

**REPORT OF THE 2010 ICCAT BIGEYE TUNA
DATA PREPARATORY MEETING**
(Madrid, Spain - April 26 to 30, 2010)

1. Opening, adoption of agenda and meeting arrangements

The Meeting was held at the ICCAT Secretariat in Madrid from April 26 to 30, 2010. Dr. Pilar Pallarés on behalf the ICCAT Executive Secretary opened the meeting and welcomed participants (“the Working Group”).

Dr. David Die (USA), meeting Chairperson, welcomed meeting participants and proceeded to review the Agenda which was adopted without changes (**Appendix 1**).

The List of Participants is included in **Appendix 2**. The List of Documents presented at the meeting is attached as **Appendix 3**. The following participants served as rapporteurs:

P. Pallarés, J. Pereira	Items 1 and 10
A. Delgado de Molina	Item 2
P. Bannerman	Item 3
C. Palma ,M. Ortiz and J. Ariz	Item 4
S. Cass-Calay	Items 5
P. de Bruyn , T. Frédou and T.S., Mahfoud Ould	Items 6
P. de Bruyn & S. Cass-Calay	Items 7
D. Die	Items 8 and 9

2. Review of historical and new information on biology

Only one new paper on biological data was presented to the Working Group. SCRS/2010/031 document presents the information gathered by the National Observer Programme on board the Uruguayan tuna fleet that operated with surface longline in the period 1998-2009. This document shows the information of 5 Japanese flag vessels operating in the EEZ of Uruguay, in 2009, during a period of six months. The Uruguayan national tuna fleet, which targets swordfish, also catches bigeye tuna, generally of 105 cm or larger. The overall observed sex ratio (male: female) was 0.76:1. Females predominated in all months except September and October (1.22:1 and 1.29:1 respectively). Males and females were equally distributed across the study area. The Japanese flagged ships operating in the Uruguayan zone, also target BET and 1770 individuals were sexed from these vessels (884 males and 886 females). These samples show that there is a greater catch of males in March, April and June, where the proportion was 1.25:1, 1.2:1 and 1.04:1 respectively. These two fleets fished at different depths, between 33 m and 50 m in the case of the Uruguayan fleet and between 95 m and 181 m in the case of the Japanese flagged fleet operating in the Uruguayan zone. These results are consistent with previous results (Miyabe, 2003).

Document SCRS/2010/026 makes some estimates of growth more inline with those made from hard part examination, using a growth function (size at-age) and applying it to the observed length compositions of the catch in order to arrive at an estimate of the number-at-age of the catch.

Various biological data collected by the U.S, Observer Program between 1992 and 2010 are available. Thus, there are size distributions by sex and total, finding a size distribution very similar for both sexes. The sex ratio (male: female) was 1.11:1. Geographical distribution was also very similar for both sexes. Relations dressed weight- length by sex and total are also available.

Table 1 shows the various parameters and conversion factors currently assumed by ICCAT to describe the Atlantic bigeye tuna stock.

Table 1. Biological parameters and conversion factors for bigeye tuna. Source: ICCAT Manual.

Item	Formulation	Notes
Growth	$L_t = 217 .3(1 - e^{-0.18(t+0.709)})$	L=FL in cm; t=years
Natural mortality	0.8 for ages 0 and 1 0.4 for older ages	per year

Length-weight	$RWT = 2.396 \cdot 10^{-5} (FL)^{2.9774}$	RWT=round weight in kg FL=fork length in cm
Length conversion factor, LD1>48 cm	$FL = \left[\frac{LD1 + 0.5 + 21.45108}{5.28756} \right]^2$	FL =fork length in cm LD1=Lower jaw - 1st dorsal length in cm
Length conversion factor, LD1<48 cm	consult www.iccat.int/Pubs_FieldManual.htm	
Product conversion factor	$RWT = 1.13 \times GWT$	RWT=round weight in kg GWT=gilled and gutted weight in kg
Size at first maturity	Between 100 and 110 cm	

3. Review of Task I data – estimation of total removals

The Secretariat presented information on the status of Task I (nominal catches) from 1950-2009. This information which was reviewed by the working group depicted detailed catches by fleet by countries showing incomplete data for 2009 (**Table 2**) and also the summary of catches by gear for all countries pooled (**Figure 1**).

It was noted by the working Group that approximately 40% of data for Task I for 2009 had been submitted. Baitboat and Longline catches were mostly unreported whereas more were reported for Purse seine fleets. Examining the catches, the Working Group noticed that some reported catch data were not assigned to any particular gear and also a minor proportion of data submitted were not in the appropriate format for easy integration into the ICCAT database for analysis.

It was emphasized that further checks be made to verify such data which may be elsewhere reported by other CPCs. The best scientific information available should be adapted where no reliable data is available to the Secretariat. Though the working group was confident in obtaining a reasonable set of data for 2009 from all parties, it was imperative that such data be provided before the deadline of June 22 2010 to so as to be considered in the assessment of July 2010. The Group therefore decided to focus more on preparing the data up to 2008.

A few provisional estimates of Task I for Cape-Verde, Guatemala, Belize and China P.R. were presented and agreed upon whilst updates were also provided for Chinese Tapei. Scientists from participating countries present at the meeting, who had not presented data for 2009 assured members of their preparedness to submit the said data to the Secretariat before the upcoming assessment. Enquiries would be sought from other countries who have not submitted data for 2009 through the proper channels.

Canning data for 2009 from one company in Ghana provided to ICCAT was inventoried and consolidated for a future incorporation into the ICCAT database system, aiming to improve knowledge on catch, species composition and size categories among others. The Working Group noted the importance of such information but noted that such confidential data provided should be used with much caution. The WG encouraged ISSF to ask the company if data for previous years could be made available in order to improve historical statistics.

The data requirements to run the MULTIFAN CL model were deliberated upon. It was mentioned that to fit any dataset in the model, there was a need to distinguish specific areas for all fleets having similar selectivity and catchability ratios and also for similar years.

A small group was tasked to review recent documents on “faux poisson” estimates with the objective of estimating catches by species as recommended in the 2007 assessment. Inadequate information on species composition and size available did not warrant the group to develop further estimates on the catches to be incorporated in the up-coming assessment.

Exploration of possible under-reported catches - Some concerns related to possible unreported catches were raised by the group. It was noted that no estimation of unreported catches of bigeye tuna were included in the ICCAT data base. At the same time the group was informed that the main sources of information to estimate under reported catches were the information derived from the statistical document of Bigeye, and the customs data bases from USA and Japan. As no customer trade data were available during the meeting, the group decided to explore to use the ICCAT statistical document data base to estimate unreported catch not reported as task I. Using this information was not easy because of the lack of conversions factors, from loin, filet, gilled and

guttled to live weight on Bigeye.

Table 3 summarizes the Bigeye Statistical Document System Data (b.sds) through 2009 and contrasts the information with the reported Task I by flag. As the b.sds data are recorded in product weight while Task data are in live weight, several conversions were applied based on information from scientists attending the meeting and based on information for other species (mainly Bluefin) and are shown in **Table 4** for the product types listed. These assumptions should be tested through observations, if further analysis of this type is attempted. This comparison indicates that Task I might not represent the total landed catch of convention area Bigeye. The amount by which Task I could under-represent actual landings is not well estimated. b.sds data recorded for exports from various fishing flags with an unknown area of capture leads to a substantial discrepancy between Task I and the scaled b.sds data. Considering only the b.sds data classified as coming from the convention area, the discrepancy amounts to an estimate of around 11,000 t over the period of comparison. Considering the total b.sds data, the discrepancy amounts to nearly 17,000 t for the period of comparison. It is noteworthy that the b.sds data implies that international trade of convention area landed Bigeye might represent less than 13% of the landed catch recorded in Task I and that a surprisingly low number of CPCs engage in export of convention area BET. Confusion among CPC's about the need for b.sds reports, especially for chartering arrangements and the limitations of the obligation to report to only certain catches; likely contribute to the low volume of international trade of convention area bet documented in the b.sds to date.

The group noted that the summarized form in which the b.sds information is currently reported to ICCAT (bi-annual summaries of direct imports and re-exports) does not give the sufficient detail for improving estimates of potential NEI and volume of Atlantic BET in international trade largely due to uncertainty about the year and area of capture for BET products in trade, the general lack of product to live weight conversions, and the potential for double counting catches submitted on the re-export certificates. These estimates could be greatly improved if the corresponding individual statistical documents and re-export certificates were made available. These detailed data exist at national levels (with identification numbers). If the commission wishes to improve the utility of the b.sds for validating Task I data an effort should be made to recover this important information. SCRS has reiterated this advice over the past decade (see general recommendations to the commission, on the SCRS reports of 2000, 2001, 2002, 2003, 2004 and 2009), but as of yet none of the detailed Bigeye b.sds information has been received by the Secretariat.

4. Review of Task II catch/effort and size data –estimation of size frequency distribution of the catch

The bigeye (BET) related Task-II information (T2CE: catch and effort data; T2SZ: size data) was presented by the Secretariat at the beginning of the meeting. Both, catalogues and data (in the form of MS-Access databases), were presented to the Group, with the most up to date (as of 2010-04-26) information available in the ICCAT-database. The time series covered all the years (1950 to 2009) for which data was available for bigeye tuna.

4.1 Catch and effort

The Working Group reviewed the available T2CE time series with BET catch. The respective catalogue is presented in **Table 5**. The Group noted once again, the heterogeneity of the time series stratification of some fleets (especially the spatial distribution and the effort units in some surface gears), and also, the lack of effort in some important fleets. The Secretariat also reported the improvements made to some longline (Uruguay, 1984-2004; Chinese Taipei, 2000-2009; Philippines, 2003-2008; Morocco, 2004-2008) and surface (Ghana, 1994-2004) historical series made by the respective CPCs. Upon request, the Secretariat prepared a table (**Table 6**) with the revisions and additions made to T2CE statistics, since 2007-06-01 (beginning of the last BET assessment). As can be seen, a large portion of the T2CE statistics of the most recent years (2005-2008) was revised by the CPCs.

The new Ghanaian T2CE series (constructed from the logbook data recovered, 1994-2009) was incorporated into the ICCAT.DB as preliminary. Updates and improvements are expected in the future. In respect to 2009 statistics, the Group considered that, despite the fact that available data for 2009 represents about 40% of T2CE reported for 2007 or 2008, a considerable amount of data from important fleets have not yet been reported to ICCAT. In consequence, 2009 was not included in the creation of the Multifan-CL input files. Nevertheless, the Group expects to receive the 2009 missing T2CE information before the BET assessment. Such estimates for 2009 are important to understand the current BET fishery trends, and will be incorporated in some of the assessment studies to be conducted during the assessment meeting of July 2010.

As described above, Guinea Equatorial also reported T2CE (in addition to T1 data) for 2009. This dataset is incomplete and without the required detail to understand if this is truly a new fishery component or represents data reported elsewhere. The Secretariat will reiterate the need for clarification with the Equatorial Guinea authorities. Meanwhile, this information will be kept as provisional and not considered in the assessments.

The current T2CE information was used to create the raw catch and effort file used to produce standardized CPUE's indices per fishery for the fisheries used in Multifan CL by using a GLM procedure. This information was only collated two days before the end of the meeting because of the difficulty in processing information from many fleets and countries provided in different spatial scales, and provided with different effort units. The working group examined the yearly coverage and number of records available in the T2CE database for the different effort units and selected only those data series that had sufficient records and a broad yearly coverage, paying special attention to the yearly overlap between series. The ICCAT secretary staff will complete the analysis and circulate an SCRS document within two weeks of the completion of this meeting so that members of the group can review the results and complete the development of the MULTIFAN file prior to the assessment meeting.

Additionally, the Secretariat informed that a new update to CATDIS (Task-I catch by quarter and 5x5 squares) dataset will be available to the assessment. This update will incorporate all the revisions shown in **Table 6**.

4.2 Size information

The complete BET size information (T2SZ) available was also reviewed by the Group. The respective catalogue is presented in **Table 7**. The Group also noted the lack of homogeneity on the T2SZ time series of some fleets (different time-space stratification, heterogeneous size class intervals, heterogeneous size class boundary limits, etc).

A table with the revisions and additions made to T2SZ statistics, since the beginning of the last BET assessment (**Table 8**) was also prepared and analyzed. The table separates the size information reported in: observed size samples and catch-at-size. As for T2CE, the T2SZ statistics of the most recent years (2005-2008) was revised by the CPCs.

A revised size composition estimation of the global "faux poissons" (all species combined) landed in Abidjan (1998-2008) was presented to the Group. Given its combined structure (per year and with no species separation) the Group decided not to consider, for the moment, this revision and retain the current "faux poissons" information available in the ICCAT-DB. The WG also reviewed a presentation of the size frequency distribution data collected by the US observer program on their pelagic longline fleet; the WG was informed that US scientists will collaborate with the Secretariat to harmonize this data with the current size observations in the ICCAT database for bigeye tuna.

The current T2SZ information reported (whether, observed size samples or raised size - CAS) was used to create the raw size samples matrices per fishery. Those matrices are another major piece of the input Multifan-CL file.

In respect to the BET-CAS (Secretariat catch-at-size estimation), the Secretariat informed that an update will be available to the assessment. This update will include all the revisions made by the various CPCs since the 2007 BET assessment.

4.3 Developing Size frequencies for Multifan CL

The WG decided to update size frequencies from 2002 forward only (see **Table 8**), as only minor changes in size or CAS information has been submitted since the 2007 Assessment for years prior to 2002. The size frequencies were summarized from actual size observations submitted to ICCAT-SCRS (size) and catch-at-size (CAS) database (**Table 7**). The CAS frequencies were down-weighted by a factor of 0.05 (5%) to equilibrate in number with the actual size samples (5% is the average level of size sampling coverage that is normally used by CPs to estimate CAS in general). Once the observed size frequencies and down-weighted CAS information were combined, the WG reviewed the size frequencies by year-quarter strata for each of the fleets by producing histograms and cumulative density plots. These were used to identify length-frequency strata that departed from the average trend for each fleet of the Multifan-CL fleet classification. Appendix 4.3 shows the various plots for the size frequencies evaluated. The WG decided to use 50 observations as minimum number of samples for a length frequency series (fleet/year/quarter strata) to be included for the Multifan-CL model. The WG also used kurtosis and skewness estimators of each length series as indicators of major departures from each fleet group. Values of kurtosis greater than 35 or skewness greater than 5 were used as diagnostic cut-offs for each fleet year-quarter length frequency series.

It was noted also that for the purse-seine fisheries from the tropical areas in the West Atlantic, some of the size observations were actually from weight frequency distributions. When these weight distributions were converted to length observations, the procedure greatly over-estimated the numbers of larger size fish in the

length frequencies. Thus the WG decided to use only the CAS for fleet ID s3 and 4 (Multifan-CL classification) which correspond to the purse-seine fisheries mentioned before. Also the length frequency of fleet 15 (longline gear), year 2002, quarter 2 was excluded, as it represented few fish, all from a single size bin. The WG also reviewed the size frequency provided by Uruguay scientists during the meeting for longline fleets operating in the south-west Atlantic from 2002 to 2009. The group decided to add this data to the overall size-frequency data and included within the longline fleets for the south Atlantic area (Fleet ID 15). **Figure 2** shows a summary of the size frequency distribution for the main groups of fleet ID input for Multifan-CL for 2002-08.

5. Review of available indices of relative abundance by fleet and estimation of combined indices

The working group reviewed several documents regarding catch per unit effort (CPUE). These documents and the group discussion that followed are summarized below. For all indices, the working group made a standard set of recommendations: (1) the construction of annual indices in biomass for surplus production models; (2) the construction of annual indices in numbers *or* biomass for virtual population analyses; (3) the construction of quarterly indices for Multifan-CL and/or Stock Synthesis (SS) model applications; and (4) when appropriate, indices for Multifan-CL and/or SS application should use the areas as defined in **Figure 3**. Additional recommendations specific to a given index are discussed below.

The relative abundance indices described below are summarized in a series of tables corresponding to each of the assessment methods that they may be used for. Two types are presented: annual indices for production models (**Table 9**) and VPA (**Table 10**) and quarterly indices for more complex models such as MULTIFAN CL and SS3 (**Table 11**). Whether any individual index should be used for base models or sensitivity runs is at the discretion of the assessment panel.

All indices were standardized using delta-lognormal or similar approaches unless otherwise noted.

5.1 Longline Indices

Document SCRS/2010/028 describes standardized catch rate indices for bigeye tuna from the U.S. pelagic longline fleet during 1986-2009. Because fishing operations are largely determined by the species targeted, a proxy target variable was defined based on the proportion of swordfish catch reported by observation. This variable was categorized using the 0.25, 0.50, 0.75, and 1.0 quartiles of swordfish catch proportion. Sets targeting bottom or non-pelagic sharks were excluded. Two indices are presented: an index in numbers of fish, and a biomass index. For both indices, a general decline is noted since the mid-1980s, with variable but lower standardized catch rates throughout the remainder of the time-series. The spatial distribution of effort is shown in **Figure 4**.

The group made the following recommendations regarding SCRS/2010/028. The annual biomass index should be used for the surplus production model runs while the annual index in numbers is most appropriate for virtual population analyses. Quarterly indices were constructed during the data preparatory meeting.

Documento SCRS/2010/029 describes the standardization of the CPUE of bigeye caught by the pelagic longline fleet of Uruguay between 1981 and 2009 using the logbooks from the fishing industry. The Uruguayan tuna fleet started its activities in a continuous manner in 1981 and it was characterized by two well-defined periods as regards fleet type and fleet operation (**Figure 5**). Up to 1991, the fleet was comprised mainly of freezer vessels that fished using Japanese type longline and directed their effort at bigeye. After that time, the majority of these vessels were replaced by “fresqueros” that use American type monofilament longline, with the exception of a few vessels that used Spanish type multi-filament longline whose target species was mainly swordfish. This study presents standardized CPUE data on bigeye tuna caught by the Uruguayan tuna fleet for these two periods separately and by the entire time series. In the standardized series a clear decline in bigeye CPUE was observed throughout the time series. The spatial distribution is shown in **Figure 6**.

The group made the following recommendations regarding SCRS/2010/029. The group noted that very few sets occur during the period when vessels that targeted bigeye and swordfish operated simultaneously, and thus, recognized that it is difficult for a statistical model to standardize across these two distinctive stanzas. Therefore, the group recommended that the two shorter time series (1981-1991 and 1992-2009) be used for the bigeye tuna assessment models. The group also recognized that the analysis presented in SCRS/2010/29 made use of more detailed information about fleet operation than is contained in the Task-II information. Therefore, the group recommended that information from this analysis be substituted for the Task-II data formerly used in the 2007 Multifan-CL assessment model. The group also noted that trends in indices in biomass and number constructed from observer data (SCRS/2010/030) were very similar and that size composition is fairly constant with time.

Therefore, the group recommended that the index in numbers from SCRS/2010/029 be used to approximate the biomass index necessary for virtual population analyses. Quarterly indices were constructed during the data preparatory meeting.

Document SCRS/2010/030 describes the standardization of bigeye CPUE using data from the observers on board the Uruguayan pelagic longline fleet between 1998 and 2009. This study standardizes the bigeye tuna catch rates observed by the National Plan of Observers on board the Uruguayan longline fleet between 1998 and 2009. Two series are discussed in this document: (1) CPUE in number of fish per 1,000 hooks, and (2) CPUE weighted to the total catch. Both series show the same trends, with a decrease in bigeye CPUE throughout the time series similar to that observed for the entire fleet. The spatial distribution of effort is shown in **Figure 7**.

Regarding SCRS/2010/030, the group recognized that these indices represent the same fishery discussed in SCRS/2010/029. The primary difference being that the indices in SCRS/2010/029 were constructed using logbook data, and the indices in SCRS/2010/030 using data from the National Observer Program. Due to the longer time series and greater volume of available data, the group recommended the use of the indices constructed using logbook data. Therefore, the group did not recommend any changes to the indices presented in SCRS/2010/030.

Document SCRS/2010/033 describes the construction of standardized CPUE indices for bigeye tuna caught incidentally by the Moroccan longline fleet during 2005-2009. Since 2003, a new longline fleet of 14 freezing vessels has targeted swordfish in the north Atlantic Ocean, especially in the area between the latitudes 23N° and 28 N° (**Figure 8**). The catches of this fishery are mainly composed of swordfish, but important catches of sharks and bigeye tuna have been made by this fleet during the most recent years.

The group made the following recommendations regarding SCRS/2010/033. Since this index is calculated in kilograms/1000 hooks, it was deemed appropriate for use in both surplus production models and virtual population analyses. Quarterly indices were constructed during the data preparatory meeting.

Document SCRS/2010/035 describes the standardization of an abundance index of bigeye tuna by the Taiwanese longline fishery in the Atlantic Ocean, 1968-2009. The index (in numbers caught per 1,000 hooks) was generated from two data sources, the TASK II series from 1968 to 1989 and the logbook series from 1990 to 2008. The interpretation of this index is complicated by several important changes during the time-series, including: (1) the fishery has increasingly targeted bigeye tuna since 1990; (2) there was an abrupt quota reduction in 2006; (3) quotas have been shared between vessels targeting bigeye and albacore, so some vessels targeting albacore may be included in the dataset used to construct the index for bigeye; (4) a fleet variable (bigeye, albacore) became available in 2002, but was not available before that time; and (5) the responsible organization for logbook compilation changed in 1995 and early years had very low observer coverage (<5% before 1993 compared to >40% after 1994). The spatial distribution of effort for the Taiwanese index is very broad, encompassing most of the Atlantic Ocean. The area stratification for this analysis is shown in **Figure 9**.

The group made the following recommendations regarding SCRS/2010/035. The group recognized that the changes in targeting complicate the interpretation of the CPUE series constructed for the complete time-series. Therefore, the group recommended the use of the separate series (1968-1989 and 1990-2009) for the purposes of assessment. The group also expressed some concerns about the elimination of trips that used >3200 hooks/basket. The analysis of the data exclusion (>3200 hooks/basket) was presented during the data preparatory meeting. Following a discussion, the working group determined that set using >3200 hooks/basket should be retained in the analysis.

The working group noted that the annual indices in numbers is most appropriate for virtual population analyses. Quarterly indices consistent with working group recommendations were constructed during the data preparatory meeting. An index of abundance in biomass was constructed for use in surplus production models.

Document SCRS/2010/036 describes the development of three standardization scenarios for the construction of abundance indices for bigeye tuna landed by the Brazilian longline during 1980 to 2008. This fishery operates in the southeast Atlantic Ocean (**Figure 10**). During this analysis, GLM analyses were used to standardize bigeye tuna CPUE considering two different distributions: Tweedie and quasi-Poisson. Three models were developed: (1) a model considering the target species, inferred from a cluster analysis as a factor; (2) a model that used a principal component analysis, following the cluster analysis, to separate the fishing vessels into fleets with similar fishing strategies; and (3) a traditional model with no target species factor being considered in the GLM. All three approaches resulted in a variable CPUE trajectory during the time-series. There was some indication of

general increase in CPUE in the most recent years, particularly for the index the used fleet strategy.

The working group recognized that the fleet characteristics of the “Brazilian longline fishery” are unusually complex (e.g. many chartered vessels with various operating characteristics), and acknowledged that simple standardization strategies may not be appropriate in this circumstance. However, the group also noted that the abundance trends resulting from the approaches described in SCRS/2010/036 are very different between themselves (**Figure 11**) and from those of other longline fleets. The group noted that, by using the “fishing strategy” approach, an unsuccessful trip (no catch) may be assumed to be caused by a decision not to target bigeye rather than a lack of abundance.

The working group requested numerous analyses. All were prepared and presented during the data preparatory meeting (**Appendix 6**). After further deliberation, the working group determined that there was no obvious reason to conclude that the Brazilian index was inappropriate for use. Therefore, the group recommended that the “strategy” index in numbers be used for production models (as a proxy for biomass) and also in the VPA. Quarterly indices were constructed at the data preparatory meeting. The working group recommends a detailed simulation study to validate the “strategy” approach.

Document SCRS/2010/037 describes the construction of standardized CPUE indices of bigeye tuna for the Japanese tuna longline fisheries operated in the Atlantic Ocean during 1961- 2008. The methods were the same as those applied during the previous assessment of bigeye in 2007, except that SST was not an available factor in the analysis, and some interaction terms were not included in the analysis. The following area definitions were used; (1) all three Atlantic areas combined and (2) the three areas analyzed separately (**Figure 3**). Annual and quarterly CPUEs in number, and annual biomass based indices were calculated to provide abundance indices to be used in models for the bigeye stock assessment in 2010. The annual trends in number and weight based CPUE series were quite similar to those of the last assessment.

