Effects of covid-19 on air/water quality and wildlife

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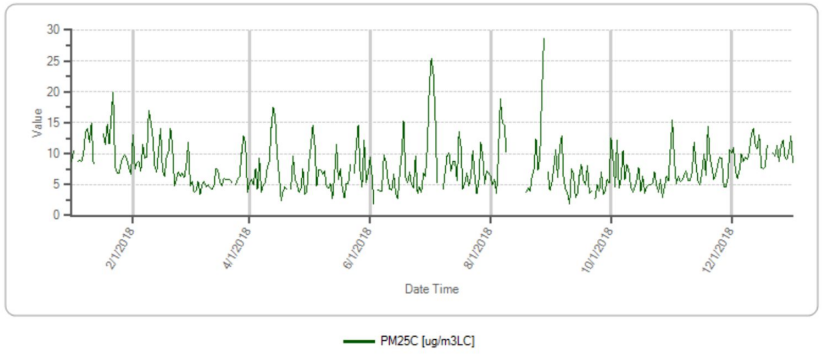
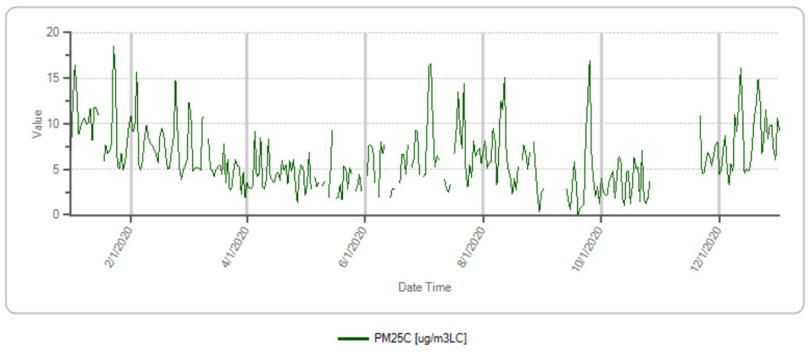
Air Quality

Before, During, and After Pandemic

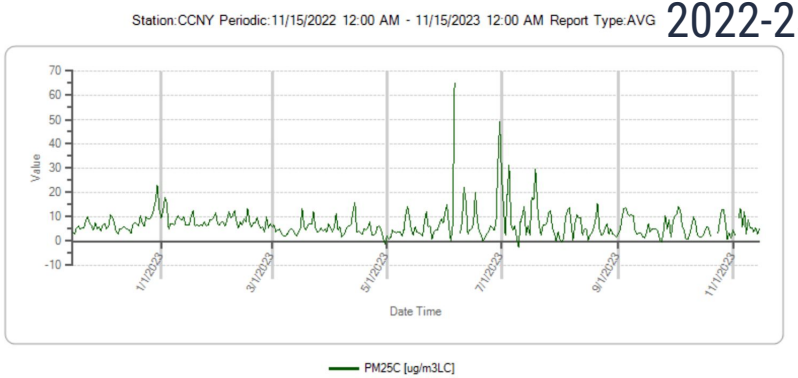
2018



2020



2022-23



-normal AQ<12.5
-PM2.5 means fine inhalable particles that are 2.5 um or less
-combustion sources like vehicles, diesel engines and industrial facilities
-pollen, smoke, road dust
-severe prolonged exposure affects lung and heart

epa.gov/indoor-air-quality

New York State . 2023. Nyaqinow.net. 2023. http://www.nyaqinow.net/.

