



Swim Beach Bacterial Monitoring Report Acadia National Park, 2004



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SUMMARY

Monitoring of bacterial densities at selected recreational swim beaches within Acadia National Park (ANP) in 2004 essentially followed the program of the previous two years (Breen, 2003; Breen et al, 2003). The bacterial sampling program was conducted in accordance with National Park Service (NPS) Director's Order #83: Public Health, to reduce the risk to park visitors of contracting a waterborne disease. Freshwater beaches sampled included the life-guarded beach at Echo Lake and the unguarded beach at Lake Wood; marine waters were sampled at the life-guarded beach at Sand Beach and in the ephemeral lagoon area at the east-end of Sand Beach. Freshwater samples were analyzed for *Escherichia coli*, marine and estuarine waters for *Enterococci* bacteria. The Health and Environmental Testing Laboratory, Maine Department of Human Services performed sample analysis. Sampling was conducted weekly from June 1, to August 30, 2004. As in previous years, bacterial levels at all locations remained well within United States Environmental Protection Agency (USEPA) guidelines throughout the sampling season.

INTRODUCTION

Director's Order #83: Public Health (National Park Service, 1999) requires that bacterial monitoring be conducted at all designated bathing beaches. A designated beach is defined as any beach identified by the park (signs, brochures, maps etc.) as "available to the public for contact recreational water activities." Designated bathing beaches at Acadia National Park (ANP) are Sand Beach and Echo Lake Beach. DO #83 states that the operation, maintenance and monitoring of bathing beaches should be in accordance with applicable state or local regulations, or in the absence of state regulations follow NPS policy. The Maine Department of Human Services (MDHS) has responsibility for protecting human health and establishing bathing beach monitoring standards in the state. As of the summer of 2004, Maine did not have an approved state regulation for bacterial monitoring at state bathing beaches, although MDHS does encourage the use of USEPA bacterial monitoring guidelines (John Chandler, MDHS, personal communication). Therefore, the program outlined and approved in ANP Standard Operating Procedure 2002-01, following the policy and guidance in DO #83, was used to conduct bacterial monitoring at park swim beaches in 2004 (Acadia National Park, 2002).

Specific bacterial monitoring requirements outlined in ANP SOP 2002-01 include:

- (a) Conducting a sanitary survey;
- (b) Preparing a bathing beach monitoring protocol;
- (c) Sampling for enterococcus or *Escherichia coli*; and
- (d) Issuing swimming advisories when bathing beach waters exceed bacterial standards.

The procedures for conducting bacterial monitoring and a sanitary survey, outlined in ANP SOP 2002-01, have been reviewed and approved by the Regional Public Health Consultant. The approved monitoring procedures identify *enterococci* as the bacterial indicator to be analyzed for at marine beaches (Sand Beach and the Lagoon), and *E. coli* as the indicator at freshwater beaches

(Echo Lake, Lake Wood).

BACTERIAL STANDARDS

The following bacterial indicators and standards, recommended by DO #83 as well as the MDHS and USEPA, have been adopted in the Acadia National Park bacterial monitoring program:

1. Marine Water Bathing Beaches
 - a. Enterococci
 - 1) **35 colonies/100 ml.** (Geometric Mean)
Or
 - 2) **104 colonies/100 ml.** (Not to be exceeded by any one sample).
2. Freshwater Bathing Beaches
 - a. Enterococci
 - 1) **33 colonies/100 ml.** (Geometric Mean)
Or
 - 2) **61 colonies/100 ml.** (Not to be exceeded by any one sample).
 - b. *E. coli*
 - 1) **126 colonies/100 ml.** (Geometric Mean).
Or
 - 2) **235 colonies/100 ml.** (Not to be exceeded by any one sample).

METHODS

Bacterial monitoring procedures implemented in 2004 are outlined in detail in the Acadia National Park standard operating procedure for "Bacterial Monitoring of Recreational Bathing Beaches" (Acadia National Park, 2002).

Water samples were collected from the park's two designated bathing beaches, Echo Lake and Sand Beach, and from the non-designated beach at Lake Wood (figure 1.). Sampling was also conducted at the Sand Beach lagoon when there was enough water present to justify sampling. The lagoon is an ephemeral pond that forms along an intermittent stream that flows into the ocean at the east-end of Sand Beach. The lagoon forms when beach accretion builds up and plugs the stream outlet. The lagoon often dries up in late summer due to drought.

