Part 1 Breeding Birds Atlas

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

import warnings
warnings.filterwarnings('ignore')

# Setting a consistent style for the plots
sns.set(style="whitegrid")


# Loading the dataset
df = pd.read_csv('breeding_bird_atlas.csv')
print("We successfully loaded the breeding_bird_atlas.csv dataset")
```

```
We successfully loaded the breeding_bird_atlas.csv dataset
```

+ Code + Text

```
# Printting main statistics
print("\n -------DATASET OVERVIEW-------")
print("Dataset Info:")
print(df.info())
print("\n -------DATASET DESCRIPTION-------")
print(df.describe(include='all'))
print("\n -------MISSING VALUES-------")
print(df.isnull().sum())
```

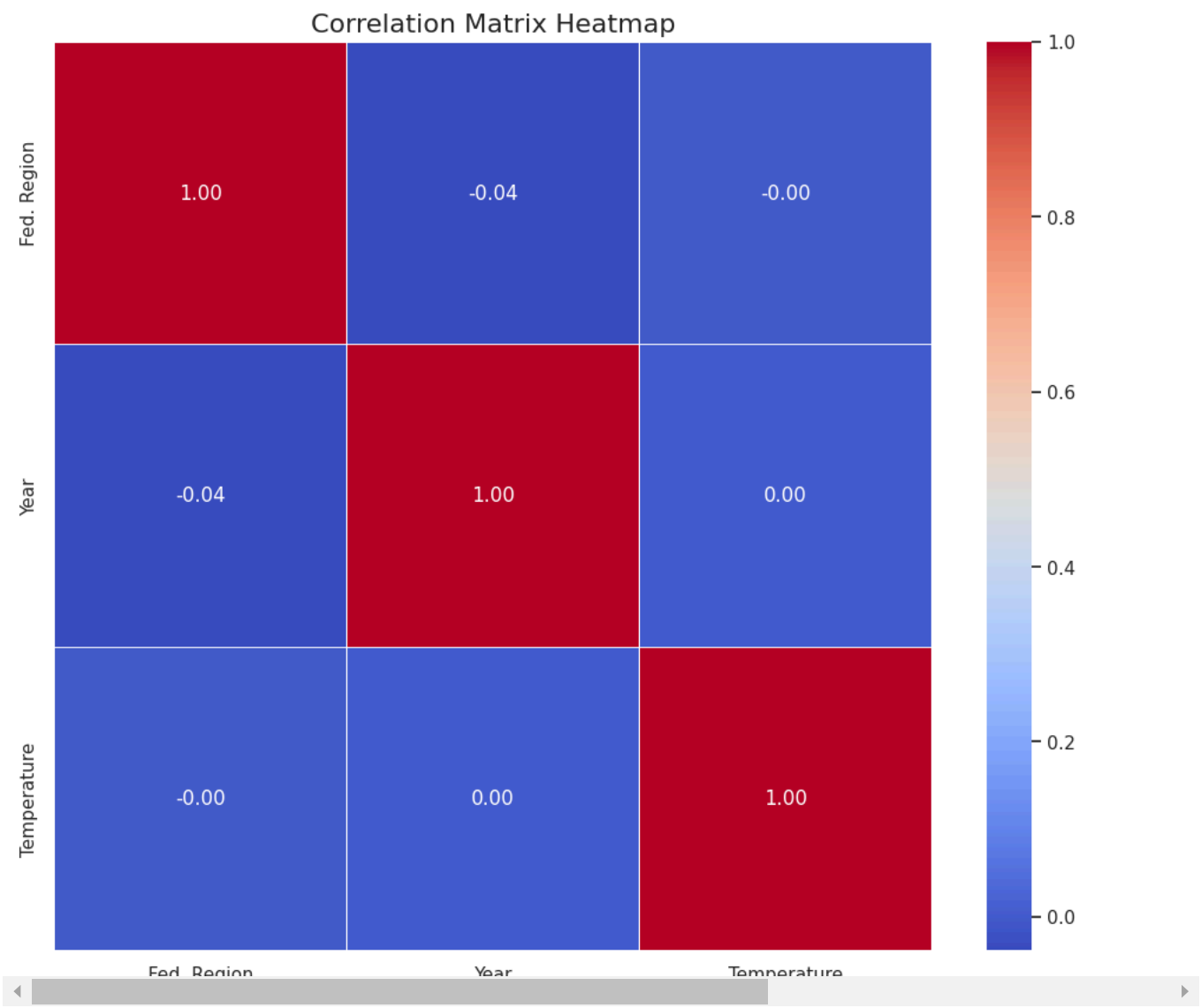
```
 -------DATASET OVERVIEW-------
Dataset Info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 152408 entries, 0 to 152407
Data columns (total 16 columns):
 #   Column                 Non-Null Count   Dtype
---  ------                 --------------   -----
 0   Fed. Region            149979 non-null  float64
 1   Block ID               151284 non-null  object
 2   Map Link               150466 non-null  object
 3   County                 147915 non-null  object
 4   Common Name            147984 non-null  object
 5   Scientific Name        149242 non-null  object
 6   NYS Protection Status  148887 non-null  object
 7   Family Name            151353 non-null  object
 8   Family Description     150405 non-null  object
 9   Breeding Behavior      150246 non-null  object
 10  Month                  1459 non-null    float64
 11  Day                    3889 non-null    float64
 12  Year                   148076 non-null  float64
 13  Temperature            152407 non-null  float64
 14  Average UB Student GPA 152407 non-null  float64
 15  Breeding Status        152407 non-null  object
dtypes: float64(6), object(10)
memory usage: 18.6+ MB
None

