2004 New York Harbor Water Quality

Regional Summary

INTRODUCTION

The City of New York has been collecting water quality data in New York Harbor since 1909. These data are utilized by regulators, scientists, educators and citizens to assess impacts, trends and improvements in the water quality of New York Harbor.

The Harbor Survey Program has been the responsibility of the New York City Department of Environmental Protection's (NYCDEP) Marine Sciences Section (MSS) for the past 20 years. This effort evolved from the initial surveys by the Metropolitan Sewerage Commission that began 96 years ago and encompassed 12 stations around Manhattan. These initial surveys were performed in response to public complaints about their quality of life near polluted waterways. The initial effort has grown into a Survey that consists of 51 stations; 34 stations located throughout the open waters of the Harbor, and upwards of 17 stations located in smaller tributaries within the City. The number of water quality parameters measured has also increased from five in 1909 to over 20 at present.

Harbor water quality has improved dramatically since the initial surveys. Infrastructure improvements and the capture and treatment of virtually all sewage that was dumped into the Harbor are the primary reasons for this improvement. During the last decade, water quality in NY harbor has improved to the point that the waters are now utilized for recreation and commerce throughout the year. These improvements in water quality have brought attention to areas within the harbor that remain impaired.

The NYCDEP's Long Term Control Program (LTCP) has begun to focus on those areas within the harbor that remain impacted. This project will look at 18 waterbodies and their drainage basins and will develop a comprehensive plan for each waterbody to attain its best use classification.

This years' report will focus on the water quality data collected by the NYCDEP during 2004. Data will be presented in four sections, each delineating a geographic region within the Harbor. Four water quality parameters will be used as indicators of water quality for this report. The four parameters are: fecal coliform bacteria, chlorophyll 'a', dissolved oxygen and Secchi transparency. These parameters and their relevance are explained in a subsequent synopsis.

The Harbor Survey program has modified its sampling program over the last several years. The number of open water stations sampled has been reduced from fifty-three to thirty-four. The statistics presented in this report reflect comparisons with only the current Harbor Survey stations.

This brief synopsis examines trends of four major indicators of environmental change in the Harbor Estuary. These four indicators are:

Fecal Coliform (FC) Bacteria – Fecal coliform concentrations are measured in NY Harbor as human-health related indicators of sewage-related pollution. Fecal coliform are a group of bacteria primarily found in human and animal intestines and are associated with sewage waste. These bacteria are widely used as indicator organisms to show the presence of such wastes in water and the possible presence of pathogenic (disease-producing) bacteria.

Chlorophyll 'a' – Chlorophyll 'a' is a plant pigment. The concentration of chlorophyll 'a' in water is used as an estimate of productivity or phytoplankton abundance.

Phytoplankton, minute free-floating aquatic plants, form the basis of the food web. Since these organisms respond quickly to environmental changes, their abundance may serve as a measure of water quality and an indicator of greater ecosystem change.

The Harbor Survey measures chlorophyll 'a' (as a surrogate for phytoplankton) to provide an assessment of ecosystem health. Levels above 20 µg/L are considered indicative of enriched or eutrophic conditions, indicating a decline in water quality.

Dissolved Oxygen (DO) – The levels of oxygen dissolved in the water column are critical for respiration of most aquatic life forms, including fish and invertebrates, such as crabs, clams, zooplankton, etc. Dissolved oxygen concentration is therefore one of the most universal indicators of overall water quality and a means of determining habitat and ecosystem conditions.

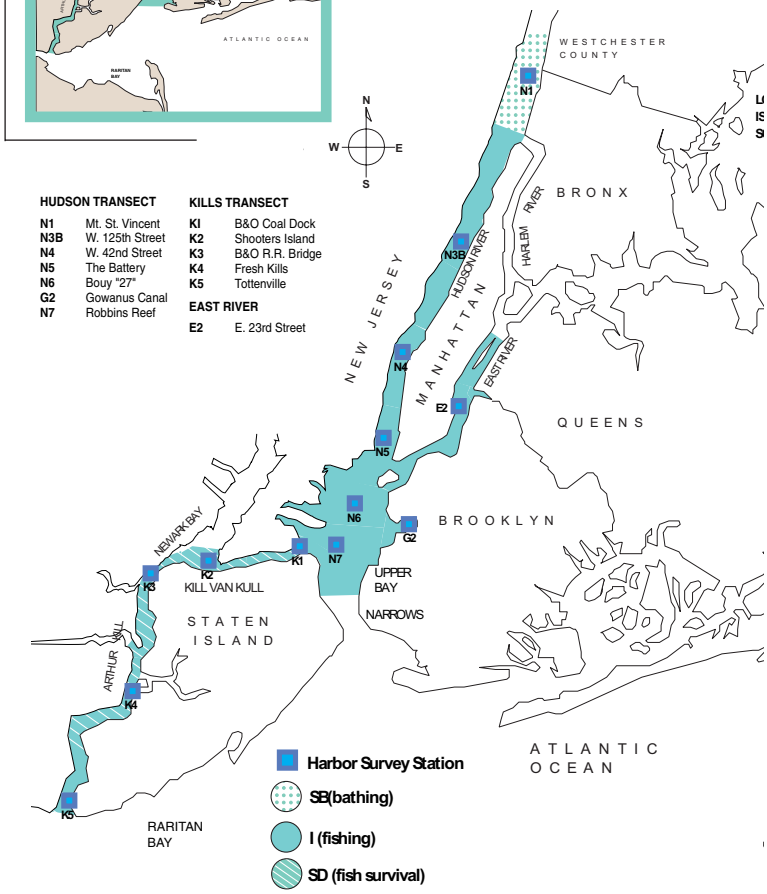
Secchi Transparency – A Secchi disk is used to estimate the clarity of surface waters. High Secchi transparency (greater than 5 feet) is indicative of clear water, with declines in transparency typically due to high suspended solid concentrations or plankton blooms. Low Secchi readings (less than 3 feet) are typically associated with degraded waters. These conditions are indicative of light limiting conditions, which in turn affect primary productivity and nutrient cycling.

Coliform and dissolved oxygen indicators are used in New York State Department of Environmental Conservation (NYS DEC) standards, to quantify ecosystem health or degradation. NYS DEC standards reflect a range of acceptable water quality conditions corresponding to the State-designated "best usage" of the water body. Common uses and NYS DEC standards for fecal coliform and dissolved oxygen are noted in the adjacent chart.

Common Water Use And NYS DEC Standards For Fresh And Saline Waters

Class	Best Usage of Waters	Fecal Coliform	Dissolved Oxygen (never-less-than)
SA	Shellfishing and all other recreational use.	No standard	5.0 mg/L
SB	Bathing and other recreational use	Monthly geometric mean less than or equal to 200 cells/100mL from 5 or more samples	5.0 mg/L
I	Fishing or boating	Monthly geometric mean less than or equal to 2,000 cells/100mL from 5 or more samples	4.0 mg/L
SD	Fish survival	No standard	3.0 mg/L

INNER HARBOR AREA



The Inner Harbor is defined as the area including: the Hudson River from the NYC- Westchester line, through the Battery to the Verrazano Narrows; the Lower East River to the Battery; and the Kill Van Kull-Arthur Kill system. This area contains 13 Harbor Survey monitoring stations that have been grouped together due to common water uses and functions, as well as similarities in point source loadings. Waters of the Inner Harbor are often continuous, through connecting branches or straits, and cover a large and diverse geographic expanse.

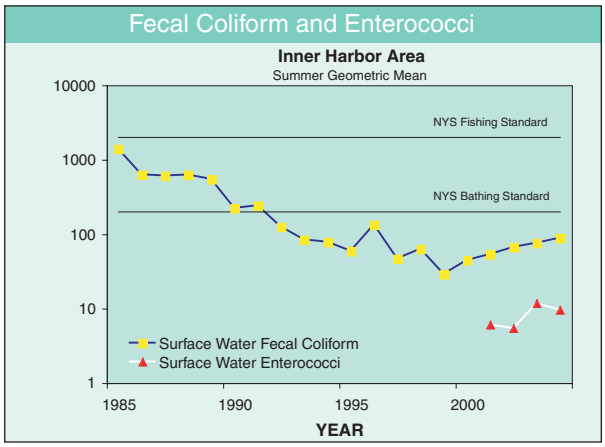
Most of the Inner Harbor Area, excluding the Kills, is classified by NYS DEC as I, for uses such as fishing or boating. Most area in the Kills is classified for fish survival only (SD), with the exception of the far southern reach of Arthur Kill which is designated as Calss I The Hudson River, from North of Spuyten Duyvil to Westchester County is designated for bathing (SB).

