

Shedding light on aquatic insects of the Colorado River Basin with citizen science

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Photo: Ryan Moseley

Why aquatic insects?

Bioindicators



Ephemeroptera
mayflies

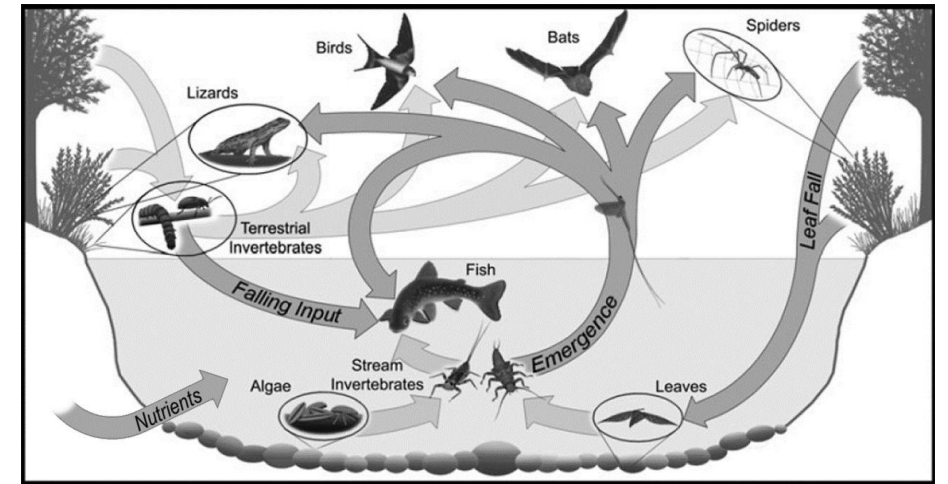


Plecoptera
stoneflies



Trichoptera
caddisflies

“EPT”

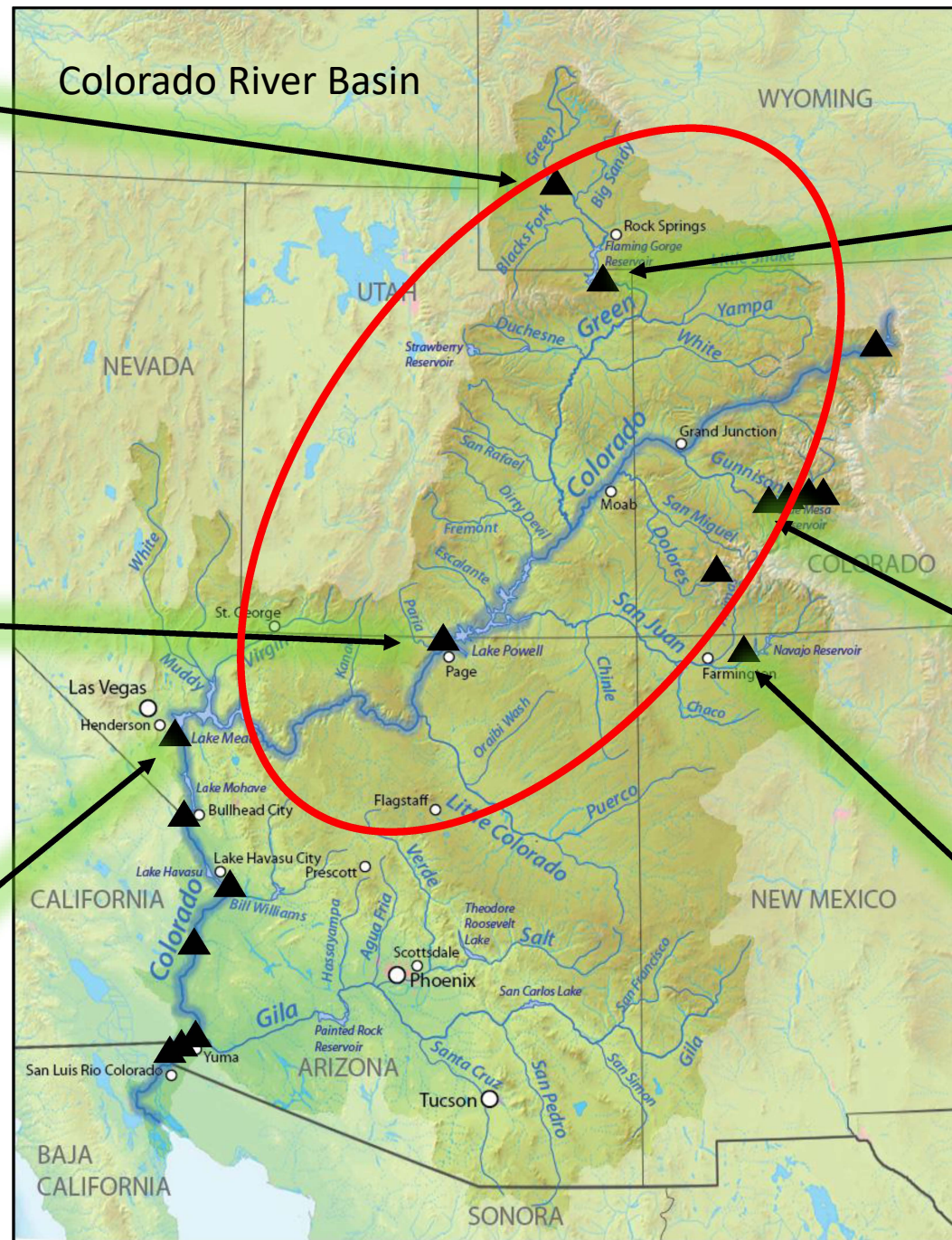


Tasty

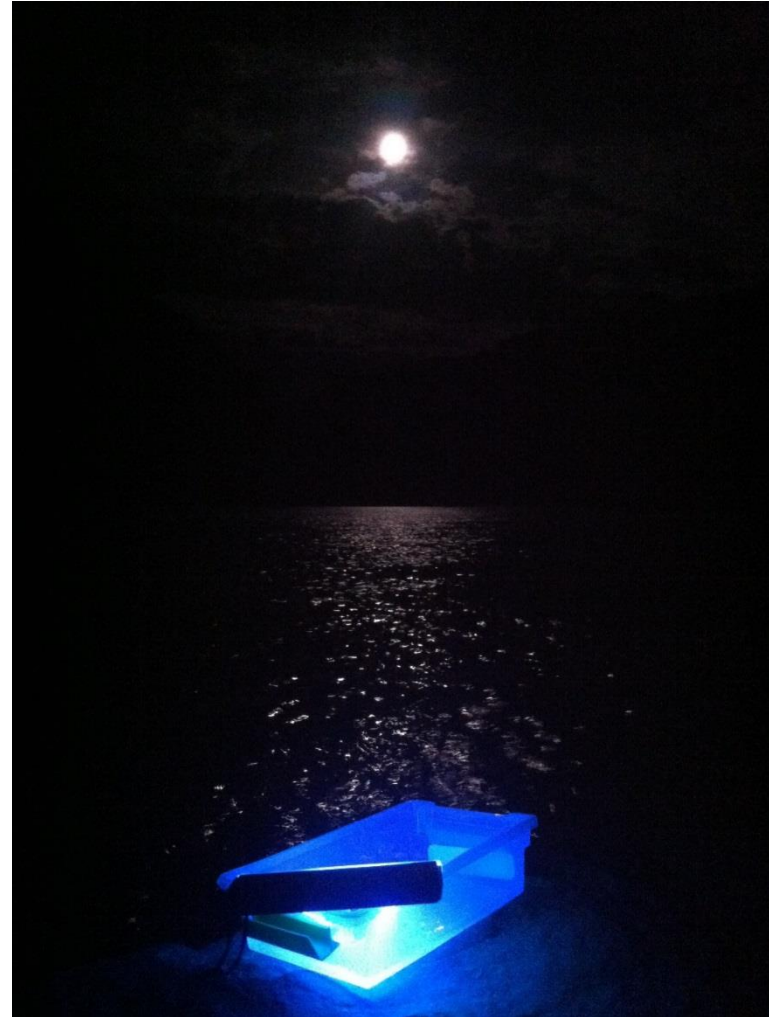
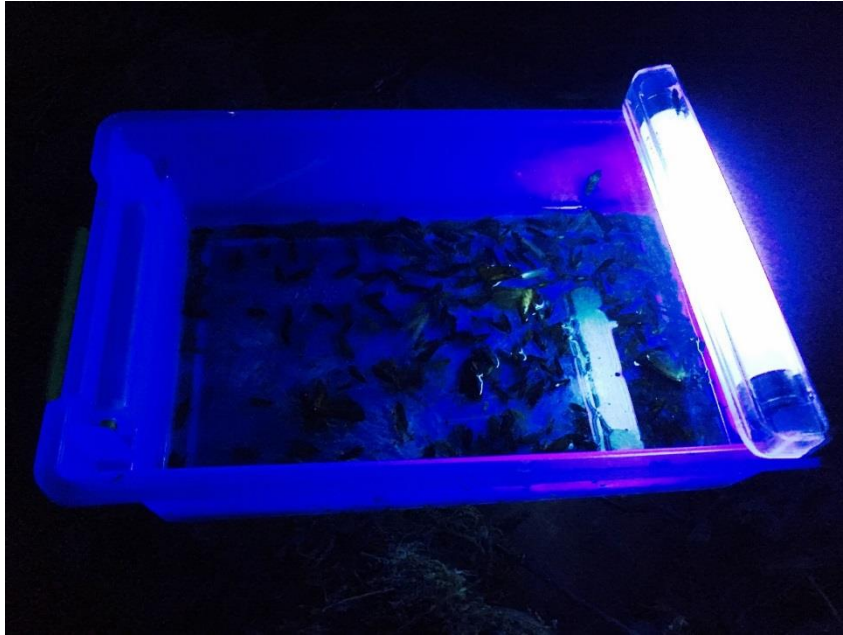


What are the **basinwide trends** of aquatic insect species richness and abundance?





