CONSIDERATIONS ON COMBINED STRATEGIES FOR COLLECTING INFORMATION AND SAMPLING OF MULTIPLE VARIABLES FOR STATISTICAL TASKS AND SCIENTIFIC STUDIES ON TUNA AND TUNA-LIKE SPECIES: ETHICAL REFLECTIONS ON SCIENTIFIC ACTIVITY IN THE CONTEXT OF T-RFMOs

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Summary

This paper remind the combined systems applied by flag states and/or scientists to obtain representative multiple variables for these fish species which can be used to prepare basic statistics tasks and/or to prepare scientific studies on different species and topics. It also pays attention to observations at sea which, together with other mechanisms in place, are used to obtain statistical tasks and to carry out research. The results obtained from research are regularly presented via scientific papers which improve the knowledge about fish and other species, provide indicators in some cases considered representative of abundance and examine various issues for improving stock assessments. Scientific studies also allow us to learn more about both fish and non-fish bycatch species, particularly in the case of the sporadic and rare events observed in some fisheries.

The paper also proposes a critical consideration of some ethical issues that may arise as a result of the biased or misleading interpretation of data and scientific studies submitted, and of the omissions or misinterpretations that may appear as fake information or post-truth in some cases regarding the tRFMO studies presented, reports and assessments.

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1. Introduction

The Tuna Regional Fisheries Management Organizations (tRFMOs) responsible for assessing and overseeing tuna and tuna-like species have issued abundant recommendations/resolutions for the compilation of data used to generate the statistical variables needed to assess the stocks for which they are responsible. These variables for particular fish species ï targeted or bycatchï are considered as *basic statistical tasks* (e.g. Task I and II) which are mandatory and the responsibility of CPCs. The recommendations/resolutions have been adapted over time to provide more detailed and robust data for plausible assessment of tuna and tuna-like species/stocks.

The tRFMOs have diverse sources of information about their stocks, probably with scarce precedents in many other types of species-fisheries. His historical series can even go back in some stocks until the middle of the last century. The information used in assessment groups usually integrates a great amount of information and experts on the respective species-fisheries. For all this, despite the limitations that may exist in some stocks in terms of data quality, biological studies about basic parameters or models used do not properly adapted to these species, the truth is that other forums can not probably provide greater progress and better diagnosis based on the global-international information available. However, it is good to recognize that sometimes the limitation of existing information should not lead groups to make pretentious approaches in their diagnoses based on models fed with uncertain data series.

It is frequently assumed that having data sets for all these species that are apparently detailed in terms of time and location (e.g. *extensive or over-extensive* stratification) and using assessment models that are more sophisticated and require more parameters and data entries necessarily implies greater verisimilitude in the assessment of these species. However, in the case of some fish species -and specially in fish bycatches with low occurrence- apparently extensive data sets could be constructed in some cases by means of software refinements with a high degree of estimation-substitution, leading to the generation of misleading data which create more uncertainty by going beyond what the raw information would justify or by blurring the analyses because the resulting data sets do not reliably represent their real historical catches, the abundance of these species, sizes, real distribution or behaviour. In these cases, simple models adapted to the information considered more reliable and the diagnoses directly based on that information are probably better approaches.

Although it is understandable that tRFMOs and CPCs emphasise compliance, it does not seem reasonable that scientists value this more than the quality of the data, the analysis and scientific contributions provided, these two issues often being confused. Within this dynamic which has been generated in some cases, we can hear declarations and read domestic and tRFMOs reports that give an idea -in my view- of the confusion that seems to exist among some managers and even among some researchers with lengthy experience in tRFMOs, while in other cases we see an intention to discredit particular countries, fleets, papers or even colleagues, or to focus debate on positions related to specific fields or species. However, it should probably be recognized that the border between science and compliance is not perfectly defined in all countries or assumed by all scientists.