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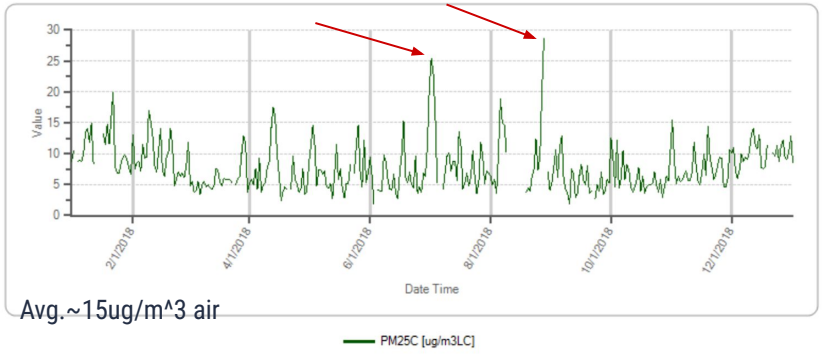
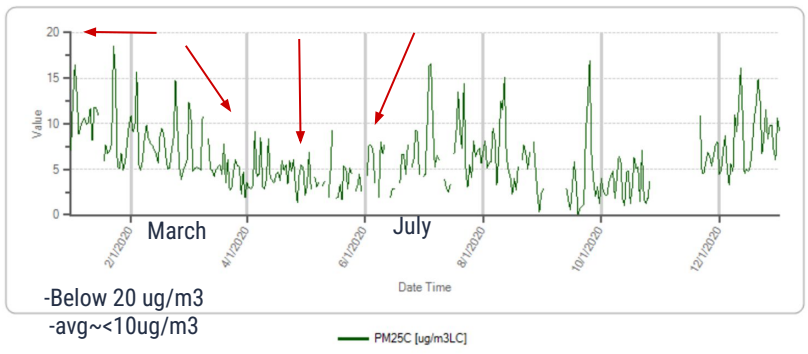


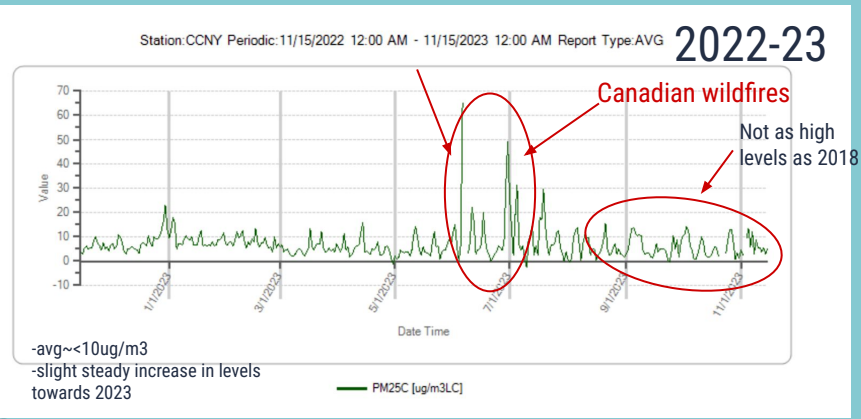
Avg.~15ug/m^3 air

2020



-Below 20 ug/m3
-avg~<10ug/m3

2022-23



-avg~<10ug/m3
-slight steady increase in levels towards 2023

New York State . 2023. Nyaqinow.net. 2023. http://www.nyaqinow.net/.

Water Quality in NYC

- *Human Mobility Shifts:* The COVID-19 pandemic led to significant shifts in human mobility, particularly in large metropolitan areas like New York City. Stay-at-home orders and other restrictions resulted in changes in commuting, tourism, and outward migration, potentially leading to decreased anthropogenic pressure on local environments**.**

Decreased Anthropogenic Pressure: The significant decreases in commuting, tourism, and outward migration resulted in reduced anthropogenic pressure on local environments. This reduction in human activity likely led to decreased industrial discharges and vehicular emissions, which could have positively impacted water quality.-The altered human mobility patterns during the pandemic may have contributed to these improvements. For instance, the reduction in human activities could have led to decreased nutrient loading and pollutant discharges into water bodies, resulting in improved water quality.

