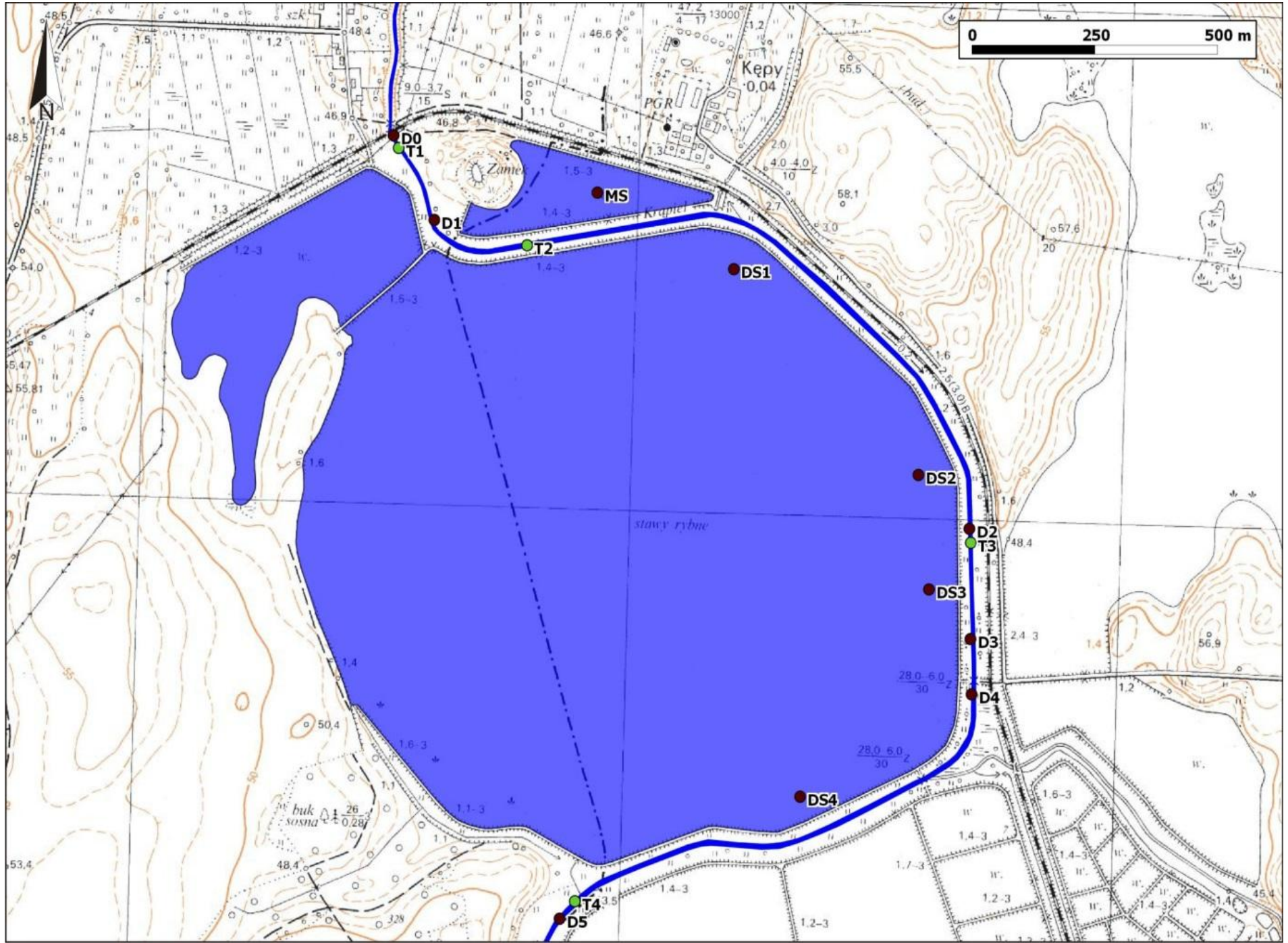
- **Wpływ bagrowania niewielkiej rzeki nizinnej (Krąpiel) na bentofaunę**
- **Badania 2008 – 2009**
- **Grant NCN nr N N305 222537**
- **Wpływ struktury krajobrazu doliny niewielkiej rzeki nizinnej na charakter fauny wybranych grup bezkręgowców wodnych**

Andrzej Zawal


0
250
500 m
N
D0
T1
D1
MS
T2
DS1
DS2
D2
T3
DS3
D3
D4
DS4
T4
D5
Kępy
PGR
Zamek
Krąpiel
stawy rybne
buk
sosna


Powódź 2007 rok


Przed bagrowaniem

Po bagrowaniu

ZAŁOŻENIA

Zmiana - spadek:

- liczby gatunków,
- liczebności,
- bioróżnorodności

Rekolonizacja:

- stopniowy wzrost liczby gatunków, liczebności i bioróżnorodności,
- zależna od zdolności migracyjnych,
- gatunki eurytopowe

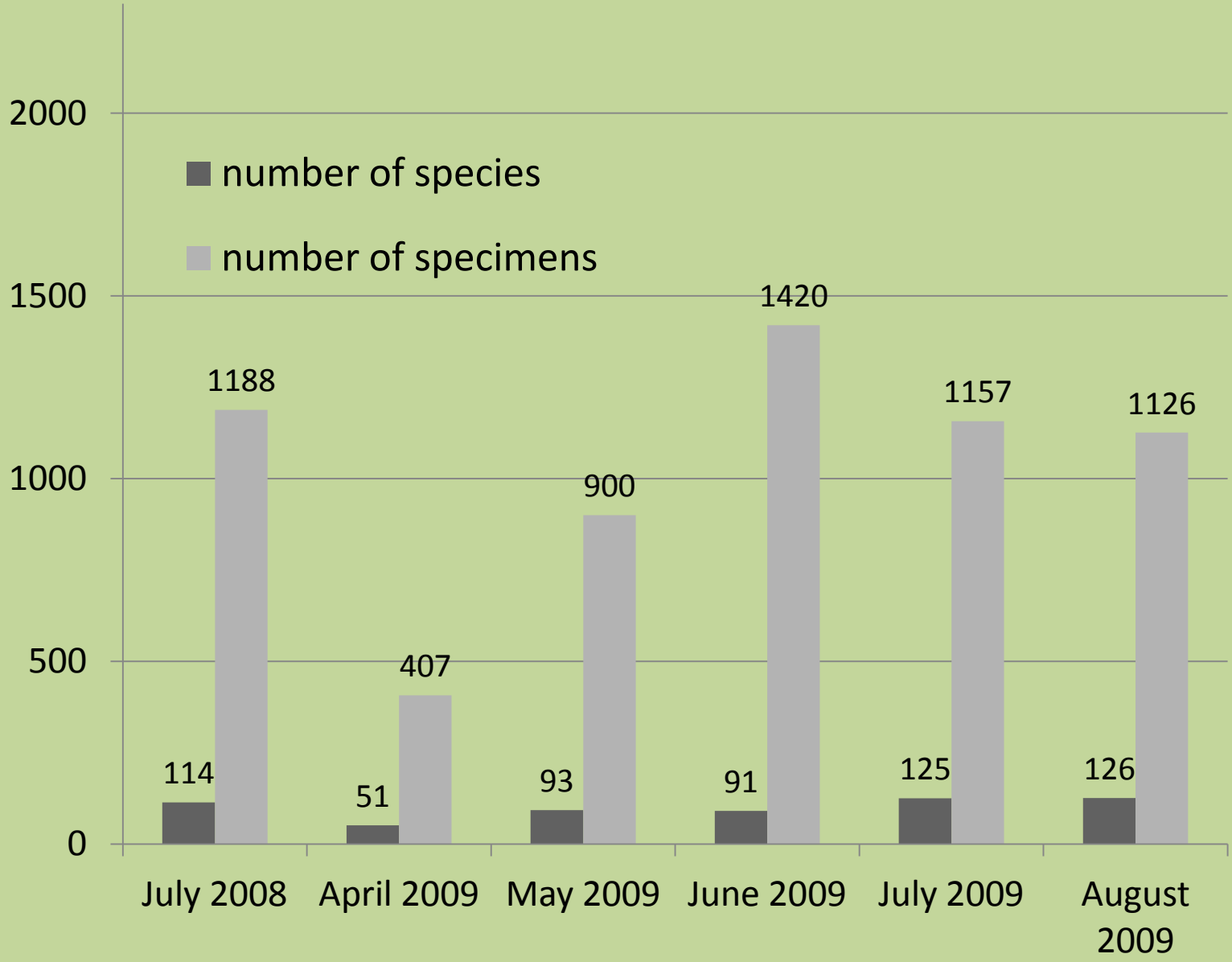
Parameters	flow (m/s)		depth (m)		bottom		plants (%)		shadow	
Localities	before dredging	after dredging	before dredging	after dredging	before dredging	after dredging	before dredging	after dredging	before dredging	after dredging
D0/1	0.5	0.46-0.51	0.7	0.7	gravel, stones	gravel, stones	0	0	lack	lack
D0/2	0.01	0.002-0.02	0.5	0.5	sand, silt, mud	sand, silt, mud	70	50-70	partly	partly
D1/1	0.013	0.09-0.16	0.4	0.5	mud	sand, gravel	30	0-10	lack	lack
D1/2	0.01	0.002-0.01	0.2	0.2	silt, mud	sand, silt, mud	90	0-40	partly	lack
D2/1	0.02	0.01-0.05	0.2	0.5	silt, mud	silt, mud	90	0-10	partly	lack
D2/2	0.002	0.001-0.002	0.1	0.2	mud	mud	100	0-40	partly	lack
D3/1	0.02	0.02-0.05	0.3	0.5	silt, mud	sand, silt, mud	20	0-10	partly	lack
D3/2	0.002	0.001-0.002	0.1	0.2	mud	sand, silt, mud	80	0-40	partly	partly
D4/1	0.14	0.09-0.2	0.5	0.5	sand, gravel	sand, gravel	0	0	partly	partly
D4/2	0.003	0.001-0.003	0.2	0.2	sand, mud	sand, mud	70	30-70	partly	partly
D5/1	0.001	0.001-0.003	0.5	0.7	mud	mud	40	0-40	partly	lack
D5/2	0.04	0.03-0.06	0.5	1.0	mud	mud	30	0-20	lack	lack

Table 1. The quantitative statement of macroinvertebrates: n.s. - number of species, n.i. - number of individuals.

