

Comparison of 2020 Monthly and Annual Average CO, NO₂, O₃, SO₂ and PM_{2.5} Concentrations in New Jersey with Data from 2019 and 2021

Analysis of the Covid-19 Impact on Air Quality in New Jersey

NJDEP Bureau of Air Monitoring

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- Air Quality exceedance days, 2010-2021
- Expanded Analysis for all criteria pollutants
 - Analyze carbon monoxide, nitrogen dioxide and sulfur dioxide data
- Determine if impact from Covid is continuing in 2021
- Summary

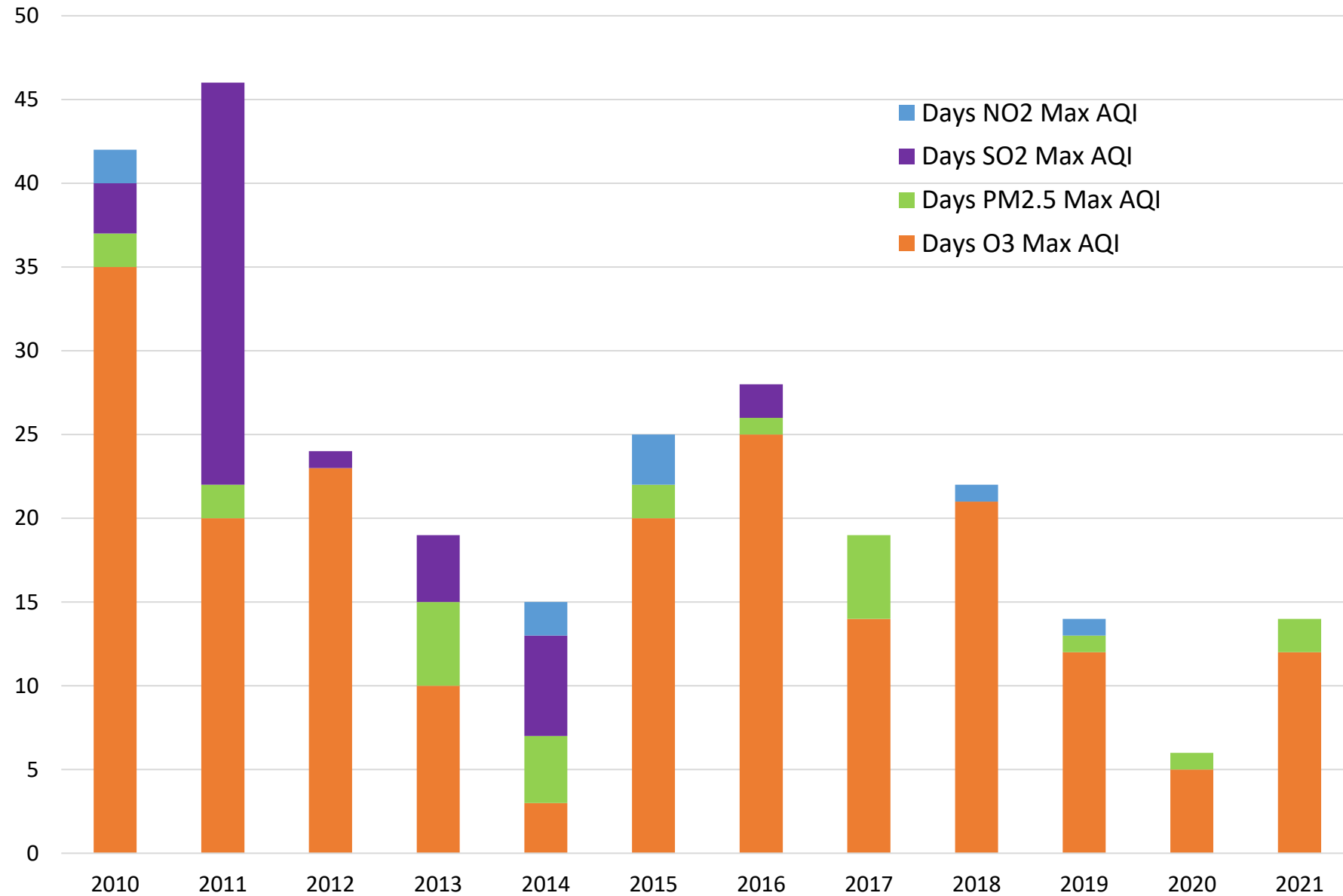
Previous Analyses

- Transportation
 - 50% reduction in light duty traffic in April 2020
 - 30% reduction in heavy duty traffic in April 2020
 - Return to 2019 volume in 2021
- Nitrogen Oxides (NOx) at 3 urban stations
 - >40% reduction in monthly NOx levels, April-May 2020
 - Update: NOx levels in 2021 back to 2019 except Jersey City
- PM2.5 at 3 urban stations
 - >30% reduction in monthly PM2.5 concentrations at urban air monitoring stations, April-May 2020
 - Update: PM2.5 levels in 2021 impacted by wildfires

Previous Analyses

- Ozone (O₃) at 6 stations
 - Analyze daily maximum 8-hour average O₃ concentrations
 - -0.5% to -9.5% decrease in 1-year average levels
 - Return to $\pm 2\%$ of 2017-2019 average in 2021
- Benzene from Elizabeth Exit 13 stations
 - Not conclusive because 2019 concentrations were low

Air Quality Index (AQI) Days Over 100 in New Jersey



New Analysis

- Carbon monoxide (CO), 6 stations
 - Monthly average and annual average concentrations
- Sulfur Dioxide (SO₂), 9 stations
 - Monthly average and annual average concentrations
- Nitrogen Dioxide (NO₂), 9 stations
 - Monthly average and annual average concentrations
- Ozone (O₃), 16 stations,
 - Monthly average and 8-month season average (March-Oct) concentrations
- Fine particles (PM_{2.5}), 12 continuous monitors
 - Monthly average and annual average concentrations

