Abundance and Diversity of Terrestrial Gastropods in Nature Preserves of Southern Illinois

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Introduction

- Terrestrial gastropods are an often-overlooked component of many habitats, but they are vulnerable to anthropogenic disturbance (like climate change and urbanization) due to their limited dispersal ability, small size, and lack of migratory behavior (Douglas et al., 2013; Gheoca et al., 2021). Ecological studies of land snails can be challenging, due to differing microhabitat requirements among species, patchy distributions, and the impact of several environmental factors at small spatial scales (Nicolai et al., 2017).
- Determining the level of sampling required to obtain accurate estimates of land snail abundance and species richness, and assessing the repeatability of these estimates over time, will be crucial for future monitoring of the impact of environmental changes on these important bioindicators (Douglas et al., 2013; Gheoca et al., 2021; Hodges & McKinney, 2018; Hotopp, 2002).
- A previous study of seven natural areas in Carbondale, Illinois conducted in 2017 provides a baseline estimate of land snail diversity and abundance. For the present study, I employed a more intensive sampling approach, including repeated sampling throughout the year and more sampling at each site, to determine:

1. the repeatability of land snail sampling studies
2. **the adequacy of repeated sampling across two seasons for assessing land snail diversity and abundance**
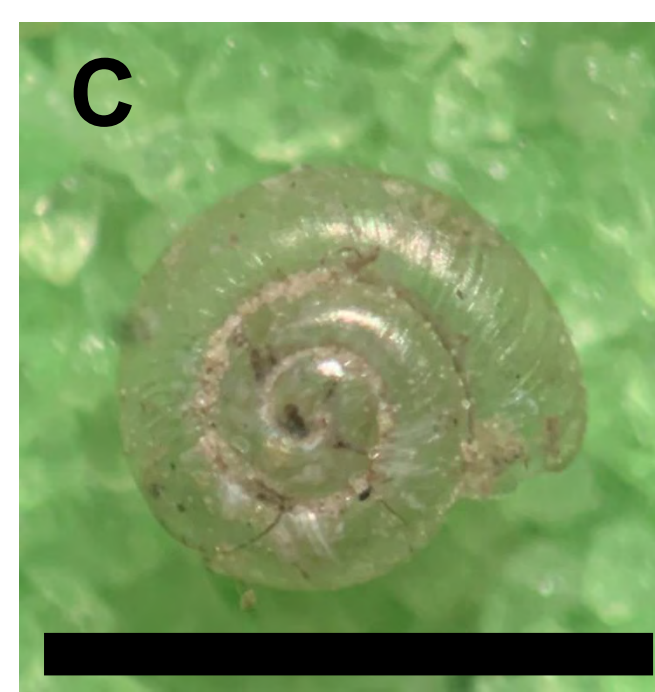3. **long-term changes or lack of changes in urban land snail communities.**

Figure 1. **A.** *Xolotrema fosteri* (shell diameter ~15 mm), **B.** *Carychium exiguum* (shell diameter ~3 mm), **C.** *Hawaiia miniscula* (shell diameter ~1.5 mm). Scale bar represents 2 mm.

Previous Study

A previous study was conducted in 2017 by Arianna Szubryt, Dr. Frank Anderson, and colleagues on the diversity and abundance of terrestrial gastropods at the seven sites sampled in this study. The data from this previous study is shown in **Table 1** below.

Species found…
- *Aplexa elongata*
- *Gastrocopta armifera*
- *Mesodon inflectus*
- *Mesodon thyroidus*
- *Mesomphix vulgatus*
- *Retinella electrina*
- *Retinella indentata*
- *Stenotrema hirsutum*
- *Striatura ferrea*
- *Strobilops aena*
- *Ventridens demissus*
- *Ventridens ligera*
- *Xolotrema fosteri*

Study Sites	Size (acres)	Average Elevation (m)	Macrosnails (>5 mm shell diameter)	Microsnails (<5 mm shell diameter)
Chautauqua Bottoms	37	124.9	8	61
Oakland	20	124.1	9	117
Pyles Fork	124	118	2	15
Brush Hill	20	150.6	17	42
Fernlands	20	145.9	16	34
William Marberry Arboretum	25	147	9	23
Thompson Woods	5	136.4	38	8

Table 1. Abundances of land snails from the pilot study.

Methods

Study Areas
Chautauqua Bottoms
Oakland
Pyles Fork
Brush Hill
Fernlands
William Marberry Arboretum
Thompson Woods

Habitat Types
Hardwood bottomland and upland, wetland, prairie
Wooded and prairie areas
Hardwood bottomland, wetland and watershed areas
Upland and lowland forests
Low-lying forest, moist habitat
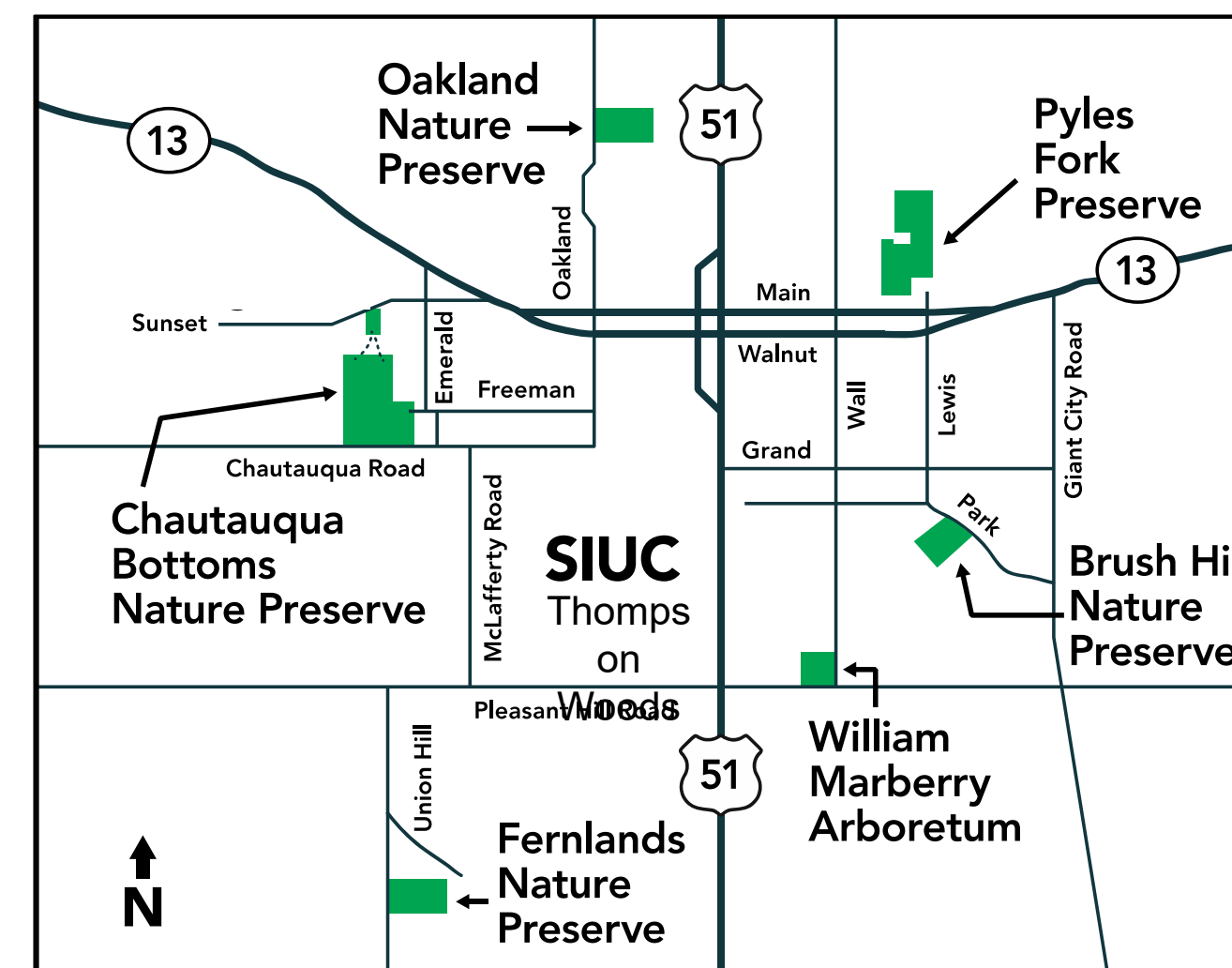Small wooded areas with grassy picnic areas
Historic upland oak forest

Figure 2. Map of sampling sites (Green Earth Trails, 2014).

Figure 3. Collections in 1-meter quadrat.

Field Sampling
- 5 ten-minute timed searches in a 1-meter quadrat per site
- 1-L leaf litter and soil sample was collected from each site
- Other data collected:
  - GPS coordinates
  - Elevation
  - Time and Date
  - Weather and Temperature

Laboratory Work
- Soil samples were dried for 24-48 hours
- Leaf litter and soil samples were passed through sieves (5-, 3-, 2-, and 1-mm)
- Sieved soil was searched under a dissecting microscope for microsnails
- Snails were identified using dichotomous keys and species descriptions

Results

Study Sites	Collection 1		Collection 2		Collection 3	
	Macro	Micro	Macro	Micro	Macro	Micro
Chautauqua Bottoms	6	12	10	2	20	1
Oakland	2	14	6	3	9	0
Pyles Fork	6	4	6	4	0	2
Brush Hill	3	7	4	0	4	1
Fernlands	19	26	9	2	9	2
William Marberry Arboretum	0	2	0	1	1	1
Thompson Woods	14	10	16	4	8	2
Totals	50	75	51	16	51	9

Table 2. Abundances of land snails from current sampling.

Study Sites	Previous Study	Collection #1	Collection #2	Collection #3
Chautauqua Bottoms	4	6	10	20
Oakland	4.5	2	6	9
Pyles Fork	1	6	6	0
Brush Hill	8.5	3	4	4
Fernlands	8	19	9	9
William Marberry Arboretum	4.5	0	0	1
Thompson Woods	19	14	16	8

Table 3. Snail per liter calculations for previous study and current study.

Discussion

Comparing Abundances:

Previous Study vs. Current Study:
If we single out each collection from this study and compare it to the previous study, the numbers are very different, and this could be due to several different factors:
- It is challenging to assess diversity and relative abundances due to patchiness or seasonality
- Pilot study had multiple people searching, one per quadrat; One person searching each quadrat in this study
- Urbanization, climate changes, and disturbance

Macrosnails:
- First fall sample compared to previous study is similar
  - Collected during same months and weather
- Second Fall sample and spring sample show similar results

Microsnails:
- 300 for one collection versus 100 for three collections
- Microsnails are often considered more important bioindicators because of their increased susceptibility to disturbance

Future Research

Species identifications are currently underway and once identified, we can begin to make more comparisons with the pilot study. Using the abundance and species comparisons we can begin to analyze the following questions:
1. the repeatability of land snail sampling studies
2. the adequacy of repeated sampling across two seasons for assessing land snail diversity and abundance
3. long-term changes or lack of changes in urban land snail communities.

To answer these questions, we can look at different factors such as:
- Species accumulation curve
- Season variability (Fall vs. Spring)
- Site habitat and disturbance variability
- Soil components and types

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Charlotte Brontë, *Jane Eyre*, and the Role of Women in Nineteenth-Century Society

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Abstract

Jane Eyre is an 1847 novel written by Charlotte Brontë that it's considered an early feminist text. My research focused on the portrayal of social roles in the novel, specifically the ones expected to be fulfilled by women, which were tightly intertwined with religious beliefs. My paper responds to the following question: **How did Brontë explore the intersection between religion and gender roles in Jane Eyre, and why is this intersection still significant in the present?**
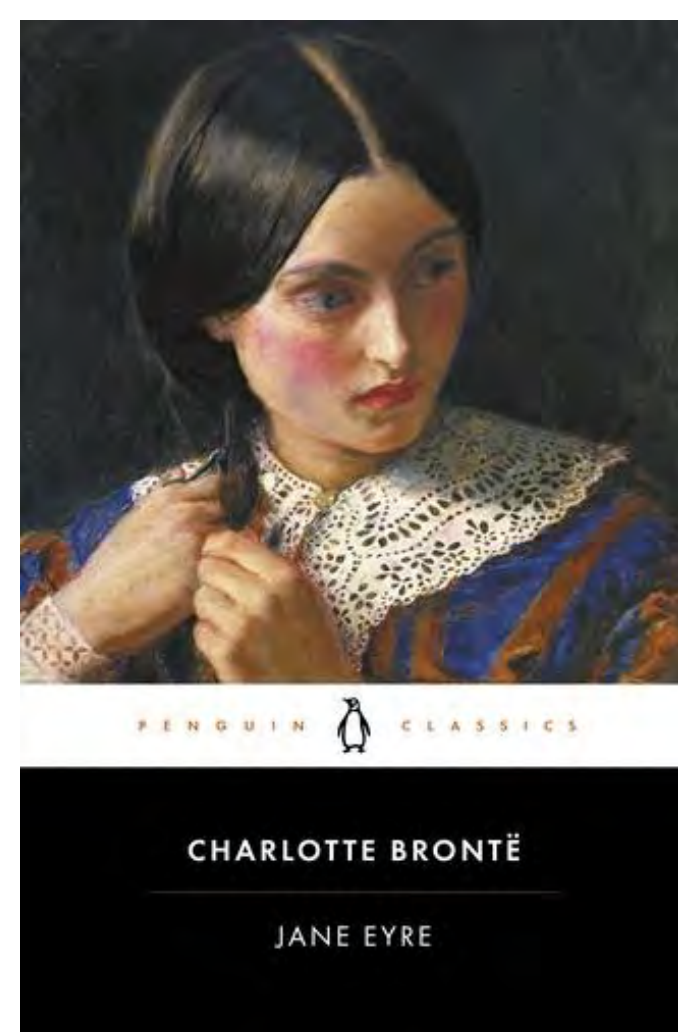
Methodology

