

Draft Programmatic Environmental Impact Statement for Oyster Restoration in Chesapeake Bay Including the Use of a Native and/or Nonnative Oyster Final Peer Review Report and Lead Agency Response

Report Content and Charge:

This report describes the peer review process used for the Draft Programmatic Environmental Impact Statement (Draft PEIS) for Oyster Restoration in Chesapeake Bay Including the Use of a Native and/or Nonnative Oyster and presents the Lead Agencies' response to the peer review. Also included are the names of the peer reviewers and their organizational affiliations, the final peer review report on the Draft PEIS, and the PEIS Writing Team responses to the peer review comments.

The process followed for the Draft PEIS peer review is consistent with the peer review plan that was developed by the Lead Agencies for the EIS project. This peer review plan was specifically designed to comply with the December 16, 2005 Office of Management and Budget's Peer Review Guidelines and was accepted by the US Army Corps of Engineers for this purpose.

The peer review plan designated the Independent Oyster Advisory Panel (OAP) as the principal group for the review of the sufficiency of the Draft PEIS.

The Lead Agencies Review and Response Process:

The chronology of the peer review process is presented as follows:

- March 29-30, 2005 - the first OAP meeting was held. The purpose of the meeting was to review the OAP charge and terms of reference, and to review the EIS research and modeling framework.
- June 28-29, 2005 and July 12, 2007 – the OAP met with the Principal Investigators to review and provide comments on the modeling, data analysis and supporting documentation for the Draft PEIS.
- June 26-27 and August 18, 2007 – the OAP met with the Principal Investigators and the EIS writing team to review and comment on preliminary sections of the Draft PEIS.
- September 11, 2008 – the EIS Writing Team provided the OAP with a final version of the Draft PEIS.
- September 19, 2008 – the OAP completed its consensus peer review report on the final version of the Draft PEIS. Note that because of scheduling conflicts, OAP members Roger Mann and Eric Powell were unable to review the DEIS prior to the September 19 review deadline. Their review comments are presented in Appendix A.

The Lead Agencies are satisfied that the key concerns raised by the OAP during review of the Draft PEIS have been addressed. The remainder of this report presents the OAP consensus review comments and the Principle Investigators' response.

Independent Oyster Advisory Panel members:

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School for Marine Science and
Technology University of Massachusetts -
Dartmouth

Dr. Eric Powell, Director
Haskin Shellfish Research Laboratory
Rutgers University

Dr. Jim Anderson
University of Rhode Island
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Natural Resource Economics

Dr. Mark Berrigan, Chief
Bureau of Aquaculture Development
Division of Aquaculture
Florida Dept. of Agriculture and
Consumer Services

Dr. Maurice Heral
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Dr. Roger Mann
Department of Fisheries Science
Virginia Institute of Marine Science,
College of William & Mary

Dr. Mike Roman, Director
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University of Maryland Center for
Environmental Science

Oyster Advisory Panel Final Review

Programmatic Environmental Impact
Statement for Oyster Restoration in
Chesapeake Bay, Including the Use of a
Native and/or Nonnative Oyster

September 19, 2008

OYSTER ADVISORY PANEL (OAP)

FINAL REVIEW OF PEIS

September 19, 2008

This is the final review of the Programmatic Environmental Impact Statement for Oyster Restoration in Chesapeake Bay (PEIS).

This review reports on the third critical review by the OAP of the PEIS. Previous reviews raised a number of technical issues. The reviews also expressed concern regarding the clarity of the document and whether the public could track the logic and reasoning relative to analysis of the proposed action and alternative actions.

The entire OAP was not available to review the current draft. However, there is a consensus among the reviewers that the technical issues have been dealt with and the readability of the report is improved so that the public can track the logic and reasoning used in the report.

Beyond details, we see no problem in issuing the main body of the report to the public. We think that the Appendices could be made available to the public via an internet site. We note that the Appendices have been given extensive review and that there is no need to reiterate the concerns that have already been made. We note that Appendices were supposed to have been prefaced with a forward to explain how the contractor dealt with the concerns of the OAP. In addition, it was recommended by the OAP that other Appendices should be added in order to give the public the full overview of the reasoning associated with the ecological risk assessment. We note that some of the forwards are missing or incomplete, and the Cerco-Noel model and the Maryland stock assessment have not been added.