The group made the following recommendations regarding SCRS/2010/037. The annual biomass index should be used for the surplus production model runs (e.g. BSP, ASPIC). The annual index in numbers is most appropriate for virtual population analyses (e.g. VPA-2BOX). Quarterly indices are intended to be used for Multifan-CL and SS applications.

5.2. Baitboat and purse seine indices

Standardized CPUE for the Azores baitboat fleet were calculated in SCRS/2010/039. The standardization used a generalized linear mixed model assuming a delta binomial-lognormal error distribution. The explanatory variables included year, quarter, a vessel classification category based upon vessel size and typical operations, and interactions between quarter and vessel class as well as between year and quarter. The Working Group noted that the general declining trend similar to the declining trends observed in other indices, but that the large fluctuations in the early period may reflect local availability to this fishery that operates in a restricted area (about 5 degree square) of the North Atlantic. In the past the Working Group discussed the possibility that local availability may be the result of local environmental factors. The Working Group recommended including this index for the Multifan-CL (quarterly index), VPA and biomass models.

The working group also reviewed an index developed for the European tropical purse-seine during 1991-2006 (Soto et al. 2009). This index represents juvenile abundance, and was applied to ages 0 and 1 during the previous assessment (ANON, 2007). This index is in biomass, which makes it appropriate to use in both surplus production models and other model platforms. A quarterly index was developed at the data preparatory meeting by (1) dividing the annual values by 4 and (2) using that value for each quarter. This was deemed acceptable since the season was not a significant factor in the delta-lognormal model (SCRS/2008/116).

5.3 Creation of combined indices

For the production models analyses, the Working Group decided to generate a combined index of abundance based on the available biomass indices (**Figure 12**).

- 1) Japanese LL
- 2) U.S. Pelagic Longline
- 3) Uruguay LL Early
- 4) Uruguay LL Late
- 5) Brazil LL (numbers as proxy for biomass)

- 6) Chinese Taipei Early
- 7) Chinese Taipei Late
- 8) Morocco LL
- 9) Azores BB

The combined index was calculated in the following manner: (1) each index was scaled relative to the longest series, the Japanese LL; (**Figure 13**) (2) the resulting annual scaled indices were weighted by the annual proportion of the catch of each fishery with respect to the overall yearly catch (**Figure 14**). This approach is nearly identical to that used during the 2007 assessment. In addition, the working group recommended that conflicting indices be identified, and that the sensitivity of the combined index to these conflicting series be explored before the assessment meeting.

5.4 Indices for VPAS and Multifan CL

Figure 15 and **Table 10** show the annual indices of abundance for VPA. All are in number except MOR_LL, AZO_BB and EU_PS which are in biomass **Figure 16** and **Table 11** show the quarterly indices to be used with MULTIFAN CL.

6. Review of Tagging data

The tagging operation consists of catching fish with the least possible stress and inserting a numbered tag in these fish before releasing them back in the water. The eventual recoveries by fishers are communicated to the institution that had carried out the tagging operation, following the indications on the tag found on the fish. The data collected are very important and provide information on growth, migration and mortality.

The tagging database system (structures, standardization, formats, submission, etc.), continues under a full revision process which started in 2008. The Secretariat's tagging database is comprised of approximately 630,000 records (released and recovered) on tuna, tuna like species and sharks). As a result of this, the 2008 ICCAT-USA joint work aimed at improving the tagging data exchange protocol and inherently the data quality (SCRS/2008/159), the Secretariat received the complete CTC tagging database (about 430,000 records, in conformity with the exchange protocol agreed) from United States. These data has been cross-checked against the current Secretariat's tagging database in order to making it as complete as possible. The Secretariat has also processed all these data according to the latest tagging format adopted by ICCAT. The tagging database has experienced considerable revision during 2008 and 2009. It is now prepared to accommodate the new elements proposed by the 2007 Ad Hoc Tagging Working Group (SCRS/2007/018). Given the planned submission of U.S. tagging from the Billfish Foundation (150,000 records), a complete cross-checking of data is foreseen for 2009. Various changes in the tagging database are also expected. The spatial distribution of the BET tag releases, recaptures and movement are shown in **Figure 17**.

Tagging data preparation for Multifan-CL

As Multifan-CL can incorporate tagging information, a preliminary tag input file for BET was created using the updated information available from the ICCAT secretariat. New information obtained from Spain was additionally used to update the database. This recovered data from Spain is part of the tagging data recovery efforts recommended during the Yellowfin tuna assessment in 2008. For Multifan-CL, tag release and recovery information is organized into groups consisting of the tags released within a particular model region and a particular year and month. The releases are further stratified by length intervals, which would normally be the same as those defined for the fishery length frequency data. The history of tag recoveries for each group is then summarized by release length interval, fishery, year and month of recapture.

Several assumptions were made regarding which data should be included in the model. It was decided that all tags recaptured within 30 days of release would not be included as these individuals would not have had time to mix sufficiently within the population after release. The times-at-liberty for the tags recorded in the ICCAT database are displayed in **Figure 18**. In addition, all data for which conflicting species information was provided, or for which no spatial information regarding the release or recapture was available, were also discarded. Problems arose in the assigning of the recaptures to specific fleets, as for much of the data, the fleet and gear were listed as unclassified. In the case of purse seine fisheries, information regarding free and FAD school catches were not included in the recapture database.

After discussion amongst the group, the assumptions made in order to assign fleet numbers to the tag recapture data are as follows:

1. All PS fleets after 1990 were separated into Free or FAD school catch depending on the size of the caught individual (>77cm = Free school, <77cm FAD). It must be noted that based on size distributions, small fish are caught by both FAD and free school fisheries, although as the catch on FADs is so much larger than on free schools, the probability of the FADs catching small fish is large and thus the assigning of data in this way may not create a major bias.
2. All BB fleets were separated according to their latitude in accordance with the MFCL fleet specifications.
3. ANT unclassified fleets assigned to PS and separated as per (1) above
4. CPV unclassified fleets assigned to BB
5. EC-ESP UNCL assigned to BB or PS dependant on latitude (North of 15° N = BB, South of 10° N = PS, there were no recaptures between 10 and 15° N)
6. EC-FRA UNCL assigned to PS and separated according to (1) above
7. EC-PRT UNCL assigned to BB
8. Senegalese PS and UNCL reassigned to FIS (tropical BB) and separated according to the fleet specifications defined for MFCL.
9. UNCL fleets with gear listed as PS, UNCL and NONE were assigned to EU type PS and separated according to (1) above.
10. UNCL fleets with gear listed as BB were assigned to FIS and separated as with (8) above.

Additional processing was required with regard to the size information, both for releases and recaptures. Where release information was missing, the lengths were assigned the modal length for the particular release event. Although Multifan-CL does not explicitly require length at recapture, this data was needed in order to assign recapture information to specific fleets as per 1 – 10 above. In this case, the VBGF suggested by Hallier et al. (2005) was used to calculate the recapture length based on the release length and time at liberty. Lastly for two individual recaptures, information regarding the recapture event did not correspond to an actual fishing event as listed in the ICCAT Task I and Task 2 databases. In these cases, the recaptured individuals were reassigned to the nearest month in which fishing occurred for the recapture fishery.

Following the application of these selection procedures to the data, an updated tag file was created for input into MFCL. The following paragraphs describe some of the characteristics of the resulting data subset.

Fish tagged

About 10,000 fish have been tagged (9,684 exactly) in the Atlantic from 1973 to 2004, mainly using traditional tags and principally in two periods. The first, of minor importance, took place between 1973 and 1982 (according to Document SCRS/1983/080, 8,204 fish were tagged). The second period, of considerable scope, covered mainly the period from 1998 to 2001. Four fleets participated in these tagging operations at different times and in different areas (**Figure 19**). Fleet 1 was more active during the first period, while fleets 4, 8 and 9 participated exclusively in the second.

These tagging operations were carried out in regions 1 and 2 with 45 and 55%, respectively, of all the tagging operations. Regarding the time period, the 55%, 24% and 17% of the tagging operations occurred in the third, second and fourth quarters respectively. The tagging in season 1 was very minor (**Table 12**).

Considering the number of fish tagged the figure changes considerably (**Table 13**). The percentage in area 2 increased from 55 to 68% as well as the percentage in the quarter 4 which comes in second place with a 26% of fish tagged. The first season remains rather marginal.

The size distribution of the individuals tagged ranged from 32 to 102 cm (**Figure 20**).

Fish recovered

The recovery rate is 12%. This proportion seems to vary considerably by quarter. It is highest during the second quarter, average in the fourth, low during the third and null in the first (**Table 14**). It is highlighted that in the third quarter, while the number of fish tagged during this quarter represents 57%, the recoveries were particularly low for this period which usually has high yields.

Regarding the size, the proportion of fish recovered does not seem to be affected by the size of the fish (**Table 15**).

Figure 21 shows the size distribution of fish recovered. Several modes are observed notably at 45 cm and 62 cm. Other modes, much less important, are also observed at different sizes.

7. Review of data needs for different assessment model options

7.1 Data inputs for Multifan-CL model.

For this assessment, catch and effort information by fleet was kept largely the same as in the 2007 assessment. The database was updated to include information up to 2008 (an additional 3 years). Revisions to the past data are fully outlined and explored in sections 3, 4 and 5 of this report. It was agreed that the same fleet definitions as those used in the 2007 assessment would be used (**Table 16**). The revised tagging information was compiled and made available for input into the MFCL model as mentioned in section 6 of this report. In terms of size information, both length and weight frequencies will be included in the MFCL assessment. Where weight frequency information was calculated from length frequencies, only one of the two series was included in MFCL. Both were included if they represented independent samples. The general assumptions included in the 2007 assessment will also be maintained such as the use of Hallier et al's (2007) growth function, the region sizes 1.00, 1.61, 0.81, for Regions 1, 2 and 3 respectively and recruitment partitioning as 0.05, 0.90 and 0.05 for Regions 1, 2 and 3 respectively. The relative size of the three regions based on the number of 5x5 squares with bigeye catches in the period 2000-2005 was used to calculate the relative area sizes, whilst recruitment was based on the spatial distribution of the catch of small bigeye tuna.

7.2 Data requirements for VPA

VPA-2Box has been used in several assessments of BET. Initial parameter settings are described in the 2007 detailed assessment report.

VPA – If a two area or sex specific model is selected, inputs must be by area or sex.	Data Available?
First and last year	YES
First, last and plus-group age	YES
Number of Indices	YES
Month of Spawning Season	YES
Fecundity Modifier (e.g weight-at-age, maturity-at-age, fecundity-at-age)	YES
Total catch at age matrix. Generally developed from the TASK II catch-at-size data using an age-slicing procedure.	NO
Data specifications for indices of abundance <ol style="list-style-type: none"> 1. biomass or numbers 2. time of year 3. First age and last age 	YES
Indices of abundance with measure of variation (if used).	YES
Partial catches at age: catch at age matrix for each fleet. Generally developed from the TASK II catch-at-size data using an age-slicing procedure – or fixed.	NO
Mortality rate	YES
Weights at age	YES
Spawner/Recruit Relationship (optional)	Not Used in 2007
Tagging Data (optional – for mixing models)	Not Used in 2007
Pro2-Box (projection software)	
VPA (Numbers-at-age, Catch-at-age, F-at-age, Discards-at-age)	Requires Model Results
Vector of natural mortality	YES
Transfer coefficients (for mixing model)	Not Used in 2007
Future vulnerability modifiers by age	Not Used in 2007, could be developed
Spawner-recruit parameters	YES
Time stream of future total allowable catch or fishing mortality rate limits.	To be developed

7.3 Data requirements for ASPIC

The surplus production model, ASPIC, has been used in several assessments of BET. Initial parameter settings are described in the 2007 detailed assessment report.

Production Models (ASPIC)	Data Available?
Time series of removals	YES
Indices of abundance (may require combined indices)	
Starting guesses and constraints on parameters (K, MSY, q, B1/K).	YES
Time stream of future total allowable catch or fishing mortality rate limits.	To be developed

7.4 Data requirements for BSP

The Bayesian surplus production model, BSP, has been used in several assessments of BET. Initial parameter and prior settings are described in the 2007 detailed assessment report.

Production Models (BSP)	Data Available?
Total catch per year. If catch data are unavailable for the early years of a fishery, the model can estimate a single constant annual catch for the missing years. Catch does not have to be allocated to fleets.	YES
At least one CPUE or other index of abundance, with or without CV.	YES
Starting guesses of the parameter values, which must give a plausible biomass trajectory.	YES
Prior distributions of the parameters (optional).	YES
The user must specify the importance function to be used in the SIR algorithm, whether to use the discrete or continuous time version of the model, etc. (See user's guide).	YES
Time stream of future total allowable catch or fishing mortality rate limits.	To be developed

7.5 Data requirements for Stock Synthesis (SS)

Many types of data may be input to SS, but no one data type is required for a model to run. Some parameters are required while others are conditional on the model configuration, depending on such options as multiple areas, growth patterns, etc. The various data inputs are summarized in Appendix XX. A detailed user manual can be found at (<http://nft.nefsc.noaa.gov/Download.html>).

In general, the SS model runs will be set up to resemble Multifan-CL in structure. Therefore, the minimal data requirements are not unlike Multifan-CL. It is advisable, although not strictly required, to start the SS model in a year where fishing mortality was negligible, and apply an assumption of the development of the fishery from that year, to the first year where catch data is available.

8. Recommendations

Provision of data

- All countries that have not supplied task I and task II data for 2009 need to do so before the data deadline of June 22 2010, in the appropriate ICCAT format. This data is essential for population projections and for VPA and Production models to be conducted during the July assessment meeting. Only data provided to the ICCAT secretariat by the deadline, in the appropriate ICCAT format, will be used in preparing the information required for the assessment.
- Continue to recover cannery data (size of fish and volume processed by species) so as to provide a database of information as far back in time as possible.
- Conduct a new revision and consolidation of the Ghana landing (weight and fish size by species) and logbook information already available. This task may involve considerable time and resources.
- Countries should use the table of reconciliation of trade and task I statistics to identify possible errors in task I reports and conduct the necessary investigations to correct such errors if they exist. This is probably best achieved by National Scientists in cooperation with fishing industry experts. In order to achieve this it may be necessary to:

- o develop ratios for estimation of round weight from some types of market products.
- o make available to the SCRS information on individual transaction documents (statistical documents and re-export certificates) of the Bigeye statistical document program.
- Encourage the WG in the future of ICCAT to come to an agreement on how to treat confidential data. The meeting participants endorsed the proposal on treatment of confidential data developed by SCRS in 2009 (ICCAT, 2010).
- Some catch data continues to be reported in categories that are not those required to support assessments. The WG recommend again that data provided to ICCAT should be characterized in the ways agreed by ICCAT guidelines.
- Countries should provide observed length frequency data as well as catch at size data for all of their fleets.

Improvements in biological knowledge

- Continue recovering historical tagging data for tropical tuna as recommended during the 2008 Yellowfin tuna assessment.
- Support continued efforts to re-establish conventional tagging and expand PSAT tagging of bigeye with the purposes of improving knowledge on mortality, growth, population structure and migration rates.

Assessment methodologies

- The performance of the Hazin et al. model (SCRS/2010/036) for cpue standardization that uses catch data by species to define fishing strategy must be simulation-tested.
- The available algorithms for the preparation of catch at age matrices from catch at size for the total fleet and by fleet need to be tested against one another to see if they can reproduce the catch at age developed during the 2007 assessment.
- The ICCAT secretariat is to prepare catch at size data after the deadline for data submission of June 22 2010 and provide it to scientists in preparation for the assessment meeting. This data is to be used by the WG in the estimation of catch at age prior to the start of the meeting.
- The working group must complete the preparation of data for MULTIFAN CL up to 2008 by correspondence. This must be done in coordination with the ICCAT secretariat staff that will provide the catch and effort data used in the development of the MULTIFAN CL input files.
- Once MULTIFAN CL input files are reviewed by the working group these files will be made available by the ICCAT through the Web.
- Use SS3 as a alternative “statistical catch at age” stock assessment model to MULTIFAN-CL in the July assessment meeting.
- The Bigeye Rapporteur, in collaboration with ICCAT secretariat staff, will coordinate efforts of the WG to test the algorithms that produce the catch at age, prepare the catch at size and finalize the development of MULTIFAN CL files.

9. Other matters

The working group acknowledged the vast improvement in the reliability of the connection, quality and speed of data access provided by the new wireless equipment available at the Secretariat. The productivity of the working group during the meeting benefitted from such continued improvements.

The working group would like to thank AZTI for offering to support and host the July assessment meeting at their facility in Pasaia.

10. Adoption of the report and closure

The report was adopted during the meeting.

The Chairman thanked the participants for their hard work.

The meeting was adjourned.

Literature cited

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Dominica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
EU.España	4072	7418	4015	5681	4515	8882	7436	9736	6849	5419	8430	1001	0	9332	8794	1361	1034	1088	0	0	0	1035	
EU.France	3885	3972	3954	4442	5201	4901	6485	8970	8985	7308	6283	8020	7074	8124	4254	4615	4266	3905	4161	3261	5023		
EU.Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
EU.Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0		
EU.Portugal	5133	2892	3962	5855	1094	5	6813	2929	4522	5350	3483	3706	3086	1861	4075	4354	6457	7428	5036	2818	5295	6233	
EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Faroe Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Gabon	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0		
Ghana	0	0	0	30	73	84	170	237	124	238	332	780	791	491	2162	1887	1720	1178	1214	2158	5031		
Grenada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Guinea Ecuatorial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Honduras	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Iceland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Japan	9504	2129	1966	2201	2294	1754	8	8170	1014	4	9863	1215	2092	2209	3351	1521	2487	3210	2308	1896	3206	3954	3523
Korea Rep.	4079	7353	5730	6018	7831	1049	3	6923	8090	9716	8022	5	4	9	9383	8989	4	6084	4438	4919	7896	2690	
Liberia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	206	16	
Libya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Maroc	0	0	0	0	0	15	170	324	394	414	387	622	625	552	120	30	0	8	0	0	0	0	
Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Mixed flags (FR+ES)	0	0	0	0	0	0	0	0	0	0	0	116	124	176	40	26	50	339	339	300	384		
NEI (ETRO)	0	0	0	0	0	0	0	0	0	0	0	0	338	1141	157	0	0	85	20	93	959		
NEI (Flag related)	0	0	0	0	0	0	0	0	0	0	0	0	0	46	369	354	758	1406	2155	4650	5856		
NEI (UK.OT)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Namibia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Netherlands Antilles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Norway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	0	0	0	
Panama	0	0	182	2710	2081	2091	2135	1493	2127	513	4518	2500	2844	2789	3165	4461	5173	5616	3847	3157	5258		
Philippines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Russian Federation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
S. Tomé e Príncipe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	8	6		
Senegal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Seychelles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sierra Leone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
South Africa	0	0	0	1	0	0	0	0	0	19	422	381	137	187	60	102	168	200	561	367	296		
St. Vincent and Grenadines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sta. Lucia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Togo	0	0	0	0	0	0	0	0	0	0	0	0	0	14	52	18	24	22	7	12	12		
Trinidad and Tobago	0	0	0	0	0	0	0	0	0	0	0	0	0	191	41	22	0	0	1	19	57		
U.S.A.	195	544	212	113	865	67	28	331	248	212	202	158	422	315	539	639	1085	1074	1127	847	623		
U.S.S.R.	2580	2729	1637	2961	3367	3652	4907	4086	2202	2229	2813	2832	635	352	1233	870	1071	1887	1077	424	95		
UK.Bermuda	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
UK.Sta Helena	0	0	0	0	0	0	0	5	22	8	9	14	23	14	19	0	0	5	1	1	3		

Uruguay	0	0	0	0	0	0	0	0	0	0	0	86	397	605	714	597	177	204	120	55	38
Vanuatu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Venezuela	136	92	117	15	24	0	21	464	244	347	661	1684	1027	4284	4142	2918	1136	349	332	115	161

Table 2 (continued)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
TOTAL (AT+MD)	8490	9607	9937	11257	13363	12677	12168	10928	11043	12830	10365	9429	7722	9210	8705	7235	6586	7966	6720	3700
	1	4	4	2	0	8	9	9	8	4	1	1	5	6	4	3	3	4	6	7
Bait boat	1828	1775	1624									1584		1356	1894	1500	1467	1543	1235	
	0	0	8	16467	20290	25552	19059	21037	21377	25867	12634	2	8756	9	0	7	1	2	9	2134
Longline	5653	6155	6240									5526	4643	5446	4839	3803	3418	4623	3901	2034
	7	6	3	62871	79004	74877	74930	68310	71856	76527	71193	5	8	6	6	5	2	2	9	9
Other surf.	293	437	607	652	980	567	357	536	434	1377	1226	1628	1138	1340	1301	716	552	447	218	23
		1633	2011									2155	2089	2273	1841	1859	1645	1755	1560	1450
Purse seine	9791	1	6	32582	33355	25782	27343	19406	16771	24533	18599	6	4	1	7	5	7	3	9	0
CP																				
Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	476	75	0	0	0	
Barbados	0	0	0	0	0	0	0	24	17	18	18	6	11	16	19	27	18	14	14	7
Belize	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	60	70	60
Brasil	591	350	790	1256	601	1935	1707	1237	644	2024	2768	2659	2582	2455	1496	1081	1479	1593	958	
Canada	10	26	67	124	111	148	144	166	120	263	327	241	279	182	143	187	196	144	130	111
Cape Verde	52	151	105	85	209	66	116	10	1	1	2	0	1	1	1	1092	1437	1147	1068	
China P.R.	0	0	0	70	428	476	520	427	1503	7347	6564	7210	5840	7890	6555	6200	7200	7399	5686	
Côte D'Ivoire	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	
	1035	1470	1465									1013	1057	1112						
EU.España	5	5	6	16782	22096	17849	15393	12513	7110	13739	11250	3	2	0	8365	7618	7454	6675	7494	8609
EU.France	5023	5581	6888	12719	12263	8363	9171	5980	5624	5529	5949	4948	4293	3940	2926	2816	2984	1629	1130	2205
EU.Ireland	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	33	0	0	0	
EU.Poland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
EU.Portugal	6233	5718	5796	5616	3099	9662	5810	5437	6334	3314	1498	1605	2590	1655	3204	4146	5071	5505	3422	5498
EU.United Kingdom	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	
FR.St Pierre et Miquelon	0	0	0	0	0	0	0	0	0	0	0	0	21	0	28	6	0	2	3	
Gabon	0	0	0	1	87	10	0	0	0	184	150	121	0	0	0	0	0	0	0	
												1204		1355	1490	1391		1326		
Ghana	5031	4090	2866	3577	4738	5517	5805	9829	13370	17764	5910	2	7106	7	1	7	9141	7	9269	
Guatemala	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1003	923	836	998	
Guinea Ecuatorial	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1227
Honduras	0	0	44	0	0	61	28	59	20	0	0	0	0	0	0	0	0	0	0	
Iceland	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
	3523	3035	3472									1808	1530	1957	1850	1402	1573	1799	1464	
Japan	1	6	2	35053	38503	35477	33171	26490	24330	21833	24605	7	6	2	9	6	5	3	0	
Korea Rep.	2690	802	866	377	386	423	1250	796	163	124	43	1	87	143	629	770	2067	2136	2599	
Libya	0	0	508	1085	500	400	400	400	400	400	400	31	593	593	0	0	4	0	0	
Maroc	0	0	0	0	0	0	0	0	0	700	770	857	913	889	929	519	887	700	802	
Mexico	0	0	0	1	4	0	2	6	8	6	2	2	7	4	5	4	3	3	1	

Table 4 Conversion factors applied to scale the BET product weight in the b.SDS.

