PERSPECTIVES FROM THE FIELD

Post Partum Environmentalism

Thomas Robert Cuba

Forty-one years ago, in 1969, the air in St. Louis was fouled by emissions from a variety of smokestacks. Meatpacking plants, power plants, chemical plants, and other manufacturers discharged without restriction. Sanitary sewer plants pumped sewage treated to basic levels directly into the Mississippi and Missouri Rivers, as well as local feeder streams, where it mixed with liquid discharges from manufacturing interests. Landfills accepted whatever people no longer wanted, and people who didn't want to wait for trash pickup just tossed garbage and waste out the window of their car.

That was the year I decided to study zoology instead of mechanical engineering. At the time, environmental jobs were scarce. The employment boom resulting from the passage of the National Environmental Policy Act (NEPA) was still years in the future. Environmental consulting didn't exist because environmental regulations didn't exist. I was, however, happy in planning to become a park ranger or a college professor. At about that time, the arrival of the environmental revolution spawned the Environmental Protection Agency along with hundreds of state and county agencies. Today, many, if not most, states actually have more than one environmental agency.

After graduation, I served in the military. This is relevant because one of the most important of my thought patterns is derived from the synergy of having been trained as a Naval Intelligence Officer and having studied ecological succession for my doctorate degree. As it turns out, both of these specialties use the same basic logical patterns. In each, one gathers data, assesses the existing set of relationships and dynamics, and then attempts to predict outcomes from actions taken, answering the question "If I do this, what happens?" In its applied sense, this is the fundamental logic train of mitigation and NEPA impact statements.

Now, nearing the end of a career in a field in which I never expected to practice, I've realized that there has been a huge paradigm shift that only people in my age group would recognize. This report is an attempt to share my view on the evolution of the profession from hippies to suits and ties.

The best way to do that is to simply tell stories about my career, but that would take more space than we have. The preceding paragraphs were provided because it is important that my vantage point have some degree of credibility: it is why my observations are more than just the ramblings of an elder statesman of the environmental profession.

The 12 Major Paradigm Shifts

Shift 1: Magnitude

In the 1960s, the St. Louis air was thick enough to taste. A drive through the city left soot on the car. There were days when it was overcast, yet there were no clouds. The spring near my parents home outside of St. Louis bubbled up gray and foul because the adjacent city disposed of sanitary effluent into a cave system. Industry discharged purple or yellow foam directly into the creeks and rivers. I was to learn a few years later that one creek I frequented was not a creek at all but, when traced a few miles upstream, the discharge from a sanitary wastewater treatment plant.

By contrast, during the 2000s, regulators were arguing about whether contaminants were hazardous at concentrations in parts per billion or per trillion. This shift reflects clearly positive success on a grand scale but may also raise the question of whether 30 years of momentum has carried regulation past the point of sustainability.[1]

Shift 2: Context

As the magnitude of environmental threats lessened, the context in which practitioners operated also changed. Graduates in 1980 would have little to no direct knowledge of the events of 1960. By 1990, severe pollution was being taught as history.

The echo of context is the *mind-set* established in the early decades of the movement. During the days of the hippies, a mind-set arose that elevated natural systems to near religious levels. The term *tree hugger* arose to describe those who valued trees above all other considerations. The *Crying Indian* commercials designed to control litter by changing individual behavior were effective but also served to establish a good-versus-evil mind-set, which is now no longer limited to tree huggers. Animal advocate groups arose from emotion, not science, and PETA (People for the Ethical Treatment of Animals) is naught but a zoological echo. Membership in these groups, however, is often populated by the less well educated amongst us.

The echo is carried through the halls of academia by professors. Faculty earning doctorates in the mid-1980s had direct knowledge from the 1960s and taught the mind-set of protectionism to students. As large problems were eliminated or diminished, new students needed to identify new threats. The mind-set only grew stronger.

