The Neustonic Fauna in Coastal Waters of the Northeast Pacific: Abundance, Distribution, and Utilization by Juvenile Salmonids

Richard D. Brodeur
Bruce C. Mundy
William G. Pearcy
Robert W. Wisseman

osu
sea
grant

OREGON SEA GRANT
ORESU-T-87-001

The Neustonic Fauna in Coastal Waters of the Northeast Pacific: Abundance, Distribution, and Utilization by Juvenile Salmonids

Richard D. Brodeur
William G. Pearcy
Bruce C. Mundy
Robert W. Wisseman

Oregon State University
Sea Grant College Program
AdS 402
Corvallis, Oregon 97331

Publication No. ORESU-T-87-001

AUTHORS

Richard D. Brodeur, senior research assistant, and William G. Pearcy, professor, are with the College of Oceanography at Oregon State University. Bruce C. Mundy works as a fishery biologist at the Honolulu laboratory of the National Marine Fisheries Service. Robert W. Wisseman is a research assistant in the Department of Entomology at Oregon State University.

SUPPORT

This publication is the result, in part, of research sponsored by Oregon Sea Grant through NOAA Office of Sea Grant, Department of Commerce, under Grant No. NA79AA-D-00106 (Project No. R/CE-10). The U.S. Government is authorized to produce and distribute reprints for governmental purposes, notwithstanding any copyright notation that may appear hereon.

The Oregon State University Sea Grant College Program is supported cooperatively by the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, by the state of Oregon, and by participating local governments and private industry.

ORDERING PUBLICATIONS

Copies of this publication are available from

Sea Grant Communications
Oregon State University
AdS A402
Corvallis, OR 97331

Please include author, title, and publication number. Upon request, we will also send a free copy of our catalogue of Oregon State University marine-related publications.

CONTENTS

TABLES AND FIGURES

Tables

In Text

In Appendix

Figures

INTRODUCTION

The surface-layer zone, occupying the upper 20 cm of the water column, represents a unique oceanic environment. A diverse assemblage of organisms occupies this zone, either in an obligate or facultative manner (Zaitsev 1970, Hempel and Weikert 1972, Cheng 1975, Peres 1982). Certain animals show morphological or biochemical adaptations to this environment and are generally found in this layer throughout their life cycles. More often, however, species may be found near the surface for only a limited part of their life cycle, as in the case of diel migrants (Zaitsev 1970). These organisms have been collectively referred to as pleuston if they are found at the air-sea interface and neuston if they reside immediately below this interface (Cheng 1975).

Comprehensive studies of the surface fauna inhabiting an extensive geographic area are rare and have been conducted mostly in oceanic regions (Hempel and Weikert 1972, Holdway and Maddock 1983a, b, Andres and John 1984). Although coastal areas harbor a less diverse zooplanktonic fauna than oceanic regions, they usually contain a much higher biomass. Coastal systems have generally been poorly studied in terms of their neustonic components; this is particularly true for the temperate coastal waters of the eastern North Pacific. Aside from the recent work of Shenker (1985) along one transect off central Oregon, the majority of studies in this area have examined only the ichthyofaunal component of the neuston (Richardson 1975, Ahlstrom and Stevens 1976, Laroche and Richardson 1979, Kendall and Clark 1982a, b, Clark 1984).

The occurrence of pleustonic and generally neustonic organisms in the diets of several pelagic predators, particularly juvenile salmonids, collected off the coast of Washington and Oregon (Brodeur, personal observation) prompted us to incorporate neuston sampling into our regular sampling regime for juvenile salmonids. The purpose of this report is twofold: to first examine the abundance and distribution patterns of all the taxa, including terrestrial insects, greater than 5 mm assumed to be quantitatively sampled by our gear, and then to compare the species composition and relative abundance of the taxa collected in the neuston nets with those found in the stomachs of juvenile coho (*Oncorhynchus kisutch*) and chinook (*O. tshawytscha*) salmon collected from the same stations at approximately the same times. These two species of salmon make up the majority of the catch of juvenile salmonids caught off Oregon and Washington (Pearcy 1984), and their food preferences in relation to available prey is of special interest (Peterson et al. 1982). These comparisons enable us to assess the importance of the neustonic fauna to the diet of these pelagic predators.

METHODS

Neuston were collected as part of the regular sampling of the OSU Early Marine Life History of Salmon Project during the months of June and September 1984 and covered the area from northern Washington (lat. 48°20' N) to southern Oregon (44°00' N). Additional samples were obtained during the NWAFC-OSU Coastwide Cooperative Study Cruise during July and August 1984, which extended from northern California (40°44' N) to northern southeast Alaska (58°30' N). The chartered drum seiner *Pacific Warwind* (PW) was used for the southern sampling up to northern Vancouver Island, and another seiner, *Bering Sea* (BS), completed the northern sampling. Stations were occupied along transects approximately 37 km apart throughout the study area (figure 1). The stations were located along each transect at distances of 4, 9, 18, 28, 37, and 46 km from the coastline, although not all stations were sampled along each transect.

Collections were made with a rectangular 1- by 0.35-m-mouth opening neuston net frame (Bartlett and Haedrich 1968) containing a conical 0.505-mm mesh Nitex net. The distance the net travelled was measured with a TSK flowmeter mounted on the bottom of the mouth opening. The net was trailed from an outrigger located amidships and held clear of the wake of the vessel. Tows lasted from 5 to 10 minutes and were made at a speed of one to two knots. The mouth of the net was generally half submerged at this speed, and we have assumed that a 17.5-cm surface stratum of water was sampled at each station. Most samples were collected during daylight hours.

Following retrieval and thorough washing of the nets, samples were examined at sea and any large debris, detritus, or gelatinous zooplankton were noted and discarded after rinsing with fresh water to remove smaller zooplankton. The remaining samples were preserved for later analysis in a 10% buffered formalin-seawater solution. Sea surface temperature, salinity, and chlorophyll a concentration were measured at each station. Temperatures were taken using a weighted bucket submerged slightly below the surface. Salinity and chlorophyll samples were taken with an NIO bottle tripped at a depth of 1 m. Laboratory analyses of these samples are discussed in Fisher and Pearcy (1985).

Laboratory techniques for the curation of the samples were modified from Smith and Richardson (1977). Prior to sorting, wet volumes were measured as follows. All larger organisms and pieces of detritus which were not discarded at sea were rinsed and removed from the sample. The remaining sample was rinsed into a graduated cylinder and allowed to settle for 15 minutes. Settled volumes were measured to the nearest 1 ml for samples smaller than 25 ml and to the nearest 5 ml for larger samples.

The total sample was sorted without the aid of magnification using glass trays which were illuminated from below. All organisms with a largest dimension of more than 5 mm were removed from the sample. Each sample was searched twice to insure that organisms were not missed. Most gelatinous forms (ctenophores, cnidarians, and siphonophores) were badly damaged and were difficult to identify beyond phyla so these were only noted. Large samples containing predominantly one taxon were first searched for less numerous taxa and then successively split with a Folsom Plankton Splitter until a subsample of manageable size for counting the dominant taxa was obtained. Sorted organisms were placed in 50% isopropyl alcohol and later identified to the lowest possible taxon.

After all individuals >5 mm had been removed from the sample, the percent contribution of the major taxonomic groups of smaller zooplankton to the remaining fraction was estimated. This unsorted fraction was then returned to the graduated cylinder and allowed to settle for 15 minutes. Its volume was then measured. Sorted samples were stored in 50% isopropyl alcohol. Displacement volumes and abundances of all the taxa were expressed per 100 m of water volume filtered.

Quantitative purse seine hauls were made immediately following the tows (Fisher and Pearcy 1985). Juvenile salmon were quickly sorted from the catch, anesthetized, identified to species, measured, and individually frozen for later analysis. Stomachs were excised in the laboratory from partially frozen specimens and preserved in a 10% buffered formalin solution and later transferred to 50% isopropyl alcohol. Prey were identified to the lowest possible taxa under a dissecting microscope. Stomach fullness was assigned a code between 0 (empty) and 5 (fully distended), and the relative state of digestion of the stomach contents was visually estimated and assigned a code between 0 (well digested) and 4 (fresh). Stomach collections were included only from stations from which five or more specimens of a single species were collected.

To compare the species composition of the diet of the juvenile salmonids to that of the neuston catches, we pooled all the stomachs of each species of salmon from each station and calculated the proportion of the total number of each prey contributed by each taxon. We included in this analyses only prey taxa identified to the family level or lower. To assess the importance of the neuston to these juvenile salmonids, we used an index modified from Schoener's (1970) index of similarity, where

$$\text{Percent Similarity Index} = PSI = 1.0 - 0.5\,\Sigma \left| r_i - p_i \right| \times 100,$$

where r and p are the proportions of prey item in the stomachs and environment, respectively, from a particular station. This index ranges from 0 (no taxa in common) to 100 (same proportions in neuston and diet).

To determine which taxa are most important to the diet of each species relative to their abundance in the neuston, we compared the proportional abundance in the diets and neuston tows using Strauss' (1979) Linear Index of Food Selection (L), defined as

$$L = r_i - p_i$$

This index ranges from -1.0 (which implies either that the prey was always rejected or that the prey item is not available to the predator) to +1.0 (total selection for a prey item). Values near zero imply that the prey is taken in proportion to its relative abundance in the environment.

RESULTS

Neuston Collections

A listing of the station data along with plankton volumes and pertinent environmental data for the 122 collections made is given in appendix table 1. A total of 145 taxa representing 13 major taxonomic categories was collected. A summary of the number of occurrences, overall mean abundance, and coefficient of dispersion (CD) for each taxa is presented in table 1. This latter index, which is the variance expressed as a percentage of the mean, is a measure of the relative aggregation or dispersion of the organisms (Elliott 1977). The coefficient of dispersion (times n-1) is compared with the expected chi-square distribution (n-1 degrees of freedom) to indicate whether the distribution of a particular taxa is very dispersed ($p < 0.01$), dispersed ($p < 0.05$), random, contagious ($p > 0.05$), or very contagious ($p > 0.01$).

The dominant species collected in each of the four cruises are given in tables 2 through 5, and a complete taxonomic list of organisms is given by station in appendix table 2. The following section discusses the important taxa collected in each of the major taxonomic categories in systematic order.

Table 1. Frequency of occurrence and mean abundance (mean of all catches/100 m^3) of all taxa collected in neuston sampling from June through September 1984. Also given is the coefficient of dispersion (CD) for taxa which occurred in at least three samples and the distribution compared to the expected chi-square distribution: VC = very contagious, C = contagious, R = random, D = dispersed, and VD = very dispersed (see text).

Species	Frequency of Occurrence (n = 122)	Mean Abundance (No./100 m^3)	CD	Dist.
POLYCHAETA				
Lepidasthenia sp.	1	0.69	---	
Alciopidae unidentified	2	1.42	---	
Tomopteris planktonis	3	7.05	12.65	VC
Tomopteris septentrionalis	1	0.54	---	
Nereidae unidentified	2	2.27	---	
Unidentified	6	4.77	7.81	VC
MOLLUSCA				
Gastropoda				
Limacina helicina	5	2.90	1.71	R
Unidentified	1	0.74	---	
Nudibranchia				
Dendronotus subramosus	2	1.39	---	
Cephalopoda				
Teuthidida	1	1.06	---	
Loligo opalescens	1	0.77	---	
Unidentified	1	0.66	---	
ARACHNIDA				
Unidentified	5	0.81	0.07	VD
OSTRACODA				
Conchoecia sp.	1	1.70	---	
COPEPODA				
Neocalanus cristatus	4	3.79	6.11	VC
ISOPODA				
Idotea resecata	2	0.80	---	
Idotea fewkesi	9	1.11	0.26	D
AMPHIPODA				
Gammaridea				
Peramphitoe humeralis	3	0.62	0.01	VD
Amphitoe lacertosa	1	0.68	---	
Amphitoe simulans	1	1.56	---	
Atylus tridens	5	0.93	0.17	D
Calliopius laeviusculus	19	5.55	25.42	VC
Eogammarus confervicolus	1	0.62	---	
Allorchestes bellabella	3	2.42	1.15	R

Species	Frequency of Occurrence (n = 122)	Mean Abundance (No./100 m^3)	CD	Dist.
Hyale frequens	1	0.68	---	
Hyalellidae unidentified	8	1.26	0.97	R
Eyakia robusta	1	0.68	---	
Heterophoxus oculatus	1	1.46	---	
Unidentified	2	0.78	---	
Hyperiidea				
Hyperia medusarum	5	1.71	1.71	R
Hyperoche medusarum	41	7.87	18.18	VC
Lestrigonus schizogenios	1	6.18	---	
Parathemisto pacifica	19	8.91	22.52	VC
Primno macropa	2	7.18	---	
Lycaea pulex	2	0.74	---	
Tryphana malmi	1	0.65	---	
Streetsia challengeri	5	5.04	1.26	R
Unidentified	2	0.79	---	
Caprellidae				
Caprella incisa	1	0.55	---	
EUPHAUSIACEA				
Euphausia pacifica	17	19.54	188.99	VC
Nematoscelis difficilis	1	7.67	---	
Nyctiphanes simplex	2	1.90	---	
Thysanoessa gregaria	1	1.32	---	
Thysanoessa longipes	1	0.77	---	
Thysanoessa spinifera	41	235.21	9217.31	VC
Unidentified	3	3.67	5.73	VC
DECAPODA				
Natantia				
Hippolyte clarki	2	1.02	---	
Hippolyte sp.	1	0.68	---	
Heptacarpus sp.	1	0.54	---	
Hippolytidae unidentified	16	3.17	9.82	VC
Pandalus sp.	2	1.45	---	
Crangon sp.	3	1.91	2.35	R
Reptantia				
Callianassidae	2	25.14	---	
Pagurus sp.	3	1.45	0.07	D
Pachycheles pubescens	7	4.83	5.02	VC
Pachycheles rudis	1	1.49	---	
Porcellanidae unidentified	14	5.88	13.23	VC
Chionoecetes tanneri	1	0.82	---	
Pugettia producta	13	3.04	6.12	VC
Cancer antennarius	20	480.96	6655.71	VC
Cancer magister	30	13.16	59.70	VC
Cancer oregonensis	24	275.57	2597.21	VC
Cancer sp. (zoea)	14	2.55	4.72	VC
Lophopanopeus bellus	4	2.09	1.23	R
Pinnixia sp.	1	1.44	---	

Species	Frequency of Occurrence (n = 122)	Mean Abundance (No./100 m^3)	CD	Dist.
Pinnotheridae unidentified	4	2.64	0.98	R
Unidentified	2	2.85	---	
INSECTA				
Odonata				
Pantala hymenaea	1	0.51	---	
Isoptera				
Zootermopsis sp.	1	0.99	---	
Plecoptera				
Perlidae	1	0.81	---	
Psocoptera				
Unidentified	24	28.91	344.10	VC
Hemiptera				
Saldula sp.	3	1.50	3.51	C
Unidentified	23	13.91	62.52	VC
Homoptera				
Aphidae	43	9.32	18.79	VC
Membracidae	3	2.48	0.19	R
Cicadellidae	13	3.41	4.67	VC
Coleoptera				
Carabidae	5	0.77	0.01	VD
Hydrophilidae	6	0.77	0.20	VD
Staphylinidae	3	0.62	0.05	D
Coccinella trifasciata	1	0.51	---	
Anatis rathvoni	1	0.65	---	
Hippodamia convergens	3	0.64	0.04	D
Mulsantina picta	7	0.91	0.25	D
Adalia bipunctata	1	2.29	---	
Cycloneda polita	1	0.71	---	
Diabrotica undecimpunctata	2	4.60	---	
Neuroptera				
Hemerobius bistrigatus	8	1.35	1.00	R
Hemerobius pacificus	14	1.30	0.67	R
Hemerobius stigmaterus	16	1.40	0.47	D
Hemerobius sp.	7	1.67	1.57	R
Micromus variolosus	7	1.00	0.28	D
Trichoptera				
Lenarchus rho	1	0.66	---	
Lepidoptera				
Geometridae	3	0.94	0.18	R
Choristoneura occidentalis	9	9.91	38.45	VC
Oecophoridae	1	0.75	---	
Unidentified	2	0.92	---	
Diptera				
Nematocera unidentified	38	2.71	3.71	VC
Tipulidae	11	1.77	0.65	R
Psychodidae	11	1.36	0.80	R
Culex sp.	1	0.57	---	
Chironomidae	1	0.65	---	
Brachycera unidentified	39	3.02	23.01	VC

Species	Frequency of Occurrence (n = 122)	Mean Abundance (No./100 m³)	CD	Dist.
Syrphidae	3	0.97	0.26	R
Ephydra sp.	2	1.56	---	
Diptera unidentified	4	0.92	0.29	R
Hymenoptera				
Aphidiidae	7	0.82	0.19	D
Braconidae	7	1.06	0.13	VD
Ichneumonidae	10	2.29	3.03	VC
Eulophidae	2	0.74	---	
Encyrtidae	1	0.54	---	
Torymidae	2	1.12	---	
Figitidae	2	0.70	---	
Cynipidae	1	1.99	---	
Ceraphronidae	1	0.99	---	
Diapriidae	1	0.68	---	
Formicidae	11	4.89	24.76	VC
Sphecidae	2	1.64	---	
Apis mellifera	1	0.74	---	
CHAETOGNATHA				
Eukrohnia hamata	1	3.92	---	
Sagitta elegans	3	6.68	4.71	VC
Unidentified	14	4.70	8.19	VC
LARVACEA				
Oikopleura sp.	1	136.97	---	
OSTEICHTHYES				
Clupea harengus pallasi	1	1.68	---	
Engraulis mordax	6	48.13	263.54	VC
Osmeridae	8	1.90	5.30	VC
Tactostoma macropus	1	0.77	---	
Brosmophycis marginata	1	0.54	---	
Cololabis saira	4	1.05	0.11	D
Syngnathus leptorhynchus	2	0.61	---	
Sebastes caurinus	1	6.18	---	
Sebastes diploproa	5	6.05	21.15	VC
Sebastes chlorostictus	1	0.77	---	
Sebastes sp.	14	1.48	0.81	R
Hexagrammos decagrammus	2	2.14	---	
Ophiodon elongatus	2	0.96	---	
Anoplopoma fimbria	1	1.56	---	
Cottus asper	1	1.37	---	
Leptocottus armatus	1	1.99	---	
Radulinus asprellus	1	1.60	---	
Scorpaenichthys marmoratus	29	3.19	4.22	VC
Agonopsis vulsa	1	1.46	---	
Stellerina xyosterna	1	0.68	---	
Liparididae	1	1.41	---	
Ronquilus jordani	13	7.34	38.49	VC
Ammodytes hexapterus	1	4.82	---	

Table 2. Frequency of occurrence and total and percent standardized abundance of the 10 most abundant taxa collected during the June cruise off Oregon and Washington.

Taxa	Frequency of Occurrence (n = 24)	Total Stand. Abundance (No./100 m^3)	Percent of Total Abundance
Euphausia pacifica	1	251.14	26.97
Cancer magister meg.	10	250.99	26.95
Ronquilus jordani	6	82.20	8.82
Cancer antennarius meg.	9	51.04	5.48
Parathemisto pacifica	1	34.71	3.72
Porcellanid megalopae	4	34.48	3.70
Cancer oregonensis meg.	3	33.64	3.61
Thysanoessa spinifera	4	30.37	3.26
Cancer sp. zoea	6	25.33	2.72
Nematocera	12	24.40	2.62

Table 3. Frequency of occurrence and total and percent standardized abundance of the 10 most abundant taxa collected during the July cruise off California to British Columbia.

