



# **FOREST BIRD MONITORING IN THE NCRM**

*Summary Report 2007-2017*

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# Report on National Capital Region Network (NCRN) Parks and Bird Data Analysis

## Overview

The dataset for the analysis consists of 126,573 rows and 30 columns, covering bird sightings and environmental data across 11 parks within the National Capital Region Network (NCRN). Each park in the dataset is represented by an acronym. Below are the full names of the parks included in the study:

1. ANTI - Antietam National Battlefield
2. CATO - Catoctin Mountain Park
3. CHOH - Chesapeake & Ohio Canal National Historical Park
4. GWMP - George Washington Memorial Parkway
5. HAFE - Harpers Ferry National Historical Park
6. MANA - Manassas National Battlefield Park
7. MONO - Monocacy National Battlefield
8. NACE - National Capital Parks-East
9. PRWI - Prince William Forest Park
10. ROCR - Rock Creek Park
11. WOTR - Wolf Trap National Park for the Performing Arts

## Analysis Objectives

1. *Bird Count and Grouping*: Determine the count of birds and group all relevant columns for comprehensive analysis.
2. *Species Classification*: Classify bird species based on their counts into endangered or common categories.
3. *Extinction Criteria Filtering*: Filter bird species based on extinction criteria (count < 5) and create a dataframe showing the parks where these birds were found.
4. *Summary Statistics*: Calculate summary statistics (temperature, wind, humidity) for specified parks concerning the extinct birds.
5. *Monthly Grouping*: Group birds by common name and month to identify the months with the highest occurrences of each species.



*6. Park Sampling Count:* Count the number of parks sampled between 2007 to 2017 in the NCRN.

*7. At-Risk Bird Species Count:* Count each at-risk bird species in each park based on PIF\_watchlist status.

*8. Sightings by Distance:* Group bird sightings by park/region and distance range (close by within 50 meters, and 50-100 meters).

*9. Bird Population Density:* Define the area of a monitoring spot in hectares and calculate bird population density.

### Geographical Distribution

To enhance the analysis, geographical distributions of bird species across the parks will be plotted using Basemap in Matplotlib. This visualization will aid in understanding spatial patterns and conservation needs.

## **Bird Count and Grouping**

The comprehensive analysis of bird populations within the NCRN parks focused on determining the count of bird species and grouping relevant columns for detailed insights. This process involved aggregating data to establish the total count of each bird species observed across all parks and systematically grouping pertinent columns such as common name, park, and observation details.

The analysis identified the top three most sighted bird species within the NCRN parks. The results are as follows:

1. Red-eyed Vireo: 8,121 sightings
2. Northern Cardinal: 6,385 sightings
3. Eastern Tufted Titmouse: 6,322 sighting.

## **Implications**

The abundance of these bird species provides valuable insights into the ecological health of the NCRN parks. Understanding which bird species are most frequently observed can assist in several key areas:

- Biodiversity Monitoring: Regular monitoring of these common species can serve as an indicator of overall biodiversity health within the parks.
- Conservation Efforts: Identifying the most common species helps prioritize conservation efforts for less frequently sighted and at-risk bird species.

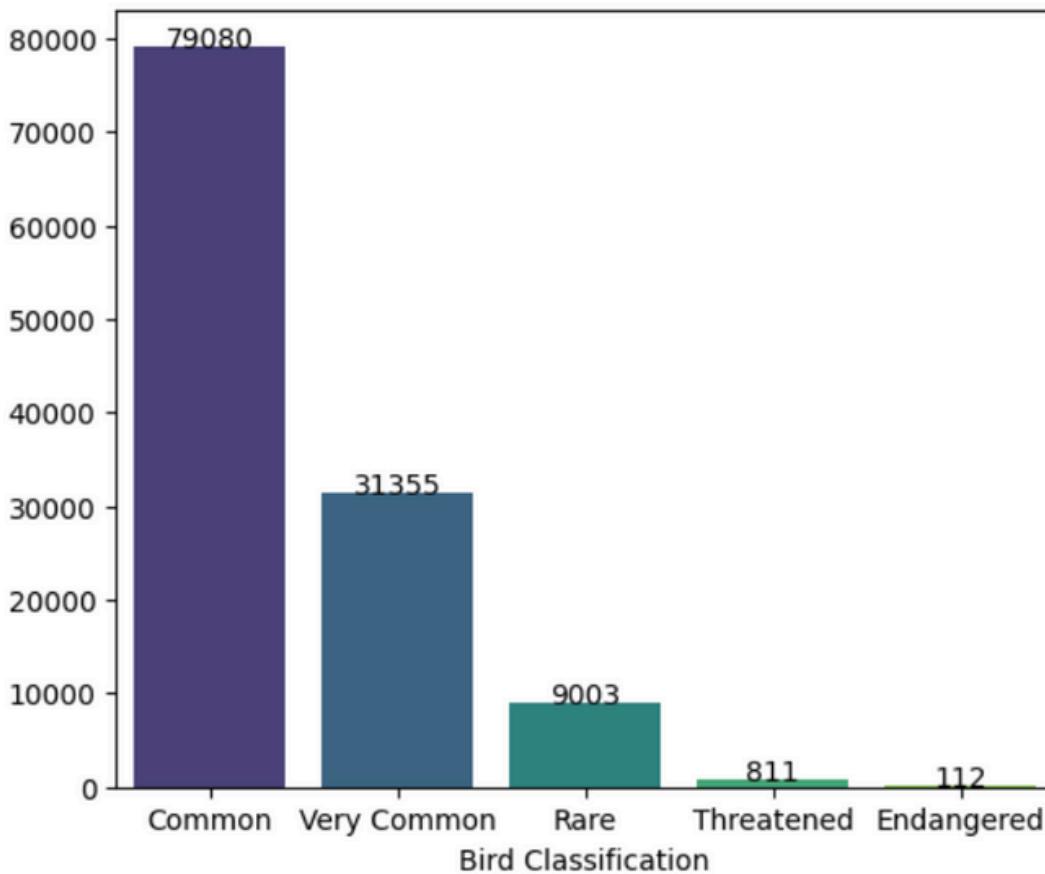
## **Species Classification**

The classification of bird species was conducted based on their observed count method provides insights into the relative abundance and potential risks faced by different bird species within the NCRN parks

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1. Endangered Species: These species are at significant risk of local extinction and require immediate conservation efforts.
2. Threatened Species: These species, while not critically endangered, still face substantial risks and should be closely monitored.
3. Rare Species: These species are less common and may need specific habitat management to ensure their sustainability.
4. Common Species: Species with counts between 501 and 5000 were identified as common, indicating a healthy population within the parks.
5. Very Common Species: These species thrive in the NCRN parks and represent a significant portion of the bird population.