Since the mid-1990s, the initial priorities of the tRFMOs regarding these fish species for which they are strictly responsible have been progressively extended to include a range of recommendations/resolutions to obtain data and assess other fish stocks when possible, as well as carrying out scientific work on species not included in their original mandates, e.g. pelagic sharks related to tuna and tuna-like fisheries, bycatch involving species that may constitute occasional or rare events in some fisheries (protected elasmobranchii, marine mammals, marine turtles, sea birds, etc.). The purpose of the recommendations/resolutions concerning these latter species is usually: (a) to identify and assess possible undesired impacts in the fisheries covered by the tRFMOs on species considered sensitive, so that they can be taken into consideration together with other factors external to these fisheries, (b) to propose effective measures to mitigate, minimise or eliminate potential undesirable impacts in these fisheries, when and where they exist, to contribute to the sustainability and conservation of these sensitive species.

On other hand, the tRFMOs in some cases encourage the presentation of *scientific papers* that can be added to their scientific collections when these exist (e.g. ICCAT Collect. Vol. Sci. Pap.) and/or included as *working papers or meeting document* to be considered in some extend within the respective scientific groups. Useful research requires method, transparency and the presentation of results. However, there is a risk that earlier works on a

particular matter may not be considered because only recent advances are regularly taken into account, or that neutral results presented may be omitted or used inappropriately (Anon. 2017[a]).

Another limitation to develop diverse scientific activity in the t-RFMOs is that the official languages are very limited in number. Most scientific groups tend more and more to develop exclusively in a single language without the possibility of interpretation between participants. Although the scientists make efforts and put goodwill to facilitate as much as possible the dynamics of work in a single language -with their respective limitations for scientists but important economic advantages for the t-RFMOs Secretariats-, this undoubtedly hinders the equality between participants to raise arguments, hypotheses and ideas or present their studies. The additional effort involved in writing and presenting papers in a non-native language is not always well matched by some other researchers who use their native or main language within the groups. Sometimes even this added difficulty for some participants, far from being positively valued, is criticized or even despised or used to take advantage during the scientific debate.

In other hand, the possibility of the *double* use of neutral scientific information, the conscious undervaluation or omission of information that is available, or criticism made with specific objectives or interests can, on occasion, make it difficult to differentiate between *good* and *bad* research and may blur the real usefulness of studies. While these dysfunctions have been observed for some time in certain fields of science where there are strong economic interests, such practices have unfortunately spread to other areas of science. The problem persists today and has become the subject of intense international debate[2]. In this sense, the role of the tRFMOs and their working groups could be important in encouraging the presentation and recording of studies and increasing the value attributed to them, but they must also be cautious and very active in preventing inappropriate or interested use or omission of the information available, the studies presented or the conclusions reached.

This paper pointed out some aspects related to the complexity of the systems regularly implemented to obtain data and generate studies on these species and subjects. Additionally, it discusses ethical issues that should be considered in the face of fake information and *post-truth*. The comments included in this paper have been recently pointed out in ICCAT and are replicated in this document in case they were useful in the framework of the IOTC where some of these aspects could be also evidenced.

2. Sampling, protocols and other considerations

Most people agree on the convenience of having a combination of means for sampling and biological studies in the different *tuna fleets*, including the coastal, recreational and artisanal fleets (CRAF). However, frequently there is a lack of information and studies of some of these CRAF segments which may be very important in some cases for some stocks and especially for some bycatch or incidental catch species that are generally poorly reported for these CRAF segments.

There is often confusion between the statistical-scientific processes used for compliance in tRFMOs and scientific activity for the purpose of research and knowledge in accordance with the values of scientific ethics (Resnik 2015) and the freedom of researchers (Catterall 2014, Folkers 2013) which implies that this activity should be subject to ethical principles and conducted via free contributions using different means of research and dissemination (Anon. 2017[a]). Ethics and freedom are both main values that should be an integral part of scientific work but, unfortunately, the system is not perfect and it may sometimes be open to restrictions and intellectual bias when the researchers receive funding from groups with specific interests (Catterall 2014).

