In [1]:

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

In [2]:

```
df1=pd.read_csv(r'C:\Users\user\Downloads\9_bottle.csv')
df1
```

```
C:\ProgramData\Anaconda3\lib\site-packages\IPython\core\interactiveshell.p
y:3165: DtypeWarning: Columns (47,73) have mixed types.Specify dtype optio
n on import or set low_memory=False.
  has_raised = await self.run_ast_nodes(code_ast.body, cell_name,
```

Out[2]:

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	Salnty	O2ml_L	STheta	C
0	1	1	054.0 056.0	19-4903CR-HY-060-0930-05400560-0000A-3	0	10.500	33.4400	NaN	25.64900	
1	1	2	054.0 056.0	19-4903CR-HY-060-0930-05400560-0008A-3	8	10.460	33.4400	NaN	25.65600	
2	1	3	054.0 056.0	19-4903CR-HY-060-0930-05400560-0010A-7	10	10.460	33.4370	NaN	25.65400	
3	1	4	054.0 056.0	19-4903CR-HY-060-0930-05400560-0019A-3	19	10.450	33.4200	NaN	25.64300	
4	1	5	054.0 056.0	19-4903CR-HY-060-0930-05400560-0020A-7	20	10.450	33.4210	NaN	25.64300	
...	...	...	...	...	...	...	...	...	...	
864858	34404	864859	093.4 026.4	20-1611SR-MX-310-2239-09340264-0000A-7	0	18.744	33.4083	5.805	23.87055	1
864859	34404	864860	093.4 026.4	20-1611SR-MX-310-2239-09340264-0002A-3	2	18.744	33.4083	5.805	23.87072	1
864860	34404	864861	093.4 026.4	20-1611SR-MX-310-2239-09340264-0005A-3	5	18.692	33.4150	5.796	23.88911	1
864861	34404	864862	093.4 026.4	20-1611SR-MX-310-2239-09340264-0010A-3	10	18.161	33.4062	5.816	24.01426	1

In [3]:
```
df=df1.head(20)
df
```

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	Salnty	O2ml_L	STheta	C
864862	34404	864863	093.4 026.4	20-1611SR-MX-310-2239-09340264-0015A-3	15	17.533	33.3880	5.774	24.15297	1

864863 rows × 74 columns

Out[3]:

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	Salnty	O2ml_L	STheta	O2Sat	.
0	1	1	054.0 056.0	19-4903CR-HY-060-0930-05400560-0000A-3	0	10.50	33.440	NaN	25.649	NaN	.
1	1	2	054.0 056.0	19-4903CR-HY-060-0930-05400560-0008A-3	8	10.46	33.440	NaN	25.656	NaN	.
2	1	3	054.0 056.0	19-4903CR-HY-060-0930-05400560-0010A-7	10	10.46	33.437	NaN	25.654	NaN	.
3	1	4	054.0 056.0	19-4903CR-HY-060-0930-05400560-0019A-3	19	10.45	33.420	NaN	25.643	NaN	.
4	1	5	054.0 056.0	19-4903CR-HY-060-0930-05400560-0020A-7	20	10.45	33.421	NaN	25.643	NaN	.
5	1	6	054.0 056.0	19-4903CR-HY-060-0930-05400560-0030A-7	30	10.45	33.431	NaN	25.651	NaN	.
6	1	7	054.0 056.0	19-4903CR-HY-060-0930-05400560-0039A-3	39	10.45	33.440	NaN	25.658	NaN	.
7	1	8	054.0 056.0	19-4903CR-HY-060-0930-05400560-0050A-7	50	10.24	33.424	NaN	25.682	NaN	.
8	1	9	054.0 056.0	19-4903CR-HY-060-0930-05400560-0058A-3	58	10.06	33.420	NaN	25.710	NaN	.