**Distribution of Bird Classifications**



## code

```
def classify_bird(count):
    if count <= 5:
        return 'Endangered'
    elif count <= 50:
        return 'Threatened'
    elif count <= 500:
        return 'Rare'
    elif count <= 5000:
        return 'Common'
    else:
        return 'Very Common'
df1['bird_classification'] = df1['bird_counts'].apply(classify_bird)
```

## **Implications**

The classification of bird species into these categories is essential for effective conservation and management strategies:

- Conservation Prioritization: Endangered and threatened species require immediate and focused conservation actions to prevent further decline.
- Biodiversity Monitoring: Continuous monitoring of all categories provides valuable data to assess the health of bird populations and the effectiveness of conservation efforts.

## Extinction Criteria Filtering

The analysis focused on filtering bird species based on extinction criteria and identifying the parks where these endangered birds were found. This filtering process provides critical insights into the distribution and conservation needs of species at risk of local extinction within the NCRN parks.

This approach identifies species that require immediate conservation attention to prevent further decline and potential extinction.

The following parks within the NCRN were identified as locations where endangered bird species (count < 5) were observed:

- Chesapeake & Ohio Canal National Historical Park (CHOH): This park recorded a significant number of birds on the verge of extinction, indicating a critical conservation area.
- Others: Parks such as George Washington Memorial Parkway (GWMP) and Harpers Ferry National Historical Park (HAFE) also showed instances of endangered bird species, albeit to a lesser extent.

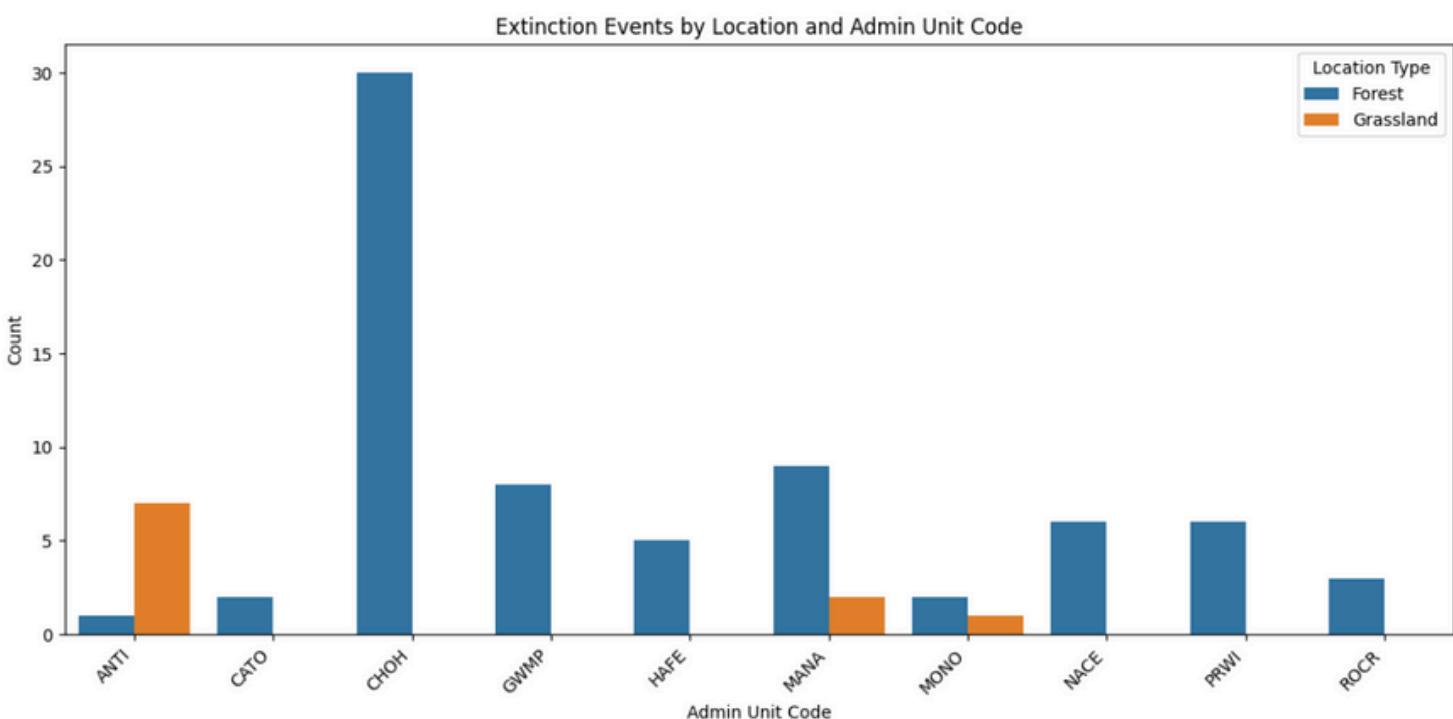
Admin_Unit_Code	Location_Type	count	
0	ANTI	Forest	1
1	ANTI	Grassland	7
2	CATO	Forest	2
3	CHOH	Forest	30
4	GWMP	Forest	8
5	HAFE	Forest	5
6	MANA	Forest	9
7	MANA	Grassland	2
8	MONO	Forest	2
9	MONO	Grassland	1
10	NACE	Forest	6
11	PRWI	Forest	6
12	ROCR	Forest	3

## Habitat Analysis

The data further reveals that the majority of endangered bird species (72 individuals) are located in forest habitats compared to a smaller number (10 individuals) in grasslands. This highlights the importance of habitat-specific conservation strategies tailored to protect vulnerable bird populations.

## Extinction Events by Location and Admin Unit Code

A bar graph depicting extinction events by location and admin unit code visually illustrates the distribution of endangered bird species across different parks within the NCRN. This visualization aids in understanding the concentration of conservation efforts needed in specific areas.



## Analysis of Environmental Factors in Specified Parks Concerning Extinct Birds

Analysis of the summary statistics for environmental factors such as temperature, wind speed, and humidity in specified parks where bird species on the verge of extinction have been observed.

