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August 9, 2000

Chris Kissinger,
Resource Officer, B.C.Parks,
2930 Trans Canada Highway
Victoria, B.C., V9B 6H6

Dear Mr. Kissinger,

Re: Satellite Channel Ecological Reserve

Teresa Durfield suggested your name to me when I asked who I should send copy of a new document referring to the Reserve.

So here it is.

Yours sincerely

Derek Ellis

Benthic Biodiversity and Stability in an Unpolluted Inlet 1965-1974 (Satellite Channel, B.C., Canada)

A manuscript drafted in 1975 by

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But for reasons now forgotten not then taken to the stage of preparation for publication

Retyped with minor editorial corrections and updates by
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July 30, 2000

This report summarizes data either only partially published in refereed journals (the 1965-1967 data) or not published at all (1968-1974).

The retyping and editing have been undertaken because the area is now a provincial ecological reserve protecting the university interest in marine benthic research. The data is currently important in view of a proposal to lay a natural gas pipeline through Satellite Channel.

Abstract

Over the nine-year period of surveys (1965-1974), the benthic infauna showed no trends in species biodiversity or abundance, but wide levels of fluctuation between 30-40 species per 0.1 m^2 sample, and 260-850 organisms/m^2. Consistently present were widely spread and abundant polychaetes, both errantia and sedentaria, molluscs, amphipods and echinoderms. Largest (heaviest) species were echinoderms and molluscs. Species usually present were the polychaetes *Nephtys sp. Maldane glebifex* and *Prionospio* sp., the bivalve molluscs *Compsomyax subdiaphana, Macoma elimata, Yoldia ensifera, Macoma carlottensis, Macoma brota,* and *Pandora grandis,* the ophiuroid *Ophiura sarsi,* the holothuroids *Molpadia intermedia* and *Pentamera lissoplica,* and the echinoid *Brisaster latifrons.* Amphipods although abundant, but were not sorted and identified to species, and not all polychaetes present were identified to species. Biodiversity therefore was slightly greater than as described here. The community although fluctuating in species biodiversity and abundance, appeared to be stable within a highly variable norm during the surveyed period 1965-1974.

Reference as: Ellis, D.V. 2000 Benthic Biodiversity and Stability in an Unpolluted Inlet 1965-1974 (Satellite Channel, B.C., Canada). University of Victoria Report.

Keywords: benthos, infauna, biodiversity, stability, Satellite Channel.

Introduction

The biodiversity and stability of ecosystems has long been a topic of interest to biologists working in both fundamental and applied studies. This manuscript reports a nine-year series of collections demonstrating some aspects of biodiversity and stability in a marine benthic sediment community (the infauna). The specific area reported on here is a single sampling station (Satellite Channel Centre) within Satellite Channel, an inlet ~15 km long, ~2 km wide and ~80 m deep, in southern British Columbia (Figure 1). The sampling station is located at the approximate midpoint of the channel, and was sampled 14 times from 1965-1974. It was intended to continue the programme indefinitely to show long-terms biodiversity trends on a pollution-free seabed in the context of long term environmental variable such as El Nino cycles, but after 1974 research funds were no longer available.

Two publications have described some of the data from 1965-1967 (Ellis 1969 and 1971). Essentially it is known that the channel has a fairly uniform muddy bottom with a diverse and abundant infauna, but with spatial differences related to depth and particle grain size.

Satellite Channel had not been subjected to any major sanitary or industrial discharges, and thus was relatively unpolluted compared to some B.C. inlets used as waste receiving areas. The Crofton pulp mill is the nearest major discharge source (~20 km distant). There are now (Year 2000) several marinas and a harbour located at each end of the channel, and much boat traffic including ferries. In 1965, the channel had the potential to serve as a reference area for studies within polluted inlets in which there was no capacity left for unpolluted reference sampling stations.

For an inlet to function in this way, as a reference inlet for polluted inlets, considerable background information is needed about it. This report contributes to providing such state-of-the-ecosystem information on benthic biodiversity and stability for the period 1965-1974, with appropriate environmental data such as sediment grain size (Ellis 1967/8 – Vol. III).