Taxa	Frequency of Occurrence (n = 40)	Total Stand. Abundance (No./100 m^3)	Percent of Total Abundance
Aphidae	24	311.52	12.43
Engraulis mordax	3	285.34	11.39
Hyperoche medusarum	17	248.51	9.92
Cancer oregonensis meg.	10	170.06	6.78
Psocoptera	13	138.92	5.54
Oikopleura sp.	1	136.97	5.46
Parathemisto pacifica	14	129.55	5.17
Cancer magister meg.	11	93.97	3.75
Choristoneura occidentalis	8	88.19	3.52
Brachycera	22	77.53	3.09

Polychaeta

Pelagic polychaetes were not well represented in our neuston samples either by occurrence or abundance. The genus Tomopteris was the most common taxa identified. Many specimens were damaged during capture and could not be identified to species. Most species had a very clumped distribution.

Mollusca

This heterogeneous group also occurred infrequently and were not very abundant in our samples. Pteropods, especially Limacina helicina, were relatively rare in our collections and were not abundant when they did occur. However, most pteropods were smaller than 5 mm, the minimum size of organisms that were sorted from the samples. The nudibranch species (Dendronotus subramosus) is not usually collected in the plankton but may have been swept off the bottom or off a floating substrate. Cephalopods were also rare in our samples and were represented only by larval stages.

Arachnida

Spiders were collected infrequently in our samples and were not identified to species. The individuals collected were most likely washed out to sea from estuaries or perhaps had inhabited forested areas close to the ocean and were blown to sea.

Ostracoda

Only one large ostracod (Conchoecia sp.) was found at our southernmost collection although many smaller individuals less than 5 mm were found but were not identified for the purposes of this study.

Copepoda

Calanoid copepods were the most numerous taxa collected in the neuston and generally made up from 10% to 90% of the unsorted zooplankton fraction. Most of the unsorted taxa were adults and late copepodite stages of the following genera: Pseudocalanus, Calanus, Neocalanus, and Epilabidocera. The only taxa large enough to include in the sorted fraction was Neocalanus cristatus, which occurred in low abundances at only a few stations. Collections of calanoid copepods were much higher in the night collections than the day collections, implying that they either migrated into the neuston at night or were able to avoid the sampling gear during daylight hours.

Isopoda

Only two species of isopods were collected in our gear. All our specimens were olive green, and, since these taxa are not known to be strong swimmers, they were probably attached to floating macroalgae, especially kelp blades. Large pieces of kelp and other plant detritus were found in the neuston hauls that contained many of these isopods. Most of these collections were made off the central Oregon coast.

Amphipoda

Most species of gammarid amphipods were infrequent and occurred in low abundances in our collections although one generally pelagic species, *Calliopius laeviusculus*, was the fifth and sixth most abundant species collected in the September cruise off Oregon and Washington and the cruise off southeast Alaska, respectively. In general, gammarid amphipods represented a higher proportion of the neuston off southeast Alaska than in more southern waters.

Hyperiid amphipods occurred more frequently and were much more important numerically than gammarids. In particular, either or both of two hyperiid species, *Hyperoche medusarum* and *Parathemisto pacifica*, were among the dominant species during each cruise. Both these species were contagiously distributed in our samples. *Hyperoche medusarum* was one of the most frequently occurring taxa in all our collections and was found in high abundances mostly in nighttime tows. Most of the large catches of hyperiids also yielded many ctenophores and hydromedusae.

Euphausiacea

As with the amphipods, much of the euphausiid catch was dominated by two species. *Euphausia pacifica* was the most abundant species in terms of total number of specimens collected during the June cruise, but this total was collected entirely at one offshore (46.9 km) station during daylight. This species was more commonly collected as adults off Canada in July and as juveniles during the September cruise. The other dominant species, *Thysanoessa spinifera*, occurred frequently, especially at stations inshore of 18 km, but showed a highly clumped distribution pattern with a high variance to mean ratio. Adult specimens were found during every cruise, but furcilia larvae and juveniles dominated the September catches when *T. spinifera* accounted for almost 87% of the total catch (table 4). One 7-min daytime tow off southern Washington during this month alone captured over 15,000 juveniles of this species. The capture of a southern euphausiid, *Nyctiphanes simplex*, at two stations off Oregon is unusual since this species has only recently been noted to occur north of California (Brodeur 1986).

Decapoda

Many species of shrimp and crab larvae were found in the neuston. Several species of shrimp larvae occurred but, with the exception of Hippolytidae zoeae, none were common or abundant. Several large juvenile or adult specimens of *Hippolyte clarki* were collected but these may not have been free-swimming and were probably associated with macroalgae. Several species of crab larvae were frequently collected; especially well represented were members of the family Porcellanidae and Cancridae. *Cancer* spp. megalopae and zoeae were very abundant in all but the September cruise and, off Canada and southeast Alaska, made up over 97% of the catch although they were found at only a limited number of stations (table 5). *Cancer* megalopae had more clumped distributions than the other species and were even more aggregated than Cancer zoea, indicating perhaps some behavioral adaptation to aggregate in high density patches.

Table 4. Frequency of occurrence and total and percent standardized abundance of the 10 most abundant taxa collected during the September cruise off Oregon and Washington.

Taxa	Frequency of Occurrence (n = 26)	Total Stand. Abundance (No./100 m^3)	Percent of Total Abundance
Thysanoessa spinifera	10	9820.31	86.99
Psocoptera	10	555.15	4.91
Hemiptera	10	303.66	2.69
Aphidae	15	77.76	0.68
Calliopius laeviusculus	10	73.71	0.65
Hyperoche medusarum	17	51.12	0.45
Callianassidae zoea	1	49.62	0.43
Formicidae	5	43.74	0.38
Cicadellidae	7	39.17	0.34
Brachycera	12	27.56	0.24

Table 5. Frequency of occurrence and total and percent standardized abundance of the 10 most abundant taxa collected during the July cruise off British Columbia and Southeast Alaska.

Taxa	Frequency of Occurrence (n = 32)	Total Stand. Abundance (No./100 m^3)	Percent of Total Abundance
Cancer antennarius meg.	4	9558.28	58.39
Cancer oregonensis meg.	4	6393.80	39.05
Thysanoessa spinifera	8	202.72	1.23
Cancer magister meg.	9	50.22	0.30
Euphausia pacifica	6	41.75	0.25
Calliopius laeviusculus	8	30.40	0.18
Hyperoche medusarum	6	22.32	0.13
Scorpaenichthys marmoratus	5	12.60	0.07
Ronquilus jordani	3	7.98	0.04
Sebastes sp.	3	6.03	0.03

Insecta

Insects were the most diverse of the major taxonomic groups collected but were numerically important only during the July and September cruises off Oregon and Washington (tables 3 and 4). With the exception of a few pupae and one chironomid larvae, all specimens were fully winged adult forms from terrestrial or riparian habitats which were probably blown out to sea rather than carried out to sea by rivers. Many of the species were light bodied and probably not strong fliers and may have been blown offshore during dispersal or mating flights. Among the more important of the 12 insect orders collected were Psocoptera (bark lice), Hemiptera (true bugs), Homoptera (aphids, plant hoppers), Coleoptera (beetles), Neuroptera (lacewings), Lepidoptera (moths), Diptera (flies), and Hymenoptera (wasps and ants). One lepidopteran species, identified as Choristoneura prob. occidentalis (Western spruce budworm, P. C. Hammond, OSU, Entomology), was abundant at some stations and was particularly obvious because of its large size. One very large dragonfly (Pantala hymenaea), which is known to undertake long migrations in the nearshore region (N. H. Anderson, OSU, Entomology), was collected 4.4 km off central Oregon.

Chaetognatha

This gelatinous-bodied phylum was not well represented in our collections and many of those collected were difficult to identify because of their mutilated condition. Only two common species were identified. Chaetognaths were most abundant off southern Oregon and northern California.

Larvacea

Larvaceans were probably more common in the study area than our collections would indicate although large individuals were rare. All larvaceans we collected were taken during one daytime collection off California and were of the genus Oikopleura.

Osteichthyes

Many taxa of fishes were collected in the neuston although only a few taxa were common or abundant enough to be important in our sampling (tables 2-6). A wide range of sizes was collected, from several preflexion larvae (3-4 mm) to large juvenile sand lance (Ammodytes hexapterus, 70-75 mm). The majority of the northern anchovy (Engraulis mordax) collected were from one night station off central Oregon. Cabezon (Scorpaenichthys marmoratus), northern ronquil (Ronquilus jordani), and rockfish (Sebastes spp.) larvae and juveniles were the most frequently caught taxa. Most preflexion Sebastes were not identifiable to species. Several offshore or deepwater taxa (Tactostoma macropus, Brosmophycis marginata, Cololabis saira, and Anoplopoma fimbria) have been rarely caught in subsurface plankton collections in the study area (Richardson 1977). Fish eggs were also collected at a number of stations, but these were not identified because they were smaller than 5 mm.

Other taxa

In addition to the above mentioned taxa, many large or fragile gelatinous species were collected and noted. Dominant among these were hydromedusae (Aequorea victoria), scyphomedusae (mostly Aurelia aurita), ctenophores (Pleurobrachia spp.), and siphonophores (Velella velella). Many smaller forms, including small copepods, euphausiid larvae, ostracods, pteropods, and cirripede cyprids were not effectively sampled by our gear and were generally not quantified.

Prey Composition of Juvenile Salmonids

The general food categories consumed by juvenile coho and chinook salmon examined from all stations during the 1984 cruise are given by percent frequency of occurrence and percent number in tables 6 and 7. During June of 1984, fishes and decapod larvae were by far the most frequently occurring prey taxa for juvenile coho salmon although decapod larvae were much more important numerically (table 6). Copepods and euphausiids were moderately important, whereas amphipods, barnacle larvae, and insects rarely occurred and were only of minor importance in the diet. Juvenile coho had a more diverse diet during July. Decapod larvae were still important prey, both in occurrence and percent by number, but fish were less important by number. Insects and amphipods greatly increased in relative importance during this month. Euphausiids occurred regularly but made up only a minor part of the diet numerically (table 6). By September, the majority of the diet consisted of amphipods and euphausiids with decapod larvae, fishes, and insects of secondary importance.

Table 6. Food habits by major taxonomic categories of juvenile coho salmon for the three cruises during 1984. The summaries for July include only those transects off Washington and Oregon (North of 43° N). Data given are the Frequency of Occurrence (F) in all nonempty stomachs and the percent of Numerical Abundance (N). Also given are summaries of the predator characteristics for each cruise.

Prey Category	June		July		Sept.	
	F (%)	N (%)	F (%)	N (%)	F (%)	N (%)
Pteropoda	---	---	4.5	0.6	8.6	2.5
Cephalopoda	---	---	1.5	0.1	6.9	0.2
Copepoda	19.4	6.5	13.4	4.0	3.4	0.1
Cirripedia	5.5	1.6	1.5	0.1	---	---
Amphipoda	4.2	1.3	64.2	18.4	86.2	52.0
Euphausiacea	13.9	4.9	64.2	9.4	70.7	23.7
Decapoda larvae	56.9	66.7	44.8	29.8	70.7	15.0
Insecta	1.4	0.1	53.7	31.9	1.7	0.1
Chaetognatha	---	---	3.0	0.1	---	---
Osteichthyes	83.9	18.7	53.7	5.4	67.2	6.4
PREDATOR CHARACTERISTICS						
No. stomachs	80		75		61	
No. empty	8		7		3	
Mean length	176.1		210.6		276.0	
Length range	121-247		144-347		177-366	

Juvenile chinook salmon consumed many of the same major prey categories as juvenile coho, with mysids replacing barnacle nauplii as the only change. There were, however, some major differences in the relative occurrence and abundance of these groups (table 7). Copepods, euphausiids, and fishes were relatively more important numerically, whereas amphipods, decapod larvae, and insects were less important for chinook compared with coho. Many of the same trends seen for each prey category in coho also were seen for chinook. Decapod larvae, fishes, and copepods were the dominant prey numerically in June and July, although the rank order of abundance shifted between the two months (table 7). Euphausiids replaced copepods as the numerically dominant group during September.

Table 7. Food habits by major taxonomic categories of juvenile chinook salmon for the three cruises during 1984. The summaries for July include only those transects off Washington and Oregon (north of 43° N). Data given are the Frequency of Occurrence (F) in all nonempty stomachs and the percent of Numerical Abundance (N). Also given are summaries of the predator characteristics for each cruise.

Prey Category	June		July		Sept.	
	F (%)	N (%)	F (%)	N (%)	F (%)	N (%)
Pteropoda	---	---	---	---	2.8	1.0
Cephalopoda	3.9	0.4	---	---	2.7	0.2
Copepoda	41.2	20.9	36.8	37.9	---	---
Mysidacea	1.9	0.1	5.2	0.3	---	---
Amphipoda	11.8	1.0	36.8	9.1	41.7	14.0
Euphausiacea	25.4	7.2	52.6	7.0	38.9	41.0
Decapoda larvae	54.9	36.3	57.9	15.8	47.2	25.7
Insecta	---	---	---	---	5.6	2.0
Chaetognatha	1.9	0.1	---	---	---	---
Osteichthyes	84.3	33.9	84.2	30.0	69.4	16.4
PREDATOR CHARACTERISTICS						
No. stomachs	62		21		39	
No. empty	11		2		3	
Mean length	178.2		149.6		222.3	
Length range	105-370		109-251		138-412	

Comparison of neuston and stomach contents

Appendix table 3 gives a detailed comparison of the stomach contents and neuston collections for each of the 13 stations for coho salmon and 3 stations for chinook salmon from which a sufficient number of stomachs (five or more nonempty) were obtained. There was a greater similarity between the numerical composition of the diet of juvenile coho and the neuston collected at the same station (mean PSI = 25.5%, range 3.3-45.2%) than the similarity seen for chinook (mean PSI = 17.4%, range 0.0-43.1%). For the one station (84-027) which compared both predator species, coho diets were more similar (PSI = 18.1%) than chinook (PSI = 0.0%) to the neuston. The maximum PSI values for coho were found at the station (84-092) where both stomach fullness and freshness were also the highest, but similar trends were not seen for the rest of the coho stomachs or the chinook stomachs.

Other than numerical similarity, a useful index of the relative utilization of the neuston by these predators is the percentage of prey taxa found in the stomachs that were also found in the neuston collections from the same stations. These percentages ranged from 16.7% to 60.0% (mean = 34.6%) for coho and from 0.0% to 60.0% (mean = 25.3%) for chinook. There did not appear to be any clear relationship between these percentages and either the stomach fullness or condition factor of the stomachs.

The Linear Index of Selection values (L) showed some interesting results for individual prey taxa of coho salmon (table 8). *Cancer oregonensis* megalopae had the highest number (n = 7) of positive L values (higher percentage in the stomachs than in the neuston samples) with only one negative L value (higher percentage in neuston samples than stomachs). All other species had four or fewer positive occurrences although two species (*Choristoneura occidentalis* and *Parathemisto pacifica*) were important to the diet when they did occur (table 8). The two euphausiid species (*Thysanoessa spinifera* and *Euphausia pacifica*), *Cancer magister* megalopae, *Hyperoche medusarum*, and *Ronquilus jordani* were important at times in both the diet and in the neuston samples. Two fish taxa (Osmeridae and *Scorpaenichthys marmoratus*) and several insect taxa (especially Brachycera and Nematocera) showed high negative L values (table 8). The results for chinook salmon were inconclusive since only three stations were examined.

Table 8. Summary of the relative importance of the dominant taxa in the diets and in the neuston collections based on the Index of Selection values given in appendix 3 for juvenile coho salmon. Data are the number of occurrences of positive selection values and positive selection values greater than 0.10, and number of occurrences of negative selection values and number of negative selection values less than -0.10.

Taxon	Positive Selection		Negative Selection	
	No. occ.	Occ.> 0.10	No. occ.	Occ.< -0.10
Cancer oregonensis	7	3	1	0
Choristoneura occidentalis	4	3	0	0
Parathemisto pacifica	4	3	1	0
Cancer antennarius	4	2	1	0
Cancer magister	4	2	3	2
Thysanoessa spinifera	4	2	4	1
Sebastes spp.	3	1	0	0
Hyperoche medusarum	3	0	2	2
Euphausia pacifica	2	1	1	1
Cancer sp. zoea	2	2	1	0
Ronquilus jordani	2	0	3	3
Osmeridae	0	0	3	1
Hemerobiidae	2	0	3	2
Hemiptera	1	0	3	0
Psychodidae	0	0	3	1
Aphidae	0	0	5	0
Scorpaenichthys marmoratus	1	0	6	2
Brachycera	1	0	8	5
Nematocera	1	0	9	4

DISCUSSION

As in all plankton sampling, a number of factors may influence the species composition and relative abundance of neuston collected at a particular station on any sampling date. Many of them are biological in origin, such as the degree of aggregation, reproductive cycles, and, in some cases, ability to migrate vertically in the water column. Others are constraints placed on the sampling by the investigator, such as time of day of sampling, weather conditions, methods of sampling, and gear used.

A large number of taxa were identified from our neuston collections, but almost one-half of these taxa, mainly spiders and insects, were of terrestrial origin and were probably not living when collected. Although not truly neustonic organisms, these fluvially or aerially transported insects may represent a substantial portion of the biomass of the neuston and diet of some pelagic fishes (Craddock 1969, Cheng and Birch 1977, 1978, Locke and Corey 1986). Other taxa, such as the isopods and some gammarid amphipods, are not normally free-swimming and were probably associated with floating macrophytes. We will first discuss the truly planktonic taxa and discuss later these terrestrial taxa, which made up a large part of the biomass of the neuston collections and were an important contribution to the diets of the salmonids.

True Planktonic Taxa

Euphausiids, hyperiid amphipods, decapod larvae, and fish larvae were numerically the dominant taxa collected in our neuston samples and in previous plankton collections made in the same area during the same time of year. Euphausiids were represented almost exclusively by *Thysanoessa spinifera* and *Euphausia pacifica*, which dominate plankton collections and vary in abundance seasonally and with distance from shore (Hebard 1966, Day 1971). Most of the euphausiids collected in neuston nets were subadults, which implies that the adults reside at greater depths, especially during the daytime. Similarly, the hyperiids were mostly represented by two species, *Hyperoche medusarum* and *Parathemisto pacifica*, which were most common in plankton net collections at inshore and offshore stations, respectively, in a study off Newport, Oregon, by Lorz and Pearcy (1975). The dominant larvae of decapod crustaceans were *Cancer* spp., which are known to show the highest larval abundances from May to July when densities may vary several orders of magnitude (Lough 1975, Shenker 1985). The megalopae of *C. magister* have been found in high densities at the surface, where they were concentrated in windrows created by Langmuir circulation (Shenker 1985).

Fish species also undergo substantial seasonal variation in the abundance of their larval and juvenile stages in the plankton. Several taxa have been found to have relatively high near-surface abundances compared to those found in the total water column (Kendall and Clark 1982a, b, Boehlert et al. 1985, Shenker 1985). Many of these same species were abundant during our study, including *Engraulis mordax*, *Sebastes* spp., *Scorpaenichthys marmoratus*, and *Ronquilus jordani*. Several others, notably *Anoplopoma fimbria*, *Hexagrammos* spp., and *Ammodytes hexapterus*, were less common in our neuston collections than expected based on previous studies. As Shenker (1985) has shown, generally only the smallest juveniles present are captured in small neuston nets such as the one used in our study.

Terrestrial Taxa

Terrestrial insects are known to be found in most nearshore neuston collections but had been found in generally low abundances off Oregon previously (Cheng and Birch 1978). Most of the insects found by Cheng and Birch and by us were weak fliers, including the Aphidae, Hemerobiidae, and numerous Diptera, which could have been blown offshore during mating or feeding flights. However, the abundance of larger insects in our collections was sometimes anomalously high, leading us to examine in detail these atypical situations.