The parks included in this analysis are:

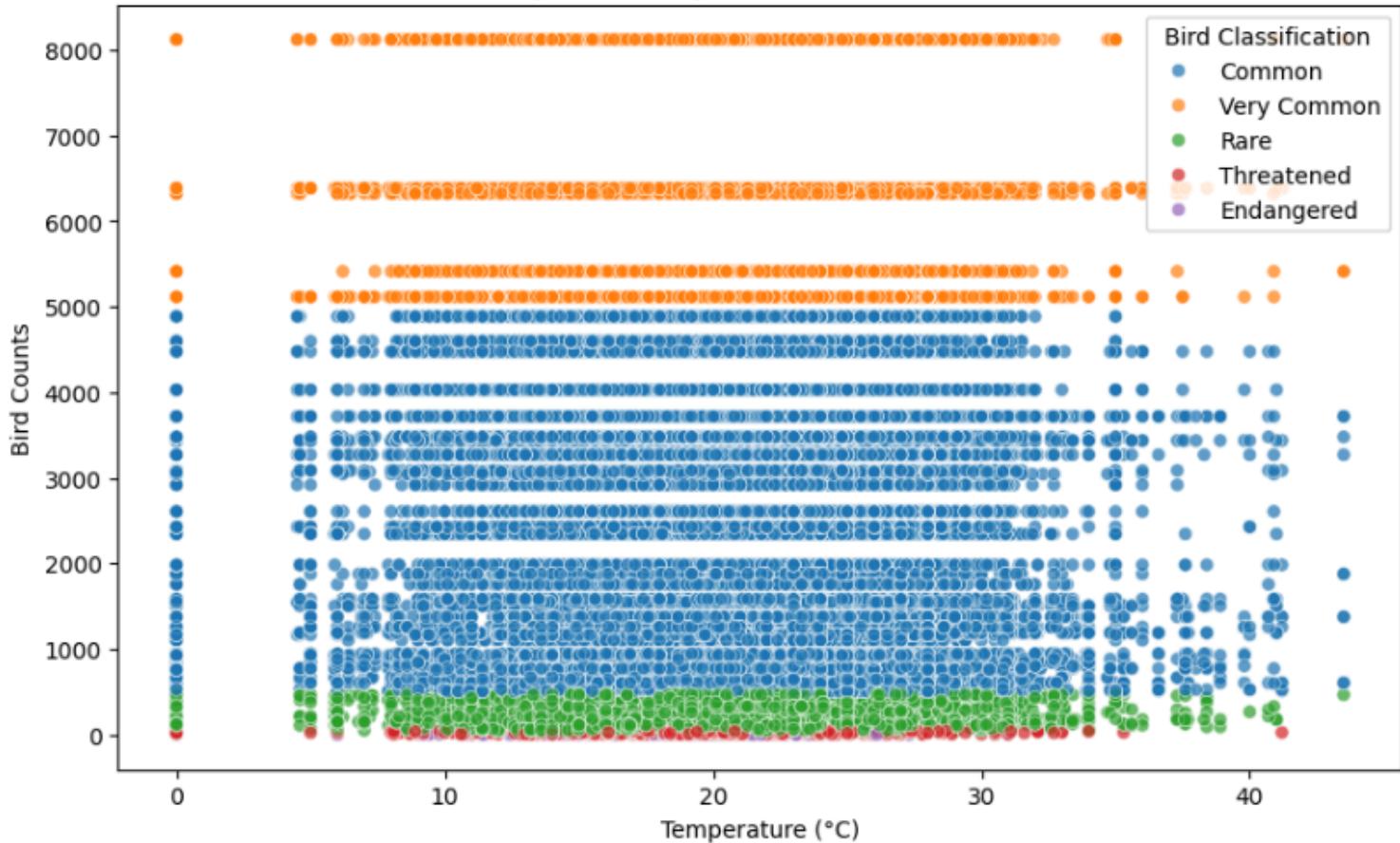
- Chesapeake and Ohio Canal National Historical Park (CHOH)
- Antietam National Battlefield(ANTI)

### Interpretation

The analysis indicates that environmental factors such as temperature, humidity, and wind speed vary across different parks. These variations might influence the habitat conditions for bird species, affecting their survival and leading to extinction events. For example, higher temperatures and lower humidity levels might create harsh conditions for certain bird species, contributing to their declining numbers.

	Temperature	Humidity	wind speed																												
CHOH	<table><tbody><tr><td>mean</td><td>19.616667</td></tr><tr><td>std</td><td>4.197297</td></tr><tr><td>min</td><td>11.000000</td></tr><tr><td>25%</td><td>18.125000</td></tr><tr><td>50%</td><td>20.050000</td></tr><tr><td>75%</td><td>21.375000</td></tr><tr><td>max</td><td>27.299999</td></tr></tbody></table>	mean	19.616667	std	4.197297	min	11.000000	25%	18.125000	50%	20.050000	75%	21.375000	max	27.299999	<table><tbody><tr><td>mean</td><td>77.546667</td></tr><tr><td>std</td><td>8.817018</td></tr><tr><td>min</td><td>52.000000</td></tr><tr><td>25%</td><td>74.000000</td></tr><tr><td>50%</td><td>77.700001</td></tr><tr><td>75%</td><td>83.750000</td></tr><tr><td>max</td><td>90.699997</td></tr></tbody></table>	mean	77.546667	std	8.817018	min	52.000000	25%	74.000000	50%	77.700001	75%	83.750000	max	90.699997	<p>unique : 4 top-: Calm (&lt; 1 mph) smoke rises vertically freq : 22</p>
mean	19.616667																														
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75%	83.750000																														
max	90.699997																														
ANTI	<table><tbody><tr><td>mean</td><td>20.537500</td></tr><tr><td>std</td><td>3.707883</td></tr><tr><td>min</td><td>16.500000</td></tr><tr><td>25%</td><td>17.275000</td></tr><tr><td>50%</td><td>20.000000</td></tr><tr><td>75%</td><td>23.400001</td></tr><tr><td>max</td><td>26.500000</td></tr></tbody></table>	mean	20.537500	std	3.707883	min	16.500000	25%	17.275000	50%	20.000000	75%	23.400001	max	26.500000	<table><tbody><tr><td>mean</td><td>74.487500</td></tr><tr><td>std</td><td>7.138714</td></tr><tr><td>min</td><td>62.700001</td></tr><tr><td>25%</td><td>71.750000</td></tr><tr><td>50%</td><td>74.250000</td></tr><tr><td>75%</td><td>78.125000</td></tr><tr><td>max</td><td>85.199997</td></tr></tbody></table>	mean	74.487500	std	7.138714	min	62.700001	25%	71.750000	50%	74.250000	75%	78.125000	max	85.199997	<p>unique : 2 top : Light air movement (1-3 mph) smoke drifts freq : 7</p>
mean	20.537500																														
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max	85.199997																														

## Impact of Temperature on Bird Counts



## Monthly Grouping of Bird Sightings

Analysis of bird sightings grouped by common name and month. The objective is to identify the months with the highest occurrences of each bird species. Understanding the monthly patterns of bird sightings can provide insights into their seasonal behaviors and habitat preferences.