	Prod Shape	Frequency	Factor
Dressed weight	DR	184	1.3
Fillet	FL	39	1.67
Gilled & gutted	GG	152	1.15
Headless	HD	2	1.15
Head & gutted	HG	4	1.3
Keboobs	KB	1	10
Loins	LO	7	1.67
Other	OT	82	2
Rounded weight	RD	46	1
Steak	ST	12	10
Unknown	UN	70	1.3
Belly Meat	BM	1	10.00

Index	US_PLL		JAP_LL_ALL		URU_LL_EARLY		URU_LL_LATE		BRA_LL		TAI_LL_EARLY_ALL		TAI_LL_LATE_ALL		MOR_LL		AZO_BB	
Effort	Biomass		Biomass		NUMBERS AS PROXY		NUMBERS AS PROXY		NUMBERS AS PROXY		Biomass		Biomass		Biomass		Biomass	
USE	ASPIC		ASPIC		ASPIC		ASPIC		ASPIC		ASPIC		ASPIC		ASPIC		ASPIC	
AREA	Mostly 1		ALL		Mostly 3		Mostly 3		Area 2 and 3		ALL		ALL		Mostly Area 1		Area 1	
YEAR	IND	CV	IND	SE	IND	sd	IND	sd	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV
1961			0.896	0.042														
1962			0.885	0.039														
1963			0.969	0.035														
1964			0.875	0.029														
1965			1.046	0.027														
1966			0.927	0.030														
1967			0.957	0.032														
1968			1.088	0.034							2.679	0.167						
1969			1.156	0.035							3.108	0.147						
1970			1.253	0.031							2.401	0.142					1.922	0.475
1971			1.273	0.028							2.015	0.145					1.352	0.789
1972			1.372	0.033							1.262	0.147					1.539	0.594
1973			1.825	0.036							0.851	0.148					2.136	0.477
1974			1.678	0.037							0.905	0.143					2.529	0.463
1975			1.199	0.030							1.051	0.146					1.817	0.461
1976			1.241	0.035							0.574	0.143					0.867	0.662
1977			1.672	0.036							0.922	0.142					0.517	0.842
1978			1.604	0.036							0.785	0.143					0.749	0.720
1979			1.393	0.033							0.520	0.152					1.704	0.608
1980			1.525	0.026					0.765	0.233	0.775	0.144					0.660	0.599
1981			1.225	0.025	2.300	0.940			0.450	0.275	0.674	0.143					0.619	0.629
1982	3.253	0.302	1.105	0.022	2.140	0.990			1.876	0.308	0.501	0.143					0.304	0.784
1983	2.264	0.217	1.118	0.030	1.130	0.340			1.132	0.320	0.463	0.143					2.059	0.570
1984	1.657	0.183	1.121	0.024	1.290	0.360			0.434	0.145	0.508	0.143					1.307	0.566
1985	1.345	0.173	1.159	0.022	0.830	0.240			0.380	0.151	0.347	0.142					1.976	0.475
1986	1.729	0.153	1.142	0.026	0.620	0.210			0.732	0.162	0.275	0.141					1.556	0.518
1987	1.291	0.147	1.230	0.027	0.660	0.290			0.866	0.247	0.426	0.145					1.314	0.552
1988	1.306	0.150	1.187	0.022	0.900	0.540			1.059	0.229	0.344	0.182					0.745	0.605
1989	1.148	0.148	0.952	0.019	0.340	0.170			0.753	0.215	0.612	0.197					1.066	0.529
1990	1.035	0.144	0.895	0.019	0.430	0.280			0.947	0.393			0.897	0.142			0.843	0.464
1991	1.099	0.143	0.861	0.020	0.350	0.360			1.453	0.364			0.875	0.139			1.090	0.535
1992	0.681	0.140	0.944	0.021			1.120	0.340	0.692	0.366			0.870	0.143			2.063	0.539
1993	0.727	0.141	0.896	0.020			2.720	0.920	0.287	0.350			0.981	0.126			1.399	0.576
1994	0.618	0.139	0.927	0.016			1.730	0.570	1.826	0.364			1.525	0.120			1.217	0.703
1995	0.572	0.138	0.881	0.015			2.360	0.570	0.251	0.078			1.402	0.120			1.899	0.574
1996	0.595	0.137	0.749	0.015			2.140	0.520	2.475	0.572			1.460	0.119			0.758	0.636
1997	0.602	0.137	0.648	0.017			1.580	0.420	1.219	0.180			1.086	0.118			0.680	0.635
1998	0.687	0.142	0.640	0.017			0.870	0.250	0.174	0.033			1.015	0.118			0.580	0.589
1999	1.211	0.150	0.647	0.020			0.980	0.250	0.492	0.064			0.915	0.118			0.116	0.863
2000	0.738	0.149	0.634	0.018			0.710	0.220	0.800	0.071			0.845	0.118			0.127	0.791
2001	0.695	0.145	0.578	0.021			0.540	0.180	0.388	0.037			0.771	0.118			0.056	0.853
2002	0.752	0.146	0.586	0.023			0.500	0.190	0.094	0.016			1.019	0.118			0.359	0.702
2003	0.460	0.142	0.624	0.020			0.500	0.170	0.909	0.072			0.961	0.119			0.044	0.861
2004	0.306	0.140	0.494	0.020			0.170	0.100	1.365	0.082			0.959	0.119			0.136	0.795
2005	0.488	0.144	0.482	0.020			0.360	0.130	1.192	0.069			0.978	0.119	0.897	0.298	0.308	0.701
2006	0.630	0.149	0.512	0.021			0.810	0.210	2.393	0.117			0.736	0.119	3.047	0.155	0.226	0.782
2007	0.522	0.148	0.496	0.023			0.290	0.120	1.948	0.100			0.845	0.119	0.158	0.517	0.160	0.827
2008	0.589	0.148	0.433	0.021			0.300	0.120	1.645	0.143			0.859	0.120	0.255	0.456	0.197	0.756
2009							0.320	0.140							0.643	0.431		

Table 10. Annual indices of abundance for VPA.

Index	US_PLL		JAP_LL_ALL		URU_LL_EARLY		URU_LL_LATE		BRA_LL		TAI_LL_EARLY_ALL		TAI_LL_LATE_ALL		MOR_LL		AZO_BB	
Effort	Numbers		Numbers		Numbers		Numbers		Numbers		Numbers		Numbers		Biomass		Biomass	
USE	VPA		VPA		VPA		VPA		VPA		VPA		VPA		VPA		VPA	
AREA	Mostly 1		ALL		Mostly 3		Mostly 3		Area 2 and 3		ALL		ALL		Mostly Area 1		Area 1	
YEAR	IND	CV	IND	SE	IND	sd	IND	sd	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV
1961			0.866	0.042														
1962			0.857	0.039														
1963			0.931	0.036														
1964			0.838	0.029														
1965			1.000	0.027														
1966			0.887	0.030														
1967			0.917	0.033														
1968			1.045	0.034							2.544	0.170						
1969			1.116	0.035							2.832	0.150						
1970			1.204	0.031							1.934	0.144					1.922	0.475
1971			1.197	0.028							1.639	0.148					1.352	0.789
1972			1.282	0.033							1.195	0.150					1.539	0.594
1973			1.680	0.037							0.930	0.151					2.136	0.477
1974			1.661	0.037							1.023	0.145					2.529	0.463
1975			1.212	0.030							1.146	0.149					1.817	0.461
1976			1.263	0.035							0.813	0.145					0.867	0.662
1977			1.597	0.036							1.016	0.144					0.517	0.842
1978			1.626	0.037							0.903	0.145					0.749	0.720
1979			1.411	0.034							0.681	0.154					1.704	0.608
1980			1.547	0.027						0.765	0.233	0.888	0.147				0.660	0.599
1981			1.244	0.025	2.300	0.940			0.450	0.275	0.681	0.145					0.619	0.629
1982			1.156	0.022	2.140	0.990			1.876	0.308	0.515	0.145					0.304	0.784
1983			1.208	0.030	1.130	0.340			1.132	0.320	0.473	0.145					2.059	0.570
1984			1.182	0.025	1.290	0.360			0.434	0.145	0.517	0.145					1.307	0.566
1985			1.223	0.022	0.830	0.240			0.380	0.151	0.362	0.144					1.976	0.475
1986	1.409	0.325	1.207	0.026	0.620	0.210			0.732	0.162	0.314	0.143					1.556	0.518
1987	2.368	0.241	1.321	0.027	0.660	0.290			0.866	0.247	0.543	0.147					1.314	0.552
1988	1.781	0.253	1.256	0.022	0.900	0.540			1.059	0.229	0.379	0.185					0.745	0.605
1989	1.791	0.246	1.014	0.019	0.340	0.170			0.753	0.215	0.671	0.200					1.066	0.529
1990	1.167	0.266	0.953	0.019	0.430	0.280			0.947	0.393			0.999	0.133			0.843	0.464
1991	1.086	0.266	0.927	0.020	0.350	0.360			1.453	0.364			0.954	0.129			1.090	0.535
1992	0.810	0.280	0.924	0.022			1.120	0.340	0.692	0.366			0.955	0.133			2.063	0.539
1993	0.936	0.273	0.931	0.020			2.720	0.920	0.287	0.350			1.020	0.118			1.399	0.576
1994	0.860	0.274	0.850	0.016			1.730	0.570	1.826	0.364			1.647	0.112			1.217	0.703
1995	0.710	0.279	0.801	0.016			2.360	0.570	0.251	0.078			1.485	0.111			1.899	0.574
1996	0.849	0.274	0.721	0.016			2.140	0.520	2.475	0.572			1.538	0.110			0.758	0.636
1997	0.874	0.271	0.658	0.017			1.580	0.420	1.219	0.180			1.110	0.110			0.680	0.635
1998	0.959	0.266	0.655	0.017			0.870	0.250	0.174	0.033			0.949	0.110			0.580	0.589
1999	1.306	0.264	0.705	0.020			0.980	0.250	0.492	0.064			0.904	0.110			0.116	0.863
2000	0.981	0.270	0.684	0.019			0.710	0.220	0.800	0.071			0.862	0.110			0.127	0.791
2001	1.232	0.260	0.607	0.021			0.540	0.180	0.388	0.037			0.754	0.110			0.056	0.853
2002	1.126	0.257	0.591	0.023			0.500	0.190	0.094	0.016			1.011	0.110			0.359	0.702
2003	0.609	0.296	0.610	0.020			0.500	0.170	0.909	0.072			0.891	0.111			0.044	0.861
2004	0.387	0.316	0.498	0.020			0.170	0.100	1.365	0.082			0.866	0.111			0.136	0.795
2005	0.581	0.297	0.493	0.021			0.360	0.130	1.192	0.069			0.842	0.110	0.897	0.298	0.308	0.701
2006	0.672	0.293	0.540	0.021			0.810	0.210	2.393	0.117			0.716	0.110	3.047	0.155	0.226	0.782
2007	0.516	0.298	0.482	0.023			0.290	0.120	1.948	0.100			0.742	0.111	0.158	0.517	0.160	0.827
2008	0.519	0.293	0.423	0.021			0.300	0.120	1.645	0.143			0.757	0.111	0.255	0.456	0.197	0.756
2009	0.472	0.302					0.320	0.140							0.643	0.431		

Table 11. Quarterly indices of abundance for Multifan-CL and Stock Synthesis.

Index			US_PLL		JAP_LL_All_Areas		JAP_LL_Area1		JAP_LL_Area2		JAP_LL_Area3		URU_LL_EARLY		URU_LL_LATE	
Effort			NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS	
USE			MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		MFCL	
AREA			Mostly 1		All Area		AREA 1		AREA 2		AREA 3		Mostly 3		Mostly 3	
YEAR	Year_Dec	Quarters	IND	CV	IND	SE	IND	SE	IND	SE	IND	SE	IND	sd	IND	sd
1961	1961.00	1			0.381	0.087			0.445	0.076	0.373	0.455				
1961	1961.25	2			0.845	0.072			0.821	0.062						
1961	1961.50	3			1.502	0.076			1.254	0.066	2.910	0.371				
1961	1961.75	4			1.100	0.070			0.838	0.064	2.677	0.185				
1962	1962.00	1			0.488	0.078			0.536	0.072	0.540	0.200				
1962	1962.25	2			0.817	0.067			0.824	0.058	1.109	0.459				
1962	1962.50	3			1.200	0.068	0.422	0.382	1.054	0.063	3.452	0.263				
1962	1962.75	4			1.064	0.066	0.173	0.829	0.906	0.065	1.777	0.136				
1963	1963.00	1			0.539	0.064			0.619	0.062	0.559	0.149				
1963	1963.25	2			0.945	0.064	0.353	0.420	1.002	0.057	0.909	0.456				
1963	1963.50	3			1.230	0.061	0.440	0.206	1.172	0.059	2.298	0.246				
1963	1963.75	4			1.132	0.058			0.948	0.053	1.812	0.179				
1964	1964.00	1			0.653	0.050	0.325	0.831	0.750	0.048	0.644	0.121				
1964	1964.25	2			0.720	0.048	0.323	0.138	0.880	0.047	1.133	0.322				
1964	1964.50	3			0.888	0.044	0.398	0.153	0.832	0.044	1.756	0.128				
1964	1964.75	4			1.114	0.045	3.022	0.229	0.971	0.047	1.699	0.094				
1965	1965.00	1			0.858	0.045	2.184	0.172	0.835	0.044	0.698	0.128				
1965	1965.25	2			0.882	0.041	0.704	0.101	0.902	0.043	1.401	0.151				
1965	1965.50	3			1.141	0.040	0.524	0.171	1.033	0.042	1.656	0.092				
1965	1965.75	4			1.093	0.042	2.933	0.199	0.821	0.044	2.151	0.093				
1966	1966.00	1			0.754	0.046	0.934	0.283	0.783	0.045	0.694	0.110				
1966	1966.25	2			0.760	0.048	0.800	0.132	0.716	0.051	0.697	0.121				
1966	1966.50	3			1.066	0.051	2.088	0.318	0.936	0.056	1.376	0.096				
1966	1966.75	4			0.954	0.057	2.443	0.223	0.866	0.067	1.231	0.101				
1967	1967.00	1			0.841	0.055	0.704	0.164	0.896	0.058	0.737	0.138				
1967	1967.25	2			0.699	0.060	0.572	0.144	0.758	0.068	1.032	0.156				
1967	1967.50	3			0.917	0.059	0.620	0.343	0.792	0.061	1.519	0.117				
1967	1967.75	4			1.239	0.051	3.061	0.269	0.925	0.054	1.673	0.099				
1968	1968.00	1			0.823	0.061	0.912	0.194	0.879	0.061	0.742	0.183				
1968	1968.25	2			1.015	0.056	1.268	0.184	0.916	0.061	1.145	0.116				
1968	1968.50	3			1.333	0.057	1.450	0.417	1.160	0.061	1.551	0.101				
1968	1968.75	4			1.013	0.065	1.596	0.299	0.939	0.074	1.670	0.113				
1969	1969.00	1			0.893	0.061	0.751	0.167	0.918	0.071	0.994	0.124				
1969	1969.25	2			1.087	0.055	0.818	0.216	0.849	0.059	1.771	0.109				
1969	1969.50	3			1.170	0.059	0.411	0.489	0.935	0.060	1.634	0.114				
1969	1969.75	4			1.291	0.072	2.348	0.376	0.954	0.074	1.920	0.145				
1970	1970.00	1			1.036	0.050	0.948	0.177	0.940	0.058	1.116	0.095				
1970	1970.25	2			1.089	0.050	1.012	0.148	0.857	0.057	1.062	0.105				
1970	1970.50	3			1.067	0.051	1.283	0.181	0.925	0.053	0.741	0.123				
1970	1970.75	4			1.649	0.062	2.161	0.140	1.055	0.088	1.666	0.112				
1971	1971.00	1			1.284	0.044	1.002	0.106	1.200	0.050	0.888	0.137				
1971	1971.25	2			1.180	0.040	1.710	0.088	0.951	0.046	0.873	0.102				
1971	1971.50	3			1.024	0.047	0.758	0.193	0.842	0.049	1.163	0.101				
1971	1971.75	4			1.253	0.052	1.612	0.108	0.952	0.064	1.195	0.140				
1972	1972.00	1			1.069	0.046	0.897	0.115	1.033	0.053	0.572	0.108				
1972	1972.25	2			1.210	0.051	1.522	0.188	1.084	0.055	0.820	0.099				
1972	1972.50	3			1.191	0.060	0.896	0.181	1.116	0.065	0.695	0.135				
1972	1972.75	4			1.657	0.072	1.793	0.193	1.394	0.101	1.447	0.117				
1973	1973.00	1			1.650	0.061	1.214	0.153	1.607	0.067	0.725	0.175				
1973	1973.25	2			1.507	0.072	2.897	0.166	1.027	0.087	0.955	0.153				
1973	1973.50	3			1.582	0.069	1.024	0.188	1.273	0.077	1.625	0.158				
1973	1973.75	4			1.916	0.063	3.739	0.139	1.080	0.085	1.612	0.122				
1974	1974.00	1			2.680	0.076	2.622	0.124	2.048	0.123	0.997	0.263				
1974	1974.25	2			1.405	0.071	1.215	0.113	1.286	0.141	1.591	0.176				
1974	1974.50	3			1.206	0.062	0.995	0.138	0.921	0.072	1.408	0.157				
1974	1974.75	4			1.589	0.065	2.589	0.118	0.873	0.101	1.249	0.143				
1975	1975.00	1			1.425	0.053	1.110	0.099	1.489	0.064	0.529	0.285				
1975	1975.25	2			1.107	0.055	1.127	0.094	1.136	0.073	0.726	0.262				
1975	1975.50	3			0.952	0.047	0.817	0.122	0.774	0.048	1.973	0.153				
1975	1975.75	4			1.353	0.064	1.528	0.136	1.056	0.096	1.402	0.115				

Table 11. Quarterly indices of abundance for Multifan-CL and Stock Synthesis (continued).

Index			US_PLL		JAP_LL_All_Areas		JAP_LL_Area1		JAP_LL_Area2		JAP_LL_Area3		URU_LL_EARLY		URU_LL_LATE	
Effort			NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS	
USE			MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		MFCL	
AREA			Mostly 1		All Area		AREA 1		AREA 2		AREA 3		Mostly 3		Mostly 3	
YEAR	Year_Dec	Quarters	IND	CV	IND	SE	IND	SE	IND	SE	IND	SE	IND	sd	IND	sd
1976	1976.00	1			1.184	0.063	0.827	0.116	1.039	0.087	0.645	0.189				
1976	1976.25	2			0.949	0.058	0.706	0.103	1.109	0.071						
1976	1976.50	3			0.974	0.060	0.748	0.123	0.844	0.068	2.129	0.287				
1976	1976.75	4			2.193	0.080	1.383	0.166	2.017	0.108	3.102	0.168				
1977	1977.00	1			1.459	0.075	0.862	0.138	1.799	0.096	1.035	0.285				
1977	1977.25	2			1.398	0.066	1.490	0.116	1.630	0.088	1.149	0.242				
1977	1977.50	3			1.366	0.066	0.718	0.146	1.512	0.073	3.177	0.227				
1977	1977.75	4			2.201	0.068	1.485	0.175	1.985	0.076	2.555	0.162				
1978	1978.00	1			1.651	0.068	1.550	0.130	1.407	0.086	0.917	0.242				
1978	1978.25	2			1.151	0.065	0.855	0.117	1.646	0.081	0.967	0.320				
1978	1978.50	3			1.609	0.064	0.994	0.177	1.452	0.068	1.606	0.153				
1978	1978.75	4			2.152	0.082	2.464	0.178	1.341	0.111	1.931	0.163				
1979	1979.00	1			1.607	0.066	1.139	0.117	1.740	0.098	0.964	0.182				
1979	1979.25	2			1.135	0.071	0.985	0.123	1.564	0.100	1.200	0.217				
1979	1979.50	3			1.321	0.061	0.735	0.176	1.402	0.060	2.617	0.285				
1979	1979.75	4			1.544	0.058	1.935	0.161	1.419	0.067	1.393	0.111				
1980	1980.00	1			1.797	0.055	1.987	0.141	1.944	0.059	0.828	0.163				
1980	1980.25	2			1.706	0.053	2.255	0.126	1.700	0.058	1.127	0.140				
1980	1980.50	3			1.315	0.042	1.128	0.139	1.303	0.041	1.338	0.122				
1980	1980.75	4			1.338	0.046	1.437	0.143	1.338	0.046	0.931	0.120				
1981	1981.00	1			1.383	0.045	0.903	0.103	1.680	0.050	0.922	0.128				
1981	1981.25	2			1.253	0.049	0.996	0.124	1.387	0.053	1.089	0.123				
1981	1981.50	3			1.079	0.046	0.880	0.111	1.059	0.050	1.124	0.148	3.411	0.804		
1981	1981.75	4			1.204	0.040	1.249	0.119	1.164	0.043	0.961	0.095	2.970	0.488		
1982	1982.00	1			1.286	0.039	1.736	0.154	1.348	0.036	0.699	0.136	1.685	0.337		
1982	1982.25	2			1.067	0.042	0.945	0.112	1.285	0.044	0.790	0.112	3.242	0.445		
1982	1982.50	3			0.988	0.042	0.740	0.135	1.039	0.042	1.129	0.130	1.898	0.271		
1982	1982.75	4			1.244	0.037	1.490	0.180	1.266	0.034	0.827	0.098	2.746	0.513		
1983	1983.00	1			1.330	0.048	1.229	0.131	1.383	0.047	0.375	0.229	1.328	0.268		
1983	1983.25	2			1.139	0.072	1.216	0.111	1.376	0.127	0.835	0.266	1.265	0.181		
1983	1983.50	3			1.061	0.057	0.714	0.156	1.321	0.061	0.915	0.149	1.236	0.162		
1983	1983.75	4			1.250	0.043	1.410	0.213	1.266	0.041	1.196	0.103	1.293	0.171		
1984	1984.00	1			1.395	0.042	1.099	0.119	1.523	0.040	0.789	0.219	0.194	0.042		
1984	1984.25	2			1.059	0.053	0.924	0.095	1.368	0.067	0.935	0.263	0.562	0.073		
1984	1984.50	3			1.025	0.043	0.990	0.165	1.101	0.041	1.092	0.120	0.707	0.086		
1984	1984.75	4			1.216	0.041	1.698	0.203	1.203	0.039	1.008	0.102	1.533	0.178		
1985	1985.00	1			1.441	0.044	0.853	0.174	1.600	0.040	0.973	0.263	0.603	0.101		
1985	1985.25	2			1.186	0.043	1.221	0.104	1.315	0.045	1.192	0.136	1.872	0.248		
1985	1985.50	3			0.993	0.037	1.186	0.237	1.100	0.033	0.884	0.110	1.284	0.169		
1985	1985.75	4			1.239	0.035	1.592	0.144	1.256	0.032	0.898	0.116	1.013	0.123		
1986	1986.00	1			1.399	0.040	0.725	0.152	1.663	0.037	1.111	0.174	0.136	0.076		
1986	1986.25	2			1.070	0.054	0.691	0.107	1.620	0.069	0.891	0.144	0.810	0.148		
1986	1986.50	3			1.108	0.051	0.851	0.214	1.157	0.053	1.158	0.101	0.400	0.069		
1986	1986.75	4			1.202	0.047	1.318	0.166	1.301	0.047	0.765	0.107	0.679	0.105		
1987	1987.00	1	1.608	0.273	1.398	0.047	1.009	0.119	1.671	0.048	1.476	0.175	1.653	0.322		
1987	1987.25	2	1.096	0.261	1.149	0.052	0.951	0.096	1.400	0.066	1.209	0.179	0.663	0.116		
1987	1987.50	3	1.981	0.243	1.208	0.054	0.804	0.147	1.414	0.061	1.163	0.116	0.855	0.123		
1987	1987.75	4	2.520	0.231	1.474	0.050	0.937	0.152	1.776	0.051	1.235	0.126	0.674	0.139		
1988	1988.00	1	1.404	0.256	1.340	0.039	0.624	0.119	1.706	0.038	0.646	0.153	0.223	0.099		
1988	1988.25	2	0.880	0.268	1.129	0.043	0.586	0.108	1.438	0.048	1.042	0.099	0.615	0.109		
1988	1988.50	3	1.437	0.247	1.187	0.041	0.615	0.167	1.389	0.041	0.980	0.090	0.896	0.145		
1988	1988.75	4	2.551	0.220	1.297	0.035	0.962	0.146	1.431	0.033	0.955	0.101	0.891	0.251		
1989	1989.00	1	1.702	0.228	1.125	0.034	0.614	0.093	1.395	0.032	1.088	0.245				
1989	1989.25	2	0.997	0.250	0.939	0.036	0.543	0.099	1.172	0.036	0.855	0.117	0.304	0.062		
1989	1989.50	3	1.659	0.240	1.010	0.034	0.706	0.180	1.087	0.030	1.089	0.104	0.372	0.073		
1989	1989.75	4	2.391	0.219	0.927	0.031	1.148	0.126	0.963	0.030	0.634	0.079	0.364	0.085		
1990	1990.00	1	1.458	0.241	1.010	0.033	0.835	0.099	1.108	0.030	0.825	0.193	0.428	0.143		
1990	1990.25	2	0.451	0.282	0.881	0.036	0.830	0.094	0.971	0.036	0.876	0.123	0.169	0.044		
1990	1990.50	3	0.891	0.259	0.870	0.034	1.057	0.223	0.914	0.031	0.875	0.093	0.398	0.086		
1990	1990.75	4	2.212	0.223	0.997	0.036	1.611	0.225	0.974	0.033	0.916	0.095	0.548	0.143		
1991	1991.00	1	0.822	0.274	1.012	0.035	0.785	0.110	1.148	0.035	0.601	0.106	0.352	0.106		

Table 11. Quarterly indices of abundance for Multifan-CL and Stock Synthesis (continued).

