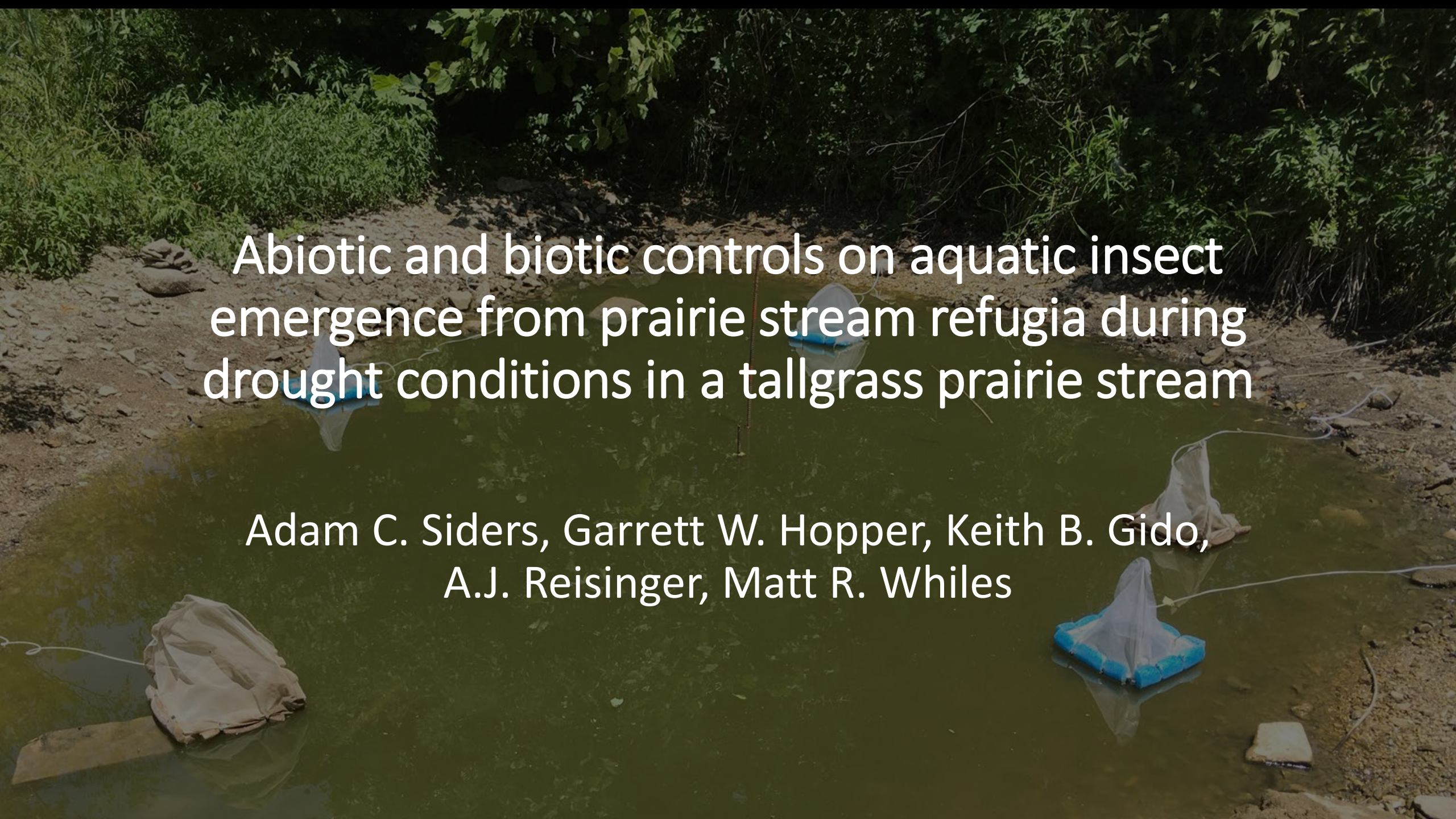

Abiotic and biotic controls on aquatic insect emergence from prairie stream refugia during drought conditions in a tallgrass prairie stream

