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OREGON STATE UNIVERSITY

FINAL REPORT

Biological Baseline Data
Youngs Bay, Oregon, 1974

by
Duane L. Higley
and
Robert L. Holton

Submitted to
Alumax Pacific Aluminum Corporation

Contract Period:
1 November 1973 through 30 April 1975

Reference 75-6

CORRECTION

Subsequent examination of the exposed mud flat transect samples (described on pages 11 and 18) revealed a second species of *Corophium, C. spinicorne*, predominantly located near the shoreline. The samples are being reanalyzed and revised versions of Figures 7 and 8, along with a tabular presentation of the data, will be presented in the supplemental final report. Preliminary results show that *C. spinicorne* is more numerous than *C. salmonis* at 20 m from the shoreline dike, but is nearly absent from stations further from the shore. Sex ratios slightly favor the females throughout the transect samples and no abrupt change occurs near the shoreline.

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April 1975

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Dean

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Daniel Hancock, John Dickinson and Sally Richardson aided in specimen identifications. James E. McCauley and Beverly Knapp provided editorial assistance. Judy Tiebout typed the text.

NOTICE

Much of the narrative in this report is preliminary and is based upon incomplete analysis of portions of the data. Consequently the reader is cautioned that conclusions presented are tentative and are subject to change when the complete data base has been more thoroughly digested.

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1

INTRODUCTION

This report presents biological baseline information gathered during the research project, "Physical, Chemical and Biological Studies on Youngs Bay." Youngs Bay is a shallow embayment located on the south shore of the Columbia River, near Astoria, Oregon. Nearby portions of the Youngs River, Lewis and Clark River, Columbia River, and Skipanon Waterway were also included in the study.

Research on Youngs Bay was motivated by the proposed construction by Alumax Pacific Aluminum Corporation of an aluminum reduction plant at Warrenton, Oregon. The research was designed to provide biological baseline information on Youngs Bay in anticipation of potential harmful effects from plant effluents.

The information collected concerns the kinds of animals found in the Youngs Bay area, and their distribution and seasonal patterns of abundance. In addition, information was collected on the feeding habits of selected fish species, and on the life history and behavioral characteristics of the most abundant benthic amphipod, *Corophium salmonis*.

Research was conducted in these areas during 1974 and 1975. Only 1974 data are presented in this report. A supplement is planned which will complete the tabular presentation of 1974 data (some data are presented in graphical form only), and provide the 1975 data. A bibliography developed on the subject of estuarine ecology and Youngs Bay will also be presented.

Sampling was conducted at approximately three-week intervals, using commonly accepted methods of animal collection. Relatively few stations were sampled for fish, because of the need to standardize conditions of capture. Data on fish capture are reported in terms of catch-per-unit effort by a particular sampling gear at a specific station. Methods used in sampling invertebrates were generally more quantitative, and allowed sampling at a greater variety of places, as well as a valid basis for the computation of densities. Locations of sampling stations are shown in Appendix Figures 1-1 through 1-6.

Checklists of invertebrate species (Appendix Table 1-1) and fish species (Appendix Table 1-2) were developed from these samples, and are referred to throughout the report. The invertebrate checklist is more specific taxonomically than are tables reporting invertebrate densities. This is because the methods employed in identification were more precise than those used in counts.

2

TEMPERATURE, SALINITY, AND TURBIDITY

METHODS

A vertical series of temperature and salinity readings was taken at each of four stations (shown on Appendix Figure 1-1). Readings were generally taken *in situ* within two hours of high tide using a portable salinometer (Industrial Instruments Co. Model RS5-3). On two occasions, however, when the portable salinometer malfunctioned, water samples were collected with a Kemmerer water bottle, measured for temperature by a pocket thermometer, and taken to Corvallis for salinity analysis by either a portable laboratory inductive salinometer (Bissett-Berman Model 6230) or a salinity-conductivity meter (Yellow Springs Instrument Corp. Model 33).

The portable salinometer was standardized against the inductive salinometer, using a series of water samples covering a salinity range of 0 to 35‰. Field readings were then corrected according to the graphical relationship thus established. In general, the portable salinometer is not considered accurate in reading salinities below 2‰.

Temperature and salinity readings were also taken in conjunction with fish and plankton sampling. These data will be presented in a later supplementary report.

Turbidity was measured at the regular temperature-salinity stations using a 20 cm secchi disc. The average depth of disc disappearance and reappearance was recorded as an indicator of suspended particulate matter at each station. Available light varied considerably and probably influenced these readings.

RESULTS

Seasonal patterns of temperature and salinity at the four stations are exhibited in Figures 1 and 2. A complete tabulation of temperature and salinity values is given in Appendix Table 2-1 and 2-2.

Water temperature ranged between 9 and 20° C during the period of study. Steep temperature gradients did not exist except at the entrance to Youngs Bay, where marine intrusion was greatest. Summer temperatures at the mouths of Youngs River and Lewis and Clark River were 1 to 3° C warmer than those at the Causeway station, and 2 to 5° C warmer than those at the bay entrance.

Salinities were generally less than 10‰ at the river mouths, but occasionally exceeded 25‰ at the deeper depths found at the Youngs Bay entrance. Salinity gradients existed at all stations during the summer and fall.

Secchi disc readings varied between 0.5 m and 2.2 m (Appendix Table 2-3).

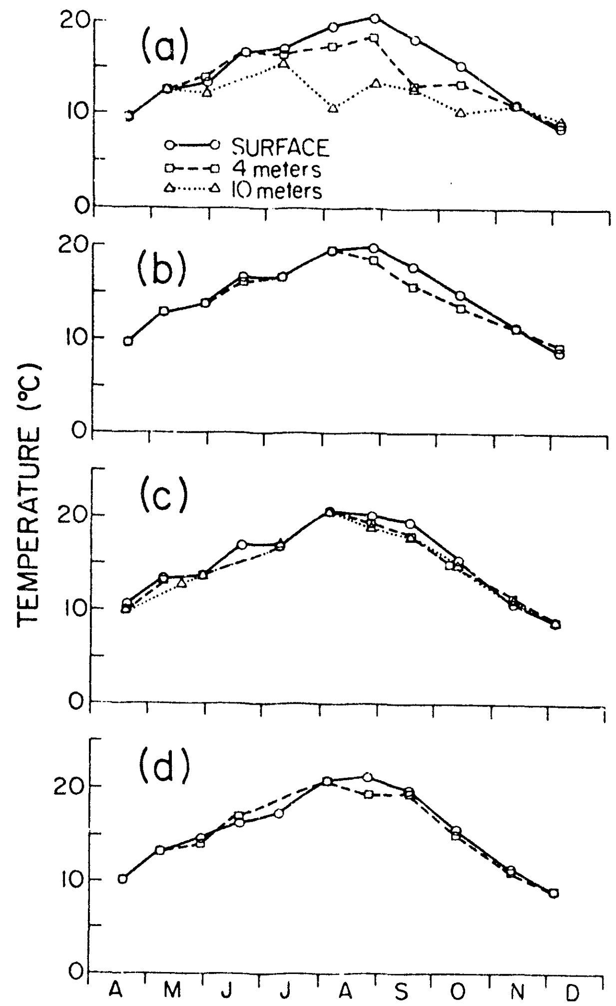

Figure 1. Seasonal changes in temperature during 1974. Measurements were taken at approximately high tide at Entrance to Youngs Bay (a), Causeway (b), Mouth of Youngs River (c), and Mouth of Lewis and Clark River (d). (Location: Appendix Figure 1-1)

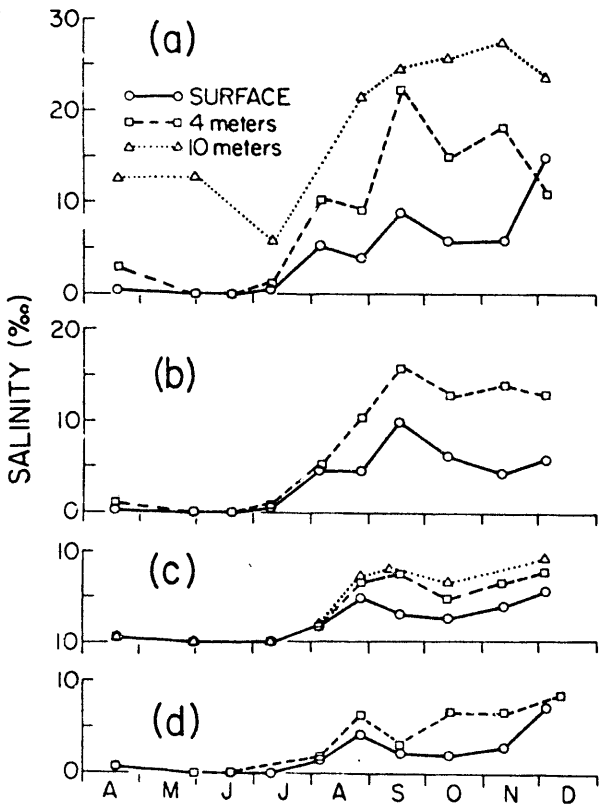

Figure 2. Seasonal changes in salinity during 1974. Measurements were taken at approximately high tide at Entrance to Youngs Bay (a), Causeway (b), Mouth of Youngs River (c), and Mouth of Lewis and Clark River (d).

3

INVERTEBRATE ZOOPLANKTON

METHODS

Invertebrate zooplankton samples were collected with a Clarke-Bumpus sampler which was towed for ten minutes in the upper one meter of water. The sampler was equipped with a 0.239 mm mesh net and a digital flowmeter; a closing device was not used. The flowmeter was calibrated at the Oregon State University Wave Research Facility.

Samples were routinely collected at Station CW-Ch 4. On 26 August 1974 samples were taken along a six-station transect extending upstream from the entrance of Youngs Bay into Youngs River (Appendix Figure 1-2). In addition, a series of samples was taken on 28 and 29 August 1974 at the PW trawl station in conjunction with a diurnal trawling program (Appendix Figure 1-6).

Samples were fixed in 3 to 5% formaldehyde buffered with sodium borate (as borax). Animals were removed from selected samples and identified as specifically as was practical; these animals were used as reference specimens during the counting procedure (see Appendix Table 1-1 for invertebrate checklist). Aliquots of sample were taken with a one-milliliter (ml) Stempel pipette and transferred to a Petri dish for identification and counting under a stereoscopic microscope. One hundred or more animals were counted from each tow, except in the few cases where less than 100 animals were captured.

RESULTS

Seasonal changes in zooplankton densities in surface water at Station CW-Ch 4 are shown in Table 1. Summer densities exceeded 4,000 zooplankters per cubic meter (m^3) (including juvenile copepods). *Eurytemora* was the most abundant copepod and *Daphnia* was the most abundant cladoceran. Zooplankton collected along the transect was similar in composition from station to station, but varied in density with no evident pattern (Table 2). Zooplankton captured during the diurnal series appeared most abundant during the pre-dawn ebb tide (Table 3).

Misitano (1974) described similar, or somewhat lower, zooplankton densities for Youngs Bay during 1972. However, this was a year of extreme flooding which created unfavorable conditions for zooplankton. He indicated (personal communication, 1975) that densities of *Eurytemora* reached 210,000 per m^3 in 1973. Similarly, Haertel and Osterberg (1967) found *Eurytemora* densities exceeding 108,000 per m^3 in the Columbia River near Chinook Point during 1964. These other investigators found greater densities and a wider variety of species because they made oblique tows which sampled the bottom as well as the surface, while the current study sampled only the surface.

Table 1. Zooplankton densities (number per m^3) at Station CW-Ch 4 during 1974. Surface tows were made with a Clarke-Bumpus net (mesh size 0.239 mm). (Location: Appendix Figure 1-2)

Zooplankter	Date / Time / Reference to high tide	8 May 1120 4.5 hrs before	28 May 1535 5.0 hrs before	19 June 1515 1.0 hr past	10 July 1455 4.0 hrs before	5 Aug 1559 High	27 Aug 1020 0.5 hr before	17 Sept 1605 2.0 hrs past	13 Oct 1245 0.5 hr past	9 Nov 1015 1.0 hr past	3 Dec 1400 1.5 hrs before
Copepoda											
Nauplii				0.7							
Harpacticoida		2.7		0.7							
Calanoida											
Diaptomus											
females		0	2.1	5.0	41.2	66.9					
males		1.1			11.0	22.3		0.7			
Total adults		1.1	2.1	5.0	52.2	89.2		0.7			
copepodites		4.9	10.5	2.2	24.7	256.4		1.5		0.5	
Eurytemora											
females		3.3	3.2		24.7	301.0	1.4	1.5	0.2	1.5	4.0
males		2.2	1.1		44.0	457.0	26.0	2.9	0.4		0.7
Total adults		5.5	4.3		68.7	758.0	27.4	4.4	0.6	1.5	4.7
copepodites		8.2	9.5		19.2	1,337.6	466.0	6.6	3.8	4.5	29.5
Epischura											
females						22.3					
males						11.2					
Total adults						33.5					
copepodites							1.4				
Rhincalanus											
copepodites											0.3
Cyclopoida											
Cyclops											
females		6.0	11.6	3.6	19.2	55.7	5.8	7.3	1.8		0.3
males		2.2	9.5	1.4	13.7	11.2	1.4		1.6		
Total adults		8.2	21.1	5.0	32.9	66.9	7.2	7.3	3.4		0.3
copepodites		18.1	68.5	12.9	16.5	211.8	17.4	17.6	6.5	1.0	3.0
Oithona similis											
copepodites						11.2					
Cladocera											
Daphnia		2.2	27.4	19.3	285.8	1,393.4	5.8	36.7	0.2	5.5	1.3
Bosmina		5.5	76.9	97.4	426.0			4.4		5.0	
Cirripedia											
Nauplii							1.4				
Unidentified crustacean											
Larvae				0.7							
	TOTAL	56.4	220.3	144.0	926.1	4,157.6	526.8	79.3	15.4	18.1	39.2

Table 2. Zooplankton densities (number per m^3) at six stations along a transect extending from the entrance of Youngs Bay to a point approximately 2.5 miles above the mouth of Youngs River. Surface tows were made with a Clarke-Bumpus net (mesh size 0.239 mm) between 1555 hours and 1820 hours, 26 August 1974. High tide was at 2115 hours. (Location: Appendix Figure 1-2)

Zooplankter	Station 1	2	3	4	5	6
Copepoda						
Calanoida						
Diaptomus						
females	1.1	0.5		0.5	0.5	
males					1.0	
Total adults	1.1	0.5		0.5	1.5	
copepodites	2.2		0.7	0.9		1.0
Eurytemora						
females	1.1	1.9	11.6	3.2	1.5	44.9
males	14.1	15.7	29.1	16.0	6.6	109.4
Total adults	15.2	17.6	40.7	19.2	8.1	154.3
copepodites	259.6	72.4	130.8	78.1	46.7	152.3
Centropages						
females				0.5		
Epischura						
copepodites		0.5				
Cyclopoida						
Cyclops						
females	3.3	6.2	8.7	1.8	5.6	
males		3.3	0.7		1.0	
Total adults	3.3	9.5	9.4	1.8	6.6	
copepodites	30.4	6.7	39.2	15.1	4.1	2.0
Cladocera						
Daphnia	18.5	8.6	8.0	3.2	1.5	
Bosmina	3.3	1.4	1.5	0.5		
Podon					1.5	
Cirripedia						
Nauplii			0.7			
TOTAL	333.4	117.2	231.0	119.7	70.0	309.5

Table 3. Zooplankton densities (number per m^3) at the PW trawl station on 28 and 29 August 1974. A diurnal series of surface tows was made with a Clarke-Bumpus net (mesh size 0.239 mm). High tides occurred at 1140 hours and 2312 hours on 28 August. (Location: Appendix Figure 1-6)

	28 August 1974				29 August 1974	
Zooplankter	1305	1555	1815	2235	0145	0635
Copepoda						
Calanoida						
Eurytemora						
females		0.5	3.2	2.7	11.5	4.2
males		1.0	0.3	3.6	10.6	5.7
Total adults		1.5	3.5	6.3	22.1	9.9
copepodites	8.6	14.5	10.0	8.8	31.3	37.6
Diaptomus						
females					0.9	
copepodites		0.2		0.3	0.5	0.5
Cyclopoida						
Cyclops						
females		0.7	2.2	0.6	3.7	2.1
males		0.5		0.6	1.8	0.5
Total adults		1.2	2.2	1.2	5.5	2.6
copepodites	2.2	5.5	8.4	3.6	11.0	3.1
Cladocera						
Daphnia	1.3	0.5	10.3	2.1	3.2	0.5
Bosmina				0.9		
Mysidae						
adults					0.9	0.5
Unidentified Crustacean larvae						0.5
Amphipoda				3.6		
TOTAL	12.1	23.4	34.4	26.8	75.4	55.3

4

LARVAL FISH

METHODS

Larval fish were collected by means of ten-minute surface tows made with a one-meter net at Station CW-Ch 4 (Appendix Figure 1-2). The mesh openings of this net vary from 0.519 to 0.551 mm.

Filtrate flow rate was measured either with a General Oceanics digital flowmeter (Model 2030/31) or with a digital flowmeter housed in a 5-inch Clarke-Bumpus frame manufactured by Kahl Scientific Instrument Corp. Filtrate volume was computed according to the manufacturer's calibration curve for the General Oceanics meter, and according to data developed by timed test runs made at the OSU Wave Research Facility in the case of the Clarke-Bumpus meter. However, a flowmeter was not available for the first tow, made on 18 April 1974; therefore the filtrate volume estimate was based upon the mean water volume filtered per minute in the eight succeeding tows.

Immediately upon collection, samples were fixed in 3 to 5% formaldehyde buffered with sodium borate (as borax). The samples were also maintained in this solution. Larval fish were identified and counted under a stereoscopic microscope. Complete counts were made of all samples except the very rich one of 9 May 1974. This sample was divided in a specially constructed splitting chamber, and a one-eighth portion was counted. Vegetative fiber in samples taken during running tides was frequently so abundant that some larvae were obscured during counting. A sample recount indicated that counts on these samples may be 5 to 10% low.

RESULTS

The variety of larval fish captured was small (Table 4). The dominant taxa were the prickly sculpin (*Cottus asper*) and members of the smelt family (Osmeridae). Smelt attained densities of nearly 10 individuals per m^3. Peak abundance occurred in the spring; no larvae were captured during the summer. During 1973 Misitano (personal communication, 1975) captured a similar variety of taxa in Youngs Bay, but found a greater variety in other portions of the Columbia River estuary.

Table 4. Densities of larval fish (number per m^3) at Station CW-Ch 4 during 1974. Surface tows were made with a one-meter net (mesh size measured at 0.519 to 0.551 mm). (Location: Appendix Figure 1-2)

Taxon	Date Time Reference to high tide	18 April 1245 2.5 hrs past	9 May 1556 0.5 hr past	28 May 1558 4 hrs before	19 June 1610 2 hrs past	5 Aug 1531 High	None Captured on:
Osmeridae		3.296	9.876	0.051	0.011	0.003	27 and 29 August 17 September 13 October 9 and 10 November 3 December
Cottidae							
Cottus asper		0.161	0.159	0.119	0.042		
Clupeidae							
Clupea harengus pallasi						0.008	
Pleuronectidae				0.010			

5

BENTHOS

METHODS

Faunal Survey

Grab and core samples were taken along transects and at other stations located in the Youngs Bay area (Appendix Figures 1-3 and 1-4). Five replicate samples were taken at Station WRT-6C:3 on 6 March 1974 in order to estimate sample variability. Otherwise, only single samples were collected.

Two Smith-McIntyre grab samplers (0.1 m^2 sample area), an Ekman grab (0.023 m^2), and a coring tube (15.2 cm diameter) were employed in the survey. Skipanon Waterway stations Skip: 1 through 7 were sampled with the tube which was pushed 20 cm into mud covered by 8 to 30 cm of water. The Smith-McIntyre grab was used at all other stations, except Skip: TB where a light mud substrate required the messenger-trip system of the Ekman grab. Depth of penetration by the Smith-McIntyre grab varied with substrate composition and the amount of lead weight added to the grab. This depth was measured at the center of the grab and ranged between 3 and 18 cm.

Samples were washed either through a 0.425 mm geologic sieve or in a trough built with 0.408 by 0.457 mm stainless steel wire cloth. No distinction is made between these sieving methods in the rest of this report. After washing, the concentrated samples were fixed in 3 to 5% formaldehyde buffered with borax.

In the laboratory samples were transferred to 40% isopropanol to which the stain Rose Bengal had been added.

A specimen collection was developed by removing animals from selected samples and identifying them as specifically as was practical using stereoscopic and compound microscopes. Samples were counted in enamel pans under a three diopter illuminated magnifier, using the specimen collection for reference. Only new or difficult to recognize animals were removed from the pans for microscopic study.

The large amounts of bark and other vegetative debris encountered in many samples made complete counts impractical. In such cases, the sample was drained, mixed thoroughly, and split into subsamples which were then measured for settled volume, and one subsample was counted.

Exposed Mud Flat Transect

On 18 September 1974, cores 40 cm deep were taken in an exposed mud flat along a 400 m transect, approximately perpendicular to the south shoreline (Appendix Figure 1-5).

The ten samples (one per station) were processed as described above, except that animals were sorted into vials by taxonomic group during the counting procedure.

The amphipod *Corophium salmonis* was further studied for changes in sex ratio and size-class structure that might occur along the transect. Each amphipod examined was sexed and sized (rostrum to telson) as follows: 0 to 0.9 mm, 1.0 to 1.9 mm, etc.

Vertical Distribution Studies

The vertical distribution of benthic infauna was studied at four stations in the Youngs Bay area (Appendix Figure 1-5). Cores 7.5 to 38 cm in depth were taken by pushing a 3.5 cm diameter plastic tube into exposed mud near the shoreline (Stations Pier 3, Airport, and CWRR) or into substrate captured in a Smith-McIntyre grab (Station FWGS:1). A plunger inserted into the tube reduced air pressure above the substrate and allowed the tube to travel more freely into the substrate. The plunger was used to extrude the core, which was sliced at 0.5 to 5 cm intervals. The sections were fixed separately in 3 to 5% formaldehyde buffered with borax.

In the laboratory each section was washed through a 0.063 mm sieve, transferred to 40% isopropanol (stained with Rose Bengal) and counted under a stereoscopic microscope.

Dry Weight Analysis

A portion of each sample taken at Station WRT-6C:3 was selected for dry weight analysis. Supplementary measurements were made on animals collected at other stations.

Animals to be weighed were picked free of debris and dried at 60° C for 24 hours. Most samples were dried in aluminum foil tares and weighed on a Mettler balance (Model K-7). Very small samples were dried on 20 mm paper filters, and weighed on a Cahn electrobalance (Model 4100).

Alcohol preservation may have affected these weight analyses through extraction of body fats. The extent of extraction is still being investigated and will be reported in the supplementary report.

Results of dry weight analyses are included with Faunal Survey results.

Substrate Texture

A substrate sample normally was removed from each grab sample and taken adjacent to each core sample by pushing a 3.5 cm tube about 5 cm into the sediment. Each sediment plug was stored in a plastic bag and returned to Corvallis for laboratory analysis.

Each sediment sample was centrifuged and measured for volume in a graduated centrifuge tube. The sample was then wet-sieved through two (sometimes three) sieves, and the fractions produced were also centrifuged and measured. Sediment fractions and descriptions are:

>0.991 mm	debris (gravel, barkchips, shells, etc.)
0.246 mm - 0.991 mm	medium and coarse sand
0.063 mm - 0.246 mm	fine sand
<0.063 mm	silt and clay

The 0.246 mm screening was omitted from some analyses, producing a 0.063 mm to 0.991 mm sand fraction. Skipanon Waterway samples Skip: 1-7 were dry-sieved through a 0.063 mm screen only, as described in Johnson and Cutshall (In Press).

Results of substrate texture analyses are presented with the Faunal Survey and Exposed Mud Flat data.

RESULTS

Faunal Survey

A summary of benthos densities is presented in Tables 5 through 8; a complete tabulation of all 1974 benthos data and attendant substrate textures is given in Appendix Table 5-1. The tables show that the amphipod *Corophium* and oligochaete worms dominated that fraction of the benthic fauna captured on a 0.425 mm screen. *Corophium* densities commonly exceeded 10,000 per m^2, and occasionally 40,000 per m^2 (Appendix Table 5-1).

Conversion to dry-weight densities (Figure 3) served to emphasize the importance of this tube-dwelling amphipod (Appendix Tables 5-3 and 5-4 summarize results of the dry-weight analyses).

Highest *Corophium* densities occurred in the quieter portions of the bay where fine sediments accumulate (e.g. Stations PW: 5 and WRT-6C:3); while regions of coarse sand, (e.g. Station FWGS: 2), harbored lower densities (Table 5).

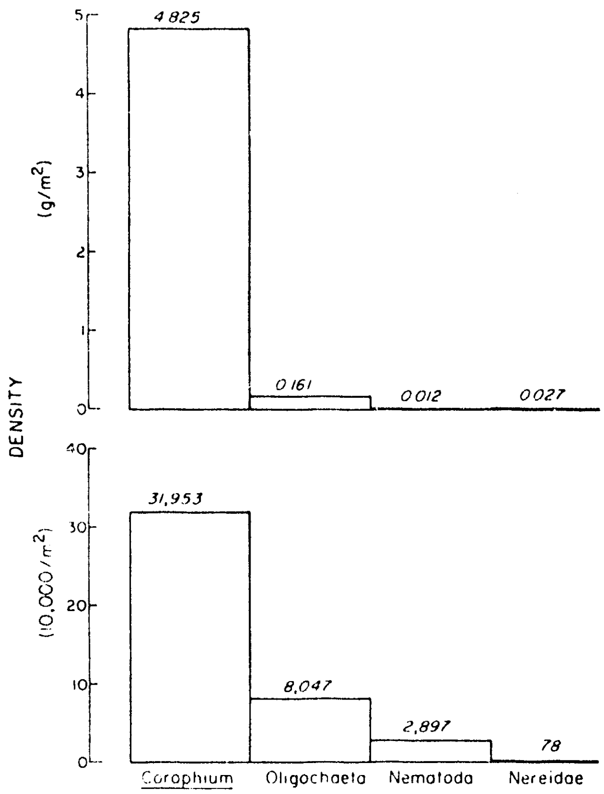

Figure 3. Dry weight and numerical densities of benthic infauna collected at Station WRT-6C:3 on 28 May 1974. (Location: Appendix Figure 1-3)

Faunal composition and density in the Lewis and Clark River and Youngs River were similar to that in Youngs Bay, while the fauna of the Skipanon Waterway contained fewer *Corophium* and more chironomids (Tables 5 to 8).

