Fish assemblages as indicator of ecological state of Lake Durowskie

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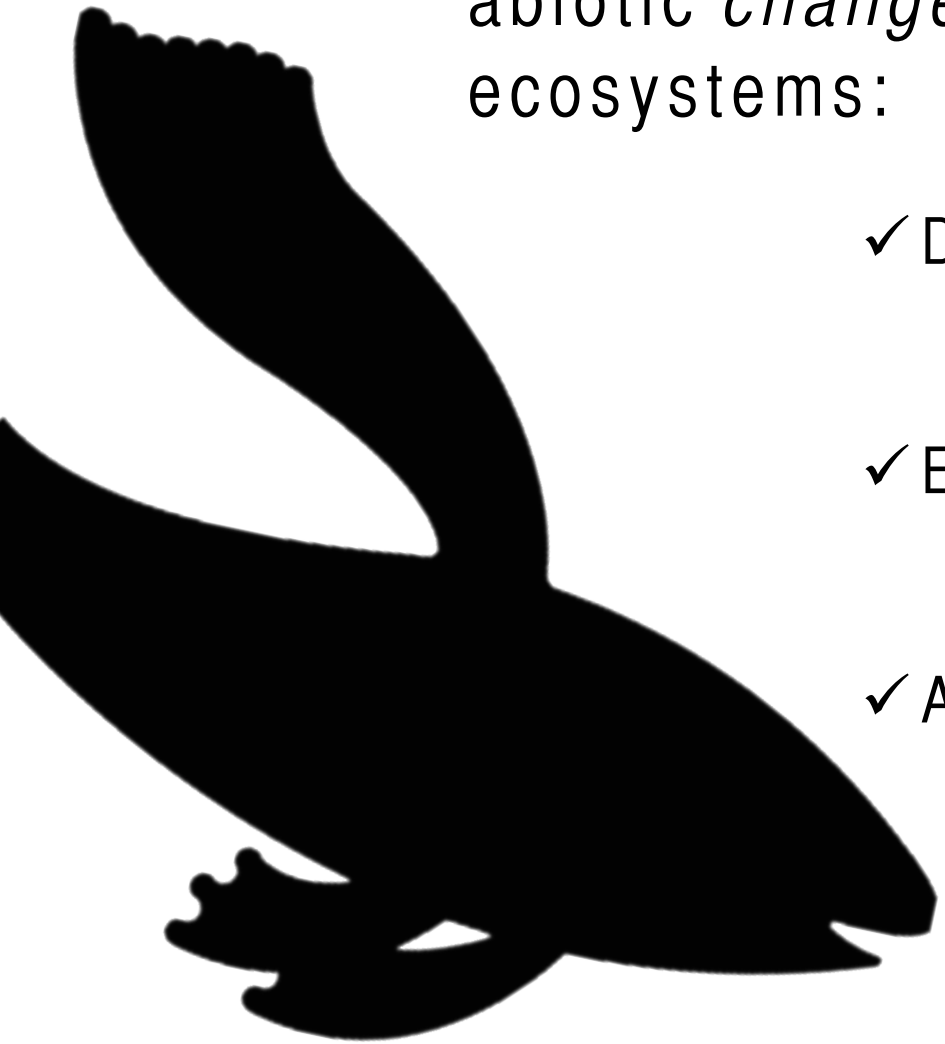
Fish assemblages can be indicators for the biotic and abiotic *state* of freshwater ecosystems

Species are adapted to:

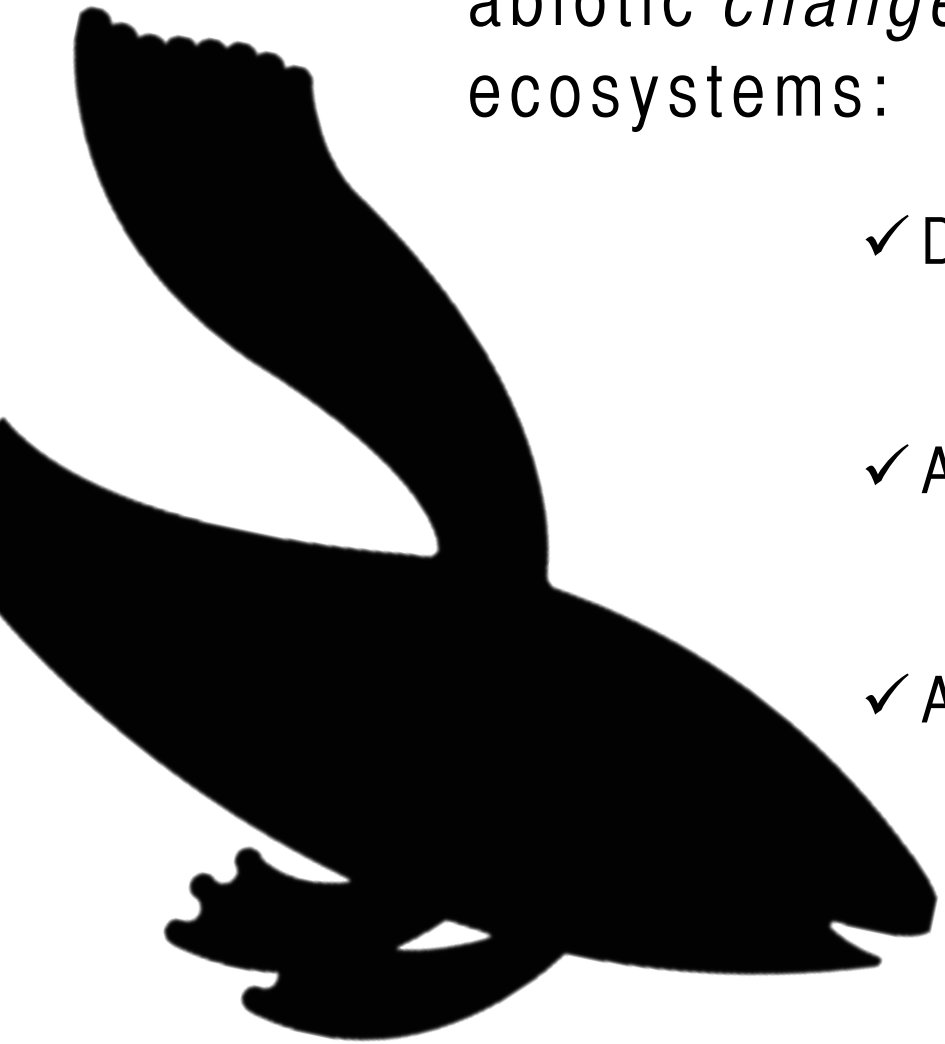
- ✓ Different oxygen levels
- ✓ Different nutrient levels
- ✓ Different water turbidity
- ✓ Different macrophytes communities.

Ichtiofauna may cause biotic and abiotic *changes* of freshwater ecosystems:



- ✓ Decrease of water transparency
- ✓ Effect on sediment structure
- ✓ Affect aquatic macrophytes abundance

Ichtiofauna may cause biotic and abiotic *changes* of freshwater ecosystems:



- ✓ Decrease of water transparency
- ✓ Affect sediments structure
- ✓ Affect aquatic macrophytes abundance

HOWEVER, changes depend on: number, size, and composition of fish populations

Aim

Determine the **ecological state** of Lake Durowskie based on **fish assemblages** using recent and historical information.

By:

- *Knowing* the **actual** species composition
- *Obtaining* species-specific morphometric variables
- *Detecting* changes in species abundance

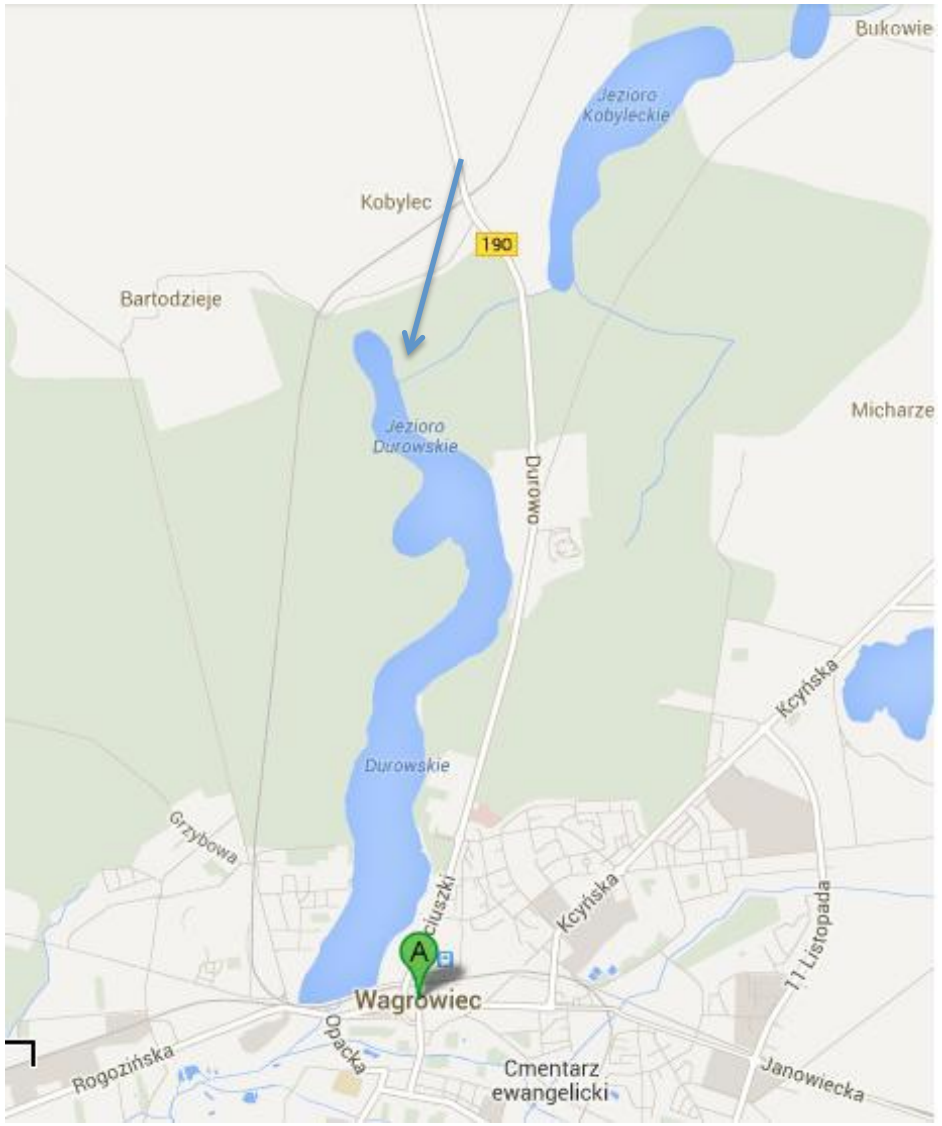
Materials & Methods

1st until the 8th of July 2013

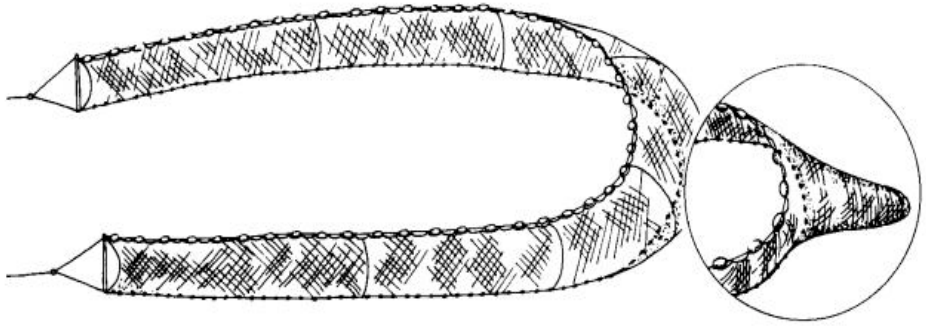
Lake Durowskie and inflow

N 52°49'6" and E 17°12'1"

Golaniecka River lake chain



Materials & Methods



3 different fishing methods:

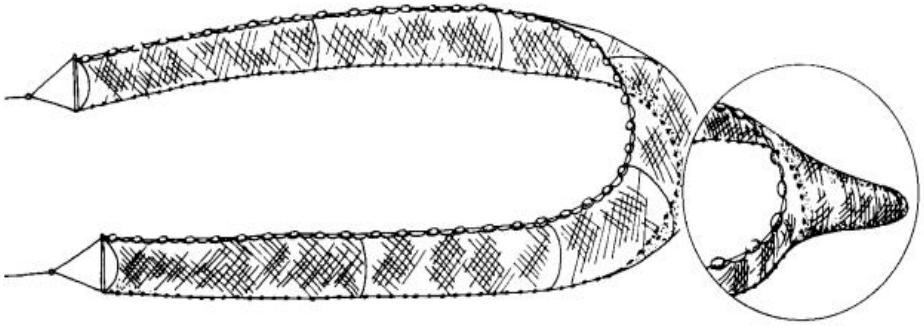
- Active

BEACH SEINE NET (length 40 m, height 2m, mesh-size 6 mm)

- Passive

- ElectroFishing

Materials & Methods

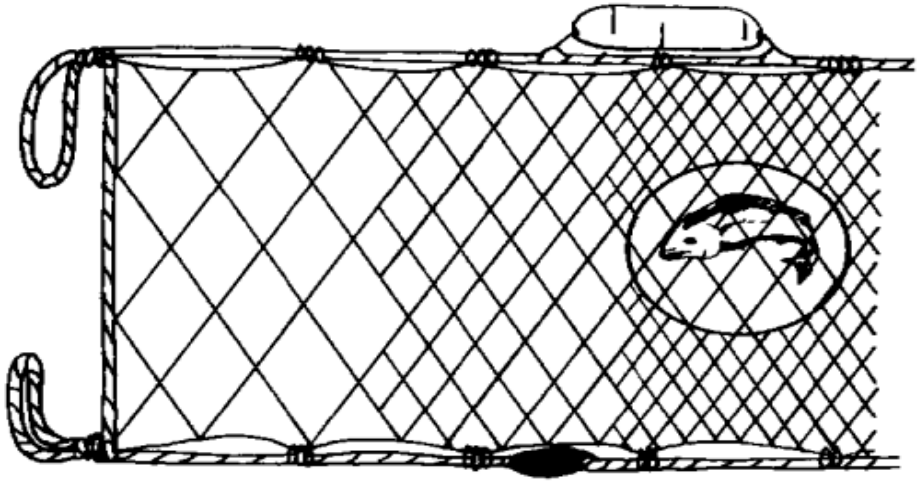


3 different fishing methods:

- Active

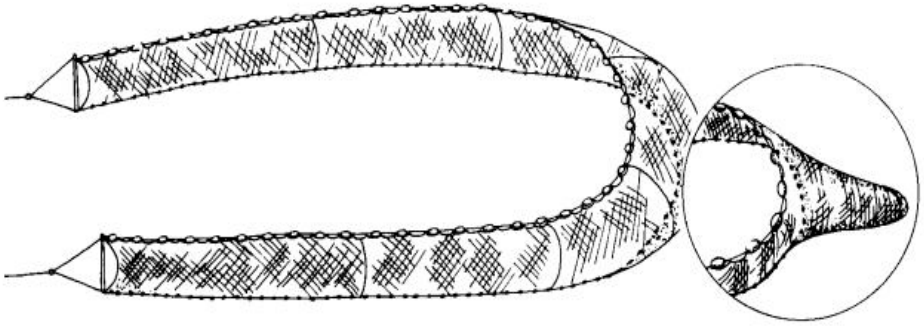
- Passive

5 nets (length, mesh-size)
- 10 m, 1 cm
- 10 m, 1.2 cm
- 25 m, 4 cm
- 25 m, 5.5 cm
- 40 m, 6 cm



- ElectroFishing

Materials & Methods



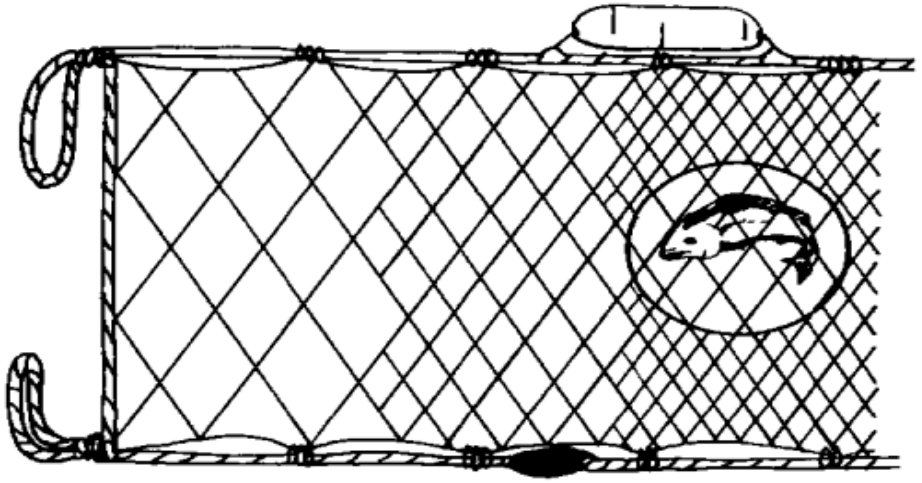
3 different fishing methods:

- Active

- Passive

- ElectroFishing

ELECTRICAL DEVICE IUP-12



Materials & Methods

- ✓ All fishes counted
- ✓ Total length
- ✓ Total weight

Materials & Methods

Historical records include catch and stocking from commercial fishery from **1954** to **2012** at Lake Durowskie

Statistics

Field Analysis

Identification of the **species** present at Lake Durowskie

Weight and **size** were compared using a two-sided Student t-test in lake and river

Similarity index **Jaccard Species Identity** (C_j)

$$C_j = \frac{j}{(a+b)-j}$$

j = total no. common of species
a = species occurring in the river
b = species occurring in lake

Statistics

Field Analysis

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Similarity index **Jaccard Species Identity** (C_j)

Historical Analysis

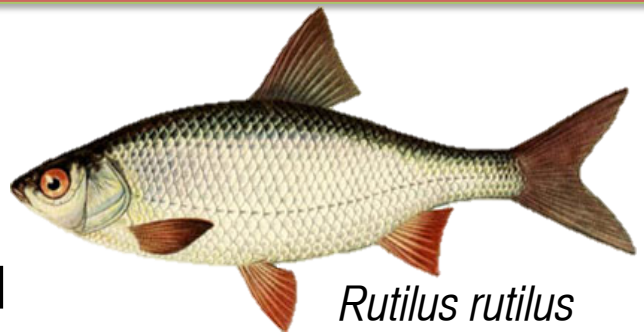
Trend analysis

linear model of catch development of *Abramis brama*, *Sander lucioperca*, *Tinca tinca*, *Esox lucius* and *Perca fluviatilis*

Comparison between commercial stocking and recent catches

Results

9 species were recorded

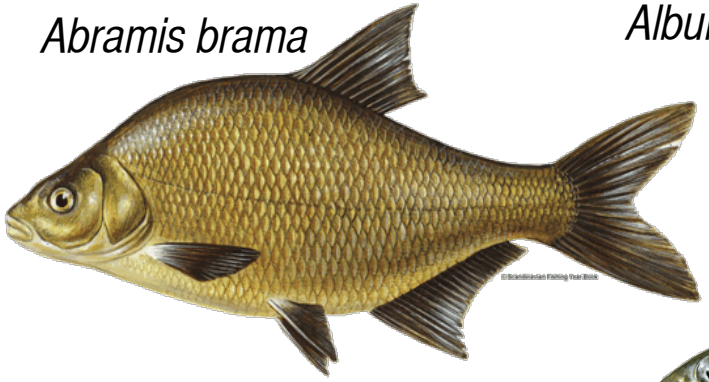


Rutilus rutilus

Esox lucius river

Scardinius erythrophthalmus

Abramis brama



Alburnus alburnus

Gobio gobio river

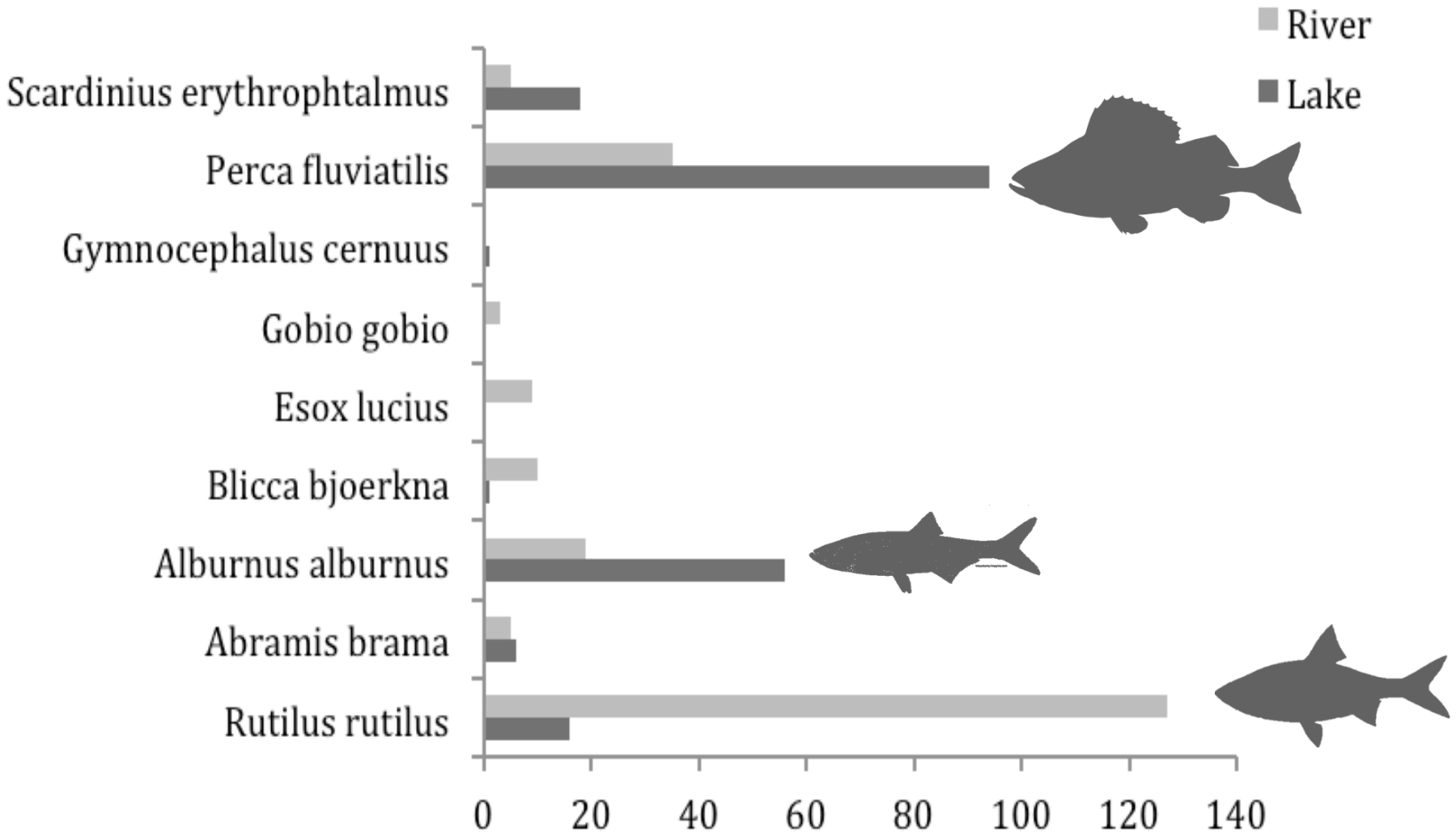
Gymnocephalus cernuus lake

Blicca bjoerkna

Perca fluviatilis

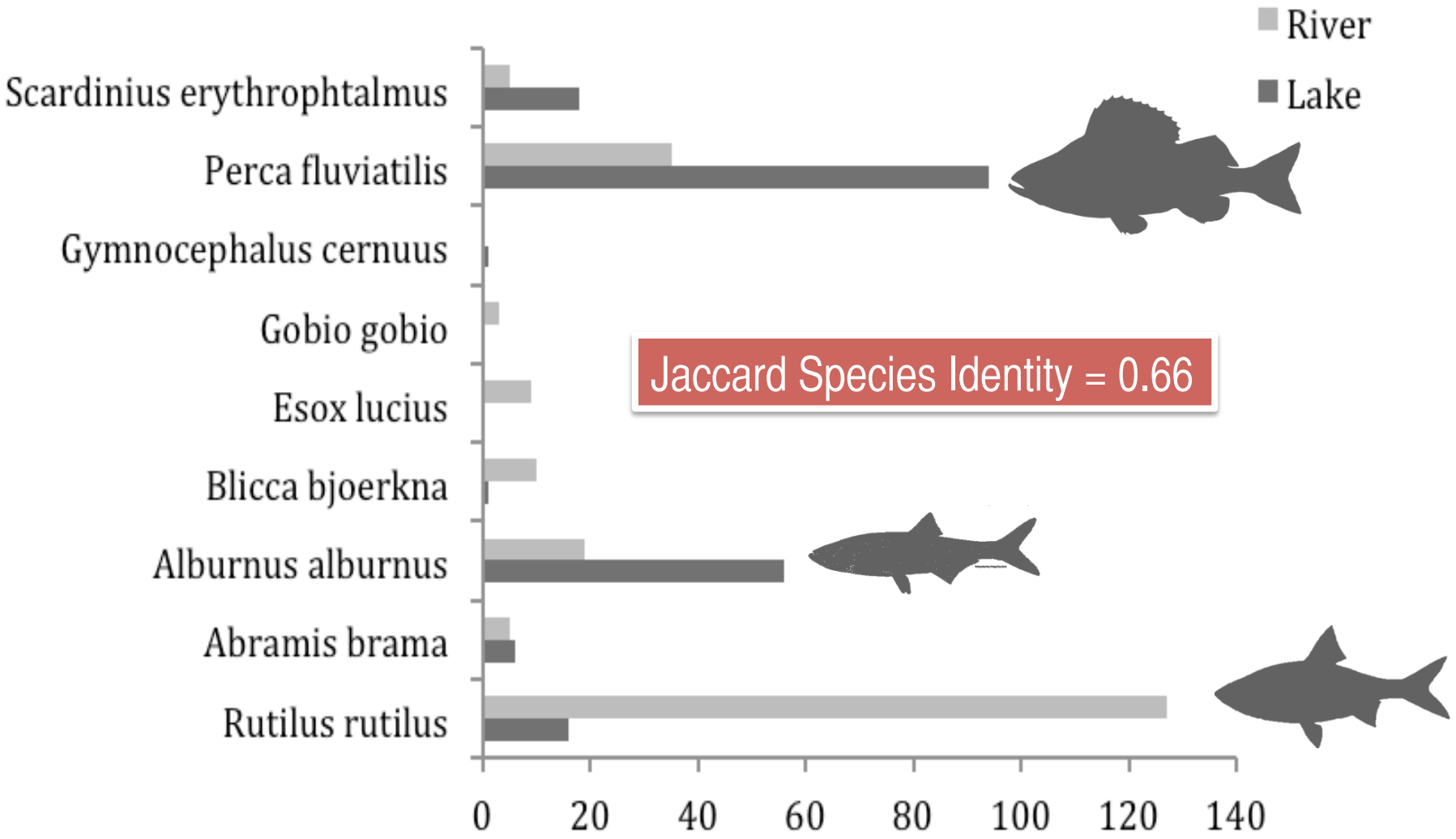
Results

Which is the **most abundant** species?



Results

Does the lake and the river present the **same ictiofauna**?

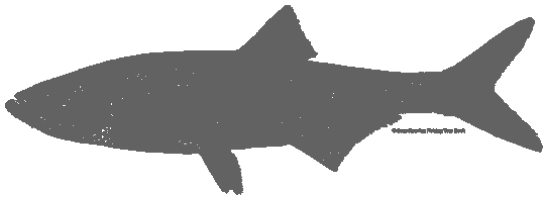


Jaccard Species Identity = 0.66

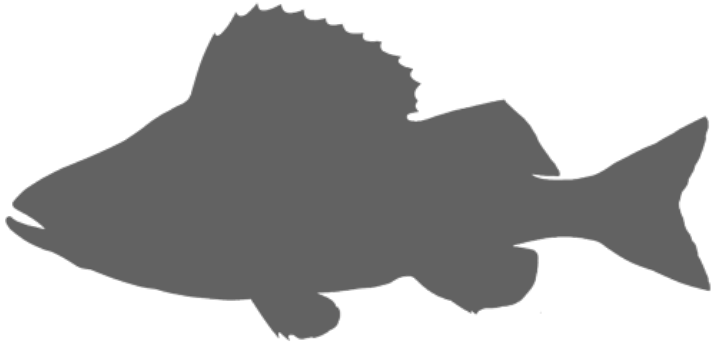
Discussion

Jaccard index→ communities are similar

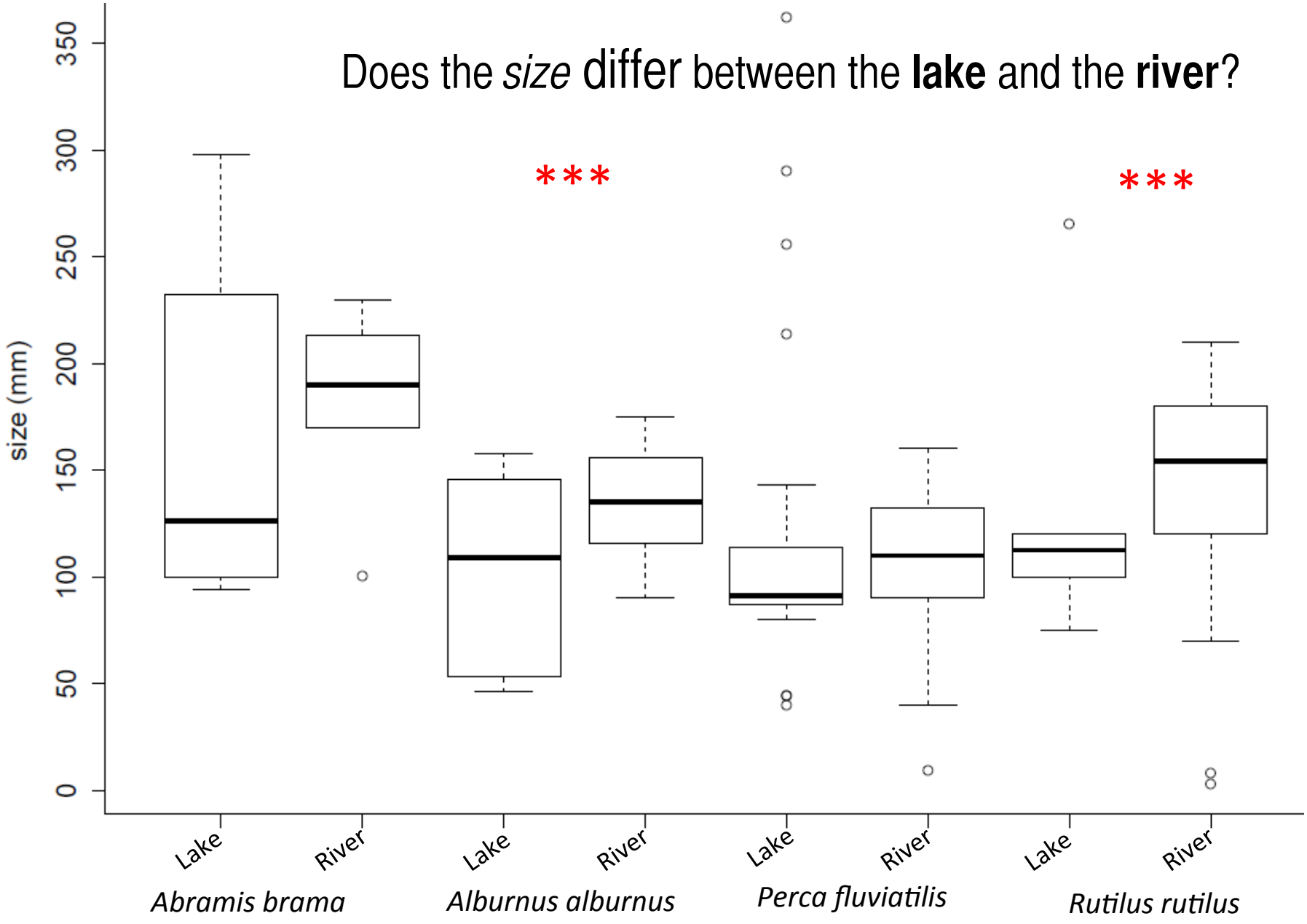
Abundance of *Perca fluviatilis* and *Alburnus alburnus* in the lakes → characteristics of **higher trophic state** of freshwater ecosystem

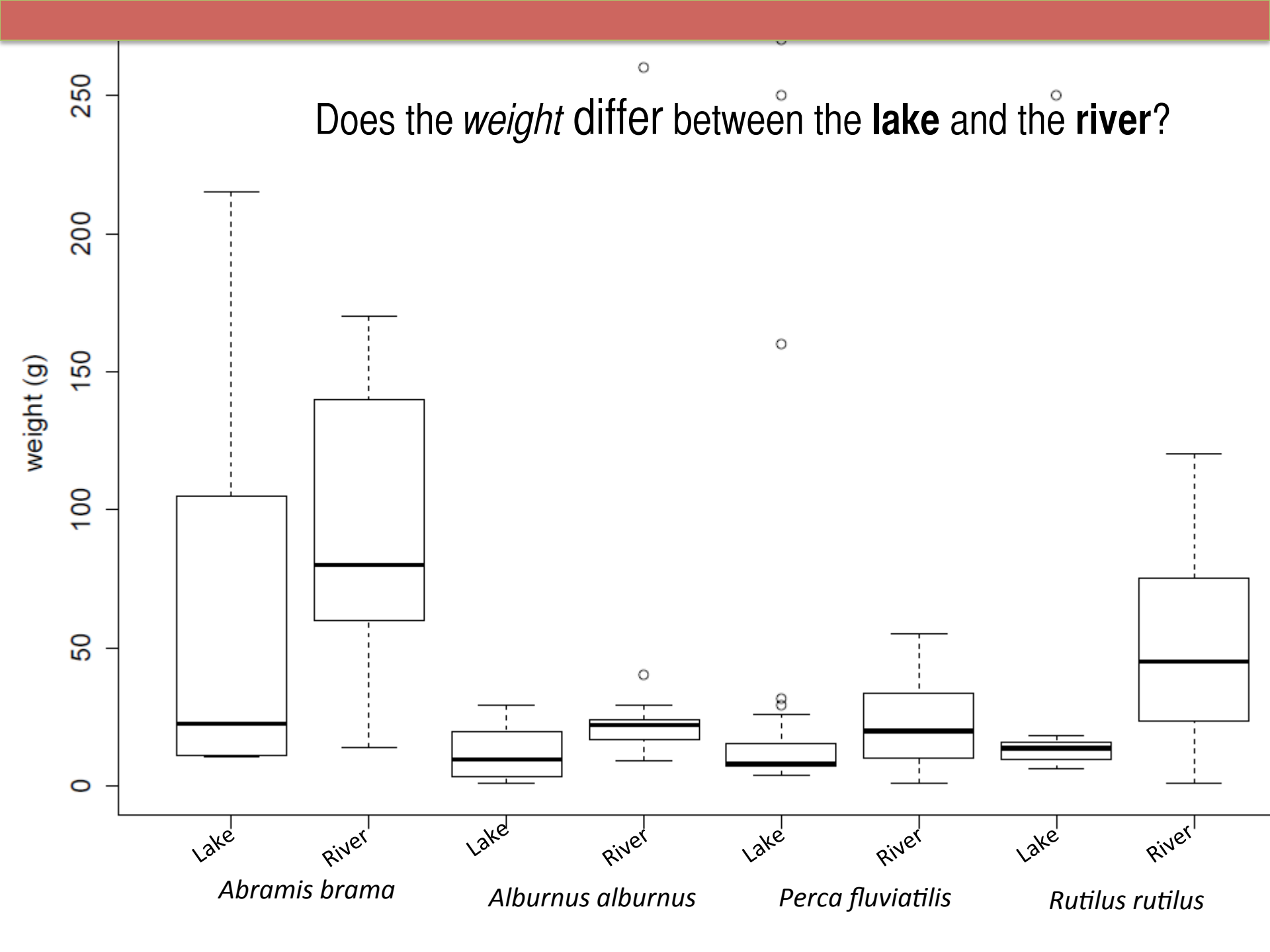


A. alburnus → survive in turbid and poorly oxygenated waters



P. fluviatilis → omnivorous species present in all kind of waters, lay in eggs around macrophytes and tree roots


Does the *size* differ between the **lake** and the **river**?
size (mm)
0
50
100
150
200
250
300
350
***
***
Lake
River
Lake
River
Lake
River
Lake
River
Abramis brama
Alburnus alburnus
Perca fluviatilis
Rutilus rutilus


Does the *weight* differ between the **lake** and the **river**?
weight (g)
0
50
100
150
200
250
Lake
River
Lake
River
Lake
River
Lake
River
Abramis brama
Alburnus alburnus
Perca fluviatilis
Rutilus rutilus

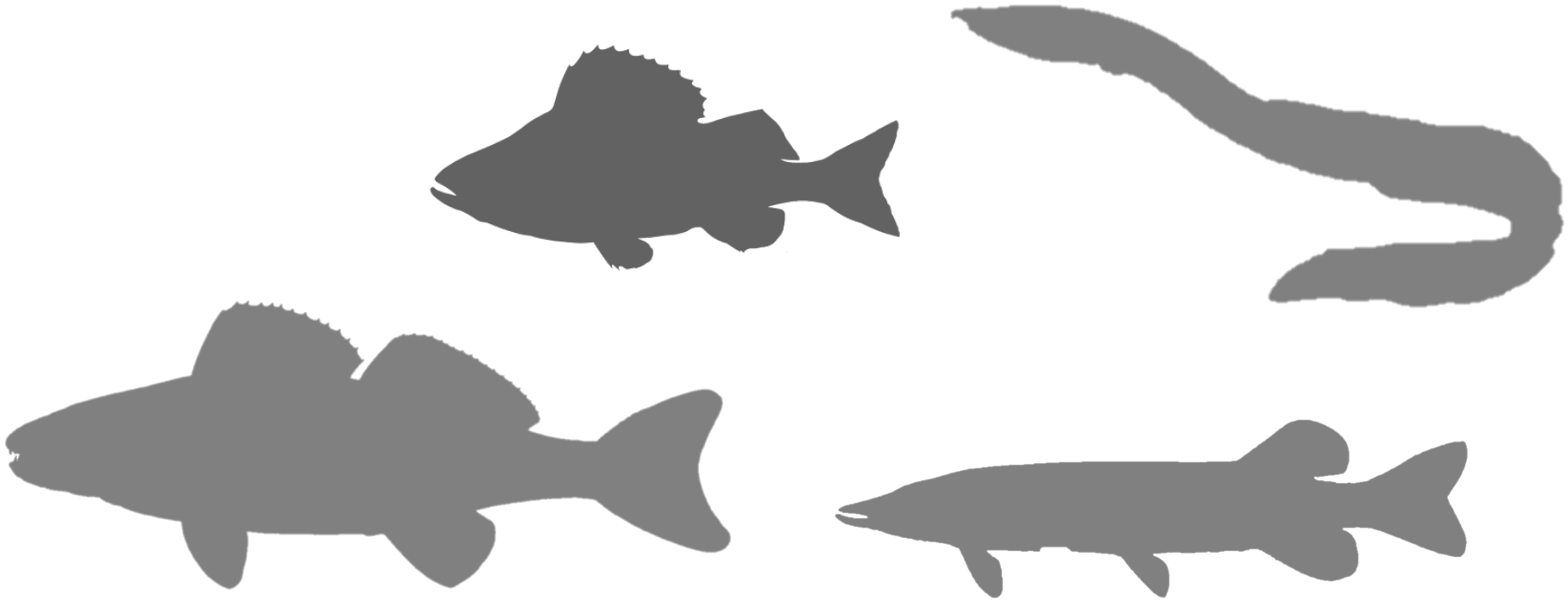
Discussion

Morphological differences: *Alburnus alburnus* and *Rutilus rutilus* breed in lakes, only the adult individuals use the rivers to move from one lake to another.

Results

Is there a **trend** in the number of catches of the *commercial species* since 1954 till now ?

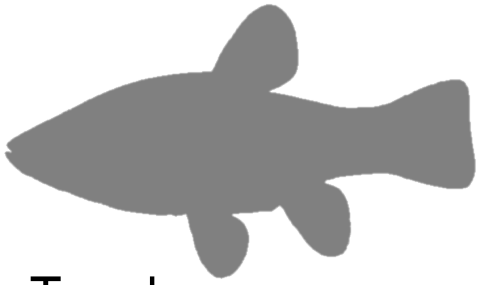
18 species were recorded



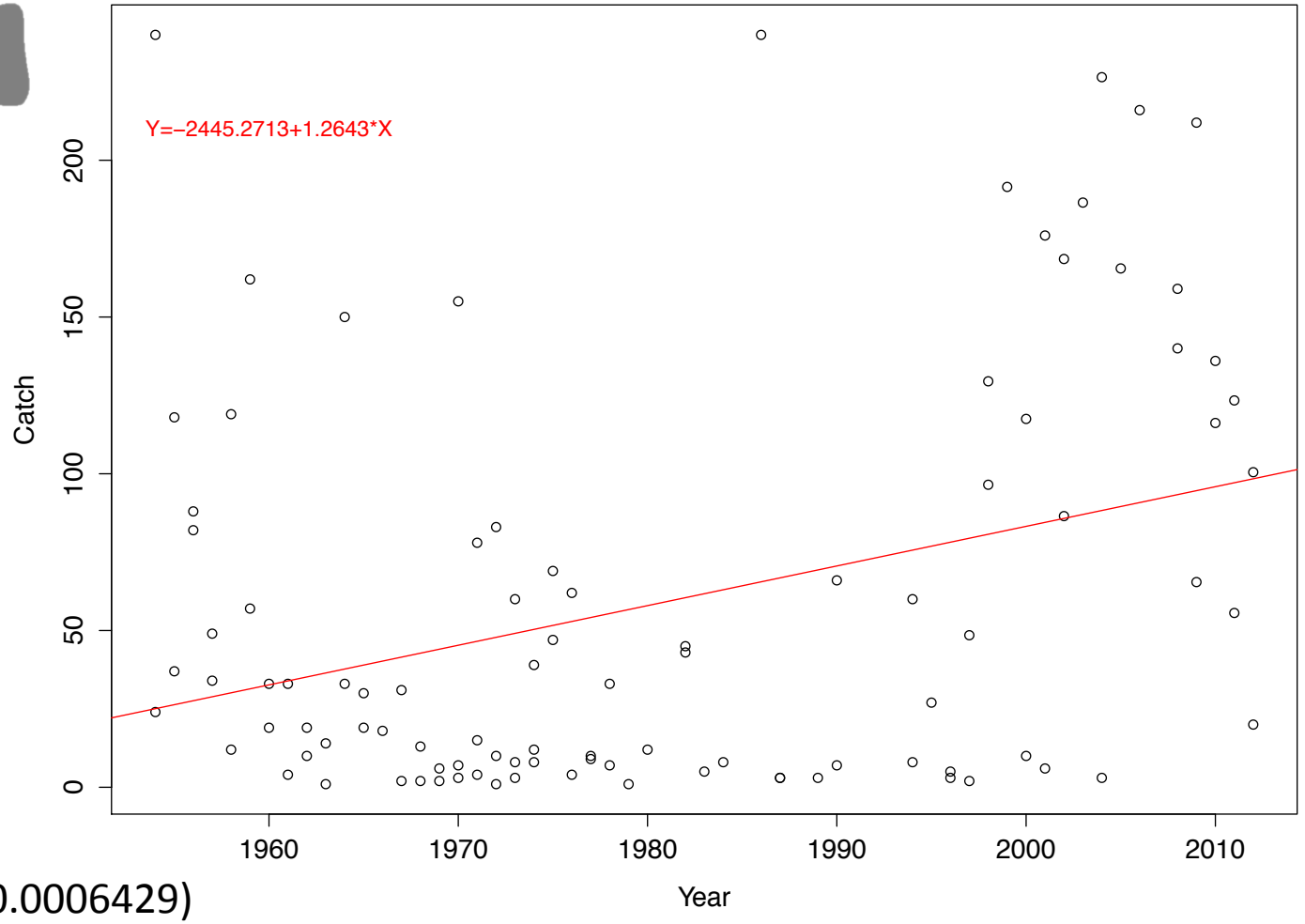
Sander lucioperca, P. fluviatilis, E. lucius and Anguilla anguilla → NO trend

Results

Is there a **trend** in the number of catches of the *commercial species* since 1954 till now ?



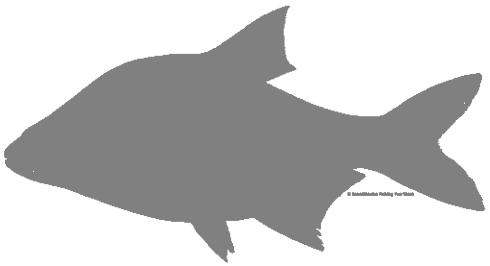
Tench *(Tinca tinca)*



+ trend

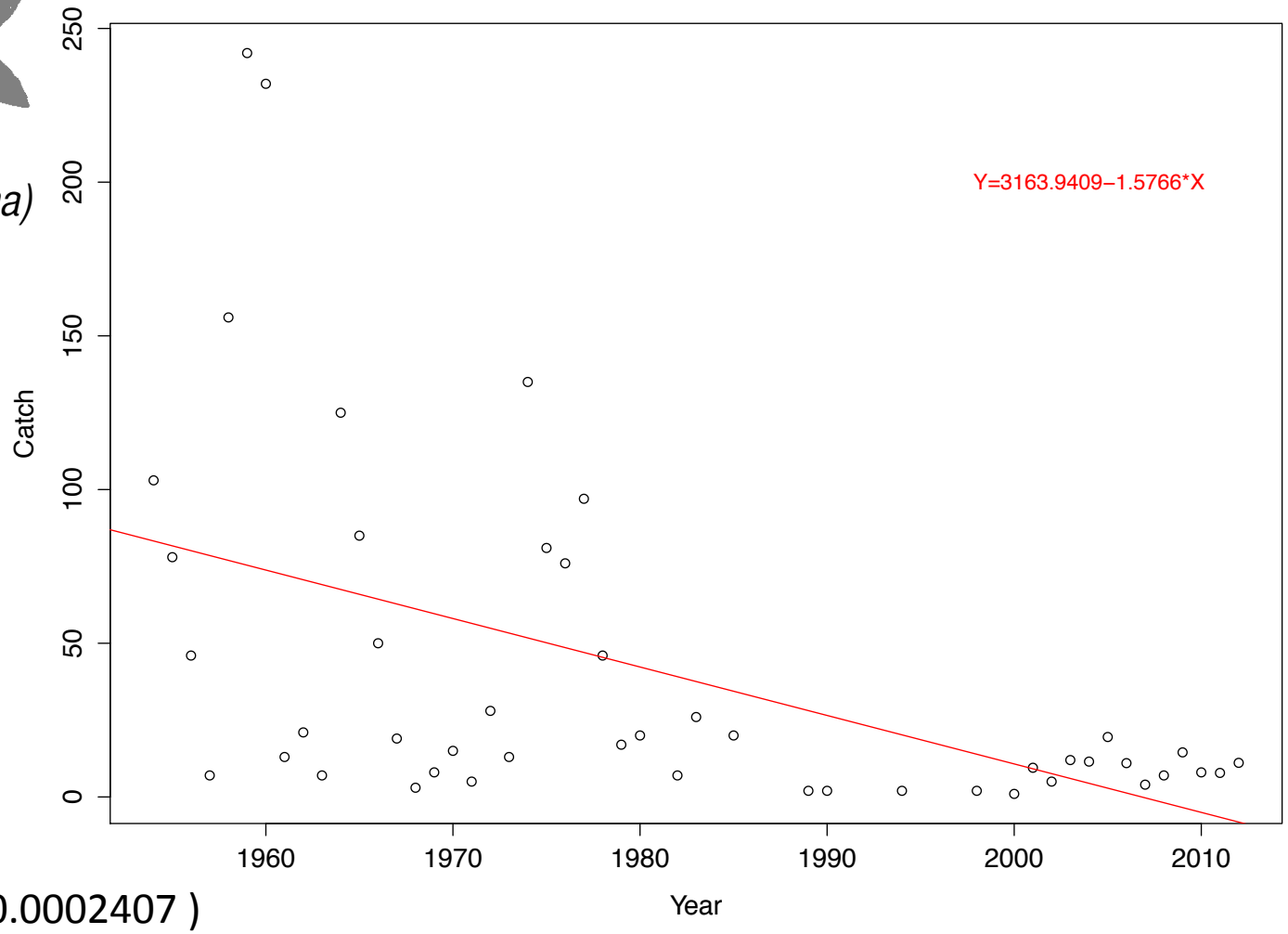
(adj. $R^2 = 0.1066$, $p = 0.0006429$)

Results



Bream *(Abramis brama)*

Is there a **trend** in the number of catches of the *commercial species* since 1954 till now ?



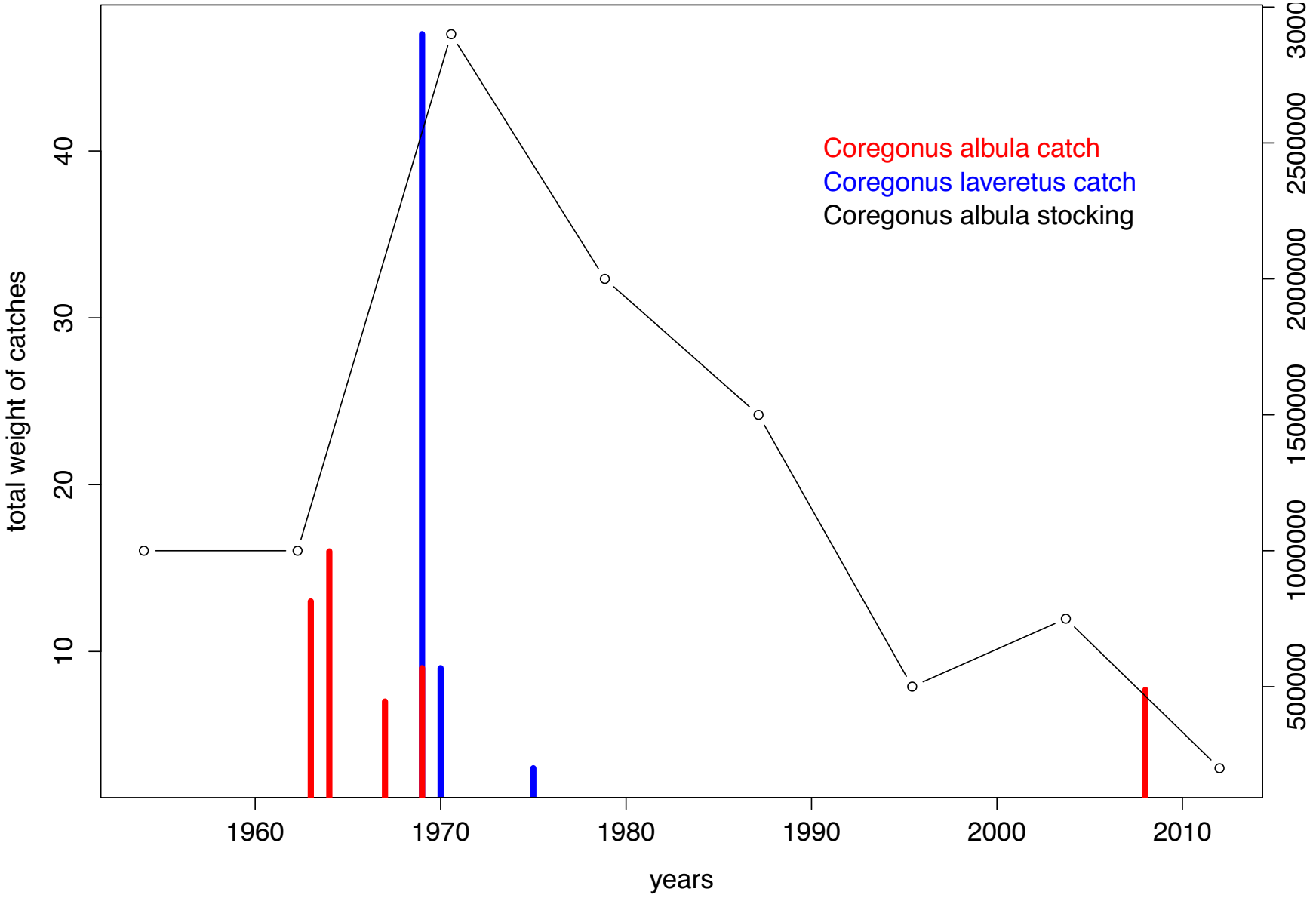
- trend

(adj. R^2 = 0.2449, p = 0.0002407)

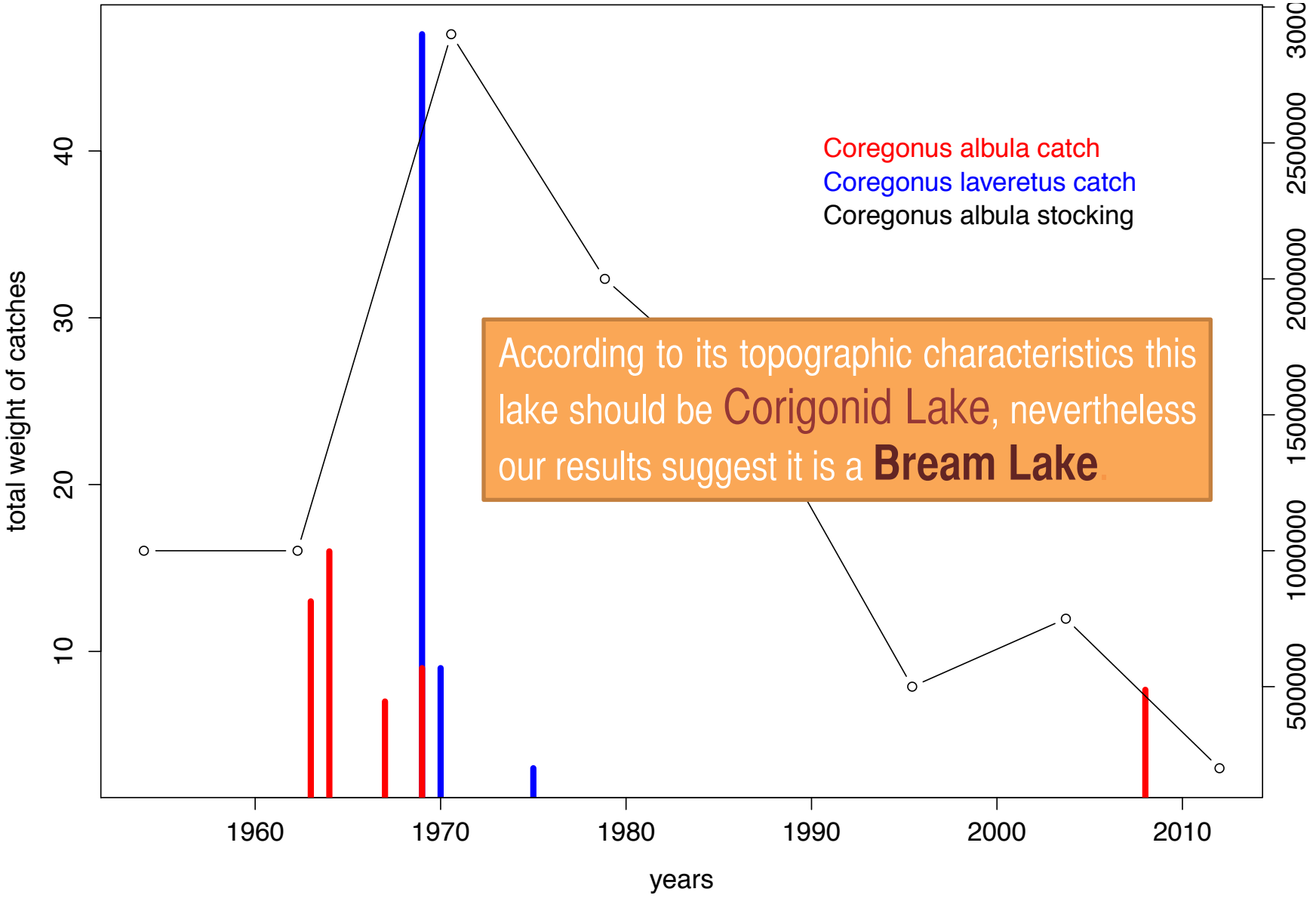
Discussion

T. tinca → increase numbers because can survive → low O_2, high turbidity

Discussion


Coregonus albula catch
Coregonus laveretus catch
Coregonus albula stocking
total weight of catches
10
20
30
40
500000
1000000
1500000
2000000
2500000
3000
1960
1970
1980
1990
2000
2010
years

Discussion


Coregonus albula catch
Coregonus laveretus catch
Coregonus albula stocking
According to its topographic characteristics this lake should be Corigonid Lake, nevertheless our results suggest it is a Bream Lake
total weight of catches
10
20
30
40
500000
1000000
1500000
2000000
2500000
3000
1960
1970
1980
1990
2000
2010
years

Conclusions

Fish assemblages indicate an ecological state of the lake → **Bream Lake**

Fish assemblages have been affected by human activity.

Domination of small Cyprinids → *Rutilus rutilus*

Domination of predator species → *Perca fluviatilis*
small perch feeds on zooplankton

Ineffective bio-manipulation

Limitations

- ✓ *Abramis brama* decrease in catches could be affected by:
  - Fisheries preferences
- ✓ Sampling methods
  - ✓ Evenly distributed sampling points
  - ✓ Extension of sampling area
- ✓ Historical data are biased towards commercial species


Thanks for your attention! :)
Dziękujemy za uwagę!
Vielen Dank für Ihre Aufmerksamkeit!
Vă mulțumesc pentru atenție!
Gracias por su atención!

Results

Which is the **size** and **weight** of the fish species?

River	Size		Weight	
Species	mean	standard error	mean	standard error
Abramis brama	180,60	22,57	92,80	27,96
Alburnus alburnus	135,11	5,28	33,37	12,69
Blicca bjoerkna	124,70	16,51	42,75	8,09
Esox lucius	290,44	44,87	256,11	102,80
Gobio gobio	140,00	30,00	34,00	13,20
Perca fluviatilis	111,54	5,51	22,41	2,44
Rutilus rutilus	149,12	3,67	50,76	2,85
Scardinius erythrophtalmus	108,00	2,30	15,60	1,91

Lake	Size		Weight	
Species	mean	standard error	mean	standard error
Abramis brama	162,67	34,14	64,42	33,54
Alburnus alburnus	99,38	5,82	11,70	1,19
Blicca bjoerkna	154,00	0,00	37,00	0,00
Gymnocephalus cernuus	95,00	0,00	13,50	0,00
Perca fluviatilis	104,04	4,44	24,82	7,93
Rutilus rutilus	115,88	10,76	27,35	14,88
Scardinius erythrophtalmus	106,50	3,86	16,39	1,54

Changes of physical and chemical properties of water leads to changes in ichtiocoenoses