

**Survey of Lepidoptera in the Canadian Shield Ecozone of
northeastern Alberta**

**II. 2001 Survey of La Butte Creek and Fidler/Greywillow
Wildland Parks**

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

by D. Macaulay and G. Pohl,
Alberta Lepidopterists' Guild

March, 2002



Figure 1. The La Butte Creek collectors (Doug Macaulay, Amanda Roe, Greg Pohl) on a granite rock outcrop.

Table of Contents

Introduction.....	3
Materials and Methods.....	3
Results	4
Discussion.....	5
Summary and Conclusions	15
Acknowledgements	16
Literature Cited	17
Appendix 1 – species list.....	20
Appendix 2 –complete specimen data	30

Introduction

In Alberta, the Canadian Shield Ecoregion is restricted to the extreme northeast part of the province (Strong and Leggat 1992). It is subdivided into the Kazan Upland and the Athabasca Plain, north and south of Lake Athabasca, respectively. This project is the second year of surveying for Lepidoptera in the Canadian Shield Ecoregion. The 2000 survey examined three recently-created Parks in the Athabasca Plain subregion (Schmidt and Pohl 2000); the current survey examines the newly formed La Butte Creek and Fidler/Greywillow Wildland Parks in the Kazan Uplands.

In the La Butte Creek Wildland Park, the dominant habitat is riparian mixed forest (RP) containing trembling aspen (*Populus tremuloides* Michx.), black poplar (*P. balsamifera* L.), willow (*Salix* spp.) and alder (*Alnus* spp.). Interspersed in this forest are granite rock outcrops (RO) with open jack pine (*Pinus banksiana* Lamb.) and lichens (Figure 1), and graminoid rich fens (GF) with sedges (*Carex* spp.) and willows. Other habitats are old-growth spruce forest (OF) containing white spruce (*Picea glauca* (Moench) Voss), sphagnum bogs (SB) containing black spruce (*Picea mariana* (Mill.) BSP.), tamarack (*Larix laricina* (Du Roi) K. Koch), and labrador tea (*Ledum groenlandicum* Oeder), and a south-facing slope (SS) dominated by sage (*Artemisia* sp.).

In Fidler/Greywillow Wildland Park, habitats included granite rock outcrops (RO) with open jackpine and lichen, sand dunes (SD) with willow and birch (*Betula* sp.), black spruce/labrador tea bogs (SB), riparian mixed forest (RF), and graminoid rich fens (GF) with willow and birch.

The purpose of this report is to provide a summary of the Lepidoptera species collected in the 2001 survey, and to compare this information to previously known distribution patterns. This information will assist in land use planning and will contribute information on the conservation status of particular Lepidoptera species.

Materials and Methods

Two study areas were sampled during the Lepidoptera survey. La Butte Creek Wildland Park was sampled from July 5 - 11, by the authors and Amanda Roe (Figure 1). Fidler/Greywillow Wildland Park was sampled from July 17 - 25 by Dave Lawrie and Vanessa Block. Additionally, some butterfly collecting was carried out in both parks from June 6 - 17, by Wayne Nordstrom and Rob Hughes.

Specimens were collected during daylight hours and at dusk via hand netting. At night, specimens were collected at a sheet illuminated by a 175-Watt mercury vapour light powered by a portable generator, and in four 25-Watt 12V DC battery powered ultraviolet light traps. Attempts were made to sample as many habitats as possible. Exact coordinates of collection sites are listed in Table 1.

Table 1: Habitats and locations of collection sites.

Site No.	Habitat	Location	Coordinates
La Butte Creek Wildland Park:			
1	RO	Rock outcrop 500m NE mouth of La Butte Ck.	59.42504° N 111.44036° W
2	RO, RP	Rock outcrop, 13km E mouth of La Butte Ck.	59.36549° N 111.12988° W
3	SB	Bog 500m N mouth of La Butte Ck.	59.42748° N 111.44427° W
4	RP, OF, SS	La Butte Point on Slave R.	59.406° N 111.453° W
5	RP	Base Camp, mouth of La Butte Ck. on Slave R.	59.42126° N 111.44612° W
6	SF	Sedge meadow 200m N mouth of La Butte Ck.	59.42114° N 111.44531° W
7	SF	Beaver pond, 3km E mouth of La Butte Ck.	59.42137° N 111.41388° W
8	SF	Sedge meadow, 5km SE mouth of La Butte Ck.	59.39542° N 111.38928° W
Fidler/Greywillow Wildland Park:			
9	RO, RP, SB, SD, SF	Fidler Point, Lake Athabasca	59.107° N 110.426° W
10	RP, SF	Burntwood Island, Lake Athabasca	58.9527° N 110.6145° W
11	RP	Bustard Island, Lake Athabasca	58.80° N 111.77° W
12	SD	Sand dunes NE of Fidler Point	59.1150° N 110.4098° W
13	RO, RP, SD, SF	N shore L. Athabasca, at northern border of Fidler/Greywillow Wildland Park	59.2433° N 110.1502° W

