

# Cracking the Color Code: Exploring the relationship between body coloration and social behavior in a cichlid fish



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## Introduction

The African cichlid fish, *Astatotilapia burtoni*, live in groups with dynamic social hierarchies.

Male *A. burtoni* can be subordinate (SUB) or dominant (DOM).

SUBs are a dull gray while DOMs exhibit vibrant blue or yellow body color. Both can change color rapidly.

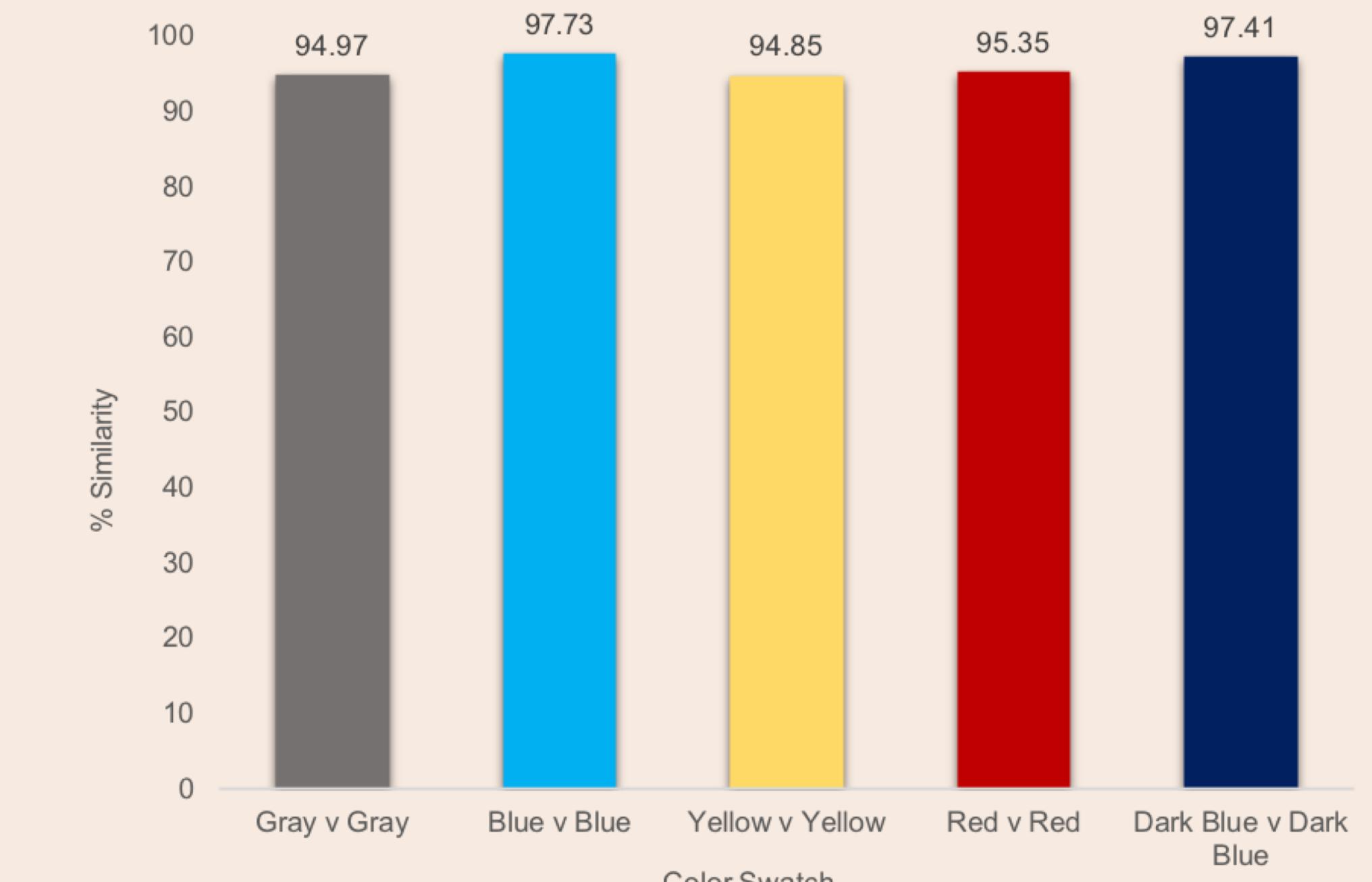
Based on space use and aggressive behavior, distinct DOM styles (bullies or homesteaders) can be observed.