Seasonal patterns in *Corophium* density are not apparent from a study of Appendix Table 5-1. This presumably arises from sampling errors. (Standard error was 20-25% of the mean for five replicate samples taken at Station WRT-6C:3; Appendix Table 5-2). However, changes in the mean dry weight of *Corophium* suggest probable seasonal events (Figure 4).

The observed early spring weight increase was probably related to rapid individual growth rates and to egg production, while the ensuing weight reduction was probably due to the release of young (carried in brood pouches by females) and deaths of overwintering adults.

Table 5. Densities of benthic fauna (number per m^2) at selected stations in Youngs Bay and the Columbia River, 1974. (Location: Appendix Figure 1-3)

Taxon / Station / Date	FWGS 1 18 June	FWGS 2 18 June	FWGS 3 18 June	P3FLG 1 7 Mar	P3FLG 3c 7 Mar	PW 1 17 Apr	PW 2 7 May	PW 3 17 Apr	PW 4 17 Apr	PW 5 7 May
Amphipoda										
Anisogammarus	20.2	10.1		65.1		10.1	18.3		50.5	135.4
Corophium	343.4	151.5	3,686.9	1,856.7	50.5	11,252.5	7,142.9	9,717.2	24,282.8	23,017.4
Eohaustorius	363.6	434.3	20.0		191.9	10.1	36.6	10.1	10.1	
Isopoda										
Mesidotea		10.1				20.2			20.2	
Gnorimosphaeroma							18.3			
Insecta										
Chironomidae										
Polychaeta										
Ampharetidae				32.5		10.1	18.3		40.4	
Nereidae				521.2		202.0		50.5	323.2	348.2
Oligochaeta			10.1	2,280.1	40.4	414.1		404.0	2,737.4	1,702.0
Hirudinea										
Nematoda		10.1		97.7	10.1	111.1		101.0	434.3	1,721.5
Nemertinea					30.3			20.2		
Mollusca										
Macoma				846.9		10.1	18.3	90.9	20.2	
Corbicula										
Hydracarina										
Ostracoda										
Mysidacea										
Neomysis										
TOTAL	727	616	3,317	5,700	323	12,040	7,253	10,393	27,919	26,924

Table 5. (cont.)

Taxon	Station / Date	CW Trough 29 May	CWRR 7 May	WRT6C 1 7 May	WRT6C 3 28 May	WRT6C 5 7 May	WRT6C 7 7 May	WRT6C 100' 7 May	WRT6C 30' 7 May
Amphipoda									
Anisogammarus						40.3			110.0
Corophium		3,545.5	20,400.0	9,152.5	31,953.1	36,451.6	22,459.5	4,913.4	5,000.0
Eohaustorius		303.3							
Isopoda									
Mesidotea									
Gnorimosphaeroma									50.0
Insecta									
Chironomidae									
Polychaeta									
Ampharetidae			66.7			80.6	226.5		1,110.0
Nereidae		10.1	1,033.3	135.6	78.1	1,008.1	226.5	78.7	20.0
Oligochaeta		20.2	33,066.7	6,711.9	8,046.9	29,314.5	31,100.0	5,543.3	5,160.0
Hirudinea									
Nematoda		111.1	1,200.0	644.0	2,890.6	1,753.9	711.9	315.0	9,100.0
Nemertinea								31.5	20.0
Mollusca									
Macoma									
Corbicula									
Hydracarina									
Ostracoda							97.0		1,800.0
Mysidacea									
Neomysis			33.3						
	TOTAL	3,717	55,800	16,644	42,969	68,629	54,822	10,882	22,270

Table 6. Densities of benthic fauna (number per m^2) at selected stations in the Skipanon Waterway, 1974. Dashes indicate taxon may have been present, but was not counted. (Location: Appendix Figur' 1-3)

Taxon	Station / Date	SKIP 1 24 Oct	SKIP 2 24 Oct	SKIP 3 24 Oct	SKIP 4 24 Oct	SKIP 5 24 Oct	SKIP 6 24 Oct	SKIP 7 24 Oct	SKIP TB 10 Nov	SKIP Ch 12 10 Nov
Amphipoda										
Anisogammarus		54.9							9.3	
Corophium		4,285.7	6,428.6	1,098.9	219.8			3,846.2	140.2	
Isopoda										
Mesidotea										
Gnorimosphaeroma										
Insecta										
Chironomidae		1,263.7	1,208.8	1,098.9	2,087.9	1,648.3	2,472.5	54.9		
Polychaeta										
Ampharetidae								54.9	9.3	
Nereidae									9.3	18.7
Oligochaeta		604.3	19,065.9	11,318.7	10,384.6	4,340.7	2,802.8	3,967.0	84.1	37.4
Hirudinea										
Nematoda		54.9	2,142.8	439.6	109.9	1,483.5	769.2			
Nemertinea					-	54.9	-	-		
Mollusca										
Macoma		54.9								102.8
Corbicula										
Hydracarina			1,098.9	384.6	164.8	109.9				
Ostracoda			604.4	109.9		439.6	164.8	54.9		
Mysidacea										
Neomysis										
	TOTAL	6,319	30,549	14,450	12,967	8,077	6,209	7,418	252	159

Table 7. Densities of benthic fauna (number per m^2) at selected stations in Youngs River, 1974. Dashes indicate taxon may have been present, but was not counted. (Location: Appendix Figures 1-3 and 1-4)

Taxon	Station / Date	YR 6 / 4 Dec	YR 5 / 4 Dec	YR 3 / 26 Aug	YR Mouth / 29 May
Amphipoda					
Anisogammarus			64.7		71.4
Corophium		9,153.3	13,689.3	2,637.4	18,857.1
Eohaustorius			64.7		
Isopoda					
Mesidotea					
Gnorimosphaeroma					
Insecta					
Chironomidae		1,098.4			142.9
Polychaeta					
Ampharetidae		434.8	32.4	54.9	71.4
Nereidae		58.6	161.8	467.0	2,142.9
Oligochaeta		13,821.5	7,378.6	26,620.9	11,071.4
Hirudinea		22.9			
Nematoda		183.0		82.4	1,785.7
Nemertinea			--	--	
Mollusca					
Macoma					
Corbicula					
Hydracarina					
Ostracoda					
Mysidacea					
Neomysis					
	TOTAL	24,783	21,392	29,863	34,143

Table 8. Densities of benthic fauna (number per m^2) at selected stations in the Lewis and Clark River, 1974. Dashes indicate taxon may have been present, but was not counted. (Location: Appendix Figures 1-3 and 1-4)

	Station	LC 10	LC 8	LC 6	LC WH
Taxon	Date	9 Nov	9 Nov	9 Nov	9 Nov
Amphipoda					
Anisogammarus			66.8		
Corophium		649.8	16,347.4	20,558.6	29,040.0
Eohaustorius					
Isopoda					
Mesidotea					
Gnorimosphaeroma					
Insecta					
Chironomidae		216.6		949.7	80.0
Polychaeta					
Ampharetidae				497.8	160.0
Nereidae				279.3	960.0
Oligochaeta		8,519.9	579.1	15,754.2	33,440.0
Hirudinea					
Nematoda			22.3	335.2	230.0
Nemertinea		--	--		240.0
Mollusca					
Macoma				167.6	160.0
Corbicula				55.9	
Hydracarina					
Ostracoda					
Mysidacea					
Neomysis					
	TOTAL	9,386	17,016	38,603	64,400

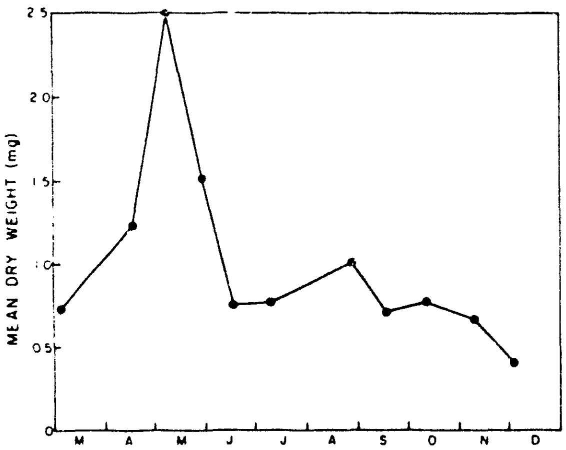

Figure 4. Seasonal changes in mean dry weight of *Corophium* during 1974. Collections were made at Station WRT-6C:3. (Location: Appendix Figure 1-3)

Exposed Mud Flat Transect

There were similarities between benthos densities and substrate textures along the mud flat transect (Figures 5 and 6). The relative densities of amphipods (predominantly *Corophium*) were related to the fine sand fraction, while oligochaete densities were related to the silt and clay fraction.

Over most of the transect, females outnumbered males (Figure 7). Near the shoreline, however, the male density increased abruptly, producing a 6:1 sex ratio favoring the males.

Size class structure varied along the transect with no apparent pattern, except for a possible increase in the relative density of smaller animals near the shoreline (Figure 8).

Vertical Distribution Studies

Most benthic forms at the stations studied were found in the upper five centimeters of substrate (Figures 9 and 10). The fauna at Stations FWGS:1 and Pier 3, located in sandy areas, was not as deeply distributed as the fauna found in the mud at Station CWRR. Harpacticoid copepods were extremely abundant in the upper two centimeters at Station CWRR.

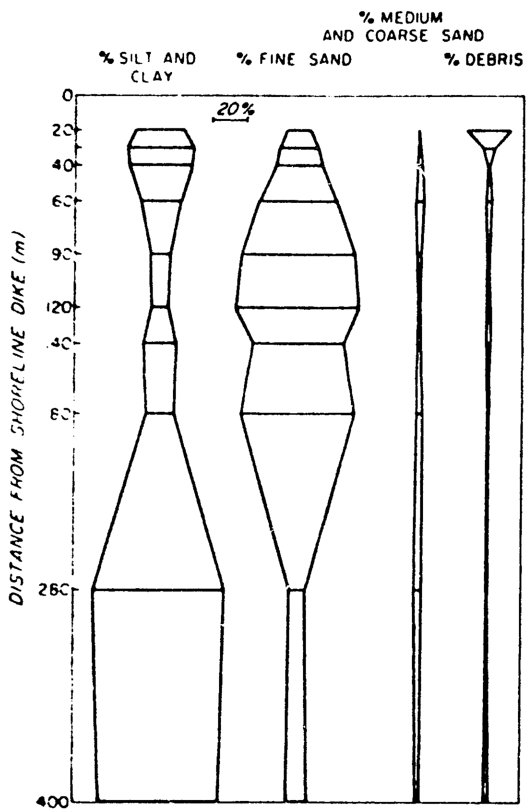

Figure 5. Substrate texture at ten stations extending 400 m along mud flat transect, 18 September 1974. The shoreline dike is set approximately 12 m back from maximum high tide mark. (Location: Appendix Figure 1-5)

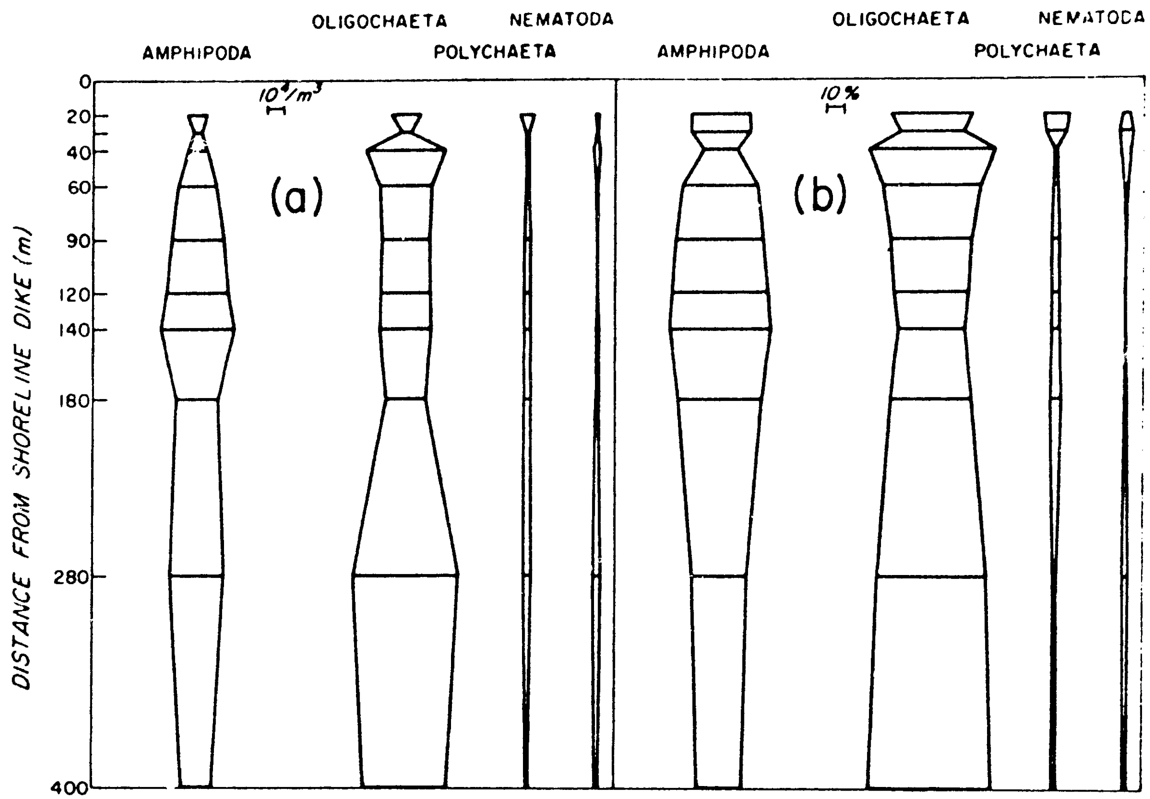

Figure 6. Absolute (a) and relative (b) numerical densities of major benthic groups found at ten transect stations, 18 September 1974. Amphipods at 20 m Station and 30 m Station included 2% and 8% *Anisogammarus*, respectively; otherwise all amphipods counted were *Corophium*. (Location: Appendix Figure 1-5)

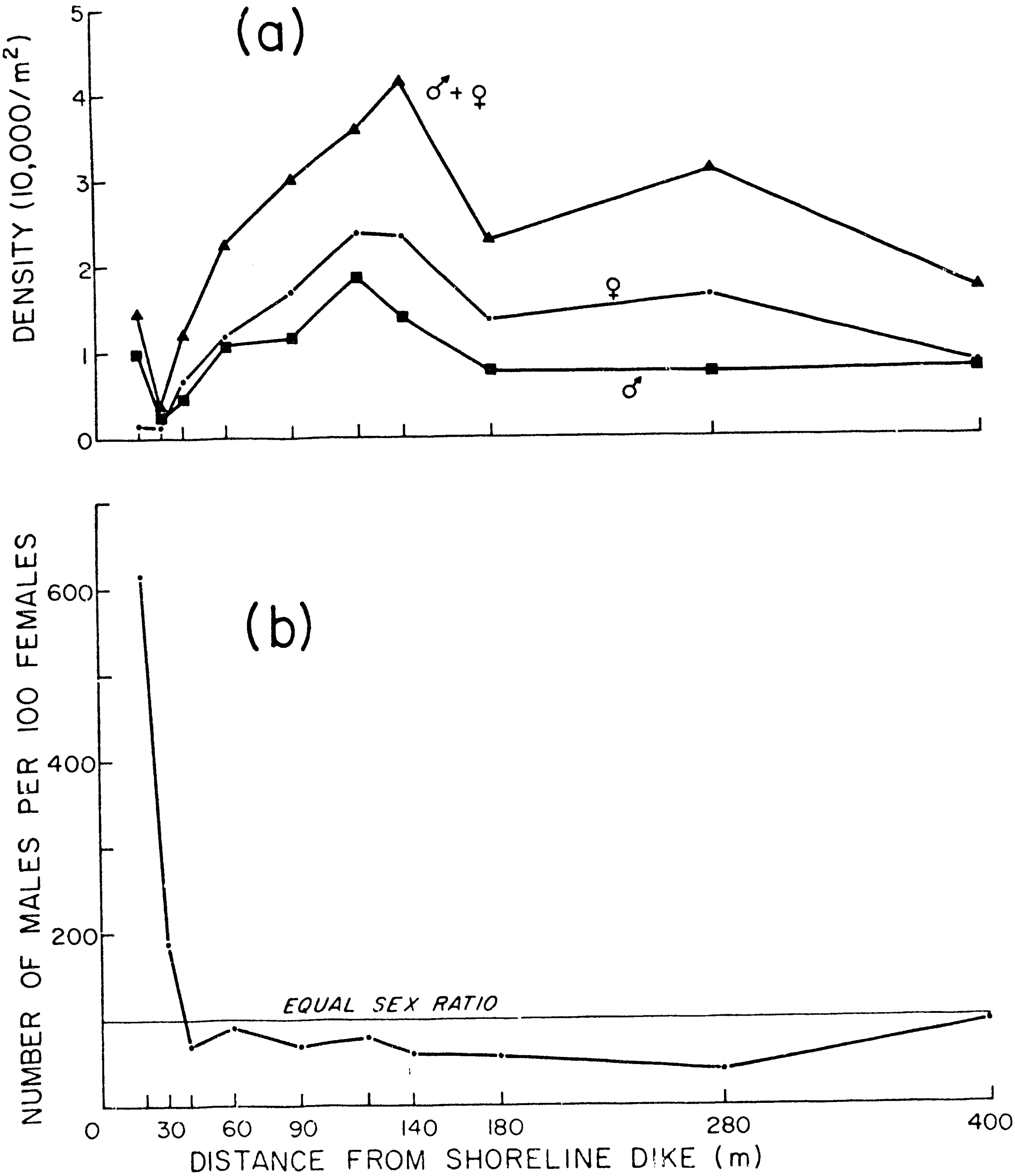

Figure 7. Changes in numerical density (a) and sex ratio (b) of *Corophium* along a transect, 18 September 1974. (Location: Appendix Figure 1-5)

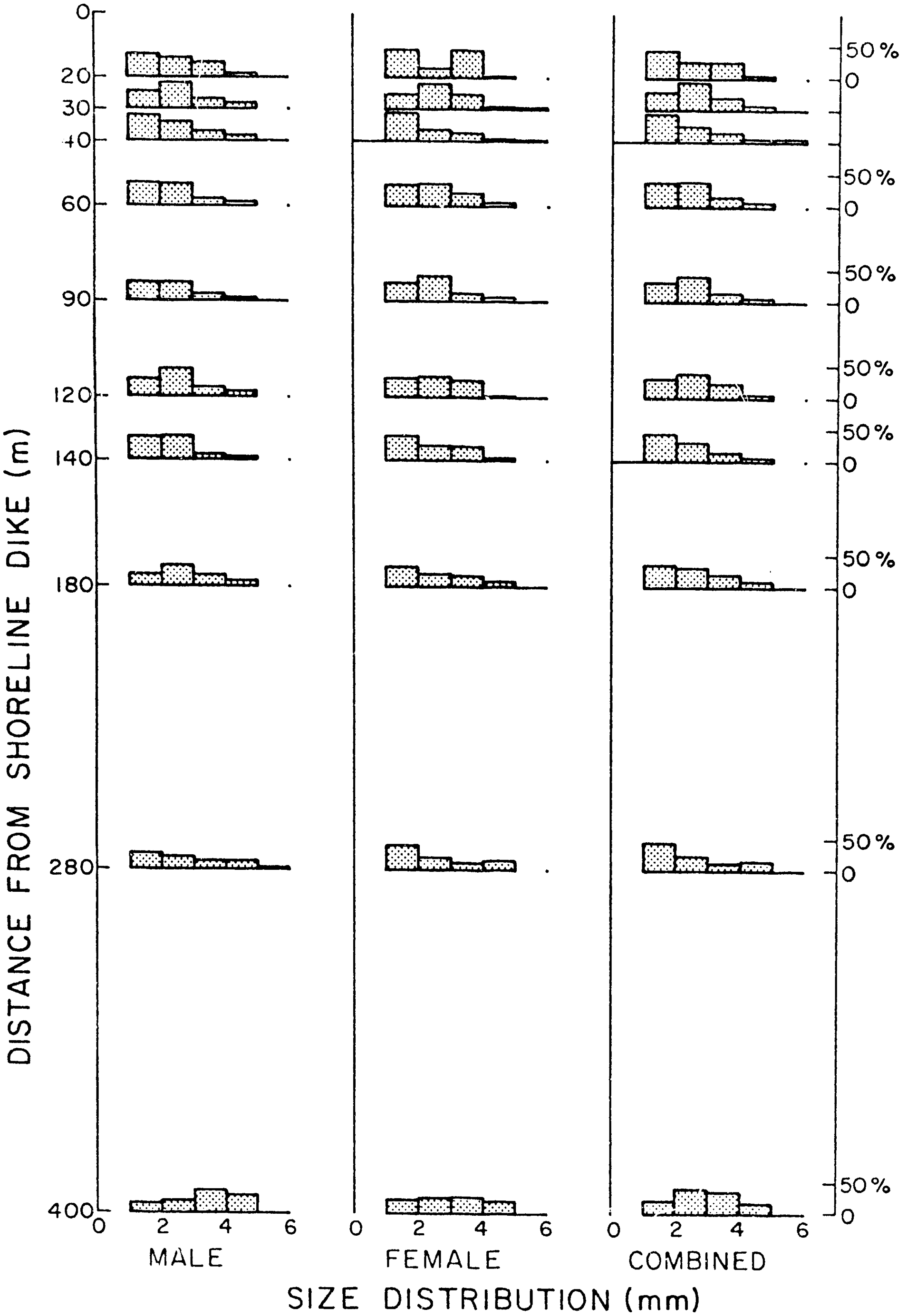

Figure 8. Relative frequencies by size of *Corophium* collected at mud flat transect stations on 18 September 1974. Some animals in the 0 to 0.9 mm size-class may have been lost in screening (0.425 mm mesh). (Location: Appendix Figure 1-5)

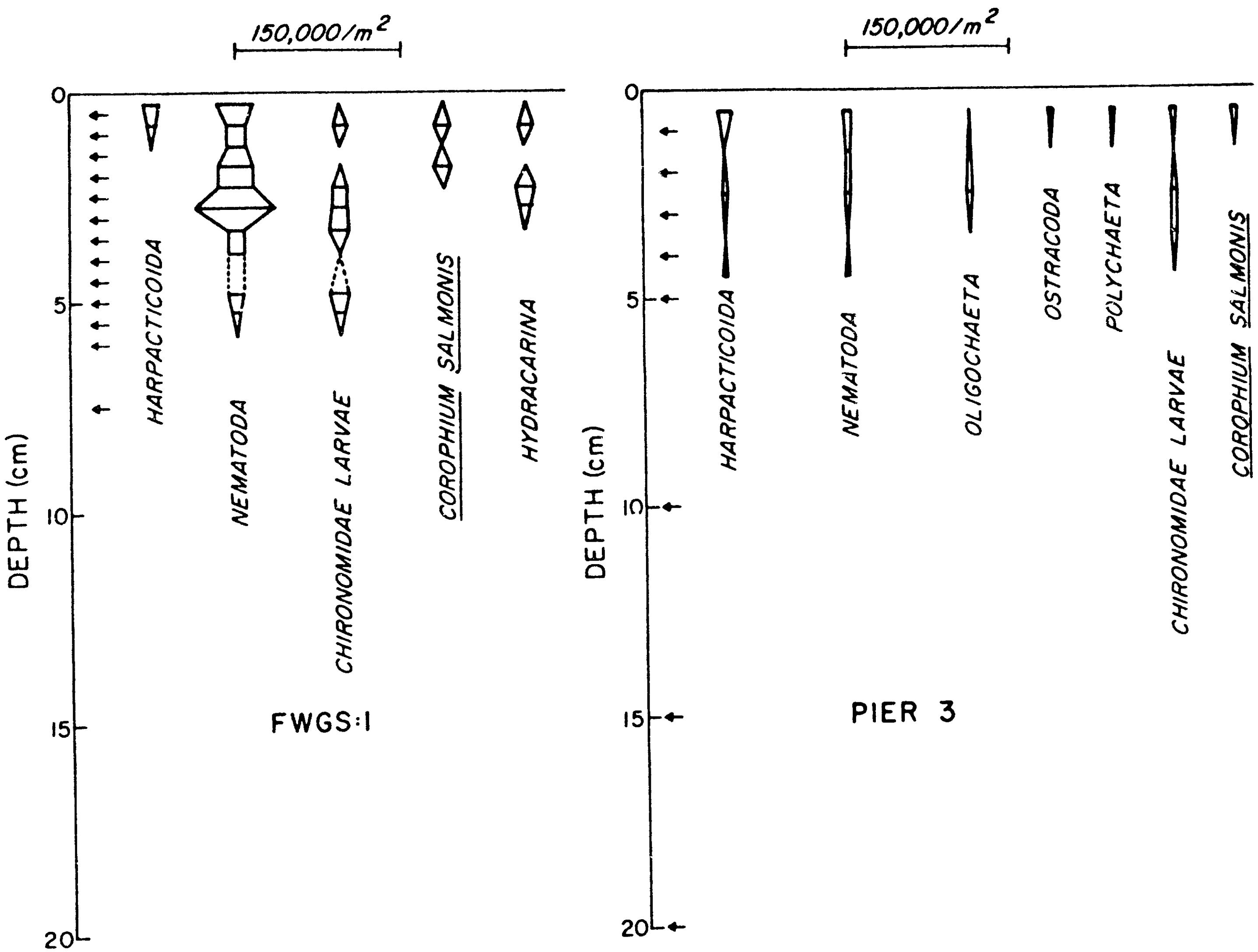

Figure 9. Vertical distributions of benthic infauna at two stations downstream from the causeway, 9 and 10 July 1974. Arrows indicate section intervals. Values were plotted at the center of each section and represent the number of animals found in a 1 cm section beneath 1 m^2 of sediment. Broken lines indicate lost samples. (Location: Appendix Figure 1-5)

