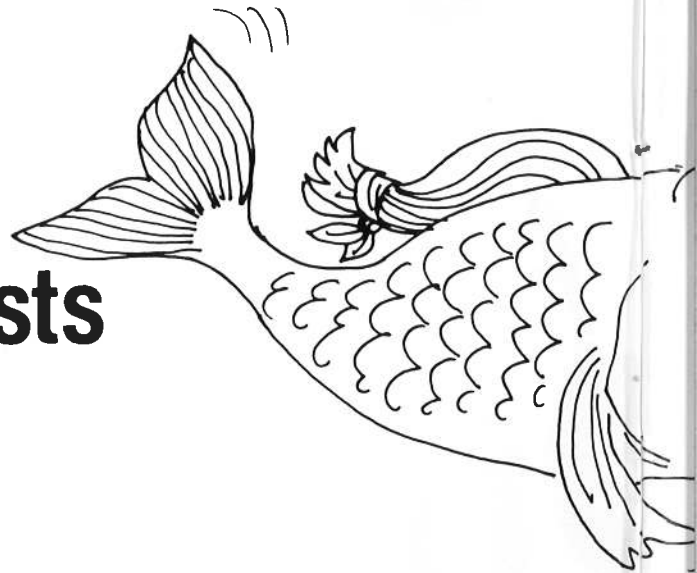


On the SEX of Fish and the GENDER of Scientists



DANIEL PAULY

Most aquatic biologists believe that adult fish grow less than juvenile fish because much of their energy goes into reproduction. This is known as the "reproductive drain hypothesis."

Although it has common sense going for it, this hypothesis is often viewed as a truism, and not for what it is.

Another problem with this hypothesis is that, in the majority of fishes with sexual growth dimorphism, it is the female which grows fastest and/or larger. This is bad for the reproductive drain hypothesis because it is usually the females which, in fish - as elsewhere in the animal king(?)dom - put most energy into reproduction, e.g., have the largest gonads.

Now what would you do? Reject the hypothesis? No, in science, things are not

that simple. The trick is to produce a suitable *ad hoc* hypothesis. Thus, to save the reproductive drain hypothesis, one could, for example, write:

The male gonad often weighs less than the female gonad. This does not necessarily imply smaller spawning losses in males because sperm, consisting almost exclusively of DNA, RNA and lipoids, is likely to be the most expensive substance in the fish body. (Symp. Zool. Soc. London, No. 44, 1979)

Where do we go from here? One could simply point out what biologist and essayist Stephen J. Gould once wrote:

We think of males as large and powerful, females as smaller and weaker, but the opposite

pattern prevails throughout nature - males are generally smaller than females, and for good reason, humans and most other mammals notwithstanding. Sperm is small and cheap, easily manufactured in large quantities by little creatures. A sperm cell is little more than a nucleus of naked DNA with a delivery system. Eggs, on the other hand, must be large, for they provide the cytoplasm (all the rest of the cell) with mitochondria (energy factories), chloroplasts (for photosynthesizers), and all other parts that a zygote needs to begin the process of embryonic growth. (From "Sex and Size" in "The Flamingo's Smile", W.W. Norton, New York, 1985.)

FURTHER READING

To read up on the positive, and often negative, experience of women in science, I recommend the following:

Cole, J.R. 1979. *Fair science: women in the scientific community*. The Free Press/Collier MacMillan Publishers, London. (This is a sociological study based on a large-scale longitudinal survey of matched female Ph.D. holders.)

Gornick, V. 1983. *Women in science: portraits from a world in transition*. Simon and Schuster,

New York. (This book presents case histories on the intellectual, professional and emotional experiences of women struggling for opportunity and recognition in science.)

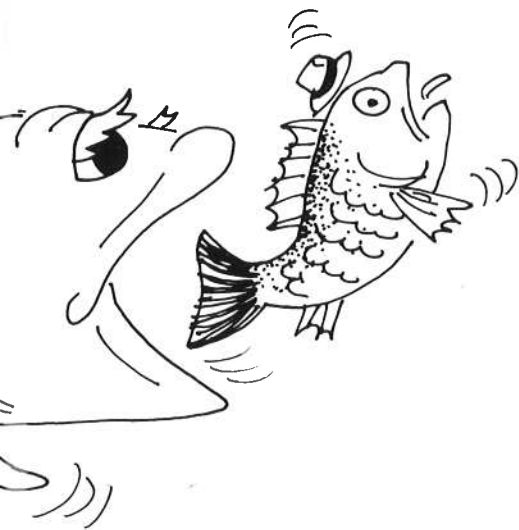
Keller, E.F. 1983. *A feeling for the organism: the life and work of Barbara McClintock*. Freeman, New York. (This biography of the recent McArthur and Nobel Prize winner emphasizes her special ability to relate to the organisms she studied.)

