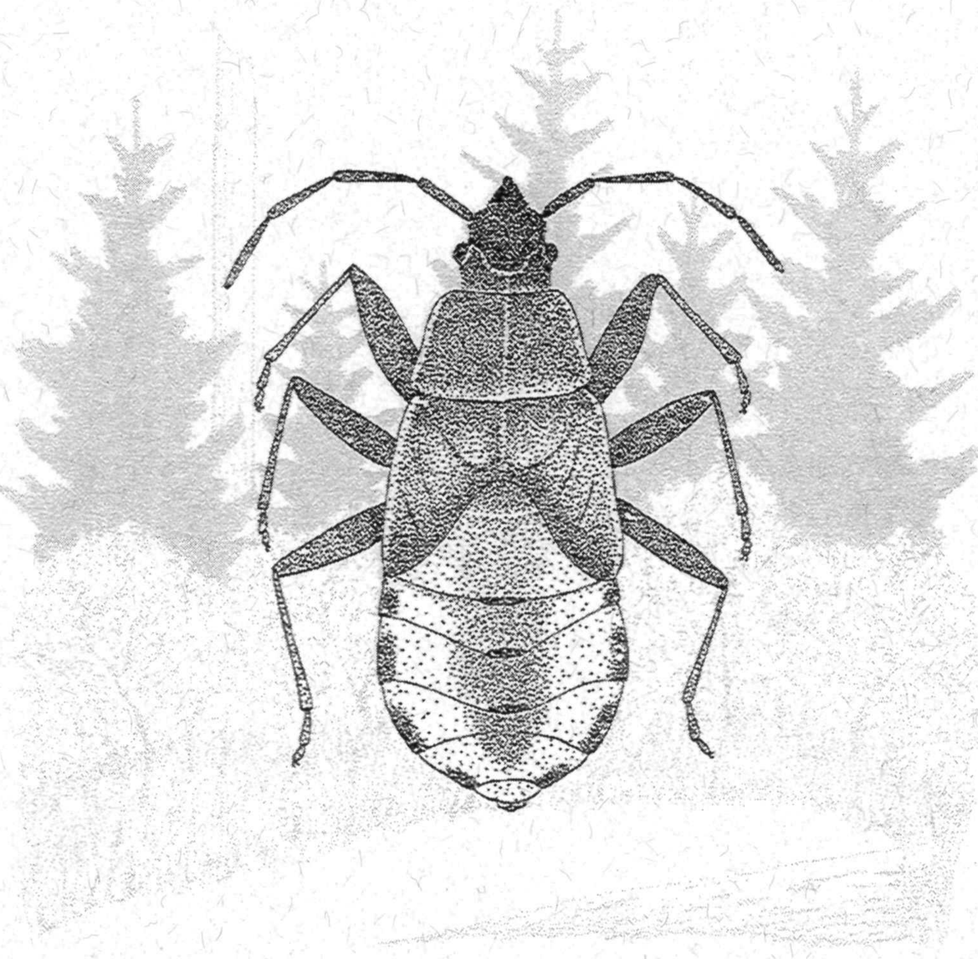
Terrestrial Riparian Arthropod Investigations In The Big Beaver Creek Research Natural Area, North Cascades National Park Service Complex, 1995-1996: Part I, Hemiptera:Heteroptera

John D. Lattin
Systematic Entomology Laboratory
Department of Entomology, Oregon State University
Corvallis, Oregon 97331-2907



U.S. Department of Interior
National Park Service - Pacific West Region
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2105 State Route 20
Sedro Woolley, WA 98284-9314

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North Cascades National Park Service Complex, comprising North Cascades National Park, Ross Lake National Recreation Area, and Lake Chelan National Recreation Area, was established in October, 1968 and is located in northwestern Washington. North Cascades National Park was established to preserve certain majestic mountain scenery, snow fields, glaciers, alpine meadows, and other unique natural features in the North Cascade Mountains for the benefit, use, and inspiration of present and future generations. Ross Lake and Lake Chelan National Recreation Areas were established to provide for outdoor recreation use and enjoyment and to conserve scenic, scientific, historic, and other values contributing to public enjoyment of these lands and waters.

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Foreword

Primary objectives of the National Park Service Natural Resource Management Program are to manage the natural resources to maintain, restore, and perpetuate the inherent integrity of ecosystems and their component habitats and community assemblages. Arthropods represent a fundamental component of these ecosystems, comprising the majority of the biological diversity and are essential to processes of nutrient cycling, decomposition, predation, herbivory, parasitism, and pollination. Knowledge of arthropod diversity, abundance and distribution can provide extremely useful information in the evaluation of environmental perturbations and biological integrity. Arthropods are ideal study organisms because of their short generation times and rapid population growth. These characteristics make them ideal as early-warning indicators of environmental change and for monitoring recovery at disturbed sites. The vast diversity of species offers the opportunity to integrate a number of sensitive indicator species into environmental assessments.

This report represents one of a series of five technical reports on our efforts to document arthropod occurrence, abundance, and habitat associations in the Big Beaver Creek Research Natural Area of North Cascades National Park Complex (NOCA), located in northwestern Washington. The first four reports document occurrence, life history information, and information concerning taxonomy of species from four major arthropod groups including the Heteroptera (Hemiptera), Coleoptera, Arachnida (Araneae), and Hymenoptera (Formicidae). Individuals from these groups largely represent ground dwelling taxa and accounted for over 70% of the total of all specimens collected by pitfall traps in the study area.

The final report of this series utilizes concepts from statistical and community ecology to classify habitats based on their arthropod assemblages, to describe structural and functional characteristics of these communities, and to identify environmental factors that influence community structure. This report also provides recommendations for development of future arthropod monitoring programs in the park.

There is also much left to be learned from the samples collected during 1995 and 1996 in the study area. Specimens from several other groups of arthropods still require identification. Among these groups, the Diptera are the most numerous making up greater than 20% of all individuals collected. Working collections will be maintained at NOCA and efforts will be made in the future to seek assistance in documenting the various species found in the remaining collection.

Funding support for this initial effort to document arthropod communities in the park was provided by the Skagit Environmental Endowment Commission. This project could also not have been done without the gracious support of John D. Lattin, Professor of Entomology, Oregon State University, and research assistants James R. La Bonte and Greg Brenner. Administrative support for transfer of funds to OSU from the park was provided by the Forest and Rangeland Ecosystem Science Center, Biological Resources Division, USGS, Corvallis, Oregon. This report series satisfies the conditions of Subagreement No. 31 between the Biological Resources Division and OSU.

Reed S. Glesne
Natural Resource Research,
Inventory, and Monitoring Branch
North Cascades NPS Complex

Abstract

A series of pitfall traps were established along the riparian corridor of the lower eight-mile reach of Big Beaver Creek , North Cascades National Park Complex (NOCA), Washington, during the summers of 1995 and 1996. Objectives of the study were to initiate efforts to document arthropod diversity and habitat associations in NOCA. Arthropods are known to represent at least 85% of the biological diversity of all flora and fauna found in the H.J. Andrews Experimental Forest in western Oregon. One might expect similar diversity in NOCA. This study of the Hemiptera:Heteroptera of the Park Complex is a contribution towards our knowledge of the insects of the Park and to the larger question dealing with the overall biological diversity found there. About 210 species of true bugs have been documented from the H.J. Andrews Experimental Forest. A similar number or even more species may be found in NOCA.

Twelve families of Hemiptera:Heteroptera are reported here from the 1995 and 1996 seasons. Twenty-four genera were recognized representing thirty-two species. Two families, the Miridae and Scutelleridae were mentioned but not treated as were the other species because the specimens of Miridae were in bad condition from the pitfall traps (they are very fragile) and the Scutelleridae (*Eurygaster sp.*) lacked adequate data. Most of the species were typical inhabitants of the riparian zone (e.g. the Anthocoridae, Lygaeidae, Nabidae, and Saldidae) whereas others in or on the water (e.g. Belostomatidae and Gerridae). A few species were surprizes - *Aradus orbiculus* Van Duzee, a strongly brachypterous specimen, rare, and usually found under bark. *Ceratocombus vagans* McAtee and Malloch is one of the most primitive living Hemiptera:Heteroptera. It is very small (under 2mm) and is a predator in the litter layer in moist habitats. It is a widespread, chiefly boreal species. *Stygnocoris sabulosus* (Schilling) was the only non-indigenous bug species recovered from the study. It is a well-known European species known to feed on seeds. *Barce fraterna banksii* Baker is a wingless pirate bug and is a predator as are many of the species collected. The two species of *Acalypta* - *A. lillianis* Torre-Bueno and *A. mera* Drake are very typical moss inhabitants in Northwest forests, especially in clearings or open stands. More collecting in different locations and habitats will enhance our knowledge and add rapidly to our general knowledge base for NOCA. Much of interest lies ahead of us.

Acknowledgments

My sincere thanks to Reed Glesne of North Cascades National Park for his interest in the arthropods of the Park and the support for the Big Beaver Creek pitfall project; James R. La Bonte of Oregon State University, who supervised the overall project, trained some of the personnel and identified the multitude of specimens and species of beetles in the traps; James R. La Bonte and Ron Holmes provided the description of the study area and methods section; Carolyn ver Linden, Oregon State University, who prepared the several different summaries of trap data found in the Appendix; to Brenda Cunningham for her illustration work; and especially to Ron Holmes, Sherry Bottoms, Kathleen McEvoy, and Brenda Cunningham who labored long and hard to place traps, remove the specimens, sort and label the individuals and prepare the vast number of samples for examination and identification; and Annelise Sirguy, who prepared the typescript of the manuscript. Their careful and accurate work made this project the success it is. My personal thanks to all for their interest and enthusiasm.

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Introduction

The suborder Hemiptera: Heteroptera, or true bugs, contains over 38,000 species (Schuh and Slater, 1995). While most species are plant feeders, there are many that are predators. Henry and Froeschner (1988) recorded 45 families, 677 genera and 3,834 species of America north of Mexico, giving us about 10% of the described world fauna. I know approximately 650 species of bugs from the state of Oregon (unpublished) and Parsons et al, (1991) reported 210 species of bugs from the H.J. Andrews Experimental Forest in western Oregon. The Andrews Forest contains about 6,400 ha of old-growth Douglas-Fir forest and some young stand sites plus non-forested habitats. Thus far, we know almost 4000 species of insects and other arthropods from this site including the bugs. The arthropods contain over 86% of the species diversity when compared with vertebrates and the vascular plants (Asquith, Lattin, and Moldenke, 1990). Here, we have recognized 12 families that contain 32 species (see species list). Two additional families were considered, the Scutelleridae represented by a single specimen of *Eurygaster* without any data, and specimens of 5 species (or more) of Miridae that were either damaged or lacked adequate numbers and structures for proper identification.

There are a number of very useful references of general nature available on these bugs. Some of these include: Blatchley (1926); Weber (1930); Slater and Baranowski (1978); Dolling (1991) which covers mostly species from the United Kingdom; Schuh and Slater (1995); Southwood and Leston (1959); McGavin (1993); Henry and Froeschner (1988); Schuh and Stys (1991); Wheeler, Schuh, and Bang (1993). Some of the more specialized references include: Hungerford (1919), Aquatic and semi-aquatic Heteroptera; Usinger (1956), Aquatic and semi-aquatic Heteroptera; Wygodzinsky and Schmidt (1991), Enicocephalomorpha; McPherson (1982), Pentatomoidea; Brooks and Kelton (1967), Aquatic and semi-aquatic Heteroptera; Harris (1928), Nabidae; Sweet (1964), Lygaeidae; and the books of Pericart (1972, Anthocoridae), (1983, Tingidae) and (1987, Nabidae). There are many references that contain revisions of the taxa, and these are referenced under each treatment and found in the literature cited. Downes (1927) published a list of the bugs of British Columbia, although there have been a few additions by Downes and Scudder since that time. Finally, the publication by Parsons et al. (1991) documents over 3400 species of arthropods from the H.J. Andrews Experimental Forest including 210 species of Hemiptera: Heteroptera. Some of the habitats there are similar to parts of North Cascades National Park and offer some comparison. As more studies are conducted, the size of the fauna will increase for all insects, including the bugs. The crucial location of the Park makes it an ideal site for investigation. North-south transects are sure to be useful along the Cascade Mountains. The east-west transects from the Olympic National Park eastward promises to be equally interesting, especially for the boreal (northern) faunal elements. Now we have had a glimpse of some of these interesting bugs that were caught by these pitfall traps. Some particularly interesting taxa include *Aradus orbiculus* Van Duzee; *Ceratocombus vagans* McAtee and Malloch, a very primitive bug; several species of *Eremocoris* and *Scolopostethus* that are boreal inhabitants; *Stygnocoris sabulosus* (Schilling), an introduced species and remarkably common on this site; *Pagasa fusca* (Stein), a ground predator on lygaeids; *Barce fraterna banksii*

Baker, an unusual species of Reduviidae; and two species of *Acalypta*, moss bugs of great interest and relevance to our northwest forests. When other collecting methods are used, other species will become known. Our national parks are very important localities for maintaining biological diversity of all types, including the bugs. Future collections will contribute much of our knowledge. I thank all those who worked so hard to bring this knowledge to us, especially those involved in the actual collection of the material and the hard work it takes to properly mount, label all of the specimens. Their efforts are much appreciated.

Study Area

Big Beaver Creek is located approximately 25 km south of the Canadian border and about 75 km east of Bellingham (Figure 1). Big Beaver Creek flows to the southeast into the south end of Ross Lake, a power-generating impoundment occupying the northern portion of the Skagit River Valley. The Big Beaver watershed is a pristine natural area that encompasses approximately 17,000 hectares including the tributary drainages of Luna Creek and McMillan Creek. The elevation ranges from 488 m on the east where Big Beaver Creek flows into Ross Lake to 2502 m at the summit of Mt. Challenger on the western boundary of the watershed. Within this watershed there are 174 km of streams represented on the USGS 7.5' topographical maps and 62 lake/ponds.