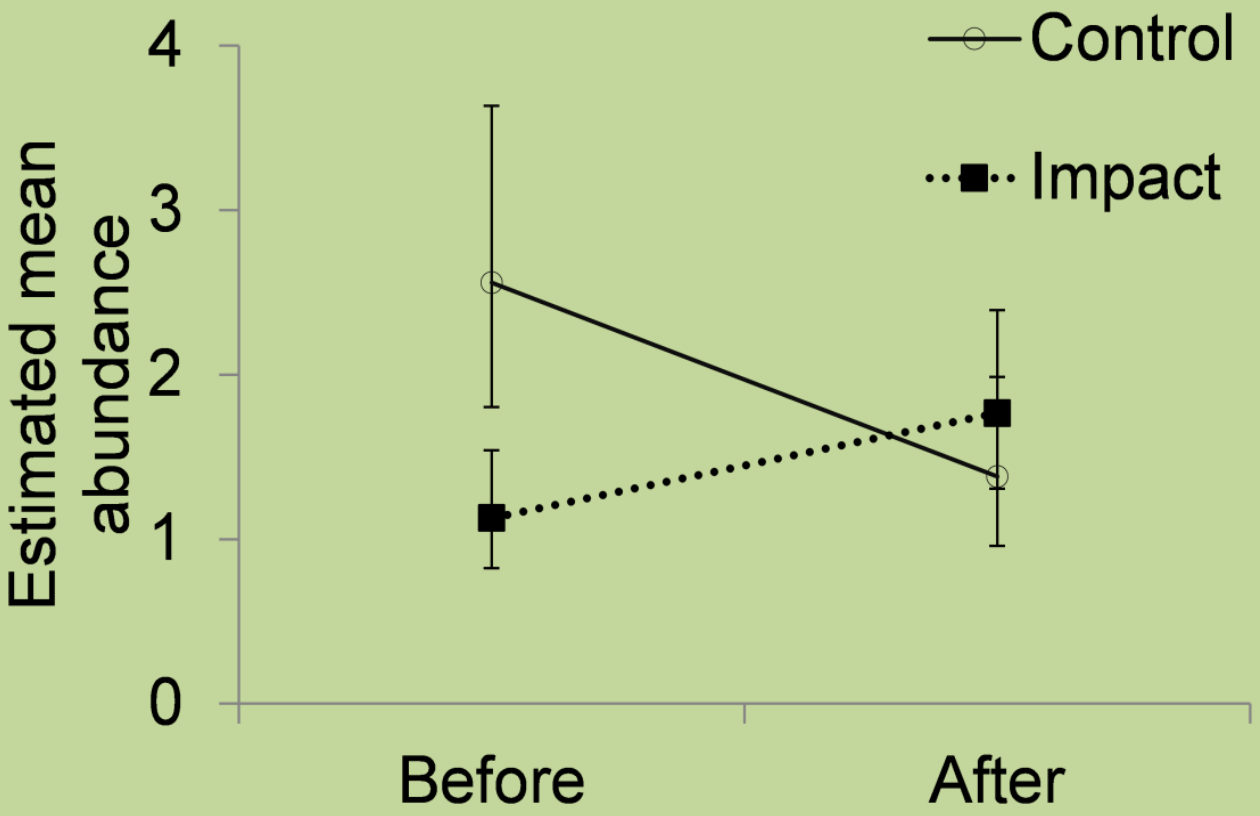
Taxa	total		before dredging		after dredging		fish ponds	
	n.s.	n.i.	n.s.	n.i.	n.s.	n.i.	n.s.	n.i.
Mollusca	36	1034	**18**	**188**	**30**	**485**	12	314
Hydrachnidia	77	4349	**27**	**559**	**70**	**3412**	23	378
Odonata	28	593	**18**	**282**	**17**	**130**	7	92
Heteroptera	22	698	**19**	**149**	**20**	**396**	7	153
Coleoptera	63	667	**27**	**96**	**48**	**386**	18	185
Trichoptera	26	462	**11**	**143**	**23**	**319**	0	0
TOTAL	252	7803	**120**	**1417**	**208**	**5128**	67	1122

Różnice istotne statystycznie:

Test Kruskala-Wallisa: H (2, N= 1518) =14.70858 p =0.0006.

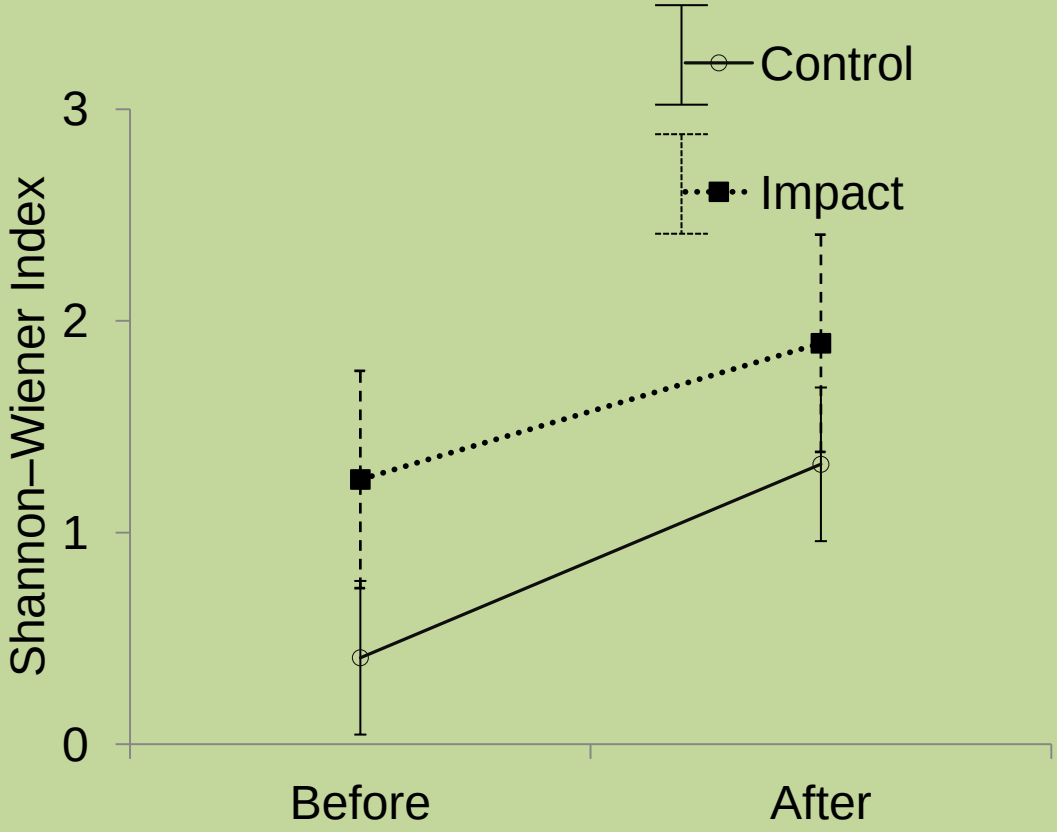


Różnice były statystycznie nieistotne test Kruskala-Wallisa: H (4, N= 1099) =4.061550 p =0.3977.



Średnie zagęszczenie makrobezkręgowców w algorytmie BACI.
Wartość zmiany jest istotna statystycznie p=0.001

Source	F statistics	df1	df2	Significance
Corrected Model	4.611	3	826	0.003
Before-after	0.270	1	826	0.603
Control-impact	2.922	1	826	0.088
BA x CI	10.800	1	826	**0.001**



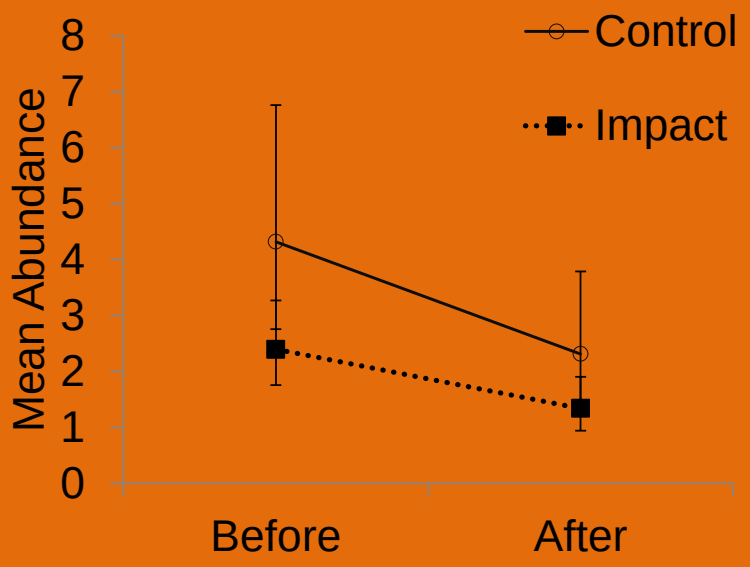
Shannon-Wiener Index dla bioróżnorodności makrobezkręgowców. Wartości zmiany nieistotne statystycznie (p>0.05)

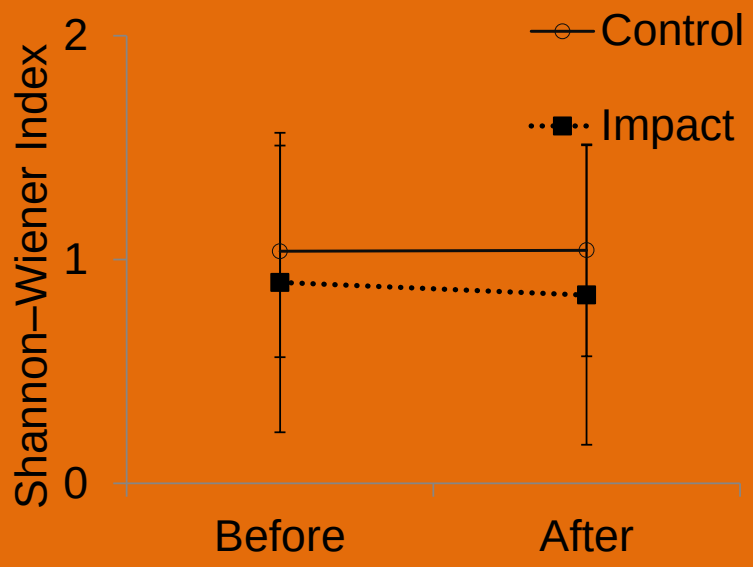
Source	F statistics	df1	df2	Significance
Corrected Model	9.428	3	116	0.000
Before-after	13.750	1	116	0.000
Control-impact	10.423	1	116	0.002
BA x CI	0.456	1	116	**0.501**

Korelacja pomiędzy liczebnością poszczególnych taksonów makrobezkręgowców a parametrami środowiskowymi.

	Hydrachnidia	Trichoptera	Coleoptera	Mollusca	Heteroptera	Odonata
flow	**-0.3566**	0.1968	**-0.4479**	-0.2042	**-0.5854**	**-0.2670**
dredging	0.0266	-0.0049	**0.4281**	**0.3308**	0.2212	0.0531
sand	-0.0810	0.0926	-0.1191	0.0643	-0.2555	0.0009
silt	0.0614	-0.1253	-0.1545	-0.1377	-0.1928	0.0464
mud	0.0680	-0.0776	0.2242	-0.0447	**0.3772**	0.0256
plants	0.2524	**-0.4577**	**0.7145**	**0.5389**	**0.5305**	0.1997

Mollusca

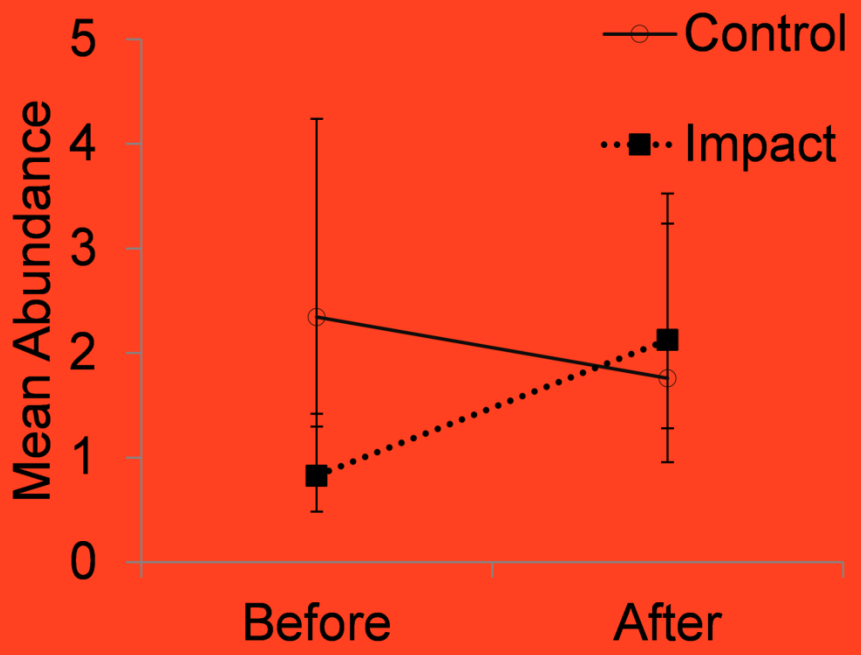


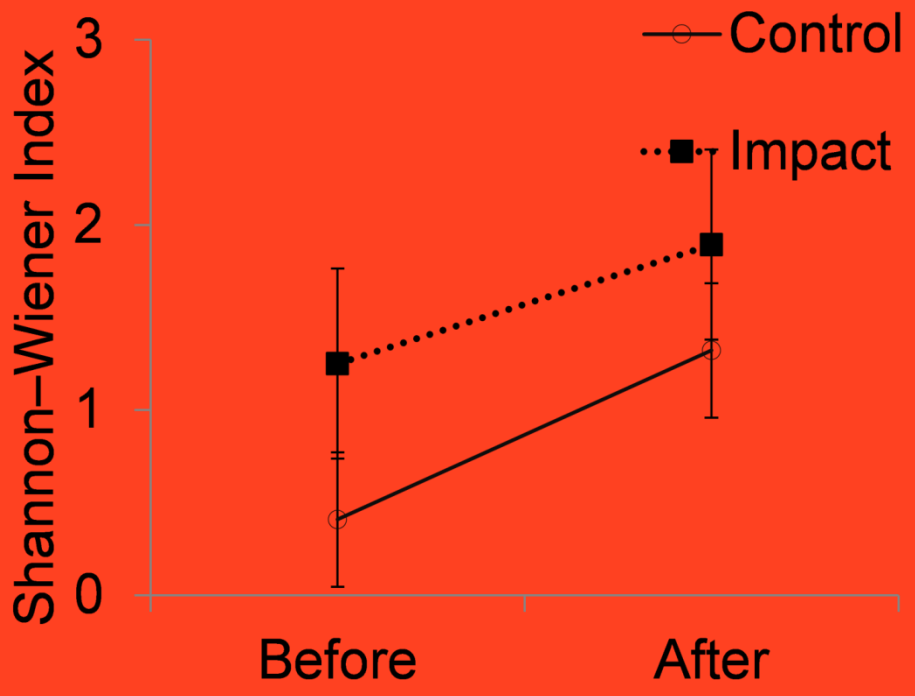


Source	F statistics	df1	df2	Significance
Corrected Model	5.634	3	128	0.001
Before-after	8.544	1	128	0.004
Control-impact	7.596	1	128	0.007
BA x CI	0.010	1	128	0.919