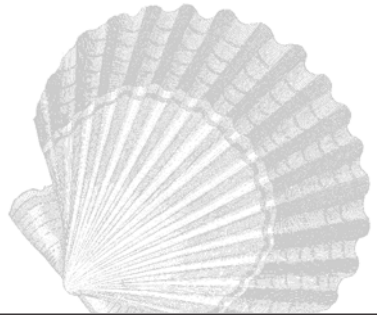
FECAL COLIFORM

All Inner Harbor stations complied with current fecal coliform (FC) standards for the water body they are located in. The 2004 regional summer geometric mean is 88cells/100mL, increased slightly from 76cells/100mL in 2003. Eight of the thirteen sites had geometric means below 100 cells/100ml, down from ten of thirteen sites in 2003. Past data has indicated that the Inner Harbor is prone to episodic degradation following rain events due to additional FC loadings from storm drains and combined sewer outflows (CSOs). One class SB station (N1) had counts exceeding the standard 200 cells/100ml on three occasions in 2004, up from one occasion in 2003. All other sites, which are designated class I, exceeded the standard of 2000 cells /100ml on nine occasions, up from one occasion in 2003.

TRENDS

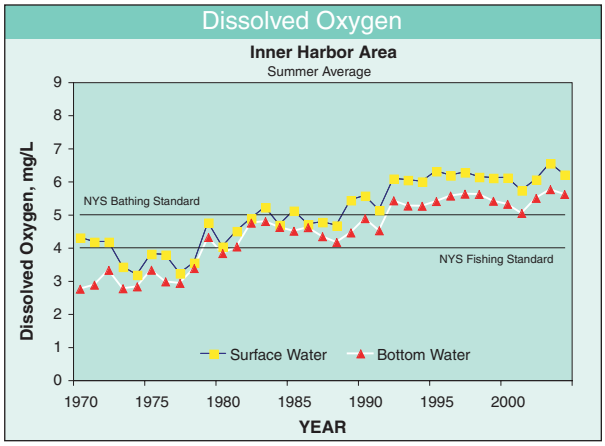
Fecal coliform levels in the Inner Harbor have dramatically declined over the last three decades. However, there has been a gradual increase over the last 5 years. The levels are still below the Bathing Standard but the trend is increasing. The FC levels averaged over 2000 cells/100ml in the early 70's and have declined to below 100 cell/100ml since early 1990. This improvement has allowed for the opening of Inner Harbor waters for most recreational activities. This improvement has been attributed to the cessation of raw sewage from New York City's Water Pollution Control Plants (WPCPs), the elimination of illegal discharges into the waterbody, and the reduction of CSOs. Year to year variations have become more apparent with the reduction of FC to levels below standards.





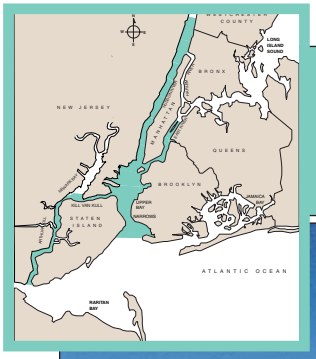
DISSOLVED OXYGEN

Dissolved oxygen (DO) values declined from 2003 values, although on average are still above standards. Summer DO values averaged 6.2mg/l for surface waters and 5.6mg/l for bottom waters, down from 2003 values of 6.5mg/l for surface waters and 5.8mg/l for bottom waters. Discrete DO measurements of surface waters failed to comply with NYSDEC standards 2.8% of the time, up from 2.1% of the time. Discrete DO measurements of bottom waters failed to comply with NYSDEC standards 8.0% of the time, up from 6.9% of the time.



TRENDS

Average summer DO values in the Inner Harbor have risen to levels above NYSDEC standards for primary contact recreation and commercial fisheries. Bottom water values have risen from approximately 3mg/l in 1970 to 5.6mg/l at present. The mitigation of impacts from the WPCPs and CSOs has shown that swings in DO may be due to the natural phenomenon such as weather.

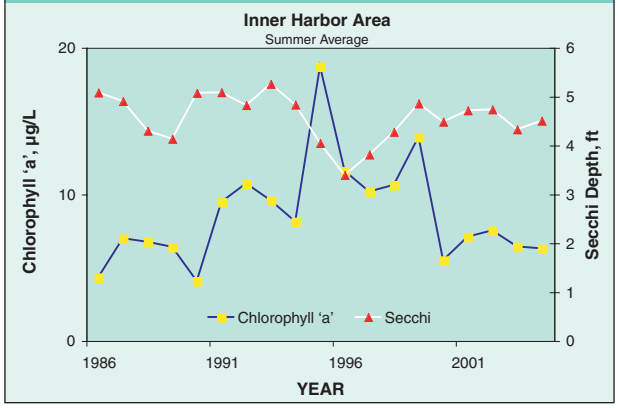


Inner Harbor Area

Chlorophyll 'a'

While water quality standards do not exist for chlorophyll 'a', concentrations in excess of 20ug/l are considered indicative of eutrophic conditions. All stations within the Inner Harbor area had average summer chlorophyll 'a' values below the 20ug/l level. Twelve of thirteen stations had summer values < 10ug/l (K5 averaged 15.5ug/l). These values are slightly better than in 2003, when eleven of thirteen stations had summer values < 10ug/l (in 2003 K5 averaged 14.8ug/l and N1 averaged 11.2ug/l). In 2004 only five discrete samples of 606 were > 20ug/l (0.8%), down from eleven discrete samples of 509 (2.2%) in 2003.

Chlorophyll 'a' and Secchi Transparency

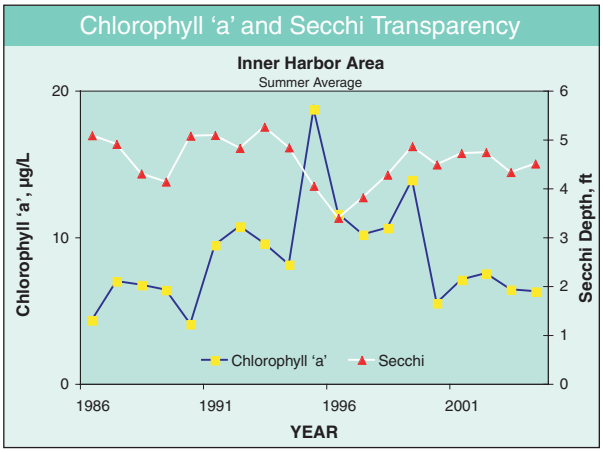


Trends

The Inner Harbor show the least inter-annual variability in chlorophyll a concentrations. Levels rarely vary more than a few percent most likely as a result of higher flushing rates from Hudson River flow. There seems to be a slight overall increase in chlorophyll a since 1985 when measurements began.

