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## Shellfish Growing Water Sanitary Survey of

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# SHELLFISH GROWING WATER SANITARY SURVEY OF <br> BAYNES SOUND, GARTLEY POINT TO DEEP BAY <br> <br> BRITISH COLUMBIA 

 <br> <br> BRITISH COLUMBIA}
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Pollution Abatement Branch<br>Environmental Protection Service<br>Pacific Region<br>Vancouver, B. C.<br>Report EPS 5-PR-74-10<br>November 1974

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ABSTRACT
A sanitary and bacteriological survey of the waters of Baynes Sound, including the tidal foreshore of Vancouver Island between Gartley Point and Deep Bay, was conducted during the periods of February 12 to March 8, 1974, and April 17 to May 10, 1974, by personnel of the Environmental Protection Service, Pacific Region.

The survey was conducted to determine the bacteriological quality of the shellfish growing waters and to assess the impact of domestic sewage discharges on the quality of the receiving waters.

A total of 276 sea water samples from 28 locations and 128 stream samples from 21 locations were collected and analysed for coliform and fecal coliform numbers using the 5-tube MPN method.

With only one exception, the water quality of the sampled areas was bacteriologically acceptable for shellfish growing waters. Unacceptable coliform densities were experienced at the mouth of Waterloo Creek located immediately north of Mud Bay.

A recommendation is made to prohibit oyster harvesting at the mouth of Waterloo Creek, and to maintain the 1000 foot closure currently in effect around the Union Bay Wharf.

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## RESUME

Le personnel du Service de protection de l'environment (région du Pacifique) a entrpris une étude sanitaire et bactériologique des eaux du détroit de Baynes et de l'avantplage contigüe qui s'étend de la pointe Gartley à la baie Deep dans $1^{\prime}$ 'lle de Vancouver, pendant les périodes du 17 février au 8 mars 1974 et du 17 avri1 au 10 mai 1974.

L'étude avait pour objet d'évaluer la qualité des eaux où se reproduisent les crustacés et les mollusques et de dé-


On a prélevé 276 échantillons d'eau de mer à 28 endroits et 128 échantillons d'eau de rivière à 21 endroits, et on les a analysés dans le but de compter les coliformes et les coliformes fécaux au moyen de la méthode MPN à 5 éprouvettes.

Tous les échantillons prélevés sauf un furent acceptables du point de vue bactériologique pour la reproduction des crustacés et des mollusques. L'échantillon prélevé à $l^{\prime}$ embouchure du crique Waterloo juste au nord de la baie Mud ne répondait pas aux normes acceptable.

On a donc recommandé d'interdire la prise d'huîtres
 d'interdiction actuelle de mille pieds autour du quai de la baie Union.

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Baynes Sound is one of British Columbia's prime oyster culture areas and extensive commercial harvesting from the foreshore waters takes place at both Denman Island and Vancouver Island. Oysters harvested from the area are processed by five shucking plants operating in Baynes Sound, or are shipped to other processors in southern British Columbia.

The area was last surveyed in April and November of 1964 by the Departments of Fisheries and National Health and Welfare, and the growing waters were shown to be of acceptable quality in the majority of those areas tested. However, due to limited time and facilities, a statistically significant number of samples was not collected in all areas and it was recommended that further sampling should take place. A full sanitary survey of Baynes Sound from Deep Bay to Gartley Point, was launched in early 1974 to reassess the quality of the growing waters. This reassessment was necessary for several reasons: (l) considerable development had taken place along the shoreline since the 1964 survey and the presence or absence of pollution from these sources must be ascertained; (2) high fecal coliform levels had been found in oyster meats taken from Ships Point, Deep Bay and Mud Bay in 1973; (3) Schedule $J$ closures imposed around the government wharves at Deep Bay and Union Bay required verification; (4) public health protection was of prime importance due to the extensive commercial harvesting of oysters in Baynes Sound.

In order to conduct a comprehensive bacteriological study of the growing areas, it was necessary to divide the survey into two sections. The first part of the survey included the shoreline of Vancouver Island from Deep Bay to Buckley Bay and was conducted from February 11 to March 15,
1974. The second part of the survey included the remainder of the shoreline as far north as Gartley Point and was conducted from April 17 to May l0, 1974. (The western shoreline of Denman Island was surveyed simultaneously with the eastern shoreline of Vancouver Island and the results of this survey can be found in EPS Surveillance Report 5-PR-74-9(3).)

The survey was conducted in late winter - early spring, coincident with heavy precipitation and unfavourable hydrographic conditions, in order that the water quality be assessed during the worst possible pollution conditions. 2.

SAMPLE STATION LOCATIONS
Due to the extensive area surveyed, sample stations were limited to those growing waters most probably subject to bacterial contamination. As a result, few sample stations were located in areas where no residential or commercial development was evident.

Three sample stations were chosen along the shoreline between Gartley Point and Union Bay. Limited shoreline development and a limited oyster resource made extensive sampling in this area unnecessary.

To evaluate domestic sewage pollution and verify the present 1000 foot wharf closure at Union Bay, four foreshore sample stations were established within a 1000 foot radius of the wharf. Sample stations were also located along the shoreline of Ship Peninsula, Mud Bay and Deep Bay to monitor growing water quality.

Sample stations were located offshore from the Baynes Sound Oyster Co., SnoCap Pacific Oysters Ltd., Mac's Oysters Ltd., Oyster House Select Oysters and Reef Oyster Cooperative, where oysters are held in wet storage.

FIGURE 1.
BAYNES SOUND SAMPLE STATION LOCATIONS



Sample stations were also located in growing waters subject to bacterial contamination from fresh water inputs. All significant freshwater inputs were sampled in conjunction with the growing water sampling program.

Sample station locations are shown in Figures 1 and 2, and a description of the marine and freshwater sample stations can be found in Tables 6 and 7 respectively, of Appendix I.
3. FIELD PROCEDURES AND METHODS
3.1 Bacteriological Sampling and Analyses

All samples for bacteriological analysis were collected in sterile 6 ounce wide-mouth bottles approximately 6 inches to one foot below the water surface. The water depth at collection points did not exceed 4 feet. Samples were collected by boat or by wading and stored in coolers at temperatures not exceeding $10^{\circ} \mathrm{C}$ until processed. Analyses were carried out in the Environmental Protection Service mobile laboratory and were performed within four hours of collection.

The total confirmed coliform MPN per 100 ml was determined using the multiple tube fermentation technique (at least 3 decimal dilutions of 5 tubes each) as described in Part 407A of the l3th edition of Standard Methods for the Examination of Water and Wastewater. (2)

The fecal coliform MPN per 100 ml was determined as described in Part 407C of Standard Methods. Incubation was for $24 \pm 2$ hours in a water bath equipped with a circulation device and maintained at $44.5^{\circ} \mathrm{C} \pm 0.2^{\circ} \mathrm{C}$.

Media used for the coliform MPN determinations was Lauryl Tryptose Broth and Brilliant Green Bile (2\%) Broth for the confirmed test, and EC medium for the fecal coliform
test. ${ }^{1}$ The MPN/ 100 ml of each sample was calculated from Table II, Recommended Procedures for the Examination of Sea Water and Shellfish, Fourth Edition (1970) (1).
3.2 Physical Testing Equipment and Analyses

Temperature and salinity measurements were determined at a depth of 6 inches to one foot below the water surface. A Beckman Model RB3-349 Solubridge Electrolytic Conductivity Meter was used during the February 12 to March 8 sampling period and after April 24 , during the second sampling period. A YSl Model 33 Salinity-Conductivity-Temperature Meter was used from April 17 to April 24 after which time it became inoperable.

Tide data is for the Point Atkinson reference port. Daily rainfall and wind velocity (range recorded between 1100 and 1600 hours) was that recorded at Canadian Forces Base, Comox. Results are presented in Appendix II. 3.3 Shellstock Sampling and Analysis

Samples were collected and stored in coolers at temperatures not exceeding $10^{\circ} \mathrm{C}$ until processed. Analyses were carried out by the Fish Inspection Laboratories, Vancouver, and were performed within 20 hours of collection. At least 12 oysters were collected for each sample.
4.

DISCUSSION OF RESULTS
Sample station locations are shown in Figures 1 and 2. Daily bacteriological and elemental data for each sample station is presented in Tables 9 and 10 of Appendix II. Total and fecal coliform MPN results for marine sample stations are summarized in Tables 1 and 2 , respectively. Bacteriological results for freshwater sample stations are summarized in Table 3. As a point of interest and future reference, fecal coliform data is summarized in terms of the two most recently proposed fecal coliform growing water

1
All test media used was Bacto Brand obtained from Difco Laboratories Detroit, Michigan.
standards presently under consideration by the National Shellfish Sanitation Program (US Food and Drug Administration). See Appendix II.

The existing growing water standard is defined as follows: "In order that an area can be considered bacteriologically safe for the harvesting of shellfish, the total confirmed coliform median MPN of the water must not exceed 70 per 100 ml , and not more than 10 per cent of the samples ordinarily exceed an MPN of 230 per 100 ml for a 5 tube decimal dilution test in those portions of the area most probably exposed to fecal contamination during the most unfavourable hydrographic and pollution conditions. The foregoing limits need not be applied if it can be shown by detailed study that the coliforms are not of direct fecal origin and do not indicate a public health hazard." 2

A total of 276 marine and 128 freshwater samples were collected for bacteriological analysis during the survey period. A minimum of six samples was collected for each marine station.

The bacteriological results presented in Table 9 indicate that all of the sample stations, with the exception of stations 2 and 23, fall within the bacteriological standards detailed above. Sample station 2, located south of Gartley Point, and sample station 23, located north of Mud Bay, exceed the 90 percentile limit of the standards. Sixteen samples were collected at station 23; therefore, there is good confidence in the statistical validity of the results. Since only six samples were collected at station 2 , an accurate 90 percentile level could not be determined, but the low fecal coliform median MPN of $1.8 / 100 \mathrm{ml}$ indicated an absence of significant contamination.

2 National Shellfish Sanitation Program Manual of Operations Part 1. Sanitation for Shellfish Growing Areas 1965 Revision, U.S. Department of Health, Education and Welfare.