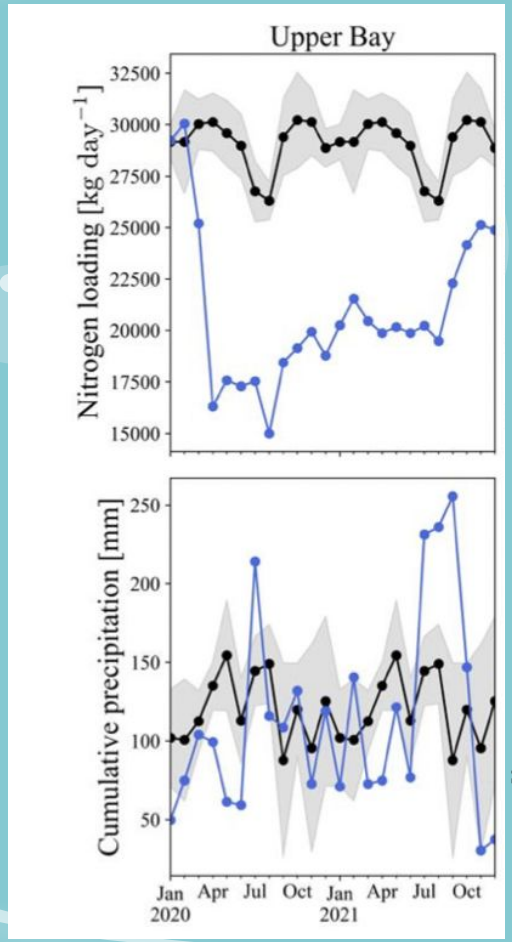
- *Wastewater Surveillance:* Wastewater data from New York City's surveillance network indicated high levels of virus detection, suggesting a potential increase in COVID-19 cases. Nearly all 14 wastewater treatment plants in the city were in the "high" detection level category, indicating likely 50 or more cases per 100,000 people**.**
- *Water Quality in New York Harbor:* Studies were conducted to assess the impact of the COVID-19 lockdown on water quality in New York Harbor. Remote sensing observations were used to assess water quality changes when field-based monitoring was hindered. The results showed that nitrogen loading into New York Harbor declined significantly in the spring of 2020 and remained below pre-pandemic values through 2021, leading to improved water clarity**.**

Indirect Effects: The pandemic's impact on sanitation, hygiene, and water consumption per capita could have indirect effects on water quality, potentially increasing wastewater production and disturbing water quality.

https://coronavirus.health.ny.gov/covid-19-wastewater-surveillance

Water Quality: NY Upper Bay

- Wastewater treatment facilities (WWTFs) showed nitrogen loadings significantly decreased in facilities serving west and lower Manhattan ,
  - contributed to a nearly 50% decrease in nitrogen loading from wastewater treatment in the Upper Bay region compared to baseline.
  - This led to improved water clarity, lower turbidity, and lower absorption coefficient of colored dissolved organic matter in the Upper Bay.
  - NY Upper Bay had a historic increase in water quality which was attributed to decreased anthropogenic pressure during lockdown

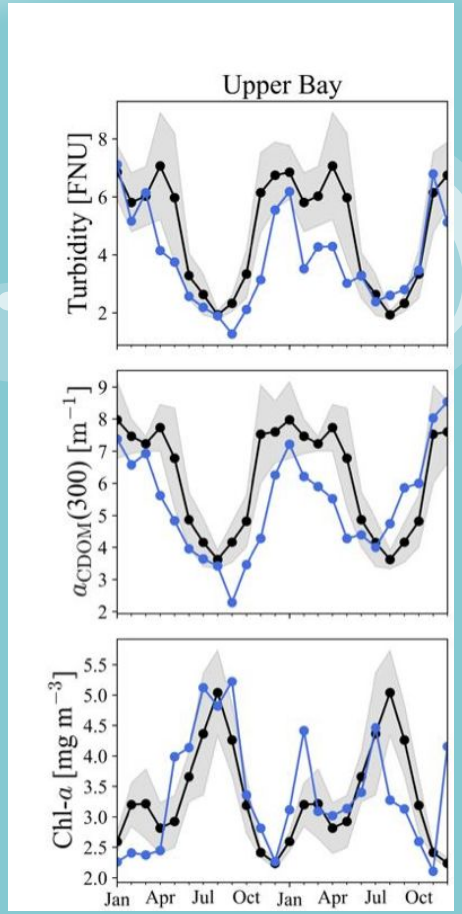


Graph of Nitrogen Loading

Sherman, Jonathan, et al. “Deciphering the Water Quality Impacts of COVID-19 Human Mobility Shifts in Estuaries Surrounding New York City.” *The Science of the Total Environment*, U.S. National Library of Medicine, 20 Oct. 2023, www.ncbi.nlm.nih.gov/pmc/articles/PMC10299840/.

