

Survey of Lepidoptera in the Sub-arctic Ecoregion of northeastern Alberta.

I. 2003 Survey of Caribou Mountains Wildland Park

prepared for the Alberta Natural Heritage Information Centre,
Parks and Protected Areas Division,
Alberta Community Development

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Figure 1. Gerald Hilchie sorting insects at camp (C. Booth photo).

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Introduction

The sub-arctic subregion of the boreal forest is represented in Alberta by three high plateaux, namely the Cameron Hills, Birch Mountains and Caribou Mountains (Strong & Leggatt 1992). The Caribou Mountains form the largest and northernmost sub-arctic plateau in the province. The recently established Caribou Mountains Wildland Provincial Park adjoins the southeast corner of Wood Buffalo National Park, and encompasses most of the Caribou Mountain plateau.

A Lepidoptera survey conducted during 2003 in the Caribou Mountains W.P.P. is the first attempt to inventory the butterfly and moth fauna of this subregion in the province, and follows a series of other inventories undertaken in the northeast boreal region, to date having focused on the Canadian Shield Ecoregion (Schmidt & Pohl 2001, Macaulay & Pohl 2002, Macaulay & Pohl 2003). The Caribou Mountain plateau contains a number of unique floral and faunal elements as a result of a sub-arctic climate influence; dominant plant communities include extensive, open peat bogs and wetland complexes.

The primary goal of this survey was to determine the presence of sub-arctic Lepidoptera fauna, and baseline information on distribution patterns and abundance. Due to the unique ecological characteristics of this region, and almost complete lack of prior knowledge of the Lepidoptera fauna, the survey of the Caribou Mountain Lepidoptera yielded a number of discoveries important to the knowledge of the provincial fauna.

Materials and Methods

Efforts were made to sample as many representative habitats as possible where these were accessible. The habitats sampled included sandy beach ridges dominated by lodgepole pine (*Pinus contorta*), bearberry (*Arctostaphylos uva-ursi*) and glandular birch (*Betula glandulosa*) (Fig. 2), dry peat bogs dominated by Labrador tea (*Ledum* spp.) and lichens (Fig. 3), wet bogs with Bog Rosemary (*Andromeda*), Cloudberry (*Rubus chamaemorus*), and an open black spruce / larch canopy. Willow (*Salix*) / sedge (*Carex*) wetlands were also sampled (Fig. 4). Aspen (*Populus tremuloides*) uplands represented a very small proportion of the landbase, but yielded Lepidoptera not occurring elsewhere; these were characterized by an open aspen / white spruce or aspen / lodgepole pine canopy (Fig. 5).

The Lepidoptera survey was conducted within Caribou Mountains Wildland Park from June 8 to 17, and July 6 to 16, 2003. Camp was on Wentzel Lake, located about 120 km northeast of Fort Vermilion. Gary Anweiler, Greg Pohl, Chris Schmidt, Ted Johnson and Wayne Nordstrom conducted the June survey. Doug Macaulay, Sherri Dunne, Jim Hilchie, Gerald Hilchie, Drajs Vujnovic, Ted Johnson and Carey Booth conducted the July survey. Specimens were collected by hand-netting during the day and at dusk. At night, specimens were collected at a sheet illuminated by a 175-Watt mercury vapour light powered by a portable generator, and in four 10-Watt 12V DC battery-powered ultraviolet light traps. Attempts were made to sample as many habitats as possible. Coordinates and habitat types of collection sites are listed in Table 1.

Specimens were identified by the authors using insect reference collections housed at the Canadian Forest Service's Northern Forestry Centre, University of Alberta's Strickland Museum and private collections of members of the Alberta Lepidopterists' Guild. Pertinent references include Freeman (1958), Handfield (1999), Heinrich (1923, 1926), Lafontaine (1998), Lafontaine and Poole (1991), McGuffin (1977), Miller (1987), Munroe (1976), Rockburn and Lafontaine (1976), Schmidt (2000). Nomenclature follows Troubridge & Lafontaine (2004). Voucher specimens have been deposited at the Canadian Forest Service Northern Forestry Centre and the University of Alberta Strickland Museum, Edmonton.

