Linear Regression

In [94]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn import preprocessing,svm
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
df=pd.read_csv(r"C:\Users\91949\Downloads\bottle.csv.zip")
df
```

```
C:\Users\91949\AppData\Local\Temp\ipykernel_13352\687492671.py:8: DtypeWa
rning: Columns (47,73) have mixed types. Specify dtype option on import o
r set low_memory=False.
  df=pd.read_csv(r"C:\Users\91949\Downloads\bottle.csv.zip")
```

Out[94]:

	Cst_Cnt	Btl_Cnt	Sta_ID	Depth_ID	Depthm	T_degC	Salnty	O2ml_L	STheta
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
864859	34404	864860	093.4 026.4	20-1611SR-MX-310-2239-09340264-0002A-3	2	18.744	33.4083	5.805	23.87072
864860	34404	864861	093.4 026.4	20-1611SR-MX-310-2239-09340264-0005A-3	5	18.692	33.4150	5.796	23.88911
864861	34404	864862	093.4 026.4	20-1611SR-MX-310-2239-09340264-0010A-3	10	18.161	33.4062	5.816	24.01426

In [95]:
```
df.info()
```

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

864863 rows × 74 columns

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 864863 entries, 0 to 864862
Data columns (total 74 columns):
 #   Column               Non-Null Count   Dtype  
---  ------               --------------   -----  
 0   Cst_Cnt              864863 non-null  int64  
 1   Btl_Cnt              864863 non-null  int64  
 2   Sta_ID               864863 non-null  object 
 3   Depth_ID             864863 non-null  object 
 4   Depthm               864863 non-null  int64  
 5   T_degC               853900 non-null  float64
 6   Salnty               817509 non-null  float64
 7   O2ml_L               696201 non-null  float64
 8   STheta               812174 non-null  float64
 9   O2Sat                661274 non-null  float64
 10  Oxy_µmol/Kg          661268 non-null  float64
 11  BtlNum               118667 non-null  float64
 12  RecInd               864863 non-null  int64  
 13  T_prec               853900 non-null  float64
 14  T_qual               23127 non-null   float64
 15  S_prec               817509 non-null  float64
 16  S_qual               74914 non-null   float64
 17  P_qual               673755 non-null  float64
 18  O_qual               184676 non-null  float64
 19  SThtaq               65823 non-null   float64
 20  O2Satq               217797 non-null  float64
 21  ChlorA               225272 non-null  float64
 22  Chlqua               639166 non-null  float64
 23  Phaeop               225271 non-null  float64
 24  Phaqua               639170 non-null  float64
 25  PO4uM                413317 non-null  float64
 26  PO4q                 451786 non-null  float64
 27  SiO3uM               354091 non-null  float64
 28  SiO3qu               510866 non-null  float64
 29  NO2uM                337576 non-null  float64
 30  NO2q                 529474 non-null  float64
 31  NO3uM                337403 non-null  float64
 32  NO3q                 529933 non-null  float64
 33  NH3uM                64962 non-null   float64
 34  NH3q                 808299 non-null  float64
 35  C14As1               14432 non-null   float64
 36  C14A1p               12760 non-null   float64
 37  C14A1q               848605 non-null  float64
 38  C14As2               14414 non-null   float64
 39  C14A2p               12742 non-null   float64
 40  C14A2q               848623 non-null  float64
 41  DarkAs               22649 non-null   float64
 42  DarkAp               20457 non-null   float64
 43  DarkAq               840440 non-null  float64
 44  MeanAs               22650 non-null   float64
 45  MeanAp               20457 non-null   float64
 46  MeanAq               840439 non-null  float64
 47  IncTim               14437 non-null   object 
 48  LightP               18651 non-null   float64
 49  R_Depth              864863 non-null  float64
 50  R_TEMP               853900 non-null  float64
 51  R_POTEMP             818816 non-null  float64
 52  R_SALINITY           817509 non-null  float64
 53  R_SIGMA              812007 non-null  float64
 54  R_SVA                812092 non-null  float64
 55  R_DYNHT              818206 non-null  float64
```

```
 56  R_O2                 696201 non-null  float64
 57  R_O2Sat              666448 non-null  float64
 58  R_SIO3               354099 non-null  float64
 59  R_PO4                413325 non-null  float64
 60  R_NO3                337411 non-null  float64
 61  R_NO2                337584 non-null  float64
 62  R_NH4                64982 non-null   float64
 63  R_CHLA               225276 non-null  float64
 64  R_PHAEO              225275 non-null  float64
 65  R_PRES               864863 non-null  int64
 66  R_SAMP               122006 non-null  float64
 67  DIC1                 1999 non-null    float64
 68  DIC2                 224 non-null     float64
 69  TA1                  2084 non-null    float64
 70  TA2                  234 non-null     float64
 71  pH2                  10 non-null      float64
 72  pH1                  84 non-null      float64
 73  DIC Quality Comment  55 non-null      object
dtypes: float64(65), int64(5), object(4)
memory usage: 488.3+ MB
```

