

# MICROBIOLOGICAL WATER QUALITY ASSESSMENT OF WATERSHED ASSOCIATED WITH SWINE PRODUCTION IN SANTA CATARINA, BRAZIL

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## ABSTRACT

## BACKGROUND

Santa Catarina State has the largest pig producers in Brazil and its West region has the highest concentration of swine production. Diagnostic assessment conducted by Embrapa Swine and Poultry Scientists in 2003 reported that more than 90% of 3,821 pig farms didn't have the required environmental license to operate. The Environmental State Promoter proposed an Adjustment Environmental Contract (AEC) to legalize these farms. Embrapa has a current project that monitors the effectiveness of AEC in terms of social, environmental and economic impacts.

## OBJECTIVE

The aim of this research was to monitor the microbiological water quality in a subbasin of Pinhal River characterized by farmers that signed with the AEC.

## MATERIALS AND METHODS

The subbasin is located in Concordia-Brazil rural area. Eight sampling points along the Pinhal River were selected. The sampling period of August to January was selected because it is the time of the year that many farmers prepare their soil to corn planting. Total Coliform, Fecal Coliform, *Escherichia coli*, and Salmonella were analyzed from each sample.

## RESULTS AND DISCUSSION

Salmonella was not present in all the samples, but monitoring points located in the lower subbasin had higher levels of Salmonella. This microorganism could be threat to human and animal health (Table 1).

The highest concentrations evaluated for the three Coliforms microorganisms were: Total Coliform, 480 UFC/ml; Fecal Coliform, 200 UFC/ml and *E. coli*, 280 UFC/ml. Tables 2, 3, and 4, shows results of Total Coliforms, Fecal Coliforms, and *E. coli* in the period of sampling. The worst microbiological water quality standards was verified in a rainy sampling day, September 20 (45 mm of rain). It shows the importance of soil conservative practices and presence of riparian vegetation, that is absent in most of farms around the river. The regulation 357/05 of National Environmental Council establishes a limit of Fecal Coliform to Pinhal River of 1,000/100 ml, its must occur in 80% of samples, considering a minimum of 6 samples in a year. In 11 samples, no one got its limit.

The AEC will continue to recommend that actions must be taken to improve the microbiological water quality of watersheds that are associated with swine production. Other results demonstrating the relationship between microbiological water quality and soil conservation, presence of riparian vegetation and use of pig waste as fertilizers will be reported.



Swine & Poultry

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**Table 1.** Results of Salmonella in the 8 points of sampling of the Pinhal River (X, means present).

Date	P1	P2	P3	P4	P5	P6	P7	P8
10/18/06	X	X	X	X	X	X	X	X
11/16/06	X	X	X	X	X	X	X	X
11/30/06	X	X	X	X	X	X	X	X
12/14/06								
12/27/06	X	X	X	X	X	X	X	X
01/10/07								
01/24/07			X	X	X	X	X	X

**Table 2.** Mean, Standard Error, Confidence Interval (95%), and Maximum Value of Total Coliforms in the dates of sampling.

Dates	Mean <sup>a</sup>	Std. Error <sup>a</sup>	Confidence Interval <sup>b</sup>	Maximum
08/30/2006 <sup>a</sup>	21,63 <sup>a</sup>	8,23 <sup>a</sup>	(20,88;22,37) <sup>a</sup>	37 <sup>a</sup>
09/14/2006 <sup>a</sup>	29,63 <sup>a</sup>	9,55 <sup>a</sup>	(28,76;30,49) <sup>a</sup>	49 <sup>a</sup>
09/20/2006 <sup>a*</sup>	277,86 <sup>a</sup>	130,51 <sup>a</sup>	(266,06;289,66) <sup>a</sup>	480 <sup>a</sup>
10/05/2006 <sup>a</sup>	35,88 <sup>a</sup>	34,94 <sup>a</sup>	(32,72;39,03) <sup>a</sup>	118 <sup>a</sup>
10/19/2006 <sup>a</sup>	70,13 <sup>a</sup>	59,11 <sup>a</sup>	(64,78;75,47) <sup>a</sup>	211 <sup>a</sup>
10/31/2006 <sup>a</sup>	31,38 <sup>a</sup>	8,45 <sup>a</sup>	(30,61;32,14) <sup>a</sup>	42 <sup>a</sup>
11/16/2006 <sup>a</sup>	36,63 <sup>a</sup>	11,9 <sup>a</sup>	(35,55;37,7) <sup>a</sup>	60 <sup>a</sup>
11/30/2006 <sup>a</sup>	57,38 <sup>a</sup>	51,14 <sup>a</sup>	(52,75;62) <sup>a</sup>	182 <sup>a</sup>
12/14/2006 <sup>a</sup>	46,25 <sup>a</sup>	47,85 <sup>a</sup>	(41,92;50,58) <sup>a</sup>	161 <sup>a</sup>
12/27/2006 <sup>a</sup>	49,75 <sup>a</sup>	20,62 <sup>a</sup>	(47,89;51,61) <sup>a</sup>	98 <sup>a</sup>
01/24/2007 <sup>a</sup>	27,5 <sup>a</sup>	6,48 <sup>a</sup>	(26,91;28,09) <sup>a</sup>	39 <sup>a</sup>

<sup>a</sup>rainy-day<sup>VI</sup>

**Table 3.** Mean, Standard Error, Confidence Interval (95%), and Maximum Value of Fecal Coliforms in the dates of sampling.