Only a few species of insects were encountered in any of the June collections off Oregon and Washington. However, starting with collection PW-077 (taken off Brookings, Oregon, on 15 July) and continuing north until collection PW-104 (taken off Seaside, Oregon, on 26 July), insects were the most obvious taxa in the samples. One species in particular, the spruce budworm (*Choristoneura occidentalis*), was abundant and large enough to be highly visible from the deck of a ship in large surface patches at several stations off Wecoma Beach, Oregon, on 25 July. Examination of the wind data taken at Newport, Oregon (unpublished data from National Climatic Data Center), revealed a substantial increase in wind velocity (with gusts up to 15 m/sec) and a change in direction (from the NW to the SE) during the early morning hours. These sudden changes appeared to be associated with a major thunderstorm which raced through western Oregon and crossed the coast close to the Wecoma Beach transect late in the evening of 24 July. According to the official climatological report (National Climatic Data Center 1984), "The thunderstorms were accompanied by spectacular lightning displays, thunder, isolated heavy rains and gusty winds. Lincoln County Emergency Services reported a gust of 61 mph at 2243 PST." This storm was apparently of sufficient intensity and originated from the right direction to blow even large, and presumably strong-flying, insects such as the spruce budworm well off to sea. Similar large floating slicks of a congener (*C. fumiferana*) of this species have been reported off eastern North America (Cheng and Birch 1978), where wind conditions may make such allochthonous inputs a normal occurrence (Locke and Corey 1986).

Utilization of Neuston by Juvenile Salmon

Many of the species that were common in the neustonic layer, such as insects, *Cancer* megalops, *Sebastes*, spp., *Scorpaenichthys marmoratus*, and *Ronquilus jordani*, were frequently found in juvenile coho stomachs. One of the largest insects collected (*Choristoneura occidentalis*) was also by far the dominant prey item by weight in the coho stomachs at the same stations where this species occurred in the neuston. The fact that several juvenile coho collected shortly after the storm had stomachs that were distended with over 100 of these insects shows the ability of juvenile coho to readily exploit even ephemeral food sources in the neuston.

The numerical similarity between the diets of the juvenile salmon examined and the neuston collections was moderate to low for all stations. The percentages of prey taxa in common between the diets and neuston were generally higher than the numerical similarity but not convincing evidence that salmon forage exclusively in this zone. However, other factors besides actual negative selection could also result in low overlap values. Among these are the following.

(1) The neuston net may not be an adequate sampling device to estimate the available prey of these predators. With the exception of some of the larger juvenile fishes and smaller copepod species, the size range and overall species composition of the neuston and diets were similar. The vulnerability of all taxa to the gear, however, may be quite variable, and highly mobile juvenile fishes would not be expected to be caught in proportion to their actual abundances as insects floating at the surface would. The preponderance of small insects (e.g., aphids and flies) in the neuston compared to the diets may reflect an inability on the part of the predator to detect these small but abundant food sources compared with larger insects (e.g., spruce budworm) nearby.

(2) Particularly in the case of well-digested stomach contents, the prey found in the stomachs at a particular station may have been consumed at another location some distance away, which may have an entirely different neuston assemblage than the station at which it was caught. This may be especially true in frontal zones where substantial differences in species abundances may be observed over relatively short distances (Shenker 1985).

(3) Differential digestion rates of prey may result in some taxa, particularly soft-bodied forms such as chaetognaths, polychaetes, and fish larvae, being overlooked in the stomachs compared to prey which are more resistant to digestion (e.g., crustaceans, insects, and juvenile fishes).

Despite the differences between the composition of the food habits and neuston within one station, there is an overall resemblance of the taxa consumed by juvenile coho salmon to those available in the surface layer. This is particularly true for the largest organisms present in the neuston, which may represent a more visible prey image at the surface. Juvenile chinook, however, do not show the same resemblance as coho, suggesting that chinook are either more selective in what they consume or, more likely, that they feed deeper in the water column than do coho juveniles.

An advantage to feeding in the surface layer is that the prey, such as decapod larvae and juvenile fishes, may often be highly aggregated in surface slicks caused by Langmuir circulation or internal waves; thus, many taxa may reach an abundance several orders of magnitude greater than that in the surrounding surface waters (Shanks 1983, Shenker 1985, Kingsford and Choat 1986). This may explain why many juvenile coho stomachs contain high numbers of a single prey species which may have been aggregated by some physical or biological feature.

The results of this study, although inconclusive, certainly suggest that juvenile coho salmon may utilize the neuston extensively when feeding in the coastal zone. Laboratory studies have shown that juvenile coho are more likely to attack prey above their horizontal plane than prey an equal distance directly in front of them (Dunbrack and Dill 1984). This type of feeding behavior is adaptive for stream-dwelling juveniles feeding on insects at the surface (Mundie 1971) and hatchery juveniles feeding on pellets falling from the surface and does not seem to be lost when these juveniles first enter the ocean.

ACKNOWLEDGMENTS

We would like to thank the crews of the F/V Bering Sea and Pacific Warwind and scientists who assisted in the field collections, including C. Banner, A. Chung, J. Fisher, and C. Wilson from Oregon State University and J. Bailey, J. Landingham, and D. Mortensen from the Auke Bay Laboratory of the National Marine Fisheries Service. The initial laboratory sortings of many of the collections and data summarizations were made by L. Krasnow. Additional taxonomic expertise was provided by J. Chapman (gammarid amphipods), W. Laroche (rockfishes), N. Anderson (Odonata), D. Belnavis (Coccinellidae), D. Ferguson (Formicidae), P. Hammond (Lepidoptera), P. Hanson (Hymenoptera), J. Lattin (Hemiptera), J. Oswald (Neuroptera), and G. Parsons (Carabidae).

LITERATURE CITED

Ahlstrom, E. H., and E. Stevens. 1976. Report of neuston (surface) collections made on an extended CalCOFI cruise during May 1972. Calif. Coop. Oceanic Fish. Invest. Rep. 18:167-180.

Andres, H.-G., and H.-C. John. 1984. Results of some neuston net catches in the warmer central North Atlantic--fish larvae and selected invertebrates. Meersforsch. 30:144-154.

Bartlett, M. R., and R. L. Haedrich. 1968. Neuston nets and South Atlantic larval blue marlin (Makaira nigricans). Copeia 1968:469-474.

Boehlert, G. W., D. M. Gadomski, and B. C. Mundy. 1985. Vertical distribution of ichthyoplankton off the Oregon coast in spring and summer months. Fish. Bull. 83:611-621.

Brodeur, R. D. 1986. Northward displacement of the euphausiid, Nyctiphanes simplex Hansen, to Oregon and Washington waters following the El Nino event of 1982-1983. J. Crust. Biol. 6(4).

Clark, J. B. 1984. Ichthyoplankton off Washington, Oregon and northern California, May-June 1981. NWAFC Proc. Rep. 84-11; 46 pp.

Craddock, J. E. 1969. Neuston fishing. Oceanus 15:10-12.

Cheng, L. 1975. Marine pleuston--animals at the air-sea interface. Oceanogr. Mar. Biol. Ann. Rev. 11:223-235.

Cheng, L., and M. C. Birch. 1977. Terrestrial insects at sea. J. Mar Biol. Ass. U.K. 57:995-997.

Cheng, L., and M. C. Birch. 1978. Insect flotsam: an unstudied marine resource. Ecol. Entom. 3:87-97.

Day, D. S. 1971. Macrozooplankton and small nekton in the coastal waters off Vancouver Island (Canada) and Washington, spring and fall of 1963. U.S. Dept. Commer., Natl. Mar. Fish. Serv., Spec. Sci. Rep. Fish. 619, 94 pp.

Dunbrack, R. L., and L. M. Dill. 1984. Three-dimensional prey reaction field of the juvenile coho salmon (Oncorhynchus kisutch). Can. J. Fish. Aquat. Sci. 41:1176-1182.

Elliott, J. M. 1977. Some methods for the statistical analysis of samples of benthic invertebrates. Freshwater Biol. Assoc. Sci. Publ. 25, 156 pp.

Fisher, J. P., and W. G. Pearcy. 1985. Studies of juvenile salmonids off northern California, Oregon, Washington and Vancouver Island, 1984. Oregon State University Sea Grant College Program ORESU-T-85-001, 24 pp.

Hebard, J. F. 1966. Distribution of Euphausiacea and Copepoda off Oregon in relation to oceanographic conditions. Ph.D. Thesis, Oregon State University, Corvallis, 94 pp.

Hempel, G., and H. Weikert. 1972. The neuston of the subtropical and boreal northeastern Atlantic Ocean. A review. Mar. Biol. 76:70-88.

Holdway, P., and L. Maddock. 1983a. A comparative survey of neuston: geographical and temporal distribution patterns. Mar. Biol. 76:263-270.

Holdway, P., and L. Maddock. 1983b. Neustonic distributions. Mar. Biol. 77:207-214.

Kendall, A. W., Jr., and J. Clark. 1982a. Ichthyoplankton off Washington, Oregon, and northern California, April-May 1980. NWAFC Proc. Rep. 82-11, 44 pp.

Kendall, A. W., Jr., and J. Clark. 1982b. Ichthyoplankton off Washington, Oregon and northern California, August 1980. NWAFC Proc. Rep. 82-12, 43 pp.

Kingsford, M. J., and J. H. Choat. 1986. Influence of surface slicks on the distribution and onshore movements of small fish. Mar. Biol. 91:161-171.

Laroche, J. L., and S. L. Richardson. 1979. Winter-spring abundance of larval English sole, Parophrys vetulus, between the Columbia River and Cape Blanco, Oregon, during 1972-1975 with notes on occurrences of three other pleuronectids. Est. Coast. Mar. Sci. 8:455-476.

Locke, A., and S. Corey. 1986. Terrestrial and freshwater invertebrates in the neuston of the Bay of Fundy, Canada. Can. J. Zool. 64:1535-41.

Lorz, H. V., and W. G. Pearcy. 1975. Distribution of hyperiid amphipods off the Oregon coast. J. Fish. Res. Bd. Can. 32:1442-1447.

Lough, R. G. 1975. Dynamics of crab larvae (Anomura, Brachyura) off the central Oregon coast, 1969-1971. Ph.D. Thesis, Oregon State University, Corvallis, 299 pp.

Mundie, J. H. 1971. The diel drift of chironomidae in an artificial stream and its relation to the diet of coho salmon fry, Oncorhynchus kisutch (Waulbaum). Can. Entomol. 103:289-297.

National Climatic Data Center. 1984. Storm data. Vol. 26 no. 7, Asheville N.C.

Pearcy, W. G. 1984. Where do all the coho go? The biology of juvenile coho salmon off the coasts of Oregon and Washington. Pp. 50-60 In: W. G. Pearcy (ed.) The influence of ocean conditions on the production of salmonids in the North Pacific. Oregon State University Sea Grant College Program ORESU-W-83-001.

Peres, J. M. 1982. Specific pelagic assemblages: (1) assemblages at the air-ocean interface. Pp. 313-372 In: Marine Ecology 5(1):313-372. Ed. by O. Kinne.

Peterson, W. T., R. D. Brodeur, and W. G. Pearcy. 1982. Food habits of juvenile salmon in the Oregon coastal zone, June 1979. Fish. Bull. 80:841-851.

Richardson, S. L. 1975. Oregon's coastal ichthyoneuston: a preliminary report. Unpub. Rept. presented at ASIH meeting, Williamsburg VA.

Richardson, S. L. 1977. Larval fishes in ocean waters off Yaquina Bay, Oregon: abundance, distribution and seasonality, January 1971 to August 1972. Oregon State University Sea Grant College Program ORESU-T-77-003. 73 pp.

Schoener, T. W. 1970. Non-synchronous spatial overlap of lizards in patchy habitats. Ecology 51:408-418.

Shanks, A. L. 1983. Surface slicks associated with tidally forced internal waves may transport pelagic larvae of benthic invertebrates and fishes shoreward. Mar. Ecol. Prog. Ser. 13:311-315.

Shenker, J. M. 1985. Biology of neustonic larval and juvenile fishes and crabs off Oregon, 1984. Ph.D. Thesis, Oregon State University, Corvallis, 156 pp.

Smith, P. R., and S. L. Richardson. 1977. Standard techniques for pelagic egg and larva surveys. FAO Fish. Tech. Pap. 175, 100 pp.

Strauss, R. R. 1979. Reliability estimates for Ivlev's electivity index, the forage ratio, and a proposed linear index of food slection. Trans. Amer. Fish. Soc. 108:344-352.

Zaitsev, Y. P. 1970. Marine Neustonology. Naukova Dumka Kiev. 264 pp.

Appendix

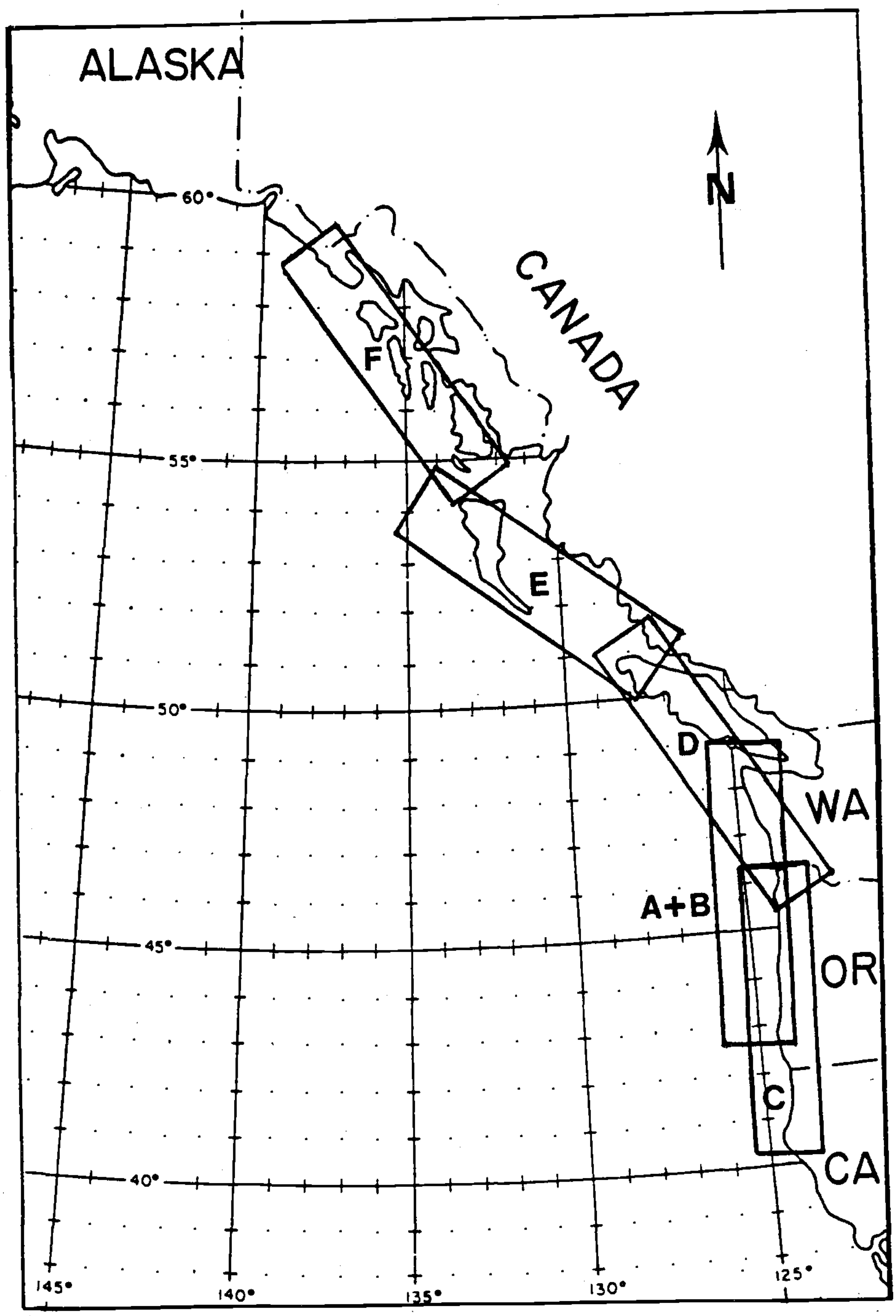

Figure 1. Index map of the Northeast Pacific Ocean showing major geographical features of sampling areas. The letters and the boxes refer to the different cruises shown in figures A through F, which follow.

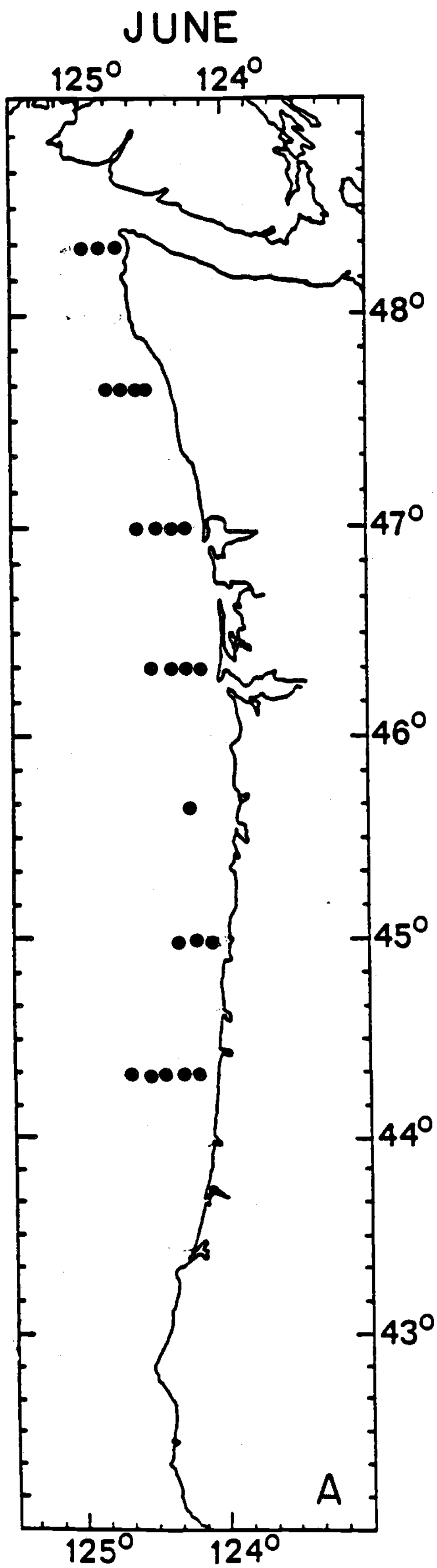

Figure 1A. Station locations for the June cruise sampled by the Pacific Warwind off Oregon and Washington

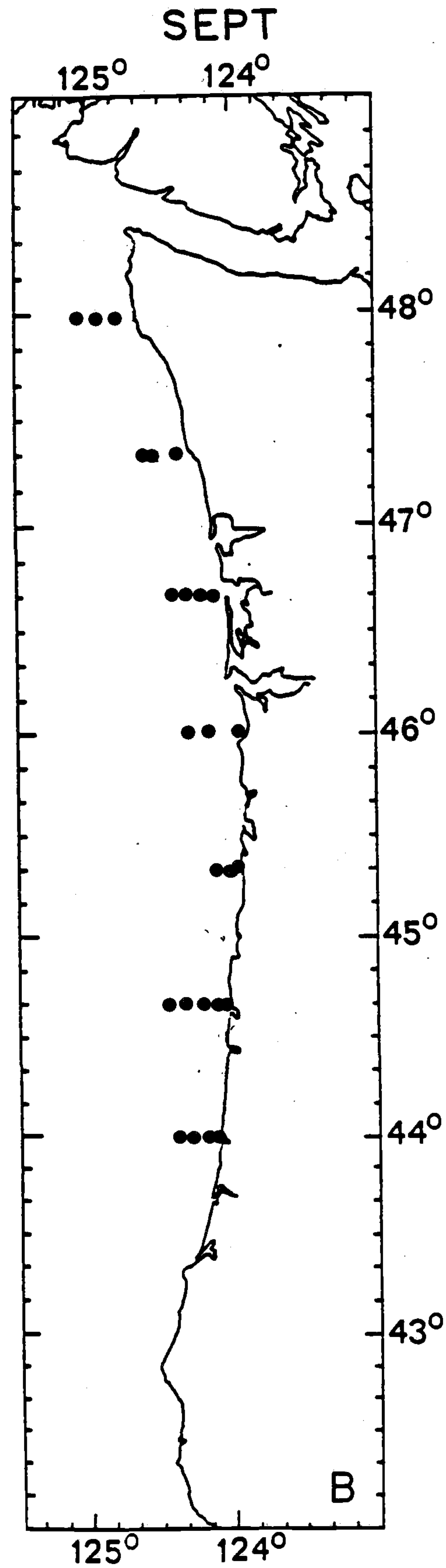

Figure 1B. Station locations for the September cruise sampled by the Pacific Warwind off Oregon and Washington.

