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

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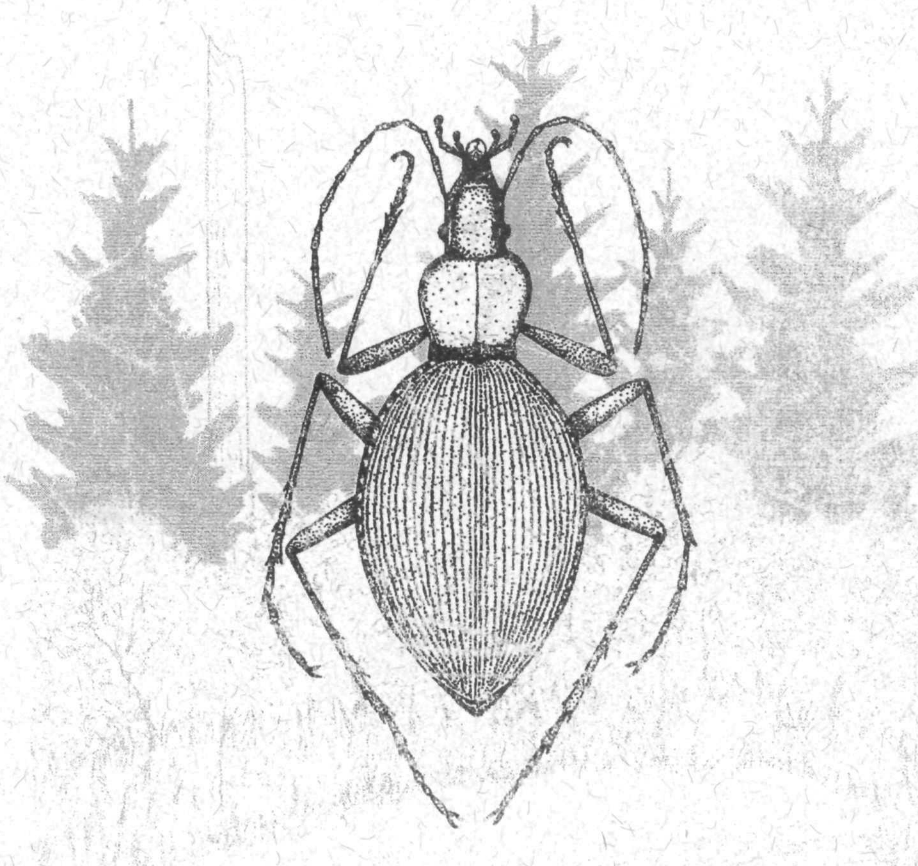

U.S. Department of Interior
National Park Service - Pacific West Region
North Cascades National Park Service Complex
Sedro-Woolley, WA 98284
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North Cascades National Park Service Complex, comprising North Cascades National Park, Ross Lake National Recreation 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.

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Abstract

The objectives of this project were to document and analyze arthropod diversity and habitat associations in wetlands and adjacent habitats along Big Beaver Creek, North Cascades National Park Complex (NOCA), Washington. Wetland and riparian habitats are vital to nutrient and energy transfer between aquatic and terrestrial systems, and are also major biodiversity foci within landscapes. Arthropods comprise the bulk of animal biodiversity and provide a host of essential ecosystem functions accentuated by their basal and intermediate positions in trophic webs. While "purely" aquatic and terrestrial arthropod faunas are often relatively well known, the same cannot generally be said of those arthropods existing at the aquatic-terrestrial interface. To this end, a series of pitfall traps was maintained during the snow-free seasons of 1995 and 1996 in riparian floristic communities along the lower 13 km of Big Beaver Creek.

As part of the Big Beaver Creek project, this study of the NOCA riparian Coleoptera (beetles) deals with one of the largest and most ecologically diverse groups of arthropods to be found within the Park Complex. The majority of the arthropods collected during this study were beetles, results similar to those of other riparian arthropod surveys. The known trophic roles of these beetles range from detritivores to predators. A total of 360 species of beetles in 49 families were identified from the 18,766 individuals collected. Discounting those species known to be attracted to carrion, almost all individuals (90%) were representatives of only four beetle families: Anthicidae, Carabidae, Elateridae, and Staphylinidae. Although the vast majority of individuals and species were true riparian constituents, some species would normally be found only in habitats such as on flowers, under bark or within truly aquatic situations. Given the remoteness and essentially pristine condition of the Big Beaver Creek study sites, it was surprising to find a few individuals of five species representing taxa introduced into North America from Europe. In both years, the Alder Swamp habitat had the greatest species richness, while the Gravel Bar habitat had the most unique species composition.

No formal statistical analysis was performed for this report. My Master's thesis at Oregon State University, as well as the final technical report on this project, will address those aspects of the study.

Acknowledgments

My sincere thanks to Reed Glesne of North Cascades National Park, whose great interest in the arthropods of the Park and subsequent support made the Big Beaver Creek Riparian Arthropod Survey possible. I cannot adequately express my appreciation for the efforts of Brenda Cunningham, Ron Holmes, Sherry Bottoms and Kathleen McEvoy, who labored long and hard to place pitfall traps, and to collect and process the specimens. They painstakingly mounted and labelled each one of the thousands of beetle specimens I identified. I could not have accomplished this task without their unstinting labor, dedication, skills and enthusiasm. Ron Holmes also contributed greatly to the study area descriptions, the methods section, and the preparation of other aspects of this report. I greatly appreciate Brenda Cunningham's cover illustration of *Scaphinotus angusticollis*, the most abundant species found in the course of this study and one of my favorite insects.

I owe a great debt to Dr. John D. Lattin, of the Oregon State University Entomology Department. Dr. Lattin was my graduate major professor during the course of the Big Beaver Creek study. He made me aware of the study, provided encouragement and guidance, and generously supported me as a graduate research assistant under his supervision.

Greg Brenner, Ph.D. candidate at Oregon State University, was not only responsible for much of the survey design, but supplied analytical and personal support above and beyond the call of duty.

The Skagit Environmental Endowment Commission provided the funding for the first year of this study. The National Park Service provided personnel and other resources in support of both years, as well as providing funding for the second year of the survey. Oregon State University and the Entomology Department funded my graduate research assistantship through the course of the study and subsequent identification work, as well as providing office space and equipment.

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List of Tables and Figures

Introduction

The goal of the Big Beaver Creek Riparian Arthropod Survey was to contribute to the knowledge of riparian arthropod diversity, abundance, distribution, habitat association and trophic roles within the North Cascades National Park Complex (NOCA). An understanding of the arthropod fauna of a given landscape develops a foundation for potentially detecting environmental change or disruption. This may be particularly true for riparian habitats. Wetland and riparian habitats are vital conduits of energy and nutrient transfer between aquatic and terrestrial systems. These habitats are also major reservoirs of biodiversity within landscapes. As foci of ecological processes, riparian corridors offer the opportunity for detecting environmental perturbances and degradation before these become apparent in more diffuse landscape features.

The vast contribution of arthropods to animal biodiversity is well known. Although precise figures vary widely, a conservative estimate is that about 85% of described animal species are arthropods (from Wilson 1988). Regional examples support this global generalization. For instance, arthropods comprise 85% of the biodiversity known from the H.J. Andrews Experimental Forest in the foothills of the western Cascades of Oregon (Parsons *et al.* 1991). The overwhelming abundance of arthropods is equally well known. Insects alone may number many millions per acre (Borror *et al.* 1989) and there may be billions of arthropods per acre of soil (from Wallwork 1976). Inextricably linked to their diversity and abundance are the ecological roles of arthropods. Insects and other arthropods provide critical trophic links between the bases and apices of food webs, providing essential ecosystem functions as herbivores, pollinators, detritivores, scavengers, parasites, predators, prey for other predators and hosts for pathogens (Thompson 1984). These characteristics, combined with their fecundity and short generation times, enable arthropods to integrate many environmental phenomena and processes, rendering them ideal subjects for monitoring environmental integrity and change.

Coleoptera (beetles) were selected as one the groups of Big Beaver Creek arthropods to receive detailed analysis. Beetles are among the most abundant arthropods collected in pitfall samples, the primary sampling method for the study. They comprised 52% (12,678 individuals) of the total litter/soil arthropods (24,477 individuals) collected in the course of the 1995 Big Beaver Creek study. Fifty to ninety percent of individuals in studies of riparian arthropod communities in Germany and Oregon were beetles (Hering 1995, 1996; Manderbach and Reich 1995; Smit *et al.* in press). Beetles are also among the most diverse groups of organisms, comprising approximately one-quarter of all known animal species. Although exact numbers are not known, about 3,500 beetle species have been recorded from Oregon alone (Parsons, G., J.R. LaBonte and J.E. Miller, in prep.). Of the approximately 3,450 arthropod species recorded from the H.J. Andrews Experimental Forest (Parsons *et al.* 1991), which covers a watershed length roughly equivalent to that of the Big Beaver Creek study, 824 species (24%) were beetles.

Beetle taxonomic diversity is reflected in a wide array of trophic strategies and roles, ranging from detritivory to parasitism. Furthermore, beetles utilize virtually all terrestrial habitats, from the deep soil to the canopies of the tallest trees. As is true of other insects, beetles are often sensitive to small differences in temperature and humidity, selecting discrete and well-defined microhabitats. Such taxonomically and ecologically diverse organisms are desirable when analyzing faunal differences between habitats. This is particularly so when habitat sites are essentially contiguous, as was the case for many of the Big Beaver Creek habitats.

An important consideration was that the Pacific Northwest beetle fauna is taxonomically relatively well known, largely because of Beetles of the Pacific Northwest (Hatch, 1953, 1957, 1961, 1965, 1971). This is in contrast to many other insect orders and arthropods, such as flies (Diptera). A further advantage is that beetles tend to remain in a good state of preservation in pitfalls, even those left for long periods or in which the preservative becomes dilute. Beetles are also relatively easy to prepare for identification.

As detailed in the following Methods section, resource constraints prevented sampling the same number of habitats in 1996 as were surveyed in 1995. The trapping period was also truncated. Because of the dissimilarity in sampling effort between years, 1996 data will generally be presented in parallel with 1995 data rather than directly compared. My M.S. thesis (in prep.) will be a detailed analysis of those habitats and periods sampled in both years.

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 and 62 lake/ponds represented on the USGS 7.5' topographical maps.

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 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 strong microclimatic variation.

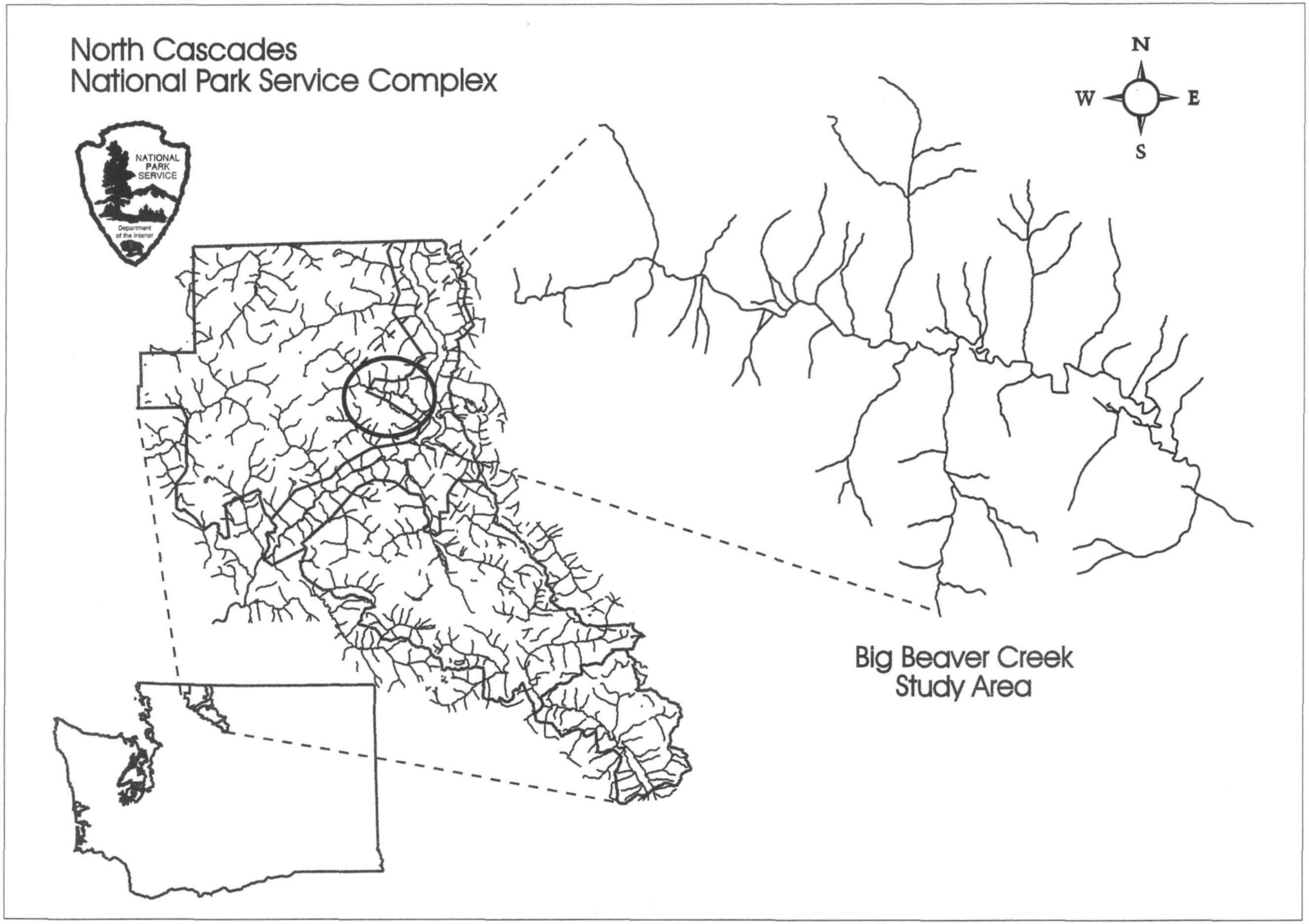


Figure 1. Location of Big Beaver Creek study area in North Cascades National Park Service Complex, Washington.

For example, the north facing slopes stay cool and moist through the summer months because they receive very little direct sunlight.

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

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). Beavers are responsible for formation of most of the pond habitat in the lower valley. Thus, aquatic and riparian communities of the lower valley are largely dependent on beavers.

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 A1 to A8). 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 included the following: Alder Swamp (AS), Acer Thicket (AT), Sphagnum

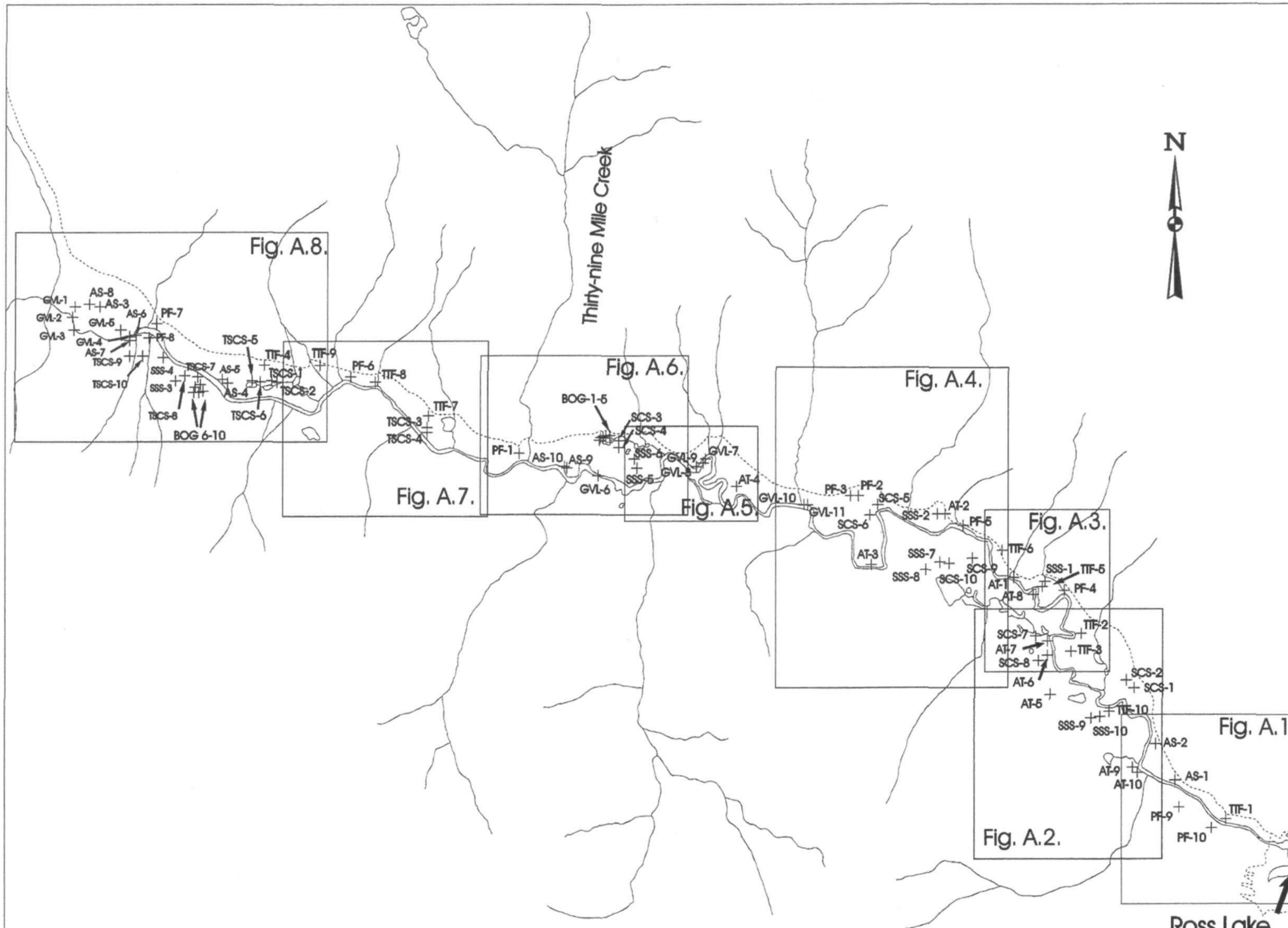


Figure 2. Arthropod pitfall trap locations, Big Beaver Creek, North Cascades National Park Service Complex, Washington, 1995-1996. (Boxes refer to aerial photos found in the Appendix, Figures A.1. - A.8.)

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*.

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. 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 with a 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 over of sampled habitats, as well as the lowest species richness of herbs and shrubs. No shrubs were dominant, average shrub cover was 21%, with average of 2.5 species per plot.

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, approximately 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 the snow-free seasons of 1995 and 1996. Pitfall traps were used for collection of all specimens. Pitfall trapping is a well-established method for sampling ground-active arthropods, with an extensive literature dealing with the protocols and limitations of this technique (*e.g.* Adis 1979, Mommertz *et al.* 1996, Spence and Niemela 1994). The primary constraints of pitfalls are that they selectively sample surface-active arthropods (versus litter-dwelling or arboreal species) and they do not provide direct unbiased measures of abundance. Pitfall traps preferentially sample large, active species and not all such are equally susceptible to this sampling method. Pitfall efficacy is also a function of climatic conditions, since these affect arthropod activity. For instance, very cold or dry conditions often result in reduced catches since many arthropods are less active under these circumstances. A further complication is that pitfalls trapping for relatively long periods may strongly attract necrophagous (carrion-feeding) insects (e.g. blowflies and burying beetles), especially traps that incidentally capture vertebrates and those with dilute preservative. There is also evidence that ethylene glycol, a standard preservative used in pitfalling, actively atttracts some species or genders of insects (Holopainen 1990). As far as I know, no such evidence exists regarding the preservative used in the Big Beaver Creek study, propylene glycol, but it seems likely that it would have similar effects.

While not negating the utility of pitfalls or the information that can be gleaned from this method, it is essential to consider these biases and limitations when analyzing pitfall data. All of the above concerns will be addressed in following discussions and analyses.

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 set 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 for 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 type, ten separate patches were randomly selected from the population of all patches of that habitat type in the study area. One pitfall trap was placed per habit patch (Figure 2), with the exception of BOG and GVL sites in 1995. There were only two patches of the BOG habitat type in the valley, for which five pitfall traps were placed at each of these sites. For GVL sites, 11 separate patches were selected in 1995 and 10 in 1996. Traps operated continuously throughout the sampling period from early May through October of 1995. In 1996, resource constraints and extensive bear damage to early season traps (up to 70% of May traps/habitat were destroyed in 1995), resulted in restricting the sampling period to early June through early October. As previously mentioned, resource constraints also reduced the number of habitat types to five: AS, GVL, PF, SCS and TTF. Thus, 91 traps were utilized in 1995 and 50 in 1996. In order to reduce "trap-out" effects and individual trap location bias, each 1996 trap position was shifted approximately 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 vertebrates collected by the pitfalls were also recorded, and all such specimens were retained.

All beetle specimens were identified, most to species. It was not possible to identify several species as the gender collected lacked the necessary taxonomic characters, such as *Lobrathium* sp. (Staphylinidae). Although three species of *Catops* (Leiodidae: Leptodirinae) were identified, complete identification of *Catops* spp. to species proved to be infeasible, as the existing taxonomic keys only enable males to be identified with certainty, and even these must have the genitalia extracted. The large numbers of these beetles rendered such procedures impractical. Since early samples only contained one species of *Nicrophorus* (Silphidae), it was decided to preserve large series of this genus in alcohol to expedite sample processing. Subsequently, two species of *Nicrophorus* were found to be present, *N. defodiens* and *N. investigator*. It was decided to simply record the alcohol specimens as *Nicrophorus* spp., since both species have very similar trophic roles (Ratcliffe 1996). Most Aleocharinae (Staphylinidae) were not identified below this level because there are no adequate taxonomic treatments for most members of this subfamily. *Catops* spp., *Nicrophorous* spp., and Aleocharinae were excluded from species counts because of these difficulties.

