APPENDIX 3C-2

November 2005
Consolidated Pre-Teleconference Comments

Peer Review of Eight
Water and Ecological Condition Indicators for
EPA's 2006 Report on the Environment

November 11, 2005

Notice:

Pre-discussion comments were prepared by each consultant individually prior to the conference call discussion. They are preliminary comments only, and are used to help consultants become familiar with the document and charge questions, develop the agenda, and identify key issues for discussion. During the discussion, consultants may expand on or change opinions expressed in their pre-discussion remarks and may introduce additional issues. For these reasons, pre-discussion comments should be regarded as preliminary and do not reflect the final conclusions and recommendations of individual consultants. These pre-discussion comments will be included as an appendix in the summary report, along with other background materials.

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Reviewer Biographies

William Creal
Michigan Department of Environmental Quality
Permits Section

I have been an Environmental Manager in Michigan for the past 17 years with extensive experience in almost all phases in the Water Program. Prior to that, I was an Aquatic Biologist with extensive experience in surface water monitoring and applying the results to Water Quality Standards, NPDES permits, and sediment remediation projects. In my 27 years experience, I have seen the water programs develop and mature, and witnessed the substantial progress that has been made in cleaning up our waters. I have provided some additional specifics below:

2003-2005 Chief, Permits Section, Water Bureau
Michigan Department of Environmental Quality

Responsible for all activities associated with the NPDES and Groundwater point source discharge permits for the state of Michigan. These activities include permit issuance, development and application of both technology and water quality based effluent limits and antidegradation requirements, and the development and maintenance of the computer database and applications for the permit management system.

1988-2003 Chief, Water Quality Appraisal Unit
Great Lakes and Environmental Assessment Section
Michigan Department of Environmental Quality

Responsible for development and implementation of Michigan Water Quality Standards, including water quality based NPDES permit limits, the surface water monitoring program, Michigan's biennial report on Water Quality, development of the list of water bodies needing Total Maximum Daily Loads (TMDLs) and the development of TMDLs, and sediment remediation projects and Natural Resource Damage Assessments for Michigan. The surface water monitoring program included sampling and reporting on results from water, sediment, fish tissue, aquatic life (primarily fish and macroinvertebrates), and microorganisms. This included development of Michigan's comprehensive surface water monitoring strategy in 1997.

1978-1988 Aquatic Biologist, Water Quality Appraisal Unit
Great Lakes and Environmental Assessment Section
Michigan Department of Natural Resources

John W. Day, Jr.
Department of Oceanography and Coastal Sciences
Louisiana State University

John W. Day, Jr. is Distinguished Professor in the Department of Oceanography and Coastal Sciences, School of the Coast & Environment at Louisiana State University, where he has taught since 1971. He has published extensively on the ecology and management of coastal and wetland systems and has over 100 peer-reviewed publications. He is co-author (with M. Kemp, C. Hall, and A. Yáñez-Arancibia) of *Estuarine Ecology*, coeditor (with C. Hall) of *Ecological Modeling in Theory and Practice*, coeditor (with W. Conner) of *The Ecology of the Barataria Basin, An Estuarine Profile*, and coeditor (with A. Yáñez-Arancibia) of the *Ecology of Coastal Ecosystems in the Southern Mexico: The Terminos Lagoon Region*. Professor Day received his PhD in marine sciences and environmental sciences from the University of North Carolina in 1971 working with Dr. H.T. Odum. Since then, he has conducted extensive research on the ecology and management of the Mississippi Delta region and for the last 25 years, he has studied

coastal ecosystems in Mexico. He was a visiting professor in the Institute of Marine Sciences of the National University of Mexico in 1978-1979, at the University of Utrecht in the Netherlands during 1986, at the Laboratoire d'Ecologie, Unversité Claude Bernard in Arles France during 1992-93, and in the Department of Geography at Cambridge University in 2000-2001. He has also worked with the University of Campeche and the Institute of Ecology in Xalapa, Mexico. Since 1992, Professor Day has worked in the Mediterranean studying the impacts of climate change on wetlands in Venice Lagoon and in the Po, Rhone and Ebro deltas. He is presently working on using wetlands as a means of removing nitrogen from the Mississippi River and for assimilation of municipal effluents. Dr. Day also served as a member of the hypoxia reassessment taskforce and published with Dr. William Mitsch an article in BioScience on approaches to removing nitrogen from the Mississippi River. He is presently serving as chair of the National Technical Review Committee that oversees the Louisiana Coastal Area program, the restoration program for the Mississippi delta. In 1998, Dr. Day received the School of the Coast & Environment Outstanding Faculty Teaching Award and in 2000, he received the Lipsey Professional Educator Award. In 2003, the Estuarine Research Federation presented Dr. Day with the National William A. Niering Education Award.

Stanley Gregory
Department of Fisheries and Wildlife
Oregon State University

Stanley Gregory is a Professor in the Department of Fisheries & Wildlife at Oregon State University (Telephone: 541-737-1951; Email:Stanley.Gregory@regonstate.edu). He received his B.S. from the University of Tennessee in 1971, M.S. and Ph.D. from Oregon State University in 1974 and 1980, Oregon State University, Department of Fisheries and Wildlife. Dr. Gregory has been involved in the development of interdisciplinary ecological studies at Oregon State for more than two decades. He has participated in the International Biological Program and the Long-Term Ecological Research Program at the H.J. Andrews Experimental Forest. Dr. Gregory has directed the stream research program informally known as the Stream Team since 1986. This interdisciplinary research program has been recognized for its contributions in teaching and research by the College of Agricultural Sciences, the College of Forestry, and the U.S. Forest Service. His research now includes nutrient dynamics, hyporheic processes, stream and river restoration, wood and habitat relationships, fish assemblages in large rivers, riparian management and restoration, and analysis of alternative future scenarios for large river basins.

Anitra Pawley
University of California and The Bay Institute

Dr. Anitra Pawley, Senior Ecologist at the Bay Institute joined the group in 1997, after completing her Ph.D. at the University of California, Davis with an emphasis on aquatic ecology. Since that time, she has focused on developing a research program dedicated to indicator development at the Bay Institute with ties to other regional research and monitoring programs. The first phase of her work on indicators focused on helping the California Bay Delta Program Authority Ecosystem Restoration Program identify appropriate indicators of program performance. She also participated in the Agency Stakeholder Ecosystem Team, a consortium of scientists who serve as technical advisors to the Ecosystem Restoration Program and the Wetland Resource Monitoring Program. Her recent projects, include the development of regional level indicators (The Bay Delta Ecological Scorecard) and the use of archival data to evaluate wetland health (Pacific Estuarine Ecological Research Program). She has developed reviews of wetland and benthic indicators. Currently, she has a dual appointment with the University of California, Davis where she is the principal researcher on a Coastal Watershed Assessment project for the National Park Service.

Prior to the work she now pursues, she coordinated the development of several statewide resource inventories/databases at the Information Center for the Environment, U.C. Davis to provide a technical tool for the assessment of restoration activities. Her experience in aquatic ecology, remote sensing and geographic information systems included research on streams, lakes and wetland ecosystems in a variety of Western Hemisphere habitats. Dr. Pawley also worked with the Tahoe Regional Planning Agency to develop their first environmental education and public outreach program.

Hans Paerl
University of North Carolina at Chapel Hill
Institute of Marine Sciences

Hans W. Paerl is Kenan Professor of Marine and Environmental Sciences, at the UNC-Chapel Hill Institute of Marine Sciences. He has designed and directed numerous water quality and environmental research programs in North Carolina, nationally and internationally, including: the Neuse River Estuary Modeling and Monitoring Program (ModMon; www.marine.unc.edu/neuse/modmon), the Ferry-Based Water Quality Monitoring Program for the Pamlico Sound System, FerryMon (www.ferrymon.org), and the EPA-STAR supported Atlantic Coastal Environmental Indicator Consortium, ACE INC (www.aceinc.org). His research includes; nutrient cycling and production dynamics of aquatic ecosystems, environmental controls of algal production (including algal blooms), and developing and testing broadly-applicable, integrative indicators of ecological condition, integrity, and sustainability in estuarine and coastal ecosystems. His work has focused on assessing the causes and consequences of eutrophication. Recent studies have included identifying the importance and ecological impacts of atmospheric nitrogen deposition in estuarine and coastal environments and the development of bio-indicators used to assess human- and climate-induced change in aquatic ecosystems. He was recently (Feb., 2003) presented with the G. Evelyn Hutchinson research achievement award by the American Society of Limnology and Oceanography for "contributing to the understanding of aquatic microbial processes, for documenting linkages among the atmospheric deposition of nitrogen, coastal eutrophication, and harmful algal blooms, and for crossing traditional research boundaries to system-level perspectives within freshwater, estuarine and marine ecosystems". His work plays a central role in identifying, managing and reversing declines in coastal water quality and fisheries habitat facing North Carolina and the nation.

N. Scott Urquhart
Department of Statistics
Colorado State University

N. Scott Urquhart directs the Space-Time Aquatic Resources Modeling and Analysis Program (STARMAP), funded by an EPA cooperative agreement, in the Department of Statistics of Colorado State University (CSU), Fort Collins, CO. He has served as a statistical collaborator for over 45 years on a wide range of projects in agriculture, the environment, and natural resources. He has been involved with both quality and quantity of water since he moved from Cornell University to the arid context of New Mexico State University in 1970. After retiring there in 1991, he collaborated closely with EPA's Environmental Monitoring and Assessment Program (EMAP) from the Department of Statistics at Oregon State University, Corvallis, OR. Since 2000 he has directed STARMAP from CSU. He is quite familiar with EMAP, The national Wetlands Inventory's (NWI) Status and Trends Program, and fairly is familiar with the National Resources Inventory (NRI) and some features of water quality programs of the United States Geologic Service (USGA), as well as a number of other national and regional natural resource surveys. He has served in numerous professional capacities in statistics, has coauthored a book, more than 60 refereed journal articles, and more then 100 other pieces of professional writing.

Comments for Sea Indicators

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Sea Level

1) Please indicate the extent to which you think the proposed indicator is appropriate, adequate, and useful (AA&U) for evaluating ecological conditions and therefore useful for contributing to an overall picture of ecological conditions.

1	2	3	4
Indicator is not AA&U	Indicator is of somewhat AA&U	Indicator is largely AA&U	Indicator is completely AA&U

Creal: (3) This indicator is proposed as an Effects Indicator, yet is clearly an Ambient Condition Indicator. I noticed that all of the Ecological Condition Indicators are proposed as Effects Indicators, and yet clearly some of these would be in other categories, such as Ambient Condition Indicators, if they were in a different set of indicators, such as Air or Water. This issue should be resolved so there is a consistent framework and thought process used in developing and presenting these indicators.

Day: (2) I am uncertain how to judge the indicator of sea level. Certainly, a knowledge of sea level change is important in understanding how coastal ecosystems, especially coastal wetlands affect sea level. And, in this sense, sea level is important. But, the important thing for understanding how coastal wetlands will react to rising sea level is to have an estimate of the rate that a particular wetland can accrete vertically in order to keep up with sea level. Coastal wetlands have been shown to be able accrete vertically for all the range of conditions of sea level rise that exist today or that are predicted in this century. Thus, there is no particular rate of sea level rise, or range of sea level rise, that is an indication of a problem in general for coastal wetlands. What must be known is the ability of a particular coastal wetland to survive a given rate of sea level rise. And wetlands in the same area, sometimes within a few hundred meters of each other, can sustain very different rates of sea level rise. I think that the discussion of sea level rise as an indicator should have a strong ecological component before it can become a useful indicator.

Gregory: (3) Changes in sea level reflect critical changes in the earth's climate and physical processes. This phenomenon has profound impacts on marine and coastal ecosystems, not to mention coastal human communities.

Paerl: (4) Excellent overall indicator of long-term change in sea level. It is easy to measure, and good historic data set available in numerous places. Highly relevant indicator with regard to a range of coastal issues, conditions, pressures. The presentation of this indicator, in the context of coastal and global change, is excellent.

Pawley: (3) Overall, I am very impressed by the presentation and supporting documentation for the calculation this indicator. Though scientists may not agree upon the causes of sea level change, the fact that sea level change has occurred and is continuing is <u>extremely important</u> and should be presented in the ROE. The discussion of the indicator could be improved by explaining how these rates of change might affect ecological condition. Picking sites as examples and explaining possible impacts given current rates of change, would improve this indicator as a communication tool.

Urquhart: (4) None.

2) Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the question: *What are the trends in the critical physical and chemical attributes of the Nation's ecological systems?* (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: (3) This indicator doesn't have sufficient data for temporal trends yet, but will soon with the satellite information. I can't understand why the tidal information is needed to be presented – it is not clear to me what is gained by presenting the first two figures using this information. I recommend that these be omitted from the indicator.

Day: (2) Again, sea level is a critically important factor affecting coastal wetlands. But it is the ability of wetlands to sustain sea level rise that is most critical.

Gregory: (3) If sea level is changing, we need to understand the rates and patterns of change. These data will be essential in exploring the consequences of potential global warming trends.

Paerl: (3/4) Excellent integrative indicator. Measurement of sea level is a god way to obtain an integrative assessment of changes in freshwater runoff vs. loss on regional and global scales.