This report was drafted in 1975, but for reasons now forgotten was not finalized for publication, even though at the time the computerized techniques for data processing were novel, as were the easily calculated and obtained rank order print-outs. The rank-ordering allowed demonstrating which species were the numerical dominants, and also most likely to be biologically significant to the mud bottom ecosystem at the time. The procedure was first used in Ellis 1969. Similarity or dissimilarity in rank orderings between new and old surveys is one approach to demonstrating similarities or changes between 1965-74 and year 2000.

This revised version of the report allows a description of the biodiversity and stability of the mud bottom fauna during 9 years 1965-1974, and provides a basis for comparison with samples obtained from the same and nearby sites now in or near to a provincial Ecological Reserve. Such a comparison will allow drawing conclusions about stability of the area over a 30 year period ~1970 – 2000, over a time when, as predicted, there was little polluting industrial development. The area has also been subject to a fishery closure during this time, although it is not known how well this has been enforced, particularly the prohibition against the inevitably biologically damaging seabed fishery for bottom fish which previously existed.

The text and Tables of this report are available from dvellis@uvic.ca (Figures by fax only) and a full copy will be deposited in, and available from, the Marine Environmental Science Collection of the archives of the University of Victoria Library by December 2000 – see www.uviclib.uvic.ca/archives/mesc

Methods

The samples collected were taken in sets of 5-10 replicates commencing 30 September 1965, with the final set on 28 January 1974 (See Table 1). All collections were made with 0.1m^2 Van Veen grab and were processed with the following routine. Small sub-samples of sediment were taken for mechanical analysis, and temperatures were recorded by thermometer within the grab. The samples were transferred to a volumeter, and volume of sediment recorded. Very small samples (<~5 l) were rejected for the quantitative analysis. Samples were next transferred to a set of screens (either 2 mm or 1 mm mesh – see Table 1). Sediments were washed away, the organisms collected into sample jars, preserved in 4% formalin neutralized with methenamine. After 3 days, the samples were transferred into 40% alcohol (ethanol or iso-propanol, depending on availability), and held until specimens were processed.

Sets of samples have been grouped into a series of Blocks for statistical purposes. Block 1 consists of samples collected and processed by the author and research assistants 1965-1967 (Ellis 1967/8). Species identifications should be consistent within Block 1. Block 2 samples were processed in the routine way by the author and a single research assistant during 1970-1971. The specimens in Block 3 samples were processed by students 1971-1974 as part of their field work in a 4th year marine ecology course presented by the author. Block 2 identifications should be consistent with Block 1, but Block 3 identifications may be less consistent. The data tables from Blocks 2 and 3 had not been retrieved at the time this report was edited, and may have been lost.

The author understands that for purposes of the year 2000 re-survey of the area, the taxonomic list provided the surveyors (through Ellis 1967/8 – see Vol. III) will be updated to current taxonomy as far as possible.

The numerical methods employed consisted of counting and recording the numbers of each species (or higher taxon), and damp-dry weighing each for wet weight biomass measures. Custom-designed software for mainframe computer (Ellis 1968) was used to calculate the number of species, means and other statistics for species numbers, wet weight biomasses, and frequency of occurrence (percentage of samples in which the species was present). Dry weight biomasses were also calculated by conversion formulae obtained from the literature, and used to calculate Pamatmat's index (abundance*dry wt). Rank ordering species by Pamatmat's index (Pamatmat 1968, Ellis 1969) correlates well with rank ordering by oxygen consumption, which in turn is a measure of biological activity.

Table 1 quantifies numbers of Polychaetes with tubes, *Maldane glebifex* and *Prionospio* sp. by a conventional numbering system of 999, to give nos./m^2 of 9990. This convention was adopted in an attempt to deal with the phenomenon of some small species being present in very large numbers, impractical to count within the time available for the project. When present, these species were coded for the summaries as 999/sample in Block 1 surveys and some of the Block 3 surveys. In the other surveys these species were present but not coded numerically. In the Block 1 surveys these tubicolous worms were sub-sampled and identified to species. Amphipods and small decapods taken by the sampler were not identified to species, but total numbers of each were included in the numerical calculations.

Results

Population statistics

Counts and weights recorded between 165 and 1974 are presented in Table 1, with diagrammatic plots in Figure 2. There is no apparent trend meriting a statistical analysis, and the summarizing statistics support the conventional assumption of non-normality for benthic population counts, i.e. S^2>mean and CV>1.