Use of **Feminist Literary Theory** and **New Historicism**. The analysis focused on how Brontë reflects religious beliefs and the limitations these imposed on women in the Victorian era in the novel.
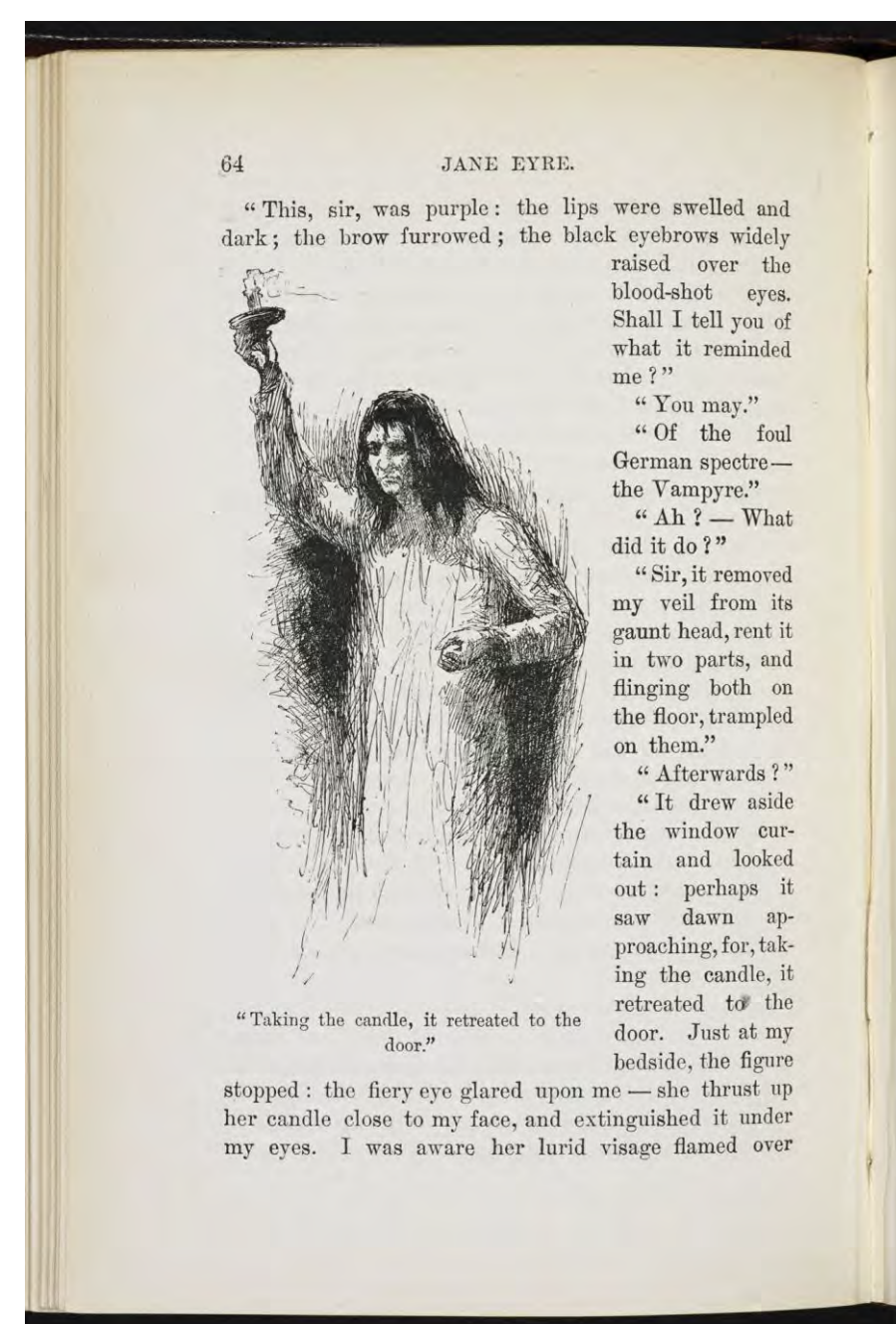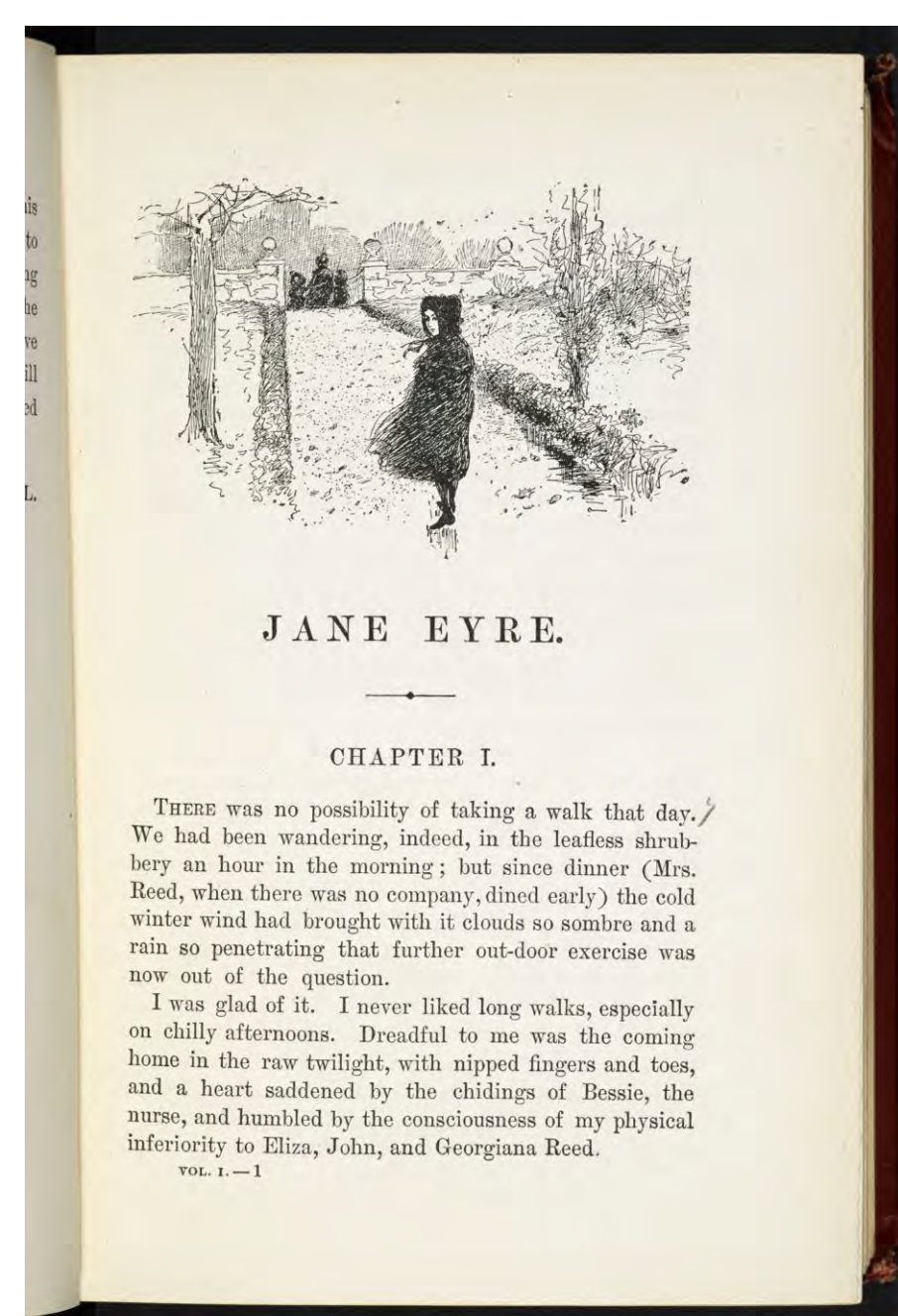
Analysis

o There are various elements in *Jane Eyre* that mirror Charlotte's life and experiences, the most notable being the portrayal of Jane's early experience in Lowood School with Charlotte and her sisters, the fact that Jane's mother was from a wealthy family and was later disinherited for marrying a clergyman, the experience of both when being a governess, and falling in love with someone she wouldn't be allowed to marry for social reasons (Ramos ch. 2)

"I care for myself. The more solitary, the more friendless, the more unsustained I am, the more I will respect myself" (Brontë 284).

o Not only the main character raises questions about the patriarchal system of Victorian England: but secondary characters such as Bertha Mason, Helen Burns, Miss Temple, and even the Rivers sisters also resist in various ways (Griesinger).

"She took my veil from its place; she held it up, gazed at it long, and then she threw it over her own head, and turned to the mirror. At that moment I saw the reflection of the visage and features quite distinctly in the dark oblong glass" (Brontë 254).

o Gilbert and Gubar's chapter of *The Woman in the Attic* dedicated to *Jane Eyre* explains Bertha's existence in the novel as "the Other," as Jane's evil *doppelgänger* who stepped out of the mirror to let free all of Jane's inner frustrations and her rage against the oppressive society she lives in (359).

o In the criticism focused on Jane's relationships with Mr. Rochester and St. John, there seems to be a general agreement that both men have a common desire to control and "tame" the protagonist, with each man using different strategies to appeal to God and moral duties (Lamonaca 249).

Conclusion

o Brontë sharply critiques religion, gender, and social norms.
o Charlotte Brontë wrote a fairytale-like ending on purpose to prevent censorship and/or backlash.
o *Jane Eyre* still is and will continue to be a key text for Feminist Literature since it represents a shift in literature written by and about women and portrays situations and stigmas that still happen today.

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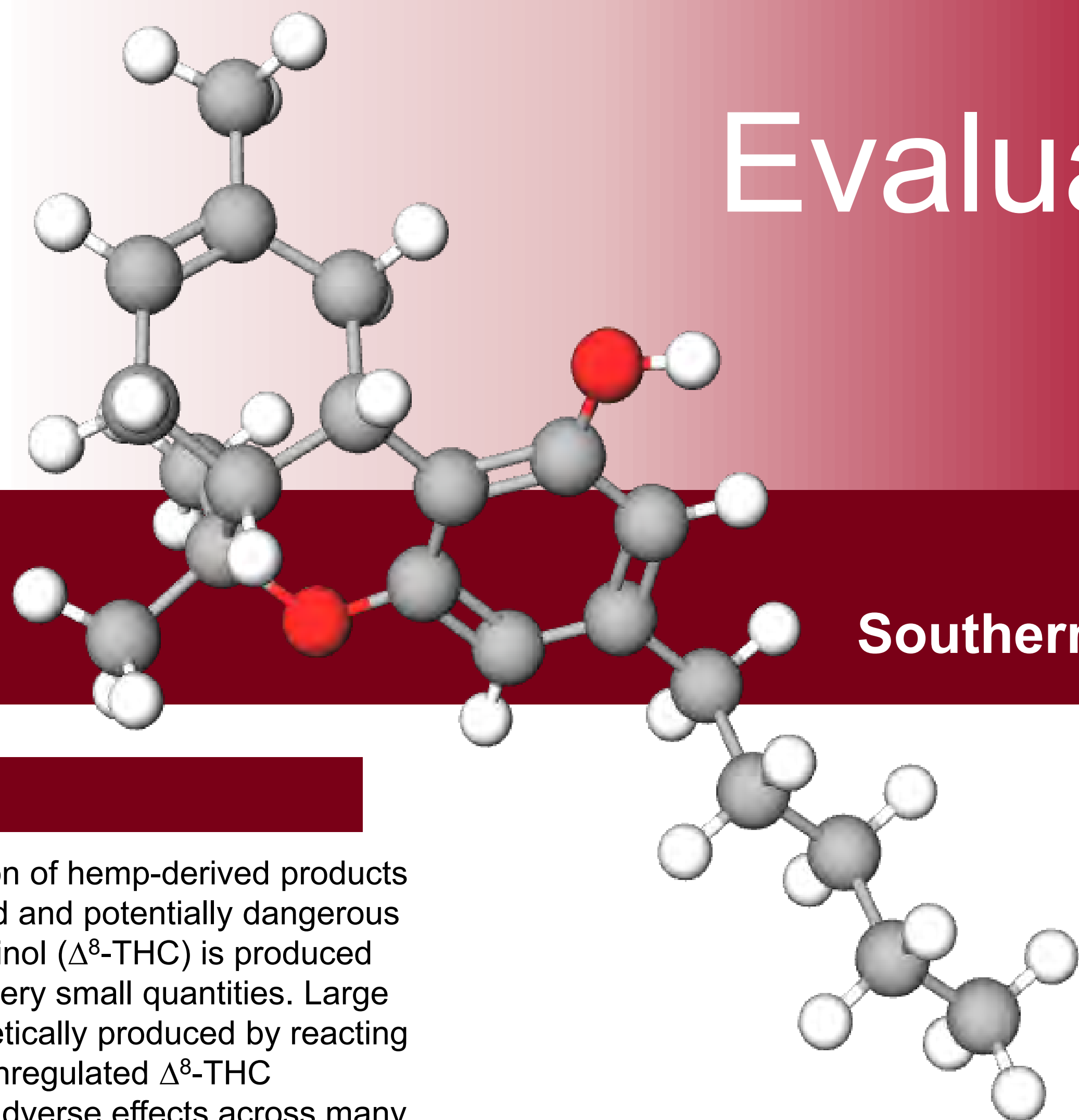
Evaluation of Content versus Label Claims of Δ^8-THC Consumer Products

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ABSTRACT

A legal loophole in the regulation of hemp-derived products exposes consumers to untested and potentially dangerous products. Δ^8-Tetrahydrocannabinol (Δ^8-THC) is produced naturally by the hemp plant in very small quantities. Large quantities of Δ^8-THC are synthetically produced by reacting Cannabidiol with acid. These unregulated Δ^8-THC containing products have had adverse effects across many states. Δ^8-THC containing consumer products (i.e., vapes, gummies, pre-rolled cones, powders, and oils) were purchased legally from area stores. Liquid chromatography with UV-visible and mass spectrometric detection was used to separate and quantitatively detect the Δ^8-THC from any other cannabinoids/ reagents. This poster compares these preliminary results to the products' labels and discusses any under or over reported values.
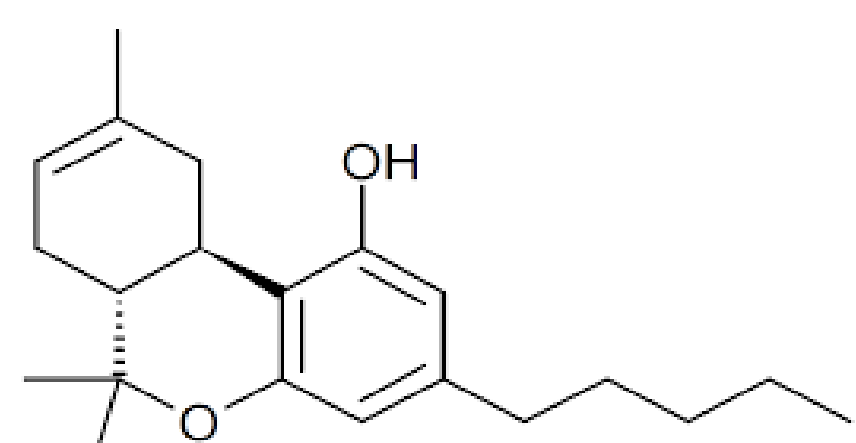
Δ^8- Tetrahydrocannabinol (Δ^8-THC)

INTRODUCTION

The passage of the Agriculture Improvement Act of 2018 (AKA, the '2018 Farm Bill') defined 'hemp' as *Cannabis sativa L.* cultivars having <0.3% Δ^9-Tetrahydrocannabinol (Δ^9-THC) by dry weight; thus, removing hemp and hemp-derived products from the U.S. Drug Enforcement Administration list of controlled substances. Several states quickly adopted their own approaches to grant licenses to grow hemp and use it in the manufacture of hemp-derived products. Hemp-derived products containing Cannabidiol (CBD) quickly flooded the marketplace and could be readily purchased at supermarkets, convenience stores, farmers markets, and online.

