

Results of odonate collecting in central Alaska, Summer 2008

**An effort to expand knowledge of dragonfly and damselfly
species diversity and distribution in Alaska**

by

John Hudson



Kennedy's Emerald dragonfly (*Somatochlora kennedyi*), a new state record discovered during this project.

October 19, 2008

USFWS Challenge Cost-Share Agreement 70181-8-J530



Members of the Dalton Highway odonate collecting expedition of 2008, one of several collecting trips discussed in this report: (l-r) John Hudson, Lisa Saperstein, Joanna Fox, Pauline Strong, and Robert Armstrong.

Project Summary

In an effort to enhance knowledge of odonate species diversity and geographic distribution in central Alaska, adult dragonflies and damselflies were collected in June and July 2008 in Fairbanks, Coldfoot, Tok, and Galena and along the Dalton, Elliot, and Richardson highways. Habitats surveyed included bogs, gravel pits, marshes, ponds, and a variety of lakes. Twenty-four species representing five families were collected.

Kennedy's Emerald (*Somatochlora kennedyi*) was discovered for the first time in Alaska and the known ranges of several species were expanded. The Prairie Bluet damselfly (*Coenagrion angulatum*), previously known in Alaska only from the Kanuti National Wildlife Refuge, was collected at two sites in Fairbanks. With 27 species, central Alaska has the greatest odonate diversity of any region of the state. Future odonate studies in the region should strive to document rare species that may occur here, focus on species-habitat associations, and identify at-risk species.

Project Overview

The species diversity and geographic distribution of Odonata (dragonflies and damselflies) in Alaska are poorly known. Recent surveys of odonates conducted and underwritten by the U.S. Fish and Wildlife Service (USFWS) have greatly improved our knowledge of these fascinating and ecologically important insects in Alaska. This report summarizes the results of odonate collecting trips in the interior of Alaska (Fig. 1) in June and July of 2008. These trips were one component of a larger odonate education, training, and outreach project funded by the USFWS Challenge Cost-share Program with in-kind contributions from several cooperating organizations. The project included training sessions on odonate collecting and identification techniques (Fairbanks and Tok), public presentations on odonate biology, ecology, and behavior (Fairbanks, Tok, Coldfoot, and Galena), and the first Alaska Dragonfly Day, a public outreach event held at Creamer's Field in Fairbanks. These events and the road trips between events provided an excellent opportunity to collect odonates across a large portion of central Alaska.

Objectives and Methods

Although our understanding of odonate diversity and distribution in Alaska has increased considerably in recent years, there are still many parts of the state where basic information on dragonflies and damselflies is incomplete or entirely lacking.

Consequently, a modest effort to collect specimens has great potential to yield important information about these ecologically important insects. The objectives of this project were to add to the growing knowledge concerning what species occur in Alaska and their distribution across the landscape. Our approach was simple: visit as many sites and habitats as possible and collect as many species as possible at each site. This hit-and-run approach allowed collecting over a much larger geographic area than would have been possible during longer, more intensive surveys at a few sites.

All collecting sites were located in the central biogeographic region of Alaska (Fig. 1). Odonates were collected at two sites along the Richardson Highway south of Fairbanks; at Moon Lake west of Tok; at several locations along the Elliot and Dalton highways between Fairbanks and Coldfoot; throughout Fairbanks; and throughout the Galena road system (Fig. 2). Odonates were also collected at a lake within the Koyukuk National Wildlife Refuge (NWR) near Galena. The Fairbanks collecting events and road trips took place during June 19-26, 2008. The Galena collecting trip took place on July 24-27, 2008. The following people participated in collecting activities: John Hudson (all sites), Pauline Strong and Robert Armstrong (all sites except Galena), Lisa Saperstein and Joanna Fox of the Kanuti National Wildlife Refuge (Fairbanks sites and the Dalton Highway), and Jerry Floyd and Karin Lehmkuhl Bodony of the Koyukuk/Nowitna NWR. In Fairbanks and Tok numerous individuals helped to collect specimens during training sessions and outreach events. At most sites a minimum of one specimen of each species was retained as a voucher for eventual archiving at the Museum of the North, University of Alaska Fairbanks or in the personal collection of JH.

Collecting sites were not chosen at random. Fairbanks sites were chosen based on the desire to conduct outdoor training sessions near water bodies with public access and that supported a diverse odonate community. Road trips between Fairbanks and the

communities of Coldfoot and Tok provided the opportunity to collect over a wide geographic area. Collecting sites visited during these trips were chosen based on ease of access, habitat type, and the presence of optimal weather conditions (i.e. sunshine and warm air temperatures) for adult odonate activity. Consequently, most sites visited during these trips were within 50 m of a road. Bogs were often targeted as they are a favored haunt of striped emerald dragonflies (Genus: *Somatochlora*). There are four species of striped emeralds that may occur in Alaska (Brush-tipped, Muskeg, Kennedy's, and Ocellated), none of which had been documented in the state at the onset of this project.