It also tends to be forgotten that the collection of information about fish species for statistical and scientific purposes to achieve different objectives and obtain multiple variables is normally conducted through the use of a variety of methods which are regularly combined (**Figure 1**). As suggested by Anon. (2017[b]), the methods applicable to each case and fleet are different and normally depend on the objectives pursued, the characteristics of the fleets, the target species, operational limitations, etc., and of course the resources available in each flag State. Statistical and scientific objectives are usually divided along operational lines into

[2] https://multimedia.europarl.europa.eu/en/third-world-congress-for-freedom-of-scientific-research_8225A_c

priority and *secondary* (also called as *higher* and *lower* priority), as not all of them can be tackled with the same levels of intensity and stratification.

The meaning of *key variables* is likely to vary according to the species of interest or the field of study that each researcher prioritises. However, there is no doubt that the main objectives include obtaining appropriately representative observations of these fish species can be carried out as required by the tRFMOs, taking into account the gears used, the target species, the space and time strata of fishing activity, the size of vessels, the availability of space and resources for collecting data on board (according to the minimum legal crew requirements in the flag State), the requirements and systems of the CPCs for the collection and communication of mandatory monitoring information (logbooks, VMS, control of landings and others, observers, etc.), the habits and landing sites of the fleet, communication systems, protocols for processing fish on board, the prevalence of target and bycatch species, the resources available to CPCs; and also the interest of scientists in obtaining data and biological samples for specific studies, among other elements.

Independently of the most appropriate procedure/s used and adapted to each fleet, it is clear that different strategies are normally applied, individually or in combinations, to provide tRFMOs with basic statistics on fish species (**Figure 1**). Observers at sea can be one element in these strategies, in which scientists should, above all, look for quality of information rather than try to attain a formal compliance objective. Programmes involving scientific observers are frequently used when the information regarding some of the variables cannot be collected by using other strategies, or to obtain data or biological samples that cannot be achieved via other procedures, or to complement or verify information obtained from other sources. It is often argued that the only disadvantage of this approach is its high cost. However, there are also other various factors that may obstruct this type of activity, its effectiveness and the reliability of the data compiled. From a scientific point of view it has a series of potential advantages, such as the quality of the taxonomic and biological information concerning the target and bycatch species, more detailed knowledge of certain parameters related to fishing patterns, and the possibility of recording observations and obtaining samples for biological studies, among others. However, it is generally recognised that there are difficulties in implementing this option where there is over-stratification in cases where fleets or fisheries have a low occurrence of certain species or rare events (Anon. 2017[b]).

The difficulty of finding an ideal design for sampling of commercial vessels using a set of multiple variables is well known and recognized. Although appropriate plans are regularly made for these programmes to ensure the representativeness and quality of target variables in combination with other sources of information also used, the objectives cannot always be fully attained with equal intensity for all the variables (e.g. Cortes 2017, Gilman and Clarke 2015), especially annual-based and with extensive stratification in the case of species with low/very low or zero occurrence. For this reason, problems of implementation may arise *a posteriori* concerning species where there are rare events (Anon 2017[b]).

In this respect, sufficient consideration is rarely given to the fact that the hard work of an scientific observer on board a fishing vessel, who is trying to determine multiple variables, is much more valuable and representative the less the observer influences regular operations on the vessel, including the free choice of the fishing areas and other elements that affect normal fishing activity, which are not generally known beforehand. However, on some occasions observer programmes attempt to prioritise certain areas or periods of observation or certain vessels for specific objectives or variables (e.g. complementing data that have been collected or obtaining samples for particular studies). The training of observers, the availability of space and the facilities on board for them to do their work, and the availability of resources in the country to set up and pursue the scientific programme, are elements that must be considered when implementing systems that are meant to be realistic, sustainable and, above all, qualitatively robust. Not all observers have the same skills in all fields, so one must be very cautious when assigning tasks on board if they require specialised knowledge (e.g. reproductive studies, sightings and taxonomy of sea birds, etc.), giving priority to the quality and verisimilitude of the information recorded rather than its quantity, ensuring also that the activities that need to be carried out on board remain within a humanly sustainable working scenario.

