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Nutrient Criteria Review Panel
Summary Points for the Executive Summary:
Feb. 1, 2011 Draft for Discussion

(To discuss: which of these should go in the Letter?)

Overview Comments

lots of work, good start, concerned about short time

Conceptual Model (Charge question 1a)

- EPA proposes a conceptual model that links nitrogen and phosphorus levels in Florida waters to biological endpoints to be protected, using multiple water quality variables and one or more analytical approaches. The general model approach provides a strong basis for choosing numeric criteria although there were numerous concerns about the details on how and where the models would be applied, and the adequacy of the data.
- The conceptual diagram is a good representation of important linkages, but Biological Endpoints and Objectives are not discussed in sufficient detail. TN and TP should be referred to as driver (rather than causal) variables; there are many factors other than nutrients that control Chl-*a*, and this is not acknowledged in the conceptual diagram.
- TN and TP loadings are likely to be better predictors of Chl-*a*, hypoxia and sea grass loss than TN or TP concentrations. TN and TP concentrations are response variables; the temporal and spatial scales over which they would be measured should be clarified.
- EPA should further discuss whether TN and TP or “reactive N and P” are the most relevant variables to link nutrient enrichment to specific effects on biological endpoints.
- The three biological endpoints (healthy sea grasses, balanced phytoplankton biomass, and balanced faunal communities) are appropriate. However, these endpoints need to be much better defined and, in some cases, more clearly connected to the explanatory variables that would be the basis for setting numeric criteria. For example, EPA needs to define “balanced” for each of the three biological endpoints, preferably in quantitative terms.
- EPA proposes to identify levels of water quality variables that would protect the biological endpoints using reference condition, stressor-response, and/or modeling approaches for a particular water body. There would be a greater confidence in the criteria if all three approaches were applied, or as many as possible, to each of the systems where data are available. The EPA document should discuss how the results from multiple approaches would be integrated to develop the final numeric criteria.
- The three analytical approaches are being applied somewhat differently within the different categories of Florida waters, and each approach has different data

1 requirements and—more importantly—different assumptions, limitations and
2 uncertainties. EPA should describe the uncertainty associated with the various
3 approaches to criteria development and discuss how this uncertainty might
4 influence the use and appropriateness of specific numeric criteria.

- 5 • The Panel agreed that Chl-*a* concentration in the water column is both sensitive to
6 nutrient inputs and an important measure of ecosystem health and therefore a
7 reasonable endpoint in itself. However, Chl-*a*, which measures phytoplankton
8 biomass, cannot be used to infer anything about primary production or whether or
9 not phytoplankton populations are “balanced” in terms of species composition or
10 relative abundance/dominance. While we support using Chl-*a* as an endpoint, its
11 limitations need to be recognized.
- 12 • Water column Chl-*a* also is linked to seagrass health because it is an indirect
13 measure of water clarity, which is essential to allow seagrass photosynthesis.
14 However, the Panel is concerned about relying upon Chl-*a* as the sole criterion to
15 protect sea grasses because in some systems, macroalgae or epiphyte growth can
16 significantly impact seagrass communities even as Chl-*a* levels remain low. EPA
17 could consider a stressor-response approach to link nutrient loading with sea grass
18 areal extent for protecting sea grass communities.
- 19 • The Panel is concerned that no direct measures of the faunal community are
20 proposed to define whether a balanced community is being protected and
21 maintained. Instead, EPA proposes to rely on attainment of the Florida State DO
22 standard as an indicator for the presence of balanced faunal communities. EPA
23 proposes to look for relationships between TN and/or TP and DO, and use those
24 relationships to determine numeric criteria for TN and TP that are protective. The
25 Panel is concerned with the absence of any reference to faunal metrics.

26 27 **General Delineation of Florida Waters (Charge question 1b)**

- 28 • In the document, EPA proposes an initial grouping of Florida waters into four
29 categories: estuaries, coastal waters, South Florida inland flowing waters, and
30 South Florida marine waters. Separation of estuarine and coastal waters is
31 appropriate, and the separate consideration of South Florida also is warranted.
32 The Panel recommends that the term “marine waters” be replaced with “estuarine
33 and coastal waters.” South Florida inland flowing waters appears to be a default
34 category without strong scientific rationale for this classification. Additional
35 comments are provided on sub-delineation and classification within the four broad
36 categories of waters.

37 38 **Florida Estuaries**

39 **Delineation and Data (Charge question 2a)**

- 40 • The geographic delineations of estuaries seem appropriate although it was not
41 clear why a salinity of 2.7 psu rather than 0.5 psu was used to delineate the upper
42 reaches of these systems.
- 43 • A finer classification based on degree of impact may be useful (e.g., to separate
44 Caloosahatchee and St. Lucie estuaries from the others given their unique
45 hydrologic relationship to Lake Okeechobee).

1 • EPA should consider adding tidal creeks as a separate ecosystem type because
2 they have different characteristics than the open estuaries and therefore may
3 require different nutrient criteria.

4 • The Panel has few issues with the data sets presented and has provided
5 suggestions for additional sources.

