IOTC Scientific Committee November 2004

Proposal concerning the project of an IOTC Atlas

by the members of the "Atlas Task Force"

1-Introduction

The goal of this paper is, following a recommendation by the IOTC Scientific Committee in 2003, to introduce with more details the potential activities and budget linked with the realization of an atlas on Indian Ocean tuna fisheries.

During its 2003 meeting the IOTC Scientific Committee agreed that such a project to publish an IOTC Tuna Atlas would be an interesting goal, but it made a request to the Atlas Task Force (coordinator Fonteneau, members Gunn, Nishida, Pallares, Liuxiong and Lucas) in order to more precisely evaluate this potential project and its cost (in terms of both human and budget). This document is a follow-up of this request by the 2003 Scientific Committee and is trying to evaluate these costs. This proposal should now be discussed and preferrably approved by the 2004 Scientific Committee..

2- A review of the global goals of an IOTC tuna atlas:

The global goals of this project were presented and approved, at least in their principle, by the 2003 IOTC Scientific Committee: it is considered by most or all tuna scientists that this type of "visual document" is very useful in order to better 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 in the field of fisheries are also widely interested by such "visual" documents showing the complex changes developed by tuna fisheries. This atlas is also very important due to the lack of this type of publication in the Indian Ocean. The small atlas published in 1995 by the IPTP was already a very positive step along the same track, but such an atlas would need to be widely expanded in term of its content and presentation, and updated.

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 also easily available at a moderate cost (sometimes free or already available).

The Atlas should (of course) cover the entire period from 1950 to the current years, e.g. more than half a century of fishery data. The maps in the atlas should show both the fishing maps of the major flags and gears (for instance Taiwan, Japan, EU and all countries reporting detailed statistics), but also maps of total extrapolated catches taken by each gear combining all countries as well as various types of visual information (biological and environmental ones) selected for there interest and relation with tuna biology and fisheries.

3- Preparation of the tuna atlas

The atlas should **target a wide range of potential readers** linked to tuna fisheries active in the Indian Ocean: scientists (both tuna scientists and scientists interested in ocean matters), fishery managers, fishermen, and each individual interested in tunas. This target group would of course be primarily from countries that are fishing tunas in the Indian Ocean, but also anybody concerned (in the region and world wide) by the conservation of Indian Ocean tunas. Such a book would for instance widely facilitate the communication between scientists working world wide in the various tuna commissions.

Atlas structure: The Atlas content should include both a general overview of the Indian Ocean tuna fisheries and the historical development of these fisheries through the establishment of reference periods as well as an updated overview of the state of the fisheries. So the Atlas structure would take into account the different characteristics of these objectives. The first one has a permanent nature, could be published under paper and CD and should be re-edited periodically. On the contrary, the second objective would require annual updates that could be distributed via the web or in a similar way.

I**ts publication in paper form is estimated to be necessary**, because this type of basic "atlas book" is always very useful and easier to use when it is available in printed form. Most users targeted by such an atlas can easily carry and read a book, but they might not have a permanent access to CDs and/or Internet. Furthermore, it is often much easier for an untrained reader to find and to read a given information in a paper book, than in a large computerized document on a PC screen. 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 PCs. This printing will add a significant cost to the atlas. Furthermore, this printed version should preferrably be made in full colors; if the cost of the color version is excessive, some of these figures and maps could also be prepared and be readable in black and white.

CD atlas: the atlas should be published and made available simultaneously in a printed book, and as a CD version. 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. Such a CD would also be easily updated and released by the IOTC in the future.

WEB: an updated version of the atlas would be also available on the IOTC web seat. This web version would content the most recent information of the fisheries and should be updated every year.

Price: in most cases, such a nice atlas should necessarily be sold, and it should not be released free of charge, as the present IOTC scientific documents. The selling price should be moderate and simply covering some of its basic costs (such as printing costs). Such selling of books has been a common practice for the other tuna commissions (IATTC and ICCAT), but it may be difficult to run it for the IOTC, for instance because of its FAO status. This price could widely compensate for the investment done in its realization, but at this stage this amount of money potentially obtained from the selling of the book is difficult to estimate.

Towards a **coediting of the atlas** with a partner interested by such a topic and experienced in this type of publication: it is clear that the IOTC has a very limited secretariat and no experience in this type of preparation and publication of such a type of book. Furthermore, its remote geographical position in Seychelles Islands, far from editors and printing companies add serious difficulties to the planned job. In such a context, the IOTC should preferably seek some coeditor of its Tuna Atlas, for instance the FAO or the IRD France (a scientific body with a great experience in editing and publishing very nice scientific atlases). Such a partnership would offer multiple advantages, in terms of cost reductions and realization of tasks that would be too complex for the IOTC secretariat.

The **number of books printed** should be decided carefully, as it should be avoided to print an excessive number of books (storage costs) or to be too quickly short of copies of the atlas. This optimal number of books should be well studied by the IOTC (and by the FAO or by the selected co-editor, as these partners have a much wider experience in the dissemination of such books), but at this stage the provisional estimate of cost was based on a guess of printed 1000 books.

The **location where the book will be printed** will modify the cost of the atlas, as some countries can make good printing of color books and at lower cost than in Europe. This technical choice should also modify the cost of mailing the atlas, from the printing company and to the final buyers. These prospects should then be carefully and precautionarily studied.

4- Cost and realization of the IOTC atlas

4-1- Overview

A first estimate of the potential cost of such an atlas was estimated by the WG based on the hypothesis of its content described in the annex 1.

The total costs can be analyzed and evaluated following a stratified estimate of its work load and costs. The present estimates have been obtained in the hypothesis of a 250 pages books with 200 pages of colored maps and/or photos and about 50 pages of black and white text, and using an Italian A4 format (as this format is suitable to the shape of the Indian Ocean). The budget has been estimated in a double alternate hypothesis (1) that all the workload will be handled by the IOTC at no additional cost, or (2) that this work will be sub-contracted to external experts or/and potential partners such as co editors of the book.