Specimens were identified using Covell (1984), Handfield (1999), Rockburn and Lafontaine (1976), and a variety of pertinent taxonomic publications, as well as reference collections possessed by the Canadian Forest Service's Northern Forestry Centre, University of Alberta's Strickland Museum and members of the Alberta Lepidopterists' Guild. Higher classification follows Kristensen (1999) and nomenclature follows Poole (1996), except where noted. Voucher specimens have been deposited at the Northern Forestry Centre and the Strickland Museum.

Results

A total of 849 Lepidoptera specimens, belonging to 30 families and 295 species, were collected. Of these, 38 species were butterflies, 142 were macro-moths and 115 were micro-moths. Forty-nine species are considered to be rare or uncommon. A species list and collection summary appears in Appendix 1; full collection data appears in Appendix 2.

Many more specimens and species were collected in La Butte Creek than in Fidler/Greywillow (Table 2). A large proportion (64.5%) of species collected in La Butte Creek were not collected at Fidler/Greywillow, while only 45.3% of species collected in Fidler/Greywillow were not collected at La Butte Creek.

Table 2. Abundance and Diversity of the 2001 Wildland Park samples.

Park	No. Specimens	No. Species	No. Unique to Park
La Butte	542	228	147
Fidler/Greywillow	307	148	67

Discussion

I. Study Limitations

Many Lepidoptera species are active as adults for a short portion of the season. Thus a complete survey of adult Lepidoptera would require regular collecting (approximately every 10 to 14 days) through the entire flight season, from the beginning of April to the end of September. As well, Lepidoptera species are often localized in particular microhabitats, some of which were not accessible on this survey. Despite these limitations, a large number of specimens and species were collected in the survey.

II Comparison of catches from the two parks

Many more specimens and species were collected in La Butte Creek than in Fidler/Greywillow Wildland Park (Table 2). This is likely due to a combination of weather and sampling differences, as well as real habitat differences.

At Fidler/Greywillow, inclement weather made some sites inaccessible, and resulted in low catches at sites which were accessible. However, at La Butte Creek, the collectors experienced calm, warm weather, resulting in larger catches.

Because it was impossible to thoroughly sample all habitats, collection efforts were concentrated on unique and accessible ones. At Fidler/Greywillow, collection efforts were concentrated on the unique shoreline habitats rather than on the forest habitats that had already been sampled at La Butte Creek. The lakeshore habitats probably harbour fewer species than the forest and riparian habitats. A greater sampling effort in the latter at Fidler/Greywillow would undoubtedly turn up many of the species collected only at La Butte Creek.

III. Species Richness

Although this survey collected a large number of Lepidoptera species, many more undoubtedly occur in the area. The butterfly fauna of the Kazan Uplands is fairly well known. The distribution records in Layberry et al. (1998) indicate that 59 species are known or expected to occur in the region. However, the moth fauna is almost completely unknown. Most previous moth records were gathered by the Forest Insect and Disease Survey of the Canadian Forest Service, which surveyed forest pests along the Slave River

and in the vicinity of Fort Smith (McGugan 1958, Prentice 1962, 1963, 1965). The total number of Lepidoptera species expected to occur in the Kazan Uplands was extrapolated from the butterfly fauna, using the proportions of butterflies, macro-moths, and micro-moths expected to occur in a northern temperate region (Varis et al. 1987); Table 3. Overall, the survey collected approximately 22% of the Lepidoptera expected to occur in the region. Butterflies were more completely sampled than the moths, due to the fact that they are conspicuous and highly mobile. The micro-moths were the least thoroughly sampled, due to their inconspicuous nature and close habitat associations.

