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Water Quality and Biological Survey at Arctic Gold and Silver Mines Ltd., Yukon Territory, Summer, 1975

Surveillance Report
EPS 5-PR-76-10

Pacific Region
September, 1976

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WATER QUALITY AND BIOLOGICAL SURVEY
AT
ARCTIC GOLD AND SILVER MINES LTD.
YUKON TERRITORY, SUMMER, 1975

by

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ABSTRACT

Biological and water chemistry data were collected from the Tank Creek watershed near the abandoned Arctic Gold and Silver Mines Ltd. mill site during the summer of 1975. Physical and chemical parameters measured and the biological communities sampled produced little evidence that the abandoned mill site has had an adverse effect on the watershed of Tank Creek. Spring runoff from the mill site appeared to have increased the extractable iron and arsenic levels and the dissolved sulfate levels in Tank Creek. A possible anomaly in the distribution of mercury in the study area was encountered. However, these increases were not great enough to affect the biological communities. The mill site appeared to have no effect on Bennett Lake.

RÉSUMÉ

Au cours de l'été 1975, on a recueilli des données biologiques et chimiques sur les eaux du ruisseau Tank près de l'endroit où se trouvait l'usine, maintenant abandonnée, des Arctic Gold and Silver Mines Ltd. L'évaluation des paramètres physiques, chimiques et l'analyse d'organismes vivants ont très peu prouvé que l'usine abandonnée avait contaminé l'eau du ruisseau Tank. On a constaté que les eaux de ruissellement du printemps en provenance de l'emplacement de l'usine contribuaient à augmenter dans l'eau du ruisseau Tank la teneur en fer et en arsenic extractibles et les quantités de sulfate dissoutes. La répartition du mercure dans la région étudiée semblait anormale. Toutefois, les augmentations étaient insuffisantes pour contaminer les organismes vivants. L'usine ne semblait pas avoir d'effet sur les eaux du lac Bennett.

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CONCLUSIONS

Except for changes in water chemistry during the spring run-off period, the abandoned mill site of Arctic Gold and Silver Mines Ltd. has had little or no effect on the water chemistry and bottom fauna community in Tank Creek. The absence of a resident fish population in Tank Creek was more likely due to the location and nature of the creek (gradient and size) than to the presence of the mine. The apparently deformed fish reported from Bennett Lake were probably due to the oligotrophic condition of the lake and not related to pollution from the abandoned mill site.

RECOMMENDATIONS

1. DINA water chemistry monitoring be continued at station 2 (9AA-S1) to provide further information on the effects of spring runoff on the water chemistry of Tank Creek and on the elevated mercury levels encountered at that station. This monitoring should be carried out over one full year on a monthly basis, and after the initial year on a periodic basis determined in part by results from the monthly sampling.

2. No further biological sampling be conducted unless the mine and mill are started up again. If this occurs, biological monitoring should be conducted again after one year of operation to reassess the mill's effect on Tank Creek.

1 INTRODUCTION

Water sampling over the past two years by Department of Indian and Northern Affairs, Whitehorse, Y.T., at Arctic Gold and Silver Mines Ltd., near Carcross, Y.T., had revealed that the water which seeps from the tailings pond during the summer months was of detrimental quality. Also, there had been recent reports from the residents of Carcross that fish caught in Bennett Lake appeared deformed in body shape. For these reasons it was proposed that a joint project be carried out by the Environmental Protection Service (EPS) and the Department of Indian and Northern Affairs, Water Rights Branch (DINA), to determine the extent of the pollution resulting from the abandoned mill site and its effect on the fish and biological organisms in Tank Creek and Bennett Lake.

1.1 Arctic Gold and Silver Mines Ltd.

The ore deposit that eventually came to be called Arctic Gold and Silver Mines Ltd. was discovered in 1905 and was worked extensively until the mid 1920s. In 1964 the owners re-investigated the property and initiated a drilling program which culminated in the construction of a mill, with the mine going into production in mid-May, 1968. Between then and October, 1969, the mill and mine were operated intermittently for various reasons. A basic floatation process was employed, without the use of potassium cyanide for gold extraction, and the sulphides were collected for shipment to Sweden. Reserves at the end of 1967 were 254,920 tons (231,258 metric tons), averaging:

0.68 oz gold /ton (17.50 g/metric ton);
17.70 oz silver/ton (506.66 g/metric ton).

