IOTC-2009-WPB-06

Preparation of data input files for the stock assessments of Indian Ocean Swordfish

IOTC Secretariat[1]

Summary

This document describes the methods used by the IOTC Secretariat to prepare catch tables, length-frequency samples and catch-at-size and catch-at-age tables for the Swordfish, for the period 1950-2007, using estimates of total catch and the available catch- and effort, size frequency data and other biological data in the IOTC database.

The IOTC Secretariat estimated total catches of swordfish, in number and weight, per year, quarter, and assessment area and fishery, for the period1950-2007, using information from the IOTC database, in particular estimates of total catches by fishery and year, and catch-and-effort and size frequency data by time-area strata. In addition, the Secretariat prepared length-frequency samples from the size frequency data available in the IOTC databases. These datasets were prepared to be used in assessments using Stock-Synthesis-III. The Secretariat also estimated Catch-at-Size and Catch-at-Age tables for the Swordfish by using the information available in the IOTC databases, to be used in assessments using Age-Structured Production Model. The results are affected by the lack of information for some fleets, periods and years, and, in particular, by the lack of catch and size data from most artisanal fleets and some industrial fleets.

Rationale

The IOTC database contains estimates of total catches by country, gear, year and IOTC Area (**Figure 1**, page 2). In addition, the IOTC database contains catch-and-effort data and size frequency data by country, gear, time-area strata and species, which generally represent a sample of the total catches estimated by country, gear, year and species.
The Secretariat used the above data to produce the following information for the swordfish:

- Input files for stock assessment models being currently used by the WPB, in particular Stock Synthesis III (SS3) and Age-Structured Production Model (ASPM).
  a. **SS3**: Estimates of total catches of swordfish, in number and weight, and non-raised length-frequency data (samples) available by year, quarter and fishery.
  b. **ASPM**: Estimates of total catches of swordfish, in number and weight, and numbers of swordfish estimated by age interval, year, quarter and fishery (which requires the estimation of total numbers of swordfish by length interval, year, quarter and fishery, or Catch-at-Size).
- Stock status indicators (e.g. trends in average weight per fishery).
- Tables of total catch by fleet, gear, year, month and five degrees square areas.

The construction of a catch-at-size table for a particular species requires that length frequency distributions are assigned to the total catch. Thus, the sampled weight estimated for each stratum (i.e. the weight resulting from summing up the weights estimated for the specimens within each length class) is raised to the nominal catch recorded for that stratum.

Species involved

Stock assessment tables were estimated for the Swordfish only. The estimation of stock assessment tables for marlins or Indo-Pacific sailfish has not been attempted in this paper due to a paucity of data.

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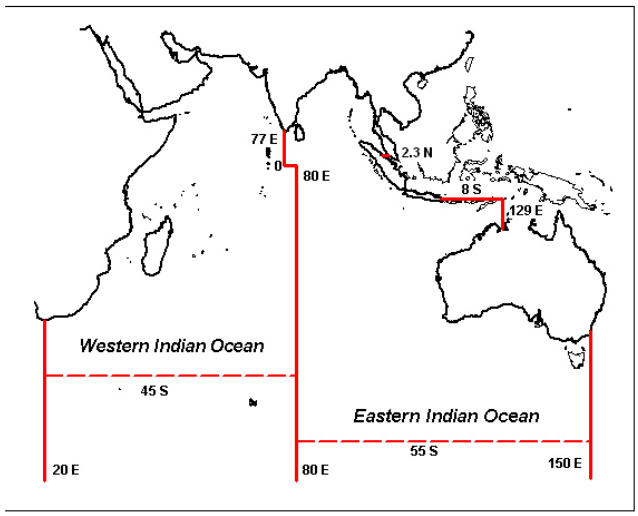
Basic Data

Four datasets are used for the preparation of stock assessment tables for the Swordfish:

- *Nominal catches*: Total catch estimates per Species, Fleet, Year, Gear and IOTC Area (**Figure 1**). The data in this dataset issues from two different sources:
  a. Reports from the flag countries or reports from other countries on the catches of foreign vessels operating within its Economic Exclusive Zone or based in ports within its territory.
  b. Estimates carried out by the IOTC Secretariat: this may involve changes in the catches reported by the above or the estimation of catches for non-reporting fleets (e.g. catches recorded under the NEI[2] category).

Figure 1: IOTC areas used for the Nominal Catches



- *Catches per area* (from catch-and-effort): Catches (in tonnes or/and in number) are recorded per Species, Fleet, Year, Gear, Fishing Mode, Time Interval (month or quarter usually) and area (usually 1^0 square areas for industrial purse seine fisheries, 5^0 square areas for industrial longline fisheries and various regular or irregular areas for artisanal fisheries). Catches per area are not available for all Nominal catches strata. When recorded, the catches in these datasets might represent the total catches of the species in the year for the fleet and gear concerned or represent simply a sample of those.
- *Size data*: Size frequency data (standard or processed length or standard or processed weight) are recorded per Species, Fleet, Year, Gear, Fishing Mode, Time Interval (month or quarter or year usually) and area (usually 5^0 square areas for purse seine fisheries, 10^0 latitude by 20^0 longitude for longline fisheries and various regular or irregular areas for artisanal fisheries). Size data are not available for all Nominal catches strata. When recorded, the size data might represent the total catches of the species in the strata concerned (or Catch-at-Size) or simply a sample of those.
- *Biological data*: includes several types of biological parameters for the swordfish, in particular:
  a. Conversion from non-standard measurements into fork length: Equations (data) used to convert specimens of swordfish measured by using non-standard procedures into the standard length measurement used for the swordfish, representing the distance from the tip of the lower-jaw to the fork of the tail (fork length).
  b. Conversion from fork length into live weight: Equations (data) used to estimate sample weights from the available lengths (length-weight relationships).
  c. Sex-ratio: Data used to estimate numbers of swordfish by sex from the available numbers of swordfish.
  d. Age-Length keys: Data used to estimate numbers of swordfish by age (Catch-at-Age) from the numbers of swordfish by length estimated (Catch-at-Size).

The type of information recorded in each case is summarized in **Table 1** below:

Table 1: Main types of fisheries statistics gathered by the IOTC

Dataset	*Fishery Strata*	*Time Strata*	*Area Strata*	*Represents*
Nominal Catches	Fleet-Gear (or gear aggregate)-Species (or species aggregate)	Year	IOTC Area	Total catches
Catches per area	Fleet-Gear (or gear aggregate)-Fishing Mode (purse seine only)-Species	Month (quarter or year)	1°square area (purse seine) 5°square area (longline) Other regular or irregular areas	Sample
Size data	Species- Fleet-Gear (or gear aggregate)-Fishing Mode (purse seine only)-Type of measurement (length or weight, standard or processed)-Size interval (between size classes)	Quarter (year or month)	5°square area (purse seine) 10°Lat.*20°Lon. area (longline) Other regular or irregular areas	Sample
Biological data	Various, depending on dataset	Various	Various, depending on dataset	Sample

[2] Not elsewhere identified

Input Tables

The Secretariat prepared the following input tables for the swordfish:

- Stock assessments of swordfish: Two sets of tables were prepared, depending on the type of assessment models to be used:
  ASPM or assessment models using Catch-at-Age data
  a. Total catches of swordfish, in number of specimens and weight, by year, quarter and assessment fishery.
  b. Total number of specimens of swordfish estimated by age (Catch-at-Age), fishery, year, and quarter
  SS3 or assessment models using non-raised length frequency data (samples)
  a. Total catches of swordfish, in number of specimens and weight, by year, quarter, assessment fishery, and assessment area.
  b. Number of swordfish specimens sampled by length interval, year, quarter, assessment fishery, and assessment area.
- Stock status indicators for billfish species: The Secretariat used total catches, catch-and-effort, length frequency samples and Catch-at-Size data in the preparation of sets of stock status indicators for swordfish, marlins and Indo-Pacific sailfish.
- Total catches by time-area strata: The Secretariat prepared a table containing estimates of total catches of swordfish, in number and weight, by fleet, gear, year, quarter, and 5^0 square areas.

An example of the above tables can be found in **Appendix I**.

Data Processing

Estimation procedures used for the preparation of data for the assessments of swordfish

The way in which the Secretariat prepared the information to be used for the assessments of swordfish is summarized below. Details about these procedures are provided in the following sections.

Assessment models using estimates of Catch-at-Age (ASPM)

1. Standardizing catch and size frequency tables
   a. Nominal catches (NC): Assigning the catches not reported by species/gear by species/gear (NC➔NCst)
   b. Catch-and-effort (CE): Assigning catches not recorded by 5^0 grid/quarter by 5^0 grid/quarter (CE➔CEst)
   c. Size frequency (SF➔LFst):
      i. Converting non-standard measurements into standard measurements
      ii. Breaking the existing lengths into the standard length class intervals used for the species (e.g. 15-18cm, 18-21cm, etc.)
      iii. Assigning samples not recorded by area (purse seine and other gears)/quarter by area/quarter
2. Breaking the NCst by quarter and 5^0 grid using the CEst (NCst➔NCds)
3. Assigning length frequency samples to all NCds strata (Fleet-Gear-Year-Quarter-PS/Other Area) (NCds➔LFcv)
4. Deriving Catch-at-Size (CAS) by scaling up length frequency distributions in LFcv from sample weight to total weight for each stratum (LFcv➔CAS)
5. Adjusting/estimating NCds weights/numbers by using average weights derived from the CAS (NCds➔NCad)
6. **Swordfish catch input file** (NCad➔**NC_{ASPM}**) Aggregating the catches in NCad by fishery (Fishery-Year-Quarter-Total catch of swordfish (in number and weight))
7. **Swordfish Catch-at-Age input file** (CAS➔**CAA_{ASPM}**): Estimating CAA for swordfish by using the existing CAS (Fishery-Year-Quarter-Age class interval (0-15+)-Total number of swordfish specimens)

Assessment models using non-raised length frequency data (SS3)

1. Standardizing catch and size frequency tables
   a. Nominal catches (NC): Assigning the catches not reported by species/gear by species/gear (NC➔NCst)
   b. Catch-and-effort (CE): Assigning catches not recorded by 5^0 grid/quarter by 5^0 grid/quarter (CE➔CEst)
   c. Size frequency (SF➔LFst):
      i. Converting non-standard measurements into standard measurements
      ii. Breaking the existing lengths into the standard length class intervals used for the species (e.g. 15-18cm, 18-21cm, etc.)
2. Breaking NCst by quarter and 5^0 grid using the CEst (NCst➔NCds)
3. Assigning length frequency samples to all NCds strata (Fleet-Gear-Year-Quarter-PS/Other Area) (NCds➔LFcv)
4. Deriving Catch-at-Size (CAS) by scaling up length frequency distributions (LFcv) from sample weight to total weight for each stratum (LFcv➔CAS)
5. Adjusting/estimating NCds weights/numbers by using average weights derived from the CAS (NCds➔NCad)
6. **Swordfish catch input file (NC_{SS3})**:
   a. Assigning the catches of swordfish (NCad) by assessment area (NCad➔NCar)
      i. Assigning the catches of selected Fleet-Gear strata (artisanal gears) to specific assessment areas
      ii. Aggregating the remaining catches of swordfish by assessment area by using NC
   b. Aggregating the catches of swordfish in NCar by assessment area and fishery (NCar➔ **NC_{SS3}**) (Fishery-Year-Quarter-Assessment Area-Total catch of swordfish (in number and weight))

7. **Swordfish length frequency samples file (LF_{SS3})**:
    a. Scaling down raised length frequency data in LFst to sample numbers (LFst➔LFsp)
    b. Assigning the length frequency samples of swordfish (LFsp) by assessment area (LFsp➔LFaf)
        i. Assigning the length frequency samples of selected Fleet-Gear strata to specific assessment areas (all artisanal and some industrial fisheries)
        ii. Assigning the remaining length frequency samples of swordfish by assessment area (most industrial fisheries)
    c. Aggregating the length frequency samples of swordfish in LFaf by assessment area and fishery (LFaf➔ **LF_{SS3}**) (Fishery-Year-Quarter-Assessment Area-Size class interval-Number of swordfish sampled)

Estimating total catches by species and assessment fishery

The catches in the IOTC nominal catches database are not recorded by species and/or by gear in all cases. The Secretariat conducted a review aiming at estimating catches when data were not available by species or gear in the IOTC database. This process was documented in a paper presented to the WPTT in 2004 (IOTC-2004-WPTT-06).

