

## Evaluation of water temperature in the Bocegaj brook and in the Kolíňany pond in terms of fish life

Mária Babošová\*, Jana Ivanič Porhajašová, Patrícia Babčanová

<sup>1</sup>Slovak University of Agriculture in Nitra, Faculty of Agrobiological and Food Resources,  
Institute of Plant and Environmental Sciences, Slovak Republic

Article Details: Received: 2022-02-21 | Accepted: 2022-04-22 | Available online: 2022-09-30

<https://doi.org/10.15414/afz.2022.25.03.200-202>



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During 2014, water temperature of the Bocegaj brook and the Kolíňany pond and its impact on fish life were monitored. Water sampling was carried out at regular monthly intervals, in the period from January to October, from six sampling points. The four sampling points were located directly on the water surface of the pond, the last place being the outlet from the pond. In this time horizon, all four seasons alternated, which was also reflected in the change of the water temperatures. The lowest average value of water temperature was recorded in January (0.5 °C) and the highest in June (19.23 °C). The maximum values of water temperature depending on the sampling point during the monitored period were found in the open water area of the pond.

**Keywords:** water, temperature, fishes, brook, pond

### 1 Introduction

One of the most important physical factors influencing life processes in the aquatic environment is water temperature, which depends on several factors (Immerová, 2012). It is mainly affected by seasonal changes. In spring, the water heats up the slowest and in the autumn it cools down the slowest. Due to the different temperatures there is a seasonal stratification of the water. Water has different temperatures at different depths (Andreji et al., 2014). The temperature of water bodies in our latitude varies not only throughout the year, but also due to the alternation of day and night, depending on the geographical location and the surrounding vegetation. Water temperature significantly affects the longitudinal distribution of fish in watercourses. In general, the temperature tolerance of individual fish species varies at relatively small intervals, and lower temperatures tend to be better tolerated than higher ones. For our fish species the upper limit, at which fish will die, is at maximum of 37 °C and the lower is at minimum of 0.3 °C. The food activity, metabolism and the overall health of fish also depend on water temperature (Beracko et al., 2014).

The aim of the work was to monitor the water temperature in various sections of the Bocegaj stream and the Kolíňany pond at regular monthly intervals and to evaluate its impact on the life of the original fish species.

### 2 Material and methods

The village of Kolíňany lies in the erosive depression of the south-eastern outcrop of Tribeč and Žitava hills, to the southwest, about 10 km from the city of Nitra. The relief is wavy to slightly rugged, with an altitude of 170 to 356 m MSL. (Regional planning of Kolíňany village, 2010). The total area of the cadastral territory of the village is 1250 ha. The boundaries of the cadastral area are formed by agricultural land, in the north the border is formed by the Bocegaj brook, in the south by a 3<sup>rd</sup> class road, which connects Beladice and Hostšová. In the north and the south, the border is formed by the top parts of hills. Neighboring villages are Žirany, Jelenec, Pohranice, Čeladice and Hostšová.

The area is a part of the lucerne – barley – wheat region. Cereals such as barley, wheat and fodder predominate in crop production. The village is an important wine region. The total area of the agricultural land fund in the

\*Corresponding Author: Mária Babošová, Slovak University of Agriculture in Nitra, Faculty of Agrobiological and Food Resources, Institute of Plant and Environmental Sciences. e-mail: [maria.babosova@uniag.sk](mailto:maria.babosova@uniag.sk)

municipality represents 80% of the area of the cadastral territory, arable land represents 90% of the total area of the agricultural land fund.

The geological structure of the area of interest consists of Neogene formations, represented by Pannonian to Ponto sediments, represented by gravel, mostly calcareous clay soils, silt, sands, gravel, lignite strata and areas with freshwater limestones can also be observed. Kolíňanský vrch is a solitary protruding island made of Mesolithic arenaceous and encrinite limestones, with the occurrence of nodular limestones, its eastern part is formed by darker limestones and dolomites (source is missing).

The interest area Kolíňany is situated in the Nitra river basin. The most important stream is the Bocegaj brook, which springs above the village of Žirany, at the foot of the Cigáň hill. It is a right-hand sprout of the Drevenica water stream, a side stream of Žitava river. A small water basin is built on this stream, which spreads on 13 ha. Its main purpose is an accumulation of water for irrigation and is also used as an experimental fish farm. A wastewater treatment plant is built near the water reservoir (Magová, 2004). There are several occasional smaller water springs in the area of interest – Kolíňanský, Nádržný, Bratský, Kováčsky brook and Majer. These are branches of the Bocegaj brook.

Based on the climatic division, the area belongs to the warm climate area, with an average number of 50 summer days, with a temperature and dry lowland climate, with long, warm and dry summers, short and mild winters and short snow cover. The average air temperature is up to 10 °C and the average annual rainfall is 580 mm.

The area of interest is deforested and intensively used for agriculture. Forest areas have been largely replaced by arable land where the vegetation of agricultural monocultures is located. Compact forest areas have been preserved on Kolíňanský vrch. The southern slope of Kolíňanský vrch is deforested, there are vineyards and a military training ground, with permanent grassland.

There is a farmyard on the eastern edge of the village, which is managed by the university farm of SUA in Nitra. A biogas station of the Kolíňany university farm is also in operation (Regional planning of Kolíňany village, 2010).