### Findings

- Month 5 (May)
- Most Frequently Seen Bird: Northern Cardinal
- Number of Sightings: 1985

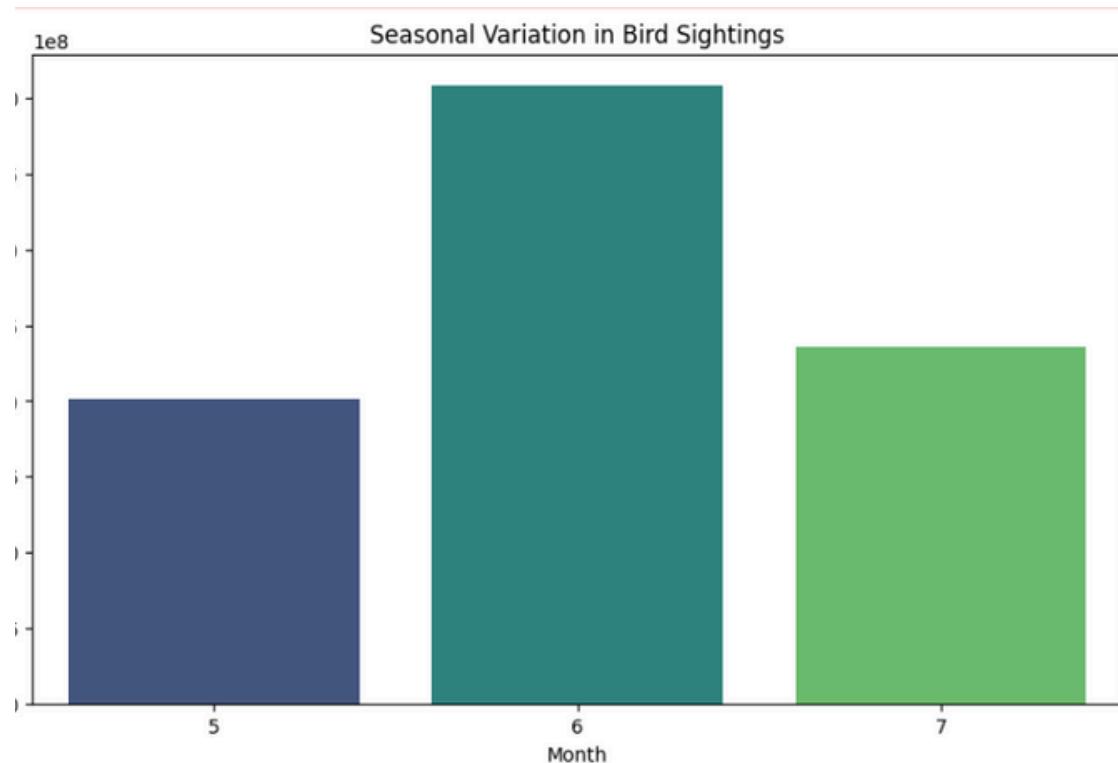
This high occurrence suggests that May is a significant month for the presence of Northern Cardinals, potentially due to favorable breeding conditions or migration patterns.

- Month 6 (June)
- Most Frequently Seen Bird: Red-eyed Vireo
- Number of Sightings: 3844

This peak in sightings indicates that June is a crucial month for Red-eyed Vireos, likely coinciding with their breeding season or other biological activities.

- Month 7 (July)
- Most Frequently Seen Bird: Red-eyed Vireo
- Number of Sightings: 2652

The sustained high number of sightings in both June and July highlights the importance of this period for the Red-eyed Vireo, possibly reflecting their breeding season or peak activity levels.



## Implications

**Conservation Efforts:** Knowing the peak months for specific bird species can help in timing conservation efforts, such as habitat protection and monitoring.

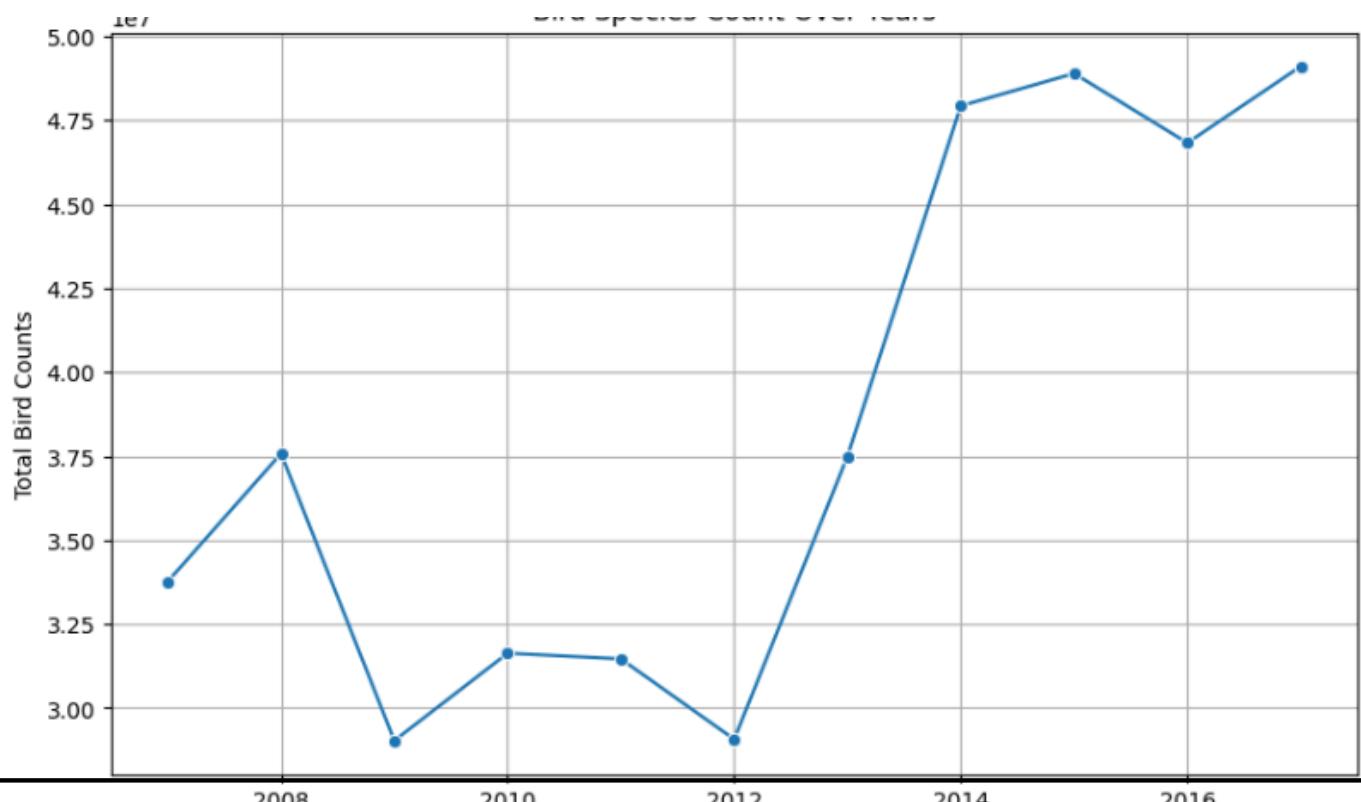
**Habitat Management:** Understanding seasonal patterns can guide habitat management practices to ensure the availability of resources during critical periods.

