ABSTRACT
In Hungary, tourism is an important economic and social activity. Leisure tourism is typically seasonal and highly dependent on water and climatic resources. Lake Balaton is one of the largest bodies of freshwater in Europe and the Lake Balaton Region is the oldest and most established holiday destination in Hungary. Lake Tisza, on the other hand, is a recently developed tourist destination; however, it does share one common characteristic with Lake Balaton: tourism is a dominant economic sector in both areas. Climate change impacts have been observed on both lakes and these changes significantly influence the development of tourism in the regions. This study, based on secondary research, observation and interviews, provides an overview of tourism development at Lake Balaton and Lake Tisza, and examines the major negative and positive impacts brought about by climate change.

KEYWORDS: Tourism, Climate change, Hungary, Lake Balaton, Lake Tisza

INTRODUCTION
Hungary is located in the heart of Europe, in the Carpathian Basin. It is a typical low-lying country: 73 per cent of its territory is flatland less than 200 meters above the sea level. The country is located at the frontier between the temperate continental and the Mediterranean climate zones, with complementary effects of the temperate oceanic climate.

In Hungary, tourism is an important economic and social activity. Leisure tourism is typically seasonal and highly dependent on water and climatic resources. The Lake Balaton Region is the oldest holiday destination in Hungary. The lake itself is a particularly significant attraction for Hungary, a country with no access to the sea. The Lake Tisza Region is a recently established tourist destination. Tourism is a dominant economic sector in both areas, with a significant
proportion of the local population being (over)dependent on its use. This dependence obviously makes tourism development and its environmental preconditions crucially important to these areas.

TOURISM AND CLIMATE CHANGE

Tourism is a major sector of the global economy, with global receipts from international tourism of US$464 billion in 2002. With a projected annual growth rate of 6.7%, annual international tourism expenditures are expected to surpass US$2 trillion by 2020 (1). Domestic tourism is many times more important than international tourism in terms of participation and economic activity. The magnitude of the implications of climate change for tourism will depend on the distribution and importance of the sector, and the characteristics of climate change (2,3).

When considering the impact of global climate on tourism a duality becomes apparent: on the one hand, tourist destinations and the tourism industry are potential victims of climate change. On the other hand, the industry contributes to global warming in various ways, the best known being the emission of greenhouse gases by road and air travel (4,5).

One critically important dimension of the tourism sector that will be sensitive to climate change is the length of the operating season. Any changes in season length have considerable implications for the short- and long-term viability of tourism and recreation enterprises (2,6,4,7).

In addition to changes in season length, climate change may have an impact on the availability and quality of the resource base upon which recreational activities depend. For example, below-average water levels reveal the sensitivity of water-based destinations to climate variability. Global warming is anticipated to modify many other ecosystems on which outdoor recreation depends.

THE STUDY AREAS: LAKE BALATON AND LAKE TISZA

Lake Balaton is the biggest freshwater lake in Central Europe. It is a typical shallow lake of 588.5 km² surface, 3.25 m average depth and 236 km shoreline length, with high sensitivity to the fluctuation of hydro-meteorological factors (1). In winter the lake is generally covered by ice. In summer the average water temperature is 23°C (8).

The water catchment area of the lake is approximately 5774 km². The main inflow is the Zala River at the south-western end, while the Sió-canal drains the water from the eastern basin into the River Danube. However, the most significant part of the lake’s water supply comes from two sources, the approximately 130 underwater springs, and precipitation in the form of rain and snow. The catchment area receives on average 621 mm of precipitation each year (9).

The existence itself of Lake Balaton is due to climate change: the lake was born about 21 thousand years ago as a consequence of the Last Glacial Maximum. As a particularly shallow lake, Lake
Balaton is a perfect indicator of the stability of the climate over the last 10,000 years. Without this climatic balance the lake would not have survived.

Lake Tisza is the second largest freshwater body in Hungary and the largest artificial lake in the country. The original Kisköre Reservoir was built in 1973, as part of the River Tisza flood control project, and its filling was finished in the 1990s. The completed reservoir - renamed as Lake Tisza - is 27 km long with a 127 km² surface. The River Tisza’s length within the reservoir is 33.6 km. Lake Tisza is also a typically shallow lake, with an average depth of 1.3 m and a maximum depth of 17 m. Unlike Lake Balaton, Lake Tisza contains several small islands of 43 km² total surface (10).

The development of the lake’s local ecology has been a gradual process and it has resulted in highly differentiated areas: swamps, shallow and deep water, and water inflow basins are all found in its mosaic structure. In the reservoir the share of macrophytes has been continuously growing compared to that of open water (10).

