

Wrasses dazzle: How fairy wrasses got their flamboyant colours

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The fairy wrasses are among the most diverse of the wrasses, with their 61 species accounting for nearly 10 percent of the family. Credit: Yi-Kai Tea.

With their exuberant colors, fiery personalities and captivating courtship displays, the fairy wrasses are one of the most beloved coral reef fish. Despite this, the evolutionary history of its genus was not well

understood—until now.

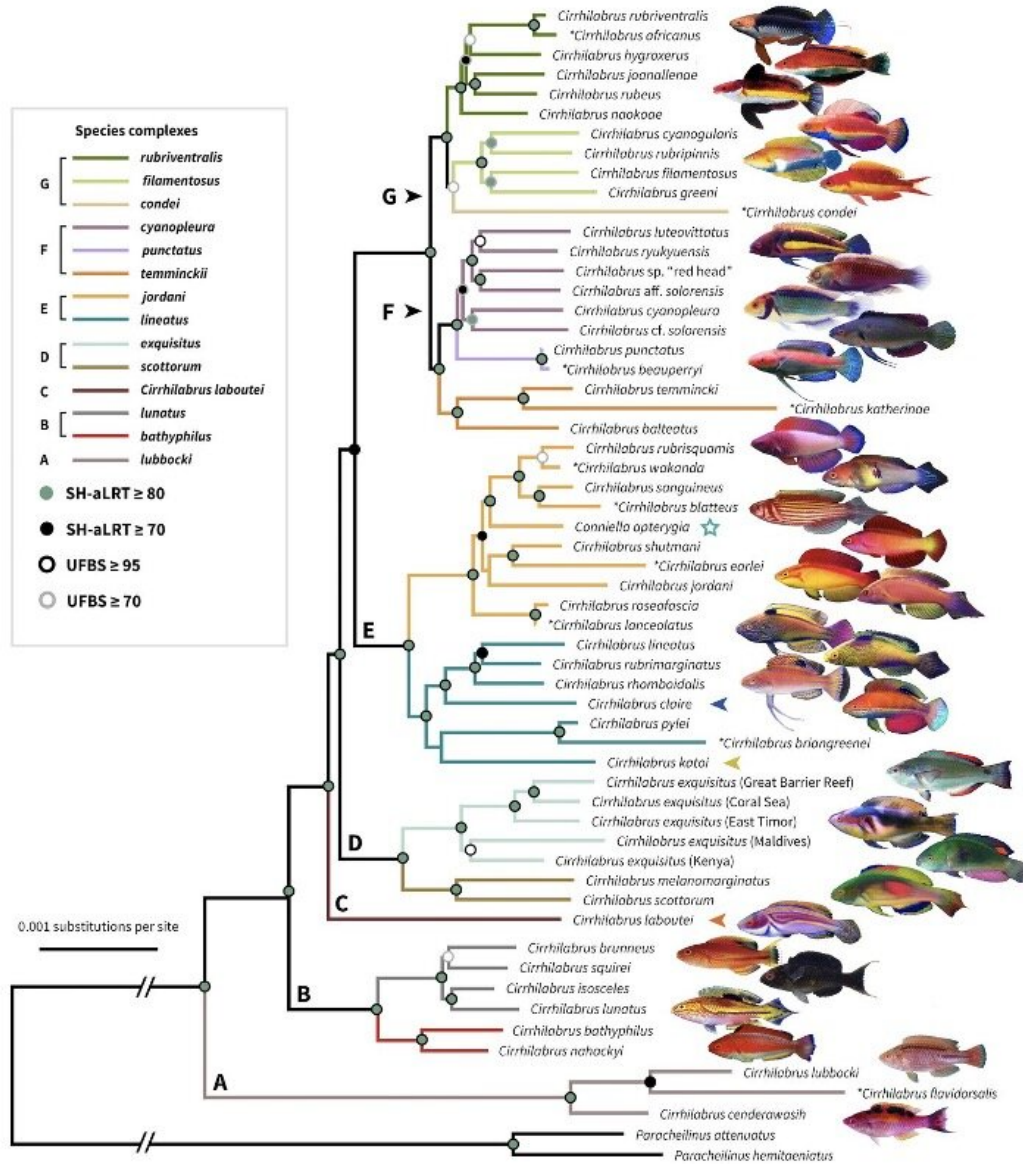
Fairy wrasses diverged in form and color after repeated sea level rises and falls during the last ice age, finds a new study. Published in top journal *Systematic Biology*, it employed a novel genome-wide dataset to make this discovery.

Lead author, ichthyologist and Ph.D. candidate at the University of Sydney, Mr Yi-Kai (Kai) Tea, says that the fish's divergence occurred rapidly and over a short amount of time.