Pawley: (4) The issue is extremely important to the condition of coastal systems and it also impacts the human condition in very substantial ways. Stating how these physical/chemical changes impact human uses would enhance the presentation. For example are we losing wetlands along the New Orleans coast due in part to sea level change? What cities are in jeopardy of flooding or area is being lost to sea level rise?

Urquhart: (4) None.

3) To what extent do you think the indicator meets the following <u>indicator definition</u>:

> *An "indicator" is **a numerical value derived from actual measurements of a pressure, ambient condition, exposure, or human health or ecological condition** over a specified geographic domain, whose trends over time represent or draw attention to underlying trends in the condition of the environment.*

1	2	3	4
Doesn't meet the definition	Only partly meets the definition	Largely meets the definition	Fully meets the definition

Creal: (3) The would score a 4 if there were sufficient years for a trend to be established.

Day: (3) The sea level data presented in the draft report that I read are adequate in describing how sea level is changing, especially with regard to using these data to analyze ecological condition. But, a certain value of sea level rise, per se, cannot be used as other indicators. For example, a high value of chlorophyll indicates eutrophication, and a certain benthic animal composition indicates stress. But , a given value of sea level, especially if it is within the range expected during this century, has little definite meaning as an ecological indicator. It must be compared to a particular wetland and its ability to accrete vertically.

Gregory: (3) The trends in sea level are important measures of the earth's environment.

Paerl: (3) This indicator integrates pressure and ambient condition when considering the coastal change issues, especially, geomorphological, biogeochemical, fisheries and overall ecosystem status and trends. This indicator can be assessed locally, regionally, and globally. One big "downside" is that this indicator cannot distinguish sea level rise from subsidence, which can be an important issue in the Gulf of Mexico and Atlantic coastal regions.

Pawley: (3) One limitation is the lack of replication of these measurements to create a population of measures to represent a particular region; however, this limitation is due to the nature of tidal gauge measures and not easily remedied. On the plus side, some areas have been measured for nearly 100 years.

Urquhart: (4) This indicator is a direct measurement of sea level elevation in oceanic areas near the US coastline, as well as the gauge height of the ocean at a dense set of coastal areas at the edge of the US. Both measures have limitations, but taken together show what is happening fairly well.

4) To what extent do you think the indicator meets each of the following <u>indicator criteria</u>:

a) The indicator makes an important contribution to answering a question for the ROE. (In this context, "important" means that the indicator answers a substantial portion of and/or a critical part of the question.)

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Day: (2)
Gregory: (3)
Paerl: (3)
Pawley: (4)
Urquhart: (4)

b) The indicator is objective. It is developed and presented in an accurate, clear, complete, and unbiased manner.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (4)
Day: (4)
Gregory: (3)
Paerl: (4)
Pawley: (4)
Urquhart: (4)

c) The underlying data are characterized by sound collection methodologies, data management systems that protect its integrity, and quality assurance procedures.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (4)
Day: (4)
Gregory: (4)
Paerl: (4)
Pawley: (4)
Urquhart: (4)

d) Data are available to describe changes or trends, and the latest available data are timely.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Day: (3)
Gregory: (3)
Paerl: (4)
Pawley: (4)
Urquhart: (4)

e) The data are comparable across time and space, and representative[1] of the target population. Trends depicted in this indicator accurately represent the underlying trends in the target population.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (4)
Day: (3)
Gregory: (3)
Paerl: (3)
Pawley: (2)
Urquhart: (3)

f) The indicator is transparent and reproducible. The specific data used and the specific assumptions, analytic methods, and statistical procedures employed are clearly stated.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Day: (3)
Gregory: (4)
Paerl: (4)
Pawley: (4)
Urquhart: (3)

Please explain:

Creal: This indicator appears very strong and important with the satellite data, but less so with the tidal gauge portion of the indicator.

Day: Again, the point is the contrast between values for sea level alone and the usefulness of sea level as an indicator of ecological condition. A rise of 5 mm/yr along a high relief rocky coast would likely cause no discernable problem. But a rise of 5 mm/yr will definitely be a problem for some coastal wetlands but not others.

Gregory: None.

Paerl: Overall, this is a useful integrative long-term indicator.

[1] An indicator seeks to describe trends in an overall target "population" (e.g., land area, type of surface water, type of emissions, U.S. population), yet data often can only be sampled from a subset of this population. The validity of the trends described by the indicator will depend on the degree to which the sampled population is representative of the target population.

Pawley: Because of the nature of old tidal gauge measures that were not randomly located and distributed, it is not possible for this indicator to represent average trends across a region or coastline. Also, it is impossible to know from the tidal gauge measures whether the changes observed represent changing sea level or land level in any specific region.

Urquhart: The global mean sea level rise provides complete coverage, so issues of target population and sampled population do not arise, although there may be some concerns about details of measurement; however, the tidal gauge data constitute a convenience collection of sites. Details of measurement methods are buried deep in a number of scientific articles, whose content may be fairly unavailable to many interested persons.

5) Do you have any suggestions for more effective graphic presentation of the data? If yes, please describe.

Creal: Yes. Delete figures 353.1 and 353.2. There is no added value being presented by these figures.

Day: Rates of present and projected sea level rise should be plotted against measured vertical accretion rates for a number of wetlands to show the range of sea level rise rates that can be sustained by different coastal wetlands.

Gregory: None.

Paerl: It is impossible to distinguish some of the colors, specially the reds, and this reviewer is <u>not</u> colorblind! Either use more contrasting colors or use hatch lines, etc. in combination with colors.

Pawley: Yes, for figure 353.1, place a scale on the bottom of the map like the scale in Figure 353.2, and amplify the areas shown so they can be seen more readily. A frequency diagram for the number of sites which fall into different categories of sea level change would also be effective. Also, showing results by <u>major cities</u> would enhance the level of information provided and capture the interest of the reader.

Urquhart: Presented graphics seem to do the job.

6) Please provide any additional comments, suggestions, or concerns regarding the indicator that you have not already noted in Questions 1 through 5. In particular, note any limitations to the indicator that you have not already described in your responses to the preceding questions.

Creal: It seems like the Great Lakes water levels should be presented also as part of this indicator. These data could help sort out the overall changes in the oceans, although they will be more cyclic and variable than the oceans.

Day: I think that the write up for this indicator should include a discussion of the accretionary responses of coastal wetlands. There is quite a literature on this. Focusing only on sea level does not give the whole picture.

Urquhart: The third paragraph of the writeup defines many acronyms, but not two found on the next page: GSLR and SLR.

7) Overall, this indicator:

Creal: Should be included in ROE06 TD (**With the deletion of the first 2 figures**).

Day: Should be included in ROE06 TD only if the modifications identified above as critical are made.

Gregory: Should be included in ROE06 TD.

Paerl: Should be included in ROE06 TD.

Pawley: Should be included in ROE06 TD.

Urquhart: Should be included in ROE06 TD.

QUESTION: The writeup acknowledges efforts to account for the effects of temperature and salinity changes on ocean volume, and thereby sea level. Good. There is undersea volcanic and other geologic activity all around the world. This reduces the volume of the space below the current sea, but how much? Has anyone looked into this? If so, how substantial an effect is it? Could this affect sea level?

Sea Surface Temperature

1) Please indicate the extent to which you think the proposed indicator is appropriate, adequate, and useful (AA&U) for evaluating ecological conditions and therefore useful for contributing to an overall picture of ecological conditions.

1	2	3	4
Indicator is not AA&U	Indicator is of somewhat AA&U	Indicator is largely AA&U	Indicator is completely AA&U

Creal: (3) This indicator is proposed as an Effects Indicator, yet is clearly an Ambient Condition Indicator. The opening paragraph of the indicator discussion clearly explains the effects that result if the ambient temperature condition increases. This indicator should be proposed as an Ambient Condition Indicator, and then some thought put into the indicators that would be used as the Effects Indicators, such as bleaching of coral reefs, frequency or extent of harmful algae blooms, or decreases in nutrients, primary production and fish production.

Day: (1) This indicator is not appropriate for evaluating ecological condition because it relies on a much too short a time period and it is unlikely that it will yield an adequate data base within a reasonable amount of time. Records of temperature change over the 20th century show a rising trend but there has been considerable variability on a decadal time scale. I believe that it would be much more useful to use the existing data set on temperature and IPCC projections of temperature increase to evaluate the impact of increasing temperature.

Gregory: (3) Sea surface temperature has tremendous implications for coastal ecosystems, climate, salmon, other fisheries, and open ocean marine systems. As with sea level, this is a fundamental measure of changes in the earth's environment.

Paerl: (3) Very useful and appropriate <u>long-term</u> indicator of changes in ocean surface temperatures. Can be deployed locally, regionally and globally. Measurements are easy to execute (given calibrated temperature measuring devices). SST "Index" is not defined and unclear (to for the unacquainted reader). This indicator is highly integrative with other indicators. Pros and cons of use and interpretational value of this indicator are clearly articulated, except is should be emphasized that short-term measurements are not necessarily indicative of SST trends.

Pawley: (3) In light of global climate change and the important of our nation's ocean's ecology for both inherent reasons and human uses, tracking ocean temperature changes over time on a national scale is extremely important. However, the indicator could be improved. In the realm of global climate change the time span for this dataset, 14 years, does not yield discernable trends, so it would be instructive to add results for other datasets for specific areas where longer term data is available. Also, the discussion refers to the index (1.1 to .9), but the graphs as presented are too small for one to easily make out the scale and to compare the results across regions. See the Heinz Center graphic pasted below for a figure that enables regional comparisons.

Urquhart: (4) This is an important indicator for possible global warming considerations.

2) Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the question: *What are the trends in the critical physical and chemical attributes of the Nation's ecological systems?* (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: (3) There is good data available for this indicator, and this trend could be important to know, even if there is no increase or decrease in sea surface temperature over time.

Day: (2) As stated above, the time scale of the index is much too short. Existing data sets on temperature are adequate. The temperature variability for the period of this indicator are within the natural variability measured during the 20th century.

Gregory: (3) See comments above.

Paerl: (4) Note however, that there are distinctly different approaches, uses and interpretations of this indicator on short-term (diel, seasonal to multiple years) vs. long-term (decadal and long-term) scales.

Pawley: (3) Yes, this indicator documents an extremely important physical aspect of our Nation's coastal ecosystem, and one that effects ecological systems in major ways; however, I am wondering if the dataset can be expanded to include more years for at least some of the regions. For example the report refers to Barry et. al 1995 and Levitus et. al. 2000 as reports that depict trends. Can data be extracted from these published papers to show trends for certain geographic regions?

Urquhart: (4) See response to 1.

3) To what extent do you think the indicator meets the following <u>indicator definition</u>:

> *An "indicator" is* ***a numerical value derived from actual measurements of a pressure, ambient condition, exposure, or human health or ecological condition*** *over a specified geographic domain, whose trends over time represent or draw attention to underlying trends in the condition of the environment.*

1	2	3	4
Doesn't meet the definition	Only partly meets the definition	Largely meets the definition	Fully meets the definition

Creal: (4) For an ambient condition indicator.
Day: (1) The data presented in figure 344-1 clearly show the deficiencies of this indicator. One would concluded from this data set that there are no significant trends in temperature over time. But the 20th century data clear show that there are trends of increasing temperatures.

Gregory: (3) The indicator reveals important physical trends in the oceans and coastal areas. Threse trends may be linked to global climate change and thus are important measures of trends in the condition of the environment.

Paerl: (3) Excellent indictor of pressure and condition. No real guidelines are given as to when (i.e. time of the day, seasonal) to make measurements. This needs to be defined so that measurements can be made in the most comparable manner. Also, 10 years hardly tells a story. It should be emphasized that this indicator is mainly of use over the long-term (decadal and longer). Good long-term data sets exist in some places, but they are not as sound as salinity or sea surface data (for comparison).

Pawley: (4) Sea surface temperature is an important aspect of ambient condition and could reflect anthropogenic pressures on the system; though the relationships are still debated. The write-up could be improved by summarizing regionally based sea surface trend research and the relationships noted for effects on ecosystems, but this would take significant expertise to distill information down to important public-level messages.

Urquhart: (4) It indicates sea surface temperature in important coastal areas of the US.

4) To what extent do you think the indicator meets each of the following indicator criteria:

a. The indicator makes an important contribution to answering a question for the ROE. (In this context, "important" means that the indicator answers a substantial portion of and/or a critical part of the question.)

