Gerry E. Studds Stellwagen Bank National Marine Sanctuary
Water Quality Action Plan

Overview

The *Gerry E. Studds* Stellwagen Bank National Marine Sanctuary (SBNMS) sits at the mouth of Massachusetts Bay, bordering or proximal to several state Ocean Sanctuaries (Cape Cod Bay, Cape Cod, South Essex, North Shore). The entire sanctuary is open to vessel traffic, and the designated shipping lanes to Boston pass in an east-west direction through the sanctuary. These lanes are used for numerous types of vessels, including container ships (with possible hazardous materials), liquefied natural gas (LNG) and oil tankers and barges, and an increasing number of cruise liners. The Massachusetts Water Resources Authority (MWRA) outfall discharges treated secondary effluent 12 miles west of the sanctuary, and the Massachusetts Bay Disposal Site for clean dredge material is located in Stellwagen Basin directly outside the sanctuary's western boundary. Materials deemed free of hazardous materials by the U.S. Army Corps of Engineers (USACE) and the U.S. Environmental Protection Agency (EPA) may be dumped at this site. The physical oceanography of the area was extensively studied in preparation for the placement of the MWRA outfall, and MWRA has implemented monitoring of water, sediment, and fish and shellfish for both nearfield and farfield since 1992.

This AP is designed to monitor, assess and conserve water quality in the sanctuary for the protection of living and cultural resources and human health, and to foster cooperation with cross-jurisdictional partners which are charged with understanding, protecting and enhancing water quality.

Description of the Issues

Point and non-point sources of pollution, both sea and shore-based, may be degrading the quality of the sanctuary's water. The SBNMS should assure that the quality of water within its boundaries and in surrounding areas remains safe for human activities and to protect the health and well-being of the site's resources. During public scoping, several issues were raised as important to the general public and user groups:

- No Existing Comprehensive Water Quality Plan
- Lack of Baseline Water Quality Data Including Toxins and Contaminants
- Appropriateness of Waste Water Discharge by Vessels in the Sanctuary
- Impacts of Municipal Sewage Outfalls and Other Waste Streams

These concerns provided the impetus for the development of a Water Quality (WQ) Action Plan (AP), comprised of two parts that address research and monitoring, as well as water quality protection from both ship and shore-side inputs, and remediation. Of particular interest were 1) the impact of the MWRA outfall effluent on Massachusetts Bay's waters and marine life, and 2) the scope and location of the sanctuary's present and future monitoring programs. Furthermore, questions were raised about the impacts of vessel discharges from an increased number of transits by large cruise liners through sanctuary waters, as well as the cumulative effects of

blackwater discharges from other types of passenger vessels (e.g., whalewatch fleet), the effects of fish gurry and other fish processing wastes from fishing vessels and shore-side inputs, the introduction of pollutants from sediments, atmospheric deposition and non-point sources.

Evaluation of Existing Regulations

National Marine Sanctuaries (NMS) have long been places that prohibit discharges within their boundaries. 15 CFR Part 922 establishes that the discharge or deposit of material or other matter within a NMS may be prohibited. With this authority, every sanctuary was designated with some type of discharge regulation to protect its natural and cultural resources. For example, most NMSs prohibit the discharge of garbage, trash, and plastics, as well as the discharge of oily wastes from bilge pumping. However, most NMSs have specific exemptions to their discharge prohibition.

Regulations for the SBNMS specifically prohibit:

Reg. 1 – Discharging or depositing, from within the boundary of the sanctuary, any material or other matter except:
- **i)** fish, fish wastes, chumming materials or bait used in or resulting from traditional fishing operations in the sanctuary;
- **ii)** biodegradable effluent incidental to vessel use and generated by marine sanitation devices approved in accordance with Section 312 of the Federal Water Pollution Control Act, as amended (FWPCA), 33 U.S.C. 1322 *et seq.*;
- **iii)** water generated by routine vessel operations (e.g., cooling water, deck wash down and graywater as defined by Section 312 of the FWPCA, excluding oily wastes from bilge pumping; or
- **iv)** engine exhaust; and

Reg. 2 – Discharging or depositing, from beyond the boundary of the sanctuary, any material or other matter except those listed in (1:i-iv) above, that subsequently enters the sanctuary and injures a sanctuary resource or quality;

Reg. 7 – Lightering in the sanctuary.

There are two areas in which federal initiatives are important to the integrity of water quality within the sanctuary and in the development of a comprehensive water quality monitoring plan for SBNMS. One area concerns federal regulations to manage hazardous/toxic substances and oil in marine waters. The other area is the federal response and rules pertaining to spills of hazardous substances and oil and petroleum substances in waterways (i.e., Natural Resource Damage Assessment procedures). While other initiatives such as state legislation can affect the control of hazardous-toxic substances in the environment we note that this pertains to marine waters under state jurisdiction (up to 3 miles) and has uneven coverage of the waters within SBNMS.

Overview of Federal Hazardous Substances Regulations

Federal efforts to manage hazardous-toxic substances consist of a variety of federal laws and statutes. The legislative acts relevant to water pollution are:

- FWPCA (33 U.S.C. 1251 *et seq*., Public Law 92-500) first enacted in 1972 and subsequently amended in 1977 (P.L. 95-217), and 1987 (i.e., Water Quality Act of 1987, P.L. 100-4) known collectively as the Clean Water Act (CWA).

- Marine Protection, Research, and Sanctuaries Act enacted in 1972 (33 U.S.C. 1401 *et seq*., P.L. 92-532), amended in 1974 so as to be consistent with the London Dumping Convention, and in 1988 by the Ocean Dumping Ban Act (P.L. 100-688).

- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9601 *et seq*., P.L. 96-510), and amended in 1986 by the Superfund Amendments and Reauthorization Act (P.L. 99-499).

- Oil Pollution Act of 1990 (33 U.S.C. 2701 *et seq*., P.L. 101-380).

- Toxic Substances Control Act first enacted in 1976 (15 U.S.C. 2601 *et seq*., P.L. 94-469) has been amended three times, and now includes four Acts: the Control of Toxic Substances - Title I, the Asbestos Hazard Emergency Response Act - Title II, the Indoor Radon Abatement Act - Title III, and the Residential Lead-Based Paint Hazard Reduction Act.

- Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 *et seq*., P.L. 94-580) amended a previous Act known as the Solid Waste Disposal Act, and was subsequently amended in 1984 by the Hazardous and Solid Waste Amendments.

- Low-Level Radioactive Waste Policy Amendments Act (42 U.S.C. 2021(b) *et seq*.).

- Marine Plastics Pollution Research and Control Act of 1987 (P.L. 100-220, 33 U.S.C. 1901 *et seq*.).

- Food and Drug Administration's regulation and control of hazardous substances via action levels of poisonous or deleterious substances in human food and animal feed, which further identifies specific poisonous or hazardous substances pertaining to consumption.

Federal Regulations/Policy Related to Nutrient and Pathogen Control

There are no direct federal regulations for control of nutrients such as nitrogen and phosphorous (NRC 2000), nor for pathogens including viruses, parasites, and bacteria (NRC, 1993). However, the federal government has established some initiative over control of nutrients and pathogens via indirect federal regulations. Indirect management of nutrients and pathogens in selected waters exists via the National Estuary Program (NEP) administered by the EPA, and was created by amendments to the Clean Water Act in 1987, including Massachusetts Bays and Buzzards Bay in Massachusetts. Many of the estuaries and waterbodies that are included within the NEP have identified excessive levels of nutrients (i.e., eutrophication) and pathogens as problems, and associated goals of reducing nutrient loadings and pathogen levels.

The NEP, administered by the EPA, is a federal policy initiative designed to manage and protect

the water quality of estuaries of significant national importance as well as the Great Lakes (EPA, 1989a). Established in 1987 via the Water Quality Act of 1987, the NEP uses a decentralized policy approach that integrates and directs state governments and the federal government in identifying pollution problems and sources, quantifying and measuring pollution problems, and developing policies to reduce and reverse the pollution problems (including financial commitment to achieve recommended actions). The overall goal of the NEP is "the protection and improvement of water quality and enhancement of living resources," of nationally significant estuaries that are "threatened by pollution, development, or overuse," (EPA; 1989b: 1).

The types of concerns and environmental problems pertaining to coastal waters and estuaries the EPA faces encompasses six major areas: 1) toxic contamination; 2) pathogen contamination; 3) eutrophication; 4) habitat loss and alteration; 5) changes in living resources; and 6) persistent marine debris (EPA, 1989a). All are potential concerns for estuaries that become designated as nationally significant and included within the NEP. In addition, these environmental concerns can also exist in other coastal water areas such as the New York Bight, and the Gulf of Mexico. For many estuaries in the NEP, toxic contamination, pathogen contamination, eutrophication, and changes in living resources were the most commonly cited concerns (EPA, 1989a).

For a review of specific federal hazardous substances regulations, see Appendix WQ.I.

Among state legislation, the Massachusetts Ocean Sanctuaries Act is the most pertinent. This act is intended to protect the ecology or the appearance of the ocean and the seabed or subsoil from any exploitation, development, or activity that would seriously alter or endanger those resources. Designation of an area as an ocean sanctuary does not regulate fisheries or other living marine resource extraction, but limits discharging and dumping, non-renewable resource development, marine construction, and shoreline alteration.

Addressing the Issues – Strategies for this Action Plan

The WG, comprised of research scientists, government officials, fishermen, water quality specialists, representatives of the Massachusetts Port Authority (Massport), and conservation organizations determined that in many areas more research must be undertaken before it can be determined that certain waste streams present potential human and/or environmental threats. In other areas, the WG determined that partnerships with outside monitoring, modeling and research efforts may provide the technical resources needed by the sanctuary for a better understanding of water quality at the site.

The WG determined that at this time, the AP for water quality should be divided into two parts, with specific strategies and activities. The two general areas are:

Part A – Water Quality Monitoring

This part of the water quality plan designs a water quality monitoring, modeling and assessment program for SBNMS that assures the goals of protecting natural and cultural resources and human health. This plan includes development of a water quality monitoring plan, encouragement of placement of oceanographic monitoring stations, and evaluation and

use of water quality models for sanctuary management. The water quality monitoring plan should evaluate the inclusion of sediment monitoring, recognizing that contaminants in sediments contribute to the quality of the overlying water. Endocrine disrupters will also be addressed in this section.

Part B – Vessel Discharges and Other Waste Streams

This part of the AP provides strategies to prevent impacts to sanctuary resources from discharges from vessels, sewage outfalls, and other waste streams. The section includes discussion of the designation of a No Discharge Zone for the sanctuary and development of a ballast water management strategy. Furthermore, strategies for addressing contingency planning for oil or other hazardous material spill as well as responses to catastrophic failures or other pollution events from sewage effluents and disposal activities are also suggested. There is a strong emphasis on interagency cooperation and responsibility.

Water Quality Action Plan Part A – Water Quality Monitoring

Overview

This portion of the WQ AP provides guidance for the continued development of a SBNMS monitoring program to assess the water quality of the sanctuary in relation to maintenance of the natural biological communities, and to provide information needed to enhance natural habitats, populations, and ecological processes.