On occasion these well known operational difficulties may even affect the representativeness of the main targeted tuna species when a very extensive or over-extensive stratification is wished. For this reason, information normally needs to be processed by national experts who are familiar with the respective fisheries, applying methods adapted to each case, including appropriate assumptions and substitutions where necessary,

and who have a reasonable grounding about the history of the fisheries and biology of these species. These difficulties can also specially affect the representativeness of observations of species whose occurrence is sporadic, rare or null in some fisheries, it not being realistic to plan a volume of observations at sea sufficient to achieve representative results on annual basis and extensive stratifications for species whose presence is sporadic, rare or null. Therefore, the efforts made and the large number of scientific studies carried out to date on these species in commercial vessels should be valued by the scientific community.

Aware of these and other limitations, ICCAT and IOTC have suggested plans for research in connection with bycatch and species such as sea birds which in some cases could be accidentally caught, based on specific recommendations and resolutions. In this sense, Scientific Working Groups (SWG) had requested specific studies of this issue based on guidelines. Recently it was suggested in SWGs of both tRFMOs cited that studies should be presented concerning the interactions with sea birds observed in restricted latitudinal range where interaction in oceanic areas is considered most likely (Lat.Ó25ºS) and during a restricted period of years specifically requested, which gives a partial idea of the scientific information available for all areas fished by different fleets as recorded in annual reports, scientific papers or other contributions presented.

If we lose sight of the scientific objectives involving all the necessary multiple variables, forget the approach and guidelines proposed by the SWGs and focus possible criticism of a system on one or more species of priority interest for a particular field of study or reader, we may be led to draw unclear or misleading conclusions about the information provided and the efficiency of the systems as a whole in long run.

Scientific criticism, when founded, is a very positive value which has led to great progress in knowledge. However, a problem regarding this type of studies of the interaction between fishery activity and non-fish species is the criticism levelled in certain circles when the results of studies do not match the readerôs expectations. We thus find that on some occasions there are dual, erroneous or misleading interpretations of the results presented, when these are not actually manipulated. For example, high rates of interaction observed in a particular fleet fishing in certain areas and using one gear or style may or may not be taken as representative of or applicable to other fleets fishing in different areas with different gear or styles, depending on who the reader is. Similarly, low or null rates of interaction in a particular fleet fishing in certain areas and using one gear or style may or may not be accepted as representative of or applicable to other different fleets fishing in different areas with different gear or styles, not covered by observations, depending on who the reader is.

As we have already pointed out, it is generally accepted that there are difficulties in developing a perfect strategy for combined sampling in commercial vessels for all objectives (both priority and secondary) in annual basis, using multiple variables and carried out by observers on commercial vessels. Nevertheless, the debate is often simplified, focusing on the minimum percentage that should be adopted for general use in all programmes involving CPC to obtain *key variables* for one or more species considered to be of *special interest* for a reader. Suggestions of this kind are often put forward without consideration of all the systems implemented to attain the basic statistical objectives established by tRFMOs. In other cases, the proposals come from parties with little direct involvement in these complex sampling programmes or with a special interest in one or some particular variables or species. Lower rates of sampling could in some cases achieve better quality of data and a number of observations equivalent to those obtained with formally greater coverage but applying less demanding protocols on board or using less skilled observers.

The measures applied for the statistical and scientific aims of the tRFMOs are by no means incompatible with other actions that may be undertaken as part of research projects or by groups with a special interest in some variables of rare events. When certain fleets, gears, styles, areas, periods, etc. that correspond to potential hotspots have been identified because of the likelihood of a relative high rate of interaction with species considered sensitive or of special interest, specific actions could be established to evaluate these strata, develop directed research and/or propose efficient mitigation measures.

