SFkFkDeer

April 24, 2024

```
[ ]: import warnings
     warnings.filterwarnings("ignore", category=DeprecationWarning)
```

```
[ ]: import pandas as pd
     import seaborn as sns
     import matplotlib.pyplot as plt
```

```
Intel MKL WARNING: Support of Intel(R) Streaming SIMD Extensions 4.2 (Intel(R)
SSE4.2) enabled only processors has been deprecated. Intel oneAPI Math Kernel
Library 2025.0 will require Intel(R) Advanced Vector Extensions (Intel(R) AVX)
instructions.
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instructions.
```

The following methods were performed to wrangle the data in Excel:

- Converting `Start Date` from `mm/dd/yy` to `yyyy-mm-dd`
- Converting `Time` from `hhmm` to `hh:mm`
- Changing one `Time` value `UNKNOWN` to `12:00` (middle of the day)
- Combining `Start Date` and `Time` into `DateTime` variable `yyyy-mm-dd hh:mm`
- Adding a `Season` variable based on `Start Date` variable
- Converting all blank values in `Value` to `1/2 * MDL RDQ Measure 2`

```
[ ]: # Load data
     df = pd.read_csv('SFkFkDeer.csv')
```

```
[ ]: # Convert DateTime to datetime data type (plot can interpret date/time values␣
      ↪in order)
     df['DateTime'] = pd.to_datetime(df['DateTime'])
```

```
[ ]: # Select relevant variables
     df = df.loc[:, df.columns.isin(['DateTime', 'Season', 'Characteristic',␣
      ↪'Value', 'Unit'])]
     df
```

```
[ ]:                DateTime  Season Characteristic    Value     Unit
     0   1998-12-16 09:15:00    Fall   Conductivity   60.000  umho/cm
     1   1999-03-24 11:45:00  Spring   Conductivity   65.000  umho/cm
     2   1999-06-09 09:50:00  Spring   Conductivity  127.000  umho/cm
     3   1999-09-28 09:50:00    Fall   Conductivity  110.000  umho/cm
     4   1999-12-01 11:20:00    Fall   Conductivity   97.000  umho/cm
     ..                  ...     ...            ...      ...      ...
     879 2022-06-29 10:38:00  Summer     Phosphorus    0.130     mg/l
     880 2022-09-27 10:55:00    Fall     Phosphorus    0.143     mg/l
     881 2022-12-13 10:50:00    Fall     Phosphorus    0.176     mg/l
     882 2023-03-09 10:10:00  Winter     Phosphorus    0.147     mg/l
     883 2023-10-24 10:56:00    Fall     Phosphorus    0.221     mg/l

     [884 rows x 5 columns]
```

```
[ ]: # Define boxplot season order and color palette
     order = ['Spring', 'Summer', 'Fall', 'Winter']
     palette = ['#7FFF00', '#FF6347', '#FFA500', '#4169E1']
```