Index Effort			US_PLL		JAP_LL_All_Areas		JAP_LL_Area1		JAP_LL_Area2		JAP_LL_Area3		URU_LL_EARLY		URU_LL_LATE	
USE			NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS	
AREA			MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		MFCL	
YEAR			Mostly 1		All Area		AREA 1		AREA 2		AREA 3		Mostly 3		Mostly 3	
Year_Dec	Quarters		IND	CV	IND	SE	IND	SE	IND	SE	IND	SE	IND	sd	IND	sd
1991	1991.25	2	0.541	0.275	0.899	0.037	1.168	0.100	0.992	0.041	0.622	0.079	0.273	0.087		
1991	1991.50	3	1.316	0.246	0.841	0.034	1.045	0.192	0.910	0.032	0.764	0.079	0.270	0.069		
1991	1991.75	4	1.341	0.231	0.902	0.038	0.827	0.235	0.939	0.036	0.760	0.095	0.183	0.145		
1992	1992.00	1	0.728	0.269	0.956	0.034	0.696	0.119	1.094	0.032	0.532	0.116			0.876	0.261
1992	1992.25	2	0.307	0.300	0.749	0.044	0.798	0.094	0.814	0.060	0.639	0.088			0.739	0.170
1992	1992.50	3	0.891	0.267	0.893	0.039	0.737	0.162	1.020	0.038	0.690	0.094			1.836	0.309
1992	1992.75	4	1.270	0.242	1.065	0.040	1.234	0.252	1.056	0.038	0.973	0.089			1.064	0.274
1993	1993.00	1	0.773	0.271	0.907	0.034	0.505	0.143	1.043	0.030	0.419	0.226			0.666	0.438
1993	1993.25	2	0.303	0.305	0.863	0.036	0.731	0.090	1.018	0.039	0.743	0.095				
1993	1993.50	3	1.006	0.255	0.906	0.034	0.857	0.140	0.964	0.034	0.963	0.076			2.182	0.586
1993	1993.75	4	1.716	0.224	0.992	0.038	1.452	0.341	0.965	0.037	0.924	0.080			3.439	0.576
1994	1994.00	1	0.784	0.270	0.949	0.029	0.379	0.158	1.101	0.027	0.633	0.102			1.972	0.683
1994	1994.25	2	0.341	0.291	0.808	0.029	0.545	0.079	0.942	0.035	0.861	0.058			2.785	0.593
1994	1994.50	3	0.744	0.265	0.771	0.028	0.550	0.340	0.816	0.029	0.776	0.054			1.405	0.359
1994	1994.75	4	1.375	0.237	0.826	0.027	0.825	0.234	0.885	0.025	0.612	0.065			1.022	0.239
1995	1995.00	1	0.485	0.279	0.925	0.029	0.491	0.132	1.061	0.026	0.825	0.119			0.765	0.244
1995	1995.25	2	0.326	0.289	0.753	0.028	0.571	0.064	0.889	0.036	0.862	0.060			1.799	0.318
1995	1995.50	3	0.867	0.249	0.786	0.028	0.743	0.152	0.839	0.029	0.832	0.057			2.618	0.400
1995	1995.75	4	1.518	0.233	0.702	0.027	0.799	0.113	0.764	0.026	0.543	0.067			3.616	0.498
1996	1996.00	1	0.554	0.284	0.862	0.027	1.100	0.138	0.926	0.024	0.717	0.092			1.620	0.379
1996	1996.25	2	0.466	0.279	0.700	0.028	0.753	0.069	0.760	0.032	0.578	0.064			2.881	0.373
1996	1996.50	3	0.798	0.256	0.661	0.029	0.853	0.099	0.645	0.028	0.873	0.080			3.270	0.453
1996	1996.75	4	0.893	0.263	0.635	0.026	0.881	0.104	0.619	0.025	0.817	0.076			0.725	0.170
1997	1997.00	1	0.793	0.267	0.744	0.028	0.904	0.099	0.786	0.025	0.495	0.131			1.055	0.235
1997	1997.25	2	0.429	0.284	0.586	0.029	0.733	0.074	0.620	0.031	0.510	0.082			1.961	0.318
1997	1997.50	3	0.853	0.257	0.658	0.031	0.607	0.236	0.628	0.029	1.030	0.083			2.993	0.495
1997	1997.75	4	1.066	0.240	0.613	0.032	0.823	0.111	0.589	0.032	0.681	0.083			0.495	0.138
1998	1998.00	1	0.763	0.269	0.719	0.031	0.709	0.083	0.786	0.031	0.318	0.202			1.595	0.296
1998	1998.25	2	0.608	0.271	0.627	0.032	0.654	0.084	0.707	0.034	0.508	0.082			0.649	0.122
1998	1998.50	3	0.942	0.262	0.675	0.033	0.858	0.167	0.613	0.032	0.871	0.076			1.350	0.194
1998	1998.75	4	1.737	0.228	0.569	0.027	1.059	0.106	0.570	0.027	0.508	0.071			0.512	0.154
1999	1999.00	1	1.102	0.261	0.668	0.029	0.942	0.093	0.686	0.027	0.424	0.168			0.186	0.074
1999	1999.25	2	1.076	0.260	0.684	0.034	1.004	0.097	0.657	0.036	0.598	0.082			1.054	0.175
1999	1999.50	3	1.149	0.256	0.695	0.040	0.514	0.227	0.683	0.040	0.770	0.079			1.959	0.237
1999	1999.75	4	1.381	0.246	0.731	0.040	0.931	0.180	0.723	0.040	0.580	0.084			0.680	0.154
2000	2000.00	1	1.038	0.276	0.881	0.031	0.833	0.092	1.001	0.029	0.410	0.203			0.140	0.078
2000	2000.25	2	0.602	0.276	0.732	0.031	1.034	0.089	0.750	0.031	0.561	0.079			0.582	0.112
2000	2000.50	3	0.730	0.277	0.601	0.035	0.710	0.145	0.624	0.034	0.495	0.083			2.215	0.365
2000	2000.75	4	1.296	0.234	0.529	0.036	0.878	0.117	0.584	0.038	0.461	0.085			0.433	0.106
2001	2001.00	1	1.041	0.264	0.726	0.031	1.034	0.079	0.723	0.031	0.318	0.167			0.180	0.089
2001	2001.25	2	0.811	0.273	0.662	0.035	0.922	0.081	0.659	0.039	0.354	0.107			0.630	0.109
2001	2001.50	3	0.742	0.272	0.527	0.047	0.379	0.169	0.546	0.047	0.775	0.120			0.917	0.150
2001	2001.75	4	1.665	0.238	0.505	0.038	0.725	0.104	0.487	0.041	0.687	0.096			0.406	0.116
2002	2002.00	1	1.124	0.256	0.511	0.032	0.495	0.077	0.550	0.032	0.533	0.366			0.218	0.075
2002	2002.25	2	0.442	0.287	0.579	0.044	0.542	0.088	0.613	0.050	0.674	0.194			0.427	0.100
2002	2002.50	3	0.803	0.272	0.659	0.055	0.400	0.484	0.690	0.052	0.558	0.132			1.220	0.197
2002	2002.75	4	1.734	0.222	0.586	0.040	0.611	0.109	0.628	0.041	0.791	0.124			0.126	0.085
2003	2003.00	1	1.006	0.258	0.696	0.033	0.675	0.079	0.778	0.034	0.478	0.319			0.157	0.075
2003	2003.25	2	0.234	0.328	0.656	0.037	0.795	0.085	0.668	0.039	0.508	0.119			0.558	0.116
2003	2003.50	3	0.311	0.305	0.561	0.040	0.226	0.253	0.547	0.041	0.796	0.080			0.940	0.129
2003	2003.75	4	1.266	0.244	0.507	0.039	0.602	0.150	0.492	0.039	0.530	0.089			0.449	0.101
2004	2004.00	1	0.492	0.299	0.467	0.029	0.668	0.079	0.497	0.028	0.177	0.260			0.042	0.062
2004	2004.25	2	0.132	0.350	0.454	0.034	0.565	0.088	0.485	0.034	0.258	0.105			0.204	0.053
2004	2004.50	3	0.278	0.311	0.502	0.043	0.357	0.300	0.482	0.042	0.597	0.088			0.385	0.066
2004	2004.75	4	1.307	0.248	0.542	0.039	0.338	0.160	0.527	0.040	0.593	0.080			0.119	0.050
2005	2005.00	1	0.856	0.254	0.477	0.031	0.534	0.073	0.508	0.032	0.569	0.633			0.024	0.037
2005	2005.25	2	0.326	0.308	0.498	0.036	0.600	0.078	0.478	0.038	0.516	0.214			0.317	0.068
2005	2005.50	3	0.565	0.293	0.456	0.041	0.391	0.206	0.443	0.040	0.571	0.099			0.479	0.079
2005	2005.75	4	1.940	0.242	0.517	0.041	0.516	0.140	0.499	0.041	0.849	0.117			0.627	0.101
2006	2006.00	1	0.997	0.272	0.451	0.033	0.368	0.069	0.592	0.036	0.200	0.633			0.189	0.062
2006	2006.25	2	0.420	0.291	0.556	0.037	0.555	0.097	0.597	0.037	0.609	0.161			0.813	0.110
2006	2006.50	3	0.833	0.270	0.560	0.043	0.107	0.831	0.540	0.042	0.639	0.086			1.894	0.212
2006	2006.75	4	1.698	0.230	0.573	0.043	0.325	0.215	0.560	0.042	0.631	0.096			0.166	0.076
2007	2007.00	1	0.989	0.266	0.520	0.040	0.299	0.122	0.645	0.037	1.383	0.449			0.167	0.062
2007	2007.25	2	0.275	0.314	0.459	0.042	0.518	0.144	0.544	0.039	0.353	0.194			0.267	0.092
2007	2007.50	3	0.585	0.273	0.431	0.043			0.436	0.039	0.711	0.122			0.529	0.094
2007	2007.75	4	1.127	0.247	0.492	0.045	0.278	0.327	0.481	0.043	0.575	0.103			0.205	0.062
2008	2008.00	1	0.642	0.264	0.439	0.036	0.275	0.162	0.507	0.032	0.468	0.214			0.123	0.049
2008	2008.25	2	0.347	0.291	0.376	0.035	0.579	0.148	0.424	0.031	0.405	0.167			0.433	0.102
2008	2008.50	3	0.652	0.276	0.432	0.039	0.146	0.417	0.416	0.039	0.602	0.078			0.503	0.088
2008	2008.75	4	1.395	0.226	0.420	0.040	0.433	0.380	0.377	0.040	0.507	0.079			0.146	0.066

Table 11. Quarterly indices of abundance for Multifan-CL and Stock Synthesis (continued).

Index Effort USE			BRA_LL		TAI_LL_EARLY_Area1		TAI_LL_EARLY_Area2		TAI_LL_EARLY_Area3		TAI_LL_LATE_Area1		TAI_LL_LATE_Area2		TAI_LL_LATE_Area3		MOR_LL		EU_PS_FAD		AZO_BB		
			NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		BIOMASS		BIOMASS		BIOMASS		
AREA			MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		
			Area 2 and 3		Area 1		Area 2		Area 3		Area 1		Area 2		Area 3		Mostly Area 1		Area 2		Area 1		
YEAR	Year_Dec	Quarters	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV	
1961	1961.00	1																					
1961	1961.25	2																					
1961	1961.50	3																					
1961	1961.75	4																					
1962	1962.00	1																					
1962	1962.25	2																					
1962	1962.50	3																					
1962	1962.75	4																					
1963	1963.00	1																					
1963	1963.25	2																					
1963	1963.50	3																					
1963	1963.75	4																					
1964	1964.00	1																					
1964	1964.25	2																					
1964	1964.50	3																					
1964	1964.75	4																					
1965	1965.00	1																					
1965	1965.25	2																					
1965	1965.50	3																					
1965	1965.75	4																					
1966	1966.00	1																					
1966	1966.25	2																					
1966	1966.50	3																					
1966	1966.75	4																					
1967	1967.00	1																					
1967	1967.25	2																					
1967	1967.50	3																					
1967	1967.75	4																					
1968	1968.00	1			1.243	0.370	2.085	0.129	2.414	0.329													
1968	1968.25	2					2.012	0.122	1.923	0.187													
1968	1968.50	3			0.470	0.819	2.220	0.106	3.371	0.196													
1968	1968.75	4					2.802	0.083	3.955	0.242													
1969	1969.00	1			3.088	0.229	2.625	0.088	1.545	0.165													
1969	1969.25	2			0.932	0.541	2.842	0.085	1.061	0.141													
1969	1969.50	3					2.083	0.102	2.824	0.102													
1969	1969.75	4			5.597	0.187	2.128	0.082	2.388	0.103													
1970	1970.00	1			1.031	0.175	2.921	0.079	0.907	0.129													
1970	1970.25	2			0.753	0.187	1.665	0.084	1.339	0.138											1.362	0.429	
1970	1970.50	3			3.460	0.229	2.589	0.082	2.491	0.092											1.357	0.491	
1970	1970.75	4			3.227	0.170	2.054	0.086	1.331	0.095											1.805	0.519	
1971	1971.00	1			1.499	0.138	1.905	0.086	0.501	0.209													
1971	1971.25	2			2.116	0.370	1.762	0.076	0.772	0.131													
1971	1971.50	3					1.244	0.096	2.132	0.105													
1971	1971.75	4			1.403	0.257	2.361	0.099	1.281	0.114											0.208	0.978	
1972	1972.00	1			0.846	0.181	1.313	0.129	1.048	0.147											0.624	0.680	
1972	1972.25	2					1.440	0.122	0.948	0.108													
1972	1972.50	3					1.095	0.127	1.171	0.088											1.339	0.482	
1972	1972.75	4			0.754	0.193	1.800	0.103	1.045	0.129											0.481	0.605	
1973	1973.00	1			0.515	0.134	1.252	0.218	0.488	0.147											1.799	0.566	
1973	1973.25	2			2.527	0.299	0.882	0.175	0.949	0.129													
1973	1973.50	3					0.690	0.157	1.882	0.118											1.831	0.471	
1973	1973.75	4			0.937	0.218	1.178	0.147	0.633	0.141											1.147	0.451	
1974	1974.00	1			1.478	0.131	2.227	0.154	0.488	0.144											1.899	0.466	
1974	1974.25	2			1.017	0.187	0.383	0.127	0.740	0.093													
1974	1974.50	3			0.355	0.370	0.493	0.115	2.119	0.089											3.814	0.413	
1974	1974.75	4			0.826	0.154	1.320	0.118	0.937	0.125											1.593	0.426	
1975	1975.00	1			0.683	0.165	2.347	0.101	0.844	0.154											1.354	0.420	
1975	1975.25	2			1.147	0.218	0.375	0.157	0.968	0.123													
1975	1975.50	3			1.286	0.541	0.827	0.112	2.899	0.097											1.972	0.408	
1975	1975.75	4			0.473	0.242	0.638	0.193	0.917	0.131											1.143	0.438	
1975	1975.75	4																			1.319	0.484	

Table 11. Quarterly indices of abundance for Multifan-CL and Stock Synthesis (continued).

Index Effort USE			BRA_LL		TAI_LL_EARLY_Area1		TAI_LL_EARLY_Area2		TAI_LL_EARLY_Area3		TAI_LL_LATE_Area1		TAI_LL_LATE_Area2		TAI_LL_LATE_Area3		MOR_LL		EU_PS_FAD		AZO_BB	
			NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		NUMBERS		BIOMASS		BIOMASS		BIOMASS	
AREA			MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		MFCL		MFCL	
			Area 2 and 3		Area 1		Area 2		Area 3		Area 1		Area 2		Area 3		Mostly Area 1		Area 2		Area 1	
YEAR	Year_Dec	Quarters	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV	IND	CV
1976	1976.00	1			0.655	0.114	1.218	0.193	0.883	0.114												
1976	1976.25	2			0.534	0.193	0.601	0.144	1.024	0.091											1.549	0.412
1976	1976.50	3			0.710	0.299	0.345	0.144	1.917	0.088											0.220	0.641
1976	1976.75	4			0.673	0.125	0.512	0.181	0.646	0.108												
1977	1977.00	1			0.890	0.107	0.431	0.187	0.905	0.104												
1977	1977.25	2			0.938	0.229	1.223	0.131	1.075	0.102											3.358	0.452
1977	1977.50	3			1.359	0.257	0.531	0.120	1.811	0.081											0.115	0.783
1977	1977.75	4			0.869	0.120	1.043	0.118	1.052	0.107											0.005	2.403
1978	1978.00	1			1.149	0.104	1.761	0.150	0.849	0.094												
1978	1978.25	2			0.552	0.257	0.694	0.136	0.799	0.078											2.970	0.380
1978	1978.50	3			3.577	0.819	0.250	0.147	1.455	0.083											0.196	0.625
1978	1978.75	4			0.654	0.165	0.577	0.170	1.114	0.114											0.003	3.258
1979	1979.00	1			0.532	0.170	0.400	0.541	1.172	0.100												
1979	1979.25	2			0.362	0.819	0.174	0.229	0.876	0.101												
1979	1979.50	3					0.270	0.187	1.180	0.101											3.738	0.372
1979	1979.75	4			1.634	0.209	0.483	0.161	0.695	0.111											0.342	0.515
1980	1980.00	1	0.799		1.450	0.127	0.111	0.276	0.712	0.095											0.252	0.909
1980	1980.25	2	0.951		0.507	0.432	0.155	0.161	0.710	0.095												
1980	1980.50	3	0.862				0.612	0.115	1.281	0.076											2.958	0.342
1980	1980.75	4	0.709		1.133	0.181	1.247	0.118	0.770	0.091											0.056	0.658
1981	1981.00	1	0.492		0.527	0.127	2.328	0.117	0.668	0.091							0.964	0.224				
1981	1981.25	2	0.585		0.406	0.276	0.330	0.131	0.626	0.092							0.964	0.224			2.600	0.346
1981	1981.50	3	0.530				0.564	0.120	0.804	0.079							0.964	0.224			0.148	0.514
1981	1981.75	4	0.436		0.511	0.147	0.913	0.134	0.435	0.123							0.964	0.224			0.094	1.093
1982	1982.00	1	1.877		0.331	0.144	1.531	0.136	0.399	0.087							0.996	0.214				
1982	1982.25	2	2.233		0.475	0.242	0.344	0.118	0.461	0.085							0.996	0.214			1.274	0.373
1982	1982.50	3	2.023		1.148	0.432	0.582	0.099	0.685	0.078							0.996	0.214			0.174	0.548
1982	1982.75	4	1.664		0.451	0.144	0.536	0.150	0.293	0.127							0.996	0.214			0.004	1.663
1983	1983.00	1	1.172		0.418	0.115	1.745	0.150	0.738	0.088							1.265	0.260				
1983	1983.25	2	1.394		0.829	0.242	0.339	0.118	0.493	0.111							1.265	0.260			1.288	0.358
1983	1983.50	3	1.263		0.435	0.257	0.186	0.129	0.521	0.112							1.265	0.260			0.581	0.464
1983	1983.75	4	1.039		0.319	0.127	0.182	0.218	0.387	0.175							1.265	0.260			1.941	0.785
1984	1984.00	1	0.437		0.429	0.103	0.990	0.201	0.565	0.187							1.414	0.280				
1984	1984.25	2	0.520		0.463	0.209	0.349	0.122	0.811	0.127							1.414	0.280			2.308	0.361
1984	1984.50	3	0.471		0.485	0.257	0.413	0.105	0.899	0.122							1.414	0.280			0.822	0.396
1984	1984.75	4	0.387		0.339	0.107	0.894	0.144	0.414	0.165							1.414	0.280			0.526	0.486
1985	1985.00	1	0.391		0.414	0.100	1.231	0.175	0.482	0.103							0.904	0.168				
1985	1985.25	2	0.465		0.502	0.299	0.160	0.114	0.437	0.100							0.904	0.168			3.634	0.300
1985	1985.50	3	0.422		0.451	0.193	0.136	0.122	0.414	0.087							0.904	0.168			0.324	0.405
1985	1985.75	4	0.347		0.479	0.101	0.228	0.181	0.171	0.144							0.904	0.168			0.572	0.553
1986	1986.00	1	0.706		0.390	0.101	0.369	0.193	0.084	0.101							0.859	0.162				
1986	1986.25	2	0.839		0.421	0.165	0.130	0.112	0.244	0.095							0.859	0.162			3.194	0.297
1986	1986.50	3	0.760		0.386	0.175	0.114	0.122	0.775	0.083							0.859	0.162			0.208	0.415
1986	1986.75	4	0.626		0.361	0.118	0.308	0.170	0.679	0.111							0.859	0.162			0.273	0.415
1987	1987.00	1	0.833		0.553	0.112	0.240	0.209	0.317	0.096							0.782	0.174				
1987	1987.25	2	0.990		0.307	0.370	0.268	0.161	0.667	0.086							0.782	0.174			2.731	0.302
1987	1987.50	3	0.897		2.225	0.257	0.342	0.150	1.156	0.086							0.782	0.174			0.218	0.414
1987	1987.75	4	0.738		0.940	0.329	0.383	0.147	0.524	0.118							0.782	0.174			0.495	0.550
1988	1988.00	1	1.051		0.867	0.541	0.158	0.257	0.328	0.098							0.827	0.193				
1988	1988.25	2	1.250		0.523	0.370			0.387	0.125							0.827	0.193			1.138	0.367
1988	1988.50	3	1.132		0.775	0.541			0.679	0.127							0.827	0.193			0.175	0.390
1988	1988.75	4	0.931				0.353	0.370	0.208	0.370							0.827	0.193			0.241	0.631
1989	1989.00	1	0.733				0.174	0.819	0.238	0.175							1.202	0.296				
1989	1989.25	2	0.871						0.550	0.123							1.202	0.296			3.609	0.310
1989	1989.50	3	0.790						0.859	0.136							1.202	0.296			0.115	0.426
1989	1989.75	4	0.649				0.986	0.170	0.366	0.150							1.202	0.296			0.060	0.554
1990	1990.00	1	0.914										0.761	0.041		0.716	0.112			1.104	0.274	

Table 12 Distribution of tagging events defined for Multifan CL by quarter and main areas .

Area/Quarter	1	2	3	4	Total	%
1		3	9	1	13	45
2	1	4	7	4	16	55
Total	1	7	16	5	29	100
%	3	24	55	17	100	

Table 13 Number of fish tagged by quarter and main area for tagging events identified for MULTIFAN CL.

Area/Quarter	1	2	3	4	Total	%
1		878	2198	56	3132	32
2	295	445	3351	2461	6552	68
Total	295	1323	5549	2517	9684	100
%	3	14	57	26	100	

Table 14 Number of releases and recoveries by quarter for tagging events identified for MULTIFAN CL.

	Quar1	Quar2	Quar3	Quar4	Total
Releases	295	1323	5549	2517	9684
Recoveries		290	377	454	1121
Recoveries/Releases (%)	0	22	7	18	12

Table 15 Number of releases and recoveries by size at the recovery time for tagging events identified for MULTIFAN CL.