## Color Standards are Consistent Across Photos



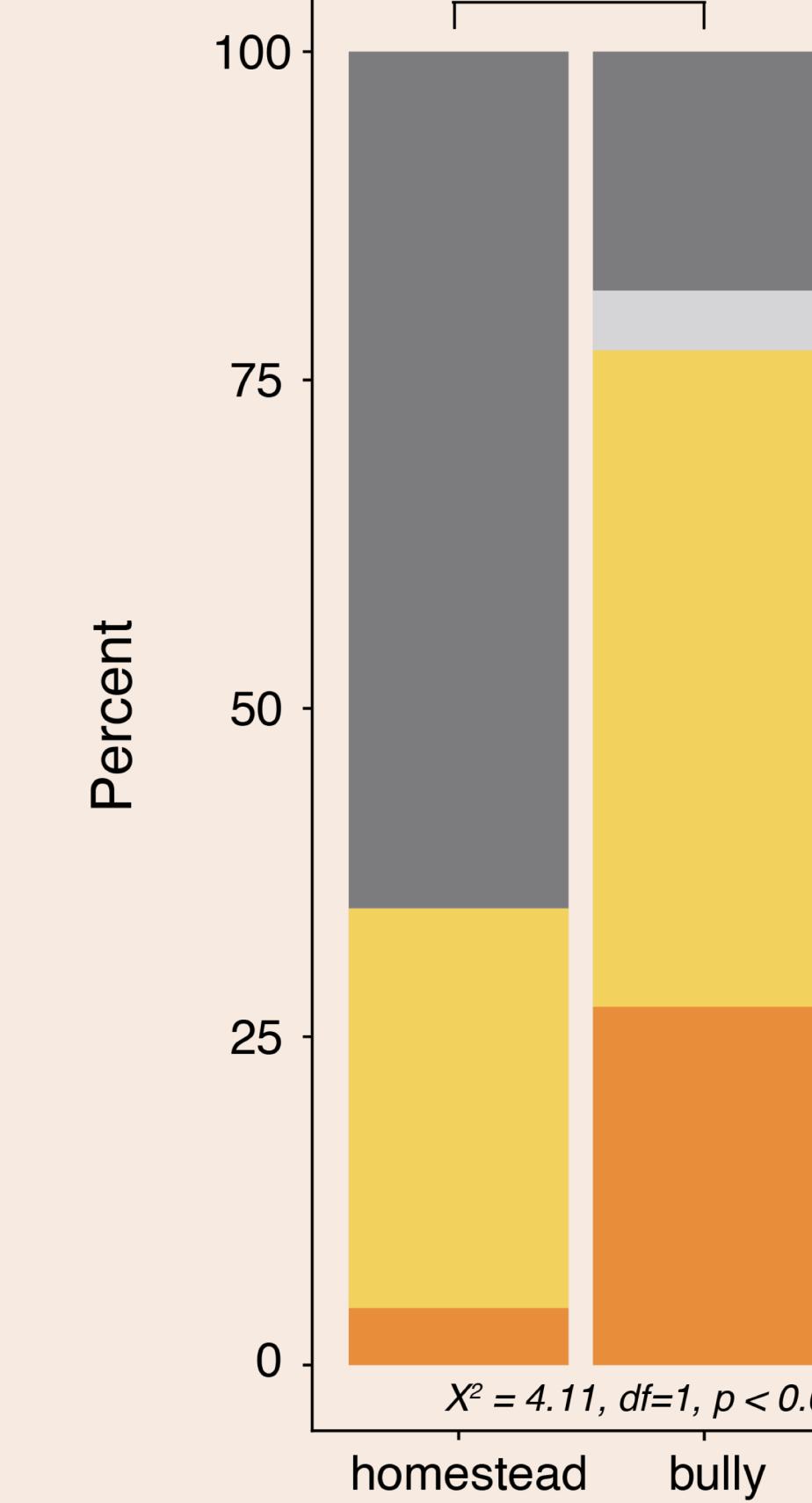
Five color swatches on the DKG Kustom Color scale were measured across ten white balanced photographs to verify the consistency of our technique (left).

All color swatches tested were **above 94% similar** across all photographs (right).