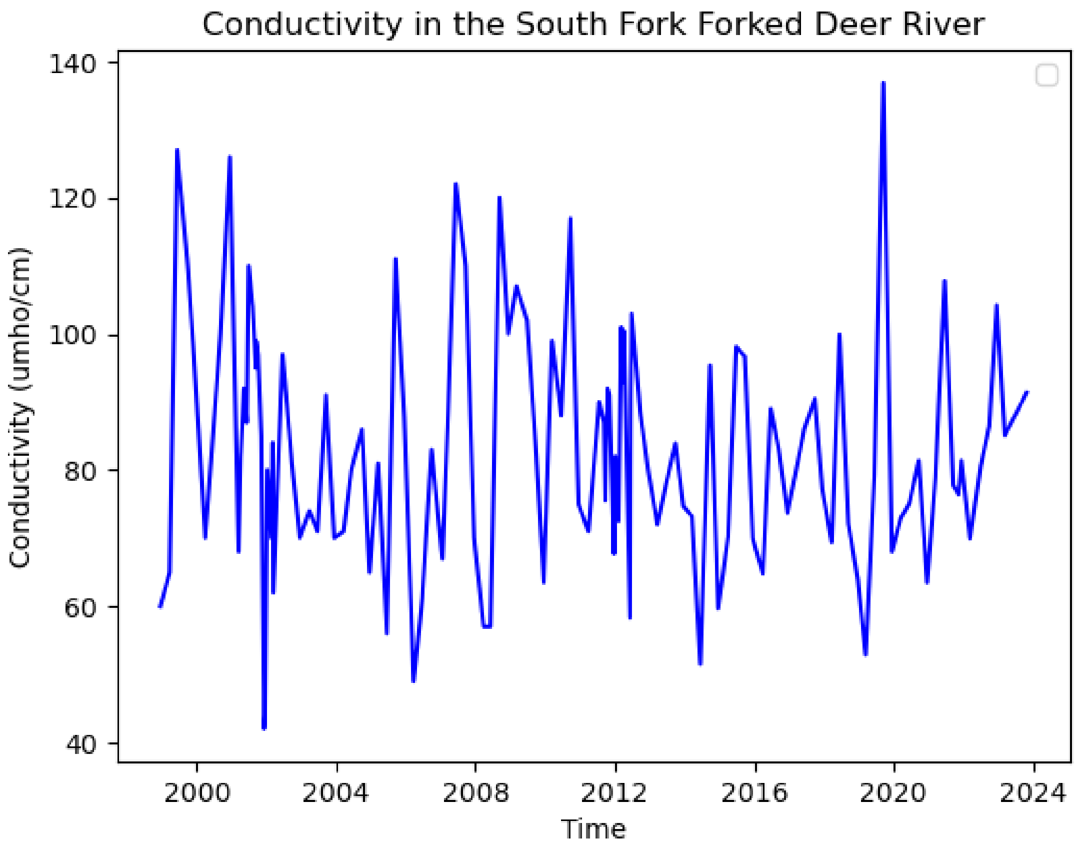
1 Conductivity Analysis

1.1 Temporal

```
[ ]: df_conductivity = df[df['Characteristic'] == 'Conductivity']
```

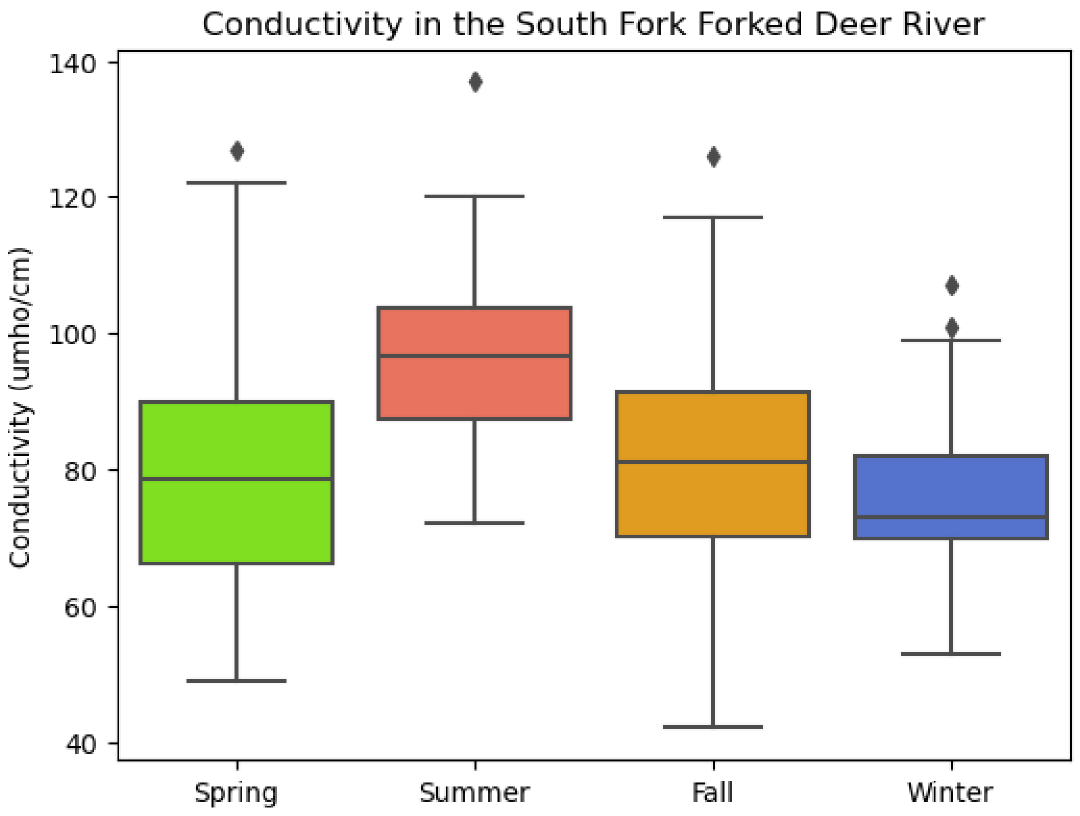
```
[ ]: sns.lineplot(x='DateTime', y='Value', data=df_conductivity, color='blue')
     plt.title('Conductivity in the South Fork Forked Deer River')
     plt.xlabel('Time')
     plt.ylabel('Conductivity (umho/cm)')
     plt.legend()
     plt.show()
```

```
/Users/brookestevens/opt/anaconda3/envs/myenv/lib/python3.9/site-
packages/seaborn/_oldcore.py:1119: FutureWarning: use_inf_as_na option is
deprecated and will be removed in a future version. Convert inf values to NaN
before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
/Users/brookestevens/opt/anaconda3/envs/myenv/lib/python3.9/site-
packages/seaborn/_oldcore.py:1119: FutureWarning: use_inf_as_na option is
deprecated and will be removed in a future version. Convert inf values to NaN
before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
No artists with labels found to put in legend.  Note that artists whose label
start with an underscore are ignored when legend() is called with no argument.
```



1.2 Seasonal

```
[ ]: warnings.filterwarnings('ignore')
     sns.boxplot(x='Season', y='Value', data=df_conductivity, order=order,␣
      ↪palette=palette)
     plt.title('Conductivity in the South Fork Forked Deer River')
     plt.ylabel('Conductivity (umho/cm)')
     plt.xlabel('')
     plt.show()
```



