Wood as an alternative tank construction material in sustainable shrimp aquaculture

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Aim

The objective of the study was to investigate the potential of utilizing wood as a sustainable alternative to plastic in the construction of recirculating shrimp (*Penaeus vannamei*) (Fig. 1) aquaculture tanks. Two locally grown wood species, Douglas Fir and Oak, were compared to fiberglass-reinforced plastic (GRP).

Figure 1: *Penaeus vannamei* reared in Douglas Fir wood tank (Photographer: J. Steindlberger)

Methodology

The experiment was conducted with *P. vannamei* over 42 days. with three treatments: fiberglass reinforced plastic as a control, Douglas Fir wood, and Oak wood. The wood planks were pre-treated in salt water for three weeks to reduce tannin concentration. Water parameters were constantly monitored and maintained. Shrimp were fed 5% of their average body weight daily. We then analyzed three parameters: i) the feed conversion ratio (FCR): the quotient of feed intake and weight gain, ii) Specific growth rate (SGR): the percentage of logarithmic increase in weight per day, iii) Survival rate (SR): the quotient of initial number and the final number of shrimp.

Results and discussion

The feed conversion ratio (FCR) showed mean values of 1.93 ± 0.08 for GRP, 1.95 ± 0.13 for Douglas Fir wood and 2.25 ± 0.15 for Oak wood ($p = 0.009$). Further analysis using Tukey's HSD post-hoc test showed that the FCR for the Oak wood group was significantly higher compared to both the GRP group ($p = 0.013$) and the Douglas Fir wood group ($p = 0.018$) (Fig. 2).

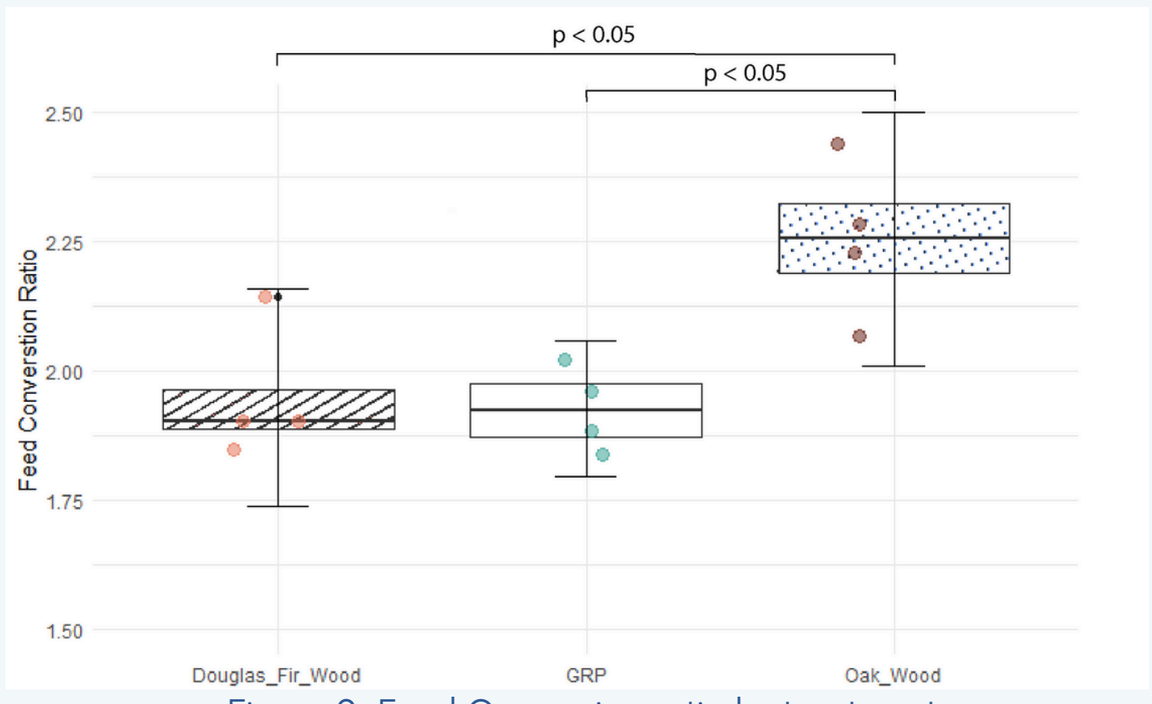

Figure 2: Feed Conversion ratio by treatment

The specific growth rates among the treatments showed mean values of 2.45 ± 0.12 for GRP, 2.38 ± 0.11 for Douglas Fir wood, and 2.32 ± 0.16 for Oak wood. Differences were not significant ($p > 0.05$) (Fig. 3).

