# ENDANGERED SPECIES ACT—BOSTON HARBOR OUTFALL



HEARING

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENT
AND NATURAL RESOURCES

OF THE

COMMITTEE ON
MERCHANT MARINE AND FISHERIES
HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

FIRST SESSION

ON

**OUTFALL CONSTRUCTION IMPACTS ON ENDANGERED SPECIES IN MASSACHUSETTS AND CAPE COD BAYS**

OCTOBER 18, 1993—BOSTON, MASSACHUSETTS

**Serial No. 103-75**

Printed for the use of the Committee on Merchant Marine and Fisheries

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# ENDANGERED SPECIES ACT—THE BOSTON HARBOR OUTFALL

MONDAY, OCTOBER 18, 1993

HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES, COMMITTEE ON MERCHANT MARINE AND FISHERIES

*Boston, Massachusetts*

The Subcommittee met, pursuant to notice, at 9:14 a.m., in the U.S. University Club, 11th Floor, Healey Library, University of Massachusetts at Boston, 100 Morrissey Boulevard, Boston, Massachusetts, the Honorable Gerry E. Studds [chairman] presiding.

Present: Representative Studds and Senator Kerry.

Staff Present: Jeffrey Pike, Counsel; Karen Steuer, Counsel; and Marvadell Zeeb, Clerk.

## OPENING STATEMENT OF THE HON. GERRY E. STUDDS, A U.S. REPRESENTATIVE FROM MASSACHUSETTS, AND CHAIRMAN, SUBCOMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES

Mr. STUDDS. I want to begin this hearing by expressing our appreciation to the Chancellor and the staff of this campus of the University of Massachusetts. They have been extraordinarily cooperative and helpful in ironing out the logistics of what is never as simple as it looks. We are deeply appreciative of their kindness. I want to thank our witnesses for assembling here.

We will be relatively informal, as Congressional hearings go. We are expecting several other members. Senator Kerry will be able to be here briefly. Congressman Saxton is our ranking Republican member from New Jersey, and is reported to be, and I quote, "in the tunnel." I will let that stand. We think Congressman Torkildsen of our State may be here as well. We must proceed, and we will do that.

As I think you all know, we are here to take a hard public look at the final stage in the consultation process under the Endangered Species Act with regard to impacts on endangered critters in Massachusetts and Cape Cod Bays, if any, due to the outfall construction that is underway. This has been an extraordinarily carefully-watched procedure. As I think you all know, the EPA's biological assessment has now been evaluated by the National Marine Fisheries Service who has that responsibility, and they have issued their biological opinion. It is that opinion that we have asked a variety of people to address today.

For the past year, this Subcommittee has been holding hearings on the reauthorization of the Endangered Species Act. We have

seen reams of testimony about the importance of saving old-growth forest habitats for the spotted owl. We have heard about the importance of protecting predators like wolves, which serve to keep other species in balance. Next month we will be holding a hearing on the medicinal uses of endangered plants, including the potential that these plants have to cure diseases such as AIDS and cancer.

What we have not heard much about is the difficulty inherent in trying to protect the fragile habitats of endangered marine species—a difficulty that arises from the unfortunate fact that we know so little about the capacity of the sea to absorb human waste, from fertilizer runoff to sewage effluent. I hope, for all of our sakes, and the sake of those endangered species that call Massachusetts and Cape Cod Bays home, that we will learn something more about that today.

As everyone in this room knows, balancing the various views on this project has been difficult for everyone. The people of Quincy and Weymouth, and all of greater Boston want a cleaner, healthier harbor. They should have it. I believe the MWRA is headed in the right direction to accomplish that. The people of all the ratepayer communities do not want to be bankrupted in order to pay for this project. Families should absolutely not bear this burden. That is why we are fighting for Federal funding. That is why I have introduced legislation to allow families to deduct their water and sewer bills from their taxable income, and that is why we will continue to work with the Administration to get relief.

Finally, the people of the South Shore, Cape Cod and the Islands, and all who rely on these bays for a living, or those who simply love the fragile beauty of this State's coast, deserve to be assured that the cumulative impacts of this project and others like it will not cause long-term degradation of the marine environment. We must be assured that endangered species like the North Atlantic right whale, which today teeters on the brink of extinction, are not pushed slowly over the edge by our lack of knowledge about the complex workings of our coastal waters.

This biological opinion we are looking at today has probably received more detailed scrutiny than almost any other public document in recent Massachusetts history. It has answered some of the questions that I, as well as the people of Cape Cod, have been asking, but it has raised questions as well. I hope to have those questions debated or answered here this morning. I suspect that some of you leaving this room today will feel assured that every safeguard has been taken to protect these waters and the whales that inhabit them. Given the controversy over the project, however, it is inevitable that there will be a diversity of opinion over the conclusions, and that others will leave here feeling that the risks of this project are simply not worth the benefits.

It will benefit us all to hear how the National Marine Fisheries Service arrived at its conclusions and the reactions of various experts to those conclusions. For more than two years, it has been my firm position that, at the very least, this outfall should not be used until full secondary treatment is in place; a monitoring plan is underway which is tied to specific management actions; and a workable contingency plan has been designed that can be quickly triggered should things go awry. I am very pleased to note that the

National Marine Fisheries Service has also recommended two of these actions to further reduce the potential for harm to endangered species.

For those of you have not had the misfortune of being exposed to a Congressional hearing before, let me point out that we proceed with a little piece of barbarity we imported from Washington—those are the three lights over here for witnesses. There is a red one, a yellow one, and a green one. We have asked all of the witnesses, some of whom have lengthy and detailed testimony, to confine their oral presentation of that testimony to no more than five minutes. That is not easy, I understand. All of the written testimony will appear in its entirety in the record. Future historians will never know what you actually said and what you did not. If we do not adhere fairly strictly to that rule, we will be unable to get to the question period and to conclude in time to go where we have got to go. When the yellow light goes on it means you have one minute left. When the red light goes on it means you are finished. We do apologize. That is a bit of rudeness that was invented in Washington. It works, however. We are sorry for the bluntness of it all.

We are going to take the seven members—eight members, I guess—eight members of the panel as an entirety. We are going to hear each of you prior to going to questions. Let me just also observe that I am going to do something which I said I would do a month or so the Cape, and that is give some of our experts here on these critters an opportunity themselves to ask questions of the Government spokesmen who are here. We will go in the order in which the names appear on the witness list.

We will begin with Mr. Thomas Bigford, who is with the Northeast Region of the National Marine Fisheries Service. Mr. Bigford.

## STATEMENT OF THOMAS BIGFORD, CHIEF, HABITAT AND PROTECTED RESOURCES DIVISION, NORTHEAST REGION, NATIONAL MARINE FISHERIES SERVICE, DEPARTMENT OF COMMERCE

Mr. BIGFORD. Thank you. Good morning, Mr. Chairman. My name is Tom Bigford, Chief of the Habitat and Protected Resources Division of NOAA's National Marine Fisheries Service northeast regional office in Gloucester. We thank you for the opportunity to discuss the Endangered Species Act and the Section 7 consultation we conducted on issuance of a national pollution discharge elimination system permit for the Massachusetts Water Resources Authority (MWRA) outfall.

Accompanying me today are two of the principal authors of the biological opinion, John Catena and Colleen Coogan, from the Northeast Regional Office of the National Marine Fisheries Service. They will help answer any technical questions. I would also like to acknowledge Commander Jack Moakley, a NOAA Corps Officer who works in NOAA's Office of General Counsel.

As you know, in September, our biological opinion on the effects of the MWRA outfall was released to EPA and the Corps of Engineers. I have attached a copy of the opinion to our written testimony for the hearing record.

The Section 7 process is complex, so we have taken great lengths to summarize it in the written testimony. Let me just note here that the process requires Federal agencies to consult with the National Marine Fisheries Service on activities they authorize, fund or carry out, and then we use the best available information to develop biological opinions that represent our opinion regarding whether proposed actions are likely to jeopardize the continued existence of the listed species. It is important to note that this process can be reinitiated and that the consultation process continues. I will discuss more on that later.

The Section 7 consultation process is very important and the Agency considers it successful. Our written testimony offers several examples of how the National Marine Fisheries Service has used consultations to reduce adverse effects. It is also essential to note that the law does allow some effects. Our objective in every consultation is to use our authorities to minimize those adverse effects and to ensure that stocks of listed species are not jeopardized. The recent MWRA consultation was just the latest of several consultations in this area related to the species of concern—the whales and the harbor porpoise (proposed for listing), and the proposed right whale critical habitat.

In developing our biological opinion, NMFS reviewed the EPA biological assessment, available technical literature, as well as extensive additional information provided by other sources, most notably Stop the Outfall Pipe, the Center for Coastal Studies, the New England Aquarium, MWRA itself, USGS and Barnstable County. Their assistance was appreciated.

The following remarks capture the essence of our efforts. Again, this is presented in greater depth in the written testimony.

The biological opinion concluded that the MWRA outfall may affect but is not likely to jeopardize the continued existence of any listed or proposed species or critical habitat. NMFS believes that water quality conditions in areas commonly used by listed species would not appreciably change from the current situation. While we do not have a precise understanding of the effects of present conditions on porpoise and whales, we are confident that the existing outfalls are not jeopardizing the continued existence of any of these species. We have concerns, but they fall short of jeopardy.

We base our findings on three key points. First, recent research has demonstrated that there is significant export of nutrients from Boston Harbor into the Bay, and model predictions indicate that the proposed discharge will not appreciably change nitrogen concentrations from existing conditions. Therefore, changes are not expected in the phytoplankton production and community structure, or in zooplankton productivity, density and availability in the areas of whale abundance.

The second key point. Existing information suggests that the present discharges are not associated with the occurrence and frequency of the red tide blooms in Massachusetts and Cape Cod Bays. Evidence suggests that nutrient levels at the proposed discharge locations are already in excess of the requirements needed by those species, including some of the toxic species.

Third point. While contaminants have been detected in harbor porpoise and large whales, pathological effects have not been dem-

onstrated. We hope that secondary treatment will reduce the levels of those toxins. NMFS has recommended that EPA require expeditious implementation of secondary treatment to reduce the toxins as swiftly as possible.

The biological opinion provides EPA with numerous conservation recommendations to assess and minimize the potential for adverse effects. The recommendations can be summarized under four broad categories: first, a contingency plan should analyze reasonable steps, including tertiary treatment; second, studies should be completed prior to the discharge of primary treated sewage at the outfall location; third, additional long-term studies and monitoring requirements must be developed and implemented; and fourth, additional permit conditions to minimize adverse effects to listed species should be considered. Our written testimony summarizes the conservation recommendations that are all in the biological opinion.

All of this will require an additional commitment by the concerned agencies and may require additional resources. This will not come cheap.

Reinitiation also is inevitable. Reinitiation will be spurred by renewal for the five-year discharge permit. It will also occur if the monitoring plan is discontinued, if new information reveals effects outside of the scope already analyzed, if the project is modified or if a new species is listed.

We have taken into consideration cumulative impacts also. We are looking to identify cumulative effects caused by both long-term use of the proposed outfall and any synergistic effects of other pollutant sources occurring throughout the Massachusetts Bays system. Of course, we are coordinating with the sanctuary, EPA, all of the agencies working collectively on the recovery plans, and the State.

In conclusion, we are confident that, given the available scientific information, conditions in Boston Harbor and the bays will improve as the new sewage treatment system is completed and put online. However, we believe it is important and necessary to implement the conservation recommendations expeditiously.

Thank you, Mr. Chairman. This concludes my testimony. John Catena, Colleen Coogan, Jack Moakley and I will try to answer your questions.

[The prepared statement of Mr. Bigford can be found at the end of the hearing.]

Mr. STUDDS. Thank you very much, sir.

Next we will hear from Mr. Richard Kotelly of Region I, EPA. Mr. Kotelly.

**STATEMENT OF RICHARD KOTELLY, DEPUTY DIRECTOR, WATER MANAGEMENT DIVISION, REGION I, ENVIRONMENTAL PROTECTION AGENCY**

Mr. KOTELLY. Mr. Chairman, I would like to thank you for the opportunity to testify this morning. My name is Richard Kotelly. I am the Deputy Director of the Water Management Division of EPA, Region I. I have held that position for 17 years. I have been employed by EPA since 1970.

I have been involved in the Boston Harbor project since it began. That project, including the Massachusetts Water Resources Authority Outfall under discussion at this hearing, has been subjected to intensive and painstaking environmental review. In fact, I know of no other project which has received this much attention from environmental agencies at the State and Federal levels. EPA's environmental reviews have demonstrated that the continued discharges of MWRA effluent into the shallow waters of Boston Harbor cause unacceptable environmental impacts on our coastal waters. There is a compelling environmental need to end these discharges as soon as possible. The new MWRA outfall is, therefore, an important part of the Boston Harbor Project. Its operation will improve water quality throughout the harbor, especially along the shores of Quincy, Winthrop, Hull and Nahant, which are most directly affected by the existing discharges.

As demonstrated by multiple environmental studies, the outfall will effectively eliminate these near shore impacts with minimal impact on the bay. Study after study has found that the Boston Harbor Project will produce great improvements in water quality, not only in the harbor, but in Massachusetts Bay as well. After all, there is no wall between the harbor and the bay. The pollutants which now flow into the harbor are carried into the bay on the outgoing tide.

We are pleased at the recent biological opinion issued by the National Marine Fisheries Service which corroborates the conclusions of these earlier reviews, in particular, the conclusion that the outfall is not likely to jeopardize endangered or threatened species.

The harbor project has already produced noticeable benefits. New pumping facilities at Deer Island have reduced discharges from combined sewer overflows. The discharge of sewage scum into the harbor ended in 1988, and the discharge of sludge was terminated in 1991. Further improvements will come as the new Deer Island treatment plant begins to come online, starting with the first half of primary treatment next summer.

It is important to understand EPA's role in this process. As a plaintiff in the Clean Water Act enforcement case against the MWRA and the Commonwealth, and as a Federal Regulatory Agency, EPA's role is to ensure compliance with the nation's environmental laws. It is our responsibility to make sure that the facilities needed to clean up the harbor and the bay are constructed. We do not design or construct those facilities ourselves. Our mandate is to review the facilities designed by the MWRA and to ensure that they will achieve compliance with the Clean Water Act and other environmental laws.

EPA began its review of the proposed MWRA outfall in 1986. We conducted an intensive study of the potential impacts of the outfall on the Massachusetts Bay ecosystem. The study examined the potential for effects on water quality, sediments, plankton, fish, marine mammals, endangered species and other aspects of the marine environment.

As part of this process, EPA initiated a consultation with the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service, concerning impacts on endangered species. During that consultation, EPA notified NMFS in writing of a plan to incorpo-

rate an Endangered Species Act biological assessment into its environmental impact statement. That approach is specifically encouraged by regulations implementing the Endangered Species Act.

Mr. Chairman, as you know, there has always been great public interest in the proposed outfall. After EPA issued a draft Environmental Impact Statement, it received a number of written comments from the public and from environmental groups. Many of these comments urge that the outfall be located even farther into Massachusetts Bay than proposed by MWRA.

After a detailed analysis, the EPA concluded that MWRA's proposal was environmentally sound and that the outfall would not have a significant long-term effect on Massachusetts Bay. Because the effects of the outfall would be limited to a small area around the diffusers, far removed from the preferred habitat of endangered species, EPA concluded that such species would not be impacted.

The record of decision for the final Environmental Impact Statement was issued in 1988 and construction of the outfall began in 1991. In late 1991 EPA began to draft a discharge permit for the new outfall. The permitting process triggered requirements for a new Endangered Species Act review. At the same time, residents of Cape Cod began to raise questions about the potential impacts of the outfall and various parties requested that EPA undertake a comprehensive biological assessment under Section 7 of the Endangered Species Act.

Given the level of public concern, as well as the availability of updated scientific information about endangered whales, EPA decided that it would be appropriate to prepare a new assessment. The development of the biological assessment was not an easy task. The marine environment is a complex system. Our evaluation of the potential impacts of the outfall required expertise in diverse scientific fields. We relied on experts both inside and outside the agency to assemble and evaluate a large body of scientific evidence. The deadline of completion of the assessment had to be extended twice because of the magnitude of the task.

The final result of our analysis was a 300-page impact assessment which cites more than 700 scientific sources, and concludes that the outfall is not likely to adversely affect endangered or threatened species, including the humpback and right whales.

The biological assessment was forwarded to NMFS for their review. On September 15th, NMFS issued its biological opinion which presents an independent analysis of the scientific evidence.

[The prepared statement of Mr. Kotelly can be found at the end of the hearing.]

Mr. STUDDS. I hate to interrupt you, sir, but your red light is on. If you will conclude.

Mr. KOTELLY. All right. I will conclude with that statement.

Mr. STUDDS. Thank you very much.

As you may have noticed, our distinguished Junior Senator has arrived, along with a note saying that Congressman Saxton is fogged in in Philadelphia. It serves him right. We will do it without him. He is the ranking Republican member of this Subcommittee. He will be fully apprised of what is going on. I am going to—because his own schedule is very packed today, I am going to interrupt, if I may, with the permission of the witnesses, and allow Sen-

ator Kerry, who will not be able to stay with us for the entirety of this hearing, to make a statement of his own, and then welcome him to stay as long as he would like.

## STATEMENT OF THE HON. JOHN F. KERRY, A SENATOR FROM THE STATE OF MASSACHUSETTS

Senator KERRY. Well, Mr. Chairman, thank you very much. It looks like all of the Phillies fans are fogged in today. I can understand why Congressman Saxton is not here.

I appreciate your courtesy in letting me come and share just a few words. I ask the indulgence of the various panelists to permit me to do so and apologize for the fact that my schedule does not permit me to stay. I did want to come because this is an issue that has greatly concerned you and me particularly, as sort of respective branch members of the Massachusetts delegation on the committees or jurisdiction. I personally applaud your leadership and sensitivity to all of the issues of concern here. I think you have balanced them extraordinarily effectively and we are all appreciative of your position of Chair of this vital Committee.

As the Vice Chairman of the National Ocean Policies Study Subcommittee on the Commerce Committee and the Senate, I have been able to work closely with you on a number of the issues of concern here. We have been able to get $500,000 to the Geological Survey for very important monitoring. We have been able to, after about seven or eight years of work, get the Stellwagen Bank Sanctuary officially designated. That is not insignificant in the context of the issues that bring us here today. Because, clearly, we did that with an overall view to the long-term sanctity of the ecosystem. It would be mindless and, in fact, negligent to the point of perhaps even generational criminality if we were to have done that only to wind up affecting the ecosystem through other well-intended and well-meaning steps that we take. I know you share that view, which is why you are here.

In addition, I crafted an amendment for NOAA which will help frame the monitoring and baseline establishment. I think that is really vital to our capacity to proceed. I am not an expert, and I don't come here to make any comments with any pretense to being an expert. Perhaps our virtue is that we sit there and gather information from all sides and try to sift through it.

The recent biological opinion raises questions, but, at the same time it answers questions. I think it is most important—and the reason I wanted to come here today is to applaud the process that brings together EPA, the Geological Survey, NMFS, the Congress, and the Massachusetts Water Resources Authority; all of the entities which are so critical to, in the future, making judgments about the opinions that have been laid out so far. They are opinions. It is called an opinion, it is indeed an opinion. There is no sufficient science at this point that frankly, in my judgment, answers all of the questions raised to anybody's satisfaction with certainty. That means that the effort that must now be put in place is the most competent, the most accountable continued monitoring and data gathering and decisionmaking process. So, it is particularly healthy that all of those entities are here today to understand that, from

our vantage point as public policymakers, we are going to be held accountable for what happens, based on your ability to make this process work in these next months and years.

While I have read much which suggests to me that the computer models are pretty good, and while there are 10 biological experts from the Government who have reviewed the opinion and data, and while there is much to suggest that indeed whatever nutrient-overloading might take place might be at the end of the outfall pipe and not move down onto Stellwagen Bank, I would be less than candid if I did not say that, just from a human perspective and measured against Murphy's Law, there is always this fear that the models may not take everything into account—that mother nature may work her will in other ways and currents may shift and things may happen. Therefore, I feel that the monitoring is really critical, and the speed of it, the competency of it, the reporting of it, I think is key to come out of here.

I hope that that will be the real accomplishment of this hearing today—it is not so much that new science is going to be answered, because I personally don't think it will be provided—but much more that a process can be put in place so the interests of all Capers—and the interests, incidentally, of our folks on the Cape are the interests of everybody in the State and everybody in the country—will be taken into consideration. They are the interests in our heritage and in the viability of that ecosystem being maintained. They are right to be vigilant and to be concerned. The interests of Quincy and the folks here in this bay are correct to push for this harbor process to be completed. The interests of every community affected by the MWRA and the costs are right to ask us as public policy people to measure those costs against impact and so forth.

So, there are no villains here I think. This is not a process that ought to seek to finger-point or find villains. It ought to guarantee that most of those interests or all that can be are satisfied by this public process. I think a rather extraordinary journey has been embarked on beginning 20 years ago with the Clean Water Act, right up through the court process and the judgments that have been made to bring us all here today, Mr. Chairman.

So, I salute you for having brought all of the interested parties together and my counsel to this assembled groups of experts. Let's not get lost on detail of one particular scientific assertion versus another. Let's guarantee that the contingency planning is done. Let's guarantee that the minimal cost alternatives within those contingency plans are properly analyzed and laid out. Let's guarantee that the best baseline possible is established with the best data possible and let's guarantee that the monitoring is second to none so that, if we have to shift gears at some point in time, we know how, we are prepared to, and it is done with consensus, not with recrimination.

Thank you, Mr. Chairman.

[The prepared statement of Senator Kerry follows:]

STATEMENT OF HON. JOHN F. KERRY, A U.S. SENATOR FROM MASSACHUSETTS, AND CHAIRMAN, COMMITTEE ON FOREIGN COMMERCE AND TOURISM

I would like to commend the distinguished Chairman of the Merchant Marine and Fisheries Committee, Congressman Studds, for convening this most important hearing today. This hearing is of particular importance in that it brings together many of the key parties, especially the Federal agencies, involved in this issue to answer questions and clarify written material. I applaud the Chairman's efforts and commitments to this issue; I know of no Member of Congress more committed to issues of marine protection than Gerry Studds. I appreciate you affording me the time today to present a brief statement outlining my continued interest regarding the long-term health of Massachusetts and Cape Cod Bays.

I certainly share the concern of South Shore and Cape Cod residents and feel that we must be wary of the impact of any solutions to cleaning up Boston Harbor that will have an adverse effect on the quality of Massachusetts and Cape Cod Bays. It is crucial in forging environmental cleanup solutions we do not merely shift pollution from one area to another, and we must strive for real solutions. Any and all actions affecting the Massachusetts and Cape Cod Bays should be judged on the effect to the overall sustainability of this region. Boating, fishing, and swimming and other ocean and shoreline commercial and recreational activities are what make our State such a beautiful, enjoyable, and viable place to live. This quality of life must be preserved and future generations of both humans and animals must be able to use and enjoy these resources as we are able to do so today.

I understand that this hearing today focuses on the issues raised in the National Marine Fisheries Service's (NMFS) Biological Opinion on the effects of the discharge of the effluent from the Massachusetts Water Resources Authority (MWRA) proposed outfall pipe on endangered species. While the NMFS opinion ultimately concludes a no-jeopardy opinion, meaning that the proposed outfall pipe will not be halted due to violations with the Endangered Species Act, it does raise many significant issues of concern.

The NMFS opinion delves into great detail regarding the ultimate questions and uncertainties that remain outstanding regarding the viability and productivity of Massachusetts and Cape Cod Bays as a result of the discharge from the proposed MWRA outfall pipe. I am sure that Congressman Studds and the many esteemed experts here today will go into much greater detail with their statements and questions. However, I would like to make a few general points.

One fact I am sure of today is that we will not walk away from this hearing with any more definitive answers regarding the science as to the long-term effects of the proposed outfall pipe. These issues are extremely complex and do not lend themselves to any simple or immediately satisfactory answers. What I believe can be accomplished today is receiving stronger commitments and assurances that the addition studies, monitoring, and a contingency plan documented by NMFS is acted on and carried out. I am grateful that the National Marine Fisheries Service (NMFS), the Environmental Protection Agency (EPA), the U.S. Geological Survey (USGS) and the Massachusetts Water Resources Authority (MWRA) are represented here today to respond to questions concerning the continued efforts necessary. We must be able to fully and confidently measure the ongoing effects of this proposed outfall to the marine ecosystem which includes the marine mammals.

In their Biological Opinion, NMFS specifically details a host of conservation recommendations. These recommendations include contingency planning, addition studies needed and necessary monitoring issues. I am particularly interested in the response to all of these issues raised and commitments as to who should be primarily responsible for implementing these measures. Of special concern remains the insufficient far-field monitoring in areas, especially at Stellwaggen Bank and Cape Cod Bay.

As the Vice-Chair of the Senate National Ocean Policy Subcommittee, I have worked hand-in-hand with Congressman Studds over the years on a host of coastal issues. In this purview, I have helped pass a $500,000 appropriations for the U.S. Geological Survey to study sediment transport and residual pollution effects in Massachusetts Bay, and I crafted an amendment to involve the National Oceanic and Atmospheric Administration (NOAA) in testing baseline data and provide monitoring assistance. I consider these efforts pieces of a larger, more holistic approach which is essential for the long-term viability of Massachusetts and Cape Cod Bays.

I worked long and hard with Congressman Studds to bring about the designation of Stellwagen Bank as a National Marine Sanctuary. The demonstration of support and level of advocacy for this designation confirms for me the deep care of individuals for the protection of this most important habitat. I am thrilled that the years

of advocacy for this designation paid off; however, we must follow through with our commitment to protect this region and do all that is possible to prevent any degradation or altering of this acknowledged significant ecosystem, home to many special marine mammals and fish species. I regret that my schedule does not allow me to remain to listen to the remainder of the proceedings today. However, I look forward to reviewing a full transcript of the hearing held today and respectfully request of Chairman Studds to receive this as soon as available.

Mr. STUDDS. Thank you very much, Senator Kerry. I appreciate it. I appreciate working with you and your staff on this matter. I hope you will stay as long as your schedule will permit. Winter is coming on the Cape, so they might find a villain or two. You never know.

We will return to the list as it is here with Mr. Doug MacDonald, Executive Director, of all things, of the Massachusetts Water Resources Authority. Mr. MacDonald, welcome.

## STATEMENT OF DOUGLAS B. MACDONALD, EXECUTIVE DIRECTOR, MASSACHUSETTS WATER RESOURCES AUTHORITY

Mr. MACDONALD. Congressman Studds, Senator Kerry, ladies and gentlemen, before I start, I would just like briefly to say to you and Senator Kennedy and Chairman Moakley and other members of our delegation in Washington, how much we appreciate your continuing assistance on a whole range of matters under the Clean Water Act that are presented in connection with our project, and particularly how much we appreciate your strenuous assistance on behalf of additional funding for the project from the Federal Government. That is, of course, intimately tied in with some of the issues that we see here today. I will go on with the rest of my prepared testimony. I did not want both of you here without thanking you for that and asking for your continued help and assistance.

I am the Executive Director of the Massachusetts Water Resources Authority. As you know, the MWRA was created to rebuild the region's crumbling water and sewer infrastructure and to implement the long delayed plan to restore water quality in Boston Harbor and Massachusetts Bay. As such, we have welcomed the recent biological assessment and the biological opinion. They essentially confirm the compliance of the plan's secondary treatment facilities and the Massachusetts Bay Outfall Tunnel with the legal requirements of the Endangered Species Act.

When I first took over as the Executive Director of the MWRA, very early on, I traveled to Cape Cod to confront what was then and remains a top priority issue for the MWRA. For months prior to that, the Agency had been at odds with interest groups on the Cape and elsewhere about the potential impacts of the outfall tunnel on Massachusetts Bay and Cape Cod Bay. We promised to listen. We asked, in return, that we be listened to. We have tried to take all of the concerns seriously and to answer them and address them as honestly and as straight-forwardly as we could. Obviously, not every question will ever be answered, but the overwhelming weight of the evidence today suggests that there is no threat to the Massachusetts Bay marine ecosystem, as presented by the outfall—and to add to my prepared testimony here, I would like to already take the words of the Conservation Law Foundation and to reiter-

ate that that statement prevails given the currently available scientific information.

In Boston, we are already witnessing how a fragile estuary can come back to life when we implement pollution prevention measures. The cessation of sludge discharges to the harbor in 1991 when the new fertilizer plant opened has resulted in a significantly cleaner water quality in the harbor. Improvements to MWRA and local water systems and sewer systems and dramatic reductions in toxics discharged by industry have yielded healthier flounder, lobsters and other marine life, as previously dead areas of the harbor now provide habitat for the bottom of the food chain. In addition, harbor beaches have been opened for swimming more frequently this past summer than at anytime in the past 50 years.

While we can all be proud of these recent achievements, by far the most dramatic improvements are yet to come, with the completion of the new treatment facilities and the relocation of the effluent discharged out of the shallow waters of the harbor, where their impacts are so negative, both to the harbor and to the bays. It is for this last reason that clearing the hurdles of the Endangered Species Act, that the biological assessment and the biological opinion are so important.

Now, on two key points contained in the NMFS opinion. On monitoring. We MWRA ratepayers are now funding an extensive program of monitoring in Boston Harbor and Massachusetts Bay. We collect samples 214 days a year. About half of these days are spent sampling in Massachusetts Bay. We collect 10,000 samples, which yield 200,000 chemical results annually. Analyses are published regularly and widely reviewed, and our water quality model is continuously fine-tuned with the testing results. Our annual outflow monitoring budget is $2.5 million. These investments have leveraged about a million dollars in annual funding from USGS and NOAA's Sea Grant Program, and the Massachusetts Bays Program has contributed another million dollars.

Our ratepayers will continue to do their part, but opportunities must be created for others to participate. We are heartened that up to $200,000 for monitoring and research will be available through the newly designated Stellwagen Bank National Marine Sanctuary. Thanks, Congressman Studds, to you for that.

EPA has received a special $400,000 appropriation to study eutrophication. Additionally, the Commonwealth Open Space Bond Bill includes $7 million for coastal monitoring. Other moneys are available from the Federal Government, including potentially, defense conversion money.

To finish quickly and talk for a moment about contingency planning, which I am sure we will have an opportunity to talk about in the question period. We are committed to contingency planning. I think the comments of Mr. Kotelly about the appropriate scope of contingency planning are well-taken. We intend to work with everyone involved to see that the contingency plans are soundly conceived and drawn.

We are very interested, as we have explained to the staff and discussed on other occasions, in the application of the principles of trigger planning to contingency planning. We can talk a little bit more about that if you would like.

In conclusion, the NMFS opinion provides a level of expert review which allows MWRA's projects to go forward in hopes of delivering on its promise of a healthier marine ecosystem for both the harbor and the bay. We look forward to a continuing partnership with all of the concerned agencies, organizations, and individuals to implement the conservation recommendations and to make sure our new facilities work—the most important issue of all, both for our customers and the environment we are charged with protecting.

Thank you for the opportunity to testify.

[The prepared statement of Mr. MacDonald can be found at the end of the hearing.]

Mr. STUDDS. Thank you very much.

Next, Mr. Bradford Butman of the U.S. Geological Survey. Mr. Butman.

## STATEMENT OF BRADFORD BUTMAN, U.S. GEOLOGICAL SURVEY

Mr. BUTMAN. Good morning. My name is Bradford Butman. I am the Chief of the U.S. Geological Survey's Branch of Atlantic Marine Geology. I would also like to introduce Dr. Rich Signell, who is the principal investigator of the modeling studies which I will be describing to you this morning.

I would also like to express my gratitude that the red light is not hooked directly to a trap door which leads to Boston Harbor and that the red light is not the death knell.

Mr. STUDDS. An intriguing idea, though.

Mr. BUTMAN. I would also like to acknowledge the support of Mr. Studds and Mr. Kerry for the USGS studies over the last few years.

Computer modeling of the circulation has been a central component of the USGS program designed to understand the transport and accumulation of contaminated sediments in Massachusetts Bay. Historically, oceanographic measurements have been the cornerstone of our understanding of currents and water properties. In coastal areas it is often difficult to obtain measurements in sufficient detail and frequency. In recent years, however, significant progress has been made in the development of numerical circulation models which are able to effectively simulate and predict transport processes which operate in coastal areas. Due to the complexity of the driving forces and topography in Boston Harbor and Massachusetts Bay, the circulation model provides one of the best mechanisms for understanding how material released from the new outfall pipe will be subsequently transported and diluted. The model provides unprecedented capabilities to investigate the complex Massachusetts Bay system. We are pleased and excited about the insight it has provided so far. As you know, the results were used extensively in the biological opinion.

I will present some of the highlights of the model studies to you this morning. You will find a more complete description of the technical details of the model in the written statement.

We use a dilution of 1:400 (one part effluent to 400 parts sea water) to indicate the effects of the outfall. For the nutrient nitrogen, these concentrations are typically smaller than the natural variability of the ambient levels and thus represent a reasonable

level beyond which the effect of the new outfall should be minimal. We illustrate the effect of the effluent at a given location by the percentage of time that effluent is more concentrated than 1 to 400 dilution is found at that location. Note that for toxics, a dilution of 1 to 30 meets water quality criteria and, thus, the 1 to 400 dilution, which we are showing here, is 12 times more dilute than required by water quality for contaminants.

I direct your attention to panel one to your right.

During winter the water is vertically well-mixed, and surface values represent levels throughout the water column. Effluent more concentrated than the 1 to 400 level from the existing outflow occurs more than 80 percent of the time in a region which includes all of Boston Harbor and the South Shore, as far as the North River. In contrast, effluent more concentrated than the 1 to 400 level from the proposed outfall is found more than 80 percent of the time in a much smaller region about 10 kilometers in diameter offshore. For both outfall locations, effluent more concentrated than 1 to 400 is found chiefly in Western Massachusetts Bay and never found around Stellwagen Bank or Race Point for this four-month simulation.

I call your attention to panel two. During the summer the simulation shows that the effluent from the existing outfall tends to remain in the lighter surface layer, while effluent from the proposed outfall tends to remain in the heavier lower layer. The figure shows the 1 to 400 dilution for the existing outfall on the left at the surface and for the proposed outfall at 15 meters depth on the right. The areal extent of the deeper waters typically affected by the proposed outfall is significantly less than the areal extent of the surface waters affected by the existing outfall. As in the winter months, effluent more concentrated than 1 to 400 is never found around Stellwagen Bank or Race Point.

For the first time, the numerical model is capable of representing the stratified summer conditions. We have produced a very short video which I would like to show you this morning, which gives a feel for the variability of the effluent distribution during a two-month summer period. The video shows two dilution levels, 1 to 200 and 1 to 400.

Mr. STUDDS. You think you have found a loophole in our proceedings here, I see.

Mr. BUTMAN. We might make it. The video shows Massachusetts Bay viewed from the southeast. Boston is in the upper left center of the screen and the tip of Cape Cod at the lower right center. The red surface shows the boundary of the dilution contour for effluent introduced at the present outfall. The areas to the left or west of this surface are concentrations in effluent in excess of 1 to 200. The blue surface shows the boundary for effluent introduced at the proposed outfall. The date is shown in the upper right-hand corner. In this simulation, one week takes about 10 seconds.

So, now we will run the simulation. We are viewing the simulation showing the 1 to 200 dilution. Each simulation for two months is going to be repeated five times, so take a moment to get oriented. For the existing outfall, concentrations of effluent in Boston Harbor are always in excess of one part effluent to 200 parts sea water, to the left or west of the red "curtain". The effluent spreads

out on the surface and often reaches the location of the new outfall.

For the proposed outfall, the effluent, shown in blue, remains in the lower layers and is concentrated within about 10 kilometers of the site. You can see the smaller area of high concentrations for the new outfall compared to the present outfall. The variability in the effluent concentration is a result of wind, freshwater flow and forcing from the Gulf of Maine which affect the plumes around in western Massachusetts Bay.

Mr. MACDONALD. That is what I was thinking. Where does it go? That is the big problem that we always have with toilets. Where does it go?

Mr. STUDDS. It just keeps dropping off toward the canal there.

Mr. BUTMAN. It gets more and more diluted.

We are now viewing the simulation showing the 1 to 400 dilution. Because the effluent is now more dilute, the surfaces occupy a much larger area. Concentrations of the effluent introduced from the present outflow are, again, always in excess of the one to 400 level in Boston Harbor. The high concentrations often extend past the proposed outfall site over Stellwagen Basin. The effluent introduced at the proposed outfall stays below the thermocline. There are occasional movements of the 1 to 400 dilution contour southeastward toward Cape Cod Bay. The more rapid movement of the effluent from Boston Harbor is caused by the stronger currents in the upper layer compared to the lower layer in summer.

In summary, for the near-field, the model simulation shows that effluent concentrations are always in excess of 1 to 200 in Boston Harbor and, for the proposed outfall, these high concentrations are restricted to a smaller area offshore.

In the far-field, Stellwagen Bank is not frequented by effluent more concentrated than 1 to 400, actually less than 1 percent of the time for the existing outfall and never for the proposed outfall. Cape Cod Bay was infrequently visited by effluent more concentrated than 1 to 400. In winter these levels were exceeded less than 40 percent of the time for the existing outfall and less than 20 percent of the time for the proposed outfall. In the summer, these levels were not exceeded by the existing outfall and less than 5 percent of the time from the proposed outfall.

I thank you for the opportunity to present these results and look forward to presenting results of the additional USGS studies in the future.

[The prepared statement of Mr. Butman can be found at the end of the hearing.]

Mr. STUDDS. Well, congratulations. You have found the soft spot of this Subcommittee. Anybody who comes up here with maps and charts and videos, we always give them a little extra.

Mr. BUTMAN. I thank you for the additional time.

Mr. STUDDS. Maybe it is a good thing Congressman Saxton did not get here. Because, as I read that, it sort of goes through the canal and heads to New Jersey. I will ask you later—I am very worried about where it is going—into someone else's State it looks like to me.

Mr. BUTMAN. Rich is here to answer those questions.

Mr. STUDDS. Thank you very much.

Mr. Scott Kraus of the New England Aquarium. Mr. Kraus.

SCOTT KRAUS, NEW ENGLAND AQUARIUM

Mr. KRAUS. Thank you. I appreciate the opportunity to testify. I am speaking today on behalf of myself, John Prescott and the Aquarium. We have been following the MWRA studies and consulting with them over time. In general, we concur with the NMFS biological opinion that the proposed outfall may affect but will not jeopardize the continued existence of any endangered or threatened marine mammal species in Massachusetts Bay.

My expertise is in right whales and, to a lesser extent, on the harbor porpoise. I will confine my comments today primarily about right whales. With regard to right whales, we believe that the limited information available is consistent with this opinion, but that there are significant gaps in the data which we trust. These gaps, at this point, are not enough, at least in our opinion, to be considered significantly reservations to continuing with the outfall. They do represent what we would consider the best information available, which in a couple of cases is pretty poor.

First of all, the distributional data on all whale species, but particularly right whales around the outfall site is very poorly known outside the whale watching season, which extends really from May to the end of October or middle of October. Between November and May, a period when right whales are known to be inhabitants of nearby Cape Cod Bay, no systematic surveys for marine mammals have been conducted in the outfall area. There are platform of opportunities records, people who have been hired to be on boats and keep an eye out, but systematic surveys of the region have not been done.

The early CeTAP survey done between 1979 and 1982 actually only had six aerial survey tracts over the region. They did not see anything. They missed, in fact, the right whale distribution in Cape Cod Bay that cannot be considered systematic. Therefore, the potential for direct contact between endangered whales and outfall effluent is unknown. Statements indicating that the whales are not common in the near-field or the proposed outfall, which is in the NMFS biological opinion, or that there is a low probability of these species encountering high levels of nutrients and contaminants from the new outfall because the endangered species are not known to frequent this particular area of Massachusetts Bay, which is an EPA assessment, are both overstated.

The bottom line is that neither the EPA or NMFS have any scientific basis for making those statements and the lack of knowledge about winter whale distribution in the region is a bit unsettling.

Secondly, the question of cumulative impacts or effects is not well-addressed. It is not anybody's fault that it is not well-addressed, it is just that it is almost impossible to address it. There are other significant problems for right whales in the region, including collisions with ships and entanglements with fixed fishing gear. Really, of more concern in this regard, is the cumulative impact of urban and industrial outfalls along the East Coast of the United States.

The right whale is the species in the North Atlantic which most frequently occupies the coastal zone of the North American Continent. As such, it travels basically from Florida to Nova Scotia in the near zone. In fact, the component of the population that travels in the near shore region are primarily mothers and calves and juveniles. So, basically, the reproductive component of the population is that component of the population which is also most vulnerable to whatever we do along the coast of the United States.

Having said all of that, right whales live pretty low on the food chain. Our studies on toxics in the tissues of right whales have indicated that they are relatively low compared to other marine mammals. Nevertheless, it is a matter of concern that we do not know thresholds for impact on reproductive success or the whole population biology and dynamics of toxics or contaminants in the food chain as they relate to right whales. The monitoring recommendations and the biological opinion are, therefore, particularly important in addressing these questions.

Finally, one of the reasons that there are so many questions about right whales and the potential effects of the outfall is that independent research efforts have been limited over the last five years. Studies on food chain effects and population biology and human effects have been in the agenda of right whale researchers since 1986. They are identified as high priorities in the recovery plan published by NMFS in 1991.

The conservation recommendations outlined in the biological opinion are essential to determine how the MWRA outfall affects marine mammals. In our opinion, if the American public wants right whales around in a hundred years, we suggest the Congress allocate additional funds for management and independent research on this species to allow NMFS to fulfill the mandate of the recovery plan. We also suggest an implementation of the recovery plan be expedited and that inter-agency cooperation and outside peer review of both research and management actions become an essential part of that implementation. These actions will ensure sound management responses to projects like the outfall and effective mitigation of all threats to the right whales.

Thank you.

[The prepared statement of Mr. Kraus can be found at the end of the hearing.]

Mr. STUDDS. Thank you very much, sir.

Now the State's and perhaps the country's other reigning expert on the critter we are focused on, Mr. Charles Mayo of the Center for Coastal Studies in Provincetown. Mr. Mayo, welcome.

## CHARLES MAYO, CENTER FOR COASTAL STUDIES

Mr. MAYO. Thank you. Mr. Chairman, thank you, and thank the members of the Subcommittee for offering this opportunity to comment on the biological opinion. Like many, I have enthusiastically supported the Boston Harbor cleanup. I have, at the same time, had some reservations regarding the potential impact which such a project might have on the coastal waters of the Commonwealth, particularly on the critical habitats of the fisheries and, of course, of the right whale.

Let me emphasize that I am supportive of the Boston Harbor cleanup. However, as we devise ways to right past errors in Boston Harbor, we must not be any less rigorous in what should, I believe, be our parallel efforts to assure the future of the bays and of the habitat of those whales. After all, Boston Harbor would not be in its sorry state if years ago we had not rushed to correct one pollution problem by in fact creating another.

For the past nine years my research has focused on the habitat use patterns and population characteristics of the northern right whale within the Cape Cod and Massachusetts Bay's ecosystem. The right whale population of the North Atlantic is depleted. Its numbers have declined, some suggest, to less than one one-hundredth of the pre-whaling levels. The recovery rate remains exceedingly low, in fact, low after many decades, after whaling had finally ceased. Possibly this is because of other perils, because of gear entanglement, collision with vessels and the fouling and elimination of critical habitats.