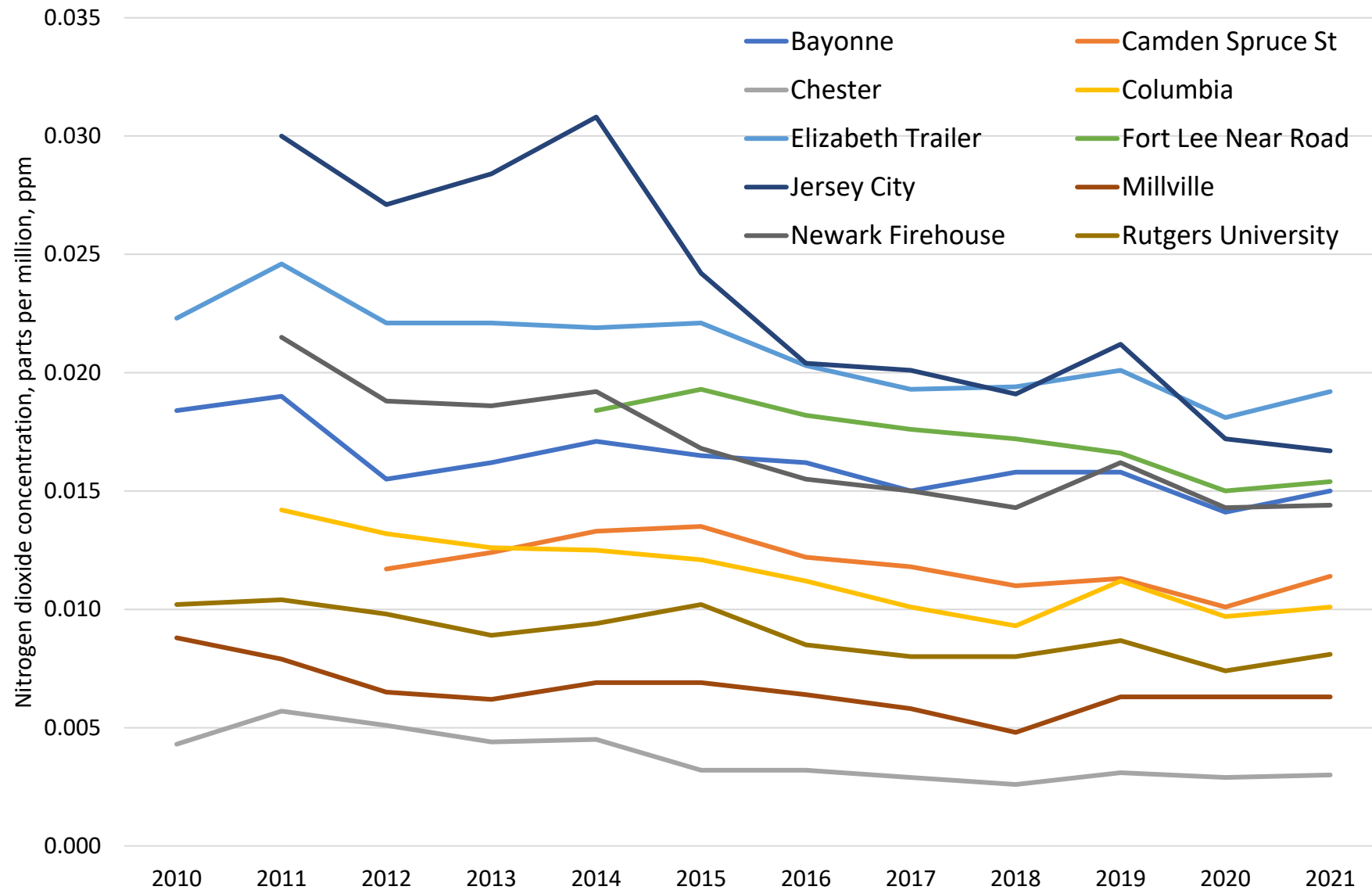
Carbon Monoxide (CO) and Sulfur Dioxide (SO₂)

- Concentrations of CO and SO₂ near detection limit in the last 5 years
 - Changed database for lower concentrations
 - Monthly average CO is <1 ppm
 - Monthly average SO₂ is <0.001 ppm
- Very small impact of Covid-19 lockdown on CO and SO₂

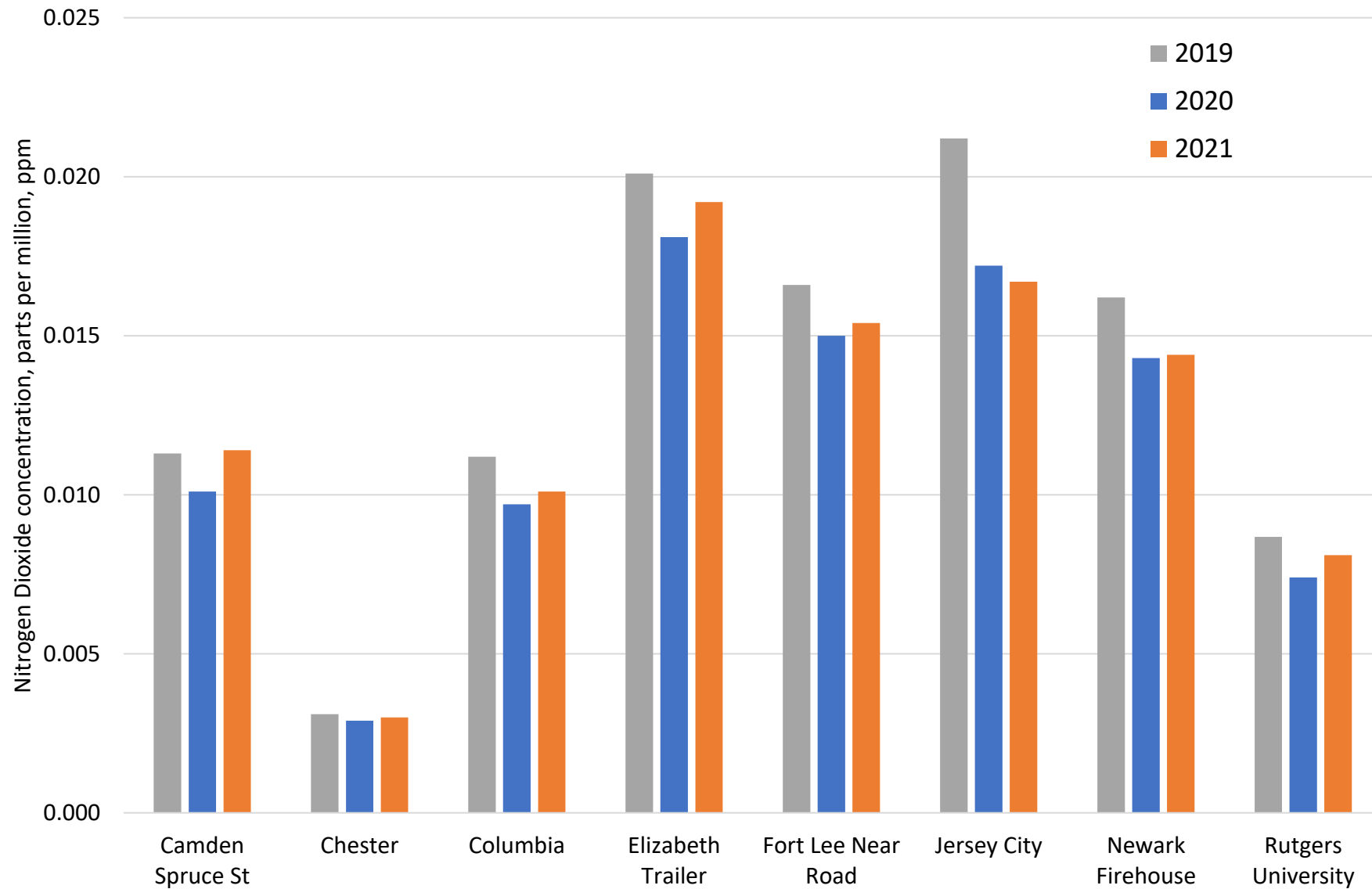
Nitrogen Dioxide (NO₂)