Bacterial monitoring was conducted weekly from June 1 through August 30, following designated sample collection procedures (Figure 2.). A single sample was collected each week near the midpoint of each beach. Samples were collected Monday or Tuesday (if Monday was a holiday) morning using sample bottles provided by the Health and Environmental Testing Laboratory

(HETL) at the Maine Department of Human Services. The HETL is the state's primary health testing lab and is certified to conduct bacterial analysis in compliance with US Environmental Protection Agency methods (USEPA, 1986).

Samples were collected by wading into the water approximately thigh deep and submerging the sample bottle about one foot below the surface. Care was taken to keep fingers from touching the lid or inside of the sample bottle thus avoiding contamination. The date, time of sampling, location, weather conditions and surface water temperature were recorded. In addition, rainfall data (taken from ANP National Atmospheric Deposition Program rain gage) for 24 and 72 hours prior to sampling were also recorded.

Samples were mailed to the lab the same day using special mailing labels and insulated shipping containers provided by the HETL.

Director's Order #83 requires an annual sanitary survey of each beach be conducted to identify any existing and potential sources of contamination. A sanitary survey of each beach was conducted May 27, 2004 and is attached in Appendix I.

RESULTS

Bacterial results for 2004 are presented in Table 1. At all locations, Echo Lake, Lakewood, Sand Beach, and Sand Beach Lagoon, bacterial densities remained well below EPA standards throughout the summer, except for a sample at Sand Beach on June 14, of 135 colonies/100ml. However, upon review that sample was considered likely to have been contaminated since every sample at Sand Beach over the past 3 years has been less than 10 colonies/100ml (the minimum detection limit), and there was no other reasonable explanation for the spike. The highest single sample *E. coli* densities at Echo Lake and Lake Wood respectively were counts of 12 and 16 colonies per 100 ml. All single *enterococci* densities at Sand Beach were less than 10 colonies per 100 ml, the minimum detection limit, except for the sample of June 14. Sand Beach Lagoon had a maximum *enterococci* count of 51 colonies/100ml. Precipitation during the summer of 2004 was unusually high and many sampling periods were preceded by rain events. Rainfall amounts for the 24 and 72 hour time periods prior to sampling are included in Table 1.

DISCUSSION

The bacterial monitoring program conducted in 2004 successfully met program objectives. Resource management staff were able to collect water samples and mail them to the state lab each week as scheduled. Except for the Sand Beach sample of June 14, there were no contamination or other major problems encountered during sample collection. Samples collected on July 26 and August 2, arrived a day late to the lab apparently due to slow mail service. Although these samples exceeded the HETL holding time limit of 30 hours, they were analyzed and reported. Results were faxed to the park by the HETL lab by Friday most weeks, so that notification, if it had been necessary, of unhealthful conditions could have been initiated.

The results of monitoring conducted in 2004 indicate that bacterial densities at all ANP sampling locations were well within DO #83 and EPA bacterial guidelines. The Acadia National Park Water Resources Management Plan (ANP, 2000) recommends bacterial monitoring be conducted seasonally over a 3 year period every decade, unless there is a reason to believe a new source of potential contamination is present. Based on the consistently low bacterial densities monitored over the three year period 2002-2004, the park plans to evaluate the need for continued bacterial sampling at park swim beaches in 2005.

LITERATURE CITED

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Figure 1.

