Johnson Lakes Canyon

Birds, Pollinators, Dragonflies and Other Species Observations

June 11-13, 2017

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Grand Canyon Trust

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Overview:

I visited the Johnson Lakes Canyon property of Richard and Susan Knezevich June 11-13, 2017. The purpose was to record and document all the wildlife I observed, focusing particularly on pollinators and birds. The following report includes the species I recorded for birds, butterflies, dragonflies, bees, flowering forbs, reptiles, amphibians and mammals.

As my primary areas of expertise are birds, dragonflies and butterflies, their diversity is likely to be better covered than other groups. That said, I did attempt to note all species I observed during my explorations of the Johnson Lakes Canyon property.

Totals:
All in all, in three days at Johnson Lakes Canyon, I observed 49 bird species, 13 butterfly species, 8 dragonfly species, 4 damselfly species, 5 species of reptiles and amphibians, and 5 species of mammals.

Areas covered by day:
June 11: I toured the canyon bottom on the roads with Rick and Susie, then hiked up to the East Mesa from the trailers located near the property's (northern) entrance, following animal trails through the biocrust until I reached the edge of Center Canyon, on the north end of the property and east of Johnson Canyon. I climbed down into Center Canyon and followed the

canyon until a fence ran across the canyon (UTM NAD 83 382265, 4107461). At this point, after a few tries, I found a spot to climb up the wall out of Center Canyon, although for future visitors I would recommend going back farther north along the canyon before attempting to exit. From here, I recrossed East Mesa and came down into Johnson Canyon through a ravine south of the lake. From there, I walked north up the canyon and returned to the trailers.

June 12: I focused on birds and pollinators in Johnson Canyon itself, although cold conditions made the latter difficult to find until it warmed up somewhat in the afternoon. In the afternoon, I conducted two pollinator transects, one in the meadow north of camp and one up on the west mesa.

June 13: I completed four more pollinator transects: one at the far south end of the property, near the planted cottonwoods; one on the east mesa slope south of Johnson lake, and one in the canyon bottom west of the cattail marsh. I also conducted an experimental pollinator survey in the canyon bottom some distance south of the lake. During each of these days, I kept bird lists for each morning and afternoon and recorded other insect and wildlife encounters.

Conditions:
The first morning (June 11) was warm and sunny. However, wind picked up in the afternoon in Center Canyon and continued through most of June 12, which was considerably colder. There were trace amounts of frost on the ground on the morning of June 13, and it remained cold until warming considerably in the afternoon. The wind and unseasonably cold weather likely reduced the numbers of pollinators I observed, and should be considered in conjunction with the numbers and diversity I recorded at Johnson Lakes Canyon.

Systematic Pollinator Surveys

The Trust is interested in developing simple protocols by which volunteers can assist with documenting pollinator diversity and density. Two methods were tested in Johnson Lakes Canyon: pollinator transects (inspired by Audubon bird count methodology) and plant-focused pollinator surveys (in order to assess the attraction and diversity of pollinators on particular plant species).

a. Pollinator Transects

Protocol: Focus on a point in distance and walk toward it, and stop at ten points along the line, with 15 steps between each point. At each point, record all pollinators and flowers observed in a 15-ft. semicircular radius in front (in direction of transect path) of observer for 2 minutes. Record and continue to next point. Record GPS waypoints at start and end of transect.

Pollinator Transect 1

Location and Habitat:

Dry meadow on north edge of camp (Russian olive grove by trailers) in Johnson Canyon. The meadow is dominated by goosefoot (*Chenopodium* sp.) and dried stems of beeflower (*Cleome lutea* or *C. serruleta*), with scattered forbs, especially tumbling mustard (*Sisymbrium altissimum*). Mature, thinned Russian olive groves adjacent. Transect walking northeast across meadow from western edge of canyon to canyon center.