Standardizing the data in the catch-and-effort table

The catches in the catch-and-effort table are recorded under different levels of aggregation.
All the catches from this record were assigned by Species-Fleet-Gear-Fishing Mode-Year-Month-5° square grid-Catch in number of fish-(and/or)-Catch in metric tons.

i. Area allocation: All the catches not recorded by 5° square areas were assigned to 5° square areas as follows:
    a. Allocation of catches recorded under irregular areas to regular grids: The catches recorded under irregular areas (e.g. port of unloading, fishing district, etc.) were assigned to the neighbouring regular grids.
    b. Allocation of catches recorded under areas that fell within a single 5° square area: all catches recorded under areas that fell within a 5° square area were assigned to the corresponding 5° square areas.
    c. Allocation of catches recorded under areas overlapping two or more 5° square areas: all catches recorded under areas that overlapped two or more 5° square areas were assigned proportionally by 5° square areas (i.e. by using the proportions obtained by dividing the amount of 1 degree square grids that fell within each 5° square area over the total amount of squares from the overlapping area).
ii. Time period allocation: The catches available in the catch-and-effort file were assigned by month as follows:
    a. Allocation of catches recorded under time period strata that fall within a single month: all catches recorded under time periods that fell within a month were assigned to the corresponding months.
    b. Allocation of catches recorded under time period strata overlapping two or more months: all catches recorded under time periods that overlapped two or more months were assigned proportionally by month (e.g. 1/3 of the catches recorded under the first quarter of a year were assigned to each of the months making up that quarter).

Standardizing the available size frequency data

The following process was used to convert the samples available for the swordfish into standard form (applies to both types of assessment models unless otherwise specified):

i. Converting from non-standard measurement types into standard length (**Table 3**): The regression equations presented in **Table 3** were used to estimate the distance from the tip of the lower jaw to the fork of the tail (fork length) for specimens of swordfish that were recorded under non-standard lengths or weights in the IOTC database (deterministic conversion).
ii. Breaking the samples according to the standard length frequency intervals used for the swordfish: The length-frequency intervals that are used for billfish species are shown in **Table 2**.

Table 2: Standard length, first length, interval and total number of size classes used for billfish species

Species	*Standard Length**	*First length (cm)*	*Interval between length classes (cm)*	*Total number of size classes*	*Maximum interval allowed (cm)*
Swordfish	Fork length	15	3	150	5
Blue marlin	Fork length	15	3	150	5
Black marlin	Fork length	15	3	150	5
Striped marlin	Fork length	15	3	150	5
Indo-Pacific sailfish	Fork length	15	3	150	5

NOTE: All samples in the IOTC database were assigned according to the specifications above; the samples recorded under length intervals greater than the maximum interval specified above were not used
***Refers to the straight distance measured, to the closest lower centimetre, between the tip of the lower-jaw and the fork of the tail (LJFL)**

a. Allocation of specimens recorded under length classes that fall within a single standard length class:

- Billfish specimens recorded under one centimetre length classes were aggregated under the corresponding three centimetre length classes (e.g. specimens recorded under the classes 15-16cm, 16-17cm and 17-18cm were accumulated under fork length class 15).
- Billfish specimens recorded under two or three centimetre length classes that fell within standard length classes were assigned to the corresponding standard length classes (e.g. specimens recorded under length classes 15-17cm or 15-18cm -for length frequency data reported by 2cm or 3cm length intervals, respectively-, were assigned to standard length class 15-18cm)

b. Allocation of specimens recorded under length classes overlapping two or more standard length classes: all the specimens recorded under length classes that overlap the standard classes used for the species (**Table 2**) were assigned proportionally to the corresponding standard length classes (e.g. 1/2 of the swordfish specimens recorded under the length class 17-19cm were assigned to length class 15-18cm and 1/2 to length class 18-20cm; 1/5 of the specimens recorded under length class 17-21cm were assigned to length class 15-18cm, 3/5 to length class 18-20cm and 1/5 to length class 20-22cm). The specimens of swordfish from samples using length class intervals 6cm or higher were discarded.

Table 3: Swordfish: Regression equations used to convert from non-standard measurements into standard lengths

Type Measurement	*Equation*	*Parameters*	*Sample size*	*Size range (cm)*	*Variance*	*Covariance ab*	*Mean Residual*	*Gradient*
Cleithrum to caudal fork length[A]	$\frac{(L+b)}{a}$	a= 0.8087 b= 8.6712						
Cleithrum to keel length[B]	$aL+b$	a=1.5511 b=13.5025	179	74-228				
Eye to Fork Length[A]	$aL+b$	a=1.066 b=10.449	123	48-255				
Pectoral fin to anal fin length[A]	$aL+b$	a=2.5407 b=25.698	1806	18-105				
Pectoral fin to caudal fork length[A]	$aL+b$	a=1.2398 b=11.204	55	60-157				
Weight gilled and gutted[D]	$(w/a)^{(1/b)}$	a=4.3491E-06 b=3.188	3600	89-266				
Weight headed and gutted[D]	$(w/a)^{(1/b)}$	a=0.000004592 b=3.137						
Weight round[C]	$(w/a)^{(1/b)}$	a=0.000003815 b=3.188						

A: Biological data on tuna and Tuna-like species gathered at the IOTC Secretariat: Status Report (Poisson 2001 Reunion) (IOTC-2005-WPTT-05)
B: Two step conversion as CKL = (0.690253*EFL) -3.541823 in formula LJFL = 8.00884+(1.07064*EFL); NOAA Data (Pacific Ocean)
C: Converted to GGT (GGT=RND/1.14 (Mejuto et al. 1998)) and inverted length-weight equation (ICCAT Mejuto et al 1998 South-East Atlantic Ocean)
D: Inverted length-weight equation (ICCAT Field Manual Chapter 2.1.9 Swordfish (Mejuto et al 1998) Southeast Atlantic)

Assessment models using estimates of Catch-at-Age (ASPM)

iii. Area allocation: The samples in the size frequency table are recorded under different types of geographic areas. The samples from this record were aggregated depending on the type of assessment to be conducted:

Figure 2: Areas used for industrial purse seiners

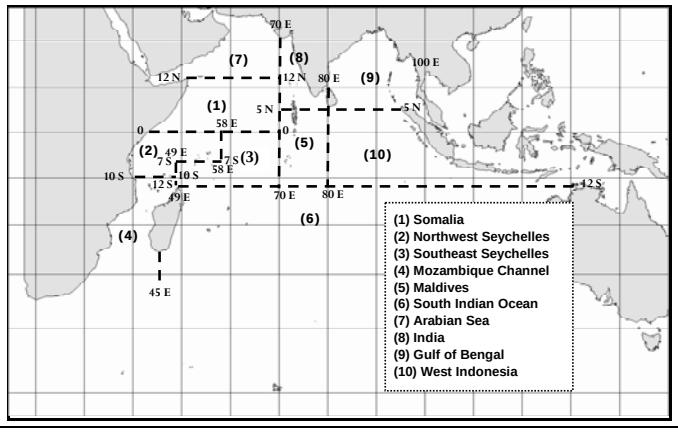
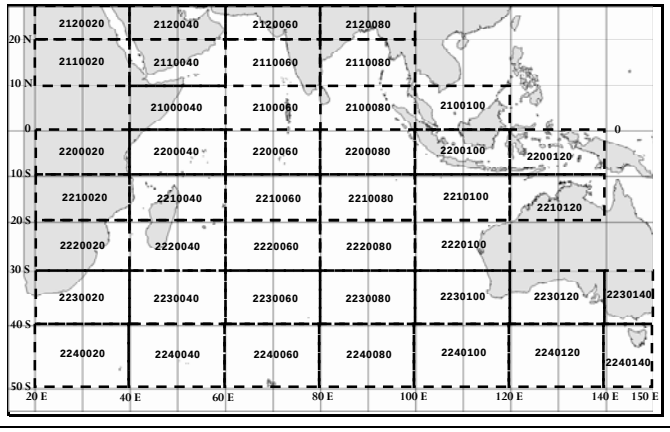


Figure 3: Areas used for other fisheries



Two different types of areas were used, depending on the type of gear used:

- Industrial purse seine fisheries: The statistical areas used for the sampling of EC purse seiners were used; these are shown on **Figure 2** (above).
- Other fisheries (industrial longline plus all artisanal fisheries): 10º latitude by 20º longitude areas were used, as shown on **Figure 3** (previous page).

It is important to note that Japan and Taiwan,China have always reported size data for their longline fisheries as per the areas shown on **Figure 3** (previous page).

The following process was followed to allocate the existing samples by area:

a. Allocation of samples recorded under irregular areas: The samples recorded under irregular areas (e.g. port of unloading, fishing district, etc.) were assigned to regular areas.
b. Allocation of specimens recorded under areas that fall within a single standard area: all specimens recorded under areas that fell within the standard areas were assigned to the corresponding areas (as shown on **Figures 2-3**).
c. Allocation of specimens recorded under areas overlapping two or more standard areas: the specimens recorded under areas overlapping two or more standard areas (**Figures 2-3**) were assigned proportionally by standard area (i.e. by using the proportions obtained by dividing the amount of 1º square grids that fell within each standard area over the total amount of squares from the overlapping area).

iii. Time period allocation: The available length frequency samples were assigned by quarter as follows:

a. Allocation of specimens recorded under time-periods that fall within a single quarter: all specimens from samples recorded under time periods that fell within a quarter were assigned to the corresponding quarter.
b. Allocation of specimens recorded under time-periods overlapping two or more quarters: all specimens from samples recorded under time-periods that overlapped two or more quarters were assigned proportionally by quarter (e.g. 2/3 of the specimens recorded under the time period February-April of any year were assigned to the first quarter (Jan-Mar) of that year while the remaining 1/3 specimens were assigned to the second quarter (Apr-Jun)).

iv. Estimation of sample weight: The weight for each sample was calculated by adding the weights estimated for all the specimens making it. The equations used to estimate weights from the available lengths are shown in **Table 4** (note that deterministic methods were used for the conversion).