At the height of production, the average daily tonnage at the mill was 150 tons (136 metric tons), (Craig and Laporte, 1972).

1.2 Study Area

The mill site and tailings pond were located about 4 kilometres south of Carcross, part way up Montana Mountain (Figure 1). The tailings pond discharged into a marsh area which is drained by Tank Creek, west of the mill site. Tank Creek runs almost due north into Bennett Lake. At the time of the survey, the only discharge from the tailings pond was seepage in quantities from two to five litres per minute, depending on the surface runoff.

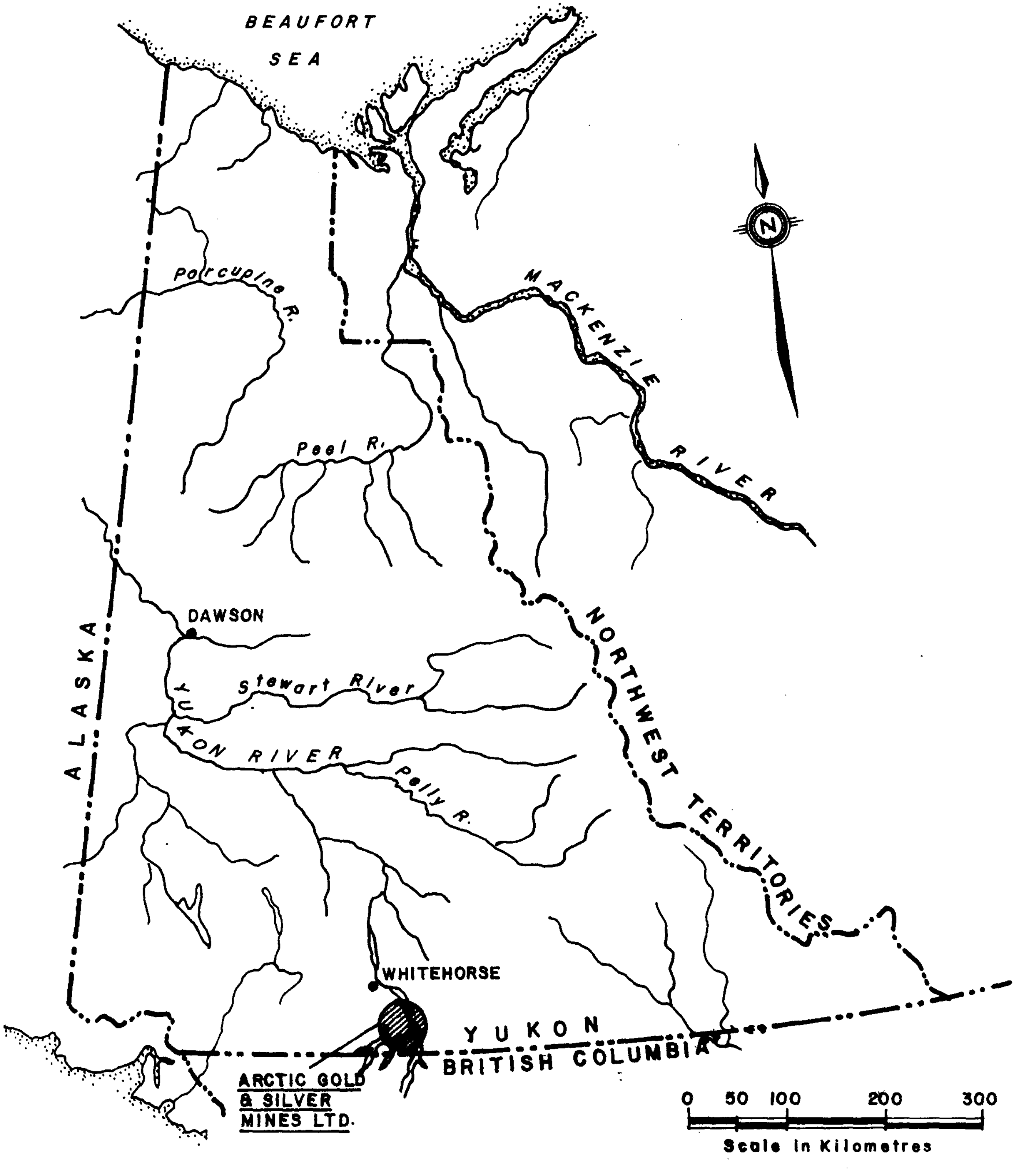

FIGURE I MAP OF THE YUKON TERRITORY SHOWING THE STUDY AREA.

