mean_days

January 26, 2024

0.1 Importing

[ ]:
```
import xarray as xr
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import os
import dill
import datetime

dill.load_session('workspace.db')
```

0.2 Datasets Preparation

[ ]:
```
def datasets_preparation():

    ds_name = ('/results2/SalishSea/nowcast-green.202111/' + i + '/
 ↪SalishSea_1d_' + '20' + str(i[5:7]) + str(dict_month[i[2:5]])+str(i[0:2]) +␣
 ↪'_' + '20' + str(i[5:7]) + str(dict_month[i[2:5]]) + str(i[0:2]) + '_grid_T.
 ↪nc')

    ds_bio_name = ('/results2/SalishSea/nowcast-green.202111/' + i + '/
 ↪SalishSea_1d_'  + '20' + str(i[5:7]) + str(dict_month[i[2:5]])+str(i[0:2]) +␣
 ↪'_' + '20' + str(i[5:7]) + str(dict_month[i[2:5]]) + str(i[0:2]) + '_biol_T.
 ↪nc')

    ds = xr.open_dataset (ds_name)
    ds_bio = xr. open_dataset (ds_bio_name)

    date = pd.DatetimeIndex(ds['time_counter'].values)

    temp_i1 = ((ds.votemper.where(mask==1)[0,0:15] * ds.e3t.where(mask==1)
    [0,0:15]).sum('deptht', skipna = True, min_count = 15) / mesh.
 ↪gdepw_0[0,15]).mean().values

    temp_i2 = ((ds.votemper.where(mask==1)[0,15:27] * ds.e3t.where(mask==1)
    [0,15:27]).sum('deptht', skipna = True, min_count = 12) / (mesh.gdepw_0
```

```
   [0,27] - mesh.gdepw_0[0,14])).mean().values

   saline_i1 = ((ds.vosaline.where(mask==1)[0,0:15] * ds.e3t.where(mask==1)
   [0,0:15]).sum('deptht', skipna = True, min_count = 15) / mesh.
↪gdepw_0[0,15]).mean().values

   saline_i2 = ((ds.vosaline.where(mask==1)[0,15:27] * ds.e3t.where(mask==1)
   [0,15:27]).sum('deptht', skipna = True, min_count = 12) / (mesh.gdepw_0
   [0,27] - mesh.gdepw_0[0,14])).mean().values

   sil_i = ((ds_bio.silicon.where(mask==1)[0,0:27] * ds.e3t.where(mask==1)
   [0,0:27]).sum('deptht', skipna = True, min_count = 27) / mesh.
↪gdepw_0[0,27]).mean().values

   nitr_i = ((ds_bio.nitrate.where(mask==1)[0,0:27] * ds.e3t.where(mask==1)
   [0,0:27]).sum('deptht', skipna = True, min_count = 27) / mesh.
↪gdepw_0[0,27]).mean().values

   ammo_i = ((ds_bio.ammonium.where(mask==1)[0,0:27] * ds.e3t.where(mask==1)
   [0,0:27]).sum('deptht', skipna = True, min_count = 27) / mesh.
↪gdepw_0[0,27]).mean().values

   diat_i = ((ds_bio.diatoms.where(mask==1)[0,0:27] * ds.e3t.where(mask==1)
   [0,0:27]).sum('deptht', skipna = True, min_count = 27) / mesh.
↪gdepw_0[0,27]).mean().values

   flag_i = ((ds_bio.flagellates.where(mask==1)[0,0:27] * ds.e3t.where(mask==1)
   [0,0:27]).sum('deptht', skipna = True, min_count = 27) / mesh.
↪gdepw_0[0,27]).mean().values

   micro_i = ((ds_bio.microzooplankton.where(mask==1)[0,0:27] * ds.e3t.
↪where(mask==1)
   [0,0:27]).sum('deptht', skipna = True, min_count = 27) / mesh.
↪gdepw_0[0,27]).mean().values

   meso_i = ((ds_bio.mesozooplankton.where(mask==1)[0,0:27] * ds.e3t.
↪where(mask==1)
   [0,0:27]).sum('deptht', skipna = True, min_count = 27) / mesh.
↪gdepw_0[0,27]).mean().values

   return (date, temp_i1, temp_i2, saline_i1, saline_i2, sil_i, nitr_i,␣
↪ammo_i, diat_i,  flag_i, micro_i, meso_i)
```

0.3 Plotting

[ ]:
```
def plotting(variable,year_variable,title,y_label):

    fig, ax = plt.subplots()
    scatter= ax.scatter(dates_new,variable, marker='.', c=pd.
 ↪DatetimeIndex(dates_new).month)
    plt.ylabel(y_label)
    ax.legend(handles=scatter.legend_elements()[0], labels=['March','April',␣
 ↪'May'])
    ax.plot(years2,year_variable,color='red',marker='*')
    fig.suptitle('Daily Mean ' + title + ' (01 March - 31 May)')
    fig.show()
```

0.4 Main Body

[ ]:
```
dict_month = {'jan': '01',
          'feb': '02',
          'mar': '03',
          'apr': '04',
          'may': '05',
          'jun': '06',
          'jul': '07',
          'aug': '08',
          'sep': '09',
          'oct': '10',
          'nov': '11',
          'dec': '12'}

path = os.listdir('/results2/SalishSea/nowcast-green.202111/')

folders = [x for x in path if (x[2:5]=='mar' or x[2:5]=='apr') or (x[2:
 ↪5]=='feb' and x[0:2] > '14')]
folders.sort()

# Open the mesh mask
mesh = xr.open_dataset('/home/sallen/MEOPAR/grid/mesh_mask202108.nc')
mask = mesh.tmask.to_numpy()

dates = np.array([])

temp_i1_mean = np.array([])
temp_i2_mean = np.array([])
saline_i1_mean = np.array([])
saline_i2_mean = np.array([])
```

