PCA_in_crabs_dataset

August 18, 2023

1 Import Libraries

[ ]:
```
import pandas as pd
pd.set_option('display.precision',3)
import io
from google.colab import files
import matplotlib.pyplot as plt
import seaborn as sns
```

[ ]:
```
uploaded = files.upload()
```

```
<IPython.core.display.HTML object>
```

```
Saving 3 - crabs.csv to 3 - crabs.csv
```

[ ]:
```
crabs_data = pd.read_csv("3 - crabs.csv")
crabs_data
```

[ ]:

	sp	sex	index	FL	RW	CL	CW	BD
0	B	M	1	8.1	6.7	16.1	19.0	7.0
1	B	M	2	8.8	7.7	18.1	20.8	7.4
2	B	M	3	9.2	7.8	19.0	22.4	7.7
3	B	M	4	9.6	7.9	20.1	23.1	8.2
4	B	M	5	9.8	8.0	20.3	23.0	8.2
..	..	..	…	…	…	…	…	…
195	O	F	46	21.4	18.0	41.2	46.2	18.7
196	O	F	47	21.7	17.1	41.7	47.2	19.6
197	O	F	48	21.9	17.2	42.6	47.4	19.5
198	O	F	49	22.5	17.2	43.0	48.7	19.8
199	O	F	50	23.1	20.2	46.2	52.5	21.1

[200 rows x 8 columns]

[ ]:
```
crabs_data = pd.read_csv("3 - crabs.csv")
crabs_data.head()
```

[ ]:

	sp	sex	index	FL	RW	CL	CW	BD
0	B	M	1	8.1	6.7	16.1	19.0	7.0
1	B	M	2	8.8	7.7	18.1	20.8	7.4

```
2  B   M      3  9.2  7.8  19.0  22.4  7.7
3  B   M      4  9.6  7.9  20.1  23.1  8.2
4  B   M      5  9.8  8.0  20.3  23.0  8.2
```

[ ]:
```
crabs_data = pd.read_csv("3 - crabs.csv")
crabs_data.tail()
```

[ ]:
```
     sp sex  index    FL    RW    CL    CW    BD
195  O   F     46  21.4  18.0  41.2  46.2  18.7
196  O   F     47  21.7  17.1  41.7  47.2  19.6
197  O   F     48  21.9  17.2  42.6  47.4  19.5
198  O   F     49  22.5  17.2  43.0  48.7  19.8
199  O   F     50  23.1  20.2  46.2  52.5  21.1
```

[ ]:
```
crabs_data = pd.read_csv("3 - crabs.csv")
crabs_data.shape
```

[ ]:
```
(200, 8)
```

[ ]:
```
crabs_data = pd.read_csv("3 - crabs.csv")
crabs_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 8 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   sp      200 non-null    object
 1   sex     200 non-null    object
 2   index   200 non-null    int64
 3   FL      200 non-null    float64
 4   RW      200 non-null    float64
 5   CL      200 non-null    float64
 6   CW      200 non-null    float64
 7   BD      200 non-null    float64
dtypes: float64(5), int64(1), object(2)
memory usage: 12.6+ KB
```

[ ]:
```
crabs_data = pd.read_csv("3 - crabs.csv")
crabs_data.info
```

[ ]:
```
<bound method DataFrame.info of     sp sex  index    FL    RW    CL    CW    BD
0    B   M      1   8.1   6.7  16.1  19.0   7.0
1    B   M      2   8.8   7.7  18.1  20.8   7.4
2    B   M      3   9.2   7.8  19.0  22.4   7.7
3    B   M      4   9.6   7.9  20.1  23.1   8.2
4    B   M      5   9.8   8.0  20.3  23.0   8.2
..  ..  ..    ...   ...   ...   ...   ...   ...
```

```
195  O   F     46  21.4  18.0  41.2  46.2  18.7
196  O   F     47  21.7  17.1  41.7  47.2  19.6
197  O   F     48  21.9  17.2  42.6  47.4  19.5
198  O   F     49  22.5  17.2  43.0  48.7  19.8
199  O   F     50  23.1  20.2  46.2  52.5  21.1

[200 rows x 8 columns]>
```