TABLE I: SUMMARY OF TOTAL CONFIRMED COLIFORM MPN DATA FOR SHELLFISH GROWING WATER SAMPLES.

| Sample <br> Station | Number of Samples |  | MPN Range | Median MPN per 100 ml | $230^{8}$ | Exceeding <br> MPN/100 ml |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 10 | $<$ | 1.8-70 | 22.5 |  | 0.0 |
| 2 | 6 | $<$ | 1.8-350 | 15.0 |  | 16.6 |
| 3 | 10 |  | 2.0-130 | 28.0 |  | 0.0 |
| 4 | 6 |  | 4.0-23 | 9.9 |  | 0.0 |
| 5 | 10 | $<$ | 1.8-79 | 6.8 |  | 0.0 |
| 6 | 10 | $<$ | 1.8-14 | 7.8 |  | 0.0 |
| 7 | 10 |  | 2.0-49 | 6.2 |  | 0.0 |
| 8 | 10 |  | 2.0-79 | 19.0 |  | 0.0 |
| 9 | 10 | $<$ | 1.8-49 | 15.5 |  | 0.0 |
| 10 | 7 | < | 1.8-49 | 4.5 |  | 0.0 |
| 11 | 10 | $<$ | 1.8-130 | $<1.8$ |  | 0.0 |
| 12 | 11 | $<$ | 1.8-240 | 2.0 |  | 9.1 |
| 13 | 6 | $<$ | 1.8-7.8 | 3.3 |  | 0.0 |
| 14 | 10 | $<$ | 1.8-49 | 33.0 |  | 0.0 |
| 15 | 9 | < | 1.8-170 | 7.8 |  | 0.0 |
| 16 | 11 |  | 1.8-350 | 14.0 |  | 9.1 |
| 17 | 11 |  | 2.0-540 | 7.8 |  | 9.1 |
| 18 | 8 | $<$ | 1.8-17 | 2.8 |  | 0.0 |
| 19 | 10 | $<$ | 1.8-33 | 8.5 |  | 0.0 |
| 20 | 9 | $<$ | 1.8-33 | 2.0 |  | 0.0 |
| 21 | 9 | $<$ | 1.8-23 | 4.0 |  | 0.0 |
| 22 | 9 | $<$ | 1.8-170 | 2.0 |  | 0.0 |
| 23 | 16 |  | 2.0-240 | 27.5 |  | 12.5 |
| 24 | 16 |  | 1.8-920 | 10.4 |  | 6.2 |
| 25 | 9 | $<$ | 1.8-41 | 2.0 |  | 0.0 |
| 26 | 11 | $<$ | 1.8 - 240 | 2.0 |  | 9.1 |
| 27 | 10 | $<$ | 1.8-130 | 3.2 |  | 0.0 |
| 28 | 12 | $<$ | 1.8-170 | 7.8 |  | 0.0 |

TABLE 2 : SUMMARY OF FECAL COLIFORM MPN DATA FOR SHELLFISH GROWING WATER SAMPLES

| Sample <br> Station | Number of Samples | MPN Range | Median MPN per 100 ml |
| :---: | :---: | :---: | :---: |
| 1 | 10 | $<1.8-22$ | 3.0 |
| 2 | 6 | < 1.8-2.0 | 1.8 |
| 3 | 10 | < 1.8-33 | 3.0 |
| 4 | 6 | $<1.8-23$ | 5.9 |
| 5 | 10 | < 1.8 - 6.8 | 2.0 |
| 6 | 10 | $<1.8-7.8$ | 2.0 |
| 7 | 10 | < 1.8-7.8 | $\sim 1.9$ |
| 8 | 10 | $<1.8-13$ | 4.4 |
| 9 | 10 | < 1.8-23 | $\sim 1.9$ |
| 10 | 7 | $<1.8-2.0$ | $<1.8$ |
| 11 | 10 | < $1.8-4.5$ | $<1.8$ |
| 12 | 11 | < 1.8-130 | $<1.8$ |
| 13 | 6 | < $1.8-2.0$ | $<1.8$ |
| 14 | 10 | $<1.8-23$ | 2.0 |
| 15 | 9 | < $1.8-6.1$ | $<1.8$ |
| 16 | 11 | < 1.8-6.8 | $<1.8$ |
| 17 | 11 | $<1.8-11$ | $<1.8$ |
| 18 | 8 | < $1.8-4.5$ | $<1.8$ |
| 19 | 10 | $<1.8-17$ | < 1.8 |
| 20 | 9 | $<1.8-4.0$ | < 1.8 |
| 21 | 9 | $<1.8-4.0$ | 1.8 |
| 22 | 9 | $<1.8-4.5$ | $<1.8$ |
| 23 | 16 | $<1.8-130$ | 4.1 |
| 24 | 16 | $<1.8-17$ | 4.5 |
| 25 | 9 | $<1.8-2.0$ | $<1.8$ |
| 26 | 11 | $<1.8-4.5$ | $<1.8$ |
| 27 | 10 | < $1.8-4.0$ | $<1.8$ |
| 28 | 12 | $<1.8-13$ | $<1.8$ |

TABLE 3 : SUMMARY OF BACTERIOLOGICAL MPN DATA FOR FRESHWATER SAMPLES

| Sample <br> Station | Number of Samples | Coliform MPN Range Total Confirmed | $\frac{(\text { per } 100 \mathrm{ml})}{\text { Fecal }}$ |
| :---: | :---: | :---: | :---: |
| Sl | 5 | 2.0-14 | 1.8-11 |
| S2 | 4 | 220-1700 | 220-1700 |
| S3 | 4 | $>16,000-5.4 \times 10^{5}$ | $>16,000-2.4 \times 10^{5}$ |
| S4 | 4 | 2.0-17 | $<1.8-4.5$ |
| S5 | 4 | < $1.8-6.8$ | < $1.8-2.0$ |
| S6 | 4 | $<1.8-14$ | $<1.8-<1.8$ |
| S7 | 6 | $<1.8-11$ | $<1.8-11$ |
| S8 | 9 | $<1.8-49$ | < 1.8-49 |
| S9 | 13 | $2.0->1600$ | < 1.8-220 |
| Sl0 | 2 | $33-70$ | $<1.8-4.5$ |
| Sll | 11 | 11-540 | < 1.8-33 |
| Sl2 | 13 | 6.8-16,000 | $<1.8-16,000$ |
| Sl3 | 2 | 2400-5400 | 68-140 |
| S14 | 6 | $<1.8-49$ | $<1.8-7.8$ |
| S15 | 6 | $<1.8-17$ | $<1.8-2.0$ |
| Sl6 | 5 | 1.8-49 | $<1.8-4.5$ |
| S17 | 6 | $<1.8-49$ | $<1.8-49$ |
| S18 | 6 | $<1.8-49$ | $<1.8-7.8$ |
| S19 | 6 | 4.5-33 | $<1.8-4.5$ |
| S20 | 6 | 11-70 | $<1.8-33$ |
| S21 | 6 | $79->16,000$ | 79-5400 |

The remaining 26 sample stations exhibited periodic high total coliform densities, often coincident with heavy precipitation. However, the corresponding fecal coliform densities were low, never exceeding an MPN of $17 / 100 \mathrm{ml}$, indicating the contamination was of non-fecal origin.

Shellstock samples collected at or near sample stations 19, 21 and 23 all were of acceptable bacteriological quality with fecal coliform MPN densities not exceeding 20/100 g (Table 4).
4.1 Gartley Point to Union Point

The growing waters between Gartley Point and Union Point are not presently being commercially exploited, primarily due to the limited oyster resource. Most of the houses in the area are relatively new and all have septic tanks and tile fields which are operating satisfactorily. One exception was the Lynn Maur Resort, where one septic tank absorption field was found to be unsatisfactory.

The source of the bacterial contamination at station 2 was not determined. However, due to the low fecal coliform densities the contamination was most probably the result of landwash. In fact, the higher coliform densities occurred on May 5, coincident with a period of increased precipitation (Figure 3).

Station 3 was located at the northeirn entrance to Baynes Sound to determine the impact of sewage discharges from the towns of Courtenay and Comox. At present, the City of Courtenay discharges $675,000 \mathrm{gpd}$ of unchlorinated sewage from an aeration lagcon into the Courtenay River. The Town of comox has no treatment facilities and raw sewage is discharged into the receiving waters at the rate of 490,000 gpd.

TABLE 4: OYSTER SHELLSTOCK COLIFORM DATA

| Sample <br> Number | Collection <br> Date | Inspection <br> Date | Coliform MPN per 100 g |  |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Total Confirmed | Fecal |  |  |  |
| 1a | Feb. 26/74 | Feb. 27/74 | 50 | $<20$ |
| $2^{\text {b }}$ | Feb. 26/74 | Feb. 27/74 | 70 | 20 |
| $3^{\text {C }}$ | Feb. 26/74 | Feb. 27/74 | 130 | $<20$ |

a collected at mouth of Waterloo Creek (Sl2) near station 23
b collected at mouth of 57 near station 19
C collected at station 21

TABLE 5: FLOW DATA FOR STREAMS S2 and S3

| Sample <br> Station | Flow (gallons per day) |  |  |  |
| :--- | :---: | :---: | :---: | :---: |
| May 7 | May 8 | May 9 |  |  |
| S3 | $-\ldots-$ | 10,800 | 8,640 |  |
| S3 | 4,155 | 4,547 | 5,082 |  |

Examination of the bacteriological data for station 3 indicates that intermittent pollution resulting from Courtenay and Comox does occur. However, the coliform levels do not present a public health hazard. Furthermore, dilution and dispersion of the effluent sufficiently reduces any potential problem from contaminated input to the growing waters between Gartley Point and Union Point.

### 4.2 Union Bay

The waters and tidal fcreshore of Union Bay lying within 1000 feet of the Government Wharf are presently under Schedule J closure (Area l4-3).

The closure in Union Bay was imposed due to the poor condition of many of the septic tanks. Union Bay was originally a docking facility for a mining company and many of the present homes are older company houses with original cedar septic tanks that collectively drain into a rock pit and subsequently into ditches with the effluent eventually reaching the foreshore. Approsimately 15 drainage culverts service the community of Union Bay and landwash emanating from these culverts flows across the foreshore to the receiving waters. Septic characteristics were observed in four of these culverts, two of which were sampled.

Freshwater inputs S 2 and S 3 had fecal coliform median MPN's of $340 / 100 \mathrm{ml}$ and $31,000 / 100 \mathrm{ml}$ respectively. The flow from these two inputs was very low during the survey period (Table 5 ) and the impact on the receiving waters was negligible. Sample stations 6 and 7, located offshore from $S 2$ and $S 3$ respectively, exhibited total coliform medians of $7.8 / 100 \mathrm{ml}$ and $6.2 / 100 \mathrm{ml}$. Nevertheless, a significant health hazard does exist since oysters could be picked from those areas over which the drainage flows. Furthermore, during periods of heavy precipitation it is


FIGURE 3 PRECIPITATION DATA
conceivable that the receiving water quality would decrease considerably as a result of pollution contributed by the drainage ditches.

Sample stations 5 and 8 were located at the northern and southern extremities respectively, of the 1000 foot wharf closure. Median total and fecal coliform MPN's at station 5 were $6.8 / 100 \mathrm{ml}$ and $2.0 / 100 \mathrm{ml}$, and at station 8 , $19 / 100 \mathrm{ml}$ and $4.4 / 100 \mathrm{ml}$, respectively.
4.3 Union Bay to Buckley Bay

Oyster leases exist along most of the coastline in this area and extensive commercial harvesting takes place. There is limited residential devel.opment, most of which occurs on the west side of the highway, approximately 800 to 1000 feet from the foreshore. New homes equipped with septic tanks are being constructed between Union Bay and Hindoo Creek. However, they would appear to be a sufficient distance from the foreshore to effectively eliminate any health risk.