"Although the fairy wrasses split from their most [common ancestor](#) some 12 million years ago, it was only within the last 2-5 million years ago that much of their divergences took place, in the Pliocene/Pleistocene epoch," said Mr Tea, a researcher in the School of Life and Environmental Sciences.

"They developed distinct colors and forms in a sort of evolutionary arms race, putting on dazzling displays in an effort to court females and chase off rival males. Also, [sea level changes](#) caused groups to become isolated, and therefore evolve separately. The repeated rise and fall of sea levels acted like a 'species pump', propelling fish into the Indian Ocean and even as far as the Red Sea. Most of this movement, however, occurred in the Pacific Ocean, in particular, around the Indo-Australian Archipelago."

Mr Tea completed the work under the supervision of Professors of Molecular Evolution, Simon Ho and Nathan Lo.



The most complete lineage of the fairy wrasses yet, with nearly 80 percent of all species represented. Credit: Yi-Kai Tea, Rudie Kuitert, Michael Hammer, Benjamin Victor, Gerry Allen and John Randall.

Decoding fish DNA

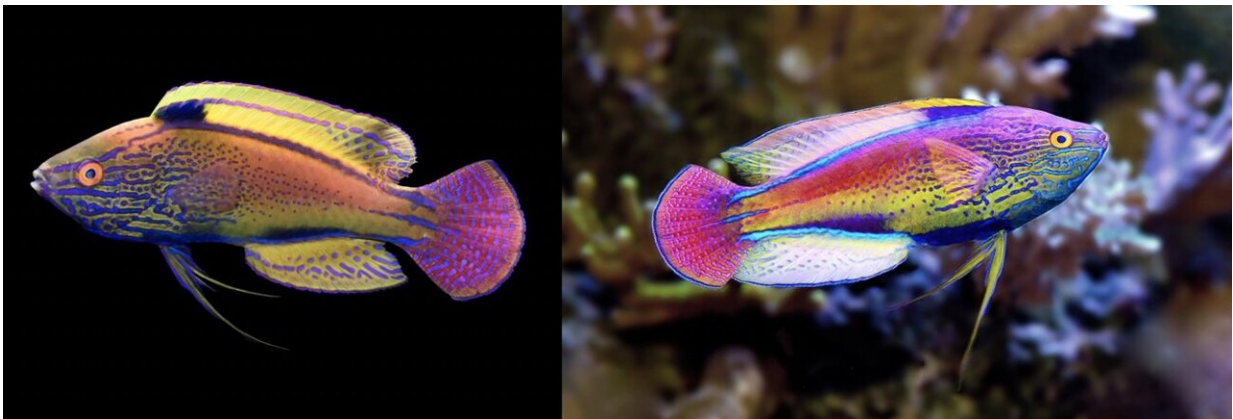
Despite the vast variation in color and form, many species of fairy wrasses have highly conserved, or similar, regions of their genome. This poses a challenge in trying to reconstruct their evolutionary history.

The current study used an approach that had not been previously attempted on fairy wrasses: by combining genome-wide ultra-conserved elements with mitochondrial DNA, the researchers reconstructed a robust evolutionary tree. Using that, they began to tease apart the reason behind the fish's diversification.

Do a little dance, make a little love

In addition to sea level fluctuations, male fairy wrasses (as with many animals, the more colorful sex) developed their bright colors and individual forms to court females.

"They do a little dance, and they are capable of changing colors, sometimes temporarily flashing bright, iridescent colors. They also do this to ward off rival males," said Mr Tea. "In a reef where multiple species often occur, there is increased pressure for males to attract not only a female's attention, but also the female of the correct species."



An Australian species, the lavender-striped fairy wrasse, in 'resting' and 'flashing' colouration. Credit: Yi-Kai Tea.

"We have only just begun scratching the surface of this exciting group, and more work still needs to be done in order to fully understand the drivers of species diversification," he continued.

That work, and the present study, might be germane to reef conservation and management, too. For example, the finless 'mutant wrasse', an Australian endemic species restricted to a narrow distribution of reefs in far northwest Western Australia, is listed as vulnerable on the International Union for Conservation of Nature Red List of threatened species. The species has been placed in its own genus, with a single species. However, Mr Tea's study finds strong evidence that this [species](#) is simply a derived fairy wrasse, and that its loss of fins likely resulted from it being 'bottlenecked' in a narrow area.

More information: Yi-Kai Tea et al, Phylogenomic Analysis of Concatenated Ultraconserved Elements Reveals the Recent Evolutionary Radiation of the Fairy Wrasces (Teleostei: Labridae: Cirrhitidae), *Systematic Biology* (2021). [DOI: 10.1093/sysbio/syab012](https://doi.org/10.1093/sysbio/syab012)

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