Collecting effort, time of year, and weather conditions can greatly influence the number of species found at a given site. Effort varied considerably among sites. Time spent collecting ranged from 0.5 to 3 hours and the number of collectors ranged from 1 to more than 40. Because most sites were visited on a single day and effort varied greatly among sites, the species lists (Tables 1-4) in this report only provides a snapshot record of the taxa encountered and are thus not intended to allow for comparison of species diversity among sites. However, these collections do serve an important purpose. When lists from multiple localities in an area are combined, a picture of the odonate community begins to emerge. For example, Table 5 in this report demonstrates how combining site level collection data from multiple sources and years allows one to compare odonate biodiversity across a region.

Adult odonates were targeted during this project. Unlike the larvae, adults are readily and reliably identified to species in the field, allowing collectors to monitor species diversity in real-time while minimizing the number of individuals retained for voucher specimens. The species lists in this report are based on field identifications of specimens that were released or voucher specimens identified with the aid of a dissecting microscope. In both cases the same morphological characters were used to make identifications. A few individuals were identified while in-flight or emerging. The individuals identified while in-flight were identified to family (Aeshnidae, Corduliidae); however, because they were the only individuals of their family encountered, they were considered a species for the

purpose of calculating species totals at a site. Two individuals were identified to species from photographs.

Results and Discussion

Twenty-four species representing five families and nearly 90% of the twenty-seven species known from central Alaska were collected during this project (Tables 1-4). All species in the families Lestidae (Spreadwings), Coenagrionidae (Bluets), Aeshnidae (Blue Darners), and Libellulidae (Skimmers) known to occur in central Alaska were collected from at least one site. However, only two of the six emerald dragonflies (Family: Corduliidae) previously known from this region were collected: American Emerald (*Cordulia shurtleffii*) and Hudsonian Emerald (*Somatochlora hudsonica*). Emerald dragonflies are difficult to capture, are localized, and infrequently encountered making documentation of their presence in an area difficult.

A third emerald species collected during this project, Kennedy's Emerald (*Somatochlora kennedyi*) (see title page), is a new record for Alaska and the only new state record discovered during the project. On 22 June several male and female Kennedy's Emeralds were collected in a bog at mile 326.6 of the Richardson Highway, between Fairbanks and Delta Junction (Table 2). The species was also found in Galena, where on 28 July, just before departing on a return flight to Fairbanks, JH found a dead female Kennedy's Emerald on the grill of a USFWS vehicle (Table 3). The Galena road system spans approximately 11 km. Based on the specimen's relatively intact condition, it was assumed that the individual was alive in Galena sometime during the summer of 2008.

This project produced new species records for all of the areas that were visited and extended the range of several species in Alaska. A Delicate Emerald (*Somatochlora franklini*) collected at mile 326.6 of the Richardson Highway represents a range extension of 80 km to the north. Few records of this species in Alaska exist. In central Alaska, Delicate Emerald dragonflies were previously known only from Tetlin NWR and the Donnelly Dome area south of Delta Junction.

The Dalton Highway collecting trip produced records that extend the northern range of several species in Alaska: Boreal Bluet (*Enallagma boreale*), Northern Bluet (*Enallagma annexum*), Taiga Bluet (*Coenagrion resolutum*), Subarctic Bluet (*Coenagrion interrogatum*), Variable Darner (*Aeshna interupta*), American Emerald, Belted Whiteface (*Leucorrhinia proxima*), and Canada Whiteface (*Leucorrhinia patricia*), a species previously known in Alaska only from Tetlin and Kanuti NWRs (Table 5).

Collecting in Fairbanks during June produced 15 species (Table 1), including three new species records for the area. The most notable new record was Prairie Bluet (*Coenagrion angulatum*), a damselfly previously known in Alaska only from Kanuti NWR where it was discovered by refuge biologists in 2004. On June 14, 2008, LS collected a Prairie Bluet at a bog on Goldstream Road northwest of Fairbanks. The species was collected at a second Fairbanks site (“Wander Lake”¹) on June 20 during one of the field training sessions.

The other new Fairbanks area records were Subarctic Bluet (*Coenagrion interrogatum*), found at Smith Lake and the Goldstream Road bog and Emerald Spreadwing (*Lestes dryas*), found at a seasonal marsh at Creamers Field. The Spreadwing specimen, along with a Cherry-faced Meadowhawk (*Sympetrum internum*) also collected at the marsh, represent the earliest known collection date (21 June) for these late-summer species in Alaska. Adults are typically first seen in mid-July and August. The tendency of this marsh to dry up by mid-July (Melissa Sikes, Program Director, Friends of Creamer’s Field, personal communication) appears to have altered the phenology of these species. These three new records increase the Fairbanks area list to 20 species (Table 5).