Results and Discussion

Table 1 summarizes the number of families, species, individuals, and individuals minus necrophages for each habitat. A total of 18,766 individuals were collected during 1995 and 1996, representing 49 beetle families and 355 species (in addition, two species of *Nicrophorus* and 3 species of *Catops* were also identified but not included in the analysis - see methods section). The total number of beetle individuals collected from Big Beaver Creek pitfall traps, during 1995, was 12,678, representing 42 families and 304 species. Resampling of five of the nine habitat types during 1996 added seven additional families and 51 additional species to the totals from 1995. Total 1996 individuals were 6,088, representing 36 families and 217 species.

In 1995, the number of families per habitat ranged from 16 (PF and TSCS) to 22 (AS and GVL). Species per habitat ranged from 51 (BOG) to 104 (AS). Including necrophages (5,884), beetle individuals per habitat ranged from 413 (BOG) to 3,267 (AT). Excluding necrophages, individuals totalled 6,794 with individuals per habitat ranging from 180 (BOG) to 1,287 (GVL). Number of families, species, and number of individuals collected at four of the five resampled habitat types in 1996 followed a pattern similar to that of 1995 (Table 1). Gravel bar samples were an exception, exhibiting fewer families and species of beetles in 1996. This may reflect the reduced sampling effort in 1996. The heavy flooding that occurred during the spring of 1996 may also have been a significant factor.

Table 2 (1995 data) and Table 3 (1996 data) display the numbers of each species in each habitat, as well as the total number of each species collected during the 1995 and 1996 Big Beaver Creek survey. Appendix Table A1 lists each species, the family it represents, the number of species found per family in the course of sampling, the trophic functional group of adults and larvae of each species, as well as comments about diet or ecology.

Family Accounts

Beetle family boundaries

Other than overall beetle abundance, the coarsest level of resolution is provided by analysis at the family level. Unfortunately, this approach is complicated by considerable controversy over the boundaries of most families of beetles. Reviewing five recent schemata of beetle families revealed surprisingly little consensus regarding several key families/groups, such as the Staphylinidae (Borror *et al.* 1989, Crowson 1981, Downey and Arnett 1995, Lawrence and Newton 1995, Stehr 1991). Although I initially followed a very conservative approach, I ultimately determined the best strategy was to utilize one of the more recent schemata. In general, I used Lawrence and Newton (1995) as the basis for family boundaries. Consequently, Cicindelidae (*Cicindela* spp.) were included within Carabidae; Leptodiridae (*Catops* spp. and *Catoptrichus frankenhaeuseri* (Mannerheim)) and Leptinidae (*Leptinus occidentamericanus* Peck) were included in Leiodidae; all Pselaphidae, the single species of Clambidae (*Empelus*

Table 1. Number of Coleoptera taxa and number of individuals collected from the Big Beaver Creek study area, North Cascades National Park Service Complex, Washington, 1995 and 1996. (AS = Alder swamp, AT = Acer thicket, BOG = Sphagnum bog, GVL = Gravel bar, PF = Douglas Fir forest, SCS = Salix - Carex swamp, SSS = Salix - Spiraea swamp, TSCS = Cedar - Salix - Carex swamp, TTF = Hemlock - Cedar Forest).

Sample Period: May - Oct. 1995 Sample Effort: (Trap - days)* =	AS 1380	AT 1200	BOG 1500	GVL 1620	PF 1200	SCS 1410	SSS 1410	TSCS 1290	TTF 1230	TOTAL 12240
NO. OF FAMILIES	22	19	17	21	16	18	18	16	17	**42**
NO. OF SPECIES**	102	78	49	79	55	72	62	65	78	**304**
NO. OF INDIVIDUALS	2082	3267	413	1355	979	1159	1083	965	1375	**12678**
NO. OF INDIVIDUALS (without Necrophages)	1102	1104	180	1287	724	647	485	544	721	**6794**

Sample Period: June - Oct. 1996 Sample Effort: (Trap - days)* =	AS 1140	AT	BOG	GVL 1170	PF 1110	SCS 1140	SSS	TSCS	TTF 1080	TOTAL 5640
NO. OF FAMILIES	20			14	18	18			19	**36**
NO. OF SPECIES**	92			46	59	73			77	**217**
NO. OF INDIVIDUALS	1328			880	1472	1154			1254	**6088**
NO. OF INDIVIDUALS (without Necrophages)	1088			749	931	702			896	**4366**

* Trap - days varied for each habitat type depending on the level of disturbance by bears and other animals.

** *Catops spp.*, *Nicrophorus spp.*, and unidentified Aleocharinae taxa were excluded from the species counts.

Table 2. Pitfall trap captures of Coleoptera from nine riparian habitat types in Big Beaver Creek, North Cascades National Park Service Complex, Washington, May - October, 1995.
(AS = Alder Swamp, AT = Acer Thicket, BOG = Sphagnum Bog, GVL = Gravel Bar, PF = Douglas-fir Forest, SCS = Salix-Carex Swamp, SSS = Salix-Spiraea Swamp, TSCS = Cedar-Salix-Carex Swamp, TTF = Hemlock-Cedar Forest.)

	HABITAT TYPES									Species	Family
SPECIES*	AS	AT	BOG	GVL	PF	SCS	SSS	TSCS	TTF	Totals	Totals
Amphizoidae (1 species)											
Amphizoa insolens LeConte				1						1	1
Anthicidae (3 species)											
Anthicus nanus LeConte				19		1				20	
Eurygenius campanulatus LeConte				373						373	
Ischalia vancouverensis Harrington	1								1	2	395
Buprestidae (1 species)											
Agrilus politus (Say)			1							1	1
Byrrhidae (7 species)											
Byrrhus kirbyi LeConte	1									1	
Curimopsis albonotata LeConte				1						1	
Cytilus alternatus Say						8	36			44	
Exomella pleuralis (Casey)								1		1	
Listemus acuminatus (Mannerheim)	1	1								2	
Morychus aeneolus LeConte				3						3	
Morychus oblongus LeConte				1						1	53
Cantharidae (4 species)											
Cantharis oregonus LeConte				1						1	
Malthodes sp.				1						1	
Podabrus conspiratus Fall					1					1	
Podabrus piniphilus Dejean		4			3				2	9	12
Carabidae (54 species)											
Agonum affine Kirby							1			1	
Agonum brevicolle Dejean			10			138	57			205	
Agonum ferruginosum Dejean	1					17	13	4		35	
Agonum piceolum LeConte	2	1								3	
Agonum thoreyi Dejean						1	17			18	
Amara littoralis Mannerheim						2				2	
Amara sanjuanensis Hatch		1								1	
Anchomenus quadratus (LeConte)						1				1	
Anisodactylus binotatus Fabricius						1				1	
Apristus constrictus Casey				1						1	
Bembidion breve (Motschulsky)				1						1	
Bembidion concretum Casey						1				1	
Bembidion convexulum Hayward						3		1		4	
Bembidion fortestriatum Motschulsky			9			5	11	5		30	
Bembidion hesperum Casey				1						1	
Bembidion inaequale Say				1						1	
Bembidion incrematum LeConte						6	11			17	
Bembidion iridescens LeConte		3								3	
Bembidion kuprianovi Mannerheim	30			2					3	35	
Bembidion semipunctatum Kirby							1			1	
Bembidion planatum LeConte				40						40	
Bembidion planiusculum Mannerheim				2						2	
Bembidion quadrifoveolatum Mann.							1			1	
Bembidion quadrulum LeConte				1						1	
Blethisa oregonensis LeConte						65				65	
Bradycellus conformis Fall			1			8		10		19	

Table 2. (Continued)

SPECIES*	AS	AT	BOG	GVL	PF	SCS	SSS	TSCS	TTF	Species Totals	Family Totals
	HABITAT TYPES										
Bradycellus lecontei Csiki							2			2	
Bradycellus nigrinus Dejean						26	15			41	
Chlaenius interruptus Horn			3			21	12			36	
Cicindela depressula Casey				26						26	
Cicindela oregona LeConte				23						23	
Diplous atterrimus Dejean				4						4	
Elaphrus clairvillei Kirby			2			1	1			4	
Elaphrus purpurans Hausen	1									1	
Harpalus cordifer Notman	6									6	
Harpalus somnulentus Dejean						1		1		2	
Leistus ferruginosus Mannerheim	12	3			1			3	22	41	
Loricera decempunctata Eschscholtz	3	6				18	31	23	1	82	
Nebria mannerheimi Fischer				40						40	
Nebria sahlbergi Fischer				20						20	
Notiophilus sylvaticus Eschscholtz					1				2	3	
Opisthius richardsoni Kirby				14						14	
Patrobus fossifrons dimorphicus Darl.	2								1	3	
Pterostichus adstrictus Eschscholtz	21					21	2		2	46	
Pterostichus herculaneus Mannerheim	9	6	1	2	27			4	18	67	
Pterostichus neobrunneus Lindroth	2	11			53				62	128	
Pterostichus riparius Dejean	28	1		4		13		23	5	74	
Scaphinotus angulatus Harris		7			2					9	
Scaphinotus angusticollis Mannerheim	35	86			343		1		211	676	
Scaphinotus marginatus Fischer	30	8		1	3	9	7	1	17	76	
Synuchus impunctatus Say					1				2	3	
Trechus chalybeus Dejean	4	6				18	6	38		72	
Trechus oregonensis Hatch	5	1					1	53		60	
Trichocellus cognatus Gyllenhal						9				9	2058
Cerambycidae (5 species)											
Brachyleptura dehiscens (LeConte)				1						1	
Leptura obliterata Haldeman		1								1	
Plectura spinicauda Mannerheim		3								3	
Xestoleptura crassipes (LeConte)			1			1		1		3	
Xestoleptura tibialis LeConte			1							1	9
Chrysomelidae (10 species)											
Altica corni Woods		1								1	
Altica tombacina Mannerheim			1	1		2				4	
Chaetocnema irregularis LeConte			1			1				2	
Chrysomela mainensis Bechyne	1									1	
Crepidodera nana (Say)						1				1	
Hippuriphila mancula LeConte						2				2	
Macrohaltica caurina Blake				2						2	
Plateumaris nitida Germar			1							1	
Pyrrhalta punctipennis Mannerheim, aberration *pallida* Beller & Hatch							3			3	
Pyrrhalta spiraeophila Hatch & Beller			1							1	18
Ciidae (1 species)											
Cis maritimus (Hatch)									1	1	1
Coccinellidae (3 species)											
Hippodamia washingtoni Timberlake							2			2	
Scymnus caurinus Horn				2						2	

Table 2. (Continued)

SPECIES*	AS	AT	BOG	GVL	PF	SCS	SSS	TSCS	TTF	Species Totals	Family Totals
					HABITAT TYPES						
Stethorus punctum picipes Casey	1									1	5
Cryptophagidae (11 species)											
Anchicera ephippiata Zimmerman								3		3	
Anchicera kamtschatica Motschulsky	6							12		18	
Anchicera ochracea Zimmerman			1					1		2	
Anchicera postpallens Casey						12	1			13	
Antherophagus ochraceus Melsh.				1						1	
Atomaria constricta Casey				1						1	
Atomaria quadricollis Casey								1		1	
Cryptophagus confertus Casey	1	3			1				5	10	
Cryptophagus lapponicus Gyllenhal		1							2	3	
Cryptophagus tuberculosus Maklin	1									1	
Henotiderus lorna Hatch					2					2	55
Curculionidae (8 species)											
Baris sparsa LeConte				1						1	
Cryptorhynchus lapathi Linnaeus							1	5		6	
Geoderces horni Van Dyke					2				1	3	
Lepesoma lecontei Casey					2					2	
Lepesoma verrucifera Casey									2	2	
Rhyncolus brunneus Mannerheim	1	1			3		1		6	12	
Steremnius carinatus Boheman	1	4			18		1		7	31	
Sthereus horridus (Mannerheim)	22	11			2				5	40	97
Dytiscidae (7 species)											
Agabus austinii Sharp								1		1	
Agabus strigulosus (Crotch)						1		3		4	
Agabus sp. (female)	1						1			2	
Dytiscus sp.						1				1	
Graphoderus perplexus Sharp			1							1	
Hydroporus pacificus Fall								1		1	
Hydroporus sp.			1							1	11
Elateridae (24 species)											
Agriotes ferrugineipennis LeConte		1								1	
Ampedus rhodopus LeConte				1						1	
Athous rufiventris Eschscholtz				1				1		2	
Athous vittiger LeConte	1								1	2	
Cardiophorus amplicollis Motschulsky				10						10	
Cardiophorus propinquus Hatch				246						246	
Ctenicera aeripennis (Kirby)							1			1	
Ctenicera angusticollis Mannerheim	5				1				1	7	
Ctenicera opacula (LeConte)		1								1	
Ctenicera volitans Eschscholtz		2								2	
Dalopius maritimus Brown		2		1						3	
Eanus striatipennis Brown			4							4	
Hemicrepidius pallidipennis Mann.	3									3	
Hypnoidus bicolor Eschscholtz				6						6	
Hypolithus dispersus Horn		1		88						89	
Hypolithus musculus Eschscholtz				54						54	
Hypolithus nocturnus Eschscholtz				1						1	
Hypolithus squalidus LeConte				3						3	
Hypolithus sp.				31						31	

Table 2. (Continued)

SPECIES*	AS	AT	BOG	GVL	PF	SCS	SSS	TSCS	TTF	Species Totals	Family Totals
				HABITAT TYPES							
Ligmargus funebris Candeze				125						125	
Megapenthes caprella (LeConte)			1							1	
Migiwa striatulus (LeConte)				9						9	
Negastrius ornatus (LeConte)				20						20	
Zorochrus caurinus Horn				6			1			7	629
Erotylidae (1 species)											
Triplax antica LeConte	1									1	1
Histeridae (1 species)											
Hypocaccus bigemmeus LeConte				2						2	2
Hydraenidae (2 species)											
Hydraena vandykei vandykei d'Orch.						2	5			7	
Ochthebius cribricollis LeConte						1				1	8
Hydrophilidae (4 species)											
Cercyon adumbratum Mannerheim	3									3	
Crenitis paradigma d'Orchymont						1		4		5	
Cymbiodyta acuminata Fall							1			1	
Helophorus auricollis Eschscholtz						2				2	11
Lampyridae (1 species)											
Phausis skelleyi Fender		2								2	2
Latridiidae (5 species)											
Enicmus cordatus Belon					2				1	3	
Melanopthalma americana Mannerheim			11			45	6	5		67	
Melanopthalma distinguenda Com.			8			1	1			10	
Melanopthalma gibbosa Herbst			2			1		1		4	
Steposthethus liratus LeConte	1									1	85
Leiodidae (20 species)											
Agathidium californicum Horn	1								1	2	
Agathidium concinnum Mannerheim	1								1	2	
Agathidium contiguum Fall	1									1	
Agathidium jasperinum Fall	3	1		1	1					6	
Anisotoma confusa Horn					1					1	
Catops basilaris Say	14									14	
Catops egenus Horn	36	5					26	22		89	
Catops simplex Say	1						1	2		4	
Catops spp.	882	2088	84	57	203	74	328	273	540	4529	
Catoptrichus frankenhaeuseri (Mann.)	2	18			1					21	
Colon inerme Mannerheim		4					2			6	
Colon magnicolle Mannerheim		2		1		1	2	3		9	
Colon nevadense Horn		3								3	
Colon serripoides Hatch						4	3	5		12	
Colon sp.		1			2				2	5	
Leiodes alesi Baronowski		1								1	
Leiodes cascadensis Baranowski	8					2	3	7	2	22	
Leiodes lateritia (Mannerheim)	1								2	3	
Leiodes puncticollis (Thomson)		2			3				1	6	
Leptinus occidentamericanus Peck	4	1	2	1					1	9	
Platycholeus opacellus Fall				1						1	4746
Lycidae (1 species)											
Dictyopterus simplicipes Mannerheim	2									2	2

Table 2. (Continued)

SPECIES*	HABITAT TYPES AS	AT	BOG	GVL	PF	SCS	SSS	TSCS	TTF	Species Totals	Family Totals
Melandryidae (1 species)											
Xylita laevigata Hellenius						1				1	1
Mordellidae (1 species)											
Mordella atrata Melsheimer			1							1	1
Nitidulidae (1 species)											
Epuraea avara Randall			1							1	1
Oedemeridae (4 species)											
Calopus angustus LeConte									1	1	
Ditylus gracilis LeConte	2	5			1			1	3	12	
Ditylus quadricollis LeConte	7	6		19			1	2		35	
Xanthochroa testacea Horn									1	1	49
Phalacridae (2 species)											
Phalacrus pencillatus Say						2				2	
Stilbus apicalis Melsheimer		1	1				3			5	7
Ptiliidae (4 species)											
Acrotrichis cognata Matthews		10	7		1		1			19	
Acrotrichis henrici Matthews			1					9		10	
Acrotrichis vicina Matthews	8	8	1			5	6	4	1	33	
Ptenidium pusillum Gyllenhal			1			1	5	7		14	76
Ptilodactylidae (1 species)											
Araeopidius monachus LeConte			1							1	1
Pyrochroidae (2 species)											
Dendroides ephemeroides Mannerheim	2	2		1						5	
Pedilus jonae Young	1									1	6
Pythidae (1 species)											
Priognathus monilicornis Randall									1	1	1
Scarabaeidae (4 species)											
Aegialia lacustris LeConte				2						2	
Aegialia opaca Brown				1						1	
Aphodius opacus LeConte		2			1				1	4	
Onthophagus nuchicornis Linnaeus						1				1	8
Scirtidae (3 species)											
Cyphon brevicollis LeConte	1	1				1	3			6	
Cyphon padi Linnaeus			1							1	
Cyphon variabilis Thunberg			5			1		2		8	15
Scolytidae (1 species)											
Gnathotrichus retusus (LeConte)						1				1	1
Scydmaenidae (3 species)											
Scydmaenus californicus Motschulsky	4	7		1	2			1	1	16	
Scydmaenus fuchsi Bndl.									1	1	
Veraphis mirabilis Marsh	2	15			4					21	38
Silphidae (3 species)											
Nicrophorus defodiens Mannerheim	40	51	57	5	10	94	96	26	22	401	
Nicrophorus investigator Zetterstedt	5	1	17	6		6	7		2	44	
Nicrophorus spp. (in alcohol)			75		41	336	140	98	90	780	
Thanatophilus lapponicus (Herbst)						2				2	1227
Sphaeritidae (1 species)											
Sphaerites politus Mannerheim	2									2	2

Table 2. (Continued)

SPECIES*	AS	AT	BOG	GVL	PF	SCS	SSS	TSCS	TTF	Species Totals	Family Totals
	HABITAT TYPES										
Staphylinidae (97 species)											
Acidota crenata Fabricius	7	1			1				1	10	
Actium barri Park & Wagner		1			3				3	7	
Aleochara bilineata Gyllenhal				2		1				3	
Aleochara bimaculata Gravenhorst			1	1						2	
Aleocharinae	348	616	18	7	138	47	99	117	117	1507	
Amphicroum maculatum Horn									1	1	
Anthobium clarkae Hatch	2				5				1	8	
Anthobium reflexicolle Casey	14			1					11	26	
Anthobium sinuosum Hatch	1	1								2	
Baeocera humeralis Fall	1		2							3	
Batrisodes albionicus (Aube)		1						3		4	
Bisnius siegwaldi (Mannerheim)	14	1			1	1	2		5	24	
Bledius suturalis LeConte				6						6	
Bolitobius kremeri Maklin	2				1				2	5	
Bryophacis discalis (Hatch)		1								1	
Bryophacis punctatissimus Hatch	2				1					3	
Bryophacis punctulatus Hatch	3									3	
Cupila excavata Park & Wagner	2		4		2	2		1		11	
Cypha crotchi Horn				2						2	
Elonium NEAR *barri* (Hatch)	2								7	9	
Elonium rugosa (Hatch)		1								1	
Empelus brunnipennis Mannerheim	2			1	1				3	7	
Erichsonius cinerascens Gravenhorst			10			1	3			14	
Eusphalerum fenyesi Bernh.	2	1								3	
Eusphalerum pothos Mannerheim	2	1	2							5	
Gabrius cushmani Hatch	2	25			1			2	6	36	
Gabrius picipennis Maklin	2		5			1	1	15		24	
Gabrius seattlensis Hatch	41					2	1	4		48	
Gabrius shulli Hatch	9								3	12	
Hemiquedius fusculus (LeConte)				2						2	
Ischnosoma fimbriatum Campbell	1	1						1		3	
Ischnosoma pictum (Horn)	2				1			1		4	
Ischnosoma splendidus (Gravenhorst)								4		4	
Lathrobium punctulatum? LeConte						3				3	
Lathrobium vancouveri Casey		1								1	
Lithocaris capitula Casey			1				1			2	
Lobrathium sp.				1						1	
Lordithon fungicola Campbell	39	2		4	13		1	11	7	77	
Lordithon poecilus Mannerheim	13	7			3		1		7	31	
Lordithon thoracicus Fabricus	1						1			2	
Lucifotychus cognatus LeConte	3			1		1		1	4	10	
Lucifotychus impellus Park & Wagner				1						1	
Mathrilaeum subcostatum Maklin		1			1		1		1	4	
Megarthrus pictus Motschulsky	7								9	16	
Megarthrus sinuaticollis Boisd. & Lac.	26		2		3				1	32	
Microedus austinianus LeConte				1						1	
Micropeplus minor Campbell								1		1	
Micropeplus nelsoni Campbell	4									4	
Mycetoporus americanus Erichson	2									2	
Mycetoporus bipunctatus Campbell									1	1	

Table 2. (Continued)

SPECIES*	AS	AT	BOG	GVL	PF	SCS	SSS	TSCS	TTF	Species Totals	Family Totals
					HABITAT TYPES						
Mycetoporus maculicollis LeConte							1			1	
Mycetoporus pacificus Campbell	3	1							2	6	
Olophrum consimile Gyllenhal							6			6	
Omalium foraminosum Maklin	3	1								4	
Ontholestes cingulatus Gravenhorst			1						1	2	
Oropodes dybasi Grigarick & Schuster				1						1	
Oropus striatus (LeConte)	2	11			3			1	4	21	
Orus punctatus Casey			1							1	
Oxyporus occipitalis Fauvel									1	1	
Oxytelus laqueatus Marsham	37	5				1		2	1	46	
Pelecomalium testaceum Mannerheim	2									2	
Philonthus crotchi Horn			15			9	6	5	1	36	
Philonthus cruentatus (Gmelin)			2							2	
Philonthus duplicatus Bernh. & Schub.								1		1	
Philonthus furvus Nordmann	1					1		1		3	
Philonthus varians Paykull		1								1	
Proteinus basalis Maklin	12	8			2		1	1	4	28	
Proteinus collaris Hatch	63	82						4	26	175	
Proteinus limbatus Maklin	7	1						1	11	20	
Pseudopsis sulcata Newman	2									2	
Quedius aenescens Maklin	1									1	
Quedius breviceps? Casey	1									1	
Quedius crescenti Hatch	1								1	2	
Quedius fulvicollis (Stephens)								10		10	
Quedius griffinae Hatch	1								1	2	
Quedius horni Hatch	21	11		2		2	1	15	7	59	
Quedius nevadensis Casey				1						1	
Quedius oculeus Casey					1					1	
Reichenbachia albionica Motschulsky	17		4	1		35	44	68	2	171	
Sonoma hespera Park & Wagner			1		1					2	
Staphylinus pleuralis LeConte	5	16			28			2	31	82	
Staphylinus rutilicauda Horn	1			1						2	
Stenus juno Fabricius						6				6	
Stenus laccophilus Casey	1					9	3	7		20	
Stenus occidentalis Casey			10				8			18	
Stenus subgriseus Casey			5			23	3			31	
Subhaida ingrata (Hatch)		1								1	
Tachinus basalis Erichson	3	1		1	1				3	9	
Tachinus crotchii Horn	61	50	10	6	13	8	12	9	12	181	
Tachinus maculicollis Maklin	8	1						1	7	17	
Tachinus nigricornis Mannerheim					2				6	8	
Tachinus semirufus Horn					10				7	17	
Tachyporus canadensis Campbell						2	7	6		15	
Tachyporus chrysomelinus Linnaeus								1		1	
Tachyporus maculicollis Campbell						1		1		2	
Tachyporus mexicanus Sharp						2	3			5	
Trichophya pilicornis Gyllenhal				5		1				6	
Unamis fulvipes Fall		1								1	3020

Table 2. (Continued)

	HABITAT TYPES										
SPECIES*	AS	AT	BOG	GVL	PF	SCS	SSS	TSCS	TTF	Species Totals	Family Totals
Tenebrionidae (2 species)											
Helops pernitens LeConte									2	2	
Scaphidema pictum Horn				13						13	15
Throscidae (2 species)											
Aulonthroscus validus LeConte					1					1	
Pactopus hornii LeConte				2						2	3
Trogositidae (1 species)											
Temnochila chlorodia Mannerheim					1					1	1
Zopheridae (1 species)											
Phellopsis porcata LeConte					3					3	3

* Catops spp., Nicrophorus spp. and unidentified Aleocharinae were excluded from the species counts.