The climate in Big Beaver Valley is determined by general weather patterns in the North Cascades, which are modified by topographic features in and around the valley. Air masses originating as frontal systems over the Pacific Ocean release moisture in the form of rain or snow as they are forced to rise over the Pickett Range. This results in a rainshadow effect for Big Beaver Valley. Miller and Miller (1971) reported a moisture gradient within the valley, with the west end receiving more moisture than the east end. Based on records from nearby weather stations rainfall is estimated to range from approximately 150 cm in the lower eastern end of the valley to 250 cm in the higher western end of the watershed (Taber and Raedeke 1976). The orientation of the valley on a northwest-southeast axis creates a strong microclimatic variation. The north facing slopes stay cool and moist through the summer months because they never receive direct sunlight.

The bedrock geology of the Big Beaver Valley is composed almost entirely of Skagit Gneiss with a few scattered outcrop remnants of Cascade River Schist (Misch 1966). Several periods of glaciation have carved out a typical flat-bottomed, steep-walled valley. The headwaters of all streams begin in the steep upper canyon walls, flowing down often into a loose talus slope and finally entering the lower gradient valley bottom. A soil moisture gradient exists from the well-drained rocky soils on the upper slopes to the saturated silty-peat soils of the valley bottom.

Because of its geographic location, the area surrounding Ross Lake is a transition zone between moist coastal forests west of the Cascade crest and dry interior forests (Franklin and Dyrness, 1973). This situation is evident in Big Beaver Valley which shares plant associations and floristic affinities with both regions (Vanbianchi and Wagstaff 1988).

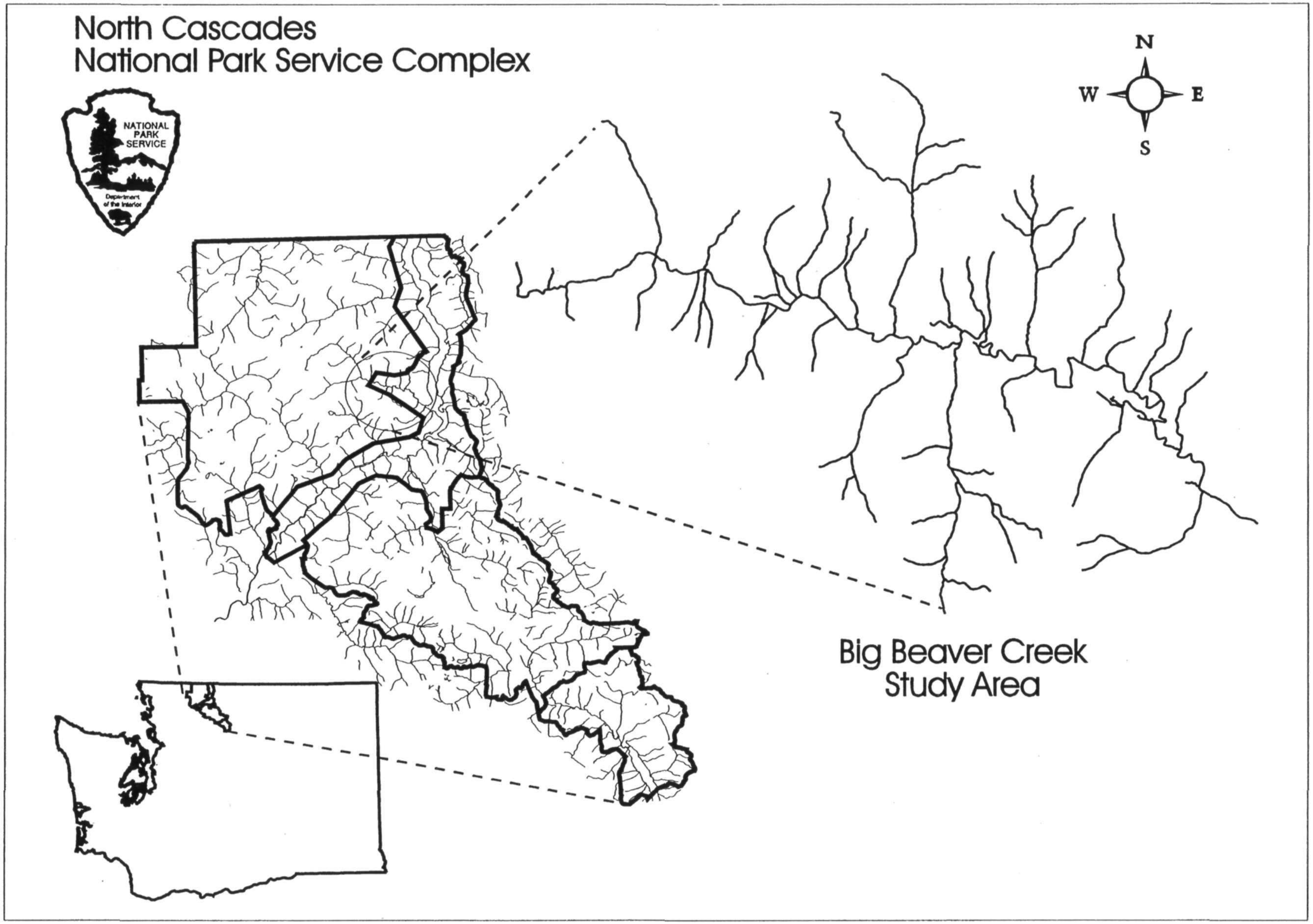

Figure 1. Location of Big Beaver Creek study area in North Cascades National Park Service Complex, and Washington state.

The vegetation of this watershed can be divided roughly into three communities: wetlands, shrubs, and forests. Finer resolution divisions can be made based on dominant species and age structure. Common wetland plant species include: aquatic species, *Potamogeton natans, Nuphar polysepalum*, and *Menyanthes trifoliata;* emergent species, *Carex* spp., *Potentilla palustris, Habernaria dilatata, Glyceria elata*, and *Equisetum* spp.; bog species, *Sphaghnum* spp., *Drosera rotundifolia, Tofieldia glutinosa*; shrub species, *Salix sitchensis, Salix lasiandra, Spiraea douglasii, Cornus stolonifera, Acer circinatum, Alnus sinuata*, and *Sambucus racemosa.* Common trees in forest communities include deciduous trees, *Alnus rubra, Acer macrophyllum, Populus trichocarpa*, and conifers, *Thuja plicata, Pseudotsuga menziesii, Tsuga heterophylla, Abies amabilis, Pinus contorta, Pinus monticola* and *Picea engelmanni.*

The vegetation and hydrography in the lower gradient sections of this valley are profoundly affected by the activities of beavers. They constantly reshape their channels, alter water levels, and harvest vegetation for food and construction materials. They create and maintain wetlands and kill large areas of riparian forest by inundation (Vanbianchi and Wagstaff 1988). Aquatic and riparian communities of the lower valley are dependent on beavers, as beavers are responsible for most of the pond habitat available.

Only the lower 13 km of the creek were sampled during this study. Along this part of the reach, Big Beaver Creek is a fourth order, low-gradient stream with many meanders. Study site elevations are modest, ranging from 494 to 579 meters. There are substantial gravel bars along this section, while the low-gradient and relatively broad valley floors have enabled the formation of extensive swamps and marshes.

A map of sample site locations are shown in Figure 2. and in aerial photographs in the Appendix (Figures A.1. to A.8.). Sample site locations were based upon a high-resolution vegetation map (Vanbianchi and Wagstaff 1988) of this stretch of Big Beaver Creek. Nine habitat types representing dominant vegetation associations, or habitats of special interest, were selected for survey in 1995 and include the following: Alder Swamp (AS), Acer Thicket (AT), Sphagnum Bog (BOG), Gravel Bar (GVL), Douglas-fir Forest (PF), Willow-sedge Swamp (SCS), Willow-spiraea Swamp (SSS), Cedar-willow-sedge Swamp (TSCS) and Cedar-hemlock Forest (TTF). Fewer resources were available in 1996 and only five habitats were sampled: AS, GVL, PF, SCS and TTF. A summary description of each habitat follows, with all parameters averaged over all trap sites.

Alder Swamp (AS) site soils were wet, predominantly sandy or loamy, with an average litter depth of 5.7 cm. The average coarse woody debris volume was 2.3 m^3 per plot. The sites were essentially flat, with an average slope of 0.6% canopy closure averaged 96%, with 8 trees per plot, on average, and mean D.B.H. of 24 cm. The dominant herbs were *Athryium filix-femina* and *Lysichitum americanum*, herb cover averaged 53%, and species richness averaged 4.4 species per plot. The only common shrub was *Rubus spectabilis*, average shrub cover was 64%, with the average species richness of 4.5 species per plot. The only common tree was *Alnus rubra*.

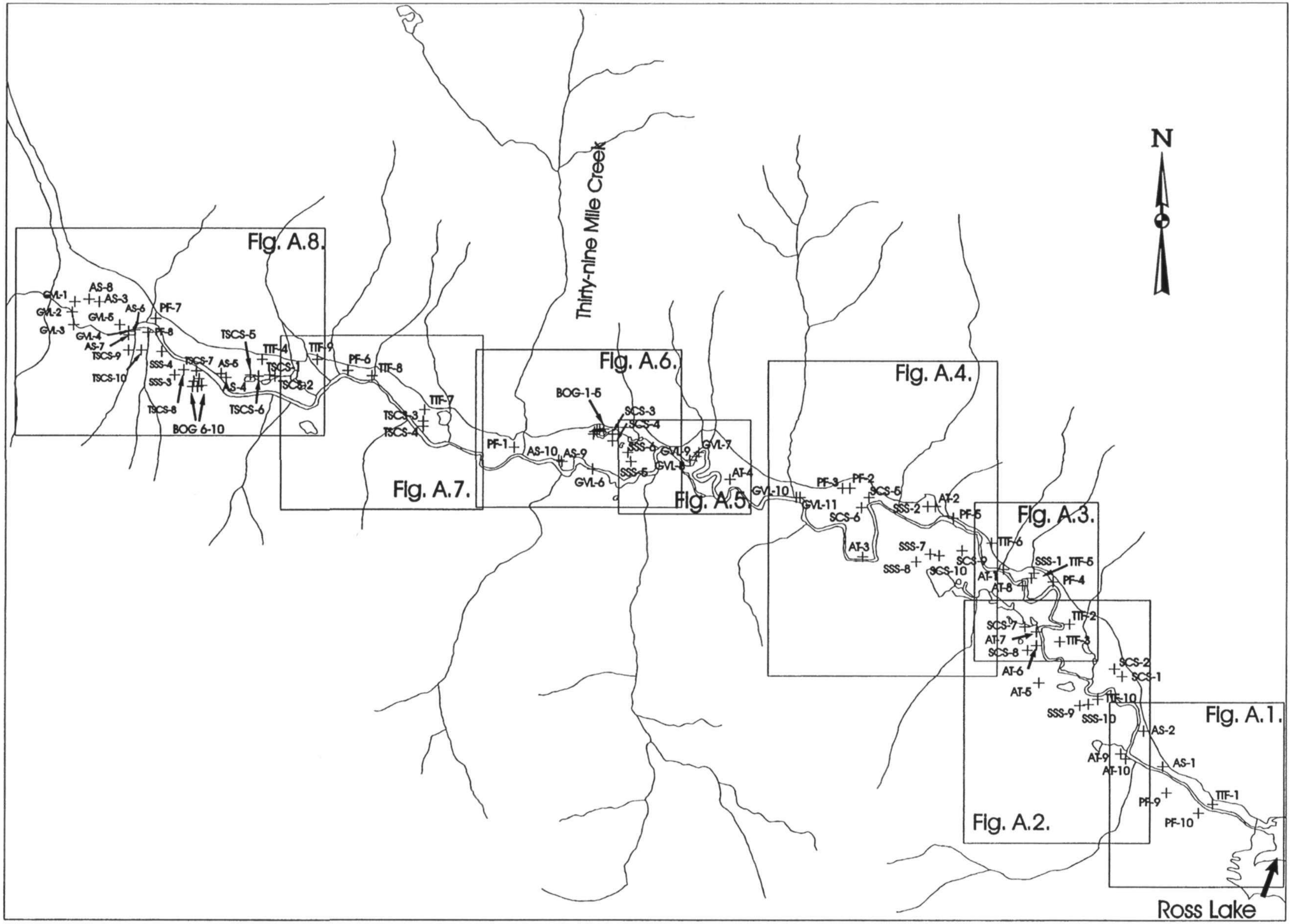

Figure 2. Arthropod pitfall trap locations, Big Beaver Creek, North Cascades National Park Complex, 1995-1996. (Boxes refer to aerial photos found in the Appendix, Figures A.1. - A.8.)

Acer thickets (AT) had moist soils which were predominantly organic or loamy, with an average litter depth of 2.4 cm. Average coarse woody debris volume was 1.7 m^3 per plot. The average site slope was 5.4%. Canopy closure averaged 98%, with 4 trees per plot and a mean D.B.H. of 13 cm. The dominant herbs were mosses and *Athryium filix-femina*. Herb cover averaged 59%, with average species richness of 3.6 species per plot. The dominant shrubs were *Acer circinatum* and *Cornus stolenifera*. Average shrub cover was 107%, with average species richness of 2.6 species per plot. The dominant trees were *A. circinatum* and *Pyrus fusca*. Acer Thickets had the greatest average shrub cover of all sampled habitats.

