

Straight TALK

by **John A. Arway**

*Executive Director
Pennsylvania Fish & Boat Commission*



Photo: Andrew L. Shields

The Precautionary Principle

In February 2017, I was invited by Chairman Gene Yaw and Minority Chairman John T. Yudichak to present testimony on behalf of the Pennsylvania Fish & Boat Commission (PFBC) to members of the Senate Environmental Resources and Energy Committee regarding pharmaceuticals in Pennsylvania's waterways. I was joined by several other panelists who spoke about the human health and environmental effects of pharmaceuticals, but the focus of my testimony was on the health of our fish. Advances in medications have certainly improved the health of people and animals in many ways. The benefits and risks associated with prescribed medications are evaluated by the researchers during their development. However, we have all seen the television ads where we hear more about the adverse side effects of pharmaceuticals than the benefits. A friend told me about his wife having problems with vertigo, and you can imagine how she felt when she read the label of the prescribed medication and found that a side effect was dizziness. Obviously, many of us are left wondering about whether the health risks of taking medications are worth the health benefits. It gets even more complicated when we are taking more than one medication and are uncertain whether they interfere with each other.

So, how do pharmaceuticals reach Pennsylvania's waterways? One route is through point source discharges from wastewater treatment plants. Processing wastewater typically involves an activated sludge treatment process. The standard treatment process varies in the removal rate for pharmaceuticals from less than 20% to greater than 90%. Standard wastewater treatment processes were not designed to remove prescription drugs, their metabolites and other emerging contaminants. Removal rates vary depending on the product. Some chemicals, like caffeine, have high removal rates. More expensive treatment processes such as reverse osmosis, ozone and advanced oxidation can result in higher removal rates. Pharmaceuticals can also enter waterways through runoff from animal feeding operations. Application of pesticides, herbicides, manure, fungicides and fertilizers can also be washed by rain and snowmelt from fields and lawns into our streams. These chemicals can affect the health of fish and aquatic life in much the same way as pharmaceuticals. In urbanized areas, pollutants, including pharmaceuticals, can enter waterways through combined sewer overflows.

Chemicals that produce hormonal changes in fish are called endocrine disrupting chemicals or EDCs. One effect of exposure to

EDCs is estrogenicity or the production of female sex hormones. The United States Geological Survey Fish Health Laboratory reported in 2013 that approximately 50% of male bass in the Delaware River, 10% in the Ohio River drainage and up to 100% of the males sampled in the Susquehanna River were found to have an intersex condition. More recent samples in the Susquehanna River confirm that 90% to 100% of male Smallmouth Bass have an intersex condition and that this condition is more severe than found in other drainages.

Intersex condition is attributed to early life stage exposure or chronic exposure of fish over their lifetime to estrogenic chemicals. More recent work has found that an egg precursor protein, vitellogenin, can indicate estrogen-like compound exposure in the short term. If vitellogenin is present in the bloodstream of female fish in non-spawning periods or in male fish anytime, then recent exposure to EDCs has likely occurred. Our current ability to detect these physiological changes in fish helps us define where pharmaceuticals and estrogen-like compounds occur.

A Pennsylvania Department of Environmental Protection (DEP) fish tissue sampling program in the Susquehanna River has been extended to its tributaries. Sadly, fish displaying estrogenic response are found everywhere, indicating that the problem is broader than we thought and not the result of a single source of estrogenic compounds such as a discharge from a sewage treatment plant. Many other chemicals have properties similar to estrogen in addition to pharmaceuticals. This finding has broadened the scope of the Susquehanna River studies. Fish with intersex condition or vitellogenin in their bloodstream is abnormal but unfortunately does not identify its specific cause.

Additional work is necessary to identify the products or mixtures of chemicals that produce these estrogenic effects. However, in the 2015 multi-agency Causal Analysis/Diagnosis Decision Information System study, endocrine disrupting chemicals, which include those with estrogen-like response, and pesticides were identified as likely causes for reduction of the Smallmouth Bass population in the Susquehanna River.

Pharmaceuticals and health-altering chemicals have different sources of origin and affect fish in different ways. Reproductive rates of Yellow Perch in Chesapeake Bay tributaries in Maryland were found to be lowest in highly suburbanized watersheds, which would contain a higher percentage of wastewater discharge. An anti-anxiety drug was found to alter perch socialization and feeding behavior in dilute concentrations in a Swedish study. Fathead Minnows were studied in an Ontario lake, where they were exposed to estrogen and estrogen-like compounds. Impacts on reproductive

organ development in males and females caused reproductive failure and near extirpation of the species in the lake.

