Machine learning for characterization of tuna aggregations under drifting FADs from commercial echo sounder buoys data

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Summary

The echosounder buoys that equip the drifting FADs (DFADs) used in tropical tuna purse-seine fisheries offer unique opportunities to observe pelagic communities and can potentially provide fishery-independent abundance indices for tropical tunas. Such data, however, differs considerably in nature depending on the software and hardware of the different brands and models, which is very often a limitation to their scientific use. This work proposes a new methodology based on machine learning, for characterizing fish aggregations under DFADs from the acoustic data collected by these devices. Our approach consists in specific processing of acoustic information, combined with random forest algorithm, to translate the raw data provided by the buoys into metrics of tuna presence and abundance. The classifications were built from a training dataset constituted from cross-referencing of acoustic and catch data recorded on the same schools, considered as tuna occurrences, and acoustic data recorded a few days after new DFAD deployments, or before DFAD visits without sets, considered as tuna absences. Our results evidenced that detection of tuna aggregations from echo sounder buoys was typically more effective during daytime periods and at ocean-specific depths. Our approach shows very good efficiency for pattern recognition of presence and absence of tuna aggregation under DFADs regardless of the ocean (75 and 79 % of correct predictions respectively in the Atlantic and Indian Ocean), but is less accurate for estimating the precise range of aggregation sizes. This work is one of the milestones towards of development of novel fishery-independent indices of abundance for tropical tuna based on acoustic data.