Animals' Sexual Changes Linked to Waste, Chemicals

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Animals throughout the world are undergoing unnatural sexual changes in response to environmental pollution, according to a group of scientists. The scientists warn that the gender-bending effects of certain man-made substances and human sewage seriously threaten polar bears, alligators, frogs, mollusks, and other wildlife.

The group's concerns are set out in a new report compiled by an international research team for the Paris-based Scientific Committee on Problems in the Environment (SCOPE) and the North Carolina-based International Union of Pure and Applied Chemistry (IUPAC). The scientists say the report represents the first major global investigation into body-altering chemicals known as endocrine active substances, or EASs.

"Understanding the scientific issues surrounding endocrine active substances is an international priority," the report states. "Endocrine disruptors affect not only humans, but also other living organisms. They affect not only our own generation, but also future generations."

The report suggests endocrine disruptors are now widespread in many animals and can seriously harm populations. The authors call for international authorities take urgent action to address the threat.

Endocrine disruptors interfere with animals' endocrine systems, leading to adverse health effects that can be passed to offspring. EASs mimic naturally produced hormones, setting off chemical reactions in the body. Endocrine disruptors can also block the action of hormones and alter their concentrations.

According to the Brussels, Belgium-based European Commission, endocrine active substances include the naturally-occurring hormones estrogen and testosterone. Other EASs are man-made substances like the synthetic hormones used in oral contraceptives and hormone-replacement therapies as well as chemicals used in industry and agriculture (such as pesticides).

Scientists first realized the scale of endocrine disruptors' gender-bending potential in the 1990s. According to Joanna Burger, studies have shown over 200 animal species around the world are known or are suspected to have been affected by EASs. Burger is co-chair of the SCOPE/IUPAC project and professor of cell biology and neuroscience at Rutgers University in New Jersey.

Sex-Change Pollution

The masculization of female polar bears in the Norwegian Arctic was linked to polychlorinated biphenyls (PCBs), an industrial pollutant that accumulates along food chains, according to a study published in 1998 in the *Journal of Wildlife Diseases.* The following year, a WWF report associated spontaneous abortions and declining seal populations along the Wadden Sea coast of the Neatherlands, Germany, and Denmark with low female hormone levels due to PCB contamination.

Studies undertaken in Lake Apopka, Florida, blame pesticide pollution for sex-organ abnormalities in Florida alligators, which researchers say have resulted in significant population losses. Females were having difficulty creating viable eggs, while males experienced premature sperm production and reductions in penis size, among other effects.

In Britain studies commissioned by the government's main environment agency found that sewage effluents caused egg development in male freshwater fish.

More recent studies published in the *Proceedings of the National Academy of Sciences* and *Environmental Health Perspectives* research journals also linked endocrine disruptors to limb deformities and feminization in frogs as well as masculization in many species of marine mollusks.

The new SCOPE-IUPAC report says endocrine disruption can be expected in all animalsin which hormones initiate physical changes, including humans.

While human effects have not been proven or quantified, the European Commission has adopted a precautionary approach based on current knowledge on the possible effects of endocrine disruption in humans. Women, they say, may experience a greater risk for breast and ovarian cancer, and the female birthrate may decline. Possible male health impacts include lower sperm counts, smaller penis size, and increased risk for testicular cancer, according to the inter-governmental body representing 15 member states.

Peter Matthiessen, head of environmental chemistry and pollution at the U.K.'s Centre for Ecology and Hydrology says a major challenge facing scientists who study the impact of endocrine active substances is that the larger the animal, the harder it is to prove the effects of EASs.

"We've got much better data towards the lower end of the animal scale than the upper end," he said. "To be sure you know what's happening, you've really got to do an experiment in the lab to replicate the effect. You can do that with a shrimp or a fish, but not with a whale."

An added challenge for researchers studying endocrine disruptors is the likelihood that the substances act together in complex cocktails. This makes work to determine precise cause and effect even more difficult.

Mattiessen is co-author of a recent U.K. study that backs the finding of the SCOPE-IUPAC report. The study, recently published in the scientific journal *Environmental Toxicology and Chemistry,* suggests that the gender-bending impacts of EASs can be reversed.

Sewage Effluents

During a five-year study, Matthiessen and his colleagues conducted a series of annual surveys of fish along the British coast to gauge trends in levels of feminization. The study was spurred by previous observations of feminization in estuarine fish, particularly the flounder, a common flatfish, Matthiessen said.

"We've known for some time that this fish has become feminized in estuaries where lots of people live and lots of sewage is going into the water."

Matthiessen said that the fish's changes were a reaction to estrogens present in human waste. Such estrogens derive largely from birth control pills and hormone-therapy drugs.

"What's really interesting is that in the Tyne [River] estuary in northeast England a really strong recovery kicked in," Matthiessen said, noting the phenomenon coincided with the upgrading of a major sewage treatment works. "Until then, most of the fish were very strongly feminized. For example, yolk was present in male blood plasma, which is highly abnormal. Then [after the sewage plant upgrade] there was this sudden drop in yolk protein concentrations which was sustained in subsequent years."

Matthiessen says modern sewage treatments, which are better at stripping out hormones, can help to tackle the problem of estrogen pollution.

Action Requested

The SCOPE-IUPAC report also calls for more detailed scientific analysis of endocrine disruptors, particularly those that may pose a risk even at very low levels. The report also advocates improved environmental safeguards, such as routine testing of chemicals for endocrine-disrupting properties.

The report also says substantial international coordination and cooperation on the issue is lacking at present and that the Intergovernmental Forum on Chemical Safety (IFCS), based in Geneva, Switzerland, should initiate global management of endocrine disruptors.

The European Union has adopted a community strategy for addressing the problem, including the development and validation of test methods and a review of laws governing chemical use. But this still doesnt go far enough, environmental groups say.

Clifton Curtis, of the Washington, D.C.-based WWF, said: "We know that the global production of chemicals is increasing, and at the same time we have warning signals that a variety of troubling threats to wildlife and human health are becoming more prevalent. It is reckless to suggest there is no link between the two, and give chemicals the benefit of the doubt.

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