Can They be Fooled?
Light Manipulation and Female Mate Choice in Guppies

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Female guppies (*Poecilia reticulata*) are known to choose mates based on the "flashiness" of the male's body and tail pigmentation[1]. This project investigated the female's ability to distinguish a naturally more orange male from a less orange male under lighting conditions which altered their color.

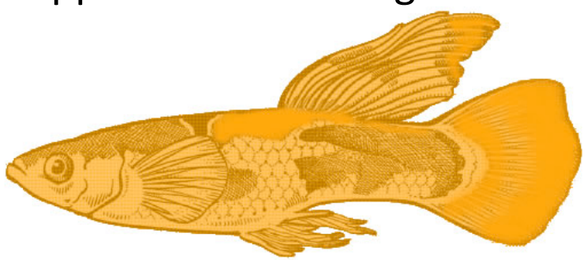
Under orange lighting, which enhances orange appearance, both males should look equally orange and thus equally attractive. Under blue lighting, orange patches will appear gray but will stand out against a blue body coloring. If females still prefer the naturally orange male under blue lighting conditions, it would indicate that patch size or placement, rather than the color of the patch, influences mate choice.

***Poecilia reticulata*:**

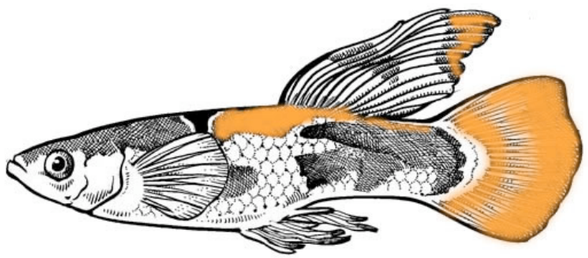
- Sexually dimorphic
- Live bearing
- Native to the islands in the Caribbean Sea
- Wild males exhibit brown coloring with few colored spots

Figure 1. Selectively bred 'fancy guppies' exhibit a great diversity of color and morphology.
http://www.koi2000.com/nl/koiflits/guppy-is-gek-op-kleur.html

Orange lighting will enhance the appearance of orange coloration

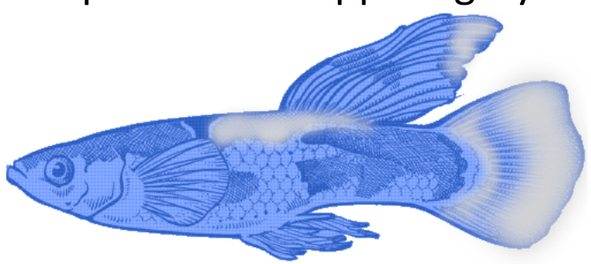


Orange light



Normal light

Under blue lighting, orange patches will appear gray



Blue light

Mate Preference Experiments:

Hypothesis: Female guppies will be able to identify naturally orange males even under artificial lighting

Figure 2. Male fish used in mate preference trials. Male 5 is more orange, Male 6 is less orange.

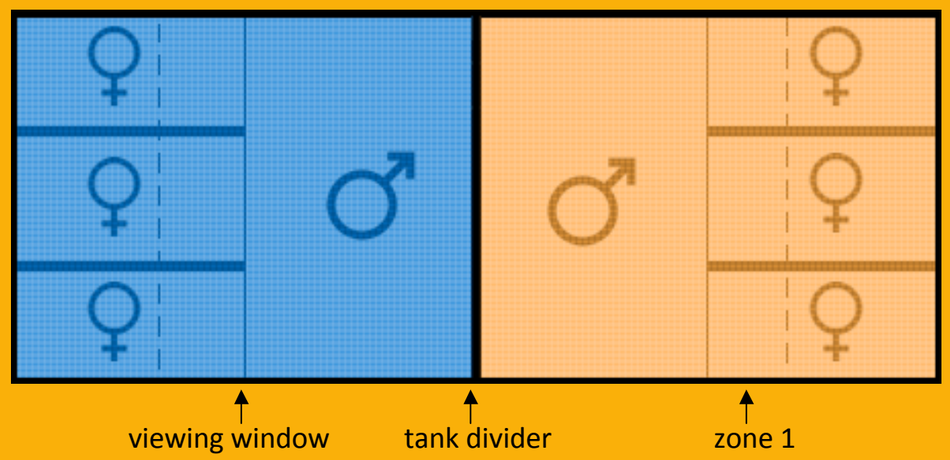


Figure 3. Experimental tank set up. A large fish tank was partitioned into two independent trial arenas by an opaque black divider. Each arena housed three females in isolated chambers separated from a single male guppy by a clear plastic viewing window[2]. The exterior of the tank was wrapped in dark plastic. Removable light filters could be placed over each arena. Experimenters observed trials from above the tank.

Conducting trials

•Two males subjectively determined to be the most (male 5) and least orange (male 6) were selected (*see figure 2*) from a small group of store bought fancy guppies. The same males were used in all trials.

• Males were displayed to the females under blue, orange, and normal lighting. Each trial lasted 15 minutes.

• Between trials, a black divider was placed over the viewing window for 3 minutes.

Observation and Recording

Female interest in the male was measured by how often she entered 'zone 1'*(dotted line in figure 3)*, the third of the chamber closest to the viewing window[1]. The total time spent in zone one and the number of visits to zone one (how many times the female crossed into zone) was recorded for each female during each 15 minute trial. The number of visits can also be used as a measure of activity.

