Department of Environment
Environmental Protection Service
Pacific Region

DATA RECORD

Baseline Environmental Data
Collected at Cape Lazo, Vancouver Island
Prior to Installation of a Domestic Sewage Outfall

by

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ABSTRACT

The Environmental Protection Service conducted a survey of water quality, sediment characteristics and benthic faunal communities in the Cape Lazo area in 1978, 1979 and 1980. The purpose was to collect baseline environmental data prior to installation of a combined domestic sewage outfall serving parts of the Regional District of Comox-Strathcona and CFB Comox.

Pisces IV submersible dives were done December 1, 1978, in two locations off Cape Lazo to visually assess the physical features of the bottom. The 1979 survey concentrated on the most favourable of the sites.

Data on water quality (salinity, temperature, dissolved oxygen and nutrients), sediment characteristics (particle size, organic carbon content, trace metals and infauna) and larger near-bottom fauna were collected November 5 and 6, 1979. Mercury concentrations in oyster tissue and intertidal sediments were examined November 28, 1980.

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1 INTRODUCTION

The Regional District of Comox-Strathcona has proposed to establish a long, deep marine outfall off Cape Lazo, extending into the Strait of Georgia. The outfall would terminate in a diffuser 2750 m out from the low tide in 60 m of water. Effluent would be screened, comminuted and chlorinated with a maximum output of 18 500 m^3 per day.

Direct visual observations of the physical condition of the bottom at two proposed outfall sites were made from the Pisces IV submersible on December 1, 1978. The subsequent 1979 survey centered on the site considered most favorable for outfall placement.

The research vessel CSS VECTOR was used for a baseline survey conducted November 5-6, 1979. Oceanographic water quality parameters of salinity, temperature, dissolved oxygen and nutrients were profiled at several stations. Substrate characteristics of particle size, organic carbon content, trace metals and infaunal invertebrate communities were examined. Bottom trawls were used to sample larger members of the benthic community.

2 DESCRIPTION OF STUDY AREA

Cape Lazo is located on the east side of Vancouver Island, approximately 130 km northwest of Vancouver, B.C. (Figure 1). The survey area covers about 2.59 sq. kilometers, the centre of which is located about 2.2 km east of Cape Lazo.

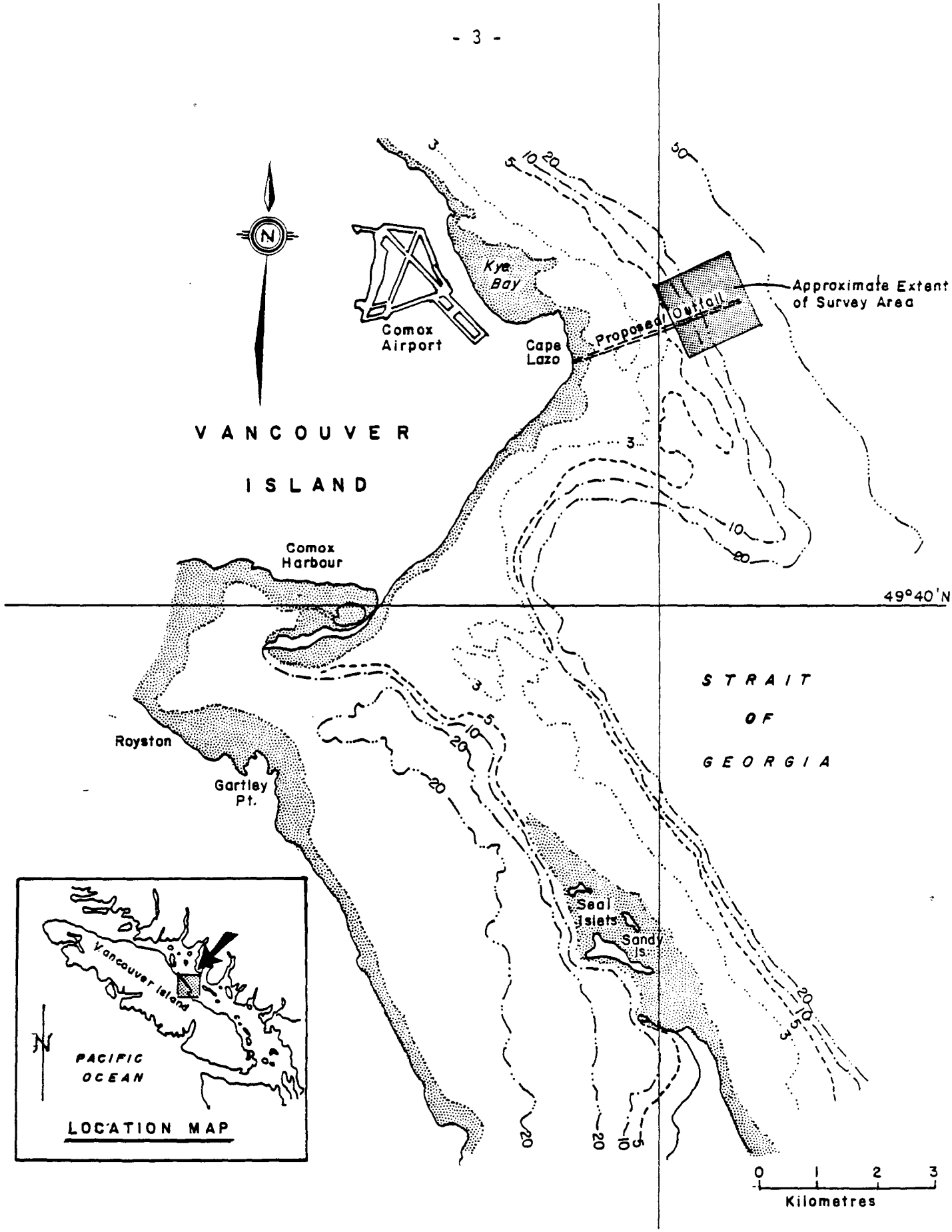

FIGURE 1 LOCATION MAP AND STUDY AREA

3 MATERIALS AND METHODS

3.1 Pisces IV Submersible

Two Pisces IV dives were made along the tracks indicated on Figure 2, December 1, 1978. During each of the dives, photographs were taken with a 70 mm Hasseblad still camera and a 16 mm Bolex cine camera. Observations were made on a tape recorder and later transcribed to dive reports.

3.2 Oceanographic Sampling

Coordinates of oceanographic, benthic and trawl stations occupied during the survey, as determined by radar from the CSS VECTOR, appear in Appendix I.

Station locations for oceanographic water quality sampling are presented in Figure 3. Samples were collected over a period of 1½ hours prior to high slack water. NIO bottles, equipped with paired, protected, reversing thermometers, were used to collect water samples over depths of 0, 2, 5, 10 m etc.

Temperatures were recorded immediately after bottle recovery and calculated to the temperature at depth using the formula of Sverdrup et al. (1946).

Dissolved oxygen levels were measured using the azide modification of the Winkler method (Swingle and Davidson, 1979). The percent saturation of oxygen in seawater was calculated using the equation outlined in Gameson and Robertson (1955).

Salinity values were measured on a "Guildline" Salinometer (Autosal Model 8400).

Water samples collected for nutrient analyses were stored frozen. Nitrite, nitrate, ammonia and ortho-phosphate were determined as outlined by Swingle and Davidson (1979).