[ ]:
```
crabs_data = pd.read_csv("3 - crabs.csv")
crabs_data.T
```

[ ]:
```
          0     1     2     3     4     5     6     7     8     9   …   190  \
sp        B     B     B     B     B     B     B     B     B     B   …     O
sex       M     M     M     M     M     M     M     M     M     M   …     F
index     1     2     3     4     5     6     7     8     9    10   …    41
FL      8.1   8.8   9.2   9.6   9.8  10.8  11.1  11.6  11.8  11.8   …  20.3
RW      6.7   7.7   7.8   7.9   8.0   9.0   9.9   9.1   9.6  10.5   …  16.0
CL     16.1  18.1  19.0  20.1  20.3  23.0  23.8  24.5  24.2  25.2   …  39.4
CW     19.0  20.8  22.4  23.1  23.0  26.5  27.1  28.4  27.8  29.3   …  44.1
BD      7.0   7.4   7.7   8.2   8.2   9.8   9.8  10.4   9.7  10.3   …  18.0

          191   192   193   194   195   196   197   198   199
sp          O     O     O     O     O     O     O     O     O
sex         F     F     F     F     F     F     F     F     F
index    42    43    44    45    46    47    48    49    50
FL     20.5  20.6  20.9  21.3  21.4  21.7  21.9  22.5  23.1
RW     17.5  17.5  16.5  18.4  18.0  17.1  17.2  17.2  20.2
CL     40.0  41.5  39.9  43.8  41.2  41.7  42.6  43.0  46.2
CW     45.5  46.2  44.7  48.4  46.2  47.2  47.4  48.7  52.5
BD     19.2  19.2  17.5  20.0  18.7  19.6  19.5  19.8  21.1

[8 rows x 200 columns]
```

[ ]:
```
crabs_data = pd.read_csv("3 - crabs.csv")
crabs_data = crabs_data.rename( columns = {'sp':'species','FL':'Frontal Lobe␣
 ↪Length','RW':'Rear Width','CL':'Carepace Length','CW':'Carepace Width','BD':
 ↪'Bodylength'})
crabs_data['species'] = crabs_data['species'].map({'B':'BLUE','O':'ORANGE'})
crabs_data['sex'] = crabs_data['sex'].map({'M':'MALE','F':'FEMALE'})
crabs_data
```

[ ]:
```
    species     sex  index  Frontal Lobe Length  Rear Width  Carepace Length  \
0      BLUE    MALE      1                  8.1         6.7             16.1
1      BLUE    MALE      2                  8.8         7.7             18.1
2      BLUE    MALE      3                  9.2         7.8             19.0
3      BLUE    MALE      4                  9.6         7.9             20.1
4      BLUE    MALE      5                  9.8         8.0             20.3
```

```
..      …      …    …                   …         …              …
195  ORANGE  FEMALE     46                21.4        18.0           41.2
196  ORANGE  FEMALE     47                21.7        17.1           41.7
197  ORANGE  FEMALE     48                21.9        17.2           42.6
198  ORANGE  FEMALE     49                22.5        17.2           43.0
199  ORANGE  FEMALE     50                23.1        20.2           46.2

     Carepace Width  Bodylength
0              19.0         7.0
1              20.8         7.4
2              22.4         7.7
3              23.1         8.2
4              23.0         8.2
..              …          …
195            46.2        18.7
196            47.2        19.6
197            47.4        19.5
198            48.7        19.8
199            52.5        21.1

[200 rows x 8 columns]
```

[ ]:
```
crabs_data.head()
```

[ ]:
```
  species   sex  index  Frontal Lobe Length  Rear Width  Carepace Length  \
0    BLUE  MALE      1                  8.1         6.7             16.1
1    BLUE  MALE      2                  8.8         7.7             18.1
2    BLUE  MALE      3                  9.2         7.8             19.0
3    BLUE  MALE      4                  9.6         7.9             20.1
4    BLUE  MALE      5                  9.8         8.0             20.3

   Carepace Width  Bodylength
0            19.0         7.0
1            20.8         7.4
2            22.4         7.7
3            23.1         8.2
4            23.0         8.2
```

[ ]:
```
crabs_data.tail()
```

[ ]:
```
    species     sex  index  Frontal Lobe Length  Rear Width  Carepace Length  \
195  ORANGE  FEMALE     46                21.4        18.0             41.2
196  ORANGE  FEMALE     47                21.7        17.1             41.7
197  ORANGE  FEMALE     48                21.9        17.2             42.6
198  ORANGE  FEMALE     49                22.5        17.2             43.0
199  ORANGE  FEMALE     50                23.1        20.2             46.2
```

```
     Carepace Width  Bodylength
195            46.2        18.7
196            47.2        19.6
197            47.4        19.5
198            48.7        19.8
199            52.5        21.1
```

[ ]:
```
crabs_data.describe(include='all')
```

[ ]:
```
        species   sex    index  Frontal Lobe Length  Rear Width  \
count       200   200  200.000              200.000     200.000
unique        2     2      NaN                  NaN         NaN
top        BLUE  MALE      NaN                  NaN         NaN
freq        100   100      NaN                  NaN         NaN
mean        NaN   NaN   25.500               15.583      12.738
std         NaN   NaN   14.467                3.495       2.573
min         NaN   NaN    1.000                7.200       6.500
25%         NaN   NaN   13.000               12.900      11.000
50%         NaN   NaN   25.500               15.550      12.800
75%         NaN   NaN   38.000               18.050      14.300
max         NaN   NaN   50.000               23.100      20.200

         Carepace Length  Carepace Width  Bodylength
count            200.000         200.000     200.000
unique               NaN             NaN         NaN
top                  NaN             NaN         NaN
freq                 NaN             NaN         NaN
mean              32.105          36.415      14.030
std                7.119           7.872       3.425
min               14.700          17.100       6.100
25%               27.275          31.500      11.400
50%               32.100          36.800      13.900
75%               37.225          42.000      16.600
max               47.600          54.600      21.600
```

