David Dow
18 Treetop Lane
East Falmouth, Ma. 02536-4814
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508-540-7142 (e)

Public Comment for the Record
C/O: U. S. Commission on Ocean Policy
1120 20 th. Street, NW
Suite 200 North
Washington, D.C. 20036

Dear Sir/Madam:

I wanted to share some thoughts with you on watershed-based management approaches for reducing the loading of nonpoint source pollutants to the coastal ocean. I attended your hearings in Boston, Ma. last week and a number of speakers testified in favor of a watershed-based approach to coastal management, but the oral testimony on this subject occurred at a high level of generality. For the past 8 years I have worked on an ecological risk assessment project on the Waquoit Bay Watershed here on Cape Cod, Ma. which was organized by the U.S. Environmental Protection Agency (EPA) and the Waquoit Bay National Estuarine Research Reserve (WBNERR). The scientific comments in this letter will be based on results from this risk assessment. The Town of Falmouth has begun a project to manage nitrogen loading from septic systems and fertilizer usage in town that has diminished the water quality in our coastal embayments, resulted in the loss of the eelgrass beds and collapse of the bay scallop harvest, and lead to periodic fish kills as decaying macroalgae used up the dissolved oxygen in the water column. My comments on management issues will stem from this endeavor.

The Waquoit Bay Watershed Ecological Risk Assessment (ERA) identified nutrients has the major anthropogenic stressor in the watershed, with phosphorus loading being the problem in the freshwater ponds and nitrogen loading being the major stressor in the bay. As you can see from the enclosed Table 5-1 in 1990 the major source of nitrogen to the watershed came from the atmospheric deposition (59%) followed by equal contributions from waste water disposal (22%, primarily septic systems) and fertilizer use (19%). If one looks at the actually loading to the bay, waste water disposal (43%) and atmospheric deposition (38%) are the major sources with fertilizer use (19%) being the least important. The reason for this change between the loading to the watershed and what enters the bay is differential uptake of nitrogen by the forested vegetation in the watershed and denitrification in the wetlands that surround water bodies. As a result of increased development and population growth within the watershed between 1938 and 1990, the atmospheric source of nitrogen has become relatively less important, while that from waste water disposal has increased. In actual magnitudes all three sources of nitrogen loading to the watershed have increased in absolute magnitude between 1938 and 1990.

Scientists from the Boston University Marine Program (BUMP) at the Marine Biological Laboratory (MBL) in Woods Hole, Ma. developed a coupled Nutrient Loading and Estuarine Loading Model (NLM/ELM) which back calculated from the critical dissolved inorganic nitrogen (DIN) concentration which allows eelgrass beds to flourish to the nitrogen loading from the watershed into Waquoit Bay responsible for this DIN level in the water column. In using the coupled NLM/ELM output one could examine different scenarios of mitigation measures on land to achieve the early 1970's level of eelgrass coverage within the bay (35% coverage). Using this hypothetical recovery goal it became apparent that one could remove all of the fertilizer use in the watershed and still only reduce the nitrogen loading to half of the critical rate. Dredging the three entrances from the bay to the coastal ocean (Vineyard Sound) in order to increase the water turnover time in the system, yielded only minimal benefits. This meant that the key to mitigation was to deal with waste water disposal from septic systems.

The Town of Falmouth on Upper Cape Cod has embarked upon a program to improve the water quality in

Bourne, Great, and Green Pond and decided to focus their mitigation strategy on fertilizer use and septic systems, since there is not much that they could do about the atmospheric deposition. A public education program has been mounted to get residents to voluntarily to reduce the fertilizer usage of nitrogen. They are considering wetland restoration/artificial wetland construction along the Coonamesset River as a method to treat the excess DIN in the ground water from septic systems in the upper part of the watershed and sewering coupled with community/centralized advanced waste water treatment plant(s) for the more densely populated areas along the coast. Since the Federal government has stopped supporting the costs of sewage plant construction and there is limited state financial support to upgrade the current Title 5 septic systems to denitrifying systems, the town will likely have to establish a sanitation district and have the citizens within this district pay a betterment fee of $1000-1300 per year for 20 years to cover the mitigation costs for improved waste water treatment. Even though there are some wealthy retirees and secondary homeowners on Cape Cod, many of our residents work in the tourism/service sector which doesn't pay that well. Affordable housing on Cape Cod is a serious problem for much of our work force and a large betterment fee for improved waste water disposal is not feasible for these workers.

Given this background I suggest that the U.S. Commission on Ocean Policy consider addressing the following issues:

* There are air shed issues that need to be addressed that are beyond the scope of local/state managers and must be addressed at a national level. Atmospheric nitrogen deposition is only one example, but one should also consider mercury deposition which has lead to fish health advisories for fish consumption in our local freshwater ponds. Acid rain has lead to low pH levels in our freshwater ponds.