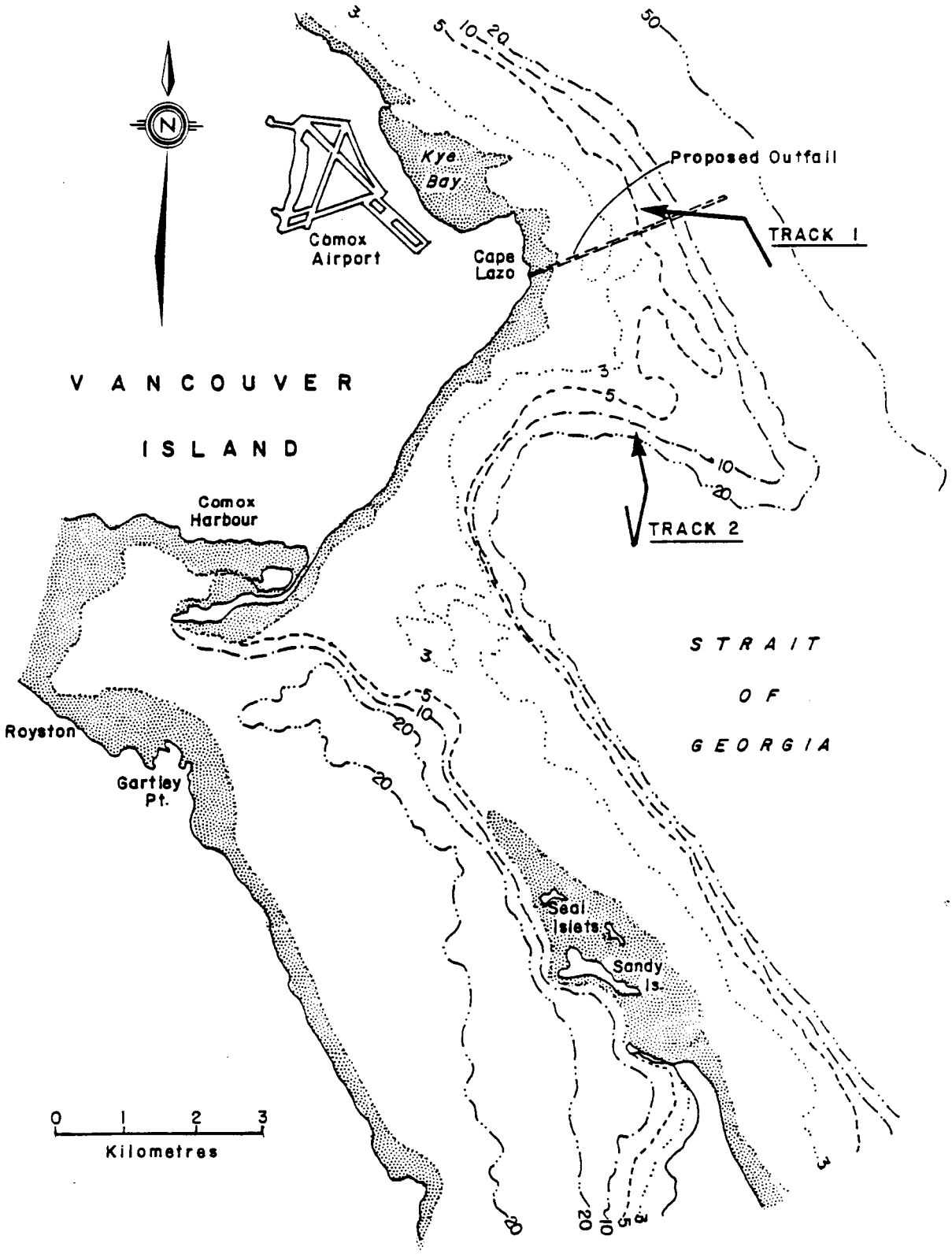

FIGURE 2 PISCES DIVE TRACKS, December 1, 1978

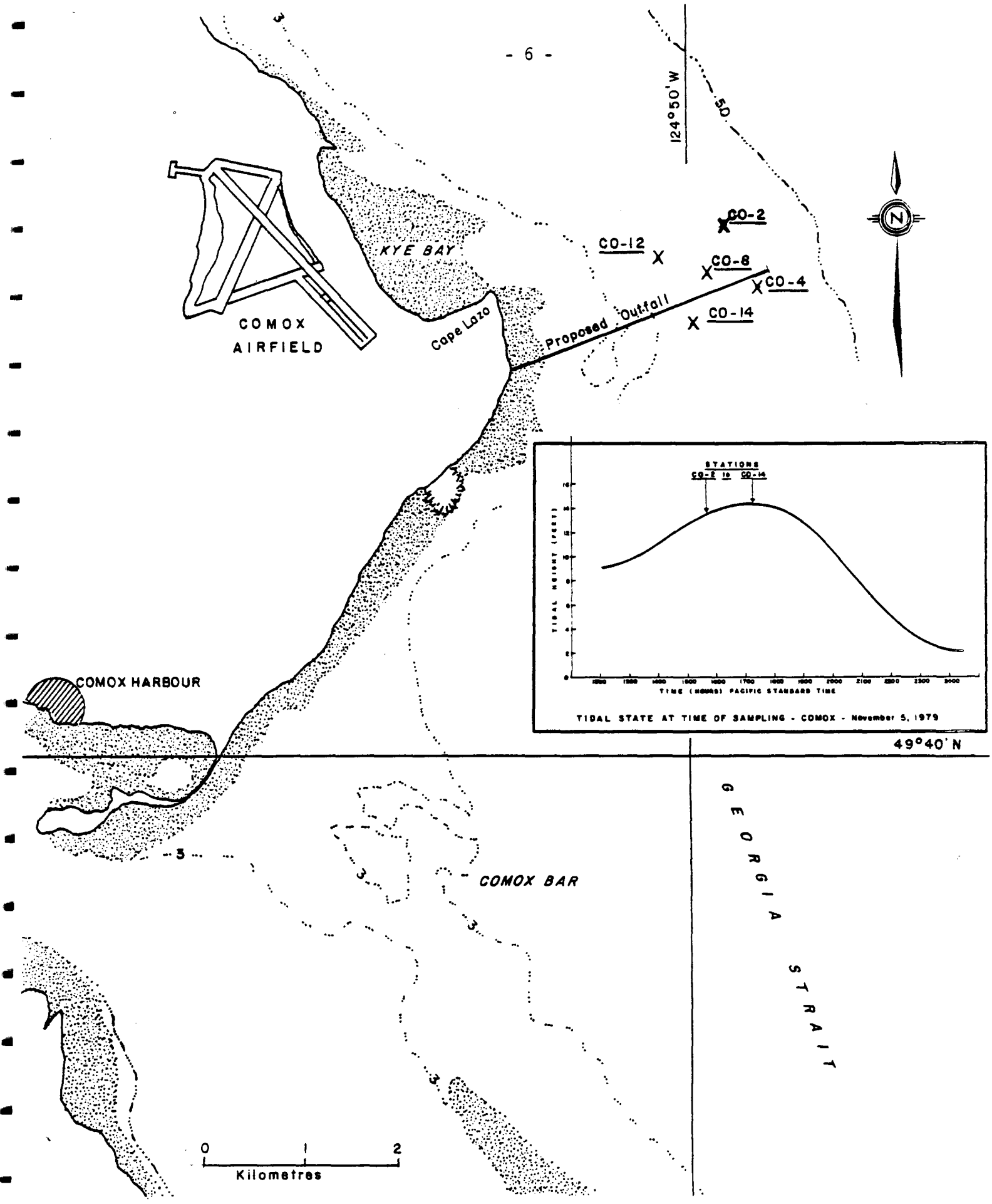

FIGURE 3 WATER QUALITY STATIONS AND TIDAL STATE DURING SAMPLING - November 5, 1979

3.3 Benthic Sampling

3.3.1 Sediments. Sediments samples were obtained with a Peterson grab sampler (0.17 m^2 in area) from stations indicated in Figure 4. After mixing until homogeneous, aliquots were drawn for analysis.