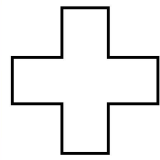
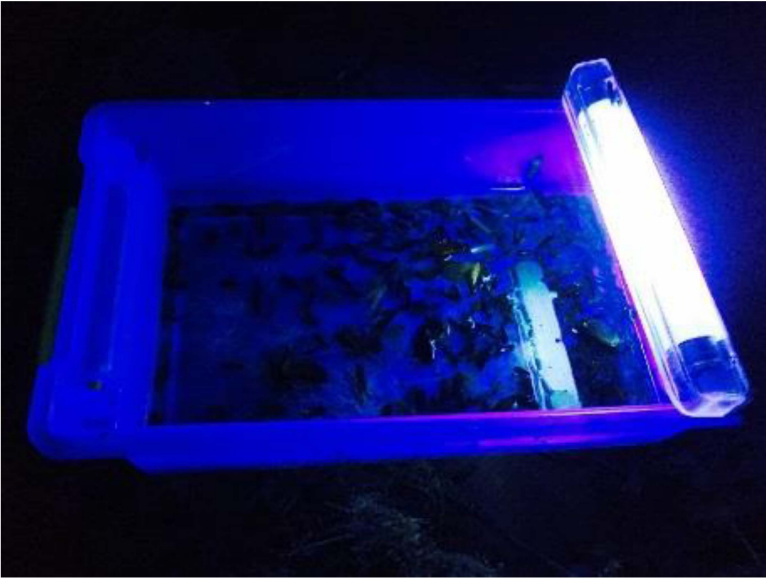
Field Methods



