Acknowledgments

Silver carp *Hypophthalmichthys molitrix*

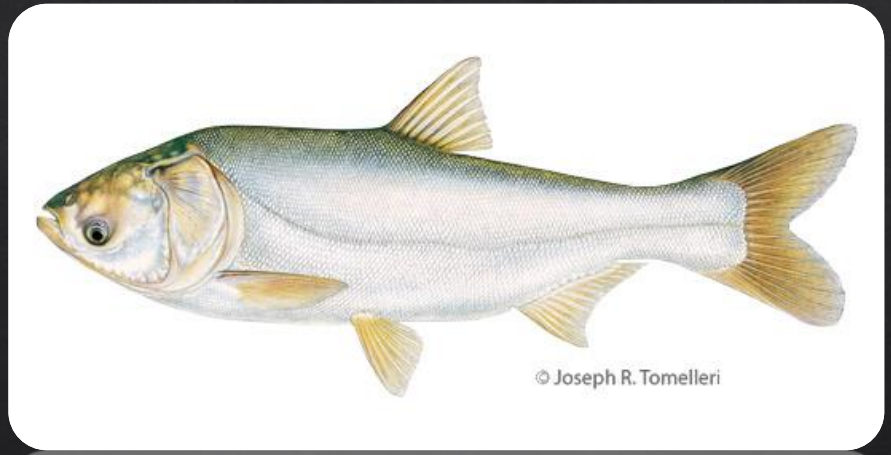
- Native to China and Russia
- Imported in the 1970's
- Hatchery ponds in Arkansas (Freeze & Henderson 1982).
- Consume zooplankton and phytoplankton (Carlson & Vondracek 2014).

The Threat of Silver Carp in the Midwest

Species of particular concern

Increased competition for resources, Negatively impacts fish condition and populations (Irons et al. 2007)

Great Lakes - 7 billion dollar a year game fish industry (Spitzer et al. 2017)



Using Active Tracking to Assess Diurnal and Seasonal Habitat Use of Silver Carp in the Wabash and White River

Dahlia Martinez[1], Scott J. Meiners[1], Daniel Roth[1], James E. Garvey[2], Robert Colombo[1]

[1]Eastern Illinois University, [2]Southern Illinois University Carbondale

Wabash River

- Tributary of the Ohio River
- Longest unimpounded river east of the Mississippi River.
- Silver carp in the Wabash:
  - Greater condition (Stuck et al. 2015).
  - Higher growth rates
  - Greater mean length and age
  - Established population of adults (Coulter et al. 2016).

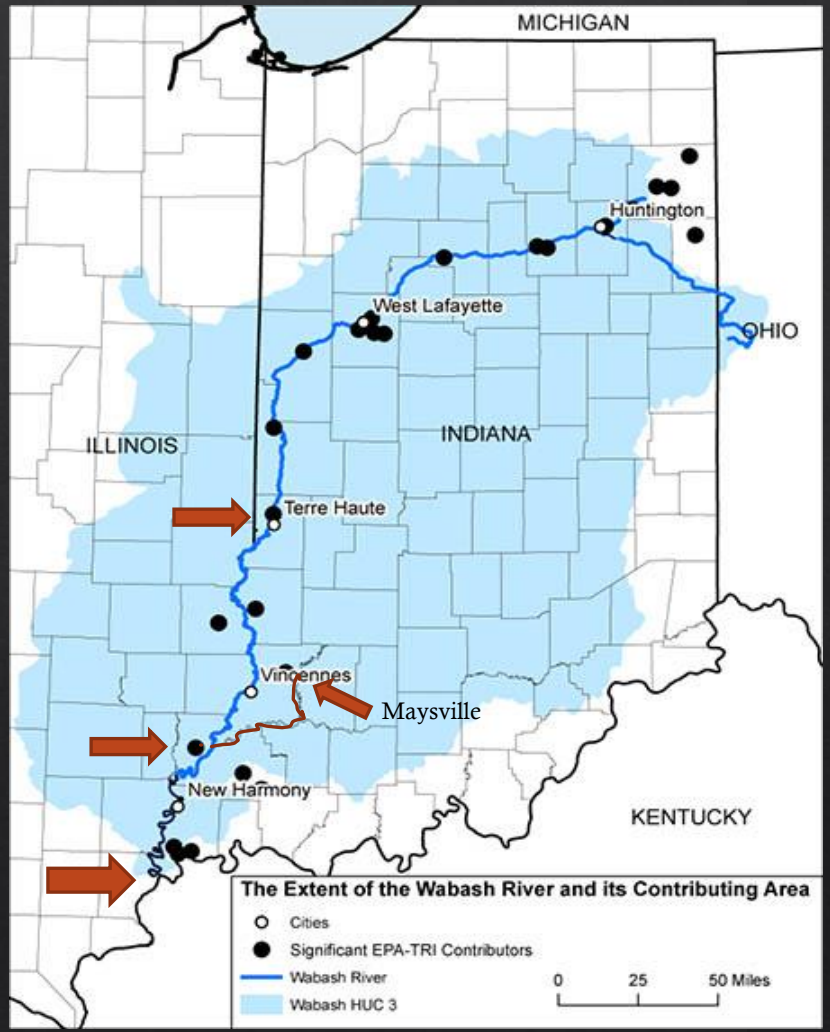
Why focus on these systems?

- Limited information
- Corridors for dispersal/spawning sites (Pretchel et al. 2018)
- Similarity to other systems (Coulter et al. 2015)
- Informed targeting
- Management plans

Objectives & Hypothesis

Assess the seasonal and diurnal movement and habitat use of Silver carp in the lower Wabash River and White River.

Hypothesize habitat selectivity varies diurnally, seasonally and dependent on environmental changes (water levels, temp, etc.)



Methods

- Wabash River : Terre Haute – Ohio River
- White River : Maysville – Wabash River

