Ecological Restoration at the Landscape Level

Thomas R. Cuba, Ph.D.
Delta Seven Inc
PO Box 3241
St Petersburg, Fl 33731
Tom.Cuba@Delta-Seven.com

Submerged Aquatic Habitat Restoration in Estuaries:
Issues, Options and Priorities
March 11 - 13, 2002
Mote Marine Laboratory
Sarasota, FL

Introduction:

The following is an amalgamation of the comments prepared for the conference and those actually presented. The original presentation was designed to stimulate a consideration of ecological restoration at landscape levels. It had been prepared for an audience composed of both research and regulatory attendees. During the course of the conference, several authors had touched on the topic in one form or another within their own presentations. As a result, the planned presentation became dynamic, being amended to incorporate their observations. In another turn of events, technical problems with the computer system during the session, disrupted the timing of the talks, reducing the available time to 10 minutes. The actual presentation was adapted on the fly resulting in a shorter, more disjunct series of comments. The following is an attempt by the author to include most of what was actually said as well as to try and relate what was intended to be said.

The author does not necessarily espouse or support all of the situations used to illustrate various issues, but presents them as a stimulus.

The Homework

Mark Fonseca has advised us on several occasions to "do the homework" and to "publish" our results so that others can benefit from our work. This is extremely good advice. There is not a person here who would not like to be able to do this on a daily basis. The reality of many of our lives, however, is that doing the homework and publishing the results simply is not in our job description. The paradigm is not that people aren t doing the homework and publishing: It is instead that for many of us these are not assigned duties: doing the homework at work is not allowed. As an employee or as a supervisor, doing the homework or expecting our subordinate to do the homework "at home" creates some very real problems under that Fair Labor Standards Act.[1] For those of us in regulation, the time clock and staffing levels often work against the ability to do homework. For those of us in private practice, the demands of clients to do things within budgetary constraints can be challenging as well. There are some consulting companies

who trim the homework out to increase profits and there are those who don t. The challenge for us as a profession is how to make doing the homework an absolute necessity in academia, government management, government permitting, government compliance, and private consultation. All of the above restrictions apply to the need to publish results as well. The publication of a peer reviewed paper, however, is even less likely to be prioritized because it takes even more time and incurs significant expenses. Bluntly said, "Who will pay for the homework to be done?" To the contrary, "Don't we all pay when it is not done?" These two questions are without answers.

As a minor proof of these statements, consider the quality of the actual science done in the regulatory routine. How much science goes into preparing most permit applications?[2] How much scientific knowledge is used in reviewing a permit application? How much is required in conducting success monitoring, or establishing a compliance program. With the noted exception of some Federal program offices which anticipate that every effort will need to stand up in court, I suggest that none of these efforts would typically withstand peer review. If we conducted every project as if it were going to be reviewed for scientific content and protocol instead of being acceptable as a permit application, we would live in a very different world indeed.

In some instances, the agency itself is large enough that it contains a research arm and a regulatory arm. Those of you in an agency based research position might be unfamiliar with this quandary. If so, try this: Take your most recent work to a random selection of those in regulatory positions within your own agency and see if they have copies. I offer this experiment based on my own experience: There have been several occasions where I have used an agency s research to support an application only to be asked for a copy by the regulatory agent.

Essential Fish Habitat and the homework.

I began with the homework perspective because it provided a very real introduction to the implementation of the Magnuson-Stevens Fishery Conservation and Management Act as it relates to Essential Fish Habitat (EFH).

The Act required that each life stage of each managed species be studied and that those habitats essential to the continued survival of that species be identified and mapped so that managers would be more able to protect it. The Act further required that each managed species have a specific Fishery Management Plan adopted to enable these protections and empower the managers: Empower them with scientifically based guidelines. The Act goes so far as to extend the protection to the primary and preferred food sources of the managed species arguing that food is as essential as is the physical habitat. These studies and plans were to produce descriptions and maps identifying Essential Fish Habitat(s) for each species.

