

The Politics of Science or the Science of Politics

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Pennsylvania Fish and Boat Commission

When I first became executive director of the Pennsylvania Fish and Boat Commission (PFBC) in 2010, a friend of mine, who was a member of the Pennsylvania General Assembly at the time, told me that I had just become a politician. I immediately took exception to his comment, which began an interesting debate about politics and science. I learned that anyone who uses his or her position to influence public policy decisions is a politician. Reluctantly, I had to admit that I just might have become a politician, since influencing public policy was the very reason I applied for the director position in the first place. I felt somewhat more comfortable with the new title of “politician” after consulting my principal online research tool, Wikipedia.com, and finding that some politicians are actually experienced in the art or science of government. After all, as a fisheries biologist who had practiced the profession for over 30 years, I certainly had the training to command the science of government. How hard could it be to learn the art of government? Little did I know!

Our debate turned next to the discussion of partisanship. He advised that I take a bi-partisan approach to finding common ground for the issues that I would be advocating. However, the more I thought about it, the more I realized that I wouldn't be just dealing with the two political parties in our legislature. Now as director of a public service agency, I had just accepted the

responsibility of administering the programs and directing staff to protect, conserve, and enhance our Commonwealth's aquatic resources and provide fishing and boating opportunities—the very mission of the PFBC.

This Resource First philosophy would require me to work with a diverse group of people to fulfill the mission. Wilson (1887) noted that the political controlled the administrative. But popular will and efficient administration could be subverted if politics became too partisan. Waldo (1980) suggested that “no problem is more central to public administration than . . . the relationship of politics and administration.” Wilson (1887) further noted that democratic politics could benefit from politically neutral public service only under the constraints of political responsibility and the scientific method (Rabin and Bowman 1984). Properly applying the scientific method and telling the truth have been key factors for my success, so the path I chose seemed to be the right one at the right time (Arway 2010).

The scientific method is defined as the “principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses” (Merriam-Webster 2016). Use of the scientific method is the bond that unifies scientists in all professions. It is often ironic to hear non-scientists say, “We will follow the science” as they discuss public policy decisions when, more often than not, it is not the science that prevails in public policy or political debates. Frequently, political, social and economic variables dominate the discussion while science takes a back-seat in decision-making (Arway 2011). However, can the scientific method also be used in political science? The elements include observation, gathering facts, and testing hypotheses through repeated experimentation to produce a set of results with a certain level of confidence that can be replicated. I have often found myself following all of the steps but becoming frustrated with the repeatability test, especially with different administrations and legislative agendas. Might that explain the wide variance associated with the results?

My greatest leadership challenge has been to find a way to inform and engage the public in public policy discussions (Arway 2015). “The public” may appear to be a third party to some, but anglers, boaters, and conservationists fluctuate from supporter to critic depending upon the issue. The 2010 U.S. Census estimated that we have over 12.7 million people in the Commonwealth, which include 1.2 million anglers (U.S. Department of the Interior 2006) and 3 million boaters (U.S. Coast Guard 2012). I concluded that in order to be effective in my role as a public administrator, I needed to be an “apolitical” politician.

For much of my early career as a PFBC fisheries biologist, I believed that I was going to change the world by producing good science. I learned, after many hours of testifying as an expert witness in administrative, civil, and criminal courts, that judges never expect absolute certainty (100%) but only an opinion to “a reasonable degree of scientific certainty.” That perspective quickly changed when I became involved in public policy and regulatory decisions.

Yes, I discovered that our laws require and our courts apply far more subjective standards of proof. In civil courts, the standard of proof is “preponderance of evidence” (more likely than not). Although the standard of proof is much greater in criminal courts—“beyond a reasonable doubt” (no reason to believe otherwise), it’s a much lower standard than scientists hold for ourselves with our own experiments. What standard of proof is used for political science decisions?

The Past

On March 30, 2016, the Pennsylvania Fish and Boat Commission (PFBC) commemorated the 150th anniversary of our founding in 1866. A convention was held in Harrisburg in 1866 to investigate water pollution being caused by the logging of Pennsylvania’s forests and serious concerns about the reduction of American Shad¹ runs in the Susquehanna River. This discussion resulted in Governor Andrew Curtin signing the law, Act of March 30, 1866 (P.L. 370, No. 336), that named James Worrall as Pennsylvania’s first Commissioner of Fisheries. In 1925, Act 1925-263 established the Board of Fish Commissioners. Then, in 1949, Act 1949-180 officially established the Pennsylvania Fish Commission (PFC) as an agency and described its powers and duties. In 1949, the Commission appointed Charles A. French as its first executive director, and in 1991, under Act 1991-39, the Pennsylvania Fish Commission (PFC) became the PFBC. This makes the PFBC the second oldest fish or wildlife agency in the nation.

Throughout its history, the Commission has evolved from a one-man operation funded solely by the General Fund to an agency with a complement of 432 staff funded by anglers and boaters through license and registration fees and the federal excise taxes on fishing and boating equipment. The agency’s mission has broadened some from the original one, but even today it is still focused on protecting, conserving, and enhancing our aquatic resources and providing fishing and boating opportunities. The Commission was originally created to solve the problems caused by dams blocking the free

migration of American Shad in the Susquehanna River and water pollution from logging filling our streams and rivers with sediment. I would now like to report on the progress we have made and the challenges that still lie ahead.

Susquehanna River Dams

In 1867, the first fishway was constructed at the Columbia (Wrightsville) Dam (built in 1840) on the Susquehanna River as the first attempt to restore anadromous fish runs to the Susquehanna River. Then, came the York Haven (1904), Holtwood (1910), Conowingo (1929), and Safe Harbor (1931) hydroelectric dams, which have been major impediments to migratory fish since they were built. In the 1950s, the resource agencies implemented a program to restore access for migratory fish to the upper Susquehanna River basin, focusing on American Shad. In response to harvest declines that signaled critically low fish-stock levels, fishing for American Shad in the Chesapeake Bay region was closed by Maryland in 1980 and then by Virginia in 1994.

Former PFC executive director Ralph W. Abele (1972–1987) fought passionately to have fish passage installed at these dams and built a shad hatchery at Van Dyke along the Juniata River to assist the restoration process. In a landmark case in 1980, the Fish Commission intervened in an appeal involving multiple applications for hydroelectric project license renewals before the Federal Energy Regulatory Commission (FERC) for the continued operation of dams on the lower Susquehanna River. The appeal resulted in the negotiation of license conditions to mitigate natural resource and recreational impacts of the projects, most notably the negative impact on the migration of American Shad up and down river. The ultimate settlement included license conditions for all dams that required the construction of fish passage facilities in consultation with regulatory and natural resource agencies (FERC Decisions 1980).

We continue to fall short of our migratory fish restoration goals of two million American Shad and five million river herring spawning upstream of the York Haven Dam. The American Shad stock in the Susquehanna River improved slowly and made an impressive comeback by 2001, when more than 200,000 adult shad were counted at the Conowingo Dam fish lifts. Recent numbers of American Shad passing the four major downriver dams reveal only 43 American Shad passing York Haven Dam in 2015. In 2010, the Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRC) identified poor efficiency of fish passage measures and facilities, low hatchery production in recent years, low numbers of spawning fish accessing quality habitat,

poor young-of-year recruitment upstream of Conowingo Dam, ocean and Chesapeake Bay mortality, turbine mortality, and predation as the major causes of this decline (SRAFRFC 2010).

The current plan calls for a nature-like fishway to be constructed by 2021 on the east side of York Haven Dam adjacent to Three Mile Island. Improvements in downstream passage rates of out-migrating American Shad and American Eels are also required. Since the Safe Harbor Dam currently has the most effective fishway on the East Coast for American Shad passage (~78%), no future changes are anticipated. The redevelopment project at Holtwood Dam provides increased power generation capacity and greater control of river flows, which allows more directed flows and passage routes to lead fish to the fish lifts. The Muddy Run Pumped Storage project is required to trap and provide upstream transport of up to one million American Eels per year.

The FERC license for the Conowingo Dam in Maryland is on an annual renewal, since the Maryland natural resource agencies continue to work with the licensee on sediment accumulation and mitigation issues on the Conowingo Pool. The U.S. Fish and Wildlife Service (FWS) reached an agreement with Exelon in May 2016 on improvements to the existing East Lift fishways, including adding hoppers to increase lift volume and reduce lift cycle time as well as significant improvements to the West Lift. Exelon is also required to fund trap and upstream transfer of up to 100,000 American Shad and 100,000 river herring annually and to develop efficient upstream trap and transfer facilities for American Eels. When Maryland resolves its issues, a 401 Water Quality Certification and then the FERC license will be completed to finalize the license renewal process.

The original charter of the PFC was to restore American Shad to the Susquehanna River. We began with the initial challenge to pass shad around a small dam at Wrightsville with a fish ladder in 1867. Our past leaders had been diligent in working in the legal, policy, and political arenas with limited success. The future of the American Shad restoration in the Susquehanna River is now fully dependent upon the ability of this and future generations working together to provide effective fish passage and not accept that the existing dams have become part of the river environment—the new normal. We hope not to forget about the importance and historical significance of the shad fishery and yield to the whims of societal demands for power. I am confident that science, engineering, and the continued public demand for shad will prevail, since the shad and our forefathers are counting on us and future generations. There is still work to be done if we ever expect to fulfill the dream

of seeing a fishable population of American Shad return to the Pennsylvania portion of the Susquehanna River.

Recently over one million man-made dams around the world have been determined to be major sources of global greenhouse gases emitting nearly a gigaton, a billion tons, of annual carbon dioxide equivalents. This includes methane (79%), carbon dioxide (17%) and nitrous oxide (4%) (Liess, et al. 2016). The authors note that the study will provide policy makers and the public necessary information about other consequences of damming rivers.

Water Pollution

The early challenges of preventing sedimentation of our streams, rivers, and lakes from the land disturbances caused by the timber industry continued throughout the entire twentieth century with the growing problems of water pollution caused by the American Industrial Revolution (Wolensky 2016).

In 1901, a law (Section 26 of Act of May 25, 1901 (P.L. 302, No. 203)) went into effect that prohibited placing poisonous substances in any waters. And, in 1909, another law was passed forbidding the emptying into any waters of the Commonwealth any waste deleterious to fish. These two laws historically established the PFBC as one of the oldest water pollution enforcement agencies not only in Pennsylvania but also in the entire nation.

Over the course of my 36-year career with the PFBC, I have seen dramatic changes in the quality of our Commonwealth's streams, rivers, and lakes. Although we inherited miles of polluted waters from our forefathers, I am pleased to say that the changes have been for the better in many ways. I don't hold those before us accountable for these polluted waters, nor should you. They lived in different times by different means. They survived off the resources provided to them by the land—for food, drink, and employment.

The Industrial Revolution required them to log our forests, mine our coal, drill for our oil and natural gas, harness the power of our rivers for electricity, aggressively farm our fields, and work in factories to produce the food and energy that our society demanded. The laws that did exist did not protect our rivers and streams because we needed those goods and services to see us through the Great Depression, two World Wars, and several conflicts. That was their legacy, and it was about making America strong for us—the future generation (Arway 2010a). What will our legacy be?

The people in public referendum ratified Article 1, Section 27, also known as the Environmental Rights Amendment, on May 18, 1971, by a four to one margin. I was in undergraduate school at the time, still trying to determine what I wanted to do in life, and can clearly remember voting for this

amendment. In the voting booth, it resonated with my personal philosophy about public rights and trust in government and still does today (Arway 2014).

Article 1, Section 27 of the Pennsylvania Constitution

The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people.

Even today, who among us could disagree with these basic principles? Many believe that Article 1 is the most important part of the Pennsylvania Constitution, since it contains the declaration of rights as inherent rights of mankind that include the right to enjoy and defend life and liberty, to reform, alter or abolish government, free elections, a speedy trial by jury, freedom of speech, bear arms . . . and the right to a clean environment (Pa. Const. art.1). These are natural, inherent, and inalienable rights that were established by our forefathers and endorsed by the people of Pennsylvania.

On December 19, 2013, the Supreme Court of Pennsylvania issued an opinion that held certain parts of our new Oil and Gas Act (Act 13 of 2012) unconstitutional (*Robinson Township v. Commonwealth of Pennsylvania*). Although I am a biologist and not a lawyer, I have spent many hours in court and on the witness stand as an expert witness defending the environmental rights of our people to aquatic resources. My primary interest in studying the decision focused on the opinion of the three justices who explained their concerns about how the law was inconsistent with Article 1, Section 27. Although the joint opinion of three justices out of seven doesn't qualify for a majority opinion, I am told that it does meet the definition of a plurality, which is significant especially when the Chief Justice agrees.

The first clause of Section 27 deals with individual environmental rights and requires all branches of government to consider the "effect of any proposed action on the constitutionally protected features." Furthermore, "The right to "clean air" and "pure water" sets plain conditions by which government must abide." Here they cite Dernbach 1999, who wrote "the measure of our progress is not just what we have but how we live, that it is not man who must adapt himself to technology but technology which must be adapted to man."

The second and third clauses of Section 27 involve the public trust and reserve the public's right to the common ownership of Pennsylvania's public

natural resources, including generations yet to come. These resources frequently include resources of public interest such as “ambient air, surface and ground water, wild flora, and fauna (including fish),” since the drafters intended “to capture the full array of resources implicating the public interest, as these may be defined by statute or at common law.”

The third clause of Section 27 establishes the Commonwealth’s duties consistent with the public trust doctrine and “designates ‘the Commonwealth’ as trustee and the people as the named beneficiaries.” This clause is our insurance policy, so-to-speak, to ensure that our air stays safe to breathe, our water remains safe to drink, and our natural resources continue to be protected for ourselves and future generations. The court reminded us that those “duties and powers attendant to the trust are not vested exclusively in any single branch of Pennsylvania’s government.” As executive director of the PFBC, I am now very proud to be able to be part of the government that upholds this constitutional obligation.

The court’s plurality opinion goes on to remind us about various environmental events that led to the decision to place our environmental rights on par with our political rights. Deforestation of our landscape in the late 1800s and early 1900s filled our streams with sediment and left behind “thousands of acres of devastated treeless acres” devoid of game and wildlife. Then, came the “industrial exploitation of Pennsylvania’s coalfields,” which fueled our steel mills along our major rivers. This industrial revolution left us with over 2,500 miles of streams polluted by acid mine drainage and rivers that would not freeze over in the winter because of a mixture of chemical antifreeze and thermal pollution. Our generation began the cleanup of our air and water, which led to the partial recovery of our natural resources. We can thank a variety of state and federal laws and regulations that placed necessary controls on industries that posed risk to our environment.

The PFBC’s mandate and philosophy has been consistent through its history since 1866: “to protect, conserve, and enhance.” This philosophy was best exemplified by former executive director Ralph Abele’s philosophy of “Resource First.” Abele charged the agency’s staff with conserving Pennsylvania’s aquatic resources. The best interests of the resource(s) were—and are—to be placed first. It wasn’t just his slogan. It was a way of life that permeated the agency and still does today (Wolensky 2016).

During the early 1980s a coal operator could travel to Harrisburg and be back home mining coal the very same day. However, under Abele’s leadership, we were told to do our duty and fear no one when we applied the new science of risk analysis to every permit application we reviewed. Abele would personally sign each permit application review and include a copy of Article

1, Section 27, in our agency comments to the Department of Environmental Resources (DER). As a result of Abele's diligence, Dr. Maurice (Doc) Goddard called the PFBC the environmental conscience of his Pennsylvania Department of Environmental Resources (PADER). Doc and Ralph were friends and colleagues, and they appreciated each other's support when it came to protecting our streams and our fish.

Over the next several decades, the Commission used the authority and autonomy of an independent administrative agency of state government to carefully appeal permits issued by the PADER and the Pennsylvania Department of Environmental Protection (PADEP). The permits were deemed unprotective of our Commonwealth's water quality and aquatic resources. This proactive approach to pollution prevention helped keep thousands of miles of Commonwealth waters from being added to the Commonwealth's list of impaired waters. Some examples follow:

The Commission provided expert testimony to support PADER's denial of a surface mining permit that would have led to the degradation of Silver Creek, in Butler County (Big "B" Mining Co. 1983). The Commission appealed PADER's issuance of a surface mining permit, and a new permit was negotiated that provided better protection of Iser's Run, Somerset County (PFC 1984). The Commission successfully appealed PADER's issuance of a surface mining permit to prevent an encroachment of Campbell Run, Clearfield County (PFC 1986). The Commission intervened in the City of Harrisburg's appeal of PADER's denial of water quality certification. The City proposed to increase the height of the Dock Street Dam on the Susquehanna River and add a hydroelectric facility (City of Harrisburg 1988). The Commission appealed PADER's issuance of a coal refuse disposal permit, and unfortunately the appeal was dismissed as untimely. The coal company filed bankruptcy years later, and the Commonwealth inherited another stream polluted by acid mine drainage (PFC 1989).

The Commission intervened and supported the PADEP's suspension and revocation of various permits on the basis that affected wetlands were of exceptional value because they were located in or along the floodplain of the reach of a wild trout stream in Elk County (Eagle Environmental 1996). Seeking to protect rare mussel and fish species, the Commission appealed PADEP's issuance of encroachment permits to sand and gravel dredgers on the Allegheny River (PFBC 2004; Hanson Aggregate 2006). The Commission appealed PADEP's issuance of an NPDES permit for a power plant at Shawville, Clearfield County. Parties ultimately reached a settlement agreement that replaced DEP's original permit thermal limits with the more protective limits and required the power company to contribute a total of \$300,000 to the Commission for mitigation (PFBC 2010).

In addition to being active and successful in challenging permit actions by state and federal regulatory agencies to defend the interests of our Commonwealth's aquatic resources, Commission staff also actively participate in environmental regulation and policy development. The PFBC executive director is a voting member of the Environmental Quality Board, and PFBC staff participated on a variety of PADER and PADEP committees and work groups involving water quality and quantity across a range of regulatory programs, including coal and non-coal mining, oil and gas, municipal, residual and hazardous wastes, stream and wetland encroachments, and water quality standards.

In 1969, the Commission created the Wilderness Trout Stream (WTS) program and added 75 streams in 1972. Today, 105 stream sections are included in the program, which qualify them for a 25 Pa. Code Chapter 93 Exceptional Value (EV) special protected water-use classification. EV represents the highest water quality protection status provided by the Commonwealth (see 25 Pa. Code Chapter 93, Pennsylvania Code 2017).

The Commission received authority from the Pennsylvania General Assembly for regulating reptiles, amphibians, and aquatic organisms and for listing rare species as state threatened and endangered (T&E) in 1974. This authority closely followed the passage of the federal Endangered Species Act of 1973 (16 U.S.C. 1531–1544, 87 Stat. 884). Wetlands that serve as habitat for PFBC-listed T&E species qualify for Exceptional Value Wetlands protection under 25 Pa. Code Chapter 105.17(1)(i). The Commission adopted Operation FUTURE (Fisheries Utilization Through User Resource Evaluation) in 1981, and as explained by former director Ralph Abele, “This marks a formally declared shift in the philosophy and mission of the Pennsylvania Fish Commission from recreation first to resource first. This truly makes the Pennsylvania Fish Commission a conservation agency.” Resource First was adopted by the Board of Commissioners as an agency motto in 1987 and then as an operation philosophy in 2008. Operation FUTURE created a hierarchical classification system for the Commonwealth's trout streams. PFBC-designated Class A trout streams qualify for special protection in 25 Pa. Code Chapter 93 as High-Quality Coldwater Fisheries, and all other designated trout streams trigger EV wetland protection for “wetlands located in or along the floodplain of a wild trout stream” (see 25 Pa. Code Chapter 105 (1)(iii), Pennsylvania Code 2017).

The late Mr. Hank Ingram, a tenured environmental attorney representing the interests of the coal industry, sand and gravel dredgers, and the Pennsylvania Landowners Association, recognized the Commission as the “most powerful environmental agency in Pennsylvania.” He further noted,

“The Fish Commission is a powerful, influential and well-funded bureaucracy which advocates and implements its policies skillfully and aggressively, seemingly independent of external control.” (Ingram, circa 1980s). Although Mr. Ingram’s comments were meant to be critical, they reflected positively on the Commission within the ranks of conservationists and revealed that the Commission cares greatly about the fate of our aquatic resources and understands their value.

Water pollution enforcement has been a top agency priority since the agency received its water pollution enforcement authority in 1901. The Commission’s “Thin Green Line” began as Fish Wardens or Water Bailiffs who were first appointed in 1879 and were assigned to stock fish and enforce the law. They were retitled Waterways Patrolmen in 1968, and in 1980 the Fish and Boat Code recodified and provided limited police powers to Waterways Patrolmen. Act 1984-66 changed the name of Waterways Patrolman to Waterways Conservation Officers (WCOs). A peak law enforcement workforce occurred in 1995 with 106 WCOs and 340 Deputy WCOs (DWCOs). Today there are 86 Commissioned Officers and 78 DWCOs. Violations of 30 Pa.C.S.A. Title 30 (Fish and Boat Code) § 2504, Pollution of Waters, and § 2502 Disturbance of Waterways and Watersheds are third degree misdemeanors punishable by a fine of not less than \$250 nor more than \$5,000, or imprisonment not exceeding 90 days, or both. Additional fines may be assessed of not less than \$20 nor more than \$50 for each fish killed (§ 923 (b)). Additional civil damages may be recovered, under 30 Pa.C.S.A. § 2506 Commonwealth actions for damage to fish, for the commercial resale value, the replacement costs or the recreational value of angling for the fish killed. Although Commission Officers have been actively enforcing water pollution law for over 100 years, Commission files are lacking early reports; however, the following major cases can be reported from over the past 30 years:

Clinton County court ordered Fran Contracting, Inc., to make restitution to the Commission in the amount of \$5,555,840 for estimated costs of abatement of pollution in Cooks Run, Clinton County. Unfortunately, the defendant went bankrupt, the Commission was unable to collect and Cooks Run remains polluted today (*Com. of PA v. Fran Contracting, Inc.* 1983). The Commission intervened in an action brought by the federal government and recovered natural resource damages in the form of lost recreational fishing use at Valley Creek, Chester County, stemming from high levels of PCBs and other toxic residues originating from Paoli Rail Yard Superfund Site (*USA v. Amtrak, Conrail and SEPTA* 1986). Approximately 700,000 gallons of diesel fuel were spilled into the Monongahela and Ohio Rivers. The Commission,

recovered natural resource damages of \$250,000 and a joint recovery with PADER of \$1.75 million that was used to conduct a recreational use survey and an aquatic habitat characterization study of the Three Rivers (Ashland Oil Inc. 1988). In connection with the release of PCBs associated with an interstate natural gas pipeline project, Texas Eastern Gas Pipeline Company paid the Commission \$1.25 million, in settlement for natural resource damages, to assess the impact of PCBs and other substances of concern on aquatic biota with respect to certain compressor station sites in southcentral Pennsylvania (*PADER v. Texas Eastern Transmission Corporation* 1988). Commission experts testified and provided evidence in an action brought by the federal government over Pennzoil Exploration and Production Co.'s discharge of brine into waters of the Commonwealth in northwestern Pennsylvania. The company agreed to pay in excess of \$1 million in damages, and \$150,000 was used for stream and lake habitat improvement projects in McKean County (*USA v. Pennzoil Exploration and Production Co.* 1989).

The Commission, and other federal and state trustees, settled its respective Oil Pollution Act and other natural resource damage claims arising out of an oil spill into the Delaware River from the tank vessel M/T Kentucky (Ashland Petroleum Company 1994). The Commission, along with other federal and state trustees, settled its respective Oil Pollution Act and other natural resource damage claims arising out of an oil spill into Delaware River at the Coastal Eagle Point Refinery (Jahre Spray/Coastal Eagle Point Oil Company 1995). As a result of the company's 1990 release of petroleum products from a pipeline break into Knapp Run and the Allegheny River, the Commission recovered \$300,000 as compensation for natural resource damages and costs of natural resource restoration (*PADER v. Buckeye Pipe Line Company, LP.* 1995). Following a train derailment in Westmoreland County in 1989, which resulted in corn syrup spilling into the Youghiogheny River and killing approximately 10,000 fish, Westmoreland County District Attorney's Office, at the Commission's request, filed a criminal complaint charging CSX with violating the pollution provision of the Fish and Boat Code. The Superior Court ultimately upheld the constitutionality of the statute's penalty provision, imposing an additional fine of \$10 per fish killed in violation of the pollution provision (*Commonwealth of Pennsylvania v. CSX Transportation, Inc.* 1995). The Commission, along with other federal and state trustees, recovered \$21.4 million in natural resource damages resulting from decades of zinc smelting operations at the Palmerton Zinc Pile Superfund Site in northeastern Pennsylvania (*USA v. Horsehead Industries, Inc.* 1998).

The Commission, along with other federal and state trustees, recovered natural resource damages from the U.S. Coast Guard Oil Spill Liability Trust

Fund for an oil spill on the Delaware River (Athos I. 2004). Following the derailment of a train operated by Norfolk Southern in McKean County, which resulted in sodium hydroxide spilling into Big Fill Run and causing damage to the aquatic natural resources of Sinnemahoning-Portage Creek and the Driftwood Branch of Sinnemahoning Creek, the Commission reached a settlement and received \$3.582 million as restitution for natural resource damages (Norfolk Southern Corporation 2006). The Commission sued Consol Energy, Inc. and reached a \$2.5 million settlement for civil damages resulting from the 2009 pollution incident in which discharges from a coal mine entered Dunkard Creek, Greene County, contributing to a massive fish kill spanning nearly 30 miles of stream in West Virginia and Pennsylvania (*PFBC v. Consol Energy, Inc.* 2011).

The Commission has been diligent and judicious in applying its authority to protect our streams and our fish as well as punishing those who violate the law and damage our aquatic natural resources, which are the common property of all the people.

Susquehanna River Impairment

An impaired waterbody is “any waterbody of the United States that does not attain water quality standards (as defined in 40 CFR part 131) due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment.” (U.S. Environmental Protection Agency 2016). The Clean Water Act, as amended, 33 U.S.C. 1251 et seq. further requires under subsection 303(d) of the Act that:

(1)(A) Each State shall identify those waters within its boundaries for which the effluent limitations required by section 301(b)(1)(A) and section 301(b)(1)(B) of this Act are not stringent enough to implement any water quality standard applicable to such waters. The State shall establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters.

The term “303(d) list” contains a state’s list of impaired and threatened waters. States are required to submit their list for Environmental Protection Agency (EPA) approval every two years. For each water on the list, the state identifies the pollutant causing the impairment, when known. In addition, the state assigns a priority for development of Total Maximum Daily Loads (TMDL), a plan designed to abate the sources and causes of impairment (40 C.F.R. §130.7(b)(4)).

Pennsylvania's 303(d) lists are due to be submitted to the U.S. EPA by April 1 of every even numbered year. However, Pennsylvania's draft report was sent out for public comment on August 1 and the deadline for comments was September 12. The final report must be submitted to U.S. EPA Region 3 for review. Within 30 days after receipt, EPA can approve, disapprove, or conditionally approve the state's list. If EPA partially approves and partially disapproves a list because some waters have been omitted, it must act within 30 days to add these waters to the state's list.

Lesions and sores caused by bacterial infections appeared in 2005 on young-of-year (YOY) Smallmouth Bass and produced a massive fish kill that still affects the fishery today. The average catch rate of adult Smallmouth Bass is only 20% of what it was prior to 2005. YOY Smallmouth Bass catch rates are 1/3 of what they were prior to 2002. Adult bass have been found with cancerous tumors, open sores, and lesions. Black spots that aren't understood (blotchy bass syndrome or melanosis), as well as high rates of intersex conditions (male bass with egg precursors and hormones, which should be found only in female bass) caused by exposure to endocrine disrupting chemicals (EDCs) now occur. These chemicals are coming from sewage treatment plant outfalls and other anthropogenic sources. Unprecedented algae blooms fueled by excessive dissolved phosphorus, along with low dissolved oxygen and high pH conditions are all factors in this complicated problem.

A team of scientists from a variety of state and federal agencies as well as academia came together in 2015 to "identify the causes of Smallmouth Bass declines on the Susquehanna River." They analyzed complex sets of environmental data to input into a U.S. Environmental Protection Agency (EPA) modeling tool called CADDIS (Causal Analysis/Diagnosis Decision Information System). They concluded, based on known evidence, that Endocrine Disrupting Chemicals (EDCs) and herbicides along with pathogens and parasites and other stressors were likely causes of the disease (Shull and Pulket 2015).

In a recent article, I discuss the facts that we know about herbicides and endocrine disrupting chemicals and why we need to begin taking action (Arway 2016). I also discuss the challenges controlling nutrients, since Pennsylvania contributes the majority of nutrients and sediments that are delivered to the Chesapeake Bay by the waters of the Susquehanna River. Dissolved phosphorus has been widely accepted as the rate-limiting nutrient that controls algae blooms in flowing waters. Therefore, it continues to make sense that we create and implement a plan (Total Maximum Daily Load) to protect the Bay, the river, and our bass.

The dissolved phosphorus dilemma of the Susquehanna River and Chesapeake Bay is a national problem identified by EPA in their National Rivers and

Streams Assessment Report (U.S. Environmental Protection Agency 2013). A key finding of the report is “Forty percent of the nation’s river and stream length has high levels of phosphorus.” It concludes, “Our rivers and streams are under significant stress and more than half exhibit poor biological condition.” Staff from the PFBC mined the dataset used in the national report and found data from the only four sites sampled on the Susquehanna River that rated poor for total phosphorus and fish metrics.

In a May 2016 News Release, the Pennsylvania Department of Agriculture proudly announced that “Pennsylvania is the third largest egg-producing state in the nation, with an average of 23.9 million hens producing more than 7 billion eggs each year.” Should it not follow that Pennsylvania is the third largest poultry litter producing state in the nation? It might be time to start thinking more about whether we are properly disposing our animal manure or over treating our soils.

On July 28, 2014, in a letter I wrote to Mr. Shawn Garvin, Regional Administrator of the U.S. EPA Region 3 Office, I observed that “a review of data produced by the United States Department of Agriculture’s National Agriculture Statistics Service shows that the acres of cropland and pastureland treated with manure ha[ve] increased 1.5 percent from 2007 through 2012 despite the fact that there are over 1,000 less farms spreading manure. Over 13 percent (3.9 million acres) of Pennsylvania’s land surface (28.6 million acres) was treated with manure and/or commercial fertilizer in 2012. It is easy to see that the concentration of these applications is greatest in the Susquehanna River Basin.”

CADDIS results were reported to the PADEP which independently decided that there is still not enough information to list the Susquehanna River as an impaired water (PADEP 2016). PADEP staff will continue to collect and evaluate data to make a “final” decision in their 2018 Integrated Report. The importance of this decision is critical to the fate of the Smallmouth Bass in the Susquehanna River. It is also integrally related to the Commonwealth’s responsibility to meet the cleanup goals for the Chesapeake Bay. We know what the problems are, but do we care enough to fix them?

When appointed PFBC executive director, I agreed to take on public policy issues that address our public rights for clean air, pure water, and the preservation of the natural, scenic, historic, and esthetic values of our environment guaranteed to all of us by Article 1, Section 27, of our state Constitution. When I took my oath of office, I welcomed my professional responsibility to uphold the Constitution and fulfill my duty as trustee of our public natural resources and to conserve and maintain them for the benefit of all the people. They are, after all, the common property of all the people, including generations yet to come. As an advocate for the Smallmouth Bass that continue to be

impacted by a variety of environmental stressors, I thought that, as an agency, we did all that we could do when our board enacted the catch and release regulations and closed bass season from May 1 through June 12 to protect the adult bass and their developing fry. I was wrong.

We can and should do more as the public service agency responsible for protecting, conserving, and enhancing our Commonwealth's aquatic resources and providing fishing and boating opportunities. We created our Save Our Susquehanna (SOS) campaign. The campaign asks all Pennsylvanians to either buy a fishing license or donate through our SOS First Giving fund-raising site to help begin fixing the river's problems. Over the past year, we have received over \$50,000 in public donations, which we matched with \$50,000 in PFBC funds. These funds were used to complete a watershed restoration project on Limestone Run, Northumberland and Montour Counties. Significant reductions in sediment and nutrients to the Susquehanna River were accomplished and native Brook Trout were transferred into the restored stream habitat.

The appearance of a single cancerous tumor on a Smallmouth Bass caught from the Susquehanna on Election Day in 2014 took this story viral and changed it from a fishing and science story to a public policy story. You can imagine the questions that were being posed on discussion boards all across the country about what caused this tumor to occur and what other problems, both aquatic and human health, it may indicate?

These known facts should serve as the basis for identifying solutions that can be used to reduce and repair the harm we have done to our land, water, and public natural resources. I previously explained that scientists are taught to follow the scientific method, which requires repeated experimentation to minimize the uncertainty with the results. I also understand the more subjective standards of proof required by the law and used by our courts for their decisions.

So, what standard of proof should be used to judge the fate and future of the remaining bass in the Susquehanna River? Five different PADEP Secretaries, spanning three separate administrations, have said, "We will follow the science for this decision." In this case, I believe that the trier of the facts should use the certainty of the information we have collected rather than focus on the uncertainty of the information we have yet to collect. Our scientists have been collecting information for over 11 years and will continue to collect information into the future. That is their job. It's time for policy makers to become brave enough to not "fear the known" or the results of their own decisions. We need to make this critical public policy decision involving the impairment of the river using a rational standard of proof based upon known facts.

The longer we delay the decision, the more probable that the harm will continue due to our fear of the unknown. So, which fear will determine the fate of our bass? Fear of the known, resulting in action, or fear of the unknown and inaction? I will continue to advocate for urgent action. Our bass depend on it, our anglers expect it, and our Constitution requires it.

The Future

Pennsylvania has 86,000 miles of streams and rivers, nearly 4,000 lakes and reservoirs, more than 404,000 acres of wetlands, and 63 miles of Lake Erie shoreline, which are home to more than 25,000 species of known plants and animals, and perhaps, many thousands more yet to be identified. These facts demonstrate the enormity and complexity of the challenges that we all face as public servants as we strive to fulfill our statutory, regulatory, and Constitutional duties to protect our environmental rights.

More than 150 species of plants and animals have been lost from Pennsylvania, and 664 others are species of greatest conservation need and are detailed in our Commonwealth's State Wildlife Action Plan: "90 birds, 19 mammals, 65 fish, 22 reptiles, 18 amphibians and 450 invertebrates. The major threats to their continued existence have been identified as residential and commercial development (15 percent), energy production and mining (13 percent), pollution (13 percent), invasive and other problematic species, and genes and diseases (12 percent)."

We currently have a population of 12,763,536 people, which continues to increase on a fixed amount of land, 45,333 square miles. As of 2015, 83,438 miles of streams and rivers, out of a total of 86,000 miles, have been assessed by PADEP staff for aquatic life use support. Approximately 19% (15,882 miles) do not fully support healthy aquatic communities. Furthermore, some of these waters are still not fishable or swimmable. We have the nation's sixteenth largest river, the Susquehanna River, which drains nearly half of Pennsylvania's land area and has been identified as a major contributor to the impairment of the Chesapeake Bay. We also know that 15,882 miles of our streams and rivers and 37,761 acres of our lakes are not attaining their aquatic life uses because of the current and legacy impacts from agriculture and coal mining creating siltation, metals, nutrients, and organic enrichment of our waters (PADEP 2016).

I believe that our future is bright but not without challenges. We have made substantial progress over the last generation by cleaning up our waters so that we can now say that we have more waters to fish today than when we were children. However, yesterday's challenges were simple compared to the environmental and natural resource challenges that we face in the future.

Today's challenges include cancerous tumors, bacterial infections, black spot, and intersex in Smallmouth Bass in the Susquehanna River; rapidly expanding deep natural gas development across Pennsylvania and the uncertainties about fracking; native Brook Trout compromised by changing climate; aquatic invasive species (AIS) outcompeting native species; lakes, rivers, and Chesapeake Bay clogged with nuisance algae blooms; fewer people, including our legislators, fishing, boating, and recreating outdoors; and our unfulfilled obligation to restore American Shad to the mighty Susquehanna River.

Our new challenges will no longer be at the local scale, thus requiring much different solutions at the watershed, regional, national, and even global scales. We will have to work across disciplines and use the appropriate science to diagnose problems. Innovative engineering skills will have to be applied to develop solutions, and we must have the political will to create laws and provide funding for solutions. It won't be easy, but I am confident that our next generation will have the knowledge, skills, abilities, and the guts to get it done right.

There was a time in American history during the Great Depression in the 1930s when a technocracy was our society's preferred form of governance (Wikipedia 2016a, 2016b). It provided for people in positions of responsibility to be selected on the basis of their technical knowledge and involved applying the scientific method to solve social problems. Technocrats are defined as individuals with technical training who perceive many important societal problems as being solvable. This is unlike our present bureaucratic system in which a group of nonelected government officials govern large institutions and enjoy managing information, processing records, and administering complex systems (Clegg, Harris, and Hopfl 2011). The German sociologist Max Weber ([1922] 1978) explained that a bureaucratic form of government was necessary because more people create a more complex administrative system and supported the need of a bureaucracy as the most efficient form of an organization. He also warned that increasing bureaucratization can lead to a soulless "iron cage" of bureaucratic, rule-based, rational control.

The most challenging part of my position has been the politics of science and trying to convince our scientists to become advocates for the science they produce. We have far too many data collectors who are well trained in the scientific method but unwilling to advocate for what it concludes. Their reluctance is often explained by their desire to stay unbiased and many believe their role is to hand over their experimental data to others who will use it to further public policy positions. Unfortunately, there are not sufficient numbers of technocrats in today's society who understand how to translate the science for policy or political decisions and far too many bureaucrats who are

concerned only about processing decisions based upon the letter of the law, regulation, or policy as defined by someone who preceded them.

My other major challenge is with the science of politics and trying to explain the meaning and importance of the science so that politicians can apply it during the drafting of the laws that they promulgate. House Bill 1576 was introduced in the General Assembly several years ago, and it was intended to place additional legislative oversight on the process of listing plants and animals on the Commonwealth's Threatened and Endangered species lists, which fall within the statutory responsibilities of the PFBC, the Pennsylvania Game Commission, and the Pennsylvania Department of Conservation and Natural Resources. HB 1576 also included the designations of wild trout streams. These designations are science-based determinations based on whether a species is rare or whether a stream supports wild trout. The science-based process was targeted to undergo a social/economic public interest test if promulgated. After many debates at public hearings across the Commonwealth, the science arguments and the public will prevail due to widespread public outcry about politicizing a truly science-based decision.

Our future decisions will be far more complicated than those of our past and present. They will involve decisions about environmental and human health impacts that will test our political, social, economic, engineering, and science knowledge and require multidisciplinary cooperation. Our scientists must understand the politics and our politicians and administrators must understand the science. We cannot afford to waste energy debating whether a river is impaired, the climate is changing, a species is rare or common or a stream supports wild trout. We need to begin rolling up our sleeves and working together, technocrats and bureaucrats, politicians on both sides of the aisle, in order to prepare for tomorrow's challenges. The alternative could be Weber's prediction.

NOTE

1. The seventh edition of *Common and Scientific Names of Fishes* can be found at <http://fisheries.org/books-journals/writing-tools/names-of-fishes-searchable-version/> and recommends capitalization of all common names of fish (e.g., American Shad).

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