

# CARIBBEAN RESEARCH INSTITUTE



WATER POLLUTION REPORT NO. 9

THE STATUS OF WATER QUALITY IN CRUZ BAY  
AND CHOCOLATE HOLE, ST. JOHN

David I. Grigg and Robert P. vanEpoel

January, 1971

(2nd Printing - June, 1971)

GOVERNMENT OF THE VIRGIN ISLANDS  
DEPARTMENT OF HEALTH, DIVISION OF ENVIRONMENTAL HEALTH

WATER POLLUTION REPORT  
Contracted By  
CARIBBEAN RESEARCH INSTITUTE  
COLLEGE OF THE VIRGIN ISLANDS

REPORT ON  
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## I. INTRODUCTION

This report is a follow-up evaluation of two bays previously studied.<sup>1</sup> It should be interpreted in that context and with reference to the original reports. The present evaluation is based on quantitative data collected in November and December of 1970, and on aerial photographs and snorkeling investigations of both bays. We wish to thank Mr. Fred Nicholson, Director of the Bureau of Public Health Laboratories for once again performing the bacteriological analyses.

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Brody, R. W., D. I. Grigg, D. M. Raup and R. P. vanEepoel,  
Report on Estuarine Environment at Cruz Bay, St. John, Government of the  
Virgin Islands, Department of Health, Division of Environmental Health:  
"Phase I Report, A Study of the Effects of Pollutants on the Waters and Sediments  
of Cruz Bay", October, 1969; "Phase II Report, A Study of the Waters, Sediments,  
and Biota of Chocolate Hole, St. John, with Comparison to Cruz Bay, St. John",  
January, 1970.

## II. CRUZ BAY

Water quality data were gathered in Cruz Bay on November 20, 1970 and again on December 1, 1970 and are summarized in Table 1. Between these times rough seas had stirred up the bottom of the bay considerably. This was evident by increased turbidity and large amounts of benthic grasses, algae, bivalve mollusks and sponges washed up on the beach. This very high energy situation must have occurred shortly before our inspection on December 1, 1970 because all of the stranded organisms were still alive at that time. Other effects of this surge action were apparent and are evident in Table 1.

The temperature was lowered at all stations, reflecting the intrusion of colder water from Pillsbury Sound. Salinity was made more uniform throughout the bay; the range was compressed from 35.6 ppt - 37.5 ppt measured on November 20, 1970 to 36.0 ppt - 36.4 ppt. At all stations except #38 (deepest in the creek), pH was higher on the second occasion. There was no change at Station #38. At all but one station (#27) there was an increase in suspended solids and Secchi depth was reduced at several stations. Visibility was obviously reduced in the northeast portion of the harbor around Government House Point and the ferry dock. In fact, the reduction (compared to summer, 1969) at Station #27 off the tip of the dock was very striking: from 4.2 meters (bottom) to 2.5 meters. Color was normal around the channel light and along the reef south to Golge Point and in a narrow band east of the reef. Elsewhere color was noticeably affected by the milky cast of suspended sand fines. Snorkeling investigation showed that there was indeed suspended sand and organic particulates in the water. Much scouring has occurred in the back reef area and this area was also the source of the large number of benthic organisms found washed up on the beach.

It is apparent that seasonal changes in sea and weather significantly affect the water in Cruz Bay (Table 2). For this reason, it is more likely that reliable indications of significant or permanent changes in water quality would be gained by comparing the data from winter, 1969 and winter, 1970. When this is done, the most striking difference is that dissolved oxygen in both areas was higher this December than a year ago: 6.2 mg/l as compared with 5.7 mg/l in the harbor and 5.6 mg/l versus 4.3 mg/l in the creek. A definite reduction in aquatic visibility is apparent, especially at Stations #14, 21, 23, 27. This is the area around Government House Point. The average Secchi disc visibility in the harbor (2.7 meters) is apparently reduced compared to 3.2 meters (average bottom depth) last year. Visibility is very much reduced compared to summer and fall of 1969. Now the bottom is visible only in that section north and west of Stations #4, 5, 6, 11, 18 and in water less than 1.5 - 2 meters along the beach. Along the north shore the bottom can be seen only in less than 1 meter. On the other hand, most stations checked in the creek area showed an increase in water clarity. The improvement here is also evident from a boat and from aerial photos.

