

**TOURISTIC AND RECREATIONAL USE
OF THE SHORE ZONE OF UKIEL LAKE
(OLSZTYN, POLAND)**

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Key words: lake, lake shores, shore accessibility, recreational impact, touristic use.

Abstract

Ukiel Lake (surface area 412 ha, maximum depth 43 m), the largest of the eleven lakes in Olsztyn, consists of four distinct basins, each with different environmental features. The presence of urban infrastructure, including a grid of streets, in the nearest proximity of the lake arises much interest in the recreational use of the lake. The present description of how the lake's shore zone around each basin is developed and managed relies on some observations gathered from monitoring the nature in the shore zone and access to the lake's water. The analysis of the actual use of the lake's tourist space was conducted on the basis of direct observations, including our assessment of the recreational pressure on the beaches, baths and near the water table. The results suggest that Ukiel Lake, owing to its size and diverse character, can be used for many different forms of recreation. Among the four basins, the most intensively developed and subjected to the highest recreational impact is Olsztyńskie Basin.

**TURYSTYCZNE I REKREACYJNE ZAGOSPODAROWANIE STREFY BRZEGOWEJ
JEZIORA UKIEL (OLSZTYN, POLSKA)**

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Słowa kluczowe: jezioro, linia brzegowa, dostępność strefy brzegowej, wpływ rekreacji, zagospodarowanie turystyczne.

A b s t r a k t

Jeziro Ukiel (powierzchnia 412 ha, głębokość maksymalna 43 m) jest największym z jedenastu jezior Olsztyna. Składa się z czterech wyraźnie wyodrębnionych plos o odmiennych warunkach środowiskowych. Obecność zabudowy miejskiej, a także sieci dróg, w tym krajowych, w bezpośrednim otoczeniu zbiornika wpływa na znaczne zainteresowanie jego rekreacyjnym użytkowaniem. W oparciu o monitoring uwarunkowań przyrodniczych strefy brzegowej i dostępu do lustra wody dokonano charakterystyki zagospodarowania brzegów poszczególnych plos jeziora. Analizę wykorzystania przestrzeni turystycznej przeprowadzono w oparciu o jej bezpośrednią obserwację, określając natężenie ruchu rekreacyjnego w obrębie plaż, kąpielisk i lustra wody.

Uzyskane wyniki wskazują, że dzięki swej wielkości i zróżnicowaniu budowy jezioro Ukiel może być wykorzystywane do różnorodnych form rekreacji. Płoso Olsztyńskie jest częścią jeziora najbardziej zagospodarowaną i poddaną największemu natężeniu ruchu rekreacyjnego.

Introduction

Lakes make up a significant tourism industry resource and their recreational function creates the main economic base for many lake areas and even whole countries (BRAGG et al. 2003, COOPER 2006). Lakes and lake shores have other economical, social and cultural functions as well, but above all they serve an ecological role. Lake shores represent characteristic transitional habitats between terrestrial and aquatic ecosystems (SCHMIEDER 2004). Most recreational activities take place on the lake shore or at least use the lake shore for access to the water table (TIKKANEN 2003, SCHMIEDER 2004). Lakeshore habitats and ecosystems are of significant importance to the total biodiversity of landscapes owing to their high structural diversity and the resulting variety of ecological niches but also because of their expanse (KAJAK 2001, SCHMIEDER 2004). However, human involvement may lead to deterioration of lake shores, especially if a lake lies in a densely populated area. In order to protect lakes and lake shores, responsible management is required, which will rely, among other things, on continuous monitoring of the status of lake shores.