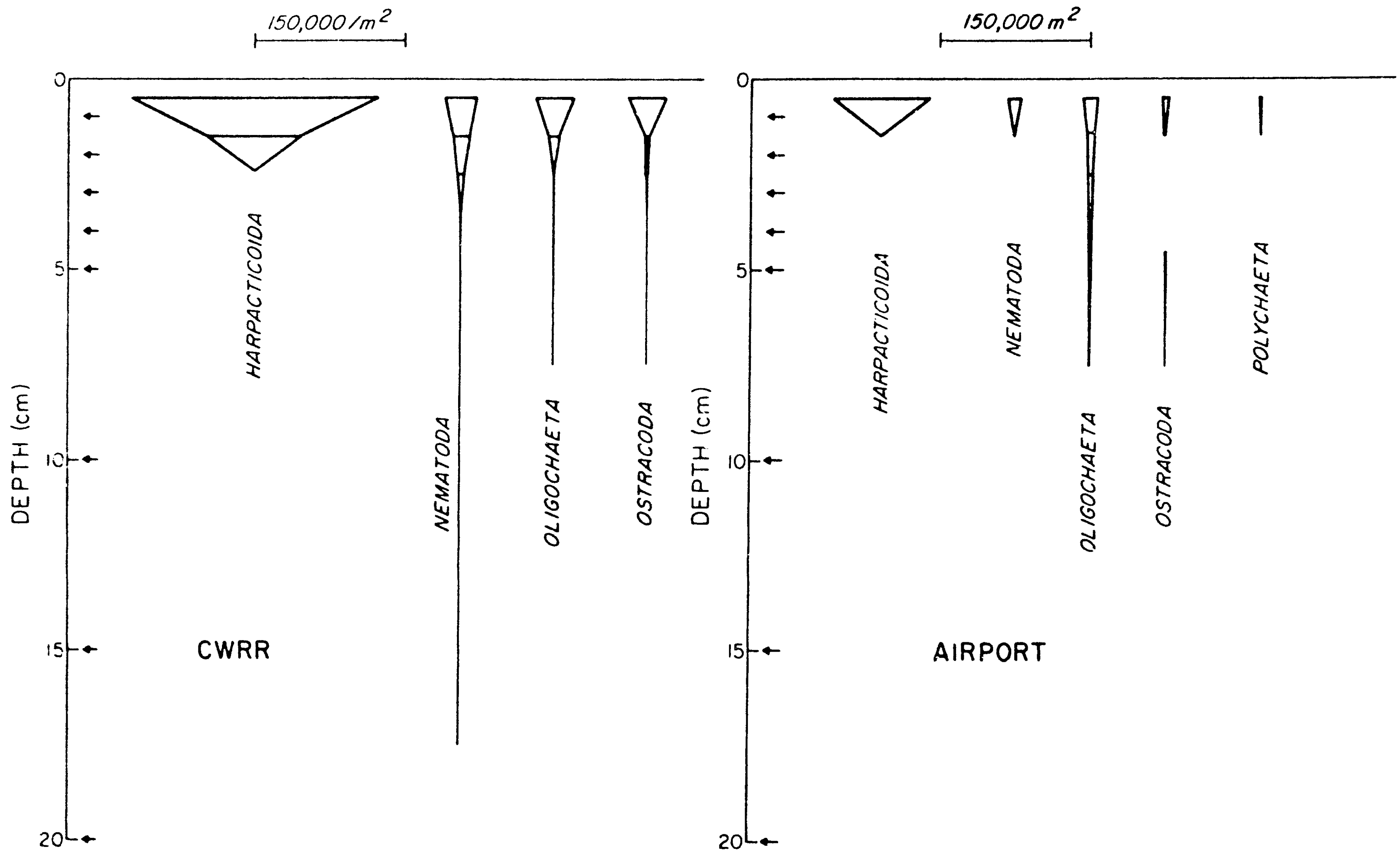

Figure 10. Vertical distributions of benthic infauna at two stations upstream from the causeway, 9 and 10 July 1974. Values for Station CWRR are means from two cores. Arrows indicate section intervals. Values were plotted at the center of each section and represent the number of animals found in a 1 cm section beneath 1 m^2 of sediment. (Location: Appendix Figure 1-5)

6

FISH, EPIBENTHIC SHRIMP, AND DUNGENESS CRABS

METHODS

Bottom Trawling

Bottom trawls were routinely made at three stations (PW, CWRR, and NMFS 1) and occasionally at one station (NMFS 2). Water depth varied from 5 to 20 feet at these locations. In addition to the periodic daytime tows, a diurnal series of tows was made at Station PW on 28 and 29 August 1974. Trawl locations are shown in Appendix Figure 1-6. A 16-foot (headrope length) semi-balloon box trawl was used in most cases. This trawl is made of knotless nylon, with a 1½-inch mesh body, 1¼-inch mesh cod end, and ½-inch mesh cod end liner (stretched measurements). The cod end liner was change to one of ¼-inch mesh on 18 June 1974.

A 16-foot otter trawl was used on 18 April 1974. Its construction and performance are similar to those of the box trawl, and the catch results have been added (with notation) to the box trawl data.

On 10 November 1974 alternate tows were made with the box trawl and a 25-foot otter trawl to investigate possible avoidance by fish of the 16-foot trawls. The 25-foot trawl has the same mesh measurements as the box trawl, but lacks the headrope overhang characteristic of box trawls.

Trawls were towed with a 50-foot bridle, attached to trawl boards, 24 x 14 inches (16-foot trawls) or 34 x 15 inches (25-foot trawl) in size.

Tows were generally five minutes in length, measured from the time the trawl reached bottom (gauged by jerks on the tow cable) to the beginning of ascent. Fish undoubtedly were captured during both descent and ascent; thus, differences in water depth may have affected catch rates. Some tows were longer or shorter than five minutes. Rate-of-catch statistics for these tows were adjusted to that of a five minute tow. For example, the number of starry flounder captured during an eight minute tow was multiplied by the factor 5/8.

Gillnetting

One routine station (Ch 8) and three occasional stations (PW, CWRR, and NMFS 1) were fished with nylon gill nets rigged to dive. A single net was generally fished for two hours during the high slack period.

Initially a 125 x 6 foot net with 1/2, 3/4, 1, 1 1/2, and 2-inch mesh panels (stretched measurements) was used. After 6 March 1974 a 90 x 9 foot net with 4, 3, and 1-1/4-inch mesh panels (stretched measurements) was used.

Seining

Beach seining was conducted at Stations P3 and WAR (Appendix Figure 1-6) using a 171-foot beach seine. The net has a continuously tapered body, composed of 7/8-inch knotted nylon mesh; the bag is made of 1/2-inch knotless mesh (stretched measurements). The seine is set perpendicular to shore with the deep end slightly hooked against the current. The bag, positioned near the shallow (shore-side) end, collects fish traveling with the current. After about 15 minutes, the seine is hand-hauled to shore, deep end first.

The seine was used experimentally with satisfactory success in catching small fish.

Catch Disposition

Fish captured by trawl, gill net, and seine were identified to species and counted. All of the fish captured by seine and gill net, and a variable portion (depending on catch size) of the fish captured by trawl were measured for total length to the nearest centimeter (e.g., fish 14.5 to 15.4 cm were designated 15 cm). These measurements were made in the lab, except for those portions of trawl catches which were returned alive to the bay.

All seine and gill net catches and a subsample representative of the fish species and size classes captured by trawl were fixed in 10% formaldehyde. The fish were taken to Corvallis, and transferred to 40% isopropanol.

All epibenthic shrimp (sand shrimp, *Crangon franciscorum*; and members of the family Mysidae) in each trawl catch were similarly fixed, taken to Corvallis, and transferred to 40% isopropanol. The quantity of shrimp contained in each trawl catch was determined by the following procedure. The displacement volume of shrimp and debris was measured. A subsample of this mixture was then divided into sand shrimp, mysids, and debris fractions, and each fraction was measured for displacement volume. The resulting proportions were applied to the total.

Dungeness crabs captured by trawl were sexed and measured for carapace width.

RESULTS

Bottom Trawling

Periodic Daytime Tows. The fish species captured in greatest abundance by trawl was the starry flounder, which usually comprised 60% or more of each catch (Figures 11, 12, and 13; see Appendix Table 6-1 for a tabular summary of trawl catch data). Distinct seasonal trends or differences among stations were not evident, except that the 1974 year-class may have been more abundant upstream (Stations CWRR and NMFS 1) than downstream at Station PW (Figure 14). The greatest variety of species was captured at Station PW (Figures 11, 12, and 13), which experiences higher salinities than the upstream stations. Shiner perch were more abundant at Station PW, and prickly sculpin at Station NMFS 1, while Pacific staghorn sculpin seemed to show no preference (Figure 15).

The sand shrimp, *Crangon franciscorum*, appeared seasonally abundant at all three stations, while mysid shrimp were more abundant at the upstream stations (Figure 14). Dungeness crabs were captured only at Station PW in early winter (Table 9).

Large starry flounder were more numerous at Station PW than at Station NMFS 1 (Figures 16 and 17). The 1974 year class seemed to appear later and in greater numbers at Station NMFS 1. The histogram modes in Figures 16 and 17 seem to change position at similar rates, suggesting that growth rates were similar at the two stations.

Diurnal Tow Series. Considerable change occurred in the number and types of animals captured during the diurnal series of trawls made at Station PW (Figures 18 and 19). The variety of fish species captured increased during the night and was greatest at dawn just before low tide (Figure 18). Starry flounder of the 1973 year class were captured at the greatest rate near high tide at night. Pacific staghorn sculpin and *Crangon franciscorum* catches increased at night. Other patterns are difficult to interpret, complicated as they are by sampling errors, the schooling behavior of some fish (e.g. shiner perch), tidal cycles, diurnal cycles, and other factors. However, it is apparent that daytime tows capture only a portion of the species which regularly appear at Station PW.

Comparative Tows. Catch statistics for tows made alternately with the 16-foot and 25-foot trawls are presented in Appendix Table 6-1. The comparative performances of the trawls have not yet been analyzed.

Gillnetting

Gill net operations captured more peamouths than other fish species (Tables 10 and 11; see Appendix Table 6-2 for a complete data summary). Shiner perch and Pacific staghorn sculpin were captured in moderate numbers. Highest catch rates occurred in summer. This may have been due to greater swimming activity during the warm-water period; however, trawl catches of peamouths were also highest during the summer (Figures 11, 12, and 13).

Seining

The same fish species were captured by beach seine as were captured by trawl (Table 12; see Appendix Table 6-3 for a complete data summary). The relatively large catches by seine of juvenile American shad and surf smelt emphasize the probable importance of shallow waters to these young fish.

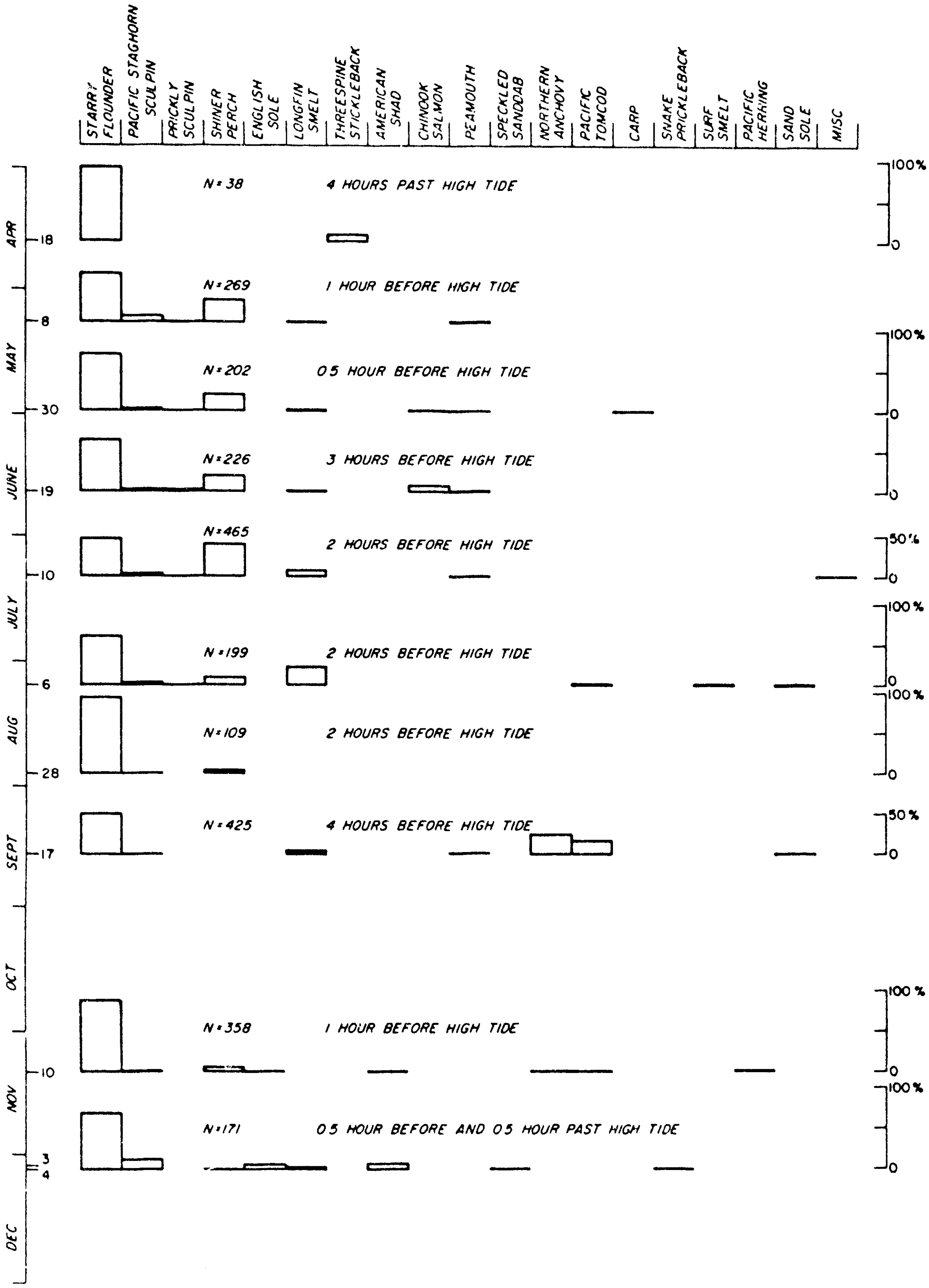

Figure 11. Relative abundances of fish species captured by trawl at Station PW during 1974. The base of each histogram is aligned with date of trawl. Total numbers of fish captured are indicated, along with reference to time of high tide. Catches of 3 December and 4 December were combined to form total catch of 171. A 16-foot box trawl was used on all dates except 18 April, when a 16-foot otter trawl was used. (Location: Appendix Figure 1-6)

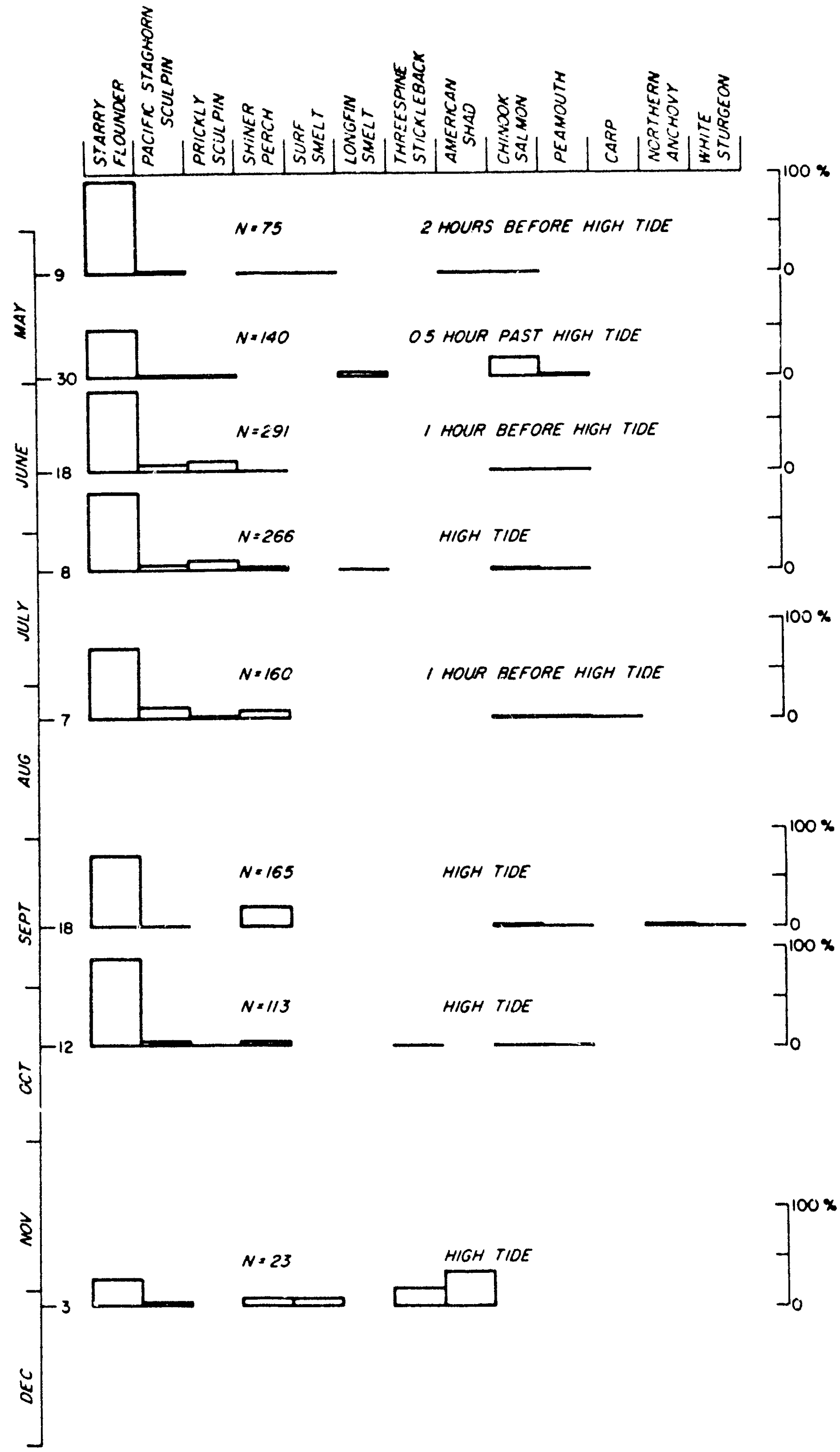

Figure 12. Relative abundances of fish species captured by trawl at Station CWRR during 1974. The base of each histogram is aligned with date of trawl. Total numbers of fish captured are indicated, along with reference to time of high tide. A 16-foot box trawl was used. (Location: Appendix Figure 1-6)

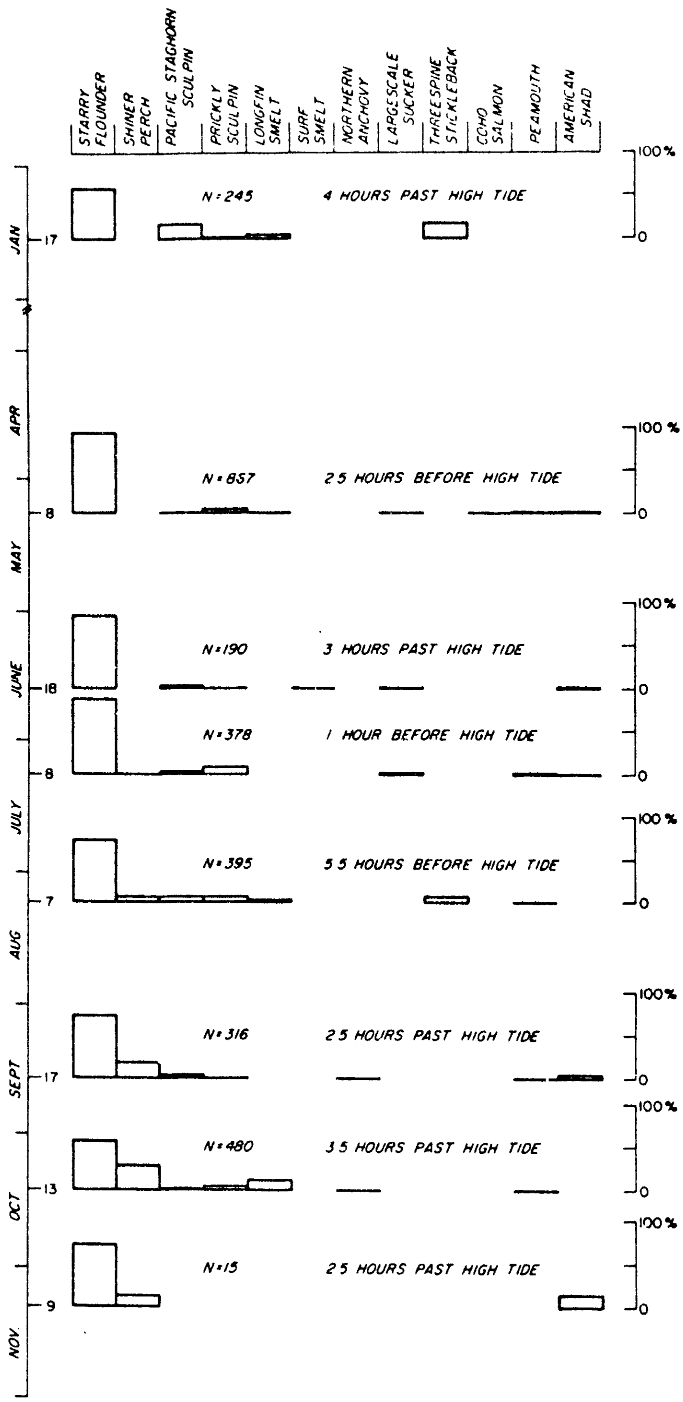

Figure 13. Relative abundances of fish species captured by trawl at Station NMFS 1 during 1974. The base of each histogram is aligned with date of trawl. Total numbers of fish captured are indicated, along with reference to time of high tide. A 16-foot box trawl was used. (Location: Appendix Figure 1-6)

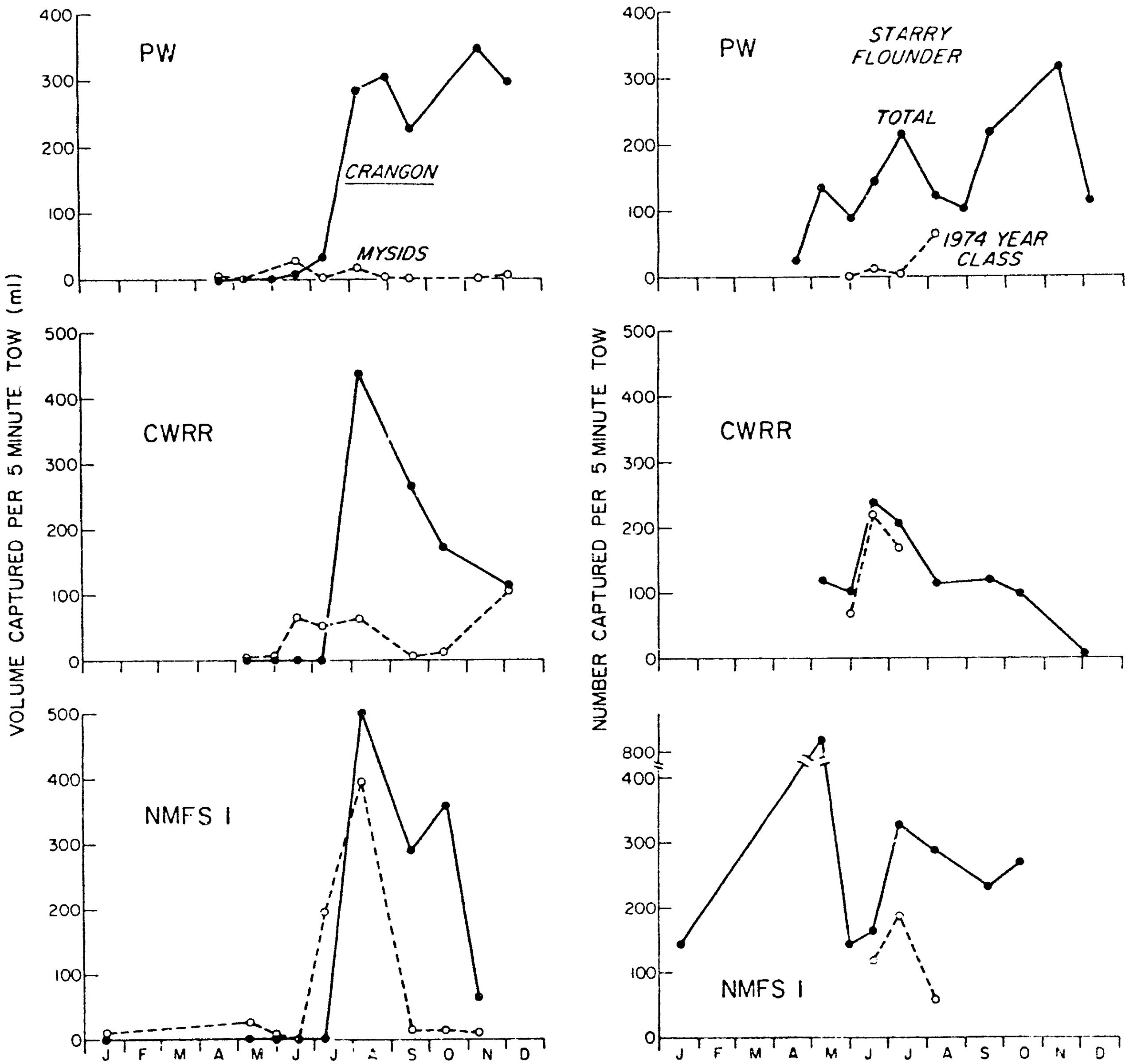

Figure 14. Seasonal changes in trawl catches of flounder and shrimp at three stations during 1974. Tows varied from 2.5 to 12 minutes. A 16-foot box trawl was used. On 18 June, the cod-end liner was changed from a one-half to a one-quarter inch liner (Location: Appendix Figure 1-6)