4-2- Detailed choice of the Atlas content: framework, text and figures and maps

The document prepared in 2003 by the atlas task force made a first review and proposal about the potential content of this atlas. These proposals are still valid, and they should be used as a starting point for the final choice of figures and maps. It can be estimated that the final choice of these figures and maps would require about 1 month of full time work by the editor of the atlas, in close contact with the experts interested by the ATLAS project (possibly a small technical WG?). At this exploratory stage, the following structure of the atlas can be envisaged:

Table 1: Numbers of pages envisaged for the atlas, stratified by types of contents

Type of page	Color	B&W pages	idem Color	Total
Text	no	40		40
Photos	yes		5	5
catch and efforts trends	yes		14	14
maps by countries/gear	yes		20	20
maps by species and gear	yes		60	60
Quarterly maps /species	yes		30	30
Maps of catch trends /gear country	no	15		15
Maps of CPUE	no	7		7
Maps of fishing efforts	no	5		5
Figures of Size distribution /gear and species	no	15		15
Pie charts of catch /areas and year & month	yes		10	10
Environment maps	no	10		10
Longline depth	no	2		2
Reference maps	no	2		2
Other figures and/or maps	yes		15	15
Total		96	154	250

4-3- Data preparation

An extensive data preparation based on the IOTC data base will be needed before making the figures and maps. It is assumed that the software could be obtained free of charge. The figures and maps would first need a data preparation, for instance extrapolation of some data sets, strata substitutions, averaging periods and gears, preparing the data sets at a convenient format before their drawing. This work has been estimated at a level of 2 month by a scientist/technician well aware of the IOTC data bases and ad hoc software.

4-4- Technical realization of the figures and maps:

This technical realization of the figures and maps will use the data prepared in 4-2 and ad hoc software. This work has been estimated at a level of 3 months by a scientist/technician well aware of the IOTC data bases and well trained in the use of mapping software and of EXCEL or similar statistical software.

4-5- Editing the figures and maps in a nice publishable format and colors.

This work has been estimated at a level of 3 months by a editing technician well trained in this type of editing and figure preparation.

4-6- Editing and validating text and figures before their submission to the printer.

This editorial work has been estimated at a level of 1 month by an editing technician well trained in this type of editing and figure preparation.

4-7- Printing of the atlas

The final stage of the work will also need various tasks leading to the printing of the atlas in close connexion with the printer. These human costs should also be part of the estimated budget. The printing will be done by a specialized printer, in Europe or in the Far East and possibly in the region (India, Mauritius Island, La Réunion?). The printing cost will be quite variable as a function of the country and of the selected printing company. At this early stage, the comparison of these printing costs and quality cannot be done, and the estimated cost is only an average indicative one estimated on a printing done in France by a good printing company.

4-8- Delivery costs

Costs of delivering the atlas to the IOTC storage facility and later to the final buyer.

These costs should also be part of the estimated budget, although they cannot be estimated as none of these 2 locations have been identified.

4-9-Publicity

A good **publicity campaign** should also be planned and launched by the IOTC in order to inform all the potential readers of such an atlas (e.g. a much greater target group than the regular participants to the IOTC meetings). This campaign will need some manpower and extra cost investment for the IOTC secretariat, estimated at 15 days and 5000$. This campaign will also incorporate a WEB based publicity and ordering system of the atlas by E-Mail.

4-10- Overall potential cost of the atlas project

The total cost of the tuna atlas will be widely dependant of:

(1) the size and quality of the project chosen

(2) the quantity of work done within the IOTC secretariat by its own staff, of by external contracted experts,

(3) the type of co-editor chosen or not by the IOTC, for instance towards the FAO or the IRD, allowing to share the technical editing work and the costs of the ATLAS.

At this stage, none of these technical and political choices can be done within the limited scope of this atlas task force. In the presently estimated project, this total cost could be in the range of about 100.000 $, but the IOTC real costs would depend of two factors:

(a) if the data preparation and mapping are done entirely at home within the IOTC secretariat, this would greatly reduce this cost, but such work may not be realistic knowing the limited IOTC staff.

(b) if the IOTC publishes the atlas alone, the cost and work load would be much higher than the same work done in co-publication with an external editing partner.

5- Conclusion

Our conclusion is that this project of an IOTC tuna Atlas should widely facilitate the work by scientists and IOTC working groups, and it should also be a highly interesting product for fishermen and fishery administrators alike.

There is no doubt that the cost of such atlas would be significant in terms of both manpower and dollars. However, as such work should preferably be done through a well organized partnership, and an efficient sharing of activities, workload and costs between interested partners, it can be concluded that this project should be well promoted by the IOTC.

Table 2: Type and costs of the actions needed for the Atlas publication

Task	Manpower cost	Month manpower	R co US
Detailed choice of the Atlas content: framework, text and figures and maps	**Work to be done by the Atlas task force and the IOTC secretariat; working by E Mail.**	**1**	
Data preparation allowing to make the figures and maps	**Work to be done by the IOTC secretariat, or by an external contract with an expert (assuming no need for new hardware or software)**	**2**	
Technical realization of the figures and maps using the data prepared in 4-2 and ad hoc software.	**Work to be done by the IOTC secretariat, or by an external contract with an expert(assuming no need for new hardware or software)**	**3**	
Editing the figures and maps in a nice publishable format and colors	**Work to be done by the IOTC secretariat, or by an external contract with an expert**	**3**	
Editing and validating text and figures before their submission to the printer	**Work to be done by the IOTC secretariat, or by an external contract with an expert**	**1**	
Doing all the tasks leading to the printing of the atlas (provisional working estimate printed in France)			
Costs of delivering the IOTC storage facility and later to the final buyer.			
Publicity	**Work to be done by the IOTC secretariat**	**0,5**	
Preparation of the CD version of the Atlas		**1**	
1000 copies of the CD			
Total budget		**11,5**	1

Annex: Potential content of the IOTC Tuna Atlas

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 about 10 pages of bilingual text (e.g. a total of about 20 pages) describing and analyzing the preparation of the data and the underlying hypothesis associated to each figure. This text would 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.