JULY

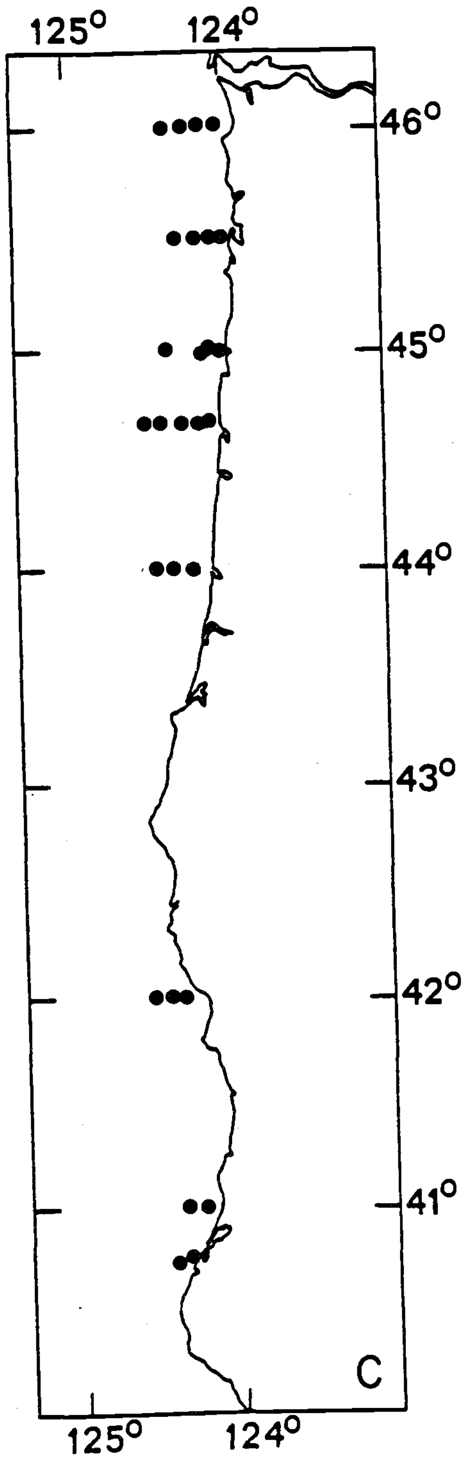

Figure 1C. Station locations for the July cruise sampled by the _Pacific Warwind_ off California and Oregon.

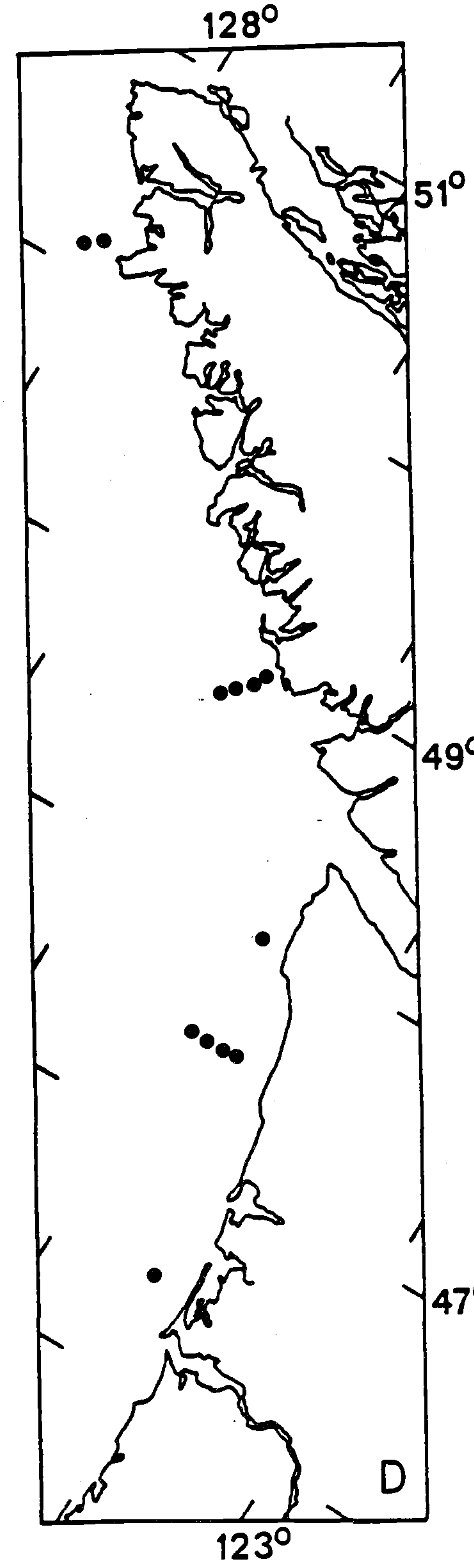

Figure 1D. Station locations for the July cruise sampled by the _Pacific Warwind_ off Washington and British Columbia.

JULY

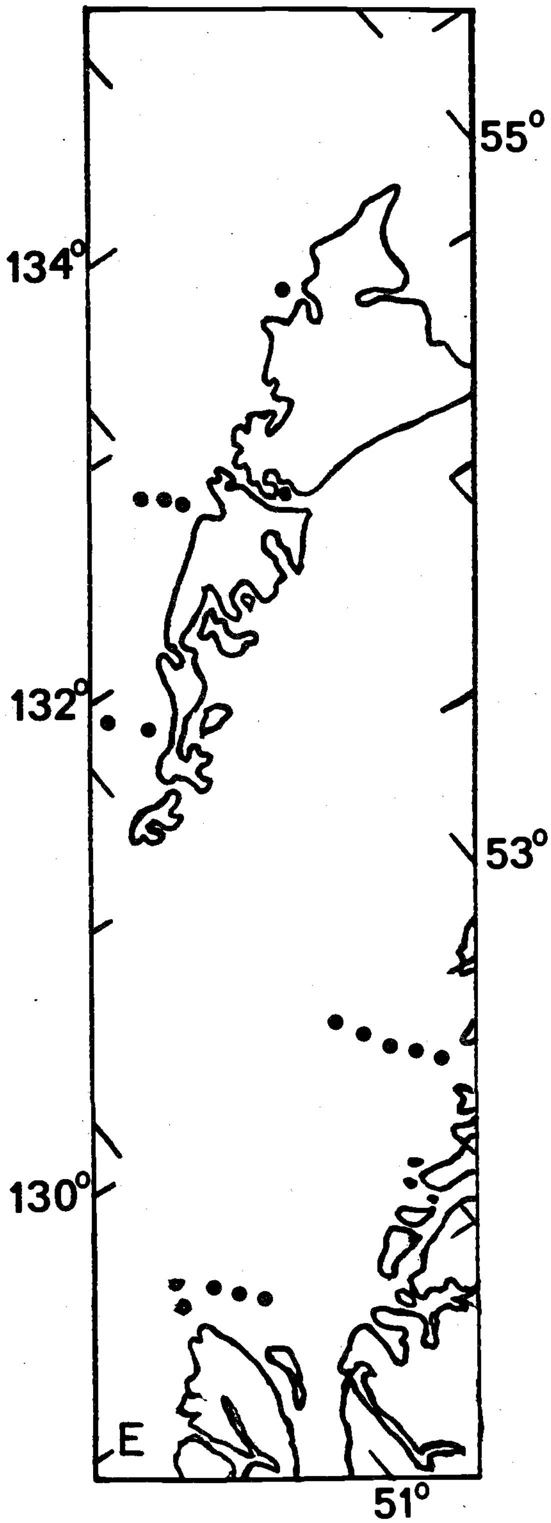

Figure 1E. Station locations for the July cruise sampled by the Bering Sea off British Columbia.

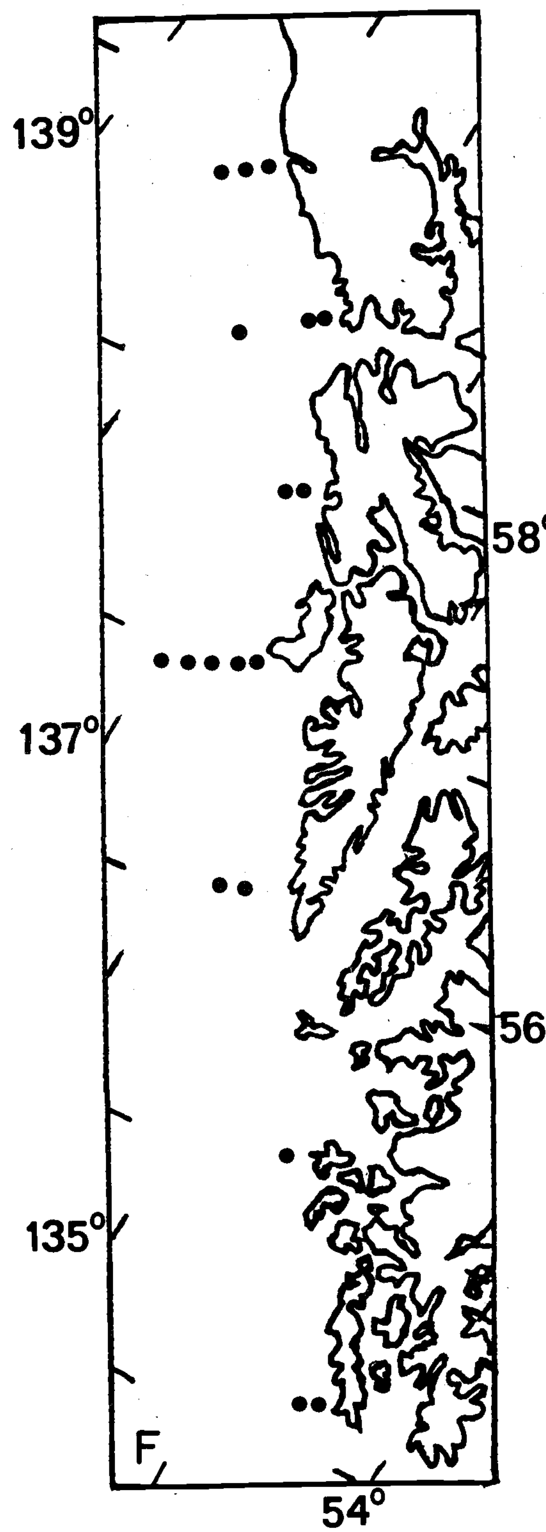

Figure 1F. Station locations for the July cruise sampled by the Bering Sea off southeast Alaska.

Appendix Table 1. Station, sample and environmental data from 1984 neuston collections.

VESSEL CODE	COLL. NUMBER	TRANSECT	DISTANCE OFFSHORE (km)	DATE	TIME	VOLUME FILTERED (m^3)	SAMPLE VOLUME (ml/100m^3)	SORTED VOLUME (ml/100m^3)	TEMP (^oC)	SAL. (o/oo)	CHLOR. A (ug/l)
PW	1	WAATCH POINT	11.4	06/04/84	1855	58.79	85.0	17.0	11.8	32.3	1.2
PW	2	WAATCH POINT	18.8	06/05/84	0700	72.26	42.9	5.5	9.8	32.3	0.9
PW	3	WAATCH POINT	28.4	06/05/84	1017	66.78	14.9	1.4	10.8	31.0	1.8
PW	9	DESTR. ISLAND	16.6	06/06/84	0932	80.96	7.4	2.4	11.9	30.4	6.3
PW	10	DESTR. ISLAND	19.2	06/06/84	1301	70.18	5.6	2.8	12.4	30.4	3.8
PW	11	DESTR. ISLAND	28.1	06/06/84	1353	70.89	4.2	1.4	13.3	29.5	0.9
PW	12	DESTR. ISLAND	37.5	06/06/84	1533	78.00	5.1	3.8	12.7	30.1	3.3
PW	18	GRAYS HARBOR	37.3	06/08/84	1535	79.10	46.7	2.5	12.0	30.2	2.6
PW	19	GRAYS HARBOR	27.7	06/08/84	1713	87.58	18.2	1.1	12.1	30.4	2.2
PW	20	GRAYS HARBOR	18.3	06/08/84	1911	68.97	13.0	5.7	12.0	30.0	2.0
PW	21	GRAYS HARBOR	11.6	06/08/84	2045	61.17	19.6	9.8	12.2	28.1	1.5
PW	26	C. DISAPPOINT.	11.8	06/10/84	0858	75.27	6.6	1.3	12.9	14.2	1.6
PW	27	C. DISAPPOINT.	38.2	06/10/84	1653	70.83	25.4	1.4	13.9	30.1	2.1
PW	28	C. DISAPPOINT.	27.5	06/10/84	1835	76.77	2.6	1.3	12.9	29.1	1.4
PW	29	C. DISAPPOINT.	19.4	06/11/84	1228	70.56	4.2	1.4	14.3	17.5	1.6
PW	37	NEHALEM	27.9	06/13/84	1537	84.16	7.1	1.1	14.1	24.8	1.8
PW	42	WECOMA BEACH	7.9	06/15/84	1228	63.63	7.8	1.5	10.3	32.1	0.9
PW	46	WECOMA BEACH	18.8	06/16/84	1211	50.33	1.9	1.9	11.9	30.7	1.0
PW	47	WECOMA BEACH	28.4	06/16/84	1251	78.96	1.2	1.2	12.9	30.0	1.0
PW	55	YACHATS	46.9	06/19/84	0839	97.95	413.4	199.0	10.5	31.5	1.1
PW	56	YACHATS	35.8	06/19/84	0954	104.55	7.6	1.9	10.4	32.0	0.5
PW	57	YACHATS	29.0	06/19/84	1113	112.79	0.8	0.8	10.9	32.7	0.4
PW	58	YACHATS	17.9	06/19/84	1243	120.56	1.6	0.8	11.4	33.3	2.2
PW	59	YACHATS	9.0	06/19/84	1409	112.49	1.7	0.8	12.1	33.2	4.5
PW	72	EUREKA	7.5	07/10/84	0628	117.21	281.5	170.6	10.8	33.7	10.2
PW	73	EUREKA	14.4	07/10/84	0943	108.05	180.4	74.0	10.6	33.5	2.0
PW	74	STRAW. PRAIRIE	10.3	07/12/84	0956	150.96	102.6	46.3	10.8	33.7	7.6
PW	76	STRAW. PRAIRIE	18.8	07/12/84	1357	133.83	20.1	6.7	11.4	33.5	2.0
PW	77	BROOKINGS	11.2	07/15/84	0710	127.44	54.1	10.9	8.3	34.0	0.3
PW	78	BROOKINGS	17.9	07/15/84	0754	184.86	37.8	5.4	8.3	34.0	0.2
PW	79	BROOKINGS	27.0	07/15/84	0927	213.92	65.4	30.3	8.6	33.9	0.4
PW	80	YAQUINA HEAD	5.7	07/19/84	0719	92.22	57.4	19.5	8.3	33.6	7.0
PW	81	YAQUINA HEAD	9.0	07/23/84	0540	183.13	139.2	38.2	9.5	33.5	20.9
PW	82	YAQUINA HEAD	18.1	07/23/84	0720	136.48	71.8	20.5	9.4	33.5	18.0
PW	83	YAQUINA HEAD	28.6	07/23/84	0849	183.13	49.1	24.5	10.3	32.5	12.3
PW	85	YAQUINA HEAD	37.0	07/23/84	1724	184.55	27.6	11.9	11.9	32.2	16.6

VESSEL CODE	COLL. NUMBER	TRANSECT	DISTANCE OFFSHORE (km)	DATE	TIME	VOLUME FILTERED (m^3)	SAMPLE VOLUME (ml/100m^3)	SORTED VOLUME (ml/100m^3)	TEMP (^{o}C)	SAL. (o/oo)	CHLOR. A (ug/l)
PW	88	SIUSLAW RIVER	26.8	07/24/84	0317	163.98	207.3	106.7	12.0	32.7	4.2
PW	89	SIUSLAW RIVER	17.3	07/24/84	0446	144.26	162.9	72.7	12.2	32.9	3.1
PW	90	SIUSLAW RIVER	9.0	07/24/84	0600	156.93	59.8	16.5	11.6	33.2	10.4
PW	92	WECOMA BEACH	4.4	07/25/84	0735	192.72	119.3	54.4	10.0	33.4	29.4
PW	93	WECOMA BEACH	8.3	07/25/84	0906	131.86	37.9	17.4	12.9	31.6	3.7
PW	94	WECOMA BEACH	9.6	07/25/84	1833	132.70	18.0	8.2	13.7	31.2	1.8
PW	95	WECOMA BEACH	18.6	07/25/84	2000	117.63	28.0	13.6	14.1	30.9	1.2
PW	96	WECOMA BEACH	29.2	07/25/84	2126	129.29	278.4	127.6	14.4	31.3	0.6
PW	97	TILLAMOOK BAY	5.3	07/26/84	0837	153.84	49.4	22.7	13.2	31.4	2.2
PW	98	TILLAMOOK BAY	10.9	07/26/84	0954	131.01	51.1	24.4	13.7	31.1	1.4
PW	99	TILLAMOOK BAY	19.0	07/26/84	1104	147.07	54.3	20.3	14.0	30.4	1.1
PW	100	TILLAMOOK BAY	28.6	07/26/84	1218	183.13	12.5	4.9	14.4	30.9	0.7
PW	101	SEASIDE	36.4	07/26/84	1556	181.73	20.3	9.3	13.8	31.3	2.8
PW	103	SEASIDE	27.1	07/26/84	1909	150.74	17.9	8.6	12.8	31.5	3.7
PW	104	SEASIDE	18.6	07/26/84	2030	174.68	26.9	13.1	13.3	31.2	0.6
PW	105	SEASIDE	9.8	07/26/84	2145	145.10	589.2	292.9	13.3	31.9	1.2
PW	106	OCEAN PARK	18.5	07/29/84	0512	183.17	73.7	35.4	13.8	27.2	13.7
PW	117	QUEETS RIVER	44.4	07/29/84	1531	135.24	24.4	6.6	14.2	31.8	0.3
PW	118	QUEETS RIVER	34.7	07/29/84	1657	122.42	8.1	2.4	14.5	31.8	1.9
PW	119	QUEETS RIVER	25.9	07/29/84	1826	119.61	21.7	9.1	13.5	32.2	5.9
PW	120	QUEETS RIVER	18.8	07/29/84	2035	126.50	34.7	14.2	13.2	32.8	1.0
PW	121	SEA LION ROCKS	11.1	07/30/84	0746	144.76	29.0	13.1	13.8	32.0	1.4
PW	126	AMPHITRITE PT.	3.8	08/01/84	0544	94.10	175.3	74.3	12.3	31.0	7.1
PW	127	AMPHITRITE PT.	11.2	08/01/84	0812	121.46	135.8	57.6	13.4	30.0	3.1
PW	128	AMPHITRITE PT.	20.9	08/01/84	0927	149.33	160.7	70.3	14.2	29.3	1.4
PW	129	AMPHITRITE PT.	28.9	08/01/84	1045	99.46	160.8	90.4	14.1	29.5	1.9
PW	136	BROOKS BAY	17.9	08/03/84	0538	144.40	107.3	27.7	13.9	31.2	1.6
PW	137	BROOKS BAY	26.9	08/03/84	0802	151.44	198.0	49.5	14.9	31.2	1.3
PW	146	SEA LION ROCKS	27.7	09/01/84	1738	188.31	18.5	9.0	14.8	31.5	4.7
PW	147	SEA LION ROCKS	18.3	09/01/84	1910	141.78	42.3	15.5	14.1	31.2	7.1
PW	148	SEA LION ROCKS	10.7	09/01/84	2037	146.70	180.6	71.5	13.2	31.7	7.1
PW	152	QUINAULT RIVER	36.2	09/02/84	1344	173.80	75.3	20.7	15.4	31.9	0.8
PW	153	QUINAULT RIVER	27.5	09/02/84	1508	163.67	10.9	0.6	15.3	32.1	0.0
PW	154	QUINAULT RIVER	23.3	09/02/84	1620	145.61	13.0	4.1	15.0	32.4	2.7
PW	164	WILLAPA BAY	12.0	09/04/84	0944	161.21	151.9	71.3	14.2	32.0	2.5
PW	165	WILLAPA BAY	18.5	09/04/84	1028	149.99	0.0	3.3	14.4	32.4	2.3
PW	167	WILLAPA BAY	28.3	09/04/84	1307	180.09	52.7	16.6	15.0	32.4	1.6
PW	168	WILLAPA BAY	37.1	09/04/84	1439	155.46	41.8	6.4	15.8	31.8	0.5

