

Background

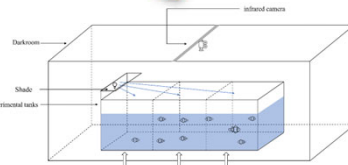
Light-emitting diodes (LEDs) have become indispensable tools for studying fish behavior in both selective fishing practices and ecological sustainability initiatives. This study systematically investigates how key light parameters spectrum, intensity, and duration influence the phototactic responses of yellowfin seabream (*Sparus latus*). Thus, the behavior of juvenile yellowfin seabream was analyzed under four LED spectral conditions and by integrating the phototaxis index (Ip) and approach-avoidance index (f). The results indicated that yellowfin seabream exhibited varying degrees of phototropism across four spectral frequencies, with responses ranging from strong to weak in the order of blue light, white light, red light, and green light. Furthermore, an initial avoidance response was observed with sudden exposure to light from darkness, while phototaxis progressively intensified with extended exposure, indicating that light duration serves as a significant modulator. Moreover, the findings substantiate the relevance of the Signal-Adaptation Hypothesis in the phototactic behavior.

Materials and methods

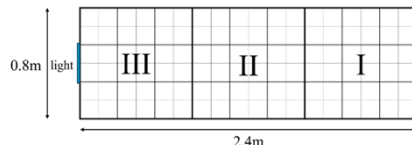
A. Test Object (*Sparus latus*)



B. Hydrostatic tank and equipment



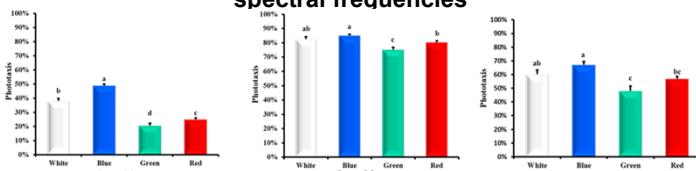
C. Division of light zones



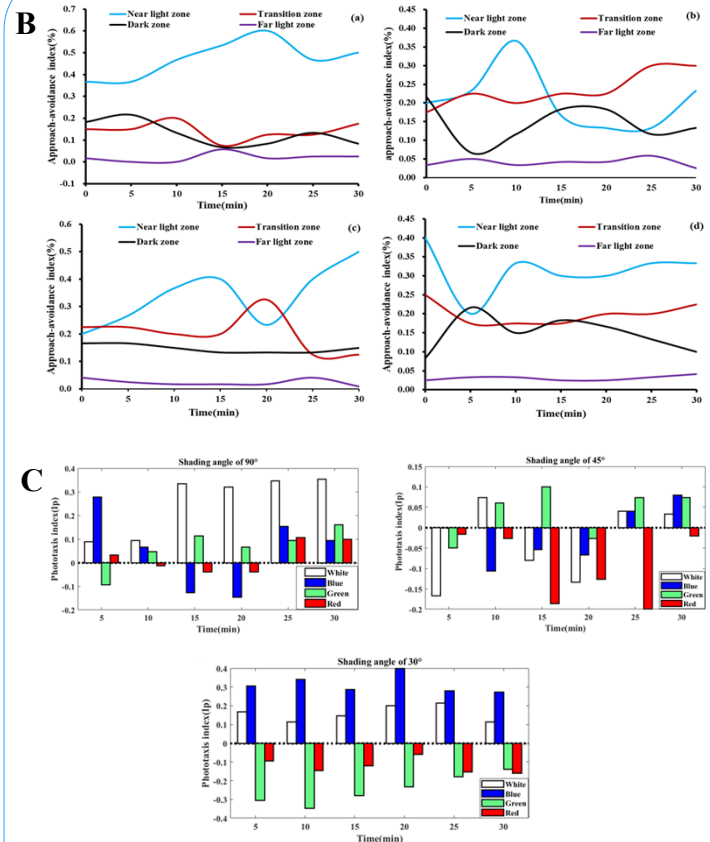
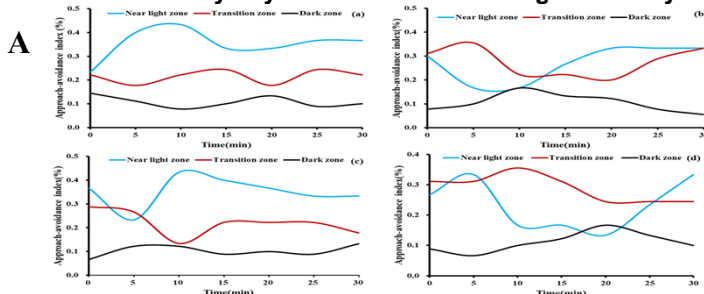
- The effects of light with different spectral frequencies on the behavior of yellowfin seabream were analyzed through observations of their behavioral trajectories and phototaxis rates.
- The video tracking software Tracker was employed to capture the positional coordinates of the test fish, allowing for a detailed description of their phototropic behavioral trajectories.

Results

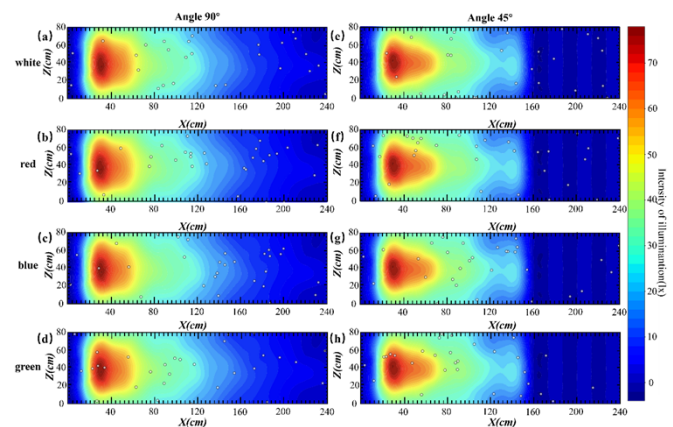
Selectivity of yellowfin seabream for spectral frequencies



Selectivity of yellowfin seabream to light intensity



Effects of light duration on phototropic behaviour of yellowfin seabream



Conclusions

- Yellowfin seabream showed distinct phototactic preferences, being most attracted to white and blue light and least responsive to red and green light.
- Under white light, phototaxis peaked at 40–60 lx, whereas under blue light it peaked at lower intensities (20–40 lx), indicating that spectral quality and intensity jointly regulate attraction.
- Fish initially avoided light after dark adaptation but showed significantly stronger attraction after 20–30 minutes, demonstrating a time-dependent modulation by light duration.
- Yellowfin seabream dynamically adjust their phototactic behavior by integrating multiple light cues, supporting the Signal-Adaptation Hypothesis and illustrating adaptive responses to changing light environments.