There are three major freshwater inputs to these growing waters: S4, located approximately 150 feet north of the Baynes Sound Oyster Co.; S5, (Hindoo Creek), located approximately 200 feet south of SnoCap Pacific Oysters Limited; and S 6 , which flows into the receiving waters at marine station 12. There was no evidence of fecal contamination in any of these streams. Marine sample station 19, located over oyster beds offshore from the Baynes Sound Oyster Co., and stations 10 and ll, located over oyster beds offshore from SnoCap Pacific Oyster Lt:d., all had satisfactory water quality. Both shucking plants utilize chemical toilets to prevent contamination of the growing waters. A single high total coliform MPN of $240 / 100 \mathrm{ml}$ was observed at station 12 , but this would appear to be an isolated case as the: water quality on all other sampling days was excellent. A single
dwelling located approximately 200 feet south of S 6 is the only source of fecal contamination to the area. However, the septic tank and field are located a sufficient distance from the stream to eliminate any health risk. Stream S6 reportedly only flows in the winter and therefore no pollution sources would be present during the summer months.

Sample station 14 was located north of the Denman Island ferry terminal at Buckley Bay. There appears to be a continuous, low level source of pollution at station 14. However, the water quality is well within the acceptable limits. Station 14 was positioned offshore from five homes equipped with septic tank facilities. The tile fields were positioned well away from the foreshore and there was no evidence of seepage.

The Denman Island ferry has an average 24 hour discharge of 200 Imperial gallons of untreated sewage effluent. There is sufficient dilution of this effluent to eliminate any health risk. Further, the 400 foot closure around the ferry terminal at Buckley Bay provides an adequate safety buffer zone.

### 4.4 Fanny Bay

Fanny Bay is almost exclusively used for commercial oyster harvesting, with most of the growing areas under lease. Three sample stations were located in Fanny Bay, and all had acceptable water quality. High total coliform MPN's were observed at all three sample stations on February 14 and 15, coincident with heavy precipitation. The corresponding fecal coliform densities were low however, indicating the pollution was of non-fecal origin. Three freshwater inputs, S7, S21 and 58 , were monitored as possible sources of fecal
contamination. The bacteriological results for $\mathrm{S7}$ (Tsable River) and 58 (Cougar Creek) indicate the absence of fecal pollution in both of these cree:ks. However, 521 had a fecal
coliform median MPN of $420 / 100 \mathrm{ml}$ most probably resulting from animal fecal matter. This creek drains pastureland located on the west side of the highway and its flow is directly coincident with precipitation intensity. There appeared to be adequate dilution of the creek after entering the receiving waters, as there was no significant deterioration in the quality of these waters (stations 15,16 ) even during periods of heavy precipitation.

The remaining houses along the roadway are a sufficient distance from the foreshore so as not to present a health hazard. Mac's Oysters Ltd. shucking plant utilizes a chemical toilet to prevent growing water contamination. Sewage from Mac's Restaurant is pumped under the road to a septic tank and tile field and does not present any danger. The septic tank and tile field for the Fanny Bay Inn are located approximately 1,000 feet from the foreshore, and there was no evidence of seepage into the receiving water.

### 4.5 Ship Peninsula

The water quality over the oyster leases at Ship Peninsula was acceptable at all stations tested. Three sample stations were located close to shore to monitor possible domestic sewage seepage. Approximately 35 homes and trailers are situated on both sides of the road along the foreshore, but only 8 are permanently occupied, the others being summer homes. Some evidence of fecal contamination was observed at S9, a drainage ditch which flows over the foreshore. The source of the pollution was not pinpointed; however, it is most likely some septic tank seepage combined with natural run-off. The flow from this ditch was minimal and did not impair the water quality at station 20 located offshore from the stream mouth. Also, oysters sampled from the stream bed had a fecal coliform MPN of $20 / 100 \mathrm{~g}$, suggesting the contamination was insignificant.

Ships Point Lodge, located at the northern tip of Ship Peninsula, has accommodation for 8 to 10 people and is a possible source of fecal contamination, although this was not observed during the survey period. There are three toilet facilities, and the septic tank is located 20 feet from the high water mark with a 12 foot tile field directed towards the foreshore.
4.6 Mud Bay

Oyster leases occupy most of the growing waters in Mud Bay, with two shucking plants operating in the area. Sample stations were located over oyster beds offshore from the Reef Oyster Cooperative shucking plant and the Oyster House Select Oysters shucking plant and also near the mouth of Coal Creek (Wilfred Creek). A fourth sample station was located in the small bay south of Ship Peninsula

The bacteriological results indicate significant contamination of the growing waters at station 23. The total coliform median MPN is $27.5 / 100 \mathrm{ml}$; however, $12.5 \%$ of the samples exceed the acceptable 90 percentile limit. The major source of the pollution to the growing waters is the Waterloo Creek (S12), where a total coliform median MPN of $540 / 100 \mathrm{ml}$ for 13 samples was observed. The probable source of contamination to Waterloo Creek is a small farm situated near the southern bank of the creek. A small creek which flows past the farm's septic tank and tile field and subsequently enters the Waterloo Creek exhibited total coliform densities of $2400 / 100 \mathrm{ml}$ and $5400 / 100 \mathrm{ml}$, suggesting septic tank seepage. Two goats were also seen grazing in the area, suggesting the possibility of direct fecal contamination to the creek. The creek was not subject to contamination from any other dwellings; however, coliform densities increased coincident with heavy rainfall, suggesting landwash
also contributed significantly to the counts observed. One oyster sample taken at the mouth of the Waterloo Creek had low coliform densities (Table 10); however, continued sampling of the oysters would be required to determine a trend in the results.

The water quality at station 24 was satisfactory although intermittent contamination was observed. Sixteen samples were collected at this station and the results can be considered to have good statistical validity. The source of the intermittent pollution was most probably the Waterloo Creek, as there are only four homes situated along the shoreline in this area. The dwellings are located approximately 80 feet from shore with septic tanks and tile fields located approximately 30 feet from the high water mark. A small creek drains this area (S14); however, there was no evidence of significant fecal contamination. The Reef Oyster Cooperative shucking plant utilizes chemical toilets to prevent growing water contamination.

Sample stations 21 and 22 both exhibited excellent water quality during the survey period. Oysters sampled from station 21 had very low coliform densities (Table 4). Homes on Ship Peninsula in the area of station 21 may be a possible source of contamination during the summer months, but did not present a problem during the survey period as they were unoccupied. Coal Creek (Sl0, Sll) provides a significant freshwater input to station 22. Coliform densities in the creek were low during the survey period; it is subject to direct contamination by 6 cows and a number of chickens on a small farm located near the highway. Three houses in the vicinity are served by septic tank absorption field systems located 60 to 200 feet from the creek.
4.7 Deep Bay
Sample stations 25 through 28 were located along the tidal foreshore between Mud Bay and Deep Bay. All stations had acceptable water quality during the survey period. Several creeks (S15 through S20) drain into the receiving waters in this area; however, none exhibited evidence of significant fecal contamination. There is very little development along the entire shoreline, thus there is little, if any, domestic sewage pollution.
There is some development in Deep Bay, with about 6 to 12 permanent residences along the foreshore. Approximately 24 homes and 10 trailers are situated along the spit, but only four homes were occupied during the survey period, the remainder being summer dwellings.
The government wharf was used primarily for moorage of fishing boats during the survey period and pollution from this source was minimal. A 1,000 foot closure is presently in effect around the government wharf.

## 4. CONCLUSIONS

(i) The waters and tidal foreshore of Baynes Sound, from Gartley Point to Deep Bay are of acceptable shellfish growing water quality, with the exception of the growing waters at the mouth of Waterloo Creek.
(ii) The sanitary survey of Union Bay indicates that many of the sewage disposal systems may be faulty and therefore the waters and tidal foreshore of Union Bay are subject to bacterial contamination during periods of heavy rainfall.
(iii) The 400 foot wharf closure at Buckley Bay is adequate.
6.

RECOMMENDATIONS
(i) The 1000 foot wharf closure at Union Bay should remain in effect until the septic tank seepage problem is rectified.
(ii) The waters off the mouth of Waterloo Creek should be closed to the taking of shellfish and signs should be erected on the foreshore to indicate the extent of the closure. A recommended closure would read: "The waters of Baynes Sound lying within a quarter mile radius measured from the mouth of Waterloo Creek located north of Mud Bay."
(iii) The present 1000 foot wharf closure at Deep Bay (Schedule J contaminated area 14-2) should be maintained until a summer water monitoring program has established that the impact of summer home occupancy and recreational boating does not extend beyond the general wharf closure of 400 feet.

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Mr. K. Cooper, Engineering Technician, and Mr. G. Derksen, Biological Technician, conducted the Sanitary Survey and carried out the sampling program.

# APPENDIX I <br> SAMPLE STATION LOCATION DESCRIPTIONS 

TABLE 6: MARINE SAMPLE STATION LOCATIONS

TABLE 7: FRESHWATER SAMPLE STATION LOCATIONS

TABLE $6:$ MARINE SAMPLE STATION LOCATIONS.

| Sample <br> Station | Latitude | Longitude | Location |
| :---: | :---: | :---: | :---: |
| 1 | 49³8'16".0N | 12454'48".0W | Southside of Gartley Pt. |
| 2 | 49037'56".0N | 124*54'40".0W | Off Lynn Maur Resort |
| 3 | 49037'27".0N | 124*52'45".0W | Between Lighthouse on Vancouver Is. and Seal Islets |
| 4 | 49036'25'.0N | 12453'23'.0W | Opposite Longbeak Pt. |
| 5 | 49*35'10".0N | 124*52'58'.0W | Union Bay $\sim 1500 '$ N. of wharf |
| 6 | 49³4'57".0N | 124*52'52".0W | Union Bay $\sim 400{ }^{\prime}$ N. of wharf |
| 7 | 49³4'37".0N | 124*52'45".0W | Union Bay $\sim 400^{\prime}$ S. of wharf |
| 8 |  | 124*52'39".0W | Union Bay $\sim 1500^{\prime} \mathrm{S}$. of wharf |
| 9 | 49³3'45".0N | 124*52'07".0W | Baynes Sound Oysters Ltd. |
| 10 | 49³3'28".0N | 124*52'02".0W | Opposite Denman Point |
| 11 | 49³2'36". ON | 124*51'29".0W | SnoCap Oysters Ltd. |
| 12 | 49³2'08".0N | 124*51'13".0W | Buckley Bay - just N. of 13 |
| 13 | 49³1'58'.0N | 124*51'05".0W | Buckley Bay |
| 14 | 49³1'32".0N | 124**9'50".0W | Buckley Bay |
| 15 | 49³0'54".0N |  | Fanny Bay |
| 16 | 49030'42".0N | 124**9'45'.0W | Fanny Bay |
| 17 | 49030'09".0N | $124^{\circ} 48^{\prime \prime} 40^{\prime \prime} .0 \mathrm{~W}$ | Fanny Bay |
| 18 | 49*30'20".0N | 124***'09".0W | Ship Peninsula |
| 19 | 49³0'03'.0N | 124* ${ }^{\circ} 7^{\prime \prime} 40^{\prime \prime} .0 W$ | Ship Peninsula |
| 20 | 49²9'42".0N | 124**7'18'.0W | Ship Peninsula |