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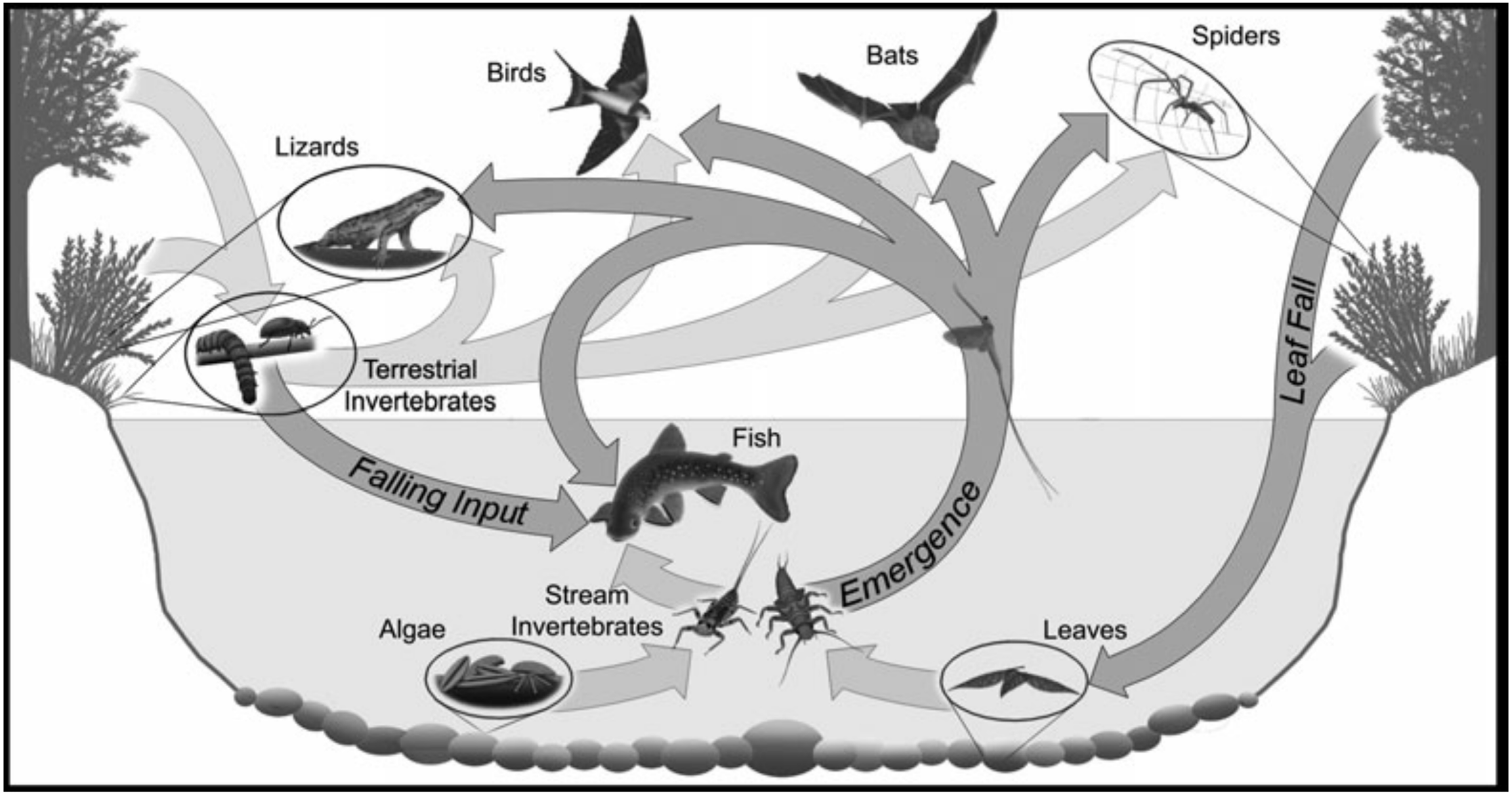
Subsidies are widespread across ecosystems

Victor Leshyk



from Baxter et al. 2005

Factors influencing aquatic invertebrate communities

- Habitat size
- Temperature
- Aquatic predators

These factors change under drought

Konza Prairie Biological Station

- Tallgrass prairie preserve in eastern Kansas
- Subject to repeated floods and drying
- Intermittent streams
- Long term ecological research site

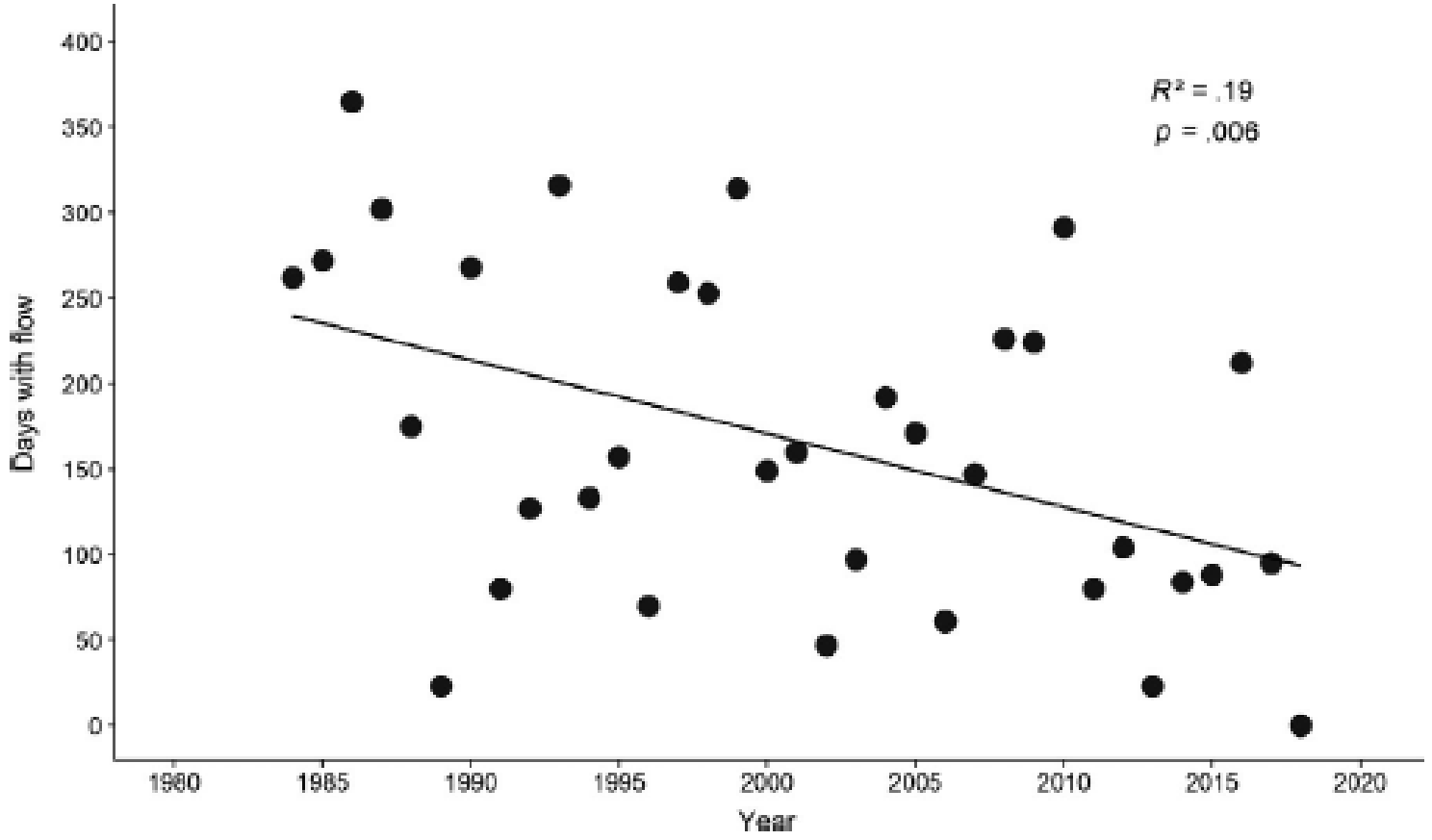
Intermittent streams are becoming more common