**Further Research:** The analysis suggests the need for further research into the factors driving these seasonal patterns, such as food availability, weather conditions, and migration routes.

## Park Sampling Count: Count the number of parks sampled between 2007 to 2017 in the NCRN.

This report provides an analysis of the number of parks sampled in the National Capital Region Network (NCRN) over a period of ten years, from 2007 to 2017. Understanding the sampling frequency and coverage is essential for evaluating the comprehensiveness of the bird monitoring efforts and the reliability of the data collected.

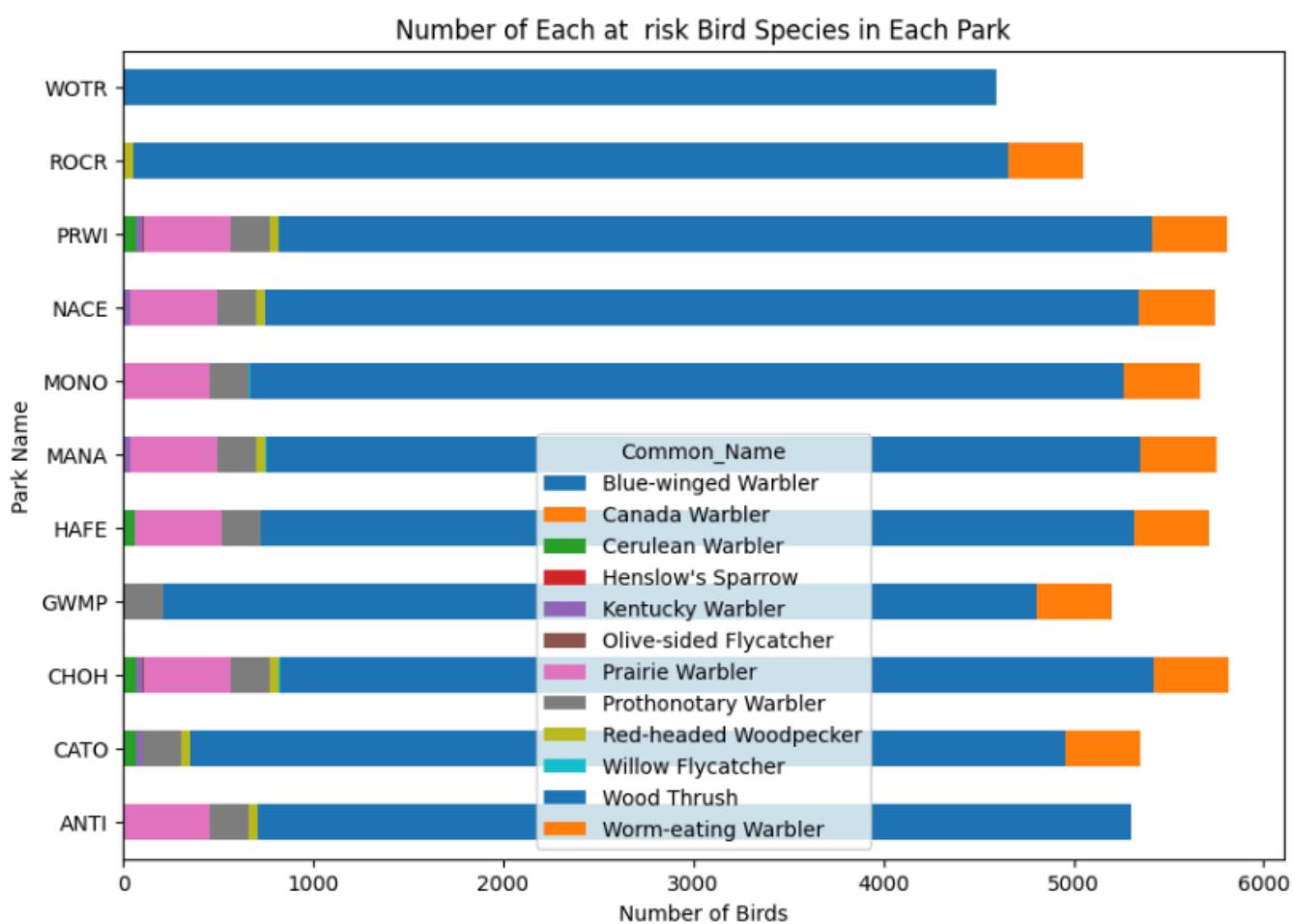
Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>Admin_Unit_Code</b>											
ANTI	197.0	202.0	160.0	174.0	160.0	151.0	198.0	493.0	3604.0	3484.0	3608.0
CATO	1041.0	888.0	798.0	869.0	833.0	802.0	1008.0	990.0	804.0	861.0	842.0
CHOH	2297.0	2716.0	1808.0	2415.0	2408.0	2015.0	2775.0	2979.0	2333.0	2307.0	2354.0
GWMP	427.0	527.0	409.0	459.0	403.0	382.0	464.0	533.0	384.0	355.0	347.0
HAFE	475.0	546.0	434.0	488.0	470.0	420.0	577.0	541.0	492.0	557.0	523.0
MANA	596.0	638.0	543.0	592.0	585.0	533.0	644.0	3150.0	1807.0	1616.0	1802.0
MONO	58.0	85.0	68.0	58.0	75.0	65.0	60.0	411.0	2334.0	2434.0	2464.0
NACE	686.0	897.0	676.0	681.0	684.0	654.0	705.0	817.0	568.0	599.0	650.0
PRWI	2715.0	2933.0	2343.0	2706.0	2517.0	2460.0	2970.0	3332.0	2495.0	2331.0	2294.0
ROCR	392.0	388.0	260.0	340.0	341.0	289.0	365.0	365.0	264.0	306.0	276.0
WOTR	15.0	14.0	14.0	16.0	11.0	14.0	28.0	150.0	125.0	124.0	146.0