Methods

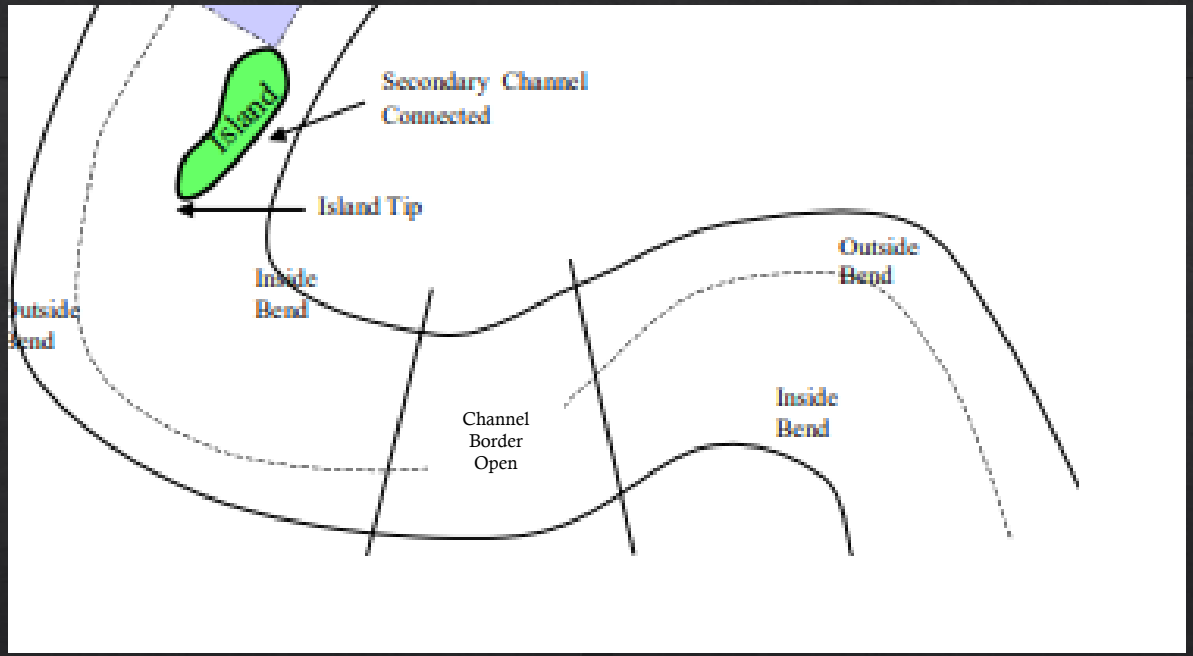
- Surgeries
- 88 tags (Summer 2021)
- 193 tags (Winter 2021)

- Monthly tracking (June 2021 – January 2022)
- Monthly macro/micro tracking
- Macro track: Full River Track (418 km)
- Diurnal tracking: Night & Day Teams
- Micro track: Single day track

Methods

- Omnidirectional & directional hydrophone
- Tag number ,Time, Date, Season, GPS location, depth (m), secchi (m), dissolved oxygen (mg/L), flow rate (m/s), temperature (°C), and conductivity
- Habitat determined using the modified Cobb index (1989)
- ANOVA's used to determine the seasonal and diurnal effects on habitat use

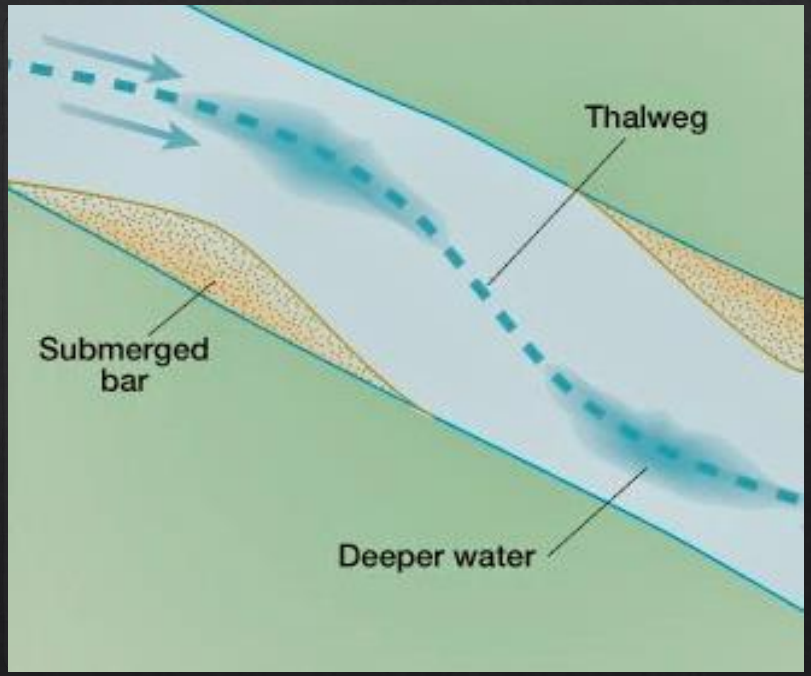
Cobb Index : Habitat Categories



Inside Bend (IB)/Outside Bend (OB)/ Channel Border Open (CBO)

Cobb Index Microhabitat Categories

Logjam (LGJ)



Thalweg (TLW)

Cobb Index Microhabitat Categories

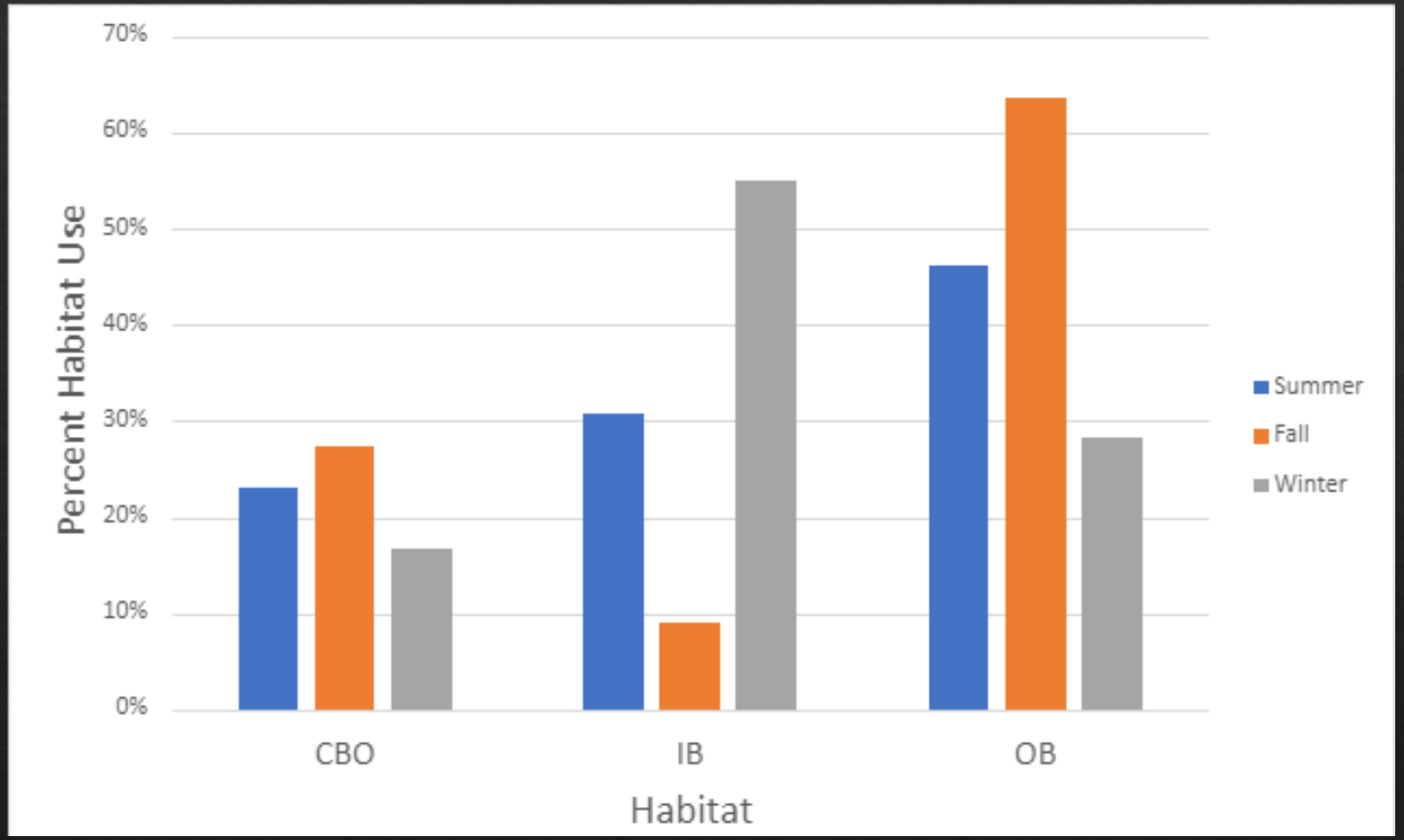
Riprap (RPR)

