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Fish Species, Juvenile Chinook Diets and  
Epibenthos in the Englishman River Estuary,  
1993

B. A. Bravender, C. Annand, A. Hillaby, and J. Naylor

Fisheries and Oceans Canada  
Science Branch, Pacific Region  
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Nanaimo, B.C. V9R 5K6

1997

Canadian Data Report of  
Fisheries and Aquatic Sciences 1021



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**Canadian Data Report of  
Fisheries and Aquatic Sciences 1021**

**1997**

**FISH SPECIES, JUVENILE CHINOOK DIETS  
AND EPIBENTHOS IN THE ENGLISHMAN  
RIVER ESTUARY, 1993**

**by**

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Cat. No. Fs 97-13/1021E ISSN 0706-6465

Correct citation for this publication:

Bravender, B. A., C. Annand, A. Hillaby, and J. Naylor. 1997. Fish species, juvenile chinook diets and epibenthos in the Englishman River estuary, 1993. *Can. Data Rep. Fish. Aquat. Sci.* 1021: 41 p.

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## ABSTRACT

Bravender, B. A., C. Annand, A. Hillaby, and J. Naylor. 1997. Fish species, juvenile chinook diets and epibenthos in the Englishman River estuary, 1993. *Can. Data Rep. Fish. Aquat. Sci.* 1021: 41 p.

As part of a joint study of the Englishman River estuary in 1993, samples of the fish community were collected with beach and stick seines on eight sampling trips between May 3 and July 30. Eighteen sites in the estuary and surrounding nearshore area were assessed. Temperature and salinity at each site were recorded and triplicate samples of the epibenthos were taken at six of the sites. Fifteen species of fish were identified from the estuary including juvenile chum and chinook salmon. Lengths, weights and diet were determined for the chinook captured and scale samples were also preserved and read by the Ageing Laboratory at the Pacific Biological Station in Nanaimo.

## RÉSUMÉ

Bravender, B. A., C. Annand, A. Hillaby, and J. Naylor. 1997. Fish species, juvenile chinook diets and epibenthos in the Englishman River estuary, 1993. *Can. Data Rep. Fish. Aquat. Sci.* 1021: 41 p.

Dans le cadre d'une étude conjointe réalisée en 1993 sur l'estuaire de l'Englishman, nous avons prélevé des échantillons de la communauté ichthyenne à l'aide de sennes de plage et de sennes à perches lors de huit campagnes d'échantillonnage menées entre le 3 mai et le 30 juin. Dix-huit sites ont été évalués dans l'estuaire et dans les eaux proches de la côte. À chaque site, nous avons enregistré la température et la salinité, et nous avons prélevé en trois exemplaires des échantillons de l'épibenthos à six des sites. Quinze espèces de poissons ont été identifiées dans l'estuaire, parmi lesquelles des juvéniles de kéta et de quinnat. Nous avons établi la longueur, le poids et le régime alimentaire des quinnats capturés, et envoyé des échantillons d'écaillés au laboratoire de la Station de biologie du Pacifique, à Nanaimo, qui les a préservés et a déterminé l'âge des spécimens.





## INTRODUCTION

The Englishman River drains into a small estuary on the east coast of Vancouver Island in the Strait of Georgia (Fig. 1). In April, 1993, this estuary and the surrounding nearshore habitat became part of the 873 hectare Parksville-Qualicum Beach Wildlife Management Area (Fig. 2). This area is now a protected preserve under the jurisdiction of the Wildlife Program (Vancouver Island Region) of BC Environment (Clermont, 1995).

Prior to the summer of 1993 knowledge of the biota of this estuary was very limited. In May a joint project was undertaken by a number of federal, provincial and private agencies to inventory the fish, vegetation, wildlife, birds, epibenthic and benthic invertebrates of this area.

The preliminary results of the initial survey may be found in Annand et al., 1993. A detailed description of the study area and analysis of the results are given in Bravender et al., 1996. Here we present the raw data on the temperatures, salinities, fish species distribution and abundance, juvenile chinook diets and epibenthos from the survey.

## MATERIALS AND METHODS

### Field Collections

The fish species at eighteen sites in the estuary and nearshore marine area were sampled during eight sampling trips made between May 3 and July 30, 1993 (Table 1). Samples were collected with either a beach seine 3 metres deep and 15.24 metres long (1.2 cm stretched mesh) or a stick seine 9.14 metres long from pole to pole with 5 mm mesh in the bunt. Duplicate sets were made with the beach seine and single sets were done with the stick seine. The sampling was usually carried out at low tide except for two evenings in July when beach seine sets were done at high tide at sites 7, 8, 17 and 18 (Fig. 1). The beach seine was set using a 5.5 m jet boat, a 3.7 m rowboat or on foot depending on the depth of the water. The stick seine was walked through shallow water up to approximately one metre deep. Sixty-nine beach seines and thirty stick seines were completed. The fish captured were counted and released, with ten of each group (salmon, sculpin etc.) from each site being preserved in 10% formalin and returned to the laboratory. Profiles to depth of salinity and temperature were recorded at all sites with a YSI Model 33 S.C.T. meter. Triplicate samples of the epibenthos were collected at six sites using a sampler first described by Sibert et al. (1977). This sled sampled the 10 cm of water immediately above the bottom and was drawn over a five metre transect close to shore in water that was approximately 1 m deep. The samples were preserved in a solution of 10% formalin and rose bengal.

## Laboratory Analysis

In the lab, the fish were removed from the preservative and rinsed in fresh water. All fish captured were identified to species as described in Hart (1973) and Scott and Crossman (1973). Examples of each species were placed in a reference collection stored at the Pacific Biological Station in Nanaimo, B.C. Sixty-seven chinook and two chum were damp dried and weighed in water to the nearest 0.1 gram using a Mettler balance. The fork length to the nearest millimetre of each fish was also recorded. Scales were collected as smears on scale cards to verify species, document growth rate and search for "release" checks, which may indicate hatchery rather than wild origin.

Stomach analysis was carried out on sixty-two chinook. The stomachs from the esophagus to the anterior portion of the pyloric caecae were removed, damp dried and weighed to the nearest 0.001 gram with an Ohaus Model TP400D balance. The stomachs were then opened and the contents removed in a petri dish. A capacity estimate from 0 to 100% was made. The stomach wall was damp dried, re-weighed and the weight of the food bolus was calculated to the nearest 0.001 gram. The percent digestion of the stomach bolus was estimated and the contents were identified using a Wild M5 stereoscopic microscope. The length of each whole or undigested prey item was measured and the percent volume of each prey type was visually quantified. The percent of the bolus completely digested was also visually estimated and, if possible, the likely prey type was noted. The stomach contents were combined into ten groups (adult Diptera, adult insect other etc.) and the Index of Relative Importance (IRI) was calculated for each group as first suggested by Pinkas et al. (1971) and modified by Levy and Yesaki (1981). Values for IRI (reported in Bravender et al., 1996) were calculated for specific areas of the estuary as well as the estuary as a whole.

Sixty-six sled samples were analyzed in the lab using a dissecting microscope and plankton turntable. The preservative was decanted from the samples through a 30  $\mu$  sieve. All samples were scanned and the large organisms were counted and removed. If possible the sample was counted as a whole. Some samples were subdivided using a Folsom splitter. Where large numbers of organisms were collected water was added to bring the total volume of the sample to 250 ml and progressive aliquots were taken until 100 of the dominant organisms had been counted. These counts were then multiplied by the split factor to calculate the total number of organisms in the sample.

The tidal heights above chart datum and tidal stage at the time of sampling were calculated using Tides and Currents for Windows software from Nautical Software, Beaverton, Oregon, U.S.A.

## RESULTS

The temperature and salinity data recorded during this study are presented in Table 2. Table 3 lists the fifteen species of fish identified in the catches and their abbreviations. Table 4 gives the total fish catch for each beach seine and pole seine set. The results of the scale analysis may be found in Table 5. Table 6 lists the fish length, fish weight, stomach content weight, estimate of fullness and percent digestion of the stomach contents for each fish. The results of the analysis of the stomach contents may be found in Table 7. The organisms identified in the epibenthic sleds and their abbreviations are presented in Table 8. The numbers of organisms  $m^{-2}$  in the epibenthic samples are listed in Table 9.

## ACKNOWLEDGMENTS

We are grateful to Rob Russell, Barry Lawley and Jeff Armstrong, Habitat and Enhancement Branch (HEB), South Coast Division, Nanaimo, B.C., who carried out the beach seining during May, 1993. Bruce Hillaby (HEB) made the field work possible by providing advice, equipment and assistance to collect the samples. He also initiated and funded the diet analysis of the juvenile chinook. Mary J. Hudson carried out the laboratory analysis of the epibenthic sleds. The scale samples were read by the Ageing Laboratory at the Pacific Biological Station in Nanaimo, B.C. Financial assistance for some of the field and laboratory work was provided by Fisheries and Oceans Canada Habitat Action Plan, Environment Analysis component, arranged by Dr. Colin Levings, Science Branch, West Vancouver Laboratory. Dr. Glen Jamieson, Science Branch, Pacific Biological Station, first suggested the study.

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Table 1. Location of sites sampled for physical characteristics, fish and epibenthos.

Site No.	Description
1.	Situating at the south end of the man-made dogleg slough on the eastern shore.
2.	At the mid-point of the man-made dogleg slough on the western shore.
3.	Located at the north end of the man-made dogleg slough on the western shore.
4.	A site in a small pool west of the breach in the dyke.
5.	Northeast of the breach in the dyke.
6.	Located on the end of the spit on the west side of the estuary.
7.	In the upper reaches of the salt slough on the east side of the estuary.
8.	At the lower end of the salt slough on the east side of the estuary.
9.	Located on the east side of the estuary inside the point.
10.	Situating on the marine foreshore of the spit at the mouth of the estuary.
11.	On a sandbar at the mouth of the river.
12.	A site beside a large stump in a shallow slough east of the dyke.
13.	Located southeast of site 12 in the same shallow slough east of the dyke.
14.	Southeast of site 13 in the same shallow slough east of the dyke.
15.	Situating at the east end of a small slough branching from the northern end of the dogleg slough.
16.	Located on the northern bank of a pool connected to the dogleg slough by a small channel.
17.	A site at the midpoint of the channel connecting the estuary and the dogleg slough.
18.	In the upper most reaches of the salt slough on the east side of the estuary.