2 METHODS

Seven stations were established for this survey (Figure 2). The Department of Indian and Northern Affairs (DINA) established four stations for sample collection. Their locations are as follows:

Station 1: on an unnamed creek entering the west side of the marsh area;

Station 2: on Tank Creek downstream from Station 6;

Station 3: on Tank Creek near its mouth at Bennett Lake;

Station 4: on Bennett Lake near the mouth of Tank Creek.

The Environmental Protection Service (EPS) established three stations for water and biological sampling (Figure 2). They were as follows:

Station 5: on an unnamed creek 30 metres upstream of DINA station 1;

Station 6: on Tank Creek downstream of the marsh area and just downstream of the road from the mill site to the pumphouse;

Station 7: on Tank Creek about 350 metres downstream from station 6 in a willow and alder swamp.

2.1 Water Chemistry

Water chemistry samples were collected by both EPS and DINA at all their respective stations. DINA collected samples on May 3, 1975, at stations 2 and 4; on June 9, 1975, at Stations 1, 2 and 3; and on September 4, 1975, at stations 1, 2, 3, and 4. Station 2 was a routine water monitoring station sampled by DINA and can be identified by DINA Identification No. 9AA-S1. The DINA samples were preserved according to "Standard Methods" and analysed for: Temperature at Sampling, pH, Turbidity, Colour, Specific Conductance, Non-Filterable Residue (105^{o}C), Fixed Non-Filterable Residue (550^{o}C), Total Alkalinity ($CaCO_3$), Total Hardness ($CaCO_3$), Dissolved Sulphate, Nitrogen (NO_2+NO_3), Total Organic Carbon, Total Inorganic Carbon, Extractable Iron, Manganese, Copper,