Within the time-series, some but not all the fluctuations could be due to changing techniques. Thus the drop in numbers from May to November 1966 could be a function of the coarser screen size in November. However the high January 1970 records indicate that similar population levels can be obtained from the coarser screen on occcasions. Differences in numbers from using 1 and 2 mm screens are also shown as not great in Ellis (1969 – and see Appendix 1). The high population density in January 1970 occurred during a period of high biomass due to an apparently coincidental appearance of many small species with large specimens of the bivalve *Compsomyax subdiaphana*, the echinoid *Brisaster latifrons*, and the holothuroid *Molpadia intermedia*.

For these surveys the counts of small tubicolous polychaetes, when very abundant, were reduced to coding their numbers as 999, hence these numbers could not be used for population densities. Nevertheless the 999 coded data shows that the biological community at Satellite Channel Centre (within the ecological reserve) consistently sustained over nine years 1965-1974 large numbers of sedentary tubicolous polychaete worms, forming a matted network at and near the sediment interface. This mat contains at least *Maldane glebifex*, a species of *Prionospio*, and presumably many other species. Actual polychaete species consistently present during the Block 1 collections (1965-1967) are provided in Ellis 1969 (and see Appendix 1))

The extent of species biodiversity is estimated partly by the species counts in Table 1 and Figure 2. This estimate will be affected by the recorded changes in screen and sample size. Nevertheless it is apparent that for samples of 5-10 0.1m^2 units screened through 2 mm mesh, the number of species is at the level of 30-40 over the nine years, and that using a 1 mm mesh increases the number to 50-60. Ellis 1969 (See Appendix 1) provides other data illustrating the differences between statistics from 1 and 2 mm specimen separating screens.

Table 1 and Figure 2 show that population densities of infauna retained by a 2 mm screen are fluctuating around 450 organisms/m^2, other than the very dense small *Prionospio* and *Maldane*, which would raise the estimate if they had been fully sorted and counted. The numbers have remained fluctuating within the level of ~250-750/m^2 over the nine-year period, showing no trend to increase or decrease. In essence this has been a stable community, although fluctuating from year to year in numbers of organisms and numbers of species (and their frequency). This sort of variability in sediment infaunas has been known for many years (Peterson and Jensen, 1911).

Significant species analysis

In order to determine which species have occurred in Satellite Channel in numbers and consistency (i.e. as numerical dominants) that would suggest they were significant in ecosystem processes, ranking lists were routinely produced by the processing software. Table 2 averages the rankings over the nine years' surveys for frequency (% of samples), abundance (gms/m^2), wet weight biomass (gm/m^2), and. Pamatmat's index (See Methods). As expected heavy (large) species are not necessarily abundant, nor frequent, but there is consistency through the years. For example the large bivalve mollusc *Compsomyax subdiaphana* was consistently (always ranked 1.0) the heaviest species present and the highest by Pamatmat's index. It was usually in the top 10 species in terms of frequency (average rank 4.9), and numbers of individuals (average rank 7.3). In short, *C. subdiaphana* was consistently widely spread in moderate numbers sufficient to show a high biomass and contribute much to the biological oxygen demand in the mud bottom community.

The overall ranking lists in Table 2 were prepared from averaging the survey rank orders for each of Blocks 1, 2 and 3, then averaging the Block averages. The table shows over the 9 years of 15 surveys, which species were most frequently ranked in the top 10 for each statistic. The number beside each species is its overall ranked order.

Table 3 reduces the large number of species and other taxa identified throughout the nine years of sampling to a list of 21 species and 4 taxa groupings most frequently in the ranking lists.

The 25 names in Table 3 reveal those species which at one time or another have occurred either widely throughout the surveys (frequency), in large numbers (density), in heavy weights (biomass), or with high values for Pamatmat's index combining numbers and dry weights (biomass) and indicating rank order in community respiration.

Twenty-one of these names refer to species, the biology of which should be examined to determine the roles the species play in the benthic ecosystem processes in Satellite channel. The balance are grouped taxa, comprising probably several species.

Of these grouped taxa, the designation Amphipoda indicates that this group is consistently present, and that species analyses are needed, to see if any particular species predominate.