Table 2. Temperature and salinity data.

Date	Site No.	Time (PST)	Depth (m)	Temp. °C	Sal. ‰
June 8	1	0930	0	18.0	12.5
"	"	"	2.25	17.0	14.5
"	"	"	4.5	16.0	15.5
June 8	2	1000	0	17.5	15.0
"	"	"	1.75	18.0	15.0
"	"	"	3.5	18.0	15.0
June 8	3	1008	0	18.0	15.0
"	"	"	1.75	18.0	16.5
"	"	"	3.5	18.0	16.5
June 8	4	1330	0	19.0	15.5
June 11	7	0900	0	14.0	12.5
June 11	8	1005	0	16.0	8.0
June 11	9	1205	0	20.5	15.5
June 11	6	1349	0	18.5	7.5
"	"	"	0.5	18.5	15.5
June 28	3	1105	0	20.0	15.0
"	"	"	1.75	21.0	16.5
"	"	"	3.5	20.0	17.5
June 28	2	1220	0	20.0	17.0
"	"	"	1.75	20.5	17.0
"	"	"	3.5	20.0	18.0
June 28	1	1230	0	21.0	15.0
"	"	"	2.0	21.0	17.0
"	"	"	4.25	21.0	18.0
June 28	10	1312	0	19.5	16.5
"	"	"	1.5	19.5	17.0

Table 2 (cont'd)

Date	Site No.	Time (PST)	Depth (m)	Temp. ° C	Sal. ‰
June 28	11	1342	0	20.0	16.5
"	"	"	0.5	20.0	15.5
June 28	9	1402	0	22.0	6.5
"	"	"	0.5	21.0	15.0
June 28	6	1440	0	20.0	13.5
"	"	"	0.5	21.0	15.0
June 29	4	0934	0	19.5	15.5
June 29	12	1120	0	19.0	14.5
June 29	8	1241	0	24.5	11.0
June 29	7	1312	0	24.5	7.5
July 12	3	1032	0	21.0	18.0
"	"	"	1.75	20.0	19.0
"	"	"	3.5	20.0	18.5
July 12	2	1040	0	21.0	18.5
"	"	"	2.0	20.0	9.5
"	"	"	4.25	20.0	19.5
July 12	1	1046	0	21.0	19.0
"	"	"	2.25	20.0	19.5
"	"	"	4.5	20.0	19.5
July 12	10	1300	0	17.5	22.0
July 12	11	1335	0	20.0	20.5
July 12	9	1415	0	19.0	18.5
"	"	"	0.5	20.0	20.0
July 12	6	1442	0	18.0	20.0



Table 2 (cont'd)

Date	Site No.	Time (PST)	Depth (m)	Temp. °C	Sal. ‰
July 13	4	0919	0	20.0	17.5
"	"	"	0.5	19.0	18.0
July 13	12	1002	0	19.5	16.5
"	"	"	0.3	19.5	18.0
July 13	13	1018	0	22.0	15.0
July 13	14	1035	0	22.0	19.0
July 13	15	1207	0	23.0	19.0
"	"	"	0.75	22.0	19.0
July 13	16	1223	0	25.0	17.0
"	"	"	0.5	24.0	17.5
July 13	8	1318	0	24.0	10.5
"	"	"	0.5	24.0	16.0
July 13	7	1330	0	26.5	12.0
"	"	"	0.3	26.0	18.0
July 21	17	1751	0	14.5	21.5
"	"	"	0.75	15.5	21.0
July 22	7	1850	0	16.5	19.0
"	"	"	0.75	14.5	21.0
July 22	8	1922	0	14.5	20.5
"	"	"	0.75	13.5	21.0
"	"	"	1.5	13.0	21.0
July 22	18	2010	0	16.0	19.5
"	"	"	0.5	14.5	17.0
July 29	3	1234	0	20.0	18.0
"	"	"	1.75	20.0	19.0
"	"	"	3.5	20.0	19.0

Date	Site No.	Time (PST)	Depth (m)	Temp. °C	Sal. ‰
July 29	2	1240	0	20.0	18.5
"	"	"	2.25	20.0	19.5
"	"	"	4.5	19.5	19.0
July 29	1	1323	0	20.0	19.0
"	"	"	2.0	20.0	19.0
"	"	"	4.0	21.0	19.5
July 29	4	1437	0	18.0	19.5
"	"	"	0.5	18.0	19.5
July 29	12	1526	0	18.5	18.5
"	"	"	1.0	18.0	19.5
July 29	17	1600	0	18.0	19.5
"	"	"	0.5	18.0	19.5
July 30	12	1207	0	19.0	17.0
July 30	6	1316	0	18.5	15.0
"	"	"	0.75	18.0	18.0
July 30	9	1431	0	14.5	21.0
"	"	"	0.5	14.0	21.0
July 30	7	1512	0	19.5	18.0
"	"	"	0.5	19.5	18.5

Table 3. Species of fish captured and abbreviations.

Abbreviation	Fish Species	Common Name
CHIN	<i>Oncorhynchus tshawytscha</i>	Juvenile chinook salmon
CHUM	<i>Oncorhynchus keta</i>	Juvenile chum salmon
COHO	<i>Onchorhynchus kisutch</i>	Juvenile coho salmon
UNSC	--	Unidentified sculpin
STSC	<i>Leptocottus armatus</i>	Staghorn sculpin
TISC	<i>Oligocottus maculosus</i>	Tidepool sculpin
SNSC	<i>Clinocottus acuticeps</i>	Sharpnose sculpin
PRSC	<i>Cottus asper</i>	Prickly sculpin
THST	<i>Gasterosteus aculeatus</i>	Threespine stickleback
SHPE	<i>Cymatogaster aggregata</i>	Shiner perch
STFL	<i>Platichthys stellatus</i>	Starry flounder
HCPR	<i>Anoplarchus purpurescens</i>	High cockscomb prickleback
SBGU	<i>Pholis ornata</i>	Saddleback gunnel
ARGO	<i>Clevelandia ios</i>	Arrow goby
TUSN	<i>Aulorhynchus flavidus</i>	Tubesnout
BAPI	<i>Syngnathus griseolineatus</i>	Bay pipefish
UNKN	--	Unidentified juvenile fish
TOTL	--	Total fish in set

Table 4. Summary of fish catches.

DAY	MON	SITE	SET	TIME	TIDE	CHIN	CHUM	COHO	UNSC	STCS	TISC	SNCS	PRSC	THST	SHPE	STFL	HCPR	SBGU	ARGO	TUSN	BAPI	UNKN	TOTL			
					(PST)	(m)																				
3	5	4	BS1	1300	2.95	0	19	0	69	0	0	0	0	0	0	0	0	0	0	0	1	0	0	89		
3	5	5	BS1	1320	3.15	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5		
3	5	6	BS1	1335	3.30	0	0	0	26	0	0	0	0	35	0	0	0	2	0	16	0	0	80			
4	5	1	BS1	1045	1.00	0	262	0	35	0	0	0	0	1	0	0	0	0	0	0	0	0	298			
4	5	3	BS1	1115	1.19	0	0	0	7	0	0	0	0	6	0	1	0	0	0	0	0	0	14			
4	5	4	BS1	1135	1.36	0	0	12	48	0	0	0	0	0	0	0	0	0	0	0	0	0	60			
4	5	5	BS1	1145	1.46	0	3	0	95	0	0	0	0	7	0	2	0	0	0	0	2	0	109			
17	5	4	BS1	1220	2.60	0	0	0	80	0	0	0	0	0	0	0	0	0	0	2	0	0	82			
17	5	6	BS1	1230	2.68	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0	38			
17	5	3	BS1	1255	2.89	0	93	0	3	0	0	0	0	4	0	0	0	0	0	0	0	0	100			
17	5	1	BS1	1315	3.06	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	24			
26	5	4	BS1	0800	3.60	0	0	0	44	0	0	0	0	0	0	0	0	0	0	1	0	0	45			
26	5	5	BS1	0810	3.59	0	2	0	54	0	0	0	0	0	0	0	0	0	0	1	0	0	57			
26	5	3	BS1	0830	3.53	0	3	0	22	0	0	0	0	0	1	0	0	0	0	1	0	0	27			
26	5	1	BS1	0850	3.45	0	1	0	60	0	0	0	0	4	0	1	0	0	0	0	1	0	67			
26	5	1	BS2	0910	3.34	0	8	2	19	0	0	0	0	4	0	1	0	0	0	0	0	0	34			
8	6	3	BS1	1040	2.26	20	2	0	2	0	0	0	0	7	0	2	0	0	0	0	0	0	33			
8	6	3	BS2	1105	2.01	25	0	0	1	4	1	0	0	11	0	0	0	0	0	0	0	0	42			
8	6	1	BS1	1130	1.78	11	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	13			
8	6	1	BS2	1150	1.60	31	0	0	0	2	0	0	0	2	0	1	0	0	0	0	0	0	36			
8	6	4	SS1	1315	1.07	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3			
8	6	4	SS2	1320	1.05	1	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	23			
11	6	7	SS1	0905	3.10	0	0	0	0	3	0	0	5	9	0	0	0	0	0	0	0	0	17			
11	6	7	SS2	0920	3.14	0	0	0	9	1	0	0	1	13	0	0	0	0	0	0	0	0	39			
11	6	8	SS1	1015	3.19	0	0	0	19	10	0	0	0	1	0	9	0	0	0	0	0	0	39			
11	6	8	SS2	1025	3.19	0	0	0	18	0	0	0	0	1	0	6	0	0	0	0	0	0	25			
11	6	9	BS1	1130	3.08	0	0	0	83	1	0	0	0	3	1	2	1	0	0	0	0	0	91			
11	6	9	BS2	1145	3.03	1	0	0	96	11	0	0	0	5	1	1	1	0	0	0	0	0	116			
11	6	6	BS1	1315	2.66	2	0	0	48	10	0	0	0	2	0	0	1	0	0	0	0	0	63			
11	6	6	BS2	1336	2.57	10	0	0	61	0	1	0	0	3	0	4	0	0	0	0	0	0	79			
28	6	3	BS1	1118	3.08	0	0	0	0	3	0	0	0	1	1	1	0	0	1	0	0	0	7			
28	6	3	BS2	1126	3.11	1	0	0	0	3	0	0	0	0	14	0	0	0	0	0	0	2	20			
28	6	1	BS1	1245	3.52	2	0	0	0	2	0	0	3	18	1	0	0	0	0	0	0	0	26			
28	6	1	BS2	1253	3.55	1	0	0	0	0	0	0	0	24	1	0	0	0	0	0	0	0	26			
28	6	10	BS1	1315	3.58	1	0	0	0	6	0	0	0	6	1	0	0	0	0	0	0	0	14			
28	6	10	BS2	1325	3.60	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	5			
28	6	11	BS1	1338	3.61	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2			
28	6	11	BS2	1345	3.61	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	3			
28	6	9	BS1	1410	3.60	0	0	0	0	8	0	0	1	1	0	1	0	0	1	0	0	0	12			
28	6	9	BS2	1422	3.59	0	0	0	6	2	0	0	0	2	0	0	0	0	0	0	0	0	10			
28	6	6	BS1	1445	3.56	3	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	6			
28	6	6	BS2	1459	3.53	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2			
29	6	4	SS1	0924	1.45	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3			
29	6	4	SS2	0927	1.49	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	7			
29	6	12	SS1	1059	2.32	0	0	0	29	10	0	0	0	10	2	1	0	0	0	0	0	0	52			
29	6	12	SS2	1108	2.42	13	0	0	24	0	0	0	0	16	0	1	0	0	0	0	0	0	54			
29	6	8	SS1	1232	3.21	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	3			
29	6	8	SS2	1245	3.33	1	0	0	0	4	0	0	0	1	0	2	0	0	0	0	0	0	8			
29	6	7	SS1	1315	3.55	0	0	0	5	7	0	0	3	11	0	0	0	0	0	0	0	0	26			
29	6	7	SS2	1323	3.61	0	0	0	10	0	0	0	0	5	0	1	0	0	0	0	0	0	16			
12	7	3	BS1	1105	3.20	0	0	0	1	0	0	0	0	89	14	1	0	0	2	0	0	0	107			
12	7	3	BS2	1116	3.24	0	0	0	0	3	0	0	0	77	1	0	0	0	0	0	0	0	81			
12	7	1	BS1	1146	3.32	1	0	0	1	0	0	0	1	851	38	0	0	0	0	0	0	0	892			
12	7	1	BS2	1200	3.34	0	0	0	0	0	0	0	1	43	120	0	0	0	1	0	0	0	165			