In [96]:

```
df.describe()
```

Out[96]:

	Cst_Cnt	Btl_Cnt	Depthm	T_degC	Salnty	C
count	864863.000000	864863.000000	864863.000000	853900.000000	817509.000000	696201.(
mean	17138.790958	432432.000000	226.831951	10.799677	33.840350	3.3
std	10240.949817	249664.587269	316.050259	4.243825	0.461843	2.(
min	1.000000	1.000000	0.000000	1.440000	28.431000	-0.(
25%	8269.000000	216216.500000	46.000000	7.680000	33.488000	1.3
50%	16848.000000	432432.000000	125.000000	10.060000	33.863000	3.4
75%	26557.000000	648647.500000	300.000000	13.880000	34.196900	5.5
max	34404.000000	864863.000000	5351.000000	31.140000	37.034000	11.

8 rows × 70 columns

In [97]:

```
df.isna().any()
```

Out[97]:

```
Cst_Cnt                False
Btl_Cnt                False
Sta_ID                 False
Depth_ID               False
Depthm                 False
                       ...
TA1                     True
TA2                     True
pH2                     True
pH1                     True
DIC Quality Comment     True
Length: 74, dtype: bool
```

In [98]:

```
df.isnull().sum()
```

Out[98]:

```
Cst_Cnt                     0
Btl_Cnt                     0
Sta_ID                      0
Depth_ID                    0
Depthm                      0
                          ...
TA1                    862779
TA2                    864629
pH2                    864853
pH1                    864779
DIC Quality Comment    864808
Length: 74, dtype: int64
```

In [99]:

```
df=df[ [ 'Salnty', 'T_degC']]
df.columns=['Sal', 'Temp']
```

In [100]:

```
df.head(20)
```

Out[100]:

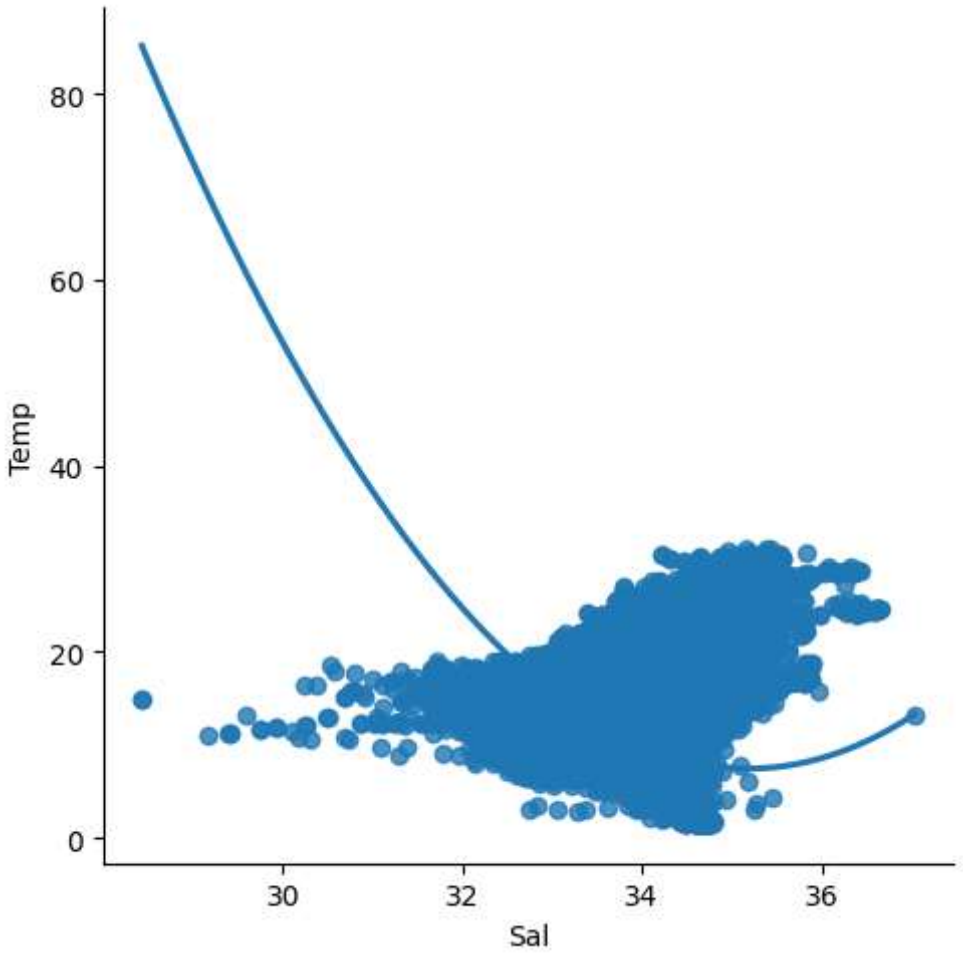
	Sal	Temp
0	33.440	10.50
1	33.440	10.46
2	33.437	10.46
3	33.420	10.45
4	33.421	10.45
5	33.431	10.45
6	33.440	10.45
7	33.424	10.24
8	33.420	10.06
9	33.494	9.86
10	33.510	9.83
11	33.580	9.67
12	33.640	9.50
13	33.689	9.32
14	33.847	8.76
15	33.860	8.71
16	33.876	8.53
17	NaN	8.45
18	33.926	8.26
19	33.980	7.96

