TL66 - ASSESSMENT OF FAECAL COLIFORM LOAD FROM WATERSHEDS DRAINING INTO SANTA CATARINA ISLAND BAY

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INTRODUCTION

Brazilian mollusk aquaculture is concentrated mainly in the State of Santa Catarina, where 95% of the national production is generated. This state produces approximately 15,000 tons/year, 73% of that amount comes from the Santa Catarina Island Bay (SCI Bay). This bay present a water surface of 430 km2 and receives the water drained from watersheds of mixed land uses with vast areas of forested land interspersed by densely populated areas (global drainage area of 1,875 km2). The Community Guide to the Principles of Good Practice for the Microbiological Monitoring of Bivalve Mollusk Harvesting Areas is the European document that gives recommendations for the assessment of the risk of contamination with bacterial and viral pathogens, according to Regulation (EC) No. 854/2004. The recommendations involve the evaluation of the sources and potential impact of faecal contamination in the vicinity of production areas. A research project has been applying similar methodology in Santa Catarina State, specifically in the SCI Bay and part of the results is presented here.

AIMS

This study aims to determine the total faecal coliform loads per second (TFCLs) of the watersheds (Wn) which streams flow into the SCI Bay and to point out the main faecal pollution sources.

METHODS

The investigation is based in three steps: monitoring of fecal coliforms levels in the waters from the largest watersheds that drains in the SCI Bay; flow measurements of the largest rivers and streams; computation of TFCLs based on the regionalization of the watersheds for water flow. The drainage area was divided in 47 watersheds (Figure 1). All of them are in the same climate zone and have the same kind of soil and vegetal land cover. However they vary in size (ranging from 743 km2 to 0.35 km2) and in land use (8% of the total area corresponds to urbanized area). From August 2012 to April 2013, water samples were collected on a fortnightly basis near the watersheds outfall. The samples were analyzed for faecal coliform levels. Flow measurements were performed using different methods, depending on the size of the stream flow. The river which drained the largest volume was continually monitored for water flow. Additionally, 26 rivers and streams had their flows measured three times, during low rain period. Finally, the obtained water flows were used for the regionalization of the remaining watersheds. Multiplying the average coliform level results by the water flow rates inferred, the TFCLs for each watershed was computed. In areas of dense urban occupation, the sewer system plans were consulted to identify the existence of sewage collection and treatment system.

RESULTS

The global TFCLs obtained for SCI Bay was 1.73x1010 MPN.s^{-1}. The watersheds W5 and W21 together contribute with 59% of overall fresh water input to the SCI Bay, but just 10% of the TFCLs, while watersheds W10, W15, W17 and W38 together contribute with 12% of fresh water input and 49% of the TFCLs. Moreover, W17 alone is responsible for 24% of the TFCLs. The results show that, in general, the most important faecal contributions are in the central area of the bay. These areas coincide with the areas of largest population density (Figure 1).