	<77 cm	>=77cm	Total
Releases	8583	1101	9684
Recoveries	1066	125	1191
Recoveries/Releases (%)	12	11	12

Table 16 Fishery definitions for the BET MULTIFAN-CL Assessment. (NOTE: Region 1= N of 25N, Region 2 = 15S to 25N, Region 3 = S of 15S). (to be moved to tables file)

Fishery	Region	Name	Fleets	Gear	Years
1	2	Early PS	21, 8, 73, 29, other	PS	1965-1985
2	2	Transition PS	21, 8, 73, 29, other	PS	1986-1990
3	2	Late PS FreeSchool	21, 8, 73, 29, other	PS	1991-2008
4	2	Late PS FAD	21, 8, 73	PS	1991-2008
5	2	Ghana BB+PS	27	BB+PS	1965-2008
6	2 (S of 10N)	TRO-south BB	21, 8, 73, other	BB	1962-2008
7	2 (N of 10N)	TRO-north BB early	21, 8, 73, 50, 53, 65, other	BB	1965-1979
8	2 (N of 10N)	TRO-north BB late	21, 8, 73, 50, 53, 65, other	BB	1980-2008
9	1	Northern BB	45,153, 154, other	BB	1965-2008
10	1	Japan LL North	12	LL	1961-2008
11	2	Japan LL TRO	12	LL	1961-2008
12	3	Japan LL South	12	LL	1961-2008
13	1	Other LL North	5, others	LL + others	1965-2008
14	2	Other LL TRO	3, 5, others	LL + others	1965-2008
15	3	Other LL South	3, 5, 20, others	LL + others	1961-2008

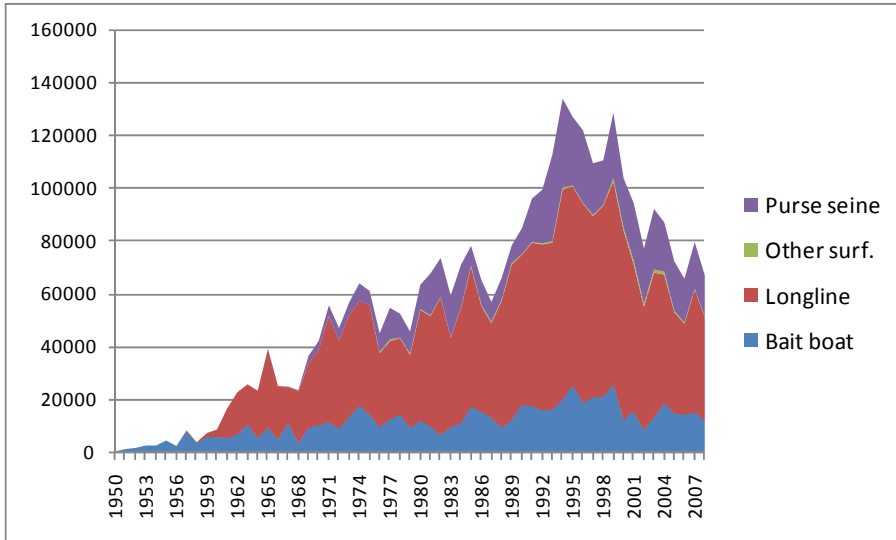


Figure 1 showing BET by the major fishing fleet

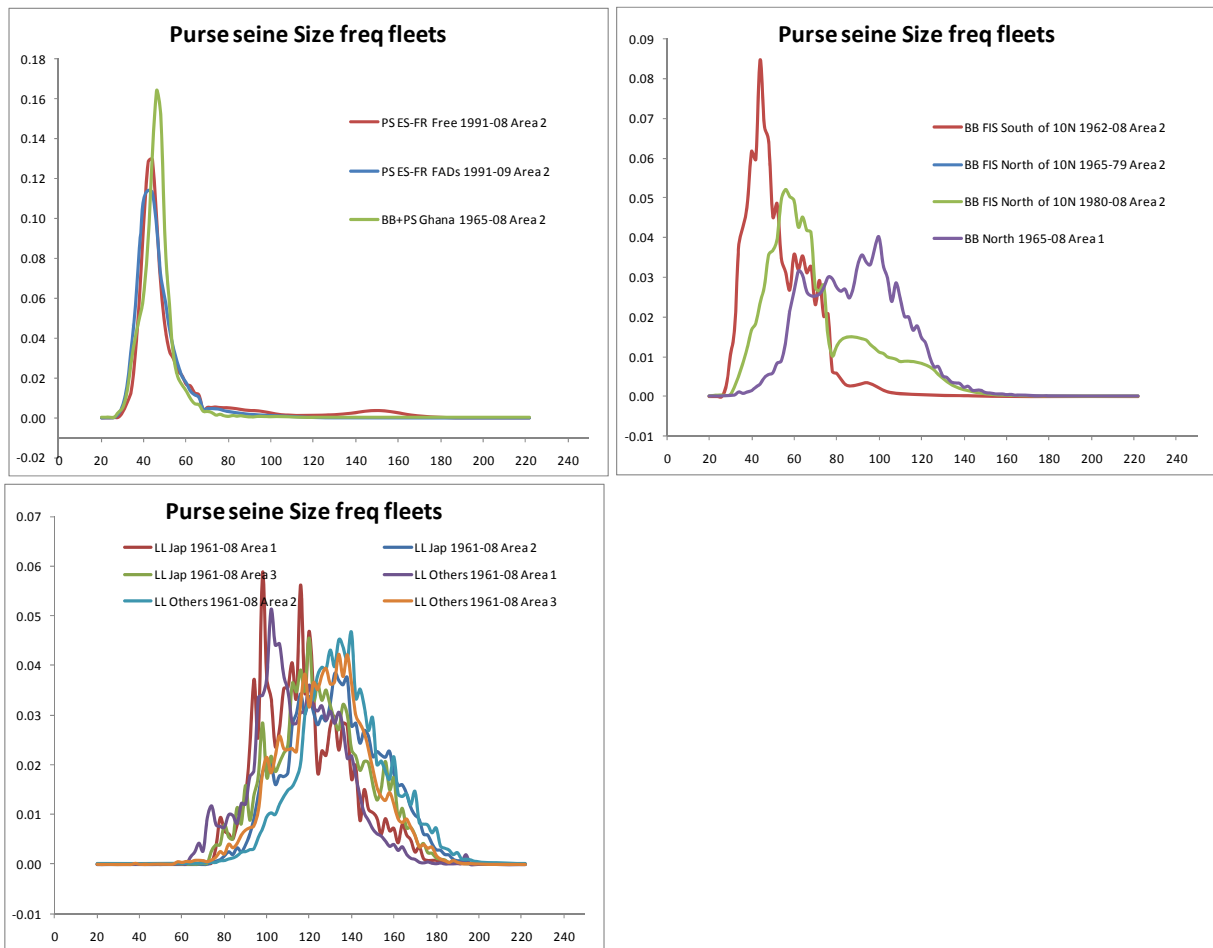


Figure 2 Summary of the size frequency data by main gear type for the fleet-ID classification used in Multifan-CL input. This data corresponds to 2002-08 size frequency data.

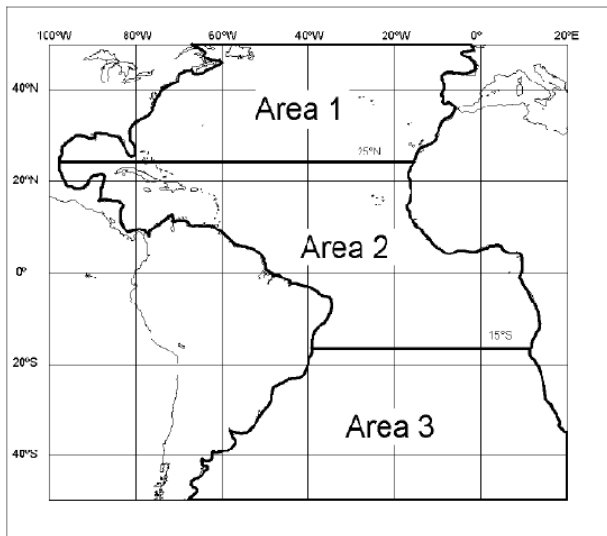


Figure 3 Areas defined for Multifan-CL applications.

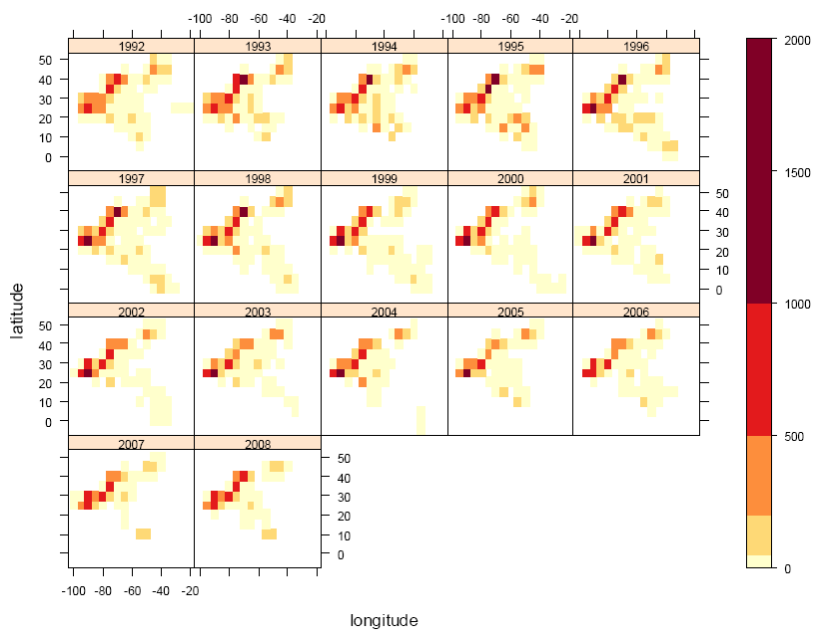


Figure 4 Trend of total annual fishing effort (1000 hooks deployed) by 5° by 5° areas from the U.S. Pelagic longline fleet since 1992. Negative longitudes indicate the western hemisphere. Positive latitudes indicate the northern hemisphere.

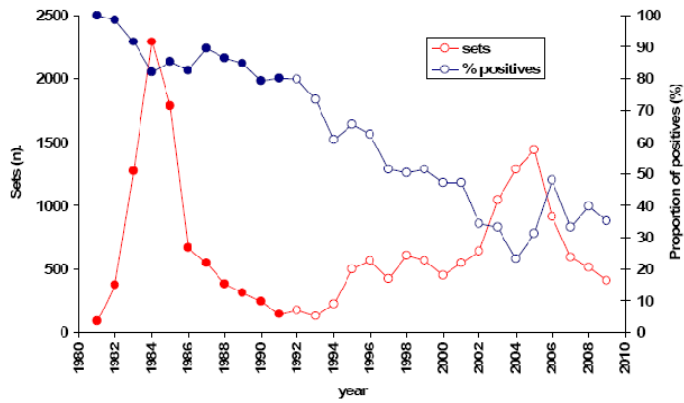


Figure 5 Number of sets and proportion of sets with captures of bigeye by Uruguayan longliners during the period 1981-2009. During 1980-1991 the vessels generally targeted bigeye. Since that time, vessels typically target swordfish.

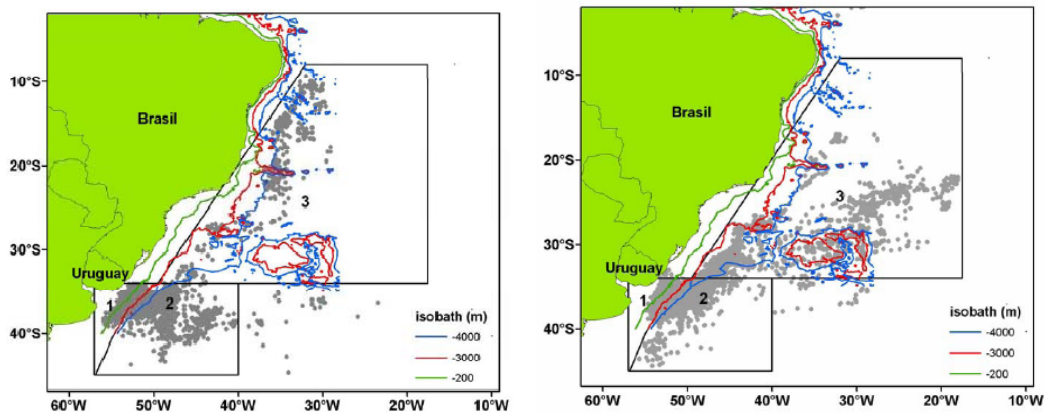


Figure 6 Distribution of sets by the Uruguayan longline fleet between 1981-1991 (left) and 1992-2009 (right). The areas (1-3) utilized for the analyses are indicated.

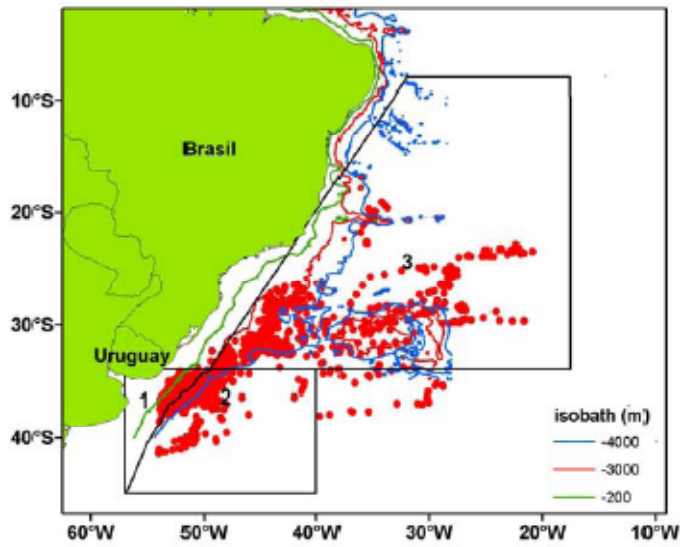


Figure 7 Distribution of sets observed by National Observer Program (PNOFA) observers on board Uruguayan longline vessels during 1998-2009. The areas (1-3) utilized for the analyses are noted.

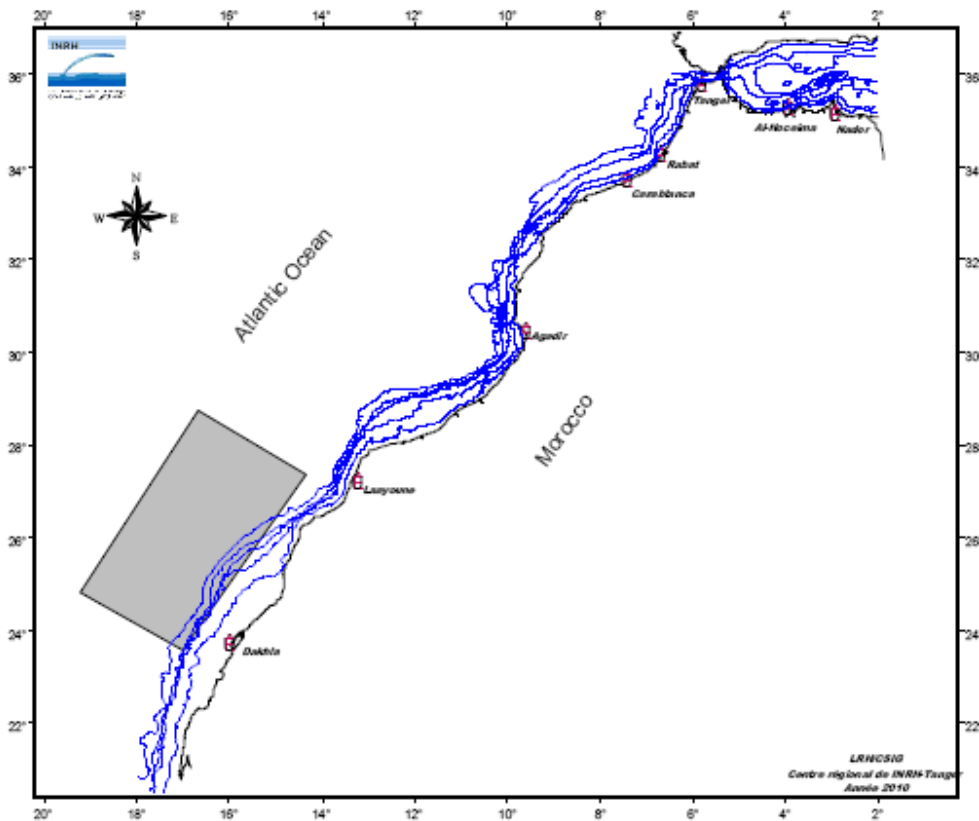


Figure 8 Geographic location of the fishing area frequented by Moroccan longliners targeting swordfish in the North Atlantic.

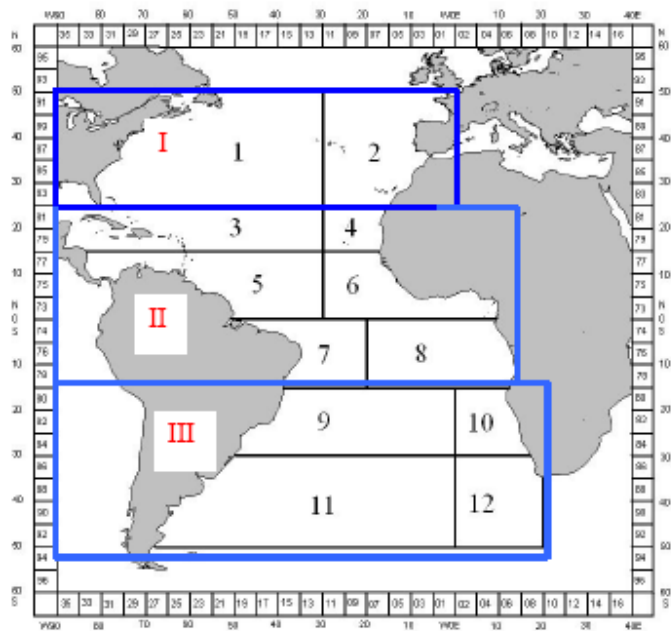


Figure 9 Area stratification for standardizing bigeye tuna CPUE, for Chinese Taipei longline fleet.

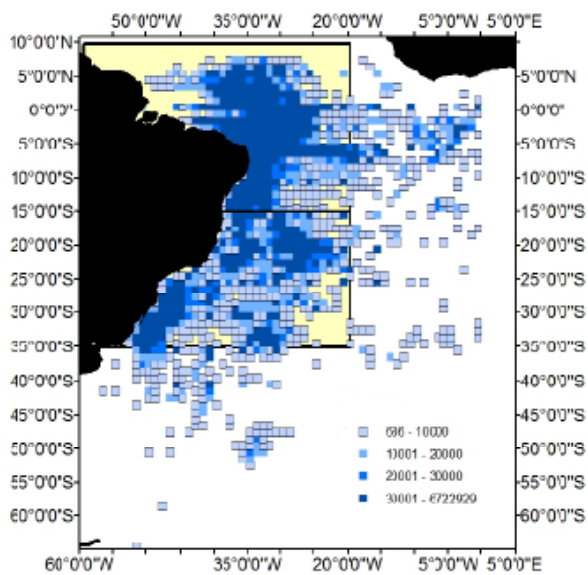


Figure 10 The distribution of effort, in numbers of hooks from the Brazilian tuna longline fleet (National and chartered vessels) from 1980-2008.

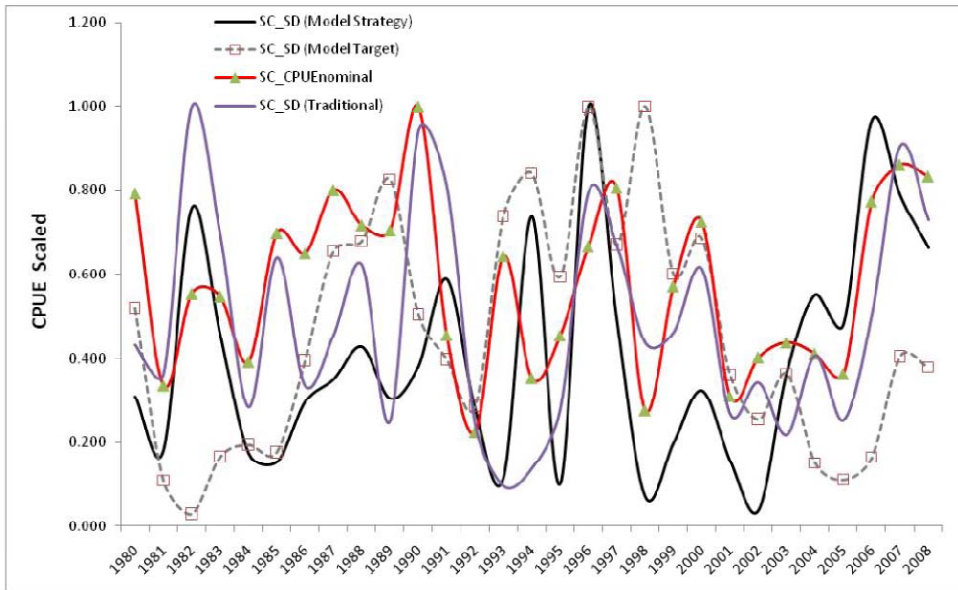


Figure 11 Comparison of indices of abundance for the Brazilian longline fleet (National vessels and contracting vessels) constructed using various methods.

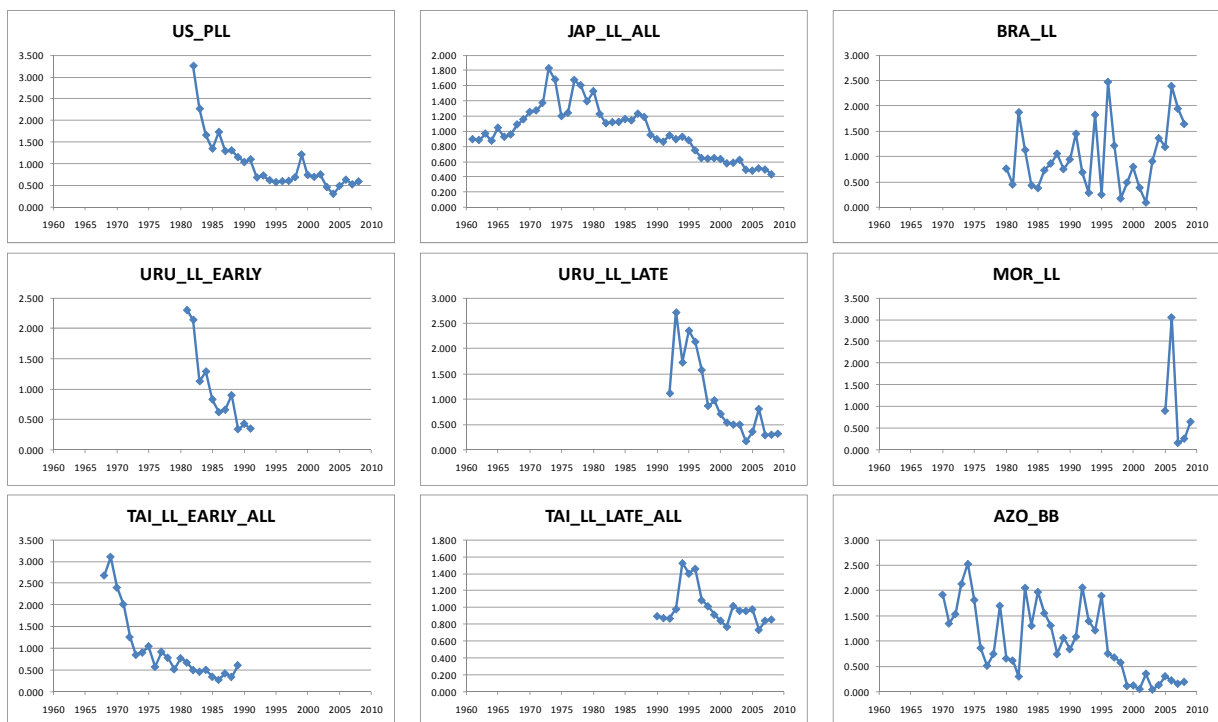


Figure 12 Annual indices of abundance for ASPIC. All are in biomass except Brazil and Uruguay which are in numbers (assumed to be a proxy for weight). All indices are scaled to the mean of each index.