VESSEL CODE	COLL. NUMBER	TRANSECT	DISTANCE OFFSHORE (km)	DATE	TIME	VOLUME FILTERED (m^3)	SAMPLE VOLUME (ml/100m^3)	SORTED VOLUME (ml/100m^3)	TEMP (°C)	SAL. (o/oo)	CHLOR. A (ug/l)
PW	175	SEASIDE	9.2	09/10/84	0850	175.17	137.0	0.5	14.8	30.8	1.8
PW	176	SEASIDE	37.0	09/10/84	1132	150.95	17.8	5.9	16.5	31.5	0.3
PW	177	SEASIDE	26.2	09/10/84	1255	138.49	12.9	2.1	15.6	30.9	0.9
PW	178	SEASIDE	16.1	09/10/84	1015	133.57	168.4	26.2	15.5	31.0	0.5
PW	182	CAPE LOOKOUT	17.3	09/11/84	1420	154.59	44.6	2.5	16.1	31.8	0.5
PW	183	CAPE LOOKOUT	9.2	09/11/84	1539	131.92	212.2	15.1	16.0	31.6	0.5
PW	184	CAPE LOOKOUT	5.3	09/11/84	1820	157.07	130.5	12.7	15.9	31.6	0.5
PW	196	YAQUINA HEAD	4.9	09/14/84	0751	100.17	124.7	49.9	13.4	33.1	8.5
PW	197	YAQUINA HEAD	9.2	09/14/84	0900	173.93	63.2	28.7	14.4	32.9	2.7
PW	198	YAQUINA BAY	18.6	09/14/84	1020	113.31	101.4	35.3	14.4	32.9	2.1
PW	199	YAQUINA BAY	28.6	09/14/84	1134	120.34	62.3	29.0	14.8	32.2	1.1
PW	200	YAQUINA HEAD	38.1	09/14/84	1245	129.74	138.7	23.1	15.6	32.1	0.8
PW	201	SIUSLAW RIVER	26.2	09/15/84	1255	140.43	46.2	13.5	15.0	31.9	0.8
PW	202	SIUSLAW RIVER	19.2	09/15/84	1406	114.95	62.6	1.7	15.3	32.1	0.7
PW	203	SIUSLAW RIVER	9.6	09/15/84	1512	141.37	205.1	3.5	15.3	32.3	0.7
PW	204	SIUSLAW RIVER	4.0	09/15/84	1609	142.49	173.3	11.9	15.3	32.7	1.8
BS	1	CAPE SCOTT	4.8	07/01/84	2235	81.70	97.9	61.2	10.2	30.9	5.7
BS	2	CAPE SCOTT	40.2	07/02/84	0930	69.23	26.0	4.3	11.3	30.9	---
BS	3	CAPE SCOTT	24.1	07/02/84	1212	63.96	7.8	1.5	11.8	31.2	2.4
BS	4	MILBANKE SOUND	8.0	07/02/84	2100	79.19	56.8	1.2	13.3	31.3	7.1
BS	5	MILBANKE SOUND	4.0	07/02/84	2305	68.17	498.7	381.3	12.2	31.1	2.4
BS	6	MILBANKE SOUND	16.1	07/03/84	0105	62.71	143.5	95.6	12.6	31.5	2.9
BS	7	MILBANKE SOUND	24.1	07/03/84	0340	100.64	44.7	39.7	12.6	0.0	2.6
BS	8	MILBANKE SOUND	32.2	07/03/84	0510	89.54	27.9	14.5	12.6	31.4	2.2
BS	14	FLAMINGO INLET	8.0	07/05/84	0715	93.87	37.2	26.6	11.0	32.1	4.1
BS	16	FLAMINGO INLET	24.1	07/05/84	1055	54.95	1.8	0.0	12.2	32.0	5.7
BS	17	ENGLEFIELD BAY	4.2	07/05/85	2156	70.52	22.6	21.2	12.2	31.1	2.1
BS	18	ENGLEFIELD BAY	8.0	07/06/84	0955	66.92	67.2	59.7	11.8	31.8	3.1
BS	19	ENGLEFIELD BAY	16.1	07/06/84	1145	65.27	1.5	1.5	12.0	32.0	1.9
BS	21	OTARD BAY	8.0	07/06/84	2130	63.88	9.3	7.8	12.4	31.9	3.4
BS	22	PT. CORNWALLIS	4.5	07/09/84	0742	59.42	50.4	47.1	11.3	30.8	8.5
BS	26	PT. CORNWALLIS	8.0	07/10/84	0758	70.01	82.8	25.7	11.2	30.9	7.3
BS	31	CAPE ADDINGTON	8.0	07/11/84	0947	69.96	35.7	14.2	11.8	31.2	7.4
BS	35	CAPE OMMANEY	24.1	07/12/84	1602	86.47	8.0	1.1	12.3	31.8	1.7
BS	36	CAPE OMMANEY	32.2	07/12/84	1740	89.79	44.5	11.1	12.2	31.6	2.4
BS	37	CAPE EDGECOMBE	4.5	07/13/84	0820	86.75	17.2	5.7	12.0	31.4	2.1

VESSEL CODE	COLL. NUMBER	TRANSECT	DISTANCE OFFSHORE (km)	DATE	TIME	VOLUME FILTERED (m^3)	SAMPLE VOLUME (ml/100m^3)	SORTED VOLUME (ml/100m^3)	TEMP (^oC)	SAL. (o/oo)	CHLOR. A (ug/l)
BS	38	CAPE EDGECOMBE	8.0	07/13/84	1005	84.24	5.9	1.1	12.2	31.6	1.9
BS	39	CAPE EDGECOMBE	16.1	07/13/84	1208	79.59	6.2	0.0	12.4	31.6	---
BS	40	CAPE EDGECOMBE	24.1	07/13/84	1344	79.31	1.2	0.0	12.7	31.6	2.3
BS	41	CAPE EDGECOMBE	32.2	07/13/84	1617	66.94	22.4	0.0	12.8	31.8	1.1
BS	52	HERBERT GRAVES	8.0	07/18/84	0921	62.75	40.0	32.1	12.5	31.5	3.0
BS	53	HERBERT GRAVES	16.1	07/18/84	1153	37.74	13.2	2.6	12.1	31.7	2.1
BS	55	GRAVES HARBOR	4.3	07/19/84	0618	62.06	29.0	9.6	11.7	32.0	8.2
BS	56	GRAVES HARBOR	8.0	07/19/84	0817	82.29	1.2	1.2	12.1	31.7	2.9
BS	59	GRAVES HARBOR	32.2	07/19/84	1256	62.62	36.7	15.9	13.8	32.0	1.2
BS	60	LITUYA BAY	32.2	07/19/84	1910	80.06	12.4	1.2	12.8	31.6	4.2
BS	64	LITUYA BAY	8.0	07/20/84	1222	69.74	7.1	0.0	13.2	30.6	1.1
BS	65	LITUYA BAY	16.1	07/20/84	1428	80.95	19.7	1.2	13.5	31.8	1.4

Appendix Table 2. Species list and number of taxa collected at each station for the Bering Sea (BS) and Pacific Warwind (PW) cruises in 1984. The data are listed in the following sequence: vessel, station, NODC species code, species, life history stage (A = adult, J = juvenile, L = larvae, Z = zoea, M = megalopae, P = pupae) and estimated abundance per 100 cubic meters of water.

BS	001	6170010702	HYPEROCHE MEDUSARUM	A	1.22
		6170011003	PARATHEMISTO PACIFICA	A	2.44
		61880301	CANCER SP.	Z	2.44
		6188030104	CANCER MAGISTER	M	1.22
		618906	PINNOTHERIDAE	Z	4.89
		8831023101	SCORPAENICHTHYS MARMORATUS	L	1.22
BS	002	5001	POLYCHAETA	A	1.44
		6170010702	HYPEROCHE MEDUSARUM	A	2.88
		6188030104	CANCER MAGISTER	M	1.44
		61890604	PINNIXIA SP.	M	1.44
		83	CHAETOGNATHA	A	1.44
BS	003	6170010702	HYPEROCHE MEDUSARUM	A	3.12
		6174020101	EUPHAUSIA PACIFICA	J	3.12
BS	004	6169120201	CALLIOPIUS LAEVIUSCULUS	A	2.52
		6170010702	HYPEROCHE MEDUSARUM	A	1.26
		61791801	PANDALUS SP.	J	1.26
BS	005	6169420301	HETEROPHOXUS OCULATUS	A	1.46
		6170010702	HYPEROCHE MEDUSARUM	A	2.93
		6174020907	THYSANOESSA SPINIFERA	A	35.20
		61880301	CANCER SP.	Z	1.46
		6188030101	CANCER OREGONENSIS	M	3934.28
		6188030102	CANCER ANTENNARIUS	M	7988.85
		6188030104	CANCER MAGISTER	M	10.26
		83	CHAETOGNATHA	A	1.46
		88260101	SEBASTES SP.	J	1.46
		8831023101	SCORPAENICHTHYS MARMORATUS	L	7.33
		8831080101	AGONOPSIS VULSA	J	1.46
		8840030201	RONQUILUS JORDANI	L	4.40
BS	006	6169120201	CALLIOPIUS LAEVIUSCULUS	A	1.60
		6174020101	EUPHAUSIA PACIFICA	A	16.08
		6174020907	THYSANOESSA SPINIFERA	A	78.81
		6188030101	CANCER OREGONENSIS	M	1325.39
		6188030102	CANCER ANTENNARIUS	M	1220.84
		88260101	SEBASTES SP.	J	1.60
		8831022901	RADULINUS ASPRELLUS	L	1.60
		8831023101	SCORPAENICHTHYS MARMORATUS	L	1.60
		8840030201	RONQUILUS JORDANI	J	1.60
		8845010101	AMMODYTES HEXAPTERUS	A	4.82
BS	007	6170010702	HYPEROCHE MEDUSARUM	A	10.93
		6170011003	PARATHEMISTO PACIFICA	A	0.99
		6174020101	EUPHAUSIA PACIFICA	A	18.87
		6174020907	THYSANOESSA SPINIFERA	A	34.77

BS	007	6188030101	CANCER OREGONENSIS	M	1022.45
		6188030102	CANCER ANTENNARIUS	M	322.93
		8831023101	SCORPAENICHTHYS MARMORATUS	L	0.99
		8840030201	RONQUILUS JORDANI	L	1.98
BS	008	617402	EUPHAUSIACEA	A	1.11
		6174020101	EUPHAUSIA PACIFICA	A	1.11
		6174020907	THYSANOESSA SPINIFERA	A	29.03
		6188030101	CANCER OREGONENSIS	M	111.68
		6188030102	CANCER ANTENNARIUS	M	25.68
BS	014	5705	TEUTHIDIDA	L	1.06
		6174020101	EUPHAUSIA PACIFICA	A	1.06
BS	017	6174020907	THYSANOESSA SPINIFERA	A	1.41
		6188030104	CANCER MAGISTER	M	1.41
		643001	GEOMETRIDAE	A	1.41
		883109	LIPARIDIDAE	L	1.41
BS	018	6174020907	THYSANOESSA SPINIFERA	A	19.42
		656603	ICHNEUMONIDAE	A	1.49
		88260101	SEBASTES SP.	l	2.98
		8831023101	SCORPAENICHTHYS MARMORATUS	L	1.49
BS	019	6174020101	EUPHAUSIA PACIFICA	A	1.53
BS	021	6169120201	CALLIOPIUS LAEVIUSCULUS	A	7.82
		6169040104	AMPHITHOE SIMULANS	A	1.56
		6174020907	THYSANOESSA SPINIFERA	A	3.13
		83	CHAETOGNATHA	A	1.56
		8827020101	ANOPLOPOMA FIMBRIA	L	1.56
BS	022	6169120201	CALLIOPIUS LAEVIUSCULUS	A	1.68
		6174020907	THYSANOESSA SPINIFERA	A	1.68
		8747010201	CLUPEA HARENGUS PALLASI	L	1.68
BS	031	6169120201	CALLIOPIUS LAEVIUSCULUS	A	2.85
		6188030104	CANCER MAGISTER	M	1.42
BS	035	6169120201	CALLIOPIUS LAEVIUSCULUS	A	3.46
BS	037	6169120201	CALLIOPIUS LAEVIUSCULUS	A	5.76
		6188030104	CANCER MAGISTER	M	17.29
BS	038	6169120201	CALLIOPIUS LAEVIUSCULUS	A	4.74
		6188030104	CANCER MAGISTER	M	7.12
BS	040	6169240101	ALLORCHESTES BELLABELLA	A	1.26
BS	052	6188030104	CANCER MAGISTER	M	1.59
BS	056	6188030104	CANCER MAGISTER	M	8.50

PW	001	6174020907	THYSANOESSA SPINIFERA	J	1.70
		617916	HIPPOLYTIDAE	Z	22.11
		61830602	PAGURUS SP.	Z	1.70
		618312	PORCELLANIDAE	Z	28.91
		6187010501	PUGETTIA PRODUCTA	M	1.70
		61880301	CANCER SP.	Z	5.10
		6188030101	CANCER OREGONENSIS	M	27.21
		6188030102	CANCER ANTENNARIUS	M	5.10
		6188030104	CANCER MAGISTER	M	3.40
		628201	APHIDAE	A	5.10
		6501	DIPTERA	A	1.70
		650101	BRACHYCERA	A	1.70
		8840030201	RONQUILUS JORDANI	L	1.70
PW	002	618312	PORCELLANIDAE	Z	2.76
		61880301	CANCER SP.	Z	13.83
		6188030101	CANCER OREGONENSIS	M	1.38
		6188030102	CANCER ANTENNARIUS	M	24.91
		6189020101	LOPHOPANOPEUS BELLUS	M	1.38
		618906	PINNOTHERIDAE	Z	2.76
		8827010201	OPHIODON ELONGATUS	L	1.38
		8831023101	SCORPAENICHTHYS MARMORATUS	L	5.53
PW	003	6183120202	PACHYCHELES RUDIS	M	1.49
		61880301	CANCER SP.	Z	1.49
		6189020101	LOPHOPANOPEUS BELLUS	M	4.49
		618906	PINNOTHERIDAE	Z	1.49
		8827010101	HEXAGRAMMOS DECAGRAMMUS	L	2.99
PW	009	617916	HIPPOLYTIDAE	Z	1.23
		61880301	CANCER SP.	Z	2.47
		6188030102	CANCER ANTENNARIUS	M	2.47
		6188030104	CANCER MAGISTER	M	1.23
		628201	APHIDAE	A	3.70
		650101	BRACHYCERA	A	1.23
		650102	NEMATOCERA	A	1.23
		650301	TIPULIDAE	A	1.23
		88260101	SEBASTES SP.	L	1.23
		8831023101	SCORPAENICHTHYS MARMORATUS	L	2.47
		8840030201	RONQUILUS JORDANI	L	9.88
PW	010	61880301	CANCER SP.	Z	1.42
		6188030102	CANCER ANTENNARIUS	M	2.84
		6189020101	LOPHOPANOPEUS BELLUS	M	1.42
		618906	PINNOTHERIDAE	Z	1.42
		628201	APHIDAE	A	1.42
		650102	NEMATOCERA	A	4.27
		8831023101	SCORPAENICHTHYS MARMORATUS	L	2.84
		8840030201	RONQUILUS JORDANI	L	62.69
PW	011	6188030102	CANCER ANTENNARIUS	M	2.82
		650101	BRACHYCERA	A	1.41
		650102	NEMATOCERA	A	1.41
		8831023101	SCORPAENICHTHYS MARMORATUS	L	1.41
		8840030201	RONQUILUS JORDANI	L	4.23

PW	012	6169120201	CALLIOPIUS LAEVIUSCULUS	A	1.28
		6188030104	CANCER MAGISTER	M	3.84
		650102	NEMATOCERA	A	3.84
		8827010101	HEXAGRAMMOS DECAGRAMMUS	J	1.28
		8831023101	SCORPAENICHTHYS MARMORATUS	L	1.28
		8840030201	RONQUILUS JORDANI	L	2.56
PW	018	6188030101	CANCER OREGONENSIS	M	5.05
		6188030102	CANCER ANTENNARIUS	M	8.84
		6188030104	CANCER MAGISTER	M	115.04
		650102	NEMATOCERA	A	1.26
		8831023101	SCORPAENICHTHYS MARMORATUS	L	1.26
PW	019	6188030102	CANCER ANTENNARIUS	M	1.14
		6188030104	CANCER MAGISTER	M	1.14
		8831023101	SCORPAENICHTHYS MARMORATUS	L	2.28
		8840030201	RONQUILUS JORDANI	L	1.14
PW	021	61791801	PANDALUS SP.	Z	1.63
		618312	PORCELLANIDAE	Z	1.63
PW	026	650101	BRACHYCERA	A	3.98
		650102	NEMATOCERA	A	1.32
PW	027	6188030104	CANCER MAGISTER	M	88.94
		650101	BRACHYCERA	A	4.23
		650102	NEMATOCERA	A	1.41
		8803030101	COLALABIS SAIRA	L	1.41
		8831023101	SCORPAENICHTHYS MARMORATUS	L	1.41
PW	037	6170040302	PRIMNO MACROPA	A	1.18
		6174020907	THYSANOESSA SPINIFERA	A	1.18
		618312	PORCELLANIDAE	Z	1.18
		6188030104	CANCER MAGISTER	M	1.18
		650102	NEMATOCERA	A	1.18
PW	042	6162020303	IDOTEA FEWKESI	A	1.57
		650102	NEMATOCERA	A	3.14
PW	046	650102	NEMATOCERA	A	1.98
PW	055	6118010401	NEOCALANUS CRISTATUS	A	3.06
		6162020303	IDOTEA FEWKESI	A	1.02
		6170011003	PARATHEMISTO PACIFICA	A	34.71
		6174020101	EUPHAUSIA PACIFICA	A	251.14
		6174020502	NYCTIPHANES SIMPLEX	A	3.06
		6174020907	THYSANOESSA SPINIFERA	A	26.54
		61880301	CANCER SP.	Z	1.02
		6188030102	CANCER ANTENNARIUS	M	2.04
		6188030104	CANCER MAGISTER	M	30.62
		628403	CICADELLIDAE	A	1.02
PW	056	6162020303	IDOTEA FEWKESI	A	0.95
		6174020907	THYSANOESSA SPINIFERA	L	0.95