Table 3. Pitfall trap captures of Coleoptera from nine riparian habitat types in Big Beaver Creek, North Cascades National Park Service Complex, June – October, 1996

(AS = Alder Swamp, AT = Acer Thicket, BOG = Sphagnum Bog, GVL = Gravel Bar, PF = Douglas-fir Forest, SCS = Salix-Carex Swamp, SSS = Salix-Spiraea Swamp, TSCS = Cedar-Salix-Carex Swamp, TTF = Hemlock-Cedar Forest) (Shaded areas represent families and species not collected in 1995).

SPECIES*	HABITAT TYPES AS	GVL	PF	SCS	TTF	Species Totals	Family Totals
Anthicidae (3 species)							
Anthicus nanus LeConte		5				5	
Eurygenius campanulatus LeConte		116				116	
Ischalia vancouverensis Harrington	11				1	12	133
Byrrhidae (2 species)							
Cytilus alternatus Say				11		11	
Morychus aeneolus LeConte					1	1	12
Cantharidae (3 species)							
Malthodes alexanderi Fender			1			1	
Malthodes sp.			1			1	
Podabrus piniphilus Dejean		1				1	3
Carabidae (45 species)							
Agonum brevicolle Dejean				308		308	
Agonum consimile Gyllenhal				4	1	5	
Agonum ferruginosum Dejean	1			34		35	
Agonum piceolum LeConte	3				1	4	
Agonum thoreyi Dejean				3		3	
Apristus constrictus Casey		1				1	
Bembidion erasum LeConte				1		1	
Bembidion fortestriatum Motschulsky				7		7	
Bembidion incrematum LeConte				5		5	
Bembidion kuprianovi Mannerheim	5		1			6	
Bembidion planatum LeConte		22				22	
Bembidion planiusculum Mannerheim		2				2	
Bembidion quadrifoveolatum Mann.				1		1	
Bembidion quadrimaculatum dubitans LeC.				1		1	
Bembidion semipunctatum Donovan				1		1	
Bembidion stillaguamish Hatch		1				1	
Blethisa oregonensis LeConte				3		3	
Calathus fuscipes Goeze	1					1	
Chlaenius interruptus Horn				5		5	
Cicindela depressula Casey		8				8	
Cicindela oregona LeConte		29				29	
Diplous atterrimus Dejean		2				2	
Elaphrus purpurans Hausen	5					5	
Harpalus cordifer Notman	1					1	
Harpalus somnulentus Dejean				3		3	
Leistus ferruginosus Mannerheim	7				7	14	

Table 3. (Continued)

SPECIES*	HABITAT TYPES					Species Totals	Family Totals
	AS	GVL	PF	SCS	TTF		
Loricera decempunctata Eschscholtz	7			25		32	
Nebria gebleri cascadensis Kavanaugh		1				1	
Nebria mannerheimi Fischer		2				2	
Nebria sahlbergi Fischer		7				7	
Patrobus fossifrons dimorphicus Darl.				1	1	2	
Pterostichus adstrictus Eschscholtz	6			11	6	23	
Pterostichus castaneus Dejean					1	1	
Pterostichus herculaneus Mannerheim	6		26		15	47	
Pterostichus neobrunneus Lindroth	1		33		36	70	
Pterostichus riparius Dejean	12				1	13	
Scaphinotus angulatus Harris			3			3	
Scaphinotus angusticollis Mannerheim	31		200		252	483	
Scaphinotus marginatus Fischer	23		1	4	15	43	
Synuchus impunctatus Say					1	1	
Trechus chalybeus Dejean	3			13		16	
Trechus oregonensis Hatch				2		2	
Trichocellus cognatus Gyllenhal				2		2	1222
Cerambycidae (1 species)							
Stenocorus flavolineatus LeConte					1	1	1
Chrysomelidae (4 species)							
Altica tombacina Mannerheim				1		1	
Chaetocnema irregularis LeConte				1		1	
Macrohaltica ambiens LeConte	1	1				2	
Pyrrhalta punctipennis pallida Bel.&Hat.				3		3	7
Ciidae (2 species)							
Cis americanus Mannerheim			1			1	
Octotemnus laevis Casey	1					1	2
Coccinellidae (2 species)							
Hippodamia washingtoni Timberlake				1		1	
Scymnus caurinus Horn		1				1	2
Colydiidae (1 species)							
Lasconotus vegrandis Horn	1					1	1
Corylophidae (1 species)							
Orthoperus scutellaris LeConte				1		1	1
Cryptophagidae (8 species)							
Anchicera ephippiata Zimmerman	1					1	
Anchicera kamtschatica Motschulsky	11					11	
Anchicera postpallens Casey				2		2	
Caenoscelis ferruginea Sahlberg					1	1	
Cryptophagus cellaris Scopoli			1			1	
Cryptophagus confertus Casey	4		13		7	24	
Cryptophagus lapponicus Gyllenhal			2		2	4	

Table 3. (Continued)

SPECIES*	AS	GVL	PF	SCS	TTF	Species Totals	Family Totals
	HABITAT TYPES						
Henotiderus lorna Hatch			1			1	45
Curculionidae (5 species)							
Lepesoma lecontei Casey			3			3	
Lepesoma verrucifera Casey			1			1	
Rhyncolus brunneus Mannerheim		1	12	1	10	24	
Steremnius carinatus Boheman			6		4	10	
Sthereus horridus (Mannerheim)	11		3		5	19	57
Dytiscidae (5 species)							
Agabus anthracinus Mannerheim				2		2	
Agabus strigulosus (Crotch)				4		4	
Agabus tristis Aube				1		1	
Hydroporus pacificus Fall	1			1		2	
Rhantus suturellus Harris				2		2	11
Elateridae (19 species)							
Ampedus carbonicolor Eschscholtz	1		1			2	
Cardiophorus amplicollis Motschulsky		3				3	
Cardiophorus propinquus Hatch		61				61	
Ctenicera angusticollis Mannerheim	1		1		1	3	
Ctenicera propola columbiana Brown					1	1	
Ctenicera resplendens (Eschscholtz)			1			1	
Ctenicera suckleyi (LeConte)			1			1	
Ctenicera umbripennis (LeConte)			1			1	
Ctenicera volitans (Eschscholtz)					1	1	
Dalopius maritimus Brown		2		1		3	
Hemicrepidius pallidipennis Mann.	2		1		1	4	
Hypolithus dispersus Horn		46				46	
Hypolithus musculus Eschscholtz	1	257				258	
Hypolithus squalidus LeConte		1				1	
Hypolithus sp.		103		2		105	
Ligmargus funebris Candeze		12				12	
Migiwa striatulus (LeConte)		17		1		18	
Negastrius ornatus (LeConte)		3				3	
Zorochrus caurinus Horn		7				7	531
Endomychidae (1 species)							
Xenomycetes laversi Hatch					1	1	1
Gyrinidae (1 species)							
*Gyrinis picipes*Aube				2		2	2
Hydraenidae (1 species)							
Hydraena vandykei vandykei d'Orch.				1		1	1
Hydrophilidae (2 species)							
Cercyon adumbratum Mannerheim	22					22	
Megasternum posticatum (Mannerheim)	1		1			2	24
Laemophloeidae (1 species)							

Table 3. (Continued)

SPECIES*	AS	GVL	PF	SCS	TTF	Species Totals	Family Totals
	HABITAT TYPES						
Laemophloeidae (1 species)							
Rhinomalus cygnaei Mannerheim	1					1	1
Latridiidae (3 species)							
Enicmus cordatus Belon			7		1	8	
Melanopthalma americana Mannerheim	1			23		24	
Steposthethus liratus LeConte	1			1		2	34
Leiodidae (16 species)							
Agathidium californicum Horn	1					1	
Agathidium contiguum Fall	2					2	
Agathidium sp. (Near *contiguum* Fall)			2			2	
Anisotoma confusa Horn					1	1	
Anisotoma errans Brown					1	1	
Catops spp.	233	114	530	146	303	1326	
Catoptrichus frankenhaeuseri (Mann.)		1		1	21	23	
Colon complicatum Hatch					1	1	
Colon inerme Mannerheim	1			1		2	
Colon magnicolle Mannerheim	1			1	1	3	
Colon schuhi Hatch				1		1	
Colon serripoides Hatch				34		34	
Hydnobius simulator Brown					1	1	
Leiodes cascadensis Baranowski	1					1	
Leiodes lateritia (Mannerheim)	3		3		5	11	
Leptinus occidentamericanus Peck	1	2	2		1	6	
Nemadus decipiens Horn			7		2	9	1425
Lucanidae (1 species)							
Ceruchus striatus LeConte			1			1	1
Lycidae (1 species)							
Dictyopterus simplicipes Mannerheim					1	1	1
Melyridae (1 species)							
Hypebaeus bicolor (LeConte)			1			1	1
Oedemeridae (2 species)							
Ditylus gracilis LeConte	1				1	2	
Ditylus quadricollis LeConte	6	1			1	8	10
Ptiliidae (4 species)							
Acrotrichis cognata Matthews	7		1	15	27	50	
Acrotrichis henrici Matthews	8			1		9	
Acrotrichis vicina Matthews	9					9	
Ptenidium pusillum Gyllenhal	3			3		6	74
Pyrochroidae (1 species)							
Pedilus jonae Young					1	1	1
Scarabaeidae (2 species)							
Aegialia opaca Brown		1				1	
Aphodius opacus LeConte			1			1	2

Table 3. (Continued)

SPECIES*	AS	HABITAT TYPES GVL	PF	SCS	TTF	Species Totals	Family Totals
Scirtidae (3 species)							
Cyphon brevicollis LeConte	1		1			2	
Cyphon padi (ab. *discolor* Panz.) Linnaeus				3		3	
Cyphon variabilis Thunberg				13		13	18
Scydmaenidae (2 species)							
Scydmaenus californicus Motschulsky	1		2		5	8	
Veraphis mirabilis Marsh			2	1	7	10	18
Silphidae (2 species)							
Nicrophorus defodiens Mannerheim	7	7	11	81	14	120	
Nicrophorus investigator Zetterstedt		9		3		12	
Nicrophorus spp. (in alcohol)				221	20	241	373
Sphaeritidae (1 species)							
Sphaerites politus Mannerheim	1				1	2	2
Staphylinidae (72 species)							
Acidota crenata Fabricius	3					3	
Actium barri Park & Wagner					2	2	
Actium hatchi Park&Wagner	1					1	
Aleochara bimaculata Gravenhorst		1				1	
Aleocharinae	346	6	388	35	267	1042	
Anthobium clarkae Hatch			4		1	5	
Anthobium reflexicolle Casey	54	2				56	
Anthobium sinuosum Hatch	4	1	3		4	12	
Atrecus macrocephalus Nordmann	1					1	
Atrecus punctiventris Fall				1		1	
Baeocera humeralis Fall	1					1	
Bisnius hesperidum Smetana	1			3		4	
Bisnius siegwaldi (Mannerheim)	4		1		3	8	
Bledius cedarensis Hatch	1					1	
Bledius suturalis LeConte		1				1	
Bolitobius kremeri Maklin	3				1	4	
Bryophacis punctatissimus Hatch					1	1	
Dianous nitidulus LeConte				1		1	
Elonium NEAR *barri* (Hatch)	11				23	34	
Empelus brunnipennis Mannerheim	8		3		5	16	
Eusphalerum fenyesi Bernh.	29					29	
Eusphalerum pothos Mannerheim	89	4				93	
Gabrius cushmani Hatch					1	1	
Gabrius picipennis Maklin	2			1		3	
Gabrius seattlensis Hatch	23					23	
Ischnosoma fimbriatum Campbell	3				1	4	
Ischnosoma pictum (Horn)	1					1	
Ischnosoma splendidus (Gravenhorst)					2	2	
Lathrobium punctulatum? LeConte				1		1	
Lathrobium vancouveri Casey				1		1	
Lithocaris capitula Casey				2		2	

Table 3. (Continued)

SPECIES*	AS	GVL	PF	SCS	TTF	Species Totals	Family Totals
	HABITAT TYPES						
Lordithon fungicola Campbell	18	1	26		23	68	
Lordithon poecilus Mannerheim	2		27		16	45	
Lucifotychus cognatus LeConte	6		1	1	1	9	
Mathrilaeum pictum Fauvel			4		1	5	
Megarthrus arcuatus Hatch				1	1	2	
Megarthrus pictus Motschulsky	17					17	
Megarthrus sinuaticollis Boisd. & Lac.	20		4		1	25	
Microedus laticollis Mannerheim		3				3	
Micropeplus nelsoni Campbell	15					15	
Mycetoporus bipunctatus Campbell	2				1	3	
Mycetoporus pacificus Campbell					2	2	
Omalium foraminosum Maklin	1	1			1	3	
Ontholestes cingulatus Gravenhorst				2		2	
Oropus striatus (LeConte)	1		1		5	7	
Oxytelus laqueatus Marsham	6					6	
Philonthus crotchi Horn	1			5		6	
Philonthus furvus Nordmann	2		1	1	2	6	
Philonthus spiniformis Hatch				2		2	
Phlaeopterus frosti Hatch		1				1	
Proteinus basalis Maklin			4		2	6	
Proteinus collaris Hatch	91				9	100	
Proteinus limbatus Maklin	4	1	2		4	11	
Pseudopsis sulcata Newman	1					1	
Quedius crescenti Hatch					1	1	
Quedius fulvicollis (Stephens)	2					2	
Quedius horni Hatch	23			1	1	25	
Reichenbachia albionica Motschulsky	1		1	48		50	
Sonoma hespera Park & Wagner	3		2			5	
Staphylinus pleuralis LeConte	3		7		28	38	
Stenus laccophilus Casey				5		5	
Stenus maritimus Motschulsky	1					1	
Stenus occidentalis Casey				3		3	
Stenus plicipennis Casey				1		1	
Stenus subgriseus Casey				9		9	
Stenus sp.		1				1	
Tachinus basalis Erichson	1		16	1	6	24	
Tachinus crotchii Horn	42	2	16	7	8	75	
Tachinus maculicollis Maklin	7	2	2		2	13	
Tachinus nigricornis Mannerheim			1			1	
Tachinus semirufus Horn			69		35	104	
Tachinus tachyporoides Horn	1					1	
Tachyporus mexicanus Sharp				1		1	2060

Tenebrionidae (1 species)							
Scaphidema pictum Horn		5				5	5
Throscidae (1 species)							
Pactopus hornii LeConte		1				1	1
Zopheridae (1 species)							
Phellopsis porcata LeConte			2		3	5	5

* Catops spp., Nicrophorus spp. and unidentified Aleocharinae were excluded from the species counts.
Shaded areas represent families and species not collected during 1995.

brunnipennis Mannerheim) and the single species of Scaphidiidae (*Baeocera humeralis* Fall) from the Park were included in Staphylinidae; Pedilidae were treated as either Anthicidae (*Eurygenius campanulatus* LeConte) or Pyrochroidae (*Pedilus jonae* Young). However, I balked at treating Scolytidae as Curculionidae.

Incidental families
As mentioned previously, pitfall traps target soil and litter arthropods active upon the substrate surface. However, incidental catches of species from families not normally part of the soil and litter fauna are not uncommon. Examples are species normally found only in association with flowers, shrubs and trees, etc. Pitfall traps in riparian zones may also capture truly aquatic species, especially adults emerging from their terrestrial aestivation, hibernation or pupal chambers. Although it is certainly useful to acknowledge such taxa in faunal lists, they should be excluded from analyses comparing soil and litter faunas. They are not only "strays" foreign to the soil and litter habitats, but pitfalls do not adquately sample such taxa. Admittedly, the analytical impact of these families and species is often at most minor, since they are almost inevitably represented by only a few individuals. The following families in Table 4 (or those species in them collected during this survey) represent "incidentals" from the indicated habitats.

Table 4. Incidental families of Coleoptera collected in pitfall traps in the Big Beaver Creek Research Natural Area, North Cascades National Park Service Complex, Washington, 1995 and 1996.

Primary Habitat	Family
Aquatic	Amphizoidae, Dytiscidae, Gyrinidae, Ptilodactylidae
Flowers, Foliage, Shrubs	Buprestidae, Cantharidae, Cerambycidae, Chrysomelidae, Coccinellidae, Melyridae Mordellidae, Phalacridae
Trees (includes dead and living)	Colydiidae, Laemophloeidae, Lucanidae, Melandryidae, Pythidae, Scolytidae Trogositidae
Woody Fungi	Endomychidae, Zopheridae

Necrophagous families and species
Necrophagous beetles, which feed upon carrion, are a particular concern to any quantitative analysis based upon pitfall samples. Carrion is an unpredictable, patchy and ephemeral resource, leading to intense competition between necrophages. As a result, necrophages, such as burying beetles (Silphidae), are often capable of detecting carrion at considerable distances, as much as

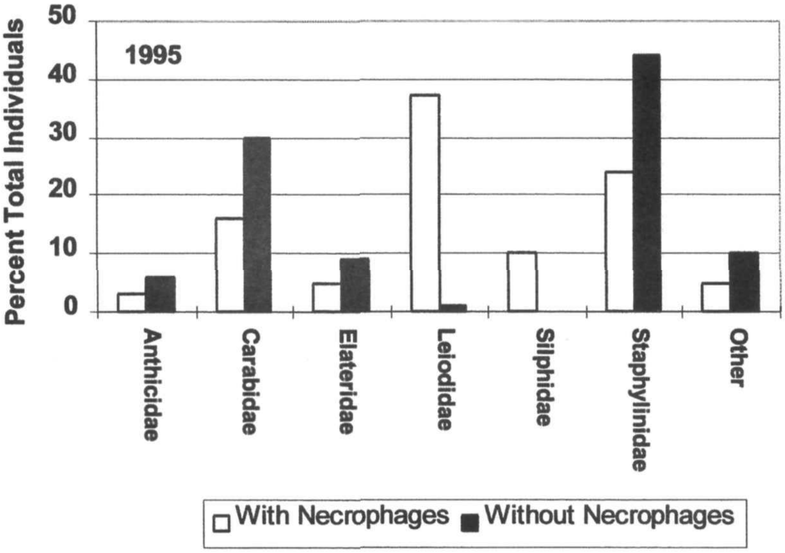
two miles away in some species of *Nicrophorus* (Ratcliffe 1996). An unfortunate consequence of this wonderful sensory capacity is that such insects are strongly attracted to pitfalls once the captured organisms begin decaying (preservatives are rarely perfect and in any event become increasingly diluted with body fluids of "prey" and with rain). This appears to be particularly true of those traps which incidentally capture vertebrates, such as small mammals and herptiles. Necrophagous beetles are usually grossly disproportionately abundant in pitfall traps, relative to their actual abundance. Forty-one percent (7,606) of the 18,766 beetles collected during 1995 and 1996 belonged to families or species known to be necrophagous (see Table 1). Such abundance greatly exceeds the real numerical contribution of these beetles to any given habitat. Furthermore, necrophagous beetles may be attracted to traps from far outside the sampled habitat, so they may not be true members of a habitat's fauna.

All species of Silphidae collected in this study are necrophagous, as are the following Leiodidae: all species of *Catops* and *Catoptrichus frankenhaeuseri.* These species should be excluded from any analysis, especially those comparing habitat faunas. It is best to exclude any *Catops* and any *Nicrophorous* from species richness and diversity analyses, since many individuals were not identified to species. Some Staphylinidae (rove beetles) are probably necrophagous, especially in the subfamily Aleocharinae, but it is uncertain whether these species feed upon carrion or upon those insects which are truly necrophagous. It is probably best to err on the side of caution and retain all Staphylinidae for analysis. Since Aleocharinae were not determined to the species level, inclusion of this subfamily in any analysis below the family level is probably inadvisable.