Sphagnum bogs (BOG) had wet, peaty "soils" without a litter layer. The average coarse woody debris volume was 0.3 m^3 per plot. Bog sites were flat, with no discernable slope. Canopy closure averaged 7%, with 0.2 trees per plot and a mean D.B.H. of 1.5 cm. The dominant herbs were *Sphagnum* spp., *Carex* spp., *Menyanthes trifoliata* and *Drosera rotundifolia*, herb cover averaged 242%, with the average species richness of 6.3 species per plot. No shrubs were dominant, average shrub cover was 21%, with average of 2.5 species per plot. Trees were rarely encountered at these sites. Bogs had the lowest average canopy closure and the greatest average herb cover.

Gravel bar (GVL) soils were dry, lacked litter and were composed of sand, gravel and cobbles. The average coarse woody debris volume was 1.5 m^3 per plot. The average slope was 3.2%. Canopy closure averaged 17%, with 0.2 trees per plot and mean D.B.H. of 27 cm. There were no dominant shrubs, and shrub cover averaged 11%, with an average species richness of 1.0 species per plot. No trees were dominant. Gravel bars had the lowest mean herb and shrub cover of sampled habitats, as well as the lowest species richness of herbs and shrubs.

Douglas fir forest (PF) soils were dry, organic or loamy, with an average litter depth of 7.6 cm. the average coarse woody debris volume was 5.3 m^3 per plot. Slopes averaged 7.8%. Canopy closure averaged 99.5%, with 15 trees per plot and a mean D.B.H. of 17 cm. Mosses were the dominant herbs, with herb cover averaging 61% and average species richness of 2.6 species per plot. Average shrub cover was 26%, with an average species richness of 2.6 species per plot. Dominant trees included *Abies amabilis, Pseudotsuga menziesii* and *Tsuga heterophylla*. These forests were the steepest of all sampled habitats, had the greatest average canopy closure, the greatest average woody debris volume, the greatest number of trees per plot and the greatest average litter depth of all sampled habitats.

Willow-sedge swamp (SCS) soils were wet and organic, with an average litter depth of 6.3 cm. A small amount of coarse woody debris was found at only one of the ten sites. These swamps were essentially flat, with an average slope of 0.3%. Canopy closure averaged 4.5%, with no trees per plot. Dominant herbs were *Carex* spp. and *Equisetum* spp., herb cover averaged 157%, with an average species richness of 6.1 species per plot. Dominant shrubs were *Salix sitchensis* and *Spiraea douglasii*, shrub cover averaged 40%, with an average species richness of 2.2 species per plot. There were no dominant trees.

Salix-spiraea swamp (SSS) soils were wet, organic and had an average litter depth of 5.3 cm. Average coarse woody debris volume was negligible, ~0.1 m^3 per plot. These sites were flat, with no discernable slope. Canopy closure averaged 19%. Dominant herbs were *Carex* spp., grasses and *Menyanthes trifoliata,* herb cover averaged 99%, with average species richness of 5.2 species per plot. Dominant shrubs were *Spiraea douglasii* and *Salix sitchensis*, shrub cover averaged 71%, with average species richness of 3.3 species per plot. There were no trees in any of the plots.

Cedar-willow-sedge swamp (TSCS) soils were organic, wet and had an average litter depth of 5.4 cm. Average coarse woody debris volume was negligible, ~0.2 m^3 per plot. All of the sites were flat. Canopy closure averaged 63%, with 0.6 trees per plot and a mean D.B.H. of 52 cm. Dominant herbs wer *Carex* spp., *Athryium filix-femina* and *Equisetum* spp., herb cover averaged 120%, with average species richness of 6.3 species per plot. Dominant shrubs were *Salix sitchensis* and *Spiraea douglasii*, shrub cover averaged 82%, with an average species richness of 4.7 species per plot. *Thuja plicata* was the dominant tree species. This habitat had the greatest species richness of both herbs and shrubs of all sampled habitats.

Cedar-hemlock forest (TTF) soils were dry, organic or loamy and had an average litter depth of 5.0 cm. Average coarse woody debris volume was 3.2 m^3 per plot. Average slope per plot was 4.8%. Canopy closure averaged 99.4%, with 6.3 trees per plot and a mean D.B.H. of 50 cm. Dominant herbs were mosses, herb cover averaged 49%, with average species richness of 6.0 species per plot. *Acer circinatum* was the dominant shrub, shrub cover averaged 41%, with average species richness of 2.7 species per plot. Dominant trees included *Thuja plicata, Acer circinatum* and *Abies amabilis*.

Methods

A survey of the terrestrial riparian Arthropod fauna of Big Beaver Creek, North Cascades National Park (Washington) was conducted during snow-free seasons of 1995 and 1996. Pitfall traps were the primary sampling method, although some beating of selected shrubs and trees was conducted in 1995.

The pitfall traps consisted of a plastic bucket 18 cm tall with a diameter of 14 cm at the top and 12 cm at the bottom. An aluminum funnel was placed inside the top to prevent arthropods from crawling or jumping out. This funnel extended about 8 cm down into the bucket with a bottom opening of 3 to 4 cm and the top tightly wedged inside and near the rim of the bucket. A 16 oz plastic cup, filled with approximately 100 ml of Propylene glycol (non-toxic "Sierra"-brand antifreeze), was placed inside the bucket.

The plastic buckets were installed into the ground so that the top of the bucket was even with the level of the surrounding substrate. A hand trowel was used to excavate the hole to accomodate the bucket, with backfill and litter repositioned to approximate the original condition of the trapsite. The cup with the antifreeze was set inside the bucket, then the funnel was installed, and finally a 2 x 25 x 25 cm wooden board supported by 2 x 2 x 5 cm legs was set over the pitfall trap to keep unwanted debris and rain out of the trap.

For each habitat, ten separate patches were randomly selected (with the exception of BOG, for which two separate habitat patches were present; and GVL, for which 11 separate patches were selected) and one pitfall trap was placed per habit patch (Figure 2.). Thus, 91 traps were utilized in 1995 and 51 in 1996. Traps operated continuously throughout the sampling period extending from early May through October. Because of resource constraints and extensive bear damage to early season traps (up to 70% of May traps/habitat were destroyed in 1995), the 1996 sampling period was restricted to early June through early October. In order to reduce "trap-out" effects and individual trap location bias, each 1996 trap position was shifted ~10 m from the 1995 position.

Extensive habitat information was recorded for the area immediately surrounding each trap site (in an 8 X 8 m grid centered upon the trap), including UTM coordinates, elevation, crude soil type (e.g. clay versus loam), soil moisture during August, litter depth, per cent canopy closure, slope, aspect, per cent herb and shrub cover (by species), tree species inventory (number of individuals and D.B.H.) and coarse woody debris inventory. the number and species of any individual vertebrates collected by the pitfalls were also recorded, and all such specimens were retained.

Hemiptera:Heteroptera Family and Species Treatments

A total of 12 families, 24 genera, and 32 species of Hemiptera:Heteroptera were collected during the 1995 and 1996 sampling periods in Big Beaver Creek. A species list showing the taxa collected, habitats, and functional feeding group category for each taxon is shown in Table 1. Specific collection data for all individual specimens is shown in the Appendix, Table A.1. (1995 data) and Table A.2. (1996 data). The pages that follow provide a detailed account of each species and appropriate literature is cited. The Literature Cited section contains all of these citations so that the reader can extend their areas of knowledge if desired. Much new information will surely be added because our knowledge is far from complete.

Family Anthocoridae

Members of the family Anthocoridae are small in size (1.5 to 5 mm) and modest in the number of species world-wide, approximately 450 species (Pericart, 1972). Schuh and Slater (1995) suggested a slightly lower number. Henry (1988) listed 23 genera and 89 species for

Table 1. Hemiptera:Heteroptera species list, habitat associations, and functional feeding groups for specimens collected from the riparian zone of Big Beaver Creek, North Cascades National Park Complex, 1995 and 1996.

Taxa	Habitat*	Functional Feeding Group
Anthocoridae		
1 *Anthocoris antevolens* White	TSCS	Predators - all life stages
Aradidae		
2 *Aradus orbiculus* Van Duzee	PF	Phytophagous on fungi
Belostomatidae		
3 *Lethocerus americanus* (Leidy)	BOG, SSS, TSCS,	Predators (aquatic) - all stages
Ceratocombidae		
4 *Ceratocombus vagans* McAtee and Malloch	AS, SSS, TSCS, TTF	Predators - all stages, living in leaf litter
Gerridae		
5 *Gerris buenoi* Kirkaldy	BOG, TSCS, SCS	Predators - all stages, water surface
6 *Gerris incurvatus* Drake and Hottes	AS, SSS, TSCS	Predators - all stages, water surface
Lygaeidae		
7 *Cordillonotus stellatus* Scudder	GVL	Phytophagous (usually on seeds) - all stages
8 *Cymus luridus* Stal	SCS	Phytophagous (usually on seeds) - all stages
9 *Eremocoris borealis* (Dallas)	AT, PF, TTF	Phytophagous (usually on seeds) - all stages
10 *Eremocoris obscurus* Van Duzee	AS	Phytophagous (usually on seeds) - all stages
11 *Geocoris pallens* Stal	SCS, SSS	Phytophagous -early instars, Predators - later instars and adults
12 *Kleidocerys franciscanus* (Stal)	SCS	Phytophagous (usually on seeds) - all stages
13 *Kleidocerys resedae* (Panzer)	AS, SSS, TSCS	Phytophagous (usually on seeds) - all stages
14 *Peritrechus saskatchewanenis* Barber	SCS	Phytophagous (usually on seeds) - all stages
15 *Scolopostethus pacificus* Barber	AS,AT,BOG,GVL,PF, SCS,SSS,TSCS,TTF	Phytophagous (usually on seeds) - all stages
16 *Scolopostethus thomsoni* Reuter	AS,AT,GVL,PF,SCS, SSS,TSCS,TTF	Phytophagous (usually on seeds) - all stages
17 *Stygnocoris sabulosus* (Schilling)	SCS, SSS, TSCS	Phytophagous (usually on seeds) - all stages
Miridae		
0 (See paragraph under Miridae)		Most Phytophagous, some Predators
Nabidae		
18 *Nabis alternatus uniformis* Harris	SSS	Predators - all stages, living on low vegetat.

Table 1. (Continued)

Taxa	Habitat*	Functional Feeding Group
19 *Nabis roseipennis* Reuter	AT, GVL	Predators - all stages, living on low vegetat.
20 *Nabis rufusculus* Reuter	BOG, SSS	Predators - all stages, living on low vegetat.
21 *Pagasa fusca* (Stein)	SCS	Predators - all stages, living on ground
Pentatomidae		
22 *Banasa dimidiata* (Say)	AT	Phytophagous - all stages
23 *Cosmopepla bimaculata* (Thomas)	BOG	Phytophagous - all stages
24 *Holcostethus tristis* (Van Duzee)	GVL	Phytophagous - all stages
25 *Neottiglossa trilineata* (Kirby)	BOG, SCS	Phytophagous - all stages
26 *Perillus exaptus* (Say)	GVL	Predator - most likely on Chrysomelidae beetles
Reduviidae		
27 *Barce fraterna banksii* Baker	BOG, TSCS	Predators - all stages
Saldidae		
28 *Micracanthia quadrimaculata* (Champion)	BOG, SCS	Predators - all stages, living on shorelines
29 *Saldula laticollis* (Reuter)	BOG, GVL, SCS	Predators - all stages, living on shorelines
30 *Saldula saltatoria* (Linnaeus)	AS, SSS, TSCS	Predators - all stages, living on shorelines
Tingidae		
31 *Acalypta lillianis* Torre-Bueno	PF	Phytophagous on mosses - all stages
32 *Acalypta mera* Drake	BOG, SCS	Phytophagous on mosses - all stages

* Alder Swamp (AS), Acer Thicket (AT), Sphagnum Bog (BOG), Gravel Bar (GVL), Douglas-fir Forest (PF), Willow-sedge Swamp (SCS), Willow-spiraea Swamp (SSS), Cedar-willow-sedge Swamp (TSCS) and Cedar-hemlock Forest (TTF).

America, north of Mexico. The most comprehensive review of this family was by Jean Pericart (1972). Although the geographical coverage of the book is the western Palearctic Region, he provided a wonderful introduction to all aspects of the family. Schuh and Slater (1995) published a compact overview of the taxa in their book on the true bugs of the world. Here, the former family Anthocoridae was divided into three families: Anthocoridae, Lasiochildae and Lyctocoridae.

Most of the known species of Anthocoridae are predaceous as adults and nymphs (Carayon, 1961; Pericart, 1972), but some species (e.g. *Paratriphleps laeviuscula* Champion) appear to be chiefly, if not entirely, phytophagous (Bachelor and Baranowski, 1975). Other taxa, while largely predaceous, are able to survive on plant matter (e.g. *Orius* Wolff and *Lyctocoris* Hahn)--see Salas-Aquilar and Ehler, (1977) for *Orius* and Chu (1969) for *Lyctocoris*.

Twelve species of *Anthocoris* Fallén were reported by Henry (1988). In spite of the importance of the species of this genus as predators of a variety of other arthropods, including pest species, no good key exists for the separation of all of our species. Kelton (1978) provided the best key available, but covers only the Canadian and Alaskan species. Fortunately, most of our species are included, but some important species are not, found in Canada; two of these species, *A. confusus* Reuter and *A. nemoralis* (Fabricius), have been introduced into North America, apparently accidentally.

