



## Project Summary

# Occurrence of *Giardia* in Connecticut Water Supplies and Watershed Animals

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The main objective of this research was to study the occurrence of *Giardia* in selected water supplies and watershed animals in Connecticut.

During the period from October, 1979 to October, 1980, water samples were collected monthly using the U.S. Environmental Protection Agency (EPA) *Giardia* sampling method at selected water utilities and analyzed for *Giardia* cysts. Additionally, samples were analyzed for total coliforms, fecal coliforms, standard plate count, yeast, turbidity, and pH.

Fecal specimens were collected from beaver, deer, squirrel, muskrat, and racoon if these animals were found on the watershed. Descriptions of the watersheds involved in this study included size, type, recreation, human inhabitation, historical water quality data, known sources of contamination, efforts to protect watershed, and species and population estimates of the watershed animals.

Correlations of the presence of *Giardia* cysts with the collected water quality data were not successful because no *Giardia* cysts were detected on the *Giardia* sampling filters.

Six out of 413 fecal animal samples collected on the reservoir watersheds were found to be positive for *Giardia*. Collection of fecal samples from trapped animals yielded a higher percentage of *Giardia* positives than those collected from live animal droppings.

Yeast was found more often in raw water samples than in treated water samples.

*This Project Summary was developed by EPA's Health Effects Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).*

### Introduction

The purpose of this study was to determine the presence of *Giardia* in selected water supplies and in specific animals found inhabiting the watersheds of these water supplies. Four hundred and thirteen animal fecal samples were collected and tested for *Giardia* during the 12-month study period. One hundred and forty-four sampling filters were collected and examined using the EPA large volume sampling method for *Giardia* cysts.

Water quality parameters including chlorine residual, total coliforms, fecal coliforms, standard plate count, pH, temperature, and turbidity were obtained from samples taken before and after the *Giardia* sampling unit was on-line. Yeast samples were taken after the *Giardia* samples were collected. If *Giardia* was found on the sampling filters, correlations with the other water quality parameters would be determined.

### Background

Very little information is known about the presence of *Giardia* in water supplies or in watershed animals in Connecticut. Similar studies to this one have been

conducted in the State of Washington where *Giardia* was found to be a common intestinal parasite of beaver and muskrat. The presence of *Giardia* would indicate a potential health hazard to the consumers of unfiltered surface water supplies in Connecticut and show *Giardia* to be potentially a widespread problem in public water supplies. Numerous outbreaks have been documented implicating *Giardia* in drinking water in such places as Rome, New York; Camas, Washington; and Aspen, Colorado, as well as others.

## Methods

This study consisted of two methods to evaluate the presence of *Giardia* in certain water supplies and the watersheds of these water supplies.

One method used EPA large volume samplers for collecting *Giardia* cysts. Once a month the selected sites were sampled, with the sampling device on-line for approximately 24 hours. Total coliform, fecal coliform, standard plate count, turbidity, and pH samples were collected for analysis prior to and after the large volume sampler was on-line. Yeast samples were taken after the large volume sampler was on-line. Total chlorine and free chlorine residual were measured at each site prior to and after the filtering unit was installed. The EPA large volume samples were used on both the raw water tap and the treated water tap if the treatment of the water supply included filtration. Where the water supply treatment did not include filtration, samples were taken only from the treated water tap.

The presence of *Giardia* in fecal specimens from watershed animals that included beaver, deer, squirrel, muskrat, and racoon was determined for those animals found on each watershed. The animal fecal samples were collected by members of the trappers association. The collected fecal samples were placed in formalin containing vials and later analyzed for *Giardia*. The trappers collected from all the different species of animals so that one species would not account for all the samples to the exclusion of another species more difficult to sample. However, because some animals were not present on the watersheds at the time of collection, all the different animal species were not sampled every month. A maximum of 10 samples per month for each selected watershed was permitted. The fecal specimens were collected by one of two methods. Animals were trapped using the leg-hold trap

during the trapping season when permission was granted by the land owner. After trapping season, all fecal samples were collected from animal droppings. Trappers collecting the fecal droppings from live animals were requested to collect samples from different locations and to take only one sample per animal. This, hopefully, would lessen the possibility of sampling an animal more than once.

Initially, the fecal samples were to be collected by only one method, live-trapping of the animals. This method was found to be more expensive than using the leg-hold trap because the trappers would have to purchase the "live-type" traps. This type of trap required more room when transporting between trapping locations. A method of marking the animals would be necessary when using the live-trapping method to prevent sampling from the same animal more than once.