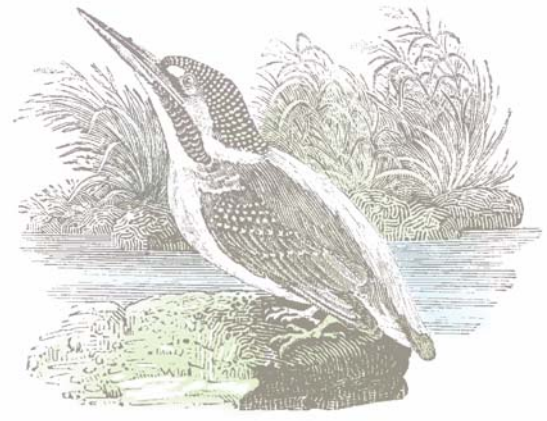
Secchi Transparency

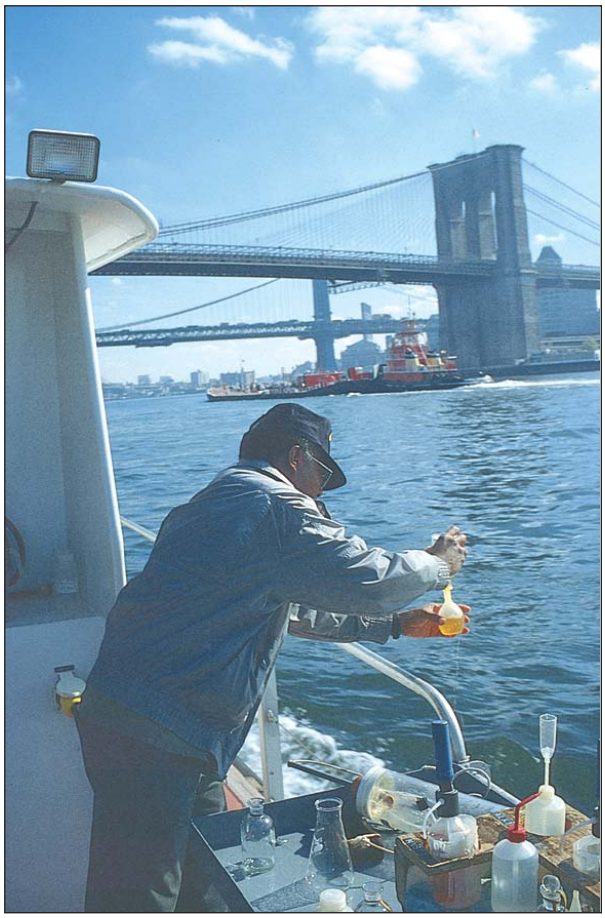
No water quality standards exist for secchi transparency. In general, high secchi numbers (depths of five feet or greater) are associated with clearer water, while low secchi numbers (depths of three feet or less) are indicative of turbid (or light limiting) conditions. Average secchi values were slightly greater in 2004 (4.32 feet in 2003 - 4.50 feet in 2004). These values are virtually identical to past years. Secchi values ranged from a low of 1.5 feet at K3 on one occasion, to a high of 9 feet at G2 and K5 on one occasion each.



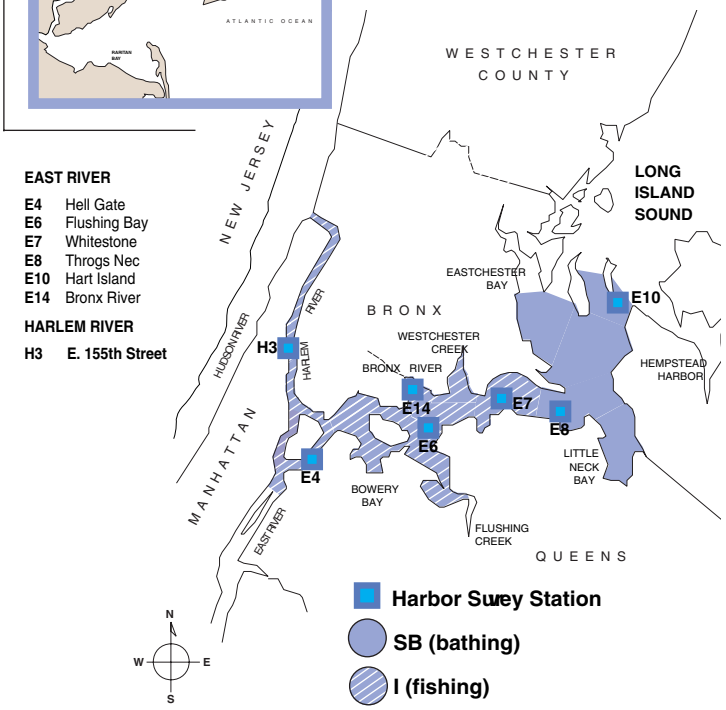
Trends

Secchi values have remained relatively constant in the Inner Harbor since measurements began in 1986, except around middle 1990s. There has been only a couple of percent variation over the last 18 years. This can most likely be attributed to the normal flow from the Hudson River.





Upper East River–Western Long Island Sound



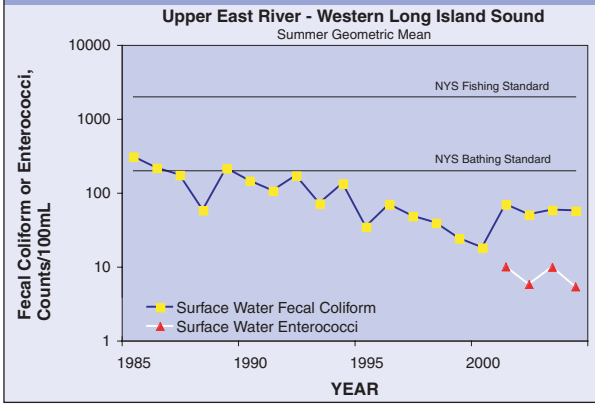
The Upper East River-Western Long Island Sound (UER-WLIS) represents the north-eastern portion of NY Harbor, from Hell Gate in the East River, up into the Western Long Island Sound (WLIS). ***The Harbor Survey Program*** *provides coverage of this area, including the Harlem River and the East River, from Roosevelt Island to Hart Island at the NYC- Westchester County boundary. This area contains 7 Harbor Survey monitoring stations. Waters of this vicinity, though divergent in salinity and depth, share similarities in pollutant loadings and are targeted for intensive management efforts as part of the* ***Long Island Sound National Estuary Program****.*

The majority of the Upper East River-Western Long Island Sound complex is classified as I, for uses such as fishing or boating, with the area east of the Bronx-Whitestone Bridge designated for bathing (SB).

Fecal Coliform

In 2004, sanitary water quality continued to be superior for this area. Fecal coliform (FC) concentrations for all monitoring sites were in compliance with their specified best use classifications for bathing and fishing. The regional summer geometric mean was 57 cells/100ml, slightly down from 59 cells/100ml from the previous year. Six of seven sites had means below 100 cells/100ml - up from five of seven sites in 2003. Class SB sites (E8 and E10) exceeded 200 cells/100ml on only six occasions (up from four occasions in 2003). Class I sites (E4, E6, E7, E14, and H3) exceeded 2000 cells /100ml on only three occasions (up from zero occasions in 2003). Change in summer geometric mean since 2003 was very similar for most sites. Average counts at E14 increased significantly, while counts at H3 decreased significantly.

Fecal Coliform and Enterococci



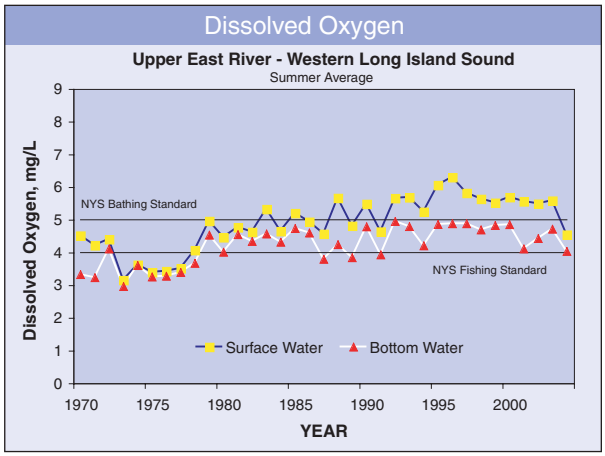
TRENDS

Fecal coliform concentrations have shown a downward trend for more than twenty years in the Upper East River-Western Long Island Sound (UER-WLIS) region. This improvement, measuring about two orders of magnitude, indicates FC concentrations met standards suitable for bathing 90% of the time over the past 15 years The ongoing upgrade of wastewater treatment facilities and improved control of flow regulators and combined sewer overflow events have had, and will continue to have, a major impact on the reduction of fecal coliform loads.