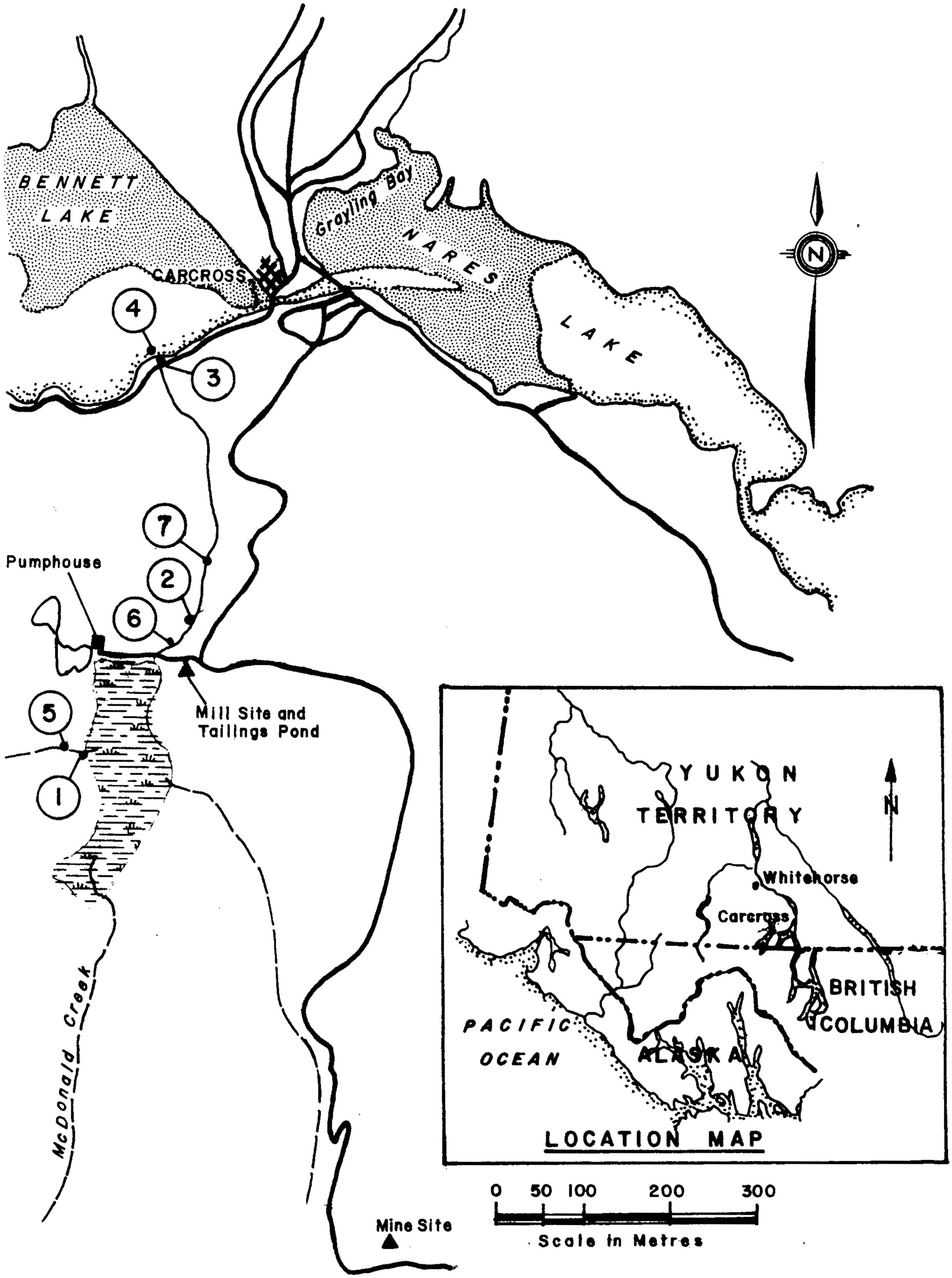

FIGURE 2 MAP OF THE STUDY AREA SHOWING THE SAMPLING STATIONS

Zinc, Lead, Mercury, Arsenic, Silver Barium, Cadmium, Molybdenum, Nickel, Dissolved Oxygen, Nitrogen (NH_3), Total Cyanide, Particulate Nitrogen and Carbon, Total Dissolved Nitrogen, Dissolved Boron, Total Phosphorous, Filterable Residue (105^{o}C) and Fixed Filterable Residue (550^{o}C). Analyses were performed by Analytical Services Division of the Water Quality Branch, Inland Waters Directorate, Vancouver, B.C.

Water chemistry samples were taken by EPS at stations 5, 6, and 7 on June 16, 1975, and July 23, 1975. Temperature conductivity and pH were measured in the field using a Yellow Spring Instrument direct reading Salinity-Conductivity-Temperature Meter (C9089-1), and a Model 29b Radiometer pH meter. Dissolved oxygen was measured using the azide modification of the Winkler method (APHA, 1971). A one-litre sample was taken to be analysed for pH, Non-Filterable Residue, Total Alkalinity as $CaCO_3$, Total Hardness as $CaCO_3$, Colour, and Turbidity; and a 500 ml sample was taken, acidified to pH 1 - 1.5 with nitric acid in the field, and analysed for extractable Calcium, Magnesium, Antimony, Barium, Cadmium, Copper, Iron, Lead, Molybdenum, Nickel, Silver, Zinc, and Mercury. The EPS samples (one litre and 500 ml) were analysed at Environment Canada Laboratory Services, West Vancouver, B.C.

2.2 Bottom Fauna

The invertebrate bottom fauna was sampled by artificial substrate samplers placed at stations 5, 6, and 7 on June 16, 1975, and retrieved on July 27, 1975. The artificial substrate samplers (ASS) were chrome-plated, barbecue chicken baskets with exterior dimensions of diameter 17 cm and length 25 cm. They were filled with rocks of a uniform size from the creek flood plain or creek bottom and had been wiped clean of debris and/or vegetative matter. The approximate surface area contained in each basket was 6000$\pm$1000 sq cm. Three samplers (A, B, and C) were completely submerged in the creek at each station and secured to the bank by a rope. When the ASS were retrieved, a surber sampler was first placed downstream and the ASS was slipped into the surber to ensure a minimum loss of organisms. The rocks were removed from the sampler in the field where they were picked clean of vegetation and organisms. The vegetation and organisms were then preserved in 70% methanol. In the Whitehorse laboratory, the organisms were separated from the vegetation and debris and roughly sorted into families. Final identification and counting of the organisms was conducted by Dr. Charles Low of Envirocon Ltd., Vancouver, B.C.

