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LAKES AND WATER RESERVOIRS IN THE CZECH REPUBLIC

M. Šobr, T. Pécs, F. Hartvich et al.: *Lakes and water reservoirs in the Czech Republic.* – Geografie – Sborník ČGS, 109, 2, pp. 189–196 (2004). – The paper provides information about the activities, work and results of the working group "Lakes and water reservoirs in the Czech Republic" during the Intensive Programme ERASMUS in August 2003 in Prague. First part of the article provides information about water reservoirs in the Czech Republic, the second describes the excursion to the Třeboň basin, and finally we present basic information about the youngest lake in the Czech Republic, Mladotické Lake, which we also visited during our field programme.
KEY WORDS: lakes – water reservoirs – ponds – Czech Republic.

1. Introduction

Under the Intensive Programme (29716-IC-1-2001-1-ERASMUS IP-5) Water management in transition countries, on the subject „Water resources in central Europe", the working group "Lakes and water reservoirs in the Czech Republic" analysed resources of slack water. The workshop activities can be divided into three areas of interest: large water reservoirs, south-bohemian ponds in Třeboň basin and an example of a natural, landslide dammed lake – Mladotické (Odlezelské) lake.

In the course of the seminary, many interesting lectures were given by the most prominent experts from scientific instituions as well as from Vltava River authority company. These lectures covered most of areas of current hydrological issues, concerning this working group's interests, including the occurrence and purposes of the valley water reservoirs, management of the fishponds, or the genetic typology of the lakes. Our field excursions were aimed at covering all three areas of interest, i.e. dams and large water reservoirs, of which we visited Štěchovice and Slapy reservoirs, fishponds in the Třeboň basin (excursion to the largest Czech pond Rožmberk) and Mladotické lake, where we took part in the field measurements.

2. Water reservoirs in the Czech Republic

There are in total 24 340 water reservoirs and fishponds within the territory of the Czech Republic, holding a total volume of 4,159 million m^3. Out of this number, there are 115 large reservoirs (in the year 2000), with a total volume of 3,521 million m^3.

The construction of the dams in the Czech Republic has been particularly intensive in the second half of 20th century, when the largest dammed lakes

were built. In the year 1945, there were only 41 dam reservoirs in Czechoslovakia, in the year 1975 their number increased to 100 only in the Czech Republic. Nowadays, the number of large water reservoirs is approximately 115.

The dam reservoirs have wide spectrum of uses and for the most part they are multifunctional. The most important uses are:

- water supply for the local population (for example w. r. Švihov on Želivka River, main source of drink water for Prague)
- water supply for the industry and energetics (w. r. Hněvkovice, providing cooling water for Temelín nuclear power plant)
- water power production (w. r. Orlík, with biggest peak water power plant)
- flood protection (w. r. Šance, w. r. Morávka in Beskydy)
- discharge regulation and retention of the water in the landscape (Vltava cascade)
- irrigation (w. r. Rozkoš in NE Bohemia)
- other uses (including fish-breeding, ship transportation and sports and leisure activities).

For illustration see Tables 1 and 2, showing the basic parameters of the most important water works. The largest dam reservoir in the Czech Republic by the water surface is Lipno I, with the area of 4 870 ha, followed by the dam reservoir Orlík, which holds the biggest volume of water (716.5 million m^3). The highest dam is the water reservoir of Dalešice, reaching the height of 99.5 m.

Apart from the large dam reservoirs, there are also water reservoirs of minor size, built for specific purposes, for example at present non-fuctional reservoirs for the floating of timber in Moravskoslezské Beskydy and in

Tab. 1 – Reservoirs with storage capacity superior to 100 million m^3 (after The Dams in Czech Republic, 2001)

Name	River	Year of completion	Capacity	Purpose
Orlík	Vltava	1963	716,5	H, C, I, R
Lipno	Vltava	1960	306	H, C, R
Nechranice	Ohře	1968	272,4	S, H, C, I, R
Slapy	Vltava	1957	269,3	H, C, I, R
Želivka (Švihov)	Želivka	1975	266	S
Slezská Harta	Moravice	1997	219	S, H, C, R
Nové Mlýny I, II, III	Dyje	1988	133,9	C, I, R, H
Dalešice	Jihlava	1978	127,3	H, R
Vranov	Dyje	1934	122,7	H, C, S, R