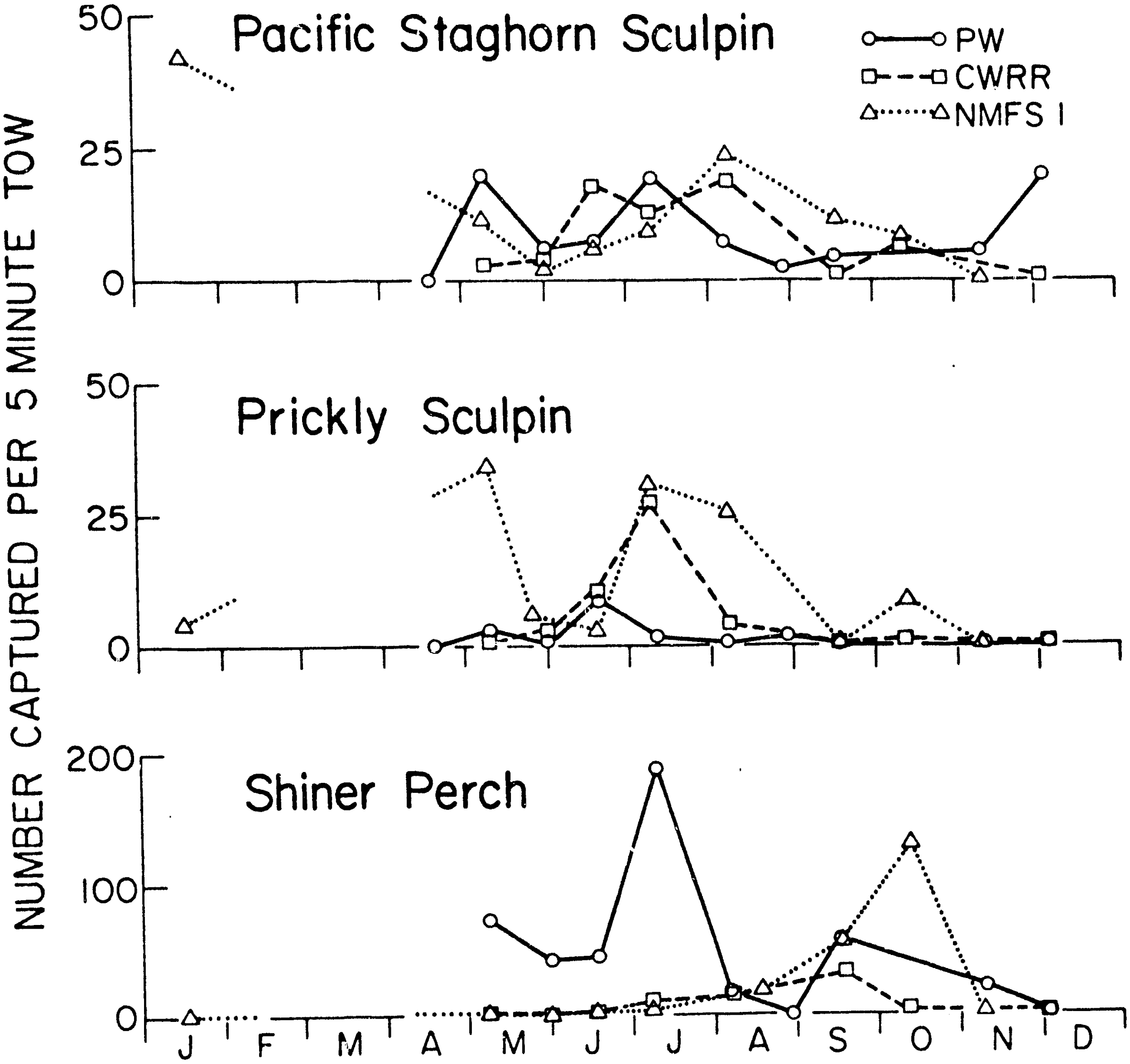

Figure 15. Seasonal changes in trawl catches of Pacific staghorn sculpin, prickly sculpin, and shiner perch at three stations during 1974. Tows varied from 2.5 to 12 minutes. A 16 foot box trawl was used. (Location: Appendix Figure 1-6)

Table 9. Dungeness crabs caught by trawl at Station PW in 1974. Crabs were not captured at other stations or on other dates. Tows were made with the box trawl except those at 0950 and 1240 hours on 10 November, when a 25-foot otter trawl was used. (Location: Appendix Figure 1-6)

Date	Time	Reference to high tide	Number caught Total	Number caught per 5 min. tow	Size (cm) Range	Size (cm) Mean
10 Nov	1315	3.5 hrs past	1	2.5	12	
10 Nov	0950	High	2	2.0	11-13	
10 Nov	1240	3 hrs past	2	5.0	11	
3 Dec	1500	0.5 hrs before	7	7.0	10-13	11.4
4 Dec	1700	0.5 hrs past	7	5.0	9-15	11.1
5 Dec	1000	4 hrs past	7	4.4	no data	
5 Dec	1020	4.5 hrs past	7	8.8	no data	

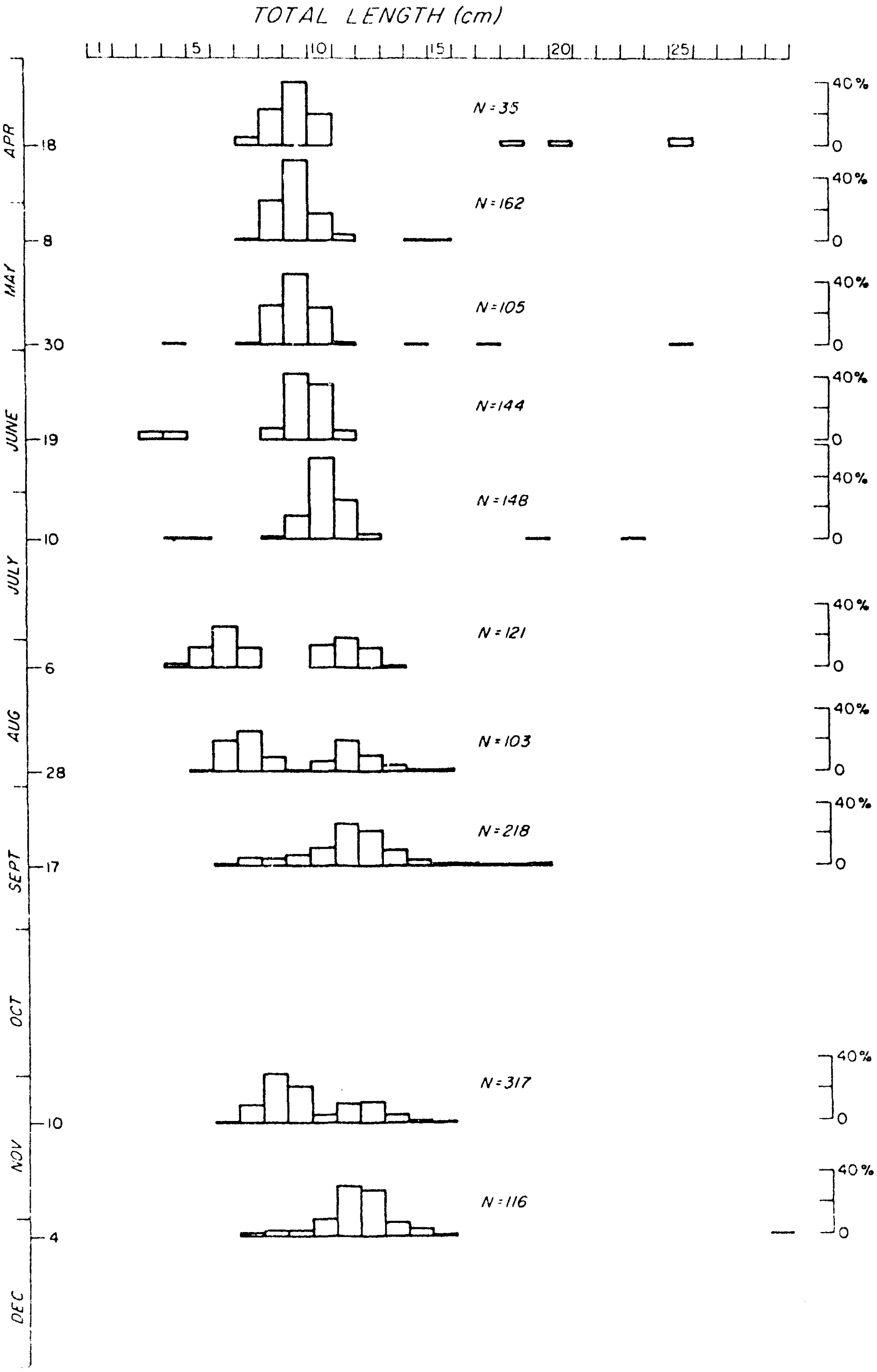

Figure 16. Length-frequency histograms for starry flounder captured by trawl at Station PW during 1974. The base of each histogram is aligned with date of trawl. The 1974 year class first appeared in the 30 May trawl. Numbers of flounder caught are indicated. A 15-foot box trawl was used on all dates except 18 April, when a 16-foot otter trawl was used. (Location: Appendix Figure 1-6)

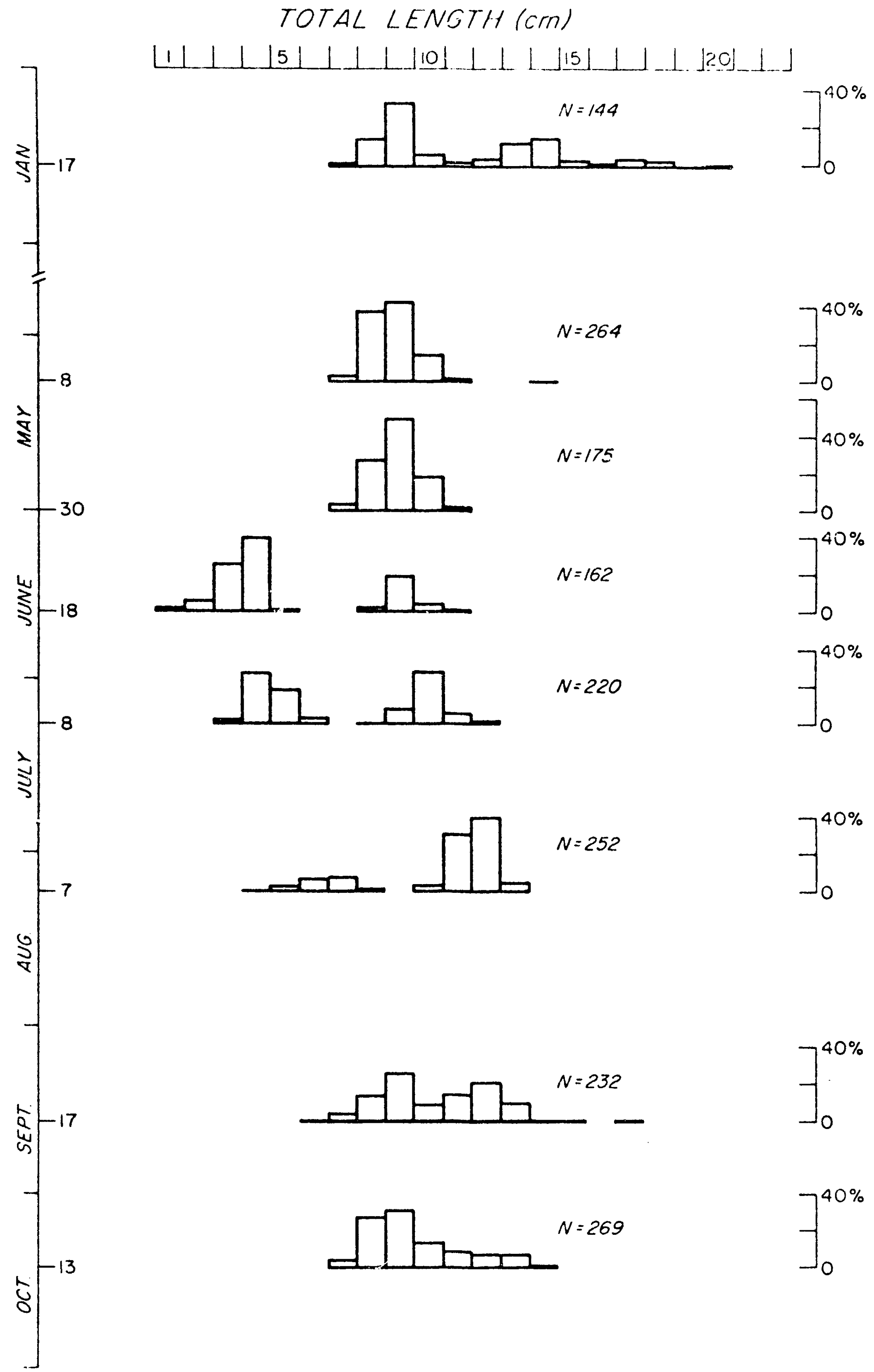

Figure 17. Length-frequency histograms for starry flounder captured by trawl at Station NMFS 1 during 1974. The base of each histogram is aligned with date of trawl. The 1974 year-class first appeared in the 18 June trawl. Numbers of flounder caught are indicated. A 16-foot box trawl was used. (Location: Appendix Figure 1-6)

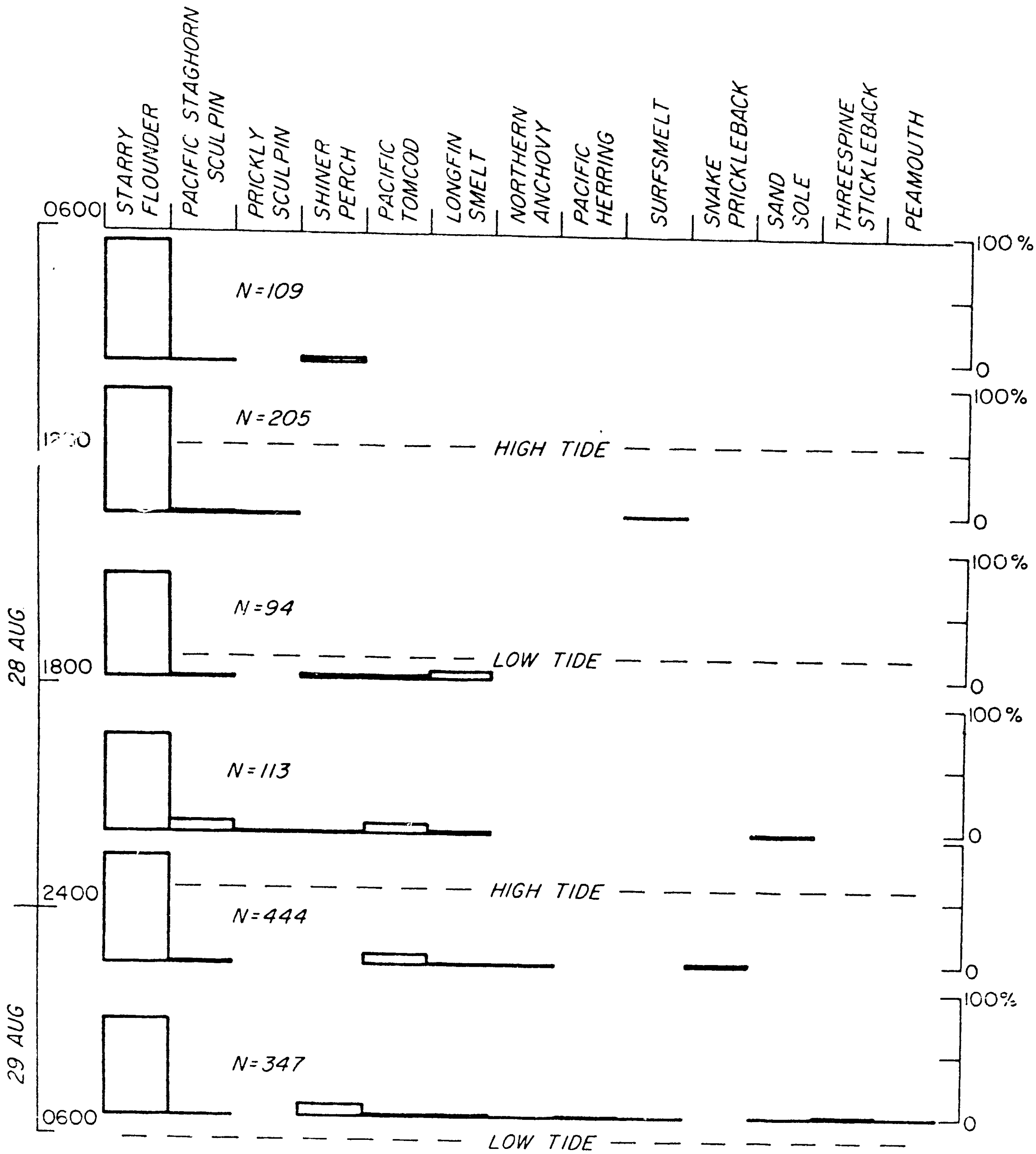

Figure 18. Relative abundances of fish species captured at Station PW during a diurnal series of trawls on 28 and 29 August 1974. The base of each histogram is aligned with date of trawl. Total catch size and times of high and low tide are indicated. A 16-foot box trawl was used. (Location: Appendix Figure 1-6)

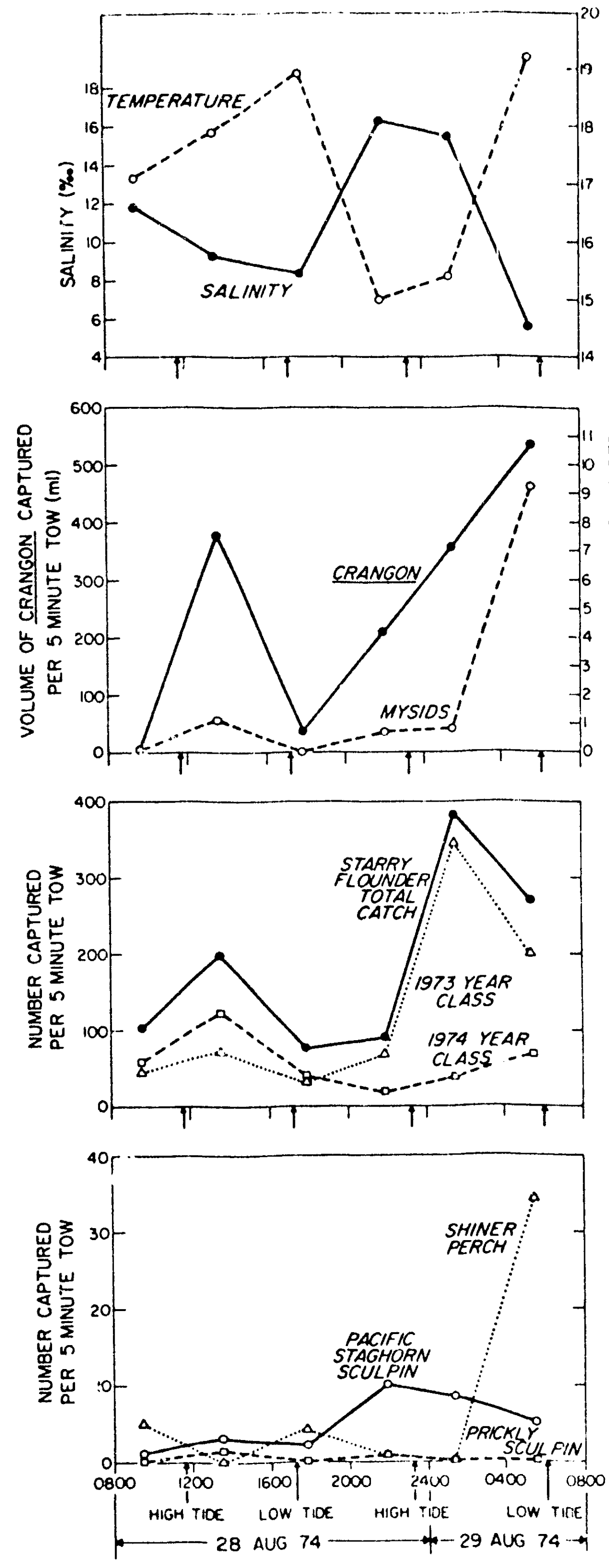

Figure 19. Changes in bottom temperature and salinity, and numbers of shrimp and selected fish species captured by trawl at Station PW. During the diurnal series on 28 and 29 August 1974, six tows were made with a 16-foot box trawl. Bottom depth varied from 2 to 5 meters. (Location: Appendix Figure 1-6)

Table 10. Number of fish caught per hour of gill net operation at Station Ch 8 during 1974. A 90-foot multifilament nylon net was used, except on 6 February and 6 March when a 125-foot monofilament nylon net was used. (Location: Appendix Figure 1-6)

Date	Time set	Reference to high tide	Length of set (hrs.)	Carp	Largescale sucker	Northern anchovy	Pacific staghorn sculpin	Peamouth	Prickly sculpin	Shiner perch	Starry flounder	TOTAL
6 Feb	1050	1.5 hrs before	1.83									0
6 Mar	1325	2 hrs past	2.25				0.4				0.9	1.3
30 May	0825	1 hr before	2.33	0.4	4.7			3.4				8.5
19 June	1226	1.5 hrs before	2.48		0.4		0.8	16.9		1.2	2.4	21.7
8 July	1525	1.5 hrs before	2.58		1.5		1.9	6.6		0.4		10.4
7 Aug	1055	6 hrs before	1.83				0.5	11.5	0.5	5.5		18.0
27 Aug	0930	1.5 hrs before	2.33		3.0		1.3	13.3		1.3	1.3	20.2
17 Sept	1400	1 hr before	2.50			8.8	0.4	12.8		4.0	0.8	26.8
13 Oct	1120	1 hr before	2.41				0.4	23.6	1.2	0.8		26.0
9 Nov	0815	1 hr before	2.50				2.0					2.0
3 Dec	1420	1 hr before	2.00								0.5	0.5

Table 11. Number of fish caught per hour of gill net operation at three stations during 1974. A 90-foot multifilament nylon net was used. (Location: Appendix Figure 1-6)

Date	Time Set	Reference to high tide	Length of set (hrs.)	American shad	Carp	Coho salmon	Largescale sucker	Longfin smelt	Northern anchovy	Pacific staghorn sculpin	Peamouth	Prickly sculpin	Shiner perch	Starry flounder	Surf smelt	White sturgeon	TOTAL
STATION: PW																	
29 May	1340	5 hrs past	2.08	0.5	1.0	0.5	3.8				19.7			0.5			26.0
10 July	1700	1 hr before	1.67				0.6			2.4	5.4						8.4
28 Aug	1435	High	2.00								2.5		0.5	0.5	0.5		4.0
10 Nov	0840	1 hr before	3.00							0.7			12.7	3.3			16.7
STATION: CWRR																	
18 June	1130	2 hrs before	2.50				0.8			3.6	5.2		3.2	0.4			13.2
18 Sept	1430	1 hr before	2.75						9.4	0.7	2.2		6.5	0.7		0.4	19.9
12 Oct	1025	1 hr before	3.33						0.3	0.3	1.8		2.1				4.5
STATION: NMFS 1																	
28 May	1522	5 hrs before	2.05				1.0				14.6			0.5			16.1
29 May	0837	High	2.55				0.8			0.4	0.8			1.2			3.2
6 Aug	0910	6 hrs past	1.83				2.7	0.5		0.5	47.0	0.5	1.6				53.0

Table 12. Catch by seine at Stations P3 and WAR, 27 August to 11 November 1974. A 171-foot beach seine was used. (Location: Appendix Figure 1-6)

Date	Time	Reference to high tide	American shad	Carp	Chinook salmon	Largescale sucker	Pacific staghorn sculpin	Peamouth	Shiner perch	Starry flounder	Surf smelt	Threespine stickleback	TOTAL
STATION: P3													
27 Aug	1510	5.5 hrs past			1		4	1	7	12		2	27
12 Oct	1530	4 hrs past	16	1	7				19	15		28	79
11 Nov	0945	1 hr before	35			6					118	2	168
STATION: PW 5													
27 Aug	1700	5 hrs before		9			7	29	13	16			74

7

CONTENTS OF FISH STOMACHS

METHODS

Fish to be examined for stomach contents were taken from preserved portions of trawl catches made at Stations PW and NMFS 1. The composition (in terms of fish species and size classes) of the subsample examined for stomach contents was approximately the same as the composition of the trawl catch.

Stomachs were excised and placed in separately labeled vials, and later examined under a stereoscopic microscope. The fullness of each stomach and the percent contribution of each food type to the total contents was estimated visually. Stomach fullness varied considerably with individuals and season. Therefore, the "fraction-of-contents" values may be misleading when considering the contributions of various food types to fish growth. For this reason, another variable is also presented: "fraction of maximum stomach volume", which is computed by multiplying "fraction of contents" times "stomach fullness".

RESULTS

The seasonal food habits of the most frequently captured fish are shown in Figure 20 (Station PW) and Figure 21 (Station NMFS 1). *Corophium* was heavily preyed upon, especially by juvenile chinook salmon, and by starry flounder during the period of rapid growth (June-September).

The overall pattern of food selection by the mixed-species population shows that *Corophium* was eaten more frequently at Station NMFS 1 than at Station PW (Table 13). The heavy consumption of bivalves at Station PW included whole clams (*Macoma*) as well as clam siphons bitten off by young flounder. Mean stomach fullness was greatest during the summer, and was consistently higher at Station NMFS 1 than at Station PW.

The general prevalance of benthic forms over planktonic forms (e.g., calanoid and cyclopoid copepods) in these results may be related both to method of fish collection (bottom trawl) and to the abundance of benthic life in this shallow-water estuary.