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	Salnty	O2ml_L	STheta	O2Sat	.
9	1	10	054.0 056.0	19-4903CR-HY-060-0930-05400560-0075A-7	75	9.86	33.494	NaN	25.801	NaN	.
10	1	11	054.0 056.0	19-4903CR-HY-060-0930-05400560-0078A-3	78	9.83	33.510	NaN	25.819	NaN	.
11	1	12	054.0 056.0	19-4903CR-HY-060-0930-05400560-0100A-7	100	9.67	33.580	NaN	25.900	NaN	.
12	1	13	054.0 056.0	19-4903CR-HY-060-0930-05400560-0117A-3	117	9.50	33.640	NaN	25.975	NaN	.
13	1	14	054.0 056.0	19-4903CR-HY-060-0930-05400560-0125A-7	125	9.32	33.689	NaN	26.043	NaN	.
14	1	15	054.0 056.0	19-4903CR-HY-060-0930-05400560-0150A-7	150	8.76	33.847	NaN	26.256	NaN	.
15	1	16	054.0 056.0	19-4903CR-HY-060-0930-05400560-0152A-3	152	8.71	33.860	NaN	26.274	NaN	.
16	1	17	054.0 056.0	19-4903CR-HY-060-0930-05400560-0200A-7	200	8.53	33.876	NaN	26.315	NaN	.
17	1	18	054.0 056.0	19-4903CR-HY-060-0930-05400560-0221A-3	221	8.45	NaN	NaN	NaN	NaN	.
18	1	19	054.0 056.0	19-4903CR-HY-060-0930-05400560-0250A-7	250	8.26	33.926	NaN	26.396	NaN	.

In [4]:

```
df.info()
```

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	Salnty	O2ml_L	STheta	O2Sat	.
19	1	20	054.0 056.0	19-4903CR-HY-060-0930-05400560-0285A-3	285	7.96	33.980	NaN	26.483	NaN	.

20 rows × 74 columns

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 20 entries, 0 to 19
Data columns (total 74 columns):
 #   Column               Non-Null Count  Dtype  
---  ------               --------------  -----  
 0   Cst_Cnt              20 non-null     int64  
 1   Btl_Cnt              20 non-null     int64  
 2   Sta_ID               20 non-null     object 
 3   Depth_ID             20 non-null     object 
 4   Depthm               20 non-null     int64  
 5   T_degC               20 non-null     float64
 6   Salnty               19 non-null     float64
 7   O2ml_L               0 non-null      float64
 8   STheta               19 non-null     float64
 9   O2Sat                0 non-null      float64
 10  Oxy_µmol/Kg          0 non-null      float64
 11  BtlNum               0 non-null      float64
 12  RecInd               20 non-null     int64  
 13  T_prec               20 non-null     float64
 14  T_qual               0 non-null      float64
 15  S_prec               19 non-null     float64
 16  S_qual               1 non-null      float64
 17  P_qual               20 non-null     float64
 18  O_qual               20 non-null     float64
 19  SThtaq               1 non-null      float64
 20  O2Satq               20 non-null     float64
 21  ChlorA               0 non-null      float64
 22  Chlqua               20 non-null     float64
 23  Phaeop               0 non-null      float64
 24  Phaqua               20 non-null     float64
 25  PO4uM                0 non-null      float64
 26  PO4q                 20 non-null     float64
 27  SiO3uM               0 non-null      float64
 28  SiO3qu               20 non-null     float64
 29  NO2uM                0 non-null      float64
 30  NO2q                 20 non-null     float64
 31  NO3uM                0 non-null      float64
 32  NO3q                 20 non-null     float64
 33  NH3uM                0 non-null      float64
 34  NH3q                 20 non-null     float64
 35  C14As1               0 non-null      float64
 36  C14A1p               0 non-null      float64
 37  C14A1q               20 non-null     float64
 38  C14As2               0 non-null      float64
 39  C14A2p               0 non-null      float64
 40  C14A2q               20 non-null     float64
 41  DarkAs               0 non-null      float64
 42  DarkAp               0 non-null      float64
 43  DarkAq               20 non-null     float64
 44  MeanAs               0 non-null      float64
 45  MeanAp               0 non-null      float64
 46  MeanAq               20 non-null     float64
 47  IncTim               0 non-null      object 
 48  LightP               0 non-null      float64
 49  R_Depth              20 non-null     float64
 50  R_TEMP               20 non-null     float64
 51  R_POTEMP             20 non-null     float64
 52  R_SALINITY           19 non-null     float64
 53  R_SIGMA              19 non-null     float64
 54  R_SVA                19 non-null     float64
 55  R_DYNHT              20 non-null     float64
```