In focusing on the body of the PEIS, the OAP noted several issues that the management team might want to address.

SECTION 2—PROPOSED ACTIONS

Overall goal—There was general agreement as the PEIS discussion evolved that the restoration goal of 12 billion oysters is ambitious and perhaps self-defeating. A more modest short-run goal might be more easily achievable. Doubling or tripling of oyster production would be a big success and contribute to developing the long-range funding required for the project.

Conflict of restoring ecological services and economic return—This was discussed at several meetings. It needs to be made clear whether these two objectives are mutually exclusive. Clearly, mechanical degradation of bars will not contribute to increasing the physical extent of the bars. This needs to be dealt with, as well as the facts that: 1) removals increase productivity and hence ecological services; 2) aquaculture is an

economic endeavor, but it also contributes to ecological services because oysters contribute to filtering water (waste production may be a negative); and 3) sites could be restricted to either harvest or bar building.

What is rehabilitation?—Rehabilitation in Chesapeake Bay is traditionally defined in terms of shell repletion or seeding. *Rehabilitation* is a new concept that has not been used to a significant degree.

Three-dimensional bars—It also needs to be made clear that three-dimensional reefs may not have been fully explored. It isn't clear that the optimal properties of reefs have been evaluated and that these have systematically employed in the design of reefs structure. *Contrary to statements in the PEIS, the ACOE reports successful development of three-dimensional bars.* It would be unfortunate if a three-dimensional reef program suffered the same treatment as the sanctuary program, where site location issues and inadequate experimental design lead to indeterminate results, limiting understanding of the value of sanctuaries. The argument of the cost of three-dimensional reefs is a good point, but careful analysis may indicate that at the end of the day some reef construction would actually be cost effective.

Best bars—Whether or not to use best bars as targets depends on analysis. The trade off between best bars and other bars and the reasons why some bars are consistently best are critical to any long range restoration strategy. The issue is really cost effectiveness and the capability to obtain quick results. It is obvious that restoration efforts cannot cover all of Chesapeake Bay, so why not concentrate on the best bars because these have the best chance for success?

Need for a plan—Overall, it is clear that any success in restoration will require a careful plan that takes into account the alternative approaches to reaching a somewhat more modest goal of oyster restoration than indicated in the PEIS. After all, a sustained doubling or tripling of the present stock would be a huge step forward. In addition, substantial successes are likely to be obtained from a major aquaculture program coupled with other restoration activities.. None of this can be accomplished without a major, carefully engineered approach coupled with disciplined management of a long-term program.

SECTION 4—ENVIRONMENTAL CONSEQUENCES

This section is particularly important as it contains the bulk of the PEIS. The section contains some assertions that may need additional qualification. There are a number of important points, such as “density dependent growth,” that relate to the success or failure of alternatives that adequately represent aspects of restoration.

Spat versus natural reproduction—Table 4-2 contemplates an extensive spat production program. Associated narrative suggests hatchery capacity might not be available. If the suminoe oyster “takes off,” extensive spat production may not be needed, and resulting substantial savings could be used to improve habitat. If the

suminoe does not take off in two or three years, it will be unlikely that continued spat production will be worthwhile.

Disease resistance—The text (4-5) points out that at least some suminoe are susceptible to Dermo. *Bonamia* is an issue. On the other hand, large numbers of suminoe have been produced in aquaculture settings. From the text, the issue of disease resistance or the development of disease resistance is not clear. However, it may be that the narrative exhausts what is known.

Shell-planting benefits—Page 4-9 indicates shell planting benefits are short lived and temporary. However, the Maryland planting program shows that planted bars are more productive than unplanted bars.

Negatives on suminoe—Several negatives are listed for the suminoe oyster (section 4.1.1.2.). These may be valid. One way of looking at this is if they are valid, introduced oysters will not “take off.”

Overview section 4.1.1.3.—This is a reasonable statement. However, there is a need to be cautious with statements like “Continuing efforts to restore the eastern oyster...would not contribute significantly to meeting the PEIS goal.” As pointed out above, a more modest goal would be a big success and possibly achievable. It needs to be made clear that some feel that the eastern oyster is doomed because of susceptibility to disease. They feel that the only way to establish an oyster population is through establishment of a non-native species.