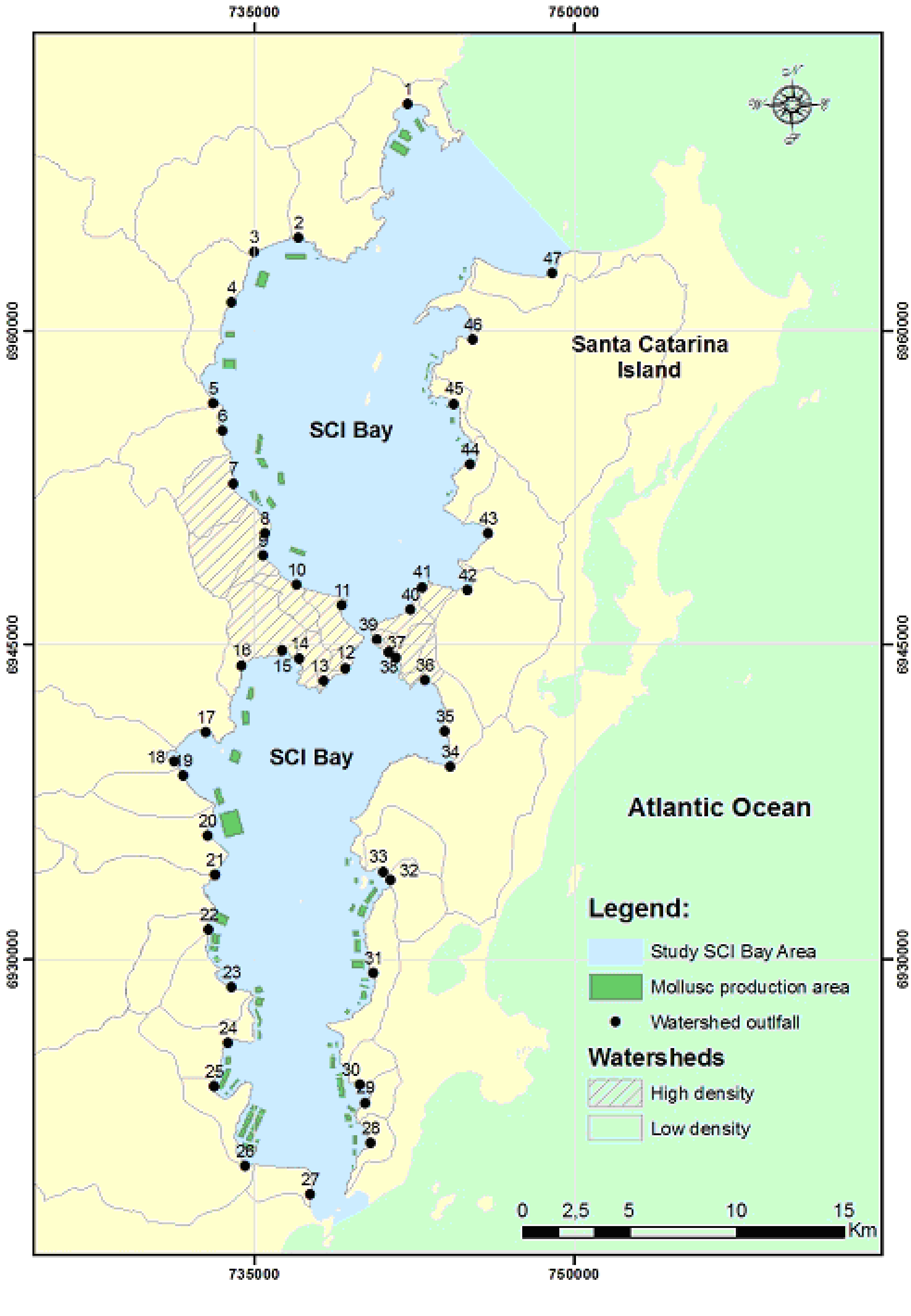

Figure 1- SCI Bay with its watersheds outfalls and production areas.

Watersheds water flow and TFCLs: Based on the maps from the company responsible for the operation of sewer systems, the densely occupied watersheds (>4,000 hab.km-2) were divided in two groups: those with less than 70% and with more than 70% of sewer system coverage (Figure 1). Surprisingly, the average TFCLs per habitant in of both groups were similar, with values of 5.31x105 $MPN.100mL^{-1}$ for the former and 1.75x106 $MPN.100mL^{-1}$ for the latter. These results indicate that the sewer systems in place have limited efficiency. This result is important and further investigations are required to confirm such evidence (Table 1).

Table 1: Watersheds water flow and TFCLs.

Watershed Id	Freshwater flow [L.s^{-1}]	Percentage contribution	TFCLs [MPN.s^{-1}]	Percentage contribution
W 1	235	0,8%	$1.22x10^{+07}$	0,1%
W 2	288	1,0%	$1.42x10^{+07}$	0,1%
W 3	557	1,8%	$2.49x10^{+07}$	0,1%
W 4	191	0,6%	$1.13x10^{+06}$	0,0%
W 5	6,024	19,9%	$8.59x10^{+08}$	5,0%
W 6	220	0,7%	$1.10x10^{+08}$	0,6%
W 7	128	0,4%	$9.60x10^{+07}$	0,6%
W 8	137	0,5%	$3.27x10^{+08}$	1,9%
W 9	73	0,2%	$8.61x10^{+08}$	5,0%
W10	140	0,5%	$1.01x10^{+09}$	5,8%
W11	176	0,6%	$5.45x10^{+08}$	3,1%
W12	31	0,1%	$3.62x10^{+08}$	2,1%
W13	20	0,1%	$7.59x10^{+07}$	0,4%
W14	118	0,4%	$6.91x10^{+08}$	4,0%
W15	392	1,3%	$2.28x10^{+09}$	13,2%
W16	30	0,1%	$4.18x10^{+07}$	0,2%
W17	3,134	10,4%	$4.20x10^{+09}$	24,2%
W18	444	1,5%	$1.55x10^{+08}$	0,9%
W19	138	0,5%	$6.99x10^{+07}$	0,4%
W20	373	1,2%	$1.24x10^{+08}$	0,7%
W21	11,690	38,7%	$8.06x10^{+08}$	4,7%
W22	154	0,5%	$3.09x10^{+06}$	0,0%
W23	157	0,5%	$2.45x10^{+07}$	0,1%
W24	155	0,5%	$6.29x10^{+05}$	0,0%
W25	87	0,3%	$5.38x10^{+05}$	0,0%
W26	1,158	3,8%	$3.89x10^{+07}$	0,2%
W27	65	0,2%	$9.37x10^{+05}$	0,0%
W28	50	0,2%	$4.55x10^{+04}$	0,0%
W29	49	0,2%	$6.95x10^{+04}$	0,0%
W30	49	0,2%	$6.07x10^{+06}$	0,0%
W31	155	0,5%	$4.98x10^{+05}$	0,0%
W32	116	0,4%	$2.48x10^{+06}$	0,0%
W33	133	0,4%	$4.06x10^{+08}$	2,3%
W34	657	2,2%	$6.91x10^{+07}$	0,4%
W35	84	0,3%	$4.08x10^{+07}$	0,2%
W36	34	0,1%	$1.11x10^{+08}$	0,6%
W37	94	0,3%	$8.19x10^{+08}$	4,7%
W38	11	0,04%	$9.98x10^{+08}$	5,8%
W39	14	0,05%	$3.53x10^{+08}$	2,0%
W40	91	0,3%	$5.44x10^{+08}$	3,1%
W41	72	0,2%	$6.50x10^{+08}$	3,8%
W42	428	1,4%	$7.41x10^{+07}$	0,4%
W43	283	0,9%	$3.39x10^{+08}$	2,0%
W44	69	0,2%	$4.95x10^{+07}$	0,3%
W45	37	0,1%	$3.94x10^{+06}$	0,0%
W46	1,352	4,5%	$2.76x10^{+07}$	0,2%
W47	127	0,4%	$8.14x10^{+07}$	0,5%

CONCLUSIONS

Watersheds in the central area of the SCI Bay are the most important source of faecal pollution. This central area shows high TFLCs even though sewer treatments systems are in place. To understand the dispersion of the faecal pollution arising from the central area of the SCI Bay and its influence on the mollusk production areas, the data presented here should be assessed using hydrodynamic modeling. Further evaluation should be addressed in order to understand the reasons for high levels of faecal coliforms in watersheds covered with almost 100% of sewer system.