It should be decided if this text should make some basic general comments describing and discussing the major changes observed in the fisheries shown by these figures. These additional explanation would be positive ones, but they would necessitate an additional work by the scientists in charge of the Atlas and an additional printing cost (estimated size of these comments: about 20 pages of English text, then a targeted total of 40 pages)

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 is 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). A set of 20 photos, 4 photos by page, could be a reasonable editorial target (then a targeted total of 5 pages).

3-Trends of yearly efforts and catches by species and/or 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 (a total of about 14 pages).

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

These maps and their totals by gear could be done by periods of 10 years (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 year step would correspond to about 140 maps if a 5 year 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).

The present recommendation is to make 10 year averages, for the major countries and for the whole fisheries (then a targeted total of about 60 pages)

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 10 years periods, preferably on extrapolated data (close to 100% of total catches). (then a targeted total of 20 pages)

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 10 years) (a targeted total of about 30 pages)

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

The type of maps used by Fonteneau 1998 (figure 5), are often interesting to show the seasonality of catches or/and the time trends of catches 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). (a targeted total of about 15 pages)

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. (a targeted total of about 7 pages)

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. These maps of efforts should be done in the atlas, but in small numbers and at small sizes (thus a targeted total of about 5 pages).

10- Size frequency distributions by gear and area during the period 1950-2000(on est fin 2004???)

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 (a targeted total of about 15 pages).

11- Multispecies pie charts showing the trends in total catches by area and their seasonal variability, possibly by country?

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 can be done for the major fisheries (by species figure 9a or by flag for the main species and fisheries) (a targeted total of about 10 pages).

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); they 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 as 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. (a targeted total of about 10 pages).

13- Figures showing 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 figures should be usefully added (preferably by area) (for instance and at least for Japanese LL, see example figure 11) (a targeted total of 2 pages).

14- Reference maps

Various maps showing all the reference 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 and during its species WG should also be usefully added to the atlas at small sizes, although these reference maps may preferably be published in the field manual planned by the IOTC (total of about 2 pages)

15- Other figures:

Various other figures could also be shown in such atlas (such a some of the figures used in the Fonteneau 1998 world atlas). This potential prospect should be kept in the budget, leaving in the budget a category of “other figures” with to the editors of the atlas (provisional total of about 15 pages).