Run (RUN)

Results

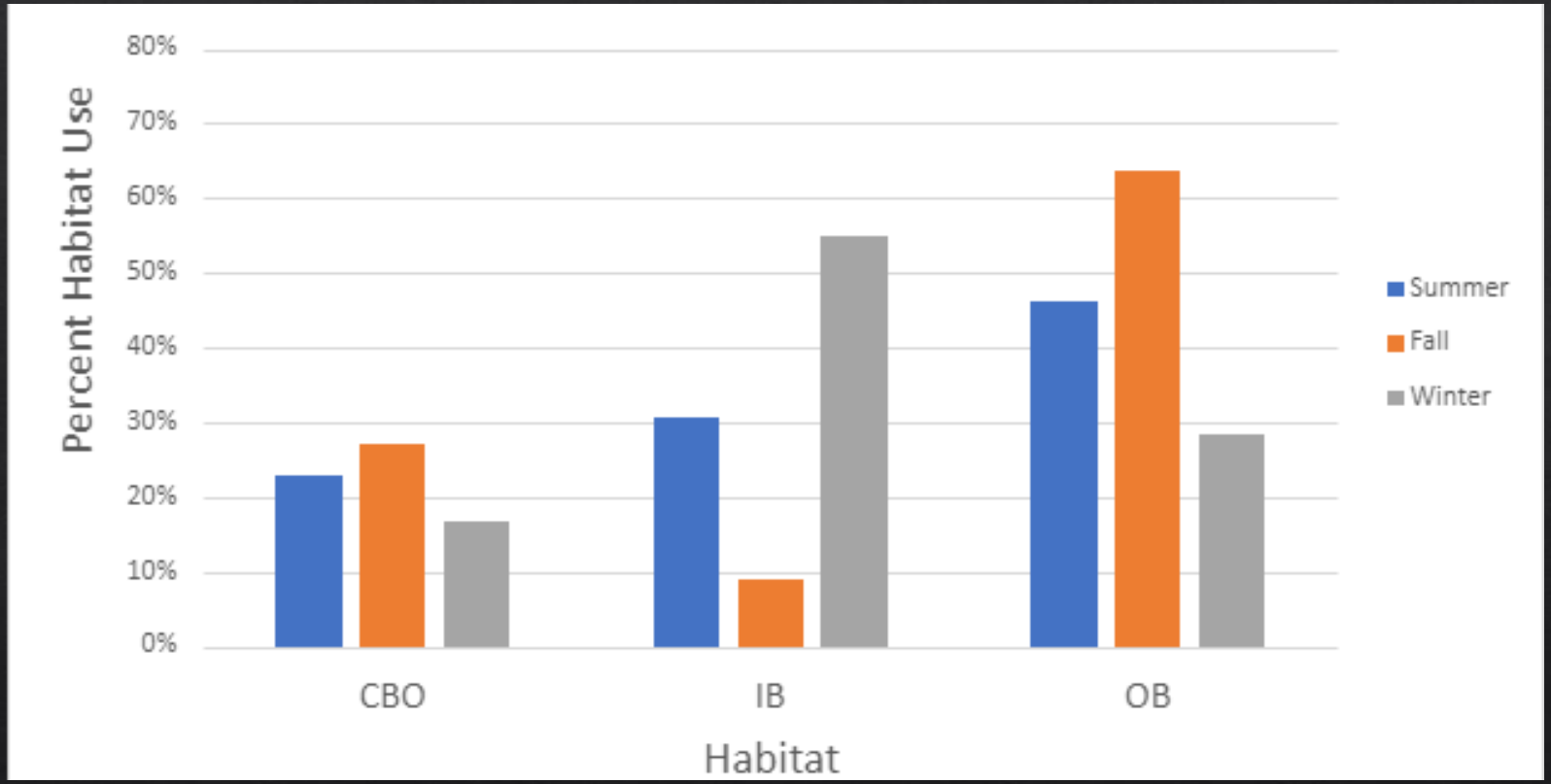
- 84 total detections
- 13 - Summer
- 11- Fall
- 60-Winter

Seasonal Habitat Use



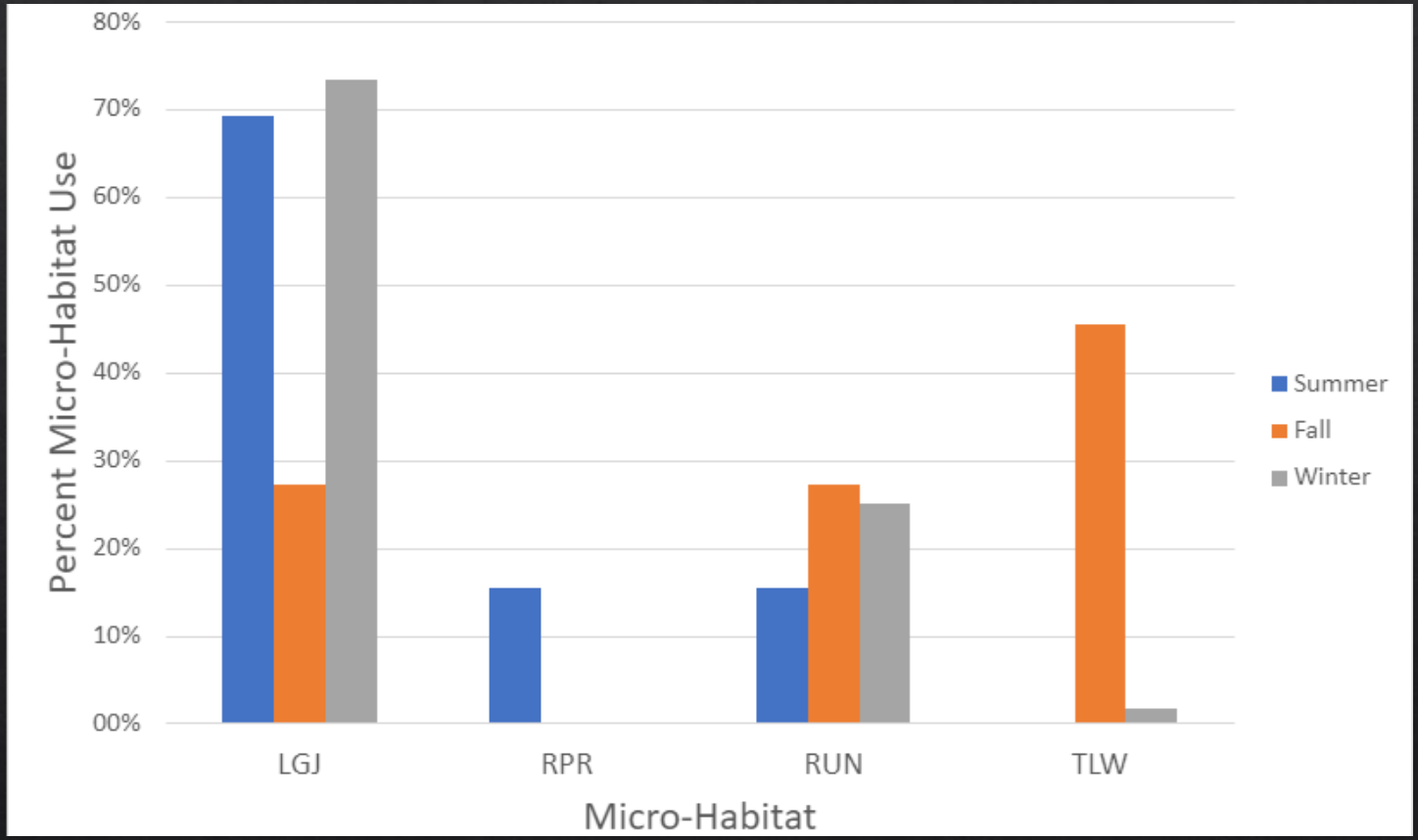
- The relation between Season & Habitat was not significant, $X^2=(2, N=84)= 9.436$, $p =0.0511$

