

GEORGIA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

Bacteria Criteria for Drinking Water and Fishing Designated Uses

Technical Support Document for the Proposed Criteria to Protect
Secondary Recreators

Elizabeth A. Booth, Ph.D., P.E. and Gillian Gilbert-Wason

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Contents

INTRODUCTION	3
PROPOSED PRIMARY AND SECONDARY RECREATION DEFINITIONS.....	3
DETERMINATION OF SECONDARY CONTACT RECREATION BACTERIA CRITERIA	5
PROPOSED BACTERIA CRITERIA.....	5

List of Tables

Table 1: Calculated Ratio for Secondary Contact Recreation	6
Table 2: Proposed Bacteria Criteria.....	8

INTRODUCTION

In 2012, the United States Environmental Protection Agency (EPA) published “Recreational Water Quality Criteria,” which prompted Georgia Environmental Protection Division (EPD) to update the bacteria rule for recreational waters as part of the 2013 Triennial Review. The recommended recreational bacterial indicators, *E. coli* in freshwater and enterococci in saltwater, were proven to have a stronger correlation with gastrointestinal, respiratory, and skin illnesses in primary contact recreators. The recommended criteria included both a geometric mean (GM) and statistical threshold value (STV) in order to protect human health during primary contact recreation while also accounting for allowable variability in water quality. The recommendation states “the STV approximates the 90th percentile of the water quality distribution and is intended to be a value that should not be exceeded by more than 10% of the samples used to calculate the GM.” EPA recommends a GM and STV duration of 30 days and no more than a 10% excursion frequency. The 2013 Triennial review included adoption of the recommended bacteria criteria for waters with the designated use of recreation.

Because waters with designated uses of drinking water and fishing are also supportive of recreational activities, EPD decided to update the bacteria criteria for these designated uses as part of the 2016 Triennial Review to adopt the best available bacterial indicator to protect human health across all uses.

EPD’s 2016 Triennial Review proposed seasonal *E. coli* and enterococci criteria based on EPA’s 2002 Draft Document “Implementation Guidance for Ambient Water Quality Criteria for Bacteria.” This document suggested adopting bacteria criteria for secondary recreation that is five times the geometric mean of the primary recreational bacteria criteria. This guidance was used to derive secondary contact recreation *E. coli* and enterococci criteria for fishing and drinking water uses in the months of April through November, which was adopted by the DNR Board with the 2016 Triennial Review. However, this guidance document was never finalized and has since been rescinded. Therefore, the bacteria criteria change proposed for the 2016 Triennial Review was not approved by EPA.

In a separate, but related rule change, EPD changed the units for bacteria from MPN or CFU to counts per 100 mL in order to avoid favoring one EPA approved testing method over another. EPA did approve this change as part of the 2016 Triennial Review.

PROPOSED PRIMARY AND SECONDARY RECREATION DEFINITIONS

Currently in Georgia Rule 391-3-6-.03(6), waters designated for recreation have bacteria criteria (*E. coli* or enterococci) protective of year-round primary contact recreation. Waters designated for fishing or drinking water have bacteria criteria (fecal coliform) protective of primary contact recreation in the months of May through October and protective of secondary contact recreation in the months of November through April.

As part of the 2019 Triennial Review EPD’s proposed rule change includes updated definitions to clarify the difference between primary and secondary contact recreation.

391-3-6-.03(3)(l):

“Primary Contact Recreation” is defined as “full immersion contact with water where there is significant risk of ingestion that includes, but is not limited to, swimming, diving, white water boating (class 3+), water skiing, and surfing.”

391-3-6-.03(3)(n):

“Secondary contact recreation” is defined as “incidental contact with the water not involving a significant risk of water ingestion such as canoeing, fishing, kayaking, motor boating, rowing, tubing, splashing, wading, and occasional swimming.”

DETERMINATION OF SECONDARY CONTACT RECREATION BACTERIA CRITERIA

In 2019, EPA released an update to its Exposure Factors Handbook, Chapter 3: “Ingestion of Water and Other Select Liquids.” This update included a study on water ingestion rates for various recreational activities in and on the water (Dorevitch et al. 2011). The activities were divided into two groups, “limited contact scenarios,” and “full contact scenarios.” The activities in this study were also used to help EPD determine which activities fall under primary and secondary recreation. EPD’s definition of secondary contact recreation is based on the activities listed as “limited contact scenarios” in this study. These activities include boating, canoeing (with and without capsizing), fishing, kayaking (with and without capsizing), rowing (with and without capsizing), wading/splashing, and walking. The “full contact scenario” activities in this study were immersion and swimming.

