The Impact of NYC Aquatic Species on Biodiversity and How they are Affected by Decreasing Dissolved Oxygen Over Time

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Introduction

New York City possesses a variety of wetland ecosystems such as ponds, rivers, bays, and harbors. Parks with these habitats contain a variety of aquatic species but how do they contribute to the biodiversity and health of urban ecosystems?

Studies have also shown that urban byproducts and waste can be toxic and detrimental to the health of a variety of aquatic organisms.

Methods

- We conducted a secondary data analysis of dissolved oxygen levels in NYC bodies of water over a period of time.
- Lower rates of dissolved oxygen indicates an increase in water pollution.
- Conducted a secondary analysis of population rates of various Hudson river fish species to detect any decreases or fluctuation that could be correlated to an increase in water toxicity/pollution.

Contributions to Biodiversity

Mallards
- Improve wetland diversity via plant dispersal
- Travel from pond to pond and excrete plants, stems, and roots which introduce new species and increase the diversity of local wetland habitats

Blue Dashers
- Important for their hunting of mosquitos and their role as prey to birds and fish
- Referred to as bioindicators because they rely on stable oxygen levels and clean water to survive

The Pumpkinseed Fish
- Act as a vital link in its ecosystem food chain
- Prey to many birds and larger fish species and impacts the population of insects through consumption

Bluegill fish
- Impact the population of invertebrate species in their ecosystem such as snails, shrimp, worms, and aquatic insects through consumption
- Key prey species for larger predator fish.

Amphibians
- One of the most vital food sources in wetlands as they are prey for many aquatic species, mammals, insects and birds
- They help maintain ecological diversity and balance in their habitats

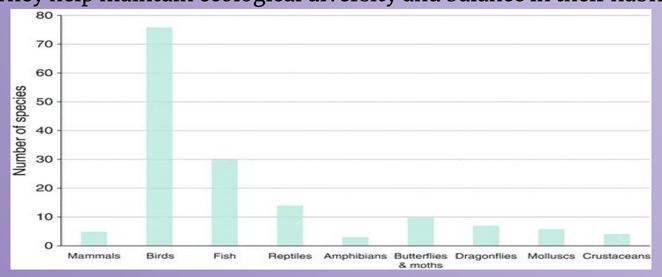


Figure 1: 140 formally designated rare species in NYC in their various taxa. Designations include: Federal or State listed Endangered, Threatened, Special Concern, or Species of Greatest Conservation (Prepared by and published with kind permission of ©David Maddox 2013. All Rights Reserved)

Data

NYC River Water Pollution:

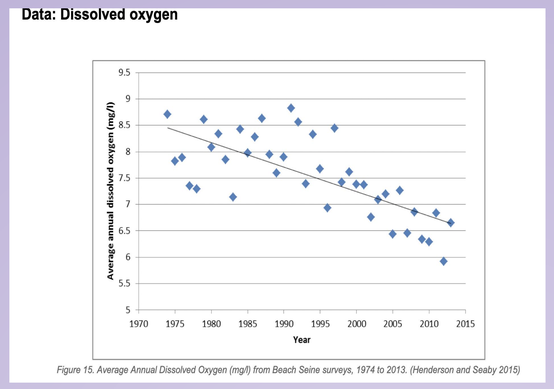
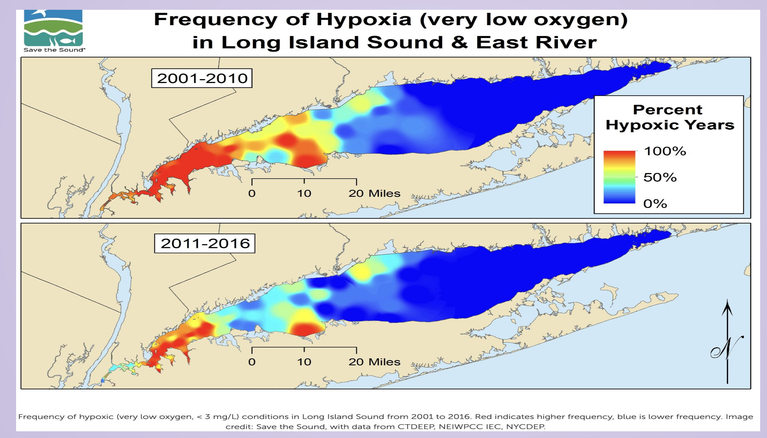


Figure 15. Average Annual Dissolved Oxygen (mg/l) from Beach Seine surveys, 1974 to 2013. (Henderson and Seaby 2015)

Figure 2: *Average Dissolved Oxygen (mg/l) from Beach Seine surveys, 1974 to 2013. (Henderson and Seaby 2015).*

Dissolved oxygen levels show decreasing trend in NYC rivers. DO is a primary criterion for water quality as per NYS law "DO levels less than 5mg/L are considered stressful for fish and levels less than 3mg/L are too low to support fish" (epa.gov).