Shift 3: Conversion of Disgust to Fear

In the 1960s and 1970s, public opinion was one of disgust over industry or political leaders allowing or even encouraging the common piggish activities dominant at the time. In the decades to follow, as pollution

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became less and less visible, activists had less photographic evidence of destruction to motivate the public. The threat became invisible. Fear became the new motivation: Fear of the known, fear of the unknown, fear of the uncertain.[2] New threats were identified at molecular levels and as genetic contaminants. Old threats remained, such as habitat loss, but these old threats do not elicit fear as a dominant motivator. The additional fear of invisible threats has grown to the point that there are people who seek therapy to deal with it.

Shift 4: Connectivity

At the onset of environmental management as a profession and as a government responsibility, regulations addressed individual species and their habitats. Management of any one particular habitat was correctly identified as being closely dependent upon actions and activities in adjacent habitats. From this arose the practices of "Ecosystem Management" and "Watershed Management."

The countercurrent to the connectivity movement was the subsequent shift, by some, away from the management of systems and back, past the point of protecting species, to the protection of individuals within the species. Under this shift, retaining a forest is deemed inadequate and has been supplanted with the desire to protect each and every tree. Maintaining deer populations is supplanted with protecting each and every deer. Arguments establishing the relationship between high populations and disease are met by establishing veterinary services for sick deer.[3] In Florida, the shift is most evident in current practice of protecting each and every blade of seagrass and each and every mangrove tree.

Shift 5: Exclusion

Arising from the elevation of nature to a near religious status is the demonization of Mankind, with the exception of the priests and priestesses of the new religion. Mankind has been designated the antagonist to nature. The new ecologist has a tendency to neglect man's status as *Homo sapiens* and to forget that this species is an integral part of nature. Forgotten is the similarity of habitat alteration by other species. An oak tree growing in a meadow alters that habitat within its sphere of influence as dramatically as does a new residential subdivision. The difference is in scale. Coral reefs, migratory herds of grazing mammals, and forests of all kinds (rain, temporal, and boreal), however, alter habitat well beyond the direct influence of an oak tree. Again, the difference is in scale. Man has a broader niche, even if its breadth stems from his ability to create suitable microhabitats within otherwise unsuitable ones (e.g., the igloo). While an arguable point, the foregoing comparison is not meant to justify Mankind's capacity for alteration, but to demonstrate the popular characterization that man is not part of nature, but is instead nature's enemy. It is to characterize the prevalent opinion that the only way to protect nature is to exclude Mankind as well as individual men.[4] The exception to the rule of exclusion is that the self-proclaimed protectors (men and women in positions of authority) are the only ones who can enter into preserves safely without causing damage. Others, regardless of education, experience, or capabilities, are excluded. In this manner, each preserve becomes a sort of ecological fiefdom of the local manager. The analogy even extends to the establishment of the fiefdom by the governing body and the appointment of the *bio-baron* (government employee) placed in charge by edict of the governing body (king). Appointments are often political and reversed, with new members from the "king's" office: Just as in fiefdoms.

Shift 6: The Profession Itself

With the advent of the working professional came the environmental streetwalker. When consulting became a competitive enterprise, those in the profession began to sort themselves into two classes: the working scientist and the *biostitute*. The National Association of Environmental Professionals (NAEP) itself was born in resistance to the latter, and NAEP's code of ethics was established to be used as a standard by which we may rid ourselves of those who would sell themselves indiscriminately. As the profession evolved, however, there arose the equivalent of the environmental "high-priced hooker." Some in the profession were no longer just scientists for sale, but scientists capable of advising (consulting) clients on methods to *circumvent* rules and criteria. All very legal but, nonetheless, a shift.