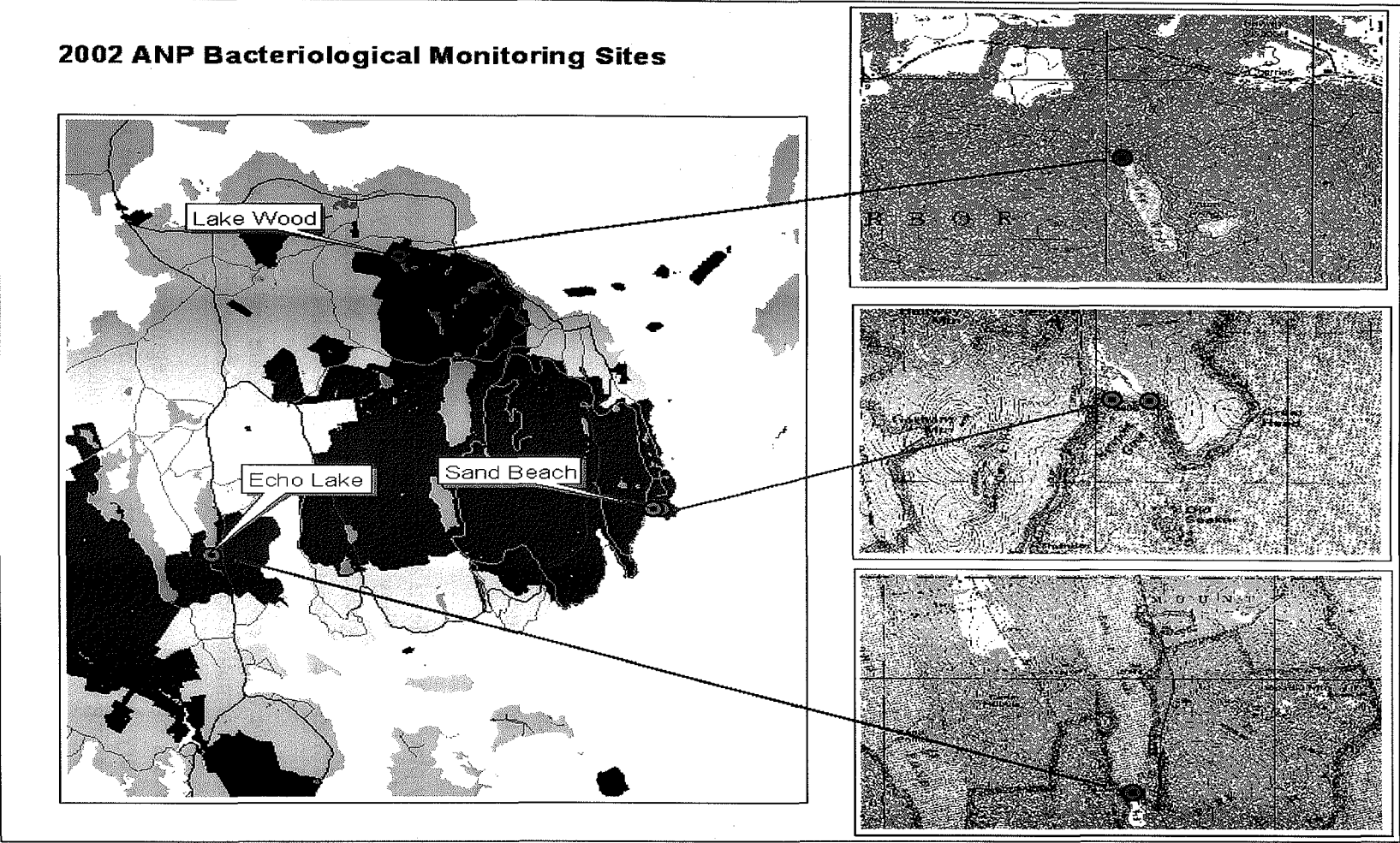


Figure 2.

RECOMMENDED SAMPLING PROCEDURES

1. Collect samples on Monday morning (or Tuesday, if Monday is a Holiday) using bottles provided by the Maine DHS laboratory.
2. Collect samples as early as possible in the morning before visitors begin using the beach at the following locations (see figure 1.):
 - Sand Beach (east and west), 2 samples, approximately 1/3 and 2/3 the length of beach
 - Sand Beach Lagoon, 1 sample, near center of lagoon area
 - Echo Lake (east and west), 2 samples approximately 1/3 and 2/3 the length of beach
 - Lake Wood, 1 sample, near center of beach at north end of lake.
3. Wade out into the surf/lake about thigh deep and face into the current/wind.
4. Collect the water sample from an incoming wave, taking care to avoid getting sediment or debris into the sample.
5. The object is to avoid capturing surface water, and to collect from at least 1-foot depth. Grasp the bottle near the base with one hand and remove the cap with the other. Be careful to avoid touching the inside of the cap or rim of the bottle. Rotate your wrist so the mouth of the bottle is pointing downward at about a 45-degree angle. Rapidly plunge the bottle to a depth of about one foot. Rotate your wrist so the mouth of the bottle points up, loses its air bubble, and fills with water. Replace the cap while still underwater.
6. Lift the capped bottle out of the water. Remove the cap and carefully pour out enough water to leave a 1/2 inch air space. Replace the cap. Be careful to not touch the inside of the bottle or the inside of the cap.
7. Immediately place the bottle in an upright position in a covered cooler containing sufficient ice to keep the samples cool until they can be mailed to the laboratory. Park lifeguards may assist in collecting water samples at guarded beaches. Resource Management staff will collect samples at Lake Wood, and from the lifeguards, then prepare samples for mailing to the lab.
8. Record the sample bottle number, station name, date and time of sampling, sampler's name and other appropriate information on the field data sheet (Appendix C.).
9. Within 6 hours of sampling mail samples via regular mail to the Health and Environmental Testing Laboratory, Maine Department of Human Services, using the form, insulated shipping container, and mailing label provided by the Laboratory (Appendix D.).

