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Size of Juvenile Salmon Prey From Southeastern Alaska and Northern British Columbia

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SIZE OF JUVENILE SALMON PREY FROM SOUTHEASTERN ALASKA AND NORTHERN BRITISH COLUMBIA

by

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ABSTRACT

Data on weight, length, and volume of prey ingested by juvenile Pacific salmon (*Oncorhynchus* spp.) and potential prey organisms from epibenthic samples are presented. Prey ingested were measured from stomachs of 895 pink (*O. gorbuscha*) and 997 chum (*O. keta*) salmon fry collected with a beach seine in nearshore areas of Auke Bay, southeastern Alaska (SEA), from March to June 1975 and 1986. Prey from stomachs of 2,983 juveniles of five Pacific salmon species collected in deeper waters were examined from purse seine samples in SEA in July-August 1983 and 1984 and in northern British Columbia in July 1984, and from research trolling samples in SEA in May 1986 and September 1987. Potential prey samples were collected with an epibenthic sled in nearshore environments of Auke Bay from mid-April to early June 1988. Subsamples of at least 100 intact individuals of a taxon were measured and weighed, when possible. Pink and chum salmon collected in nearshore environments had consumed 68 taxonomic and life-history categories of small invertebrate prey primarily, including many insects and arachnids. Salmon collected in deeper waters had eaten approximately 34 larger taxa, about half invertebrates and half teleosts of varying size. Epibenthic samples contained 58 categories, with copepods predominating. No significant differences were found when weight data were compared with similar taxa from other sources.

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INTRODUCTION

Biologists working with Pacific salmon (*Oncorhynchus* spp.) diet, ecology, and bioenergetics, especially those in modeling, are often interested in measurements of organisms eaten by juvenile salmon or found in habitats where salmon are feeding. Such information on potential prey generally exists as theses (Urquhart 1979, Barnard 1981, Landingham 1982) or unpublished data, not accessible to others. Many studies lack support to obtain prey measurements specific to their sampling season and area, thus making published literature values essential for reference.

Various studies of juvenile salmon ecology, including diet, have been conducted by the Auke Bay Laboratories in southeastern Alaska (SEA) since 1964 (Bailey et al. 1975). The early work addressed estuarine carrying capacity in relation to salmon enhancement and resulted in published data on volume of prey from pink (*O. gorbuscha*) and chum (*O. keta*) salmon stomachs, and potential prey collected with a Clarke–Bumpus sampler. Later work included two theses (Landingham 1982, Cordell 1986) and a 4-year study of juvenile salmon recruitment in Auke Bay (Mortensen et al. 2000), and diet studies of epipelagic juveniles (Landingham et al. 1998; Weitkamp and Sturdevant 2008). Other work on Alaska juvenile pink and chum salmon ecology includes studies of early marine ecology of hatchery–reared fish from Prince William Sound (Urquhart 1979, Barnard 1981), diets of fish after the *Exxon Valdez* oil spill (Sturdevant et al. 1996), and trophic interactions of hatchery and wild fish (Sturdevant et al. 2012a).

This report presents archived data on length, width, volume, wet weight, and dry weight of prey eaten by juvenile salmon that were collected by Auke Bay Laboratories in the 1970s and

1980s. Data are from samples collected in nearshore habitat during salmon early marine life history and in deeper, epipelagic habitat from samples of juvenile salmon en route to the Gulf of Alaska. Samples included stomach contents of pink and chum salmon fry collected in Auke Bay with a beach seine (Landingham 1982, Mortensen et al. 2000), stomach contents of older pink, chum, sockeye (*O. nerka*), coho (*O. kisutch*), and Chinook (*O. tshawytscha*) salmon collected from northern British Columbia (NBC) and SEA using a purse seine (Landingham et al. 1998), and stomach contents of juvenile coho and Chinook collected from SEA during research trolling (Orsi and Wertheimer 1995). Data on potential prey collected during the nearshore recruitment study (Celewycz and Cordell 1988, Mortensen et al. 2000) are also presented. Renewed interest in reporting this archived data was prompted by the continuing scarcity and relevance of prey quality data in current trophic studies (e.g., Orsi et al. 2004, Sturdevant et al. 2012a, b).