Table 5. Scale reading data for juvenile chinook captured in 1993.

Date	Station	Fish No.	Age	No. Circuli	Comments
June 8	3	1	00	8	
"	"	2	00	8	
"	"	3	00	7	
"	"	4	00	8	
"	"	5	00	10	
"	"	6	00	8	
"	"	7	00	9	
"	"	8	00	10	
"	"	9	00	8	
"	"	10	00	8	
June 11	6	11	00	8	
"	"	12	00	8	
June 28	10	13	00	6	
June 8	1	16	00	5	
June 28	6	17	00	11	
"	"	18	00	10	
"	"	19	00	7	
"	"	20	00	7	
"	"	21	00	8	
"	11	22	00	9	
June 29	8	23	00	10	Release check
June 28	1	24	00	10	Release check
July 13	12	25	00	10	
"	"	26	00	10	
"	"	27	00	12	Prominent check
"	"	28	00	9	
"	"	29	00	10	
"	"	30	00	12	Prominent check
"	"	31	00	9	
July 12	10	32	00	14	Release check
July 30	6	33	00	13	
"	"	34	00	11	
"	"	35	00	9	Prominent chk ( 6 circuli)
June 11	9	36	00	5	
July 22	18	37	00	14	Prominent chk (11 circuli)
"	"	38	00	9	
"	"	39	00	9	
June 29	12	40	00	10	
"	"	41	00	8	

Date	Station	Fish No.	Age	No. Circuli	Comments
June 29	12	42	00	10	
"	"	43	00	8	
June 29	12	44	00	10	
"	"	45	00	8	
"	"	46	00	8	
"	"	47	00	9	
"	"	48	00	8	
"	"	49	00	9	
June 11	6	50	00	7	
"	"	51	00	7	
"	"	52	00	8	
"	"	53	00	8	
"	"	54	00	7	
"	"	55	00	9	
"	"	56	00	5	
"	"	57	00	7	
"	"	58	00	7	
"	"	59	00	8	
July 12	1	60	00	8	
July 29	17	61	00	13	
June 28	3	62	00	7	
July 12	6	63	00	10	Prominent check
June 28	1	64	00	8	
"	"	65	00	9	
July 12	6	66	-	- *	
"	"	67	-	- *	
"	"	68	-	- *	
"	"	69	-	- *	

\* Unable to read



Table 6. Length and weight of all juvenile salmon captured and stomach capacity, content weight and percent digested for juvenile chinook analyzed for diet.

Date	Site No.	Fish No.	Len. (mm)	Wt. (g)	Stom. Wt.(g)	Stom. Wall Wt. (g)	Bolus Wt. (g)	Est. Full. %	Dig. %
June 8	3	1	73.5	4.8	0.159	0.098	0.061	50	100
"	"	2	70.5	4.3	0.204	0.108	0.096	80	60
"	"	3	69.5	4.4	0.169	0.101	0.068	85	80
"	"	4	68.5	4.0	0.151	0.087	0.064	80	50
"	"	5	72.5	4.8	0.185	0.108	0.077	50	75
"	"	6	78.0	5.8	0.170	0.111	0.059	60	50
"	"	7	74.0	5.1	0.166	0.091	0.075	60	90
"	"	8	73.5	6.1	0.130	0.092	0.038	10	100
"	"	9	74.0	5.2	0.185	0.095	0.090	80	100
"	"	10	72.5	4.6	0.121	0.089	0.032	30	100
June 11	6	11	75.0	5.1	0.158	0.116	0.042	30	50
"	"	12	57.5	2.4	-	-	-	-	-
June 28	10	13	58.0	2.3	-	-	-	-	-
June 8	3	14	55.0	2.0	-	-	-	-	- *
"	"	15	56.0	2.1	-	-	-	-	- *
June 8	1	16	56.5	1.8	0.047	0.028	0.019	40	95
June 28	6	17	73.5	4.5	0.142	0.114	0.028	45	90
"	"	18	75.5	5.1	0.265	0.125	0.140	100	65
"	"	19	60.0	2.2	0.061	0.033	0.028	50	60
"	"	20	65.5	2.9	0.060	0.055	0.005	10	0
"	"	21	57.5	2.2	0.070	0.041	0.029	25	80
"	11	22	73.5	4.2	0.174	0.086	0.088	90	50
June 29	8	23	69.5	3.7	0.093	0.076	0.017	60	70
June 28	1	24	87.0	7.3	0.463	0.190	0.273	100	65
July 13	12	25	67.0	3.5	0.064	0.046	0.018	25	60
"	"	26	68.5	4.4	0.147	0.106	0.041	45	40
"	"	27	59.5	2.9	0.157	0.058	0.099	100	0
"	"	28	65.0	3.5	0.112	0.072	0.040	50	15
"	"	29	66.0	3.8	0.129	0.085	0.044	40	60
"	"	30	73.5	4.7	0.195	0.108	0.087	90	30
"	"	31	61.5	2.6	0.056	0.056	0	0	-
July 12	10	32	79.0	4.4	0.175	0.080	0.095	70	60
July 30	6	33	92.0	8.6	0.417	0.272	0.145	75	50
"	"	34	80.5	5.9	0.150	0.115	0.035	35	25
"	"	35	80.0	5.6	0.208	0.103	0.105	90	50
June 11	9	36	43.5	1.2	0.026	0.017	0.009	40	100

Table 6 (cont'd)

Date	Site No.	Fish No.	Len. (mm)	Wt. (g)	Stom. Wt.(g)	Stom. Wall Wt. (g)	Bolus Wt. (g)	Est. Full. %	Dig. %
July 22	18	37	85.5	7.3	0.312	0.154	0.158	90	20
"	"	38	78.5	4.1	0.178	0.077	0.101	85	30
"	"	39	59.0	2.6	-	-	-	-	-
June 29	12	40	63.0	2.9	0.124	0.078	0.046	90	50
"	"	41	66.0	3.2	-	-	-	-	-
"	"	42	63.5	2.7	-	-	-	-	-
"	"	43	64.0	2.7	0.144	0.077	0.067	80	60
"	"	44	57.0	2.1	0.062	0.053	0.009	20	0
"	"	45	57.5	1.9	0.049	0.035	0.014	50	60
"	"	46	68.5	3.5	0.119	0.077	0.042	85	50
"	"	47	59.5	2.4	0.094	0.024	0.022	90	60
"	"	48	64.5	2.8	0.046	0.024	0.022	90	85
"	"	49	65.5	3.0	0.114	0.068	0.046	100	70
June 11	6	50	62.0	2.9	0.082	0.059	0.023	50	100
"	"	51	62.0	2.8	0.088	0.046	0.042	60	75
"	"	52	58.0	2.4	0.084	0.034	0.050	100	70
"	"	53	55.0	2.0	0.042	0.025	0.017	65	10
"	"	54	63.0	3.3	0.102	0.066	0.036	75	75
"	"	55	69.5	4.1	0.102	0.070	0.032	10	100
"	"	56	52.5	1.6	0.053	0.024	0.029	85	20
"	"	57	56.5	2.2	0.085	0.042	0.043	90	40
"	"	58	67.5	2.8	0.087	0.048	0.039	80	60
"	"	59	59.5	2.5	0.090	0.037	0.053	95	20
July 12	1	60	74.0	4.1	0.207	0.097	0.110	95	30
July 29	17	61	74.0	4.5	-	-	-	100	0
June 28	3	62	62.5	2.8	0.096	0.050	0.046	70	40
July 12	6	63	72.5	4.1	0.137	0.092	0.045	50	70
June 28	1	64	63.0	2.5	0.080	0.061	0.019	40	0
"	"	65	70.5	3.9	0.136	0.084	0.052	50	35
July 12	6	66	74.0	3.7	0.094	0.054	0.040	35	75
"	"	67	73.0	3.9	0.111	0.067	0.044	45	60
"	"	68	74.0	4.2	0.135	0.093	0.042	50	30
"	"	69	63.5	2.6	0.081	0.050	0.031	60	85

\* Chum

Table 7. Stomach contents of juvenile chinook.