Ukiel Lake, which lies in the Masurian Lake District (north-eastern Poland) and, more specifically, in Olsztyn (Figure 1), a town with a population of 176 thousand, is evidently an example of a lake subjected to strong man-made pressure. The Masurian Lake District is one of the major tourist destinations in Poland and the lakes are the foundation for development of the tourism industry in this region (LIJEWSKI et al. 2008, *New 7 wonders* 2011). Olsztyn, the capital city of Warmia and Mazury Province, has eleven lakes, of which Ukiel Lake is the largest (LOSSOW et al. 2005). The surface area of the lake is 412 ha (Table 1), and the shoreline is strongly developed (the shoreline development factor equals 3.14) with numerous inlets, bays and peninsulas. Some of the lake shore rises quite high above the water

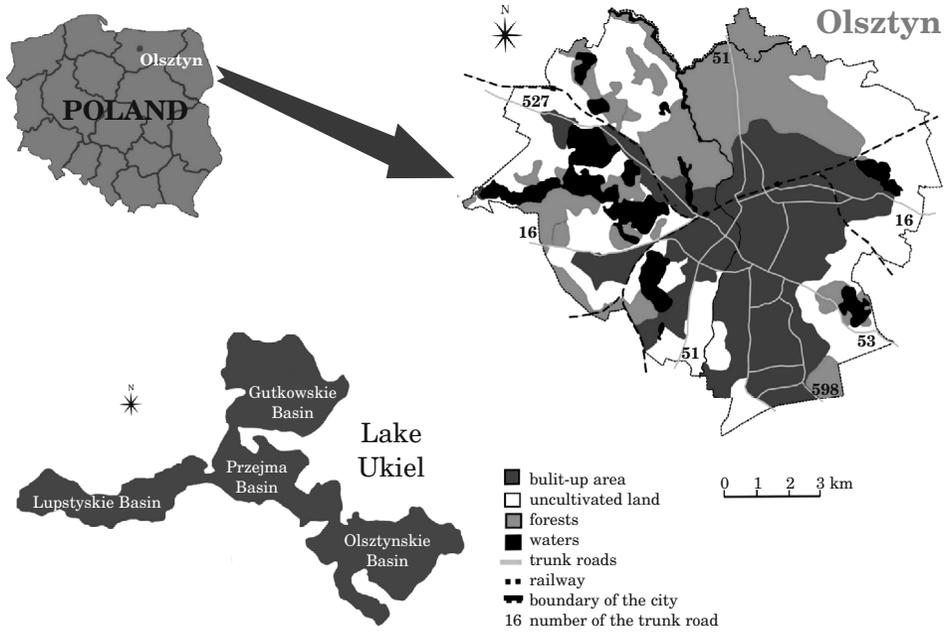


Fig. 1. Location of Olsztyn and Ukiel Lake

Table 1

Morphometric parameters of Ukiel Lake

Basin	Surface area [ha]	Maximum depth [m]	Average depth [m]	Lakeshore length [m]	Number of housing estates near lake shores
Olsztyńskie	120.4	20	7.0	6580.0	2
Gutkowskie	117.9	43	13.2	5187.8	2
Łupstyskie	85.4	32	10.1	4875.9	1
Przejma	84.9	41	12.7	5767.5	0
Ukiel Lake	412	43	10.6	22550	4

table, forming cliff banks up to 20 meters high. The natural watercourses supplying the lake with water are small streams, flowing through forests and fields. The Kortówka River is the only watercourse draining water from the lake. Ukiel Lake consists of four distinct basins, each with different environmental features (LOSSOW et al. 2005). The actual surface area of the lake's catchment basin is 1,675 ha, of which 62.7% is afforested, 21.6% is fallow land, 12.4% is arable land, 2.9% is developed and 0.4% is covered by surface waters. The drainage basin of the lake's basins Przejma and Łupstyskie is dominated by forests, whereas the catchment of the basins Gutkowskie and, especially, Olsztyńskie, are mainly developed areas or fallow land.

The presence of urban infrastructure, including a grid of streets, in the nearest proximity of the lake arises much interest in the recreational use of the lake. The main purpose of the present work has been to characterize the shoreline management and the actual use of the lake's tourist space.