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Day: (1)
Gregory: (3)
Paerl: (4)
Pawley: (3)
Urquhart: (4)

b. The indicator is objective. It is developed and presented in an accurate, clear, complete, and unbiased manner.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (4)
Day: (2)
Gregory: (3)
Paerl: (3)
Pawley: (4)
Urquhart: (3)

c. The underlying data are characterized by sound collection methodologies, data management systems that protect its integrity, and quality assurance procedures.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (4)
Day: (2)
Gregory: (4)
Paerl: (4)
Pawley: (4)
Urquhart: (4)

d. Data are available to describe changes or trends, and the latest available data are timely.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Day: (2)
Gregory: (3)
Paerl: (2)
Pawley: (2)
Urquhart: (4)

e. The data are comparable across time and space, and representative[2] of the target population. Trends depicted in this indicator accurately represent the underlying trends in the target population.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (4)
Day: (2)
Gregory: (3)
Paerl: (3)
Pawley: (4)
Urquhart: (4)

[2] An indicator seeks to describe trends in an overall target "population" (e.g., land area, type of surface water, type of emissions, U.S. population), yet data often can only be sampled from a subset of this population. The validity of the trends described by the indicator will depend on the degree to which the sampled population is representative of the target population.

f. The indicator is transparent and reproducible. The specific data used and the specific assumptions, analytic methods, and statistical procedures employed are clearly stated.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (4)
Day: (2)
Gregory: (3)
Paerl: (3)
Pawley: (4)
Urquhart: (3)

Please explain:

Creal: This appears to be an excellent ambient condition indicator. The only shortcoming noted is that the more recent data is not used. The explanation is that the Heinz 2005 report will be released soon with this more recent data included in this indicator. Given the limited resources in EPA for this project, this seems to be a very acceptable solution.

Day: Again, the point is that the temperature record measured by this indicator is simply inadequate to show long term trends or spatial variability in an ecologically meaningful way.

Gregory: The approaches for measuring sea surface temperature are well documented. Our ability to measure sea surface temperature accurately and precisely has advanced rapidly in recent decades. This is an important measure of the earth's changing environment and has enormous implications for coastal ecosystem dynamics.

Paerl: It should be pointed out that this indicator is most useful and appropriate over long time scales (decades or longer, as a meaningful indicator of climate change. Over shorter time scales it may be useful and indicative of other physical-chemical and environmental changes, such as shifts in ocean circulation, el niño and other climatic oscillations, etc.

Pawley: The low score for (d) reflects my belief that this dataset should be updated and expanded upon (include other longer term sources) if at all possible, before it is considered adequate or complete. For example for the Pacific Northwest there is significant research on the effect of sea surface temperatures on fish populations – this information would make the discussion more interesting and noteworthy to readers in various regions across the US.

Urquhart: Sea surface Temperature provides complete coverage, so issues of target population and sampled population do not arise, although there may be some concerns about details of measurement. The methodology is not reproducible, as once the satellite has passed, the sensors can not be pointed at the same spot again at the same time. The intent of the indicator is clear; however, it is very complicated and subject to continuing refinement so its accuracy may improve with time.

5) Do you have any suggestions for more effective graphic presentation of the data? If yes, please describe.

Creal: No, except to make sure that the graph is readable when published. The review graph was pretty hard to read due to the small print size.

Day: I suggest that this indicator be de-emphasized and temperature data and predictions documented by the IPCC used for discussions of ecological impact. There is abundant data that temperature is increasing and there are numerous studies that show the impact of increasing temperatures on ecosystems. The indicator contributes only in a minor way to an understanding of temperature trends and their effects on ecosystems.

Gregory: The EMAP national database is a statistically sound approach to measuring the condition of freshwater in the nation. The use of reference sites for specific regions throughout the US solves some of the challenges in interpreting this indicator because concentrations within a region can be expressed relative the expected distribution of concentrations. This indicator could be expanded to include an assessment of the limiting nutrient within regions (using Redfield ratios)

Paerl: The figure (Fig. 344-1) is not very informative and can be misleading. Ten years of data is simply too short to have this indicator be a useful indicator for establishing climatic change.

Pawley: Yes, expand on size of graphs relative to the map so that the trends or lack of trends can be viewed more readily. Add other datasets if possible to amplify the number of years represented.

Urquhart: Draft graphics are reasonable.

6) Please provide any additional comments, suggestions, or concerns regarding the indicator that you have not already noted in Questions 1 through 5. In particular, note any limitations to the indicator that you have not already described in your responses to the preceding questions.

Creal: This indicator provides useful information on an ambient condition, even if there is no change indicated in sea surface temperature by the indicator. Knowing that there is no change is just as useful as an indicator that shows a change.

Day: I found the presentation for this indicator to be poorly done. There is a large literature on temperature change and the impacts on ecosystems that are very poorly reflected in this write up. This needs to be redone.

Note: In general, I found the treatment of both sea level and temperature to be shallow and rather simplistic. The response of ecosystems to forcings such as sea level and temperature are complex and highly variable. The search for simple indicators is often misleading. For example, I have seen a single level of 20 ug/l for chlorophyll applied for the Louisiana coastal zone as an indicator of eutrophication. There natural water bodies in the coastal zone with little if any anthropogenic impact that have have chlorophyll levels significantly higher than 20 ug/l. Thus, it is clear a single standard is not appropriate. As another example, high turbidity levels have been used in some EPA documents to indicate poor water quality conditions in some

Louisiana bays even though these bays receive direct input of river water and high suspended levels are considered as a positive for restoring eroding coastal wetlands.

Pawley: No additional comments yet.

Urquhart: Two matters: First, the documentation confuses this issue of measurement design, or what I would prefer to call the response design, with the concept of a sampling design. The former concerns how to measure the response; the latter concerns where to measure it. Those are two separate matters. They shouldn't be confused.

Secondly, the SST is defined to be the average temperature for the warmest season of the year. This is a legitimate indicator, but we get cold, too. It appears that major changes may be occurring in the cool/cold seasons, especially in Alaska and nearby regions. Consider also the average temperature in the coolest season of the year.

7) Overall, this indicator:

Creal: Should be included in ROE06 TD.

Day: Should *not* be included in ROE06 TD.

Gregory: Should be included in ROE06 TD.

Paerl: Should be included in ROE06 TD only if the modifications identified above as critical are made.

Pawley: Should be included in ROE06 TD only if the modifications identified above as critical are made.

Urquhart: (Between) Should be included in ROE06 TD/Should be included in ROE06 TD only if the modifications identified above as critical are made.

Comments for Fresh Surface Water Indicators

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Streambed Stability in Wadeable Streams

1) Please indicate the extent to which you think the proposed indicator is appropriate, adequate, and useful (AA&U) for evaluating our nation's waters and for contributing to an overall picture of our nation's waters.

1	2	3	4
Indicator is not AA&U	Indicator is of somewhat AA&U	Indicator is largely AA&U	Indicator is completely AA&U

Creal: (4) The proposed indicator is conceptually AA&U. This is proposed as an ambient indicator of surface waters, namely wadeable streams, which is very appropriate. This is a major factor in many of these streams, which strongly influences the biota able to inhabit these streams.

Gregory: (3) Channel stability is an important measure of the condition of the nation's surface waters. Many land uses and channel practices have dramatically altered the stability of streams---sedimentation, hydrologic alteration, channel modification have decreased stability below natural ranges while dams, gravel mining, and hydrologic alteration have increased stability beyond natural ranges.

Paerl: (3) This indicator appears relevant to a variety of stream use and designation criteria. It appears broadly applicable across many regions. The indicator parameters can be readily measured and quantified. This indicator appears sensitive enough to detect differences and trends over a wide range. It is not clear how this indicator could be used to characterize and potentially distinguish anthropogenic from natural stressors. How could this indicator be used in this context?

Pawley: (3) The indicator conceptually represents an important principal of steam quality; however, without trends data, comparisons to a reference set of streams, or a comparison between regions, the indicator is not extremely meaningful.

Urquhart: (4) None.

2) Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *water question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: (3) This is an important indicator for wadeable streams.

Gregory: (2) As stated above, this is an important area an dis a causal factor on biotic decline, but it is a less direct measure than some of the other indicators and some of the problems in interpretation decrease its contribution.

Paerl: (3) Overall, this indicator is useful for answering the relevant ROE water questions. What is the effect of stream length and how is this compensated for or "normalized"? The potential connection of this indicator to biological indicators, including microalgae (epiphytes and periphyton), macrophytes, invertebrates, higher animals and their habitats, is not clearly made. How does this indicator "fit" in the context of ecosystem structure and function? This indicator needs ecological/ecosystem context.

Pawley: (3) The concept for the indicator is sound; however, as it stands now, the Relative Streambed Stability indicator is a baseline study and does not really answer the question, "What are the trends in extent and condition of fresh surface waters"; though in the future with more years of data the question could be answered. Trends might also be construed to refer to how regions differ, so the indicator might be more meaningful if the results were shown regionally.

Urquhart: (3) None.

3) FOR WADEABLE STREAMS AND LAKE FISH TISSUE INDICATORS ONLY (for coastal sediment and harmful algal blooms, skip to question 4):

Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *ecological condition question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: (3) This proposed indicator strongly influences the ecological condition of wadeable streams. This is especially true in many urban streams, where the flow dynamics of the stream have been severely modified, resulting in unstable streambeds. In these areas, poor ecological communities are routinely found. This indicator measures this attribute, and helps interpret the cause of this condition.

Gregory: (3) Channel stability is an important physical template for aquatic communities. As such, it is a critical determinant of ecological conditions. Unfortunately, there are substantial difficulties in interpreting this indicator. EPA should be sure to have fluvial geomorpholoists review this indicator carefully before including it.

Paerl: (2/3) See above comments. In particular, the connection of this indicator to ecological structure and function of wadeable streams is not clear. How does this indicator "fit" in the context of ecosystem structure and function? This indicator needs ecological/ecosystem context.

Pawley: (3) The indicator does address a critical physical attribute of an important ecosystem, wadeable streams; however, the write-up can be more explicit about the connection between this indicator and aspects of ecological (in particular biotic) condition. A quote from an EPA website puts aspects measured through this indicator assessment in perspective, "Sediments suspended in the water column of coastal wetlands, estuaries, and near-shore zones decrease light penetration and thereby cause undesirable shifts in communities of algae, invertebrates, and fish. Bedded sediments, those that have settled out and lie on the bottom of a water body of interest, physically alter the habitat of macroinvertebrates and algae leading to a shift in the fish community from generalist feeding and spawning fish to more bottom-oriented, silt- and turbidity-tolerant fish."
http://www.epa.gov/NHEERL/research/aquatic_stressors/sediment_issues.html. The relationship between the RSS and ecological condition should be made clearer.

Urquhart: (3) None.

4) To what extent do you think the indicator meets the following indicator definition:

An "indicator" is ***a numerical value derived from actual measurements of a pressure, ambient condition, exposure, or human health or ecological condition*** *over a specified geographic domain, whose trends over time represent or draw attention to underlying trends in the condition of the environment.*

1	2	3	4
Doesn't meet the definition	Only partly meets the definition	Largely meets the definition	Fully meets the definition

Creal: (2) This is a baseline set of data that are being proposed, therefore there will be no trend over time. However, this should not be viewed as a shortcoming such that the indicator should not be presented or used in this report.

Gregory: (3) Channel stability is calculated from stream power and sediment size. It clearly is derived from actual measurements of ecological conditions.

Paerl: (2) Indicator describes condition, but is not well connected to sources of pressure or measurements of ecological state or change. Needs ecological context (ecosystem function, use designation). Potential observational linkages to total N and P seem interesting and possibly useful in the context of scaling up this indicator to ecosystem structure and function, but this needs to be better developed.

Pawley: (3) The indicator largely meets the definition but does not include a measure of trends as it is presently reported, as it represents the results of a one-time sampling event.
Urquhart: (3) Because this is the first time this indicator has been evaluated nationally, it cannot be used for detecting trends, but this is acknowledged in the limitations section. The indicator does a credible job of capturing some important aspects of sediment in streams.
Urquhart: (3) Because this is the first time this indicator has been evaluated nationally, it cannot be used for detecting trends, but this is acknowledged in the limitations section. The indicator does a credible job of capturing some important aspects of sediment in streams.

5) To what extent do you think the indicator meets each of the following <u>indicator criteria</u>:

a) The indicator makes an important contribution to answering a question for the ROE. (In this context, "important" means that the indicator answers a substantial portion of and/or a critical part of the question.)

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (2)
Paerl: (2/3)
Pawley: (2)
Urquhart: (4)

b) The indicator is objective. It is developed and presented in an accurate, clear, complete, and unbiased manner.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2/3)
Gregory: (2)
Paerl: (3)
Pawley: (2)
Urquhart: (3)

c) The underlying data are characterized by sound collection methodologies, data management systems that protect its integrity, and quality assurance procedures.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (3)
Paerl: (3)
Pawley: (4)
Urquhart: (4)

d) Data are available to describe changes or trends, and the latest available data are timely.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Gregory: (1)
Paerl: (3)
Pawley: (1)
Urquhart: (1)

e) The data are comparable across time and space, and representative[3] of the target population. Trends depicted in this indicator accurately represent the underlying trends in the target population.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (3)
Paerl: (3)
Pawley: (3)
Urquhart: (4)

f) The indicator is transparent and reproducible. The specific data used and the specific assumptions, analytic methods, and statistical procedures employed are clearly stated.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2/3)
Gregory: (3)
Paerl: (3)
Pawley: (2)
Urquhart: (3)

Please explain:

Creal: My major problem with this indicator was that I couldn't find how it is determined. The Field Operations Manual cited gave how the data was collected, but there is no way to determine how the reference conditions were determined, and then how the indicator was calculated, at least from the references given. This is likely a function of the WSA report being in draft and

[3] An indicator seeks to describe trends in an overall target "population" (e.g., land area, type of surface water, type of emissions, U.S. population), yet data often can only be sampled from a subset of this population. The validity of the trends described by the indicator will depend on the degree to which the sampled population is representative of the target population.

not available for us to review this information. Also, the figure for the indicator is very difficult to understand what it is presenting.