The Galena portion of this project represented the first intensive odonate survey in the northwestern portion of central Alaska where virtually nothing was known about odonates. Although five odonate specimens were collected in Koyukuk NWR (Nogahabara Dunes) in July 2001, they have not yet been identified. The July collecting trip to Galena/Koyukuk NWR resulted in 17 species, 16 species from the Galena road

¹ Place names in quotations were created by the authors or are unofficial community-accepted place names.

system and 9 species collected at a single lake in the refuge (Table 4). A Boreal Whiteface (*Leucorrhinia borealis*) photographed in June 19, 2008 by USFWS biologist Karin Lehmkuhl Bodony brings the species count for the area to 18. Galena/Koyukuk NWR was the only area where Black Meadowhawk (*Sympetrum danae*), a late-summer species, was collected. On July 27 hundreds of Black Meadowhawks were emerging from “Duck Lake” in Galena.

Of all the biogeographic regions in the state, central Alaska supports the highest diversity of odonate species. With the discovery of Kennedy’s Emerald during this project, twenty-seven species are now known from the region, nine more species than in southeastern Alaska - the second most diverse region. Greater habitat diversity, land area, and warm summers probably contribute to this high diversity, although a relatively high density of roads (i.e. greater accessibility) and a greater effort to collect in the region may also be factors.

With continued collecting, more species are likely to be discovered in central Alaska. Future odonate surveys should focus on bog habitats where three *Somatochlora* spp. known from the Yukon Territory might be found. Beyond gaining an understanding of what species occur here and where, the habitat requirements and relative abundance of dragonflies and damselflies in central, and other regions of the state, deserves attention. Combined, this information is essential for evaluating the conservation status of Alaska’s odonates and to ensure their continued existence in the face of a variety of threats such as pollution, habitat loss, and climate change.

Acknowledgements

Literally hundreds of people collected dragonflies during this project. The efforts of everyone who grabbed a net during Dragonfly Day to catch, and learn about, the dragons and damsels near Creamer’s Field are greatly appreciated. Community members and visitors in Tok and Galena willingly swung nets and collected important information for this project. The collecting efforts of Robert Armstrong, Pauline Strong, and Joanna Fox

are especially appreciated as are the efforts of the many training session participants. Thanks to Heather Johnson (Tetlin NWR) and Karin Lehmkuhl Bodony (Koyukuk/Nowitna NWR) for their hospitality and for arranging transportation and housing during our visits. Jerry Floyd, a Koyukuk/Nowitna NWR pilot, provided air transportation to “Loon Lake”. Nancy and Jim DeWitt graciously provide housing for John, Bob, and Pauline while in Fairbanks. Dennis Paulson confirmed the identity of a Canada Whiteface from a photograph. Finally, this project would not have been possible without the leadership and organization of Lisa Saperstein (Kanuti NWR). Lisa administered the USFWS challenge cost-share grant for this project, organized training sessions and collecting trip logistics, and expertly collected and identified odonates in the field.