Table 1. Swim Beach Bacterial Monitoring Results, 2004

ACAD Resource Management

SAMPLE #	SITE	DATE	COLLECTOR	TIME	TEMP	Rain (in 24h)	Rain (in 72h)	LAB	ECOLI	ENT
04E-WTR-05608	Echo Lake	6/1/2004	K. Sheehan	0940	12.2	0	0	DHS	0	
04E-WTR-05586	Lake Wood	6/1/2004	K. Sheehan	0920	13.9	0	0	DHS	3	
04E-WTR-05618	Sand Beach	6/1/2004	K. Sheehan	0845	6.8	0	0	DHS		10
04E-WTR-05637	Sand Beach Lagoon	6/1/2004	K. Sheehan	0845	12	0	0	DHS		10
03E-WTR-09046	Echo Lake	6/7/2004	K. Sheehan	0900	13.2	0.1	0.1	DHS	0	
03E-WTR-09060	Lake Wood	6/7/2004	K. Sheehan	0830	15.2	0.1	0.1	DHS	1	
03E-WTR-09085	Sand Beach	6/7/2004	K. Sheehan	1000		0.1	0.1	DHS		10
03E-WTR-09077	Sand Beach Lagoon	6/7/2004	K. Sheehan	0955	10.5	0.1	0.1	DHS		10
04E-WTR-05602	Echo Lake	6/14/2004	K. Sheehan	0735	15	0	0	DHS	0	
04E-WTR-05601	Lake Wood	6/14/2004	K. Sheehan	0810	19	0	0	DHS	3	
04E-WTR-05631	Sand Beach	6/14/2004	K. Sheehan	0850	11	0	0	DHS		135
04E-WTR-05625	Sand Beach Lagoon	6/14/2004	K. Sheehan	0845	16	0	0	DHS		10
04E-WTR-05594	Echo Lake	6/21/2004	K. Sheehan	1030	18.3	0	0.3 3	DHS	0	
04E-WTR-05587	Lake Wood	6/21/2004	K. Sheehan	1215		0	0.3 3	DHS	9	
04E-WTR-05630	Sand Beach	6/21/2004	K. Sheehan	1145	10.5	0	0.3 3	DHS		10

SAMPLE #	SITE	DATE	COLLECTOR	TIME	TEMP	Rain (in 24h)	Rain (in 72h)	LAB	ECOLI	ENT
04E-WTR-05622	Sand Beach Lagoon	6/21/2004	K. Sheehan	1140	21.9	0	0.3 3	DHS		51
03E-WTR-09048	Echo Lake	6/28/2004	E. Seger	1120	19.2	0	1.3 5	DHS	5	
03E-WTR-09058	Lake Wood	6/28/2004	E. Seger	1155	20.5	0	1.3 5	DHS	13	
03E-WTR-09076	Sand Beach	6/28/2004	E. Seger	0850		0	1.3 5	DHS		10
04E-WTR-05593	Echo Lake	7/6/2004	K. Sheehan	0745		0.1	0.3 5	DHS	2	
04E-WTR-05595	Lake Wood	7/6/2004	K. Sheehan	1100		0.1	0.3 5	DHS	4	
03E-WTR-09082	Sand Beach	7/6/2004	K. Sheehan	1045		0.1	0.3 5	DHS		10
04E-WTR-05636	Sand Beach Lagoon	7/6/2004	K. Sheehan	1030		0.1	0.3 5	DHS		10
04E-WTR-05600	Echo Lake	7/12/2004	K. Sheehan	0940	20.7	0	0.1	DHS	0	
04E-WTR-05596	Lake Wood	7/12/2004	K. Sheehan	0900	22	0	0.1	DHS	3	
04E-WTR-05624	Sand Beach	7/12/2004	K. Sheehan	0805	12.1	0	0.1	DHS		10
03E-WTR-06056	Sand Beach Lagoon	7/12/2004	K. Sheehan	0800	20	0	0.1	DHS		10
03E-WTR-09044	Echo Lake	7/19/2004	K. Sheehan	1030	20.7	0.33	0	DHS	0	
03E-WTR-09062	Lake Wood	7/19/2004	K. Sheehan	1100	22.6	0.33	0	DHS	6	
03E-WTR-09086	Sand Beach	7/19/2004	K. Sheehan	1135	11.7	0.33	0	DHS		10
04E-WTR-05623	Sand Beach Lagoon	7/19/2004	K. Sheehan	1130	20.7	0.33	0	DHS		10