Dominant families

Of the 42 beetle families collected in the Big Beaver Creek survey during 1995, the bulk of individuals and species were provided by just a few of these (Figures 3 and 4). Excluding necrophages (as recommended previously), 90% of beetle individuals collected during 1995 were derived from just four families - Anthicidae, Carabidae, Elateridae and Staphylinidae, with only 10% contributed by the other 37 families (Fig. 3). Similar patterns were also observed for the reduced set of 1996 samples. Two families, Carabidae (30%) and Staphylinidae (44%) contributed almost three-quarters of the individuals in 1995. This pattern held true in 1996, with Carabidae contributing 28% and Staphylinidae 47% of the individuals. The proportions and relative dominance of the "Big 4" families varied with each habitat type. This was especially true of Anthicidae and Elateridae, which were at most minor faunal components outside of GVL. Both Carabidae and Staphylinidae were generally numerically significant in all habitats, with Carabidae tending to be dominant in open habitats and Staphylinidae tending to be so in closed canopy habitats.

The domination of the "Big 4" was not as pronounced when analyzing overall species composition. In fact, Anthicidae became insignificant (at 1%). The presence or absence of necrophagous species had little affect, since the total number of these species was only 7 (approximately 2%). Excluding necrophages, Carabidae, Elateridae, Leiodidae and



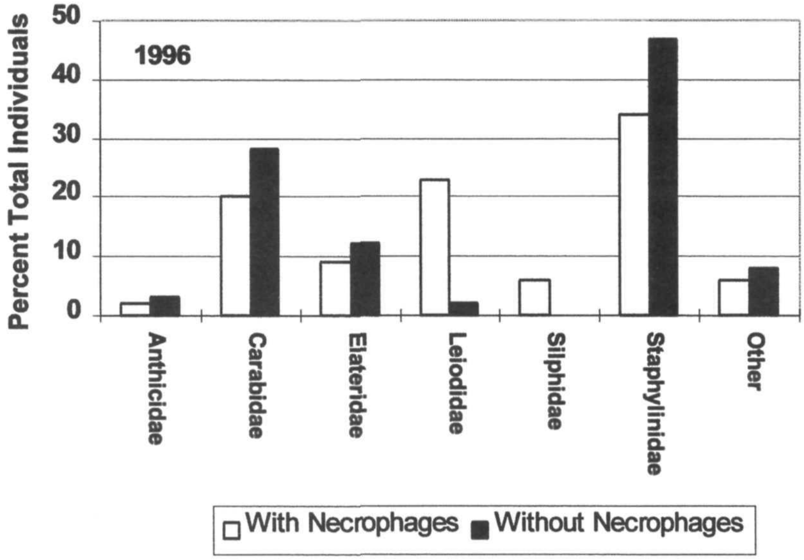


Figure 3. Percent composition of major Coleoptera families by total number of individuals, Big Beaver Creek, North Cascades National Park Service Complex, Washington, 1995 and 1996.

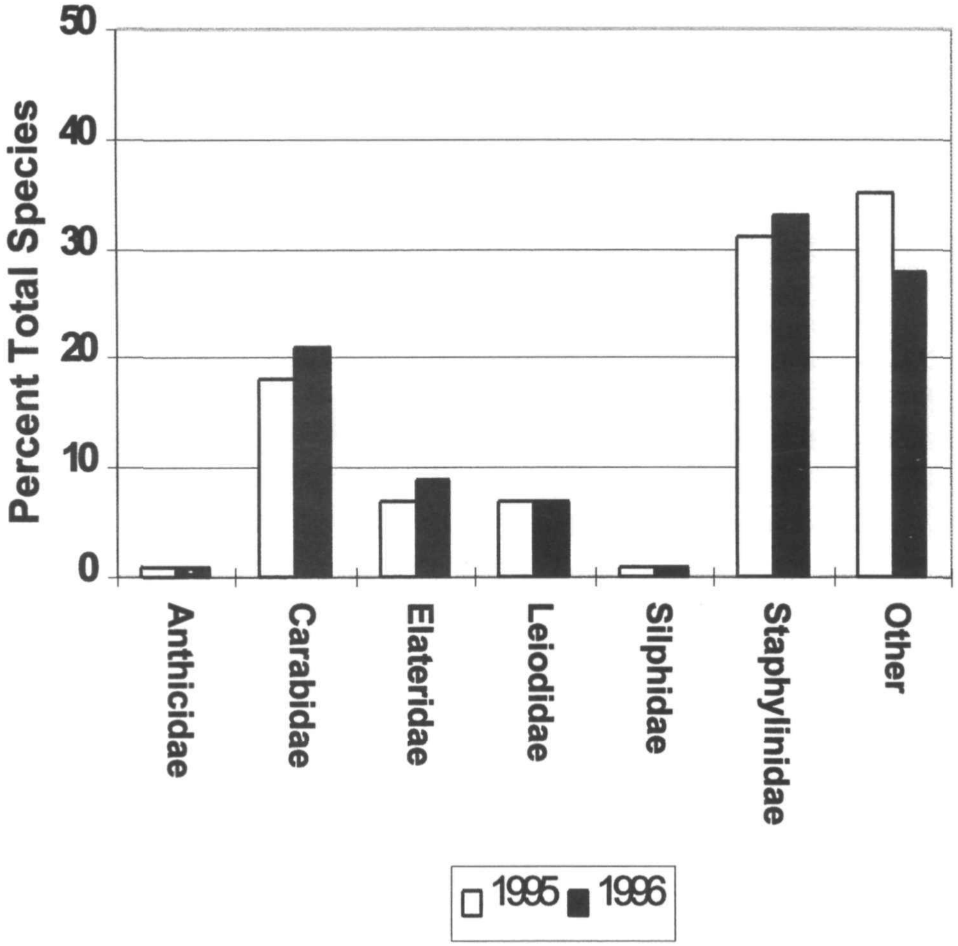


Figure 4. Percent Composition of major Coleoptera families by total number of species collected, Big Beaver Creek, North Cascades National Park Service Complex, Washington, 1995 and 1996.

Staphylinidae accounted for 63% of all species in 1995, with other non-necrophagous families accounting for 37% (Fig. 4). It is interesting to note that the maximum species richness of these 37 other families was only 11, with a mean richness of 3 species per family (with many less than that). 1996 data reflected a similar pattern, with 69% of all species derived from Carabidae, Elateridae, Leiodidae, and Staphylinidae. As with abundance, carabids and Staphylinidae were the most dominant families, together contributing about 50% of all species during 1995 and 1996. Again, patterns of family dominance varied with habitat. Carabidae and Staphylinidae tended to be significant components in all habitats, with dominance patterns similar to that of abundance.

It is not feasible to comment on all 49 families found in the Big Beaver Creek survey. Given the relatively minor contributions of most families to the fauna, that would be of dubious value. I will provide some general comments on the biology and significance of the six families which were abundant or species-rich: Anthicidae, Carabidae, Elateridae, Leiodidae, Silphidae and Staphylinidae.

Anthicidae (Ant-like Flower beetles)

Anthicidae are a somewhat heterogenous family now including genera that were once placed in the Pedilidae (*Eurygenius*) or in the Pyrochroidae (*Ischalia*) (Lawrence and Newton 1995). This is not a particularly diverse family in North America, with about 215 species in North America north of Mexico (Poole and Gentili 1996) and with about 30 or so in the Pacific Northwest (Parsons, G., J.R. LaBonte, and J.E. Miller in prep.). Anthicidae are most closely related to several other families (Aderidae and Scraptiidae) in the same general lineage as the Tenebrionidae (Lawrence and Newton 1995). Discounting necrophages, Anthicidae were the fourth most abundant family in Park pitfalls, with 395 individuals collected in 1995 and 133 collected in 1996. The vast majority were from a single species, *Eurygenius campanulatus* LeConte. Virtually all Park anthcids were collected from the gravel bar habitat.

Most adult anthicids are fairly small, 2-4 mm long, although *Eurygenius campanulatus* adults are up to 11 mm in length. As the common name suggests, they are ant-like in form, with heads that are more or less square, anteriorly-narrowed pronota, slender legs and have elytra which are parallel or somewhat rounded. Antennae are composed of rounded segments, which often become gradually larger toward the apex. Adults of several genera have a large "horn" extending from the anterior of the pronotum over the head, the purpose of which is unknown. Many adult anthicids are largely pale brown, often with dark blotches or bands on the elytra. *Eurygenius* are distinctively mottled gray on a dark background. The body of adult anthicids is pubescent. Larvae are stout, with short legs, and may have short caudal processes (Stehr 1991). The abdomen is generally lightly sclerotized. Most mature larvae are 4-7 mm in length, although those of *Eurygenius* are larger (Stehr 1991).

Anthicids are found in various habitats, often associated with decaying vegetation on the surface of the ground. Many species are components of the ground surface faunas of open areas, such as sand dunes, ocean beaches and the shores of bodies of water (Arnett 1968). Adults are often found on flowers or foliage, hence the common name for the family. Adults of most species are probably omnivorous, although some are predators and others may only feed upon nectar and pollen (Stehr 1991). Most larvae are believed to be omnivorous or mycetophagous in the decaying vegetation where they are found (Stehr 1991). Species in the genus *Ischalia* (one species, *I. vancouverei*, was found during this survey) have nocturnal adults which rest on foliage or under bark during the day. The larvae of this genus are found under bark and in rotting wood, presumably feeding upon fungi therein although they may be facultative predators (Young 1985). Adults of most other anthicids are at least partly diurnal.

Relatively little has been published on the biology of anthicids. A somewhat generalized discussion of this topic can be found in Stehr (1991). I know of no comprehensive taxonomic treatment of North American or Pacific Northwestern Anthicidae, other than that found in Hatch (1965).

<u>Carabidae (Carabid beetles or predaceous ground beetles, and tiger beetles)</u>

Carabid beetles are one of the largest beetle families, with about 40,000 species worldwide (Lövei and Sunderland 1996). They are particularly well represented in the Pacific Northwest, with about 500 species in Oregon ((Bousquet and Larochelle 1993). Carabids are related to many of the aquatic families, such as Amphizoidae, Dytiscidae and Gyrinidae (Lawrence and Newton 1995). The tiger beetles, once placed in their own family of Cicindelidae, are now regarded merely as specialized members of the Carabidae (Bousquet and Larochelle 1993). Discounting necrophages, Carabidae were the second most abundant family in Park pitfalls in both years, with 2,058 individuals and 54 species in 1995 and 1,222 individuals and 43 species in 1996.

Adult carabids vary greatly in size and shape, ranging from 1.2-40 mm in length. Most Pacific Northwest species are black or brown, but some are brightly colored. The head of most species is prognathous, pointing forward, presumably an adaptation to aid prey capture, with the antennae generally long and thin. The mandibles are usually prominent and in some genera, *e.g. Cicindela*, *Omus*, *Promecognathus,* are elongate and toothed. The legs of most species are rather elongate and thin, and most species are relatively rapid runners. Most, but not all, adult carabids lack dense pubescence on the bulk of the body.

Carabid larvae usually have fairly long legs, long caudal processes which are unsegmented (versus Staphylinidae), have large prognathous heads and large mandibles, are active on substrate surfaces and within litter, and are rapid runners. The few carabid genera with parasitic larvae (*e.g. Brachinus* and *Lebia*) are active only through the first instar, thereafter being inactive, stout and short-legged. Larval abdomens can be either lightly or heavily sclerotized. Carabid larvae are easily confused with those of Staphylinidae. Tiger beetle (*Cincindela, Omus*) larvae have large dorsal abdominal hooks and large flat heads with upturned mandibles, adaptions for ambush predation from their burrows in the soil and substrates.

Carabid beetles are often referred to as "predaceous ground beetles". Both adjectives are misnomers, for many species are found on plant foliage and flowers while others are herbivorous or omnivorous as adults. Indeed, the breadth of habitat and diet exhibited by this diverse family is remarkable. Pacific Northwestern carabids can be found from the intertidal zone to alpine permanent snowfields. They are abundant in deserts, forests, at lake and stream margins, in meadows, agricultural lands and cities. Within these habitats, carabids burrow in the soil, wander over the ground, paddle amid marsh vegetation and forage under water, wedge themselves under tree bark, climb shrubs and trees, and forage for insects upon mountain ice and snow. The Pacific Northwest has a substantial exotic carabid species component, mostly derived from western Europe (Hatch 1953, Lindroth 1961-1969), that is indicative of disturbed or anthropogenic habitats (Spence 1990). While sterotypical carabids are believed to be generalist predators of small invertebrates, many have more restricted diets, specializing upon springtails (Bauer 1982), slugs and snails (Green 1975), or millipedes (LaBonte 1983). As mentioned above, several are even parasitic as larvae (Thiele 1977). Adult carabids are generally regarded as important beneficial predators in agroecosystems (Thiele 1977), but studies demonstrating the actual impact of carabids on pest species are limited. Many carabids include substantial amounts of plant matter in their diet, mainly in the form of seeds and fruits, and some of these beetles may only be facultative predators (Hengeveld 1980, Johnson and Cameron 1969). Some of the carabid genera and species most typical of forest habitats in the Pacific Northwest are known to eat Douglas-fir seeds in captivity (Johnson *et al.* 1966).

As a result of several regional works (Hatch 1953, Lindroth 1961-1969), the composition of the Pacific Northwest carabid fauna is well understood. A good resource on carabid biology and ecology is Thiele (1977). There are also several compendia of carabid papers on a wide variety of subjects (*e.g.* Desender *et al.* 1994, Stork 1990).

Elateridae (Click beetles or wireworms)

Elateridae are a rather poorly known family, despite being common, conspicuous and encompassing some agriculturally important species. The North American species diversity is substantial, with 928 species known (Poole and Gentili 1996). The Pacific Northwest probably has several hundred species, but the distributions of most species are poorly known. Elaterids are related to Buprestidae and a few other families in that lineage (Lawrence and Newton 1995). Discounting necrophages, Elateridae were the third most abundant family in Park pitfalls both years, with 629 individuals and 24 species in 1995 and 531 individuals and 19 species in 1996. The vast majority of Park elaterids were found in the gravel bar habitat.

Elaterid larvae and adults have a remarkably consistent appearance. Adults range from 2-45 mm in length, have elongate and parallel-sided pronota which often have very pronounced hind angles, have short legs with long, slender elytra and are somewhat dorsoventrally flattened. Antennal segments are somewhat broadened and asymmetric, lending a serrate appearance to the antennae. While most adults are brown or black, some species are strikingly patterned with dark blotches or bands against a pale background (particularly on the elytra) or vice versa, while several species are resplendently metallic. The body of many adult elaterids is covered with a thin-to-dense pubescence. Most larvae are long and slender, cylindrical, with short and inconspicuous legs, small heads and short or absent caudal processes (Stehr 1991). The entire body is heavily sclerotized, generally pale brown, and is devoid of pubescence. This distinctive appearance is the source of the common name of "wireworm".

Adult elaterids are most often associated with foliage and flowers. Most appear to be at least partly diurnal. They can be extremely common. The common name of "click beetles" arises from the ability of all adults to flip themselves into the air starting from a position with the dorsum resting upon a surface. A prong at the posterior of the ventral prothorax fits into a groove between the mid-coxae when the anterior of the body is raised from the surface. A projection in the groove prevents the prong from contacting the bottom of the depression until contraction of the pro- and mesothoracic muscles creates sufficient tension to suddenly and sharply drive it home. The resulting energy released against the surface hurls the beetle as much as 30 cm into the air, performing one or more full rotations en route back to the surface (Klausnitzer 1983). This remarkable process functions both as a means of escaping predators and of righting the beetles when they've fallen from vegetation. Adult feeding behavior is poorly documented, but some are known to feed upon leaves, flowers and pollen. Many adults may not feed at all.

Elaterid larvae are usually found in the soil, in litter or in rotting wood (White 1983). Many of the soil dwellers are root feeders, accounting for the economic significance of some species (Swan and Papp 1972). Those found in litter or rotting wood are usually predatory, presumably feeding upon a variety of small invertebrates. The feeding behavior of most species is unknown and the preceding generalizations are based upon relatively few species. Predation is particularly associated with a subfamily, the Denticollinae, that includes some of the most diverse genera in North America. Most of the Park species from this study are members of this subfamily.

As previously mentioned, elaterid biology is generally poorly known, with the exception of some economically important species associated with agricultural systems. A generalized treatment of elaterid biology can be found in Stehr (1991). I know of no comprehensive taxonomic treatments of the North American or Pacific Northwestern species, other than those in Hatch (1971). The commentary on larval biology, as well as the elaterid trophic data in Table A1, largely stemmed from the comments of Dr. Paul Johnson at South Dakota State University.

Leiodidae (Round fungus beetles, Mammal-nest beetles, Small carrion beetles)

Current concepts of the Leiodidae, based largely upon larval morphology, encompass what were formerly two additional families, the Leptinidae (Mammal-nest beetles) and Leptodiridae (Small carrion beetles) (Lawrence and Newton 1995). Consequently, this family is composed of species exhibiting a broad range of appearance and habits. Adults are somewhat unprepossessing and little is known of many species. In the broad sense used here, the family is not particularly speciose, with approximately 153 species in North America (Poole and Gentili 1996) and 75-80 in the Pacific Northwest (Parson G., J.R. LaBonte and J.E. Miller in prep.). If necrophages are included, Leiodidae are the most numerous family represented in Park pitfalls (6,161 individuals and 26 species in 1995 and 1996). If necrophages are excluded, as recommended for any analysis, Leiodidae are still one of the more numerous and diverse families, with 89 individuals and 15 species in 1995 and 76 individuals and 15 species in 1996. Leiodidae are loosely related to other staphylinoid families, such as Staphylinidae, Silphidae and Ptiliidae (Lawrence and Newton 1995). As previously stated, pitfalls functioned as baits for necrophagous leiodids, so their associations with specific habitats are suspect. However, it is worth noting that gravel bars had the fewest leiodids (including necrophages) of any habitat. Necrophagous and non-necrophagous leiodids were otherwise scattered throughout all habitats.

Adult leiodids (in the strict sense) are small (1-7 mm long), round, shiny, lack pubescence, have relatively long legs and short, clubbed antennae. The head is small and recessed into the anterior of the broad pronotum. Several genera (*Agathidium*, *Anisotoma*) can contract the body into a more or less tight ball, with the head fitting into a ventral recess on the metathorax. This is presumably a defensive posture (Wheeler 1984). Most adults are dark or brown. Mammal-nest beetles (the only species in this survey is *Leptinus occidentamericanus*) are approximately 2 mm long, flat, pubescent, have reduced eyes and are pale. Small carrion beetles (*Catops* spp., *Catoptrichus frankenhaeuseri*, *Colon* spp., *Platycholeus*) are 1-6 mm in length, are roundedly-elongate with apically tapered elytra, have rather short legs, have pubescent bodies and tend to be various shades of brown. Many have a noticeably iridescent sheen.

Larval leiodids are 2-8 mm long when mature, are slender with round heads and short legs and have short caudal processes, which are 1- or 2-segmented (Stehr 1991). Their developmental rate can be phenomenally rapid. Some species of *Anisotoma* have larval spans of only 2 days (Stehr 1991)! This is presumably an adaptation to feeding upon slime molds, some of which are extremely ephemeral.

Leiodid biology is as variable as the external appearance of the adults. Adult and larval leiodids in the strict sense are predominantly fungivorous (*e.g.* Crowson 1984), feeding upon a wide variety of fungi found in rotting wood, under bark, in animal nests and in litter or soil. Some species of *Agathidium* and *Anisotoma* feed upon slime molds, with *Anisotoma* relying solely upon this resource (Newton 1984). Species of *Leiodes* feed predominantly upon subterranean fungi and some European species are renowned for detecting truffles (Newton 1984). The mouse nest beetle, *Leptinus occidentamericanus*, is restricted to the nests and fur of small mammals such as mice, shrews, voles. Adults and larvae probably scavenge organic materials from the nests and in host fur (Peck 1982). Adults are phoretic upon the hosts (Peck 1982). Most small carrion beetles (*Catops* spp., *Catoptrichus*) feed upon decaying organic matter, such as carrion or putrid fungi (White 1983), and are presumably capable of detecting such resources from considerable distances. The biologies of *Colon* species are virtually unknown, but they are presumed to be scavengers or may feed upon mycelial fungi (Newton 1984).

Some leiodids, mainly those in the strict sense, are relatively well known biologically and taxonomically. Hatch (1957) provides a somewhat dated regional taxonomic review of this family. A number of relatively recent revisions are available for some of the Leiodidae *sensu stricto*, for instance Baranowski (1993). Some ecological information is contained within those revisions, but several chapters in Wheeler and Blackwell (1984) go into considerably greater depth, including Blackwell (1984), Newton (1984) and Wheeler (1989).

Silphidae (Burying beetles, Carrion beetles)

The Silphidae are now treated in a rather narrow sense, excluding and raising to family rank a group of detritivorous beetles, the Agyrtidae (Ratcliffe 1996). The Silphidae as thus defined are largely necrophagous. The biology and taxonomy of this family is well understood, since adults are often quite showy and conspicuous, have interesting burying and brood care behaviors, and one species, *Nicrophorus americanus* Olivier, is listed as federally endangered. This family is not speciose, with 30 species in North America (Ratcliffe 1996) and approximately 20 species in the Pacific Northwest (Hatch 1957). Silphids were the fourth most abundant beetles in Park pitfalls during 1995 and 1996 (1,600 individuals) with, however, little species diversity (3 species). All silphids collected in Park pitfalls are necrophages and as such should be excluded from any analysis. Silphidae are loosely related to other staphylinoid families, such as Leiodidae, Staphylinidae and Ptiliidae. As previously stated, pitfalls functioned as baits for these necrophagous beetles, so their associations with specific habitats are suspect. However, it is worth noting that gravel bars had far and away the fewest silphids of any habitat, perhaps in part due to inappropriate substrates for carrion burial. Silphids were present in all other habitats.