Gregory: This indicator draws on the important EMAP national database. The major problem with this indicator is its interpretation. Some anthropogenic changes cause channels to be less stable, some cause them to be more stabile. Some effects are transient, some are long lasting. Some are limited to a small area, others are distributed over long reaches of the river network. What does it mean to be higher or lower than the competence of the channel to move sediments? Is it the result of natural processes or is it anthropogenic? Is it on-going or simply a reflection of the past? How will it affect the biota? I suspect that geomorphologists would argue extensively about its interpretation in a physical sense alone. Then ecologists would have much discussion about how the ecological consequences should be interpreated. I can easily see the importance and potential for this indicator but this measure of sediment and channel competence is difficult to interpret.

Paerl: See above comments which address these issues.

Pawley: The data collection methods appear to be collected in a statistically sound, unbiased matter however, the level of sampling per stream is problematic as streambed characteristics vary significantly over time and probably should be normalized by season or precipitation events. It is not clear that this was done in its calculation. It is also unclear why this particular indicator was chosen among the many physical aspects of stream condition.

Urquhart: This indicator cannot be used for change or trends at this time, as this is only the first time it has been evaluated nationally. Its definition is not transparent, and information about its exact definition does not seem to be immediately available on the web.

6) Do you have any suggestions for more effective graphic presentation of the data? If yes, please describe.

Creal: Yes. This figure desperately needs to be revised so it is understandable. As it is presented, I am having difficulty determining what is being presented. I believe that this is important information that needs to be readily communicated to the non-technical person, and the proposed figure does not do this. Consideration should be given to a geographical presentation of this indicator also.

Gregory: The simple cumulative curve may be of interest to geomorphologists, but the public, decision makers, and politicians will not get much out of it. This does not illustrate the magnitude or extent of the condition in a way that conveys its environmental consequences. This needs a lot of work. Check with graphical illustrators and landscape architects.

Paerl: Graphics appear adequate to appropriately represent this indicator. It would be useful to extend or break out the graphics to potentially assess regional differences, and trends within regions.

Pawley: Yes, present the information regionally to determine if there are differences among regions in the nation on Relative streambed stability. Another concept would be compare those streams with dams and those without dams to ensure that streams are appropriately segregated in

a manner that would ensure that positive measurements for the RSS indicator are because of "healthy conditions".

Urquhart: YES: Show a map of the sample points, as shown at http://www.epa.gov/OWOW/monitoring/wsa/WSAProbabilityDesign.pdf. The graph's vertical axis would be much more readable if the units were (1,000 km), so displayed values would be like 200, 400, 600, 800 and 1,000.

7) Please provide any additional comments, suggestions, or concerns regarding the indicator that you have not already noted in Questions 1 through 5. In particular, note any limitations to the indicator that you have not already described in your responses to the preceding questions.

Creal: This indicator could be a great indicator. EPA should push the states to adopt this in their monitoring programs, and greatly expand the opportunity to gather additional data on many streams in the country.

Urquhart: See NSU's comments to the panel about joint presentation of the first four indicators together.

8) Overall, this indicator:

Creal: Should be included in ROE06 TD.

Gregory: Should *not* be included in ROE06 TD.

Paerl: Should be included in ROE06 TD only if the modifications identified above as critical are made.

Pawley: Should be included in ROE06 TD only if the modifications identified above as critical are made.

Urquhart: Should be included in ROE06 TD.

Nitrogen and Phosphorus in Wadeable Streams

1) Please indicate the extent to which you think the proposed indicator is appropriate, adequate, and useful (AA&U) for evaluating our nation's waters and for contributing to an overall picture of our nation's waters.

1	2	3	4
Indicator is not AA&U	Indicator is of somewhat AA&U	Indicator is largely AA&U	Indicator is completely AA&U

Creal: (2/3) This indicator is proposed as a pressure to surface waters, not as an ambient condition. This is a change from the other proposed indicators involving nitrogen and phosphorus in rivers and streams. For these freshwater streams, phosphorus would typically be the limiting nutrient, and would be readily expressed in plant growth if in sufficient quantities. This means that the nitrogen portion of this indicator would be of lesser importance. My major problem with this indicator is that it is based on a one-time water sample taken from streams that are likely quite variable in these two parameters; therefore the characterization of concentration data for these streams may not be representative.

Gregory: (3) N & P are the most important nutrients that determine aquatic productivity. The many anthropogenic sources and the profound ecological consequences (e.g., eutrophication, hypoxia) make this indicator extremely important.

Paerl: (3) This indicator is relevant indicator, well-linked to water quality and habitat conditions, relatively easy to determine and apply. Can be comparable between and among wadeable streams and hence serve for trend analysis on regional scales. Not sure about comparativeness on national scale. More comparative data are needed from various regions before this determination can be made.

Pawley: (**2**/3) The indicator depicts important information on the range of Nitrogen and Phosphorus in wadeable steams; however, it is not presented in the context of an N or P standard so the public can adequately interpret its importance. The indicator should answer questions such as, "How does this range of conditions compare to what we would expect from pristine or least impacted sites? Are conditions elevated overall across the nation?" Though it is interesting to a scientist to view the cumulative frequency distribution, saying that the "Thresholds for favorable or unfavorable water quality vary from one part of the country to another." does not give the audience a sense of context in order to find the indicator compelling. With changes in the data presentation (see below), I would rate the indicator much higher.

Urquhart: (4) None.

2) Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *water question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: (2/3) Conceptually, this indicator would make an important contribution. However, my concern is with the limited samples that are being used to characterize these streams.

Gregory: (4) Eutrophication of our nations water and extensive zones of hypoxia in freshwater and coastal areas are central to the water question. This indicator is one of the major drivers.

Paerl: (3) Important indicator. Well linked to natural and anthropogenic stressors and potential ecological effects. The variability among streams is huge, but this is not surprising and shows its potential use in identifying specific sources and drivers.

Pawley: (3) The indicator addresses an important principal of water quality, the range of total N and P levels in wadeable streams. However, of more interest is whether the systems have elevated levels of nitrogen. Without trends data, comparisons to a reference set of "least impacted" streams, or a comparison between regions, the indicator does not reach its potential as a water quality condition measure.

Urquhart: (3) None.

3) FOR WADEABLE STREAMS AND LAKE FISH TISSUE INDICATORS ONLY (for coastal sediment and harmful algal blooms, skip to question 4):

Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *ecological condition question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: (2/3) These nutrients, especially phosphorus, can dramatically impact the ecosystems in these wadeable streams. However, my major concern is as presented in #2 with the limited sample size used.

Gregory: (4) Nutrient content of surface waters is a fundamental measure of the ecological condition.

Paerl: (3) Sound and useful indicator that can be linked to both stressors and effectors. Easily quantified. To what extent does stream length affect the measurement? Need more data to make develop regional thresholds with regard to key WQ issues such as algal production, oxygen dynamics, and altered community structure. Regional and national assessment of this indicator could benefit from existing data sets among state agencies, researchers (universities and other educational institutions) and municipalities.

Pawley: (3) The indicator addresses a critical chemical attribute frequently affected by anthropogenic disturbance of an important type of ecosystem, wadeable streams; however, the write-up needs to link the level of this indicator to ecological condition in a more concrete way. This is difficult but mentioning national water quality thresholds and their relationship to algal communities and fish kills, would improve the indicator explanation. *Also, one might show the ratio of N to P as it is known to be an important indicator of nutrient availability (the dissolved portion is more important generally to algal community responsed).* It would also be useful to link the levels by region to regional thresholds – nutrient criteria if the statistical format for the data collection effort would support this type of analysis. *I am under the impression that it would.*

Urquhart: (3) None.

4) To what extent do you think the indicator meets the following <u>indicator definition</u>:

An "indicator" is ***a numerical value derived from actual measurements of a pressure, ambient condition, exposure, or human health or ecological condition*** *over a specified geographic domain, whose trends over time represent or draw attention to underlying trends in the condition of the environment.*

1	2	3	4
Doesn't meet the definition	Only partly meets the definition	Largely meets the definition	Fully meets the definition

Creal: (2) This is presented as a baseline dataset for this indicator; therefore there are no trends over time.

Gregory: (4) Again, major nutrient concentrations are numerical values derived from measurements of ecological condition. They also draw attention to critical trends. The spatial distribution also draws attention to spatial extent and magnitude of the conditions.

Paerl: (3) Good overall and relevant indicator of state, condition and potential drivers/stressors (pressures) in a wide variety of wadeable streams.

Pawley: (2) This is a baseline study, so the lack of trends information and regional reporting is my reason for giving this a low score.
Urquhart: (3) Because this is the first time this indicator has been evaluated nationally, it cannot be used for detecting trends, but this is acknowledged in the limitations section.

5) To what extent do you think the indicator meets each of the following <u>indicator criteria</u>:

a) The indicator makes an important contribution to answering a question for the ROE. (In this context, "important" means that the indicator answers a substantial portion of and/or a critical part of the question.)

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (4)
Paerl: (3)
Pawley: (3)
Urquhart: (4)

b) The indicator is objective. It is developed and presented in an accurate, clear, complete, and unbiased manner.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Gregory: (4)
Paerl: (4)
Pawley: (3)
Urquhart: (4)

c) The underlying data are characterized by sound collection methodologies, data management systems that protect its integrity, and quality assurance procedures.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (1)
Gregory: (4)
Paerl: (3)
Pawley: (3)
Urquhart: (4)

d) Data are available to describe changes or trends, and the latest available data are timely.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (1)
Gregory: (3)
Paerl: (4)
Pawley: (2)
Urquhart: (1)

e) The data are comparable across time and space, and representative[4] of the target population. Trends depicted in this indicator accurately represent the underlying trends in the target population.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (1)
Gregory: (3)
Paerl: (3)
Pawley: (2)
Urquhart: (4)

f) The indicator is transparent and reproducible. The specific data used and the specific assumptions, analytic methods, and statistical procedures employed are clearly stated.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (4)
Paerl: (3)
Pawley: (3)
Urquhart: (4)

Please explain:

Creal: There are two issues driving the low scores here – the use on limited data on each stream to derive the indicator, and the lack of any thresholds for interpretation of the data presented.
Gregory: The EMAP national database is a statistically sound approach to measuring the condition of freshwater in the nation. The use of reference sites for specific regions throughout the US solves some of the challenges in interpreting this indicator because concentrations within

[4] An indicator seeks to describe trends in an overall target "population" (e.g., land area, type of surface water, type of emissions, U.S. population), yet data often can only be sampled from a subset of this population. The validity of the trends described by the indicator will depend on the degree to which the sampled population is representative of the target population.

a region can be expressed relative the expected distribution of concentrations. This indicator could be expanded to include an assessment of the limiting nutrient within regions (using Redfield ratios)

Paerl: An increased number of measurements over a broad geographic region will help improve both the utility and meaningfulness (linkage to specific stressors and effects) of this indicator. Also, it would be useful to link this indictor to larger streams and rivers (down stream) to gain information of utilization, attenuation, sedimentation and other losses (e.g. denitrification) of N and P.

Pawley: No trends data are provided, regional results with comparisons to reference conditions would provide more information. From the indicator write-up, it seems that this information will be available in the near future, "Reference levels for total N and total P in streams (i.e., levels that would allow streams to be classified as to least disturbed, moderately disturbed, and most disturbed based on regional reference sites) vary from region to region; these reference levels will be available from the WSA to provide such a classification of streams nationally, but they are not available at this time."

I am also concerned about the wide range of variability possible in these sites, which are sampled only once. Precipitation events cause wide fluctuation in nutrient levels, so I would like to understand better how these factors were accounted for in the study.

Urquhart: This indicator cannot be used for change or trends at this time, as this is only the first time it has been evaluated nationally.

6) Do you have any suggestions for more effective graphic presentation of the data? If yes, please describe.

Creal: Yes. The figure needs to better present the findings so a non-technical person can understand what the data means, even if it is only in a general sense. Some general threshold needs to be represented with the data, even if it is only presented as a "Rule of Thumb". A commonly used such threshold has been 100 ug/l for total phosphorus, recognizing that this threshold must be used with caution in specific streams. However, even with such drawbacks, the information can be quickly conveyed that a substantial portion of streams may be over enriched with phosphorus. Also, consideration should be given to a geographical representation of the data; so spatial trends could be examined.

Gregory: Again, EPA needs to devote considerable attention to the graphical representation of the data. These figures are of interest to some scientists but are largely uninterpretable to the public and decision makers. This needs a lot of work.

Paerl: OK as is.

Pawley: For the total distribution map, add colors to show where we would considered a site to be impacted, or showing elevated nutrients.

Divide the data up regionally if possible and compare N and P to rough standards.

Urquhart: YES: Show a map of the sample points, as shown at

http://www.epa.gov/OWOW/monitoring/wsa/WSAProbabilityDesign.pdf

The graph's vertical axis would be much more readable if the units were (1,000 km), so displayed values would be like 200, 400, 600, 800 and 1,000.