A species diversity index and evenness index was calculated for the organisms collected using the following formuli:

$$\text{Species Diversity } (H') - \Sigma\, p_i \log p_i$$

where $p_i = n_i/N$

n_i = the number of individuals in the ith species

N = the total number of individuals sampled

$$\text{Evenness } (J) = \frac{\Sigma\, p_i \log p_i}{\log s}$$

where s = the total number of species sampled

$J_{max} = 1$

These formuli are described by Pielou (1966, 1967).

2.3 Fish

At stations 2 and 3, attempts were made to collect fish using a Smith-Root Type VIII electro-fisher. A barrier net was placed in the creek and approximately 30 metres of stream, upstream of the net, were fished with periodic checking of the net. Station 2 was fished for 640 seconds and station 3 was fished for 480 seconds.

3 RESULTS

3.1 Water Chemistry

The DINA and EPS water chemistry reults are summarized in Tables 1 and 2, respectively. Generally, all parameters measured were within the expected ranges, with two anomalies being apparent. The mercury levels found by the DINA analysis were higher at stations 2 and 4 than at stations 1 and 3.

On May 3, 1975, at station 2 there were higher specific conductance, iron, arsenic, and sulphave levels than on any other sampling date for this station.

The generally low values for the parameters measured are indicative of waters originating from runoff.

3.2 Bottom Fauna

There were 1140 individuals, representing 23 species and 17 families, collected in the artificial substrate samplers during the survey. The species list is shown in Table 3. Table 4 shows the distribution of the species among the stations and the number of individuals collected per species. There was an increase in the number of species per station as one moved downstream with 8 species and 6 families at station 5; 10 species and 8 families at station 6; and 15 species and 12 families at station 7.

Table 5 shows the diversity and evenness indicies for each ASS. In cases where one species contained more than 85% of the individuals present in a sampler, the indicies were calculated twice, once with all species and once with the dominant species removed. Generally, the diversity at stations 5 and 6 was similar with higher evenness at station 6. Station 7 contained a high percentage of black fly larvae (simulidae sp.) which lowered the diversity and evenness. However, by recalculating the indices without including the black flies, station 7 had the highest diversity. Evenness was similar at stations 6 and 7.

3.3 Fish

No fish were caught at either stations 6 or 7. Station 5 was too small to electrofish successfully.

TABLE 1 SUMMARY OF DINA WATER CHEMISTRY ANALYSIS (1975)
(mg/ℓ unless otherwise stated)