Table 1. Habitats and locations of collection sites, Caribou Mountains Wildland Provincial Park.

Site #	Habitat*	Locality	Coordinates
1	SS/SB	Horseshoe L.	59.45°N 114.743°W
2	SS/SB	Horseshoe L.	59.451°N 115.726°W
3	SS/SB	Horseshoe L.	59.468°N 115.729°W
4	SS	Margaret L. fishing lodge, cutline E of fishing lodge	58.95°N 115.26°W
5	SS	Margaret L. fishing lodge airstrip, cutline N of fishing lodge	58.949°N 115.265°W
6	SB	Margaret L. fishing lodge airstrip	58.949°N 115.265°W
7	SB	Margaret L. fishing lodge airstrip	58.949°N 115.26°W
8	UL/SB	Pitchimi L., SW shore, overgrown airstrip at SW end of lake	58.97°N 114.82°W
9	UL/SB	Wentzel L., E shore, Fish & Wildlife cabin	59.011°N 114.426°W
10	SB	Wentzel L., E shore, sandy point	59.032°N 114.46°W
11	UL	Wentzel L., E shore, cutline E base camp	59.043°N 114.412°W
12	SB	Wentzel L., E shore, cutline E of camp	59.048°N 114.415°W
13	SB	Wentzel L., E shore, SE of camp	59.052°N 114.426°W
14	OP	Wentzel L., E shore, nr. base camp	59.061°N 114.429°W
15	UL/OP	Wentzel L., E shore, 1km NE base camp	59.066°N 114.42°W
16	UL	Wentzel L., N end, thin island at N end of lake	59.07°N 114.47°W
17	SB	Wentzel L., N shore	59.063°N 114.425°W
18	SS	Wentzel L., N shore, E of Wentzel R. mouth	59.07°N 114.47°W
19	UL	Wentzel L., NE shore	59.066°N 114.419°W
20	SB	Wentzel L., NE shore	59.075°N 114.418°W
21	SS	Wentzel L., S shore, pond 500 m S of S shore	58.98°N 114.47°W
22	SB	Wentzel L., SE outlet	58.98°N 114.431°W
23	SB	Wentzel L., SW outlet	58.971°N 114.484°W
24	SB	Wentzel L., W shore	59.014°N 114.512°W
25	SS	Wentzel R., nr. mouth	59.097°N 114.485°W
26	SS	Wentzel R., nr. mouth	59.111°N 114.494°W
27	SS	Wentzel R., nr. mouth	59.12°N 114.509°W
28	SS	Wentzel R., nr. mouth	59.128°N 114.508°W
29	UL/OP	Wentzel L., E shore, 2km N camp	59.025°N 114.418°W
30	OP	Wentzel L., E shore, 3km S camp	59.036°N 114.449°W
31	SB	Wentzel L., E shore, 1km N camp	59.057°N 114.414°W
32	SB	Wentzel L., W shore, Big Bad James's fishing camp	59.049°N 114.517°W
33	SS	Wentzel L., W shore	59.062°N 114.488°W

* **Habitat types:** OP – open pine, SB – black spruce / labrador tea peatland, SS – willow / sedge wetland or meadow, UL – mixed aspen upland



Figure 2. Sandy beach ridge showing open pine / bearberry habitat (C. Schmidt photo).



Figure 3. Raised bog dominated by lichen and *Ledum* (C. Schmidt photo).



Figure 4. Open fen east of Horseshoe Lake (D. Macaulay photo).



Figure 5. Open mixed aspen stand, Wentzel Lake east shore (C. Schmidt photo).

Results

A total of 214 Lepidoptera species, representing 24 families, were recorded during the 2003 inventory of Caribou WPP. Of these, 36 species were butterflies, 110 were macro-moths and 68 were micro-moths. Twenty-nine species are of special interest due to their limited occurrence in the province, or because of significant new range information, including two species recorded from Alberta for the first time. A species list and collection summary appears in Appendix 1; complete collection data appears in Appendix 2.

