

1997
NEW YORK HARBOR
WATER QUALITY SURVEY



NEW YORK CITY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTEWATER POLLUTION CONTROL
MARINE SCIENCES SECTION



1997
NEW YORK HARBOR
WATER QUALITY
SURVEY



*The Harbor
Survey Vessel,
The Osprey*





August, 1998

The New York City Department of Environmental Protection (DEP) performs an intensive, annual survey of water quality in New York Harbor. The following is a copy of the **1997 New York Harbor Water Quality Survey**. This report includes summarized data and a discussion of our monitoring results in this, the 88th year of the program.

The purpose of the Harbor Survey Program is to assess the effectiveness of New York City's various water pollution control programs, and their combined impact on water quality. Tables, graphs, and figures in the report summarize New York Harbor water quality for the Summer of 1997, assess long term trends (some dating back to 1909), and provide data for computerized water quality models.

We are continuously striving to improve our performance and enhance the usefulness of this report. Consequently, your comments are encouraged. Questions or suggestions may be directed to Alan I. Stubin or Naji Yao of DEP's Marine Sciences Section at 212-860-9378. Your interest in the quality of New York City's waters is greatly appreciated.

Very truly yours,

A handwritten signature in black ink, appearing to read 'Joel A. Miele Sr.', written over a white background.

Joel A. Miele Sr., P.E.
Commissioner

PROGRAM OVERVIEW

The New York City Department of Environmental Protection (NYC DEP) monitors the waters surrounding New York City. These estuarine waters (composed of a mix of oceanographic and riverine sources) are collectively referred to as New York Harbor. NYC DEP's current monitoring program, **The New York Harbor Water Quality Survey** has developed from an effort begun by the Metropolitan Sewerage Commission in 1909, in response to public concerns about gross pollution in the Harbor. The monitoring program has continued to expand since the early 1900's when only twelve stations were used to record the impacts of sewage pollution. At present, NYC DEP monitors 53 stations throughout the Harbor, measuring over a dozen water quality parameters for both surface and bottom waters.

NYC DEP performed its **88th Water Quality Survey of New York Harbor in 1997**. The Harbor Survey, funded primarily by NYC DEP and performed by the DEP's Marine Sciences Section, monitors the quality of the Harbor waters and identifies the impacts of pollution control programs to these waters. This program provides the longest documented assessment of human impacts on the City's water environment. Through its sampling of a number of water quality and human-health related indicators, this survey: identifies changes in the environmental health and ecosystem quality of the New York Harbor; describes long-term water quality trends; and provides a unique data base for regional scientists, educators, and private citizens.

Based on these indicators and other performance measures, there is evidence that New York Harbor's environment is cleaner, and the water quality better, than they have been since the turn of the century. Through development and upgrades to NYC's sewage treatment system, as well as operational improvements implemented over the past 10 years, and a suite of aggressive and innovative pollution control programs, NYC DEP has:

- Virtually eliminated raw sewage discharges;
- Reduced illegal discharges by more than 70%;
- Increased wet-weather related floatables capture to almost 70%;
- Reduced toxic metals loading to the wastestream from industrial sources by over 90%.

...New York Harbor's environment is cleaner, and the water quality better, than they have been since the turn of the century.

Consequential to these actions there is strong evidence of improvements to New York Harbor water quality and ecosystem health. These range from the reestablishment of breeding populations of peregrine falcons and other waterfowl (including bald eagles) in several areas of the Harbor, to improved benthic communities in the lower New York Bay, and include:

- The opening of all NYC public beaches since 1992 and the lifting of wet-weather swimming advisories for all but three of these beaches;
- The upgrading of 68,000 acres of shellfish beds since 1985 and the removal of shellfishing restrictions for 30,000 acres off of the Rockaways and in Raritan Bay;
- Signs of the reestablishment of short-nose sturgeon;
- Decreases in chemical concentrations in fish tissues and a subsequent relaxing of state advisories on human consumption of striped bass in parts of the Hudson River;
- A 50-90% reduction from peak levels of priority pollutants in fine-grained sediment in the Hudson River.

This report provides information as to how well New York Harbor waters (spanning from the Westchester-Bronx border on the Hudson and in Western Long Island Sound, to the Kills around Staten Island, to the Sandy Hook-Rockaway transect) are meeting their state-designated use classifications, such as swimming and fishing. Benefits that have resulted due to improved Harbor water quality are also documented.

Coney Island Beach



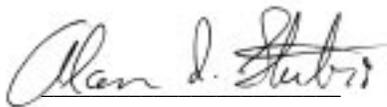
ACKNOWLEDGEMENTS

The 1997 Harbor Survey Program was made possible by the cooperative efforts of the New York City Department of Environmental Protection's Marine Sciences Section, Special Projects Laboratory, and the Marine Section. These sections are all within the Bureau of Wastewater Pollution Control. The continued development of the Harbor Survey program has been made possible by the dedication and professionalism of numerous staff from this Bureau.

