SKEENA RIVER

A Cursory Investigation of the Productivity of the Skeena River Estuary

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April, 1972

INTRODUCTION

The present investigation was initiated subsequent to receipt of a port development proposal for the Skeena estuary near Prince Rupert. The proposal includes a major industrial and bulk loading complex involving reclamation of Flora Bank, and construction of deep water berths outside of Kitson Island and on the edge of the bank capable of accommodating ships up to 250,000 tons.

Phase I of the project which is scheduled for completion in 1973 involves the construction of a causeway to Kitson Island which would cut off the channels between Flora Bank, Lelu Island and the mainland. Four million cubic yards of sand would be required and are to be dredged from Agnew and Horsey Banks. The proposed development is to continue until 1978 when up to 3,500 acres will have been reclaimed using 100 million cubic yards of fill.

The Skeena River is located south of Prince Rupert and is the basis for the fishing industry in the area. Fishing is reported to contribute 36 percent of the base income in Prince Rupert.

Flora Bank is situated at the entrance to Inverness Passage and represents an area of 970 acres above low mean tide (L.M.T.) and an area of 2,180 acres (including Agnew and Horsey Banks) covered by three fathoms of water or less at L.M.T. This represents the second largest bank area in the estuary.

Estuaries represent a complex ecosystem resulting from varying combinations of physical-chemical, and biological situations. The high sedimentation rate and entrainment of nutrients provide the basis for elevated primary productivity which result in accelerated rates of energy transfer from the benthic biota to carnivorous fishes. Juvenile salmonids and many marine fishes and invertebrates spend a vital segment of their young life in the estuary and undergo rapid growth and physiological changes before moving to offshore waters.

Fluctuations in water temperature and salinity restrict the number of species of indigenous estuarine residents and places many of them near the limit of their physiological tolerance range. This makes the energy flow in the food web particularly unique and highly vulnerable to interruption by even minor physical or chemical changes.

METHODS AND MATERIALS

The biological sampling program was designed to provide indications of the contribution of Flora Bank to the overall productivity of the estuary. Thirteen stations were established as depicted in Figure 1. Sampling commenced in June 1971 and was terminated in October. Sampling included the eelgrass distribution of the estuary, types and