Frequency of hypoxic (very low oxygen, < 3 mg/L) conditions in Long Island Sound from 2001 to 2016. Red indicates higher frequency, blue is lower frequency. Image credit: Save the Sound, with data from CTDEEP, NEIWPCC IEC, NYCDEP.

Figure 3: *Frequency of hypoxic (very low oxygen < 3 mg/L) Conditions in Long Island sound from 2001 to 2016. Red indicates higher frequency, blue is lower frequency. Image credit: Save the Sound, with data from CTDEEP, NEIWPCC IEC, NYCDEP.*

NYC River Species:

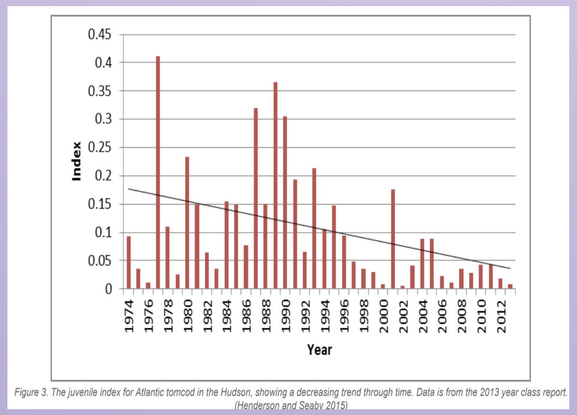


Figure 3. The juvenile index for Atlantic tomcod in the Hudson, showing a decreasing trend through time. Data is from the 2013 year class report. (Henderson and Seaby 2015)

Figure 4: *The Juvenile index for Atlantic tomcod in the Hudson showing a decreasing trend through time. Data is from 2013 class report (Henderson and Seaby 2015)*

The juvenile index for the Atlantic tomcod in the Hudson river demonstrates a significant decrease in population. Long term decline in the Tomcod is a result of exposure to PCBs. Although the tomcod population displayed year to year variation, overall it is in long-term decline.

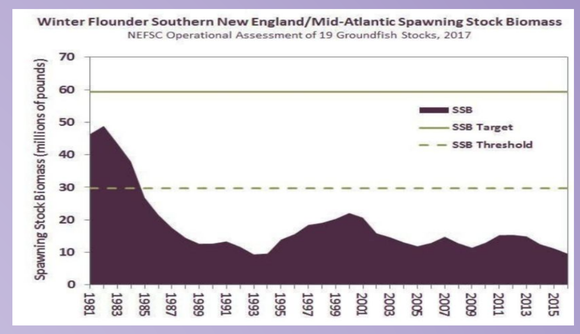


Figure 5 *the spawning stock biomass of winter flounder form the Southern New England/Mid-Atlantic stock of winter flounder shown well*

The population of the winter flounder fish has significantly decreased over time. The winter flounder fish is one of the most abundant types of demersal fish found in the Hudson estuary and the Long Island sound. They respond to thermal conditions of their environment and a decline in their population can be linked to pollution.

Analytic Conclusion

Decreasing or low levels of DO can be fatal and is caused by excess nutrients delivered to the water by human pollution.
- Dead zones are unable sustain populations of fish, amphibians, corals, and aquatic ecosystems (epa.gov)

Hypoxia happens near coastal areas associated with developed urban landscapes that dump nutrients into water bodies.
- Impoundments, municipal waste treatment plants, septic seepage, and failed package plants, as well as industrial point sources, are contributors to water pollution (epa.gov).

The data highlights a positive correlation between the decline in Hudson River aquatic species and the decrease in dissolved oxygen in Hudson River waters over time.
- The Hudson River has been polluted with carcinogens like PCBs from industries for decades which cause low hypoxia levels.
- It has edged the NYS criteria for safe DO levels for years

Population decrease threatens biodiversity
- Loss of biodiversity disrupts the food chain and decreases ecosystem productivity.
- Water pollution directly decreases the biodiversity of NYC ecosystems which is detrimental to overall health and stability of its services to the city.

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