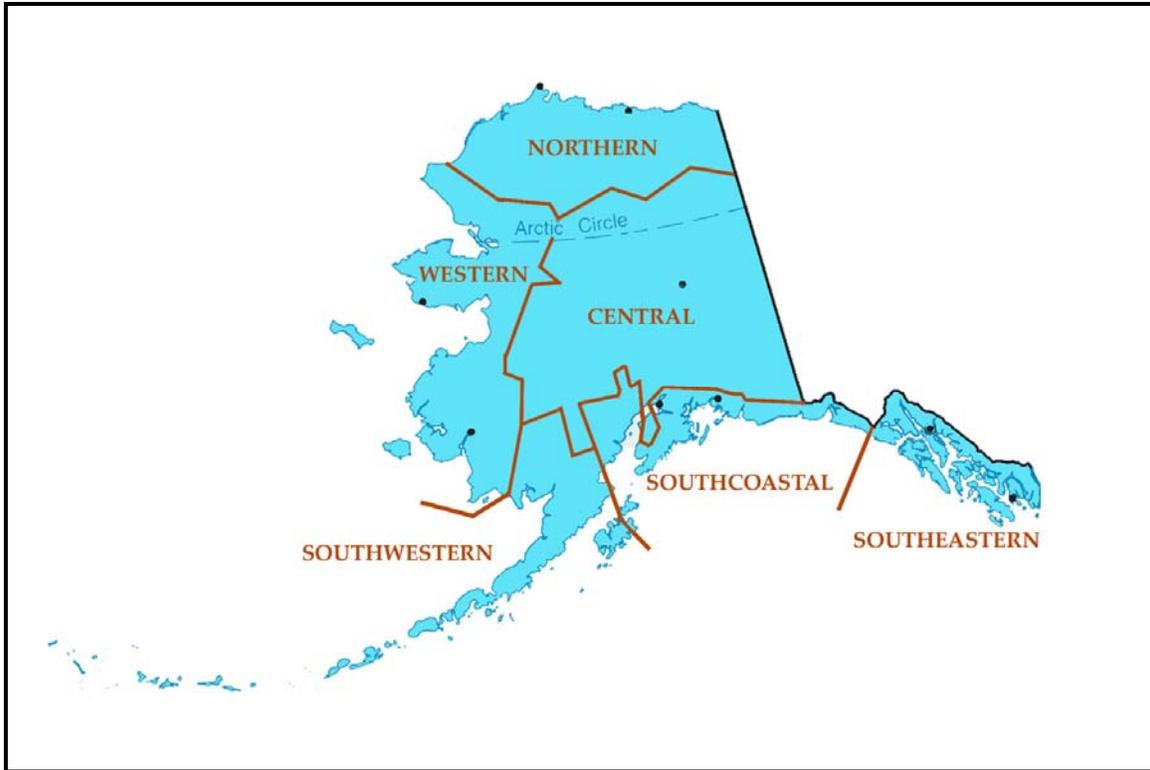


Figure 1. Biogeographic regions of Alaska (based on B. Kessel and D. D. Gibson, Status and Distribution of Alaska Birds, Studies in Avian Biology 1, 100 pp., 1978)

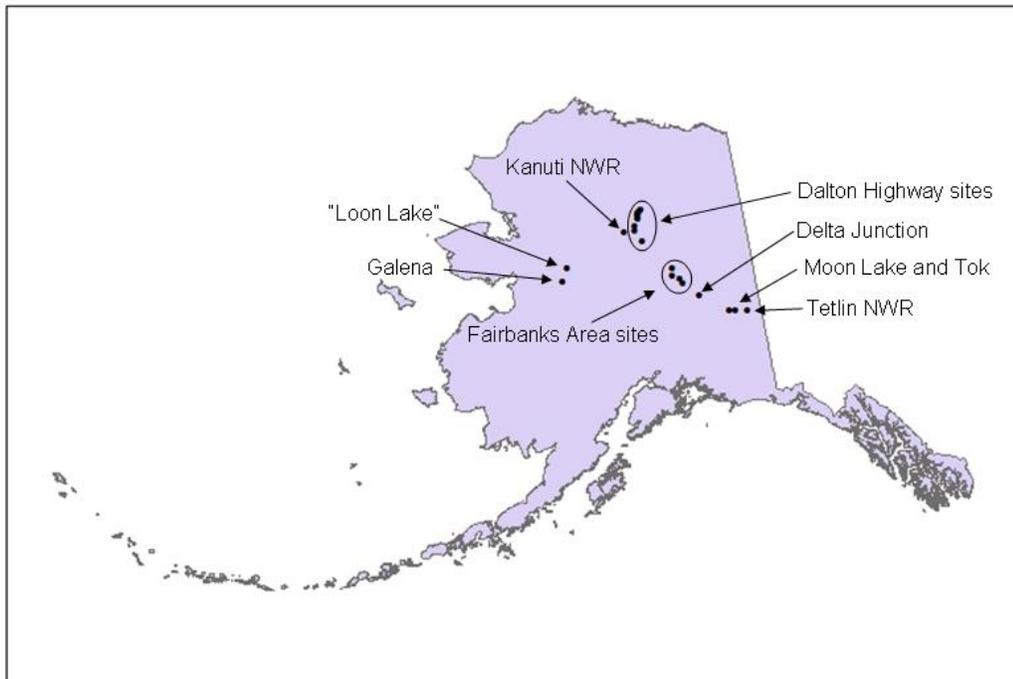


Figure 2. Collecting sites visited during this project and other areas where odonates have been surveyed in central Alaska. The Fairbanks Area group of sites includes site DH11 (Elliot Highway) and two sites on the Richardson Highway (Eielson Farm Road and “Kennedy’s Bog”).

Table 1. Odonate species collected at five sites in Fairbanks, Alaska in June 2008.