TABLE 6: Cont'd

| Sample <br> Station | Latitude | Longitude | Location |
| :---: | :---: | :---: | :---: |
| 21 | 49*29'30'.0N | 124* ${ }^{\circ} 7^{\prime \prime} 40^{\prime \prime}$.0W | Ship Peninsula |
| 22 | 49²8'55".0N | 124* ${ }^{\circ} 7^{\prime} 25^{\prime \prime} .0 W$ | Mud Bay |
| 23 | 49*28'14'.0N |  | Mud Bay |
| 24 | 49*27'52".0N | 124**7'14'.0W | Mud Bay |
| 25 | 49*28'03'.0N |  | Mud Bay |
| 26 | 49²7'36".0N | 124*44'54".0W | Deep Bay |
| 27 | 49*27'45".0N | 124* ${ }^{\circ} 3^{\prime \prime} 45^{\prime \prime} .0 \mathrm{~W}$ | Deep Bay ~ 400' S. of wharf |
| 28 | 49*27'59".0N | 124* $4^{\prime} 10^{\prime \prime} .0 \mathrm{~W}$ | Deep Bay |

TABLE 7 : FRESHWATER SAMPLE STATION LOCATIONS
Sample Location
Station

Sl Mouth of Washer Creek, Union Bay

S2
S3
S4

S5
S6

S7
S8
S9

Sl0
Sll
Sl2
Sl3

S14

S15
Sl6
Sl7
S18
Sl9

S20

Culvert $\sim 400^{\prime}$ N. of wharf, Union Bay
Culvert ~ 400' S. of wharf, Union Bay
Unnamed creek N. side of Baynes Sound Oysters Ltd.
Hindoo Creek S. side of SnoCap Oysters Ltd.
Mouth of unnamed creek just north of Buckley Bay.
Tsable River at Island Hwy. bridge.
Cougar Creek at Island Hwy. bridge.
Mouth of storm water ditch, Ship Peninsula at intersection of Ship Point Road and Baynes Road.
Coal Creek at Island Hwy.
Mouth of Coal Creek
Waterloo Creek at Island Hwy.
Ditch on westside of Island Hwy. draining into Waterloo Creek.
Mouth of first unnamed creek south of Waterloo Creek.
Rosewall Creek at Island Hwy. Small stream just north of McNaughton Creek. McNaughton Creek at Island Hwy.

Cook Creek at Island Hwy.
First unnamed creek south of Cook Creek at Island Hwy.
Second unnamed creek south of Cook Creek at Island Hwy.

## APPENDIX II

BACTERIOLOGICAL RESULTS AND SAMPLING CONDITIONS

## TABLE 8: SUMMARY OF FECAL COLIFORM MPN DATA FOR PROPGSED SHELLFISH GROWING WATER STANDARDS

TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES

TABLE 10: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR FRESHWATER SAMPLES

TABLE 8 : SUMMARY OF FECAL COLIFORM MPN DATA FOR PROPOSED SHELLFISH GROWING WATER STANDARDS.*

| Sample <br> Station | Number of Samples | MPN <br> Range | Median MPN \% per 100 ml 43 | Exceeding <br> MPN/100 ml | \% Exceeding <br> 76 MPN/100 ml |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 10 | $<1.8-22$ | 3.0 | 0.0 | 0.0 |
| 2 | 6 | $<1.8-2.0$ | 1.8 | 0.0 | 0.0 |
| 3 | 10 | < 1.8-33 | 3.0 | 0.0 | 0.0 |
| 4 | 6 | < 1.8-23 | 5.9 | 0.0 | 0.0 |
| 5 | 10 | < $1.8-6.8$ | 2.0 | 0.0 | 0.0 |
| 6 | 10 | < $1.8-7.8$ | 2.0 | 0.0 | 0.0 |
| 7 | 10 | < 1.8 - 7.8 | $\sim 1.9$ | 0.0 | 0.0 |
| 8 | 10 | $<1.8-13$ | 4.4 | 0.0 | 0.0 |
| 9 | 10 | $<1.8-23$ | $\sim 1.9$ | 0.0 | 0.0 |
| 10 | 7 | < $1.8-2.0$ | < 1.8 | 0.0 | 0.0 |
| 11 | 10 | < $1.8-4.5$ | < 1.8 | 0.0 | 0.0 |
| 12 | 11 | < $1.8-130$ | < 1.8 | 9.1 | 9.1 |
| 13 | 6 | < 1.8 - 2.0 | < 1.8 | 0.0 | 0.0 |
| 14 | 10 | < 1.8-23 | 2.0 | 0.0 | 0.0 |
| 15 | 9 | < $1.8-6.1$ | $<1.8$ | 0.0 | 0.0 |
| 16 | 11 | < $1.8-6.8$ | < 1.8 | 0.0 | 0.0 |
| 17 | 11 | < 1.8 - 11 | $<1.8$ | 0.0 | 0.0 |
| 18 | 8 | < 1.8-4.5 | $<1.8$ | 0.0 | 0.0 |
| 19 | 10 | $<1.8-17$ | $<1.8$ | 0.0 | 0.0 |
| 20 | 9 | < $1.8-4.0$ | $<1.8$ | 0.0 | 0.0 |
| 21 | 9 | < 1.8 - 4.0 | 1.8 | 0.0 | 0.0 |
| 22 | 9 | < $1.8-4.5$ | $<1.8$ | 0.0 | 0.0 |
| 23 | 16 | . $1.8-130$ | 4.1 | 12.5 | 6.25 |
| 24 | 16 | $<1.8-17$ | 4.5 | 0.0 | 0.0 |
| 25 | 9 | < 1.8-2.0 | < 1.8 | 0.0 | 0.0 |
| 26 | 11 | < 1.8 - 4.5 | $<1.8$ | 0.0 | 0.0 |
| 27 | 10 | < $1.8-4.0$ | $<1.8$ | 0.0 | 0.0 |
| 28 | 12 | $<1.8-13$ | < 1.8 | 0.0 | 0.0 |

* U.S. Food and Drug Administration proposed standards per 100 ml .
(1) Proposed at Microbiology Task Force Meeting June, 1973 median MPN of 23,90 percentile of 76 .
(2) Proposed at 8 th National Shellfish Sanitation Workshop median MPN of 14,90 percentile of 43 .
TABLE 9 : BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.

| $\begin{aligned} & \text { Sample } \\ & \hline \text { Date } \\ & (1974) \end{aligned}$ | Station: <br> Sample Time | 1 |  |  | Location: |  | Sound - Gartley Point |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | TideConditions |  | Water Temp. $\left({ }^{\circ} \mathrm{C}\right)$ | Total Précip. (in.) | Wind (mph) | $\begin{gathered} \text { Local } \\ \text { Sea } \\ \text { Cond. } \end{gathered}$ | $\begin{gathered} \text { Salinity } \\ (\mathrm{ppt}) \end{gathered}$ | Coliform <br> MPN/ 100 ml |  |
|  |  | Time | Ht. (Ft) |  |  |  |  |  | Total | Fecal |
| Apr 17 | 1600 | $\begin{aligned} & 1400 \\ & 1955 \end{aligned}$ | $\begin{array}{r} 10.6 \\ 6.9 \end{array}$ | 11.0 | 0.0 | E@ 2-5 | -- | 14.0 | 23 | $<1.8$ |
| Apr 18 | 1100 | $\begin{aligned} & 0925 \\ & 1510 \end{aligned}$ | $\begin{array}{r} 7.1 \\ 11.2 \end{array}$ | 10.0 | 0.01 | E@ 3-7 | ripple | 16.5 | 22 | 6.1 |
| Apr 19 | 1115 | $\begin{aligned} & 0950 \\ & 1605 \end{aligned}$ | $\begin{array}{r} 6.1 \\ 12.0 \end{array}$ | -- | 0.02 | SE@ 15-18 | -- | -- | 33 | 4.5 |
| Apr 22 | 1420 | $\begin{aligned} & 1120 \\ & 1820 \end{aligned}$ | $\begin{array}{r} 2.9 \\ 13.9 \end{array}$ | 9.6 | 0.12 | NE@ 3-11 | -- | 18.0 | 49 | <1. 8 |
| Apr 23 | 1045 | $\begin{aligned} & 0500 \\ & 1200 \end{aligned}$ | $\begin{array}{r} 13.8 \\ 2.2 \end{array}$ | 9.5 | TR | NW@ 9-13 | -- | 21.0 | 17 | 20 |
| Apr 24 | 1055 | $\begin{aligned} & 0530 \\ & 1240 \end{aligned}$ | $\begin{array}{r} 13.8 \\ 1.7 \end{array}$ | - | 0.02 | NW@ 4-11 | -- | -- | $<1.8$ | <1.8 |
| Apr 25 | 1215 | $\begin{aligned} & 0600 \\ & 1325 \end{aligned}$ | $\begin{array}{r} 13.6 \\ 1.6 \end{array}$ | 8.5 | 0.71 | SE@ 6-14 | ripple | 9.0 | 34 | 22 |
| Apr 26 | 1100 | $\begin{aligned} & 0645 \\ & 1410 \end{aligned}$ | $\begin{array}{r} 13.1 \\ 1.8 \end{array}$ | 8.0 | 0.24 | E@ 3-6 | ripple | 13.5 | 70 | 6.8 |
| Apr 29 | 1700 | $\begin{aligned} & 1100 \\ & 1800 \end{aligned}$ | $\begin{array}{r} 11.0 \\ 4.2 \end{array}$ | 12.2 | TR | E@ 3-9 | ripple | 12.0 | 14 | <1.8 |
| Apr 30 | 1510 | $\begin{aligned} & 1245 \\ & 1910 \end{aligned}$ | $\begin{array}{r} 10.7 \\ 5.2 \end{array}$ | -- | 0.01 | NE@ 9-16 | -- | -- | 4.0 | 4.0 |




TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.
Sample Station: 5

| $\begin{aligned} & \text { Date } \\ & \text { (1974) } \end{aligned}$ | Sample Time | Tide Conditions |  | Water Temp. $\left({ }^{\circ} \mathrm{C}\right)$ | $\begin{aligned} & \text { Total } \\ & \text { Precip. } \\ & \text { (in.) } \end{aligned}$ | Wind (mph) | Local Sea Cond. | $\begin{aligned} & \text { Salinity } \\ & \text { (ppt) } \end{aligned}$ | Coliform <br> MPN/ 100 ml |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Time | Ht. (Fti) |  |  |  |  |  | Total | Fecal |
| Apr 17 | 1540 | $\begin{aligned} & 1400 \\ & 1955 \end{aligned}$ | $\begin{array}{r} 10.6 \\ 6.9 \end{array}$ | 11.0 | 0.0 | E® $2-5$ | - | 17 | 4.0 | <1.8 |
| Apr 18 | 1050 | $\begin{aligned} & 0925 \\ & 1510 \end{aligned}$ | $\begin{array}{r} 7.1 \\ 11.2 \end{array}$ | 10.8 | 0.01 | E@ 3-7 | ripple | 16.8 | <1.8 | <1.8 |
| Apr ${ }^{19}$ | 1135 | $\begin{aligned} & 0950 \\ & 1605 \end{aligned}$ | $\begin{array}{r} 6.1 \\ 12.0 \end{array}$ | -- | 0.02 | SE@ 15-18 | -- | -- | 2.0 | 2.0 |
| Apr 22 | 1415 | $\begin{aligned} & 1120 \\ & 1820 \end{aligned}$ | $\begin{array}{r} 2.9 \\ 13.9 \end{array}$ | 9.2 | 0.12 | NE@ 3-11 | ripple | 22.8 | 22 | 2.0 |
| Apr 23 | 1035 | $\begin{aligned} & 0500 \\ & 1200 \end{aligned}$ | $\begin{array}{r} 13.8 \\ 2.2 \end{array}$ | 9.5 | TR | NW@ 9-13 | -- | 22.0 | 13 | 2.0 |
| Apr 24 | 1045 | $\begin{aligned} & 0530 \\ & 1240 \end{aligned}$ | $\begin{array}{r} 13.8 \\ 1.7 \end{array}$ | 11.5 | 0.02 | NW@ 4-11 | ripple | 23.2 | 4.0 | 4.0 |
| Apr 25 | 1205 | $\begin{aligned} & 0600 \\ & 1325 \end{aligned}$ | $\begin{array}{r} 13.6 \\ 1.6 \end{array}$ | 9.5 | 0.71 | SE@ 6-14 | ripple | 24.0 | 6.8 | 4.5 |
| Apr 26 | 1045 | $\begin{aligned} & 0645 \\ & 1410 \end{aligned}$ | $\begin{array}{r} 13.1 \\ 1.8 \end{array}$ | 9.0 | 0.24 | E@ 3-6 | ripple | 19.0 | 79 | 2.0 |
| Apr 29 | 1255 | $\begin{aligned} & 1100 \\ & 1800 \end{aligned}$ | $\begin{array}{r} 11.0 \\ 4.2 \end{array}$ | -- | TR | E® 3 - 9 | -- | -- | 11 | 2.0 |
| Apr 30 | 1445 | $\begin{aligned} & 1245 \\ & 1910 \end{aligned}$ | $\begin{array}{r} 10.7 \\ 5.2 \end{array}$ | -- | 0.01 | NE@ 9-16 | -- | -- | 6.8 | 6.8 |

$$
\begin{array}{llllllllllll}
\text { TABLE } & \text { 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES. }
\end{array}
$$

TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.



| TABLE <br> Sample | Station: | TERIO <br> 9 | OGICAL AN | NALYSES | RESULTS A <br> Locatio | ND SAMPLIN <br> : Baynes | G CONDIT <br> Sound | IONS FOR <br> ysters Ltd | ARINE | AMPLES . |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { Date } \\ (1974) \end{gathered}$ | Sample Time | $\begin{array}{r} \mathrm{T} \\ \text { Cond } \\ \text { Time } \end{array}$ | de Htions (Ft) | Water <br> Temp. <br> $\left({ }^{\circ} \mathrm{C}\right)$ | ```Total Precip. (in.)``` | Wind <br> (mph) | Local Sea Cond. | Salinity (ppt) | $\begin{array}{r} \text { Coli } \\ \text { MPN } / \end{array}$ | $\begin{aligned} & \text { form } \\ & \text { 100 ml } \\ & \text { Fecal } \end{aligned}$ |
| Apr 17 | 1530 | $\begin{aligned} & 1400 \\ & 1955 \end{aligned}$ | $\begin{array}{r} 10.6 \\ 6.9 \end{array}$ | 11.0 | 0.0 | E@ $2-5$ | -- | 16.0 | 49 | 23 |
| Apr 18 | 1040 | $\begin{aligned} & 0925 \\ & 1510 \end{aligned}$ | $\begin{array}{r} 7.1 \\ 11.2 \end{array}$ | 10.0 | 0.01 | E@ 3-7 | ripple | 15.5 | <1. 8 | <1.8 |
| Apr 19 | 1155 | $\begin{aligned} & 0950 \\ & 1605 \end{aligned}$ | $\begin{array}{r} 6.1 \\ 12.0 \end{array}$ | -- | 0.02 | SE@ 15-18 | -- | -- | 2.0 | <1.8 |
| Apr 22 | 1405 | $\begin{aligned} & 1120 \\ & 1820 \end{aligned}$ | $\begin{array}{r} 2.9 \\ 13.9 \end{array}$ | 9.1 | 0.12 | NE@ 3-11 | ripple | - 21.0 | 23 | 2.0 |
| Apr 23 | 1025 | $\begin{aligned} & 0500 \\ & 1200 \end{aligned}$ | $\begin{array}{r} 13.8 \\ 2.2 \end{array}$ | 9.0 | TR | NW@ 9-13 | -- | 21.2 | 17 | 4.5 |
| Apr 24 | 1040 | $\begin{aligned} & 0530 \\ & 1240 \end{aligned}$ | $\begin{array}{r} 13.8 \\ 1.7 \end{array}$ | 10.5 | 0.02 | NW@ 4-11 | ripple | 23.2 | $<1.8$ | $<1.8$ |
| Apr 25 | 1155 | $\begin{aligned} & 0600 \\ & 1325 \end{aligned}$ | $\begin{array}{r} 13.6 \\ 1.6 \end{array}$ | 9.5 | 0.71 | SE@ 6-14 | ripple | 25.5 | 2.0 | $<1.8$ |
| Apr 26 | 1030 | $\begin{aligned} & 0645 \\ & 1410 \end{aligned}$ | $\begin{array}{r} 13.1 \\ 1.8 \end{array}$ | 8.5 | 0.24 | E@ 3-6 | ripple | 18.0 | 49 | 4.0 |
| Apr 29 | 1220 | $\begin{aligned} & 1100 \\ & 1800 \end{aligned}$ | $\begin{array}{r} 11.0 \\ 4.2 \end{array}$ | - | TR | E@ 3-9 | -- | -- | 33 | 4.5 |
| Apr 30 | 1415 | $\begin{aligned} & 1245 \\ & 1910 \end{aligned}$ | $\begin{array}{r} 10.7 \\ 5.2 \end{array}$ | - | 0.01 | NE@ 9-16 | -- | -- | 14 | $<1.8$ |



| TABLE <br> Sample | 9: BAC <br> Station: | CTERIOL $11$ | OGICAL AN | NALYSES | RESULTS <br> Locati | D SAMPLING : SnoCap | CONDIT <br> Oysters | IONS FOR <br> Litd. | RINE | MPLES |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Date | Sample | Cond | de tions | Water Temp. | Total Precip. | Wind | $\begin{gathered} \text { Local } \\ \text { Sea } \end{gathered}$ | Salinity | $\begin{array}{r} \text { Col } \\ \text { MPN } / \\ \hline \end{array}$ | $\begin{aligned} & \text { form } \\ & 100 \mathrm{ml} \end{aligned}$ |
| (1974) | Time | Time | Ht. (Ft!) | $\left({ }^{\circ} \mathrm{C}\right)$ | (in.) | (mph) | Cond. | (ppt) | Total | Fecal |
| Apr 17 | 1515 | $\begin{aligned} & 1400 \\ & 1955 \end{aligned}$ | $\begin{array}{r} 10.6 \\ 6.9 \end{array}$ | 11.0 | 0.0 | E@ 2-5 | -- | 14.0 | 13 | <1.8 |
| Apr 18 | 1030 | $\begin{aligned} & 0925 \\ & 1510 \end{aligned}$ | $\begin{array}{r} 7.1 \\ 11.2 \end{array}$ | 10.2 | 0.01 | E@ 3-7 | ripple | 18.8 | <1.8 | <1. 8 |
| Apr 19 | 1230 | $\begin{aligned} & 0950 \\ & 1605 \end{aligned}$ | $\begin{array}{r} 6.1 \\ 12.0 \end{array}$ | -- | 0.02 | SE@ 15-18 | -- | - | <1.8 | <1. 8 |
| Apr 22 | 1400 | $\begin{aligned} & 1120 \\ & 1820 \end{aligned}$ | $\begin{array}{r} 2.9 \\ 13.9 \end{array}$ | 9.0 | 0.12 | NE@ 3-11 | ripple | 23.6 | 13 | <1. 8 |
| Apr 23 | 1015 | $\begin{aligned} & 0500 \\ & 1200 \end{aligned}$ | $\begin{array}{r} 13.8 \\ 2.2 \end{array}$ | 9.2 | TR | NW@ 9-13 | -- | 22.2 | 2.0 | <1.8 |
| Apr 24 | 1030 | $\begin{aligned} & 0530 \\ & 1240 \end{aligned}$ | $\begin{array}{r} 13.8 \\ 1.7 \end{array}$ | 10.2 | 0.02 | NW@ 4-11 | ripple | 22.0 | $<1.8$ | $<1.8$ |
| Apr 26 | 1025 | $\begin{aligned} & 0645 \\ & 1410 \end{aligned}$ | $\begin{array}{r} 13.1 \\ 1.8 \end{array}$ | 9.0 | 0.24 | E@ 3-6 | calm | 16.0 | 130 | 4.5 |
| Apr 29 | 1210 | $\begin{aligned} & 1100 \\ & 1800 \end{aligned}$ | $\begin{array}{r} 11.0 \\ 4.2 \end{array}$ | -- | TR | E@ 3-9 | -- | -- | $<1.8$ | <1.8 |
| Apr 30 | 1410 | $\begin{aligned} & 1245 \\ & 1910 \end{aligned}$ | $\begin{array}{r} 10.7 \\ 5.2 \end{array}$ | -- | 0.01 | NE@ 9-16 | -- | -- | <1.8 | <1.8 |
| May 1 | 1555 | $\begin{aligned} & 1430 \\ & 2020 \end{aligned}$ | $\begin{array}{r} 10.9 \\ 6.2 \end{array}$ | -- | 0.02 | SE@ 12-16 | -- | - | $<1.8$ | <1.8 |