Description of the Issues

During scoping and in the WG, comments were categorized under several issue areas. The breakdown of comments addressing monitoring were as follows:

- *No Existing Comprehensive Water Quality Plan:* Questions raised here included 1) Do present regional water quality monitoring programs provide sufficient framework to meet sanctuary water quality monitoring needs or should greater effort be expended on a sanctuary-specific monitoring plan?, and 2) Should the sanctuary develop contingency and hazardous materials (HAZMAT) plans, and, if so, what issues potentially impacting sanctuary waters or marine life should be addressed.
- *Lack of Baseline Water Quality Data Including Toxins and Contaminants:* Questions raised here included 1) Are the sanctuary's resource qualities significantly affected by point and nonpoint sources of pollution from land, and is it the sanctuary's role to monitor these sources?, 2) Does the sanctuary have sufficient data to establish a baseline for water quality, toxins and contaminants? 3) Is the existing water quality baseline sufficient to establish a benchmark for future water quality monitoring? and 4) Is the sanctuary's present data gathering program sufficient to meet its water quality data needs?
- *Impacts of Municipal Sewage Outfalls and Other Waste Streams:* Questions raised here included 1) Is the MWRA outfall harming sanctuary resource qualities? 2) Are any present or planned outfalls harming (or could potentially harm) sanctuary resource qualities? What other waste streams may be impacting sanctuary resource qualities (e.g., mariculture and fish processing)? 3) Will a possible LNG lightering operations in an ocean-based facility near the sanctuary boundary affect sanctuary resources? 4) What research should be done to assess management and public concerns?

Informed management of biological resources within SBNMS requires monitoring of a range of physical, biological, geological and chemical variables in a range of matrices. Water quality monitoring and research has received a relatively small share of the research and monitoring funding at the sanctuary to date relative to monitoring of biota, in part due to the distance of the sanctuary from the coast, oceanographic circulation patterns, and competing priorities. However, the sheer multiplicity of several past and current activities in the sanctuary may have negative water quality impacts.

Much of the pollution reaching the sanctuary comes from non-point sources or from distant point sources. Several waste water treatment facilities discharge into Massachusetts Bay to the north

and south of the Sanctuary, with the largest, the MWRA outfall, discharging over 300 million gallons each day 12 miles from the sanctuary's western boundary. Air pollution from power plants, some as far away as the Midwest discharge a variety of chemicals onto the bay, some of which are accumulated by organisms. In addition, the region is heavily traveled by commercial and recreational vessels and cruise ships that discharge wastes during their voyages. Other sources of contamination include clean material disposal at the Massachusetts Bay Disposal Site (MBDS), and disturbances during the laying of underwater pipes and cables (only one of which crosses the sanctuary). Of concern are the cumulative impacts of multiple activities that may affect the resources of the sanctuary.

Several issues were raised during the public comment period. Public comments focused on the absence of a comprehensive water quality monitoring plan. The issues identified include effects of the Massachusetts Bays Disposal Site, effects of atmospheric deposition, assessment of nitrogen inputs from MWRA outfall and non-point sources, and harmful algal blooms. During WG discussions some additional issues were raised. Two specific issues were impacts of contaminants on lobster growth and abundance of sand lance (and accumulation of polychlorinated biphenyls [PCBs] in fish).

Monitoring for all of these issues would take considerable resources. In an effort to maximize the effort at minimal expense, the proposed monitoring activities must draw from the comprehensive review and discussions used to develop the MWRA monitoring programs focused on ecosystem-based management questions (NAS, 1995). The recommended sanctuary monitoring program asks some of the same questions and is a modified version of the MWRA plan, with changes that provide for the sanctuary's overall goals and in response to some of the issues raised by the public and the WG. In addition, to maximize the usefulness of the data, collaboration with other monitoring programs is recommended and would be consistent with the mandated objective of the resource protection program to establish cooperative agreements and other mechanisms for coordination among all the agencies participating in sanctuary management. Furthermore, the monitoring plan should be implemented in phases to address critical and time-sensitive issues, but also provides a baseline of monitoring data to be assessed over the long term.

Addressing the Issues – Strategies for Part A

The overarching goal of the sanctuary is the protection and conservation of its natural and cultural resources. The basic questions are: (1) What are contaminants of concern? (2) Are contaminants present at levels that could negatively affe*ct* organisms? (3) What constitutes appropriate monitoring activities based on our current knowledge? and (4) What process should be used to identify future monitoring activities as funding becomes available or as new issues arise? In addition to monitoring of water quality variables, oceanographic information on movement of water masses is relevant to potential impacts on food resources and ecosystem components.

There are four strategies in the Water Quality Monitoring section of the WQ AP. The first strategy discusses the development of a site-specific water quality monitoring program, the next strategy discusses current oceanographic monitoring and new technologies, the third strategy

focuses on integration of the data into models to assess the health of the sanctuary, and the fourth details delivery of this monitoring data to the public.

- WQ.A.1 – Develop a Water Column Monitoring Plan
- WQ.A.2 – Encourage Placement of Oceanographic Monitoring Stations in SBNMS and Integrate Monitoring Stations into Site Characterization Research Planning
- WQ.A.3 – Evaluate the Use and Utility of Models for Sanctuary Management
- WQ.A.4 – Develop a Water Quality Outreach and Education Program

Each strategy is detailed below.

STRATEGY WQ.A.1 – DEVELOP A WATER QUALITY MONITORING PLAN

Objective: To adopt a water quality monitoring program designed to assess water quality in the sanctuary focusing on specific questions. To provide an adequate database to assess changes in sanctuary water quality and effects on resources.

Implementation: SBNMS research and monitoring staff, research and monitoring advisory panel.

Strategy Summary

The sanctuary has had a water monitoring program (albeit small) in place for several years. In 2001, sanctuary staff developed a plan to examine whether the MWRA outfall (which began operating in September 2000) was causing increased nutrient eutrophication impacts to the sanctuary. To maximize the use of resources and obtain compatible information with ongoing monitoring efforts, the sanctuary added four stations to MWRA's existing five stations within the sanctuary. Since 2001, MWRA consultants have sampled those four additional stations in August and October (two of the six MWRA surveys each year). Sampling includes measurements of water column physical variables (salinity, temperature, density structure), nutrients, chlorophyll and dissolved oxygen, as well as phytoplankton and zooplankton. The four sanctuary stations are strategically placed to detect nutrient inputs to the sanctuary from the Gulf of Maine (GOM) to the north, and from the MWRA outfall to the west. The data allow inferences about fine scale circulation patterns and water column productivity in SBNMS, and are used for the 3-dimensional model that has been developed to assist managers with understanding how the system might respond to increased and decreased levels of nutrients, dilution of outfall, and dispersion. Furthermore, the data will provide a strong basis for optimizing sampling sites under Strategy WQ.A.1– Activity A.1.3 below.

The activities in this section are suggested as ways of increasing monitoring capabilities, refining data needs, and maximizing data utility. Justifications for each of these activities and/or details on how they can be implemented are also included below. Sediments as a source of contaminants to the water column continues as an issue, although research to date indicates that this is not a significant threat in the sanctuary at this time but warrants periodic investigation.

Activities (9)

(A.1.1) *Establish a Science and Technical Committee to review the monitoring program and related collaborations.*
Appoint a scientific and technical committee to meet quarterly and review the monitoring and research activities and provide advice to the sanctuary management. Broad representation of physical, chemical, biological and geological oceanography should be represented to provide an integrated review of all the scientific and technical activities of the sanctuary. This group should attend the meetings of the Outfall Monitoring Science Advisory Panel and arrange for special workshops or meetings to discuss specific concerns regarding the sanctuary.

(A.1.2) *Characterize the contaminant loading to the sanctuary from sources.*
Monitoring programs are most effective when they are designed around specific questions. Without understanding the loading of nutrients, metals, organic chemicals and other pollutants from respective sources (air, vessels, outfalls, and other activities), it is difficult to develop a monitoring program that will provide useful results and identify ways to answer some of the more challenging ecosystem-based questions.

(A.1.3) *Evaluate the MWRA outfall as a source of contaminants and other pollutants.*
Although other potential sources of pollution exist, the proximity of the MWRA to the sanctuary and the size of its discharge (>300 mgd) warrant a special focus on this source. The MWRA publishes annual water quality reports that should be used to develop contaminant loadings from this source. As per requirements in the National Pollutant Discharge Elimination System (NPDES) permit, MWRA also prepares an annual report to the sanctuary about water quality status and changes. This information should be posted on the sanctuary's web site. Unfortunately, equally detailed data do not exist for other outfalls or sources.

(A.1.4) *Identify specific monitoring questions and develop a monitoring and research plan around these questions, including to what extent do the MWRA outfall, other outfalls, and other sources of pollution impact the sanctuary (also see Activities B.1.3 and B.3.3).*
Although a characterization report should be completed in advance of a monitoring plan development, the presence of the outfall and the effort that went into identifying questions and monitoring activities to answer these questions provide a framework for initial monitoring activities in the sanctuary. Thus, two areas (5km and 5-70km from the MWRA outfall) are being monitored to enhance understanding of fine-scale circulation and to evaluate whether nutrient levels are changing. The sanctuary should follow the process that will identify the needs, the questions, data and approach needed to answer the questions, analysis of results and an evaluation of how well the management questions are answered (NAS, 1995). The WG recommends convening a workshop or series of workshops to identify the questions and indicators that would have to be monitored to answer these questions.

(A.1.5) *Present the results and analysis of the current monitoring program and incorporate findings into management actions, as appropriate.*

During the first two years of the expanded MWRA monitoring stations in the sanctuary, the data analysis showed variability in some stations, reflecting shifts in water masses as well as growth of local plankton populations. MWRA outfall effects seemed minor by comparison. The study report (Hunt, et al., 2003) recommended a review of the value added from each measurement relative to the sanctuary management objectives, and this activity embraces that recommendation. The review would use the public and stakeholders to identify the questions and rely on the scientific community, with their understanding of regional dynamics, to develop a process to achieve management objectives.

(A.1.6) *Coordinate water quality monitoring with other monitoring and research activities within the sanctuary.*
Water quality monitoring in support of the sanctuary goals of protecting natural and cultural resources should be closely connected with fisheries, whale, habitat, maritime archeology research, and other monitoring programs. The sanctuary should develop long-term strategies for research and monitoring and plan for complementarities in data use by establishing cooperative agreements and other mechanisms for coordination among all the agencies participating in sanctuary management.

(A.1.7) *Develop and manage a database for use by scientists, visitors and sanctuary staff.*
Database management is key to ensuring timely analysis of data, long-term availability for scientists, and for coordination among those conducting research and monitoring programs. Currently, various data sets are held by individual researchers, the MWRA and the sanctuary. Coordination of the Stellwagen Bank water quality data is essential. In the short-term a focus group should review data needs for the Sanctuary managers and scientists and recommend an approach that maximizes data availability to the users. This focus group should include those familiar with geographic information systems and include the outreach and education staff.

(A.1.8) *Encourage research and monitoring of endocrine disrupters and their effects on sanctuary resources.*
At this point in time, research indicates that this group of contaminants does not present an immediate threat to sanctuary resources. However, the sensitivity of this issue and the potential detrimental effects on sanctuary resources by endocrine disrupters (e.g., PCBs, polynuclear aromatic hydrocarbons [PAHs], pesticides) which may enter the sanctuary through numerous sources, including sewage outfalls, runoff, air deposition, suggests the need for vigilance and continued research.