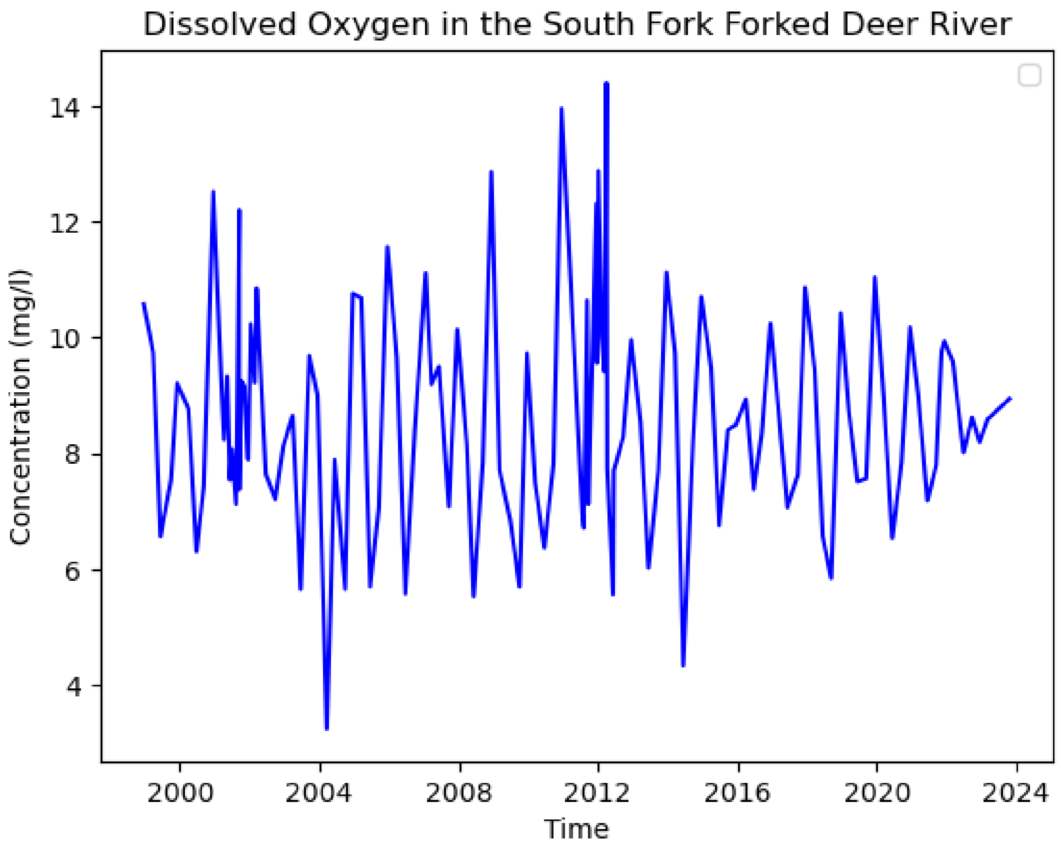
2 Dissolved Oxygen Analysis

2.1 Temporal

```
[ ]: df_do = df[df['Characteristic'] == 'Dissolved oxygen (DO)']
```

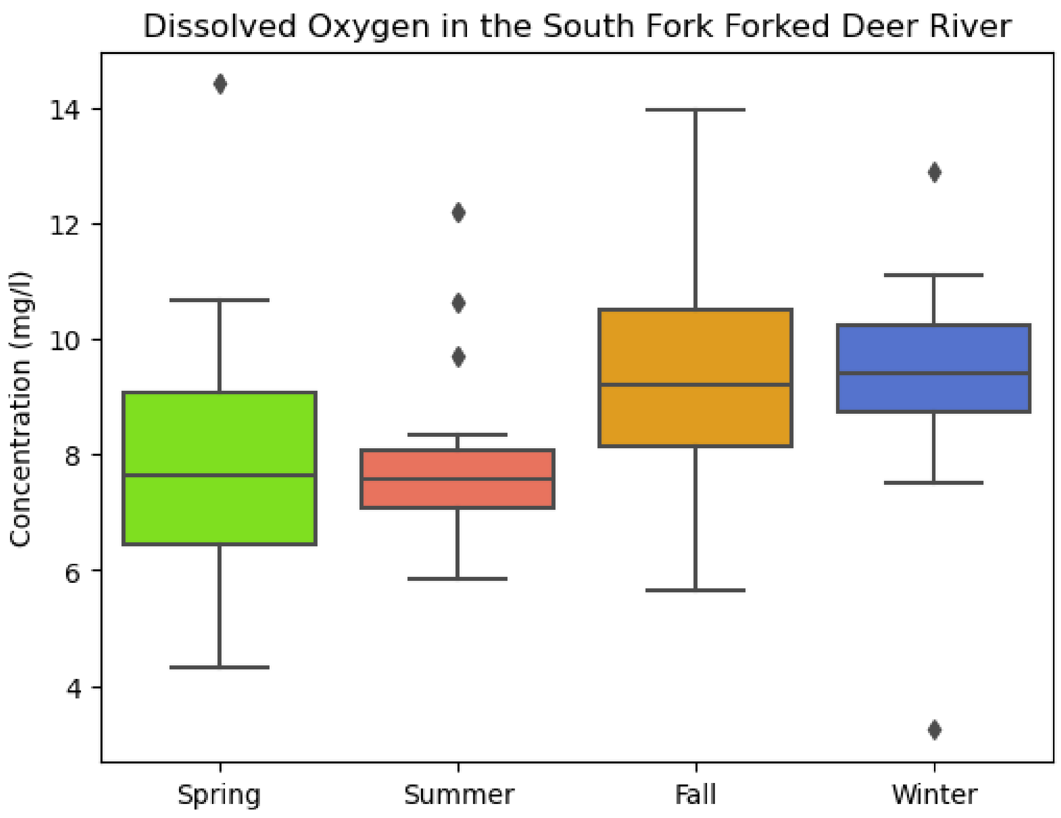
```
[ ]: sns.lineplot(x='DateTime', y='Value', data=df_do, color='blue')
     plt.title('Dissolved Oxygen in the South Fork Forked Deer River')
     plt.xlabel('Time')
     plt.ylabel('Concentration (mg/l)')
     plt.legend()
     plt.show()
```

```
No artists with labels found to put in legend.  Note that artists whose label
start with an underscore are ignored when legend() is called with no argument.
```



2.2 Seasonal

```
[ ]: warnings.filterwarnings('ignore')
     sns.boxplot(x='Season', y='Value', data=df_do, order=order, palette=palette)
     plt.title('Dissolved Oxygen in the South Fork Forked Deer River')
     plt.ylabel('Concentration (mg/l)')
     plt.xlabel('')
     plt.show()
```

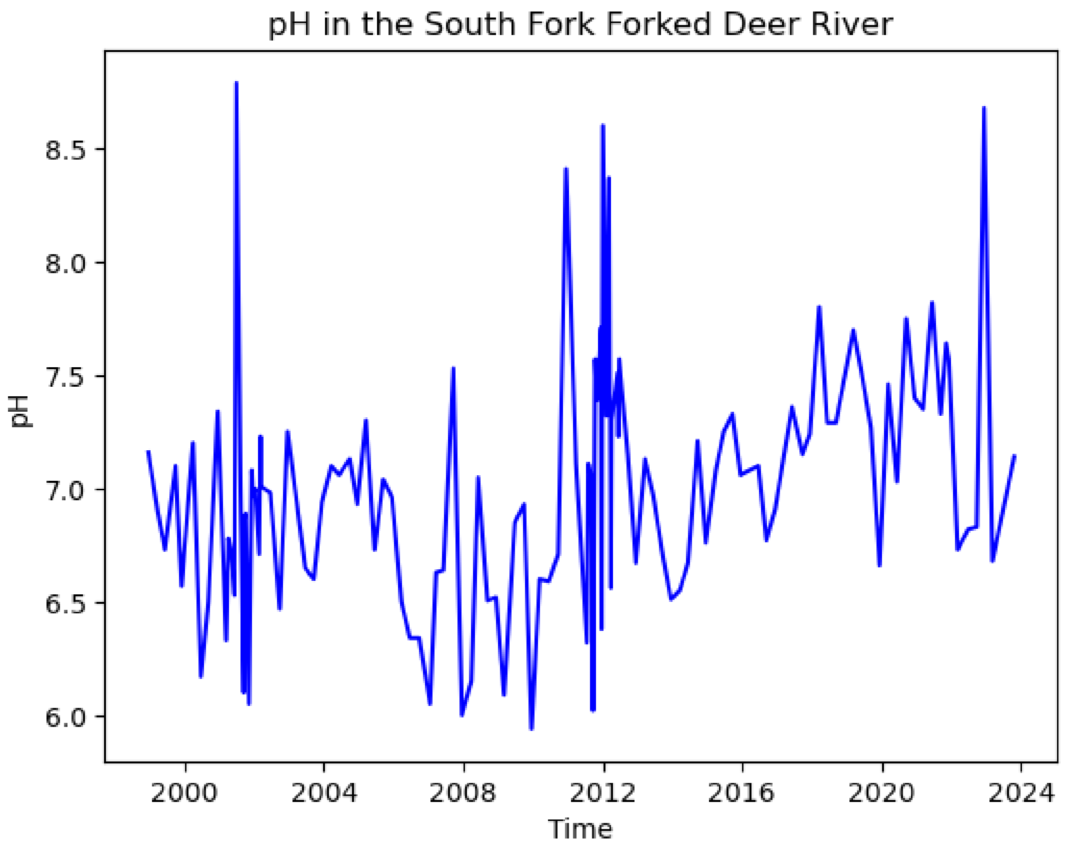


3 pH Analysis

3.1 Temporal

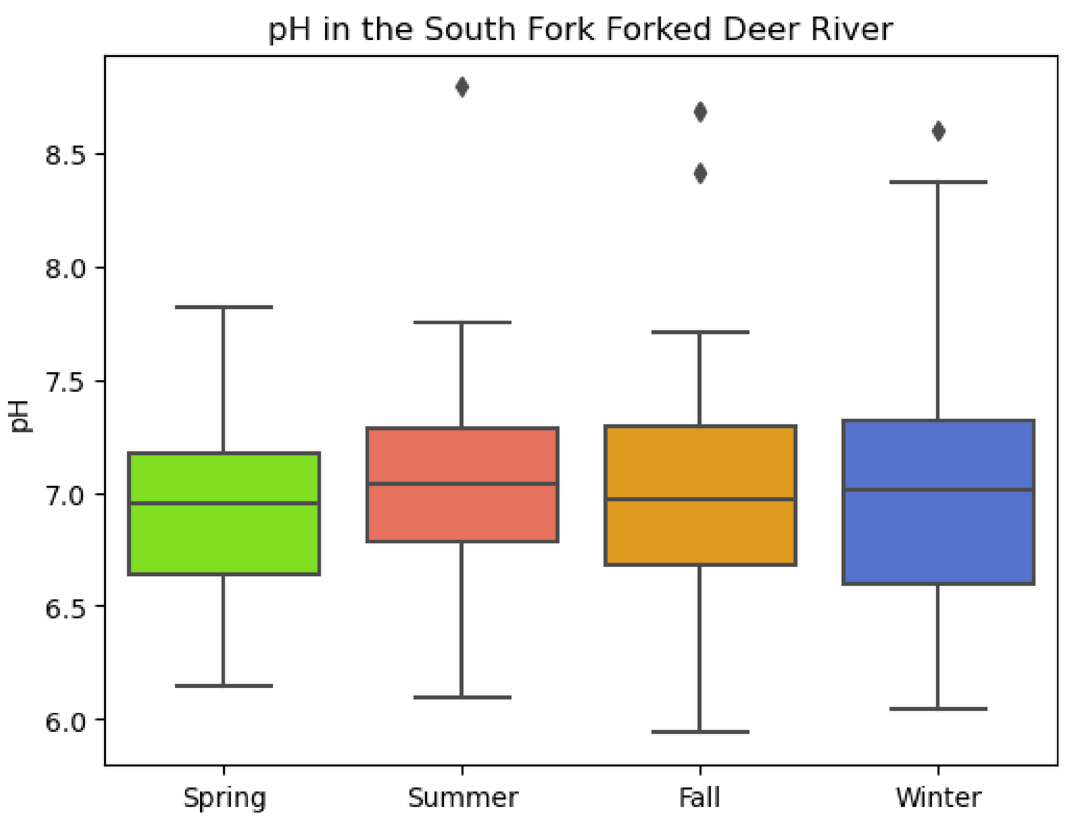
```
[ ]: df_ph = df[df['Characteristic'] == 'pH']
```

```
[ ]: sns.lineplot(x='DateTime', y='Value', data=df_ph, color='blue')
     plt.title('pH in the South Fork Forked Deer River')
     plt.xlabel('Time')
     plt.ylabel('pH')
     plt.show()
```