7) Please provide any additional comments, suggestions, or concerns regarding the indicator that you have not already noted in Questions 1 through 5. In particular, note any limitations to the indicator that you have not already described in your responses to the preceding questions.

Creal: If this indicator is included, there needs to be some qualifications presented that clearly describe that this is based on one sample from each stream, and that this may not be adequate to represent the nutrient condition in these streams. **This is critical, as is the graphical presentation of the data.**

Urquhart: See NSU's comments to the panel about joint presentation of the first four indicators together.

The QA/QC documentation says the "Data Collection Date: UNKNOWN" Yet the data sources section of the writeup explicitly gives this information!

8) Overall, this indicator:

Creal: Should be included in ROE06 TD only if the modifications identified above as critical are made.

Gregory: Should be included in ROE06 TD.

Paerl: Should be included in ROE06 TD.

Pawley: Should be included in ROE06 TD only if the modifications identified above as critical are made.

Urquhart: Should be included in ROE06 TD.

DETAIL: Writeup, paragraph 2, l6, stray "," after probability

Benthic Macroinvertebrates in Wadeable Streams

1) Please indicate the extent to which you think the proposed indicator is appropriate, adequate, and useful (AA&U) for evaluating our nation's waters and for contributing to an overall picture of our nation's waters.

1	2	3	4
Indicator is not AA&U	Indicator is of somewhat AA&U	Indicator is largely AA&U	Indicator is completely AA&U

Creal: (4) This is proposed as an Effects Indicator of Ecological conditions. This is an excellent indicator for wadeable streams, and has been used in this capacity for the past fifty years.

Gregory: (4) Macroinvertebrates are important components of aquatic ecosystem. This is a fundamental measure of aquatic communities. This indicator is an enormously important measure of the environemtn.

Paerl: (3) Overall, very useful, broadly applicable and readily quantifiable indicator. Can be compared within, between and among streams. Indicator shows a good spread when compared among streams, which would allow for quantifiable comparisons. Limitations are mainly due to the fact that samplings only occurs one time per years and are limited spatially as well.

Pawley: (3) Benthic Macoinvertebrates are known to be important indicators -- sensitive to disturbances in stream chemistry and physical disturbance. The write-up states that "The benthic macroinvertebrate IBI in wadeable streams in the U.S. was found to vary from less than 10 to more than 95, with higher values (more diversity) much more common than lower values (Figure 341-1). The write-up should be more explicit about how much more common, high values actually are and what values correspond to least impacted sites. Also, I was unable to link to the website showing the indicator calculation so it is difficult for me to assess the validity of the data analysis method (see my questions below).

Urquhart: (4) None.

2) Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *water question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: (4) This proposed indicator integrates the conditions of the wadeable streams over a period of about one year, and provides a very important and critical indication of the condition of the wadeable stream.

Gregory: (4) As stated above, macroinvertebrates are one of the fundamental components of aqautic ecosystems, are critical for ecological processes, and provide food for higher trophic levels. This is directly related to the ability of aquatic ecosystem to sustain the biota.

Paerl: (3) Indicator can be representative of ecological condition and change in a broad range of ecosystems. Combined with the fact that it is quantifiable, indicator should have broad application in geographically diverse systems and regions. It is not clear how reference conditions are identified and established.

Pawley: (3) The indicator addresses an important but indirect measure of water quality, benthic community health. Without trends data, comparisons to a reference set of "least impacted" streams, or a comparison between regions, the indicator does not reach its potential as a water quality condition measure.

Urquhart: (3) None.

3) FOR WADEABLE STREAMS AND LAKE FISH TISSUE INDICATORS ONLY (for coastal sediment and harmful algal blooms, skip to question 4):

Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *ecological condition question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: This proposed indicator does an excellent job of summarizing the diversity and biological balance that is present in wadeable streams. These attributes are used in the Multi Metric Indices used to develop this indicator.

Gregory: (4) Macroinvertebrates are one of the most sensitive and relevant indicators of the ecological conditions in streams and rivers. The interpretation of the responses is not confounded by commercial harvest, sport harvest, migration, etc.

Paerl: (3) See above comments. Overall, indicator can be highly useful in detecting and quantifying ecological condition, especially when coupled to other stressors (nutrients, dissolved oxygen, other pollutants, sedimentation). Indicator allows for local and regional comparisons.

Pawley: (3) The indicator addresses a critical biological attribute frequently affected by anthropogenic disturbance of an important type of ecosystem, wadeable streams; however, the

write-up needs to link the level of this indicator to ecological condition in a more concrete way. Looking at the values both regionally and by index sub-components, would be beneficial, to see how the results are distributed and what differences in distributions might mean, in terms stream ecology.

Urquhart: (3) None.

4) To what extent do you think the indicator meets the following <u>indicator definition</u>:

An "indicator" is ***a numerical value derived from actual measurements of a pressure, ambient condition, exposure, or human health or ecological condition*** *over a specified geographic domain, whose trends over time represent or draw attention to underlying trends in the condition of the environment.*

1	2	3	4
Doesn't meet the definition	Only partly meets the definition	Largely meets the definition	Fully meets the definition

Creal: (3) This is presented as a baseline set of information for comparison to future surveys, so there is limited temporal trend. However, this indicator does integrate conditions over a limited temporal basis, generally thought to be about 1 year. Also, I was unable to find the specific index and metrics used for this project when reviewing the references presented to support this indicator. I suspect this information is in the draft WSA report that is currently unavailable to us for review. I am familiar with these indices and metrics, and am comfortable that they are being properly used, but would like to confirm this at some point.

Gregory: (3) It is data based and clearly measures conditions and trends.

Paerl: (3) This indicator is useful for describing and quantifying pressures, ambient conditions and exposure.

Pawley: (2) This is a baseline study, so the lack of trends information and regional reporting is my reason for giving this a low score.
Urquhart: (3) Because this is the first time this indicator has been evaluated nationally, it cannot be used for detecting trends, but this is acknowledged in the limitations section.

5) To what extent do you think the indicator meets each of the following <u>indicator criteria</u>:

a) The indicator makes an important contribution to answering a question for the ROE. (In this context, "important" means that the indicator answers a substantial portion of and/or a critical part of the question.)

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (4)
Gregory: (4)
Paerl: (3)
Pawley: (2)
Urquhart: (4)

b) The indicator is objective. It is developed and presented in an accurate, clear, complete, and unbiased manner.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Gregory: (2)
Paerl: (3)
Pawley: (2)
Urquhart: (3)

c) The underlying data are characterized by sound collection methodologies, data management systems that protect its integrity, and quality assurance procedures.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (4)
Paerl: (4)
Pawley: (2)
Urquhart: (4)

d) Data are available to describe changes or trends, and the latest available data are timely.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (3)
Paerl: (3)
Pawley: (2)
Urquhart: (1)

e) The data are comparable across time and space, and representative[5] of the target population. Trends depicted in this indicator accurately represent the underlying trends in the target population.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (2)
Paerl: (2/3)
Pawley: (2)
Urquhart: (4)

f) The indicator is transparent and reproducible. The specific data used and the specific assumptions, analytic methods, and statistical procedures employed are clearly stated.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (4)
Paerl: (3)
Pawley: (3)
Urquhart: (3)

Please explain:

Creal: This is an excellent indicator. The lower scores are due to this being a baseline survey with no temporal trends, and no apparent explanation of the MMI used to develop the indicator.

[5] An indicator seeks to describe trends in an overall target "population" (e.g., land area, type of surface water, type of emissions, U.S. population), yet data often can only be sampled from a subset of this population. The validity of the trends described by the indicator will depend on the degree to which the sampled population is representative of the target population.

Gregory: The models for interpreting macroinvertebrate data have grown tremendously in recent years. I am surprised and disappointed that EPA has chosen to use the multimetric IBI approach rather than the reference system-based observed over expected approach (derived from RIVPAKS). Multimetric indicators take several important response curves and scrunches them into one index. Ecologists have widely debated the streangths and weaknesses of multimetric IBIs versus model based approaches of O/E. I am surprised EPA chose what I think is a more blurred index that is more difficult to interpret. In particular, it is difficult to relate causal factors to IBIs but there has been considerable success in relating tolerances to observed and expected community structure. I know that EPA scientists have used both systems. I think they chose the wrong one here. I would have rated 5b and 5e higher if they had used the O/E approach.

Paerl: See above comments which apply to these questions.

Pawley: The write-up is not clear enough about the construction of the index. Usually regional reference conditions are taken into account when the index is constructed; however, the I was unable to find supporting documentation on-line at the website suggested. There were field methods posted, but I could not find information on how the index was constructed and how comparisons could be made across regions or across methods (Two methods were used, but I would like to see a demonstration of their comparability if the results of the two methods are aggregated to rate streams nationally.) Also, as this is the first baseline condition study, no trends data are provided. And similar to my comments on other wadeable stream indicators, regional results with comparisons to reference conditions would enhance the presentation and level of information provided.

I am also concerned about the wide range of variability possible in these sites, which are sampled only once. Precipitation and other natural and anthropogenic disturbances, can cause wide fluctuations in benthic biota in specific areas, so I would like to understand better how this variability is accounted for in the study.

Urquhart: This indicator cannot be used for change or trends at this time, as this is only the first time it has been evaluated nationally. Its definition is not transparent, and information about its exact definition does not seem to be immediately available on the web.

6) Do you have any suggestions for more effective graphic presentation of the data? If yes, please describe.

Creal: The figure used to present the indicator is not very informative. There is no explanation of the MMI, no indication of in which direction the scores indicate better communities, no indication of where reference sites would score, and no geographical presentation of the information. In some indices, we have used a scale from negative to positive to convey where conditions are better, with negative scores found in less than “average” conditions, and positive scores found in better than “average” conditions. For example, if in Figure341-1 a score of 50 is “average” (or the mid point of expectations – Scott, bear with me), the scale could be redone with 50 rescaled to 0 and scores adjusted in the positive and negative range. This rapidly conveys to a reader what the data represent. Also, we have had problems with some of these indices being scaled to only even numbers, and thereby creating an illusion of a bigger difference than may actually exist (for example, the difference between a score of 50 and 60 may only be 5 points instead of 10 points as indicated on the graph).

Gregory: See my comments for stability and N&P. These graphics are dry, nonintuituve, and will not compel anyone to do anything about trends in the environment. Show this graph to your friends and family and ask them what it tells them.

Paerl: Graphics are OK

Pawley: Divide the data presentation by ecoregions if possible to show how the sites compare to local reference conditions and depict the regional distribution maps in addition to the scores aggregated nationally. Depict the scores using a system that rates them by their level of impact. If 60% of the streams have a benthic index of 45, what does this mean? It sounds bad to me, but I cannot be sure without some sore of rating system. (Note the figure below from the Ecological Assessment of Western Wadeable Streams and Rivers, page 17 for an example, pasted below)

Urquhart: YES: Show a map of the sample points, as shown at
http://www.epa.gov/OWOW/monitoring/wsa/WSAProbabilityDesign.pdf
The graph's vertical axis would be much more readable if the units were (1,000 km), so displayed values would be like 200, 400, 600, 800 and 1,000.

7) Please provide any additional comments, suggestions, or concerns regarding the indicator that you have not already noted in Questions 1 through 5. In particular, note any limitations to the indicator that you have not already described in your responses to the preceding questions.

Creal: The reference sites were not identified in any fashion. This would be nice to see where in the country these were. Also, some explanation of the MMI needs to be added to this indicator. Overall, I would strongly urge this indicator be included, and expanded over time to incorporate data being generated by a variety of monitoring programs.

Urquhart: See NSU's comments to the panel about joint presentation of the first four indicators together.
The QA/QC documentation says the "Data Collection Date: UNKNOWN" Yet the data sources section of the writeup explicitly gives this information!

8) Overall, this indicator:

Creal: Should be included in ROE06 TD.

Gregory: Should be included in ROE06 TD only if the modifications identified above as critical are made.

Paerl: Should be included in ROE06 TD.

Pawley: Should be included in ROE06 TD only if the modifications identified above as critical are made.

Urquhart: Should be included in ROE06 TD.