Field Methods



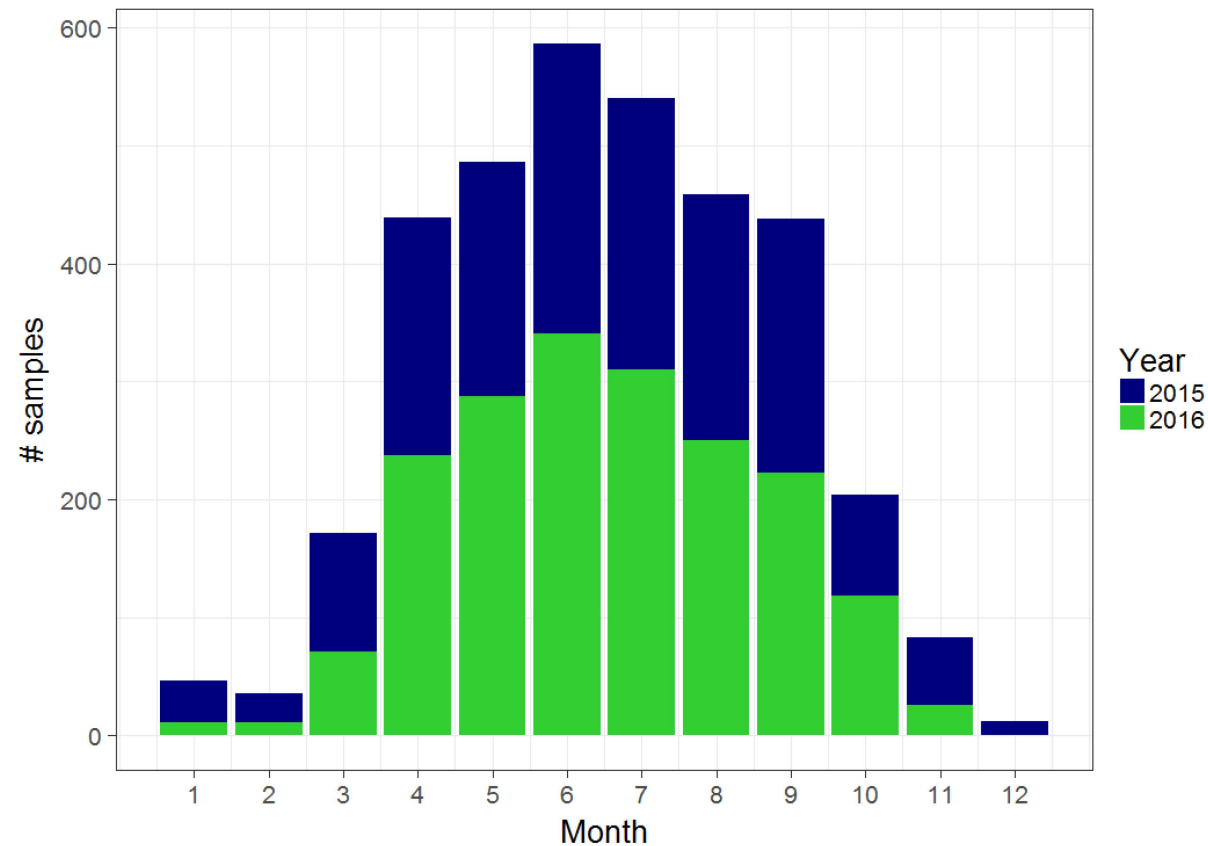
Field Methods



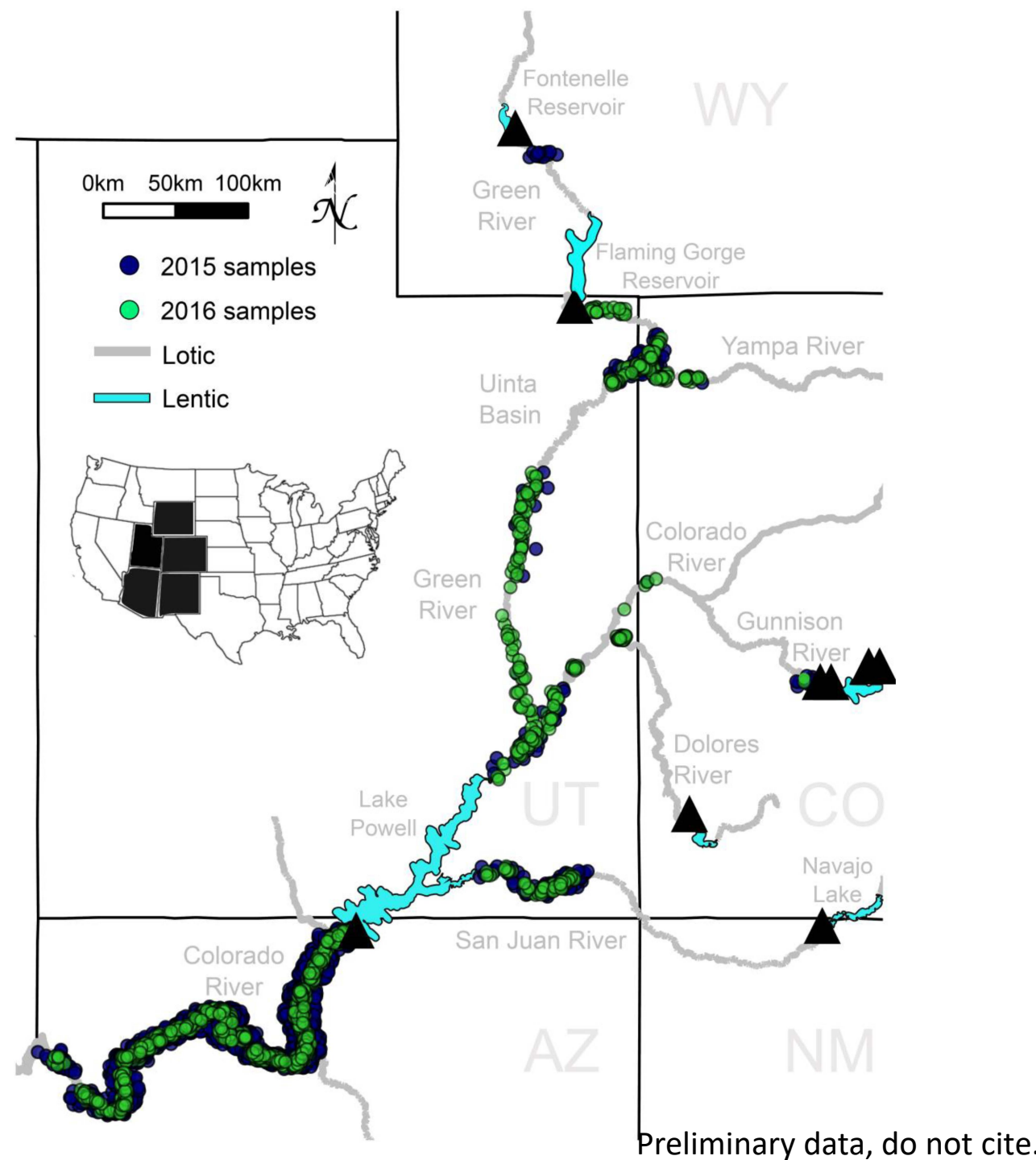
Citizen
Science

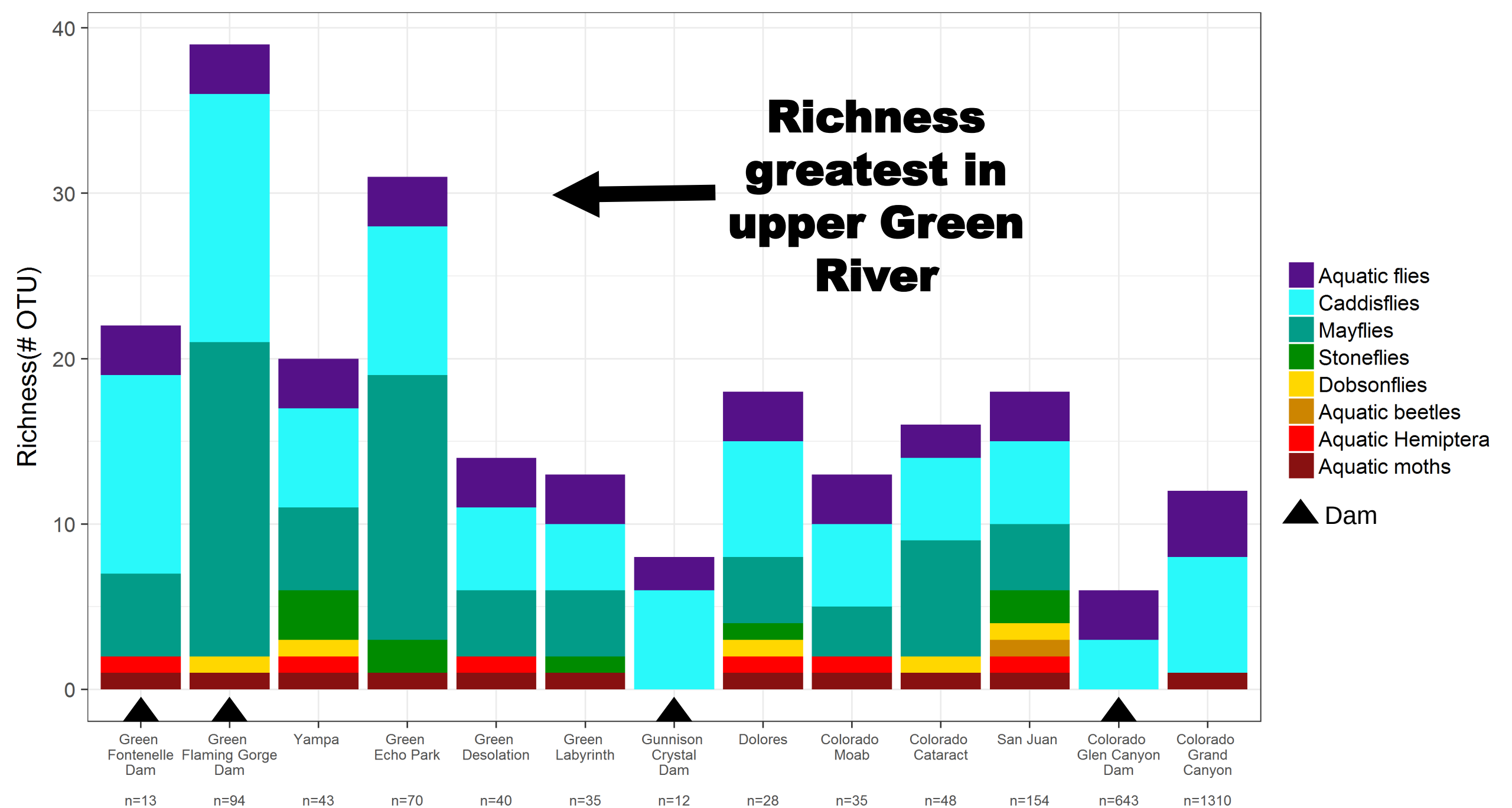
Light Trap Sample Distribution 2015 - 2016