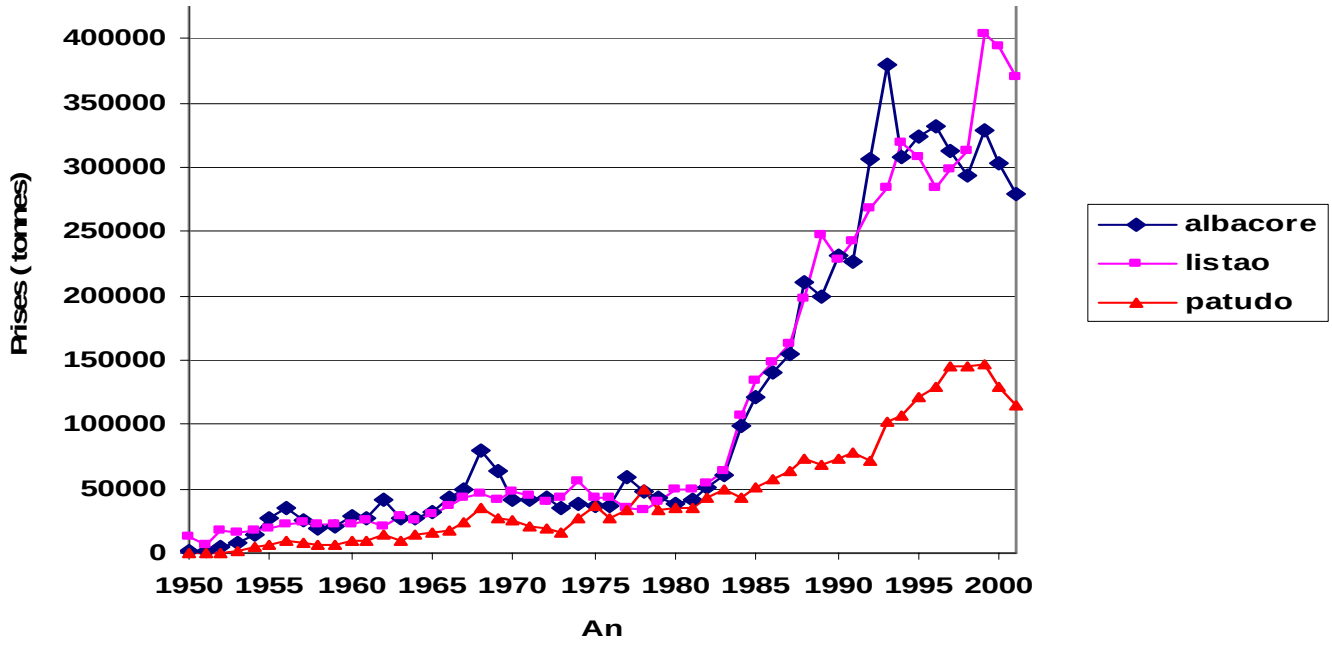


Figure 1: Example of line figure: yearly catches by species and gear

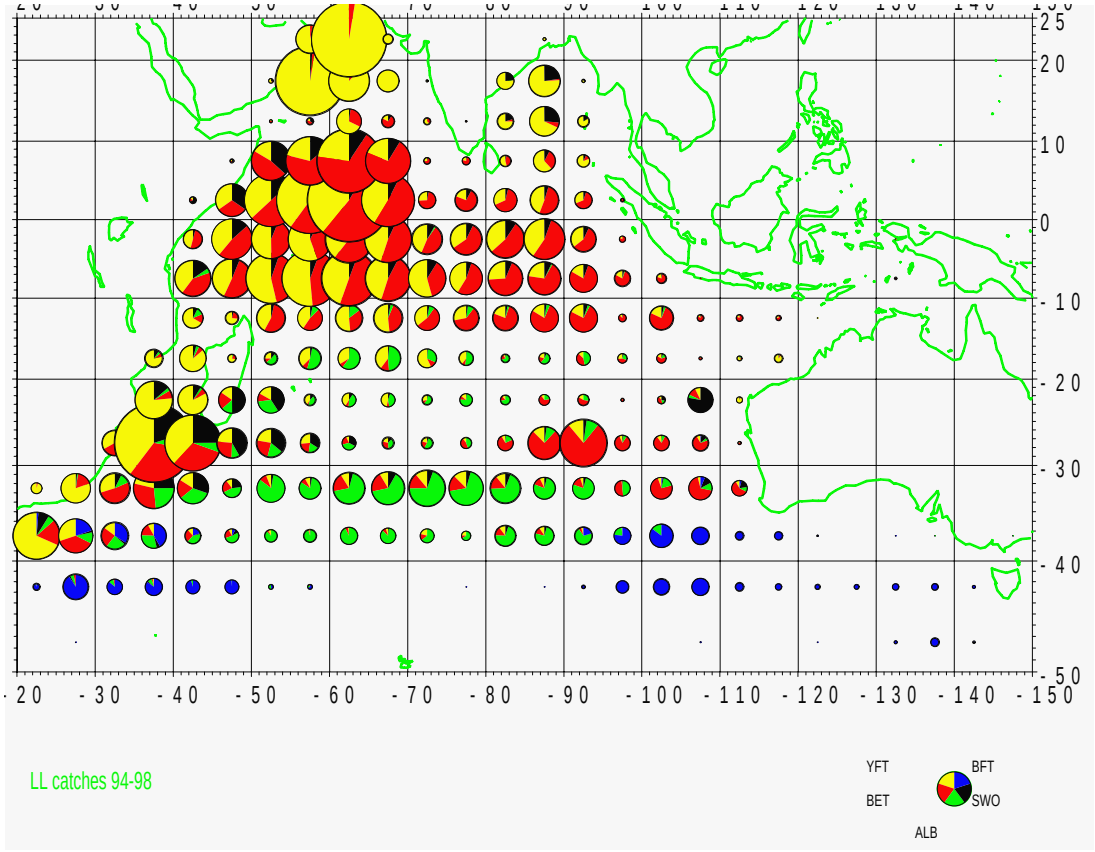


Figure 2- Multispecies maps of yearly catches by gear and country

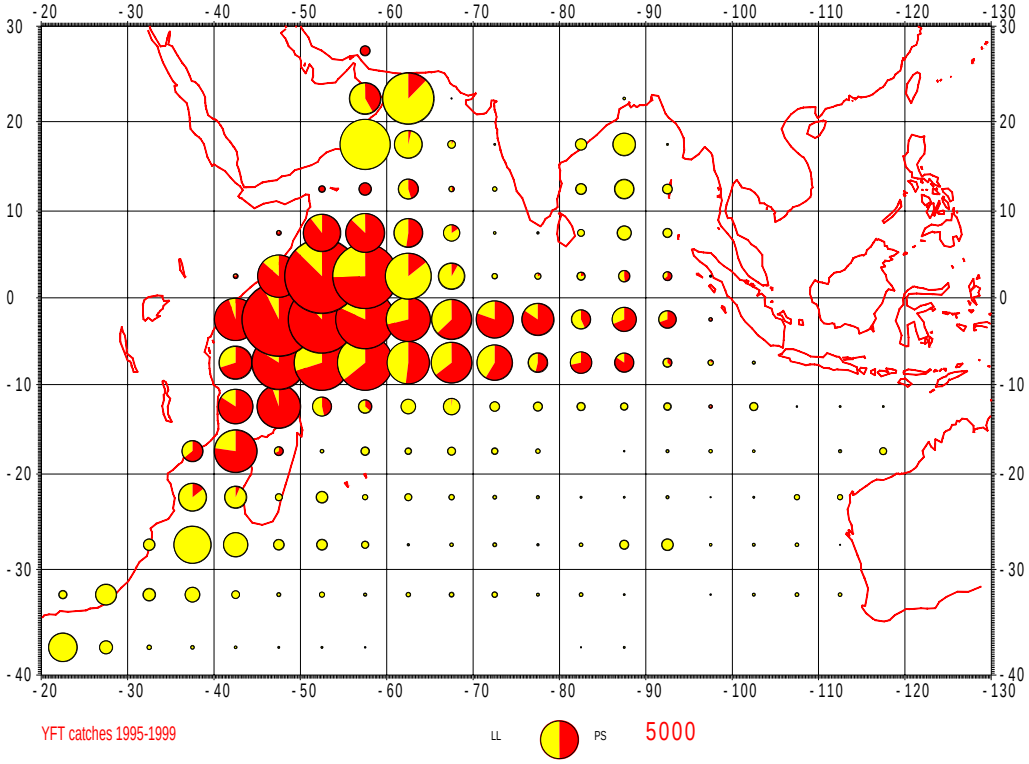


Figure 3: Pie maps of catches by species (YFT) and gear (PS & LL) , yearly averages of several years