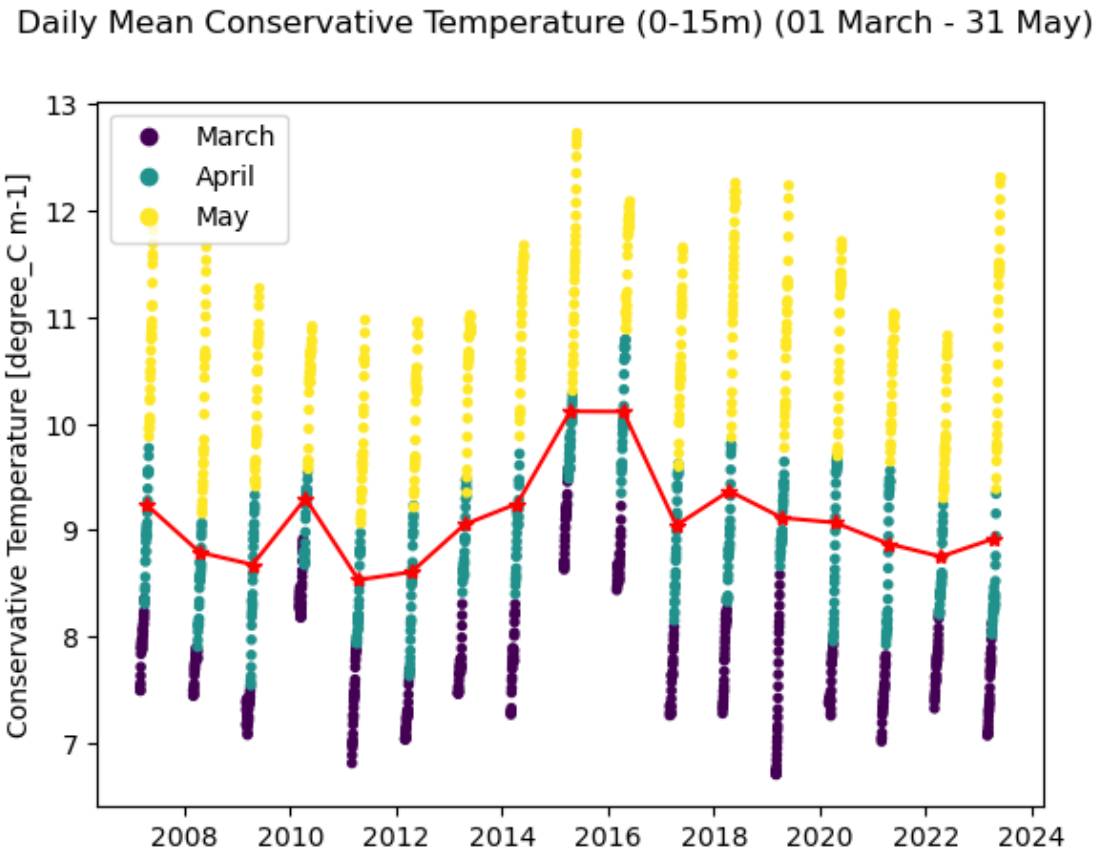
```
sil_i_mean = np.array([])
nitr_i_mean = np.array([])
ammo_i_mean = np.array([])

diat_i_mean = np.array([])
flag_i_mean = np.array([])

micro_i_mean = np.array([])
meso_i_mean = np.array([])

for i in folders:

    date, temp_i1, temp_i2, saline_i1, saline_i2, sil_i, nitr_i, ammo_i,␣
 ↪diat_i, flag_i, micro_i, meso_i = datasets_preparation()

    dates = np.append(dates,date.date)

    temp_i1_mean = np.append(temp_i1_mean,temp_i1)
    temp_i2_mean = np.append(temp_i2_mean,temp_i2)
    saline_i1_mean = np.append(saline_i1_mean,saline_i1)
    saline_i2_mean = np.append(saline_i2_mean,saline_i2)

    sil_i_mean = np.append(sil_i_mean,sil_i)
    nitr_i_mean = np.append(nitr_i_mean,nitr_i)
    ammo_i_mean = np.append(ammo_i_mean,ammo_i)

    diat_i_mean = np.append(diat_i_mean,diat_i)
    flag_i_mean = np.append(flag_i_mean,flag_i)

    micro_i_mean = np.append(micro_i_mean,micro_i)
    meso_i_mean = np.append(meso_i_mean,meso_i)

    print(i)

# Sorting the time-series

dates_new= dates[np.argsort(dates)]

temp_i1_mean = temp_i1_mean[np.argsort(dates)]
temp_i2_mean = temp_i2_mean[np.argsort(dates)]
saline_i1_mean = saline_i1_mean[np.argsort(dates)]
saline_i2_mean = saline_i2_mean[np.argsort(dates)]

sil_i_mean = sil_i_mean[np.argsort(dates)]
nitr_i_mean = nitr_i_mean[np.argsort(dates)]
ammo_i_mean = ammo_i_mean[np.argsort(dates)]
```