In a recent presentation to PFBC Commissioners, Eric Wright, a Geisinger Health Systems representative, discussed the prevalence of unused medications available in homes. Geisinger has championed removal of prescription drugs from unintended use and from the environment through a “take-back” box program. Medications are gathered by the National Guard from take-back boxes from secure locations throughout Pennsylvania and transported for incineration. In 2016, the Pennsylvania National Guard serviced approximately 500 take-back boxes and collected 66,000 pounds of unused pharmaceuticals. That’s over 30 tons. We were so impressed with this program that PFBC has partnered with Geisinger to install a take-back box in our Harrisburg Headquarters to provide a way for citizens to safely dispose of unused medications and help improve the health of the Susquehanna River and its Smallmouth Bass. Removing unused pharmaceuticals from homes keeps them from being flushed down the toilet. Pharmaceuticals removed from homes during this program included cardiovascular, pain, psychiatric, antibiotics, endocrine, digestive, anti-inflammatory, breathing, cold and allergy, and other medications. It was clear from this presentation that if the Geisinger take-back program didn’t exist, these pharmaceuticals may not have been properly disposed of and possibly released into the Susquehanna River.

How can society make progress in reducing pharmaceuticals from getting into our lakes, streams and rivers? Removing unused pharmaceuticals from homes and providing proper disposal alternatives is an important first step. Improving our wastewater treatment processes to provide more effective removal of medications and break down products is another effective solution.

The DEP has found that water collected from Susquehanna River tributary streams not directly impacted by wastewater treatment plants produced estrogenic effects. While we aren’t completely certain about what compounds are producing the estrogenic effects, our agency is cooperating with DEP and federal agencies to further evaluate the problem. At the same time, we have strongly recommended to DEP and the United States Environmental Protection Agency (EPA) that actions need to begin on the Susquehanna River. We need to begin implementing not only studies to define the precise nature of the water quality problems but also begin instituting remedies to fix the problems. We believe an impaired designation would provide access to funding sources that will not only help clean up the river but help with Pennsylvania’s efforts in meeting Chesapeake Bay loading limits and goals. We are currently working with EPA and DEP to identify Susquehanna River Basin priorities and focus efforts on reducing pharmaceuticals, nutrients, sediment and other contaminants in the Susquehanna River Basin.

There are many in government who believe that we must delay decisions until all the science is completed, so we are absolutely certain of the problem before we act. Unfortunately, those who rationalize delaying action are, intentionally or irresponsibly, living in the past. Fenstad and Matsuura 2005 discuss the evolution of environmental policy development throughout the world and describe the early stages as curative. In other words, continued human development didn’t allow the environment to heal itself, so society had to help by passing laws and policies that required those who profited from degrading our

environment to pay for the cost of pollution control—the Polluter Pays Principle. We quickly learned that it was too costly to continue to treat all our pollution and adopted the Prevention Principle, which requires a reduction in the amount of degradation as a matter of equity and feasibility. The work we have done has resulted in more miles of fishable and swimmable waters—just as the Clean Water Act intended.

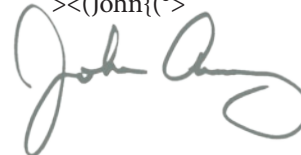
Today, we have new challenges and risks associated with genetically modified organisms (i.e. Roundup® resistant crops), climate change, the unintended impact of pharmaceuticals and many other threats.

However, there are many, like me, who believe in the third principle, which requires us to anticipate uncertain risks and use scientific knowledge to act before it is too late and damage is done—the Precautionary Principle (PP). The PP was used in the 1992 Rio Earth Summit: “When there are threats of serious and irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.” Again in 1998, at the Wingspread Conference, the PP was emphasized but went further and added, “In this context the proponent of an activity, rather than the public, should bear the burden of proof.” More recently at a meeting of the World Commission on the Ethics of Scientific Knowledge and Technology, the PP was stated as “When human activities lead to morally unacceptable harm that is scientifically plausible but uncertain, actions shall be taken to avoid or diminish that harm.”

The adult bass in the Susquehanna River have melanistic spots, intersex conditions, cancerous tumors and bacterial infections causing external sores and lesions. Our young-of-year bass continue to be infected by bacteria causing sores, lesions and mortality. Our scientists have said that the likely causes of these abnormalities are EDCs, herbicides, parasites and pathogens. Why does Pennsylvania refuse to apply the Precautionary Principle and initiate action before it’s too late?

Your Director,

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The mission of the Pennsylvania Fish & Boat Commission is to protect, conserve and enhance the Commonwealth’s aquatic resources, and provide fishing and boating opportunities.

Fenstad, Jens Erik and Koichiro Matsuura. 2005. The Precautionary Principle. World Commission on the Ethics of Scientific Knowledge and Technology, United Nations Educational, Scientific and Cultural Organization, 7 place de Fontenoy, 75352 Paris 07 SP.

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