Table 4: Swordfish: Equation used to convert from standard (lower-jaw to fork) length into round weight

Species	*Gear Type/s*	*From type measurement – To type measurement*	*Equation*	*Parameters*	*Sample size*	*Length*
Swordfish	All gears	Fork length(cm) – Round Weight(kg)[A]	$w^{live} = aL^{b}$	a=0.0000042030 b=3.21340	n/a	n/a

A: ICCAT (Mejuto et al., 1988)

Assessment models using non-raised length frequency data (SS3)

iii. Scaling raised length frequency data down to sample numbers: The length frequency data in the IOTC database do not represent sample numbers in all cases as some countries report length frequency data that has been raised in various ways (e.g. to the catches in the stratum covered through sampling, to the total catches estimated for the country, etc.). The sample numbers were used in these cases to scale down the reported length frequency data, i.e. the number of specimens recorded under each length class was multiplied by the number obtained by dividing the total number of specimens sampled (all lengths combined) by the total number of specimens in the raised length frequency (all lengths combined).

iv. Allocation of assessment area: The existing samples were aggregated by assessment area. The areas used for the assessment are shown in **Table 5** and **Figure 4** (next page). The catches of swordfish from areas outside the four assessment areas were assigned to the closest area, as indicated through the arrows on **Figure 4**. **Table 5** shows also total catches by area accumulated for the entire catch data series (1950-2007) and the contribution that the catches from each area made out of the total accumulated catches for 1950-2007, and in recent years (2003-07).

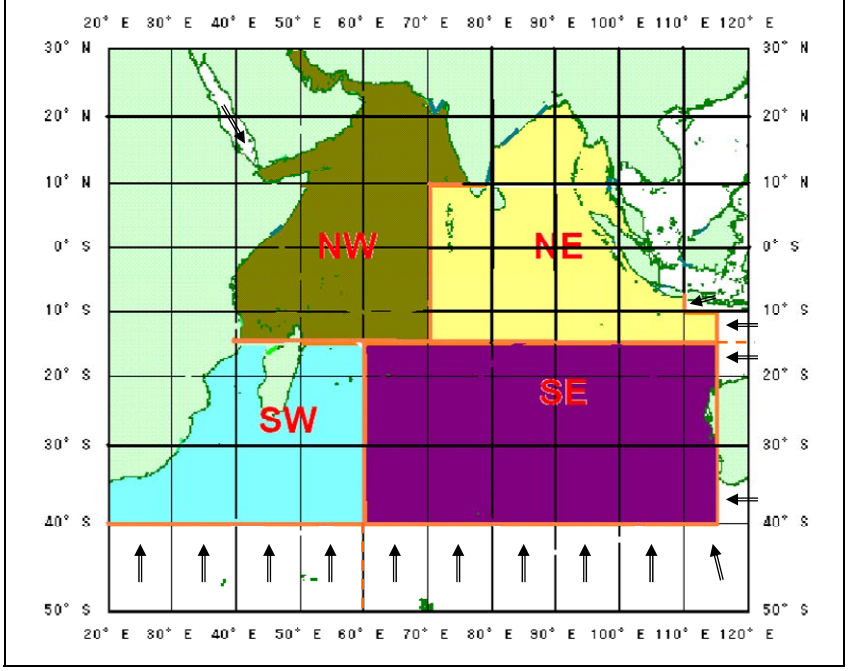
Table 5: Areas used for the assessments of Indian Ocean swordfish; the total catches (tonnes) accumulated for the period 1950-2007 (Total Catch 50-07), the relative importance of the catches in each area over both the entire catch series (%50-07) and in current years (%03-07), and the catches by assessment fishery (see Table ??) in each of the areas concerned are also shown

Area	*Description*	*Catch (t) 50-07*	*% 50-07*	*% 03-07*	*Catches by Fishery (t)*						
					ALGI	*AUEL*	*EUEL*	*ISEL*	*JPLL*	*TWFL*	*TWLL*
NW	Northwest Indian Ocean	183,906	31	35	1,731		6,382	3,252	27,151	1,524	143,865
SW	Southwest Indian Ocean	164,507	28	22	178		33,394	19,456	22,886	20	88,573
NE	Northeast Indian Ocean	152,901	26	24	25,365		1,246		12,933	40,023	73,334
SE	Southeast Indian Ocean	82,927	14	20	648	10,679	27,922	1,943	10,683	8	31,045

The following process was used to allocate the existing samples by area:

a. Allocation of the samples available for selected fisheries to specific assessment areas: The samples available for some selected fisheries were fully assigned to specific assessment areas on the assumption that the majority of the specimens sampled on those fisheries came from the area assigned. This is thought to be the case with the majority of artisanal fisheries for which there is size data available and with a limited number of industrial fisheries. Details on the areas that were assigned to each fleet-gear size frequency stratum can be found in **Appendix II.**
b. Allocation of the samples available for other fisheries:
    a. Allocation of specimens recorded under areas that fall within a single assessment area: all specimens from samples recorded under areas that fell within one of the areas used for the assessment (**Figure 4**) were assigned to the corresponding assessment area.
    b. Allocation of specimens recorded under areas overlapping two or more assessment areas: all specimens from samples recorded under areas that overlapped two or more assessment areas were assigned proportionally by assessment area (i.e. by using the proportions obtained by dividing the amount of 1º square grids that fell within each 5º square area over the total amount of squares from the overlapping area)

Figure 4: Areas used for the assessments using non-raised length frequency data (SS3)



v. Time period allocation: The available length frequency samples were assigned by quarter in the same way as indicated in iii.a. and iii.b. (page 6, ASPM)
vi. Allocation of assessment fishery: Each Fleet-gear stratum in the length frequency data table was assigned to the corresponding assessment fishery. Details on the fisheries that were assigned to each fleet-gear length frequency stratum can be found in **Appendix III**. **Table 6**, on next page, shows the fisheries that are used for the assessment of swordfish. **Table 6** (next page) shows also total catches by fishery accumulated for the entire catch data series (1950-2007) and the contribution that the catches from each fishery made out of the total accumulated catches for 1950-2007, and in recent years (2003-07).

The resulting data were aggregated to obtain the number of swordfish specimens sampled by standard length interval (3cm), year, quarter, assessment fishery, and assessment area. An example of the Input Table containing the samples to be used in the SS3 stock assessments can be found in **Appendix I**.

It is important to note that no weighting procedure was used when aggregating the available samples by assessment fishery and area.

Table 6: Fisheries used for the assessments of Indian Ocean swordfish; the total catches accumulated for the period 1950-2007 (Total Catch 50-07) and the relative importance of each fishery over both the entire catch series (%50-07) and in current years (%03-07) is also shown

Fishery	*Description*	*Total Catch 50-07*	*% 50-07*	*% 03-07*
ALGI	Contains data for all gillnet, trolling and other minor artisanal fisheries	27,923	5	7
AUEL	Contains data for the longline fishery of Australia (target is SWO)	10,679	2	2
EUEL	Contains data for EU longliners (from Spain, Portugal and the UK) plus other longliners assimilated to EU longliners (generally owned by Spanish nationals), all targetting SWO	68,944	12	32
ISEL	Contains data for the semi-industrial longline fleets operating in Reunion(France), Mayotte(France), Madagascar, Mauritius and the Seychelles, which also target SWO	24,651	4	5
JPLL	Contains data for the longline fishery of Japan plus other fleets assimilated to the Japanese fleet (e.g. South Korea, Thailand, Oman)	73,653	12	6
TWFL	Contains data for the fresh-tuna longline fleets of Taiwan and Indonesia, plus other fresh-tuna longline fleets assimilated to those and all sport fisheries and fleets operating hand lines	41,574	7	9
TWLL	Contains data for the large scale tuna longline fleet of Taiwan,China, plus other longline fleets assimilated to the Taiwanese fleet (a component of those fleets may target SWO)	336,816	58	39

Breaking the nominal catches by time-period and area

The aim of this process is to break the catches recorded in the nominal catches table by time-period and area strata. This information is used:

- For the estimation of total catches by fishery, year, quarter and assessment area (input file for SS3): The catches recorded in the nominal catches table (by year and fishery) need to be further broken by fishery, year quarter and assessment area (**Figure 4**), as required for SS3 stock assessments.
- For the estimation of catch-at-size tables: The length distributions of tuna species may change depending on the area and/or time fished and therefore the estimation of catches-at-size is likely to be improved if this information is used.
- For the estimation of total catches by time-period and 5° square area for the Tuna Atlas.

The steps given to assign the catches available for each NC stratum per month and 5° square areas are indicated below:

i. Nominal catches strata for which catches per time and area exist:
   a. Deleting strata from the catches per time and area table: The catches per time and area for NEI-(deep)-freezing longliners and NEI-fresh tuna longliners were not used because they refer to very specific areas and time-periods and are not considered to be representative of the activities of these fleets.
   b. Breaking the nominal catches per time and area: The nominal catches were broken per time and area in years for which spatio-temporal catches are available for the fleet concerned.

ii. Nominal catches strata for which catches per time and area do not exist:
   a. Catches per area are available for the same fleet in years before or after the year concerned:
      i. Catches for the same species are available: The catches recorded in the five years closest to the year of reference were accumulated and the average values obtained used to break the catches per area in the year concerned. Data extending to up to 25 years above or below the year concerned are used.
      ii. Catches for other species are available:
         a. The catches recorded in the year of reference were accumulated and the average values obtained used to break the catches per area in the year concerned
         b. The catches recorded in the five years closest to the year of reference were accumulated and the average values obtained used to break the catches per area in the year concerned. Data extending to up to 25 years above or below the year concerned are used.
   b. Catches per area are not available for the same fleet in years before or after the year concerned or they are available but very far in time (more than 25 years before or after the year concerned):
      i. Fleets that are presumed to operate as other fleets for which catches per area exist: This refers mainly to industrial fleets. The catches per area available for other fleets (and years) are used to break the nominal catches per month and 5° square area/s.
         a. Catches per area for the alternative fleet are available for the same year: This information is used to break the nominal catches per time and area.
         b. Catches per area for the alternative fleet are not available for the same year: The same substitution scheme as the one defined in ii.a. above is used.

      The fisheries for which the above substitution scheme was used and the alternate fleets and gears selected for substitution in each case can be found in **Appendix IV**.

ii. Fleets that are presumed to operate in specific areas: This refers mainly to artisanal and semi-industrial fleets. One or more 5° square areas were assigned to each fleet.

c. Time-area catches exist for other fleets in the areas concerned: The nominal catches are broken per month and area according to the proportion that the catches available from other fleets make in the area/s concerned.

d. Time-area catches do not exist for other fleets in the areas concerned: The catches for the fleet concerned are broken proportionally per month and area.

Estimating Catch-at-Size (CAS)

Catch-at-Size data are used in the estimation of Catch-at-Age, which is one of the input files used in ASPM or stock assessments that use estimates of Catch-at-Size or Catch-at-Age.

The aim of this process is to estimate length frequency distributions for each species, year and gear type. Thus, the accumulated weight estimated from the specimens making up the length frequency shall be the same than the total weight recorded in the stratum concerned and the weight issuing from all the strata shall be equal to the total catches recorded for the species in the year concerned. These data are used to estimate catches-at-age and other information used for stock assessment.

The time-area resolution used for the estimation of catches-at-size depends on the gear type (see 'Standardizing the available size frequency data' on page 2 for details). The minimum sample size was set to 30 specimens. The samples made up of less than 30 fish were completed with specimens from other stratum/a until the minimum sample size (30 specimens) was attained.

