USING FADs TO DEVELOP BETTER ABUNDANCE INDICES FOR TROPICAL TUNA

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SUMMARY

Through its Fishery Improvement Project (FIP), OPAGAC launched a research project with AZTI to support stock assessments for the Indian Ocean. OPAGAC is contributing to abundance indices development, both fishery dependent and independent, by providing its FAD data, which is necessary to support and improve the sustainable management of tropical tuna nowadays. For fishery dependent indices this includes catch and effort, sizes, and FAD density; and for fishery independent indices the acoustic records of beacons' echo sounders is provided. Additionally, to contribute to a more comprehensive study, a temporal data series was made available.

KEYWORDS

Catch/effort; Biomass; Fishing technology; Purse seining; Tuna fisheries; Data collections.

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Modern technology is ensuring fishing fleets around the world are as efficient and effective as possible. Particularly regarding the purse seine fishery, several technological improvements resulted in increased efficiency (Torres-Irineo et al. 2014), including the use of GPS buoys to more accurately locate drifting Fish Aggregating Devices (dFADs) and other floating objects, and the introduction of echo sounder buoys to monitor the amount of biomass aggregated under FADs (Lopez et al. 2014). Nowadays, the generalized use of FADs equipped with satellite buoys coupled with echo sounders is causing rapid changes in the fishing strategy and fleet, as they continuously provide fishers with near real-time information about the accurate location of the FADs and an estimate of the biomass aggregated underneath each FAD. Moreover, the echo sounder buoys have also the potential of being an observation platform to evaluate relative abundances of FAD-associated fish using fishery independent data. This potential source of information, independent from catching efficiency and fleets dynamics, may be used by scientists in future stock assessments.

The introduction of man-made FADs in the early 1990s has been considered by many as the most significant technological innovation that has occurred in tropical tuna fishing in the last decades (Ariz et al. 1999; Miyake 2005). However, since its introduction, it has proven difficult to define a fishing effort unit for purse seiners (Fonteneau et al. 1999; Fonteneau et al. 2013).

The relationship between catch per unit effort (CPUE) and abundance is key to stock assessment models. The provision of fine scale buoy and echo sounder data from the OPAGAC fleet aims at assisting attempts to develop indices of abundance from purse seine fisheries, something that has proved difficult since the beginning of these fisheries. For this reason, most of the stock assessments of tropical tunas worldwide (yellowfin, bigeye) are based on longline, and to a lesser extent pole-and-line, CPUE indices.

The information needed to improve fishery-dependent abundance indices is:

a) Buoy density per 1º x 1º grid;
b) Characteristics and technical evolution of the beacons utilized;
c) Historical evolution of the number of supply vessels and their association with the purse seiners.

It is important to note that this complements other information reported, which includes vessel details, logbooks from purse seiners and supply vessels, well maps from purse seiners and landing statistics, apart from the sampling conducted in port and observer data, which assist in the estimates of catch by purse seiners. Moreover, it adds to what is already reported by the Spanish FAD Logbook (please check Ramos et al. 2017 and references therein for further details), such as:

- Vessel name
- Number of trip
- Registration
- Position
- Date
- Hour
- FAD identification
- FAD type
- FAD design characteristics
- Type of buoy
- Type of activity
- Type of activity with the buoy
- If the activity is a set, the results of the set in terms of catch and bycatch
- Characteristics of any attached buoy or positioning equipment
- Observations

The information needed to try to develop new fishery-independent indices consists of the acoustic records of the beacons' echo sounders. Data of all the operational buoys per purse seiner and day throughout each year will be made available, replacing deactivated buoys by new buoys to maintain that number throughout the series for which there is information. Nevertheless, it should be taken into account that echo sounders provide an estimate of the biomass found underneath each FAD in an aggregated status and not discriminated by species, thus despite being fishery independent, this information might need to be cross checked with logbook records to perceive species richness and its relative abundance. Hence, the main objective of this project is to support in providing estimates of tuna abundance at FADs by species, suitable for selective fishing and fisheries independent estimates of tropical tuna abundance.

Considering that it is necessary to have an historical series to be able to incorporate indices of abundance in the evaluations of fish populations, the data available covers the longest possible period of time, from 2010 (or earlier if it existed) to December 2017. This is one of the voluntary initiatives being implemented by the OPAGAC fleet, in the framework of its FIP (Herrera and Morón 2017).

Annex 1 - Format of the information to be requested from buoy suppliers' companies

The information will have the below described components, which are the usual formats reported for AZTI to verify the number of active buoys in each tRFMO.

a. Information about buoys' daily positions

To determine the densities of satellite buoys per grid of 1º x 1º and month, and the evolution of the characteristics of the buoys used by the OPAGAC fleet in the Indian Ocean, it is necessary to have the daily position of each buoy (identified with its unique code) according to the format described below. A single csv. file will be prepared independently for each company and year.
The information collected in the csv. files is:

- date [dd-mm-aa]
- hour [hh: mm]
- unique identification code of the buoy [the format varies depending on the manufacturer, although it is always alphanumeric]
- latitude [expressed in degrees and minutes in decimal values],
- latitude [expressed in degrees and minutes in decimal values], and
- speed [knots].

b. Information on acoustic records

The data of all operational buoys per purse seiner and day will be sent throughout the year, replacing buoys deactivated by new buoys to maintain that number throughout the series for which there is information.

Components provided per buoy manufacturer:

- ZUNIBAL: Company, Buoy Code, date (day, hour), Type (position or echo sounder), Latitude, Longitude, Speed, Drift, Total;
- SATLINK: Company, Buoy Code, md, date (day, time), Latitude, Longitude, bat, temp, speed, drift, layer1, layer2, layer3, layer4, layer5, layer6, layer7, layer8, layer9, layer10, total , maximum, mag1, mag2, mag3, mag4, mag5, mag6, mag7, mag8;
- MARINE INSTRUMENTS: Company, Buoy code, date (day, time), lat, mode, lon, light, poll, temperature, vcc, date2, gain, layers, layerbits, maxdepth, sd1, sd2, sd3, sd4, sd5, SD6, SD7, SD8, SD9, SD10, SD11, SD12, SD13, SD14, SD15, SD16, SD17, SD18, SD19, SD20, SD21, SD22, SD23, SD24, SD25, SD26, SD27, SD28, SD29, SD30, sd31, sd32, sd33, sd34, sd35, sd36, sd37, sd38, sd39, sd40.

Annex 2 - Format of the information requested from the companies

To determine the historical evolution of the number of supply vessels and their association with the purse seiner(s), each company will prepare tables with the following fields:

- Year: year of activity
- Company name
- Name of the purse seiner(s)
- Name of the supply, in case the purse seiner has worked totally or partially supported by the supply
- Percentage of dedication of the supply vessel to the purse seiner (0.50 if the supply has been shared by two purse seiners, 1.00 if the supply has been exclusive to one purse seiner)

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