MATERIALS AND METHODS

This report contains four data sets. One data set of prey from stomach analysis pertains to pink and chum salmon fry collected in Auke Bay at weekly intervals during spring in 1975 and 1986 (Landingham 1982, Mortensen et al. 2000). The fry were sampled with a 37-m beach seine in nearshore habitats with depths < 4 m. The second data set pertains to pink, chum, sockeye, coho, and Chinook salmon juveniles collected with purse seines in epipelagic marine waters of coastal SEA and inside passages during summer in 1983 and 1984 and in NBC in 1984 (Landingham et al. 1998). The third data set pertains to coho and Chinook salmon juveniles collected during summer research trolling in outside waters of northern SEA in May 1986 and

September 1987 (Orsi and Wertheimer 1995). All fish subsampled for stomach analysis were anesthetized using tricaine methanesulfonate and measured to the nearest millimeter fork length (FL). Stomachs were excised and preserved with 10% formalin in seawater until stomach analysis was conducted in the laboratory.

The final data set pertains to potential prey organisms collected from the nearshore environment in Auke Bay from mid-April to early June 1988 (Celewycz and Cordell 1988) where salmon fry were feeding (Landingham 1982, Mortensen et al. 2000). The nearshore epibenthic organisms were sampled with a sled pulled by hand at depths of 0.5 m, along a 10-m transect at the + 2.0 ft (+ 0.61 m) tide level. The sled had 11-cm-high runners, a protective nylon apron, and a hoop framework 90° to the runners. The organisms were collected in a conical, 30-cm-diameter, 243-micron plankton net with a codend. A small net float fastened at the top of the hoop helped prevent the sled runners from digging into the substrate. A 10-m pulling line was fastened to the net bridle. Epibenthic samples were fixed in 5% formalin and preserved in 35% isopropyl alcohol until they were moved into water for rehydration before weighing.

Subsamples of prey that were in good condition from salmon stomachs were used for length, width, and weight measurements. When possible, at least 100 of each taxon from stomachs or sled samples were measured and weighed. In general, small invertebrate taxa were measured to the nearest 0.1 millimeter with an ocular micrometer on the highest usable power and weighed (wet and dry; nearest 0.1 µg) on a Cahn millibalance. Large invertebrates and fish were hand-measured to the nearest millimeter and weighed to the nearest milligram on a Mettler balance. Samples large enough to handle were blotted dry before they were wet weighed; otherwise, they were placed in tared aluminum dishes and all liquid was drawn off with lab tissues. Dry weights were obtained by drying the sample in an oven at a constant temperature (65 °C) until weights were constant. Mean lengths and widths were used to compute prey volumes according to general shape (e.g., cylinder, cone, and sphere).

RESULTS

Prey organisms were taken from three collections of juvenile salmon stomachs. A pool of 895 pink and 997 chum salmon (27–114 mm FL) were sampled from nearshore habitats during spring in Auke Bay (Table 1). Older juvenile salmon were sampled by purse seine (pink, chum, sockeye, coho, and Chinook; 90–324 mm FL) and by trolling (coho and Chinook; 230-650 mm FL) during summer from deeper, epipelagic waters. Epibenthic prey were taken from 36 samples collected from low- and medium-gradient beaches with fine to coarse substrate; samples were collected during four periods from mid-April to early June.

Prey from pink and chum salmon sampled in Auke Bay included 68 taxonomic and life-history categories. Over half of this set consisted of various insect and arachnid taxa that were not abundant in stomachs, and which were therefore pooled into minute, small, and medium categories and weighed in combination (Table 2). Within these pooled groups, small and medium individuals were most abundant and included specimens that could be handled for weighing. Sample sizes for most other taxa included 30-100 specimens.

Prey samples from five species of Pacific salmon in NBC and SEA in epipelagic waters were less diverse than in nearshore Auke Bay and included approximately 34 taxa (Tables 3 and 4). However, different sizes of several taxa were measured at different times and locations in

August 1983 and 1984 (SEA) and July 1984 (NBC, SEA) (Table 3), and in May 1986 and September 1987 (Table 4). Prey categories consisted of approximately half invertebrate and half teleost taxa, typically with 20-70 specimens in different months and years. The great size range within and among taxa indicates the spatial and temporal variability of prey ingested by five Pacific salmon species (Landingham et al. 1998). For example, a wide variety of amphipods were common prey in all stomach content datasets, with lengths differing by a factor of 8, widths by a factor of 4, and volumes by more than 100 times (Tables 2-4).

