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Sex Roles

Even species thought of as typical, with one gender per sex and individuals who maintain a single sex throughout life, often have gender roles quite different from the traditional template. Indeed, in some species, males (apart from making sperm) look and behave much as females do in other species, and females (apart from making eggs) look and behave much as males do in other species. If these species could express their thoughts about us, they would describe our gender distinctions as reversed.

BODY SIZES REVERSED

Anglerfish are deep-sea fish who have what looks like a tiny fishing pole attached to their head. A spine projects out in front of the fish, and somewhat upward, with a frilly or luminescent bulb at its tip to lure prey. When prey comes near, the anglerfish lunges forward, “angling” and then gobbling it up.

Predators catch prey in countless tricky ways. The anglerfish's fishing pole is a neat curiosity, but what is more interesting is that the anglerfish just described are all female—fisherwomen, not fishermen. Is the anglerfish another example of an all-female species? Nope. Anglerfish males

exist, but they are tiny and are called "dwarf males." These anglerfish males are incapable of independent existence. They have large nostrils for homing in on perfumes released by the females and pinchers, instead of teeth, to grasp little projections on the female. After a male attaches to the back or side of a female, their epidermal tissues fuse and their circulatory systems unite, and the male becomes an organ of the female. Multiple males may attach to one female, a case of polyandry. They thereby turn into two or more genetically distinct individuals in one body, a colony.¹

These fish were discovered in 1922 by an Icelandic biologist who observed two small fish attached by their snouts to the belly of a large female. He thought the small fish were juveniles being suckled by their mother—which mammals do all the time, but which would be big news for fish.² Three years later, the small attached fishes were discovered to be reproductively mature males.

An attached male was called a "parasite," by analogy to the small ectoparasites on the outside of large individuals, such as the barnacles attached to whales or leeches that cling to people who bathe in tropical streams. The terminology is unfortunate, because here the relationship is presumably reciprocal. The anglerfish male is "merely an appendage of the female, and entirely dependent on her for nutrition. . . . [S]o perfect and complete is the union of husband and wife that one may almost be sure that their genital glands ripen simultaneously, and it is perhaps not too fanciful to think that the female may possibly be able to control the seminal discharge of the male and to ensure that it takes place at the right time for fertilization of her eggs."³

Over one hundred species of anglerfish are distributed throughout the world at depths below one mile. For all anglerfish, the females are much larger than the males. In other respects, though, anglerfish are diverse, exhibiting a rainbow of their own. Some species have attaching dwarf males that fuse with the body of a female, as just described; others have both free-living males and attaching males; and still other species have males who are exclusively free-living. Indeed, whenever one looks deeply into any biological category, a rainbow is revealed. The living world is made of rainbows within rainbows within rainbows, in an endless progression.

SEX ROLES REVERSED

The pipefish is a small pencil-like fish with a circular mouth that resembles a small musical pipe, like a flute. In some species of pipefish, the embryos are "glued" to the male's underside. The young fish develop there and swim away when they are mature. In other pipefish species, the males have protective skin flaps that partially cover the fertilized eggs.

In their close relative the seahorse, the skin flap is elaborated into a pouch that fully encloses the developing embryos. A female seahorse places eggs in a male's pouch. The eggs are fertilized there, forming embryos, and the male becomes "pregnant." The male provides oxygen, maintains the right salt balance, and nourishes and protects the embryos in his sac.⁴

We might think that seahorses and pipefish reverse male and female roles relative to mammals. To determine whether this impression is correct, we must consider the "parental investment" made by males and females in the raising of young. A male contributes a sperm to the embryo, which provides little energy or nutrients. A female contributes a full-sized egg to the embryo. A female therefore starts out by putting a larger investment in the embryo than the male does.

Biologists define "sex-role reversal" as occurring when the total parental investment by males in raising the young exceeds that of females.⁵ Male seahorses and pipefish provide a great deal of parental investment in terms of time spent rearing the young in their pouches or glued to their undersides. Does what the males do for the young by the time the embryos mature add up to more than what the females do, given that females invested more at the beginning?

Simply having males provide some care for the young doesn't qualify as sex-role reversal. Species showing some male parental care are too numerous to mention. Many male fish watch over and nourish eggs in nests on the sea floor or lake bottom, and others even store the eggs in their cheeks (called mouth brooders). The specific way males provide parental care depends on the species, and the seahorse's pouch is one of many curious delivery styles. The style of care doesn't matter, the amount does. So, are seahorses sex-role reversed? That is, does

the cumulative parental investment by male seahorses exceed that of females?