Table 1 below uses the data provided on Table 3-96 of the Dorevitch et al. study and EPD’s calculation of the ingestion rate ratio of limited contact to full contact scenarios. This ratio was determined using weighted ingestion rate averages based on the number of individuals engaging in each activity. The median weighted ratio of primary contact to secondary contact water ingestion is 2.1, indicating that full (primary) contact recreators ingested 2.1 times more water than limited (secondary) contact recreators. Thus, a secondary contact recreation bacteria criteria 2.1 times higher than the primary contact recreation bacteria criteria should be equally protective of human health.

PROPOSED BACTERIA CRITERIA

Based on the results of the Dorevitch et al. study, EPD calculated that individuals engaging in primary contact recreation activities ingested 2.1 times more water than individuals engaging in secondary contact recreation activities. EPD used these calculations to derive secondary contact recreation criteria for *E. coli* and enterococci by multiplying the primary contact recreation criteria by 2.1.

EPD believes that this calculated ingestion ratio for secondary contact recreational waters during the non-recreational season yields acceptable criteria for the protection of human health from incidental water contact while incorporating superior bacterial indicator organisms across all uses.

The proposed drinking water bacteria criteria are as follows:

1. For the months of May through October, when water contact recreation activities are expected to occur, culturable *E. coli* not to exceed a geometric mean of 126 counts per 100 mL based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. There shall be no greater than a ten percent excursion frequency of an *E. coli* statistical threshold value (STV) of 410 counts per 100 mL in the same 30-day interval.

Table 1: Calculated Ratio for Secondary Contact Recreation

Source: Dorevitch et al. (2011).

Table 3-96. Estimated Water Ingestion during Water Recreation Activities (mL/hr)

Secondary Recreational Activities	Activity	Surface Water Study										% of each activity	Ingestion Based on Weighting Each 2° Activity			Weighted Average of the Surface Water and Swimming Pool Study (2° Recreation)			Ratio of Limited Contact to Full Contact														
		Surface Water Study				Swimming Pool Study				Activity			Recreation			Recreation			Recreation														
		N	Median	Mean	Upper Confidence Limit	N	Median	Mean	Upper Confidence Limit	Median	Mean		Upper Confidence Limit	Median	Mean	Upper Confidence Limit	Median	Mean	Upper Confidence Limit	Median	Mean	Upper Confidence Limit	Median	Mean	Upper Confidence Limit								
Boating/Fishing	Boating	316	2.1	3.7	11.2	0	-	-	-	-	-	-	7.3%	0.15	0.27	0.81	2.10	3.70	11.20	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Canoeing	766	-	-	-	76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	No capsiz	-	2.2	3.8	11.4	-	2.1	3.6	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	With capsiz	-	3.6	6	19.9	-	3.9	6.6	22.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	All activities	-	2.3	3.9	11.8	-	2.6	4.4	14.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Fishing	600	2	3.6	10.8	121	2	3.5	10.6	-	-	-	-	19.3%	0.45	0.76	2.32	2.33	3.95	12.01	-	-	-	-	-	-	-	-	-	-	-	-	
	Kayaking	801	-	-	-	104	-	-	-	-	-	-	-	16.5%	0.33	0.59	1.78	2.00	3.58	10.77	-	-	-	-	-	-	-	-	-	-	-	-	
	No capsiz	-	2.2	3.8	11.4	-	2.1	3.6	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	With capsiz	-	2.9	5	16.5	-	4.8	7.9	26.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	All activities	-	2.3	3.8	11.6	-	3.1	5.2	17	-	-	-	-	20.8%	0.50	0.82	2.54	2.39	3.96	12.22	-	-	-	-	-	-	-	-	-	-	-	-	-
	Rowing	222	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	No capsiz	-	2.3	3.9	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	With capsiz	-	2	3.5	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
All activities	-	2.3	3.9	11.8	-	-	-	-	-	-	-	-	5.1%	0.12	0.20	0.60	2.30	3.90	11.80	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Boating/Fishing	2705	-	-	-	301	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Wading	Wading/splashing	0	-	-	-	112	2.2	3.7	11.2	25.7%	0.57	0.95	2.88	2.20	3.70	11.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Walking	0	-	-	-	23	2	3.5	10.6	5.3%	0.11	0.18	0.56	2.00	3.50	10.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total Wading	0	-	-	-	135	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Total All Activities	2705	-	-	-	436	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Surface Water + Swimming Pool Study	3006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Average Ingestion (mL/hr)	-	2.20	3.78	11.44	-	2.38	4.06	12.70	-	-	-	-	100.0%	2.22	3.78	11.49	2.19	3.76	11.40	-	-	-	-	-	-	-	-	-	-	-	-	-	