Site	Cushman Rd.	Smith Lake	“Wander Lake”	Goldstream Rd. bog	Creamer’s Field
Date	19 June	19 June	20 June	20 June	21 June
Latitude (N)	64.797149	64.864811	64.860981	64.911591	64.866716
Longitude (W)	-147.713632	-147.869935	-147.704247	-147.938816	-147.740213
Habitat	floodplain ¹	bog lake	gravel pit	bog lake ²	season. marsh
Species known from central Alaska					
Suborder Zygoptera (damselflies)					
Family Lestidae					
<i>Lestes disjunctus</i> (Northern Spreadwing)					
<i>L. dryas</i> (Emerald Spreadwing)					
Family Coenagrionidae					
<i>Enallagma boreale</i> (Boreal Bluet)					
<i>E. annexum</i> (Northern Bluet)					
<i>Coenagrion angulatum</i> (Prairie Bluet)					
<i>C. resolutum</i> (Taiga Bluet)					
<i>C. interrogatum</i> (Subarctic Bluet)					
<i>Nehalennia irene</i> (Sedge Sprite)					
Suborder Anisoptera (dragonflies)					
Family Aeshnidae					
<i>Aeshna eremita</i> (Lake Darner)					
<i>A. juncea</i> (Sedge Darner)					
<i>A. sitchensis</i> (Zigzag Darner)					
<i>A. subarctica</i> (Subarctic Darner)					
<i>A. interrupta</i> (Variable Darner)					
<i>A. septentrionalis</i> (Azure Darner)					
Family Corduliidae					
<i>Cordulia shurtleffii</i> (American Emerald)					
<i>S. franklini</i> (Delicate Emerald)					
<i>S. albicincta</i> (Ringed Emerald)					
<i>S. hudsonica</i> (Hudsonian Emerald)					
<i>S. kennedyi</i> (Kennedy’s Emerald)					
<i>S. sahlbergi</i> (Treeline Emerald)					
Family Libellulidae					
<i>Leucorrhinia proxima</i> (Belted Whiteface)					
<i>L. hudsonica</i> (Hudsonian Whiteface)					
<i>L. borealis</i> (Boreal Whiteface)					
<i>L. patricia</i> (Canada Whiteface)					
<i>Libellula quadrimaculata</i> (Four-spotted Skimmer)					
<i>Sympetrum danae</i> (Black Meadowhawk)					
<i>S. internum</i> (Cherry-faced Meadowhawk)					
Total species (27)	6	8	10	9	6

¹this site consisted of several shallow water bodies in a former side-channel of the Tanana River; ²former peat mining site

Table 2. Odonate species collected at three sites between Fairbanks and Tok, Alaska in June 2008.

Site	Eielson Farm Rd. (Moose Creek)	"Kennedy's Bog" (Aurora Lodge)	Moon Lake (Tok)
Date	22 June	22,23 June	22 June
Latitude (N)	64.713937	64.503439	63.376396
Longitude (W)	-147.193437	-146.966823	-143.545618
Habitat	gravel pit	bog & ditch	oxbow lake
Species known from central Alaska			
Suborder Zygoptera (damselflies)			
Family Lestidae			
<i>Lestes disjunctus</i> (Northern Spreadwing)			
<i>L. dryas</i> (Emerald Spreadwing)			
Family Coenagrionidae			
<i>Enallagma boreale</i> (Boreal Bluet)			
	X		
<i>E. annexum</i> (Northern Bluet)			
	X		X
<i>Coenagrion angulatum</i> (Prairie Bluet)			
<i>C. resolutum</i> (Taiga Bluet)			
		X	
<i>C. interrogatum</i> (Subarctic Bluet)			
<i>Nehalennia irene</i> (Sedge Sprite)			
Suborder Anisoptera (dragonflies)			
Family Aeshnidae			
<i>Aeshna eremita</i> (Lake Darner)			
	X		
<i>A. juncea</i> (Sedge Darner)			
		X	
<i>A. sitchensis</i> (Zigzag Darner)			
<i>A. subarctica</i> (Subarctic Darner)			
<i>A. interrupta</i> (Variable Darner)			
<i>A. septentrionalis</i> (Azure Darner)			
		X	
Family Corduliidae			
	X		
<i>Cordulia shurtleffii</i> (American Emerald)			
<i>S. franklini</i> (Delicate Emerald)			
		X	
<i>S. albicincta</i> (Ringed Emerald)			
<i>S. hudsonica</i> (Hudsonian Emerald)			
<i>S. kennedyi</i> (Kennedy's Emerald)			
		X ¹	
<i>S. sahlbergi</i> (Treeline Emerald)			
Family Libellulidae			
<i>Leucorrhinia proxima</i> (Belted Whiteface)			
	X		
<i>L. hudsonica</i> (Hudsonian Whiteface)			
		X	X
<i>L. borealis</i> (Boreal Whiteface)			
		X	X
<i>L. patricia</i> (Canada Whiteface)			
<i>Libellula quadrimaculata</i> (Four-spotted Skimmer)			
	X	X	
<i>Sympetrum danae</i> (Black Meadowhawk)			
<i>S. internum</i> (Cherry-faced Meadowhawk)			
Total species (27)	6	8	4
¹ new species record for Alaska			

Table 3. Odonate species collected along the Elliot and Dalton highways in June 2008.