Anthocorus antevolens White, was the only member of the family Anthocoridae found in the study area. It was originally described from California (White, 1879). It is a widely distributed species in the Pacific Northwest and beyond. Major references to distribution are to be found in Anderson (1962), Kelton (1978) and Henry (1988). Anderson (1962) gave a nice discussion of *A. antevolens,* a species he studied British Columbia and Oregon. Kelton (1978) provided a brief overview of the species in Canada. Both publications should be referred to by the interested reader. According to Anderson, there may be as many as three generations per year in our region. Hibernation occurs as an adult, usually a fertilized female. He also stated that this anthocorid was associated with aphids, mites and other small arthropods on broad-leafed shrubs and trees including willow, birch, oak and orchard trees.

Anthocorus antevolens also occurs sparingly on conifers (Anderson, 1962; Lattin and Stanton, 1992). The latter reference includes a fine drawing of the adult. Other structural features of this species are provided by Kelton (1978). A condensed review of the appropriate literature on this bug is provided by Lattin and Stanton (1992).

The specimen recorded here was from a beat sample at the Cedar-willow-sedge- Swamp. *Salix sitchensis* was one of the dominant shrubs at the site, and the host plant given for this bug. This species of anthocorid is likely to be a common insect on willows, especially along the riparian region.

Family Aradidae

Schuh and Slater (1995) reported about 211 genera and 1800 species of this family in the world. Froeschner (1988) cited 10 genera and 123 species from America North of Mexico. After reviewing all the species and their known distributions, I found that there might be as many as 4 genera and 34 species in the Park. Thus far, only *Aradus (Aradus) orbiculus* Van Duzee has been documented for the Park, a single, strongly brachypterous female. This is a rarely encountered species and certainly not one expected to be found in a pitfall trap!

Typically, aradids or "flat bugs" are found under bark or on the outside of certain fungi. Most species are fungus feeders and have unusually long, coiled stylets inside their head, used to reach the fungal strands under the bark. Several species of *Aradus* are known to feed directly on living trees, normally pine trees. Our species, known for years under the name of the European species, *A. cinnamoneus* Panzer, is now known as *A. antennalis* Parshley in the west (Froeschner, 1988). The males may have straplike wings (stenopterous), fully developed wings (macropterous), or short-wings in the females. I have taken this species on different species of pines in Oregon and it should be found in the Park.

While we know amazingly little about the habits or even the distributions of many species, there are some useful publications that assist in their identification (Parshley, 1921; Usinger, 1936; Usinger and Matsuda, 1959; Matsuda, 1977; and Picchi, 1977). Two of these are outstanding works of science and include Parshley (1921) and Usinger and Matsuda (1959). The first is a learned revision of the genus *Aradus* and the other is a book on the classification of the family Aradidae. Both are highly recommended. Reading the introductory pages of Parshley, one must remind oneself that this was written over 75 years ago.

Family Belostomatidae

This is another small worldwide taxon with nine genera and 146 species recognized to date (Lauck and Menke, 1961; Schuh and Slater, 1995). Three genera and 21 species occur in the United States and Canada (Polhemus, Polhemus and Henry, 1988). Only two genera and two species are known from northern Washington and British Columbia (Menke, 1963, 1979). Thus far, only *Lethocerus americanus* (Leidy), described in 1847, has been collected in North Cascades National Park. Surprisingly, this large, robust aquatic species was collected from three pitfall traps, a very atypical habitat for a normally aquatic bug. This is a very widespread species and Polhemus, Polhemus and Henry (1988) reported it from 40 provinces and states. This species is a very powerful flyer, likely contributing to its wide distribution.

Lethocerus americanus is predaceous and, because of its large size, capable of killing even small fish besides insects and other prey. I was bitten by this species many years ago and remember it still as a very painful event. All stages are predaceous in the water, the size of their prey roughly correlates with their own size. Normally, this species is found in still water and is not considered a stream dweller. It is possible that it might be found in the very quiet backwaters or overflow ponds beside the streams. It would also occur in the large impoundment. It is interesting to note that likely, the smallest heteropteran we have in the United States and Canada, *Ceratocombus vagans*, and the largest, *Lethocerus americanus,* have been collected in the pitfall traps in North Cascades National Park.

Family Ceratocombidae

This is a small, but widely distributed family with about 46 described species (Stys, 1995). There are many undescribed species in this family. The genus *Ceratocombus* Signoret, to which our species *C. vagans* McAtee and Malloch belongs (1925), presently contains about 25 species world-wide. However, Stys (1995) stated that there may be hundreds of undiscovered species of these minute predators. *Ceratocombus vagans* was originally placed in the family Cryptostemmatidae, then in the Ceratocombidae, then in the Dipsocoridae, and finally back in Ceratocombidae. Stys (1995) produced a fine summary of this taxon and related groups. Henry (1988) reported only four species of Ceratocombidae from America north of Mexico, all placed in the genus *Ceratocombus.*

The Ceratocombidae is placed in the Dipsocoromorpha by Stys (1995), and considered the second most primitive group of Hemiptera:Heteroptera after the Enicocephalomorpha (Schuh and Slater, 1995). It is remarkable that representatives of both of these primitive groups are found in the forests of the Pacific Northwest. Thus far, the Ceratocombidae is only represented by *Ceratocombus vagans* in North Cascades National Park. The family Aenictopecheidae (*Boreostolus americanus* Wygodzinsky and Stys) has not yet been collected; however, both *C. vagans* and *B. americanus* are found in the mature Douglas-fir forests in western Oregon and there is a record of *B. americanus* from western Washington (Wygodzinsky and Schmidt, 1991). It may well be found in the Park. The evolutionary and temporal histories of these bugs far exceed the histories of these massive forests. There are other relictual taxa in these forests as well and some of these too will surely be found in North Cascades National Park. A publication on these insects is underway (J.D. Lattin, in preparation).

Ceratocombus vagans was described by McAtee and Malloch from Maryland (1925). Although synonomyzed with *Ceratomcombus niger* Uhler by Blatchley in 1926, *C. vagans* is still regarded as a valid species from Florida, Maryland, New York, Ontario, Virginia and Panama. I studied the species in northern Michigan and have found it in western Oregon (Parsons et al. 1991), and now report it from the North Cascades where 16 individuals were recovered from the pitfall traps. Five different habitats produced these specimens; Alder Swamp (AS), Willow-spiraea Swamp (SSS), Cedar-willow-sedge Swamp (TSCS), Cedar-hemlock Forest (TTF) and Douglas-fir Forest (PF). That such a small bug (1.5 to 2mm) should appear in reasonable numbers in pitfall traps is remarkable for they are usually considered rare. All individuals had reduced wings although the species is known to be fully winged (macropterous) as well (McAtee and Malloch, 1925; Lattin, unpublished).

Ceratocombus vagans is a predaceous species. I have observed it feeding upon oribatoid mites and springtails (Collembola) in northern Michigan. An individual bug will approach a collembolan, insert its stylets into the springtail, withdraw them, and then draw back a short distance. The prey quickly becomes immobile and the bug approaches and feeds upon it. In the bogs of northern Michigan, there is only a single generation. Eggs are laid at the end of summer, in this case, they are inserted into the tissues of the sphagnum moss by means of their well developed ovipositor. Their very small size and their secretive habits have resulted in their presumed scarcity. They can be reared with relative ease using microarthropods as food. A great deal remains to be learned about them. Certainly, *Ceratocombus vagans* is a boreal species and a fairly common inhabitant of the shaded, moist, litter layers in and near the riparian zone.

Family Gerridae

There are about 60 genera representing about 500 species that have been described from the world (Schuh and Slater, 1995). Smith (1988) cited 8 genera and 46 species from America, north of Mexico. Curiously, he did not include Oregon and Washington records from Stonedahl and Lattin (1982). They reported 6 species from Oregon and Washington and one (*Metrobates trux infuscatus* Usinger) from Oregon. Generally, our species are associated with still water, either on ponds or lakes or on the quiet backwaters of streams and rivers. *Metrobates trux infuscatus*, cited above, only occurs on running water, usually on large rivers in our region. More records will surely be added when collectors know of its existence on large rivers.

Only two species of *Gerris* Fabricius have been found within the park. These include *G. buenoi* Kirkaldy and *G. incurvatus* (Drake and Hottes). Several other species of Gerridae are likely to be taken there including *Gerris remegis* Say, *Gerris incognita* (Drake and Hottes) and *Limnoporus notabilis* (Drake and Hottes). Andersen and Spence (1992) provided a contemporary revision and discussion of the latter species. The first and third species are large in size and should be looked for on larger bodies of water and/or at higher elevations (Stonedahl and Lattin, 1982). The second species seems to favor ponds and lakes, but may be found on streams and rivers as well.

All genera known are predaceous feeders on the surface of water. They will attack emerging aquatic insects and may attack other insects caught in the water surface film, their occurrence in pitfall traps is curious although they often leave the water, particularly at the end of the season, and hibernate as adults away from the water.

As can be seen from the sample data, all of the specimens of *Gerris buenoi* were taken from pitfall traps in the bogs, whereas *G. incurvatus* was taken from traps from four habitats, but not bogs. Both species occur in fully winged (macropterous) forms, as well as reduced winged (brachypterous) forms (Stonedahl and Lattin, 1982). Naturally, their vagility is influenced by the degree of wing development. Only macropterous forms can fly.

Family Lygaeidae

This is one of the largest families of the Hemiptera: Heteroptera with around 500 genera and 4,000 species (Slater, 1964; Schuh and Slater, 1995). Slater and O'Donnell (1995) provided an updated catologue of Lygaeidae of the world from 1960-1994. Ashlock and Slater (1988) reported 81 genera and 318 species from America north of Mexico. The fauna of the Pacific Northwest is derived chiefly from boreal elements and the collections from the pitfall traps from the Park reflect this derivation. Most of the species encountered are ground-dwellers and feed on fallen seeds. *Geocoris pallens* Stal is an exception since it is herbivorous in the early life stages and then becomes predaceous. Thus far, only one introduced species of Hemiptera:Heteroptera has been encountered, *Stygnocoris sabulosus* (Schilling) from Europe.

While other non-indigenous species have been taken in the Pacific Northwest (Asquith and Lattin, 1991), they have not yet been found in the Park.

Cordillonotus stellatus Scudder (1984) was described from northeastern Oregon and reported from British Columbia, California and Washington. Judging from the information from the specimens in the type series, it is found on trees and shrubs, likely feeding on seeds. Scudder (1984) tentatively placed this species and genus into the tribe Rhyparochromini pending the collection of the nymph. While the specimen reported upon here resembles the habitus drawing given by Scudder, it lacks the pair of long setae on the anterior corners of the pronotum. Possibly they have been broken off. All other known specimens have been collected on the east side of the Cascade Mountains. Additional information and specimens are highly desired to enable confirmation.

Only two specimens of *Cymus luridus* Stal were collected in 1995 and these specimens were from beat samples on *Carex*. This species is quite widespread but originally described from New Jersey by Stal (1874). Most known species are found associated with sedges in moist environments. Slater (1952) published on the biology of this species and later (1963) described the nymphs. Hamid (1971) published on aspects of the history of this species and in 1975, published a revision of the Cyminae of the World. Ashlock and Slater (1988) reported this species all across the United States (chiefly northern) and southern Canada. In our area, it was reported from British Columbia, Alberta, Idaho, Washington, and Oregon. Not surprisingly, the specimens of this species were collected from the sedges along Big Beaver Creek.

The genus *Eremocoris* Fieber is distributed throughout the Northern Hemisphere with 12 species reported from America, north of Mexico (Ashlock and Slater, 1988). While the identification of species in eastern North America is quite possible, there is great confusion about the identity of western species (Sweet, 1977). Having examined all the original descriptions of our potential species, it appears that six "species" might be found in the Park, but this does not take into consideration possible synonymies. I took the conservative approach, using the oldest names, the literature, and descriptions as the base.

Accordingly, the two species here recorded are *Eremocris borealis* (Dallas), the most abundantly collected, and *E. obscurus* Van Duzee. The first species was collected in 1995 and 1996 while the second species was taken only in 1995. Sweet (1977) provided a thorough review of the status of *E. borealis* and, thus, the identity seems quite good. *Eremocoris obscurus* Van Duzee was described from Wellington, Vancouver Island, British Columbia in 1906; the specimen fits the description. These species of Lygaeidae are well known seed feeders in the litter layer of a variety of habitats (Sweet, 1964) and thus, their occurrence in pitfall traps is not surprising. Sweet's masterful papers (1964) provided a wonderful view of the activities of the northeastern species of *Eremocoris* and other ground-inhabiting lygaeids and should be considered by all interested people.

Some useful papers on this taxon include: Dallas(1852); Van Duzee (1906); Parshley (1919); Van Duzee (1921): Downes (1927); Barber (1928); Walley (1929); Torre-Bueno (1946); Sweet (1977); Ashlock (1979); Slater and O'Donnel (1995); Wheeler (1996). What is really needed is a thorough revision of the North American fauna which includes the western species.

Geocoris pallens Stal is the only member of the genus to be taken during the study. It was described by Stal in 1854 from California. As with a number of Lygaeidae taxa in North America, the western fauna has received remarkably little attention other than the descriptions of some species. Readio and Sweet (1982) provided a detailed study of the genus *Geocoris* Fallen but only as far west as the 100th meridian. Some of the eastern species extend westward of course but the western fauna is still to be worked out as well as Readio and Sweet did in 1982. This is a large, difficult genus that is commonly collected in many different ground habitats including agroecosystems. Because the species are predaceous in the later nymphal stages and in the adult stage, they are highly regarded as predators in different agroecosystems. Eastern species are fairly easily identified now but it is another matter in the west where only a great deal of work will clarify this group. The identification represents the best possible, considering our present state of knowledge.