Within Season Habitat Use



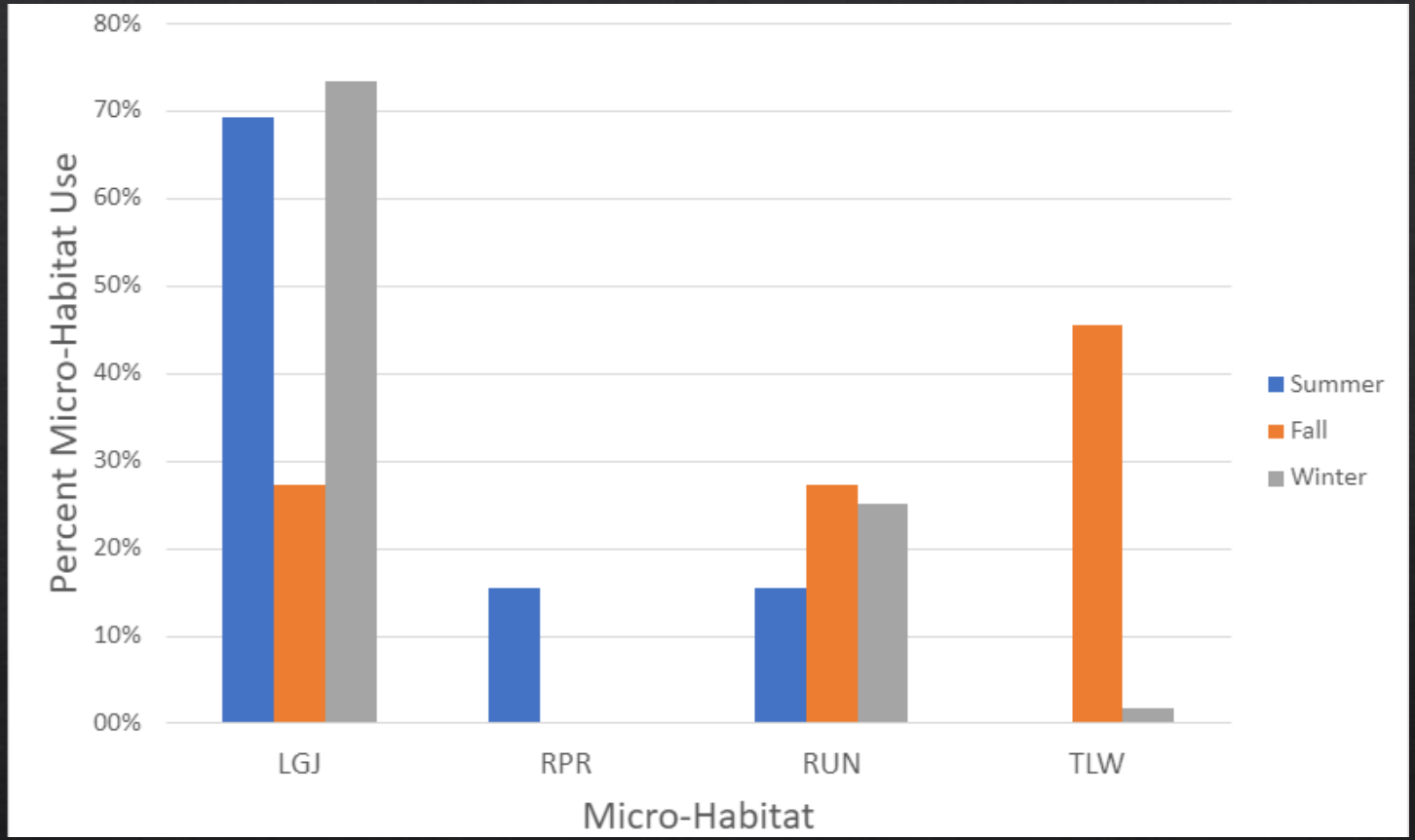
- There was no significant difference in habitat use during the Summer, X^2=(2, N=13)= 1.0769, p =0.5836
- There was no significant difference in habitat use during the Fall, X^2 =(2, N=11)= 5.0909, p =0.0784
- There was a significant difference in habitat use during the Winter, X^2 =(2, N=60)= 13.90, p =0.0010

