Aspects of the morphological development and feeding performance of larval striped trumpeter (*Latris lineata*) in culture

by

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Declarations

This thesis contains no material which has been accepted for a degree or diploma by the University or any other institution, and to the best of my knowledge and belief is original material, containing no material previously published or written by another person except where due acknowledgment is made in the text of the thesis.

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Abstract

Striped trumpeter (*Latris lineata*) is a new candidate species for aquaculture in temperate Australia. Survival of larvae prior to flexion has proven a bottleneck in the production of this species for culture. In addition, almost all juveniles cultured to date exhibit malformations of the jaw that may impede larval feeding success. Body size and morphology impose constraints upon feeding success in larvae of broadcast spawning fishes. Furthermore, larvae have an absolute reliance upon sense organs for the detection and subsequent capture of prey. In this study, aspects of morphological development and feeding performance were described in larval striped trumpeter. Chemosensory and mechanosensory organs were present and presumed functional soon after hatching, while the eye was functional coincident with first-feeding on day 7 post-hatching. The structure of the photoreceptors in different regions of the retina of the larvae suggested the area specialised for the most acute image formation corresponded to a visual field in the fronto-ventral region. Analysis of videocinematography of feeding larvae in the horizontal plane confirmed a forward-directed functional visual field. The area of the visual field increased with larval ontogeny from day 13 to day 17 post-hatching, due to the wider range of reactive angles used by older larvae. Maximum reactive distances of larvae to rotifer prey (~5.1mm) were 97% of larval standard length, while the distance at which larvae initiated a strike at the prey was much lower (~0.45mm) at 8% of larval standard length. Visual angles determined from larval feeding behaviour were higher than the minimum separable angles predicted by histology, such that the functional acuity of the larvae was not as good as that predicted by retinal structure. Jaw malformation was only evident in post-flexion larvae greater than 10 mm standard length and was characterised by an open jaw in which cartilage and bone elements appeared structurally normal but were in abnormal positions. The effects of light intensity and microalgal cell density (turbidity) on larval feeding behaviour were assessed in short-term feeding trials. None of the pre-flexion larvae used to investigate optimal light conditions for feeding exhibited jaw malformations. Larvae fed equally well in clearwater (no microalgal cells present) in a light intensity range of 1-10 $\mu mol.s^{-1}.m^{-2}$. An ontogenetic

improvement in photopic visual sensitivity of larvae was indicated by improved feeding at 0.1 $\mu mol.s^{-1}.m^{-2}$ between day 8 and day 23 post-hatching. Algae-induced turbidity had different effects on larval feeding response dependent upon the previous visual environment of the larvae. Young larvae, day 9 post-hatching, reared in clearwater showed decreased feeding capabilities with increasing turbidity, while older clearwater reared larvae fed well at all turbidities tested. Likewise, greenwater (with microalgal cells present) reared larvae had increased feeding capabilities in the highest algal cell densities tested compared with those in low algal cell density, and clearwater to which they were naive. This study demonstrated that striped trumpeter larvae are primarily visual feeders with a small visual field relative to larval body size, that jaw malformation is unlikely to impede feeding in pre-flexion larvae, and that greenwater may provide a benefit to larval feeding although the previous visual environment of larvae affected subsequent feeding responses.

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Table of contents

List of tables

List of figures