Site	Elliot Hwy. site 11	Dalton Hwy. site 10	Dalton Hwy. site 9	Dalton Hwy. site 1	Dalton Hwy. site 8	Dalton Hwy. site 7
Date	26 June	26 June	26 June	24 June	26 June	26 June
Latitude (N)	65.0982	66.1255	66.5389	66.6657	66.9395	66.9593
Longitude (W)	-147.7420	-150.1672	-150.7950	-150.6606	-150.4193	-150.3927
Habitat	pond	pond	road	beaver ponds	floating bog	lake
Species known from central Alaska						
Suborder Zygoptera (damselflies)						
Family Lestidae						
<i>Lestes disjunctus</i> (Northern Spreadwing)						
<i>L. dryas</i> (Emerald Spreadwing)						
Family Coenagrionidae						
<i>Enallagma boreale</i> (Boreal Bluet)		X				X
<i>E. annexum</i> (Northern Bluet)						X
<i>Coenagrion angulatum</i> (Prairie Bluet)						
<i>C. resolutum</i> (Taiga Bluet)	X	X		X	X	X
<i>C. interrogatum</i> (Subarctic Bluet)					X	X
<i>Nehalennia irene</i> (Sedge Sprite)						
Suborder Anisoptera (dragonflies)						
Family Aeshnidae						
<i>Aeshna eremita</i> (Lake Darner)						
<i>A. juncea</i> (Sedge Darner)			X			X
<i>A. sitchensis</i> (Zigzag Darner)				X		
<i>A. subarctica</i> (Subarctic Darner)						
<i>A. interrupta</i> (Variable Darner)		X				
<i>A. septentrionalis</i> (Azure Darner)					X	
Family Corduliidae						
<i>Cordulia shurtleffii</i> (American Emerald)						X
<i>S. franklini</i> (Delicate Emerald)						
<i>S. albicincta</i> (Ringed Emerald)						
<i>S. hudsonica</i> (Hudsonian Emerald)		X				
<i>S. kennedyi</i> (<i>Kennedy's Emerald</i>)						
<i>S. sahlbergi</i> (Treeline Emerald)						
Family Libellulidae						
<i>Leucorrhinia proxima</i> (Belted Whiteface)					X	X
<i>L. hudsonica</i> (Hudsonian Whiteface)	X			X	X	X
<i>L. borealis</i> (Boreal Whiteface)	X			X		
<i>L. patricia</i> (Canada Whiteface)					X	
<i>Libellula quadrimaculata</i> (Four-spotted Skimmer)		X				
<i>Sympetrum danae</i> (Black Meadowhawk)						
<i>S. internum</i> (Cherry-faced Meadowhawk)						
Total species (27)	3	5	1	4	6	8

Table 3 cont. Odonate species collected along the Elliot and Dalton highways in June 2008.

Site	Dalton Hwy. site 6	Dalton Hwy. site 2	Dalton Hwy. site 4	Dalton Hwy. site 3	Dalton Hwy. site 5
Date	26 June	24 June	25 June	25 June	25 June
Latitude (N)	67.0520	67.1388	67.1412	67.1584	67.2323
Longitude (W)	-150.3416	-150.3561	-150.3558	-150.3539	-150.2241
Habitat	thermokarst pond	small lakes	small lakes	beaver ponds	gravel pit
Species known from central Alaska					
Suborder Zygoptera (damselflies)					
Family Lestidae					
<i>Lestes disjunctus</i> (Northern Spreadwing)					
<i>L. dryas</i> (Emerald Spreadwing)					
Family Coenagrionidae					
<i>Enallagma boreale</i> (Boreal Bluet)	X	X	X		
<i>E. annexum</i> (Northern Bluet)	X	X			
<i>Coenagrion angulatum</i> (Prairie Bluet)					
<i>C. resolutum</i> (Taiga Bluet)	X		X	X	
<i>C. interrogatum</i> (Subarctic Bluet)			X	X	
<i>Nehalennia irene</i> (Sedge Sprite)					
Suborder Anisoptera (dragonflies)					
Family Aeshnidae					
<i>Aeshna eremita</i> (Lake Darner)					
<i>A. juncea</i> (Sedge Darner)			X	X	
<i>A. sitchensis</i> (Zigzag Darner)					
<i>A. subarctica</i> (Subarctic Darner)					
<i>A. interrupta</i> (Variable Darner)					
<i>A. septentrionalis</i> (Azure Darner)					
Family Corduliidae					
<i>Cordulia shurtleffii</i> (American Emerald)			X	X	X
<i>S. franklini</i> (Delicate Emerald)					
<i>S. albicincta</i> (Ringed Emerald)					
<i>S. hudsonica</i> (Hudsonian Emerald)					
<i>S. kennedyi</i> (Kennedy's Emerald)					
<i>S. sahlbergi</i> (Treeline Emerald)					
Family Libellulidae					
<i>Leucorrhinia proxima</i> (Belted Whiteface)			X		
<i>L. hudsonica</i> (Hudsonian Whiteface)	X		X	X	
<i>L. borealis</i> (Boreal Whiteface)					
<i>L. patricia</i> (Canada Whiteface)					
<i>Libellula quadrimaculata</i> (4-Spotted Skimmer)					
<i>Sympetrum danae</i> (Black Meadowhawk)					
<i>S. internum</i> (Cherry-faced Meadowhawk)					
Total species (27)	4	2	7	5	1

Table 4. Odonate species collected in Galena, Alaska and the Koyukuk National Wildlife Refuge (KNWR) in July 2008.