Adult silphids have two basic morphs, one (*e.g. Thanatophilus lapponicus* (Herbst)) which is mid-to-large sized (10-16 mm long), flat, somewhat circular in outline, with short clubbed antennae, often with carinate or tuberculate elytra, and normally dull dark without contrasting colors. *Nicrophorus*, on the other hand, are large (10-30 mm in length), convex, with large heads, clubbed antennae with the clubs often bright orange, a glossy surface, and the elytra are brightly banded black and orange. Adults may mimic bumblebees (Ratcliffe 1996). Larvae also come in two morphs, one (*e.g. Thanatophilus*) which is flat, broad, heavily sclerotized throughout, and dark. *Nicrophorus* larvae are convex and cylindrical, with greatly reduced sclerites, and are pale (Ratcliffe 1996). Both have short legs and short caudal processes.

Suitable habitat for silphids is more defined by the presence of the ephemeral resources upon which both larvae and adults feed than by other factors, although vegetation and soil structure may be constraints (Lomolino *et al.* 1995, Ratcliffe 1996). The following discussion of silphid biology is derrived from Ratcliffe (1996). After *Thanatophilus* adults locate a carcass, eggs are laid in the surrounding soil. Larvae hatch and feed upon the carcass without parental care. Extensive adult predation of fly larvae from carrion, and in the vicinity thereof, has been observed. Upon location of a carcass, adult *Nicrophorous* behave quite differently, parental pairs burying the carcass (in part or entirely) in a chamber in the soil, preparing it for larval consumption via mastication, salivary secretions and manipulation into a food ball, making a larval feeding "pit" in the top of the food ball, and feeding and grooming the larvae until they pupate. Both genera may have several generations per year. Adults feed largely upon fly larvae, but also upon carrion.

Several good sources for taxonomic and biological information on silphids exist. Hatch (1957) provides a good, if somewhat dated taxonomic review for the Pacific Northwest. Anderson and Peck (1985) provide good keys to Canadian Silphidae, while Ratcliffe (1996) has good keys that treat many species in the Pacific Northwest, including larvae, and provides a wealth of ecological and biological information on this family.

Staphylinidae (Rove beetles)

The rove beetles are among the most taxonomically and biologically diverse families. The Staphylinidae may be the most speciose beetle family in the world. Staphylinids are not only the most speciose beetle family in North America, with about 4059 recorded species, but they may be the most speciose family of all North American insects (Poole and Gentili 1996). Known Pacific Northwestern species number between 450-500 species (Parsons, G., J.R. LaBonte, and J.E. Miller in prep.), but the taxonomy and species distributions of this family are so poorly known it is certain there are many species present which are not yet recorded from this area. The boundaries of this family have recently been significantly expanded (Lawrence and Newton 1995), now including species formerly in families such as Clambidae and Scaphidiidae. The entire family of Pselaphidae has been subsumed within the staphylinids. Rove beetles are loosely related to other families in their lineage, such as Leiodidae, Ptiliidae and Silphidae (Lawrence and Newton 1995). Staphylinidae were the most abundant beetles in Park pitfalls, and the most diverse, with 3,018 individuals and 97 species collected during 1995 and 2,060 individuals and 72 species in 1996. The species count is conservative, as only a few of the taxonomically recalcitrant Aleocharinae could be determined to species. Staphylinidae were abundant in all sampled Park habitats, although they appeared relatively less abundant and diverse in open habitats.

Archetypal adult staphylinids have a very distinctive appearance: elongate general body form, with a square or round head distinct from the pronotum, elongate or round pronotum, short legs, short and unclubbed antennae, and the most distinctive feature, short elytra exposing most of the slender abdomen. However, short elytra are shared by some members of other families, while some staphylinids have elytra long enough to completely (or nearly so) cover the abdomen. This is characteristic of an abundant and diverse subfamily, the Omaliinae. Many staphylinids are quite "stocky", while those formerly in the Pselaphidae often have clubbed antennae. Typical staphylinid larvae are also rather distinctive, superficially similar to those of Carabidae, but with segmented caudal appendages (Stehr 1991). "Atypical" larvae may bear little resemblance to this stereotype. Most staphylinids are quite small, under 5-6 mm, but many members of the subfamily Staphylininae are 10-12 mm long and some species get to over 20 mm in length. Most staphylinids are brown or black, but some species are maculate and a few have metallic coloration.

Staphylinids are remarkably varied with regard to their biology and ecology. They occur in virtually all habitats, although there are relatively few species associated with foliage (there are several genera which are flower associates). Rove beetles can be found along the margins of bodies of water, burrowing in soil and substrates, in the rocky and sandy intertidal zones, in and on carrion and dung, in bird and mammal nests, in and on fungi, under bark, in decaying wood, amid litter, and in the nests of ants and termites. Larvae and adults are generally presumed to have similar habitat preferences although larvae are believed to require higher moisture regimes than adults. Although stereotypically staphylinids are regarded as generalist predators of invertebrates, this is not true for a great many species. Some are truly fungivorous, such as many Aleocharinae and Phloeocharinae (*e.g. Megarthrus* and *Proteinus*), while several genera of Omaliinae are believed to feed upon pollen (*e.g. Eusphalerum*) (Newton 1984). Association with a potential food resource does not imply feeding upon it - many staphylinids associated with carrion, dung or fungi in fact prey upon the maggots and adult flies utilizing these materials (*e.g. Tachinus*) (Campbell 1973). Several genera are specialized predators: some species of *Aleochara* are parasitoids of fly pupae, some of the former Pselaphidae are mite specialists and *Stenus* are specialized predators of springtails, capturing these elusive prey with modified mouthparts reminiscent of dragonfly larvae (Crowson 1984). It is best to recognize that the diets of most staphylinid species are more a matter of conjecture, supposition and extended generalization than of verified knowledge. Larvae, in general, presumably feed upon the same food as adults (Stehr 1991). Unfortunately, along with the family's taxonomic intransigence, this limits the utility of staphylinids for monitoring or survey efforts focusing upon trophic roles.

Overall, our knowledge of staphylinid biology, ecology and taxonomy is rather scant. This may be in part due to the lack of study the family has received in North America and also because many staphylinid genera are truly challenging taxonomically. There are no comprehensive North American treatments of the family. The only Pacific Northwest family-breadth taxonomic work is the rather dated treatment in Hatch (1957). There are a number of recent revisions of various North American genera, particularly in the subfamilies Omaliinae and Tachyporinae (*e.g.* Campbell 1973, 1978, 1979, 1982, 1991; Smetana 1971). There are still a great many staphylinid taxa in desperate need of revision or good keys, especially the Aleocharinae. I know of no good source for information on staphylinid biology in general, although Newton (1984) provides some data on fungivorous species.

Species Accounts

Exotic species

Five of the beetle species collected during the Big Beaver Creek survey are not indigenous to North America (Hatch 1953, 1957, 1971; Lindroth 1961-1969): *Anisodactylus binotatus* Fabricius (Carabidae), *Calathus fuscipes* Goeze (Carabidae), *Cryptorhynchus lapathi* Linnaeus (Curculionidae), *Onthophagus nuchicornis* Linnaeus (Scarabaeidae) and *Philonthus cruentatus* (Gmelin) (Staphylinidae). Four additional species, all staphylinids, are thought to be probable exotics (Hatch 1953, 1957): *Aleochara bilineata* Gyllenhal, *Aleochara bimaculata* Gravenhorst, *Pseudopsis sulcata* Newman and *Trichophya pilicornis* Gyllenhal. None of these represent intentional introductions. The means by which such accidental introductions occur are varied, depending upon the biology of any particular species. *Cryptorhynchus lapathi* was presumably introduced via nursery stock or potted plants. Probable avenues of introduction for soil and litter dwellers are ship ballast or nursery stock/potted plants (Lindroth 1957). This would seem to be the most likely route of introduction for *A. binotatus*, *C. fuscipes*, *Pseudopsis sulcata* and *T. pilicornis*. While this may have been how the remaining exotics arrived in North America, their association with dung (Hatch 1957, 1971) may be significant, as habitat and food for the scarab and as habitat and a source of food (maggots/flies) for the staphylinids. This suggests they may have been introduced through "contaminated" hay and fodder with imported livestock, or they may have flown onto the ships awaiting departure in harbors, attracted to the dung produced by said livestock.

All of the above species are capable of dispersing over long distances through flight, and over shorter spans via walking. Where human activities are more pronounced, especially where large quantities of material such as soil and yard debris are moved, the potential for human-mitigated dispersal becomes quite high. In relatively pristine areas such as Big Beaver Creek, which is also quite remote from human habitations, such passive dispersal seems unlikely. However, the possibility exists that dung associated species could be transported via hay and fodder for pack and riding stock. In addition, park revegetation programs may also contribute to the dispersal of exotic species. The re-vegetation program at North Cascades National Park raises plants in Marblemount, located outside of the Park, that are later transplanted to various locations in the Park. I found *C. fuscipes* in Sedro Woolley, not far west of Marblemount, which supports the argument that exotic species could be spread through the Park via such programs.

The impact of these exotic species upon indigenous species is unknown. Many introduced species are more-or-less restricted to disturbed anthropogenic habitats (Spence 1990, Spence and Spence 1988). Such species should have little or no effect upon indigenous species in pristine habitats. There also appears to be little, if any, competitive displacement of those indigenous species with which the exotics come into contact (Spence 1990). However, some evidence of exotic invasion of pristine habitats and possible competitive displacement of indigenes is accumulating (LaBonte and Nelson 1998, Niemela and Spence 1994). Since the habitat of *C. lapathi* is largely defined by the presence of its food plants, cottonwood and willow (Hatch 1971), it was not particularly surprising to find it at Big Beaver Creek. This species has been known to achieve pest status (Hatch 1971), so competitive interactions between it and cottonwood/willow herbivores are possible. *Onthophagus nuchicornis* utilizes the relatively massive dung of large ungulates such as cows and horses. The smaller dung of indigenous ungulates is presumably less suitable (that of elk may be usable), so this species may not represent a competitive threat to indigenous dung beetles. It is interesting that the majority of known exotics from this study were found in open habitats, such as bogs, gravel bars and open swamps. This suggests that such habitats are vulnerable to colonization by exotic beetles, perhaps by presenting conditions somewhat similar to those of disturbed anthropogenic situations.

Based upon the survey data for both years, the exotic component of Big Beaver Creek's beetles is minimal - a few species and very few individuals, only 26 total, less than about 0.2% of the non-necrophages. Monitoring of the proportion of exotic species and their relative abundance may provide a gauge of habitat quality. Substantial increases in the exotic component may be indicative of deterioration of relatively pristine habitats and/or encroachment of exotics upon the indigenous fauna.

Rare species

Based on the 1995 survey data, 74% (224) of the 304 (excluding necrophage species) total species were represented by 10 or fewer individuals, 62% (189) had totals of 5 or less, and 31% (93) were represented by only a single specimen! The pattern for 1996 was very similar: 75% (163) of 217 species were represented by 10 or fewer individuals, 64% (140) were represented by 5 of fewer individuals, and 35% (75) were represented by only one individual. Clearly, the Big Beaver Creek beetle fauna, as sampled by pitfalls, corresponds to the generalization that most species are relatively rare, with only a few being common (see examples in Magurran 1988). For 1995, after the 22 most abundant species, the total for any one species represented less than 1% of the total individuals, after subtracting necrophages and Aleocharinae from total individuals (since Aleocharinae contained multiple species). Many of these "rare" species represented incidental (Gaston 1994) families and taxa, as discussed earlier. Some may have been only transients through the sampled habitats, while others may simply not have been particularly vulnerable to pitfalls. Species whose adult phenologies were asynchronous with the sampling period may also have appeared infrequently. Whether any of these species are truly "rare" remains an open question, but most beetle species can be found to be relatively abundant in preferred microhabitats using specific sampling methods during appropriate periods. Of course, the abundance of any species or group of species, will vary throughout time. "Rare" species one year may be common another, and *vice versa*.

Common or abundant species

As with the family accounts, it is simply not feasible to provide commentary on each of the 355 species found in the Big Beaver Creek survey. In many instances, there is little additional information beyond that given in Table A1. Furthermore, most species contributed little to the overall abundance, presumably indicative of their ecological significance to these habitats (excluding the possibility of keystone effects). Based on 1995 data, the 20 most common species (excluding necrophages) comprised 46% (3,093) of the total non-necrophagous individuals. Of these species, 1 is an anthicid, 10 are carabids, 3 are elaterids, 1 is a member of the Latridiidae (the Minute Brown Scavenger beetles) and 5 are staphylinids.

Thirteen of the twenty most abundant species collected in 1995 were also in the "top twenty" of the 1996 samples. *Scaphinotus angusticollis* was the most abundant species collected in both years. Further comparisons of abundant species between years are not warranted because only a subset of the habitats sampled in 1995 were sampled in 1996. Consequently, the following discussion will only treat those numerically dominant species sampled during 1995 since the entire complement of habitat types was only represented during that field season.

I will provide, where possible, comments on the biology and ecology of these species, in order of the family to which they belong. In general, there is much better documenation for carabid species than those of other families, which will be borne out in the following discussions. Although the following information is derived from various sources, distribution and habitat records for families other than Carabidae largely stem from Hatch (1953-1971), while Stehr (1991) provided much dietary data. Elaterid trophic data was kindly provided by Dr. Paul J. Johnson (South Dakota State University). Carabid information largely originated with Lindroth (1961-1969) or my own studies.

Anthicidae - *Eurygenius campanulatus* LeConte

This species ranked #2 in abundance, with 373 individuals, solely from the gravel bar habitat. Little has been published on the habits and ecology of this species. Adults frequent flowers, perhaps feeding upon pollen and nectar. However, adults may also be detrivorous and/or omnivorous. Larvae are associated with plant debris and litter, presumably either feeding upon it directly or upon fungi associated with this material (Stehr 1991). I have collected it in open habitats with sandy and gravelly soils distant from any water. Hatch (1965) lists this species as common.

Carabidae - *Agonum brevicolle* Dejean

This species ranked #4 in abundance, with 205 individuals. A few specimens were found in the sphagnum bogs, but the vast majority were associated with two willow swamp habitats, SCS (138 individuals) and SSS (57 individuals). This species belongs to a subgenus (*Melanagonum*) which is notable for the great similarity in appearance of its members (Lindroth 1961-1969). It is often necessary to extract the male genitalia to confirm identity, and that may not be entirely diagnostic. Although little has been published on *A. brevicolle*, the following generalized comments regarding *Melanagonum* probably apply well. *Melanagonum* are all lacustrine and wetland species (Lindroth 1961-1969) and are often very abundant in marshes and swamps, especially those that have sparse or broken tree canopies. Most frequent habitats with dense vegetation (Lindroth 1961-1969). Adults and larvae are predators of small invertebrates. Adults overwinter, mating in spring, with larvae present in spring and early summer (Lindroth 1992). Adults are predominantly nocturnal and are capable of flight. *Agonum brevicolle* is known from the Queen Charlotte Islands (British Columbia) south to California (Kavanaugh 1992, Lindroth 1961-1969), apparently restricted to regions along or west of the Cascade Crest. On the Queen Charlottes, it is restricted to marshes and bogs below 250 m elevation (Kavanaugh 1992).

Carabidae - *Blethisa oregonensis* LeConte

This species ranked #19 in abundance, with 65 individuals, all from the SCS habitat. *Blethisa oregonensis*, as with all other members of this genus, is a lacustrine and wetland species restricted to the margins of ponds, bogs, swamps, *et cetera*. Adults and larvae are predators of small invertebrates. Adults enter the water when disturbed and to forage for prey, remaining submerged for up to 3 minutes (LaBonte and Johnson 1989). Larvae may be similiarly amphibious. As with other species of *Blethisa* (Lindroth 1992), adults overwinter, mating in spring, with larvae present in spring and summer. Pupation occurs in summer, with eclosion apparently occuring in early fall. Adults are nocturnal and are capable of flight (Lindroth 1961-1969). Some have been found in winter refugia, under the bark of dead trees, distant from any bodies of water (R.E. Nelson, personal communication). This species is strictly Pacific Northwestern and is known from British Columbia to the southern border of Oregon (LaBonte and Johnson 1989). With one exception, all known locales are from west of the Cascade Crest (LaBonte and Johnson 1989).

Carabidae - *Loricera decempunctata* Eschscholtz

This species ranked #11 in abundance, with 82 individuals, from all habitats but BOG, GVL and PF. Most specimens were found in SCS, SSS and TSCS. These beetles are not strictly wetland inhabitants, and are found in a variety of moist habitats: agricultural plantings with closed canopies, shaded forest floors, at seeps, in swamps, and along the margins of bodies of water. Habitats can be open or shaded and vegetation can range from virtually absent to dense. Adults of congeners selectively predate upon springtails (Collembola), utilizing combs of setae behind and below the mandibles in conjunction with coarse setae on the basal antennal segments to "fence in" these elusive prey (Bauer 1982). Adults overwinter, presumably mating in spring. New adults eclose in late summer (Lindroth 1961-1969), suggesting that larvae are present in spring and summer, with pupation occuring in summer as is typical of other species of *Loricera* (Lindroth 1992). Adults have no particular photoperiodic rhythm (Bauer 1982) and are capable of flight (Lindroth 1961-1969). This species is widespread over a wide range of elevations from Alaska to California, mostly west of the Cascade Crest (Kavanaugh 1992).

Carabidae - *Pterostichus herculaneus* Mannerheim

This species ranked #17 in abundance, with 67 individuals, from all habitats but SCS and SSS. Most specimens were found in forested habitats (PF and TTF). This species belongs to a subgenus, *Hypherpes*, with great diversity in the western United States (about 70 species recognized) (Bousquet and Larochelle 1993), although this diminishes with increased latitude. *Hypherpes* is among the most taxonomically challenging groups of *Pterostichus*, with many species only confidently identified via male genitalia. *Hypherpes* is a rather uniform species group, with characteristics presumably associated with the forest habitat of most members: absent dorsal setae, fused elytra and extreme brachyptery. Adults overwinter, remaining active throughout the winter in moderate climes. As with other *Pterostichus*, adults and larvae are stereo-typically regarded as generalist predators of invertebrates. However, laboratory observations indicate that adults of at least some *Hypherpes* species are facultative seed feeders (Johnson et al. 1966). The frequent presence of *Hypherpes* species at fruit baits (personal observation) indicates they may also be opportunistic frugivores. A conservative trophic generalization would be that adults are predominantly predaceous but facultatively omnivorous. Adults and larvae are nocturnal.

Pterostichus herculaneus is a somewhat eurytopic species, at least when considered throughout its range. It can be found in oak-Douglas fir savannah, forest margins, from coniferous to deciduous forests, often but not exclusively in dense and closed-canopy stands. These habitats can be quite dry to moist. Elevations range from low to moderate. The phenology of newly eclosed adults is bimodal, with most occuring in late summer and early fall, but with some from late spring to early summer (Lindroth 1961-1969). This pattern suggests both adults and larvae may overwinter. Johnson *et al.* (1966) observed this species feeding upon Douglas-fir seeds in the lab. The distribution appears to be from Alaska to California and west of the Rockies (Lindroth 1961-1969).

Carabidae - *Pterostichus neobrunneus* Lindroth

This species ranked #8 in abundance, with 128 individuals. Almost all specimens were found in PF or TTF, with a few in AS and AT. As with *P. herculaneus*, this species has all the typical characteristics of *Hypherpes*. It appears to be less eurytopic than *P. herculaneus*, apparently restricted to open or closed-canopy mesic or xeric coniferous forests. In Oregon, it is known from moderate elevations (approximately 1500 m) up to timber limit. It is not surprising to find it at the lower elevations of Big Beaver Creek, given the common pattern of elevational depression of life zones with increased latitude. Newly eclosed adults are known from mid-July to early September (Lindroth 1961-1969), indicating larvae in spring and summer, with summer pupae. There are no published feeding records, but I assume this species would also be a facultative seed eater. The range is from Alaska to Oregon, east to the Rockies (Lindroth 1961-1969).

Carabidae - *Pterostichus riparius* Dejean

This species ranked #15 in abundance, with 74 individuals. Specimens were found in all habitats but BOG, PF and SSS, with most individuals in AT and TSCS. This species belongs to the subgenus *Cryobius*, a group predominantly associated with subalpine, alpine and tundra habitats in either moist or dry situations. Kavanaugh (1992) found this species restricted to the shaded margins of medium-sized streams at moderate elevations while Lindroth (1961-1969) stated that it was usually found in forests near water, remarking that it was the least cold-adapted species in the subgenus. I have repeatedly found it in subalpine moist meadows in the Cascades and Rockies. Since newly eclosed adults are predominantly known from late summer (Lindroth 1961-1969), the phenology is apparently that of spring and summer larvae with summer pupae and overwintering adults. I know of no published feeding records, but adults and larvae are presumably generalist predators. The range extends from Alaska to Oregon, east to Montana (Lindroth 1961-1969).

Carabidae - *Scaphinotus angusticollis* Mannerheim

This species was the most abundant of Big Beaver Creek non-necrophagous beetles, with 675 individuals, or 10% of all non-necrophagous beetles collected. However, this is almost certainly a perfect example of the sampling biases of pitfall traps. While I have found *S. angusticollis* to legitimately be quite common, based upon hand collecting and baiting (see below) of this and related species, I have never found it to be numerically dominant, let alone to such an overwhelming degree. Instead, it is probable that these large and highly active beetles are especially vulnerable to pitfalls. Large size and high activity are characteristics known increase the susceptibility of insects to pitfall trapping (*e.g.* Spence and Niemela 1994). Despite these caveats, this species probably has a significant role in riparian habitats since it is abundant, large, active and relatively long-lived as an adult. *Scaphinotus angusticollis* was virtually absent from open habitats (1 specimen in SSS) and was common in all forested habitats (including AT), but was far and away most abundant in PF (343, or 51% of all specimens) and TTF (211, or 31% of specimens).

Scaphinotus are primarily forest and forest margin dwellers, although several species can be common in clear-cuts and members of one subgenus can be abundant in savannah and some anthropogenic habitats. Like *Pterostichus* (*Hypherpes*), most species overwinter as adults and may be active during the winter in mild climates. Larvae are also present during winter. Adults appear to be least abundant during xeric periods, such as in high summer.