- At least 25% of the world's rivers are intermittent
- Up to 50% of the world's rivers may be intermittent when including headwater streams
- More perennial rivers are becoming intermittent

Datry et al. 2020

Increased drying on Konza Prairie

- Fewer days with flow in Kings Creek
- In 2018 complete loss of flow in lower reaches
- Pools disconnected from stream flow remained



Hopper et al. 2019

Overarching question

Which abiotic and biotic factors predict emergence during drought conditions?

Hypotheses

Emergence abundance and biomass will **increase** as pool conditions become harsher through **drying** and **increased temperatures**

Emergence biomass will be positively correlated with **pool surface area**

Emergence biomass will be negatively correlated with **fish biomass**

Methods

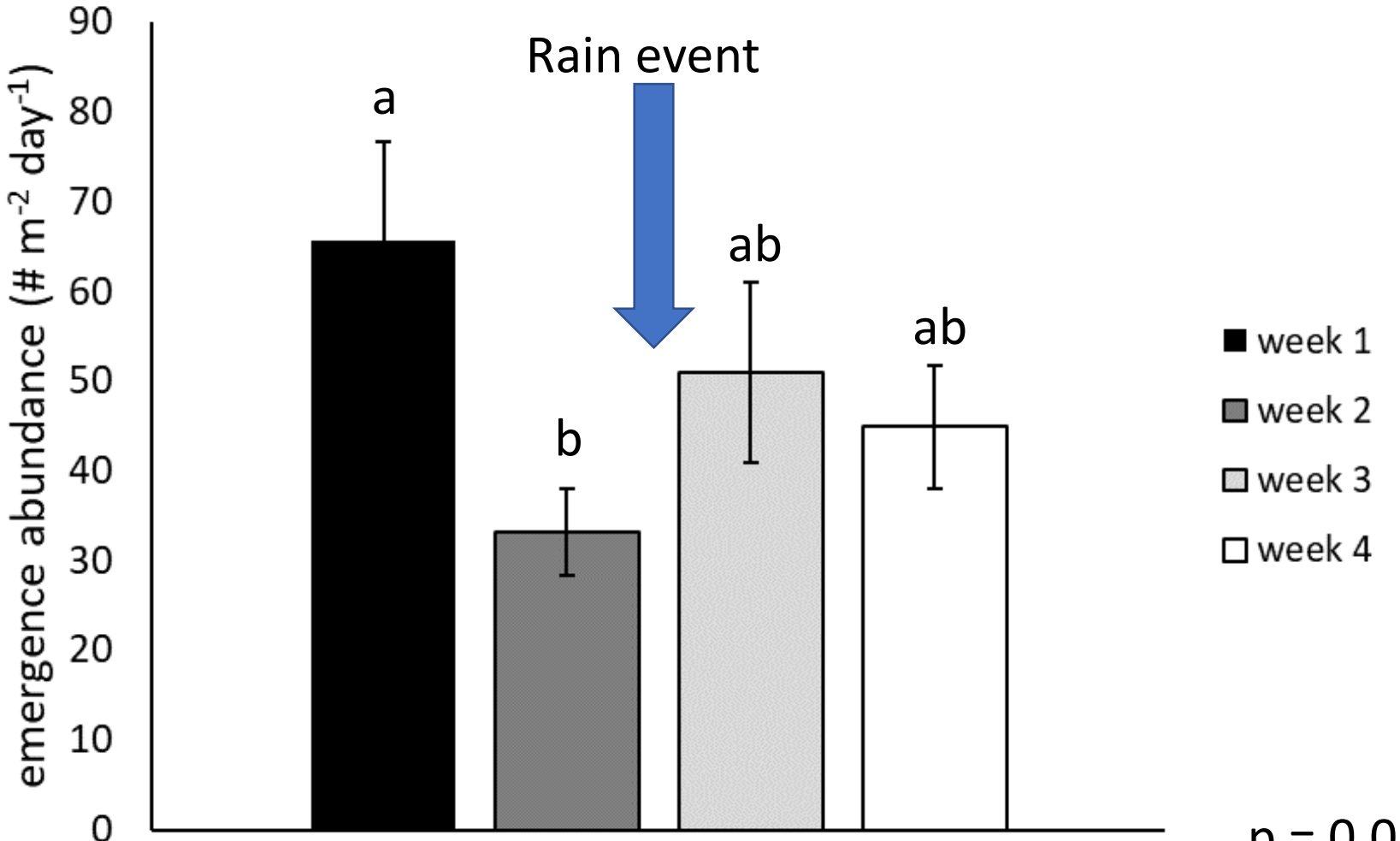
- Sampled 12 consecutive pools
- Collected benthic and emergent samples for 4 weeks
- Sampled fish in pools using single-pass seine hauls
- Measured pool parameters, surface area, depth, temperature

Major taxa

- Collected emergent invertebrates from 5 orders and 17 families
  - Chironomids most abundant and typically accounted for most of the biomass

