Effects of material and structure types on drifting speed of fish aggregation devices (FAD) in tuna purse seine fishery

王禹程[1]，周成[1]，万荣[1]， 郭绍健[1]

上海海洋大学海洋科学学院, 上海 201306
College of Marine Sciences, Shanghai Ocean University,
Shanghai 201306, P. R. China

Abstract

The associative behavior of tunas around fish aggregation devices (FAD) in influenced by the drifting speed and trajectory. Based on expertise, fishermen modify the structural specifications to slow down drifting speed of FADs, which enhances the aggregation stability of tuna aggregation around FADs. However, few trials and experiments have been developed to quantify the effects of material and structure types on drifting speed. To address this gap, 10 different types of FAD models were tested under 5 different current velocities in a flume tank and compared drifting times using pairwise Wilcoxon tests. Results showed that FAD-F2-Cc exhibited the fastest drifting speed, while FAD-Br-C1 and FAD-Br-Nb had the slowest drifting speed. When floating structures are the same, FAD models with Cotton rope (1) and Netting bundle submerged structure had the slowest and almost the same drifting speeds. When submerged structures are the same, using Bamboo raft as the floating structure can slow down the drifting speed. Results suggested that it is feasible to replace the netting bundle with the cotton rope of the same diameter for constructing submerged structure and use bamboo to construct floating structure to slow down drifting speed, thus reducing the proportion of synthetic materials in FAD construction.

BACKGROUND

The drifting speed and trajectory of the fish aggregation devices (FAD) affect the associative behavior of tunas. Based on expertise, fishermen modify the structural specifications to slow down FADs' drifting speed, so as to enhance the aggregation stability of tuna around FAD. However, these FADs made from synthetic materials are regarded as possible negative impacts on marine ecosystems by t-RFMOs. So far, four t-RFOMs have adopted a suite of management measures to limit in the FAD design and deployment number, and encourage to use ecological FAD.

MATERIALS AND METHODS

- **10 FAD models were tested at National Engineering Research Center for Oceanic Fisheries, Shanghai Ocean University, China, using a flume tank.**
- **FAD models were scaled following Froude's law. The geometrical scale ratio between the models and actual FAD is 1/6, while the twine diameter/mesh size scale ratio is 1/3.**
- **All FAD models was measured at 5 current velocities, ranging from 15 cm/s to 55 cm/s, and set up with an interval of 10 cm/s**

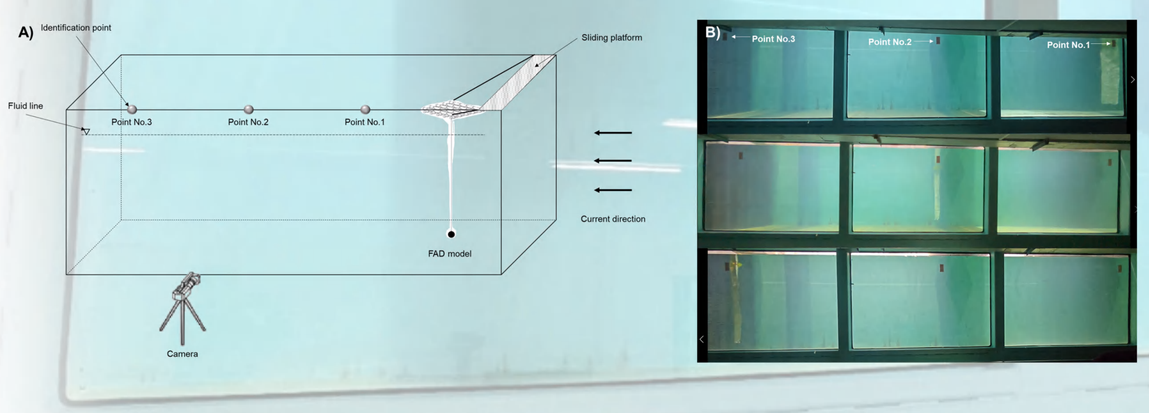

Fig. 1 The setup of flume tank experiment (A) and view of the FAD model's floating structure center reaching three identification points (B)