Seasonal Micro-Habitat Use



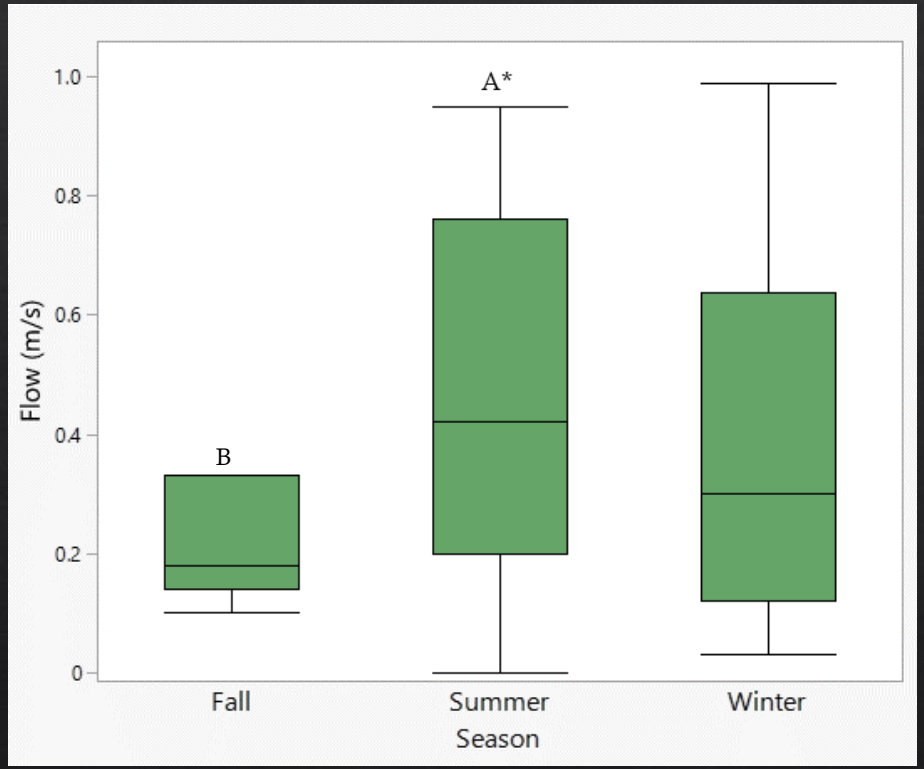
- The relationship between Season & Micro-Habitat was significant, $X^2=(3, N=84)= 40.43$, $p < 0.001$

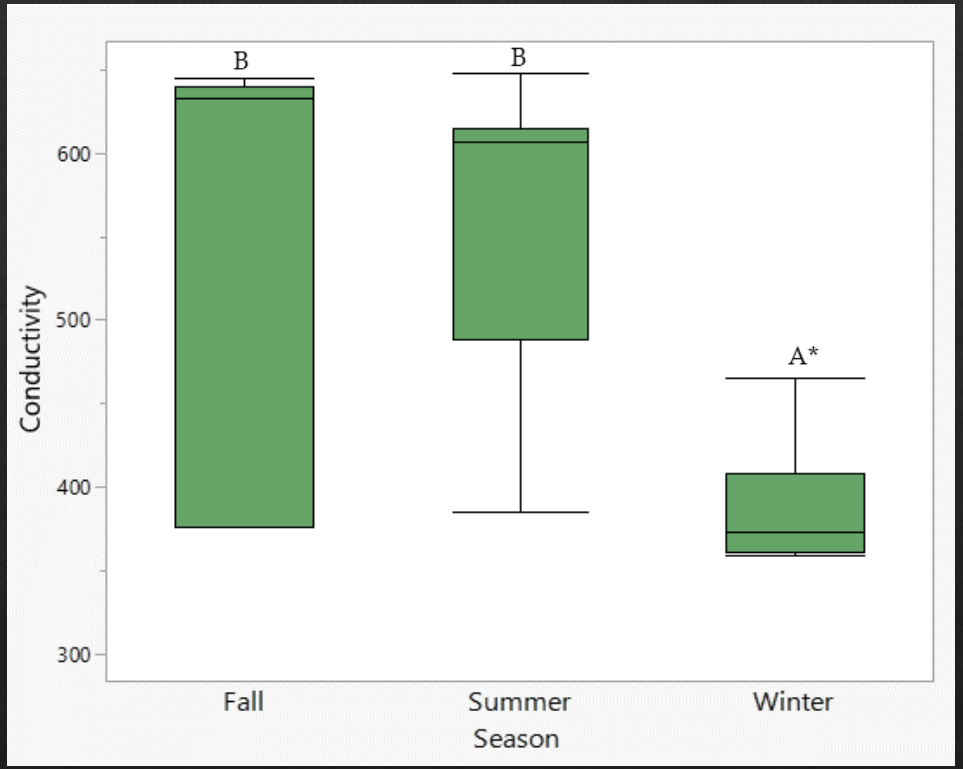
Within Season Micro-Habitat Use



- There was a significant difference in micro-habitat use during the Summer, X^2=(2, N=13)= 7.5385, p =0.0231
- There was no significant difference in habitat use during the Fall, X^2 =(2, N=11)= 0.7273, p =0.6951
- There was a significant difference in habitat use during the Winter, X^2 =(2, N=60)= 48.10, p <0.001