We know, for instance, that whales were once common, before the 1600's, in the eastern North Atlantic. Now they are gone from the Bay of Biscay, from the Coast of Norway and from the shores of North Africa. In the western North Atlantic today, we may be viewing the last stand of the great right whale, for no longer do they feed or nurse in their old haunts, in the shallows of Delaware Bay, in the Chesapeake and Long Island Sound. Yet, the last right whales still do visit North America. For, among the few remaining habitats they still use, they come to the coast of Massachusetts, to the bays where the sewage from Boston has and will be discharged in the hundred million gallon lot.

We know from our studies that probably more than two-thirds of the remaining 325 or fewer right whales left in the entire North Atlantic Ocean visit the bays to feed on the rich plankton, to socialize and to nurse their young. As the right whale is clearly one of the most severely imperiled of the great whales, and as the bay's system is one of its few remaining habitats, I propose to you and to the Subcommittee that we cannot take any chance with the bay's ecosystem. We must assure its future by both cleaning up the harbor and by coping with the uncertainty which dominates our management, such as it is, of the coastal waters, by instituting a rigorous monitoring plan.

The biological opinion correctly recognizes what has been given little emphasis by Government agencies in the past—that coastal ecosystems, which are so very important to human and animal societies are unfathomably complex and, in spite of our efforts, nearly impossible to truly manage. So, absent an iron-clad predictive model of coastal ecosystems and yet confronted by the pressing need to clean up Boston Harbor, it may well be that the MWRA project is the best present-day solution. We must acknowledge, as the biological opinion has, that the consequences of the project are not absolutely known, while the consequence to the right whale of an error in our prediction may, in a very real sense, be absolute.

In recognition of these conditions, the biological opinion recommends, in general terms, the monitoring of right whale habitat. With regard to these recommendations, I respectfully encourage the following: One, that the recommendations be fully implement-

ed; two, that monitoring of right whale habitat begin immediately. I think this is very important. It is very late in the game, after all. Our knowledge of any change in the ecosystem will be only as good as our description of conditions before the outfall is online. Accurate study of the pre-outfall conditions and the response of the whales and their resources must begin now. It should have begun a long time ago.

Three, that monitoring of the habitat and the plankton resources associated with the whales' feeding area be made part of the discharge permit and be tightly coordinated with the ongoing bay-wide studies that have been referred to before; and finally, four, that design of whale habitat studies be constructed to make use of present knowledge of the species with respect to scale, distribution and occurrence of feeding and non-feeding activities.

In closing, the development of a good monitoring plan for right whales, their resources and habitat may trap the unforeseen changes and delicate balances on which these whales depend. Implementation of such a plan will require haste, commitment, coordination and funds and, last, the focused encouragement of officials from Federal, State and private agencies.

Just a last comment.

Mr. STUDDS. The red light does not apply to constituents of mine.

Mr. MAYO. OK. I did not bring a video. I am sorry. Just a comment though in closing, and that is that the right whale may indeed be the canary in the mine. We often talk about that. Let me point out that, if we do not listen to the canary, we do not hear what it is telling us about the habitats of our precious bays. My hope is that monitoring will give us at least some ear to hear what they are saying about this system that is so important to us and to the whales.

Thank you.

[The prepared statement of Mr. Mayo can be found at the end of the hearing.]

Mr. STUDDS. Thank you. That was very eloquent.

Ms. Alix Ritchie, speaking for the Cape Code Commission. Welcome.

## ALIX RITCHIE, CAPE COD COMMISSION

Ms. RITCHIE. Thank you, Mr. Chairman, Senator Kerry. Thank you very much. Thank you for this hearing. My name is Alix Ritchie. I am a member and the immediate past chair of the Cape Cod Commission. I am also the President of the Association for the Preservation of Cape Cod. I am pleased to be here today on behalf of Barnstable County and the Cape Cod Commission, to comment on the biological opinion. My remarks are based on an analysis that has been performed for Barnstable County by a panel of five scientists selected for their expertise and special qualification in fields relevant to this review.

The Federal Government has already highlighted the national significance of Massachusetts and Cape Cod Bays by taking three important actions: Designation of the Bays as an estuary of national significance; designation of Stellwagen Bank as a national marine sanctuary, and thank you for that; and proposing the desig-

nation of eastern Cape Cod Bay as a critical habitat for the right whale.

Cape Codders have always been aware of the productivity and value of Cape Cod and Massachusetts Bays and Stellwagen Bank. Concern for the region's resources, and for the long-term impact that the proposed MWRA project may have on this system, particularly on the endangered and threatened species it supports, have led regional and local governments on Cape Cod, as well as many individual Cape Codders to carefully scrutinize the MWRA proposals.

Residents' concerns led Barnstable County's legislative body, the Assembly of Delegates, to pass a resolution in November 1991, a copy of which was submitted for the record, outlining the county's major concerns regarding the use of the MWRA outfall facility. The resolution includes a set of specific actions to be taken to protect the bay's ecosystem. Many of these actions are embodied in the conservation recommendations and additional studies specified in the NMFS opinion. We are pleased to see that NMFS agrees with the county's call to action. We believe that these measures are vital to the protection of our endangered species.

As part of the Cape's ongoing evaluation of the MWRA project, the Barnstable County Commissioner Science Advisory Panel, SAP, another acronym here, reviewed the EPA's work plan for the biological assessment, the assessment itself and the biological opinion. Copies of these documents have been provided to you. NMFS considered the SAP's comments in preparing the opinion and incorporated many of the issue raised in their reports, in the conservation recommendations and additional studies.

Before reviewing with you some of our specific comments on the opinion in the conservation recommendations, I would like to make three points regarding the process that has culminated in this decision.

First, the intent of the consultation process under Section 7 of the Endangered Species Act is to determine the project's potential impact on endangered and threatened species and their habitats prior to an agency's making irretrievable commitments of funds to the project. In this instance, however, NMFS conducted its detailed consultation and rendered an opinion after the Army Corps of Engineers had issued a construction permit for the outfall tunnel, and after the MWRA had committed more than $400 million and had begun construction of the tunnel. Important decisions had been made regarding the location and the engineering of the outfall and significant moneys had been spent on the project. Thus, we believe there was an irretrievable commitment to the project before this opinion was rendered, implicitly limiting the field of alternatives and mitigation options considered by NMFS.

Second, we are concerned that this process has been based on the underlying assumption that where there is conflicting credible scientific evidence of where there is uncertainty regarding impact, the benefit of the doubt goes to the project. This appears to us to be in conflict with the intent of the act in which the benefit of the doubt was to go to the endangered and threatened species and their habitat.

The county's SAP agreement with the NMFS no-jeopardy finding is valid only—and I emphasize only—under the assumptions regarding the process as outlined in the fact sheet accompanying the biological opinion. I would like to quote the SAP report. "All SAP members agree with the finding of no jeopardy, however, the constraints leading to this finding, as annunciated in the fact sheet accompanying the opinion, were new to the panel, and had not been enunciated before the SAP. The agreement of SAP members on the finding of no jeopardy is linked with these ground rules."

Finally, we believe very strongly that the analysis which forms the basis of this opinion is flawed, in that it did not consider whether existing conditions in Massachusetts and Cape Cod Bays are contributing to the threat to the endangered and threatened species and their habitats, thus whether NMFS should approve any action which may also pose a threat. Both the biological assessment and the opinion describe the degradation that has occurred in the bays and the impacts that will result from the discharge. This is particularly going to reference the right whale recovery plan which refers to the general degradation of coastal marine habitats and may ultimately be the most important factor affecting the recovery of the northern right whale.

We praise the biological opinion for its thorough treatment of a number of the issues. We believe that all of the conservation recommendations and additional studies are critical to the determination of whether future operations will jeopardize the continued existence. We emphasize that these should be completed prior to discharge for those that are called for.

In addition to the recommendations, we would like to highlight four things I will summarize quickly. First is an independent far-field monitoring program, which must be developed and implemented prior to the operation of the outfall; that meaningful change in the environmental conditions which affect threatened and endangered species must be defined; clear goals and objectives must be identified for monitoring to be meaningful; and a management process is totally inadequate without a definition of meaningful change.

Second, we agree on the importance of contingency plans, and we recommend that contingency plans also address needed actions as a result of any breakdown in the facility—and we emphasize specificity, in terms of allowed treatment levels, timeframes, and alternative upgradings; third, we are concerned about the effect of growth on the system, the opinions, findings, note the lack of consideration given to growth. We believe that productive growth should be included.

Finally, I would like to note quickly that we understand that there are additional costs here. We believe that costs should be shared. We are concerned that what is being addressed here is an issue of assessing difficulties and of impacts in a remote location and understanding them before it is too late. We agree that dead whales are not a good measure of adverse impacts; but it is unclear as to what the appropriate indicators are and how they are to be measured. We feel we are still left with a critical question unanswered, which is how do we prevent harm from becoming jeopardy, and jeopardy from becoming disaster?

[The prepared statement of Ms. Ritchie can be found at the end of the hearing.]

Mr. STUDDS. Thank you very much.

Finally, on the panel, Mr. Peter Shelley of the Conservation Law Foundation. Mr. Shelley.

## STATEMENT OF PETER SHELLEY, CONSERVATION LAW FOUNDATION

Mr. SHELLEY. Thank you, Mr. Chairman, members of the Subcommittee, and Senator Kerry. Thank you for holding these hearings.

This is a difficult, complex issue, but not certainly the first that has been associated with this project. I would like to commend everyone who has been involved in this, as well as earlier complex issues for the straightforward, intelligent and focused advocacy that has been brought to it. Particularly the Cape advocates, who have been, in my view, highly responsible for carrying the burden of making us all aware of this issue. I think they have done a terrific job on that.

I have been involved in this project longer than the MWRA, since early 1983. Back then, billions of gallons of wastes were being discharged. They were damaging the resources of Boston Harbor. They were injuring the users of Boston Harbor. They were, as the computer modeling now indicates, well within its range of accuracy, significantly damaging the resources of Massachusetts Bay.

The lawsuit that CLF filed in 1983 was not intended and we do not think it has produced a proposal that is shifting pollution from Boston Harbor out into Massachusetts Bay. That was not our intent. I do not think that that is what is going on. We are committed to doing everything with this Subcommittee and others to make sure that does not happen.

We have also actively participated in outfall issues. Some of the issues with the MWRA we have not participated in as extensively as others, but in outfall issues, I think I can say, we have been involved from the very beginning. We were involved opposing the waiver of the secondary treatment application in the early 1980's. We opposed the reapplication for a waiver of secondary treatment in the mid-1980's. We have been heavily involved with the siting process of this outfall. We have reviewed all of the studies, to the extent of our abilities. We have consulted with outside scientists, including scientists who have dived in the area of the existing outfalls, who have dived in the area of the proposed outfall.

We have looked at the issues raised by the Cape, and they are important issues. Based on our present understanding, based on the best currently available scientific information, we think that this proposed outfall technology and location is the best—best in the sense that it minimizes the risks to all Massachusetts Bay resources, including endangered species. Based on that same currently-available scientific information, our view is that the EPA/NMFS' conclusions, with respect to no jeopardy, no likely jeopardy are well within their bounds and probably accurate.

Nonetheless, there is risk and uncertainty. I would like to emphasize that we strongly agree with the conservation recommenda-

tions made by the National Marine Fisheries Service, which will help to minimize those risks and uncertainties, in some cases, entirely eliminate them; in others just reduce them.

As for the contingency planning, the alternative discharge scenario studies, and additional biological studies, including the focused work on North Atlantic right whales, I would underline again the comments of Scott Kraus and Stormy Mayo on the fact that, unless you look at the canary, look in the cage once in a while, you will not know if it has died or is even sick. I think the fact of the matter is that the research protocol on right whales right now is not adequate to determine the health of the canary up and down its range, in this case, the right whale.

On the issue of monitoring, we are strongly supportive of the notion of an independent far-field monitoring effort and a focused management effort, again, on the resource. The MWRA (and its ratepayers) have been carrying the weight of most of the monitoring in this resource area. That is not appropriate. This is a Statewide resource. It is a national resource. As part of the estuaries program, we had hoped there would be some efforts made to develop a more comprehensive monitoring program and have it implemented by now. That has not happened. Monitoring is absolutely essential if we are able to act in time. As I said, I think this activity is a Massachusetts responsibility predominantly.

On the level-of-treatment-before-discharge issue, as you may know, we fought and lost this issue in Court. We had hoped to persuade the judge that the project could be built in a way that the secondary would be online by the time the outfall was used. We did lose that.

The MWRA's recent decision to rehabilitate some of its existing outfalls, however, raises the possibility of some different scenarios that certainly are worth investigation; either partial or full inshore discharge. I think, on a biological level, it is not immediately obvious to us that simply because those inshore outfalls are available that they should be used. I think there are some studies that have to be done and looked at the impact of doing that on a whole range of resources and a decision made after those studies are concluded.

The other aspect on secondary treatment I think we need to explore further is the capability of this plant to beat current permitted primary treatment numbers. To the extent MWRA can discharge its effluent from this plant at a higher level, it ought to do so, and the permit ought to require that.

Finally, I would also like to join with Scott and Stormy and others and suggest that, as important as these chronic issues are, with respect to endangered species issues, the Federal right whale recovery plan still has not been seriously implemented. I think that it is very important for the National Marine Fisheries Service, across the range of this whale, to do everything in its power to implement that recovery plan. I would call on this Subcommittee to use whatever influence it can to facilitate that.

Thank you very much.

[The prepared statement of Mr. Shelley can be found at the end of the hearing.]

Mr. STUDDS. Thank you very much, sir.

I want to thank Senator Kerry for his time here.

Normally we apply the red light system to the members of the Committee in the question period, but I do not see any overwhelming necessity to do that now, since there is only one of us. I promise not to hold you captive indefinitely. I also promise to keep my promise of several months standing, to allow a couple of you to ask a couple of others of you some questions on your own.

First, let me just think out loud for a moment. These will probably come in no particular sequence, so do not look for a logical sequence of questioning.

You caught my attention, Mr. Shelley, a moment ago when you were speaking of the implementation of the right whale recovery plan. Who is responsible for that? Is that you, NMFS?

Mr. SHELLEY. Yes.

Mr. STUDDS. OK. What is the matter with it? What is it and why isn't it happening?

Mr. BIGFORD. I do not think there is anything wrong with the plan itself. It is a couple of years old and could probably use a little bit of tinkering to make sure that the recommendations are as up-to-date as possible.

Mr. STUDDS. Could you give us a concise summary of what its recommendations are?

Mr. BIGFORD. There are dozens and dozens of recommendations in it, including everything from research to management of the stocks and monitoring. It is a very complex listing of specific recommendations involving all of the Federal agencies that have a stake in managing resources—all of the agencies that would normally consult with the National Marine Fisheries Service.

Mr. STUDDS. Are any of those recommendations generally being carried out?

Mr. BIGFORD. Some of them are being carried out. The biggest problem other than just plain time (it is the typical bureaucratic response) is the resources are not there to conduct the research that is pointed out, to conduct the monitoring, to work with the various groups. It is a resources issue. It is a typical problem of insufficient resources to conduct the recommendations.

Mr. STUDDS. I understand that, because I spend too much time in Washington. Is the English translation of that that we have not got any money, so we have not started yet?

Mr. BIGFORD. No. It is we do not have enough money to do anything faster than we have. We have started.

Mr. STUDDS. We have.

Mr. BIGFORD. We are not proceeding as quickly as we would like to.

Mr. STUDDS. Let me ask you and also either Mr. Kraus or Dr. Mayo, what is the status of the monitoring, pursuant to the recommendations in that recovery plan? Is it underway?

Mr. BIGFORD. There is a lot of different monitoring.

Mr. KRAUS. There is no money for monitoring at this time.

Mr. STUDDS. There is, therefore, no monitoring at this time?

Mr. KRAUS. What has been done has been done on our own ticket.

Mr. BIGFORD. Right, but it relates to the recovery plan.

Mr. STUDDS. OK.

Mr. Shelley, you mentioned, I think, that ship strikes on whales are *a,* if not *the,* leading cause of death that we know of; is that correct?

Mr. SHELLEY. I do not know if I mentioned that. It is certainly my understanding that a lot of the whales that are observed on shore have either evidence of a strike or are suspected to have been killed by ship collisions.

Mr. STUDDS. Do our right whale folks concur with that?

Mr. KRAUS. It is 30 percent of all known right whale mortalities are known to either—primarily ship strikes, and to a far lesser extent, entanglements with fixed fishing gear.

Mr. STUDDS. As I understand it, the right whale has the good sense to be an off-season visitor to the Cape; is that correct?

Dr. MAYO. I think we should add that we do not understand the biology of these animals well enough to sample—in fact, this is true of all large mammals—to sample that very important part of the story, which is the effects of, for instance habitat degradation or things like reproductive success. So, indeed the dramatic animals on the beach are often given the cause of collision or entanglement. The habitat question remains wholly unanswered.

Mr. STUDDS. It just occurred to me that, insofar as ship strikes are a major problem, that might be something we could deal with. I mean, is that something that we should—what would help? If there were an international regime that mandated slower speeds in those areas, would that be helpful? What could we do for that?

Mr. KRAUS. In the Southeastern United States, the National Marine Fisheries Service has coordinated a group of agencies to look at that as a feasible solution to ship strikes in the near shore zone of Northeastern Florida and Georgia. They are in the process of trying to implement something like that. That would probably be effective.

Mr. STUDDS. I assume that would require IMO, international action?

Mr. KRAUS. That is my understanding, but I am not certain.

Dr. MAYO. What I might add, the distribution of these whales, the areas that are so critical, are probably not by any means all established. We simply do not know where they are and what areas ought to be considered for that management.

Mr. STUDDS. We cannot just ask them to stay out of the channel.

Dr. MAYO. Exactly.

Mr. STUDDS. Mr. Bigford.

Mr. BIGFORD. We are addressing that issue here too. Scott is right. Off the Southeast Coast of Georgia, there has been particular attention, but here also. In the Great South Channel, EPA, the National Marine Fisheries Service and the Coast Guard are collaborating on announcements to mariners to caution people when the whales are in the area and how they may transit with safer consideration to the whales, with particular attention to right whales.

Mr. STUDDS. Who is hanging out there in the winter besides the whales?

Mr. BIGFORD. The greatest attention has been over the fall, I believe.

Mr. STUDDS. Not when they are not there yet?

Mr. BIGFORD. The notices are directed to the larger vessels——

Mr. STUDDS. Yes.

Mr. BIGFORD.—not just to the fisherman.

Mr. STUDDS. All right.

Mr. KRAUS. If I might comment? The problem with that is that we do not know, because there is no monitoring, when the whales are there.

Mr. STUDDS. It is a little hard to warn ships away then.

Mr. BIGFORD. That is why we started the program——

Mr. STUDDS. Right.

Mr. BIGFORD.—without an end period.

Mr. STUDDS. Right.

Mr. BIGFORD. It is ongoing.

Mr. STUDDS. Dr. Mayo, I think you answered the question I was going to ask you at the very end of your statement. I was going to ask you specifically what we could do to ensure that the effects on the whales are detected and mitigated in time. You listed a series of things at the very end of your statement. Do you want—would you like any additional time to elaborate on that? I think what you enumerated at the end was fairly consistent with what NMFS had recommended in terms of their conservation recommendations; am I correct?

Dr. MAYO. Well, I think there needs to be a lot more flesh on it. The point we need to remember about these habitats is that, although we, as one group, have been studying the environment for some time—I think I can safely say that none of us who are working in our project have a passing understanding yet of exactly what it is that right whales need. We are getting there, but we have not arrived. I think we need to get a little bit closer to begin to make those judgments.

Mr. STUDDS. Right. Let me put it this way. When Mr. Kotelly in just a moment is prepared to commit the EPA to treat as binding the recommendations of the National Marine Fisheries Service and to state to us that he is going to make it a condition of the permit, is there anything we should add before we get that commitment from him? Do they still need fleshing?

Dr. MAYO. Yes. I think there are lots of ways of looking at it. I believe there needs to be considerable detail. I do not think it was in the scope of Fisheries probably to put that detail down. There is monitoring and there is monitoring. We have some excellent monitoring going on within the Bay system, but it is certainly in no way reflective of what we need to know of right whales and their habitat.

Mr. STUDDS. I think I get that message.

Now, Mr. Kotelly, I was struck by the fact that your testimony does not seem to me yet to be an unequivocal commitment to respecting the recommendations of NMFS. As I understand it, you said you are going to take their recommendations on additional monitoring back to the Monitoring Task Force. What is the Monitoring Task Force and who is on it?

Mr. KOTELLY. The Monitoring Task Force consists of representatives actually from many of the people at this table. NMFS is on it; people from the University of Massachusetts, Massachusetts DEP are on it; there are three organizations from the Cape, including Mr. Mayo's organization; NOAA is on it; people from Harvard. So,

we do have a good cross sectional representation from all the scientific community. Certainly, we would like to have their input on the recommendations before we commit to doing them all. Because we do have, as I say, a good cross representation here.

Mr. STUDDS. Well, are you aware of anyone better qualified to make these recommendations than either Mr. Kraus or Dr. Mayo?

Mr. KOTELLY. Well, Dr. Mayo's group is on the Task Force.

Mr. STUDDS. Yes. Are you aware of anyone better qualified than those two?

Mr. KOTELLY. Their qualifications are certainly held in the highest regard by EPA and the rest of the scientific——

Mr. STUDDS. That was not my question. Are there any people as knowledgeable as these two in this field, to your knowledge?

Mr. KOTELLY. I am not an expert on that, sir. I just cannot say. I know that they are important experts that we rely on, and we have quoted them extensively in our biological assessment. To say that they are the only ones that can make decisions on monitoring is—it may be a little too far-fetched. I think there are others who can also have input in this monitoring plan as well.

Mr. STUDDS. Well, who else do you think might have useful input?

Mr. KOTELLY. Well, I would say that everybody who is on this Committee. If you want me to name them, sir, I will; but I will present this for——

Mr. STUDDS. OK. No, no. I just want to make sure that those who know the most about this are heeded and paid attention to here.

Mr. KOTELLY. I think we have a good cross-representation. As I say, I will submit this list to the Subcommittee——

Mr. STUDDS. Right.

Mr. KOTELLY.—with my testimony.

Mr. STUDDS. A cross-section of people is not always the ideal way to gather expertise, as you know. For example, I would not be much help, because I do not know much about it.

Mr. KOTELLY. Neither would I, to be honest with you.

Mr. STUDDS. Well, I hope neither of us is on the Task Force then.

Mr. KOTELLY. Neither you nor I are on it.

Mr. STUDDS. Great.

Mr. KOTELLY. There are others that are.

Mr. STUDDS. That is some reassurance, I am sure, to the critters in question.

Mr. Shelley, you speak, or at least you recommend—and I am a little surprised, if I understand you correctly, that the MWRA and the EPA consider the water quality impacts of the various treatment options all the way from full use of the new outfall as soon as the new primary treatment plant is built, to no use of the outfall until secondary treatment is online—that full range of options. Are you suggesting that that range has never been considered before?

Mr. SHELLEY. It certainly has not been considered at the same level of some of the other analyses. I did not believe that the MWRA was even capable of using its existing outfalls, from an engineering standpoint, in that kind of way—mixing and matching them—until a report was filed with the Court, I think in the Endangered Species litigation, suggested that those were mitigation or response options that were feasible from an engineering stand-

point. There have been a number of studies. There have been studies that compared one outfall site to another outfall site for the complete loading of the effluent from the plant. In terms of utilizing the new inshore structures that it will have available to it to minimize—or optimize, I guess, the discharge protocol, I do not think that has been done. As I say, I do not know what the conclusions would be, because the inshore resources are very sensitive and already seriously injured. I think it has to be done. I think it has to be done as part of the contingency planning.

One of the things that has always back-stopped some of my opinions about this outfall is the notion I have that impacts, if properly monitored and observed in that monitoring, would be reversible—they would be reversible in the immediate term and also in the long-term. Part of the ability to do that with knowledge that you are making the right decision and balancing everything correctly is doing a detailed study of these different discharge options. I think the MWRA has said they will do that. I do not know if they have done it or what the status of it is.

Mr. STUDDS. Well, Mr. MacDonald, speaking of discharge options, there has been quite a bit of press about your construction schedule, as you know, which has kept all of us awake. First the tunnel is on schedule, and then it is not, then the treatment plant is on schedule, and then it is ahead of schedule. We all get a little confused following it. You do not suppose it is possible that, given the delays in the tunnel itself, we may never actually see primary effluent discharged into the bays?

Mr. MACDONALD. I think that is less likely—less than 50/50. I think we will see the tunnel completed in due time to go ahead with our proposal to discharge primary treatment—primary effluent from the new outfall location.

Mr. STUDDS. Of course, another way of saying that is—it is not impossible.

Mr. MACDONALD. I tried to hedge it as nicely as I could.

Mr. STUDDS. I do not know whether that means I am rooting for you to hurry up or slow down, but whichever it takes. As you know, there are a lot of folks who feel pretty strongly about that.

Now, Mr. Bigford, on that subject, how come NMFS did not include among its conservation recommendations one that would delay the use of the outfall until secondary treatment was in place?

Mr. BIGFORD. It relates to our opinion of the possibility of the current situation causing jeopardy with the stock—having the likelihood of causing jeopardy to the right whales or the hump back whales. Basically, we think the current situation is not threatening the continued existence of the species. It is not likely to affect the species. If the current situation is not affecting it, then we think a concerted effort to improve the current situation is going in the right direction. If that means they continue with the current discharges, albeit it at a different location, while source reduction, improved treatment, reduced toxins and reduced nutrients, and all sorts of other specific actions are being taken, we think the situation is acceptable.

Mr. STUDDS. If I understand you correctly, you are pointing out that the current situation does indeed affect the creatures in question; am I correct?

Mr. BIGFORD. Yes, I would——

Mr. STUDDS. Probably adversely?

Mr. BIGFORD. The current situation has adverse effects. The future situation has adverse effects. Neither the current nor the future situation have adverse effects that are so extensive that they are likely to jeopardize the continued existence of the species. So, we accept that there are effects. I think everybody does. That is the price of our——

Mr. STUDDS. You think that moving from what we are doing now to the temporary discharge of primary effluent, as is currently contemplated, would be an improvement of the situation?

Mr. BIGFORD. It certainly will not be any worse. I think that has been verified by the USGS models that we saw, and that is our conclusion.

Mr. STUDDS. OK. I just wanted to make sure I understood what you were contending.

Now, if I may—I am going to first ask both Dr. Mayo and Mr. Kraus whether there are questions. This can be just a dialogue. It can actually be a conversation—as if we were real people instead of at a hearing setting—whether there are observations you would like to make, questions you would like to direct at any of your fellow panelists or dialogue which you would like to enter into? Stormy?

Dr. MAYO. Yes. First, I wanted to reflect on what Mr. Shelley had to say—and that is that, indeed, the impacts in this situation look reversible, and you can straighten out problems if you see them. It certainly seems to be reasonable.

Mr. STUDDS. Use the mike, sir, if you can, please.

Dr. MAYO. That probably does not apply to right whales. It is conceivable—I am not saying it does apply here—but it is certainly conceivable that an animal as imperiled as this one, that something could happen in its habitat that we are not looking at a recoverable situation. Maybe with clams and plankton, or whatever, that is possible. I did have one question. It is one that has troubled me. I want to embrace the concept of no jeopardy. I would like to do that. It feels reasonable. The reasoning that I see in the biological opinion continues to trouble me. That is the statement that, in fact, we led off which was something to the effect that we expect—we may expect effects from the new project, but it is judged that they will not jeopardize the species. My problem is that we just do not understand the animals or their relationship to the habitat and it is hard for me to understand how we can make the leap from saying there will be effects to knowing that there will not be jeopardy. I would like to accept that; but I am curious, from NMFS point of view, how one can say there will be effects on the species but there will not be jeopardy. What is the missing bit of information that assures that?

Mr. BIGFORD. It sounds as if that is aimed in my direction. I took one shot at trying to answering it. Maybe Colleen Coogan can offer a slightly different perspective on the same answer that I already provided and John Catena perhaps too.

Mr. STUDDS. She is welcome to come up here and use one of these mikes. Have a seat and identify yourself for the record, if you will.

Ms. COOGAN. I am Colleen Coogan, I work with NMFS in the Northeast Regional Office. Our conclusion, based on the best available information and a lot of that was the USGS modeling studies, was that there may currently be effects of which we are not certain. But we know that marine mammals out there have toxins, regardless of whether they are pathological. They are encountering them. We know that Red Tide may affect them. We know that there may be effects, and some of the effects may be caused by the current outfall.

Based on the USGS modeling and other studies that have been done, we are not expecting those effects to change due to moving outfall offshore. We think that our conservation recommendations are geared toward identifying what the effects may be of the current and of the continued discharge of primary treated sewage. But, we think that, under current situations and when the discharge is moved, there is not jeopardy to the populations. So, although there may be effects currently caused by the Boston Harbor discharge, we do not believe that those effects are the cause of the continued decline of the right whale. They are contributing to it. There may be effects, but we do not think it is the cause of the jeopardy.

Mr. STUDDS. Go ahead.

Dr. MAYO. I would just make a point. I appreciate that thought process, and I may share a lot of it; but I hope we do not leave here thinking that we understand that we know that there are effects on this population by something, whatever it is, and then make the assumption that, although there are those effects, seen and unseen, known and unknown, that there is not jeopardy being brought to this species by those effects. We do not understand these animals well enough to make that assumption. We may well have to go forward. NMFS is probably correct—that the present plan makes a lot of sense and will abate problem in the habitat; but, to say that there will be effects and then to make the leap and say, but there will not be jeopardy, is to make a larger assumption than I think any of us in the work with the right whales can dare to make.

Mr. STUDDS. Stormy, you still have the floor, if you want to either think out loud or ask somebody else a question.

Dr. MAYO. Well, let's see—no, I will leave it.

Mr. STUDDS. We will come back to you, if you want. Mr. Kraus, would you like to do the same?

Mr. KRAUS. I have one question.

Mr. STUDDS. Use the mike, please.

Mr. KRAUS. Excuse me.

I understand that NMFS and EPA have both water quality and long-term monitoring of oceanographic systems all along the East Coast. I am curious about the whole cumulative effects section of the biological opinion and what the process is. Is there anybody in NMFS—is there a long-term strategic plan for assessing cumulative effects on ecosystems, habitats and endangered species within the agency, that actually looks specifically at things like right whales and short-nose sturgeon and harbor porpoise, and whatever else there is, relative to their distribution along the East Coast, vis-a-vis outfalls and all of these other things? In other words, is there

some sort of strategy within NMFS or the EPA to look at this systematically?

Because one of the problems here is that, as far as I can tell, the homework has not been done, possibly because it is beyond our ability—you know, all I can do is raise the questions. I do not know what the answers are on that. So, is there a strategy for addressing these kinds of questions in the future? This is not the last time this question is going to come up.

Mr. BIGFORD. There are certainly strategies among Federal agencies to monitor marine environmental quality. It is not just a mission of NOAA's. When you threw in EPA, that is appropriate, because EPA is very involved in this through their E-Map Programs. NOAA has a Status and Trends Program. NOAA has a lot of other living resource monitoring programs. The Department of the Interior is talking about embarking on a biological survey. I think there are a lot of Federal agencies that are part of this, working very closely with State agencies. The problem with a lot of that is that it does not focus on endangered species. If you want to apply some of the findings to endangered species, it is a secondary use of the information, rather than a focused intent of the monitoring program. That is one of the benefits of a biological opinion and a recovery plan—you can focus some of the monitoring work directly on the species of concern.

NOAA research and monitoring often does not get very specific about right whales and short nose sturgeon or any other listed species, or their critical habitat. The finer research objectives divide our budget with fewer resources and attention focused on any one of them. I think the "we" is all-encompassing. It holds for the National Marine Fisheries Service, but I think it also holds for a lot of other groups. It is an expansive need that has never been met.

Mr. KRAUS. Is there coordination? You had mentioned several different agencies doing what sounded like similar things. Is there coordination between the agencies, or is this——

Mr. BIGFORD. There definitely is coordination between EPA and NOAA. The Department of the Interior and its biological survey is very new on the block, and I know that EPA and NOAA have been meeting with them, but that does not involve me and I do not know much about that. It is less than a year old. NOAA and EPA are working very closely together, sharing platforms, sharing research protocols, monitoring objectives, working very closely. But remember that it only comes together with endangered species through a recovery plan. As the Congressman has pointed out, the recovery plan has not been fully implemented. So, there is a great opportunity to do a better job here. No one would deny that.

Colleen, maybe you have something to add to that?

Ms. COOGAN. Yes. If I could, I would like to contribute a little bit. Right now in the Northeast, NMFS does not really have a dedicated endangered species research program going on. As you know, most of our information comes from independent researchers scrambling for funding. Every year it comes from a different place. We have looked at habitat, or area-wide impacts for endangered species, again, through the Section 7 consultation process. It has been done with a few rivers, looking at short nose sturgeon. We are initiating bay-wide consultations and region-wide consultations

with EPA, with the Corps of Engineers and other Federal agencies; but we are doing it through the consultation process, not through an overall research program right now.

Mr. STUDDS. Feel free.

Mr. KRAUS. I think I am all set. Thank you.

Mr. STUDDS. You may never again get the chance to have these people all held captive.

Mr. KRAUS. I know where they live.

Mr. STUDDS. In fairness, is there anyone else on the panel who would like to address—would you like to say something to these scientists who have been harassing you, Mr. Kotelly?

Mr. KOTELLY. I do not feel harassed, Congressman. One of the issues you raised earlier is secondary treatment, when it comes online. One of the recommendations by NMFS is that secondary treatment be built expeditiously. We agree with that. So, to the MWRA's credit, they have in fact moved up one of the batteries of secondary to 1996. Originally, in the beginning, there was just primary in 1995 and secondary in 1999. Then, during the process, we moved up one battery, to 1996, and then the MWRA volunteered a second battery. So, in 1996, we should have two batteries of secondary online, which is much ahead of schedule. So, it is possible, if in fact the tunnel is delayed one year, and there is, as Doug says, a 50/50 chance, I think it is more like 80/20, it is possible.

Mr. STUDDS. Keep going. This is very encouraging testimony.

Mr. KOTELLY. It is possible that when the outfall is ready that the two batteries will also be ready.

Mr. STUDDS. Poor Mr. MacDonald. Everybody is sitting here praying for him to be inefficient in at least one respect.

Anyone else who would like to—we will give everyone a chance to make a final observation. Mr. Butman?

Mr. BUTMAN. I just wanted to make one comment about the monitoring program. I would like to hear what Scott and Stormy have to say about this. I think it is important in whatever monitoring program is designed, especially in the far field, that it includes not just what we call—might think of monitoring, counting of animals or assessments of populations, but really to understand the processes by which these animals are affected and contaminants are transported through the system. That predictive capability is really what is going to help us in the long term for management decisions. As I say, I am not sure what the monitoring program actually has in mind. I think the process-oriented research is equally as important to understand the monitoring results as the monitoring results themselves.

Dr. MAYO. I share that view. I do not think that—there is a need to—I do not know if it is to count animals, but to take a pretty close look at them, because it is that interaction that is the focus of the opinion and of our concern. I certainly share your view that without knowledge of the process—without attention to that—strict attention to it, we do not contribute anything to an ability to mitigate problems in the future to turn to EPA and complain or whatever it is, or in fact to congratulate MWRA on a well-done job, which is another possible reflection of the monitoring program.

Mr. STUDDS. Ms. Ritchie?

Ms. RITCHIE. I will be the first to insist that I am not a scientist. So, the questions I have may perhaps be more common sense than science-oriented. I go back to the question which we raised in our testimony, which is you can do all of the monitoring you want to do, and it is all good, but you have to know what you are looking for. I think that the issue here, as Stormy brought out, as you move from the question of identifying harm to identifying jeopardy, is what is the meaningful change that you are looking for? How do you define meaningful change, short of dead whales? Somehow we have to have a good definition of what that meaningful change is, otherwise we do not know what we are measuring. It seems to me, then we are saying, well, we have impacts, but we sort of know what they are and we sort of do not know what they are. We sort of have some good ways to measure, and we sort of do not. We are not really sure what we are looking for, and maybe we hope it is all going to come out all right in the end. Quite frankly, as non-scientist, I am not real happy with that. I suspect maybe the whales might not be either.

So, I come back to this question of meaningful change—that until we have that defined, it seems that the effort is only half-baked.

Mr. STUDDS. Let me say what I plan to do is to give everyone a chance to make a final observation, if you wish. It is not mandatory. Then I will say a couple of words myself, and we will be done. Before we get to that final process, does anybody want to take one last chance? Mr. Bigford?

Mr. BIGFORD. I had two short points, one of them following up on the last comment. The biological opinion and certainly the written testimony does not in any way, shape, or manner, attempt to spell out a complete monitoring plan or explain how we are going to detect change. We certainly realize that we need a lot more flesh there. We also realize that it is far more than people within NOAA that are going to contribute some flesh. The same thing holds for a contingency plan. I note in the written testimony of other witnesses that there is some concern about the lack of flesh in the monitoring plan—that objectives do not seem connected to problems. We realize that the document and some of our recommendations were not fully spelled out. The intent of a biological opinion was not to develop a final monitoring plan. So, greater depth will be necessary.

Also, one other comment that has come up several times from people, from Cape Cod especially, is the concern about some statements in a fact sheet that the National Marine Fisheries Service prepared. There was a misstatement. The fact sheet was for our use in explaining some of these complex issues to the general public. Specifically we were talking about the adequacy of available information and proceeding ahead amidst scientific uncertainty. I apologize for the confusion there. Just let it be said that we do indeed have enough information to base our conclusion of, not likely to jeopardize. We have enough information to make that decision and no misstatement or misinterpretation that we might have fostered through our fact sheet should cloud that.

Mr. STUDDS. Anyone else, before we go to our final round?

[No response.]

Mr. STUDDS. OK.

The next step in this process, as I understand it, is the determination by EPA as to whether or not to issue this permit. As I also understand it, EPA and CZM have committed to a public hearing in the course of that process. Is that correct—where people will have a chance to have further input? I assume at that time you will hear again much of what you have heard here. It is a decision we are all going to have to live with, as are the critters we are concerned about, for a long time to come.

What I would like to do is to go down and give each of you a chance to have one final word, if you will. You do not have to have any final word if you do not want. You can be very brief. You can be moderately brief. If there is one overwhelming thought you would like to have remain in the mind of particularly the EPA at this point, who really has the next decision to make in this process, please feel free to do so.

We will just start at the other end, Mr. Shelley?

Mr. SHELLEY. Thank you, Mr. Chairman. This comment is not directed toward EPA, but it is an observation that my role of historian allows me to make here. Many of the opinions and certainly the conclusions my group has reached are based on reviews of thick documents. We have added a couple of feet of documents to the literature and also some technology and stuff, but that helps us make decisions. The simple fact of the matter is that inadequately treated sewage and industrial waste water and street runoff is what is going to jeopardize these resources, jeopardize the whales, potentially kill whales. As one of the historians of Metropolitan Boston, I would like to point out that a new treatment plant was built on Deer Island in 1968, and it was essentially non-functional 12 years later because of a lack of investments and a lack of leadership coming from this sewer agency. I do not accuse Mr. MacDonald of lacking leadership. I think he has done a terrific job with the MWRA. The fact of the matter is that operating this plant at the levels that all of the predictions are based on is going to require significant amounts of money. Money, to my environmental colleagues down in Washington, does not seem to be much of an issue for the Clean Water Act reauthorization.

I have to say that I have a very deep concern that having the local service territory pay such a large amount of the capital program for this project, and the absence of a broader-based state assistance or a broader-based Federal assistance for all municipal areas, puts tremendous pressure on operation and maintenance. As someone who has seen the results of not operating and maintaining a plant, I hope to God we do not repeat that. I really do. I wish I could persuade some of my environmental colleagues down in Washington that this still is a priority. I do have a concern in that area that I do not know how to wrestle with particularly, other than to say the paper looks good, but I hope we make it happen.

Mr. STUDDS. I agree with you. I am going to mention that in my final remarks.

Ms. Ritchie, do you want a parting shot?

Ms. RITCHIE. Very briefly. I guess my concern is that perhaps overall we are profligate with our marine environment. I am concerned with what appears to be a departure of what I understood

to be the principle of the Endangered Species Act, which is that somewhere in the intent and in subsequent Court cases, that the benefit of the doubt should go to the species. One worries that this is a case of out-of-sight, out-of-mind. How do we ensure that that is not true? I am not sure that the answers are all in.

I guess, finally, it seems to me that the bottom line is perhaps that even harm is not basically acceptable.

Mr. STUDDS. Dr. Mayo?

Dr. MAYO. Yes. Just a thought. That is that, at least something is jeopardizing the right whale. That jeopardy is extreme, and we should not be misled and think that we understand what that is. We have some guesses, but I would suggest that in another century we will have a very different view of our statements today. Something is jeopardizing the animals, and we do not know much about what that is.

We do know that one of the few places they still go to make a living, and apparently those few that come here still do make some living, is the bay system. Unfortunately, we do not understand the relationship between the animals in that system, what they require, exactly how much jeopardy is provided by what happens along the coastlines. It is sad that we cannot know all of that. We do not and we must recognize that. Then we have to conclude that the only thing we can do is take the best shot we can. The outfall is likely that. At the same time, we must acknowledge that we do not know exactly what is going to happen and we will monitor, because we do not know the cause of jeopardy, not because we understand it. Thank you.

Mr. STUDDS. Thank you. Mr. Kraus?

Mr. KRAUS. I actually want to throw a caveat at the whole monitoring issue. That is that we are concerned about endangered species. I would not depend entirely, for example, upon right whales as the canary. The reason for that is that it is an extremely small population. There is a wide variation, random variation, which appears to be natural in its reproductive rates and its distribution. In every habitat where we have a long-term study going, we have seen years in which the number of animals in the habitat has been less than a quarter of the average. Apparently these are natural variations. At least we have not been able to detect any changes. There is a tremendous variation. In Cape Cod Bay there are some years where there are very few animals, and some years there are nearly half the population. So that, depending upon a single year's sighting, you could, for example, put the outfall online and next year see 150 right whales in Cape Cod Bay and conclude that the outfall was a great thing for right whales and we should put them all over the East Coast. That would be a mistake. The reason—you would need to average this kind of information over a long period of time.

I am not looking for welfare for scientists, but it is going to take some commitment, and it is going to take a commitment that is a little bit longer-sighted than the average Government commitment to research and management.

Mr. STUDDS. Well said.

Mr. Butman?

Mr. BUTMAN. I would just like to echo what Stormy said, that Massachusetts Bay is really a tremendously complex system. I

think that the results that we showed you today of the physical modeling, are perhaps some of the processes which we understand the best. The subsequent biological effects and chemical effects are clearly more difficult and a next step.

There were two studies mentioned in the biological opinion that USGS is intimately involved in or is actually conducting—the 3-D summer modeling and the transport of sediments and the locations of the potential long-term accumulation of toxins in those sediments. We look forward to working with the other Federal agencies and everybody who is involved in Massachusetts Bay to bring those results to them.

Mr. STUDDS. Mr. MacDonald, do you want to say anything?

Mr. MACDONALD. Well, I was listening to a Woody Guthrie tune yesterday which had a reference to the laughing salmon making their ways up the fish ladder at the New Bonneville Dam. I thought to myself, it really is a lesson in humility to those of us who have the role in this job to be building this thing.

I certainly agree with Dr. Mayo, that I wonder what we will all be looking at a hundred years from now as the implications of all of this.

For us, for now, I would like really simply to say one short thing. This issue, over the last year and a half that I have been working on it, has had a lot of public controversy attendant and all kinds of opportunities for the real and the unreal or the plausibly real to come into the discussion. I think it is wonderful how people have pulled together and tried to create a climate of sanity to continue to discuss these very very difficult issues. I hope we can continue that. I know I saw the first today of what I am sure is going to be a renewed discussion of these mix and match options that Peter Shelley was mentioning down at the end of the table. Those options, themselves, are emerging from our outfall studies which are themselves tied to our own interest in making good on our commitment to some kind of sane contingency planning for all of this. So, if we can continue to maintain this whole discussion with the commitment to earnestness and sanity that I think everyone who has helped us with the issue has tried to do, I think we will certainly be well served. I am very grateful to everyone for that.