In [101]:

```
sns.lmplot(x='Sal',y='Temp', data=df,order=2, ci=None)
```

Out[101]:

```
<seaborn.axisgrid.FacetGrid at 0x20b92f19190>
```



In [103]:

```
df.fillna(method='ffill',inplace=True)
```

```
C:\Users\91949\AppData\Local\Temp\ipykernel_13352\205861073.py:1: Setting
WithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-do
cs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (http
s://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy)
  df.fillna(method='ffill',inplace=True)
```

In [104]:

```
x=np.array(df['Sal']).reshape(-1,1)
y=np.array(df[ 'Temp']).reshape(-1,1)
```

In [105]:

```
df.dropna(inplace=True)
```

```
C:\Users\91949\AppData\Local\Temp\ipykernel_13352\1552371080.py:1: Settin
gWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-do
cs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (http
s://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returni
ng-a-view-versus-a-copy)
  df.dropna(inplace=True)
```

In [106]:

```
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.25)
```

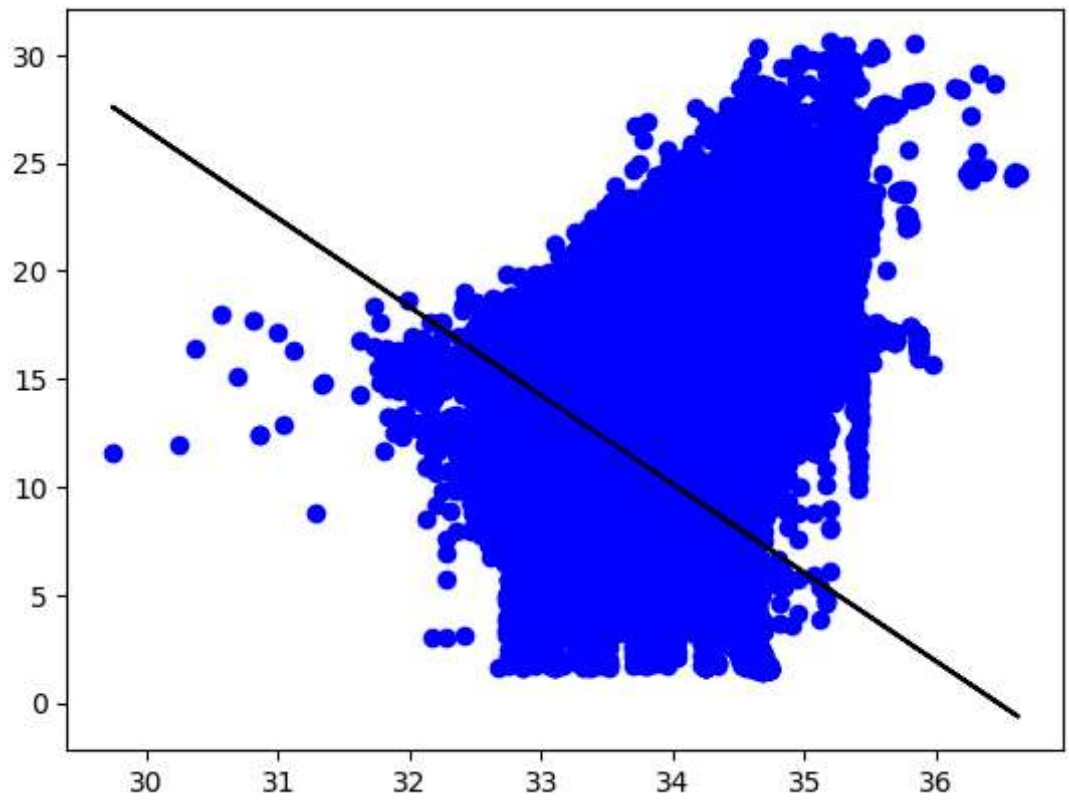
In [107]:

```
regr=LinearRegression()
regr.fit(x_train,y_train)
print(regr.score(x_test,y_test))
```

```
0.20498680913493517
```