DISSOLVED OXYGEN

Average summer DO values for the Upper East River and Western Long Island Sound vicinity met and exceeded 4mg/l (conditions suitable for fishing) in surface waters at all but one site (E6). However, the DO values in bottom waters at four of seven sites failed to exceed this value. In addition, average values at the two stations designated as SB were below the acceptable 5mg/l standard for bathing use for both surface (E8) and bottom (E8 and E10) waters. The UER-WLIS were problem areas during summer 2004. Although long-term trends remain positive, average DO levels were significantly lower in 2004 than in recent years. 2004 DO levels in the UER-WLIS show high numbers of non-compliance incidents with NYSDEC standards. Discrete DO measurements of surface and bottom waters failed to comply with the standards 42% from 13% in 2003.and 50% from 33% in 2003, respectively.

2004 DO levels in the Upper East River and Western Long Island Sound are the lowest throughout the harbor. Summer DO averaged 4.5mg/l and 4.0mg/l for surface and bottom waters down from 5.6mg/l and 4.7mg/l in 2003. Summer bottom minimum DO levels decreased in the UER-WLIS in 2004 compared with average minimum DO over the ten year period from 1994 - 2003. Incidents of hypoxia (DO <3.0mg/L) were measured in surface and bottom waters at all stations from July 12th through September 13th. Minimum DO levels were recorded on August 23rd marking the extent of hypoxia events. The frequency and extent of hypoxia events are significantly worse traveling northeasterly from the East River into the Western Long Island Sound (from E4 to E6 & E14 to E7 to E8 to E10). Furthermore, it is suggested that the spatial extent of hypoxia (DO<3.0mg/L) has become worse in recent years; more hypoxia events are recorded over a wider regional area in 2004 compared with the past 10 years.



TRENDS

Since 1970, trend analysis for the UER-WLIS area shows an increase in DO of about 1.5 mg/L for surface waters and 2mg/L for bottom water, but dropped 1mg/L from both depths in 2004. Most notable, are improvements in bottom waters that have risen from well below fishable (4 mg/L) to close to bathing standards (5 mg/L). Trends however also demonstrate high DO variability, with an increasing gap between surface and bottom water improvements since the mid-1980s (This suggests the formation of two separate water masses or pronounced stratification).

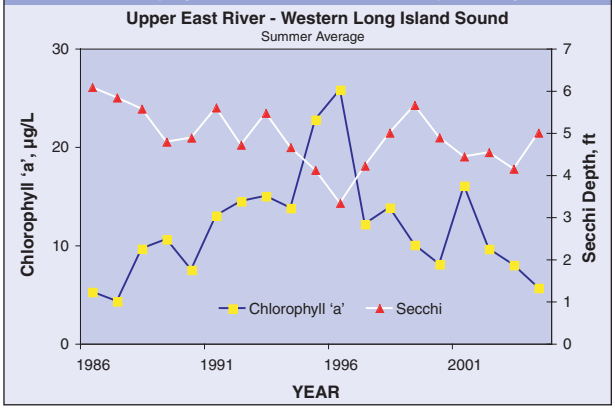
In the WLIS in particular, conditions symptomatic of eutrophic waters have been observed since the late 1980s. These conditions include extremely high surface water DO (often associated with algae blooms) and sporadic, but extremely low, bottom DO. This decline in water quality is being addressed by the *Long Island Sound Study*.

Upper East River–Western Long Island Sound

Chlorophyll 'a'

Chlorophyll 'a' concentrations for the Upper East River - Western Long Island Sound were slightly better than the previous year, with an average summer concentration of 5.66ug/l, down from 7.98ug/l. All stations had average summer values < 20ug/l. Six of seven stations had summer values < 10ug/l (E10 averaged 13.0ug/l) - slightly better than 2003 (in 2003, five of seven stations had summer values < 10ug/l (E8 averaged 11.1ug/l and E10 averaged 19.6ug/l). Average region-wide chlorophyll values have decreased for the past three years. In 2004 only four discrete samples out of 119 were > 20ug/l (3.4%) - down from eight discrete samples out of 106 (7.5%) in 2003.

Chlorophyll 'a' and Secchi Transparency



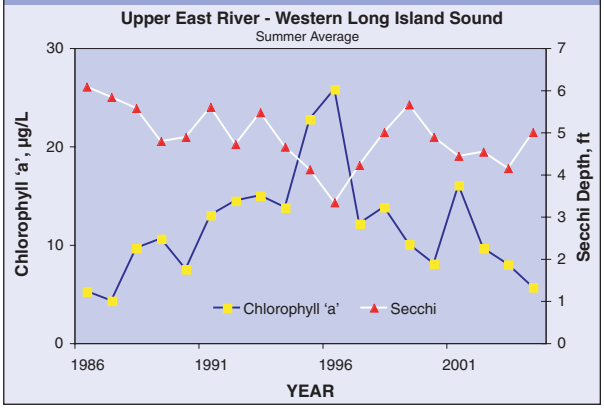
Trends

Until experiencing a sharp decrease of almost 13 µg/L in 1997, chlorophyll 'a' in the UER-WLIS showed a fairly consistent rate of increase, close to 5 µg/L every three years. Since 1997, values have been decreased stable with exception of year 2001. Current chlorophyll 'a' levels demonstrate group values to be well below 20 µg/L and within pre-1990 levels.

Secchi Transparency

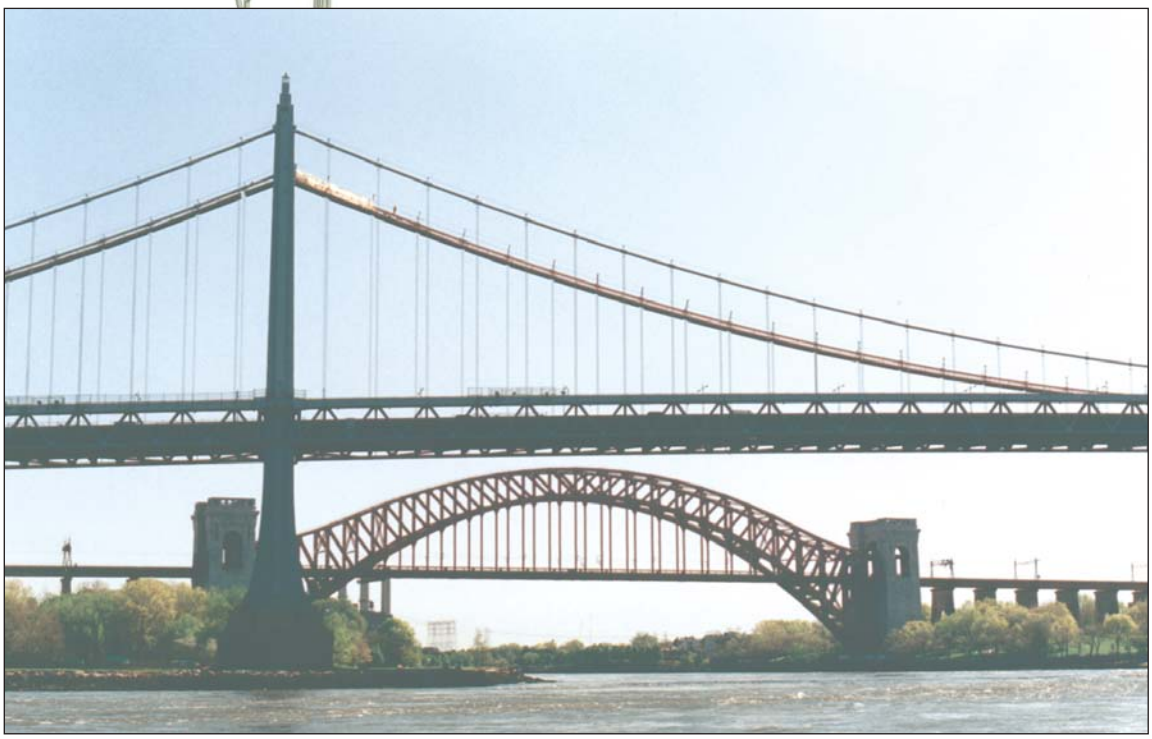
Average secchi transparencies for six out of seven sites were greater than 5 feet. The remaining station, H3, had average values of 3.2 feet. Average secchi values were slightly greater in 2004 (5.21 ft.) than in 2003 (4.14 ft.). Increasing secchi transparencies correspond to improving water clarity, coinciding with improving (decreasing) chlorophyll a concentrations. Secchi values ranged from a low of 1.5 ft at H3 on several occasions, to a high of 9 feet at E7 on several occasions.