Analysis	Station 1		Station 2			Station 3		Station 4	
	June 9	Sept. 4	May 3	June 9	Sept. 4	June 9	Sept. 4	May 3	Sept. 4
Temp. @ Sampling °C	3.0	5.0	1.0	8.0	7.0	3.0	8.9	1.0	7.8
pH: Laboratory	7.4	7.7	7.8	7.6	7.6	7.8	7.6	6.2	7.7
Turbidity (Turb. Units)	0.26	0.18	2.6	0.53	0.53	0.38	0.23	4.0	0.34
Colour (Rel. Units)	32.0	25.0	43.0	30.0	10.0	<5.0	<5.0	<5.0	10.0
Sp. Conductance (μmho/cm)	56.3	59.6	142.0	57.8	49.9	63.2	60.0	11.4	57.1
Total Diss. Solids (calc'd)	-	-	7.0	-	-	-	-	29.0	-
Residue: N.F. (105°)	-	-	2.0	-	-	-	-	24.0	-
Residue: Fixed N.F. (550°)	-	-	5.0	-	-	-	-	5.0	-
Alkalinity: Phenol, $CaCO_3$	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alkalinity: Total, $CaCO_3$	22.6	27.0	58.4	25.8	20.8	25.1	23.8	3.09	24.2
Hardness: Total, $CaCO_3$	26.2	28.6	55.9	26.8	22.4	28.4	26.9	1.8	25.9
Calcium (Ca): Dissolved	-	9.0	-	-	7.3	-	9.3	-	8.1
Sulphate (SO_4): Dissolved	2.3	2.0	14.2	3.1	3.2	5.9	5.4	0.9	4.0
Nitrogen (N): $NO_2 + NO_3$	0.002	<0.002	-	0.002	<0.002	0.010	0.076	-	0.045
Carbon (C): Total Organic	7.9	7.7	4.1	6.2	4.9	4.2	2.5	2.0	4.9
Carbon (C): Total Inorganic	4.7	6.2	12.4	6.2	4.4	6.0	4.7	1.2	4.7
Iron (Fe): Extractable	0.36	0.26	1.1	0.31	0.16	0.047	0.028	0.11	0.17
Manganese (Mn): Extractable	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper (Cu): Extractable	<0.001	<0.001	0.005	<0.001	<0.001	<0.001	<0.001	0.007	<0.001
Zinc (Zn): Extractable	<0.001	<0.001	0.002	0.009	<0.001	<0.001	<0.001	0.046	<0.001
Lead (Pb): Extractable	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
Mercury (Hg): Extractable (μg/ℓ)	0.11	<0.05	0.17	0.11	3.8	<0.05	<0.05	0.15	<0.05
Arsenic (As): Extractable	0.0004	0.0005	0.0188	0.0044	0.0078	0.0004	0.0008	0.0009	0.0052
Silver (Ag): Extractable	0.008	<0.005	<0.005	0.005	<0.001	0.007	<0.005	<0.005	<0.005
Barium (Ba): Extractable	0.04	0.03	-	0.03	0.02	0.03	-	-	0.02
Cadmium (Cd): Extractable	<0.0002	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	-	<0.0002
Carbon (C): Particulate	0.094	0.024	-	0.15	0.098	0.072	0.12	-	0.14
Nitrogen (NH_3)	0.004	0.007	-	0.004	0.002	0.003	0.005	-	0.006
Cyanide (CN): Total	<0.001	-	-	<0.001	<0.005	<0.001	<0.005	-	<0.005
Molybdenum (Mo): Extractable	<0.0005	0.001	-	-	-	-	-	<0.002	0.002
Nickel (Ni): Extractable	<0.001	<0.001	-	-	-	-	-	0.002	<0.001
Nitrogen (N): Particulate	-	-	-	0.016	0.011	0.007	0.011	-	0.014
Nitrogen (N): Total Dissolved	-	-	-	0.25	0.123	0.20	0.110	-	0.163
Selenium (Se): Extractable	-	<0.0001	-	-	<0.0001	-	-	<0.0001	<0.0002
pH: Field	7.1	-	-	7.3	-	7.4	-	-	-
Dissolved Oxygen	1.5	-	-	1.0	-	6.0	-	-	-
Flow: cfs	10.0	8.0	-	10.0	-	10.0	-	-	-
Residue: Filterable (105°C)	81.0	-	-	66.0	-	62.0	-	-	-
Residue: Fixed Filt. (550°C)	62.0	-	-	36.0	-	30.0	-	-	-
Boron (B): Dissolved	0.01	-	-	0.01	-	0.005	-	-	-
Phosphorus (P): Total	0.0035	-	-	0.008	-	0.006	-	-	-

TABLE 2 SUMMARY OF EPS WATER CHEMISTRY ANALYSIS (1975)
(mg/ℓ unless otherwise stated)