Sediment grain size was determined by wet sieving through three sizes of screens (0.5 mm, 0.25 mm and 0.0625 mm) with the fraction passing through the final screen estimated by calculation.

Organic carbon content was determined using the chromic acid-sulphuric acid digestion method described by Swingle and Davidson (1979).

Sediments for trace metal analyses were air dried at room temperature, disaggregated and sieved. Analysis was as outlined by Swingle and Davidson (1979).

3.3.2 Fauna. Benthic invertebrates were removed from grab samples by sieving through a 0.5 mm screen. Material retained was preserved in 10% formalin and, after three days, transferred to 50% propanol for storage. Identifications were made to species where possible.

Otter trawls were done over a distance of one nautical mile along the track shown in Figure 5. All organisms were identified and enumerated. In addition, flatfish caught were measured and weighed.

3.4 Intertidal Mercury Sampling

Surface sediments were collected November 28, 1980, on a +4.5 foot tide from Goose Spit and Point Holmes (Figure 6). Analysis was performed for mercury by the EPS chemistry laboratory.

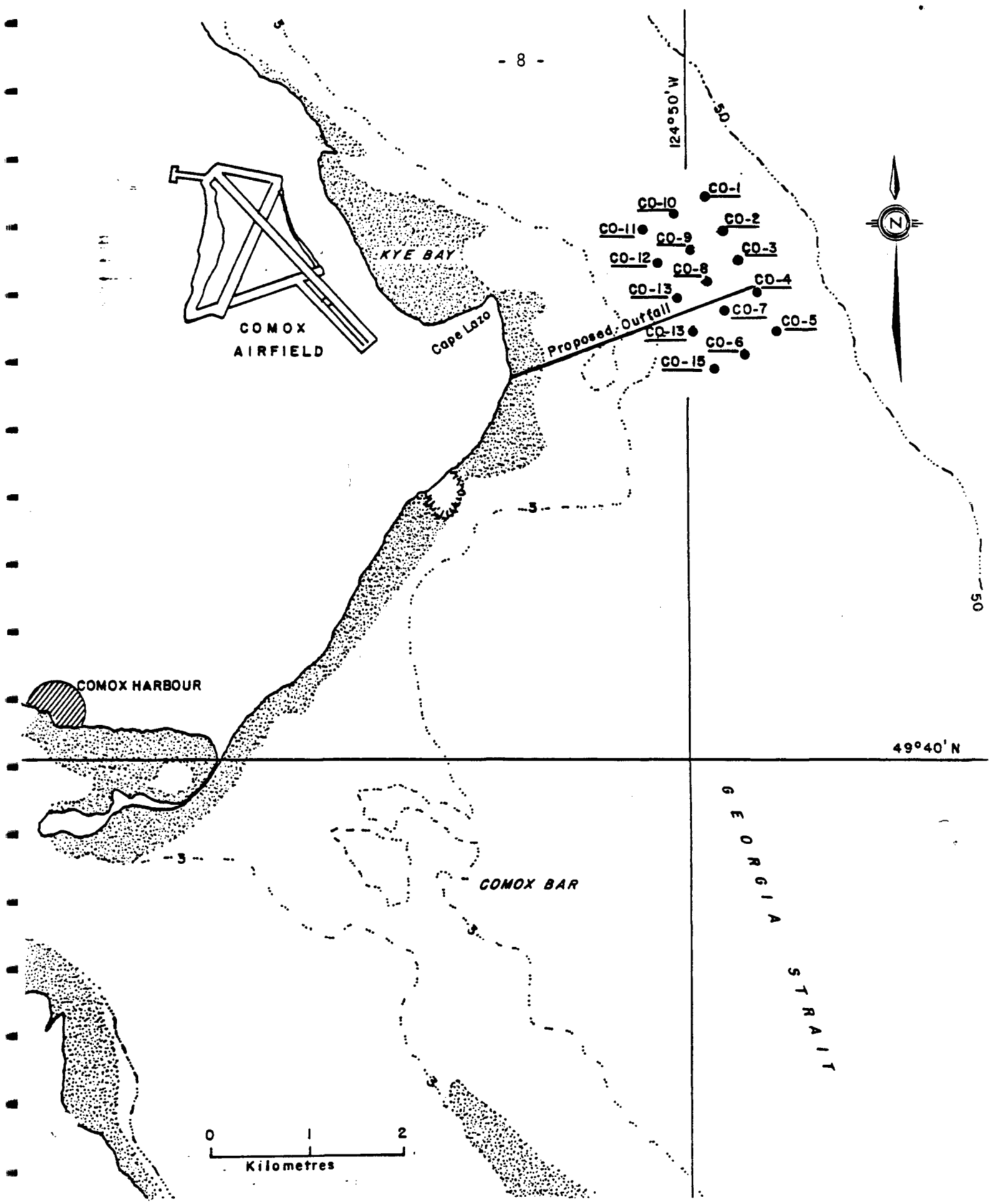

FIGURE 4 BENTHIC STATIONS. November 6.1979

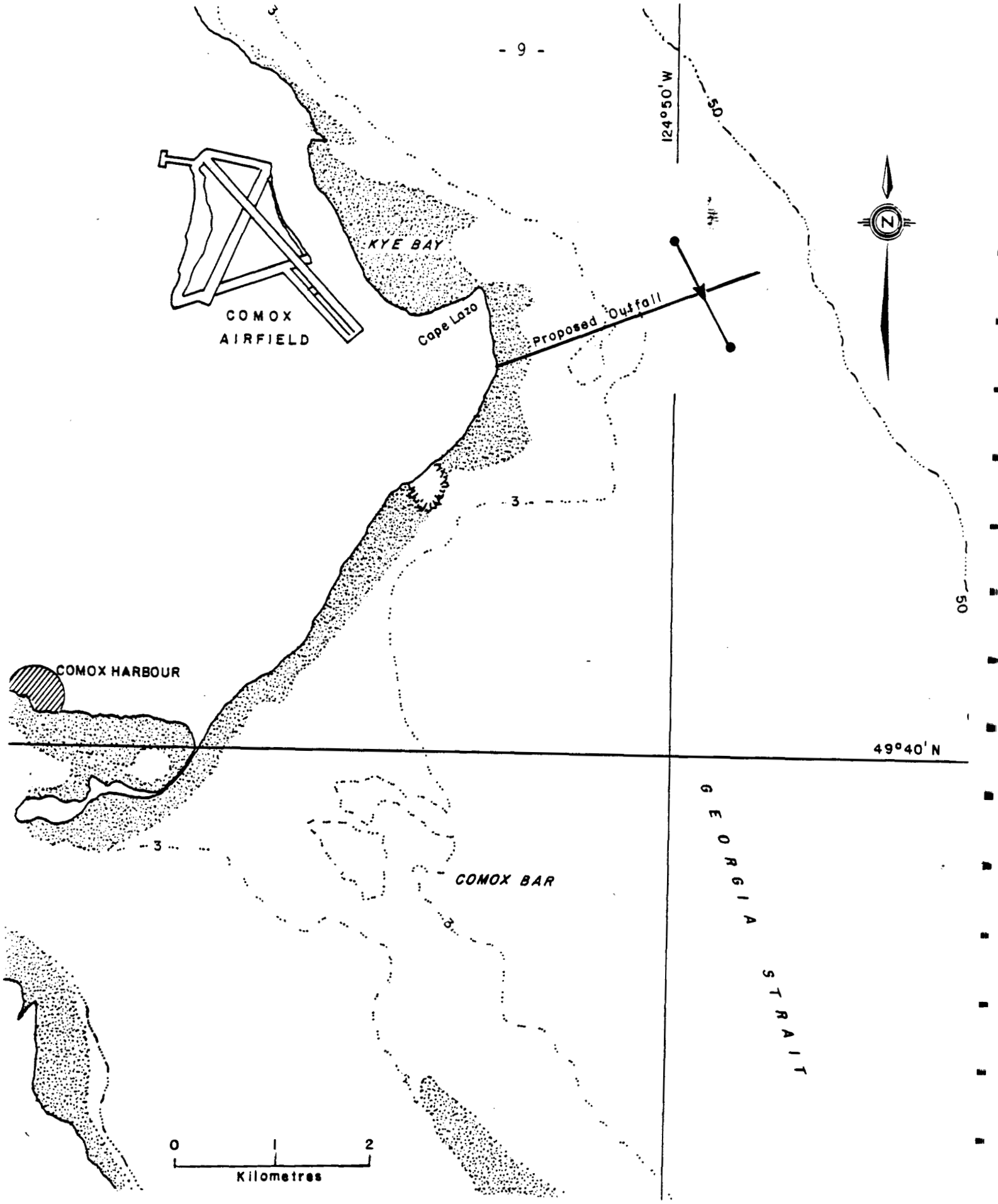

FIGURE 5 OTTER TRAWL TRACKS 1 and 2, November 6, 1979

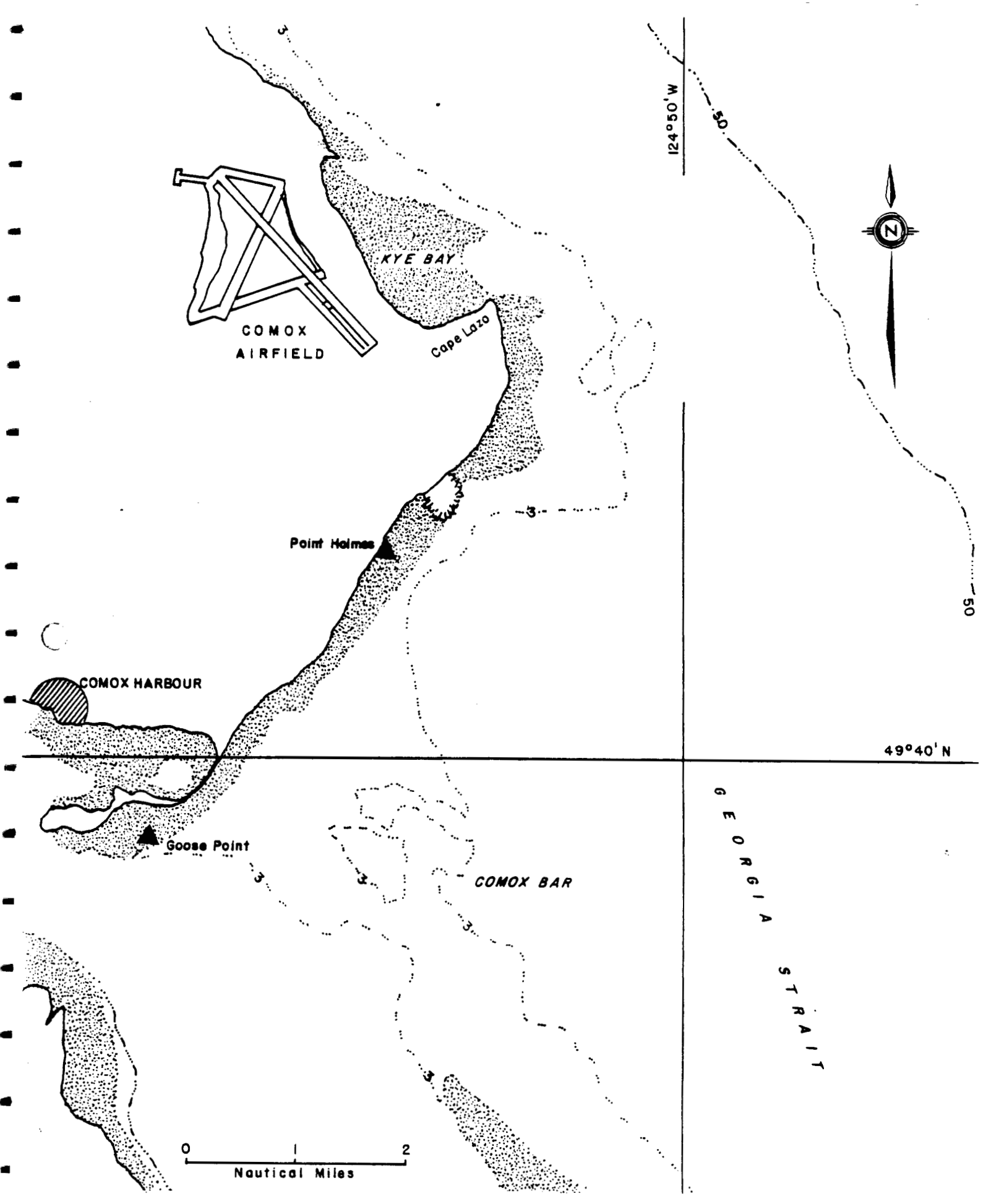

FIGURE 6 INTERTIDAL STATIONS, November 28, 1980

4 RESULTS

4.1 Summary of Results