The terms polychaeta errantia, polychaeta sedentaria and polychaeta with tubes are categories grouping those specimens not separated to species. These will probably encompass a moderate number of species, some abundant, some rare. Thus representatives of these groups are often present, but no one species has been identified within the categories shown, other than *Prionospio* sp and *Maldane glebifex* which can comprise the bulk of the worm mats.

Conclusions

Over the nine-year period of surveys, the benthic infauna showed no trends in species biodiversity or abundance, but there were wide levels of fluctuation between 30-40 species per 0.1 m^2 sample, and 260-850 organisms/m^2.There were abundant polychaetes, both errantia and sedentaria, and molluscs. Largest (heaviest) species were mostly echinoderms and molluscs. Amphipods were abundant, but were not sorted and identified to species. Species consistently present were the polychaetes *Nephtys sp., Maldane glebifex* and *Prionospio* sp., the bivalve molluscs *Compsomyax subdiaphana, Macoma elimata, Yoldia ensifera, Macoma carlottensis, Macoma brota,* and *Pandora grandis,* the Ophiuroid *Ophiura sarsi,* the holothuroids *Molpadia intremedia* and *Pentamera lissoplica,* and the echinoid *Brisaster latifrons.* The community although fluctuating in species biodiversity and abundance, appeared to be stable within a highly variable norm.

Acknowledgements

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Table 1. Summary statistics for samples from Satellite Channel Centre

	Screen mesh mm	No. sam ples	No. spp /smpl	No. orgs $/m^2$ *	Maldane glebifex $/m^2$ **	Prionospio sp. $/m^2$ **	Polychaetes with tubes $/m^2$ **	Biomass wet weight gm/m^2	Biomass dry weight gm/m^2
Block 1									
30 Sep 65	1	10	53	471	9990	9990		681.1	36.30
10 Jan 66	1	10	57	539	9990	9990		861.3	48.00
24 May66	1	10	63	616	9990	9990		1341.9	63.37
29 Nov66	2	5	33	338	9990	9990		820.0	44.60
9 May 67	2	10	37	413	9990	9990		790.5	42.69
Block2									
22 May68	2	10	41	248				834.0	52.40
21 Oct 68 18 Nov 68	2	10	41	429				810.2	37.85
13 May69	2	10	40	262				1204.6	71.86
9 Sep 70	2	10	41	434				1247.2	67.46
Block 3									
6 Jan 70	2	9	32	762			9990	1279.1	66.00
5 Nov 70	2	9	39	439	9990			710.0	38.54
28 Jan 72	2	12	40	358			9990	1148.1	66.27
5 Jan 73	2	6	38	473				723.2	43.85
28 Jan 74	2	5	38	330				713.4	43.68

Mean	42.4	440.1	940.3	51.63
S^2	80.24	17574.9	595007	160.12
S	8.96	132.57	243.93	12.65
Smean	2.39	35.43	65.19	3.78
95% Confidence limits	5.13	76	139.84	7.25
L1	48	516	1080.17	58.88
L2	37	364	800.49	44.38
CV	21.13	30.12	25.94	24.50

*Number of organisms/m^2, other than Polychaetes with tubes, *Maldane glebifex* and *Prionospio*

** numbers coded as 999/sample, meaning too numerous to count in the project time available.

Table 2. Species rankings by various statistics (numbers are averaged rankings from all surveys)

