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Stressed mothers may mean babies can't find home

Environmental stresses, including warmer and more acidic seawater, associated with deteriorated ecosystems and changing environmental factors have long been touted as threats to species' long term survival and general ecosystem health. Particularly in coral reefs, where effects such as more frequent bleaching events and increased temperatures and acidity have already been observed, species responses will be critical to developing scientific responses for maintaining healthy ecosystems. Dr Monica Gagliano's research on coral reef damselfish, *Pomacentrus amboinensis*, has made important discoveries on the species' specific response and shed light on the broader issues.

What effects will we observe as environments change?

As environmental factors change animals are likely to be stressed. An indicator of stress that is often used is asymmetry. For fish, abnormalities in hearing structures may interfere with settlement on a reef, which is a vital part of the animals' life cycle. Most reef fish spend some time in the open ocean after hatching, before finding a place on the reef to settle and breed. A sophisticated hearing system that enables fine distinction between frequencies is needed by young fish to determine where to go. Dr Gagliano and her research colleagues examined effects of stress on fish settlement by examining otolith (ear bone) assymetry in hatched damselfish. At hatching, 41 per cent had symmetrical otoliths and 59 per cent asymmetrical. When the team examined the otoliths at the settlement stage a few weeks later, far fewer asymmetrical individuals were found to have made their way back to a reef.

Why are we observing these changes?

Asymmetry is an accepted measure of stress, but what stress is specifically causing otolith asymmetry in damselfish hatchlings? To answer this question Dr Gagliano and Dr McCormick looked at the parental environment of damselfish eggs. In their laboratory research, they determined the effects of maternal stress on offspring characteristics by exposing fertilised fish eggs gathered from the wild to different levels of the stress hormone, cortisol.

Previous studies have demonstrated that this species release cortisol from their ovaries in response to environmental stress. Elevation of cortisol levels in their experiment induced changes in the timing of hatching. Increased cortisol levels may therefore be a mechanism of parents ensuring their offspring's immediate survival. However, in this experiment Dr Gagliano and Dr McCormick also demonstrated that hatchlings receiving the high dose of cortisol were more than twice as likely to have asymmetrical ear bones compared with those that received none. This suggests that stressed mothers produce offspring that are much less likely to survive.

What does this all mean?

The take home message of this research is that while stress is part of life for reef fishes, new stresses are now being piled on top of existing ones and fish are showing the effects. Stressed fish in turn are more likely to confer this stress onto their offspring through hormonal controls such as elevated cortisol levels for fish eggs. This hormonal control that is used to confer increased immediate survival on hatchlings is potentially resulting in reduced fitness later in life. As environmental factors place greater stress on reef fish hormonally mediated maternal effects will play an important role in population dynamics and offspring ability to settle on coral reefs.

More info: monica.gagliano@jcu.edu.au

"In our opinion, ear bone asymmetry in the early life stages of reef fish interferes with their capacity to find and settle on coral reefs," says Dr Gagliano.

References:

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