Table 3: Diversity of sampled Lepidoptera, and total expected diversity of the Kazan Upland natural region. Expected proportions of species are from Varis et al. (1987); expected number of butterfly species is based on Layberry et al. (1998) and Bird et al. (1995). Other values are extrapolated.

Taxonomic group	No. Spp. collected	Expected % of spp.	Expected No. spp.	% collected
Butterflies	38	4.5	59	64.4
Macro-moths	142	35.6	467	30.4
Micro-moths	115	60.0	787	14.6
Total	295	100.0	1311	22.5

III. Distribution patterns and taxa of particular interest

The majority of the species collected in the survey are typical boreal species occurring over much of northern North America. However, some elements of other faunas were collected as well, including some from the mountainous regions of Alberta, and others more commonly collected in the grasslands. Many records provided substantial range extensions (>500 km), providing valuable information for a region that has had limited Lepidoptera sampling in the past.

The following section contains details of notable range extensions or other significant records, including locality and habitat information from the present survey, and relevant biological or behavioral information from published sources, where available. As well, we have included an indication of the species' general abundance in Alberta, as "abundant", "common", "uncommon", or "rare". Because many of these species are known from fewer than 20 records in Alberta, these categories are based on the authors' experience rather than exact counts of observations or collection specimens. The list is broken down into three parts; butterflies, macro-moths, and micro-moths.

A. Butterflies:

Range and biological information is from Bird et al. (1995) and Layberry et al. (1998).

HESPERIIDAE

Polites peckius - A common species in central Alberta, but it has only been collected in a few sites in northwestern Alberta in wet or grassy areas. It was collected in both parks, representing the most northerly records for western Canada.

PIERIDAE

Euchloe creusa (Figure 2) – An uncommon and localized species that has been collected in seven localities in Alberta’s boreal forest, where it appears to prefer open canopy jack pine forest. It is more commonly encountered in the Rocky Mountains.



Figure 2. *Euchloe creusa* (ex. 2000 Shield survey, Richardson River Park).

LYCAENIDAE

Lycaena hyllus – A common species in central Alberta, but it has only been collected in a few sites in northern Alberta, in wet or grassy areas. Other northerly records are from Fort Simpson, NWT and Zama City, AB.

Agriades glandon megalos - A common subspecies, collected in both parks, that is restricted to the rock outcrops there. It is much more commonly found in the foothills of the Rocky Mountains.

NYMPHALIDAE

Speyeria atlantis - A common species collected in Fidler/Greywillow, where it is at its northern range boundary.

Limenitis archippus (Figure 3) – An uncommon species in northern Canada. The specimen taken at La Butte Creek is near the northern limits of its range; only two more northerly records exist, at Ft. Smith and Hay River, NWT.

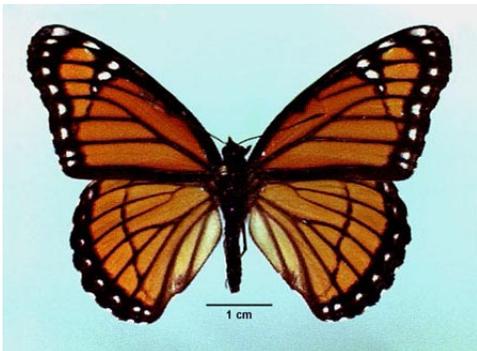


Figure 3. *Limenitis archippus* (pictured specimen from Taber, AB).

SATYRIDAE

Coenonympha tullia mackenziei – A rare and localized subspecies found only in the grassy areas of northern Alberta and NWT. It was collected at La Butte Creek. In Alberta, this subspecies is unique to the Kazan Uplands and has only been found once before, at Nyarling River.

Oeneis macounii – Specimens were taken at La Butte Creek, from granite outcrops with open jackpine forest. This is near the northern edge of its range, although three records exist for the NWT.

B. Macro-moths:

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

GEOMETRIDAE

Itame andersoni– A uncommon species, collected in both parks. It prefers boggy habitats (McGuffin 1977).

Orthonama evansi (Figure 4) - A rare species that was collected in both parks. In La Butte Creek it was collected beside a beaverpond that had a lush semi-aquatic plant community. The only other record of this species in Alberta is a single specimen in the Bowman collection at the University of Alberta, taken near Edmonton over 50 years ago.