		6188030104	CANCER MAGISTER	M	3.82
PW	057	6162020303	IDOTEA FEWKESI	A	0.88
PW	058	6162020303	IDOTEA FEWKESI	A	0.82
		650102	NEMATOCERA	A	2.48
PW	059	6170010702	HYPEROCHE MEDUSARUM	A	0.88
		6188030102	CANCER ANTENNARIUS	M	0.88
		6188030104	CANCER MAGISTER	M	1.77
		628201	APHIDAE	A	0.88
		650102	NEMATOCERA	A	0.88
		650401	PSYCHODIDAE	A	0.88
PW	072	5001200101	TOMOPTERIS PLANKTONIS	A	17.91
		5113010102	LIMACINA HELICINA	A	1.70
		61110501	CONCHOECIA SP.	A	1.70
		616921	GAMMARIDAE	A	0.85
		6170010103	HYPERIA MEDUSARUM	A	1.70
		6170010702	HYPEROCHE MEDUSARUM	A	7.67
		6170011003	PARATHEMISTO PACIFICA	A	5.97
		6174020401	NEMATOSCELIS DIFFICILIS	A	7.67
		6174020907	THYSANOESSA SPINIFERA	A	0.85
		6188030104	CANCER MAGISTER	M	0.85
		628201	APHIDAE	A	20.47
		650102	NEMATOCERA	A	0.85
		650301	TIPULIDAE	A	0.85
PW	073	5001200101	TOMOPTERIS PLANKTONIS	A	0.92
		5113010102	LIMACINA HELICINA	A	4.62
		6170010702	HYPEROCHE MEDUSARUM	A	37.94
		6170011003	PARATHEMISTO PACIFICA	A	0.92
		6174020101	EUPHAUSIA PACIFICA	L	0.92
		6174020907	THYSANOESSA SPINIFERA	A	0.92
		81130101	OIKOPLEURA SP.	A	136.97
PW	074	5113010102	LIMACINA HELICINA	A	5.96
		6170010702	HYPEROCHE MEDUSARUM	A	11.92
		6170011003	PARATHEMISTO PACIFICA	A	0.66
		6174020901	THYSANOESSA GREGARIA	A	1.32
		628201	APHIDAE	A	0.66
		650102	NEMATOCERA	A	0.66
PW	076	6170010702	HYPEROCHE MEDUSARUM	A	1.49
		6170011003	PARATHEMISTO PACIFICA	A	0.74
		6188030104	CANCER MAGISTER	M	0.74
		628201	APHIDAE	A	3.73
		650102	NEMATOCERA	A	2.24
		650401	PSYCHODIDAE	A	2.24
		83	CHAETOGNATHA	A	2.24
PW	077	6170010103	HYPERIA MEDUSARUM	A	4.70
		6170010702	HYPEROCHE MEDUSARUM	A	20.40
		6174020907	THYSANOESSA SPINIFERA	J	1.56
		6175	DECAPODA	J	0.78

		61830602	PAGURUS SP.	Z	1.56
		6256	PSOCOPTERA	A	0.78
		628201	APHIDAE	A	6.27
		628402	MEMBRACIDAE	A	2.35
		650101	BRACHYCERA	A	0.78
		650102	NEMATOCERA	A	0.78
		657307	FORMICIDAE	A	0.78
		8300000101	EUKROHNIA HAMATA	A	3.92
		8300000303	SAGITTA ELEGANS	A	11.77
PW	078	59	ARACHNIDA	A	1.08
		6118010401	NEOCALANUS CRISTATUS	A	10.81
		6170010702	HYPEROCHE MEDUSARUM	A	20.01
		6174020907	THYSANOESSA SPINIFERA	A	1.62
		6256	PSOCOPTERA	A	12.98
		628201	APHIDAE	A	41.11
		628402	MEMBRACIDAE	A	3.24
		628403	CICADELLIDAE	A	1.08
		629101	APHIDIIDAE	A	1.62
		630903	HYDROPHILIDAE	A	0.54
		6317110401	MULSANTINA PICTA	A	1.62
		6324030101	DIABROTICA UNDECIMPUNCTATA	A	0.54
		6413020101	HEMEROBIUS BISTRIGATUS	A	1.62
		6413020102	HEMEROBIUS PACIFICUS	A	1.08
		650101	BRACHYCERA	A	7.03
		650102	NEMATOCERA	A	9.73
		656602	BRACONIDAE	A	1.08
		656703	EULOPHIDAE	A	0.54
		656707	ENCYRTIDAE	A	0.54
		657307	FORMICIDAE	A	0.54
		83	CHAETOGNATHA	A	3.24
PW	079	6170010702	HYPEROCHE MEDUSARUM	A	1.40
		617402	EUPHAUSIACEA	A	0.93
		6174020907	THYSANOESSA SPINIFERA	A	3.73
		6256	PSOCOPTERA	A	0.46
		628201	APHIDAE	A	11.21
		628402	MEMBRACIDAE	A	1.86
		629101	APHIDIIDAE	A	0.46
		630503	CARABIDAE	A	0.93
		630903	HYDROPHILIDAE	A	0.46
		631001	STAPHYLINIDAE	A	0.46
		6317110301	HIPPODAMIA CONVERGENS	A	0.46
		6317110401	MULSANTINA PICTA	A	0.46
		6413020102	HEMEROBIUS PACIFICUS	A	0.93
		6413020103	HEMEROBIUS STIGMATERUS	A	0.93
		6464020101	CHORISTONEURA OCCIDENTALIS	A	0.93
		650101	BRACHYCERA	A	5.14
		650102	NEMATOCERA	A	0.46
		650301	TIPULIDAE	A	0.93
		650401	PSYCHODIDAE	A	0.46
		652301	SYRPHIDAE	A	0.46
		656602	BRACONIDAE	A	0.93
		656603	ICHNEUMONIDAE	A	0.93
		656703	EULOPHIDAE	A	0.93

		656712	TORYMIDAE	A	0.93
		657307	FORMICIDAE	A	3.73
PW	080	6188030104	CANCER MAGISTER	M	71.56
		629101	APHIDIIDAE	A	1.08
		650101	BRACHYCERA	A	2.16
		83	CHAETOGNATHA	A	24.94
PW	081	5001200102	TOMOPTERIS SEPTENTRIONALIS	A	0.54
		6162020303	IDOTEA FEWKESI	A	0.54
		6170010702	HYPEROCHE MEDUSARUM	A	6.55
		6170011003	PARATHEMISTO PACIFICA	A	2.18
		6174020101	EUPHAUSIA PACIFICA	A	0.54
		6174020907	THYSANOESSA SPINIFERA	A	0.54
		6188030101	CANCER OREGONENSIS	M	1.09
		6188030104	CANCER MAGISTER	M	4.36
		6256	PSOCOPTERA	A	13.10
		6271	HEMIPTERA	A	1.63
		62740601	SALDULA SP.	A	0.54
		628201	APHIDAE	A	43.13
		6413020102	HEMEROBIUS PACIFICUS	A	1.09
		6413020103	HEMEROBIUS STIGMATERUS	A	1.63
		650101	BRACHYCERA	A	4.36
		650102	NEMATOCERA	A	1.09
		650301	TIPULIDAE	A	3.27
		650401	PSYCHODIDAE	A	0.54
		656602	BRACONIDAE	A	1.63
		656603	ICHNEUMONIDAE	A	1.63
		657307	FORMICIDAE	A	2.73
		875503	OSMERIDAE	L	0.54
		88260101	SEBASTES SP.	L	0.54
PW	082	6162020303	IDOTEA FEWKESI	A	2.19
		6170090801	STREETSIA CHALLENGERI	A	0.73
		6188030104	CANCER MAGISTER	M	0.73
		6256	PSOCOPTERA	A	15.38
		6271	HEMIPTERA	A	1.46
		628201	APHIDAE	A	27.11
		629101	APHIDIIDAE	A	0.73
		630903	HYDROPHILIDAE	A	0.73
		6317110401	MULSANTINA PICTA	A	0.73
		6413020101	HEMEROBIUS BISTRIGATUS	A	2.19
		6413020102	HEMEROBIUS PACIFICUS	A	1.46
		6413020103	HEMEROBIUS STIGMATERUS	A	2.19
		6464020101	CHORISTONEURA OCCIDENTALIS	A	2.19
		650101	BRACHYCERA	A	8.79
		650102	NEMATOCERA	A	0.73
		650301	TIPULIDAE	A	2.93
		650401	PSYCHODIDAE	A	0.73
		652301	SYRPHIDAE	A	1.46
		656602	BRACONIDAE	A	1.46
		657307	FORMICIDAE	A	1.46
		83	CHAETOGNATHA	A	2.93
		875503	OSMERIDAE	L	0.73

PW	083	6162020303	IDOTEA FEWKESI	A	0.54
		6256	PSOCOPTERA	A	5.46
		6271	HEMIPTERA	A	1.63
		62740601	SALDULA SP.	A	3.27
		628201	APHIDAE	A	3.27
		6317110401	MULSANTINA PICTA	A	0.54
		64130201	HEMEROBIUS SP.	A	0.54
		650101	BRACHYCERA	A	4.36
		650102	NEMATOCERA	A	0.54
PW	085	6170010702	HYPEROCHE MEDUSARUM	A	0.54
		6170011003	PARATHEMISTO PACIFICA	A	1.08
		6256	PSOCOPTERA	A	80.73
		6271	HEMIPTERA	A	0.54
		628201	APHIDAE	A	14.08
		6324030101	DIABROTICA UNDECIMPUNCTATA	A	8.66
		650101	BRACHYCERA	A	1.08
		83	CHAETOGNATHA	A	1.62
		88260101	SEBASTES SP.	L	0.54
PW	088	5113010102	LIMACINA HELICINA	A	1.21
		6118010401	NEOCALANUS CRISTATUS	A	0.60
		6169090101	ATYLUS TRIDENS	A	0.60
		6170010103	HYPERIA MEDUSARUM	A	0.60
		6170010702	HYPEROCHE MEDUSARUM	A	7.92
		6170011003	PARATHEMISTO PACIFICA	A	18.90
		6170090801	STREETSIA CHALLENGERI	A	13.41
		6174020101	EUPHAUSIA PACIFICA	L	25.61
		6174020907	THYSANOESSA SPINIFERA	A	0.60
		6174020907	THYSANOESSA SPINIFERA	J	16.46
		6174020907	THYSANOESSA SPINIFERA	L	1.21
		617916	HIPPOLYTIDAE	Z	1.21
		6188030101	CANCER OREGONENSIS	M	4.26
		6188030102	CANCER ANTENNARIUS	M	2.43
		6271	HEMIPTERA	A	3.04
		628201	APHIDAE	A	34.76
		628403	CICADELLIDAE	A	0.60
		629101	APHIDIIDAE	A	0.60
		6413020102	HEMEROBIUS PACIFICUS	A	0.60
		6413020103	HEMEROBIUS STIGMATERUS	A	0.60
		6413020201	MICROMUS VARIOLOSUS	A	0.60
		650101	BRACHYCERA	A	3.04
		650102	NEMATOCERA	A	3.04
		650301	TIPULIDAE	A	3.65
		656603	ICHNEUMONIDAE	A	0.60
		83	CHAETOGNATHA	A	7.92
		8840030201	RONQUILIS JORDANI	L	1.21
PW	089	50010218	LEPIDASTHENIA SP.	A	0.69
		6169090101	ATYLUS TRIDENS	A	1.38
		6170010702	HYPEROCHE MEDUSARUM	A	13.17
		6170011003	PARATHEMISTO PACIFICA	A	18.02
		6170040302	PRIMNO MACROPA	A	13.17
		6170090801	STREETSIA CHALLENGERI	A	9.70
		6174020101	EUPHAUSIA PACIFICA	A	6.23

		6174020907	THYSANOESSA SPINIFERA	A	31.88
		617916	HIPPOLYTIDAE	Z	1.38
		6188030101	CANCER OREGONENSIS	M	9.01
		6188030102	CANCER ANTENNARIUS	M	1.38
		6256	PSOCOPTERA	A	2.07
		62740601	SALDULA SP.	A	0.69
		628201	APHIDAE	A	56.84
		629101	APHIDIIDAE	A	0.69
		6413020101	HEMEROBIUS BISTRIGATUS	A	0.69
		6413020102	HEMEROBIUS PACIFICUS	A	1.38
		6413020103	HEMEROBIUS STIGMATERUS	A	0.69
		650101	BRACHYCERA	A	7.62
		650102	NEMATOCERA	A	2.77
		650301	TIPULIDAE	A	1.38
		656603	ICHNEUMONIDAE	A	0.69
		83	CHAETOGNATHA	A	4.15
		8747020101	ENGRAULIS MORDAX	L	0.69
		88260101	SEBASTES SP.	L	2.77
		8831023101	SCORPAENICHTHYS MARMORATUS	L	0.69
PW	090	59	ARACHNIDA	A	0.63
		6256	PSOCOPTERA	A	4.46
		628201	APHIDAE	A	12.74
		650101	BRACHYCERA	A	1.91
		650102	NEMATOCERA	A	1.91
		650301	TIPULIDAE	A	1.91
		650401	PSYCHODIDAE	A	0.63
		8300000303	SAGITTA ELEGANS	A	7.64
PW	092	5113010102	LIMACINA HELICINA	A	1.03
		6170011003	PARATHEMISTO PACIFICA	A	1.03
		6188030104	CANCER MAGISTER	M	1.03
		6226010101	PANTALA HYMENAEA	A	0.51
		6256	PSOCOPTERA	A	1.55
		6271	HEMIPTERA	A	1.55
		628201	APHIDAE	A	2.07
		628403	CICADELLIDAE	A	1.03
		6317110101	COCCINELLA TRIFASCIATA	A	0.51
		6413020101	HEMEROBIUS BISTRIGATUS	A	0.51
		6413020102	HEMEROBIUS PACIFICUS	A	1.55
		6413020103	HEMEROBIUS STIGMATERUS	A	3.11
		6413020201	MICROMUS VARIOLOSUS	A	2.07
		6464020101	CHORISTONEURA OCCIDENTALIS	A	12.45
		650101	BRACHYCERA	A	4.66
		875503	OSMERIDAE	L	0.51
PW	093	6174020907	THYSANOESSA SPINIFERA	L	0.75
		617916	HIPPOLYTIDAE	Z	0.75
		6188030104	CANCER MAGISTER	M	0.75
		6271	HEMIPTERA	A	0.75
		628201	APHIDAE	A	1.51
		6413020101	HEMEROBIUS BISTRIGATUS	A	0.75
		643001	GEOMETRIDAE	A	0.75
		6464020101	CHORISTONEURA OCCIDENTALIS	A	4.55
		646506	OECOPHORIDAE	A	0.75

		650101	BRACHYCERA	A	1.51
PW	094	6174020101	EUPHAUSIA PACIFICA	A	0.75
		6174020907	THYSANOESSA SPINIFERA	A	0.75
		6256	PSOCOPTERA	A	0.75
		650101	BRACHYCERA	A	0.75
PW	095	6271	HEMIPTERA	A	0.85
		875503	OSMERIDAE	L	0.85
PW	096	5001200101	TOMOPTERIS PLANKTONIS	A	2.32
		5706010101	LOLIGO OPALESCENS	L	0.77
		6162020301	IDOTEA RESECATA	A	0.77
		6170010702	HYPEROCHE MEDUSARUM	A	23.97
		6170010901	LESTRIGONUS SCHIZOGENIOS	A	6.18
		6170011003	PARATHEMISTO PACIFICA	A	28.61
		6170080101	LYCAEA PULEX	A	0.77
		617916	HIPPOLYTIDAE	Z	4.64
		618312	PORCELLANIDAE	M	1.54
		6187010501	PUGETTIA PRODUCTA	M	0.77
		61880301	CANCER SP.	Z	0.77
		6188030101	CANCER OREGONENSIS	M	33.25
		6188030102	CANCER ANTENNARIUS	M	1.54
		6188030104	CANCER MAGISTER	M	10.05
		6271	HEMIPTERA	A	0.77
		628201	APHIDAE	A	2.32
		6317110301	HIPPODAMIA CONVERGENS	A	0.77
		64130201	HEMEROBIUS SP.	A	3.09
		6413020101	HEMEROBIUS BISTRIGATUS	A	0.77
		6413020102	HEMEROBIUS PACIFICUS	A	2.32
		6413020103	HEMEROBIUS STIGMATERUS	A	0.77
		6413020201	MICROMUS VARIOLOSUS	A	0.77
		6464020101	CHORISTONEURA OCCIDENTALIS	A	61.10
		650101	BRACHYCERA	A	3.86
		657307	FORMICIDAE	A	0.77
		83	CHAETOGNATHA	A	7.73
		8747020101	ENGRAULIS MORDAX	L	278.44
		8759040301	TACTOSTOMA MACROPUS	L	0.77
		8803030101	COLOLABIS SAIRA	L	0.77
		88260101	SEBASTES SP.	L	1.54
		8826010108	SEBASTES CAURINUS	L	6.18
		8826010111	SEBASTES DIPLOPROA	L	26.29
		8826010143	SEBASTES CHLOROSTICTUS	L	0.77
		8831023101	SCORPAENICHTHYS MARMORATUS	L	7.73
		8840030201	RONQUILIS JORDANI	L	1.54
PW	097	6170080501	TRYPHANA MALMI	A	0.65
		6174020101	EUPHAUSIA PACIFICA	L	0.65
		6174020907	THYSANOESSA SPINIFERA	A	1.95
		618304	CALLIANASSIDAE	Z	0.65
		618312	PORCELLANIDAE	Z	0.65
		6188030101	CANCER OREGONENSIS	M	1.30
		6256	PSOCOPTERA	A	0.65
		6271	HEMIPTERA	A	1.30
		628201	APHIDAE	A	3.25

		630503	CARABIDAE	A	0.65
		6317110201	ANATIS RATHVONI	A	0.65
		6317110401	MULSANTINA PICTA	A	0.65
		6413020103	HEMEROBIUS STIGMATERUS	A	0.65
		6413020201	MICROMUS VARIOLOSUS	A	0.65
		6464020102	CHORISTONEURA OCCIDENTALIS	A	1.95
		650101	BRACHYCERA	L	1.30
		650102	NEMATOCERA	A	16.90
		650301	TIPULIDAE	A	0.65
		650401	PSYCHODIDAE	A	2.60
		650508	CHIRONOMIDAE	A	0.65
		656603	ICHNEUMONIDAE	A	0.65
		656712	TORYMIDAE	A	1.30
		83	CHAETOGNATHA	A	1.30
		875503	OSMERIDAE	L	9.75
		88260101	SEBASTES SP.	L	1.30
		8831023101	SCORPAENICHTHYS MARMORATUS	L	0.65
PW	098	617001	HYPERIIDAE	A	0.76
		6174020101	EUPHAUSIA PACIFICA	A	0.76
		6174020907	THYSANOESSA SPINIFERA	L	1.52
		628201	APHIDAE	A	0.76
		628403	CICADELLIDAE	A	0.76
		650102	NEMATOCERA	A	7.63
		650401	PSYCHODIDAE	A	2.28
		875503	OSMERIDAE	L	0.76
PW	099	616923	HYALELLIDAE	A	2.03
		6174020907	THYSANOESSA SPINIFERA	L	0.67
		6271	HEMIPTERA	A	1.35
		628201	APHIDAE	A	2.71
		628403	CICADELLIDAE	A	0.67
		630503	CARABIDAE	A	0.67
		64130201	HEMEROBIUS SP.	A	4.75
		6413020101	HEMEROBIUS BISTRIGATUS	A	1.35
		6413020102	HEMEROBIUS PACIFICUS	A	4.07
		6413020103	HEMEROBIUS STIGMATERUS	A	2.03
		6413020201	MICROMUS VARIOLOSUS	A	1.35
		6464020101	CHORISTONEURA OCCIDENTALIS	A	3.39
		650101	BRACHYCERA	A	10.19
		650102	NEMATOCERA	A	4.75
		650401	PSYCHODIDAE	A	3.39
PW	100	6170010702	HYPEROCHE MEDUSARUM	A	0.54
		6271	HEMIPTERA	A	0.54
		6413020102	HEMEROBIUS PACIFICUS	A	1.09
		6413020103	HEMEROBIUS STIGMATERUS	A	0.54
		6464020101	CHORISTONEURA OCCIDENTALIS	A	1.63
		6501	DIPTERA	A	0.54
		8831023101	SCORPAENICHTHYS MARMORATUS	L	1.09
PW	101	6174020907	THYSANOESSA SPINIFERA	A	0.55
		618312	PORCELLANIDAE	Z	0.55
		6187010501	PUGETTIA PRODUCTA	M	0.55
		6256	PSOCOPTERA	A	0.55

