fish-mercury-data-analysis

September 18, 2022

1 Fish mercury data analysis

Author of this notebook: Izael Manuel Rascón Durán A01562240 Módulo 1: Estadística para ciencia de datos e Inteligencia Artificial avanzada y ciencia de datos. Grupo: 102

Mercury contamination of fish in edible freshwater is a direct threat to our health. A recent study was conducted in 53 Florida lakes to examine factors influencing the level of mercury contamination. The variables that were measured can be found in mercury.csv and are described as follows:

X1 = identification number X2 = lake name X3 = alkalinity (mg/l calcium carbonate) X4 = PH X5 = calcium (mg/l) X6 = chlorophyll (mg/l) X7 = average mercury concentration (part per million) in the muscle tissue of the group of fish studied in each lake X8 = number of fish studied in each lake X8 = number of fish studied in the lake X9 = minimum mercury concentration in each group of fish X10 = maximum mercury concentration in each group of fish X10 = maximum mercury concentration in each group of fish X11 = estimate (by regression) of mercury concentration in each group of fish X11 = estimate (by regression) of the mercury concentration in the 3-year-old fish (or average mercury when age is not available) X12 = indicator of the age of the fish (0: young; 1: mature).

Around the main research question that arises in this study: what are the main factors influencing the level of mercury contamination in fish in Florida lakes? Parallel questions may arise that break down this general question:

- Is there evidence to assume that the average concentration of mercury in the lakes is harmful to human health? Consider that the reference regulations for assessing maximum Hg levels (Regulation 34687-MAG and international regulations EC 1881/2006 and Codex Standard 193-1995) state that the average mercury concentration in fishery products should not exceed 0.5 mg Hg/kg.
- Will there be significant difference between mercury concentration by age of fish?
- If the sampling was done by casting a net and analyzing the fish that the net encountered, will the number of fish encountered influence the mercury concentration in the fish?
- Do the concentrations of alkalinity, chlorophyll, calcium in the lake water influence the mercury concentration of the fish?

1.1 Database exploration

1.1.1 Accessing the database and setting up the required libraries

1.1.2 Analyze dataset features

In the next codeblock we can see all the available features of the dataset already described

```
['name' 'alkalinity' 'ph' 'calcium' 'chlorophyll' 'mean_merc_porc'
 'num_fish' 'min_merc_porc' 'max_merc_porc' 'merc_estimate_porc'
 'age_fishes']
```

Which features are categorical? These values classify the samples into sets of similar samples. Within categorical features are the values nominal, ordinal, ratio, or interval based? Among other things this helps us select the appropriate plots for visualization.

- Nominal: name.

Which features are numerical? Which features are numerical? These values change from sample to sample. Within numerical features are the values discrete, continuous, or timeseries based? Among other things this helps us select the appropriate plots for visualization.

- Continuous: alkalinity, ph, calcium, chlorophyll, mean_merc_porc, min_merc_porc, max_merc_porc and merc_estimate_porc.
- Discrete: age_fishes and num_fish.

X1	name	alkalinity	ph	calcium	chlorophyll	mean_merc_porc	\
1	Alligator	5.9	6.1	3.0	0.7	1.23	
2	Annie	3.5	5.1	1.9	3.2	1.33	
3	Apopka	116.0	9.1	44.1	128.3	0.04	
4	Blue Cypress	39.4	6.9	16.4	3.5	0.44	
5	Brick	2.5	4.6	2.9	1.8	1.20	

X1	num_fish	min_merc_porc	max_merc_porc	merc_estimate_porc	age_fishes
1	5	0.85	1.43	1.53	1
2	7	0.92	1.90	1.33	0
3	6	0.04	0.06	0.04	0
4	12	0.13	0.84	0.44	0
5	12	0.69	1.50	1.33	1

Extra observations The dataset have no missing values in any feature, which means we don't have to worry about fill empty values. We can observe that there it is 11 features that are numerical data type and 1 that are string data type.

We might need to convert in future the string features (categorical data) to numerical data types (numerical data).

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 53 entries, 1 to 53
Data columns (total 11 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   name                53 non-null     object
 1   alkalinity          53 non-null     float64
 2   ph                  53 non-null     float64
```

```
 3   calcium             53 non-null     float64
 4   chlorophyll         53 non-null     float64
 5   mean_merc_porc      53 non-null     float64
 6   num_fish            53 non-null     int64
 7   min_merc_porc       53 non-null     float64
 8   max_merc_porc       53 non-null     float64
 9   merc_estimate_porc  53 non-null     float64
 10  age_fishes          53 non-null     int64
dtypes: float64(8), int64(2), object(1)
memory usage: 5.0+ KB
```

1.1.3 Database exploration

Describe the numerical features

	alkalinity	ph	calcium	chlorophyll	mean_merc_porc	\
count	53.000000	53.000000	53.000000	53.000000	53.000000	
mean	37.530189	6.590566	22.201887	23.116981	0.527170	
std	38.203527	1.288449	24.932574	30.816321	0.341036	
min	1.200000	3.600000	1.100000	0.700000	0.040000	
25%	6.600000	5.800000	3.300000	4.600000	0.270000	
50%	19.600000	6.800000	12.600000	12.800000	0.480000	
75%	66.500000	7.400000	35.600000	24.700000	0.770000	
max	128.000000	9.100000	90.700000	152.400000	1.330000	

	num_fish	min_merc_porc	max_merc_porc	merc_estimate_porc	age_fishes
count	53.000000	53.000000	53.000000	53.000000	53.000000
mean	13.056604	0.279811	0.874528	0.513208	0.811321
std	8.560677	0.226406	0.522047	0.338729	0.394998
min	4.000000	0.040000	0.060000	0.040000	0.000000
25%	10.000000	0.090000	0.480000	0.250000	1.000000
50%	12.000000	0.250000	0.840000	0.450000	1.000000
75%	12.000000	0.330000	1.330000	0.700000	1.000000
max	44.000000	0.920000	2.040000	1.530000	1.000000

Describe the categorical features

	name
count	53
unique	53
top	Alligator
freq	1

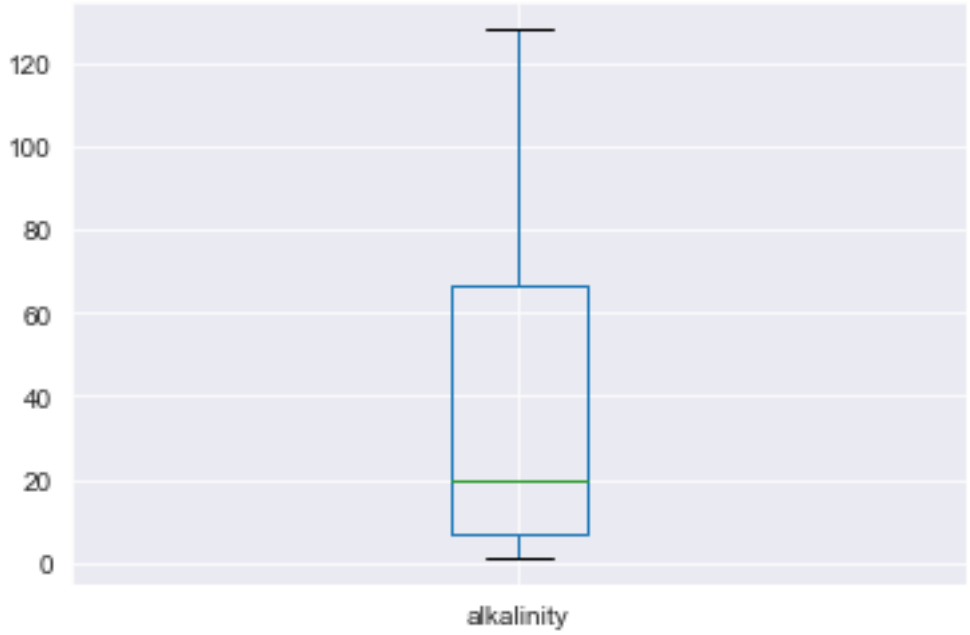
name	Alligator
alkalinity	17.3
ph	5.8
calcium	3.0
chlorophyll	1.6
mean_merc_porc	0.34

```
num_fish                  12.0
min_merc_porc             0.04
max_merc_porc             0.06
merc_estimate_porc        0.16
age_fishes                 1.0
Name: 0, dtype: object
```

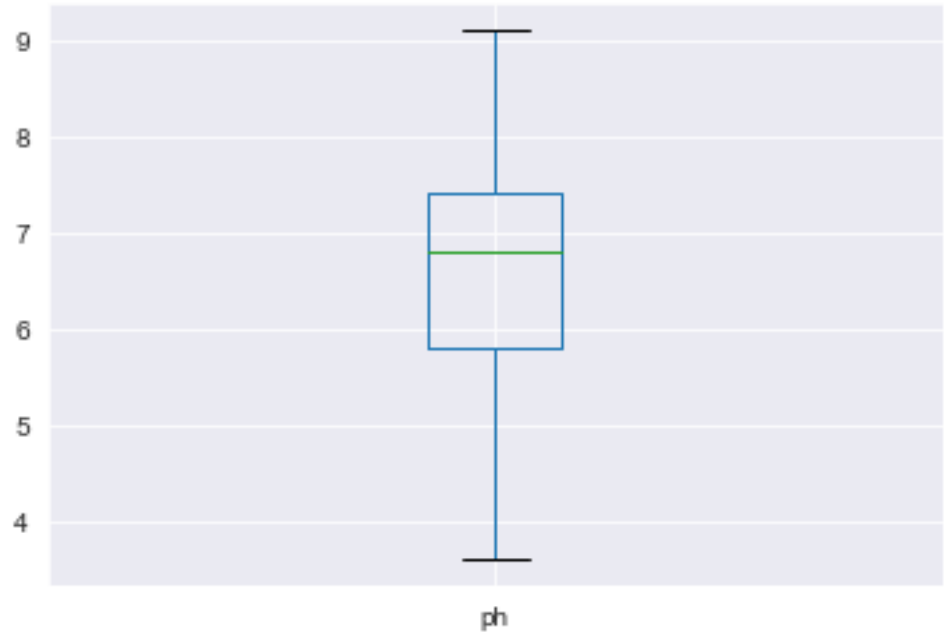
Describe the variables with using visualization tools

Cuantitative variables positional measures and outliers detection

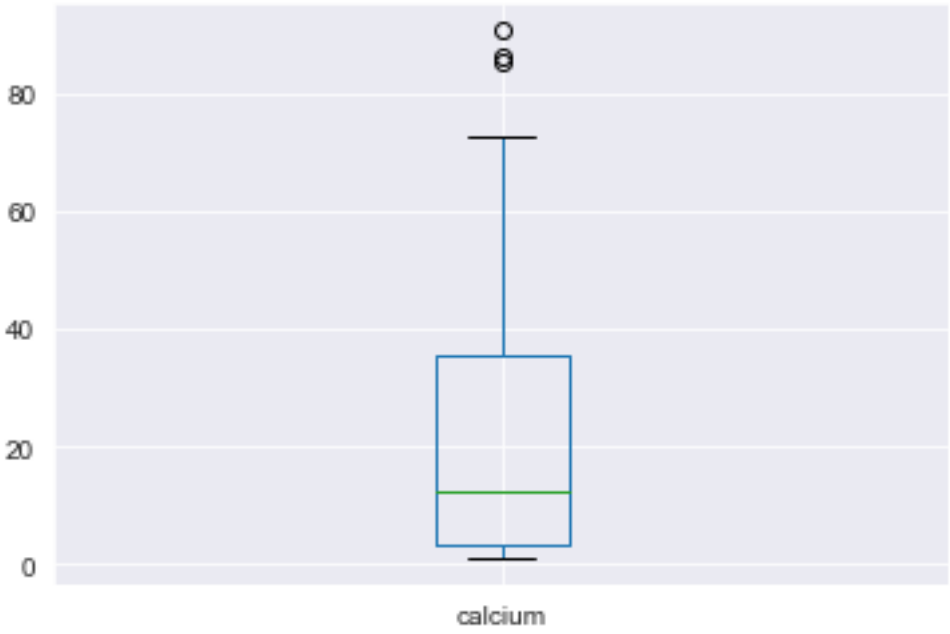
```
<AxesSubplot:>
```



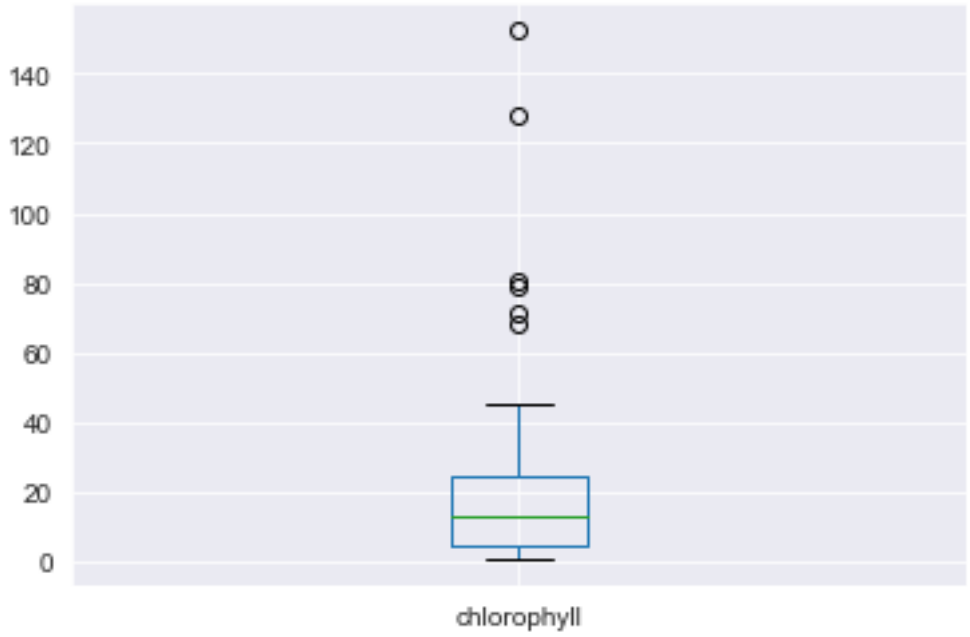

```
<AxesSubplot:>
```



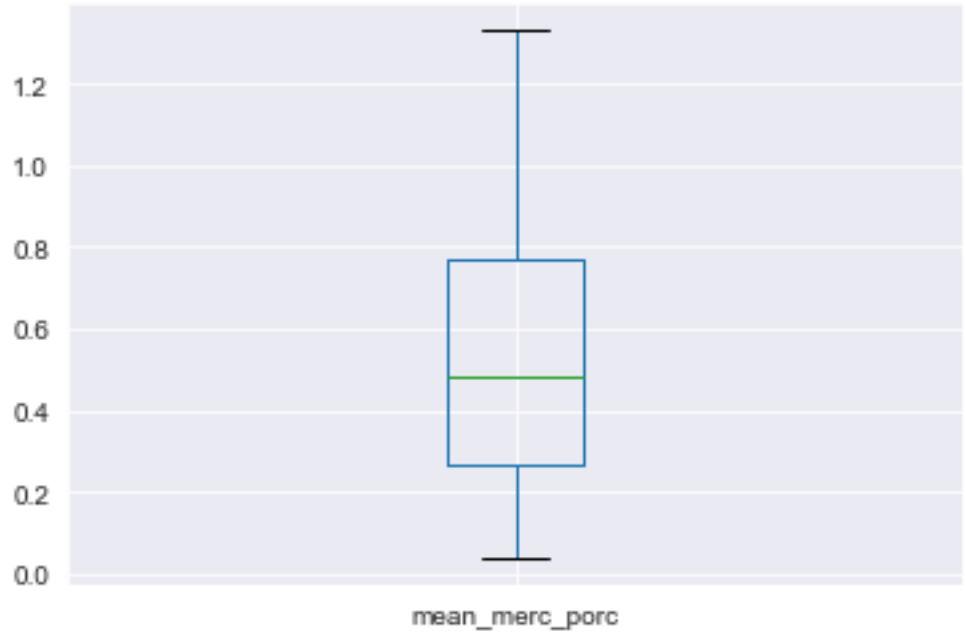
<AxesSubplot:>



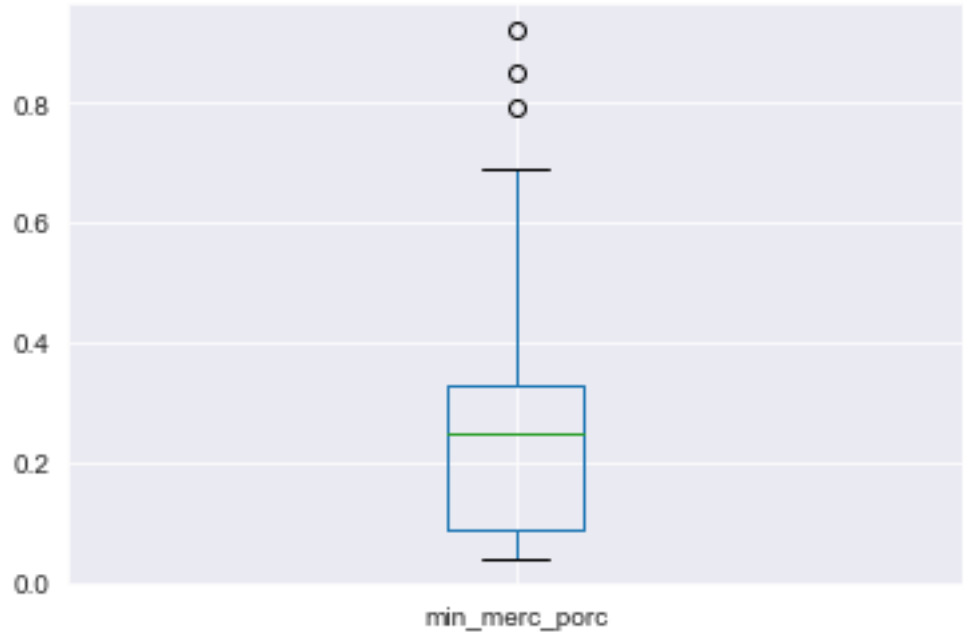
<AxesSubplot:>



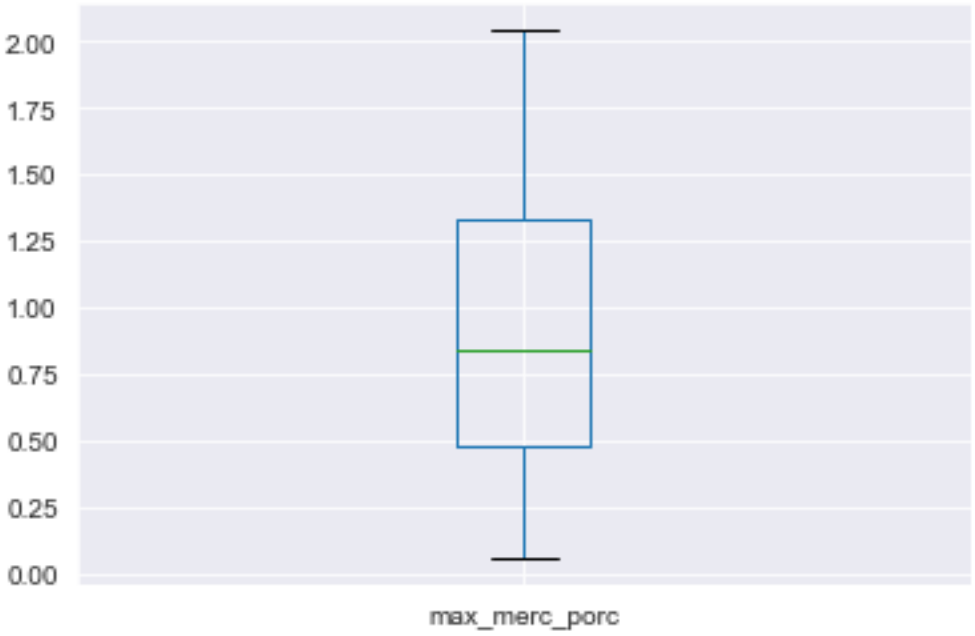
<AxesSubplot:>



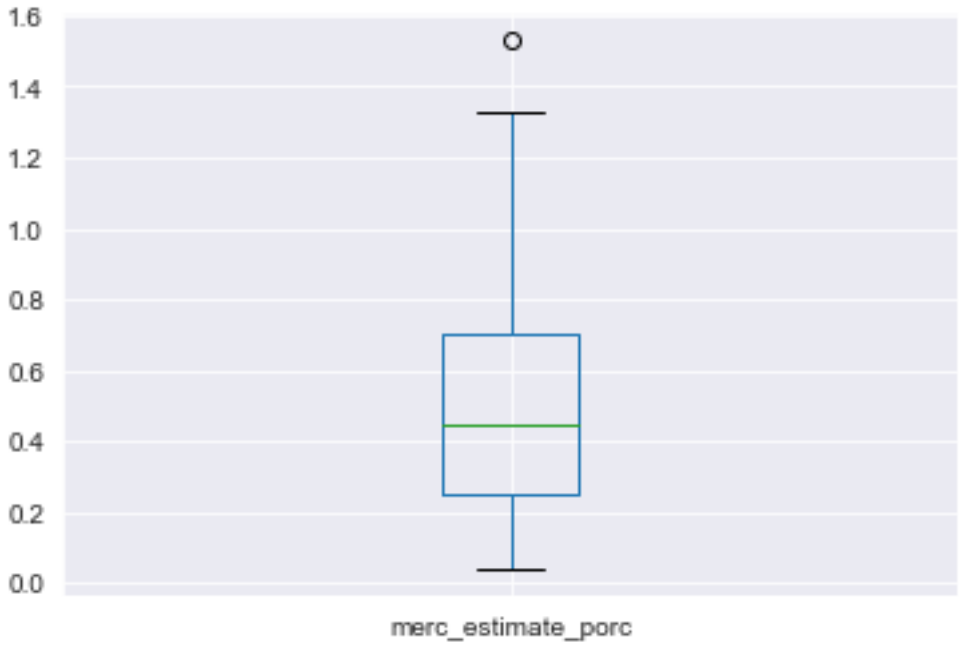
<AxesSubplot:>



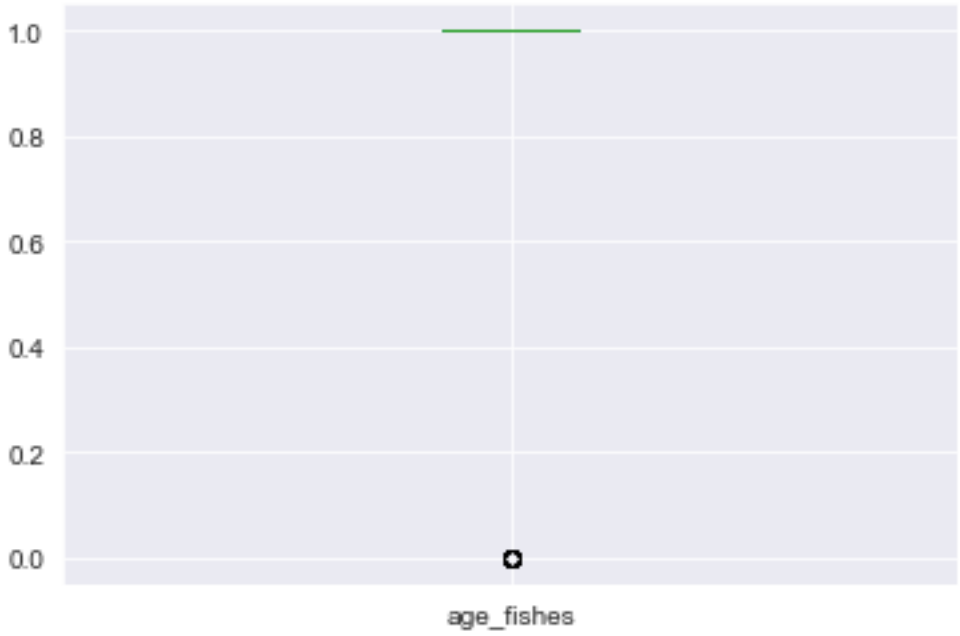
<AxesSubplot:>



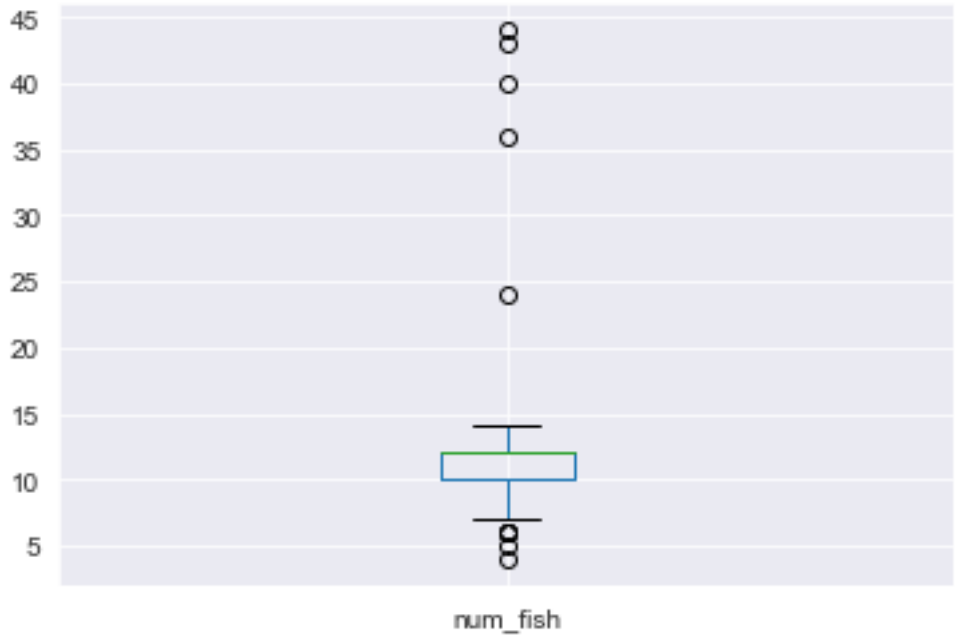
<AxesSubplot:>




```
<AxesSubplot:>
```




```
<AxesSubplot:>
```



We get the salaries outliers:

```
X1
3                Apopka
9            Deer Point
14    East Tohopekaliga
17              Griffin
26            Kissimmee
Name: name, dtype: object

7
```

Identify the data quality Here we are looking for duplicated data, missing data and validating the relevance of each variable. There is no duplicated regiestries

```
0
```

There's is no null data

```
name                0
alkalinity          0
ph                  0
calcium             0
chlorophyll         0
mean_merc_porc      0
num_fish            0
```

```
min_merc_porc         0
max_merc_porc         0
merc_estimate_porc    0
age_fishes            0
dtype: int64
```