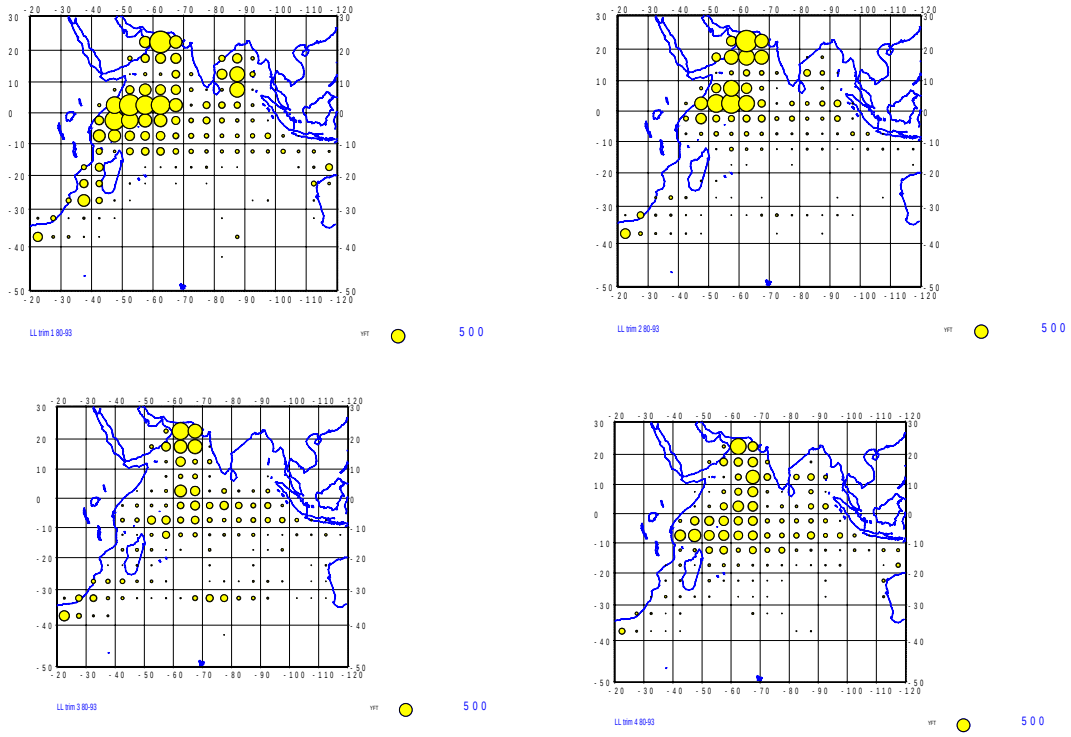


Figure 4: Quarterly maps of catches , (preferably multi gear) by species

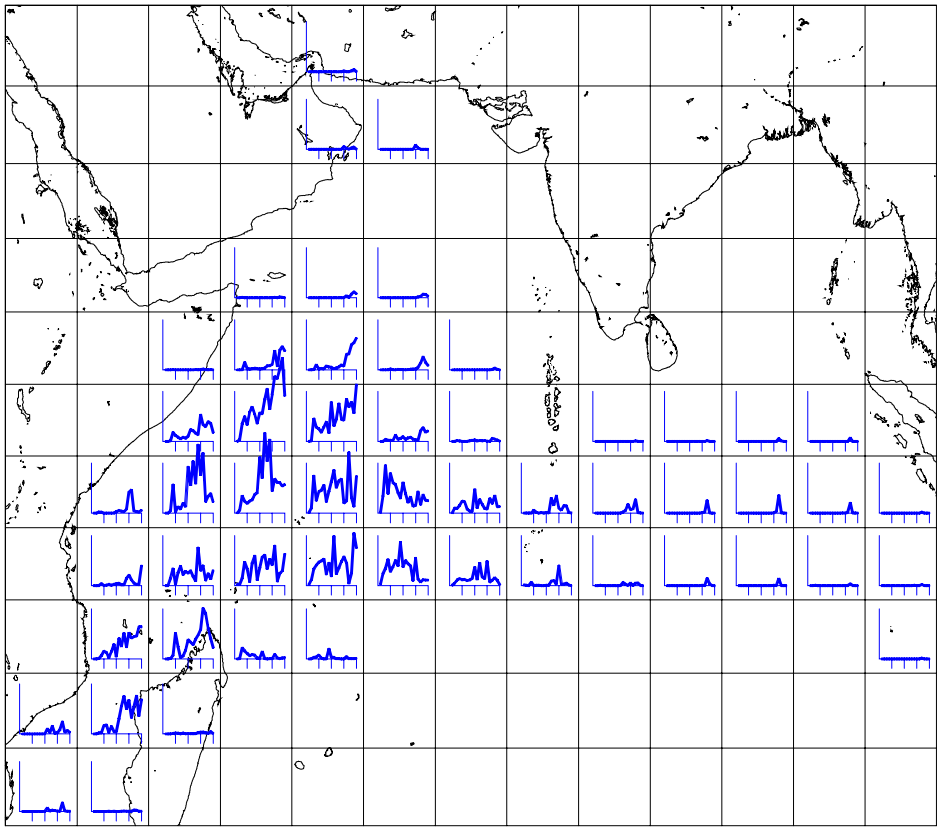


Figure 5: Maps showing the trends of PS efforts by 5° squares during the period 1950-2000