Figure 4. *Orthonama evansi*.

SATURNIIDAE

Antheraea polyphemus - A common species that is at the northern edge of its range. Collected from La Butte Creek, it has not previously been reported north of central Alberta (Bowman 1951, Tuskes et al. 1996, McGugan 1958), but it has been collected by the authors at Ft. McMurray and Zama City.

SPHINGIDAE

Smerinthus jamaicensis - A common species that is rarely found north of central Alberta. It was collected in both parks. The only other northern record is a series collected by the authors near Zama City, AB. Larvae feed on a variety of trees, including poplar, willow, and birch.

Darapsa pholus – An uncommon boreal forest specialist known from scattered localities across northern Alberta. It was collected at several localities in La Butte Creek Park. Larvae feed on *Viburnum* (Hodges 1971).

NOTODONTIDAE

Schizura leptinoides - An uncommon species, collected in both parks. It is rarely found north of central Alberta. The only other northern Alberta record is from Fort McMurray.

ARCTIIDAE

Host and range information is from Schmidt (2000).

Haploa lecontei - An uncommon species rarely found north of central Alberta. It was collected in both parks. The only other northern Alberta records are from Fort McMurray and Lac La Biche. It is generally found in riparian habitats.

Grammia speciosa (Figure 5) – A northern range extension for this rare species, which is associated with wetlands. It was collected at a beaver pond on La Butte Creek. Other Alberta records are Barrhead and Wagner Natural Area, near Edmonton.



Figure 5. *Grammia speciosa*.

Grammia williamsii (Figure 6) – A northern range extension for this species, collected in both parks. It is quite common in jack pine forests and across the southern prairies in southern Alberta.



Figure 6. *Grammia williamsii*.

NOCTUIDAE (sensu Poole 1996)

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

Macrochilo bivittata – These records are a northern range extension for this uncommon species associated with moist riparian habitats. It was collected in a sedge fen at La Butte Creek.

Abrostola urentis – This is a northern range extension for this uncommon species, collected in a bog at La Butte Creek (Lafontaine and Poole 1991).

Chrysanympa formosa – An uncommon species, collected in both parks, it is found in localized colonies associated with *Vaccinium*. The La Butte Creek specimens were found only on rock outcrops.

Syngrapha selecta - A rare species, collected in Fidler / Greywillow, it is found in localized colonies and is easily confused with *S. viridisigma*. There is one other specimen collected in the foothills west of Calgary.

Nola cilicoides - A northern range extension for this common species, collected at three sites in La Butte Creek Park.

Panthea acronyctoides – An uncommon species, collected in both parks. These records are a northern range extension.

Cucullia sp. prob. omissa (Figure 7) – An uncommon species, collected in a sedge fen in La Butte Creek Park. If this determination is correct, this is a significant northern range extension, from Banff, Alberta and Swift Current, Saskatchewan (Poole 1995).



Figure 7. *Cucullia omissa*.

Polia propodea - An uncommon species, collected at Fidler Point. This is a northern range extension of a species that is much more common in the foothills of the Rocky Mountains than in the boreal forest (McCabe 1980).

Trichordestra tacoma – A northern range extension for this uncommon species, collected at Fidler/Greywillow.

Trichosilia mollis – A northern range extension for this uncommon species, which was collected in both parks. It is more common in mountainous regions, but is occasionally found in central Alberta. At La Butte Creek it was associated with rock outcrops.

Euxoa sinilinea – A rare species, collected at Fidler/Greywillow. It has only been collected twice before in Alberta (G. Anweiler pers. comm.), and the survey record is a northern range extension.