Material and Methods

The present description of how the lake's shore zone around each basin is developed and managed relies on some observations gathered while monitoring the wildlife in the shore zone and the access to the water table around all the lake's basins. The method used for evaluation of the suitability of natural water bodies for angling was applied (SKRZYPCZAK 2005). Six properties (indices) were taken into consideration, as shown in Table 2, all of which define possible penetration of the shore line, not just by anglers but also by people pursuing other forms of recreation. The indices were assigned weights, which reflect varied importance attached to the possible recreational use of the lake shores. Four of these properties are termed stimulants, i.e. they identify the lake as more attractive and accessible; two are the so-called destimulants, which depress the lake's attractiveness and availability for recreation (Table 2). The preferences direction was made uniform by the method of a shift towards the maximum, thus changing destimulants into stimulants. Charac-

Table 2
Parameters of natural conditions of water bodies for performing the angling function
(SKRZYPCZAK 2005)

Property	Measure unit	Character of property*	Weight
Shoreline development factor (K) $K = \frac{L}{2\sqrt{2\pi P}}$ L – shoreline length, P – surface	value of factor	S	0.10
Shoreline with a 1–5 m wide belt of emergent plants	% of shoreline length	S	0.25
Shoreline with a > 5 m wide belt of emergent plants	% of shoreline length	D	0.10
Drainage basin (up to 100 m) afforested, with the groundwater level < 1.0 m	% of shoreline length	S	0.20
Drainage basin (up to 100 m) covered with boggy forests, wetlands and swamps	% of shoreline length	D	0.10
Access to water table – anglers' paths (point access) and line access (width 1–10 m – 1 point 11–20 m – 2 points 21–30 m – 3 points, ect.)	points/100 m of shoreline	S	0.25

* Character of the property in the sense of stimulating (S – a stimulant) or limiting (D – a destimulant)

teristics which acted as stimulants were standardized by dividing the value of the factor by the value of the reference point (standard). The highest values of the characteristics were taken as standards. Next, the standardized characteristics were multiplied by the weights of the factors, and the results were added up. This way, a synthetic measure was obtained, which is a weighted average of the standardized characteristics.

The data for computing values of the above measure for all the four basins of Ukiel Lake were collected during field measurements and observations with additional information found in relevant literature and from a map of the lake's bathymetry.

The analysis of the actual use of the lake's tourist space consisted of direct observations lasting from 25 July to 7 August 2007 and 2008, which additionally included the authors' assessment of the recreational pressure on the beaches, baths and the lake's surroundings. The observations covered six beaches (3 around Olsztyńskie Basin, and one around each of the other three basins). The observations were carried out every day from 12.00 to 2.00 p.m. On each occasion, the number of people relaxing on or near the beach as well as the number of people using all types of water equipment (paddle boats, canoes, yachts, motor-boats, etc.) were counted. The information about the water and air temperature was provided by the Water Emergency Service lifeguards, who take such measurements every day on guarded beaches.

Results

Gutkowskie basin has the most favourable conditions for the development of water recreation (the value of the measure 0.7; Table 3). It has the best access to the water table, owing to the fact that this lake's basin lies in the nearest vicinity of two housing estates and near a main road (Table 1, Figure 1). There is a continuous stretch of the lake's shore with good access to open water near the town's developed area (Figure 1, Figure 2). Further, 14 fishing jetties, 2 recreational piers and a beach were inventoried along this part of the lake's shoreline. About 46.5% of the shoreline is overgrown with a belt of helophytes (emergent plants), although the belt of vegetation is over 5 meter wide just along 16.5% of the shoreline (Table 3).

The second most favourable natural conditions for water relaxation purposes can be found around Olsztyńskie Basin (Table 3). This basin has a large share of afforested land along the shoreline (46.15%) and a belt of emergent aquatic plants (48.9%). It is also characterized by a high water accessibility index (3.37 points). The open water is accessible from about 31% of the shoreline (Figure 2). The longest section of the shore where the water table

Table 3
Parameters of the natural conditions and value of the synthetic measure for particular basins of Ukiel Lake with respect to the recreational functions

Property	Basin			
	Olsztyńskie	Gutkowskie	Łupstyskie	Przejma
Shoreline development factor (K)	1.70	1.36	1.50	1.78
Shoreline with a 1–5 m wide belt of emergent plants	24.0	30.0	15.8	16.4
Shoreline with a > 5 m wide belt of emergent plants	24.9	16.5	10.0	15.1
Drainage basin (up to 100 m) afforested, with the groundwater level < 1.0 m	46.1	21.8	31.2	64.5
Drainage basin (up to 100 m) covered with boggy forests, wetlands and swamps	0	0	0	0
Access to water table	3.37	3.94	2.47	1.6
Value of synthetic measure	0.65	0.70	0.57	0.60

Measure units as in Table 2.

