LOUISIANA UNIVERSITIES MARINE CONSORTIUM
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20 December 1999

Gulf of Mexico Hypoxia Working Group
C/o NOAA, National Centers for Coastal Ocean Science
1305 East-West Highway, Room 9127
Silver Spring, MD 20910

Re: Comments on Integrated Assessment (IA) of the Causes and Consequences of Hypoxia in the Gulf of Mexico

These comments are offered from my perspective as a researcher on the issue, a lead author of one of the CENR reports, and a participant at many levels in the public education and information exchange regarding the issue, and do not reflect the views of my institution, Louisiana Universities Marine Consortium.

The IA has essentially accomplished the goal set forth, which is to consolidate and synthesize the information in the six CENR technical reports and provide a concise document that can be used by the Working Group to develop a Management Plan. The [redacted]

p. 9, Executive Summary, currently the statements on reintroducing river water are balanced. There may be additional information coming from the Jan. 13/14 workshop that might be suitable for incorporation into the final draft of the IA.

p. 9-10, Executive Summary, the discussion of potential management strategies is very well balanced.

p. 13, "1. The Problem," 2nd para, sentence that begins "Mobile organisms, leave, die…" Should delete the words "die, or are eaten." The mobile ones mostly escape; it is the immobile ones that eventually die as the oxygen levels continue to decline.

p. 14 and figure 2.1, upwelled nutrients should be included only as a possibility, but further statements are warranted that the contribution is unlikely given that this process is limited to outer shelf and slope environments and that the physical mechanism is not present to bring them to the continental shelf where hypoxia occurs.

p. 17, Box on "Factors Potentially Contributing…", Organic loading section is correct as written, but can be strengthened based on the Hypoxia Science Meeting (Dec. 3, St. Louis) results. Brian Eadie stands by his previous analysis (Eadie et al. 1994), and indicates that the Goñi et al. (1998) article does not negate his and/or the work on stable carbon isotopes in Turner and Rabalais (1994) and Rabalais et al. (1996).

p. 17, Box on "Factors Potentially Contributing…", wetland loss is fine as written, but the *Spartina*-based carbon isotope signatures are restricted to very close to shore and the source of the carbon over the broad area affected by hypoxia is produced by marine phytoplankton.

p. 17, Box on "Factors Potentially Contributing….", again the source of upwelled nutrients is possible (as are many factors), but unlikely for the reasons given above.

p. 18, "Trends in Indicators of Production, Low-Oxygen Stress, and River…" Suggest a paragraph on historical evidence prior to the 1900 horizon of figure 2.2. This would be the foraminiferan data of B. K. Sen Gupta (presented in Rabalais et al. 1996, and CENR #1) that shows prior to 1900, there is an indication that hypoxia was NOT a problem. These and other data support the other data presented in the IA that oxygen stress has worsened since the 1950s.

p. 19, "—Long term records – drainage basin changes." These statements that put into historical perspective the changes in landscape and nutrients is good.

p. 20, "—Shorter-term records." The section on 1999 can probably be changed now that Don Goolsby had updated flux calculations through Sep/Oct 99. Data he showed in St. Louis indicated a higher streamflow than 1997, 1998, and a higher DIN flux. In fact, the increase in DIN compared to the 2 previous years is a steeper increase than the streamflow increase. The streamflow data were mirrored in the lower salinity signal waters during the July 1999 sampling effort. The nutrient data for that period are not yet available.

p. 21, "Sources, Loads, and Trends of River Nutrients." This section can probably be updated with further data analyses presented by Don Goolsby in St. Louis (Dec. 3).

p. 24-25, declining catch of penaeids with years of greatly increased hypoxia. This "increase" is based on the 5-d estimate made in mid to late July. This is not really a suitable comparison because the catch data span a much greater time period than the 5-d mapping exercise. Better comparisons are likely available from the monthly data, but these analyses have not yet been conducted. I think it is more accurate to state that adequate data do not exist (or have not yet been analyzed) to determine relationships between hypoxia (extent, severity, duration) and shrimp catch. The long-term trend downward in catch since the late 1970s, however, is consistent with the sedimentary indicators of worsening hypoxia stress. The next section (p. 25 on economics data analysis) makes a much clearer statement concerning the limitations of the economic data than the section about fisheries data.

p. 27, 4. Effects of Changing Nutrient Loads, "No Loading Change" Scenario. There was a good sentence removed from a previous version that should be considered for re-inclusion. Last paragraph before Figure 4.1 following "....between 1955 and 1980 (see figure 4.1). If future nutrient increases are modest, the ecosystem might be expected to remain stable, although the system will still be stressed.... However, even if....

p. 30, last paragraph in "Increased Loading Scenario" concerning harmful algal blooms. *Pseudo-nitzschia* spp. is a group of ....sometimes.... toxic diatoms. Not all are toxic, but toxic forms ARE found in the surface waters influenced by the Mississippi River, and *Pseudo-nitzschia*, overall, has increased in the area as Mississippi River N flux has increased.

p. 31, Effects if Reduction Measures Are Undertaken, Changes in the Gulf of Mexico. Paragraph beginning with change in P flux. The data record for P is much shorter than that of N. For this reason and the complications of sediment adsorption, there is not a statistical relationship with time. The trend is up, however. To say that P loads over the century have probably decreases is not supported by data. It is likely that P and N flux were high during deforestation, clearing of land, and draining of soils. With soil erosion measures, P may have gone down for a while, but then likely up again with the addition of P fertilizers (which have increased statistically, longer record). Organic N loads were probably high in the period of expansion of agriculture, then stabilized, then total N went back up again with the advent of N fertilizer use (increase in the nitrate component, not the organic component). The last part of the paragraph about model responses to N reductions is accurate. The first part of the paragraph should be revised.

p. 33, 5. Approaches for Reducing Nutrient Loads. First two bullets are very good.

p. 35, comment about reductions in atmospheric nitrogen emissions…probably not warranted, should be reconsidered. It appears that this conclusion is based on the amount of deposition directly on the Gulf (1%) compared to the N flux from the river system. Within the basin, however, atmospheric N contributes 16% of the load. Thus further reductions in emissions within the basin appear to be warranted.

p. 36, Table 5.1, footnotes 4 and 5 are missing from the copy I downloaded.

p. 37, paragraph before Figure 5.1, need a reference to "a current national goal is to establish two million miles of conservation buffers…"

p. 38, Table 5.2, the potential nitrogen reduction from diverting rivers in coastal Louisiana is probably an overestimate. The Jan 13-14 workshop will hopefully come to resolution on these values. This makes the unit cost for N removal ratio greater than it should be (Table 5.3).

p. 43, Monitoring Needs section. Need to emphasize that the river monitoring data needs to be integrated with the offshore ecological data on appropriate time scales.

p. 48, Longer-term Priorities box, statement about atmospheric deposition contradicts earlier statement concerning unwarranted remedial actions. Atmospheric in the watershed is a component worth examining now and in the future. As human population increases, the effects of atmospheric N will also increase (based on current predictions of river N load based on population, atmospheric N, and fertilizer use).

I hope these comments are useful as you complete this document for submission to CENR for its review. I there are any statements that need clarification, please do not hesitate to contact me.

Sincerely,

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