Mr. STUDDS. What were the salmon laughing about?

Mr. MACDONALD. I think the salmon were laughing—as Woody Guthrie said, "as long as you are going to roll on down to the Pacific, you might as well do us all some good work in doing so." So, it is a good thing that those dams are being built to generate electricity, make aluminum and chromium and everything else. The salmon could laughingly make their way up the fish ladders in the meantime. That was not so very long ago.

Mr. STUDDS. Yes.

Mr. MACDONALD. I think there are plenty of people here who are cognizant of the fact that it did not turn out quite that way. I think the MWRA has to be the first to acknowledge that this is one of the very difficult features of this kind of project.

Mr. STUDDS. This Committee just returned from the Pacific Northwest and did not see a single salmon smile, never mind laugh.

Do either of the assaulted Federal agencies wish to have a last word here?

Mr. KOTELLY. Just a point on the permit. You are right. The next Federal action will be the permit. We have committed to having at least two public hearings, one at the Cape and one in Boston—perhaps two in Boston, starting next March.

As the other historian, Peter mentioned being around in 1983. Actually, I was too, when we first started on the Boston Harbor Project. I can tell you that, at that time, we had a real major disgrace on our hands. NOAA had depicted Boston Harbor as the worst-polluted harbor on the East Coast at that time.

I think we have made a great deal of progress since then. As I mentioned earlier, we got rid of the scum, floatable material, the grease and oil. We also got rid of the sludge in 1991. We have seen considerable improvement to the harbor. I think the outfall, where it is located, with its dilution and dispersion will certainly clean up Boston Harbor even more without degradation to Massachusetts Bay.

Obviously, there is a lot of concern which we have heard this morning. We are taking all of the recommendations from the biological opinion given by NMFS and others on the monitoring and contingency planning very seriously. We intend to do everything we can to protect Massachusetts Bay.

Mr. STUDDS. Mr. Bigford, you wanted to comment?

Mr. BIGFORD. Sorry to interject. Thank you for this opportunity. I do not feel assaulted—certainly no less so than in a normal internal staff meeting. I think this has been a cooperative effort. I believe the agencies, the citizen groups, the academic institutions, everybody who is involved in this has pulled together quite well. I certainly appreciate all of the contributions that they have made to the biological opinion and the entire consultation process.

Besides the groups mentioned earlier, I just wanted to give special thanks to the citizen groups who have been doing a lot of this on their own time, and also the MWRA Outfall Monitoring Task Force, which has proved to be a very good sounding board for a lot of the issues that we have been working on. I think that the whole effort has been very illuminating. As somebody pointed out in their written testimony (I believe it was the Cape Cod group or the Science Advisory Panel), this consultation process is ongoing. We look forward to working with all of these groups into the future, too.

Mr. STUDDS. Thank you very much. Let me just say that we have some questions submitted to us by some of the aforementioned citizens groups—and I concur with you heartily in the constructive role they have played. We are going to ask you, if you folks would not mind, to submit written answers to those for our record. We do not have time to ask them all at this point.

If I could just close with an observation or two. First of all, I think all of you, and each in your own way, in your own responsibilities and your own knowledge and areas of expertise, have shouldered an enormous burden here, and I think, for the most part, discharged it very very well. I know what kind of pressure you are under, Mr. MacDonald. I know the kind of scorn and abuse that some of the agencies have taken from time to time. As you have been candid yourself in saying, your record is not perfect. No one's

is. There have been mistakes made, especially mistakes of omission I think more in this case, than of commission over the years.

When I listen to the scientists, and particularly to Dr. Mayo, I almost hear a cry of the heart here, because, as I understand it, you have given so much of your soul and blood to the study of this animal, and it is in such peril, and you acknowledge sort of transcending your scientific expertise, that decisions have to be made in uncertainty, and they do. That is something that people who work where I do are very familiar with. It is a very humbling, very sobering kind of thing because of the consequences, as we have said. So often when you are dealing with the oceans, there are some mistakes you can only make once, and we do not want to make that mistake.

I think you have all done an extraordinary job. Mr. Shelley, you reminded me when you spoke at the very end there—there are some—this is not really the focus of this hearing, but there are two statutes really that bring us here—the Clean Water Act, and the Endangered Species Act. Among the endangered creatures these days are those two statutes, let me tell you. If we cannot make them work, and that includes adequate public funding and resources of the Clean Water Act, in particular—if we cannot do that, we are going to lose public support for the most fundamental environmental statutes of the land and, in the process, jeopardize the continued extension and existence of those statutes. If we think we face problems now in the marine environment and elsewhere, can you imagine if we did not have these fundamental statutory tools to try, in our halting and imperfect way, to address them?

Just let me alert everybody—and I do not know which friends in the environmental community in Washington you are referring to, but I hope they had a rude awakening last week, when we almost lost the National Biological Survey on the floor—nothing but a scientific data gathering initiative of the new Secretary of the Interior. The sole mission is to do the best possible job of gathering scientific data. There is no management, no regulatory responsibilities, no enforcement responsibilities, just gathering data. We may or may not be able to pass that bill because of the reaction around the country against the Endangered Species Act. We have seen very close to home here some of the reaction when you do not fund mandates such as the Clean Water Act. So, between the two, I think we have imperiled the statutes as well as the critters. I think that ought to be a very sobering note for all of us.

I want to just end by saying that, in this particular instance, I think it has been an enormously constructive panel. I really thank you.

It is clear, I trust, Mr. Kotelly, when your hearing process is over, that you will listen very carefully to the most knowledgeable people here. I am very confident that we will see binding conditions on that permit that speak to the conservation recommendations of NMFS, reinforced and fleshed out, as suggested by the expertise here.

Mr. MacDonald, as you know, I am rooting for you to be very efficient in some ways, and somewhat of a sluggard in others, so that we end up without the problem of primary effluent in the outfall.

I want to thank you all. If this were easy, we would not have spent two hours discussing it. It ain't—as someone once said—that simple. Very few things are. I want to thank you for doing one of the most difficult tasks of all, which is educating people who work where I do. That is a challenge of the first order. You have done it very well.

We thank you. We look forward to the next steps in this process.

The Subcommittee stands adjourned.

[Whereupon, at 11:05 a.m., the Subcommittee was adjourned, and the following was submitted for the record:]

STATEMENT OF
THOMAS E. BIGFORD
CHIEF, HABITAT AND PROTECTED RESOURCES DIVISION
NORTHEAST REGION, NATIONAL MARINE FISHERIES SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES
COMMITTEE ON MERCHANT MARINE AND FISHERIES
U.S. HOUSE OF REPRESENTATIVES

BOSTON, MASSACHUSETTS

OCTOBER 18, 1993

Good morning Mr. Chairman and members of the subcommittee, I am Thomas Bigford, the Habitat and Protected Resources Division Chief of the National Marine Fisheries Service's (NMFS) Northeast Region. I would like to thank you for the opportunity to discuss our Endangered Species Act (ESA) section 7 consultation and Biological Opinion on the effects of the Massachusetts Water Resources Authority (MWRA) outfall on endangered and threatened species. Accompanying me today are John Catena and Colleen Coogan, from the Northeast Regional Office who were involved in drafting the biological opinion and will answer any technical questions that the Subcommittee may have.

As you know, on September 15, 1993, we released our Biological Opinion on the effects of the MWRA outfall on endangered and threatened species to the U.S. Environmental Protection Agency (EPA) Region I Administrator and the U.S. Army Corps of Engineers (Corps) New England Division. I have attached a copy of the opinion to my testimony to be submitted for the hearing record.

I would like to summarize the details of the opinion, how we arrived at the conclusion and recommendations listed in the document, and make some general comments on the section 7 consultation process.

Section 7 of the ESA requires Federal agencies to consult with NMFS on activities they authorize, fund, or carry out which may affect marine species listed as threatened or endangered under the law or any critical habitat of such a species. The action agency (in this case the EPA and Corps) submits a report, called a biological assessment, which describes the activity and discusses all potential effects to endangered and threatened species and their habitats. NMFS reviews the biological assessment and the best available scientific and commercial data and, if the action is determined to be likely to adversely affect a listed species, NMFS prepares a biological opinion on the effects of the proposed activity. Biological opinions represent NMFS' opinion regarding whether proposed actions are likely to jeopardize the continued existence of listed species. ESA regulations (50 CFR 402.02) state that a finding of likely to jeopardize the continued existence of a species requires evidence that the action "...reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." Reasonable and prudent alternatives to the proposed action are

developed where possible to prevent jeopardy when such a finding is reached. The opinion also usually includes conservation recommendations to reduce the impacts of the action agency's activities.

The section 7 consultation can be reinitiated if new information becomes available on the project or listed species that changes the basis for the original consultation or if the action is modified so as to affect a listed species or critical habitat in a manner not previously considered. For this project, consultation will be reinitiated at least every five years in conjunction with EPA's review of MWRA's application for renewal of the discharge permit for the outfall.

The section 7 consultation process is a very important tool for NMFS in conserving protected species. Clearly, the section 7 process is most valuable during the pre-application or project planning process. At this time, agencies or project applicants are made aware of the presence of listed species and may adjust their activity to complete the project without adversely affecting the species. When adverse effects are unavoidable, they are assessed relative to the ultimate test of whether the action is likely to jeopardize the continued existence of any listed species. If a jeopardy situation exists, then NMFS works with the action agency to develop reasonable and prudent alternatives to avoid jeopardy. If a not likely to jeopardize

determination is made, measures still are sought and recommended that will reduce or mitigate those effects that are unavoidable.

Several consultations in the Massachusetts Bay region demonstrate the effectiveness of section 7. In two cases where the agency found jeopardy, the Pittston oil refinery (1978) and oil and gas lease sales in the Georges Bank region (1982), the potential effects were unacceptable and ultimately the projects were not undertaken for a variety of reasons. Major no jeopardy consultations include the Central Artery and Third Harbor Tunnel project and the designation of the Massachusetts Bay Disposal Site (MBDS). A no jeopardy finding for the MBDS was based on the Corps establishing a dredging and disposal schedule that was less likely to affect listed species and implementing an observer program that has provided some information on the presence of whales near the disposal site. The MBDS designation prohibited the disposal of material not meeting the dredged material testing protocol. It has forced a hard look at alternate methods of managing contaminated dredge material in the region. In addition, consultations on regional fishery management plans have led to provisions for maintaining closed areas, modifying gear, and tailoring effort-reduction management regimes to minimize incidental take of protected species.

The recent MWRA consultation considered the proposed issuance of a permit by the EPA to the MWRA for the discharge of treated

sewage into Massachusetts Bay and the Corps issuance of a permit for construction of the 9.5 mile sewage outfall tunnel.

Under a Federal court order, the MWRA is scheduled to begin discharging primary-treated sewage through the outfall tunnel at the new location in Massachusetts Bay late in 1995. Secondary treatment will be phased in over the subsequent four-year period so that all effluent receives secondary treatment by 1999.

EPA prepared a biological assessment on the impact of the proposed MWRA outfall on listed species and submitted it to NMFS in April 1993. EPA determined that the project was not likely to adversely affect listed species. In developing its biological opinion, NMFS reviewed the EPA biological assessment as well as extensive additional information provided by other sources (e.g., "Stop the Outfall Pipe," Center for Coastal Studies, New England Aquarium, MWRA, U.S. Geological Survey, Barnstable County).

NMFS assessed the potential effects of the proposed discharge of primary- and secondary-treated sewage on all listed and proposed endangered and threatened species and critical habitat in Massachusetts and Cape Cod bays. However, the opinion focused on right, humpback, and fin whales, harbor porpoise, and proposed right whale critical habitat.

The biological opinion concluded that, based on the best available information, issuance of a permit for discharge of sewage at the proposed MWRA outfall may affect, but is not likely to jeopardize the continued existence of any listed or proposed species or critical habitat under NMFS' jurisdiction. NMFS believes that water quality conditions in areas commonly used by listed species would not appreciably change due to the relocation of the outfall. While we do not have a precise understanding of the effects of present conditions on porpoise and whales, we are confident that the existing outfalls are not jeopardizing the continued existence of any of these species. However, we remain concerned about its potential effects on these animals and marine habitat in general. These concerns form the basis for the conservation recommendations included in the biological opinion.

The factors that form the basis for determining that the outfall may affect, but is not likely to jeopardize, the continued existence of any listed or proposed species or critical habitat under NMFS jurisdiction include the following:

(1) Recent research has demonstrated that there is significant export of nutrients from Boston Harbor into Massachusetts Bay. Modeled predictions indicate that the proposed discharge will not appreciably change nitrogen concentrations from existing conditions in the areas used by right, humpback, and fin whales. Therefore, changes are not

expected in phytoplankton production and community structure, and zooplankton productivity, density, and availability in areas of whale abundance.

(2) Existing information suggests the present discharges are not associated with the occurrence and frequency of red-tide blooms in Massachusetts and Cape Cod bays. Red tide blooms in this area appear to be associated with a buoyant fresh-water plume originating from the Androscoggin/Kennebec River (Maine) system. In addition, evidence suggests that nutrient levels at the proposed discharge location are already in excess of requirements of many phytoplankton species, including the toxic phytoplankton Alexandrium. Thus, this species should not benefit from an increase in nitrogen in the area near the proposed discharge.

(3) While heavy metals and organochlorines have been detected in harbor porpoise from the Gulf of Maine population, there is no information about the source of the toxins and pathological effects have not been demonstrated. Porpoise occurring in Boston Harbor and in the outfall's vicinity are likely to be transient individuals, and will therefore not be exposed to long-term effects of the outfall.

(4) There is limited information on the effects of toxins such as organochlorines and heavy metals on baleen whales.

Although presence of organochlorines and heavy metals has been documented in whales from the North Atlantic, toxic effects have not been observed in the endangered whales that feed seasonally in Massachusetts and Cape Cod bays. The level of most toxins in the effluent will be reduced when secondary treatment is implemented. Expeditious implementation of secondary treatment and a further reduction of toxic loadings to the treatment plant would ensure that the potential for impacts of pollutants to listed species is further minimized.

We have provided EPA with numerous conservation recommendations to assess and minimize the potential for any adverse effects to listed species and marine habitat. These recommendations can be summarized into four broad areas:

(1) A contingency plan should analyze reasonable steps, including tertiary treatment options, that could be taken to correct any adverse effects revealed by monitoring;

(2) Studies should be completed prior to the discharge of primary-treated sewage at the new outfall location to provide additional information to determine if further restrictions are necessary to protect listed species;

(3) Additional long-term studies and monitoring requirements to ensure that effects, if any, to listed species are detected and mitigated prior to the development of conditions that could lead to jeopardizing the continued existence of any of these species; and

(4) Additional permit conditions to minimize any adverse effects to listed species and marine habitat.

Specific conservation recommendations contained in the biological opinion include:

- The U.S. Geological Survey hydrodynamic dilution model under stratified conditions should be completed and reviewed prior to discharge.

- EPA should provide NMFS with a detailed characterization of the effluent and the reaction of its contaminants with sea water. Additionally, information regarding particulate and toxic transport, re-suspension, and accumulation should be evaluated to identify long-term depositional sites.

- Studies should be conducted to provide information on the distribution and composition of plankton patches in Massachusetts and Cape Cod bays and to provide predictive information on the effects of the proposed discharge.

- Continuation of the existing MWRA monitoring program should be a condition of the discharge permit or court order. Any proposals to change the monitoring plan significantly should be submitted to NMFS for consideration of reinitiation of consultation.

- EPA should develop a monitoring plan, in association with the MWRA program or in addition to it, that will include seasonal physical and biological observations in Stellwagen Bank and Basin and Cape Cod Bay.

- EPA should require accurate tracking of the effluent during different seasons to verify the models used to predict dilution.

- Copepod patches in Cape Cod and Massachusetts bays should be studied and monitored in right whale high use areas.

- Whale distribution in Cape Cod and Massachusetts bays should be monitored through annual or biennial seasonal surveys. Additionally, Federal agencies should jointly conduct surveys throughout New England to count whales and identify their patterns of distribution.

- EPA, Corps, and NMFS should consult on cumulative impacts of ocean discharges and disposal on regional water bodies in

the Northeast, such as Long Island Sound and the Gulf of Maine.

- Federal agencies should study the effects of toxins on endangered species.

- NMFS recommends that chronic toxicity testing should be required in the permit or court order for the proposed discharge.

- NMFS recommends that effluent limits be established for all pollutants that have the potential to violate acute or chronic water quality or interim sediment quality criteria.

- EPA should require MWRA to reduce pollutant loadings in the effluent.

Implementation of many of these recommendations will not be possible without an additional commitment by the concerned agencies, and may require additional resources. We have had an initial meeting with EPA Region I staff and agreed to meet again to develop a plan to implement the conservation recommendations after they thoroughly review the biological opinion.

It is important to remember that consultation will be reinitiated under any of the following conditions:

(1) Upon application for renewal of each five-year discharge permit;

(2) The monitoring program is discontinued;

(3) New information reveals effects of the proposed project on listed species or critical habitat to an extent not previously considered;

(4) The project is modified in a manner that may affect listed species or critical habitat in a way not considered in this opinion; or

(5) A new species is listed or critical habitat designated that may be affected by the project.

Many other sources of pollution exist in the Gulf of Maine region and represent a cumulative threat to endangered and threatened species. The ambient conditions in this area resulting from natural and anthropogenic contributions were considered in this opinion to determine whether discharge at the proposed outfall is likely to jeopardize the continued existence of listed species. NMFS remains concerned about the potential for low-level chronic effects inhibiting the ability of these species to recover from endangered or threatened status. We are working with EPA and other agencies to identify and address these multiple or

cumulative threats on a region-wide basis. The additional monitoring we have suggested should provide us with an opportunity to identify cumulative effects caused by both long-term use of the proposed outfall and any synergistic effects of other pollutant sources occurring throughout the Massachusetts Bay ecosystem.

NMFS is also working with Stellwagen Bank National Marine Sanctuary staff and the EPA, Corps, U.S. Coast Guard, and other agencies to develop a coordinated plan to address implementing both the actions outlined in the Northern Right Whale and Humpback Whale Recovery Plans as well as conservation recommendations provided in various biological opinions on projects in the area. We look forward to continuing this effort with EPA regarding the conservation recommendations described in this opinion.

In conclusion, we are confident that, given the available scientific information, conditions in Boston Harbor and Massachusetts and Cape Cod bays will improve as the new sewerage treatment system is completed and pollutants in the discharge are reduced. However, we believe that it is necessary to implement the conservation recommendations to ensure that threats are assessed and minimized and to promote the recovery of endangered and threatened species.

Thank you Mr. Chairman, this concludes my testimony. I would be glad to answer any questions you or members of the Subcommittee may have.

TESTIMONY OF
RICHARD P. KOTELLY
DEPUTY DIRECTOR, WATER MANAGEMENT DIVISION
REGION I, U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES
COMMITTEE ON MERCHANT MARINE AND FISHERIES
U.S. HOUSE OF REPRESENTATIVES
OCTOBER 18, 1993

Mr. Chairman, I would like to thank you for the opportunity to testify this morning. My name is Richard P. Kotelly. I am the Deputy Director of the Water Management Division of EPA Region I. I have held that position for seventeen years. I have been employed by EPA since 1970.

I have been involved in the Boston Harbor project since it began. That project, including the Massachusetts Water Resources Authority outfall under discussion at this hearing, has been subjected to intensive and painstaking environmental review. In fact, I know of no other project which has received this much attention from environmental agencies at the state and federal levels.

EPA's environmental reviews have demonstrated that the continued discharges of MWRA effluent into the shallow waters of Boston Harbor cause unacceptable environmental impacts on our coastal waters. There is a compelling environmental need to end these discharges as soon as possible. The new MWRA outfall is, therefore, an important part of the Boston Harbor project. Its operation will improve water quality throughout the Harbor, especially along the shores of Quincy, Winthrop, Hull, and

Nahant, which are most directly affected by the existing discharges. As demonstrated by multiple environmental studies, the outfall will effectively eliminate these near-shore impacts with minimal impact on the Bay.

Study after study has found that the Boston Harbor project will produce great improvements in water quality, not only in the Harbor but in Massachusetts Bay as well. After all, there is no wall between the Harbor and the Bay--the pollutants which now flow into the Harbor are carried into the Bay on the outgoing tide. We are pleased that the recent biological opinion issued by the National Marine Fisheries Service corroborates the conclusions of these earlier reviews, in particular the conclusion that the outfall is not likely to jeopardize endangered or threatened species.

The Harbor project has already produced noticable benefits. New pumping facilities at Deer Island have reduced discharges from combined sewer overflows. The discharge of sewage scum into the Harbor ended in 1988, and the discharge of sludge was terminated in 1991. Further improvements will come as the new Deer Island treatment plant begins to come on line, starting with the first half of the primary treatment next summer.

It is important to understand EPA's role in this process. As a plaintiff in the Clean Water Act enforcement case against the MWRA and the Commonwealth, and as a federal regulatory agency, EPA's role is to ensure compliance with the nation's environmental laws. It is our responsibility to make sure that

the facilities needed to clean up the Harbor and the Bay are constructed. We do not design or construct those facilities ourselves. Our mandate is to review the facilities designed by the MWRA, and to ensure that they will achieve compliance with the Clean Water Act and other environmental laws.

EPA began its review of the proposed MWRA outfall in 1986. We conducted an intensive study of the potential impacts of the outfall on the Massachusetts Bay ecosystem. The study examined the potential for effects on water quality, sediments, plankton, fish, marine mammals, endangered species, and other aspects of the marine environment. As part of this process, EPA initiated consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service concerning impacts on endangered species. During that consultation, EPA notified NMFS in writing that it planned to incorporate an Endangered Species Act biological assessment into its Environmental Impact Statement. That approach is specifically encouraged by regulations implementing the Endangered Species Act.

Mr. Chairman, as you know, there has always been great public interest in the proposed outfall. After EPA issued a draft Environmental Impact Statement, we received a number of written comments from the public and from environmental groups. Many of these comments urged that the outfall be located even farther into Massachusetts Bay than proposed by MWRA. After detailed analysis, EPA concluded that MWRA's proposal was environmentally sound, and that the outfall would not have

significant long-term effects on Massachusetts Bay. Because the effects of the outfall would be limited to a small area around the diffusers, far removed from the preferred habitat of endangered species, EPA concluded that such species would not be impacted. The record of decision for the final Environmental Impact Statement was issued in 1988, and construction of the outfall began in 1991.

In late 1991, EPA began to draft a discharge permit for the new outfall. The permitting process triggered requirements for a new Endangered Species Act review. At the same time, residents of Cape Cod began to raise questions about the potential impacts of the outfall, and various parties requested that EPA undertake a comprehensive biological assessment under section 7 of the Endangered Species Act. Given the level of public concern, as well as the availability of updated scientific information about endangered whales, EPA decided that it would be appropriate to prepare a new assessment.

The development of the biological assessment was not an easy task. The marine environment is a complex system, and our evaluation of the potential impacts of the outfall required expertise in diverse scientific fields. We relied on experts both inside and outside the agency to assemble and evaluate a large body of scientific evidence. The deadline for completion of the assessment had to be extended twice because of the magnitude of the task.

The final result of our analysis was a three hundred page impact assessment, which cites more than seven hundred scientific sources and concludes that the outfall is not likely to adversely affect endangered or threatened species, including the humpback and right whales.

The biological assessment was forwarded to NMFS for their review. On September 15, NMFS issued its biological opinion, which presents an independent analysis of the scientific evidence. That analysis concludes that the outfall is not likely to jeopardize protected species.

The biological opinion includes a number of conservation recommendations, which are intended to provide further protection for endangered and threatened species. Although the implementation of these recommendations is discretionary, EPA intends to give NMFS's recommendations very careful consideration. We have already begun discussions with NMFS, MWRA and others concerning implementation of the recommendations.

For example, two of the recommendations concern the development of a contingency plan, in the event that unexpected problems are caused by the MWRA discharge. EPA supports the development of such a plan, and is working with NMFS and MWRA to define its scope. The purpose of such a plan is to identify potential solutions to any problems which may arise, so that a remedy can be implemented quickly if needed.

One of the contingency planning recommendations calls for preparation of an Environmental Impact Statement on tertiary

treatment. Tertiary treatment, however, could take many different forms depending on the specific nature of the environmental problem to be addressed. EPA believes that it is impossible to produce a meaningful environmental impact statement without knowing the nature of the facilities to be constructed. We have discussed this matter with NMFS. During these discussions, it has become clear that NMFS's real concern is to ensure that plans for tertiary treatment facilities are developed to the point that construction of the facilities can be accomplished with minimal delays if the need arises. EPA agrees that this is a desirable goal. We are working with both MWRA and NMFS to ensure that contingency plans for tertiary treatment are developed. It is important to note, however, that nothing in EPA's biological assessment, NMFS's biological opinion, or any of the other environmental reviews concerning the Boston Harbor project suggests that there will be a need for tertiary treatment. The development of plans for such treatment is simply a precautionary measure, which will save time in the event that the results of studies or monitoring unexpectedly indicate that tertiary treatment is necessary.

A number of the recommendations propose modifications and additions to the MWRA's outfall monitoring plan. That plan was developed by the Outfall Monitoring Task Force. The Task Force is an independent team of scientists which includes representatives from academic and scientific institutions,

environmental groups, and federal and state regulatory agencies. Several Cape Cod organizations are represented on the Task Force.

This Committee should be aware that the MWRA's monitoring plan is already one of the most intensive in the world, and will cost $2.7 million this year alone. EPA is not oppose to additional monitoring where useful information might be produced. We plan to present NMFS's recommendations to the Outfall Monitoring Task Force for their input, and will discuss the Task Force's comments with both NMFS and MWRA before making a final decision concerning any of the recommendations.

EPA agrees with NMFS's recommendation that implementation of the monitoring plan should be required through an enforceable mechanism. The current monitoring plan, which is designed to collect data on baseline conditions in Massachusetts Bay before the discharge begins, is required by order of the federal court overseeing the Boston Harbor project.

NMFS also makes specific recommendations concerning NPDES permit conditions. EPA agrees with NMFS that the discharge permit for the outfall should require chronic toxicity testing. EPA also agrees that permit limits should be established for all priority pollutants which are or may be discharged at a level that will have a reasonable potential to violate water quality standards.

The Endangered Species Act consultation process has focused public attention on endangered whales in Massachusetts Bay. At the same time, a recovery plan has been issued for the northern

right whale. The recovery plan identifies the most important threats to the survival of this whale. NMFS, EPA, the Coast Guard, and others have been discussing methods to implement the recovery plan and to reduce threats to the survival of the species. We now have a unique opportunity to develop and implement practical programs to provide real protection for endangered whales at a time when public interest and support are high.

First, in order to reduce ship collisions and fishing gear entanglements with northern right whales and with humpback whales, there is a need to develop programs to disseminate whale hazard information and vessel operator cautions.

Second, it is important to maximize efforts to free entangled or stranded northern right whales and humpback whales. Such steps could include enhancing the efficiency of the existing whale entanglement response team; establishing back-up disentanglement equipment; establishing a communication network among frequent users of the area; supporting research to identify how fishing gear could be designed or deployed differently to reduce entanglement risks; and establishing protocols for monitoring entangled animals and assessing the need for response.

Third, it is important to identify and protect habitats essential to the survival and recovery of right whales and humpback whales, and to map these areas on nautical charts. Measures to ensure the protection of these areas might include monitoring for contaminants that could impact whales or their



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food chain; developing standard procedures for collection and analysis of whale tissue for contaminant levels; and conducting research to better define the factors that control the distribution and abundance of organisms such as copepods that are consumed by right whales.

We believe there will be a need to coordinate Federal, state, international, and private efforts to facilitate this recovery effort.

I would be happy to answer any questions you may have.

ADDENDUM TO THE TESTIMONY OF RICHARD P. KOTTELLY
DEPUTY DIRECTOR, WATER MANAGEMENT DIVISION
REGION I, U.S. ENVIRONMENTAL PROTECTION AGENCY

OCTOBER 18, 1993

MWRA OUTFALL MONITORING TASK FORCE

Dr. Judith Pederson, Chair
chair
MCZM

Members
*(area of expertise)*

Tom Bigford
NMFS/NOAA

Dr. Robert Buchsbaum
*(Living resources)*
MAS

Russell DeConti
Center for Coastal Studies

Dr. Eugene Gallagher *(Benthic)*
Environmental Science Program
UMass/Boston

Dr. Diane Gould *(Phytoplankton)*
Mass Bays Program, MCZM

Dr. Russell Isaac
Chief Sanitary Engineer
DEP/Water Pollution Control (DWPC)

Susan Nickerson
APCC (Association for the Preservation of Cape Cod)

Professor Paola Rizzoli
*(Modeller)*
Department of Earth, Atmospheric, & Planetary Sciences
MIT

David Tomey
US EPA Region 1

Leigh Bridges
DFWELE/DMF

John Catena
NMFS/NOAA

Dr. Ron Etter *(Benthic)*
Dept. of Biology

Dr. Bernard Gardner *(Oceanographer)*
Environmental Science Program
UMass/Boston

William Hubbard
US ACOE

Professor Joseph Montoya
*(Phytoplankton)*
Harvard University

Dr. Donald K. Phelps
*(Toxicology)*
EPA-Narragansett

Dr. Richard Signell
*(Modeller, Physical Oceanography)*
USGS (United States Geological Survey)

Dr. Gordon Wallace
*(Chemical Oceanographer)*
Environmental Science Program
UMass/Boston

Richard Foster
Acting Director, MEPA

Alternates

Brad Barr
MCZM

Colleen Coogan
NMFS/NOAA

Steve Halterman
MDEP, Water Pollution Control (DWPC)

Dr. Matthew Liebman
*(Marine Ecologist)*
US EPA Region 1

Janet C. Labonte
US EPA Region 1
Emily Potts
SWIM (Northeastern U.)

David Shepardson
MEPA

MWRA and Consultants

Dr. James Blake
SAIC

Dr. Carlton Hunt
Batelle

Dr. Jack Kelly
Batelle

Dr. Michael Connor
MWRA

Ken Keay
MWRA

Dr. Michael Mickelson
MWRA

Wendy Smith
MWRA

Guest Invitees

Dr. David Aubrey *(geologist)*
Woods Hole Oceanographic Institution

Maureen Eldredge
Center for Marine Conservation

Susan Redlich
MWRA Wastewater Advisory Comm.

Sharon Dean
EOEA

Pat Hughes
Cape Cod Commission

Dr. Henry Rines
Applied Sciences Association

Larry Schafer, PE

MASSACHUSETTS WATER RESOURCES AUTHORITY
Charlestown Navy Yard
100 First Avenue
Boston, Massachusetts 02129

Telephone: (617) 242-6000
Facsimile: (617) 241-6070

**TESTIMONY OF DOUGLAS B. MACDONALD BEFORE THE MERCHANT MARINE AND FISHERIES COMMITTEE OF THE UNITED STATES HOUSE OF REPRESENTATIVES**
**BOSTON, MASSACHUSETTS**
**OCTOBER 18, 1993**

Congressman Studds, Ladies and Gentlemen:

My name is Douglas B. MacDonald and I am the Executive Director of the Massachusetts Water Resources Authority. As you know, the MWRA was created to rebuild the region's crumbling water and sewer infrastructure and to implement the long-delayed plan to restore water quality in Boston Harbor and Massachusetts Bay. As such, we have welcomed the U.S. EPA's recent biological assessment and the National Marine Fisheries Services' Biological Opinion essentially confirming the compliance of the planned secondary treatment facilities and the Massachusetts Bay outfall tunnel with the legal requirements of the Endangered Species Act.

About 19 months ago, I took over as Executive Director of the MWRA. During my second week on the job, I travelled to Cape Cod to confront what was then, and remains, a top priority issue for the Authority. For months prior to that, the agency had been at odds with interest groups on the Cape and elsewhere about the potential impacts of the outfall tunnel on Massachusetts and Cape Cod bays. We promised to listen and asked that we be listened to in return. We have tried to take all the concerns seriously, and to address them honestly. Obviously, all the questions will never be answered, but the overwhelming weight of evidence suggests that no threat to the Mass. Bay marine ecosystem is presented by the outfall.

In Boston Harbor, we are already witnessing how a fragile estuary can come back to life when we implement pollution prevention measures. The cessation of sludge discharges to the harbor in December of 1991, when the MWRA's new sludge-to-fertilizer plant opened, has resulted in significant cleaner water in the harbor. Improvements to MWRA and local sewer systems, and dramatic reductions in toxics discharged by industries, have yielded healthier flounder, lobsters and other marine life as previously "dead" areas of the harbor bottom now provide habitat for the bottom of the food chain. Harbor beaches have been open for swimming more frequently this past summer than at any time in the past 50 years.

While we can all be proud of these recent achievements, by far the most dramatic improvements are yet to come, with the completion of the new treatment facilities, and the relocation of the effluent discharge out of the shallow waters of the harbor, where their impacts are so negative, both to the harbor and the bay. It is for this last reason that clearing the hurdles of the Endangered Species Act lawsuit, the Biological Assessment and the Biological Opinion are so important.

I would like to specifically address two key points contained in the NMFS opinion.

**Monitoring**

MWRA ratepayers are funding an extensive program of monitoring in Boston Harbor and Massachusetts Bay. Samples are collected 214 days each year--almost half of these days are spent sampling in Massachusetts Bay. We collect 10,000 samples which yield 200,000 chemical results annually. Analyses are published regularly and widely reviewed, and our water quality model is continuously fine-tuned with the testing results. Our annual outfall monitoring budget is $ $2.5 million. These investments have leveraged about $1 million in annual funding from the U.S. Geological Survey and the National Oceanic and Atmospheric Administration's Sea Grant program. In addition, the Mass. Bays Program has contributed another $1 million.

Although our ratepayers will continue to do their part, opportunities must be created for others to participate. We are heartened that up to $200,000 for monitoring and research will be available through the newly-designated Stellwagon Bank National Marine Sanctuary (thanks to Congressman Studds' efforts). EPA has received a special $400,000 appropriation to study eutrophication in Massachusetts and Cape Cod bays.

The Commonwealth of Massachusetts' Open Space Bond Bill includes $7 million for coastal monitoring, and EPA's Environmental Mapping and Assessment at both a national and regional scale could provide additional monitoring. We have even been involved in discussions about converting defense dollars and technology to serve the peacetime needs of the marine environment.

**Contingency Planning**

In anticipation of the NMFS opinion, and for our own operational purposes, the MWRA has been exploring so-called "contingency" options in the hopefully unlikely event of either a physical disruption to the outfall or treatment system, or a negative biological impact in the Bay. As highlighted in the Opinion, we will pay particular attention to any indication of harmful impacts on the endangered North Atlantic Right Whale. We are focusing on the concept of "trigger" planning, which would elicit progressive responses from the MWRA as a result of findings from ongoing monitoring efforts. Advanced treatment options at Deer Island--while we have no reason to believe they will be necessary--are already being developed, and related institutional, environmental and cost consequences are being analyzed. We believe the "trigger" approach to contingency planning is both cost-effective and environmentally responsible.

In conclusion, the NMFS opinion provides a level of expert review which allows the MWRA's project to go forward, in hopes of delivering on its promise of a healthier marine ecosystem for the harbor and the bay. We look forward to continuing our partnership with all concerned agencies, organizations and individuals to implement the conservation recommendations and to make sure the new facilities work--both for our customers and the environment we are charged with protecting. Thank you for the opportunity to testify.

# MODELLING THE DILUTION OF THE EFFLUENT INTRODUCED INTO MASSACHUSETTS BAY BY THE NEW BOSTON OUTFALL

Bradford Butman and Richard P. Signell
U.S. Geological Survey
Branch of Atlantic Marine Geology
Woods Hole, Massachusetts

Testimony prepared for

HEARING ON THE RESULTS OF THE
ENDANGERED SPECIES ACT CONSULTATION
ON THE BOSTON HARBOR OUTFALL

Hearing held by
U.S. House of Representatives
Committee on Merchant Marine and Fisheries
Subcommittee on Environment and Natural Resources

Congressman Gerry E. Studds, Chairman

Hearing held
October 18, 1993
University of Massachusetts at Boston

## INTRODUCTION

My name is Bradford Butman. I am Chief of the U.S. Geological Survey's Branch of Atlantic Marine Geology, located in Woods Hole, Massachusetts. I have a doctoral degree in physical oceanography from the Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography (1975), and over the last 20 years have conducted studies of processes affecting the transport of suspended material in the coastal ocean. I would also like to introduce Dr. Richard P. Signell. Dr. Signell is a physical oceanographer who received his doctoral degree, also from the MIT/WHOI joint program, in 1989. He has been the principal investigator of the numerical modelling studies which I will describe to you this morning.

The cleanup of Boston Harbor and the assessment of effects on Massachusetts Bay has occupied the attention of Massachusetts's citizens and ratepayers for many years. Massachusetts Bay is a major resource for the Commonwealth. It is used for recreation, transportation, fisheries, and tourism as well as waste disposal and Stellwagen Bank, on the eastern side of Massachusetts Bay, has recently been designated as the Nation's 12th National Marine Sanctuary by the National Oceanic and Atmospheric Administration (NOAA).

## U.S. GEOLOGICAL SURVEY STUDIES OF MASSACHUSETTS BAY

Since 1987, the U.S. Geological Survey (USGS) has been engaged in a multi-disciplinary investigation of circulation and sediment transport in Boston Harbor and Massachusetts Bay (Butman et al, 1992). This work has been funded by the USGS and by a Joint Funding Agreement with the Massachusetts Water Resources Authority (MWRA). The program has also received support from the National Oceanic and Atmospheric Administration and benefitted from the very able logistical assistance of the U.S. Coast Guard. It is coordinated with the studies funded by the Massachusetts Environmental Trust and the Environmental Protection Agency's (EPA) Massachusetts Bays Program. The USGS program has been carried out in cooperation with other investigators at the Massachusetts Institute of Technology, the University of Massachusetts at Boston, the University of New Hampshire, the Woods Hole Oceanographic Institution and HydroQual, Inc.

The USGS studies have been designed to provide an understanding of the geological system and hydrodynamics of the Massachusetts Bays, particularly the transport and accumulation of sediments and associated contaminants. I am pleased to be able to present some of the results of these studies to you today.

The USGS program includes:

* Geologic mapping to identify the sea floor environments and potential locations of sediment and contaminant accumulation. These have been used to identify key monitoring sites by the Outfall Monitoring Committee. In 1993, we began systematic

mapping of the Stellwagen Bank National Marine Sanctuary

* Circulation modeling and direct observations of ocean currents to understand how water and materials are transported to and through the system.

* Long-term observations of currents and suspended sediments at one location near the new outfall to document seasonal and interannual variability and the rare and/or catastrophic events that play a major role in the transport of sediments.

* Compilations of existing and new observations of contaminants in sediments to document the past and present levels bay wide and to provide a baseline to measure change.

A long-term objective of the program is to develop a predictive capability for sediment transport and accumulation.

The USGS Massachusetts Bay study is part of a broader program to understand the accumulation and transport of polluted sediment in U.S. coastal waters. Because many coastal metropolitan areas are faced with similar pollution issues, these results and techniques developed in the Massachusetts Bay study will be applicable to other regions.

A central component of the USGS program in Massachusetts Bay has been computer modeling studies of circulation, which provide a framework for interpretation of oceanographic measurements and insight into mixing and transport processes. As discussed in more detail below, the USGS has conducted three-dimensional modeling studies of circulation and mixing patterns in Massachusetts Bay, including a comparison of the dilution of effluent from the present MWRA outfalls at President Roads and the proposed new MWRA outfall in Massachusetts Bay. These simulations show that although effluent concentrations in the immediate vicinity of the proposed outfall will increase, the extent of Massachusetts Bay affected by the highest concentrations will dramatically decrease. Concentrations of effluent near Stellwagen Bank are extremely small in both current and proposed outfall simulations.

## BACKGROUND TO ESTUARINE AND COASTAL OCEANOGRAPHIC MODELING

Before presenting specific results of the computer simulations of the effect of the new outfall on the waters of Massachusetts Bay, it is important to describe the rationale for the use of numerical models in these studies. An important element in understanding the fate of pollutants discharged into the coastal waters is understanding the mixing and transport processes which control the dispersal of water-borne materials. In the coastal ocean, these processes are driven by winds, river discharge, heating and cooling of the sea surface, tides, and remote effects from the waters offshore. Historically, oceanographic measurements have been the cornerstone of our conceptual and theoretical understanding of currents and water

properties. In coastal areas, because of the irregular coast line and topography and the complex forcing of the flow, it is difficult to obtain measurements in sufficient detail and frequency to resolve the spatial and temporal scales of the circulation.

In recent years significant progress has been made in the development of numerical circulation models which are able to simulate and predict the transport processes which operate in coastal areas. Such models, when properly configured and validated with observational data, often provide the best information on water transport processes in these geographic areas. Due to the complexity of the driving forces and topography in Boston Harbor and Massachusetts Bay, the circulation model provides one of the best mechanisms for understanding how material released from the new outfall pipe will be subsequently transported and diluted.

## DESCRIPTION OF HYDRODYNAMIC MODELING STUDIES

Over the past two years, the USGS has conducted extensive modeling studies of transport processes in Massachusetts Bay using the Estuarine and Coastal Ocean Model (ECOM) circulation model developed by Blumberg and Mellor (1980). The version used by the USGS is an improved version that allows for larger time steps called ECOM-si (si stands for semi-implicit). This model is used in conjunction with available observational data to determine the fate and transport of contaminants, nutrients, and other water-borne materials in Massachusetts Bay, including effluent from the proposed outfall site. The modeling work has been reviewed by the Massachusetts Bay Model Evaluation Group, consisting of a group of distinguished scientists having expertise in hydrodynamic processes and computer modeling. The MWRA, under separate contract to Hydroqual, Inc., is using the hydrodynamic model to develop a water quality model of Massachusetts Bay.

ECOM-si is a coastal ocean model highly respected among oceanographic scientists. Developed over the past 10 years, the basic ECOM model has been used on over 30 major studies including studies of ocean dynamics; semi-enclosed seas; estuarine systems; flows in open channels; and it is actively being applied in forecasting for Great Lakes and Norwegian coastal waters. It is recognized among oceanographers as a useful tool for simulating ocean transport processes.

The ECOM-si model is a time-dependent, three-dimensional model that is capable of simulating currents and water properties driven by the full suite of coastal ocean forcing mechanisms. Wind-stress, river runoff, offshore discharges of fresh water, heat flux, precipitation and evaporation, tides, and remote forcing by the open ocean all are incorporated in the model framework. It can account for evolving water masses, fresh water plumes, fronts, and eddies. Free surface elevation is also calculated so that tides and storm surge events can be simulated. Vertical variations in the currents, such as coastal upwelling, are simulated. Vertical mixing processes are accounted for through the use of a submodel developed by Mellor and Yamada (1982). A complete description of the governing equations

and numerical techniques can be found in Blumberg and Mellor (1987).

In the USGS studies, the ECOM-si model is configured to encompass all of Massachusetts and Cape Cod Bays, which combine to form a roughly 100x50 km semi-enclosed basin with an average depth of 35 m in the western Gulf of Maine (figures 1 and 2). The area also includes Stellwagen Bank. The modeling was done over an 18 month period, based on data from January 1990 to July 1991.

To solve the equations of the model, the model is driven with observed data at the lateral model boundaries and at the sea surface:

(a) Tidal elevations. The model is driven with tidal elevation at the offshore boundaries using data from a well-calibrated tidal model of the Gulf of Maine (Naimie and Lynch, 1991). Tidal data are specified for each five minute interval over the modeled time span.