- Analyze monthly averages from 9 stations
- Covid year impact observed at all 9 stations (March-May data)
 - -42% to -23% decrease over 2019 concentrations
- Pre-covid (2010-2019) year-to-year average % difference in annual average NO₂ concentrations ranges from -3.6% to -0.3%
- Covid Impact in 2021 may be continuing at 8 of 9 stations
 - 7 stations have slightly higher NO₂ levels in 2021 than 2020, but < 2019
 - 1 station has lower NO₂ levels in 2021 than 2020
- 1 station has “recovered” from Covid impact: higher NO₂ levels in 2020 than 2019 (Camden Spruce St.)

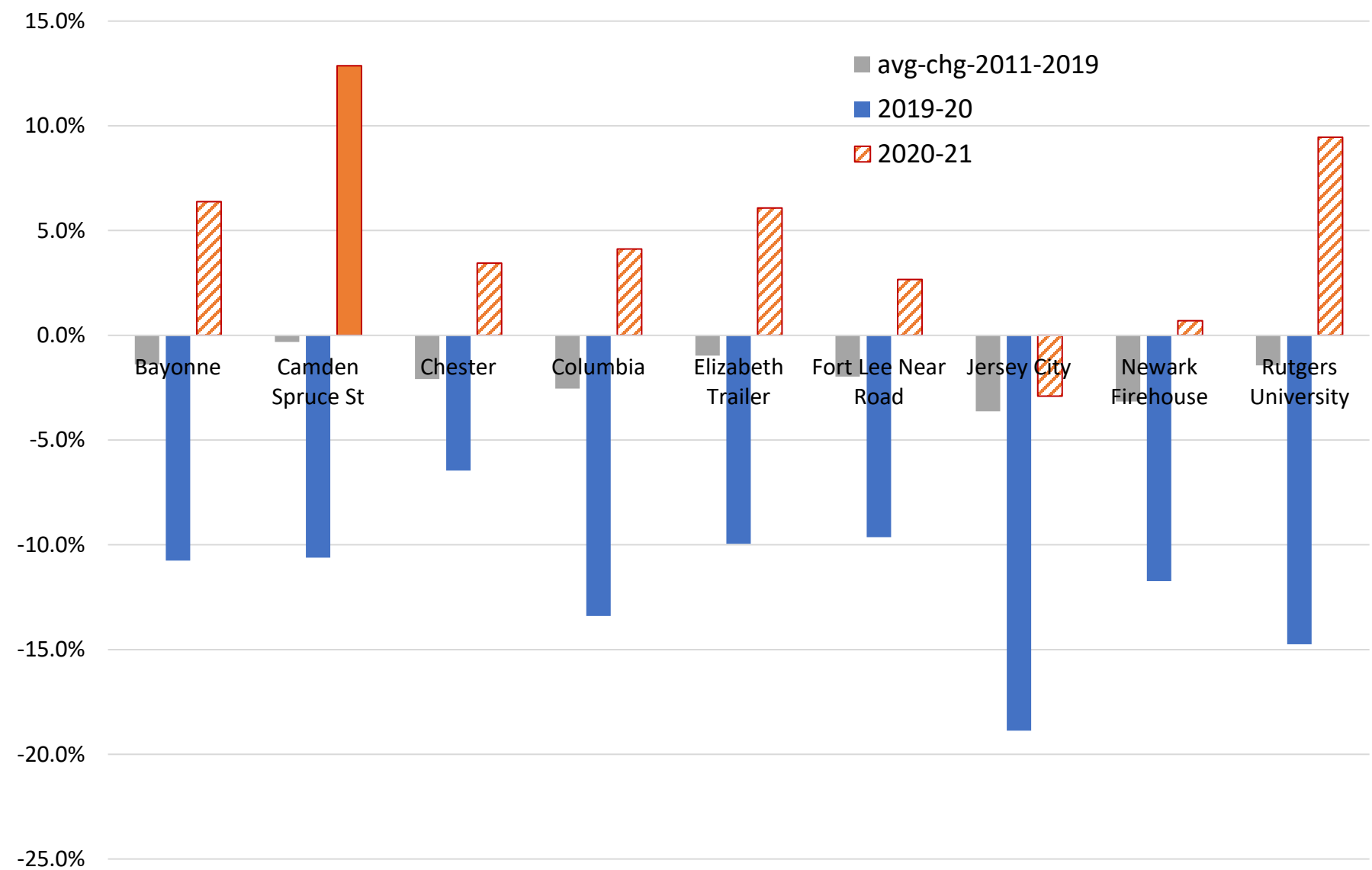
Trend in Annual Average Nitrogen Dioxide Concentrations at
NJDEP Stations, 2010-2021, ppm



Annual Average Nitrogen Dioxide Concentrations at 9 NJDEP Stations, 2019-2021, ppm



