Effect of inter-FAD distances on the movements of tuna in an array of FADs: an empirical modeling approach

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Summary

Understanding the effects of increasing FAD densities on the movements and ecology of tropical tuna is key to provide science-based advices on the limits in the total number of FADs. Previous electronic tagging studies conducted on different arrays of FADs allowed characterizing the time spent by tuna associated with FADs and out of them. In this paper, we combined these data with a model of tuna motion in an array of FADs. Tuna motion was simulated through a correlated random-walk model, that mimics a random-search behaviour of tunas in the FAD array. The parameters that set the tuna motion, namely the sinuosity of the trajectory and the orientation radius (i.e. the distance at which tuna can detect the FADs) were calibrated using the field data collected on three different arrays of anchored FADs (Hawaii, Mauritius, Maldives) characterized by distinct FAD densities. Our results show that the model can best fits the field data for an orientation distance of 5-7 km and a low sinuosity of the correlated random-walk motion (c=0.8-0.94). The model was then run on different FAD-array densities and the relation between the inter-FAD distances, the connectivity of the FAD array and the time spent by tuna out of the FADs were derived.