Date: **6/12/17**	**Time** **Start: 2:15 pm** **End: 2:52 pm**	**Location (UTM NAD 83)** **Start: 382206, 4108462** **End: 382289, 4108536**	**Conditions** cool (~70 F), sunny, light breeze

Key: *italics = description OR latin name*
bold = pollinating behavior observed

Point	**Pollinators** observed within 15 ft. semicircular forward radius	**Flowers** in bloom within 15 ft. semicircular forward radius	**Notes**
1	Blue sp. (tribe *Polyommatini*) butterfly	*Sisymbrium altissimum*	3 wandering gliders (dragonflies) hunting in this area
2	sphecid wasp - *all shiny black, 1.5 cm* sphecid wasp - *red + black abdomen, 2 cm*	None	
3	native bee *with black and white striped abdomen, pale green eyes, 1.2 cm*	None	
4	Blue sp. (tribe *Polyommatini*) butterfly	None	
5	None	None	
6	None	*Sisymbrium altissimum*	
7	None	*Hackelia virginiana*	
8	None	None	
9	Black fly (*Simuliidae* family)	*Sisymbrium altissimum, Hackelia virginiana*	
10	Marine Blue (*Leptotes marina*); Acmon Blue (*Plebejus acmon*); sphecid wasp - *red + black abdomen, 2 cm*	*Sisymbrium altissimum, Hackelia virginiana*	
TOTAL:	6 pollinator species		

Pollinator Transect 2

Location and Habitat: West Mesa, near north end of property, a few hundred yards from edge of Johnson Canyon. Transect running south across juniper woodland with scattered pinyon, sagebrush, rabbitbrush, Mormon tea and bitterbrush. Lots of bare soil and less biocrust than elsewhere on the mesa, with many hyalineherb (*Hymenopappus filifolius*) present.

Date: 6/12/17	**Time** **Start: 4:35 pm** **End: 5:08 pm**	**Location (UTM NAD 83)** **Start: 382175, 4108733** **End: 382107, 4108662**	**Conditions** somewhat cool, sunny, calm

Key: *italics = description OR latin name*
bold = pollinating behavior observed

Point	**Pollinators** observed within 15 ft. semicircular forward radius	**Flowers** in bloom within 15 ft. semicircular forward radius	**Notes**
1	None	*Hymenopappus filifolius*	
2	None	*Hymenopappus filifolius*	
3	*Apis mellifera* (European honeybee), Tachinid fly - *tiny, <1 cm long* **both pollinating *H. filifolius***	*Hymenopappus filifolius*	2 Variegated Fritillaries observed outside 15 ft. radius
4	None	*Hymenopappus filifolius*	
5	None	*Hymenopappus filifolius*	Variegated Fritillary just outside 15 ft. radius
6	None	*Hymenopappus filifolius* *Opuntia fragilis*	
7	Variegated Fritillary (*Euptoieta claudia*) **pollinating *H. filifolius***	*Hymenopappus filifolius* *Opuntia fragilis*	
8	None	*Hymenopappus filifolius*	
9	None	*Hymenopappus filifolius*	
10	Variegated Fritillary (*Euptoieta claudia*)	*Hymenopappus filifolius*	
TOTAL:	3 pollinator species		

Pollinator Transect 3

Location and Habitat:
Forb-filled meadow at south end of property with scattered ricegrass, paralleling and about 20 feet from wash with willows, Russian olive and young cottonwoods. Transect walking south, parallel to road. Most common forbs were globemallow, tumbling mustard and sticktight.

Date: 6/13/17	**Time** **Start: 10:25 am** **End: 10:54 am**	**Location (UTM NAD 83)** **Start: 380954, 4106552** **End:** not recorded	**Conditions** Quite cool, sunny, light to occasionally gusty breeze