Frequency	Abundance	Biomass (wet weight)	Pamatmat's Index
4.7 Sternaspis fossor	2.8 Sternaspis fossor	1.0 Compsomyax subdiaphana	1.0 Compsomyax subdiaphana
4.9 Compsomyax subdiaphana	4.6 Ophiura sarsi	3.0 Brisaster latifrons	3.8 Macoma elimata
5.3 Ophiura sarsi	5.3 Macoma elimata	3.3 Molpadia intermedia	4.4 Sternaspis fossor
5.4 Macoma elimata	7.1 Maldane glebifex **	4.8 Macoma elimata	4.5 Ophiura sarsi
7.0 Nephtys sp **	7.3 Compsomyax subdiaphana	5.1 Ophiura sarsi	6.2 Travisia pupa *
8.5 Yoldia ensifera	8.0 Yoldia ensifera	5.6 Travisia pupa	6.5 Molpadia intermedia
11.2 Amphipoda *	10.7 Amphipoda ***	7.1 Macoma brota *	6.9 Nephtys sp **
13.6 Macoma carlottensis		8.2 Pentamera lissoplica	9.5 Yoldia ensifera
		8.8 Pandora grandis **	
		9.1 Yoldia ensifera ***	
Other species present in rankings			
Prionospio sp.	Polychaeta errantia	Lumbrineris bifurcata	Lumbrineris bifurcata
Maldane glebifex	Polychaeta with tubes	Nephtys punctata	Pentamera lissoplica
Pista cristata	Prionospio sp.	Macoma calcarea	Pista cristata
Lumbrineris bifurcata	Yoldia amygdalea		Pephtys punctata
Yoldia amygdalea	Nephtys sp.		Macoma brota
Nephtys punctata	Nephtys punctata		Brisaster latifrons
Macoma brota	Lumbrineris latreilli		Polychaeta errantia
Polychaeta with tubes	Lumbrineris bifurcata		Polychaeta sedentaria
Polychaeta errantia	Ophiura leptoctenia		
	Macoma carlottensis		
	Macoma brota		

* absent Block 1 samples ** absent Block 2 samples *** absent Block 3 samples

Table 3. Species consistently or frequently in the statistics ranking lists, hence expected to have some significance in the biology of the Satellite channel ecosystem 1965-1974.

Taxa	Species consistently in the ranking lists	Species frequently in the ranking lists
Errant polychaetes	Nephtys sp.	Lumbrineris latreilli
		Lumbrineris bifurcata
		Nephtys punctata
		Polychaeta errantia
Sedentary polychaetes		Prionospio sp.
		Maldane glebifex
		Pista cristata
		Polychaeta sedentaria
		Polychaeta with tubes
Bivalve molluscs	Compsomyax subdiaphana	Yoldia amygdalea
	Macoma elimata	Macoma calcarea
	Yoldia ensifera	
	Macoma carlottensis	
	Macoma brota	
	Pandora grandis	
Ophiuroids	Ophiura sarsi	Ophiura leptoctenia
Holothuroids	Molpadia intermedia	
	Pentameria lissoplica	
Echinoids	Brisaster latifrons	
Others	Amphipoda	