Tab. 2 – The most important water power plants in Czech Republic (after The Dams in Czech Republic, 2001)

Name	River	Year of completion	Capacity (MW)	
Dlouhé Stráně	Desná	1996	650	pumped storage
Dalešice	Jihlava	1978	450	pumped storage
Orlík	Vltava	1963	364	peak
Slapy	Vltava	1957	144	peak
Lipno	Vltava	1960	120	peak
Štěchovice II	Vltava	1949 (rehab. 1995)	45	pumped storage
Kamýk	Vltava	1963	40	peak
Štěchovice I	Vltava	1944	22,5	peak
Střekov	Labe	1936	19,5	run-of-river
Vranov	Vranov	1933	16,32	peak

Šumava or numerous multi-purpose reservoirs used mostly for the fire protection and recreation in towns and villages.

Our programme included a visit of two dams on the Vltava River. First, we visited the information centre of the Vltava cascade in Štěchovice, where we learned about the history of the building of the Cascade as well as about the course of the catastrophic 2002 floods on the dams. Then we absolved a guided tour in the peak water power plant with pumped storage in Štěchovice, which was still under repairs after the floods. Other goal of the trip was the dam Slapy, situated in the Vltava cascade above Štěchovice. This is one of the biggest dams in the Czech Republic, exceeding the height of 65 m and holding over 270 mil. m^3. The warden of the lake guided us inside the body of the dam and explained us, among other, the function of its stability measuring devices.

3. Ponds in the Třeboň basin

Small water reservoirs and ponds play very important role in the water circulation by improving the water infiltration and its retention in the landscape. Particularly the fishponds are being built since 12^{th} century and therefore they strongly influence the appearance of the country as well. As mentioned above, the participants of the IP Erasmus visited the Třeboň basin, one of the most famous and typical pond basins.

The Třeboň basin is located in South Bohemia, not far from the Austria border. Its surface is formed by a flat or only slightly undulated plain, reaching the altitudes between 403–550 m a.s.l. The basin is rich in both surface and groundwaters due to its geological structure, mostly consisting of layers of sedimentary rocks and crystalline rocks in higher elevations.

This region has been influenced by human activity for more than eight centuries. A particularly important phenomenon is the building of an extensive system of fishponds, shallow water basins of various size, artificial lakes with area ranging from 0,1 to several hundreds hectares. The ponds can be classified according to their water source:

- the sky ponds
- headwater ponds
- river and brook ponds.

The first group ponds are supplied only by the rainwater, which is rather soft and contains only small amount of mineral substances. The ponds, belonging to the second group, are fed by the spring water, localized either on the shores or on the bottom. The spring water may be significantly mineralised. The third category is the most common type, these ponds have the inflow of cool and well-oxygenated water from the water flows, which is suitable for the biota.

As a rule, people nowadays automatically connect the characteristic Czech landscape with ponds, scattered patches of forest and meadows, mixed with fields. This image can actually be found typically in Třeboň basin. Some of the ponds lie in the open countryside, while hills and forests embrace others, but they all have one thing in common: they are of antropogenic origin.

The Třeboň basin has a unique network of artificial canals, which fill and drain the fishponds used for local traditional fish breeding (particularly carps). There are nowadays 465 fishponds in the basin, covering total area of 7 484 hectares. The tradition of fish breeding that made the Třeboň region famous dates back for many centuries (Kuklík, Hrbáček 1984).

3. 1. History of ponds

The oldest fishponds were built almost 900 years ago. The first pond in Bohemia was constructed as early as in the year 1115 a.d. The oldest pond in southern Bohemia is Dvořište – founded in 1363 a.d. The building started with coming of the Christian monks, who founded several monasteries in the region. The development of the pond-building craft may be described on the example of the Třeboň basin. The first significant development of the pond building took place during the era of kings Jan Lucemburský and Karel IV., in the 14th century. Then the ponds mainly served as a drinking water source and also already for the fish breeding, securing thus the source of additional food.