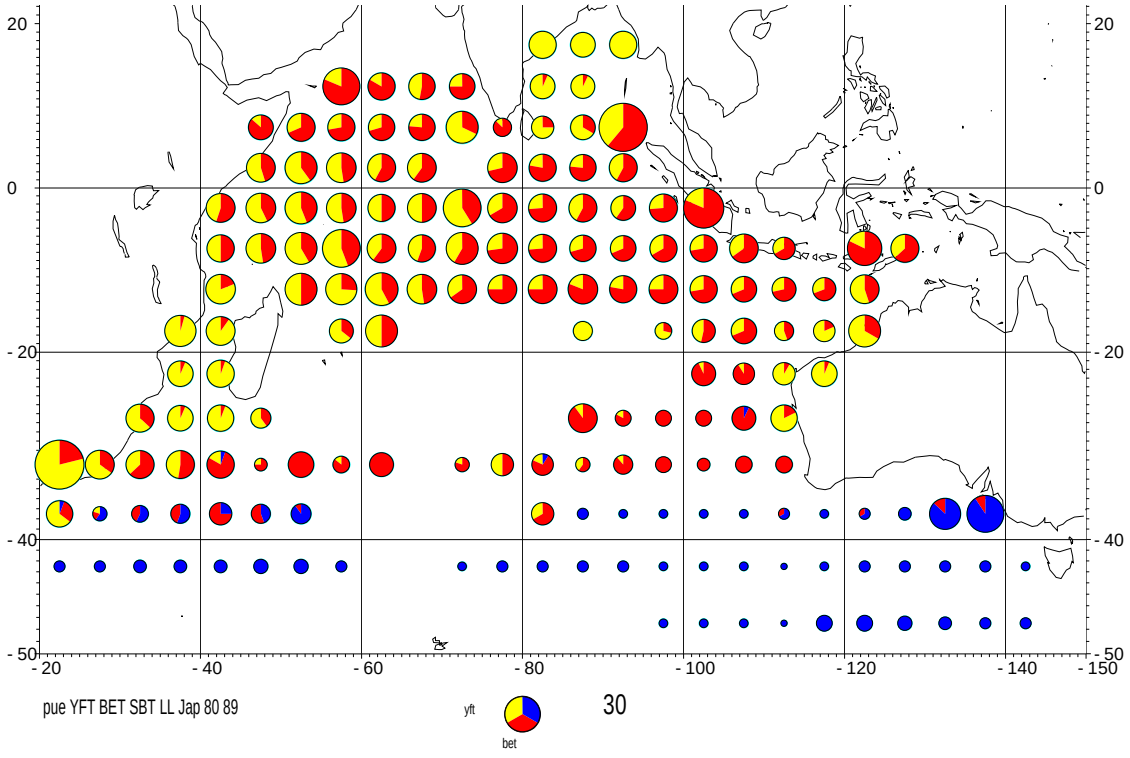


Figure 6: Maps of average cpue

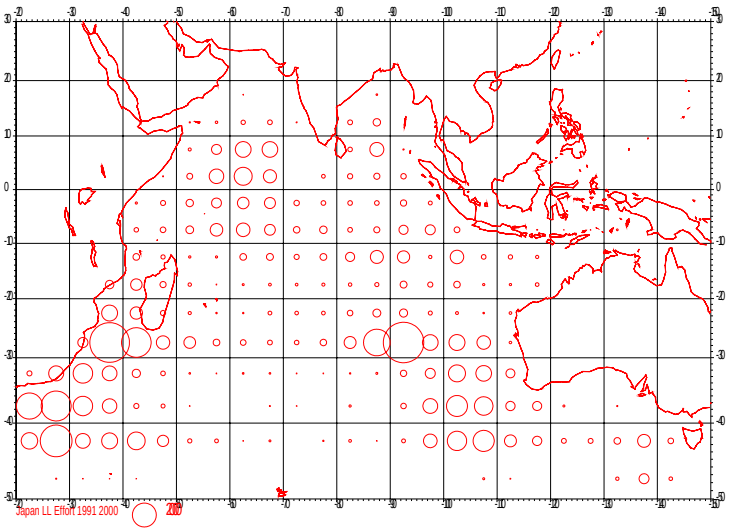


Figure 7: Maps of fishing efforts (or curve maps given by fig 5)