The amount of length frequency data available is scarce for some fisheries and/or periods. The use of length frequency information from fleets and/or gears other than the one for which nominal catches are recorded is required in many cases. The substitution scheme used to assign length frequency data per time and area is explained below:

i. Length frequency data are available for the stratum concerned:

a. Deleting samples from the length frequency table: The samples recorded for South Korea were not used because they are presumed to be very incomplete.

b. Assigning the available length frequency distributions by strata: The remaining length frequency distributions were assigned by strata.

ii. Length frequency data are not available for the stratum concerned:

a. Length frequency data are available within the year before or after the quarter concerned:

i. Length frequency data are available for the same fleet and gear. Two substitution schemes are used depending on the gear type:

a. Industrial purse seiners: The areas defined in **Figure 2** are used. The following latitude and longitude are assigned to each area[3]:

Table 7: Coordinates assigned to PS areas (used for strata substitution)

PS Area	*Q-Lat-Lon*	*PS Area*	*Q-Lat-Lon*
(1) Somalia	1 00 040	(6) S Indian Ocean	2 20 060
(2) NW Seychelles	2 00 020	(7) Arabian Sea	1 20 040
(3) SE Seychelles	2 00 060	(8) India	1 00 080
(4) Moz. Channel	2 10 020	(9) Gulf of Bengal	1 00 100
(5) Maldives	2 00 080	(10) W Indonesia	2 00 100

b. Other gears: The areas defined in **Figure 3** are used. Two regions are identified:

i. Areas below 10°S

ii. Areas above 10°S

Table 8: Time-area substitution scheme used to assign samples to nominal catches strata with less than 30 swordfish lengths measured (note that only the first five steps and the last are shown)

Step	*Lat*	*Long*	*Qtr*	*Description*
1	0	0	-0.25	Length frequency data from the same area and previous quarter are used for substitution, if any
2	0	0	0.25	Length frequency data from the same area and following quarter are used for substitution, if any
3	0	-20	0	Length frequency data from the first area to the West and same quarter are used for substitution, if any
4	0	20	0	Length frequency data from the first area to the East and same quarter are used for substitution, if any
5	0	-20	-0.25	Length frequency data from the first area to the West and previous quarter are used for substitution, if any
764	0	120	1.00	Length frequency data from the area 120 degrees to the East and following year are used for substitution, if any

Note that the latitude and longitude defined above for industrial PS and those from the 10*20 grids for other fisheries are used

[3] Note that the substitution scheme is based on changes in time and/or space (latitude and/or longitude). The areas assigned are used for the substitution.

The sizes of the specimens of yellowfin tuna and bigeye tuna seem to vary markedly depending on the latitude. The substitution scheme is therefore applied independently to each area (i.e. Length frequency data from areas below 10°S are not used for strata in the North and *vice versa*). **These regions are used for all species, including swordfish. The size data available for the swordfish need to be analyzed in order to assess if the sizes of swordfish vary significantly depending on the area or time fished.**

The substitution process is based on changes in time (quarter) and/or space (latitude and/or longitude). An example of the first substitution steps is shown in **Table 8** (previous page).

ii. No length frequency data are available for the same fleet and gear: Information from other fleet/s is used. The length frequency data available from other fleets that are presumed to operate the same areas and/or use the same fishing techniques are used for substitution. The same substitution scheme in time and area is applied in each case. Three levels of aggregation are established. The complete substitution tables for each species are shown in **Appendix V**. **Table 9** below shows an example of the substitution scheme:

Table 9: Nominal catches strata and alternative fleets from which length frequency samples are used in the case that less than 30 lengths of swordfish are available for the NC strata concerned (example)

Catch Strata			*Level Aggregation 1*		*Level Aggregation 2*		*Level Aggregation 3*	
Species	*Gear*	*Fleet*	*Gear Ag1*	*Fleet Ag1*	*Gear Ag2*	*Fleet Ag2*	*Gear Ag3*	*Fleet Ag3*
SWO	LL	IND	LL	AG3	LL	AG2	LL	AG1
SWO	LL	IRN	LL	AG2	LL	AG2	LL	AG1
SWO	LL	JPN	LL	AG1	LL	AG1	LL	AG1
SWO	LL	KOR	LL	AG1	LL	AG1	LL	AG1
SWO	LL	NEI-DFRZ	LL	AG3	LL	AG2	LL	AG1
SWO	LL	PHL	LL	AG3	LL	AG2	LL	AG1
SWO	LL	SUN	LL	AG2	LL	AG2	LL	AG1
SWO	LL	SYC	LL	AG3	LL	AG2	LL	AG1
SWO	LL	THA	LL	AG1	LL	AG1	LL	AG1
SWO	LL	TWN	LL	AG3	LL	AG2	LL	AG1

For example, if no samples of swordfish are recorded for the longline fishery of South Korea in the NC stratum concerned (or the sample is made up of less than 30 specimens) the samples available for South Korea and/or Japan and/or Thailand are combined. The time-area substitution scheme referred to in the previous section applies also in this case.
If no samples are available for the above fleets the second level of aggregation is used and the third level is used in the case that no samples are found.

b. No length frequency data are available within the year before or after the quarter concerned:

i. Length frequency data are available for the same fleet in other years: The samples for the three years that are closest to the year concerned are used. Only the samples from the 25 years before or after the year concerned are used.

ii. No length frequency data are available for the same fleet in other years or they are very far in time (more than 25 years ahead or behind the year concerned). The available length data for other fleets are used. The information from the fleets and gears specified in **Appendix V** and the above substitution scheme (b.i.) apply in this case.

c. No Length frequency data are available for the gear concerned in the 25 years before or after the year concerned:

i. Length frequency data are available for the same fleet and gear anytime at all: all available samples are used (i.e. the accumulated length frequency for the whole period is used).

ii. No length frequency data are available for the same fleet and gear anytime at all: The available length data for other fleets are used. The information from the fleets and gears specified in **Appendix V** and the above substitution scheme (c.i.) apply in this case.

The average weights estimated from the samples (by using the equation in **Table 4**) are used to estimate the number of specimens or the weight for each stratum in the CAS table:

- Longline fisheries: The catches are usually recorded in numbers. The average weights estimated from the sample are multiplied by the numbers of fish recorded (from the NC table) to obtain the weights per stratum. This method is also used for fisheries other than longline for which only numbers of fish are recorded.
- Other fisheries: The catches are usually recorded in weight. The average weights estimated from the sample are divided by the weight recorded (from the NC table) to obtain the numbers per stratum. This method is also used for longline fisheries for which only the weights are recorded.

The resulting weights are accumulated per fleet, gear, year, species and IOTC Area. The factor resulting from dividing the total catches estimated for the species (nominal catches) and those issuing from the CAS table is used to estimate total weight, total number of fish and number of fish per length class for each stratum in the CAS table (i.e. the numbers of swordfish by length class for each stratum are scaled up/down so as the total number of fish for the stratum matches the number of fish estimated in the NC)

Estimating total catches by area

The catches and numbers of fish in the NC table are weighted by following the same approach (as explained in the last part of the previous section).
The catches in the resulting NC table are then aggregated depending on the assessment method to be used:

Assessment models using estimates of Catch-at-Age (ASPM)

i. Allocation of assessment fishery: Each Fleet-gear stratum in the NC table was assigned to the corresponding assessment fishery. Details on the fisheries that were assigned to each fleet-gear length frequency stratum can be found in **Appendix III**. The fisheries that are used for the assessment of swordfish are presented in **Table 6** (page 8).
ii. Aggregation of catches by year, quarter and assessment fishery: The above catches were aggregated by year, quarter and assessment fishery. An example of the Input Table containing the Total Catches table to be used in the ASPM stock assessments can be found in **Appendix I**.

Assessment models using non-raised length frequency data (SS3)

i. Allocation of assessment fishery: As in i. above.
ii. Allocation of assessment area: The catches in the NC table were aggregated by assessment area. The areas used for the assessment are shown on **Figure 4** (page 6). The catches of swordfish from areas outside the four assessment areas were assigned to the closest area, as indicated through the arrows on **Figure 4**
The following process was used to allocate the existing samples by area:
   a. Allocation of catches for selected fisheries to specific assessment areas: The catches of swordfish estimated for some selected fisheries were fully assigned to specific assessment areas on the assumption that the majority of the catches from those fisheries came from the area assigned. This is thought to be the case with the majority of the artisanal fisheries having catches of swordfish and with a limited number of industrial fisheries. Details on the areas that were assigned to each fleet-gear catch stratum can be found in **Appendix II**.
   b. Allocation of catches for other fisheries: All other catches in the NC table were assigned to the corresponding assessment areas, i.e. the catches recorded under each 5 square area were assigned to the assessment area containing that 5^0 square area. The catches estimated for 5^o squares outside the assessment areas were assigned to the closest assessment area, as indicated through the arrows on **Figure 4**.
iii. Aggregation of catches by year, quarter, assessment area, and assessment fishery: The above catches were aggregated by year, quarter, assessment area, and assessment fishery. An example of the Input Table containing the Total Catches table to be used in the SS3 stock assessments can be found in **Appendix I**.

Estimating Catch-at-Age (CAA)

The catches-at-age (CAA) for the swordfish were estimated from the available catches-at-size.
CAA was estimated using a VB model and swordfish data from the Indian Ocean (Young, J., and A. Drake. 2004[4]):

$L(t) = L_{\infty}\left(1 - e^{-K[t-t_0]}\right)$ where:

Species	Sex	L_{∞}	t_0	k
SWO	Female	323.4	-3.413	0.08148
	Male	260.47	-3.3808	0.1096

An Age-Length key, both sexes combined, was derived from above (Sheng-Ping Wang, *pers.comm.*) and used to convert the numbers of specimens estimated by length (CAS) into age (CAA). The referred Age-Length key is shown in **Appendix VI**.
The resulting Catches-at-Age were aggregated by Age class (0-15+), year, quarter and assessment fishery. An example of the Input Table containing the CAA table to be used in the ASPM stock assessments can be found in **Appendix I**.

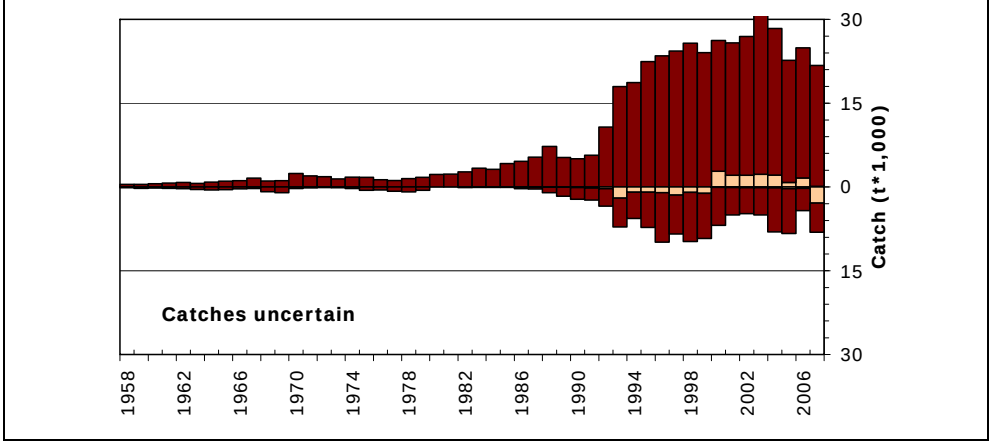
[4] Young, J., and A. Drake. 2004. Age and growth of broadbill swordfish (Xiphias gladius) from Australian waters. Final report for project 2001/014, Fisheries Research Development Corporation, Canberra, Australia. 121 pp.