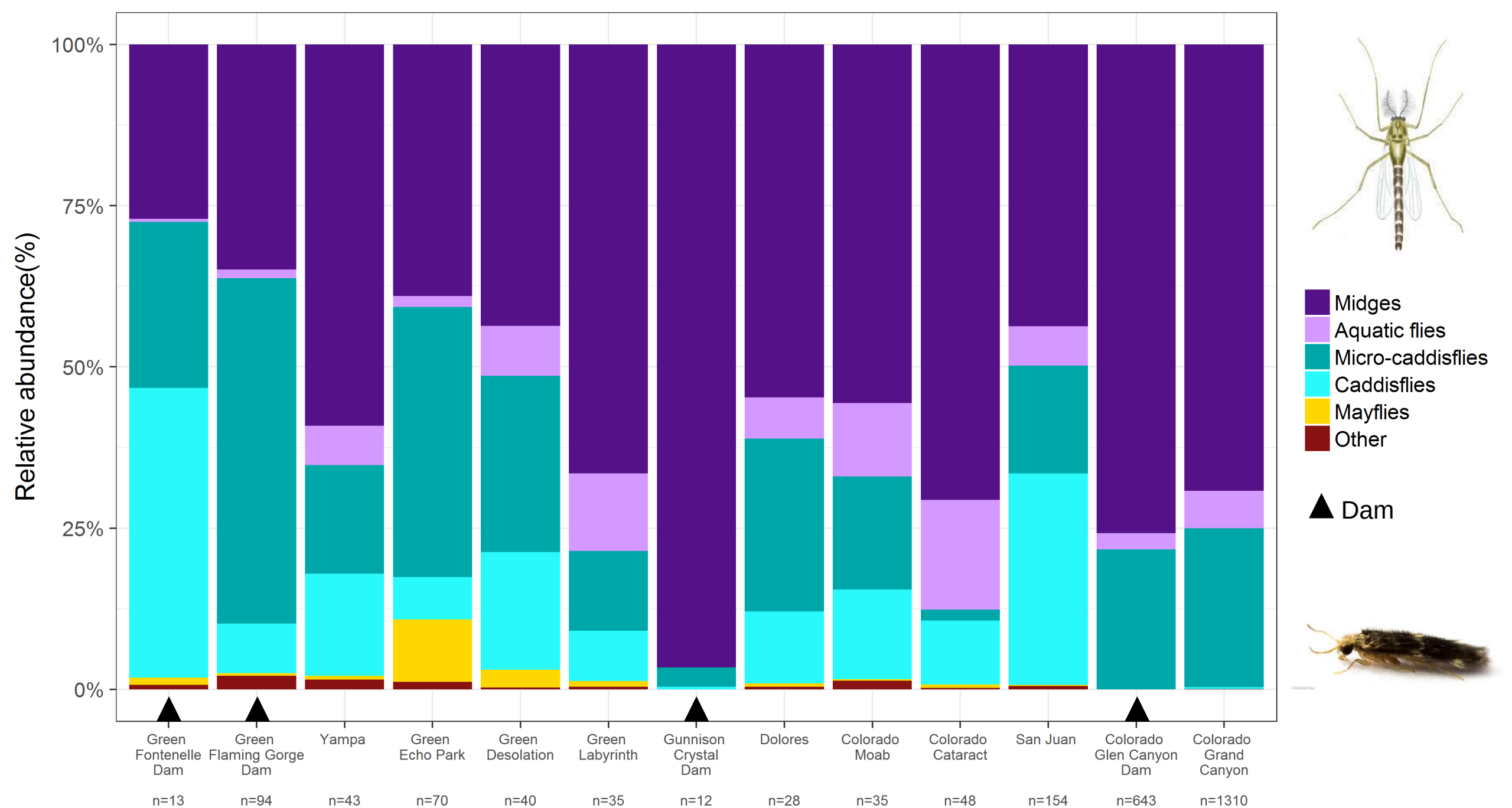
Temporal Coverage

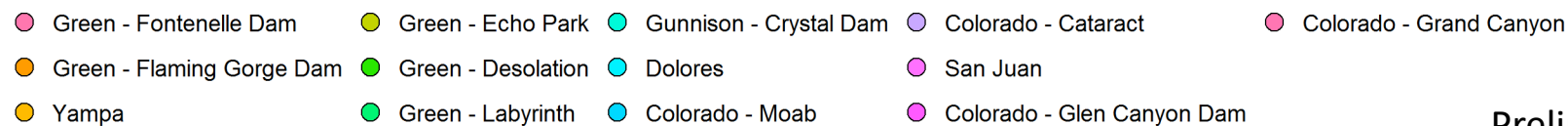
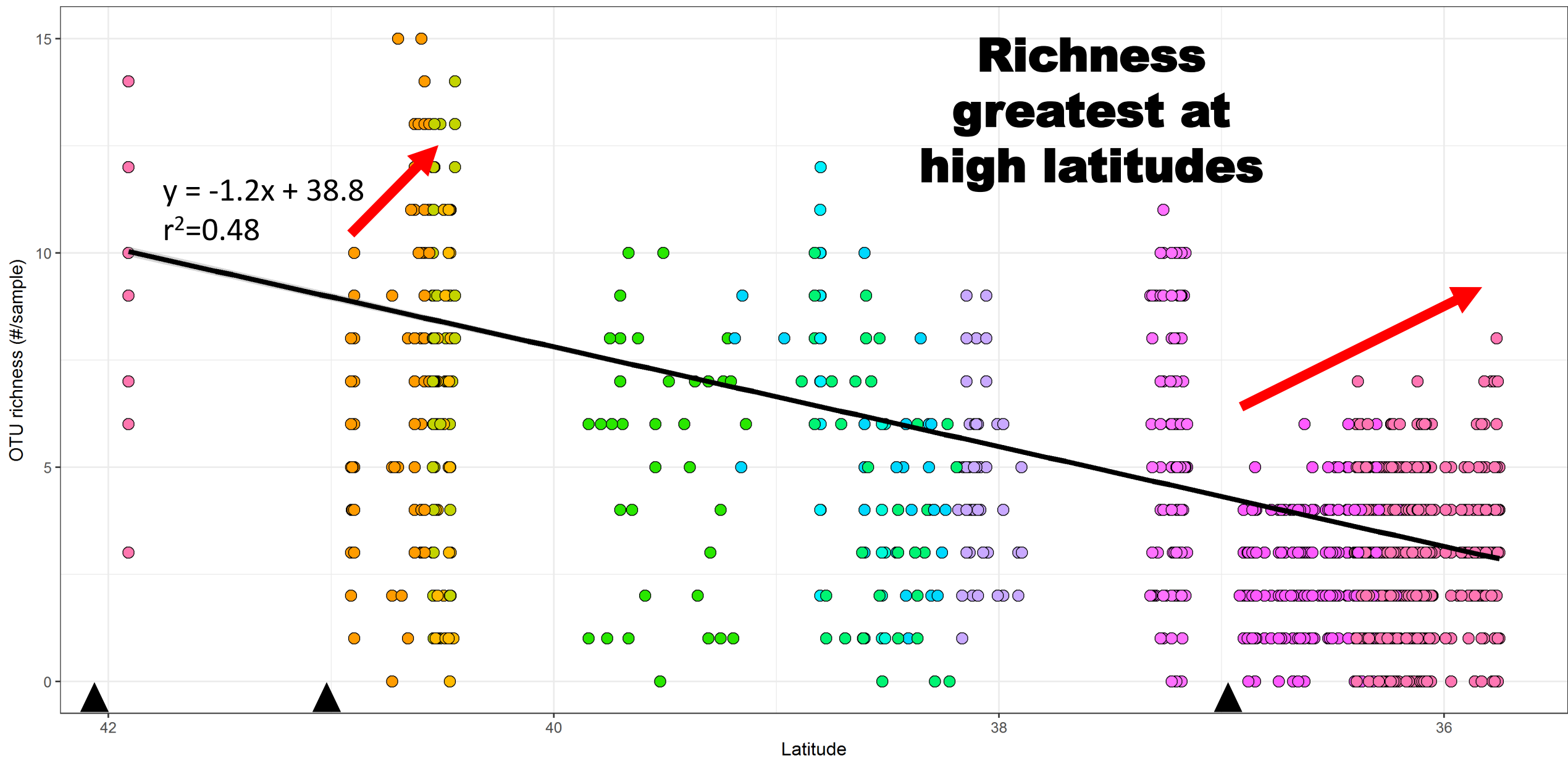


2,562 samples
from **1,657** unique sites

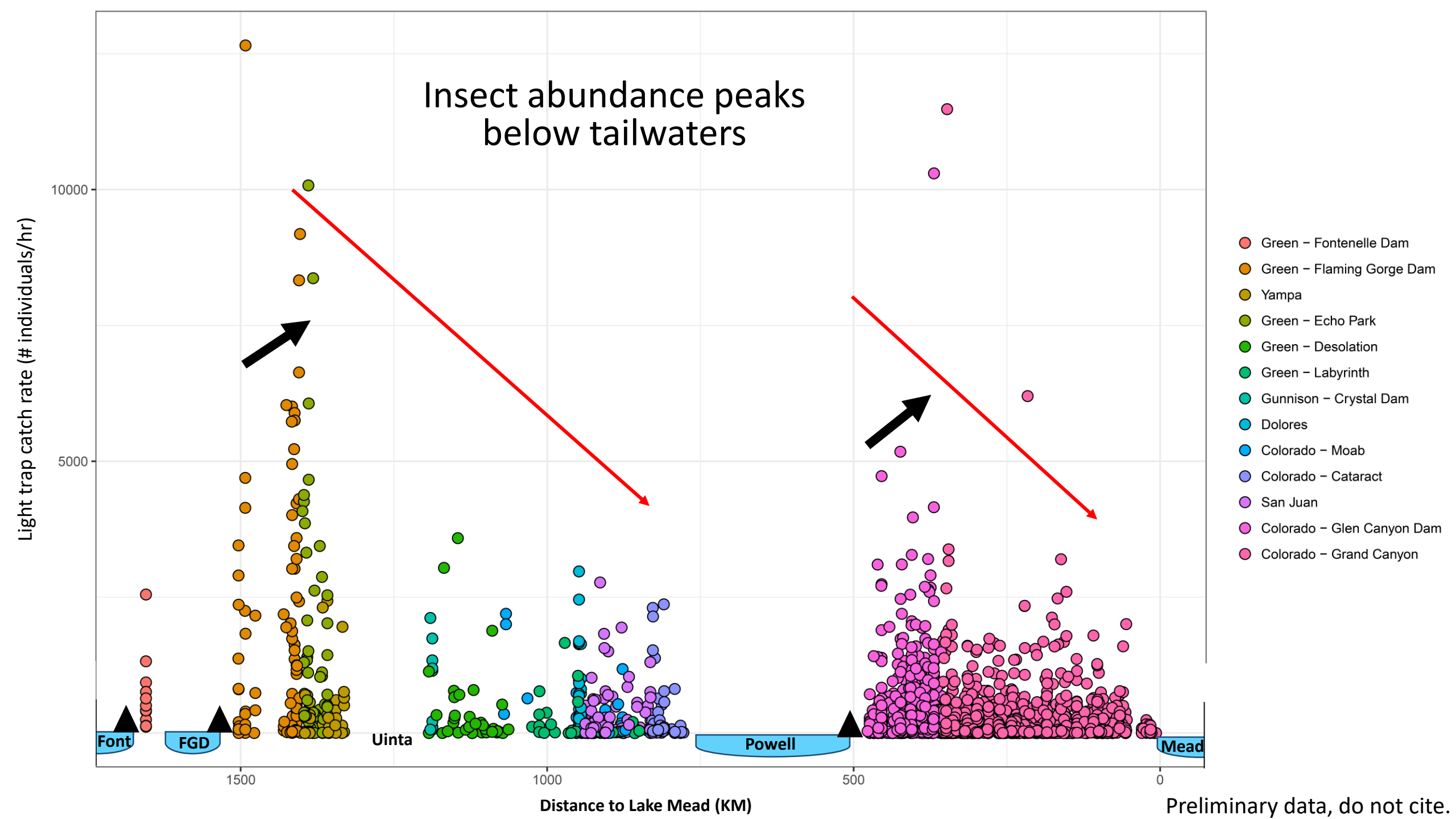




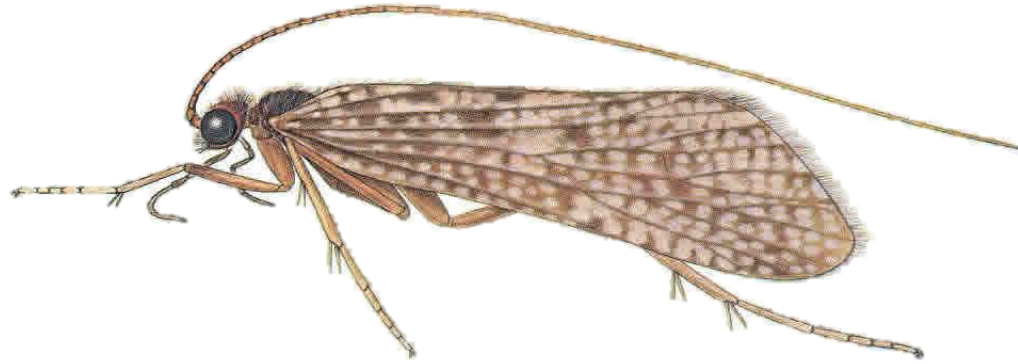




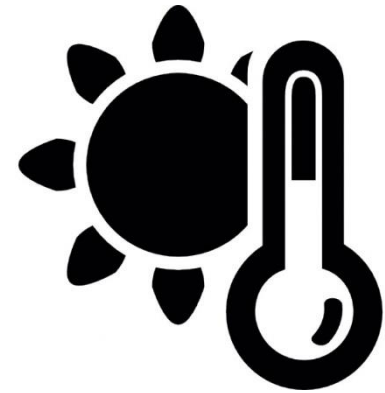
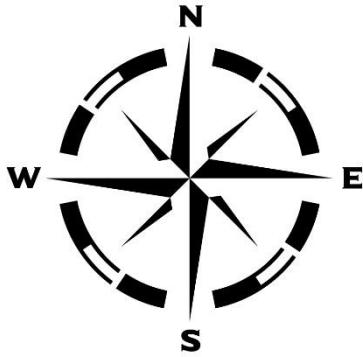
Preliminary data, do not cite.



What environmental variables best describe the **occupancy and abundance of aquatic insects** in the Colorado River Basin?



Hydropsyche sp.