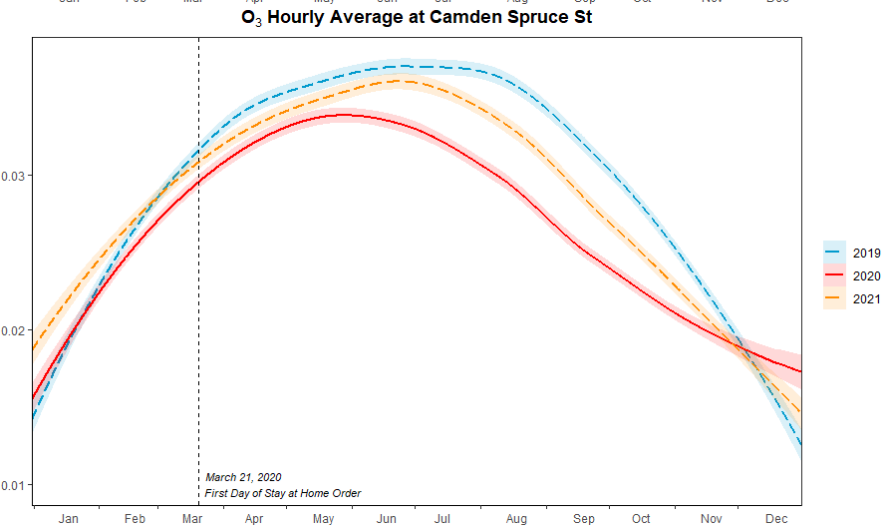
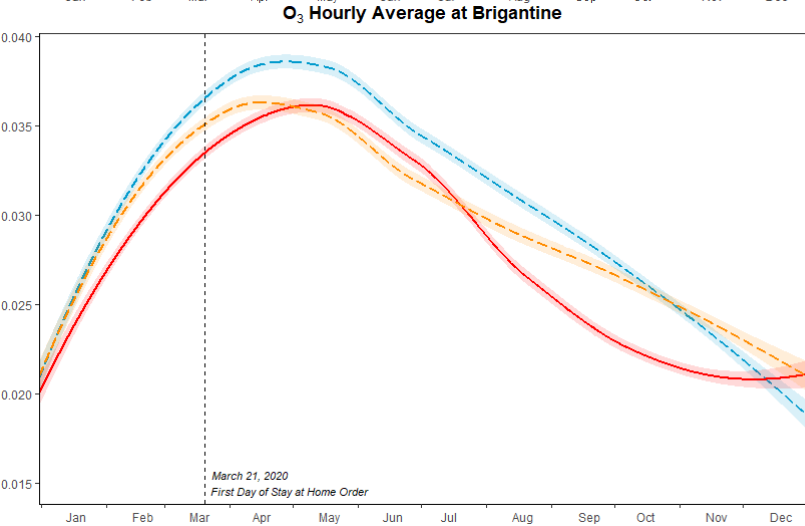
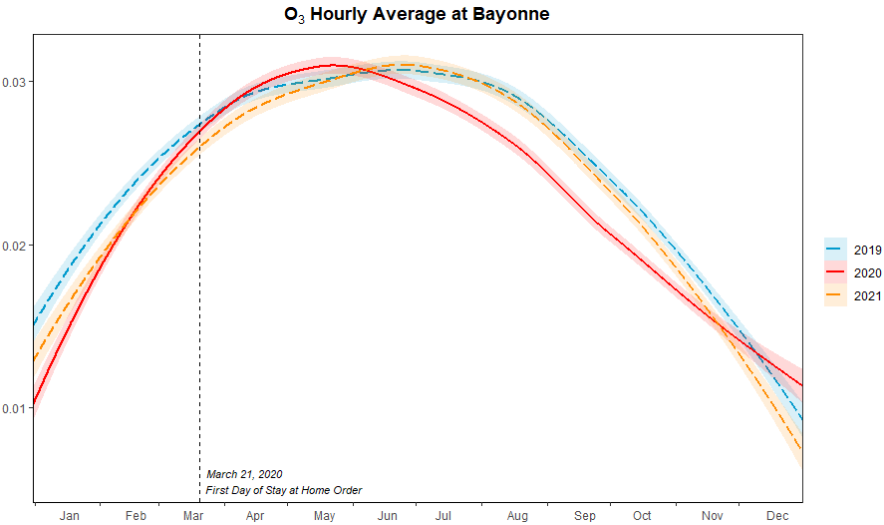
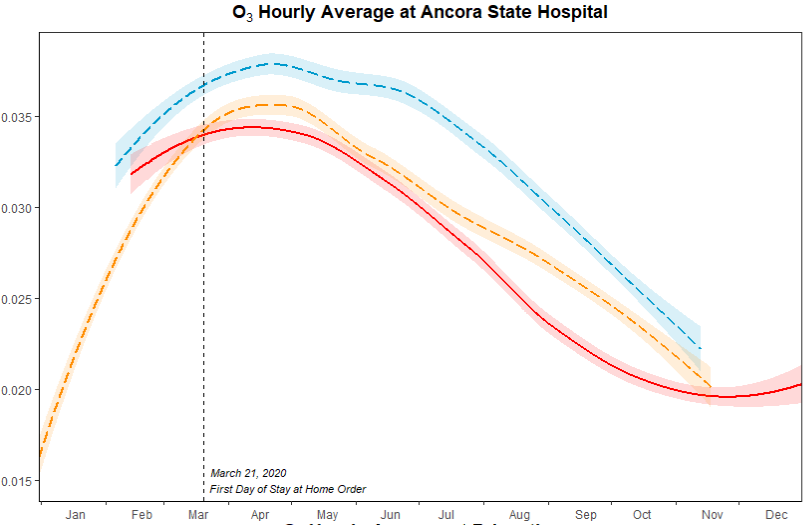
Percent Difference in Annual Average Nitrogen Dioxide Concentrations at 9 NJDEP Stations, 2019-2020 and 2020-2021