Results

Total catch by year

The total catches by assessment fishery and year estimated from the process for the swordfish are shown in **Appendix VII**. The catches estimates for 2006-07 are likely to change in the future, especially for some longline fleets that have reported preliminary catches to the Secretariat (Taiwan,China, Japan, Indonesia).
The swordfish is caught by industrial longliners, gillnets and, to a lesser extent, other artisanal or recreational fisheries. **Figure 5** shows the status of the catches of swordfish for 1958-2007.

Figure 5: Uncertainty of annual catch estimates for swordfish (SWO). The amount of the catch below the zero-line has been categorized as uncertain by the Secretariat. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets (1958-2007).



The catches of swordfish estimated are thought to be more uncertain since the mid-90's due to:

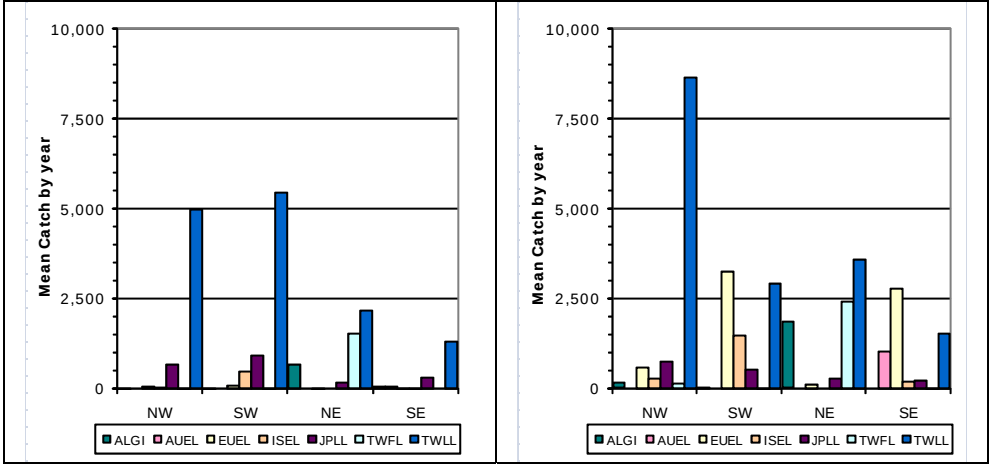
- Non-reporting industrial longliners (NEI): The amount of non-reporting longliners targeting swordfish has been increasing in recent years due to the shift of vessels from the Atlantic Ocean to the Indian Ocean.
- Poor reports from IOTC CPC's: The catches of swordfish recorded for the longline fleet of India were estimated by the IOTC Secretariat as India as never reported catches for its commercial longline fleet (around 70 vessels operating since 2004). Malaysia and Indonesia do not report catches for longliners under their flags that are not based in these countries. The catches for this component were estimated by the IOTC Secretariat.
- Conflicting catch reports: The catches for South Korean longliners reported as nominal catches and catches and effort are conflicting, with higher catches recorded in the CE table.

Catches per quarter, fishery and assessment area and Catch-at-Size data (CAS)

The precision of the estimates is likely to vary depending on the quality of the catches (see the above section), the availability of catches in time and space and the amount (coverage) and representativeness of the samples available for swordfish.

Completeness of time-area catches: **Figures 6** and **7** show mean catches (tonnes) of swordfish by year estimated by assessment area and fishery for 1988-97 and 2003-07.

Figures 6-7: Average catches of swordfish by year estimated by Area and Fishery for the entire time series (1988-1997; left) and in current years (1998-2007; right)



The amount of catches that are available in time and space *versus* the total catches of swordfish estimated are shown in the **Figures 8 to 12** below. The amount of catches for which time-area information is available has been changing over time. Three different periods can be identified:

- 1954-1966: The total catches of swordfish estimated for this period are low (below 1,500t). Between 20-30% of the total catches estimated come from fisheries for which time-area catches are either not available or poor quality. No time-area catches are available from the Taiwanese longline fleet for this period.
- 1967-1988: The total catches of swordfish estimated for this period range between 1,500t and 3,000t (1967-84) and between 4,000t and 8,000t for subsequent years (1985-88). Time-area information is available from the majority of the fleets with catches of swordfish estimated for this period, representing more than 95% of the total catches of swordfish estimated in most years.
- 1989-2007: The total catches of swordfish estimated for this period range between 6,000t and 35,000t. Between 25-30% of the total catches estimated come from fisheries for which time-area catches are either not available or poor quality. No time-area catches are available for:
    - Fresh-tuna longliners from Taiwan,China and Indonesia
    - Longliners from India and various other fleets, in particular longline fleets targeting swordfish (NEI)

Figure 8: Total catches of swordfish (SWO) available in time and space *versus* the total catches recorded for the species (all gears combined).

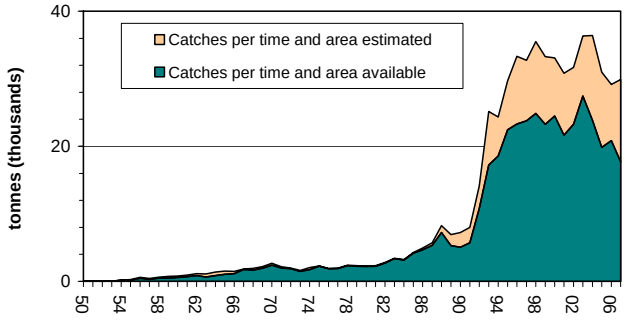


Figure 9: Total catches of swordfish (SWO) available in time and space *versus* the total catches recorded for the species (longline Taiwan,China and assimilated fleets)

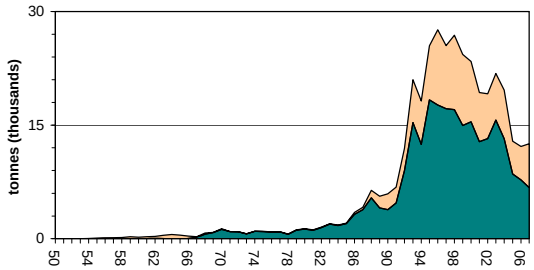


Figure 10: Total catches of swordfish (SWO) available in time and space *versus* the total catches recorded for the species (longline fisheries for swordfish)

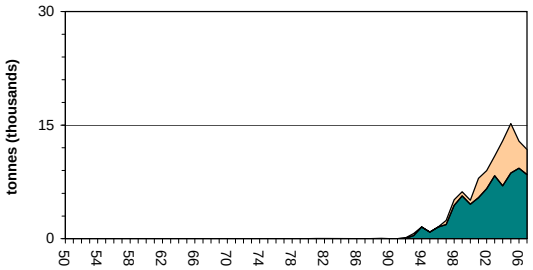


Figure 11: Total catches of swordfish (SWO) available in time and space *versus* the total catches recorded for the species (longline Japan and assimilated fleets)

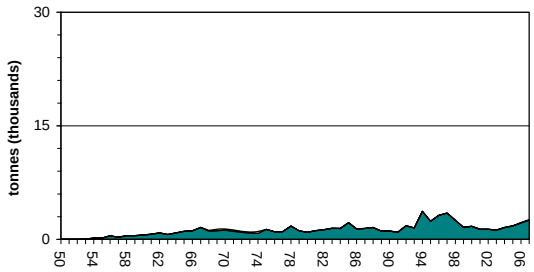
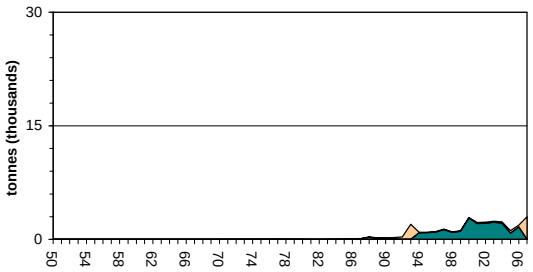


Figure 12: Total catches of swordfish (SWO) available in time and space *versus* the total catches recorded for the species (artisanal fisheries).



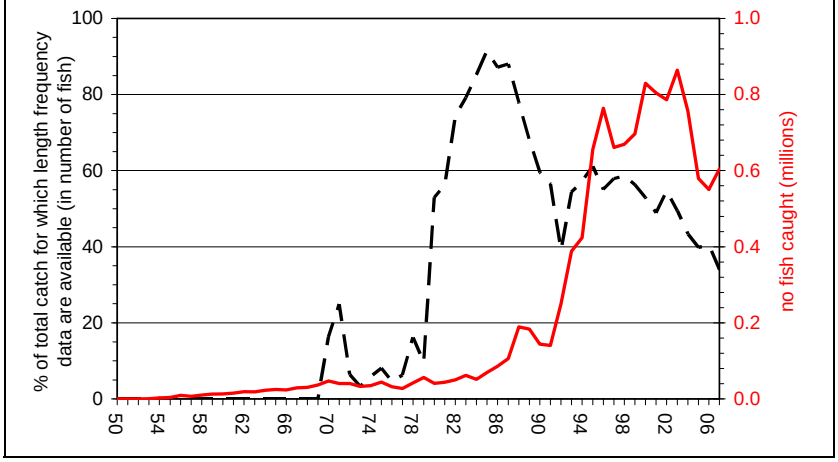
The lack of data or poor quality data existing for some periods and/or fisheries may compromise the quality of the catches that are estimated for the assessments of swordfish, as this information is used to break the catches in the nominal catches by quarter and assessment area.