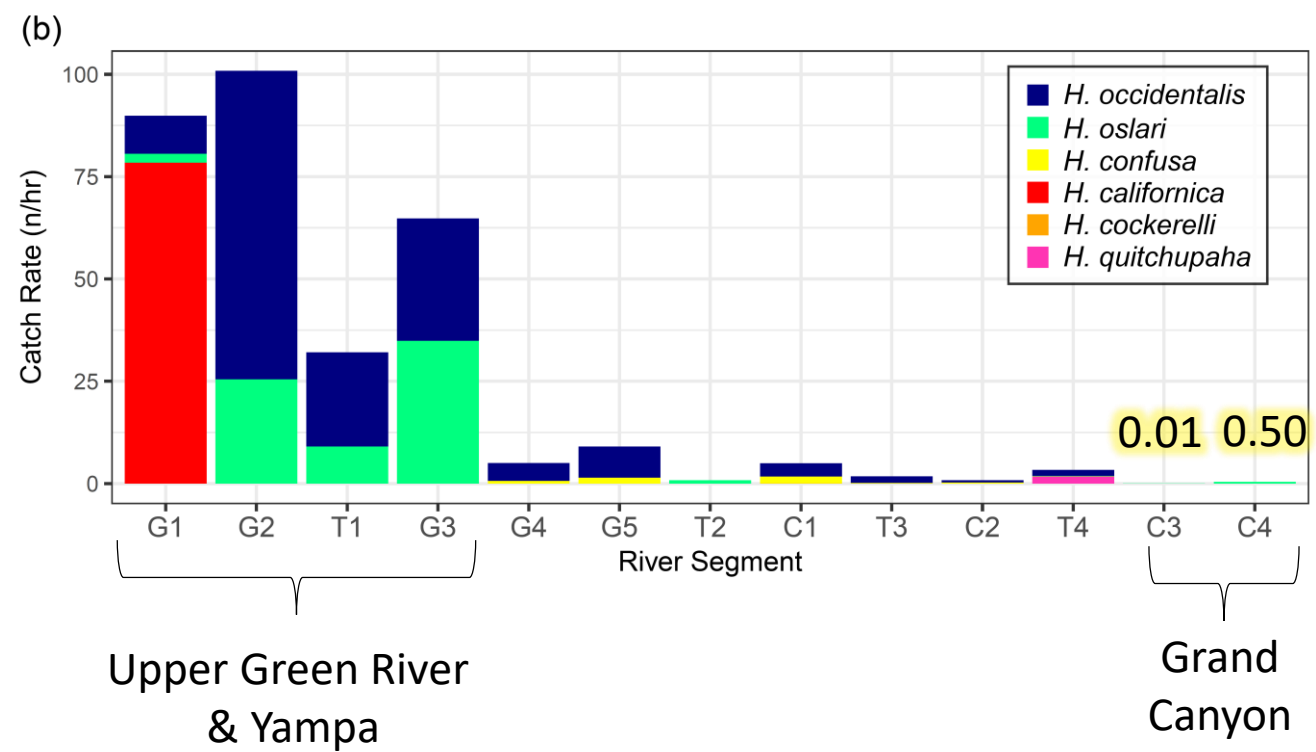
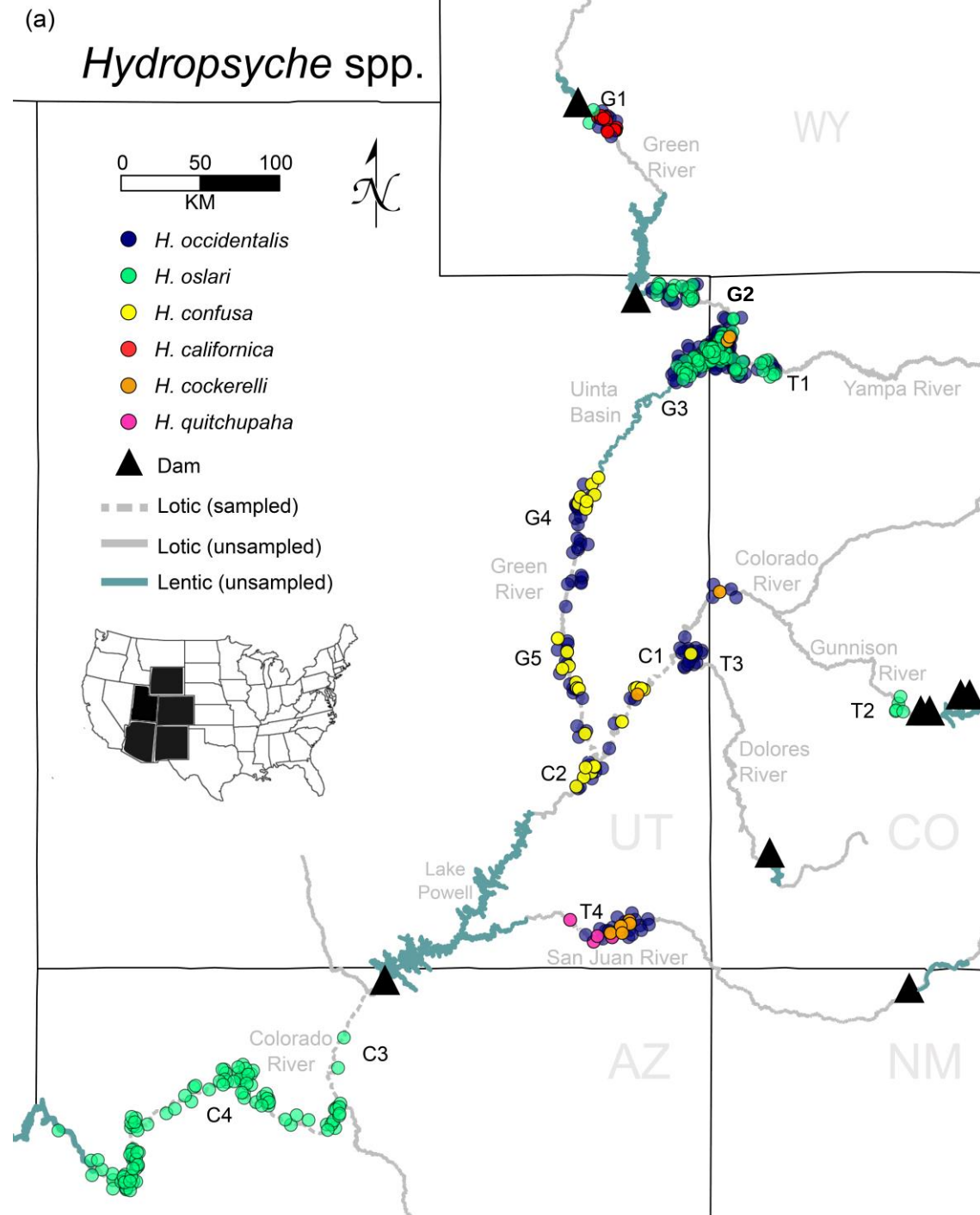




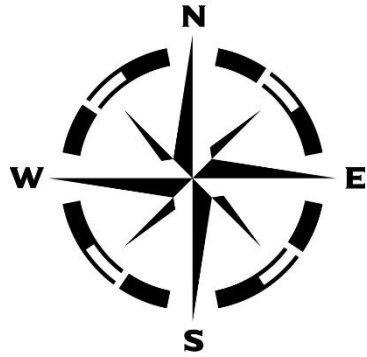
Hydropsyche spp. in light traps

- 79% of light trap samples contained caddisflies ($n = 2039$)
- 23% of light trap samples contained *Hydropsyche* ($n = 599$)
- Collected 6 species of *Hydropsyche*
- 18,527 individual *Hydropsyche*
 - 97% identified to species ($n = 17,889$)





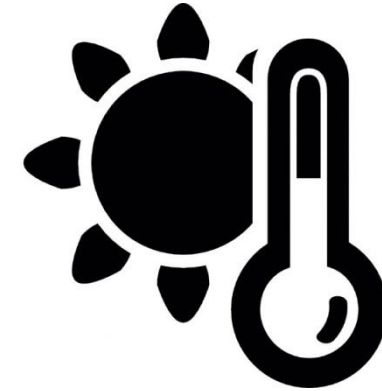
Preliminary data, do not cite.



- Latitude
- Day of year
- Sampling site
- Distance from dam



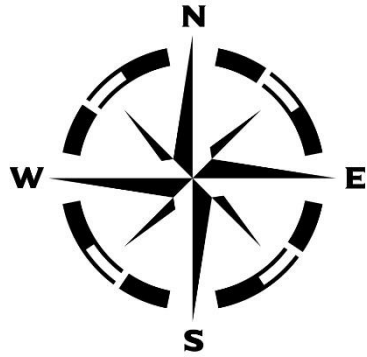
- Mean daily discharge
- Daily change in stage height



- Mean water temperature
- Range in annual water temperatures

Species	Occupancy	Detection	Abundance
<i>Hydropsyche occidentalis</i>	λ (MeanT),	p (Stage + Stage ² + Lat + Lat ² + Day + Day ²)	Stage + Stage ² + MeanT + MeanT ² + Day + Day ² + (1 Site)
<i>Hydropsyche oslari</i>	λ (Stage),	p (Sites + Lat + Lat ²)	Stage + Stage ² + Lat + (1 Site)
	λ (RangeT),	p (Sites + Lat + Lat ²)	
<i>Hydropsyche confusa</i>	λ (.),	p (RangeT + RangeT ² + MeanT + MeanT ²)	Lat + Lat ² + RangeT + RangeT ² + MeanT + MeanT ² + (1 Site)
	λ (.),	p (Lat + Lat ² + RangeT + RangeT ²)	
	λ (.),	p (Lat + Lat ² + MeanQ + MeanQ ²)	

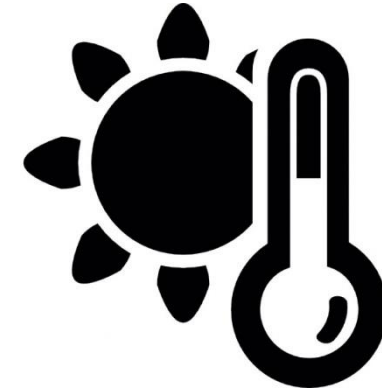
Top models describing occupancy and abundance of *Hydropsyche* spp. in the Colorado River Basin