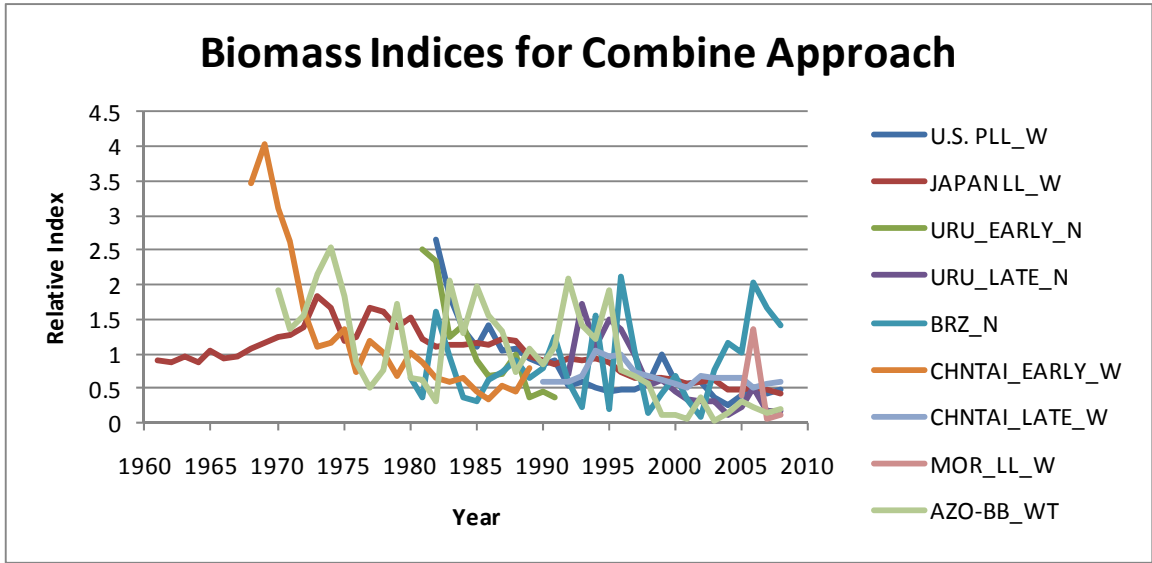


Figure 13 Biomass indices used to construct the combined index for ASPIC scaled to overlapping time series.

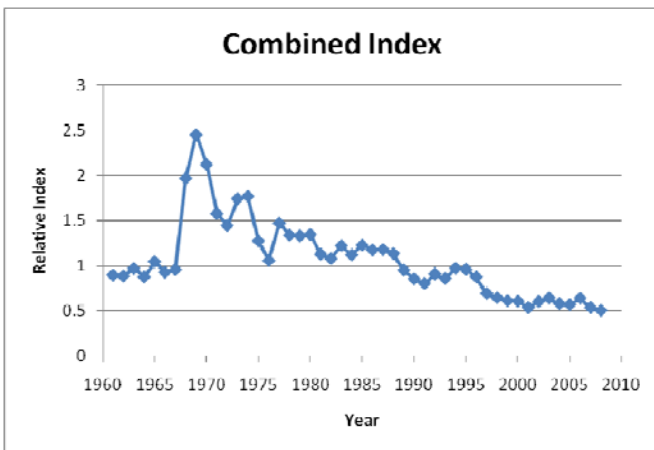


Figure 14 The combined index weighted by catch.

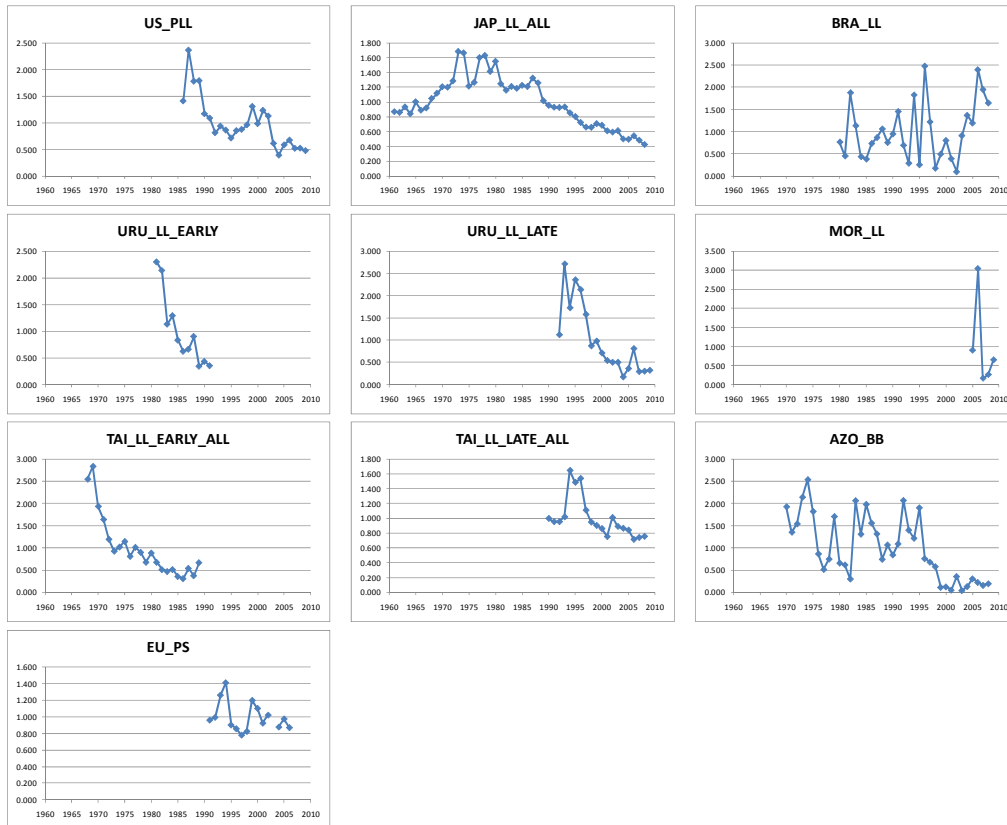


Figure 15 Annual indices of abundance for VPA. All in number except MOR_LL, AZO_BB and EU_PS which are in biomass.

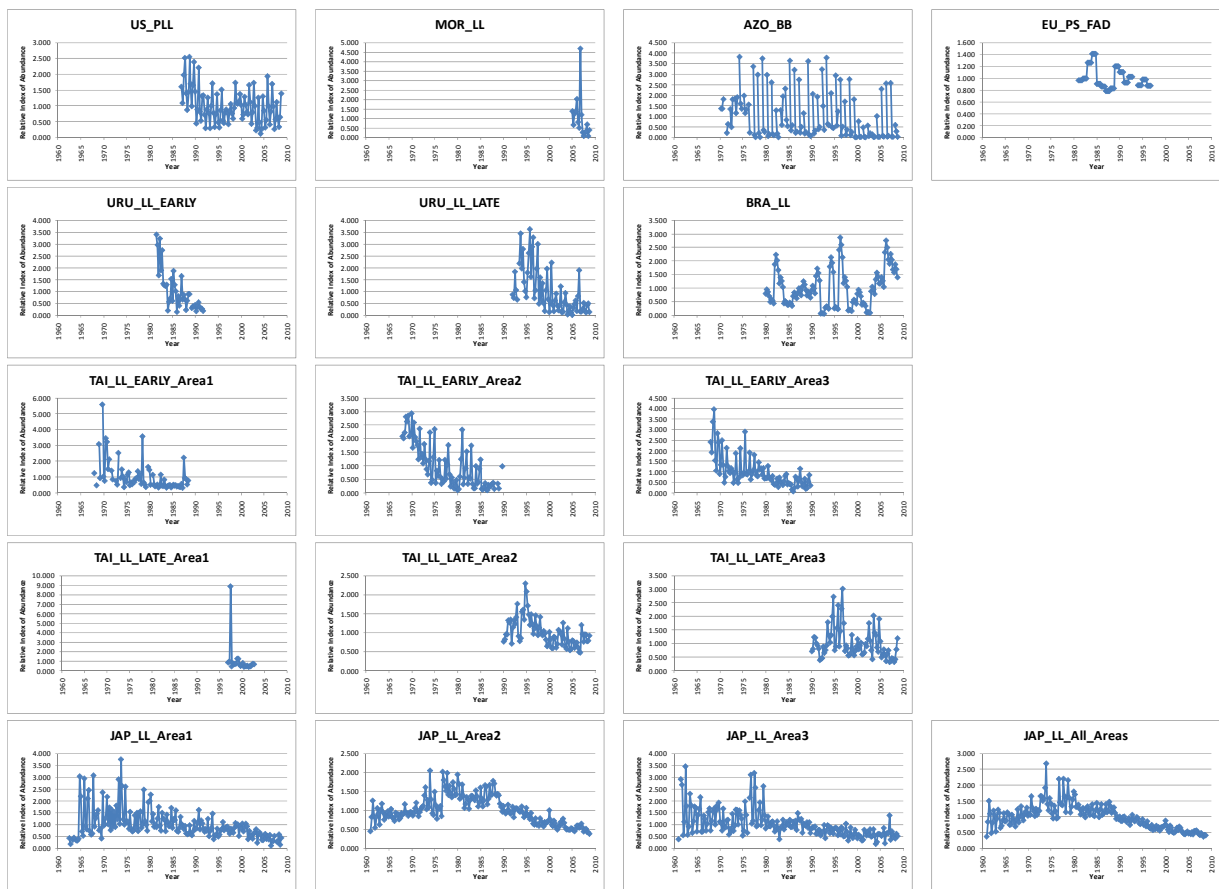
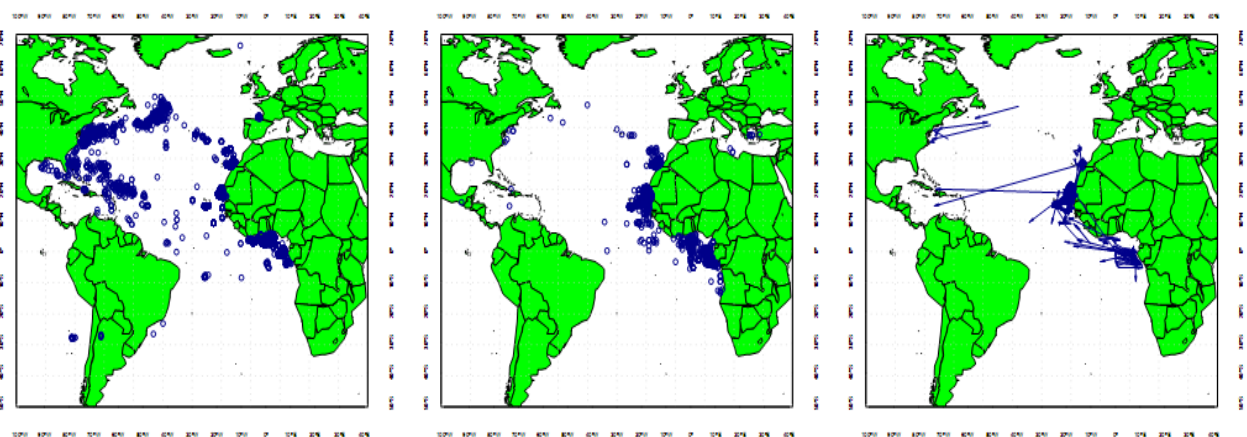


Figure 16 Quarterly indices available for use in Multifan-CL and Stock Synthesis applications. All are in numbers except MOR_LL, EU-PS and AZO_BB which are in biomass.



a) Releases

b) Recaptures

c) Movement

Figure 17 BET tag releases, recaptures and movement (Stat Bull , XXXVIII)

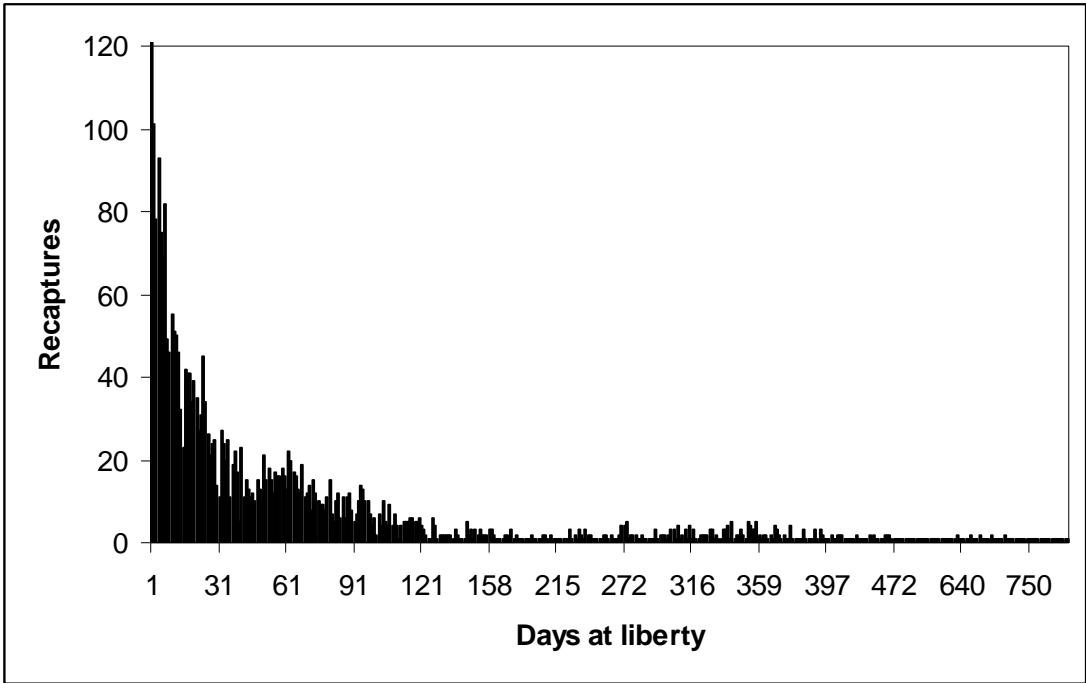


Figure 18 Days at liberty for recaptured bigeye tuna.

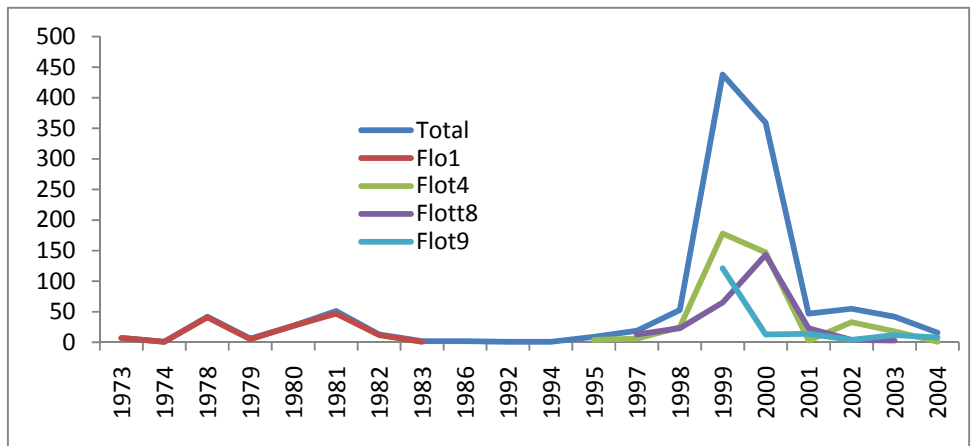


Figure 19 Distributions of tagging operations by year and fleet.

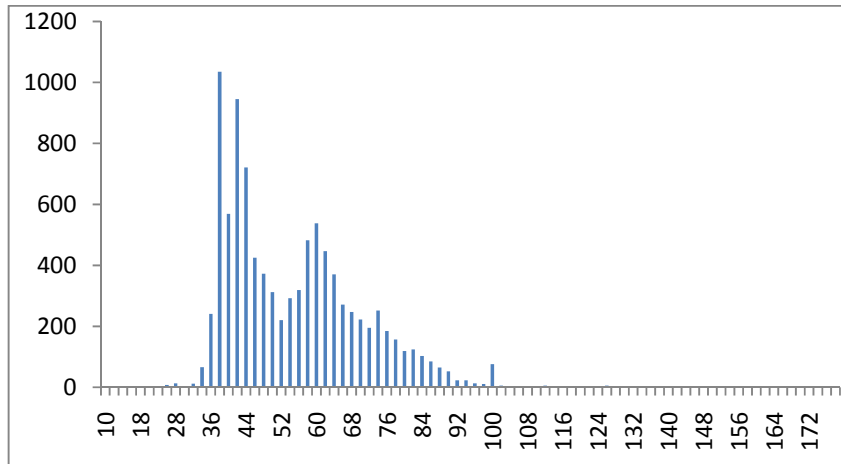


Figure 20 Size distribution of fish tagged for tagging events selected for MULTIFAN CL.

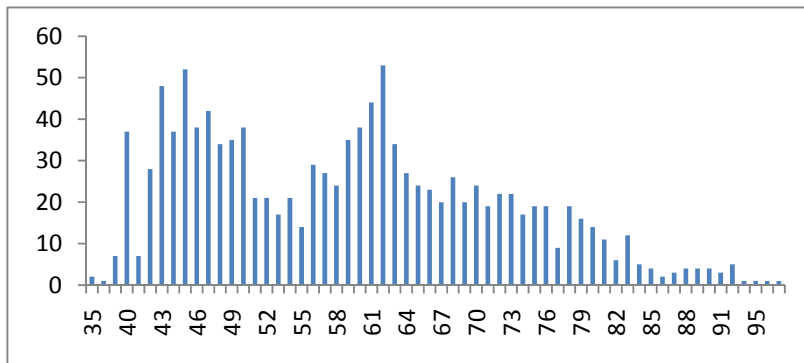


Figure 21 Size distribution of recoveries for tagging events selected for MULTIFAN CL.

AGENDA

1. Opening, adoption of the Agenda and meeting arrangements.
2. Review of historical and new information on biology
3. Review of Task I data – estimation of total removals
4. Review of Task II catch/effort and size data – estimation of size frequency distribution of the catch
5. Review of available indices of relative abundance by fleet and estimation of combined indices
6. Review of Tagging data
7. Review of data needs for different assessment model options
8. Recommendations
9. Other matters
10. Adoption of the report and closure

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Appendix 3

LIST OF DOCUMENTS

- SCRS/2010/022 Bigeye (*Thunnus obesus*) bycatch estimates from the albacore Spanish surface fishery in the North East Atlantic:2007-2009 years. Ortiz de Zárate, V., Perez, B. and Ruiz, M.
- SCRS/2010/026 Construction and examination of Stock Synthesis Assessment Model for bigeye tuna. Schirripa, M.
- SCRS/2010/028 Standardized catch rates for bigeye tuna (*Thunnus obesus*)from the pelagic longline fishery in the northwest Atlantic and the Gulf of Mexico. Ortiz, M.
- SCRS/2010/029 Estandarización de la CPUE del atún ojo grande, *Thunnus obesus*, capturado por la flota de palangre pelágico de Uruguay entre 1981 y 2009. Pons, M. and Domingo, A.
- SCRS/2010/030 Estandarización de la CPUE del atún ojo grande, *Thunnus obesus*, con datos obtenidos por observadores a bordo en la flota de palangre pelágico de Uruguay (1998 – 2009). Pons, M. and Domingo, A.
- SCRS/2010/031 Distribucion y composicion de tallas de *Thunnus obesus*, obtenida del programa nacional de observadores de la flota palangrera uruguaya (1998-2009). Domingo, A., Forselledo, R. and Pons, M.
- SCRS/2010/033 Updated standardized cpue for bigeye tuna (*Thunnus obesus*) caught incidentaly by the Moroccan longline fleet targeting swordfish in the North Atlantic. Period 2005-2009. N. Abid, M. Idrissi, B. Jilali and F. El Omrani
- SCRS/2010/034 Recent Taiwanese Bigeye Tuna Fisheries in the Atlantic Ocean. Liu, H.
- SCRS/2010/035 Verification of catch-effort data and standardization of abundance index of bigeye tuna by Taiwanese longline fishery in the Atlantic Ocean. Hsu, C.
- SCRS/2010/036 Standardized CPUE series of bigeye tuna, *Thunnus obesus*, caught by Brazilian tuna longline fisheries in the southwestern Atlantic ocean (1980 – 2008). Hazin, H.G., Fredou, T., Hazin, F. and Travassos, P.
- SCRS/2010/037 Standardized CPUE of bigeye tuna of the Japanese tuna longline fisheries operated in the Atlantic ocean (1961- 2008). Satoh, K. and Okamoto, H.
- SCRS/2010/038 Standardized bigeye tuna, *Thunnus obesus*, CPUE for Multifan CL fisheries. Kell, L and Palma, C.
- SCRS/2010/039 Standardized CPUE index for bigeye (*Thunnus obesus*) from landings of the Azorean baitboat fleet. Ortiz, M., Cass-calay, S. and Pereira, J.

Appendix 4

Review of size frequency data for bigeye tuna

The Secretariat provided the input data of size measurements (size) and catch-at-size data (CAS) available at the ICCAT database (**Figure 1**). For bigeye tuna, there are substantial size information from the major fisheries. The WG decided to review and update size data from 2002 forwards only, as not substantial changes have been submitted for years prior to 2002 since the last assessment.

The following plot shows the proportion of each size information data type and by each of the flag-fleets available for 2002-08 (include all size and CAS data). **Table 1** presents a summary of the fleet-ID classification

used for the Multifan-CL input size frequency data. **Figure 2** shows the contribution of size frequency data by flag-fleet to each of the fleet-ID classification of the Multifan-CL input data.