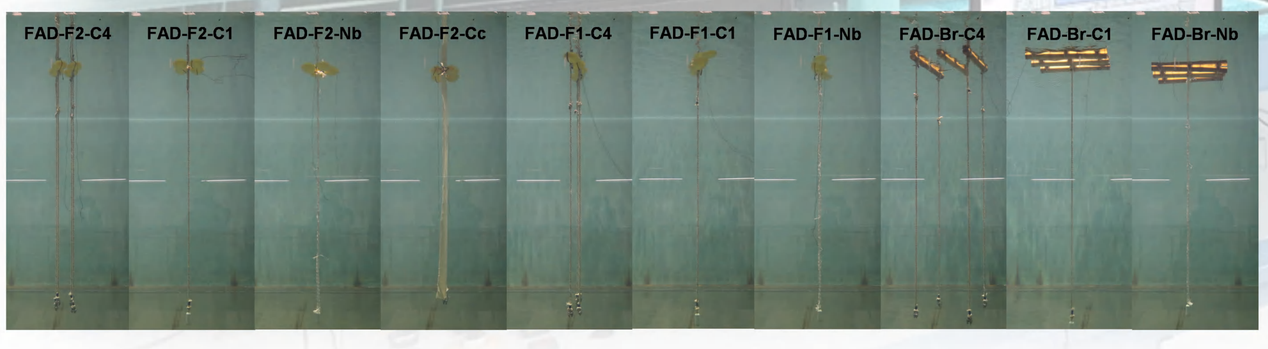

Fig. 2 Experimented FAD models with coded names labeled on the top

RESULTS

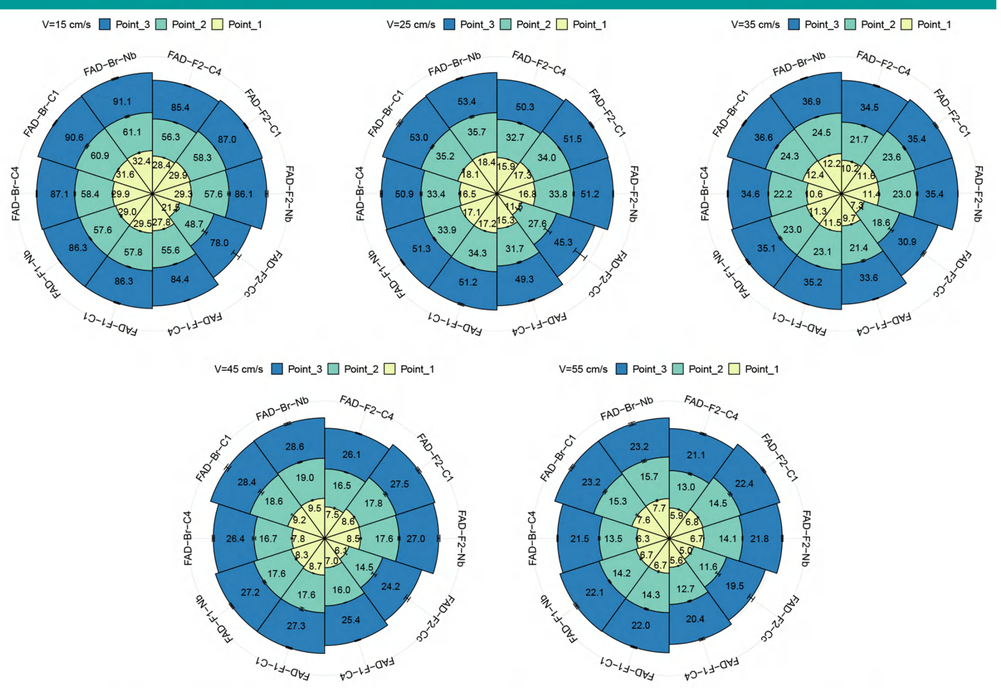

Fig. 3 Drifting time at different current velocities

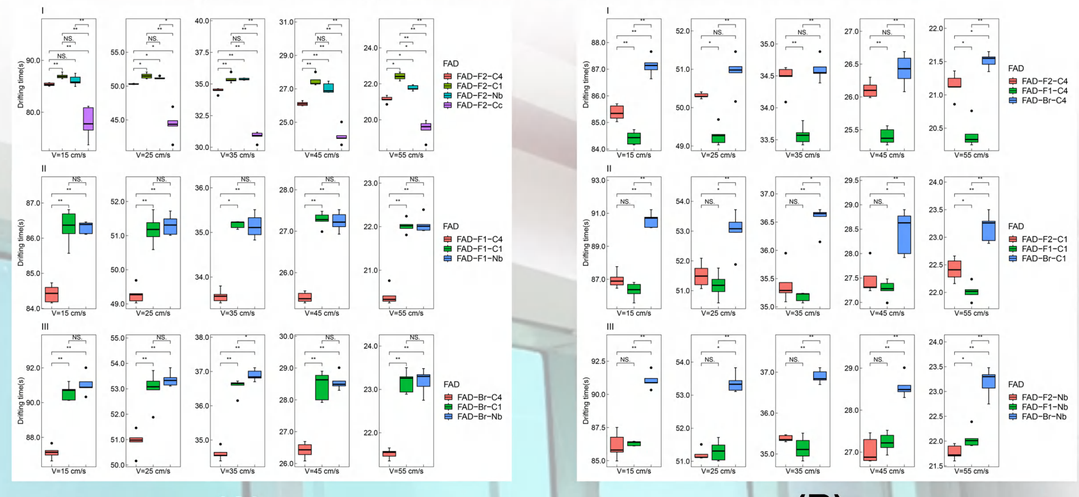

Fig. 4 Drifting time distribution Box-plot of FAD models with the same floating structure (A, I: Float (2×2); II: Float (1×4); III: Bamboo raft.) and same submerged structure (B, I: Cotton rope (1); II: Cotton rope (4); III: Netting Bundle). Note: * signified weak difference in drifting time, ** signified significant difference in drifting time, and NS. signified no significant difference in drifting time.

CONCLUSIONS

- **FAD-Br-C1 and FAD-Br-Nb had the slowest drifting speed and almost the same drifting speeds.**
- **Using bamboo as raft structure can slow down the drifting speed of FAD models .**
- **cotton ropes and netting bundles of the same diameter are interchangeable as submerged structures and both of them have the potential to slow down the drifting speed of FADs.**