

PROPOSAL FOR AN IOTC ATLAS OF TUNA FISHERIES

Report by the “Atlas Task Force”

1-INTRODUCTION

The goal of this paper is following a recommendation by the IOTC Scientific Committee in 2002, to introduce the potential realisation by the IOTC secretariat of an atlas on Indian Ocean tuna fisheries. This paper is based on the work done by E Mail by a small task force (Fonteneau, Gunn, Nishida, Pallares, Xu Liuxiong, Lucas). This proposal should now be discussed by the WPDCS and possibly by the 2003 Scientific Committee.

2-GLOBAL GOALS OF AN IOTC TUNA ATLAS

It is considered by most or all tuna scientists that this type of document is very useful in order to understand the multiple and complex changes in the tuna fisheries, especially during their historical period but also during recent years. Fishermen, government officials and policy makers especially, but not only, in the field of fisheries, are also widely interested by such “visual” documents. Furthermore, there is no doubt nowadays that such an atlas should be quite easy to make:

(1) because the IOTC and environmental data are now fully and easily available using the modern data bases developed by the IOTC staff, and

(2) because the hardware and software needed to prepare these figures are now easily available at a moderate cost (sometimes free or already available).

This atlas is also very important because the type of visual information given by a tuna atlas has been very seldom published by the IOTC and they are *de facto* difficult to obtain in the Indian Ocean. The atlas published by the IPTP in 1995 was already a very positive step in along the same track, but this document would need to be widely expanded in term of its content and presentation, and updated.

The Atlas should (of course) cover the entire period from 1950 to the current years. The maps in the atlas should show both the fishing maps of the major flags and gears (for instance Taiwanese and Japanese LL or EU and Japan PS), but also the total catches taken by each gear combining all countries. This type of maps should be carried out on extrapolated catches (tentatively to 100% of the catches). This preliminary work is often quite difficult and tedious to do, but this task should necessarily be conducted. This type of extrapolation of catch and efforts was done by Fonteneau and by FAO for their world atlas, or by the ICCAT and SPC secretariats, but is not presently available in the IOTC data base.

The type of maps and figures used in the atlas should first be decided upon by scientists in concertation with our concerned clients (as well as the time and area strata used to do these maps and figures).

3- POTENTIAL CONTENT OF THE IOTC TUNA ATLAS

3-1- Text

The text of the atlas should be quite short, as the main goal of the atlas is to show figures and maps. This text should necessarily contain 10 to 20 pages of bilingual text describing and analyzing the preparation of the data and the underlying hypothesis associated to each figure. This text would simply target all the technical explanation in the data preparation and data handling, an information needed to understand how the maps and figures were prepared. This text would make extensive references to the various IOTC documents already existing on these topics. This text should not discuss the content of the figures.

3-2- Photos showing the main fishing gears and vessels active in the IO.

This type of illustrations would not be the 1st priority in the atlas, but it would be positive in the opening chapters to show the main fishing vessels and the main fishing locations linked with the IO tuna fisheries (covering the artisanal, industrial and possibly the sport fisheries).

3-3-Trends of yearly catches by species and gear

The first set of figures should show a summary of the total yearly catches by country, large areas and gear (for the major countries and gears), the information given in the IOTC statistical bulletin (typical example figure 1). The total catches by species should also be given.

3-4- Multispecies maps of average catches by gear and countries:

These maps and their totals by gear could be done by periods of 5 to 10 year, or by larger periods selected on an *ad hoc* basis. The advantage to have short periods of time is obvious, but these short intervals would increase the number of maps (and corresponding workload and cost of the atlas), often without adding significant information because of the year to year stability of fishing. As an example, a 5 years step would correspond to about 140 maps if a 5 years average is selected to make the maps (cf table 1). Maps for purse seiners should be available by fishing mode (free schools and FAD catches)(example figure 2). The most detailed geographical stratification possible should be used, e.g. 1° squares for surface and 5° squares for LL fisheries (and 5° squares for maps combining the 2 types of fisheries). It is proposed to adopt a representation of circles with an area proportional to the values of the parameter plotted in each area (and not the logarithmic scale used by the IPTP in its atlas).