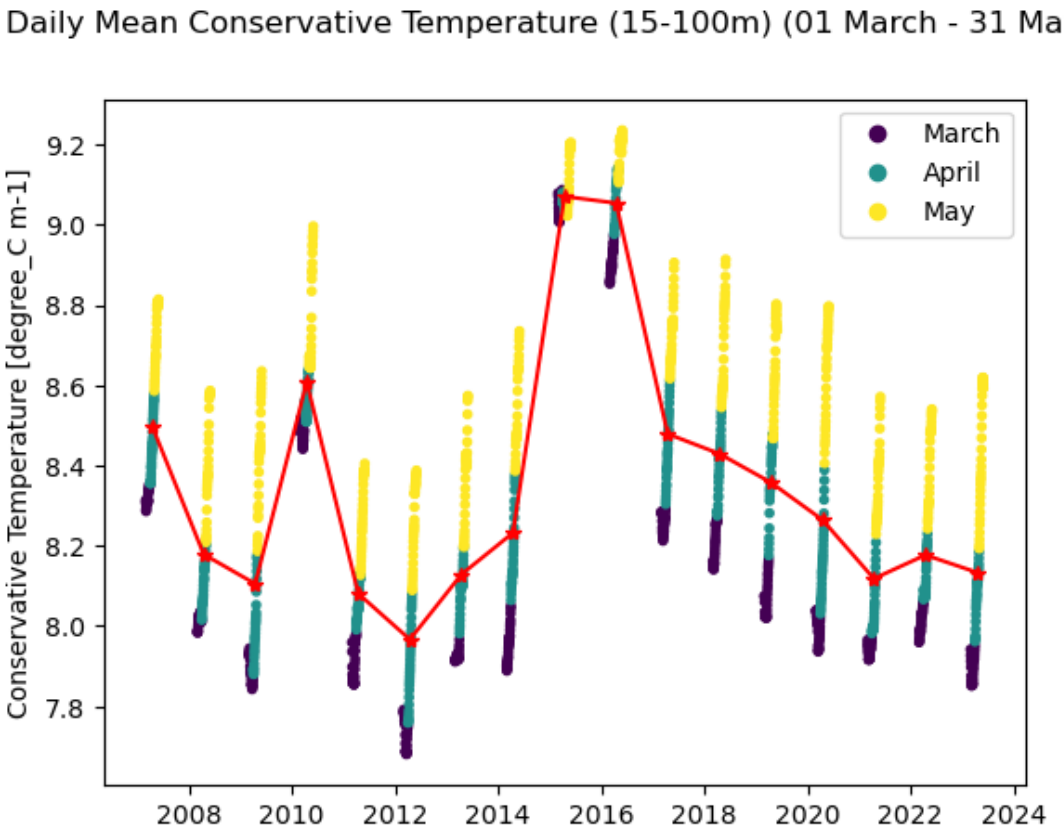
```
diat_mean = diat_i_mean[np.argsort(dates)]
flag_mean = flag_i_mean[np.argsort(dates)]

micro_i_mean = micro_i_mean[np.argsort(dates)]
meso_i_mean = meso_i_mean[np.argsort(dates)]

# Calculating the monthly means

years2 = []

temp_i1_year = []
temp_i2_year = []
saline_i1_year = []
saline_i2_year = []

sil_i_year = []
nitr_i_year = []
ammo_i_year = []

diat_i_year = []
flag_i_year = []

micro_i_year = []
meso_i_year = []

years = range (2007,2024)

for i in years:
    years2.append(datetime.datetime(i,4,15))

    temp_i1_year.append(temp_i1_mean[pd.DatetimeIndex(dates_new).year==i].
 ↪mean())
    temp_i2_year.append(temp_i2_mean[pd.DatetimeIndex(dates_new).year==i].
 ↪mean())
    saline_i1_year.append(saline_i1_mean[pd.DatetimeIndex(dates_new).year==i].
 ↪mean())
    saline_i2_year.append(saline_i2_mean[pd.DatetimeIndex(dates_new).year==i].
 ↪mean())

    sil_i_year.append(sil_i_mean[pd.DatetimeIndex(dates_new).year==i].mean())
    nitr_i_year.append(nitr_i_mean[pd.DatetimeIndex(dates_new).year==i].mean())
    ammo_i_year.append(ammo_i_mean[pd.DatetimeIndex(dates_new).year==i].mean())

    diat_i_year.append(diat_i_mean[pd.DatetimeIndex(dates_new).year==i].mean())
    flag_i_year.append(flag_i_mean[pd.DatetimeIndex(dates_new).year==i].mean())
```

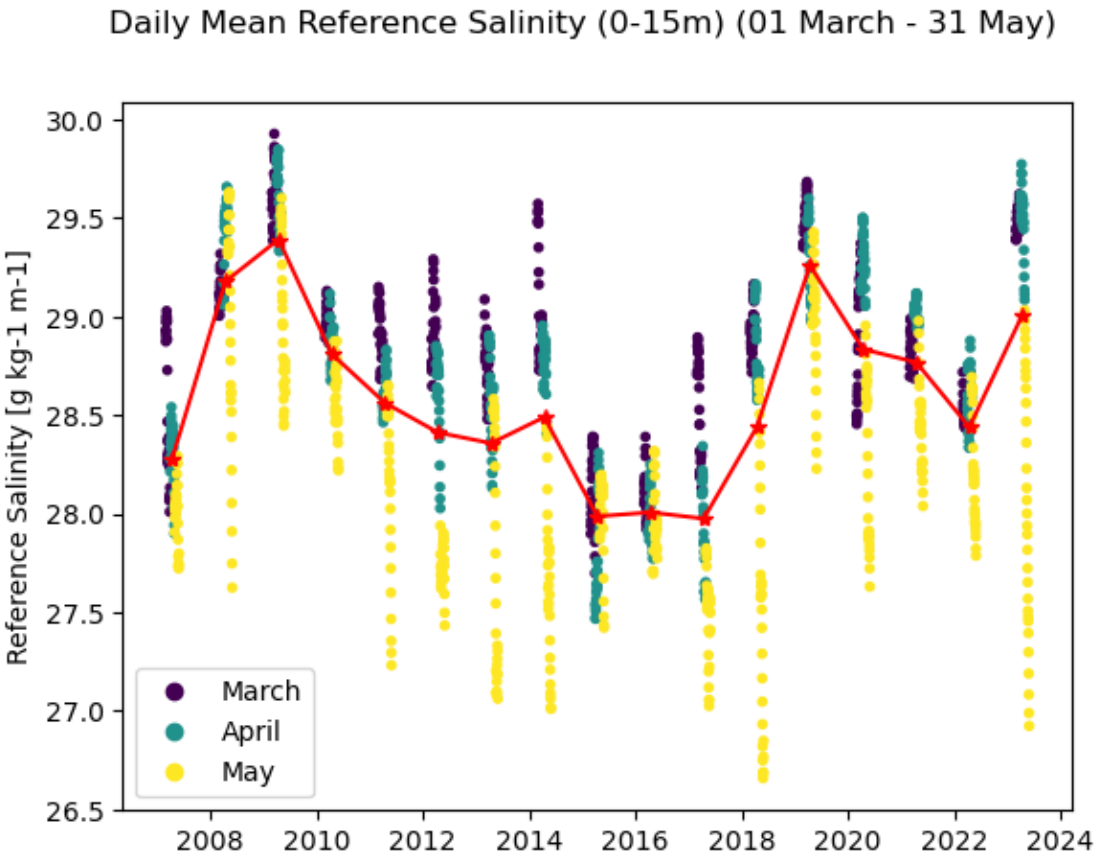
```
    micro_i_year.append(micro_i_mean[pd.DatetimeIndex(dates_new).year==i].
 ↪mean())
    meso_i_year.append(meso_i_mean[pd.DatetimeIndex(dates_new).year==i].mean())

# Plotting

plotting(temp_i1_mean, temp_i1_year, 'Conservative Temperature (0-15m)',
'Conservative Temperature [degree_C m-1]')
plotting(temp_i2_mean, temp_i2_year, 'Conservative Temperature (15-100m)',
'Conservative Temperature [degree_C m-1]')
plotting(saline_i1_mean, saline_i1_year, 'Reference Salinity (0-15m)',
'Reference Salinity [g kg-1 m-1]')
plotting(saline_i2_mean, saline_i2_year, 'Reference Salinity (15-100m)',
'Reference Salinity [g kg-1 m-1]')

plotting(sil_i_mean, sil_i_year, 'Silicon Concentration',
'Silicon Concentration [mmol m-2]')
plotting(nitr_i_mean, nitr_i_year, 'Nitrate Concentration',
'Nitrate Concentration [mmol m-2]')
plotting(ammo_i_mean, ammo_i_year, 'Ammonium Concentration',
'Ammonium Concentration [mmol m-2]')

plotting(diat_i_mean, diat_i_year, 'Diatom Concentration',
'Diatom Concentration [mmol m-2]')
plotting(flag_i_mean, flag_i_year, 'Flagellate Concentration',
'Flagellate Concentration [mmol m-2]')

plotting(micro_i_mean, micro_i_year, 'Microzooplankton Concentration',
'Microzooplankton Concentration [mmol m-2]')
plotting(meso_i_mean, meso_i_year, 'Mesozooplankton Concentration',
'Mesozooplankton Concentration [mmol m-2]')
```