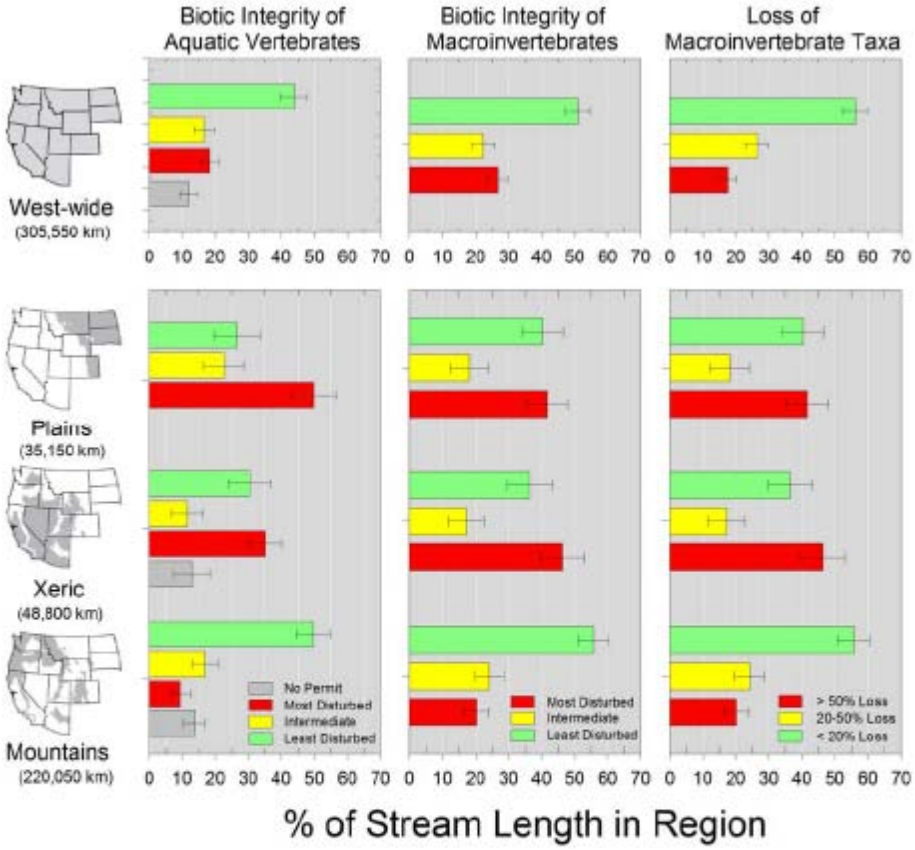


Figure 5. Summary of results for ecological condition indicators for all of the West, and for three climatic regions. Bars (with 95% confidence intervals) show the percentage of stream length in each region with index scores in each condition class. Numbers in parentheses are the total perennial stream length in each region. Regional results are sorted according to the aquatic vertebrate results, with regions at top having the highest proportion of stream length in most disturbed condition. For aquatic vertebrates, a small percentage of stream length in each region could not be assessed due to small stream size: West-wide=9%; Plain=1%; Xeric=10%; Mountains=10%.

Contaminants in Lake Fish Tissue

1) Please indicate the extent to which you think the proposed indicator is appropriate, adequate, and useful (AA&U) for evaluating our nation's waters and for contributing to an overall picture of our nation's waters.

1	2	3	4
Indicator is not AA&U	Indicator is of somewhat AA&U	Indicator is largely AA&U	Indicator is completely AA&U

Creal: (4) This is an excellent indicator that is needed to help the public understand the issue of contaminants in lake fish tissue. This indicator is shown as an Exposure Indicator for Humans, which it is when the predator fish data base is considered, but this is also presented as an Exposure Indicator for wildlife when the bottom dwelling fish database is considered and the Indicator table should be revised to reflect this. This aspect of the indicator is mentioned in the third paragraph of the indicator writeup.

Gregory: (3) This indicator is an important measure of the abundance of contaminants in a key biotic component and an important human food resource.

Paerl: (3) Indicator is relevant, appropriate and adequate. There is no mention of temporal (i.e. weekly, seasonal) aspects of sampling. What impacts does the temporal scale have on indicator values, distributions, etc.? Other than that aspect, the pros and cons and limitations are conveyed in a clear and objective manner.

Pawley: (3) Contaminants in fish tissue is a widely applied indicator that should be used to indicate the level of contamination of the lakes and reservoirs throughout the United States. It provide important information that can be directly used for local fish advisories and, to provide information on possible food chain effects. The current level of contaminants in fish nationwide depicts a disturbing pattern. The indicator is entirely appropriate; however, trends will make the indicator more compelling – so a subset of these measurements should be made on a regular basis as the WSA continues. A depiction of regional patterns will make the information even more meaningful to the public.

Urquhart: (4) None.

2) Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *water question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: (4) This is a critical indicator for the trends in the contamination/quality/safety of consumable fish. However, there is no presentation of data over time, and this indicator is proposed to use only the WSA data generated from 1999-2004. Also, there is no use of the extensive fish contaminant database that exists for the Great Lakes.

Gregory: (3) I struggled with this measure because I think the indicator is important but it does not really demonstrate the consequence for aquatic systems or humans.

Paerl: (3) Indicator appears appropriate and considerable importance, both from ecosystem and human health perspectives.

Pawley: (4) The indicator addresses an important measure of water and sediment quality, as fish tissue levels aggregate responses both spatially and temporally.

Urquhart: (3) None.

3) FOR WADEABLE STREAMS AND LAKE FISH TISSUE INDICATORS ONLY (for coastal sediment and harmful algal blooms, skip to question 4):

Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *ecological condition question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: (4) I believe this is an important and critical indicator that should be used as extensively as possible, and that this indicator will provide important information regarding the exposure of wildlife (and some idea of contaminant levels in an overall ecosystem). However, I am unable to understand the Charge Question we are supposed to be answering here – specifically, I am having trouble with the phrase "trends in biomeasures of exposure to common environmental pollutants". I'm simply not sure what this means.

Gregory: (3) This indicator contributes to our awareness of POTENTIAL detrimental ecological conditions. There are many challenges to its interpretation.

Paerl: (2/3) Indicator is somewhat important. This is a more relevant indicator of ecosystem and human health than ecological condition.

Pawley: (4) The indicator addresses a critical biological attribute frequently affected by anthropogenic disturbance of important aquatic ecosystems, lakes and reservoirs. Looking at the values regionally would be interesting, to determine how the results are distributed and what differences in distributions might mean, in terms of contaminant affects. A regional representation of the results would allow the index to answer questions such as, "Are lakes on the east coast more impacted by mercury than the west coast?" In addition, linking the results to ecological or human impacts would enhance the index. " If all lakes and reservoirs exceeded the Mercury standard, what does this mean in terms of ecological and human health".

Urquhart: (3) None.

4) To what extent do you think the indicator meets the following <u>indicator definition</u>:

*An "indicator" is **a numerical value derived from actual measurements of a pressure, ambient condition, exposure, or human health or ecological condition** over a specified geographic domain, whose trends over time represent or draw attention to underlying trends in the condition of the environment.*

1	2	3	4
Doesn't meet the definition	Only partly meets the definition	Largely meets the definition	Fully meets the definition

Creal: (2) Part of the reason for this score is the response found to T1Q3, where EPA has indicated that this in not applicable. An explanation needs to be provided as to why this indicator is being presented the way it is – the response indicates that this is not considered an indicator. The other factor is the lack of any temporal trends in the indicator as presented.

Gregory: (3)

Paerl: (3) Good indicator of ambient condition, potentially exposure, and human health and ecological condition.

Pawley: (3) This is a baseline study, so the lack of trends information and regional reporting is my reason for giving this a slightly lower score.

Urquhart: (3) Because this is the first time this indicator has been evaluated nationally, it cannot be used for detecting trends, but this is acknowledged in the limitations section.

5) To what extent do you think the indicator meets each of the following <u>indicator criteria</u>:

a) The indicator makes an important contribution to answering a question for the ROE. (In this context, "important" means that the indicator answers a substantial portion of and/or a critical part of the question.)

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (4)
Gregory: (2)
Paerl: (2/3)
Pawley: (3)
Urquhart: (4)

b) The indicator is objective. It is developed and presented in an accurate, clear, complete, and unbiased manner.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Gregory: (3)
Paerl: (3)
Pawley: (4)
Urquhart: (4)

c) The underlying data are characterized by sound collection methodologies, data management systems that protect its integrity, and quality assurance procedures.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (4)
Gregory: (3)
Paerl: (3)
Pawley: (4)
Urquhart: (4)

d) Data are available to describe changes or trends, and the latest available data are timely.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Gregory: (3)
Paerl: (2/3)
Pawley: (2)
Urquhart: (1)

e) The data are comparable across time and space, and representative[6] of the target population. Trends depicted in this indicator accurately represent the underlying trends in the target population.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (4)
Gregory: (2)
Paerl: (3)
Pawley: (4)
Urquhart: (2)

f) The indicator is transparent and reproducible. The specific data used and the specific assumptions, analytic methods, and statistical procedures employed are clearly stated.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Gregory: (3)
Paerl: (3/4)
Pawley: (4)
Urquhart: (4)

Please explain:

Creal: The indicator is not completely developed, nor explained in the writeup. Otherwise, this is an excellent indicator.

Gregory: The mix of species used to develop the indicator makes it difficult to interpret the results. It is a measure of abundance in living fish but it is not a direct measure of the ecological

[6] An indicator seeks to describe trends in an overall target "population" (e.g., land area, type of surface water, type of emissions, U.S. population), yet data often can only be sampled from a subset of this population. The validity of the trends described by the indicator will depend on the degree to which the sampled population is representative of the target population.

effects. It provides an incomplete picture of contaminants, but it is one of the few measures we have that can be used as an indicator of contaminants in aquatic ecosystem. For that reason, it is important to use the indicator.

Paerl: See comments listed above.

Pawley: I was impressed by the description of the sampling methodology and believe that fish tissue is a very conservative and repeatable indicator of contaminant effects. Collecting data over time to determine trends will enhance the indicator quality. And similar to my comments on other indicators, regional results with comparisons to reference conditions would enhance the presentation and level of information provided. The only potential problem with this indicator is its evaluation of mercury in areas where mercury might be naturally occurring. There are some areas where mercury is naturally high, and difficult to remove despite the application of mercury reduction measures.

Urquhart: This indicator cannot be used for change or trends at this time, as this is only the first time it has been evaluated nationally.

6) Do you have any suggestions for more effective graphic presentation of the data? If yes, please describe.

Creal: Yes. The data need to be compared to the thresholds that EPA has established, such as the mercury fish tissue criterion of 0.3 mg/kg. There are 2 figures of the 500 sampling sites but no indication given as to why there are 2 figures, or what they represent – perhaps one is of predators and one if of bottom dwellers? Also, spatial representation of some contaminants would be very useful with this indicator, such as where the lakes are with mercury over 0.3 mg/kg, or if there are clumped distributions of high levels of a contaminant.

Pawley: Show how fish tissue contaminants compare by region in addition to the scores aggregated nationally. The coastal fish contaminants index provided a good example of this technique (see illustration pasted below). Also rate the magnitude of the exceedance of the top 3 contaminants regionally as well. The levels are depicted but they need to be more directly compared to the MDL's and shown using a simpler graphic format.

Urquhart: Show a map of the collection sites for the two kinds of fish. It appears that the sample points shown are two copies of the map of sample lakes at
http://www.epa.gov/waterscience/fishstudy/results.htm,
not lakes where fish were collected.

7) Please provide any additional comments, suggestions, or concerns regarding the indicator that you have not already noted in Questions 1 through 5. In particular, note any limitations to the indicator that you have not already described in your responses to the preceding questions.

Creal: This is an excellent indicator that should be used, and expanded as much as possible. I would strongly recommend including the Great Lakes database as another lake indicator, as this database has trend information indicated from the 1970s on.

Urquhart: See NSU's comments to the panel about joint presentation of the first four indicators together.

8) Overall, this indicator:

Creal: Should be included in ROE06 TD.

Gregory: Should be included in ROE06 TD.

Paerl: Should be included in ROE06 TD only if the modifications identified above as critical are made.