TABLE .9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES. Sample Station: 12

| $\begin{gathered} \text { Date } \\ (1974) \end{gathered}$ | Sample Time | Tide Conditions |  | Water Temp. $\left({ }^{\circ} \mathrm{C}\right)$ | Total Precip. (in.) | Wind (mph) | Local Sea Cond. | $\begin{gathered} \text { Salinity } \\ (\mathrm{ppt}) \end{gathered}$ | Coliform <br> MPN/ 100 ml |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Time | Ht. (Fti) |  |  |  |  |  | Total | Fecal |
| Apr 26 | 1020 | $\begin{aligned} & 0645 \\ & 1410 \end{aligned}$ | $\begin{array}{r} 13.1 \\ 1.8 \end{array}$ | 9.0 | 0.24 | E@ 3-6 | -- | 19.0 | 33 | 1.8 |
| Apr 29 | 1155 | $\begin{aligned} & 1100 \\ & 1800 \end{aligned}$ | $\begin{array}{r} 11.0 \\ 4.2 \end{array}$ | -- | TR | E@ 3-9 | -- | -- | $<1.8$ | $<1.8$ |
| Apr 30 | 1400 | $\begin{aligned} & 1245 \\ & 1910 \end{aligned}$ | $\begin{array}{r} 10.7 \\ 5.2 \end{array}$ | -- | 0.01 | NE@ 9-16 | -- | -- | 240 | 130 |
| May 1 | 1520 | $\begin{aligned} & 1430 \\ & 2020 \end{aligned}$ | $\begin{array}{r} 10.9 \\ 6.2 \end{array}$ | -- | 0.02 | SE@ 12-16 | -- | - | 4.5 | 2.0 |
| May 2 | 1130 | $\begin{aligned} & 0940 \\ & 1555 \end{aligned}$ | $\begin{array}{r} 5.5 \\ 11.7 \end{array}$ | 9.2 | TR | SE@ 7-12 | ripple | 26.5 | 4.5 | <1.8 |
| May 3 | 0920 | $\begin{aligned} & 0335 \\ & 1025 \end{aligned}$ | $\begin{array}{r} 14.0 \\ 4.2 \end{array}$ | 9.6 | 0.0 | SE@ 6-10 | ripple | 22.0 | $<1.8$ | $<1.8$ |
| May 6 | 1145 | $\begin{aligned} & 0525 \\ & 1225 \end{aligned}$ | $\begin{array}{r} 13.4 \\ 2.1 \end{array}$ | -- | 0.11 | SE@ 7-15 | -- | -- | 2.0 | $<1.8$ |
| May 7 | 0915 | $\begin{aligned} & 0555 \\ & 1300 \end{aligned}$ | $\begin{array}{r} 13.2 \\ 2.0 \end{array}$ | -- | 0.03 | SE@ 13-23 | -- | . -- | 2.0 | $<1.8$ |
| May 8 | 1120 | $\begin{aligned} & 0625 \\ & 1335 \end{aligned}$ | $\begin{array}{r} 12.9 \\ 2.2 \end{array}$ | 9.8 | TR | SE@ 0-18 | choppy | 20.0 | 17 | <1.8 |
| May 9 | 1345 | $\begin{aligned} & 0705 \\ & 1415 \end{aligned}$ | $\begin{array}{r} 12.6 \\ 2.6 \end{array}$ | -- | 0.22 | S@ 5-17 | -- | -- | $<1.8$ | $<1.8$ |
| May 10 | 0945 | $\begin{aligned} & 0740 \\ & 1450 \end{aligned}$ | $\begin{array}{r} 12.1 \\ 3.2 \end{array}$ | -- | TR | NE@ 2-10 | -- | -- | 2.0 | $<1.8$ |



TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.

| $\begin{gathered} \text { Date } \\ (1974) \end{gathered}$ | Sample Time | Tide Conditions |  | Water Temp. $\left({ }^{\circ} \mathrm{C}\right)$ | Total Precip. (in.) | Wind (mph) | Local Sea cond. | $\begin{gathered} \text { Salinity } \\ (p p t) \end{gathered}$ | Coliform <br> MPN/ 100 ml |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Time | Ht. (Ft') |  |  |  |  |  | Total | Fecal |
| Feb 12 | 1345 | $\begin{aligned} & 0850 \\ & 1600 \end{aligned}$ | $\begin{array}{r} 14.8 \\ 4.9 \end{array}$ | 6.0 | 0.32 | NW@ 7-10 | choppy | 22.0 | <1.8 | <1.8 |
| Feb 13 | 1010 | $\begin{aligned} & 0925 \\ & 1655 \end{aligned}$ | $\begin{array}{r} 14.1 \\ 4.8 \end{array}$ | 6.0 | 0.82 | SE@ 28-33 | choppy | 26.0 | 17 | 4.5 |
| Feb 14 | 0935 | $\begin{aligned} & 0445 \\ & 0955 \end{aligned}$ | $\begin{aligned} & 11.2 \\ & 13.4 \end{aligned}$ | 4.5 | 0.27 | E@ 3-14 | calm | 19.0 | 49 | 1.8 |
| Feb 15 | 0930 | $\begin{aligned} & 0640 \\ & 1040 \end{aligned}$ | $\begin{aligned} & 11.8 \\ & 12.7 \end{aligned}$ | 6.4 | 1.01 | SE@ 8-18 | choppy | - 27.0 | 170 | <1.8 |
| Feb 18 | 1450 | $\begin{aligned} & 1420 \\ & 2130 \end{aligned}$ | $\begin{array}{r} 12.1 \\ 4.5 \end{array}$ | 6.5 | 0.32 | SE@ 9-15 | choppy | 25.5 | 7.8 | <1.8 |
| Feb 19 | 0940 | $\begin{aligned} & 0510 \\ & 1040 \end{aligned}$ | $\begin{aligned} & 14.2 \\ & 10.4 \end{aligned}$ | 5.2 | 0.0 | N@ $0-5$ | calm | 27.0 | 27 | 6.1 |
| Feb 20 | 1540 | $\begin{aligned} & 1100 \\ & 1555 \end{aligned}$ | $\begin{array}{r} 9.9 \\ 12.7 \end{array}$ | -- | 0.09 | SE@ 23-31 | -- | -- | 2.0 | 2.0 |
| Feb 21 | 1045 | $\begin{aligned} & 0550 \\ & 1130 \end{aligned}$ | $\begin{array}{r} 14.3 \\ 9.2 \end{array}$ | 6.5 | 0.58 | NE@ 2-8 | ripple | 27.0 | 4.5 | <1.8 |
| Feb 22 | 1010 | $\begin{aligned} & 0610 \\ & 1200 \end{aligned}$ | $\begin{array}{r} 14.5 \\ 8.5 \end{array}$ | 6.2 | TR | SE@ 3-18 | calm | 27.5 | 4.5 | <1.8 |


TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.
Sample Station: 17

| $\begin{gathered} \text { Date } \\ (1974) \end{gathered}$ | Sample Time | Tide Conditions |  | Water <br> Temp. <br> $\left({ }^{\circ} \mathrm{C}\right)$ | Total Precip. (in.) | Wind (mph) | Local Sea Cond. | $\begin{gathered} \text { Salinity } \\ \text { (ppt) } \end{gathered}$ | $\begin{aligned} & \text { Coliform } \\ & \text { MPN/ } 100 \mathrm{ml} \\ & \hline \end{aligned}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  | Time | Ht. (Ft; ) |  |  |  |  |  | Total | Fecal |




TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND

| TABLE | 9: BACTERIOLOGICAL ANALYSES |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.

TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.

| $\begin{gathered} \text { Date } \\ (1974) \end{gathered}$ | Sample Time | Tide Conditions |  | Water Temp. $\left({ }^{\circ} \mathrm{C}\right)$ | $\begin{aligned} & \text { Total } \\ & \text { Precip. } \\ & \text { (in.) } \end{aligned}$ | Wind (mph) |  | Local Sea Cond | $\begin{gathered} \text { Salinity } \\ (p p t) \end{gathered}$ | Coliform <br> $\mathrm{MPN} / \cdot 100 \mathrm{ml}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | $\frac{\text { MPN } / \cdot}{\text { Total }}$ |  |  |  | $\frac{100 \mathrm{ml}}{\text { Fecal }}$ |  |
| Feb 12 | 1325 | $\begin{aligned} & 0850 \\ & 1600 \end{aligned}$ | $\begin{array}{r} 14.8 \\ 4.9 \end{array}$ |  | 6.5 | 0.32 | NW@ |  | 7-10 | choppy | 27.5 | <1.8 | <1.8 |
| Feb 13 | 0945 | $\begin{aligned} & 0925 \\ & 1655 \end{aligned}$ | $\begin{array}{r} 14.1 \\ 4.8 \end{array}$ | 5.5 | 0.82 | SE@ | 28-33 | choppy | 25.0 | 2.0 | 2.0 |
| Feb 14 | 0915 | $\begin{aligned} & 0445 \\ & 0955 \end{aligned}$ | $\begin{aligned} & 11.2 \\ & 13.4 \end{aligned}$ | 6.5 | 0.27 | E@ | 3-14 | calm | 26.5 | 14 | <1.8 |
| Feb 15 | 0905 | $\begin{aligned} & 0640 \\ & 1040 \end{aligned}$ | $\begin{aligned} & 11.8 \\ & 12.7 \end{aligned}$ | 6.5 | 1.01 | SE@ | 8-18 | choppy | - 28.0 | 2.0 | <1.8 |
| Feb 18 | 1430 | $\begin{aligned} & 1420 \\ & 2130 \end{aligned}$ | $\begin{array}{r} 12.1 \\ 4.5 \end{array}$ | 7.0 | 0.32 | SE@ | 9-15 | choppy | 27.5 | 4.0 | <1.8 |
| Feb 19 | 0920 | $\begin{aligned} & 0510 \\ & 1040 \end{aligned}$ | $\begin{aligned} & 14.2 \\ & 10.4 \end{aligned}$ | 5.8 | 0.0 | N@ | 0-5 | calm | 27.5 | 22 | 4.0 |
| Feb 20 | 1510 | $\begin{aligned} & 1100 \\ & 1555 \end{aligned}$ | $\begin{array}{r} 9.9 \\ 12.7 \end{array}$ | -- | 0.09 | SE@ | 23-31 | -- | -- | 33 | 17 |
| Feb 21 | 1100 | $\begin{aligned} & 0550 \\ & 1130 \end{aligned}$ | $\begin{array}{r} 14.3 \\ 9.2 \end{array}$ | 7.0 | 0.58 | NE@ | 2-8 | ripple | 28.5 | 7.8 | <1.8 |
| Feb 22 | 1025 | $\begin{aligned} & 0610 \\ & 1200 \end{aligned}$ | $\begin{array}{r} 14.5 \\ 8.5 \end{array}$ | 6.8 | TR | SE@ | 3-18 | ripple | 27.5 | 9.2 | 4.0 |
| Feb 26 | 1020 | $\begin{aligned} & 0735 \\ & 1425 \end{aligned}$ | $\begin{array}{r} 14.6 \\ 5.3 \end{array}$ | 5.5 | TR | N@ | $2-7$ | ripple | 24.0 | 22 | <1.8 |



| TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMP Sample Station: 21 Location: Ship Peninsula. |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} \text { Date } \\ (1974) \end{gathered}$ | Sample Time | Tide Conditions |  | Water Temp. $\left({ }^{\circ} \mathrm{C}\right)$ | $\begin{aligned} & \text { Total } \\ & \text { Precip. } \\ & \text { (in.) } \end{aligned}$ | Wind (mph) |  | Local Sea Cond. | $\begin{gathered} \text { Salinity } \\ (p p t) \end{gathered}$ | Coliform <br> MPN/ 100 ml |  |
|  |  | Time | Ht. (Fti) |  |  |  |  | Total |  | Fecal |
| Feb 12 | 1310 | $\begin{aligned} & 0850 \\ & 1600 \end{aligned}$ | $\begin{array}{r} 14.8 \\ 4.9 \end{array}$ | 6.0 | 0.32 | NW@ | @ 7-10 |  | ripple | 27.0 | 4.0 | 1.8 |
| Feb 13 | 0930 | $\begin{aligned} & 0925 \\ & 1655 \end{aligned}$ | $\begin{array}{r} 14.1 \\ 4.8 \end{array}$ | 5.5 | 0.82 | SE@ | @ 28-33 | choppy | 24.0 | 1.8 | <1.8 |
| Feb 14 | 0905 | $\begin{aligned} & 0445 \\ & 0955 \end{aligned}$ | $\begin{aligned} & 11.2 \\ & 13.4 \end{aligned}$ | 5.5 | 0.27 | E@ | 3-14 | calm | 27.2 | 23 | 2.0 |
| Feb 15 | 0855 | $\begin{aligned} & 0640 \\ & 1040 \end{aligned}$ | $\begin{aligned} & 11.8 \\ & 12.7 \end{aligned}$ | 5.5 | 1.01 | SEa | ( 8-18 | choppy | 12.8 | 17 | 4.0 |
| Feb 13 | 1420 | $\begin{aligned} & 1420 \\ & 2130 \end{aligned}$ | $\begin{array}{r} 12.1 \\ 4.5 \end{array}$ | 6.5 | 0.32 | SE@ | @ 9-15 | calm | 26.0 | <1.8 | <1.8 |
| Feb 19 | 0905 | $\begin{aligned} & 0510 \\ & 1040 \end{aligned}$ | $\begin{aligned} & 14.2 \\ & 10.4 \end{aligned}$ | 5.5 | 0.0 | N@ | 0-5 | calm | 27.0 | 4.5 | 2.0 |
| Feb 20 | 1415 | $\begin{aligned} & 1100 \\ & 1555 \end{aligned}$ | $\begin{array}{r} 9.9 \\ 12.7 \end{array}$ | -- | 0.09 | SE@ | a 23-31 | - | -- | 4.5 | 2.0 |
| Feb 21 | 1115 | $\begin{aligned} & 0550 \\ & 1130 \end{aligned}$ | $\begin{array}{r} 14.3 \\ 9.2 \end{array}$ | 6.5 | 0.58 | NE@ | @ 2-8 | ripple | 27.0 | 2.0 | 2.0 |
| Feb 22 | 1030 | $\begin{aligned} & 0610 \\ & 1200 \end{aligned}$ | $\begin{array}{r} 14.5 \\ 8.5 \end{array}$ | 6.0 | TR | SE@ | 3-18 | ripple | 27.5 | <1.8 | <1.8 |


| TABLE | 9: BACTERIOLOGICAL ANALYSES |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.


TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.

| Sample | tation: 23 cont'd |  |  |  | cation: Mud Bay |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| -Date | Sample | $\begin{array}{r} \mathrm{Tj} \\ \text { Cond } \end{array}$ | ide <br> itions | Water Temp. | Total Precip. (in.) | Wind (mph) | Local Sea Cond. | $\begin{gathered} \text { Salinity } \\ (p p t) \end{gathered}$ | Coliform |  |
| (1974) |  | Time | Ht. (Ft!) | $\left({ }^{\circ} \mathrm{C}\right)$ |  |  |  |  | Total | Fecal |
| Mar 1 | 0845 | $\begin{aligned} & 0350 \\ & 0905 \end{aligned}$ | $\begin{aligned} & 11.1 \\ & 13.8 \end{aligned}$ | 4.2 | 0.03 | SW@ 8-17 | calm | 25.5 | 4.5 | 4.5 |
| Mar 6 | 1010 | $\begin{aligned} & 1005 \\ & 1525 \end{aligned}$ | $\begin{array}{r} 9.0 \\ 13.4 \end{array}$ | -- | 0.0 | N@ 2-10 | -- | -- | 2.0 | <1.8 |
| Mar 7 | 1020 | $\begin{aligned} & 0455 \\ & 1050 \end{aligned}$ | $\begin{array}{r} 14.8 \\ 7.7 \end{array}$ | -- | 0.02 | NW@ 5-10 | -- | -- | 14 | 2.0 . |
| Mar 8 | 1025 | $\begin{aligned} & 0525 \\ & 1130 \end{aligned}$ | $\begin{array}{r} 14.9 \\ 6.5 \end{array}$ | -- | 0.18 | SE@ 34-40 | -- | -- | 2.0 | 2.0 |

TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.

| $\begin{gathered} \text { Date } \\ (1974) \end{gathered}$ | Sample Time | Tide Conditions |  | Water Temp. $\left({ }^{\circ} \mathrm{C}\right)$ | ```Total Precip. (in.)``` | Wind (mph) | Local <br> Sea Cond: | $\begin{gathered} \text { Salinity } \\ (\mathrm{ppt}) \end{gathered}$ | Coliform <br> MPN/ 100 ml |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Time | Ht. (Ft!) |  |  |  |  |  | Total | Fecal |
| Feb 12 | 1250 | $\begin{aligned} & 0850 \\ & 1600 \end{aligned}$ | $\begin{array}{r} 14.8 \\ 4.9 \end{array}$ | 7.0 | 0.32 | NW@ 7-10 | choppy | 25.0 | 2.0 | 2.0 |
| Feb 13 | 1140 | $\begin{aligned} & 0925 \\ & 1655 \end{aligned}$ | $\begin{array}{r} 14.1 \\ 4.8 \end{array}$ | 6.0 | 0.82 | SE@ 28-33 | choppy | 26.0 | 33 | 4.5 |
| Feb 14 | 1110 | $\begin{aligned} & 0955 \\ & 1755 \end{aligned}$ | $\begin{array}{r} 13.4 \\ 4.8 \end{array}$ | 5.5 | 0.27 | E@ 3-14 | ripple | 26.0 | 920 | 17 |
| Feb 15 | 1030 | $\begin{aligned} & 0640 \\ & 1040 \end{aligned}$ | $\begin{aligned} & 11.8 \\ & 12.7 \end{aligned}$ | 6.2 | 1.01 | SE@ 8-18 | ripple | 28.5 | 2.0 | <1.8 |
| Feb 18 | 1540 | $\begin{aligned} & 1420 \\ & 2130 \end{aligned}$ | $\begin{array}{r} 12.1 \\ 4.5 \end{array}$ | 6.5 | 0.32 | SE@ 9-15 | ripple | 28.0 | 4.5 | 4.5 |
| Feb 19 | 1110 | $\begin{aligned} & 1040 \\ & 1510 \end{aligned}$ | $\begin{aligned} & 10.4 \\ & 12.4 \end{aligned}$ | 6.0 | 0.0 | N@ $0-5$ | calm | 27.0 | 1.8 | 1.8 |
| Feb 20 | 1600 | $\begin{aligned} & 1555 \\ & 2245 \end{aligned}$ | $\begin{array}{r} 12.7 \\ 4.5 \end{array}$ | -- | 0.09 | SE@ 23-31 | -- | -- | 13 | 13 |
| Feb 21 | 0855 | $\begin{aligned} & 0550 \\ & 1130 \end{aligned}$ | $\begin{array}{r} 14.3 \\ 9.2 \end{array}$ | 5.8 | 0.58 | NE@ 2-8 | -- | 26.5 | 13 | 7.8 |
| Feb 22 | 0835 | $\begin{aligned} & 0610 \\ & 1200 \end{aligned}$ | $\begin{array}{r} 14.5 \\ 8.5 \end{array}$ | 5.0 | TR | SE@ 3-18 | calm | 26.5 | 7.8 | 2.0 |
| Feb 26 | 1120 | $\begin{aligned} & 0735 \\ & 1425 \end{aligned}$ | $\begin{array}{r} 14.6 \\ 5.3 \end{array}$ | 6.5 | TR | N@ 2-7 | ripple | 26.0 | 79 | <1.8 |


| TABLE | 9: BACTERIOLOGICAL ANALYSES |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.



TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.
Sample Station: 27

| $\begin{gathered} \text { Date } \\ (1974) \end{gathered}$ | Sample Time | Tide Conditions |  | Water Temp. $\left({ }^{\circ} \mathrm{C}\right)$ | $\begin{aligned} & \text { Total } \\ & \text { Précip. } \\ & \text { (in.) } \end{aligned}$ | Wind (mph) | $\begin{gathered} \text { Local } \\ \text { Sea } \\ \text { Cond. } \end{gathered}$ | $\begin{gathered} \text { Salinity } \\ \text { (ppt) } \end{gathered}$ | Coliform <br> MPN / 100 ml |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Time | Ht. (Ft) |  |  |  |  |  | Total | Fecal |
| Feb 12 | 1215 | $\begin{aligned} & 0850 \\ & 1600 \end{aligned}$ | $\begin{array}{r} 14.8 \\ 4.9 \end{array}$ | 7.0 | 0.32 | NW@ 7-10 | choppy | 28.0 | <1.8 | <1.8 |
| Feb 13 | 1115 | $\begin{aligned} & 0925 \\ & 1655 \end{aligned}$ | $\begin{array}{r} 14.1 \\ 4.8 \end{array}$ | 6.5 | 0.82 | SE@ 28-33 | ripple | 28.0 | <1.8 | <1.8 |
| Feb 14 | 1050 | $\begin{aligned} & 0955 \\ & 1755 \end{aligned}$ | $\begin{array}{r} 13.4 \\ 4.8 \end{array}$ | 6.0 | 0.27 | E@ 3-14 | ripple | 27.0 | 130 | 2.0 |
| Feb 15 | 1015 | $\begin{aligned} & 0640 \\ & 1040 \end{aligned}$ | $\begin{aligned} & 11.8 \\ & 12.7 \end{aligned}$ | 6.8 | 1.01 | SE@ 8-18 | ripple | 28.5 | 4.5 | <1.8 |
| Feb 18 | 1525 | $\begin{aligned} & 1420 \\ & 2130 \end{aligned}$ | $\begin{array}{r} 12.1 \\ 4.5 \end{array}$ | 7.0 | 0.32 | SE@ 9-15 | ripple | 28.5 | <1.8 | <1.8 |
| Feb 19 | 1055 | $\begin{aligned} & 1040 \\ & 1510 \end{aligned}$ | $\begin{aligned} & 10.4 \\ & 12.4 \end{aligned}$ | 6.2 | 0.0 | N@ $0-5$ | calm | 27.0 | 1.8 | <1.8 |
| Feb 20 | 1650 | $\begin{aligned} & 1555 \\ & 2245 \end{aligned}$ | $\begin{array}{r} 12.7 \\ 4.5 \end{array}$ | -- | 0.09 | SE@ 23-31 | -- | -- | 49 | 4.0 |
| Feb 21 | 0910 | $\begin{aligned} & 0550 \\ & 1130 \end{aligned}$ | $\begin{array}{r} 14.3 \\ 9.2 \end{array}$ | 6.5 | 0.58 | NE@ 2-8 | ripple | 28.5 | 1.8 | <1.8 |
| Feb 22 | 0900 | $\begin{aligned} & 0610 \\ & 1200 \end{aligned}$ | $\begin{array}{r} 14.5 \\ 8.5 \end{array}$ | 5.2 | TR | SE@ 3-18 | ripple | 26.5 | 13 | <1.8 |
| Feb 28 | 0950 | $\begin{aligned} & 0830 \\ & 1600 \end{aligned}$ | $\begin{array}{r} 14.1 \\ 4.2 \end{array}$ | 6.2 | 0.62 | SE@ 21-27 | ripple | 29.0 | 7.8 | 2.0 |