Pisces IV dives made during December 1978 indicated the area off Cape Lazo, surveyed in 1979, as a preferred location for the sewage outfall (Appendix II). Sediments in this area were coarse and compact implying good water circulation. In addition, the slope was favourable for construction. The benthic environment in total appeared less sensitive compared to the other site examined further south (Figure 1).

Although the water column was slightly stratified nearshore with respect to salinity, temperature and dissolved oxygen, offshore stations were more mixed (Table 1). Concentrations of dissolved nutrients were comparable among stations at depths to 10 m (Table 2). Nitrate and ortho-phosphate increased considerably below this depth at offshore stations.

The substrate in the study area was composed primarily of fine to coarse sand (Table 3). Broken shell and polychaete tubes were common throughout. Sediment particle size was generally in the 0.25 to 0.0625 mm range (Table 4). An increase in coarser material (greater than 0.5 mm) was noted at the nearshore stations (CO-12, 14). Organic carbon content averaged 10 $mg.gm^{-1}$, increasing somewhat with distance from shore (17 $mg.gm^{-1}$ at CO-5) (Table 5). A similar situation existed for iron (Fe) with other trace metals having random or uniform distribution patterns (Table 6).

Benthic fauna captured in the otter trawls was dominated by flatfish (Pacific sanddab, Dover and rock sole) and shrimps (Tables 7 and 8). Polychaetes were abundant among the benthic invertebrates, making up the bulk of recorded species and biomass in grabs (Table 9).