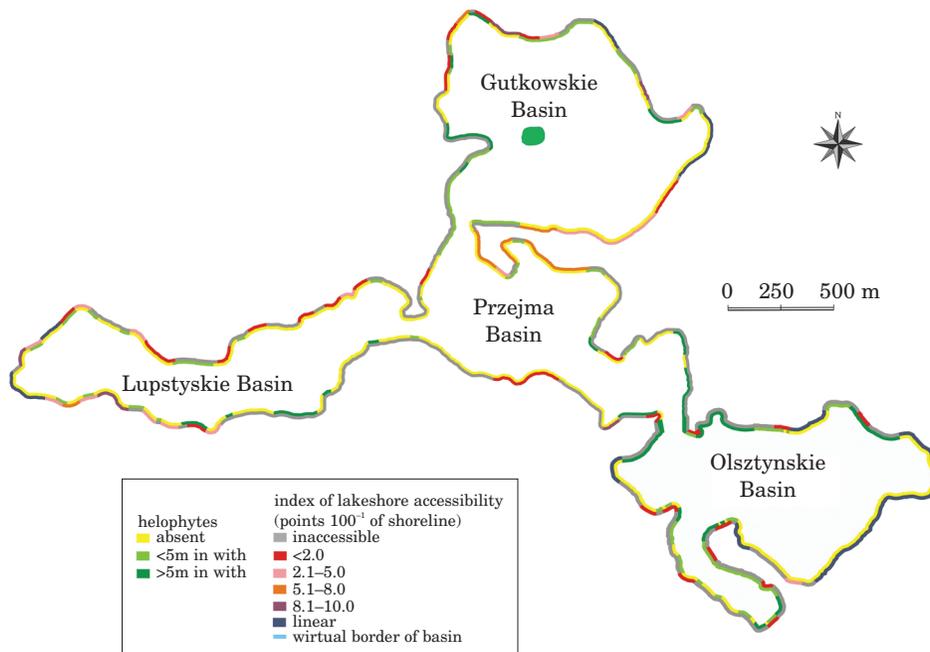


Fig. 2. Spatial distribution of emergent water plants and water table accessibility index values along the shoreline of Ukiel Lake

can be easily accessed by people (over 1,400 meters) is in the south-eastern part of the basin, where three beaches are located (including the largest one on Ukiel Lake, called the Municipal Beach). Other facilities located on the south-eastern shores of Olsztyńskie Basin are the water police base, the Volunteer Lifeguards Association base and three sports and recreation centres. Two other sports centres, a holiday centre with a water equipment rental and some water recreational facilities, such as 16 recreational and 9 angling jetties can be found around this basin of Ukiel Lake. Two housing estates and a main road are situated in the vicinity of this basin.

The basins Przejma and Łupstyskie have less easily accessible shores (Table 3). Access to the water table along some longer section of the shore can be found only near a housing estate by Łupstyskie Basin. There are also 12 fishing jetties and a small beach around this lake's basin. The fourth lake's basin called Przejma, where neither residential nor hydroengineering constructions can be found, has just one beach and over 64% of the shore zone is covered by forests. There is only point access to the water table (Table 2).

