New species of fish displays striking color difference between males and females

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A new species of freshwater fish in the family Characidae, called Hyphessobrycon myrmex, exhibits an intriguing sexual dichromatism: Adult males are a deep reddish-orange, while females and juveniles are pale yellow. The species has been described in an article published in the *Journal of Fish Biology*. H. myrmex is approximately 2 cm long and lives in the waters of the Formiga River, a tributary of the Juruena River in Serra dos Parecis, Mato Grosso State. The Formiga is part of the Tapajós Basin.

"Sexual dichromatism, a form of sexual dimorphism, is common among vertebrates, especially birds and fish. A classic example is the peacock," said one of the authors of the study, ichthyologist Murilo Pastana, affiliated with MZ-USP.

The specimens described in the study were collected between 2011 and 2015 during the expeditions that sought to produce an inventory of the Characiform fish fauna (Teleostei, Ostariophysi) from South America. Characiformes are one of the largest and most diverse orders of freshwater fish, comprising 2,171 recognized species distributed in families such as Parodontidae (scrapetooths), Curimatidae (toothless characins), Prochilodontidae (flannel-mouthed characins), Anostomidae (Leporinus spp., headstanders), Crenuchidae (South American darters), Hemiodontidae (halftooths), Gasteropelecidae (freshwater hatchetfishes), Characidae (lambari, piaba, pacu, piranha, tambaqui, dourado, brycon), Acestrorhynchidae (smallscale pike characins), Cynodontidae (dogtooth characins, vampire tetras), Erythrinidae (trahira,

tigerfish), Lebiasinidae (pencilfishes), and Ctenoluciidae (pike characins).

"The Characiformes are dominant wherever they occur. In South America, they predominate in all river basins, alongside the Siluriformes, the order of catfish families," said Menezes.

Completed in 2015, the project set out to collect specimens from the headwaters of the Amazon rivers that rise in central Brazil. "These ichthyofaunas inhabit specific ecosystems," Menezes explained. "There are species that occur only in one particular stream and aren't found in nearby streams or rivers. Because the headwaters are located in upland plateau areas, the rivers have many rapids and waterfalls that isolate headwater species from those found farther downstream."

Large falls on major Amazon rivers are priority locations for the construction of hydroelectric dams, so ichthyologists are racing against the clock to inventory as many species as possible. "The construction of power plants destroys everything that exists in these ecosystems," Menezes said.

Some 30 new species of Characiformes were discovered during the project's seven expeditions, conducted between 2011 and 2016. Approximately 1,750 species live in South America, and the rest live in Africa. Their size ranges from 1.7 cm to 2 m. Sexual dichromatism is common, but males and females of H. myrmex stand out for the sharp contrast in their respective hues.

"Ichthyologists were well aware of dichromatism in certain species of Characidae, but no one had set out to identify all dichromatic species, where they live, and the function of dichromatism in their behavior," Pastana said. Having detected dichromatism in H. myrmex, Pastana decided to conduct a detailed survey and discovered that 109 species of

Characiformes are dichromatic—57 of them in the family Characidae, as shown in the study.

He also found that dichromatism is present in six of the 24 known families of Characiformes. Five families are South American, and one is African. Sexual dimorphism in these six families is not just chromatic. It also appears in the size difference between sexes, in fin size, and even in behavior.

According to Pastana, the most surprising case of sexual dimorphism in behavior is in Copella arnoldi, which belongs to the Lebiasinidae family of pencilfishes or tetras found in southern Central America and in South America. C. arnoldi is often referred to as a splash tetra because of its reproductive behavior. "This is one of the most spectacular cases of reproductive behavior in fish and of task segregation between sexes while mating," Pastana said.

"When the male and female are ready to mate, they leap out of the river and attach themselves by fin suction to the underside of an overhanging leaf. They lay and fertilize their eggs on the leaf, not in the water. The male watches the eggs and intermittently splashes them using its elongated tail fin to keep them moist."

According to Pastana, the male's long tail fin is another facet of sexual dimorphism in the species. When the eggs hatch, the fry fall into the water from the leaf. The female plays no part in the process after spawning.

More information: M. N. L. Pastana et al, A new sexually dichromatic miniature Hyphessobrycon (Teleostei: Characiformes: Characidae) from the Rio Formiga, upper Rio Juruena basin, Mato Grosso, Brazil, with a review of sexual dichromatism in Characiformes, *Journal of Fish Biology* (2017). DOI: 10.1111/jfb.13449

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