During the Hussite wars, the development was temporarily suppressed. However, in the first half of the 15th century, under the reign of the Rožmberks (one of the mightiest noblemen family in Czech kingdom), it took a new direction. By 1450 a.d., there were only about 20 fishponds, with an area of 700 hectares. The turn of the 15th and 16th century and the 16th century was the busiest period of fishpond construction. By that time, in the regions with fertile soils the pond farming was abandoned (for example in the Elbe valley).

Famous names of important fishpond builders of this era include Štěpánek Netolický, Jakub Krčín, Mikuláš Ruthard (Janský, Šobr et al. 2003). The ponds Velký Tisý, Opatovický and Horusický were constructed by Josef Štěpánek Netolický under the reign of Duke Petr Vok of Rožmberk. However, Netolický´s paramount work was the Golden Canal (Zlatá stoka), which supplies water into the largest pond in southern Bohemia from the Lužnice River.

In the second half of the 16th century, Jakub Krčín of Jelčany became renowned for the construction of large-sized ponds and he also contributed to extension and modernisation of others (Dvořište, Opatovický etc.). Among other works, he constructed the pond Rožmberk (1590 a.d.), then the largest pond in Europe and currently the biggest pond in Czech Republic – with water area of 489 hectares (originally even 1 060 hectares).

The third famous developer and builder was Mikuláš Ruthard, who played an important role in the construction of the pond system near Chlumec. He supervised the construction of the ponds and became renowned for the building of the Staňkovský pond (1544 a.d.), which is the longest and deepest of the Czech ponds, and holds the biggest amount of water.

In the 17th century, especially after the Thirty Years War, pond fishing declined. At the end of the 18th century, during the reforms by Austrian emperor Joseph the second, the ponds had to give way to more profitable wheat growing. The beginning of the 19th century was a period of rapid pond drying in southern Bohemia and in the course of the years 1825–52 five large and twelve smaller ponds in the Třeboň basin were abandoned. However, some of them were renewed in the second half of the 19th century.

Aside from the Třeboň basin, many ponds are located in the České Budějovice basin, in Blatensko (southeast from Plzeň), in Polabí, and in the basins along the lower courses of the rivers Dyje and Odra. In total, there are approximately 21 000 ponds with an area of 49 000 hectares in the Czech Republic, out of which 40 000 hectares in Bohemia. Ten ponds with surface of more than 200 hectares are located in southern Bohemia. The ponds of similar size occur in other places in the Czech Republic only sporadically – lake Máchovo (north Bohemia), Nesyt (southern Moravia), Velké Dářko (north of Českomoravská highland) (Janský, Šobr et al. 2003).

Nowadays the main function of the ponds is the fish-production for profit, both for the Czech market and for the export. In Třeboň basin, the most of the fishponds are owned and operated by the joint-stock company Třeboň Fisheries. Some of the ponds have other uses as well, like flood-control and recreation (for example Máchovo lake).

Apart from these functions, the ponds play an important role in the protection of natural environment as well, some of the bogs and ponds are even protected as wetlands of international significance. There are many particularly protected areas, including two Ramsar Sites (Třeboň Fishponds and Třeboň Peatlands), five national natural reserves, 27 other small-scale protected areas and an European Ecological Network core area (Ševčík, Nedbalová 1995). The Třeboň Biosphere Reserve is a unique birdlife territory. In the core area as well as in the natural reserves and monuments within the buffer zone, many unique and endangered species occur.

Current problems of ponds include eutrophization, caused by intensive agriculture and fish-farming management (fertilizing, liming, large fish stocks), and siltation, which has been a problem since the 15th century due to heavy load of clayey material in the watercourses. During our excursion to the dam of Rožmberk pond, we discussed the situation on the pond in the course of 2002 catastrophic flood and the current ecological problems of the Třeboň basin ponds with the warden of the pond.

4. Mladotické (Odlezelské) Lake

Among the tasks of our working group were the field research and measurements, which we performed on our field trip to Mladotické lake.