SAMPLE #	SITE	DATE	COLLECTOR	TIME	TEMP	Rain (in 24h)	Rain (in 72h)	LAB	ECOLI	ENT
04E-WTR-5605	Echo Lake	7/26/2004	E. Seger	1000	20.7	0	0.4	DHS	1	
04E-WTR-05607	Lake Wood	7/26/2004	E. Seger	1036	23.1	0	0.4	DHS	2	
04E-WTR-05638	Sand Beach	7/26/2004	E. Seger	0856	12.5	0	0.4	DHS		10
04E-WTR-05629	Sand Beach Lagoon	7/26/2004	E. Seger	0915	19.2	0	0.4	DHS		10
04E-WTR-05588	Echo Lake	8/2/2004	K. Sheehan	1030	22.6	0	0	DHS	12	
04E-WTR-05609	Lake Wood	8/2/2004	K. Sheehan	9:30	24	0	0	DHS	1	
04E-WTR-05632	Sand Beach	8/2/2004	K. Sheehan	0845	12.8	0	0	DHS		10
04E-WTR-05626	Sand Beach Lagoon	8/2/2004	K. Sheehan	0900	21.3	0	0	DHS		10
04E-WTR-05592	Echo Lake	8/9/2004	E. Seger	0940	22.6	0.12	0.1 2	DHS	1	
04E-WTR-05597	Lake Wood	8/9/2004	E. Seger	0900	23.3	0.12	0.1 2	DHS	6	
04E-WTR-05633	Sand Beach	8/9/2004	E. Seger	1030	11.6	0.12	0.1 2	DHS		10
04E-WTR-05615	Sand Beach Lagoon	8/9/2004	E. Seger	1045	20.7	0.12	0.1 2	DHS		10
04E-WTR-05585	Echo Lake	8/16/2004	K. Sheehan	0745	21.6	0.06	2.9 1	DHS	2	
04E-WTR-05599	Lake Wood	8/16/2004	K. Sheehan	0730	22.4	0.06	2.9 1	DHS	10	
04E-WTR-05634	Sand Beach	8/16/2004	K. Sheehan	0635	13.3	0.06	2.9 1	DHS		10
04E-WTR-05598	Echo Lake	8/23/2004	K. Sheehan	1015	20.5	0	1.2	DHS	4	
04E-WTR-05582	Lake Wood	8/23/2004	K. Sheehan	0930	21.8	0	1.2	DHS	16	

SAMPLE #	SITE	DATE	COLLECTOR	TIME	TEMP	Rain (in 24h)	Rain (in 72h)	LAB	ECOLI	ENT
04E-WTR-05614	Sand Beach	8/23/2004	K. Sheehan	0820	12.5	0	1.2	DHS		10
04E-WTR-05603	Echo Lake	8/30/2004	K. Sheehan	1042	20.7	0	0	DHS	0	
04E-WTR-05583	Lake Wood	8/30/2004	K. Sheehan	1015	22.7	0	0	DHS	2	
04E-WTR-05613	Sand Beach	8/30/2004	K. Sheehan	0930	14.6	0	0	DHS		10

Bathing Beach Sanitary Survey,
Acadia National Park, 2004

Introduction

A sanitary survey was conducted on May 27, 2004 at Echo Lake, Lake Wood, and Sand Beach swim beaches. Bacterial monitoring will be conducted at these three bathing beaches in 2004. Each beach was walked to look for possible sources and pathways of contamination. Potential sources of bacterial contamination to these beaches remains essentially unchanged from last year, and no obvious problem areas were identified. The following description of the surroundings of each beach with possible sources of contamination is essentially unchanged from previous years.