3.2 Seasonal

```
[ ]: warnings.filterwarnings('ignore')
     sns.boxplot(x='Season', y='Value', data=df_ph, order=order, palette=palette)
     plt.title('pH in the South Fork Forked Deer River')
     plt.ylabel('pH')
     plt.xlabel('')
     plt.show()
```



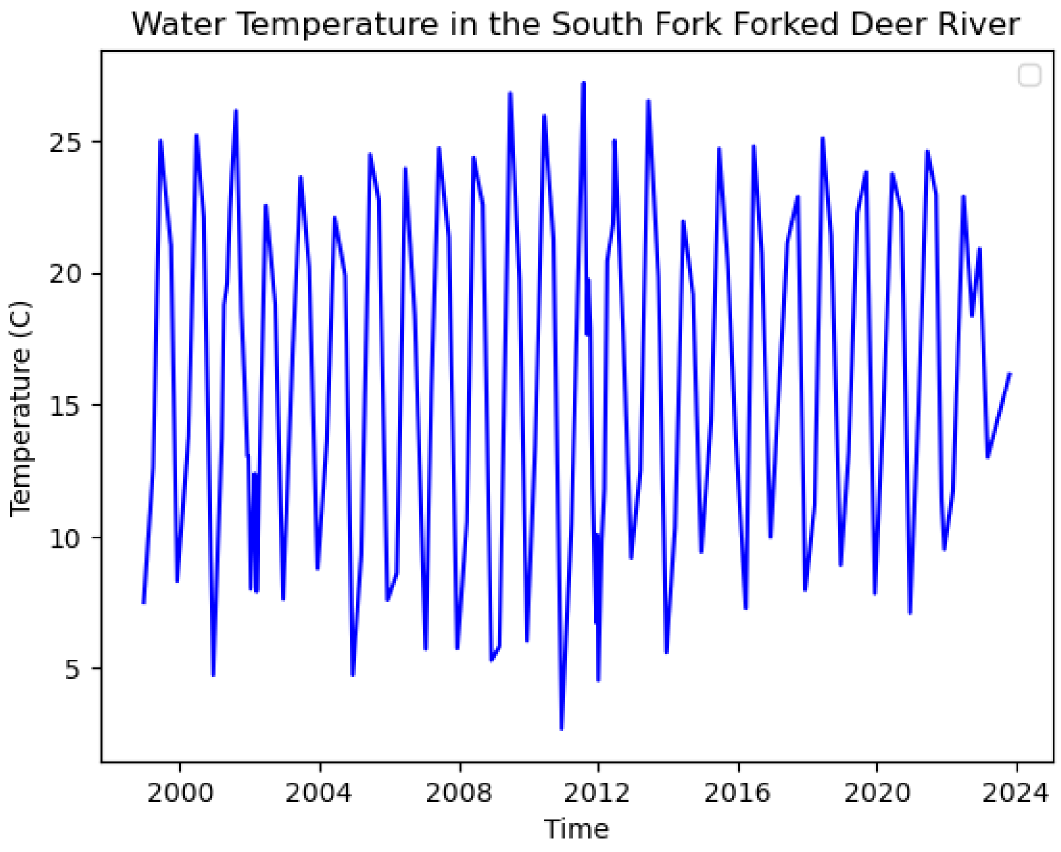
4 Water Temperature Analysis

4.1 Temporal

```
[ ]: df_watertemp = df[df['Characteristic'] == 'Temperature, water']
```

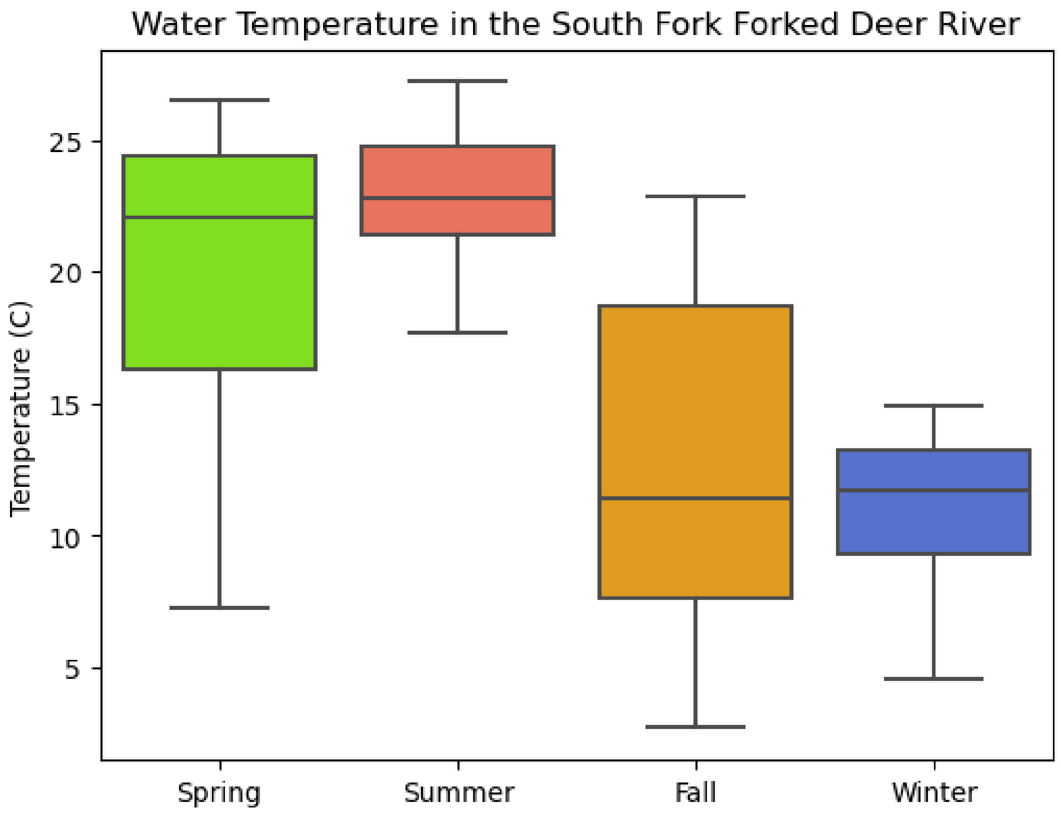
```
[ ]: sns.lineplot(x='DateTime', y='Value', data=df_watertemp, color='blue')
     plt.title('Water Temperature in the South Fork Forked Deer River')
     plt.xlabel('Time')
     plt.ylabel('Temperature (C)')
     plt.legend()
     plt.show()
```

```
No artists with labels found to put in legend.  Note that artists whose label
start with an underscore are ignored when legend() is called with no argument.
```