Water Quality: NY Upper Bay

- The study showed observations by comparing a baseline of 2017-2019/pre covid with covid and 2021:post the heat of covid.
  - Turbidity, or cloudiness/haziness of the water, was lower in 2020 and the beginning of 2021 than in 2017-2019(the baseline), as expected. But, in June 2021,when the shutdowns were stopping, the turbidity quickly increased higher than pre pandemic levels
    - April 2020 - early 2021: turbidity is 40% lower than baseline pre pandemic levels
    - In june 2021 turbidity increased and exceeded the baseline pre pandemic levels in august (+35%)
  - This study shows the possibility of better water quality. A possible solution would be to limit the amount of wastewater discharge and loading.
    - In covid, we saw that less wastewater discharge led to increase water quality and when the discharge started again it reached higher than pre pandemic levels. Lower atmospheric pollution, due to shutdowns and less human mobility, led to improved water clarity



Graph of Turbidity

Sherman, Jonathan, et al. “Deciphering the Water Quality Impacts of COVID-19 Human Mobility Shifts in Estuaries Surrounding New York City.” *The Science of the Total Environment*, U.S. National Library of Medicine, 20 Oct. 2023, www.ncbi.nlm.nih.gov/pmc/articles/PMC10299840/.

Wildlife - "Anthropause"

"Anthropause" is a dramatic decline in human activity due to the pandemic

Reduced human activity → short-term positive effects (decreased pollution and reduced disturbance for wildlife in urban areas)

- Hypothesized some species may have experienced lower levels of stress
    - Jon Witman of Brown University studied whether the **sharp decline of tourists led shy marine fish to behave bolder**
        - A behavioral change that could alter ecosystem dynamics
        - Reasonable to consider how some animals ***may venture into areas they typically avoid due to human presence***
    - **White-crowned sparrows** began singing more quietly while the distance across which they could communicate more than doubled. The birds also sang at **lower frequencies, which is associated with an improved ability to defend territory** (Anthes, 2023)

Anthes, E. (2022, July 16). *Did Nature Heal During The Pandemic "Anthropause"?* The New York Times. https://www.nytimes.com/2022/07/16/science/pandemic-nature-anthropause.html

Wildlife Risk

According to a 2002 U.S. Environmental Protection Agency (EPA) National-Scale Air Toxics Assessment study, it was reported that New York county has the third highest cancer risk in comparison to all the counties in the US. Obviously, this is not good for humans, but these animals are just at risk and prone to cancers and diseases from pollution and chemicals.

According to a study (Saeida Saadat, 2020), New York saw around 50% more cleaner air in 2020 then the year before. It is not coincidental that during this period of less air pollution and an ease to biodiversity destruction, NYC observed the snowy owl in over 130 years in Central park.