Tetrahydrocannabinol (THC)

Cannabidiol (CBD)
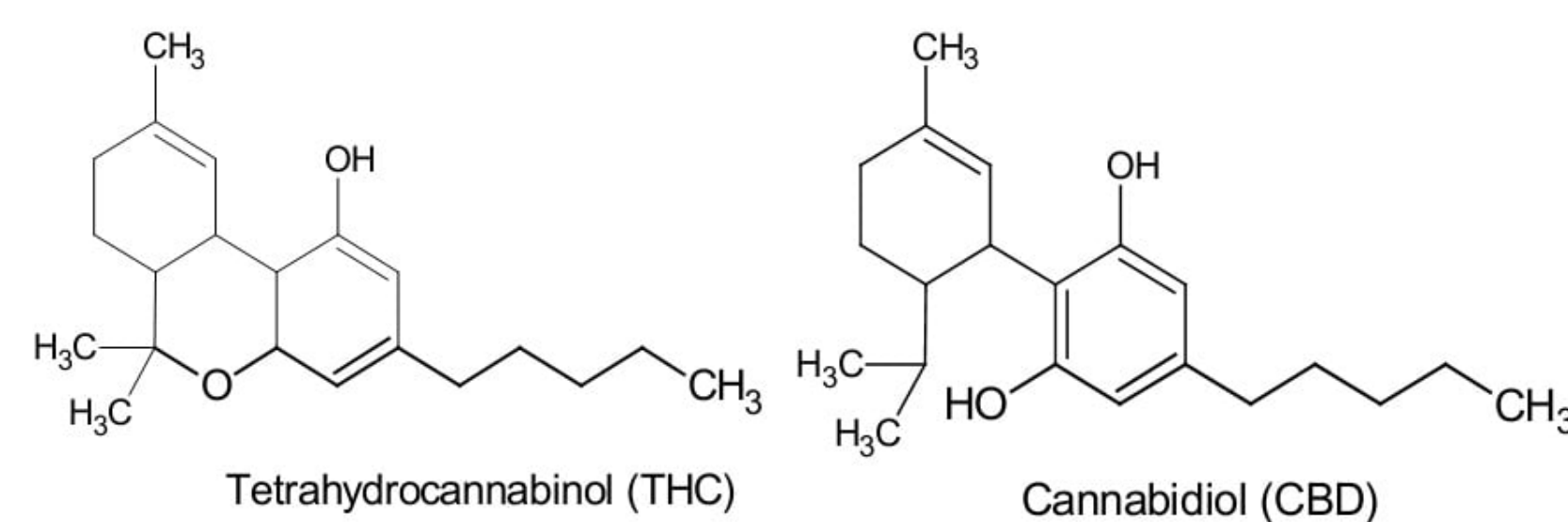
The 2018 Farm Bill that made hemp legal failed to address that there are other stereoisomers of Δ^9-THC that hemp plants produce – though in smaller quantities like Δ^8-THC. Δ^8-THC is also psychoactive and not regulated like Δ^9-THC.

This legal loophole has created a booming market for Δ^8-THC containing products. Hemp cultivars have been identified that produce higher quantities of Δ^8-THC though much Δ^8-THC on the market is produced synthetically by reacting CBD with acid (Jeong, 165-176). Δ^8-THC containing products may be purchased by individuals under the age of 21 years in those states that have not yet regulated its sale. The Food & Drug Administration (FDA) recently issued a consumer advisory on the serious health risks of consuming Δ^8-THC (5 Things, 1-5). In addition, numerous news outlets in Illinois have reported several adverse events where minors were sickened by consumption of Δ^8-THC containing products readily purchased near their public schools (McCoppin).

The majority of the Δ^8-THC consumer products used in this study were purchased in Jackson and Williamson Counties located in Southern Illinois. Gummy B was donated for testing and was originally purchased in Rockford, Illinois. These products were analyzed, and preliminary results are reported.

MATERIALS & METHODS

Standards

CBD, Δ^8- THC, and Δ^9-THC standard solutions were prepared using certified reference materials purchased from Cayman Chemicals. A 1000 µg/mL stock solution was prepared containing all three cannabinoids. It was then serially diluted to generate a series of standard solutions in the concentration range of 0.625 to 100 µg/mL. Standard solutions were divided into 1-mL aliquots and stored at -20°C until needed for analysis.

Samples

All consumer products were prepared and diluted guided by their individual COA to a concentration between .625 µg /mL and 100 µg /mL using HPLC grade methanol. The products containing biomaterial were ground, sieved, extracted using methanol, filtered, and diluted. The gummies were first dissolved in water and then diluted further with methanol.

Analysis methods

A Shimadzu LCMS-2020 system with a UV-visible diode array detector and mass spectrometer was used for this study. The separation was performed using a Cortecs Shield RP18 column (2.7µm particles, 2.1mm × 150 mm), and the column temperature was kept at 45ºC. The isocratic separation (40% Mobile phase A (0.1% Formic Acid in water); 60% Mobile phase B (0.1% Formic acid in acetonitrile) took 35 minutes. The flow rate was 0.2 mL/min, and the injection volume was 10 µL. The detection wavelength was 230 nm.

Calibration

Calibration curves plotted for each standard were accepted with correlation coefficients R^2 of 0.999 or better. The limit of detection (LOD) and limit of quantification (LOQ) were obtained for each individual standard and defined as 3.3 (uncertainty of intercept/slope) and 10 (uncertainty of intercept/slope), respectively.

RESULTS & DISCUSSION

The Δ^8-THC consumer products analyzed included the fluid from four vape cartridges, two pre-rolled cones containing hemp flower, two edible gummies, an oil, and a powder.

Sample Name	Product Type	CBD claim wt%	CBD wt%	Δ^9-THC claim wt%	Δ^9-THC wt%	Δ^8- THC claim wt%	Δ^8- THC wt%
Vape A	Fluid	<LOD	ND	<LOD	8.290 +/- 0.686	77.441	69.240 +/- 0.517
Vape B	Fluid	<LOD	ND	<LOD	<LOD	92.71	78.681 +/- 0.135
Vape C	Fluid	<LOD	ND	<LOD	ND	91.3	86.848 +/- 7.237
Vape D	Fluid	<LOD	ND	<LOD	ND	83.25	67.355 +/- 0.820
Pre- Roll A	Flower	0.192	<LOD	<LOD	ND	33.93	<LOD
Pre- Roll B	Flower	0.595	2.640 +/- 0.013	<LOD	<LOQ	6.406	5.747 +/- 0.220
Gummy A	Edible	0.016	ND	0.2315	<LOD	0.0279	<LOD
Gummy B	Edible	<LOD	ND	0.0304	<LOD	1.5365	<LOQ
Oil	Oil	5.348	5.402 +/- 0.004	<LOD	<LOD	4.988	4.738 +/- 0.016
Powder	Powder	10.127	10.878 +/- 0.011	0.218	<LOD	<LOD	<LOD

ND – Not Detected; LOD/LOQ: CBD 0.294/0.891, Δ^9-THC 0.246/0.747, Δ^8-THC 0.426/1.351

The FDA requires consumer products under their regulation to contain +/-10% of the claimed amount on the product label. Analysis of the ten currently unregulated consumer products revealed only three consumer products met this criteria – Vape C, the oil, and the powder. Vape A contained +/-10% of the stated Δ^8-THC; however, it also contained Δ^9-THC, which was not reported on the label. Pre-roll B met the labeling requirement for Δ^8-THC but over reported the CBD. Vapes B and D and Gummies A and B all contained less than the label claims. One challenge encountered in this study which will be addressed in future analyses is the limits of detection and quantification. Both need to be lowered to measure the tiny amounts reported on several consumer products.

CONCLUSIONS

Preliminary results suggest that Δ^8-THC consumer product labeling has much room for improvement. Several consumer products in this survey had unreported as well as over reported cannabinoid components. Consumers trust that product labels are accurate, and mislabeling can lead to adverse events ***including death*** if customers unknowingly consume more cannabinoids than intended or if products are sold to and consumed by minors.

ACKNOWLEDGMENTS

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Effect of a Novel Piezo1 Mechanosensitive Channel Modulator: Calcium Imaging

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Introduction

The Piezo1 mechanosensitive ion channel plays a crucial role in various essential physiological processes, such as respiration, urination, and blood pressure regulation[1]. Currently, there are no safe inhibitors of Piezo1 channels approved for human use[2]. **This study aims to identify a Novel Modulator of Piezo1 (NMP) by repurposing an existing drug known to affect other ion channels.** We conducted Ca^{2+} imaging on HEK293T cells that stably overexpress Piezo1 channels with a red fluorescent protein marker at amino acid residue 1591 using the Cal520 dye on a confocal microscope. During the experiment, we observed the Ca^{2+} influx over a 200-second period with the following treatments: NMP, Yoda1 (a Piezo1 activator), and Yoda1 followed by an additional NMP application. The results demonstrated a significant decrease in Ca^{2+} influx when NMP was introduced to channels previously treated with Yoda1. This suggests that NMP could serve as a valuable research tool for inhibiting Piezo1 ion channels. Considering the administrable nature of NMP, it may offer a promising avenue for pharmacological research concerning Piezo1 malfunction mutations, providing potential insights and treatment strategies in this area.

Materials and Methods

Cell Culturing: HEK 293T-1591-hPiezo1-mcherry cells were cultured using DMEM supplemented with Sodium Bicarbonate, Fetal Bovine Serum, and Penicillin-Streptomycin solution. The cells were incubated at 37°C under a 5% CO_2. To ensure the expression of Piezo1, 2.8 µg/ml puromycin was employed to selectively eliminate cells that did not express the target protein.

Ca^{2+} Imaging: Cells were seeded onto poly-L-lysine coated coverslips in cell media and allowed to incubate for 24 hours. To conduct Ca^{2+} imaging, the cells were treated with 3 µM Cal-520AM dye (Abcam, MA) for 90 minutes at 37°C, followed by an additional 30 minutes at 37°C in Hank's balanced salt solution supplemented with 10 mM glucose and 25 mM HEPES. The imaging process was performed using a laser scanning confocal microscope (FV3000; Olympus, Tokyo, Japan) according to the manufacturer's guidelines. Three experimental groups (NMP, Yoda1, and Yoda1 + NMP) were utilized by using the ALA-VM4 perfusion system to precisely deliver the chemicals to the cells. After obtaining the baseline fluorescent intensity (F_o) for 30 seconds of exposure to DMSO, the cells were subjected to 10 µM Yoda1 or 50 µM NMP, while recording the changes in fluorescence for all experimental groups. In the Yoda1 + NMP group, NMP was applied at 75s with Yoda1. Fluorescence intensity data were analyzed using ImageJ and normalized in each time using the baseline intensity.

Statistical Analysis: Data analysis was conducted using Graphpad Prism 9, employing One-way ANOVA to compare the results among the three groups. Statistical significance was denoted as * $p<0.05$, ** $p<0.01$, and *** $P<0.001$.