 -------DATASET DESCRIPTION-------
         Fed. Region Block ID  \
count   149979.000000   151284
unique            NaN     5695
top               NaN    5669B
freq              NaN       99
mean         5.804693      NaN
std          5.704587      NaN
min          0.000000      NaN
25%          4.000000      NaN
50%          5.000000      NaN
75%          8.000000      NaN
max         99.000000      NaN

                                                Map Link       County  \
count                                             150466       147915
unique                                              5567          219
top     http://www.dec.ny.gov/data/dfwmr/bba/pdf/5669b...  ST LAWRENCE
freq                                                 100         8858
mean                                                 NaN          NaN
std                                                  NaN          NaN
min                                                  NaN          NaN
25%                                                  NaN          NaN
```

```
50%                                                  NaN          NaN
75%                                                  NaN          NaN
max                                                  NaN          NaN

                Common Name     Scientific Name NYS Protection Status  \
count                147984              149242                148887
```

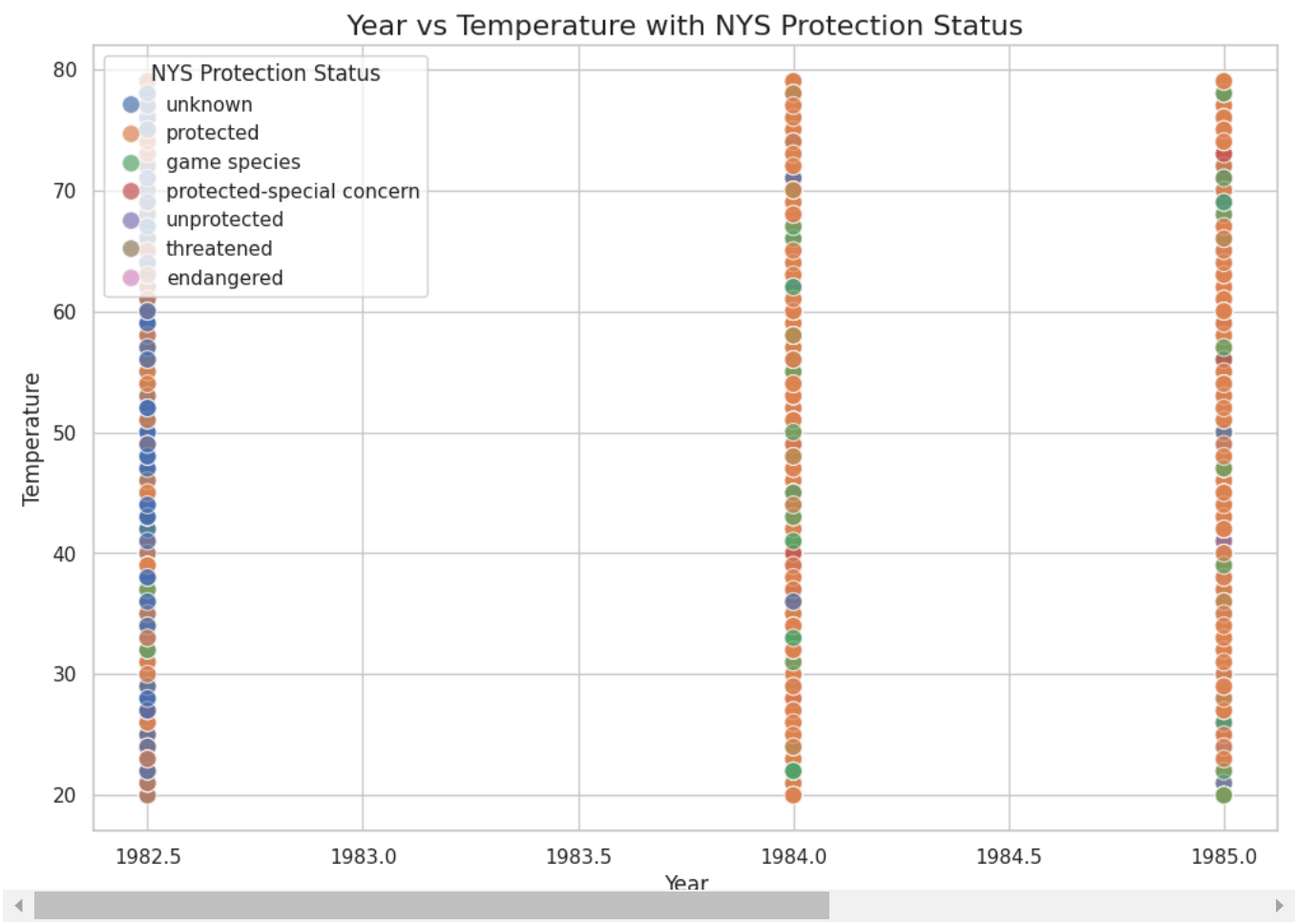
```