6 **Assessment Endpoints (Charge question 2b)**

7 • It is appropriate that EPA use healthy seagrass communities as one of its
8 biological endpoints.

9 • To protect seagrass communities, EPA should consider a measure of epiphyte
10 abundance in addition to the proposed determination of Chl-*a* in the water
11 column.

12 • Whether Chl-*a* is an appropriate endpoint for assessing “balanced” phytoplankton
13 communities, depends on how EPA defines “balanced”, which has not been done.

14 • Direct indicators of faunal community balance should be considered in addition to
15 DO. When hypoxic conditions are observed, impacts on the biota usually have
16 already occurred. It is preferable to identify indicators that show stress on the
17 faunal community before such degraded conditions develop.

18 • Diel variability in DO needs to be considered when establishing DO water quality
19 targets. DO criteria may be better characterized by percent saturation.

20
21 **Approaches (Charge question 2c)**

22 • N and P may be limiting in different portions of the fresh to marine continuum,
23 and in some cases may be co-limiting. Thus, a dual nutrient (N and P) strategy is
24 warranted and we agree with EPA’s decision to take this approach.

25 • The Panel acknowledges the substantial effort made to date to collect data and
26 evaluate possible approaches to criteria development for these waters, but is
27 concerned that the timetable for completion of this work may be unrealistic.

28 • Our experience suggests that if the reference condition approach can be
29 implemented, it might be the most “time-efficient” pathway to developing
30 nutrient criteria. The Panel was disappointed that more attention was not given to
31 the stressor-response approach. We urge caution in EPA’s apparent emphasis on
32 water quality modeling approaches; if this approach is selected, a reasonable
33 representation of internal nutrient cycling needs to be included.

34 • In light of climate-related effects on hydrology and temperature regimes, as well
35 as increases in freshwater withdrawals for human use, the Panel recommends that
36 EPA consider the possibility that thresholds could be crossed, fundamentally
37 changing these systems.

38
39 **Florida Coastal Waters (Charge question 3a)**

40 **Delineation and data sources**

41 • EPA proposes to use remotely-sensed chlorophyll (Chl_{RS}-*a*) to develop a
42 reference criterion associated with a balanced phytoplankton population in the
43 coastal zone. The approach is appropriate and sensible for this large, poorly
44 sampled region, although the Panel is concerned that no direct measurements of
45 nutrients are proposed to verify the strength of the relationship between pollutant
46 loads and observed Chl-*a* concentrations.

- EPA proposes to use chlorophyll data from coastal waters out to 3 miles. (Under the Clean Water Act, water quality criteria apply to state coastal waters, defined for Florida as waters out to 3 nautical miles on the Atlantic coast and 9 nautical miles on the Gulf coast.) However, when developing coastal criteria, the Panel recommends that EPA consider remote-sensed chlorophyll in waters beyond the 3-mile zone because some blooms observed in coastal waters may form further offshore. In addition, data from the entire shelf should be used to improve the calibration of remotely-sensed and field-measured (*in situ*) chlorophyll.
- The proposed coastal segments are a result of historical precedence, and EPA may wish to consider segments defined in terms of bathymetry.
- It is not clear whether the ten-year remote-sensing dataset constitutes an adequate baseline, given decadal-scale variability.

Assessment Endpoints (Charge question 3 b)

- Chl_{RS-a} is the most feasible indicator of nutrient status for coastal waters, although it is influenced by more than nutrients and is not a useful indicator of species composition.

Approaches (Charge question 3c)

- In order to relate remote-sensed chlorophyll to water column chlorophyll levels, it is necessary to calibrate satellite sensor readings using field-measured chlorophyll data. The approach to calibration has been thorough, and the Panel agrees with use of *in situ* calibration data taken within 3 hours of the satellite overpass.
- The ratio between the chlorophyll concentrations in the upper two meters and the full euphotic zone needs to be established, and obvious antecedent bloom data points should be removed from analyses.
- Because available satellite-based sensors will change over time, as some platforms are retired and others are launched, the Panel recommends that EPA cross-calibrate data from existing sensors with future sensors as they become available.

South Florida Inland Flowing Waters

Rationale for Criteria (Charge question 4)

- EPA should consider viewing South Florida inland flowing waters as a source of nutrients to downstream, more oligotrophic, systems rather than for any valued ecological attributes that may be unique to them.

Delineation and Data Sources (Charge question 4a)

- EPA proposes to derive numeric criteria for South Florida inland flowing waters, including canals, as instream protection values (IPV) for TN and TP using the reference condition approach.
- The Panel is not convinced from the material provided that IPV nutrient criteria are appropriate for these uniquely artificial and highly managed ecosystems.
- The underlying problem is that the canals are classified as Class III waters (with a designated use of recreation and balanced population of fish and wildlife), although their primary purpose is management of water quantity.
- However, given the limited options available to EPA, and the reality that nutrient criteria are required for these waters, the Panel believes that EPA has taken a reasonable approach.