- **Latitude**
- Day of year
- Sampling site
- Distance from dam



- Mean daily discharge
- **Daily change in stage height**



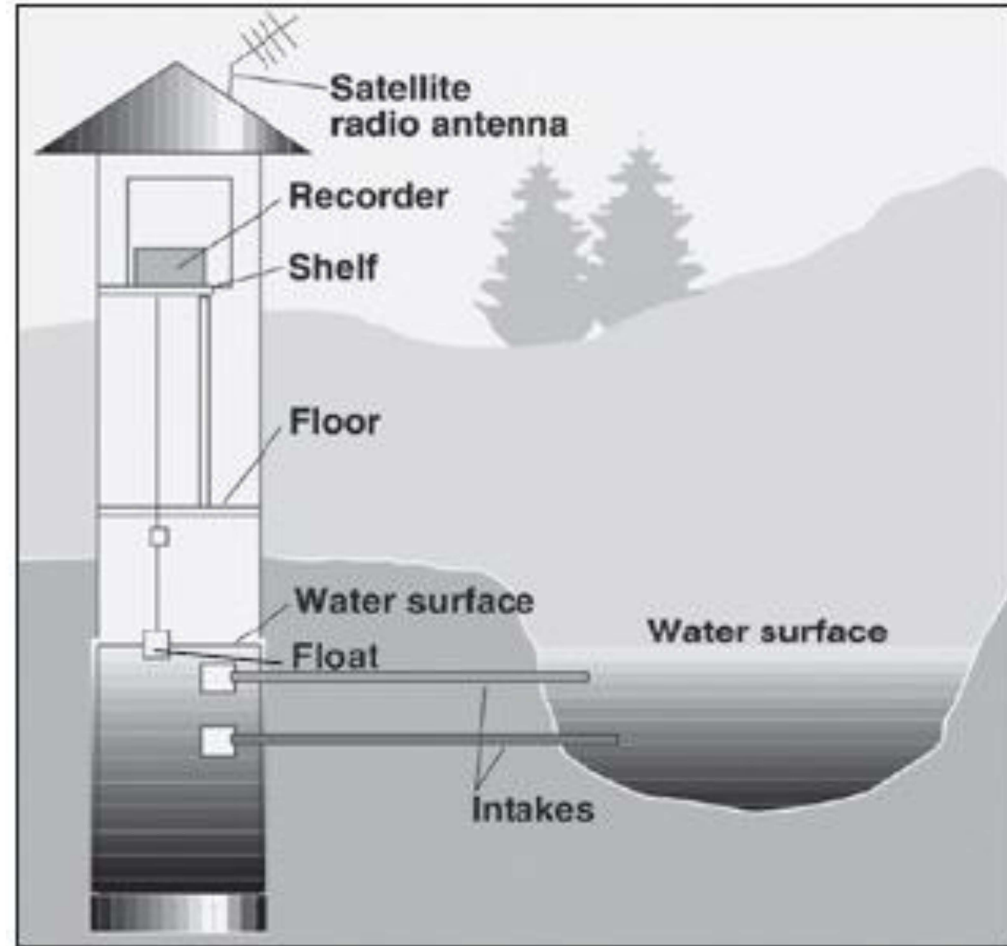
- **Mean water temperature**
- **Range in annual water temperatures**

	Lat	Day	Site	Mean Q	Stage change	Mean Temp	Range Temp
<i>H. occidentalis</i>						11.1 °C ± 1.3 °C	20.1 °C ± 3.8 °C
<i>H. oslari</i>						11.7 °C ± 1.4 °C	11.0 °C ± 5.9 °C
<i>H. confusa</i>						12.2 °C ± 0.6 °C	23.6 °C ± 1.8 °C

Top models describing occupancy and abundance of *Hydropsyche* spp. in the Colorado River Basin