(A.1.9) *Convene a focus group within the next year to review current data on sand lance populations and relevant studies related to impacts on their populations.*
Sand lance, a key species in the Stellwagen Bank food web, may be an indicator of environmental health and water quality in the sanctuary. A focus group synthesizing data from oceanographic and meteorological monitoring stations, fishermen's reports, National Oceanic and Atmospheric Administration (NOAA) Fisheries surveys and other sources may help build a better picture of local cause and effect for sand lance variability. Although excessive nitrogen from the MWRA outfall effluent has been posited as one cause for recent sand lance declines, monitoring indicates that two winters with low temperatures and an extended drought period may also play a role. Coordination with other groups is highly recommended, including MWRA

which is required by its NPDES permit to address potential outfall impacts to whales and their food chain.

STRATEGY WQ.A.2 – ENCOURAGE PLACEMENT OF OCEANOGRAPHIC MONITORING STATIONS IN SBNMS AND INTEGRATE MONITORING STATIONS INTO SITE CHARACTERIZATION RESEARCH PLANNING

Objective: To obtain high quality, timely data to better assess water quality changes that may affect sanctuary resources, and to provide more detailed information about water quality to researchers and the public.

Implementation: SBNMS Research and Monitoring Staff.

Strategy Summary

This strategy builds upon recommendations of the U.S. Ocean Commission (www.oceancommission.gov) which calls for increased funding for integrated ocean observing systems and the use of emerging technologies. Federal and state governments are committing to support the Ocean Observing Systems (OOS) that will provide long-term data for coastal and marine regions. The Gulf of Maine Ocean Observing System (GOMOOS) is already functioning and provides a variety of physical and biological data, some in real time, and provides immediate access to weather and sea state**.**

Activities (4)

(A.2.1) *Review current existing OOS, including satellite imagery with data relevant to the sanctuary and identify data that are relevant to research and monitoring activities.*
These data will be an integral component of a Sanctuary monitoring program, and should be expanded wherever possible.

(A.2.2) *Evaluate emerging technology for ability to address specific sanctuary needs.*
One of the challenges for long-term data collection in the ocean is the lack of probes and sensors that can reliably measure variables of interest. Although probes for dissolved oxygen and chlorophyll are readily available they are not problem-free. Probes for nutrients, plankton, and trace levels of chemicals are needed but are even less reliable. Nevertheless, new technologies are being developed and it is anticipated that within a few years, they will be affordable and used routinely in water quality monitoring programs. In addition, recent developments in platforms offer more choices for deploying sensors.

(A.2.3) *Develop a plan for integrating current OOS and other research and monitoring activities within the sanctuary water quality monitoring plan, research agenda, and other monitoring activities.*
OOS data, whether from GOMOOS or other sources should be integrated with monitoring activities and used in data analysis to improve understanding of the system. Conceptual and mathematical models also provide a framework for examining the relationships among data from physical, biological and chemical oceanography.

(A.2.4) *Evaluate emerging technologies for remote sensing of surface currents and other oceanographic and meteorological data and make use of appropriate technologies where deemed feasible.*
The sanctuary is a region with complex currents that influence dispersion events. This information is not only useful for interpretation of water quality data, but movement of plankton and other organisms. New technologies are being developed to interpret remote sensing of surface currents, surface winds, and other variables. We recommend this as a workshop topic as a first step in integrating this data with SBNMS research and monitoring activities. Coastal radar (CODAR), Acoustic Doppler, and quick scatterometer (QuickSCAT) are currently in use and should be continued.

STRATEGY WQ.A.3 – EVALUATE THE USE AND UTILITY OF MODELS FOR SANCTUARY MANAGEMENT

Objective: To better understand the physical processes that direct the water movements of the sanctuary for more informed decision making in areas that address water quality; and to deliver more timely and accurate information to the public.

Implementation: SBNMS research and monitoring staff, research partners.

Strategy Summary

Conceptual and numerical models currently exist that may have applications for sanctuary management. Models may be used to describe phenomena, forecast future events, or be used to evaluate different scenarios. Models are most effective when designed for specific purposes. Data from research and monitoring can be used to verify models and together may be a powerful tool in managing natural resources. In order to effectively use and develop models, the WG recommends that the sanctuary identify needs for which models would be used. For example, water quality questions that might be answered by models include: concentration levels of particular chemicals that would be expected from hazardous spills and/or sewage outfall failures, and vessel discharges from cruise and other ships that cumulatively release wastes in the sanctuary.

The WG recommends that the activities focus on determining what models exist, what questions could best be answered by these sorts of models, and how the sanctuary can set up a process to ensure that these models address the needs of the sanctuary.

Activities (3)

(A.3.1) *Compile a list of all models (harmful algal bloom [HAB], Bays Eutrophication Model [BEM], GOM etc.) and determine direction of these models as applied to sanctuary goals.*
Several different models exist for the GOM and Massachusetts and Cape Cod Bay. The sanctuary should develop a short paper summarizing the existing models that are relevant to the issues adopted by the Council. For example, the HAB model, the BEM, the physical

oceanography models for the GOM and Massachusetts and Cape Cod Bays (Signell, et al., 2000; Lynch 19xx) the U.S. Coast Guard (USCG) hazardous materials models, Natural Resources Damage Assessment Model for Coastal Marine Environments (NRDAM/CME) developed for type A spills for the U.S. Department of the Interior (DOI) etc. Evaluate these models relative to SBNMS questions.

(A.3.2) *Develop discussions around food-web models (e.g., sand lance and whales).*
Although they are important, food web models are among the most difficult to generate. Two specific issues of interest to the SBNMS are: understanding sand lance populations and assessing food availability for marine mammals. Generalized food web models exist, however, detailed food-web models often fall short of expectations. Thus, this issue, as with Activity A.3.1, should first involve gathering existing models for the region and evaluating their effectiveness in providing information for the sanctuary. Incorporate information generated in sand lance forum suggested in Activity A.1.9.

(A.3.3) *Determine the need for a model evaluation group (MEG).*
One of the most effective means of ensuring that models address the questions is to convene a model evaluation group to oversee model development. This has worked well in the Massachusetts and Cape Cod Bay area where the MEG provides guidance to modelers in developing future scenarios based on nutrient levels and other issues.

STRATEGY WQ.A.4 – DEVELOP A WATER QUALITY OUTREACH AND EDUCATION PROGRAM

Objective: To provide more timely and accurate information to the research community and public, to build a constituency for the public and to help protect sanctuary resources.

Implementation: SBNMS research and monitoring staff, SBNMS education and outreach staff .

Strategy Summary

sanctuary outreach and education activities should explore areas of overlap with other organizations and agencies involved in water monitoring in the region and coordinate with these groups for a more effective outreach effort to targeted audiences. The WG recommends two major efforts for the outreach and education activities: (1) identify and prepare materials specific to water quality issues for SBNMS and (2) coordinate with other programs to reduce overlap and share resources.

Activities (3)

(A.4.1) *Prepare outreach and education materials, including web pages, that deliver sanctuary monitoring data and analyses to the public on a timely basis.*
Two issues should be pursued. Outreach efforts should be coordinated to complement and increase awareness of this program and to identify the specific results of the sanctuary monitoring. Data from the monitoring program should be available within a reasonable time

frame (e.g., 3-6 months) annually. The results from the program should be used to educate the public on water quality issues in general and the importance of these in the sanctuary.

(A.4.2) *Develop materials to facilitate understanding of the relationships between and among water and sediment quality, ecosystem assessment and ecosystem alteration.*
The interrelationship between water and sediment quality and ecosystems is complex and difficulty to explain to stakeholders and the public. The sanctuary should prepare materials for the broad and diverse audience (stakeholders) associated with SBNMS that describes water and sediment quality, ecosystems, ecosystem impacts and the interrelationship of the physical, chemical, geological and biological components. Particularly challenging is the concept of risk associated with natural and human-induced alterations and what is acceptable and what is not. The details of achieving this should be determined by the sanctuary's outreach and education staff with input from appropriate stakeholders.

(A.4.3) *Partner with existing organizations and coordinate sanctuary outreach and education efforts.*
Several organizations are committed to outreach and education efforts in the GOM, including: GOMOOS, which has a full time outreach person and has developed a network for introducing mariners to its products, and MWRA which supports several outreach and education programs in water quality based on data collected from its monitoring activities. The WG recommends the production of a biennial report that describes the results of the SBNMS water quality monitoring program in the context of MWRA and other monitoring activities. Where messages overlap, joint efforts should result in reaching larger audiences.

Water Quality Action Plan Part B – Vessel Discharges and Other Waste Streams

Overview

This portion of the water quality AP provides guidance for the protection of sanctuary water quality from vessel discharges and other waste streams, including sewage effluents and catastrophic spills; and to enhance stewardship of sanctuary water quality by user groups, including shipping, cruise lines, whalewatch industry, fishing industry, and municipal wastewater facilities. While Part A of this AP addresses monitoring plans, evaluation of monitoring technologies and data assessment, Part B is focused on actively reducing levels of wastes entering sanctuary waters, and responding to or remediating effects of large and/or possible catastrophic waste streams.

Description of the Issues

During scoping and in the WG, comments were categorized under several issue areas. The breakdown of comments addressing vessel discharges and other waste streams were as follows:

- *Appropriateness of Waste Water Discharge by Vessels in the SBNMS:* Questions raised here included 1) Are whalewatch vessels and the expanding number of cruise Discharge Areas in the near shore lead to more discharge in the sanctuary and will that create a water quality problem? 3) Are the dumping of bilge water and ballast water contributing to the degradation of the sanctuary's water quality? And 4) If discharges are deemed a threat to the well-being of sanctuary resources, how can the discharges be prevented? Should the sanctuary become a No Discharge Area?
- *Impacts of Municipal Sewage Outfalls and Other Waste Streams:* Questions raised here included 1) Is the MWRA outfall harming sanctuary resource qualities? 2) Are any present or planned outfalls harming (or could potentially harm) sanctuary resource qualities? What other waste streams may be impacting sanctuary resource qualities (e.g., mariculture and fish processing)? 3) Will a possible LNG lightering operations in an ocean-based facility near the sanctuary boundary affect sanctuary resources? 4) What research should be done to assess management and public concerns?

The WG focused on water quality issues related to discharges from a variety of sources. In addition to reviewing cruise ship and other large vessel wastewater discharges in the sanctuary, the WG included biological wastes from fishing vessels, factory trawlers, whale watch vessels and recreational boats. Included in the discussions are consideration of cumulative impacts from the numerous vessels traversing and recreating in the sanctuary. Ballast water discharges are also discussed as a source of biological contamination.

The WG also discussed the potential for hazardous waste spills and contaminant releases other than traditional vessel discharges but seemed appropriate to include in this section. These discharges may include spills and lost product occurring during product transfers at a proposed LNG docking facility outside sanctuary boundaries, untreated sewage from the MWRA outfall pipe and other municipal sewage operations, and hazardous materials from vessels.

The range of contaminants in vessel discharges that may affect sanctuary resources and human health is broad, but observed impacts are not well established to date. These contaminants include biological wastes, such as bacteria, viruses, non-native organisms carried in ballast (including bilge water, sea chests), and a variety of chemicals used to treat biological wastes or used for boat maintenance and other purposes.

Research has shown that ballast water is one of the primary means of introducing exotic species into an environment, with New England being no exception. Large numbers of vessels pass over the sanctuary each year on their way to and from Boston and other ports in Massachusetts and Cape Cod Bays. An established whale watch industry is migrating to larger and faster boats, with greater capacity for passengers and the concomitant amount of shipboard wastes. The cruise industry has almost quadrupled its visitation to the Port of Boston over the past decade with MassPort listing more than 208,000 passengers and a record-setting (expected) 94 ship calls in 2004.