Shift 7: Education and Professional Qualifications

As the profession evolved, it became apparent that not all scientists were good managers. Managing an ecosystem was discovered to be vastly different than managing an agency riddled with policy and regulations created by political or legal forces in juxtaposition to the laws of nature. And so was born the education track known as *environmental policy* and variations thereof. *Environmental science and policy* as a track was intended to provide qualified managers in the workforce but was sold to students as a less difficult pathway to a job in consulting or in regulatory agencies. The sacrifice was that the new breed of managers would have better honed process and social skills at the expense of a diminished understanding of the natural system being managed. Because policy and regulation derive from legal and political forces, and the education failed to provide the details of the natural systems, the management standard became more reliant on mantra and dogma than science. The new managers were, in many cases, unable to grasp conflicts between legislated and natural laws. Nature, being illiterate, often fails to react in accordance with policy.

Shift 8: Professional Development Practices

At approximately the same time that education tracks in environmental policy became widespread, so did tracks in environmental science or environmental studies. These latter two programs gave emerging professionals the skills needed to function in entry-level jobs. In fact, they were created to fill the industry need for entry-level workers who, while labeled as environmental scientists in their job description, actually spent more time in field technician or compliance types of jobs. The educational profile varies broadly based on the electives chosen, but seldom is an in-depth body of knowledge imparted to these students. Professional development practices allowed for advancement into management jobs or even scientist-level jobs based on nothing more

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substantive than on-the-job training. The latter, while exceptionally valuable, cannot replace structured classes and guided laboratory experiences in a more classical education.

Shift 9: Elevation of Certifications over Education

As both regulations and charlatans became more commonplace, the government decided to protect the public through several processes of certification. By contrast, the engineering profession was already regulated and was the profession to which ecological scientists turned when there was a need to restore or manage habitats by structural alteration of certain elements of the managed habitat. Somewhere along the line, however, the engineering opinion on restoration became dominant over the ecological opinion. Ecology had become secondary to engineering nationwide. Working environmental professionals without advanced degrees sought to bolster their credentials in order to regain a credible professional foothold. Those with advanced degrees often sought to rely on that higher education, often without success. The issuance of both private and public certifications proliferated. Certifications may now be found in a wide variety of fields from gopher tortoise relocation to something called a HAZWOPER (Hazardous Work Operations and Emergency Responses). The unintended consequence is that having a doctorate in reptilian ecology is now insufficient to qualify a person to touch a gopher tortoise, but a weekend class in the handling and care of the animal during transport will put you among the elite.

Shift 10: Academia and Activism

Once upon a time, there was an *Ivory Tower* from which grand observers looked out over the land and documented their observations in journals. When the children of the 1960s earned their doctorate degrees in the 1990s, some flung open the tower gates to venture into the world as environmental activists. This activist on intellectual steroids often takes action to the detriment of science. As a result of this sortie, some gains may have been made, but the scientific principle of noninterference was sacrificed. The proper observer is charged with observing in a manner which does not alter the experiment at hand. The activist professor in combination with the product of the environmental policy education track created a situation in which those with grants to award will often award them to those whose results are predestined.

Shift 11: The Onset of the Data-Free Environment

The latest advance in environmental management is the broad application of the *precautionary principle*. This doctrine teaches that if we have no data, we must adopt both a regulatory and a protectionist position based in the avoidance of doing unintentional harm. This seems like sound judgment and worked well when we sent lesser primates into space before the more highly evolved. As applied now, however, virtually everything is expected to be damaging until proven safe. Since there are no completely safe options in life, everything remains potentially damaging. From a regulatory position, once the precautionary position is codified, there is little incentive to conduct the exculpatory research. The problem has been solved. Move on. There is also little, if anything, which can subsequently escape the regulatory straightjacket.

Shift 12: The Backlash

In 1969, when we (myself included) were writing congress and mayors to enact restrictions on the wholesale destruction rampant at the time, the public rallied behind us. The nongovernmental organization (NGO) was seen as a white knight riding in to save the planet for both man and nature. (There, I did it, too. I separated them.) In the summer of 2011, however, a nationwide outcry arose to disband the Environmental Protection Agency. The trusty steed of the people is now seen by many as a simple manufacturer of manure.