Epibenthic prey samples contained 58 categories, over half of which were copepods (21 Harpacticoida, 8 Calanoida, and 2 Cyclopoida). The number of specimens per category often exceeded 100, reflecting their high relative abundance in sled samples (Table 5; Celewycz and Cordell 1988).

DISCUSSION

How valid are comparisons between prey data presented here and data from other studies? We compared 1) mean dry weights of similar taxa from stomachs of pink and chum salmon that we collected in Auke Bay with those from Prince William Sound, Alaska (Barnard 1981); 2) mean volumes of similar taxa from stomachs of pink and chum salmon that we collected in Auke Bay with those from Traitor's Cove in southeastern Alaska (Bailey et al. 1975); and 3) mean dry weights of prey from sled samples with those from stomachs in Auke Bay. Two sample *t*-tests indicated that means of all comparisons were not significantly different; however, prey sizes in all data sets were highly variable (standard deviation > mean).

Gross examination of three comparison datasets indicated that mean prey volumes from Auke Bay and Traitor's Cove varied least for similar taxa and about as many measurements were greater as were lesser; overall, mean volume from Auke Bay was greater than mean volume from Traitor's Cove (Bailey et al. 1975). Mean dry weight of prey from Auke Bay was about twice that from Prince William Sound (Barnard 1981), although most weights were similar. At Auke Bay, mean dry weight per individual prey from epibenthic sled samples was greater than that of the same taxa in pink and chum stomach samples, similar to chum salmon prey in Puget Sound, Washington (Feller and Kaczynski 1975). In contrast, size selectivity of juvenile salmon for large prey specimens relative to those in the environment has also been documented (Cordell 1986). In addition, wet weights of calanoid taxa and stages that were sampled in central Auke Bay with vertical plankton nets (Coyle et al. 1990), and ratios of prey dry:wet weight (Omori 1969), were similar to our data.

The data presented here were gained through careful measurement of specimens in very good condition. Juvenile salmon prey on a wide range of organisms in diverse habitats, resulting in prey data that vary with spatial and temporal conditions and predator life stage; clearly, the prey size-specific data from our study provides further information for researchers studying fish food habits and prey fields and will benefit investigations of relative prey quality and bioenergetics. However, those who wish to use these data should carefully note the predator species, size, season, and locality for each data set, and judge for themselves whether the prey data are applicable to a particular situation. Future studies should address the need for direct measurement of energy densities of key prey taxa by size and life stage (Davis et al. 1998, Orsi et al. 2004, Aydin et al. 2005, Cross et al. 2005).

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Table 1.-- Species, number (*N*), and fork length (mm) of juvenile salmon examined for stomach contents from beach seine collections in Auke Bay, purse seine collections in northern British Columbia (NBC) and southeastern Alaska (SEA), and research trolling collections in northern SEA, by date.

			Length (mm)	
Date	Species	*N*	Range	Mean
Auke Bay (beach seine)				
March-June 1975	Pink	539	27-54	33.0
	Chum	557	30-114	40.7
March-May 1986	Pink	197	29-49	35.4
	Chum	191	33-59	40.4
June-July 1986	Pink	159	30-90	54.0
	Chum	249	39-88	54.0
NBC and SEA (purse seine)				
August 1983, July-August 1984	Pink	815	90-229	145.7
	Chum	453	80-279	149.4
	Sockeye	361	105-290	146.1
	Coho	543	112-324	220.5
	Chinook	38	134-324	221.0
Northern SEA (troll)				
May 1986, September 1987	Coho	52	230-380	415.7
	Chinook	721	160-650	280.0

Table 2.-- Length and width (mean and range, mm), wet and dry weight (mg), and volume (mm^3) of prey taxa from stomachs of juvenile pink and chum salmon collected in Auke Bay, Alaska, from March to June 1975 and 1986. Data for Arachnida and Insecta (except Chironomidae and Collembola) represent pooled samples of several taxa in minute, small, and medium categories. Specimens were adults unless otherwise noted. Dashes indicate no data. Taxa are ordered by NODC taxonomic codes (National Oceanographic Data Center, 1984).