* Even though there is a clear relationship between increased nitrogen loading/loss of eelgrass beds/reduced harvest of bay scallops in Waquoit Bay, the long term changes in the piscivorous finfish populations represent a combination of offshore fish harvesting and inshore habitat loss/degradation. To resolve these fishery problems requires inter jurisdictional coordination between local/state/Federal agencies and even within a given governmental level cooperation between water quality agencies and those that oversee fisheries. The collapse of the bay scallop harvest following the loss of eelgrass beds shows that fishery managers need to conduct more research on the functional value of Essential Fish Habitat (EFH) and not just designate large areas as EFH based upon the eggs, larvae, juvenile, or adult stages of a managed species occurring in a given area of ocean. Also more research/monitoring needs to be done to separate the anthropogenic impacts of fisheries harvesting from habitat loss/degradation on finfish populations which recruit over wide regions unlike shellfish which often recruit from within coastal embayments and are influenced by land use changes within local watersheds.

* Federal resources need to be made available to deal with the shortage of waste water disposal infrastructure in coastal areas which have experienced rapid population growth in recent times, since localities lack the financial resources to address this problem. There are a number of secondary socioeconomic issues that arise from this lack of waste water disposal infrastructure. In order to reduce the nitrogen loading from septic systems the towns have increased minimum lot size, which has lead to more sprawl and exacerbated the affordable housing problem because of the high price of land. The sprawl leads to congestion/increased fuel consumption/increased greenhouse gas emissions and more runoff of nonpoint pollutants from roads which close shellfish beds following heavy rain storms. Since more of our population is living along the coast, pollution from nonpoint sources of pollution will require more than best management practices to mitigate this problem. This suggests an important role for the watershed planning process and Federal funds to implement the section 6217 program under the Coastal Zone Management Act (CZMA).

* The state Executive Office of Environmental Affairs (EOEA) has an Estuary Program in which the University of Massachusetts-Dartmouth, School of Marine Science & Technology provides technical support to assess the nitrogen loading problems in different watersheds within the commonwealth. Since many local planners lack this level of technical expertise, it is important to find a mechanism to help them out. The Waquoit Bay Watershed ERA met twice with local/state managers in order to get feedback on the

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ecological risk assessment as it proceeded from the Problem Formulation stage through risk analysis/characterization stages.

* Since much of the atmospheric deposition entering the Waquoit Bay watershed is attenuated by the forests, wetlands, and vegetated boundaries along streams before it reaches the bay, other areas of the country should consider adopting the Land Bank Program found on Cape Cod where a property tax surcharge is approved by a town to purchase open space. The Commonwealth of Massachusetts helps support the Land Bank Program, so that it is an example of a successful local/state partnership.

Thanks for your consideration in this matter.

Yours truly,

David Dow

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**Table 5-1. Relative contributions of each of the major sources of nitrogen to the Waquoit Bay estuary in 1938 and 1990**[a]

| Source of nitrogen | 1938 Nitrogen load | | 1990 Nitrogen load | |
|---|---|---|---|---|
| | $10^3$ kg $y^{-1}$ | % | $10^3$ kg $y^{-1}$ | % |
| To the watershed | | | | |
| Atmospheric deposition | 91.3 | 95 | 95.5 | 59 |
| Wastewater disposal | 2.1 | 2 | 35.7 | 22 |
| Fertilizer use | 3.2 | 3 | 30.5 | 19 |
| Total | 96.6 | 100 | 161.7 | 100 |
| To the estuary | | | | |
| Atmospheric deposition | 8.4 | 77 | 9.1 | 38 |
| Wastewater disposal | 0.7 | 7 | 10.5 | 43 |
| Fertilizer use | 1.7 | 16 | 4.7 | 19 |
| Total | 10.9 | 100 | 24.3 | 100 |

[a]The propagated error of the modeled N load is 14% (Valiela et al. 1997). The percent contribution from each source of nitrogen is slightly different from those published in Valiela et al. 1997 and those used in Figure 1-5. The differences result from the need to use regional trends to incorporate historical changes. In some instances these regional trends were slightly different from the Waquoit Bay specific information used in the original publication. The difference between the regional approach, and the Valiela et al. (1997) results fall within the standard error of the model.

Source: Bowen and Valiela (2001a)

the early 1970s the nitrogen load exceeded 20 kg N $ha^{-1}$ $y^{-1}$, and eelgrass meadows were notably smaller in area. The loss of eelgrass habitat continued through 1990. The historical reconstruction indicates that the nitrogen loads corresponding to the near-complete destruction of eelgrass meadows ranged only between 15 and 30 kg N $ha^{-1}$ $y^{-1}$ (Fig. 5-3, top).

We carried our extrapolation one step further to look at the secondary effects of eelgrass decline on the decrease in scallop harvest. Because the presence of seagrass is required for the maintenance of many taxa, including commercial shellfish and finfish species, a change in eelgrass cover implies drastic changes in the rest of the estuarine food webs in affected estuaries. During the time span when eelgrass meadow area decreased, the annual harvest of bay scallops in Waquoit Bay decreased as well (Fig. 5-3). We can therefore claim that urban development can be demonstrably linked to drastic restructuring of estuarine ecosystems.

### 5.1.3 Effects of Other Stressors on Eelgrass

Other stressors are potentially damaging both to existing eelgrass beds and to efforts at reintroducing eelgrass to estuaries, although these stressors are minor in comparison to nitrogen loading because they are restricted to very small regions of the bay or they occur only