How could one tell which sex was contributing the most overall to the raising of offspring? An indication comes from the supply and demand of each sex at the time of mating. We're all familiar with supply and demand during courtship. A belle at an Alaskan mining camp has men entreating her with bags of gold dust and promises of trips to Paris. A bachelor on a love-boat cruise is entertained by women offering duty-free Cuban cigars and football lore memorized from the 49ers playbook. Let's extend this idea.

If one sex, say A, is providing most of the parental care, then few are receptive to mating at any particular time because most are occupied with raising offspring. Conversely, the other sex, B, is not very involved with raising offspring and has many individuals ready and willing to mate. This asymmetry in the supply and demand of mates leads to a dynamic tension between the sexes. The Bs compete for access to and control of the As. Provided their freedom of choice is not thwarted by the Bs' control, the As choose which B they wish to mate with.

Biologists call the ratio of receptive females to willing males the "operational sex ratio." The operational sex ratio isn't fifty-fifty because the sex with the higher parental investment is occupied with raising the offspring and is relatively unavailable for mating compared with the other sex.⁶

Returning to the seahorses and pipefish, we can ask which sex is relatively unavailable for mating because of their efforts in raising offspring. Swedish investigators found two nearby North Sea pipefish species that are indeed sex-role reversed. The females from both these species produce enough eggs for about two males during the time it takes for one male to raise his young. In the wild, the number of females with ripe eggs consistently exceeds the number of receptive males. Females in these species are polyandrous, with a harem of males. In addition, these females are larger than the males and develop bright colors at courtship time, presumably for the males to choose among, reversing Darwin's classic peacock story. Furthermore, the females, not the males, compete with one another, forming dominance hierarchies for access to the males who will tend their eggs. Nine other pipefish species in which the females

alone have sexual coloration and/or grow larger than the males are thought to be sex-role reversed as well.

On the other hand, seahorses and certain other pipefish species are not sex-role reversed; they follow the model of Darwin's peacocks. Male seahorses can raise their young and get ready for the next embryos faster than female seahorses can produce egg batches. The result is a net surplus of males wanting eggs compared to females offering eggs. Males aggressively tail-wrestle and snout-snap one another for access to females, whereas females don't have any specific aggressive behaviors among themselves. Male seahorses tend to be larger, more colorful, and more distinctly patterned than females.⁷

Thus sex-role reversal definitely occurs in nature. Many feel that the concept of an operational sex ratio effectively extends Darwin's theory of sexual selection to cover sex-role reversed species—after all, the logic is the same for the mating strategies in both sex-role-typical species and sex-role-reversed species, with the identities of the excess sex and rate-limiting sex simply flipped. But no theory has been proposed to explain why sex-role reversal occurs in the first place.

Sex-role reversal is found in birds, especially aquatic and sea birds. When sex-role reversal occurs, the double standard can reverse too. Wattled jacanas from the Chagres River in Panama are large, squat black birds with white wing tips, a red face, and a long, yellow probing bill used to feed among shallow freshwater plants like hyacinths. The raucous, beefy females spend their days jousting with one another at the borders of their territories. Within these territories, harems of smaller males tend the eggs and chicks.

DNA fingerprinting has shown that males raise eggs laid by the female who controls their harem, even when the eggs were fathered by males outside the harem. The females clearly went outside their harem to obtain matings and yet burdened the males within their harem with the job of raising the young. The investigators, themselves male, were outraged, asserting that male jacanas were being "cuckolded" in spite of contributing so much parental care. One investigator stated, "It's about as bad as it can be for these guys."⁸

The converse probably wouldn't have provoked such outrage. A female in a harem controlled by a male might raise a chick fathered by that

male and placed there by a female from a neighboring harem. We could imagine many reasons for such an adoption. The female might find it advantageous to raise the chick in return for the controlling male's provisioning and protection of the young she has mothered herself. Similarly, a male jacana might find it advantageous to raise a chick mothered by the controlling female in return for the controlling female's provisioning and protection of the young he has fathered himself. Thus, sex-role reversal implies that the double standard also reverses. This idea takes some getting used to.

Other birds showing sex-role reversal include two shore birds, Wilson's phalarope and the spotted sandpiper.⁹ Apparently, no mammals exhibit sex-role reversal, presumably because of the very high parental investment by mammalian females. In addition to the egg, a mammalian female supplies milk to the embryo and carries the young to term, either in a placenta or a pouch. For a mammalian male, this act is hard to follow. To exceed this already high parental investment by a female, a male would require a social system allowing him to care for his offspring well beyond the age of weaning, as may be approached in humans.

The evolution of the mammalian placenta and pouch is usually presented as a physiological advance, an adaptation for nurturing embryonic development in a climate that has cooled globally since the time of dinosaurs. Alternatively, the evolutionary force behind the placenta and pouch may have been for females to assume control of their offspring. A side effect is that males then acquire an incentive to control females.