areas during the night.

The findings of this research indicated that the previously-documented variation in fishery production for *R. tapirina* is likely related to the movement of individuals from the estuary to the marine environment during their second or third years of life; fluctuations in the amount of estuarine habitat available within the Coorong as a consequence of extreme variability in freshwater inflows to the system; and the removal of individuals by the commercial fishery. The sustainability of this population would depend on an ecosystem-based management approach that ensured the delivery of seasonal freshwater inflows to the estuary; maintained connectivity between the estuarine and marine environments; and managed the commercial fishery, particularly during periods of poor environmental condition.

## **Declaration**

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

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