Two species of *Kleidocerys* Stephens were taken during this study, *K. franciscanus* (Stal) and *K. resedae* (Panzer). Specimens of *Kleidocerys* are phytophagous, usually on shrubs and trees. This is another Holarctic genus, found in North America and in the Old World. As with a number of such taxa, the proper names for the species has not been resolved completely. *Kleidocerys franciscanus* was described from California by Stal (1859) and *K. resedae* was described from Germany by Panzer (1797). The latter is supposed to be a Holarctic species but not all agree with this conclusion. Barber (1953) published a revision of *Kleidocerys* in the United States and provided a key to the included species. Scudder (1962) published on the Ischnorhynchinae of the world that included this genus. Ashlock and Slater (1988) listed seven species in the United States and Canada. Both species were beaten from *Spiraea douglasii* during this study (collected via beating rather than pitfall). A specimen of *K. franciscanus* was beaten from *Carex* as well. According to Southwood and Leston (1959), *K. resedae* usually occurs on the catkins of alder *(Alnus* spp.) or birch *(Betula spp.)*. Alder is a common riparian tree and is most likely that *K. resedae* lives on it. Wheeler (1976) wrote on the life history of *K. resedae* on birch and ericaceous shrubs in eastern North America. Solid host data on the other species is not available. These are common insects and careful collecting, paying particular attention to host plants, will likely clear up at least this one point. Specimens of *Kleidocerys* produces a powerful odor when collected, particularly noticeable when an aspirator is used to catch them!

The genus *Peritrechus* Fieber is another Holarctic genus. Five species are reported for America north of Mexico by Ashlock and Slater (1988), including one species, *P. distinguendus* (Flor) introduced from Europe and known only from Newfoundland. Our species taken from a pitfall trap is *P. saskatchewanensis* Barber described by him in 1918 from Oxbow, Saskatchewan with a paratype from Los Angeles County, California. Walley (1929) provided a key to the four native species and reports three species from British Columbia, including *P. saskatchewanensis*. Species of this genus are found on the ground where they feed on seeds. This genus is included in the tribe Rhyparochromini by Scudder (1984) and Sweet (1991). Both of these authors add new genera and species to the tribe. One of these, *Cordillonotus stellatus* Scudder, is dealt with earlier in the paper.

Scolopostethus Fieber is yet another Holarctic genus found in the Park. Two species have been recognized - *S. pacificus* Barber and *S. thomsoni* Reuter, the latter a Holarctic species as well (Ashlock and Slater, 1988). They recognized five species from Canada and the United States. Both species were well represented in the pitfall traps. They are typical litter-inhabiting species that feed on seeds. Sweet (1964) presented a fine treatment on *S. thomsoni* as he does with the other species of Lygaeidae. As with the other Lygaeidae in our region, there are still a number of taxonomic problems to be resolved and the genus *Scolopostethus* is no exception.

Scolopostethus pacificus was described by Barber (1918) based upon specimens from several locations in California. The specimens from this study fit the description of *S. pacificus* rather well and were abundant in a number of pitfall traps. A detailed study that compares this species with *S. thomsoni*, another very common species in the traps would be highly desirable since little is known about either species in our area.

Scolopostethus thomsoni Reuter was described from Sweden and has long been known from North America. Ashlock and Slater (1988) recorded this species from Alaska, Arizona, British Columbia, California, Colorado, Connecticut, Iowa, Idaho, Illinois, Indiana, Massachusetts, Maine, New Hampshire, New Jersey, New Mexico, New York, Nova Scotia, Ohio, Ontario, Quebec, South Dakota and Utah. We know it from Oregon (Parsons et al, 1991) and now from Washington. Southwood and Leston (1959) discuss this species in Great Britain and Sweet (1964) provided a thorough study of the species in New England when it is often associated with sedges where they likely feed on seeds. They are reported as seed feeders in Great Britain as well (Southwood and Leston, 1959).

Stygnocoris sabulosus (Schilling) is the only non-indigenous bug species encountered during this study in the Park. It was probably introduced from Europe and most likely in the ballast of ships (Asquith and Lattin, 1991). Like so many of the ground-inhabiting Lygaeidae, it too feeds on seeds. Southwood and Leston (1959) provided comments on the species in the United Kingdom where all specimens they examined, as ours were, had fully developed wings. This macropterous condition certainly enhanced the opportunities for dispersal. Asquith and Lattin (1991) provided discussion, distribution map and a habitus drawing of the adult (Note: the plate legends were transposed so the illustration of *S. sabulosus* is labeled *Stygnocoris rusticus* (Fallén) in error). Ashlock and Slater (1988) reported it from British Columbia and Oregon in the Pacific Northwest as well as Maine, Nova Scotia, New York, Newfoundland, and Quebec in the Northeast. A congener, *Stygnocoris rusticus* (Fallén) is found in the same general area in the Pacific Northwest but has not yet been taken in the Park. Most of the individuals of *S. rusticus* collected have had reduced wings, a characteristic that probably limits the vagility of the species.

Megalonotus sabudicola (Thomas), another introduced species of European Lygaeidae, is now widespread in western North America and to a more limited extent, in eastern North America. All examined individuals from the New World have had fully developed wings (Asquith and Lattin, 1991). The earliest known collection date for this species is 1921 while those of *S. sabulosus* and *S. rusticus* are 1924 and 1919 respectively (Asquith and Lattin, 1991).

Family Miridae

This large family was represented by about seven species, several damaged because they are so delicate and unlikely to survive pitfall trap capture very well. These are found on trees, shrubs, and forbs. At least one was a predator, *Phytocoris sp.* (but damaged). These bugs are best collected via beating or sweeping specific host plants or grasslands and the specimens killed dry (in ethyl acetate fumes) rather via the pitfall traps. These collecting techniques provide useful host data and utilizes their species richness. Certainly, many mirids will be found associated with specific plant species found in the riparian zone of Beaver Creek, especially but not exclusively, on the shrubs and trees. At least 86 species are known from the H.J. Andrews Forest in western Oregon (Parsons, et al., 1991). When appropriate collecting has been done, then a more suitable discussion can be written.

Family Nabidae

This is a small family of about 20 genera and 500 species (Schuh and Slater, 1995). Henry and Lattin (1988) reported 10 genera and 34 species from America north of Mexico. As far as known, all species are predaceous but a few are known to include plant juices in their diet. Several have rather specialized habits (e.g. the genus *Pagasa* feeding on ground-inhabiting Lygaeidae, especially species of *Blissus*) but most appear to be generalist predators on insects living on grasses, forbs, and shrubs (Lattin, 1989), but rarely do they get into trees. It is remarkable that so few species occur in the United States and Canada. It seems that many of our species of Nabidae have wide distribution (Henry and Lattin, 1988). Some of the species are conspicuous members in a variety of agroecosystems and as such, are important controlling elements of some pest species of insects (e.g. *Nabis alternatus uniformis, N. roseipennis*) (Lattin, 1989). Several excellent publications are available on the Nabidae. Pericart (1987) published a fine book on the group as found in Europe. Since we share many taxa, it is of great value to us. Harris (1928) provided excellent coverage to our fauna, including some biological information. Although there are a few additions since that time and some changes in the higher classification as well (Kerzhner, 1981; Pericart, 1987; Lattin, 1989; Schuh and Slater, 1995), his publication is of great value in determining most of our species. Mundinger (1922) provided life history information on two of the species cited from the Park, *Nabis roseipennis* and *N. rufusculus*.

Nabis alternatus uniformis Harris was described from California in 1928 as a form of *Nabis alternatus* Parshely. Henry and Lattin (1988) cited this subspecies from British Columbia, California, Colorado, Missouri, New Mexico, Oregon, South Dakota and Texas. The record from Washington is new. Further work is needed to see if this is really a geographical subspecies rather than a color form of the nominate form with which it occurs. This is a species commonly found in our environment, including agroecosystmes, and it is a predator where it occurs. The specimen was beaten from "herbs".

Nabis roseipennis Reuter was described from Wisconsin but is now known to be widespread. Henry and Lattin (1988) reported it from Alabama, Alberta, British Columbia, Colorado, Connecticut, District of Columbia, Delaware, Florida, Iowa, Idaho, Illinois, Indiana, Kansas, Massachusetts, Maine, Michigan, Minnesota, Mississippi, Missouri, North Carolina, New Jersey, Nova Scotia, New York, Nebraska, Ohio, Ontario, Pennsylvania, Quebec, South Dakota, Tennessee, Virginia, Vermont, West Virginia and Wisconsin. Thus, it comes as no surprise to find it in the Park. Mundinger (1922) provided details of its life history and illustrations of the nymphs and adults. The species is another conspicuous member of the predator fauna of agroecosystems besides many natural habitats. Hibernation occurs as an adult.

Nabis rufusculus Reuter was described from Illinois and New York, but is now known to have a very wide distribution including Washington (Henry and Lattin, 1988). Mundinger (1922) gave detailed information on this species in New York together with illustrations of the nymphs and adult. Less is known about this species than the proceeding two but it is quite widespread in both natural and disturbed environments. It does not, however, seem to be a common species in agroecosystems. I have taken it on blackberries so it is possible it might occur in berry fields. It too seems to be a generalist predator, but a less conspicuous one. Specimens were beaten from *Alnus rubra* and *Spiraea douglasii* in this study.

Pagasa (Lampropagasa) fusca (Stein) is a predaceous, ground-inhabiting nabid (Harris, 1928; Lattin, 1989). The genus *Pagasa* Stal is found in the Nearctic and the Neotropical Regions (Harris, 1928). The genus *Prostemma* Laporte de Castelnau occurs in the Old World where species have similar habits (Kerzhner, 1981; Pericart, 1987). *Pagasa fusca* is a widespread species in North and South America. It has been reported from Alberta, Arizona, British Columbia, California, Colorado, Connecticut, District of Columbia, Louisiana, Idaho, Illinois, Indiana, Kansas, Manitoba, Massachusetts, Maine, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, Nova Scotia, New York, Nebraska, Newfoundland, Ontario, Pennsylvania, South Dakota, Texas, Utah and Wisconsin (Harris, 1928; Henry and Lattin, 1988) in America north of Mexico. I have seen specimens of this species from Minnesota, Oregon, and now of course, Washington. The last revision of this genus was that of Harris (1928), suggesting that a contemporary effort is highly desirable. Harris (1928) reported *P. fusca* feeding on leafhoppers and the lygaeid *Geocoris uliginosus* (Say). He also collected the nabid with the lygaeids *Blissus leuocopterous* Say and *Myodocha serripes* Olivier in Mississippi. Froeshner (1944) and Reinert (1978) reported species of *Pagasa* feeding on two species of chinch bugs (*Blissus* spp.). This is a very characteristic, ground-inhabiting predator, apparently feeding mostly on Lygaeidae found in its habitat. It is a striking species, polished black and varied in wing development. The single specimen seen had short (brachypterous) fore wings, but long-winged forms are known (macropterous) (Harris, 1928; Lattin, 1989). This should be an expected component of the litter inhabiting insect fauna in the Park where both adults and nymphs are predaceous. A thorough study of this "species" is likely to discern more than one taxon. A so-called subspecies is known and found in Pingree Park, Colorado *Pagasa (Lampropagasa) fusca nigripes* Harris, but this taxon appears to be a color variety (dark legs) of the nominate species.

Family Pentatomidae

The bugs of the family Pentatomidae belong to one of the largest families of Hemiptera: Heteroptera (Schuh and Slater, 1995). They reported around 760 genera and over 4100 species from the world. Sixty genera and 222 species were reported from America, north of Mexico (Froeschner, 1988). Clearly, this family shows greater diversity in the tropical and sub-tropical regions of the world compared to the more temperate areas. Several of the species reported in the paper were beaten from the vegetation while others were recovered from the pitfall traps. One collected species is predaceous while others are plant feeders, feeding on grasses, forbes and trees. These are not particularly riparian species, but would be tied to particular plants, some of which would occur along streams. The fine book by McPherson (1982) provided a rich source of information on the Pentatomoidea of northeastern North America. Several of our species are included and much useful information is provided.

Only a single specimen of *Banasa dimiata* Say (usually spelled *dimidiata* but now considered to be *dimiata*, see Froeschner, 1988) was encountered. Many different possible host plants are listed for this species. The single specimen was beaten from *Sambucus racemosa* (red elderberry) thicket. This must be very widespread since it was described from Florida and Georgia and is now reported from the entire United States, southern Canada and northern Mexico by Thomas and Yonke (1981). Some of the other species of *Banasa* are known from conifers rather than forbs or deciduous trees.

Cosmopepla bimaculata Thomas was represented by three specimens collected by beating. No host records accompanied these specimens. McPherson (1982) provided extensive literature references for this species including many different plant species. This is a conspicuously marked taxon and readily recognized by its small size, black color and the red/yellow marks. Sound host information is desirable for our region and careful observations of adults and nymphs will be useful. Three specimens were beaten from “herbs” during this study. As with most taxa, stink bugs winter over as adults. In our area, a single generation per year is likely but farther south, a second generation may occur (McPherson, 1982). Like most pentatomids, *Cosmopepla bimaculata* is phytophagous. McDonald (1986) published a revision of the genus *Cosmopepla* Stal and his paper should be consulted.

Seven species of *Holcostethus* Fieber are reported by Froeschner (1988) following the generic revision of McDonald (1974) and the subsequent paper by McDonald (1982). The single species thus far collected is *Holcostethus tristis* (Van Duzee), described from British Columbia (Van Duzee, 1904). McPherson (1982) treats four species of *Hocostethus,* but not *H. tristis* since it is only known to occur in Alberta, British Columbia, California, Idaho, Montana, Oregon, Utah and Washington (Froeschner, 1988). At least one species (*H. abbreviatus* Uhler) was reported from grasses and weeds by McPherson (1982). He also provided references to possible host plants of *H. limbolarius* Stal. Oetting and Yonke (1971) reported this species from grasses and clovers in Missouri. Again, careful attention to host plants would be helpful for our species.