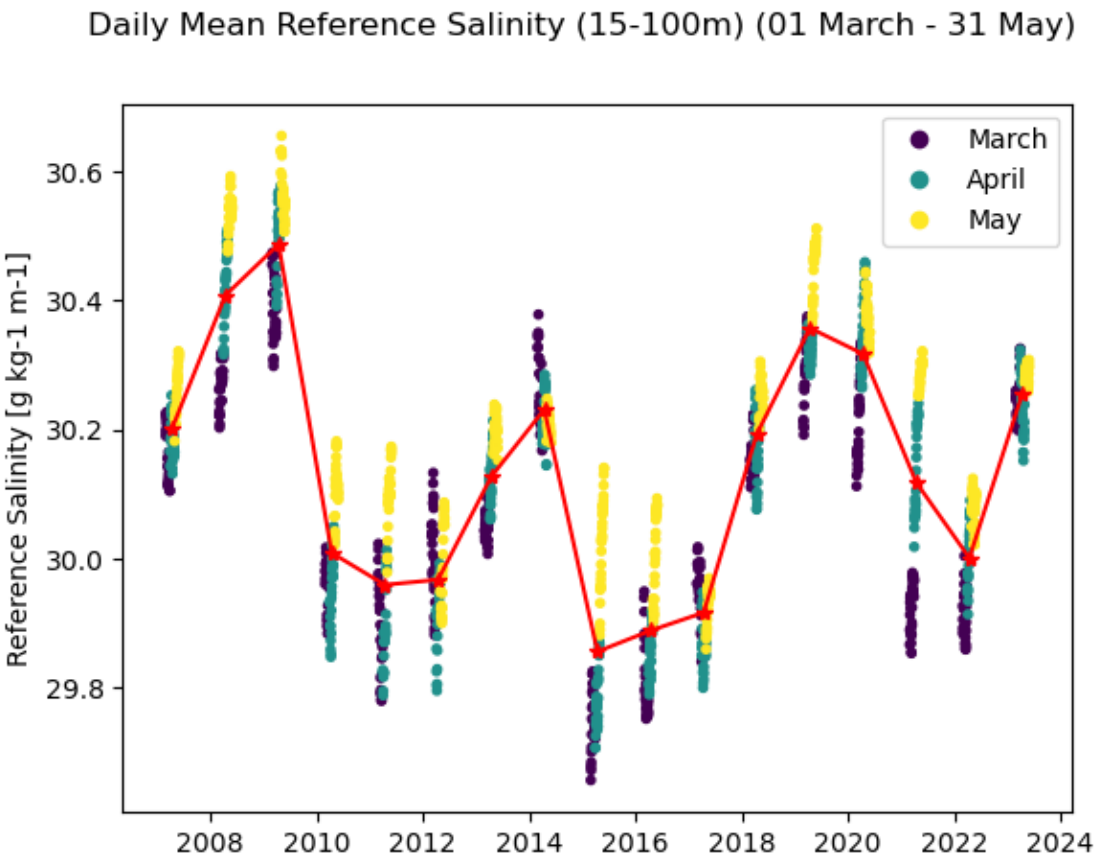
[ ]:
```
# Plotting

plotting(temp_i1_mean, temp_i1_year, 'Conservative Temperature (0-15m)',
'Conservative Temperature [degree_C m-1]')
plotting(temp_i2_mean, temp_i2_year, 'Conservative Temperature (15-100m)',
'Conservative Temperature [degree_C m-1]')
plotting(saline_i1_mean, saline_i1_year, 'Reference Salinity (0-15m)',
'Reference Salinity [g kg-1 m-1]')
plotting(saline_i2_mean, saline_i2_year, 'Reference Salinity (15-100m)',
'Reference Salinity [g kg-1 m-1]')

plotting(sil_i_mean, sil_i_year, 'Silicon Concentration',
'Silicon Concentration [mmol m-2]')
plotting(nitr_i_mean, nitr_i_year, 'Nitrate Concentration',
'Nitrate Concentration [mmol m-2]')
```