Analysis	Station 5		Station 6		Station 7	
	June 16	July 23	June 16	July 23	June 16	July 23
Field						
Temperature °C	3.0	9.8	8.0	13.0	7.4	12.2
Conductivity (μhmos/cm)	25.	32.	38.	30.	38.	30.
Dissolved Oxygen	10.10	7.85	8.40	8.15	8.90	8.30
pH	7.05	7.00	7.00	7.15	7.40	7.20
Laboratory						
pH		7.0		7.0		7.0
Non-Filterable Residue		< 3.		< 3.		4.
Total Alkalinity (mg/ℓ $CaCo_3$)		22.		18.		18.
Colour (CO Units)		28.		21.		18.
Turbidity (FTU)		0.27		0.66		0.41
Total Hardness (mg/ℓ $CaCo_3$)		20.		19.		19.
Calcium (Ca)		5.7		5.2		5.2
Magnesium (Mg)		1.5		1.4		1.4
Metals (Extractable)						
Antimony (Sb)	< 0.3	< 0.03	< 0.3	< 0.03	< 0.3	< 0.03
Arsenic (As)		< 0.01		0.02		0.01
Barium (Ba)	< 0.3	0.26	< 0.3	0.20	< 0.3	0.19
Cadmium (Cd)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Copper (Cu)	< 0.1	< 0.01	< 0.1	< 0.01	< 0.1	< 0.01
Iron (Fe)		0.03		0.43		0.20
Lead (Pb)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Molybdenum (Mo)	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (Ni)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Silver (Ag)	< 0.01	< 0.03	< 0.1	< 0.03	< 0.1	< 0.03
Zinc (Zn)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Mercury (Hg) μg/ℓ		< 0.15		< 0.15		< 0.15

TABLE 3 SUMMARY OF THE INVERTEBRATE SPECIES

Phylum Arthropoda

- *Class Crustacea*
  - *Order Amphipoda*
    - *Family Gammaridae*
      - *Gammrus lacustris*
- *Class Insecta*
  - *Order Coleoptera*
    - *Family Dytiscidae*
      - *Dytiscus sp*
  - *Order Diptera*
    - *Family Tendipedidae*
      - *Sub family Hydrobaeninae*
        - *Corynoneura sp*
        - *Spaniotoma sp*
      - *Sub family Pelopiinae*
        - *Pentaneura sp*
    - *Family Simulidae*
      - *Simulidae sp*
      - *Simulidae sp pupa*
    - *Family Empididae*
      - *Adult Empididae sp*
  - *Order Emphemeroptera*
    - *Family Heptageniidae*
      - *Cinygmula sp*
    - *Family Baetidae*
      - *Centroptilum sp*
      - *Pseudocleon sp*
      - *Siphlonurus sp*
  - *Order Homoptera*
    - *Family Aphididae*
      - *Aphididae sp*
    - *Family Psyllidae*
      - *Psyllidae sp*

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Order Plecoptera
Family Nemouridae
Sub family Nemourinae
Nemoura sp

Family Perlodidae
Sub family Isopulinae
Isoperla similis

Order Tricoptera
Family Brachycentridae
Brachycentridae sp.

Family Rhyacophilidae
Atopsyche sp

Family Limnephilidae
Astenophylax sp
Limnephilidae sp pupa

Family Lepidostomatidae
Lepidostoma sp

Phylum Annelida

Class Oligochaeta
Oligochaeta sp

Class Hirudinea
Order Rhynchobdellida
Family Glossiphoniidae
Glossiphonia complanata

TABLE 4 SUMMARY OF INVERTEBRATE DISTRIBUTION BY SPECIES AND STATION

Species	Station 5			Station 6			Station 7		
	A	B	C	A	B	C	A	B	C
Gammarus lacustris	-	-	-	-	-	12	-	-	1
Dytiscus sp	-	-	-	-	-	1	-	-	-
Corynoneura sp	-	-	-	-	1	-	-	-	-
Spaniotoma sp	1	-	-	-	2	-	3	4	1
Pentaneura sp	3	-	-	-	1	3	3	1	3
Simulidae sp	6	2	85	-	-	-	201	262	414
Simulidae sp pupa	1	-	-	-	-	-	2	5	40
Adult Empididae sp	-	-	-	-	-	-	2	-	-
Cinygmula sp	-	-	-	-	-	-	6	7	1
Centroptilum sp	-	-	-	-	3	5	-	-	-
Pseudocleon sp	-	-	-	1	-	-	-	1	-
Siphlonurus sp	-	-	-	-	-	-	-	2	-
Aphididae sp	-	-	-	-	-	-	1	-	-
Psyllidae sp	-	-	-	1	-	-	-	-	-
Nemoura sp	18	1	13	-	-	-	1	-	-
Isoperla similis	-	-	-	-	1	7	4	2	5
Brachycentridae sp	1	-	-	1	-	-	-	-	-
Atopsyche sp	-	-	-	-	-	-	-	-	1
Astenophylax sp	-	1	-	-	-	-	-	-	-
Limnephilidae sp pupa	-	-	-	-	-	-	1	-	-
Lepidostoma sp	-	1	-	-	-	-	-	-	-
Oligochaeta	-	-	-	-	-	-	-	4	-
Glossiphonia complanata	-	-	-	-	-	3	-	-	-