C. Micro-moths (Figure 8):

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

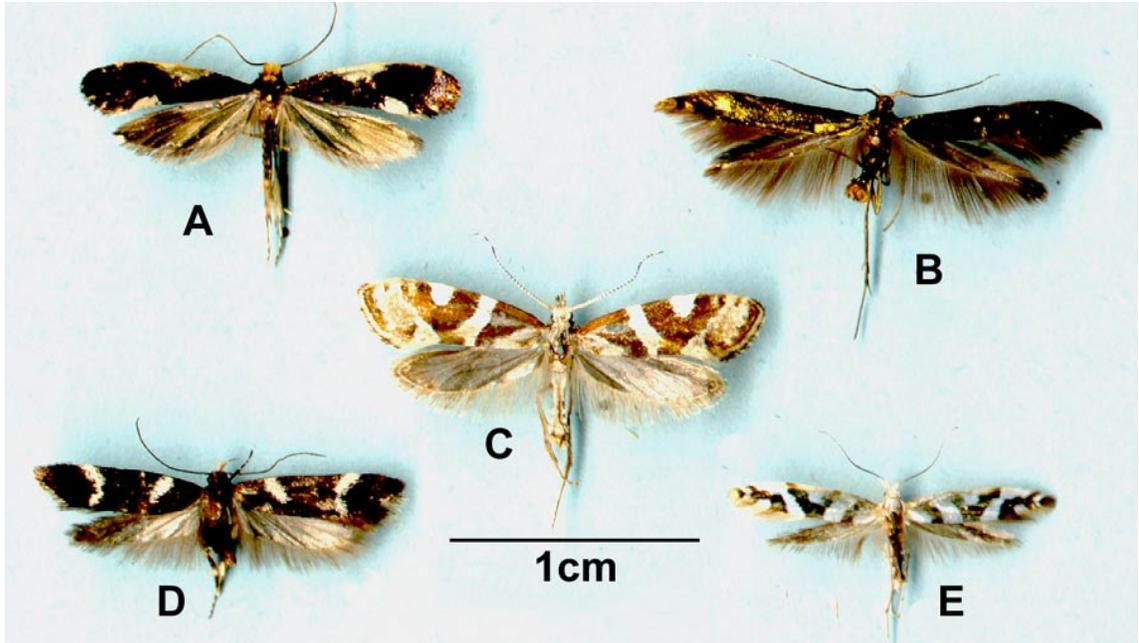


Figure 8. Representative micro-moths collected on the 2001 Shield Survey. A, *Monopis spilotella*; B, *Coleophora trifolii*; C, *Plutella vanella*; D, *Chionodes lugubrella*; E, *Argyresthia goedartella*.

TINEIDAE

Tinea irrepta - A northern range extension for this uncommon species. It was collected in both parks.

Niditinea orleansella - An unpublished record for Alberta, but the species has recently been collected near Lac La Biche (Pohl et al., *in prep*). It was collected in both parks, and is likely widely distributed but uncommon in Alberta.

Monopis monachella - A northern range extension for this uncommon species. It was collected at Fidler Point.

PLUTELLIDAE

Plutella vanella (Figure 8C) - This rare species was collected at La Butte Creek. It is known from scattered localities across the boreal zone in the prairie provinces.

COLEOPHORIDAE

Mompha tricristatella - A northern range extension for this rare species. It was collected at dusk, from a cleared area around our base camp on the mouth of La Butte Creek.

GELECHIIDAE

Helcystogramma fernaldella - This represents a northern range extension in Alberta, but the species has been reported from Alaska and Yukon Territory (Hodges 1986). This uncommon species was collected in a sedge fen at La Butte Creek.

SESIIDAE

Albuna pyramidalis – A northern range extension for this common species, collected at Fidler Point. It is rarely collected or observed since it is a small dayflyer, but it is common wherever its hostplant fireweed (*Epilobium*) is found (Eichlin and Duckworth 1988).

COSSIDAE

Acosus populi - A northern range extension for this uncommon species. It was collected at La Butte Creek.

TORTRICIDAE

Range and host information is primarily from Heinrich (1923, 1926).

Bactra furfurana - This is a northern range extension for this uncommon species. It was collected in two sedge fens at La Butte Creek. This holarctic species feeds on rushes (*Juncus* spp.), and is closely associated with wetlands. These habitats are undercollected, so the species is probably more abundant and widely distributed than is currently known.

Endothenia nubilana – This is a northern range extension for this common species, collected in a sedge fen at La Butte Creek. It is a root and stem borer of hedge nettle (*Stachys palustris*).

Hulda impudens - A northern range extension for this uncommon species, collected from riparian forest at La Butte Creek.

Olethreutes metallicana - A common species, collected in both parks. This record is a northern extension to its known range, but probably does not represent the true northern limits of its distribution.

Phaneta sp. A - Although not yet identified to species, this constitutes a northern range extension, since no *Phaneta* are currently reported from this area. It was collected among the sage (*Artemisia* sp.) on a south-facing slope on "La Butte" itself, on the bank of the Slave River (Figure 9). It is probably more commonly distributed in the prairies.