[ ]:
```
crabs_data.columns
```

[ ]:
```
Index(['species', 'sex', 'index', 'Frontal Lobe Length', 'Rear Width',
       'Carepace Length', 'Carepace Width', 'Bodylength'],
      dtype='object')
```

[ ]:
```
crabs_data.shape
```

[ ]:
```
(200, 8)
```

[ ]:
```
crabs_data['class'] = crabs_data.species + crabs_data.sex
crabs_data['class'].value_counts()
```

[ ]:
```
BLUEMALE        50
BLUEFEMALE      50
ORANGEMALE      50
ORANGEFEMALE    50
Name: class, dtype: int64
```

1.0.1 we will start the basic exploration of dataset

[ ]:
```
data_columns = ['Frontal Lobe Length','Rear Width','Carepace Length','Carepace␣
↪Width','Bodylength']
crabs_data[data_columns].describe()
```

[ ]:

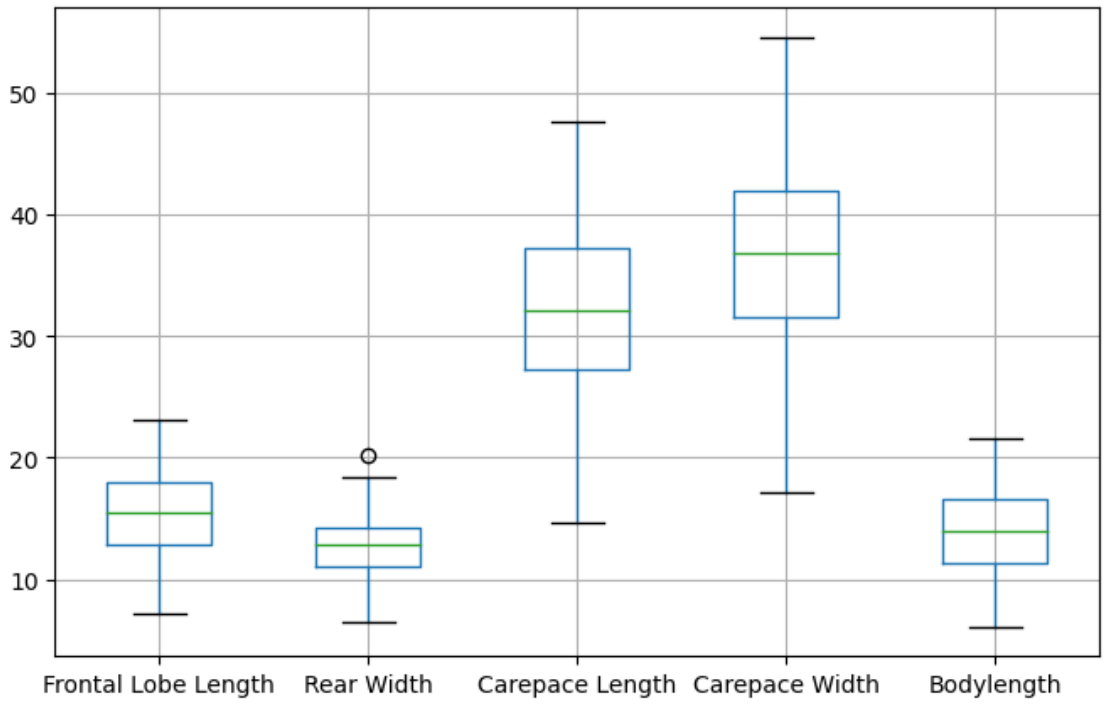
	Frontal Lobe Length	Rear Width	Carepace Length	Carepace Width	\
count	200.000	200.000	200.000	200.000	
mean	15.583	12.738	32.105	36.415	
std	3.495	2.573	7.119	7.872	
min	7.200	6.500	14.700	17.100	
25%	12.900	11.000	27.275	31.500	
50%	15.550	12.800	32.100	36.800	
75%	18.050	14.300	37.225	42.000	
max	23.100	20.200	47.600	54.600	

	Bodylength
count	200.000
mean	14.030
std	3.425
min	6.100
25%	11.400
50%	13.900
75%	16.600
max	21.600

1.0.2 Box plot of the Relevant features

[ ]:
```
fig, ax = plt.subplots(figsize=(8,5))
crabs_data[data_columns].boxplot()
```