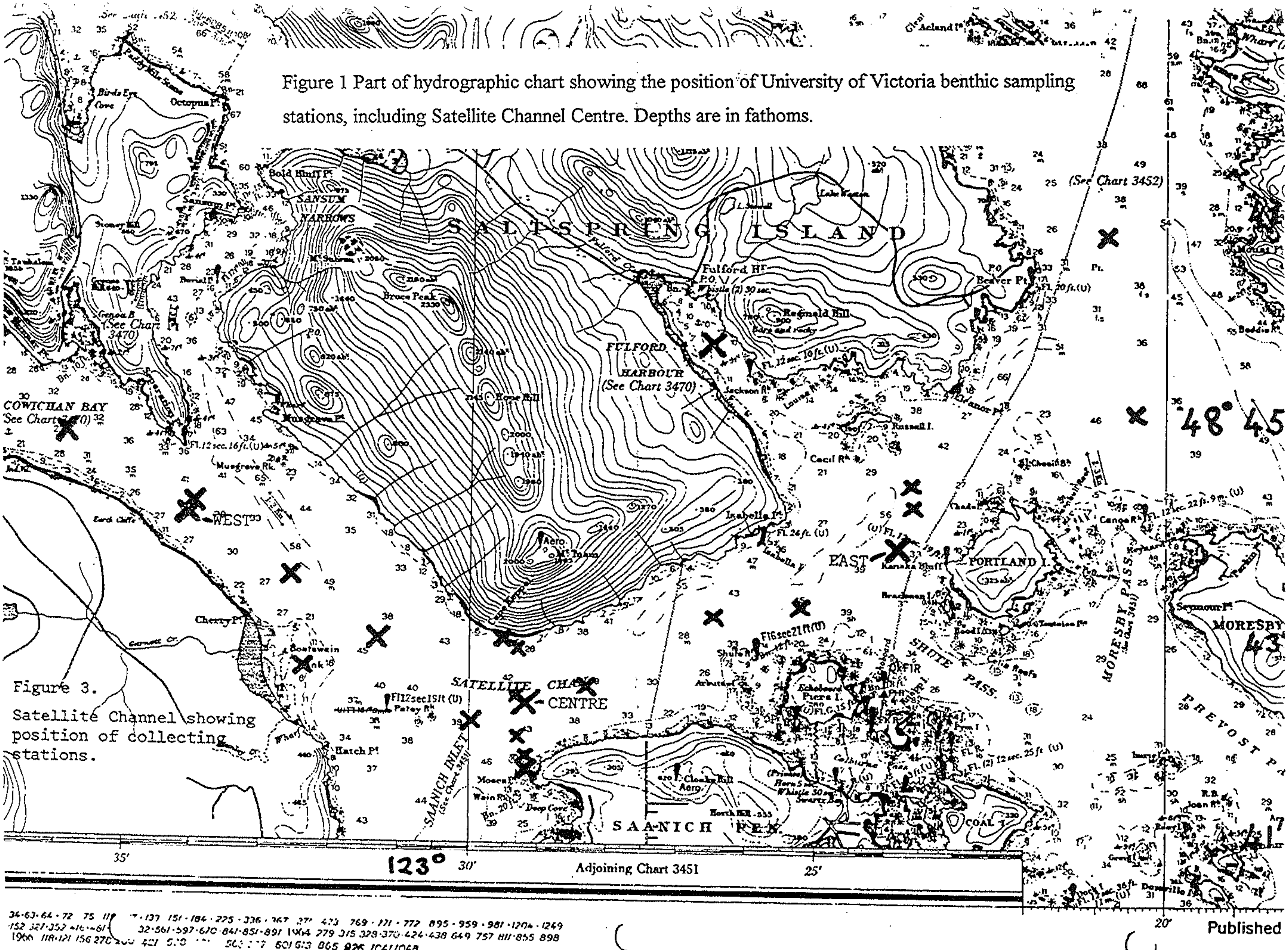

Figure 1 Part of hydrographic chart showing the position of University of Victoria benthic sampling stations, including Satellite Channel Centre. Depths are in fathoms.

Figure 3.
Satellite Channel showing position of collecting stations.