The rate of recreational movement during the analyzed period of time ranged from 0 to 4,366 persons (Table 4, Figure 3). It mainly depended on the weather and was higher in 2008 (Figure 3). The air temperature in 2007 ranged from 18 to 25°C, and water temperature varied from 18 to 19°C; in 2008, the respective temperatures were 19–29°C and 21–24°C. In 2008, there were more sunny, rainless days. More people tended to arrive at the lake

Table 4

The intensity of recreational traffic at Ukiel Lake

Observation time	Number of visitors					
	beaches and baths		water table		total	
	mean (\pm SD)	range	mean (\pm SD)	range	mean (\pm SD)	range
Weekdays	455.3 (\pm 543.2)	0–1902	65.2 (\pm 63.6)	0–208	520.5 (\pm 589.2)	0–2022
Weekend	1485.0 (\pm 1730.0)	8–4094	114.6 (\pm 100.8)	16–272	1599.6 (\pm 1801.6)	26–4366
Total	749.5 (\pm 1099.1)	0–4904	79.3 (\pm 77.5)	0–272	828.8 (\pm 1154.2)	0–4366

during weekends (mean 1599.6 persons) than on weekdays (mean 520.5 persons). One reason is that more events, e.g. sailing regattas, beach ball games or outdoor concerts, are organized at weekends, and they can attract more people, despite possibly worse weather conditions. On average, about 90% of the visitors stayed on the beaches; around 10% used all kinds of water equipment, mainly paddle boats and canoes (over 70%).

The recreational movement is mainly oriented towards Olsztyńskie Basin, where over 93% of all visitors come to relax (Figure 3), with 91% choosing the