Chlorophyll 'a' and Secchi Transparency



Trends

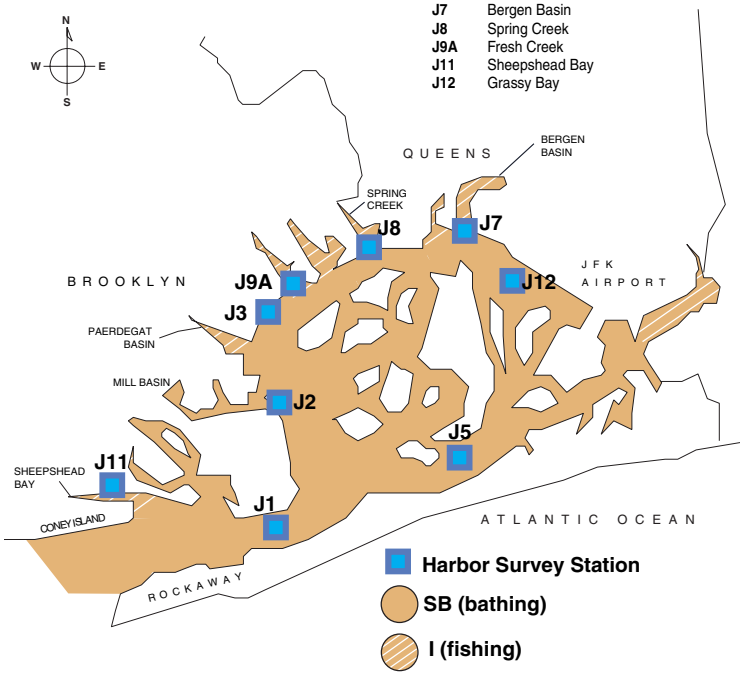
For UER-WLIS stations as a group secchi transparency has varied between about 4 and 6 feet since 1985. The transparency once dropped to 3.3ft in 1996 but climbed back after that. Improved transparencies may coincide with a significant decrease in Chlorophyll 'a' since1996 for the same waters



JAMAICA BAY

JAMAICA BAY

J1	Rockaway Inlet
J2	Mill Basin
J3	Canarsie Pier
J5	Railroad Trestle
J7	Bergen Basin
J8	Spring Creek
J9A	Fresh Creek
J11	Sheepshead Bay
J12	Grassy Bay



Jamaica Bay is located at the southwestern end of Long Island. This urban, estuarine embayment and national park consists primarily of tidal wetlands, upland areas, and open waters. The Bay and its drainage area are almost entirely within the boroughs of Brooklyn and Queens, except for a small area at the eastern end that is in Nassau County. Jamaica Bay joins the New York Harbor to the west, via the Rockaway Inlet at the tip of Breezy Point and includes the Rockaway Peninsula which forms the southern limit of the Bay and separates it from the Atlantic Ocean. This estuarine water body, consisting of approximately 20 square miles of open water, is covered by 9 Harbor Survey monitoring stations.

Open waters of Jamaica Bay are classified for bathing or other recreational use (SB). Areas within the Bay's tributaries and dead-end canals are prone to reduced water quality due to direct surface runoff and poor flushing. These areas are designated for secondary contact use (I), such as fishing or boating.

FECAL COLIFORM

In 2004, sanitary water quality was superior for Jamaica Bay. Summer fecal coliform (FC) concentrations were well below 200cells/100mL (SB) standards for all stations.

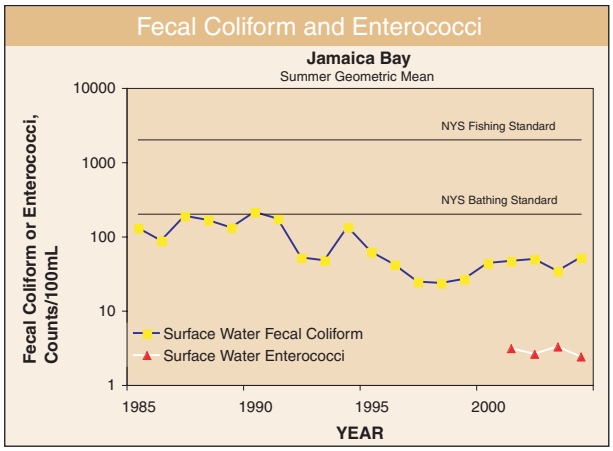
Four of nine sites had geometric means below 50 cells/100mL. Two stations' geometric means were less than 20 cells/100mL (an order of magnitude below State Standards).

Under wet weather conditions, the Bay experiences localized degradation. At these times, spikes in FC may temporarily exceed the SB standard of 200cells/100mL for the entire northern portion of the Bay (from Mill Basin to Bergen Basin). This decrease in water quality is limited to the Bay proper, as Lower NY Bay waters (immediately outside of the mouth of Jamaica Bay) are not typically affected by wet weather events.

Trends

Mean FC levels in Jamaica Bay as a whole have been at or below 200 cells/100mL State Standards for bathing over the past 20 years. FC levels peaked at 200 in 1990, reached at low of 23 in 1998, and have since increased to 51 cells/100mL.

The DEP continues to improve sewage system operations. Design and construction of CSO storage tanks continue in several JB tributaries. Additionally, DEP skimmer vessels work to control floatable debris in Jamaica Bay as part of the "Boom and Skim" program.

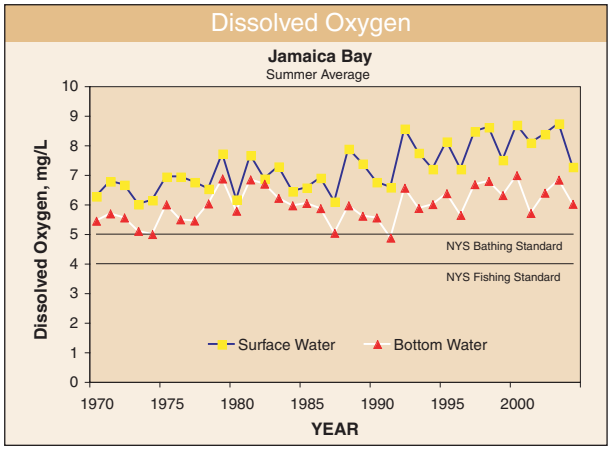


Dissolved Oxygen

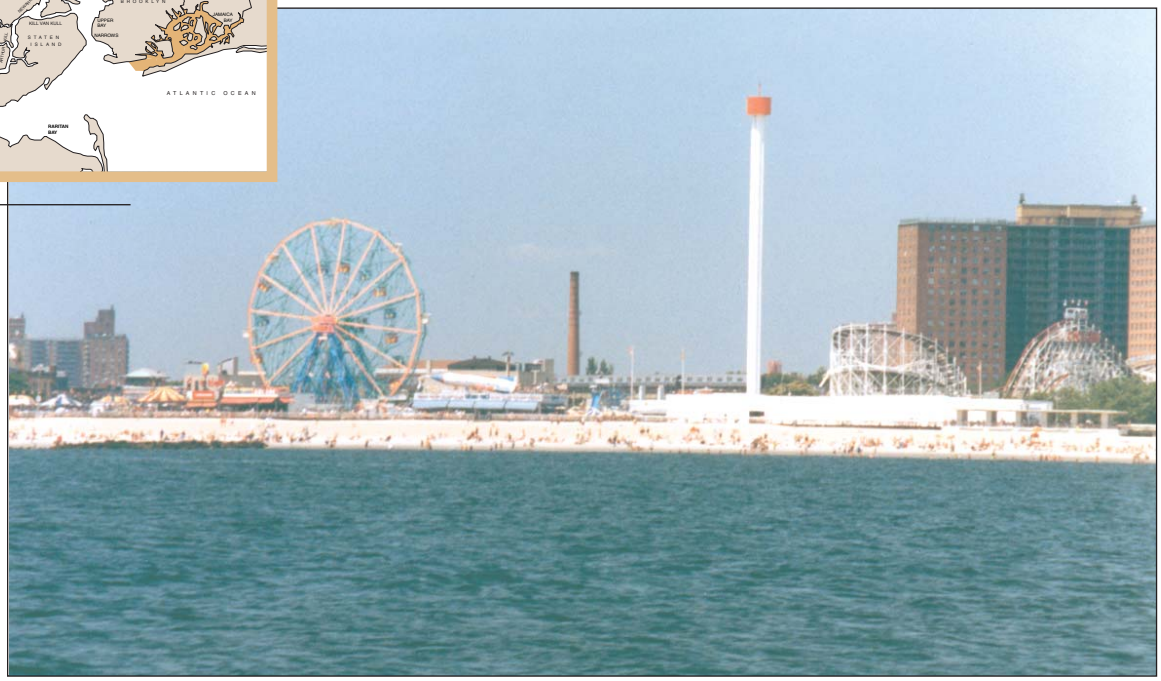
The 2004 summer averages for dissolved oxygen (DO) for surface and bottom waters surpassed the New York State standard of 5mg/L for bathing (SB) at all 9 Jamaica Bay sites. Individual measurements failed to comply with the applicable standard 21 times of 288 measurements. Several hypoxia events (DO <3.0mg/L) were recorded at northeastern most stations J7 (Bergen Basin) and J12 (Grassy Bay).