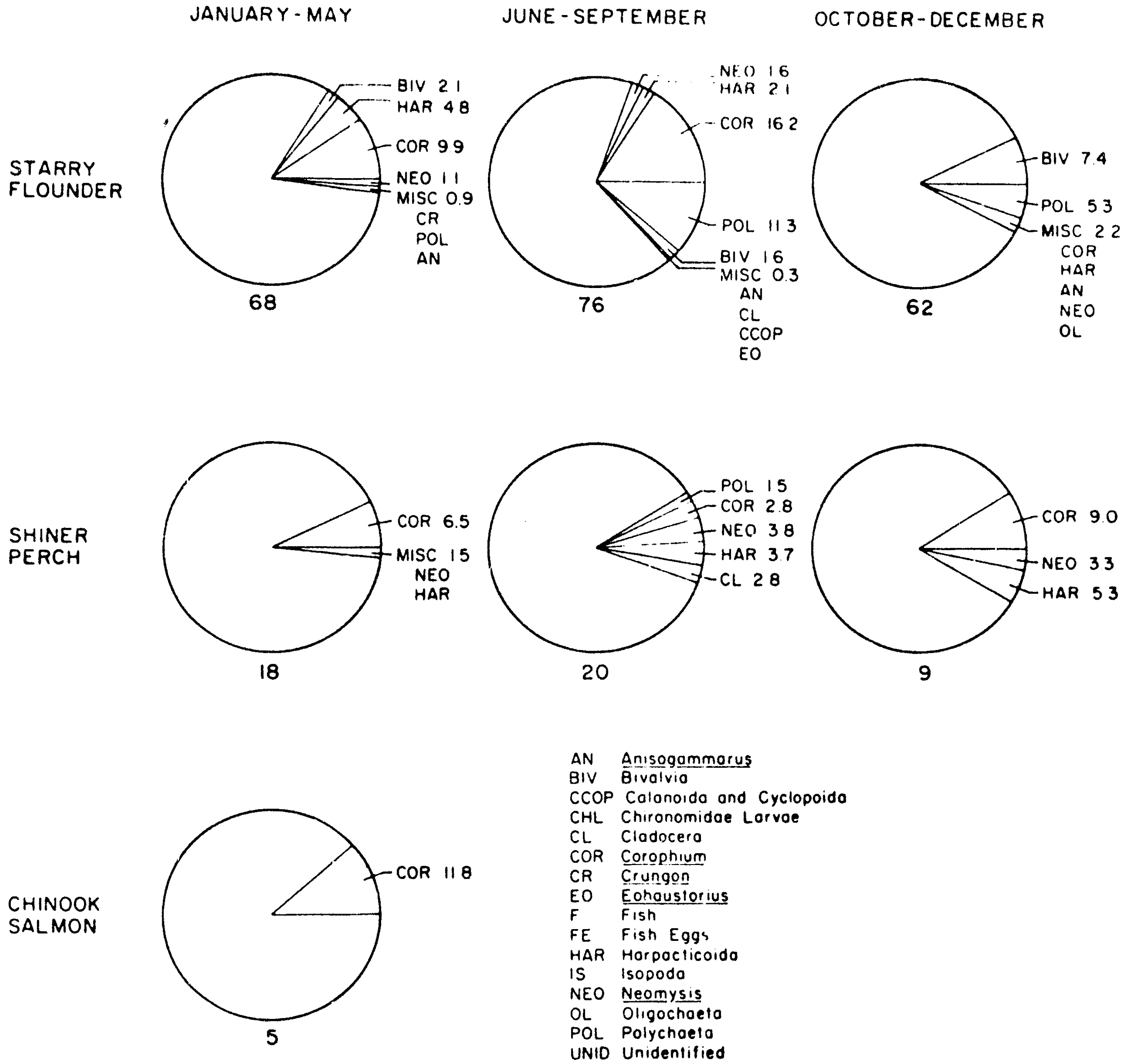

Figure 20A. Contributions of food types to stomach contents of starry flounder, shiner perch and chinook salmon captured by trawl at Station PW. Contributions are represented as fractions of maximum stomach volume. This representation shows the fraction of the stomach which was empty, and is helpful in showing seasonal changes in food habits, where the consumption rate undergoes seasonal cycles. (Location: Appendix Figure 1-6)

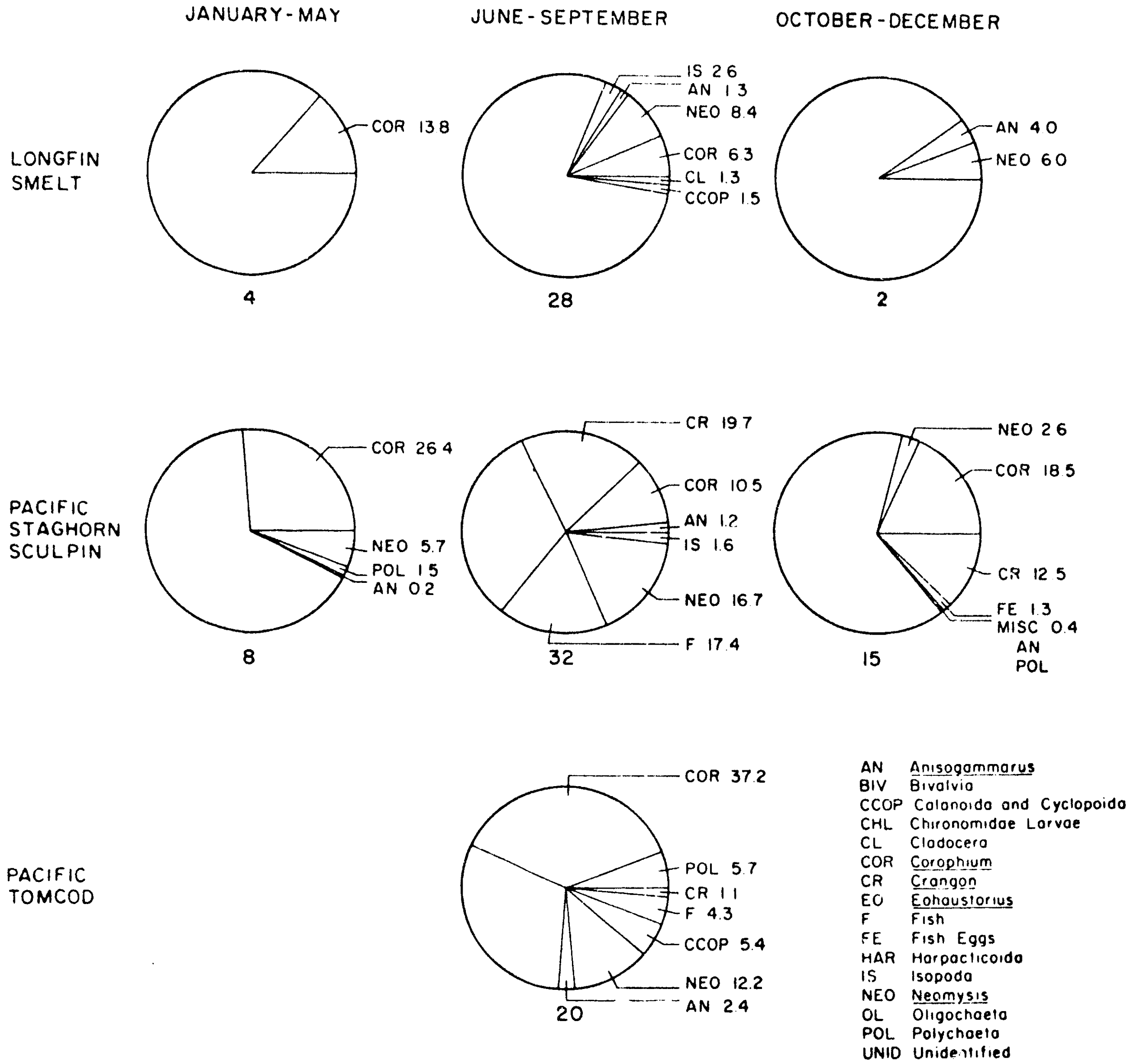

Figure 20B. Contributions of food types to stomach contents of longfin smelt, Pacific staghorn sculpin and Pacific tomcod captured by trawl at Station PW. Contributions are represented as fractions of maximum stomach volume. This representation shows the fraction of the stomach which was empty, and is helpful in showing seasonal changes in food habits, where the consumption rate undergoes seasonal cycles. (Location: Appendix Figure 1-6)

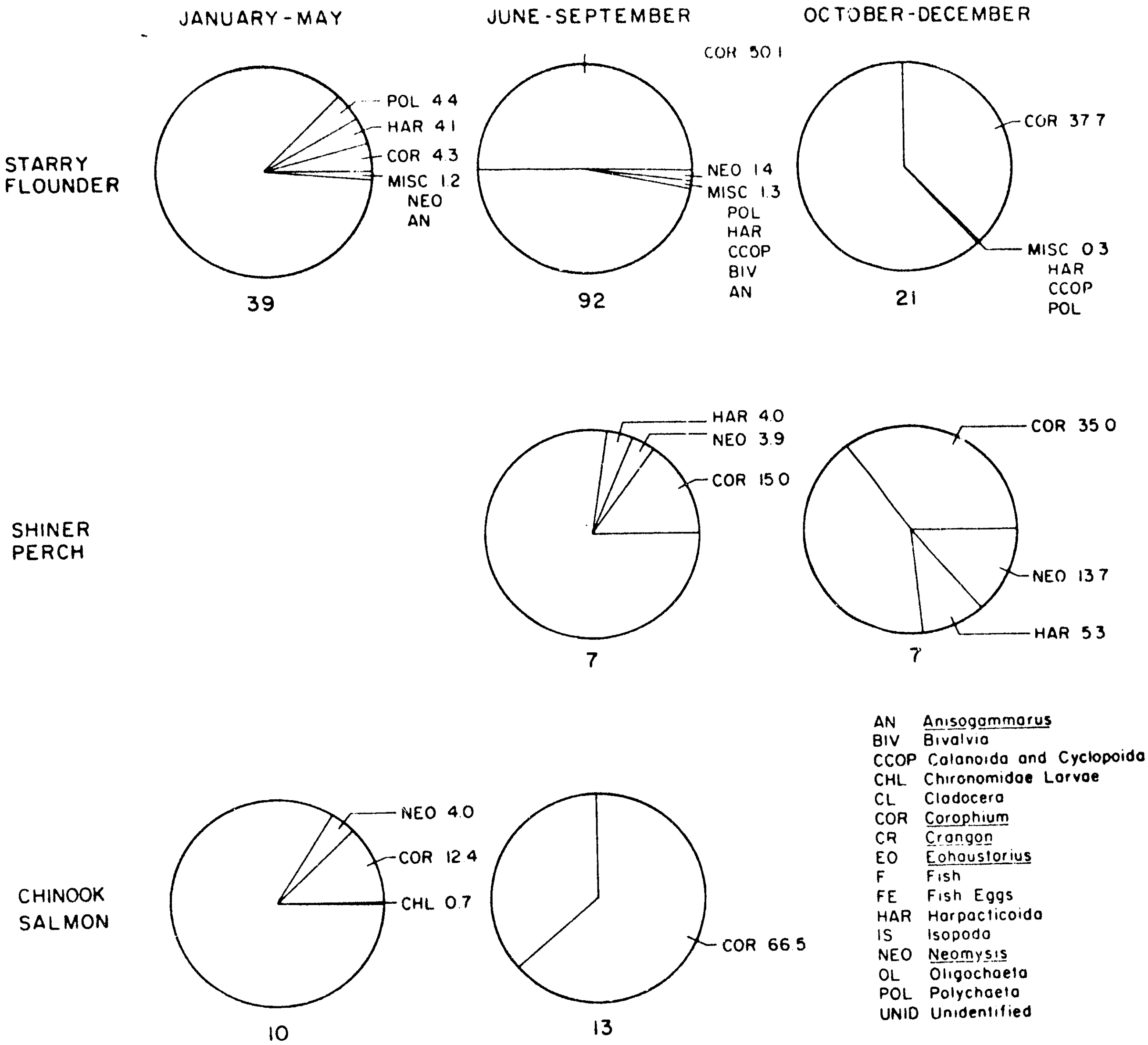

Figure 21A. Contributions of food types to stomach contents of starry flounder, shiner perch and chinook salmon captured by trawl at Station NMFS 1. Contributions are represented as fractions of maximum stomach volume. This representation shows the fraction of the stomach which was empty, and is helpful in showing seasonal changes in food habits, where the consumption rate undergoes seasonal cycles. (Location: Appendix Figure 1-6)

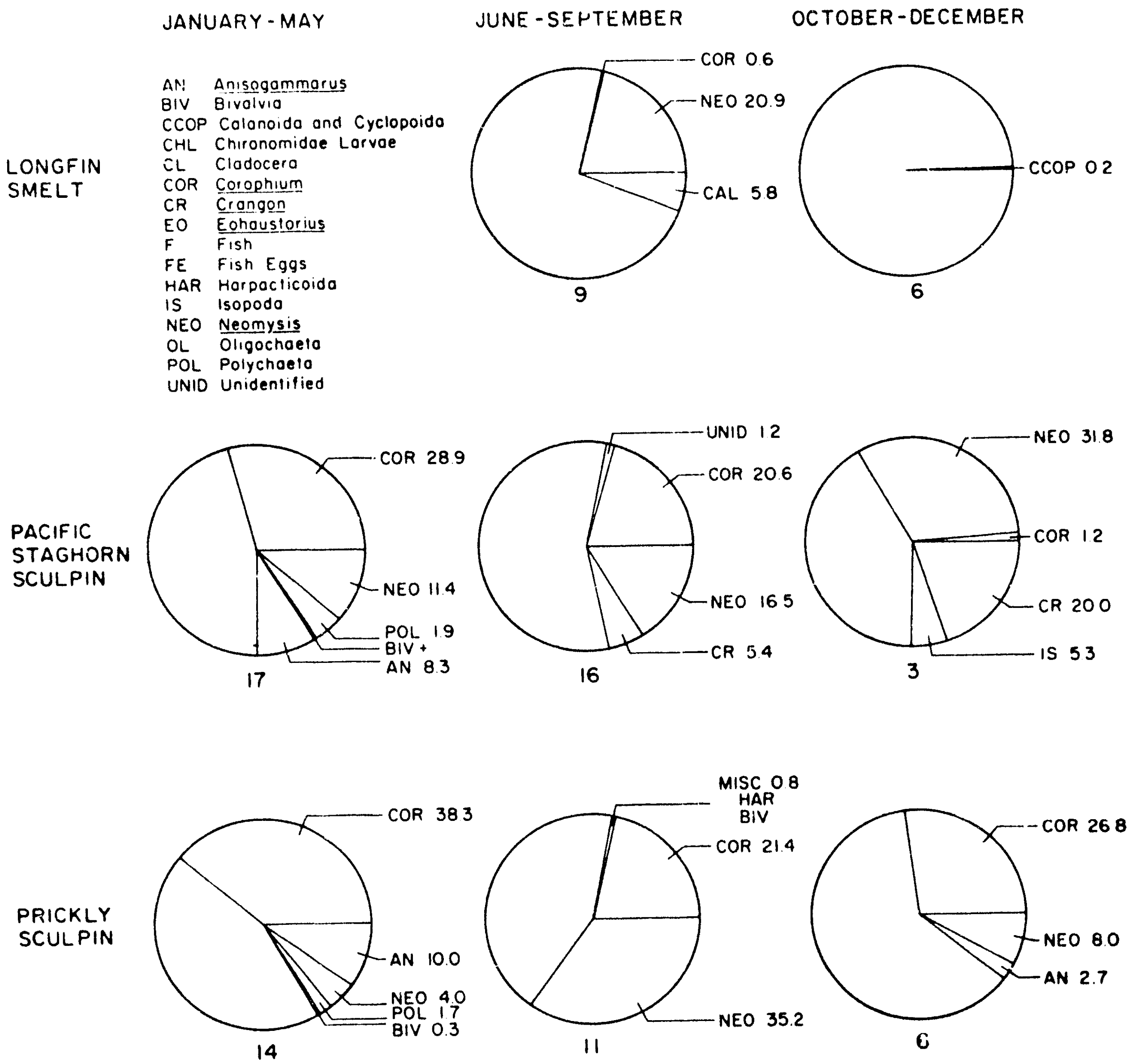

Figure 21B. Contributions of food types to stomach contents of longfin smelt, Pacific staghorn sculpin and prickly sculpin captured by trawl at Station NMFS 1. Contributions are represented as fractions of maximum stomach volume. This representation shows the fraction of the stomach which was empty, and is helpful in showing seasonal changes in food habits, where the consumption rate undergoes seasonal cycles. (Location: Appendix Figure 1-6)

Table 13 Mean contributions of various food types to stomach contents of fish captured at Stations PW and NMFS 1. The values approximately represent the seasonal importance of each food type to the mixed-species population of fish sampled by trawling. (Location: Appendix Figure 1-6)

Food	Station	Mean fraction of stomach contents (%)		
		Jan-May	June-Sept	Oct-Dec
Amphipoda				
Corophium	PW	62.9	32.8	18.0
	NMFS 1	52.5	74.3	74.2
Anisogammarus	PW	1.4	2.3	5.9
	NMFS 1	7.6	+	0.7
Copepoda				
Harpacticoida	PW	19.1	5.7	6.8
	NMFS 1	18.8	0.8	1.9
Calanoida &	PW	2.8	5.5	0.7
Cyclopoida	NMFS 1	0	3.1	6.2
Decapoda				
Crangon	PW	0.7	4.8	4.2
	NMFS 1	0	1.0	2.1
Mysidacea				
Neomysis	PW	6.4	17.5	12.2
	NMFS 1	9.7	18.4	10.0
Polychaeta	PW	1.2	13.6	10.5
	NMFS 1	10.0	0.6	1.2
Mollusca				
Bivalvia	PW	3.6	4.1	37.3
	NMFS 1	10.3	0.1	0
Fish	PW	0	4.3	0
	NMFS 1	0	0	0
Mean fullness	PW	20.0	39.4	17.6
	NMFS 1	33.5	51.8	37.8

+ indicates trace amount

APPENDIX TABLES

Table 1-1. Checklist of invertebrate fauna captured in Youngs Bay, Skipanon Waterway, Youngs River, Lewis and Clark River, and Columbia River during 1974.*

Phylum Nemertinea

Phylum Nematoda

Phylum Annelida
- Class Hirudinea
- Class Oligochaeta
- Class Polychaeta
  - Subclass Errantia
    - Family Nereidae
      - *Neanthes diversicolor*
  - Subclass Sedentaria
    - Family Ampharetidae
      - *Amphicteis* sp.

Phylum Mollusca
- Class Bivalvia
  - Family Cyrenidae
    - *Corbicula fluminea*
  - Family Tellenidae
    - *Macoma inconspicua*

Phylum Arthropoda
- Subphylum Chelicerata
  - Class Arachnida
    - Order Hydracarina
- Subphylum Mandibulata
  - Class Insecta
    - Order Diptera
      - Family Chironomidae
  - Class Crustacea
    - Subclass Branchiopoda
      - Order Diplostraca
        - Suborder Cladocera
          - Family Bosminidae
            - *Bosmina* sp.
          - Family Chydoridae
            - *Eurycercus lamellatus*
          - Family Daphnidae
            - *Daphnia* sp.
          - Family Polyphemidae
            - *Podon* sp.

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* Classification based on Light, et al. (1961), Meglitch (1972), and Pennak (1953).

Table 1-1. (cont.)

Subclass Ostracoda
Subclass Copepoda
- Order Calanoida
  - Family Centropagidae
    - *Centropages* sp.
  - Family Diaptomidae
    - *Diaptomus* sp.
  - Family Eucalanidae
    - *Rhincalanus* sp.
  - Family Temoridae
    - *Epischura* sp.
    - *Eurytemora hirundoites*
- Order Cyclopoida
  - Family Cyclopoidae
    - *Cyclops* sp.
  - Family Oithonidae
    - *Oithona similis*
- Order Harpacticoida
  - Family Canuellidae
    - *Canuella canadensis*
  - Family Ectinosomidae
    - *Ectinosoma* sp.
  - Family Cletodidae
    - *Huntemannia jadensi*

Subclass Cirrepedia
Subclass Malacostraca
- Superorder Peracarida
  - Order Mysidacea
    - Family Mysidae
      - *Neomysis mercedis*
  - Order Isopoda
    - Suborder Flabellifera
      - Family Sphaeromatidae
        - *Gnorimosphaeroma oregonsis*
    - Suborder Valvifera
      - Family Idoteidae
        - *Mesidotea (Saduria) entomon*
  - Order Amphipoda
    - Suborder Gammaridea
      - Family Corophiidae
        - *Corophium salmonis*
      - Family Gammaridae
        - *Anisogammarus confervicolus*
        - *Anisogammarus* sp.
      - Family Haustoriidae
        - *Eohaustorius estuarius*
      - Family Phoxocephalidae
        - *Paraphoxus milleri*

Table 1-2. Checklist of fish species captured in Youngs Bay, 1974.*

COMMON NAME	SCIENTIFIC NAME	FAMILY
American shad	*Alosa sapidissima* (Wilson)	Clupeidae
Carp	*Cyprinus carpio* Linnaeus	Cyprinidae
Chinook salmon	*Oncorhynchus tshawytscha* (Walbaum)	Salmonidae
Coho salmon	*Oncorhynchus kisutch* (Walbaum)	Salmonidae
English sole	*Parophrys vetulus* Girard	Pleuronectidae
Largescale sucker	*Catostomus macrocheilus* Girard	Catostomidae
Longfin smelt	*Spirinchus thaleichthys* (Ayres)	Osmeridae
Northern anchovy	*Engraulis mordax* Girard	Engraulidae
Pacific lamprey	*Entosphenus tridentatus* (Gairdner)	Petromyzontidae
Pacific herring	*Clupea harengus pallasi* Valenciennes	Clupeidae
Pacific staghorn sculpin	*Leptocottus armatus* Girard	Cottidae
Pacific tomcod	*Microgadus proximus* (Girard)	Gadidae
Peamouth	*Mylocheilus caurinus* (Richardson)	Cyprinidae
Prickly sculpin	*Cottus asper* Richardson	Cottidae
Ringtail snailfish	*Liparis rutteri* (Gilbert and Synder)	Cyclopteridae
Sand sole	*Psettichthys melanostictus* Girard	Pleuronectidae
Shiner perch	*Cymatogaster aggregata* Gibbons	Embiotocidae
Snake prickleback	*Lumpenus sagitta* Wilimovsky	Stichaeidae
Speckled sanddab	*Citharichthys stigmaeus* Jordan and Gilbert	Bothidae
Starry flounder	*Platichthys stellatus* (Pallas)	Pleuronectidae
Steelhead trout	*Salmo gairdneri* Richardson	Salmonidae
Surf smelt	*Hypomesus pretiosus* (Girard)	Osmeridae
Threespine stickleback	*Gasterosteus aculeatus* Linnaeus	Gasterosteidae
White sturgeon	*Acipenser transmontanus* Richardson	Acipenseridae

* Based on American Fisheries Society (1970).

Table 2-1. Vertical temperature series taken during 1974. Depth is measured surface to bottom. (Location: Appendix Figure 1-1)

STATION: ENTRANCE TO YOUNGS BAY

Temperature (°C)

Depth (m)	18 Apr	8 May	29 May	19 June	10 July	5 Aug	27 Aug	17 Sept	13 Oct	11 Nov	4 Dec
0	9.7	12.6	13.5	16.6	17.0	19.5	20.3	18.1	15.4	11.2	8.7
1	9.8				17.1						
2	9.7	12.6	13.7	16.4	16.9	19.6	19.5	15.5	14.5	11.3	8.6
3	9.7				16.5						
4	9.8	12.6		16.5	16.4	17.3	18.2	13.1	13.3	10.9	9.0
5	9.7				16.5						
6	9.7	12.6	13.5	16.8	16.2	15.8	16.4	13.2	11.2	10.9	9.2
7	9.6				16.1						
8	9.9	12.6		16.1	16.0	15.7	13.9	13.2	10.7	10.9	9.7
9	10.4			15.7	15.8						
10	9.6	12.6	12.2		15.5	10.9	13.5	12.8	10.5	11.1	9.7
11					15.5		13.2	12.2			
12		12.7	12.0		15.6	11.0			10.5	10.9	9.7
13											9.7

STATION: CAUSEWAY

Temperature (°C)

Depth (m)	18 Apr	8 May	29 May	19 June	10 July	5 Aug	27 Aug	17 Sept	13 Oct	11 Nov	4 Dec
0	9.7	12.8	13.8	16.7	16.8	19.6	19.8	17.9	14.9	11.3	8.6
1	9.8				16.8						
2	9.7	12.8	13.7	16.2	16.7	19.7	19.1	17.9	14.6	11.3	8.9
3	9.9				16.9						
4	9.6	12.8	13.6	16.2	16.7	19.8	17.5	15.7	13.5	11.1	9.1
5	9.8				16.6	19.6	17.6				
6		12.8	13.8	16.2	16.7			14.9	13.2	11.0	9.1
7					16.6						
8				15.9						11.1	
9										10.9	

Table 2-1. (continued)

STATION: MOUTH OF YOUNGS RIVER

Temperature (°C)

Depth (m)	18 Apr	8 May	29 May	19 June	10 July	5 Aug	27 Aug	17 Sept	13 Oct	11 Nov	4 Dec
0	10.6	13.4	13.8	17.0	16.9	20.7	20.3	19.6	15.5	10.9	8.8
1	10.4										
2	10.5	13.1	13.5		16.9	20.6	19.4	19.5	15.2	11.2	8.8
3	10.2										
4	10.0				16.9	20.6	19.4	18.0	15.0	11.2	8.9
5	10.0										
6	10.2	12.9	13.5		16.9	20.6	19.2	17.9	14.9	11.2	8.8
7	10.1										
8	10.1				17.0	20.7	19.1	17.9	14.7	11.2	8.8
9	10.3										
10	10.1	12.8	13.5		17.1	20.4	18.9	17.9	14.8	11.2	8.9
11	10.1										
12			13.5		17.1	20.3		17.9	14.7	11.2	
13										11.2	
14		12.8									

STATION: MOUTH OF LEWIS AND CLARK RIVER

Temperature (°C)

Depth (m)	18 Apr	8 May	29 May	19 June	10 July	5 Aug	27 Aug	17 Sept	13 Oct	11 Nov	4 Dec
0	10.1	13.1	14.5	16.2	17.2	20.8	21.1	19.7	15.6	11.2	8.9
1	10.0				17.2						
2	9.9	13.1	13.8	16.6	17.4	20.9	19.5	18.9	14.8	11.1	9.0
3	9.9				17.5						
4	10.0	13.1	13.9	16.9		20.7	19.3		14.8	11.0	8.9
5	9.9						19.2	18.3			
6		13.1	13.6			20.6			14.7	11.3	8.9
7											9.0

Table 2-2. Vertical salinity series taken during 1974. Depth is measured surface to bottom. Readings for 8 May are probably inaccurate due to malfunction of salinometer. (Location: Appendix Figure 1-1)

STATION: ENTRANCE TO YOUNGS BAY

Salinity (‰)

Depth (m)	18 Apr	8 May	29 May	19 June	10 July	5 Aug	27 Aug	17 Sept	13 Oct	11 Nov	4 Dec
0	0.4	0	0	0	0.4	5.5	3.9	8.8	5.7	5.8	14.8
1	0.4				0.4						
2	0.4	0	0	0	0.4	5.4	5.0	17.8	9.3	7.6	5.2
3	2.0				0.9						
4	3.0	0		0	1.2	10.4	9.1	22.4	14.8	18.3	11.2
5	3.3		0		1.3						
6	4.1	0		0	2.6	14.7	13.5	23.2	22.7	23.0	14.6
7	5.0				3.3						
8	6.5	0		1.1	3.7	16.7	20.8	23.3	24.7	26.6	23.2
9	7.7			3.1	5.2						
10	12.6	0	12.8		5.7	26.3	21.5	24.6	25.7	27.4	23.6
11					5.8		22.7	25.8		27.3	
12		0	16.1		5.8	26.2			26.8		23.5
13											24.2

STATION: CAUSEWAY

Salinity (‰)

Depth (m)	18 Apr	8 May	29 May	19 June	10 July	5 Aug	27 Aug	17 Sept	13 Oct	11 Nov	4 Dec
0	0.3	0	0	0	0.6	4.7	4.6	10.0	6.3	4.4	5.8
1	0.6				0.6						
2	0.6	0	0	0	0.6	4.7	6.6	10.3	9.7	8.1	8.0
3	0.6				0.6						
4	0.8	0	0	0	0.9	5.2	10.4	15.8	13.0	14.0	13.1
5	0.7				1.2	5.4	10.6				
6		0	0	0	1.2			18.0	15.2	16.6	14.9
7					1.2						
8				0						17.3	
9										17.2	