Intertidal sediments and oysters at the two sites sampled were free of mercury contamination (Table 10).

REFERENCES

Gameson, A.L.H., and K.J. Robertson. The Solubility of Oxygen in Pure Water and Seawater. J. Appl. Chem. 5:502 (1955).

Sverdrup, H.V., M.W. Johnson and R.H. Fleming. The Oceans: Their Physics, Chemistry and General Biology. Prentice-Hall, New York, 1087 pp. (1946).

Swingle, R.B., and J.W. Davidson. Environmental Laboratory Manual. Environmental Protection Service (1979).

4.2 Oceanographic Data

Tables 1 and 2

TABLE 1 WATER QUALITY, NOVEMBER 5, 1979

STATION	TIME (Hrs.PST)	DEPTH (m)	SALINITY (0/00)	TEMPERATURE (°C)	DISSOLVED OXYGEN (mg/l)	OXYGEN SATURATION (%)
CO-2	1540	0	28.00	10.12	7.70	83.30
		2	28.18	10.03	7.75	84.27
		5	28.39	10.05	7.75	84.43
		10	28.69	9.90	7.20	78.33
		25	29.11	9.57	6.40	69.29
		50	29.45	9.32	6.00	64.72
		57(BTM)[a]	-	-	-	-
CO-4	1610	0	28.08	10.07	7.55	82.12
		2	28.20	9.99	7.70	83.67
		5	28.35	9.99	7.60	82.65
		10	28.67	9.92	7.30	79.43
		25	29.21	9.48	6.25	67.56
		50	29.44	9.32	6.00	64.72
		62(BTM)	-	-	-	-
CO-8	1630	0	27.95	10.10	7.65	83.19
		2	28.01	10.03	7.60	82.55
		5	28.52	9.94	7.40	80.48
		10	28.79	9.82	7.05	76.59
		25	29.21	9.48	6.25	67.56
		40	29.28	9.43	6.15	66.43
		47(BTM)	-	-	-	-
CO-12	1655	0	28.01	10.10	7.70	83.77
		2	28.15	10.04	7.70	83.73
		5	28.57	9.93	7.50	81.57
		8	28.69	9.86	7.25	78.79
		13(BTM)	-	-	-	-
CO-14	1715	0	28.18	10.02	7.60	82.62
		2	28.24	10.01	7.55	82.09
		5	28.32	9.99	7.60	82.64
		10	28.73	9.85	7.15	77.70
		15(BTM)	-	-	-	-

[a]Bottom

TABLE 2 DISSOLVED NUTRIENTS, NOVEMBER 5, 1979

STATION	DEPTH (m)	NITRATE (mg/l)	NITRITE (mg/l)	AMMONIA (mg/l)	o-PHOSPHATE (mg/l)
CO-2	0	0.288	0.012	0.0060	0.0685
	2	0.289	0.012	L0.0050	0.0675
	5	0.289	0.012	L0.0050	0.0665
	10	0.306	0.012	L0.0050	0.0700
	25	0.339	0.011	L0.0050	0.0773
	50	0.358	0.009	L0.0050	0.0803
	57(BTM)[a]	-	-	-	-
CO-4	0	0.303	0.013	0.0072	0.0706
	2	0.295	0.013	L0.0050	0.0693
	5	0.294	0.013	L0.0050	0.0675
	10	0.309	0.012	L0.0050	0.0693
	25	0.349	0.009	L0.0050	0.0780
	50	0.360	0.009	L0.0050	0.0795
	62(BTM)	-	-	-	-
CO-8	0	0.301	0.013	0.0057	0.0685
	2	0.300	0.012	0.0060	0.0699
	5	0.303	0.012	L0.0050	0.0696
	10	0.318	0.012	L0.0050	0.0710
	25	0.258	0.098	L0.0050	0.0777
	40	0.352	0.010	L0.0050	0.0788
	47(BTM)	-	-	-	-
CO-12	0	0.299	0.013	L0.0061	0.0700
	2	0.294	0.013	L0.0058	0.0695
	5	0.297	0.013	L0.0050	0.0695
	8	0.305	0.013	0.0054	0.0706
	13(BTM)	-	-	-	-
CO-14	0	0.302	0.013	0.0060	0.0706
	2	0.289	0.013	0.0074	0.0706
	5	0.298	0.013	0.0070	0.0705
	10	0.309	0.013	0.0052	0.0706
	15(BTM)	-	-	-	-

L = less than
[a]Bottom

4.3 Benthic Study Data

4.3.1 Sediment Characteristcs

Tables 3, 4, 5 and 6

TABLE 3 VISUAL DESCRIPTION OF PETERSON GRAB SAMPLES, NOVEMBER 6, 1979

Station	Depth (m)	Volume Sieved (liters)	Description
CO-1	58	2.5	Mainly medium sand containing a small amount of coarse sand. Small broken shells. 3 x rocks approximately 2.5 cm in length.
CO-2	58	2.3	Mainly medium sand with some coarse sand. Small broken shells.
CO-3	64	3.5	Mainly medium sand with some coarse sand. Several (23 x) rocks approximately 2.5 to 4 cm in size.
CO-4	59	6.0	Mainly medium sand with some coarse sand. Broken shell material.
CO-5	68	6.0	Fine sand with broken shell material. 1 x piece of wood bark. 2 x holothurians.
CO-6	48	4.0	Fine sand with broken shell material. Some coarse sand. A few polychaete tubes.
CO-7	44	6.0	Medium and fine sand with broken shell material. Some polychaetes and bivalves.
CO-8	53	6.0	Medium and fine sand with broken shell material. Some gastropods, brittle stars, polychaetes. Empty polychaete tubes and bivalves.
CO-9	53	3.8	Fine sand with broken shell material. Some pieces of wood bark and polychaete tubes.
CO-10	55	5.0	Medium and fine sand with broken shell material. Some empty polychaete tubes and bivalves.
CO-11	20	3.0	Mainly coarse sand. A number of gastropods (Olivella) on the sand surface.
CO-12	14	3.0	Coarse and medium sand. A number of gastropods (Olivella) on the sand surface.
CO-13	13	2.0	Coarse and medium sand. A number of gastropods (Olivella) on the sand surface. Some broken shell material.
CO-14	16	1.0	Coarse and medium sand.
CO-15	18	2.0	Coarse and medium sand. Some polychaete tubes. Dead vegetation.

TABLE 4 SEDIMENT PARTICLE SIZE, NOVEMBER 6, 1979

Station	Sediment Size (% retained on Screen)			
	G0.5mm	0.25mm	0.0625 mm	L0.0625 mm
CO-1	45.7	20.6	19.3	14.4
CO-2	1.1	6.4	89.3	3.2
CO-3	26.9	19.7	51.1	2.3
CO-4	0.0	2.9	92.7	4.3
CO-5	0.0	2.9	93.4	3.7
CO-6	0.0	1.6	95.0	3.4
CO-7	0.5	2.3	95.8	1.4
CO-8	0.2	4.3	93.9	1.6
CO-9	0.7	4.3	94.0	1.0
CO-10	2.1	20.3	76.4	1.2
CO-11	21.9	67.1	11.0	0.0
CO-12	15.9	49.4	34.6	0.0
CO-13	22.1	56.9	21.0	0.1
CO-14	39.5	51.6	8.9	0.0
CO-15	8.3	38.4	52.7	0.6