Due to the variation in sampling effort among the northeastern boreal surveys (as a result of wildfires (2002), variation in number of researchers, and/or inclement weather), comparisons of species richness and abundance among the northern wildland parks sampled to date has limited utility; however, comparison of all parks to a relatively well-known boreal mixedwood site (Schmidt 2001) shows that the Caribou Mtn WP fauna exhibits the highest proportion of unique species among all the northeast boreal parks inventoried to date (Table 2), although it may have relatively low diversity, based on the fact that the sample size was by far the largest to date, but species richness remains slightly lower than that of La Butte / Fidler-Greywillow.

Table 2. Lepidoptera abundance and species richness of northeast boreal Wildland Parks.

Site	No. Specimens	No. Species	% unique ¹
Caribou Mtns WP	1045	214	44
Colin-Cornwall WP	437	138	36
La Butte & Fidler-Greywillow WPs	542	228	28
Marguerite / Maybelle/ Richardson River WPs	280	175	37
Cooking Lake – Beaver Hills ²	55,000 ²	310 ²	---

¹ – proportion of macro-moth species NOT occurring at the Cooking L. dry mixedwood boreal site. ² – macro-moth species only. Data from Schmidt (2001).

Discussion

I. Factors affecting the Survey

Based on the ecological land classification, aerial photography and opportunistic aerial reconnaissance undertaken during the survey sessions, we feel that representative sites of most habitat types were adequately sampled; the only habitat types not sampled (due to inaccessibility) were the steep escarpments of the Caribou plateau, particularly in the northeast corner of the park. Open, non-treed habitats such as this likely yield additional species restricted to these sites. Future survey work should be directed to include these habitats.

Since Lepidoptera are active as adults for only a short portion of the season, a complete inventory would require a minimum sampling regime of approximately every 10 to 14 days through the entire flight season, generally from the end of April until late September (the season is likely shorter on the Caribou plateau). The sampling undertaken for this study therefore represents only a portion of the total fauna (see below). The spring weather conditions on the Caribou plateau are however indicative of a relatively abbreviated active Lepidoptera season; even nights with above average nighttime temperature lows during the June trip yielded extremely few or no moths in light traps. Almost all nocturnal species were recorded during the July survey session. Sampling prior to early June is therefore unlikely to yield additional species, but sampling later in the summer would undoubtedly increase knowledge of the Lepidoptera fauna.

II. Species Richness

Although this survey recorded a large number of Lepidoptera species, many more undoubtedly occur in the area. Extrapolation of species richness based on the expected butterfly fauna (Varis et al. 1987), which is relatively well-known, suggests there may be as many as about 1000 species (Table 3). These estimates are based on proportions of Lepidoptera groups in temperate areas, and the diversity of the Caribou Mtn. fauna may be somewhat lower since it is characterized by sub-arctic faunal and climate elements. Arctic and sub-arctic faunas show higher proportions of day-flying groups, such as butterflies (Lafontaine & Wood 1991).

On average, approximately 35% of the Lepidoptera expected to occur in the region were recorded during the survey, with a greater relative representation than moths due to the fact that they are more conspicuous and therefore easier to sample. Complete knowledge of the the micro-moths remains the lowest, due to their inconspicuous nature and close habitat associations.

Table 3: Expected Lepidoptera species richness of the Caribou Mtns region, based on Varis et al. (1987), Layberry et al. (1998) and Bird et al. (1995).

Taxonomic group	known no. spp.	Expected % of all Lepidoptera spp. ¹	Expected no. spp.	% known
Butterflies	36	5	54 ²	66.7
Macro-moths	110	35	378	29.1
Micro-moths	68	60	648	10.5
Total	214	100	1080	-

1 - Based on Varis et al. (1987). 2 - Based on Bird et al. (1995) and Lafontaine et al (1998).

III. Characteristics of the Caribou Mountains WP Lepidoptera Fauna

Comparisons of the Caribou Mountains fauna to the previous inventories carried out in northeastern Alberta, and to a southern boreal site (Table 2), reflect the fact that the Caribou Mountains are within the sub-arctic rather than the boreal ecoregion; a higher number of species not found elsewhere in the province also occur, which are detailed below.