The Cumulative Impact of the 12 Paradigm Shifts

At the outset, I mentioned there were too many stories to tell, so I have presented my view in summary form within the aforementioned 12 steps. I now relate five stories which will serve to demonstrate at least some of the professional evolutionary processes at work. In telling these, just as I did in the series on ethics published over the years in the *Environmental Professional*, names will be changed to conceal the identities of the participants. That is particularly important here because the guilty party (not the biologist) is often on faculty somewhere and not directly involved in the situation presented. His guilt is in providing a poor education.

A "Documented" Case of Evolution

Everyone knows (or ought to know) that evolution is a theory. It seems to be rather good as a theory, but the scientific definition of a *proof* is too stringent to be met by the available data. In 2005, a report claimed to provide direct proof that a local coastal marine fish had evolved in the span of about 50 years.

The study was conducted on a marine shallow-water fish which is a mid-level predator. Historical studies of its diet reported shrimp as the main prey. The student[5] collected samples of the fish from all along the coast in question and analyzed stomach contents of literally thousands of specimens. The results were two-fold. The first was that the fish was caught in more places along the coast than had been reported previously and had increased in numbers (based on catch per unit effort). The second was that the stomach contents were different from the data collected 50 years ago. So far, the story is straightforward. The conclusions, however, are a different tale.

The student concluded that the fish had expanded its range and developed new dietary patterns. Both of these were attributed to evolutionary processes based in genetics, implying a new subspecies had arisen. What the student neglected to consider (in the paper, at least) were these facts: (1) The local government had installed literally thousands of artificial reef units, and the fish being studied oriented to hard bottom while feeding in surround-

ing sand flats. (2) The local shrimp fishery had expanded and was in direct competition with the fish for the food source.

Applying the logic of Occam's razor, one would need to consider that the reef program had increased the physical habitat, enabling more members of the species to exist, and that the combination of more members and the fishing fleet had led to predation on secondary and tertiary prey. The sadness in this story is not misjudgment by the relatively new student, but the failure of faculty and peer reviewers to bring the obvious to the fore.

To the student's credit, though, actual data were used. The next example is more compelling.

The Public Multi-Use Facility

In this case, the student sought a postgraduate degree in environmental science and policy. The study (thesis) was to include both science and management aspects to demonstrate the student's competence.

The situation (names redacted) is as follows. The county operated certain public facilities, one of which was not used to capacity by one recreational group, so a second group had been granted authority to use it when the first group was not. The nature of the use by the first group was such that the soil could reasonably be expected to contain chemicals (elemental metals) produced by the activity. The use is commonplace throughout the United States, and most facilities conduct maintenance activities to remove the byproduct on a routine basis.

The second recreational use was also rather common. What was uncommon was the joint use. The student postulated that the joint use exposed the second group to hazards by exposure to the by-product from the first use through the production of dust clouds during the second use. The actual element has been shown to be harmful to humans if ingested in chronic or high quantities. The student also postulated that the element would dissolve with rainfall and travel through the groundwater to contaminate the nearby creek, killing fish. The contamination of drinking-water wells was also postulated. The degree was awarded based on the thesis and the action of the county to close the facility entirely to both uses. The county stopped short of declaring it a hazardous waste site.

During questions at the conference where the paper was presented, it was learned that the student had not sampled the soils to determine the concentrations of the offending element. The mechanism for ingestion by the second group was never tested. The element is bound in soils above a certain pH and to a greater degree in soils of a certain composition. The pH was never tested, and the soils were not determined to be silica based or carbonate based. The element is also bound by organic matter, and the student had not analyzed the soil for organic content. The depth to the water table was not determined. Neither the slope nor direction of the gradient of the potentiometric surface was determined, making the exposure of the creek and wells speculative. The student had not determined whether the element could be or would be dissolved in rain, nor how far, in what direction, or how fast it would travel. In fact, it had not been determined that it would travel at all.