The Mladotické (called also Odlezelské) lake is the youngest natural lake in the Czech Republic. It originated in the year 1872 after intensive rainfall,

Fig. 1 – Practical work on Mladotice Lake

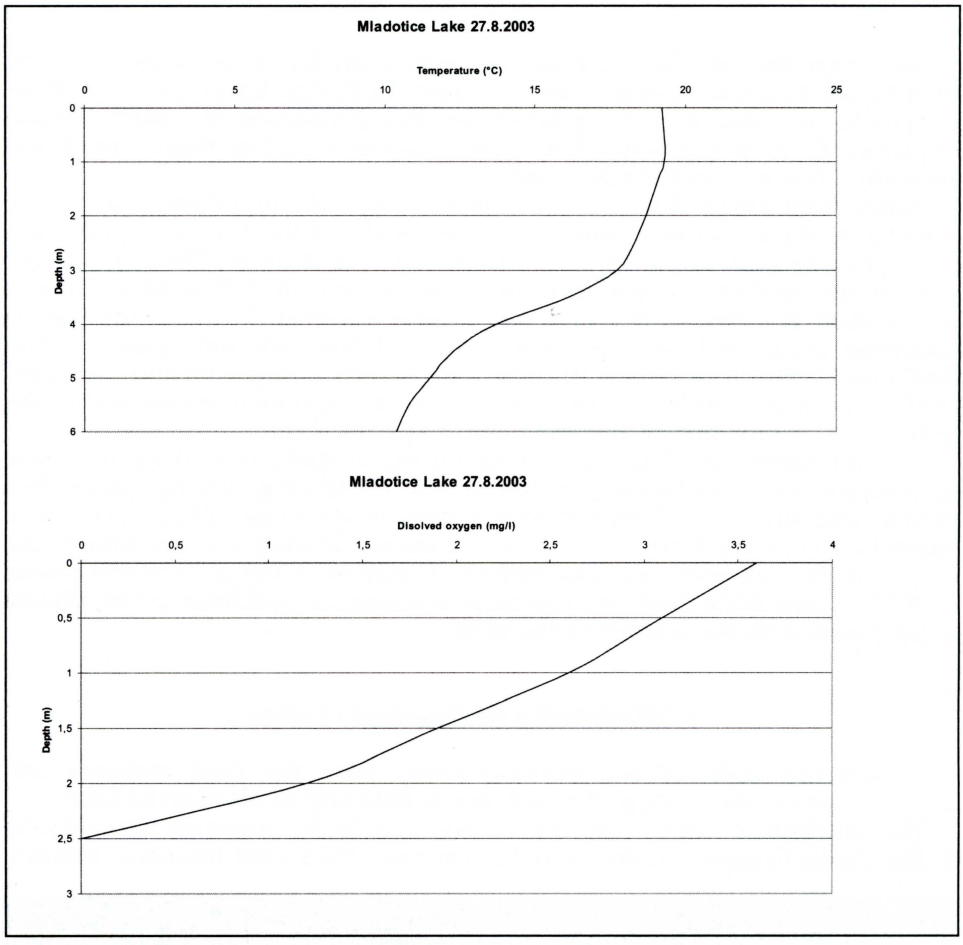

Fig. 2 – Vertical profiles of water temperature (typical summer vertical stratification) and dissolved oxygen (oxygen amount is measurable only to depth of 2,5 m)

when the valley of the Mladotický brook was blocked by a landslide. The brook-valley was dammed in the lenght of about 300 meters. Some basic parameters of the lake:

- surface area: 4,55 hectares
- maximum depth: 6,7 m
- maximum width: 80 m
- 12 villages in catchment area.

All results of research activities (Janský, Urbanová 1994; Janský 2003; Janský, Šobr et al. 2003) were presented during the field work The members of the Working Group took part in measuring of physical and biological characteristics of water quality (conductivity, temperature, transparency, water colour, dissolved oxygen, zooplankton – see fig. 1, 2). We discussed results of our observation and also current ecological problems (nutrification, siltation, and negative impact of agriculture) on the water ecosystem of the Mladotické Lake.

5. Conclusion

Under the Intensive Programme Water management in transition countries (on the subject „Water resources in central Europe") the Work Group Lakes and water reservoirs in the Czech Republic give informations about genetic types of slack waters. Our lectures and excursions was divided into three parts. Under the excursion to the central Bohemia participants saw Slapy and Štěchovice water reservoirs. There is a long tradition of geographic research of Mladotické (Odlezelské) Lake, which is phenomenal of origin. Participants of group Lakes and water reservoirs could see under the one-day excursion to catchement of lake all problems (nutrification, siltation etc.). Under the excursion to the South Bohemia participants gave lecture about fishponds in Třeboň basin direct to history and present problems.