### 2.1 Characteristics of sampling points

The sampling points were chosen so that the water temperature could be assessed as objectively as possible in terms of fish life. 6 sampling points were identified along the entire length of the stream:

1. sampling point: situated approximately 50 m in front of the WWTP, depth approximately 0.3 m.

The surrounding banks are overgrown with grassy vegetation, *Rosa canina* and *Salix alba*;

2. sampling point: located a few meters from the WWTP outlet. The main woody plants are *Salix alba* and *Rosa canina*. Significant water pollution can be observed here;
3. sampling point: the mouth of the stream into the pond. The banks are lined with reeds, willows and poplars;
4. sampling point: located on the north-western edge of the pond. In the surrounding area there are stands of common reed;
5. sampling point: is situated at the end of the pond. The shores of the pond are lined with poplars and willows;
6. sampling point: located below the mouth of the pond.

### 2.2 Sample collection and processing

Water samples were taken regularly at monthly intervals during 2014 during the months from January to October. The water temperature (°C) of the samples was determined using a digital thermometer.

The measured values were compared with the system of limit and recommended values, which are stated by the National Council of the Slovak Republic in Government Regulation no. 269/2010 Coll., In Annex no. 2 part C for the carp fish zone. In terms of fish farming, these values must not be exceeded, as the water would be unsuitable for fish farming and reproduction.

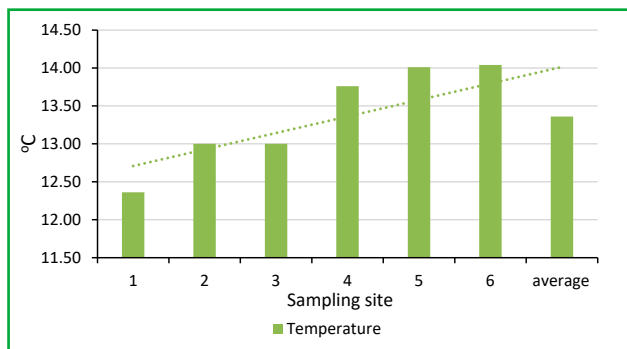
## 3 Results and discussion

According to Government Regulation no. 269/2010 Coll. for surface waters suitable for the life and reproduction of native fish species – for the carp water zone, the water temperature limit of 28 °C must not be exceeded. Based on the obtained results, it can be stated that during the monitored period, the limit value was not exceeded during any months or at any of the sampling points. The highest water temperature (22.1 °C) during the observed period was recorded in June at sampling point no. 6, which was situated below the mouth of the pond. In the same month, the highest average temperature (19.23 °C) for the entire length of the study was also recorded. The lowest temperature (0.40 °C) was detected in January, at sampling points located at the mouth of the stream into the pond (sampling point no. 3) and at the end of the pond (sampling point no. 5) (Table 1).

Depending on the sampling point, it can be stated that the water temperature usually increased gradually from the first to the last sampling point, where its highest average value was also recorded (14.04 °C). However, the most significant increase was found at the sampling point no. 2, which was located behind the wastewater

**Table 1** Water temperature (°C) depending on the sampling time

Month	Sampling site						
	1.	2.	3.	4.	5.	6.	average
January	0.60	0.60	0.40	0.50	0.40	0.50	0.50
February	7.10	7.10	7.00	6.90	7.30	7.20	7.10
March	9.70	9.80	9.90	10.10	10.10	10.20	9.97
April	14.70	14.60	14.20	14.40	14.50	14.60	14.50
May	16.10	16.20	16.00	16.10	16.20	16.30	16.15
Jun	16.10	16.50	17.90	21.10	21.70	22.10	19.23
July	16.80	16.80	17.10	18.30	18.90	18.80	17.58
August	12.30	17.60	16.90	18.50	18.80	18.60	17.12
September	16.90	17.30	17.20	17.80	18.10	17.90	17.53
October	13.30	13.50	13.40	13.90	14.10	14.20	13.73
Average	12.36	13.00	13.00	13.76	14.01	14.04	13.36



**Figure 1** Average water temperature (°C) depending on the sampling place

treatment plant. The highest average temperatures at the last three sampling points ranged from 13.76 to 14.04 °C (Fig. 1), probably due to the fact that it was an open water area of the pond and more sunlight fell there, hence water heats up faster (Immerová, 2012).

Increasing ambient temperature increases metabolic activity of fish, and eventually their oxygen consumption. As the oxygen concentration in the water decreases with increasing temperature, a high-temperature environment causes stress to most fish (Beracko et al., 2014). According to Košč (2008), higher water temperature also affects the speed of food digestion in fish. The intake and use of food in carp fish is in the range of water temperature from 7 to 30 °C. Temperature below 7 °C metabolism is reduced and the fish stop eating.

#### 4 Conclusions

The aim of the work was to monitor the water temperature in various sections of the Bocegaj stream and the Koliňany pond at regular monthly intervals

and to evaluate its impact on the life of the original fish species. During 2014, the water temperature was monitored in the brook Bocegaj and in the Koliňany pond, which belongs to the university farm of the Slovak University of Agriculture in Nitra. The water temperature varied depending on the time and location of collection. The lowest average value of water temperature was recorded in January (0.5 °C) and the highest in June (19.23 °C). Depending on the sampling point, the highest values of water temperature were in the sampling points located on the open water area of the pond, where the water warms up faster. In comparison with Government Regulation of SR No. 269/2010 Coll. For the carp water zone, the water temperature limit was not exceeded during the monitored period.

#### Acknowledgments

This research was supported by the grant project VEGA 1/0604/20.

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