Results

Calcium imaging on Piezo1 expressed cells
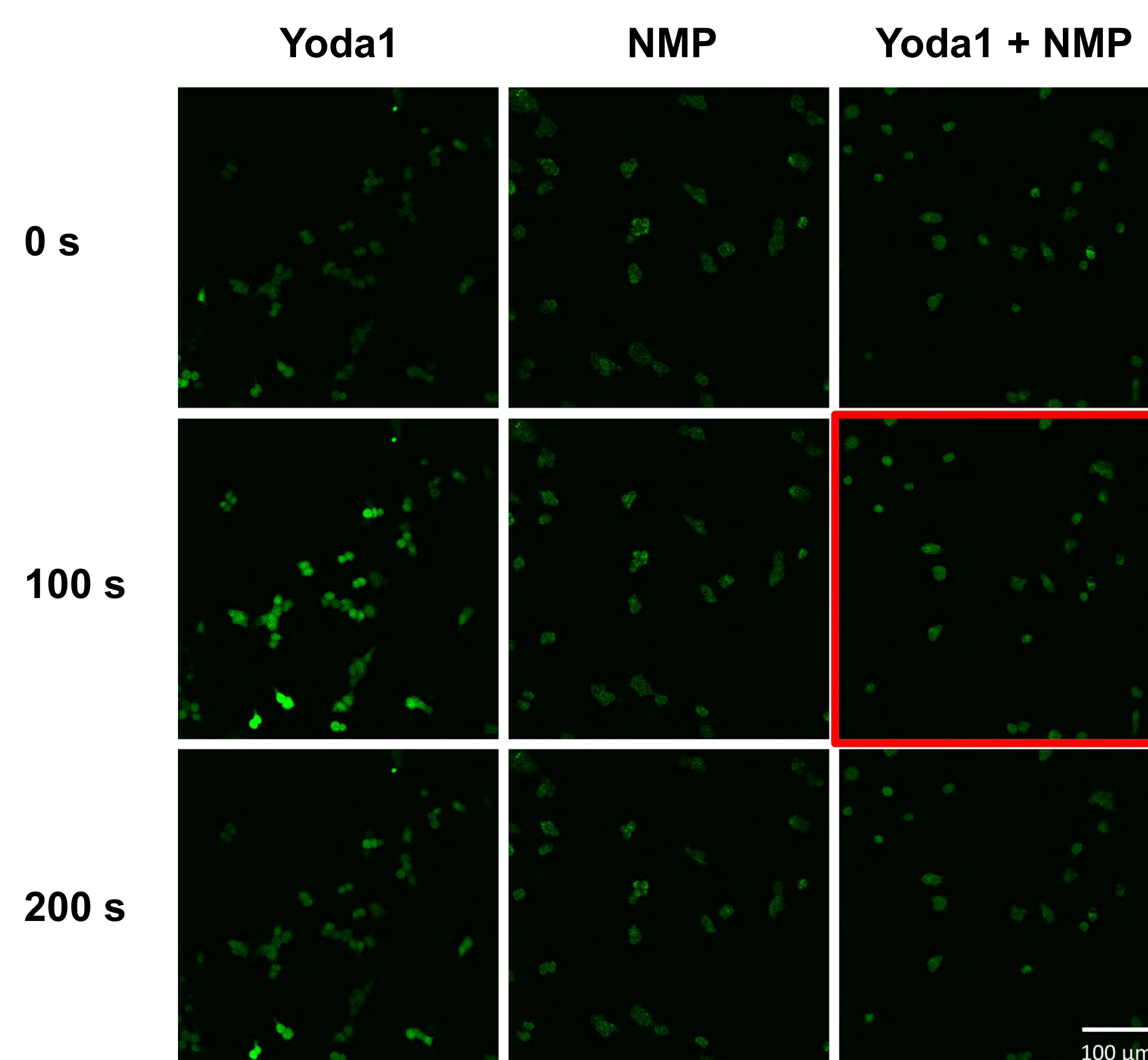
Figure 1. Representative images of Ca^{2+} imaging.
To see the effects of NMP on the Ca^{2+} influx of Piezo1-overexpressed cells, Cal520 dye was used. (red box) At 100s, NMP significantly decreased fluorescent intensity that was pretreated by Yoda1.

Summary & Conclusions

In this study, we investigated the impact of a newly discovered modulator of the Piezo1 ion channel, referred to as NMP, using Ca^{2+} imaging in Piezo1-CL1 cells with the Cal-520AM dye.
Our findings revealed the following observations:
- Yoda1, a well-known activator of the Piezo1 channel, led to an increase in fluorescent intensity.
- NMP alone did not cause any significant change in fluorescent intensity.
- When NMP was applied in conjunction with Yoda1, it effectively inhibited the Yoda1-induced increase in fluorescent intensity.

These results strongly suggest that NMP functions as an inhibitor of Ca2+ influx through the Piezo1 ion channel. Therefore, NMP holds great potential as a novel and valuable Piezo1 inhibitor, presenting itself as a valuable tool for research in the field of mechanobiology.
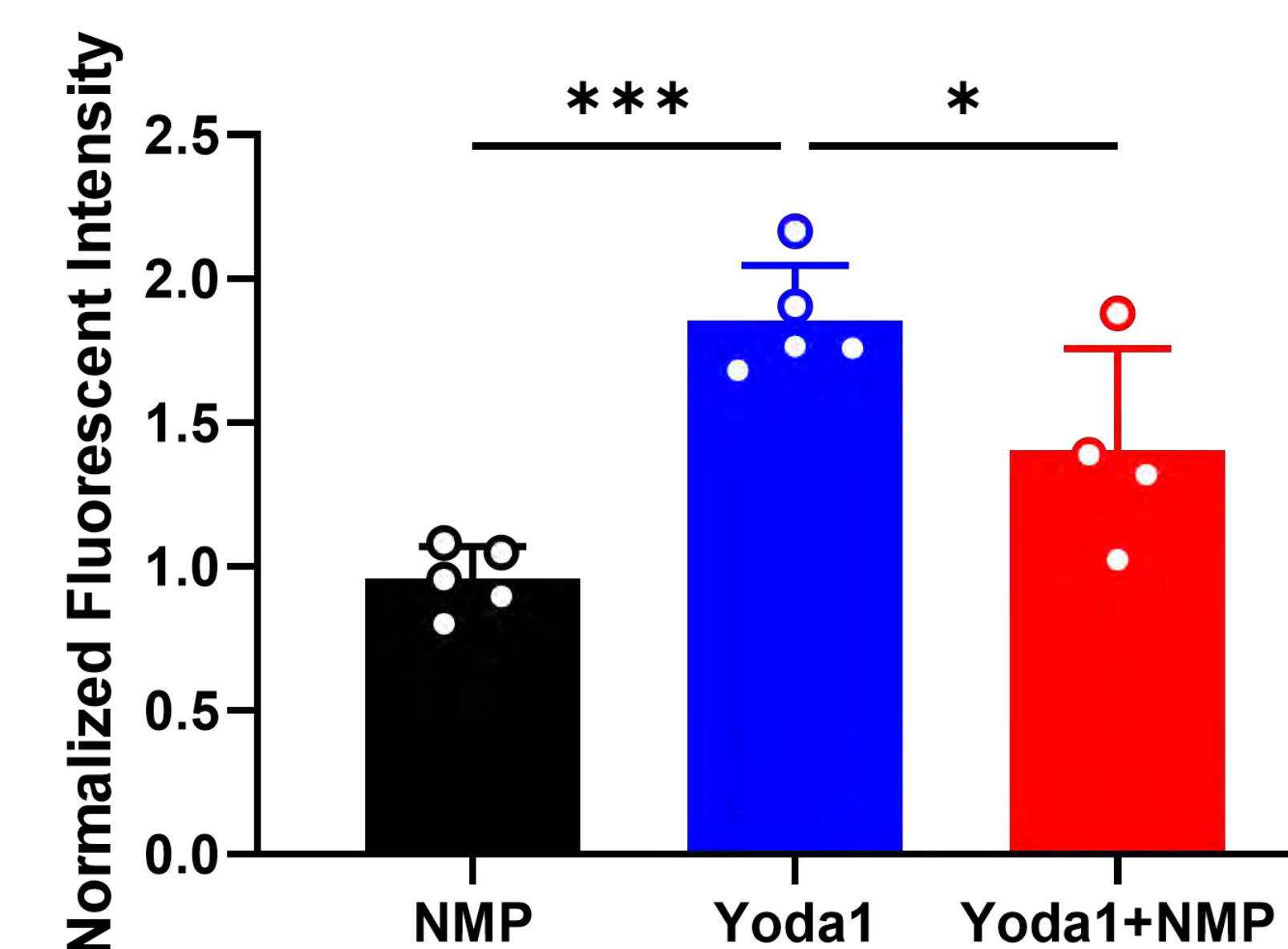
NMP decreased Yoda1-induced Ca^{2+} influx
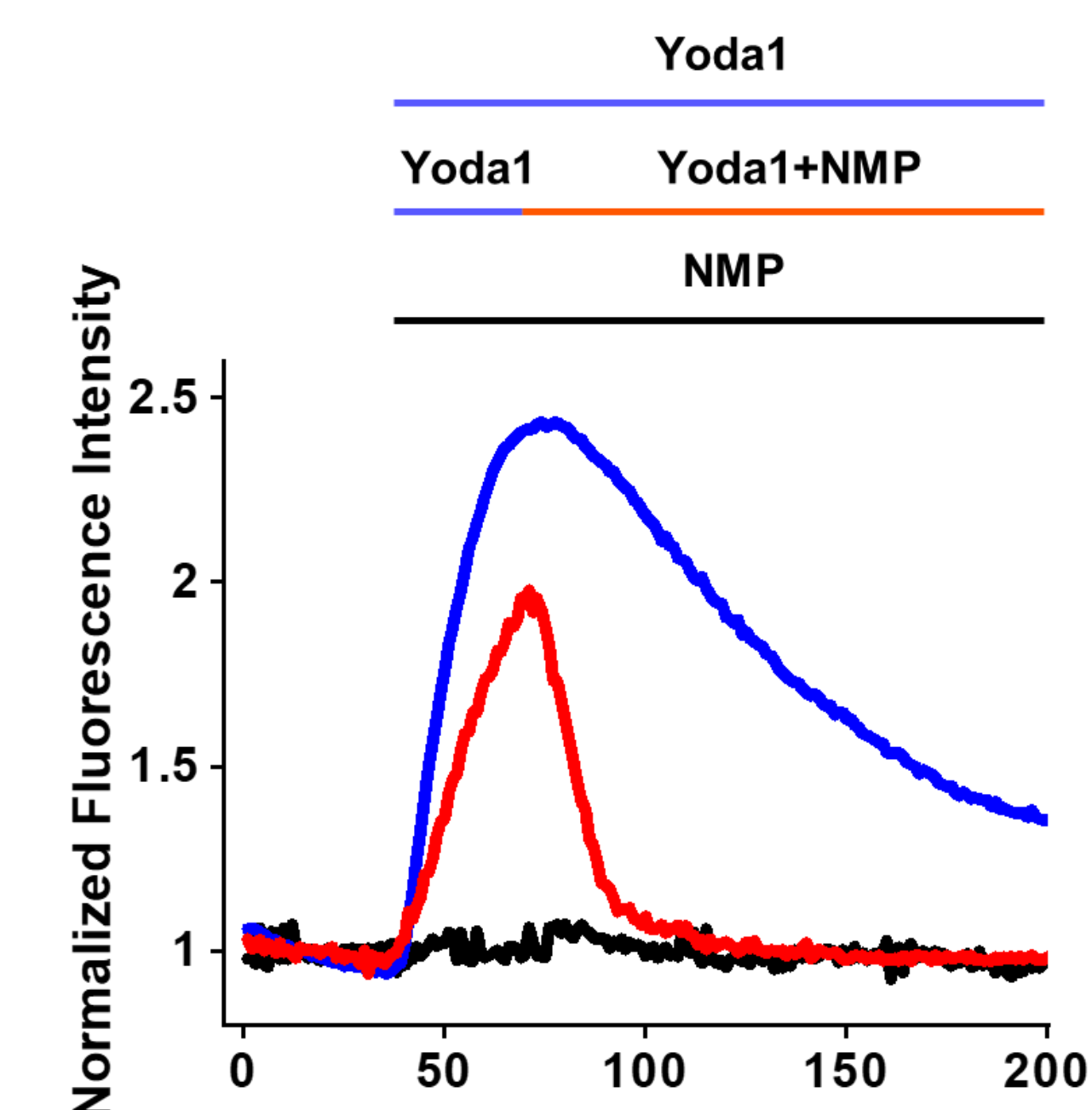
Figure 2. Time lapse fluorescence intensity changes.
At 30s, either Yoda1 or NMP was applied. At 75s, we introduced a combination of NMP and Yoda1 using a perfusion system. NMP effectively reduced the fluorescence intensity increase caused by Yoda1, while NMP alone did not alter the intensity.

NMP inhibited Piezo1 channel

Figure 3. Summary of calcium imaging experiments.
At 120 seconds in Figure 2, data were collected and normalized using the NMP group (n=5). Yoda1 significantly increased fluorescent intensity (p=0.002, n=5), which was significantly reduced by adding NMP (p=0.0327, n=4).

Acknowledgements

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It's Getting Hot in Here: An Investigation into the Environmental Plasticity of Larval Zebrafish (*Danio rerio*)

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Background

Climate Change and Ectotherms
Climate change has been occurring at a faster rate and to a higher degree than many animals can adapt to, and recent studies have investigated the effects of temperature increases in ectotherms and factors including:

- stress physiology   - sex determination   - behavior
- energetic cost   - mortality

To combat these negative thermal effects, studies are looking into using **environmental programming** to increase phenotypic plasticity.

Environmental Programming
Environmental programming is an event induced in early development that leads to an adaptation of the animal to similar events when encountered later in life.

For example, recent studies show that larval/juvenile fish, including zebrafish, exposed to dietary plant protein are likely to better utilize that feed source later in life, compared to groups that were not programmed (Kwasek et al. 2020, Geurden et al. 2013, Molinari et al. 2021).

Similarly, environmental programming could help sensitive organisms adapt to factors such as temperature changes.

Model Organism
This study will use **larval zebrafish** as a model for environmental plasticity of ectothermic organisms. Zebrafish are often used as a model species due to their fast generation time, juvenile plasticity, and fecundity (Avdesh, 2012; Brown, 2015). Previous studies have also indicated they are an accurate model for their wild counterparts and the effects of climate change (Morgan 2019).

Image 1. Zebrafish brood stock used in experiment

Methods

1. Zebrafish brood stock will be combined (male and female) into tanks and spawned the morning after combining.
2. At swim-up stage, 2-4dph (days-post hatch), the larvae will be evenly divided into two groups with 3 tanks each:
    - environmental control (EC)
    - environmental programming (EP)
3. The EP treatment will be intubated at 33*C, the EC will remain at 27*C.
4. After programming, all treatments will remain at 27*C for larval rearing.
5. At 30dph the EC and EP treatments will be spilt into 6 tanks each (12 total) to create the following groups: EC27, EC33, EP27, EP33 (3 replicates each)
6. EC33 and EP33 will undergo the environmental challenge at 33*C. EC27 and EP27 will remain at 27*C during the challenge.

Housing Conditions
Housing conditions for zebrafish will be based on previous studies and protocols for zebrafish husbandry (Table 1).

This temperature trial will be conducted in the Center for Fisheries, Aquaculture, and Aquatic Sciences at SIUC. All experiments will be carried out in strict accordance with the recommendations in the Guide for the Care and Use of Laboratory Animals of SIUC.