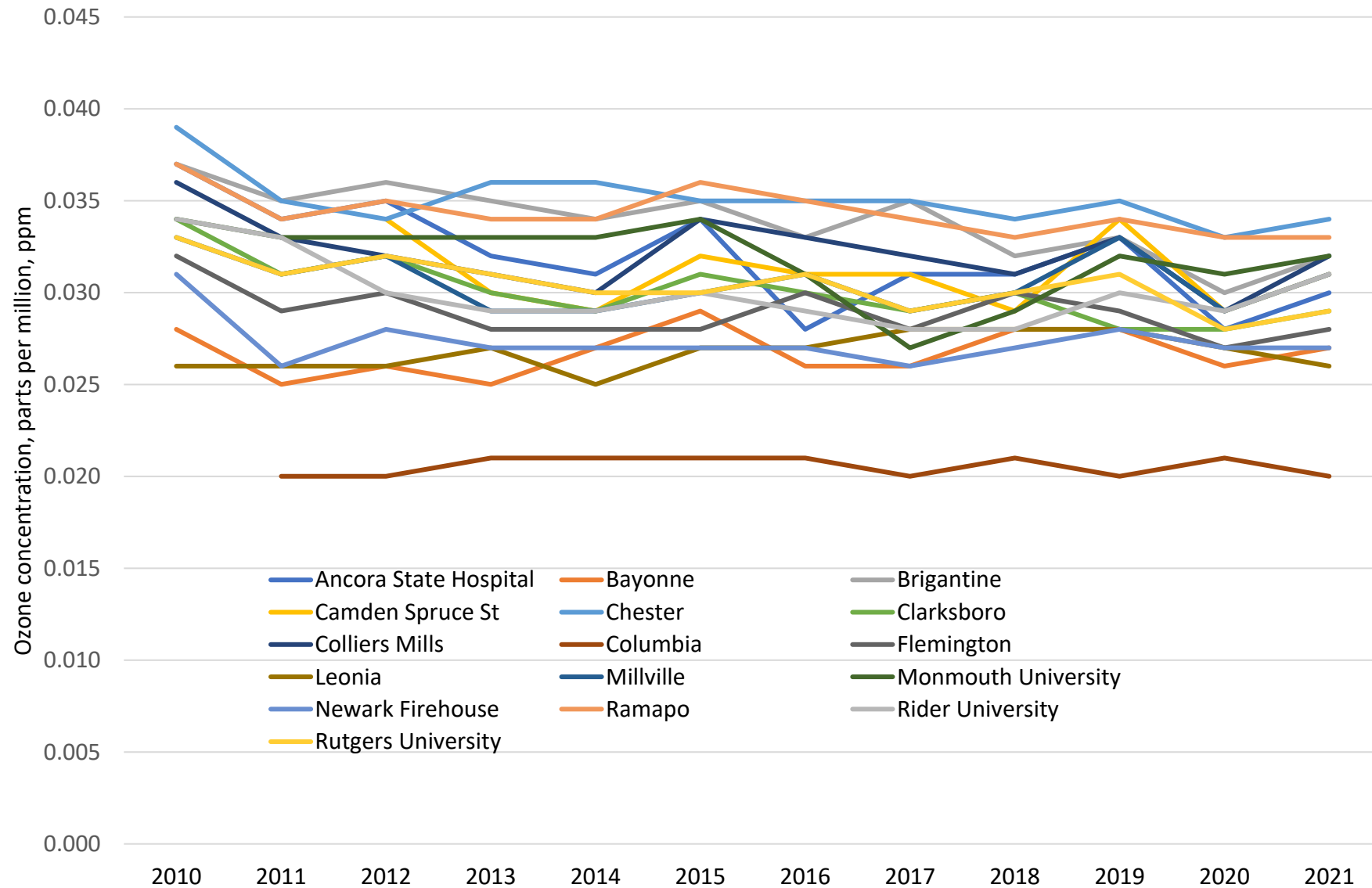
Ozone (O_3)

- Analyze monthly averages from 16 stations
- Covid year impact observed at 14 of 16 stations (Mar-Oct data)
 - -15.2% to -2.9% decrease over 2019 concentrations
- Pre-covid (2010-2019) year-to-year average % difference in season average O_3 concentration ranges from -2.0% to +0.9%
- Covid Impact in 2021 may be continuing at 13 of 16 stations
 - 9 stations have slightly higher O_3 levels in 2021 than 2020, but < 2019
 - 2 station has lower O_3 levels in 2021 than 2020
 - 2 stations have same O_3 levels in 2021 as 2020, but 2020 was <2019
- 2 stations have “recovered” from Covid impact: higher O_3 levels in 2021 than 2019 (recover from covid)
- 1 station was not impacted by Covid and has higher O_3 levels in 2021 than 2020

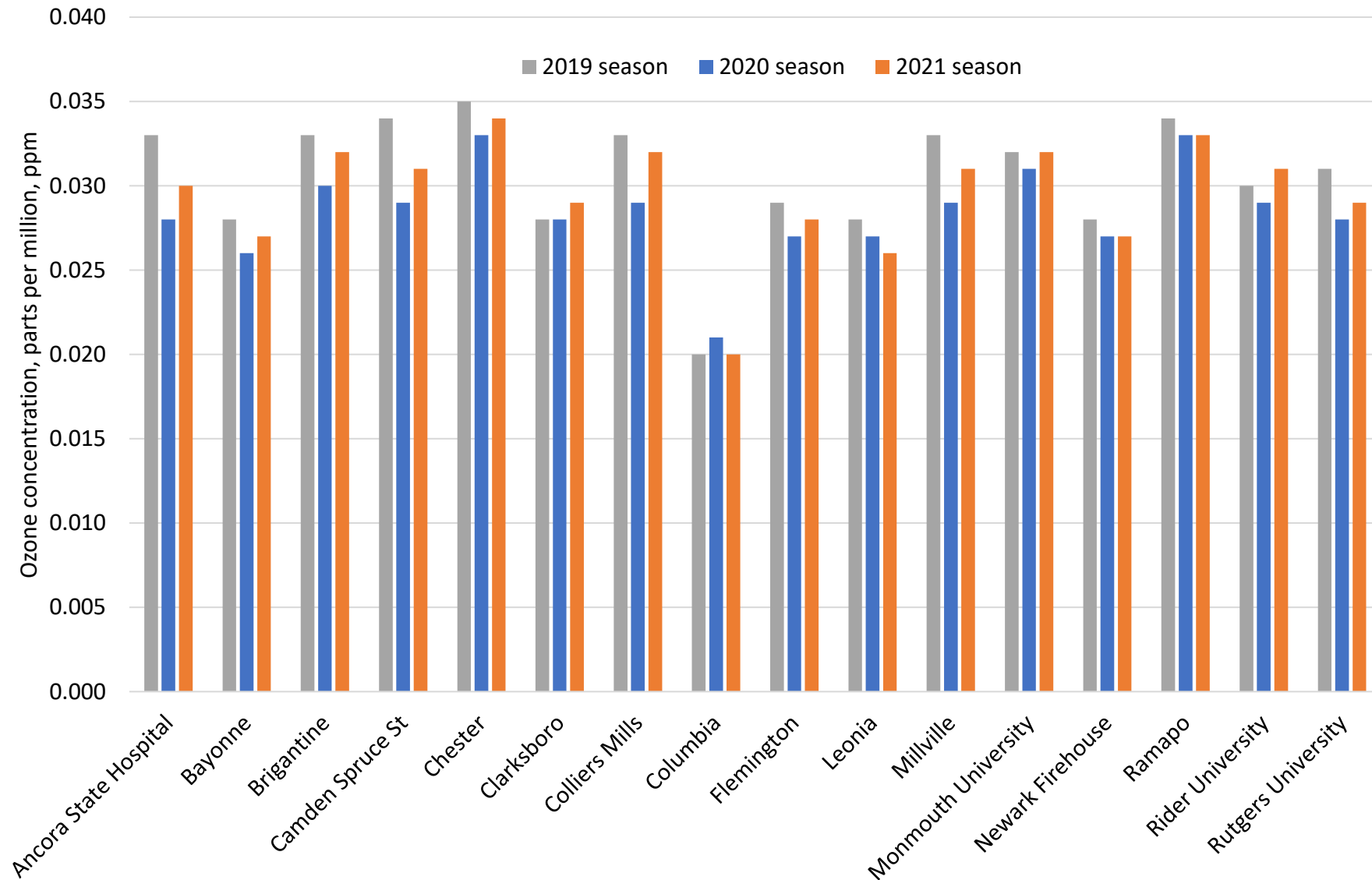
Smooth Plot Charts of Monthly Average Ozone Concentrations at 4 NJDEP Stations