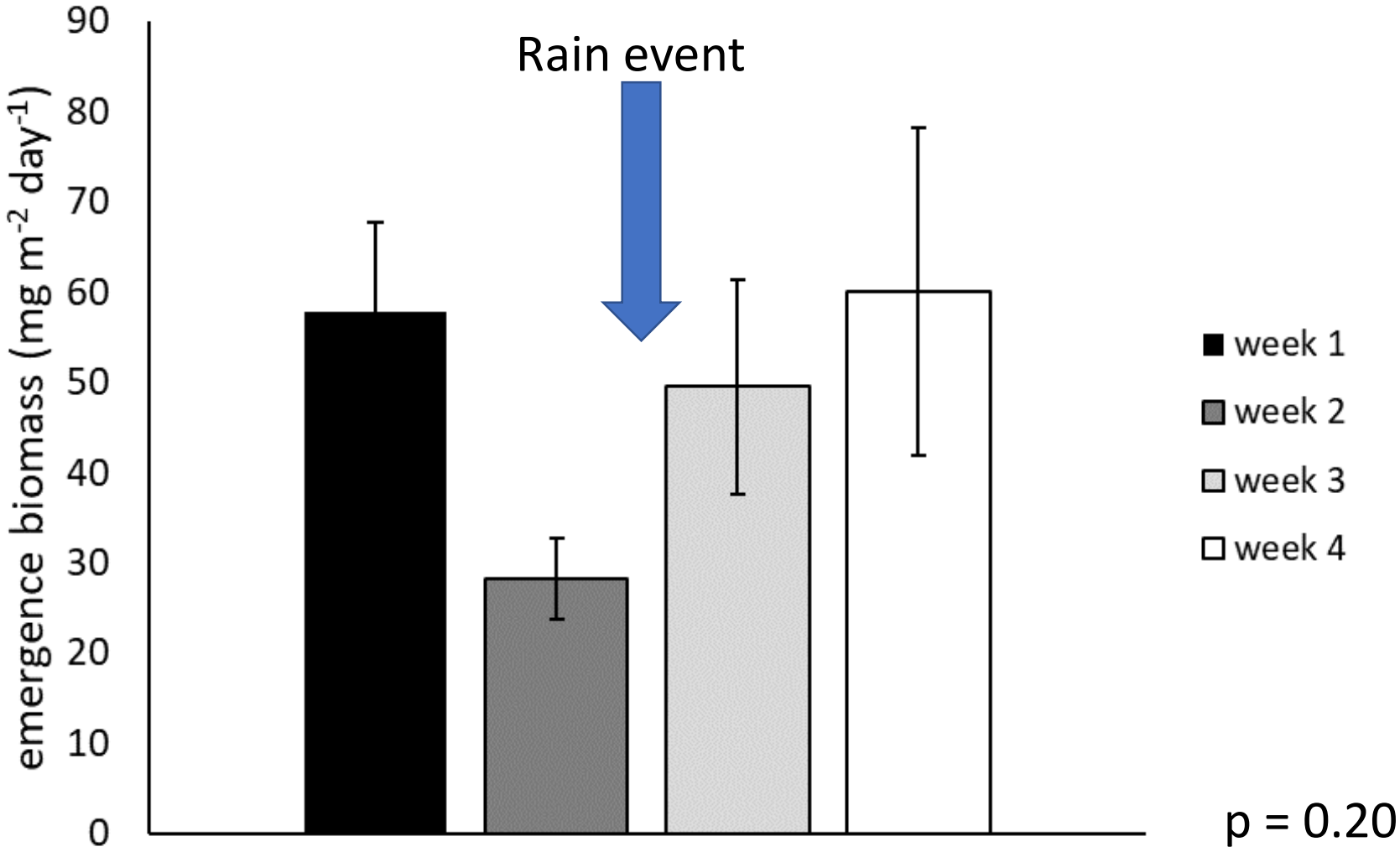
- Seven species of fishes

Average emergence abundance decreased as drought proceeded