# Data cleaning and preprocessing
columns_to_drop = ['Average UB Student GPA', 'Day', 'Map Link', 'Month']
df = df.drop(columns=columns_to_drop)

def is_numeric(value):
    try:
        float(value)
        return True
    except ValueError:
        return False

object_columns = ['Block ID', 'Common Name', 'Scientific Name', 'Family Name', 'Family Description', 'County', 'NYS Pro
for col in object_columns:
    numeric_mask = df[col].apply(is_numeric)
    df.loc[numeric_mask, col] = 'Unknown'

df['Fed. Region'] = df['Fed. Region'].fillna(df['Fed. Region'].median())
df['Year'] = df['Year'].fillna(df['Year'].median())
df['Temperature'] = df['Temperature'].fillna(df['Temperature'].median())

object_columns_with_missing = ['Block ID', 'County', 'NYS Protection Status', 'Breeding Status', 'Breeding Behavior']
for col in object_columns_with_missing:
    df[col] = df[col].fillna(df[col].mode()[0])

string_columns = df.select_dtypes(include=['object']).columns
for col in string_columns:
    df[col] = df[col].str.lower().str.strip()

def handle_outliers(df, columns):
    for col in columns:
        Q1 = df[col].quantile(0.25)
        Q3 = df[col].quantile(0.75)
        IQR = Q3 - Q1
        lower_bound = Q1 - 1.5 * IQR
        upper_bound = Q3 + 1.5 * IQR
        df[col] = df[col].clip(lower_bound, upper_bound)
    return df

numeric_columns = ['Fed. Region', 'Year', 'Temperature']
df = handle_outliers(df, numeric_columns)

print("\n -------MISSING VALUES AFTER CLEANING-------")
print(df.isnull().sum())
```