In [109]:

```
y_pred=regr.predict(x_test)
plt.scatter(x_test,y_test,color='b')
plt.plot(x_test, y_pred, color='k')
plt.show()
```

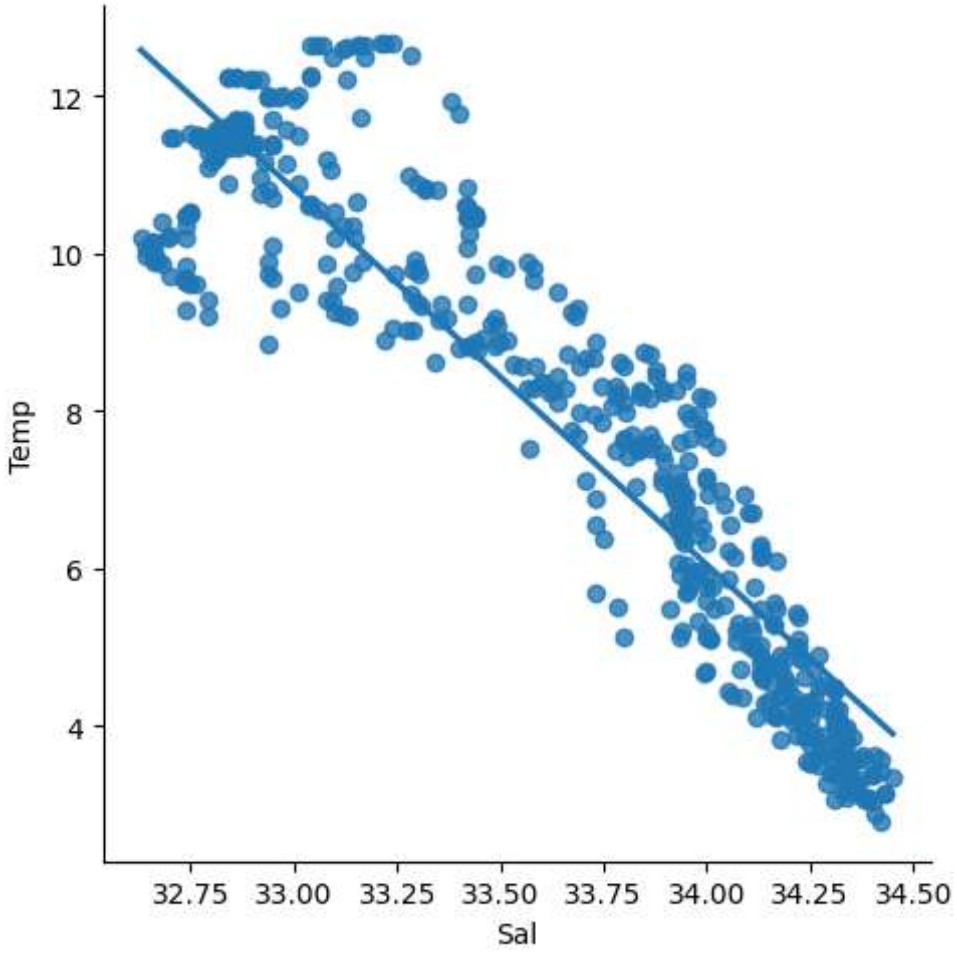


In [110]:

```
df500=df[:] [:500]
sns.lmplot(x='Sal',y='Temp', data=df500, order=1, ci=None)
```