Table 1. Optimal Housing Conditions for Zebrafish

Optimal Housing Conditions for Zebrafish (*Danio rerio*)	
Temperature	26-28.5 °C
pH	6.8-7.5
Conductivity	300-1,500 µS
Dissolved Oxygen (O$_2$)	>6.0 mg/L

(Avdesh et al. 2012; Morgan et al. 2019)
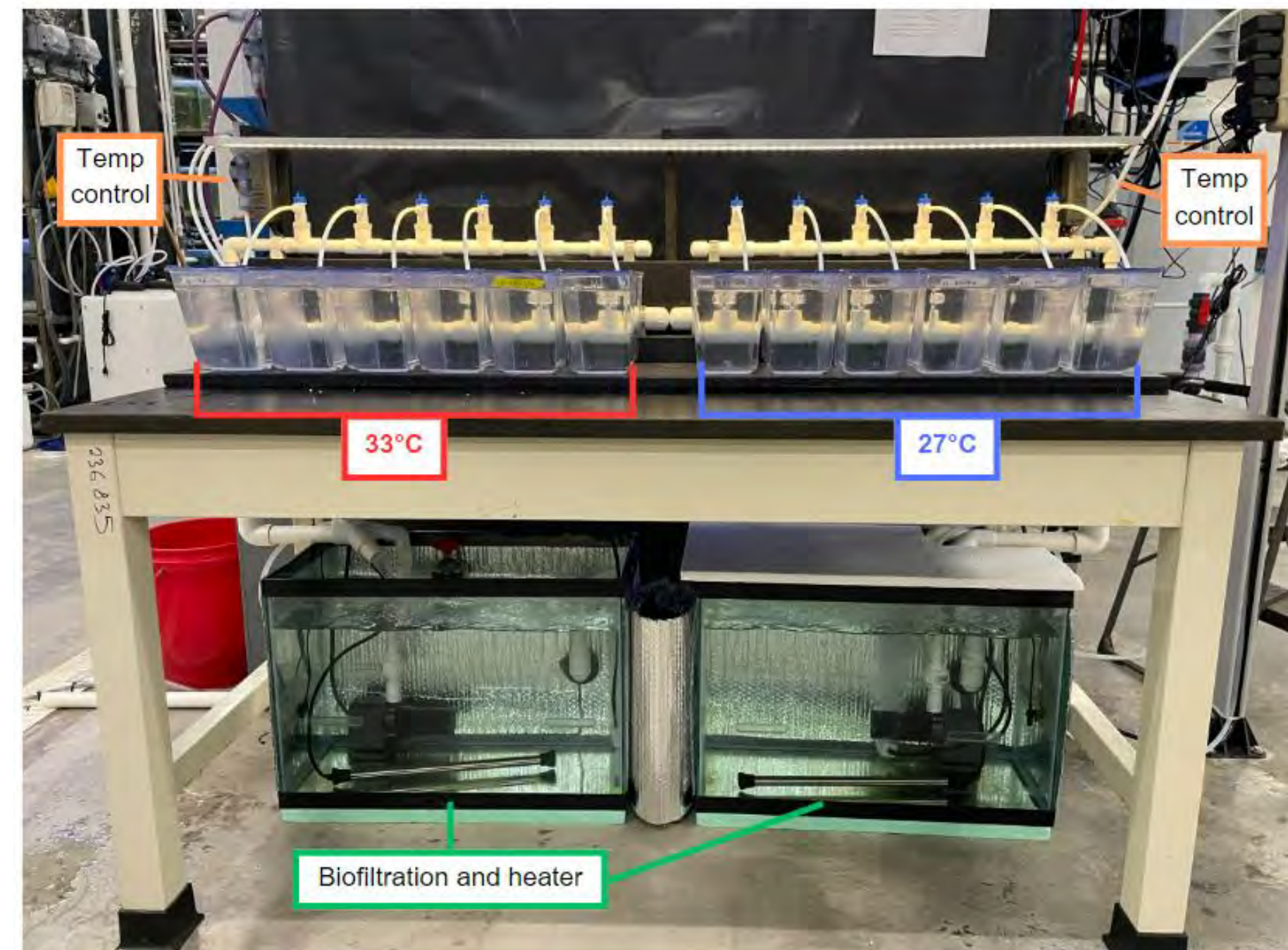
Experimental Setup

Image 2. Experimental Tank System

The above system (Image 2) will be used for this temperature trial. The system is divided into two sides with their own heater and temperature control, one side will house the EP treatment and the other the EC treatment. This will allow an accurate and gradual change of temperature during the environmental programming and challenge, while keeping the control treatment at 27*C.

Experimental Design

Environmental Programming at 3dph

- Environmental Programming (EP) Treatment: EP27 and EP33 will be incubated at 33*C for 24 hours.
- Environmental Control (EC) Treatment: EC27 and EC33 will remain at their optimal temperature of 27*C.
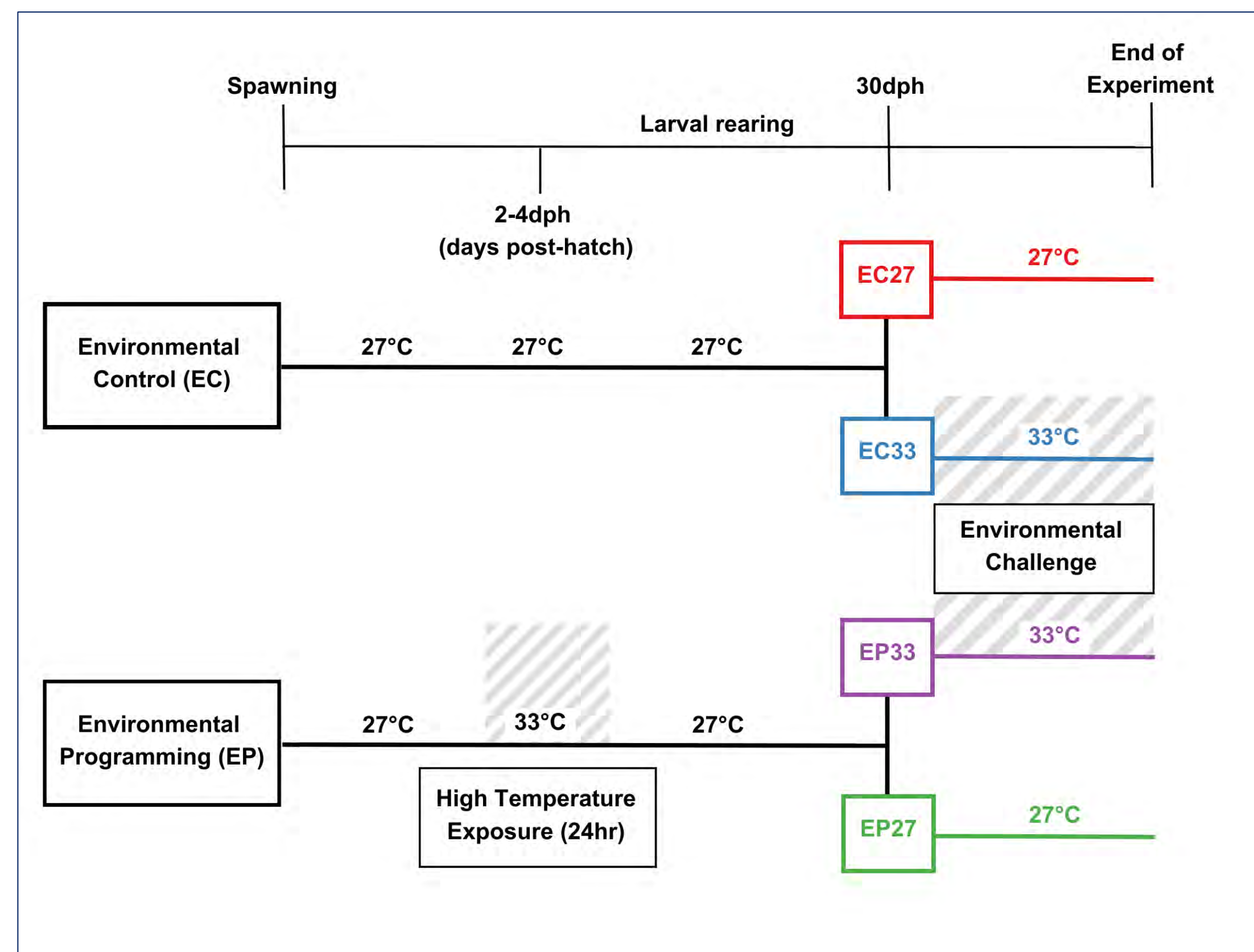- All treatments will then remain at 27*C until 30dph (pre-adult stage).

Figure 2. Experimental Timeline

Environmental Challenge at 30dph

- Environmental Challenge Groups: EC33 and EP33 treatments will be cultured at 33*C until the fish at least double their weight.
- Non-Challenged Groups: EC27 and EP27 treatments will be cultured at their optimal temperature of 27*C during the same period.
- Post-challenge fish will be euthanized with tricaine methanesulfonate (MS-222) and final total lengths, weights, survival %, and FCR calculated and assessed.

Expected Results

The following results will be measured to determine the success of the environmental programming: average weight (g) and total length (mm), weight gain (G and %), feed conversion rate (FCR), and survival %. Survival % will be calculated after both the environmental programming and challenge.

Over the experimental timeline, initially we expect that the EP treatments will both experience higher mortality compared to the EC treatments (Figure 3.). However, we don't anticipate to see significant differences in survival at this stage. After the larval rearing (control period), we expect the environmental challenge to cause a larger, significant drop in survival % for the EC33 compared to EP33, due to the lack of environmental programming at the larval stage for that treatment. The EC27 and EP27 treatments will experience little to no charge in survival % during the environmental challenge at 30dph.

After the environmental challenge, we expect the EP33 treatment to have better FCR and weight gain compared to the EC33 treatment, due to the environmental programming and thermal plasticity induced during the larval stage.
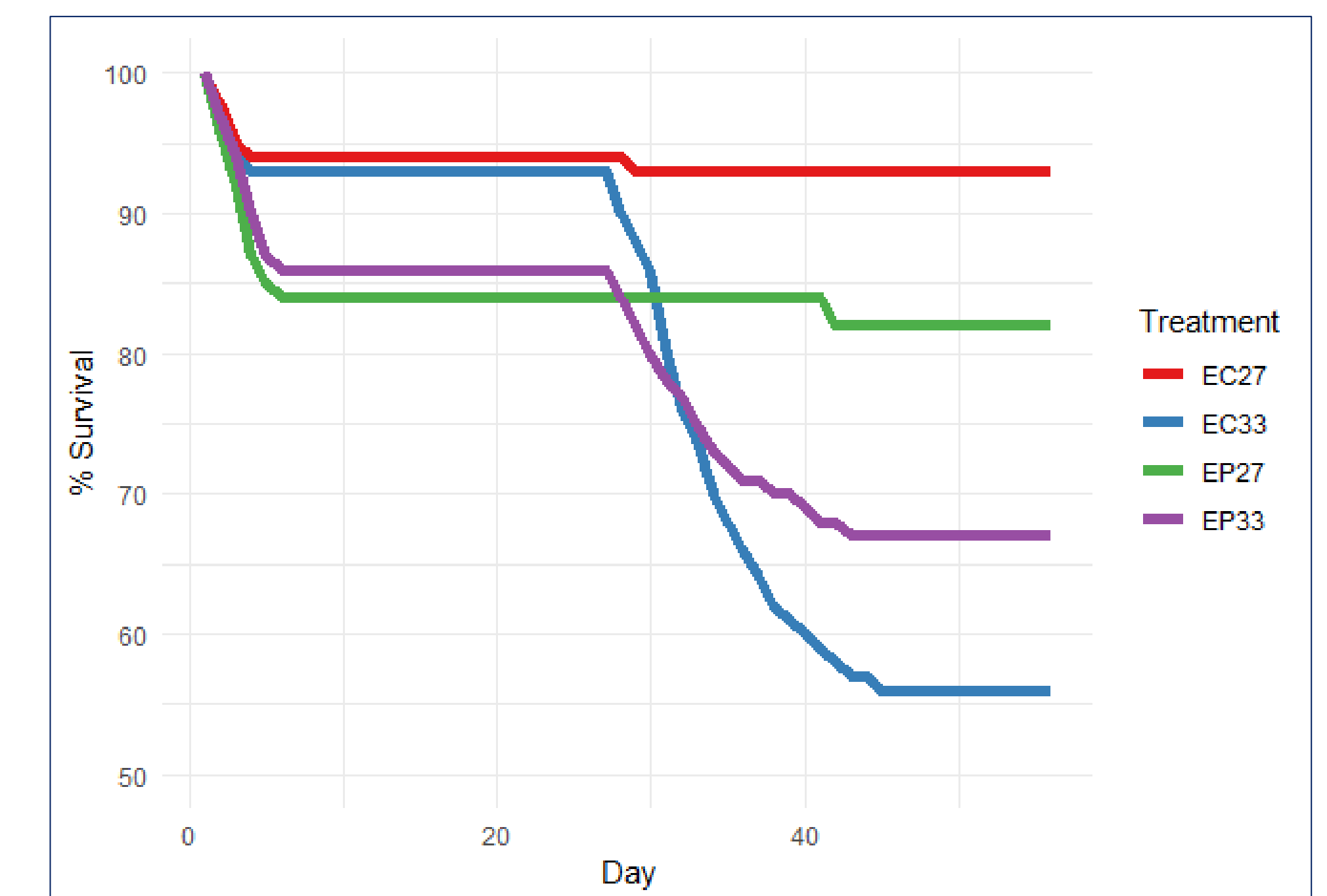

Figure 3. Expected Survival of Treatment Groups
(Coded with the help of Tanya Fendler, SIU PhD student)

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Acknowledgements

Photo by Inubi, ""ゼブラダニオ 白バック", Adobe Stock

Over a century of data reveals climate-driven earlier flowering in a native annual

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Southern Illinois University, Carbondale; School of Biological Sciences

Douglas Goldman, USDA

Introduction

Many species of plants and animals are responding to climate change via phenological shifts. The consequences of these shifts are poorly understood but may include mismatches with mutualists or necessary resources. The impacts of climate change vary geographically, but few studies have examined these factors in a single species. Flowering plants provide an excellent model to understand phenological shifts across large geographic ranges. *Triodanis perfoliata* (Campanulaceae) is a novel study system that occurs across a broad range and has an extensive historical records. I predicted that flowering time would shift through time and vary across geographic space.

Methodology

I used digitized herbarium records to build a large dataset of flowering time (n=1484 samples) of *T. perfoliata* spanning the contiguous U.S (1895-2022). The data were heavily vetted for pseudoreplication, temporally and spatially, as well as for erroneous points (i.e., oceanic points).

