

# Possible role of beavers in contamination of the Masurian Lake District water (north-eastern Poland) with *Cryptosporidium* spp. and *Giardia duodenalis*

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## INTRODUCTION

Parasitic protozoa *Cryptosporidium* spp. and *Giardia duodenalis* may pose a serious threat to the human and animal health. An important source of these parasites may constitute a recreational water, such as in the areas attractive to tourists, the Masurian Lake District (Poland).

The aim of the study was to assess the contamination of lake water with zoonotic parasites *Giardia duodenalis* and *Cryptosporidium* spp. and the possible influence of beavers on spread of these parasites.

## MATERIAL & METHODS

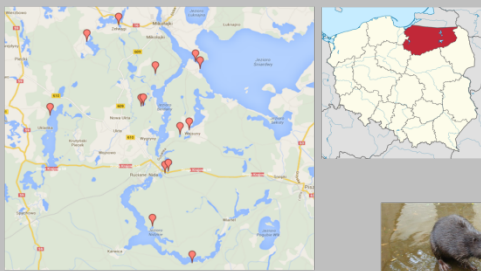


Fig. 1 Masurian Lake District - area of the study



A total of 79 water samples were taken around the habitats of beavers from 14 localities situated in the recreational Masurian Lake District (north-eastern Poland) (Fig. 1).

Water was sampled in the spring and autumn seasons, at different distances from beavers' lodges (0-2, 10, 30, and 50 m) (Fig. 2).

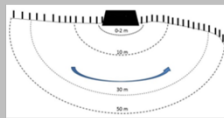


Fig. 2 The zones of water sampling near the beaver lodge

Water samples (50 L) were filtered, next, immunomagnetic separation (IMS) and Direct Fluorescence Assay (DFA) were performed (based on US EPA Method 1623) for the presence of (oo)cysts of *Giardia duodenalis* and *Cryptosporidium* spp. IMS product was tested by nested and real time PCR, following by initial (oo)cysts disruption by freezing (liquid nitrogen) and warming cycles, and DNA extraction.

## RESULTS

**DFA results.** Overall, among 79 water samples examined in DFA, in 36 of them (45.6%) the low amounts of *Cryptosporidium* oocysts were observed, while in 26 samples (32.9%) more numerous cysts of *Giardia* were found. The presence of both parasites was found in 12 samples (15.2%).

**Seasonal dependence.** The amount of *Giardia* cysts in samples collected in spring was approximately 3 times higher than in autumn. Conversely, a larger number of *Cryptosporidium* oocysts were detected in samples collected in autumn than in spring (Fig. 3, 4).

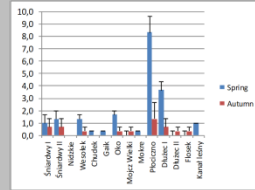


Fig. 3. Seasonal dependence of *Giardia* cysts recorded by DFA (mean, SD)

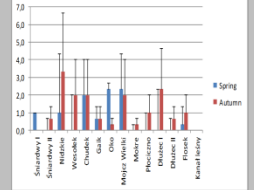


Fig. 4. Seasonal dependence of *Cryptosporidium* oocysts recorded by DFA (mean, SD)

The numbers of *Giardia* cysts significantly decreased with the distance from beavers' lodges while the numbers of *Cryptosporidium* oocysts did not show such dependence (Tab. 1).

Table 1 Densities of the parasites per 100 L water detected by DFA in selected sampling zones (mean values  $\pm$  SD for spring and autumn)

Zone	<i>Giardia</i> cysts	<i>Cryptosporidium</i> oocysts	Total (oo)cysts
0-2 m	15.3 $\pm$ 25.4	11.6 $\pm$ 8.1	13.5 $\pm$ 18.6
10 m	18.8 $\pm$ 46.3	12.5 $\pm$ 19.7	15.7 $\pm$ 35.0
30-50 m	5.0 $\pm$ 8.2	19.4 $\pm$ 23.7	12.2 $\pm$ 18.8

Table 2 Densities of *Giardia* and *Cryptosporidium* (oo) cysts in water of individual localities estimated by DFA

Locality	Density of <i>Giardia</i> cysts per 100 L	Density of <i>Cryptosporidium</i> cysts per 100 L	Total density of (oo)cysts per 100 L
Śniardwy (A)	37.0	22.2	59.2
Śniardwy (B)	44.4	14.8	59.2
Nidzkie	0	96.2	96.2
Wesołek	37.0	44.4	81.4
Chudek	7.4	88.8	96.2
Gaik	7.4	29.6	37.0
Oko	44.4	59.2	103.6
Mojcz Wielki	7.4	96.2	103.6
Mokre	7.4	7.4	14.8
Płociczno	214.6	22.2	236.8
Dłużec (A)	96.2	51.8	148.0
Dłużec (B)	7.4	14.8	22.2
Fłosek	7.4	29.6	37.0
forest's watercourse	7.4	0	7.4
Mean $\pm$ S.E.	37.5 $\pm$ 15.3	41.2 $\pm$ 8.8	78.7 $\pm$ 16.3

By PCR, *Giardia* DNA was found in 38 samples (48.1%), whereas DNA of *Cryptosporidium* was found in only 7 samples (8.9%). Sequence analysis evidenced *Giardia* isolates belonging to zoonotic assemblages: A and B.

## CONCLUSIONS

- Results of study showed water contamination with (oo)cysts of *Giardia duodenalis* and *Cryptosporidium* spp. in the tested region of Poland and indicates a need for implementation of appropriate preventive measures to protect tourists' health.
- Detection of these parasites in the vicinity of beavers' lodges may also confirm the potential role of beavers as a reservoir of these parasites.



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