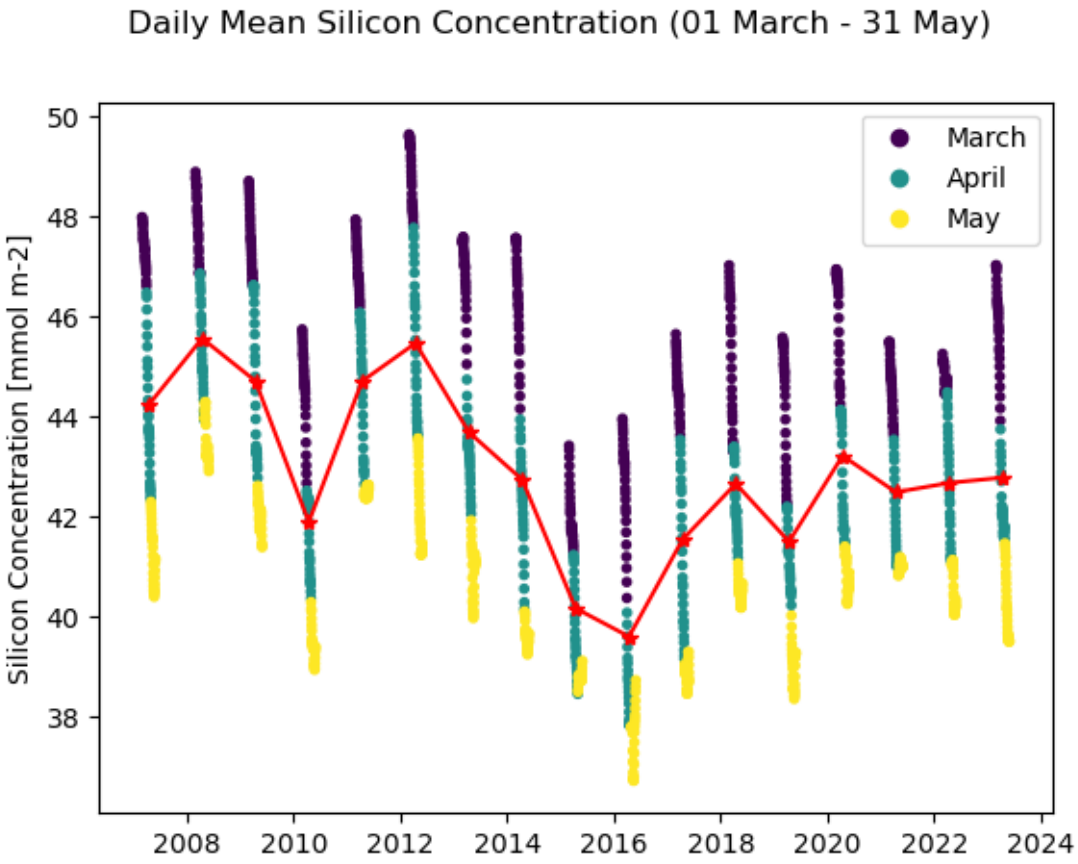
```
plotting(ammo_i_mean, ammo_i_year, 'Ammonium Concentration',
'Ammonium Concentration [mmol m-2]')

plotting(diat_i_mean, diat_i_year, 'Diatom Concentration',
'Diatom Concentration [mmol m-2]')
plotting(flag_i_mean, flag_i_year, 'Flagellate Concentration',
'Flagellate Concentration [mmol m-2]')

plotting(micro_i_mean, micro_i_year, 'Microzooplankton Concentration',
'Microzooplankton Concentration [mmol m-2]')
plotting(meso_i_mean, meso_i_year, 'Mesozooplankton Concentration',
'Mesozooplankton Concentration [mmol m-2]')
```