Table 2-2. (continued)

STATION: MOUTH OF YOUNGS RIVER

Depth (m)	18 Apr	8 May	29 May	19 June	10 July	5 Aug	27 Aug	17 Sept	13 Oct	11 Nov	4 Dec
	Salinity (‰)										
0	0.6	0	0		0	1.7	4.8	3.0	2.6	3.9	5.4
1	0.6										
2	0.6	0	0		0	1.7	6.2	3.2	3.1	5.4	6.4
3	0.7										
4	0.7				0	1.7	6.4	7.3	4.6	6.4	7.1
5	0.7										
6	0.7	0	0		0	1.8	7.1	7.9	5.5	7.7	7.4
7	0.7										
8	0.7				0	1.8	7.2	8.0	5.9	7.8	8.1
9	0.8										
10	0.8	0	0		0	2.0	7.2	7.9	6.4	7.8	9.0
11	0.8								6.7		
12			0		0	2.1		8.0		7.8	
13										7.9	
14		0									

STATION: MOUTH OF LEWIS AND CLARK RIVER

Depth (m)	18 Apr	8 May	29 May	19 June	10 July	5 Aug	27 Aug	17 Sept	13 Oct	11 Nov	4 Dec
	Salinity (‰)										
0	0.7	0	0	0	0	1.4	4.3	2.3	2.1	2.9	7.2
1	0.7				0						
2	0.7	0	0	0	0.2	1.4	5.9	3.2	1.6	5.5	8.3
3	0.8				0.3						
4	0.8	0	0	0		1.7	6.3		6.6	6.7	8.4
5	0.8						6.3	6.7			
6		0	0			2.0			6.9	7.6	8.7
7											10.1

Table 2-5. Turbidity readings taken during 1974. Depth of visibility of a 20 cm secchi disc was recorded at each station. No adjustments were made for time of day or conditions of weather. (Location: Appendix Figure 1-1)

	Secchi Disc Visibilities (m)									
Station	18 Apr	8 May	28 May	10 Jul	5 Aug	27 Aug	17 Sep	13 Oct	11 Nov	4 Dec
Entrance to Youngs Bay	0.8	0.6	1.0	-	-	-	1.5	2.2	1.5	1.6
Causeway	0.7	0.7	0.7	0.7	1.0	1.6	1.5	1.5	1.5	1.6
Mouth of Youngs River	0.7	0.7	-	0.7	1.7	1.0	1.0	1.2	1.1	-
Mouth of Lewis and Clark River	0.5	0.6	0.6	0.6	0.7	0.7	1.0	1.4	1.1	1.5

Table 5-1. Summary of benthos densities (number per m^2) for stations in the Youngs Bay area during 1974. Sampling gear used was Smith-McIntyre grab samplers (SM = older model; NSM = newer, stainless steel model), a 15.2 cm coring tube, and an Ekman dredge (0.023 m^2). Substrate texture is given for most samples. A few samples were sieved only with a 0.063 mm screen; most were sieved either with 0.063 mm, and 0.991 mm screens, or these screens and a 0.246 mm screen. In all cases the percent silt and clay is given by the <0.063 mm fraction. A dash indicates taxon may have been present, but was not counted. (Location: Appendix Figures 1-3 and 1-4)

STATION	FWGS 1	FWGS 1	FWGS 2	FWGS 3	FWGS 3	P3-FLG 1	P3-FLG 3C
DATE	18 June	10 July	18 June	18 June	10 July	7 March	7 March
GEAR	SM	SM	SM	SM	SM	SM	SM
FRACTION OF SAMPLE COUNTED	1.0	1.0	1.0	1.0	1.0	0.31	1.0
SUBSTRATE TEXTURE (%)							
>0.991 mm	0	0.5	0	0	4.4	1.2	0.2
0.246 mm - 0.991 mm	85.3	82.9	33.4	97.8	71.7	14.1	97.7
0.063 mm - 0.246 mm	14.7	15.5	63.6			44.8	
<0.063 mm	0	1.1	3.0	2.2	23.9	39.9	2.1
SAMPLE DEPTH (cm)	10	7	9	6.5	5.5		9.5
TAXON							
Amphipoda							
Anisogammarus	20.2	40.4	10.1			65.1	
Corophium	343.4		151.5	3,686.9	8,323.2	1,856.7	50.5
Eohaustorius	363.6	1,859.6	434.3	20.2			191.9
Paraphoxus							
Isopoda							
Mesidotea		10.1	10.1				
Gnorimosphaeroma							
Insecta							
Chironomidae		10.1			10.1		
Polychaeta							
Ampharetidae						32.5	
Nereidae					60.6	521.2	
Oligochaeta				10.1	10.1	2,280.1	40.4
Hirudinea							
Nematoda			10.1		40.4	97.7	10.1
Nemertinea		-			-	-	30.3
Mollusca							
Macoma		20.2				846.9	
Corbicula							
Hydracarina							
Ostracoda							
Decopoda							
Pacifastacus		10.1					
Crangon							
Mysidacea							
Neomysis		20.2					
TOTAL	727	1,970	616	3,717	8,444	5,700	323

Table 5-1 (continued)

STATION	PW 1	PW 2	PW 2	PW 2	PW 2	PW 2	PW 2
DATE	17 April	17 April	7 May	29 May	17 June	9 July	12 Oct
GEAR	SM	SM	SM	SM	SM	SM	NSM
FRACTION OF SAMPLE COUNTED	1.0	1.0	0.552	1.0	1.0	1.0	1.0
SUBSTRATE TEXTURE (%)							
>.991 mm	0.5	1.1	0.5	0.1		1.4	0.2
.246 mm - .991 mm	89.2	20.9	28.0	16.1		91.0	18.1
.063 mm - .246 mm		74.7	71.5	77.4			76.7
<.063 mm	10.3	3.3	0	6.4		7.6	5.0
SAMPLE DEPTH (cm)	6	6.5	7	7	9	6	9.5
TAXON							
Amphipoda							
Anisogammarus	10.1	10.1	18.3			30.6	65.4
Corophium	11,252.5	4,555.6	7,142.9	8,646.5	27,230.0	17,724.5	224.3
Eohaustorius	10.1	222.2	36.6	40.4	10.0	61.2	766.4
Paraphoxus							
Isopoda							
Mesidotea	20.2						
Gnorimosphaeroma			18.3				
Insecta							
Chironomidae					10.0		
Polychaeta				50.5	170.0		
Ampharetidae	10.1		18.3	-	-		
Nereidae	202.0	141.4		-	-	51.0	859.8
Oligochaeta	414.1	30.3		40.4	140.0	193.9	551.4
Hirudinea							
Nematoda	111.1			40.4		173.5	46.7
Nemertinea		-		-	-	-	-
Mollusca							
Macoma	10.1	131.3	18.3			10.2	850.5
Corbicula							
Hydracarina							
Ostracoda							
Decopoda							
Pacifasticus							
Crangon							
Mysidacea							
Neomysis							18.7
TOTAL	12,040	5,090	7,253	8,818	27,560	18,245	3,383

Table 5-1 (continued)

STATION	PW 2	PW 3	PW 4	PW 5	PW 5	PW 5	PW 5
DATE	3 Dec	17 April	17 April	17 April	7 May	30 May	18 June
GEAR	NSM	SM	SM	SM	SM	SM	SM
FRACTION OF SAMPLE COUNTED	1.0	1.0	1.0	0.513	0.522	0.25	0.25
SUBSTRATE TEXTURE (%)							
>.991 mm	0	0		0.7	0.4		0.4
.246 mm - .991 mm	21.4	89.1		14.3	15.5		93.0
.063 mm - .246 mm	73.4			71.7	65.9		
<.063 mm	5.2	10.9		13.3	18.2		6.6
SAMPLE DEPTH (cm)	11	6	5	6	3		10
TAXON							
Amphipoda							
Anisogammarus	46.7		50.5	39.4	135.4		40.3
Corophium	9.3	9,717.2	24,282.8	36,043.3	23,017.4	45,920.0	13,790.3
Eohaustorius	243.9	10.1	10.1	19.7			
Paraphoxus	130.8						
Isopoda							
Mesidotea			20.2				
Gnorimosphaeroma							
Insecta							
Chironomidae							
Polychaeta							1,290.3
Ampharetidae			40.4	19.7			-
Nereidae	897.2	50.5	323.2	905.5	348.2	840.0	-
Oligochaeta		404.0	2,737.4	2,480.3	1,702.0	2,080.0	3,225.8
Hirudinea							
Nematoda		101.0	434.3	3,661.4	1,721.5	1,080.0	685.5
Nemertinea	37.4	20.2		-	-	-	-
Mollusca							
Macoma	467.3	90.9	20.2				
Corbicula							
Hydracarina							
Ostracoda							
Decapoda							
[illegible]							
Crangon							
Mysidacea							
Neomysis	46.7						40.3
TOTAL	1,879	10,393	27,919	43,169	26,924	49,920	19,073

Table 5-1 (continued)

STATION	PW 5	PW 5	CW Trough	CWRR	CWRR	CWRR	WRT-6C 1B
DATE	12 Oct	3 Dec	29 May	7 May	18 June	9 July	7 March
GEAR	NSM	NSM	SM	SM	SM	SM	SM
FRACTION OF SAMPLE COUNTED	1.0	0.38	1.0	0.303	0.129	1.0	0.25
SUBSTRATE TEXTURE (%)							
>.991 mm	0.2	0.8	ND		0.4	0.7	2.0
.246 mm - .911 mm	19.2	10.6	36.3		29.0	1.0	21.4
.063 mm - .246 mm	76.0	72.6	ND			10.0	61.2
<.063 mm	4.6	15.9	ND		70.6	88.3	15.4
SAMPLE DEPTH (cm)	11	12	6	15	13	17	10
TAXON							
Amphipoda							
Anisogammarus		48.4					
Corophium	30,523.4	57,845.0	3,545.5	20,400.0	23,333.3	12,255.1	45,443.5
Eohaustorius	280.4	24.2	30.3				
Paraphoxus							
Isopoda							
Mesidotea							
Gnorimosphaeroma							
Insecta							
Chironomidae							
Polychaeta							241.9
Ampharetidae				66.7		51.2	-
Nereidae	448.6	1,113.8	10.1	1,033.3	731.7	542.9	-
Oligochaeta	112.1	774.8	20.2	33,066.7	37,317.0	50,295.9	[illegible]
Hirudinea							
Nematoda	252.3	677.9	111.1	1,200.0	1,056.9	2,183.7	201.6
Nemertinea	-	72.6			-	-	-
Mollusca						10.2	40.3
Macoma							
Corbicula							
Hydracarina							
Ostracoda							
Decopoda							
Pacifasticus							
Crangon							
Mysidacea							
Neomysis		24.2		33.3		71.4	
TOTAL	31,617	60,581	3,717	55,800	62,439	65,520	49,274

Table 5-1 (continued)

STATION	WRT-6C	WRT-6C	WRT-6C	WRT-6C	WRT-6C	WRT-6C	WRT-6C
	1	1	3A	3B	3C	3D	3E
DATE	17 April	7 May	6 March	6 March	6 March	6 March	6 March
GEAR	SM	SM	SM	SM	SM	SM	SM
FRACTION OF SAMPLE COUNTED	0.25	0.2975	1.0	1.0	1.0	1.0	1.0
SUBSTRATE TEXTURE (%)							
>.991 mm	0.7	0.3	1.1	1.2		1.4	0.5
.246 mm - .991 mm	16.0	21.4	2.6				
.063 mm - .246 mm	62.4	61.9	63.0	83.9		54.5	83.6
<.063 mm	20.8	16.4	33.3	14.9		44.1	15.9
SAMPLE DEPTH (cm)	7.5	6	9	10	9	7	7
TAXON							
Amphipoda							
Anisogammarus			90.9	30.3	50.5	70.7	30.3
Corophium	1,747.8	9,152.5	50,272.7	43,494.9	32,858.6	42,737.4	26,666.7
Eohaustorius							
Paraphoxus							
Isopoda							
Mesidotea							
Gnorimosphaeroma							
Insecta							
Chironomidae							
Polychaeta							
Ampharetidae	5.7		90.9	50.5	30.3	50.5	40.4
Nereidae		135.6	303.0	434.3	383.8	494.9	313.1
Oligochaeta	395.4	6,711.9	6,535,3	6,555.5	4,222.2	3,666.7	1,545.4
Hirudinea							
Nematoda	232.0	644.0	1,838.4	2,656.6	787.9	1,808.1	606.1
Nemertinea			-	-	-	-	-
Mollusca							
Macoma			20.2		20.2		
Corbicula							
Hydracarina							
Ostracoda							
Decopoda							
Pacifasticus							
Crangon							
Mysidacea							
Neomysis			10.1				
TOTAL	2,381	16,644	59,162	53,222	38,354	48,828	29,202

Table 5-1 (continued)

STATION	WRT-6C 3	WRT-6C 3	WRT-6C 3	WRT-6C 3	WRT-6C 3	WRT-6C 3	WRT-6C 3
DATE	17 April	7 May	28 May	17 June	8 July	26 Aug	16 Sept
GEAR	SM	SM	SM	SM	SM	NSM	NSM
FRACTION OF SAMPLE COUNTED	0.127	0.135	0.13	0.131	0.521	0.146	0.17
SUBSTRATE TEXTURE (%)							
>.991 mm	1.1	1.1	2.3	0.4	1.5	2.0	6.5
.246 mm - .991 mm	52.1	6.5	11.4	86.8	5.9	6.0	7.4
.063 mm - .246 mm		54.6	72.3		80.6	82.2	78.4
<.063 mm	46.7	37.8	14.0	12.8	12.0	9.8	7.7
SAMPLE DEPTH (cm)	8	5.5	8	10.5	8.5	14	15
TAXON							
Amphipoda							
Anisogammarus	317.5						
Corophium	46,349.2	18,358.2	31,953.1	32,692.3	22,325.6	22,756.4	23,681.3
Eohaustorius							
Paraphoxus							
Isopoda							
Mesidotea							
Gnorimosphaeroma							
Insecta							
Chironomidae							54.9
Polychaeta							
Ampharetidae		74.6			19.4		
Nereidae	317.5	373.1	78.1	846.2	620.2	769.2	494.5
Oligochaeta	4,841.3	3,209.0	8,046.9	12,769.2	8,352.7	16,025.6	19,890.1
Hirudinea							
Nematoda	952.4	223.9	2,890.6	4,000.0	1,259.7	448.7	1,868.1
Nemertinea							219.8
Mollusca							
Macoma				76.9	19.4		
Corbicula							
Hydracarina				153.8			
Ostracoda							
Decopoda							
Pacifasticus							
Crangon							
Mysidacea							
Neomysis				76.9			
TOTAL	52,778	22,239	42,969	50,615	32,597	40,000	46,209

Table 5-1 (continued)

STATION	WRT-6C 3	WRT-6C 3	WRT-6C 3	WRT-6C 5	WRT-6C 7	WRT-6C 7	WRT-6C 7
DATE	12 Oct	9 Nov	3 Dec	7 May	17 April	7 May	30 May
GEAR	NSM	NSM	NSM	SM	SM	SM	SM
FRACTION OF SAMPLE COUNTED	0.23	0.256	0.23	0.25	0.395	0.312	1.0
SUBSTRATE TEXTURE (%)							
>.991 mm	0.9	0.9	1.2	1.6	2.3	1.2	1.0
.246 mm - .991 mm	11.3	82.8	8.3	45.6	6.5	5.7	7.6
.063 mm - .246 mm	74.2		75.8		53.7	63.6	48.7
<.063 mm	13.3	16.2	14.7	52.8	37.5	29.5	42.7
SAMPLE DEPTH (cm)	11	10.5	14.6	11	13	10	8
TAXON							
Amphipoda							
Anisogammarus			162.5	40.3			
Corophium	22,235.8	25,474.5	19,544.9	36,451.6	27,954.0	22,459.5	16,686.9
Eohaustorius	81.3						
Paraphoxus							
Isopoda							
Mesidotea							
Gnorimosphaeroma							
Insecta							
Chironomidae							
Polychaeta							
Ampharetidae				80.6		226.5	30.3
Nereidae	609.8	255.5	447.0	1,008.1	383.6	226.5	313.1
Oligochaeta	11,138.2	12,518.2	13,774.9	29,314.5	23,324.5	31,100.0	10,202.0
Hirudinea							
Nematoda	1,219.5	2,445.3	1,544.1	1,733.9	1,432.2	711.9	727.3
Nemertinea		401.4	12.9		-		-
Mollusca							
Macoma		145.9	284.4				
Corbicula							
Hydracarina							
Ostracoda						97.0	
Decapoda							
Pacifasticus							
Crangon							
Mysidacea							
Neomysis							
TOTAL	35,285	41,241	35,880	68,629	53,095	44,822	27,960

Table 5-1 (continued)

STATION	WRT-6C 7	WRT-6C 7	WRT-6C 7	WRT-6C 7	WRT-6C 100'	WRT-6C 30'	SKIP 1
DATE	8 July	28 Aug	12 Oct	3 Dec	7 May	7 May	24 Oct
GEAR	SM	NSM	NSM	NSM	SM	SM	CORE
FRACTION OF SAMPLE COUNTED	1.0	0.525	0.49	0.347	0.6411	1.0	1.0
SUBSTRATE TEXTURE (%)							
>.991 mm	1.1	1.1	0.4	1.4			
.246 mm - .991 mm	7.4	57.4	6.2	7.1			
.063 mm - .246 mm	56.6		60.1	70.4			
<.063 mm	35.0	41.5	33.3	21.1			4.4
SAMPLE DEPTH (cm)	10	14	11.5	14	10.5		20
TAXON							
Amphipoda							
Anisogammarus						110.0	54.9
Corophium	14,838.4	27,339.2	28,435.1	17,251.7	4,913.4	5,000.0	4,285.7
Eohaustorius							
Paraphoxus							
Isopoda							
Mesidotea							
Gnorimosphaeroma						50.0	
Insecta							
Chironomidae							1,263.7
Polychaeta							
Ampharetidae	90.9			161.7		110.0	
Nereidae	525.3	607.1	782.4	458.2	78.7	20.0	
Oligochaeta	17,383.8	30,160.7	26,450.4	10,754.7	5,543.3	5,160.0	604.3
Hirudinea							
Nematoda	242.4	500.0	267.2	188.7	315.0	9,100.0	54.9
Nemertinea	-	-	-		31.5	20.0	
Mollusca							
Macoma				26.9			54.9
Corbicula							
Hydracarina							
Ostracoda						1,800.0	
Decopoda							
Pacifasticus							
Crangon							
Mysidacea							
Neomysis							
TOTAL	33,081	58,607	55,935	28,841	10,882	22,270	6,319

Table 5-1 (continued)

STATION	SKIP 2	SKIP 3	SKIP 4	SKIP 5	SKIP 6	SKIP 7	SKIP TB
DATE	24 Oct	24 Oct	24 Oct	24 Oct	24 Oct	24 Oct	9 July
GEAR	CORE	CORE	CORE	CORE	CORE	CORE	EKMAN
FRACTION OF SAMPLE COUNTED	1.0	1.0	1.0	1.0	1.0	1.0	0.5
SUBSTRATE TEXTURE (%)							
>.991 mm							0
.246 mm - .991 mm							
.063 mm - .246 mm							12.5
<.063 mm	4.1	16.6	18.6	7.4	61.0	13.3	87.5
SAMPLE DEPTH (cm)	20	20	20	20	20	20	-
TAXON							
Amphipoda							
Anisogammarus							43.6
Corophium	6,428.6	1,098.9	219.8			3,846.2	13,703.7
Eohaustorius							
Paraphoxus							
Isopoda							
Mesidotea							
Gnorimosphaeroma							
Insecta							
Chironomidae	1,208.8	1,098.9	2,087.9	1,648.3	2,472.5	54.9	
Polychaeta							
Ampharetidae						54.9	
Nereidae							21.6
Oligochaeta	19,065.9	11,318.7	10,384.6	4,340.7	2,802.2	2,967.0	261.4
Hirudinea							
Nematoda	2,142.8	439.6	109.9	1,483.5	769.2	439.6	610.0
Nemertinea	-	-	-	54.9	-	-	-
Mollusca							
Macoma							
Corbicula							
Hydracarina	1,098.9	384.6	164.8	109.9			
Ostracoda	604.4	109.9		439.6	164.8	54.9	
Decopoda							
Pacifastacus							
Crangon							21.8
Mysidacea							
Neomysis							
TOTAL	30,549	14,450	12,967	8,077	6,209	7,418	14,562

Table 5-1 (continued)

STATION	SKIP TB	SKIP CH12	YR 6	YR 5	YR 3	YR MOUTH	LC 10
DATE	10 Nov	10 Nov	4 Dec	4 Dec	26 Aug	29 May	9 Nov
GEAR	NSM	NSM	NSM	NSM	NSM	SM	NSM
FRACTION OF SAMPLE COUNTED	1.0	1.0	0.408	0.289	0.34	0.141	0.259
SUBSTRATE TEXTURE (%)							
>.991 mm	1.3	0.3	31.6	3.8	14.6	1.8	16.3
.246 mm - .991 mm	}	}	10.7	}		}	}
.063 mm - .246 mm	9.2	8.3	25.3	87.6	41.8	45.5	56.7
<.063 mm	89.5	91.3	32.4	8.6	43.5	52.7	27.0
SAMPLE DEPTH (cm)	19	19	13.5	13	18	8	14
TAXON							
Amphipoda							
Anisogammarus	9.3			64.7		71.4	
Corophium	140.2		9,153.3	13,689.3	2,637.4	18,857.1	649.8
Eohaustorius				64.7			
Paraphoxus				-			
Isopoda							
Mesidotea							
Gnorimosphaeroma							
Insecta							
Chironomidae			1,098.4			142.9	216.6
Polychaeta							
Ampharetidae	9.3		434.8	32.4	54.9	71.4	
Nereidae	9.3	18.7	58.6	161.8	467.0	2,142.9	
Oligochaeta	84.1	37.4	13,821.5	7,378.6	26,620.9	11,071.4	8,519.9
Hirudinea			22.9				
Nematoda			183.0		82.4	1,785.7	
Nemertinea				-	-		-
Mollusca							
Macoma		102.8					
Corbicula							
Hydracarina							
Ostracoda							
Decopoda							
Pacifasticus							
Crangon							
Mysidacea							
Neomysis							
TOTAL	252	159	24,783	21,392	29,863	34,143	9,386

Table 5-1 (continued)

STATION	LC 8	LC 6	LC WH	LC WH
DATE	9 Nov	9 Nov	7 March	9 Nov
GEAR	NSM	NSM	SM	NSM
FRACTION OF SAMPLE COUNTED	0.42	0.167	0.33	0.117
SUBSTRATE TEXTURE (%)				
>.991 mm	4.1	29.1	54.2	12.7
.246 mm - .991 mm .063 mm - .246 mm	} 29.9	} 51.4	} 29.2	} 62.1
<.063 mm	66.0	19.5	16.7	25.1
SAMPLE DEPTH (cm)	14.9	17.2	11.5	
TAXON				
Amphipoda				
Anisogammarus	66.8		91.7	
Corophium	16,347.4	20,558.6	12,813.4	29,040.0
Eohaustorius			91.7	
Paraphoxus			-	
Isopoda				
Mesidotea				
Gnorimosphaeroma				
Insecta				
Chironomidae		949.7		80.0
Polychaeta			825.7	
Ampharetidae		502.8	-	160.0
Nereidae		279.3	-	960.0
Oligochaeta	579.1	15,754.2	18,165.1	33,440.0
Hirudinea				
Nematoda	22.3	335.2	30.6	320.0
Nemertinea	-		-	240.0
Mollusca				
Macoma		167.6		160.0
Corbicula		55.9		
Hydracarina				
Ostracoda				
Decopoda				
Pacifasticus				
Crangon				
Mysidacea				
Neomysis				
TOTAL	17,016	38,603	32,018	64,400

Table 5-2. Results of replicate benthos sampling. Total counts were made on contents of five Smith-McIntyre grab samples taken at Station WRT-6C:3, 6 March 1974. (Location: Appendix Figure 1-3)

	Mean (5 samples)	Standard deviation	Standard error of mean (%)
Corophium	3,406.0	1,861.4	24.4
Anisogammarus	5.4	2.6	21.7
Polychaeta	43.2	7.4	7.6
Oligochaeta	446.0	209.2	21.0
Nematoda	152.0	83.5	24.5

Table 5-3. Mean dry weights of benthic animals collected during 1974. Organisms were sorted into the taxonomic groups shown and dried at 60° C for 24 hours. Some samples were formed by combining organisms found at different stations or dates. All organisms were preserved initially in formaldehyde and transferred to 40% isopropanol, and thus were subjected to alcohol extraction. (Location: Appendix Figures 1-3 and 1-4)

Taxon	Sample size	Mean dry weight (mg)	Station and date of collection
Amphipoda			
Anisogammarus	16	0.400	WRT6C:30' 7 May; P3FLG:1 7 March; WRT6C:3 6 March; FWGS:2 18 June
Eohaustorius	214	0.469	FWGS:1 10 July; FWGS:2 18 June
Corophium	342	0.146	PW:5 18 June
	322	0.137	CWRR 9 July
Polychaeta			
Nereidae	41	0.339	WRT6C:3 March-May
	31	0.597	WRT6C:3 June-December
Ampharetidae	52	0.268	WRT6C:30' 7 May
Oligochaeta	233	0.030	WRT6C:3
	1,148	0.020	WRT6C:3 April-November
	1,486	0.048	CWRR 9 July
Nematoda	253	0.0042	WRT6C:3 March-December
Nemertinea	18	0.578	WRT6C:3 September-November
Mollusca			
Macoma			
Approx 2 cm diameter	5		P3FLG:1 7 March
shell		172.1	
soft parts		21.3	
Approx 1 cm diameter	15	35.8	P3FLG:1 7 March
Approx .4 cm diameter	4	3.05	WRT6C:1B 7 March; WRT6C:3 17 June; WRT6C:3 9 November

Table 5-4. Mean dry weight of *Corophium* collected at Station WRT-6C:3 during 1974. Organisms were dried for 24 hours at 60° C. Preservation in 40% isopropyl alcohol may have caused weight losses through alcohol extraction. (Location: Appendix Figure 1-3)

Date	Sample size	Mean dry weight (mg)
6 March	652	0.074
17 April	304	0.123
7 May	244	0.249
28 May	392	0.151
17 June	419	0.076
8 July	477	0.077
26 August	337	0.101
16 September	410	0.071
12 October	538	0.077
9 November	690	0.063
3 December	478	0.041

Table 6-1

CAPTURE BY TRAWL

Capture by trawl: Summary of data for four stations during 1974. Capture was by 16-foot box trawl except for (1) a 16-foot otter trawl, Station PW, 18 April, 1515 hours, and (2) a 25-foot otter trawl, Station PW, 10 November, 0950 and 1240 hours. All trawls had one-half inch cod end liners, except the box trawl which was changed from a one-half to a one-quarter inch liner on 18 June. Starry flounder were separated into 1973 year class, 1974 year class, and older fish where length frequency histograms showed distinct divisions of these groups (see Figures 16 and 17); otherwise, no year class distinction was made. Mean size was computed where the number of a species measured was six or greater. Size was measured as total length to the nearest centimeter. (Location: Appendix Figure 1-6)

Table 6-1. Capture by trawl.