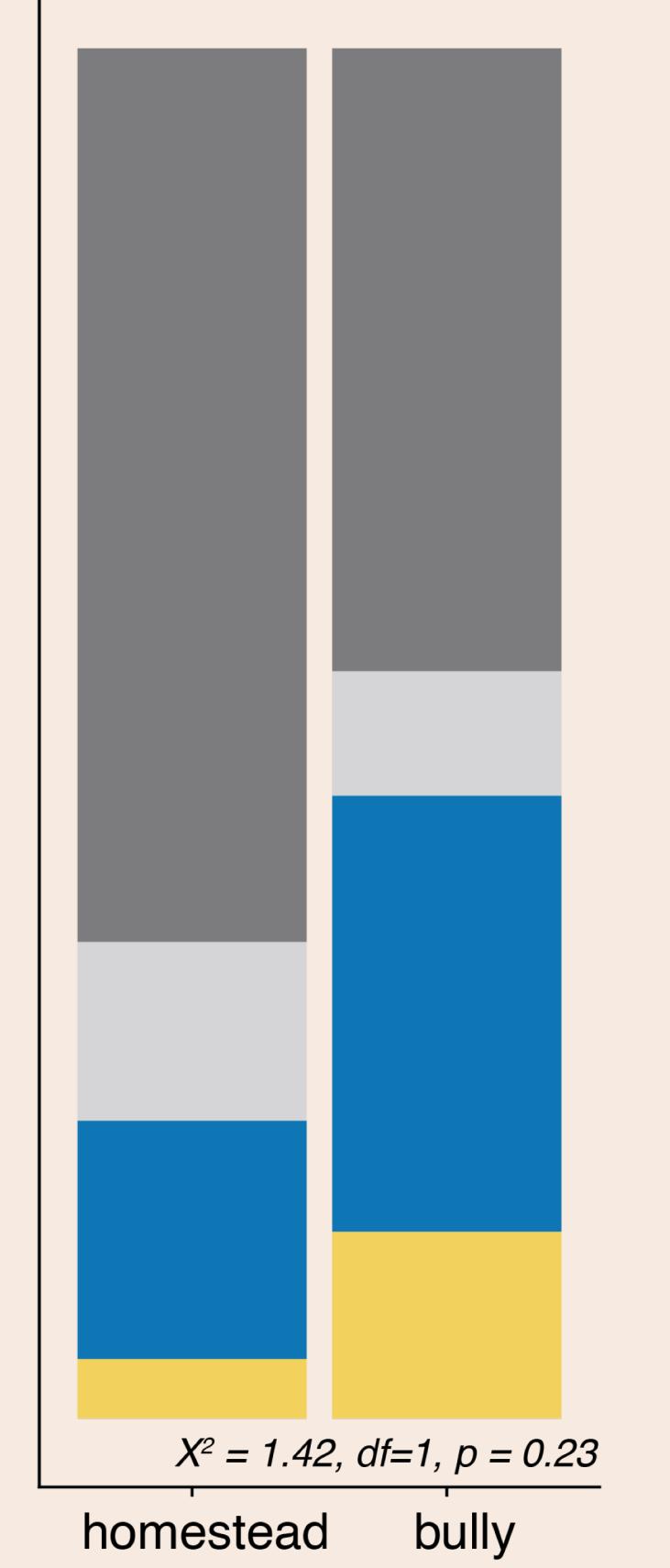


## DOM styles exhibit different coloration at the flank

### R1 (flank)



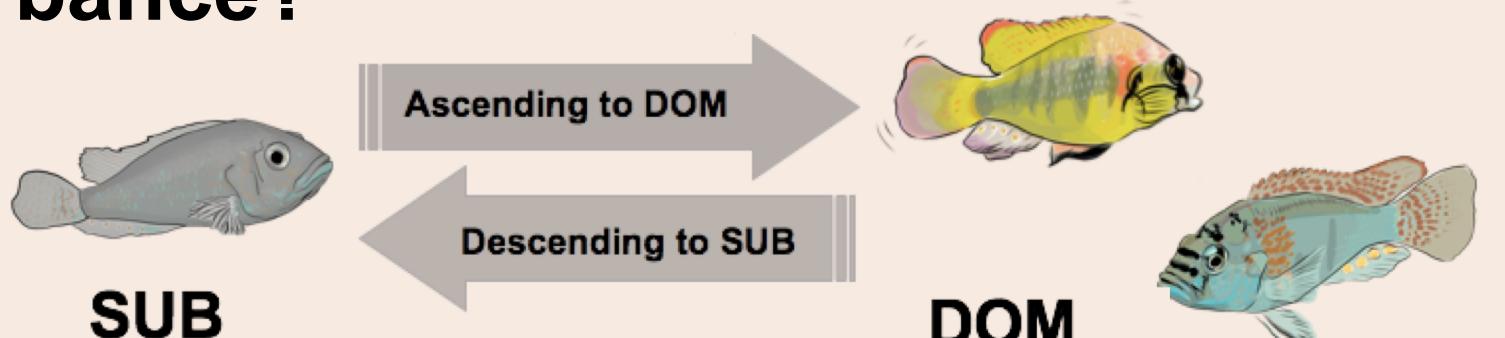
### R2 (ventral)



Averaging across pre- and post-disturbance values, bully DOMs have **significantly brighter flanks**.

## Research Question

- Does body color correlate with DOM style?
- Does body color change in response to a stressful disturbance?