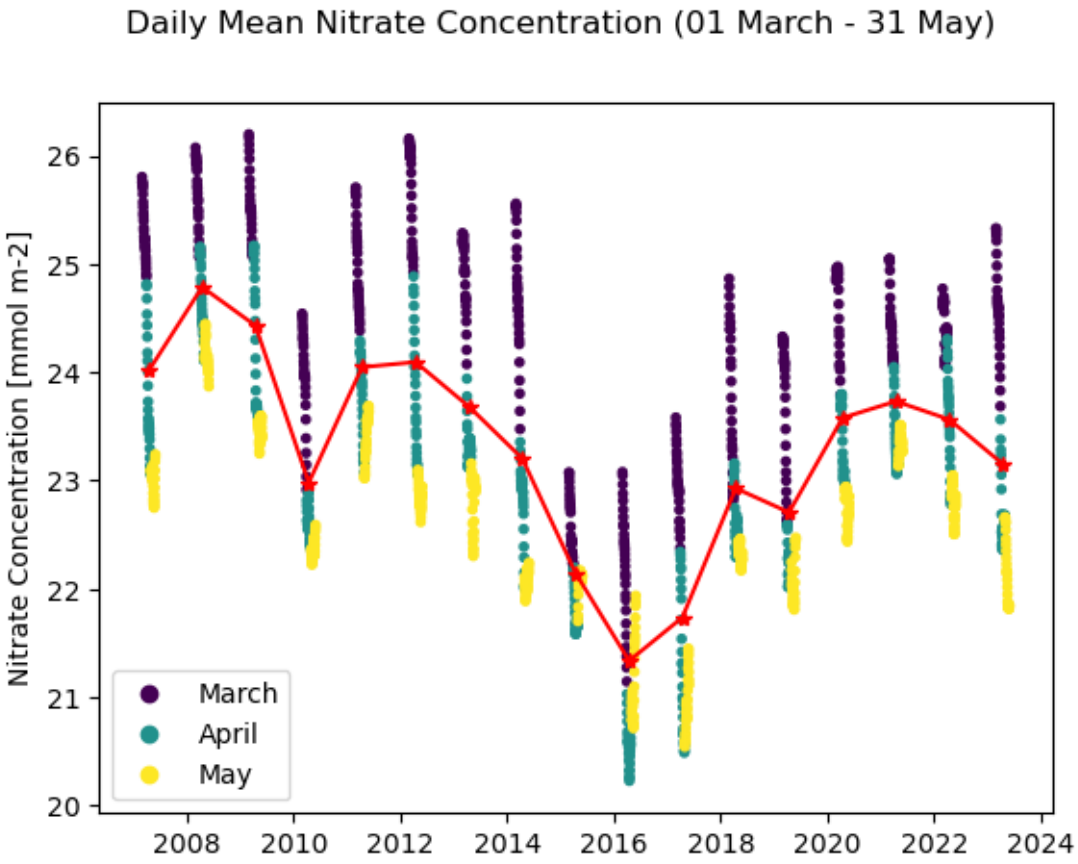


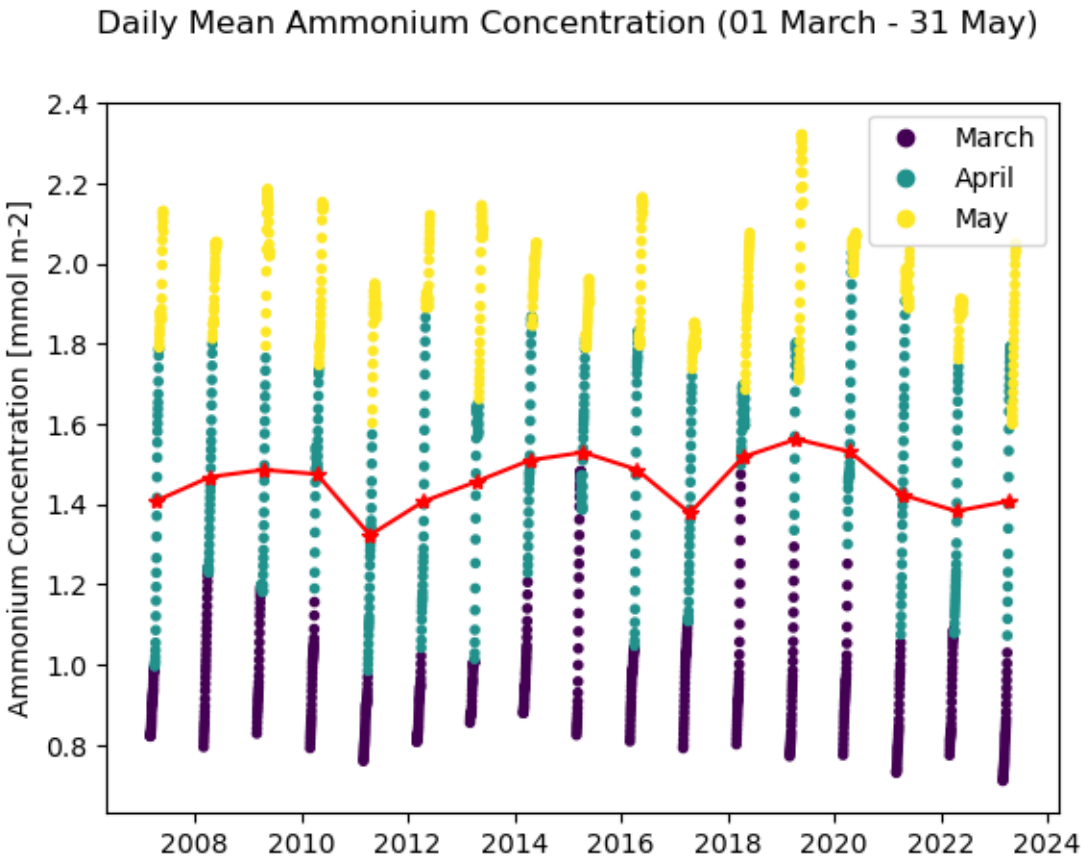

Daily Mean Conservative Temperature (15-100m) (01 March - 31 May)
Conservative Temperature [degree_C m-1]
9.2
9.0
8.8
8.6
8.4
8.2
8.0
7.8
2008
2010
2012
2014
2016
2018
2020
2022
2024
March
April
May