Completeness of length data: The total numbers of swordfish caught and sampling coverage estimated for 1950-2007, by year and fishery, are shown in **Figures 13 to 17** (next page). The coverage was estimated as the amount (expressed as a percentage) that the total amount of swordfish (in number) from strata having at least 30 specimens of swordfish sampled made out of the total amount of

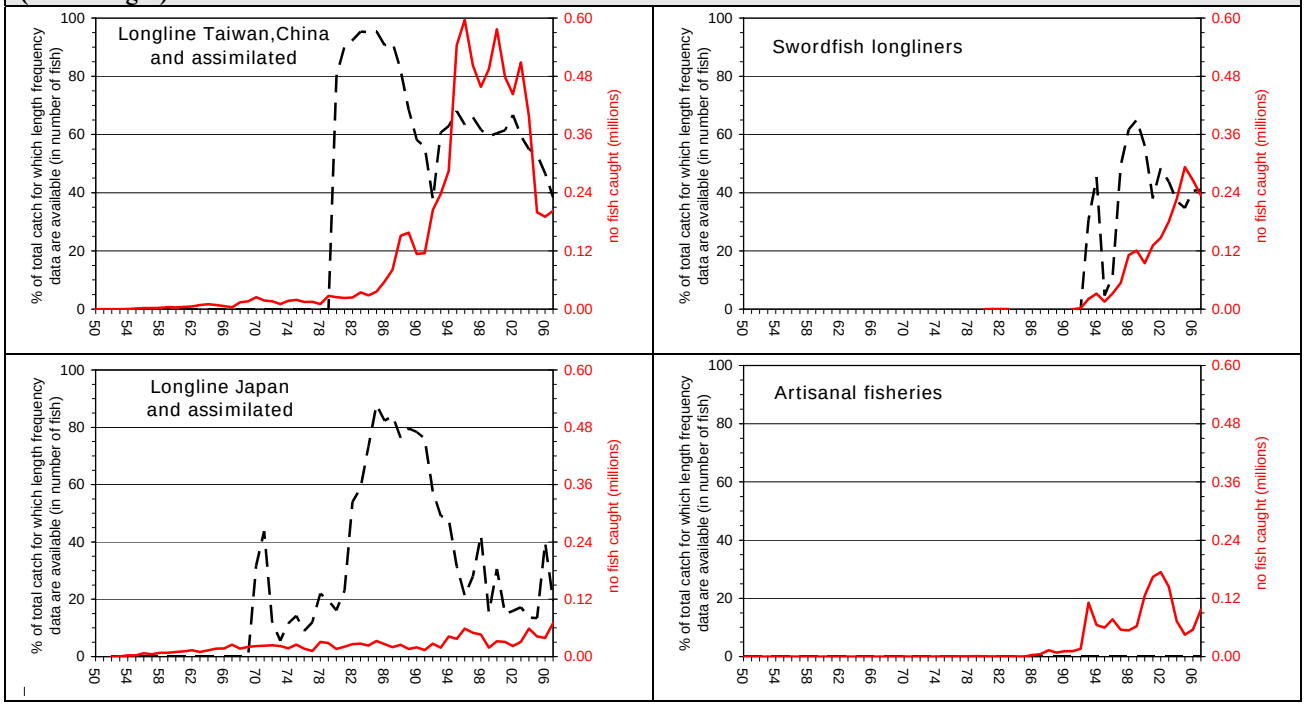
swordfish (numbers) estimated for that year, and fishery. The amount of catches for which length frequency samples are available has been changing over time. Four different periods can be identified:

- 1950-1969: The total catches of swordfish estimated for this period are low (below 1,500t in most years). No size frequency data are available for this period. The majority of the catches of swordfish for the period come from the Japanese and Taiwanese longine fleets.
- 1970-1979: The total catches of swordfish estimated for this period range between 2,000t and 3,000t. Size frequency data is only available for the longline fishery of Japan. Between 3-16% of the total catches estimated (in number) are covered through sampling. Samples are not available for the longline fishery of Taiwan,China during this period.
- 1980-1991: The total catches of swordfish estimated for this period range from 2,000t to 8,000t. Samples are available for the majority of the strata having catches of swordfish, representing 55-91% of the total catches of swordfish estimated (in number), depending on the year.
- 1992-2007: The total catches of swordfish estimated for this period range between 14,000t and 35,000t. Between 40-60% of the total catches estimated (in number) come from fisheries for which samples are available. The main problems are:
  - Poor sample sizes and time-are coverage for the longline fishery of Japan
  - Lack of length samples for the longline fisheries of Seychelles, India, Oman and various other flags (NEI)
  - Lack of samples or poor quality samples from gillnet and other artisanal fisheries.

Figure 13: Total numbers of swordfish (SWO) estimated (continuous line) and proportion (in number of fish) estimated (broken line) for strata having length frequency data (all gears combined), by year (1950-2007).



Figures 14-17: Total numbers of swordfish (SWO) estimated (continuous line) and proportion (in number of fish) estimated (broken line) for strata having length frequency data, by year (1950-2007): longline Taiwan,China and assimilated fleets (top left), longline fisheries for swordfish (top right), longline Japan and assimilated fleets (bottom left), and artisanal fisheries (bottom right)



The lack of length samples or low sampling coverage for some periods and/or fisheries may compromise the assessments that use length frequency samples or CAA data derived from estimates of CAS, adding uncertainty to the results.

The numbers of fish measured per strata in relation with the total numbers caught by several longline fisheries, mainly Japan, has been declining in recent years. The representativeness of the samples might be also compromised for this reason.

Figures 18-29 (next two pages) below show length frequency distributions for original samples (blue line) and catches at size estimated (orange bars) for the entire catch-series, all fisheries combined, and by decade and type of fishery (only periods from which samples are available are shown).
Figures 30-31 (page 17) show the catches at size estimated for periods in which no samples were available, for the longline fisheries of Taiwan,China and Japon.

The length frequency distributions for some fisheries and periods differ significantly from the length frequency samples; this is especially the case with:

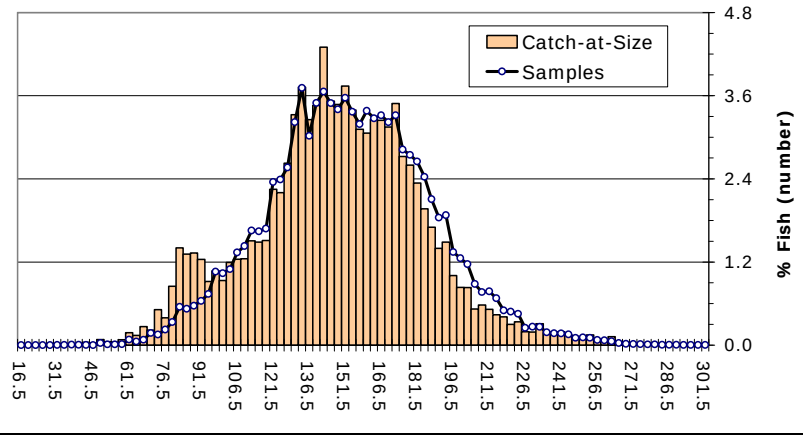
- Longline fishery of Japan and other assimilated fleets for the period 2000-07.
- Artisanal fisheries over the entire period

The following reasons may explain the referred discrepancies:

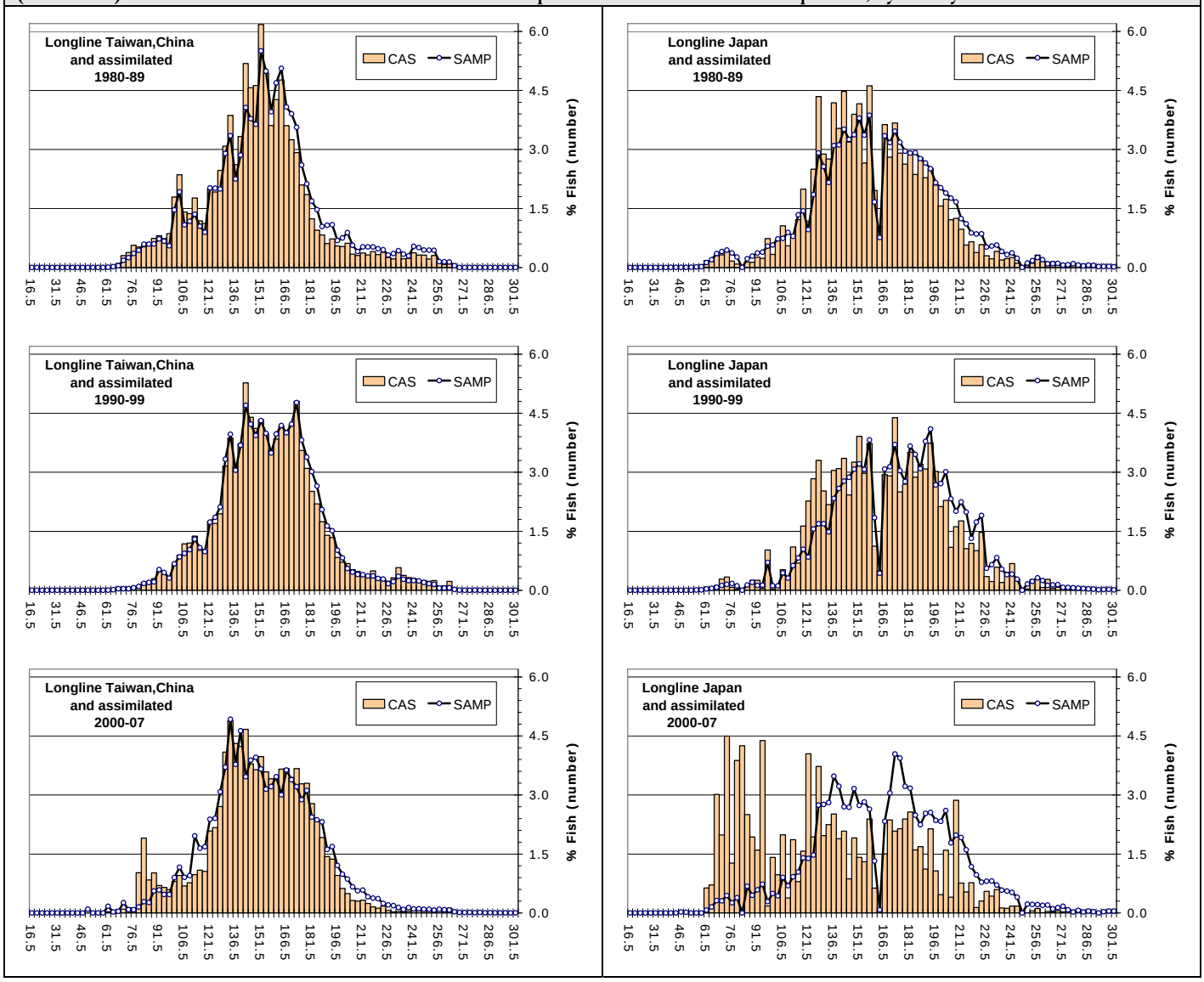
- No weighting applied in the aggregation of samples under the strata selected for the assessment: No weighting procedure is used in the allocation of the individual samples available to the fishery, area and period concerned. The samples available for each assessment area, fishery, year and quarter are aggregated by summing up all the specimens sampled by length class from all the fleets and gears concerned and over the entire area and period. However, the sample weights derived from the samples may represent various levels of coverage, depending on the strata involved.
- Catches at size derived from samples containing a low number of specimens: The shape of some CAS distributions tends to suggest that the number of specimens from which the catches at size were derived is too low. The minimum number of specimens needed for a sample to be raised to total catches, 30 specimens, is the same for all species. This number may be insufficient for species having a wide length frequency distribution, as it is the case with the swordfish.

In addition, some length classes (80-83cm; 164-167cm; 249-252cm) are poorly represented in the length frequency distributions derived from both the samples and the CAS for Japan over the entire time series. These gaps originate in the conversion (deterministic) from measurements of swordfish from the eye to the fork of the tail into lower-jaw fork length, as the measurements reported by Japan for the swordfish refer mostly to eye-fork length measurements aggregated into 5cm length classes.

