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VALIDATING THE RELATIONSHIP BETWEEN METABOLIC RATE AND OTOLITH CARBON ISOTOPES IN AN ICONIC AUSTRALIAN FISH SPECIES

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Understanding physiological histories is important in deciphering past population influences and to predict future responses. Studies have suggested that there is a relationship between physiology (metabolic rate) and the carbon isotopic composition ($\delta^{13}C$) of fish ear bones (otoliths), however, no studies have experimentally validated this by combining otolith chemical analysis and respirometry techniques. A controlled laboratory experiment will be vital to assuring accuracy of field metabolic rates and inferences of environmental conditions. We aim to develop a geochemical tracer of metabolic rate from archived fish ear bones (otoliths) of snapper (*Chrysophrys auratus*): a commercially, culturally and recreationally important fish species found throughout Australasia. First, juvenile snapper were raised in four temperature treatments (20°C, 24°C, 28°C, 32°C) and subsequently, intermittent-flow respirometry was used to measure oxygen uptake rates and calculate standard metabolic rate (SMR) and maximum metabolic rate (SMR). Second, otolith $\delta^{13}C$ was analysed using isotope ratio mass spectrometry. Lastly, this validated relationship has been applied to otolith chemical analyses and key environmental variables of wild-caught snapper, collected from temperate Australian coasts and spanning 45 years of otolith material. The correlation between metabolic rate, otolith $\delta^{13}C$ and temperature has assisted in uncovering detailed and accurate metabolic histories of temperate Australian snapper populations, allowing us to understand past demographics and environmental conditions in order to make future predictions. Our project will be the first known study to reconstruct long-term, annually-resolved metabolic histories of a fish species using biomineralised tissues, with methods developed being applicable to other fish species.

Keywords: Otolith, carbon isotopes, tissue chemistry, respirometry, metabolic rate, physiology

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