Staff gage

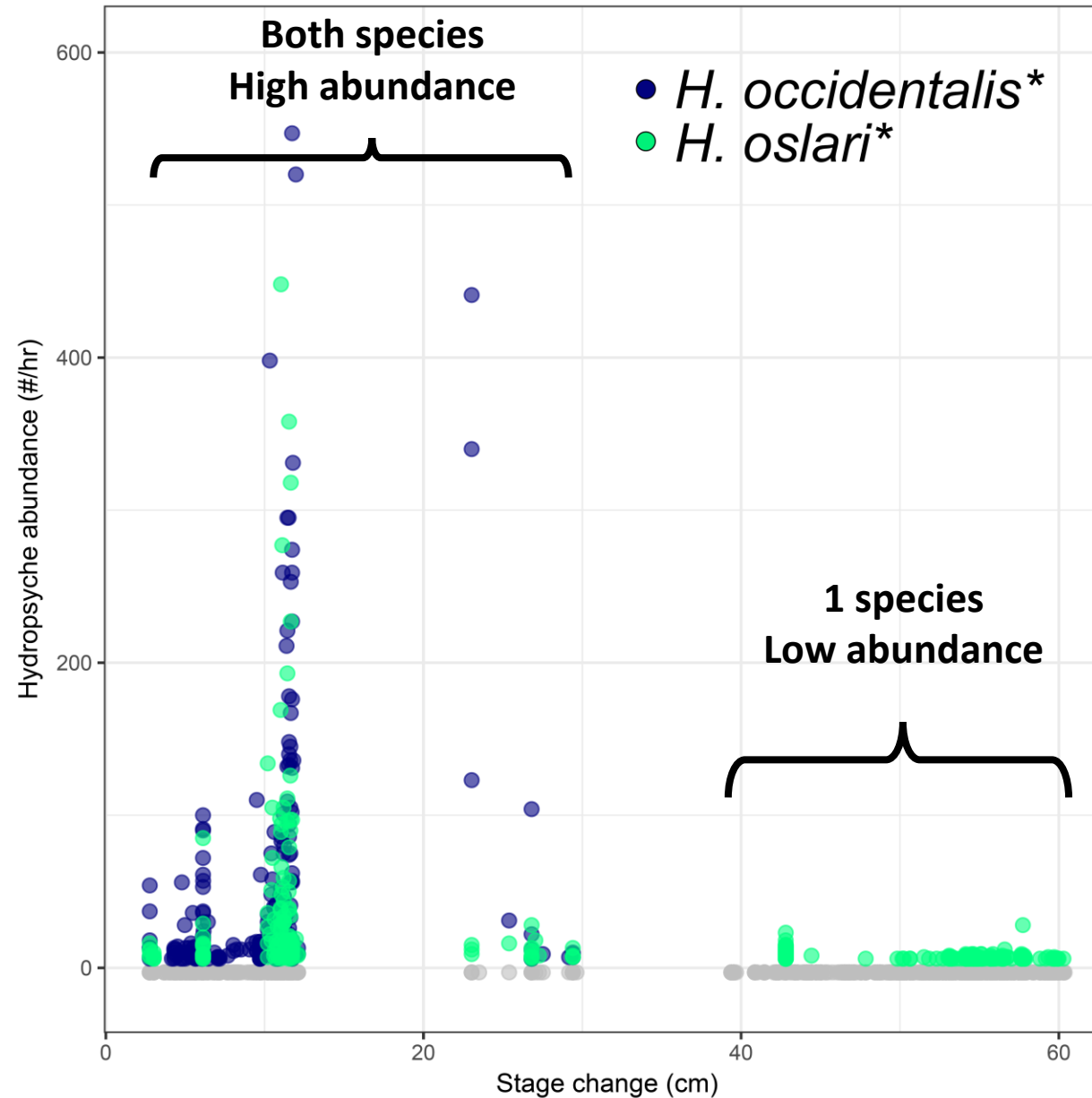


Typical USGS streamgage

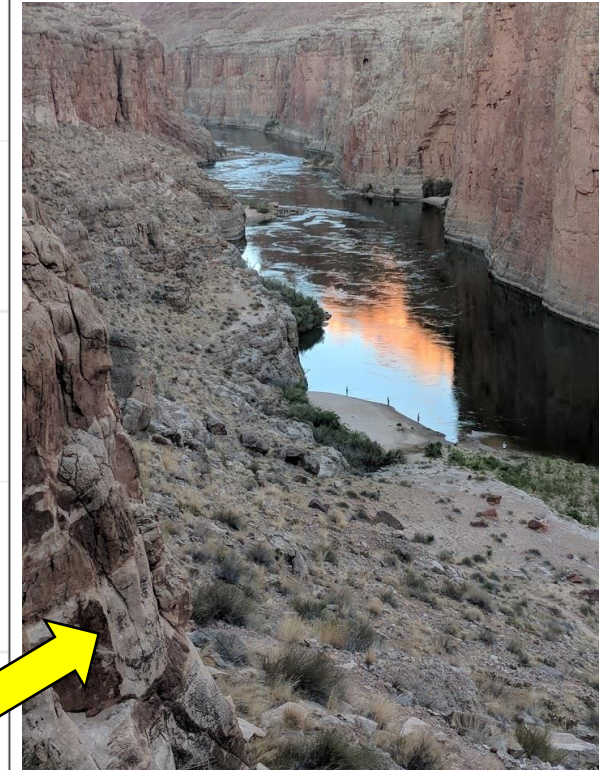
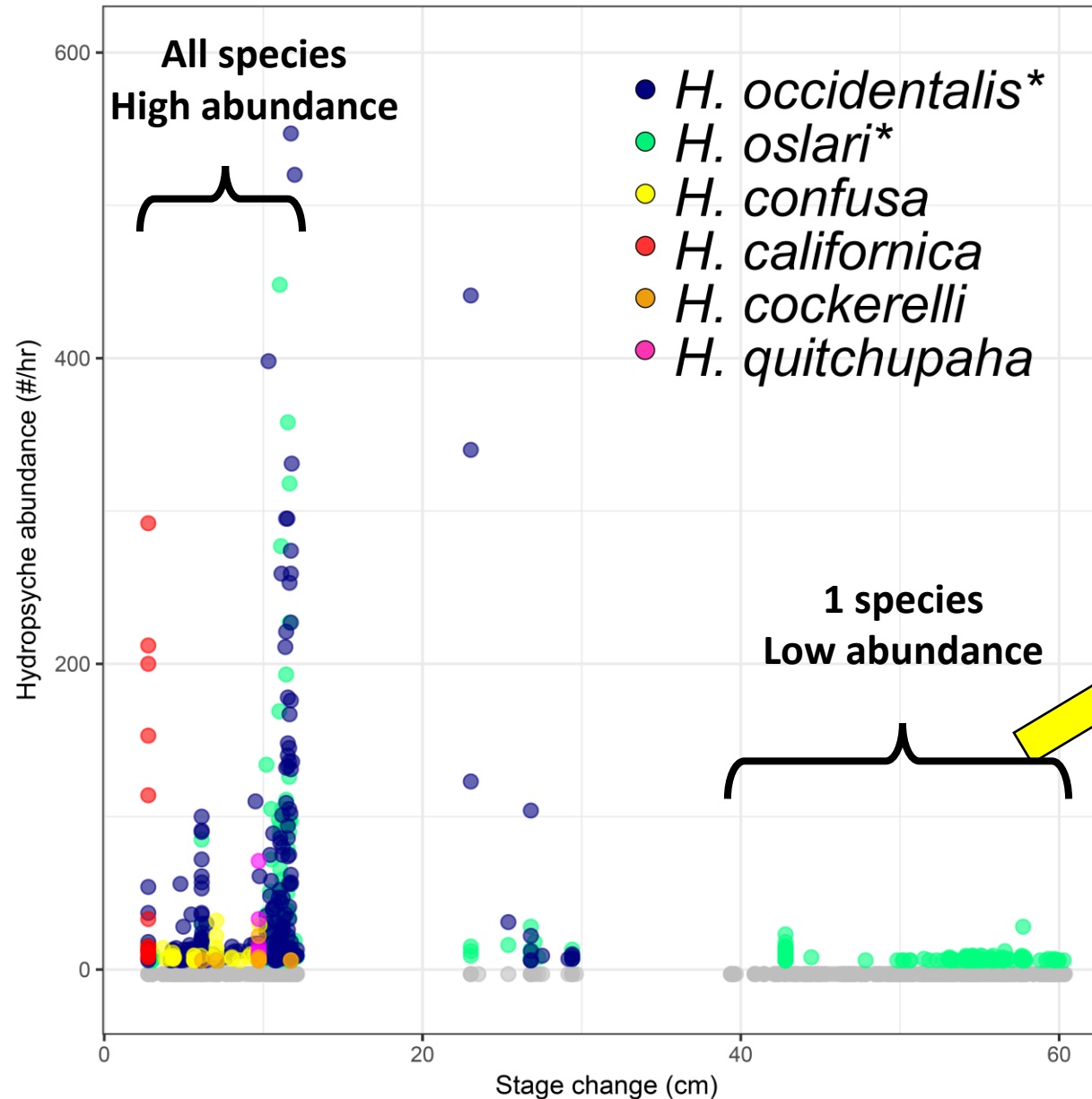


“intertidal zone”

Stage change & *Hydropsyche* spp.



Stage change & *Hydropsyche* spp.

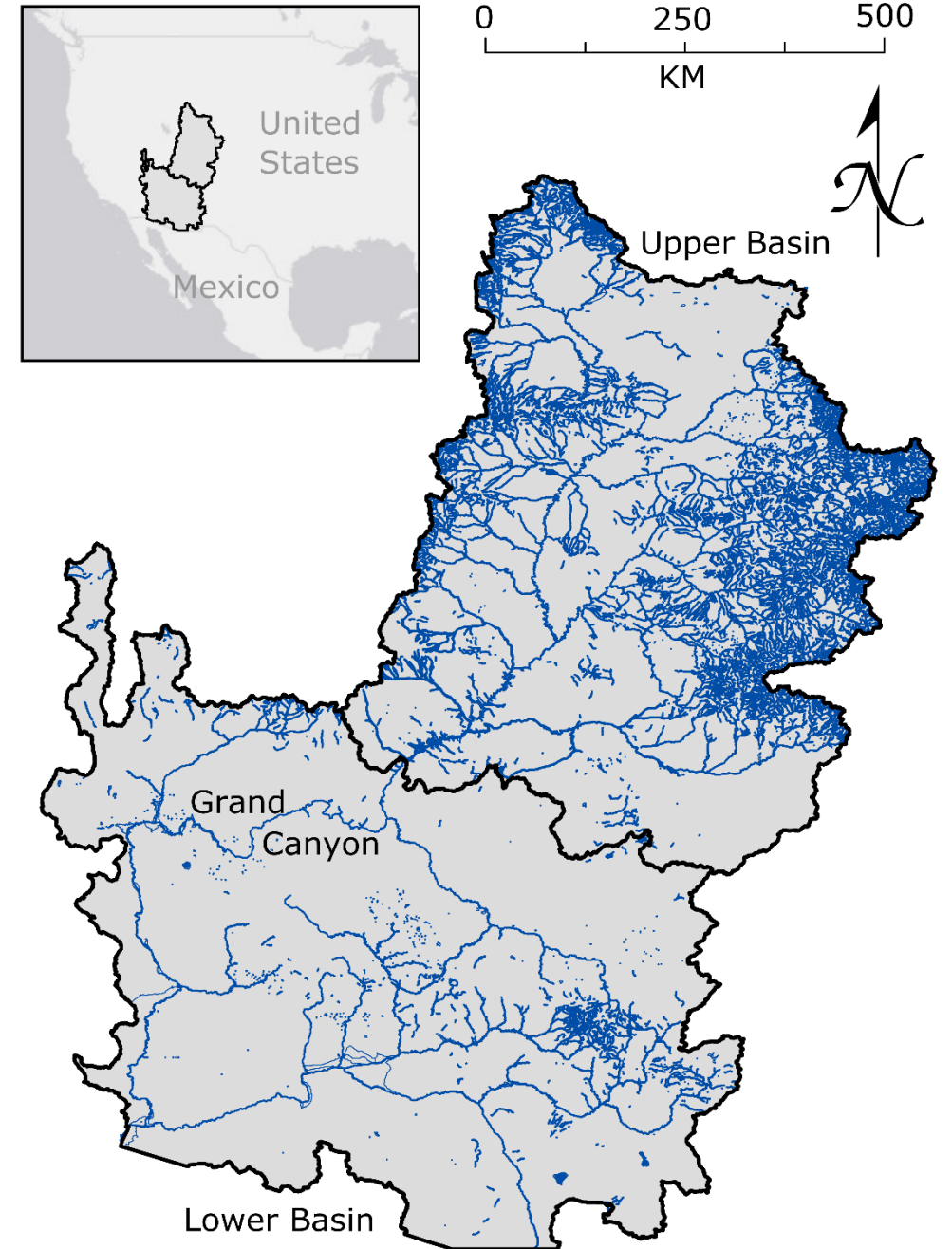


Daily stage change fluctuation in Glen and Grand Canyons range from 1.3 to 2 feet

Is the dispersal of aquatic insects
in the Colorado River Basin
limited by network connectivity?



Hydropsyche oslari
mtDNA CO1

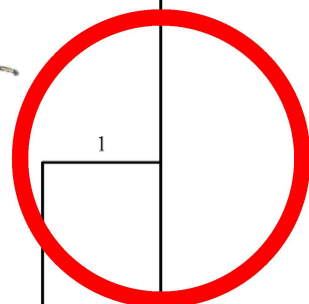


- LEGEND
- Flaming Gorge
 - Lodore Canyon
 - Yampa River
 - Whirlpool Canyon
 - Gunnison River
 - Grand Canyon East
 - Grand Canyon West
 - Voucher