Fish No.	Prey organism	Length (mm)	Total #	% Volume
1.	Digested	-	-	-
2.	Harpacticoid copepod	2.7	1	2
	Diptera Ephydriidae	3.1	1	5
	Diptera Chloropodidae	4.6	1	11
	Diptera Drosophilidae	2.2		
	"	1.5		
	"	1.8		
	"	2.3	4	12
	Hymenoptera Formicidae (partially digested)		2	10
3.	Diptera Dolichopodae	6.2	1	17
	Decapoda	3.5	1	2
4.	Harpacticoid copepod	1.6	1	1
	Diptera Ephydriidae	4.1		
	"	3.2		
	"	3.2		
	"	2.1	4	47
	Araneida (partially digested)		1	
5.	Diptera Ephydriidae	2.9		
	"	3.0	2	12
	Diptera Drosophilidae	2.0		
	"	1.8	2	7
	Order Hymenoptera	2.9	1	6
6.	Diptera Ephydriidae	3.4		
	"	2.6		
	"	2.6		
	"	2.7		
	"	3.5	5	25
	Diptera Drosophilidae	2.0		
	"	2.1		
	"	2.4		
	Diptera Drosophilidae (partially digested)			
	Diptera Drosophilidae (partially digested)			

Fish No.	Prey organism	Length (mm)	Total #	% Volume
6. (cont'd)	Diptera Drosophilidae (partially digested)		6	20
	Araneida Zodaridae (body only)	3.1	1	5
7.	Hymenoptera Formicidae sub family Myrmicinae	2.4	1	5
	Diptera Ephydriidae	2.8	1	5
8.	Digested	-	-	-
9.	Digested	-	-	-
10.	Digested	-	-	-
11.	Diptera Drosophilidae	1.7		
	Diptera Drosophilidae (partially digested)			
	Diptera Drosophilidae	2.1		
	"	1.6		
	"	2.2		
	Diptera Drosophilidae (partially digested)			
	Diptera Drosophilidae	1.8		
	"	2.1		
	"	1.6		
	Diptera Drosophilidae (partially digested)			
	Diptera Drosophilidae	1.8	11	12
	Diptera Cecidemyiidae	3.1		
	"	3.3		
	Diptera Cecidemyiidae	2.6		
Diptera Cecidemyiidae (partially digested)				
Diptera Cecidemyiidae (partially digested)		5	10	
Hymenoptera Mymaridae	1.5	1	1	

Fish No.	Prey organism	Length (mm)	Total #	% Volume
11. (cont'd)	Hymenoptera sub-order Apocrita (partially digested)	1.8	1	1
	Gammaridean amphipod	4.2		
	Gammaridean amphipod	3.1	2	10
	Insect larva	8.4	1	12
	"	2.0	1	1
16.	Copepoda ( <i>Oithona helgolandica</i> )	0.6	2	2
17.	Hymenoptera Cynipidae (partially digested)		1	1
	Order Homoptera	2.4	1	9
18.	Decapod larva (megalops)	6.0		
	"	5.8		
	"			
	Decapod larva (megalops) (partially digested)			
	Decapod larva (megalops) (partially digested)		4	25
	Gammaridean amphipod (partially digested)			
19.	Gammaridean amphipod (partially digested)			
	Gammaridean amphipod (Corophiidae)	5.6	2	35
	Pycnogonida	1.5	1	5
	Araneida (Oecobiidae) (partially digested)			
			2	10
20.	Diptera Ephydriidae (partially digested)	3.9	1	100

Fish No.	Prey organism	Length (mm)	Total #	% Volume
21.	Cirripedia	9.0		
	"	6.5	2	4
	Hymenoptera Mymaridae	1.6	1	1
	Gammaridean amphipod (partially digested)		1	15
22.	Decapod larva (megalops)	8.5		
	"	7.0	2	40
	Gammaridean amphipod (partially digested)	5.8	1	6
	Vegetation	3.0	1	4
23.	Mysid ( <i>Hemimysis lamornae</i> )	4.0	1	20
	Hymenoptera	3.9	1	10
24.	Diptera Chloropidae	5.1		
	"	4.8		
	"	5.5		
	"	5.2		
	"	5.2		
	"	4.9		
	"	5.0		
	"	5.1		
	"	4.6		
	Diptera Chloropidae (partially digested)		10	20
	Diptera Ephydriidae (partially digested)			
	Diptera Ephydriidae (partially digested)			
	Diptera Ephydriidae	3.5	3	10
	Diptera Drosophilidae	2.1	1	1
	Hymenoptera Mymaridae	1.8	1	1
	Diptera Tenthredinae	3.0	1	1
	Hymenoptera Formicidae	4.1		
"	4.0	2	2	
Harpacticoid copepod	1.9	1	1	
Order Diptera (heads only)	-	14	-	

Fish No.	Prey organism	Length (mm)	Total #	% Volume
25.	Diptera Drosophilidae (partially digested)		1	10
	Diptera Ephydriidae "	3.5 2.7	2	30
26.	Gammaridean amphipod	5.6	2	30
	"	6.0		
	Diptera Ephydriidae	3.0	2	15
	Diptera Ephydriidae	2.6		
	Diptera Drosophilidae "	1.8 2.0		
27.	Fish larva	15.1	5	100
	"	12.0		
	"	14.1		
	"	12.5		
	"	14.8		
28.	Diptera Chloropidae (partially digested)		1	40
	Gammaridean amphipod	2.0	4	40
	"	3.9		
	"	5.1		
	"	4.9		
	Diptera Drosophilidae	1.8	1	4
Hymenoptera Formicidae	1.3	1	1	
29.	Gammaridean amphipod	6.2	1	15
	Diptera Anthomyiid (Scathopagidae)	4.5	1	25
30.	Diptera Chloropidae (partially digested)			
	Diptera Chloropidae (partially digested)			
	Diptera Chloropidae (partially digested)			
	Diptera Chloropidae (partially digested)			
	Diptera Chloropidae (partially digested)			



Fish No.	Prey organism	Length (mm)	Total #	% Volume
30. (cont'd)	Diptera Chloropidae	4.9		
	Diptera Chloropidae	4.0	6	50
	Gammaridean amphipod	7.0	1	8
	Insect larva	7.0	1	8
	Order Homoptera (partially digested)	2.7	1	4
31.	Empty			
32.	Cirripedia	8.0	1	6
	Fish larva	16.1	1	17
	Decapod larva (megalops)	3.3		
	Decapod larva (megalops) (partially digested)		2	4
	Gammaridean amphipod (partially digested)	2.6	1	3
	Diptera Drosophilidae	4.2	1	5
	Order Diptera (partially digested)		1	3
	Diptera Ephydriidae	1.8	1	2
	Hymenoptera Formicidae	1.4	1	1
	33.	Decapod larva (megalops) (partially digested)		1
Gammaridean amphipod		4.1	1	15
Diptera Sciomyzidae		6.0	1	25
34.	Gammaridean amphipod	7.0		
	"	6.1	2	30
	Diptera Ephydriidae	5.5		
	Diptera Ephydriidae (partially digested)		2	45
35.	Decapod larva (megalops)	2.4		
	"	2.8	2	6
	Decapod larva (18 sets eyes)			
	Gammaridean amphipod	3.1		
	"	5.2		
	"	6.3		

Fish No.	Prey organism	Length (mm)	Total #	% Volume
35.	Gammarideam amphipod	5.4		
(cont'd)	"	5.1		
	"	6.0		
	"	3.9		
	"	4.8		
	"	3.9		
	"	4.4		
	"	3.6		
	"	5.6		
	"	4.0		
	"	3.8		
	"	6.0	15	44
<hr/>				
36.	Digested -	-	-	-
<hr/>				
37.	Fish larva	15.9		
	"	7.3		
	"	10.0		
	"	15.1		
	"	14.3	5	55
	Diptera Ephydriidae	3.4	1	6
	Diptera Cecidomyiidae	5.1		
	"	5.2		
	Diptera Cecidomyiidae (partially digested)	5.9		
	Diptera Cecidomyiidae (partially digested)	5.0	4	15
	Diptera Culicidae	3.4	1	4
<hr/>				
38.	Homoptera Aphididae	2.0	1	4
	Diptera Cecidomyiidae	4.8	1	4
	Diptera Culicidae	5.0	1	6
	Diptera Ephydriidae	4.5		
	"	4.2		
	"	4.6		
	"	3.1		
	Diptera Ephydriidae (partially digested)			

