

July 11, 2003

Mr. Glenn Haas, Director  
Division of Watershed Management  
Department of Environmental Protection  
1 Winter Street  
Boston, MA 02108

Ms. Linda Murphy, Director  
Office of Ecosystem Protection  
U.S. Environmental Protection Agency  
Water Technical Unit "SEW"  
P.O. Box 8127  
Boston, MA 02114

Re: Massachusetts Water Resources Authority, Permit Number MA0103284  
Outfall Contingency Plan, Zooplankton Threshold Evaluation Report

Dear Mr. Haas and Ms. Murphy:

The Massachusetts Water Resources Authority ("MWRA") is pleased to submit the attached report, "[A review of zooplankton communities in the Massachusetts Bay/Cape Cod Bay system](#)," to satisfy the outfall Contingency Plan requirement that MWRA report on the results of special zooplankton studies and evaluate whether a scientifically valid zooplankton community threshold could be developed.<sup>1</sup> This report was required by the Environmental Protection Agency ("EPA") and Massachusetts Department of Environmental Protection ("DEP") in place of the zooplankton threshold that was dropped from the Contingency Plan.

The original zooplankton threshold, "shift to a near-shore community" in the 1997 outfall monitoring Contingency Plan was based on a presumption that the estuarine copepod genus *Acartia* was food limited. However, additional scientific information subsequently confirmed that *Acartia* species are generally restricted to estuaries not because they have a selective advantage at higher levels of nutrients, but because their development requires the lower salinities found in estuaries. Therefore, *Acartia* abundance is not a good indicator of nutrient effects on zooplankton, and the Outfall Monitoring Science Advisory Panel (OMSAP), EPA, and DEP recommended that the *Acartia* threshold be deleted from the Contingency Plan. In place of an *Acartia*-based Contingency Plan threshold, OMSAP recommended:

"Since the Massachusetts and Cape Cod Bays system flows like a 'conveyor belt' from north to south, MWRA should develop a method for analyzing the current data spatially and temporally to contrast differences between the northern boundary stations and Cape Cod Bay" (OMSAP 2000).

The attached report includes a comprehensive literature review, analyses of spatial and temporal patterns with respect to the "conveyor belt" hypothesis, and exploratory multivariate analyses of the zooplankton data. MWRA found that the zooplankton community structure in the bays showed strong seasonal patterns that appear to be related primarily to intra-annual fluctuations in

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<sup>1</sup> MWRA 2001. Massachusetts Water Resources Authority Contingency Plan Revision 1. Boston: Massachusetts Water Resources Authority. Report ENQUAD ms-071. 47 p.

temperature. Some components of the communities, e.g., *Calanus finmarchicus* abundance, may respond to large-scale factors such as the North Atlantic Oscillation. No evidence was found to support a conveyor belt hypothesis that would explain variations in zooplankton abundance as resulting from periodic infusions of individuals into northern Massachusetts Bay with subsequent transport to the south. Peak abundances of several taxa are often coincident at the boundary stations, the nearfield region, and in Cape Cod Bay. They also may occur earlier in the year at the southern than at the northern stations. There is no consistent north-south sequence in peak abundances of important taxa.

During the two years of monitoring since the initiation of effluent discharge through the relocated MWRA outfall, there have not been any apparent effects of the discharge on zooplankton abundance or community structure. Both were within the variability recorded during the baseline period.

Based on the analyses, MWRA believes that the development of a simple numerical threshold that can effectively capture shifts in zooplankton species or abundance at local or regional scales that may be related to the relocation of the outfall is highly unlikely. The zooplankton in the system do not show a systematic pattern of occurrence from north to south in the bays, generation times are long relative to the average transport time in the bays, and zooplankton community or abundance responses to chlorophyll biomass are not apparent in the data. Except for the estuarine zooplankton species found in embayments like Boston Harbor, zooplankton in the bays appear to respond simultaneously to large-scale environmental factors at regional scales rather than local ones. Thus, defining a meaningful simple, numerical threshold for the zooplankton community is not possible at this time.

In order to detect potential outfall-related change in zooplankton, MWRA believes the data must be:

- evaluated within the context of other oceanographic and monitoring parameters;
- analyzed using exploratory statistical methodologies to elucidate whether community changes occurred after the outfall began discharging; and
- further evaluated statistically if future exploratory analyses suggest outfall-induced shifts in abundance or composition.

In its interpretive synthesis reports, MWRA will continue to evaluate the zooplankton community at scales appropriate to the monitoring questions and characteristics observed in this data set to ensure that potential outfall-related effects are detected if they occur.

MWRA appreciates the consideration EPA and DEP have given to the ongoing process of revising the Contingency Plan. MWRA shares EPA and DEP's view that the plan, as a "living document," needs to be reviewed and improved or revised based on current scientific understanding. If you have any questions about this report, please do not hesitate to contact Dr. Andrea Rex of my staff at (617) 788-4708.

Sincerely,

Michael J. Hornbrook  
Chief Operating Officer

Attachment (Click on report title to view online):

Kropp RK, Turner JT , Borkman D, Emsbo-Mattingly S, Hunt CD, Keay KE. 2003. [A review of zooplankton communities in the Massachusetts Bay/Cape Cod Bay system](#). Boston: Massachusetts Water Resources Authority. Report ENQUAD 2003-06. 39 pp plus appendices.

**Cc:**

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