Although cruise ships are just a portion of the large vessels transiting the SBNMS, they are attracting more attention from the general public, environmental organizations, and government agencies, due to the increasingly large volumes of waste that they are capable of producing, and the growth of the industry. Unlike other large vessels that carry primarily cargo and a small crew, in terms of waste production, cruise ships are the equivalent to a small city, however they are not subject to the stringent regulations and monitoring requirements to which land-based facilities are required to comply. Such attributions have prompted action on the national and regional levels to address the real or perceived threats that cruise ships currently represent.

NMSs have long been places that prohibit discharges within their boundaries. 15 CFR Part 922 establishes that the discharge or deposit of material or other matter within a National Marine Sanctuary may be prohibited. With this authority, every sanctuary was designated with some type of discharge regulation to protect its natural and cultural resources. For example, most NMSs prohibit the discharge of garbage, trash, and plastics, as well as the discharge of oily wastes from bilge pumping. However, most NMSs have specific exemptions to their discharge prohibition. (See "Evaluation of Existing Regulations" earlier in this report.)

The NMSP reports that the exemptions for effluent discharges from marine vessels in NMS regulations were adopted in the 80's and 90's using definitions in Section 312 of the FWPCA, particularly the definition of "discharge incidental to the normal operation of a vessel." However, the newer and bigger cruise ships capable of meeting every conceivable demand of the cruising population probably were not factored into the definition of "vessel" nor into the definition of "normal operation" of a vessel. "Discharge" was defined, but even then, the types and amounts of pollutants found in the discharge characteristics of today's typical cruise ships have changed dramatically since the NMSP's regulations were crafted. It would be reasonable, therefore, for the NMSP to re-evaluate the exemptions it has allowed for discharges in NMSs and possibly eliminate some of those exemptions or to amend the exemptions to include ship speed (knots while transiting) and discharge point (in port or transiting) requirements.

The NMSP has created a WG that is addressing the issue of cruise line wastewater discharges in sanctuaries, with the possibility of developing a system-wide set of regulations pertaining to this class of ship. Therefore, the SBNMS is deferring development of cruise line regulations in this

AP, and will pursue activities that incorporate voluntary compliance and user stewardship education.

Broadly speaking, cruise liners and other large ocean-going ships, including cargo vessels and military ships, generate seven basic types of wastes or waste streams: black water, gray water, hazardous wastes, solid wastes, oily bilge water and oily sludge, ballast water, and incinerator wastes. Definitions of these waste streams can be found in Appendix II along with Table 1 Summarizing Contaminant From Vessels, Current Regulations, and Options for Minimizing Environmental Impacts. Whalewatch vessels generate blackwater, oily bilge water and solid wastes/garbage. Fishing boats generate oily blackwater, bilge water, fish processing wastes and garbage.

Emergency oil spills or spills of hazardous substances in U.S. waters come under regulations that are known as Natural Resource Damage Assessments (NRDA). It is possible to apply NRDA regulations to any vessel discharge that contains oil and petroleum, and/or toxic substances if the discharge causes injury and damage to marine resources and living organisms. It is also possible to apply the CWA to discharges of petroleum and hazardous substances as well as excessive nutrients, and sewage containing pathogens and bacteria that could impair water quality. Lastly, the disposal of plastic trash, and other overboard trash by vessels is regulated by the Marine Plastic Pollution Research and Control Act of 1987 in the U.S. as well as MARPOL 73/78 Annex V. Vessel discharges that could be problematic are: Black Water (vessel sewage), Grey Water (containing oils, cleaning solvents, metals, pesticides, medical waste), Bilge Water (contains fuel, oils, cleaning agents, paint, rags), Ballast Water (foreign marine organisms), Hazardous Materials (chemicals from cleaning and photo processing, paints, solvents, inks), and Solid Waste disposal (refer to the section on vessel discharge for more detail).

NRDA involve a federal process to receive compensation from spills of oil and/or hazardous substances that subsequently damage natural resources, and address resource recovery or restoration efforts (Ofiara and Seneca 2001, Ofiara 2002). This effort started in the 1980s and involves two federal agencies that have developed separate federally approved rules and procedures, the DOI and NOAA. The approved rules apply to assessments of economic losses (economic damages in adopted language) that result from such spills in waterways under U.S. jurisdiction.

The DOI was 1) given legal responsibility and authority to develop procedures to use in the case of hazardous substance spills and oil spills in all navigable waters of the United States under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) amended by the Superfund Act of 1986 (SARA), and 2) seek legal means to recover assessed economic damages that can result from spills of hazardous substances. The legal liabilities and responsibilities are stipulated in CERCLA of 1980 and SARA of 1986, commonly referred to as CERCLA by practitioners. Oil was not included within CERCLA because it was previously covered under the CWA (CWA; enacted in 1970 as the Water Quality Improvement Act partially in response to the famous Santa Barbara oil spill, amended by the Federal Water Pollution Control Act of 1972, and further amended in 1977). However, the rules and procedures developed by the DOI also refer to oil spills. For both the CWA and CERCLA, these laws provide that natural resource damages are to be compensatory and not punitive, following

common law principles relating to damages (compensatory damages are favored over punitive damages). The first versions of these procedures were published in 1986 and in 1987, referred to as "type B" rules and as "type A" rules, respectively. These were subsequently revised in 1994 and in 1996 as required by federal court order.

In 1990, the Oil Pollution Act (OPA)was passed which gave the NOAA legal responsibility and liability over oil spills in the nations waterways. For all oil spills that occurred after August 1, 1990, OPA 1990 supersedes the regulations, responsibilities, and liabilities stipulated in the Clean Water Act. However, OPA does not regulate crude oil and petroleum products which are either treated as hazardous substances under CERCLA or under the CWA. NOAAs procedures were published in 1996 after undergoing an extensive period of development and formulation beginning in 1990.

NRDA rules and procedures are referred to as liability rules by economists. The procedure involves both fines and penalties or damage awards to return the injured environment back to predamaged levels. Parties become legally responsible for any and all damages from such spills. Damage awards include the sum of response costs, social damages, and restoration costs (sometimes these include the cost of purchasing equivalent natural resources). Difficulties consist of measuring social damages and the costs of restorations. The specific fines and penalties are summarized below.

Penalties under CWA (Note: K refers to thousands, M refers to millions):
Penalties for discharges of oils and hazardous substances under the CWA (Section 311) include (see Ofiara and Seneca 2001 for detail):

liability penalties:
for small vessels: <$125/gross ton or <$125K per incident.
for large vessels: <$150/gross ton or <$250K per incident.

civil penalties:
class I <$25,000/incident
class II <$125,000/incident.

Penalties under CERCLA:
Penalties for discharges of hazardous substances under CERCLA include:

liability penalties:
For vessels carrying toxicants: the larger of <$300/gross ton or <$5M per incident.
For all other vessels: <$300/gross ton or <$500K per incident.
For pipelines: $5M-$50M per incident.
For any facility: $50M + all response costs per incident.

civil penalties:
class I penalty: <$25,000/incident,
class I penalty: <$25,000/day for each day the violation occurs.

Penalties under OPA:
Penalties for discharges of oil under OPA include:

liability penalties:
For small tank vessels (≤3,000 gross ton): the larger of <$1200/gross ton or <$2M per incident.
For large tank vessels (>3,000 gross ton): <$1200/gross ton or <$10M per incident.
For all other vessels: <$600/gross ton or <$500K per incident.
For offshore facilities: $75M + all removal costs per incident.
For onshore facilities: ≤$350M per incident.

Addressing the Issues – Strategies for Part B

Results from water column monitoring at the present time indicates that water quality in the sanctuary is free of dangerous levels of pollutants that may cause harm to natural and cultural resources and lead to serious human health threats. However, vigilance of the levels of discharges to sanctuary waters is necessary, if these water quality standards are to be maintained. In addition, other aspects of ecosystem protection that are affected by vessel and shore-side discharges, such as maintenance of biodiversity and food web dynamics, require that the sanctuary actively work with user groups that may be impacting sanctuary waters. In addition, the sanctuary must also prepare for those cases where catastrophic events negatively impact water quality, with contingency plans for cleanup or resource protection and/or remediation. Prevention of catastrophic events is also key in any water quality protection plan.

There are four strategies in the Vessel Discharges and Other Wastewater Streams part of the WQ AP. The first two strategies discuss efforts to reduce water pollution threats from vessel discharges that are part of regular vessel operation; the third strategy addresses sanctuary involvement in the reduction of threats from sewage effluents and other shore-side wastewater streams; and the fourth strategy focuses on response to or prevention of catastrophic events, such as oil and other hazardous spills or releases of raw sewage.

- WQ.B.1 – Reduce Threats to Sanctuary Water Quality from Vessel Discharges (Other Than Ballast Water)
- WQ.B.2 – Reduce Ballast Water Exchanges in the Sanctuary
- WQ.B.3 – Reduce Impacts of Municipal and Other Shore-Based Wastewater Streams
- WQ.B.4 – Develop Contingency Plans to Address Catastrophic Events in the Sanctuary and Support Programs that Would Prevent Major Water Pollution Events

Each strategy is detailed below.

STRATEGY WQ.B.1 – REDUCE THREATS TO SANCTUARY WATER QUALITY FROM VESSEL WASTEWATER DISCHARGES (OTHER THAN BALLAST WATER)

Objective: To conserve water quality in the sanctuary while encouraging compatible uses and encouraging stewardship.

Implementation: SBNMS research and monitoring staff, SBNMS education and outreach staff.

Strategy Summary

Recognizing that the sanctuary is home to endangered marine mammals and the location for active fishing for species intended for human consumption, the WG recommends the sanctuary use a precautionary approach to protecting water quality. The WG understands that some events are high probability but individually have low impact (e.g., release of waste water in an open sea), others are low probability and have high impacts (e.g., oil spills). One of the questions that the WG grappled with was the cumulative impact of low impact events and how to manage this in the context of SBNMS and the region. For example, a recent study showed that plume discharge from cruise ships traveling between 9-17.4 knots was diluted between 200,000:1 to 640,000:1. These values were higher dilutions (i.e. better for the environment) than predicted and related in part to propeller secondary dilutions. The issue of cumulative impacts from all vessels is not explored and vessels standing still, e.g. whale watching boats, fishing vessels, and others moving more slowly may have local impacts. Thus the WG recommends adopting a precautionary approach utilizing voluntary compliance until the other factors have been evaluated (e.g., cumulative impacts from all vessels on a daily basis; and calculation of risks associated with high probability, low impact activities).

Activities (5)

(B.1.1) *Develop guidelines on vessel discharges that recommend no discharge of black water, gray water, bilge water, ballast water, hazardous chemicals, solid wastes, and fish wastes in excess of quantities normally produced by traditional fishing methods within the sanctuary, and encourage vessels transiting sanctuary waters to abstain from dumping through voluntary compliance. Include a reporting component to provide documentation on discharge locations.*
As an area deemed to be of special national significance, the sanctuary has a responsibility to maintain water quality at the highest possible quality. Any contribution of pollutants from waste streams provide potential threats to the safety of sanctuary resources. Understanding the potential impacts of these waste streams is critical in the development of best management practices for water quality and this should be pursued.