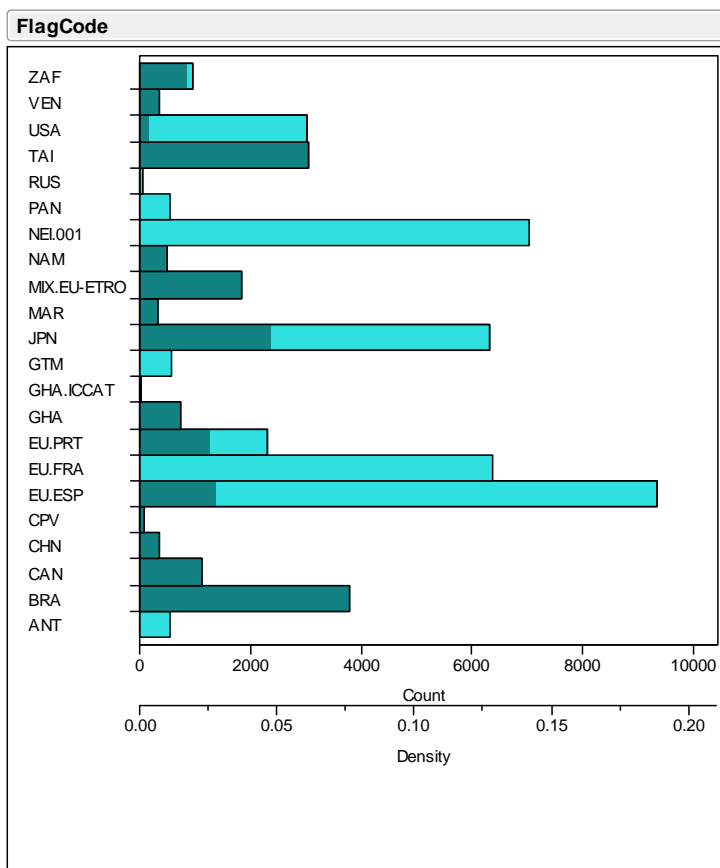
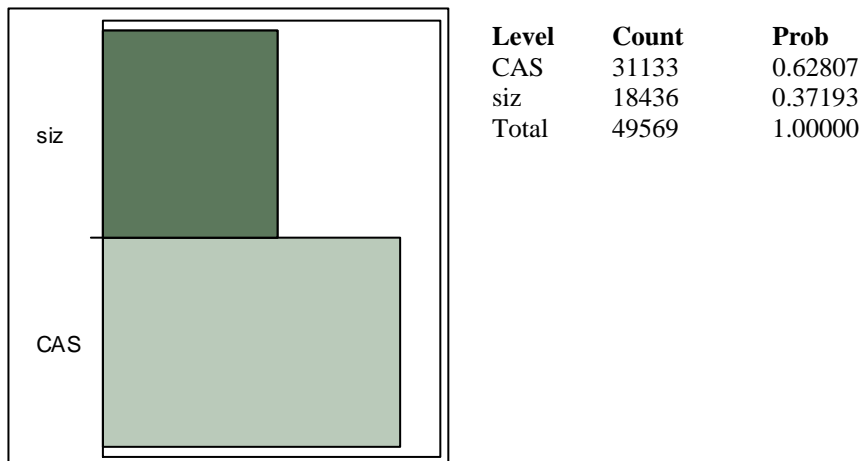
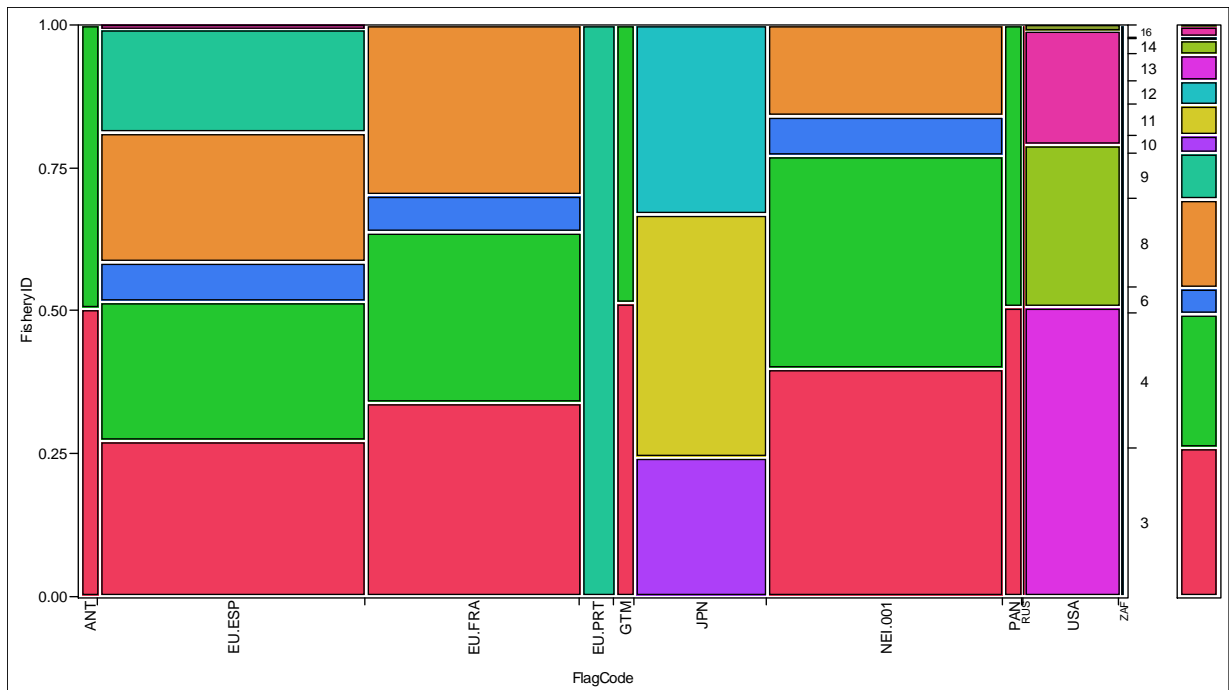


Figure 1. Size frequency data for bigeye tuna 2002-2008. The top plot shows the distribution by type of size information: size measurements (siz), and catch-at-size raised information (CAS) The left plot shows the data distribution by flag-fleet and the shade area in each bar represents the size measurement proportion of each case.

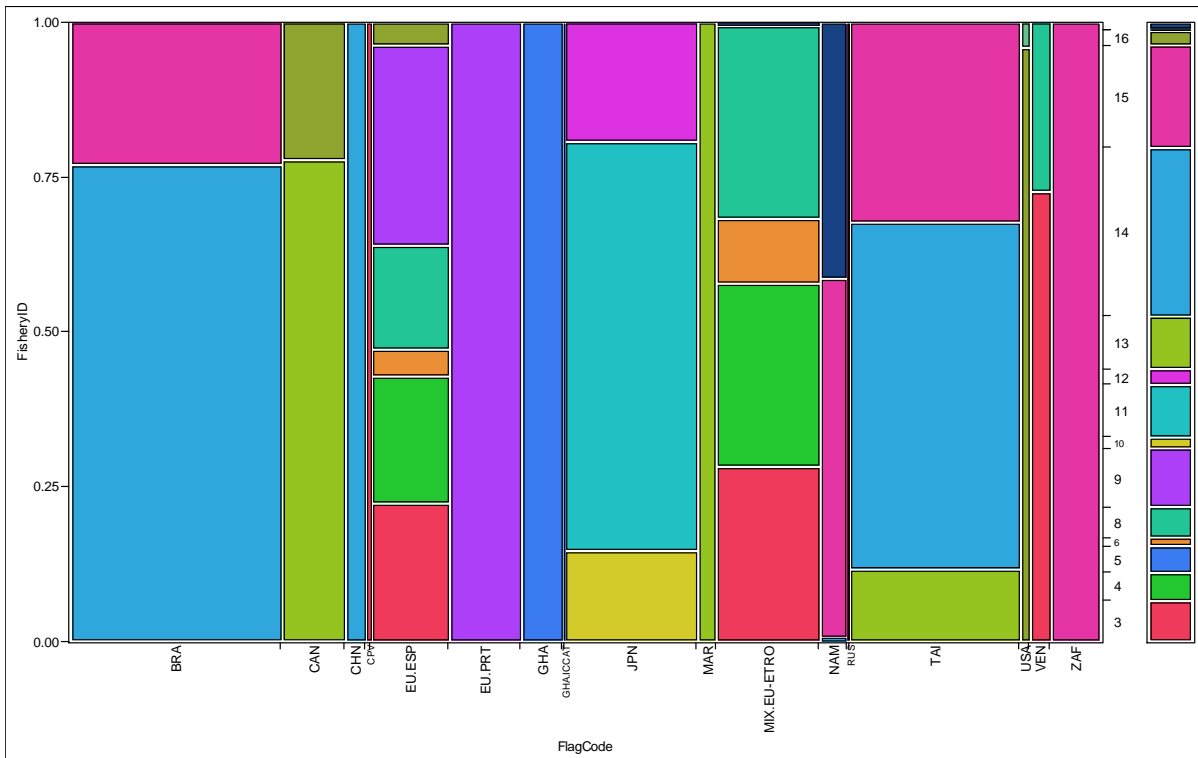
Table 1. Code and description of the fleet-ID classification used for Multifan-CL input of size frequency data.

Fleet ID	Description
1	PS RS+F 1965-85 Area 2
2	PS RS+F 1986-90 Area 2
3	PS ES-FR Free 1991-08 Area 2

4	PS ES-FR FADs 1991-09 Area 2
5	BB+PS Ghana 1965-08 Area 2
6	BB FIS South of 10N 1962-08 Area 2
7	BB FIS North of 10N 1965-79 Area 2
8	BB FIS North of 10N 1980-08 Area 2
9	BB North 1965-08 Area 1
10	LL Jap 1961-08 Area 1
11	LL Jap 1961-08 Area 2
12	LL Jap 1961-08 Area 3
13	LL Others 1961-08 Area 1
14	LL Others 1961-08 Area 2
15	LL Others 1961-08 Area 3

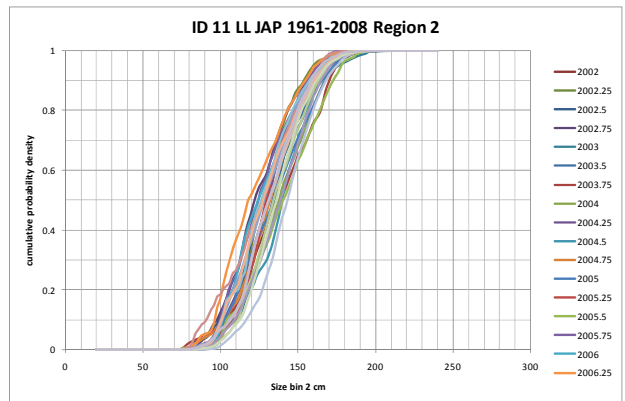
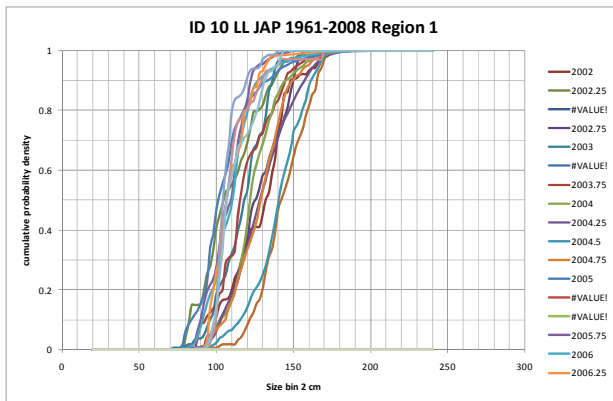
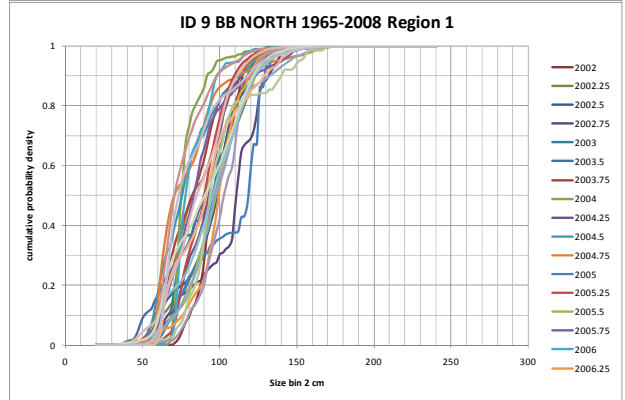
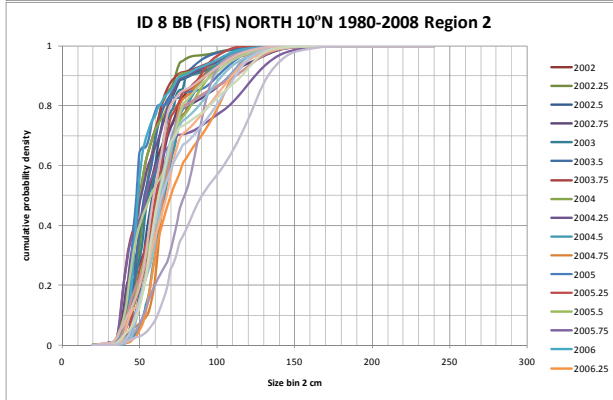
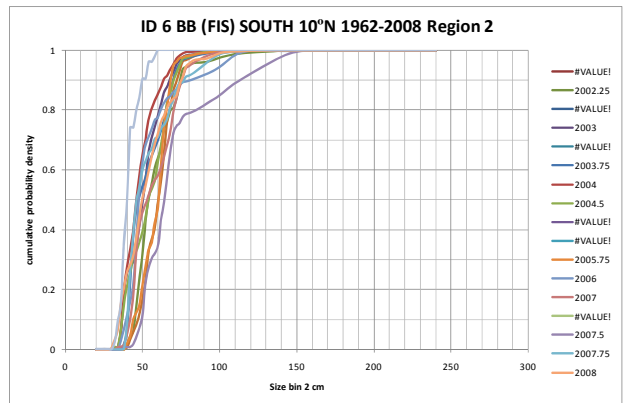
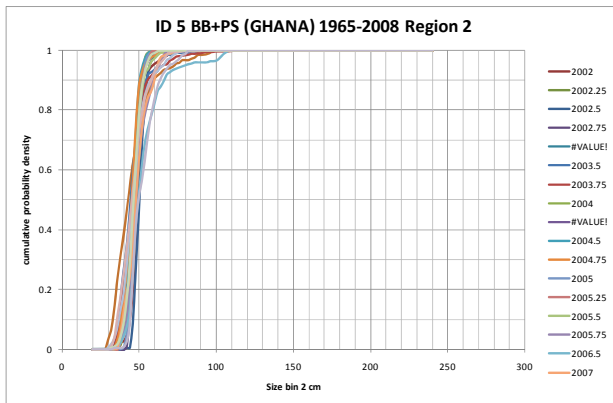
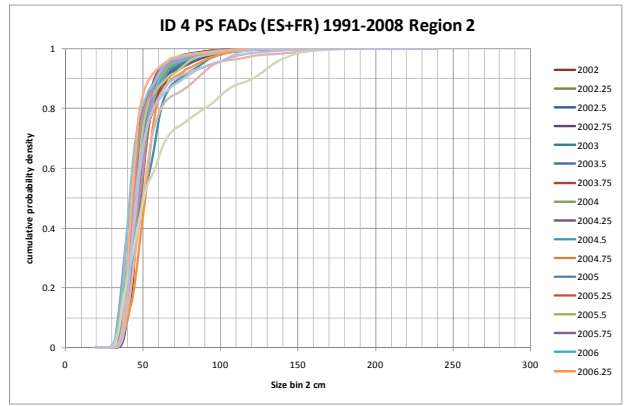
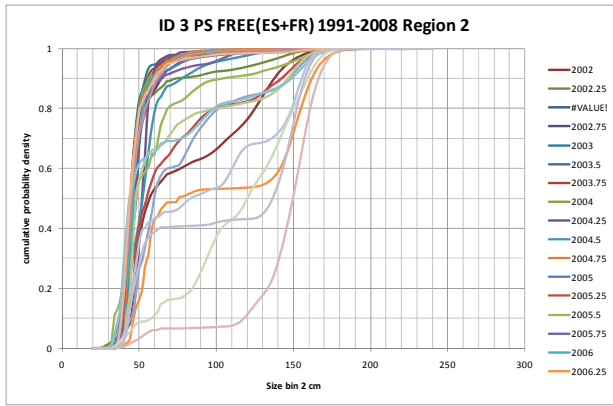


CAS



Size

Figure 2. Distribution of size frequency data by type (CAS top plot, Size bottom plot) for each of the Multifan-CL fleet-ID (rows) and the correspondent proportion by each flag-fleet (columns). This represents size information 2002-2008 at the Secretariat.



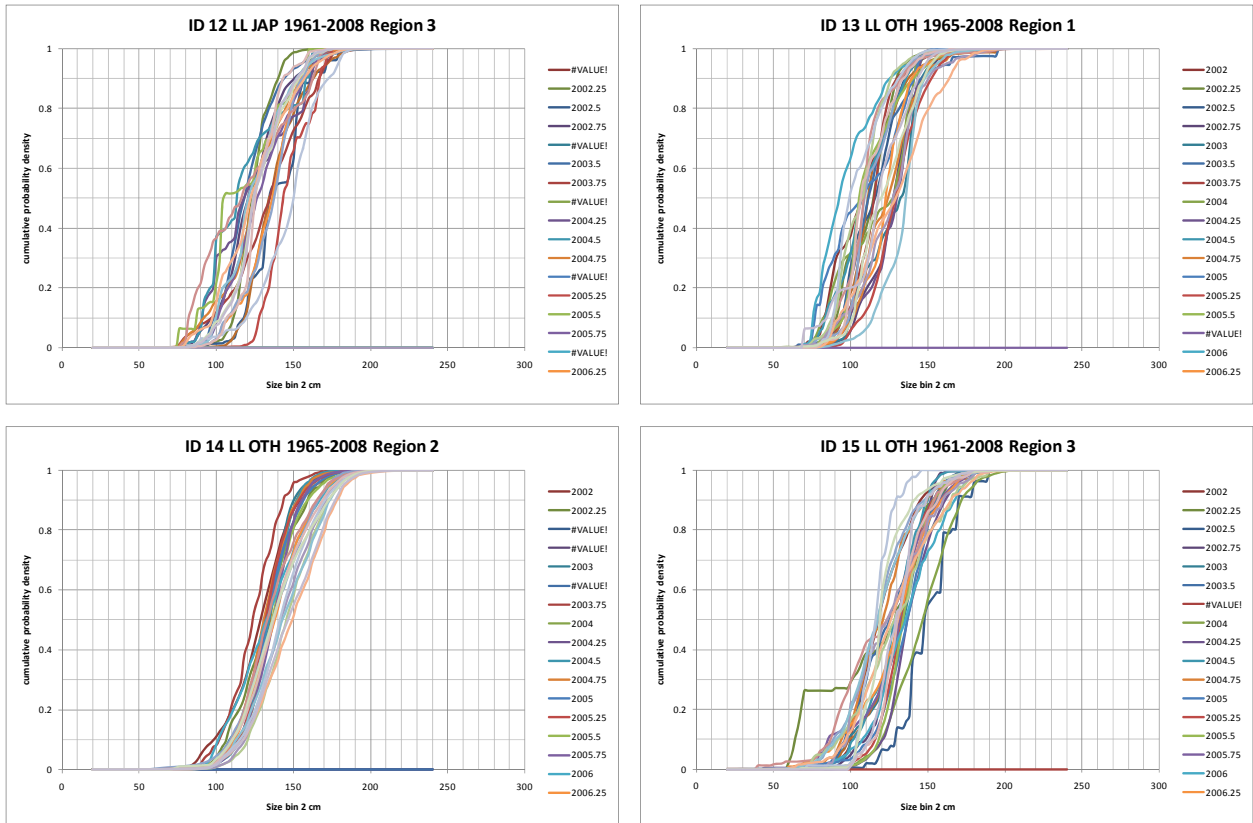


Figure 3. Cumulative size frequency distributions for year-quarter 2002-08 for each of the Fleet ID of Multifan-CL input (each plot). Each line represents a size-frequency series input, after filtering by number of samples, kurtosis and skewness. Note: The WG decide to remove the size component data for the Fleet-ID 3 & 4 because of biased estimation when converted from catch weight distribution.

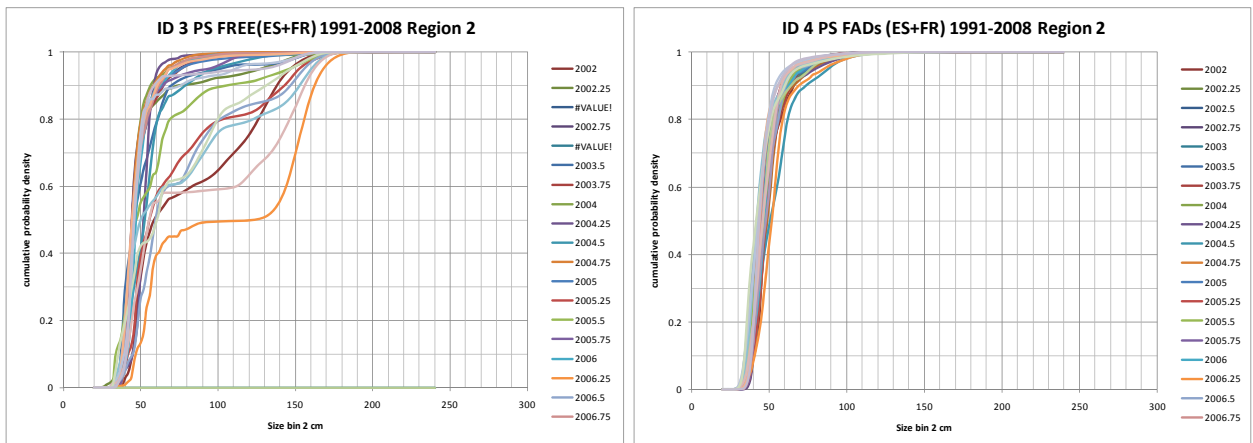


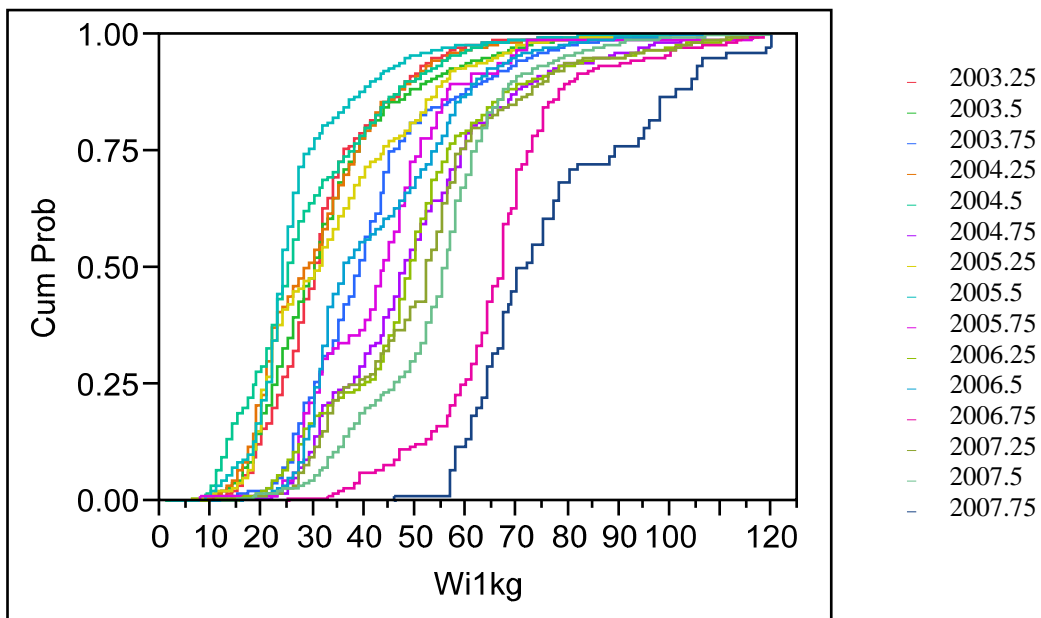
Figure 4. Cumulative size frequency distribution for fleet-ID 3 & 4 after excluding the size component from the length-frequency input data.