4.2 Seasonal

```
[ ]: warnings.filterwarnings('ignore')
     sns.boxplot(x='Season', y='Value', data=df_watertemp, order=order,␣
       ↪palette=palette)
     plt.title('Water Temperature in the South Fork Forked Deer River')
     plt.ylabel('Temperature (C)')
     plt.xlabel('')
     plt.show()
```



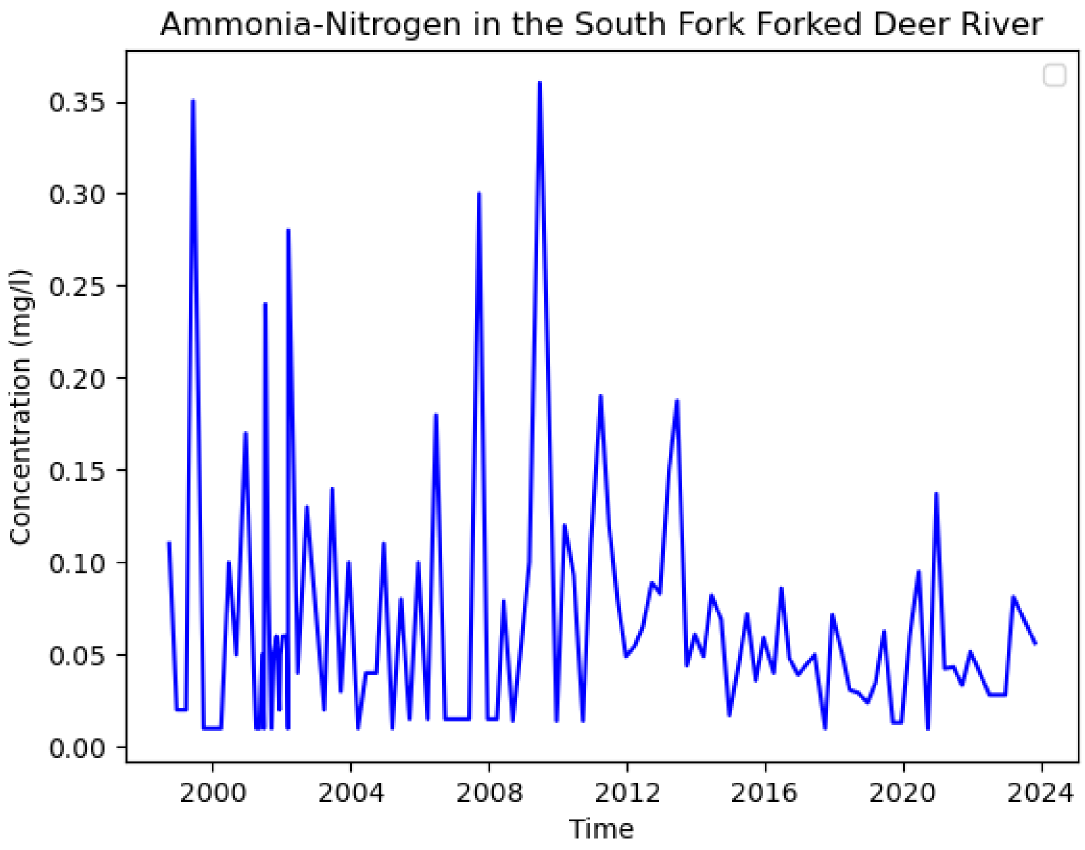
5 Ammonia-Nitrogen Analysis

5.1 Temporal

```
[ ]: df_ammnit = df[df['Characteristic'] == 'Ammonia-nitrogen']
```

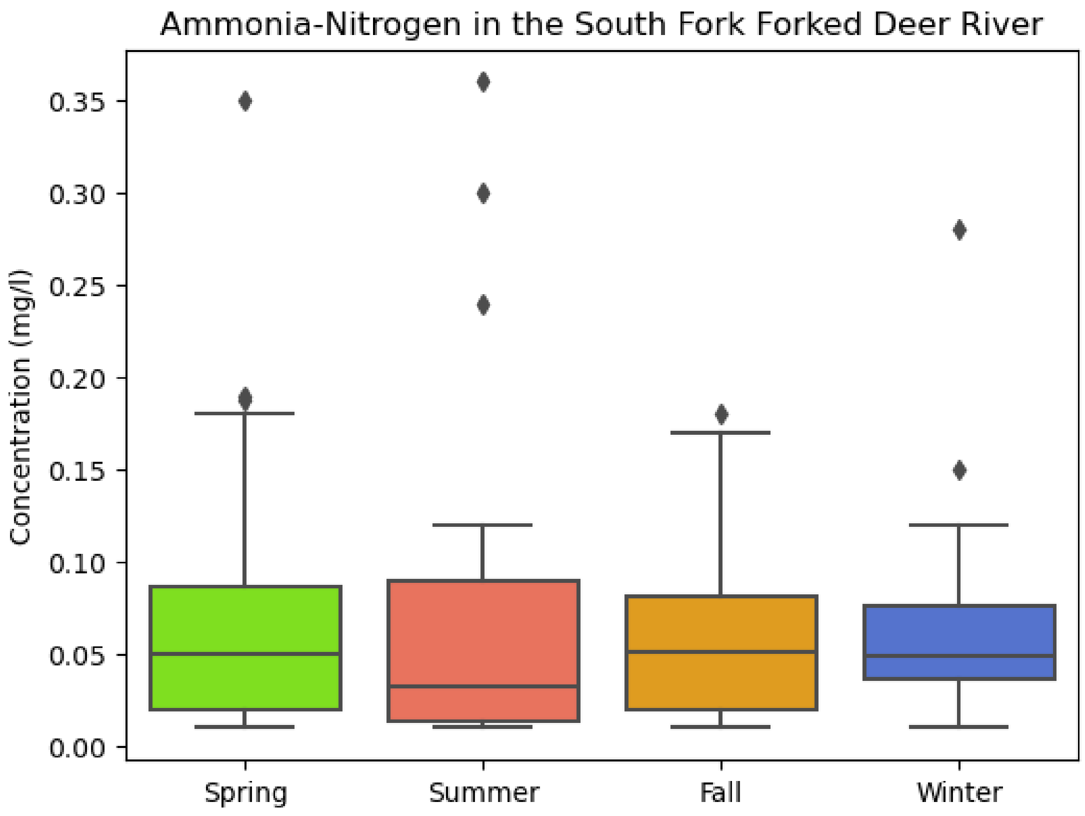
```
[ ]: sns.lineplot(x='DateTime', y='Value', data=df_ammnit, color='blue')
     plt.title('Ammonia-Nitrogen in the South Fork Forked Deer River')
     plt.xlabel('Time')
     plt.ylabel('Concentration (mg/l)')
     plt.legend()
     plt.show()
```

```
No artists with labels found to put in legend.  Note that artists whose label
start with an underscore are ignored when legend() is called with no argument.
```