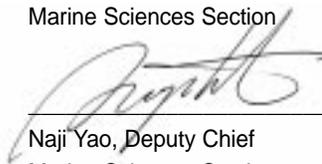
This effort was jointly produced by the staff of the Marine Sciences Section, including: Jordan Adelson, Bernadette Boniecki, Michael Cacioppo, Harold Coakley, Haymankumar Lochan, Raymond Negrón, Marie O'Shea, Andrew Owens, Beau Ranheim, Yin Ren, Cori Rizzo, Farzana Shaheed, Bessie Stantley, Alan Stubin, Naji Yao, Jiye Zhang and Captain of the HSV Osprey, Robert Smith.

This report benefited from the review of Robert Adamski, Phil Heckler, Robert Alpern, Mary Keating, Cathy DelliCarpini, Les Coleman, Robert LaGrotta, Arthur Ashendorff, Anne Seeley, Jerry Volgendi, Stella Rozelman, and the staff of the Marine Sciences Section. Laboratory analyses and data production were supervised by Trikam Patel and Patrick Jagessar, and performed by Lovely Chacko and Gilbert Roman. Microbiology was conducted by Lorraine Johnson, Maureen DeSouza, and Pari Malakkhani. Computer and database enhancements were made possible through the ongoing contributions of Phil Markowitz and Sarah Ho. Contractual assistance was provided by Fay Jacques and Jasen Tompkins. Design and publishing were overseen by Panero Design, Inc.

This report was written by:
The City of New York
Department of Environmental Protection
Bureau of Wastewater Pollution Control
Marine Sciences Section
April 10, 1998



Alan I. Stubin, Chief
Marine Sciences Section



Naji Yao, Deputy Chief
Marine Sciences Section

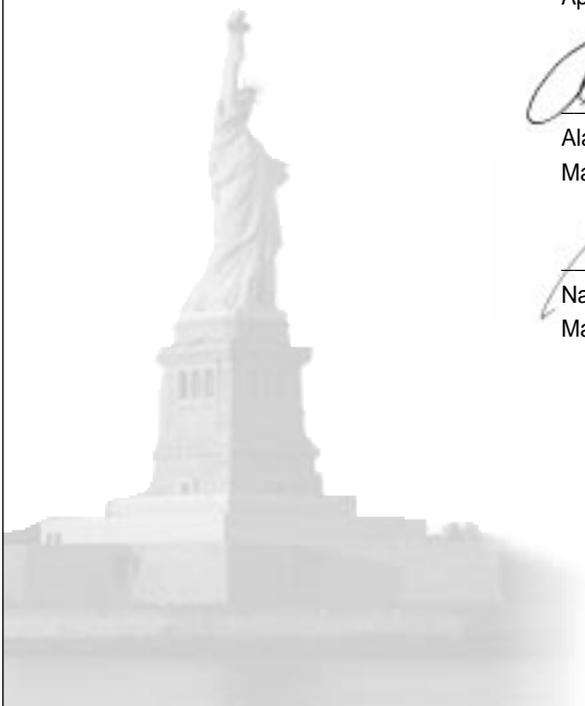


TABLE OF CONTENTS

PROGRAM OVERVIEWIV

ACKNOWLEDGEMENTSVI

SURVEY SYNOPSIS.....VIII

INTRODUCTION..... 1

 Factors Affecting Water Quality in New York Harbor2

 Regional Hydrodynamics2

 Regional Population Growth Since The 1800s2

 Physical Changes.....5

 Pollutant Sources6

 Pollutant Abatement and Water Quality in New York Harbor

 Historical Changes to Sewage Treatment.....11

 More Recent Changes to Sewage Treatment.....11

 Water Pollution Control Plant Construction11

 Shoreline Survey and Sentinel Monitoring.....12

 Reduced Raw Sewage Bypassing.....12

 Storm Water Program15

 Abatement of Combined Sewer Overflows.....15

 Industrial Pretreatment.....17

 Other Pollution Reduction Programs18

METHODS

 Sampling.19

 Fecal Coliform20

 Dissolved Oxygen21

 Nutrients21

 Chlorophyll 'a' and Plankton22

 Secchi Transparency.....23

 Temperature, Salinity, and Density23

 Additional Parameters.....23

 Statistical Analysis and Data Presentation24

 Quality Assurance / Quality Control.....24

RESULTS AND DISCUSSION

 Coliform Bacteria.....25

 Dissolved Oxygen33

 Nutrients40

 Chlorophyll 'a' and Phytoplankton.....46

 Secchi Transparency.....50

 Salinity, Temperature, and Density52

BENEFITS DUE TO IMPROVED WATER QUALITY

 Evidence of Recent Changes in Ecosystem Quality55

 Continuing Challenges56

 Conclusion.....57

REFERENCES59

SURVEY SYNOPSIS

NYC DEP monitors a number of common water quality indicators. These include human health indicators, such as sewage-related coliform bacteria; and environmental health indicators such as dissolved oxygen, nutrients, and chlorophyll 'a'. A summary of the summer (June through September) 1997 water quality conditions follows:

Fecal coliform bacteria, an indicator of raw or partially treated sewage, have exhibited significant long-term reductions throughout the Harbor since the early 1970s. This water quality improvement can be attributed to: continued water pollution control plant construction and upgrades throughout the Harbor area; the abatement of illegal discharges; reduced raw sewage bypassing due to improved surveillance and inspection of the sewer system; and increased capture of wet weather combined sewer overflows. In 1997, average conditions met swimmable standards at all but three locations in the Harbor.