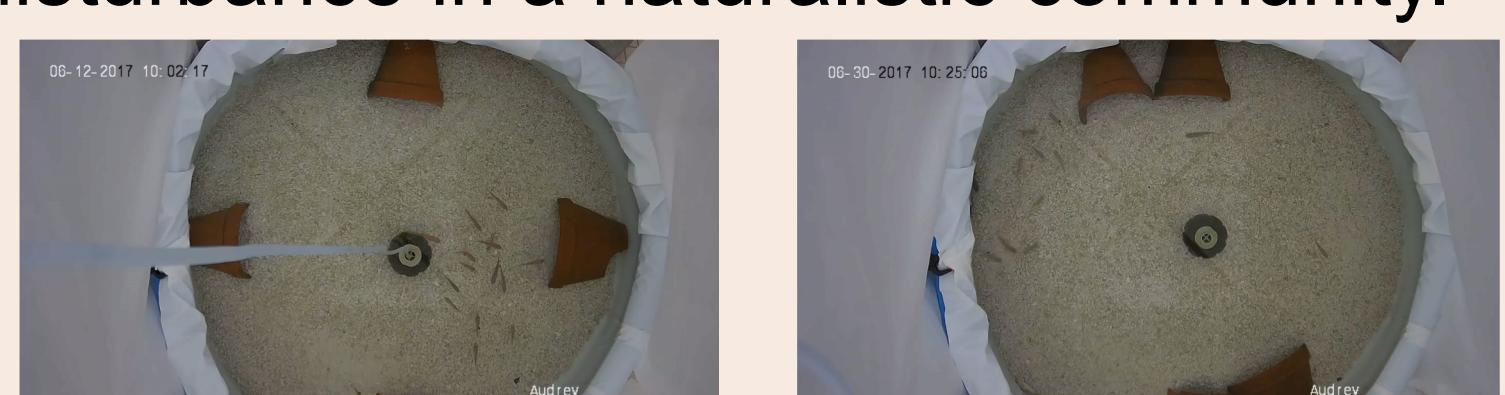


## Methods

To quantify color, we developed a protocol to answer the following questions:

- Where on the body will determine the fish's color precisely and accurately?
- Does this method distinguish yellow vs. blue?

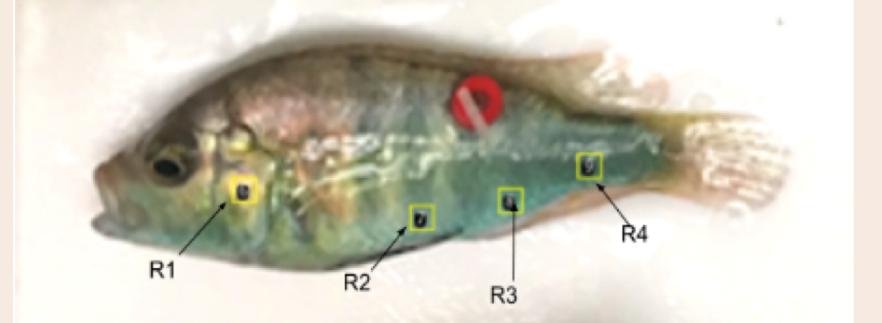
Photographs of DOMs were taken pre- (left) and post- (right) disturbance in a naturalistic community.



DOM coloration was analyzed using standardized photographs with a DKG Kustom Color scale.