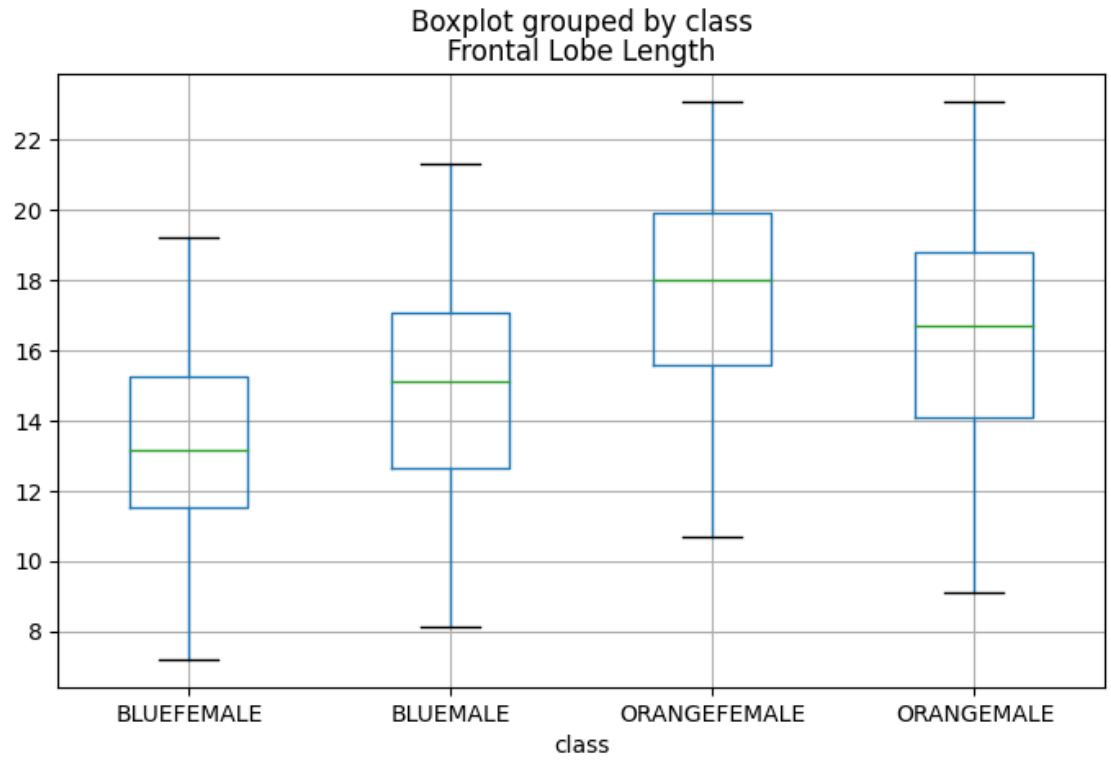
[ ]:
```
<Axes: >
```



1.0.3 Initial visualization of classes

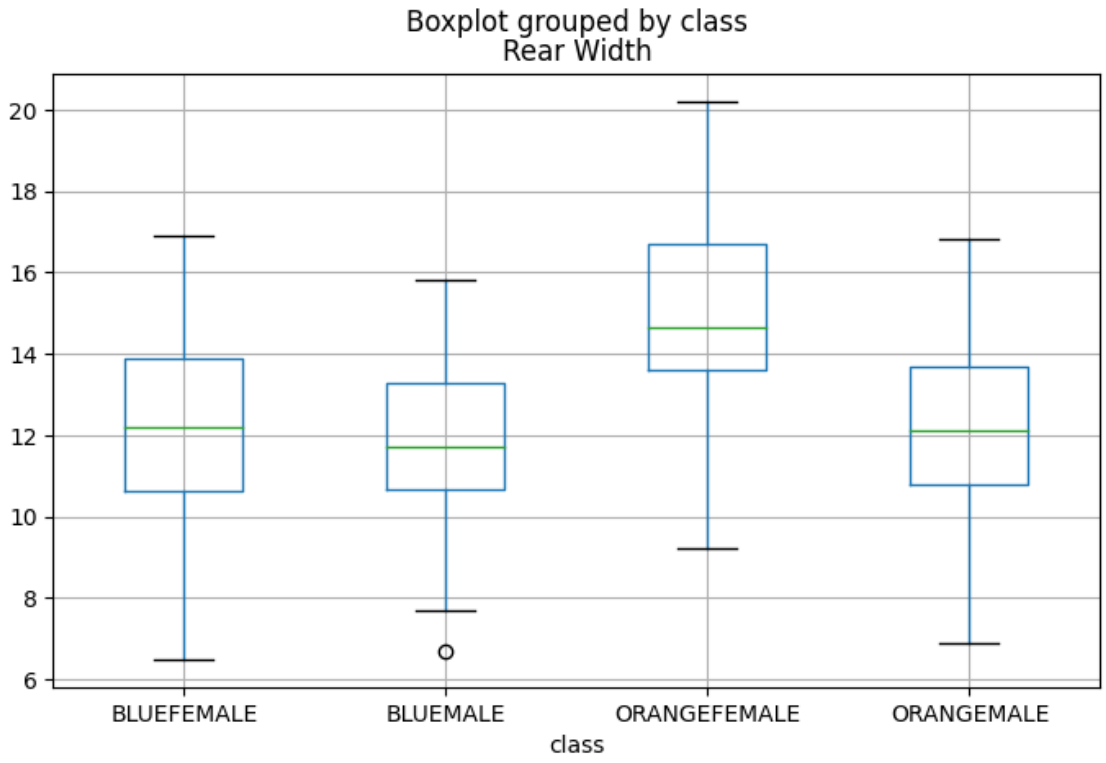
[ ]:
```
crabs_data.boxplot(column = 'Frontal Lobe Length', by = 'class' , figsize =␣
↪(8,5))
```