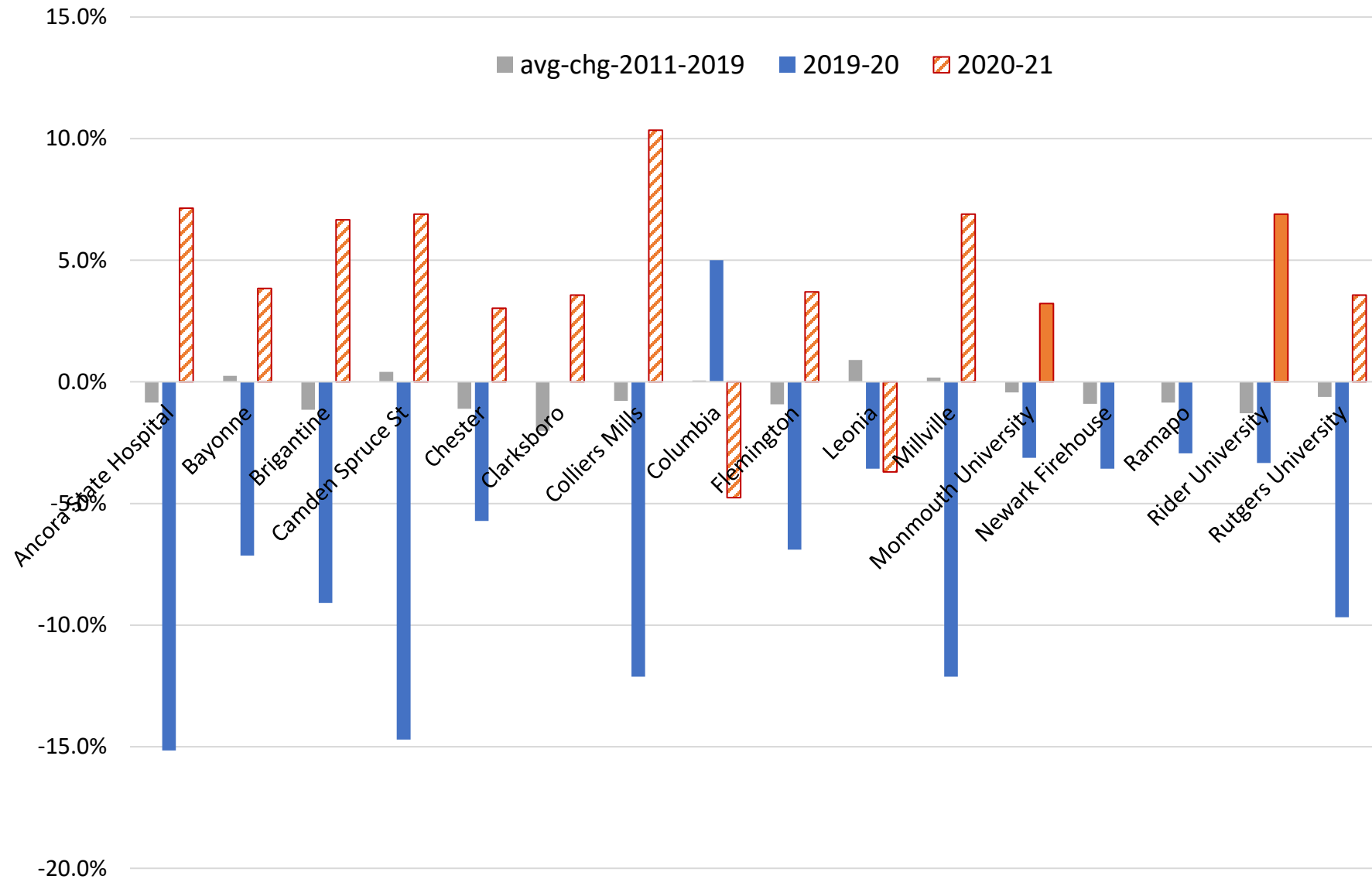
Trend in Mar-Oct Average Ozone Concentrations at NJDEP Stations, 2010-2021, ppm



Ozone Season (Mar-Oct) Average Ozone Concentrations at 16 NJDEP Stations, 2019-2021, ppm