As with *Pterostichus* (*Hypherpes*), *Scaphinotus* have characteristics associated with forest-dwelling carabids - fused elytra and extreme brachyptery, resulting in flightlessness. *Scaphinotus* adults are generally regarded as being confined to the soil surface and adjacent cover, but members of the subgenus *Stenocantharis* (to which *S. angusticollis* belongs) readily climb tree trunks and shrubs. Larvae are apparently found only on the soil surface and in litter.

Scaphinotus are persistently referred to as strictly feeding upon slugs and snails. This may be true of larvae, but is not so for adults of most Pacific Northwest species. Although adults will readily attack and consume small and modest-sized slugs and snails (*e.g.* Greene 1975), there is ample literature documenting their preying upon a wide variety of other invertebrates (*e.g.* Larochelle 1972), including other adult *Scaphinotus*. A very effective strategy for collecting adult *Scaphinotus*, fruit baiting, strongly suggests that adults may be facultative frugivores.

Scaphinotus angusticollis is found in mesic deciduous, mixed and coniferous forests and forest margins at elevations from sea-level to approximately 1300 m. Newly eclosed adults are known from May and July through September (personal observation, Lindroth 1961-1969). I have found larvae at almost any time of the year. Adults feed upon small and moderate-sized slugs and snails, but have also been observed to feed upon a wide variety of other invertebrates (personal observations), including large squashed banana slugs, earthworms, immature stinkbugs (Pentatomidae) and large millipedes (although these may have been previously trampled). They are readily captured at fruit baits (apple, banana, peach) and I've maintained adults in culture for months on huckleberries and other berries. Adults are largely crepuscular or nocturnal, though it is far from uncommon to observe diurnal activity. Larvae are apparently strictly nocturnal. The range is limited to west of the Cascade Crest, extending from Alaska to northern California (Lindroth 1961-1969).

<u>Carabidae - *Scaphinotus marginatus* Fischer</u>
This species was much less abundant than *S. angusticollis*, with only 76 individuals and ranking #14 in abundance. *Scaphinotus marginatus* was less restricted to forested habitats, appearing in all but one habitat (BOG). However, abundance peaked strongly in two habitats, AS (30 individuals) and TTF (17 specimens). This species is much smaller and somewhat less active

than *S. marginatus*, which may render it less sucsceptible to pitfalling. However, hand collecting and baiting both seem to bear out that it is often less common than *S. angusticollis*.

Scaphinotus marginatus is probably the most eurytopic *Scaphinotus* in the Pacific Northwest, existing in urban gardens, alpine talus slopes, steppe riparian woodlands, oak and oak-Douglas fir savannah, open and closed-canopy deciduous forests, mixed and coniferous forests and forest margins. The elevational range extends from sea-level to at least 2,300 m. Newly eclosed adults are known from late May to late July (Lindroth 1961-1969). I have observed both adults and larvae feeding upon small and modest-sized slugs and snails. However, I have also seen adults feed upon fragmented mealworm larvae and small caterpillars and Larochelle (1972) observed them feeding upon fly eggs. I frequently find adults feeding on fruit bait. Adults are apparently strictly crepuscular or nocturnal, as are larvae. *Scaphinotus marginatus* has the largest range of any western North American *Scaphinotus*, from Alaska to northern California and east to central Alberta (Lindroth 1961-1969).

Carabidae - *Trechus chalybeus* Dejean

Trechus chalybeus ranked #16 in abundance, with 72 individuals. It was most abundant in TSCS and SCS, but was also found in low numbers in AS, AT and SSS. *Trechus chalybeus* is found in a variety of habitats, from lowland forests to montane and subalpine meadows, but it is most often associated with shaded moist soil. As with some cogeners (*e.g.* Mitchell 1963), adults and larvae are believed to be generalist predators of small invertebrates, particularly eggs and mites. Newly eclosed adults are primarily found in early summer, but some have been found in late summer/early fall, which raises the possibility of overwintering as both larvae and adults (Lindroth 1961-1969). Adults are nocturnal and flightless, with strongly brachypterous hind wings (Lindroth 1961-1969). The distribution of *T. chalybeus* extends from Alaska south to northern California and east to Colorado and Wyoming (Bousquet and Larochelle 1993, Kavanaugh 1992). Some species of *Trechus* are notoriously difficult to discriminate, the male genitalia being the only firm diagnostic character. This is the case with *T. chalybeus* and *T. oregonensis*.

Carabidae - *Trechus oregonensis* Hatch

Trechus oregonensis ranked last in abundance among the "top 20", with 60 individuals. While present in low numbers in AS, AT and SSS, almost all specimens were found in TSCS (53, or 88% of all individuals). As with *T. chalybeus*, this species is found over a wide elevational range and in similar habitats. At lower elevations (down to sea level), it is most often associated with shaded moist areas amid forests. At higher elevations, it is frequently found in montane and subalpine wet meadows. The comments on biology under *T. chalybeus* are generally applicable to *T. oregonensis*. However, newly eclosed adults are apparently only known from late summer/early fall (J.R. LaBonte unpub. data, Lindroth 1961-1969), so overwintering may be confined to adults. Hind wings are even more reduced than in *T. chalybeus*. The known range of *T. oregonensis* is similar to that of *T. chalybeus*, but is not quite as extensive, from Alberta south to northern California and east to Colorado (Bousquet and Larochelle 1993, Lindroth 1961-1969). *Trechus oregonensis* is often sympatric with *T.*

chalybeus, with both species frequently being found together in the same microhabitat. Nothing has been published on how, or whether, these two species parse their habitat. Undoubtedly, the great external similarity between these congeners renders the problem more intractable.

Elateridae - *Cardiophorus propinquus* Hatch

Cardiophorus propinquus belongs to the subfamily Cardiophorinae, while the two remaining elaterid "top 20" species (*Hypolithus dispersus* and *Ligmargus funebris*) belong to the subfamily Denticollinae. Both subfamilies presumably have larvae which are predominantly predaceous, but which may be facultatively herbivorous (P.J. Johson, South Dakota State University, personal communication). Adult trophic relationships are uncertain, although *Cardiophorus* adults are often found on flowers and foliage. No comprehensive catalog of North American Elateridae has been published for decades, so distributional data is limited to that of Hatch (1971). There are no recent comprehensive taxonomic treatments of these genera, so Hatch (1971) remains the most current treatment. However, generic appellations in the Denticollinae have changed a great deal since then (Poole and Gentili 1996).

Cardiophorous propinquus ranked #3 in abundance, with 246 individuals, all found in the gravel bar habitat. Adults of this genus are relatively small, from 4-11 mm in length. Adults are distinctive, with compact bodies loosely clothed dorsally with coarse setae and are dark, often with pale spots on the elytra. This genus is associated with open, often xeric, habitats, frequently with loose or sandy/gravelly soil. Hatch (1971) records *C. propinquus* from British Columbia, Idaho and Washington, stating it is found along streams at altitudes ranging from approximately sea level up to about 1200 m.

Elateridae - *Hypolithus dispersus* Horn

Hypolithus dispersus ranked #10 in abundance, with 89 individuals. Virtually all individuals (approx. 99%) were found in the gravel bar habitat, with 1 found in AT. Adult *Hypolithus*, as currently defined (Poole and Gentili 1996), are among the smallest Elateridae to be found in the Pacific Northwest, with adults from 2-5.5 mm in length. The generic placement of *Hypolithus* species has fluctuated wildly over the past hundred years - for instance, Hatch (1971) treats most species as belonging to the genus *Negastrius*, a group with much more narrowly defined boundaries today (Poole and Gentili 1996). The only "comprehensive" North American key to these related genera is Horn (1891). Although Thomas L. Casey treated Elateridae in his various publications, his keys are not readily usable. Hatch (1971) gives neither keys nor species-specific treatments to this group. Horn (1891) states *H. dispersus* is known from Nevada, Washington and, dubiously, Nova Scotia. I have frequently found adults of this genus (perhaps this species) under stones in gravel bars.

Elateridae - *Ligmargus funebris* Candeze

This species ranked #9 in abundance, with 125 individuals, all from gravel bar traps. Adult *Ligmargus funebris* are moderate-sized elaterids 7-10 mm in length, dark with a faint bronze cast, elongate with the dorsum clothed in coarse setae. As with *Hypolithus dispersus*, the generic placement of this species has changed frequently within the past century. Hatch (1971) places this species in *Hypolithus*, while Horn (1891) regards it as a species of *Cryptohypnus*. Horn (1891) is the only "comprehensive" North American treatment, although Hatch (1971) has keys to the Pacific Northwestern species. Hatch (1971) states both larvae and adults of *L. funebris*, and related species, are usually found near streams under rocks and debris. He records *L. funebris* from southern British Columbia south to Oregon and east to western Montana. I have often found adults of this species under stones in gravel bars.

Latridiidae - *Melanopthalma americana* Mannerheim

The common name for this family is the Minute Brown Scavenger Beetles. Adults are tiny, between 1-3 mm in length, are generally various shades of brown, have clubbed antennae and coarsely faceted eyes, possess coarsely punctate elytral striae and the elytra are thinly clothed with long setae. Little has been published about the biology of this family. Members are predominantly associated with moldy animal and plant substances and some species are common in animal nests (White 1983). Latridiids are frequently found where grain or other foodstuffs are stored, presumably because moldy material is present (White 1983). Adults are commonly swept from vegetation or found in litter (Hatch 1961). Adults and larvae primarily feed upon mold spores (Crowson 1984).

Melanopthalma americana was #18 in abundance, matching *Pterostichus herculaneus* with 67 individuals. It was confined to open riparian habitats, found only in BOG, SCS, SSS and TSCS. However, the vast majority of individuals (67%) were found in SCS sites. Another 16% were found in BOG sites. Adults of this species are typical latridiids, with little to distinguish them at a casual glance from other members of the family. There are about 30 species of *Melanophthalma* in North America (Poole and Gentili 1996), but I know of no comprehensive treatment. Downie and Arnett (1996) treat the 10 eastern U.S. species and Hatch (1961) treats the 7 species he knew of from the Pacific Northwest. Hatch (1961) records *M. americana* from British Columbia south to Oregon and east to Idaho, stating it had been reared from logs of subalpine fir and was readily collected from vegetation. Downie and Arnett (1996) further record this species from California, as well as Indiana and Pennsylvania.

Staphylinidae - *Lordithon fungicola* Campbell

Lordithon fungicola ranked #13 in abundance, with 77 individuals. It was found in all habitats except BOG and SCS. It was most abundant in forested habitats, with 51% of individuals from AS and 17% from PF. This species belongs to a moderately large genus with 37 species known from North and Central America (Campbell 1982). Little has been published on the biology of this group - for instance, none of the larvae of North American species have been described. The strong association with fungi led to the assumption that adults and larvae were fungivorous. However, this was, in part, erroneous. Both adults, and probably larvae, are predators of fly larvae feeding upon fungi, *e.g.* Mycetophilidae, while larvae may be partially or facultatively mycetophagous (Campbell 1982). Campbell (1982) provides the following information. *Lordithon fungicola* was first described in 1982. Prior to that, individuals of this species were generally identified as *L. obsoletus* (Say) (*e.g.* Hatch 1957), an eastern U.S. species. Adults are known from March through October, with most seen during June and July. Adults have been found in a wide variety of mushrooms, including species of *Polyporus*. *Lordithon fungicola* is a widespread transcontinental species found from Alaska south to California and New Mexico, east to Labrador, Newfoundland and the eastern seaboard.

Staphylinidae - *Proteinus collaris* Hatch

This species ranked #6 in abundance, with 175 individuals. *Proteinus collaris* was present in only four habitats: AS, AT, TSCS and TTF. Of these, it was represented by only a few individuals in TSCS (4 total), with the vast majority (83%) in AS and AT. *Proteinus* are quite distinctive staphylinids: small (approx. 1.5 mm long), dark, with oval bodies with rounded pronota and clubbed antennae. Relatively few species belong to this genus, with 10 known from North America (Poole and Gentili 1996) and 3 from the Pacific Northwest (Hatch 1957). As with so many staphylinids, little has been published on the biology of this genus. *Proteinus* adults and larvae are normally associated with a wide variety of decaying soft fungi, as well as dung, carrion and rotting vegetation (Newton 1984). However, the trophic role of this genus has not been definitely ascertained. In Seattle, *P. collaris* was collected from alder litter and pine litter in late winter (Hatch 1957). This species has been recorded only from western Washington state (Hatch 1957, Moore and Legner 1975).

Staphylinidae - *Reichenbachia albionica* Motschulsky

At #7, *Reichenbachia albionica* ranked just behind *Proteinus collaris* in abundance, with 175 individuals. This species was found in all habitats but AT and PF, but the vast majority of individuals (86%) were associated with the more-or-less open swamp habitats: SCS, SSS and TSCS. The subfamily to which this species belongs, the Pselaphinae, was generally regarded as a separate family until recently (Lawrence and Newton 1995). Adults are in part distinguished from other Staphylinidae by their small size, compact bodies, clubbed or asymmetric antennae, inflexible abdomens, and often have one or more large frontal foveae between the eyes. *Reichenbachia albionica* is typical in all the above respects, verging upon rotundity and only 1-1.5 mm long. The genus is the largest in the subfamily, with about 400 species world-wide and 60 species in North America north of Mexico (Chandler 1997). Of these, 8 are known from the Pacific Northwest (Chandler 1997). Little has been written about the biology of the genus, but, like most other pselaphines (Chandler 1997), adults and larvae of *Reichenbachia* are presumably predators of small invertebrates such as mites. Chandler (1997) provides the following information. Adults have been collected around cattails, from cottonwood and leaf litter, from leaf litter beside sloughs and by sweeping introduced grasses. The known distribution is from Alaska south to northern California and east to Idaho.

Staphylinidae - *Staphylinus pleuralis* LeConte

With 81 individuals, *Staphylinus pleuralis* ranked #12 in abundance. Although found in AS, AT, PF, TSCS and TTF, most individuals (72%) came from PF and TTF. At lengths up to 17 mm, these beetles were among the largest common staphylinids collected from Big Beaver Creek. Other than size, distinctive characteristics of *Staphylinus pleuralis* include a large, square head and dorsal patches of pale setae along either side of the abdomen. 33 species of *Staphylinus* are known from North America (Poole and Gentili 1996), with about 10 in the

Pacific Northwest (Hatch 1957). To many, these are the archetypal staphylinids, both in appearance and behavior. Adults and larvae of *Staphylinus* are generalist predators upon a wide array of invertebrates, including slugs and snails, worms, and the larvae and adults of many insects (Balduf 1935). Virtually nothing has been published on the biology of *S. pleuralis*. The range of this species extends from British Columbia south to Oregon and east to Utah (Moore and Legner 1975). Hatch (1957) records *S. pleuralis* as common.

Staphylinidae - *Tachinus crotchii* Horn

Tachinus crotchii was the most abundant staphylinid, ranking #5 in abundance with 181 individuals. This species was truly ubiquitous, and was found in every habitat. However, abundance sharply peaked in AS (34% of individuals) and AT (28%), remaining at roughly equal abundance throughout the other habitats. The genus *Tachinus* is relatively large, with about 120 species world-wide and between 40-50 in North and Central America (Campbell 1988). Because of several revisionary works by Campbell (1973, 1988), the taxonomy and distribution of this genus are much better understood than those of most North American staphylinids. Most *Tachinus* are associated with decaying organic matter, such as leaf litter, rotting mushrooms and fungi, carrion and dung (Campbell 1973). Although found in such habitats, adults and larvae are apparently predominantly predaceous upon insect larvae found there (*e.g.* fly larvae) (Campbell 1973), while larval *Tachinus* may be at least facultatively mycetophagous (Campbell 1973). The following information is derived from Campbell (1973). Most specimens of *T. crotchii* are known from dung or decaying plant material. Records of adults peak between March and July, but some have been found as early as February and as late as September. I suspect the early records stem from specimens at the southern portion of this species' range. *Tachinus crotchii* is distributed from southern British Columbia to central California, from the Cascade Crest to the west.

Conclusions

The Big Beaver Creek beetle study provided baseline information necessary to understand the composition and trophic structure of riparian arthropod faunas within NOCA, and in a larger context, within the Pacific Northwest. Despite the numerous taxa documented in the course of the study, probably many more remain to be found. The beetle species captured during 1995 and 1996 represent at most a substantial subsample of the overall beetle fauna present at Big Beaver Creek. Pitfalls only effectively sample those species active within shallow litter and soil surface habitats. The vast majority of aquatic, foliage, flower and tree species will not be found in pitfalls. For instance, of the 824 beetle species known from the H.J. Andrews Experimental Forest in western Oregon (Parsons *et al.* 1991), about half were aquatic, foliage, flower or tree species, habitats poorly sampled by pitfalls. In sharp contrast, only about a quarter (91) of the Big Beaver Creek species frequent such habitats. Assuming that the representation of species at Big Beaver Creek is similar to the Andrews Forest, many additional beetle species remain to be recorded from this site. For instance, many species not known from Big Beaver Creek have distributions as listed in the Hatch volumes which should place them within the area. Such "incomplete results" are no more than would be expected. It is most unlikely that any pitfalling sampling regime in a reasonably diverse set of habitats would yield all available species, even those susceptible to pitfalling, in only two years. Although pitfalling has been conducted at the Andrews Forest for over two decades (Parsons *et al.* 1991), previously unrecorded species continue to be documented via this method (Parsons, G., J.R. LaBonte and J.E. Miller, in prep.).

The 1996 samples unequivocally illustrated the limitations of single-year pitfalling. Despite the reduced trapping regime (only 50 traps in 5 habitats), the 1996 samples yielded 51 species not seen in 1995. Of these, almost all were represented by only one or two individuals. Furthermore, 85 species present in 1995 were absent in 1996. This latter phenomenon may be at least partially due to the reduced trapping regime in 1996. However, as with the new 1996 species, the vast majority of the 1996 absent species were represented in 1995 by very few individuals. Consequently, the total species turnover between 1995 and 1996 was almost entirely due to the presence or absence of "rare" species. As previously discussed, such species may be inherently resistent to pitfalling, may be incidentals from habitats other than the soil surface and litter, may have phenological refuges from pitfall traps or may be genuinely rare. High turnover rates in "rare" species are no more than would be expected.

Of greater significance than a relatively great "rare" species turnover was the high proportion of shared common species between years. 13 (65%) of the "top 20" abundant species in 1995 were also in the "top 20" of 1996: *Agonum brevicolle*, *Cardiophorus propinquus*, *Eurygenius campanulatus*, *Hypolithus dispersus*, *Lordithon fungicola*, *Pterostichus herculaneus*, *P. neobrunneus, Proteinus collaris, Reichenbachia albionica, Scaphinotus angusticollis, S. marginatus, Staphylinus pleuralis* and *Tachinus crotchii.* Although the ranking of these species was not generally the same between years, *Scaphinotus angusticollis* was the most abundant species in both years. As previously stated, the abundance of *S. angusticollis* in these samples is probably an artifact of the sampling method.

It is obvious from Tables 2 and 3 that the beetle faunas of the habitats sampled at Big Beaver Creek exhibit qualitative and quantitative differences. These differences are expressed at ordinal, family and species scales. Gravel bars, a seemingly barren and homogenous habitat, had the greatest abundance, the second-highest species richness and the most unique species composition in 1995. The apparently unprepossessing alder swamps, otherwise notable primarily for the difficulty of travel through them, had the highest species richness both years and the highest abundance in 1996. This information has great significance for riparian management. An example of family-level differences is provided by the Elateridae, which were abundant and species-rich in the gravel bar habitats, but were insignificant in all other habitats. Detrivorous and predaceous Elateridae such as those in gravel bars may be less important in more vegetated habitats. Another instructive example was provided by two species of carabids. *Scaphinotus angusticollis* was common in all forested habitats, but was most abundant in the Douglas-fir and cedar-hemlock forests and least abundant in alder swamps. In contrast, *S.*

marginatus was least abundant in Douglas-fir and most abundant in alder swamps. This may be indicative of competition between these two congeners, although microhabitat preferences must also be considered.

Habitats also differed in trophic representation, as is evident from a comparison of species abundance values in Tables 2 and 3 with functional feeding group categories in Appendix Table A1. Although predation and detrivory were the dominant trophic modes in all sampled habitats (both via individuals and species), as might be expected from soil and litter faunas, fungivores were very poorly represented in the gravel bars while they were prominent in forested habitats. Thus, trophic modes offer another avenue of analysis.

At its most basic level, this report is a list of the beetles found in the course of the Big Beaver Creek Riparian Arthropod Suvey. The value of this information cannot be overstressed. Our knowledge of terrestrial riparian arthropod faunas is poor at best, despite the recognition of the critical importance of riparian areas as links between terrestrial and aquatic environments. Through the Big Beaver Creek survey, preliminary information on the presence, habitat associations and phenology of over 350 riparian beetle species within North Cascades National Park has been acquired. Most of these species were not previously known from the Park. Many of the habitats have never been systematically sampled anywhere in the Pacific Northwest. Several exotic species were detected within the essentially pristine Big Beaver Creek area of the Park. Such information establishes the baselines vital for monitoring and management, as well as providing potential research directions. For instance, there was no *a priori* recognition of alder swamps and gravel bars as habitats with great species richness. These habitats, which formerly may have been dismissed as having no particular management significance, should receive priority in any management scheme. Research into why riparian beetles are abundant and species-rich within these habitats could be most fruitful.

It is clear from the 1996 results that much remains to be learned of the terrestrial riparian beetle associations of even the modest portion of Big Beaver Creek sampled during this survey. Key information that can only be acquired by ongoing surveys and those conducted in other parts of the Park includes species habitat fidelity and constancy, patterns of relative abundance (especially variability), phenology throughout multiple years, effects of catastrophic events such as fires and floods, *et cetera*. Nonetheless, the Big Beaver Creek Riparian Arthropod Survey has provided valuable insight into key components of a set of habitats critical to the long-term management of North Cascades National Park.

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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, Washington, 1995-1996.

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

Figure A. 4. Photo 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.