Figure 9. Sage slope on La Butte, on the bank of the Slave River.

Croesia curvalana - An uncommon species, collected at Fidler Point. This record is a northern range extension. It feeds on blueberry (*Vaccinium* spp.).

Archips alberta - An uncommon species, collected at Fidler/Greywillow. It is widespread throughout the Boreal forest, and feeds on spruce (*Picea* spp.).

Aphelia alleniana - This is a northern range extension for this uncommon species, collected at La Butte Creek.

Clepsis peritana - This is a northern range extension for this uncommon species, collected at La Butte Creek. It feeds on strawberry (*Fragaria* spp.).

Phtheochroa waracana - A northern range extension for this uncommon species, collected in a sedge meadow at La Butte Creek.

Aethes monera septentrionalis - A northern range extension for this uncommon subspecies, collected on a rock outcrop at La Butte Creek.

PYRALIDAE

Dasypyga alternosquamella – This rare species was collected at Fidler/Greywillow. It is a new record for Alberta.

CRAMBIDAE

Munroessa icciusalis - This uncommon species, collected in both parks, is reported from northern North America (Munroe 1972), but had not specifically been reported from Alberta before. It feeds on water plants, especially *Potamogeton* spp..

Parapoynx maculalis (Figure 10) - This is a new Alberta record for this rare species, collected in both parks. It had previously been reported in eastern Canada, only as far West as Lake of the Woods, ON (Munroe 1972), but unpublished records exist for Saskatchewan (Pohl, pers. comm.). It is probably widespread across the boreal zone, but localized in areas where its waterlily hosts (*Nuphar*, *Nymphaea*, *Brasenia* spp.) are available.



Figure 10. *Parapoynx maculalis*.

Pyrausta orphisalis - A northern range extension for this uncommon species, collected at the margin of La Butte Creek. It feeds on mints, including *Satureia* and *Monarda* (Munroe 1976).

Nomophila nearctica - This common species, collected at Fidler Point, is associated with grassland habitats. It feeds on many plants, including grasses and clover (*Trifolium* spp.) (Munroe 1973). This record is a northern range extension.

Agriphilia ruricolella - A northern range extension for this uncommon species, collected on a rock outcrop at La Butte Creek.

Catoptria latiradiella - A northern range extension for this uncommon species, collected at both parks.

Summary and Conclusions

A total of 295 Lepidoptera species were collected on this survey of which 115 are microlepidoptera and 180 are macrolepidoptera, including 38 butterflies. Although the majority of these species are typical inhabitants of the boreal forest of western north America, some species were previously considered to be inhabitants of the mountain or grassland ecosystems. Some species records were at the edge of their known range, and

many records were considerable northern range extensions. One butterfly species, *Coenonympha tullia mackenziei*, is classified as rare. This particular subspecies is restricted to northeastern Alberta and the adjacent Northwest Territories. Five macro-moth species (*Orthonama evansi*, *Grammia virguncula*, *Cucullia omissa*, *Syngrapha selecta* and *Euxoa sinilinea*) are classified as rare. They are all associated with riparian zones of the Kazan uplands. Four micro-moth species (*Mompha tricristatella*, *Plutella vanella*, *Phaneta* sp. A, and *Rhopobota unipunctana*) are considered to be rare, although their status may change with more intensive collecting. Four species of micro-moths constitute new records for Alberta; *Niditinea orleansella*, *Munroessa icciusalis*, *Parapoynx maculalis*, *Dasyphyga alternosquamella*. The record of *P. maculalis* is a range extension from Lake of the Woods, Ontario. With further sampling many more riparian and Canadian Shield specialists await discovery in the region.

Acknowledgements

This report would not have been possible without the assistance of the Alberta Lepidopterists' Guild, particularly Dave Lawrie and Amanda Roe, who collected, curated, and identified specimens along with the authors. As well, Wayne Nordstrom and Rob Hughes collected specimens and made field identifications on the June collecting trip. Gary Anweiler and Chris Schmidt provided and confirmed many identifications. Also thanks to Vanessa Block, Benny Gaudet, and Ted Johnson for capturing specimens.