Taxon	NODC code	*N*	Mean length (mm)	Length range (mm)	Mean width (mm)	Width range (mm)	Wet weight (mg)	Dry weight (mg)	Volume (mm^3)
Polychaeta larvae	5001	58	4.2	2.4-6.9	0.2	0.1-0.4	--	0.0309	0.19
Gastropoda veliger	51	53	0.7	0.6-0.9	--	--	--	0.0064	0.02
Limacinidae	511301	64	0.4	0.2-0.7	--	--	--	0.0190	0.04
Bivalvia-juvenile	55	50	0.4	0.3-0.5	--	--	--	0.0080	0.02
Arachnida-Pseudoscorpionida*	5906	71	4.8	2.8-10.2	1.6	0.6-4.0	7.16	0.9890	9.59
Arachnida-Araneae*	5911	100	3.0	1.5-5.8	1.1	0.6-2.3	1.34	0.2850	2.63
Mites-Acarina*	5922	39	2.1	1.1-5.9	0.5	0.3-2.0	0.44	0.0720	0.50
Pycnogonida*	60	100	--	1.5-5.8	--	0.6-2.3	--	0.2850	2.63
Cladocera- *Evadne* sp.	61090501	52	0.8	0.6-1.0	0.5	0.3-0.7	--	0.0110	0.05
Calanoida-adult	6118	100	1.3	0.6-3.3	0.5	0.2-1.3	--	0.0259	0.24
Harpacticoida ovisac	6119	100	0.6	0.3-0.9	0.4	0.2-0.7	--	0.0086	0.04
Harpacticoida general	6119	100	1.3	0.6-1.9	0.4	0.3-0.6	--	0.0131	0.19
Harpacticus sp. females	61191001	100	1.4	1.0-1.9	0.4	0.3-0.5	0.11	0.0160	0.14
Harpacticus sp. males	61191001	100	1.2	0.7-1.6	0.3	0.2-0.5	0.04	0.0030	0.06
Cirripedia-nauplius	6130	86	0.7	0.5-1.3	0.5	0.3-0.9	--	0.0098	0.05
Cirripedia-molt	6130	79	--	--	--	--	3.57	0.1540	--
Cirripedia-settling stage	6130	19	0.8	0.5-1.2	--	--	--	0.0520	0.12
Cirripedia-cyprid	6130	100	0.9	0.8-1.4	0.5	0.4-0.8	--	0.0137	0.14
Mysidacea	6151	65	10.7	5.2-16.7	1.2	0.5-2.4	11.81	1.0970	11.3
Mysidacea-juvenile	6151	6	0.7	0.4-1.3	0.4	0.3-0.8	--	0.0240	0.07
Cumacea	6154	100	1.4	1.2-1.6	0.5	0.5-0.6	--	0.0415	0.29
Isopoda	6158	4	2.7	2.0-4.5	1.2	1.1-1.6	--	0.2550	3.07
Amphipoda, Gammaridea-small	6169	59	3.7	1.0-10.3	0.5	0.2-2.1	--	0.0970	0.61
Amphipoda, Gammaridea-medium	6169	100	3.7	1.4-6.1	0.8	0.2-1.7	1.34	0.1690	2.01
Amphipoda, Hyperiidea-*Themisto*	61700110	8	2.0	1.7-2.8	0.3	0.2-0.6	--	0.0213	0.13
Euphausiacea-nauplius	6174	83	0.3	0.2-0.6	--	--	--	0.0003	0.01

Table 2. -- Cont.

Euphausiacea-calyptopis/furcilia	6174	50	1.2	0.5-2.7	0.3	0.2-0.5	--	0.0066	0.07
Decapoda-zoea	6175	33	0.8	0.7-1.4	0.6	0.4-0.9	--	0.0148	0.14
Insecta-general minute[1]	62	39	2.1	1.1-5.9	0.5	0.3-2.0	0.44	0.0720	0.50
Insecta-general small[2]	62	100	3.0	1.5-5.8	1.0	0.6-2.3	1.34	0.2850	2.63
Insecta-general medium[3]	62	71	4.8	2.8-10.2	1.6	0.6-4.0	7.16	0.9890	9.59
Insecta-Collembola	620902	100	1.4	1.1-1.8	0.4	0.3-0.5	--	0.0152	0.14
Insecta-Chironomidae-larvae	650508	31	3.1	1.8-4.3	0.3	0.2-0.5	--	0.0480	0.28
Insecta-Chironomidae-pupa	650508	30	2.6	1.9-3.7	0.5	0.3-0.7	--	0.0560	0.54
Insecta-Chironomidae-adult	650508	100	2.0	1.3-2.6	0.4	0.3-0.6	--	0.0332	0.20
Chilopoda	66	5	19.6	16-24	0.7	1.0-0.5	7.28	1.3150	6.70
Larvacea-*Oikopleura*	84130101	100	0.7	0.3-1.1	0.4	0.1-0.7	--	0.0079	0.07
Teleostei-eggs	8735	72	0.8	0.4-1.5	0.8	0.4-2.0	--	0.0360	0.28