There are now many boats anchored in the bay than a year ago, and a small floating dock has been placed off the beach to service ferry boats. Boat traffic in and out of the bay is noticeably heavier. In the creek the water color is still very bad and in the area of Stations #34 and #36, there was a great deal of oil. The septic odor of sewage was very bad here on November 20, 1970 and it was noted that where the sewer line comes out of the bulkhead near Station #30 the elbow was broken loose and sewage was being discharged upward out of the break to the water surface. Of six samples evaluated for fecal coliforms and streptococci this was the only positive sample, with 2 fecal coliform per 100 ml.

In summary, Cruz Bay water quality on the whole is worse now than it was a year ago. Accompanying this reduction of quality, however, has been a relative improvement in the quality of the creek water. Presently, it seems likely that most of the change is due to seasonal wave action in Cruz Bay. This has disturbed bottom sediments in the outer bay and promoted unusual mixing between the waters of the harbor and the creek. This mixing has resulted, because of the usual inequity in these water masses, in a relative improvement of creek water quality at the expense of a simultaneous reduction in harbor water quality. It is therefore difficult to determine if Cruz Bay has sustained any permanent, long-term change in water quality.

### III. CHOCOLATE HOLE

Data collected in Chocolate Hole in November are given in Table 3. The bay shows very few changes since our survey a year ago. Water color, visibility and bottom organisms seem to be in as good condition now as then and the bottom can still be seen throughout the bay. The only quantitative observation of note is a significantly lower salinity at Station #7, where the pond connects to the bay. This salinity depression is undoubtedly caused by outflowing pond water which, considering the unusual amounts of rainfall during the past year, must now be quite brackish. Monthly averages for water quality data are given in Table 4.

There are now 4-5 boats anchored in the bay and littering of the sea bottom is increasing: several cans and other items were noted. Except for these, no adverse changes were noted.