(b) Wind. Wind direction and speed measurements are introduced into the model as surface conditions based upon meteorological data from the National Oceanic and Atmospheric Administration Boston Buoy, which is located very near the location of the proposed outfall. Values are given for measurements every four hours and are applied uniformly over the modeled area.

(c) Heat flux. Heat flux is also applied uniformly over the modeled area, and is calculated using insolation data from the Woods Hole Oceanographic Institution, relative humidity from Logan Airport, and wind speed, air temperature and sea surface temperature values from the Boston Buoy. As in the case of wind, heat flux values are introduced in four hour intervals.

(d) Fresh water inflow. Data for river runoff from the Charles and Merrimack Rivers are introduced into the model using daily USGS gauged measurements interpolated into four hour values. Freshwater inflow due to the current MWRA effluent discharges at Nut and Deer Island are also included. When modeling the effect of the proposed outfall, the fresh water associated with the effluent is discharged at the new location.

Data for calibrating and verifying the model were obtained through an intensive field program during the period 1990-1991 (Geyer et al, 1992). Verification was based primarily on comparing the subtidal circulation statistics at nine current observation sites located in Massachusetts and Cape Cod Bays. The model results compare favorably with observed conditions, indicating valid predictions of dispersion and transport within western Massachusetts Bay.

The model and observed data indicate that the major horizontal transport mechanisms in Massachusetts Bay are wind and river runoff. Tides play an important role in vertical

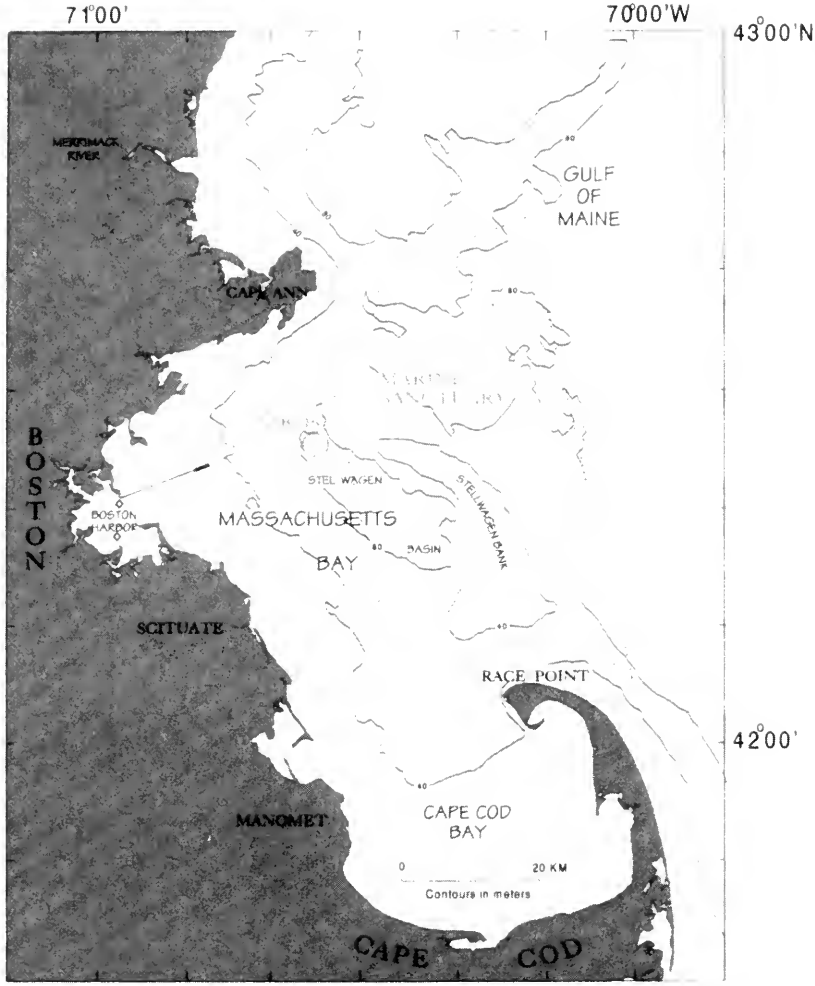


Figure 1. Bathymetric map showing Massachusetts and Cape Cod Bays, present sewage outfalls at President Roads and Nut Island in Boston Harbor (diamonds), location of new ocean outfall for treated Boston sewage in western Massachusetts Bay (average flow about 20 $m^3 s^{-1}$), the boundaries of the Stellwagen Bank National Marine Sanctuary, and the location of the Massachusetts Bay Disposal Site (MBDS). The annual rate of river discharge from the Merrimack is about 215 $m^3 s^{-1}$ and through Boston Harbor is about 10 $m^3 s^{-1}$.

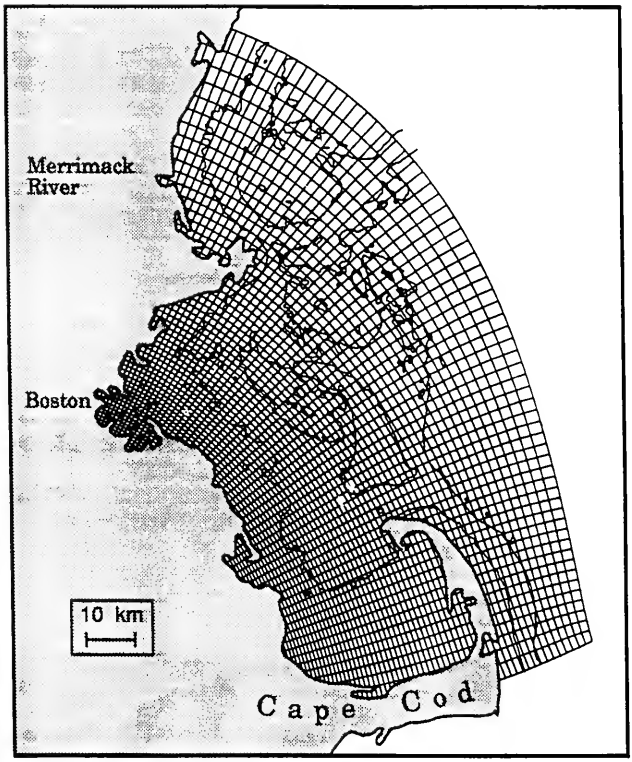


Figure 2. Model grid for the three-dimensional circulation model of Massachusetts and Cape Cod Bays. The curvilinear orthogonal grid allows the mesh resolution to vary spatially, having a minimum grid spacing of 600 m and a maximum spacing of 6000 m. The grid spacing in the vicinity of the proposed outfall is about 1000 m. There are currently 10 vertical sigma levels in the model, evenly spaced throughout the water column.

mixing processes due to their strength, but since they are periodic they essentially displace material back and forth over the length of the tidal excursion with little net transport. The tides have a large effect on the flushing of Boston Harbor, but they play little role in transporting material over distances comparable to the size of Cape Cod and Massachusetts Bays.

Studies have shown that the mean flow of water in Massachusetts Bay is in a counterclockwise direction (figure 3). The USGS modeling studies support this interpretation. The modeling results indicate that this pattern is caused by the southward direction of the coastal current flowing from the Gulf of Maine, in combination with mean westerly winds. Western Massachusetts Bay, including the area around the proposed MWRA outfall, is usually not included in this circulation but rather lies to the west of the coastal current. During winter months (November through April), waters in the Massachusetts Bay are well mixed vertically. During the late spring and summer months, however, freshwater inflow from the Gulf of Maine and surface warming cause the water to become stratified, and mixing between the upper layer and deeper colder layer is reduced.

Simulations of effluent dilution were performed by tracking the concentration of a passive tracer introduced with the fresh water at the outfall. Using observed treatment plant flow data provided by the MWRA, the USGS modeled areas of effluent dilution from both the present outfall near the mouth of Boston Harbor as well as the proposed new outfall in Massachusetts Bay. Coastal circulation models are not appropriate for modeling the near field turbulent entrainment of a rising plume, so the simulations performed with ECOM-si are tuned to match the near field dilution (dilution occurring within 175 feet of the outfall) predicted by EPA's ULINE model for near field dilution (EPA 1988).

## PREDICTIONS OF EFFLUENT DILUTION

The results of the modeling of effluent dilution from the existing outfall in Boston Harbor and from the proposed outfall in Massachusetts Bay shows that moving the outfall into Massachusetts Bay:

* greatly reduces effluent concentrations in Boston Harbor;

* increases effluent concentrations in the immediate vicinity of the new outfall, but overall reduces the size of the region in Massachusetts Bay frequently visited by higher concentrations.

These results reflect increased dilution of the effluent associated with the greater water depth and the increased distance from the coast at the new location.

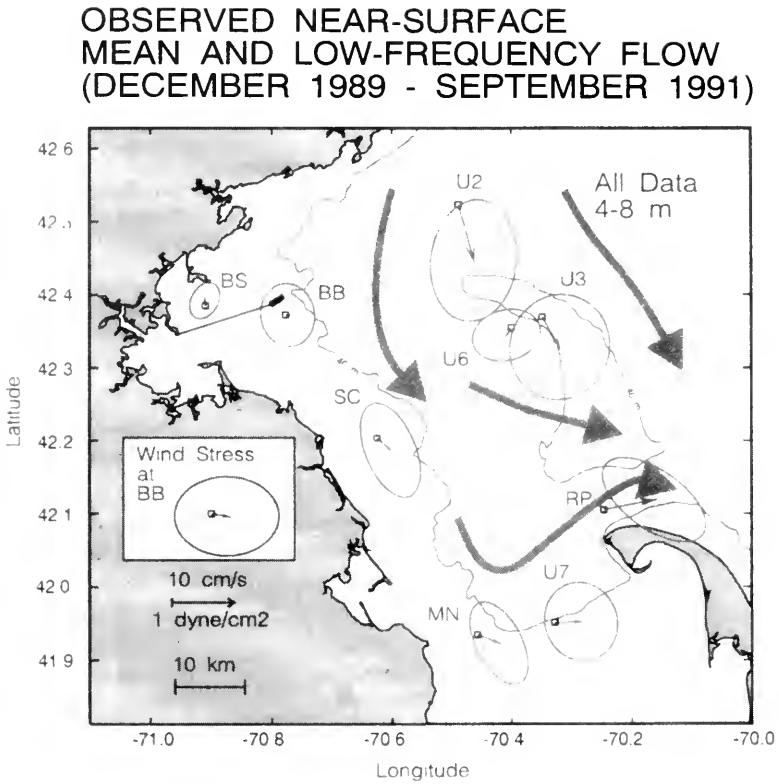


Figure 3. Map showing the mean flow (solid arrows) and the daily variability (shown as ellipses centered around the tip of the mean flow) for all near-surface (4-8 m depth) current measurements made from December 1989 to September 1991. Typically, the daily-averaged current originates at the station symbol and flows toward any location within the ellipse. The arrows and ellipses have been scaled to correspond to the distance a particle moving with that current would travel in one day. The mean-flow pattern suggests weak flow into Massachusetts Bay from the north and across Stellwagen Bank, southeastward along-shore flow near Scituate and Plymouth, easterly flow in Cape Cod Bay, and outflow in the channel north of Race Point (bold arrows). The area of the new ocean outfall is an area of weak flow compared to the outer bay and there is no strong preferred direction of flow; it is apparently located to the west of the stronger residual coastal current system. This means that water and material here are mixed and transported by a variety of processes rather than being swept in a consistent direction by well-defined steady currents. Station BB is the USGS long-term monitoring station. From Geyer et al (1992).

A dilution of 1:400 (1 part effluent to 400 parts seawater) is used to summarize the effects of the outfall. For nitrogen, concentrations of effluent diluted 1:400 are typically smaller than the natural variability of the ambient nitrogen levels (see EPA, 1993, page 4-20). Thus for this nutrient, this dilution represents a reasonable level beyond which the effect of the new outfall should be minimal.

The effect of the effluent at a given location is illustrated by the frequency or percentage of time that effluent more concentrated than 1:400 dilution is found at the location.

WINTER: During winter unstratified conditions, effluent is well-mixed vertically, and surface values represent levels throughout the water column. Over a period from December 1990 to March 1991, effluent more concentrated than the 1:400 level from the existing outfall occurs more than 80% of the time in a region which includes all of Boston Harbor, and the South Shore as far as the North River (figure 4). In contrast, effluent more concentrated than the 1:400 level from the proposed outfall is found more than 80% of the time in a much smaller (10 km diameter) region offshore. For both outfall locations, effluent more concentrated than 1:400 is found chiefly in western Massachusetts Bay and never found around Stellwagen Bank or Race Point.

SUMMER: During the summer stratified conditions, simulations show that effluent from the existing outfall tends to remain in the lighter surface layer, while effluent from the proposed outfall tends to remain in the heavier lower layer. For the surface waters, therefore, while effluent more concentrated that 1:400 is found frequently in western Massachusetts Bay with the existing outfall, it almost never occurs with the proposed outfall (figure 5). At 15 m depth, the situation is reversed, with effluent more concentrated than 1:400 dilution found typically in a 10 km diameter region around the proposed outfall, and almost never occurring with the existing outfall (figure 6). The areal extent of the deeper waters typically affected by the proposed outfall is significantly less than the areal extent of the surface waters affected by the existing outfall. As in the winter months, effluent more concentrated than 1:400 is never found around Stellwagen Bank or Race Point.

The entire 18-month simulation (January 1, 1990 to July 1, 1991) shows:

* Stellwagen Bank was not frequented by effluent more concentrated than 1:400 (less than 1% of the time for the existing outfall and never for the proposed outfall)

* Cape Cod Bay was infrequently visited by effluent more concentrated than 1:400. In winter, these levels were exceeded less than 40% of the time from the existing outfall and less than 20% of the time from the proposed outfall. In summer, these levels were not exceeded by the existing outfall and less than 5% of the time from the proposed outfall.

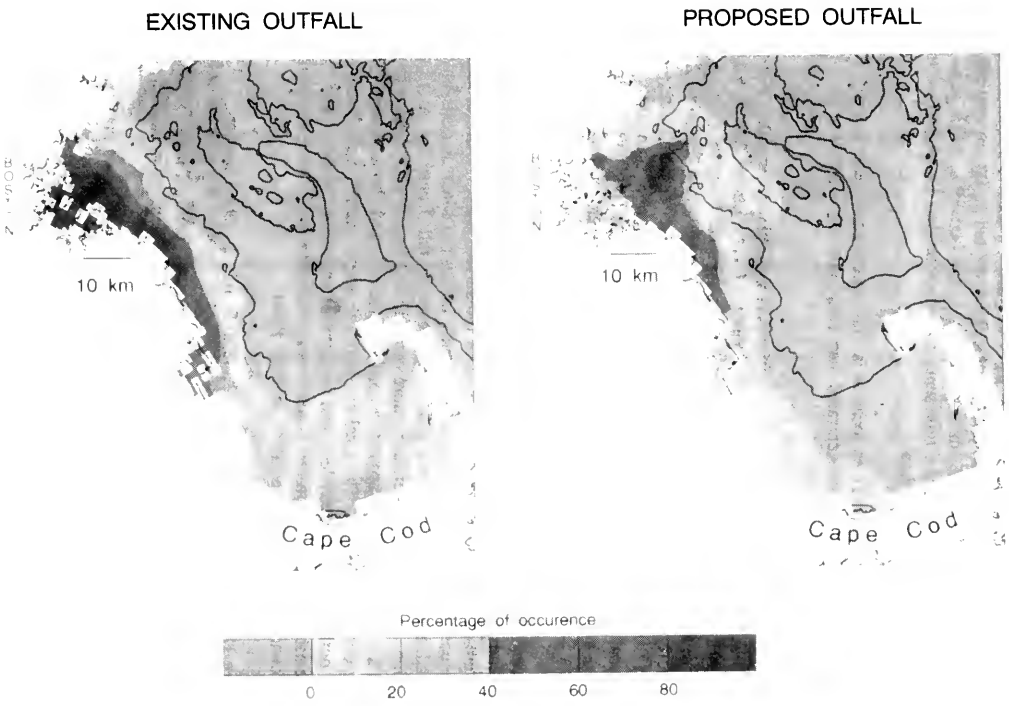


Figure 4. Model predictions of the percentage of time that the concentration of effluent is more than 1 part of effluent to 400 parts seawater at the surface for the existing outfall and for the proposed outfall (simulation for the period December 1, 1990 to March 31, 1991).

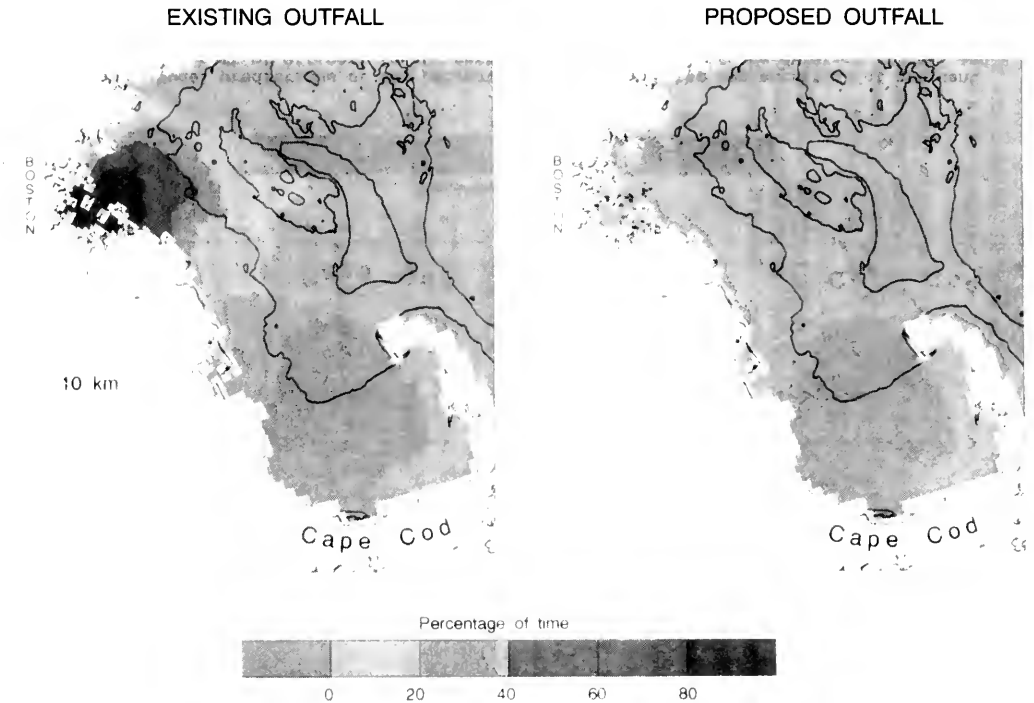


Figure 5. Model predictions of the percentage of time that the concentration of effluent is more than 1 part effluent to 400 parts seawater at the surface for the existing outfall and for the proposed outfall (simulation for the period May 1 to August 31, 1990).

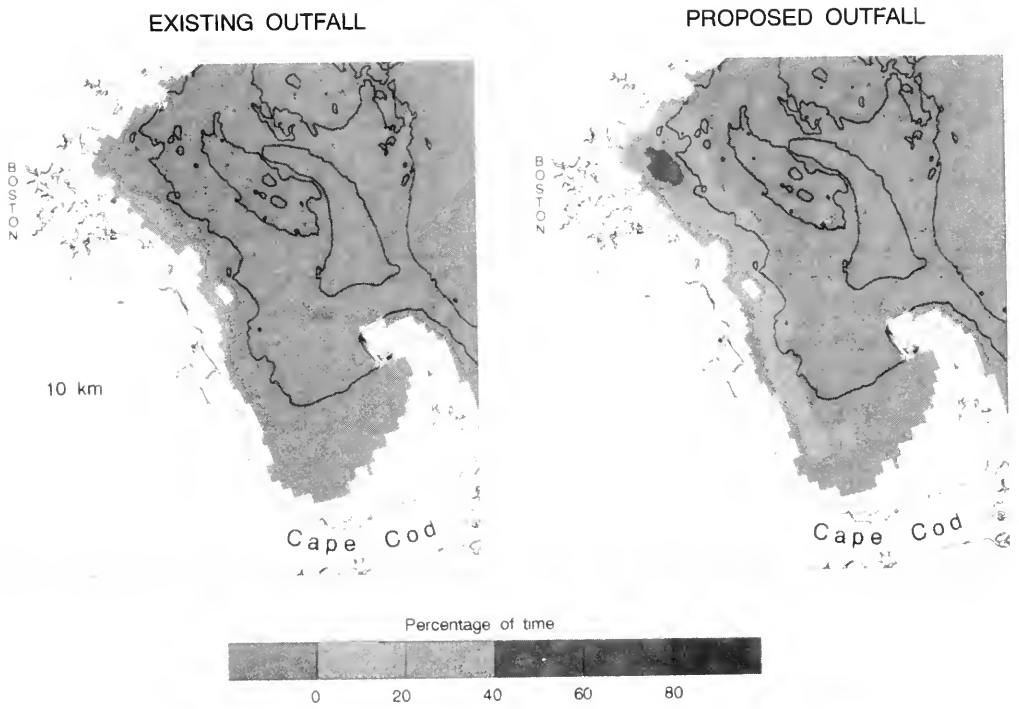


Figure 6. Model predictions of the percentage of time that the concentration of effluent is more than 1 part of effluent to 400 parts seawater at 15 m for the existing outfall and for the proposed outfall (simulation for the period May 1 to August 31, 1990).

The time variability of dilution of the effluent in Massachusetts and Cape Cod Bay is illustrated by a video simulation.

These results are consistent with the conclusion reached in the Supplemental Environmental Impact Statement (EPA, 1988) that relocating the outfall to the new location in Massachusetts Bay, while significantly improving the dilution of effluent in Boston Harbor, will not significantly alter the effluent concentrations in most of Massachusetts Bay.

I thank you for the opportunity to present these results of the USGS modeling studies. We look forward to continuing the USGS studies of sediment and contaminant transport in the Massachusetts Bays to provide a regional framework to aid in managing this valuable resource.

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Testimony on the NMFS Biological Assessment of the Potential impact of the MWRA outfall on Endangered Species

Scott Kraus
Associate Scientist
New England Aquarium
Boston, MA 02110

John Prescott
Executive Director
New England Aquarium
Boston, MA 02110

In general, we concur with the NMFS biological opinion that the proposed MWRA outfall may affect, but will not jeopardize the continued existence of any endangered or threatened marine mammal species in Massachusetts Bay. With regard to right whales, we believe that the limited information available is consistent with this opinion, but that there are significant gaps in the data which should be addressed.

First, the distributional data on all whale species around the outfall site is very poorly known outside the whalewatching season. From November to May (a period when right whales are known to be inhabitants of nearby Cape Cod Bay), no systematic surveys for marine mammals have been conducted in the outfall area. Therefore, the potential for direct contact between endangered whales and outfall effluent is unknown. Statements indicating "whales are not common in the nearfield of the proposed outfall" (NMFS Bio. Opinion, p. 58), and "there is a low probability of these species encountering high levels of nutrients and contaminants from the new outfall, because .... the endangered species are not known to frequent this particular area of Massachusetts Bay" (EPA Assessment, p. 4-106) are overstated. Neither the EPA nor NMFS have any scientific basis for making these statements, and the lack of knowledge about winter whale distribution in the outfall area is unsettling.

Second, the question of cumulative effects is not well addressed. There are other significant problems for right whales in the region including collisions with ships and entanglements in fixed fishing gear. However, the cumulative effects of urban and industrial outfalls along the east coast of the U.S. are not addressed. Because this species travels in the nearshore zone of the U.S., it may be susceptible to cumulative effects on habitat throughout their range. The monitoring recommendations in the Biological Opinion are therefore particularly important in beginning to address this question.

Finally, one of the reasons that there are so many questions about the right whale and the potential effects of the outfall is that the independent research efforts in this area have been systematically curtailed. Food chain effects, population biology, and human effects questions related to this rarest of whales have

been on the agenda of right whale researchers since 1986. They are identified as high priorities in the NMFS right whale Recovery Plan, published in 1991. The conservation recommendations outlined in the Biological Opinion are essential to determine if the MWRA outfall affects marine mammals and their habitats.

If the American public wants right whales around in 100 years, we suggest that Congress allocate additional funds for management and independent research on this species, to allow NMFS fulfill the mandate of the recovery plan. We also suggest that implementation of the recovery plan be expedited, and that interagency cooperation and outside peer review of both research and management actions become an essential part of that implementation. These actions will ensure sound management responses to projects like the outfall, and effective mitigation of all threats to right whales.

Dr. Charles Mayo

Comments to the Committee on
Merchant Marine and Fisheries
regarding
Endangered Species Consultation
on the
Boston Harbor Outfall

The following comments are presented in light of my substantial agreement with the conclusions of the National Marine Fisheries Service's Biological Opinion and are intended to express an ongoing concern with our lack of knowledge about the physical and biological processes which influence the endangered species, especially the northern right whale.

The Biological Opinion reasonably sets forth the circumstances which confront us as we in good faith try to right the wrongs which have been visited on Boston Harbor for so many decades. NMFS correctly recognizes what has been given little emphasis by governmental agencies in the past - that coastal ecosystems which are so very important to human and animal societies are unfathomably complex and, in spite of our efforts, nearly impossible to truly manage.

Absent very good predictive models of the ocean ecosystem and confronted by our need to clean Boston Harbor, it may well be that the MWRA project is the best present-day solution. But we must acknowledge, as this Biological Opinion does, that the consequences of the project are not absolutely known. And, particularly in the case of such rare resources as the right whales, we must do all that we can to understand the effects of the project on the habitat and critical resources of the whale - we must assure that there is a sensitive monitoring of the habitat, the whales, and the resources on which they depend so that we may document and correct any changes in the whale's habitat should unpredicted and detrimental changes occur. To this end the Biological Opinion recommends in general terms the monitoring of right whale habitat. With regard to these recommendations I respectfully encourage:

1. That these recommendations be fully implemented.

2. That monitoring begin immediately - our knowledge of any changes in the right whale habitat will be only as good as our description of the conditions before the outfall is on line - accurate description of the pre-outfall conditions and the response of the whales and their resources must begin now.

3. That monitoring directed at right whales be tightly coordinated with ongoing Bays-wide studies and be made a part of the discharge permit.

4. That the design of whale habitat studies be constructed to make use of present knowledge of the species with respect to scale, distribution, and occurrence of feeding and non-feeding activities.

The development of a good monitoring plan for the right whales, their resources, and the habitat will require, therefore, haste, commitment, coordination, and funds, and the encouragement of officials from federal, state, and private agencies.

The Bays ecosystem - Massachusetts and Cape Cod Bays - presents us with a perfect example of the collision that occurs between various environmental issues and human activities. With the essential guidance of our congressional delegation, Stellwagen Bank has recently been declared a national marine sanctuary.....with the interest of many citizens and scientists, we have recognized the importance of Cape Cod Bay to the northern right whale ..... but, also, with the acquiescence of some agencies and individuals in the past, toxics were disposed in quantities and at locations in northwestern Massachusetts Bay, fouling the ocean in ways which we cannot monitor. Apparently, the collision cannot be avoided or, perhaps, controlled. My concern is that, if we also do not monitor the collision between human use of the sea and our need for a healthy sea, we will never have any hope of protecting the habitats so critical to the well being of the people and the precious right whales of Massachusetts.

The sewage outfall project reviewed by NMFS is an example of this collision - and the issue of monitoring is critical. The outfall is designed to dispose of hundreds of millions of gallons of treated effluent into a habitat seasonally occupied by three species of endangered whales, one of which, the right whale, has been the center of my research for the past eight years.

The future of the last right whales probably depends on our careful stewardship of the Bays - for it is to Cape Cod Bay each year that numbers of right whales still come, the last of what must have been an extraordinary migration before our ancestors began to hunt them. Today, although many of their habitats have been lost over the centuries and their numbers drastically declined, the right whales still continue to feed and socialize in the Bays. The relationship, habitat to whale, is profound: if the food resources decline or otherwise are not acceptable, it is likely that the whale will be severely impacted, for we know that the whales are lured to the Bays each winter not by chance but by unusual concentrations of microscopic food organisms which the whales filter from the sea by the hundred pound lot. We have studied the rich patches of tiny shrimp-like creatures, the zooplankton, on which the right whales depend and have determined some of the basic characteristics of the association between the food and the whales' behavior. We can say with certainty that the Bays' ecosystem provides what the whales need to make a living in the winter and early spring, but we also believe that the resources are marginal, that finding the small patches (thin layers perhaps no more than 200 yards across and ever changing in the flow of the currents) is difficult. Our data suggest that the success of the whales in the Bays, the only known winter and early spring feeding ground for the species, may indeed be marginal, though presently acceptable - that densities in the food patches are high but so variable and apparently susceptible to change from natural and anthropogenic influences that the dynamic relationship between the zooplankton food and the feeding right whale is always tenuous.

The present plans to abate the pollution problems of Boston Harbor, where, incidentally, I imagine right whales in better times once visited, place the sewage effluent - up to 1.3 billion

gallons/day - east of Boston in a weak current which sweeps south into southern Massachusetts and Cape Cod Bays. On the one hand, the proposal cleans up Boston Harbor and improves the treatment of the sewage. On the other hand we are confronted by an effluent which, although it appears to be better "packaged", is placed in a location and at a depth which are considerably different from that which presently exists. My concern is not that the construction and engineering plans are faulted, on the contrary, they appear to be an effective - if ultimately temporary - solution to a sewage disposal problem which has overwhelmed a productive coastal habitat. The problem which we must confront for the sake of the right whales and for our own well being is that the certainty of engineers, scientists, and planners today will likely dissolve tomorrow. Boston Harbor's sorry state is itself an example of this problem. We can imagine that in the past century Boston sought to solve a pollution problem which threatened the city and its habitat. The best solution at that time was for the sewage to be piped into the coastal waters where it was predicted that tides would sweep the toxins out and dilute them in what appeared to be an infinite sea. Some objected, saying that we did not then understand the ocean or the resources well enough to predict the consequences of near-shore disposal of that quantity of noxious material. But need and assurance prevailed and the outfalls in Boston Harbor were built. I propose to you that we do know much more about the sea and the coastal environment and that we, to this day, view the sea not as our garden but as our dump ..... and to this day, we do not understand the powerful yet delicately balanced forces which shape the ocean system that support our fisheries, our recreation, and the last of the right whales. So today: we can know something of the movement of the effluent southward, but not the effects of variable overturns on the productive surface of the sea; we understand how sewage nutrients influence the growth of plants but we cannot predict which microscopic plants will grow and how they will affect the zooplankton at the base of the food web; we know that the present secondary treatment will reduce the total pollution load in the Bays but we do not know how the injection of the effluent into a potential feeding area of the last right whales will effect the deep layers of food.

Some things have not changed much in the past century. We continue, with few alternatives, to consider the sea our dumping ground, yet it remains clear that we cannot accurately predict the consequences of many of our actions in the ocean environment just as we could not when outfalls were first constructed in Boston Harbor. Unfortunately, the right whales have declined while their needs remain a mystery. In the simplest terms we know now why they come to the Bays and we sense how pivotal are our decisions in their future. But we do not know how the zooplankton patches form, or exactly where they come from, or how the whales feed beneath the surface, or, even, what would happen to the last 330 or so right whales of the North Atlantic if the Bays were disrupted in unexpected ways by the relocation and treatment of the Boston effluent. Uncertainty is still the dominant theme of our management efforts in the sea.

# CAPE COD COMMISSION

3225 MAIN STREET
P.O. Box 226
BARNSTABLE, MA 02630
508-362-3828
FAX: 508-362-3136


TESTIMONY OF THE CAPE COD COMMISSION
BEFORE THE SUBCOMMITTEE ON ENVIRONMENT AND
NATURAL RESOURCES OF THE HOUSE COMMITTEE ON
MERCHANT MARINE AND FISHERIES
REGARDING THE NATIONAL MARINE FISHERIES SERVICE
BIOLOGICAL OPINION ON THE EFFECTS OF THE
OPERATION OF THE PROPOSED MWRA OUTFALL
IN MASSACHUSETTS BAY

PRESENTED OCTOBER 18, 1993
BY
ALIX L. L. RITCHIE

OCTOBER 18, 1993
TESTIMONY OF THE CAPE COD COMMISSION
BEFORE THE SUBCOMMITTEE ON ENVIRONMENT AND
NATURAL RESOURCES OF THE HOUSE COMMITTEE ON
MERCHANT MARINE AND FISHERIES

Mr. Chairman, and members of the Subcommittee, I am Alix Ritchie, a member and the immediate past chair of the Cape Cod Commission. I am pleased to be here today on behalf of Barnstable County and the Cape Cod Commission, to comment on the Biological Opinion prepared by the National Marine Fisheries Service (NMFS), on the effects of the proposed operation of the Massachusetts Water Resources Authority's (MWRA) outfall, as described in the NPDES permit application before the Environmental Protection Agency, on endangered and threatened species and their habitats in Massachusetts and Cape Cod bays. My remarks are based on analysis that has been performed for Barnstable County by a panel of five scientists selected for their expertise and special qualifications in fields relevant to this review.

The federal government has highlighted the national significance of Massachusetts and Cape Cod bays by taking three signficant actions:

* designation of the bays as an Estuary of National Significance;

* designation of Stellwagen Bank as a National Marine Sanctuary; and

* proposing the designation of eastern Cape Cod Bay as Critical Habitat for the right whale.

Cape Codders have always been aware of the productivity and value of Cape Cod and Massachusetts Bays and Stellwagen Bank. Concern for the region's resources, and the long term impact the MWRA project may have on this ecosystem, particularly on the endangered and theatened species it supports, have led regional and local governments on Cape Cod, as well as many individual Cape Codders, to carefully scrutinize the MWRA project

Residents' concerns led Barnstable County's legislative body, the Assembly of Delegates, to pass a resolution in November 1991, a copy of which has been submitted for the record, outlining the County's major concerns regarding the MWRA facility. The resolution includes a set of specific actions to be taken to protect the bays' ecosystem. Many of these actions are embodied in the Conservation Recommendations and Additional Studies specified in the Opinion. We are pleased to see that NMFS agrees with the County's call to action, and we believe that these measures are vital to the protection of our endangered species.

As a part of the Cape's on-going evaluation of the MWRA project, the Barnstable County Commissioners' Science Advisory Panel (SAP) reviewed EPA's Workplan for the Biological Assessment, the Assessment itself, and the Biological Opinion. Copies of these documents have been provided to you. The NMFS considered the SAP's comments in preparing the Opinion, and incorporated many of the issues raised in their reports in the Conservation Recommendations and Additional Studies.

Before reviewing with you some of our specific comments on the Opinion and the conservation recommendations, I'd like to make three points regarding the process that has culminated in this decision. The intent of the consultation process, under Section 7 of the Endangered Species Act, is to determine a project's potential impact on endangered and threatened species and their habitats prior to an agency(ies) making irretrievable commitments of funds to the project.

In this instance, however, the NMFS conducted its detailed consultation and rendered an opinion after the Army Corps of Engineers had issued a construction permit for the outfall tunnel, and after the MWRA had committed more than $400 million and begun construction of the tunnel. Important decisions had been made regarding the location and engineering of the outfall and significant monies had been spent on the project. Thus, we believe there was a irretrievable commitment to the project before this Opinion was rendered, implicitly limiting the field of alternatives and mitigation options considered by NMFS.

Secondly, we are concerned that this process has been based on the underlying assumption that, where there is conflicting credible scientific evidence or where there is uncertainty regarding impact, the benefit of the doubt goes to the project. This appears to us to be in conflict with the intent of the Act, in which the benefit of the doubt was to go to the endangered and threatened species and their habitat. The County's SAP 's agreement with the NMFS "no jeopardy" finding is valid only under the assumptions regarding the process as outlined in the Fact Sheet accompanying the Biological Opinion. I quote the SAP report:

> *All SAP members agree with the finding of No Jeopardy. However, the constraints leading to this finding, as enunciated in the Fact Sheet accompanying the Biological Opinion, were new to the panel and had not been enunciated before to the SAP. The unanimous agreement of the SAP members on the finding of No Jeopardy is linked closely with the Fact Sheet "ground rules."*

Finally, we believe very strongly that the analysis which forms the basis of this project is flawed in that it did not consider whether the existing conditions in Massachusetts and Cape Cod bays are contributing to the threat to endangered and threatened species and their habitats, and thus whether the NMFS should approve any action which may additionally pose a threat. Both the Biological Assessment and the Opinion describe the degradation that is occuring in the bays, and the impacts that will result from the discharge of effluent from the MWRA facility.

The Right Whale Recovery Plan states, on page 11, that " the general degradation of coastal marine habitats may ultimately be the most important factor affecting recovery of the northern right whale." Thus it is possible that conditions as they currently exist in the Bays are threatening the population and their habitat.

The Biological Opinion provides a quite thorough treatment of the significant environmental issues regarding the discharge of partially and fully treated sewage effluent and its potential to impact on the Bays system and to harm endangered and threatened species. The Opinion raises a number of appropriate questions and calls for needed studies.

We believe that all of the Conservation Recommendations and Additional Studies included in the Opinion are critical to the determination of whether future operations of the MWRA facility will jeopardize the continued existence of endangered and threatened species. We emphasize the need for many of these, including alternative analyses, to be completed prior to any discharge from the outfall. We agree with NMFS that these recommendations must become part of the discharge permit, the Court Order, or any other relevant federal or state actions: Their implementation cannot be left to chance.

In addition to the recommendations contained within the Biological Opinion, we strongly urge you to assure that the following actions are taken:

1. The far-field monitoring program must be developed and implemented prior to the operation of the outfall. At present, we do not have adequate baseline data to evaluate future environmental change. Without this baseline, we will be unable to determine whether there are adverse impacts from the outfall, and thus whether endangered and threatened species and their habitats are in jeopardy. The importance of far field monitoring has been highlighted by our SAP in their review of the Biological Assessment and the Opinion.

2. Meaningful change in environmental conditions which affect the threatened and endangered species of concern must be defined. Clear goals and objectives must be identified for monitoring to be useful in determining change. Members of the SAP address these points in their comments on the Opinion. The management process is inadequate without a definition of meaningful change in order to determine whether adverse impact is occuring. In addition, benchmarks are required for determining whether the contingency plan must be invoked.

3. We agree with NMFS on the importance of developing a contingency plan, and being prepared to implement it if necessary. We recommend that this contingency plan also address needed actions as a result of any breakdown in the facility, and that the plan identify alternatives to using the proposed outfall. The plan should be specific in terms of allowed treatment levels, permissible timeframes before contingency actions are required, and alternative upgrading procedures.

4. The MWRA should be required to address the effect of growth on the sewage system and its future capacity. The Opinion's findings are based upon specific flow assumptions, and it notes the lack of consideration given to growth in the volume of effluent. The projected growth in the service area should be analysed, and the time over which this capacity is projected should be identified.

Full and effective implementation of these recommendations and those in the Opinion will require additional funds. We believe these costs should not be borne solely by the MWRA ratepayers. The protection of Massachusetts and Cape Cod bays and their resources are a national and statewide concern, and thus the costs of protective measures must be shared.

In closing, I would note that neither the Biological Opinion nor the consultative process which preceded it, has addressed the difficulty of assessing impacts in a remote location BEFORE IT IS TOO LATE. While we would all agree that dead whales as a measure of adverse impact is not acceptable, it is unclear as to what the appropriate indicators are and how they are to be measured. We are still left with the critical question unanswered: How do we prevent harm from becoming jeopardy, and jeopardy from becoming disaster?

## EVALUATION OF

## "NOAA FISHERIES ENDANGERED SPECIES ACT SECTION 7 CONSULTATION: BIOLOGICAL OPINION"

Issued 8 September 1993 by the
Northeast Marine Fisheries Service Northeast Region
Relative to the Issuance of a National Pollutant Discharge
Elimination System (NPDES) Permit for the
Massachusetts Water Resources Authority (MWRA) Outfall

by the

**Science Advisory Panel (SAP)**
Barnstable County Commissioners

3 October 1993

The Science Advisory Panel for the Barnstable County Commissioners has reviewed the NOAA Fisheries Endangered Species Act Consultation Biological Opinion for the NPDES Permit for the MWRA outfall.

All SAP members agree with the finding of No Jeopardy. However, the constraints leading to this finding, as enunciated in the Fact Sheet accompanying the Biological Opinion, were new to the panel and had not been enunciated before to the SAP. The unanimous agreement of the SAP members on the finding of No Jeopardy is linked closely with the Fact Sheet "ground rules".

The SAP also strongly endorses the need for the Conservation Recommendations. It is our understanding that these Conservation Recommendations will be applied in some sense as permit, regulatory or legal requirements to the outfall operation.

However, the SAP has some reservations about the adequacy and completeness of the Conservation Recommendations. Nearly every Panel member review has some specific comments on the need for improved recommendations, or specifics for improving the recommendations. Though not all repeated here, we encourage NOAA to examine these SAP comments carefully.

In particular, the Contingency Planning recommendations appear reasonable and are to be encouraged. However, Dr. Smayda points out the need to clarify the process for implementation of the Contingency Planning: what measure will be used to determine adverse impacts on the Endangered Species, and how will that measure "trigger" specific actions? MWRA or EPA should clarify this line of reasoning, so the public is assured that this contingency planning will be more than just a paper study.

The Additional Studies recommended also are encouraged. However, some Panel members document the lack of focus of such studies. What are the goals and objectives of such studies? What are the driving scientific questions? How will the specified studies achieve those goals and answer those questions? Without a clearer indication of specific goals and questions, there can be little assurance that the studies will help resolve issues directly related to Endangered Species and the Consultation Process. Since the Consultation Process is a continuing process, not limited to the present time but continuing throughout the life of the outfall, it is imperative that th.

"studies" provide information that can guide this debate in the future. Specific details and recommendations from the SAP on these additional studies are included in the individual submittals included with this document.

The Monitoring Plan is similarly an important component of the Conservation Recommendations. Like the Additional Studies, though, the Monitoring Plan appears to lack a scientific or management specificity. What are the major scientific or engineering issues to be resolved by the monitoring? Is the design adequate to resolve these issues? Of particular concern, as indicated by Dr. Taylor and others, is the adequacy of this monitoring to distinguish human effects from natural variability in a strongly variable ecosystem. Without adequate thought and experimental design at the beginning of the monitoring effort, funds and effort can be wasted with little or no gain to the objectives of the Consultation Process. MWRA already has a monitoring plan, which not all the SAP has reviewed. How do the recommendations for monitoring proposed by NOAA fit into the MWRA monitoring program? Coordination clearly is essential. Specific comments on the monitoring plan elements are in the individual submittals included with this document.

Finally, the Other Permit conditions have been found to be germane, particularly the requirements for chronic toxicity testing and reduction of pollutant loadings.

Detailed submittals by the members of the Barnstable County Commissioners' Science Advisory Panel (SAP) are attached.

# EVALUATION OF

# "NOAA FISHERIES ENDANGERED SPECIES ACT SECTION 7 CONSULTATION: BIOLOGICAL OPINION"

Issued 8 September 1993 by the
Northeast Marine Fisheries Service Northeast Region
Relative to the Issuance of a National Pollutant Discharge
Elimination System (NPDES) Permit for the
Massachusetts Water Resources Authority (MWRA) Outfall

David G. Aubrey, PhD.

Aubrey Consulting, Inc.
Suite 2-3
350 Gifford Street
Falmouth, MA 02540

and

Science Advisory Panel (SAP)
Cape Cod Commission

3 October 1993

This review of the Biological Opinion (Opinion) focused on the following aspects:

1) Is the conclusion of "no-jeopardy" justified in the Opinion, and by available data presented in the Opinion as well as other sources of information?