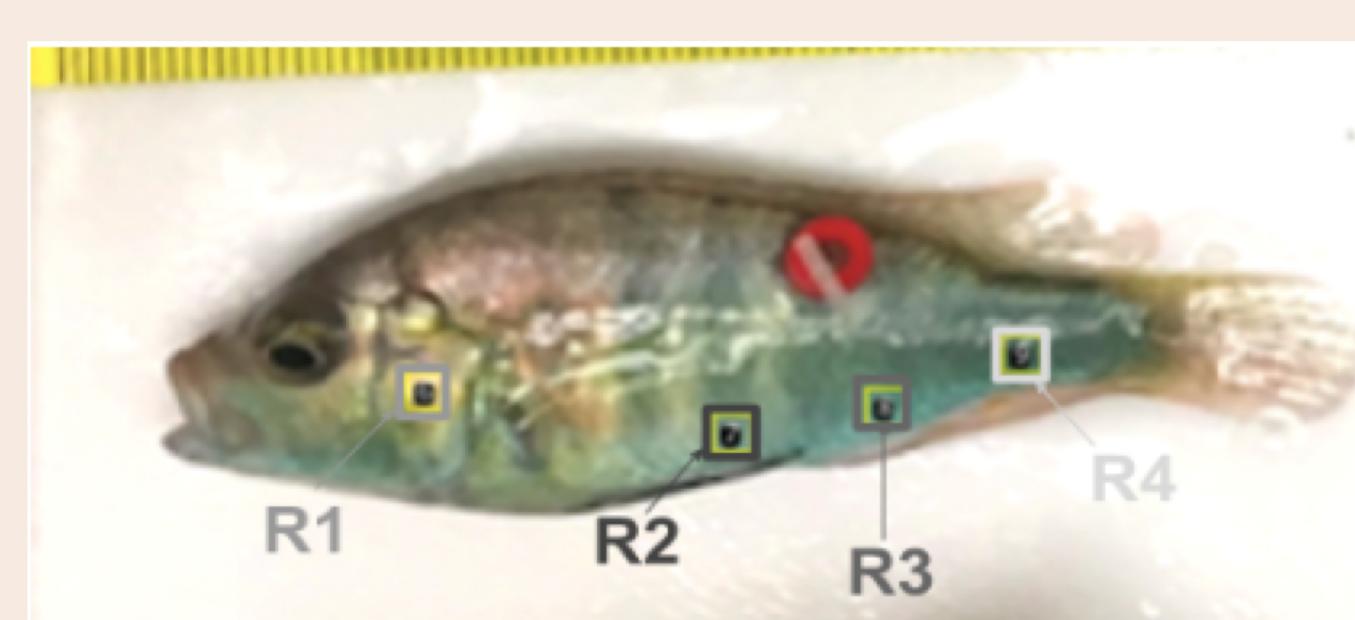


We analyzed RGB values in Fiji and compared percent similarity across color swatches and four regions of each fish.



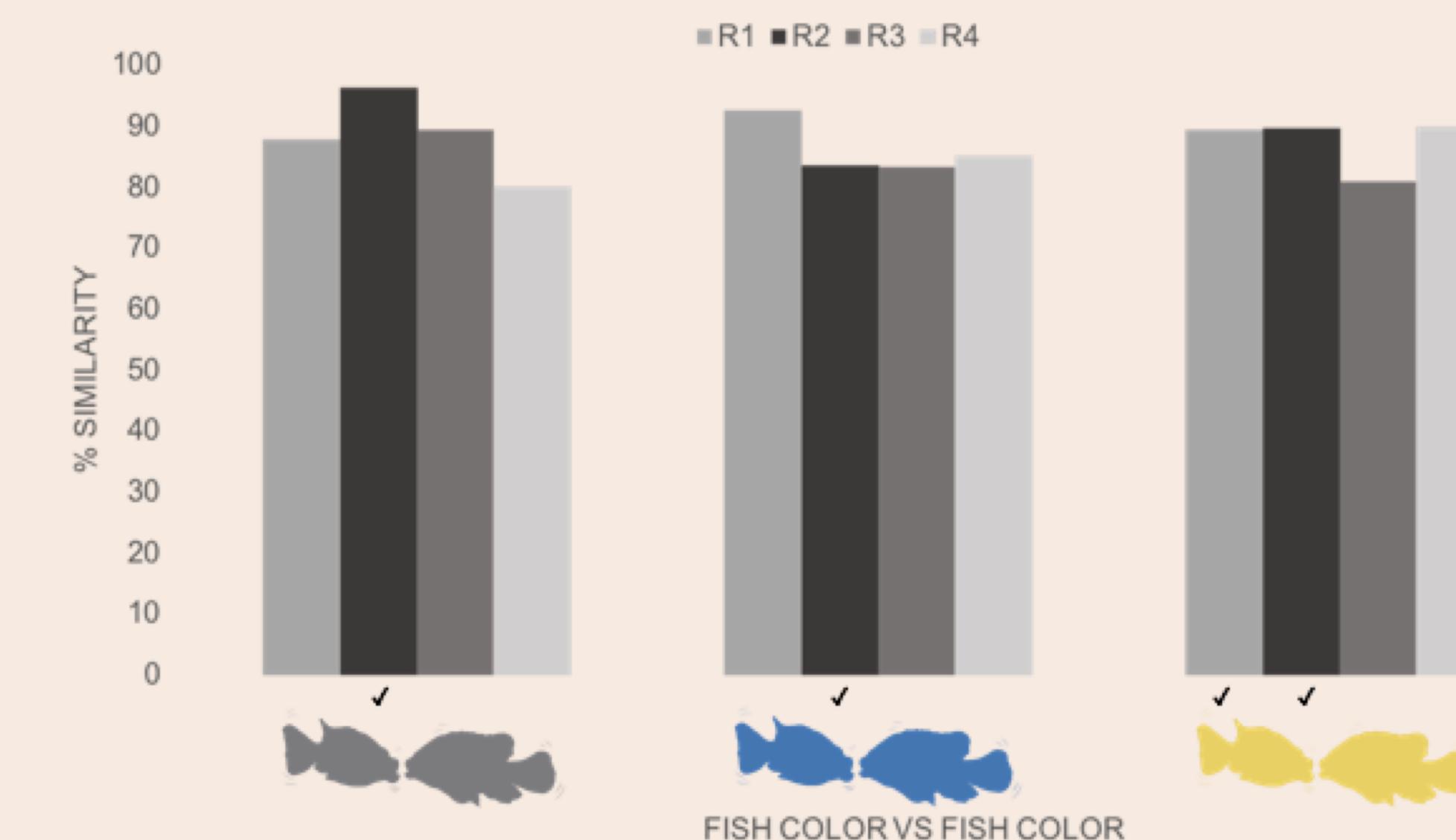
The four regions of interest on each fish where we analyzed RGB values.