3. An example of erroneous interpretation

An example of an inappropriate interpretation of the results obtained in a scientific study, which could give rise to erroneous or misleading conclusions, can be found e.g. in Wanless and Small (2017). In that document

presented to the IOTC the authors use a figure from an ICCAT-EBYC paper by dealing with areas of the Atlantic (Ramos-Cartelle *et al.* 2017) as an ñ*example of how extrapolation from non-representative data can be misleading*ò, criticising the unrepresentative nature of the sampling in relation to the observations made of sea birds, using it as an argument for proposing higher levels of coverage by observers to obtain *key variables* for sea birds.

In this respect the following comments should be pointed out:

(1) The study by Ramos-Cartelle *et al.* (2017) was done following the guidelines of the ICCAT-EBYC Working Group restricting the requested analyses to scientifically observed interactions with sea birds in each fleet in the Atlantic for Lat. Ó25ºS during the requested 2010-2014 period. ICCAT-EBYC requested such information in order to evaluate, in each case, the interaction rates observed for those species according to data available for those specific areas and fleets using certain gear and styles during that particular time period defined. The results submitted to ICCAT-EBYC from that study were thus considered only for the strata and times observed and were complementary to those provided from this and other fleets, for the same or other areas in the Atlantic.

(2) In no way did the study by Ramos-Cartelle *et al.* (2017) propose or suggest that the observations available for the Atlantic in the 2010-2014 period at Lat. Ó25ºS (all of them with null interaction of sea birds during all the trips observed) should be extrapolated or generalised to other Atlantic (or Indian) Ocean fishing areas or other fleets, etc. In order to avoid any such biased interpretation by the reader, the authors included a very informative figure in the paper in which the position of the Atlantic observations were superimposed on the nominal effort of the Atlantic fishing fleet for Lat. Ó25ºS for combined years (Task II data, years combined), coinciding with the criterion recommended in Anon. (2017[b]). The authors thus indicated that no attempt should be made by readers to generalise or manipulate -in one sense or another- the results obtained beyond their strict meaning and scope. The usefulness of that study should not therefore be questioned, given the objective specified by guidelines of the ICCAT-EBYC Working Group and the geographical limitations to sampling indicated by its authors for that particular time period. The problem, I fear, is more in the reader's use, misinterpretation of data and *post-truth* than in the content of the study itself.

(3) The study by Ramos-Cartelle *et al.* (2017) does show that the potential problem postulated of high/positive interaction rates for sea birds in all Atlantic longline areas-fleets-gears/styles South of Lat. Ó25ºS, as described for some particular areas-fleets, cannot be generalised to all Atlantic areas-fleets-gears/styles at Lat. Ó25ºS, since, for at least the period observed and the areas and fleet-gear/style analysed in that particular study (including mitigation measures implemented) the interaction observed with sea birds was null, in spite of the abundant sightings of sea birds identified in the fishing areas studied. This finding was corroborated in a recent study considering all areas observed in the Atlantic Ocean over a period of 25 years (Fernández-Costa *et al.* 2018) which information had been mostly previously provided in different *fora* considering the respective mandatory recommendations and scientific guidelines.

(4) A study using similar methodology but following the specific guidelines of the WPEBYC was presented in 2016 (Fernández-Costa *et al.* 2016) covering IOTC regions (IOTC-2016-WPEB12-29), showing positive and null interactions with seabirds for the areas-times requested. However, this document was not quoted in Wanless and Small (2017).

4. Ethical considerations

Society normally trusts the results of scientific research to be an honest and accurate reflection of the work carried out (Anon. 2009). As researchers, we should also be able to trust that our work will be treated with respect. When this respect and this trust are lost and the most basic professional standards are disregarded, researchers not only generate confusion but seriously affect the relationship among scientists and also between science and society which must be based on truth and trust.

The conduct in the sciences must clearly be subject to the generally accepted principles of ethics and freedom (Bolton 2002, Grant 2002, Anon. 2017[a]). These ethical principles should not only encompass the data, methods and processes used but also the correct interpretation and use of the results obtained, both by the authors and

by other scientists who may make use of the research available. Unfortunately, the source of funding for scientists may sometimes come to condition or bias their work and/or the interpretation of results produced by others (Catterall 2014), a question that has become a matter of serious concern under discussion on an international level in various fields of science, leading to the creation of discussion forums and the drafting of ethical codes of conduct regarding scientific activity in universities, businesses, foundations, research institutes, etc. all over the world.