Lipman-Blumen, J. *How ideology shapes women's lives*, p. 146-154. In W.H. Freeman. *Hormones and reproductive behavior*. San Francisco. (This article, originally published in *Scientific American*,

September 1972, shows how a woman's life goals, particularly her educational and occupational aspirations, are guided by the type of sex-role ideology acquired in childhood.)

For more on the feminist critique of the male domination of science and its negative implications, look up the following:

Keller, E.F. 1985. *Reflections on gender and science*. Yale University Press, New Haven and London. (Keller examines the deeply-rooted myth which casts objectivity, reason and mind [and science] as male; and subjectivity, feeling and nature as female. She then speculates as to what might happen if it were otherwise.)



Or one could ask why many male scientists, known otherwise for the rigor of their reasoning, tend to booby trap themselves when it comes to dealing with sex.

I have conducted my own small, and admittedly rather unrigorous, survey. Most of the male aquatic biologists I asked (unsurprisingly) agreed with the first quote (i.e., the notion of "the most expensive substance"); while most female colleagues (unsurprisingly) agreed with the second quote.

There shouldn't be divisions along sexual lines like this in science. And this brings us to the real topic of this essay, namely, the fact that there are too few females in the field of aquatic biology, and in science in general. Booby traps, such as those uncovered above, can be presumed to occur all over the place.

Keller, E.F. 1987. *On the need to count past two in our thinking about gender and science.* New Ideas in Psychol. 5(2):275-287. (Keller presents material to back the suggestion that evolutionary biology "cannot be properly understood without attention to the way in which our thinking - or perhaps... our absence of thought - about male and female nature have crept into our thinking about nature.")

Kevles, B. 1986. *Females of the species: sex and survival in the animal kingdom.* (This is a review of females as active participants in evolution.)

Rosser, S. 1985. *The feminist perspective on science: is*

Science needs more female scientists, many more, to locate and diffuse all the hidden booby traps laid throughout the fields of science by centuries of male domination.

Here is another example from aquatic biology: why is it that the (male-authored) books I have read about seals suggest that adult males have "harems," while the (only) female seal biologist I know argues that it is the females who opt to share a reduced number of male seals, because the males only consume fish and ignore their pups?

Clearly we need to find good answers to these questions. Aquatic biology - and science in general - needs more female scientists, many more, to locate and diffuse all the hidden booby traps laid throughout the fields of science by centuries of male domination.

Time will allow, after some decades when parity has been achieved at all levels, from lab benches to the national academies and funding agencies, for females to show whether they have a specific genius that will enrich the sciences with specifically female concepts, as was suggested two decades ago by enlight-

***reconceptualization possible?* J. Nat. Assoc. Women Deans, Administrators and Counselors. Fall 1985: 29-36. (Rosser presents criteria for a science, especially biology, that would "include us all," rather than be formulated from the perspective of white, middle-class and upper-class western males.)**

To further investigate the question posed above, as to why female fish grow larger than males inspite of their larger reproductive investment, see:

Pauly, D. 1984. *A mechanism for the juvenile-to-adult transition in fishes.* Journal de Conseil International pour l'Exploration de la Mer 41:280-284.

ened persons, such as the anthropologist Ashley Montagu, the psychoanalyst Bruno Bettelheim, as well as by Evelyn Fox Keller (see box).

An alternative view is that women in science will be no better, but also not worse, than men - as suggested by many feminists.

But it really doesn't matter. The problems which man(?)kind faces are simply too big to lose one half of the world's potential scientists just because some people confuse sex (a biological fact) with gender, which is "what culture makes of sex: the cultural transformation of male and female infants into adult men and women." (Keller 1987, see box.)

Things being as they are, I believe, however, that it won't be sufficient to achieve parity for male scientists not to discriminate against their female colleagues - i.e., to offer "equal opportunities."

Having often to reassure my 8-year old daughter that, yes, women can and should become professional divers, scientists and airplane pilots, I can experience at the personal level, and not only from reading or hearsay, how females are "eased out" of "male activities" that, after all, are interesting and challenging but which girls are not supposed to dream of achieving. (One doesn't have to rely on such anecdotes. There is empirical evidence for these processes - see box.)

Special encouragement is thus needed, such as the fellowship created exclusively for female scientists by the Canadian government. ICLARM addresses this issue in the editorial on page 2.

For those who might still be interested: a possible solution to the fish growth riddle above is that fish do not stop growing because they start to reproduce, but start to reproduce when they stop growing. Logic doesn't preclude this, does it? (See box for a reference.)



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