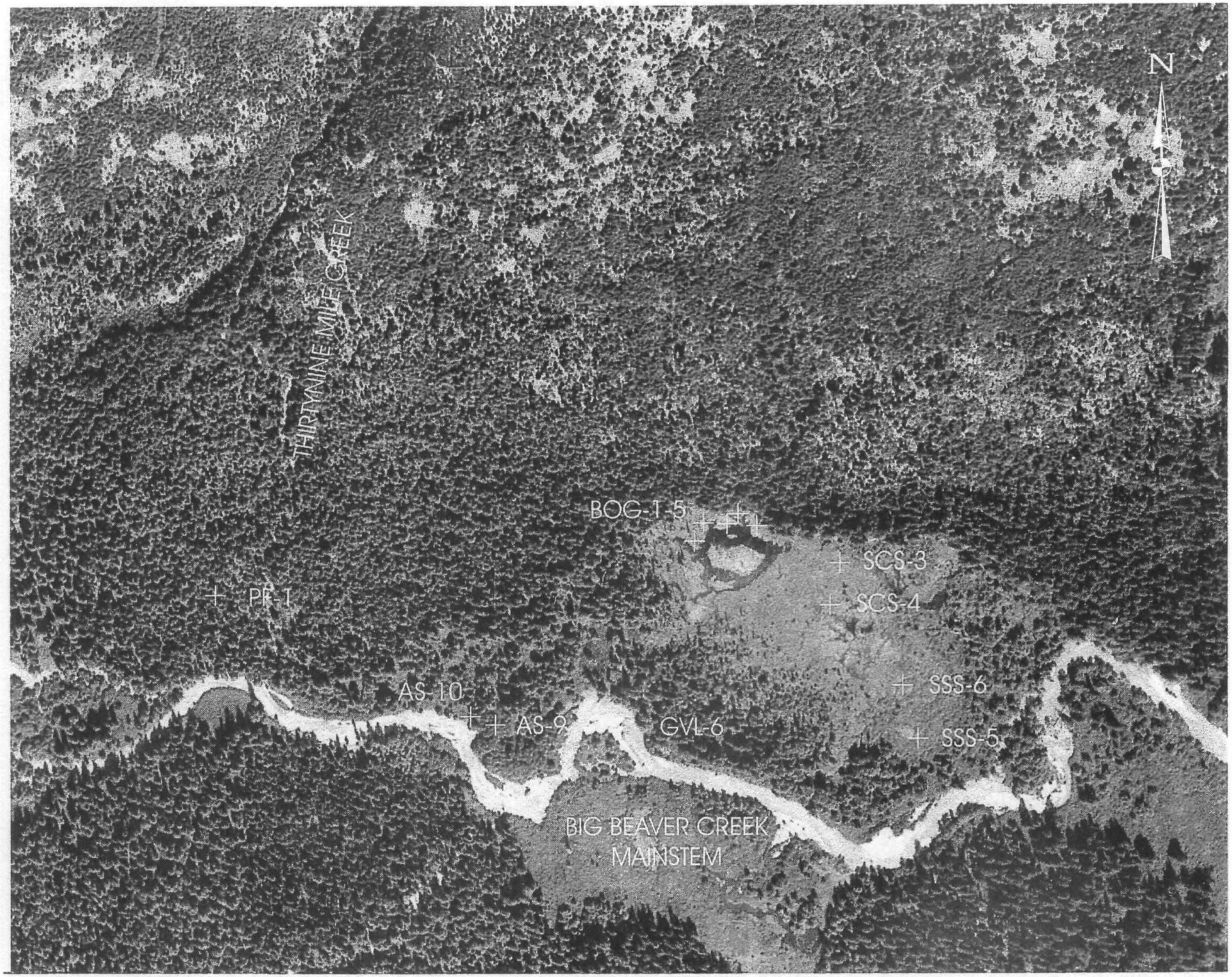

Figure A.6. Photo 6. Arthropod pitfall trap locations, Big Beaver Creek, North Cascades National Park Service Complex, 1995-1996.

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. Trophic data for Coleoptera collected from the Big Beaver Creek Watershed, NOCA, during 1995 and 1996.

KEY TO FUNCTIONAL GROUPS (derived from and similar to Parsons et al. 1991): ? = trophic role uncertain, ~ = associated with trophic resource, but may not feed upon it, Ad = larvae fed or provisioned by adults, D = detritivore, Dg = dung feeder, Fl = flower (incl. pollen, nectar) feeder, Fu = fungivore, H = herbivore, Ms = moss feeder, Nf = non-feeding, O = Omnivore, Pa = parasite, Pr = predator, Rt = root feeder, Sd = seed feeder, Sp = sap / exudate feeder, Sv = Scavenger, X = xylophage.

FAMILY	SPECIES	FUNCTIONAL GROUP		COMMENTS
		Adults	Larvae	
Amphizoidae	Amphizoa insolens LeConte	Pr	Pr	Prey upon immature/adult stoneflies. Aquatic.
Anthicidae	Anthicus nanus LeConte	Fl?, O?	Fu?, O?	
Anthicidae	Eurygenius camplanatus LeConte	Fl	D	
Anthicidae	Ischalia vancouverensis Harrington	Nf?	~X	Larvae may feed upon fungi in rotting wood.
Buprestidae	Agrilus politus (Say)	Fl	X	Larval hosts include maples and willows.
Byrrhidae	Byrrhus kirbyi LeConte	Ms	Ms	Feed upon mosses
Byrrhidae	Curimopsis albonotata LeConte	Ms	Ms	Feed upon mosses
Byrrhidae	Cytilus alternatus Say	Ms	Ms	Feed upon mosses
Byrrhidae	Exomella pleuralis (Casey)	Ms	Ms	Feed upon mosses
Byrrhidae	Listemus acuminatus (Mannerheim)	Ms	Ms	Feed upon mosses
Byrrhidae	Morychus aeneolus LeConte	Ms	Ms	Feed upon mosses
Byrrhidae	Morychus oblongus LeConte	Ms	Ms	Feed upon mosses
Cantharidae	Cantharis oregonus LeConte	Fl, Pr	Pr	Adults and larvae prey upon small invertebrates.
Cantharidae	Malthodes alexanderi Fender	Pr?	Pr?	
Cantharidae	Malthodes sp.	Pr?	Pr?	
Cantharidae	Podabrus conspiratus Fall	Pr	Pr	Adults and larvae prey upon small invertebrates.
Cantharidae	Podabrus piniphilus Dejean	Pr	Pr	Adults and larvae prey upon small invertebrates.
Carabidae	Agonum affine Kirby	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Agonum brevicolle Dejean	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Agonum consimile (Gyllenhal)	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Agonum ferruginosum Dejean	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Agonum piceolum LeConte	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Agonum thoreyi Dejean	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Amara littoralis Mannerheim	O	Pr	Adults readily feed upon seeds.

FAMILY	SPECIES	Adults	Larvae	COMMENTS
Carabidae	Amara sanjuanensis Hatch	O	Pr	Adults readily feed upon seeds.
Carabidae	Anchomenus quadratus (LeConte)	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Anisodactylus binotatus Fabricius	O	Pr	EXOTIC. Adults feed upon seeds, plant parts.
Carabidae	Apristus constrictus Casey	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion breve (Motschulsky)	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion concretum Casey	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion convexulum Hayward	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion erasum Le Conte	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion fortestriatum Motschulsky	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion hesperum Casey	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion inaequale Say	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion incrematum LeConte	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion iridescens LeConte	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion kuprianovi Mannerheim	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion planatum LeConte	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion planiusculum Mannerheim	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion quadrifoveolatum Mannerheim	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion quadrimaculatum dubitans LeConte	Pr / H / Sd	Pr	Adults known to eat young plants and seeds.
Carabidae	Bembidion quadrulum LeConte	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bembidion semipunctatum Donovan	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Blethisa oregonensis LeConte	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Bradycellus conformis Fall	O	Pr	Adults readily feed upon seeds, vegetation.
Carabidae	Bradycellus lecontei Csiki	O	Pr	Adults readily feed upon seeds, vegetation.
Carabidae	Bradycellus nigrinus Dejean	O	Pr	Adults readily feed upon seeds, vegetation.
Carabidae	Calathus fuscipes (Goeze)	Pr / H / Sd	Pr	EXOTIC, Adults known to feed on plants and seeds.
Carabidae	Chlaenius interruptus Horn	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Cicindela depressula Casey	Pr	Pr	Adults and larvae prey upon invertebrates.
Carabidae	Cicindela oregona LeConte	Pr	Pr	Adults and larvae prey upon invertebrates.
Carabidae	Diplous atterrimus Dejean	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Elaphrus clairvillei Kirby	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Elaphrus purpurans Hausen	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Harpalus cordifer Notman	O	Pr	Adults extensively herbivorous - seeds, etc.
Carabidae	Harpalus somnulentus Dejean	O	Pr	Adults extensively herbivorous - seeds, etc.
Carabidae	Leistus ferruginosus Mannerheim	Pr	Pr	Adults specialized predators of springtails.
Carabidae	Loricera decempunctata Eschscholtz	Pr	Pr	Adults specialized predators of springtails.

FAMILY	SPECIES	Adults	Larvae	COMMENTS
Carabidae	Nebria gebleri cascadensis Kavanaugh	Pr	Pr	Adults & larvae feed upon small invertebrates.
Carabidae	Nebria mannerheimi Fischer	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Nebria sahlbergi Fischer	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Notiophilus sylvaticus Eschscholtz	Pr	Pr	Adults prey upon springtails, mites.
Carabidae	Opisthius richardsoni Kirby	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Patrobus fossifrons dimorphicus Darlington	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Pterostichus adstrictus Eschscholtz	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Pterostichus castaneus (DeJean)	Pr / Sd?	Pr	Adults may feed upon seeds, as do congeners.
Carabidae	Pterostichus herculaneus Mannerheim	Pr/Sd	Pr	Adults known to feed upon seeds.
Carabidae	Pterostichus neobrunneus Lindroth	Pr/Sd?	Pr	Adults may feed upon seeds, as do congeners.
Carabidae	Pterostichus riparius Dejean	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Scaphinotus angulatus Harris	Pr	Pr	Specialized predators of slugs & snails.
Carabidae	Scaphinotus angusticollis Mannerheim	Pr	Pr	Prey on slugs, snails, thought to eat other invertebrates.
Carabidae	Scaphinotus marginatus Fischer	Pr	Pr	Prey on slugs, snails, thought to eat other invertebrates.
Carabidae	Synuchus impunctatus Say	Pr/Sd	Pr	Esp. subcortical. Adults known to eat seeds.
Carabidae	Trechus chalybeus Dejean	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Trechus oregonensis Hatch	Pr	Pr	Adults & larvae prey upon invertebrates.
Carabidae	Trichocellus cognatus Gyllenhal	Pr	Pr	Adults & larvae prey upon invertebrates.
Cerambycidae	Brachyleptura dehiscens (LeConte)	Fl	X	Larval hosts are recently dead conifers.
Cerambycidae	Leptura obliterata Haldeman	Fl	X	Larval hosts are dead and dying conifers.
Cerambycidae	Plectura spinicauda Mannerheim	H	X	Larval hosts include hardwoods and conifers.
Cerambycidae	Stenocorus flavolineatus (LeConte)	Fl	X	Larval hosts are probably hardwoods.
Cerambycidae	Xestoleptura crassipes (LeConte)	Fl	X	Larvae occur in well-decayed conifers.
Cerambycidae	Xestoleptura tibialis LeConte	Fl	X	Larvae occur in well-decayed conifers.
Chrysomelidae	Altica corni Woods	H	H	Recorded from Cornus pubescens.
Chrysomelidae	Altica tombacina Mannerheim	H	H	Recorded from dogwood, fireweed.
Chrysomelidae	Chaetocnema irregularis LeConte	H	Rt	Recorded from a wide variety of plants.
Chrysomelidae	Chrysomela mainensis Bechyne	H	H	Breeds & feeds upon alder foliage.
Chrysomelidae	Crepidodera nana (Say)	H	Rt	Hosts are cottonwood, willow, etc.
Chrysomelidae	Hippuriphila mancula LeConte	H	H	Host is Equisetum. Larvae inside stems.
Chrysomelidae	Macrohaltica ambiens (LeConte)	H	H	Adults & larvae feed on alder leaves.
Chrysomelidae	Macrohaltica caurina Blake	H	H	Adults recorded from Ribes.
Chrysomelidae	Plateumaris nitida Germar	H	H	Water lilies, aquatic plants. Larvae aquatic.
Chrysomelidae	Pyrrhalta punctipennis Mannerheim	H	H	Feed upon willow.
Chrysomelidae	Pyrrhalta spiraeophila Hatch & Beller	H	H	Feed upon spirea.

FAMILY	SPECIES	Adults	Larvae	COMMENTS
Ciidae	Cis americanus Mannerheim	Fu	Fu	Feed upon polypore fungi.
Ciidae	Cis maritimus Hatch	Fu	Fu	Feed upon fungi.
Ciidae	Octotemnus laevis Casey	Fu	Fu	Known from many polypore fungi
Coccinellidae	Hippodamia washingtoni Timberlake	Pr	Pr	Prey upon aphids
Coccinellidae	Scymnus caurinus Horn	Pr	Pr	Prey upon mealybugs, scales, aphids, & mites.
Coccinellidae	Stethorus punctum picipes Casey	Pr	Pr	Prey upon mites, incl. spider mites.
Colydiidae	Lasconotus vegrandis Horn	Pr	Fu?, Pr	Eat subcortical invertebrates. Young larvae eat fungi.
Corylophidae	Orthoperus scutellaris LeConte	Fu	Fu	Adults & larvae feed upon fungal spores.
Cryptophagidae	Anchicera ephippiata Zimmerman	Fu?	Fu?	Eat fungi & molds in litter, nests, etc.?
Cryptophagidae	Anchicera kamtschatica Motschulsky	Fu?	Fu?	Eat fungi & molds in litter, nests, etc.?
Cryptophagidae	Anchicera ochracea Zimmerman	Fu?	Fu?	Eat fungi & molds in litter, nests, etc.?
Cryptophagidae	Anchicera postpallens Casey	Fu?	Fu?	Eat fungi & molds in litter, nests, etc.?
Cryptophagidae	Antherophagus ochraceus Melsheimer	Fl	D?	Larvae occur in bumblebee nests.
Cryptophagidae	Atomaria constricta Casey	Fu	Fu	Eat fungi & molds in litter, nests, etc.
Cryptophagidae	Atomaria quadricollis Casey	Fu	Fu	Eat fungi & molds in litter, nests, etc.
Cryptophagidae	Caenoscelis ferruginea (Sahlberg)	Fu	Fu	Adults & larvae eat molds and fungal spores.
Cryptophagidae	Cryptophagus cellaris (Scopoli)	Fu	Fu	Adults & larvae eat molds and fungal spores.
Cryptophagidae	Cryptophagus confertus Casey	Fu	Fu	Eat fungi & molds in litter, nests, etc.
Cryptophagidae	Cryptophagus lapponicus Gyllenhal	Fu	Fu	Eat fungi & molds in litter, nests, etc.
Cryptophagidae	Cryptophagus tuberculosus Maklin	Fu	Fu	Eat fungi & molds in litter, nests, etc.
Cryptophagidae	Henotiderus lorna Hatch	Fu?	Fu?	Eat fungi & molds in litter, nests, etc.?
Curculionidae	Baris sparsa LeConte	H	H, Rt	Larvae stem & root feeders upon Asteraceae.
Curculionidae	Cryptorhynchus lapathi Linnaeus	H	X	EXOTIC. On Populus, Salix.
Curculionidae	Geoderces horni Van Dyke	H	Rt	Often a pest of caneberries & strawberries.
Curculionidae	Lepesoma (= Dyslobus) lecontei Casey	H	Rt	Adults eat conifer flowers and young cones.
Curculionidae	Lepesoma (= Dyslobus) verrucifera Casey	H	Rt	Adults feed upon foliage.
Curculionidae	Rhyncolus brunneus Mannerheim	X	X	Under bark of dead conifers.
Curculionidae	Steremnius carinatus Boheman	Rt	Rt	Conifer root feeder, girdler. Vector of black-stain root disease.
Curculionidae	Sthereus (= Lobosoma) horridus (Mannerheim)	D?	D?	Adults in litter, on bark, or in logs.
Dytiscidae	Agabus antthracinus Mannerheim	Pr / Sv	Pr	Prey upon small aquatic invertebrates
Dytiscidae	Agabus austinii Sharp	Pr	Pr	Prey upon small aquatic invertebrates
Dytiscidae	Agabus strigulosus (Crotch)	Pr	Pr	Prey upon small aquatic invertebrates
Dytiscidae	Agabus tristis Aube	Pr / Sv	Pr	Prey upon small aquatic invertebrates
Dytiscidae	Agabus sp. (female)	Pr	Pr	Prey upon small aquatic invertebrates
Dytiscidae	Dytiscus sp. (larva)	Pr	Pr	Prey upon aquatic invertebrates/vertebrates

FAMILY	SPECIES	Adults	Larvae	COMMENTS
Dytiscidae	Graphoderus perplexus Sharp	Pr	Pr	Hatch (1953) says "rare"
Dytiscidae	Hydroporus pacificus Fall	Pr	Pr	Prey upon small aquatic invertebrates
Dytiscidae	Hydroporus sp.	Pr	Pr	Prey upon small aquatic invertebrates
Dytiscidae	Rhantus suturellus (Harris)	Pr / Sv	Pr	Prey upon small aquatic invertebrates
Elateridae	Agriotes ferrugineipennis LeConte	Fl, H	Rt	Larvae feed upon grasses.
Elateridae	Ampedus carbonicolor (Eschscholtz)	Fl	Pr / D	Larvae subcortical predators of invertebrates.
Elateridae	Ampedus rhodopus LeConte	Fl, H	Pr, SV	Larvae also eat bacterial & fungal slimes.
Elateridae	Athous rufiventris Eschscholtz	Fl, H	Pr	Adults nocturnal.
Elateridae	Athous vittiger LeConte	Fl, H	Pr	Adults nocturnal.
Elateridae	Cardiophorus amplicollis Motschulsky	Fl, H	Pr	Associated with sandy areas.
Elateridae	Cardiophorus propinquus Hatch	Fl, H	Pr	Associated with sandy areas.
Elateridae	Ctenicera aeripennis (Kirby)	Fl, H	Pr	Larvae are facultative phytophages.
Elateridae	Ctenicera angusticollis Mannerheim	Fl, H	Pr	Larvae are facultative phytophages.
Elateridae	Ctenicera opacula (LeConte)	Fl, H	?	Larvae are facultative phytophages.
Elateridae	Ctenicera propola columbiana (Brown)	Fl	Pr	Larvae are litter/soil predators of invertebrates.
Elateridae	Ctenicera resplendens (Eschscholtz)	Fl	Pr	Larvae are litter/soil predators of invertebrates.
Elateridae	Ctenicera suckleyi (LeConte)	Fl	Pr	Larvae are litter/soil predators of invertebrates.
Elateridae	Ctenicera volitans Eschscholtz	Fl, H	Pr	Larvae are facultative phytophages.
Elateridae	Ctenicera umbripennis (LeConte)	Fl	Pr	Larvae are litter/soil predators of invertebrates.
Elateridae	Dalopius maritimus Brown	Fl, H	Rt	
Elateridae	Eanus striatipennis Brown	Fl, H	Pr	Known from montane bogs & wet meadows.
Elateridae	Hemicrepidius pallidipennis Mannerheim	Fl, H	Pr	Larvae may be facultative phytophages.
Elateridae	Hypnoidus bicolor Eschscholtz	Fl, H	Pr	Riparian. Sometimes a minor agricultural pest.
Elateridae	Hypolithus dispersus (Horn)	Fl, H	Pr	Riparian, in gravel/sand bars.
Elateridae	Hypolithus musculus (Eschscholtz)	Fl, H	Pr	Riparian, in gravel/sand bars.
Elateridae	Hypolithus nocturnus Eschscholtz	Fl, H	Pr	Riparian.
Elateridae	Hypolithus squalidus LeConte	Fl, H	Pr	Riparian.
Elateridae	Hypolithus sp.	Fl, H	Pr	Riparian, in gravel/sand bars.
Elateridae	Ligmargus funebris Candeze	Fl, H	Pr	Riparian.
Elateridae	Megapenthes caprella (LeConte)	Fl, H	X	
Elateridae	Migiwa sp. (= striatulus LeConte?)	Fl, H	Pr	
Elateridae	Negastrius ornatus (LeConte)	Fl, H	Pr	Riparian, in gravel/sand bars.
Elateridae	Zorochrus caurinus Horn	Fl, H	Pr	Riparian, in gravel/sand bars.
Endomychidae	Xenomycetes laversi Hatch	Fu	Fu	Adults & larvae eat polyporus fungi.
Erotylidae	Triplax antica LeConte	Fu	Fu	Recorded from Polyporus

FAMILY	SPECIES	Adults	Larvae	COMMENTS
Gyrinidae	Gyrinus picipes Aube	Pr / Sv	Pr	Feed at water surface on aquatic invertebrates.
Histeridae	Hypocaccus bigemmeus LeConte	Pr	Pr	Sandy areas near water. Larvae in sand.
Hydraenidae	Hydraena vandykei vandykei d'Orchymont	H, Sv	Pr?, Sv?	Eat aquatic periphyton, etc.
Hydraenidae	Ochthebius cribricollis LeConte	H, Sv	Pr?, Sv?	Eat aquatic periphyton, etc.
Hydrophilidae	Cercyon adumbratum Mannerheim	D, Dg, Sv	D, Dg, Sv	Adults & larvae eat rotting vegetation, etc.
Hydrophilidae	Crenitis paradigma d'Orchymont	Sv	Pr	Larvae prey upon small aquatic invertebrates.
Hydrophilidae	Cymbiodyta acuminata Fall	Sv?	Pr	Larvae prey upon small aquatic invertebrates.
Hydrophilidae	Helophorus auricollis Eschscholtz	D, H	Pr	Adults known to feed upon dead grass & algae.
Hydrophilidae	Megasternum posticatum (Mannerheim)	D / Sv	D / Sv	Adults & larvae feed on decaying vegetation.
Laemophloeidae	Rhinomalus cygnaei (Mannerheim)	Fu?	Fu?	Adults & larvae may eat subcortical fungi.
Lampyridae	Phausis skelleyi Fender	Pr	Pr	Larvae eat slugs, snails, insect larvae.
Latridiidae	Enicmus cordatus Belon	Fu	Fu	Adults and larvae eat slime mold spores.
Latridiidae	Melanopthalma americana Mannerheim	Fu	Fu	Adults & larvae eat fungal spores, esp. molds.
Latridiidae	Melanopthalma distinguenda Comolli	Fu	Fu	Adults & larvae eat fungal spores, esp. molds.
Latridiidae	Melanopthalma gibbosa Herbst	Fu	Fu	Adults & larvae eat fungal spores, esp. molds.
Latridiidae	Steposthethus liratus LeConte	Fu?	Fu?	Adults & larvae probably eat fungal spores.
Leiodidae	Agathidium californicum Horn	Fu	Fu	Feed upon basidiomycetes & slime molds.
Leiodidae	Agathidium concinnum Mannerheim	Fu	Fu	Feed upon basidiomycetes & slime molds.
Leiodidae	Agathidium contiguum Fall	Fu	Fu	Feed upon basidiomycetes & slime molds.
Leiodidae	Agathidium sp. (near contiguum Fall)	Fu	Fu	Feed upon basidiomycetes & slime molds.
Leiodidae	Agathidium jasperinum Fall	Fu	Fu	Feed upon basidiomycetes & slime molds.
Leiodidae	Anisotoma confusa Horn	Fu	Fu	Adults & larvae obligate slime mold feeders.
Leiodidae	Anisotoma errans Brown	Fu	Fu	Adults & larvae obligate slime mold feeders.
Leiodidae	Catops basilaris Say	Sv/Dg	Sv/Dg	Eat carrion, dung, decaying fungi, etc.
Leiodidae	Catops egenus Horn	Sv/Dg	Sv/Dg	Eat carrion, dung, decaying fungi, etc.
Leiodidae	Catops simplex Say	Sv/Dg	Sv/Dg	Eat carrion, dung, decaying fungi, etc.
Leiodidae	Catops spp.	Sv/Dg	Sv/Dg	Eat carrion, dung, decaying fungi, etc.
Leiodidae	Catoptrichus frankenhaeuseri (Mann.)	Sv	Sv	At carrion, rotten fungi. Adults fall/winter.
Leiodidae	Colon complicatum Hatch	Fu?	Fu?	Adults & larvae eat subterranean fungi?
Leiodidae	Colon inerme Mannerheim	Fu?	Fu?	Adults & larvae eat subterranean fungi?
Leiodidae	Colon magnicolle Mannerheim	Fu?	Fu?	Adults & larvae eat subterranean fungi?
Leiodidae	Colon nevadense Horn	Fu?	Fu?	Adults & larvae eat subterranean fungi?
Leiodidae	Colon schuhi Hatch	Fu?	Fu?	Adults & larvae eat subterranean fungi?
Leiodidae	Colon serripoides Hatch	Fu?	Fu?	Adults & larvae eat subterranean fungi?
Leiodidae	Colon sp.	Fu?	Fu?	Adults & larvae eat subterranean fungi?