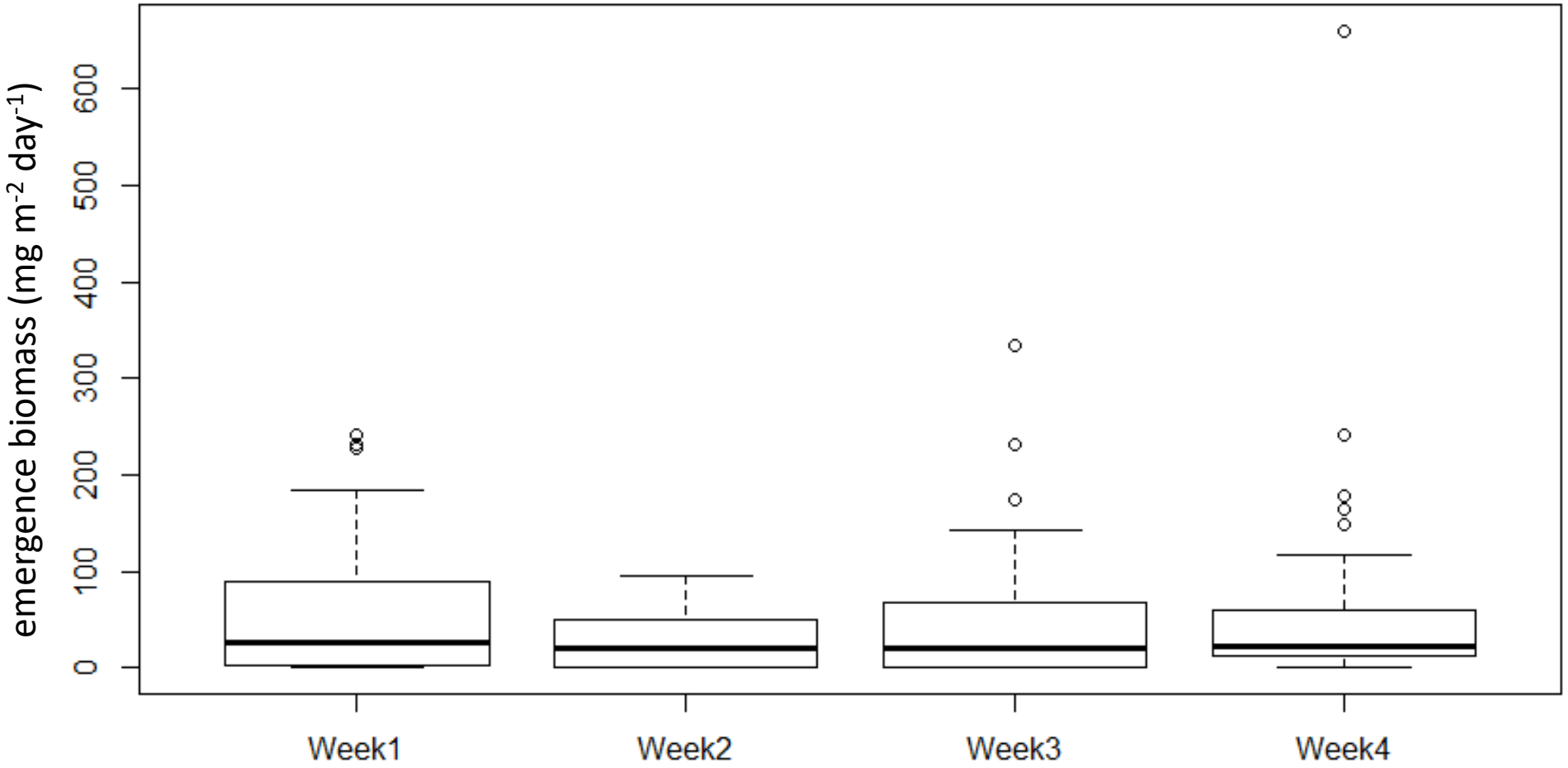


p = 0.057

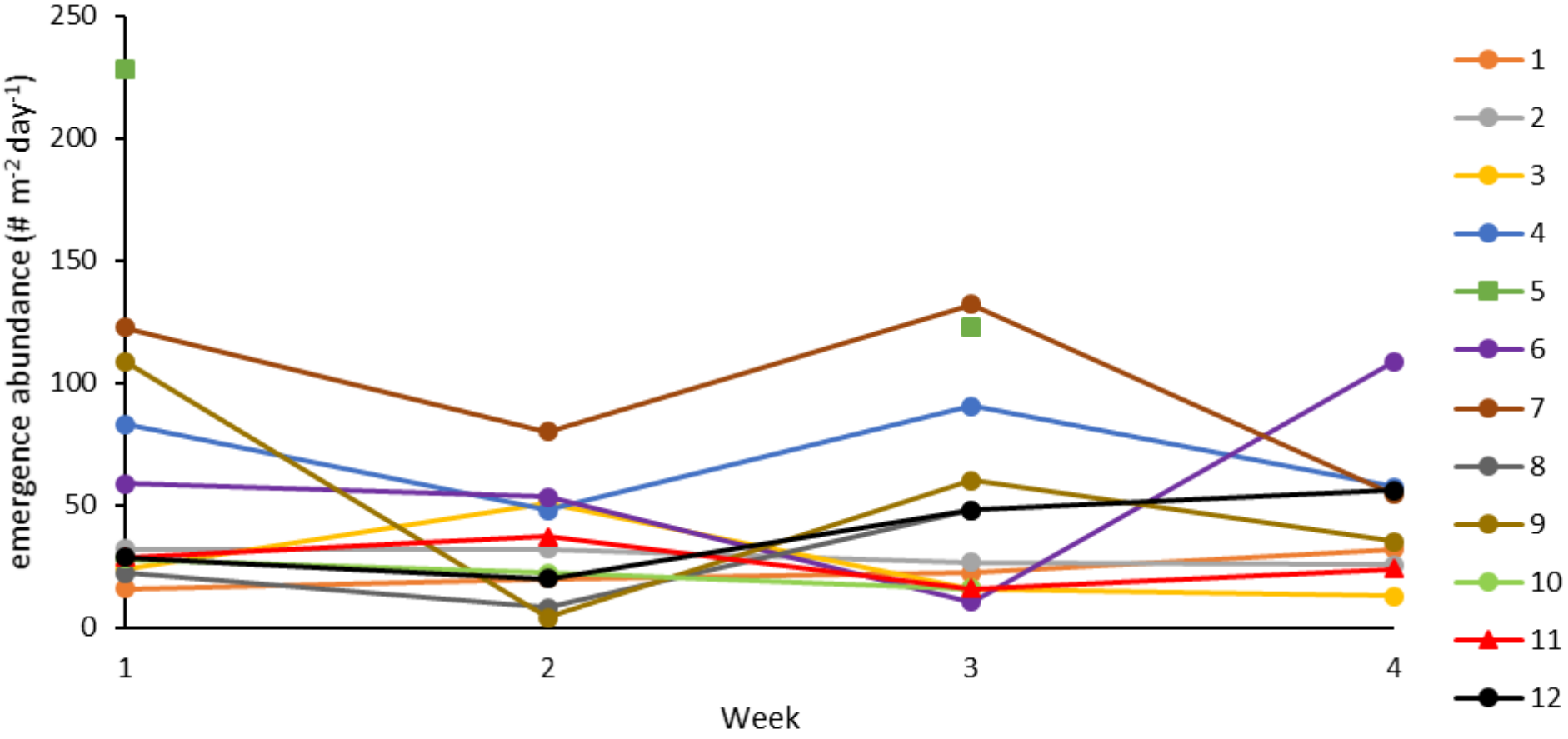
Average emergence biomass decreased prior to the rain event