The Act goes on to define an adverse impact as one to either quantity or quality of the EFH. The implication is clearly that EFH, once defined, can exist at different qualitative levels. Finally, there is a requirement that any Federal action (including the issuance of a COE permit) must include a consultation on the effects to EFH. Compensation for impacts to EFH were to be based in the broad balance of the needs of *all* the managed species. This seemed to be a pretty good

approach.

The reality of the requirement was that the science wasn t all there and the funds to conduct it was not readily available. The consequence was the Generic Amendment to the Fisheries Management Plans[3] which describes and adopts EFH for managed species in a broad all encompassing manner, technically satisfying the Act but not achieving the detailed empowerment originally desired. In the Amendment *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.

The act recognized that some habitats may be more threatened than others and identified the more specific "Habitat Areas of Particular Concern" (HAPC). The effect may be negated[4] by an equally diluted seemingly all encompassing definition of HAPC, including the importance of the ecological function provided by the habitat. [5]

The result of the inability to enact the legislation to the fullest extent intended is an unusual one. As an example, the exotic green mussel is a biological community on a hard structure and is, by the plan, defined as Essential Fish Habitat. Bridge pilings are EFH. A beer can in which a toad fish has taken refuge is EFH. These are obviously absurd extensions, but the line between an absurd interpretation and a realistic one is not easily discerned; and the line is derived from staff interpretations which may or may not be well founded and may or may not be consistent with that of other staff. Each derivation also sets a precedent in interpretation that the advocates of equal treatment have been known to use as a means of reducing regulatory control. Raising the bar requires a rule change: Lowering it only requires a bad and precedent setting decision. The topic of consistent treatment is discussed elsewhere. It is, for now, only necessary to recognize that there is a significant difference between the equal treatment of people and the equal treatment of habitats. Consistency must not preempt ad hoc scientific knowledge.

By definition, estuarine mud is EFH. Even those polluted muds laced with PCB s[6] or heavy metals are within the definition of EFH. When an agency undertakes a restoration program and fills an old dredge hole then plants seagrass, the agency action is adversely affecting the EFH that is the mud. By policy, these activities are normally accepted because there are still good biologists enacting the law. The conversion from an impaired system (polluted mud) to a viable one is not recognized in the FMP but is easily recognized by the biologist as a conversion from one type of EFH to another, higher quality EFH. But the act makes no differentiation between the recovery of a dredge hole and placing an artificial reef in a grass bed. Such an action represents no less of a conversion than does filling in a dredge hole. Planting seagrass in a sand flat represents a desirable conversion from one type of EFH to another, yet replacing seagrass with a sand flat is considered unacceptable; by personal policy.

Considering the common practice of sinking ships to create reefs it is clear that the sunken vessel is not EFH until it is colonized by the associated biological community. It has become acceptable to place these reefs on sand but not in mud (they sink) and not in grass beds. Note

that sand, mud, and sea grass are all EFH of equal legal stature. Sand is EFH which is indispensable to many managed species; pink shrimp, red drum, gray snapper, yellowtail snapper, lane snapper, flounders, and rays. There is some work that indicates that some open sands are more productive than are grass beds.[7]

The practical application of the Act has apparently resulted in an informal consensus based prioritization of EFH which places a high value on reefs and SAV, and a low value on muds and sands. Is this the correct order of things? This is another question without an answer.

Agency policy and the homework.

The need for individual biologists to implement ecological regulations has had some intriguing effects on the homework question. It is extremely important that the reader recognize that not all these effects come at the hands of biologists. Many come from other professions and from elected or appointed managers who are not biologists. The broad definitions and other factors have led to the development of policies to fill the gap.

One of the greatest hurdles to consultants and regulatory agents doing the homework is the policy of using formally or informally approved crutches for ecological thought in lieu of ad hoc study.[8]

The dynamics go like this. When the agency is willing to accept the crutch, the owner is unlikely to ask the consultant to provide a deeper understanding (the science). The ecological impairment is presented using a variety of programmed decision aids such as WRAP, E-WRAP, WET, HSI, HEA, HGM, and HEP.[9] Without going into whether these procedures are valuable or not, the effect is that the applicant's agent only needs to do enough homework to respond to the questions in the guidance documents, and no more.[10] Doing more is deemed to be unnecessary because it goes beyond the regulatory demands.

When the application is based on the crutch (per agency direction), it must be evaluated by the crutch. The agency scientist cannot legitimately bring up issues (scientific concerns) outside the parameters of the crutch. The result is cookbook permitting. The existence of these documents defies the programmatic inclusion of the homework and obviates the use of real science to evaluate an impact and design a solution. The unfortunate situation is that the practice of using these guides does not reflect the intent.

The desire to simplify the collection and use of data has also occurred in the field of ecological monitoring. The use of the AGGRA or Braun-Blanquet methods of SAV monitoring has become common in monitoring work. The methods have been adapted for use in reef faunal characterizations as well. The methods were developed to be used as indicators, characterizing systems, but have been converted to be an end point of interpretation instead of an entry point to deductive reasoning. The reliance on any single characteristic as an end point, is ill advised: Cover is only one of innumerable characteristics that must be understood in order to effectively manage our ecosystems. This reduction of complex systems to indices follows in the path of those who use statistics as an answer in not as a tool. Statistics and indices are meant to be guide posts, not inarguable termini of thought. The use of statistics in such a manner in environmental

design can lead to ecological stagnation. Designs including performance controlled by the statistical mean of ecological data from unimpaired systems can eliminate the ability of the system to undergo natural fluctuations.[11]

The terminal use of statistics and programmed methods has, at times, become dogmatically preemptive of scientific thought. Is the guidance provided by the use of EFH on the same path?

From science to dogma and back again.

The development and use of the programmed guides mentioned above has a parallel in scientific thought as well.

Consider the statement that *"Seagrass beds are full of life. We already know this and need not investigate it further."* Recognizing the wide variation in habitat, condition, composition, physical factors, chemical factors, the generalization in the statement is indeed a broad one. In my experience I confess to not having run across a natural seagrass bed that is devoid or even depauperate in its faunal components. Conversely, I know of several examples of where a mitigation area or an impacted or altered natural bed is quite poorly populated. In an exploratory study, I placed a video camera in an impaired mangrove channel and left it for 30 minutes. The camera captured one shrimp. The companion effort, in an unimpaired mangrove channel of equal dimension, the fauna was too numerous to count. It is likely that parameters other than the presence or absence of various flora affect habitat suitability. These parameters go unrecognized in generalizations. And so, as a companion generalization, I believe that *"We should not under estimate man's ability to construct a bad habitat or to alter a good one so that it is no longer functional."*

But I bring up the dogmatic status of seagrasses and mangroves[12] as a nursery to illustrate another point: The metamorphosis of science into policy. The life cycle of scientific thought goes something like this. First there is a simple observation. This is followed by curiosity, imagination, investigation, discussion, even argument. These result in the publication of scientific papers. From these arise paragraphs in text books. Generalizations drawn from these paragraphs give rise to platitudes, dogma, and finally rote. Eventually, when an observation is made that contradicts the rote of policy, the cycle begins anew. Knowing this, perhaps we can avoid the ecological damages incurred during the dogmatic phases. Breaking the paradigm of not doing the homework is a mandatory step in developing the avoidance mechanism.

Jim Beever told a story during the discussion session that illustrates Man's ability to fail quite well. Jim mentioned that he had conducted a small study of mitigation and restoration success.[13] He reported that restoration (habitat management conducted by government) is more successful than mitigation (habitat management conducted by consultants). I am not going to argue this at all. But consider the two types of projects. In the first, the government is in the lead role. Many times the government relies on consultants to carry out these projects, so ask yourself, *"Is the determinative factor the consultant?"*

In the government restoration project a government biologist is often directing the project. The engineer will design the project to meet the criteria of the ecologist. The project is often not required to meet standards adopted by the local Home Owners Association or other anthropogenic need, except perhaps that of a nature park. Finally, but perhaps most significantly, the agency biologist can look throughout a bay or watershed and find the best site available. There is no pressure (credit ratios) for on site mitigation.

The dynamics of the mitigation project are quite different. The owner is demanding low cost. The engineer has the lead role. The project team may or may not include a biologist at all.

During the mitigation permit review process, the agency team usually is led by the engineer. An agency biologist may or may not be involved. The final design of the mitigation is most often the result of a negotiated settlement, not a consensual agreement between ecologists. The negotiation team includes the owner, his attorney, the engineer and the agency representatives. In many agencies biologists are not required on either team. I have personally witnessed a Ph.D. ecologist sitting across the table from a government environmental specialist with a GED: The government agent required modifications to the mitigation design which assured its failure, but which also assured the issuance of the permit. This is a rare case, but the dynamic is common. The government agent was making requirements based in the rote dogma learned during the "on the job training." What is much more common is for two well credentialed ecologists to agree that the best method of mitigation is not allowed by the regulation and to agree to try and make something work.

Is it possible that this common dynamic of mitigation designs prepared by non biologists and reviewed by the rote derived from regulations may have affected Jim's results?

Economics

As usual, the driving force in these dynamics is "now" economics ("now" as opposed to "future" economics). During my career, I have witnessed the reduction in minimum qualifications[14] in order to save the tax dollar (government) or increase the profit dollar (consultant). The justification has always been "we don't do science here, we regulate (or file permit applications)." Each side has a routine policy of relying upon the other. The consultant will rely on the agency to find and correct errors in applications while the agency relies on the consultant for professional conduct in the preparation of the application.

As a result, there is a lack of both creativity and accountability. One engineer whom I challenged (when I was with an agency) responded that he only sealed the engineering within the plan. Mitigation was not engineering and the failure was the result of the agency approving a bad plan.

Can we as a profession expect "homework" when we don't require accountability? The proof of the lack of accountability in mitigation or restoration is in the policy of the regulations. I challenge each of you to look to your own agency s regulations. Is there a requirement that the design (applicant) team includes a biologist? Is proof required that submitted mitigation plans have been approved, designed, reviewed, even looked at by a biologist? Is there a requirement

that an agency biologist examine the mitigation plan?[15] Do your regulatory staff have both the expertise *and the time* to review these plans? Is the expertise based in science or rote application of dogma? Does the dogma preempt the scientific expertise?

Every application form and agency approval form has a place for the signature and seal of the engineer. Does your agency form have a place for the signature of the biologist? When the mitigation is in trouble, which biologist is accountable? In a recently issued permit there is a special condition in the success criteria that there be 10,000 shoots of seagrass per square meter: No species of grass is identified. When this fails, who will be accountable?[16]

Monitoring reports are required on a periodic basis by most regulatory agencies issuing mitigation permits. There are numerous examples of maintenance actions and monitoring reports[17] which were conducted and prepared respectively by the lawn service, the owner, the engineer, or even a local volunteer group.[18] There is one case where an owner had the first report prepared by a consultant and then copied the text for each subsequent report, changing the dates and taking new photographs. There are other examples where the monitoring report is submitted by the consulting ecologist to the owner, who then edits it before submitting it.[19]

How does your agency rate? Does your agency have a requirement that the monitoring report be prepared by or under the supervision of a credentialed ecologist or biologist? Is your reviewing biologist expected to review monitoring reports for permits he or she has issued? What mechanism exists to provide positive feedback and a means of improvement. Isn't this also part of the homework?

The lost opportunity for effective monitoring is not entirely limited to private proposals. In one recent government restoration project there is multi million dollar commitment to construction and a less than 4 thousand dollar commitment to monitoring. Many times, when a restoration project is undertaken by a governmental agency it is first presumed to be self mitigating. It is therefor logical that to monitor it would only prove the obvious and be a waste of money.

Is this presumption based in platitudes and dogma? In one instance such as this, there are well respected scientists, not involved with the restoration project, who voiced the opinion that the result will be an ecological disaster. They are within a different and non regulatory group and were ignored. With no one monitoring it, will we ever know? I respectfully suggest that homework standard must be applied to all projects. Therein lies even another conundrum. Many funding sources are restricted to funding construction only and are not allowed to fund the research of monitoring, even rote monitoring. In some instances, even matching dollars used for monitoring are disqualified. The economics of the system discourages both the scientific process and the process of betterment.

The local focus

One result of all of the dynamics presented to this point has been that most projects, of whatever origin, have a distinct local focus. The *written* guidance from the federal government in the Fishery Management Plans (regarding compensation for impacts to EFH) and other documents

promotes proximity of compensation, but clearly advises that the design and placement of restoration or mitigation be determined by system wide needs.[20] The state guidance is the opposite, demanding higher mitigation ratios once the mitigation crosses an ecologically transparent boundary known as the property line.

The local focus of research can often be the result of the economic backing of the work. The limitations of funding will define the boundary of the work either temporally or spatially.

One purpose of this paper is to stimulate thought on these topics at a level beyond the project at hand. The affect and value of the local action should be examined not only at the project level but at the landscape level as well. Will the local project have a beneficial affect on the balance, interplay, and total function of the surrounding areas as well? Has our penchant for localized thought influenced our interpretation?

We heard one author lamenting that the seagrass bed they were monitoring was invaded by *Caulerpa prolifera*. The Generic Amendment to the FMPs and my notes tell me that *C. prolifera* is a native and natural component of Florida's ecosystem and is designated as EFH. Others have worked hard to put *Typha latifolia* and *Salix caroliniana* on lists of plants to be removed from mitigation areas. These freshwater plants are also native to Florida. Their detractors claim they are undesirable because they form mono cultures.[21] This dogma withers when it is also noted that mangroves, *Spartina, Juncus*, and seagrass also tend to mono cultures. So I ask, "When, in our minds, does the resource become the enemy?"

"Who defines the enemy?" *C. toxifolia* is an exotic and it is invasive. The Green Mussel is exotic and invasive. While the definition of EFH makes no distinction opposing exotics, most ecologists would take exception to that oversight and work to control the invader. Isn't the periodic invasion of one system a natural and beneficial part of interactive competition? Should an invasion by a native be lumped in the same category as an invasion by an exotic? These questions give rise to another, that of stability in both managed and restored systems.

J.P. Sutherland wrote about multiple stable points in succession. Jack (John C.) Briggs[22] provides insight into the work of many other zoogeographers who have pointed out that the genetics of populations in unstable habitats are more diverse than those of stable ones. Assemblages in stable habitats are less likely to recover quickly from perturbations than are those of unstable habitats. It would appear, that in many cases the unstable condition is much more ecologically robust than is the stable one. Another way of comparing these two habitats and their assemblages is that the stable one may be more diverse at any point in time, but the unstable one may be more diverse through periods of time. Which of us can say which is the more desirable? Isn't a mixture of the two warranted? In population dynamics (at landscape levels) locally unstable populations can be stable through their range or through subsections of their range. Doesn't stability need to be measured both temporally and geographically? Each of us might be well served in questioning ourselves and examine how much dogma, how much rote has subliminally affected our own projects.

There is one relevant study wherein the investigator very elegantly derived the locations of the

most stable populations of locally occurring seagrass beds. These beds were used as controls for the remainder of the study. Several researchers have lamented over the bioturbation of rays and other fauna (even manatees) being a detriment to the seagrass, creating instability.[23] But these fauna are often managed species under the FMPs. Are they not deserving of their own EFH and the protection thereof?

Why is stability the most desired condition? Why is predictive stability the management target of choice? Why is a long term mono culture of *Thalassia* a more desirable ecosystem than is a mixture of ephemeral grasses and algae, vacillating occasionally to open sand and back? One clue is in the popular *desirability* of habitats and systems.

Desirability permeates our laws and our funding, like it or not. The Magnuson-Stevens act itself is based on commercial and recreational fishing needs. If we manage huge offshore tracts for the benefit of one *desirable* species or even one suite of species, what will be the effect on other species? The artificial reefs placed along the west coast of Florida may well benefit the EFH of one managed species and degrade that of another. There is no data but there is the dogma that habitat loss is the largest threat to survival. Is the dogma valid? Does that dogma apply to those fishes requiring open sand? At the landscape level, and in particular in the FMPs, the desirability is couched in strong terms of balance. Some impacts to EFH are going to be acceptable. Doesn't the landscape level balance and connectivity need to become a part of the equation?

In previous discussions on these thoughts, one person referred to productivity as the measure which would place seagrass above open sand in determining the EFH priorities. A phycologist, however, recently admonished me that micro algae on the surface of the sands may be greater primary producers than are seagrasses and the production is more available to the consumers. If production is the criteria, should we be eliminating grassbeds to create sand flats? Why is high productivity an espoused management target?

The platitudes of stability, combined with the prioritization of one type of EFH over another, (regardless of the condition of that EFH), and the policy of on site mitigation have combined to create a locally focused and ineffective (Beever) collective management effort.[24]

Concluding remarks

EFH management might provide an extremely useful tool in elevating on site mitigation to landscape levels. EFH, as written, already incorporates the protection of all life stages and food sources of the managed species. When EFH can be used to balance habitat conversions from one form of EFH to another (sand to grass, grass to reef, reef to sand?) and when these decisions can be based on scientifically founded balanced landscape level ecosystem needs, reflected in FMPs, we may have a more viable standard of performance for both mitigation and restoration design. Re examining the policy of type for type mitigation (without increases in ratios) is also possible. The EFH guidance would allow for a new standard, that of "landscape need" mitigation. Non type mitigation was abandoned in part because of the penchant for choosing the cheapest compensation. At the landscape level, ecosystem needs can be defined, avoiding the constraints of location and the dogma of type. There is an old admonition to think globally and act locally.

Clearly we are acting locally, but if we are enacting dogma, are we still thinking at all, much less thinking globally?

A second element to this new standard may be in the exertion of control over the managed ecosystem. In the past ecological managers, mostly engineers, have used control theory to manage our systems. The derivation is easily traceable to a combination of societal needs and statistics. We have modeled the ecosystem and then managed it based on statistical averages or high water lines dictated by society. The loss is that systems with innate and large variabilities are forced (controlled) into narrowly fluctuating tolerances. Our systems became very predictable and ecologically stale. Every excursion outside the model is treated as a catastrophic event; flooding of flood plains may be the best example. How many federal disaster areas have been declared where these dynamics were involved?

Mankind tends to uniformity. Nature tends to an organized ebb and flow of apparent chaos. We learned in the everglades and in countless lakes that total control can lead to disastrous results, ecologically, sociologically, and economically. Both recent and ancient theorems of restoration ecology and land (system) management suggest that management by influence may yield better results than does management by control. Under management by influence, systems are nudged, not forced. Systems are kept within boundaries, but when within the boundaries, they are allowed to fluctuate. With the advent of fractal based ecosystem modeling using fuzzy logic control nodes, we have the ability to design dynamic management targets. We now need to define the boundaries.

In the daily routine many good biologists are being forced into rote and locally focused determinations. Our natural systems are simply too complex to be subjected to generalizations. The regulated community complains that it is unfair to have different regulations and standards in different areas. Unfortunately the Laws of Nature do not respect the laws of man and are not sympathetic to our (collective) inability to regulate our ecological and sociological activities appropriately.

Ecosystems work at ecosystem levels; landscape levels. They are not defined by site boundaries and political jurisdictions. It is only when owners, engineers, politicians, and attorneys stop practicing ecology that we can take the next forward step in sustainable development.

END NOTE 1:

In the history of mitigation, inland or freshwater policy developed that pushed designs to include on site versus off site mitigation. The policy was a response to desires to maintain some latent ecological value in developed landscapes. An unfortunate side effect of the regulations was that the retained or mitigated habitats seldom had any degree of connectivity with the adjacent development. In many instances connectivity is best provided by upland corridors. The lawyers decided that protecting otherwise developable uplands would result in a taking. Eventually, the small preserved or mitigated sites in developed areas began to be known as postage stamps of nature. Island zoogeographic principles began to emerge as these postage stamps became more and more isolated by concrete and the manicured pseudo-open spaces of lawns and even some parks.

Mitigation banks became an alternative. The mitigation banks that I have seen are almost entirely wetlands, routinely converting viable and necessary upland habitat to wetlands to generate credits. This is not likely to produce any result other than the satisfaction of ratios.