Trends

Average DO levels were well above 5.0mg/L bathing standards as early as 1970. DO variability is high within and between years and the gap between surface and bottom waters is increasing since the mid 1980s. High surface DO levels are often due to super-saturated conditions attributable to algae blooms and eutrophic waters.



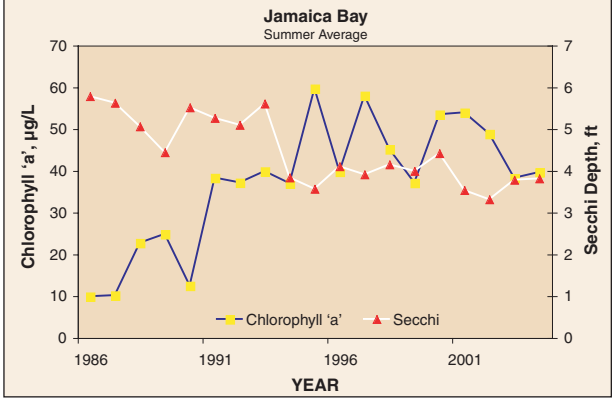
JAMAICA BAY



CHLOROPHYLL 'a'

High chlorophyll 'a' concentrations in Jamaica Bay are indicative of eutrophic conditions. The slow turnover of water within the Bay allows for development of large standing phytoplankton populations. Of the four geographic Harbor Survey regions, Jamaica Bay continues to display the widest range of individual chlorophyll 'a' measurements. Values ranged from a high of 171 at station J8 (Spring Creek) to a low of 1.4ug/L at station J1 (Rockaway Inlet). All nine stations have summer averages above 20ug/L. On average, chlorophyll 'a' concentrations for the Bay measured 39.6ug/L. This is consistent with recent years, but well above levels tell-tale of enriched or eutrophic waters.

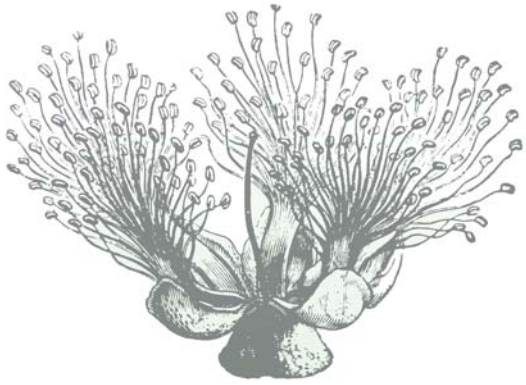
Chlorophyll 'a' and Secchi Transparency



Trends

Chlorophyll 'a' concentrations in Jamaica Bay have increased over the past 18 years. Yearly summer averages peaked in 1995 at 58.7 ug/L. Average concentrations over the past 5 years range between 37 and 54 ug/L.

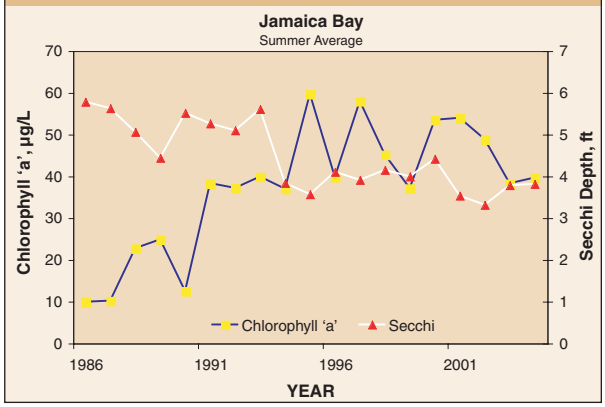
These conditions have coincided with prolonged algae blooms in Jamaica Bay and reports of nuisance algae in the tributaries and canals.



Secchi Transparency

Secchi transparencies range from 2.0 to 9.5 feet. One station at Rockaway Inlet had average readings above 5 feet (depths associated with cleaner waters). This location is outside the Bay proper and experiences greater water exchange than sites within the Bay. Average Secchi values for interior Bay survey sites ranged from 3.3 to 4.5 feet.

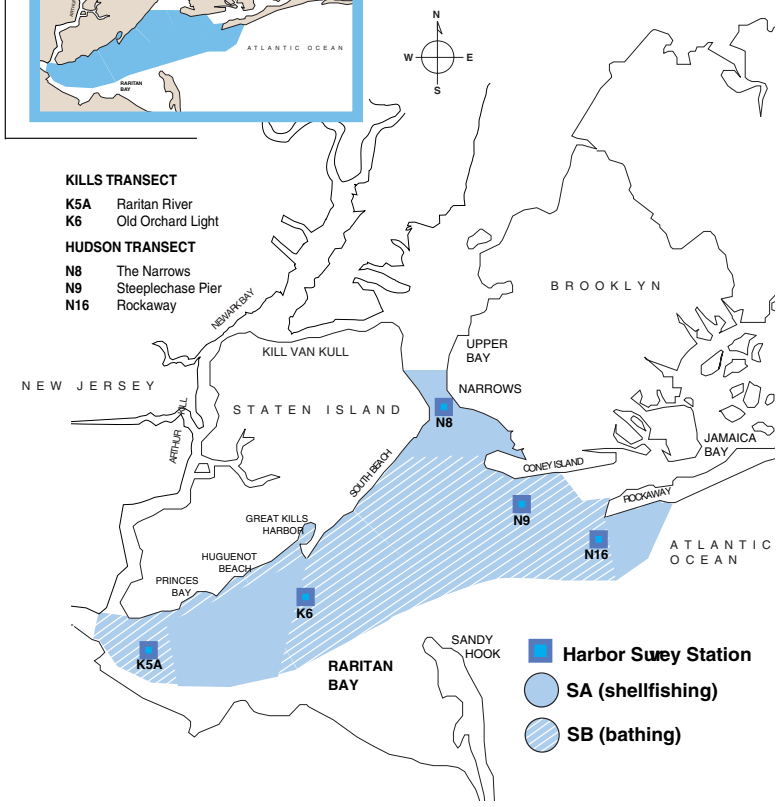
Chlorophyll 'a' and Secchi Transparency



Trends

Secchi transparency depth decreases as chlorophyll levels increase. Secchi average depths greater than 5.0 were typical before 1993. Average depths between 3.5 and 4.0 are typical after 1993. No change was observed between 2003 and 2004 secchi depths.

Lower New York Bay–Raritan Bay



*The Lower NY Bay-Raritan Bay (LNYB-RB) vicinity represents the most oceanic portion of the **Harbor Survey Program**. This area of 100 square miles is represented by 5 Harbor Survey monitoring stations and is composed mostly of open shallow waters, partially confined by Brooklyn's Coney Island to the north, Staten Island to the northwest, and New Jersey's Middlesex and Monmouth Counties and Sandy Hook to the south. The remainder of its eastern boundary is open to Rockaway Inlet and the greater Atlantic Ocean.*

This area of the Harbor is classified for bathing and other recreational use (SB). Portions of those waters are also designated for the permitted use of shellfishing (for relay to cleaner waters, but not direct consumption), having a stricter use classification of SA.