High variation in biomass data

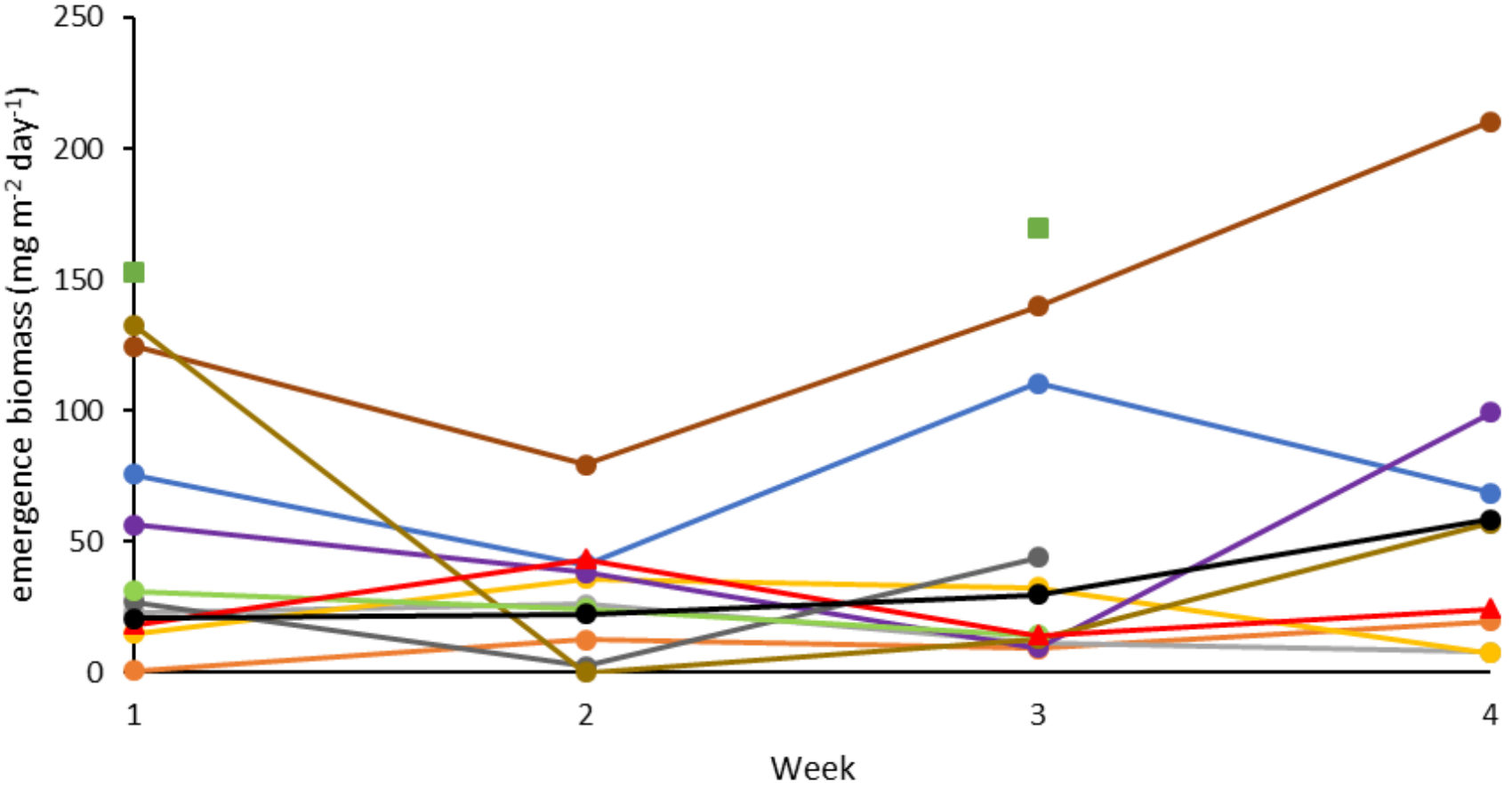


Emergence abundance differed across sites



factor	p-value
site	<0.0001
week	0.20
site x week	0.10

Emergence biomass differed across sites



1 most upstream

12 most downstream

factor	p-value
site	0.0003
week	0.09
site x week	0.02

Hypotheses

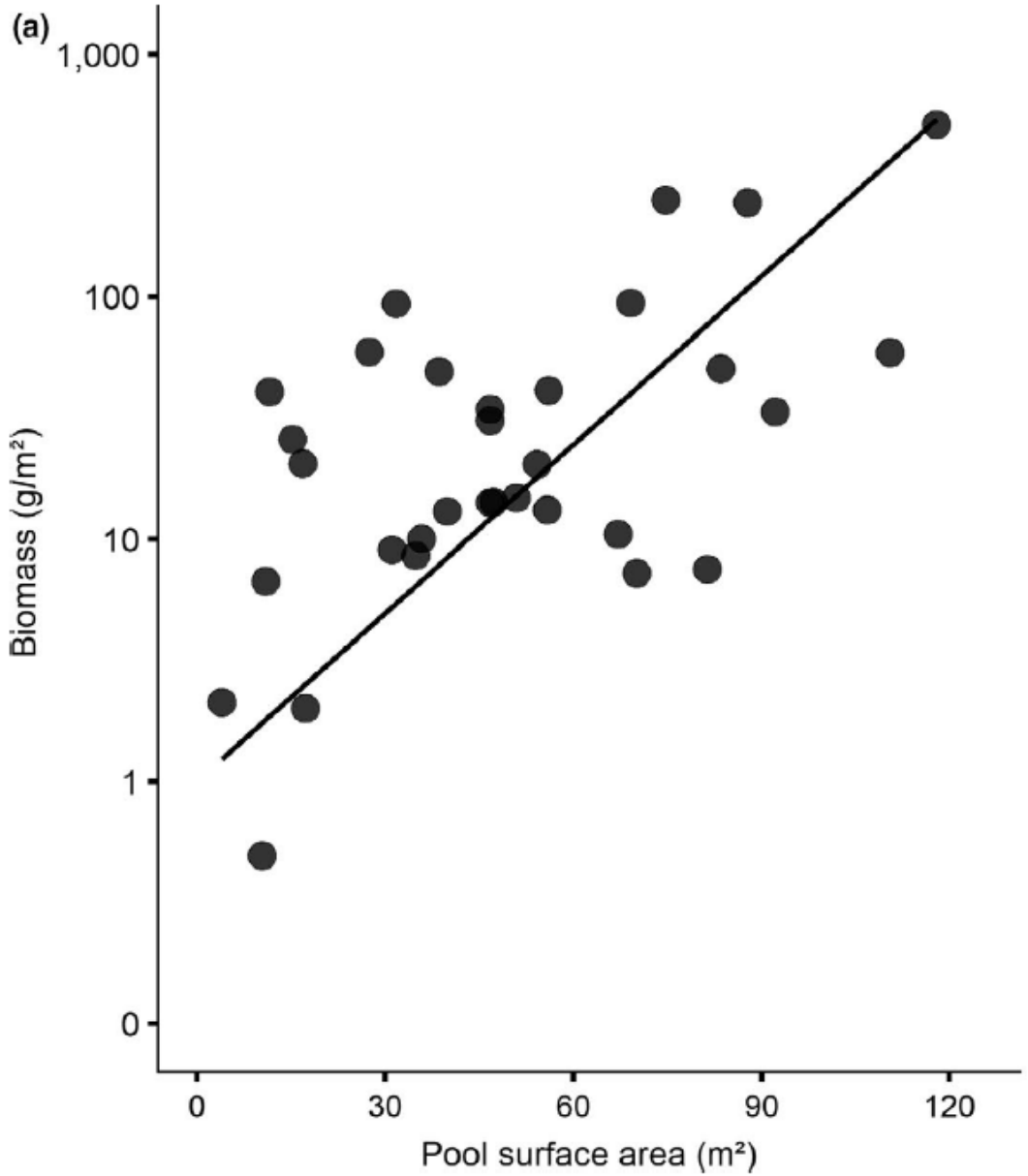
Emergence abundance and biomass will **increase** as pool conditions become harsher through **drying** and **increased temperatures**

?