This work builds substantially on previous work by filling important spatiotemporal gaps in this dataset. To determine if flowering time has shifted for this species temporally and spatially, I ran a multiple regression in R (R Core Team, 2018), with flowering date as a response variable and year, elevation, latitude, longitude, and their interactions as explanatory variables after rarifying the data
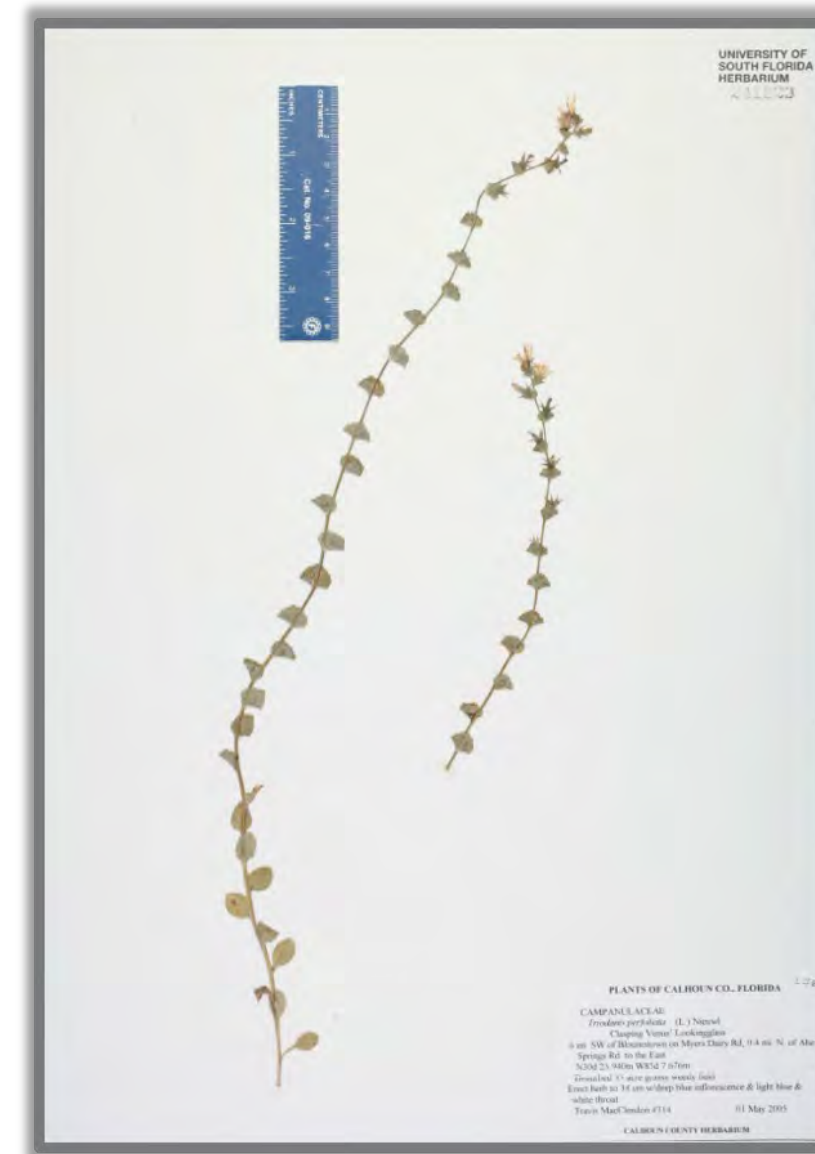
Results

Geographic variation and year both significantly influenced flowering date across 127 years for *T. perfoliata* (Table 1; Fig. 1). Historically, flowering occurred later in spring than in contemporary populations (Fig. 1).

Table 1. Summary statistics from a multiple regression to examine the influence of year, elevation, and geographic location on flowering date for *T. perfoliata*. The model is highly significant ($F_{8,1484}$ = 337, P < 2.2 e -16). *$P \leq 0.01$; **$P \leq 0.001$; *** $P \leq 0.0001$).

Term	Estimate	SE	t-ratio	P
Intercept	54.93	56.32	-0.98	0.33
Year	0.07	0.01	-5.05	***
Elevation	0.03	0.12	0.25	0.80
Latitude	9.44	1.13	8.34	***
Longitude	-1.73	0.47	-3.65	***
Lat x Long	0.05	0.01	4.13	***
Lat x Elevation	3.50e-4	3.20e-3	0.11	0.91
Long x Elevation	-2.77e-5	1.15e-3	-0.02	0.98
Lat x Long x Elev	7.54e-6	2.96e-5	0.26	0.80
Adj R^2				0.64

Results, continued

Further, flowering date is significantly influenced by latitude with plants at higher latitudes flowering much later in the year than more southern latitudes (Fig. 2). This suggests that phenology is heavily dependent on geographic location. Various ecological factors could drive these patterns, such as regional variation in climate change and microenvironmental. Evolutionary history of populations across geographic space could influence this pattern as well, if flowering has a genetic basis.
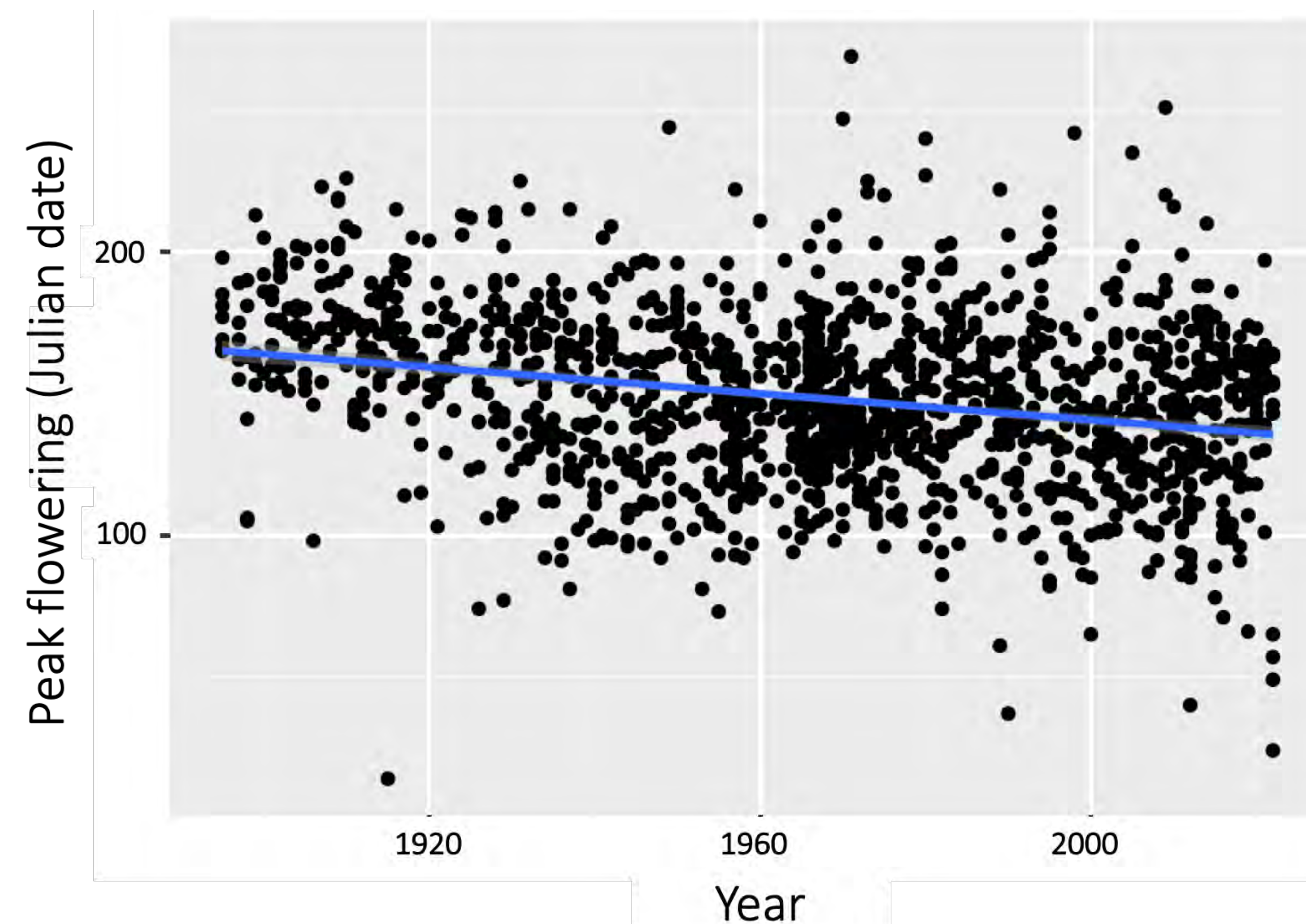

Figure 1. Scatterplot of raw flowering date through time for n=1484 samples; best fit trend line added for clarity. The peak flowering date occurs earlier in more contemporary samples in a dataset ranging from 1895 to 2022 (Table 1; P $\leq$ 0.0001).
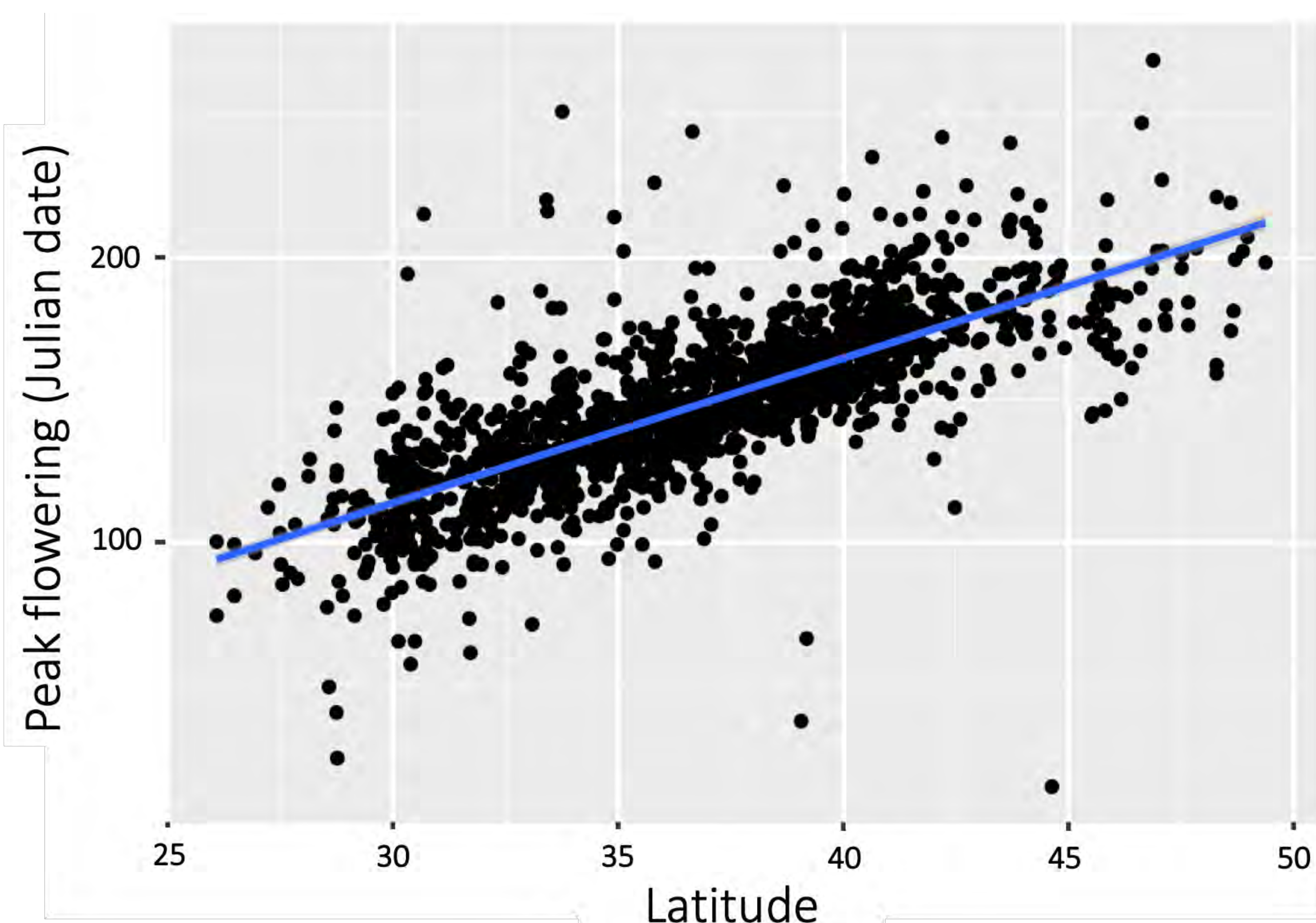

Figure 2. . Scatterplot of raw flowering date across latitudes for n=1484 samples in the contiguous US; best fit trend line added for clarity. Plants at higher latitudes flower later than plants at lower latitudes, regardless of the year of the collection (Table 1; *** P $\leq$ 0.0001).