```
 56  R_O2                 0 non-null      float64
 57  R_O2Sat              0 non-null      float64
 58  R_SIO3               0 non-null      float64
 59  R_PO4                0 non-null      float64
 60  R_NO3                0 non-null      float64
 61  R_NO2                0 non-null      float64
 62  R_NH4                0 non-null      float64
 63  R_CHLA               0 non-null      float64
 64  R_PHAEO              0 non-null      float64
 65  R_PRES               20 non-null     int64
 66  R_SAMP               0 non-null      float64
 67  DIC1                 0 non-null      float64
 68  DIC2                 0 non-null      float64
 69  TA1                  0 non-null      float64
 70  TA2                  0 non-null      float64
 71  pH2                  0 non-null      float64
 72  pH1                  0 non-null      float64
 73  DIC Quality Comment  0 non-null      object
dtypes: float64(65), int64(5), object(4)
memory usage: 11.7+ KB
```

In [5]:

```
df.describe()
```

Out[5]:

	Cst_Cnt	Btl_Cnt	Depthm	T_degC	Salnty	O2ml_L	STheta	O2Sat	Oxy_
count	20.0	20.00000	20.000000	20.000000	19.000000	0.0	19.000000	0.0	
mean	1.0	10.50000	99.350000	9.618500	33.593421	NaN	25.905684	NaN	
std	0.0	5.91608	86.143867	0.872313	0.203257	NaN	0.296826	NaN	
min	1.0	1.00000	0.000000	7.960000	33.420000	NaN	25.643000	NaN	
25%	1.0	5.75000	27.500000	8.747500	33.434000	NaN	25.655000	NaN	
50%	1.0	10.50000	76.500000	9.845000	33.494000	NaN	25.801000	NaN	
75%	1.0	15.25000	150.500000	10.450000	33.768000	NaN	26.149500	NaN	
max	1.0	20.00000	285.000000	10.500000	33.980000	NaN	26.483000	NaN	

8 rows × 70 columns

In [6]:

```
df.columns
```

Out[6]:

```
Index(['Cst_Cnt', 'Btl_Cnt', 'Sta_ID', 'Depth_ID', 'Depthm', 'T_degC',
       'Salnty', 'O2ml_L', 'STheta', 'O2Sat', 'Oxy_µmol/Kg', 'BtlNum',
       'RecInd', 'T_prec', 'T_qual', 'S_prec', 'S_qual', 'P_qual', 'O_qua
l',
       'SThtaq', 'O2Satq', 'ChlorA', 'Chlqua', 'Phaeop', 'Phaqua', 'PO4u
M',
       'PO4q', 'SiO3uM', 'SiO3qu', 'NO2uM', 'NO2q', 'NO3uM', 'NO3q', 'NH3u
M',
       'NH3q', 'C14As1', 'C14A1p', 'C14A1q', 'C14As2', 'C14A2p', 'C14A2q',
       'DarkAs', 'DarkAp', 'DarkAq', 'MeanAs', 'MeanAp', 'MeanAq', 'IncTi
m',
       'LightP', 'R_Depth', 'R_TEMP', 'R_POTEMP', 'R_SALINITY', 'R_SIGMA',
       'R_SVA', 'R_DYNHT', 'R_O2', 'R_O2Sat', 'R_SIO3', 'R_PO4', 'R_NO3',
       'R_NO2', 'R_NH4', 'R_CHLA', 'R_PHAEO', 'R_PRES', 'R_SAMP', 'DIC1',
       'DIC2', 'TA1', 'TA2', 'pH2', 'pH1', 'DIC Quality Comment'],
      dtype='object')
```

In [7]:

```
df2=df.dropna(axis=1)
df2
```

Out[7]:

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	RecInd	T_prec	P_qual	O_qual
0	1	1	054.0 056.0	19-4903CR-HY-060-0930-05400560-0000A-3	0	10.50	3	1.0	9.0	9.0
1	1	2	054.0 056.0	19-4903CR-HY-060-0930-05400560-0008A-3	8	10.46	3	2.0	9.0	9.0
2	1	3	054.0 056.0	19-4903CR-HY-060-0930-05400560-0010A-7	10	10.46	7	2.0	9.0	9.0
3	1	4	054.0 056.0	19-4903CR-HY-060-0930-05400560-0019A-3	19	10.45	3	2.0	9.0	9.0
4	1	5	054.0 056.0	19-4903CR-HY-060-0930-05400560-0020A-7	20	10.45	7	2.0	9.0	9.0
5	1	6	054.0 056.0	19-4903CR-HY-060-0930-05400560-0030A-7	30	10.45	7	2.0	9.0	9.0
6	1	7	054.0 056.0	19-4903CR-HY-060-0930-05400560-0039A-3	39	10.45	3	2.0	9.0	9.0
7	1	8	054.0 056.0	19-4903CR-HY-060-0930-05400560-0050A-7	50	10.24	7	2.0	9.0	9.0
8	1	9	054.0 056.0	19-4903CR-HY-060-0930-05400560-0058A-3	58	10.06	3	2.0	9.0	9.0
9	1	10	054.0 056.0	19-4903CR-HY-060-0930-05400560-0075A-7	75	9.86	7	2.0	9.0	9.0

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	RecInd	T_prec	P_qual	O_qual
10	1	11	054.0 056.0	19-4903CR-HY-060-0930-05400560-0078A-3	78	9.83	3	2.0	9.0	9.0
11	1	12	054.0 056.0	19-4903CR-HY-060-0930-05400560-0100A-7	100	9.67	7	2.0	9.0	9.0
12	1	13	054.0 056.0	19-4903CR-HY-060-0930-05400560-0117A-3	117	9.50	3	2.0	9.0	9.0
13	1	14	054.0 056.0	19-4903CR-HY-060-0930-05400560-0125A-7	125	9.32	7	2.0	9.0	9.0
14	1	15	054.0 056.0	19-4903CR-HY-060-0930-05400560-0150A-7	150	8.76	7	2.0	9.0	9.0
15	1	16	054.0 056.0	19-4903CR-HY-060-0930-05400560-0152A-3	152	8.71	3	2.0	9.0	9.0
16	1	17	054.0 056.0	19-4903CR-HY-060-0930-05400560-0200A-7	200	8.53	7	2.0	9.0	9.0
17	1	18	054.0 056.0	19-4903CR-HY-060-0930-05400560-0221A-3	221	8.45	3	2.0	9.0	9.0
18	1	19	054.0 056.0	19-4903CR-HY-060-0930-05400560-0250A-7	250	8.26	7	2.0	9.0	9.0
19	1	20	054.0 056.0	19-4903CR-HY-060-0930-05400560-0285A-3	285	7.96	3	2.0	9.0	9.0

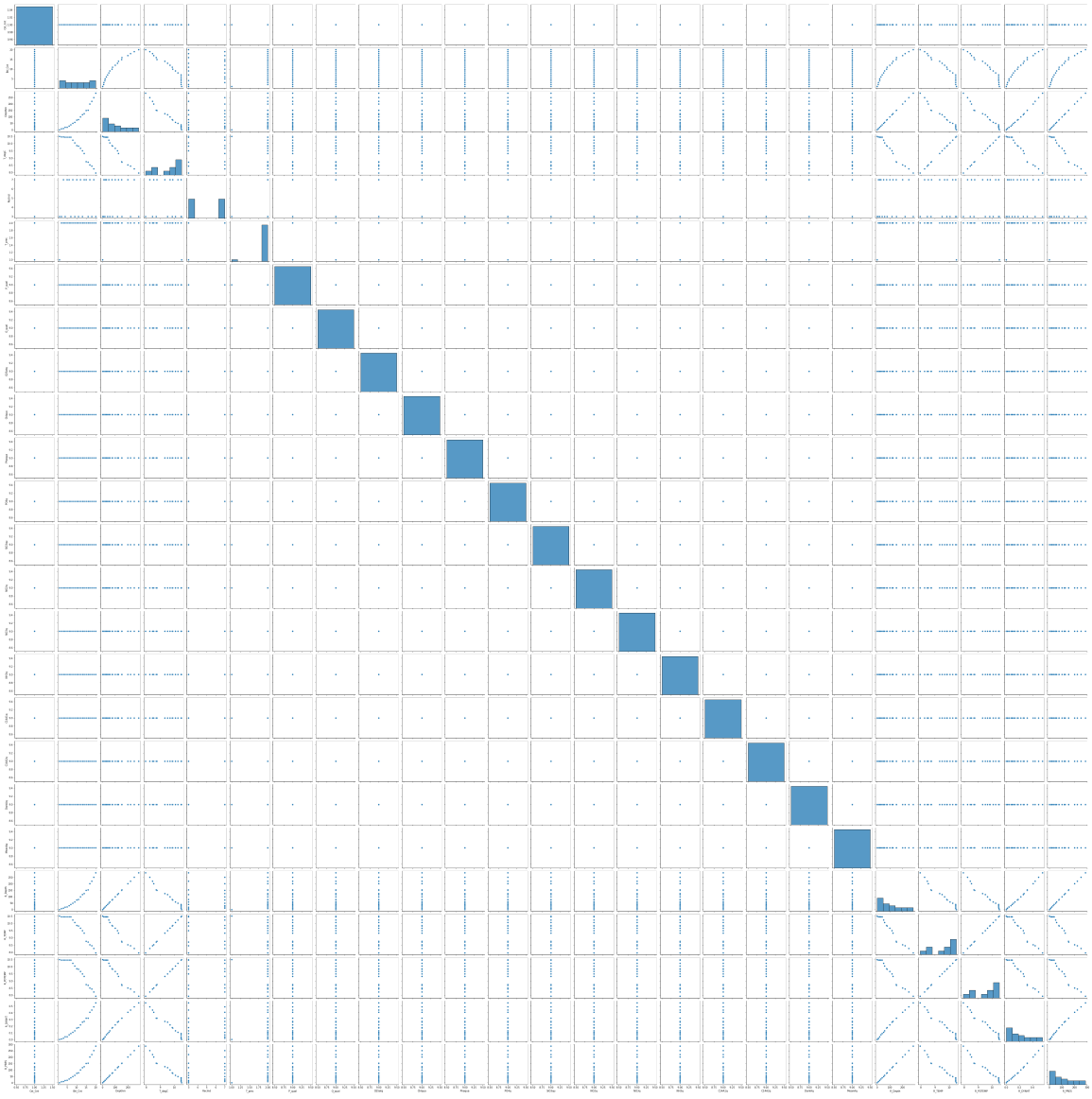
20 rows × 27 columns

In [8]:

```
sns.pairplot(df2)
```

Out[8]:

```
<seaborn.axisgrid.PairGrid at 0x27627c2ceb0>
```



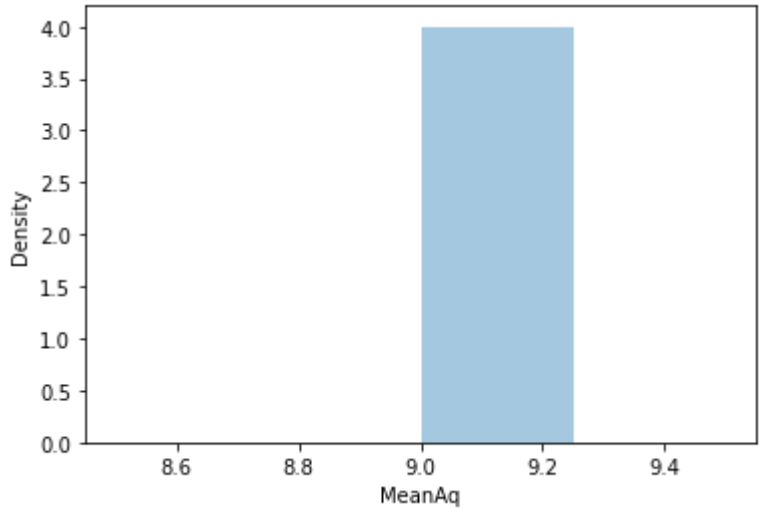
In [9]:

```
sns.distplot(df['MeanAq'])
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\distributions.py:2557:
FutureWarning: `distplot` is a deprecated function and will be removed in
a future version. Please adapt your code to use either `displot` (a figure
-level function with similar flexibility) or `histplot` (an axes-level fun
ction for histograms).
  warnings.warn(msg, FutureWarning)
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\distributions.py:306: U
serWarning: Dataset has 0 variance; skipping density estimate.
  warnings.warn(msg, UserWarning)
```

Out[9]:

```
<AxesSubplot:xlabel='MeanAq', ylabel='Density'>
```

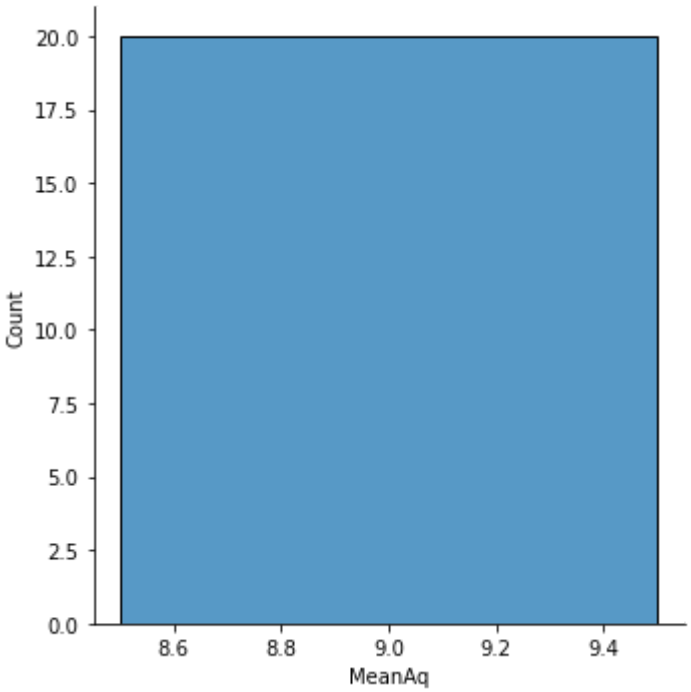


In [10]:

```
sns.displot(df["MeanAq"])
```

Out[10]:

```
<seaborn.axisgrid.FacetGrid at 0x2765b980e20>
```



In [11]:

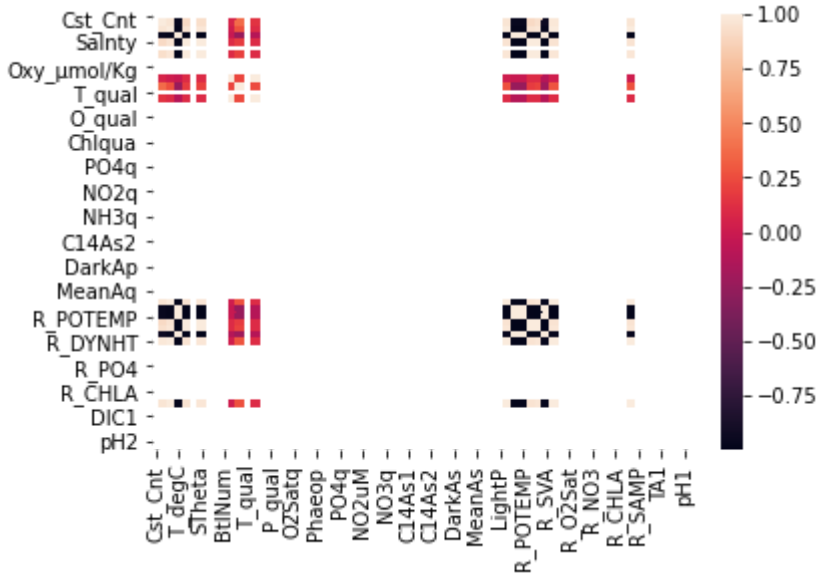
```
df1=df[['Cst_Cnt', 'Btl_Cnt', 'Sta_ID', 'Depth_ID', 'Depthm', 'T_degC',
       'Salnty', 'O2ml_L', 'STheta', 'O2Sat', 'Oxy_µmol/Kg', 'BtlNum',
       'RecInd', 'T_prec', 'T_qual', 'S_prec', 'S_qual', 'P_qual', 'O_qual',
       'SThtaq', 'O2Satq', 'ChlorA', 'Chlqua', 'Phaeop', 'Phaqua', 'PO4uM',
       'PO4q', 'SiO3uM', 'SiO3qu', 'NO2uM', 'NO2q', 'NO3uM', 'NO3q', 'NH3uM',
       'NH3q', 'C14As1', 'C14A1p', 'C14A1q', 'C14As2', 'C14A2p', 'C14A2q',
       'DarkAs', 'DarkAp', 'DarkAq', 'MeanAs', 'MeanAp', 'MeanAq', 'IncTim',
       'LightP', 'R_Depth', 'R_TEMP', 'R_POTEMP', 'R_SALINITY', 'R_SIGMA',
       'R_SVA', 'R_DYNHT', 'R_O2', 'R_O2Sat', 'R_SIO3', 'R_PO4', 'R_NO3',
       'R_NO2', 'R_NH4', 'R_CHLA', 'R_PHAEO', 'R_PRES', 'R_SAMP', 'DIC1',
       'DIC2', 'TA1', 'TA2', 'pH2', 'pH1', 'DIC Quality Comment']]
```

In [12]:

```
sns.heatmap(df1.corr())
```

Out[12]:

<AxesSubplot:>



In [13]:

```
df2=df.dropna(axis=1)
df2
```

Out[13]:

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	RecInd	T_prec	P_qual	O_qual
0	1	1	054.0 056.0	19-4903CR-HY-060-0930-05400560-0000A-3	0	10.50	3	1.0	9.0	9.0
1	1	2	054.0 056.0	19-4903CR-HY-060-0930-05400560-0008A-3	8	10.46	3	2.0	9.0	9.0
2	1	3	054.0 056.0	19-4903CR-HY-060-0930-05400560-0010A-7	10	10.46	7	2.0	9.0	9.0
3	1	4	054.0 056.0	19-4903CR-HY-060-0930-05400560-0019A-3	19	10.45	3	2.0	9.0	9.0
4	1	5	054.0 056.0	19-4903CR-HY-060-0930-05400560-0020A-7	20	10.45	7	2.0	9.0	9.0
5	1	6	054.0 056.0	19-4903CR-HY-060-0930-05400560-0030A-7	30	10.45	7	2.0	9.0	9.0
6	1	7	054.0 056.0	19-4903CR-HY-060-0930-05400560-0039A-3	39	10.45	3	2.0	9.0	9.0
7	1	8	054.0 056.0	19-4903CR-HY-060-0930-05400560-0050A-7	50	10.24	7	2.0	9.0	9.0
8	1	9	054.0 056.0	19-4903CR-HY-060-0930-05400560-0058A-3	58	10.06	3	2.0	9.0	9.0
9	1	10	054.0 056.0	19-4903CR-HY-060-0930-05400560-0075A-7	75	9.86	7	2.0	9.0	9.0

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	RecInd	T_prec	P_qual	O_qual
10	1	11	054.0 056.0	19-4903CR-HY-060-0930-05400560-0078A-3	78	9.83	3	2.0	9.0	9.0
11	1	12	054.0 056.0	19-4903CR-HY-060-0930-05400560-0100A-7	100	9.67	7	2.0	9.0	9.0
12	1	13	054.0 056.0	19-4903CR-HY-060-0930-05400560-0117A-3	117	9.50	3	2.0	9.0	9.0
13	1	14	054.0 056.0	19-4903CR-HY-060-0930-05400560-0125A-7	125	9.32	7	2.0	9.0	9.0
14	1	15	054.0 056.0	19-4903CR-HY-060-0930-05400560-0150A-7	150	8.76	7	2.0	9.0	9.0
15	1	16	054.0 056.0	19-4903CR-HY-060-0930-05400560-0152A-3	152	8.71	3	2.0	9.0	9.0
16	1	17	054.0 056.0	19-4903CR-HY-060-0930-05400560-0200A-7	200	8.53	7	2.0	9.0	9.0
17	1	18	054.0 056.0	19-4903CR-HY-060-0930-05400560-0221A-3	221	8.45	3	2.0	9.0	9.0
18	1	19	054.0 056.0	19-4903CR-HY-060-0930-05400560-0250A-7	250	8.26	7	2.0	9.0	9.0
19	1	20	054.0 056.0	19-4903CR-HY-060-0930-05400560-0285A-3	285	7.96	3	2.0	9.0	9.0

20 rows × 27 columns

In [14]:

```
x=df1[['Cst_Cnt','RecInd','Depthm','R_PRES']]
y=df1[['Depthm']]
```

In [15]:

```
from sklearn.model_selection import train_test_split
```

In [16]:

```
x_train,x_test,y_train,y_test = train_test_split(x,y,test_size=0.3)
```

In [17]:

```
from sklearn.linear_model import LinearRegression

lr=LinearRegression()
lr.fit(x_train,y_train)#ValueError: Input contains NaN, infinity or a value too large for
```

Out[17]:

```
LinearRegression()
```

In [18]:

```
print(lr.intercept_)
```

```
[-3.97903932e-13]
```

In [19]:

```
coef= pd.DataFrame(lr.coef_)
coef
```

Out[19]:

	0	1	2	3
0	0.0	1.058154e-13	1.0	2.372512e-14

In [20]:

```
print(lr.score(x_test,y_test))
```

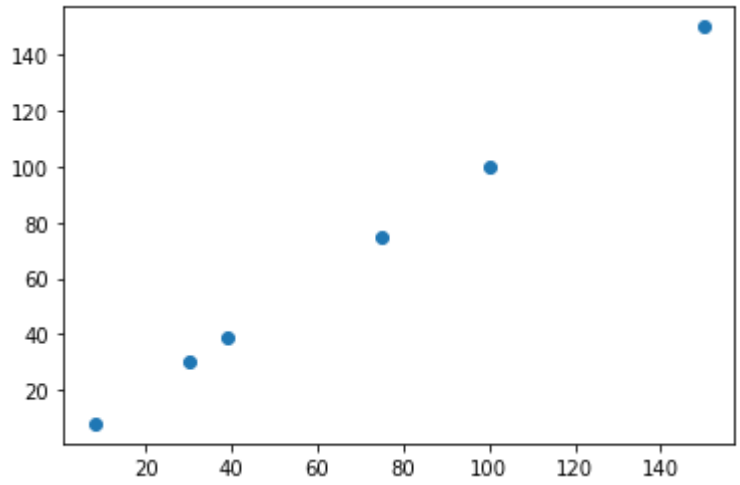
```
1.0
```

In [21]:

```
prediction = lr.predict(x_test)
plt.scatter(y_test,prediction)
```

Out[21]:

```
<matplotlib.collections.PathCollection at 0x27662e11850>
```



In [22]:

```
lr.score(x_test,y_test)
```

Out[22]:

```
1.0
```

In [23]:

```
lr.score(x_train,y_train)
```

Out[23]:

```
1.0
```

In [24]:

```
from sklearn.linear_model import Ridge,Lasso
```

In [25]:

```
rr=Ridge(alpha=10)
rr.fit(x_train,y_train)
```

Out[25]:

```
Ridge(alpha=10)
```

In [26]:

```
rr.score(x_test,y_test)
```

Out[26]:

```
0.9999937548317964
```

In [27]:

```
la=Lasso(alpha=10)
la.fit(x_train,y_train)
```

Out[27]:

```
Lasso(alpha=10)
```

In [28]:

```
la.score(x_test,y_test)
```

Out[28]:

```
0.9999973286746021
```

Elastic Net

In [29]:

```
from sklearn.linear_model import ElasticNet
en = ElasticNet()
en.fit(x_train,y_train)
```

Out[29]:

```
ElasticNet()
```

In [30]:

```
print(en.coef_)
```

```
[ 0.00000000e+00 -0.00000000e+00  9.99746994e-01  1.92864346e-04]
```

In [31]:

```
print(en.intercept_)
```

```
[0.00668493]
```

In [32]:

```
prediction=en.predict(x_test)
print(prediction)
```

```
[ 39.0043394   75.00217429 100.00086361 149.99785652  30.00488068
   8.0062038 ]
```

In [33]:

```
print(en.score(x_test,y_test))
```

```
0.999999993330917
```

Evaluation Metrics

In [34]:

```
from sklearn import metrics
```

In [35]:

```
print("Mean Absolute Error:",metrics.mean_absolute_error(y_test,prediction))
```

```
Mean Absolute Error: 0.003434209856950569
```

In [36]:

```
print("Mean Squared Error:",metrics.mean_squared_error(y_test,prediction))
```

```
Mean Squared Error: 1.520106309589754e-05
```

In [37]:

```
print("Root Mean Squared Error:",np.sqrt(metrics.mean_squared_error(y_test,prediction)))
```

```
Root Mean Squared Error: 0.003898854074711894
```