Alternative 2: enhance restoration—This section tends to confuse the issues of disease, genetics, and habitat. They are not equivalent. It is clear that a significantly enhanced oyster population is not possible with increased habitat. The seeding program has some success in contributing to reducing the decline. However, a seeding program by itself, in the short term, cannot enhance habitat. The repletion program contributed to enhanced productivity, but fossil shell may not be available or cost effective in the future. Bar construction seems to have had important success. It is expensive, but it may be the most cost effective alternative. The development of disease-resistant mutations in wild oysters is somewhat speculative, and it is not known whether disease is expressed in well-fed fast growing oysters.

This alternative is the most important in terms of not only whether the oyster can be restored, but it is also important in the impact on the strategy of restoration.

Alternative 3 harvest moratorium—This alternative speaks to the need for multiple alternatives. Does it make sense to simply stop harvesting oysters in Chesapeake Bay, or is there a synergy of approaches that would be economically optimal and result in an increase of ecological services? The important aspect of this alternative is to increase habitat. However, it is not certain that this can be accomplished in the short term even with a moratorium without habitat enhancement.

It is not clear how a moratorium would enhance the development of disease resistance.

It is difficult to make inferences on the basis of the sanctuary program, as pointed out previously.

Alternative 4 cultivate eastern oysters—This alternative (probably with the addition of non-native oysters), like alternative 2, will be a critical component of restoration. Like alternative 2, it is under-analyzed, and this should be pointed out.

Explaining the RRM—The OAP recommended that a stand-alone, easy to understand description of the RRM needed to be included in the main body of the report. Also, give an example or two of the multicolored bar charts. This has not been done.

Monte Carlo simulation—The Monte Carlo simulation needs to be redone and included in the text.

Report needs final read-over editing—Note, Figure 1 is in millions of pounds, but this unit is not mentioned in paragraph 2, page 2-1. Figure 3-2 legend is incorrect.

Appendix A:

Additional Comments from Dr. Roger
Mann and Dr. Eric Powell

OYSTER ADVISORY PANEL (OAP)

FINAL REVIEW OF PEIS

Additional comments offered by Roger Mann of the Virginia Institute of Marine Science.
September 23, 2008

My apologies for not participating in the consensus panel review via Dr. Rothschild. I have been at sea for the past two weeks. The time frame for the requested review was short after I came back to the dock, and this has limited my ability to thoroughly review every section in the manner that I would have preferred, but I understand the need to respond to looming deadlines. I have concentrated on the PEIS Volume 1 document. A thorough review of the Appendices was not reasonable in the available time frame given the size of the assembled documents, although I have been through these in past iterations.

I am in general agreement with the summary FINAL REVIEW prepared by Dr. Rothschild for the OAP members. My comments should be considered in addition to those offered in the FINAL REVIEW. They do not require rewriting of the PEIS before its public release, but I do think they should be addressed as part of the final revisions after public comment as the document is delivered to Colonel Aninos, Secretary Bryant and Secretary Griffin.

General presentation and ability to follow the arguments through the sections.

This has been improved, although I am not sure that the addition of yellow digital "post it" notes substitutes for a thorough editing of the many paragraphs that are represented by them. This is a watershed document between the assembly of a vast and diverse array of information on one side, and a series of documents addressing decisions through implementation. The need for concise, unambiguous writing cannot be underestimated.

The statement of need and purpose on page ES-4.

While general and well intended in its initial scope, this was not well written as originally stated and, in the light of findings since its original offering, needs explanation and revision for this document. The OAP consensus touches on this. There is a need to separate the goals of ecological and economic restoration. It would allow more productive discussion of what can be achieved in each of the Alternatives, and thus assist the decision process. There needs to be clear and separate ecological or economic goals and expectations for any action taken under the alternatives.

Definition of terms.