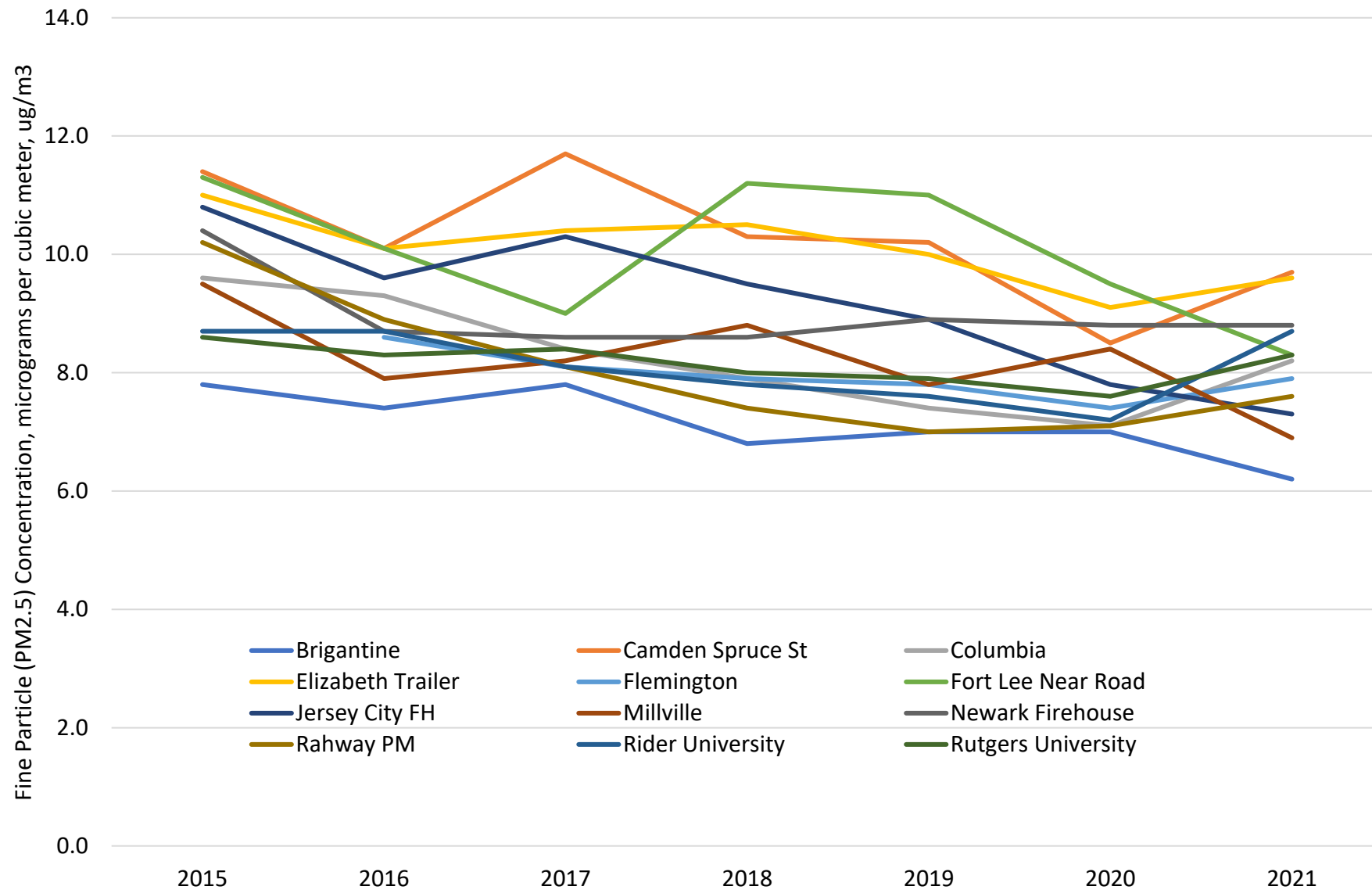
Percent Difference in Ozone Season (Mar-Oct) Average Ozone Concentrations at 16 NJDEP Stations, 2019-2021



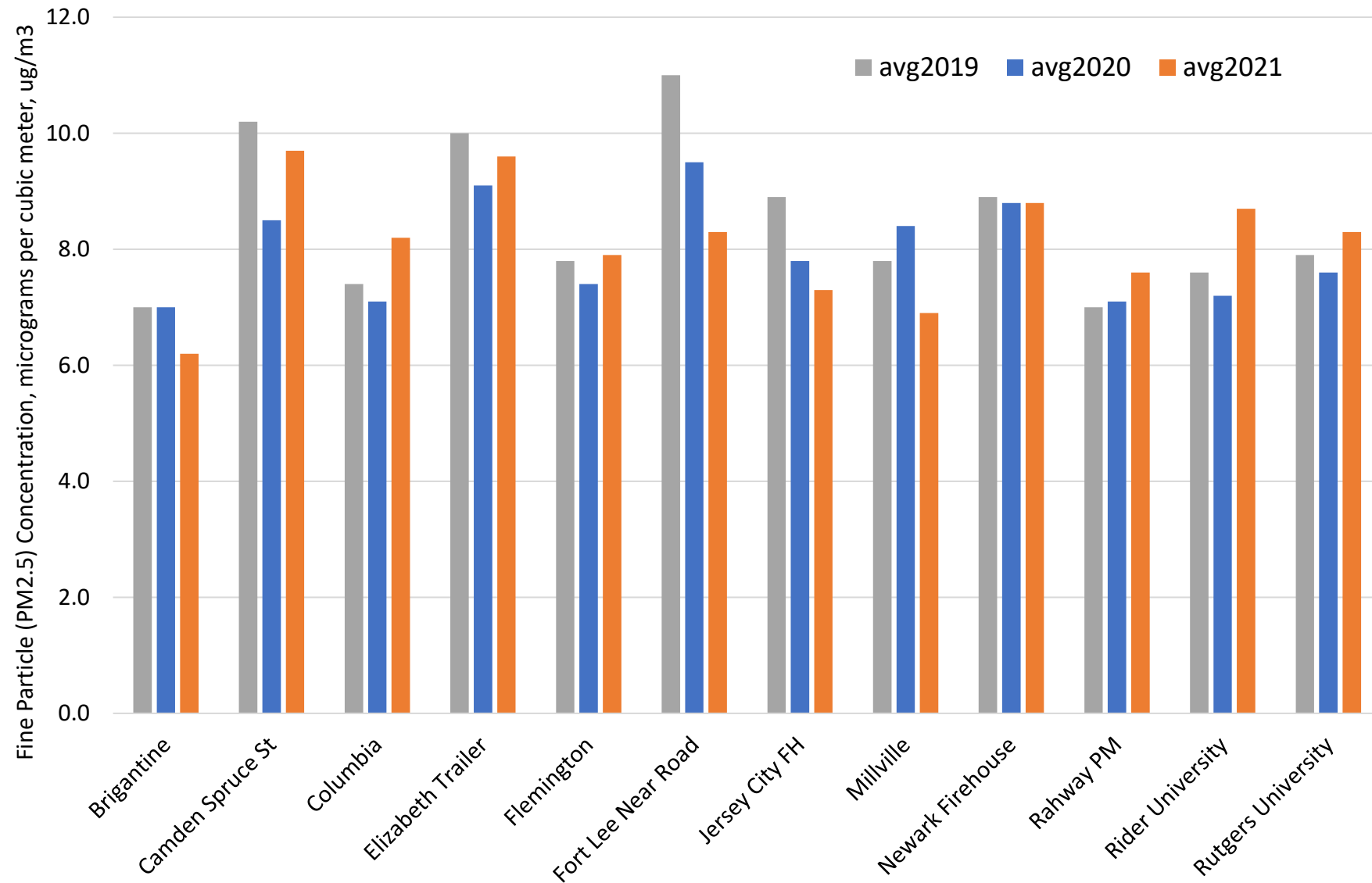
Fine Particles (PM2.5)