Emergence biomass will be positively correlated with **pool surface area**

Emergence biomass will be negatively correlated with **fish biomass**

Fish biomass was positively correlated with pool surface area

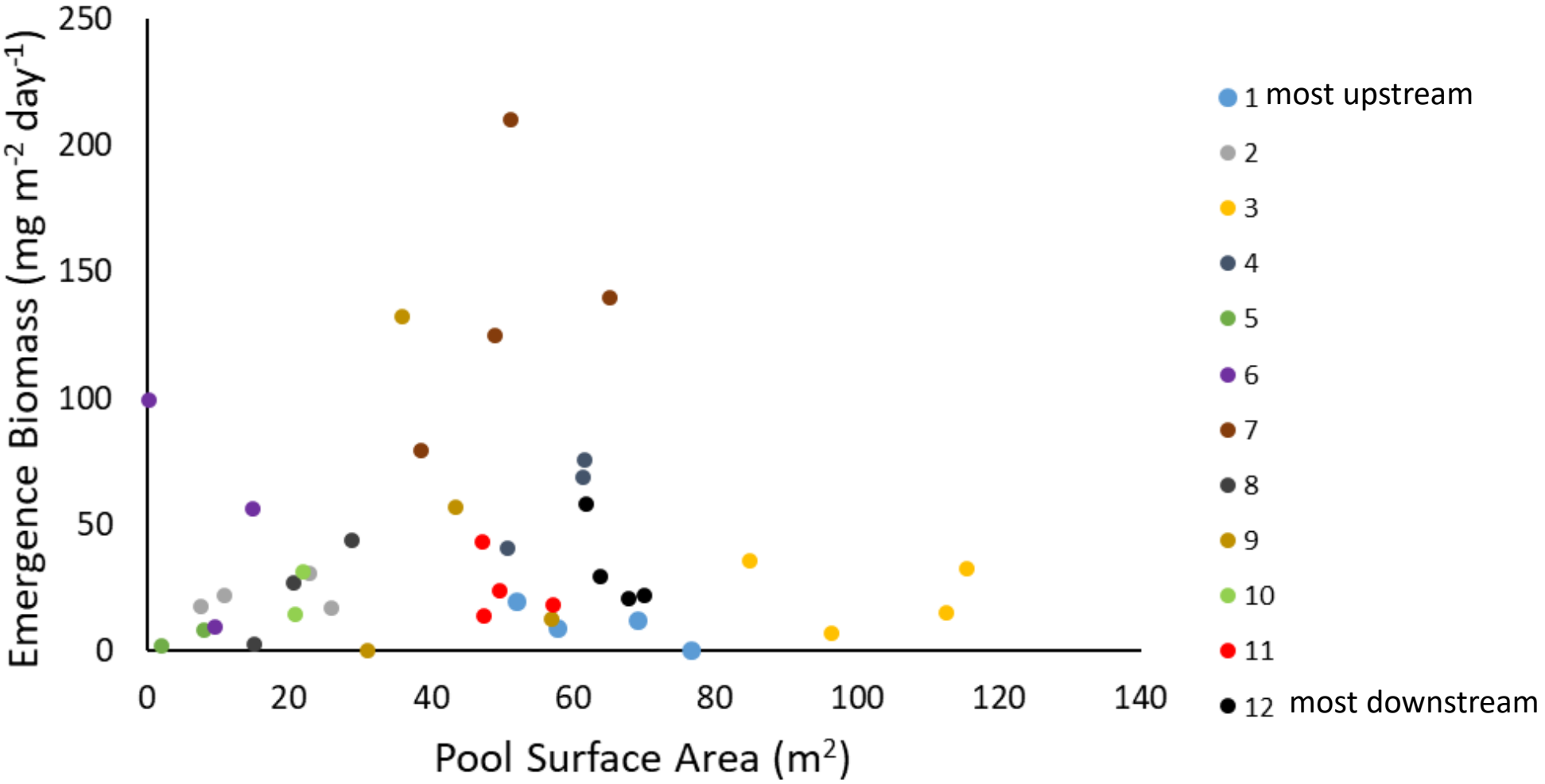


$R^2 = 0.85$

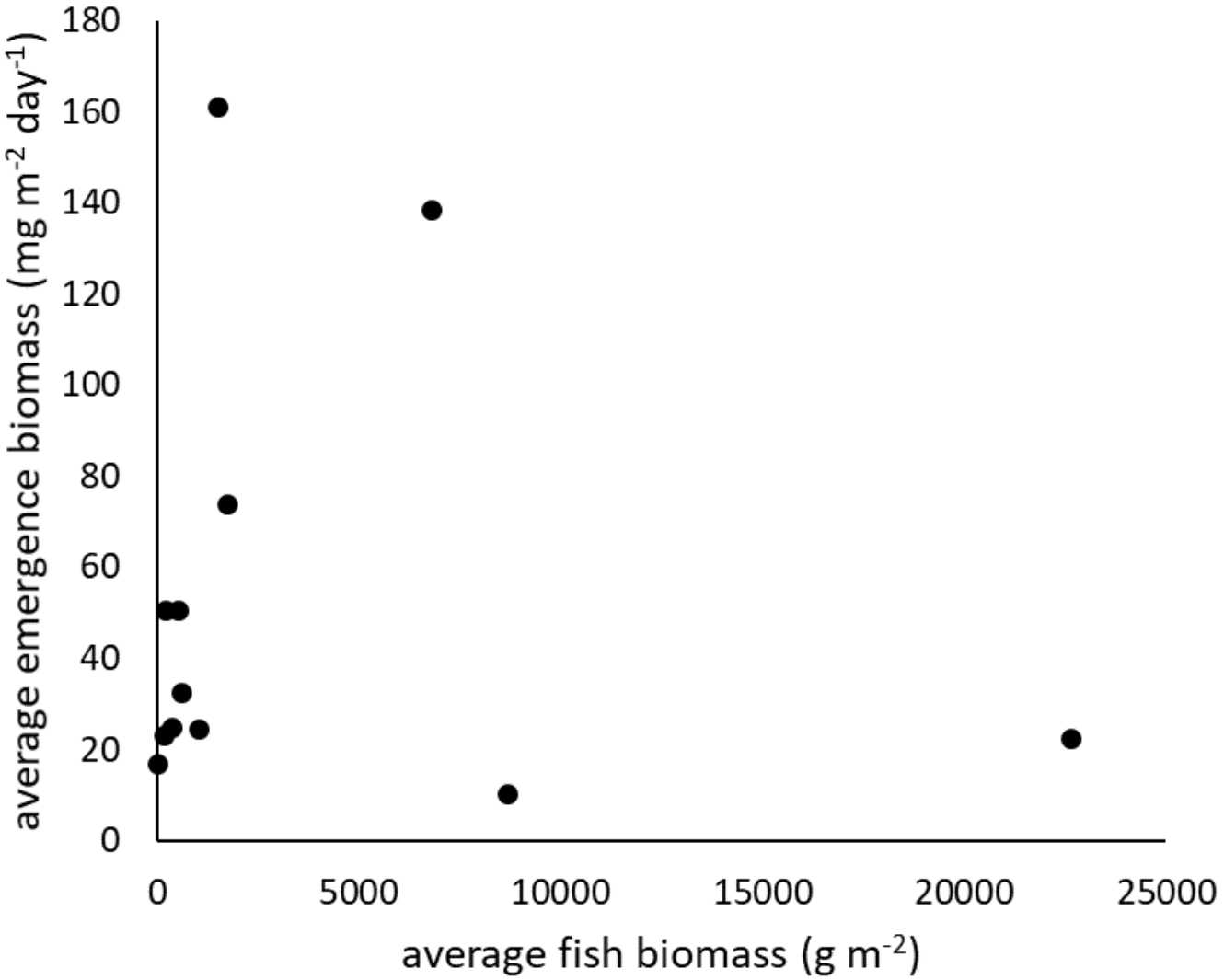
$p = 0.002$

Hopper et al. 2019

No correlation between surface area and emergence biomass



No correlation between fish biomass and emergence biomass



Hypotheses

Emergence abundance and biomass will **increase** as pool conditions become harsher through **drying** and **increased temperatures** ?

Emergence biomass will be positively correlated with **pool surface area** ✗

Emergence biomass will be negatively correlated with **fish biomass** ✗

Results in context

- Highest emergence biomass of any study at Konza (28 – 60 mg m^{-2} day^{-1})
  - 2-3X higher than Gray 1987 (20.3 mg m^{-2} day^{-1})
  - 4-8X higher than permanent pools in Bonjour et al. 2020 (8.94 mg m^{-2} day^{-1})
- Pools become emergence subsidy hot spots during drought
- Results suggest that taxa are resistant to drying conditions

Next steps

- Multiple regression model to determine how combinations of factors influence emergence
- Process benthic invertebrate samples
- Quantify the importance of fish vs invertebrate predators in predicting emergence abundance and biomass
- Return to Konza summer 2020 to resample during non-drought conditions

Questions