According to Froeschner (1988), the genus *Neottiglossa* Kirby contains seven species in America north of Mexico. Rider (1989) revised the genus and recognized only five valid species. While there may be at least two species of *Neottiglossa* in our area, only *N. trilineata* (Kirby) appeared in the 1995 and 1996 samples (grasses seem to be favored hosts [McPherson, 1982] see appendix). Kirby described the species from Saskatchewan, Canada and it shows a typical north temperate distribution across Canada and northern United States. Care must be taken in identifying this species. Structural differences between the posterior margin of the male genetalic capsule (Rider, 1989, fig. 3) is a more reliable character then the color patterns on the head and pronotum, particularily the development (or not) of a medium pale stripe on the head. McPherson (1982) also discussed *N. trilineata* and *N. undata* (Say) and gave references as available, especially for *N. undata*. One must remember that more boreal populations may be darker in color because of the incomplete metabolism of the sclerotin, resulting in more deposition in the cuticle. While color characters may be convenient at times, structural characters may be less susceptible to variation due to temperature.

The genus *Perillus* Stal is represented by seven species in America north of Mexico (Froeschner, 1988). Only a single species, *Perillus exaptus* (Say), was taken in this study. It was described in 1832. Froeschner reported this species from Alberta, British Columbia, California, Colorado, "Dakota", Illinois, Indiana, Massachusetts, New York, Nova Scotia, Newfoundland, Ohio, Ontario, Quebec, Utah, Washington and Wyoming. This is the only predaceous stink bug thus far collected from the Park. McPherson (1982) provided some information on the species but closed by saying that nothing is known about its prey. Knight (1952) reviewed the genus but had little to say about this species. It is reasonable to assume that the normal prey will be one or more beetle species of the family Chrysomelidae. Thomas (1992) made brief mention of the species in his treatment of the Asopinae of the Western Hemisphere and provided a key to the seven species of *Perillus*. *Perillus bioculatus* (Fabricius) is a well-known predator of the Colorado Potato Beetle and the story has been told many times. What is overlooked is that the bug was described from eastern United States in 1775 by Fabricius, well before the arrival of the beetle from the Rocky Mountain area! Therefore, the bug must have been feeding on some other insect, very likely another species of *Leptinotarsa,* the genus that contains the Colorado Potato beetle. Close attention to the species of insects found with *Perillus exaptus* in the park will certainly be of great value.

Family Reduviidae

This is one of the major families in the Hemiptera:Heteroptera with a world fauna of about 930 genera and 6500 species (Schuh and Slater, 1995). The family is especially well developed in the warmer regions of the world. Forty-seven genera and 57 species were reported from the continental United States and Canada by Froeshner (1988). Only 8 genera and 11 species are known from Oregon (Lattin, unpublished). Five species were reported from the H.J Andrews Experimental Forest by Parsons et al (1991), including *Barce fraterna banskii.* It is clear that the number of species of Reduviidae quickly falls off in the north temperate region.

Two apterous specimens of *Barce fraterna banksii* Baker (1910) were collected during 1995 from pitfall traps. Wygodzinsky (1966), in his monumental treatise on the subfamily to which *Barce* belongs, stated that this so-called race is widespread in western and southwestern United States. Froeschner (1988) cited only California, Texas, Greater Antilles and Mexico to Ecuador. These records suggest a distribution of this taxon in Oregon (Parsons et al, 1991) and now northern Washington. The so-called "races" mentioned by Wygodzinsky require further evaluation and published records should be based upon actual specimens. Some clarification of the distribution pattern is required. Banks (1909) described *Barce uhleri* from North Carolina, but Froeschner (1988) reported this species from Alberta, Iowa, Indiana, Kansas, Massachusetts, Missouri, North Carolina, New Jersey, New York, Oklahoma, South Dakota, Saskatchewan and Virginia, thus, northwestern specimens should be examined carefully.

The form found in the Park and in the H.J. Andrews Experimental Forest in Oregon is a temperate taxon associated with low to mid-elevational coniferous forests. It appears to be associated with damp ground conditions at both sites. Readio (1927) wrote about this species, indicating that habitats with moisture seemed to be required. If all of our individuals are wingless (apterous), then they would have limited vagility in the Pacific Northwest. This might be a counter point to *Hydrometra martini* Kirkaldy, a very widespread species of Hydrometridae in North America and to the south. It is often winged, but our specimens from Oregon are wingless and very limited in their distribution--not known from the conifer forests (Lattin, unpublished). It has been reported from British Columbia by Smith (1988).

Family Saldidae

This is a widely distributed but modestly sized family of riparian bugs with 26 genera and 265 species (Schuh and Slater, 1995). Polhemus (1988) cites 12 genera and 69 species in America, north of Mexico. Three species of shore bugs (Saldidae) are found in the park. All are predaceous in all stages of their nymphal and adult life, feeding on small invertebrates (usually insects) found along the margins of water of all types (Stock and Lattin, 1976). The wing patterns found on the adults are subject to considerable variation, confounding the problems of identification and complicating the taxonomic history of many common species. These problems have been or are being worked out by several individuals (Cobben, 1960; Polhemus, 1984, 1985, 1988; Lindskog, 1981; Schuh, 1967).

Micracantha quadrimaculata (Champion) is a very widespread species. It was described from Panama (Champion, 1900) and ranges through parts of Central America, Mexico and western North America as far north as British Columbia, Canada (Polhemus, 1988). It is small (3mm), fast and not always easy to collect (Bennett and Cook, 1981). Schuh (1967) provided a drawing of the fore wing, showing the typical color pattern. Although other species of *Micracanthia* are found in the general area of the Park, thus far, this is the only one to be detected. *Micracanthia schuhi* Lattin was described from specimens collected in moist, mossy slopes beside a small stream on Mt. Hood, Oregon (Lattin, 1968). Searching a similar moist habitat in the park might disclose this species. It has been collected in other similar habitat farther south in the Oregon Cascades. For consideration of the *Saldula-Micracanthia* complex, see Lindskog (1986)

The correct name of *Saldula laticollis* (Reuter) has been the subject of controversy for many years. Part of the problem has come from trying to determine the identity of the taxon and its true geographical distribution. Some taxa of the family Saldidae have very broad distribution in the northern temperate region and often display considerable variation over that range. For *S. laticollis*, the 1981 paper by Lindskog provided a clear discussion of the controversy that has existed. He leads the reader through the maze of papers and concepts. The true type locality of *S. laticollis* was Sitka, Alaska rather than Siberia as once thought.

Because of these named complications, there is literature on this taxon from our area under several different scientific names. This concept was called *Saldula fernaldi* Drake (1949) for many years, the type being from Newfoundland. Later, Drake (1962) synonomized it with *Saldula palustris* (Douglas), at the time a species of Europe believed to occur in North America. Stock and Lattin (1976) provided biological information on this taxon from the coast of western Oregon under the name *Saldula palustris*. The current name for our species is *Saldula laticollis* (Reuter). It should be noted that the resolution of the *Saldula palustris--Saldula pallipes* in northern America still is being investigated. Only a few specimens of *S. laticollis* appeared in the pitfall traps in North Cascades National Park. *Saldula saltitoria* (Linnaeus) was by far the most common. See appendix for details.

Saldula saltatoria (Linnaeus): This shore bug was described from Europe in 1758 by Linnaeus. It is known to be a Holarctic species according to current efforts (Polhemus, 1988). A look at the catalog of Heteroptera (Polhemus, 1988) discloses a very wide distribution pattern in mid to northern North America including British Columbia, Washington and Oregon. According to Polhenus (1988) "American records for *Saldula c-album* (Fieber) refer mainly to *Saldula saltatoria* (Linnaeus). A few may pertain to undescribed species." Indeed, there was a very pale specimen that appeared to be *S. c-album* and I ran into that species in the key of Usinger (1956). A careful arrangement of the many specimens from the Park into the eunomic series for the bug eventually convinced me that it was indeed only a pale individual of *S. saltatoria* (Schuh, 1967). Thus, there are only three species of Saldidae now known within the Park. Other species are surely to be found in North Cascades National Park, particularly at higher elevations.

Family Tingidae

The lace bugs belong to a modest sized family of about 250 genera and 1900 species (Drake and Ruhoff, 1965; Schuh and Slater, 1995). Froeschner (1988) reported 22 genera and 154 species from the United States and Canada. It is easy to see that the temperate region has a much reduced fauna. Most species are found in the tropical and subtropical regions of the world where they feed on a wide variety of plants. While there are likely to be quite a few more species of lace bugs in the Park, usually associated with trees and shrubs (e.g. *Salix* and *Alnus*), only two species were recovered from the pitfall traps set in the riparian transect. Both species of Tingidae belonged to the genus *Acalypta* Westwood, *A. lillianis* Torre-Bueno and *A. mera* Drake. Species of the genus feed on several kinds of mosses, usually growing on the ground or growing on fallen logs. A third species, *Acalypta saundersi* Downes will surely be collected in the Park. It seems to prefer rather loose-growing mosses found on fallen logs. Specimens of these attractive bugs are most easily collected by gathering quantitites of mosses and processing it through a Tullgren separator where heat and light drive out the bugs into a vial of alcohol below; surprisingly, a few appeared in the pitfall traps.

Acalypta lillianis was represented by three specimens from the Douglas-fir habitat type. Originally described from New York, it is the most widely distributed *Acalypta* in North America, but chiefly in the north, especially in the west (Torre-Bueno, 1916; Drake and Lattin, 1963; Froeshner, 1988). It was first reported from Oregon by Parsons et al (1991) and now from Washington although it had been known from Alaska, British Columbia and Idaho, among many other localities (Froeschner, 1988). Like many species of *Acalypta*, reduced-wing forms generally are more common than long-winged macropterous forms (Drake, 1928; Drake and Lattin, 1963). Some are also known with only reduced-wing as reported in 1990 by Lattin and Moldenke (e.g. *Acalypta saundersi* Downes).

Acalypta mera was originally described from British Columbia and Oregon by Drake (1941). Subsequently, it was placed into synonmy with *Acalypta barberi* Drake, a species described earlier from Merrifield, New York (Drake and Lattin, 1963). Our species was then long known under the name *A. barberi*. Golub (1973) considered *A. barberi* to be a synonym of *A. parvula* (Fallen), a species previously known to occur in Europe and believed to be introduced into North America by that author. No mention was made of *Acalypta mera* Drake. Froeschner (1976) follows Golub in his treatment of this species of *Acalypta* calling it *A. parvula* and supporting the idea that this was an introduced species found on both coasts. This is certainly not true. While one east coast collection may represent an introduction since virtually no specimens have been collected since it was described, the west coast populations are native beyond doubt. They are associated with the massive mature old-growth forests of British Columbia, Washington and Oregon (Drake and Lattin, 1963; Lattin and Moldenke, 1990; Parsons et al, 1991). If species with such distribution patterns are found and are automatically considered introduced species, much of our fauna would be considered introduced. That is simply not true. We do have non-indigenous species and some of these have been clearly identified as such, but we have hundreds of native species as well. Because of the confusion about the proper name of our species of

Acalypta, I have resurrected the name *Acalypta mera*, originally described by Drake from British Columbia and Oregon as the name of our species previously labeled *A. barberi* and much later, *A. parvula*. The type of precise comparison of specimens from the Pacific Northwest with European specimens of *A. parvula* have not yet been published. We do have naturally distributed species that have a small extension into the Pacific Northwest from the Old World (e.g. *Derephysia foliaceae* (Fallen) [Lattin, 1987]). *A. parvula* may be such a species but it is definitely not an artificial introduction as suggested. Morris (1975) reports *Acalypta parvula* from the limestone grasslands of Great Britain. Our species is found primarily in the forests of Pacific Northwest (Lattin, 1993).

Conclusions

Too much speculation about the insect fauna would be inappropriate at this time. What we have seen in the Hemiptera:Heteroptera collected in the pitfall traps along Big Beaver Creek can be considered only a snapshot of the total fauna. In spite of its brevity, this initial study of the true bug fauna of the park is most interesting with a number of significant species recorded. Reading the accounts of each species will give the reader an idea of what is known and and what awaits discovery. The physical location of the park and the virtual unknown status of its insect fauna make it a delight to study. Sitting as it does at the cross-roads of a massive east-west boreal transect and a north-south transect along the Cascades and south into the Sierra Mountains simply begs for additional study.

The recency of the Pleistocene ice shield in the park and its relative isolation makes it an ideal study site for boreal insects. Some of the areas within the park have been ice-free for a relatively short period of time. There is the possibility that the faunal and floral elements may be still recolonizing some of the habitats. One should read Nelson and Coope (1982), Pielou (1991), and Elias (1994) for an overview of the Pleistocene and some of the conditions that prevailed as well as the recovery of the landscape. The North Cascades National Park is an ideal location for high resolution studies. Those who have labored long and hard to obtain the specimens for this study have provided us with the basis for such an effort. It could not have started without them.

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Appendix

Figure A.1. Arthropod pitfall trap locations, Big Beaver Creek, North Cascades National Park Service Complex, 1995-1996.

Figure A.2. Arthropod pitfall trap locations, Big Beaver Creek, North Cascades National Park Service Complex, 1995-1996.

Figure A.3. Arthropod pitfall trap locations, Big Beaver Creek, North Cascades National Park Service Complex, 1995-1996.

Figure A. 4. Arthropod pitfall locations, Big Beaver Creek, North Cascades National Park Service Complex, 1995-1996.