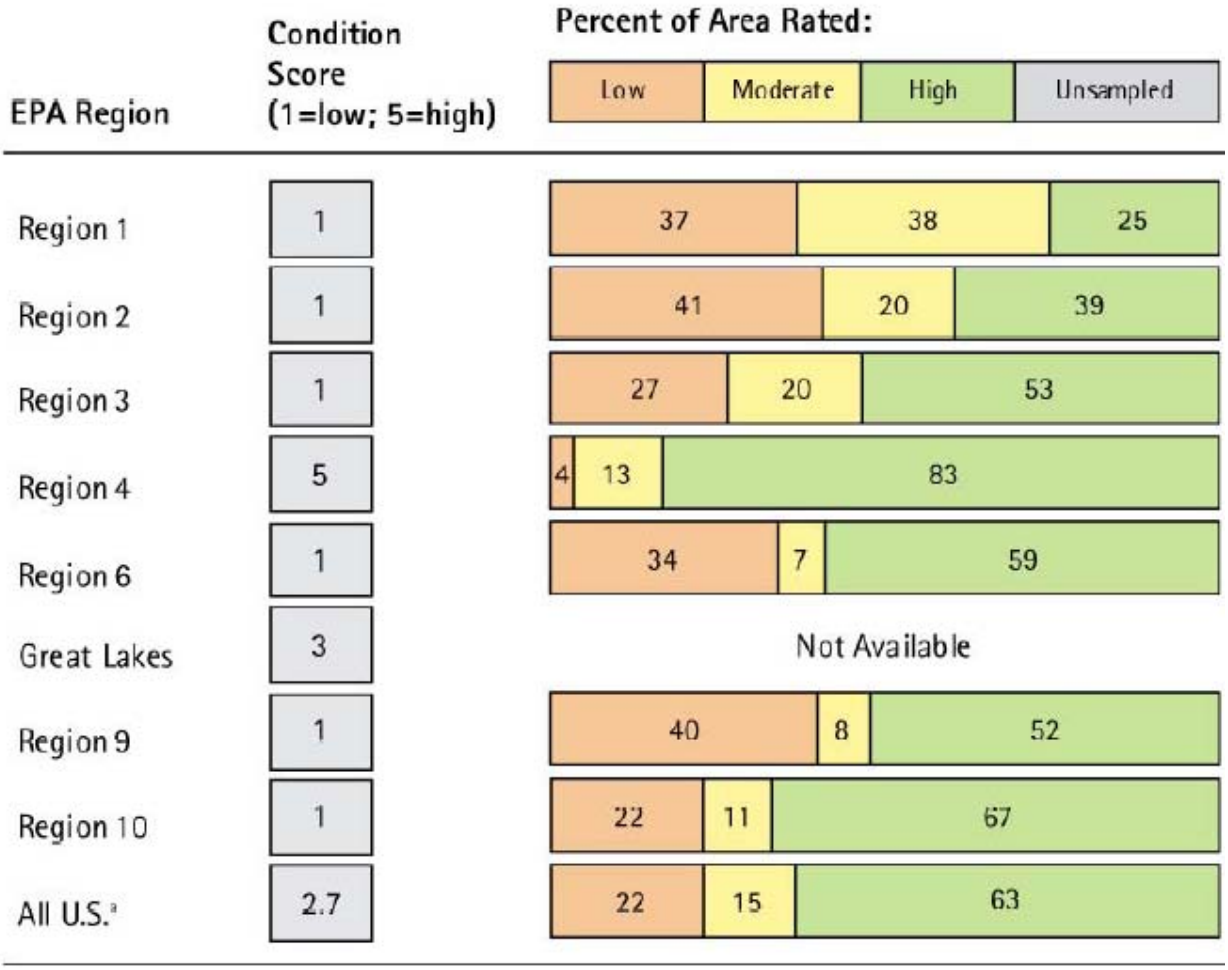
Pawley: Should be included in ROE06 TD only if the modifications identified above as critical are made.

Urquhart: Should be included in ROE06 TD.

NOTE: The writeup mentions the contiguous 48 states; the proper term is the conterminous 48 states; elsewhere EPA has been fairly careful about this. (Many states are NOT contiguous to each other, but as a set they are conterminous.) Check the writeup on the Coastal Sediment quality Index, for example.

The supplied information ignores the levels of the contaminants in relation to human health. Consumption standards exist. What proportion of the lakes have contaminant levels such that a person with a high fish consumption from that lake would be at a health risk? In other words, at how much risk do these contaminants really put our population, or any identifiable parts of it, like poor people who appear to fish a lot in some areas.

Figure 335-1: Overall Summary of Condition Based on the Fish Tissue Inc



Source: National Coastal Condition Report II, US EPA, 2004.

Notes: [a] The national score is based on an aerially weighted mean of the regional scores.

[b] The fish tissue contaminants index is based on a whole-body analysis of the fish.

Comments for Coastal Water Indicators

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Coastal Sediment Quality Index

1) Please indicate the extent to which you think the proposed indicator is appropriate, adequate, and useful (AA&U) for evaluating our nation's waters and for contributing to an overall picture of our nation's waters.

1	2	3	4
Indicator is not AA&U	Indicator is of somewhat AA&U	Indicator is largely AA&U	Indicator is completely AA&U

Creal: (2) EPA has made revisions to this indicator to improve it, but I still have reservations that this is a tool best used as a screening tool, with appropriate follow-up actions, not as an indicator.

Gregory: (3) This index combines contaminants in sediments and toxicity to one species of amphipod to create and sediment quality index. It provides a relative measure of the potential consequences of exposure of invertebrates to toxic substances in the environment.

Paerl: (2) Clearly, coastal sediment quality is an important variable with regard to overall ecological state, condition, trends, fisheries and human health concerns. As such, it is reasonable one to include in the ROE06. However, I question the broad sensitivity and hence applicability of this indicator, as presented. "Nationwide, only 6 percent of coastal sediments had high toxicity scores". Does this mean that there's little or no problem with the other 94 percent, or is the indicator somewhat insensitive to the broad suite of sediment conditions that characterize the remaining coastal zone? Also, there appeared to be quite a bit of regional difference – some regions had "no toxicity" while in other regions up to 20% of systems showed some sort of toxicity problem. What is the reason for this?

Part of this very noticeable difference may be due to the choice of test (bioassay) organisms for determining toxicity. The amphipod species chosen for the assay (*Ampelicsca abdita*) may be more or less appropriate for certain regions simply due to habitat (water quality/condition) preference. This is one reason why it would be desirable to use a suite of indicator organisms, ranging in trophic level (i.e. microbes, algae, macrophytes, fish) to broaden the spectrum for determining toxicity along trophic, biogeochemical and geographic gradients.

There are additional problems, including defining and establishing reference conditions, setting threshold criteria for determining "toxicity". There is a very wide range of effects from toxins ranging from physiological effects, stress, impacts on reproductive processes, disease, and viability (mortality). These need to be included somehow (in addition to mortality) in evaluating whether or not sediments exhibit toxicity.

Lastly, this indicator should probably be renamed to "Coastal Sediment <u>Toxicity</u>", since there are many other factors, including dissolved oxygen concentrations, sediment size, porosity, stability and chemical composition, that determine "Quality".

Pawley: (3) Contaminated sediments pose an important threat to benthic organisms and to estuarine ecosystems as a whole. This indicator as it is now presented is much improved over the previous version but there are still some enhancements that could improve the index. A particular question that should be answered in the write-up, is how the ratings of low, medium, and high were chosen (ie., in terms of numbers of contaminants exceeding the ERL) . As the survey continues, multiple years or trends will improve the index.

Urquhart: (3) None.

2) Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *water question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: (2) This indicator has several limitations that make it a concern for importance. These include the use of the ERL and ERM endpoints, and the interpretation of the area represented by the sediment toxicity tests.

Gregory: (3) Exposure to toxic substances is an important measure of the nations quatic and coastal ecosystem. Though there are problems in interpretation, the approach is conceptually sound and repeatable.

Paerl: (2/3) This indicator is important, but it is neither cast nor presented properly and effectively. The response (evaluative) organisms need to be broadened (to include different trophic levels) beyond one species that may or may not be relevant to the habitat or ecosystem in question. There is no mention of temporal scales for appropriate measurements. When should samples be collected and assayed. This is important from diel, seasonal and interannual perspectives.

Pawley: (4) The indicator addresses an important measure of sediment quality and indirectly water quality.

Urquhart: (2.4) The charge question addresses both extent and trends. Neither the data nor writeup says anything about trends.

3) FOR WADEABLE STREAMS AND LAKE FISH TISSUE INDICATORS ONLY (for coastal sediment and harmful algal blooms, skip to question 4):

Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *ecological condition question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: NA

Gregory: (3) This indicator specifically addresses toxic substances in the environment.

4) To what extent do you think the indicator meets the following <u>indicator definition</u>:

*An "indicator" is **a numerical value derived from actual measurements of a pressure, ambient condition, exposure, or human health or ecological condition** over a specified geographic domain, whose trends over time represent or draw attention to underlying trends in the condition of the environment.*

1	2	3	4
Doesn't meet the definition	Only partly meets the definition	Largely meets the definition	Fully meets the definition

Creal: (2) There have been many instances where the sediment guidelines do not provide valid results conducive for use as an indicatory of conditions. The guidelines have proven most useful as a screening tool indicative of the need for further work in a localized area.

Gregory: (3) The index is a measure of the potential exposure within known ranges of toxicity to a benthic organism.

Paerl: (2) See limitations mentioned above. Condition is probably best addressed with this indicator, but only to a limited extent. There's little relevance of this indicator to exposure, whether among flora, fauna or humans. Another problem…the index is not clearly defined.

Pawley: (3.5) I would give this a 3.5. This is a baseline study, so the lack of trends information for giving this a slightly lower than perfect score.

Urquhart: (3.5) The chemical aspects meet the definition; the bioassay may or may not really address ecological condition. Nevertheless, the evaluation process is objective.

5) To what extent do you think the indicator meets each of the following <u>indicator criteria</u>:

a) The indicator makes an important contribution to answering a question for the ROE. (In this context, "important" means that the indicator answers a substantial portion of and/or a critical part of the question.)

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Gregory: (3)
Paerl: (2)
Pawley: (3)
Urquhart: (3)

b) The indicator is objective. It is developed and presented in an accurate, clear, complete, and unbiased manner.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Gregory: (2)
Paerl: (2)
Pawley: (4)
Urquhart: (4)

c) The underlying data are characterized by sound collection methodologies, data management systems that protect its integrity, and quality assurance procedures.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (3)
Paerl: (3)
Pawley: (4)
Urquhart: (4)

d) Data are available to describe changes or trends, and the latest available data are timely.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Gregory: (3)
Paerl: (1)
Pawley: (3)
Urquhart: (1)

e) The data are comparable across time and space, and representative[7] of the target population. Trends depicted in this indicator accurately represent the underlying trends in the target population.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Gregory: (2)
Paerl: (1/2)
Pawley: (4)
Urquhart: (2.5)

f) The indicator is transparent and reproducible. The specific data used and the specific assumptions, analytic methods, and statistical procedures employed are clearly stated.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (2)
Gregory: (3)
Paerl: (3)
Pawley: (4)
Urquhart: (4)

Please explain:

[7] An indicator seeks to describe trends in an overall target "population" (e.g., land area, type of surface water, type of emissions, U.S. population), yet data often can only be sampled from a subset of this population. The validity of the trends described by the indicator will depend on the degree to which the sampled population is representative of the target population.

Creal: I have used sediment chemistry and sediment toxicity results on numerous occasions, and have found it necessary to be very cautious in interpreting them. The sediment guidelines do not work in many situations, precisely because of the way they are developed. Sediment toxicity tests are difficult to do enough of to provide adequate spatial representation, and there also is a problem here with interpretation. Overall, these are good tools to address localized issues, but I am hesitant about using these as a national indicators.

Gregory: The major problem with this indicator is that it is a numerical listing of the number of contaminants that fall with a known range of toxicity to a single species of benthics invertebrate. It does not provide any measure of the magnitude of the impact on the ecosystem or biota. It does not consider other sources of contaminants (water, food, suspended matter). The index is expressed as a percent of estuarine area where such concenatrtions are found but it does not provide any measure of the impact of even small proportions of the estuary having levels of contaminants of concern. I generally think that it is useful to include but I'm not sure how it will be interpreted. Many could look at the graphs and conclude that contaminants are not a critical problem in the nations estuaries because more than 80% of the area was in the low range for almost all regions.

Paerl: Sediment contaminant levels may not change from year to year or season to season, but sensitivities (among target organisms) do. How is this important distinction captured and evaluated by this indicator?

Pawley: I was largely satisfied with the changes that were made in this index.

Urquhart: This indicator covers space fairly well, except for Alaska, but that limitation is noted. It does not include any information about time, nor is there any indication that subsequent data will be obtained.

6) Do you have any suggestions for more effective graphic presentation of the data? If yes, please describe.

Creal: No. The presentation of the data was very good and clearly understandable.

Gregory: It might be better to present a stacked histogram of moderate and high contamination and leave the low category off the graph. Also, it may be useful to calculate and present the mortalities lower than 20% (e.g., 5, 10, 15%).

Paerl: Overall, graphics are not very useful and/or informative. What do the regional differences reflect? Start over again rethinking and recasting the use and application of this indicator.

Pawley: Just a clarification. Explain ERL and ERM in the legend for those readers who do not know these terms.

Urquhart: The results could be presented around a map of the US, as few readers are familiar with the definitions of the EPA regions.

7) Please provide any additional comments, suggestions, or concerns regarding the indicator that you have not already noted in Questions 1 through 5. In particular, note any limitations to the indicator that you have not already described in your responses to the preceding questions.

Creal: I appreciate the improvements that EPA has made in this proposed indicator. However, I still have reservations about using this indicator. EPA has proposed using this indicator with noting the limitations of the indicator. If these limitations are clearly and prominently stated, this may be a solution. Assuming this, I am going to recommend including. However, I could just as easily recommend not including.

Paerl: Please see comments above.

Urquhart: If this indicator is included in the final report, the paragraph on the bioassay needs to be expanded. First, why was this particular bioassay used? Secondly, what is the mortality rate of unchallenged organisms? Medical trials include a placebo. The QA data should contain some of this sort of info.

The third paragraph in the data section needs a lot of work. What does its second sentence add?

CRITICAL CHANGE: The comments here and elsewhere about missing data are sloppy at best, and simply wrong at worst. Why were selected sites missing? What characteristics do they share? The sampling design does NOT assure the last sentence. If the missing sites share any characteristics, then the sampled population to which inferences can be made differs from the target population, perhaps substantially. This is the reason a substantial part of sample survey methodology addresses how to treat missing data. Missing data may severely restrict desired inferences. The last sentence of the data section and last two sentences of T1Q3 are NOT TRUE!!!

The EPA response to the Ecological Indicators Group Review says that "… the effects of TOC are noted in the text." Where?

8) Overall, this indicator:

Creal: Should be included in ROE06 TD. (**recommended with qualification and hesitation)**

Gregory: Should be included in ROE06 TD.