G = greater than
L = less than

TABLE 5 SEDIMENT ORGANIC CARBON CONTENT, NOVEMBER 6, 1979

Station	Organic Carbon (mg/g)	Station	Organic Carbon (mg/g)
CO-1	11	CO-9	L10
CO-2	10	CO-10	L10
CO-3	11	CO-11	L10
CO-4	13	CO-12	L10
CO-5	17	CO-13	L10
CO-6	10	CO-14	L10
CO-7	L10	CO-15	L10
CO-8	L10		

L = less than

TABLE 6 SEDIMENT TRACE METALS, NOVEMBER 6, 1979

STATION	Hg (ppm)	Cd (ppm)	Cr (ppm)	Cu (ppm)	Mn (ppm)	Ni (ppm)	Pb (ppm)	Zn (ppm)	Fe (ppm)
CO-1	0.161	L1.23	18.7	13.6	296.0	L9.85	L9.85	20.7	20 200
CO-2	L0.098	L1.24	18.4	14.4	241.0	L9.91	L9.91	39.6	21 100
CO-3	0.166	L1.24	20.3	14.9	322.0	L9.89	L9.89	28.5	23 900
CO-4	L0.099	L1.18	16.4	12.0	239.0	L9.44	L9.44	20.2	18 500
CO-5	0.271	L1.19	17.0	14.5	228.0	L9.49	L9.49	23.0	17 900
CO-6	0.164	L1.21	16.3	10.8	214.0	L9.72	L9.72	17.9	18 600
CO-7	L0.102	L1.19	17.3	9.95	220.0	L9.54	L9.54	21.0	20 500
CO-8	0.216	L1.22	18.2	10.4	239.0	L9.79	L9.79	20.3	20 800
CO-9	0.186	L1.20	15.4	8.39	208.0	L9.59	L9.59	16.7	18 100
CO-10	0.190	L1.23	20.3	11.2	245.0	L9.80	L9.80	22.7	25 800
CO-11	L0.096	L1.19	40.8	11.3	263.0	L9.57	10.20	17.5	56 500
CO-12	L0.100	L1.22	53.0	11.8	349.0	L9.76	L10.50	16.4	67 800
CO-13	L0.099	L1.20	25.0	9.01	281.0	L9.56	L9.56	20.7	35 200
CO-14	L0.097	L1.23	26.7	9.97	291.0	L9.84	L9.84	24.2	38 900
CO-15	L0.097	L1.23	17.7	8.51	240.0	L9.69	L9.69	14.9	23 100

L = less than

4.3.2 Benthic Fauna

Tables 7, 8 and 9

TABLE 7 OTTER TRAWL DATA, TRAWL #1, NOVEMBER 6, 1979

Specimen	Number	Length cm	Weight gms
Citharichthys sordidus (Pacific sanddab)	9	14.3	32
		14.8	35
		16.1	48
		13.6	30
		11.8	23
		11.4	18
		12.2	22
		16.3	44
		15.7	45
Lepidopsetta bilineata (Rock sole)	21	20.6	85
		24.0	155
		25.7	210
		19.5	90
		22.5	145
		19.5	80
		19.5	80
		17.1	51
		16.2	47
		16.6	47
		14.1	23
		16.9	41
		16.4	45
		14.8	30
		14.9	33
		15.0	37
		14.9	35
		13.5	23
		13.5	24
		13.6	23
		10.9	11
Microstomus pacificus (Dover sole)	3	17.8	41
		13.7	22
		13.4	24

...cont'd

TABLE 7 OTTER TRAWL DATA, TRAWL #1, NOVEMBER 6, 1979 (continued)

Specimen	Number	Length cm	Weight gms
Luidia foliolata	1		
Pycnopodia helianthoides	3		
Paracrangon echinata	25		
Crangon sp.	8		
Chorilia longipes	4		
Pandalus stenolepis	1		
Spirontocaris sp.	6		
Munida quadrispina	1		
Strongylocentrotus sp.	1		
Cadlina luteomarginata	2		
Triopha carpenteri	17		
Hermissenda sp.	2		
Ascidia paratropa	9		
Ophiuroidea	2		
Pycnogonidae	1		
Octopus (small)			
Large volume of algae, mostly Ulva			

TABLE 8 OTTER TRAWL DATA, TRAWL #2, NOVEMBER 6, 1979

Specimen	Number	Length cm	Weight gms
Lepidopsetta bilineata (Rock sole)	9	13.8	20
		14.1	32
		15.7	36
		17.8	56
		18.4	60
		22.0	120
		28.9	310
		23.7	155
Microstomus pacificus (Dover sole)	1	13.6	26
Pisaster ochraceus	1		
Paracrangon echinata	13		
Crangon sp.	2		
Ophiuroidea	9		
Ascidia paratropa	4		
Hermissenda sp.	4		
Dendronotus sp.	1		
Small shrimp - unidentified	1		
Scallop	4		
Cottidae	1		
Squid	1		

TABLE 9 INVERTEBRATES RECORDED FROM PETERSON GRAB SAMPLES, NOVEMBER 6, 1979

CLASSIFICATION	STATION (CO-)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15[a]
ANNELIDA															
Oligochaeta					1					1					
Polychaeta															
Aphroditoidae (unid.)[b]			1												
Hermothoe imbricata			1		1		1	4	2						3
Polyodontidae															
Peisidice aspera			1												
Phyllodocidae															
Eteone sp.									1						1
Phyllodoce polynoides							1								
Phyllodoce sp.				2	2		1		1			1			
Hesionidae (unid.)							1								
Syllidae															
Autolytus cornutus		1													
Exogone sp.						1									
Exogone lourei	2	1													
Syllis sp.			2						1						
Syllis heterochaeta								1	1						
Nephytidae															
Nereis sp.							4		2						3
Nephtys sp.		5		10	10	5	2	5	3	1	1	2		2	1
Glyceridae															
Glycera sp.							2	2	3	2	1	1	1		2
Glycera capitata		3	2	2	6	4									
Onuphidae															
Onuphis iridescens			2	2	1	2	3	2		3	1				
Lumbrineridae															
Lumbrineris sp.			1	1	4	2									
Lumbrineris inflata									1						
Lumbrineris S.Y. sp.								1							
Lumbrineris S.B. sp.								1							
Lumbrineris C sp.							2		4						3
Dorvilleidae (unid.)							1								

.../cont'd

TABLE 9 (continued) INVERTEBRATES RECORDED FROM PETERSON GRAB SAMPLES, NOVEMBER 6, 1979

CLASSIFICATION	STATION (CO-)														
	1	2	3	4	5	6	7	8	9	10	10	12	13	14	15[a]
Orbiniidae (unid.)			1	1			1						1		
Orbinia felix						2									
Leitoscoloplos pugettensis					3										
Scoloplos sp.									1				1		
Scoloplos acmeceps						2	5								1
Scoloplos armiger													1		
Paraidae															
Aricidea neosuccica	2		1		3		1		1		2				
Aricidea succica					1										
Spionidae (unid.)	1	2		12	8	17		2		1	1				
Laonice cirrata				1											
Malococeros glutaeus															2
Prionospio sp.							1								
Prionospio steenstrupi						1									
Polydora sp.								1							
Spio sp.					2		5		8			1			
Spio cirrifera							4								
Spiophanes berkeleyorum	2														
Magelona sp.							1			1					
Magelona longicornus				1											
Chaetopteridae (unid.)															1
Cirratulidae (unid.)															1
Tharyx sp.				1	5										
Ophellidae															
Ammontrypane aulogaster											2	15	6	5	
Armandia brevis								1							
Sternaspis scutata					1	1									
Travisia sp.									1	1					
Travisia brevis	2			1	2	1									
Capitellidae (unid.)					4										1
Capitella capitata				1											1
Mediomastus sp.				1	2										
Notomastus sp.														1	