*Included in pooled Insecta measurements

[1]Insecta-general minute: Thysanura-Machilidae; Psocoptera; Coleoptera; Coleoptera-Staphylinidae, Elateridae; Diptera; Hymenoptera-Chalcidoidea

[2]Insecta-general small: Ephemeroptera; Homoptera; Psyllidae; Aphididae; Coleoptera; Diptera; Diptera-Ephydridae; Culicoidea; Hymenoptera-Braconidae, Ichnemonidae, Eupelmidae; Diapriidae; Formicidae

[3]Insecta-general medium: Hemiptera; Cicadellidae; Coleoptera; Neuroptera; Trichoptera; Trichoptera-Limnephilidae; Lepidoptera; Lepidoptera-larvae; Diptera; Diptera-Anthomyiidae-larvae; Hymenoptera.

Table 3.-- Length (mm), wet and dry weight (mg), and volume (mm^3) of taxa by life-history stage from stomachs of juvenile pink, chum, sockeye, coho, and Chinook salmon collected using a purse seine in northern British Columbia (NBC) and southeastern Alaska (SEA) in August 1983 and in July and August 1984. Dashes indicate no data. Taxa are ordered by NODC taxonomic codes (National Oceanographic Data Center, 1984).

Taxon	NODC code	*N*	Life-history stage*	Mean length (mm)	Length range (mm)	Mean width (mm)	Width range (mm)	Wet weight (mg)	Dry weight (mg)	Volume (mm^3)	Sample date
Tomopteris sp.	50012001	4	6	8.8	8.6-9.1	1.8	1.7-1.8	6.84	0.73	22.4	August 83
Limacinidae	511301	119	9	0.7	0.4-1.2	--	--	--	0.06	0.2	August 84
Gonatidae	570703	8	8	17.9	12.1-217	4.0	3.3-4.6	129.9	16.23	224	August 84
Calanoida	6118	100	9	2.7	1.7-3.1	0.8	0.5-1.7	0.89	0.15	1.4	August 83
Neocalanus cristatus	6118010201	25	9	6.0	5.4-6.6	1.7	1.4-2.2	9.43	0.84	13.6	July 84
Epilabidocera longipedata	6118270102	31	9	2.6	2.1-3.0	0.7	0.5-0.9	1.07	0.14	1.1	August 84
Hyperia sp.	61700101	11	9	11.4	6.8-13.6	2.2	1.2-3.1	31.58	3.88	42.4	August 83
Themisto libellula	6170011002	15	9	10.3	8.2-12.5	1.3	0.8-1.7	12.07	1.48	13.6	August 83
T. libellula	6170011002	56	9	6.9	3.8-11.0	1.5	0.7-2.4	14.1	1.37	12.9	July 84
T. pacifica	6170011003	56	9	4.2	2.3-6.4	0.8	0.4-1.6	1.61	0.17	1.9	August 83
Primno macropa	6170040302	69	9	4.0	1.7-8.9	0.7	0.3-1.4	1.87	0.21	1.4	August 83
P. macropa	6170040302	60	9	3.7	2.2-10.8	1.1	0.6-4.5	4.12	0.42	3.2	August 84
Vibilia sp.	61701901	60	9	4.5	2.8-5.8	0.8	0.6-1.0	2.32	0.29	2.4	July 84
Euphausia pacifica	6174020101	2	8	9.6	6.9-12.4	0.8	0.7-0.9	2.85	0.23	4.8	August 83
Thysanoessa inermis	6174020902	5	8	15.9	11.4-13.8	1.8	1.4-1.5	10.02	1.05	40.1	July 84
T. spinifera	6174020907	41	8	14.1	4.8-23.0	1.5	0.3-2.9	13.7	1.37	23.1	August 83
T. spinifera	6174020907	40	8	8.8	7.4-21.2	0.8	0.5-2.0	3.64	0.38	4.4	July 84
Brachyura-zoea	6188	43	4	2.5	1.6-2.9	2.0	0.9-2.7	2.62	0.29	8.2	August 83
Brachyura-zoea	6188	60	4	1.9	1.2-2.7	--	--	2.78	0.21	4.1	July 84
Brachyura-megalops	6188	60	6	3.8	2.8-5.0	1.8	1.3-2.4	4.61	0.43	9.2	July 84
Brachyura-megalops	6188	33	6	3.5	2.6-4.2	2.0	1.5-2.7	6.03	0.63	10.2	August 83
Brachyura-megalops	6188	61	6	4.7	2.5-5.0	1.8	1.5-2.2	7.71	0.90	12.4	August 84
Teleostei-eggs	8735	47	2	4.9	--	--	--	7.85	2.26	62.3	August 84
Clupea pallasii	874701020101	7	8	81.1	71-92	9.1	8.0-12.0	3139.5	548.05	5284.1	August 84
Osmeridae	875503	78	8	23.9	13-35	1.8	1.0-3.5	42.9	6.24	60.8	July 84
Osmeridae	875503	63	8	29.5	13-41	2.4	1.0-4.0	69.8	9.90	133.4	August 84
Myctophidae	876214	148	8	13.1	8-18	1.8	0.5-3.0	22.9	4.28	33.3	July 84