2) Are the Conservation Recommendations presented in the Opinion necessary, valid and relatively comprehensive?

I address each of these issues separately below.

## 1) Justification of the "no-jeopardy" Opinion

In the Opinion provided by NMFS, the Endangered Species Act Section 7 Consultation process is outlined. In particular, the actions that NMFS must take are detailed, particularly in light of scientific uncertainty. Specifically, the consultation document specifies that

"• In situations where there is conflicting credible scientific evidence or where there is uncertainty regarding impact, a jeopardy conclusion is difficult to justify. Although a certain amount of new studies may be requested to assist in the decision, NMFS must ultimately make its conclusion on the available information."

and also,

"• Even though an action may affect or is likely to adversely affect a listed species, it does not necessarily follow that the action will jeopardize the continued existence of the species. In order to find jeopardy, NMFS must have evidence, as stated in the ESA regulations:

that the action reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species."

My review is based on the MWRA Outfall Biological Opinion Fact Sheet which accompanied the Opinion, and assumes all of the process elements (two of which are extracted above) are correct. If these processes are not correct, then my assessment of the NMFS Opinion might change.

The major points of concern by the SAP in previous reviews (October 1992 comments on "Final Work Plan for Performing a Biological Impact Assessment and Related Tasks in Support of Preparation of an Endangered Species Technical Memo" and the 10 July 1993 comments on "Assessment of Potential Impact of the MWRA Outfall on Endangered Species: Biological Assessment Prepared pursuant to Section 7 of the Endangered Species Act") related to the vast uncertainties in our ability to predict in any quantitative fashion the precise effects of outfall relocation on physical and biological processes in Massachusetts Bay. These uncertainties include physical processes such as circulation, mixing, dispersal, and sedimentation, as well as biological processes related to phytoplankton, zooplankton, and ultimately to marine mammals and other endangered species. Whereas ongoing modeling is expected to reduce the uncertainty in some physical circulation and mixing processes, it was not clear how the uncertainties in biological processes was to be reduced.

The Outfall Biological Opinion Fact Sheet suggests that jeopardy must be proven by available evidence, whereas no-jeopardy can be based on relative lack of data or scientific insight. This approach seems to short-change the endangered species, though I can understand its utility in a contentious and litigious regulatory environment.

With the Section 7 consultation procedures and guidance given above, and the difficulty of basing a jeopardy decision on uncertainty, I must agree with the NOAA NMFS finding of No-Jeopardy.

Moreover, I strongly agree with the need for contingency planning, additional studies, and monitoring. More detailed comments on these issues are provided in the next section. I also strongly encourage NMFS to evaluate constantly the results of these additional studies and monitoring results, to assure Consultation can be re-initiated if the available data or studies elsewhere warrant such re-initiation. However, to assure such attention by NMFS, a commitment is required to dedicate adequate high quality scientific talent to such reviews. Without such a commitment, this process allowing re-initiation of consultation may not be successful.

In addition, the significant scientific uncertainties outlined clearly in the Opinion must be addressed in a scientifically-defensible fashion and in a phased approach, to help guide this open-ended consultation process. Details are discussed below.

**2) Conservation Recommendations**

The Opinion provides three types of Conservation Recommendations: a) Contingency Planning, b) Additional Studies, and c) Monitoring. These are discussed in detail below. In general, monitoring and further studies can be misdirected easily, at great cost to the agencies. I can think of few monitoring tasks which have succeeded without clearly stated objectives and goals, whereas I can think of dozens of monitoring and "study" programs which have failed to

achieve the intended purpose, because of lack of direction, focus or competent implementation. This observation strongly suggests that NMFS must clearly state the objectives of such studies, and assure that the methodology is adequate to attain the objectives. In the case of discrimination of effects of xenobiotics on strongly variable population dynamics in a highly variable physical environment, these objectives and approaches must be thought out carefully and enunciated completely. In my opinion, as discussed below, neither the additional studies nor the monitoring components have been given this level of essential thought or written documentation. While I agree in general with the Conservation Recommendations, in their present state they provide too much opportunity for failure to achieve objectives pertinent to the Endangered Species Act. In addition, their vagueness may lead to continued debate, rather than resolving any debate themselves.

Since the Opinion's finding of no-jeopardy relies on the lack of available information, future reviews must be done with improved information, to dispel some of the uncertainty. Thus, the Conservation Recommendations must be well-focused and well-constrained.

a) **CONTINGENCY PLANNING**: The contingency planning recommended by NMFS, including the examination of mitigation measures such as tertiary treatment and reduction of loadings, is essential. This process should not stop with a single examination now, but a process should be established whereby mitigation options are continuously examined as new technologies or new data become available throughout the lifetime of the outfall. Criteria for acceptance or desirability of new or enhanced treatment alternatives should be developed.

b) **ADDITIONAL STUDIES** (A-1 through A-8): Though in principal some of these studies appear useful, some of the recommendations are so sparse that such studies may well prove useless. In particular:

A-1: 3-D dilution model: Who will review the 3-D model? For what purposes? How will this review fit into the consultation process? This "study" is entirely unclear.

A-2: Partitioning of chemicals: important question. How will this be folded into the consultation process?

A-3: What is "particle focussing" methodology? How will this methodology help with the consultation process? Why is there such a focus on lateral transport, as opposed to vertical transport? Clearly the two pathways are linked. Who will review the USGS studies, and for what purpose? How will this review be effected? Who will coordinate it? What regulatory powers will be associated with this review? Since these studies will not be complete before anticipated start of initial discharge, is NOAA recommending that discharge not take place until these studies are completed?

A-4: This comment sounds like a scientist with a method to sell (acoustics) developed it, but it is stated without full benefit of the scientific basis behind such studies. What are the goals of such studies? How will these studies provide "predictive information on the effects of the proposed outfall plume on plankton patches along those horizons?" I agree that plume monitoring is important, but I fail to see any focused purpose in this element of the modeling. To be useful, acoustic monitoring must be a part of an overall program, and cannot be a program in and of itself.

A-5: Why focus on this single alternative proposed by Bova (1993)? Instead, a whole suite of alternatives could be considered. This "study" should be part of the overall recommendation P-3, and not singled out as a specific "study." I recommend incorporating this alternative into P-3, and removing it as a separate "study."

A-6: I am not clear on what A-6 proposes. How is this different from P-3? Is this an alternative analysis to use of the outfall pipe, to recommend development of a new sewage treatment system? What EIS preparation is referred to here?

A-7: I agree with this recommendation.

A-8: This is a key issue, and should be completed before the initiation phase. Give this topic a high priority, as it has come up before in SAP recommendations in the past. However, I would not limit the "study" to other outfalls, rather the focus should be on embayments that experience long-term, chronic input of pollutants of various sorts from various sources, including excess nutrients, pesticides, and the like. Thus, A-8 is a key recommendation which should receive increased focus and an accelerated schedule. This "study" should include workshops, perhaps an international symposium of experts world-wide familiar with such issues, and refereed papers and summaries. This cannot be just a paper study, since our knowledge of such chronic pollution is increasing yearly, and much of the data may not be published yet.

c) **MONITORING**: Monitoring is recommended for key issues. I can see no thread in the monitoring proposed, and cannot find the goals of such monitoring stated anywhere. As a country, the U.S. is good at monitoring (taking data); however, we are poor in designing monitoring programs that can resolve specific issues. Part of this poor design record is due to the complexity of detecting human impacts in a highly variable natural system. However, part of this poor design record is due to lack of effort at the beginning. I encourage the NOAA to assure cost-efficient and effective monitoring recommendations, to assure some utility will come from the effort.

M-1) I agree with this recommendation.

M-2) What are the purposes of seasonal physical and biological observations in the farfield? What are the specific goals of such monitoring? Can we in fact achieve any desired goal, given available ability to discriminate natural from induced changes? As written, this recommendation is so non-specific as to be useless, except it may direct EPA to formulate a specific farfield program, hopefully with carefully considered goals and methodology.

M-3) Again, this recommendation sounds like input from a single scientist. The focus here seems to be on use of a TECHNIQUE, rather than a scientifically defined GOAL. If the goal is to verify a numerical model prediction, then the goal should be stated, and a carefully planned suite of model verifications should be carried out. This recommendation misses the point, and might lead to use of acoustic backscatter techniques for plume tracking, with no necessary accompanying measurements to interpret those measurements.

M-4) Once again, the goals of such monitoring are unclear. While this work will keep a consultant or academic busy, the utility will come from clearly defined goals and methods. As written, this monitoring could be of little value without a well-defined plan, including comparisons of such copepod patches outside of the right whale high use area (controls or comparisons).

M-5) This appears a reasonable requirement, though how such data will be interpreted is unclear. The requirement may help track the endangered species in the bay, but how will it be used to determine no-jeopardy compliance? Why would studies be conducted once every decade? What are the appropriate time scales? This recommendation would seem to require more fine-tuning, as do the other recommendations.

M-6) In principle I agree with this requirement. However, I would like to see a specific goal, such as "to determine appropriate water use and discharge regulations and enforcement in the

New England waters, in light of their specific mixing and transport processes, habitation and use patterns, and biological framework including endangered species."

M-7) I am not qualified to address this recommendation.

d) **OTHER PERMIT CONDITIONS:** Other permit conditions are given, as follows:

P-1) Chronic toxicity testing would seem to be necessary, given the low-level, long-term input conditions associated with the outfall.

P-2) I agree with this condition.

P-3) While I agree with this condition, I am curious what NOAA has in mind. Alternative sewage treatment options? Source reduction? Further treatment of sewage?

# SCIENTIFIC REVIEW OF THE NOAA NMFS BIOLOGICAL OPINION REGARDING THE EFFECTS OF THE MWRA OUTFALL ON ENDANGERED SPECIES

**Dr. Cabell S. Davis,**
**Associate Scientist, WHOI.**

**September 21, 1993.**

Summary

The NMFS Biological Opinion provides an informed review of the potential impact of the MWRA outfall on endangered species, and recommendations based on this review are reasonable and prudent. I endorse the NMFS conclusion of no-jeopardy, since, based on available evidence, relocation of the outfall a relatively short distance to the east is not likely to cause detectable changes in the habitats of the endangered species. The right whale is the only endangered species that could be impacted (i.e., has a significant proportion of its total population in the Bays region), but this species has not been observed in the location of the proposed outfall. If the predicted dilutions of effluent are correct, nutrient increases in habitat areas will be indistinguishable from background. In addition, there is no scientific evidence that relocating the outfall will affect the occurrence of red tides. I agree with both NMFS and EPA that secondary treatment is essential for the long-term health of the bays environment. The effects of short-term, 4-year, discharge of primary-treated sewage and associated toxins on the Bays environment are not known, but appear not to be very different from the current situation.

I also endorse NMFS' Conservation Recommendations as being essential for protection of the endangered species and their environments. As stated in the Opinion, these Recommendations are actually requirements for issuance of the NPDES permit and address critical scientific issues not included in EPA's Biological Assessment. These issues must be addressed prior to permit issuance since they may alter current predictions of plume transport and deposition thus requiring reinitiation of consultation with NMFS. As stated in the Opinion, further scientific studies required include modeling the effects of wind forcing, Gulf of Maine inflow patterns, sub-grid scale mixing, and water column stratification on initial dilution and plume development and transport. Enhanced monitoring of farfield habitats is also recommended to detect potential habitat alterations due to short and long-term loading. In addition, I recommend that long term biological-physical moorings be established in both nearfield and farfield (habitat) areas and that the monitoring program also include analysis of satellite infra-red and ocean color. Plume tracking using acoustics is also a good idea but should include optical instrumentation as well. I agree with NMFS that a thorough comparative review of other ocean outfalls should be done, but I believe this should be done as a pre-requisite to issuance of the permit. Such a study would likely provide significant insights into the potential impacts of nutrients and toxins in the proposed outfall on the benthic and pelagic environments of the Bays.

The NMFS recommendation for establishment of an implementable contingency plan prior to issuance of the permit is also prudent. The plan should include a time-table for implementation. If the effluent transport and dilution does not occur as predicted and chronic or acute conditions arise in the endangered species habitats, swift action may be necessary to remedy the situation, including a changeover to tertiary treatment. A several-year conversion period may not be adequate if high rates of habitat alteration occur.

Critical Scientific Issues and Recommendations:

Many important scientific issues were raised by the NMFS Biological Opinion. Several of these issues were also ones I had raised in my review of the EPA Biological Assessment. The Conservation Recommendations of NMFS largely address these issues. I summarize and amplify below the issues/recommendation I feel are most important.

Literature review:

I agree with the NMFS that a thorough comparative review of existing ocean outfall sites should be required (NMFS recommendation A-8). I believe, however, that this should be done prior to issuance of the NPDES permit. The focus of the review should be on examination of impacts of nutrient loading on plankton and benthic community structure, species distribution and abundance, productivity patterns, plume transport, toxic loadings and their spatial and temporal incorporation into the food webs, and other components of habitat degradation. New insights are likely to be gained by examining sites with similar physical or biological properties to the Bays region. This analysis should include examination of historical satellite imagery (CZCS and IR) to determine patterns and extent of eutrophication in relation to wind forcing. The literature review alone, however, is insufficient, and further modeling and monitoring studies are needed.

Modeling:

If effluent dilutions predicted by the modeling studies of Roberts and Signell are correct, nutrient and toxic increases in habitat areas will be indistinguishable from background levels. This presupposes that the modeling results are accurate. Although the NMFS asserts (p 36) that the model has a "high degree of reliability relative to verification with field data", they also note (p 28) that the model is not accurate for summer conditions. It would be worth comparing the modeled dilution contours shown in Figure 4 with field data.

Potential problems that remain to be addressed with the modeling studies are related to initial dilution, sub-grid scale mixing, stratification, wind-forcing, and Gulf of Maine boundary conditions. Specific problems to be addressed include:

- The accuracy of the initial dilution model is critical, since, on a volume basis, the daily discharge volume is approximately the same as the volume of the initial dilution zone. This means that the latter volume must turnover 50 times per day for a 50:1 dilution. The EPA mixing zone (1.2 km2) contains a volume that is only 3-7 times that of the daily discharge. In order to meet EPA dilution requirements at the edge of the mixing zone, the turnover of the volume of this zone must be very high. The model of Roberts indicates that the proper dilution will be achieved and EPA asserts that the model predictions are even conservative, but, to my knowledge, the effects of wind and tidally induced advection have not been examined.

- During stratified conditions, the thermocline in Massachusetts Bay is at depths of 10-25 m (p 10). Since the bottom depth at the proposed site is about 30 m, this means the distance between thermocline and the diffusers (which will be on the bottom) will be only 5-20 m. It is not clear whether this distance is enough for the discharged effluent to mix sufficiently so that it will not penetrate the thermocline and enter the surface mixed layer.

- If sub-grid scale mixing processes are substantially different from those modeled, plume patches including filaments and streamers could remain intact in the surface layer or at the pycnocline over longer periods than predicted by the current models.

• Injection of the effluent plume into the mixed layer together with prevailing southwest winds would tend to push the plume offshore toward Stellwagon Basin (18 km) and Bank (26 km). Such distances are relatively small given that wind forcing can transport fluid and particles tens of kilometers in only a few days.

• The wind forcing used in the USGS model was for two years. Interannual variations in wind patterns are common and have been shown to be very important in determining the degree of offshore transport of buoyant plumes. Selected scenarios of wind forcing (direction and magnitude) should be modeled to examine the effect on effluent transport. In particular, southwest wind forcing of a surface trapped effluent plume should be examined for possible transport to farfield habitats.

• It was suggested that strong offshore forcing due to storm events could lead to shoreward transport of the effluent. This only would be true if the effluent remained in the bottom layer below the thermocline. If the plume penetrated into the surface mixed layer in the summer or is mixed throughout the water column in winter, the effluent could be transported seaward of the proposed site. By contrast, effluent at the current discharge site is likely to be diluted due to nearshore upwelling and is unlikely to be transported seaward to the extent that an offshore plume would be.

• Storm events would increase the volume of discharged effluent, reduce the degree of secondary treatment, and increase transport. The combination of these effects should be modeled especially since such wet weather/storm conditions can occur frequently (e.g. bi-weekly) throughout the year.

• Changes in circulation patterns in the Gulf of Maine could result in altered inflow and outflow patterns in the Bays. Such variability could be due to wind patterns, freshwater buoyancy plumes entering the region or internal wave fields propagating across the Gulf. Such variability should be examined using the USGS model because it could affect the flow field within the Bays region and transport of the sewage effluent.

Monitoring:

I agree with NMFS that long-term deposition of plume borne particulates are not modeled effectively, and that it is therefore important to monitor such deposition. Since the settling regions are not in the vicinity of the proposed outfall Stellwagon Basin and Cape Cod Bay may serve as repository sites. During the first four years, a total of 197,000 tons (135 tons/d) of POC will be discharged. This discharge will also contain considerable amounts of toxic contaminants (200 tons of copper, 18 tons of lead, 2 tons of PCBs), the fate of which is largely undetermined. Although it is stated that most of the currently discharged particulates are flushed into the Bays, this level is not certain, and enhanced monitoring in farfield sites is needed to quantify the loading. In particular, Stellwagon Basin, due to its relatively close proximity to the proposed outfall site, could act as a catch basin for outfall particulates, especially if the offshore transport is more important that present models predict. Contaminants in mammals and chronic effects on mammals also should be monitored.

It is not clear whether chlorination will be extensive enough to kill all pathogens in the effluent. Monitoring transport of these disease vectors is therefore important.

Attraction of right whales to the outfall site is only a remote possibility. The generation time of the zooplankton (Calanus) in February/March (when the right whales are present) is about two months which is much longer than their residence time in the vicinity of the outfall (days at most). Thus it is not possible for a population growth response to occur at that time. Dense Calanus patches are caused by swimming behaviors of the copepods interacting with physical convergence.

Since the outfall will be a divergent site, the nearfield advection associated with effluent discharge is unlikely to cause dense aggregations of copepods to form. Monitoring of this site for such patches however is necessary to confirm this conclusion. Acoustical and optical instrumentation can be used for such sampling which can be done in conjunction with acoustical tracking of the plume. Trophodynamic enhancement of zooplankton populations could occur during late summer when water temperatures are warm and zooplankton generation times are 1-2 weeks, but the right whales are not present in the Bays at that time of year.

Red tides have occurred naturally for centuries. No clear evidence exists that nutrient pollution increases the likelihood of these blooms. I agree with D. Anderson that there is no scientific basis for concluding that relocation of the outfall will increase occurrence of red tides. Nonetheless, the monitoring program should include a component to measure the abundance and distribution of these species.

Monitoring should also include high resolution time series measures of nutrient and plankton abundance and taxonomic composition both in the nearfield and in habitat areas. Moored biological/physical arrays are recommended for this purpose. These moorings could be set along transect lines to the east and south to examine distribution and abundance of plankton along paths from the outfall site to Stellwagon Basin/Bank and Cape Cod Bay. Such moorings should include ADCPs, CTDs, fluorometers, and optical zooplankton counters. I agree with NMFS that such monitoring should also include sampling in copepod patches at the outfall site and in the Stellwagon and Cape Cod Bay habitats. The monitoring program should also include analysis of satellite imagery for IR and color (SeaWifs). Acoustical tracking of the plume is also recommended.

Other considerations:

I agree with the NMFS that contingency planning is essential. The contingency plan should have an associated implementation schedule or time table which should be expeditious. If habitat alterations are observed to be occurring at a rapid rate, it is important to have a contingency plan that allows rapid cessation of the pollutant discharge or conversion to tertiary treatment. Such a contingency plan should meet the approval of the NMFS in consultation with other organizations prior to permit issuance.

I also agree that NMFS should review the "Additional Studies" prior to issuance of the permit to determine whether reinitiation of consultation is required. Regular meetings between EPA, COE, and NMFS to consult on the endangered species and their habitats are deemed essential. Chronic toxicity testing of the effluent is very important as is the establishment of limits on priority pollutants. Requirements for further reductions in pollutant loadings are also recommended.

Conclusion

I concur with the findings of the NMFS Biological Opinion. The decision of no-jeopardy is sound, provided the Conservation Recommendations are adhered to by EPA. The only modification to the NMFS recommendations I feel is essential is that the comparative study of existing ocean outfalls be done prior to issuance of the NPDES permit.

# EVALUATION OF

# "NOAA FISHERIES ENDANGERED SPECIES ACT SECTION 7 CONSULTATION - BIOLOGICAL OPINION"

Issued 8 September 1993 by the
National Marine Fisheries Service Northeast Region
Relative to the Issuance of a National Pollutant Discharge
Elimination System (NPDES) Permit for the
Massachusetts Water Resources Authority (MWRA) Outfall

**Robert D. Kenney, Ph.D.**

Graduate School of Oceanography
University of Rhode Island

and

Science Advisory Panel
Cape Cod Commission

20 SEPTEMBER 1993

I have reviewed the Biological Opinion (hereafter the Opinion) issued by the National Marine Fisheries Service Northeast Region (NMFS-NER) as part of their consultation under Section 7 of the Endangered Species Act with the Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (COE) relative to the issuance of a National Pollutant Discharge Elimination System (NPDES) permit for the proposed relocation and upgrade of the Massachusetts Water Resources Authority (MWRA) sewage outfall for the Boston metropolitan area. The Opinion expresses the conclusions of NMFS-NER as to whether or not the operation of the new outfall is, considering all relevant scientific and commercial data, likely to adversely affect or jeopardize the continued survival of endangered or threatened species or their critical habitats.

In the Opinion, NMFS concludes that issuance of the NPDES permit to MWRA is not likely to jeopardize the continued existence of any endangered or threatened species, or their critical habitats, either listed or proposed, in Massachusetts Bay and Cape Cod Bay. NMFS acknowledges that operation of the MWRA outfall may adversely affect one or more of the listed species/habitats. NMFS also acknowledges that scientific knowledge of all of the linkages which might be involved in potential impacts on listed species is incomplete in many areas, but that the Opinion must be made on the best available existing information.

My review and evaluation primarily encompasses two aspects of the Opinion:

(1) Is/are the conclusion(s) of the "no-jeopardy" Opinion justified in light of my own scientific expertise and the scientific evidence presented/summarized in the Opinion, the earlier Biological Assessment prepared by EPA relative to the outfall (hereafter the Assessment), the 10 July 1993 evaluation of the Assessment submitted by the Barnstable County Commissioners' Science Advisory Panel (hereafter the SAP evaluation), and EPA's 25 August response to the SAP evaluation (hereafter the EPA response)?

(2) Given the acknowledged scientific uncertainties, the weaknesses in the Assessment pointed out in the SAP evaluation, and recommendations made by the SAP, are any Conservation Recommendations included in the Opinion sufficient to (a) ensure that operation of the outfall is not likely to seriously impact the listed populations or critical habitats in question, (b) provide for mitigation of adverse impacts short of actual jeopardy, and (c) prepare for adverse impacts which might, in fact, jeopardize one or more listed species or critical habitats due to unforeseen or foreseen but very low probability circumstances?

1. Justification for a no-jeopardy opinion:

Since I was in general agreement with the overall conclusion of the Assessment that the existing scientific information indicated that the outfall was unlikely to seriously affect the populations of endangered/threatened cetaceans and turtles found in the Massachusetts Bays system, I also concur with the no-jeopardy opinion. It seems to me that in this case the system of environmental safeguards installed to protect endangered marine fauna has functioned as it was designed to. A project is designed, a determination is made that protected species may be affected, and the Section 7 consultation is initiated. EPA provides the review of existing scientific information necessary for NMFS to make a judgment. All interested parties have the opportunity to evaluate and comment on the completeness of EPA's review and the validity of their conclusions. NMFS makes a final determination in accord with existing scientific information and statutory requirements.

I believe that the conclusion of no jeopardy is well-supported by the existing scientific data. In my review of the Opinion, I found no substantive scientific errors. Even the critics on the SAP felt that the Assessment was a relatively complete review of the available literature. None of the SAP members, nor any other critics of the outfall project to my knowledge, has cited evidence that showed the outfall was likely to impact the protected species present. NMFS indicates in the Fact Sheet accompanying the Opinion that clear evidence for likely impact is necessary for a jeopardy conclusion, and that a jeopardy conclusion would be difficult to justify based only on lack of information or on conflicting evidence.

The majority of the problems which I and the other SAP members have had with the Assessment and the MWRA outfall project in general are with data gaps and uncertainties. Though I do not believe that serious impacts are likely, I recognize that a number of potential avenues of impact do exist. Many of the linkages involved in these potential avenues of impact are very poorly understood. My own most serious misgivings are with the potential of increased frequency of red tides and their possible impacts on protected species in the region. Reasonable scientific opinion on both sides of this question exists, exemplified by the comments of Dr. Smayda in the SAP evaluation, Dr. Malone's response to Smayda included with the EPA response, and the other literature cited in the Assessment, Opinion, SAP evaluation, and EPA response. But none of these authorities to my knowledge has presented evidence that impacts which jeopardize any protected species are likely, only that they might be possible given our poor understanding of the mechanisms which produce red tides. Given these circumstances, a no-jeopardy conclusion seems to be the only choice available.

In the Opinion, NMFS reiterates that the consultation is to be reinitiated any time the situation changes or whenever new information comes to light indicating possibility of jeopardy, at minimum every five years during the NPDES permit renewal process. Assuming that enforcement mechanisms exist which are strong enough to compel effective, timely mitigation in the event of a jeopardy conclusion during a future consultation, the fact that new data will reinitiate consultation and can change NMFS' conclusions relieves a great deal of my own misgivings about the outfall project.

Many of the critics of the outfall project, particularly those from outside the scientific or environmental management communities, do not seem to clearly understand some of the issues involved and the constraints under which the regulatory agencies involved must operate. The Endangered Species Act, like most wildlife or fisheries management legislation, considers impacts and management plans at the level of the population, not the individual. For example, many "animals rights" activists cannot accept that harvest of some individuals can benefit the majority of the population. Along similar lines, "not likely to jeopardize the continued existence of the species" is not the same as "no possibility of adverse impact to any individual". Critics would like MWRA to have to demonstrate that the outfall will have no effect, with certainty. Rarely, if ever, do we have the luxury of certainty in science.

2. Sufficiency of the Conservation Recommendations:

In the Opinion, NMFS states that operation of the outfall "may affect" protected species. A series of Conservation Recommendations were included in the Opinion to "assess or reduce adverse impacts of the MWRA outfall on listed species." There are four types of recommendations: contingency planning, additional studies (A-1 through A-8), monitoring (M-1 through M-7), and other permit conditions (P-1 through P-3).

The Conservation Recommendations in the Opinion are much more detailed and far-reaching than I expected they would be. Coupled with the reinitiation of consultation at five-year or shorter intervals, any adverse impacts should be detectable well before effects have become irreversible. I believe that the Conservation Recommendations should be sufficient to allay most of the concerns expressed by the SAP in our evaluation of the Biological Assessment, in particular those concerns involving data gaps or uncertainties.

For example, my own evaluation of the Assessment included five recommendations for conditions that I hoped NMFS would include in their Opinion. All five are explicitly or implicitly included in the Opinion and it's Recommendations. Below I have summarized each of my recommendations in a few words, and briefly mentioned how the Opinion (or other document) has addressed that topic:

(i) Further development and validation of the hydrographic and water quality models: Recommendation A-1 states that the stratified, 3-D model should be reviewed prior to discharge from the new outfall.

(ii) Regular surveys for endangered species at and near the proposed outfall site: Recommendation M-6 explicitly includes regular systematic surveys for endangered species which would be capable of detecting changes in distribution and/or abundance. In addition, Recommendations M-1 and M-2 deal with the nearfield and farfield monitoring program. Mammals are not explicitly mentioned, but they should logically be a component of this monitoring. The Opinion recommends that M-1 and M-2 should be completed before issuance of the NPDES permit.

(iii) Explicitly required completion of all of the secondary treatment facilities: The EPA response to our SAP evaluation addressed this point, indicating that completion of all secondary treatment facilities would be an explicit condition of the NPDES permit and is required by court order. In addition, the contingency planning Recommendation requested that EPA and COE begin contingency planning for tertiary treatment and complete an EIS for tertiary treatment as part of it.

(iv) Monitoring of nutrients, phytoplankton abundance and species patterns, zooplankton abundance and species patterns, red tides, benthic conditions, contaminant concentrations, etc., with contingency plans for action to be taken in the event of any potential adverse conditions not predicted by the modeling effort: Recommendations M-1 through M-5 all deal with monitoring

nearfield and farfield conditions, and M-6 with monitoring cumulative effects over wider scales. The contingency planning Recommendation requires EPA and COE to submit to NMFS, prior to NPDES permit issuance, a list of possible mitigation measures which might be instituted if necessary. In addition, my recommendation was directly cited in the Opinion (p.47) in discussion of strong cautionary measures required because of the uncertainties in potential impacts generated in the nearfield and transported to the farfield.

(v) Further reductions of effluent concentrations of toxic substances: Recommendation P-3 states that EPA should require such reductions by MWRA.

It would be possible to construct a similar list of findings from the SAP evaluation and point out in detail how the Conservation Recommendations in the Opinion may or may not address each point. However, I don't feel that would add much to this evaluation. I am quite satisfied that the Conservation Recommendations effectively deal with most of the Panel's criticisms of the Assessment and the outfall project. I must add two qualifications to my favorable evaluation, however: (i) I have not seen the MWRA monitoring plan referred to in Recommendation M-1. My favorable evaluation of the Opinion is based on the presumption that monitoring, as currently designed in the MWRA proposed scheme with the improvements and expansion specified in the Conservation Recommendations, will be sufficiently comprehensive. (ii) I would feel even more assured if I were more certain that all of the Conservation Recommendations will become explicit conditions of the NPDES permit. Some of the Recommendations contained explicit language relative to enforceability; I think that should apply to all of them.

Evaluation of

# NOAA'S BIOLOGICAL OPINION OF THE POTENTIAL IMPACT OF THE MWRA OUTFALL ON ENDANGERED SPECIES

Biological Assessment Prepared Pursuant to
Section 7 of the Endangered Species Act

(USEPA REGION I, 1993)

Prepared by

Dr. Ted Smayda
Mackerel Cove Associates
P.O. Box 26
Saunderstown, RI 02874

Submitted to
Aubrey Consulting, Inc.
Falmouth, MA 02540

MCA Rept. 93-10 (1993)

## SUMMARY

The proposed Contingency Planning, Additional Studies and Monitoring elements of the Conservation Recommendation of the NOAA Biological Opinion were found to be too limited. Recommendations for additional activities in each category are given.

It is recommended that the Massachusetts Water Resource Administration be required to prepare a Quality Assurance Statement indicating procedures to be followed to establish retrofitting needs and criteria to be applied should mitigation initiatives be needed.

It is recommended that the proposed focus on additional physical and chemical studies be expanded significantly to include relevant biological studies which are seriously neglected, in the Additional Studies element.

The proposed monitoring effort is very inadequate to the need for quantitative, process-oriented information, and should be significantly upgraded to meet the needs for, and intended application of such data.

## INTRODUCTION

NOAA's Biological Opinion that the discharge of treated sewage into Massachusetts Bay is unlikely to jeopardize the existence of any endangered or threatened species in the area can not be refuted, given the criteria used by NOAA to define "jeopardy", i.e., an appreciable likelihood that a reduction of "both the survival and recovery of a listed species in the wild [will occur] by reducing the reproduction, numbers or distribution of that species". NOAA acknowledges, however, undescribed affects may occur. This reviewer contends that the occurrence of such undescribed affects, or other presently unrecognized affects of potentially jeopardizing consequences likewise can not be refuted based on available data. Thus, this intricate and complex ecosystem problem, intractable from available scientific information, presents a *Gordian Knot*. Clearly, existing law places the burden of proof on the plaintiff, rather than the defendant. In essence, this represents a decision making strategy seemingly based on legal models developed for conflict-resolution of human interactions, rather than based on an environmental or ecosystem model. In short, I accept NOAA's Biological Opinion as one based on legal criteria which may or may not be warranted by available scientific evidence. This critique will therefore take the form of evaluating three of NOAA's Conservation Recommendations: Contingency Planning, Additional Studies and Monitoring, rather that entering into scientific rebuttal of the Biological Opinions presented by NOAA.

EVALUATION OF CONSERVATION RECOMMENDATIONS

1. *Contingency Planning:*

The request for mitigation measures, including tertiary treatment options, to be submitted by EPA/COA prior to issuance of the NPDES permit is laudable, as is the request for development of an EIS for tertiary treatment options.

A conspicuous omission is the failure to hold the Massachusetts Water Resources Authority (MWRA) responsible for preparation and dissemination for review of a contingency plan revealing what procedures and criteria will be used by MWRA to detect and mitigate against potential effluent-impact effects jeopardizing endangered species. Therefore, MWRA should be required to prepare and to disseminate a Quality Assurance Statement documenting how online and proposed monitoring efforts relevant to the Deer Island project will be able to distinguish between events reflective of natural variability vs. adverse, degradative or favorable events resulting from effluent discharge from the proposed outfall. Procedures to be followed in retrofitting actions, if needed for negative impact mitigation, are to be described.

2. *Additional Studies*

The recommended studies, with the exclusion of an undefined pathogen effort and marine mammal response to diffuser noises, deal primarily with physical and chemical issues. The conspicuous omission of biological studies, otherwise, is puzzling, particularly given concern over biotic responses, toxicity outbreaks, foodweb vectoring of toxins, and the need for quantitative, process oriented analyses of trophic responses, both direct and indirect ones, to anticipated nutrient loading and dispersal. It is noteworthy that the biological conclusions presented (pp. 58-59) in the Biological Opinion are based on interpretations from a very incomplete data set and generalized extrapolations. It is remiss of NOAA not to require validation of some of the more relevant conclusions, through rigorous field and experimental testing of these employing quantitative approaches with suitable replication. The need for such biological studies is further evident on pp. 39-47 of the Biological Opinion, which redounds in cautionary statements and expressions of uncertainty in reaching conclusions as to the biological impact of the Deer Island facility.

3. *Monitoring*

Monitoring programs are *pro forma* activities associated with evaluation of impacts of environmental assaults. The recommended monitoring effort is therefore not unexpected, including specific recommendations that would engage NOAA elements. Based on the specific monitoring activities listed, however, the monitoring program recommended is remarkably insensitive to the issues addressed and need for essential data established during the contentious discussions prior to issuance of the Biological Opinion. NOAA and EPA should take cognizance of the statement on p. 39 on the Biological Opinion that planktonic "responses may only be confirmed through undertaking of a

sensitive and prolonged monitoring program of farfield areas'. It is recommended that NOAA be much more specific in its recommended monitoring program elements. These should include incorporation of the following aspects.

- Ongoing and proposed monitoring programs are too limited and lack required seasonal and regional coverage, sampling frequency, quantification and key measurements appropriate to assessment and forecasting of most probable environmental and biotic consequences of effluent discharge.

- The Massachusetts Bay site of the proposed outfall is regionally an open system. It is subject to significant farfield influences, such as the incursion of toxic bloom elements and nutrients from the Gulf of Maine and North Shore, and itself has a farfield influence in Cape Cod Bay and Stellwagen Bank. Proposed and ongoing monitoring programs should incorporate suitable farfield surveillance strategies.

- An ecosystem analysis incorporating suitable models of physical processes is essential in the evaluation of the fate, distribution, actual and potential foodweb and toxic consequences of the stimulated primary production expected to accompany sewage effluent discharge. Routine monitoring surveys are not adequate to this requirement, and must be based on process-oriented strategies having appropriate temporal and spatial coverage scaled to the dynamics of the phytoplankton, zooplankton, fish and marine mammals. Suitable incorporation of benthic processes into the monitoring activities is also needed.

Review of the National Marine Fisheries Service (NMFS) Biological Opinion on the Operation of the MWRA Outfall Tunnel.

Reviewed by:
Craig D. Taylor
Associate Scientist
Woods Hole Oceanographic Institution

10 October 1993

The NMFS's Biological Opinion has by-and-large supported the conclusions of the EPA Biological Assessment by their finding of "no jeopardy," that some of the endangered species under consideration may be affected by the proposed outfall and its effluents, but that it is not likely that the existence or recovery of these species will be jeopardized. Available information in support of this conclusion is reasonable and this reviewer in general concurs, as he did with the overall conclusions of the EPA Biological Assessment.

The preparers of the NMFS Biological Opinion have recognized that the scientific information available in some topic areas is incomplete and proceeding with the outfall entails some environmental risk, albeit an acceptable risk at this stage of the game, given the extremely narrow range of possible alternatives. Given that some risk does exist, however, the preparers have also incorporated into their report a recommended series of studies and monitoring activities, that if properly executed would not interfere with progression of the outfall, but with appropriate legal support, could serve a crucial role in protecting the environment and it's endangered species, should an unforeseen difficulty arise. A "back-up" plan of this sort is just plain smart, in the opinion of this reviewer. The preparers have made recommendations in three areas a) additional studies on crucial topics where scientific information is lacking, b) formulation of a plan for monitoring potential effects of the proposed outfall, and c) development of a contingency plan should results of the previous two activities indicate that endangered species are being placed in jeopardy by the outfall.

Additional studies proposed for completion prior to discharge primarily involve the continuation or application of predictive modeling in areas where this information is presently

lacking. It is entirely reasonable, for example, to pursue results of the three-dimensional dilution model under summer-stratified conditions, as was originally proposed by the EPA. Continued use of the model may address questions such as possible effects of discharge penetration of the thermocline, whether-or-not significant lateral transport of coherent patches of discharge may occur and possibly extend effects of the outfall into the farfield, or to address more complex effects of stochastic events such as storms or rare combinations of physical events that may affect transport processes into the farfield. It seems to this reviewer that some of the weakest predictive modeling information concerns the deposition, transport and resuspension of particulate matter discharged from the outfall. Given the high affinity of toxic materials for this fraction of the effluent and, hence, potential for farfield accumulations, it will be prudent to review the results of the USGS modeling studies that are presently being undertaken in this area. Proposed acoustic studies addressing plankton patch dynamics is also reasonable, given the possibility of such accumulations attracting certain endangered species. Though there may be some discussion as to which areas are the most relevant for continued study, the suggestions of the preparers have pinpointed some areas where additional information that could be obtained relatively straight-forwardly might substantiate conclusions that presently are based upon "the best available" but perhaps incomplete information.

This reviewer believes that an effective program for monitoring the effects of the proposed outfall is absolutely essential. If such a program is not undertaken in this project, someone, somewhere will be doomed to repeat this costly exercise again. Such a monitoring program will be the ground truth of the modeling efforts that were heavily relied upon for this project and will be in the future. It is being learned that stochastic phenomena are important modifiers of the environment and that coastal ecosystems are highly variable in time and space. It is absolutely clear that the monitoring programs of the past, possessing limited resolution both in time and space will be insufficient to understand the complex interactions between coastal ocean physics, chemistry, and biology that will be necessary to unequivocally predict the safety of anthropogenic intrusions into the environment such as the Boston Harbor Outfall. Long term, high temporal and spatial resolution time series monitoring of water column physics, chemistry and biology, as well as studies of the dynamics of particle transport and redistribution that extends significantly into the farfield will be necessary to dissect potential outfall-mediated effects from a background of variable natural phenomena. High resolution studies will also be necessary to "capture" relatively

rare sporadic physical events that may, never-the-less, possess strong influences upon the distribution of outfall effluents. The recommendation of the NMFS preparers that an appropriate monitoring program be a condition of the NPDES permit is good advice, as it is all to easy to down-play this crucial activity once the system is in place. A mechanism of enforcement, as suggested by the NMFS people, is probably essential.

All of the above would be moot if new information from scientific studies or monitoring activities indicated that damage to the environment was occurring and nothing could be done for 20 years. A plan for effective mitigation should indeed be incorporated as the preparers suggest. It is entirely reasonable to prepare a plan that would allow improvements in treatment to be expeditiously put into place should environmental effects detrimental to endangered species become manifest.

In conclusion this reviewer believes that a reasonable case for "no jeopardy" has been presented. However, given the fact that some of the conclusions are based a "best available scientific evidence" basis it is suggested that the conservation recommendations presented in the NMFS report, or an appropriate modification thereof, be implemented.

CLF Conservation Law Foundation

Testimony of the Conservation Law Foundation
Before
The House Subcommittee on Environment and Natural Resources

October 18, 1993

Dear Chairman Studds and members of the Subcommittee:

We appreciate this opportunity to discuss with you the reactions of the Conservation Law Foundation (CLF) to the Endangered Species Act consultation between the Environmental Protection Agency (EPA) and the National Marine Fisheries Service (NMFS) on the Boston Harbor outfall. It was ten years ago this year that CLF filed the lawsuit against the Metropolitan District Commission that ultimately produced the court order that is now driving the cleanup of Boston Harbor. A huge new treatment plant is being constructed on Deer Island and a 9.5 mile outfall pipe -- the subject of this hearing -- is being built. CLF remains intensely interested in the progress of this cleanup and committed to seeing that cleaning up Boston Harbor does not simply cause new environmental problems elsewhere.

Thus we welcomed the consultation between EPA and NMFS on the question of whether discharge from the new outfall location would jeopardize any threatened or endangered animals. Careful consideration of technical information from a variety of disciplines was needed to arrive at a good judgement of whether significant adverse effects on these animals were likely.

We find both EPA's biological assessment and NMFS's biological opinion to be well researched and well considered, and we believe that the conclusion of no likely jeopardy for any endangered or threatened species is appropriate and responsible given the currently available scientific information. Emphasis on this last phrase is important, because there are many inadequacies in our understanding of the physical, chemical and biological processes in Massachusetts and Cape Cod Bays. Consequently, the predictive abilities of the various marine sciences are low. Undesirable scenarios that are today judged to be unlikely may in fact occur in the future.

For example, harbor porpoises and right whales may turn out to frequent the area around the outfall: the survey effort there to date has been inadequate. Alternatively, enhanced productivity near the outfall resulting from increased nutrients may attract these and other species of whales. In either case, their exposure to toxic contaminants could be higher than expected. The deposition pattern for particulates from the new

■ Headquarters: 62 Summer Street, Boston, Massachusetts 02110-1008 • (617) 350-0990 • FAX (617) 350-4030
□ Maine Office: 60 Ocean Street, Rockland, Maine 04841-3632 • (207) 594-8107 • FAX (207) 594-9314
□ Vermont Office: 21 East State Street, Montpelier, Vermont 05602-2152 • (802) 223-5992 • FAX (802) 223-0060

outfall -- currently unknown -- could deliver contaminants to unexpected locations where sea turtles or whales feed. The widely held fear of increased red tides from offshore delivery of nutrients could come to pass, in spite of judgements today that that is unlikely, and right whales, humpback whales and fin whales could conceivably start washing up dead on our beaches as a result.

Although we agree with the biological opinion that the likelihood of these calamitous scenarios coming to pass is very low, they cannot be ruled out altogether. Therefore, we support the conservation recommendations included in the biological opinion, and we applaud NMFS's stated intention of reinitiating formal consultation every five years, or sooner if new information or other changes warrant it. Our specific reactions to each of the conservation recommendations follows.

Contingency Planning

We agree that, prior to issuance of the NPDES permit, some contingency planning should occur for the possibility that treatment in excess of secondary treatment may be necessary in the future. We suggest that it take the form of a study of the options for and feasibility of reducing nutrients, solids, and contaminants. We question, however, whether preparation of an EIS at this stage would be feasible, given that the specific operational requirements for any tertiary treatment have not yet been defined.

The contingency planning should also include a study of the feasibility of partially or completely diverting the effluent back to some or all of the current outfalls near Deer Island, in the event that offshore discharge is determined to be deleterious in unexpected ways. This study is essentially the same as A-5 below, which NMFS recommends as a mitigative measure.

