



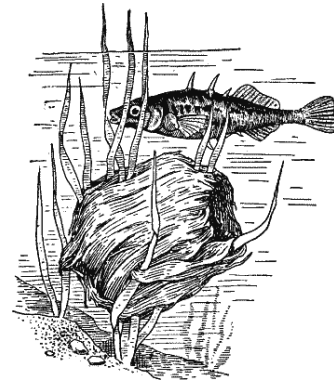
## ScienceWatch – Whose Children Are They Anyhow?

***“It’s a wise father who knows his own child.” –W. Shakespeare***

The male three-spined stickleback (*Gasterosteus aculeatus*) works very hard at fatherhood. During the spring-to-summer breeding season he stakes out a territory, collects grasses and algae, and using sticky secretions from his body, builds a tunnel-shaped nest in a shallow depression on the lake bottom. Now in full breeding colors he does a zigzag courtship dance to entice a gravid female into his nest. If he is successful, she enters and lays her eggs, which he fertilizes and then he immediately chases her away. He then spends the next 6-8 days guarding the nest and vigorously fanning the eggs to oxygenate them. Once the eggs hatch he continues to guard the tiny fry for a few more days until they swim away. All this activity takes its toll and the male’s health deteriorates. Nevertheless, after a brief rest he repeats the process several times during the breeding season.

As a reward for all his hard work the male may end up raising young fathered by another male known as a “sneaker”. Sneakers approach the rival's nest while he is busy dancing for the female, and after she has spawned, the sneaker darts through the nest and releases his sperm. This may occur before or after the nest owner has passed through the nest to fertilize the eggs. Estimates vary, but up to half of stickleback nests can contain varying proportions of eggs fertilized by a sneaker. The sneaker phenomenon also occurs in other fish such as the bluegill – see *ScienceWatch: Father Knows Best* (March 2004).

Nesting stickleback males often eat some or all of the eggs they guard, a practice called “filial cannibalism”. The incidence of filial cannibalism may be affected by the physical condition of the father. Studies suggest that the males eat eggs when they need to improve their physical condition, giving up some or all of the current brood in order to produce more progeny in the future. Another factor that may affect cannibalism is the question of paternity. Nesting males may eat a clutch containing foreign eggs because it is not advantageous for them to invest energy in raising another male’s children. However, no one has determined that nesting males can recognize eggs that were not fertilized by them.



Now a study in the April 27, 2010 issue of the *Proceedings of the Royal Society B* by Marion Mehlis, an evolutionary biologist at the University of Bonn, Bonn, Germany, and her colleagues, looks at whether nesting males can determine the paternity of the eggs they are guarding and use this knowledge to decide whether or not to eat the eggs.

Sticklebacks were collected at the beginning of the breeding season, set up as pairs in separate tanks and allowed to spawn. The scientists collected the eggs from 92 nests after

spawning and determined the total number of eggs in each clutch. During the next three months they set up six different exchange conditions in which 0, 20, 40, 60, 80 and 100 per cent of the male's eggs were replaced by those from another nest. To distinguish foreign from those fertilized by the nesting male they stained one or the other with a blue dye known not to affect viability. After the egg exchanges were done they placed each nest back in its tank and reintroduced the nesting male. Body measurements were taken periodically to assess the physical condition of each male.

Eighty-two males accepted the nest and began their normal behavior of fanning the eggs. Ten other males immediately destroyed the nest and were not included in the analyses. The number of nests in each exchange condition ranged from 11 to 20. After one week the nests were removed and all the remaining native and foreign eggs were counted.

Total cannibalism occurred in 57 of the 82 nests, and its occurrence was strongly influenced by the presence of the foreign eggs. In general, as the proportion of foreign eggs went up, the rate of total cannibalism went up, indicating that the males could determine the proportion of foreign eggs in the nest and adjust their rate of filial cannibalism appropriately. Cannibalism also increased as the breeding season progressed, especially for males with many foreign eggs, and males in poorer physical condition were more likely to eat the whole clutch.

Since a previous study showed that adult sticklebacks recognize their siblings by smell, the authors think olfactory cues allow nesting males to discern the presence of foreign eggs. They suggest that as the eggs develop and the father's genes get expressed, the developing embryos emit a "paternal" odor that the nesting male can detect and he acts accordingly.

All of this makes sense in a world where males are trying to raise their own offspring and not those of others.

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*A male stickleback in breeding colors attracts a female*