IV. Distribution patterns and taxa of particular interest

The majority of the species reported here are typical boreal species occurring across northern North America. Most notable, however, were elements of the sub-arctic fauna, some of which had previously not been known to occur in Alberta. Many records provided substantial range extensions (>500 km), providing valuable information for a region that has had limited Lepidoptera sampling in the past. *Gynaephora rossii* and *Sympistis heliophila* were both recorded from Alberta for the first time.

Specimens collected during the survey will also aid in clarifying the taxonomy of several species which appear not to belong to any currently named species, such as *Xanthorhoe* species near *ramaria* and *Dodia* species near *albertae*. The following section details the species of special interest which were recorded during the Caribou Mtns WP inventory.

A. Butterflies:

Range and biological information is from Bird et al. (1995) and Layberry et al. (1998). Nomenclature follows that of Layberry et al. (1998) except as noted.

HESPERIIDAE

Pyrgus centaureae freija – This species occurs locally in open peatlands of the boreal forest, with relatively few occurrences in Alberta. The provincial conservation status is currently S2S3, “Imperiled / Vulnerable”. This species was common at many sites in Caribou Mtns WP (often the most common butterfly species), and vast amounts of suitable habitat occur across the Caribou plateau. Adults were associated with *Rubus chaemomorus* L., the presumed larval foodplant; adults were also observed taking nectar at *Andromeda* flowers.

PAPILIONIDAE

Papilio machaon hudsonianus – The provincial conservation status of this species is S2S3 (Imperiled / Vulnerable) due to the limited number of known occurrences; one individual was collected nectaring at bearberry blossoms, but no other individuals were seen and it appears to be rare in the Caribou Mtns.

PIERIDAE

Pieris rapae – This ubiquitous species is often a garden pest in urban areas, and generally does not occur in habitats that do not show significant human disturbance. It was therefore surprising to find this species in the Caribou Mtns, occurring along lakeshores and beaches. Caterpillars likely feed on leafy crucifers growing along the lakeshores.

Colias chippewa – A rare species that occurs in the northern foothills and sub-arctic subregions of boreal northern Alberta. The two Caribou Mtn sites reported here are the fifth and sixth known localities for the province. The specimens were collected in a wet bog flying near water bodies.

Colias canadensis – There are few boreal populations of this species in the province. In the Caribou Mtns this species is uncommon, and is associated with legumes growing in aspen or mixed wood uplands with exposed mineral soil, a habitat with very limited occurrence. Boreal populations of *C. canadensis* appear to be distinct at the subspecies level from mountain populations, showing a lighter ventral side and a higher proportion of albino females than mountain populations.



Figure 6. *Boloria frigga* (C. Schmidt photo).



Figure 7. *Eufidonia discospilata* (C. Schmidt photo).

LYCAENIDAE

Albulina (= *Vacciniina*) *optilete yukona* – This species is uncommon and local elsewhere in Alberta, but was common at many sites in the park.

NYMPHALIDAE

Limenitis archippus – An uncommon species throughout much of western Canada. Only one specimen was recorded in Caribou Mtns WP, at Horseshoe Lake. This is near the northern limits of its range, with four other northern records at Colin-Cornwall WP, La Butte Creek WP, and Ft. Smith and Hay River, NWT.

B. Macro-moths:

Range and biological information is from Bowman (1951), McGugan (1958), Prentice (1962, 1963), and Tuskes et al. (1996) except as noted.

GEOMETRIDAE

Aspitates taylorae – An uncommon species that occurs locally in open peat bogs of northern Alberta. This species has only recently been added to the provincial fauna, and there are only a few known localities (Schmidt 2003), south as far south as Fort Assiniboine (Holmes Crossing ER) and Calling Lake.

NOTODONTIDAE

Clostera brucei – Published records (Bowman 1951) show this species as occurring in the southern boreal region; recent records from Zama City (Macaulay, Pohl & Volney, unpubl. data) and Colin-Cornwall WP (Macaulay & Pohl 2002), in addition to occurrence in the Caribou study area, show that it ranges much further north than previously thought.