Paerl: Should *not* be included in ROE06 TD (not as currently presented. Modifications needed are substantial and in all likelihood will take longer than the revision period).

Pawley: Should be included in ROE06 TD.

Urquhart: Should be included in ROE06 TD only if the modifications identified above as critical are made. NOTE: Two places in the QA/QC writeup, web links are repeated on successive lines. Is the second intended to be different from the first?

Indicator limitations, line 2, stray there is a "and".

Harmful Algal Bloom Outbreaks in the Gulf of Mexico (Region 4)

1) Please indicate the extent to which you think the proposed indicator is appropriate, adequate, and useful (AA&U) for evaluating our nation's waters and for contributing to an overall picture of our nation's waters.

1	2	3	4
Indicator is not AA&U	Indicator is of somewhat AA&U	Indicator is largely AA&U	Indicator is completely AA&U

Creal: (3) This is a regional indicator. I am unclear as to what the difference is between a regional indicator and what constitutes a national indicator, and how and why certain regional indicators are selected. However, this is an appropriate and useful indicator for the western coast of Florida.

Gregory: (2) The interpretation of HABs is difficult. It is an episodic phenomenon for which monitoring is patchy and still developing. Causes are complex.

Paerl: (2) HABs (red tides) in Florida coastal waters are a **regional** water quality and (potentially) an environmental health problem. They need to be monitored and characterized. A good monitoring network is already in place in Florida, in large part because the water quality/health impacts are realized and constitute (at times) a serious ecological and economic problem. However, there is also a need to link the occurrence, intensity and persistence to environmental forcing features and controls. This indicator does not do this. It is a purely observational indicator. The purpose of "this conceptual model is to serve as an ecological indicator, and not as a linkage to eutrophication or anthropogenic stressors". EPA has a choice of adopting this indicator based on that qualification (i.e. merely descriptive), as opposed to linking it to causative agents/factors, which it currently does not do.

Pawley: (2) Harmful Algal Blooms (HABs) are important on the coast, but depicting the results for only one area and one species is not very compelling as a national level index. Also, the write-up should be improved to better explain the results shown (see below). Furthermore, it is not clear to me that this is anything but a natural phenomenon, which is important but I don't think it warrants the high level of attention that it would received in the National ROE.

Urquhart: (3) EPA has explained why this indicator ought to be included in the ROE, and has responded to many earlier criticisms. However, what really is the INDICATOR? If it is the number and duration of outbreaks as the title suggests, where does frequency enter? The figure suggests a substantial decline in the NUMBER of events, but by focusing on their duration, the figure tends to convey another message. Perhaps a more informative indicator would be the monthly average area of shell bed closures, in indicator which would show effects on humans, and could be graphed. (I realize that some people might regard this suggested indicator as an administrative one, but would provide a direct indication of the scale of the problem which could be easily communicated.)

2) Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *water question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

Creal: (2/3) This indicator provides information on a specific coastal area that represents an environmental condition that is important to the area. However, there is considerable debate as to whether this is a condition that is exacerbated by human input or not.

Gregory: (3) It is an important indicator of one aspect of water quality that is of tremendous concern for some ecosystems and human communities.

Paerl: (3) This indicator is an important one for describing overall **condition** of coastal waters, from both ecological and health perspectives. It is useful for describing the condition of coastal waters for bathing, fishing and overall recreational use.

Pawley: (3) The indicator addresses a measure that is important aspect of coastal water quality, but only regionally in its current form. If it is placed in the report as a placeholder for more complete characterization on a national level, that seems appropriate, but I am unsure if this goal is realistic and attainable at the present time.

Urquhart: (3) This indicator does characterize a condition of coastal waters for a limited area.

3) FOR WADEABLE STREAMS AND LAKE FISH TISSUE INDICATORS ONLY (for coastal sediment and harmful algal blooms, skip to question 4):

Please indicate the extent to which you think the proposed indicator makes an important contribution to answering the ROE *ecological condition question* it is intended to answer (see table in charge for list of questions). (Note: An indicator may be judged less important if it makes a smaller or less critical contribution to answering the question posed than the other indicators, or if it covers an area of less or diminishing importance environmentally.)

1	2	3	4
Indicator is not important	Indicator is of minor importance	Indicator is important	Indicator is critical

This question did not apply to this indicator.

4) To what extent do you think the indicator meets the following <u>indicator definition</u>:

An "indicator" is ***a numerical value derived from actual measurements of a pressure, ambient condition, exposure, or human health or ecological condition*** *over a specified geographic domain, whose trends over time represent or draw attention to underlying trends in the condition of the environment.*

1	2	3	4
Doesn't meet the definition	Only partly meets the definition	Largely meets the definition	Fully meets the definition

Creal: (4) This indicator clearly meets the definition of a numerical valued derived from actual measurements of an ambient condition. The data are timely, and recent.

Gregory: (2) We have little knowledge of longterm patterns of HABs. The trends may not provide clear measure of trends in the condition of the environment and anthropogenic causes.

Paerl: (2) The indicator describes state, potential exposure or ecological condition, but is not linked to underlying causes and hence not very useful as a basis or criterion for <u>management actions</u>. What's there to be managed from a WQ/habitat perspective if the indicator is disconnected from causes? It will be more useful for these purposes if linked to causative factors and changes therein. This indicator will be most useful if applied in the context of a suite of physical-chemical drivers being measured in water quality and habitat condition assessment programs.

Pawley: (4) The indicator addresses trends regionally, hence the high score.

Urquhart: (3) No comment.

5) To what extent do you think the indicator meets each of the following <u>indicator criteria</u>:

a) The indicator makes an important contribution to answering a question for the ROE. (In this context, "important" means that the indicator answers a substantial portion of and/or a critical part of the question.)

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (2)
Paerl: (2)
Pawley: (2)
Urquhart: (2)

b) The indicator is objective. It is developed and presented in an accurate, clear, complete, and unbiased manner.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (2)
Paerl: (3)
Pawley: (4)
Urquhart: (3)

c) The underlying data are characterized by sound collection methodologies, data management systems that protect its integrity, and quality assurance procedures.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (2)
Paerl: (3)
Pawley: (4)
Urquhart: (2.5)

d) Data are available to describe changes or trends, and the latest available data are timely.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (2)
Paerl: (3)
Pawley: (3)
Urquhart: (4)

e) The data are comparable across time and space, and representative[8] of the target population. Trends depicted in this indicator accurately represent the underlying trends in the target population.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (2)
Paerl: (3)
Pawley: (4)
Urquhart: (2)

f) The indicator is transparent and reproducible. The specific data used and the specific assumptions, analytic methods, and statistical procedures employed are clearly stated.

1	2	3	4
Doesn't meet this criterion at all	Only partly meets this criterion	Largely meets this criterion	Fully meets this criterion

Creal: (3)
Gregory: (3)
Paerl: (3)
Pawley: (4)
Urquhart: (3)

Please explain:

Creal: EPA has revised this indicator to use only one state's information and only address the western coast of Florida.

Gregory: Few regions have databases on HABs. Even the Florida example is of limited duration. Admittedly, the indicator is a major concern in coastal systems. I am not confident that the data will establish unambiguous trends in the quality of the nations coastal waters. This is one of the weaker and more limited indicators that probably will be included for the purpose of representation of high visibility environemental phenomena.

[8] An indicator seeks to describe trends in an overall target "population" (e.g., land area, type of surface water, type of emissions, U.S. population), yet data often can only be sampled from a subset of this population. The validity of the trends described by the indicator will depend on the degree to which the sampled population is representative of the target population.

Paerl: The indicator is clearly defined and can be assessed broadly in space and time, depending on the availability of observational networks and sampling programs that are adequately distributed in space and time. There is excellent coverage in many coastal environments on Florida, although some are under-represented. The way the indicator is currently proposed for deployment and assessment, it will only ensure observational data, not cause and effect information. This indicator needs to be part of a physical-chemical-biotic assessment program in order to be able to utilize it in a cause and effect context.

Pawley: I am largely satisfied with the changes that were made in this index; however, do not find it as important as other measures. A conceptual model that ties the indicator to potential causes and effects would assist the write-up.

Urquhart: The volunteer collected data may be sound, but the extent of QA on site location is unclear. Relation between target and sampled populations is unclear.

6) Do you have any suggestions for more effective graphic presentation of the data? If yes, please describe.

Creal: Yes. A spatial view of where the blooms are known to be occurring would be useful. The graphs should indicate where the blooms occurred for each bloom.

Paerl: Data need to be shown in geographic maps that a geo-referenced over time, in order to make this indicator more useful to describe spatio-temporal trends. Showing the numbers of events is useful, but including geographic distributions will enhance the utility and application of this indicator and may make it more useful from a cause and effect perspective (i.e. linking it to physical-chemical drivers).

Pawley: Yes, just show duration of blooms; unless the number is extremely critical for explaining ecological effects. ***It is not clear in the write-up.*** Also, showing an estimate of the area affected would enhance the indicator.

Urquhart: Express some of the results on maps. For example, show near-shore areas having more that 30 (for example) days with HAB, and show several years.

7) Please provide any additional comments, suggestions, or concerns regarding the indicator that you have not already noted in Questions 1 through 5. In particular, note any limitations to the indicator that you have not already described in your responses to the preceding questions.

Creal: This indicator raises the issue again of what constitutes a national indicator versus what is considered a regional indicator. I am unclear as to what the difference is between a regional indicator and what constitutes a national indicator. However, I do support the use of these types of indicators, as most indicators will only represent certain regions of the United States. This area is definitely appropriate for a suite of indicators, as is the Great Lakes, for example. I would strongly recommend the development and use of a suite of indicators for the Great Lakes in particular for this type of report.

Pawley: The write-up needs to include more information on what the data show. The number of blooms has declined while the duration has increased. Perhaps the number of blooms is not as important as the duration.

8) Overall, this indicator:

Creal: Should be included in ROE06 TD.

Gregory: Should be included in ROE06 TD. **(though not enthusiastically)**

Paerl: **May** be included in ROE06 TD **only if the modifications identified above as critical are made** (and only as a regional indicator for Florida and nearby Gulf Coast states).

Pawley: Should be included in ROE06 TD only if the modifications identified above as critical are made. ***Only if a national level effort to measure this indicator in other coastal regions is planned.***

Urquhart: Should be included in ROE06 TD only if the modifications identified above as critical are made.

What constitutes critical changes should be decided on the conference call. My concerns are more accumulative than a few specific matters.

The writeup needs to clearly acknowledge that the causes of HABs are not at all well understood at this time.

Additional Comments

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Additional Comments from William Creal

Laurie Waite
ERG
110 Hartwell Avenue
Lexington, MA 02431

Dear Ms. Waite;

It is my pleasure to forward my pre-meeting comments on the proposed water and ecological condition indicators to you. These comments are a result of my critical review of the additional and/or revised water and ecological condition indicators that the U.S. Environmental Protection Agency (EPA) proposes to use for its 2006 Report on the Environment, as requested in the October 14, 2005 charge letter.

After reviewing these materials, I still feel that EPA's Environmental Indicators Initiative is an excellent initiative. I applaud EPA for the initiative, and encourage them to continue this effort. I also encourage EPA to continue to develop and present more indicators – there are still simply too few in this report. There exists a wealth of information in many discontinuous databases to develop information for the needed indicators. EPA needs to find these databases, and construct the indicators. I believe these databases now exist primarily for the fresh surface waters, coastal waters, and fish contaminant indicators. The data for groundwater, wetlands and recreation are usually not as well developed at this time.

Along this line, I again encourage EPA to reevaluate the use of state databases. Finding a way to do this, and to use the state monitoring resources to assist in this project, would greatly increase the available information and indicators available for this report.

In these indicators, EPA has proposed the Contaminants in Lake Fish Tissue. This is an excellent start to developing a suite of indicators for PCBs and mercury. These two pollutants have caused widespread contamination across the United States. For these pollutants, there should be indicators in all four categories – pressures, ambient, exposure and effects. I believe these indicators presently exist for these pollutants, and datasets are available for them. As an example, for the Great Lakes there is trend data available for all of the following indicators:

Pressures
Atmospheric deposition of PCB and mercury

Ambient
PCB and mercury concentrations in water
Sediment core mercury concentrations
Exposures
Fish concentrations of mercury and PCB
Eagle concentrations of mercury and PCB

Effects
Number of eagle nests
Eagle reproductive success

I also continue to struggle with the difference between what is considered a national indicator and what is considered a regional indicator. I have reviewed the indicators, heard the explanation given on the very first conference call, and read the response given when I submitted the question again. I am having trouble distinguishing between the two at this point, and suggest that maybe there is no need at this time to distinguish between the two. All indicators could be considered national for the water body types they represent, and the data available at any time may only be regional in nature. As additional data become available for the water body type, the indicator simply becomes more robust, or national.

In closing, EPA has undertaken an important and difficult task here, and again I applaud their effort. My comments are intended to improve and strengthen this important process. In no way should they be construed to represent that the indicator initiative is not important.

Thank you again for the opportunity to participate in this effort. It has been my pleasure.

Sincerely,

William Creal