.../cont'd

TABLE 9 (continued) INVERTEBRATES RECORDED FROM PETERSON GRAB SAMPLES, NOVEMBER 6, 1979

CLASSIFICATION	STATION (CO-)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15[a]
Maldonidae (unid.)	1		1		1				1						
Maldane glebifex					2	1									1
Myriochele aculata	1			2	2		9	2	9	5					1
Sabellidae															
Pectinaridae															
Pectinaria granulata			1							1					2
Ampharetidae (unid.)		2		1	3			2		1					
Amage anops						1	1	1							
Ampharete sp.										1		2		1	
Ampharete acutifrons															1
Melinnampharete sp.											1				
Terebellidae (unid.)			1						1						
Pista cristata	1														
Pista fasciata								1							
Terebellides sp.				1											
Terebellides stroemi					1			2							
MOLLUSCA															
Gastropoda															
Mytrella tubrulossa		4		3			1	5	2	9					
Odostomia sp.					1										
Olivella baetica								1		2	4	8	5		
Nudibranchia															
Aglaja diomedia		1													
Bivalvia															
Acila sp.							8	9	11	6					
Astarte borealis										1			1		
Axinopsida ciliata				2	6		1								
Compsomyax subdiaphana	1									1					
Crenella divoricata	2						1			3					
Cyclocardia gouldi									6						
Nucula quirica				2											
Nucula tenuis								1							

.../cont'd

TABLE 9 (continued) INVERTEBRATES RECORDED FROM PETERSON GRAB SAMPLES, NOVEMBER 6, 1979

CLASSIFICATION	STATION (CO-)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15[a]
Nuculana minuta										1					
Pandora filosa				1			1			1					
Psephidia lordi		2		2	1		1	1	3	5				1	
Spisula sp.												8		1	
Thracia sp.							1								
Thyasira gouldi						1									
Transennella tantilla						1		1							
Truncacila castrensis										1					
Solen sicarius												1			
ECHINODERMATA															
Ophuroidea (unid.)	1	1	2	1	3			3	1						1
Ostracoda															
Cucumaria miniata				1											
Holothuroidea															
Parastichopus californiensis	1		1												
ARTHROPODA															
Crustacea															
Copepoda (unid.)											1				
Amphipoda															
Gammaridea (unid.)	1	6	6	5	7	3	2	9	6	3	1	2	4	2	6
Caprellidae (unid.)															1
Caprella mendax															1
Euphausiacea (unid.)		1													
Decapoda															
Caridea															
Crangon franciscorum				1					1						
Heptacarpus taylori							1								
Spirontocaris prionata			1												
Brachyura															
Cancer productus								1							
Anomura															
Pagurus sp.								1							
Pagurus samuelis															1

.../cont'd

TABLE 9 (continued) INVERTEBRATES RECORDED FROM PETERSON GRAB SAMPLES, NOVEMBER 6, 1979

CLASSIFICATION	STATION (CO-)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15[a]
SIPUNCULA (unid.)								1							1
NEMERTEA (unid.)							1						1		
NEMATODA (unid.)			1												

a see table 3 for volumes of sediment sieved at each station
b unidentified

4.4 Intertidal Mercury Data

November 28, 1980

TABLE 10 MERCURY CONCENTRATIONS IN OYSTERS AND INTERTIDAL SEDIMENTS, NOVEMBER 28, 1980.

Sample	Location	Mercury (ppm) Dry Weight	Wet Weight
A. Sediments			
1	Goose Spit	L0.088	
2	"	L0.094	
3	"	L0.097	
1	Point Holmes	L0.094	
2	"	L0.098	
3	"	L0.100	
B. Tissue			
1	Goose Spit	L0.099	L0.022
2	"	0.113	0.029
3	"	L0.095	L0.023
1	Point Holmes	L0.094	L0.021
2	"	L0.095	L0.023
3	"	L0.096	L0.023

L = Less Than.

APPENDIX I

STATION POSITIONS, NOVEMBER 5-6, 1979

APPENDIX I STATION POSITIONS, NOVEMBER 5-6, 1979

Station		Latitude	Longitude
CO-1		49° 43.1' N	124° 49.8' W
CO-2		49° 42.9' N	124° 49.7' W
CO-3		49° 42.7' N	124° 49.5' W
CO-4		49° 42.5' N	124° 49.35'W
CO-5		49° 42.3' N	124° 49.2' W
CO-6		49° 42.2' N	124° 49.55'W
CO-7		49° 42.4' N	124° 49.65'W
CO-8		49° 42.6' N	124° 49.9' W
CO-9		49° 42.8' N	124° 50.0' W
CO-10		49° 42.95'N	124° 50.1' W
CO-11		49° 42.85'N	124° 50.4' W
CO-12		49° 42.7' N	124° 50.3' W
CO-13		49° 42.5' N	124° 50.1' W
CO-14		49° 42.3' N	124° 50.0' W
CO-15		49° 42.1' N	124° 49.8' W
Trawl Track #1	Start	49° 42.65'N	124° 49.9' W
	Stop	49° 42.2 'N	124° 49.5' W
Trawl Track #2	Start	49° 42.74'N	124° 50.0' W
	Stop	49° 42.18'N	124° 49.66'W

APPENDIX II

PISCES IV DIVE REPORTS
DECEMBER 1, 1978

APPENDIX II SUMMARY OF PISCES DIVE REPORTS

The general conclusions from the dives were:

1. The sediment characteristics at Track 1, northeast of Cape Lazo, appeared much coarser and more compacted than at Track 2, southwest of Cape Lazo. This observation implies better circulation at the Track 1 site, as well as cheaper installation costs due to the firm base to work on.

2. The slope at Track 1 appeared to be suitable for construction also the depths throughout most of the outfall's length are fairly shallow, thereby reducing construction costs relative to the Track 2 location.

3. The marine benthic environment at Track 1 was considered less sensitive, generally, than at Track 2.

DIVE REPORT - COMOX

Pisces Dive #718

Comox

Track 1

December 1, 1978

Film exposed - 16 mm rolls 15, 16, 17
- 70 mm Film #3 58-70

Observers: - Packman
- Holman

Water Column

The water column was very clear, with good visibility throughout most of the descent. Some detritus and zooplankton were encountered between 40 meters and the bottom (63 meters). The readings observed on the CTD unit are presented in Table 1.

TABLE 1 CTD READINGS

Depth	Temperature(°C)	Conductivity	Dissolved Oxygen (mg/l)
0 m	8.50	31.34	9.40
15 m	8.55	31.36	7.40
27 m	8.57	33.40	8.70
45 m	8.80	32.00	7.85
63 m (bottom)	9.00	32.50	6.40
53 m (bottom)	8.85	32.19	7.30
43 m (bottom)	8.80	32.14	7.00
20 m (bottom)	8.50	31.36	8.00
16 m (bottom)	8.50	31.36	7.50

Bottom Characteristics

Throughout the course of the dive the substrate was sandy in nature, with the grain size being smaller in the deeper portion of the dive. The substrate looked excellent for construction purposes with the slope not being a problem for a pipeline. The substrate was coarse enough that divers would not have a visibility problem arising from stirred up sediment. At the 20 meter depth rippling was apparent in the sandy substrate, presumably arising from wave surge.