Table 3. -- Cont.

Myctophidae	876214	35	8	11.7	9.6-13.6	1.9	1.1-3.2	14.4	2.26	23.5	August 84
Theragra chalcogramma	8791030701	1	8	65.0	--	9.0	--	1314	323.20	4133	August 83
T. chalcogramma	8791030701	13	8	48.3	33-55	5.9	4-8	780.2	134.45	1329.1	July 84
T. chalcogramma	8791030701	38	8	66.2	44-77	7.4	5.0-11.5	1690.7	282.60	2845.7	August 84
Sebastes sp. -small	88260101	74	8	14.7	9.0-24.0	2.4	1.0-4.0	51.8	6.95	22.2	July 84
Sebastes sp. -medium	88260101	3	6	56.0	55-58	8.3	7-9	1520.2	316.88	3057.7	August 84
Sebastes sp. -small	88260101	5	8	14.1	7.0-41.0	2.4	2.2-9.0	51.2	9.81	62.5	August 83
Sebastes -large	88260101	5	8	66.2	62-72	9.6	9.0-10.0	1436.4	267.65	4789.3	August 83
Hemilepidotus	88310214	20	8	12.0	11.4-18	2.6	1.8-3.3	39.9	6.03	63.7	August 84
Stichaeidae	884212	14	8	25.5	20-31	3.0	2.5-4.0	85.86	14.78	185	July 84
Stichaeidae	884212	3	8	35.7	35-36	4.7	4.5-5.0	224.7	41.85	619.1	August 84
Ammodytes hexapterus	8845010101	8	8	75.1	59-93	5.0	4.0-7.5	1173.5	249.58	1473.8	August 84
A. hexapterus -small	8845010101	18	8	31.5	20-45	2.5	1.0-4.0	72.5	16.19	157	August 83
A. hexapterus -medium	8845010101	20	8	71.5	24-85	6.8	2.5-9.0	1175	253.30	2595	July 84
A. hexapterus -large	8845010101	3	8	85.0	76-94	6.8	6-7.5	1291	336.50	3115.7	August 83
A. hexapterus -large	8845010101	3	8	122.3	81-151	9.0	7.0-11.0	6275	1516.20	7776.4	July 84
Pleuronectidae	885704	56	8	14.8	8-56	4.3	2.0-11.0	48.12	7.46	38.2	July 84

*Life-history stage (codes are independent of those presented in Table 4): 2 - egg; 4 - zoea; 6 - larva; 8 - juvenile; 9 – adult

Table 4.-- Length and width (mean, range; mm), weight (wet and dry; mg), and volume (mm^3) of prey taxa by life-history stage from stomachs of juvenile chinook and coho salmon collected during research trolling in southeastern Alaska (SEA) in 1986 and 1987. Invertebrates were generally measured with an ocular micrometer to the nearest 0.1 mm. Dashes indicate no data. Taxa are ordered by NODC taxonomic codes (National Oceanographic Data Center, 1984).