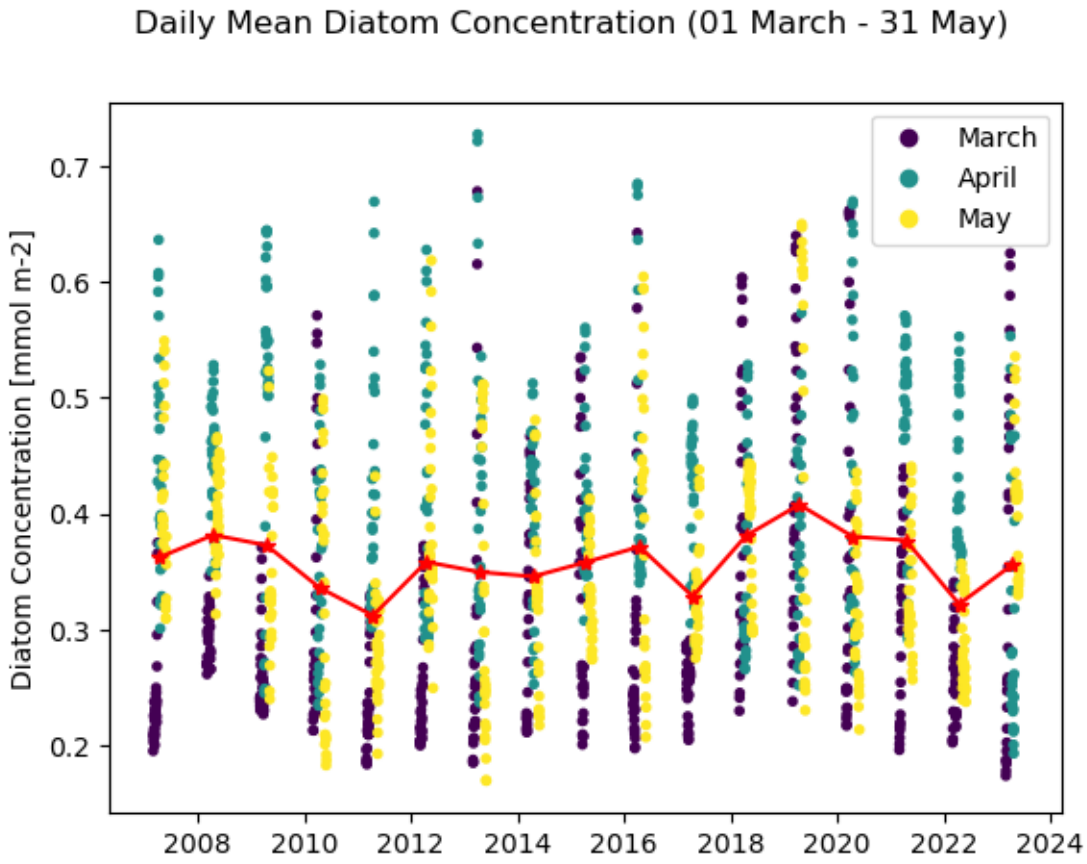

Daily Mean Reference Salinity (0-15m) (01 March - 31 May)
Reference Salinity [g kg-1 m-1]
30.0
29.5
29.0
28.5
28.0
27.5
27.0
26.5
2008
2010
2012
2014
2016
2018
2020
2022
2024
March
April
May

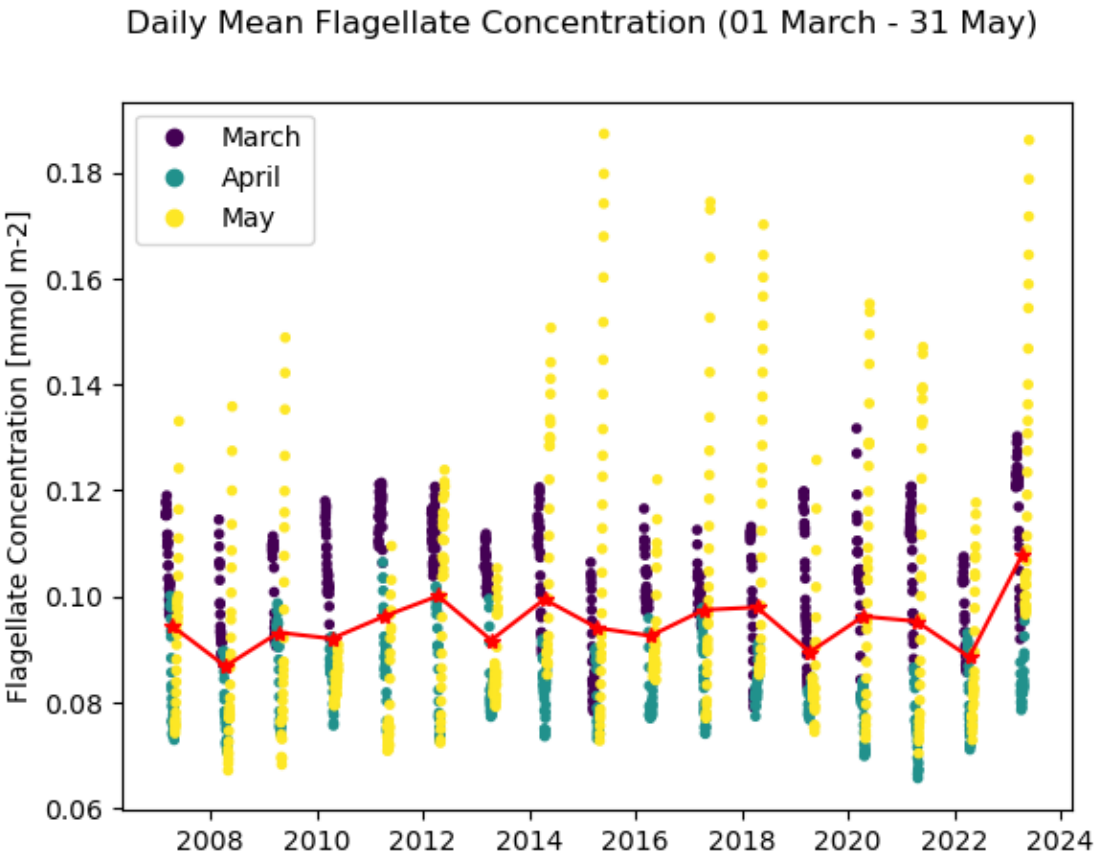

Daily Mean Reference Salinity (15-100m) (01 March - 31 May)
Reference Salinity [g kg-1 m-1]
30.6
30.4
30.2
30.0
29.8
2008
2010
2012
2014
2016
2018
2020
2022
2024
March
April
May