In the same manner that brevity and concise text structure will assist the reader, attention to the use of critical terms will facilitate the decision process. Even at this stage such critical terms as restoration, rehabilitation and refurbishment are not defined - yet they are at times almost used interchangeably. It is not until page 4-9 that I can find a definition of rehabilitation. If the terms were adequately defined at the outset then following statements would be less ambiguous. For example the practice of deploying seed in reserves in Maryland is not restoration because it is not self sustaining - so it should not be portrayed as such. Both states under current practices are requested to report areas of reef restored. What they (the states) in fact do is report areas to which shell and/or seed have been added. These are not restored, yet they are the basis of the current "restoration activity" that is subsumed in various of the Alternatives. Identifying the preferred Alternative(s) will be much easier if there is a clear statement of goals and expectations that accompany each term.

Oyster disease resistance and tolerance are, like the terms mentioned above, these are frequently used interchangeably. They are not the same and at least in the science literature considered to be distinct.

Table ES-1.

This complicated table may be both an asset and hindrance to facilitating the decision process. The summary concept is nice, but in the process it has resulted in some of the "boxes" in the matrix being too simplistic. Take, for example, the box on page ES-12 that examines Introducing the Suminoe Oyster effects on Other Ecosystem Components. The suggestion of negative impact on phytoplankton is actually a desired impact. This is explained later in the text, many pages later, yet here it seems illogical and confusing. An initial criticism of this table was that it examined both impact and tried to estimate uncertainty in each of these boxes. This was confusing. The reduction of the presentation to a descriptive summary is better, it just needs to be sensitive to the words so that the reader receives the intended message on first reading.

All of these suggestions can, I believe, be incorporated into the final revision after public comment.

Respectfully submitted.

Roger Mann

Review of Draft Programmatic Environmental Impact Statement for Oyster Restoration in Chesapeake Bay

Eric Powell

I have had little time to review the PEIS as the final document was made available during a period of time in which I was participating as Chief Scientist in an extended field program in support of the NMFS surf clam/ocean quahog stock survey and assessment. Rather than a detailed review, I offer more general concerns about the content, approach, and deficiencies of the document. I do not recapitulate previous objections to the Oyster Demographic Model. As this model is wholly inadequate, as has been stated in earlier reviews, further attention to it or to any of its predictions is not warranted.

1. The PEIS has a preferred option and a series of alternatives. Only one alternative, the moratorium alternative, deals specifically with management of the oyster fishery, yet a stated goal of the PEIS is to “establish an oyster population that reaches a level of abundance in Chesapeake Bay that would support sustainable harvests comparable to harvest levels during the period 1920-1970” (p. ES-4). Neither the preferred option nor any of the alternatives dealing with other than aquaculture approaches should be given further credence without a clear plan as to how management of the natural oyster beds is to be improved over what is available at present in order to achieve the goal of sustainability. The absence of even a few words to this effect in the PEIS is a grave weakness that suggests that the document does not intend to deal definitively with one of the most basic issues limiting the success of any restoration program. I note that presently the Chesapeake Bay management program does not have:
 - a. A bi-state Fisheries Management Plan (FMP) that provides for coordinated management of the resource – the salinity gradient in the bay, by itself, requires such an approach.
 - b. Established biological reference points to fix fishing mortality rates and to set abundance and rebuilding goals to achieve sustainability.
 - c. Quantitative survey methodology implemented in all significant resource regions (although Virginia has implemented a solid survey program in some bay reaches) – no resource can be managed successfully without quantitative information on resources abundance, biomass, and mortality.
 - d. A stock assessment review process including a SAW (stock assessment workshop) to provide yearly unbiased reviews of the survey and stock assessment, a clear and concise statement of the status of the stock, and

recommendations for management of the resource that directly impact yearly State regulatory goals for the resource.

- e. A TAL (total allowable landings) limit that restricts harvest to a known fraction of bay abundance or biomass – controlling effort is not an acceptable alternative.
- f. An area management plan to distribute the TAL so as to limit overharvesting regionally.

All federal fisheries have each of the five first criteria and even for oysters, many states have implemented at least some. Area management is used successfully for a number of federal and state shellfish species and is a requirement for oysters in which market value and population dynamics vary over the salinity gradient. The PEIS should couch evaluation of the preferred and alternative options within the understanding that no option, preferred or alternative, save for the aquaculture alternatives, can move forward successfully without implementation of a dramatically improved management program for the bay resource. This (or these) management program(s) should be part of the risk assessment for each of the options covered by the PEIS. The PEIS should present a clear description of the management structures that must be present prior to implementation of all options save the option maintaining the present scenario (and this too should include an improved management alternative) and the moratorium alternative.

- 2. The PEIS gives some passing attention to the need to manage the shell resource of the bay without embedding this requirement into any of the approaches, preferred or alternative, that address the wild resource. Oyster beds cannot be managed without a survey program that can provide information on the shell budget. Shell management is critical to any restoration program. Allocating potentially limited shell resources to address the most urgent needs requires prioritization based on shell balance, population productivity, and use factors. Management should implement a plan to assure that the fishery is shell neutral – as much carbonate returned to the bay yearly as removed – and this should also be part of the management program underpinning any option, preferred or alternative, seeking to achieve sustainability. Failure to address in a substantive way the requirements of shell management underpinning many of the proposed actions is a fundamental weakness in the PEIS, that in my opinion makes impossible the weighing of potential risk and possibility of success.
- 3. I am struck that the PEIS does not include, in weighing risk, the likelihood that *C. ariakensis* shell is taphonomically more active than *C. virginica*. Can *C. ariakensis* shell sustain the shell resource needs of the natural beds? I note that the shell of *C. ariakensis* is thinner and more prone to *Polydora* boring. Both bode ill for the stability of this shell after death. No substantive research

has taken place to evaluate this key question. I cannot find how this absence of information is carried through in any risk analysis, but I would opine that no species should be introduced until this question is adequately addressed.

4. The PEIS (p. ES-4) opines that the harvest of 1920-1970 was sustainable and erects this as an abundance/harvest goal. I see no reason to believe that the 1920-1970 harvest represents a sustainable-yield harvest. The PEIS documentation is unconvincing and alternative literature analyses (e.g., Rothschild et al.) opine otherwise. Federal management of fisheries is predicated on evaluating the relationship between surplus production and abundance or biomass. This information is used to set optimum yield goals. Nowhere in the PEIS is there even an attempt to consider surplus production. Nowhere in the PEIS is there even an attempt to evaluate maximum sustainable yield biomass. The stated purpose of the PEIS proposal does not rest on the firm foundation of modern fisheries resource management. In addition, the complication of requiring substrate balance to sustain any *msy* goal is not addressed.
5. The PEIS puts the total abundance of market-size oysters at 809 million (p. ES-5). I doubt this estimate. As of October 2007, there were just over 600 million animals of this size just in the New Jersey waters of Delaware Bay. The PEIS estimate is likely indicative of the inadequacy of survey design that limits the ability to conduct a quantitative estimate of abundance. One wonders how any risk assessment can be made relative to any sustainability goal without the firm foundation of quantitative survey estimates of abundance and biomass.
6. I quote from p. 1-18: “Neither Maryland nor Virginia conducts surveys to estimate the size of the oyster population in their respective portions of the Bay.” Why consider any option, preferred or alternative, to restore the wild population of the bay without a basic database on the abundance and biomass of the stock. The PEIS is cavalier in excusing this absolute deficiency that should prevent exercise of any options beyond those dealing solely with aquaculture. Frankly, I am amazed that the PEIS process continues without resolution of the basic deficiencies in resource management presently inherent to the two states.
7. I quote from p. 2-6: “The continuing loss of hard bottom habitat is highlighted as a major obstacle to oyster restoration throughout this Draft PEIS[†]; however, no attempt was made to determine the level of habitat alteration that might be required to restore the oyster populations to the benchmark goal for the actions evaluated in this Draft PEIS.” So, the PEIS evaluation is utterly inadequate. This statement invalidates consideration of any but aquaculture options. In my opinion, the non-aquaculture alternatives of the PEIS should be deleted from

[†] I find this statement to be an egregious exaggeration: the PEIS gives some limited attention to the problem, but very limited.

the final product until such time as a clear evaluation of the “level of habitat alteration” is available and can be included in the consideration of options, preferred and alternative. The PEIS is wholly inadequate in this most important constraint on success of any option beyond aquaculture![‡]