Additional Studies

We agree that additional studies A-1, A-2, A-3, A-5, and A-6 should be conducted prior to discharge of primary treated sewage from the new outfall, with the results reviewed by NMFS. With respect to A-4, we believe that reliable predictions on the effects of the outfall plume on plankton patches will not realistically be possible, even with additional studies, so we question the usefulness of requiring this study prior to discharge. Monitoring plankton patches should occur, however, both before and after discharge.

We urge that another study be conducted prior to discharge of primary-only effluent. The MWRA should study the operational possibilities of a range of options from full use of the new outfall as soon as the new primary plant is completed to no use of the new outfall until full secondary treatment is possible. The inshore and offshore water quality impacts of this range of options should be assessed by EPA before permitting discharge of effluent receiving only primary treatment.

We agree with the final two recommended studies, A-7 and A-8, although we question the likely usefulness of A-8(b).

Monitoring

We support all of the monitoring recommendations in the biological opinion.

Permit Conditions

We support recommendations P-1, P-2, and P-3 as conditions for EPA to include in the NPDES permit for the new outfall. We believe that these requirements are better handled through conditions for the new permit than through changes in the court order.

In addition, we believe that the court order should be amended so that, as soon as the new primary plant is in operation, the interim treatment standards are increased by reducing the interim limitations on biological oxygen demand and total suspended solids. The rationale for this change is that the MWRA is meeting the current interim limitations most or all of the time, and the new primary plant is expected to function better than the existing ones. Therefore the MWRA should be held to higher standards of treatment as soon as it is capable of meeting them. We invite EPA to join us in seeking this change in the court order.

Implementation of the Right Whale Recovery Plan

There is a final point that we would like to make.

The consultation that has prompted this hearing was initiated because of concerns about endangered animals, especially endangered whales. The whale of greatest concern in Massachusetts Bay is the right whale, which is in fact the most highly endangered large whale in the world. With probably fewer than 350 animals remaining in the entire North Atlantic Ocean,

these whales are known to be suffering injuries and direct mortalities from two sources that are much more tangible than the hypothetical adverse effects from Boston's wastewater. Ship collisions and net entanglements are well-established sources of right whale injuries and deaths in U.S. waters, yet little is being done here in New England to reduce these encounters.

We take this opportunity to call upon the National Marine Fisheries Service, especially its Northeast region, to expedite implementation of the right whale recovery plan. While we applaud the agency for its careful study of possible impacts from the MWRA outfall, we urge it now to direct the same energy toward concrete action that will reduce the number of right whales that are struck by ships and entangled in fishing nets. And we hope that this Subcommittee will insist that this is accomplished expeditiously.

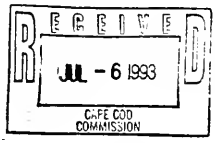
Thank you for your consideration of these comments.

Sincerely,

Eleanor M. Dorsey
Staff scientist

Peter Shelley
Senior attorney

AUBREY CONSULTING, INC.




DRAFT, 22 June 1993
NOT FOR DISTRIBUTION

# BARNSTABLE COUNTY COMMISSIONERS SCIENCE ADVISORY PANEL

## COMMENTS ON:

## ASSESSMENT OF POTENTIAL IMPACT OF THE MWRA OUTFALL ON ENDANGERED SPECIES:

## BIOLOGICAL ASSESSMENT PREPARED PURSUANT TO SECTION 7 OF THE ENDANGERED SPECIES ACT

### INTRODUCTION

The "Assessment of Potential Impact of the MWRA Outfall on Endangered Species, a biological assessment prepared pursuant to Section 7 of the Endangered Species Act" (hereafter the "Assessment") by the EPA, is reviewed here by the Science Advisory Panel (SAP) for the Barnstable County Commissioners (Table 1). The SAP previously provided recommendations on the Final Work Plan for the Assessment (in October, 1992) and met once with representatives from the EPA and its consultants (Arthur D. Little) in Boston to discuss the issues associated with the Work Plan.

### SCOPE OF ANALYSIS

The Assessment was reviewed by the SAP at the request of the Barnstable County Commissioners, for the following specific purposes:

(1) Was the original Work Plan successfully achieved?

(2) Is the EPA or NOAA National Marine Fisheries Service (NMFS) in a position to "insure" that the operation of the outfall pipe "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical"?

350 Gifford Street, Suite 2-3 • Falmouth, Massachusetts 02540
Telephone (508) 457-0810 Fax (508) 457-0734

(3) Are there studies or data that were not cited in the Assessment, that would be helpful to the NMFS for preparation of their Biological Opinion?

## FINDINGS

The primary findings of the SAP are summarized here. In general, the Assessment represents a relatively complete summary of existing literature on endangered species in the reigon, and provides a useful overview of the oceanography of the area based on recently published studies by various external investigators. Detailed comments by the members of the SAP are included as attachments to this document. These detailed comments include specific details addressing item (3) in Scope of Analysis.

Some of the findings of note are listed below:

1) The Assessment has changed markedly from the original Work Plan submitted for completion of the Biological Assessment. The most critical variations from the Work Plan include the following:

a) The use of null hypotheses was eliminated from the work product.

b) Less reliance on the numerical model results for both circulation and water quality was possible, due to the ongoing development and work on the models that made the final results unavailable for this study.

c) The application of dose-response methodology was largely eliminated because of lack of sufficient data in the marine environment.

d) One complete sector of the Work Plan, the review of the MWRA's Outfall Monitoring Plan and Contingency Plan, was omitted for reasons not explained in the Assessment.

e) The Work Plan indicated a separate report would be prepared by Dr. Thomas Malone critiquing the earlier work of Dr. Smayda regarding the nutrient issues. The SAP has not yet received this report for review.

2) The Assessment is a relatively complete review (with exceptions noted in the Attachments and herein) of the status of Massachusetts Bay oceanography and ecosystem health, and of the potential effects from the outfall pipe operation on the ecosystem and oceanographic system.

3) The Assessment relies heavily on qualitative terminology rather than quantitative methodology to achieve its opinion that the MWRA tunnel effluent is unlikely to jeopardize endangered species and their habitat.

4) The Assessment draws parallels between the zones of impact of the present outfall pipe and the proposed outfall pipe, with the implication that any improvement over the present situation is worthwhile. This parallel is flawed in that the proposed outfall is closer to the endangered species habitat than the present outfall, the effects now will be concentrated in deeper water closer to the Gulf of Maine inflow (a possible source of toxic algal blooms), and the increase in nitrogen loading will be measurably above background levels for some distance from the outfall (735 $km^2$ at least). This parallel also begs the question about whether the Endangered Species Act will

permit ANY LEVEL OF IMPACT, such that the comparison with the present outfall site is not germane.

5) The long-term impact of this increased nutrient loading to the Massachusetts Bay system has not been fully addressed. What are the possible impacts to the Bay system from long-term, low-level chronic nutrient loading? Given that the outfall will certainly be in operation for decades, if not a half-century or more, the long-term, chronic input should be addressed at least by analogy to other embayments world-wide experiencing such long-term input.

6) The Assessment does not specifically address the relative impacts of the outfall operations under the planned phasing of Secondary Treatment, versus the scenario of delayed or canceled secondary treatment. Will there be a difference in the environmental degradation if secondary treatment never comes on line, or if it is delayed by a decade or more? If there are no significant differences, does this finding affect the decision to elect secondary treatment?

7) The potential effects of pathogens (such as viruses and bacteria) on endangered species have not been discussed. Experience at the San Diego ocean outfall, for instance, indicates that bacterial die-off occurs much more slowly than predicted by models, resulting in violations of California water quality standards in the nearshore waters. What are the analogous conditions in Massachusetts Bay, and what are the implications for the endangered species?

8) Whereas the Work Plan focused strongly on the 3-D model results from the USGS and MWRA, the present Assessment states that such model results are not critical for reaching their conclusions. It is not clear why this reversal in opinion has occurred, and why the presently unavailable model results would not enhance the Assessment as originally indicated. Specifically, pages 13 and 14 of the Work Plan show a suite of scenarios that were to be examined using the 3-D model results. Why is analysis of these scenarios no longer necessary to complete the Assessment?

9) Some earlier comments by the SAP have not been addressed in a comprehensive fashion. We assume these earlier comments (included here as an attachment) will be reviewed by NOAA/NMFS while completing their Biological Opinion, rather than reiterating all the comments here. However, some of the potentially critical issues not addressed in the Assessment are mentioned here briefly:

i) The potential for geoaccumulation of toxics is not addressed. The Assessment merely states that resuspension will reduce the sediment toxicity by moving the sediment from place-to-place. However, resuspension may accelerate accumulation of toxic sediments in some locations (depocenters), which presently are accumulation sites for fine-grained sediments. Can such depocenters be located based on existing information? What impact might geoaccumulation in specific depocenters have on sand lances or benthophages?

ii) What are the effects of surface waves on plume and sediment dispersal? The Work Plan stated the 3-D model would use such waves as input parameters. In the absence of such full 3-D model results, can the assessment discuss the role of surface gravity waves in dispersing sediments and water? For instance, the present outfall and dispersal patterns are concentrated in shallow water, where wave action is much greater. By contrast, the proposed outfall location is located in what may be more quiescent deeper waters where wave mixing may be less significant. Is this a significant process affecting dispersal of sediments and water?

iii) The chemical form of the nutrients may vary depending on secondary versus primary treatment, ranging possibly from more organic complexes for primary treatment versus more dissolved inorganic (and more readily usable) forms for secondary treatment. What is the

significance (if any) of the altered chemical form of the nutrients, and what are the chemical pathways and rates for chemical transformations that alter these forms?

10) The Assessment indicates that during summer conditions, the plume would be trapped below the thermocline. However, the available data indicate that the surface mixed layer deepens to 20-25 m in the late summer and early fall. Under these conditions, the nutrients would discharge directly into the surface waters of Massachusetts Bay. This scenario is not discussed in the Assessment.

11) If there is enhanced productivity in the area directly around the proposed outfall, what is the probability of attraction of endangered species to this area for foraging, and what impacts would such attraction have on these species?

12) No discussion is presented of phosphate or silicate loadings from the proposed outfall location, and their effect on phytoplankton dynamics. Will there be any effects on phytoplankton dynamics from altered phosphate input into this deeper water site (as opposed to solely an increase in nitrogen loading)?

13) A method of drawing conclusions about various impacts, termed the "weight of evidence" approach, has been applied in this Assessment. The weight of evidence methodology is poorly defined, non-quantitative, and subject to bias. NOAA should evaluate whether such "weight of evidence" ranking is an acceptable methodology, particularly when performed by proponents of a project, rather than by a panel of experts formed from individuals having different but balanced biases. Weight of evidence may be appropriate for a National Academy of Sciences panel consisting of individuals selected specifically to offset biases, but may not be as appropriate for a project proponent and its consultants to apply, when the biases are clearly not balanced.

## SUMMARY

The Assessment is a reasonably complete document meeting many of the objectives stated in the Work Plan. Exceptions to this completeness are indicated in the accompanying attachments as well as in the brief listing of results above.

The attachments by the individual scientists on the SAP show a range of opinion regarding the Assessment: two scientists find the Assessment relatively convincing and thorough, one states generao agreement with the findings while providing some caveats, and two are in more serious disagreement about whether the document can "insure" that the outfall pipe "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical."

The following conditions, including both those of general concern and those unique to the embayment, make it difficult to complete an unambiguous Assessment:

- Lack of critical data on chronic, low-level nutrient input to partially enclosed coastal embayments.

- Lack of critical data on dose-response relationships for complex mixtures of contaminants (including nutrients and toxins) in shallow coastal ecosystems.

- Lack of numerical modeling results anticipated for the study, due to ongoing development of the modeling techniques.

• Paucity of field data on some critical aspects of the phytoplankton dynamics in Massachusetts and Cape Cod bays.

Since these data are not available, a method is required to make interim decisions lacking full and complete data (a common situation in many decision-making processes). However, the Biological Assessment process must be a SCIENTIFIC process, and not a POLITICAL one, which passes the test of critical scientific review.

Based on the divided opinion of the SAP, the Biological Assessment fails to pass the test of Scientific Acceptance; NOAA/NMFS should formulate its Biological Opinion with this divided evaluation in mind.

## RECOMMENDATION

The SAP recommends that NOAA/NMFS consider initiation of a thorough scientific review of this issue, through a reputable organization (such as the National Academy of Sciences), to obtain a balanced and representative scientific consensus on this highly sensitive issue and area. Given the major gaps in our present state-of-knowledge of relevant issues, as acknowledged throughout the Assessment, a comprehensive and unbiased review should be considered.

TABLE I

SCIENTIFIC ADVISORY PANEL
BARNSTABLE COUNTY COMMISSIONERS

| | |
|---|---|
| Dr. David G. Aubrey, Chairman<br>(Coastal Processes) | Aubrey Consulting, Inc. and<br>W.H.O.I. |
| Dr. Cabell Davis<br>(Zooplankton) | W.H.O.I. |
| Dr. Robert Kenney<br>(Marine mammals) | U.R.I. |
| Dr. Ted Smayda<br>(Phytoplankton) | Mackerel Cove Associates and<br>U.R.I. |
| Dr. Craig Taylor<br>(Oxygen dynamics/eutrophication) | W.H.O.I. |

( ) = Oceanographic specialty
W.H.O.I.: Woods Hole Oceanographic Institution
U.R.I.: University of Rhode Island

# EVALUATION OF

# ASSESSMENT OF POTENTIAL IMPACT OF THE MWRA OUTFALL ON ENDANGERED SPECIES: BIOLOGICAL ASSESSMENT PREPARED PURSUANT TO SECTION 7 OF THE ENDANGERED SPECIES ACT

PREPARED BY

Dr. David G. Aubrey
Aubrey Consulting, inc.
Suite 2-3
350 Gifford Street
Falmouth, MA 02540
(508) 457-0810

15 June 1993

## SUMMARY

The "Assessment of Potential Impact of the MWRA Outfall on Endangered Species: biological assessment prepared pursuant to Section 7 of the Endangered Species Act" (hereafter the Assessment) has been reviewed to determine its adequacy according to the scope discussed in the summary document. In brief, the Assessment is a reasonably complete description of the oceanography and endangered species habitats of Massachusetts and Cape Cod bays. Some exceptions of this completeness are indicated in the details provided below.

Unfortunately, the Assessment does not address some critical issues identified in the October, 1992, SAP review of the Work Plan by A.D. Little, to the detriment of the final product. Examples include the low-level chronic input of nutrients to Massachusetts Bay, and its effects over periods of decades; effects of surface waves on mixing and dispersion processes; and geoaccumulation. In addition, the report uses a "weight of evidence" metric to conclude lack of impact on the endangered species, which methodology is neither quantitative nor rigorous. Lack of data impairs the ability to derive an unambiguous and thorough evaluation of the effects of the proposed outfall siting. In addition, the reliance on comparison of the effects of the present outfall pipe with the proposed siting is unjustified: the Endangered Species Act appears not to require solely an improvement over existing conditions, but rather no jeopardy, period.

In my opinion, the Assessment cannot "insure" that the outfall pipe "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical."

## PHYSICAL MODEL REVIEW

One of the disappointing aspects of the Assessment is the lack of data from the physical models (circulation and water quality). In the Work Plan by A.D. Little, considerable emphasis was placed on the model results. Now, the Assessment says its results are "valid and are not conditional upon future modeling efforts." This finding requires some further justification, given the original focus on modeling efforts. That the model results are not available is not the fault of the Assessment; however, the heavy reliance in the Work Plan seems to require some more discussion of the need or lack of need of such models for decision-making.

Use of the initial dilution model is also of some concern, since it is based on work by Roberts and co-workers and relies heavily on empirical laboratory studies rather than a solid understanding of basic principles of initial dilution. The extrapolation of Roberts' results are also uncertain: his estimate of initial dilution occuring within 1.75 water depths somehow translates to a zone of influence of 0.26 $km^2$; I cannot reconcile these two estimates. The Assessment assumes that no adverse effects will occur in the initial mixing zone, because it is too small. The rationale for this assumption is not made clear.

The use of various spatial scales discussed in the report is initially clarified by definition of four different scales in the Assessment. The remainder of the report essentially ignores this scale

problem, and leaves unclear which scales are being discussed. Somehow, the lack of impact on a bay-wide scale is translated to a lack of impact on endangered species, when in fact a smaller spatial scale impact could also affect the endangered species. Why the report relies on baywide scales instead of smaller scales for evaluating impacts is unclear.

The report also makes use of dilution estimates, comparing the existing outfall site with the proposed outfall location. The shrinkage of dilution zones with the new outfall location is used as justification for no impact. The fact that the new outfall will have a smaller spatial impact is used as justification for "no impact" required in the Endangered Species Act. Finally, the inference is clear that the existing outfall has had no deleterious effects on the environment, so the proposed outfall should be even better. I know of no data summary which shows the existing outfall has not had serious effects on various aspects of the environment (phytoplankton, toxic blooms, oxygen content). If such a review has not been done, then this argument is useless.

It is disappointing that the computer models, while not perfect, could not be merged more into this Assessment, given their strong billing in the Work Plan.

## GEOLOGICAL PROCESSES

The original comments by the SAP on the Work Plan for the Biological Assessment included some questions about geological processes. These comments should be reviewed, because the Assessment appears to ignore these processes completely in their review. One statement, that resuspension will decrease toxicity, is clearly erroneous. Since the potential for bioaccumulation was investigated in some detail, it would seem more balanced to discuss geoaccumulation as well, including the effects of resuspension and transport to depocenters where toxins might be concentrated.

Review of the U.S. Environmental Protection Agency's Biological Assessment

# Assessment of Potential Impact of the MWRA Outfall on Endangered Species

Reviewed by:
Craig D. Taylor
Associate Scientist
Woods Hole Oceanographic Institution

20 June 1993

In my opinion the biological assessment submitted by the Environmental Protection Agency (EPA) is a thorough and convincing document indicating, relative to the present outfall in Boston Harbor, that the proposed MWRA outfall in Massachusetts Bay is not likely to have an effect on chosen endangered species or the food chain that supports them. Working in favor of the outer discharge site are a) a more favorable effluent dispersion because of input into deeper waters via better designed diffusers, b) modest tidal currents that foster local spreading of the effluent without large directed flows that would tend to rapidly transport undisbursed plumes great distances, and c) relatively high and variable background levels of nutrients and foreign substances in the receiving waters that make enrichment and, hence, potential impact upon the system undetectable after modest dilution of the effluent.

With respect to nutrients, the above conclusions have been backed in part by use of physical modeling (Blumberg-Mellor model) to establish the dilution field of both the present and proposed discharge sites in order to estimate the aerial magnitude of nutrient enrichment and possible effects upon primary production, on the premise that the majority of nitrogen introduced into Boston Harbor via the present outfall is flushed into Massachusetts Bay, and similar loading to the outer site would, hence, be experienced. It is my understanding from discussions with colleagues that this model is quite good for the purposes intended. It is still in some state of development with respect to modeling summer-stratified conditions and modeling some of the finer details, but the preparers of the assessment assert that the overall conclusions will not be affected by further refinements of the model. Given the dramatic improvement in the predicted effluent dilution at the outer site I would tend to agree. First, I agree that input of nutrients to the outer site will likely be similar to that presently input from Boston Harbor as a mechanism of nitrogen removal, denitrification, will be a relatively minor player (burial in sediments is probably of similar magnitude). Denitrification predominantly

occurs in the microaerobic surficial microlayer of the sediment through which $NH_3$ derived from remineralization of the relatively small portion of particulate nitrogen that actually reaches the sediments, is fluxed. As the $NH_3$ diffuses through the surface microlayer on its way to the water column, a fraction is oxidized to $NO_3$ (nitrification), a portion of which is subsequently re-reduced to $N_2$ where it escapes from the system. The combined effect is to favor physical mechanisms of nitrogen removal from relatively well flushed systems such as Boston Harbor. Hence, transport of large amounts of additional nitrogen to Massachusetts Bay will likely not occur via input from the proposed outfall. Secondly, the modeled zone around the proposed outfall where nutrient enrichment above ambient is predicted to be significant (e.g., 200:1 dilution zone) is remarkably small, with migration of effluent plume tending toward the west. The eastern boundary of the dilution gradient is quite sharp, according to this model, and only 5-8 km closer to Stellwagen Bank than that predicted for the present outfall. It appears to this reviewer that mixing is sufficiently intense at the outer site that some degree of uncertainty regarding the details of the model can be tolerated without altering the overall conclusion that nutrient input into Massachusetts Bay will likely not be much different. It would seem that a substantial modeling oversight would be required to alter these conclusions, such as unforeseen lateral transport of a coherent plume for substantial distances.

With respect to potential effects of outfall-related nutrient enrichment upon phytoplankton populations the preparers have used a reasonable weight of evidence approach to conclude that the proposed outfall will not lead to large changes in phytoplankton populations. An additional approach regarding this may be to look at the zone of significant nutrient enrichment and predict the typical length of time a phytoplankter would be typically be exposed to these enriched conditions. For example, given proposed outfall discharge rates (about 200,000 $m^3hr^{-1}$) and a volumetric estimation of the 200:1 dilution zone (about 216,000 $m^3$) an estimated dilution rate of approximately 0.93 $hr^{-1}$ is obtained. Assuming rapid homogeneous mixing within this zone the 95% clearance time is approximately 3 hr. This is, of course, not an entirely correct approach to be employed and will yield an underestimate for this term, but when modeled properly the clearance time still might be rather short. Given various nutrient-stimulated phytoplankton growth rates it should be possible to provide a worst case estimation of the zone of phytoplankton population enrichment. The quasi-steady state zone of biomass increase would be the result of the race between the ability of the phytoplankton to rapidly respond to transient nutrient enrichment and being dispersed to population levels that are indistinguishable from that of the receiving waters. It also may be possible to predict nutrient effects on phytoplankton by comparison of predicted dilution properties of the outer outfall site with similar measures obtained for Boston Harbor where,

in addition, nutrient and biomass gradients have been measured in various monitoring studies A similar approach might also be applicable to the assessment of local zooplankton response to phytoplankton population density increases. This reviewer would anticipate that the time of exposure to enriched phytoplankton food sources may be short relative to the time required for zooplankton to show significant growth enhancement from a population point of view, before they are dispersed into the background.

The preparers have presented a reasonable body of evidence to support the conclusion that the proposed outfall will not likely affect regional water column and bottom water dissolved oxygen content below established standards. Particulate Organic Matter (POM) from primary treated effluent, if transported some 20 km east to Stellwagen Basin, a region of characteristically lower bottom water DO, may induce respiratory consumption of oxygen to below State standards. Of interest in this discussion would be an estimate of the nominal and most rapid transport time of effluent-derived POM to this basin, as the Biological Oxygen Demand (BOD) of this material will significantly decrease in transit.

The general topic area concerning effects of toxic substances, threshold of toxicity, bioamplification, etc. are not generally within this reviewer's area of expertise. However, as far as this reviewer can tell from a general viewpoint, the preparers seem to have presented a reasonable case suggesting that outfall toxics will not translate into measurable effects on the endangered species considered. They have relied minimally upon modeling by addressing expected concentrations to be experienced outside the zone of initial dilution, using concentration values that have been directly measured in the outfall effluent.

In conclusion this reviewer believes that overall the preparers have presented a good case for undetectable effects of the proposed outfall upon the chosen list of endangered species, relative to present inputs from Boston Harbor. The major element working in favor of the outer outfall site is the high rates of mixing and dilution to be expected. Given the levels and natural variability in nutrients and various substances within the receiving waters of this site the zone of perturbation will likely be quite small and will not be located very much closer to the Stellwagen Bank ecosystem.

Evaluation of

# ASSESSMENT OF POTENTIAL IMPACT OF THE MWRA OUTFALL ON ENDANGERED SPECIES

Biological Assessment Prepared Pursuant to
Section 7 of the Endangered Species Act

(USEPA REGION I, 1993)

Prepared by

Dr. Ted Smayda
Mackerel Cove Associates
P.O. Box 26
Saunderstown, RI 02874

Submitted to
Aubrey Consulting, Inc.
Falmouth, MA 02540

MCA Rept. 93-1 (1993)

## SUMMARY

This reviews the Biological Assessment prepared by EPA pursuant to Section 7 of the Endangered Species Act, and entitled Assessment of Potential Impact of the MWRA Outfall on Endangered Species. The sections dealing with potential nutrient impacts upon phytoplankton community structure and dynamics and toxic bloom events are focused upon in this critique. The EPA assessments of the potential nutrient-phytoplankton interactions accompanying installation of the MWRA outfall site are seriously marred by numerous misunderstandings of phytoplankton processes and their regulation; failure to distinguish between mass balance effects, phytoplankton community organization and species-specific processes; incomplete consideration of available literature; the analytical approach used in data selection, interpretation and *in situ* extrapolation is seemingly slanted to favor the basic conclusion reached - i.e., of non-endangerment, and the conclusions reached are basically anecdotally-based rather than scientifically rigorous. It is uncertain to what extent, and whether these shortcomings falsify the conclusion arrived at by EPA: that the new outfall is unlikely to adversely impact endangered species. EPA's acknowledged absence of key data sets, inability to quantify complex factor interactions, the reliance on a "weight-of-evidence" approach to arrive at conclusions (for which statistical confidence limits cannot be derived), and shortcomings of the nutrient-phytoplankton analyses needed for extrapolation to assess associated upper trophic level dynamics, however, challenge whether this conclusion has the sound scientific basis required to resolve this issue, or is an artifact.

EVALUATION

The assessment document acknowledges repeatedly that most of the essential processes and trophic linkages relevant to assessment of the potential impact of the MWRA outfall on endangered species cannot be quantified. Illustrative examples of this include the statements that (p.ES-11) "understanding the factors which stimulate and maintain toxic algae (*sic*) blooms remains elusive". That (p. 4-29), given lack of understanding of natural population dynamics of the phytoplankton, their controlling mechanisms and impact of anthropogenic modification, "it is difficult at this time to quantify the exact risk of potential adverse effects on the phytoplankton community due to discharges from the new outfall". That, (p.4-34) "Few data exist to quantitatively assess the risk of adverse effects to higher trophic levels, i.e., protected species and their prey, resulting from nutrients introduced at the proposed outfall". That, (p.4-39) "The risk that the outfall relocation would increase the frequency or enhance the severity of [toxic] blooms cannot be quantified at this time given the current limited understanding of bloom dynamics and the complexity of controlling factors, including factors other than nutrients". The Assessment's recommendation (p.4-39) that "....further research and close field monitoring of the discharge are highly recommended, in order to quantify and further refine these prediction" acknowledges both the inadequacy of the data set to resolve the assessment issues, and that the conclusions, at best, are speculative guesses rather than "*predictions*", and which cannot be assigned statistical confidence levels. Hence, in this reviewer's opinion, the conclusions reached in the assessment are anecdotal.

The EPA assessment is stated to be based on (p.4-4) "...a weight-of-evidence determination of the likelihood of a particular effect occurring". Moreover, this (at least with regard to nutrient-related issues) is based (p.4-4) "...on examining all available information on the issue, including supporting and opposing evidence" (see also p. ES-7), reported in the scientific literature and the opinions of experts via personal communications. Conclusions attributed to "*personal communication* " from T. Malone, without supporting evidence, are frequent in the Assessment.

It is not true, however, that "all available information" was assessed. There is conspicuous absence of reference to many relevant papers in, for example, the seven proceedings (totaling > 2500 pp) of International conferences on harmful algal blooms. The Assessment (pp. 4-26-28) focusing on potential outbreaks of the nuisance alga, *Phaeocystis pouchetii,* present at the outfall site and contiguous waters completely ignores the highly relevant and extensive Dutch literature which documents its long-term occurrence patterns there, linkage to eutrophication and its nutritional physiology. Moreover, the authors of the Assessment incorrectly state (p.4-28) that *Phaeocystis* is a dinoflagellate! This serious error seriously challenges the credentials of those who prepared that section of the Assessment dealing with phytoplankton ecophysiology. There are significant differences in the ecophysiology and environmental regulation of this nuisance alga and dinoflagellates. The use of *Phaeocystis* as representative of dinoflagellates in terms of the latter's environmental regulation, including that by nutrients, is inappropriate. This confusion is an additional constraint on the significant admission of uncertainty by EPA underpinning its "weight-of-evidence" conclusion expressed on p.4-29:

> "We do not have a complete understanding of the natural dynamics of phytoplankton communities and controlling mechanisms, nor of the linkages between anthropogenic additions of nutrients and changes in phytoplankton community structure, productivity, or other key response variables. Because of these limitations, it is difficult at this time to quantify the exact risk of potential adverse effects on the phytoplankton community due to discharges from the new outfall. However, based on the weight of evidence provided above, it is reasonable to conclude that discharges from the new outfall would not lead to large changes in phytoplankton community structure and productivity on a baywide scale. For example, even based on the worst-case scenario that all of the current nitrogen loading from Boston Harbor is representing a new source to the bay, the prevailing evidence seems to suggest that discharges of nutrients from the new outfall would not lead to dramatic baywide changes in primary productivity. Increases in nutrient concentrations, the first prerequisite link in the chain of impact events, for one thing, are likely to be localized. Potential effects on the phytoplankton community are likely to be localized as well. Such changes may include stimulated biomass yield, carbon production rates, and species growth rates, based on results of experimental nutrient-enrichment studies."

EPA in this statement and throughout the Assessment uses a "baywide scale" standard, the effect of which is not only to diminish through dilution effects expected nutrient loading but to simplify analysis of most probable impacts. Thus, the Assessment concluded that *baywide* changes in primary productivity and phytoplankton biomass are probably unlikely. However, it is generally recognized that environmental and biotic patchiness are major determinants of food web dynamics and regulation. Although the Assessment acknowledges such "localized" consequences of the outfall delivery, it does not adequately evaluate the resultant sub-regional patchiness and associated food web consequences. The baywide approach, i.e. average resultant changes, is inadequate to the required analyses. Note also EPA's use of such equivocal expressions as "*seems to suggest*" and "*are likely to be*" in the above quotation, and representative of the Assessment generally. That is, ambivalent, scientifically non-rigorous conclusions (= *guesses*) are a consequence of the "weight-of-evidence" approach used, as well as reflect the lack of adequate data to evaluate the issues of endangerment under consideration.

The authors should also have known that the MERL experiments alluded to (p.4-27) in support of the conclusion that phytoplankton species composition is not significantly altered at steady-state nitrogen concentrations is irrelevant. The MERL mesocosms must include frequent vertical mixing to prevent sinking of the phytoplankton. However, the majority of nuisance algal species are inhibited by turbulence (data of Berdalet, Estrada, Maranda, Pokorny, White) leading to death and/or a reduced growth rate. Their blooms usually occur during summer stratification, during which many exhibit diel vertical migrations.

This inadequate understanding of phytoplankton ecophysiology is evident throughout the Assessment. The authors indicate their extensive use of the Blumberg-Mellor model to generate results is based primarily on a winter-

spring simulation (p.ES-8). While the possibility of modeling simulation of summer stratified conditions is indicated (p 4-1), the authors state "the present conclusions are not conditional upon future modeling results." Yet harmful algal bloom events, their nutrient regulation and trophic consequence are seasonal issues, with the summer stratified period being the critical period for such blooms and their nutrient regulation and potential disruption of normal food web structure and energy flow. Thus, the Assessment's focus on the winter-spring diatom bloom is irrelevant to the Assessment issues. The extrapolations (p.4-17-20) of the distributional patterns, outfall dilution contours, variability, and expected nutrient enrichment above ambient condition from the winter-spring to the stratified conditions, phytoplankton community composition, blooms and trophic relationship during the summer are not appropriate. Summer conditions require separate analysis.

EPA's dubious understanding of the nutrient-phytoplankton issues to be resolved is also evident in other ways. Significance is attributed (p.4-27) to Kelly et al.'s failure to find correlations among various variables measured in the 1992 synoptic monitoring program, i.e. there was "a general lack of correlation between nutrient concentrations and phytoplankton or zooplankton species composition". There is a wealth of data indicating that (at least among marine phytoplankton) indicator species of various nutrient levels do not occur. The absence of such correlations, therefore, is not indicative that variations in nutrient concentrations do not regulate plankton community composition. This is contrary to the Assessment's interpretation that the negative evidence from Massachusetts Bay that species composition there is not influenced by nutrients is, therefore, indicative that the MWRA outfall will have no effect on species' composition. The Assessment makes another serious error of extrapolation (p.4-24) in its confusion between phytoplankton responses as biomass vs. changes in community structure. Based on the log-log yield-dose (i.e. primary production vs. DIN concentration) relationship presented (Figure 4-5), the report concludes that "additional inputs of nutrients into the bay would not result in ....changes in the phytoplankton community". This interpretation cannot be applied. Figure 4-5 allows one to conclude only that annual primary production increases with annual DIN inputs. It provides absolutely no information as to whether changes in species composition or other alterations in community structure also accompanied the changing DIN inputs plotted in Figure 4-5. It therefore cannot be used by EPA as supporting evidence for the latter.

The EPA report appears to be procrustean in being biased in seeking support for its conclusions regarding nutrient-phytoplankton relationships. Thus (p.4-37), after acknowledging that phytoplankton species selection may be influenced by nutrient ratios, the report concludes "there is no *a priori* reason that such shifts will cause blooms of toxic species". In reaching this conclusion, a significant literature is overlooked, with justification for this conclusion seemingly based primarily on a tenuous summer event in Chesepeake Bay. The report wrongly asserts (p.4-37) "to date, there appears to be little empirical evidence demonstrating that anthropogenic nutrient additions cause outbreaks of toxic phytoplankton species". The authors, in fact, cite the work of Smayda (1989, 1990) in other contexts, but ignore the strong global evidence presented by him for an apparent linkage between nutrient buildup and harmful bloom events. The report dismisses the Geraci et al. report (p.4-42) as only "circumstantial" (p.4-43) that 14 humpback whales died of STX poisoning after consumption of mackerel. The report (p.3-43) indicates 81 dead fin whales

have been recorded in this region during this century, death being attributable to unknown causes. The report does not acknowledge potential STX contributions to this mortality, despite the fact that the fin whale diet is similar to that of the humpback. The apparent failure to record a "death of a right whale due to STX in Canadian waters where these blooms occur at greater frequency and in proximity to summer feeding areas" (p.4-41) is seemingly invoked as support for the improbability of morbid vectoring of STX to cetacean populations.

The report (p.4-38) refutes the possibility of nutrient regulation of blooms by citing the 1976 anoxic outbreak of *Ceratium tripos* in New York Bight. This bloom, as all those familiar with this anoxic event know from published literature, cannot be attributed to nutrients. In citing this bloom as not supportive of the nutrient-regulation hypothesis, the authors fail to recognize that red-tide blooms which occur in frontal systems or on the continental shelf differ from those closer onshore in that the latter are heavily influenced by nutrient conditions, whereas the former are more heavily influenced by water column physics. The New York Bight *Ceratium* bloom outbreak is, therefore, not relevant to the issue. The authors also placed heavy weight on Malone's personally communicated, but unsubstantiated view (p.4-38) that he "has observed that many (if not most) coastal systems subject to increased nutrient loading have not experienced an increase in the frequency of toxic or nuisance algal blooms". There is substantial contrary evidence.

The authors' general misunderstanding of bloom dynamics issues is also illustrated by their representative conclusion (p.4-38) "that changes in the frequency or extent of toxic blooms with the relocated outfall are not likely". What is meant by extent is obscure, but the authors fail to consider the effects of elevated nutrient delivery from outfall discharge on the magnitude and duration of the toxic *Alexandrium tamarense* blooms which currently occur in the region of the proposed outfall site, for example. They conspicuously fail to incorporate into their analyses the buoyant surface plume entrainment of toxic *Alexandrium tamarense* observed by Franks and Franks and Anderson (whose papers are cited) and shown to periodically pass through the proposed outfall site. The potential effects of such bloom enhancement and downstream dispersal of larger toxic bloom populations resulting from injections of outfall nutrients into the entrainment watermasses are completely ignored. The authors' acknowledgement that bloom dynamics, species selection and community structure are under multifactorial control prompts them to dismiss nutrients as not playing a significant role in regulating such processes (see p.4-36-39).

The apparent procrustean bias to dismiss the potential for nutrient induced changes in, and altered phytoplankton dynamics, therefore is evident in the general approach of the Assessment to muster exceptions to such regulation, its use of non-peer reviewed personal communications (i.e., opinions), and in its exclusion of numerous reports documenting nutrient modified effects will potentially occur.

The accompanying "weight-of-evidence" approach used to prepare this report applies an anecdotal approach at the expense of the scientific assessment required. Frankly, I do not know whether the proposed outfall siting will be beneficial, without effect, or be detrimental to the endangered species in question. However, I strongly disagree that the EPA Biological Assessment has

applied the necessary rigor in the collation, synthesis and extrapolation of relevant data in support of the conclusions reached, and which are based upon a quasi-scientific approach. Moreover, a basic question is ignored. How will post-construction events due to natural variation be distinguished from adverse, degradative or, even, favorable events resulting from effluent discharge at the proposed outfall site? The latter is to be located in a highly variable region physically, optically and subjected to incursions of entrained, toxic dinoflagellates exposed to elevated nutrient discharge. The EPA acknowledges (p.4-20) the occurrence of "considerable variability". The need to distinguish between natural variability vs. anthropogenic induced changes (particularly if inimical) is essential to allow engineering solutions to mitigate the latter effects, if necessary.

The Assessment also suffers from the scaling factor applied as a standard of change, i.e. whether baywide changes will occur. For example (p.4-24), "dramatic baywide changes in nitrogen concentrations [from outfall discharge] are not expected", and that "baywide changes in phytoplankton communities are not likely to occur". While these conclusions may be reasonable at the baywide boundary condition, the report does not assess the nature and consequences of the anticipated nutrient gradients and associated trophodynamic processes associated with localized and patchy nutrient modified habitats. The report also excludes vectoring of STX, for example, to endangered cetaceans on the grounds that they probably will not be attracted to the enrichment plume. However, the report does not consider the potential for migratory prey, such as mackerel and capelin (species reported to have STX body burdens resulting from local red tide blooms) to ingest toxic prey in the enrichment plume, and then to vector these toxins to offshore populations of the piscivorous humpback and fin whales. This is a serious omission.

There is repeated reference to the fact that Kemp's Ridley and loggerhead turtles feed extensively on crabs (pp.ES-14, 3-56, 4-44, 4-46), with the genus *Cancer* being "one of the main food items" of these turtles during their summer visits locally, as well as extensive feeding of Ridley's on blue crabs (*Callinectes sapidus*) (p.3-56). The report concludes that these endangered turtles will not be adversely affected by toxic algae since (p.4-46) "crabs of the genus *Cancer*, a preferred prey of both species, are not known vectors for biotoxin transfer". This is in error. Foxall et al. (1979) have demonstrated STX accumulation in the New England rock crab, *Cancer irroratus*, feeding on toxic clams (*Mya arenaria*) which became intoxicated upon filtering *Alexandrium tamarense*. Moreover, *Callinectes sapidus*, a dietary item for the loggerhead turtle, also has been reported to become STX affected during toxic dinoflagellate blooms (Wardle et al. 1975). Such omissions from the Biological Assessment Report further compromise the claim (p.ES-7) that an "examination of all available information" was made in arriving at an Impact Assessment. Such omissions also compromise conclusions based on the procedure EPA used (p.ES-7) to arrive at "a weight-of-evidence determination of the likelihood of the particular effect occurring".

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# REVIEW OF:

# "Assessment of Potential Impact of the MWRA Outfall on Endangered Species" — A Biological Assessment prepared by the U.S. Environmental Protection Agency pursuant to Section 7 of the Endangered Species Act

Robert D. Kenney, Ph.D.

Graduate School of Oceanography
University of Rhode Island

and

Science Advisory Panel
Cape Cod Commission

DRAFT — 28 MAY 1993

SUMMARY:

EPA is to be commended for the effort which obviously went into the preparation of this Biological Assessment, and reviewing the vast amount of information published relative to the marine ecosystem in Massachusetts waters. There are a number of errors in the document, no doubt unavoidable when attempting to summarize such a large amount of information. Many of the errors I found had no effect on the conclusions, since they would lead one toward more conservative conclusions. And much information remains to be gathered. Despite these acknowledged data gaps and errors in the Assessment (detailed following), I feel relatively comfortable with the Assessment's overall conclusion that operation of the proposed MWRA sewage outfall in Massachusetts Bay is unlikely to impact the populations of endangered species inhabiting Massachusetts Bay and Cape Cod Bay (hereafter "the Bays" for brevity). My judgments are based primarily on my expertise in the biology of the endangered species, and only secondarily on my more limited knowledge of physical oceanography, plankton dynamics, toxicology, etc. I am sure that the other members of the Science Advisory Panel will make up for my limitations in reviewing those areas of the Assessment.

I am most comfortable with the conclusions relative to potential impacts related to nutrient enrichment, somewhat less so with the sections on toxic contaminant impacts, and least so with the conclusions related to impacts from possible increases in the frequency of toxic phytoplankton blooms. All of the Assessment's conclusions seem to rely heavily on the results of the current version(s) of the circulation models for the Bays. It appears to me that validation of the existing models thus far shows the models to be good predictors of nutrient loadings from the current outfall. If the modeling predictions for the new outfall are correct, then nutrient loading in the Bays (and in Boston Harbor) outside of the immediate vicinity of the outfall will be lower than existing levels, so any potential impacts of the new outfall must similarly be less likely.

In my opinion, right whales are the only one of the endangered species included in the Assessment at all likely to suffer significant detrimental impact to their population from the outfall. Even though the proportion of the population utilizing the Bays system in a given year is less than 20%, and usually substantially smaller than that, it is frequently a critical segment of the population (mothers and calves, juveniles), and the population is so severely depleted that small impacts on a few individuals might have serious effects. Nevertheless, the models predict no detectable change in nutrients due to the change in outfall location in the eastern half of Cape Cod Bay, which is the primary right whale feeding area. Therefore significant outfall-related changes in zooplankton species or abundance, already highly variable between years with no apparent detrimental effect on the whale population, are not likely. Significant effects of toxic phytoplankton blooms on right whales are probably also not likely, since the seasons of principal right whale occupancy (April) and red tide frequency (summer) are largely non-overlapping.

The other endangered whale and sea turtle species are much less likely to be significantly impacted by any aspect of the proposed outfall. The proportions of their populations inhabiting the Bays at any given time are small, probably so small that a single catastrophic event, even one which killed most of the individuals in the Bays at the time, would not have a significant impact on population survival, status, or recovery. The numbers of sea turtles in the Bays at any time is negligible, though this is least clear for the Kemp's ridley. Nutrient loadings so severe as to radically alter the food chain in the Bays to completely different species would simply mimic events in 1986 (and possibly now underway in 1993), when sand lance stocks crashed and humpback and fin whales simply moved elsewhere to feed. Sighting data since the late 1970's, when relatively intensive study of cetaceans off the Northeast coast began, and limited data for prior years, suggest that drastic shifts in cetacean distributions are frequent responses to interannual and longer-term variability in prey stocks (Payne *et al.*, 1986, 1990; Kenney *et al.*, in prep.). An increased frequency of toxic phytoplankton blooms, which the assessment suggests is not likely, could impact a few, or even more, individual

humpback or fin whales on occasion. However, this is also not likely to cause significant impact at the population level. The only known previous event of this nature, the death of 14 humpbacks in 1987 attributed to eating mackerel with high saxitoxin loads, represented less than 0.3% of the entire western North Atlantic humpback population, and only 2-3% of the Gulf of Maine regional feeding stock.

