SALINITY SENSITIVITY IN EARLY LIFE STAGES OF AN AUSTRALIAN FRESHWATER FISH, MURRAY COD (*Maccullochella peelii peelii* Mitchell 1838)

Piyapong Chotipuntu

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Abstract

The Murray cod (*Maccullochella peelii peelii* Mitchell 1838) is Australia's largest freshwater fish. Once highly abundant in the Murray-Darling river system, populations have drastically declined in recent decades. Many causes for this decline have been proposed, including over-fishing, habitat loss and altered river flow regimes. This study hypothesised that elevated salinities have led to selective mortality in some developmental stages, which have in turn depleted stock recruitment and adult populations.

The objectives of this study were to determine the optimal, threshold, upper sublethal and lethal salinities for development of eggs, yolk-sac larvae, fry and fingerlings of *M. peelii peelii*. Investigation the impact of salinity on fertilisation utilised gametes of trout cod (*M. macquariensis*, Cuvier 1829) instead of *M. peelii peelii*. Studies were carried out in a controlled laboratory environment using test media prepared from commercial sea salt.

The results showed that the eggs of the trout cod hatched only when fertilised and incubated in freshwater, and only larvae hatched in freshwater survived through the yolk absorption period of 12 days. Yolk utilisation efficiencies were not significantly different among the salinities of 0-0.30 g/L. There was no effect of pre- or post-fertilising processes on the salinity tolerances of yolk-sac larvae. No larvae survived at salinities higher than 0.30 g/L during the yolk utilisation period.

Lethal salinity concentration in Trout cod and Murray cod larvae was exposure time dependent. The 1 day LC50 of the larvae was 1.97 and 2.33 g/L respectively, compared with the 12 day LC50 values of 0.50 and 0.35 g/L respectively. The threshold (no effect level) salinities of larvae of Trout cod and Murray cod were 0.46 and 0.34 g/L respectively at 12 days exposure. The salinity sensitivities of fry of Murray cod were moderated by increasing pH between pH 6.2 and 8.8, and stimulated by increasing temperatures from 15 to 30°C. The optimal salinity was only slightly affected by temperature. The threshold and upper sublethal salinities varied slightly depending on feeding regime. The salinity sensitivities of fingerlings of Murray cod

were: LC50 = 13.7 g/L; optimal salinity from 4.6 to 5.0 g/L ; threshold salinity from 5.9 to 7.4 g/L, and upper sub-lethal salinity from 9.2 to 9.9 g/L – with the range in all cases affected by acclimation period salinity.

The blood osmolality at LC50 of the fingerlings was 444 mOsmol/kgH_2O or equivalent to 14.2 g/L, and the dehydration rate was 4.8%. The osmolality increased significantly in salinities higher than 9.0 and 6.0 g/L when fish were exposed for a period of 1 day and 41 days respectively. The oxygen consumption increased significantly in salinities higher than 8.0 g/L. Distortion of the notochord and corrosive skin syndrome were major symptoms describing sub-lethal effects found in the embryos, and fry and fingerlings of Murray cod respectively.

Noting the risks of extrapolating directly from laboratory to field conditions, it is predicted that when salinity in natural habitats increases above 0.34 g/L a significant impact on Murray cod recruitment will result.

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