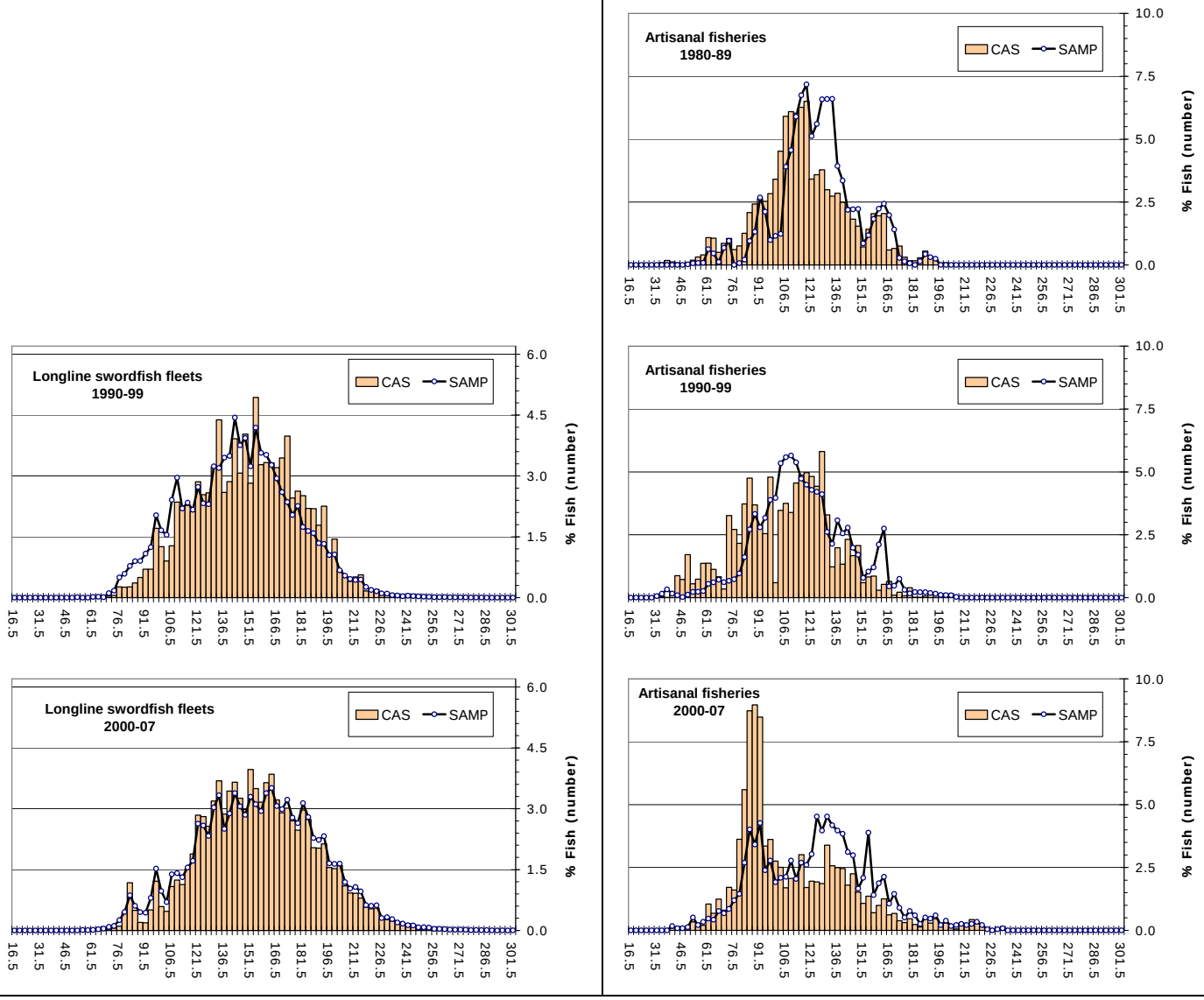
Figure 18: Proportion that the numbers of swordfish sampled (blue line)/estimated (CAS; orange bars) under each 3cm length class (in number) make out of the total numbers of swordfish sampled/ estimated over the entire time-area series (1950-2007), all fisheries combined.



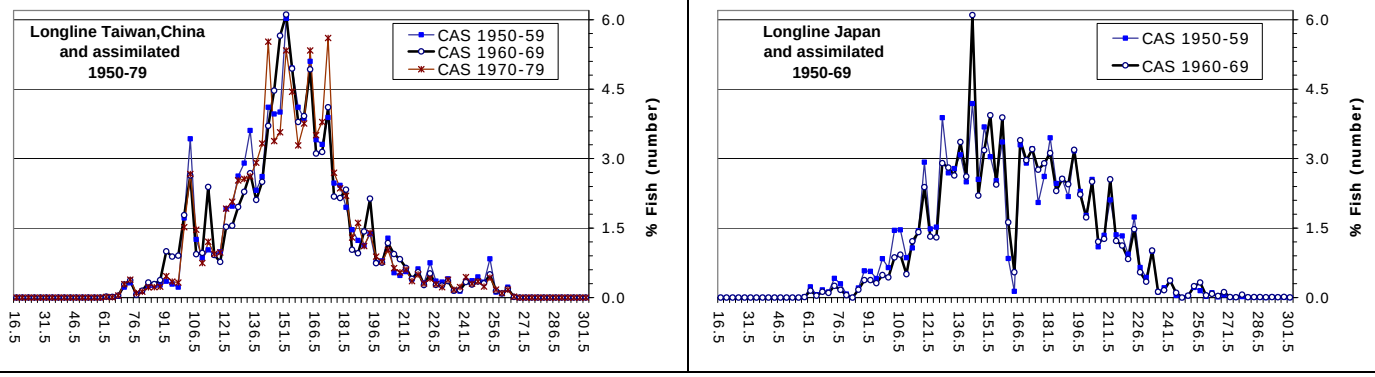
Figures 19-24: Proportion that the numbers of swordfish sampled (blue line)/estimated (CAS; orange bars) under each 3cm length class (in number) make out of the total numbers of swordfish sampled/estimated over different periods, by fishery



Figures 25-29 (cont.): Proportion that the numbers of swordfish sampled (blue line)/estimated (CAS; orange bars) under each 3cm length class (in number) make out of the total numbers of swordfish sampled/estimated over different periods, by fishery



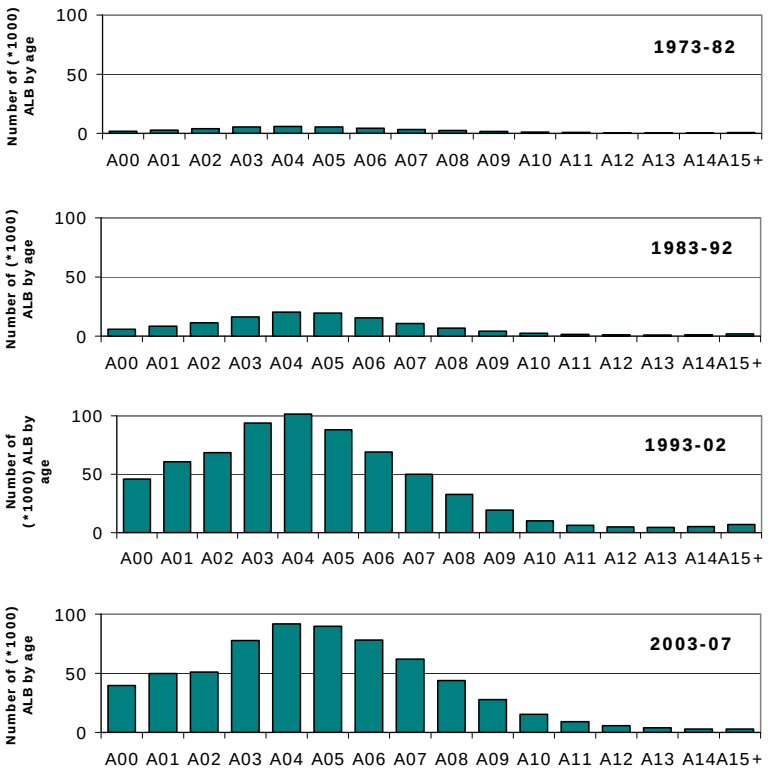
Figures 30-31: Proportion that the numbers of swordfish estimated (CAS) under each 3cm length class (in number) make out of the total numbers of swordfish estimated over periods in which no samples were available, by fishery



Catch-at-age tables (CAA)

The total numbers of swordfish by age class estimated for different periods are shown in **Figure 32**; the numbers of swordfish obtained by age class, fishery, area and year are shown in **Appendix VIII**. The estimates of catches-at-age are likely to be affected by a lack of data for some fisheries and periods (see the previous sections).

Figure 32: Average numbers of swordfish (SWO) by age class (classes 15 and above are represented as 15+) and fishery estimated for 1973-82, 1983-92, 1993-02 and 2003-07



APPENDIX I
ASPM: Examples of Input Tables

a. NC_{ASPM}

Species	Fishery	Year	TimePeriod	Tno	Tmt	AvW(kg)
SWO	EUEL	1993	4	5349	207	39

Where:

Field	Description
Species	Species code (swordfish only SWO)
Fishery	Fishery code used for the assesment
Year	Calendar year
TimePeriod	Time period used for the assesment (refers to quarter in this case); 1 (Jan-Mar); 2 (Apr-Jun); 3 (Jul-Sep); 4 (Oct-Dec)
Tno	Total number of fish caught (estimated by using the average weights from the available samples; involves substitution)
Tmt	Total weight of fish caught (in metric tons); total catches broken by quarter and assessment area by using the available catch-and-effort and/or size frequency data (more reliable than numbers)
AvW(kg)	Average weight (kg) of the swordfish specimens in the stratum (AvW=Tmt*1000/Tno)

b. CAA_{ASPM}

Method	Species	Fishery	Year	Quarter	Tno	0	1	…	14	15
DMSP2	SWO	EUEL	1993	4	5349	360	610	…	8	8

Where:

Field	Description
Method	Type of method used to estimate CAA
Species	Swordfish
Fishery	Fishery used for the assessment
Year	Calendar Year
Quarter	1 (Jan-Mar); 2 (Apr-Jun); 3 (Jul-Sep); 4 (Oct-Dec)
Tno	Total number of fish estimated
0	Total number of fish estimated for Age group 0
14	Total number of fish estimated for Age group 14
!	!
15	Total number of fish estimated for Age group 15+

SS3: Examples of Input Tables

a. NC_{SS3} (SWO_SScatch)

ID	Species	Fishery	Year	TimePeriod	Area	Tno	Tmt	AvW(kg)
665	SWO	EUEL	1993	4	NW	5349	207	39

Where:

Field	Description
ID	Unique number used to identify each stratum in the table (Species-Fishery-Year-TimePeriod-Area)
Species	Species code (swordfish only SWO)
Fishery	Fishery code used for the assesment; refer to the fishery section below for details
Year	Calendar year
TimePeriod	Time period used for the assesment (refers to quarter in this case); refer to the TimePeriod section below for details
Area	Assessment Area; refer to the assessment area section below for details
Tno	Total number of fish caught (estimated by using the average weights from the available samples; involves substitution)
Tmt	Total weight of fish caught (in metric tons); total catches broken by quarter and assessment area by using the available catch-and-effort and/or size frequency data (more reliable than numbers)
AvW(kg)	Average weight (kg) of the swordfish specimens in the stratum (AvW=Tmt*1000/Tno)

b. LF_{SS3} (SWO_SSamples)

CatchID	Species	Fishery	Year	TimePeriod	Area	noSampled	mtSampled	AvWeight(kg)	FirstClassLow	SizeInterval	L001	..	L002
1325	SWO	JPLL	1978	1	NE	183	10	52	**15**	**3**	**0**	..	**0**

Where:

Field	Description
CatchID	ID corresponding to the stratum in SWO_SScatch Table for which size data is presented
Species	Species code (swordfish only SWO)
Fishery	Fishery code used for the assesment; refer to the fishery section below for details
Year	Calendar year
TimePeriod	Time period used for the assesment (refers to quarter in this case); refer to the TimePeriod section below for details
Area	Assessment Area; refer to the assessment area section below for details
noSampled	Total number of fish sampled
FirstClassLow	Length corresponding to the first size class bin, in cm (15cm for swordfish)
SizeInterval	Interval used; 3cm for SWO
L001…L150	Number of fish measured for length class 15cm(inclusive) to 18cm(exclusive), 18-21, 21-24, etc.