Taxon	NODC code	*N*	Life-history stage*	Mean length (mm)	Length range (mm)	Mean width (mm)	Width range (mm)	Wet weight (mg)	Dry weight (mg)	Volume (mm^3)
Polychaeta -adult	5001	24	9	33.2	21-45	4.3	2-8	190.8	22.957	473.0
Myopsida -small	5706	9	8	12.0	4-25	4.0	2-8	212.0	28.470	62.8
Myopsida -medium	5706	11	8	40.0	25-62	13.0	10-16	2993.0	353.900	1782.0
Myopsida -large	5706	2	9	123.0	114-133	20.0	18-22	18849.0	2240.190	12926.0
Cirripedia-molt	6130	20	9	--	--	--	--	100.4	3.575	--
Isopoda	6158	1	9	12.5	--	2.4	--	28.0	3.150	58.0
Gammaridea	6969	58	9	8.1	4.6-23.1	1.7	0.9-3.1	18.0	1.507	18.8
Themisto libellula	6170011002	14	9	15.6	14-18	3.3	3.0-4.5	155.8	13.539	133.4
Primno macropa	6170040302	41	9	10.3	6.8-13.2	2.8	2.0-4.0	36.7	3.562	63.6
Euphausia pacifica	6174020101	56	8	12.2	7-16	1.7	1.0-2.5	19.7	2.552	27.7
Thysanoessa longipes	6174020905	19	8	12.0	8-20	4.0	3.0-5.0	48.9	6.197	140.2
T. raschii	6174020906	55	8	13.6	7-28	3.6	2.0-6.0	45.7	6.108	141.5
T. spinifera[1]	6174020907	25	8	8.0	6.8-11.5	1.3	1.0-2.2	11.3	1.683	20.5
T. spinifera[2]	6174020907	9	8	19.2	11-24	2.9	1.5-4.0	50.7	14.891	126.7
Decapoda-megalops	6175	8	6	5.1	3.8-5.9	3.1	2.7-3.6	39.2	4.969	38.5
Decapoda-juvenile	6175	1	8	1.9	--	1.8	--	18.0	4.525	2.8
Pasiphaea pacifica	6179050101	8	8	52.4	42-71	4.9	4.0-6.0	604.5	92.703	987.6
Sclerocrangon alata	6179220202	1	8	10.5	--	2.8	--	32.0	3.725	65.4
Fish-general -small	8735	11	6-8	24.0	8-46	3.2	1.5-5.0	148.0	25.932	192.9
Clupea pallasii -small	874601020101	14	8	92.0	83-109	15.0	12-17	4836.0	881.520	15870.0
C. pallasii -small	874601020101	24	8	71.0	58-82	12.0	9-14	2460.0	469.990	7500.0
C. pallasii -medium	874601020101	6	8	142.0	131-153	20.0	18-22	15188.0	3253.090	44588.0
C. pallasii -large	874601020101	4	9	171.0	160-182	28.0	23-35	35179.0	9726.120	108142.0
Osmeridae -larvae	875503	6	6	4.0	3.6-4.9	0.2	0.1-0.3	0.5	0.049	0.2
Mallotus villosus -small	8755030201	10	8	55.0	48-64	5.4	4-7	806.7	137.337	1259.0
M. villosus -medium	8755030201	14	8	84.2	64-103	10.0	6-14	2744.0	608.480	7149.0
Sebastes sp. -small	88260101	7	6	13.4	5.5-13.0	2.0	1-2	20.0	2.814	40.4

Table 4. -- Cont.

Hemilepidotus sp.	88310214	4	8	19.0	19-20	4.0	4-5	59.6	27.940	92.2
Eumicrotremus orbis	8831090506	3	8	15.0	12-18	6.7	6-8	287.7	42.225	528.6
Anarrhichthys ocellatus	8842020201	4	6	54.0	41-88	1.0	1-2	71.7	10.681	67.0
Ammodytes hexapterus -tiny	8845010101	70	6	25.0	16-36	1.0	1-3	58.3	6.982	53.8
A. hexapterus -small	8845010101	8	8	86.0	81-92	7.4	7-9	1873.0	393.130	3693.0
A. hexapterus -medium	8845010101	11	8	107.0	93-120	8.0	7-10	2832.0	596.050	6085.0
A. hexapterus -large	8845010101	4	9	135.0	122-160	11.0	10-14	7353.0	1852.900	14067.0
Pleuronectidae	885704	1	6	21.0	--	9.0	--	124.0	19.275	189.0

*Life-history stage (codes are independent of those presented in the Table 3): 6 - larvae; 8- juvenile; 9 - adult
[1]spring 87
[2]spring 87

Table 5. -- Wet and dry weight (wt; mg) of prey taxa collected in nearshore epibenthic habitats of Auke Bay, Alaska, using an epibenthic sled during March, April, May, and June 1988. Dashes indicate no data. Taxa are ordered by NODC taxonomic codes (National Oceanographic Data Center, 1984).

