

INVESTIGATOR'S ANNUAL REPORT 1985
(Natural Sciences Research)

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This form is to be completed by the researcher and returned to the Superintendent of the Park by JANUARY 1. See reverse for additional instructions.

TO SUPERINTENDENT	PARK Isle Royale	REGION Midwest
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1. Project Title
Bacteriological Water Quality of Isle Royale National Park

2. Name(s) of Researcher(s) and Institution(s)
Dr. Susan T. Bagley, Dept. Biological Sciences, Mich. Technol. Univ.

3. Source(s) and Amount(s) of Funds Other Than NPS, if Any
MTU, for use of facilities and personnel

4. Starting Date of Project May, 1985	5. Percent Completion of Project to Date: 100%	6. Est. Additional Time Required for Completion Beyond January 1st: Years _____ Months _____
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7. Summary: (a) of progress; (b) of significant findings, if any, to date; (c) recommendations regarding future course, i.e., on basis of work so far, should it proceed as planned, be reoriented, expanded, reduced, time schedule and support level adjusted, etc.;

As a follow-up to studies conducted during the 1984 season, water samples from the NE half of Isle Royale National Park were tested for levels of bacteriological indicators of water quality. The tests were conducted to determine the general water quality in and around the park and also to monitor for possible human impacts on these waters (particularly near campground areas).

The following sites were sampled approximately biweekly from May 28 to September 25, 1985: Malone Bay campground (MBC); Malone Bay dock (MBD); Chippewa Harbor (CH); Hatchet Lake (HL); Todd Harbor (TH); McCargoe Cove (MC); Chickenbone Lake West (CLW); Belle Isle (BI); Raspberry Island (RI); Benson Creek - site 3 (BC3); and South Shore (Lake Superior) control (SSC). The BC3 and SSC sites were also included in the 1984 survey of bacteriological water quality in and around Rock Harbor. Each sample was tested for levels of total coliforms (TC), fecal coliforms (FC), and fecal streptococci (FS), as well as for temperature and conductivity.

General results of the 1985 survey are as follows. Essentially no TC or FC were detected in the SSC samples throughout the sampling season, while levels of FS averaged 16/100ml. This indicates that some FS may routinely occur (probably from land run-off) and that good, aseptic sampling techniques were used throughout the survey. The BI and RI sites generally had TC, FC and FS levels close to those of SSC. Three more sites (MBC, MBD, and MC) usually had indicator values close to the SSC values except for samples collected on September 3 (MBC and MBD) and September 25 (MC). The CH, HL, and TH samples intermittently had TC and FS levels close to or above 100/100ml throughout the season, although FC levels were elevated only on September 3 (CH, HL, and TH) and September 25 (CH). As was found during 1984, the BC3 site had high levels of TC (at times over 1200/100ml), FC, and FS throughout the 1985 season. Similar trends were found with the CLW samples, although the indicator levels were lower than reported for BC3.

8. Signature of Investigator

Susan T. Bagley

Date

1/8/86

9. RSP Number

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Investigator's Annual Report

Isle Royale National Park

"Bacteriological Water Quality of Isle Royale National Park"

S. T. Bagley, p. 2

Although TC and FS were routinely detected from many of the sampling sites, FC levels were usually low in comparison and the FC/FS ratios usually indicated that the bacterial contamination was from non-human sources. There were several exceptions to this, however. Most notably, for samples collected on September 3, three sites (BC3, TH, CLW) showed clear evidence of human fecal contamination and four sites (MBC, CH, HL, and BI) had FC/FS ratios indicating a possible mixture of human and non-human sources of contamination. This sampling date was, of course, just after Labor Day weekend and these seven sites may have increased visitor usage during that time period (and therefore potentially greater impact on the water systems). Other dates and sites for which the FC/FS ratios indicated human or a mixture of human/non-human contamination were: June 4 (CLW); July 23 (CLW); August 20 (MC); and September 25 (CH, CLW, MC). The CLW site routinely had elevated levels of TC and FC, in particular, indicating possible routine and persistent contamination from human fecal sources. A second sampling site in Chickenbone Lake (CLX) was tested on September 3 and 25; the resulting values showed some TC and FC contamination, but not from human sources. A second Benson Creek site (BC2) was also sampled during September; although the indicator levels were close to those of BC3, the FC/FS ratios indicated that the contamination was more from non-human than human sources. It is also possible that the higher water temperatures at CLW and BC3 aided in the survival and persistence of the contaminating indicator organisms.

Some of the TC and FC colonies/site/date were identified to determine the types of coliforms appearing in the water samples. From all sites, the TC were mixtures of Escherichia coli, Klebsiella, and Enterobacter, in particular, with some Citrobacter. The percentage of colonies tested identified as E. coli generally increased for the September 3 samples. Most or all of the FC were E. coli. These results are of interest because E. coli generally does not occur from non-human sources (such as other warm-blooded animal fecal material and vegetation); and generally does not survive as well once introduced into the environment as do the other genera of coliforms. Consistent isolation of E. coli, particularly as a FC, indicates fairly constant sources of these indicators of recent, human fecal contamination. More intensive studies with more colonies/sample would have to be conducted to fully assess the situation, however.

Overall, most of the sites sampled throughout 1985 had low levels of TC and FC indicator organisms, except for the sampling date just after the Labor Day weekend. Those sites from inland lakes and streams or protected harbors (e.g., BC3, HL, TH, MC, and CLW) seemed more likely to have higher levels of indicator organisms in part due to warmer water temperatures, potentially higher levels of organic nutrients, and less circulation/flushing of water in the systems. There is some evidence that human fecal contamination occurred on a random basis at some sites and on a continuing basis at others. These types of tests have value in monitoring such situations, particularly at more susceptible sites with increased visitor use and at times when movement/placement of sanitary facilities is being considered. Identification of the coliform genera present will also provide evidence as to the source and therefore potential human health concerns of the contamination. As was noted in last year's report, bacteriological monitoring of TC and FS can also indicate increased land/vegetation run-off and increased nutrient loading to the aquatic systems.

1985

Data and
results notes.

(WQ coliform bacteria data)
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