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Shrnutí

JEZERA A PŘEHRADNÍ NÁDRŽE V ČESKÉ REPUBLICE

Článek podává informace o činnosti a výsledcích pracovní skupiny „Jezera a přehradní nádrže v České republice" v průběhu intensivního programu ERASMUS v srpnu 2003 v Praze. V první části se zabýváme problematikou přehradních nádrží, druhá část je věnována rybníkům v Třeboňské pánvi, v poslední části uvádíme základní informace o Mladotickém (Odlezelském) jezeru.

V průběhu IP Erasmus posluchači vyslechli několik přednášek, kde dostali informace o všech genetických typech jezer na území Česka. Zorganizovali jsme rovněž několik terénních exkurzí – přehrady Slapy a Štěchovice, Mladotické (Odlezelské) jezero a rybník Rožmberk v Třeboňské pánvi.

Na území Česka se nachází celkem 24 340 vodních nádrží a rybníků, které zadržují celkem 4,159 mld. m^3. Velkých nádrží je k roku 2000 evidováno 115, ty zadržují celkem 3,521 mld. m^3 vody. Nejvíce přehrad bylo postaveno po roce 1945. Přehrady mají různé funkce, většinou jsou víceúčelové. Slouží jako zásobárny pitné vody (Švihov), zásobárny vody pro průmysl (Hněvkovice), jsou na nich instalovány vodní elektrárny, plní protipovodňovou funkci, jsou regulátory průtoku vody v řekách, jejich voda je využívána na zavlažování a rovněž slouží k rekreačním účelům (sport, rybaření, koupání). Základní parametry některých našich vodních nádrží jsou v tabulkách 1 a 2 (Dams in Czech Republic 2000).

Intenzivní program zahrnoval návštěvu vodních děl Slapy a Štěchovice, které jsou součástí Vltavské kaskády. Účastníci programu se seznámili s funkcí Vltavské kaskády v době katastrofálních povodní v srpnu 2002.

Nejvýznamnější rybniční soustava v Česku se nachází v Třeboňské pánvi. První rybníky byly založeny ve 12. století, velký rozvoj rybníkářství nastal ve 14. století za vlády Karla IV. a v 15.–16. století. Nejznámějšími staviteli jsou Štěpánek Netolický a Jakub Krčín z Jelčan, kteří se proslavili stavbami Zlaté stoky resp. rybníka Rožmberk (Kuklík, Hrbáček 1984; Ševčík, Nedbalová 1995). V rámci exkurze do Jižních Čech jsme navštívili náš největší rybník Rožmberk (489 ha). Byli jsme seznámeni se současným ekologickým stavem a funkcemi jihočeských rybníků. Vyzdvižen byl též vliv celé rybniční soustavy na průběh povodně na Lužnici v srpnu 2003.

Mladotické (Odlezelské) jezero je nejmladším přírodním jezerem v Česku. Vzniklo přehrazením údolí Mladotického potoka mohutným sesuvem v důsledku intenzivních přívalových srážek v roce 1872. V době terénní exkurze s účastníky programu jsme prezentovali dosavadní výsledky výzkumu (Janský, Urbanová 1994; Janský 2003; Janský, Šobr et al. 2003). Rovněž jsme prováděli měření základních fyzikálních vlastností vody (průhlednost, teplota, vodivost, rozpuštěný kyslík) a odběry zooplanktonu (obr. 1 a 2). Rovněž jsme diskutovali současné ekologické problémy celého povodí.

Obr. 1 – Praktické práce na Mladotickém jezeře

Obr. 2 – Vertikální teplotní profil (typické letní zvrstvení) a rozpuštěný kyslík (rozpuštěný kyslík se vyskytoval pouze do hloubky 2,5 m); a – osa x – teplota (°C), osa y – hloubka (m); b – osa x – rozpuštěný kyslík (mg/l), osa y – hloubka (m).

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