Results:

JMP was used to analyze data collected over 126 fifteen minute trials with eighteen females

- When male 6 (the less orange male) was being displayed, females spent a higher percent of the trial time in zone one (*figure 3*).
- Orange lighting was correlated with increased activity (*figure 4*).
- Females made significantly* more visits to zone one when male 6, the less orange male, was being displayed under orange light (*figure 5*).

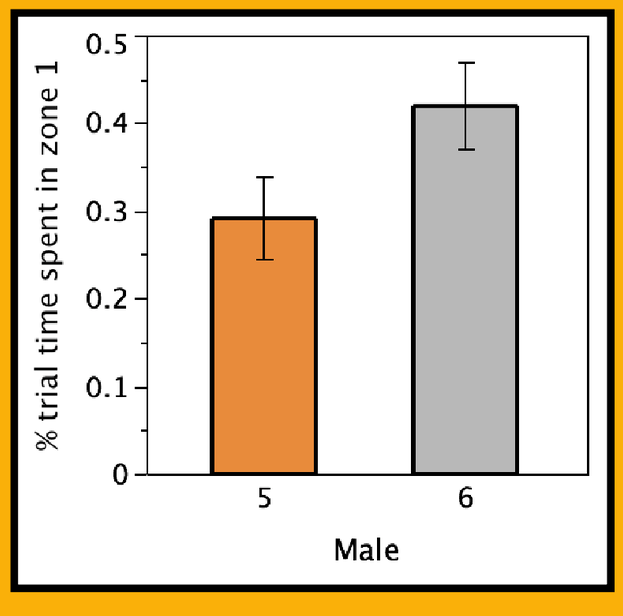


Figure 3. % time spent in zone one by male being displayed (p = 0.0658)

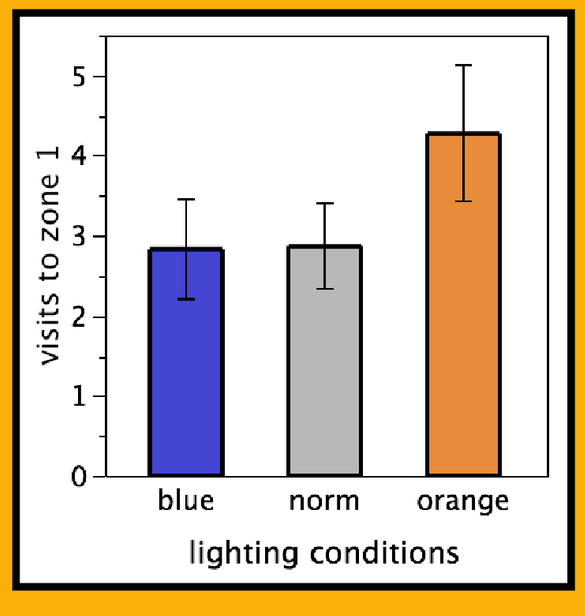


Figure 4. Number of visits to zone one by lighting condition (p = 0.0556)

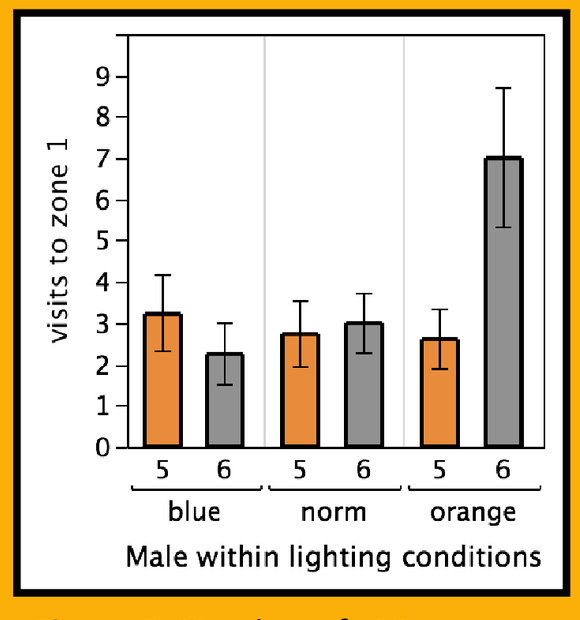


Figure 5. Number of visits to zone one by lighting condition and male being displayed (*p = 0.0155)

Conclusion and Future Directions:

There is a weak correlation between lighting condition and mate preference.

Interpreting the results

•Contrary to the expected result, females spent more time in zone one when the less orange male (male 6) was being displayed, though this result was not quite statistically significant. This outcome could have been influenced by other variables between the two males, such as size.

•While females did make significantly more visits to zone one in the presence of male 6 under orange light, it is debatable that this increase in motor activity is an indication of mate preference.

Follow up studies

•Investigating the size difference and behavioral variations between the males may have shed light on the direction of female preference.

•Future studies might further examine the visible light spectrum available to guppies and their ability to view ultraviolet light (Smith et al 2002). This might be an important factor in color-based mate preference that is not accounted for in our study.

References:
1: K. D. Long, A.E. Houde (1989). Orange Spots as a Visual Cue for Female Mate Choice in the Guppy (Poecilia reticulata). Ethology. 82:316-324.
2: E. J. Smith., J. Partridge, K.N. Parsons, E.M. White, I. C. Cuthill, A.T.D. Bennett, S. C. Church.(2002). Ultraviolet vision and mate choice in the guppy (Poecilia reticulata). Behavioral Ecology. 13:11-19.
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