```
 -------MISSING VALUES AFTER CLEANING-------
Fed. Region             0
Block ID                0
County                  0
Common Name             0
Scientific Name         0
NYS Protection Status   0
Family Name             0
Family Description      0
Breeding Behavior       0
Year                    0
Temperature             0
Breeding Status         0
dtype: int64
```

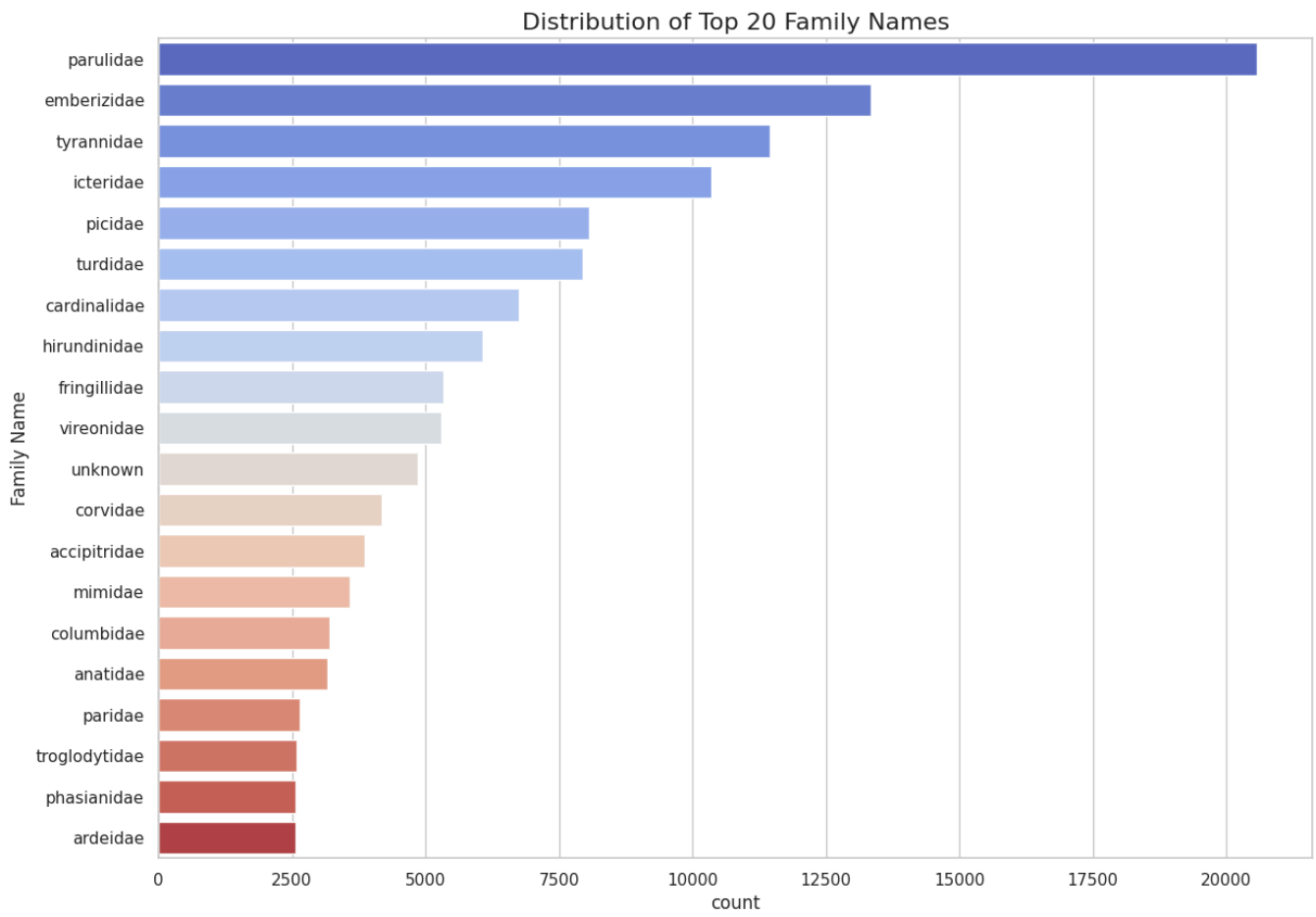
```
# Data Visualization
plt.figure(figsize=(12, 10))
corr_matrix = df[numeric_columns].corr()
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', fmt=".2f", linewidths=0.5)
plt.title("Correlation Matrix Heatmap", fontsize=16)
plt.show()
```



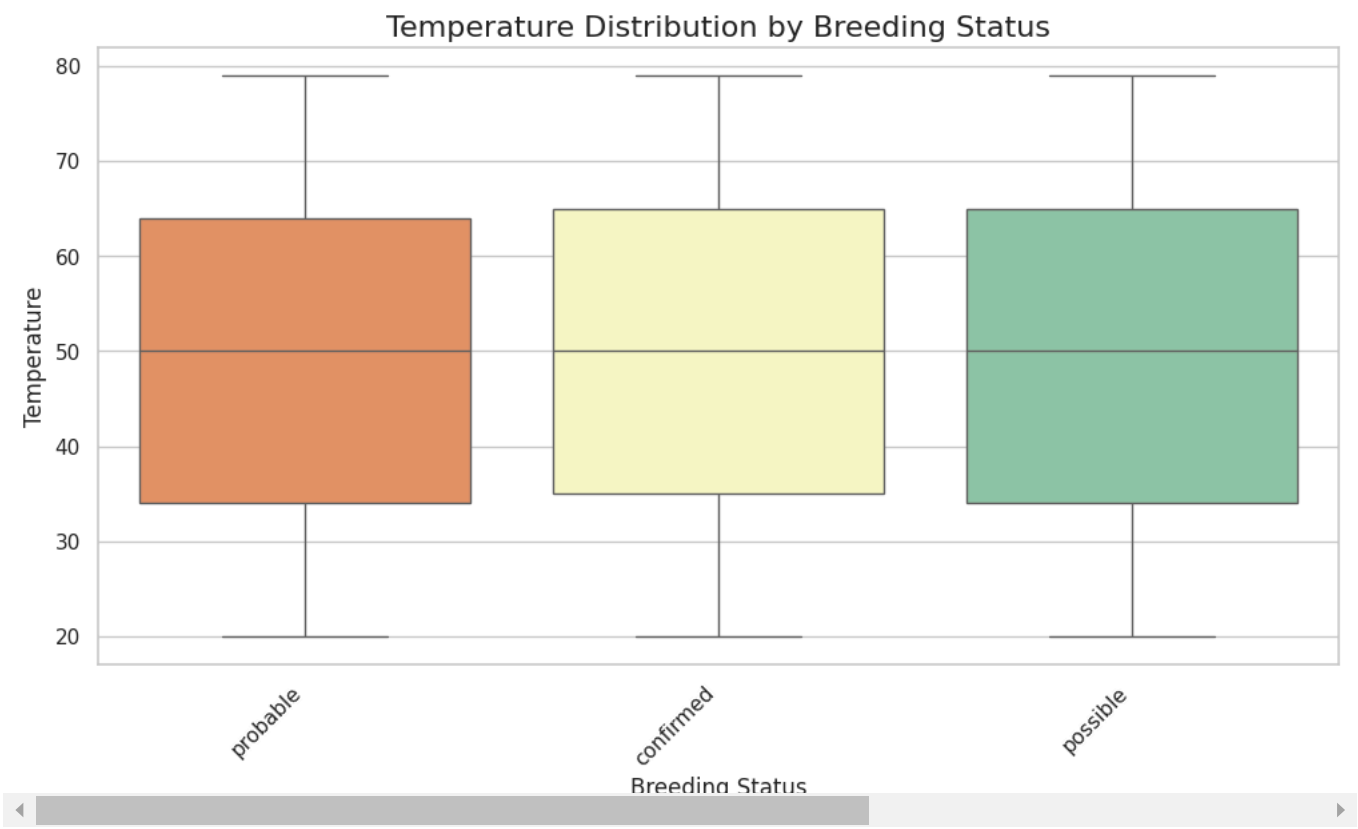