		6271	HEMIPTERA	A	1.65
		628201	APHIDAE	A	19.25
		6413020103	HEMEROBIUS STIGMATERUS	A	0.55
		650101	BRACHYCERA	A	2.75
		650102	NEMATOCERA	A	4.95
PW	103	617916	HIPPOLYTIDAE	Z	0.66
		6188030102	CANCER ANTENNARIUS	M	0.66
		628201	APHIDAE	A	2.65
PW	104	6174020907	THYSANOESSA SPINIFERA	J	0.57
		628201	APHIDAE	A	0.57
		650102	NEMATOCERA	A	1.14
PW	105	6118010401	NEOCALANUS CRISTATUS	A	0.68
		6169090101	ATYLUS TRIDENS	A	0.68
		616923	HYALELLIDAE	A	0.68
		6170010702	HYPEROCHE MEDUSARUM	A	19.29
		6170011003	PARATHEMISTO PACIFICA	A	0.68
		6170090801	STREETSIA CHALLENGERI	A	0.68
		6174020907	THYSANOESSA SPINIFERA	A	1.37
		6174020907	THYSANOESSA SPINIFERA	L	1.37
		617916	HIPPOLYTIDAE	Z	0.68
		61792201	CRANGON SP.	Z	0.68
		6188030101	CANCER OREGONENSIS	M	8.27
		6501	DIPTERA	A	0.68
		83	CHAETOGNATHA	A	2.06
		875503	OSMERIDAE	L	1.37
		8831020803	COTTUS ASPER	L	1.37
		8831023101	SCORPAENICHTHYS MARMORATUS	L	2.06
		8831081501	STELLERINA XYOSTERNA	L	0.68
PW	106	5001	POLYCHAETA	A	1.09
		6170010702	HYPEROCHE MEDUSARUM	A	0.54
		6170011003	PARATHEMISTO PACIFICA	A	1.63
		6174020907	THYSANOESSA SPINIFERA	L	0.54
		6175	DECAPODA	Z	4.91
		617916	HIPPOLYTIDAE	Z	1.63
		61791605	HEPTACARPUS SP.	J	0.54
		61792201	CRANGON SP.	Z	4.36
		6183060226	PAGURUS SP.	M	1.09
		618312	PORCELLANIDAE	Z	0.54
		6187010501	PUGETTIA PRODUCTA	M	2.18
		6188030101	CANCER OREGONENSIS	M	1.63
		8792010101	BROMOPHYCIS MARGINATA	L	0.54
		8826010111	SEBASTES DIPLOPROA	L	0.54
		8827010201	OPHIODON ELONGATUS	L	0.54
		8840030201	RONQUILIS JORDANI	L	1.63
PW	117	6271	HEMIPTERA	A	0.73
		6413020101	HEMEROBIUS BISTRIGATUS	A	3.69
		6413020201	MICROMUS VARIOLOSUS	A	0.73
		8831023101	SCORPAENICHTHYS MARMORATUS	L	0.73
PW	118	6187010501	PUGETTIA PRODUCTA	M	0.81

		625401	PERLIDAE	A	0.81
		64130201	HEMEROBIUS SP.	A	0.81
		6413020201	MICROMUS VARIOLOSUS	A	0.81
		650101	BRACHYCERA	A	0.81
		8831023101	SCORPAENICHTHYS MARMORATUS	L	1.63
PW	119	6187010501	PUGETTIA PRODUCTA	M	0.83
		628201	APHIDAE	A	0.83
		6420	LEPIDOPTERA	A	0.83
		8831023101	SCORPAENICHTHYS MARMORATUS	L	0.83
PW	120	6187010501	PUGETTIA PRODUCTA	M	2.37
		628201	APHIDAE	A	0.79
PW	121	61792201	CRANGON SP.	Z	0.69
		6187010501	PUGETTIA PRODUCTA	M	3.45
		618803	CANCER SP.	Z	0.69
		6188030101	CANCER OREGONENSIS	M	4.83
		8747020101	ENGRAULIS MORDAX	L	6.21
		88260101	SEBASTES SP.	L	0.69
		8831023101	SCORPAENICHTHYS MARMORATUS	L	4.83
PW	126	59	ARACHNIDA	A	1.06
		617916	HIPPOLYTIDAE	Z	1.06
		618312	PORCELLANIDAE	M	19.12
		6187010501	PUGETTIA PRODUCTA	M	6.37
		61880301	CANCER SP.	Z	1.06
		6189020101	LOPHOPANOPEUS BELLUS	M	1.06
		83	CHAETOGNATHA	A	3.18
		8831023101	SCORPAENICHTHYS MARMORATUS	L	8.50
PW	127	617001	HYPERIIDAE	A	0.82
		6174020907	THYSANOESSA SPINIFERA	A	0.82
		617916	HIPPOLYTIDAE	Z	1.64
		6183120201	PACHYCHELES PUBESCENS	M	10.70
		6187010304	CHIONOECETES TANNERI	M	0.82
		6187010501	PUGETTIA PRODUCTA	M	16.46
		61880301	CANCER SP.	Z	2.46
		6188030104	CANCER MAGISTER	M	1.64
		650101	BRACHYCERA	P	4.11
		65380101	EPHYDRA SP.	P	2.46
		88260101	SEBASTES SP.	L	4.11
		8831023101	SCORPAENICHTHYS MARMORATUS	L	0.82
		8840030201	RONQUILIS JORDANI	L	0.82
PW	128	617916	HIPPOLYTIDAE	Z	0.66
		6183120201	PACHYCHELES PUBESCENS	M	12.72
		6187010501	PUGETTIA PRODUCTA	M	2.00
		6188030104	CANCER MAGISTER	M	0.66
		650101	BRACHYCERA	P	0.66
		65380101	EPHYDRA SP.	P	0.66
		88260101	SEBASTES SP.	L	0.66
PW	129	618312	PORCELLANIDAE	Z	1.00
		6183120201	PACHYCHELES PUBESCENS	M	4.02

		6188030104	CANCER MAGISTER	M	1.00
PW	136	6170010702	HYPEROCHE MEDUSARUM	A	11.77
		6170011003	PARATHEMISTO PACIFICA	A	48.47
		6174020907	THYSANOESSA SPINIFERA	A	0.69
		618312	PORCELLANIDAE	Z	14.54
		6183120201	PACHYCHELES PUBESCENS	M	0.69
		6187010501	PUGETTIA PRODUCTA	M	0.69
		61880301	CANCER SP.	Z	0.69
		6188030101	CANCER OREGONENSIS	M	101.80
		8820020110	SYNGNATHUS LEPTORHYNCHUS	L	0.69
		88260101	SEBASTES SP.	L	0.69
		8831023101	SCORPAENICHTHYS MARMORATUS	L	5.54
PW	137	57	CEPHALOPODA	L	0.66
		6170010702	HYPEROCHE MEDUSARUM	A	63.39
		6170011003	PARATHEMISTO PACIFICA	A	0.66
		6174020907	THYSANOESSA SPINIFERA	A	1.32
		617916	HIPPOLYTIDAE	Z	0.66
		618312	PORCELLANIDAE	Z	7.92
		6183120201	PACHYCHELES PUBESCENS	M	1.32
		6188030101	CANCER OREGONENSIS	M	4.62
		650101	BRACHYCERA	A	0.66
		88260101	SEBASTES SP.	L	0.66
PW	146	6170010702	HYPEROCHE MEDUSARUM	A	0.53
		6174020101	EUPHAUSIA PACIFICA	A	0.53
		8820020110	SYNGNATHUS LEPTORHYNCHUS	J	0.53
		8831023101	SCORPAENICHTHYS MARMORATUS	L	0.53
PW	147	6170010702	HYPEROCHE MEDUSARUM	A	3.52
		6174020907	THYSANOESSA SPINIFERA	A	0.70
		650101	BRACHYCERA	A	1.41
		8831023101	SCORPAENICHTHYS MARMORATUS	L	8.46
PW	148	5001	POLYCHAETA	A	0.68
		6169040117	PERAMPHITHOE HUMERALIS	A	0.68
		6169040118	AMPHITHOE LACERTOSA	A	0.68
		6169090101	ATYLUS TRIDENS	A	1.36
		6169240201	HYALE FREQUENS	A	0.68
		6169420918	PARAPHOXUS ROBUSTA	A	0.68
		6170010702	HYPEROCHE MEDUSARUM	A	5.45
		6170011003	PARATHEMISTO PACIFICA	A	0.68
		617916	HIPPOLYTIDAE	Z	1.36
		61791601	HIPPOLYTE SP.	J	0.68
		618312	PORCELLANIDAE	Z	1.36
		6187010501	PUGETTIA PRODUCTA	M	1.36
		6188030101	CANCER OREGONENSIS	M	9.54
		6188030102	CANCER ANTENNARIUS	M	2.04
		650102	NEMATOCERA	A	1.36
		657106	DIAPRIIDAE	A	0.68
		8747020101	ENGRAULIS MORDAX	L	0.68
		8826010111	SEBASTES DIPLOPROA	L	2.04
		8831023101	SCORPAENICHTHYS MARMORATUS	L	17.04

PW	152	5001	POLYCHAETA	A	2.30
		6188030101	CANCER OREGONENSIS	M	0.57
		628201	APHIDAE	A	2.30
		650101	BRACHYCERA	A	0.57
PW	153	6174020907	THYSANOESSA SPINIFERA	J	0.61
		628201	APHIDAE	A	1.22
		650401	PSYCHODIDAE	A	0.61
PW	154	6170010702	HYPEROCHE MEDUSARUM	A	0.68
		6174020907	THYSANOESSA SPINIFERA	A	1.37
		628201	APHIDAE	A	0.68
		875503	OSMERIDAE	L	0.68
PW	164	5134060104	DENDRONOTUS SUBRAMOSUS	J	1.24
		6169040117	PERAMPHITHOE HUMERALIS	A	0.62
		6169090101	ATYLUS TRIDENS	A	0.62
		6169120201	CALLIOPIUS LAEVIUSCULUS	A	0.62
		6169210109	EOGAMMARUS CONFERVICOLUS	A	0.62
		6169240101	ALLORCHESTES BELLABELLA	A	4.34
		6174020907	THYSANOESSA SPINIFERA	A	0.62
		6174020907	THYSANOESSA SPINIFERA	J	9656.96
		618304	CALLIANASSIDAE	Z	49.62
		618312	PORCELLANIDAE	M	0.62
		6188030101	CANCER OREGONENSIS	M	3.10
		6188030102	CANCER ANTENNARIUS	M	1.24
		628201	APHIDAE	A	1.24
		650102	NEMATOCERA	A	0.62
		650301	TIPULIDAE	A	0.62
		650401	PSYCHODIDAE	A	0.62
		8300000303	SAGITTA ELEGANS	A	0.62
		8747020101	ENGRAULIS MORDAX	L	0.62
PW	165	500124	NEREIDAE	A	0.66
		6169120201	CALLIOPIUS LAEVIUSCULUS	A	0.66
		6170010702	HYPEROCHE MEDUSARUM	A	0.66
		6170090801	STREETSIA CHALLENGERI	A	0.66
		6174020907	THYSANOESSA SPINIFERA	J	11.33
		617916	HIPPOLYTIDAE	Z	10.00
		6179160102	HIPPOLYTE CLARKI	J	1.33
		6188030101	CANCER OREGONENSIS	M	0.66
		628201	APHIDAE	A	2.00
		630903	HYDROPHILIDAE	A	0.66
		6413020102	HEMEROBIUS PACIFICUS	A	0.66
		6418070101	LENARCHUS RHO	A	0.66
		643001	GEOMETRIDAE	A	0.66
		650101	BRACHYCERA	A	1.33
		650102	NEMATOCERA	A	1.33
		650301	TIPULIDAE	A	2.00
PW	167	500124	NEREIDAE	A	3.88
		6169040117	PERAMPHITHOE HUMERALIS	A	0.55
		6169120201	CALLIOPIUS LAEVIUSCULUS	A	4.44
		6169240101	ALLORCHESTES BELLABELLA	A	1.66
		6171010703	CAPRELLA INCISA	A	0.55

		617916	HIPPOLYTIDAE	Z	1.11
		6188030101	CANCER OREGONENSIS	M	0.55
		6271	HEMIPTERA	A	0.55
		628201	APHIDAE	A	1.11
		8831023101	SCORPAENICHTHYS MARMORATUS	L	0.55
PW	168	6170010702	HYPEROCHE MEDUSARUM	A	1.28
		6183120201	PACHYCHELES PUBESCENS	A	0.64
		6188030102	CANCER ANTENNARIUS	M	0.64
		8803030101	COLOLABIS SAIRA	L	1.28
PW	175	616923	HYALELLIDAE	A	0.57
		6174020907	THYSANOESSA SPINIFERA	L	1.14
		6256	PSOCOPTERA	A	0.57
		650101	BRACHYCERA	A	0.57
PW	176	6170010702	HYPEROCHE MEDUSARUM	A	0.66
PW	178	5001	POLYCHAETA	A	16.47
		51	GASTROPODA	J	0.74
		6169120201	CALLIOPIUS LAEVIUSCULUS	A	53.90
		616923	HYALELLIDAE	A	3.74
		6170010103	HYPERIA MEDUSARUM	A	0.74
		6170010702	HYPEROCHE MEDUSARUM	A	0.74
		617402	EUPHAUSIACEA	A	8.98
		6174020502	NYCTIPHANES SIMPLEX	A	0.74
		6174020907	THYSANOESSA SPINIFERA	A	145.24
		6183120201	PACHYCHELES PUBESCENS	M	3.74
		61880301	CANCER SP.	Z	0.74
		6188030101	CANCER OREGONENSIS	M	0.74
		6576080101	APIS MELLIFERA	A	0.74
		8803030101	COLOLABIS SAIRA	L	0.74
PW	182	500114	ALCIOPIDAE	A	1.29
		6169120201	CALLIOPIUS LAEVIUSCULUS	A	1.29
		6170010702	HYPEROCHE MEDUSARUM	A	3.88
		6174020907	THYSANOESSA SPINIFERA	A	0.64
PW	183	6162020303	IDOTEA FEWKESI	A	1.51
		616923	HYALELLIDAE	A	0.75
		6170010702	HYPEROCHE MEDUSARUM	A	2.27
		6501	DIPTERA	P	0.75
		650102	NEMATOCERA	A	0.75
		8747020101	ENGRAULIS MORDAX	L	1.51
PW	184	6413020102	HEMEROBIUS PACIFICUS	A	0.63
		8747020101	ENGRAULIS MORDAX	L	1.27
PW	196	6188030101	CANCER OREGONENSIS	M	0.99
		6246020101	ZOOTERMOPSIS SP.	A	0.99
		6256	PSOCOPTERA	A	492.16
		6271	HEMIPTERA	A	7.98
		628201	APHIDAE	A	4.99
		628403	CICADELLIDAE	A	0.99
		64130201	HEMEROBIUS SP.	A	0.99

		6413020103	HEMEROBIUS STIGMATERUS	A	1.99
		6464020101	CHORISTONEURA OCCIDENTALIS	A	0.99
		650101	BRACHYCERA	A	1.99
		650102	NEMATOCERA	A	5.98
		652301	SYRPHIDAE	A	0.99
		656602	BRACONIDAE	A	0.99
		656804	CYNIPIDAE	A	1.99
		657105	CERAPHRONIDAE	A	0.99
		657307	FORMICIDAE	A	37.93
		657501	SPHECIDAE	A	0.99
		8831021801	LEPTOCOTTUS ARMATUS	L	1.99
PW	197	59	ARACHNIDA	A	0.57
		6169120201	CALLIOPIUS LAEVIUSCULUS	A	0.57
		6256	PSOCOPTERA	A	0.57
		6271	HEMIPTERA	A	121.88
		628201	APHIDAE	A	22.99
		628403	CICADELLIDAE	A	12.64
		629101	APHIDIIDAE	A	0.57
		631001	STAPHYLINIDAE	A	0.57
		6317110501	ADALIA BIPUNCTATA	A	2.29
		6413020102	HEMEROBIUS PACIFICUS	A	0.57
		6413020103	HEMEROBIUS STIGMATERUS	A	1.72
		6420	LEPIDOPTERA	A	1.14
		650101	BRACHYCERA	A	11.49
		650102	NEMATOCERA	A	5.17
		65050301	CULEX SP.	A	0.57
		656602	BRACONIDAE	A	0.57
		656603	ICHNEUMONIDAE	A	9.19
		656803	FIGITIDAE	A	0.57
		657307	FORMICIDAE	A	2.87
		657501	SPHECIDAE	A	2.29
PW	198	6170010702	HYPEROCHE MEDUSARUM	A	0.88
		6170011003	PARATHEMISTO PACIFICA	A	0.88
		6256	PSOCOPTERA	A	20.29
		6271	HEMIPTERA	A	52.06
		628201	APHIDAE	A	10.59
		628403	CICADELLIDAE	A	5.29
		6413020103	HEMEROBIUS STIGMATERUS	A	0.88
		650101	BRACHYCERA	A	0.88
PW	199	5001	POLYCHAETA	A	6.64
		6162020301	IDOTEA RESECATA	A	0.83
		6169120201	CALLIOPIUS LAEVIUSCULUS	A	4.98
		616923	HYALELLIDAE	A	0.83
		6170010103	HYPERIA MEDUSARUM	A	0.83
		6170010702	HYPEROCHE MEDUSARUM	A	1.66
		6256	PSOCOPTERA	A	23.26
		6271	HEMIPTERA	A	49.02
		628201	APHIDAE	A	10.80
		628403	CICADELLIDAE	A	7.47
		630503	CARABIDAE	A	0.83
		631001	STAPHYLINIDAE	A	0.83
		6317110401	MULSANTINA PICTA	A	0.83

		64130201	HEMEROBIUS SP.	A	0.83
		650101	BRACHYCERA	A	2.49
		650102	NEMATOCERA	A	0.83
		656603	ICHNEUMONIDAE	A	2.49
		656803	FIGITIDAE	A	0.83
		657307	FORMICIDAE	A	0.83
PW	200	500114	ALCIOPIDAE	A	1.54
		5134060104	DENDRONOTUS SUBRAMOSUS	A	1.54
		6169120201	CALLIOPIUS LAEVIUSCULUS	A	2.31
		616923	HYALELLIDAE	A	0.77
		6170010702	HYPEROCHE MEDUSARUM	A	3.08
		6174020101	EUPHAUSIA PACIFICA	A	1.54
		6174020905	THYSANOESSA LONGIPES	A	0.77
		6174020907	THYSANOESSA SPINIFERA	A	1.54
		6256	PSOCOPTERA	A	4.62
		6271	HEMIPTERA	A	58.57
		628201	APHIDAE	A	7.70
		628403	CICADELLIDAE	A	9.24
		630503	CARABIDAE	A	0.77
		630903	HYDROPHILIDAE	A	1.54
		6317110401	MULSANTINA PICTA	A	1.54
		6413020102	HEMEROBIUS PACIFICUS	A	0.77
		6413020103	HEMEROBIUS STIGMATERUS	A	1.54
		650101	BRACHYCERA	A	3.85
		650102	NEMATOCERA	A	1.54
		656602	BRACONIDAE	A	0.77
		656603	ICHNEUMONIDAE	A	3.85
PW	201	616921	GAMMARIDAE	A	0.71
		6170010702	HYPEROCHE MEDUSARUM	A	3.56
		6174020101	EUPHAUSIA PACIFICA	A	0.71
		6256	PSOCOPTERA	A	0.71
		6271	HEMIPTERA	A	7.12
		628201	APHIDAE	A	5.69
		628403	CICADELLIDAE	A	2.84
		6317110601	CYCLONEDA POLITA	A	0.71
		650101	BRACHYCERA	A	1.42
PW	202	6170010702	HYPEROCHE MEDUSARUM	A	6.08
		6256	PSOCOPTERA	A	1.73
		6271	HEMIPTERA	A	0.86
		628201	APHIDAE	A	4.34
		6413020103	HEMEROBIUS STIGMATERUS	A	2.60
		650101	BRACHYCERA	A	0.86
PW	203	59	ARACHNIDA	A	0.70
		6169120201	CALLIOPIUS LAEVIUSCULUS	A	4.24
		616923	HYALELLIDAE	A	0.70
		6170010702	HYPEROCHE MEDUSARUM	A	8.48
		6179160102	HIPPOLYTE CLARKI	A	0.70
		6256	PSOCOPTERA	A	2.12
		6271	HEMIPTERA	A	2.82
		628201	APHIDAE	A	1.41
		630903	HYDROPHILIDAE	A	0.70

	656603	ICHNEUMONIDAE	A	1.41
	657307	FORMICIDAE	A	1.41
	8826010111	SEBASTES DIPLOPROA	L	0.70
PW 204	6169120201	CALLIOPIUS LAEVIUSCULUS	A	0.70
	6170010702	HYPEROCHE MEDUSARUM	A	7.71
	6170080101	LYCAEA PULEX	A	0.70
	6256	PSOCOPTERA	A	9.12
	6271	HEMIPTERA	A	2.80
	628201	APHIDAE	A	0.70
	628403	CICADELLIDAE	A	0.70
	6317110301	HIPPODAMIA CONVERGENS	A	0.70
	64130201	HEMEROBIUS SP.	A	0.70
	650101	BRACHYCERA	A	0.70
	650102	NEMATOCERA	A	0.70
	657307	FORMICIDAE	A	0.70
	8826010111	SEBASTES DIPLOPROA	L	0.70

Appendix Table 3. Detailed comparison of the numerical percentage of stomach contents of juvenile salmon pooled for one station (r_i) and neuston collections (p_i) taken at the same station. Only those taxa which make up at least 1.0% of the total food or neuston for that station were included. Also given is the Linear Index of Food Selection (L) for each taxa.