Sand Beach

This marine beach is located off the park loop road in Newport Cove on the East Side of Mount Desert Island. Sand Beach is a guarded beach that receives high visitor use in July and August. The beach is approximately 600 feet long. Water temperatures at Sand Beach range from the low 50's (degrees F) in early summer to low's 60's in August. The cold temperatures limit the time most bathers spend in the water. A small freshwater pond is located behind the fenced dune at the east-end of the beach. A shallow intermittent lagoon forms along the stream that flows from the pond when beach accretion seals off flow into the ocean. When the stream breaches the dune and flows into the ocean at the east end of the beach the lagoon disappears. When the shallow lagoon forms, the warm water attracts visitors including children for wading. Water temperatures in the lagoon reach the upper 70's (degree F).

Potential Sources of Contamination – The area surrounding Sand Beach is completely within Acadia National Park. The only anthropogenic sources of bacterial contamination are associated with park operations and visitor use. Possible sources of bacterial contamination include:

- 1) Direct contamination by bathers and other beach users (dogs are prohibited).
- 2) Sand Beach parking lot, capacity 140 vehicles. Storm drains channel runoff from the parking lot.
- 3) Park Loop Road (Ocean Drive).
- 4) Sand Beach restrooms and bathhouses, septic is pumped to a leach field approximately 1500 feet to the north of Sand Beach.
- 5) Sand Beach residence/septic, also located approximately 1500 feet north of the beach.

Bacterial Monitoring History - Bacterial monitoring for enterococci was conducted in 2002, and the mid-1990's at Sand Beach. Results from 2002 sampling consistently showed densities of < 10 colonies per 100 milliliters which reflects the minimum detection limit for this lab test, and are consistent with bacterial densities from the mid-1990's monitoring. In 2003, two samples were collected each week, one from the eastern half of the beach and one from the western half. All samples had bacterial densities <10 colonies per 100 ml.

Echo Lake Beach

This freshwater beach is located at the south end of Echo Lake, off Route 102 on the west-side of Mount Desert Island (see attached map). Echo Lake is 237 acres and has a maximum depth of 66 feet. Echo Lake beach is a guarded beach that receives high visitor use in July and August. The beach is approximately 150 feet long. Water temperature ranges from the mid-60's (degree F) in June to the high 70's in August. Lurvey Spring brook is the major inlet and flows into Echo Lake from the west-end of the beach.

Potential Sources of Contamination – Except for a single private inholding [a seasonal summer camp owned by the Appalachian Mountain Club (AMC)] the shoreline and upland portions of the watershed within 1 kilometer of Echo Lake Beach are within Acadia National Park. In addition to direct contamination by bathers other possible sources of contamination include:

- 1) Echo Lake beach parking lot, capacity 120, sheet drainage off the parking lot is to the south and east.
- 2) Echo Lake Beach restrooms.
- 3) Echo Lake Ranger residence/septic system.
- 4) Camp Beech Cliff, a day use summer camp, approximately 1.5 kilometers north of Echo Lake Beach on the west side of the lake. Private residences at the north end of Echo Lake, 2-2.5 kilometers from beach.

Bacterial Monitoring History – Single sample results for *E. coli* at Echo Lake Beach in 2002 ranged from 0 to a high of 100, with a maximum geometric mean of 12.1 colonies/100ml. In 2003, two samples were also collected each week at Echo Lake, one from the eastern half of the beach and one from the western half. Sample results in 2003 ranged from 0-38 colonies/100ml.

Lake Wood Beach

The primary swimming area at Lake Wood is an unguarded beach located at the north end of the lake. Lake Wood is not a designated swimming beach on any park maps, but it is relatively well known to local residents and some visitors. Access is by gravel road off of the Crooked road at the north end of Mount Desert Island. The main swimming area is a small grass and gravel beach, less than 100 feet long, located at the north end of the lake. Lake Wood is 17 acres, with a maximum depth of 11 feet. Water temperature reaches the upper 70's in mid-summer. The amount of use has not been determined but it is likely less than 40 people per 100 linear feet.

Potential Sources of Contamination

- 1) Direct contamination by bathers (dogs are prohibited from swimming).
- 2) A small parking lot (approximately 10-car capacity), is 600 feet from the beach.
- 3) A small one-person composting toilet located at the parking lot.

Bacterial Monitoring History - Single sample results for *E. coli* at Lake Wood in 2002 ranged from 0 to a high of 96, with a maximum geometric mean of 9.7 colonies/100ml. Sample results in 2003 ranged from 0-16 colonies/100ml.