Because of the remaining data gaps and uncertainties in the ecosystem linkages in the Bays system, I would recommend that the National Marine Fisheries Service include the following conditions in their Biological Opinion issued for this Section 7 consultation relative to the proposed outfall:

(i) Further development and validation of the hydrographic and water quality models for the Bays should continue. Models should incorporate water column stratification, as well as biological processes (nutrient uptake, denitrification, etc.). Continued agreement of current observed conditions with model predictions for the present outfall location would lend much more believability to any predictions for the new outfall.

(ii) The site of the proposed outfall, and the surrounding area, should be surveyed regularly for the presence of endangered species. The Biological Assessment relies heavily on the fact that endangered species are rarely observed in that area. However, sighting frequencies are strongly effort-dependent (i.e. "the more you look, the more you are likely to see", and vice-versa), and it is not clear what the level of sighting effort in the outfall vicinity has been relative to other locations (e.g. Stellwagen Bank, eastern Cape Cod Bay).

(iii) Completion of the entire set of secondary treatment facilities should be explicitly required, with no possibility of stopping part-way because conditions at that point seem to look "good enough."

(iv) An effective monitoring program should be established to track nutrients, phytoplankton abundance and species patterns, zooplankton abundance and species patterns, red tides, benthic conditions, contaminant concentrations, etc., with contingency plans for action to be taken in the event of any potential adverse conditions not predicted by the modeling effort.

(v) Every effort should be required to further reduce effluent concentrations of toxic substances, particularly those such as PCB's with known or suspected effects on higher vertebrates (e.g. immunosuppression, carcinogenicity).

SPECIFIC COMMENTS:

The following comments deal with specific items in the EPA Biological Assessment. As mentioned earlier, my review focused on the material directly concerned with the endangered species, though all sections of the Assessment were reviewed. Minor errors in spelling, grammar, etc. have not been included. Because the Executive Summary section did not contain supporting literature citations which would enable checking, and should contain the same information which is in more detail in later sections, my comments there are quite limited.

Each comment below is keyed to the appropriate section of the Assessment by page, paragraph, and line number (e.g.: P 1/¶ 1/L 1). I've counted paragraphs from the top of each page, including partial paragraphs but excluding headers and subheaders.

P ES-4/¶ 4/L 3: 'low of 100 animals'. See comment later (p. 6).

P ES-4/¶ 5: This is a common problem throughout the Assessment. It confuses right whale occurrence in the Bays with occurrence in the entire western Gulf of Maine. In the Bays, earliest sightings are in February and the peak is in April. The period stated in the Assessment more properly refers to the Great South Channel, which, though off Massachusetts, is not part of the Bays system. Jeffreys Ledge is also beyond the Bays, to the north.

P ES-5/¶ 2/L 5: Why limited to "in inshore waters?" This sentence should more properly read "It is estimated that one-third of right whale mortalities are caused by ship collisions and entanglement in fishing gear."

P ES-5/¶ 4/L 3&4: Should be "western North Atlantic" stock. There is probably a separate breeding stock on the eastern side of the North Atlantic.

P ES-13/¶ 3/L 5-7: This sentence, describing an overlap between right whales and *Alexandrium* blooms in the Bays, is likely in error. Firstly, "most of the feeding population of right whales" is <u>never</u> in the Bays. The largest number of individuals identified in the Bays in any year was 54 in 1986 (Kraus and Kenney, 1991), which was an anomalous year with right whales resident through the summer and fall. 54 is only about one-sixth of the known identified total. Excluding 1986 and 1987, the years with summer residency, over 91% of all right whale sightings in the Bays are in March-May, with 47.8% in April (Kraus and Kenney, 1991), while I believe that red tides occur primarily during the summer months.

P ES-21/¶ 3/L 10: Right whales are sighted only rarely on Stellwagen Bank (see Figs. 2 and B-15 through B-28 in Kraus and Kenney, 1991).

P 2-3/¶ 3/L 4: Meyer *et al.* (1979) is probably not the most appropriate reference for Stellwagen Bank bathymetry.

P 3-1/¶ 1/L 9: While it is true that the CETAP surveys sighted no sperm whales in the Gulf of Maine, there have been some sightings in the north-central Gulf and near Browns Bank (Hain *et al.*, in prep.).

P 3-6/¶ 1: The estimates in Winn *et al.* (1987) are for Georges Bank (as defined therein) only, and do not include the rest of the Gulf of Maine. They are also not corrected for individuals not sighted due to diving. The estimates in Hain *et al.* (1992) for fin whales, and in CETAP (1982) for right and humpback whales, are scaled for missed animals and would be better for the three endangered species. There are no scaled estimates for any of the other cetacean species.

P 3-6/¶ 2/L 4-6: This statement is not true for all cetacean species. The general trend is for cetaceans to be where their food is, which might be correlated with bathymetry and fronts for some prey species. Humpback distributions are directly correlated to steep bottoms, but right whales tend to be over deeper waters displaced at some distance from the steep bottom and frontal zone (Brown and Winn, 1989).

P 3-7/¶ 1/L 3-4: A recent publication (which I can't find for the life of me) suggested that the attribution of "right" whale meaning "correct" whale to early English whalers might be simply folk wisdom and not accurate (I'm guilty of writing this myself many times.). The alternative suggested was right whale in the sense of "true" whale, a literal translation from the Latin genus name *Eubalaena*.

P 3-7/¶ 2: This paragraph uses the term "population" in two different and non-equivalent senses: one for the three subspecies (Note that not all researchers accept separate species status for the southern right whale. Few valid systematic studies have been done. Dr. Jim Mead (Mead, 1992) from the Smithsonian is in the doubter's camp.), and one for separate breeding stocks within the North Atlantic. "Stock" might be the better term in the latter case.

P 3-7/¶ 3/L 9-11: It is an exaggeration to say that heavy right whale exploitation continued in the North Atlantic until 1935. Yankee pelagic whalers largely switched to sperm whales in the 18th Century. The eastern Atlantic fishery essentially stopped in 1926 (Brown, 1986). A calf was shot by fisherman in

Florida in 1935, but the main 20th Century U.S. whaling was from Long Island, where only ten were killed or struck and lost between 1900 and 1924 (Reeves and Mitchell, 1986).

P 3-7/¶ 3/L 11: The estimate of 100 animals in 1935 is unsupported by citation of source, and likely pure conjecture. There are no reliable estimates of western North Atlantic stock abundance prior to CETAP. I have back-calculated possible 1935 abundance based on current estimates and a range of annual rates of increase (Kenney, 1991, 1992; Kenney, Winn, and Macaulay, in prep.). It is possible that far fewer than 100 animals survived at the population's low point, in 1935 or earlier. This is supported by extremely low genetic variability in the population (Brown, 1991; Schaeff *et al.*, 1991, 1992).

P 3-7/¶ 4/L 7-8: The "missing" right whales in the winter include far more than juvenile and adult males. In fact, some juveniles have been showing up in the calving grounds, particularly in the last few years. The missing whales include most juveniles of both sexes, all adult males, and all non-reproductive adult females (those just finishing lactation or resting years, plus any which may simply not breed at all).

P 3-8/¶ 1/L 1-2: The numbers and other data presented in Kraus *et al.* (1992) were preliminary, and many have been changed during revisions. This was a draft contract report to MMS, and probably should not have been made available outside of MMS until after revisions were completed. This should be kept in mind for any citations from the report contained in the Assessment.

P 3-8/¶ 1: Dave Gaskin's information on the status of the photoidentification work is not entirely current. Knowlton *et al.* (in prep.) have attempted to address this issue by presuming that any whale which has not been resighted for five years or more has died. The population size by this method is somewhere between 290 and 295 (changes slightly with newly matched photos), but does not account for some unknown number of animals which have never been photographically identified.

P 3-8/¶ 2/L 4-5: The source used for the existence of other high-use habitats is not stated, and this belief is based on sparse original information. There are only three good possibilities for areas with large numbers of right whales between current high-use habitats off New England and Florida. Two of these were areas of shore-based right whaling — Long Island (Reeves and Mitchell, 1986) and the North Carolina Outer Banks (Reeves and Mitchell, 1988). In both of these, the animals taken were very likely migrants moving northward along the coast in the late winter and early spring. Such migrants are still sighted, though much less frequently than during the periods when those

fisheries were active and right whale populations were much larger. The only other possible "high-use area" not currently occupied is Delaware Bay. Some right whales were taken during Colonial times around Cape May, New Jersey. It is not always clear whether these were coastal migrants or whether they actually entered Delaware Bay. It has frequently been suggested that Delaware Bay was once a major calving ground. However, the written descriptions of large numbers of whales in the Bay date from the very early Colonial era and are not clear as to species identity or numbers, and it has been speculated that at least some of these whales may have been gray whales, known to have existed in the North Atlantic into the Colonial era (Mead and Mitchell, 1984).

P 3-8/¶ 4: Excluding the anomalous years of 1986 and 1987, between 1950 and 1989, right whales were seen in the Bays only 7 times in June and 4 times in July (Kraus and Kenney, 1991). "Regular" occurrence is better described as mid-February through May. Stellwagen Bank and Jeffreys Ledge are <u>not</u> primary right whale feeding grounds, but only locations of sporadic sightings. This paragraph again mixes the Bays with the larger western Gulf of Maine region. Some right whales enter Cape Cod Bay in the late winter, with 25-40 individuals <u>total</u> over a given season (maximum of 54 in 1986). Peak occurrence is in April. They then leave and go to the Great South Channel, where most or all of the population might feed in a given year. Peak occurrence there is in May, with departure for Nova Scotia between the end of May and early July, depending on year (Kenney, Winn, and Macaulay, in prep.). I continue to be skeptical about the Watkins and Schevill sighting of 70 in one day; they were apparently with a group of right whales and assumed that all of the distant blows they could see were also right whales. The figure of half the total cataloged population visiting the Bays refers to over all years from the entire database, and <u>not</u> to any single year.

P 3-11/¶ 1/L 15-17: Kraus *et al.* (1987) is not the best reference for right whale patterns in 1987; Figure 3-4 suggests that they included only sightings through 1986 in their analysis. See Hamilton and Mayo (1990) or Kraus and Kenney (1991) for later, more complete analyses. In 1987, there was a summer residency similar to that in 1986, primarily east of Cape Cod.

P 3-11/¶ 2/L 1-3: Many of the statements which have been made in the literature concerning lack of recovery by right whales have been based on no data; there are simply <u>no</u> quantitative estimates of right whale abundance in the western North Atlantic prior to CETAP's in 1979. None of the references cited here provide any data or statistical analyses relative to trends in right whale abundance. My analysis of long-term trends in Great South Channel sighting rates (which <u>are</u> corrected for effects of changes in sighting effort as

suggested by Gaskin) demonstrated a statistically significant increase (Kenney, 1991, 1992; Kenney, Winn, and Macaulay, in prep.). After attempting to quantify the portion of the increase due to improvements in sighting efficiency, there was still an increase in sighting rate of 3.8%. This is close to rates calculated from calf production and photoidentification, however still lower than rates in South African or Argentine right whales.

P 3-11/¶ 3/L 7: Kraus (1990) suggested that adult mortality rates were likely less than 1% per year.

P 3-12/¶ 1/L 1-3: No one has done any quantitative study of sei whale abundance since CETAP, but the population should be expected to be growing in the absence of whaling (ended in 1972) or any other known anthropogenic or natural source of increased mortality. In 1987, 1988, and 1989, we saw lots of sei whales in the Great South Channel where they had been extremely rare before (Kenney, in prep.), perhaps evidence for a growing population.

P 3-12/¶ 2/L 1-2: There are two species of *Ammodytes* in New England and Canadian waters, *A. americanus* and *A. dubius*.

P 3-13/¶ 3/L 8-10: See earlier comment (pp. 6-7) about right whales in the Mid-Atlantic.

P 3-16/¶ 2/L 3-5: Only a very small proportion of the population winters off Georgia and Florida, with the location of the majority still unknown.

P 3-16/¶ 3/L 1-2: What is the source for this? I am not aware of evidence for southward coastal migration.

P 3-16/¶ 5/L 5-6: This is only one of a number of possibilities, all of which are only speculation at this point.

P 3-17/¶ 3/L 10: There is no basis for suggesting that the wintering ground, except for the calving area, is south of Nova Scotia.

P 3-17/¶ 4/L 4-6 and 11-13: There is little or no evidence for "frequent trips" between feeding areas. Mate's tagged whales did make some long excursions from Nova Scotian waters, but the number tagged was very small, and only in the late-summer/fall.

P 3-18/¶ 3/L 6: Watkins and Schevill described the speed of a feeding right whale as "up to 3 knots" or "2-3 knots," which I presume is the source for 4.5 km/hr (ca. 2.5 knots). But Mayo's studies in Cape Cod Bay suggest that

speeds while feeding are usually around 1 knot (1.9 km/hr).

P 3-19/¶ 1/L 7-8: Copepod patches in the Great South Channel are not usually near the surface, except in a couple of years when they did not vertically migrate on a 24-hour cycle (Wishner *et al.*, 1988, in prep.). Most right whale feeding in the Great South Channel is not seen, and is presumed to occur at depth (Kraus and Kenney, 1991; Kenney, Winn, and Macaulay, in prep.).

P 3-19/¶ 3/L 7-9: This seems to be a misinterpretation of the data. Mate *et al.* (1992) showed mean percent submergence of 78%, and a mean dive time of 86 sec. However, most dives are short and shallow ones between blows during a surfacing bout, following by a longer, deeper (presumed feeding or traveling) dive. Mate's data showed dives up to 14.1 minutes, and CETAP data showed dives to 15.8 min. Many feeding dives last longer than 3 minutes, and typically are in the 10-12 min range. Data from our radio-tagging study in the Great South Channel in 1988 and 1989 (Winn *et al.*, in prep.) showed that dives within surfacing bouts were typically less than 27 sec, while inter-bout dives averaged 2 min 7 sec and ranged to a maximum of 22 min 43 sec.

P 3-21/¶ 2/L 4-8: The comparison between Sherman's and Mayo's data is not valid. The former are based on MARMAP samples collected by paired bongos and integrated over the entire water column. The latter are from discrete samples collected over very short horizontal and vertical distances within zooplankton patches.

P 3-22/¶ 2/L 11-12: I don't believe that it has been established that nutrient availability is the primary immediate factor in the development of right whale prey patches, in the Bays or elsewhere. It is just as possible that the patches develop from zooplankton which are produced elsewhere, then advected into and concentrated within a specific area by physical or a combination of physical and behavioral processes. Productivity is still an ultimate underlying factor, but the immediate factor is the concentration and patch development process.

P 3-22/¶ 2/L 12-15: Many of the literature sources which include krill as right whale prey also specify juvenile krill. The swimming speed of a feeding right whale is very similar to that of a fishing plankton net, and krill are very difficult to sample. Right whales probably have to swim much faster to catch krill, with a much higher energetic cost. Hamner *et al.* (1988) observed southern right whales swimming at speeds up to 8 knots (14.8 km/hr) while feeding on *Euphausia superba* near Antarctica. The choice to leave an area of obviously high krill abundance, possibly for another of high copepod abun-

dance, may very well be energetically "correct."

P 3-22/¶ 4/L 8-10: Maximum density sampled in 1989 was 331,000 /$m^3$ in a surface layer (Wishner *et al.*, in prep.).

P 3-23/¶ 5/L 4: Updated information shows a somewhat longer mean calving interval, somewhere around 3.7-3.9 years (Knowlton *et al.*, in prep.).

P 3-23/¶ 6/L 2-4: How is a 13-14 month gestation period consistent with conception in the summer? Peak calving is in December-February, therefore peak conception would be October-January. Right whales exhibit surface-active group behavior (the presumed sexual activity) in every known habitat from spring through fall, and we expect to see them doing the same thing when we finally locate their winter habitat(s).

P 3-23/¶ 5/L 6-7: In only one case has a right whale in this population had two calves two years apart, which this implies. All other females wait at least one year ("resting" year) between weaning and becoming pregnant with the subsequent calf.

P 3-24/¶ 3/L 3-4: In March of 1935, a right whale calf was shot and killed off Florida by fishermen, who also tried to kill the mother. A photograph of the adult was published in the New York Herald Tribune. That individual has been photographed and re-identified in April 1959 in Cape Cod Bay, in April 1980 in the Great South Channel, in October 1985 with a calf in Cape Cod Bay and off Plum Island, and most recently in March 1992 in Cape Cod Bay. Since it was already a mature adult in 1935, in 1992 it must have been at least 63 years old (Kraus *et al.*, in prep.).

P 3-24/¶ 5/L 11-12: The estimate of humpback population abundance in Braham (1984) is likely significantly out of date. All of the individual estimates he included are now at least a decade old. At annual rates of increase as high as the 10.3% maximum rate cited on p. 3-38, the current world-wide population could be as large as 33,000.

P 3-25/Fig. 3-6: There is no Kraus *et al.* (1991) in the literature cited, so this is probably from Kraus *et al.* (1987). It appears that the data only go through 1986. It would have been enlightening to know how many of the non-M/C sightings in June-November were also from 1986.

P 3-26/¶ 3/L 4: What is the evidence/source for humpback calving around Ireland. All other humpback calving grounds I am aware of are in tropical waters. Humpbacks are known from, and songs have been recorded in, the Cape

Verde Islands (Winn *et al.*, 1981), which makes more sense as an eastern North Atlantic calving ground.

P 3-28/¶ 3: It is not clear to me, in the absence of literature citations, why the toxic dose should be related to metabolic rate. Does this mean metabolic rate, which is higher in a humpback than a sea otter, or weight-specific MR, which is lower? And doesn't the toxic dose depend on both the saxitoxin concentration in the prey and the amount of prey consumed?

P 3-30/¶ 1: It seems confusing to introduce two sets of numbers to prove the same point, when it is not clear how they relate. What years were encompassed by the OCS data? Since the northeast OCS is much larger than the Gulf of Maine, why so many fewer entanglements?

P 3-30/¶ 2/L 6-7: These numbers don't add up. If the Gulf of Maine humpback stock is 600 whales, a 4.8% annual mortality rate means that 28 whales die in entanglements each year, but only 5 or 6 deaths are known for 1975-1990.

P 3-32/¶ 5/L 2: I believe that this should be Mona Passage.

P 3-33/¶ 1/L 3: There is no direct evidence for right whale mother/calf pairs getting a free ride in the Gulf Stream. Mention of this in Kraus *et al.* (1992) was speculation based on what should be adaptively and energetically beneficial to the animals.

P 3-33/¶ 6/L 6-8: *Calanus* samples reported by Wishner for 1986 were from the Great South Channel, not the Bays. So they are not from the same location as the data reported by Payne. In addition, sample densities in the two papers are not directly comparable, since Wishner's data were from MOCNESS (i.e. vertically discrete) samples and Payne's were based on MARMAP bongo (i.e. vertically integrated) tows. Our 1989 data in the Great South Channel were another order of magnitude higher than 1986 (Wishner *et al.*, in prep.), and Mayo has collected samples in Cape Cod Bay another order of magnitude denser still.

P 3-35/¶ 2: The argument presented in this paragraph is not clear. Mike Payne and I have talked about this many times over the years. His 1986 paper used humpback sighting distribution relative to abundance and distribution of sand lance and distributional changes by humpbacks coincident with the sand lance explosion to support the hypothesis that humpback distribution was related to sand lance patterns. We both also recognized that humpback distribution was clearly related to steeply sloping bottom topography. He hypothesized that

humpbacks used the bottom in these areas as a barrier to help capture sand lance schools. My hypothesis (Kenney, 1984) was based upon literature descriptions (Reay, 1970) of the densest populations of sand lance (which burrow into the bottom at night, during dormancy periods, and to escape predators) being found on the tops of small banks and the steep edges of larger banks, where currents maintained high oxygen levels in the sediment pore waters.

P 3-35/¶ 4/L 5-7: Our report of humpbacks (with rights, fins, and seis) feeding on euphausiids in the canyons was based on indirect evidence only. Observations were from aircraft, with no plankton samples possible. The fact that all four species were feeding together on the same reddish patches near the surface suggested that the prey was krill.

P 3-36/¶ 2/L 11: The sand lance explosion occurred in the 1970's, not so "recent years" any more. In fact, it appears that sand lance populations are currently declining.

P 3-36/¶ 3/L 8-10: It is not likely that the whale's tongue is the primary mechanism for forcing the engulfed water out through the baleen (see Lambertsen, 1983).

P 3-36/¶ 5: The jaw-scuffing noted by Hain was seen only in 1991, when humpbacks on Stellwagen were rather scarce. Since humpbacks in the Bays fed on sand lance in many previous years without scraping their faces, it is probably not related simply to feeding on sand lance. It is more likely related to something different about 1991. Possibilities include greatly reduced sand lance stocks, so the whales had to go after the last few remaining, or an influx of other sand lance predators (we also saw many large schools of spiny dogfish and probable bluefish during the airship surveys where the jaw-scuffing was noticed) which caused the sand lance to remain buried most of the time.

P 3-38/¶ 1/L 1: Implies that only 4-6 year old females breed. Should probably read "beginning at four to six years old."

P 3-39/¶ 4/L 7-9 & 14-15: The CETAP estimates, also utilized in Hain *et al.*, are now 12+ years out of date, and populations can be expected to have increased in that period.

P 3-39/¶ 4/L 17: I could find no mention of pre-exploitation fin whale abundance in the CETAP 1979 Executive Summary (the actual publication date was 1981), nor in any of the CETAP reports. If it had been, it would surely have been based on previously published information, which should have been cited

here instead.

P 3-40/¶ 1/L 2-3: What is the current estimate for the North Atlantic population on which the statement is based, and its source? The previous sections of the paragraph mention estimates for portions of the North Atlantic, some overlapping, some seriously outdated, and none of which include Greenland, Iceland, or the eastern side of the basin.

P 3-40/¶ 2/L 5-6: Part of the reason for the described distribution is effort — very few surveys have been done in waters deeper than 2000 m. Hain *et al.* (1992) included description of fin whale sightings in waters deeper than 4,000 m.

P 3-40/¶ 4: Source?

P 3-40/¶ 5/L 8-11: Based on mostly speculation. Humpback and fin whales are normally abundant in the Great South Channel from spring through fall in most years, and insufficient data exist to show that 1986 and 1987 numbers were higher than normal. In 1986 and 1987, we also had relatively abundant humpbacks off southern New England, between Long Island and Martha's Vineyard (G. Klein, URI, M.S. thesis in prep.).

P 3-43/¶ 1/L 5-6: This is not necessarily so; the warp on a lobster pot extends from the pot on the bottom to the float at the surface.

P 3-45/¶ 1/L 1: Why "Most"? I would think that <u>all</u> fin whale calves arrive with their mothers.

P 3-45/¶ 4/L 3-4: Source for statement about herring?

P 3-48/¶ 5/: Is this information relevant, since it refers to Antarctic and North Pacific stocks during heavy whaling pressure?

P 3-49/¶ 2/L 6-7: The CETAP data showed most sei whale sightings in the spring. Overall depth range was 31-3579 m, and 90% were in 49-2124 m. There is no mention of 100-1800 m.

P 3-50/¶ 2: Blue whales are generally classified as relatively stenophagous predators on euphausiids, with only rare or occasional feeding on copepods, so they are not really strong competitors with right whales. Payne *et al.* do not mention blue whale sightings. Wenzel *et al.* (1988) summarized the 1986 and 1987 blue whale sightings — one whale in October 1986 (recorded as feeding, but with no identification of prey) and two in August 1987 (one observed

feeding, with krill patches seen at the surface).

P 3-50/¶ 3/L 3: The stated length only refers to males. Sperm whales are extremely dimorphic, and females do not exceed 11-12 m (38 ft).

P 3-50/¶ 4/L 6-7: The apparent centering of sperm whale distribution along the shelf break is an artifact of survey effort. CETAP surveys largely stopped at the shelf break, where sperm whale habitat begins. Sperm whales are found throughout the deeper waters beyond the shelf.

P 3-51/¶ 3/L 2-3: Shoop and Kenney (1992) reported summer loggerhead abundance, also based on the CETAP data, of 7,000-10,000. However, any of the estimates do not factor in turtles missed due to submergence. If the figure of 57 minutes per hour spent submerged cited on p. 3-52 is correct, the number of loggerheads off the Northeast during the summer could be as high as 200,000.

P 3-51/¶ 3/L 10-11: Source for loggerhead thermal tolerance? Shoop and Kenney (1992) reported loggerhead sea turtles active in waters much colder than 15°, with a minimum of 7°.

P 3-52/¶ 6/L 2-4: "All" can be a dangerous word to use in biology. I have seen adult-sized ridleys off the east coast of Florida on several occasions in January 1992 and 1993.

P 3-57/¶ 3/L 10-12: Thompson's report was on surveys off the Southeast coast, so she would have mentioned Gulf of Maine densities only for comparison. They would have been data from CETAP surveys (See Shoop *et al.*, 1981, CETAP, 1982, and Shoop and Kenney, 1992 for leatherback abundance estimates). I find density estimates like this not particularly useful unless they are converted to abundances, or used in direct comparisons of two or more areas.

P 3-58/¶ 5/L 1-3: Like for right whales and humpbacks, leatherbacks catching a ride in the Gulf Stream makes perfect sense, but there is little evidence.

P 3-58/¶ 6/L 3-4: Payne *et al.* (1986) seems to be the wrong reference here, perhaps it should be Payne and Selzer?

P 4-20/Table 4-4: Difference (column 3) for April should be 6.7 and not 14.2

P 4-30/¶ 5/L 9-11: There is no "normal northern migration" from Stellwagen Bank during the summer (see my previous comment on p. 7). The normal north-

ward migration in the summer is from the Great South Channel; right whales usually leave the Bays in April/May and move to the Great South Channel.

P 4-30/¶ 6 (continuing to next page): There is no evidence for any significant occurrence of right whales in Long Island Sound. Reeves *et al.* (1978) mention four whales seen "off eastern Long Island Sound" in 1885, but these were likely northbound migrants. See my earlier comment (pp. 6-7) relative to right whales in Delaware Bay and Mid-Atlantic coastal waters.

P 4-33/¶ 4/L 6-8: Mackerel stocks declined along with herring during the pulse of foreign distant-water-fleet fishing, also releasing sand lance from competition. In addition, all three of these pelagic fish species probably prey on each others eggs, larvae, and juveniles, so the interrelationships go beyond simple competition.

P 4-41/¶ 2-4 (Question 8): Does not address the temporal overlap or non-overlap of right whales and red tides.

P 4-43/¶ 2: Geraci claimed that sub-lethal doses of brevitoxin weakened the dolphins and compromised their immune systems, so that they succumbed to a variety of chronic pathogens. This was despite a lack of previous studies demonstrating chronic immunosuppression (or any chronic effects) by biotoxins and positive brevitoxin assays (apparently being questioned themselves) in only a few animals. Many more animals also had high body burdens of PCB's, a known immunosuppressive, yet this was not implicated in the mortality. There was also evidence (in the Smithsonian's data, apparently not published as yet) for endocrine abnormalities in the dead animals, including a drastic decrease in age at sexual maturity in females. PCB's are also known to affect reproductive systems. Dr. Haebler at the EPA Narragansett Lab could provide a much more thorough and knowledgeable critique of this evidence, but in my opinion it is not convincing enough to warrant inclusion in the Assessment.

P 4-46/¶ 1/L 10-11: Source for statement on shallow-water foraging by loggerheads? CETAP (1982) and Shoop and Kenney (1992) showed loggerheads broadly distributed across much of the shelf.

P 4-47/¶ 7: Why are the measurements in this paragraph only in units of ml/L? They should have been converted to mg/L so as to be comparable to the other data reported.

P 4-51/¶ 5/L 4-5: Source for statement on impermeable integument of cetaceans and sea turtles?

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he MWRA Outfall on Endangered Species".

eviewed by Dr. Cabell S. Davis, Associate Scientist, WHOI.

e of Review: June 3, 1993.

ummary

The Biological Assessment presents a strong case for the lack f impact of the MWRA outfall on the endangered species of assachusetts and Cape Cod Bays and the food webs upon which they epend. A generally comprehensive review of existing information, ncluding recent monitoring studies, was used to establish a sound asis for the conclusion that the outfall will have a negligible ffect on the endangered species. Although ecological structure nd function is expected to be seriously impacted in the immediate icinity of the outfall (< 1 km radius), this effect will decrease harply with distance from the site due to strong dispersal forces (tidal and wind mixing).

As pointed out in the Assessment, the impact of the proposed outfall must be viewed with respect to that of the existing discharge. In terms of linear distance, the proposed site is only about 25% closer to Stellwagon Bank and 10% closer to Provincetown. If the modeling and laboratory studies of Roberts and Signell are accurate, the dissipation will be much greater at the proposed site than at the existing site and the areal extent of the impact of the proposed outfall will be considerably smaller than currently exists at the present site.

While I am in basic agreement with the findings of the Assessment, there are some caveats that must be considered. First, the 3-D modeling studies by USGS are preliminary, and although the Assessment states that future "refinements" to the model are not likely to alter the conclusions, the effects of effluent input level, subgrid-scale mixing rate, wind patterns, and influence of Gulf of Maine currents have not yet been examined and could potentially alter the predicted transport of effluent. Second, the long-term (20-30 years) cumulative effects of the outfall on the Bays environment was not addressed. Third, the effect of the proposed outfall was not considered in relation to environmental impacts of existing offshore sewage outfalls in other areas of the world ocean. Fourth, the potential harmful effects of pathogens, such as viruses and bacteria present in the effluent, to the endangered species are not discussed. Finally, the possibility that locally enhanced plankton productivity from the proposed outfall could attract endangered species to the contaminated area was not considered.

These caveats aside, I am in basic agreement with the findings of the Assessment. When considered in the context of existing versus proposed discharge sites, the likelihood that these issues will become important is probably small. Overall the movement of the outfall from the present to the proposed location will likely have negligible consequences for the Bays ecology including the endangered species. The issues mentioned above are discussed more fully below.

Potential Concerns with Assessment

1. Preliminary modeling - The input levels of effluent to the USGS model critically depend on results from Roberts' laboratory and

substantially less than that predicted by Roberts, a surface buoyancy plume of fresh, poorly-diluted, effluent potentially could form at the outfall site. Such a buoyant plume would be resistant to vertical mixing and could conceivably be advected into critical habitats by wind forcing.

It is stated in the Assessment that the mixed layer depth during summer is 15-25 m. Since the diffuser stacks extend 2-10 m off the bottom (which is at 25 m), it appears that the effluent will be discharged into the surface mixed layer and will not stay below the thermocline as stated. Since the surface layer during the stratified time of year can be transported considerable distances due to the reduced friction, the effluent plume could possibly enter critical habitats. The modeling and laboratory studies by Roberts of the initial diffusion apparently did not did not take into account surface gravity waves or tidal currents. These studies also have apparently not been critically examined in the field situation.

The effects of different wind patterns on transport of effluent has not been examined using the USGS 3-D model. The model thus far has included real wind data over the period 12/1/1990-3/29/91. Franks (1990) showed that wind patterns differ from year to year and can have a large influence on offshore transport of buoyancy driven flows. Wind records from different years have not yet been used to force the USGS model, and the potential for wind-forced offshore transport of the effluent into critical habitats was not examined.

In addition to wind, the effects of different inflow patterns from the Gulf of Maine was not modeled. Such external forcing can have a large effect on the circulation patterns in the Bays region. The degree of freshwater input into the Gulf of Maine varies substantially from year to year and can influence the inflow to the Bays region. The site of the proposed outfall, being further offshore than the current site, could be more subject to variations in current patterns induced by wind forcing and Gulf of Maine flow.

The effect of the magnitude of the subgrid-scale mixing rate used in the USGS model has not yet been fully examined. If the true mixing rate is considerably smaller than that used in the model, the dilution of the effluent could be substantially less, and the plume could potentially be carried substantially farther than present model results indicate.

B. Long-term effects - The proposed outfall will be in existence for perhaps 20-30 years, yet the cumulative impact over time was not discussed. The Assessment indicates that the initial five years of discharging primary-treated sewage could lead to intermittent oxygen reductions in Stellwagon Basin below State standards, but that these would be within the natural range of variability. Continued discharge of primary-treated sewage beyond the five year period could potentially have a significant negative impact on the benthic environment in the critical habitat.

Although the Assessment provides information on the expected loading of chemical contaminants in the region around the outfall, these predictions are based on dilution with receiving waters. Continued discharge of secondary-treated effluent over 20-30 years could potentially add significantly to the estimated levels if the contaminants are accumulated in the surrounding sediments and resuspended by strong wind events such as storms.

C. Relation to other outfalls - While the Assessment compares

[illegible] sewage outfalls, a thorough, [illegible] of known changes in species composition, chemical contamination, and eutrophication at a wide variety of other outfall sites was not provided. Comparisons were made between the MWRA outfall nutrient loading and other marine systems using Nixon's plot of primary productivity versus nutrient input. Included in this plot was the [illegible]obe Bay, Hawaii before and after sewage input. The results [illegible] used to show that the proposed outfall is not likely to cause substantially increased phytoplankton production. Comparisons were also made with outfalls off the coast of California to indicate that chemical contamination due to chlorinated hydrocarbons and heavy metals are not likely to be substantial.

A thorough analysis of existing information, from outfalls world-wide, on gradients in species composition and chemical contamination in the plankton and benthos as a function of local circulation was not done. Such an analysis would likely provide clear empirical evidence as to the expected areal extent of nutrient and toxic contamination from the proposed MWRA outfall.

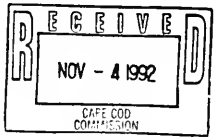
D. Pathogens - The potential dangers of pathogenic organisms to the health of the endangered species was not discussed in the Assessment. While the longevity of mammalian viruses and bacteria in seawater is poorly studied, these disease vectors could potentially adversely affect the endangered species. The location of the proposed site is closer to Stellwagon Bank and could bring such pathogens into closer proximity to the endangered species. This is only a remote possibility since the proposed discharge will be only about 25% closer to Stellwagon.

E. Attraction of endangered species - Another remote possibility [illegible]he attraction of the endangered species to the location of the [illegible]posed outfall. Local eutrophication of the environment predicted by the EPA could serve as a region of high concentrations of plankton. Local enhancement of the zooplankton populations in this region could be an attraction for Right whales which are known to feed in dense aggregations of zooplankton. This is probably not a major concern, however, since, although the mean flow of seawater through the outfall area is very weak, the residence time of the zooplankton populations in this area, due to physical diffusion (days), is much shorter than their generation time (weeks). This is even more likely during the winter-spring period when the water tenperature is cold and zooplankton generation times are 1-2 months. This time of year is the principal period for feeding by the Right whales as well. Thus, although phytoplankton may increase locally, the zooplankton populations will probably have no significant change.

Conclusion

The caveats discussed above are probably not major concerns. The principal focus should be kept on the potential differences between existing and proposed outfall locations. The EPA has presented a convincing case for the lack of effect of the proposed outfall on the endangered species. The Right whale population appears to be [illegible] only species which has a major portion of its total population [illegible]abiting the Bays region. The proposed relocation of the MWRA outfall a relatively short distance to the east does not appear to present any additional danger to this species than that which already exists. The zooplankton populations (Calanus) upon which it feeds are unlikely to be significantly impacted by this relocation.

AUBREY CONSULTING, INC.




2 November 1992

BARNSTABLE COUNTY COMMISSIONERS
SCIENCE ADVISORY PANEL

COMMENTS ON
"FINAL WORK PLAN FOR PERFORMING A BIOLOGICAL IMPACT ASSESSMENT
AND RELATED TASKS IN SUPPORT OF PREPARATION OF AN ENDANGERED SPECIES TECHNICAL MEMO"

OCTOBER 1992

The work plan proposed by A.D. Little (dated 24 July 1992; hereafter referred to as the 'Work Plan') was analyzed for its completeness and adequacy for its intended purpose. The Work Plan addressed the Endangered Species Technical Memorandum (ESTM) for the Boston Harbor outfall from Deer Island. To perform the scientific analysis of this Work Plan, a Science Advisory Panel (SAP -- Table I) was established by the Barnstable County Commissioners. The SAP is composed of scientists having exemplary scientific credentials, and who are specialists in various aspects of oceanography pertinent to the A. D. Little work plan. The work plan was reviewed individually and then collectively in meetings and through correspondence. The comments of the individual SAP members are attached as addenda. The overall comments of the SAP are contained in this present document.

SCOPE OF ANALYSIS: The scope of work for the SAP was defined by the County Commissioners, specifically:

1) After A.D. Little completes its Endangered Species Technical Memorandum, will EPA be in a position to "insure" that the operation of the outfall pipe "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical?"

2) In what ways is the Plan inadequate to address the question posed above in No. 1, and what other specific tasks or inquiries would, in the opinion of the Panel, be necessary in order to answer the question above.

In the opinion of the SAP, following completion of the ESTM, EPA WILL NOT be in a position to "insure" that the operation of the outfall pipe is not likely to jeopardize the living resources. The panel came to this conclusion because of limitations in the scope and approach of the ESTM, as well as the lack of availability of data on key issues in studies which are ongoing and which likely won't be completed by the time the ESTM is submitted.

350 Gifford Street, Suite 2-3 • Falmouth, Massachusetts 02540
Telephone (508) 457-0810 Fax (508) 457-0734

With regards to 2) above, the following comments recommend specific actions that would strengthen the ESTM and, later, the Biological Impact Assessment. The SAP has assumed based on discussions with EPA that the A. D. Little analysis is for the ESTM, and not a complete Biological Impact Assessment.

FINDINGS: Written contributions by individual SAP members are contained in the following addenda. Comments from one panelist, Dr. C. Taylor, are not included as an addenda, because his cruise schedule made him unavailable for meetings and reviews of results. Following is a brief listing of major points consistently raised about the Work Plan.

• The methodology proposed by the Work Plan ignores the effects on Turtles and Sturgeon. Analogous analysis must be performed for these latter two endangered species. There is an inconsistency between the list of species considered for the Massachusetts Bay Disposal Site and the MWRA outfall.

• The list of endangered species ignores possible impacts on birds that feed on marine organisms. Although this issue may not end up as a significant one, it should be addressed formally and reasons provided for not including these species in the ESTM. Possible species to consider include the Piping Plover, the Roseate Tern, and the Least Tern.

• The hypotheses in the Work Plan are so general and unfocused as to be of little use for the ESTM. The generality of the hypotheses makes them untestable using existing data and other scientific information. For instance, a review of the hypotheses shows few if any are testable based on available scientific data.

• The use of threshold effects, as recommended by the Work Plan, is not appropriate for an ecosystem approach. Threshold effects, while applicable perhaps for hydrocarbon analyses on specific organisms (for instance), are inappropriate for polymixtures of organisms, where synergism is important. Little-to-no experimental data exist to evaluate threshold effects on ecosystems comparable to Massachusetts Bay.

• Sublethal effects are not adequately considered in the proposal. In particular, the threshold effects, if used, must include concentrations of materials combined with the time or duration of exposure. The methodology to calculate the dosages to evaluate threshold effects is not provided.

• Geoaccumulation of toxics in sediments is not discussed, nor is its possible role in the food chain dynamics leading to the endangered species. Sedimentation processes must be included in the analysis, though the modeling section does not indicate that this will be done. Since the benthic contribution to the food chain is pertinent to at least some of the endangered species, geoaccumulation should be addressed.

• The role of the benthos in the impact assessment is not clarified. Will the role of benthos as a food chain member and bio-accumulator be considered in the analysis?

• The Work Plan should include a discussion of the nutrient speciation as well as nutrient concentrations, as the impacts are considered. After secondary treatment the nutrients will be in a different chemical form, some of which will be more readily available to the phytoplankton.

• The physical model being applied by the USGS for MWRA is an excellent, state-of-the-art model, applied by competent modelers. However, care must be taken in extrapolating hydrodynamic results to dynamic ecosystem processes, including nutrient cycling, heavy metal accumulation, and similar issues. The dynamics of the ecosystem processes including

sedimentation processes must be incorporated in the analysis, instead of assuming passive admixtures move with the fluid.

• Since the Work Plan relies heavily on model results for completing their impact assessment, the Work Plan must await the availability of the model output prior to its issuance.

• An ecosystem model probably is not appropriate as a predictive tool at this time, due to the lack of verification data for such a model on a bay-wide scale. However, an ecosystem model would be a useful tool for diagnostic examination of the effects of the outfall on the ecosystem. In addition, some process-oriented models focused on low order modes of the biological system would add to the orderliness of the examination of biological impacts.

• The ranking methodology proposed by the Work Plan is inadequate for biological impact assessment, but adequate for the ESTM.

• The time and space scales of pertinent impacts have not been defined well in the Work Plan. The time scales should include those small enough to include phytoplankton blooming, and long enough to consider the likely lifetime of the outfall usage (100 years is a good planning horizon). Space scales for the hypotheses likewise have not been identified. Is a mixing zone considered (if so, what is its spatial extent)?

• A population viability analysis (including population, genetics, and demographics) for the affected endangered species would provide a useful adjunct to the ESTM and biological impact assessment.

• The scope of the consultation with experts should expand beyond phone calls, questions about published literature, and review of the ESTM or biological assessment. The consultation with experts should include substantive discussions and exchange of ideas.

• The Work Plan should include a discussion and motivation for the selection of the worst case scenario for biological impacts. The implicit assumption is that the worst case is an increase of nutrient concentration within the bay, whereas in fact the worst case might be a decrease of nutrients in the bay. Discussion of this issue is essential.

SUMMARY: The SAP has identified a host of issues that a proper ESTM and biological assessment should consider. We encourage A. D. Little and EPA to include discussion of these pertinent aspects in their documentation, to provide full and complete analysis of impacts for the Endangered Species Consultation. The SAP recommends full consideration of the above comments, as well as those contained in the addenda, in the Work Plan.

Several recommendations came from our discussions:

• EPA should host a 2-3 day intensive scientific workshop between modelers (ecosystem, hydrodynamic and water quality) and biologists, chemists, geologists, and biogeochemists, to assure that the proper questions are being asked of the models, and that the models are used to the maximum extent possible, given inherent limitations, to guide the biological impact assessment.

• Analog case studies should be included in the Work Plan to examine the impact of chronic, low level pollution (nutrients, heavy metals) on large ecosystems such as the Seto Inland Sea, Baltic Sea, Adriatic Sea, and Black Sea (for instance), to examine parallels to Massachusetts Bay. Such case studies would provide valuable contrasts and comparisons as an alternative to the imprecision of existing process level models and data in Massachusetts Bay.

• Diagnostic ecosystems models, or at least low order biological process models, would guide the biological assessment from various mixes of different input and processes resulting from those inputs. Focus on Calanus trophic dynamics might be one useful process model.

• Population viability analysis for the endangered species in question would be a useful adjunct to the biological impact assessment.

TABLE 1

Scientific Advisory Panel
Barnstable County Commissioners

| | |
|---|---|
| Dr. David G. Aubrey, Chairman<br>(Coastal Processes) | Aubrey Consulting, Inc. and<br>W.H.O.I. |
| Dr. Cabell Davis<br>(Zooplankton) | W.H.O.I. |
| Dr. Robert Kenney<br>(Marine mammals) | U.R.I. |
| Dr. Ted Smayda<br>(Phytoplankton) | Mackerel Cove Associates and<br>U.R.I. |
| Dr. Craig Taylor<br>(Oxygen dynamics/eutrophication) | W.H.O.I. |

( ) = Oceanographic specialty
W.H.O.I.: Woods Hole Oceanographic Institution
U.R.I.: University of Rhode Island

Evaluation of

# FINAL WORK PLAN FOR PERFORMING A BIOLOGICAL IMPACT ASSESSMENT AND RELATED TASKS IN SUPPORT OF PREPARATION OF AN ENDANGERED SPECIES TECHNICAL MEMO (A. D. LITTLE DOC. 64945)

Prepared by

Dr. David G. Aubrey
Aubrey Consulting, Inc.
Suite 2-3
350 Gifford Street
Falmouth, MA 02540
(508) 457-0810

1 November 1992

## SUMMARY

This document reviews the physical oceanographic and geological aspects of the A. D. Little Work Plan in support of the ESTM. Although little detail was provided about the physical oceanographic and geological aspects of the study, these elements are critical to an impact assessment, and must be described fully and clearly in the Work Plan. In general, the rationale for using the different mix of numerical models proposed by A.D. Little was not clear, and the applicability of the various models (USGS, TEA, ELA, ADDAMS) in different mixes and to address different questions, is not described.