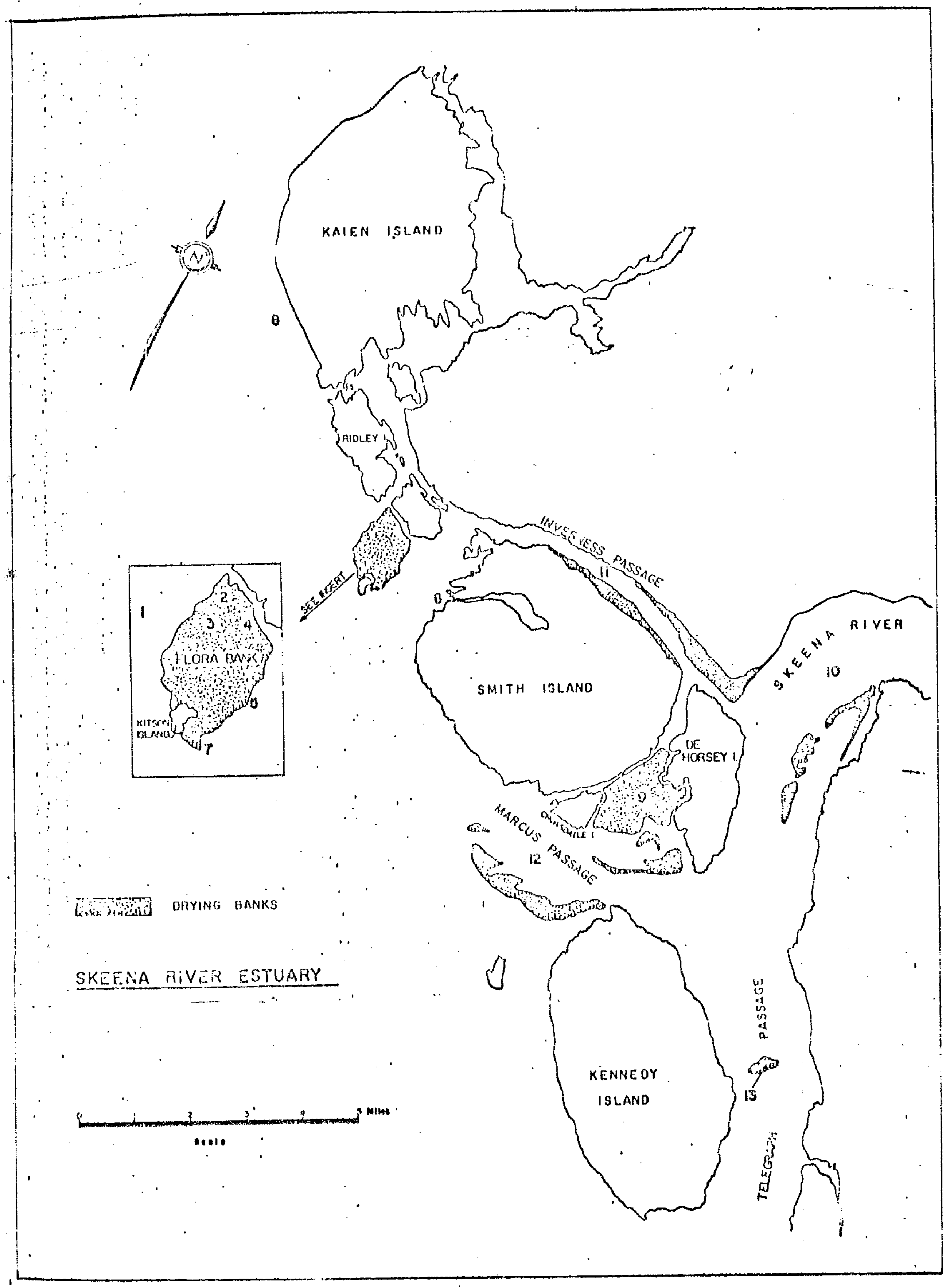

Figure 1. Sampling Stations 1 to 13.

abundance of major planktons as well as kinds and abundance of fishes and their major food source.

The major areas in the Skeena River estuary that support eelgrass were recorded from a fixed wing aircraft during low tide on July 25, 1971. Colour and colour-infra red photography as well as visual observations were used for this survey. Results from these two techniques showed only small variations.

Vertical plankton hauls were made at all stations on August 31 and October 6, 1971 (except station #8 on October 6) using a 270 μ net with a 50 cm. hoop diameter. Samples were preserved in 5 percent formalin. Species identification and counts were made using a binocular microscope and a Sedgewick Rafter cell.

Fish in the estuary were sampled in June, July, August and October using a 150 foot long 4 fathom deep seine net with mesh sizes ranging from 0.25 to 1 inch. Samples were also taken on August 31 using a trawl net with a 1.15 inch mesh bag and a 0.5 inch mesh cod end. Fish were identified, measured, and their stomach contents analyzed and recorded as to frequency of occurrence (percent of stomachs examined in which each food item occurred) and percent representation (the number of individuals of each food type in the whole sample expressed as a percentage of the total number of organisms in the sample).

RESULTS AND DISCUSSION

Eelgrass Distribution

The eelgrass densities and the percentages of total eelgrass for each bank area in the estuary was determined by visual estimation and photographic methods. Both estimates produced similar results and indicated that Flora Bank supports between 50 and 60 percent of the total eelgrass in the Skeena River estuary. The distribution of eelgrass as determined by photographs is portrayed in Figure 2.

The importance of eelgrass is that it contributes much of the food base for fish, shellfish, and waterfowl in the shallow areas just as phytoplankton sustains much of the marine life in deeper waters. Significant contributions of eelgrass to the food web are made through its primary productivity, its abundant epiphytes, the many species of associated microfauna, and ultimately its conversion to detritus by microbial decomposition. In addition the shallow water and rooted vegetation provides protection from predation for small and immature fishes.