[ ]:
```
<Axes: title={'center': 'Frontal Lobe Length'}, xlabel='class'>
```



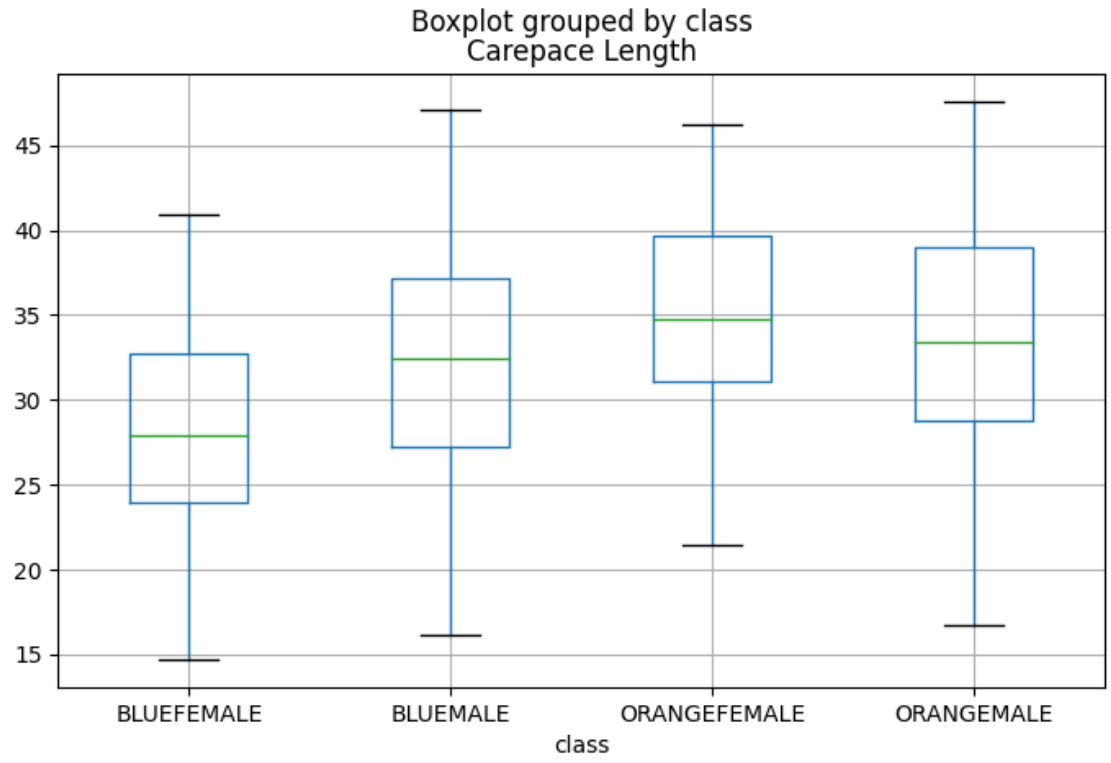
[ ]:
```
crabs_data.boxplot(column = 'Rear Width', by = 'class' , figsize = (8,5))
```