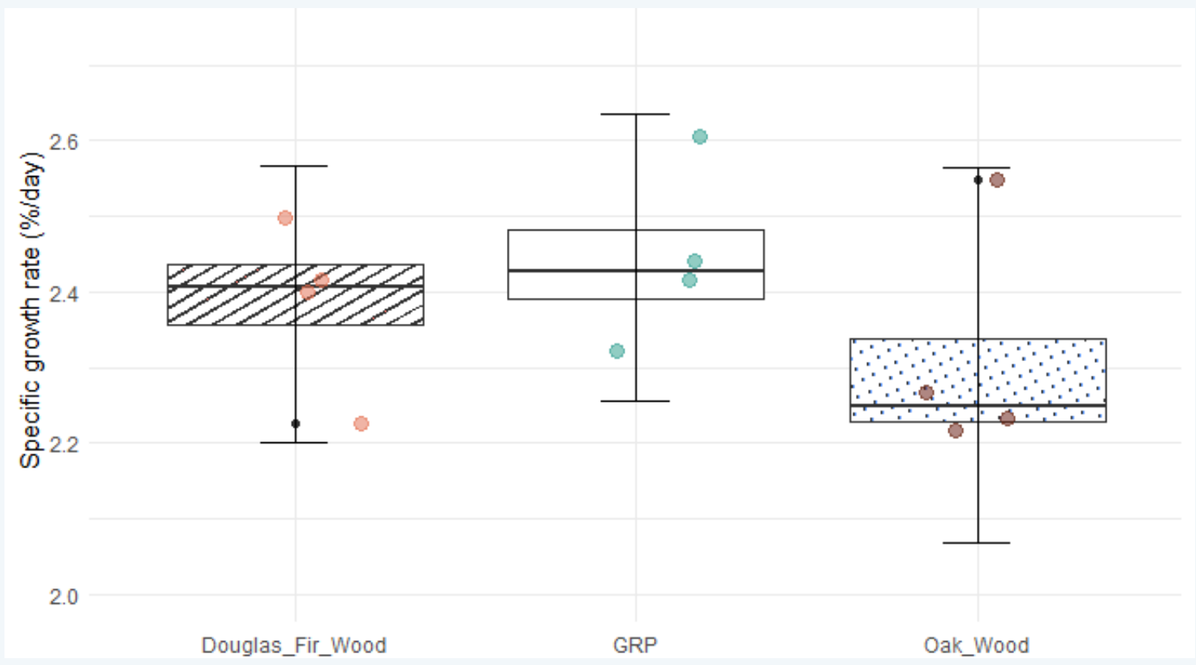

Figure 3: Specific growth rate by treatment

Survival rates were 81.0% ± 6.7 for GRP, 72.6% ± 9.8 for Douglas Fir wood and 63.1% ± 9.82 for Oak wood, a Tukey's HSD post-hoc test showed a significance between the GRP and the Oak $p = 0.047 < 0.05$ (Fig. 4).

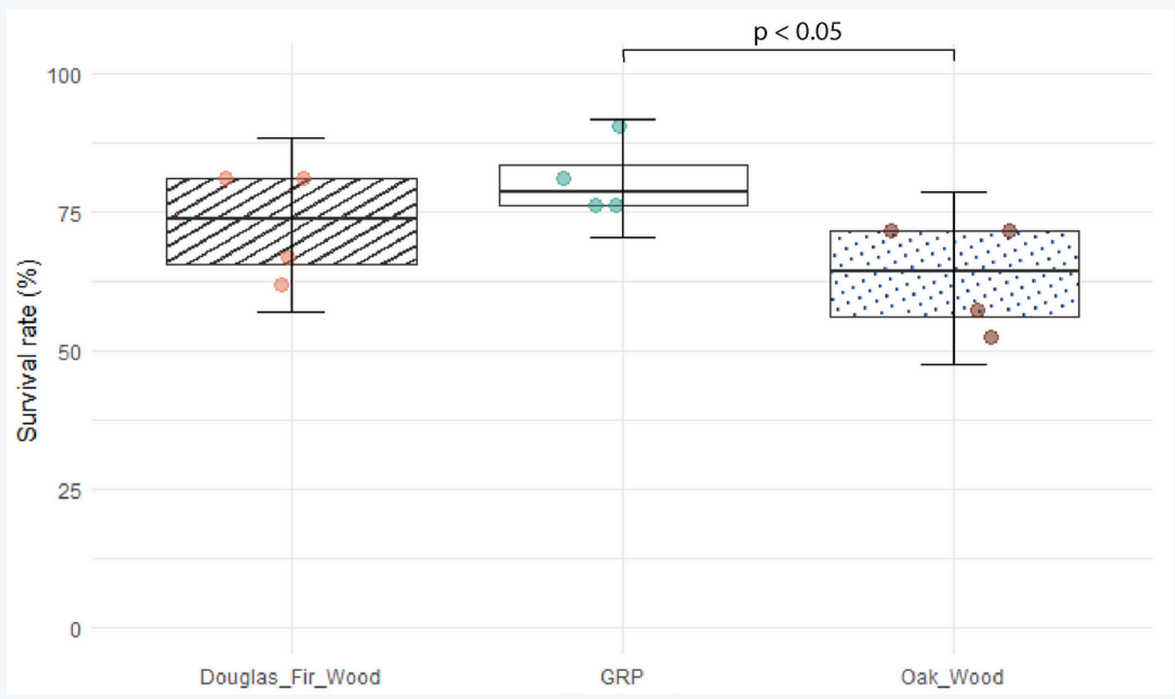

Figure 4: Survival rate by treatment

The study shows no significant differences in growth and survival parameters between GRP and Douglas Fir wood, suggesting Douglas Fir's potential as a sustainable alternative to plastic for constructing aquaculture tanks. The lower performance of Oak wood might be attributed to its high tannin concentration, which could be a stress factor that negatively affects shrimp health and growth. However, in lower concentrations, tannins can improve feed efficiency, enhance disease resistance, and contribute to better overall growth and health of aquatic organisms (Barboza et al., 2020; Gomes et al., 2022). Furthermore, the shrimp actively grazed on the biofilm formed on the surface of the wood, which has the potential for antimicrobial and anti pathogenic properties (Ünal Turhan et al., 2019).

Conclusion

Our results suggest that certain wood species have the potential to replace plastic in tank construction for more sustainable aquaculture practices. Additionally, the presence of tannins in wood, known for their antiviral and antibacterial properties, suggests a potential advantage of wood over plastic in fostering a healthier aquaculture environment.