# CHOCOLATE HOLE, ST. JOHN

Figure 2  
Locations of Stations

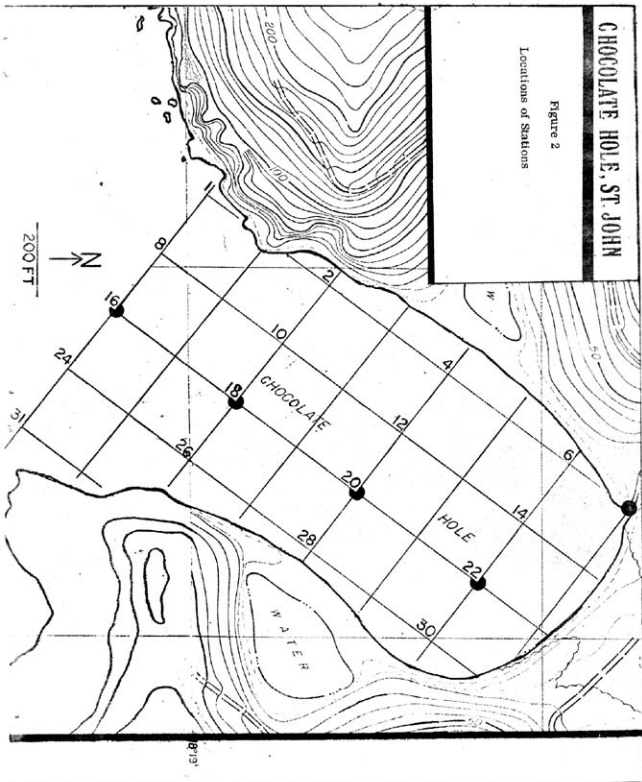


TABLE 1

CRUZ BAY, ST. JOHN  
WATER QUALITY DATA, NOV.-DEC., 1970

Station	Date	Temp. ° C.	Sal. ‰	pH	D. O.		Secchi Depth M.	Suspended Solids MG/L.	Fecal Coliform per 100 ML	Fecal Strep per 100 ML
					MG/L	% Sat.				
4	11/20/70	28.0	37.5	8.1	6.4	102	B	27.2	0	0
	12/1/70	27.1	36.0	8.3	6.3	97	B	32.2	--	--
14	11/20/70	27.9	37.5	8.1	5.9	94	3.0	17.6	--	--
	12/1/70	27.0	36.2	8.3	6.3	97	2.8	20.6	--	--
18	11/20/70	28.0	37.5	8.1	6.8	108	B	8.6	0	0
	12/1/70	27.1	36.0	8.3	6.2	95	B	16.1		
21	12/1/70	27.2	36.0	8.2	6.2	95	2.8	13.0	--	--
23	12/1/70	27.1	36.0	8.3	6.3	97	2.3	23.7	--	--
27	11/20/70	28.0	35.6	8.1	6.3	99	3.0	16.1		
	12/1/70	27.2	36.2	8.3	6.1	94	2.5	13.9	0	0
<b>AVERAGE</b>		27.5	36.5	8.2	6.3	98	2.7-B	18.9	0	0
30	11/20/70	28.0	37.5	8.1	5.8	92	2.0	0.0	2	0
	12/1/70	26.8	36.0	8.2	6.1	94	2.3	18.0		
34	12/1/70	26.6	36.4	8.2	5.6	85	--	16.2	--	--
36	11/20/70	28.0	36.7	8.1	5.4	86	0.8	14.1	0	0
	12/1/70	26.6	36.2	8.2	5.4	82	--	19.1		
38	11/20/70	28.2	35.7	8.0	5.3	83	1.25	13.7	0	0
	12/1/70	26.6	36.4	8.0	5.3	80	--	21.3		
<b>AVERAGE</b>		27.3	36.4	8.1	5.6	86	1.6	14.6	< 1	0

CRUZ BAY, ST. JOHN  
MONTHLY AVERAGES FOR SIX WATER QUALITY PARAMETERS

STATION	DATE	TEMP. ° C.	SAL. ‰	pH	D. O. MG/L	SECCHI DEPTH METERS	FECAL COLIFORM AND STREP CELLS/100 ML
<u>4</u>	AUG/69	29.5	36.2	-	-	-	-
	SEP/69	29.2	36.5	8.3	6.0	3.8B	8
	DEC/69	27.2	36.5	8.3	6.1	3.8B	0
	NOV/70	28.0	37.5	8.1	6.4	3.8B	0
	DEC/70	27.1	36.0	8.3	6.3	3.8B	-
<u>14</u>	AUG/69	29.5	36.3	-	-	-	-
	SEP/69	29.3	36.6	8.3	5.2	3.5B	31
	DEC/69	27.2	36.5	8.4	5.9	3.5B	-
	NOV/70	27.9	37.5	8.1	5.9	3.0	-
	DEC/70	27.0	36.2	8.3	6.3	2.8	-
<u>18</u>	AUG/69	29.5	36.4	-	-	-	-
	SEP/69	29.5	37.5	8.3	5.7	1.8B	4
	DEC/69	27.0	36.5	8.4	5.8	1.8B	7
	NOV/70	28.0	37.5	8.1	6.8	1.8B	0
	DEC/70	27.1	36.0	8.3	6.2	1.8B	-
<u>21</u>	AUG/69	29.5	36.3	-	-	-	-
	SEP/69	29.4	37.0	8.3	5.6	3.2B	48
	DEC/69	27.1	36.5	8.4	5.7	3.2B	-
	NOV/70	-	-	-	-	-	-
	DEC/70	27.2	36.0	8.2	6.2	2.8	-
<u>23</u>	AUG/69	30.0	36.0	-	-	-	-
	SEP/69	29.6	36.6	8.3	4.7	2.7B	15
	DEC/69	27.3	36.5	8.3	4.7	2.7B	11
	NOV/70	-	-	-	-	-	-
	DEC/70	27.1	36.0	8.3	6.3	2.3	-
<u>27</u>	AUG/69	30.0	35.6	-	-	-	-
	SEP/69	29.5	36.6	8.3	5.5	4.2B	7
	DEC/69	27.2	36.5	8.4	5.9	3.9	0
	NOV/70	28.0	35.6	8.1	6.3	3.0	0
	DEC/70	27.2	36.2	8.3	6.1	2.5	-
<u>30</u>	AUG/69	30.0	28.2	-	-	-	-
	SEP/69	29.8	36.2	8.2	4.3	1.9	12
	DEC/69	26.9	36.5	8.3	5.3	2.2	-
	NOV/70	28.0	37.5	8.1	5.8	2.0	2
	DEC/70	26.8	36.0	8.2	6.1	2.3	-
<u>34</u>	AUG/69	30.0	35.9	-	-	-	-
	SEP/69	29.7	36.6	8.2	4.3	1.1	79
	DEC/69	27.3	36.5	8.3	3.8	1.5	-
	NOV/70	-	-	-	-	-	-
	DEC/70	26.6	36.4	8.2	5.6	-	-
<u>36</u>	AUG/69	30.0	36.0	-	-	-	-
	SEP/69	29.8	36.0	8.2	4.3	1.1	80
	DEC/69	27.3	36.5	8.3	4.4	1.5	-
	NOV/70	28.0	36.7	8.1	5.4	0.8	0
	DEC/70	26.6	36.2	8.2	5.4	-	-
<u>38</u>	AUG/69	29.5	36.8	-	-	-	-
	SEP/69	29.6	37.1	8.1	4.0	0.8	20
	DEC/69	27.4	36.6	8.3	3.7	1.8	3
	NOV/70	28.2	35.7	8.0	5.3	1.3	0
	DEC/70	26.6	36.4	8.0	5.3	-	-