5.2 Seasonal

```
[ ]: warnings.filterwarnings('ignore')
     sns.boxplot(x='Season', y='Value', data=df_ammnit, order=order, palette=palette)
     plt.title('Ammonia-Nitrogen in the South Fork Forked Deer River')
     plt.ylabel('Concentration (mg/l)')
     plt.xlabel('')
     plt.show()
```



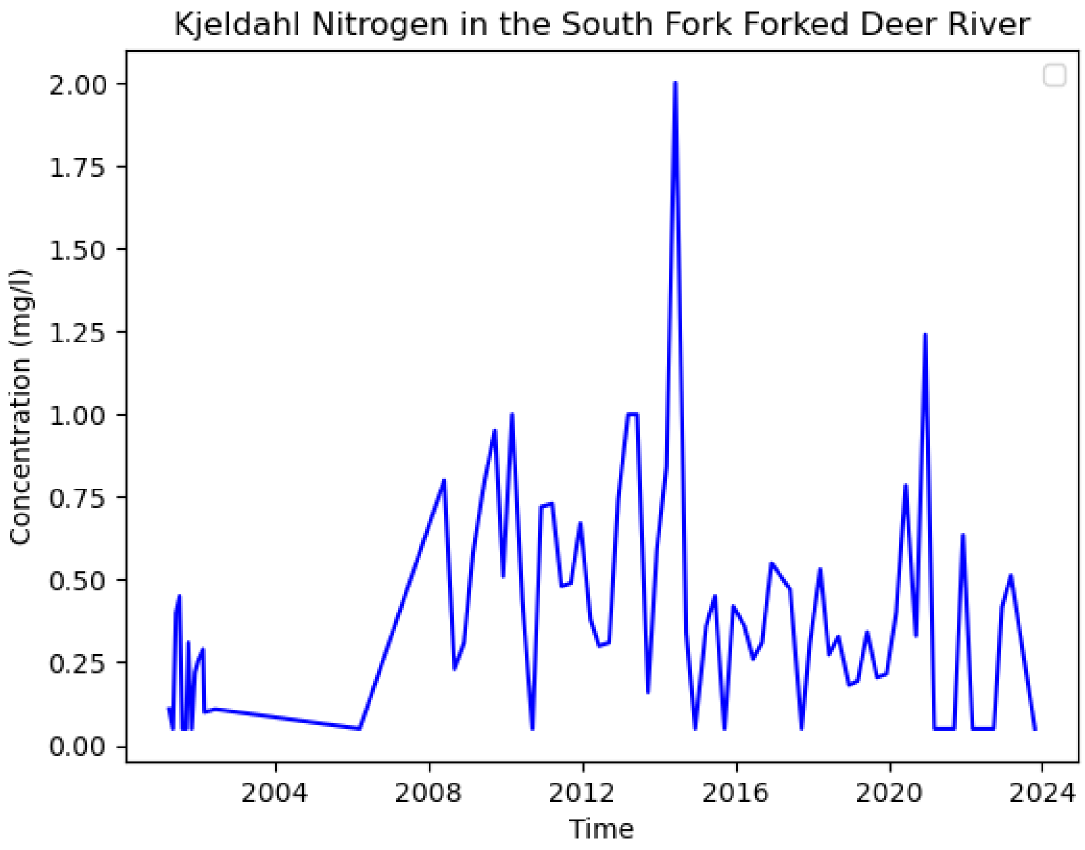
6 Kjeldahl Nitrogen Analysis

6.1 Temporal

[ ]:
```
df_kn = df[df['Characteristic'] == 'Kjeldahl nitrogen']
```

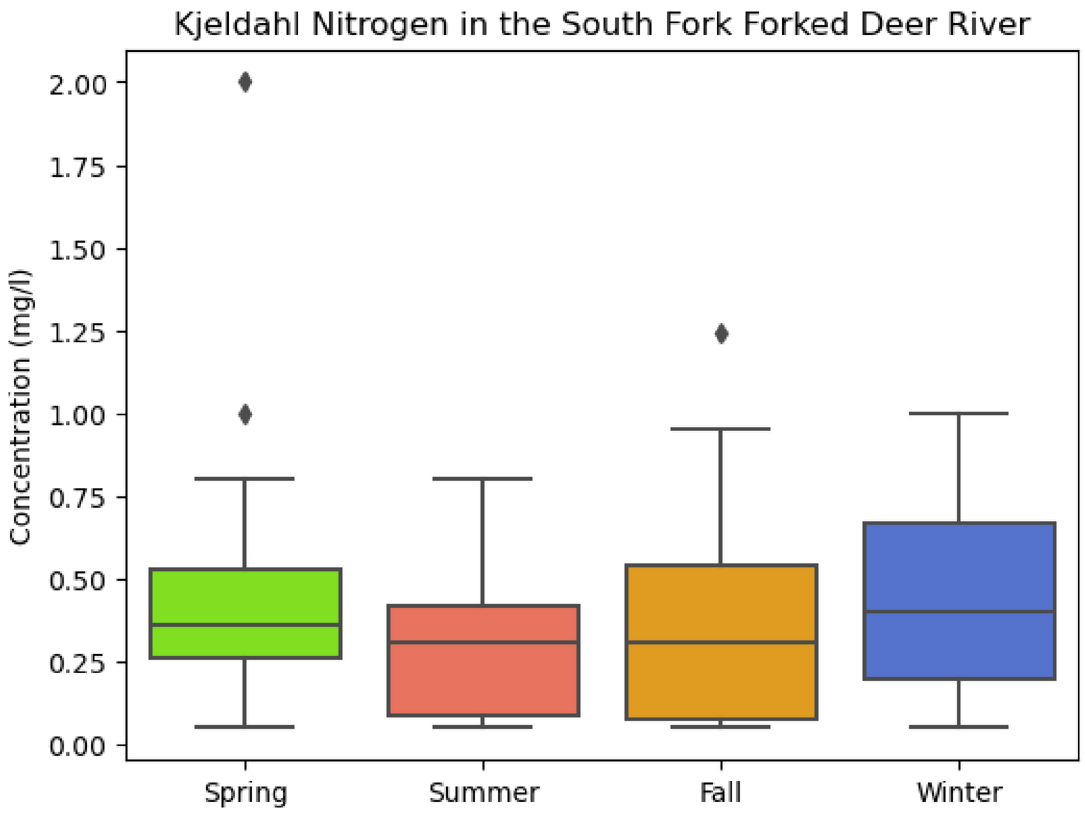
[ ]:
```
sns.lineplot(x='DateTime', y='Value', data=df_kn, color='blue')
plt.title('Kjeldahl Nitrogen in the South Fork Forked Deer River')
plt.xlabel('Time')
plt.ylabel('Concentration (mg/l)')
plt.legend()
plt.show()
```

```
No artists with labels found to put in legend.  Note that artists whose label
start with an underscore are ignored when legend() is called with no argument.
```