A reader with ethical principles should not take the results of a scientific study out of context, copying and pasting part of an article and disregarding the context and the scope of the results obtained as described by the authors. Unfortunately, this type of practices identified in some cases as *post-truth* (see e.g. Keyes 2004) has become more frequent nowadays with the greater use of social media and internet technologies (Monkman *et al*. 2017). In this sense, the FAO has already given warnings about the growing media pressure and concerning some fisheries for food production -which contribute to avoid the *globesity*- and marine ecosystems, versus anthropogenic-industrial activities with huge and global environmental-warming impacts (Parker *et al.* 2018); and the interest of some groups in giving their own interpretation or spin to the information available in order to support their own views or interests. The FAO has also pointed out the importance of taking a position occupying the high ground and based on science (FAO 2004). Some years ago such *post-truth* practices were frequently known in certain circles but they seem to have become more generalised today and make relatively effective use of social networks to influence public opinion, political decisions and/or, of course, get funding. tRFMO and scientific working groups should perhaps be cautious and act in consequence in the face of practices of this kind, which could be used in some cases to blur analyses, take data or results obtained in scientific studies out of context or according to convenience, etc., in order to ensure that their scientific papers presented, reports and diagnoses concerning the state of these stocks and other matters within the scope of their responsibility are not omitted, used improperly, disregarded or manipulated as *post-truth*.

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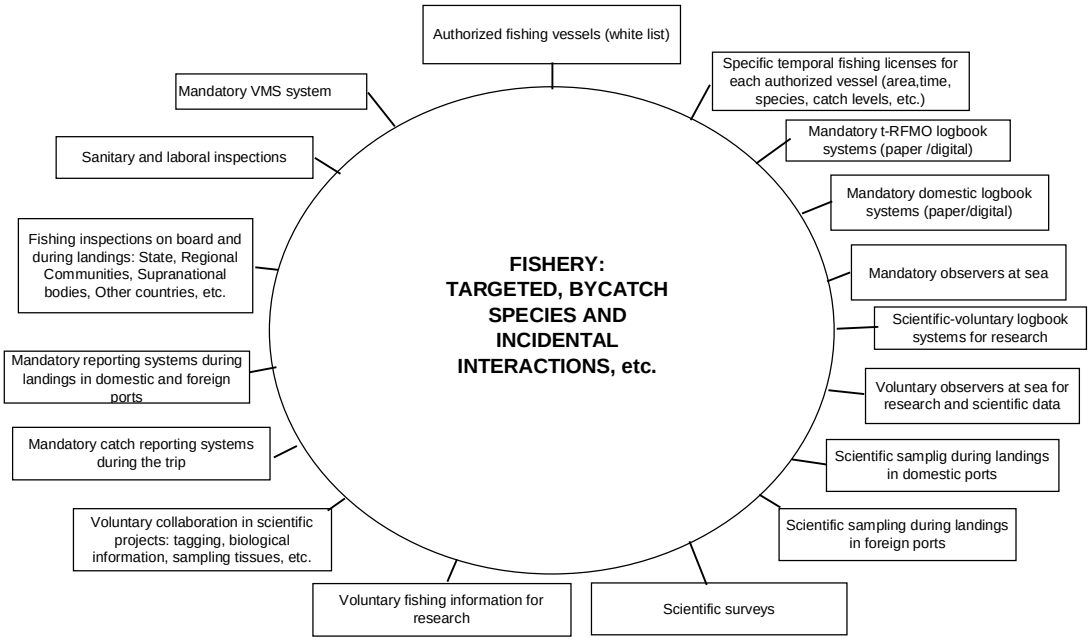

Figure 1. Some of the complex systems and strategies implemented in some cases for the monitoring, management and control of the fisheries, for obtaining basic information for CPCs / t-RFMOs and supporting the scientific activity.