Seabirds foraging within random forests

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Abstract:

In the Humboldt Current system, large colonies of boobies and cormorants breed in sympatryand feed on anchovy. Their breeding success depends largely on prey availability around the colonies, which may be compensated to some extent through variation in their foraging effort. Anchovy availabilityin this ecosystem may depend on natural shifts in its distribution triggered by climatic variability and/or on localized depletions generated by the industrial fishery. Deciphering which from the climatic and anthropogenic processes has a more pronounced effect is important for designing pertinent ecosystem-based fishery management options.

To address such question, we use here field data collected in Peru on a breeding colony North of Lima between 2008 and 2013. The foraging effort (time at sea, distances covered, maximum range from the colony, etc.) is documented for >800 trips. The local climatic conditions aregiven by satellite data i.e. sea surface temperature, chlorophyll-a, wind and upwelling intensity. The forage fish abundance and distribution arecharacterized from acoustic scientific surveys. The industrial fishing activity isdescribedby regional landings and the management regime in use. We use random forests (Breiman 2001) of regression trees to assess the relative importance of the covariates on seabird foraging effort because they authorize (i) dealing with 'low n high p' samples possibly concerned by pseudo replication, involving a variety of categorical and continuous variables, relaxing the assumptions of normality or other specific distribution required by classic parametric models (ii) exploring non linear relationships involving complex interactions between predictor variables. We show that the fishing activity has an effect as least as important as the environmental variability and that the two species modulate their foraging effort in different ways. Random forests could be also be used for prediction within the adaptive management currently in use in Peru.

References:

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