3-5- Pie chart maps of catches by species and gear, yearly averages of several years

These maps, see example figure 3, should be done upon the extrapolated data sets (extrapolated by gear), targeting levels of total catches, close to the total catches of the species. These maps should be prepared using a different scale for each species. They could be done by 5 or 10 years periods, preferably on extrapolated data (close to 100% of total catches).

3-6- Quarterly maps of catches, Multi gear catches by species

The atlas should necessarily show the seasonality of the IO tuna fisheries, since most fisheries are widely driven by the monsoon regime (see example figure 4). Quarterly maps should be used for the major species (not necessarily during the entire period and for average periods of 5 to 10 years).

3-7- Maps showing the trends of catch by 5° squares during the period 1950-2000

The type of maps used by Fonteneau 1998 (given figure 5) are often interesting to show the seasonality of catches or/and the time trends of catches, cpue or efforts by species (or of cpues). This type of figure should also be envisaged for the major species, flags and gears, and/or for catches by the combined fisheries (extrapolated ones).

3-8 Maps of cpue

Maps of cpue are most often disappointing and quite poor in terms of carrying a useful scientific information (see example figure 6). However at least some of these maps should be given indicatively for longliners and purse seiners, but probably in very small numbers.

3-9 Maps of fishing efforts

Maps of fishing efforts are quite easily made (see example figure 7). These maps of fishing effort can be done using pie chart by country for the main fishing countries. They are of course interesting, but most often quite redundant with maps showing catches. A decision should be taken upon the need to have these maps in the atlas.

3-10- Size frequency distributions by gear and area during the period 1950-2000

The size distribution of the major species and their changes over time in the fishery should be given for the major gears and species, and for the entire fisheries, preferably by large areas and during periods of several years. However, size distributions are quite difficult to show in a simple and efficient way (for instance showing well the time and space trends by gear). Various types of representations of sizes could be envisaged, from basic histograms plotted on a map, to Fonteneau type pie charts (see example figure 8). Probably the flags are less interesting in this matter. When catch at size are available (extrapolated and substituted; this is the case for yellowfin, skipjack and bigeye), these figures should preferably be done on these extrapolated size distributions.

3-11- Multispecies pie charts showing the trends in total catches by area and their seasonal variability

This type of pie diagram is not common in the international literature, but many tuna scientists consider that they are highly valuable to show complex heterogeneities, for instance the time and space heterogeneity of catches by fishery (see example figure 9). These figures are easy and not expensive to make, as the Fonteneau software is easily available (under VISUAL BASIC) upon request, free of charge, allowing to make these diagrams. This type of pie chart diagrams could be used in order to show the trends of yearly or/and seasonal catches by large area and they they can be done for the major fisheries (by species figure 9a or by flag for the main species and fisheries).

3-12- Environmental maps

These maps would show the distribution in the IO of the major environmental parameters conditioning tuna distribution and their movements: sea surface temperature, thermocline depth and gradient, oxygen rates and oxycline depth, surface and subsurface currents, wind, others (see example figure 10); these maps could be done both at a yearly and at a seasonal level (quarterly). All these environmental maps should be done at the same geographical scale than the fishery maps. A further interesting step would be to make maps or figures combining environmental and fishery data (using a GIS). These maps should also show the most recent environmental areas proposed by Alan Longhurst for the Indian Ocean because these maps are highly suitable to select fishing zones that are consistent with the environment.

3-13- Figures showing the changes in longline depth

This information is fundamental in the interpretation of catch rates obtained by longliners, but is seldom available. When this info is available, such figure should be usefully added (preferably by area) (for instance and at least for Japanese LL, see example figure 11).