Primary Recreational Activities	Activity	Surface Water Study				Swimming Pool Study				1° Recreation Ingestion/2° Recreation Ingestion	1° Recreation Ingestion/2° Recreation Ingestion																					
		N	Median	Mean	Upper Confidence Limit	N	Median	Mean	Upper Confidence Limit		Median	Mean	Upper Confidence Limit																			
Primary Recreational Activities	Immersion	0	-	-	-	112	3.2	5.1	15.3	Immersion/2°	1.44	1.35	1.33	1.00	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Swimming	0	-	-	-	114	6	10	34.8	Swimming/2°	2.71	2.65	3.03	1.00	1.00	1.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Average Ingestion (mL/hr)	-	-	-	-	226	4.6	7.55	25.05	Avg 1° Ingestion/2°	2.07	2.00	2.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	Weighted 1° Ingestion (mL/hr)	-	-	-	-	-	4.61	7.57	25.14	Weighted 1°/2°	2.08	2.00	2.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total	2705	-	-	-	662	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

N = Number of participants.
 UCL = Upper confidence limit (i.e., mean + 1.96 × SD).
 - = No data.
 Source: Dorevitch et al. (2011).

2. For the months of November through April, culturable *E. coli* not to exceed a geometric mean of 265 counts per 100 mL based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. There shall be no greater than a ten percent excursion frequency of an *E. coli* statistical threshold value (STV) of 861 counts per 100 mL in the same 30-day interval.
3. The State does not encourage swimming in these surface waters since a number of factors which are beyond the control of any State regulatory agency contribute to elevated levels of bacteria.

The proposed bacteria criteria for fishing waters are as follows:

1. Estuarine waters:

For the months of May through October, when water contact recreation activities are expected to occur, culturable enterococci not to exceed a geometric mean of 35 counts per 100 mL based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. There shall be no greater than a ten percent excursion frequency of an enterococci statistical threshold value (STV) of 130 counts per 100 mL the same 30-day interval.

For the months of November through April, culturable enterococci not to exceed a geometric mean of 74 counts per 100 mL based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. There shall be no greater than a ten percent excursion frequency of an enterococci statistical threshold value (STV) of 273 counts per 100 mL the same 30-day interval.

2. All other fishing waters:

For the months of May through October, when water contact recreation activities are expected to occur, culturable *E. coli* not to exceed a geometric mean of 126 counts per 100 mL based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. There shall be no greater than a ten percent excursion frequency of an *E. coli* statistical threshold value (STV) of 410 counts per 100 mL in the same 30-day interval.

For the months of November through April, culturable *E. coli* not to exceed a geometric mean of 265 counts per 100 mL based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. There shall be no greater than a ten percent excursion frequency of an *E. coli* statistical threshold value (STV) of 861 counts per 100 mL in the same 30-day interval.

The State does not encourage swimming in these surface waters since a number of factors which are beyond the control of any State regulatory agency contribute to elevated levels of bacteria.

3. For waters designated as shellfish growing areas by the Georgia DNR Coastal Resources Division, the requirements will be consistent with those established by

the State and Federal agencies responsible for the National Shellfish Sanitation Program. The requirements are found in National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish, 2007 Revision (or most recent version), Interstate Shellfish Sanitation Conference, U.S. Food and Drug Administration.

EPD is also removing the statement in our current fishing and drinking water uses that allows for higher bacteria criteria if water quality and sanitary studies show that the bacteria is from a non-human source. Since E. coli and enterococci are better indicators for gastrointestinal illness than our previous indicator (fecal coliform), EPD believes the source of the bacteria (human or non-human) is no longer relevant and therefore is not an appropriate justification for allowing higher bacteria criteria.

The information in Table 2 displays the proposed criteria. However, the table is not being adopted into the rules.

Table 2: Proposed Bacteria Criteria

Designated Use	Season	Indicator	Geometric Mean	STV
Drinking Water	Primary contact recreation (May – October)	E. coli	126 counts per 100 mL	410 counts per 100 mL
	Secondary contact recreation (November – April)	E. coli	265 counts per 100 mL	861 counts per 100 mL
Fishing (Estuarine)	Primary contact recreation (May – October)	Enterococci	35 counts per 100 mL	130 counts per 100 mL
	Secondary contact recreation (November – April)	Enterococci	74 counts per 100 mL	273 counts per 100 mL
Fishing	Primary contact recreation (May – October)	E. coli	126 counts per 100 mL	410 counts per 100 mL

	Secondary contact recreation (November – April)	E. coli	265 counts per 100 mL	861 counts per 100 mL
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