```
plt.figure(figsize=(12, 8))
sns.scatterplot(data=df, x='Year', y='Temperature', hue='NYS Protection Status', palette="deep", s=100, edgecolor="w", a
plt.title("Year vs Temperature with NYS Protection Status", fontsize=16)
plt.show()
```



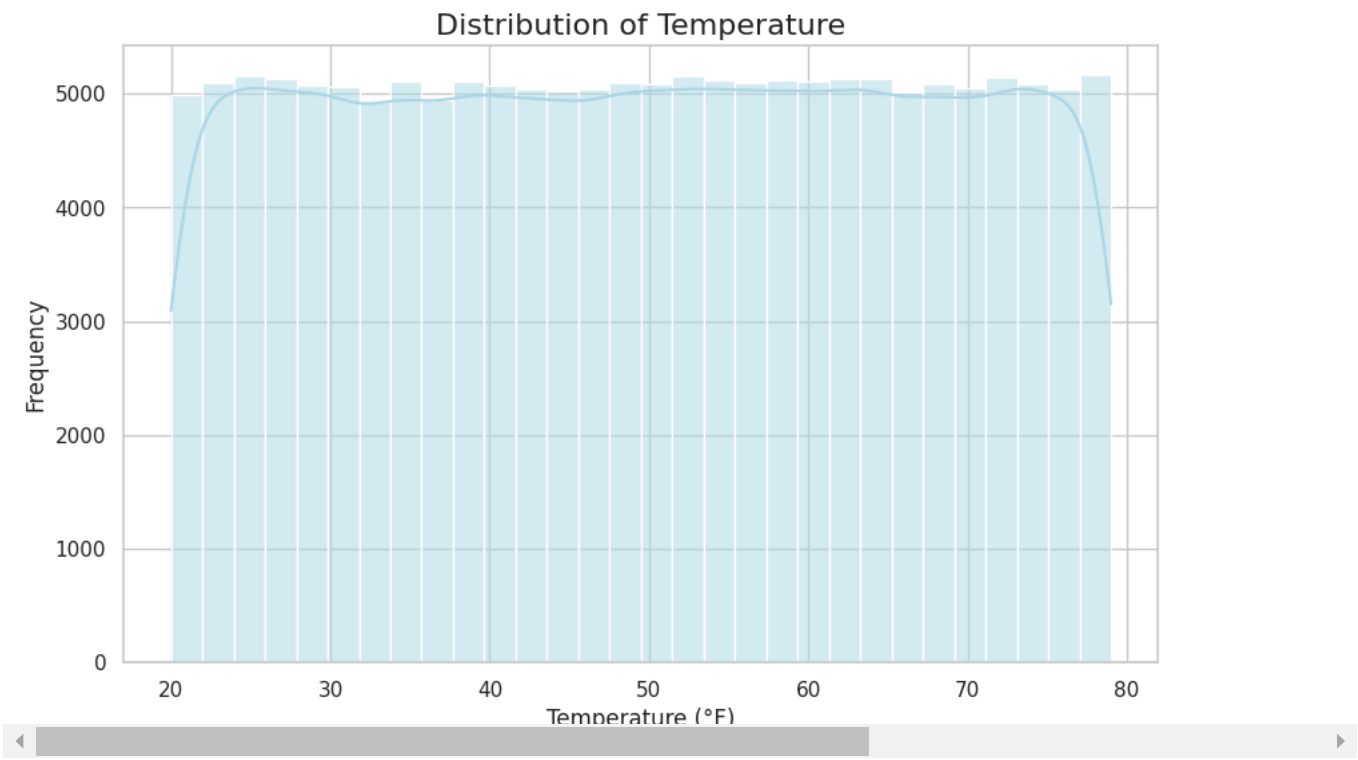