FAMILY	SPECIES	Adults	Larvae	COMMENTS
Leiodidae	Hydnobius simulator Brown	Fu	Fu	Adults & larvae feed upon subterranean fungi.
Leiodidae	Leiodes alesi Baronowski	Fu	Fu	Adults & larvae eat subterranean fungi.
Leiodidae	Leiodes cascadensis Baranowski	Fu	Fu	Adults & larvae eat subterranean fungi.
Leiodidae	Leiodes lateritia (Mannerheim)	Fu	Fu	Adults & larvae eat subterranean fungi.
Leiodidae	Leiodes puncticollis (Thomson)	Fu	Fu	Adults & larvae eat subterranean fungi.
Leiodidae	Leptinus occidentamericanus Peck	Sv	Sv	Ectoparasite/inquilines of small mammals.
Leiodidae	Nemadus decipiens (Horn)	D / Sv	D / Sv	Adults & larvae eat decaying organic matter.
Leiodidae	Platycholeus opacellus Fall	D?	D?	Termitophilous with dampwood termites.
Lucanidae	Ceruchus striatus LeConte	Nf	X	Larvae eat sapwood of decaying Douglas fir.
Lycidae	Dictyopterus simplicipes Mannerheim	Fl, Pr	D?	Adults feed upon nectar, probably invertebrates.
Melandryidae	Xylita laevigata Hellenius	Fu?	Fu?	Adults and larvae in decaying conifer logs.
Melyridae	Hypebaeus bicolor (LeConte)	Pr? / ~Fl	Pr? / Sv?	Adults in other genera eat small invertebrates.
Mordellidae	Mordella atrata Melsheimer	Fl	Fu?	Larvae of some congeners in shelf fungi.
Nitidulidae	Epuraea avara Randall	Sv?, Sp	Sv?, Sp	At sap, fermenting fruit, flowers, under bark.
Oedemeridae	Calopus angustus LeConte	Fl	Fu?, X?	Larvae in both live and dead trees.
Oedemeridae	Ditylus gracilis LeConte	Nf?	X	Larvae feed upon moist rotten conifer wood.
Oedemeridae	Ditylus quadricollis LeConte	Nf?	X	Larvae feed upon moist rotten conifer wood.
Oedemeridae	Xanthochroa testacea Horn	Nf?	X	Larvae in decaying wood.
Phalacridae	Phalacrus pencillatus Say	Fl, Fu	Fu	Adults, larvae eat smuts, rusts, mildews, etc.
Phalacridae	Stilbus apicalis Melsh.	Fu	Fu	Eat molds & mildews on dead or dying leaves.
Ptiliidae	Acrotrichis cognata Matthews	Fu	Fu	Adults and larvae feed upon fungal spores.
Ptiliidae	Acrotrichis henrici Matthews	Fu	Fu	Adults and larvae feed upon fungal spores.
Ptiliidae	Acrotrichis vicina Matthews	Fu	Fu	Adults and larvae feed upon fungal spores.
Ptiliidae	Ptenidium pusillum Gyllenhal	Fu	Fu	Adults and larvae feed upon fungal spores.
Ptilodactylidae	Araeopidius monachus LeConte	Nf?	D?	Larvae are aquatic, may be detrivores.
Pyrochroidae	Dendroides ephemeroides Mannerheim	Nf	Fu?	Larvae eat fungi under bark, in decayed wood?
Pyrochroidae	Pedilus jonae Young	Fl	D?, Sv?	Larvae associated with decaying vegetation.
Pythidae	Priognathus monilicornis Randall	X?	X?	Adults,larvae under bark, in decaying conifers.
Scarabaeidae	Aegialia lacustris LeConte	D	D	Adults & larvae eat decaying organic matter.
Scarabaeidae	Aegialia opaca Brown	D	D	Adults & larvae eat decaying organic matter.
Scarabaeidae	Aphodius opacus LeConte	Dg	Dg	Recorded from deer dung.
Scarabaeidae	Onthophagus nuchicornis Linnaeus	Dg	Ad-Dg	EXOTIC. In domestic stock dung.
Scirtidae	Cyphon brevicollis LeConte	Nf?	D	Adults terrestrial, Larvae aquatic detritivores.
Scirtidae	Cyphon padi Linnaeus	Nf?	D	Adults terrestrial, Larvae aquatic detritivores.
Scirtidae	Cyphon variabilis Thunberg	Nf?	D	Adults terrestrial, Larvae aquatic detritivores.

FAMILY	SPECIES	Adults	Larvae	COMMENTS
Scolytidae	Gnathotrichus retusus (LeConte)	Fu	Fu	Recorded from alder, conifers. Ambrosia beetles.
Scydmaenidae	Scydmaenus californicus Motschulsky	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Scydmaenidae	Scydmaenus fuchsi Brendel	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Scydmaenidae	Veraphis mirabilis Marsh	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Silphidae	Nicrophorus defodiens Mannerheim	Sv/Pr/Dg	Ad-Sv	Adults: carrion, feces, fly larvae. Larvae: carrion.
Silphidae	Nicrophorus investigator Zetterstedt	Sv/Pr/Dg	Ad-Sv	Adults: carrion, feces, fly larvae. Larvae: carrion.
Silphidae	Thanatophilus lapponicus (Herbst)	Sv	Sv	On carrion. Cold-adapted.
Spaeritidae	Sphaerites politus Mannerheim	Dg/D/Fu?	Dg?, D?	Adults: decayed plant material, bear dung, fungi.
Staphylinidae	Acidota crenata Fabricius	Pr?	Pr?	Prey upon small invertebrates?
Staphylinidae	Actium barri Park & Wagner	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Staphylinidae	Actium retractum Casey	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Staphylinidae	Aleochara bilineata Gyllenhal	Pr	Pa	probable EXOTIC. Prey upon non-adult flies.
Staphylinidae	Aleochara bimaculata Gravenhorst	Pr	Pr	probable EXOTIC. In dung, dead vegetation.
Staphylinidae	Aleocharinae			Detritivores, fungivores, predators, etc.
Staphylinidae	Amphicroum maculatum Horn	Fl	?	Adults probably feed upon pollen.
Staphylinidae	Anthobium clarkae Hatch	Pr?	Pr?	Prey upon small invertebrates?
Staphylinidae	Anthobium reflexicolle Casey	Pr?	Pr?	Ex: mouse nests. Prey on small invertebrates?
Staphylinidae	Anthobium sinuosum Hatch	Pr?	Pr?	Prey upon small invertebrates?
Staphylinidae	Atrechus macrocephalus (Nordmann)	Pr	Pr	Adults & larvae feed on small invertebrates.
Staphylinidae	Atrechus punctiventris (Fall)	Pr	Pr	Adults & larvae feed on small invertebrates.
Staphylinidae	Baeocera humeralis Fall	Fu	Fu	Adults & larvae eat slime molds, basidiomycetes.
Staphylinidae	Batrisodes albionicus (Aube)	Pr	Pr	Eat springtails and other small invertebrates.
Staphylinidae	Bisnius hesperidum Smetana	Pr	Pr	Adults & larvae feed on small invertebrates.
Staphylinidae	Bisnius siegwaldi (Mannerheim)	Pr	Pr	Adults & larvae feed on small invertebrates.
Staphylinidae	Bledius cedarensis Hatch	H	H	Adults and larvae feed upon algae and diatoms.
Staphylinidae	Bledius suturalis LeConte	H	H	Adults and larvae feed upon algae and diatoms.
Staphylinidae	Bolitobius kremeri Malkin	Pr	Pr	Mycophilus predator. Eat maggots?
Staphylinidae	Bryophacis discalis (Hatch)	~Fu	~Fu	Associated with fungi, in litter, under bark, etc.
Staphylinidae	Bryophacis punctatissimus Hatch	~Fu	~Fu	Associated with fungi, in litter, under bark, etc.
Staphylinidae	Bryophacis punctulatus Hatch	~Fu	~Fu	Associated with fungi, in litter, under bark, etc.
Staphylinidae	Cupila excavata Park & Wagner	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Staphylinidae	Cypha crotchii Horn	?	?	Biology unknown.
Staphylinidae	Dianous nitidulus LeConte	Pr	Pr	Adults & larvae feed on small invertebrates.
Staphylinidae	Elonium NEAR barri (Hatch)	Fl	?	Adults probably feed upon pollen.
Staphylinidae	Elonium rugosa (Hatch)	Fl	?	Adults probably feed upon pollen.

FAMILY	SPECIES	Adults	Larvae	COMMENTS
Staphylinidae	Empelus brunnipennis Mannerheim	Fu	Fu	Adults & larvae feed upon fungal spores.
Staphylinidae	Erichsonius cinerascens Gravenhorst	Pr?	Pr?	Adults recorded from sphagnum bogs.
Staphylinidae	Eusphalerum fenyesi Bernh.	Fl	?	Adults probably feed upon pollen.
Staphylinidae	Eusphalerum pothos Mannerheim	Fl	?	Adults probably feed upon pollen.
Staphylinidae	Gabrius cushmani Hatch	Pr	Pr	Adults & larvae prey upon small invertebrates.
Staphylinidae	Gabrius picipennis Maklin	Pr	Pr	but also frequent carrion, dung & detritus.
Staphylinidae	Gabrius seattlensis Hatch	Pr	Pr	As for congeners.
Staphylinidae	Gabrius shulli Hatch	Pr	Pr	As for congeners.
Staphylinidae	Hemiquedius fusculus (LeConte)	Pr	Pr	Adults & larvae prey upon small invertebrates.
Staphylinidae	Ischnosoma fimbriatum Campbell	~Fu	~Fu	Adults & larvae are associated with fungi.
Staphylinidae	Ischnosoma pictum (Horn)	~Fu	~Fu	Adults & larvae are associated with fungi.
Staphylinidae	Ischnosoma splendidus (Gravenhorst)	~Fu	~Fu	Adults & larvae are associated with fungi.
Staphylinidae	Lathrobium punctulatum? LeConte	Pr	Pr	Adults & larvae prey upon small invertebrates.
Staphylinidae	Lathrobium vancouveri Casey	Pr	Pr	Adults & larvae prey upon small invertebrates.
Staphylinidae	Lithocaris capitula Casey	Pr?	Pr?	Adults & larvae in decaying plant matter.
Staphylinidae	Lobrathium sp.	Pr	Pr	Adults & larvae prey upon small invertebrates.
Staphylinidae	Lordithon fungicola Campbell	Pr	Pr	Adults and larvae eat fly larvae. Mycophilus.
Staphylinidae	Lordithon poecilus Mannerheim	Pr	Pr	Adults and larvae eat fly larvae. Mycophilus.
Staphylinidae	Lordithon thoracicus Fabricius	Pr	Pr	Adults and larvae eat fly larvae. Mycophilus.
Staphylinidae	Lucifotychus cognatus LeConte	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Staphylinidae	Lucifotychus impellus Park & Wagner	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Staphylinidae	Mathrilaeum pictum (Fauvel)	Fl? / Sv?	?	Adults recorded from flowers and carrion.
Staphylinidae	Mathrilaeum subcostatum Maklin	~Fl, Sv?	?	Adults on flowers and carrion.
Staphylinidae	Megarthrus arcuatus Hatch	Fu	Fu	Adults eat Agaricales, larvae eat fungal spores.
Staphylinidae	Megarthrus pictus Motschulsky	Fu	Fu	Adults eat Agaricales, larvae eat fungal spores.
Staphylinidae	Megarthrus sinuaticollis Boisduval & Lacordaire	Fu	Fu	Adults eat Agaricales, larvae eat fungal spores.
Staphylinidae	Microedus austinianus LeConte	?	?	Riparian along montane sand and gravel bars.
Staphylinidae	Microedus laticollis (Mannerheim)	Pr?	Pr?	Adults and larvae may eat small invertebrates.
Staphylinidae	Micropeplus minor Campbell	Fu	Fu	Adults and larvae eat basidiomycetes, molds.
Staphylinidae	Micropeplus nelsoni Campbell	Fu	Fu	Adults and larvae eat basidiomycetes, molds.
Staphylinidae	Mycetoporus americanus Erichson	~Fu	~Fu	Adults and larvae associated with fungi.
Staphylinidae	Mycetoporus bipunctatus Campbell	~Fu	~Fu	Adults and larvae associated with fungi.
Staphylinidae	Mycetoporus pacificus Campbell	~Fu	~Fu	Adults and larvae associated with fungi.
Staphylinidae	Nitidotachinus tachyporoides (Horn)	Pr	Pr	Adults & larvae feed upon small invertebrates.
Staphylinidae	Olophrum consimile Gyllenhal	?	?	Adults: in litter & debris along streams, ponds.

FAMILY	SPECIES	Adults	Larvae	COMMENTS
Staphylinidae	Omalium foraminosum Maklin	Pr	Pr	Congener at carrion, decaying plant material.
Staphylinidae	Ontholestes cingulatus Gravenhorst	Pr	Pr	Associated with dung. Feed upon flies?
Staphylinidae	Oropodes dybasi Grigarick & Schuster	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Staphylinidae	Oropus striatus (LeConte)	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Staphylinidae	Orus punctatus Casey	Pr?	Pr?	Adults & larvae prey upon small invertebrates?
Staphylinidae	Oxyporus occipitalis Fauvel	Fu	Fu	Eat fleshy fungi (basidiomycetes: Agaricales).
Staphylinidae	Oxytelus laqueatus Marsham	~Dg, Sv?	~Dg, Sv?	From carrion, dung, detritus. Saprophagous.
Staphylinidae	Pelecomalium testaceum Mannerheim	Fl	?	Adults: esp. at skunk cabbage. Probably pollenivores.
Staphylinidae	Philonthus crotchi Horn	Pr	Pr	Adults & larvae prey on mycophagous flies.
Staphylinidae	Philonthus cruentatus (Gmelin)	Pr	Pr	EXOTIC. In dung & carrion. Prey upon flies.
Staphylinidae	Philonthus duplicatus Bernhauer & Schubert	Pr	Pr	Adults & larvae prey on mycophagous flies.
Staphylinidae	Philonthus furvus Nordman	Pr	Pr	Recorded from carrion. Prey upon flies.
Staphylinidae	Philonthus spiniformis Hatch	Pr	Pr	Adults & larvae feed upon small invertebrates.
Staphylinidae	Philonthus varians Paykull	Pr	Pr	Adults & larvae prey on mycophagous flies.
Staphylinidae	Phlaeopterus frosti Hatch	Pr / Sv?	Pr / Sv?	Congeneric adults seen eating snowfield insects.
Staphylinidae	Proteinus basalis Maklin	Fu/Sv	Fu/Sv	Under carrion, in moss.
Staphylinidae	Proteinus collaris Hatch	Fu/Sv	Fu/Sv	Recorded for alder & pine litter
Staphylinidae	Proteinus limbatus Maklin	Fu/Sv	Fu/Sv	Fungi, leaf litter, compost
Staphylinidae	Pseudopsis sulcata Newman	Fu	Fu	Possible EXOTIC. Eat polyporous fungi.
Staphylinidae	Quedius aenescens Maklin	Pr	Pr	Adults & larvae prey upon invertebrates.
Staphylinidae	Quedius breviceps Casey	Pr	Pr	Adults & larvae prey upon invertebrates.
Staphylinidae	Quedius crescenti Hatch	Pr	Pr	Adults & larvae prey upon invertebrates.
Staphylinidae	Quedius fulvicollis (Stephens)	Pr	Pr	Recorded from swamps, marshes and bogs.
Staphylinidae	Quedius griffinae Hatch	Pr	Pr	Adults & larvae prey upon invertebrates.
Staphylinidae	Quedius horni Hatch	Pr	Pr	Adults & larvae prey upon invertebrates.
Staphylinidae	Quedius nevadensis Casey	Pr	Pr	Adults & larvae prey upon invertebrates.
Staphylinidae	Quedius oculeus Casey	Pr	Pr	Adults & larvae prey upon invertebrates.
Staphylinidae	Reichenbachia albionica Motschulsky	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Staphylinidae	Sonoma hespera Park & Wagner	Pr?	Pr?	Eat mites, springtails, other small invertebrates?
Staphylinidae	Staphylinus pleuralis LeConte	Pr	Pr	Adults & larvae prey upon invertebrates.
Staphylinidae	Staphylinus rutilicauda Horn	Pr	Pr	Adults & larvae prey upon invertebrates.
Staphylinidae	Stenus juno Fabricius	Pr	Pr	Adults specialized for capturing springtails.
Staphylinidae	Stenus laccophilus Casey	Pr	Pr	Adults specialized for capturing springtails.
Staphylinidae	Stenus maritimus Motschulsky	Pr	Pr	Adults specialized for capturing springtails.
Staphylinidae	Stenus occidentalis Casey	Pr	Pr	Adults specialized for capturing springtails.

FAMILY	SPECIES	Adults	Larvae	COMMENTS
Staphylinidae	Stenus plicipennis (Casey)	Pr	Pr	Adults specialized for capturing springtails.
Staphylinidae	Stenus subgriseus Casey	Pr	Pr	Adults specialized for capturing springtails.
Staphylinidae	Subhaida ingrata (Hatch)	?	?	Biology not recorded.
Staphylinidae	Tachinus basalis Erichson	Pr, ~Fu	Pr, ~Fu	From dung, carrion and decaying fungi.
Staphylinidae	Tachinus crotchii Horn	Pr, ~Fu	Pr, ~Fu	Recorded from carrion, dung & fleshy fungi.
Staphylinidae	Tachinus maculicollis Maklin	Pr, ~Fu	Pr, ~Fu	Recorded from carrion, dung & fleshy fungi.
Staphylinidae	Tachinus nigricornis Mannerheim	Pr, ~Fu	Pr, ~Fu	From dung, carrion and decaying fungi.
Staphylinidae	Tachinus semirufus Horn	Pr, ~Fu	Pr, ~Fu	From dung, carrion and decaying fungi.
Staphylinidae	Tachyporus canadensis Campbell	Pr	Pr	Adults from herbage, ant & animal nests.
Staphylinidae	Tachyporus chrysomelinus Linnaeus	Pr	Pr	Adults from herbage, ant & animal nests.
Staphylinidae	Tachyporus jocosus Say	Pr	Pr	Adults from herbage, ant & animal nests.
Staphylinidae	Tachyporus maculicollis Campbell	Pr	Pr	Adults from herbage, ant & animal nests.
Staphylinidae	Tachyporus mexicanus Sharp	Pr	Pr	Adults from herbage, ant & animal nests.
Staphylinidae	Trichophya pilicornis Gyllenhal	~Fu	~Fu	Possible EXOTIC. Associated with fungi.
Staphylinidae	Unamis fulvipes Fall	?	?	Biology unrecorded.
Tenebrionidae	Helops pernitens LeConte	X?	X?	Adults found in decaying logs and wood.
Tenebrionidae	Scaphidema pictum Horn	D	D	Adults and larvae in sandy riparian areas.
Throscidae	Aulonthroscus validus LeConte	~Fl	Pr?, Fu?	Live in decaying wood. Reportedly predaceous,
Throscidae	Pactopus hornii LeConte	~Fl	Pr?, Fu?	Same as above, but in Europe reportedly eating mycorrhizae.
Trogositidae	Temnochila chlorodia Mannerheim	Pr	Pr	Eat subcortical invertebrates, especially scolytids.
Zopheridae	Phellopsis porcata LeConte	Fu	Fu	Feed upon polypore fungi. Also under bark.

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 development is in the best interest of all our people. The department also promotes the goals of the Take Pride in America campaign 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.

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