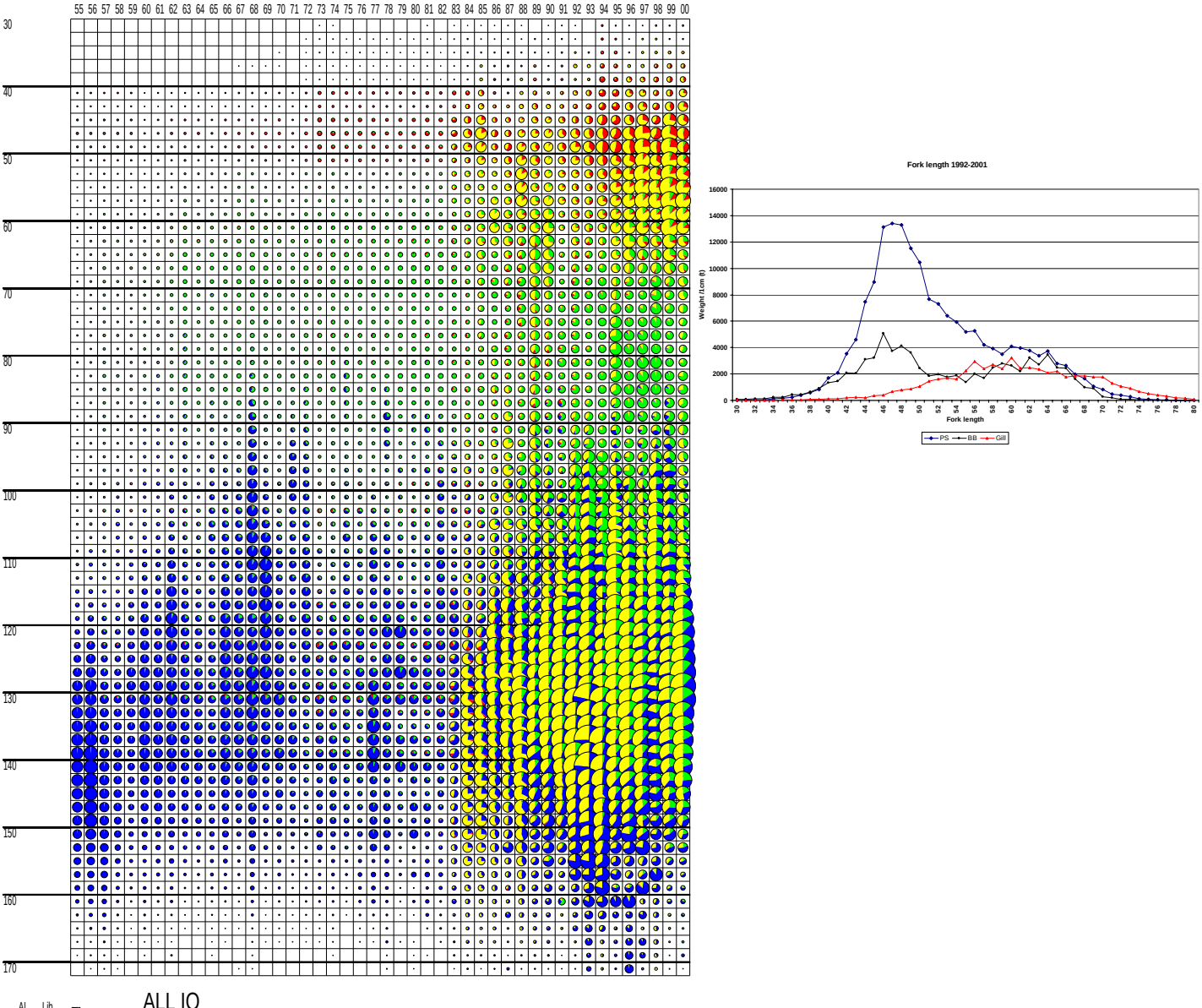
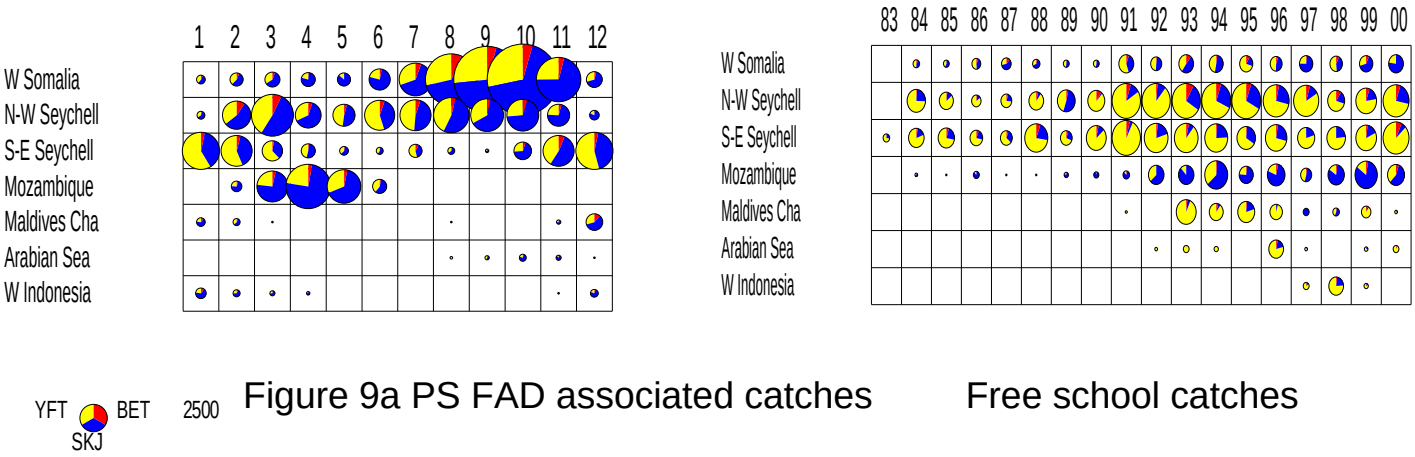


Figure 8: Size frequency distributions by gear (YFT pie chart and SKJ curve; The histogram can be placed on a map)