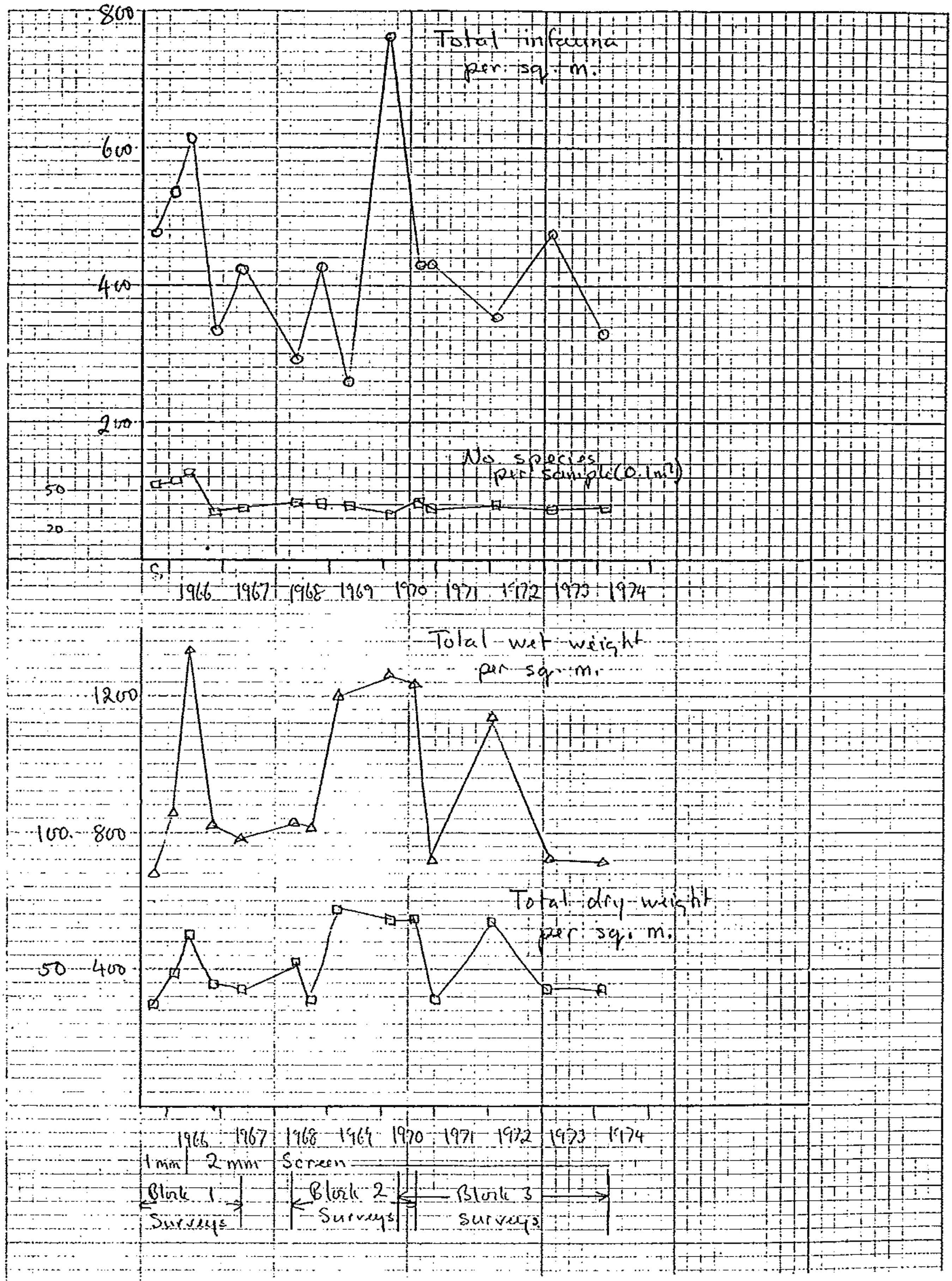

Figure 2. Trend histograms for number of species, number of organisms, wet weight biomass and dry weight biomass.

Appendix 1

Tables from Ellis (1969) showing

(1) The effects on summary statistics of screening through 1 and 2 mm meshes.

(2) Ecologically significant species at Satellite Channel Centre as indicated by the collections from 1965-1967.

TABLE I

Test of the effect of 1 and 2 mm mesh screens on the species indicated as ecologically significant in two localities[1, 2]

Taxon	Kanish Bay 2 mm	Kanish Bay 1 mm	Nanoose Bay 2 mm	Nanoose Bay 1 mm
Hemipodus borealis	–	–	*	*
Lumbrinereis	*	*	*	*
Nephthys	*	*	†	*
Arenicola	–	–	*	*
Cirratulidæ	†	*	–	–
Maldane glebifex/Prionospio tube masses	*	*[3]	–	–
Maldanidæ	*	*	–	–
Pista cristata	–	–	*	*
Prionospio	–	–	*	*
Terebellides stræmi	†	*	–	–
Unidentifiable polychætes	*	*	–	–
Acila castrensis	–	–	*	*
Axinopsis	†	*	*	*
Compsomyax subdiaphana	*	*	–	–
Lucinoma	*	*	–	–
Macoma elimata	*	*	–	–
Nucula	*	*	–	–
Mitrella	*	†	–	–
Amphiodia urtica	–	–	*	*
Amphiuridæ	–	–	*	*
Lyconectes aleutensis	*	*	–	–
Number of taxa indicated by both mesh sizes	11		9	
Number of taxa indicated by 2 mm mesh only	1		0	
Number of taxa indicated by 1 mm mesh only	3		1	

[1] In these and subsequent tables the following symbols are used:
  * denotes indicated by the criteria
  † denotes present at the station but not indicated by the criteria
  – denotes not present at the station
  § denotes no data

[2] Data in 2 mm columns are from the 2 mm mesh screen; data in 1 mm columns are the sum of organisms retained by both 1 and 2 mm mesh screens.

[3] Two species.