ARCTIIDAE

Dodia sp. nr. *albertae* (Fig. 8)– Specimens of this genus collected in the study area appear to represent two species, *D. albertae* and an apparently undescribed species resembling *D. albertae*. Both species occur in wet peat bog habitat, but preliminary data suggests *D. nr. albertae* has a more northerly boreal / sub-arctic distribution. Adults of this species were collected both with mercury vapour lights and flying during the day.

Pararctia yarrowii (Fig. 9)– The presence of this species in the study area was quite unexpected, since it is primarily a species of high alpine and arctic habitats. Prior published information shows the nearest known populations in the Rocky Mountains (Ferguson et al. 2000), although there is a single recent



Figure 8. *Dodia* sp. nr. *albertae* (G. Anweiler photo).



Figure 9. *Pararctia yarrowii* on lichen in peat bog southeast of camp (D. Macaulay photo).

record for the Clear Hills northwest of Peace River (Northern Forest Research Centre). It appears that this rare species inhabits suitable habitat such as open peatlands in the sub-arctic and upper foothills subregions in Alberta. *P. yarrowii* is generally found on alpine scree slopes; these specimens were found in open Lodgepole Pine / Bearberry forest along the beach ridge of Wentzel Lake, and in a peat bog located just southeast of camp (Figure 3).

LYMANTRIIDAE

Range and biological information is from Ferguson (1978) except as noted.

Gynaephora rossii (Fig. 10) - This is a predominantly arctic / alpine species, and is the first record for the province. A single larva of this species was collected beside Horseshoe Lake (Fig. 4) feeding on *Rubus acaulis*. The larva was reared on *R. acaulis*, but refused both *R. pubescens* and *R. chaemomorus*, although it would accept raspberry (*R. idaeus*) leaves, on which it fed until mid August. It then stopped feeding and remained inactive in its cage until late August when it pupated, hatching on September 29th. The fact that no adult moths were seen, and that the larvae were relatively common, suggests that this species requires multiple years to mature, and populations may be synchronized to emerge only in certain years.



Figure 10. Female *G. rossii* laying egg just after emergence on September 29th, 2003 (D. Macaulay photo).

NOCTUIDAE (sensu Poole 1996)

Range and biological information is from Bowman (1951) and McGugan (1958), except as noted.

Syngrapha diasema (Fig. 8) – Although this species is widespread across the Holarctic region, it is very rare. The only previous Alberta record was for Nordegg; the present record fills in a large distribution gap between Nordegg and the northeast reaches of Great Slave Lake, NWT (Lafontaine & Poole 1991). This species was relatively common in habitats that contained *Betula nana*, its larval host plant (Lafontaine & Poole 1991).

Syngrapha ignea – In Alberta, this species was previously recorded only from alpine and sub-alpine meadows. *S. ignea* is primarily a species of the western Cordillera, with populations along coastal Labrador and an isolated record from Great Slave Lake, NWT (Lafontaine & Poole 1991). Specimens netted during the July trip were collected nectaring at *Ledum*.



Figure 11. *Syngrapha diasema* at MV sheet trap just north of camp (C. Booth photo).

Sympistis heliophila – This sub-arctic species represents a new record for the province, the nearest previous records from extreme northeastern SK (Hooper 1992). Adult moths are diurnal, and were found nectaring at *Arctostaphylos*.

Polia propodea - This uncommon boreal species is rarely collected in Alberta. It occurs in peatland habitats throughout the boreal region, but is known from less than ten localities.

Lasionycta taigata - This uncommon boreal species is rarely collected in Alberta. It occurs in peatland habitats throughout the boreal region, but is known from less than ten localities.

Heliothis borealis – This species is rare throughout its western North American range. It is uncommon in the Caribou Mountains; adults were observed nectaring at bearberry blossoms and occasionally at Bog Rosemary. The caribou Mtn and La Butte / Colin-Cornwall recods are the northernmost known localities.



Figure 12. *Sympistis heliophila* (G. Anweiler photo).

C. Micro-moths:

Range and biological information is from Bowman (1951) and Prentice (1965), unless otherwise noted.