## Two Body Regions Consistently Identify Grey, Blue or Yellow Fish

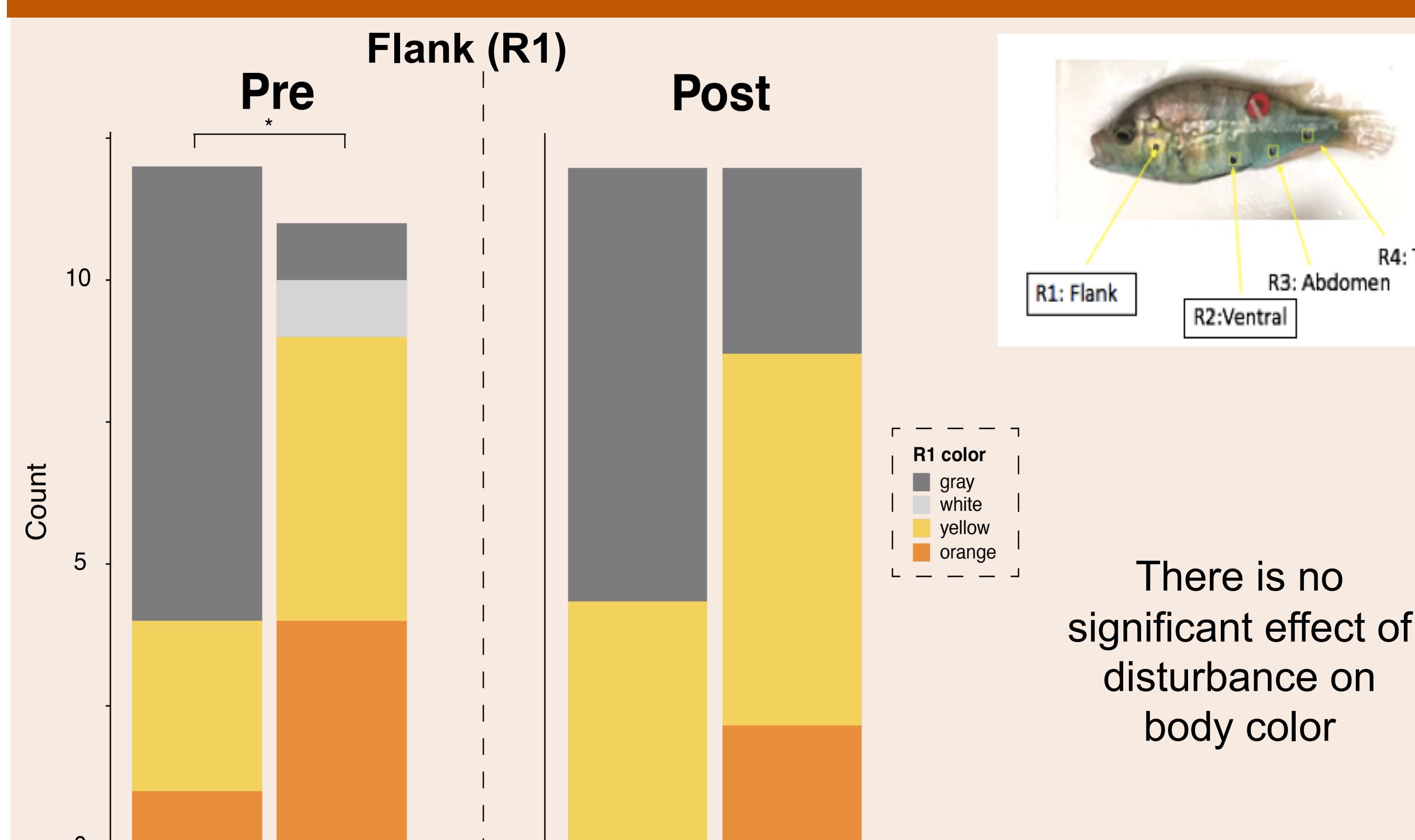
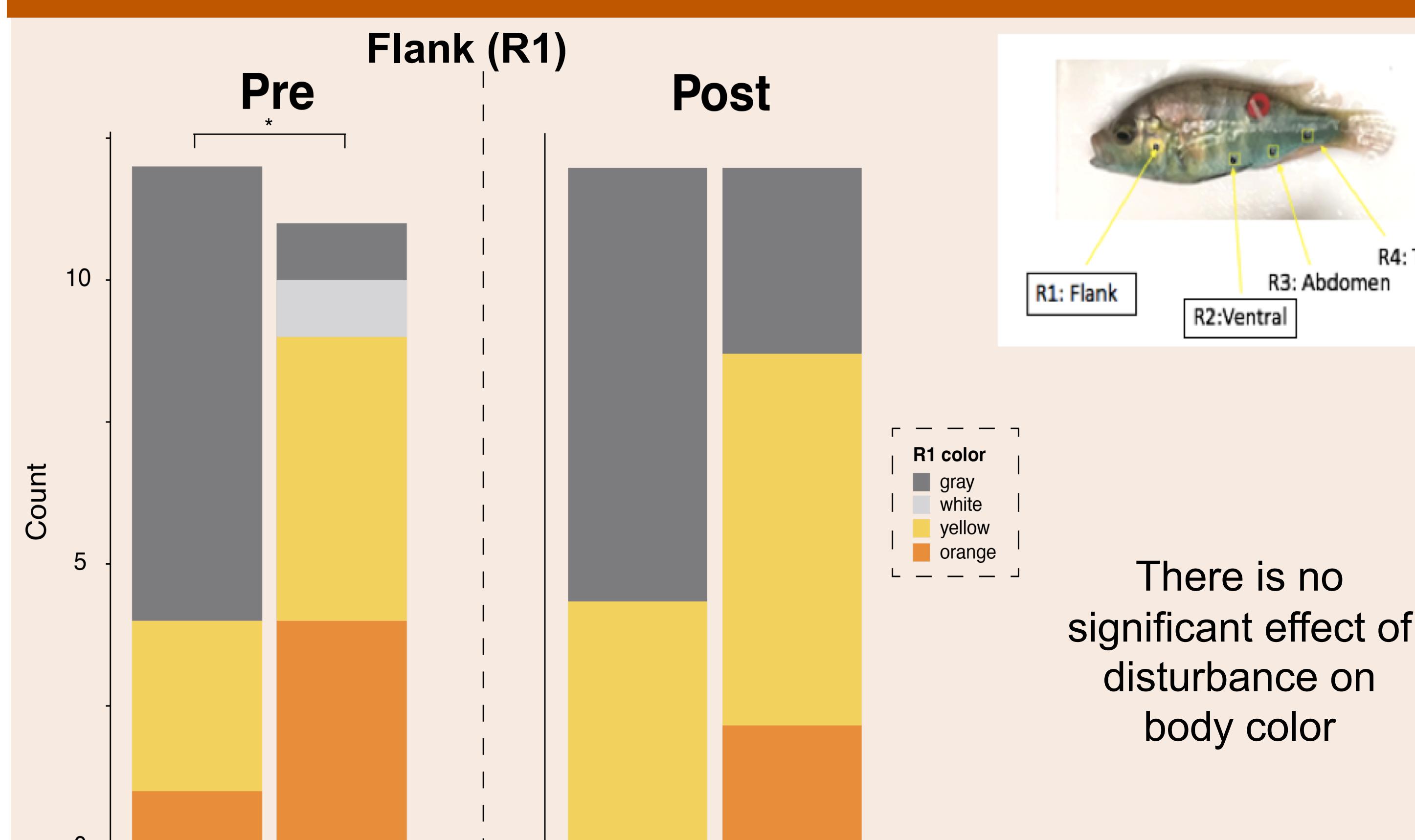