TABLE 9: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR MARINE SAMPLES.

| $\begin{aligned} & \text { Date } \\ & 1974) \end{aligned}$ | Sample Time | ```Tide Conditions``` |  | Water <br> Temp. <br> $\left({ }^{\circ} \mathrm{C}\right)$ | Total Precip. (in.) | Wind <br> (mph) | Local Sea Cond. | Salinity (ppt) | Coliform <br> MPN/ 100 ml |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Time | Ht. (Ft:) |  |  |  |  |  | Total | Fecal |
| Feb 12 | 1155 | $\begin{aligned} & 0850 \\ & 1600 \end{aligned}$ | $\begin{array}{r} 14.8 \\ 4.9 \end{array}$ | 6.5 | 0.32 | NW@ 7-10 | choppy | 28.0 | 13 | <1. 8 |
| Feb 13 | 1105 | $\begin{aligned} & 0925 \\ & 1655 \end{aligned}$ | $\begin{array}{r} 14.1 \\ 4.8 \end{array}$ | 6.2 | 0.82 | SE@ 28-33 | swell | 25.0 | <1.8 | <1. 8. |
| Feb 14 | 1040 | $\begin{aligned} & 0955 \\ & 1755 \end{aligned}$ | $\begin{array}{r} 13.4 \\ 4.8 \end{array}$ | 5.0 | 0.27 | E@ 3-14 | ripple | 15.0 | 170 | 13 |
| Feb 15 | 1010 | $\begin{aligned} & 0640 \\ & 1040 \end{aligned}$ | $\begin{aligned} & 11.8 \\ & 12.7 \end{aligned}$ | 7.0 | 1.01 | SE@ 8-18 | choppy | 28.5 | 2.0 | $<1.8$ |
| Feb 18 | 1520 | $\begin{aligned} & 1420 \\ & 2130 \end{aligned}$ | $\begin{array}{r} 12.1 \\ 4.5 \end{array}$ | 7.0 | 0.32 | SE@ 9-15 | choppy | 29.0 | $<1.8$ | $<1.8$ |
| Feb 19 | 1050 | $\begin{aligned} & 1040 \\ & 1510 \end{aligned}$ | $\begin{aligned} & 10.4 \\ & 12.4 \end{aligned}$ | 4.5 | 0.0 | N@ $0-5$ | calm | 24.5 | 7.8 | $<1.8$ |
| Feb 20 | 1000 | $\begin{aligned} & 0530 \\ & 1100 \end{aligned}$ | $\begin{array}{r} 14.2 \\ 9.9 \end{array}$ | 6.5 | 0.09 | SE@ 23-31 | choppy | 27.5 | 7.8 | 2.0 |
| Feb 21 | 0905 | $\begin{aligned} & 0550 \\ & 1130 \end{aligned}$ | $\begin{array}{r} 14.3 \\ 9.2 \end{array}$ | 6.8 | 0.58 | NE@ 2-8 | rolling | 28.5 | 7.8 | 2.0 |
| Feb 22 | 0905 | $\begin{aligned} & 0610 \\ & 1200 \end{aligned}$ | $\begin{array}{r} 14.5 \\ 8.5 \end{array}$ | 5.8 | TR | SE@ 3-18 | calm | 26.0 | 31 | 1.8 |
| Feb 27 | 1030 | $\begin{aligned} & 0800 \\ & 1505 \end{aligned}$ | $\begin{array}{r} 14.4 \\ 4.7 \end{array}$ | 7.0 | 0.09 | SE@ 17-22 | -- | 27.0 | 7.8 | $<1.8$ |
| Feb 28 | 1000 | $\begin{aligned} & 0830 \\ & 1600 \end{aligned}$ | $\begin{array}{r} 14.1 \\ 4.2 \end{array}$ | 6.8 | 0.62 | SE@ 21-27 | choppy | 29.0 | 4.0 | 1.8 |
| Mar 1 | 0905 | $\begin{aligned} & 0350 \\ & 0905 \end{aligned}$ | $\begin{aligned} & 11.1 \\ & 13.8 \end{aligned}$ | 6.5 | 0.03 | SW@ 8-17 | rolling | 28.5 | <1. 8 | $<1.8$ |


TABLE 10: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR FRESHWATER SAMPLES
Sample Station: S2

| Date <br> $(1974)$ | Time of <br> Collection | Total <br> Precip. <br> (in.) | Coliform <br> MPN/lo0 me |
| :---: | :---: | :---: | :---: | :---: |
| May 2 | 1155 | TR | Fecal |


| TABLE $10:$ | BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR <br> FRESHWATER SAMPLES. |
| :---: | :---: | :---: |
| Sample Station: S3 | Location: Union Bay |


| Date <br> (1974) | Time of <br> Collection | Total <br> Precip. <br> (in.) | $\frac{c}{\text { Coliform }}$MPN $/ 100$ me |
| :--- | :--- | :--- | :--- | :--- |
| May 2 Fecal |  |  |  |

TABLE 10: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR FRESHWATER SAMPLES.
Sample Station: S5

| Date <br> (1974) | Time of <br> Collection | Total <br> Precip. <br> (in.) | Coliform <br> MPN/lo0 ml |  |
| :---: | :---: | :---: | :---: | :---: |
| Apr. 19 | 1240 | 0.02 | 2.0 | 2.0 |
| May 2 Fecal |  |  |  |  |
| May 6 | 1140 | TR | $<1.8$ | $<1.8$ |
| May 7 | 1540 | 0.11 | 6.8 | $<1.8$ |


| TABLE $10:$BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR <br> FRESHWATER SAMPLES. |  |
| :---: | :---: |
| Sample Station: S6 | Location: Creek just north of Buckley Bay |

$$
\begin{aligned}
& \text { dipaxd } \\
& \text { teqou }
\end{aligned}
$$

$$
\begin{gathered}
\text { Date } \\
(1974)
\end{gathered}
$$

$$
\begin{array}{ll}
\text { May } 2 \\
\text { May } & 3 \\
\text { May } & 6 \\
\text { May } 7
\end{array}
$$

$$
\begin{aligned}
& 1130 \\
& 0925 \\
& 1145 \\
& 0915
\end{aligned}
$$

\[

\]

$$
\begin{array}{lcc}
\text { TR } & 4.5 & <1.8 \\
0.0 & 2.0 & <1.8 \\
0.11 & <1.8 & <1.8 \\
0.03 & 14 & <1.8
\end{array}
$$

TABLE 10: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR

| Date <br> $(1974)$ | Time of <br> Collection | Total <br> Precip. <br> (in.) | Coliform <br> MPN $/ 100$ m $\ell$ |
| :---: | :---: | :---: | :---: | :---: |
| Feb. 12 Focal |  |  |  |

TABLE 10: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR FRESHWATER SAMPLES.
Sample Station: S8

TABLE 10: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR

| Date | Time of | $\begin{gathered} \text { Total } \\ \text { Precip. } \end{gathered}$ |  | $\mathrm{m} \ell$ |
| :---: | :---: | :---: | :---: | :---: |
| (1974) | Collection | (in.) | Total | Fecal |
| Feb. 12 | 1520 | 0.32 | 790 | 220 |
| Feb. 13 | 1130 | 0.82 | 240 | 79 |
| Feb. 14 | 0940 | 0.27 | 79 | 13 |
| Feb. 15 | 0945 | 1.01 | 240 | 110 |
| Feb. 18 | 0945 | 0.32 | 17 | $<1.8$ |
| Feb. 19 | 1435 | 0.0 | 6.3 | $<1.8$ |
| Feb. 21 | 1530 | 0.58 | 2.0 | $<1.8$ |
| Feb. 22 | 0850 | TR | 540 | 130 |
| Feb. 25 | 1000 | 0.14 | 13 | 4.5 |
| Feb. 26 | 1500 | TR | 540 | 2.0 |
| Feb. 27 | 1000 | 0.09 | 49 | $<1.8$ |
| Feb. 28 | 1435 | 0.62 | >1600 | 13 |
| March 1 | 1055 | 0.03 | 1600 | 4.5 |


TABLE 10: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR FRESHWATER SAMPLES.

TABLE 10: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR

TABLE 10: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR FRESHWATER SAMPLES.
Sample station: Sl5

|  |  | Total | Coliform |
| :---: | :---: | :---: | :---: |
| Date | Time of | Precip. | MPN 100 m |
| (1974) | Collection | (in.) | Fotal |

TABLE 10 : BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR FRESHWATER SAMPLES.
Sample Station: S17

| $\begin{gathered} \text { Date } \\ \text { (1974) } \end{gathered}$ | Time of Collection | $\begin{gathered} \text { Total } \\ \text { Precip. } \\ \text { (in.) } \end{gathered}$ | $\begin{aligned} & \text { Coliform } \\ & \text { MPN/100 ml } \end{aligned}$ |  |
| :---: | :---: | :---: | :---: | :---: |
| Feb. 12 | 1300 | 0.32 | $<1.8$ | $<1.8$ |
| Feb. 13 | 0915 | 0.32 | 49 | 49 |
| Feb. 14 | 0854 | 0.27 | 2.0 | $<1.8$ |
| Feb. 15 | 0915 | 1.01 | 17 | $<1.8$ |
| Feb. 13 | 0905 | 0.32 | 13 | 13 |
| Feb. 19 | 1415 | 0.0 | 4.5 | <1.8 |

TABLE 10: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR FRESHWATER SAMPLES.

| Sample Station: Sl8 | Location: | Cook Creek |  |
| :---: | :---: | :---: | :---: |
| Date <br> $(1974)$ | Time of <br> Collection | Total <br> Precip. <br> (in.) | Coliform <br> Total |
| Feb. 12 | 1155 | 0.32 | $<1.8$ |
| Feb. i3 Fecal |  |  |  |


TABLE 10: BACTERIOLOGICAL ANALYSES RESULTS AND SAMPLING CONDITIONS FOR

Sample Station: S2l Location: Storm water pipe at station 16 \begin{tabular}{c}

| Coliform |
| :---: |
| MPN $/ 100 \mathrm{~m} \mathrm{\ell}$ |
| Total Fecal | <br>

\hline
\end{tabular}