Date	Time	Reference to high tide	Species	Number caught Total	Number caught Per 5 min. tow	Number measured	Size (cm) Range	Size (cm) Mean
			STATION: PW					
18 Apr	1515-1527	4 hrs past	Starry flounder	35	14.6	35	7-25	10.3
			1973 year class	*31*	*12.9*	*31*	*7-10*	*9.3*
			older fish	*4*	*1.7*	*4*	*18-25*	
			Threespine stickleback	3	1.3	3	5	
			TOTAL	38	15.9	38		
8 May	1500-1506	1 hr before	Starry flounder	162	135	162	7-15	9.0
			1973 year class	*160*	*133.3*	*160*	*7-11*	*9.9*
			older fish	*2*	*1.7*	*2*	*14-15*	
			Pacific staghorn sculpin	20	16.7	20	10-17	12.9
			Prickly sculpin	3	2.5	3	13-14	
			Longfin smelt	4	3.3	4	8-13	
			Peamouth	6	5	6	16-30	20.7
			Shiner perch	74	61.7	74	9-14	11.8
			TOTAL	269	224.2	269		
30 May	0917-0925	0.5 hr before	Starry flounder	142	88.8	105	4-25	9.2
			1974 year class	*1*	*0.6*	*1*	*4*	
			1973 year class	*101*	*63.1*	*101*	*7-11*	*9.6*
			older fish	*3*	*1.9*	*3*	*14-25*	*18.3*
			Pacific staghorn sculpin	6	3.8	1	14	
			Chinook salmon	5	3.1	5	7-9	
			Peamouth	2	1.3	2	16-20	
			Shiner perch	41	25.6	41	9-15	11.4
			Carp	1	0.6	1	66	
			Longfin smelt	4	2.5	4	4-13	
			Prickly sculpin	1	.6	1	16	
			TOTAL	202	126.3	174		
19 June	1122-1127	3 hrs before	Starry flounder	144	144	144	3-11	8.9
			1974 year class	*12*	*12*	*12*	*3-4*	*3.5*
			1973 year class	*132*	*132*	*132*	*8-11*	*9.4*
			Pacific staghorn sculpin	8	8	8	9-14	11.1
			Prickly sculpin	8	8	8	8-15	11.3
			Longfin smelt	2	2	2	9-11	
			Chinook salmon	18	18	18	8-10	9.2
			Peamouth	2	2	2	19-23	
			Shiner perch	44	44	44	9-14	10.5
			TOTAL	226	226	226		
10 July	1605-1610	2 hrs before	Starry flounder	215	215	148	4-23	10.2
			1974 year class	*3*	*3*	*3*	*4-5*	
			1973 year class	*143*	*143*	*143*	*8-12*	*10.1*
			older fish	*2*	*2*	*2*	*19-23*	
			Pacific staghorn sculpin	20	20	20	8-19	9.7
			Osmeridae	1	1	1	3	
			Prickly sculpin	2	2	2	9	
			Longfin smelt	35	35	35	3-12	9.7
			Clupeidae	1	1	1	5	
			Peamouth	3	3	3	17-23	
			Shiner perch	188	188	184	8-15	9.5
			TOTAL	465	465	394		
6 Aug	1435-1440	2 hrs before	Starry flounder	121	121	121	4-13	8.2
			1974 year class	*66*	*66*	*66*	*4-7*	*5.3*
			1973 year class	*55*	*55*	*55*	*10-13*	*11.0*
			Pacific staghorn sculpin	8	8	8	15-20	16.1
			Prickly sculpin	1	1	1	11	
			Longfin smelt	43	43	43	8-12	9.9
			Shiner perch	19	19	19	5-13	9.6
			Sand sole	1	1	1	16	
			Pacific tomcod	2	2	2	16-17	
			Surf smelt	4	4	4	8-9	
			TOTAL	199	199	199		

Table 6-1. Capture by trawl (continued)

Date	Time	Reference to high tide	Species	Number caught Total	Number caught Per 5 min. tow	Number measured	Size (cm) Range	Size (cm) Mean
28 Aug	0930-0935	2 hrs before	Starry flounder	103	103	103	5-15	8.8
			Pacific staghorn sculpin	1	1	1	12	
			Shiner perch	5	5	5	6-10	
			TOTAL	109	109	109		
	1330-1335	2 hrs past	Starry flounder	199	199	176	5-17	8.8
			Pacific staghorn sculpin	3	3	3	11-14	
			Prickly sculpin	2	2	2	2	
			Surf smelt	1	1	1	16	
			TOTAL	205	205	182		
	1750-1755	5.5 hrs before	Starry flounder	78	78	60	5-16	9.3
			Pacific staghorn sculpin	2	2	2	5-13	
			Longfin smelt	6	6	6	10-12	10.8
			Shiner perch	4	4	4	6-10	
			Pacific tomcod	4	4	4	8-9	
			TOTAL	94	94	76		
	2155-2200	2 hrs before	Starry flounder	89	89	82	5-41	10.5
			Pacific staghorn sculpin	10	10	10	10-19	13.6
			Prickly sculpin	1	1	1	14	
			Longfin smelt	2	2	2	10-11	
			Shiner perch	1	1	1	6	
			Sand sole	1	1	1	14	
			Pacific tomcod	9	9	9	7-9	7.9
			TOTAL	113	113	106		
29 Aug	0125-0130	2 hrs past	Starry flounder	384	384	384	6-16	11.2
			Pacific staghorn sculpin	8	8	8	13-19	16.9
			Longfin smelt	4	4	4	10-12	
			Northern anchovy	4	4	4	10-13	
			Pacific tomcod	35	35	35	7-22	10.8
			Snake prickleback	9	9	9	22-33	27.6
			TOTAL	444	444	444		
	0530-0535	6 hrs past	Starry flounder	270	270	270	5-16	10.5
			Pacific staghorn sculpin	5	5	5	5-16	
			Longfin smelt	10	10	10	10-11	10.8
			Peamouth	1	1	1	23	
			Shiner perch	34	34	34	7-13	11.4
			Threespine stickleback	8	8	8	4	4.0
			Pacific herring	5	5	5	4-5	
			Northern anchovy	2	2	2	13	
			Pacific tomcod	10	10	10	8-20	16.4
			Surf smelt	1	1	1	9	
			Sand sole	1	i	1	17	
			TOTAL	347	347	347		
17 Sept	1038-1043	4 hrs before	Starry flounder	218	218	218	6-19	11.1
			Shiner perch	58	58	58	7-13	10.6
			Snake prickleback	1	1	0		
			Pacific staghorn sculpin	5	5	5	12-14	
			Longfin smelt	21	21	21	7-12	10.1
			Peamouth	8	8	8	15-21	18.4
			Pacific tomcod	67	67	67	6-17	8.5
			Northern anchovy	184	184	184	10-15	12.4
			Sand sole	1	1	1	17	
			TOTAL	563	563	562		

Table 6-1. Capture by trawl (continued)

Date	Time	Reference to high tide	Species	Number caught: Total	Number caught: Per 5 min. tow	Number measured	Size (cm): Range	Size (cm): Mean
10 Nov	0910-0915	1 hr before	Starry flounder	317	317	317	6-15	9.4
			Pacific staghorn sculpin	6	6	6	11-15	12.5
			American shad	2	2	2	11-12	
			Shiner perch	22	22	22	7-12	8.1
			English sole	2	2	2	11-12	
			Northern anchovy	2	2	2	11-12	
			Pacific herring	6	6	6	11-12	11.5
			Pacific tomcod	1	1	1	9	
			TOTAL	358	358	358		
	1315-1317	3.5 hrs past	Starry flounder	129	322.5	129	7-16	9.9
			Shiner perch	4	10	4	7-9	
			Northern anchovy	1	2.5	1	13	
			English sole	1	2.5	1	13	
			Snake prickleback	1	2.5	1	17	
			Dungeness crab	1	2.5	1	12	
			TOTAL	137	342.5	137		
	0950-0955	High tide	Starry flounder	495	495	263	5-27	10.2
			Pacific staghorn sculpin	8	8	7	13	10.1
			Surf smelt	1	1	0		
			Longfin smelt	39	39	38	10-14	12.2
			Snake prickleback	7	7	7	15-17	15.9
			Shiner perch	808	808	531	7-13	8.9
			Pacific tomcod	4	4	4	10-19	
			English sole	22	22	19	10-13	11.5
			Northern anchovy	42	42	33	7-16	13.7
			American shad	5	5	5	11-12	
			Dungeness crab	2	2	2	11-13	
			TOTAL	1433	1433	909		
	1240-1242	3 hrs past	Starry flounder	144	360	144	7-19	19.8
			American shad	2	5	2	9-11	
			Shiner perch	22	55	22	7-10	8.3
			Pacific herring	1	2.5	1	11	
			Dungeness crab	2	5	2	11	
			TOTAL	171	427.5	171		
3 Dec	1500-1505	0.5 hr before	Starry flounder	3	3	2	7-30	
			American shad	8	8	8	8-10	[illegible]
			Longfin smelt	3	3	3	9-11	
			Dungeness crab	7	7	7	10-13	11.4
			TOTAL	21	21	20		
4 Dec	1700-1707	0.5 hr past	Starry flounder	116	82.9	116	7-29	11.4
			Pacific staghorn sculpin	21	150	21	11-23	13.9
			American shad	3	2.1	3	8-9	
			Longfin smelt	2	1.4	2	11	
			Shiner perch	2	1.4	2	7-8	
			English sole	11	7.4	11	2-12	9.3
			Speckled sanddab	1	0.7	1	6	
			Snake prickleback	1	0.7	1	29	
			Dungeness crab	7	5	7	9-15	11.2
			TOTAL	164	116.6	164		
5 Dec	1000-1008	4 hrs past	American shad	19	11.9	0		
			Dungeness crab	7	4.4	0		
			TOTAL	26	16.3	0		
	1020-1028	4.5 hrs past	Starry flounder	14	8.8	0		
			Longfin smelt	11	6.9	0		
			American shad	22	13.8	0		
			Dungeness crab	14	8.8	0		
			TOTAL	61	38.3	0		

Table 6-1. Capture by trawl (continued)

Date	Time	Reference to high tide	Species	Number caught: Total	Number caught: Per 5 min. tow	Number measured	Size (cm): Range	Size (cm): Mean
			STATION: NMFS 2					
19 June	1440-1445	0.5 hr past	Starry flounder	379	379	379	1-11	5.9
			1974 year class	*208*	*208*	*208*	*1-5*	*2.9*
			1973 year class	*171*	*171*	*171*	*8-11*	*9.4*
			Pacific staghorn sculpin	6	6	6	7-16	12.3
			Prickly sculpin	8	8	8	2-8	5.9
			American shad	2	2	2	14-15	
			Longfin smelt	4	4	4	6-9	
			Chinook salmon	6	6	6	9-10	9.2
			Peamouth	5	5	5	16-20	
			Shiner perch	13	13	13	9-13	10.7
			Surf smelt	1	1	1	6	
			TOTAL	424	424	424		
			STATION: CWRR					
9 May	1440-1445	2 hrs before	Starry flounder	119	119	119	6-12	8.4
			Pacific staghorn sculpin	3	3	3	4-7	
			Shiner perch	1	1	1	10	
			TOTAL	123	123	123		
	1455-1500	2 hrs before	Starry flounder	69	69	69	7-14	8.8
			Pacific staghorn sculpin	2	2	2	4-5	
			American shad	1	1	1	13	
			Surf smelt	1	1	1	6	
			Chinook salmon	1	1	1	10	
			Shiner perch	1	1	1	12	
			TOTAL	75	75	75		
30 May	1014-1020	0.5 hr past	Starry flounder	102	85	102	2-10	
			1974 year class	*67*	*55.8*	*67*	*2*	*2.0*
			1973 year class	*35*	*29.2*	*35*	*7-10*	*8.9*
			Pacific staghorn sculpin	4	3.3	4	7-12	
			Prickly sculpin	3	2.5	3	1-10	
			Longfin smelt	5	4.2	5	8-10	
			Chinook salmon	24	20	24	7-10	8.6
			Peamouth	2	1.7	2	8-10	
			TOTAL	140	116.7	140		
18 June	1159-1204	1 hr before	Starry flounder	238	238	238	1-11	3.3
			1974 year class	*219*	*219*	*219*	*1-5*	*2.8*
			1973 year class	*19*	*19*	*19*	*8-11*	*9.4*
			Pacific staghorn sculpin	18	18	18	6-14	9.5
			Prickly sculpin	29	29	29	1-12	2.5
			Chinook salmon	3	3	3	7-8	
			Peamouth	1	1	1	25	
			Shiner perch	2	2	2	11-12	
			TOTAL	291	291	291		
	1223-1228	1 hr before	Starry flounder	120	120	120	1-11	3.6
			1974 year class	*102*	*102*	*102*	*1-4*	*2.5*
			1973 year class	*18*	*18*	*18*	*8-11*	*9.7*
			Pacific staghorn sculpin	13	13	13	6-14	9.0
			Prickly sculpin	10	10	10	1-16	5.9
			Longfin smelt	3	3	3	9-11	
			Chinook salmon	9	9	9	5-8	7.4
			Peamouth	3	3	3	18-21	
			Shiner perch	1	1	1	11	
			TOTAL	159	159	159		

Table 6-1. Capture by trawl (continued)

Date	Time	Reference to high tide	Species	Number caught: Total	Number caught: Per 5 min. tow	Number measured	Size (cm): Range	Size (cm): Mean
8 July	1650-1655	High tide	Starry flounder	207	207	207	1-11	4.6
			1974 year class	*169*	*169*	*169*	*1-6*	*3.4*
			1973 year class	*38*	*38*	*38*	*9-11*	*9.[illegible]*
			Pacific staghorn sculpin	13	13	13	7-13	8.6
			Prickly sculpin	27	27	27	1-14	5.0
			Longfin smelt	1	1	1	11	
			Chinook salmon	4	4	4	7-9	
			Peamouth	3	3	3	17-23	
			Shiner perch	11	11	11	9-14	11.4
			TOTAL	266	266	266		
7 Aug	1535-1540	1 hr before	Starry flounder	114	114	114	3-13	6.6
			Pacific staghorn sculpin	19	19	19	9-15	11.1
			Prickly sculpin	4	4	4	7-13	
			Chinook salmon	4	4	4	9-12	
			Peamouth	4	4	4	18-21	
			Shiner perch	14	14	14	4-13	10.1
			Carp	1	1	1	51	
			TOTAL	160	160	160		
18 Sept	1520-1525	High tide	Starry flounder	119	119	119	6-16	9.7
			Pacific staghorn sculpin	1	1	1	9	
			Peamouth	3	3	3	17-25	
			Shiner perch	33	33	33	6-12	9.1
			Northern anchovy	5	5	5	11-13	
			Chinook salmon	3	3	3	12-13	
			White sturgeon	1	1	1	60	
			TOTAL	165	165	165		
12 Oct	1140-1145	High tide	Starry flounder	98	98	98	7-14	9.9
			Pacific staghorn sculpin	6	6	6	13-15	14.3
			Prickly sculpin	1	1	1	14	
			Shiner perch	5	5	5	7-11	
			Peamouth	1	1	1	14	
			Threespine stickleback	1	1	1	5	
			Chinook salmon	1	1	1	12	
			TOTAL	113	113	113		
3 Dec	1545-1550	High tide	Starry flounder	6	6	6	11-23	14.3
			Pacific staghorn sculpin	1	1	1	3	
			American shad	8	8	8	7-9	8.0
			Surf smelt	2	2	2	4-5	
			Shiner perch	2	2	2	8	
			Threespine stickleback	4	4	4	4-6	
			TOTAL	23	23	23		

STATION: NMFS 1

Date	Time	Reference to high tide	Species	Number caught: Total	Number caught: Per 5 min. tow	Number measured	Size (cm): Range	Size (cm): Mean
17 Jan	1325-1335	4 hrs past	Starry flounder	144	72	144	7-20	11.5
			Pacific staghorn sculpin	42	21	42	7-15	11.4
			Prickly sculpin	4	2	4	5-15	
			Longfin smelt	12	6	12	6-13	11.6
			Threespine stickleback	43	21.5	43	4-6	5.2
			TOTAL	245	122.5	245		
8 May	1400-1405	2.5 hrs before	Starry flounder	814	814	264	7-14	8.8
			Pacific staghorn sculpin	11	11	11	11-14	12.1
			Prickly sculpin	34	34	34	6-15	9.1
			American shad	1	1	1	14	
			Longfin smelt	1	1	1	11	
			Coho salmon	1	1	1	18	
			Peamouth	4	4	4	16-23	
			Largescale sucker	1	1	1	56	
			TOTAL	867	867	317		

Table 6-1. Capture by trawl (continued)

Date	Time	Reference to high tide	Species	Number caught Total	Number caught Per 5 min. tow	Number measured	Size (cm) Range	Size (cm) Mean
9 May	1126-1128.5	5 hrs before	Starry flounder	36	72	36	7-15	9.0
			Pacific staghorn sculpin	1	2	1	13	
			Prickly sculpin	11	22	11	5-8	6.5
			American shad	1	2	1	13	
			Longfin smelt	2	4	2	11-12	
			Chinook salmon	2	4	2	8-12	
			Coho salmon	9	18	9	16-18	16.8
			TOTAL	62	124	62		
	1150-1156	5.5 hrs before	Starry flounder	73	60.8	73	7-14	8.9
			Pacific staghorn sculpin	8	6.7	8	10-15	12.6
			Prickly sculpin	7	5.8	7	5-13	7.6
			American shad	1	0.8	1	13	
			Longfin smelt	2	1.7	2	9-10	
			TOTAL	91	75.8	91		
30 May	1106-1112	1.5 hrs past	Starry flounder	175	145.8	175	7-11	8.9
			Pacific staghorn sculpin	2	1.7	2	8-12	
			Prickly sculpin	6	5	6	6-16	11.5
			Longfin smelt	3	2.5	3	8-9	
			Peamouth	1	0.8	1	21	
			Chinook salmon	17	14.1	17	7-10	8.2
			TOTAL	204	169.9	204		
18 June	1541-1546	3 hrs past	Starry flounder	162	162	162	1-11	5.0
			1974 year class	*119*	*119*	*119*	*1-6*	*3.4*
			1973 year class	*43*	*43*	*43*	*8-11*	*9.1*
			Pacific staghorn sculpin	6	6	6	6-15	9.7
			Prickly sculpin	3	3	3	2-9	
			American shad	2	2	2	15	
			Surf smelt	1	1	1	6	
			Chinook salmon	15	15	15	7-9	1.8
			Largescale sucker	1	1	1	22	
			TOTAL	190	190	190		
8 July	1600-1605	1 hr before	Starry flounder	327	327	220	3-12	6.7
			1974 year class	*126*	*126*	*126*	*3-6*	*4.3*
			1973 year class	*94*	*94*	*94*	*8-12*	*10.0*
			Pacific staghorn sculpin	9	9	9	9-17	12.8
			Prickly sculpin	31	31	31	2-14	8.2
			American shad	1	1	1	15	
			Peamouth	4	4	4	22-25	
			Shiner perch	3	3	3	11-14	
			Largescale sucker	3	3	3	42-43	
			TOTAL	378	378	271		
7 Aug	1115-1120	5.5 hrs before	Starry flounder	288	288	252	4-13	10.5
			1974 year class	*52*	*52*	*52*	*4-8*	*6.4*
			1973 year class	*200*	*200*	*200*	*10-13*	*11.6*
			Pacific staghorn sculpin	24	24	24	10-17	13.0
			Prickly sculpin	26	26	26	6-16	11.5
			Longfin smelt	12	12	12	9-13	10.8
			Peamouth	2	2	2	16-22	
			Shiner perch	19	19	19	9-14	10.8
			Threespine stickleback	24	24	24	4-5	4.8
			TOTAL	395	395	359		
17 Sept	1717-1727	2.5 hrs past	Starry flounder	232	116	232	6-17	10.2
			Pacific staghorn sculpin	12	6	12	4-17	12.5
			Prickly sculpin	1	0.5	1	12	
			American shad	14	7	14	5-9	6.1
			Peamouth	1	0.5	1	17	
			Shiner perch	55	27.5	55	7-13	10.6
			Northern anchovy	1	0.5	1	13	
			TOTAL	316	158	316		

Table 6-1. Capture by trawl (continued)

Date	Time	Reference to high tide	Species	Number caught: Total	Number caught: Per 5 min. tow	Number measured	Size (cm): Range	Size (cm): Mean
13 Oct	1555-1600	3.5 hrs past	Starry flounder	269	269	269	7-14	9.5
			Pacific staghorn sculpin	8	8	8	12-18	14.5
			Prickly sculpin	20	20	20	4-14	9.7
			Longfin smelt	52	52	52	9-16	10.9
			Peamouth	1	1	1	19	
			Shiner perch	129	129	129	8-14	10.7
			Northern anchovy	1	1	1	10	
			TOTAL	480	480	480		
9 Nov	1145-1150	2.5 hrs past	Starry flounder	11	11	11	7-13	9.8
			American shad	2	2	2	8	
			Shiner perch	2	2	2	8-11	
			TOTAL	15	15	15		

Table 6-2. Capture by gill net: Summary of data for four stations during 1974. Capture was by 90-foot multifilament nylon net except for sets made at Station Ch8 on 6 February and 6 March; on these dates a 125-foot monofilament nylon net was used. Nets were rigged to sink; fish were measured for total length to the nearest centimeter. Means were computed for samples of greater than five fish. (Location: Appendix Figure 1-6)

Date	Time	Reference to high tide	Species	Number caught Total	Number caught Per hour	Number measured	Size (cm) Range	Size (cm) Mean
			STATION: PW					
29 May	1340-1545	5 hrs past	Starry flounder	1	0.5	1	8	
			American shad	1	0.5	1	17	
			Coho salmon	1	0.5	1	16	
			Peamouth	41	19.7	41	13-26	17.8
			Largescale sucker	8	3.8	8	42-52	47.2
			Carp	2	1.0	2	52-54	
			TOTAL	54	26.0	54		
10 July	1700-1840	1 hr before	Pacific staghorn sculpin	4	2.4	4	13-15	
			Peamouth	9	5.4	9	17-20	17.5
			Largescale sucker	1	0.6	1	51	
			TOTAL	14	8.4	14		
28 Aug	1435-1635	High	Starry flounder	1	0.5	1	7	
			Peamouth	5	2.5	5	18-30	
			Shiner perch	1	0.5	1	11	
			Surf smelt	1	0.5	1	21	
			TOTAL	8	4.0	8		
10 Nov	0840-1140	1 hr before	Starry flounder	10	3.3	10	7-12	8.7
			Pacific staghorn sculpin	2	0.7	2	15-16	
			Shiner perch	38	12.7	38	10-13	11.2
			TOTAL	50	16.7	50		
			STATION: CWRR					
18 June	1130-1400	2 hrs before	Starry flounder	1	0.4	1	9	
			Pacific staghorn sculpin	9	3.6	9	13-15	14.0
			Peamouth	13	5.2	13	15-27	19.8
			Largescale sucker	2	0.8	2	38-50	
			Shiner perch	8	3.2	8	11-12	11.4
			TOTAL	33	13.2	33		
15 Sept	1430-1715	1 hr before	Starry flounder	2	0.7	2	8-9	
			Pacific staghorn sculpin	2	0.7	2	14	
			Peamouth	6	2.2	6	18-33	20.8
			Shiner perch	18	6.5	18	10-13	11.4
			Northern anchovy	26	9.4	26	12-15	13.2
			White sturgeon	1	0.4	1	160	
			TOTAL	55	19.9	55		
12 Oct	1025-1345	1 hr before	Pacific staghorn sculpin	1	0.3	1	13	
			Peamouth	6	1.8	6	17-19	17.8
			Shiner perch	7	2.1	7	10-11	10.4
			Northern anchovy	1	0.3	1	13	
			TOTAL	15	4.5	15		
			STATION: NMFS 1					
28 May	1522-1725	5 hrs before	Starry flounder	1	0.5	1	9	
			Peamouth	30	14.6	30	16-29	18.4
			Largescale sucker	2	1.0	2	43-46	
			TOTAL	33	16.1	33		

Table 6-2. Capture by gill net (continued)

Date	Time	Reference to high tide	Species	Number caught: Total	Number caught: Per hour	Number measured	Size (cm): Range	Size (cm): Mean
29 May	0837-1110	High	Starry flounder	3	1.2	3	9	
			Pacific staghorn sculpin	1	0.4	1	15	
			Peamouth	2	0.8	2	19-22	
			Largescale sucker	2	0.8	2	39-49	
			TOTAL	8	3.2	8		
6 Aug	0910-1110	6 hrs past	Pacific staghorn sculpin	1	0.5	1	15	
			Prickly sculpin	1	0.5	1	16	
			Longfin smelt	1	0.5	1	12	
			Peamouth	86	47.0	86	16-24	17.9
			Largescale sucker	5	2.7	5	38-45	
			Shiner perch	3	1.6	3	10-11	
			TOTAL	97	53.0	97		