Source	Sum of squares	Df	Mean Square	F-statistic	p
	19,421	1	19,421	47,160	0,000
Before-after	0,004	1	0,004	0,009	0,927
Control-impact	0,154	1	0,154	0,373	0,548
BA x CI	0,005	1	0,005	0,012	0,914
Error	8,236	20	8,236		

Hydrachnidia

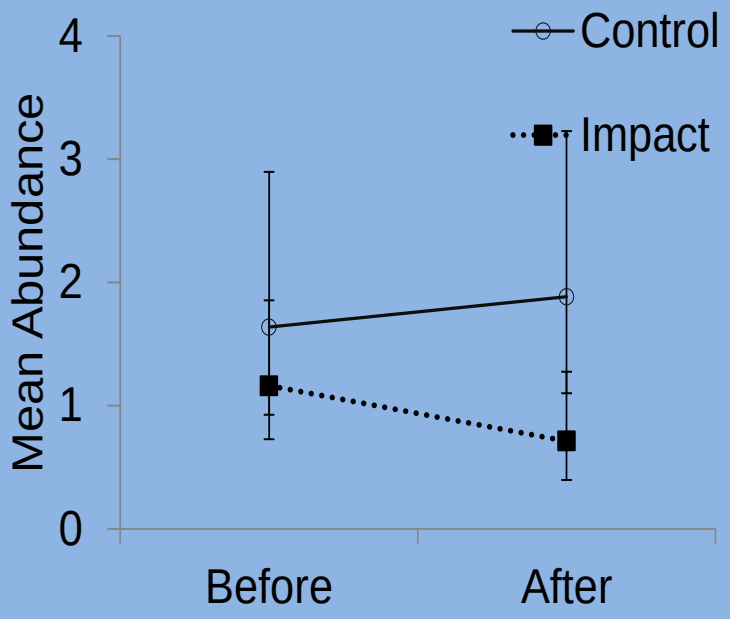


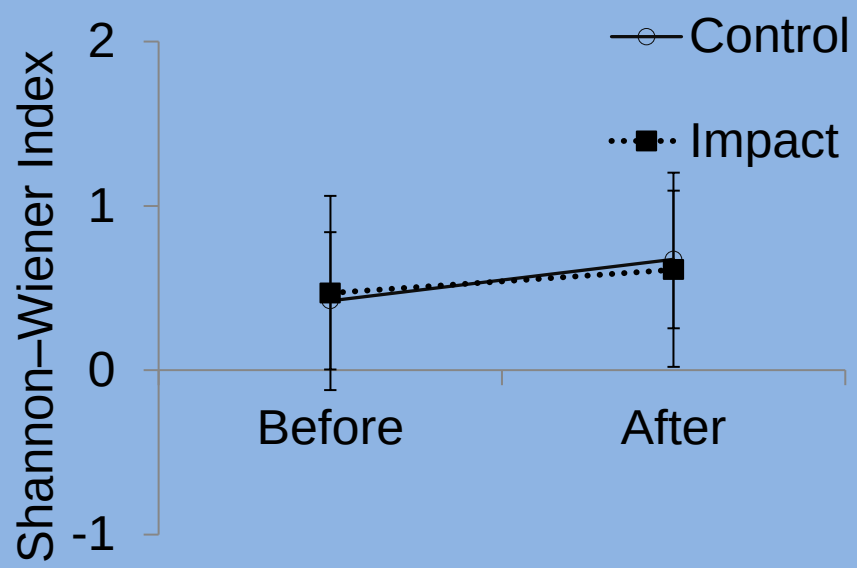


Source	F statistics	df1	df2	Significance
Corrected Model	3.662	3	262	0.013
Before-after	1.666	1	262	0.198
Control-impact	2.457	1	262	0.118
BA x CI	5.864	1	262	**0.016**

Source	Sum of squares	Df	Mean Square	F-statistic	p
Intercept	31.697	1	31.697	130.938	0.000
Before-after	3.233	1	3.233	13.355	0.002
Control-impact	2.665	1	2.665	11.008	0.003
BA x CI	0.097	1	0.097	0.403	0.533
Error	4.841	20	0.242		

Odonata

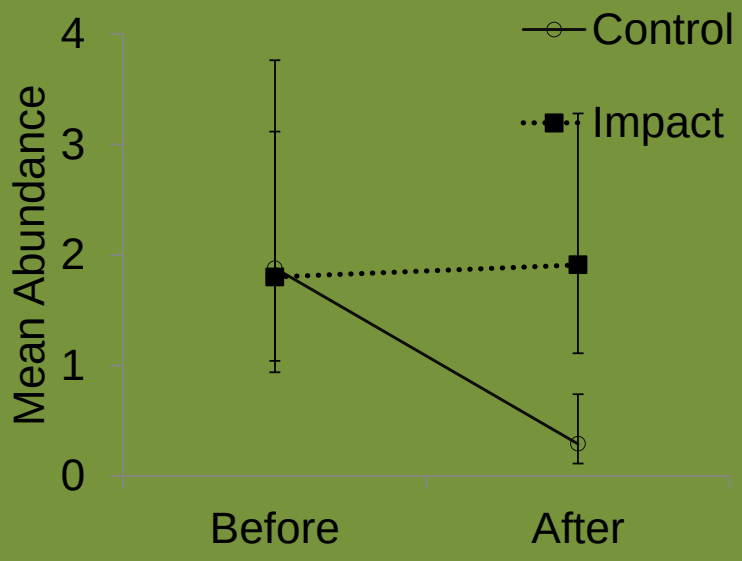


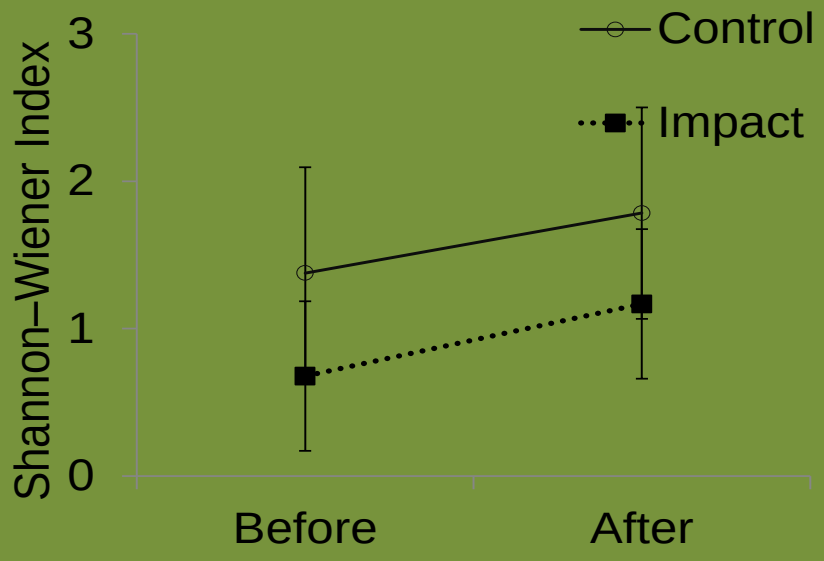


Source	F statistics	df1	df2	Significance
Corrected Model	2.357	3	50	0.083
Before-after	0.415	1	50	0.522
Control-impact	5.951	1	50	0.018
BA x CI	1.355	1	50	0.250

Source	Sum of squares	Df	Mean Square	F-statistic	p
Intercept	31,697	1	31,697	130,938	0,000
Before-after	3,233	1	3,233	13,355	0,002
Control-impact	2,665	1	2,665	11,008	0,003
BA x CI	0,097	1	0,097	0,403	0,533
Error	4,841	20	4,841		

Heteroptera

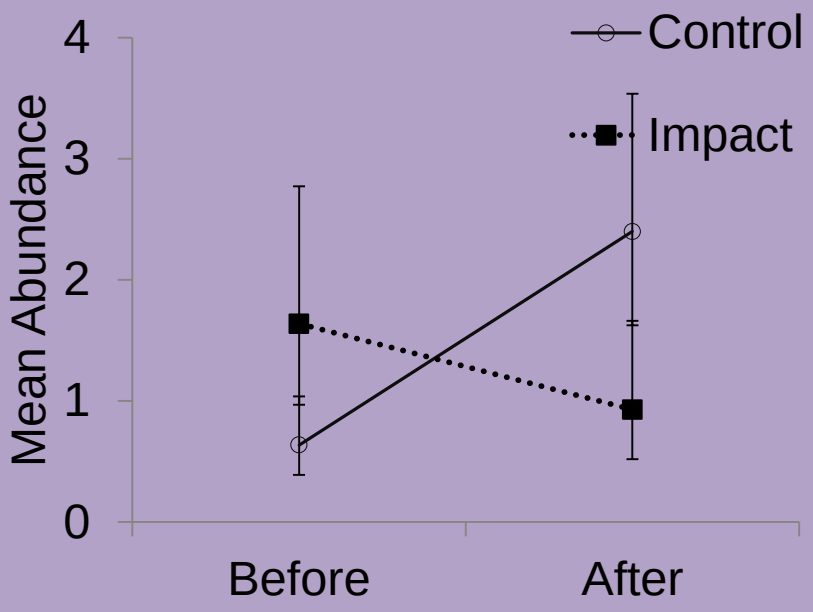


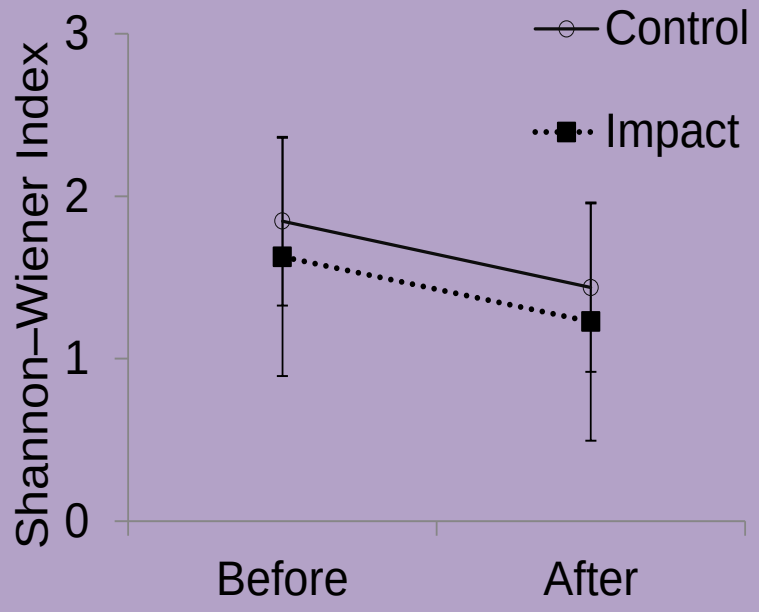


Source	F statistics	df1	df2	Significance
Corrected Model	5.212	3	141	0.002
Before-after	8.402	1	141	0.004
Control-impact	7.883	1	141	0.006
BA x CI	9.528	1	141	0.002

Source	Sum of squares	Df	Mean Square	F-statistic	p
Intercept	33.418	1	33.418	70.590	0.000
Before-after	1.070	1	1.070	2.260	0.148
Control-impact	2.312	1	2.312	4.884	0.039
BA x CI	0.009	1	0.009	0.019	0.892
Error	9.468	20	9.468		

Coleoptera

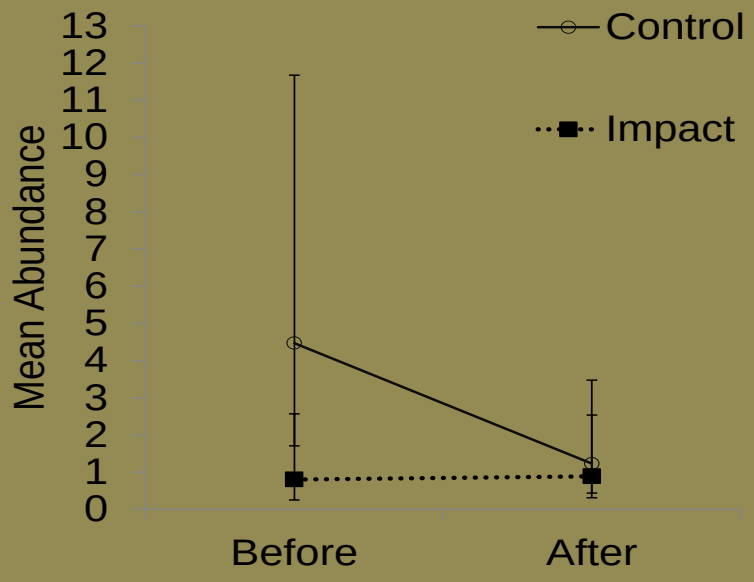


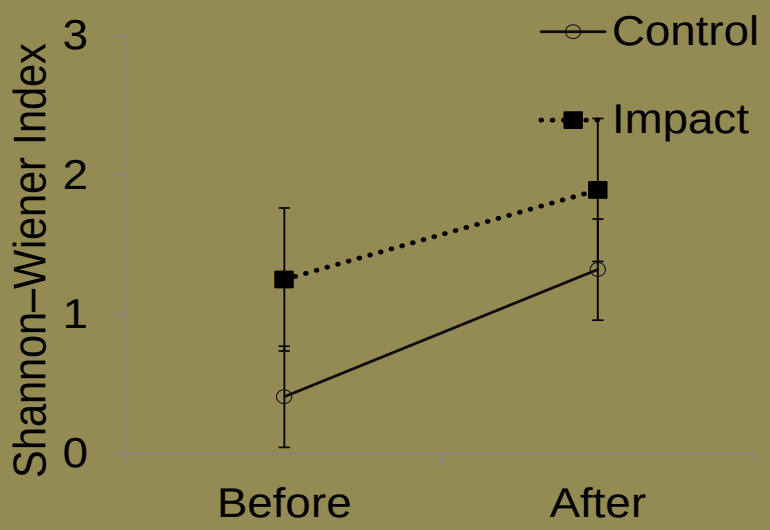


Source	F statistics	df1	df2	Significance
Corrected Model	6.604	3	156	0.000
Before-after	2.238	1	156	0.137
Control-impact	0.000	1	156	0.997
BA x CI	13.910	1	156	0.000

Source	Sum of squares	Df	Mean Square	F-statistic	p
Intercept	50.253	1	50.253	101.452	0.000
Before-after	0.869	1	0.869	1.755	0.200
Control-impact	0.246	1	0.246	0.496	0.489
BA x CI	0,000	1	0,000	0,000	0.986
Error	9.907	20	0.495		

Trichoptera





Source	F statistics	df1	df2	Significance
Corrected Model	3.885	3	69	0.013
Before-after	2.187	1	69	0.144
Control-impact	4.892	1	69	0.030
BA x CI	3.004	1	69	0.088

Source	Sum of squares	Df	Mean Square	F-statistic	p
Intercept	31,697	1	31,697	130,938	0,000
Before-after	3,233	1	3,233	13,355	0,002
Control-impact	2,665	1	2,665	11,008	0,003
BA x CI	0,097	1	0,097	0,403	0,533
Error	4,841	20	0,242		

Podsumowanie BACI

Cała Fauna – liczebność +, H bez zmian

Mollusca – bez zmian

Hydrachnidia – liczebność +, H bez zmian

Odonata – bez zmian

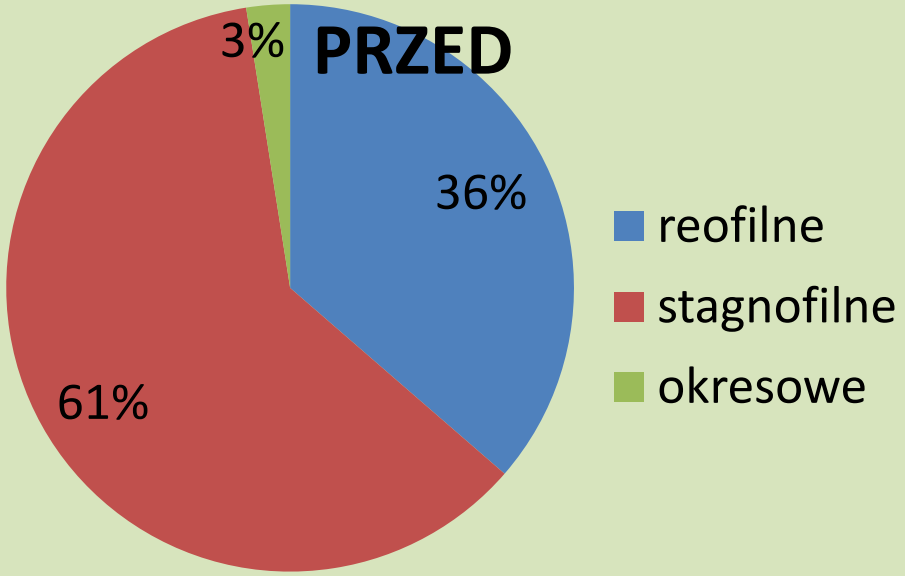
Heteroptera – liczebność +, H bez zmian

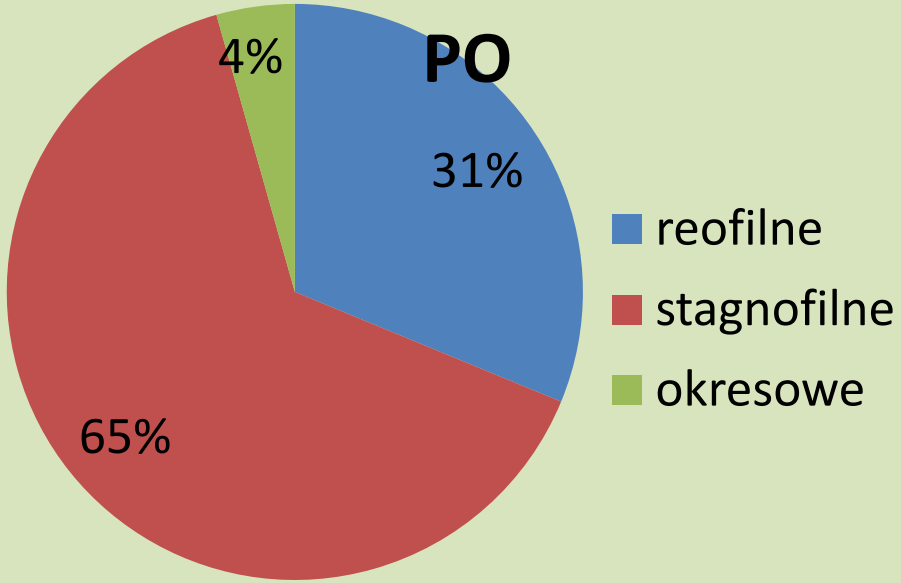
Coleoptera – liczebność –, H bez zmian

Trichoptera – bez zmian

Całość fauny

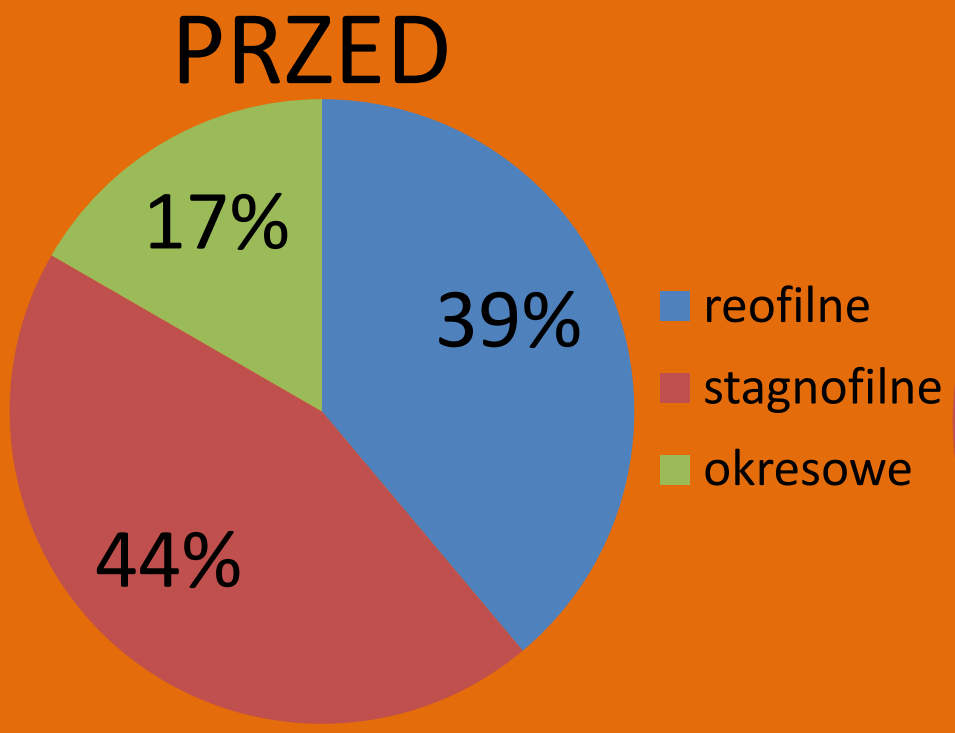
	przed	po
reofilne	44	64
stagnofilne	74	132
okresowe	3	9

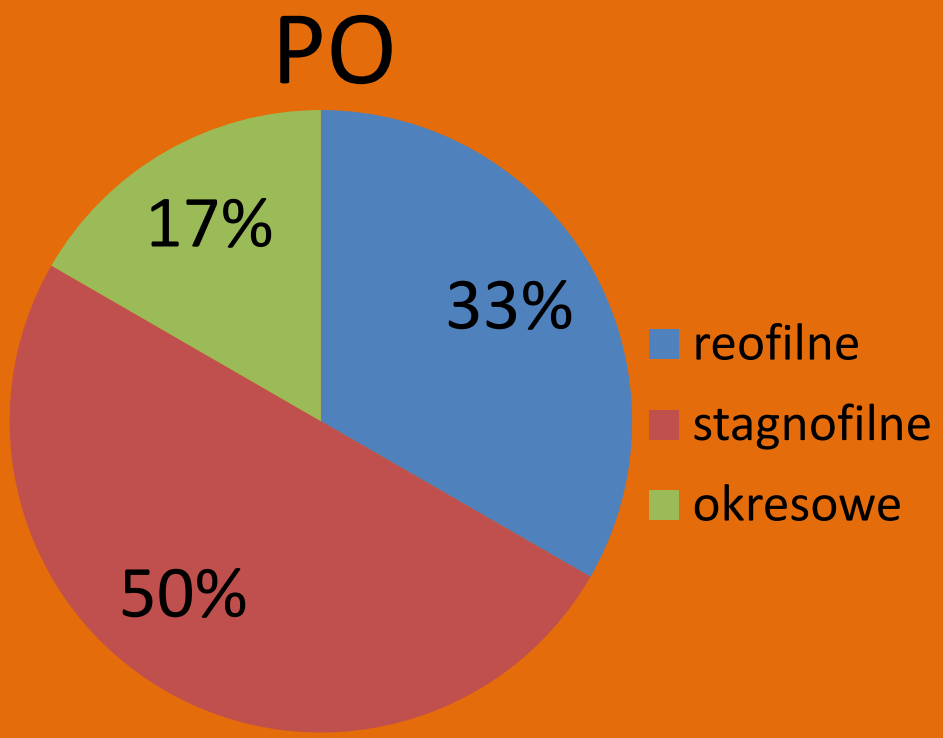




Mollusca

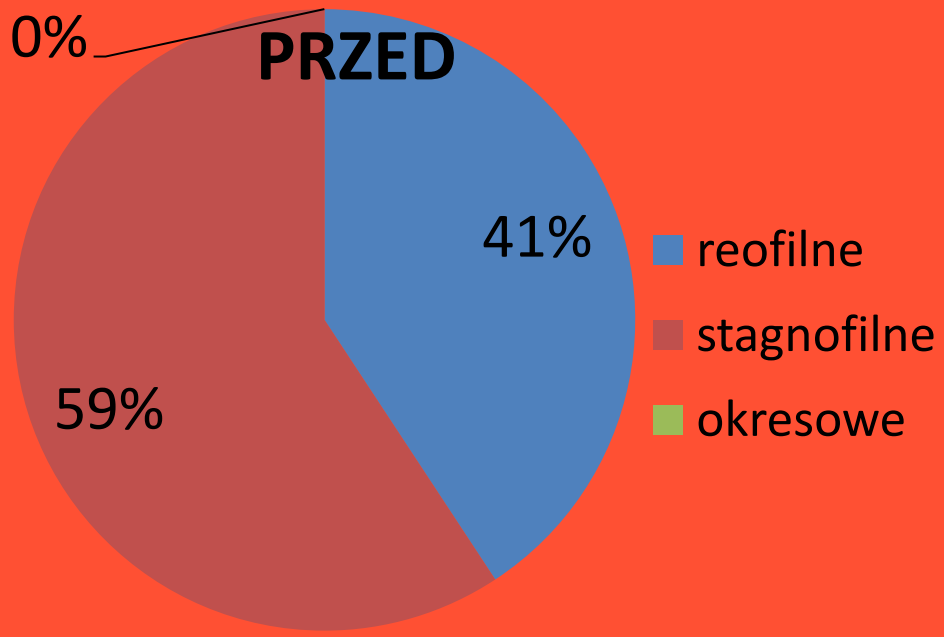
	przed	po
reofilne	7	10
stagnofilne	8	15
okresowe	3	5

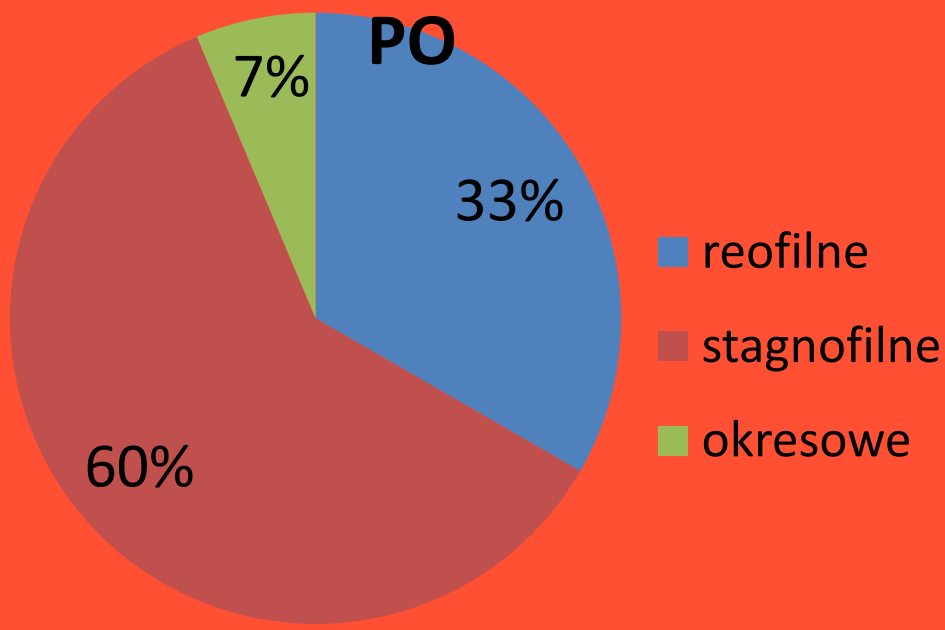




Hydrachnidia

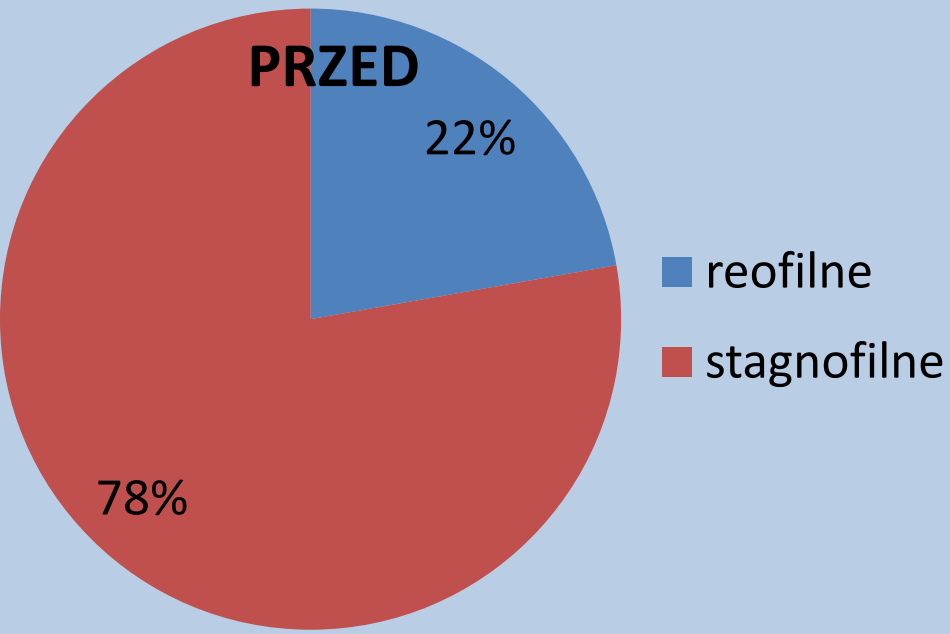
	przed	po
reofilne	11	21
stagnofilne	16	38
okresowe	0	4

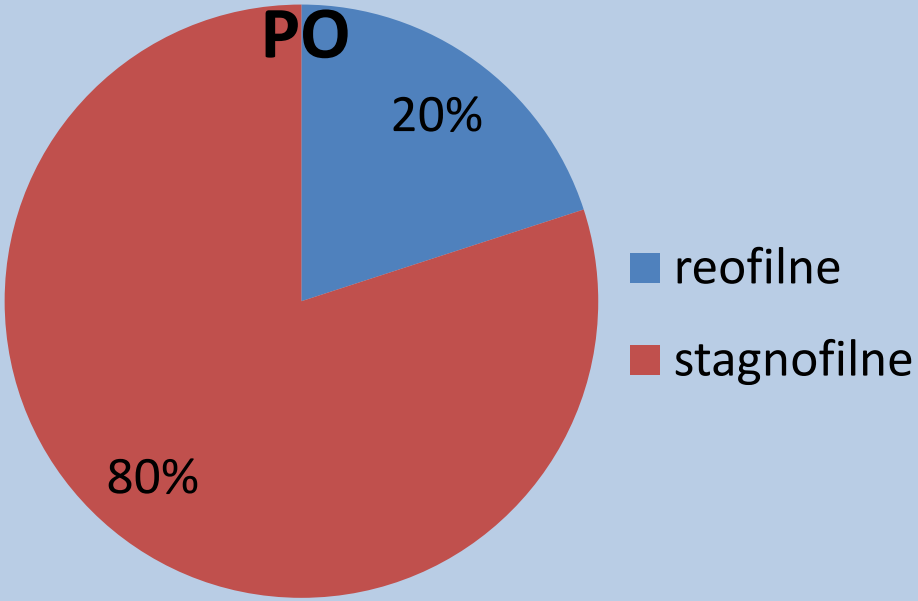




Odonata

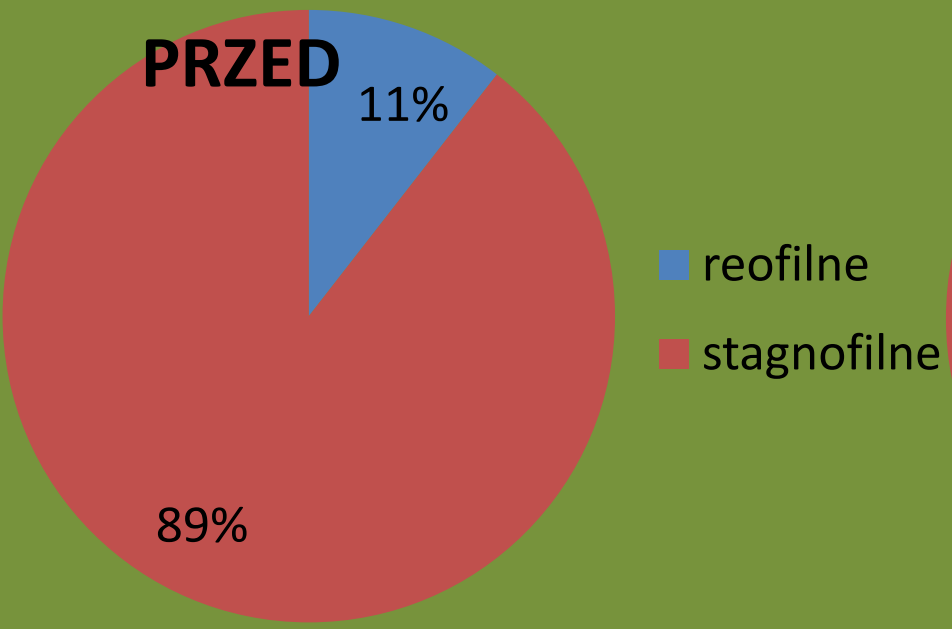
	przed	po
reofilne	4	4
stagnofilne	14	16

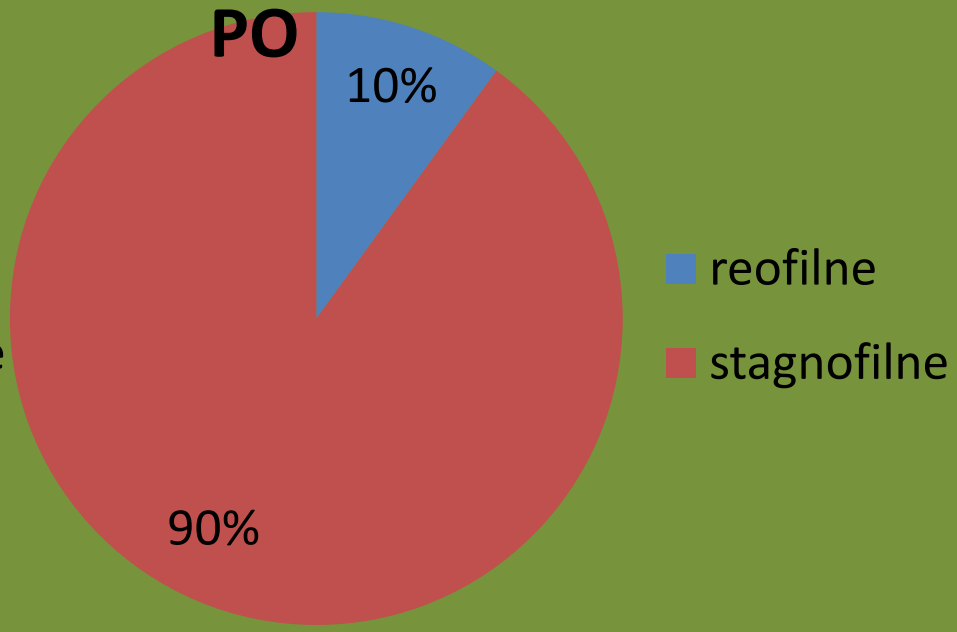




Heteroptera

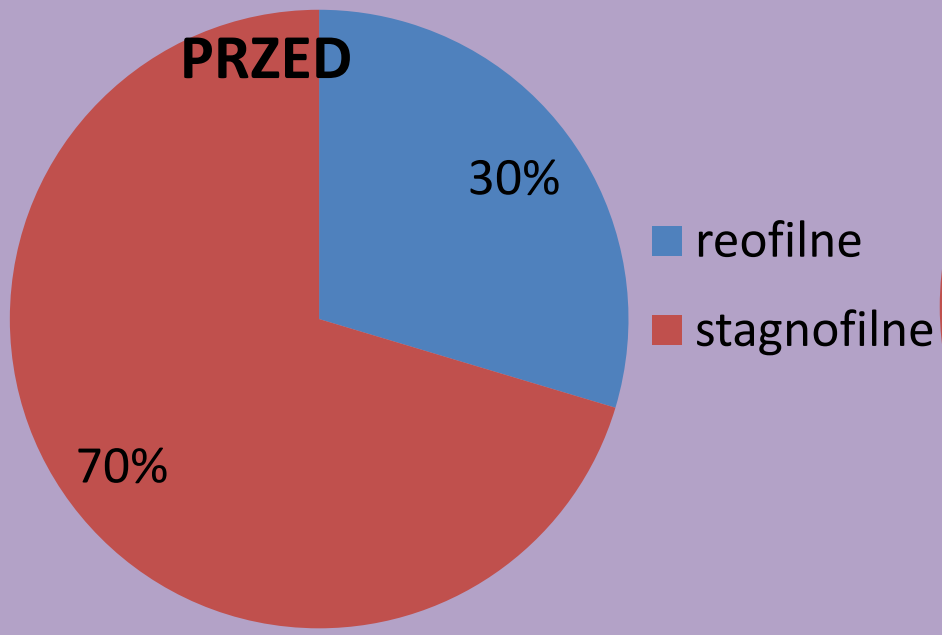
	przed	po
reofilne	2	2
stagnofilne	17	18

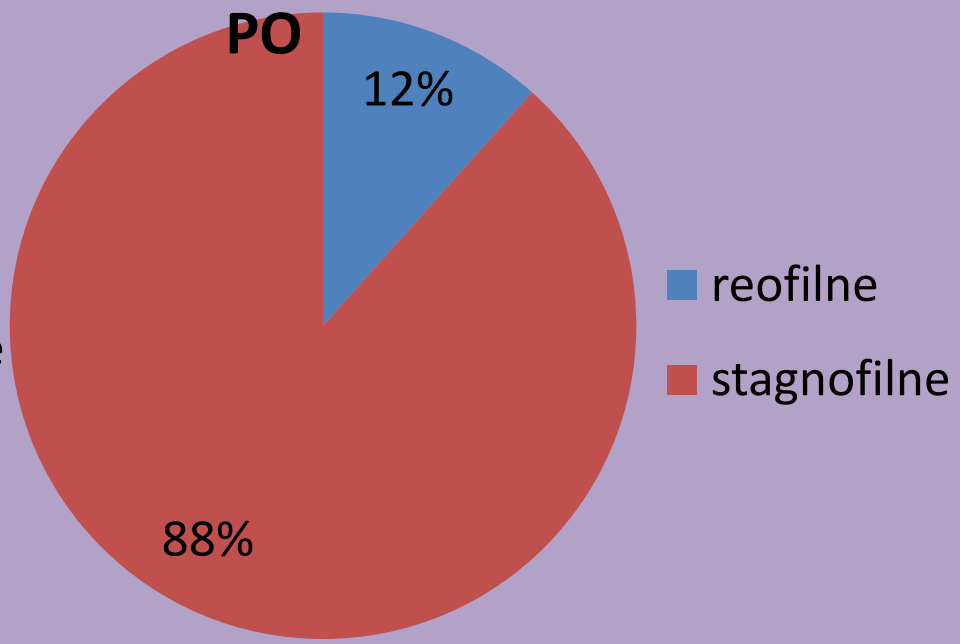




Coleoptera

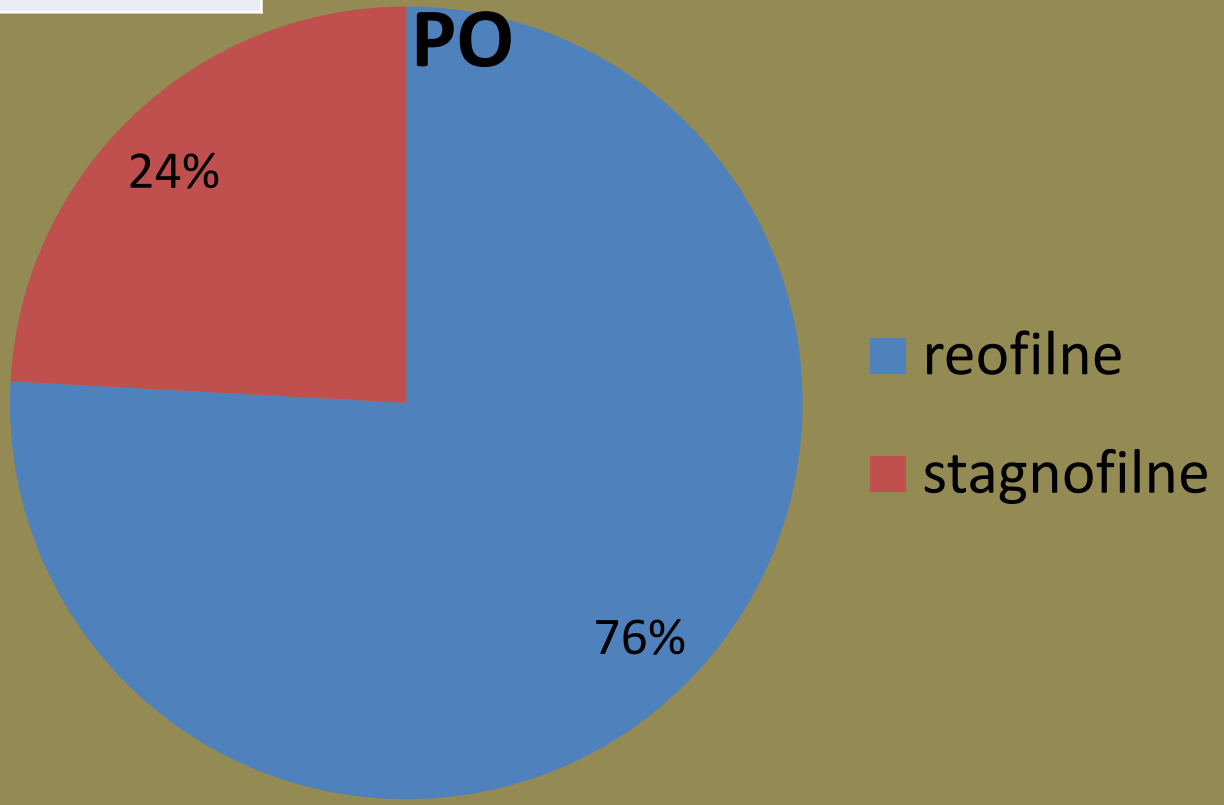
	przed	po
reofilne	8	5
stagnofilne	19	38





Trichoptera

	przed	po
reofilne	12	22
stagnofilne		7



Podsumowanie – status ekologiczny

Cała Fauna – reofilne ↑ %↓, stagnofilne↑, % ↑

Mullusca – reofilne ↑ %↓, stagnofilne ↑, % ↑

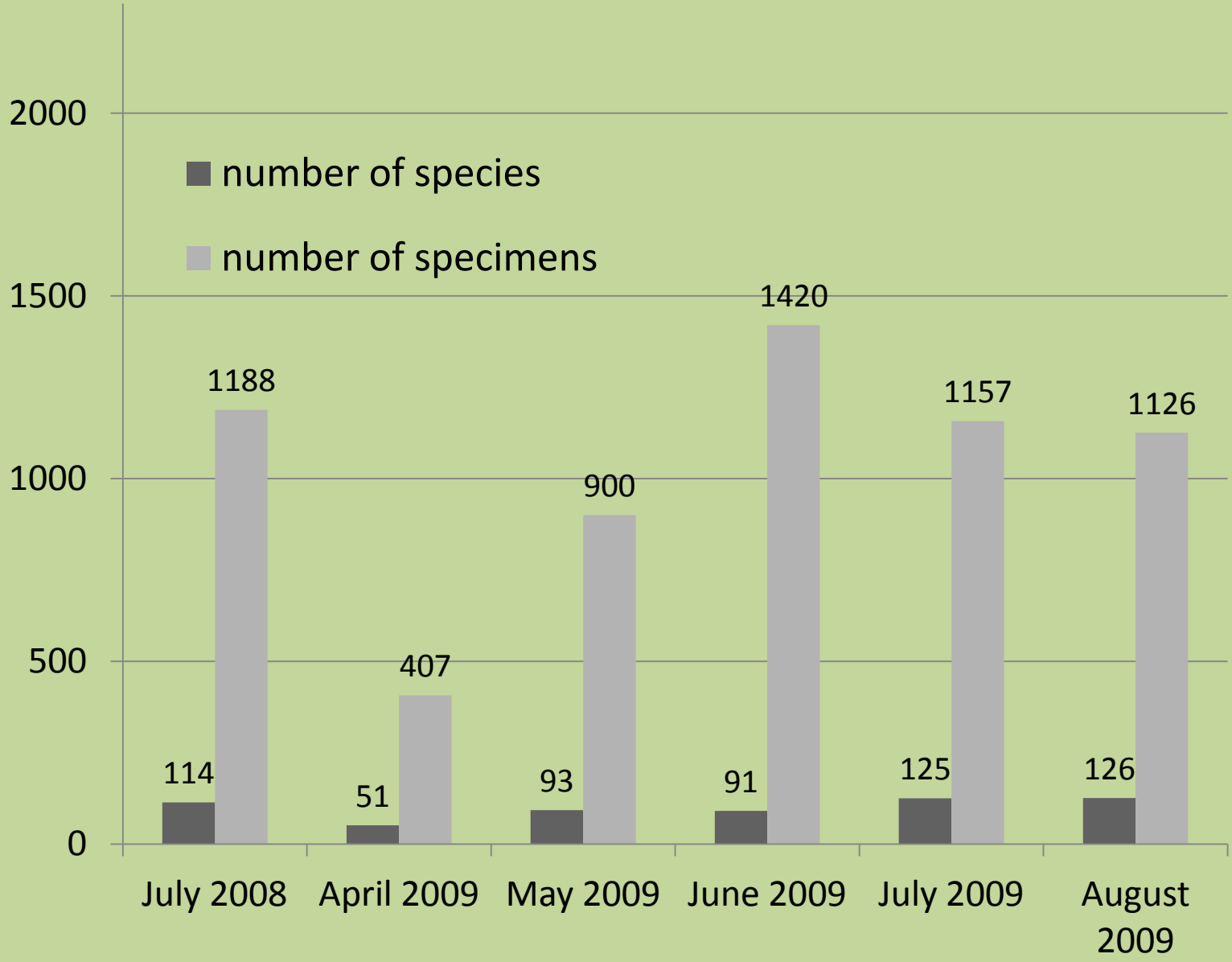
Hydrachnidia – reofilne ↑%↓, stagnofilne ↑, %↑

Odonata – reofilne ⇔%↓, stagnofilne ↑, %↑

Heteroptera –reofilne ⇔%↓, stagnofilne ↑, %↑

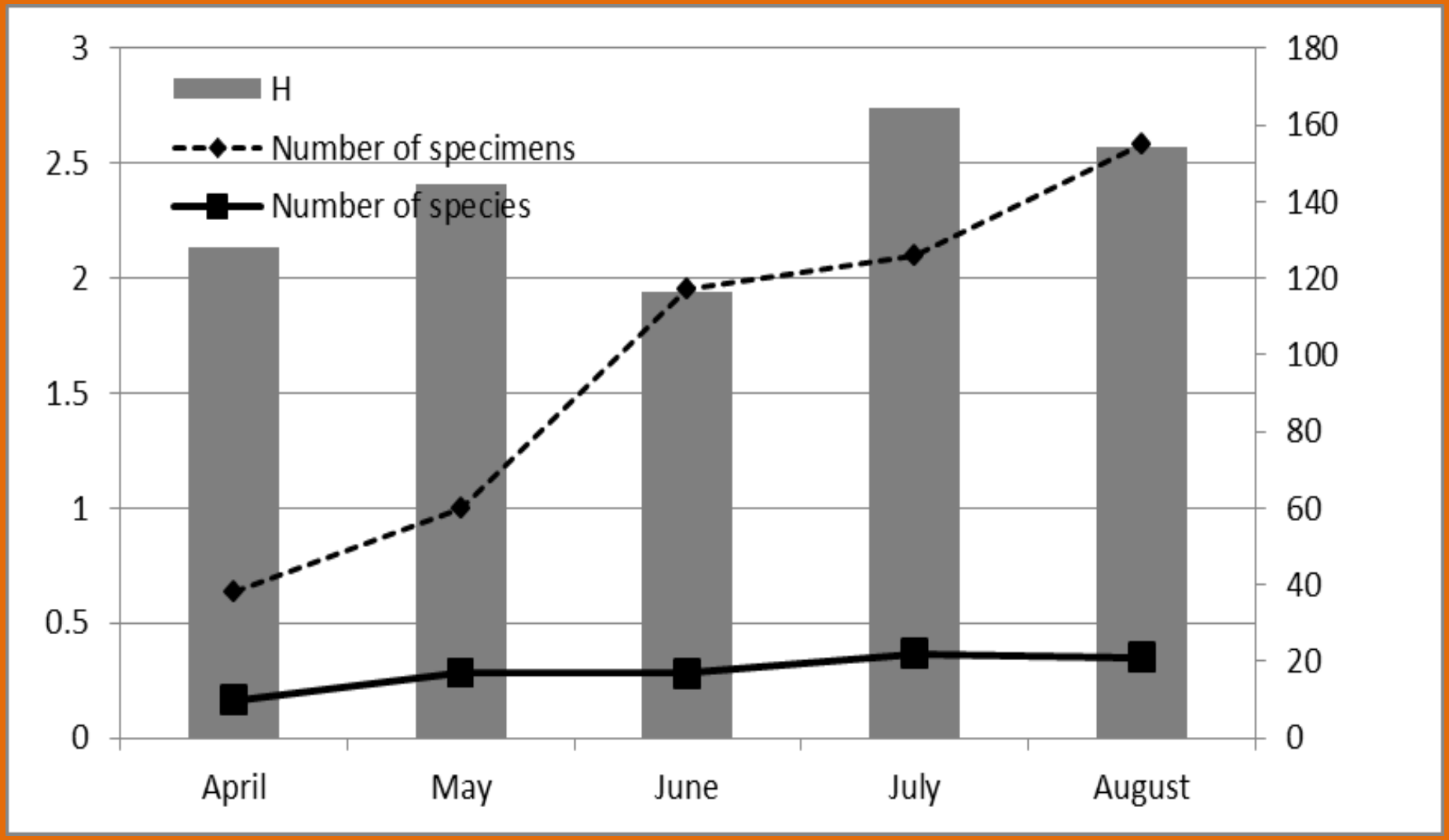
Coleoptera – reofilne ↓%↓, stagnofilne ↑, %↑

Trichoptera – reofilne ↑%↓, stagnofilne ↑, %↑

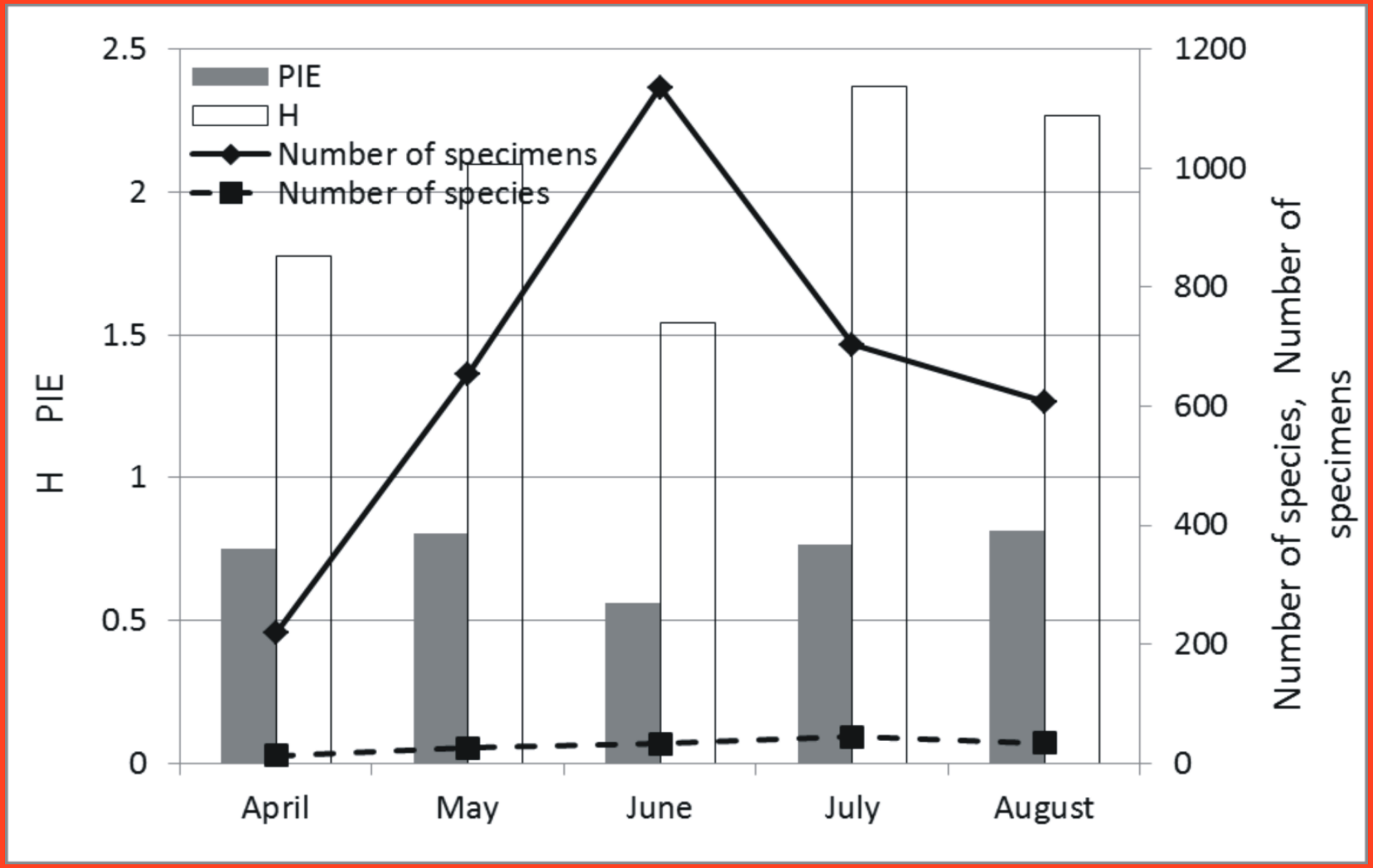


Różnice były statystycznie nieistotne test Kruskala-Wallisa: H (4, N= 1099) =4.061550 p =0.3977.

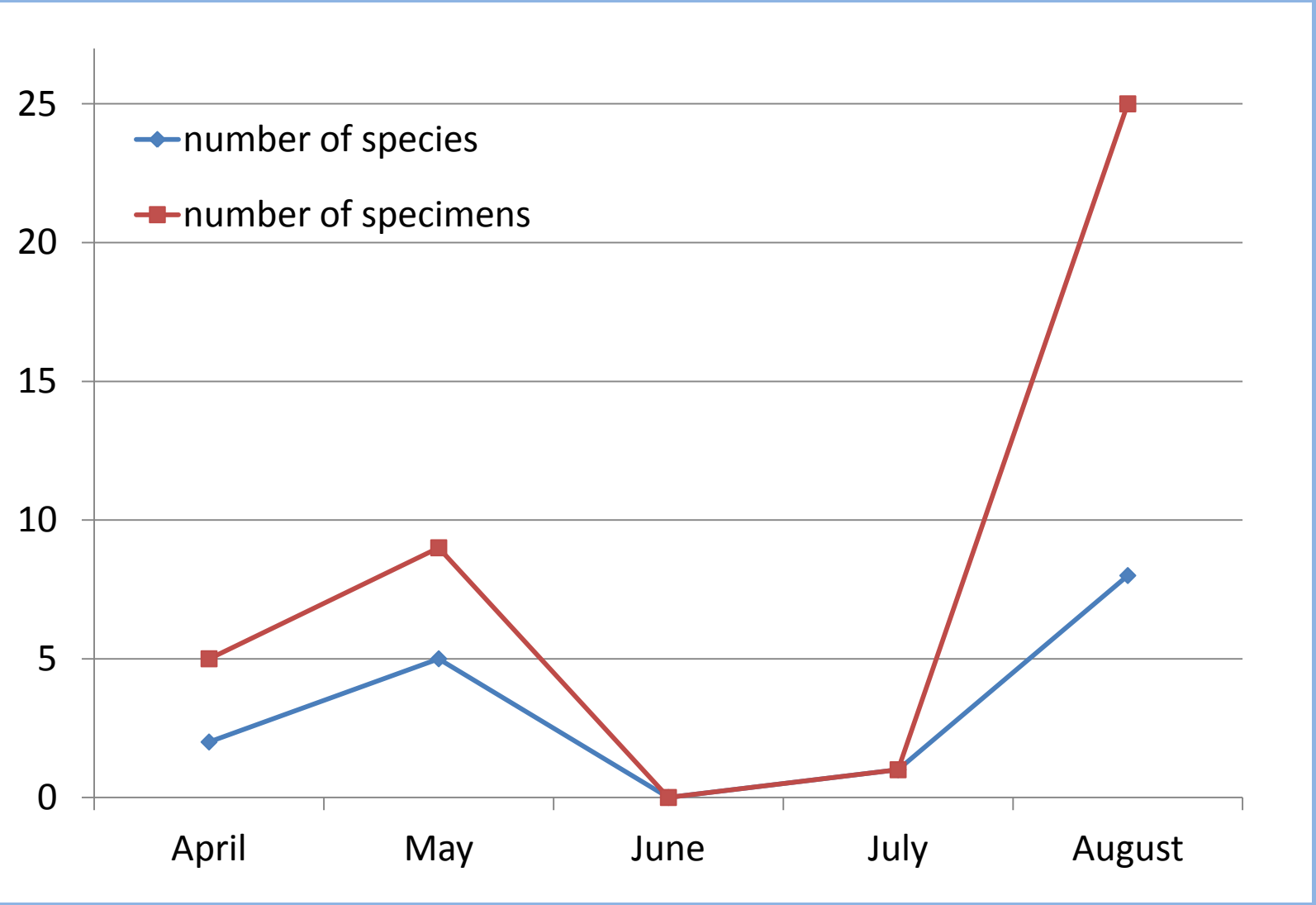
Mollusca


H
Number of specimens
Number of species
3
2.5
2
1.5
1
0.5
0
180
160
140
120
100
80
60
40
20
0
April
May
June
July
August