Fecal Coliform

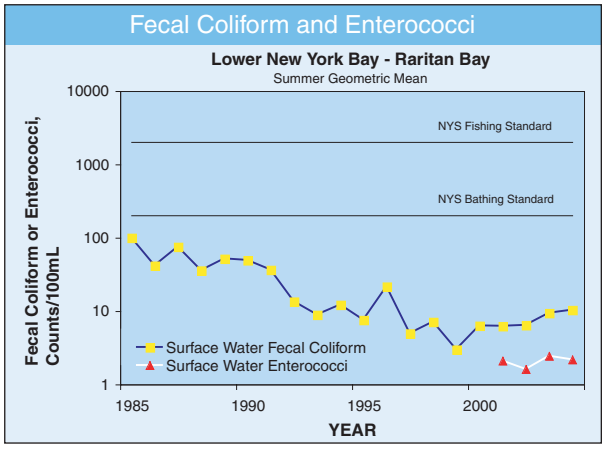
In 2004, Sanitary water quality as estimated by fecal coliform (FC) was superior for the Lower New York Bay - Raritan Bay (LNYB-RB) compared to other waterbodies.

Summer average FC numbers show waters of the LNYB-RB meet and surpass NYS standards for this area. All 5 stations had geomeans less than 50 cells/100mL.

TRENDS

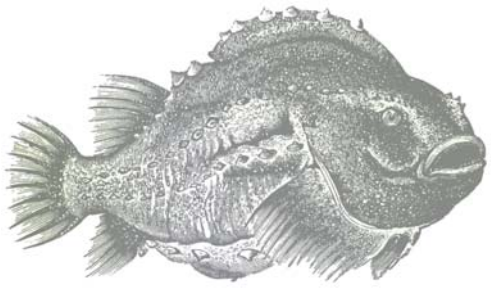
Coliform concentrations for LNYB-RB show significant declines (more than an order of magnitude) from the mid 1980s to the present time. While FC concentrations for surface waters were always below 200cells/100mL, recent average FC levels in 1999 were 3 cells/100mL. Levels have increased to 10 cells/100mL since 1999.

These improvements have allowed for the opening of all NYC public beaches since 1992 and the lifting of wet weather swimming advisories.



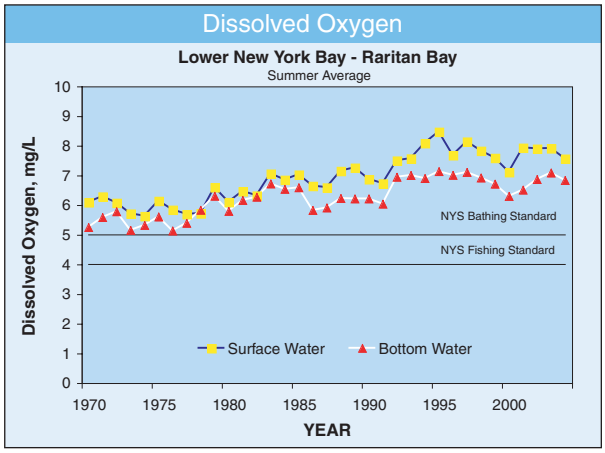
DISSOLVED OXYGEN

Dissolved oxygen (DO) values for top and bottom waters show good compliance with the NYS DO standard of 5mg/L. Average DO values failed to comply with state standards at a single station (K5A). Actual DO values were found to be below 5mg/L 6 times out of 74 measurements and minimum DO values were never below 4.0mg/L. This is true despite K5A proximity to more degraded waters in the Arthur Kill, Narrows, and mouth of Jamaica Bay.



TRENDS

Since 1970, average DO concentrations have increased over 15mg/L from 6.1 to 7.6 mg/L for surface waters, and from 5.2 to 6.8mg/L for bottom waters. Most of the improvement in the LNYB-RB area is attributable to improved water quality at station K5A. This improvement reflects loading decreases in sanitary waste into Arthur Kill and the Raritan River.



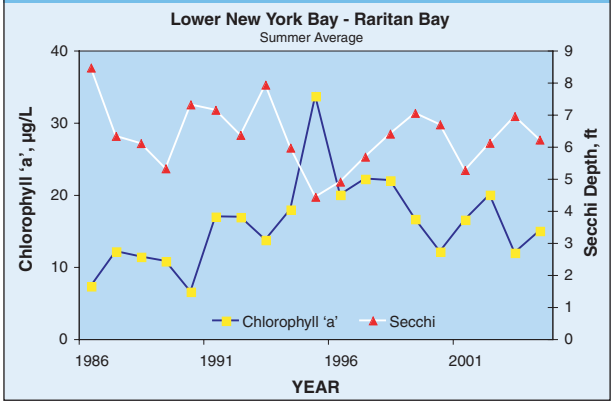
[8] ***USEPA recommended CSO controls*** *- a set of management actions issued in 1996 by the US Environmental Protection Agency for the purpose of mitigating CSO impacts. These actions are collectively referred to as 'The Nine Minimum Controls' (see full Harbor Survey Report).*

Lower New York Bay–Raritan Bay

Chlorophyll 'a'

The 3 LNYB-RB stations paralleling the Staten Island beaches into Raritan Bay, had average chlorophyll concentrations above 20ug/L. Levels above 20ug/L indicate eutrophic conditions. Based on an increase of citizen complaints, phytoplankton blooms (algae slicks) appear to have become more common place to these waters in the past few years. This area of relatively shallow, slower moving water appears ideal for bloom formation, as nutrient rich Harbor waters empty into the Bay area. Slower moving waters allow for the condensing organic material and the growth of algae into tangible slicks, often visible from shore bathing areas. Contact with nutrient-rich oceanic waters only further serves to fuel additional phytoplankton growth until slicks are dispersed again or washed out of the Bay area. The two most eastern LNYB-RB stations had average concentrations closer to 10ug/L. This is likely due to better tidal flux - a more active exchange of Harbor and oceanic waters).

Chlorophyll 'a' and Secchi Transparency



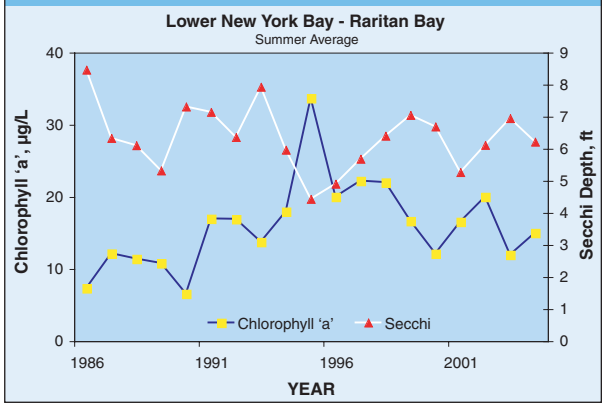
TRENDS

Average chlorophyll a concentrations for the LNYB-RB area remained at or below 15ug/L until 1991. From this time on, concentrations began to increase. Average levels exceeding 20ug/L were first measured in 1995. Chlorophyll a values range from 10 to 20 ug/L over the past 9 years. The average is 15.0ug/L in 2004.

SECCHI TRANSPARENCY

Average Secchi values for LNYB-RB stations were all above 5 feet. A high average value of 10 feet was recorded at Rockaway Point (station N16). This site, the most oceanic of the Harbor Survey's 53 monitoring stations, commonly experiences the widest range in Secchi values. In 2004, measurements at N16 ranged from 5.5 to 16 feet. Levels above 5 feet indicate clean conditions and superior water quality.

Chlorophyll 'a' and Secchi Transparency



TRENDS

While group average values for the LNYB-RB sites are typically 1 to 2 feet higher than those of Jamaica Bay, Secchi trends show similar patterns for both waterbodies.