Yet, the story the student told is a good one. It was just told in a data-free environment. The research was an exercise in the misapplication of the precautionary principle. Unfortunately, the result, based on nothing more than fear, was the closure of a popular recreational facility. Of course, a secondary result was the credentialing of an improperly trained student as a recognized environmental professional.

Protected Species and Population Models

Models can range from simple to complex. One can model the arc of a baseball by using the ball's weight, initial speed, rotation, and stitching alignment, the air temperature, and the humidity. Models like that are rather precise and reliable. Models of any nature ought to follow certain scientific methods in development. The methods include constructing the model by using known relationships among the variables, including as many variables as are possible or reasonable, and incorporating existing data for verification, calibration, and validation.

These are distinct steps that ought to be followed in a distinct order. In verification, the relationships among variables are to be tested to assure that the internal mathematics used are correct. In calibration, adjustments can be made to make model output reflect observed data more closely. In validation, the task is "demonstrating that the model is a reasonable representation of the actual system: that it reproduces system behaviour with enough fidelity to satisfy analysis objectives" (Jane Hillston, personal communication, 2012).

Once a reasonable model is constructed, the next question is what to do with it. Models to manage protected wildlife are used in constructing regulations and management actions that will enhance the survival of the managed species.

Telling this story now becomes even more difficult because, if I mention the actual protected species, I will give away the names of the incompetent. Instead, I will challenge the reader to inspect the basis of models in use in the reader's area of practice and see if the story fits.

In my case, the species is moderately elusive. What is known is limited. The gestation period, litter size, time to sexual maturity, and general life span are known. The preferred food sources are known. The population can be divided into a small number of subpopulations, but the rate of migration among populations is unknown. Its thermal tolerance is understood, but its disease and predation rates are not. There is a good bit of data on the outcome of serious or lethal interactions with man, but not on the frequency of either lethal or sublethal interactions with man. Specifically, to illustrate the latter, species carcasses are found, but the number of carcasses not found is completely unknown.

What is not known is the existing population size. Superficially, this may seem

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insignificant. The model used by the regulatory agency, however, has been constructed for one purpose: to predict population size and its response to various management strategies and actions.

In their simplest forms, population models must include the initial population size, as well as the rate of addition and the rate of loss to the population. All the other variables are used to develop rates of additions or losses, which then generate a subsequent predicted population. Nuances of internal age structure, gender ratios, and breeding success are important for annual predictions, but less so for long-term projections. In any case, the mandatory component is the ability to measure the population or at least infer growth or decline by using proxies.

The model in question has been verified by using *professional opinion* in lieu of *data*. It has been calibrated and validated in a bureaucratic catch-22. Specifically, in the story I tell, the agency emphatically denies the ability to determine the population and then goes further, denying the ability to determine relative changes in the population. The claim is that each year the counting technique cannot be relied upon to return the same estimate of the overall population, so interannual comparisons cannot be relied upon. In short, the observed data set is completely unreliable. At the same time, the agency claims to have calibrated and validated the model by using reliable population data.

The model has been accepted by state and federal agencies and is being used to manage the species. Such a use would not be as repugnant were the primary management technique to be something other than complete separation of man from the managed species. The outcome is severe economic hardship based in nothing but speculation.

Essential Fish Habitat: The Circle of Life Meets Circular Logic

At the outset of my career, agents and agencies were protecting habitats and species based on a variety of parameters. One of these was the depth of knowledge that a specific regulator had on a particular habit or species. Sure, the ordinance or law was, or might have been, on the books, but, in practice, specific agency staff made the choice of whether a project could proceed. Part of that decision was based on the individual regulator's interest in habitats or species involved, which was used to answer the regulatory question "Is this impact *acceptable*?" To a great extent, each regulator assigned protective values locally and, to a modest degree, arbitrarily within the confines of his or her education and experience.