Comparisons and correlations were made between the different collection methods of obtaining the animal fecal specimens, the site locations, and the physical and bacteriological test data with the presence of *Giardia*.

## Laboratory Methods

The EPA large volume sampling filters were analyzed according to EPA methodology. The animal fecal samples were processed using the formalin-ether sedimentation concentration technique, then examined microscopically. The enumeration and isolations of yeast were based on APHA *Standard Methods for the Examination of Water and Waste Water*. The bacterial analysis, turbidity, color, odor, and pH determinations were also performed according to *Standard Methods for the Examination of Water and Waste Water* by the Laboratory Division of the Connecticut State Department of Health Services. The temperature and chlorine residual were determined at each site. The total and free chlorine residual were determined by DPD colorimetric method.

The sites that were sampled for *Giardia* were selected in two ways: (1) areas with low and high stool positivity rates for *Giardia*, and (2) watershed with no known human activity (protected) and with human activity and/or human sources of sewage contamination (semi-protected). *Giardia*-positive stool sample data provided by the State Department of Health were used to calculate human stool positivity rates for each town in Connecticut. Rates varied from .03 per 1,000 to 1.94 per 1,000. Two towns with

low *Giardia* positivity rates were selected and matched with two towns with high *Giardia* positivity rates based on population density and population served by a community water supply. The project director selected additional sites based on criterion No. 2. One source that had been selected was changed because it had not been used as a water supply for several years.

## Results

A total of 413 fecal specimens were submitted to the laboratory for *Giardia* determination over the consecutive 12-month study period from November, 1979 through October, 1980. Only six samples (1.4%) were found to be positive for *Giardia*. Fecal samples submitted during trapping from November, 1979 through February, 1980 were 2.34% positive for *Giardia*. Fecal samples collected after trapping season were 1.1% positive.

During the fecal specimen examination for *Giardia* cysts, other parasites were found. The beaver specimens, mainly from one watershed, had the lowest percentage of parasites found of the animal types studied with 16.7%. The racoons studied were found to have the most parasites of the animals examined with 64.8% of the specimens giving a positive result. Most of the other parasites found were helminths.

A total of 144 water sampling filters were collected for *Giardia* analysis using the EPA large volume sampling method. All of these filters were determined to be negative for the presence of *Giardia*. A total of 288 water samples were submitted for bacteriological analysis. Of the three types of bacteriological analyses used, total coliform, fecal coliform, and standard plate count, bacteria were found in the majority of the raw water samples. Bacteria were not present in most of the treated water samples.

A total of 74 samples were tested for the presence of yeast. Thirty samples were from raw water sources and 44 were from treated water sources. Yeast was found in 12 of the raw water samples and in 3 of the treated water samples.

## Conclusions

1. *Giardia* cysts were not recovered from any of the 144 *Giardia* sampling filters examined.
2. Only six, four muskrat (*Ondatra zibethicus*) and two racoon (*Procyon lotor*), of 413 animal fecal specimens

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examined were found to be positive for *Giardia*.

3. Animal fecal specimens collected from the leg-hold trapped animals showed a slightly higher percent positivity for *Giardia* than specimens collected from the live animal droppings.
4. The racoon fecal specimens were found to have the most parasites of the animal types examined. The beaver specimen had the lowest percentage of total parasites found.
5. Coliform bacteria and yeast were found frequently in raw water samples and less frequently in treated water samples.
6. The bacteriological water quality data collected during the month that *Giardia* positives were found in animal fecal samples showed no relationship to the presence of *Giardia* in animal fecal samples.
7. If the areas selected are representative of Connecticut water supplies and watersheds, then *Giardia* was not prevalent in Connecticut water supplies during the period of the study.

## Recommendations

Since the recovery rate for cysts is generally known to be below 10% for the EPA sampling method, it cannot be stated that *Giardia* does not exist in Connecticut water supplies. Gross contamination of the water supplies by *Giardia* appears unlikely in those areas sampled. The presence of *Giardia* in water supplies can be more accurately determined if the recovery rate for this method improves significantly.

Additional collection of animal fecal specimens using the leg-hold trapping method would be the best method for determining the presence of *Giardia* in watershed animals, and thus, the potential for contamination of water supplies.

Further testing of yeast in water supplies might be useful in determining its possible relationship to *Giardia*.

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*The complete report, entitled "Occurrence of Giardia in Connecticut Water Supplies and Watershed Animals," (Order No. PB 85-151 199/AS; Cost: \$10.00, subject to change) will be available only from:*

*National Technical Information Service*

*5285 Port Royal Road*

*Springfield, VA 22161*

*Telephone: 703-487-4650*

*The EPA Project Officer can be contacted at:*

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