STATION: 84-010
DATE: June 6
NUMBER OF STOMACHS: 5
MEAN FULLNESS: 2.8
PSI: 4.0

PREDATOR SPECIES: Coho
LOCATION: Destruction Island 16.6 km
NUMBER EMPTY: 0
MEAN CONDITION: 2.7
STOMACH TAXA IN NEUSTON: 3 of 11 (27.2%)

Species	r_i	p_i	L
Cancer oregonensis meg.	48.7	---	0.49
Cancer sp. zoea	26.8	1.8	0.25
Calanus sp.	16.7	---	0.17
Crangon sp. zoea	2.2	---	0.02
Cottidae larvae	1.4	---	0.01
Sebastes sp.	1.1	---	0.01
Pinnotherid zoea	1.8	1.8	0.00
Lophopanopeus bellus meg.	---	1.8	- 0.01
Aphidae	---	1.8	- 0.01
Scorpaenichthys marmoratus	0.4	3.6	- 0.03
Cancer antennarius meg.	---	3.6	- 0.04
Nematocera	---	5.5	- 0.06
Ronquilus jordani	---	80.0	- 0.80

STATION: 85-011
DATE: June 6
NUMBER OF STOMACHS: 8
MEAN FULLNESS: 1.2
PSI: 23.7

PREDATOR SPECIES: Coho
LOCATION: Destruction Island 28.1 km
NUMBER EMPTY: 1
MEAN CONDITION: 1.6
STOMACH TAXA IN NEUSTON: 1 of 6 (16.7%)

Species	r_i	p_i	L
Cancer antennarius meg.	30.0	---	0.30
Calanus pacificus	30.0	---	0.30
Calanus marshallae	3.4	---	0.03
Cancer magister meg.	3.4	---	0.03
Hemilepidotus spinosus	3.4	---	0.03
Cancer sp. zoea	23.7	25.0	- 0.01
Brachycera	---	12.5	- 0.13
Nematocera	---	12.5	- 0.13
Scorpaenichthys marmoratus	---	12.5	- 0.13
Ronquilus jordani	---	37.5	- 0.38

STATION: 84-012
DATE: June 6
NUMBER OF STOMACHS: 10
MEAN FULLNESS: 2.4
PSI: 27.3

PREDATOR SPECIES: Coho
LOCATION: Destruction Island 37.5 km
NUMBER EMPTY: 1
MEAN CONDITION: 2.3
STOMACH TAXA IN NEUSTON: 1 of 6 (16.7%)

Species	r_i	p_i	L
Thysanoessa spinifera	39.3	---	0.39
Cancer magister meg.	41.6	27.3	0.14
Hemilepidotus spinosus	5.9	---	0.06
Sebastes sp.	4.8	---	0.05
Cancer sp. zoea	2.3	---	0.02
Tipulidae	1.2	---	0.01
Calliopius laeviusculus	---	9.1	- 0.09
Hexagrammos decagrammus	---	9.1	- 0.09
Scorpaenichthys marmoratus	---	9.1	- 0.09
Ronquilus jordani	---	18.2	- 0.18
Nematocera	---	27.3	- 0.27

STATION: 84-018
DATE: June 8
NUMBER OF STOMACHS: 11
MEAN FULLNESS: 2.5
PSI: 43.9

PREDATOR SPECIES: Coho
LOCATION: Grays Harbor 37.3 km
NUMBER EMPTY: 1
MEAN CONDITION: 2.7
STOMACH TAXA IN NEUSTON: 4 of 10 (40.0%)

Species	r_i	p_i	L
Cancer antennarius meg.	38.7	6.7	0.32
Cancer sp. zoea	6.3	---	0.06
Hemilepidotus spinosus	6.3	---	0.06
Cancer oregonensis meg.	7.2	3.8	0.03
Sebastes sp.	2.7	---	0.03
Ammodytes hexapterus	1.8	---	0.02
Scorpaenichthys marmoratus	2.7	1.0	0.02
Pugettia producta meg.	1.0	---	0.01
Emerita analoga zoea	1.0	---	0.01
Nematocera	---	1.0	- 0.01
Cancer magister meg.	32.8	87.5	- 0.55

STATION: 84-019
DATE: June 8
NUMBER OF STOMACHS: 10
MEAN FULLNESS: 3.5
PSI: 9.3

PREDATOR SPECIES: Chinook
LOCATION: Grays Harbor 27.7 km
NUMBER EMPTY: 0
MEAN CONDITION: 2.7
STOMACH TAXA IN NEUSTON: 3 of 19 (15.8%)

Species	r_i	p_i	L
Crangon sp. zoea	31.4	---	0.31
Osmeridae larvae	12.8	---	0.13
Thysanoessa spinifera	12.2	---	0.12
Neocalanus cristatus	11.6	---	0.12
Cancer oregonensis meg.	6.3	---	0.06
Euphausia pacifica	4.1	---	0.04
Metridia pacifica	2.9	---	0.03
Parathemisto pacifica	2.3	---	0.02
Hippolytidae zoea	1.7	---	0.02
Pagurus sp. meg.	1.2	---	0.01
Cancer antennarius meg.	8.7	20.0	- 0.11
Ronquilus jordani	0.6	20.0	- 0.19
Cancer magister meg.	---	20.0	- 0.20
Scorpaenichthys marmoratus	---	40.0	- 0.40

STATION: 84-027
DATE: June 10
NUMBER OF STOMACHS: 8
MEAN FULLNESS: 3.4
PSI: 18.1

PREDATOR SPECIES: Coho
LOCATION: Cape Disappointment 38.2 km
NUMBER EMPTY: 1
MEAN CONDITION: 2.4
STOMACH TAXA IN NEUSTON: 1 of 4 (25.0%)

Species	r_i	p_i	L
Sebastes sp.	36.3	---	0.36
Hemilepidotus spinosus	36.3	---	0.36
Hexagrammos decagrammus	9.0	---	0.09
Nematocera	---	1.4	- 0.01
Cololabis saira	---	1.4	- 0.01
Scorpaenichthys marmoratus	---	1.4	- 0.01
Brachycera	---	4.3	- 0.04
Cancer magister meg.	18.1	91.3	- 0.73

STATION: 84-027
DATE: June 10
NUMBER OF STOMACHS: 5
MEAN FULLNESS: 4.0
PSI: 0.0

PREDATOR SPECIES: Chinook
LOCATION: Cape Disappointment 38.2
NUMBER EMPTY: 0
MEAN CONDITION: 3.1
STOMACH TAXA IN NEUSTON: 0 of 4 (0.0%)

Species	r_i	p_i	L
Hemilepidotus spinosus	53.8	---	0.54
Cancer sp. zoea	30.7	---	0.31
Ophiodon elongatus	7.6	---	0.08
Ronquilus jordani	7.6	---	0.08
Nematocera	---	1.4	- 0.01
Cololabis saira	---	1.4	- 0.01
Scorpaenichthys marmoratus	---	1.4	- 0.01
Brachycera	---	4.3	- 0.04
Cancer magister meg.	---	91.3	- 0.91

STATION: 84-092
DATE: July 25
NUMBER OF STOMACHS: 6
MEAN FULLNESS: 3.8
PSI: 45.2

PREDATOR SPECIES: Coho
LOCATION: Wecoma Beach 4.4 km
NUMBER EMPTY: 0
MEAN CONDITION: 3.5
STOMACH TAXA IN NEUSTON: 7 of 14 (50.0%)

Species	r_i	p_i	L
Parathemisto pacifica	44.0	2.9	0.41
Choristoneura occidentalis	39.7	35.5	0.04
Hyperoche medusarum	2.5	---	0.03
Cancer oregonensis meg.	2.5	---	0.03
Atylus tridens	2.1	---	0.02
Thysanoessa spinifera	1.0	---	0.01
Coccinella trifasciata	---	1.4	- 0.01
Pantala hymenaea	---	1.4	- 0.01
Osmeridae larvae	---	1.4	- 0.01
Limacina helicina	1.3	2.9	- 0.02
Cancer magister meg.	---	2.9	- 0.03
Cicadellidae	---	2.9	- 0.03
Psocoptera	0.4	4.4	- 0.04
Hemiptera	---	4.4	- 0.04
Aphidae	0.9	5.9	- 0.05
Micromus variolosus	---	5.9	- 0.06
Hemerobiidae	3.8	13.6	- 0.10
Brachycera	0.4	13.3	- 0.13

STATION: 84-094
DATE: July 25
NUMBER OF STOMACHS: 7
MEAN FULLNESS: 3.0
PSI: 20.8

PREDATOR SPECIES: Coho
LOCATION: Wecoma Beach 9.6 km
NUMBER EMPTY: 0
MEAN CONDITION: 2.6
STOMACH TAXA IN NEUSTON: 3 of 17 (17.6%)

Species	r_i	p_i	L
Choristoneura occidentalis	21.3	---	0.21
Parathemisto pacifica	18.7	---	0.19
Cancer oregonensis meg.	9.8	---	0.10
Ronquilus jordani	7.3	---	0.07
Cancer antennarius meg.	6.7	---	0.07
Hyperoche medusarum	4.1	---	0.04
Ophiodon elongatus	4.1	---	0.04
Clupea harengus pallasi	2.6	---	0.03
Nematocera	2.6	---	0.03
Sebastes sp.	1.5	---	0.02
Thysanoessa spinifera	12.0	25.0	- 0.13
Euphausia pacifica	8.3	25.0	- 0.17
Brachycera	0.5	25.0	- 0.24
Psocoptera	---	25.0	- 0.25

STATION: 84-097
DATE: July 26
NUMBER OF STOMACHS: 9
MEAN FULLNESS: 1.6
PSI: 28.5

PREDATOR SPECIES: Coho
LOCATION: Tillamook Bay 5.3 km
NUMBER EMPTY: 0
MEAN CONDITION: 1.8
STOMACH TAXA IN NEUSTON: 8 of 14 (57.1%)

Species	r_i	p_i	L
Euphausia pacifica	30.0	1.2	0.29
Atylus tridens	13.4	---	0.13
Microgadus proximus	7.5	---	0.08
Thysanoessa spinifera	8.9	3.7	0.05
Hemerobiidae	6.0	1.2	0.05
Cancer antennarius meg.	4.4	---	0.04
Ronquilus jordani	4.4	---	0.04
Citharichthys stigmaeus	1.5	---	0.02
Choristoneura occidentalis	3.0	3.7	- 0.01
Hemiptera	1.5	2.4	- 0.01
Chaetognatha	1.5	2.4	- 0.01
Cancer oregonensis	---	2.4	- 0.02
Brachycera	---	2.4	- 0.02
Torymidae	---	2.4	- 0.02
Sebastes sp.	---	2.4	- 0.02
Psychodidae	---	4.9	- 0.05
Aphidae	---	6.1	- 0.06
Osmeridae	6.0	18.3	- 0.12
Nematocera	10.4	31.7	- 0.21

STATION: 84-098
DATE: July 26
NUMBER OF STOMACHS: 10
MEAN FULLNESS: 0.7
PSI: 25.8

PREDATOR SPECIES: Coho
LOCATION: Tillamook Bay 10.9 km
NUMBER EMPTY: 4
MEAN CONDITION: 1.2
STOMACH TAXA IN NEUSTON: 3 of 9 (33.3%)

Species	r_i	p_i	L
Thysanoessa spinifera	32.1	10.5	0.22
Cancer magister	17.8	---	0.18
Choristoneura occidentalis	14.3	---	0.14
Hemerobiidae	7.1	---	0.07
Hemiptera	7.1	---	0.07
Caprella incisa	3.6	---	0.04
Brachycera	3.6	---	0.04
Euphausia pacifica	7.1	5.2	0.02
Aphidae	---	5.2	- 0.05
Cicadellidae	---	5.2	- 0.05
Osmeridae	---	5.2	- 0.05
Psychodidae	---	15.8	- 0.16
Nematocera	7.1	52.7	- 0.46

STATION: 84-099
DATE: July 26
NUMBER OF STOMACHS: 7
MEAN FULLNESS: 2.6
PSI: 28.9

PREDATOR SPECIES: Coho
LOCATION: Tillamook Bay 19.0
NUMBER EMPTY: 1
MEAN CONDITION: 2.1
STOMACH TAXA IN NEUSTON: 6 of 11 (54.5%)

Species	r_i	p_i	L
Choristoneura occidentalis	77.0	7.8	0.69
Thysanoessa spinifera	1.2	1.5	0.00
Cicadellidae	---	1.5	- 0.02
Carabidae	---	1.5	- 0.02
Hemiptera	0.4	3.1	- 0.03
Micromus variolosus	---	3.1	- 0.03
Hyalellidae	---	4.7	- 0.05
Aphidae	---	6.2	- 0.06
Psychodidae	---	7.8	- 0.08
Nematocera	1.6	10.9	- 0.09
Hemerobiidae	14.8	28.1	- 0.13
Brachycera	3.1	23.9	- 0.21

STATION: 84-105
DATE: July 26
NUMBER OF STOMACHS: 10
MEAN FULLNESS: 2.8
PSI: 27.6

PREDATOR SPECIES: Coho
LOCATION: Seaside 9.8 km
NUMBER EMPTY: 0
MEAN CONDITION: 2.5
STOMACH TAXA IN NEUSTON: 5 of 15 (33.3%)

Species	r_i	p_i	L
Cancer oregonensis meg.	79.7	19.1	0.61
Cancer magister meg.	8.2	---	0.08
Pachycheles rudis meg.	1.0	---	0.01
Diptera	0.8	1.6	- 0.01
Atylus tridens	0.3	1.6	- 0.01
Parathemisto pacifica	0.1	1.6	- 0.01
Neocalanus critatus	---	1.6	- 0.02
Hyalellidae	---	1.6	- 0.02
Streetsia challengeri	---	1.6	- 0.02
Hippolytidae	---	1.6	- 0.02
Crangon sp. zoea	---	1.6	- 0.02
Stellerina xyosterna	---	1.6	- 0.02
Osmeridae	0.1	3.1	- 0.03
Cottus asper	---	3.1	- 0.03
Chaetognatha	---	4.8	- 0.05
Scorpaenichthys marmoratus	---	4.8	- 0.05
Thysanoessa spinifera	---	6.2	- 0.06
Hyperoche medusarum	7.3	44.5	- 0.37

STATION: 85-147
DATE: Sept. 1
NUMBER OF STOMACHS: 5
MEAN FULLNESS: 1.6
PSI: 3.3%

PREDATOR SPECIES: Coho
LOCATION: Sea Lion Rocks 18.3 km
NUMBER EMPTY: 0
MEAN CONDITION: 2.5
STOMACH TAXA IN NEUSTON: 2 of 11 (18.2%)

Species	r_i	p_i	L
Parathemisto pacifica	93.2	---	0.93
Cancer oregonensis meg.	2.5	---	0.03
Limacina helicina	1.7	---	0.02
Thysanoessa spinifera	1.2	5.0	- 0.04
Brachycera	---	10.0	- 0.10
Hyperoche medusarum	1.1	25.0	- 0.24
Scorpaenichthys marmoratus	---	60.0	- 0.60

STATION: 84-165
DATE: Sept. 4
NUMBER OF STOMACHS: 5
MEAN FULLNESS: 3.2
PSI: 34.9

PREDATOR SPECIES: Coho
LOCATION: Willapa Bay 18.5 km
NUMBER EMPTY: 0
MEAN CONDITION: 2.4
STOMACH TAXA IN NEUSTON: 3 of 5 (60.0%)

Species	r_i	p_i	L
Engraulis mordax	48.0	---	0.48
Parathemisto pacifica	8.4	---	0.08
Cancer oregonensis meg.	8.1	1.9	0.06
Hyperoche medusarum	3.7	1.9	0.02
Thysanoessa spinifera	31.1	32.1	- 0.01
Calliopius laeviusculus	---	1.9	- 0.02
Streetsia challengeri	---	1.9	- 0.02
Hydrophilidae	---	1.9	- 0.02
Hemerobiidae	---	1.9	- 0.02
Lenarchus rho	---	1.9	- 0.02
Geometridae	---	1.9	- 0.02
Brachycera	---	3.8	- 0.04
Nematocera	---	3.8	- 0.04
Aphidae	---	5.6	- 0.06
Tipulidae	---	5.6	- 0.06
Hippolytidae	---	32.1	- 0.32

STATION: 85-196
DATE: Sept. 14
NUMBER OF STOMACHS: 8
MEAN FULLNESS: 2.5
PSI: 43.1

PREDATOR SPECIES: Chinook
LOCATION: Yaquina Head 4.9 km
NUMBER EMPTY: 1
MEAN CONDITION: 2.4
STOMACH TAXA IN NEUSTON: 6 of 10 (60.0%)

Species	r_i	p_i	L
Engraulis mordax	22.7	---	0.23
Hyperia medusarum	11.3	---	0.11
Brachycera	6.8	0.4	0.06
Atylus tridens	4.5	---	0.05
Cicadellidae	4.5	0.2	0.04
Aphidae	4.5	1.0	0.04
Parathemisto pacifica	2.3	---	0.02
Hemerobiidae	2.3	0.6	0.02
Hemiptera	---	1.1	- 0.01
Formicidae	2.3	6.7	- 0.04
Psocoptera	38.6	86.8	- 0.48