Fish No.	Prey organism	Length (mm)	Total #	% Volume
38. (cont'd)	Diptera Ephydriidae (partially digested)			
	Diptera Ephydriidae	3.9	7	40
	Diptera Dolichopodidae	3.1		
	"	4.0	2	8
	Diptera Tabanidae	5.0	1	2
	Order Strepsiptera	2.0	1	2
<hr/>				
40.	Gammaridean amphipod	8.9	1	10
	Diptera Ephydriidae	5.5	1	9
	Hemiptera Miridae	4.9	1	8
	Hymenoptera Formicidae	1.2		
	"	1.0		
	"	1.3	3	3
	Diptera Drosophilidae	4.0		
"	2.1	2	10	
<hr/>				
43.	Diptera Ephydriidae	2.6		
	"	2.9	2	6
	Hymenoptera Formicidae	2.1		
	"	1.2		
	"	1.2		
	"	1.3	4	8
	Diptera Drosophilidae	2.0		
	"	2.1		
	"	2.2		
	"	2.5		
	"	2.9		
	"	2.2		
	"	2.2		
	"	2.3		
	"	2.6		
	"	1.9		
	"	3.0		
	"	1.4		
"	2.3			
"	2.0			
"	1.8			
"	2.0			

Fish No.	Prey organism	Length (mm)	Total #	% Volume		
43. (cont'd)	Diptera Drosophilidae	1.9	18	20		
	"	1.5				
	Isopoda	0.8				
	"	0.7				
	"	0.8				
	"	0.9				
	Hymenoptera Miridae	2.1			4	1
Araneida		1	3			
			1	2		
-----						
44.	Diptera Ephydriidae	4.4	1	100		
-----						
45.	Gammaridean amphipod	3.1	1	10		
	Hymenoptera Mymaridae	1.2	2	10		
	Hymenoptera Mymaridae (partially digested)	1.3				
	Order Hymenoptera (partially digested)		1	20		
-----						
46.	Diptera Drosophilidae	2.5	4	8		
	"	1.5				
	"	2.1				
	"	2.4				
	Diptera Ephydriidae	3.0				
	"	2.9				
	"	2.6				
	"	2.8				
	"	2.2				
	"	2.3			6	15
	Gammaridean amphipod	4.5			1	7
	Hemiptera Miridae	2.1			3	20
	"	2.5				
"	3.0					
-----						
47.	Copepoda (partially digested)		1	4		
	Fish larva (partially digested)		1	18		
	Diptera Ceratopogonidae	1.8	2	6		
	"	1.4				

Table 7 (cont'd)

Fish No.	Prey organism	Length (mm)	Total #	% Volume
47. (cont'd)	Diptera Simuliidae	1.3	1	3
	Hymenoptera Argidae	2.1	1	4
	Hymenoptera Formicidae	1.7		
	"	1.5	2	3
48.	Diptera Drosophilidae	2.6		
	Diptera Drosophilidae (partially digested)		2	6
	Diptera Ephydriidae	2.1	1	5
	Hymenoptera Mymaridae	1.4	1	4
49.	Hemiptera Miridae	3.0		
	"	3.1		
	Hemiptera Miridae (partially digested)			
	Hemiptera Miridae	2.9		
	"	3.1	5	10
	Hymenoptera Mymiridae	1.2	1	2
	Diptera Drosophilidae	2.6		
	"	2.1	2	5
	Diptera Ephydriidae	4.6		
	Diptera Ephydriidae (partially digested)		2	10
50.	Digested	-	-	-
51.	Diptera Drosophilidae	2.1		
	"	2.6		
	"	2.7		
	"	2.6		
	"	2.5		
	"	2.4		
	"	2.3		
	"	2.9		
	"	2.3		
	Diptera Drosophilidae (partially digested)		10	14
	Order Homoptera	2.4		
"	3.0	2	5	

Table 7 (cont'd)

Fish No.	Prey organism	Length (mm)	Total #	% Volume
51. (cont'd)	Hymenoptera Formicidae	3.2	1	3
	Insect larva	2.4		
	Insect larva (partially digested)	2.1	2	3
52.	Order Homoptera	2.3	1	5
	Diptera Phoridae	4.2	1	20
53.	Decapoda Caridea	2.1		
	Decapoda Caridea (partially digested)			
	Decapoda Caridea (partially digested)			
	Decapoda Caridea	2.3		
	"	2.0		
	"	10.0	6	45
	Gammaridean amphipod	5.0	1	15
	Hymenoptera Braconidae (partially digested)		1	20
	Diptera Culicidae (partially digested)	1.0	10	
54.	Diptera Drosophilidae	2.7		
	"	2.5		
	Diptera Drosophilidae (partially digested)		3	6
	Order Homoptera	2.1	1	2
	Hymenoptera Formicidae	2.0	1	1
	Insect larva	4.6	1	4
	Diptera Sepsidae	2.3	1	2
	Diptera Dolichopodidae	5.1	1	10
55.	Digested	-	-	-
56.	Gammaridean amphipod	7.0		
	Gammaridean amphipod (partially digested)			
	Gammaridean amphipod	5.4		
	"	6.1		

Fish No.	Prey organism	Length (mm)	Total #	% Volume
56. (cont'd)	Gammaridean amphipod	2.5	6	80
	"	4.5		
57.	Decapoda Caridea	15.0	1	50
58.	Harpacticoid copepod	1.4	2	2
	"	1.2		
	Gammaridean amphipod	4.0	4	38
	"	5.1		
	"	4.6		
	Gammaridean amphipod (partially digested)			
59.	Gammaridean amphipod	3.5	16	70
	"	5.2		
	"	2.9		
	"	4.7		
	"	3.4		
	"	5.2		
	"	5.8		
	"	4.2		
	"	3.1		
	"	2.5		
	"	3.6		
	"	4.2		
	Gammaridean amphipod (partially digested)			
	Gammaridean amphipod (partially digested)			
Gammaridean amphipod (partially digested)				
Gammaridean amphipod (partially digested)				
Insect larva		2	10	
60.	Diptera Ephydriidae	5.7		
	"	7.5		
	"	4.6		



Fish No.	Prey organism	Length (mm)	Total #	% Volume
60. (cont'd)	Diptera Ephydriidae	5.0		
	"	5.1	5	45
	Gammaridean amphipod	6.4	1	13
	Order Homoptera	2.8	1	1
	Diptera Phoridae (partially digested)		1	1
	Araneida	2.4	1	3
	Hemiptera Miradae	4.6	1	7
<hr/>				
61.	Fish larva	16.8		
	"	13.5		
	"	15.2		
	"	10.1		
	"	14.1		
	"	23.0		
	"	14.2		
	"	14.2		
	Fish larva (partially digested)			
	Fish larva	16.6		
	"	14.3		
	"	15.0	12	70
	Diptera Culicinae (partially digested)		1	5
	Diptera Ephydriidae	5.0		
	"	3.6	2	10
Diptera Sciomyidae	5.1			
"	3.4			
"	4.6	3	15	
<hr/>				
62.	Gammaridean amphipod	5.7	1	40
	"	2.8		
	"	2.1		
	"	2.1		
	"	2.4		
	Gammaridean amphipod (partially digested)			
	Gammaridean amphipod	3.1		
	"	2.7		

Fish No.	Prey organism	Length (mm)	Total #	% Volume
62. (cont'd)	Gammaridean amphipod	1.6	9	12
	Hymenoptera Formicidae	3.0	1	8
63.	Gammaridean amphipod	5.7	1	18
	Diptera Drosophilidae	2.2		
	Diptera Drosophilidae (partially digested)		2	12
64.	Gammaridean amphipod	3.0		
	Gammaridean amphipod (partially digested)		2	25
	Hemiptera Miridae	3.2	1	30
	Hymenoptera Mymaridae	1.2		
	"	1.5		
	"	1.3		
	Hemiptera Mymaridae	1.5	4	13
	Diptera Drosophilidae	2.2	1	7
	Diptera Ephydriidae	1.7	1	15
	Order Homoptera	2.0	1	10
65.	Hymenoptera Formicidae	5.0	1	27
	Hymenoptera Mymaridae	1.6	1	2
	Order Acarina suborder Prostigmata	1.3	1	1
	Diptera Drosophilidae	2.0		
	Diptera Drosophilidae (partially digested)		2	13
	Diptera Ephydriidae	5.0	1	22
	66.	Order Hymenoptera	2.4	1
Hemiptera Miridae		2.0	1	8
Gammaridean amphipod		2.1		
"		2.5		
Gammaridean amphipod (partially digested)			3	10
67.	Cirripedia	3.5	1	4
	Order Homoptera	2.3	1	8
	Diptera Culicidae	3.0	1	6
	Hymenoptera Mymaridae	1.9	1	2

Fish No.	Prey organism	Length (mm)	Total #	% Volume
67. (cont'd)	Hemiptera Miridae	3.8	1	15
68.	Gammaridean amphipod	9.5	1	25
	Diptera Sciomyzidae	5.8	1	20
	Diptera Ephydriidae	3.9	1	15
69.	Gammaridean amphipod	6.0	1	9
	Hymenoptera Formicidae	2.1	1	6

Table 8. Epibenthic organisms captured and abbreviations.

<b>Abbreviation</b>	<b>Epibenthos</b>
AMPH	Amphipods
BCYP	Barnacle cypris
BIVA	Bivalves
BNAU	Barnacle nauplii
CALA	Calanoid copepods
CHIL	Chironomid larvae
CAJU	Calanoid copepod juveniles (copepodites)
CLAD	Cladocerans
CNAU	Copepod nauplii (calanoid, cyclopoid, harpacticoid)
COTT	Cottid fish
CRME	Crab megalops
CUMA	Cumaceans
CYCL	Cyclopoid copepods
DECA	Decapods
ECTO	Ectoprocts
EGGS	Unidentified eggs
EGSA	Egg sac
FIEG	Fish eggs
FILA	Fish larvae
GAEG	Gastropod egg cases
GAST	Gastropods
HARP	Harpacticoid copepods
INSE	Insects
INSL	Insect larvae
ISOP	Isopods
LARV	Larvacea
MEDU	Medusae
MITE	Mites
MYSI	Mysids
NEMA	Nematodes
OSTR	Ostracods
POLY	Polychaetes
ROTI	Rotifers
TANA	Tanadaceans
TARD	Tardigrades
TOTL	Total
TUNI	Tunicates
WORM	Unidentified worms

Table 9. Epibenthic sled samples numbers m<sup>-2</sup>.

