

Fish pass 'hot genes' onto their grandchildren

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A pair of spiny chromis (*Acanthochromis polyacanthus*) on the Great Barrier Reef. Credit: Dr Jennifer Donelson.

Fish that are able to adjust to warming waters may pass heat-tolerant genes not just onto their children, but their grandchildren too.

Dr. Jennifer Donelson is an Australian Research Council (ARC) Future Fellow at the ARC Centre of Excellence for Coral Reef Studies at James Cook University (Coral CoE at JCU). She is speaking at the 2019 Coral Reef Futures Symposium in Sydney, today [October 23].

Dr. Donelson's research explores the ability of fish to acclimate to future [warming](#). So far, her work has focused on two generations of fish: parents and their offspring. Her next chapter of work digs deeper and brings in a third [generation](#).

"Ocean warming of one to three degrees Celsius has a [negative effect](#) on coral reef fish," Dr. Donelson said.

"Traits such as growth, reproduction, aerobic capacity (the ability to deliver energy to the muscles), and sex determination are all affected."

"So, the projected warming under climate change could have severe effects on coral reef fish populations."

Dr. Donelson says fish that grow in warmer conditions from early life can improve their thermal performance "a little".

"But the real improvements happen when their parents have experienced warm ocean conditions too."

Exposing the parents to higher water temperatures appears to signal which genes to switch on, or off. This alteration of genes in the offspring is 'acclimation', and acts as a buffer against increasingly warming waters.

Dr. Donelson found that both the rate and magnitude of warming can

produce different results.

"With only a 1.5C increase, fish were able to fully restore the negative effects of warming on their physiology and reproduction in two generations," she said.

"With a greater increase in warming, fish really began to struggle. While they were able to restore aerobic capacity, they ceased to reproduce after two generations. Obviously, that's a terminal impact."

"When fish experienced only a 1.5C increase in each generation (totalling +3C in two generations), they restored aerobic capacity and partially restored reproductive ability."

Dr. Donelson is now testing if an improved tolerance to warmer waters still holds after the offspring generation go back to cooler conditions.

"This new chapter of work will also focus on the traits and genes of three generations," she said. "And how their early-life conditions affect their grandkids."

"In a warming world, there are clear limits to what fish can cope with. My research is getting us closer to identifying the mechanisms that help some acclimatise to modest amounts of heating."

The ARC Future Fellows are awarded to outstanding mid-career researchers to undertake research in areas of national priority.

Dr. Donelson's work will provide significant benefits to Australian and international communities that rely on [fish](#) for nutrition, as well as economic and social values.

Dr. Jennifer Donelson presents 'You can't escape your past: how thermal

experience of previous generations affect current generation performance' at 11:15 am on Thursday 24 October at the 2019 Coral Reef Futures Symposium at the Australian National Maritime Museum in Sydney.

The symposium also features a free public forum, 'What Every Australian Should Know About Climate Change.' A panel of four world-renowned experts discuss [climate change](#) and renewable energy. They will then answer questions from the audience.

Provided by ARC Centre of Excellence for Coral Reef Studies

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