Site	"Karin's Lot"	"Hidden Lake"	"Buckbean Bog"	"Alexander Lake"	"Duck Lake"
Date	24,26 July	25 July	24,25,27 July	25 July	24,27 July
Latitude (N)	64.7497	64.7485	64.7433	64.7485	64.7438
Longitude (W)	-156.8741	-156.8868	-156.8983	-156.8828	-156.8181
Habitat	pond	marsh	bog	lake	lake
Species known from central Alaska					
Suborder Zygoptera (damselflies)					
Family Lestidae					
<i>Lestes disjunctus</i> (Northern Spreadwing)			X		X
<i>L. dryas</i> (Emerald Spreadwing)			X		X
Family Coenagrionidae					
<i>Enallagma boreale</i> (Boreal Bluet)				X	
<i>E. annexum</i> (Northern Bluet)				X	
<i>Coenagrion angulatum</i> (Prairie Bluet)					
<i>C. resolutum</i> (Taiga Bluet)		X			
<i>C. interrogatum</i> (Subarctic Bluet)					
<i>Nehalennia irene</i> (Sedge Sprite)					
Suborder Anisoptera (dragonflies)					
Family Aeshnidae					
<i>Aeshna eremita</i> (Lake Darner)					X
<i>A. juncea</i> (Sedge Darner)	X				
<i>A. sitchensis</i> (Zigzag Darner)			X		
<i>A. subarctica</i> (Subarctic Darner)			X		
<i>A. interrupta</i> (Variable Darner)		X			X
<i>A. septentrionalis</i> (Azure Darner)	X				
Family Corduliidae					
<i>Cordulia shurtleffii</i> (American Emerald)			X		
<i>S. franklini</i> (Delicate Emerald)					
<i>S. albicincta</i> (Ringed Emerald)					
<i>S. hudsonica</i> (Hudsonian Emerald)					
<i>S. kennedyi</i> (Kennedy's Emerald)					
<i>S. sahlbergi</i> (Treeline Emerald)					
Family Libellulidae					
<i>Leucorrhinia proxima</i> (Belted Whiteface)				X	
<i>L. hudsonica</i> (Hudsonian Whiteface)					
<i>L. borealis</i> (Boreal Whiteface)					
<i>L. patricia</i> (Canada Whiteface)					
<i>Libellula quadrimaculata</i> (Four-spotted Skimmer)		X			
<i>Sympetrum danae</i> (Black Meadowhawk)					X
<i>S. internum</i> (Cherry-faced Meadowhawk)	X		X	X	X
Total species (27)	3	3	6	4	6

Table 4 cont. Odonate species collected in Galena, Alaska and the Koyukuk National Wildlife Refuge (KNWR) in July 2008.

Site	"Elmer's Pond" (Galena)	"Tower Marsh" (Galena)	Galena road system	"Loon Lake" (KNWR)
Date	24,27 July	24,27 July	Summer '08	25 July
Latitude (N)	64.7313	64.7339		65.1769
Longitude (W)	-156.7558	-156.7761		-156.6638
Habitat	pond/marsh	bog		lake/bog
Species known from central Alaska				
Suborder Zygoptera (damselflies)				
Family Lestidae				
<i>Lestes disjunctus</i> (Northern Spreadwing)	X	X		X
<i>L. dryas</i> (Emerald Spreadwing)				
Family Coenagrionidae				
<i>Enallagma boreale</i> (Boreal Bluet)				X
<i>E. annexum</i> (Northern Bluet)				X
<i>Coenagrion angulatum</i> (Prairie Bluet)				
<i>C. resolutum</i> (Taiga Bluet)				
<i>C. interrogatum</i> (Subarctic Bluet)				
<i>Nehalennia irene</i> (Sedge Sprite)				
Suborder Anisoptera (dragonflies)				
Family Aeshnidae				
<i>Aeshna eremita</i> (Lake Darner)	X			X
<i>A. juncea</i> (Sedge Darner)	X	X		X
<i>A. sitchensis</i> (Zigzag Darner)	X	X		X
<i>A. subarctica</i> (Subarctic Darner)				
<i>A. interrupta</i> (Variable Darner)				
<i>A. septentrionalis</i> (Azure Darner)				
Family Corduliidae				
<i>Cordulia shurtleffii</i> (American Emerald)				X
<i>S. franklini</i> (Delicate Emerald)				
<i>S. albicincta</i> (Ringed Emerald)				
<i>S. hudsonica</i> (Hudsonian Emerald)				
<i>S. kennedyi</i> (<i>Kennedy's Emerald</i>)			X ¹	
<i>S. sahlbergi</i> (Treeline Emerald)				
Family Libellulidae				
<i>Leucorrhinia proxima</i> (Belted Whiteface)				X
<i>L. hudsonica</i> (Hudsonian Whiteface)				
<i>L. borealis</i> (Boreal Whiteface)				
<i>L. patricia</i> (Canada Whiteface)				
<i>Libellula quadrimaculata</i> (Four-spotted Skimmer)				
<i>Sympetrum danae</i> (Black Meadowhawk)	X			X
<i>S. internum</i> (Cherry-faced Meadowhawk)	X			
Total species (27)	6	3		9