Key: *italics = description OR latin name*
bold = pollinating behavior observed

Point	**Pollinators** observed within 15 ft. semicircular forward radius	**Flowers** in bloom within 15 ft. semicircular forward radius	**Notes**
1	Sphecid wasp **pollinating *Hackelia virginiana***	*Sphaeralcea parvifolia, Oenothera pallida, Sisymbrium altissimum, Hackelia virginiana*	
2	Native ladybird beetle (*Coccinellidae* family)	*S. parvifolia, O. pallida, S. altissimum, H. virginiana*	
3	None	*S. parvifolia, O. pallida, S. altissimum, H. virginiana*	
4	None	*S. parvifolia, O. pallida*	
5	Native bee sp. - *black and white abdomen, 1 cm* **pollinating *S. parvifolia***	*S. parvifolia, H. virginiana*	Fig. 4 on following page
6	None	*S. parvifolia, S. altissimum*	
7	Tachinid fly	*S. parvifolia, H. virginiana*	
8	White-lined Sphinx (*Hyles lineata*) larva	*H. virginiana*	
9	Blue sp. (tribe *Polyommatini*) butterfly	*S. parvifolia*	ants tending aphids on globemallow
10	Metallic sweat bee (*Agapostemon sp.*) **pollinating *S. parvifolia***	*S. parvifolia, O. pallida, H. virginiana*	
TOTAL:	7 pollinator species		

Fig. 1 - Ants tending aphids on *S. parvifolius*

Fig. 2 - Checkered White pair (female below)

Fig. 3 - Clouded Sulphur (*Colias philodice*)

Fig. 4 - Native bee pollinating *Sphaeralcea*

Pollinator Transect 4

Location and Habitat:
East Mesa; pinyon-juniper slope near Johnson Canyon rim, south of lake. Bare ground with scattered bitterbrush and bunchgrasses. Transect walking east upslope.

Date: 6/13/17	**Time** **Start: 12:29 pm** **End: 1:04 pm**	**Location (UTM NAD 83)** **Start: 381424, 4107105** **End: 381490, 4107066**	**Conditions** sunny, warmer, little wind

Key: *italics = description OR latin name*
bold = pollinating behavior observed

Point	**Pollinators** observed within 15 ft. semicircular forward radius	**Flowers** in bloom within 15 ft. semicircular forward radius	**Notes**
1	Variegated Fritillary (*Euptoieta claudia*), Black fly (*Simuliidae* family), Bee - *tiny, <1 cm, black* **pollinating *H. filifolius***	*Hymenopappus filifolius*	
2	*Apis mellifera* (European honeybee) **pollinating *H. filifolius***	*H. filifolius*	aphids on *H. filifolius* and robber fly (*Asilidae* family) hunting
3	**2** Tachinid flies **pollinating groundsel**	*H. filifolius*	
4	Bee - 1.2 cm, black-and-white striped abdomen	*H. filifolius*	
5	None	*H. filifolius*	
6	Bee - same species as above: 1.2 cm, black-and-white striped abdomen **pollinating groundsel**	*H. filifolius*	robber fly (*Asilidae* family)
7	None	*H. filifolius*	oblong, brown beetle on stem
8	None	*H. filifolius, Packera multilobata*	
9	None	None	
10	None	None	
TOTAL:	6 pollinator species		

Pollinator Transect 5

Location and Habitat:
Meadow along east slope of canyon between wall and cattail marsh north of Johnson Lake. Meadow primarily dried cheatgrass with skunkbush sumac (*Rhus trilobata*) and forbs.

Date: 6/13/17	**Time** Start: 1:45 pm End: 2:08 pm	**Location (UTM NAD 83)** Start: 381775, 4108005 End: 381711, 4107942	**Conditions** warm, little wind, cloudless