TABLE 3

CHOCOLATE HOLE, ST. JOHN  
WATER QUALITY DATA, NOV. 13, 1970

Station	Temp. ° C.	Sal. ‰	pH	D. O.		Secchi Depth M.	Light Extinction (Ft-Candle/M)	
				MG/L	% Sat.		Top Meter	To Bottom
7	28.5	34.8	8.2	5.1	80	B	--	--
16	28.5	--	8.2	6.0	94	B	2,600	705
18	28.1	36.0	8.2	6.3	98	B	3,020	745
20	28.1	--	8.1	6.2	98	B	330	655
22	28.0	36.0	8.1	6.0	95	B	3,000	1,640
<b>AVERAGE</b>	28.2	35.6	8.2	5.9	93	B	2,275	936

TABLE 4

CHOCOLATE HOLE, ST. JOHN  
MONTHLY AVERAGES FOR SIX WATER QUALITY PARAMETERS

Station	Date	Temp.	Sal. ‰	D.O. MG/L	PH	Secchi Depth Meters	Fecal Strep & Coliform Cells/100ml
2	Oct./69	30.0	36.7	4.9	7.8	B	48
	Nov./69	28.5	36.1	6.0	8.3	B	3
	Dec./69	27.6	36.4	6.5	8.4	B	-
	Nov./70	-	-	-	-	B	-
5	Oct./69	29.5	-	4.5	7.8	B	24
	Nov./69	28.4	36.2	6.1	8.3	B	< 1
	Dec./69	27.8	36.4	6.5	8.4	B	0
	Nov./70	-	-	-	-	B	0
7	Oct./69	-	-	-	-	B	0
	Nov./69	28.7	36.0	6.0	8.4	B	0
	Dec./69	28.2	36.4	6.2	8.4	B	0
	Nov./70	28.5	34.8	6.0	8.2	B	0
18	Oct./69	30.0	36.3	5.5	7.8	B	6
	Nov./69	28.6	36.2	6.0	8.3	B	< 1
	Dec./69	27.4	36.4	6.5	8.4	B	0
	Nov./70	28.1	36.0	6.3	8.2	B	-
20	Oct./69	29.6	36.7	6.1	7.8	B	0
	Nov./69	28.8	36.2	6.0	8.3	B	0
	Dec./69	27.7	36.4	6.2	8.4	B	1
	Nov./70	28.1	-	6.0	8.1	B	-
22	Oct./69	29.6	36.7	6.5	7.8	B	14
	Nov./69	28.5	36.2	6.0	8.4	B	4
	Dec./69	27.8	36.3	6.5	8.4	B	-
	Nov./70	28.0	36.1	5.1	8.1	B	-
26	Oct./69	30.0	36.7	6.0	7.8	B	82
	Nov./69	28.5	36.1	6.1	8.3	B	2
	Dec./69	27.8	36.4	6.5	8.4	B	-
	Nov./70	-	-	-	-	B	-
30	Oct./69	29.4	36.7	6.4	7.8	B	302
	Nov./69	28.4	36.2	6.0	8.4	B	20
	Dec./69	27.8	36.4	6.2	8.4	B	0
	Nov./69	-	-	-	-	B	-
P1	Oct./69	30.0	36.7	2.7	7.2	-	-
	Nov./69	28.7	35.4	5.7	8.2	-	3
	Dec./69	30.8	37.8	5.9	8.2	-	-
P2	Oct./69	30.5	-	2.8	7.4	-	-
	Nov./69	28.0	35.7	6.0	8.3	-	19
	Dec./69	30.6	38.3	5.8	8.6	-	-