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Fishy future written in the genes

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The roadmap to the future of the gorgeously-decorated fish which throng Australia's coral reefs and help earn the nation $5 billion a year from tourism may well be written in their genes.

Of particular importance may be to protect 'pioneer' fish populations which are able to re-colonise regions of reef devastated by global warming and other impacts or settle new areas as the corals move south, says Dr Line Bay of the ARC Centre of Excellence in Coral Reef Studies, James Cook University (JCU) and Australian Institute of Marine Science (AIMS).

Dr Bay and her colleagues Dr Julian Caley of AIMS and Prof Ross Crozier of the School of Marine and Tropical Biology, JCU have been studying the relationships among fishes across the Great Barrier Reef using genetic means to establish which populations are long-established and which seem to come and go in a pattern of local extinction and re-colonisation.

By studying the mitochondrial DNA of spiny damselfish collected from 15 reefs along 3 transects (lines) across the north, middle and south of the GBR, the researchers have been able to build up a 'history' of the damselfish's population.

"It's really interesting. We found, for example, that populations at the southern end of the Great Barrier Reef are 'younger' than those in the central or northern parts and have experienced larger population fluctuations. This suggests they undergo cycles of local extinction and resettlement, which are nothing to do with human activity – whereas the central and northern populations are far more stable."

Dr Bay says these fish populations that come and go at the edge of the Great Barrier Reef may represent the sort of natural pioneering that goes on at reef margins normally: however in times of extreme change such as global warming and acidifying oceans they take on fresh significance.

"It's about understanding how fish populations on separate reefs are connected to one another – that is the key to whether or not a species may be at risk of complete extinction.

The spiny damselfish is significant because, unlike many other reef fish it does not release its eggs into the sea currents, but broods them on the home reef, meaning that a much higher percentage of its young 'stay home' rather that settle on distant reefs.

"Our work clearly indicates that this damselfish is a homebody that rarely moves far from its natal reef. When these fish do move, they don't go far and tend to relocate to neighbouring reefs and this can be seen in their genes. What is also clear is that not all populations are equal and that some populations may be more vulnerable to natural population size fluctuations and local extinctions compared to others. These population dynamics have probably been going on for a long time before humans started impacting on the reef."

However the research has immediate relevance to successful management of the GBR in times of extreme change, she adds. "If we can understand how reefs are connected, in terms of their fish populations, we can make sure we take steps to protect the ones which supply the pioneers who resettle devastated or maybe new coral areas if corals move in response to warmer water and changed conditions.

A particular area of interest is the southern end of the GBR, off Gladstone, where scientists expect that corals which have less tolerance for the very high water temperatures likely to occur further north will settle, bringing with them populations of reef fish.

Dr Bay says that the spiny damselfish population at the southern end of the GBR displays this unstable, ebb-and-flow pattern in its genes.

"If populations on the edge of the distribution are the ones that we rely on to colonise new habitats, then we need to make sure they are adequately protected," she says

"Our data indicate that they are potentially more vulnerable than more centrally located populations. This in turn suggests that management should pay particular attention to such southern populations."

Source: ARC Centre of Excellence in Coral Reef Studies