Key: *italics = description OR latin name*
bold = pollinating behavior observed

Point	**Pollinators** observed within 15 ft. semicircular forward radius	**Flowers** in bloom within 15 ft. semicircular forward radius	Notes
1	Checkered White (*Pontia protodice*) **pollinating *S. parvifolia***	***Sphaeralcea parvifolia***	
2	Checkered White (*Pontia protodice*) **pollinating *S. parvifolia***	***S. parvifolia***	
3	Bee **x 3** - *Tiny, <1 cm, black* **pollinating *S. parvifolia;*** Metallic sweat bee (*Agapostemon sp.)* **-** *with black-and-white abdomen* **pollinating *S.* parvifolia**	***S. parvifolia***	
4	Clouded Sulphur (*Colias philodice*) **x 2**	None	Bluet (*Enallagma* sp.) damselfly
5	Checkered White (*Pontia protodice*) **x 2, one pollinating *S. altissimum***; Sphecid wasp - *red + black abdomen*	*Sisymbrium altissimum*	
6	Checkered White (*Pontia protodice*) **x 2 pollinating *S. altissimum*;** Orange Sulphur (*Colias eurytheme*); Metallic sweat bee - *with all green abdomen* **pollinating *S. altissimum***	*Sisymbrium altissimum*	
7	Checkered White (*Pontia protodice*); Orange Sulphur (*Colias eurytheme*); Sphecid wasp - *red + black abdomen*	*Sisymbrium altissimum*	
8	None	*Sisymbrium altissimum*	Assassin bug (*Reduviidae* family) on *S. altissimum*
9	None	None	
10	None	None	
TOTAL:	7 pollinator species		

b. Plant-focused Pollinator Survey

Method: Focus on one blooming plant species that is concentrated in an area and appears to be attracting pollinators. Within a set time frame (10 minutes), check 100 individuals of this plant species and record any pollinators observed on the blooms. Record the center of the observed area in GPS, the date, start and end time, plant focal species and habitat.

Date: 6/13/17
Start Time: 11:44 am
End Time: 11:54 am
Location: UTM NAD 84 - 381224, 4107015
Habitat: Open sagebrush scrub with interspersed native bunchgrasses and forbs, near wash in canyon bottom. Area covered in counting 100 plants less than 10 m x 10 m.
Plant focus species: Hyalineherb (*Hymenopappus filifolius*)
Pollinators Observed:

Common Checkered-Skipper (*Pyrgus communis*) **x2**
Metallic Sweat Bee (*Agapostemon sp.*)
Variegated Fritillary (*Euptoieta claudia*)
Tachinid fly - *thin, red and black*
Bee - *tiny, shiny black, <1 cm*
Tachinid fly - *all black, spiny*
Unid. Beetle - *1 cm, oblong, all red*
Moth larvae - *2 cm, gray w/ white stripe along flank*
Acmaeodera bowditchi (beetle)
Total: 10 pollinators observed in a survey of 100 individual plants


Fig. 5 -Tachinid fly on hyalineherb


Fig. 6 - Common Checkered-Skipper on hyalineherb

Forbs in Bloom at Johnson Lakes Canyon, 6/11-13/2017

Scientific Name	Common Name	Abundance	Distribution	Notes on Pollinators
Gaillardia pinnatifida	Hopi Blanketflower	<10 plants	dry meadow in Johnson Canyon	Visited by bees
Psilostrophe sparsiflora	Greenstem Paperflower	uncommon, sparsely distributed	upper slopes of Center Canyon	
Tragopogon dubius	Yellow Salsify	5 plants	wet meadow in Johnson Canyon along east side of lake	
Sisymbrium altissimum	Tumbling Mustard	abundant	dry meadows in Johnson Canyon	Visited by butterflies and smaller bees
Opuntia erinacea	Common Pricklypear	fairly common, but few in bloom	Lower slopes of Johnson and Center Canyons	
Opuntia fragilis	Brittle Pricklypear	common	mesas	
Hackelia virginiana	Sticktight	common	meadows and road edges on canyon floor	Favored by smaller butterflies, especially blues (tribe *Polyommatini*) in JLC
Datura wrightii	Sacred Datura	common locally	edge of Johnson canyon near cliffs, especially west of lake	Usually a favorite of sphinx moths, but none observed at JLC
Melilotus officinalis	Yellow Sweet-Clover	only 2 plants observed	south edge of Johnson lake	Frequented by European honeybees
Descurainia pinnata	Pinnate Tansymustard	uncommon and local	canyon floor, south of lake	Visited by very small (<1 cm) native bees
Oenothera pallida	Pale Evening-Primrose	common locally	Johnson canyon floor and edges of canyon	Surprisingly, no pollinators observed
Hymenopappus filifolius	Hyalineherb	abundant; most common flowering forb on mesas	mesas, slopes, and dry sage communities in valley	Frequented by bees, tachinid flies, and butterflies; the most popular flower among pollinators during my time at JLC
Penstemon eatonii	Firecracker Penstemon	sparsely distributed	mostly valleys and shaded slopes into canyons	
Penstemon palmeri	Palmer's Penstemon	sparsely distributed	mid-way up slopes into canyons	Usually a bumblebee and carpenter bee favorite, although none observed at JLC this trip