GELECHIIDAE

Chionodes viduella - this uncommon holarctic species is an inhabitant of alpine and sub-arctic areas. It has been reported previously from Banff and Bilby, as well as from a few localities in the Northwest Territories and Yukon Territory (Hodges 1999). It feeds on birch and raspberry.

TORTRICIDAE

Sparganothis violaceana - This rare and little-known species has been reported from Labrador to British Columbia (Lambert 1950). The Caribou Mountains specimen represents a northern range extension.

Choristoneura albaniana - This northern species is uncommon in Alberta. It feeds on *Prunus* species (Dang 1992).



Figure 13. *Lita sexpunctella* (C. Schmidt photo).

Clepsis moeschleriana - This rare species is known from northern boreal sites across North America, but was previously known in Alberta only in the Rocky Mountains (Freeman 1958). This specimen has unusual maculation, but its identity was confirmed via genitalic examination.

Apotomis paludicolana - This species has only recently been documented as occurring in Alberta (Pohl et al. in press), where it was reported from the Edmonton area. It is likely an inhabitant of bogs throughout northern Alberta.

Olethreutes sordidana - This rare species was previously known only from the type locality of Coliseum Mountain, near Nordegg (Heinrich 1926). This represents a significant new locality and range extension.

Olethreutes bowmanana - This uncommon holarctic species was previously known from Siberia, Alaska, and the Rocky Mountains (Miller and Jalava 2000).

Ancylis tineana - This is an uncommon species, which was previously known only as far North as the Edmonton area. It feeds on *Populus* and *Prunus* (Miller 1987).

Pammene bowmanana - This is an uncommon species, which was previously known only as far North as the Edmonton area.

SCHRECKENSTEINIIDAE

Schreckensteinia festaliella - This rare species has only recently been documented as occurring in Canada (Pohl et al., in prep.). Besides the Caribou Mountains locality, it has been collected in the Edmonton area. It was previously thought to be introduced to North America from Europe, but its presence in the Caribou Mountains, far from human disturbance, suggests that it is likely native to this continent. It feeds on *Rubus* leaves.



Figure 14. *Pyrausta borealis* (C. Schmidt photo).

CRAMBIDAE

Pediasia truncatella - This is an uncommon species, known from the boreal forest and Rocky Mountains.

Pediasia ericella - This uncommon species has only recently been documented as occurring in Canada (Pohl et al., in prep.). It is known from a number of scattered localities throughout the province.

Summary and Conclusions

A total of 214 Lepidoptera species, representing 24 families, were recorded during the 2003 inventory of Caribou WPP. Of these, 36 species were butterflies, 110 were macro-moths and 68 were micro-moths. Twenty-nine species are of special interest due to their limited occurrence in the province, or because of significant new range information, including two species recorded from Alberta for the first time.

Although the majority of these species are typical inhabitants of the boreal forest of western North America, five macro-moth species (*Pararctia yarrowii*, *Gynaephora rossii*, *Syngrapha diasema*, *Syngrapha ignea*, *Sympistis heliophila*) are found only in sub-arctic and/or alpine habitats; two of these species (*G. rossii* and *S. heliophila*) are new to the provincial fauna. Four micro-moth species (*Chionodes viduella*, *Clepsis moeschleriana*, *Olethreutes sordidana*, and *O. bowmanana*) are also known only from subarctic and alpine sites. No butterfly species restricted to arctic / alpine habitats were recorded, although several are at the edge of their known range, and many records represent considerable northern range extensions. Four butterfly species are currently on the provincial tracking list (ANHIC 2004) (*Pyrgus centaureae freija*, *Colias chippewa* (= *Colias palaeno* of authors), *Papilio machaon hudsonianus*, and *Vacciniina optilete yukona*). All occur in the boreal forest but exist in localized populations. Similarly, six macro-moth species (*Dodia* sp. nr. *albertae*, *Aspitates taylorae*, *Syngrapha diasema*, *Polia propodea*, *Lasionycta taigata*, and *Sympistis heliophila*) are provincially rare with few known localities in the boreal region.



Figure 15. Ted Johnson at MV sheet trap by Fish & Wildlife camp.

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