6.2 Seasonal

```
[ ]: warnings.filterwarnings('ignore')
     sns.boxplot(x='Season', y='Value', data=df_kn, order=order, palette=palette)
     plt.title('Kjeldahl Nitrogen in the South Fork Forked Deer River')
     plt.ylabel('Concentration (mg/l)')
     plt.xlabel('')
     plt.show()
```



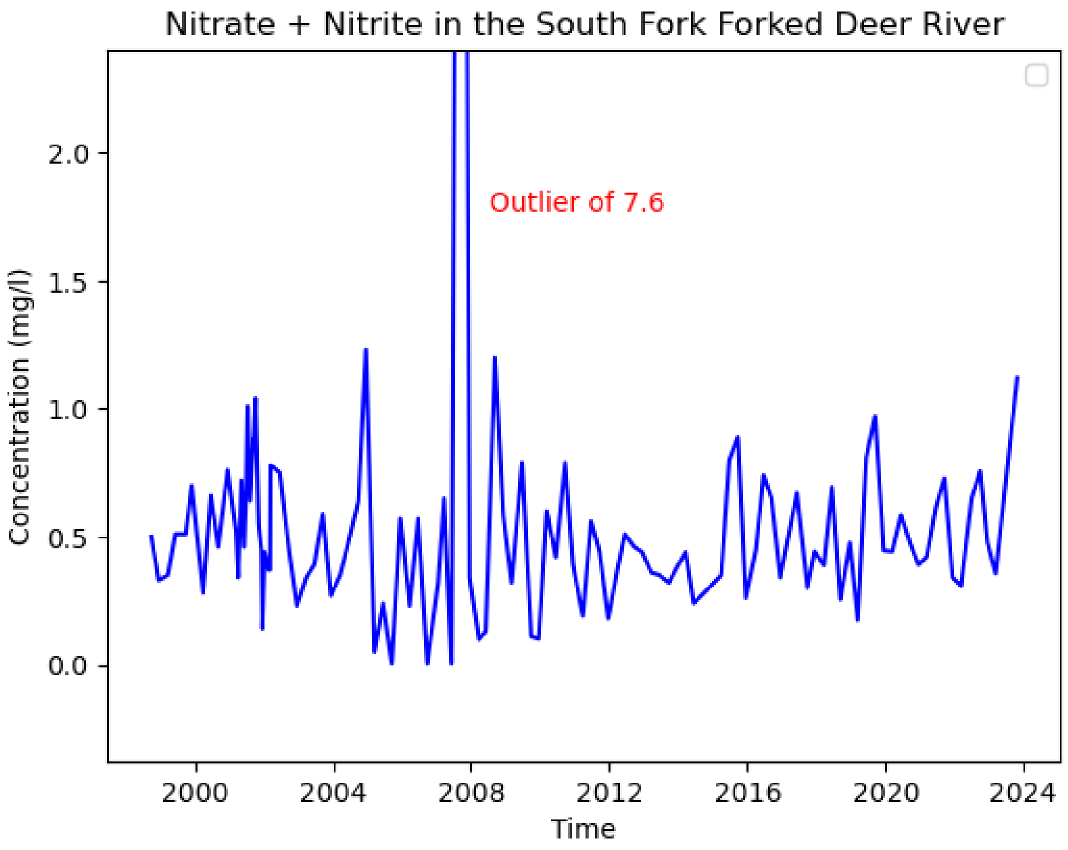
7 Nitrate + Nitrite Analysis

7.1 Temporal

```
[ ]: df_nn = df[df['Characteristic'] == 'Nitrate + Nitrite']
```

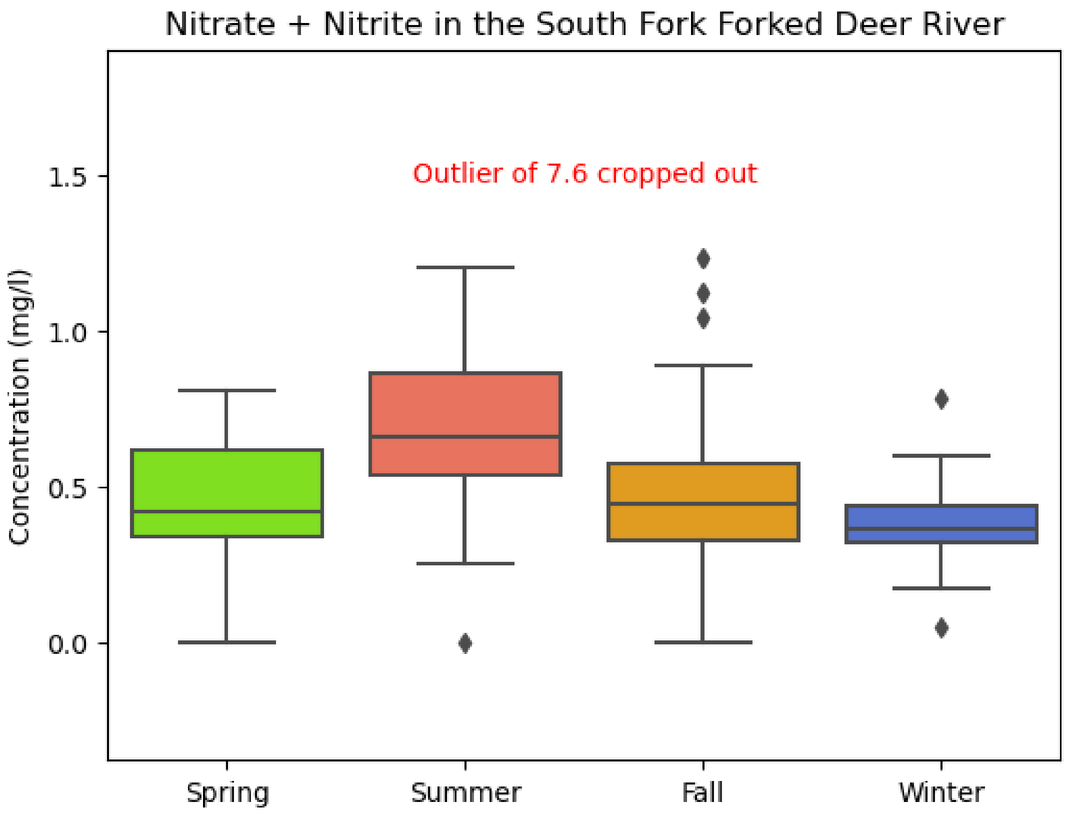
```
[ ]: sns.lineplot(x='DateTime', y='Value', data=df_nn, color='blue')
     plt.title('Nitrate + Nitrite in the South Fork Forked Deer River')
     plt.xlabel('Time')
     plt.ylabel('Concentration (mg/l)')
     plt.ylim(None, 2.4)
     plt.text(15000, 1.8, 'Outlier of 7.6', fontsize=10, color='red', ha='center',␣
      ↪va='center')
     plt.legend()
     plt.show()
```

```
No artists with labels found to put in legend.  Note that artists whose label
start with an underscore are ignored when legend() is called with no argument.
```



7.2 Seasonal

[ ]:
```
warnings.filterwarnings('ignore')
sns.boxplot(x='Season', y='Value', data=df_nn, order=order, palette=palette)
plt.title('Nitrate + Nitrite in the South Fork Forked Deer River')
plt.ylim(None, 1.9)
plt.text(1.5, 1.5, 'Outlier of 7.6 cropped out', fontsize=10, color='red',␣
  ↪ha='center', va='center')
plt.ylabel('Concentration (mg/l)')
plt.xlabel('')
plt.show()
```