[ ]:
```
<Axes: title={'center': 'Rear Width'}, xlabel='class'>
```



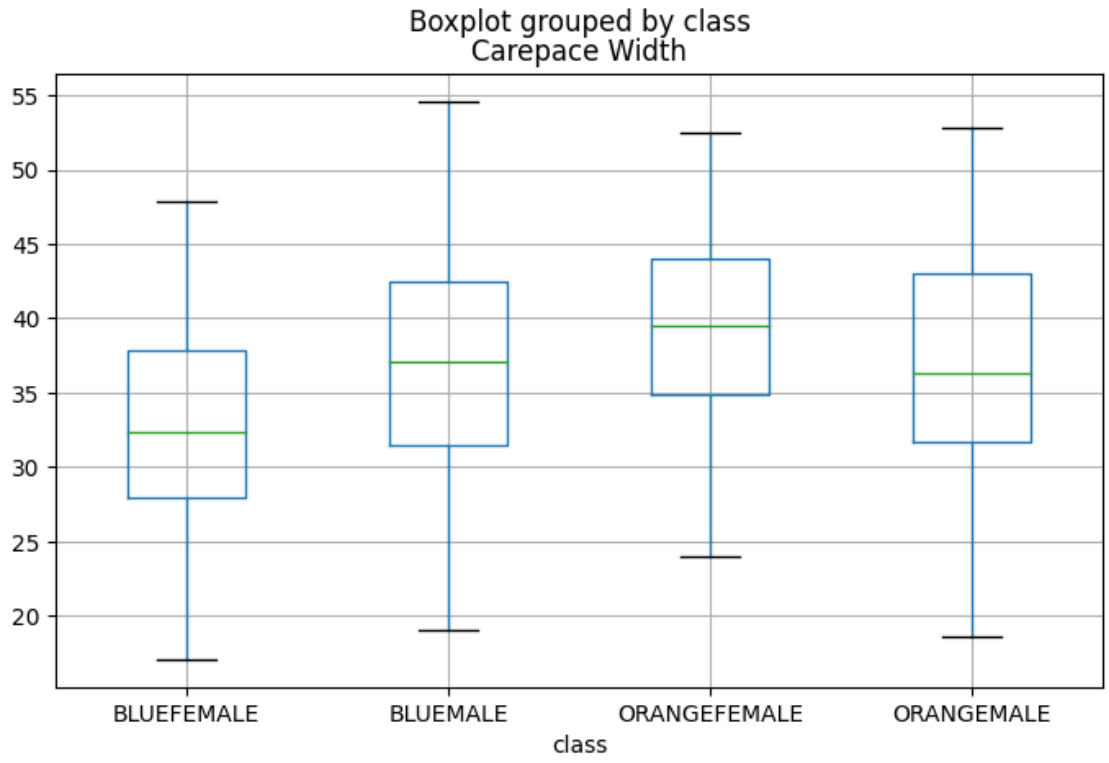
[ ]:
```
crabs_data.boxplot(column = 'Carepace Length', by = 'class' , figsize = (8,5))
```

[ ]:
```
<Axes: title={'center': 'Carepace Length'}, xlabel='class'>
```



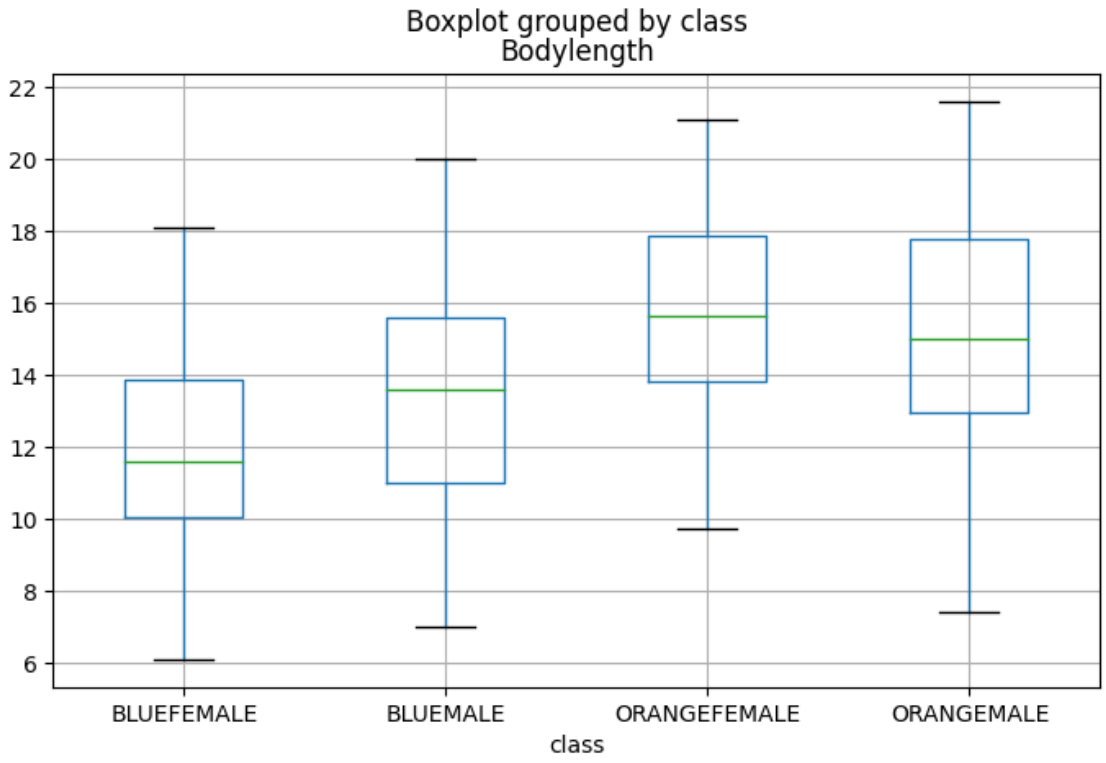
[ ]:
```
crabs_data.boxplot(column = 'Carepace Width', by = 'class' , figsize = (8,5))
```