(B.1.2) *Assemble a discharge WG to investigate the potential for designating the sanctuary a No Discharge Area under NMSA. Compile additional background information needed to support development of No Discharge Zone designation and regulations, including on-board disposal practices (including use of Advanced Wastewater Treatment Facilities) and impacts to resources from black water, gray water, bilge water, hazardous wastes, solid wastes, desalination effluent, and ballast water. Coordinate with EPA in the development of regulations to ensure consistency with state NDZ created under CWA 312 40 CFR 140.*
As an area of special national significance, the sanctuary must be managed under higher standards than surrounding waters. In the absence of critical scientific knowledge about the effects of waste streams, a precautionary approach should be employed. Proving the absence of deleterious effects should be the burden of the waste stream producer, rather than the reverse of

having the sanctuary be responsible for the burden of proof. The delay in releasing wastes on outward bound trips (to pass beyond the sanctuary boundary) should not create logistical problems for the vast majority of ships, and in-bound trips will require planning for dumping prior to reaching the sanctuary boundary or preferably in making arrangements for dockside pumpout facilities. The creation of a NDZ may also encourage the development and installation of advanced wastewater treatment technologies on board.

(B.1.3) *Develop a research program that examines the cause and effect relationship between discharges and impacts to the ecosystem. This needs to be done in conjunction with other agencies and organizations and focus on issues of highest importance (also see Activities A.1.4 and B.3.3).*

The WG recommends that the sanctuary work with the industries and recreational users of the sanctuary and the EPA to use existing plume discharge information for cruise ships and apply it to SBNMS. This may require additional field studies and should include risk assessments of cumulative impacts from all vessels likely to discharge into the sanctuary and estimate concentrations on a daily basis and impacts from near-shore no discharge zones. This information can be used to develop a policy for the sanctuary based on data relevant to the region. Other research priorities include evaluating the impacts of contaminants at the levels within the sanctuary, impacts from fish processing wastes, and ballast water discharge. The WG recommends convening a focus group to review the issue and make specific recommendations for a long-term, water-quality research plan for the Sanctuary. This focus group should be informed of other research that can be applied to the region.

(B.1.4) *Develop an outreach and education campaign with the cruise and whale watch industries as well as commercial shipping, fishing and recreational fishing groups to enhance "green" cruising and obtain compliance on a voluntary SBNMS NDZ for all waste streams except engine cooling water*.

As regulations may take a considerable length of time to codify, it is imperative that water quality not be degraded in the interim. A concerted education campaign can become a means of enhancing the tourism experience by informing the passengers and crew and instilling a sense of stewardship, while reducing the quantity of pollutants entering the waters. If voluntary compliance proves effective in maintaining or improving water quality, the process of designating a NDZ may be deferred.

(B.1.5) *Encourage development of pump out facilities for both large and small vessels, and support creative solutions in ports and harbors that host vessels that visit the sanctuary.*

> <u>*Rationale:*</u> Pump out facilities will only be used if access is simple and inexpensive. Development of additional capacity in major ports and harbors is imperative if the sanctuary receives NDZ status.

STRATEGY WQ.B.2 – REDUCE BALLAST WATER EXCHANGES IN THE SANCTUARY

Objective: To conserve the quality of sanctuary waters and protect the biodiversity of the ecosystem from the threat of invasive species.

Implementation: SBNMS research and monitoring staff, SBNMS education and outreach staff.

Strategy Summary

Ballast water is used for trim, safety and stabilization of vessels and adapted to loads and sea conditions. The International Maritime Organization, the USCG, Canada and several other countries and states have either voluntary guidance or legislation requiring ballast water management. Because of the lack of alternative treatments, the preferred interim treatment is ballast water exchange in mid-ocean for vessels entering the exclusive economic zones (EEZ). Unfortunately, it is difficult to access the level of voluntary compliance, even with the mandatory reporting forms. The USCG has a report to Congress that says compliance is very low (NBIC 2001). In New England, only about 35% of the vessels submit forms, an insufficient number to draw any conclusions. Moreover, coastal vessels do not have to report ballast water exchange or submit forms.

Studies indicate that ballast water is one of the major vectors for exotic species introductions. Over 80% of the world's goods are transported by ships that globally discharge approximately 10 billion metric tons each year. Over 3,000-7,000 species are carried in ballast tanks daily, and though few become established and fewer become invasive, those that do may cause economic and ecological harm. The greatest concern has been focused on coastal areas where introduced species have dramatically impacted nearshore ecosystems, aquaculture and harbor and port infrastructure.

More recently, the presence of the compound tunicate, *Didemnum* cf. *lahillei,* on Georges Bank and reported, but not confirmed, on Stellwagen Bank raises new concerns. On Georges Bank this tunicate has spread over approximately 6.5 sq. mi. of prime scallop gravel and sand habitat. Our knowledge about the biology of this organism is sparse. In near-shore areas the species is very aggressive, forms large colonies, some extending 18 inches or more, and grows over other organisms. It has been implicated in causing mortality of bivalves and overgrowing smaller organisms in shallow regions, but no studies have been done to evaluate the impact in the deeper water habitats.

Unfortunately, once marine organisms are established, it is virtually impossible to remove them. Thus, prevention is the best option for managing introduced species. Current efforts in the Northeast are focusing on a regional ballast water management plan as other efforts at the international and national levels move forward. These efforts include identification of scientifically based alternative ballast water exchange zones, actions for ports and harbors, and increased pressures for compliance with current voluntary ballast water management efforts.

Because of the potential impact on fisheries, scallops, and the ecosystem, we recommend that the sanctuary support the regional ballast water management efforts and consider prohibiting exchange of ballast water by vessels that traverse the area.

Activities (2)

(B.2.1) *Adopt a precautionary approach and encourage prevention of introductions of invasive species through development of ballast water exchange guidelines for the sanctuary through formal Memoranda of Understanding with cruise lines and the shipping industry and other shipping related sources.*
The sanctuary is used by fishermen and scallopers that depend on a healthy, functioning ecosystem. Because of the threat of invasive species such as the compound tunicate, *Didemnum* cf. *lahillei*, which may cause serious impacts to the ecosystem, the WG recommends a precautionary approach to ballast water exchange be adopted by all vessels. Thus, we recommend that the sanctuary encourage vessels traversing Stellwagen Bank to refrain from discharging in the sanctuary. Similarly, all vessels should take care to ensure that hulls, bilge water, fishing gear, diving gear, and sea chests are free of all species. This is especially important for fishing vessels that fish both in Georges Bank and Stellwagen Bank, to minimize the potential to transfer the aggressively growing *Didemnum* cf. *lahillei* to Stellwagen Bank.

(B.2.2) *Prepare educational materials for vessels that provide documentation of impacts and actions that vessel crews and owners can take to prevent new introductions.*
This is an opportunity to collaborate with Sea Grant programs, the Northeast Aquatic Nuisance Species Panel, the USCG, and others in developing outreach and educational materials such as posters for vessels, brochures, and specific alternative actions that are cost-effective for all vessels.

STRATEGY WQ.B.3 – REDUCE IMPACTS OF MUNICIPAL AND OTHER SHORE-BASED WASTEWATER STREAMS

Objective: Protect sanctuary water quality and foster interagency cooperation.

Implementation: SBNMS management, SBNMS research and monitoring staff.

Strategy Summary

Probably the largest anthropogenic, point source of nutrient inputs to the Massachusetts Bay system is the MWRA outfall. The program grew out of a court settlement to address sewage disposal and associated water quality problems of Boston Harbor with a cost of $3.8 billion (NRC, 1993; MRWA, 2003; MWRA, 2004). While scientific studies indicate that effluent discharges from the MWRA outfall are not a nutrient concern to Massachusetts Bay and the sanctuary, there is discussion and concern over levels of chlorine discharge in the immediate area of the outfall diffusers. MWRA de-chlorinates its effluent before discharge, with strict limits on chlorine residuals in the effluent set under the NPDES permit. Added demands on this system, and/or the addition of new sewage outfalls into Massachusetts Bay, however, may introduce additional nutrients and pollutants that could potentially affect the sanctuary. Cumulative impacts of all waste streams are also unknown at this time and should be monitored.

MWRA's NPDES permit requires an annual report to the sanctuary reviewing any effects on sanctuary resources by the MWRA outfall effluent. Any new or expanded waste streams need

NPDES permit request for a wastewater stream entering Massachusetts Bay, and which might affect sanctuary resources, should incorporate sanctuary monitoring and reporting components, developed in consultation with the sanctuary.

Activities (3)

(B.3.1) *Review and comment on all NPDES requests for municipal wastewater streams that may impact sanctuary waters, and require sanctuary monitoring and reporting components to any NPDES permit.*
The sanctuary's right to consultation on activities affecting the sanctuary should be validated and secured through coordination with other permitting agencies. The sanctuary should take a proactive position in the permitting of activities that may have an affect on sanctuary resources.

(B.3.2) *Continue to provide representation on the MWRA Outfall Monitoring Science Advisory Pane (OMSAP) to track actions that may have impacts on the sanctuary.*
Sanctuary representation on the OMSAP's Interagency Advisory Committee will assure that sanctuary interests are kept at the forefront of discussion and that recommendations from the panel accommodate sanctuary interests and needs.

(B.3.3) *Convene a focus group to determine the need for a research program that examines the cause and effect relationship between shore-based point source discharges and impacts to the sanctuary ecosystem. Other areas of discussion may be air deposition and non-point source urban runoff. This needs to be done in conjunction with other agencies and organizations and focus on issues of highest importance.*
This activity parallels the research program suggested in B.1.3 and can be incorporated within the development of a monitoring plan suggested in Activity A.1.4 based on the characterization of contaminant loading as determined by Activity A.1.2.

STRATEGY WQ.B.4 – DEVELOP CONTINGENCY PLANS TO ADDRESS ACTIONS AND RESPONSIBILITIES TO REMEDIATE CATASTROPHIC WATER QUALITY EVENTS IN THE SANCTUARY AND SUPPORT PROGRAMS THAT PREVENT WATER POLLUTION EVENTS

Objective: To protect water quality, evaluate water quality after pollution events, and provide mechanisms to remediate problems when pollution events occur.

Implementation: SBNMS management and other government agencies.

Strategy Summary

The sanctuary has worked with the USGS and NOAA's Hazardous Materials Office to develop contingency plans for oil spills and other hazardous material spills that may occur in the SBNMS. Continued coordination in this effort is essential for the future protection of sanctuary water quality and resources in the event of a spill.

Likewise, other significant (and possibly catastrophic) events may occur involving other pollutants, most significantly, the MWRA outfall and the release of partially treated or raw sewage. MWRA's emergency response plan for the outfall covers the possibility of catastrophic failure from natural hazards, including coastal storms (hurricanes, tornadic events, northeasters, and earthquakes). Coastal storms may result in flooding of holding and processing/digesting tanks, and power outages resulting in accidental releases of untreated or partially treated sewage in Boston Harbor. A severe earthquake may impact MWRA operations by damaging treatment facilities or the outfall pipe, leading to accidental releases of untreated or partially treated sewage.

Even storms that are not considered catastrophic in nature may produce effects that impact sanctuary water quality. Heavy rainstorms may flood the holding tanks and lead to release of untreated or partially treated sewage. Monitoring the number of these events and the water quality impacts must also be a sanctuary priority.

The cumulative effects of small events may also have a detrimental effect on sanctuary water quality, including such activities as lightering (the transfer of fuel products which is illegal in the sanctuary) and small vessel collisions (and the release of stored fuel products). In these cases, prevention is the preferred route (as opposed to containment and cleanup).