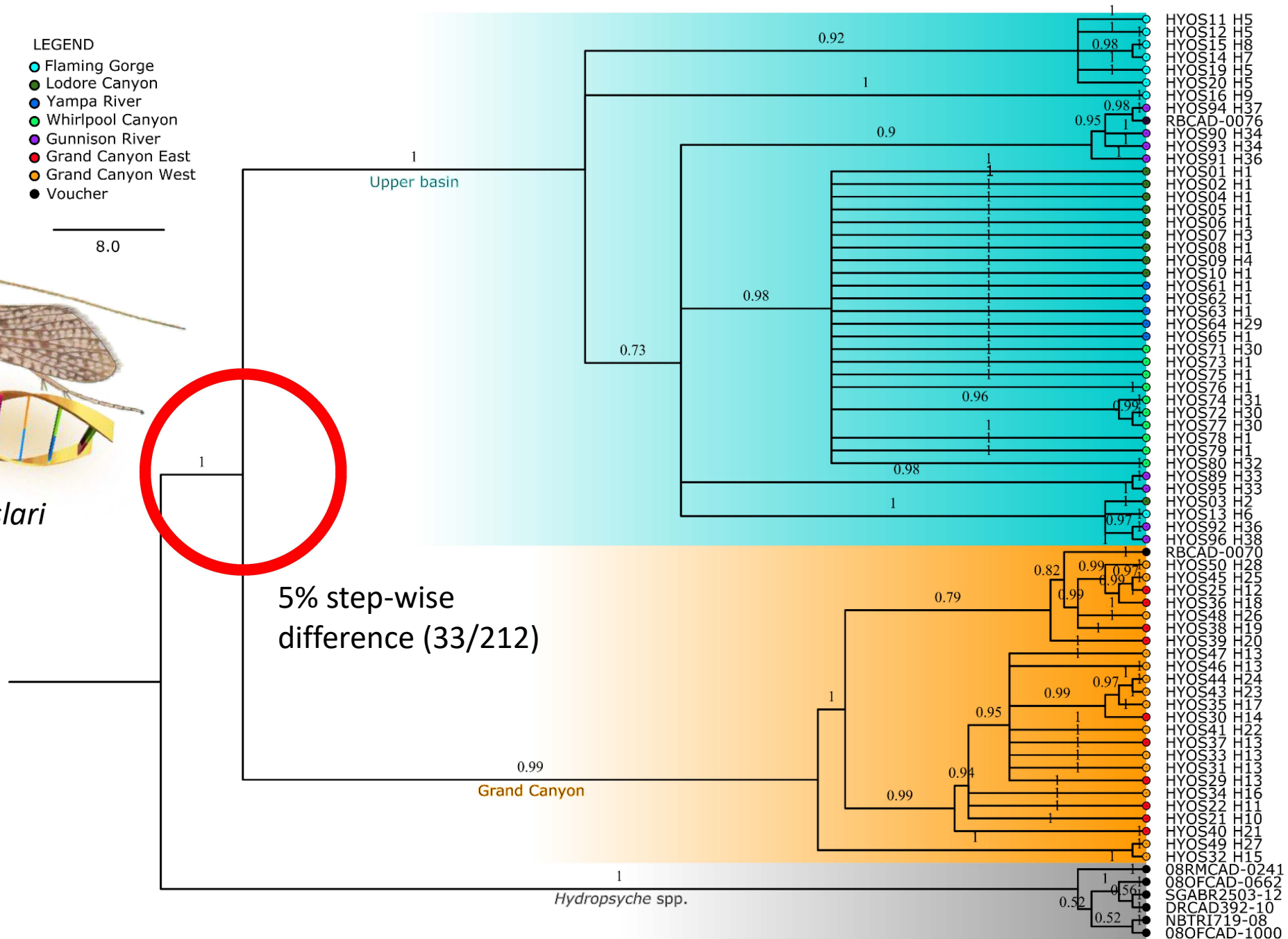
8.0



Hydropsyche oslari
mtDNA CO1

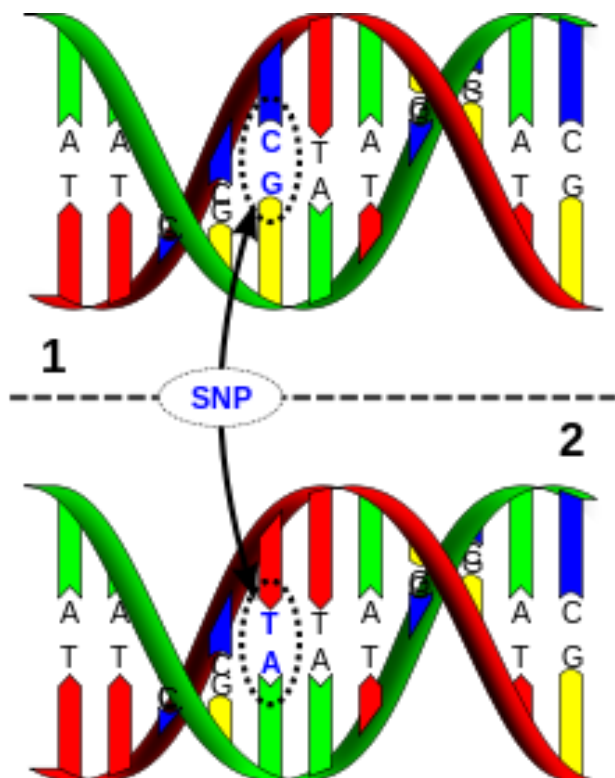


5% step-wise
difference (33/212)



Preliminary data, do not cite.

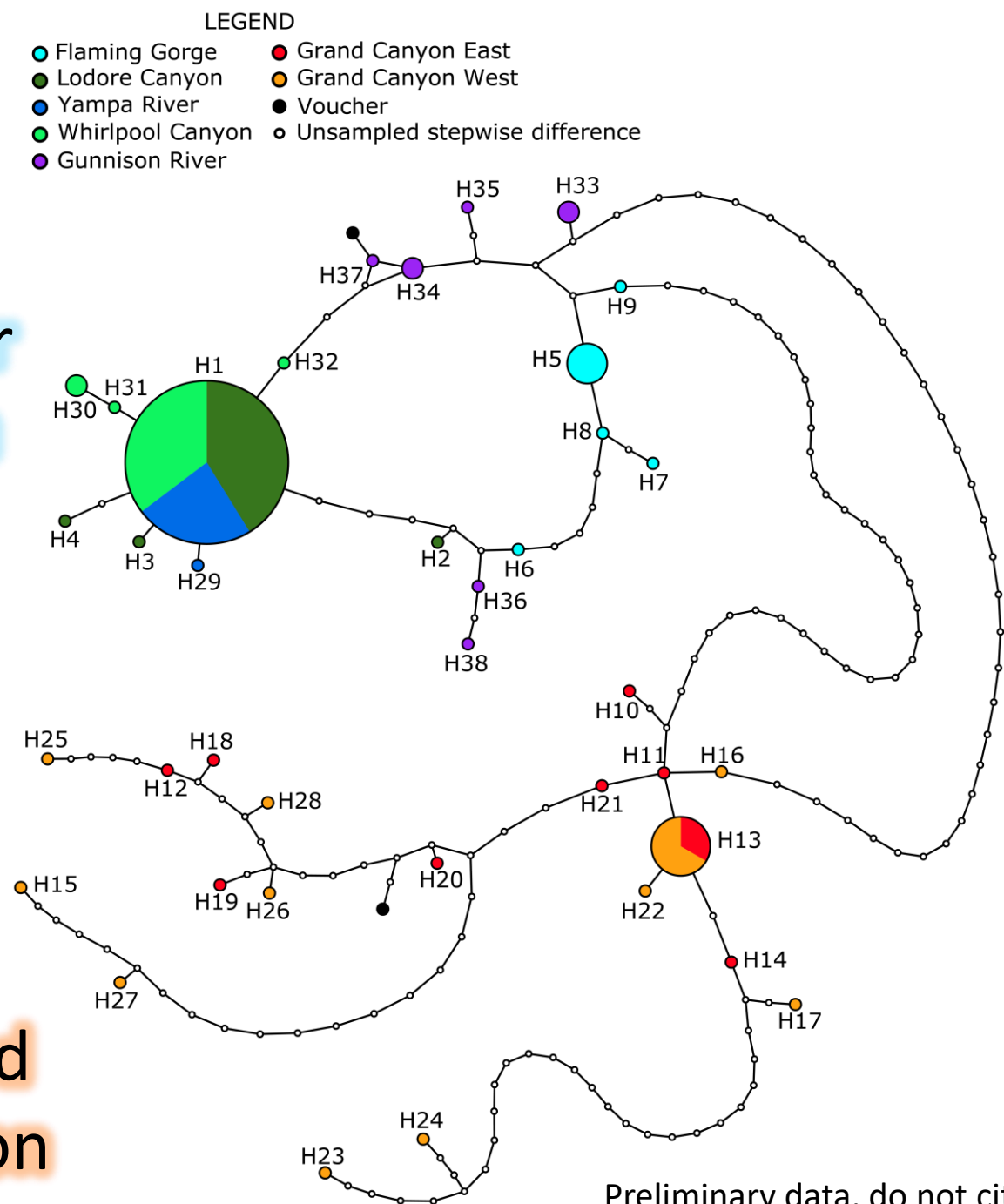
Haplotype analysis



“SNP” single-nucleotide polymorphism

Upper Basin

Grand Canyon

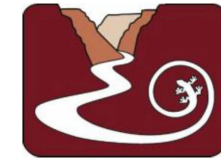


Preliminary data, do not cite.

Many hands make light (traps) work

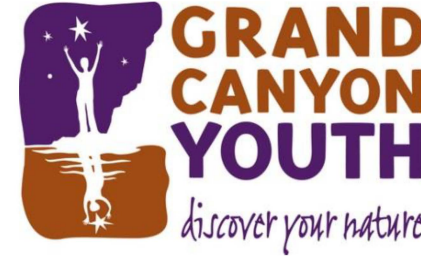


adrift adventures
Dinosaur National Monument
National Park Service Authorized Concessioner

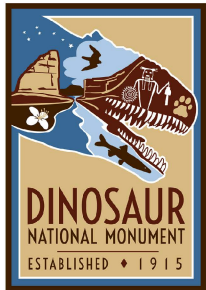
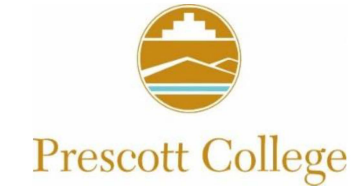


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HATCH
RIVER EXPEDITIONS



WESTERN STATE
COLORADO UNIVERSITY
Learning. Elevated.



HOLIDAY
RIVER
EXPEDITIONS



GREEN RIVER OUTFITTERS



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