METHODS

Various research methods were used for the completion of this paper. Statistical data and qualitative information were gathered from secondary sources such as: the tourist authorities of the Lake Balaton and the Lake Tisza regions, the Hungarian Tourist Board, and various environmental agencies. Data collected from such sources were analysed in order to understand the current tourism situation in the study areas, and to comprehend the potential impacts of climate change on the lakes. The conclusions of impact assessment projects carried out by the authors in the Lake Balaton region were also applied to gain further evidence.

Information on tourism supply and on international and Hungarian tourism demand helped to visualize the responses of tourists and tourist enterprises to climate change. Secondary information was complemented by personal observation in both areas and by interviews with one tourism representative in each region.

RESULTS

It is obvious that natural features play a significant role in the destination choice of leisure tourists: sunshine and beach attract the majority of tourists all around the world (1). In Hungary, most domestic trips are made with the motivation of recreation, and a significant proportion of all foreign visits are also made by leisure tourists (11,9). The main destinations of pleasure seekers are lake resorts which are mostly visited during the summer.

Analysis shows that the two lakes significantly differ in size, population and popularity among tourists as well as in natural characteristics. Despite its artificial background and its unique situation as a paradise for motorboats and jet skis (the use of which are strictly forbidden on Lake Balaton),
today Lake Tisza is the wilder natural area. This difference in environmental characteristics and image is mostly explained by the history of the lakes' development: Lake Balaton is an almost 200 year old resort, while Lake Tisza was born only 30 years ago and has just recently become an established tourist destination. While today Lake Balaton is a classic water-based family destination for all generations who mainly look for passive enjoyment (although this market situation is slowly changing), Lake Tisza has attracted two very different segments since the beginning of its development: the physically active, more adventurous kind on the one hand, and the environmentally conscious ecotourist on the other.

TOURISM AT LAKE BALATON AND LAKE TISZA

Lake Balaton is a popular summer destination due to its warm, shallow water and sandy beaches. The lake is about an hour’s drive from Budapest and attracts approximately 1 million tourists each year, as well as day and weekend visitors. Registered tourists spend approximately 4 million nights around the lake annually. The magnitude of unregistered tourism is very difficult to estimate, but is considered to be substantial.

The peak season for tourism is short, comprising only eight weeks. The peak corresponds to the summer vacation period for schools in the sending countries, and to the period when the lake is warm and amenable for swimming. In practice, depending on the weather, the period of intense use is often shorter, only four or five weeks during July and August. During this time extremely high numbers of people visit the lake, and the destination becomes quite crowded (approximately 55% of all the visitors arrive during these summer weeks) (6). As a result, many commercial establishments are only economically viable during this short period, and are only marginally viable during the shoulder season. Seasonality, therefore, puts pressure on the infrastructure, facilities and establishments around the lake for a short time and leads to poor economic prospects during the off-season. While tourism brings jobs to the region, many cease at the end of the season. Even so, this seasonal employment remains very important for a region where most local communities are dependent upon tourism.

During the last decades Lake Tisza has become a popular holiday destination, especially among Hungarian tourists. The Kisköre reservoir has attracted visitors since its completion, as it compared favourably with the crowded and expensive Lake Balaton, the traditional holiday site. As a result of this popularity the more appealing "Lake Tisza" name was suggested, general and tourism infrastructure has been developed, and the government has designated the area an official tourist destination.

Lake Tisza consists of five water basins which offer different activities and services. The southern bays are mainly used for water sports and for beach activities, while the quiet backwaters are
popular for anglers, birdwatchers and all those who are interested in nature (12). This double profile makes the lake a very attractive destination, but it also leads to conflicts between users, especially between those who support and those who oppose the use of motor boats.

In 2001 the region experienced a 30 per cent growth in tourist numbers compared to 2000: nearly 60,000 guests spent approximately 300,000 nights at Lake Tisza. Foreign guests accounted for 25 per cent of all arrivals. The majority of Hungarian visitors (93 per cent) arrived from the neighbouring regions and Budapest (10).

CLIMATE CHANGE AT LAKE BALATON AND LAKE TISZA

Tourism at both lakes is dependent upon water quality and quantity. If the beaches are not attractive enough tourists turn elsewhere. Less demand means less income on both the individual and community level. Unfortunately, water characteristics are vulnerable to climatic factors, particularly to warming and precipitation.

Water quality is an ongoing concern for both lakes, and measures have been taken to reduce the loadings of phosphorus and to control direct pollution from nearby urban, rural and resort areas. Contamination from waterborne waste is not considered to be a major problem as all waste from sewers is treated and much of the treated water is not returned to the lakes. Turbidity remains a source of discomfort for many tourists, although it is mostly natural due to the shallow nature of the lakes. In warm years, algae is a major concern in Lake Balaton, with eutrophication and blooms causing distress to beach users in late summer (4). Lake Tisza, as a shallow lake, is also threatened by eutrophication, though the problem has not been as serious as in the case of Lake Balaton.