Sphaeralcea parvifolia	Small-leaf Globemallow	common	dry meadows in Johnson Canyon	Relatively few pollinators observed, but visited by several species of native bees

Fig. 7 - Dainty Sulphur on *S. parvifolia*

Fig. 8 - Marine Blue on *H. filfolius*

Fig. 9 - Descuarainia pinnata

Fig. 10 - Leafcutter bee (Megachile sp.) on Gaillardia pinnatifida

Birds of Johnson Lakes Canyon, 6/11/17 – 6/13/17

Key:
Species: Common name according to the AOU Checklist of North American Birds, 7th edition. **Bold** species name means that it was NOT detected on the 2016 Bioblitz (report not yet in for 2017 Bioblitz).

Abundance:
R = rare; only one encounter, **U = uncommon;** low numbers and/or less than four encounters
C = common; many encounters, **A = abundant;** high numbers and/or encountered frequently

Habitat: **R = riparian/canyon bottom or slopes; M = mesas; W = wetlands**

Breeding: **C = confirmed breeding; P = probable breeding**

Species	Abundance	Habitat	Breeding Status; notes
Spotted Towhee	**A**	R,M	C - young
Song Sparrow	**C**	R	
Chipping Sparrow	**A**	R, M	C - young
Plumbeous Vireo	**U**	R	P - territorial pair
Red-tailed Hawk	**U**	R, M	C - young on nest ledge
Ash-throated Flycatcher	**C**	R, M	C - nest with four eggs in cavity in Gambel oak near old trailer
Cassin's Kingbird	**U**	R	
Violet-green Swallow	**A**	R, W	C - many nests in the cliffs
Cliff Swallow	**C**	R	C - colony nesting in the cliffs on the west wall just north of camp
Black-headed Grosbeak	**C**	R	
Western Wood-Pewee	**U**	R	prefers cottonwoods for nesting
Eurasian Collared-Dove	**U**	R	
Mourning Dove	**C**	R, M	
Canyon Wren	**C**	R	C - four recently fledged young
Rock Wren	**C**	R, M	C - three young with parent
Bewick's Wren	**C**	R	C - six young in camp
White-throated Swift	**C**	R, M	C - nest in crevices in canyon walls
Turkey Vulture	**U**	R, M	
Lesser Goldfinch	**C**	R	mainly in camp area
House Finch	**C**	R, M	
Western Bluebird	**R**	R	apparently only one pair in canyon; likely nesting in junipers north of camp
Virginia's Warbler	**C**	R	prefers drier areas south of lakes, especially Gambel oak and sagebrush