Plankton

Juvenile copepodites were the most abundant planktonic forms encountered in the August and October collections. Table I shows the number of copepods per

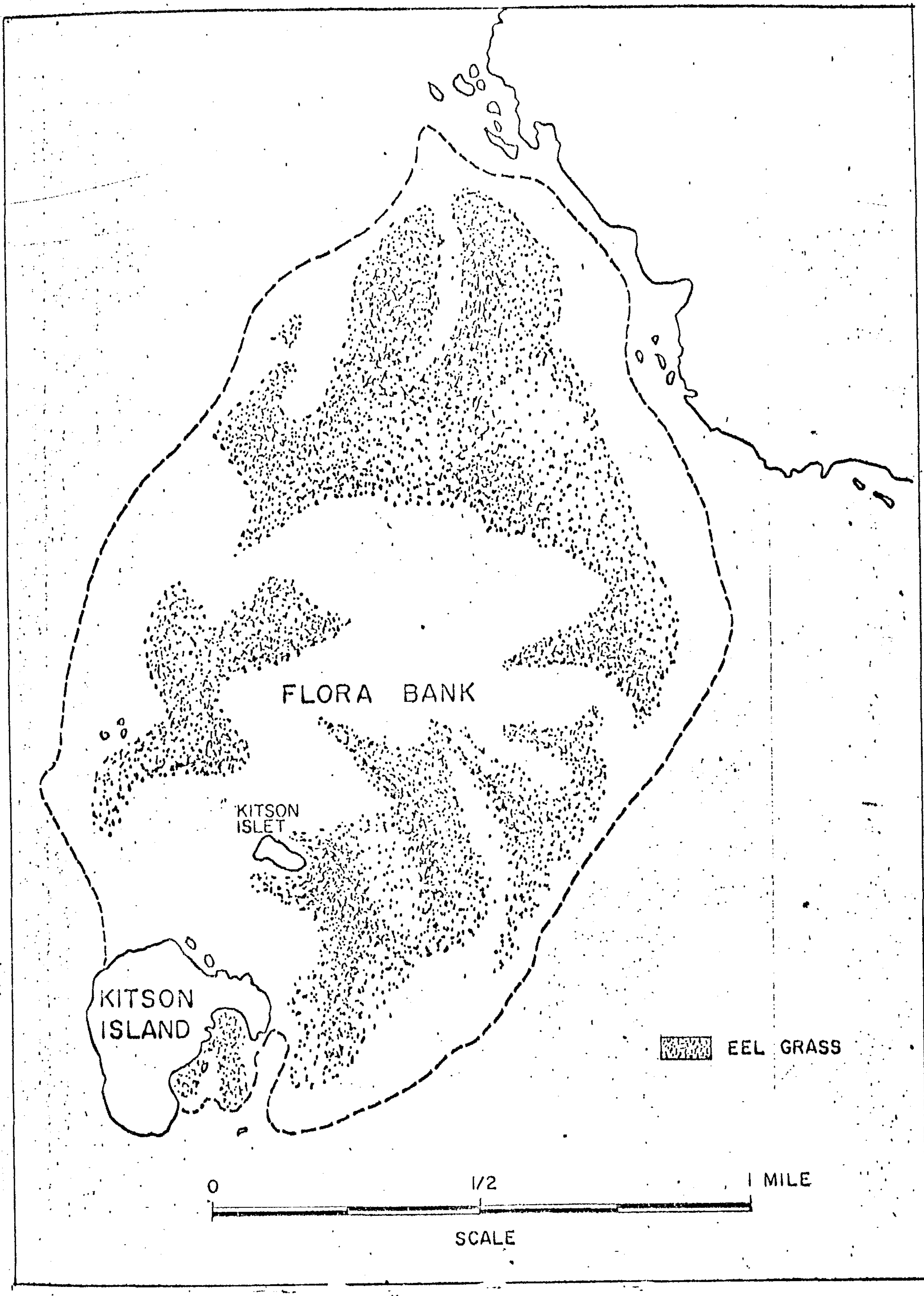

Figure 2. Flora Bank Eelgrass Distribution (July 25, 1971).

volume of water sampled on August 30, 1971. Only insignificant variations in numbers and kinds of plankton collected was noted between the August and October collections. However this is not surprising since plankton blooms generally occur in the spring while late summer and winter are characterized by relatively stable communities.