Activities (6)

(B.4.1) *Continue to work with the USCG and NOAA Hazardous Materials Office in the updating of oil spill and hazardous material spill contingency plans for the sanctuary.*
Present contingency planning should be continued on a timely basis to make all partnering agencies aware of their responsibilities, tasks, and staffing requirements. Periodic drills for assigned staff is critical to smooth operations in an emergency.

(B.4.2) *Work with MWRA to develop a sanctuary component to their emergency response plan for the outfall and make this information transparent to the public.*
A contingency plan that addresses effects on the sanctuary of a potential failure of one of the world's largest sewage treatment facilities and remedial actions to protect water quality is important for both preparedness and public perception.

(B.4.3) *Develop a monitoring program to sample sanctuary waters after pollution events such as MWRA system failures and/or storm-water overflows (incorporate this emergency monitoring within the general monitoring plan – see Activity A.1.6).*
A major component missing in the present MWRA and SBNMS water monitoring plans is event-driven sampling geared to system failures and storm-water overflows. While 98% of the effluent in 2002 had undergone secondary treatment, there was still some of the waste-stream that is being released untreated or partially treated. Monitoring programs in 2002, found weekly and monthly levels of total suspended solids above exceedance levels , although these were not deemed problematic. The WG recommends that the sanctuary work with MWRA to establish a time-sensitive event-driven monitoring program that can evaluate the effects of these pollution events on sanctuary water quality , following the procedures outlined in the NPDES permit. The

OMSAP reviews exceedances and provides scientific opinion on the level of concern and whether additional monitoring or studies are required. We recommend that this process be expanded to include impacts to the sanctuary.

(B.4.4) *Support expansion of the USCG Automatic Identification System (AIS) to as many vessels as possible in an effort to reduce possible ship collisions.*
The USCG new AIS (cited in the MMVS AP) also may prove to have a positive influence in the prevention of vessel collisions and the concomitant protection of water quality.

(B.4.5) *Coordinate with the USCG, USCG Auxiliary and other education and outreach partners in developing boating safety programs for vessels that visit or transit through the sanctuary.*
A key element to the protection of sanctuary water quality is an informed user base. Coordination with agencies and organizations that offer boating safety courses will provide a means of delivering water quality protection messages targeted at recreational boaters. Messages may include, but are not limited to the following topics: proper disposal of waste oil, sewage (pumpout stations), and bilge water. Better navigational skills and boating awareness may also decrease the possibility of vessel collisions.

APPENDICES
(WATER QUALITY)

APPENDIX WQ. I – Specific Federal Hazardous Substances Regulations

Clean Water Act (CWA)

The CWA as it is now known, refers to a series of federal regulations and laws developed over the 1948 to present period. There is a long history of concern over the integrity of water quality in marine waters based on the CWA and the 1970 version was the first to address recovery of response costs of oil spills in navigable waters. In 1977 the CWA was amended containing Section 311 which provided for the liability of discharges of hazardous substances and/or oil into U.S. navigable waters and cost recovery of these discharges. Cost recovery included actual costs incurred for the removal of the substance (i.e., hazardous substance and/or oil), and costs incurred for the restoration or replacement of natural resources damaged and/or destroyed by the discharge of the substance into navigable waters. However, the CWA was not implemented by the EPA for such spills in marine waters until the 1980s when it was used in combination with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The CWA was subsequently amended in 1987 by the Water Quality Act of 1987 (P.L. 100-4). Hazardous substances now regulated by the CWA now number 126 (40 C.F.R. Ch. I, Sect. 131.36).

The Water Quality Act of 1987 also revised financial limits concerning penalties and cost recovery (Ward and Duffield, 1992; 33 U.S.C. Sect. 1321). It stipulated that the liability for a owner-operator of an inland oil barge (i.e., a non-self-propelled vessel carrying oil certified to operate in the inland waters of the U.S.) not exceed $125 per gross ton or $125,000, whichever is greater. For any other vessel carrying oil or a hazardous substance, liability was set at $150 per gross ton or $250,000, whichever is greater. And liability for owner-operators of an onshore/offshore facility was not to exceed a maximum of $50 million. These liability limits do not apply if the owner-operators responsible for the spill or discharge can be shown to be the result of willful negligence *or* willful misconduct. Then the full amount of the actual costs of restoration, etc. can be sought. In addition to the above liability owners-operators may face civil penalties (class I and/or class II civil penalties) resulting from spills or discharges of hazardous wastes or oil. Present limits on civil penalties via CWA were amended by the Oil Pollution Act (OPA) of 1990 and are a maximum penalty of $25,000 for a class I civil penalty and a maximum of $125,000 for a class II penalty (33 U.S.C. 2701, Sect. 4301). Furthermore additional penalties can be assessed due to failure to notify the appropriate agency of the state or federal government and failure to report a spill or discharge of oil or a hazardous substance. Such failure to report can result in a fine or imprisonment up to a maximum of 5 years (33 U.S.C. 2701, Sect. 1403).

Two laws were subsequently passed, CERCLA in 1980 and OPA in 1990, that supersede CWA regarding cost recovery of discharges of hazardous substances and oil, respectively. These new laws were written so that if a conflict between CERCLA and CWA were to arise, CERCLA would apply. And for any discharges of oil on or after August 18, 1990 OPA applies. It is also possible that in the case of mixed spills or discharges (e.g., oil and hazardous substances) more than one law can prevail, e.g., both CERCLA and OPA.

Ocean Dumping of Wastes

The Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 (Public Law 92-532) regulates and manages the transportation, disposal and dumping of nondredged material such as

sewage sludge, and of dredged material such as material dredged from deepening navigation channels into the territorial sea (i.e., 0-3 nautical miles), the contiguous zone (i.e., 3-12 nautical miles), and beyond these limits into the open ocean (U.S. Congress, OTA, 1987; NRC, 1994; 33 U.S.C. 1401 *et seq*.). It has since become known as the Ocean Dumping Act (ODA). Any material that can adversely affect human health, the health of the marine environment, or the economic potential of the ocean is regulated under this Act. Several federal agencies were given jurisdiction over ocean dumping; NOAA and EPA have administration over ocean dumping of nondredged material, while the USACE has administration over ocean dumping of dredged material. In addition, the MPRSA of 1972 required at the U.S. Department of Commerce (DOC) initiate and continue a comprehensive program of monitoring and research of the effects of dumping materials into ocean waters.

Congress amended this Act in 1977 (P.L. 95-153) and imposed a statutory deadline to end ocean dumping of all sewage sludge by December 31, 1981 (U.S. Congress, OTA, 1987; USCCAN, 1988; 33 U.S.C. 1412a). However, municipalities in the New York metro area argued they could not develop sufficient alternative plans by this date. The EPA tried to force New York City (the largest of these municipalities) to end ocean dumping of sewage sludge in 1981, the City sued the EPA and a federal court ruled in favor of the City (*City of New York v. EPA* 543 F. Supp. 1084, S.D.N.Y. 1981). The EPA did not appeal this decision. Following this decision, federal legislation was introduced to reverse this decision and end sludge dumping at the 12-mile dumpsite in the New York Bight. Prompted by this action, the EPA promulgated a decision on April 1, 1985 to close the 12-mile dumpsite and move sewage sludge dumping to a new offshore site, the 106-Mile Ocean Waste Dump Site commonly referred to as the 106-mile dumpsite (also known as the Deepwater Municipal Sludge Site). In 1986, Congress passed the Water Resources Development Act (P.L. 99-962) that amended previous versions of MPRSA (33 U.S.C. 1414a). It stipulated that on December 15, 1987 the 12-mile dumpsite would be officially closed to sewage sludge dumping. Sewage sludge dumping subsequently began at the 106-mile dumpsite on March 17, 1986, and ended at the 12-mile dumpsite on December 31, 1987 (USCCAN, 1988).

The Ocean Dumping Ban Act of 1988 (P.L. 100-688) subsequently amended all previous federal ocean dumping statutes pertaining to the dumping of non-dredged material (33 U.S.C. 1401); it phased out sewage sludge dumping at the 106-mile dumpsite by December 31, 1991 and that the Governors of New York and New Jersey report annually to the EPA on progress towards a plan to develop alternative management and treatment of sewage sludge other than ocean dumping along with a scheduled phase out of ocean dumping. It also contained substantially revised penalties and civil penalties for not complying with the 1991 deadline. In 1992 sludge dumping ceased at the 106-mile dumpsite; New York City, one of the last municipalities that continued sludge dumping after the 12-mile dumpsite was closed, and had entered into a consent decree and enforcement agreement with EPA in August 10, 1989 to cease sludge dumping on June 30, 1992 (Martin, 1991; Hunt, et al., 1996). In addition to a timed phase out of ocean dumping of sewage sludge, the Ocean Dumping Ban Act of 1988 also contained amendments that addressed the disposal and dumping of medical wastes in ocean waters. Maximum civil penalties were set at $125,000 per violation, and criminal penalties were established up to a maximum of $250,000 per violation and/or imprisonment up to 5 years and any property used in committing the violation would be forfeited to the United States Government (33 U.S.C. 1401, Sect. 3201).

Contaminated Sediment – Superfund Sites

The CERCLA of 1980 was enacted in December 1980 (P.L. 96-150) as a response to cleanup the nation's most contaminated sites (mainly former industrial sites and properties, referred to as brownfields and superfund sites [Smary and Dewitt, 1997]) and from public outrage over incidents such as Love Canal near Niagara Falls, NY (DOI 1994, 1996, 42 U.S.C. 9601 *et seq*.). Administered by the EPA, CERCLA was designed to handle the discharge of hazardous substances, to address cleanup of highly contaminated sites, and was the first Act associated with uniform procedures to use to assess natural resource damages that were subsequently developed and promulgated by the U.S. Department of the Interior (DOI) (Bacher, 1993; Campbell, 1993; Dower and Scodari, 1987; Evans, 1997; Anderson, 1993; Helton, 1993; U.S. Congress, OTA, 1987; DOI, 1986 and 1987; Ward and Duffield, 1992).[1] CERCLA was subsequently amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA) and now these highly contaminated sites are referred to as Superfund Sites (e.g., New Bedford Harbor is designated as one such site which has settled for $99.6 million in damages from hazardous substances discharge) (42 U.S.C. 9601). The term Superfund refers to a fund generated from taxes on the petroleum, chemical, and waste disposal industries. The EPA can use this fund to 1) pay for cleanups, 2) pay for EPA enforcement actions to monitor private-party cleanups, and 3) to recover response costs from responsible parties (Hockley and Martin, 1997). To avoid overlap and duplication with the CWA the following rule was used. Where CERCLA and the CWA are in conflict, provisions are such that CERCLA shall apply. And oil not covered by CERCLA is covered by OPA 1990.

CERCLA was designed to cover discharges of hazardous substances (i.e., all substances regulated under CWA, Toxic Substances Control Act (TSCA), Resource Conservation and Recovery Act (RCRA), Clean Air Act, and CERCLA, which now exceed several hundred in number [40 C.F.R. Sect. 302, Table 302.4 1996]), and some petroleum including crude oil that had been designated as a hazardous substance under any of the above federal environmental statutes including subsequent amendments (i.e., "hazardous substance" does not include petroleum, crude oil or any fraction thereof, *which is not otherwise specifically listed or designated* as a hazardous substance under other federal statutes [42 U.S.C. Sect. 9601(14)]). It excludes other petroleum not so designated as a hazardous substance under the above federal statutes, referred to as the "petroleum exclusion."