Holes in the bottom arising from infaunal burrowers were not abundant at any time during the dive. Worm castings were noted on the surface of the sediment in the deeper portion of the dive.

Bottom Fauna

A summary of the benthic and bathypelagic epifauna noted during this dive is presented in Table 2. The fauna observed was typical of a sandy bottom community and changed with depth as the shore was approached. In the deeper area covered at the beginning of the dive the dominant faunal forms included small unidentified shrimp, thin white sea pens and Dover or lemon sole. Throughout the dive a diverse representation of starfish was noted. A band of different faunal forms was encountered between 30 and 25 meters of depth. In this area there occurred an abundance of burrowing anemones (Pachycerianthus sp.) scallops and small octopii. The dominant fish type throughout the dive was sole.

TABLE 2

TAXON		ABUNDANCE
Sponge	- unidentified	1 noted
Polychaeta	- Serpulida and/or Sabellide	Evenly spaced and fairly abundant below 40 meters
Anthozoa	- *Ptilosarcus gurneyi*	Approximately 3 noted
	- unidentified thin white sea pen	Approximately 29 noted in deeper portion of dive site
Actinaria	- *Metridium senile*	3 noted
	- *Pachycerianthus* sp.	Noted occasionally in deeper water. Between 30-25 meters there were 3-4 per square meter
	- unidentified Anemone	Noted occasionally
Gastropoda	- Nudibranchia (unidentified)	Occasionally noted
	- *Dirona* sp.	Occasionally noted
	- *Armina* sp.	Occasionally noted
	- *Gastropteron pacificum*	1 noted
Bilvalvia	- unidentified scallop	Abundant - approximately one per square meter at the 28 meter depth
Cephalopoda	- *Octopus* sp.	Fairly common at 25 meters
	- unidentified Squid	Noted occasionally
Crustacea	- *Pandalus platyceros*	1 noted
	- unidentified pink shrimp	Noted occasionally
	unidentified small pink shrimp	Lots at beginning of dive - approximately 5 per square meter. Numbers declined as depth decreased.
	- *Pagurus* sp.	Noted occasionally
	- *Pugettia producta*	2 noted

TABLE 2 (continued)

TAXON		ABUNDANCE
Asteroidea	- *Solaster* sp.	Noted occasionally
	- *Mediaster* sp.	Noted occasionally
	- *Pycnopodia* sp.	Noted occasionally
	- *Evasterias* sp.	Fairly common
	- *Luidia* sp.	Noted occasionally
	- *Pteraster* sp.	Noted occasionally
	- *Pisaster brevispinus*	Fairly common
	- *Dermasterias imbricata*	Noted occasionally
	- *Orthasterias koehleri*	Noted occasionally
	- Unknown Asteroidea	Noted occasionally
Echinoideia	- *Strongylocentrotus droebachiensis*	1 noted
Ascidiacea	- *Ascidia paratropa*	Fairly common around the 28 meter depth
Pisces	- Skate	3 noted
	- Clupeidae	1 noted
	- Embiotocidae (surf perch)	A school followed the boat around
	- Stichaeidae	Noted occasionally
	- *Ophiodon elongatus*	3 noted
	- Cottidae	Noted occasionally
	- *Scorpaenichthys marmoratus*	1 noted
	- Agonidae	Noted occasionally
	- Sole (Lemon or Dover)	Fairly abundant
	- *Psettichthys melanostictus* (Sand Sole)	Noted occasionally

Conclusions

The bottom throughout this dive was composed of compacted sand. As a result, the epifauna, although being quite diverse, was not particularly abundant. The dominant fish type was sole. The bottom slope and material appeared to be ideal for the construction of a deep marine outfall.

DIVE REPORT - COMOX

Pisces Dive #719

Comox

Track 2

December 1, 1978

Film exposed - 16 mm rolls 18, 19
- 70 mm Film #4 Frames 0-45

Observers: - Packman
- Holman

Water Column

Visibility was good throughout the water column with not too much detritus or zooplankton being present. A fair number of scyphozoans were observed in the upper reaches of the water column. Scyphozoans were also observed at greater depths but their numbers were decreased. Some siphonophores were noted at approximately 60 meters. The data obtained with the CTD probes are presented in Table 1.

TABLE 1 CTD READINGS

Depth	Temperature(°C)	Conductivity	Dissolved Oxygen (mg/l)
40 m	8.90	32.00	8.8
60 m	9.20	32.50	7.3
78 m (bottom)	9.30	32.90	6.4
70 m (bottom)	9.18	32.50	6.5
43 m (bottom)	9.12	32.39	6.6
23 m (bottom)	9.00	33.20	7.2

Bottom Characteristics

The sediment type was markedly different from that observed on the Track 1 dive, that is, a soft clay mud substrate with a thin overlay of very light sediment. The visibility at or close to the bottom was very much reduced compared to the Track 1 dive location also, the sediment was much more readily disturbed and re-suspended by the submersible, hence further reducing visibility.

Bottom Fauna

A list of the fauna observed during the course of this track is presented in Table 2. During the first half of the dive the dominant epifaunal form was the thin white sea pen. There were also 5-10 infaunal holes per square meter and 1-2 pink shrimp per square meter.

During the second half of the dive, where the depth was shallower and the sediment coarser, the number of animals was reduced markedly. However, in this area very few sea pens and pink shrimp were apparent. There was still a stable, diverse and productive community present.

TABLE 2

TAXON		ABUNDANCE
Actinaria	- Metridium sp.	Noted occasionally
	- Pachycerianthus sp.	Fairly common
	- Unknown	Noted occasionally
	- Thin white sea pens	5-10 per square meter during deeper portion of the dive; after ascending slope the numbers dropped off markedly
Gastropoda	- Dirona sp.	Quite abundant on coarser sediment in shallower water
	- Nudibranchia	Noted occasionally

.../cont'd

TABLE 2 (continued)

TAXON		ABUNDANCE
Cephalopoda	- *Octopus* sp. (small)	1 noted
	- squid	1 noted
Crustacea	- pink shrimp	1-2 per square meter at the beginning of dive declining to very few in shallower portion of dive
	- *Pagurus* sp.	Noted occasionally - more frequently in shallower, sandy area
Asteroidea	- *Mediaster* sp.	Fairly common
	- *Pisaster brevispinus*	Noted occasionally
	- *Evasterias* sp.	Noted occasionally
	- *Pyconopodia* sp.	Noted occasionally
	- Unidentified	Noted occasionally
Pisces	- *Squalus acanthias*	1 noted
	- *Hydrolagus colliei*	1 noted
	- *Gadus macrocephalus*	2 noted
	- Zoarcidae	Fairly common
	- Embiotocidae (surf perch)	2 schools noted
	- *Sebastes* sp.	2 noted
	- *Ophiodon elongatus*	1 noted
	- Cottidae	Noted occasionally
	- Agonidae	Common during first half of dive - predominant fish species during second half of dive
	- Pleuronectidae	Noted occasionally
	- *Psettichthys melanostrictus*	Noted occasionally

Conclusions

The bottom sediments in the deeper portion of this dive track were very fine indicating that currents were minimal. The bottom fauna, both epifauna and infauna, was quite abundant. Fauna could be adversely affected by the discharge of sewage, with specific reference to the accumulation of organic material in the sediments.

The fine sediment in this area would easily be stirred up by divers involved in submarine construction, reducing visibility and thereby increasing construction time and expense.