The opportunity to inventory the butterflies and moths was made possible through an invitation from Wayne Nordstrom of the Parks and Protected Areas Division (Alberta Natural Heritage Information Centre unit) to the members of the Alberta Lepidopterists' Guild. In addition, parks staff of the Lac La Biche District made this project feasible by providing logistic support, including transportation, field camps and food. Without the efforts of Ted Johnson, Jennifer Gammon and the rest of the parks staff along with the field camp crew, this project would not have been possible.

Literature Cited

- Bird, C.D., G.J. Hilchie, N.G.Kondla, E.M. Pike and F.A.H. Sperling. 1995. Alberta Butterflies. Provincial Museum of Alberta, Edmonton, AB. 347 pp.
- Bowman, K. 1951. Annotated list of Lepidoptera of Alberta. *Can. J. Zool.* 29:121-165.
- Covell, C.V. JR. 1984. A Field Guide to the Moths of eastern North America. Houghton Mifflin, Boston, MA. 496 pp.
- Eichlin, T.D. and W.D. Duckworth. 1988. Sesiodea, Sesiidae. Fasc. 5.1 *in* Dominick, R.B., et al. The Moths North of Mexico. Wedge Entomological Research Foundation, Washington, DC.
- Ferguson, D.C., P.A. Opler, M.J. Smith, and J.P. Donahue. 2000. Moths of western North America. 3. Distribution of Arctiidae of western North America. Part 1. Text, maps, and references. C.P. Gillette Arthropod Biodiversity Museum, Ft. Collins, CO. 171pp.
- Gielis, C. 1993. Generic revision of the Superfamily Pterophoridae (Lepidoptera). *Zoologische Verhandelingen Leiden* 290: 1-139.
- Handfield, L. 1999. Le guide des papillons du Quebec. Version populaire. Broquet. Ottawa. 536 pp. + 123 plates.
- Heinrich, C. 1923. Revision of the North American moths of the subfamily Eucosminae of the family Olethreutidae. *Bull. U.S.N.M.* 123:1-298.
- Heinrich, C. 1926. Revision of the North American moths of the subfamilies Laspeyresiinae and Olethreutinae. *Bull. U.S.N.M.* 132:1-216.
- Hodges, R.W. 1971. Sphingoidea. Fasc. 21 *in* Dominick, R.B., et al. The Moths North of Mexico. E.W. Classey Ltd. and the Wedge Entomological Research Foundation, London, UK.
- Hodges, R.W., T. Dominick, D.R. Davis, D.C. Ferguson, J.G. Franclemont, E.G. Munroe, and J.A. Powell 1983. Check list of the Lepidoptera of America North of Mexico. E. W. Classey Ltd. and the Wedge Entomological Research Foundation. London, UK. 284pp.
- Hodges, R.W. 1986. Gelechioidea: Gelechiidae (in part): Dichomeridinae, Fasc. 7.1 *in* Dominick, R.B., et al. The Moths North of Mexico. Wedge Entomological Research Foundation, Washington, DC.

