Defining the "Filter-Feeding" Commitment of the Bay Agreement

Revised Draft - February 10, 2002

What is the purpose of this document?

The Chesapeake Bay Agreement of 2000 calls for "**By 2004 assess the effects of different population levels of filter feeders such as menhaden, oysters and clams on Bay water quality and habitat**." The purpose of this document is to provide a substantive ***definition*** of this commitment so that:

1. a Bay Program consensus can be developed as to the details of the management objectives and
2. the appropriate technical analyses can be planned for and conducted by the Bay Program

Plans for conducting the scientific work that may be needed to meet this commitment are currently under discussion by the Living Resources, Modeling and Monitoring Subcommittees and the Scientific and Technical Advisory Committee (STAC) of the Bay Program.

In assembling this document, numerous viewpoints were sought and included. This tended to increase the number of factors to consider. Therefore, **some of the recommendations herein may need to be modified based upon what is achievable given our current state-of-knowledge and the time frame available**.

Background

The impetus behind this commitment was the growing recognition that filter-feeding by various organisms in the Chesapeake Bay could possibly have a significant positive impact upon water quality and habitat, especially by improving water clarity and controlling algal blooms. A number of researchers have made the case that filter-feeding can have significant effects on the ecosystem and recent examples of introductions of exotics, such as the zebra mussel in the Great Lakes, have provided evidence that filter-feeding impacts can be significant in aquatic systems.

It is clear that populations of some major filter feeding organisms in the Bay, such as oysters and menhaden, are near historic lows. Restoring some portion of this lost filter-feeding capacity is, therefore, being perceived by many as a possible adjunct to land-based controls to improve water quality. What is not clear, however, is how important this filter-feeding effect is since there are many complexities in the Bay's food web and in the cycling of nutrients and other materials. The Bay Agreement commitment was intended to provide the impetus to seek a quantitative answer to this outstanding question.

Management Questions

In seeking information to support management decisions, the Bay Program has often and successfully used the approach of developing management questions that clarify and focus the collection and analysis of technical information to support a broad initiative. In this case, the following management questions can be posed:

1. Are filter-feeding organisms in the Chesapeake Bay and its tributaries capable of significantly improving water and habitat quality at present, historical, or potentially restorable population levels?

2. If filter-feeding organisms ***are*** judged to be capable of significantly improving water and habitat quality, what are:

a. the key species and the range of population levels among the suite of important filter-feeders required to see positive impacts?

b. the important relationships with "bottom-up" (e.g. nutrient/sediment inputs) controls that could influence the impact of filter-feeders?

Specific Impacts to be Investigated

While the Bay Agreement language and background information, above, provides the general thinking behind the commitment, it does not provide a definition of the "effects" that is specific enough to focus the technical work. **It is recommended that the following effects be included in the assessment:**

1. water clarity and resultant influence on SAV populations

2. productivity, biomass (chlorophyll) and species composition of phytoplankton and zooplankton

3. dissolved oxygen

4. nutrient dynamics (recycling, denitrification, burial, etc)

5. significance of the above to, and altered relationships among, recreationally and commercially important finfish and shellfish

6. differences in effects nearshore vs. offshore and by salinity zone

Assumptions and Approaches

In order to start bounding the nature of the work required to fulfill this commitment, "filter-feeding" must be defined. Filter-feeding in the aquatic environment usually refers to organisms that obtain their food by processing large volumes of water to remove particles. These particles can be living or dead material that vary in nutritional value. Often the organism has an optimal range of particle sizes that are collected by its feeding structures and behaviors although selection of individual particle types other than by size is usually limited. Sometimes feeding may cease in the presence of high sediment loads, large numbers of unpalatable or toxic algae, low dissolved oxygen, low temperature or other environmental factors. **It is recommended that in this assessment, particles be defined to include phytoplankton, zooplankton, bacteria, and both organic and inorganic particulate matter**. This should allow for a comprehensive assessment of the impacts listed above.

Another decision to consider before proceeding is which filter-feeding organisms will be included in the assessment. The Agreement calls for organisms "...such as oysters, clams and menhaden." which clearly does not limit the effort to the named organisms. **It is recommended that analyses include a comprehensive suite of the significant filter-feeders in the Bay, either under current conditions or in scenarios describing alternative levels of filter-feeding organisms.** Without consideration of the simultaneous effects of the major filter-feeders (fish, plankton and benthos), misleading conclusions could be drawn about the effects of any population individually or the communities collectively because these effects are unlikely to be linear or simply additive. It is also recognized that adequate monitoring data may only exist for a subset of the major filter feeders and that other populations may need to be estimated from more limited monitoring or research studies.

A workshop organized by STAC is currently planned for spring, 2002 to review alternative analytical approaches. For questions as complex as those posed by this commitment, it is widely recognized that **some type of mathematical model or suite of models will be required**. Data required to calibrate and verify will be one of the important considerations in any model choice and will be one of the considerations in future monitoring activities by the Bay Program and its partner agencies. **Analysis of monitoring data** could be another useful tool to investigate alternative hypotheses concerning the effects of filter-feeders. A **synthesis of available research** would be a natural prelude to this effort.

A final consideration is how this work will **interface with fisheries management**. It is unlikely that in the near future we will have functional models for management that span the link between land and air based inputs of pollutants and the abundance and distribution of recreationally and commercially important finfish and shellfish although the gap has been narrowing over the years. What is more realistic is that fisheries management considerations could work hand-in-hand with the filter-feeding assessment. For example, if fisheries managers determine that a certain population level of menhaden is needed to sustain important predators, this level could provide guidance on the population levels tested in the filter-feeding assessment. Likewise, if the filter-feeding assessment indicates that certain population levels of filter-feeders (e.g. oysters) are need to have a significant beneficial impact on water and habitat quality, this could be factored into fisheries management decisions.

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This document was prepared by Robert Magnien, circulated to a wide audience of Bay Program managers and scientists, and benefited from the input of the following reviewers:

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