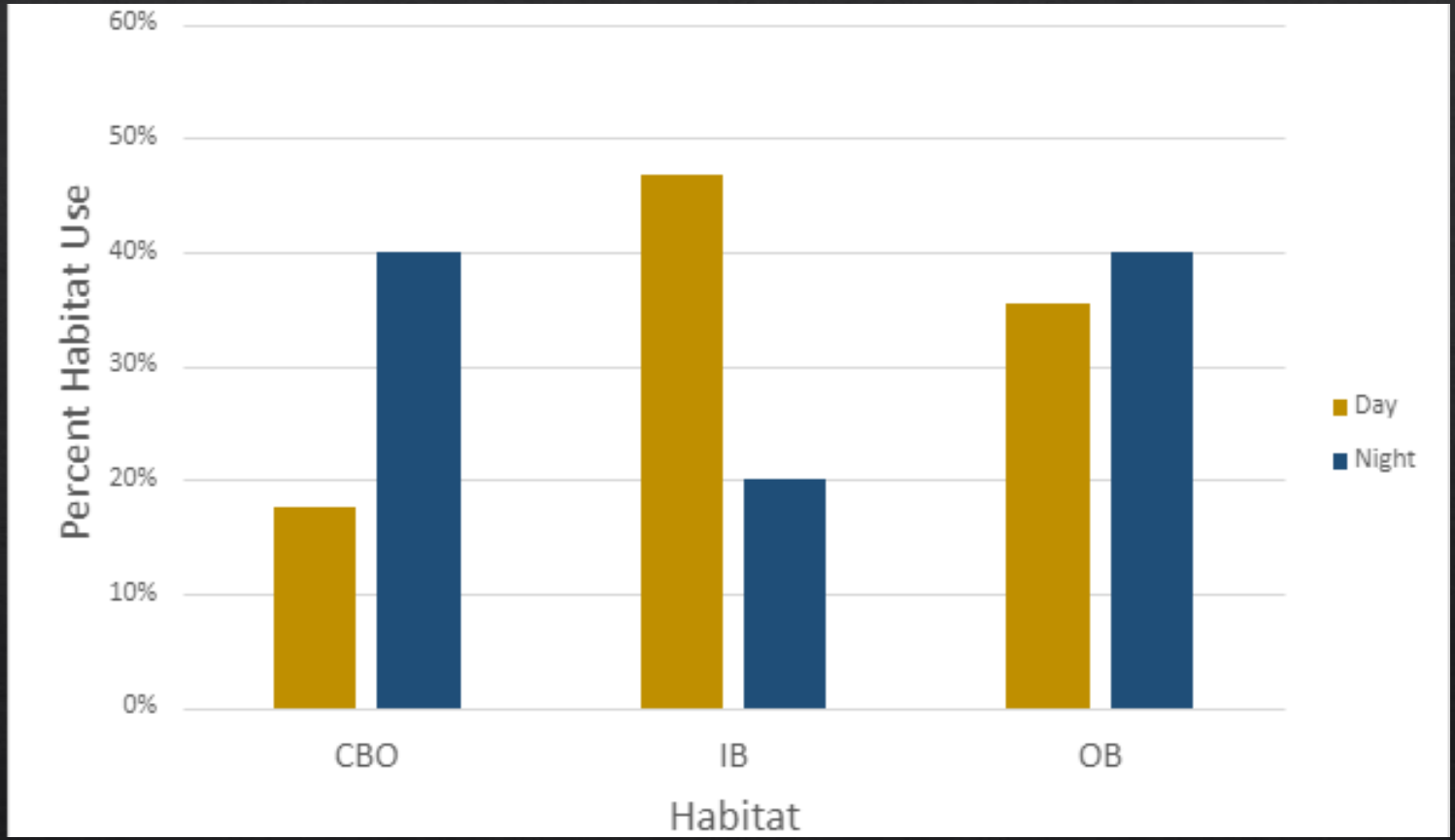
Seasonal Habitat Use





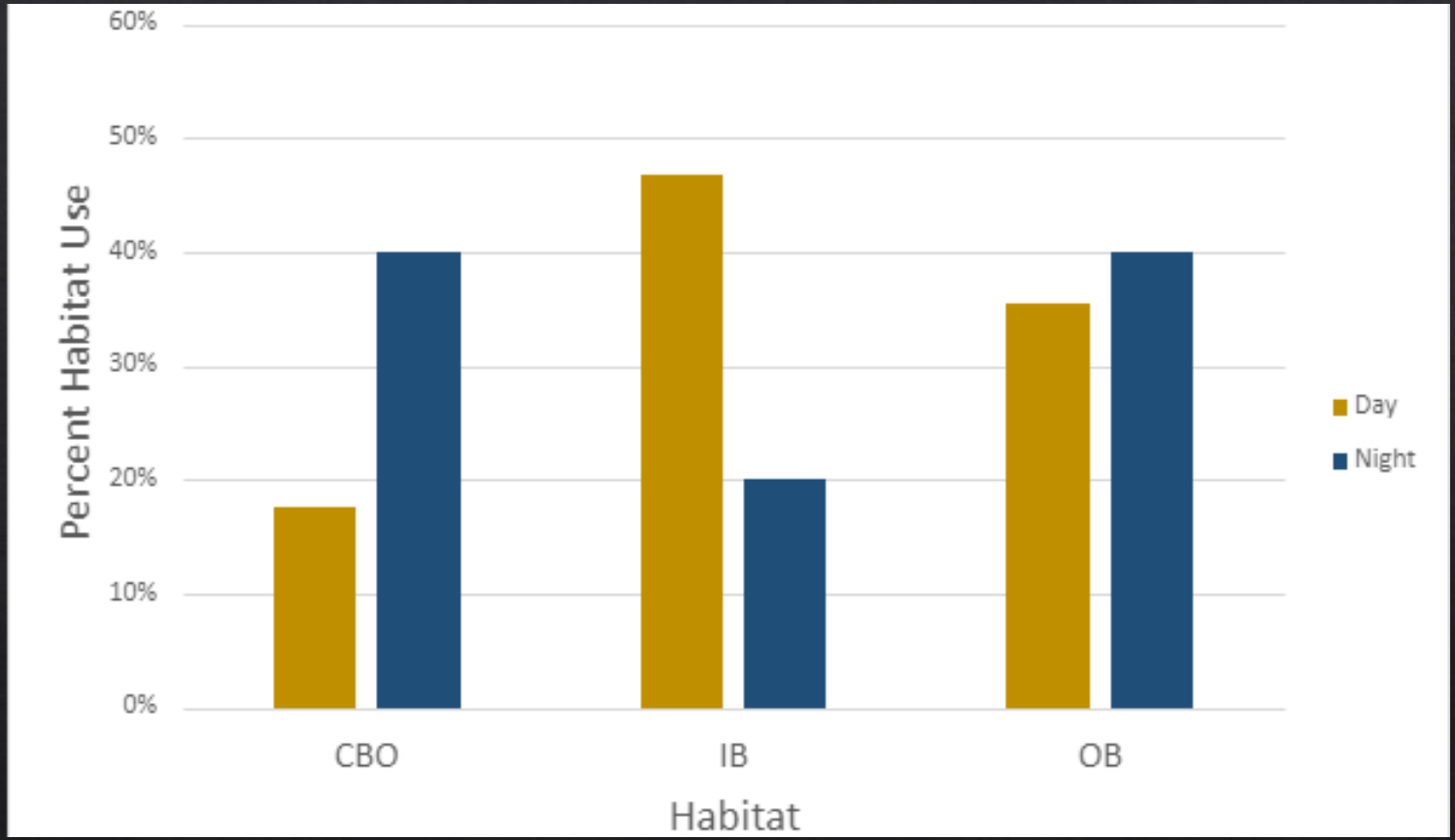
- Season had a significant effect on flow ($F(2,83)=47.255$, $p<0.001$)
- Season had a significant effect on conductivity ($F(2,83)=76.10$, $p<0.001$)
- Season had a significant effect on D.O. ($F(2,83)=47.26$, $p<0.001$)

