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# Small Graphs Comparison to Assess the Independence within Fishing Fleets

Well designed management systems are able to conciliate sometimes antagonist purposes, preserve natural resources and preserve economics activities linked to this natural resources exploitation. In general, identifying a relevant management measure need a careful assessment of anthropogenic pressure on resources. When pressure is due to a set of actors, it is necessary to figure out and to take into account their potential synergistic and/or antagonistic relationships to accurate estimate.

Graphs (networks) are obvious tools for representing sets of pairwise relationships among a set of entities and therefore makes graph's theory studying the properties of mathematical objects defined as sets of nodes and edges relevant to understand multiple actors relationships. Most graph-based studies available in the literature are focused on graphs with common features of so called real-world graphs that is, with large number of entities (several hundred or thousand) and very low densities ( <0.1).

However, many case studies do no fit into the paradigm of large dimensions. For instance in fisheries, fleets may include only ten or few tens of interacting actors. Based on a set of small empirical graphs describing pairwise relationships (the edges) among a set of vessels (the nodes) of two french fishing fleets we tackle the problem of comparing graphs of different orders and the question of testing whether some observed small graphs can be considered as outcomes of some random graph models. This approach is based on the Graphlet Correlation Distance (GCD) a recently develop metric to quantify the distance between two graphs based on the Graphlet Correlation Matrix (GCM).

First, we extend the domain of applicability of the GCD to small graphs and we show its efficiency to identify similarities or differences between small graphs. Then we propose a statistical test to assess if an empirical graph can be considered as an outcome of an Erdös-Rényi random graph models assumed characterising independent relationships.
Using our statistical test we show that independent behaviour between fishermen within one of the studied fleet cannot be excluded. Such conclusion is key for appropriate use of fishing statistics in the process of deriving sustainable management of marine resource.