The distribution of plankton is to a large extent governed by external factors such as currents, tides, weather conditions, salinity stratification and nutrient availability. Diurnal migrations and prey-predator relationships also affect their distribution and abundance. Because of the complexity of factors affecting the planktonic community and the limited data collected during 1971 it is difficult to assess the relationships between the shallow bank areas and the plankton. However the data indicated that food in the size range taken by larvae needlefish were the most abundant planktonic forms present on the banks and undoubtedly represent an important link in the complex food web of the estuary.

Fish

Table II shows the numbers of herring, surfsmelt and needlefish seined in June, July, August and October of 1971. Flora Bank yielded 98, 59 and 99 percent respectively of the total herring, surfsmelt and needlefish catch. The majority of the herring belonged to the 0+ year class and

TABLE I

VERTICAL PLANKTON HAULS (270 m Net)

STATIONS 1 - 13 AUGUST 30, 1971

Station	Depth	M^3 Sampled	Juvenile Copopodites/m^3 x10^6	P. minutus/m^3 x10^6	A. longiremis x10^6	Oithona/m^3 x10^6	Noctiluca/m^3 x10^6	Oikopleura/m^3 x10^6
1	10.9	2.1	3.95	0.29	.47	1.1	.63	.32
2 *	4.6	0.9	3.3	0	.33	1.85	.37	0
3 *	5.5	1.1	5.2	1.2	.9	2.12	.61	0
4 *	4.9	0.9	4.8	.33	.33	2.2	2.22	0
5 *	4.6	0.9	2.2	.33	0	.37	.37	0
6	7.9	1.5	0.9	0	.2	.22	3.78	0
7 *	4.9	0.9	2.2	0	0	.37	1.85	0
8	10.9	2.1	3.95	2.5	1.1	0	2.38	.16
9	4.2	0.8	0.4	0	0	0	0	0
10	10.9	2.1	8.7	3.5	0.14	.63	0	.16
11	3.7	0.7	0	0.4	0	0	0	0
12	9.1	1.7	2.94	1.76	0.18	.39	6.47	.39
13	4.6	0.9	7.8	1.1	0	1.11	2.22	0

* Stations on Flora Bank

P. minutus - Pseudocalanus minutus

A. longiremis - Acartia longiremis

TABLE II

NUMBERS OF THE THREE MOST ABUNDANT SPECIES
OF FISH CAUGHT WITH A 150 FT. SEINE NET

* Indicates stations on Flora Bank

DATE 1971	STATION	CLUPEA PALLASII (herring)	HYPOMESUS PRETIOSUS (surf smelt)	AMMODYTES HEXAPTERUS (needlefish)
June 19	1	5	1	0
	* 3	1	1	0
	* 4	1	0	13
	* 5	786	3	317
	* 7	38	1	0
July 26	1	0	0	0
	* 2	0	0	0
	* 3	3	0	10
	* 4	0	0	219
	* 5	53 (larval)	2	784
	6	11	0	4
	* 7	0	0	12
	8	0	0	0
	9	0	0	0
	11	0	0	0
Aug 26	* 2	110	40	0
	* 3	0	0	0
	* 4	0	312 (larval)	308
	* 5	0	0	2590
	6	0	0	0
	* 7	0	0	0
	8	0	1	0
	10	0	0	0
	11	0	210 (larval)	0
	13	1	0	0
Oct 2 - 4	* 2	0	0	0
	* 3	0	0	0
	* 5	107	14	0
	6	0	36	0
	* 7	0	0	0
	8	0	0	0
	9	2	0	0
	10	1	0	0
	11	1	15	0
	12	0	0	0

it would appear that these fish utilize the abundant food supply and shelter of the eelgrass of Flora Bank to carry them through the vulnerable early life stages.