Diurnal Habitat Use



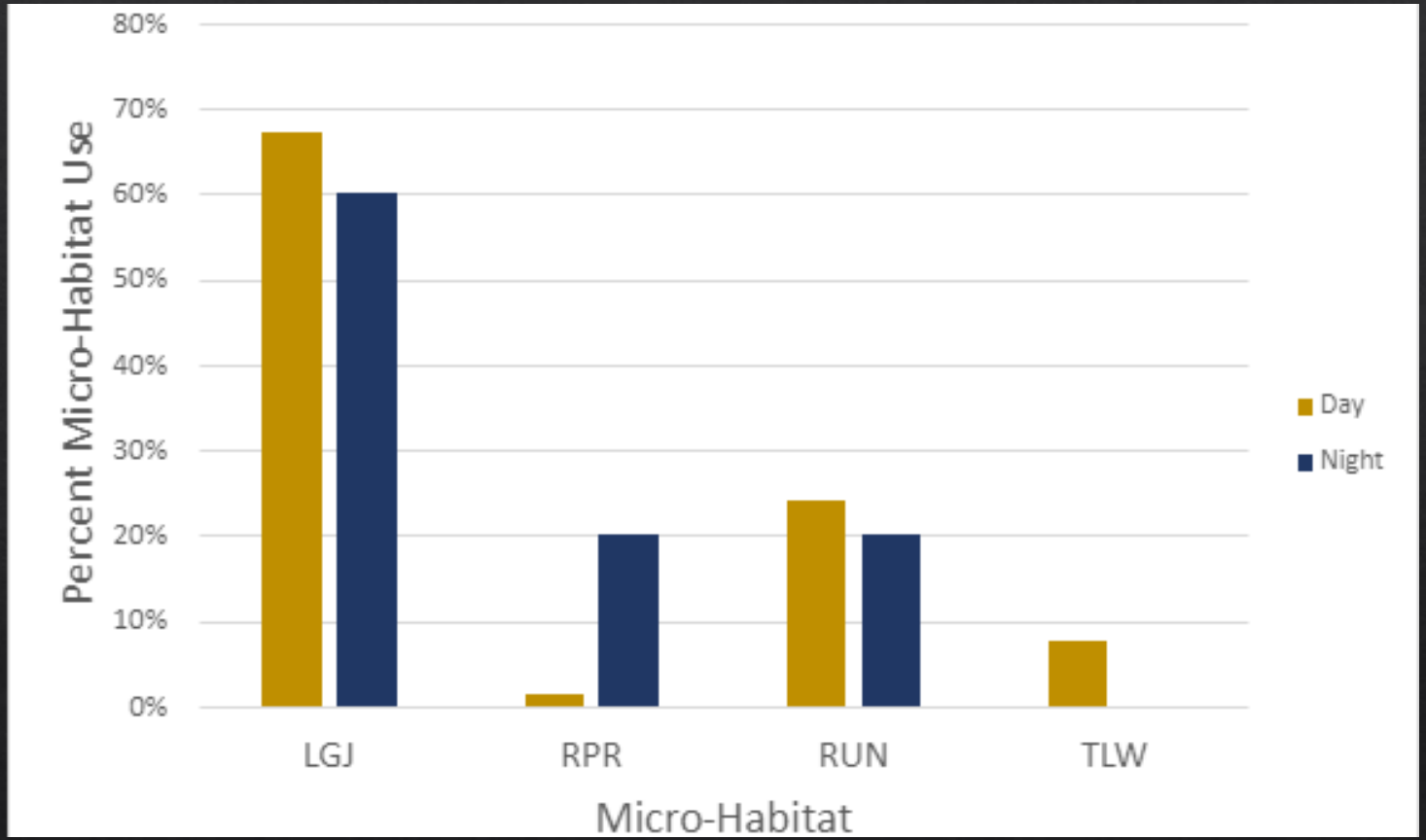
- Time of day had no significant effect on habitat
- $X^2 = (2, N=84) = 2.001, p = 0.3677$

Within Diurnal Habitat Use



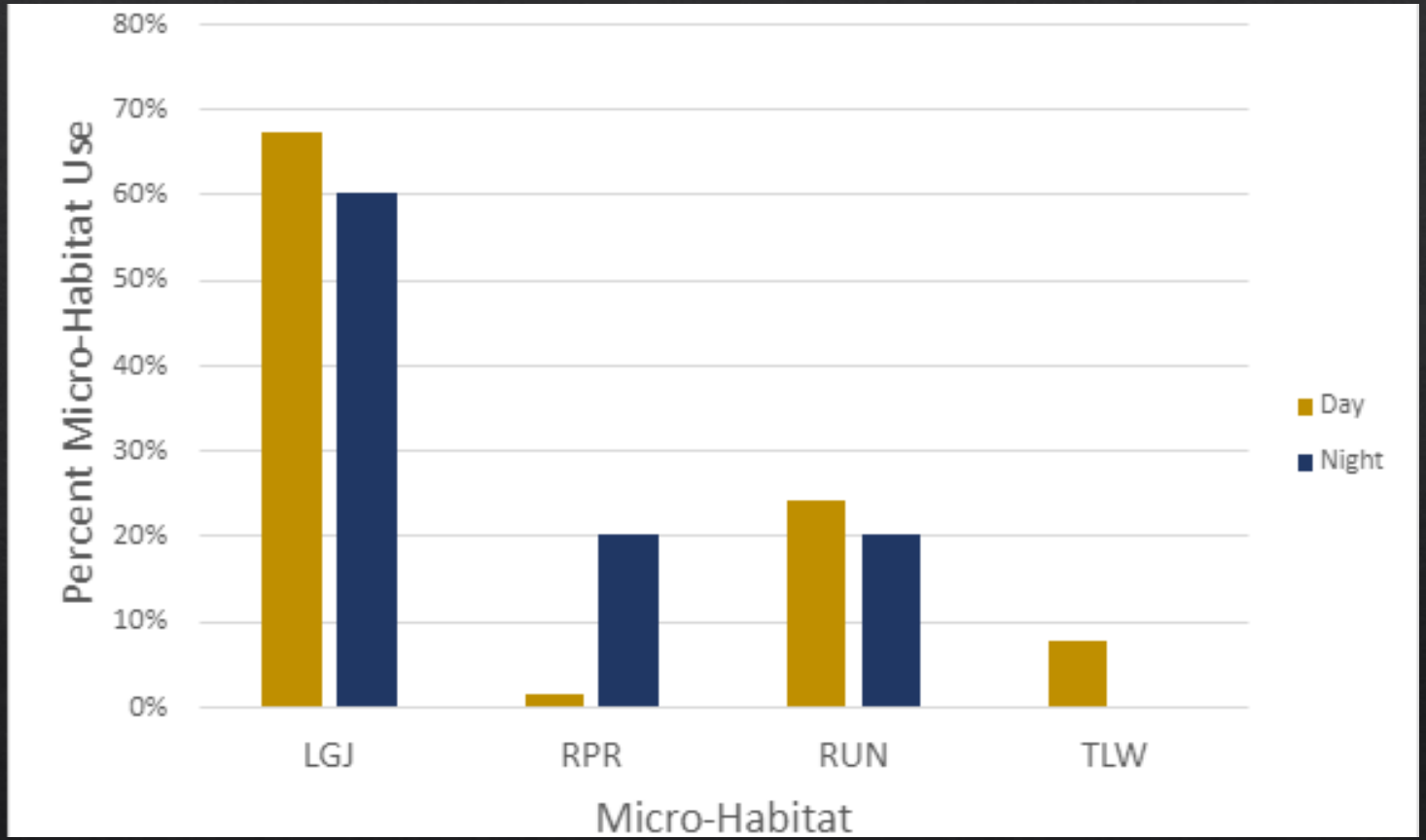
- There was a significant difference in habitat use during the Day, X^2 =(3, N=79)= 83.3797, p< 0.0001
- There was no significant difference in habitat use during the Night, X^2 =(2, N=5)= 0.40, p =0.8187