## At-Risk Bird Species Count in NCRN Parks

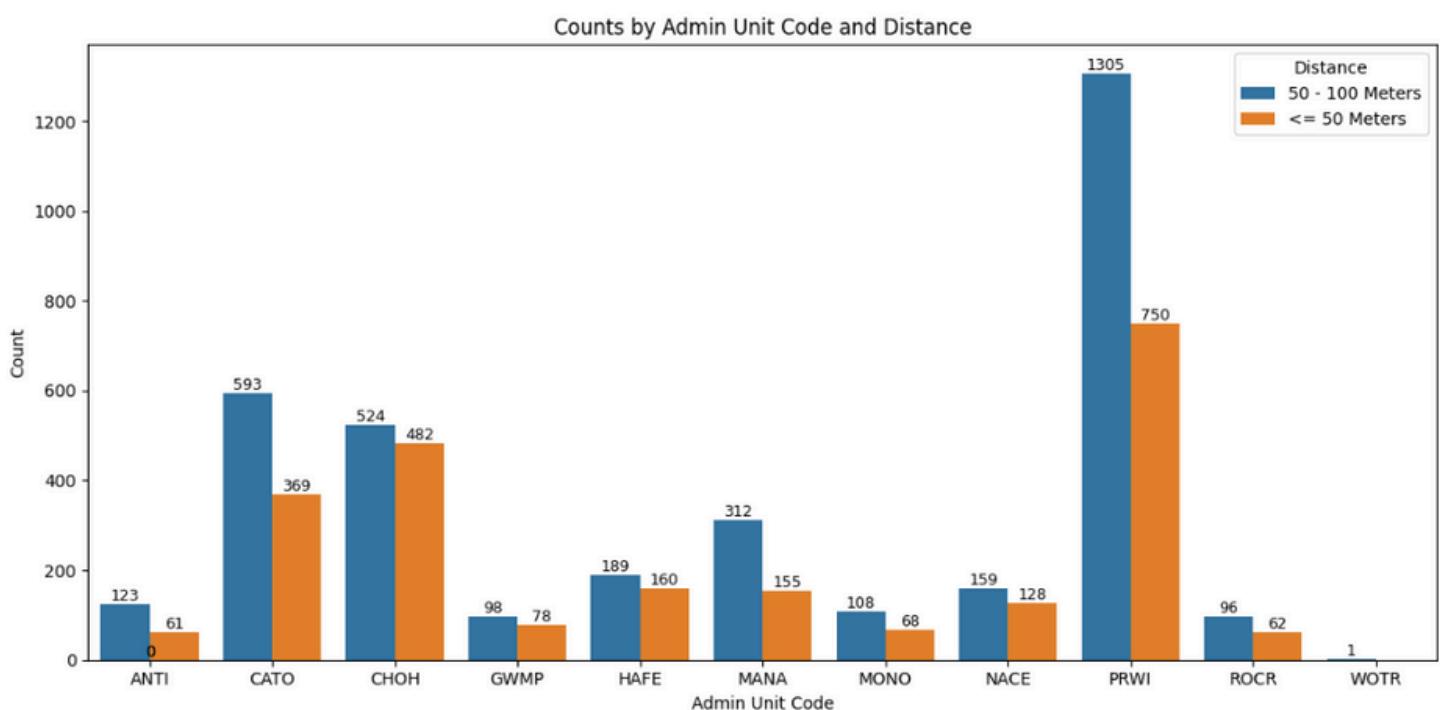
Analysis of the sightings of at-risk bird species within the NCRN. The objective is to understand the frequency of sightings of birds that are at risk according to the Partners in Flight (PIF) watchlist. The data is categorized by park and region and analyzed based on two distance ranges: within 50 meters and 50-100 meters.

Filtering the dataset to include only at-risk bird species based on the PIF watchlist status.



### Distance Range:

The difference in sighting numbers between the two distance ranges can provide insights into the habitat preferences of at-risk bird species. For example, if more sightings are within 50 meters, it may indicate that these species prefer closer, possibly more sheltered environments.



## Insights from Bird Population Density Analysis

Population density calculations provide crucial information about the abundance and distribution of bird species, aiding in conservation planning and management.

## **High Population Density Species-**

### Red-eyed Vireo

- Average Bird Count: 8121
- Population Density: 2586.31 birds per hectare

This high density suggests that the species thrives in the monitored habitats, possibly due to favorable environmental conditions and suitable nesting and foraging opportunities.

### Northern Cardinal

- Average Bird Count: 6385
- Population Density: 2033.44 birds per hectare

This species' presence in significant numbers underscores its ecological resilience and widespread distribution across the monitored parks.

## **Low Population Density Species**

### Ruby-crowned Kinglet

- Average Bird Count: 1
- Population Density: 0.32 birds per hectare

The Ruby-crowned Kinglet exhibits a very low population density, indicating it is less common or found in smaller numbers per hectare across the NCRN parks. This species may have specific habitat requirements or face challenges that limit its distribution and abundance.

### Snowy Egret

- Average Bird Count: 1
- Population Density: 0.32 birds per hectare

Similar to the Ruby-crowned Kinglet, the Snowy Egret also has a low population density, suggesting it may occupy specialized habitats or face conservation challenges within the monitored areas.

### **Insights and Implications**

**Conservation Priorities:** High-density species like the Red-eyed Vireo and Northern Cardinal indicate areas of ecological significance within the NCRN. Conservation efforts should prioritize maintaining and enhancing habitats that support these species to ensure continued population health.

**Habitat Management:** Understanding population densities helps in identifying habitat quality and potential conservation threats. Areas with low-density species may require targeted conservation actions to address habitat loss, degradation, or other factors impacting their populations.

