Global analysis of beaching events in French dFAD trajectory data for impacts on sensitive habitats and proximity to ports

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Summary

Beaching events of dFADs in coastal environments are a major concern as they contribute to marine debris and ghost fishing, and pose a threat to sensitive marine habitats, such as coral reefs. A number of proposals have been made to reduce these negative impacts, including by selective placement of dFAD deployments to avoid areas with a high probability of beaching or by physically removing beached dFADs from landing sites. All of these potential mitigation measures depend on a detailed understanding of where and when beaching events occur. Though previous analyses of dFAD beaching events have looked at their spatial distribution, these analyses have not included the most recent time period (e.g., 2014 to the present), which has seen a dramatic increase in dFAD use, nor have they considered the spatial relationships between beachings and sensitive coastal habitats or ports. Here, we have done a global analysis of trajectory data from dFADs deployed by French purse-seiners over the period 2007-2018 using an improved methodology for identifying beaching events. Results indicate that not only has the number of beaching events increased in recent years, but the fraction of all deployed dFADs that beach has also increased. We hypothesize that this is because the very large number of deployed dFADs has led to an increasing number of dFADs not being fished upon, giving them more time to beach. We identify coastal hotspots for beachings, and in particular beachings in coral reefs, and show that a non-negligible fraction of beachings occur in offshore, shallow-water areas (e.g., seamounts). By backtracking from beaching areas, we identify deployment areas that have a high probability of leading to a beaching event within 3 months. Though many beachings occur in remote areas, a significant number are sufficiently close (<50km) to a port capable of carrying out a dFAD clean-up operation if proper incentives can be put in place to sustain such operations.

Introduction

Over the last decades, purse seine fishing companies have massively invested in dFADs to increase fishery productivity. However, the use of dFADs is associated to a number of potential negative impacts, in particular, beaching events of dFADs in coastal environments which contribute to marine debris and ghost fishing, and pose a threat to sensitive marine habitats, such as coral reefs (Filmalter et al. 2013, Maufroy et al. 2015, Balderson & Martin 2015).

The overarching objective of this work is to come out with a detailed understanding of where and when beaching events occur to be aware of the effectiveness of potential mitigation measures and to anticipate the potential beaching of dFADs.

Material and Methods

To begin with, we developed first a beaching detection algorithm to identify potential beaching events. This algorithm is based primarily on the spatial proximity of multiple positions from the same buoy and also on basic characteristics such as water column depth, distance from land, and distance to ports. We then used a retrospective analysis of available dFAD trajectories and produced probability maps of beaching. We also identified the main characteristics of trajectories that resulted in beaching, such as place and time of deployment, place and time of beaching. We related this information to available knowledge on the nature and type of habitats (coral reefs, seagrass) to quantify the risks of damage and also estimated the distance of beaching areas to ports in order to explore the feasibility of carrying out a dFAD clean-up operation.

Results and Discussion

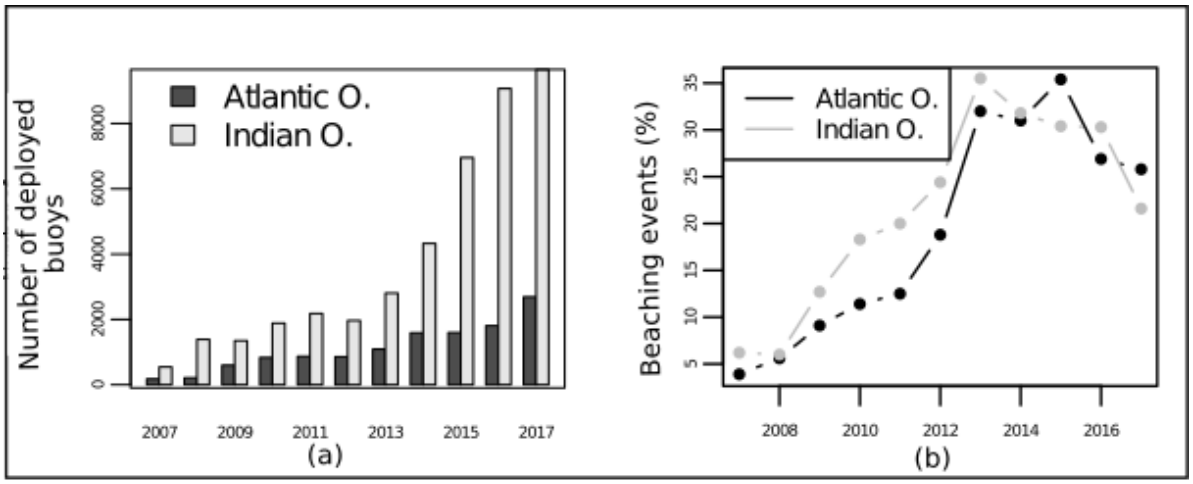

Figure1. (a) Number of new buoys deployed and (b) percentage of these that beached, in the Indian and Atlantic oceans over the period 2007-2017.

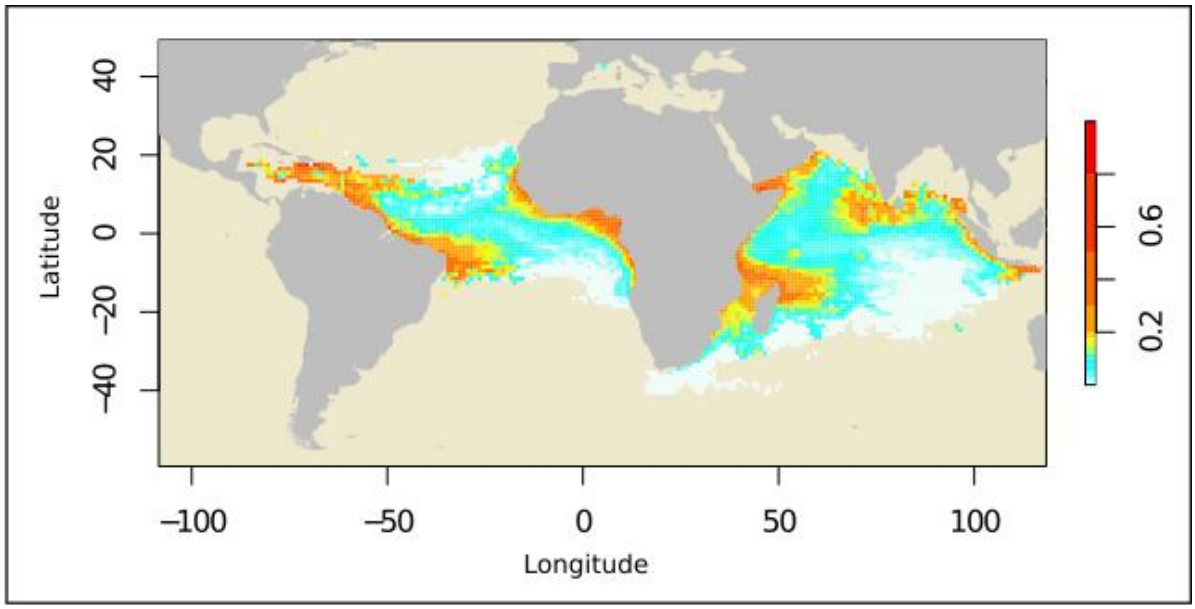

Figure2. Proportion of dFADs passing by each 1°x1° grid cell that beached, over the period 2007-2017.

References

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