STATION: Ch 8

Date	Time	Reference to high tide	Species	Number caught: Total	Number caught: Per hour	Number measured	Size (cm): Range	Size (cm): Mean
6 Feb	1050-1240	1.5 hrs before	TOTAL	0	0	0		
6 Mar	1325-1540	2 hrs past	Starry flounder	2	0.9	0		
			Pacific staghorn sculpin	1	0.4	0		
			TOTAL	3	1.3	0		
30 May	0825-1045	1 hr before	Peamouth	8	3.4	8	16-20	18.0
			Largescale sucker	11	4.7	11	44-53	47.4
			Carp	1	0.4	1	51	
			TOTAL	20	8.5	20		
19 June	1226-1455	1.5 hrs before	Starry flounder	6	2.4	6	8-9	8.7
			Pacific staghorn sculpin	2	0.8	2	13-14	
			Peamouth	42	16.9	42	15-21	18.3
			Largescale sucker	1	0.4	1	46	
			Shiner perch	3	1.2	3	10-13	
			TOTAL	54	21.7	54		
8 July	1525-1800	1.5 hrs before	Pacific staghorn sculpin	5	1.9	5	13-17	
			Peamouth	17	6.6	17	16-21	18.6
			Largescale sucker	4	1.5	4	42-46	
			Shiner perch	1	0.4	1	11	
			TOTAL	27	10.4	27		
7 Aug	1055-1245	6 hrs before	Pacific staghorn sculpin	1	0.5	1	14	
			Prickly sculpin	1	0.5	1	13	
			Peamouth	21	11.5	21	16-23	18.2
			Shiner perch	10	5.5	10	10-13	11.4
			TOTAL	33	18.0	33		
27 Aug	0930-1140	1.5 hrs before	Starry flounder	3	1.3	3	8-13	
			Pacific staghorn sculpin	3	1.3	3	13-15	
			Peamouth	31	13.3	31	17-20	18.0
			Largescale sucker	7	3.0	7	67-70	69.0
			Shiner perch	3	1.3	3	10-12	
			TOTAL	47	20.2	47		
17 Sept	1400-1630	1 hr before	Starry flounder	2	0.8	2	13-15	
			Pacific staghorn sculpin	1	0.4	1	14	
			Peamouth	32	12.8	32	17-30	19.2
			Shiner perch	10	4.0	10	10-12	10.9
			Northern anchovy	22	8.8	22	11-14	12.8
			TOTAL	67	26.8	67		

Table 6-2. Capture by gill net (continued)

Date	Time	Reference to high tide	Species	Number caught Total	Per hour	Number measured	Size (cm) Range	Mean
13 Oct	1120-1345	1 hr before	Pacific staghorn sculpin	1	0.4	1	14	
			Prickly sculpin	3	1.2	3	15	
			Peamouth	57	23.6	57	17-31	19.0
			Shiner perch	2	0.8	2	12	
			TOTAL	63	26.0	63		
9 Nov	0815-1045	1 hr before	Pacific staghorn sculpin	5	2.0	5	13-15	
			TOTAL	5	2.0	5		
3 Dec	1420-1620	1 hr before	Starry flounder	1	0.5	1	13	
			TOTAL	1	0.5	1		

Table 6-3. Capture by seine: Summary of data for two stations during 1974. Net used was a 171-foot beach seine with one-half inch bag and seven-eighths inch body (stretched measurements). (Location: Appendix Figure 1-6)

Date	Time	Reference to high tide	Species	Number caught	Number measured	Size (cm) Range	Mean
			STATION: P3				
27 Aug	1510	5.5 hrs. past	Starry flounder	12	21	6-12	7.6
			Pacific staghorn sculpin	4	4	8-13	
			Chinook salmon	1	1	10	
			Peamouth	1	1	6	
			Shiner perch	7	7	6-9	6.7
			Threespine stickleback	2	2	4	
			TOTAL	27	36		
12 Oct	1530	4 hrs. past	Starry flounder	15	15	7-12	8.9
			American shad	16	16	6-8	7.0
			Shiner perch	19	19	8-12	9.0
			Threespine stickleback	28	28	4-6	4.9
			Carp	1	1	65	
			TOTAL	79	79		
11 Nov	0945	1 hr. before	American shad	35	35	9-12	8.7
			Chinook salmon	7	7	11-15	13.0
			Largescale sucker	6	6	41-56	47.2
			Threespine stickleback	2	2	4-5	
			Surf smelt	118	118	9-12	1[illegible].8
			TOTAL	168	168		
			STATION: WAR				
27 Aug	1700	5 hrs. before	Starry flounder	16	9	9-12	10.1
			Pacific staghorn sculpin	7	7	8-12	9.9
			Peamouth	29	29	11-18	13.9
			Shiner perch	13	6	11-13	11.8
			Carp	9	9	60-74	64.1
			TOTAL	74	60		

APPENDIX FIGURES

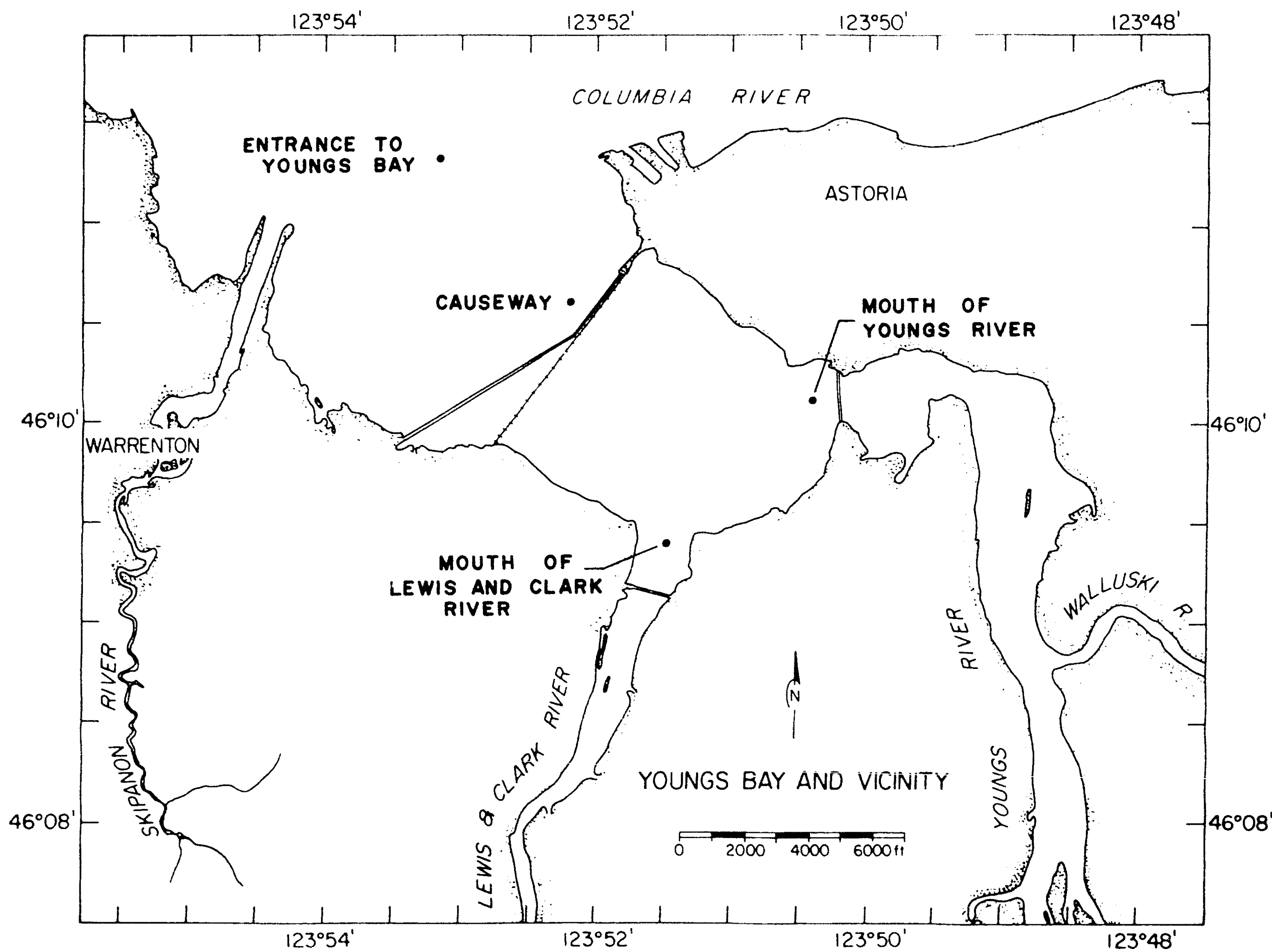

Figure 1-1. Location of stations where temperature, salinity, and turbidity measurements were made.

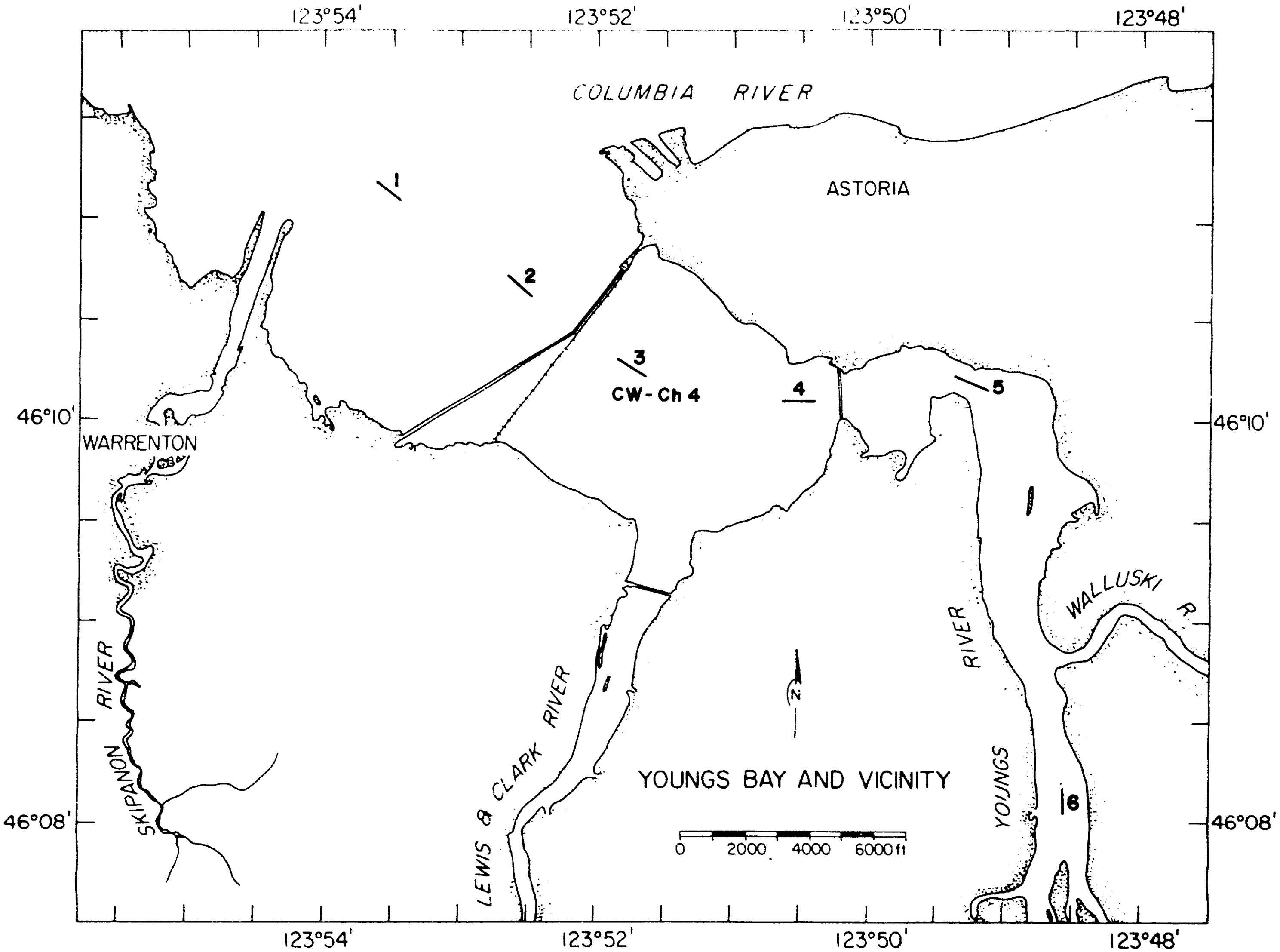

Figure 1-2. Location of zooplankton and larval fish sampling stations. Transect stations are numbered 1 to 6. Transect station 3 was located at regular sampling station CW-Ch 4.

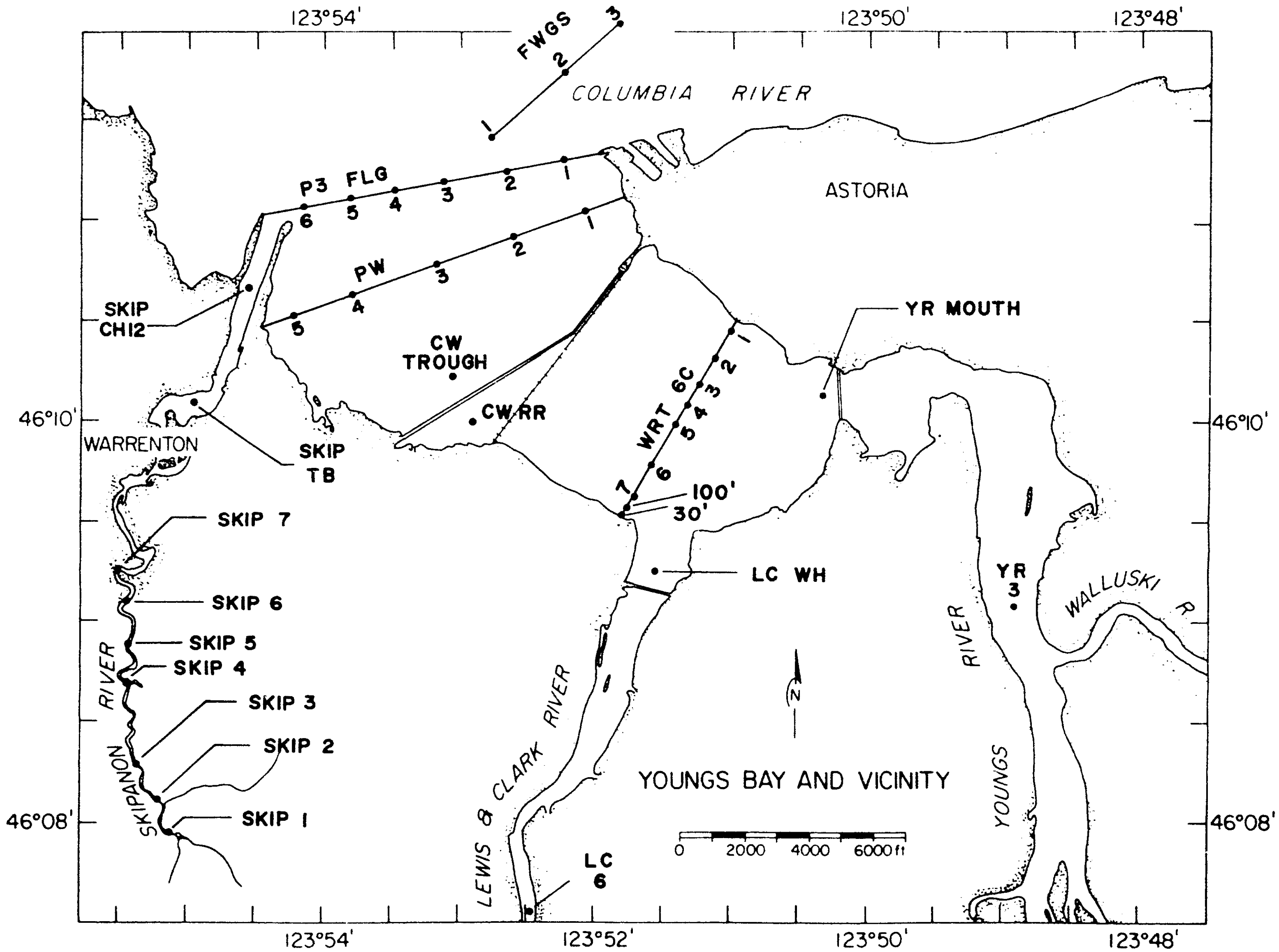

Figure 1-3. Location of stations where benthos grab and core samples were taken in the Youngs Bay area. Additional stations are shown in Appendix Figure 1-4.

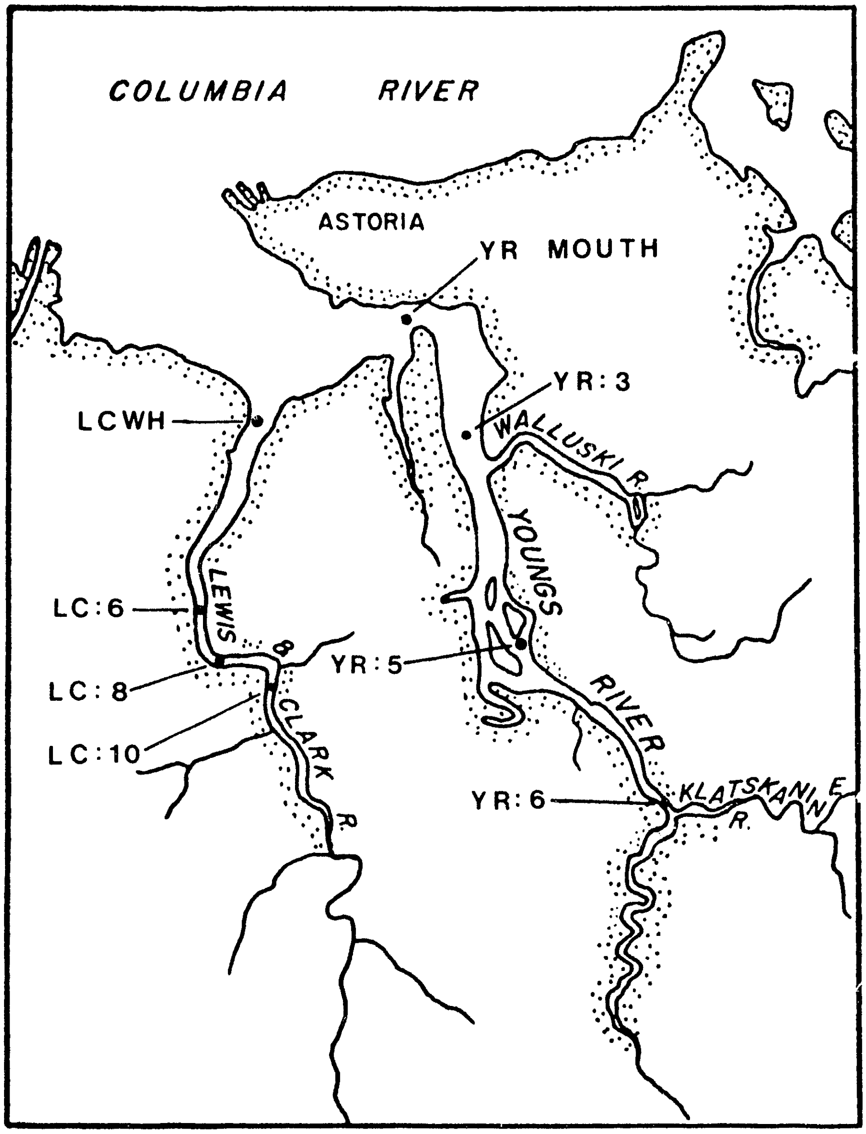

Figure 1-4. Location of stations where benthos grab samples were taken in Youngs River and Lewis and Clark River.

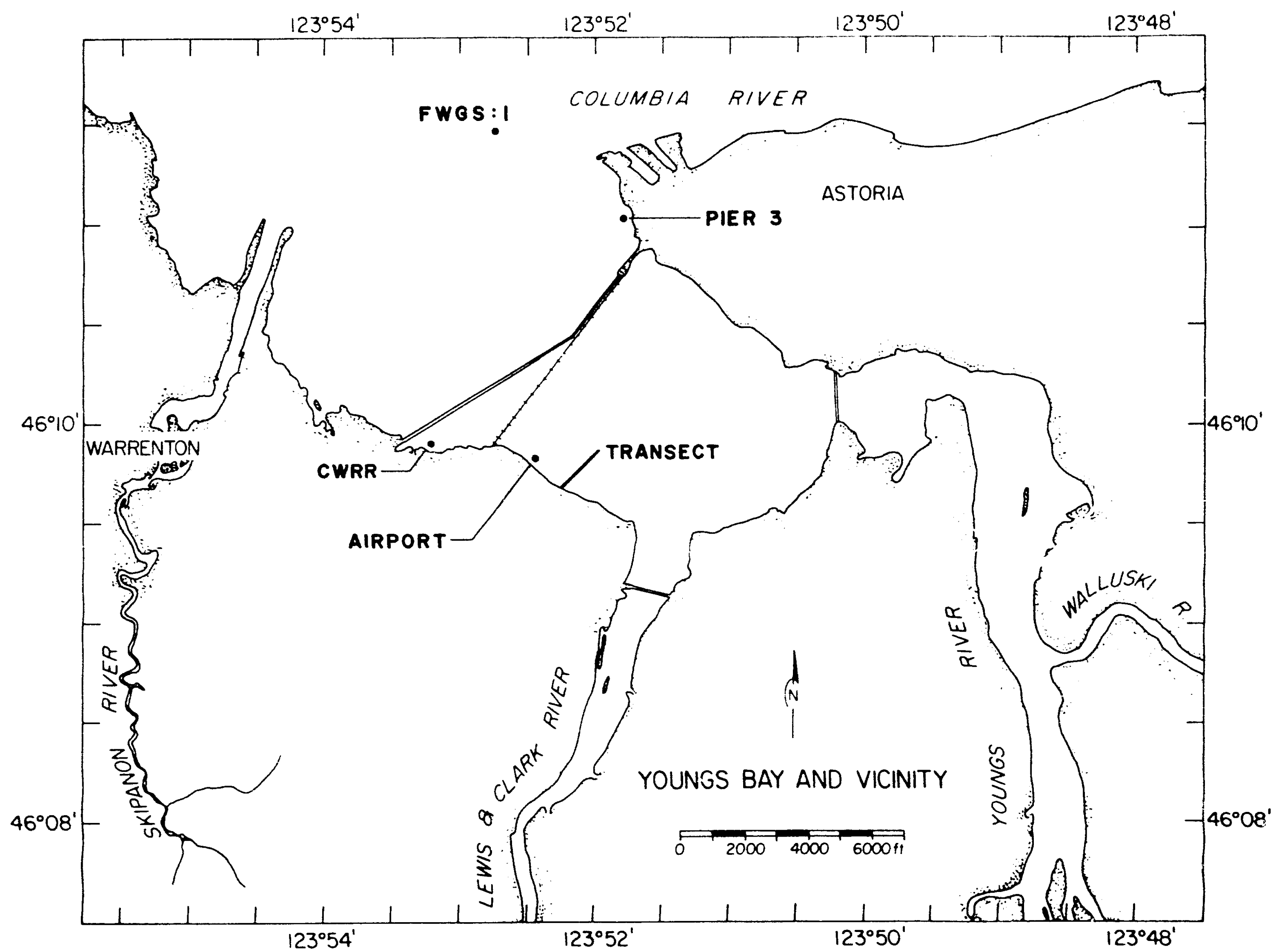

Figure 1-5. Location of transect used in sampling exposed mud flat for benthic infauna, and of stations where cores were taken for vertical distribution studies.

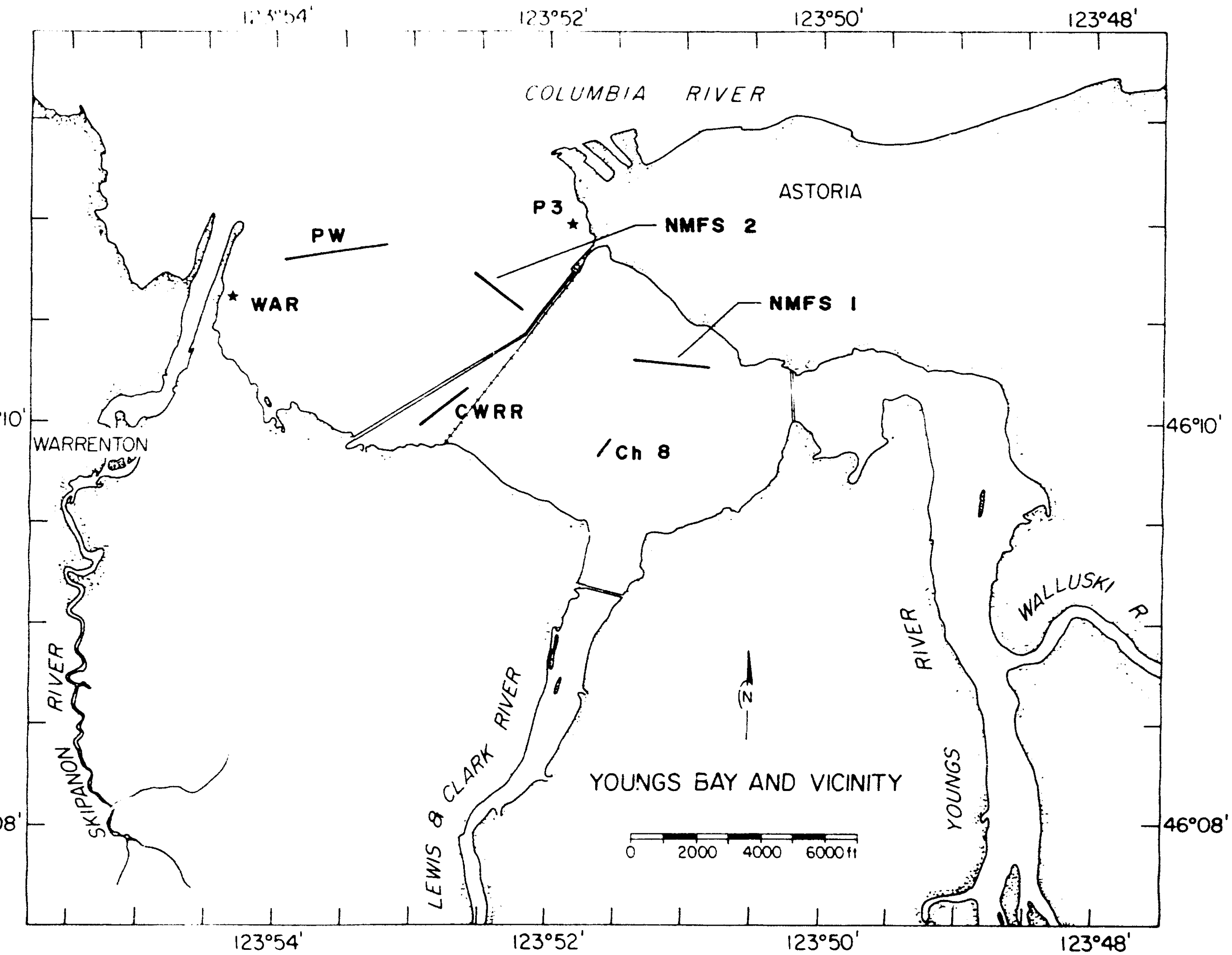

Figure 1-6. Location of trawl, gill net, and seine sample stations. Seine stations are indicated by stars.

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