8. A good deal of discussion of the relative risk between different bay regions can be found in the PEIS. I am struck by the consistently positive outcome in the oligohaline reaches of the Maryland Chesapeake. One wonders if the basis for this judgment is correct. At low salinity, growth is slow and fecundity can be limited. If the metric is shear abundance, then perhaps this outcome can be expected, as mortality rates likely are low and life spans likely long in this reach. But, the metric should be production, as a primary goal expressed by the PEIS on p. ES-4 is to “support sustainable harvests comparable to harvest levels during the period 1920-1970.” Given this stated goal, risk assessments should be in terms of surplus production, not abundance or biomass. Production sustains fisheries, not standing crop. It is very unlikely, in my judgment, that the oligohaline Chesapeake will retain such an apparent beneficial outcome to stock manipulation of any kind when the metric used is consistent with the goal espoused.
9. I am struck throughout the PEIS that no attempt is made to identify the most serious negative outcomes of a species introduction, and to consider their likelihood. What are the potential deal breakers? How likely are such events to come to pass? The PEIS should devote a section to such outcomes, regardless of their likelihood. In my opinion, the most serious outcomes deal with any occurrence that would impose on the average layman or oysterman the need to distinguish accurately the two species. Two examples are perhaps extreme, but should have been carefully considered in the PEIS.
 - a. What would happen if *C. ariakensis* was sufficiently competitive to drive *C. virginica* to abundance levels that would trigger state rules on threatened and endangered species? In New Jersey, this would force a permanent fishery closure if the two species could not be routinely separated with low error. The PEIS admits that an introduced species will move up the eastern seaboard. I submit that special attention should be given to the degree of risk incurred of this outcome.
 - b. What would happen if *C. ariakensis* resulted in an increased level of human disease, caused for example by *Vibrio parahaemolyticus*? The PEIS summarizes research that is ambiguous in the degree to which *C. ariakensis* may accumulate *Vibrio* relative to *C. virginica*. The fact that a clear and

[‡] Honestly, I am mortified that this document would have been put together and subjected to review without the subject of habitat maintenance/alteration being fully and thoroughly reviewed and without detailed recommendations being made in support of each of the options preferred and alternative necessitating the same!

consistent conclusion cannot be made from the presently available data is sobering. But, *C. ariakensis* has a shorter shelf life than *C. virginica* and very likely most incidences of sickness from *Vibrio* come from handling post-harvest; either boat to dock, dock to restaurant, or within the restaurant. All Delaware Bay-derived illnesses in the last decade likely come from this source as *Vibrio* levels in oysters in the bay are consistently found to be far below federal harvest guidelines. I can read in the PEIS no evaluation of the relative risk of human-induced illness between the two species based on post-harvest handling. Consider an outcome in which the bay was closed to one species and not the other. Without the ability to consistently separate species, the entire fishery would have to be closed. The PEIS offers no clear discussion of the risk of options including the use of *C. ariakensis* on human health beyond the studies on the animal prior to harvest. This is a gross inadequacy that should be reflected in a higher risk in the use of the non-native options.

8. The PEIS gives little attention to the impact of the spread of an introduced nonnative species throughout the eastern seaboard. The PEIS contemplates the high likelihood that an introduced species will spread rapidly to other states. Should the PEIS not more carefully evaluate the implications of this outcome? The PEIS appears to treat the subject parochially, limiting detailed attention to Chesapeake Bay, for acts of more global consequence. The narrow focus on Chesapeake Bay would seem to be a fundamental flaw given the potential for any oyster species to spread outside of its originating bay.

Appendix B:

Response to OAP Comments from the
PEIS Writing Team

**PEIS Writing Team Responses to Final OAP Review
(September 22, 2008)**

(Responses to statements relevant to the pre-draft PEIS are inserted
in **Bold** below)

**OYSTER ADVISORY PANEL (OAP)
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The “forewords” which the OAP was told would be included with the appendices are, for formatting purposes, now termed “Notes to Reader” and appear as the first text page after the appendix cover sheets. One important Note to Reader, the one for Appendix B (Ecological Risk Assessment), was inadvertently omitted in the pre-draft PEIS sent for OAP review. That omission has been corrected. Appendices E, F, G and H did not require forewords, as explained in the introduction to the

appendices, because the relevance of their content to the PEIS was not affected by revisions made in response to OAP comments. Two publications documenting the Cerco-Noel model were included in the PEIS as Appendix H (Chesapeake Bay Environmental Modeling Package). The revised Maryland stock assessment was included as Attachment 7 to Appendix A, since it is an update and revision to Attachments 2 and 3 of that Appendix.