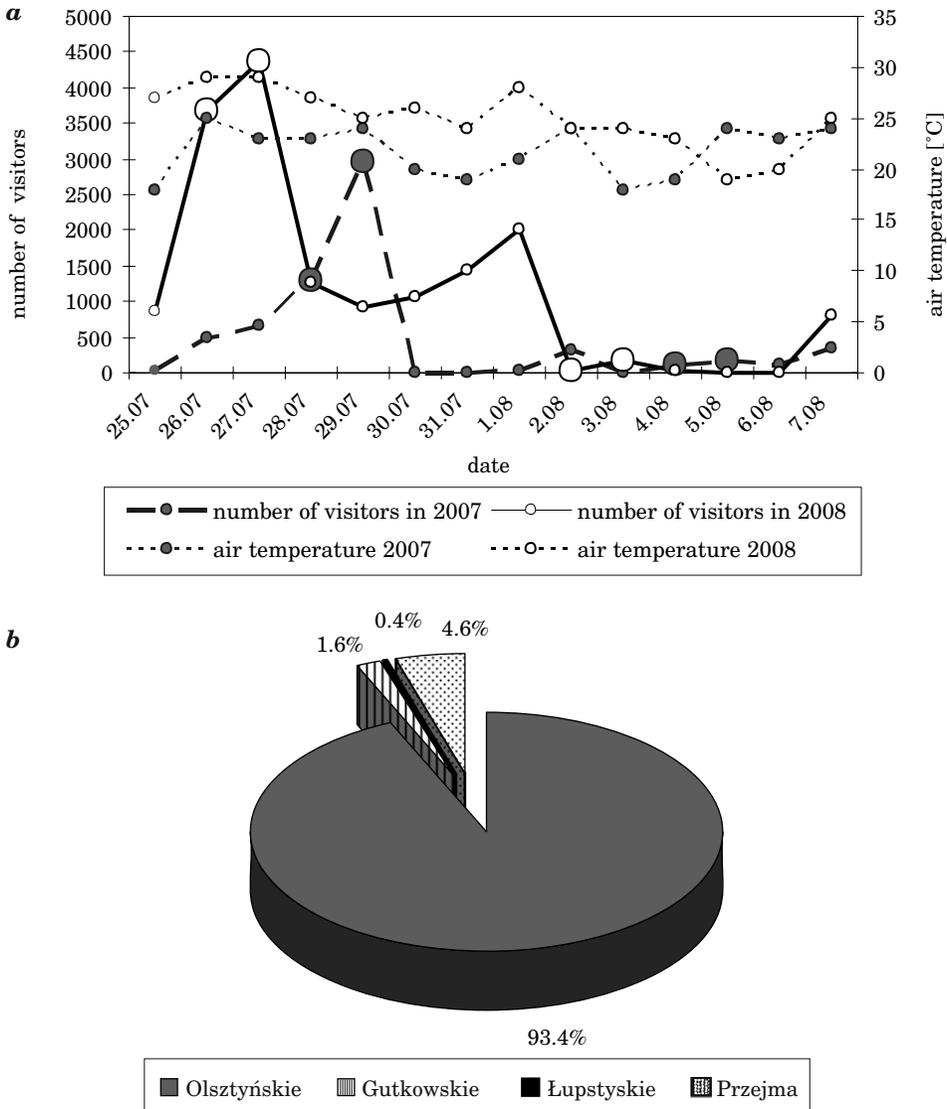


Fig. 3. The intensity of recreational traffic at Ukiel Lake: *a* – number of visitors resting by Ukiel Lake and the air temperature during the study. Large points stand for weekends, *b* – spatial distribution of recreational traffic rates around Ukiel Lake

Municipal Beach. Most of the events take place on the Municipal Beach because it has the best sports and recreational facilities. Likewise, most people using water sports equipment stay on Olsztyńskie Basin, where they can rent boats. The second most popular beach is the one by the basin called Przejma (4.6%). This beach owes its popularity to its location – near forests and far from

urban compact development. The other two basins, Gutkowskie and Łupstyskie, are only marginally developed to serve recreational purposes and consequently are visited mainly by residents of the nearby housing estates.

Discussion

For water tourism and recreational use, the most suitable are large water reservoirs, covering over 100 ha, where many forms of water recreation are possible and which lend themselves to sailing (LIJEWSKI et al. 2008). Other factors which enhance the recreational attractiveness of lakes are presence of forests on lake shores, easy access to shores and good transport accessibility (DEDIO 1989, DEJA 2001). The results of our study suggest that Ukiel Lake, owing to its size and diverse character, can be used for many different forms of recreation (Table 1, Table 3, Figure 2). It is a lake with a well-developed shoreline, moderate water plant growth of the shores (37.6%) and a large share of afforested catchment basin (62.7%). It also possesses quite well developed tourist amenities (6 larger beaches, 6 sports and recreation centers). The fact that the lake lies in a town means that it is easily accessible, e.g. by public transport. The most easily accessible are the basins Gutkowskie and Olsztyńskie (Table 3, Figure 2). Because of its location inside a town, Ukiel Lake experiences recreational pressure not just during the summer season but all year round.

Lakes are vulnerable ecosystems, sensitive to changes caused by tourists and holidaymakers, and the type and extent of such changes are a function of the type and variety of tourist uses, the number of people who use the lake for recreation and the natural surroundings (COOPER 2006, HALL and HÄRKÖNEN 2006). All parts of Ukiel Lake can be classified as holomictic (dimictic) and eutrophic water bodies (LOSSOW et al. 2005). The trophic status increases from the least eutrophic Gutkowskie Basin, through Przejma and Olsztyńskie to the basin called Łupstyskie. Among the four basins, Olsztyńskie Basin is the most intensively developed and subjected to the highest recreational pressure (over 93% of all visitors, 3 beaches, 5 sports and recreation centers). At the same time, Olsztyńskie Basin is the least resistant to degradation (low average depth, small volume of the hypolimnion), whereas the other basins have better natural conditions (LOSSOW et al. 2005).

Because of the highly diversified use of lakes and their basins (e.g. water supply, fishing, transportation, agriculture, housing), and a variety of water recreation activities, it is difficult to assess the actual influence of tourist and recreational activities on changes in the natural environment. According to LOSSOW et al. (2005) recreational activities near or on Ukiel

Lake are responsible for around 3.3% of the external nitrogen load and 4.5% of the external phosphorus load reaching the lake. However, the changes are not limited to the inferior water quality but can also be noticed in the shore zone and littoral of lakes, that is the two components of the lake's environment which are most attractive and therefore most intensively used by holidaymakers (LIDDLE and SCORGIE 1980, COOPER 2006). It has been demonstrated that around 10% of the shoreline of Ukiel Lake is used for recreation, but the percentage goes up to 30% when Olsztyńskie Basin alone is considered. Such strong and continually increasing recreational pressure, exacerbated by the lack of a management plan based on good knowledge of the lake's environment, may lead to the degradation of Ukiel Lake.

