CHAPTER 6 Differential strategies and escape responses in male and female rainbowfish (*Melanotaenia duboulayi*).

6.1 ABSTRACT

The escape performances of male and female rainbowfish (*Melanotaenia duboulayi*) were compared using a novel trawl apparatus. Males showed significantly faster escape responses from the first exposure and consistently escaped more quickly over the remaining 4 runs. It is hypothesised that variation in escape performance is related to sexual asymmetry in reproductive costs. Females tend to invest more time in predator avoidance while males tend to be risk takers. The strategy adopted by males calls for quick responses when predation threat is imminent.

6.2 INTRODUCTION

Bateman (1948) recognised that different factors limit reproductive rates in males and females. Females tend to invest more in reproduction and tend to be the choosier sex, whereas males compete amongst themselves for access to females. Parker (1984b) and Maynard Smith (1977) both emphasised the conflict between the sexes and used ESS models to analyse how these may be resolved. These types of models suggest that males and females are likely to adopt different strategies to solve a variety of problems. Sexual asymmetry in mating costs may have far-reaching consequences, including effects on the amount of energy invested in predator avoidance responses of males and females (Sih 1994).

In rainbowfish (*Melanotaenia spp*.) males are both bigger and brighter than females. While courting females, males often spar with one another, erecting their fins and beating water at one another with their tails. Having dispensed with rival males, the dominant male then displays towards the females, again by erecting all of his fins and shaking his body vigorously. Both the strategy of maximising mating opportunities and their vigorous displays renders males open to greater predation threat owing to increased conspicuousness. We may expect that animals that have eye-catching displays should show stronger anti-predator responses. Male rainbowfish should therefore be better able to avoid predators given that they are at greater risk of attack. The aim of this chapter is to determine if male rainbowfish are better able to avoid a novel trawl apparatus.

6.3 METHODS

To investigate the sexual differences in escape responses, 60 fish (30 male and 30 female) were separated into mono-sex groups of 5. All groups were exposed to the protocol outlined in Experiment 1, Chapter 5. Unfortunately, one of the males leapt from the bucket prior to testing one of the groups. During that trial the fish showed uncharacteristically high levels of skittering and freezing behaviours. These data were therefore discounted, leaving 5 replicates of male fish and 6 replicates of female fish. These data could not be normalised owing to the high number of fish that did not

escape from the trawl. A non-parametric one-way ANOVA using Wilcoxon Scores (Rank Sums) and a Kruskal-Wallis test analysis (SAS 6.1, 1996) was used to compare the escape latency of males and females over repeated runs.

6.4 RESULTS

Males showed a slightly lower escape latency than females ($\chi^2 = 5.9108$, df = 1, Prob > $\chi^2 = 0.015$). Neither sex showed a significant improvement in escape response with repeated exposure to the trawl ($\chi^2 = 4.4678$, df = 4, Prob > $\chi^2 = 0.3464$ and $\chi^2 = 4.5181$, df = 4, Prob > $\chi^2 = 0.340$ for females and males respectively). Females showed far more variability in response than males (Figure 6.1).