In focusing on the body of the PEIS, the OAP noted several issues that the management team might want to address.

SECTION 2—PROPOSED ACTIONS

Overall goal—There was general agreement as the PEIS discussion evolved that the restoration goal of 12 billion oysters is ambitious and perhaps self-defeating. A more modest short-run goal might be more easily achievable. Doubling or tripling of oyster production would be a big success and contribute to developing the long-range funding required for the project.

No response was required to this statement.

Conflict of restoring ecological services and economic return—This was discussed at several meetings. It needs to be made clear whether these two objectives are mutually exclusive. Clearly, mechanical degradation of bars will not contribute to increasing the physical extent of the bars. This needs to be dealt with, as well as the facts that: 1) removals increase productivity and hence ecological services; 2) aquaculture is an economic endeavor, but it also contributes to ecological services because oysters contribute to filtering water (waste production may be a negative); and 3) sites could be restricted to either harvest or bar building.

This contradiction is stated on page ES-5 of the Executive Summary and discussed in greater detail in Section 2.1.1 (pg. 2-2). The role of removal (i.e., harvest) in increasing oyster productivity, a phenomenon generally recognized in finfisheries, was not discussed in the PEIS because no data or information was provided by oyster managers and researchers to document that phenomenon in Chesapeake Bay oyster populations. The role of aquaculture in providing ecological services is explored in Section 4.1.5 and 4.1.6.

What is rehabilitation?—Rehabilitation in Chesapeake Bay is traditionally defined in terms of shell repletion or seeding. *Rehabilitation* is a new concept that has not been used to a significant degree.

Shell reclamation as a means of rehabilitating oyster habitat is discussed in Section 1.3.1 (pg. 1-13).

Three-dimensional bars—It also needs to be made clear that three-dimensional reefs may not have been fully explored. It isn't clear that the optimal properties of reefs have

been evaluated and that these have systematically employed in the design of reefs structure. *Contrary to statements in the PEIS, the ACOE reports successful development of three-dimensional bars.* It would be unfortunate if a three-dimensional reef program suffered the same treatment as the sanctuary program, where site location issues and inadequate experimental design lead to indeterminate results, limiting understanding of the value of sanctuaries. The argument of the cost of three-dimensional reefs is a good point, but careful analysis may indicate that at the end of the day some reef construction would actually be cost effective.

Additional text describing the promising results of the ACOE medium-relieve reefs in the Great Wicomico River was added in Section 1.3.1 (pg 1-15). However, it should be pointed out that, based on comments received during PEIS review, OAP panel members differ in their views as to the potential value of three-dimensional reefs for restoring Bay-wide oyster populations.

Best bars—Whether or not to use best bars as targets depends on analysis. The trade off between best bars and other bars and the reasons why some bars are consistently best are critical to any long range restoration strategy. The issue is really cost effectiveness and the capability to obtain quick results. It is obvious that restoration efforts cannot cover all of Chesapeake Bay, so why not concentrate on the best bars because these have the best chance for success?

No response was required to this statement. The concept of using best bars in oyster restoration is discussed in Section 2.2.2.

Need for a plan—Overall, it is clear that any success in restoration will require a careful plan that takes into account the alternative approaches to reaching a somewhat more modest goal of oyster restoration than indicated in the PEIS. After all, a sustained doubling or tripling of the present stock would be a huge step forward. In addition, substantial successes are likely to be obtained from a major aquaculture program coupled with other restoration activities.. None of this can be accomplished without a major, carefully engineered approach coupled with disciplined management of a long-term program.

No response was required to this statement.

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Spat versus natural reproduction—Table 4-2 contemplates an extensive spat production program. Associated narrative suggests hatchery capacity might not be available. If the suminoe oyster “takes off,” extensive spat production may not be

needed, and resulting substantial savings could be used to improve habitat. If the suminoe does not take off in two or three years, it will be unlikely that continued spat production will be worthwhile.

While these observations represent potential outcomes, they are speculative. In order to maintain consistency in the PEIS evaluation of the proposed action and alternatives, the implementation plans were assumed to be executed as described.