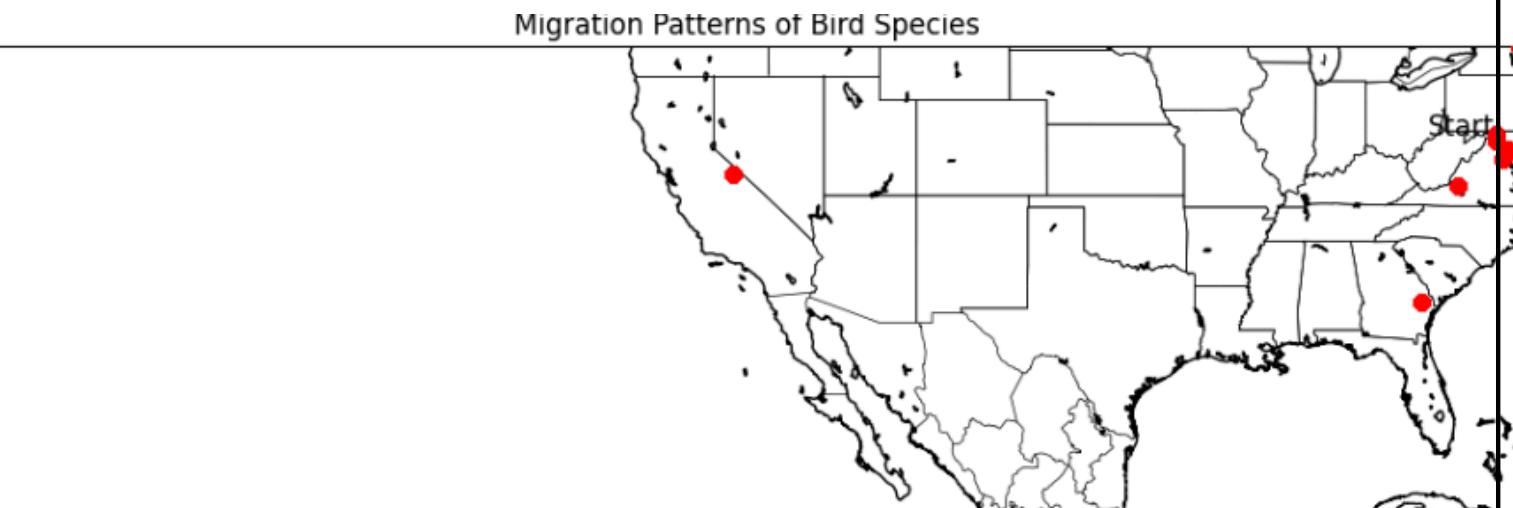
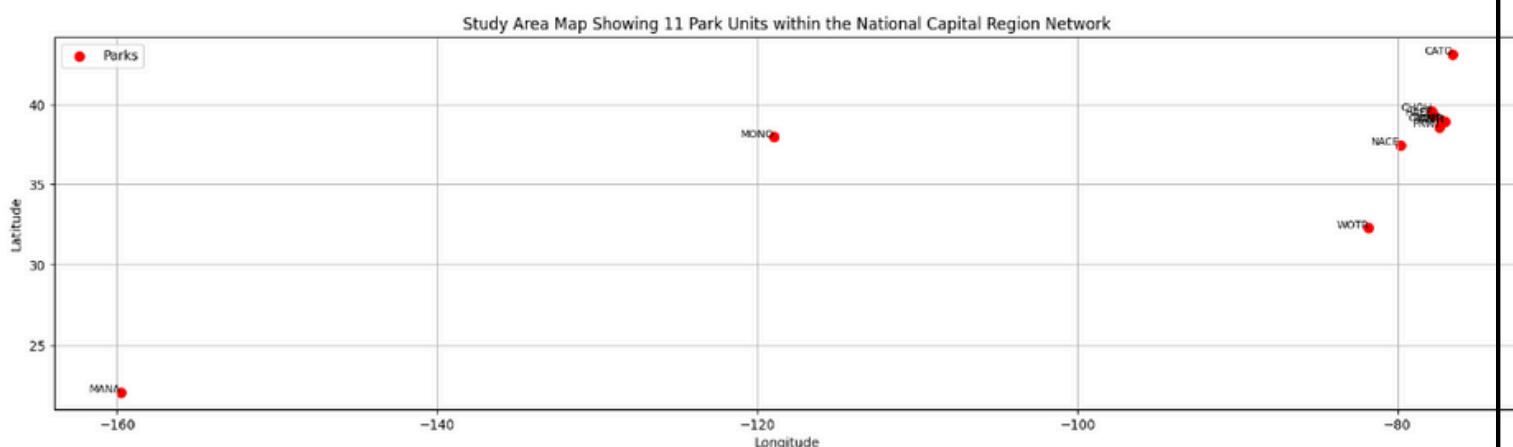
**Biodiversity Conservation:** By focusing on both high and low-density species, conservation strategies can be tailored to promote biodiversity conservation across different habitats and ecological niches within the National Capital Region Network.

## Geographical Distribution of Bird Species in the National Capital Region Network (NCRN)

### Richness of Species Distribution:

Species richness is concentrated predominantly in parks such as ANTI, CATO, CHOH, GWMP, HAFE, NACE, PRWI, ROCR, and WOTR, which are centrally located within the NCRN.