- 1 • The proposed inventory of inland flowing waters that catalogues and distinguishes
2 natural streams and canals should provide very useful information.
- 3 • EPA is considering use of the Landscape Development Index (LDI) as an
4 approach to identify areas with reference conditions. The LDI is a surrogate for
5 stressors, including TN and TP loads, associated with various land uses. The 100-
6 m stream/canal buffers proposed for use with the LDI may be too limited, and
7 may not capture impacts from land uses in the full watershed.
- 8 • The proposed classification appears reasonable as it incorporates surface and
9 subsurface flow regimes, soil types and land use; however legacy N and P effects
10 also must be considered.

11 **Assessment Endpoints (Charge question 4b)**

- 12 • Because canals are unique aquatic ecosystems, more information needs to be
13 presented on how balanced natural populations are to be assessed.
- 14 • The Panel recommends further consideration and assessment of the response
15 variables to be used and the form of the nutrients (i.e., those with short-term
16 versus long-term bioavailability) that are most relevant. It was not clear that
17 sufficient data are available to support either the invertebrate or phytoplankton
18 endpoints for canals.
- 19 • The Panel suggests that four other endpoints be considered: DO, algal community
20 structure, primary productivity, and benthic algal community structure, though
21 these also may not be supported by available data.

22 **Approaches (Charge question 4c)**

- 23 • EPA proposes two approaches for determining numeric criteria for South Florida
24 inland flowing waters. The first is based on reference conditions and the second
25 is based on stressor-response relationships. Either of these approaches could
26 work for these waters, although it was not clear if the available data would show
27 interpretable patterns.
- 28 • For the **reference condition** approach, data on historical annual values of TN and
29 TP from a set of least-disturbed sites (identified using $LDI < 2$) would be used to
30 develop lognormal distributions of TN and TP under least disturbance.
31 Variability of nutrient levels in the least-disturbed sites will reflect heterogeneity
32 in hydrology, geology, etc. Failure to account for such heterogeneity, which is
33 also present in disturbed sites, may result in numeric criteria that are under- or
34 over-protective.
- 35 • The Panel also notes that selecting “least disturbed sites” using an $LDI < 2$ may
36 not be feasible in this region that has been subject to active management for many
37 years.
- 38
- 39 • The **stressor-response** approach should also work if a suitable relationship
40 between Chl-*a* and nutrient load can be demonstrated in the canals, but several of
41 the same caveats apply here as for setting limits in coastal waters.
- 42 • As with the approach based on reference conditions, the relationship between Chl-
43 *a* and TN or TP is likely to be modulated by the effects of hydrological,
44 geological, and other covariates. Failure to account for such factors may lead to
45 criteria that are over- or under-protective.

- The document needs to address how regression models will be used to determine numeric criteria, specifically, how they will determine the level of Chl-*a* considered to be protective of balanced phytoplankton and faunal communities.

South Florida Estuarine and Coastal Waters

Delineation and Data (Charge question 5a)

- Southern Florida estuarine and coastal waters have a rather different nutrient regime than other parts of the state, given their oligotrophic nature and susceptibility to upstream water management (versus nutrient regulatory) decisions. The Panel agrees that these waters should be considered separately for purposes of nutrient criteria development.
- However, the proposed subdivision/subclassification of South Florida estuarine and coastal waters does not clearly relate to the oceanographic circulation and degree of connectivity in the region.
- Data identified seem appropriate.

Approaches (Charge question 5b)

- EPA proposes to use a reference condition approach using least-disturbed sites or a binomial test applied to a distribution of raw data. Both approaches have merit and the Panel encourages application of both to provide a more robust evaluation of criteria.
- If least-disturbed sites are located seaward, nutrient levels may be diluted by oligotrophic ocean water and not be representative of nearshore reference conditions.
- More thought needs to be given to implementation issues, such as how to define exceedance of the criteria.
- Over the last 100 years, the coastal and estuarine waters of South Florida have experienced enormous changes in freshwater inflows, salinity and residence times, with associated changes in nutrient cycling and seagrass extent. These past alterations should be considered when defining reference conditions.
- Seagrass coverage and extent of epiphytic colonization should be considered as endpoints, in addition to water column chlorophyll.
- The document should clarify which coastal and estuarine areas will be under the jurisdiction of the forthcoming nutrient criteria, versus other regulations (e.g., for federal and state protected waters).

Downstream Protection Values

(Charge question 6)

- EPA proposes to use DPV criteria to ensure that upstream N and P water quality criteria will be set at levels that will protect downstream estuarine designated uses. However, the entire Panel was not convinced that DPVs contribute to water quality protection beyond that which is already achieved given existing regulations for water quality standards and TMDLs.
- The proposal to apportion load reduction as an equal fractional load reduction for each tributary to a waterbody appears to formalize, and unnecessarily restrict, the allocation options available under the existing (TMDL) process.

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- The modeling of load reduction apportionment for upstream segments is a valid approach, but watershed characteristics such as predominant land-use (especially urbanized area) should be considered.
 - EPA should justify the choice of the LSPC model and explain why it is the most applicable model for this case.
 - The timeframe of the modeling should be linked to the response of biological endpoints in the receiving waters; annual average values may grossly under-predict the impact of large storm events.
 - The document needs to discuss the impact on criteria of P cycling and transformation in watersheds, lakes, and canals.