Dissolved oxygen (DO), vital to most aquatic life, is considered low at levels less than (<) 5 mg/l and is lethal to many organisms at levels of <3 mg/l. Of 53 stations monitored over the summer, dissolved oxygen concentrations of <3.0 mg/l were recorded only a single time at four bottom stations in the Upper East River and Western Long Island Sound waters. Trend analysis reveals that DO concentrations have improved throughout the Harbor since 1968, with the exception of sites in Jamaica Bay and Western Long Island Sound. Although many sites violated standards at least once during the summer of 1997, DO compliance since 1992 remains high relative to pre-1992 results.

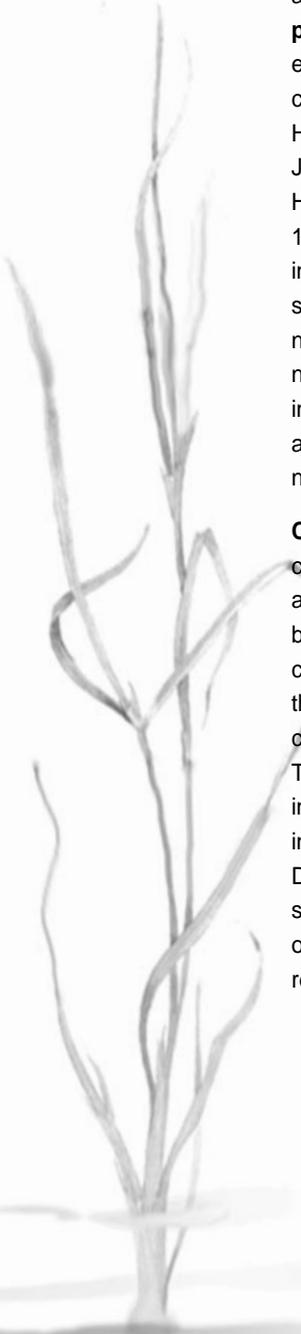
NYC DEP monitors a number of common water quality indicators.

Tanker awaits daybreak in Upper Bay





Nutrients, natural life-sustaining substances, are critical to maintaining an appropriate balance for the health and productivity of aquatic systems. High levels of nutrients or *eutrophication* is considered detrimental to aquatic habitats and diminishes the recreational value of these waters. **Nitrogen and phosphorus**, used as indicators of nutrient enrichment, continue to be found in high concentrations for most Harbor waters. Highest 1997 levels were observed in Jamaica Bay, the Kills, and the East and Harlem Rivers. Trend analyses of the past 13 years demonstrate little significant change in nutrient levels for most Harbor Survey stations. This is likely due to consistent nutrient discharges from both point and nonpoint sources. NYC DEP is currently involved in a regional effort to implement aggressive actions for reducing Harbor nutrient loadings over the next 15 years.



Chlorophyll 'a' is a plant pigment, the concentration of which in water is used as an estimate of productivity or phytoplankton biomass (see below). High chlorophyll 'a' concentrations, common to some areas of the Harbor, are typically associated with conditions symptomatic of eutrophication. Trend analysis reveals significant increases in chlorophyll 'a' since 1989, with strongest increases to have occurred in Jamaica Bay. Despite this long term trend, average 1997 summer concentrations (with the exception of Jamaica Bay) appear to have declined relative to 1995 conditions.

The presence of algae or **phytoplankton** are also indicative of water quality, with certain species and higher plankton concentrations evidence of eutrophic conditions. In the Harbor, high phytoplankton concentrations or *blooms* are most common in outlying areas (Western Long Island Sound and Lower NY Bay-Raritan Bay) and embayments (Flushing Bay and Jamaica Bay). Blooms are cyclic in their intensity and appear highest in early spring and late summer, with diatoms and green algae being pre-dominate in the Harbor.

A Secchi disk is used to estimate the transparency of surface waters. High **Secchi transparency** is indicative of clear water, while low Secchi readings are typically associated with light-limiting conditions and degraded waters. Secchi data from 1985-97 reveals a declining trend in transparency at most locations throughout the Harbor, with exceptions of the Kills. Decreases in Secchi transparency appear inversely related to increases in chlorophyll 'a'.