[ ]:
```
<Axes: title={'center': 'Carepace Width'}, xlabel='class'>
```



[ ]:
```
crabs_data.boxplot(column = 'Bodylength', by = 'class' , figsize = (8,5))
```

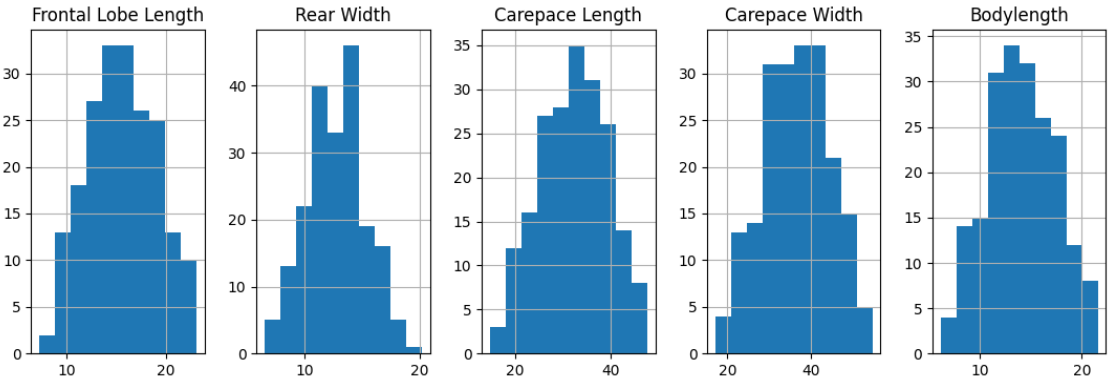
[ ]:
```
<Axes: title={'center': 'Bodylength'}, xlabel='class'>
```



1.0.4 Histograms

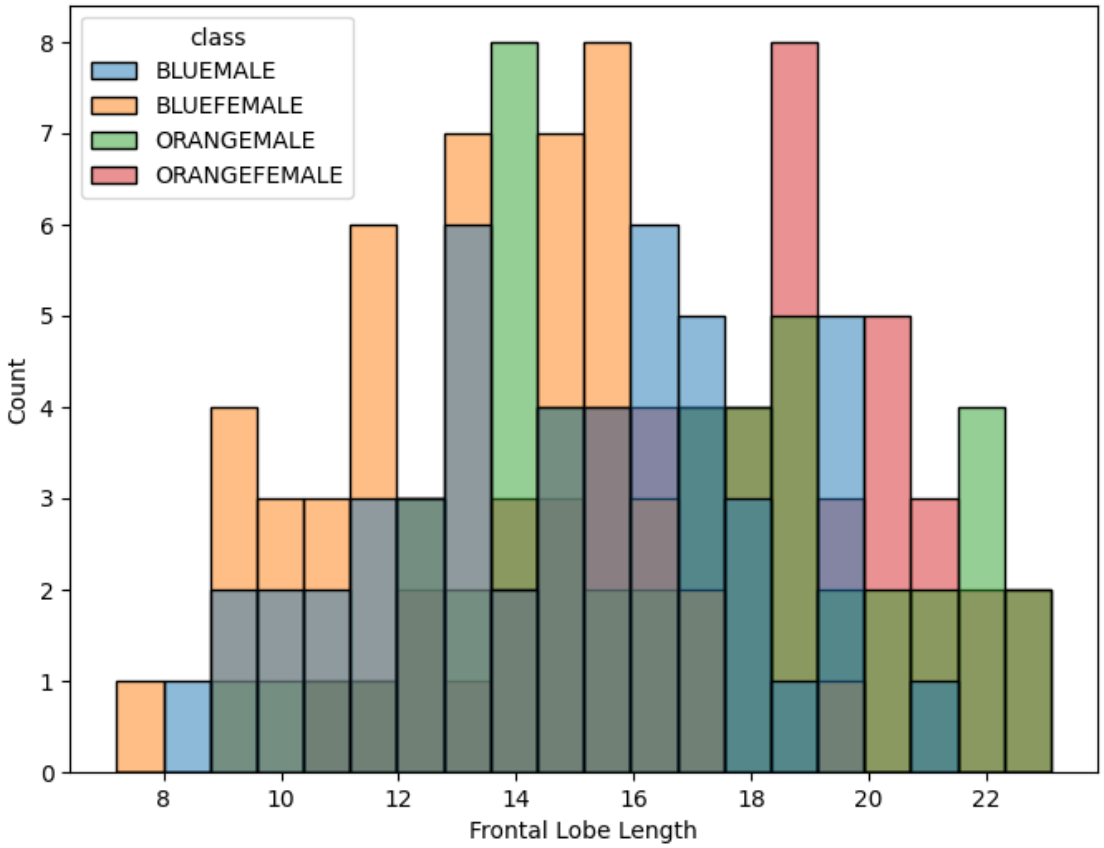
[ ]:
```
crabs_data[data_columns].hist(figsize=(16,4),layout=(1,6))
```