TABLE 5 SUMMARY OF THE DIVERSITY (H') AND EVENNESS (J) FOR THE INVERTEBRATE POPULATION

Station Number	Sample	Diversity (H')	Evenness (J)
5	A	0.5208	0.6692
	B	0.5786	0.9610
	C	0.1700	0.5647
6	A	0.4473	1.0000
	B	0.6489	0.9284
	C	0.5734	0.9523
7	A	0.2338 (0.8771)	0.2338 (0.9192)
	B	0.2057 (0.8223)	0.2156 (0.9105)
	C	0.1952 (0.3890)	0.2161 (0.4603)

( ) Denotes the diversity and evenness indices calculated without the Simulidae which represented 90% for 3A, 91% for 3B, and 89% for 3C of the total number of individuals.

4 DISCUSSION

4.1 Water Chemistry

The low values for lead, zinc, and silver found during this study indicated that the abandoned mill site had little or no effect on the water chemistry of Tank Creek. The suspected problem of acid leaching from the tailings, producing a low pH and increased heavy metal concentrations in the receiving waters, was not encountered.

The high mercury level (relative to the other dates and stations) encountered at station 2 on September 9, 1975, indicated that mercury may be entering the system from either the tailings pond or natural mineral deposits in the area. This situation should be monitored further to determine whether this was the actual value for mercury or resulted from sample contamination.

The data from station 2 on May 3, 1975, indicated that spring runoff from the tailings pond did cause elevated concentrations of dissolved sulphate, extractable iron and arsenic, and specific conductance in Tank Creek. The tailings contained large amounts of pyrite (FeS_2) and arseno pyrite (FeAsS) (Craig and Laporte, 1972), which could account for the iron and arsenic levels. Sulphates were the end product of the process and it is possible that sulphates present in the tailings pond could result in elevated sulphate levels in runoff waters. The higher specific conductance indicated a general increase in ionic concentrations in the water. Although these values were higher than on other dates, they did not pose a threat to the aquatic environment (in light of the literature reviewed in McKee and Wolf, 1963, and Environmental Protection Agency, 1973).

The dissolved oxygen concentrations at stations 1, 2, and 3 for June 9, 1975, were low. This was most likely due to problems with instrumentation rather than decreased values.

The closeness of the hardness, conductivity, and field pH readings in the DINA and EPS data suggested that the two sets of data were comparable.

4.2 Bottom Fauna

The number of species found at the three EPS stations and the calculated species diversity indices indicated that the abandoned mill site presently has little or no effect on the bottom fauna of Tank Creek. If the seepage was affecting the bottom fauna, one would expect to see both a decrease in number of species and diversity at stations 6 and 7 when, in fact, the reverse is the case. The increase in species numbers and population diversity encountered as one moves downstream is attributed to the increase in the size of the stream at station 7 and a more diverse habitat. It was also noted that several species more sensitive to heavy metal pollution, namely the Ephemeroptera (Servizi and Burkhalter, 1970) were encountered at stations 6 and 7 and not at station 5.

4.3 Fish

The abundance and type of bottom fauna present provide ample food for fish. However, the apparent lack of fish at EPS stations 2 and 3 most likely was related to the size, elevation, and resultant (12%) gradient of the stream. This situation is common in mountain streams of this nature.

The deformed appearance of the fish taken from Bennett Lake by the local people was in all probability due to the unproductive nature of the lake and not a result of pollution emanating from the abandoned mill site. Fish from oligotrophic lakes such as Bennett Lake are noted for their large heads in relation to their bodies and thus give the impression of being deformed (P. Savoie, Fisheries Officer, Northern British Columbia and Yukon South, Personal Communication).

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