Disease resistance—The text (4-5) points out that at least some suminoe are susceptible to Dermo. Bonamia is an issue. On the other hand, large numbers of suminoe have been produced in aquaculture settings. From the text, the issue of disease resistance or the development of disease resistance is not clear. However, it may be that the narrative exhausts what is known.

The PEIS text summarizes the information currently available on this topic.

Shell-planting benefits—Page 4-9 indicates shell planting benefits are short lived and temporary. However, the Maryland planting program shows that planted bars are more productive than unplanted bars.

The text was revised in Section 4.1.1.2 (pg. 4-9) to indicate that the benefits of shell planting may not be short lived if the shell is colonized and contributes to development of a growing oyster population.

Negatives on suminoe—Several negatives are listed for the suminoe oyster (section 4.1.1.2.). These may be valid. One way of looking at this is if they are valid, introduced oysters will not “take off.”

No response was required to this statement.

Overview section 4.1.1.3.—This is a reasonable statement. However, there is a need to be cautious with statements like “Continuing efforts to restore the eastern oyster...would not contribute significantly to meeting the PEIS goal.” As pointed out above, a more modest goal would be a big success and possibly achievable. It needs to be made clear that some feel that the eastern oyster is doomed because of susceptibility to disease. They feel that the only way to establish an oyster population is through establishment of a non-native species.

No response was required to this statement.

Alternative 2: enhance restoration—This section tends to confuse the issues of disease, genetics, and habitat. They are not equivalent. It is clear that a significantly enhanced oyster population is not possible with increased habitat. The seeding program has some success in contributing to reducing the decline. However, a seeding program by itself, in the short term, cannot enhance habitat. The repletion program contributed to enhanced productivity, but fossil shell may not be available or cost effective in the future. Bar

construction seems to have had important success. It is expensive, but it may be the most cost effective alternative. The development of disease-resistant mutations in wild oysters is somewhat speculative, and it is not known whether disease is expressed in well-fed fast growing oysters.

This alternative is the most important in terms of not only whether the oyster can be restored, but it is also important in the impact on the strategy of restoration.

The discussion of Alternative 2 addresses the issues raised in this comment to the extent that the existing data and information allow. No response was required to this statement

Alternative 3 harvest moratorium—This alternative speaks to the need for multiple alternatives. Does it make sense to simply stop harvesting oysters in Chesapeake Bay, or is there a synergy of approaches that would be economically optimal and result in an increase of ecological services? The important aspect of this alternative is to increase habitat. However, it is not certain that this can be accomplished in the short term even with a moratorium without habitat enhancement.

It is not clear how a moratorium would enhance the development of disease resistance.

It is difficult to make inferences on the basis of the sanctuary program, as pointed out previously.

The discussion of Alternative 3 addresses the issues raised in this comment to the extent that the existing data and information allows. The synergy of approaches is explored in consideration of the combinations of alternatives. No response was required to this statement

Alternative 4 cultivate eastern oysters—This alternative (probably with the addition of non-native oysters), like alternative 2, will be a critical component of restoration. Like alternative 2, it is under-analyzed, and this should be pointed out.

Cultivation of the eastern oyster as a component of restoration is explored in the analysis of the combinations of alternatives. The scope of the analysis of this alternative was limited to the economic approach established by the PDT. As explained in Section 2.2.4, the analysis did not investigate alternative approaches to implementing aquaculture. Such analyses may be appropriate at later stages of the PEIS process.

Explaining the RRM—The OAP recommended that a stand-alone, easy to understand description of the RRM needed to be included in the main body of the report. Also, give an example or two of the multicolored bar charts. This has not been done.

A brief description of the RRM, in terms appropriate for anticipated PEIS readers, is presented on pages 4-54 and 4-55 of the PEIS.

Monte Carlo simulation—The Monte Carlo simulation needs to be redone and included in the text.

This issue was addressed by Doug Dixon in his revisions to the economics analysis made in response to comments from OAP member Jim Anderson.

Report needs final read-over editing—Note, Figure 1 is in millions of pounds, but this unit is not mentioned in paragraph 2, page 2-1. Figure 3-2 legend is incorrect.

A final copy edit identified a number of such errors, and they have been corrected.