Out[110]:

```
<seaborn.axisgrid.FacetGrid at 0x20b930a6c50>
```



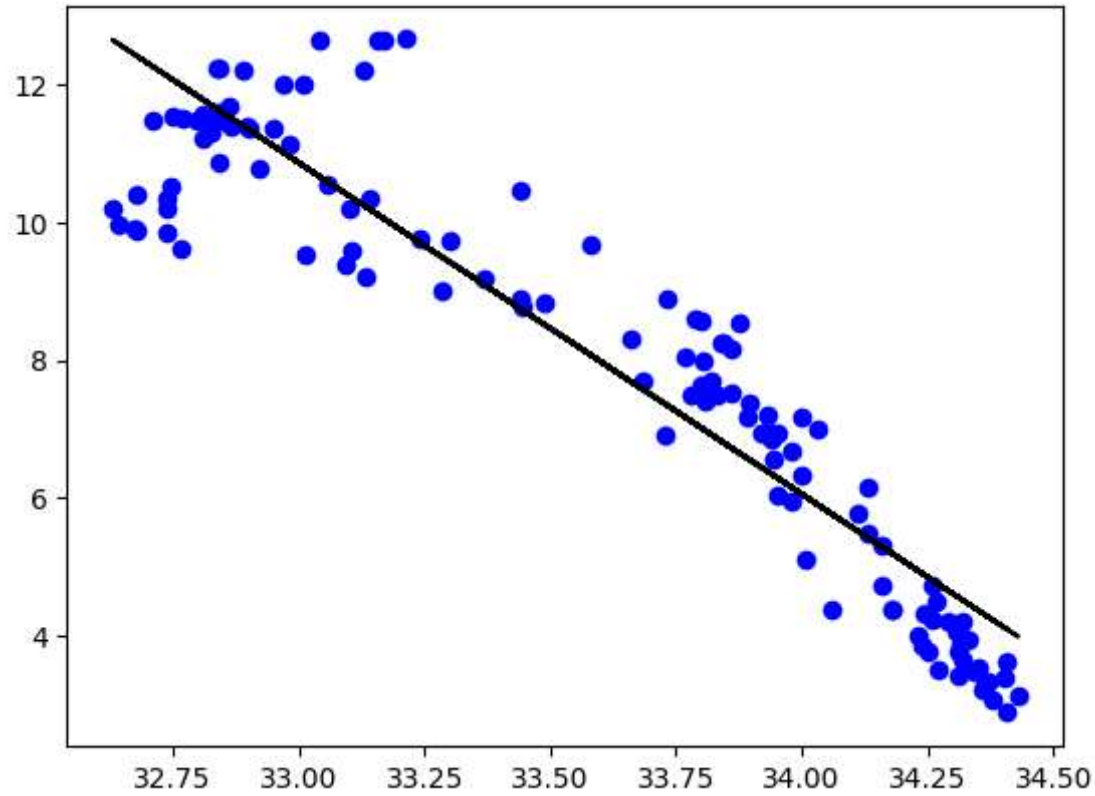
In [112]:

```
df500.fillna (method='ffill', inplace=True)
x=np.array(df500['Sal']).reshape(-1,1)
y=np.array(df500 [ 'Temp']).reshape(-1,1)
df500.dropna (inplace=True)
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.25)
regr=LinearRegression ()
regr.fit(x_train,y_train)
print("Regression:",regr.score(x_test,y_test))
y_pred=regr.predict(x_test)
plt.scatter(x_test,y_test,color='b')
plt.plot(x_test,y_pred, color='k')
plt.show
```

```
Regression: 0.8679290669545694
```

Out[112]:

```
<function matplotlib.pyplot.show(close=None, block=None)>
```



In [115]:

```
#Evaluevating a model
from sklearn.linear_model import LinearRegression
from sklearn.metrics import r2_score
model=LinearRegression()
model.fit(x_train,y_train)
y_pred=model.predict(x_test)
r2=r2_score(y_test,y_pred)
print("R2_Score: ",r2)
```

```
R2_Score:  0.8679290669545694
```

conclusion:

Dataset we have taken is poor for linear model but with smaller data works well with linear model