As *Shift 4* ran its course and as federal agents began the Managed Species programs, some residual scientists within the agencies correctly recognized that species management was more than minimum catch size. Specifically, if one were to manage gag grouper (or any other fish) properly, then just simply restricting the catch would not manage the population. Marine fish, especially those with recreational or commercial value, often spend their lives in a wide variety of places. Larvae may be planktonic. Postlarvae need to be able to locate habitat for the small juveniles to grow into midsized fish. Migration from mangrove roots to seagrass, sand flats, or hard structure may or may not occur. Similarly, each stage may sustain itself on differing food sources, some even switching from grazer to omnivore or carnivore. To actually manage an entire population of fish, the habitats and food availability must be assured throughout all the life stages.

Then the dominoes began to line up. To assure that a preferred food of a subadult grouper was available, the entire life stage of the prey had to be managed. Managing one species captured the management of a wide variety of habitats and prey. Managing several species required managing more habitats and prey. By the time the entire rule was composed under the Generic Amendment to the Fisheries Management Plans,[6] which describes and adopts essential fish habitat (EFH) for managed species in a broad, all-encompassing manner, "all estuarine waters, including the water column, and all estuarine substrates, including mud, sand, shell, rock, and the associated biological community, as well as all emergent and submergent intertidal and subtidal vegetation including seagrass, algae, mangroves, and marsh grasses are considered EFH." The definition covers all conceivable habitats, making no distinction between natural and artificial; pristine or impaired.

Recognizing the all-encompassing nature of the foregoing definition, the act further recognized that some habitats may be more threatened than others and identified the more specific habitat areas of particular concern (HAPC) in an attempt to unwind the circular logic that created the definition. The effect may be negated[7] by an equally diluted, seemingly all-encompassing definition of HAPC, including "the importance of the ecological function provided by the habitat."[8]

The circularity is most easily demonstrated with a story about seagrass protection in an area with no protected species except the sturgeon. The animal prefers sand habitat to seagrass, and protecting seagrass can be seen as counter to providing the sand habitat needed for sturgeon. According to the rule, the grass and sand are both EFH. The protected species requiring sand in preference to grass would make the sand habitat an HAPC. In this instance, the rule places a higher value on the sand, yet most of the regulators still preferentially protect the grassbed. Consider the same logic in a manufactured scenario: In an area rich in seagrass and devoid of hard structure, would it be acceptable to remove grass and install an artificial reef? The point being made is not moot. Some federal agents have abandoned the concept of natural habitat and gone so far as to suggest that abandoned oil rigs and navigational markers be protected as EFH because there are lots of fish there.

In the development and application of EFH, the logic of protection and management went from inadequate and arbitrary, through a filter of population science, to an all-encompassing mandate, and back to arbitrary, with a legally defensible veneer of equal treatment for permit applicants.

Assessment Crutches

In the last sentence of the previous section, I refer to the legal defensibility suffered by agents at the hands of attorneys.

As it turns out, our situation is not due entirely to poor science. Much of the elimination of science within the regulatory profession is a result of the legal profession. Somewhere, someone decided that all regulations must be applied absolutely equally to all permit *applicants*. Well, that's fine at a broad level, but in practice it fails to consider that all applicants are not all proposing projects in the same habitats with the same potential for impacts. It fails to allow for differences in the character of one seagrass bed over another. It fails to allow for all the things that make habitats different.

The solution to both legal equitability and agency inadequacy was the creation of programmed solutions. There are many. In Florida, the current favorite is the unified mitigation assessment method (UMAM), but there is also the wetland rapid assessment procedure (WRAP). E-WRAP was subsequently created for estuarine areas. The federal agencies developed the habitat suitability index (HSI) and the habitat evaluation and assessment (HEA) procedures. Each of these differ, but each uses a formula into which judgment-based values are assigned in a manner that spits out a defensible and equitable solution. Each of these fails and for a variety of reasons, but the most common point of failure is at the development of the judgment-based values. That is not to imply that the mathematics in the formulas are acceptable, for the math is just as arbitrary. Its redeeming value, at least to the attorneys, is its consistency, which serves to treat all applicants the same.