Estuaries are reported to represent obligate feeding areas for juvenile anadromous fishes including salmon, trout and smelt. However few juvenile salmonids were captured during the survey and it is suggested that the majority of these fishes had left the estuary prior to the end of June or that they were successful in evading capture. An extensive sampling program will be carried out by the Fisheries Service in the spring and early summer of 1972 to determine the role of the shallow bank areas of the estuary in the life of the young salmon prior to their movement out to sea.

The bottom trawl produced limited numbers of blennies, greenling, sole, flounder and eelpout. Of these the starry flounder (*Platichthys stellatus*) was the most abundant.

The stomach contents of the herring, surfsmelt and needlefish were analyzed and are reported in Table III. These data indicate that the copepod *Pseudocalanus minutus* served as the major food source for the juvenile fish both in terms of frequency of occurrence and percent abundance.

FREQUENCY OF OCCURRENCE[1] AND PERCENT REPRESENTATION[2] OF THE MAJOR FOOD ITEMS FOR HERRING, NEEDLEFISH, AND SURF SMELTS AS DETERMINED BY STOMACH CONTENT ANALYSIS

DATE	FOOD SPECIES	*Clypea pallasii* Herring FREQUENCY OF OCCURRENCE	*Clypea pallasii* Herring PERCENT REPRESENTATION	*Ammodytes hexapterus* Needlefish FREQUENCY OF OCCURRENCE	*Ammodytes hexapterus* Needlefish PERCENT REPRESENTATION	*Hypomesus pretiousus* Surf Smelts FREQUENCY OF OCCURRENCE	*Hypomesus pretiousus* Surf Smelts PERCENT REPRESENTATION
June 19 1971	P. minutus	82 %	96 %	90 %	98 %	67 %	99 %
	C. glacialis	59 %	2 %	80 %	1 %	33 %	0.4 %
		N = 20		N = 10		N = 3	
July 26 1971	P. minutus	47 %	61 %	66 %	93 %		
	Tortanus sp.	67 %	22 %	59 %	3.4 %		
	C. glacialis	60 %	13 %	10 %	0.2 %		
		N = 15		N = 29			
Aug. 26 1971	P. minutus	69 %	96 %				
	C. abdominalis	38 %	2 %				
	Tortanus sp.	30 %	0.9 %				
		N = 11					
Oct 2-4 1971	P. minutus	46 %	57 %			45 %	14 %
	Oikopleura sp.					50 %	83 %

1 FREQUENCY OF OCCURRENCE - Percent of the stomachs examined in which each food item occurred.

2 PERCENT REPRESENTATION - The number of individuals of each food type in the whole sample expressed as a percentage of the total number of food organisms in the sample.

P. minutus - Pseudocalanus minutus

C. glacialis - Calanus glacialis

C. abdominalis - Centropages abdominals

SUMMARY AND CONCLUSIONS

The 1971 investigation of the Skeena River estuary consisted primarily of eelgrass distribution, plankton types and density, and fish distribution in these waters. Results indicate that Flora Bank supports approximately 60 percent of all the eelgrass and almost 100 percent of the juvenile herring and needlefish captured between June and October at various stations in the estuary.

The planktonic community structure was sampled only twice in 1971 and does not permit the comparison of Flora Bank with the rest of the estuary. However because of the high abundance of plankton feeding fish the plankton-fish feeding relationship represents an integral part of the complex food web of Flora Bank.

The present data indicate that Flora Bank is the most important shallow water area of the Skeena River estuary in terms of rearing juvenile fishes. The proposed port development would completely destroy the complex Flora Bank ecosystem and damage to the fisheries resource of the Skeena River and its estuary would be immense. Since the fishing industry contributes 30-40 percent of the base income in Prince Rupert it is probable that the construction of port facilities in this important tidal flat area would be economically unsound, and it is suggested that water areas away from estuaries should be investigated as alternate port development sites.