Diurnal Habitat Use



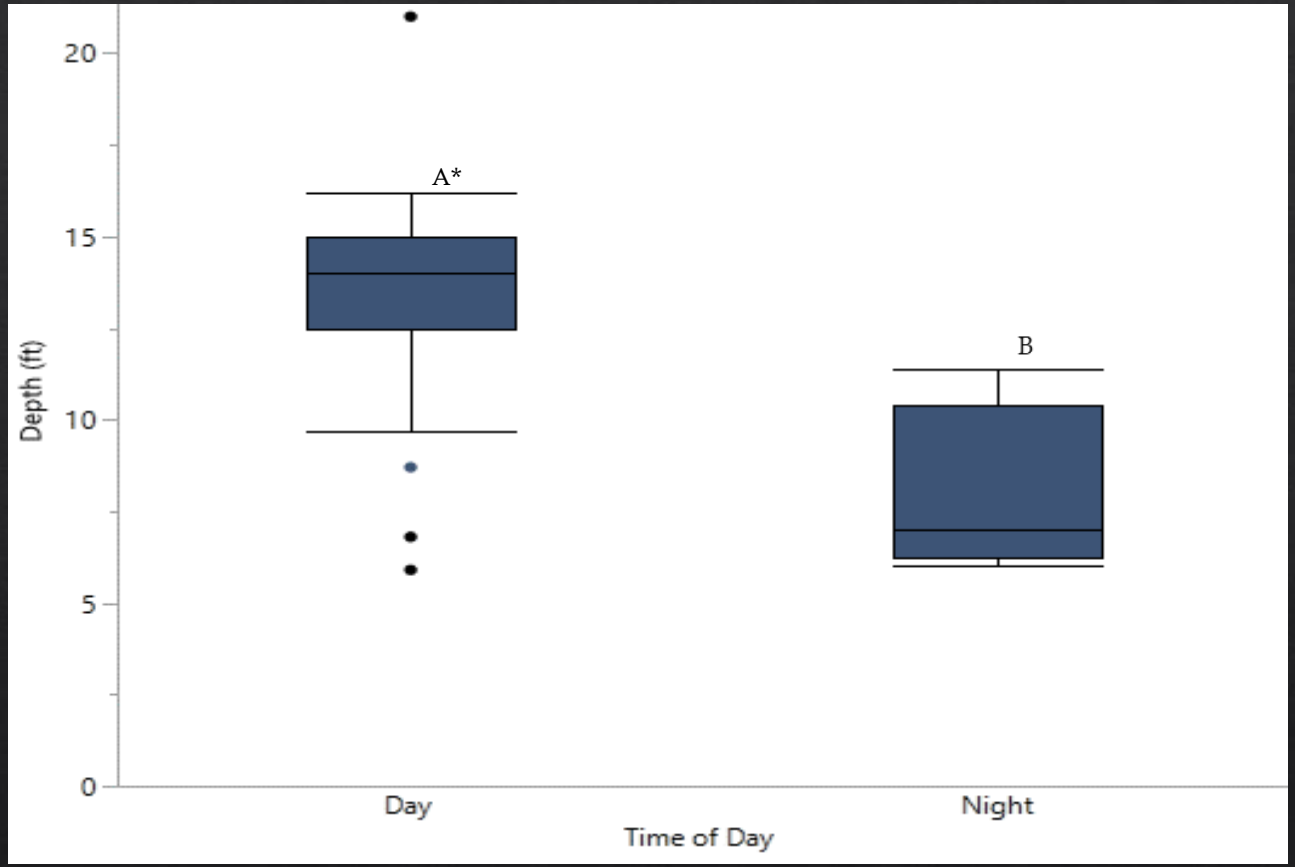
- Time of day had no significant effect on micro-habitat use
- $X^2 = (3,N=84)= 7.379$, $p = 0.0607$

Within Diurnal Micro-Habitat Use



- There was a significant difference in habitat use during the Day, X^2 =(2, N=79)= 10.2025, p< 0.0061
- There was no significant difference in habitat use during the Night, X^2 =(2, N=5)= 1.60, p =0.4493

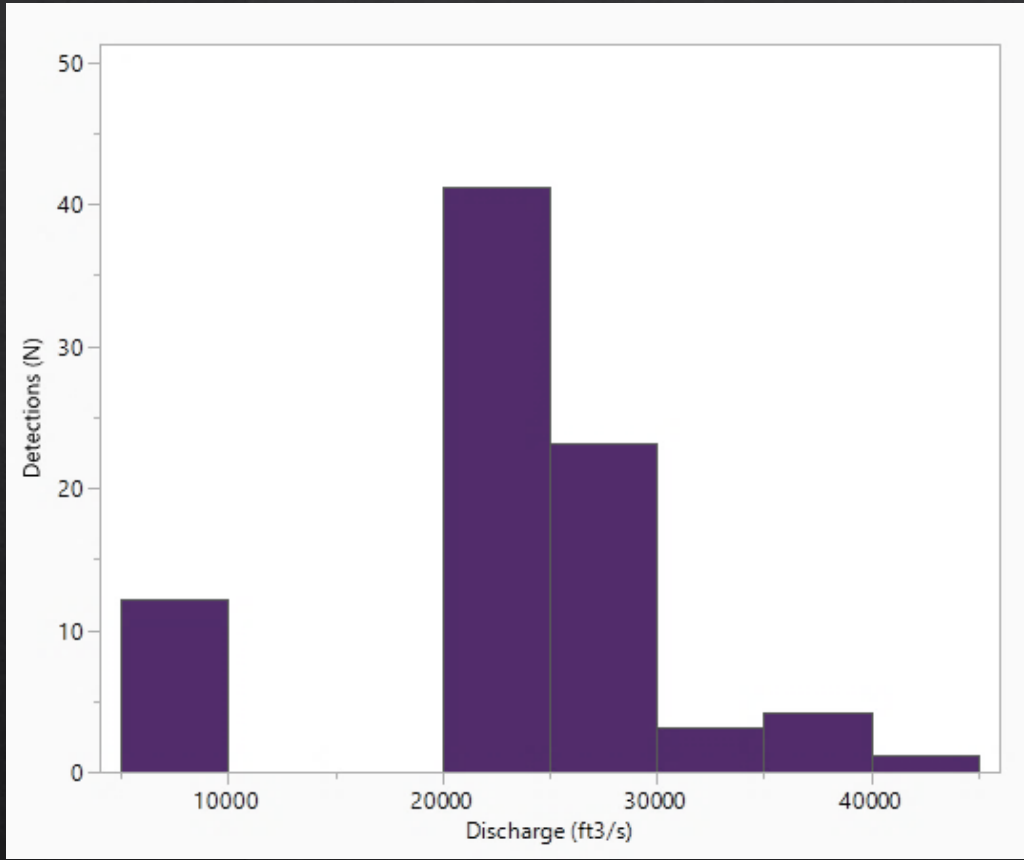
Diurnal Habitat Use



- The depth at which tags were located was also significantly affected by time of day ($F_{(1,23)} = 9.524$, $p < .05$)

Limitations

- Length of the study
- Number of Tags
- Water levels & weather
- Preference
- Boat interference & Carp behavior



Discussion

Habitat use of Silver carp did vary seasonally and diurnally

Summer & Winter - Logjam

Fall- Thalweg

Time of day did not have a significant effect on habitat/microhabitat use.

Significant effect on depth

Discussion

Further seasonal research necessary

Assessment of Effort

Targeted management plans

Questions?

damartinez2@eiu.edu

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