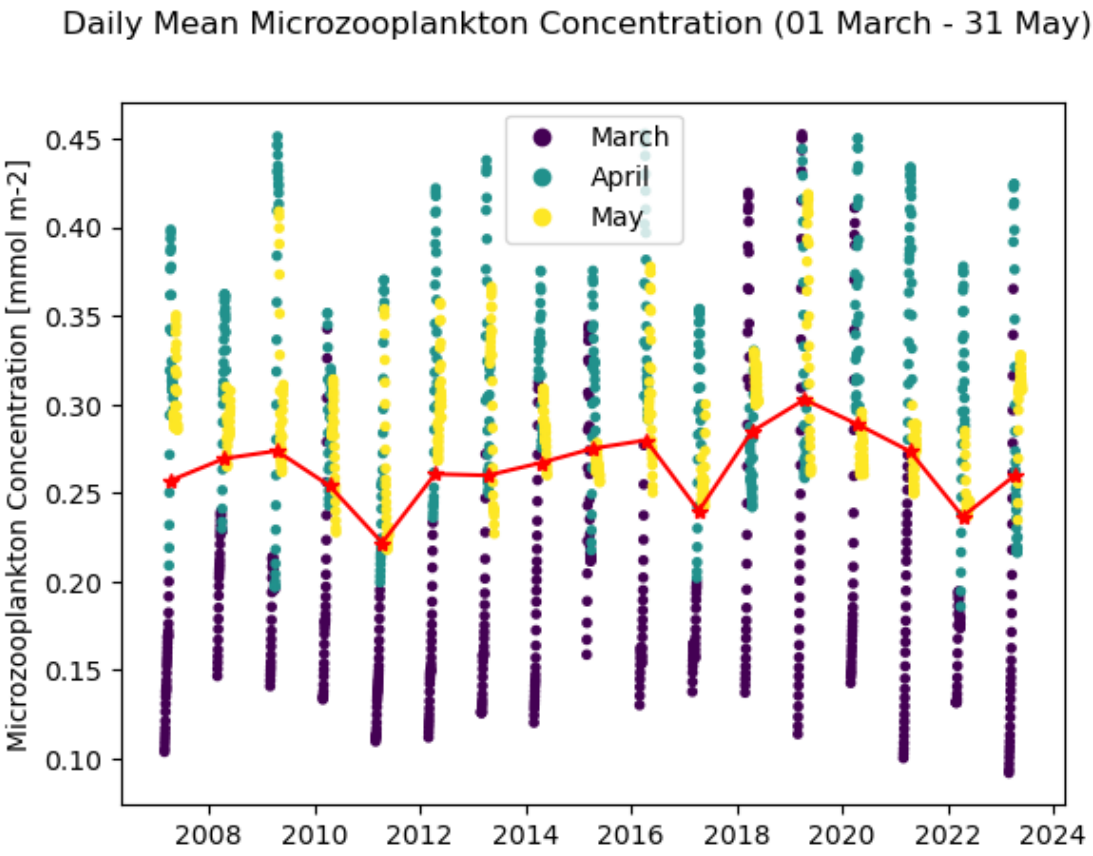

Daily Mean Silicon Concentration (01 March - 31 May)
Silicon Concentration [mmol m-2]
50
48
46
44
42
40
38
2008
2010
2012
2014
2016
2018
2020
2022
2024
March
April
May

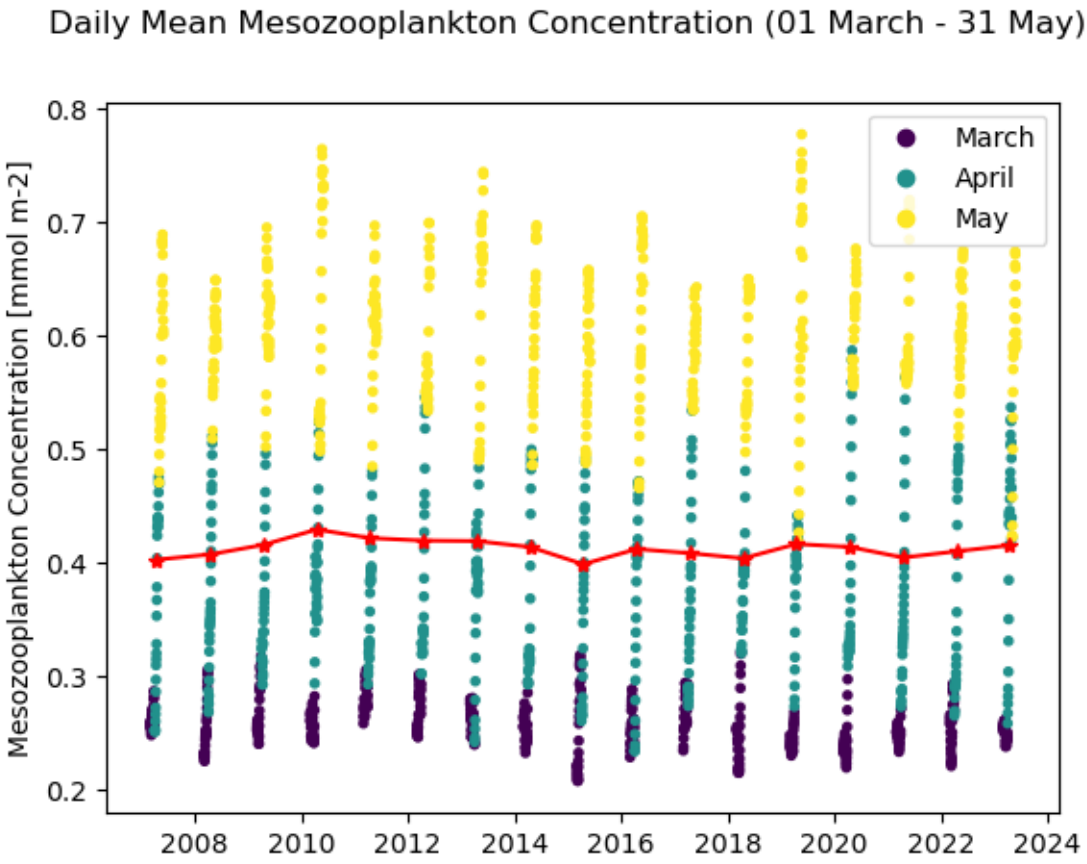

Daily Mean Nitrate Concentration (01 March - 31 May)
Nitrate Concentration [mmol m-2]
26
25
24
23
22
21
20
2008
2010
2012
2014
2016
2018
2020
2022
2024
March
April
May


Daily Mean Ammonium Concentration (01 March - 31 May)
Ammonium Concentration [mmol m-2]
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
2008
2010
2012
2014
2016
2018
2020
2022
2024
March
April
May


Daily Mean Diatom Concentration (01 March - 31 May)
Diatom Concentration [mmol m-2]
0.2
0.3
0.4
0.5
0.6
0.7
2008
2010
2012
2014
2016
2018
2020
2022
2024
March
April
May


Daily Mean Flagellate Concentration (01 March - 31 May)
March
April
May
Flagellate Concentration [mmol m-2]
0.18
0.16
0.14
0.12
0.10
0.08
0.06
2008
2010
2012
2014
2016
2018
2020
2022
2024


Daily Mean Microzooplankton Concentration (01 March - 31 May)
Microzooplankton Concentration [mmol m-2]
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
2008
2010
2012
2014
2016
2018
2020
2022
2024
March
April
May


Daily Mean Mesozooplankton Concentration (01 March - 31 May)
Mesozooplankton Concentration [mmol m-2]
0.8
0.7
0.6
0.5
0.4
0.3
0.2
2008
2010
2012
2014
2016
2018
2020
2022
2024
March
April
May

[ ]: