

”Report Title”

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812355 Fish sampling and monitoring

812356 Fish ecological status assessment

October 23, 2018

Abstract

Most European rivers are impacted by various anthropogenic pressures and in need for action in order to reach a good ecological status as required by the EU Water Framework Directive. Since benthic invertebrates are good bio-indicators, they are often used to monitor rivers and to assess organic pollution, habitat availability and overall degradation. For this study the multi-habitat sampling approach was carried out in the unimpacted river Ois and in the channelized

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Maiergraben in order to assess differences in benthic invertebrate communities. At the unimpacted river different mineral habitats, biotic cover and flow velocities are present, whereas the impacted site is very homogenous. Furthermore, a higher number of taxa, EPT-Taxa and sensitive taxa occur at the Ois, which is a result of high habitat heterogeneity. The Maiergraben on the other hand shows low taxa diversity and very high abundances of generalists such as chironomids. In order to reach a good ecological status at the Maiergraben the need for action should not be ignored but appropriate measures should be implemented to restore the rivers biodiversity.

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Contents

Abstract	i
Table of contents	ii
1 Results	1
1.1 Ois River	1
1.1.1 Length-frequency distribution	1
1.1.2 Abundance and Biomass	5

1 Results

1.1 Ois River

1.1.1 Length-frequency distribution

This distribution of salmonid length in the investigated area of the Ois ranged from 45mm to 433mm. 72% of the total catch had a length of less than 120mm, which is the threshold for young-of-the-year (YOY) fish. Distribution of adult fish can be see in [Fig. 1](#). Fish length among the mesohabitats trends toward the largest fish in pools, decreasing in size to runs and then riffles containing the smallest fish. The median length of brown trout was similar in the riffle and run sections.

The Rothschild section of the river had similar length brown trout populations when compared to the Hinterleiten. The rainbow trout populations in the Rothschild were significantly larger than that of the Hinterleiten in all three mesohabitats. Additionally, the rainbow trout populations in all sampled areas were larger than the brown trout populations.

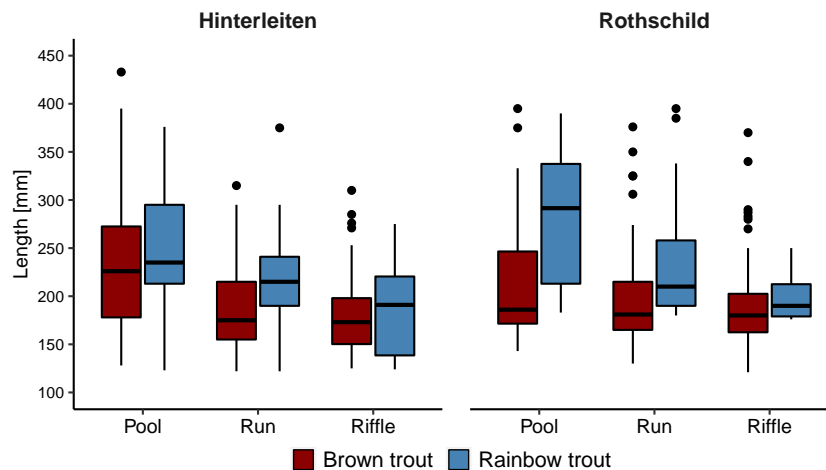


Figure 1. Boxplots displaying length of adult fish in investigated mesohabitats.

Brown trout (*Salmo trutta*)

A very healthy brown trout population can be seen in the length-frequency chart of the combined sample areas ([Fig. 2](#)). A total of 1866 brown trout were caught in 9 sample sites. Fish of less than 120mm in length represent the YOY, while the 1+ age class (>120mm) and 2+ age class (>220mm) are clearly visible along with several individuals larger than 300mm. YOY fish account for the majority of the catch at 74%, indicating successful spawning.

Comparing the length-frequency of the two sampled sections ([Fig. 3](#)) shows that the Hinterleiten has a higher portion of YOY at approximately 80% of the total catch, while The 1+ fish accounted for only 13% of total catch. The YOY in the Rothschild section

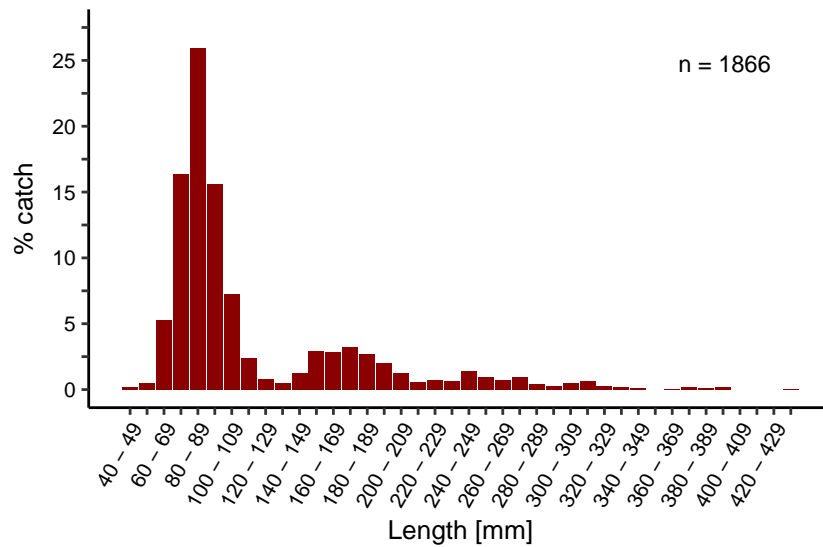


Figure 2. Length-frequency plot showing population structure of brown trout in the River Ois.

accounted for 60% of total catch and the 1+ age class represented around 28% of total catch.

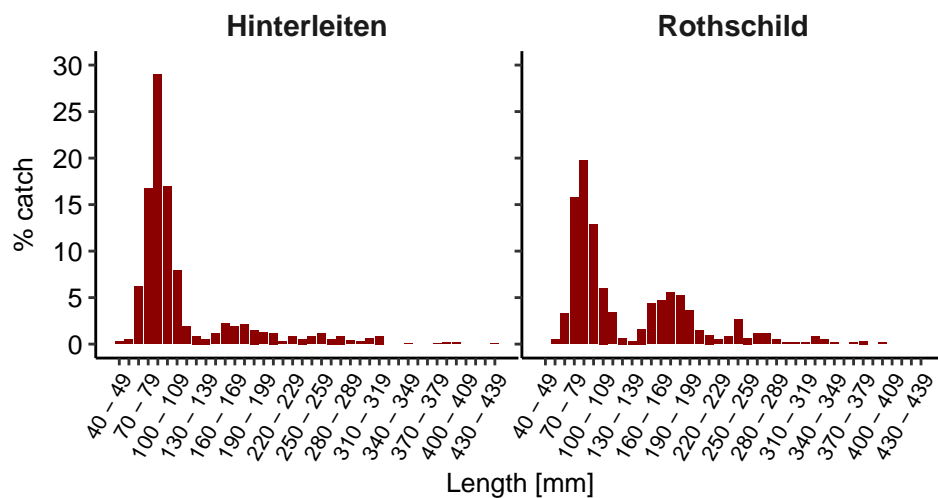


Figure 3. Length-frequency plot showing the difference in population structure of brown trout in two sections of the River Ois.

A comparison of brown trout populations in different mesohabitats can be seen in [Fig. 4](#). All age classes are present in the pool habitat, with YOY accounting for less than 50% total catch. 1+ and 2+ fish accounted for 28% and 15% of the pools respectively. Run mesohabitats contained more juvenile fish with YOY representing 72% of the population. 21% of the population were 1+ fish leaving less than 7% fish greater than 220mm in length. The riffles contained the highest percentage of YOY at 87%. 1+ fish made up 11% of the population, with very few fish larger than 220mm.

A representation of the brown trout population in each of the sampled sites is shown in [Fig. 5](#). It can be seen that larger fish tend to occur most often in pool mesohabitats,

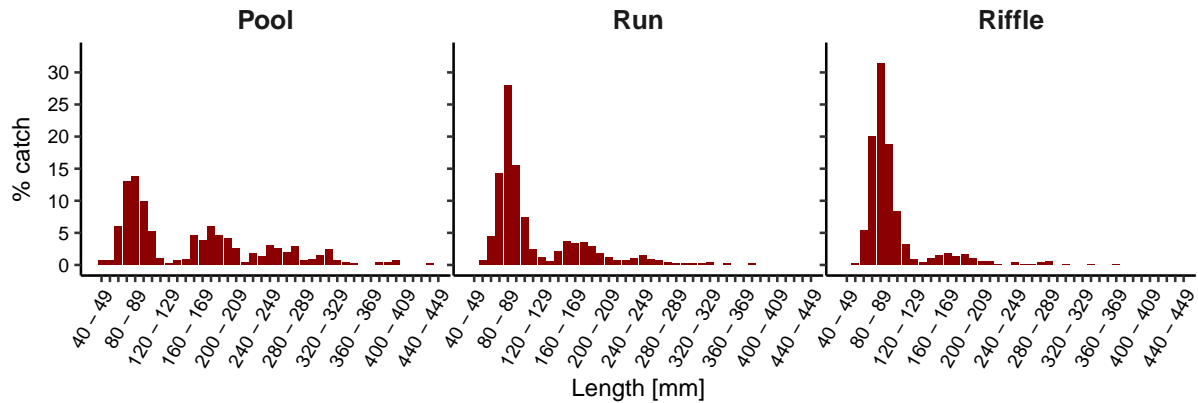


Figure 4. Length-frequency plot of brown trout populations in different meso-habitats of River Ois.

less frequently in runs, and rarely in riffles. YOY represent the majority of caught fish in the riffles and runs of all three sections. The lower riffle of the Hinterleiten contained the youngest population with YOY accounting for 92% of total catch. All mesohabitats within the Rothschild showed a higher proportion of large fish when compared with the Hinterleiten habitats. The Rothschild pool was unique in that YOY represented only 29% of the catch, with 1+ fish (48%), 2+ fish (17%) and fish larger than 300mm (6%) accounting for the remainder.

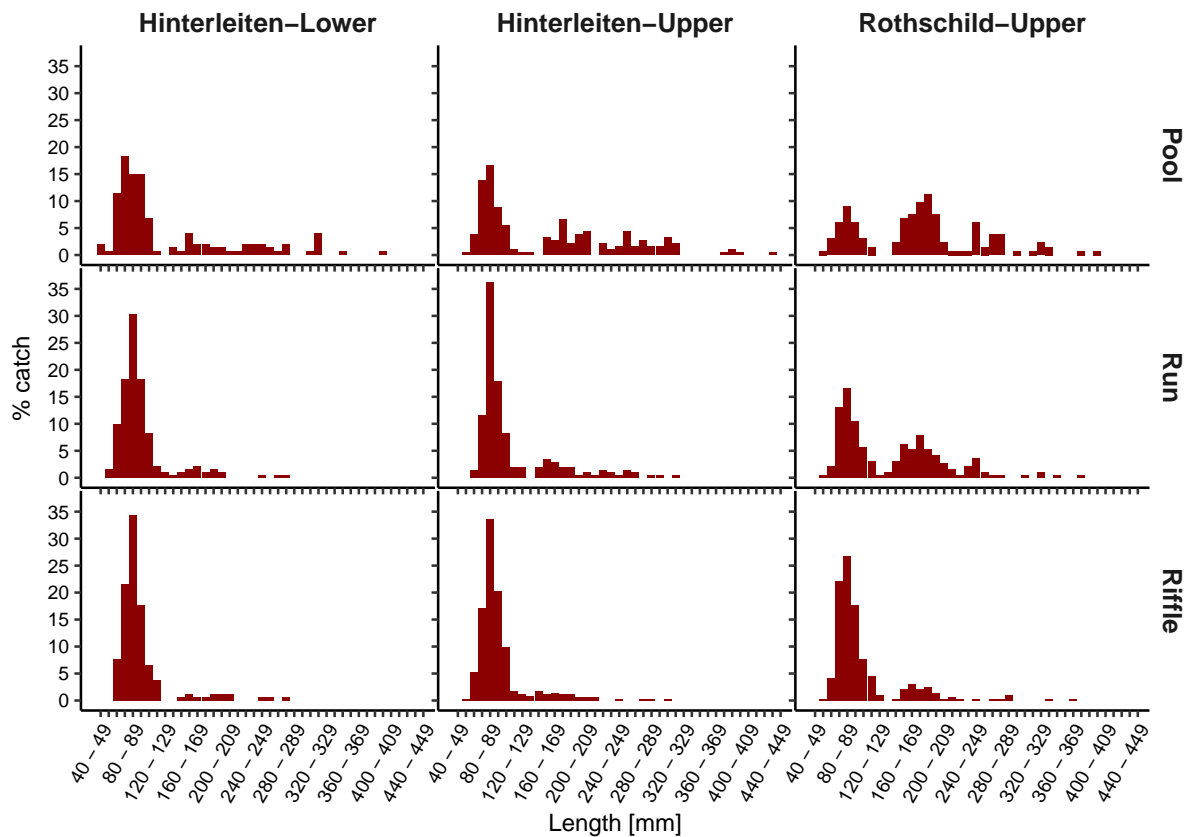


Figure 5. Length-frequency plots of brown trout in the 9 sampled sections.

Rainbow trout (*Onchorhynchus mykiss*)

The population structure of rainbow trout sampled in the Ois can be seen in Fig. 6. All ages classes are present, with a high percentage of YOY fish. Rainbow trout YOY were defined as individuals less than 150mm in length and accounted for 67% of the 383 rainbow trout that were sampled. 1+ fish (>150mm) were 20%, 2+ fish (>250mm) were 10% and fish larger than 350mm were less than 3% of the total catch.

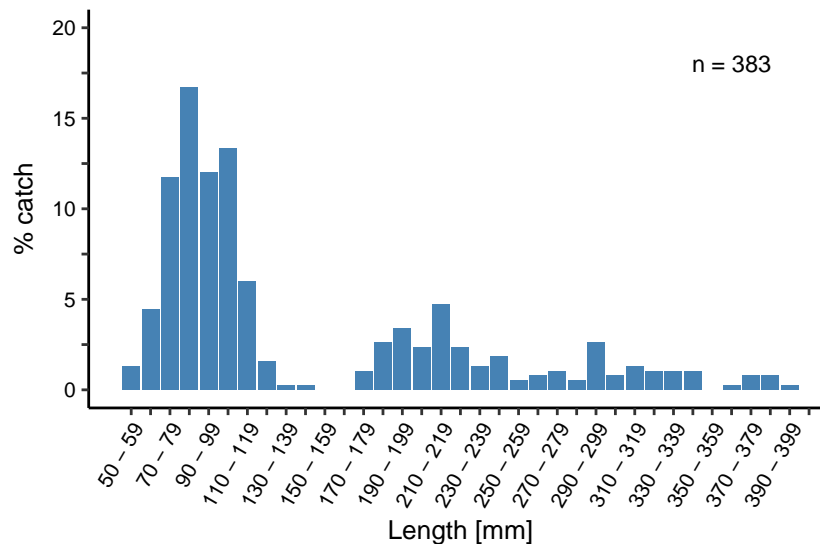


Figure 6. Length-frequency plot showing population structure of rainbow trout in the River Ois.

The rainbow trout populations between the two sections are quite similar (Fig. 7) with the Rothschild having a slightly older population. YOY had the highest portion of total catch in the Hinterleiten with 70% and 63% in the Rothschild. 1+ fish were comparable with 19% and 20%. The share of 2+ fish was lower in the Hinterleiten (10%) than the Rothschild (12.5%). 350mm plus fish were mostly absent from the Hinterleiten, but contributed 6% of the total catch in the Rothschild.

The age class distribution of rainbow trout among the mesohabitats (Fig. 8) is comparable to the brown trout (Fig. 4). The pool sections are characterized by an almost even distribution among the age classes. The pools were composed of 38% YOY, 31% 1+ fish, 27% 2+ fish and 4% were larger than 350mm. The runs had a younger population structure with 71% of the total catch being YOY. 1+ fish (22%), 2+ fish (5%) and >350mm fish made up just over 2% in the remainder of the runs. Riffles had the youngest population by far, with 91% being YOY. The riffles also contained 7% 1+ fish, 2% 2+ fish and no fish larger than 350mm.

The length-frequency of rainbow trout the sampled sections (Fig. 9) also follow the trends identifiable in the brown trout (Fig. 5). Larger fish can be found in the pools, while more juveniles are found in runs and riffles. Populations between the three sections are quite similar. More detailed analysis is not possible due to the small sample size.

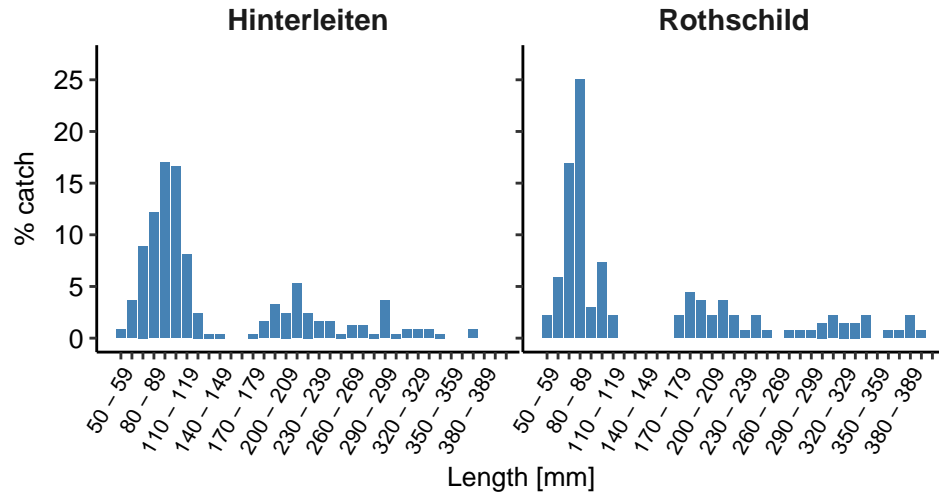


Figure 7. Length-frequency plot showing the difference in population structure of rainbow trout in two sections of the River Ois.

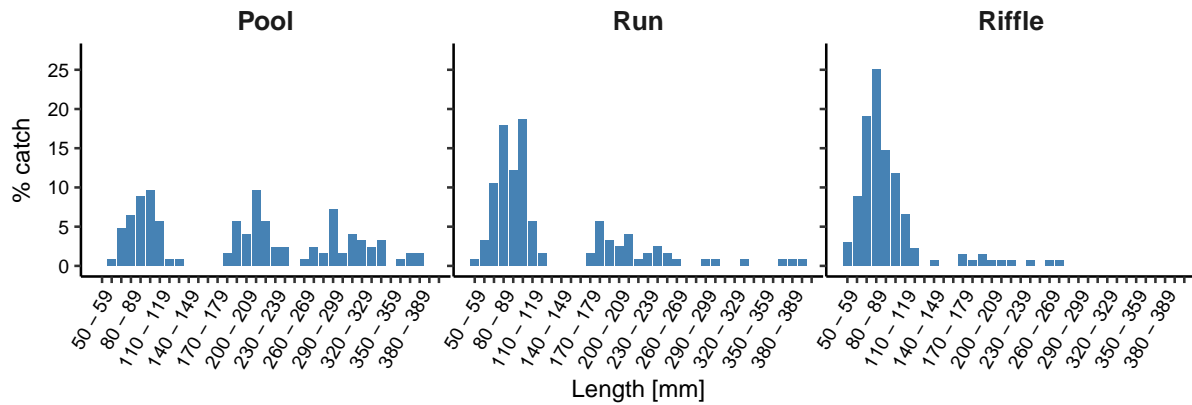


Figure 8. Length-frequency plot of rainbow trout populations in different meso-habitats of River Ois.

1.1.2 Abundance and Biomass

The sum of total catch for each sampled site was divided by the area sampling to calculate abundance and biomass. These values were then weighted according to the habitat distribution of the Hinterleiten and Rothschild sections. The ratio of mesohabitats can be seen in [Table 1](#).

Table 1. Habitat distribution among the river sections.

	Hinterleiten	Rothschild
mesohabitat	[%]	[%]
pool	30	10
run	27	50
riffle	43	40

The combined abundance and biomass of all salmonid species can be seen in [Fig. 10](#). The calculated abundance of the Hinterleiten was 2922 individuals per hectare. Of those individuals, 1299 could be found in riffles, 1016 in pools, and 607 in runs. The Rothschild

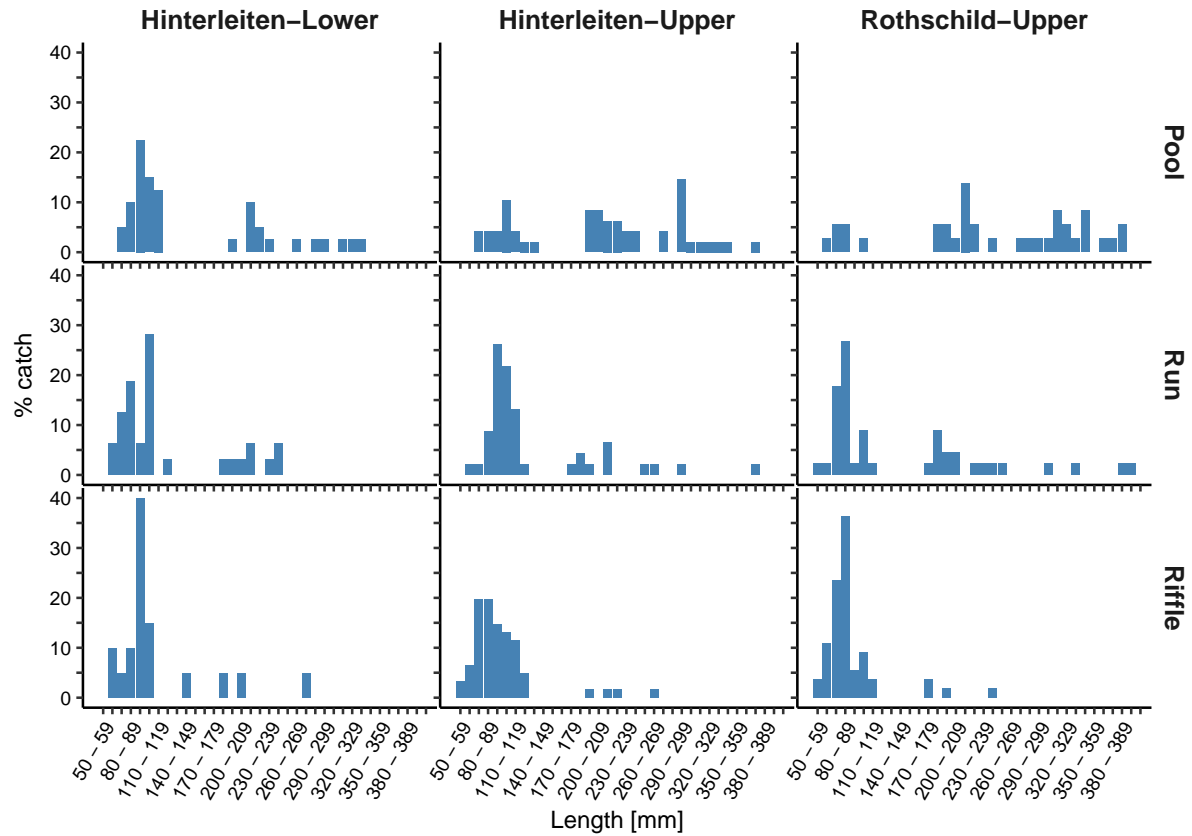


Figure 9. Length-frequency plots of rainbow trout in the 9 sampled sections.

had slightly less abundance at 2396 individuals per hectare. Of these, 1065 could be found in riffles, 777 in runs, and 553 individuals in pools. Due to habitat distribution, the Hinterleiten had a higher abundance than the Rothschild.

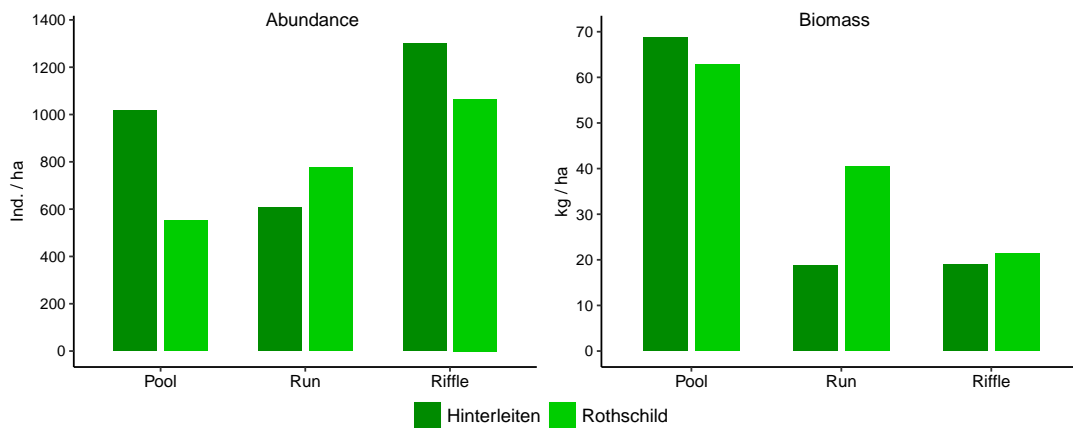


Figure 10. Weighted distribution of combined abundance and biomass of salmonid species in the mesohabitats of two sampled sections.

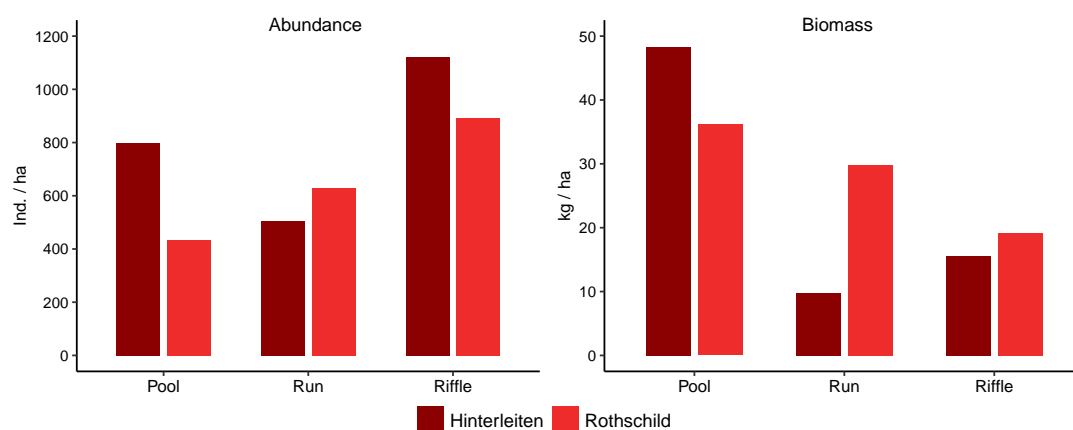


Figure 11. Weighted distribution of abundance and biomass of brown trout population in the mesohabitats of two sampled sections.

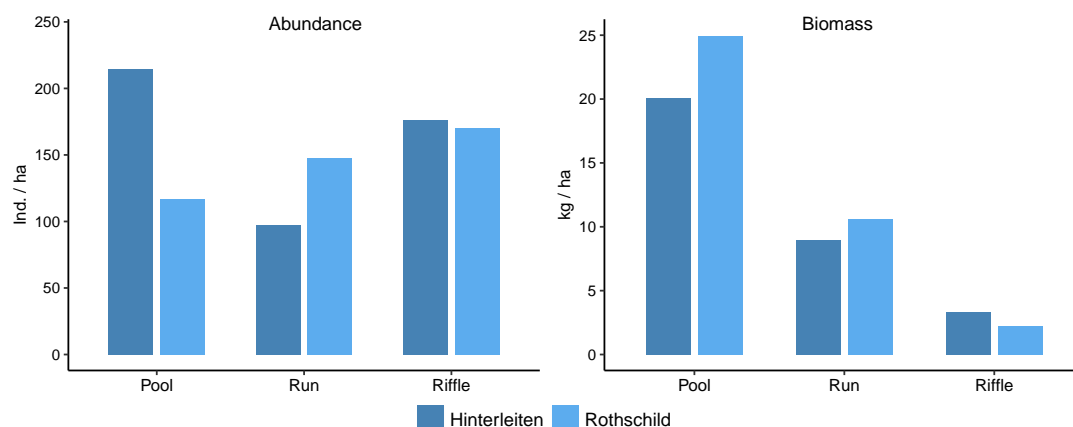


Figure 12. Weighted distribution of abundance and biomass of rainbow trout population in the mesohabitats of two sampled sections.

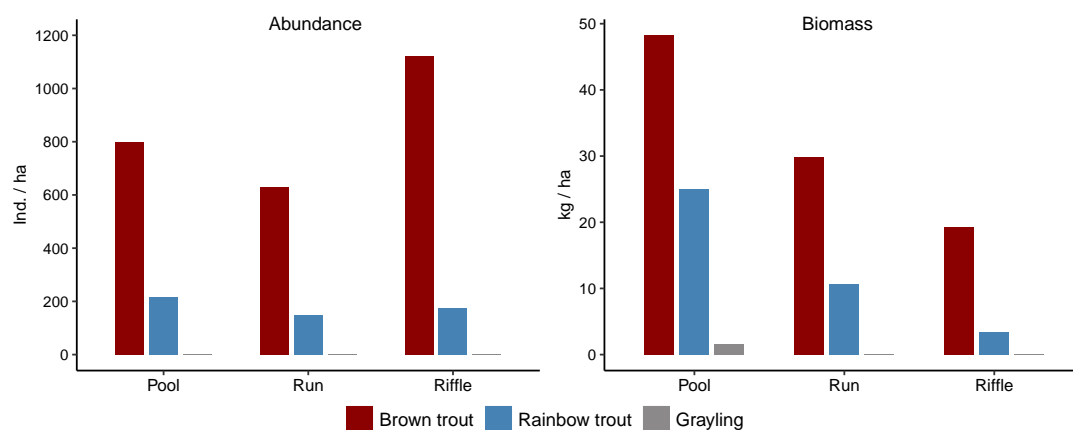


Figure 13. Comparison of the distributed abundance and biomass of salmonid species in mesohabitat components of the River Ois.

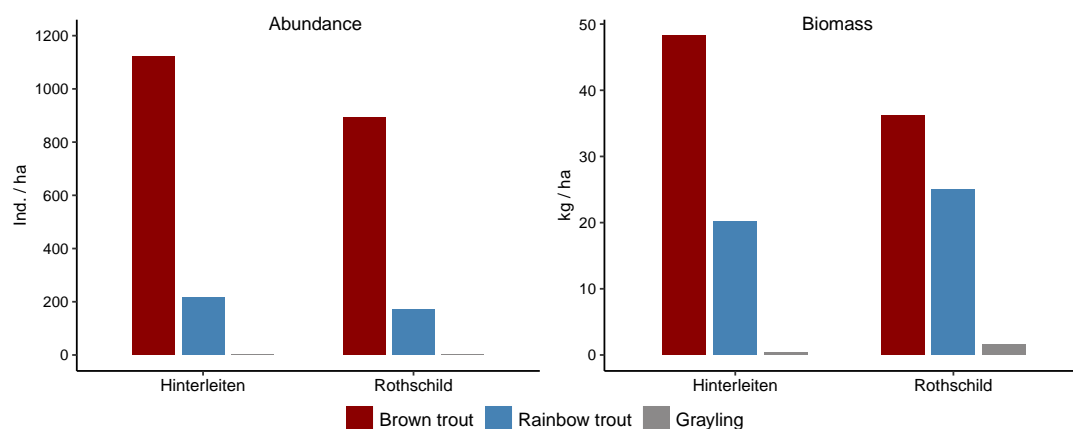


Figure 14. Comparison of distributed abundance and biomass of salmonid species in Hinterleiten and Rothschild sections.

Table 2. Habitat distribution among the river sections.

	Habitat.dis	Hinterleiten				Habitat.dis	Rothschild	
		Ind.ha	kg.ha	Ind.ha.dis	kg.ha.dis		Ind.ha	kg.ha
All Species	%					%		
Pool	30	3387	229.0	1016	68.7	13	4193	475.2
Run	27	2247	69.5	607	18.8	47	1661	86.5
Riffle	43	3022	44.3	1299	19.1	40	2644	53.3
Brown trout								
Pool	30	2661	160.8	798	48.3	13	3286	273.8
Run	27	1874	36.2	506	9.8	47	1346	63.8
Riffle	43	2606	36.2	1120	15.6	40	2213	47.7
Rainbow trout								
Pool	30	714	67.0	214	20.1	13	883	189.2
Run	27	360	33.2	97	9.0	47	315	22.7
Riffle	43	411	7.8	177	3.3	40	423	5.6
Grayling								
Pool	30	12	1.1	4	0.3	13	25	12.2
Run	27	13	0.1	3	0.0	47	0	0.0
Riffle	43	5	0.3	2	0.2	40	0	0.0