¹this record represents a single female collected from the grill of a U.S. Fish and Wildlife Service vehicle

Table 5. Odonate diversity at 5 locations in central Alaska (NWR, National Wildlife Refuge).

	Fairbanks	Kanuti NWR	Tetlin NWR	Galena/Koyukuk NWR	Delta Junction
Species known from central Alaska					
Suborder Zygoptera (damselflies)					
Family Lestidae					
<i>Lestes disjunctus</i> (Northern Spreadwing)	X	X		X	X
<i>L. dryas</i> (Emerald Spreadwing)	X			X	X
Family Coenagrionidae					
<i>Enallagma boreale</i> (Boreal Bluet)	X	X	X	X	X
<i>E. annexum</i> (Northern Bluet)	X	X	X	X	X
<i>Coenagrion angulatum</i> (Prairie Bluet)	X	X			
<i>C. resolutum</i> (Taiga Bluet)	X	X	X	X	X
<i>C. interrogatum</i> (Subarctic Bluet)	X	X	X		X
<i>Nehalennia irene</i> (Sedge Sprite)	X	X	X		X
Suborder Anisoptera (dragonflies)					
Family Aeshnidae					
<i>Aeshna eremita</i> (Lake Darner)	X	X	X	X	X
<i>A. juncea</i> (Sedge Darner)	X	X	X	X	X
<i>A. sitchensis</i> (Zigzag Darner)	X	X	X	X	
<i>A. subarctica</i> (Subarctic Darner)		X	X	X	
<i>A. interrupta</i> (Variable Darner)	X	X	X	X	X
<i>A. septentrionalis</i> (Azure Darner)			X	X	X
Family Corduliidae					
<i>Cordulia shurtleffii</i> (American Emerald)	X	X	X	X	X
<i>S. franklini</i> (Delicate Emerald)			X		X
<i>S. albicincta</i> (Ringed Emerald)		X	X		X
<i>S. hudsonica</i> (Hudsonian Emerald)	X		X		X
<i>S. kennedyi</i> (Kennedy's Emerald)				X	
<i>S. sahlbergi</i> (Treeline Emerald)					X
Family Libellulidae					
<i>Leucorrhinia proxima</i> (Belted Whiteface)	X	X	X	X	X
<i>L. hudsonica</i> (Hudsonian Whiteface)	X	X	X		X
<i>L. borealis</i> (Boreal Whiteface)	X	X	X	X ¹	X
<i>L. patricia</i> (Canada Whiteface)		X	X		
<i>Libellula quadrimaculata</i> (Four-spotted Skimmer)	X	X	X	X	X
<i>Sympetrum danae</i> (Black Meadowhawk)	X	X		X	X
<i>S. internum</i> (Cherry-faced Meadowhawk)	X	X		X	X
Total species (27)	20	21	20	18	22
¹ photographed in Koyukuk NWR on 19 June 2008 by Karin Lehmkuhl Bodony					

Appendix

Photographs of selected collecting sites



Goldstream Road bog, Fairbanks



Seasonal marsh at Creamer's Field, Fairbanks



“Wander Lake”, a former gravel pit in northeast Fairbanks



“Kennedy’s Bog”, mile 326.6 Richardson Highway



Floating bog (site 8), mile 149 Dalton Highway



Thermokarst lake (site 6), Dalton Highway



Roadside flooding along Dalton Highway (site 4)



Gravel pit on Dalton Highway (site 5)



Pond near north end of Grayling Lake (site 7), Dalton Highway



“Duck Lake”, Galena



“Alexander Lake”, Galena



Marsh north of Elmer's Pond, Galena



"Tower Marsh", Galena



“Loon Lake”, Koyukuk NWR