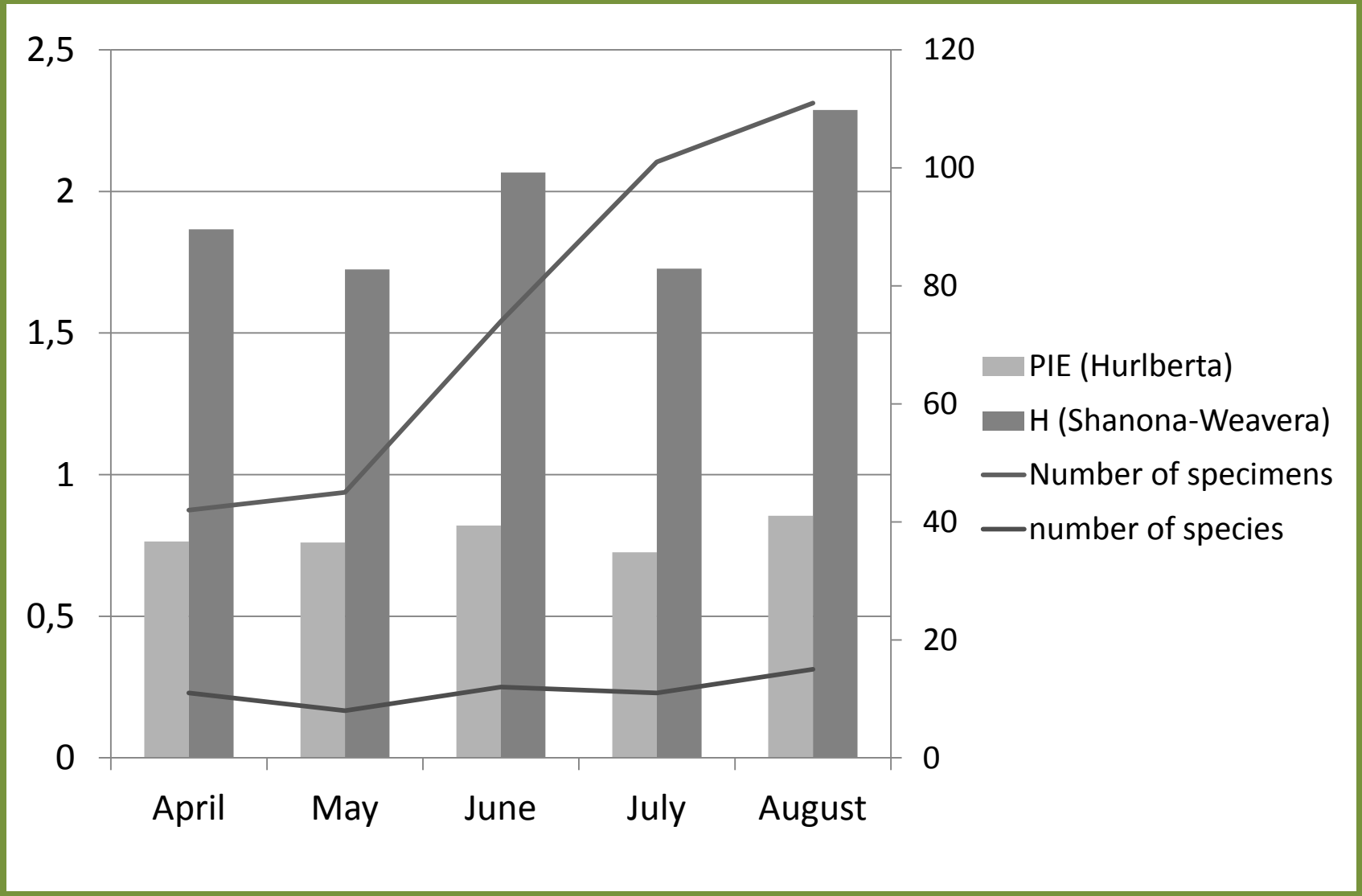
Hydrachnidia



Odonata

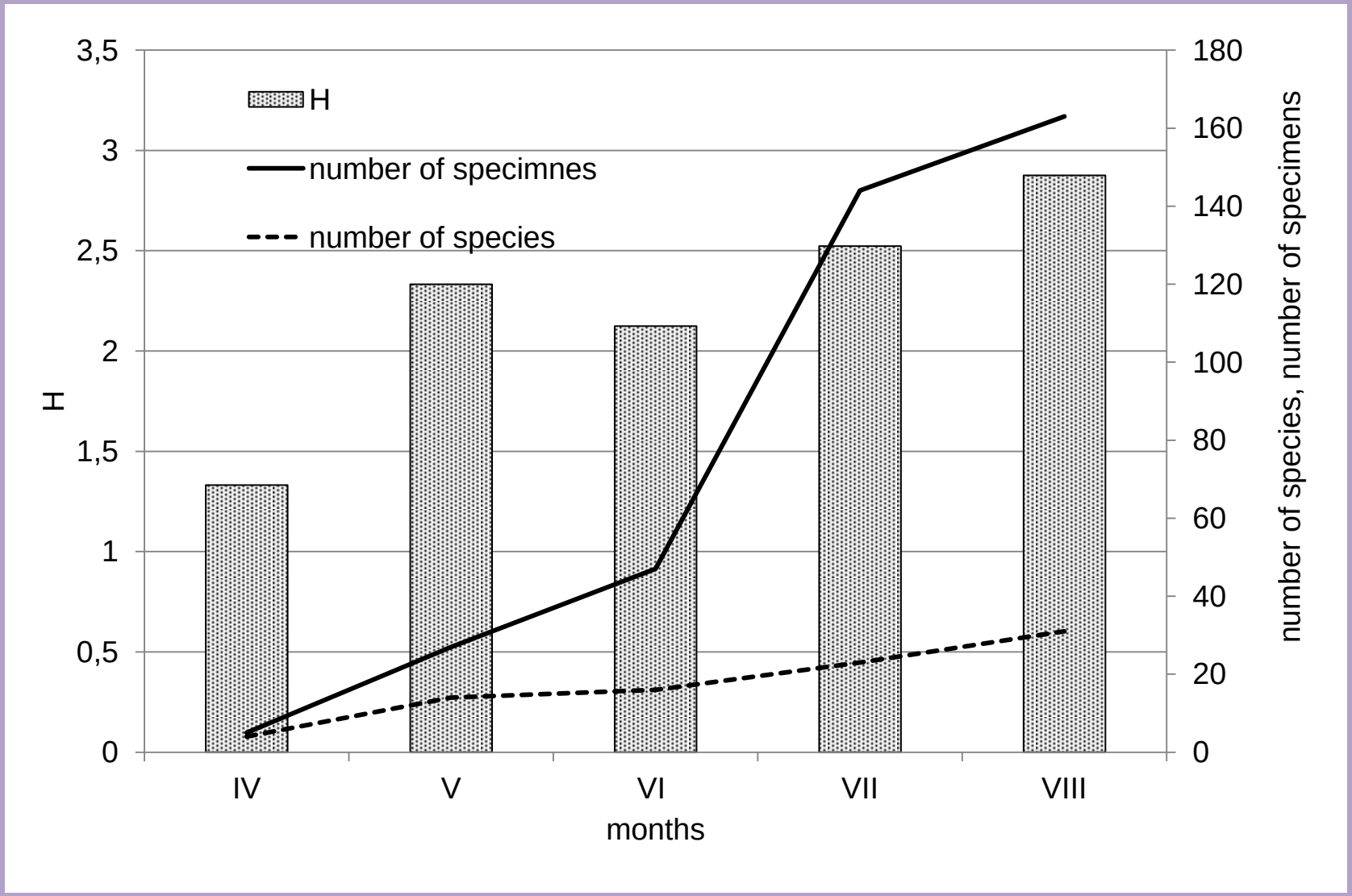

25
20
15
10
5
0
number of species
number of specimens
April
May
June
July
August

Heteroptera



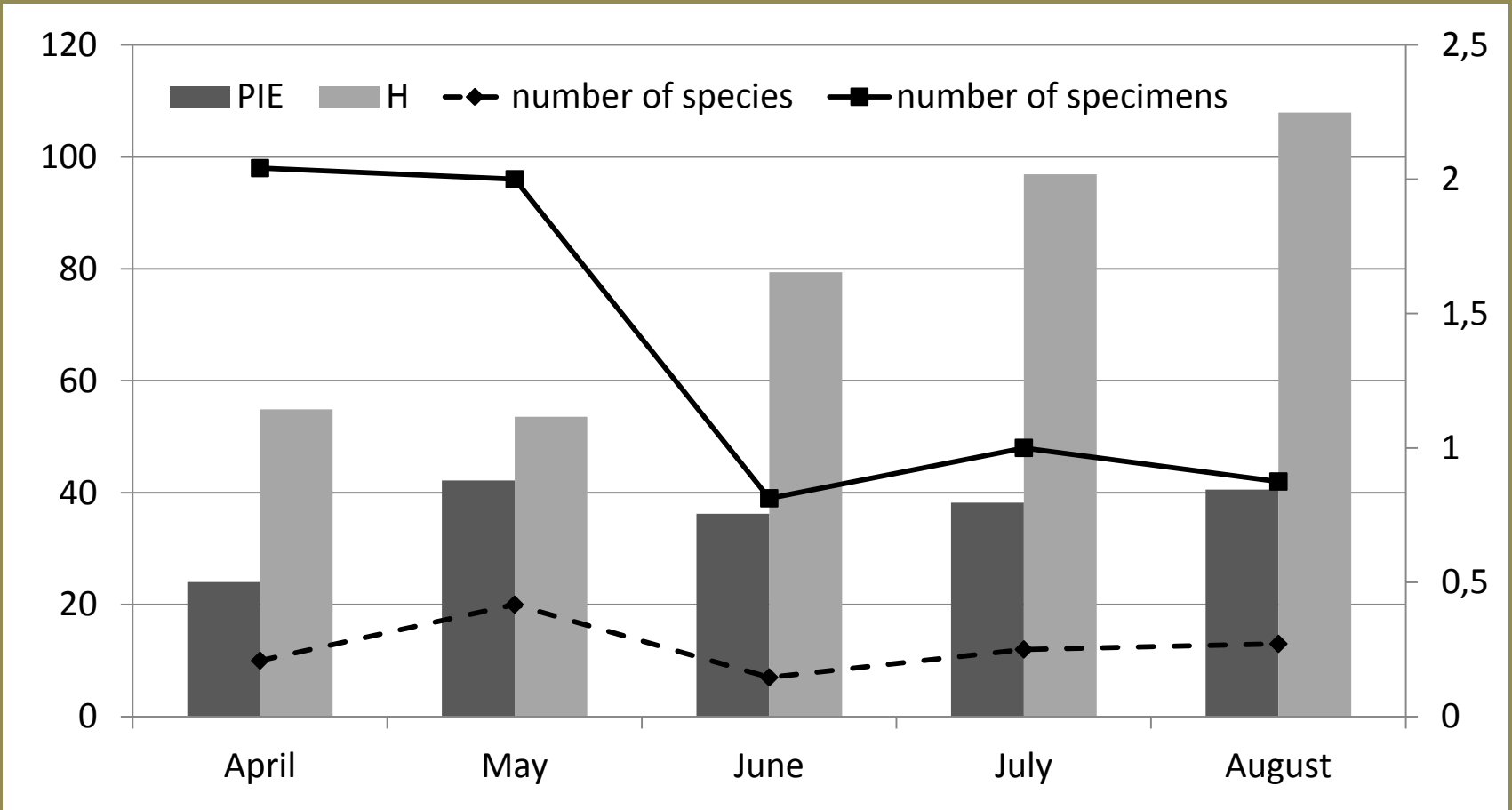
Liczba gatunków, liczebność i współczynniki bioróżnorodności w miesiącach po bagrowaniu

Coleoptera



Bogactwo gatunkowe, liczebność i wskaźnik bioróżnorodności Shannona-Weavera (H) w poszczególnych miesiącach po bagrowaniu.

Trichoptera



Fenologia chruścików w rzece po bagrowaniu: H - Shannon-Weaver index, PIE - Hurlbert index.

PODSUMOWANIE TEMPA REKOLONIZACJI

Cała Fauna – spadek, bez zmian ???

Mollusca – ciągły wzrost

Hydrachnidia – spadek, fenologia

Odonata – fenologia

Heteroptera – ciągły wzrost

Coleoptera – ciągły wzrost

Trichoptera – fenologia

PODSUMOWANIE

Zmiana:

- wzrost liczby gatunków,
- wzrost liczebności,
- bioróżnorodność na tym samym poziomie

Rekolonizacja:

- szybka rekolonizacja z uwydatnieniem fenologii,
- brak zależności od zdolności migracyjnych,
- gatunki eurytopowe (stagnofilne) i reofilne


DZIĘKUJĘ ZA UWAGĘ