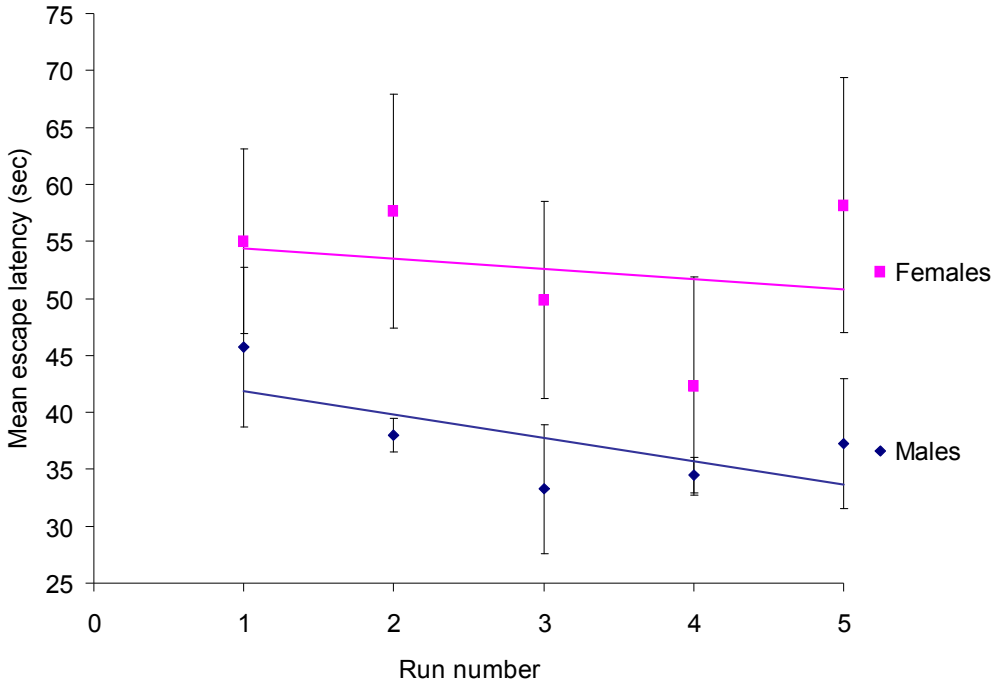

Figure 6.1. The mean escape latency in seconds (± SE) for male (diamonds) and female (squares) rainbowfish over 5 successive runs. Solid lines represent linear trends.

6.5 DISCUSSION

It is apparent from this experiment that males are far better than females at avoiding the trawl apparatus from the initial run onwards. It is unlikely that this difference is related to the differences in morphology between the sexes. Larger size would hamper escape in this instance as the size of the escape hole would be relatively smaller for the deeper bodied males. Likewise, increased swimming speed is unlikely to aid escape efficiency. The lower escape latencies displayed by males are most likely the result of intersex behavioural or cognitive differences. The ability to solve novel problems may be a result of the higher level of predation threat males experience in

the wild. However, females tend to be the more vigilant sex and appear to form the basis of the majority of shoals, so we may have expected the opposite result. Female guppies, for example, tend to in invest more effort in anti-predator behaviour than males and spend more time shoaling (Magurran and Seghers 1994b).

It may be that females reduce predation risk by increased vigilance and crypsis, relying more heavily on shoaling for protection. That is, females may be proactive in predator avoidance since their reproductive success is directly related to longevity rather than access to mates. Males on the other hand appear to be reactive, ignoring the possibility of predation threat, while spending more time on sparring and courtship behaviours. Male guppies spend most of their time following females attempting to acquire more copulations, even at the cost of increased predation risk (Godin and Dugatkin 1996). Males often exploit female predator vigilance by attempting to sneak copulations when females are distracted by predators. Gonopodial thrusts are most common in high risk streams (Luyten and Liley 1985). Males may well react to predators at the last moment, fleeing only when the danger is imminent. Furthermore, female guppies have been shown to prefer bold males (Godin and Dugatkin 1996) so selection appears to be driving males to adopt an extreme anti-predator response characterised by last moment avoidance. The fact that male rainbowfish are not only brighter than females but also larger, and therefore likely to be preferentially targeted by predators, means that this scenario is even more applicable to the evolution of escape responses in rainbowfish.

It would be interesting to determine to what extent males have an ability to solve novel problems from birth and/or if this ability is improved through experience. Furthermore, the variation between males and females is likely to differ in regions where predation threat varies.

These data highlight the fact that males and females are under different selection pressures, which are driven primarily by asymmetry in reproduction costs. While females are more cautious and tend to invest more time in predator avoidance, males tend to be risk takers and probably respond to predators at the last possible moment.

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