Conclusions & Future Research

My results add support to previous work (Berg et al., 2019); here I demonstrated with a much more complete dataset that flowering time is significantly advancing for this species across the contiguous US. The magnitude of climate change varies regionally, for example in the extent of spring warming (Fig. 3). This study system provides the opportunity to understand how variation in climate change influences biological responses in a single species. My future research will focus on identifying which climatic factors are influence peak flowering and if there are regional patterns in the magnitude and direction of flowering time shifts.
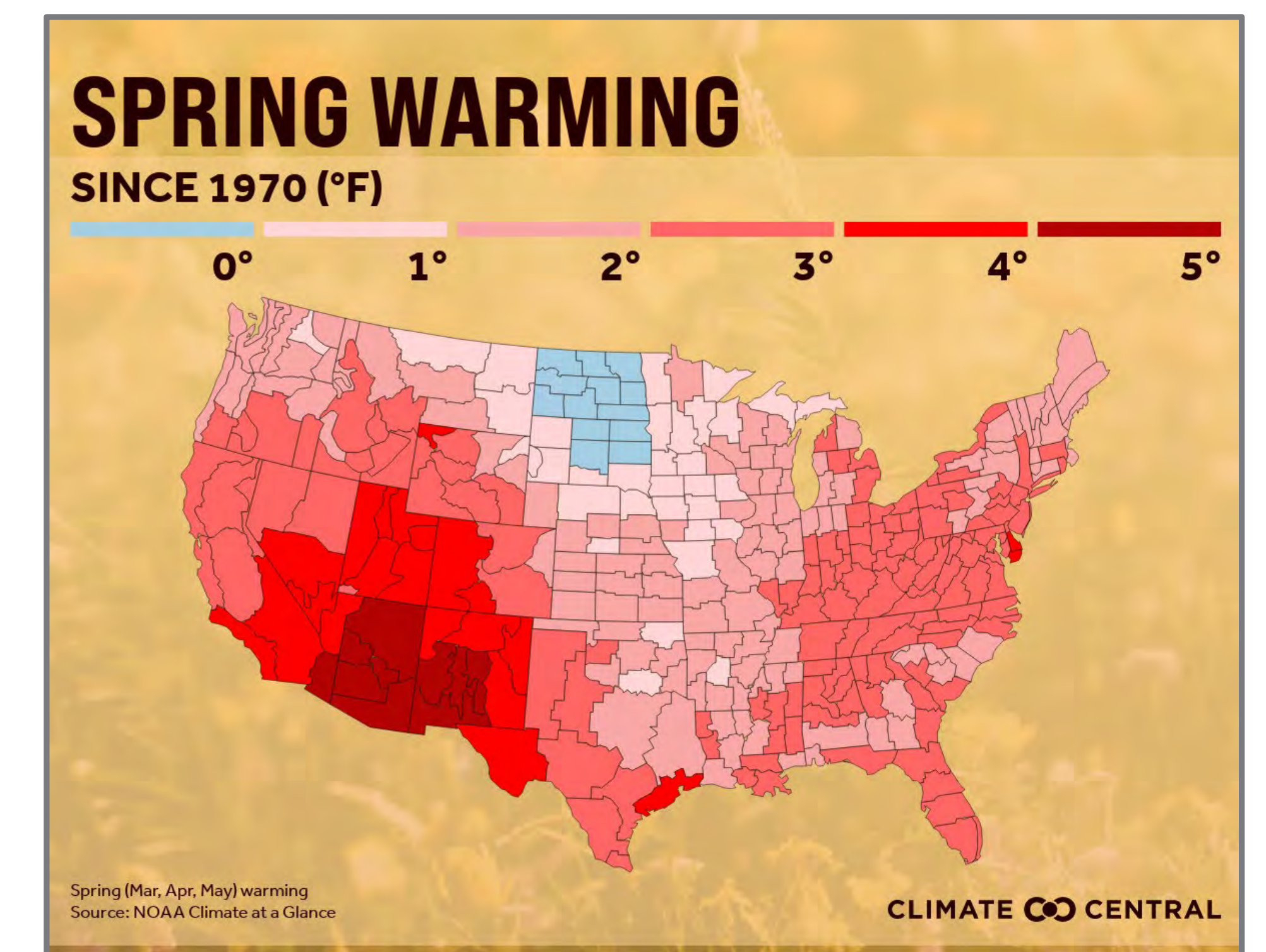

Figure 3. Map showing the extent of spring warming across the contiguous US since 1970. Note that the extent of warming varies regionally, suggesting that climate-driven shifts in phenology could also vary significantly for species such as *T. perfoliata*. (Source: NOAA)

Acknowledgements
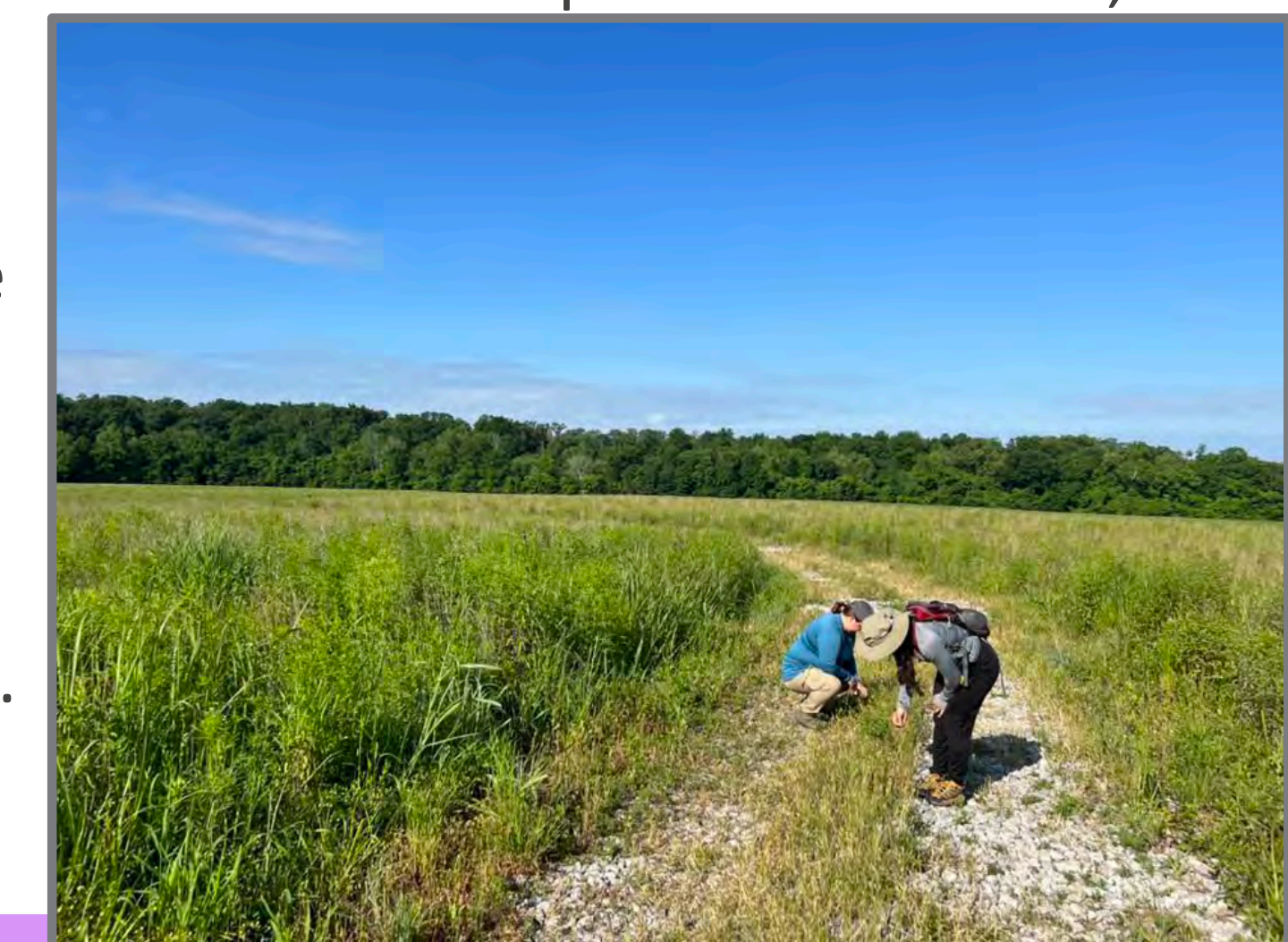
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Navigating the Path to Student Retention at Southern Illinois University: Exploring the Impact of Mentorship, Preceptors, and Clinical Readiness

By: Jonathan Montoya, Dr. Kelli D. Whittington
Southern Illinois University Department of Human Health and Sciences

Abstract

This study aims to further investigate the crucial factors that influence student retention rates at Southern Illinois University Carbondale (SIU) with a focus on the impact of mentorship, preceptors, and clinical readiness. With the growing concern regarding student retention rates in higher education institutions, it is important to identify effective strategies that help enhance the retention rates. The study will adopt a mixed methods approach using both quantitative and qualitative data combining a survey as well as preceptor evaluations to gain insight into students' experiences and perceptions while in the nursing program. All data collected will be used to relate to the topic on how they influence student retention while focusing on mentorship, preceptorship and clinical readiness. The findings of this project showed that all examined factors had a positive influence on student retention rates at SIU's BSN Program. Responses from students on the survey mentioned mentors that helped and guided them through the materials of the program and had an influence with their motivation to be in the BSN program. This continuous positive feedback from students and preceptors shines light on student retention and a positive learning environment.

Objectives

- To identify the key factors influencing student retention rates within the nursing program at SIUC.
- To examine the impact of mentorship on nursing students' retention and academic success.
- To explore the role of preceptors in shaping nursing students' perceptions and its correlation with their commitment to the profession.
- To assess the significance of clinical readiness in influencing nursing students' persistence in their educational journey.

Methodology

Mentoring in your Nursing Career Online Survey N=11
- 1-item open ended question asking about a mentor who kept you motivated in your studies (See Table 1).
- All responses were anonymous
- Used SurveyMonkey

Preceptor Clinical Evaluations Online Survey N=302
- 7-item evaluation and strengths section scoring students in their clinical performance and listing individual strengths (See table 1 and 2).

Data Collection and Participants
Data was collected from students enrolled in the nursing program for the 2022-2023 academic year as well as the preceptor evaluations. Contact information for subjects was obtained from faculty and Nursing Program Director Dr. Kelli D. Whittington.

Results

Table 1 represents themes from respondents on how mentors have helped and guided them through their academic journey.

Themes/ Categories	Participant Responses
Motivation	"ALWAYS helping students with everything. School advice, life advice, and all. She keeps myself and a lot of other student's motivated to keep going."
Presence/ Availability	"There are so many, but recently an instructor has offered to meet with me electronically every week for a one on one. This is set up as a means to keep me focused and grounded. I was letting my online atmosphere studying guide my anxiety. The mentor helped coach me through the anxiety and allowed me to vent while giving me constructive feedback."
Helpfulness	"Dr. X has made a huge difference in my educational career. She has allowed me to come to her office on multiple occasions and get an outside perspective on school tasks."
Coaching/ cheering	"Dr. X has played a significant care in keeping me motivated through our studies. Dr. X constantly made efforts to keep all her students motivated at all levels of study. She has always made it known that her office is open for students to come ask questions or do anything that we needed (point us in the right direction). A specific experience where her mentorship played a role was when she looked for specific resources to get me more involved with organizations that support minority students like me. By always having resources available and looking for additional resources has made me more motivated and engaged as a student because I know that I have someone I can rely on and someone to talk to when needed."

Table 2 presents the descriptive statistics (Likert scale average from preceptor evaluations) for each question of the evaluation, demonstrating how BSN nursing students performed based on the preceptor evaluations scores.

Area of Evaluation	Overall BSN Preceptor Evaluations Score Percentage
Positive Attitude and Professional Communication	98.45 %
Eager to Seek Out Learning Opportunities	97.67 %
Accepts Constructive Feedback and Plans for Improvement	98.21 %

Table 3 provides a summary of the strengths identified from the qualitative data from preceptors.

Strengths/Themes	Description
Teamwork & Collaboration	BSN students showed strong teamwork and collaboration skills by engaging with staff.
Attitude	Students maintained a positive outlook, creating a positive learning environment.
Helpfulness	BSN students offered help and support healthcare professionals/peers as well as patients.
Eagerness to learn	Students showed a desire to be present and learn. Actively seeking learning opportunities.

Conclusion

- The findings showed that all examined factors had a positive influence on student retention. Commitment to continuous improvement and the use of tools such as evaluations and mentor survey responses contributed to enhancing student learning experiences.
- The results also indicated that students were motivated and involved in their learning experiences, as mentioned by preceptors, and students acknowledged the positive impact of mentors on their learning environment. These factors collectively led to higher student retention rates in the BSN program.
- The findings indicated that factors such as continuous improvement, evaluations, and mentor feedback positively influenced student retention. Students' eagerness to learn, combined with a supportive learning environment, contributed to higher retention rates. Optimizing these factors can create a positive and engaging BSN program.

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Acknowledgements

Promoting Culturally Competent Care: Assessing Cultural Awareness in Nursing Students

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Nursing, College of Health and Human Sciences

Southern Illinois University CARBONDALE

Introduction

- Cultural awareness is crucial in nursing education as it focuses on patient-centered care and understanding how social and cultural factors influence health and behaviors. It enhances communication between healthcare professionals and patients, leading to better care quality.

- Diverse nursing students face barriers such as financial constraints, lack of emotional and moral support, and limited mentorship.

- Projections show that the population of minorities is expected to exceed the Caucasian population in the next twenty years.