Dates	Mean <sup>a</sup>	Std. Error <sup>a</sup>	Confidence Interval <sup>b</sup>	Maximum
08/30/2006 <sup>a</sup>	14 <sup>a</sup>	3,66 <sup>a</sup>	(13,67;14,33) <sup>a</sup>	19 <sup>a</sup>
09/14/2006 <sup>a</sup>	20,75 <sup>a</sup>	9,1 <sup>a</sup>	(19,93;21,57) <sup>a</sup>	29 <sup>a</sup>
09/20/2006 <sup>a*</sup>	110,86 <sup>a</sup>	57,02 <sup>a</sup>	(105,7;116,01) <sup>a</sup>	200 <sup>a</sup>
10/05/2006 <sup>a</sup>	21,75 <sup>a</sup>	17,71 <sup>a</sup>	(20,15;23,35) <sup>a</sup>	62 <sup>a</sup>
10/19/2006 <sup>a</sup>	45,75 <sup>a</sup>	27,07 <sup>a</sup>	(43,3;48,20) <sup>a</sup>	109 <sup>a</sup>
10/31/2006 <sup>a</sup>	23 <sup>a</sup>	6,82 <sup>a</sup>	(22,38;23,62) <sup>a</sup>	34 <sup>a</sup>
11/16/2006 <sup>a</sup>	29,5 <sup>a</sup>	8,93 <sup>a</sup>	(28,69;30,31) <sup>a</sup>	40 <sup>a</sup>
11/30/2006 <sup>a</sup>	44 <sup>a</sup>	24,45 <sup>a</sup>	(41,79;46,21) <sup>a</sup>	102 <sup>a</sup>
12/14/2006 <sup>a</sup>	37,13 <sup>a</sup>	40,24 <sup>a</sup>	(33,49;40,76) <sup>a</sup>	133 <sup>a</sup>
12/27/2006 <sup>a</sup>	38,88 <sup>a</sup>	11,7 <sup>a</sup>	(37,82;39,93) <sup>a</sup>	63 <sup>a</sup>
01/24/2007 <sup>a</sup>	19 <sup>a</sup>	3,55 <sup>a</sup>	(18,68;19,32) <sup>a</sup>	24 <sup>a</sup>

<sup>a</sup>rainy-day<sup>VI</sup>

**Table 4.** Mean, Standard Error, Confidence Interval (95%), and Maximum Value of *Escherichia coli* in the dates of sampling.

Dates	Mean <sup>a</sup>	Std. Error <sup>a</sup>	Confidence Interval <sup>b</sup>	Maximum
08/30/2006 <sup>a</sup>	7,75 <sup>a</sup>	7,3 <sup>a</sup>	(7,09;8,41) <sup>a</sup>	25 <sup>a</sup>
09/14/2006 <sup>a</sup>	8,38 <sup>a</sup>	10,04 <sup>a</sup>	(7,47;9,28) <sup>a</sup>	26 <sup>a</sup>
09/20/2006 <sup>a*</sup>	167 <sup>a</sup>	81,71 <sup>a</sup>	(159,61;174,39) <sup>a</sup>	280 <sup>a</sup>
10/05/2006 <sup>a</sup>	14,13 <sup>a</sup>	18,93 <sup>a</sup>	(12,41;15,84) <sup>a</sup>	56 <sup>a</sup>
10/19/2006 <sup>a</sup>	23,13 <sup>a</sup>	32,93 <sup>a</sup>	(20,15;26,1) <sup>a</sup>	102 <sup>a</sup>
10/31/2006 <sup>a</sup>	7,5 <sup>a</sup>	6,12 <sup>a</sup>	(6,95;8,05) <sup>a</sup>	16 <sup>a</sup>
11/16/2006 <sup>a</sup>	7,13 <sup>a</sup>	10,88 <sup>a</sup>	(6,14;8,11) <sup>a</sup>	33 <sup>a</sup>
11/30/2006 <sup>a</sup>	14 <sup>a</sup>	26,82 <sup>a</sup>	(11,57;16,43) <sup>a</sup>	80 <sup>a</sup>
12/14/2006 <sup>a</sup>	9,13 <sup>a</sup>	9,86 <sup>a</sup>	(8,23;10,02) <sup>a</sup>	28 <sup>a</sup>
12/27/2006 <sup>a</sup>	11,5 <sup>a</sup>	10,04 <sup>a</sup>	(10,59;12,41) <sup>a</sup>	35 <sup>a</sup>
01/24/2007 <sup>a</sup>	8,25 <sup>a</sup>	5,82 <sup>a</sup>	(7,72;8,78) <sup>a</sup>	19 <sup>a</sup>

<sup>a</sup>rainy-day<sup>VI</sup>