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LATERAL LINE AND OLFACTORY SENSORY SYSTEMS IN THE BIOLOGY OF THE BANDED KOKOPU *Galaxias fasciatus*

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Abstract

The banded kokopu, *Galaxias fasciatus*, is one of the five diadromous galaxiid species, which form the basis of New Zealand's recreational and commercial whitebait fishery. With a continual decline in the abundance of whitebait species, additional knowledge on factors affecting galaxiid populations is crucial. This thesis examines the use of olfactory and lateral line sensory systems in the biology of banded kokopu as both adults and juveniles (whitebait).

The feeding biology of banded kokopu adults was investigated through olfactory source localisation. In the presence of a 2 cm s^{-1} current flow, fish used both olfaction and the superficial neuromasts of the lateral line system to locate the food source. A physical block of one olfactory nostril did not affect the olfactory search strategy employed by banded kokopu.

Banded kokopu whitebait were tested for their response to adult galaxiid odours. Migratory whitebait exhibited a species-specific attraction to adult conspecifics. There was no response shown to odours from adults of other galaxiid species, the inanga (*G. maculatus*) or koaro (*G. brevipinnis*) at any concentration tested. This pheromonal attraction may play an important role in habitat selection during migration.

The effect of poor water quality on sensory performance was also investigated. After exposure to 0.5 μg Cd^{2+} l^{-1} for 48 hours, the attraction to adult pheromones had been eliminated, indicating this level of cadmium exposure had impaired olfactory function. The lateral line system was not blocked until a concentration of 2 μg Cd^{2+} l^{-1}. Whitebait were also tested for a preference/avoidance response at 2 μg Cd^{2+} l^{-1} and showed neither a preference for, or an avoidance of, a concentration which would disable both the lateral line and olfactory sensory systems. This concentration is within the current water quality criteria for protection of aquatic life. The disabling of these sensory systems may render migratory cues undetectable, affecting habitat selection by whitebait, which may ultimately affect the distribution of banded kokopu populations.

This thesis furthers our understanding of the mechanisms of migration and feeding in banded kokopu. The use of both the lateral line and olfactory sensory systems in the location of food odours by adult fish provides the first demonstration of the use of the lateral line system in olfactory source localisation in fish. The importance of water quality in the detection of possible migratory cues has been illustrated with cadmium, where inhibition of sensory systems rendered pheromonal cues undetectable. The pheromonal attraction exhibited by whitebait to adults provides a possible migratory cue used by whitebait in locating habitat for colonisation. The identification of a migratory cue could help in the conservation of banded kokopu populations and in the management of New Zealand's whitebait fishery.

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