```
plt.figure(figsize=(14, 10))
sns.countplot(data=df, y='Family Name', order=df['Family Name'].value_counts().index[:20], palette="coolwarm")
plt.title("Distribution of Top 20 Family Names", fontsize=16)
plt.show()
```




```
plt.figure(figsize=(12, 6))
sns.boxplot(data=df, x='Breeding Status', y='Temperature', palette="Spectral")
plt.title("Temperature Distribution by Breeding Status", fontsize=16)
plt.xticks(rotation=45, ha='right')
plt.show()
```




```
plt.figure(figsize=(10, 6))
sns.histplot(df['Temperature'], bins=30, kde=True, color='lightblue')
plt.title('Distribution of Temperature', fontsize=16)
plt.xlabel('Temperature (°F)')
plt.ylabel('Frequency')
plt.show()
```




```
#identify numeric and categorical columns
numeric_columns = df.select_dtypes(include=[np.number]).columns
categorical_columns = df.select_dtypes(exclude=[np.number]).columns

# Task8 - Converting the features with string datatype to categorical
def label_encode(series):
    return pd.Categorical(series).codes

for col in categorical_columns:
```

```
        df[col] = label_encode(df[col])

    # Creating binary target for 'Breeding Status'
    df['Breeding Status Binary'] = (df['Breeding Status'] == df['Breeding Status'].max()).astype(int

    # Task7 - Identify uncorrelated or unrelated features
    # Computing the correlation matrix
    correlation_matrix = df.corr()

    # Getting the correlation with the target
    target_corr = correlation_matrix['Breeding Status Binary'].abs().sort_values(ascending=False)

    # Setting a threshold for low correlation to 0.3
    threshold = 0.03

    # Identifying the features with low correlation
    low_corr_features = target_corr[target_corr < threshold].index.tolist()
    sufficient_corr_features = target_corr[target_corr >= threshold].index.tolist()

    print("\nFeatures with low correlation to 'Breeding Status' that could be dropped:")
    print(low_corr_features)
    print("\nFeatures sufficiently correlated with 'Breeding Status' that should not be dropped:")
    print(sufficient_corr_features)
```

```
    Features with low correlation to 'Breeding Status' that could be dropped:
    ['Fed. Region', 'Scientific Name', 'Block ID', 'Temperature', 'Year']

    Features sufficiently correlated with 'Breeding Status' that should not be dropped:
    ['Breeding Status Binary', 'Breeding Status', 'Breeding Behavior', 'Family Description', 'Family Name', 'NYS Protection Status', 'Co
```

```
    # Task9 - Normalizing non-categorical features
    def normalize(column):
        min_val = column.min()
        max_val = column.max()
        if min_val == max_val:
            return pd.Series(0, index=column.index)
        return (column - min_val) / (max_val - min_val)

    for col in numeric_columns:
        df[col] = normalize(df[col])

    print("\nShape of the dataset:", df.shape)
    print("\nFirst few rows of the processed dataset:")
    print(df.head())
    print("\nColumn datatypes:")
    print(df.dtypes)
```

```
    Shape of the dataset: (152408, 13)

    First few rows of the processed dataset:
       Fed. Region  Block ID  County  Common Name  Scientific Name  \
    0     0.357143      3345      56          204              216
    1     0.571429      3034       0            1               94
    2     0.571429      3345       0            3               18
    3     0.571429      3475       0            3               18
    4     0.571429      3039       0            5               69

       NYS Protection Status  Family Name  Family Description  Breeding Behavior  \
    0                      5           47                  41                112
    1                      2           45                  41                107
    2                      1            3                  35                110
    3                      1            3                  35                114
    4                      1           13                  14                112

       Year  Temperature  Breeding Status  Breeding Status Binary
    0   1.0     0.661017                2                       1
    1   1.0     0.983051                0                       0
    2   1.0     0.881356                2                       1
    3   1.0     0.542373                1                       0
```