DAY	MON	SITE	TIME (PST)	REP	AMPH	BCYP	BIVA	BNAU	CALA	CHIL	CAJU	CLAD	CNAU	COTT	CRME	CUMA	CYCL	DECA
8	6	3	1015	1	212	0	0	0	76	4	0	0	326	0	0	0	520	0
8	6	3	1020	2	32	0	0	0	0	0	56	0	24	2	0	0	164	0
8	6	3	1028	3	2	0	0	4	10	0	0	0	14	0	0	0	4	0
8	6	4	1330	1	36	0	2	32	12	0	36	0	744	0	0	0	252	0
8	6	4	1333	2	34	0	4	22	8	0	38	0	236	0	0	34	56	0
8	6	4	1338	3	6	4	0	38	2	0	38	0	484	0	0	0	104	0
11	6	7	0940	1	16	0	0	30	8	0	42	0	244	0	0	0	72	0
11	6	7	0945	2	46	4	0	48	4	0	16	0	896	0	0	0	280	0
11	6	7	0950	3	14	0	0	56	4	0	22	0	976	0	0	0	344	0
11	6	8	1005	1	20	0	0	4	0	0	22	0	52	0	0	0	40	0
11	6	8	1015	2	4	0	0	4	2	0	40	0	254	0	0	0	0	0
11	6	8	1017	3	58	0	2	0	6	0	174	0	534	0	0	0	78	0
11	6	9	1205	1	24	0	0	0	14	0	50	0	626	0	0	0	22	0
11	6	9	1208	2	302	0	0	0	8	0	42	0	1126	0	0	0	6	0
11	6	6	1355	1	4	0	4	0	0	0	0	0	142	0	0	0	4	0
11	6	6	1402	2	8	0	0	2	0	0	0	0	20	0	0	0	0	0
DAY	MON	SITE	TIME (PST)	REP	ECTO	EGGS	EGSA	FIEG	FILA	GAEG	GAST	HARP	INSE	INSL	ISOP	LARV	MEDU	
8	6	3	1015	1	0	0	0	0	2	0	0	3876	0	0	0	2	0	
8	6	3	1020	2	0	6	0	0	0	4	0	1072	0	0	0	0	0	
8	6	3	1028	3	0	0	0	0	0	0	0	78	0	0	0	0	0	
8	6	4	1330	1	0	2	0	0	0	6	0	4604	0	0	6	0	0	
8	6	4	1333	2	0	8	0	0	0	8	0	1984	0	0	8	0	0	
8	6	4	1338	3	0	4	0	0	0	8	0	2116	0	0	8	0	0	
11	6	7	0940	1	0	0	0	0	0	8	0	422	2	0	0	0	0	
11	6	7	0945	2	0	20	0	0	0	52	0	2520	2	0	0	0	0	
11	6	7	0950	3	0	4	0	0	0	20	0	2280	0	0	0	0	0	
11	6	8	1005	1	0	0	0	0	0	12	0	766	0	0	0	0	0	
11	6	8	1015	2	0	0	0	0	0	2	14	876	0	0	0	0	0	
11	6	8	1017	3	0	0	0	0	0	34	0	4176	2	0	0	0	0	
11	6	9	1205	1	0	6	0	0	0	0	0	5312	0	0	0	0	0	
11	6	9	1208	2	0	4	0	0	0	0	2	5406	14	0	0	0	0	
11	6	6	1355	1	0	6	0	0	0	332	0	2060	0	0	0	0	0	
11	6	6	1402	2	0	2	0	0	0	144	0	1172	0	0	0	0	0	
DAY	MON	SITE	TIME (PST)	REP	MITE	MYSI	NEMA	OSTR	POLY	ROTI	TANA	TARD	TUNI	WORM	TOTL			
8	6	3	1015	1	12	0	44	278	206	0	0	0	0	64	5622			
8	6	3	1020	2	2	0	248	132	180	0	0	0	4	76	2002			
8	6	3	1028	3	0	0	12	12	16	0	0	0	2	2	156			
8	6	4	1330	1	0	6	200	38	288	2	0	0	0	0	6266			
8	6	4	1333	2	4	0	72	24	352	2	0	0	0	40	2934			
8	6	4	1338	3	0	0	36	4	280	2	0	0	0	0	3134			

Table 9 (cont'd)

DAY	MON	SITE	TIME (PST)	REP	MITE	MYSI	NEMA	OSTR	POLY	ROTI	TANA	TARD	TUNI	WORM	TOTL
11	6	7	0940	1	2	0	136	184	210	0	6	0	4	12	1398
11	6	7	0945	2	8	0	1688	1088	1292	4	8	0	0	64	8040
11	6	7	0950	3	0	0	136	132	184	0	2	0	0	12	4186
11	6	8	1005	1	0	0	46	78	172	0	0	0	0	6	1218
11	6	8	1015	2	0	0	24	12	88	0	0	0	0	0	1320
11	6	8	1017	3	4	6	222	190	860	0	34	0	0	20	6400
11	6	9	1205	1	0	2	22	6	376	0	2	0	0	0	6462
11	6	9	1208	2	0	22	26	16	126	0	16	0	0	2	7118
11	6	6	1355	1	4	10	464	176	128	0	0	0	0	2	3336
11	6	6	1402	2	4	2	388	108	72	0	0	0	0	2	1924

DAY	MON	SITE	TIME (PST)	REP	AMPH	BCYP	BIVA	BNAU	CALA	CHIL	CAJU	CLAD	CNAU	COTT	CRME	CUMA	CYCL	DECA
11	6	6	1405	3	6	0	0	2	2	0	0	0	168	0	0	0	2	0
28	6	3	1134	1	16	2	10	52	2	0	300	0	572	0	0	4	132	0
28	6	3	1138	2	0	4	2	20	2	0	780	0	492	0	0	0	196	0
28	6	3	1141	3	4	2	2	8	0	0	356	0	180	0	0	0	92	0
28	6	9	1405	1	0	0	8	1958	2	0	1290	6	1104	0	0	0	50	0
28	6	9	1406	2	0	0	14	6084	4	0	2344	6	1782	0	0	0	76	0
28	6	9	1409	3	0	2	24	6000	10	0	1834	14	1550	0	0	0	44	0
28	6	6	1445	1	0	0	6	428	0	0	58	0	66	0	0	0	4	0
28	6	6	1455	2	0	0	10	614	2	0	642	0	348	0	0	0	50	0
29	6	4	0929	1	0	0	0	44	24	0	84	0	66	0	0	0	40	0
29	6	4	0933	2	0	0	2	90	420	0	388	0	174	0	0	0	632	0
29	6	4	0937	3	0	0	4	6	8	0	178	0	102	0	0	0	84	0
29	6	8	1249	1	18	0	0	2	20	0	156	0	692	0	0	0	124	0
29	6	8	1252	2	14	0	0	0	20	0	172	0	420	0	0	0	124	0
29	6	8	1257	3	6	0	0	12	4	0	100	0	598	0	0	0	12	0
29	6	7	1333	1	70	0	2	0	0	0	26	0	160	0	0	0	16	0

DAY	MON	SITE	TIME (PST)	REP	ECTO	EGGS	EGSA	FIEG	FILA	GAEG	GAST	HARP	INSE	INSL	ISOP	LARV	MEDU
11	6	6	1405	3	0	6	0	0	0	72	0	1600	0	2	0	0	0
28	6	3	1134	1	0	16	0	0	0	2	8	500	0	0	0	0	0
28	6	3	1138	2	0	14	0	0	0	4	0	324	0	0	2	0	0
28	6	3	1141	3	0	10	0	0	0	0	0	114	0	0	0	0	0
28	6	9	1405	1	0	6	0	0	0	4	0	88	0	0	2	0	8
28	6	9	1406	2	0	32	0	0	0	4	2	56	0	0	6	0	14
28	6	9	1409	3	0	22	0	0	0	0	0	90	0	0	8	0	2
28	6	6	1445	1	0	0	0	0	0	2	4	76	0	0	8	0	0
28	6	6	1455	2	0	2	0	0	0	2	0	88	0	0	0	0	0
29	6	4	0929	1	0	0	0	0	0	4	4	260	0	0	4	0	0
29	6	4	0933	2	0	0	0	0	0	4	2	704	0	0	30	0	0
29	6	4	0937	3	0	0	0	0	0	2	6	92	0	0	4	0	0

Table 9 (cont'd)