YFT BET SKJ 2500

Figure 9a PS FAD associated catches Free school catches

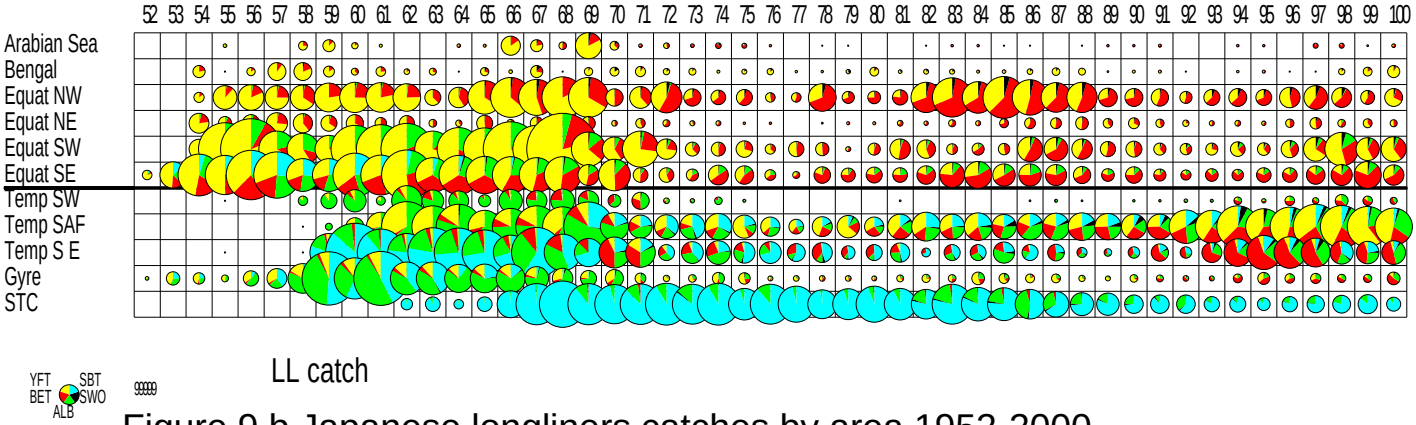


Figure 9 b Japanese longliners catches by area 1952-2000

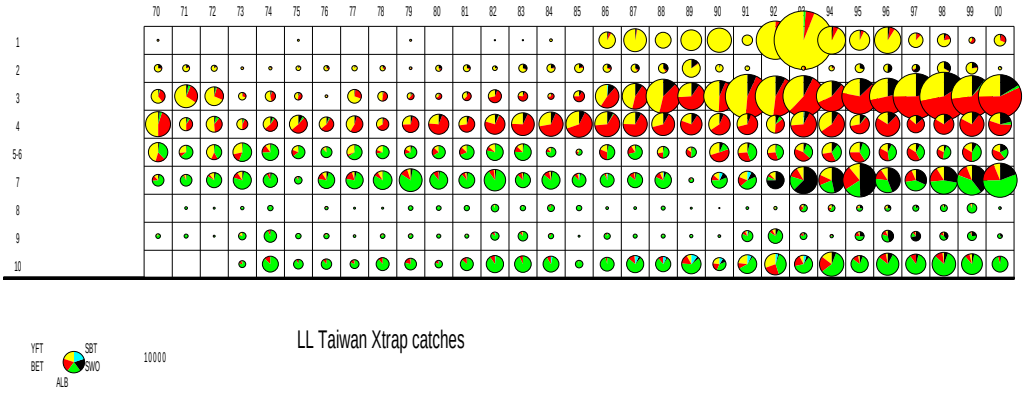


Figure 9 c Taiwanese longliners catches by area 1967-2000

Figure 9: Multispecies pie diagrams showing the trends in total catches by area and their seasonal variability for various fleets

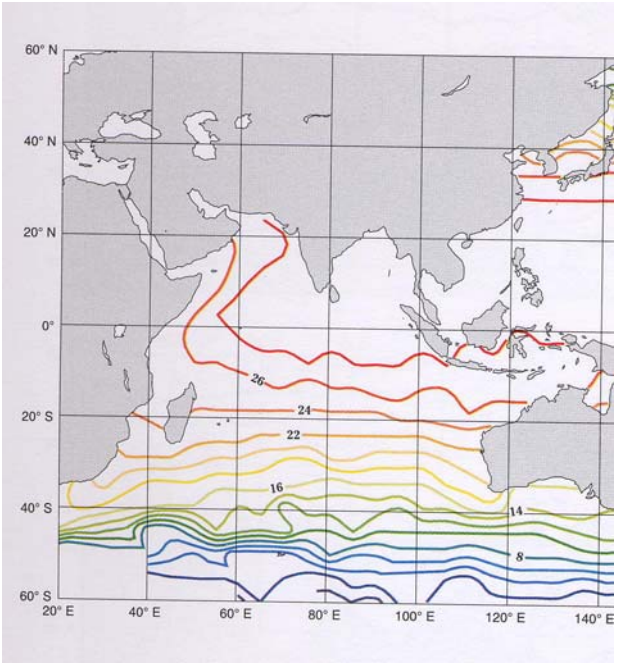


Figure 10- Environmental maps; SST as an exemple

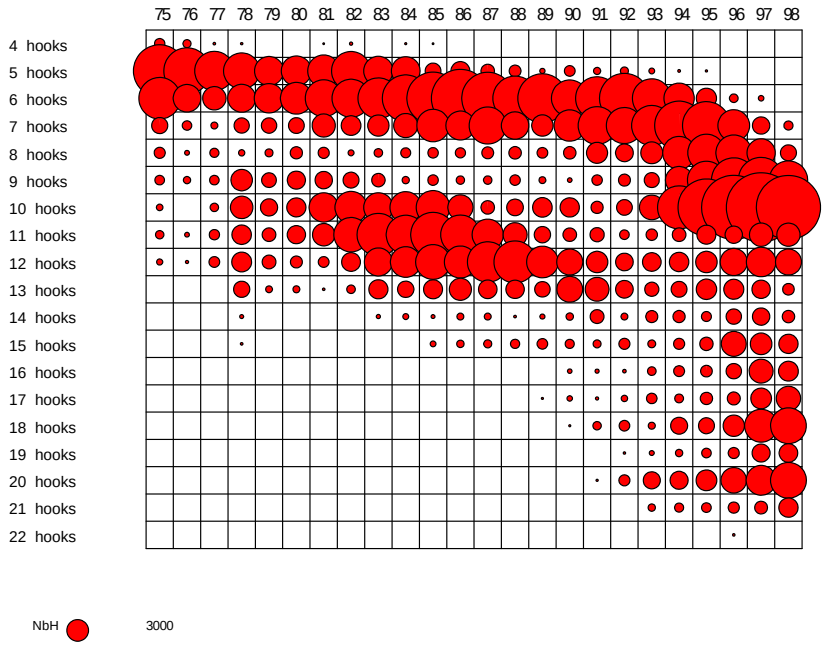


Figure 11: Changes in estimated longline depth (Numbers of hooks between floats)