Optimizing routes of Big Fishing Vessels

Context and objectives

The purpose of this project is to improve sustainability of oceanic fisheries through savings in fuel costs, time at sea and reducing environmental impact. Two main fishing strategies are used to capture fish: (1) targeting fish swimming in free schools; and, (2) targeting fish swimming around drifting objects. This project will develop optimization methodologies to improve vessel route planning by optimizing operational choices such as:

- Our aim is to optimize de operation of a fleet consisting in 6 fishing vessels, 6 support vessels and several thousands of buoys (FADs). However, this could be expanded to consider multiple fleets later.
- Vessel loading (In order to reduce the hull resistance and reduce fuel consumption).
- Weather routing using data coming from public institutions with different types of meteorological models and model outputs and finally data from Earth observation for sea surface currents and other oceanographic parameters. The cost between two points can vary a lot due to environmental condition, but methodical forecast has its own uncertainties and error. Therefore, these exact costs would be unknown.
- Consider species biomass and distribution from probabilistic forecasts.
- Consider species composition to aim at high value species and sizes
- Placement of FADs, recovery or controlled biodegradation. FADs are floating objects that have been modified and placed in the fishing areas by the fishers to attract fish, and to facilitate their aggregation and capture.
    - A deciding factor for the energy efficiency of the fishing vessel, is the ability to choose the FADs with more probability of having big or profitable tuna aggregations, combined with the best route available to visit and/or fish all this FADs in the most energetically efficient way.
    - There is a second important factor that many FADs get lost with economic losses for the industry.
    - Finally, the aim is to produce and deploy biodegradable FADs that should be lost in the ocean and not reach the coast for a minimal ecological impact.
- There are also additional constrains to be considered with the end-user. For example, 1) they usually only fish during the day; 2) some prefer not

to navigate over night when in the fishing area; 3) there might be areas they prefer to avoid due to closeness to pirates.

- Consider competing fleets (e.g. Asiatic) using AIS data (optional).

The trade-off between good solutions and the speed of the algorithm will be critical, therefore a systematic literature review of the state-of-the-art of route-vessel optimization by search heuristics will be the first step.
There would be possibility of collaborating with visualization experts (Czech Republic partners) and with other Big Data experts from Germany, Belgium and Poland within DataBio project.

Supervisors:

Jose A. Lozano (UPV & BCAM; ja.lozano@ehu.es)

Jose A. Fernandes (AZTI; jfernandes@azti.es)

Required skills: Programming in R and/or java, basics of optimization

Required language: Spanish or English. Basque proficiency will be also valued.

Research line: Route optimization and Big Data

Duration and Dates: 6 months (negotiable), starting during 2018 with some flexibility

Covered expenses: To be negotiated

Other: Confidentiality agreement might be needed