

# Hypersaline waters pose new challenges for reconstructing environmental histories of fish based on otolith chemistry

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ABSTRACT: We investigated the effect of hypersaline conditions on the water chemistry of the Coorong Lagoon, the terminal estuary of Australia's largest river, and the otolith chemistry of a common fish within the system. Water samples and fish were collected from 10 sites along the Coorong, ranging in salinity from 5.8 to 123.4, on six occasions over 14 months. Water (Ca, Ba, Mg, Mn, and Sr) and otolith (Ba : Ca, Sr : Ca, Mg : Ca, Mn : Ca, Na : Ca, Li : Ca, $\delta^{13}C$, and $\delta^{18}O$) concentrations were measured. Water Sr, Mg, and Ca concentrations exhibited conservative behavior (i.e., concentrations increased with salinity). Water Ba concentration decreased from near-freshwater to marine salinities followed by an increase from marine to hypersaline waters, a pattern not previously reported in the literature. Three of the six otolith element : Ca ratios and $\delta^{18}O$ showed significant linear correlations with salinity, but the best fit model for Ba : Ca was a segmented regression with a breakpoint. Positive linear correlations were also found between otolith Ba : Ca and water Ba : Ca, as well as otolith Mg : Ca and water Mg : Ca. Results have implications for reconstructing past salinities inhabited by fish, because they imply that several elemental and isotopic ratios will be necessary to determine whether fish have inhabited, or been exposed to, hypersaline environments.

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