Figure A.5. Arthropod pitfall trap locations, Big Beaver Creek, North Cascades National Park Service Complex,1995-1996.

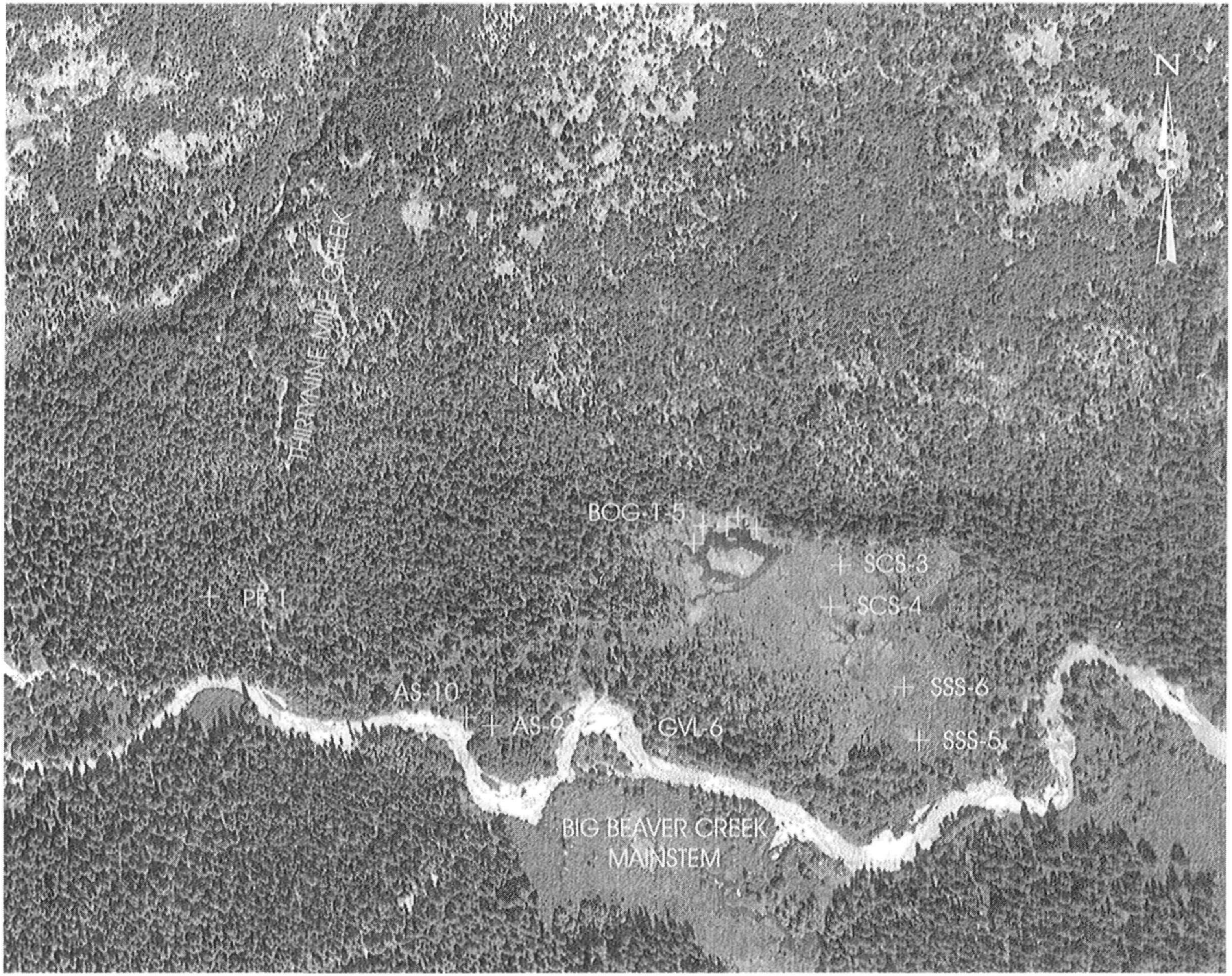

Figure A.6. Arthropod pitfall trap locations, Big Beaver Creek, North Cascades National Park Service Complex, 1995-1996.

Figure A. 7. Arthropod pitfall trap locations, Big Beaver Creek, North Cascades National Park Service Complex, 1995-1996.

Figure A. 8. Arthropod pitfall trap locations, Big Beaver Creek, North Cascades National Park Service Complex, 1995-1996.

Table A1. Hemiptera: Heteroptera collected in the Big Beaver Creek Research Natural Area, North Cascades National Park Complex, Whatcom County, Washington, 1995.

Family/Genus/Species	Author	No. of Individuals	Habitat Trap #	Method	Date	Elevat. (m)	UTM East	UTM North
Anthocoridae								
Anthocoris antevolens	White	1	TSCS-3	BEAT	11JUL95	518	635680	5407230
Belostomatidae								
Lethocerus americanus	(Leidy)	1	BOG-7	PITFALL	8JUN95	573	633920	5407500
Lethocerus americanus	(Leidy)	1	TSCS-10	PITFALL	9AUG95	579	633480	5407780
Lethocerus americanus	(Leidy)	1	SSS-4	PITFALL	7SEP95	570	633640	5407770
Ceratocombidae								
Ceratocombus vagans	McAtee and Malloch	3	SSS-1	PITFALL	17OCT95	497	640450	5406050
Ceratocombus vagans	McAtee and Malloch	7	TSCS-6	PITFALL	11OCT95	561	634390	5407580
Ceratocombus vagans	McAtee and Malloch	2	TTF-1	PITFALL	14SEP95	494	641850	5404220
Ceratocombus vagans	McAtee and Malloch	1	AS-10	PITFALL	18OCT95	512	636740	5406930
Ceratocombus vagans	McAtee and Malloch	1	TSCS-8	PITFALL	7SEP95	567	633810	5407630
Ceratocombus vagans	McAtee and Malloch	1	SSS-2	PITFALL	12SEP95	497	639620	5406570
Gerridae								
Gerris buenoi	Kirkaldy	4	BOG-1	PITFALL	18OCT95	512	637090	5407170
Gerris buenoi	Kirkaldy	1	BOG-4	PITFALL	15AUG95	512	637020	5407150
Gerris buenoi	Kirkaldy	2	BOG-7	PITFALL	11OCT95	573	633920	5407500
Gerris buenoi	Kirkaldy	2	BOG-4	PITFALL	18OCT95	512	637020	5407150
Gerris buenoi	Kirkaldy	1	BOG-6	PITFALL	11OCT95	573	633880	5407500
Gerris buenoi	Kirkaldy	1	BOG-9	PITFALL	11OCT95	573	633930	5407560
Gerris buenoi	Kirkaldy	1	TSCS-7	PITFALL	7SEP95	567	633910	5407620
Gerris buenoi	Kirkaldy	2	BOG-9	PITFALL	7SEP95	573	633930	5407560
Gerris buenoi	Kirkaldy	1	TSCS-7	PITFALL	9AUG95	567	633910	5407620
Gerris buenoi	Kirkaldy	1	BOG-9	PITFALL	9AUG95	573	633930	5407560
Gerris buenoi	Kirkaldy	1	BOG-4	PITFALL	8SEP95	512	637020	5407150
Gerris buenoi	Kirkaldy	3	BOG-6	PITFALL	9AUG95	573	633880	5407500
Gerris buenoi	Kirkaldy	3	BOG-10	PITFALL	9AUG95	573	633890	5407540
Gerris buenoi	Kirkaldy	1	BOG-1	PITFALL	11JUL95	512	637090	5407170
Gerris incurvatus	Drake and Hottes	1	TSCS-6	PITFALL	9JUN95	561	634390	5407580
Gerris incurvatus	Drake and Hottes	1	TSCS-9	PITFALL	7SEP95	579	633380	5407780
Gerris incurvatus	Drake and Hottes	1	TSCS-9	PITFALL	8JUN95	579	633380	5407780
Gerris incurvatus	Drake and Hottes	1	SSS-6	PITFALL	14JUN95	512	637280	5406990
Gerris incurvatus	Drake and Hottes	1	AS-7	PITFALL	6JUL95	573	639640	5406200
Gerris incurvatus	Drake and Hottes	1	TSCS-9	PITFALL	6JUL95	579	633380	5407780
Gerris sp. nymph		1	SCS-2	PITFALL	10JUL95	494	634140	5407570
Lygaeidae								
Cordillonotus stellatus	Scudder	1	GVL-8	PITFALL	14JUN95	506	637760	5406930
Cymus luridus	Stal	2	SCS-1	BEAT	10JUL95	494	641140	5405230
Eremocoris borealis	(Dallas)	1	AT-3	PITFALL	12SEP95	494	639110	5406180
Eremocoris borealis	(Dallas)	1	TTF-7	PITFALL	8UG95	518	635690	5407320
Eremocoris borealis	(Dallas)		AT-7	no information			640470	5405590
Eremocoris borealis	(Dallas)	1	TTF-7	PITFALL	5JUL95	518	635690	5407320
Eremocoris borealis	(Dallas)	1	AT-7	PITFALL	12JUL95	494	640470	5405590
Eremocoris borealis	(Dallas)	2	AT-3	PITFALL	13JUL95	494	639110	5406180
Eremocoris borealis	(Dallas)	1	AT-7	PITFALL	16AUG95	494	640470	5405590
Eremocoris borealis	(Dallas)	1	AT-3	PITFALL	13JUL95	494	639110	5406180
Eremocoris borealis	(Dallas)	1	AT-7	PITFALL	13SEP95	494	640470	5405590
Eremocoris borealis	(Dallas)	1	AT-5	PITFALL	15JUN95	512	640490	5405180
Eremocoris obscurus	Van Duzee		AS-5	no information			634100	5407600

Table A1. (Continued).

Family/Genus/Species	Author	No. of Individuals	Habitat Trap #	Method	Date	Elevat. (m)	UTM East	UTM North
Lygaeidae								
Geocoris pallens	Stal	1	SSS-7	PITFALL	16AUG95	494	639640	5406200
Geocoris pallens	Stal	3	SCS-9	PITFALL	13SEP95	494	639890	5406230
Kleidocerys franciscanus	(Stal)	2	SCS-1	BEAT	21SEP95	494	641140	5405230
Kleidocerys resedae	(Panzer)	1	TSCS-3	BEAT	11JUL95	518	635680	5407230
Kleidocerys resedae	(Panzer)	1	SSS-6	BEAT	11JUL95	512	637280	5406990
Peritrechus saskatchewanensis	Barber	3	SCS-10	PITFALL	16AUG95	494	639710	5406190
Scolopostethus pacificus	Barber	1	GVL-2	PITFALL	11OCT95	573	632940	5408080
Scolopostethus pacificus	Barber	5	SCS-1	PITFALL	14AUG95	494	641140	5405230
Scolopostethus pacificus	Barber	1	SSS-2	PITFALL	17OCT95	497	639620	5406570
Scolopostethus pacificus	Barber	1	GVL-1	PITFALL	10AUG95	576	632960	5408160
Scolopostethus pacificus	Barber	2	SSS-2	PITFALL	12SEP95	497	639620	5406570
Scolopostethus pacificus	Barber	1	AS-8	PITFALL	11OCT95	573	634100	5407600
Scolopostethus pacificus	Barber	1	TTF-7	PITFALL	8AUG95	518	635690	5407320
Scolopostethus pacificus	Barber	6	SSS-2	PITFALL	18AUG95	497	639620	5406570
Scolopostethus pacificus	Barber	2	GVL-1	PITFALL	6JUL95	576	632960	5408160
Scolopostethus pacificus	Barber	2	TTF-7	PITFALL	7SEP95	518	635690	5407320
Scolopostethus pacificus	Barber	1	TSCS-10	PITFALL	6JUL95	579	633480	5407780
Scolopostethus pacificus	Barber	1	PF-2	PITFALL	12SEP95	503	639010	5406710
Scolopostethus pacificus	Barber	1	AT-7	PITFALL	19OCT95	494	640470	5405590
Scolopostethus pacificus	Barber	1	TSCS-10	PITFALL	11OCT95	579	633480	5407780
Scolopostethus pacificus	Barber	1	BOG-5	PITFALL	18OCT95	512	637010	5407130
Scolopostethus pacificus	Barber	1	PF-6	PITFALL	5JUL95	561	635090	5407620
Scolopostethus pacificus	Barber	24	GVL-2	PITFALL	9AUG95	573	632940	5408080
Scolopostethus pacificus	Barber	9	GVL-2	PITFALL	8JUN95	573	632940	5408080
Scolopostethus thomsoni	Reuter	4	AT-3	PITFALL	13JUL95	494	639110	5406180
Scolopostethus thomsoni	Reuter	1	AS-3	PITFALL	7SEP95	570	633150	5408160
Scolopostethus thomsoni	Reuter	2	AS-8	PITFALL	10AUG95	573	633070	5408180
Scolopostethus thomsoni	Reuter	2	AT-4	PITFALL	18OCT95	494	638070	5406780
Scolopostethus thomsoni	Reuter	2	AS-4	PITFALL	11OCT95	561	634140	5407570
Scolopostethus thomsoni	Reuter	1	AS-10	PITFALL	15AUG95	512	636740	5406930
Scolopostethus thomsoni	Reuter	8	AS-8	PITFALL	7SEP95	573	633070	5408180
Scolopostethus thomsoni	Reuter	1	AS-8	PITFALL	8JUN95	573	633070	5408180
Scolopostethus thomsoni	Reuter	1	AS-4	PITFALL	7JUL95	561	634140	5407570
Scolopostethus thomsoni	Reuter	1	SCS-2	PITFALL	14SEP95	494	634140	5407570
Scolopostethus thomsoni	Reuter	3	TSCS-10	PITFALL	9AUG95	579	633480	5407780
Scolopostethus thomsoni	Reuter	3	AS-8	PITFALL	6JUL95	573	633070	5408180
Scolopostethus thomsoni	Reuter	1	AS-5	PITFALL	9JUN95	561	634100	5407600
Scolopostethus thomsoni	Reuter	1	AS-7	PITFALL	7SEP95	573	633380	5407900
Scolopostethus thomsoni	Reuter	2	AS-10	PITFALL	12SEP95	512	636740	5406930
Scolopostethus thomsoni	Reuter	1	TTF-1	PITFALL	13JUN95	494	641850	5404220
Scolopostethus thomsoni	Reuter	2	AS-7	PITFALL	6JUL95	573	633380	5407900
Scolopostethus thomsoni	Reuter	1	AS-3	PITFALL	6JUL95	570	633150	5408160
Scolopostethus thomsoni	Reuter	1	AS-7	PITFALL	9AUG96	573	633380	5407900
Scolopostethus thomsoni	Reuter	1	SSS-10	PITFALL	16AUG95	494	640880	5405010
Scolopostethus thomsoni	Reuter	5	AS-10	PITFALL	11JUL95	512	636740	5406930
Scolopostethus thomsoni	Reuter	8	AS-8	PITFALL	10AUG95	573	633070	5408180
Scolopostethus thomsoni	Reuter	1	AT-5	PITFALL	13SEP95	512	640490	5405180
Scolopostethus thomsoni	Reuter	1	AT-5	PITFALL	16AUG95	512	640490	5405180
Scolopostethus thomsoni	Reuter	1	AS-3	PITFALL	10AUG95	570	633150	5408160
Scolopostethus thomsoni	Reuter	1	SSS-5	PITFALL	15AUG95	512	639530	5406140
Scolopostethus thomsoni	Reuter	1	TTF-7	PITFALL	7SEP95	518	635690	5407320
Scolopostethus thomsoni	Reuter	1	SCS-3	PITFALL	11JUL95	512	637160	5407130
Scolopostethus thomsoni	Reuter	25	GVL-2	PITFALL	6JUL95	573	632940	5408080
Scolopostethus thomsoni	Reuter	71	AS-5	PITFALL	7JUL95	561	634100	5407600
Stygnocoris sabulosus	(Schilling)	3	SCS-5	PITFALL	18OCT95	497	639160	5406640
Stygnocoris sabulosus	(Schilling)	2	SCS-5	PITFALL	12SEP95	497	639160	5406640
Stygnocoris sabulosus	(Schilling)	2	SSS-5	PITFALL	12SEP95	512	639530	5406140
Stygnocoris sabulosus	(Schilling)	2	SCS-4	PITFALL	12SEP95	512	637160	5407080
Stygnocoris sabulosus	(Schilling)	2	SCS-4	PITFALL	12SEP95	512	637160	5407080
Stygnocoris sabulosus	(Schilling)	1	SCS-4	PITFALL	15AUG95	512	637160	5407080
Stygnocoris sabulosus	(Schilling)	6	TSCS-3	PITFALL	10OCT95	518	635680	5407230
Stygnocoris sabulosus	(Schilling)	1	SSS-8	PITFALL	19OCT95	494	639530	5406140
Stygnocoris sabulosus	(Schilling)		no information					