DAY	MON	SITE	TIME (PST)	REP	ECTO	EGGS	EGSA	FIEG	FILA	GAEG	GAST	HARP	INSE	INSL	ISOP	LARV	MEDU	
29	6	8	1249	1	0	0	0	0	0	2	0	2016	0	0	0	0	0	
29	6	8	1252	2	0	0	0	0	0	4	0	2056	0	0	0	0	0	
29	6	8	1257	3	0	2	0	0	0	2	2	350	0	0	0	0	0	
29	6	7	1333	1	0	2	0	0	0	0	0	1320	0	0	2	0	0	
DAY	MON	SITE	TIME (PST)	REP	MITE	MYSI	NEMA	OSTR	POLY	ROTI	TANA	TARD	TUNI	WORM	TOTL			
11	6	6	1405	3	8	6	936	300	96	0	0	0	0	8	3214			
28	6	3	1134	1	0	0	112	92	1656	8	2	0	2	12	3500			
28	6	3	1138	2	2	0	46	22	1036	6	0	0	2	8	2962			
28	6	3	1141	3	2	0	36	14	82	2	0	0	2	0	906			
28	6	9	1405	1	0	0	32	34	3750	30	0	0	26	0	8398			
28	6	9	1406	2	2	0	36	50	11166	50	0	0	14	0	21742			
28	6	9	1409	3	0	0	50	74	22000	62	0	0	32	0	31818			
28	6	6	1445	1	4	0	40	16	240	28	0	0	4	4	988			
28	6	6	1455	2	0	0	8	0	100	32	0	0	78	0	1976			
29	6	4	0929	1	2	0	10	2	102	0	0	0	0	4	650			
29	6	4	0933	2	4	0	10	0	172	8	0	0	0	2	2642			
29	6	4	0937	3	0	2	6	2	168	2	0	0	0	0	666			
29	6	8	1249	1	0	0	8	2	26	0	0	0	0	10	3076			
29	6	8	1252	2	0	4	28	8	96	12	4	0	0	2	2964			
29	6	8	1257	3	2	0	40	4	62	8	0	0	0	8	1212			
29	6	7	1333	1	6	0	76	444	136	2	12	0	0	18	2292			
DAY	MON	SITE	TIME (PST)	REP	AMPH	BCYP	BIVA	BNAU	CALA	CHIL	CAJU	CLAD	CNAU	COTT	CRME	CUMA	CYCL	DECA
29	6	7	1337	2	30	0	0	2	0	0	24	0	88	0	0	0	16	0
29	6	7	1339	3	34	0	0	0	0	0	20	0	228	0	0	0	8	0
12	7	3	1121	1	0	0	0	0	0	0	1004	0	268	0	0	2	148	0
12	7	3	1124	2	68	0	0	0	14	0	950	0	268	0	0	20	388	0
12	7	3	1128	3	10	0	0	6	2	0	558	0	224	0	0	2	248	0
12	7	9	1410	1	2	0	0	92	64	0	652	2	7988	0	0	0	56	0
12	7	9	1412	2	0	0	2	22	66	0	714	0	4416	0	0	0	78	0
12	7	9	1414	3	0	0	0	18	46	0	404	0	3542	0	0	0	44	0
12	7	6	1442	1	0	0	0	30	4	0	192	0	1366	0	0	0	52	0
12	7	6	1445	2	0	0	4	42	18	0	602	0	1158	0	0	0	144	0
12	7	6	1448	3	0	0	0	24	18	0	314	0	1090	0	0	0	84	0
13	7	4	0936	1	0	0	0	146	520	0	596	0	672	0	0	0	92	0
13	7	4	0937	2	4	2	0	88	82	0	212	0	488	0	0	0	220	0
13	7	4	0939	3	0	0	0	44	238	0	0	0	308	0	0	0	52	0
13	7	8	1312	1	6	0	4	28	2	0	4	0	142	0	0	2	22	0
13	7	8	1315	2	10	0	0	8	0	0	14	0	440	0	0	0	222	0
DAY	MON	SITE	TIME (PST)	REP	ECTO	EGGS	EGSA	FIEG	FILA	GAEG	GAST	HARP	INSE	INSL	ISOP	LARV	MEDU	
29	6	7	1337	2	0	0	0	0	0	0	2	764	4	0	0	0	0	
29	6	7	1339	3	0	4	0	0	0	0	0	440	0	0	0	0	0	

Table 9 (cont'd)

DAY	MON	SITE	TIME (PST)	REP	ECTO	EGGS	EGSA	FIEG	FILA	GAEG	GAST	HARP	INSE	INSL	ISOP	LARV	MEDU	
12	7	3	1121	1	0	2	0	0	0	0	0	44	0	0	0	0	4	
12	7	3	1124	2	0	2	4	0	0	2	6	528	0	0	2	0	0	
12	7	3	1128	3	2	2	0	0	0	0	0	96	0	0	0	0	0	
12	7	9	1410	1	0	4	0	0	0	2	8	684	0	0	22	0	0	
12	7	9	1412	2	0	2	0	0	0	0	0	330	0	0	24	0	0	
12	7	9	1414	3	0	0	0	0	0	6	0	192	0	0	6	0	0	
12	7	6	1442	1	0	0	0	0	0	98	0	268	0	0	4	0	0	
12	7	6	1445	2	2	2	0	0	0	150	4	656	0	0	0	0	0	
12	7	6	1448	3	0	2	0	0	0	30	4	346	0	0	0	0	0	
13	7	4	0936	1	0	0	0	0	0	12	0	110	0	0	36	0	0	
13	7	4	0937	2	0	0	0	0	0	10	0	672	0	0	16	0	0	
13	7	4	0939	3	0	0	0	0	0	24	4	152	0	0	10	0	0	
13	7	8	1312	1	0	2	0	0	0	0	0	96	0	0	6	0	0	
13	7	8	1315	2	2	0	0	0	2	4	4	1582	0	0	8	0	0	
DAY	MON	SITE	TIME (PST)	REP	MITE	MYSI	NEMA	OSTR	POLY	ROTI	TANA	TARD	TUNI	WORM	TOTL			
29	6	7	1337	2	0	0	44	204	28	2	2	0	0	28	1238			
29	6	7	1339	3	4	0	124	160	96	0	14	0	0	22	1154			
12	7	3	1121	1	0	0	64	14	204	0	0	0	0	64	1818			
12	7	3	1124	2	4	0	988	458	384	0	30	0	0	124	4240			
12	7	3	1128	3	2	0	112	158	40	0	0	2	0	18	1482			
12	7	9	1410	1	2	0	50	12	13960	8	0	0	0	8	23616			
12	7	9	1412	2	2	0	2	8	4968	0	0	0	0	0	10634			
12	7	9	1414	3	0	0	30	8	5626	0	0	0	0	0	9922			
12	7	6	1442	1	0	0	108	16	1038	0	0	0	0	0	3176			
12	7	6	1445	2	0	0	50	52	90	2	0	0	10	0	2986			
12	7	6	1448	3	0	0	54	14	26	0	0	0	10	0	2016			
13	7	4	0936	1	0	0	54	4	792	0	0	0	0	4	3038			
13	7	4	0937	2	2	0	18	0	328	0	0	0	0	0	2142			
13	7	4	0939	3	2	0	8	8	280	0	0	0	2	2	1134			
13	7	8	1312	1	4	0	48	16	40	0	0	0	0	0	422			
13	7	8	1315	2	0	0	36	22	48	0	0	0	2	4	2408			
DAY	MON	SITE	TIME (PST)	REP	AMPH	BCYP	BIVA	BNAU	CALA	CHIL	CAJU	CLAD	CNAU	COTT	CRME	CUMA	CYCL	DECA
13	7	8	1318	3	6	2	0	4	2	0	8	0	294	0	0	0	32	2
13	7	7	1339	1	4	0	0	6	6	0	2	0	730	0	0	0	86	0
13	7	7	1340	2	54	0	0	0	4	0	2	0	138	0	0	0	30	0
13	7	7	1343	3	36	0	0	0	2	0	6	0	210	0	0	0	76	0
29	7	3	1200	1	6	0	0	2	64	0	904	0	620	0	0	0	86	0
29	7	3	1202	2	6	0	0	10	72	0	480	0	766	0	0	6	142	0
29	7	3	1205	3	24	0	0	0	72	0	1032	0	604	0	0	4	272	0
29	7	4	1445	1	4	14	42	428	40	0	434	70	1084	0	0	0	338	0
29	7	4	1449	2	0	0	24	136	18	0	190	34	712	0	0	0	196	0
29	7	4	1454	3	0	0	48	26	142	0	3282	198	8718	0	0	0	1342	0



Table 9 (cont'd)

DAY	MON	SITE	TIME (PST)	REP	AMPH	BCYP	BIVA	BNAU	CALA	CHIL	CAJU	CLAD	CNAU	COTT	CRME	CUMA	CYCL	DECA
30	7	6	1320	1	4	2	6	14	4	0	36	8	722	0	0	0	42	0
30	7	6	1332	2	6	0	6	38	20	0	100	2	548	0	2	0	76	0
30	7	6	1337	3	0	0	2	70	58	0	264	0	662	0	0	0	172	0
30	7	9	1428	1	12	4	6	8	388	0	448	0	244	0	0	0	136	0
30	7	9	1434	2	12	2	8	16	268	0	380	0	384	0	0	0	200	0
30	7	7	1508	1	24	2	2	34	6	0	26	0	304	0	0	0	24	0
DAY	MON	SITE	TIME (PST)	REP	ECTO	EGGS	EGSA	FIEG	FILA	GAEG	GAST	HARP	INSE	INSL	ISOP	LARV	MEDU	
13	7	8	1318	3	0	0	0	0	0	0	0	412	0	0	8	0	0	
13	7	7	1339	1	0	2	0	0	0	0	0	862	2	0	0	0	0	
13	7	7	1340	2	0	2	0	0	0	2	0	650	8	0	0	0	0	
13	7	7	1343	3	0	0	0	0	0	0	0	406	2	0	2	0	0	
29	7	3	1200	1	0	0	0	0	0	2	12	142	0	0	6	0	0	
29	7	3	1202	2	0	0	0	0	0	4	8	162	0	0	12	0	0	
29	7	3	1205	3	0	0	0	0	0	8	4	560	0	0	4	0	0	
29	7	4	1445	1	16	0	0	0	0	134	30	212	0	0	6	0	0	
29	7	4	1449	2	16	0	0	0	0	60	16	92	0	0	0	0	0	
29	7	4	1454	3	34	0	0	0	0	1062	22	94	0	0	2	0	2	
30	7	6	1320	1	0	2	0	0	0	20	4	1552	0	0	4	0	0	
30	7	6	1332	2	2	2	0	0	0	24	6	740	0	0	4	0	0	
30	7	6	1337	3	8	8	0	0	0	0	6	448	0	0	2	0	0	
30	7	9	1428	1	10	6	0	0	2	1132	0	732	0	0	0	0	0	
30	7	9	1434	2	12	28	0	2	0	1304	6	1020	0	0	2	0	0	
30	7	7	1508	1	0	4	0	0	0	64	4	716	0	0	0	0	0	
DAY	MON	SITE	TIME (PST)	REP	MITE	MYSI	NEMA	OSTR	POLY	ROTI	TANA	TARD	TUNI	WORM	TOTL			
13	7	8	1318	3	0	0	24	2	146	0	0	0	0	2	944			
13	7	7	1339	1	0	0	40	10	408	0	0	0	0	6	2164			
13	7	7	1340	2	2	0	6	52	122	0	12	0	0	6	1090			
13	7	7	1343	3	2	0	22	36	68	0	0	0	0	8	876			
29	7	3	1200	1	2	0	516	56	86	0	6	0	0	52	2562			
29	7	3	1202	2	2	0	356	130	82	0	0	0	0	72	2310			
29	7	3	1205	3	2	0	1028	304	200	0	8	0	0	74	4200			
29	7	4	1445	1	12	0	404	74	448	0	0	0	4	10	3804			
29	7	4	1449	2	4	0	162	8	180	0	0	0	8	12	1868			
29	7	4	1454	3	4	0	406	6	4094	0	0	0	12	0	19494			
30	7	6	1320	1	10	0	802	830	462	0	0	0	2	32	4558			
30	7	6	1332	2	6	0	282	28	246	0	0	0	2	4	2144			
30	7	6	1337	3	8	0	206	16	158	0	0	0	2	2	2092			
30	7	9	1428	1	2	0	36	12	240	0	0	0	4	4	3426			
30	7	9	1434	2	2	0	38	12	296	0	0	0	2	6	4000			
30	7	7	1508	1	2	0	260	40	328	0	14	0	0	10	1864			