Species	Abundance	Habitat	Breeding Status; notes
Common Yellowthroat	**A**	W	
Yellow Warbler	**C**	R	
Woodhouse's Scrub-Jay	**U**	R, M	C - young
Common Raven	**C**	R, M	C - young
Peregrine Falcon	**U**	R	P - territorial pair
Say's Phoebe	**C**	R	
Black-throated Gray Warbler	**U**	M	
Gray Vireo	**U**	R, M	P - adult carrying caterpillar, likely toward nest
Blue-gray Gnatcatcher	**C**	R, M	C - nest in Gambel oak on southeast corner of south Johnson lake with three young
Black-chinned Hummingbird	**U**	R, M	P - female mobbing scrub-jays in typical nest-defending behavior
American Robin	**C**	R, M	
Long-eared Owl	**R**	R	single individual roosting in Gambel oak copse (out in open, early) along eastern road, north side of lakes
Bushtit	**U**	R	travels in large, roaming flocks
Western Tanager	**R**	R	likely a migrant
Virginia Rail	**R**	W	
American Coot	**U**	W	
Wild Turkey	**U**	R	
Common Nighthawk	**U**	R	foraging in evening over camp area
Western Screech-Owl	**U**	R	heard calling from camp area
Red-winged Blackbird	**U**	W	
Brown-headed Blackbird	**U**	R	
Gambel's Quail	**R**	R	south end of Johnson canyon
Lazuli Bunting	**R**	R	a single territorial pair in the cottonwoods at the south end of canyon
Juniper Titmouse	**U**	R	
Northern Flicker	**U**	R	
Gray Flycatcher	**U**	R, M	
Willow Flycatcher	**R**	R	one encountered in meadow north of camp - migrant?

Total Species: 49
9 species not found on 2016 Bioblitz (bold)
13 confirmed breeding (nests/young)

Four JLC birds endemic to the Southwest

Fig. 11 - Plumbeous Vireo in Gambel oak

Fig. 12 - Gray Vireo in sagebrush

Fig. 13 - Young Canyon Wren

Fig. 14 - Virginia's Warbler in Gambel oak

Fig. 15 - Peregrine Falcon patrolling low over cliff

Fig. 16 - Long-eared Owl roosting in open!

Fig. 17 - Long-eared Owl roosting in open!

Fig. 18 - Ash-throated Flycatcher

Fig. 19 - Ash-throated Flycatcher nest cavity with eggs in Gambel oak

Fig. 20 - Cassin's Kingbird on Cleome sp.

Fig. 21 - Blue-gray Gnatcatcher feeding young in nest in Gambel oak

Fig. 22 - Red-tailed Hawk fledglings on nest ledge

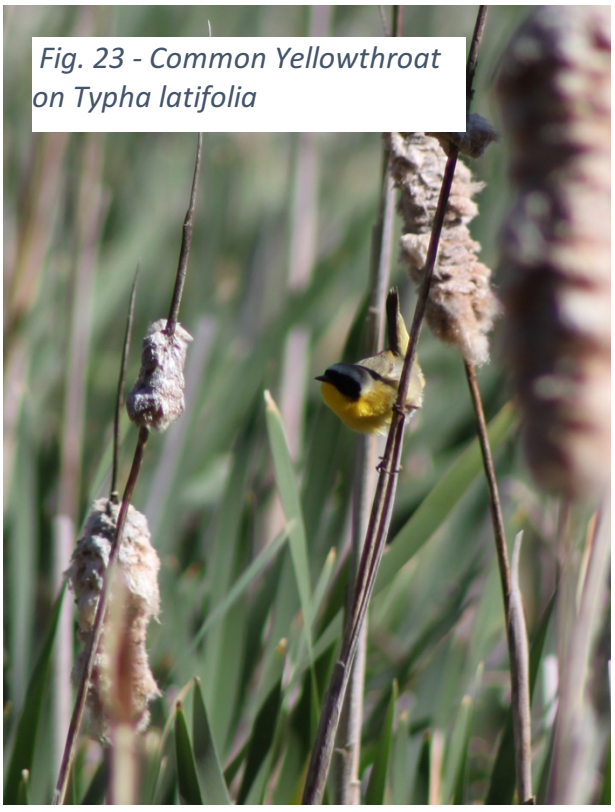

Fig. 23 - Common Yellowthroat on Typha latifolia

Insects of Johnson Lakes Canyon, 6/11/17-6/13/17

Butterflies: (13 species)
Note: English names are those used in *The North American Butterfly Association (NABA) Checklist & English Names of North American Butterflies*, *second edition*
In order of most to least common
Checkered White
Clouded Sulphur
Variegated Fritillary
Common Buckeye
Orange Sulphur
Marine Blue
Western Tiger Swallowtail
Acmon Blue
Weidemeyer's Admiral
Common Checkered-Skipper
Queen
Rocky Mountain Duskywing
Dainty Sulphur
Variable Checkerspot