We compared fish body color percent similarity over four body regions (R1- R4) for ten color-matched individuals.

We found that **R1 (flank)** and **R2 (ventral)** were the best regions to determine body color (right).

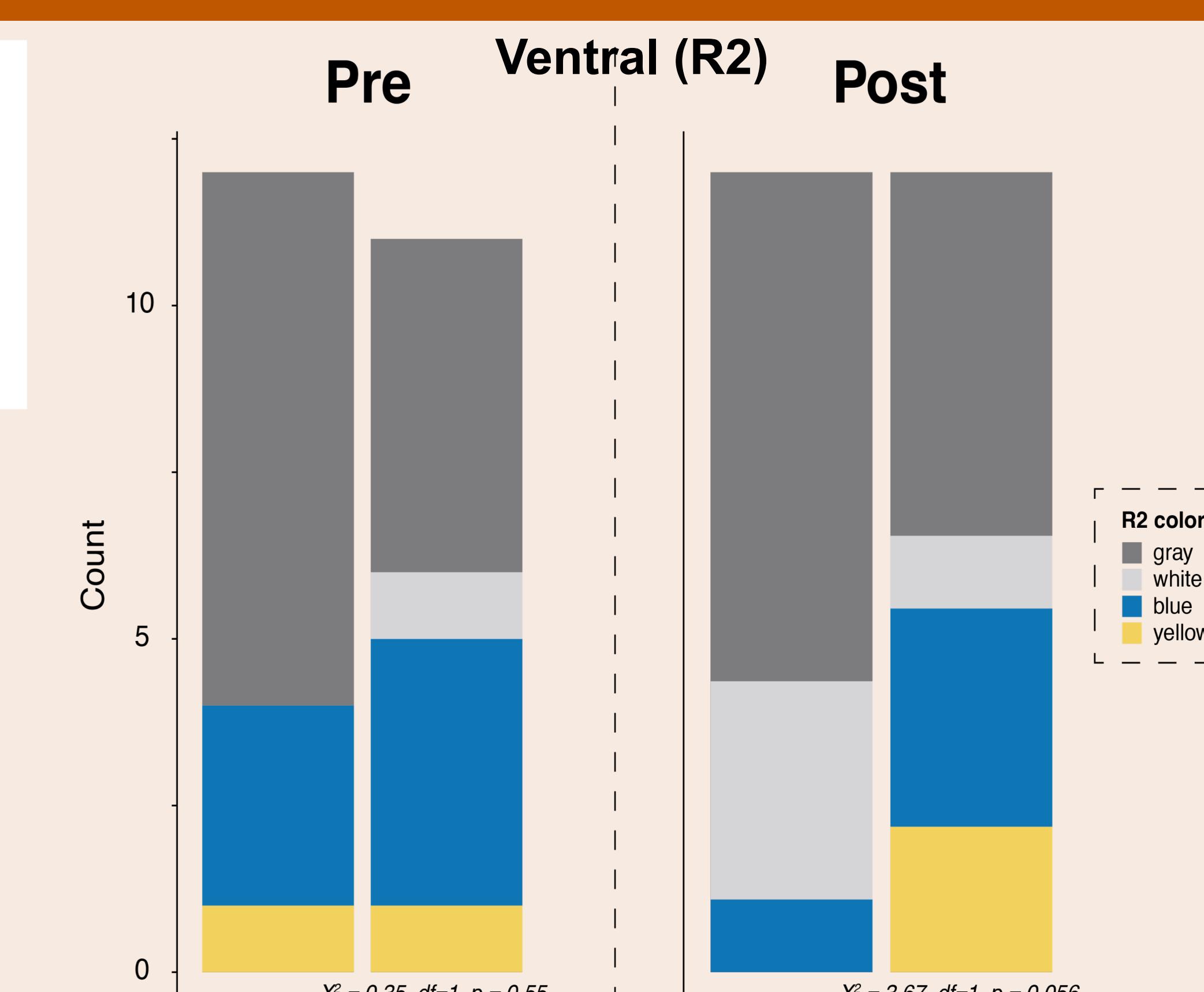


## Body Color Differs with DOM Style



There is no significant effect of disturbance on body color

Bully DOMs are **significantly brighter** (yellow or orange) at **R1** than homesteader DOMs pre disturbance.

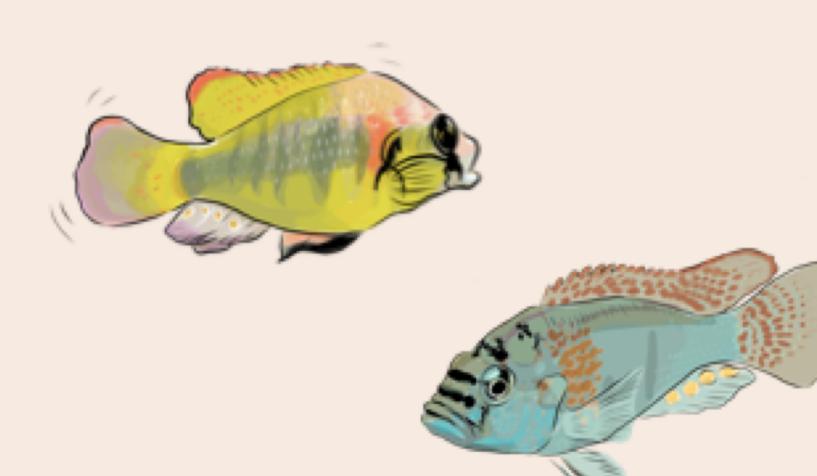


Bully DOMs tend to be brighter (blue and yellow) at **R2** than homesteader DOMs post disturbance.

## Conclusions

- We have established a reliable method to assess body color in *A. burtoni* fish.

### Bullies



### Homesteaders



- DOM styles differ in body coloration at their flank.
- DOM body color does not significantly change in response to a disturbance.

## Acknowledgments

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