Table 9 (cont'd)

DAY	MON	SITE	TIME (PST)	REP	AMPH	BCYP	BIVA	BNAU	CALA	CHIL	CAJU	CLAD	CNAU	COTT	CRME	CUMA	CYCL	DECA
30	7	7	1513	2	0	0	0	4	14	0	64	0	648	0	0	0	46	0
30	7	7	1515	3	2	4	0	26	8	0	20	0	414	0	0	0	36	0

DAY	MON	SITE	TIME (PST)	REP	ECTO	EGGS	EGSA	FIEG	FILA	GAEG	GAST	HARP	INSE	INSL	ISOP	LARV	MEDU
30	7	7	1513	2	0	2	0	0	0	6	4	820	0	0	16	0	0
30	7	7	1515	3	0	2	0	0	0	6	10	1266	4	0	2	0	0

DAY	MON	SITE	TIME (PST)	REP	MITE	MYSI	NEMA	OSTR	POLY	ROTI	TANA	TARD	TUNI	WORM	TOTL
30	7	7	1513	2	2	0	262	54	894	0	0	0	0	20	2856
30	7	7	1515	3	12	0	820	102	734	0	2	0	0	12	3482

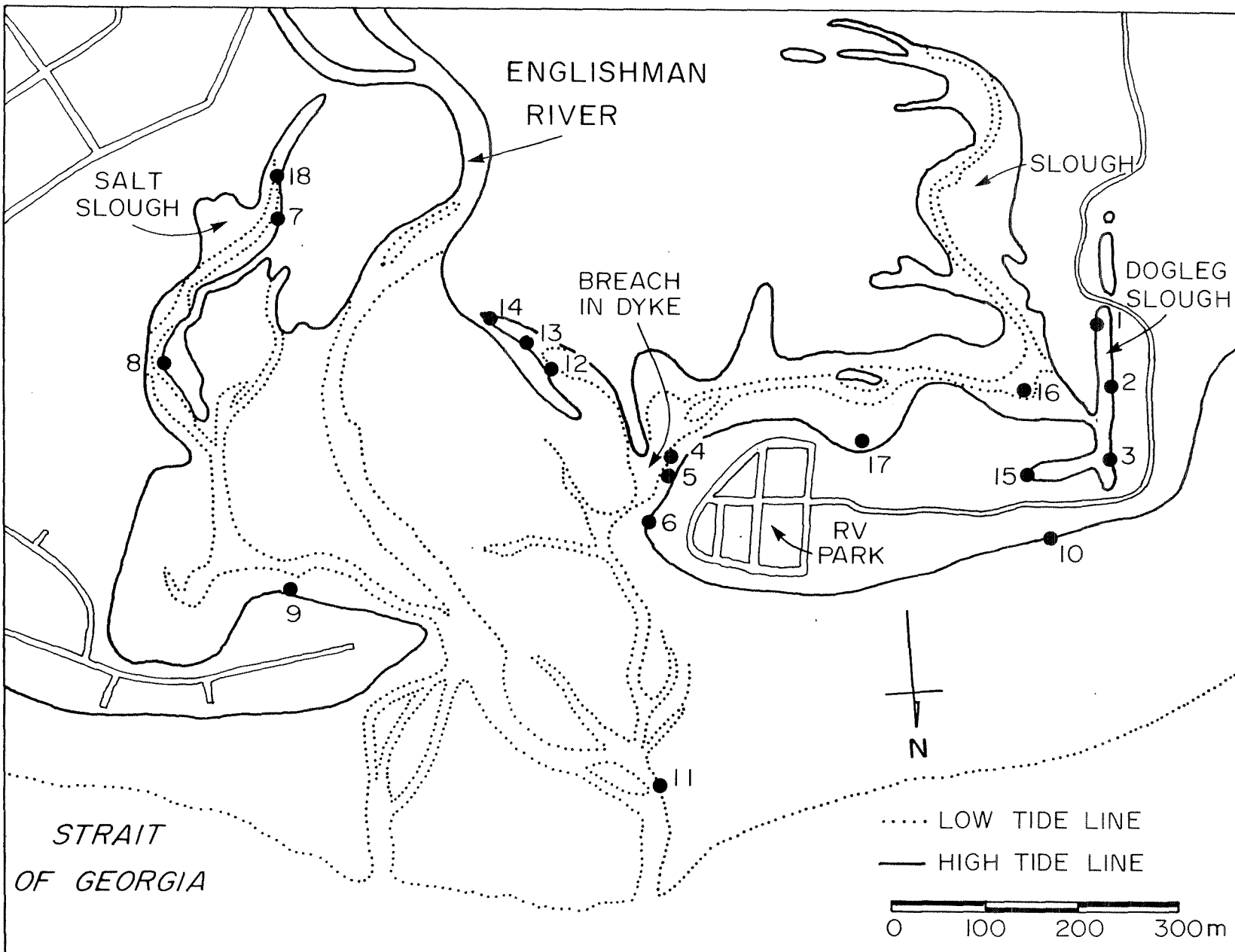


Figure 1. Map of the Englishman River estuary showing the 18 sites sampled in the 1993 survey.



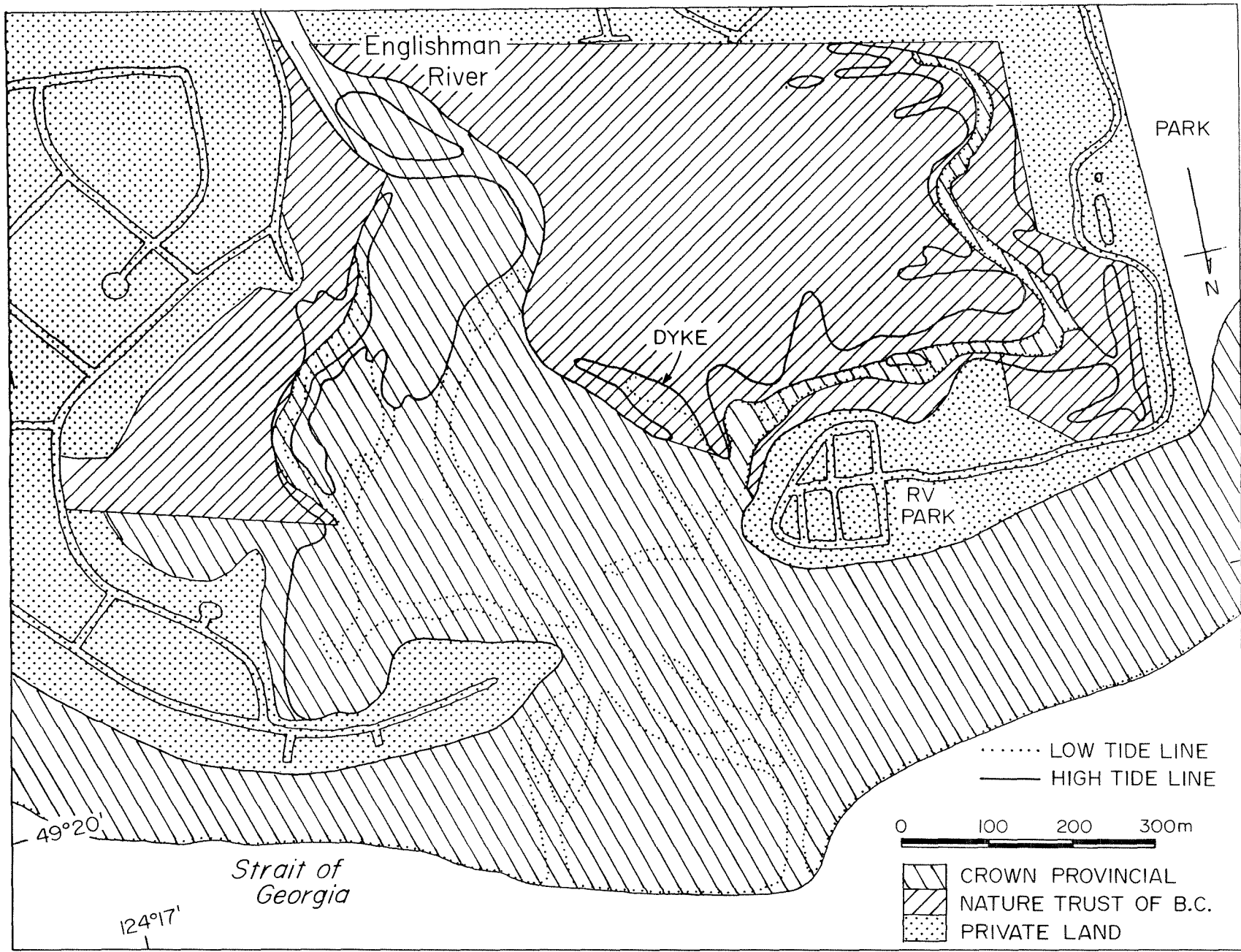


Figure 2. Map showing the location of the provincial and Nature Trust wildlife management area.