Catch at Size (CAS-kg). Oneway Analysis of Wilk By YQ

FisheryID=13
 FlagCode=CAN
 GearGrp=LL

Means and Std Deviations

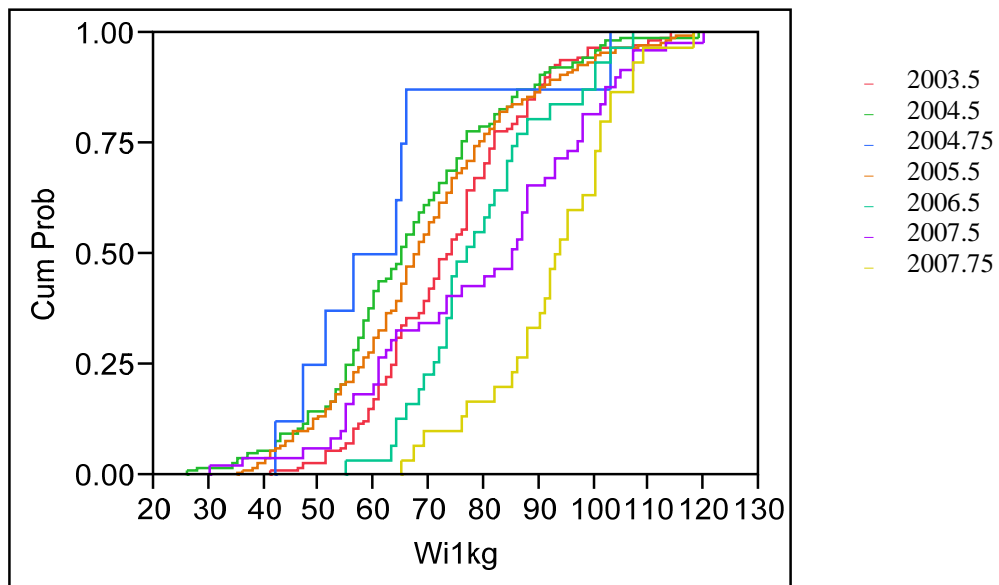
Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
2003.25	1427	31.9537	11.9033	0.3151	31.336	32.572
2003.5	2277	32.7005	14.7283	0.3087	32.095	33.306
2003.75	483	41.0828	15.0598	0.6852	39.736	42.429
2004.25	587	31.0000	13.7552	0.5677	29.885	32.115
2004.5	3669	28.7563	14.5654	0.2405	28.285	29.228
2004.75	220	50.0227	17.8211	1.2015	47.655	52.391
2005.25	636	33.8491	15.9229	0.6314	32.609	35.089
2005.5	4943	27.0176	11.3961	0.1621	26.700	27.335
2005.75	85	43.4353	15.1496	1.6432	40.168	46.703
2006.25	620	49.8323	18.8191	0.7558	48.348	51.316
2006.5	3991	42.4688	15.1353	0.2396	41.999	42.939
2006.75	202	66.2970	14.9050	1.0487	64.229	68.365
2007.25	190	52.0842	18.2491	1.3239	49.473	54.696
2007.5	2739	54.1756	14.6861	0.2806	53.625	54.726
2007.75	76	76.7500	17.4571	2.0025	72.761	80.739



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 FlagCode=CAN
 GearGrp=oth

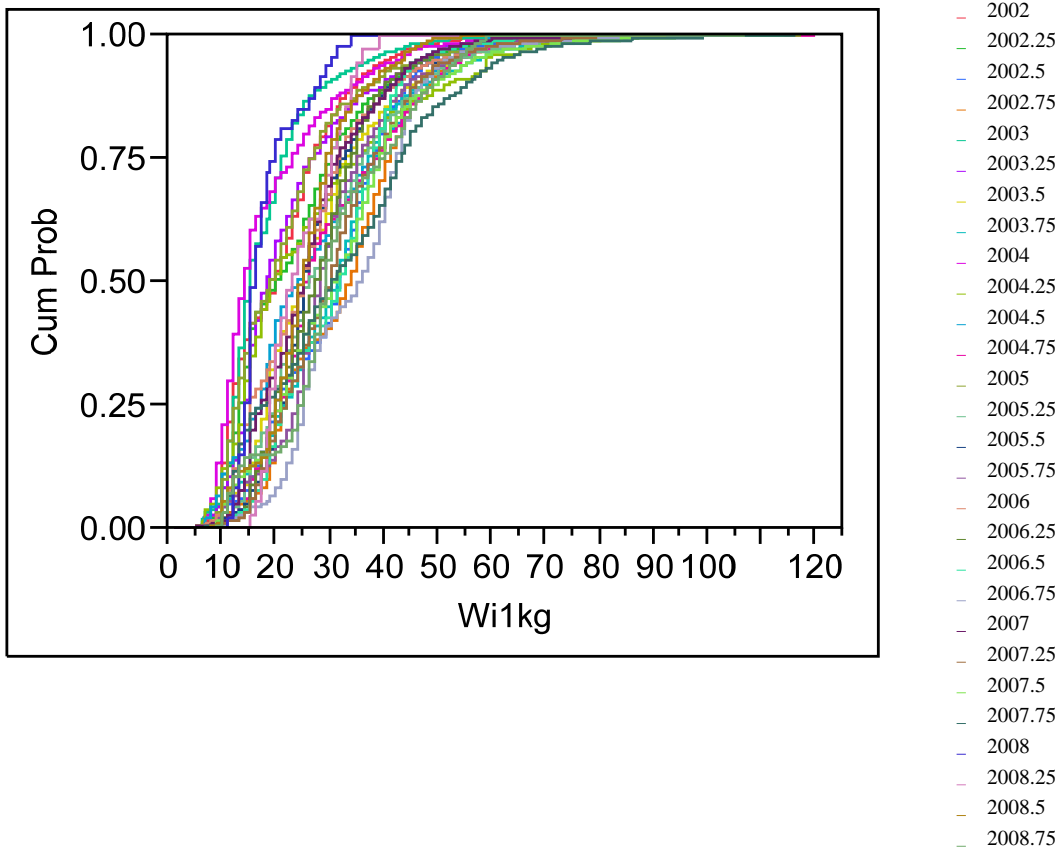
Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
2003.5	112	73.7500	14.2832	1.3496	71.076	76.424
2004.5	103	66.5631	17.6228	1.7364	63.119	70.007
2004.75	8	61.7500	18.8661	6.6702	45.978	77.522
2005.5	214	69.2570	17.4155	1.1905	66.910	71.604
2006.5	31	79.3548	12.8467	2.3073	74.643	84.067
2007.5	49	79.6122	21.0325	3.0046	73.571	85.653
2007.75	30	92.4000	12.6644	2.3122	87.671	97.129



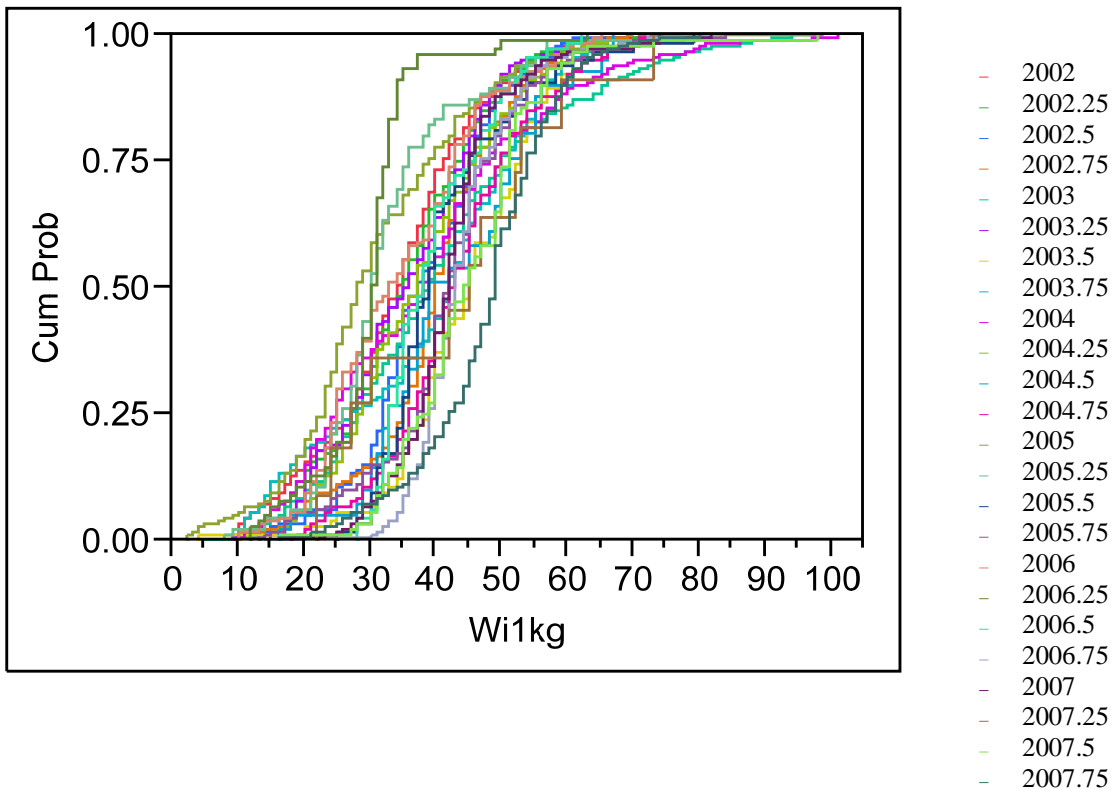
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 GearGrp=LL
 No Weight Rows 697
 Means and Std Deviations

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2002	2661	20.9064	10.4346	0.2023	20.510	21.303
2002.25	1448	23.3377	12.9667	0.3408	22.669	24.006
2002.5	3253	30.6326	12.1030	0.2122	30.217	31.049
2002.75	3256	32.7119	12.8286	0.2248	32.271	33.153
2003	1553	18.0515	9.0458	0.2295	17.601	18.502
2003.25	564	22.0160	11.5937	0.4882	21.057	22.975
2003.5	806	27.5782	13.3922	0.4717	26.652	28.504
2003.75	3074	31.1002	13.6069	0.2454	30.619	31.581
2004	921	18.3105	11.1229	0.3665	17.591	19.030
2004.25	166	25.8133	16.2722	1.2630	23.320	28.307
2004.5	1331	27.2322	13.9097	0.3813	26.484	27.980
2004.75	5090	29.9843	13.2577	0.1858	29.620	30.349
2005	1046	21.7342	12.2952	0.3802	20.988	22.480
2005.25	560	29.1893	13.1739	0.5567	28.096	30.283
2005.5	2803	28.0025	11.4901	0.2170	27.577	28.428
2005.75	3728	29.8908	11.8917	0.1948	29.509	30.273
2006	1352	25.9734	12.9198	0.3514	25.284	26.663
2006.25	1186	28.0978	10.5595	0.3066	27.496	28.699
2006.5	4989	30.8783	11.0014	0.1558	30.573	31.184
2006.75	4683	34.5381	11.9991	0.1753	34.194	34.882
2007	1601	26.1830	11.1967	0.2798	25.634	26.732
2007.25	932	30.9635	12.2261	0.4005	30.178	31.749
2007.5	3189	31.4842	14.6153	0.2588	30.977	31.992
2007.75	3061	32.5087	17.0534	0.3082	31.904	33.113
2008	47	17.8511	5.6027	0.8172	16.206	19.496
2008.25	35	24.6857	6.6676	1.1270	22.395	26.976
2008.5	178	25.3933	8.8670	0.6646	24.082	26.705
2008.75	186	30.9839	12.2459	0.8979	29.212	32.755



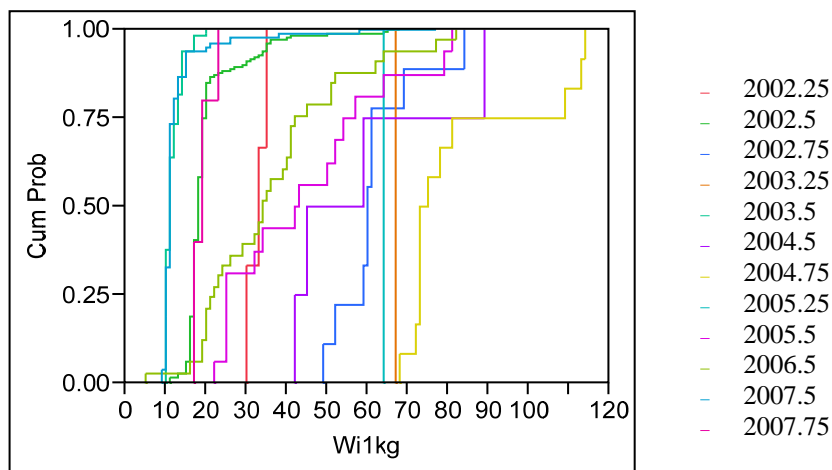
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 GearGrp=LL
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 Means and Std Deviations

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2002	1236	33.9927	12.3284	0.3507	33.305	34.681
2002.25	671	35.2906	11.7574	0.4539	34.399	36.182
2002.5	185	38.3838	10.3124	0.7582	36.888	39.880
2002.75	533	39.9081	10.9725	0.4753	38.974	40.842
2003	930	40.9075	17.3298	0.5683	39.792	42.023
2003.25	225	35.7244	11.7616	0.7841	34.179	37.270
2003.5	75	44.8800	11.3077	1.3057	42.278	47.482
2003.75	265	39.3472	15.4819	0.9510	37.475	41.220
2004	287	38.6969	17.5139	1.0338	36.662	40.732
2004.25	180	37.6278	12.3533	0.9208	35.811	39.445
2004.5	41	42.7317	12.3228	1.9245	38.842	46.621
2004.75	242	43.2934	11.4221	0.7342	41.847	44.740
2005	375	30.8720	14.0143	0.7237	29.449	32.295
2005.25	85	32.3882	11.3043	1.2261	29.950	34.827
2005.5	63	41.1905	10.3517	1.3042	38.583	43.798
2005.75	160	41.9688	11.4058	0.9017	40.188	43.750
2006	129	34.5271	12.1675	1.0713	32.407	36.647
2006.25	77	29.5584	7.6700	0.8741	27.818	31.299
2006.5	68	39.6471	8.1254	0.9854	37.680	41.614
2006.75	520	44.0731	7.9676	0.3494	43.387	44.759
2007	313	42.2300	9.0205	0.5099	41.227	43.233
2007.25	11	43.0909	16.0777	4.8476	32.290	53.892
2007.5	91	44.9231	10.9028	1.1429	42.652	47.194
2007.75	260	47.7462	10.4581	0.6486	46.469	49.023



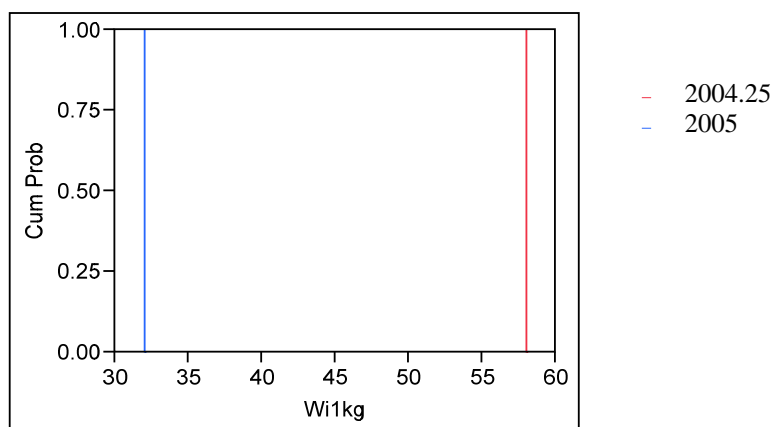
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 FlagCode=USA
 GearGrp=oth
 No Weight Rows 51
 Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
2002.25	3	32.6667	2.5166	1.453	26.415	38.918
2002.5	366	20.0055	7.5388	0.394	19.231	20.780
2002.75	9	61.6667	10.1242	3.375	53.884	69.449
2003.25	2	67.0000	0.0000	0.000	67.000	67.000
2003.5	226	11.6726	2.1227	0.141	11.394	11.951
2004.5	4	58.7500	21.4845	10.742	24.563	92.937
2004.75	12	83.5000	17.5110	5.055	72.374	94.626
2005.25	1	64.0000	.	.	.	.
2005.5	16	44.3750	19.2141	4.804	34.137	54.613
2006.5	33	36.2424	17.5018	3.047	30.037	42.448
2007.5	82	12.4390	6.4139	0.708	11.030	13.848
2007.75	5	19.0000	2.4495	1.095	15.959	22.041



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 No Weight Rows 1
 Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
2004.25	1	58.0000	.	.	.	.
2005	1	32.0000	.	.	.	.



Stock synthesis (SS) data requirements.

Many types of data may be input to SS, but no one data type is required for a model to run. Some parameters are required while others are conditional on the model configuration, depending on such options as multiple areas, growth patterns, etc.

The user should consult the manual (<http://nft.nefsc.noaa.gov/Download.html>) for a full description of the data requirements for a given model structure.

The data inputs include:

- Dimensions (years, ages, N fleets, N surveys, etc.)
- Fleet and survey names, timing. Etc.
- Catch biomass
- Discards
- Mean body weight
- Length composition set-up
- Length composition
- Age composition set-up
- Ageing imprecision definitions
- Age composition
- Mean length or bodyweight-at-age
- Generalized size composition (e.g. weight frequency)
- Tag-recapture
- Stock composition
- Environmental data
- Mortality, growth and fecundity

In addition, there are required and optional parameter inputs. *Optional inputs are required for more complex model formulation (e.g. multiple growth patterns, submorphs, areas)*. The correct specification of these parameters is complex, but is fully described in the user's manual.

- Number of growth patterns and sub-morphs
- Design matrix for assignment of recruitment to area/season/growth pattern
- Design matrix for movement between areas
- Number of and definition of time blocks that can be used for time-varying parameters
- Specifications for mortality, growth and fecundity
- Natural mortality and growth parameters for each gender x growth pattern
- Maturity, fecundity and weight-length for each gender
- Recruitment distribution parameters for each area, season, growth pattern
- Cohort growth deviation
- Environmental link parameters for any biological parameters that use a link
- Time-varying setup for any biological parameters that use blocks
- Seasonal effects on biology parameters
- Phase for any biological parameters that use annual deviations
- Spawner-Recruitment parameters
- Recruitment deviations
- Method for calculating fishing mortality (F)
- Initial equilibrium F for each fleet
- Catchability (Q) setup for each fleet and survey
- Catchability parameters
- Length selectivity, retention, discard mortality setup for each fleet and survey
- Age selectivity setup for each fleet and survey
- Parameters for length selectivity, retention, discard mortality for each fleet and survey
- Parameters for age selectivity for each fleet and survey

- Environmental link parameters for any selectivity/retention parameters that use a link
- Time-varying setup for any selectivity/retention parameters
- Tag-recapture parameters
- Variance adjustments
- Error structure for discard and mean body weight
- Controls for weighting likelihood components (lambdas)

Appendix 6

Alternative methods used to standardized bigeye CPUE of the Brazilian longline fishery

Brazil scientists presented additional analyses of the standardized catch rates of the Brazilian longline fishery for comparison matters with the fleet strategy model. The group suggested that model should be rerun excluding bigeye tuna catch to the dataset used to determine the fishing tactics (cluster analysis and PCA). A comparison between GLM analyses using tweedie distribution and delta-lognormal was also suggested. All two approaches resulted in a very similar CPUE trajectory during the time-series **Figure 1**. A summary of the proportion of vessels operating under the various “fleet strategies”, by year was produced by the model “strategy without bigeye catch” **Figure 2**. This figure indicates that, similarly to the original model (SCRS/2010/036), the vessel strategies vary during the time series. **Figure 3** shows the nominal and standardized CPUE constructed excluding bigeye catch for the strategy definition. There was some indication of a general increase in CPUE in the most recent years.

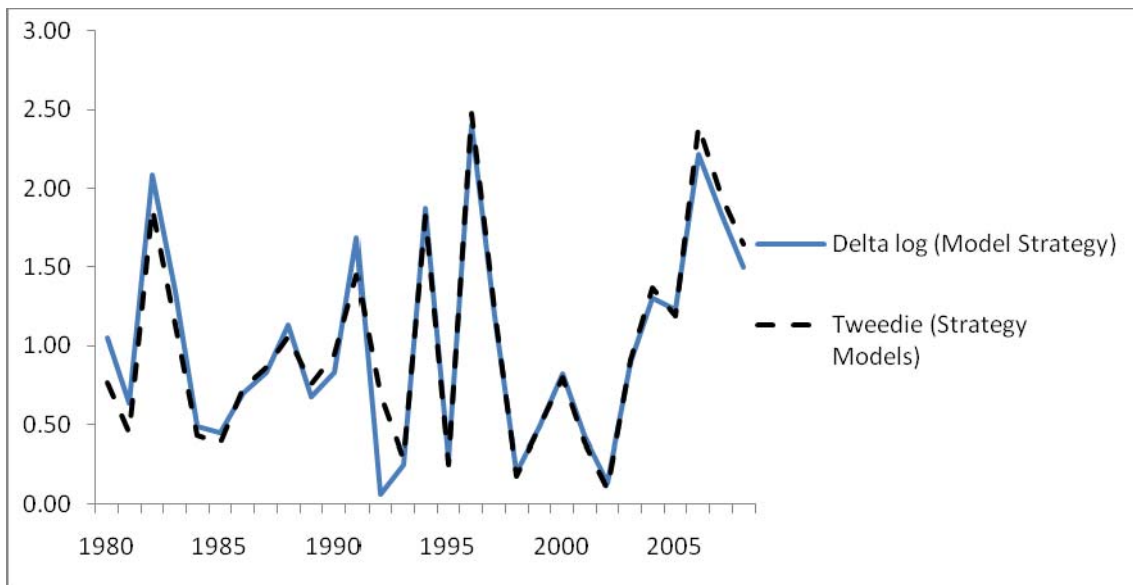


Figure 1. Comparison of indices of abundance from model strategy using Tweedie and delta-lognormal distribution. The series have been scaled to the mean of the common years.

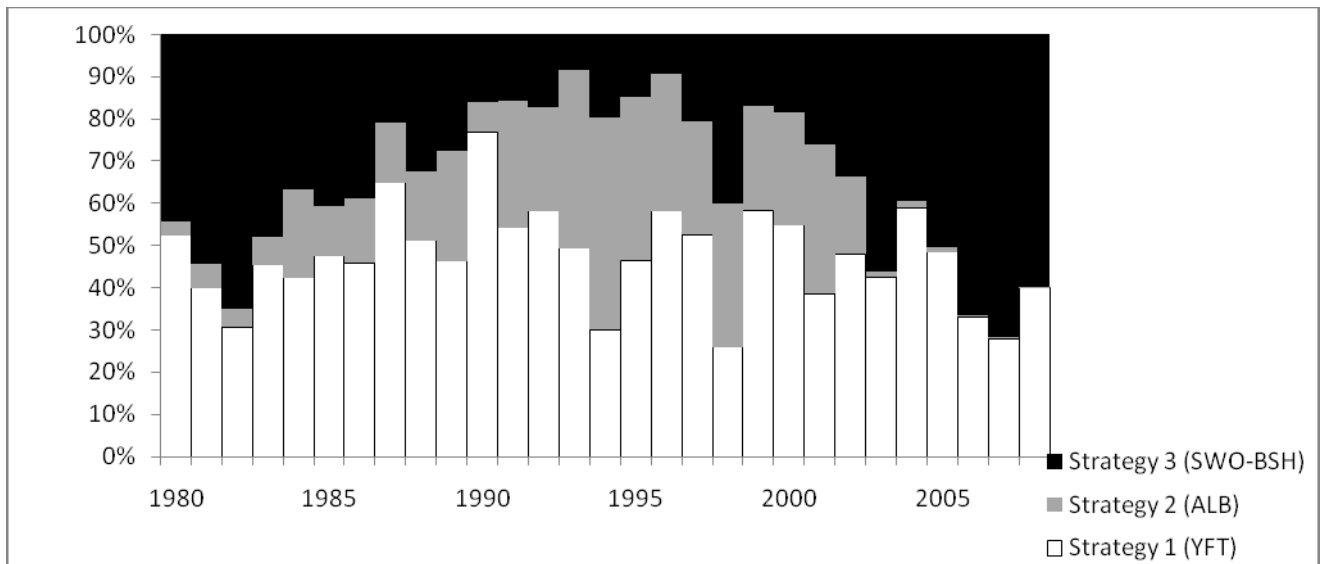


Figure 2. Relative frequency of Strategy 1 to 3, by Year, model fishing strategy without bigeye catch.

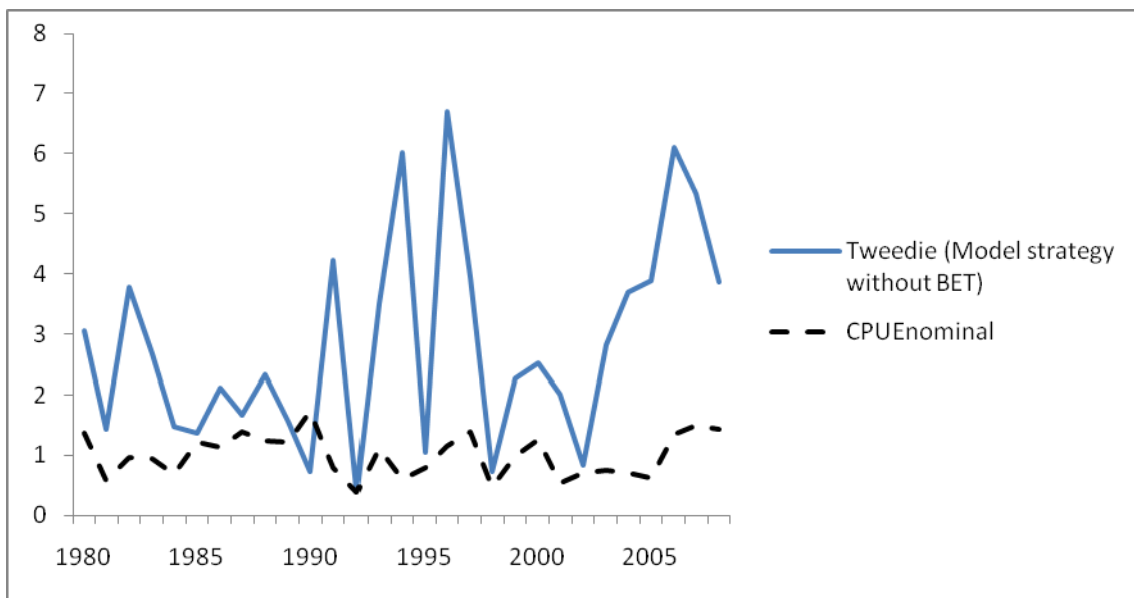


Figure 3. Standardized and nominal indices of abundance for the Brazilian longline fleet constructed excluding bigeye catch for the strategy definition.