Table A1. (Continued).

Family/Genus/Species	Author	No. of Individuals	Habitat Trap #	Method	Date	Elevat. (m)	UTM East	UTM North
Nabidae								
Nabis alternatus uniformis	Harris	1	SSS-6	BEAT	11JUL95	512	637280	5406990
Nabis roseipennis	Reuter	1	AT-7	PITFALL	19OCT95	494	640470	5405590
Nabis roseipennis	Reuter	1	GVL-8	PITFALL	14JUN95	506	637760	5406930
Nabis roseipennis	Reuter	2	GVL-9	PITFALL	11JUL95	506	637760	5406930
Nabis rufusculus	Reuter	1	BOG-5	BEAT	21SEP95	512	637010	5407130
Nabis rufusculus	Reuter	1	SSS-6	BEAT	21SEP95	512	637280	5406990
Nabis rufusculus	Reuter	1	BOG-1	PITFALL	15AUG95	512	637090	5407170
Pagasa fusca	(Stein)	1	SCS-10	PITFALL	16AUG95	494	639710	5406190
Pentatomidae								
Banasa dimiata	(Say)	1	AT-9	BEAT	12JUL95	497	641130	5404620
Cosmopepla bimaculata	(Thomas)	3	BOG-5	BEAT	11JUL95	512	637010	5407130
Holcostethus tristis	(Van Duzee)	1	GVL-2	PITFALL	8JUN95	573	632940	5408080
Holcostethus tristis	(Van Duzee)	1	GVL-6	PITFALL	11JUN95	509	637000	5406860
Neottiglossa trilineata	(Kirby)	1	BOG-6	PITFALL	6JUL95	573	633880	5407500
Neottiglossa trilineata	(Kirby)	1	BOG-6	PITFALL	8JUN95	573	633880	5407500
Perillus exaptus	(Say)	5	GVL-2	PITFALL	8JUN95	573	632940	5408080
Reduviidae								
Barce fraterna banksii	McAtee and Malloch	1	BOG-10	PITFALL	11OCT95	573	633890	5407540
Barce fraterna banksii	McAtee and Malloch	1	TSCS-7	PITFALL	11OCT95	567	633910	5407620
Saldidae								
Micracanthia quadrimaculata	(Champion)	10	BOG-3	PITFALL	11JUL95	512	633880	5407500
Micracanthia quadrimaculata	(Champion)	1	BOG-9	PITFALL	7SEP95	573	633930	5407560
Micracanthia quadrimaculata	(Champion)	1	BOG-4	PITFALL	8SEP95	512	637020	5407150
Micracanthia quadrimaculata	(Champion)	6	BOG-5	PITFALL	15AUG95	512	637010	5407130
Micracanthia quadrimaculata	(Champion)	1	SCS-3	PITFALL	11JUL95	512	637160	5407130
Micracanthia quadrimaculata	(Champion)	1	BOG-4	PITFALL	18OCT95	512	637020	5407150
Micracanthia quadrimaculata	(Champion)	7	BOG-4	PITFALL	11JUL95	512	637020	5407150
Micracanthia quadrimaculata	(Champion)	3	BOG-2	PITFALL	11JUL95	512	637060	5407170
Micracanthia quadrimaculata	(Champion)	4	BOG-4	PITFALL	15AUG95	512	637020	5407150
Micracanthia quadrimaculata	(Champion)	4	BOG-2	PITFALL	8SEP95	512	637060	5407170
Micracanthia quadrimaculata	(Champion)	1	BOG-8	PITFALL	9AUG95	573	633950	5407510
Micracanthia quadrimaculata	(Champion)	1	BOG-7	PITFALL	9AUG95	573	633920	5407500
Micracanthia quadrimaculata	(Champion)	3	BOG-3	PITFALL	18OCT95	512	633880	5407500
Micracanthia quadrimaculata	(Champion)	1	BOG-1	PITFALL	18OCT95	512	637090	5407170
Micracanthia quadrimaculata	(Champion)	1	SCS-9	PITFALL	13SEP95	494	639890	5406230
Micracanthia quadrimaculata	(Champion)	1	SCS-3	PITFALL	11JUL95	512	637160	5407130
Micracanthia quadrimaculata	(Champion)	1	BOG-8	PITFALL	6JUL95	573	633950	5407510
Micracanthia quadrimaculata	(Champion)	1	BOG-9	PITFALL	6JUL95	573	633930	5407560
Micracanthia quadrimaculata	(Champion)	1	BOG-10	PITFALL	6JUL95	573	633890	5407540
Micracanthia quadrimaculata	(Champion)	1	BOG-2	PITFALL	15AUG95	512	637060	5407170
Micracanthia quadrimaculata	(Champion)	1	SCS-3	PITFALL	12SEP95	512	637160	5407130
Micracanthia quadrimaculata	(Champion)	5	BOG-1	PITFALL	11JUL95	512	637090	5407170
Micracanthia quadrimaculata	(Champion)	6	BOG-3	PITFALL	15AUG95	512	633880	5407500
Micracanthia quadrimaculata	(Champion)	1	BOG-5	PITFALL	15AUG95	512	637010	5407130
Micracanthia quadrimaculata	(Champion)	1	BOG-2	PITFALL	11JUL95	512	637060	5407170
Saldula laticollis	(Reuter)	1	GVL-4	PITFALL	8JUN95	570	633380	5407930
Saldula laticollis	(Reuter)	1	BOG-1	PITFALL	18OCT95	512	637090	5407170
Saldula laticollis	(Reuter)	1	BOG-8	PITFALL	8JUN95	573	633950	5407510
Saldula laticollis	(Reuter)	1	GVL-9	PITFALL	18OCT95	506	637760	5406930
Saldula saltatoria	(Linnaeus)	1	TSCS-5	PITFALL	6SEP95	561	634330	5407590
Saldula saltatoria	(Linnaeus)	2	TSCS-9	PITFALL	8JUN96	579	633380	5407780
Saldula saltatoria	(Linnaeus)	5	TSCS-5	PITFALL	9JUN95	561	634330	5407590
Saldula saltatoria	(Linnaeus)	1	AS-6	PITFALL	9AUG95	570	633430	5407940
Saldula saltatoria	(Linnaeus)	1	SSS-1	PITFALL	13JUN95	497	640450	5406050
Saldula saltatoria	(Linnaeus)	2	TSCS-6	PITFALL	9JUN95	561	634390	5407580
Saldula saltatoria	(Linnaeus)	1	TSCS-1	PITFALL	6SEP95	558	634480	5407590
Saldula saltatoria	(Linnaeus)	9	TSCS-1	PITFALL	7JUL95	558	634480	5407590
Saldula saltatoria	(Linnaeus)	1	TSCS-2	PITFALL	6SEP95	558	634520	5407580
Saldula saltatoria	(Linnaeus)	4	TSCS-5	PITFALL	7JUL95	561	634330	5407590
Saldula saltatoria	(Linnaeus)	6	AS-6	PITFALL	6JUL95	570	633430	5407940
Saldula saltatoria	(Linnaeus)	5	TSCS-1	PITFALL	10AUG95	558	634480	5407590

Table A1. (Continued).

Family/Genus/Species	Author	No. of Individuals	Habitat Trap #	Method	Date	Elevat. (m)	UTM East	UTM North
Scutelleridae								
Eurygaster sp.		No information						
Tingidae								
Acalypta lillianis	Torre-Bueno	3	PF-6	PITFALL	5JUL95	561	635090	5407620
Acalypta mera	Drake	1	SCS-3	PITFALL	15AUG95	512	637160	5407130
Acalypta mera	Drake	1	BOG-1	PITFALL	14JUN95	512	637090	5407170
Acalypta mera	Drake	2	SCS-3	PITFALL	12SEP95	512	637160	5407130
Acalypta mera	Drake	1	BOG-2	PITFALL	18OCT95	512	637060	5407170
Acalypta mera	Drake	1	SCS-3	PITFALL	18OCT95	512	637160	5407130
Acalypta mera	Drake	1	BOG-2	PITFALL	18OCT95	512	637060	5407170
Acalypta mera	Drake	1	SCS-3	PITFALL	12SEP95	512	637160	5407130
Acalypta mera	Drake	1	SCS-4	PITFALL	12SEP95	512	637160	5407080

Table A2. Hemiptera: Heteroptera collected in the Big Beaver Creek Research Natural Area, North Cascades National Park Complex, Whatcom County, Washington, 1996.

Family/Genus/Species	Author	No. of Individuals	Habitat Trap #	Method	Date	Elevat. (m)	UTM East	UTM North
Aradidae								
Aradus orbiculus	Van Duzee	1	PF-6	PITFALL	11JUL96	561	635090	5407620
Ceratocombidae								
Ceratocombus vagans	McAtee and Malloch	1	PF-2	PITFALL	9JUL96	503	639010	5406710
Gerridae								
Gerris buenoi	Kirkaldy	1	SCS-7	PITFALL	8OCT96	494	640380	5405630
Gerris incurvatus	Drake and Hottes	2	AS-7	PITFALL	11JUL96	573	633380	5407900
Lygaeidae								
Eremocoris borealis	(Dallas)	7	PF-4	PITFALL	7OCT96	500	640600	5405980
Kleidocerys resedae	(Panzer)	1	AS-3	PITFALL	10OCT96	570	633150	5408160
Scolopostethus pacificus	Barber	1	AS-1	PITFALL	7OCT96	500	641460	5404520
Scolopostethus thomsoni	Reuter	1	AS-8	PITFALL	11JUL96	573	633070	5408180
Scolopostethus thomsoni	Reuter	1	AS-10	PITFALL	10JUL96	512	636740	5406930
Scolopostethus thomsoni	Reuter	3	AS-10	PITFALL	9OCT96	512	636740	5406930
Scolopostethus thomsoni	Reuter	2	PF-6	PITFALL	9OCT96	561	635090	5407620
Scolopostethus thomsoni	Reuter	1	SCS-10	PITFALL	8OCT96	494	639710	5406190
Pentatomidae								
Neottiglossa trilineata	(Kirby)	1	SCS-6	PITFALL	9JUL96	497	639100	5406560
Saldidae								
Saldula laticollis	(Reuter)	4	SCS-9	PITFALL	10SEP96	494	639890	5406230
Saldula saltatoria	(Linnaeus)	1	AS-6	PITFALL	10OCT96	570	635090	5407620

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their developement is in the best interest of all our people. The department also promotes the goals of the Take Pride in America campaing by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

(NPS D 226) (November 1997)