SCHMIEDER (2004) emphasizes lack of information about the shoreline of lakes, while OSTENDORP (2004) suggests that principal quality components in the system for evaluation of the quality of lake shores that he is developing (the Integrated Lakeshore Quality Assessment) should comprise "forms and intensities of human activities in the lakeshore zone". To determine the impact of tourism on lake shores it is necessary to identify areas in the land water interface that were developed for the purpose of tourist accommodation, active recreation and other areas serving functions related to the tourism industry (FURGALA-SELEZNIOW et al. 2010). According to the World Lake Vision Committee (2003) "decision making for lake management should be based on sound science and best available information".

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References

- BRAGG O.M., DUCK R.W., ROWAN J.S., BLACK A.R. 2003. *Review of methods for assessing the hydromorphology of lakes. Report for Scotland and Northern Ireland Forum for Environmental Research* (SNIFFER), www.sniffer.org.uk, pp. 138, access: 14.09.2011.
- COOPER CH. 2006. *Lakes as tourism destination resources*. [In:] *Lake Tourism. An integrated approach to lacustrine tourism systems*. Eds. C.M. Hall, T. Härkönen. *Aspects of Tourism*, 32: 27–42.
- DEDIO T. 1989. *Atrakcyjność jezior obszaru młodoglacjalnego dla rekreacji (na przykładzie jezior Polski Północno-Zachodniej)*. *Przegląd Geograficzny* LXI(1–2): 77–96.
- DEJA W. 2001. *Przydatność rekreacyjna strefy brzegowej jezior Polski*. Bogucki Wyd. Nauk. S.C., Poznań, pp. 64.
- FURGALA-SELEZNIOW G., SANKIEWICZ D., SKRZYPCZAK A., MAMCARZ A. 2010. *The impacts of tourism and recreation on lake shores: a case study of Limajno and Stobajno Lakes in north-eastern Poland*. [In:] *Lake Tourism Research. Towards Sustaining Communities – and – Lake Environments. Occasional Research Publication*. Eds. N. McIntire, R. Koster, H. Lemelin. Lakehead University, Centre for Tourism & Community Development Research, Thunder Bay, Canada, pp. 99–111.
- HALL C.M., HÄRKÖNEN T. 2006. *Lake tourism: an introduction to lacustrine tourism systems*. *Aspects of Tourism*, 32: 3–26.
- KAJAK Z. 2001. *Hydrobiologia – limnologia. Ekosystemy wód śródlądowych*. Wyd. Nauk. PWN, Warszawa, pp. 360.

- LIDDLE M.J., SCORGIE H.R.A. 1980. *The effects of recreation on freshwater plants and animals: a review*. Biol. Conserv., 17: 183–206.
- LJEWski T., MIKUŁOWSKI B., WYRZYKOWSKI J. 2008. *Geografia turystyki Polski*. PWE. Warszawa, pp. 384.
- LOSSOW K., GAWROŃSKA H., MIENTKI C., ŁOPATA M., WIŚNIEWSKI G. 2005. *Jezióra Olsztyna – stan troficzny, zagrożenia*. Wyd. „Edeycja”, Olsztyn, pp. 155.
- New 7 wonders of nature* 2011, www.new7wonders.com, access: 14.09.2011.
- OSTENDORP W. 2004. *New approaches to integrated quality assessment of lakeshores*. Limnologica, 34: 160–166.
- SCHMIEDER K. 2004. *European lake shores in danger – concepts for sustainable development*. Limnologica, 34: 3–14.
- SKRZYPCZAK A. 2005. *Ocena przydatności rekreacyjnej naturalnych zbiorników wodnych dla wędkarstwa*. Folia Turistica, 16: 115–129.
- TIKKANEN I. 2003. *Classification of lake tourism activities in Finland: a resource approach*. [In:] *International Lake tourism Conference 2–5 July, 2003*. Ed. T. Härkönen. Savonlinna, Finland, pp. 287–303.
- World lake vision committee*. 2003. *World lake vision. A call to action*. International Lake Environment Committee. World Lake Vision, <http://www.ilec.or.jp/eg/wlv/index.html> 38 pp, access: 14.09.2011.