One specific area of concern is the reliance on the USGS physical oceanographic model of circulation within the Bays system. The report describing modeling results will not be published for months. Since the ESTM relies heavily on the model results (p. 10-14), clearly the water quality and circulation models must be available prior to completion of the ESTM. The TEA/ELA model is not as comprehensive as the USGS/HYDROQUAL model, and therefore better results would be expected from the latter model, which is progressing steadily forward.

A further concern regards the transport paths and depocenters for toxics contained within the effluent. Though the USGS model is the best available description of water motion in the bay, and thence of particles moving passively with that water, toxics and other effluent material may move much differently due to the effects of sedimentation. Sediments commonly strip the water of various toxic chemicals, and carry them to the bottom rapidly. If this sedimentation occurs near the outfall pipe, there is a potential for deposition and accumulation of toxic material in depocenters throughout the Bay. Such accumulations could affect local benthic fauna, and also could be transported through the food chain to the endangered species of concern. The Work Plan does not address these issues for the outfall tunnel, though it does include some dredge material review in its ADDAMS numerical model for the Third Harbor Tunnel Project, Boston Harbor Improvement Project dredging activities, and Continued use of the Massachusetts Bay Disposal Site for dredged materials disposal.

## PHYSICAL MODEL REVIEW:

The A. D. Little Work Plan proposes to use the ADDAMS numerical model to consider the effects of three projects occurring in the same time frame as the MWRA outfall tunnel project: the Third Harbor Tunnel Project, Boston Harbor Improvement Project dredging activities, and Continued use of the Massachusetts Bay Disposal Site for dredged materials disposal. In addition, the Work Plan proposes to use the USGS model outputs (presumably the velocity data) to derive a second set of water column concentrations. Since the USGS circulation model does not appear to have a sedimentation component, the intent of this exercise as applied to dredged sediments is unclear. Sediments are not passive particles, a notable distinction being their ability to move vertically through the water column under the combined action of turbulence and gravity. Since the USGS model appears not to include a sedimentation component, the resulting questions (1 and 2 on bottom of p. 11 of the Work Plan) cannot be addressed as proposed using the USGS model.

The A. D. Little Work Plan also proposes to use the hydrodynamic model output from the USGS to support the ESTM for the following purposes:

- To predict nutrient concentrations under various environmental conditions and wastewater management scenarios in farfield areas in support of the biological impact assessment;

- To predict toxic chemical concentrations under various environmental conditions and wastewater treatment scenarios in the farfield areas;

- To update predictions of water quality compliance/non-compliance for specific toxic effluent constituents (copper, mercury, dieldrin, and PCB) that were predicted to potentially exceed criteria in the Final SEIS and taking into account new loadings presented in Shea, 1992."

These three needs cannot be fulfilled by the model output as it now exists. First, discussion is lacking regarding the manner in which nutrients are to be transported. There is no simple connection between the hydrodynamical model of USGS and transport of advected/diffused materials: such transport calculations require a more complete water quality model that includes advective and diffusive processes. To my knowledge, the USGS model will not suffice for this purpose, but instead, the ESTM will have to await the HYDROQUAL model results.

Second, the chemical contaminants commonly become associated rapidly with sediments (organic or inorganic), and are rapidly recycled to the bottom sediments. This process is not part of the USGS model, and thus the model in its present form is not germane for the question of compliance. Though this approximation may provide an estimate of the highest expected concentration of these materials in the water column (a useful calculation) due to direct input from waterborne sources, it ignores the actual processes which accumulate and concentrate toxics in small areas. For instance, geoaccumulation could concentrate toxic chemicals near the bottom; storms could consequently release these materials to the water column, resulting in non-compliance events not estimated by the present analysis. Such calculations require a water quality and sedimentation model, which may not be available until Spring, 1993, or later.

The Work Plan does propose application of one water quality model: the coupled TEA hydrodynamic model with the companion ELA water quality model. TEA and ELA must be three-dimensional if they are to predict the water quality parameters accurately. Will TEA results be compared with the USGS model? How will the vertical structure of the water column be included in the calculations? What data are to be used to "calibrate" or "verify" the TEA/ELA model as applied to Massachusetts Bay? The Work Plan only states it will use available data for such verification. Are such data adequate to provide the "validation" to within 10 percent, as suggested by the Work Plan? Probably not. This application seems wrought with questions, which cannot be addressed with the abbreviated work plan and sketchy details.

The Work Plan (or at the least the ESTM) should motivate the application of these different numerical models (TEA/ELA versus USGS/HYDROQUAL) for addressing different issues. It might be better to use the USGS/HYDROQUAL models when they become available, as they are supposed to be superior to the TEA/ELA models.

GEOLOGICAL PROCESSES:

Once material enters the water column, whether suspended, dissolved, or otherwise present, it is normally cycled through a variety of chemical, biological, biogeochemical, and geological processes. One common process is the accumulation of toxic material on sediments (through a number of mechanisms) and the subsequent rapid settling of those materials to the bottom of the Bay. This process of "scrubbing" of particulate or dissolved material from the water column can result in accumulation of toxics in depocenters. These materials may remain for prolonged periods, be covered by sediments and removed from further processing, or may be resuspended and retransported to another location. Physical processes commonly dictate that

sediment will accumulate unevenly over a bottom, with some locations gathering much sediment, and others gathering much less or even eroding.

The importance of geoaccumulation for Massachusetts Bay is significant. Effluent will bring with it a variety of toxic chemicals (e.g., copper, PCB's, mercury, dieldrin) which may be accumulated by sediments. Depocenters have been identified within the Bay system, where accumulation of toxics might take place. Once in the sediments in large concentrations, these toxics might be introduced into the food chain by benthic organisms, and ultimately can be introduced directly to the endangered species in question (see comments by R. Kenney). This benthic conveyor belt has been ignored in the Work Plan -- a significant gap. The ESTM should evaluate the potential for adverse effects or impacts resulting from this linkage. In order to address this issue, the ESTM may have to await model results which incorporate a realistic sedimentation and "scrubbing" process model, perhaps added to the water quality model. Without such calculations and elucidation of food chain dynamics, these impacts cannot be quantified.

REVIEW OF A.D. LITTLE DOCUMENT ENTITLED "FINAL WORK PLAN FOR PERFORMING A BIOLOGICAL IMPACT ASSESSMENT AND RELATED TASKS IN SUPPORT OF PREPARATION OF AN ENDANGERED SPECIES TECHNICAL MEMO"

Dr. TED SMAYDA

21 SEPTEMBER 1992

## SUMMARY

The A.D. LITTLE Work Plan for a Biological Impact Assessment of the potential effects of the Boston Harbor outfall pipe on endangered species has been reviewed. MACKEREL COVE ASSOCIATES has focused on the suitability of the Work Plan to assess the potential impact that chronic delivery of the anticipated nutrient and toxic chemical loadings will have on phytoplankton dynamics, including toxic species events, and associated, potential foodweb alterations which would influence the habitat, behavior and ecology of endangered species. It is concluded that the proposed Work Plan is inadequate to this task, and would not provide the necessary data and analyses of the kind needed for preparation of an Endangered Species Technical Memo (ESTM). While the scientific hypotheses to be assessed are generally adequate, the proposed assessment procedures to test these hypotheses are generally inadequate. Resolution of the biologically relevant hypotheses requires experimentation, whereas the Work Plan seeks resolution from retrospective literature analyses or ongoing descriptive field studies. The proposed use of establishing "threshold effect concentrations" of nutrients and toxic chemical loadings as a major aspect of assessment is inappropriate. Complex factor interactions, synergistic effects, differential responses of the various life cycle stages, successional changes and trophodynamic processes preclude effective use of the "threshold" concept, which is basically a dose - response relationship employing a single factor - single species matrix. Neither this approach, nor the application of nutrient mass balance concepts will resolve the primary issue to be assessed: whether biotic changes and altered trophodynamics of key species, including prey of endangered species, will accompany outfall discharge, and at what frequency, magnitude, time period, and persistence, and whether such changes and alterations will be beneficial or detrimental to endangered species. Instructions to Work Plan implementers are inadequate, with definitions of key concepts not given; guidelines to the depth and breadth of analyses to be carried out are ambiguous; qualitative approaches are favored over quantitativeness; there are no statements as to the limitations of the available data sets to permit preparation of the ESTM, nor what selection criteria were used to prepare the Draft Bibliography to be used in the analyses. Failure to include this bibliography with the Work Plan has compromised assessment of the Work Plan's avoidance of data and information selectivity which might skew the results of the ESTM analyses. The ability of the proposed Work Plan to provide convincing, relatively unambiguous findings is doubted.

SPECIFIC WORK PLAN COMMENTS

Section 2.0: Technical Approach for Biological Impact Assessment:

A literature review is proposed as the primary procedure by which to assess potential habitat modification and associated changes in biotic structure and their trophic linkages impacting endangered/threatened species accompanying the proposed MWRA outfall location and effluent discharge. While a literature survey is certainly an important relevant activity, the Work Plan targets anecdotal, historical and descriptive elements and the preparation of an inventory of past, present and future research initiatives as the primary objectives of this activity. This is a static approach not appropriate to the endangered species assessments. The most probable endangered species are upper trophic level components whose biology and ecology are impacted by dynamic, intricate trophic linkages which must be quantified to assess impact. Conspicuously absent in the Work Plan, therefore, are directives that *quantitative* analyses are required, rather than the proposed descriptive overview, or acknowledgment that the proposed literature review and proposed consultations with recognized experts can not replace the need for experimental approaches for testing the Work Plan hypotheses, or to resolve impact issues. The Work Plan specifically states (p. 3) that " Much of the detailed and follow-up literature reviewing will be performed as part of the biological impact assessment and will focus on confirming or disproving potential linkages between causes and effects." This Work Plan directive and the hypotheses listed appear to approach the ESTM issues from a theoretical aspect, rather than from the required specificity.The Work Plan provides no guidelines as to the quality and quantity of the available data bank. Failure to include the Draft Bibliography in the Work Plan prevents assessment of whether the included items are adequate and sufficient for the purpose. To what extent will the conclusions of the literature review be governed by the Work Plan bibliography screened?

The proposed Biological Impact Assessment (2.3) seeks to define potential adverse linkages between outfall discharge of nutrients and toxic chemicals threatening endangered species. Will the evaluators be provided with a list (beyond the four given on p. 12) of the specific toxic chemicals, their concentrations and seasonal variability expected to be present in the effluent? If so, what is the source of this data, and evidence that the data are indeed representative of the anticipated effluent discharge, given that the outfall is not online? It is a common experience of experimentalists that assessment of effluent enrichments on phytoplankton species composition, abundance and productions is extremely difficult to quantify because of the changing chemical composition of effluent, including its temporal and spatial variability in its stimulatory and inhibitory properties. Further, what nutrients are to be considered and predicted (see 2.4, p. 12)? Section 2.3.1 refers to "primary nutrients" defined (p.6) as nitrogen, phosphate and silica. However, it is well established that evaluations of outfall nutrient loading require knowledge of the total concentrations of N, P and Si. Will the dissolved and particulate organic pools of these nutrients be included with the inorganic fractions in the analyses? Phytoplankton growth is influenced by the ratios of availability of nutrients (Redfield Ratio) and turnover times. Will these aspects be considered as part of the "primary nutrient" effects

assessment? Failure of the Work Plan to define "primary nutrients" perpetuates the subjective, non-rigorous approach intrinsic in this document, and inconsistent with the needed quantitative rigor needed for the ESTM. It is well established that nutrient turnover times must be considered in assessment of nutrient - phyoplankton relationships. Will such considerations be included; the Work Plan appears to leave this decision up to the evaluators.

Will estimates of carbon flux to depth and potential accompanying hypoxic and/or anoxic effects in the benthic habitat be evaluated? While there is appropriate focus on phytoplankton and zooplankton in the Work Plan, there is conspicuous avoidance of requesting benthic impact assessment. Given the well known association between nutrient loading and bottom water oxygenation, and the dependence of some of the potential endangered species on the benthic habitat and biota, this omission in the Work Plan is curious.

The biological impact assessment is to evaluate the *"likelihood of each of the potential linkages"*. However, the requirement that this be accomplished by *"comparing data from the scientific literature on threshold effect concentrations to both measured and predicted environmental concentrations"* presents a major problem: I.e., the concept of a "threshold effect". This concept, which is repeatedly invoked (pp. 8,9,11), is the central theme of this Work Plan and the yardstick by which potential impact is to measured against. "Threshold effect", however, is not defined; it is traditionally a single species response parameter, whereas the assessment of endangered species impacts requires a trophodynamic and community approach. Threshold effects should be based on experimentation, but there is a conspicuous lack of such data of the type required. Moreover, the type of experimentation needed to derive threshold effects must incorporate effects of factor interactions, including synergistic effects; consider different life cycle stage responses, etc. It will be very difficult to apply the "threshold effect" approach called for in the Work Plan and vitiates the entire effort to fulfill the required impact assessment. The proposed use of the USGS model is commendable. However, the apparent lack of a specific biological model to be used as the basis for establishing which trophic processes and transfer steps between trophic levels (beyond the vague hypothesis generalizations in Section 2.3.1) is a serious limitation. Such guidance is essential to defining what specific parameters and processes need to be quantified and included in the biological impact assessment. Presently, this determination is to be made by the evaluators, a subjectivity inconsistent with ESTM needs.

Predicted Effects of Primary Nutrients on Endangered Species (2.3.1)

Seven questions are posed in this section of the Work Plan, five of which can be responded to based on available information and phrasing of the questions.

#1. Will primary nutrients in the discharge discernably increase levels outside the mixing zone? Ans: Probably.

4

#2. Could elevated nutrients increase seasonal phytoplankton succession, species composition, patch density, biomass? Ans: Yes.

#3. Could altered successional patterns favor toxic phytoplankton species over non-toxic ones? Ans: Yes.

#4. Could nutrient-mediated changes in phytoplankton community structure and function affect similar attributes of zooplankton, upon which right whales and primary prey of humpback and fin whales depend? Ans: Yes.

#6. Could toxins from toxic phytoplankton blooms pass up the food chain to humpback and fin whales causing death? Ans: Yes.

Available literature supports these responses to five of the questions falling within the expertise of this reviewer. The significance of these responses is that the Work Plan has combined, if not confused, first principles' type questions with habitat or endangered species-specific questions and hypotheses. This is reflected in the tendency of the Work Plan to formulate predicted effects questions as *"could"* questions and the locally endangered species issues as *"would"* questions. Moreover, the responses to the *"could"* questions can not be applied to the *"would"* questions; that is, the nine null hypothesis statements ($H_o$ I-9) to be evaluated.

An approach suggested by the Work Plan is to assess the likelihood that an impact is 1) likely to occur; 2) unpredictable, or 3) unlikely to occur. The decisions are to be based on consideration of "threshold effects", a criterion of evaluation that has serious shortcomings, as pointed out above. Moreover, evaluation of the nine null hypothesis statements can not be achieved from a literature survey, nor from ongoing and projected field surveys. The hypotheses require experimental approaches for resolution (which have yet to be done in the region of concern); they are not tractable from descriptive field surveys, nor testable from a literature review. Thus, the Work Plan places very high reliance on evaluative procedures not appropriate to the ESTM issues of concern.

The potential occurrence of toxic phytoplankton bloom events stimulated by outfall nutrient discharge has received much attention. Remarkably, however, the Work Plan does not define the scope of the needed assessment. In addition to toxic species events, it is important to assess potential noxious, harmful or nuisance species bloom occurrences, but these are neglected in the Work Plan. Noxious, harmful and nuisance species blooms may result in unsuitable food sources for herbivores preyed upon by endangered species, their unsuitability being the consequence of inadequate cell size, palatability or chemical composition. Assessment of the potential occurrence of hypoxia and anoxia resulting from the degradation of such species blooms avoided by herbivores also does not appear to be a Work Plan element, nor assessment of carbon fluxes. The latter is also relevant to the benthic habitat and its biota overlooked in the Work Plan.

The same critique applies to Section 2.3.2 (Predicted Effects of Toxic Chemicals on Endangered Species), including ambiguous, if not unachievable, reliance on "threshold effect" concentrations. The Work Plan, by its focus on threshold effects and concentrations as an impact assessment yardstick, applies a chemical (?EPA) criterion to trophodynamic processes, rather than the relevant biological criteria which determine chemical habitat impacts on endangered species. The threshold concept is irrelevant to the ESTM and thwarts realization of the basic objectives of the Work Plan.

A conspicuous omission in the Cumulative Impacts (2.3.3) section is failure to include watershed activity and altered use effects as part of the assessment requirement.

The inclusion of Model Predictions for Nutrients and Toxic Chemicals (2.4) is commendable, but reliance on deriving threshold effects levels for biological impact assessment vitiates projected uses of this model. Failure to indicate which biological model will be used and coupled to the hydrodynamic model is a shortcoming.

*RECOMMENDATIONS*

1). Data and analagous studies from other coastal regions and experimental studies should be included in the Work Plan assessments to allow utilization of a much larger data base and to overcome the serious limitations of the data base available for the Massachusetts Bay ecosystem. Many of the problems and hypotheses formulated in the Work Plan are of a generic type and amenable to such analyses.

2). Most of the hypotheses formulated are not testable, their resolution requires important data not presently available and which can be obtained only by experimentation. There are no shortcuts to the need to initiate suitably scaled experimental field studies and, on a smaller scale, on selected processes relevant to the ESTM. These studies should be carried out based on an ecosystem model, for which such studies would provide appropriate rate constants. A minimum of five to ten years would be needed for an integrated, multi-disciplinary experimental field program to lay the basis for resolution of the ESTM issues. It must be recognized that the issues raised in the document are at the cutting edge of contemporary biological oceanography, and represent major, unresolved issues as to the environmental and biotic regulation of the structure, dynamics and persistence of marine ecosystems, which frequently have endangered species at their apex.

3). The present Work Plan should be dropped, and a new plan developed which takes in account the limitations of the present plan, the available data sets and ESTM needs.

BARNSTABLE COUNTY COMMISSIONERS
BOSTON HARBOR OUTFALL PIPE
SCIENCE ADVISORY PANEL

ROBERT D. KENNEY, PH.D.

22 SEPTEMBER 1992

This document outlines a work plan for development of an Endangered Species Technical Memorandum (ESTM), by Arthur D. Little in cooperation with EPA, relative to a proposed sewage outfall offshore of Boston, Massachusetts. The ESTM will provide background scientific information underlying a required Biological Impact Assessment (BIA) of the potential impacts of the proposed outfall on endangered and/or threatened marine species. Because of my own area of expertise, my review will focus primarily on the details of potential impacts on the endangered species themselves, rather than at lower trophic levels. The latter will be addressed more completely by the other Science Advisory Panel members.

There is some lack of clarity in the work plan as to the differences between the ESTM, the formal BIA process, and the biological assessment section of the ESTM. For example, the title indicates that the BIA is done in support of the ESTM, when it seems to me that the reverse is true. Overall, the work plan seems to be largely adequate if it is simply the plan for the ESTM. It describes the expected content of the ESTM (section 1.0), and outlines the components of a BIA which are suggested by the Endangered Species Act (section 2.0), with the remainder of the plan devoted to description of the various tasks to be undertaken to prepare the ESTM. On the other hand, as a plan for a BIA, it is woefully inadequate. The hypotheses are too general, and the method used to test each hypothesis is qualitative, not statistically rigorous, and based on criteria which may be difficult or impossible to define. There is little or no discussion of what course of action will be followed in the event that null hypotheses are rejected or that insufficient data exist for evaluation. Will additional studies be conducted as part of the BIA to fill critical data gaps (Section 2.0, item f)? There is also no indication that the BIA will include any discussion of alternative actions (Section 2.0, item e).

The first two tasks - literature review (section 2.1) and consultation with recognized experts (section 2.2) are relatively straight-forward. There does seem to be a lack of individuals in the list of consultants with expertise in endangered species other than cetaceans. This seems to me a general weakness in the entire document - the tasks seem concentrated on potential impacts on the three endangered whales commonly found in the area while ignoring other species. The plan does mention three sea turtle species and the short-nosed sturgeon in other places. There are other sea turtles species documented for Massachusetts waters, as well as endangered birds, and the endangered blue and sei whales are also known from Massachusetts Bay. I must confess profound ignorance about the sturgeon, but my knowledge of the other species suggests that it may, in fact, be justifiable to conclude that potential impacts on them would be negligible. However at the stage of developing a work plan it seems to be acting in some haste. There should at least be a literature/data review and consultation process prior to making any conclusions. It should be the BIA which determines that there is little or no likelihood of impact, not the work plan for an ESTM in support of said assessment.

Section 2.3 comprises the bulk of the work plan, outlining the assessment of potential impacts from the outfall. The plan considers two sources of potential impacts, primary nutrients and toxic chemicals, with cumulative impacts of the proposed outfall with other actions treated as a third source of potential impact. The work plan's proposed scheme is to conceptualize each route

of potential impact on an endangered or threatened species as a sequence of linkages between components of the regional ecosystem, then to attempt to evaluate the likelihood of each linkage. This seems to be a logical way to proceed, with the caveat that linkages in ecology are often much more complex than they at first appear to be.

Within each of the two primary impact sources discussed, the potential impact linkages are stated as null hypotheses, with the expectation that each would be scientifically testable. The plan indicates that the likelihood of rejection of each hypothesis will be estimated by a qualitative ranking scheme, based on whether the level of change due to the outfall in the parameter under analysis exceeds threshold levels determined from the literature. This seems less than rigorous, but part of the difficulty may again lie in lack of a clear delineation between the ESTM and the subsequent BIA which will rely on the ESTM. It would seem to me acceptable to use qualitative methods for initial assessment in an ESTM, but I would expect quantitative, statistically valid testing of clearly-stated, narrowly-defined hypotheses in a more formal BIA.

The set of hypotheses relative to potential impacts of primary nutrients (section 2.3.1) are well-structured in a hierarchical scheme arranged according to increasing number of linkages from the outfall itself. This arrangement makes it so that failure to reject a null hypothesis early in the list probably eliminates the requirement to test later hypotheses dependent on it. The set of hypotheses seems to me relatively complete, with some exceptions (and the work plan does specify "will include but not be limited to"). The lack of consideration of endangered species other than right, humpback, and fin whales was mentioned above. Another missing ecosystem component is the benthos. Benthic organisms are not part of the food web leading to planktivorous or piscivorous whales, but they could be involved in nutrient cycling affecting those food webs indirectly. Some of the other endangered species (e.g. sturgeons and some turtles), on the other hand, are benthic feeders. Furthermore, the sand lance, a critical link in pelagic food webs in the Bays and important whale prey, hibernates, rests, and escapes from predators by burrowing into clean, sandy, well-oxygenated bottoms. Changes in bottom characteristics could potentially eliminate sand lance habitat. Another concern has to do with the stated limitation to 'outside the mixing zone', particularly as pertains to toxic phytoplankton (hypothesis 3). This is outside my area of expertise, but what is the potential of a current bringing water containing cysts of some toxic species into the mixing zone and initiating a bloom that would then spread beyond?

The hypotheses related to potential impacts of toxic chemicals (section 2.3.2) are similarly arranged in a hierarchical fashion, and again seem relatively complete. In fact, the endangered turtles and fish are actually mentioned here. There does seem to be a lack of any concern for potential direct impacts of toxics on any of the organisms in the food chains leading to the endangered species - this may be entirely warranted, but I don't know. There is again a lack of inclusion of the benthos - perhaps even more important in consideration of toxic impacts. Again, some endangered species feed directly on benthic organisms, and benthic processes may potentially affect others indirectly. Another question is whether sand lance can accumulate toxics from contact while buried in the sediment. An additional route of exposure to toxics may exist for humpback whales. There is evidence that humpbacks collide with the bottom during feeding - whether the contact is simply incidental or actually purposeful in order to drive buried sand lance from the sediment into the water column is not known. What is the potential for resuspension of accumulated toxics in the sediment and subsequent ingestion by the whale?

Section 2.3.3 discusses the potential cumulative impacts of the outfall combined with three other activities - the Third Harbor Tunnel Project, Boston Harbor Improvement Project dredging, and use of the Massachusetts Bay Disposal Site. At earlier meetings, Panel members discussed other potential actions which may occur, notably watershed processes. However the stipulation of "reasonably certain to occur" may preclude inclusion of possible future changes or continuation of current processes in the assessment. The approach in this section seems to be to include all of

the combined impacts in circulation models to derive the predicted concentrations, and test the same sets of hypotheses used for the outfall alone, although this is not actually stated directly. One weakness is the consideration of spatially cumulative impacts alone, with no mention of cumulative impacts over the time scale of the probable lifetime of the proposed outfall.

Section 2.4 includes the modeling as a separate task in support of the ESTM and/or BIA. Model outputs of predicted concentrations of nutrients and toxics will be used in the estimation of impact likelihoods. In fact, it is not at all clear why at least some portions of this section were included in the work plan. The modeling itself is apparently being done by someone other than A.D. Little, and the Water Quality Criteria are not directly related to potential impacts on endangered species. A clearly stated indication of how the model results would be used in the assessment process would seem to me to be sufficient.

In summary, the work plan is largely adequate (with a few holes as noted) as a plan for developing an Endangered Species Technical Memorandum, but not acceptable as a plan for conducting a Biological Impact Assessment. There are many instances where it seems probable that insufficient information exists in the literature to determine what the "threshold effects level" for a given parameter may be, and the ESTM will likely have a significant number of its null hypotheses where no estimation of rejection likelihood is possible. For the ESTM, that would be acceptable. However, the full BIA process may well have to include some number of studies to develop sufficient scientific information to go forward with testing of those hypotheses. The concept of "threshold effects level" itself seems to be poorly defined, and perhaps completely undefineable for anything other than direct toxic impacts on a single target species. Finally, the acceptable level of impact will very likely differ between different endangered species. For example, fin and humpback whale populations could very likely absorb some impacts which might prove devastating for right whales - their populations are larger, they feed on more diverse prey species, they have a wider selection of alternative habitats, they do not appear to use Cape Cod Bay as an important nursery area, and they apparently possess much more genetic variability. I would recommend that the BIA process include population viability analysis of right whales (as well as any other species suspected to have similar critically endangered status and a high impact likelihood) to help in definition of the levels of impact the population(s) might absorb.

Review of A.D. Little document entitled "Final Work Plan for Performing a Biological Impact Assessment and Related Tasks in Support of Preparation of an Endangered Species Technical Memo"

Prepared by Dr. Cabell S. Davis (Associate Scientist, Woods Hole Oceanographic Institution) for Aubrey Consulting, Inc.

October 27, 1992

*Summary*

A. D. Little proposes to use an extensive literature review together with results of a USGS hydrodynamic model to estimate the effects, if any, of nutrient and toxic chemical inputs into Massachusetts and Cape Cod bays from the proposed MWRA sewage outfall on the endangered species in this region. Consultation with experts in marine mammals, toxic phytoplankton, zooplankton, and toxic pollutants is also proposed. Overall, I found the hypotheses to be so general that they are largely untestable. This generality then reduces ability to eliminate ambiguous findings and reduces the overall adequacy of the proposed impact assessment. The Plan treats the biological environment as static rather than dynamic. Recommendations for improvement of the Plan include more focussed hypotheses, initial literature review to make the plan more specific, the provisional use of field and/or laboratory studies to augment literature information, the use of coupled biological--physical modeling, more specific description of the time--space scales of the study including scenarios for physical forcing of the hydrodynamic model, consultation with a statistician for proper statistical design of the study. It is highly probable that if the Plan is followed in its present form, ambiguous results will be obtained. In my opinion, therefore, the Plan is inadequate in addressing the critical questions under the Endangered Species Act, and the EPA will not be able to use the results to insure that the operation of the outfall pipe will not jeopardize the endangered species.

Specific comments are provided in the following sections:

*Completeness of Scientific Hypotheses*

Although the hypotheses are presented in a straightforward and logical manner, as stated, they are too general to be testable. As an example of over-generality, Hypothesis $H_o4$ regarding nutrient-related impacts states that "Changes in phytoplankton community structure and function, due to nutrients from the proposed discharge, will have no discernable effect on the areal or temporal distribution, species composition, patch density, or biomass production of zooplankton communities in the Bays." Well, at present there is no way to determine whether changes in the phytoplankton community will affect the zooplankton population. We know from laboratory experiments and field studies that zooplankton are generalists in their consumption, but we also know that they grow better on some species of phytoplankton than others. So to test this hypothesis, one would have to be able to accurately predict what the change in the phytoplankton community might be in terms of actual species dominance and then conduct experiments to determine whether the fecundity and growth of the zooplankton populations would be affected.

Predicting species shifts in the phytoplankton, whether natural or man-made is presently not possible to any reasonable degree of accuracy. Predicting the effects of such changes on zooplankton populations is also not possible. As stated, by being so general, the hypotheses are largely meaningless.

The time-space scales over which the hypotheses apply are not clearly stated. For example, the hypotheses refer to effects of the outfall on biota in the area "outside the mixing zone" but the boundaries of this zone and the area outside it are not defined. The time scales to be examined are not given.

The first hypothesis regarding nutrients appears flawed. The lack of a concentration change in inorganic nitrogen, for example, does not necessarily imply that nitrogen is not being incorporated into particulate matter in the water column. Thus the second hypothesis does not follow from the first, i.e., that a change in nutrient concentration is required for a change in phytoplankton. There could be a large change in phytoplankton with little or no change in nutrients.

*Adequacy of the Proposed Impact Assessment and Ability to Eliminate Ambiguous Findings*

As general as the hypotheses are, the proposed methods for testing them are equally vague. They are presented in a single paragraph after the hypotheses and are followed by a disclaimer stating essentially that, if the hypotheses cannot be answered, then there will be a discussion of the "lines of evidence suggesting the corresponding concerns", whatever that means. No statistical design for testing the hypotheses is specified.

The proposal relies almost exclusively on the scientific literature for estimating "sensitivities/susceptibilities of the target species to nutrient loading and related ecological changes". Target species are not defined. Does that mean just the endangered species or all the dominant species in the food chain listed in the hypotheses? It is unlikely that the literature will provide even a fraction of the answers required to estimate "apparent threshold effect concentrations", whatever that means (not defined either).

The use of the USGS hydrodynamic model for studying the physical circulation of the Bays is a wise choice. This model is state-of-the-art and should give the best estimates of circulation possible at present. The model does not include any biology, however, and therefore the dynamics of nutrient (or toxin) utilization is suspect. Using a simple exponential decay rate for nutrient (or toxin) loss is not meaningful. The distributions of passive tracers generated by the model will provide insights into the "worst case scenario" for nutrient transport. Without modeling the biology (nutrient-plankton dynamics) together with the physics, the estimates of nutrient (or toxin) dispersal will be of little value.

In general it is not specified how the USGS model will be used. What areas of the Bays will be examined? What will the physical forcing be exactly? For example, what wind patterns and intensities will be used? Will the effects of translating storms be examined? What is the grid spacing of the model and over what range of time-space scales is it valid? What external flow

patterns (i.e., boundary conditions) from the Gulf of Maine will be used and how will the predicted current patterns from the model and their effects on nutrient and toxin transport be analyzed? How are these related to the endangered species distributions? Are the species listed in the Plan the only endangered species in the Bays?

*Recommendations for Improvement of the Plan*

1) The hypotheses should be much more specific regarding the particular species to be studied, where and when they live in the bays, and the mechanisms to be examined regarding transport of toxins or other alterations of their habitat.

2) A thorough literature review should be done in order to give the study a clearer focus on the endangered species and the specific mechanisms by which they may be impacted.

3) Do not rely completely on literature information; the needed information may not exist. Design fiel, laboratory, and modeling studies to address critical questions.

4) Incorporate a biological model of plankton dynamics in the USGS model to provide more realistic assessments of fates of nutrients and toxins and their effects on food chain dynamics. Two types of modeling are suggested including: 1) simple food chain models containing 3-4 compartments such as nutrients, phytoplankton, zooplankton, and detritus, and 2) population models of selected species including the endangered species and key species affecting their survival such as dominant prey species. The simple food chain models coupled with the physical model will provide insights into the first order effects of the spread of pollutants through the food chain in time and space. Such food web models will allow testing the effects of rates of nutrient uptake, grazing, cell and detrital sinking, decomposition, and resuspension on plankton production rates. Population models applied to key species should be used to examine effects of various biological and physical forcings on the projected population dynamics including lethal and sublethal effects of toxins and food (or other resource) availability. By keeping both types of models as simple as possible and focussed on specific questions and processes, the number of parameters which must be estimated remains small and interpretation of results is straightforward.

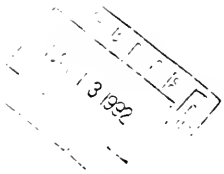
5) Specify the time-space scales and regions to be studied with respect to each of the endangered species. Specify physical, chemical, and biological forcings to be used in the modeling.

6) Consult with a statistician to design an statistically appropriate protocol for assessing the impact on each endangered species.

7) A study of the role of the benthos in the accumulation and transport of pollutant materials that may impact the endangered species should be examined. Potential effects include direct impact on benthic organisms which may be eaten by the endangered species, anoxia resulting from eutrophication of the habitat, and resuspension of contaminated sediments by wind mixing events. One scenario is that Cape Cod Bay could serve as a large settling basin for outfall particulates, which, over long time scales (eg, > 20 years) could accumulate in significant

quantities in the bay. Anoxic layers could potentially result, or storm mixing could resuspend toxic or nutrient laden sediments, significantly altering the quality of the habitat in the bay. Such interactive effects of physical forcing on long term outfall potential must be examined. In evaluating the role of the benthos, consideration should be given to the so called demersal-planktonic forms, those that are epibenthic or infaunal by day and move up into the water column at night. Such forms include mysiids (*Neomysis americana*), ostracods (*Podon, Evadne*), sand launce (*Ammodites*), and decapod larvae. Other plankton have benthic life stages, such as resting eggs in the copepod *Centropages hamatus* (a known food of the right whale), which may be adversely affected by deterioration of the benthic habitat.

8) Focus should be kept on the potential differences in impact between the existing discharge site in Boston Harbor and the proposed new site off shore. Even if potential impacts are found with the proposed discharge, they may not be significantly different from those already posed by the existing situation.



BARNSTABLE COUNTY ASSEMBLY OF DELEGATES

In the Year Nineteen Hundred and Ninety-One

RESOLUTION 91-20

(as amended March 4, 1992, Resolution 92-5)

Cape Cod Bay is an extraordinary natural system that represents both economic and environmental value to Cape Cod. Any activity in the Bay is of critical importance to Cape Cod. Therefore, the elected and appointed public officials of Barnstable County support an action plan by our government to protect Barnstable County citizens' vital interest in the integrity of Cape Cod and Massachusetts Bay ecosystems and cause the MWRA to take, at a minimum, certain actions.

Barnstable County acknowledges the extended regulatory and judicial history but Barnstable County does not agree with the MWRA's plan to locate the wastewater outfall in Massachusetts Bay because:

1) This decision does not advance efforts to utilize innovative treatment technologies or to conserve valuable drinking water supplies.

2) Financial investments have been made in transportation of waste, rather than in source reduction and treatment;

3) This decision was based on the merits of the MWRA facility alone and did not consider a bays-wide perspective;

4) Scientific data used for decision-making are too incomplete to justify the assurances that have been offered concerning no significant adverse impact to the marine ecosystem;

5) The siting decision was driven more by socioeconomic factors than by available scientific information.

Now therefore,

*BE IT HEREBY RESOLVED by the Barnstable County Assembly of Delegates that:*

The government of Barnstable County will take the following actions to protect our citizens' vital interest in the health of Cape Cod and Massachusetts Bay ecosystems as follows:

1. Insist upon secondary treatment of all effluent prior to discharge unless an improvement can be obtained by biological or technological alternatives which could substitute for existing methods of treatment for the benefit of Massachusetts and Cape Cod Bay.

2. Urge EPA Region I to require a Far Field Monitoring Program, sufficient to identify potential ecosystem impacts, as a condition of the National Pollutant Discharge Elimination System (NPDES) Permit.

3. Request that EPA Region I conduct a public hearing on Cape Cod on the MWRA's request for an NPDES Permit.

4. Insist that decisions regarding the MWRA Treatment Facility and its operation incorporate an analysis of the costs and benefits of protecting the integrity of the marine ecosystem.

5. Work in close alliance with the Barnstable County legislative delegation and local governments to accomplish the objectives stated herein.

6. Barnstable County shall instruct the Federal and State Delegation to insist upon the restoration of federal funding to the Boston Harbor clean up project previously allocated.

**Barnstable County believes that the MWRA should at a minimum, take the following actions:**

1. Conduct a Far Field Monitoring Program.

Cape Cod residents are concerned about the long term impacts of the MWRA discharge on the environmental integrity of Cape Cod Bay and Stellwagen Bank. The monitoring plan to be implemented should include a far field element adequate in scope and magnitude to detect subtle environmental changes to the ecosystem, in particular the shallow inshore areas and Stellwagen Bank, that might occur as a result of the MWRA discharge. Analysis of the data should be reviewed by independent researchers.

2. Agree on what observed trends and/or measured concentrations of contaminants will trigger review and action by the MWRA and the regulatory agencies. This should be done in concert with state and federal regulatory agencies and the scientific community, and should be agreed to before the operation of the outfall. A schedule for taking remedial steps based on observed trends and/or measured concentrations must also be prepared.

Cape Cod residents should be confident that the results of the environmental monitoring program will be used by decisionmakers. There should be a plan that delineates the steps that will be taken if the trend continues and the remedial action(s) that would be implemented to mitigate impacts.

3. Develop a contingency plan that addresses an emergency shutdown of the MWRA waste treatment facility.

Cape Cod residents are concerned that once the MWRA waste treatment facility outfall is in operation, there will be no alternative means of treating and discharging waste should there by any problems with the operation of the facility. Cape Cod residents are concerned that there are no incentives to expedite repairs to the facility in the event of a breakdown, since the attitude is one of "the marine environment can handle it." MWRA should develop a contingency plan that details the actions that will be taken in the event of a malfunction at the facility to bring the facility back on line as rapidly as possible. MWRA should develop incentives to ensure peak performance of the waste treatment facility. This incentives program could result in fewer operational problems in the facility, and reduce the likelihood that the contingency plan would have to be invoked. At a minimum the operations plan should be strictly enforced.

4. Evaluate acceleration of the schedule for secondary treatment of all of the estimated volume of effluent.

The MWRA should review its schedule for bringing full secondary treatment on line, and prepare a report that outlines the feasibility of accelerating the schedule. This assessment should include an evaluation of the most cost-effective means of treating and waste considering the environmental, engineering, and facilities planning issues relevant to the MWRA system.

5. Investigate and implement means of reducing the discharge volume and the level of contaminants in the discharge further back in the treatment system.

MWRA has indicated that they have an aggressive industrial pre-treatment program. MWRA has also been working to eliminate infiltration problems in its collection system to reduce the total volume of flow requiring treatment. MWRA should re-evaluate its goals in these two programs to determine if they can be more aggressive in reducing contaminants and total flow into the system. In addition, MWRA should look at future growth potential in its member communities, and evaluate whether smaller, independent municipal treatment facilities should be constructed as one means of reducing the total volume of discharge into the marine ecosystem. The MWRA should implement its combined sewer overflow (CSO) facilities plan more quickly than presently planned, as one means of reducing treatment volumes and potentially reduce treatment costs.

6. Conduct a feasibility study of advanced treatment of waste.

Cape Cod residents are concerned that nutrients and toxics from the discharge might pollute Massachusetts and Cape Cod Bays and Stellwagen Bank. MWRA must find a feasibility study on tertiary treatment that includes an analysis of the environmental, engineering, and facilities planning issues. If a contaminant(s) of concern is identified as requiring advanced treatment, the MWRA should delineate the most cost-effective means of treating the waste, including environmental, engineering, and facilities planning issues.

7. Support a Bays-wide environmental status and trends program.

The MWRA should encourage and work with state and federal agencies representatives, the Massachusetts Legislature and the Congress, to develop a Bays-wide environmental status and trends program, in conjunction with the monitoring program. Current and future decisions concerning the use of the marine ecosystem require a better understanding of the functioning of the system than is now available. The cumulative effects of human activities that impact the marine ecosystem need to be assessed and understood.

8. Participate in the development of a comprehensive management program for Massachusetts and Cape Cod Bays.

The MWRA should work with the appropriate local, state, and federal agencies to incorporate the information gathered in the status and trends program into management decisions regarding activities that impact the Massachusetts and Cape Cod Bays system. These management efforts might include improvements to the state and/or federal water quality standards.

9. Initiate and maintain a public information program on MWRA activities for the communities surrounding Massachusetts and Cape Cod Bays.

The MWRA should focus some of its efforts on providing information on its activities and programs to citizens in the communities surrounding Massachusetts and Cape Cod Bays.

The foregoing Resolution was amended by unanimous vote of the Barnstable County Assembly of Delegates representing 90.96% of the population of Barnstable County present and voting at a meeting held on March 4, 1992.

Attest:

Susan V. Walker

Susan V. Walker, Speaker
Assembly of Delegates

## BARNSTABLE COUNTY ASSEMBLY OF DELEGATES

### In the Year Nineteen Hundred and Ninety-Three

### Resolution 93-13

**To comment on the Biological Assessment of the potential effects of the MWRA outfall on endangered species prepared by the Environmental Protection Agency.**

WHEREAS, a Science Advisory Panel (the Panel) was established by the Barnstable County Commissioners;

WHEREAS, the Panel is composed of scientists having exemplary scientific credentials and who are specialists in various aspects of oceanography pertinent to the Biological Assessment;

WHEREAS, the Panel determined that it was difficult to complete an unambiguous Assessment;

WHEREAS, the Panel has found that there is a lack of critical data on chronic, low-level nutrient input to partially enclosed coastal embayments;

WHEREAS, the Panel has found that there is a lack of critical data on dose-response relationships for complex mixtures of contaminants (including nutrients and toxins) in shallow coastal ecosystems;

WHEREAS, the Panel has found a lack of numerical modeling results anticipated for the Assessment, due to ongoing development of the modeling techniques; and

WHEREAS, the Panel has found a paucity of field data on some critical aspects of the phytoplankton dynamics in Massachusetts and Cape Cod bays.

NOW THEREFORE,

*BE IT HEREBY RESOLVED, the Barnstable County Assembly of Delegates:*

Strongly recommends that NOAA/NMFS consider a finding of jeopardy in the Biological Opinion based on the lack of critical data and the need for a comprehensive committee review of the potential effects of the outfall on endangered species and their habitat in Massachusetts and Cape Cod bays.

Requests that NOAA/NMFS consider initiation of a thorough scientific review of this issue, through an organization such as the National Academy of Sciences to obtain a scientific consensus on this highly sensitive issue and area.

Requests that NOAA/NMFS carefully review the monitoring plan for the outfall, should it be permitted, to assure that a well-defined and defensible strategy is in place to detect outfall-related changes in the environment, including but not limited to effects from low-level, continuous input of nutrients and heavy metals.

The foregoing resolution was adopted by unanimous vote of the Barnstable County Assembly of Delegates, with Delegates representing 72.08% of the population of Barnstable County present and voting at a meeting held July 21, 1993

Attested by:

Diane C. Thompson

Diane C. Thompson, Clerk
Assembly of Delegates

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