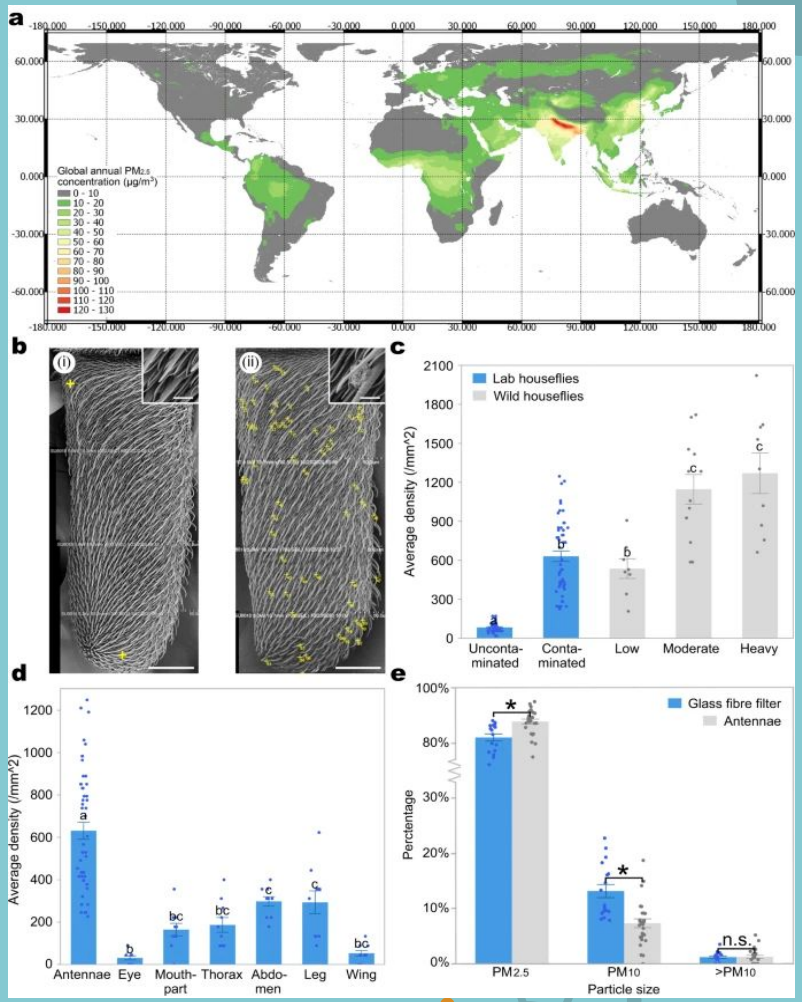
Saadat S, Rawtani D, Hussain CM. Environmental perspective of COVID-19. Sci Total Environ. 2020 Aug

Effect on Insects

According to Professor Mark Elgar from the University of Melbourne, PM2.5 particles accumulate much more on the antenna of many insects in comparison to the rest of its body. The abundance of PM2.5 causes disturbances to their olfactory receptors and to the strengths of brain signals.

- 40% of the world's landmass exceed the WHO recommendations for PM2.5 concentrations.
- In June of 2023, the Canadian wildfires introduced staggered levels of PM2.5 concentrations. Many insects simply died due to the harsh nature of the wildfires
- Catastrophic effects can occur with diminishing insect populations.

The anthropause, which lowered PM2.5 levels, provides evidence that wildlife populations in all sectors take a toll.



Wang, Q., Liu, G., Yan, L. *et al.* Short-term particulate matter contamination severely compromises insect antennal olfactory perception. *Nat Commun* 14, 4112 (2023). https://doi.org/10.1038/s41467-023-39469-3

Wildlife and Environmental Policies

Addressing air pollution and its impact on wildlife is crucial for biodiversity conservation

Many animals rely on clean air for health survival; air pollution can harm and increase risk for extinction of wildlife species by disrupting ecosystems, affecting food sources, and damaging habitats

- **Human-animal interconnection** - factors that harms wildlife can ultimately be detrimental to humans, as we rely on healthy ecosystems for clean air, water, and food and ecosystem health.
- **U.S. Fish and Wildlife Service** monitors air quality in regions that are more prone to human-caused air pollution and wildlife disturbances
    - **Clean Air Act** - aimed to reduce and control air pollution nationwide
- **Wilderness Act** (created the National Wilderness Preservation System to protect national parks/forests/wildlife refuges)

Stokstad, E. (2020, August 13). *The Pandemic Stilled Human Activity. What did this 'Anthropause' Mean for Wildlife?* ScienceInsider . https://www.science.org/content/article/pandemic-stilled-human-activity-what-did-anthropause-mean-wildlife