These policies have been translocated into the marine management principles. On site mitigation for a channel or marina has no real meaning, but agencies have been known to project property lines in order to establish proximity based boundaries.

In the entire history of mitigation, cumulative impacts have been an incomprehensible part of the rule. In the history of mitigation, landscape level opportunities have often existed, and yet are not often enacted due to property boundaries, political boundaries, or the raw ignorance of landscape ecology by all involved.

END NOTE 2:

Make no mistake: I am in complete agreement with those who espouse "doing the homework." In reaching that goal, there are hurdles. Doing the homework of identifying some of these is not meant to be depressing, but motivating. Surmounting these hurdles while ecological recovery is still achievable demands action in addition to admonition.

END NOTE 3:

An Apology. I know and readily admit that I have not done all the homework I wanted to do in preparing this paper. Having it adjusted on the fly (twice) did not help. Fortunately, my intent was not to present a scientific paper, but a thought stimulating one. And yet, if I have mis spoken, I offer my apologies.

FOOTNOTES:

(Reformatted for txt file format)

1. After the close of the meeting, I learned that several NOAA offices provide time to research the literature. I applaud that policy.

2. Please don't take this the wrong way. The question is not whether the applying or reviewing biologist has the ability and knowledge: It is whether other constraints allow for these skills to be applied in the regulatory context.

3. Gulf of Mexico region. The Generic amendment applies to all FMPs.

4. We will need to see how these are applied in the long term before a final assessment of the effectiveness can be made.

5. They have already been identified as essential connoting a good deal of implicit importance. See 50 CFR 600.815(A)(9).

6. Polychlorinated biphenyls.

7. The quick turnover from diatom to grazer results in a low standing crop, but the primary production is reportedly rapid. The diatom is also more easily assimilated into the food chain.

8. There is a long history to the development and use of the procedures. Equality of treatment, consistency, common methods, and the occasional participation by the under educated have been forcing factors in their use. Each requires the best judgement of the preparer. *None* of those reviewed require the user (applicant or respondent) to be ecologically credentialed.

9. There is a list of 39 accepted procedures at http://www.wes.army.mil/el/emrrp/emris/emrishelp6/assessment_procedures_acronymns_and_key_references.htm. Not all of these apply to Florida and the proliferation reflects the scientific community's displeasure with the universal applicability of the approaches. Still, the Florida legislature (HB 2365) requires a "uniform wetland mitigation assessment method" applicable to all habitats. As of the date of this paper, it is in draft form.

10. WRAP was adopted by the South Florida Water Management District but is used by numerous other regulators because it is easy. Easy to use, easy to understand, easy to generate ratios. One unwanted side effect is that it can be used by less skilled or totally un-credentialed agents (applicant or respondent). E-WRAP was never adopted by the authoring agency, but is commonly used by other agencies under individual office policy.

11. Select almost any flood control project to find the proof of this theorem.

12. Both sea grass and mangroves are highly protected as EFH, regardless of their condition.

13. See also FDEP 1990, WSWWMD 1991, and Waterways Experiment Station 1991.

14. Lower minimum qualifications in hiring reduce the cost of the employee to the employer.

15. Most county and state agencies do require a biological review. Many cities do not.

16. "Compressed succession" has as its cornerstone, the Clementsian model. Even if that model were dominant in the subject location, the required density is still extreme. If the dynamics of the Gleasonian and Markovian models prevail, compliance is impossible.

17. The details are not mentioned to avoid legal problems.

18. One such unsupervised group of volunteers removed all the *Baccharis* thinking it was Brazilian Pepper. With proper supervision, the volunteer force is highly valuable.

19. When I wonder why I constantly run across these situations by accident and they remain unknown within the agencies, I revert to my own dogma that the time available limits the effectiveness of the agency.

20. The practical application by many federal agents is to very strongly encourage on site mitigation.

21. In fact, where these form mono cultures, stable hydroperiods are usually contributory.

22. *Marine Zoogeography*. See also Pielou, *Biogeography*.

23. Consider stability as requiring a scaling qualifier. In the species stability model, a bioturbation event is a perturbation. In the system stability model, the elimination of bioturbation events is a perturbation.

24. Please see End Note 1.