Dragonflies: (8 species)
In order of most to least common
Common Green Darner
Flame Skimmer
Eight-spotted Skimmer
Blue-eyed Darner
Wandering Glider
Twelve-spotted Skimmer
Variegated Meadowhawk
Striped Meadowhawk
Dot-tailed Whiteface

Damselflies: 4 morphospecies (unidentified to species)
Moths: White-lined Sphinx (*Hyles lineata*) - larva; three other unidentified morphospecies
Grasshoppers: *Trimerotropis cyaneipennis* (Blue-winged Grasshopper)

Bees/Wasps:
Apis mellifera (European honeybee)
Agapostemon sp. (metallic sweat bee)
Xylocopa sp. (carpenter bee)
Lasioglossum sp. (sweat bee)
Megachile sp. (leafcutter bee)
Bembix sp. (predatory sand wasp)
Polistes sp. (paper wasp)

Fig. 24 - Metallic sweat bee (Agapostemon sp.)

Fig. 25 - Predatory sand wasp (Bembix sp.)

Fig. 26 - Vivid Dancer (Argia vivida) damselfly

Fig. 27 - Common Green Darner dragonfly

Fig. 28 - Tachinid fly

Fig. 29 - Blue-winged Grasshopper (Trimerotropis cyaneipennis)

Fig. 30 - White-lined Sphinx (Hyles lineata) larva

Fig. 31 - Marine Blue with European honeybee

Fig. 32 - Paper wasp (Polistes sp.) in alcove

Fig. 33 - Rocky Mountain Duskywing on cheatgrass

Mammals of Johnson Lakes Canyon, 6/11-13/2017

Bold = not on 2017 Bioblitz mammal report (first report to be compiled)

Direct Observation:
Rock Squirrel (*Otospermophilus variegatus*)
Gray Fox (*Urocyon cinereoargenteusi)*
Uinta Chipmunk (*Tamias umbrinus*)
Desert Cottontail (*Sylvilagus audubonii*)

Evidence: (scat, prints)
Mule Deer (*Odocoileus hemionus*)

Reptiles/Amphibians of Johnson Lakes Canyon, 6/11-13/2017
Western Whiptail (*Aspidoscelis tigris*)
Plateau Striped Whiptail (*Aspidoscelis velox*)
Eastern Fence Lizard (*Sceloporus undulatus*)
Western Terrestrial Garter Snake (*Thamnophis elegans*)
Woodhouse's Toad (*Anaxyrus woodhousii*)

Fig. 34 - Rock Squirrel (Otospermophilus variegatus)

Fig. 35 - Plateau Striped Whiptail (Aspidoscelis tigris)

Fig. 36 - Eastern Fence Lizard (Sceloporus undulatus)

Miscellaneous Notes/Photos:

On June 11, I observed a series of holes in the western sandstone wall of Center Canyon (UTM NAD 83 382265, 4107461) appear to be the nests of sandstone-nesting bees, genus *Anthophora*. I found a few more of these holes in the west wall of Johnson Canyon. While the abundance and variation in size and shape of the holes originally led me to consider geologic forces as an explanation for these holes, Michael Orr (michael.christopher.orr@gmail.com) thinks that these holes are likely made by bees, most likely *Anthophora peritomae.*

Interestingly, I discovered several of these holes plugged or bordered with pinyon pine resin. Michael Orr says that these resin plugs are suggestive of bees in the genus *Dianthidium,* which often reuse sandstone nests. Michael welcomes any further observations or photos of these nests and any bees using them.