- The National Council of State Boards of Nursing Workforce Centers conducted a survey in 2020 that showed that minority nurses make up 19.4% of registered nurses in the workforce (Smiley, 2020)
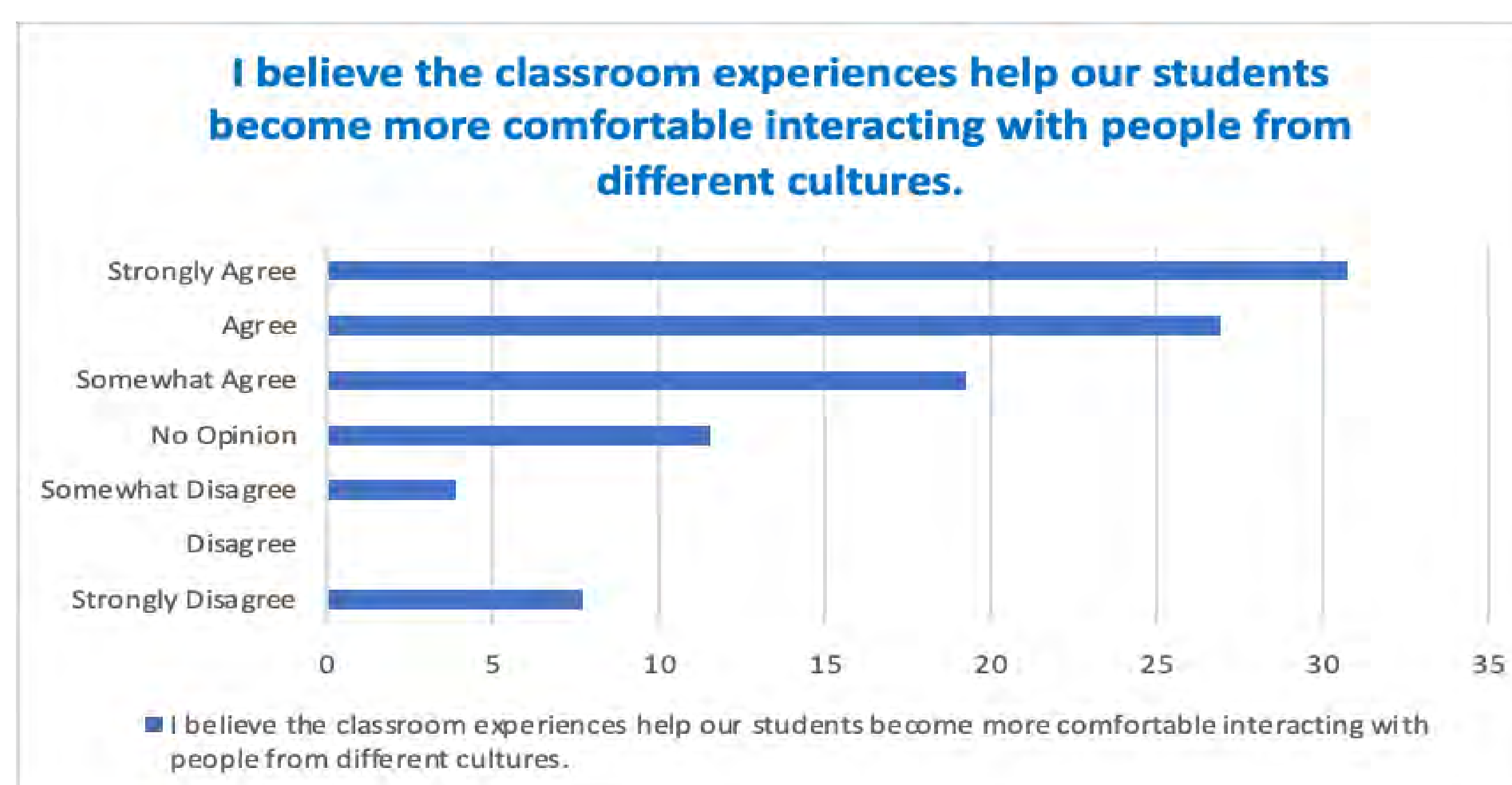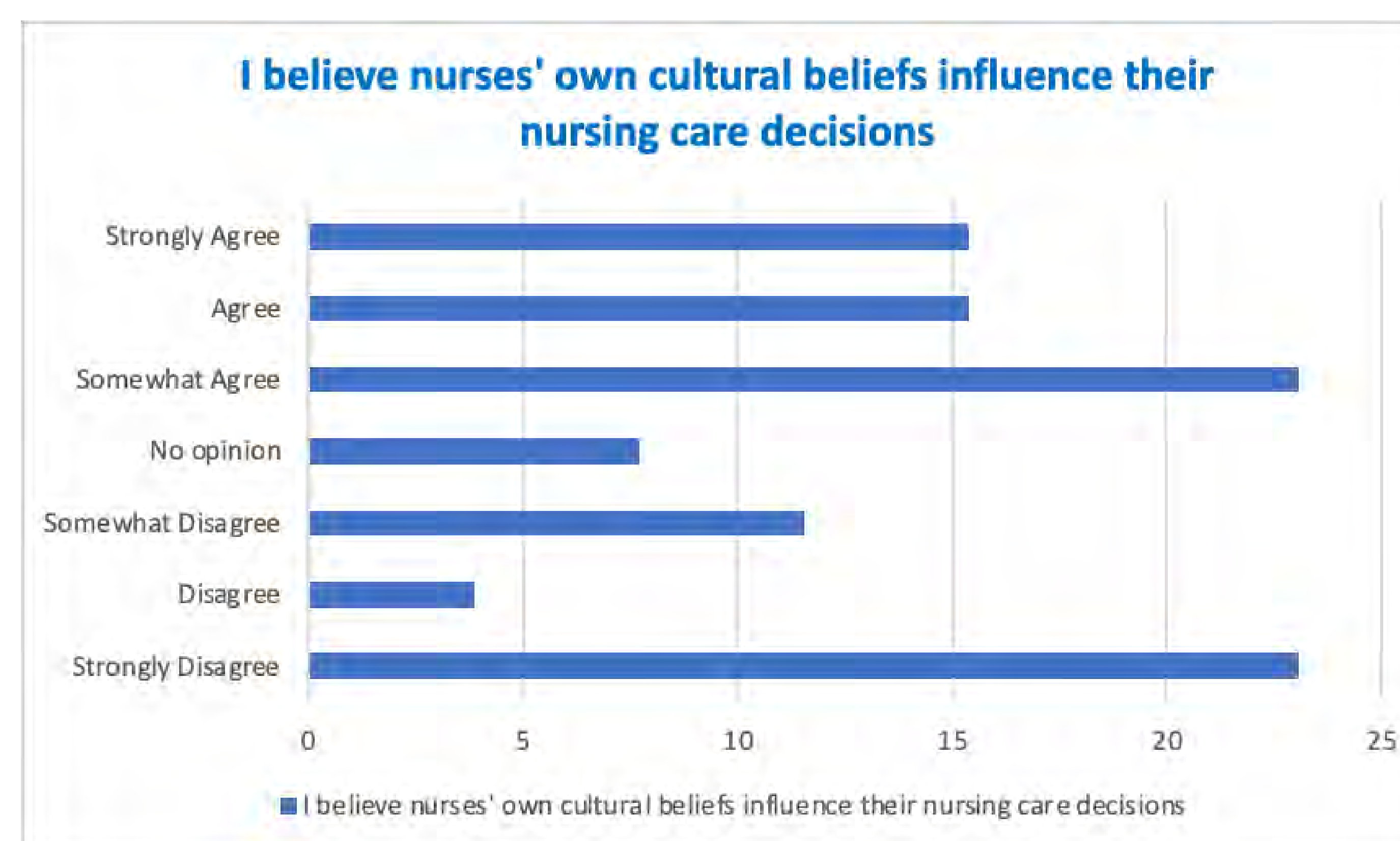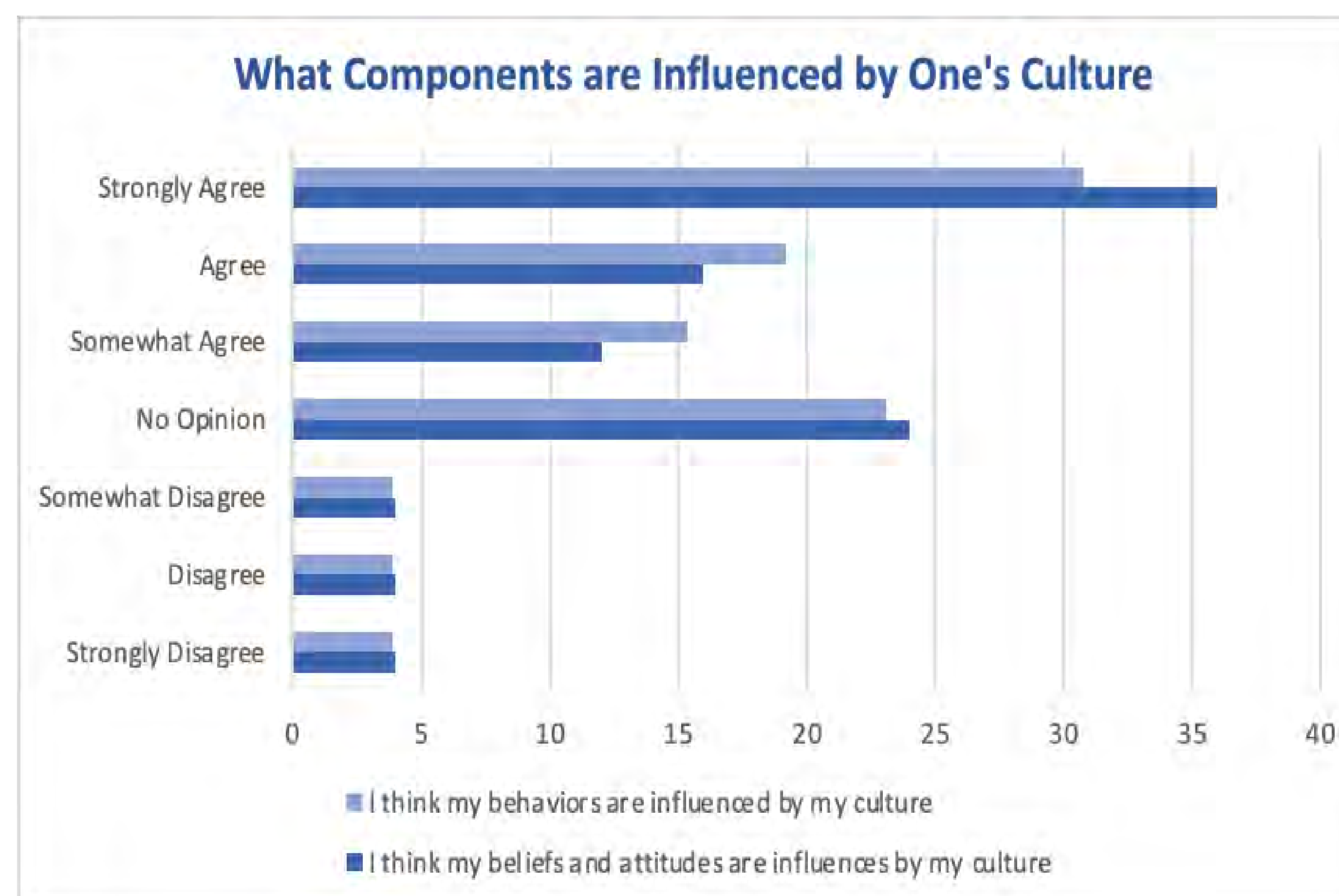
Key Terms

Term	Definition
Underrepresented students	• Those who identify as LGBTQ • Male students • individuals from African American, Hispanic, Asian, American Indian, and Alaskan native backgrounds
Holistic Admissions	• Admissions strategy that assesses an applicant's unique experiences alongside traditional measures of academic achievement such as grades and test scores.
Cultural awareness	• Being conscious of one's own culturally shaped values, beliefs, perceptions, and biases.

Methodology

- The study used a quantitative survey to collect information on the current demographics and cultural awareness of SIU's Nursing program.

- Population was undergrad SIU nursing students
- The survey included questions about age, ethnicity, gender identity, and a modified version of the Cultural Awareness Scale(CAS) (Rew, 2017).

- 14% response rate, n = 27

Results

What Components are Influenced by One's Culture

- I think my behaviors are influenced by my culture
- I think my beliefs and attitudes are influences by my culture

I believe nurses' own cultural beliefs influence their nursing care decisions

- I believe nurses' own cultural beliefs influence their nursing care decisions

I believe the classroom experiences help our students become more comfortable interacting with people from different cultures.

- I believe the classroom experiences help our students become more comfortable interacting with people from different cultures.

Conclusion

- Holistic admission process has proven effective.

- Areas of improvement can lead to better curriculum which better prepare nurses to treat diverse patients.

- Overall, this research contributes to the broader goal of fostering cultural awareness and competence within the nursing profession. By promoting diversity in nursing education and addressing barriers to enrollment, we can create a healthcare workforce that is better equipped to provide equitable and patient-centered care to all individuals, regardless of their background.

Limitations

- Small sample size
- Lack of generalizability
- Timing of survey dispersion

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• Diana Galvan, Rosendo Ugalde, Erika Ugalde, Erik Ugalde, Mayra Ornelas, and Jonathan Montoya for always supporting.me.

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Student Athletes Perspective on Their Mental Health

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Faculty Mentor: Dr. Philip Anton

Objective

This research focuses on the mental health of current student athletes at a Division I University. It focuses on identifying major themes and issues that student athletes have regarding their mental health and how it is handled on campus. Stigma, available resources and stressors were the main focuses of this study.

Background

Students face a multitude of stressors daily. These can range from simply going to class, financial hardships and just generally having a social life. But when it comes to college athletes, they have additional stressors that factor into how they are feeling (Fraley, et al., 2020). One of the areas of interest is the utilization of mental health services. While studies have shown that students both non-athletes and athletes know about mental health services, only about ten to twenty percent of student athletes utilize the services (Bird, et al. 2020; NCAA, 2022). This is potentially a detriment to them overall because issues that get left untreated make the situation worse overall (Fraley, et al., 2020).

Methodology

Participants completed a semi-structured interview. Each interview was formatted with demographic questions first and then questions based on certain themes. These themes included stigma, resource availability and comfortability around the subject. These interviews were recorded and then transcribed to aid in the analysis process. Each interview was line coded and separated into themes. These major themes were then developed into a word cloud.

Results

This study show that the main themes are communication, expectations and stigma. Athletes felt that there is stigma around seeking support. This can be summarized by Athlete five saying " **athletes are supposed to be, well, really mentally strong…tough…I feel like it is really hard to kind of admit that you're struggling sometimes because nobody wants to be seen as the person who like, can't handle it".** They also all said that coaches communicating about their high expectations and checking in more regularly would be beneficial. **"…Just to talk about what's going on and maybe try to understand why…"**, said by athlete one. The lack of communication paired with high expectations leads to an unsupportive environment best stated by athlete six, **"…It just makes you not even want to, like, talk to somebody about things…you're more worried about how they're going to like, treat you at practice".** The combination of these two themes add to the stigma around seeking help.

Table 1

Sex	Age	Year
Female	22	Senior
Male	18	Sophomore
Female	21	Senior
Female	21	Senior
Female	19	Sophomore
Female	22	1st year Grad Student
Female	21	Junior

Direct Quotes

"I want to be a person, a student and then an athlete like that you know? Treat me like a person, a real person who has to deal with this".

"I think it should be less of a conversation, more of like taking action because across the country…some college athletes, are literally committing suicide every other week".

"…everyone's very easily replaceable and its always just about performance. They(coaches) don't really care about the person as much after they can't really use them anymore".

normalized appreciation stressed feeling-heard
overcompensation suicide acknowledgment
appreciated advocate
reinforcement stop-comparing overcompensating
psychologist empathy frustrating balance
high sports mentally-strong
cautious
stress-relief stigma self-image prioritized negative motivation
expectations sports-psychologist
performance self-worth isolated injured relatable
realistic unfair overrun injury trust support prioritizing
communication favoritism
physically-strong listening burden tutoring anxiety positive
feelings eating-disorder

Conclusion

This study shows that some major improvements can and should be made to improve performances for student athletes. Most of the concerns brought up could be solved by just improving communication among coaches, athletic departments and student athletes. This study aids in showcasing what student athletes think should be done regarding supporting mental health and destigmatizing the issue. Participants want other student athletes to know that its okay to not be okay and to seek help when needed.

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