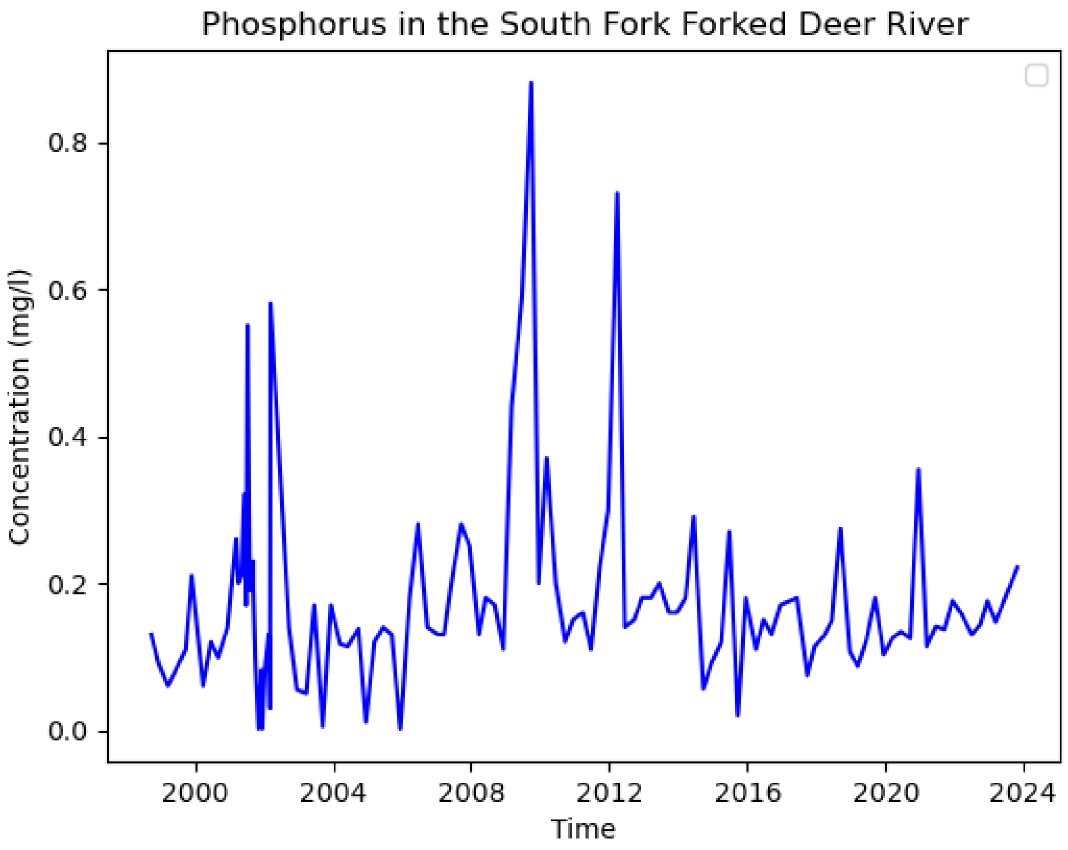
8 Phosphorus Analysis

8.1 Temporal

```
[ ]: df_phosphorus = df[df['Characteristic'] == 'Phosphorus']
```

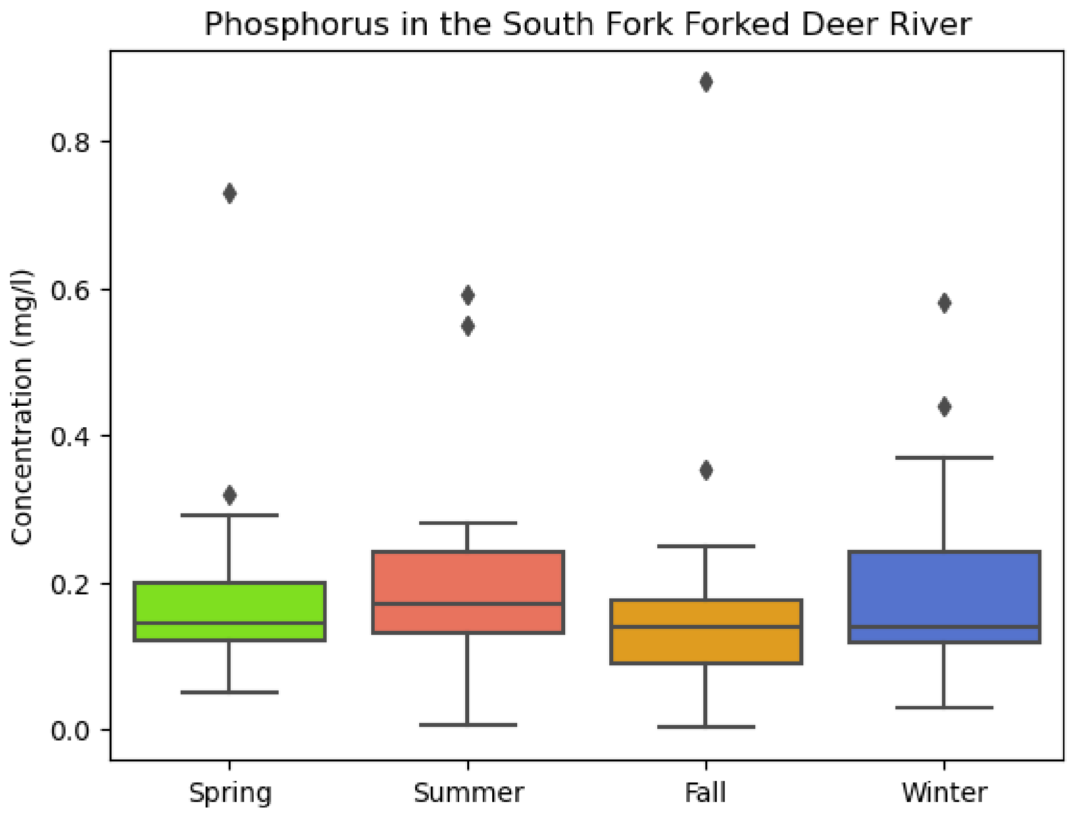
```
[ ]: sns.lineplot(x='DateTime', y='Value', data=df_phosphorus, color='blue')
     plt.title('Phosphorus in the South Fork Forked Deer River')
     plt.xlabel('Time')
     plt.ylabel('Concentration (mg/l)')
     plt.legend()
     plt.show()
```

```
No artists with labels found to put in legend.  Note that artists whose label
start with an underscore are ignored when legend() is called with no argument.
```



8.2 Seasonal

```
[ ]: warnings.filterwarnings('ignore')
     sns.boxplot(x='Season', y='Value', data=df_phosphorus, order=order,␣
       ↪palette=palette)
     plt.title('Phosphorus in the South Fork Forked Deer River')
     plt.ylabel('Concentration (mg/l)')
     plt.xlabel('')
     plt.show()
```


Phosphorus in the South Fork Forked Deer River
Concentration (mg/l)
0.0
0.2
0.4
0.6
0.8
Spring
Summer
Fall
Winter