- Analyze monthly and annual averages from 12 stations, 2015-2021, data from continuous monitors only (Filter data not included)
- Covid year impact observed at 10 of 12 stations (Mar-May data)
 - -27.9% to -12.5% decrease over 2019 concentrations
- Pre-covid (2015-2019) year-to-year average % difference in annual average PM2.5 concentration ranges from -6.3% to +0.3%
- Covid Impact may be continuing in 2021 at 7 of 12 stations
 - 3 stations have slightly higher PM2.5 levels in 2021 than 2020, but < 2019
 - 2 station have lower PM2.5 levels in 2021 than 2020, but no covid effect in 2020
 - 2 stations have lower PM2.5 levels in 2021 as 2020, and with covid effect
- 5 stations have “recovered” from Covid impact: higher PM2.5 levels in 2021 than 2019

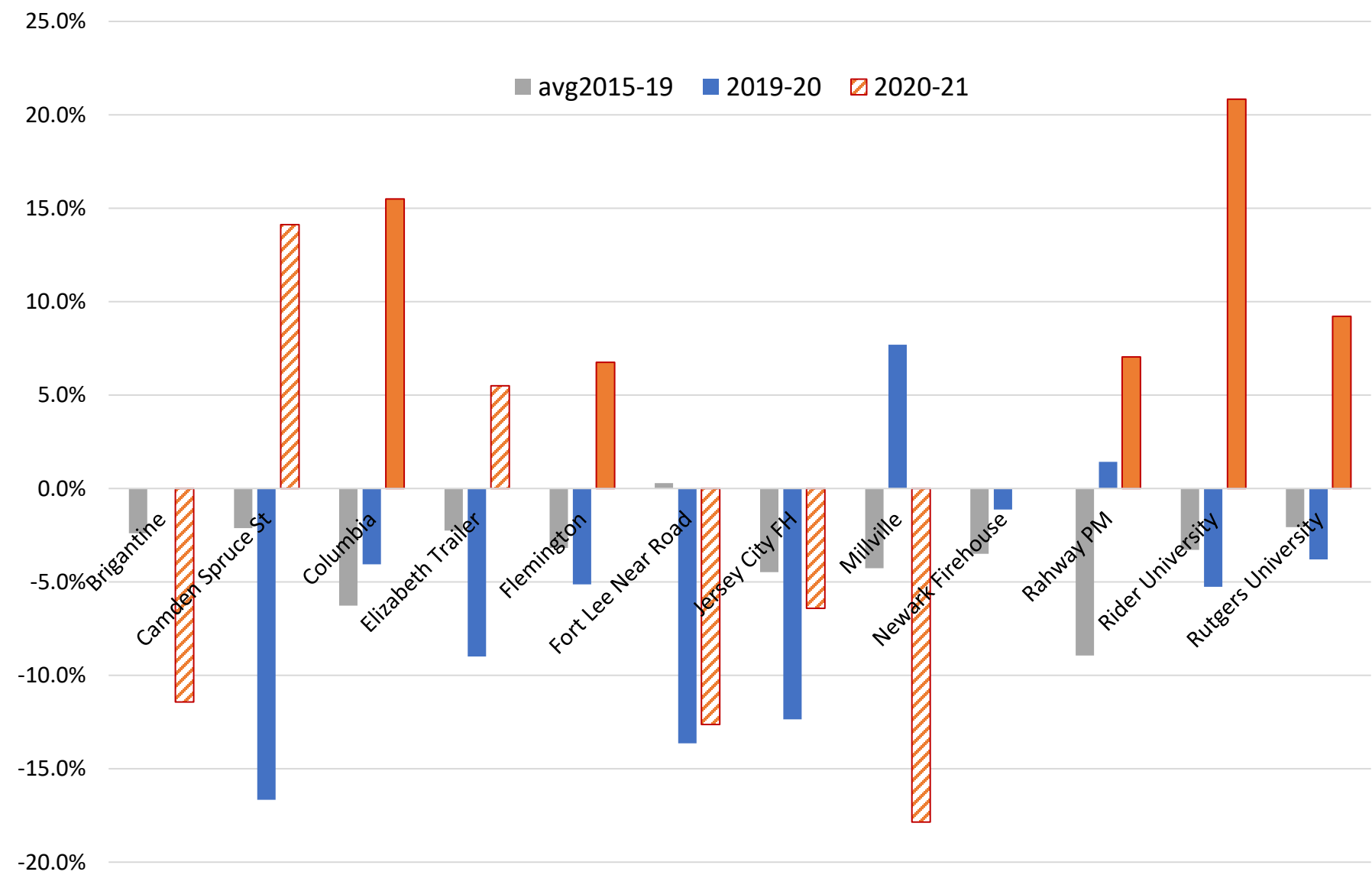
Trend in Annual Average Fine Particle (PM2.5) Concentrations at 12 NJDEP Stations, 2015-2021, ug/m3



Annual Average Fine Particle (PM2.5) Concentrations at 12 NJDEP Stations, 2019-2021, ug/m3



Percent Difference in Annual Average Fine Particle (PM2.5) Concentrations at 12 NJDEP Stations, 2019-2021



Summary

- Analyzed monthly, annual average and seasonal average data for CO, NO₂, O₃, SO₂ and PM_{2.5}
- No Covid impact for CO or SO₂ in 2020
- Covid impact observed at all 9 NO₂ stations
 - Continuing at 8 stations in 2021
- Covid impact observed at 14 of 16 O₃ stations
 - Continuing at 13 stations in 2021
- Covid impact observed at 10 of 12 PM_{2.5} stations
 - Continuing at 7 stations in 2021

Additional Future Analysis

- Use of statistical analysis to determine probability of Covid impact continuing into 2021
- Analysis of vehicle mix and/or more detailed traffic counts
- Analysis of maximum concentrations and/or comparison to the concentrations of National Ambient Air Quality Standards

2020 Air Quality Summary
available at:

<https://www.nj.gov/dep/airmon/index.html>

Questions, comments

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