Interpretation and application of the petroleum exclusion has been a controversial issue, and one must be careful in its application (Bacher, 1993; Hockley and Martin, 1997). The EPA has interpreted this exclusion as follows and courts appear to agree with this interpretation: where hazardous substances have been mixed with or added to crude oil in the refining process or are indigenous to petroleum, the petroleum exclusion shall apply and these substances are not covered by CERCLA (OPA now covers this type of oil-petroleum). Petroleum that contains hazardous substances that have been added to or have increased in concentration from the use of oil (e.g., oil waste), from storage or any reason other than from the normal refining process is covered by CERCLA; the petroleum exclusion does not apply in these cases. Furthermore, the courts have taken this a step farther based on communication with the EPA in the case of a "mixed spill." Where oil is contaminated with any amount of a hazardous substance the spill or discharge of the multiple substance may be covered under CERCLA (i.e., is "so commingled that

... they [i.e., oil and the hazardous substance] cannot be separated, the entire spill is governed under CERCLA," clarification added [EPA, 1987; Bacher, 1993; Hockley and Martin, 1997]).

CERCLA established liability of potentially responsible parties from spills/discharges of hazardous substances into or upon the navigable waters of the United States including the territorial seas (i.e., ocean waters from mean low water to 3 nautical miles) and adjoining shorelines, waters of the contiguous zone (i.e., 3-12 nautical miles), or which may affect natural resources belonging to or under U.S. management including natural resources within the exclusive economic zone (i.e., ocean waters up to 200 nautical miles) established by the Fishery Conservation and Management Act of 1976 (DOI, 1994 and 1996; 42 U.S.C. 9601, Sect. 1004). Such parties are liable for all removal and necessary response costs incurred, and damages to natural resources including reasonable assessment costs. This liability has become referred to as the sum of removal costs, compensable value from damages, and the reasonable costs of assessment.

Probably the most significant aspect of CERCLA was that it required the promulgation and development of a set of uniform procedures to use to assess natural resource damages for the first time. In developing the procedures, two specific rules were formulated by DOI associated with two discharge categories, small or less significant discharges and large or significant discharges (DOI, 1986; 1987; 1994; 1996). These rules are known as type A rules for small spills or discharges and type B rules for large spills or discharges. Dollar limits are set for damage recovery for spills or discharges of hazardous substances. Spills or discharges from any facility are not to exceed $50 million relating to resource damages. As with the CWA, if such spills or discharges of hazardous substances can be shown to be the result of willful negligence *or* willful misconduct *or* caused by a violation of relevant safety, construction, or operating standards or regulations, the above limits on damage recovery are not applicable and the full amount of damages can be sought from the responsible party (42 C.F.R. Sect. 9607; Ward and Duffield, 1992).

The Superfund amendments to CERCLA amended the limits of liability towards potentially responsible parties and penalties, and established civil penalties as well (42 U.S.C. 9601, Sects. 107, 109). Limits on liability for any potentially responsible party were set at a maximum of 1) for any vessel that carries a hazardous substance as cargo or residue, the larger of $300 per gross ton or $5 million, 2) for any other vessel the larger of $300 per gross ton or $500,000, 3) for pipelines from $5 million to $50 million, and 4) for any facility the sum of all response costs plus $50 million. As in the case of CWA if it can be shown that a spill or discharge was the result of willful neglect *or* willful misconduct *or* if potentially responsible parties fail or refuse to provide reasonable cooperation and assistance, the above liability limits do not apply and the liability is set at the full costs of removal plus damages in addition to the above preset limits. Furthermore, any claim that is authorized by Section 107 or 111 can be asserted directly against any guarantor that provides evidence of financial responsibility for a vessel and or facility. The limit of liability for any guarantor was set to equal the aggregate amount (sum) of the monetary limits of the following: insurance policy, guarantee, surety bond, letter of credit, or similar instrument obtained from the guarantor. Punitive damages also apply in the case where the person or party responsible fails to properly provide removal or remedial action if requested by Presidential order (such as an Executive Order), an amount equal to the amount of any costs incurred by the

Hazardous Substance Response Fund due to response activities up to a maximum of 3 times the amount of these costs.

Penalties from failure to notify appropriate government agencies of a spill or discharge, destruction of records, and false information were amended in 1986 to be punishable by imprisonment up to a maximum of 3 years (up to 5 years for a second or subsequent violation). Civil penalties were amended to include a class I penalty with a maximum of $25,000 per violation, a class I penalty with a maximum of $25,000 per day for each day the violation continues, and a judicial assessment for the purpose of assessment and collection of a penalty of a maximum of $25,000 per day for each day the violation (or failure or refusal) continues (a maximum of $75,000 per day for a second or subsequent violation).

Oil Spills

The OPA of 1990 (P.L. 101-380) was enacted in direct response to several oil spills that occurred in 1989 and 1990 (the *Exxon Valdez* spill being the largest), signed into law by President Bush (33 U.S.C. 2701). It defined the extent of liability of oil spills and discharges into or upon U.S. navigable waters, the territorial seas (i.e., to include ocean waters measured from the point of mean low water up to 3 nautical miles) and adjacent shorelines, and the exclusive economic zone (i.e., including ocean waters from territorial seas up to 200 nautical miles) (DOC, 1996; Kenefick, 1997; 33 U.S.C. 2701, Sect. 1002). OPA was designed to cover oil not already designated as a hazardous substance, which CERCLA covers, and applies to oil spills and discharges after August 18, 1990; prior to this date CWA applied. Similar to CERCLA it required the development and promulgation of specific procedures by NOAA, the responsible federal agency, to use to assess natural resource damages attributable to oil spills. These procedures were published in 1996 (DOC, 1996; 15 C.F.R. 990) and have been the source of much controversy.

In general, OPA provided for the liability for removal costs and damages resulting from an oil spill or discharge for responsible parties (owner-operators) (33 U.S.C. 2701, Sect. 1002). This liability is now treated as the sum of response costs incurred (i.e., removal costs), compensable value, and the reasonable costs of assessment. Limits on liability were also stipulated in OPA. The total of the liability of a responsible party is set at a maximum for a tank vessel of $1200 per gross ton *or* for a vessel greater than 3,000 gross tons $10 million *or* for a vessel smaller than 3,000 gross tons $2 million, whichever is greater. For any other vessel maximum liability is set at the greater of $600 per gross ton or $500,000. For an offshore facility total liability is set at the sum of $75 million plus all removal costs, and for onshore facilities and deepwater ports maximum liability is not to exceed $350 million (33 U.S.C. 2701, Sect. 1004). The exceptions to this liability limit are: (1) if it can be shown that the spill was the result of willful gross negligence *or* willful misconduct *or* the violation of applicable federal safety, construction, or operations regulation; (2) if the responsible party fails or refuses (a) to report the spill incident where the responsible party knows or has reason to know of the incident, (b) to provide all reasonable cooperation and assistance requested pertaining to removal, or (c) does not comply with an order under other federal statues (CWA as amended by OPA, Intervention on the High Seas Act); and (3) for spills from Outer Continental Shelf facilities or vessels carrying oil as cargo from such facilities. In these cases the above liability limits do not apply and the full costs of recovery and damage can be sought.

Toxic Substances

The TASCA of 1976 (P.L. 94-469) was specifically designed to address the manufacture, processing, distribution, use, and disposal of manufactured chemicals (Brown and Johnson, 1997; Shapiro, 1990; 15 U.S.C. 2601). It is not a "cradle-to-grave" law (i.e., it does not cover substances from manufacture to disposal), it is designed to force the chemical industry to inform the EPA of what it is manufacturing. If a substance (i.e., individual chemical or mixture of chemicals) is potentially harmful to human health or the environment (i.e., poses a risk to human health or to the environment), the EPA must conduct studies and review industry studies to determine if the specific substance poses unacceptable risk. If so, the substance may undergo a regulatory action. There are more than 60,000 chemicals presently on the TSCA inventory; a number that could exceed effective management. For example, data limitations and deficiencies were found to exist for substances on the TSCA inventory from a sample of toxicity data conducted by the National Academy of Sciences (NAS, 1984). However, progress has been made concerning specific chemical products and/or their variants such as asbestos, chlorofluorocarbon propellants, dioxin, hexavalent chromium, PCBs (banned by the TSCA when passed in 1976), certain metal-working fluids, lead-based paint, radon, and possibly formaldehyde (Brown and Johnston, 1997; Shapiro, 1990).

Solid and Hazardous Wastes Disposal

The RCRA (P.L. 94-580) was enacted to deal with the generation and eventual disposal of solid and hazardous wastes (Dower, 1990; 42 U.S.C. 6901). This legislation controls the handling and final deposition of solid and hazardous waste products in accepted or approved waste storage facilities. It was designed as a "cradle-to-grave" regulatory action for the generation, transport, treatment, storage, and disposal of hazardous wastes. It is meant to manage and control hazardous wastes once deposited at accepted sites. If hazardous substances infiltrate (immigrate) to waterways, it is a violation of RCRA, and that subsequent laws such as CERCLA and OPA may apply concerning discharges into such waterways.

Marine Plastics and Vessel Garbage

The Act to Prevent Pollution (APPS) from Ships (33 U.S.C. 1901 *et seq.*) was amended by the Marine Plastics Pollution Research and Control Act (MPPRCA) in 1987 (P.L. 100-220, 33 U.S.C. 1901 *et seq.*) and enforced by the U.S. Coast Guard. The MPPRCA was enacted to officially implement Annex V of the International Convention for the Prevention of Pollution from Ships (1973) and its 1978 Protocol, referred to as MARPOL 73/78 which the U.S. ratified in 1978 (NRC, 1995). These actions addressed the practice of throwing shipborne garbage and plastics overboard while at sea, and are meant to outright ban all overboard disposal of plastics, and limit other discharges of solid wastes based on the material and vessel's location and distance from shore (NRC 1995). Solid wastes or "trash" generated from normal vessel operations include the following: domestic garbage (galley [kitchen] waste and food packaging), operational wastes (old fishing gear, fish processing material, and items from vessel maintenance), and cargo-related garbage (packaging materials and dunnage [timber, pallets, packaging to protect cargo from damage]). Annex V of MARPOL and the MPPRCA prohibit disposal of all trash within 3 nautical miles of shore, from 3-12 nautical miles cargo-related wastes that float are prohibited from discharge as well as all other "trash" not ground to less than 1-inch. From 12 to 25 nautical miles cargo-related wastes the float are prohibited from

discharge, and beyond 25 nautical miles only plastic trash are prohibited from discharge.

Food and Drugs

Besides the EPA, the Food and Drug Administration (FDA) of the U.S. Department of Health and Human Services (DHHS) has regulatory responsibility over various hazardous substances that have been found in edible human food and in animal feed (DHHS, FDA 1992). In amounts above the action level that the FDA has established, the FDA has authority to take legal action to remove the products from the market (40 C.F.R. 180.34(f)). Even in cases where an action level has not been established, the FDA can still pursue legal action based on a minimal detectable level of the contaminant. For fish products the FDA has established action levels for the substances aldrin and dieldrin, chlordane (including its residue products), chlordecone (or its tradename Kepone), DDT, DDE, and TDE, endrin, heptachlor and heptachlor epoxide, mercury, mirex, and toxaphene (DHHS, FDA, 1992). For crabmeat products an FDA action level was established for chlordecone (Kepone). And for shellfish products, action levels have been established for chlordecone (Kepone), mercury, and paralytic shellfish toxin.

