Mating Success

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Source: BioScience, 57(3) : 304

Published By: American Institute of Biological Sciences

URL: https://doi.org/10.1641/B570323

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WHAT MALE DISPLAYS SAY

Darwin proposed the theory of sexual selection to explain exaggerated male traits—bright colors and attention-getting behaviors, for example—that would seem likely to attract predators and thus be eliminated by natural selection. Do sexually selected male traits persist simply because they draw female attention, or do they actually demonstrate some aspect of a male's fitness?

Theoretically, if the variation between males in the expression of a sexually dimorphic trait depends on condition, then males in better physical condition would have higher mating success. Russell Bonduriansky, of the University of New South Wales in Sydney, put this theory to the test recently (see the January issue of *American Naturalist*). He measured the covariation of condition dependence and sexual dimorphism by measuring physical traits in giant stilt-legged flies (*Telostylinus angusticollis*) reared on different larval diets.

Bonduriansky analyzed seven size and shape measurements, including sexual and nonsexual traits. Sexual traits—head length and width, antenna length, foretibia length—are those that play a direct role in the male–male encounters that determine which individuals have access to females. Males of this neriid fly aggregate on rotting bark to challenge, and at times fight, other males. They posture with their upper bodies raised in the air, and in fights they strike each other using their heads, antennae, and forelegs. The nonsexual traits, including overall body size and other measures, are an important basis for comparison.

Although both sexual and nonsexual traits were affected by diet, the responses of sexual traits to different diets were more pronounced. Individuals at the small end of the scale—those raised on a poor diet—showed little or no dimorphism, while large individuals raised on rich food were the most dimorphic. Bonduriansky's analysis of male and female body shapes not only revealed distinct dimorphic growth but demonstrated clear condition effects. In fact, condition accounts for more than 90 percent of the variation in sexual dimorphism in this species.

Because condition dependence and sexual dimorphism both show phenotypic variation, they are generally difficult to evaluate precisely. The strong linkage in this species "suggests that these two complex traits share a common genetic and developmental basis," concludes the author. "Sexual dimorphism may be a pleiotropic effect of conditionally expressed sex-linked genes" that are turned on in physically fit males...and in turn turn on females.

WHAT MAY DISMAY: INTERSEX FISH

News reports last fall drew attention to the prevalence of intersex fish—males with oocytes, or immature eggs, in their testes—among smallmouth bass and, to a lesser extent, largemouth bass in the Potomac River. US Geological Survey scientists are currently investigating the prevalence of intersex fish throughout the Chesapeake watershed, as well as in four major US river systems, and the potential role of sewage treatment discharges and agricultural runoff in causing these abnormalities.

While sewage treatment plants are known to be sources of estrogenic compounds in the environment, their effects on the development and reproduction of aquatic organisms are only beginning to be understood. Dalma Martinovic, William Hogarth, Rachel Jones, and Peter Sorenson, of the University of Minnesota's Department of Fisheries, Wildlife, and Conservation Biology, recently published a study showing the impact of environmental estrogens from effluent on the reproductive behavior of fathead minnows (see the February issue of *Environmental Toxicology and Chemistry*).

In their study, the researchers found that male fatheads (*Pimephales promelas*) exposed to sewage treatment plant effluent for three weeks had significantly elevated levels of the egg-yolk precursor vitellogenin and significantly lowered androgen levels circulating in their blood. Similar results were achieved when, in a second experiment, male fish were kept for three weeks in water containing a level of estradiol comparable to that of the effluent.

The purpose of the study was to determine what impact this change in the males had on their ability to reproduce. In the wild, spawning is a competitive activity among these male fish, with better spawning territories going to the more aggressive individuals. When male fish exposed to effluent were tested for their ability to spawn, they succeeded when no other males were present, though they took longer to establish nests. When challenged to spawn in the presence of untreated males, however, they failed to reproduce. Control males in the competitive spawning experiment exhibited more agonistic and nest-related behaviors than effluent-exposed males, and sexual dimorphism was more pronounced in the untreated males than in the effluent-exposed males.

The estradiol-treated males in the second experiment had reproductive outcomes similar to the effluent-exposed fish: They were able to hold nests and sire young in the noncompetitive scenario, but in competition with untreated males, they had trouble reproducing. By contrast, when male fatheads were exposed to a synthetic androgen in the same experimental design, treated males displayed more aggressive behaviors and acquired more nests than untreated controls.

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doi:10.1641/B570323
Include this information when citing this material.