- Kristensen, N.P. (*editor*) 1999. Arthropoda: Insects, part 35: Lepidoptera; Moths and Butterflies. *in* Handbook of Zoology, Vol. IV. Walter de Gruyter, Berlin, Germany.
- Lafontaine, J.D. 1998. Noctuidea, Noctuidae (part), Noctuinae - (Part - Noctuini). Fasc. 27.3 *in* Dominick, R.B., et al. The Moths North of Mexico. Wedge Entomological Research Foundation, Washington, DC.
- Lafontaine, J.D., R. Poole. 1991. Noctuidea, Noctuidae (part), Fasc. 25.1 *in* Dominick, R.B., et al. The Moths North of Mexico. Wedge Entomological Research Foundation, Washington, DC.
- Layberry, R.A., P.W. Hall, & J.D. Lafontaine. 1998. The Butterflies of Canada. University of Toronto Press, Toronto, ON. 280 pp.
- McCabe, T.L. 1980. A reclassification of the *Polia* complex for North America (Lepidoptera: Noctuidae). The State Education Department, Albany, NY. 141 pp.
- McGuffin, W.C. 1977. Guide to the Geometridae of Canada (Lepidoptera). II. Subfamily Ennominae. 2. Memoirs of the Entomol. Soc. Can. #101. 191 pp.
- McGugan, B.M. 1958. Forest Lepidoptera of Canada recorded by the Forest Insect Survey. Vol. 1 – Papilionidae to Arctiidae. Canadian Department of Agriculture, Ottawa, ON. 76 pp.
- Munroe, E. 1972. Pyraloidea: Pyralidae (Part): Scopariinae and Nymphulinae, Fasc. 13.1A *in* Dominick, R.B., et al. The Moths North of Mexico. E.W. Classey Ltd. and the Wedge Entomological Research Foundation, London, UK.
- Munroe, E. 1973. A supposedly cosmopolitan insect: the celery webworm and its allies, genus *Nomophila* Hübner (Lepidoptera: Pyralidae: Pyraustinae). *Can. Ent.* 105:177-216.
- Munroe, E. 1976. Pyraloidea: Pyralidae: Pyraustinae: Pyraustini (Conclusion). Fasc. 13.2B *in* Dominick, R.B., et al. The Moths North of Mexico. E.W. Classey Ltd. and the Wedge Entomological Research Foundation, London, UK.
- Mustelin, T., R. Leuschner, K. Mikkola and J.D. Lafontaine, 2000. "Two new genera and thirteen new species of owlet moths (Lepidoptera: Noctuidae), mainly from southern California." *Proc. San Diego Society of Nat. History* No. 36.
- Pohl, G.R., J.-F. Landry, D.W. Langor, and J.R. Spence (in prep). Moths and butterflies (Lepidoptera) of the boreal mixedwood forest near Lac La Biche, Alberta, including new provincial records.

- Poole, R.W. 1995. Noctuidea, Noctuidae (part). Fasc. 26.1 *in* Dominick, R.B., et al. The Moths of North America North of Mexico. Wedge Entomological Research Foundation, Washington, DC.
- Poole, R.W. 1996. Nomina Insecta Nearctica. A check list of the insects of North America, Vol. 3: Diptera, Lepidoptera, Siphonaptera. Entomological Information Services, Rocksville, MD. (4 Volume set and CD-ROM).
- Powell, J.A. and S. Cho 2000. North American Tortricidae checklist (Lepidoptera). Electronically published at:
<http://www.cnr.berkeley.edu/sperlinglab/PEET/cklist.html>.
- Prentice, R.M. 1962. Forest Lepidoptera of Canada recorded by the Forest Insect Survey. Vol. 2 – Nycteolidae Notodontidae Noctuidae Liparidae. Canada Department of Forestry, Ottawa, ON. 281 pp.
- Prentice, R.M. 1963. Forest Lepidoptera of Canada recorded by the Forest Insect Survey. Vol. 3 – Lasiocampidae Drepanidae Thyatiridae Geometridae. Canada Department of Forestry, Ottawa, ON. 543 pp.
- Prentice, R.M. 1965. Forest Lepidoptera of Canada recorded by the Forest Insect Survey. Vol. 4 – Microlepidoptera. Canada Department of Forestry, Ottawa, ON. 840 pp.
- Razowski, J. 1997. Cochylini (Lepidoptera: Tortricidae) of Canada. *Acta Zoologica Cracoviensia* 40:107-163.
- Rockburne, E.W. and J.D. Lafontaine. 1976. The Cutworm Moths of Ontario and Quebec. Printing and Supply Services of Canada, Ottawa, ON. 164 pp.
- Schmidt, B.C. 2000. The Tiger moths (Arctiidae) of Alberta. Published by the author.
- Schmidt, B.C. and G.R. Pohl 2000. Survey of the Butterflies and Moths (Lepidoptera) of the Canadian Shield Natural Region of Alberta. Unpubl. Report, Alberta Natural Heritage Information Centre, Parks and Protected Areas Division, Alberta Natural Resource Service, Edmonton, AB.
- Strong, W. and K.R. Leggat 1992. Ecoregions of Alberta. Alberta Forestry, Lands, and Wildlife, Edmonton, AB. 59pp.
- Tuskes, P.M., J.P. Tuttle and M.M. Collins. 1996. The Wild Silkmoths of North America. A natural history of the Saturniidae of the United States and Canada. Cornell University Press. Ithaca, NY. 246. pp.
- Varis, V., J. Jalava, and J. Kyrki, 1987. Check-list of Finnish Lepidoptera. *Notulae Ent.* 67: 49-118.