Fig. 37 - Resin plugs in sandstone holes, possibly the nests of *Dianthidium* bees

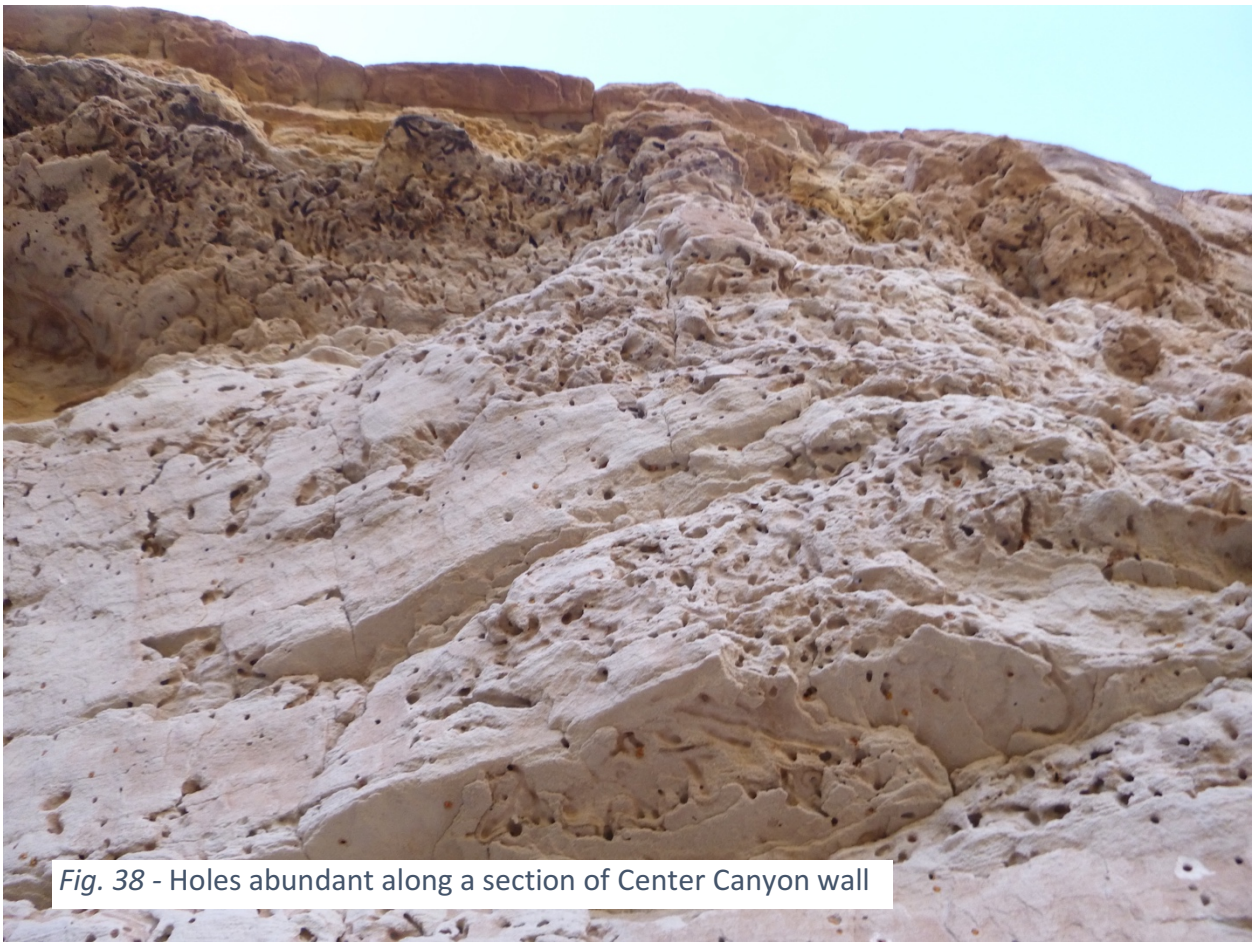

Fig. 38 - Holes abundant along a section of Center Canyon wall

Fig. 39 - These iron concretions on the east rim of Johnson Canyon were striking in their shape.

Finally, a big thank you to Rick and Susie Knezevich for having me out on their property, and for their wonderful kindness, generosity, and conservation work. Thanks also to Mary O'Brien for sending me out to JLC and to the scientists of the 2016 Bioblitz, whose reports were a helpful reference in confirming some of my identifications, especially for plants.