[ ]:
```
array([[<Axes: title={'center': 'Frontal Lobe Length'}>,
        <Axes: title={'center': 'Rear Width'}>,
        <Axes: title={'center': 'Carepace Length'}>,
        <Axes: title={'center': 'Carepace Width'}>,
        <Axes: title={'center': 'Bodylength'}>, <Axes: >]], dtype=object)
```



[ ]:
```
plt.figure(figsize=(8,6))
sns.histplot(crabs_data,x="Frontal Lobe Length",hue='class',bins=20)
```

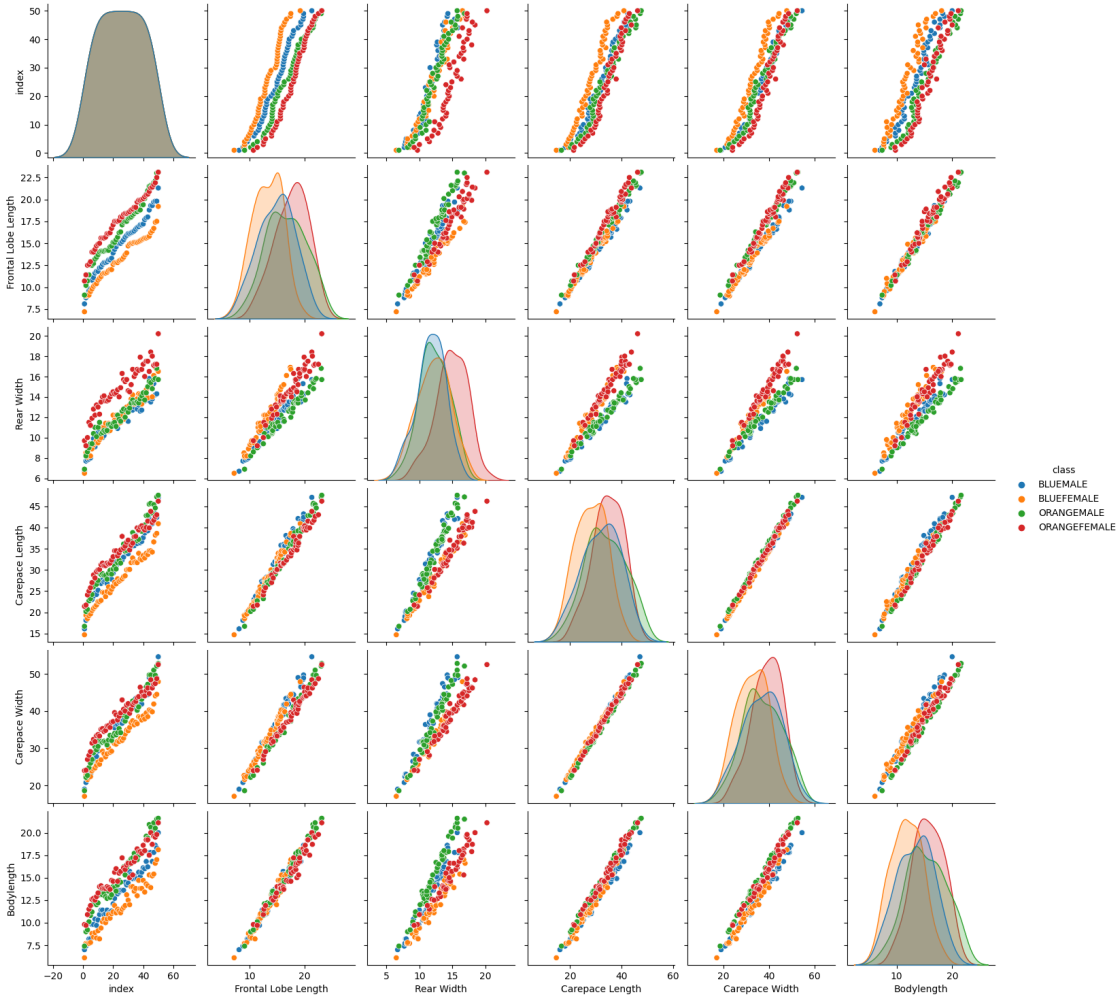
[ ]:
```
<Axes: xlabel='Frontal Lobe Length', ylabel='Count'>
```



1.0.5 Pairplots

[ ]:
```
sns.pairplot(crabs_data,hue='class')
```

[ ]:
```
<seaborn.axisgrid.PairGrid at 0x7da0f5e2e5f0>
```


index
Frontal Lobe Length
Rear Width
Carepace Length
Carepace Width
Bodylength
class
BLUEMALE
BLUEFEMALE
ORANGEMALE
ORANGEFEMALE