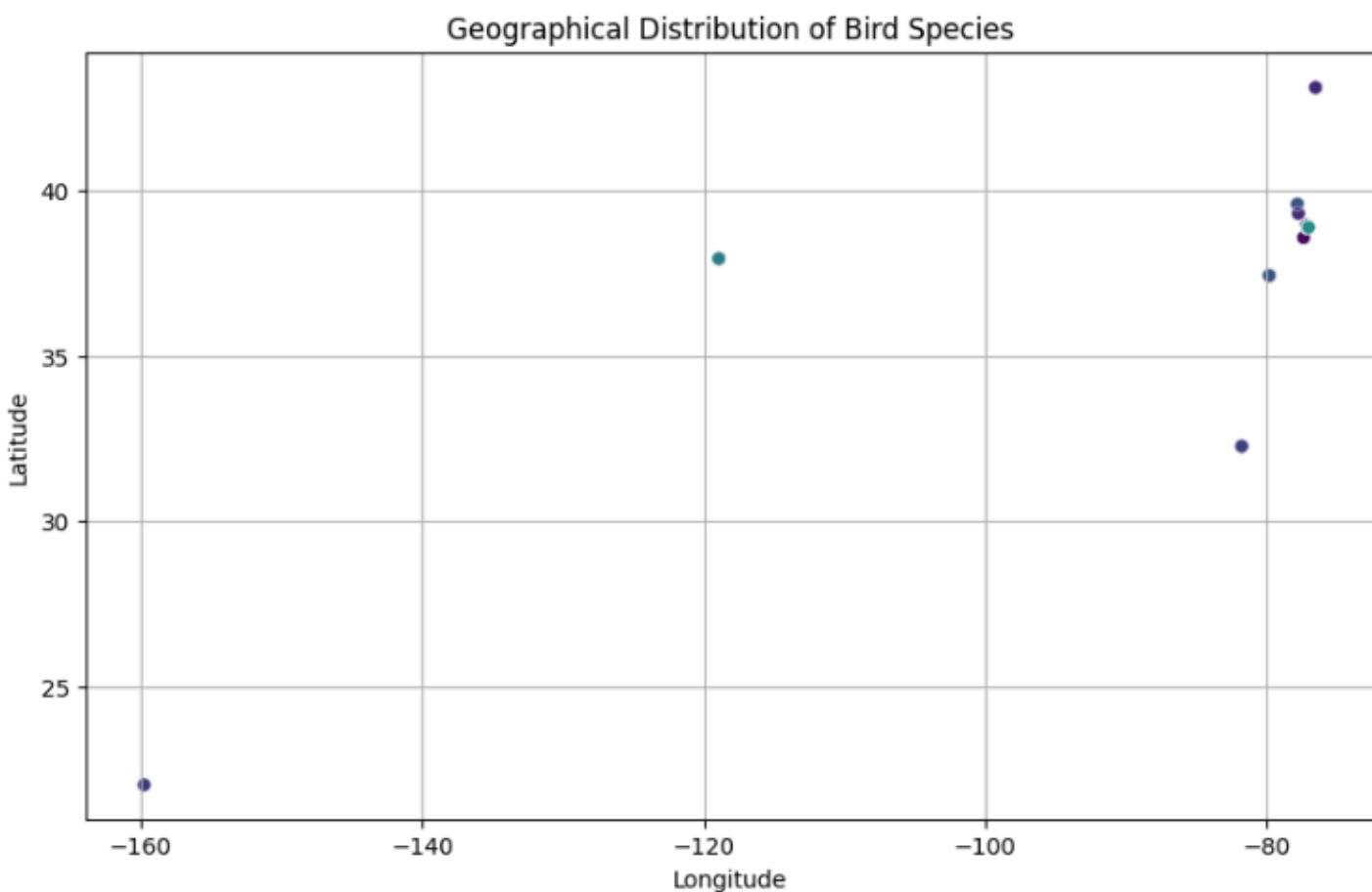
Parks MONO and MANA, located farther away from the main cluster of parks, exhibit comparatively lower species richness.



## Spatial Patterns and Conservation Needs:

The clustering of species richness in specific parks indicates localized biodiversity hotspots within the NCRN. These areas are critical for maintaining diverse bird populations and supporting ecosystem resilience.

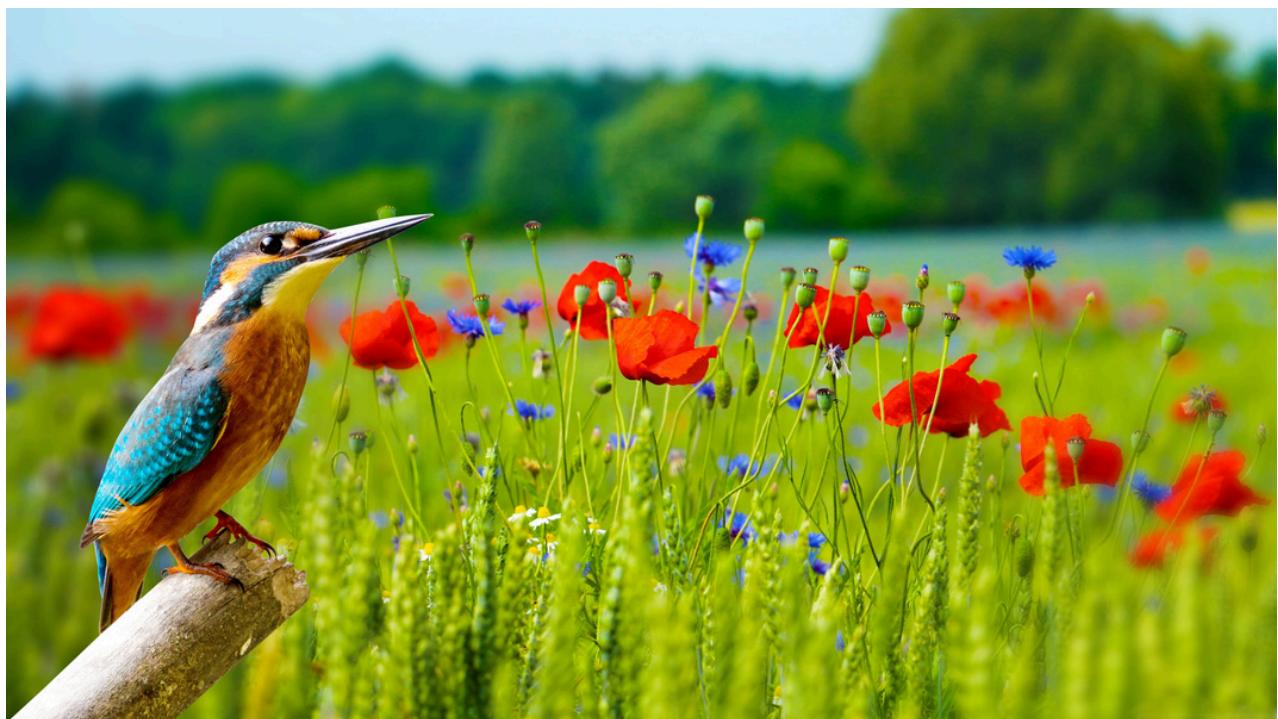
Parks MONO and MANA, due to their isolated geographical positions, may have distinct ecological characteristics or face unique conservation challenges that differ from those of centrally located parks.



Understanding the geographical distribution of bird species is essential for effective conservation planning in the NCRN. By identifying biodiversity hotspots and areas with unique ecological features, conservation strategies can be tailored to ensure the preservation and sustainability of bird populations across this vital region. Future efforts should focus on enhancing habitat quality, mitigating threats, and promoting ecosystem health to support diverse bird communities within the National Capital Region Network.

## **Conclusion**

The analysis of the geographical distribution of bird species across the National Capital Region Network (NCRN) parks reveals significant insights into species richness and spatial patterns, crucial for conservation planning and management.



### **Recommendations**

1. Focus Conservation Efforts: Prioritize conservation efforts in parks with high species richness to protect biodiversity hotspots.
2. Integrated Management: Implement integrated management practices that address habitat fragmentation, climate change impacts, and invasive species.
3. Monitoring and Adaptation: Continuously monitor bird populations and adapt conservation strategies based on ongoing ecological research and data-driven insights.