3-14- References maps

Various maps showing all the references maps used for each fishery by national scientists (such as the ET areas used by the EU scientists) and for each species by the IOTC for statistical goals could also be usefully added to the atlas.

4- DISSEMINATION OF A TUNA ATLAS: PAPER VS COMPUTERIZED FORM, OR PREFERABLY BOTH?

The tuna atlas would of course be available in a computerized PDF file that could be easily available on CD and on the IOTC WEB site.

However **its publication in a paper form would also be highly desirable**, because this type of basic "atlas book" is always very useful and easier to use when it is available in printed form. Users of the atlas can easily carry a book, but who do not live night & day with their computers. Furthermore, it is often much easier to find a given information in a paper book than in a computer file. This

need for a printed version of the atlas is ever more stringent for fishermen, for developing countries and for fishery managers, because most often these potential users of the tuna atlas are much less familiar with an intensive use of PCs. This printing will add a significant cost to the atlas (editing of printable figures and text and printing of the book), but this cost could be reduced if the printing is done in a well selected country. Furthermore, this printed version should preferably be made in full colors, but if the cost of the color version is excessive, most or all these figures could also be prepared in order to be readable in black and white.

On the other side, it could also be envisaged that the CD version could have more detailed maps (for instance yearly maps) and more photos than the printed book.

5- COST AND REALIZATION OF THE IOTC ATLAS

The potential cost of the atlas should be evaluated as soon as possible by the IOTC secretariat when its contents have been established. The locations where the best quality and prices to do such printing should be explored by the IOTC secretariat. It should be kept in mind at this stage that the realization of the atlas could be hampered by 2 types of main problems:

(1) The cost of its preparation and of its dissemination (printing and/or CD and WEB). This cost may be excessive in comparison of the limited IOTC regular budget.

However, its budget should be clearly estimated and it could probably be obtained from peculiar interested donors (among others Japan, the EU¹, Australia, the FAO, tuna boats associations, etc) independently of the regular IOTC yearly budget.

(2) The time of the expert(s) available to prepare this atlas: as the IOTC staff is very limited, part of the expertise needed for the preparation of the atlas might need to be obtained from external sources, for instance temporarily contracting external experts in this type of work. This would have an additional cost that should be estimated in the Atlas budget.

6- CONCLUSION

Our conclusion is that this project of an IOTC tuna Atlas should widely facilitate the work by scientists and IOTC working groups. It should also be a highly interesting product for fishermen and fishery administrators alike. The extra funding necessary to do this task should first be estimated as soon as possible by the IOTC secretariat, and this budget should be obtained from parties and countries interested by Indian Ocean tunas in an ad hoc basis. Such work should be initiated as soon as possible by the IOTC secretariat. If all the necessary steps are well handled by the IOTC secretariat, this atlas could probably be finalized in 2005.

Table 1: Example of estimated numbers of pie chart maps of catches by species and gear by 5 years intervals

gear	country	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	Total
LL	Japan	1	1	1	1	1	1	1	1	1	1	1	11
	Taiwan				1	1	1	1	1	1	1	1	8
	Korea						1	1	1	1	1	1	6
	Spain										1	1	2
	France										1	1	2
	Australia									1	1	1	3
PS	France							1	1	1	1	1	15
	Spain							1	1	1	1	1	15
	NEI EU							1	1	1	1	1	15
	Russia								1	1			6
	Japan								1	1	1	1	12
BB	Maldives							1	1	1	1	1	5
	Madagascar						1						1
Driftnet								1	1				2
oth	india						1	1	1				3
Total													106
multispecies Yearly maps catches/gear													
Extrapolated data													
	LL all	1	1	1	1	1	1	1	1	1	1	1	11
	PS all	1	1	1	1	1	1	1	1	1	1	1	11
	All gears	1	1	1	1	1	1	1	1	1	1	1	11
	Total												33