TABLE II

Species indicated as ecologically significant in the time-series at Satellite Channel (Centre), and from stations in the trough of the channel

Taxon	Time-series							Trough (West to East)							
	65/16/1–10	66/1/1–10	66/12/1–10	66/24/1–6	67/25/1–10	Total listings	Total occurrences	66/2/1–10	66/2/13–22	65/17/1–5	65/19/9–16	65/20/1–11	66/3/1–13	Total listings	Total occurrences
Aphrodite japonica	–	–	–	–	–	0	0	–	–	–	*	–	–	1	1
Glyceridæ	–	–	–	–	*	1	1	–	–	–	–	–	–	0	0
Hemipodus borealis	†	†	†	†	†	0	5	†	*	†	†	†	†	1	6
Lumbrinereis bifurcata	*	*	†	*	–			†	–	†	†	†	†		
Lumbrinereis latreilli	†	*	*	–	–	5	5	†	†	†	*	†	†	1	6
Lumbrinereis	–	–	–	–	*			–	–	–	–	–	–		
Nephthys cæcoides	–	–	*	–	–	5	5	*	†	*	*	*	*	5	6
Nephthys	*	*	–	*	*			*	†	*	*	*	*		
Onuphis iridescens	†	†	†	†	–	0	5	*	*	*	*	–	†	4	5
Onuphis	–	–	–	–	†			–	–	–	–	–	–		
Chætozone setosa	–	–	–	–	–	0	0	–	–	–	†	*	*	2	3
Laonice cirrata	–	–	†	*	–	1	2	†	†	†	†	†	–	0	5
Maldane glebifex	*	*	*	*	*	5	5	†	*	*	*	*	*	5	6
Phyllochætopterus prolifica	–	–	–	–	–	0	0	–	–	–	*	–	†	1	2
Pista cristata	*	*	*	†	–	4	5	*	*	*	†	*	*	5	6
Pista	–	†	–	†	*			–	–	†	†	†	†		
Praxillella affinis pacifica	†	†	†	†	–	0	4	†	†	*	*	†	†	2	6
Prionospio	*	*	*	*	*	5	5	*	*	*	*	*	*	6	6
Spio filicornis pacifica	–	–	–	–	–	0	0	–	–	–	*	–	–	1	1
Sternaspis fossor	*	*	*	*	*	5	5	*	*	*	*	*	*	6	6
Telepsavus costarum	–	–	–	–	–	0	0	–	*	–	–	–	–	1	1
Tharyx parvus	–	–	†	–	–	0	1	†	–	–	†	†	*	1	4
Travisia pupa	–	†	*	*	†	2	5	†	†	†	†	†	–	0	5
Travisia	†	–	–	–	–			–	–	–	–	–	–		
Metopa	§	§	§	*	–	1	1	§	§	§	§	§	§	§	§
Axinopsis sericatus	†	†	†	–	–			†	†	*	†	*	*	3	6
Axinopsis viridis	*	†	*	–	–	2	5	*	†	*	†	†	†	2	6
Axinopsis	–	–	–	†	†			–	–	–	–	–	–	–	–
Compsomyax subdiaphana	*	*	*	*	*	5	5	*	*	*	*	*	*	6	6
Macoma carlottensis	†	†	†	†	†	0	5	*	*	*	*	*	*	6	6
Macoma elimata	*	*	*	*	*	5	5	†	*	†	*	*	*	4	6
Modiolus modiolus	–	–	–	–	–	0	0	–	–	–	†	*	–	1	2
Yoldia amygdalea	†	†	†	–	–	0	3	*	*	*	*	*	†	5	6
Yoldia ensifera	*	*	*	*	*	5	5	*	*	*	*	*	*	6	6
Yoldia thraciæformis	–	–	–	–	†	0	1	*	*	†	–	–	–	2	3
Mitrella	†	*	†	–	†	1	4	–	†	†	†	–	†	0	4
Tachyrhynchus	–	–	–	*	–	1	1	–	–	–	†	†	†	0	3
Amphiodia urtica	†	†	†	†	†	0	5	†	†	†	*	†	†	1	6
Amphipholis	–	–	–	–	–	0	0	–	–	–	*	–	–	1	1
Ophiura leptoctenia	†	*	*	†	†	2	5	–	–	†	†	†	–	0	3
Ophiura sarsi	*	*	*	*	*	5	5	†	*	†	†	*	†	2	6
Brisaster latifrons	*	†	*	*	†	3	5	–	*	*	†	–	–	2	3
Molpadia intermedia	*	*	*	–	†	3	4	–	–	–	–	–	–	0	0
Pentamera lissoplica	*	†	†	*	*	3	5	–	–	*	†	†	†	1	4