Secchi transparency in LNYB-RB decreased from 1986-1989, increased in the early 1990s, then decreased again from a 1993 high of over 8 feet to a 1995 low of 4.4 feet. The average level is over 6 feet in 2004.

Harbor-Wide Improvements

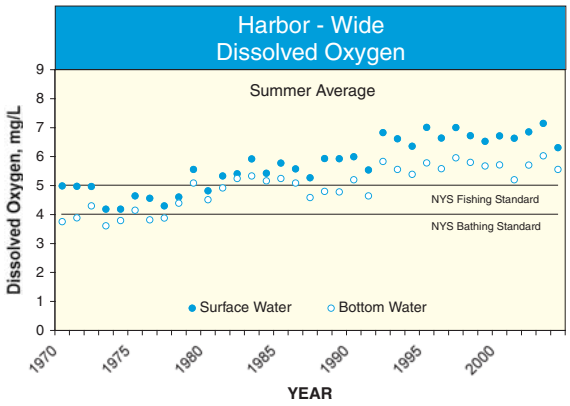
Harbor-wide, water quality trends are difficult to interpret for 2004. As discussed in the regional portion of this report many areas of the harbor show some decrease in water quality as measured by these indicators. The open waters of the Harbor have, over the last several years remained largely stable. The areas that have shown the most variability are the UER/LIS and Jamaica Bay.

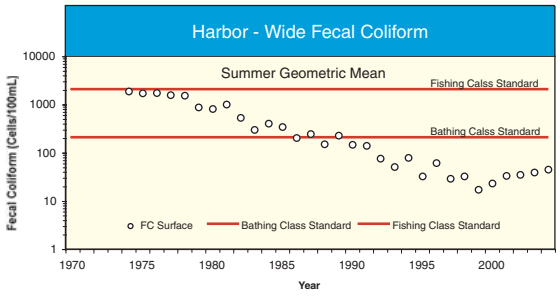
Dissolved oxygen, especially showed a significant decrease in these regions of the Harbor. This decrease ranged from two to twenty percent and was most evident in the Upper East River/Long Island Sound, and the bottom waters of Jamaica Bay. Average dissolved oxygen levels are still above standards but more individual samples exceeded regulatory limits in 2004.

Fecal coliform trends while showing a slight increase have for the most part remained stable for the past several seasons. The NYCDEP Harbor Survey Program began sampling Enterococcus in 2001. This additional effort was made to prepare for the change from fecal coliform to Enterococcus as an indicator of bacterial contamination. Currently we do not have enough data to confidently discuss any trends related to Enterococcus. We have presented the data in conjunction with the fecal coliform data for illustration purposes only.

Currently we are investigating possible links to weather as the trigger for the variability of water quality throughout New York Harbor. While we sampled fewer "wet" weather events in 2004 than the previous year, the events we sampled may have been greater in magnitude and caused a temporary degradation in water quality during our sampling period. Several years of correlating weather and sampling will be necessary to determine if there is a direct link.

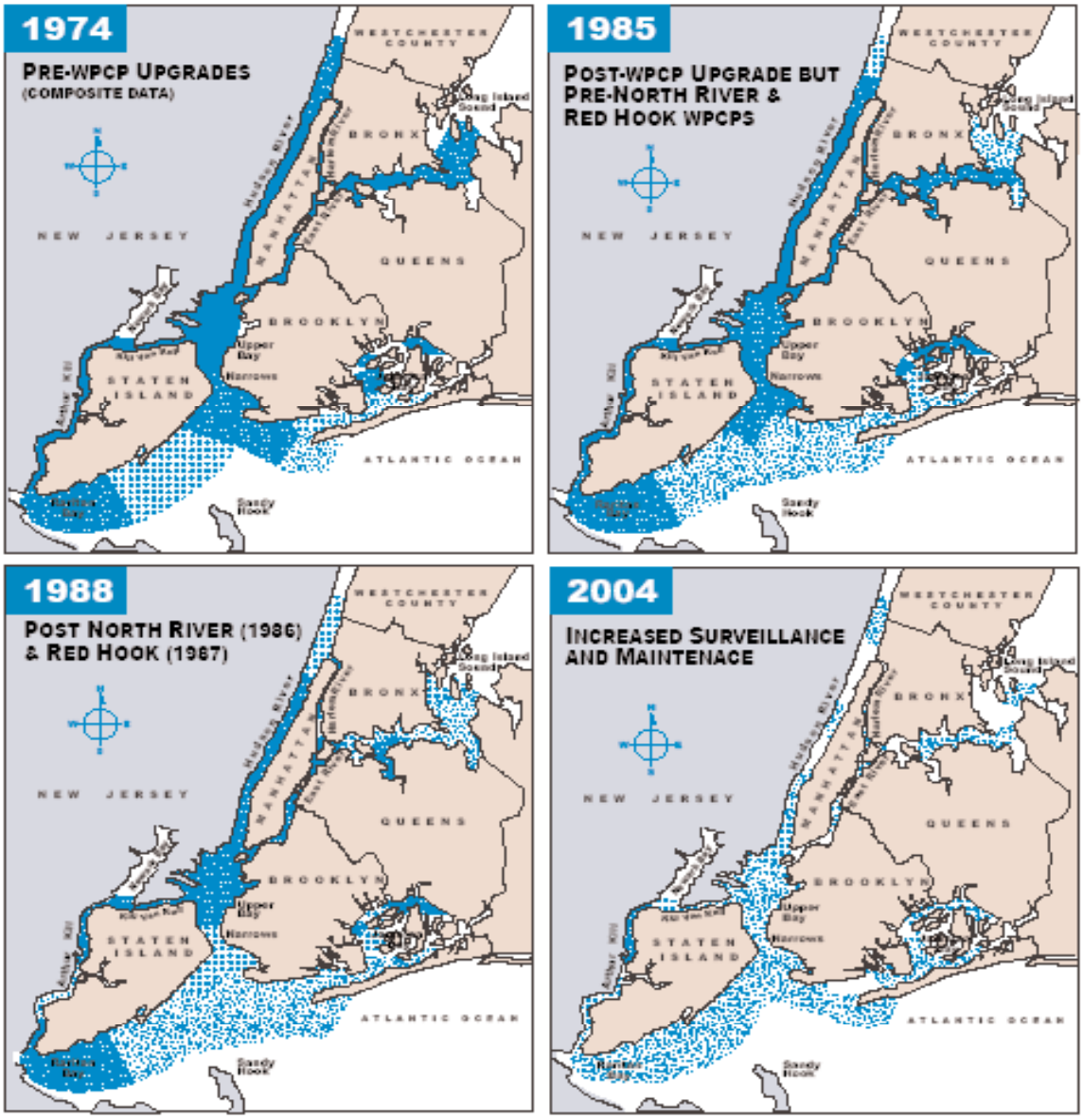
Water quality throughout the open waters of New York Harbor still meets standards a vast majority of the time.





Harbor-Wide Water Quality Improvements Over Four Time Periods

SUMMER GEOMETRIC MEAN FOR FECAL COLIFORM IN SURFACE WATERS



NYC DOH requirements preclude bathing near sewer outfalls and where rainfall may substantially increase coliform levels.

NYS Best-Use Classifications: ≤ 200 FC/100mL=SB (Bathing); ≤ 2000 FC/100mL=I (Fishing)
Poor does not meet fishing standards; *Superior* does not imply shellfishing quality

Acknowledgements

The 2004 Harbor Survey Program was made possible by the cooperative efforts of the Marine Sciences Section, the Special Projects Laboratory, and the Marine Section of the New York City Department of Environmental Protection's 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.

The responsible personnel for the Harbor Survey from Marine Sciences Section included: Section Chief Beau Ranheim, Markus Koelbl, William Lopez, Dan Marcktell, Andrew Owens, Yin Ren, Naji Yao, and Carrie Munill.

Marine Section personnel involved with the Harbor Survey include:

The Special Project Laboratory is supervised by Trikan Patel and Patrick Jagessaar, with analysis performed by: Lovely Chacko, Liji Isaac, Anna Chemyak, Osafo Barker, and Nicole Pinede.

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This Summary was revised by Naji Yao, Dan Marcktell, Carrie Munill, Yin Ren, and Beau Ranheim.

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