The chemical, physical and biological quality of the lakes’ water is measured by regional organisations of the Ministry of Environment and Water Management and the Ministry for Health, Social and Family Affairs in co-operation with the National Public Health and Medical Officers’ Service (13).

Excellent water quality at Lake Balaton indicates chlorophyll content lower than 25 mg/m³, while quality is unacceptable if the chlorophyll content exceeds 75 mg/m³. Warming increases the amount of algae present, which is an indicator of the development of chlorophyll-a concentrations. The presence of algae in the water has various effects: green colouring as a visual effect, perceived low quality as an impact on visitors’ satisfaction, and the development of allergic symptoms in cases of sensitivity as a health impact.

According to measurements carried out at 35 beaches during the summer of 2003, water quality at Lake Balaton was suitable for recreation (excellent at 22 beaches and satisfactory at 13 beaches) (13). According to perception research however, visitors in general are only moderately content with the quality of Lake Balaton’s water: in a recent survey, the average satisfaction value was 3.4
on a scale 1 to 5 (5 indicating the highest satisfaction) (11). This value is partly explained by the visual impact of algae. In addition, Lake Balaton is usually less transparent than any sea, due to sand particles that improve circulation but blur the water.

Water quality at four Lake Tisza beaches, as measured by the National Public Health and Medical Officers’ Service, generally improved during the period of 2001-2003. However, by the end of the 2003 season the quality of the water only proved acceptable at two beaches, due to the high summer month temperatures and to the impact of tourist use (14).

Another significant variable affecting tourism is the quantity of water in the lakes. As has already been mentioned, Lake Balaton’s major sources of water supply are precipitation, the Zala River, and underwater springs. In the case of Lake Tisza, due to its nature as a reservoir, water is steadily supplied by the River Tisza.

The water level of Lake Balaton has been regulated since 1977: it must be between 70 cm and 110 cm (measured at Siófok at 103.41 m above sea level). In case the water level rises above 110 cm, the Sió-canal is opened in order to protect the lakeshore resorts and infrastructure. However, in the last three years, water quantity has been continuously decreasing at Lake Balaton, so the canal has been closed since April 2000 (15).

During April 2003 water level was 70-71 cm, following an unusually low 40 cm in September 2002 and 54 cm in August 2001. While these figures are far from being the lowest ever measured, this is the first time in the history of recorded measurements that the lake has experienced three dry years in a row. Though it may be debated whether these unusual data are simply due to natural fluctuation or caused by global warning, the ecological and economic consequences prompted decision makers to consider possible solutions. Such interest has been expedited by the dynamic interaction between water quantity and quality: low water quantity allows algae to grow faster, mostly due to more light and higher temperature, leading to poorer water quality. In addition to ecological damage, a low water level may have long-term negative impacts on tourism, fishing and recreational boating (15).

Artificial water supply has been suggested as one possible solution to increase water level in the lake. At the moment this solution has been declared unfeasible by researchers, as the microbiological and chemical characteristics of most possible sources are too different than the lake’s water. In the future the development of a high quality control mechanism may make such water input feasible (although other questions may arise regarding the effect on the Little-Balaton wetland area, and on the artificial water supply source) (16).

Another idea is to construct large ponds along the Sió-canal (at the outflow of the water from the lake) that would serve as water reservoirs to store water for the dry periods. Obviously, this solution would involve huge construction costs and damage the natural environment of the area.
DISCUSSION
Climate change directly effects the natural supply of the Lake Balaton and Lake Tisza regions: temperature increase lengthens the season as late spring and early autumn also become suitable for bathing, but at the same time July and August may be uncomfortably hot for tourists. Water quality is directly affected, particularly through eutrophication and by threatening the lakes’ fish stock. Considering the man-made supply of the regions, temperature and water quality changes require effective and efficient co-operation between tourist businesses and local authorities. This may involve promotional activities, and/or development of less climate-dependent tourist services.
As a consequence of climate change, tourist demand is indirectly affected since changing natural resources either attracts different segments or discourages potential visitors to the lakes. However, if global warming similarly influences the Mediterranean region, some of the Southern European beaches may lose their competitiveness, and existing demand may turn toward Central and Northern European beach resorts.
At the moment, the impacts brought about by climate change are partly negative, such as decreasing water quality and quantity, and partly positive, such as longer seasons and increased demand from city dwellers for water-based escapes.
The responses of Lake Balaton and Lake Tisza differ to a certain extent. While eutrophication is already a relatively serious problem in the case of Lake Balaton, it is more aptly characterised as a threat than a present danger in Lake Tisza. Due to the different nature of the lakes, Lake Balaton suffers more from low levels of precipitation. Lake Tisza, as a reservoir, has a significant supply source which makes water level regulation an easier task. The ecosystems of both lakes are threatened by global warming, but Lake Balaton has experienced more serious ecological problems as non-endemic fish species are more apt to suffer from natural changes.

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