Taxon	NODC code	N	Life-history stage*	Wet weight (mg)	Dry weight (mg)
Foraminifera	3448	13	8	0.11	0.010
Hydrozoa	3701	23	K	0.47	0.034
Nematoda	47	55	C	0.09	0.002
Polychaeta	5001	87	6	0.15	0.013
Gastropoda	51	30	7	9.15	4.059
Gastropoda-snail	5103	2	M	0.09	0.005
Bivalvia	55	98	7	0.01	0.001
Cladocera-*Evadne*	61090501	75	8	0.07	0.002
Ostracoda	6110	158	8	0.06	0.008
Calanoida					
Calanoida	6118	30	F	0.04	0.003
Calanus sp.	61180102	3	8	0.52	0.080
Calanus sp.	61180102	11	F	0.28	0.051
Eucalanus bungii	6118030102	1	8	0.26	0.010
Pseudocalanus sp.	61180505	129	8	0.07	0.012
Pseudocalanus sp.	61180505	24	F	0.13	0.022
Centropages abdominalis	6118170101	80	8	0.11	0.014
Acartia sp.	61182901	86	8	0.11	0.014
Harpacticoida					
General	6119	85	8	0.09	0.007
Egg packet	6119	29	M	0.15	0.007
Harpacticus sp.	61191001	48	F	0.04	0.005
Harpacticus sp.	61191001	84	N	0.10	0.010
Harpacticus sp.	61191001	98	O	0.10	0.016
Zaus sp.	61191002	48	F	0.05	0.003
Zaus sp.	61191002	143	L	0.05	0.004
Zaus sp.	61191002	12	N	0.22	0.002
Zaus sp.	61191002	200	O	0.04	0.003
Zaus sp.	61191002	25	U	0.05	0.005
Peltidiidae	611911	3	8	0.09	0.013
Tisbe sp.	61191301	275	8	0.05	0.005
Tisbe sp.	61191301	56	F	0.07	0.002
Tisbe sp.	61191301	230	L	0.07	0.010
Danielssenia typica	6119140401	10	8	0.10	0.027
Laophontidae	611915	91	8	0.03	0.003
Diosaccidae	611928	12	8	0.06	0.004

Table 5. -- Cont.

Diosaccidae	611928	8	L	0.55	0.016
Amphiascopsis cinctus	6119280301	66	8	0.08	0.017
Dactylopodia sp.	61193101	18	8	0.07	0.020
Parathalestris jacksoni	6119310302	14	8	0.14	0.024
Cyclopoida					
General	6120	1	8	0.06	0.010
Oithona sp.	61200901	17	8	0.08	0.006
Cirripedia	6130	262	2	0.04	0.003
Cirripedia	6130	5	8	0.15	0.062
Cirripedia	6130	285	E	0.09	0.015
Cirripedia	6130	134	Z	1.46	0.083
Mysidacea	6151	114	A	1.77	0.351
Cumacea	6154	35	8	0.26	0.041
Isopoda	6158	5	A	0.19	0.024
Amphipoda-Gammaridea-small	6169	10	A	0.65	0.092
Euphausiacea	6174	180	1	0.03	0.002
Euphausiacea	6174	256	2	0.03	0.003
Euphausiacea-furcilia/calyptopis	6174	132	6	0.04	0.005
Caridea-shrimp	6179	2	8	12.06	1.805
Insecta-Coleoptera	6302	2	6	0.77	0.125
Insecta-Hymenoptera-Chalcidoidea	6567	1	8	0.54	0.140
Phoronida	77	10	6	0.07	0.003
Oikopleura dioica	8413010101	240	8	0.10	0.006
Teleostei	8735	240	1	0.35	0.008
Teleostei-Stichaeidae	884212	1	7	14.02	2.680

*Life-history stage (codes are independent of those presented in the Tables 3 and 4): 1 - egg; 2 - nauplius; 6 - larva; 7 - juvenile; 8 - adult; A - adults and juveniles mixed;
C - undetermined; E - cyprid; F - copepodid; K - medusa; L - egg-bearing females; M - egg case; N - adult males; O - adult females; U - mating pair; Z - shed exuviae.