APPENDIX WQ.II –Definitions of Cruise Ship Discharges

Broadly speaking, cruise ships generate seven basic types of wastes or waste streams: black water, gray water, hazardous wastes, solid wastes, oily bilge water and oily sludge, ballast water, and incinerator wastes.1 Definitions of these wastes and descriptions of their associated environmental concerns tend to vary slightly, depending on the source. Therefore, for the purposes of this AP, the SBNMS will use the definitions and descriptions included in EPA's Cruise Ship White paper (2000) and the Bluewater Network's petition to the NMSP (2003).

1. *Black Water:* (sewage from toilets, urinals and medical facilities) A typical cruise ship generates as much as 210,000 gallons of black water during a one-week voyage. The black water aboard a ship is more concentrated than land-based sewage, and has the potential to contain harmful viruses or protozoa (fecal coliform is used as an indicator in water quality testing for the presence of human waste which can contain viruses or bacteria such as fecal coliform This type of discharge can be harmful to the health of both humans and marine environments. Black water can be treated or stored aboard ship with Marine Sanitation Devices (MSDs) although the chemicals (chlorine, ammonia, or formaldehyde) sometimes used to treat the sewage can be harmful to marine organisms. MSDs are U.S. Coast Guard certified; however, the standards for MSDs are considerably lower than those for municipal treatment sources.

Section 312 of the CWA requires MSDs on all vessels within 3 nautical miles of shore. It should be noted that untreated sewage is currently allowed to be discharged in waters that are beyond 3 miles from shore.

2. *Gray Water:* (wastewater from sinks, showers, galleys, and laundry) On average, cruise ships generate an estimated 1 million gallons of gray water per week. According to the Bluewater Network (2002 and 2004), gray water can harm the environment to an equal extent or significantly more than raw sewage. Currently, there are no federal regulations that prohibit the discharge of gray water in U.S. waters (with the exception of the Great Lakes and Alaska).

3. *Hazardous Waste:* (waste from photo processing labs, x-ray development fluid, dry-cleaning, print shop, fluorescent and mercury vapor lamp bulbs, batteries, paint, and maintenance chemicals) Hazardous wastes can present a serious threat to human health and the environment. Cruise ships maintain separate processors for hazardous and non-hazardous waste. Members of the International Council of Cruise Lines (ICCL) have agreed not to dispose of hazardous wastes into the marine environment.

4. *Solid Waste:* (waste from food, plastic, paper, wood, cardboard, cans, glass, etc.) Most countries do not dispose of plastics anywhere at sea; however, other garbage, such as paper and metal, can be disposed of beyond 25 nautical miles from shore, and garbage ground to pieces under an inch can be discharged beyond 3 nautical miles from shore. Food waste can be discharged beyond 12 nautical miles, and, if put through a grinder, beyond 3 nautical miles.

5. *Oily Bilge:* (waste oil from engine and machines that accumulates and mixes with water in the bilge) Cruise ships are estimated to generate up to 25,000 gallons of oily bilge on a one-week voyage. Oily bilge is processed through an oil-water separator (OWS) aboard the ship.

[1]The Ocean Conservancy, *Cruise Control, 2002, p.10*.

Separated oil can be reused, incinerated, or off-loaded in port. Disposal of oily bilge is addressed legally in several legislative documents: the Oil Pollution Act of 1990 (OPA 90) and Section 311 of the CWA, the MARPOL and the APPS. In general, oil waste is generated during normal ship operations or as a result of collisions, groundings, fueling spills, or bilge pumping. Since the early 1980s, studies have shown that oil, even in extremely small quantities and at low concentrations, can adversely affect many forms of marine life, from fish and sea birds to marine mammals and coral reefs.

Other waste streams of concern include the following:

6. *Ballast Water:* (water held in the ballast used to stabilize ships) Ballast water is one vector for the introduction of non-native species. Cruise ships do not often experience instability within port and are not likely to exchange ballast water there. However, they do frequently travel near to the coast and can be carrying hundreds of thousands of gallons of ballast water at a time. Some states require vessels involved in coastal trade to report and to conduct a ballast water exchange at least 50 miles offshore. Vessels are required to file a ballast water management report 24 hours prior to discharging ballast in state waters.

7. *Air Emissions*: (ship exhaust) Cruise ships contribute to the degradation of air quality at a local level, where the concentration of pollution and repeated visits to a given location may have detrimental effects on the environment. Cruise ships are estimated to produce the equivalent of exhaust from 12,000 automobiles daily.

In order to provide additional perspective on the constituents in cruise ship discharges and the daily or yearly production of those wastes, Table 1 below is provided to highlight the components of constituents that might otherwise be overlooked. For instance, in describing cruise ship discharges, wastes such as expired medicine may not normally come to mind. However, this may be an issue for the SBNMS if the concentrations of such wastes are significant enough to impact SBNMS resources. It should be noted that the cruise ship industry has established waste management practices to treat, dispose of, and recycle various wastes produced during daily operations, which, if properly and consistently employed, would limit such concerns.

TABLE 1 – Waste Production from/on Cruise Ships

Waste Stream	Amount Produced
Gray Water	Daily Production per ship Minimum 93,000 gallons Maximum 283,000 gallons Average 195,000 gallons
Black Water	Daily Production per ship Minimum 8.000 gallons Maximum 21,000 gallons Average 13,000 gallons
Bilge Water	Daily Production per ship Minimum 1,250 gallons Maximum 3,200 gallons Average 2,200 gallons
Paper and Plastic Materials	4 cubic meters are generated on each ship per day.
Food Waste	Almost 2 cubic meters of food waste are generated on each ship per day.
Glass Waste	875 pounds of crushed glass are landed for recycling on each ship per year.
<u>Hazardous Wastes</u>	
Batteries	10 pounds
Discarded and Expired Chemicals	247 pounds
Medical Waste	6 pounds
Rags/Debris/Fuel Filters	11 gallons
Fluorescent Lights	21 pounds
Explosives	Less than 1 pound
Dry Cleaning Waste	16 gallons
Photo Waste	323 gallons
Spent Paints and Thinners	30 gallons

Source: Royal Caribbean International & Celebrity Cruises Environmental Report, 2000

Summary: The actual impacts to the marine environment from cruise ship waste streams depends upon the specific characteristics of the discharge and the receiving waters. Very little is known about the impacts of or the cumulative effects of these discharges on the environment as they have yet to be studied.

APPENDIX WQ.III – Summary of Contaminants From Vessels, Current Regulations, and Options for Minimizing Environmental Impacts

Sewage – Black Water:
Produced from: vessel sewage and wastewater from medical facilities (note there are floating hospitals). It is more concentrated than land-based sources since it is diluted with less water (3 qts/flush vs. 3-5 gal/flush).

Includes: bacteria, viruses, nutrients, chemicals and deodorants (chlorine, ammonia, formaldehyde).

Production: typical cruise ship produces an est. 210,000 gal/week; no data on other vessels.

Regulations: Federal regulations under CWA classify sewage as a pollutant. Cruise ships are not subject to National Pollutant Discharge Elimination System (NPDES) permitting program, which require land-based facilities to obtain permits for discharges. Section 312 of CWA regulates blackwater from cruise ships where vessels are required to possess a U.S. Coast Guard certified marine sanitation device (MSD).

Specifics:
- requires the use of MSDs for all vessels within 3 miles of the coast.
- vessels over 65 feet must have a type II or type III MSD (type II = standard of 200 fecal coliform per per 100 ml of water, type III unit is to contain sewage until it can be disposed of [a holding tank]).
- CWA can be applied to any discharge beyond the 3-mile limit, but affects water within it.
- raw sewage can be legally discharged beyond 3 nautical miles.

Gray Water:
Produced from: wastewater from sinks, showers, laundry, and galleys.

Includes: suspended solids, oil, grease, ammonia, nitrogen, phosphates, copper, lead, mercury, nickel, silver, zinc, detergents, cleaners, other metals, pesticides, medical and dental waste.

Production: typical cruise ship produces an est. 1,000,000 gal/week; no data on other vessels.

Regulations: Federal regulations do not prohibit discharge in state or U.S. waters, except for the Great Lakes and state waters of Alaska.
Bilge Water:

Produced from: fuel, oil, and wastewater from engines and machinery that collects at the bottom *of a ships hull, from spills, leaks, routine operations, and condensation.*

Includes: fuel, oil, fresh and salt water, rags, cleaning agents, paint, metal shavings, and live organisms.

Production: typical cruise ship produces an est. 25,000 gal/week; up to 2 million gallons per day released in U.S. by all vessels.

Regulations: Section 311 of CWA states:

- discharge of oil content < 15 parts oil per one million parts water (ppm) <= 12 miles is prohibited,
- discharges with oil content > 100ppm > 12 miles is prohibited.
- Also discharge of oily waste is addressed under MARPOL, and under the Act to Prevent Pollution from Ships (APPS).

Ballast Water:

Produced from: fresh, brackish, and salt water from harbors and ports in estuarine and coastal areas and discharged at another location. This has led to introduction of invasive species.

Includes: thousands of species of marine organisms, larvae, fish eggs, microorganisms.

Production: typical cruise ship uses millions of gallons.

Regulations: No federal regulations. Ballast Water Management for Control of Nonindigenous Species Act in California requires vessels to exchange ballast water in waters beyond 200 nautical miles from land and at least 2000 meters deep, or to retain all ballast water, but until recently coastal traffic vessels (e.g. those within the Exclusive Economic Zone or 200 miles of the coast are exempt). Cruise vessels are exempt, however new regulations require vessels to exchange ballast before entering the EEZ and to report ballast treatment for coastal traffic vessels.

Hazardous Materials:

Produced from: by-products of dry cleaning and photo processing operations, paints and solvents, batteries, fluorescent light bulbs containing mercury, and print shop wastes (cruise ships) and metals, oil, solvents, and a variety of other materials from other vessels.

Includes: chemicals and dry cleaning agents, photo processing chemicals, paints and solvents, mercury, and inks and dyes from printing processes.

Production: typical cruise ship produces an est. 110 gal/week photo processing chemicals,5 gal/week of dry cleaning wastes, 10 gal/week of used paint; unknown amounts for other vessels.

Regulations: RCRA requires hazardous substances be offloaded to land-based treatment or disposal facilities for all cruise ships and other vessels that generate or transport such materials.

Solid Waste:

Produced from: normal operations.

Includes: food waste, cans, glass, wood, cardboard, paper, and plastic. Also ash of incinerated wastes is discharged at sea. Other waste is disposed on shore and/or recycled on shore.

Production: typical cruise ship produces an est. 8 tons/week; no data on other vessels.

Regulations: APPS and CWA. Marine Plastic Pollution and Control Act regulates the disposal of plastic and garbage.

Specifics:

- disposal of plastics is prohibited in any waters,
- floating dunnage and packing materials are prohibited in navigable water within 25 nautical miles from land,
- other garbage (paper, glass, rags, metal, and similar material) is prohibited within 12 nautical miles from shore (unless it is macerated, where it can be disposed of beyond land).

Fish Waste

Produced from: normal fishing boat operations and large shore-side facilities

Includes: fish parts, blood, gurry

Production: typical fishing boat operations produces xx gal/week; factory vessels produce xx gal/week; a proposed processing plants may discharge rates of up to xx gal/week.

Regulations: state regs on gurry disposal ??? prohibit wastes in certain areas ?????, no fed regs on fishing wastes

**Source: Above information draws heavily from MBNMS - Proposed Action Plans: Water Quality - Cruise Ship Discharges Action Plan.*

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