The preceding paragraph, I am sure, will rankle some readers and create amused consternation, and perhaps disbelief, in others. The proof is in participating in a negotiation between an applicant and an agency. On several occasions, I have sat in a room where mixture of government agents and consultants have negotiated these judgment-based parameters. In WRAP, for example, each parameter is assigned a score of 1, 2, or 3. UMAM uses scores of 1–10, but the agency has declared by policy that scores of 1 or 10 are impossible, so the actual range is 2–9. A parameter is discussed by the participants, and a score is assigned. In my experience, usually about eight people participate in the scoring. Perhaps one or two of these have the scientific wherewithal to understand the ecological implications, the others being representatives of statute or policy. On its surface, this consensus-based derivation may seem appropriate. In practice, in each session that I have witnessed, only one or perhaps two of the eight have actually been on site. The applicant's ecologist is the only one who has been on site long enough to have even traversed the entire site, much less form a firsthand opinion. In most cases, the majority of the people involved in the negotiations have not read the scientific report submitted by the applicant. In other words, they look at an aerial photograph and make mantra-based judgments about the habitat in question.

The few scientists who are employed in the private sector or the public sector are restricted from actually using the science and forced to use the crutches provided for lesser minds or in the interest of legal equitability. In attempting to apply what little science is left, the actual scientist, whether he or she be in the public or private sector, is outnumbered by those who are constrained either by their job description or by their intellectual capacity, and the result is largely an hypothetical assessment.

Conclusion

Through no particular fault of any one person or program, science and the practice of both the environmental professional and the environmental activist has changed over the past 40 years. The contribution by science has been subverted by the contributions from attorneys, case law, regulatory expediency, inadequate education, inappropriate hiring and development practices, and the fear laden expectations of the lay community. Laws are passed and programs developed in opposition to the very heart of the science.

The correction that is to come must include a time when legislators, judges, attorneys, engineers, and policy makers cease to practice applied ecology. I know that this correction will come, and the trend documented here will eventually reverse itself. Perhaps this commentary will assist. I am certain of my prediction because no matter how hard Tallahassee or Washington may try, we all know "*You can't legislate natural law*."

Nature will follow her own laws, and it is for us to understand them, not to correct them.

Notes

1. Considering the body of regulation as a *development* and recalling that sustainable development ought to be qualified within categories of environment, economics, society, and politics, the question of the sustainability of regulations is worth pursuing.
2. Fear of the uncertain is a cornerstone of the precautionary principle.
3. In the 2000s, there was a proposal to develop antibiotics for certain coral diseases and to hand inoculate infected individuals.
4. See United Nations biodiversity program maps for rewilding programs.
5. *Student* is used in the generic sense of a person conducting a study.
6. The Gulf of Mexico region. The Generic Amendment applies to all Fisheries Management Plans.
7. We will need to see how these are applied in the long term before a final assessment of the effectiveness can be made.
8. They have already been identified as essential connoting a good deal of implicit importance. See 50 CFR 600.815(A)(9).

Reference

US Department of the Interior. 2010, October 1. 50 CFR 600.815: Contents of Fishery Management Plans. In *Code of Federal Regulations*, annual edition. US Government Printing Office, Washington, DC. Available at http://cfr.vlex.com/vid/600-815-contents-fishery-management-plans-19896480.

Address correspondence to: Thomas Robert Cuba, Chief Scientist, Delta Seven Inc., PO Box 3241, St. Petersburg, FL 33731; (phone) 727-823-2443; (e-mail) tom.cuba@delta-seven.com.

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