APPENDIX II

Areas allocated to Fleet-Gear strata in the Catch-and-Effort and Size Frequency datasets for the assessments of Swordfish using Area strata (SS3)

Fleet	Gear	Assessment Area
AUS	ELL	SE
AUS	HAND	SE
FRA-REU	ELL	SW
FRA-REU	TROL	SW
FRAT	ELL	NW
FRAT	HAND	NW
FRAT	TROL	NW
IDN	FLL	NE
IDN	GILL	NE
IDN	HAND	NE
KEN	TROL	NW
LKA	FLL	NE
LKA	G/L	NE
LKA	GILL	NE
LKA	HAND	NE
LKA	TROL	NE
MDG	ELL	SW
MDV	FLL	NE
MUS	ELL	SW
NEI-DFRZ	TLL	SW
NEI-IDN	FLL	NE
OMN	FLL	NW
PAK	GILL	NW
SYC	ELL	NW
SYC	HAND	NW
THA	FLL	NE
TZA	BB	NW
TZA	OTHER	NW
TZA	PSS	NW
TZA	TROL	NW
ZAF	LL	SW
ZAF	SLL	SW
ZAF	SPOR	SW
ZAF	TLL	SW

APPENDIX III

Fisheries allocated to Fleet-Gear strata in the Nominal Catch, Catch-and-Effort and Size Frequency datasets for the assessments of Swordfish

Artisanal fisheries other than hand line and recreational fisheries

Fishery	Fleet	Gear
ALGI	FRA-REU	TROL
ALGI	FRAT	TROL
ALGI	IDN	GILL
ALGI	IND	GILL
ALGI	IND	LIFT
ALGI	IND	TRAW
ALGI	IND	TROL
ALGI	KEN	TROL
ALGI	LKA	G/L
ALGI	LKA	GILL
ALGI	LKA	TROL
ALGI	PAK	GILL
ALGI	TWN	GILL
ALGI	TZA	BB
ALGI	TZA	OTHER
ALGI	TZA	PSS
ALGI	TZA	TROL

Longline fisheries targeting Swordfish

Fishery	Fleet	Gear
AUEL	AUS	ELL

Fishery	Fleet	Gear
EUEL	ESP	ELL
EUEL	ESP	LLEX
EUEL	GBR	ELL
EUEL	GBR	LL
EUEL	GIN	ELL
EUEL	KEN	ELL
EUEL	NEI-DFRZ	ELL
EUEL	PRT	ELL
EUEL	PRT	LL
EUEL	PRT	SLL
EUEL	SEN	ELL
EUEL	TZA	LL
EUEL	URY	ELL
EUEL	ZAF	LL
EUEL	ZAF	SLL
EUEL	ZAF	TLL

Fishery	Fleet	Gear
ISEL	FRA-REU	ELL
ISEL	FRAT	ELL
ISEL	MDG	ELL
ISEL	MUS	ELL
ISEL	MUS	LL
ISEL	SYC	ELL

Other longline fisheries, and handline and recreational fisheries

Fishery	Fleet	Gear
JPLL	JPN	LL
JPLL	KOR	LL
JPLL	OMN	LL
JPLL	THA	LL

Fishery	Fleet	Gear
TWFL	AUS	HAND
TWFL	BLZ	FLL
TWFL	CHN	FLL
TWFL	FRAT	HAND
TWFL	IDN	FLL
TWFL	IDN	HAND
TWFL	IND	FLL
TWFL	IND	HAND
TWFL	LKA	FLL
TWFL	LKA	HAND
TWFL	MDV	FLL
TWFL	MYS	FLL
TWFL	NEI-ICE	FLL
TWFL	NEI-IDN	FLL
TWFL	OMN	FLL
TWFL	SYC	HAND
TWFL	THA	FLL
TWFL	TWN	FLL
TWFL	ZAF	SPOR

Fishery	Fleet	Gear
TWLL	BLZ	LL
TWLL	CHN	LL
TWLL	IDN	LL
TWLL	IND	LL
TWLL	IND	LLEX
TWLL	IRN	LL
TWLL	MDG	LL
TWLL	NEI-DFRZ	LL
TWLL	NEI-DFRZ	TLL
TWLL	PHL	LL
TWLL	SUN	LL
TWLL	SYC	LL
TWLL	TWN	LL
UNCL	LKA	LL

APPENDIX IV

Industrial fleets for which no catches per time and area are available and alternate fleets whose data were used for substitution

Fleet Code	Fleet Name	Gear Code	IOTC Area	Year From	Year To	Alternate Fleet Code	Alternate Gear Code
BLZ	Belize	FLL	IO_Eastern	2001	2005	TWN	LL
BLZ	Belize	FLL	IO_Western	2001	2007	TWN	LL
BLZ	Belize	PS	IO_Eastern	2001	2002	ESP	PS
BLZ	Belize	PS	IO_Western	2001	2002	ESP	PS
GBR	United Kingdom	ELL	IO_Eastern	2005	2007	ESP	ELL
GBR	United Kingdom	ELL	IO_Western	2005	2007	ESP	ELL
GBR	United Kingdom	LL	IO_Western	2004	2004	ESP	ELL
IRN	Iran, Islamic Republic	LL	IO_Western	1976	2002	TWN	LL
IRN	Iran, Islamic Republic	PS	IO_Eastern	1996	1998	ESP	PS
IRN	Iran, Islamic Republic	PS	IO_Western	1992	2007	ESP	PS
KEN	Kenya	ELL	IO_Eastern	2005	2007	ESP	ELL
KEN	Kenya	ELL	IO_Western	1980	2007	TWN	LL
MDG	Madagascar	ELL	IO_Western	2002	2007	ESP	ELL
MDG	Madagascar	LL	IO_Eastern	2005	2005	TWN	LL
MDG	Madagascar	LL	IO_Western	2005	2005	TWN	LL
MUS	Mauritius	LL	IO_Western	1978	1981	TWN	LL
MYS	Malaysia	FLL	IO_Western	2006	2006	MUS	LL
NEI-DFRZ	NEI-Deep-freezing	ELL	IO_Eastern	2002	2007	ESP	ELL
NEI-DFRZ	NEI-Deep-freezing	ELL	IO_Western	2002	2007	ESP	ELL
NEI-DFRZ	NEI-Deep-freezing	LL	IO_Eastern	1985	2007	TWN	LL
NEI-DFRZ	NEI-Deep-freezing	LL	IO_Western	1985	2007	TWN	LL
NEI-DFRZ	NEI-Deep-freezing	TLL	IO_Western	2004	2004	TWN	LL
PAK	Pakistan	LL	IO_Western	1991	2000	TWN	LL
PRT	Portugal	SLL	IO_Western	2004	2004	ESP	ELL
SEN	Senegal	ELL	IO_Western	2003	2004	ESP	ELL
SUN	Soviet Union	LL	IO_Eastern	1977	1985	TWN	LL
SUN	Soviet Union	LL	IO_Western	1964	1989	TWN	LL
SUN	Soviet Union	PS	IO_Eastern	1985	1985	NEI-OTH	PS
URY	Uruguay	ELL	IO_Western	2001	2006	ESP	ELL

APPENDIX V

Swordfish: Substitution scheme used for the estimation of Catches-at-Size (Fleet-Gear)

Gear	Fleet	GearA	FleetA	GearA2	FleetA2	GearA3	FleetA3
BB	TZA	BB	AG1	BB	AG1	SURF	AG1
ELL	AUS	ELL	AG1	ELL	AG1	LL	AG1
ELL	ESP	ELL	AG2	ELL	AG1	LL	AG1
ELL	FRA-REU	ELL	AG3	ELL	AG1	LL	AG1
ELL	FRAT	ELL	AG3	ELL	AG1	LL	AG1
ELL	GBR	ELL	AG2	ELL	AG1	LL	AG1
ELL	GIN	ELL	AG2	ELL	AG1	LL	AG1
ELL	KEN	ELL	AG2	ELL	AG1	LL	AG1
ELL	MDG	ELL	AG3	ELL	AG1	LL	AG1
ELL	MUS	ELL	AG3	ELL	AG1	LL	AG1
ELL	NEI-DFRZ	ELL	AG2	ELL	AG1	LL	AG1
ELL	PRT	ELL	AG2	ELL	AG1	LL	AG1
ELL	SEN	ELL	AG2	ELL	AG1	LL	AG1
ELL	SYC	ELL	AG4	ELL	AG1	LL	AG1
ELL	URY	ELL	AG2	ELL	AG1	LL	AG1
FLL	BLZ	FLL	AG1	FLL	AG1	LL	AG1
FLL	CHN	FLL	AG3	FLL	AG1	LL	AG1
FLL	IDN	FLL	AG3	FLL	AG1	LL	AG1
FLL	IND	FLL	AG2	FLL	AG1	LL	AG1
FLL	LKA	FLL	AG3	FLL	AG1	LL	AG1
FLL	MDV	FLL	AG2	FLL	AG1	LL	AG1
FLL	MYS	FLL	AG3	FLL	AG1	LL	AG1
FLL	NEI-ICE	FLL	AG3	FLL	AG1	LL	AG1
FLL	NEI-IDN	FLL	AG3	FLL	AG1	LL	AG1
FLL	OMN	FLL	AG2	FLL	AG1	LL	AG1
FLL	THA	FLL	AG3	FLL	AG1	LL	AG1
FLL	TWN	FLL	AG3	FLL	AG1	LL	AG1
G/L	LKA	GILL	AG1	GILL	AG1	GILL	AG1
GILL	IDN	GILL	AG2	GILL	AG2	GILL	AG1
GILL	IND	GILL	AG1	GILL	AG1	GILL	AG1
GILL	LKA	GILL	AG1	GILL	AG1	GILL	AG1
GILL	PAK	GILL	AG1	GILL	AG1	GILL	AG1
GILL	TWN	GILL	AG3	GILL	AG1	GILL	AG1
HAND	AUS	HAND	AG1	HAND	AG1	LL	AG1
HAND	FRAT	HAND	AG2	HAND	AG1	LL	AG1
HAND	IDN	HAND	AG5	HAND	AG1	LL	AG1
HAND	IND	HAND	AG3	HAND	AG1	LL	AG1
HAND	LKA	HAND	AG3	HAND	AG1	LL	AG1
HAND	SYC	HAND	AG4	HAND	AG1	LL	AG1
HATR	LKA	HAND	AG3	HAND	AG1	LL	AG1
LIFT	IND	LIFT	AG1	LIFT	AG1	GILL	AG1

Gear	Fleet	GearA	FleetA	GearA2	FleetA2	GearA3	FleetA3
LL	BLZ	LL	AG1	LL	AG1	LL	AG1
LL	CHN	LL	AG1	LL	AG1	LL	AG1
LL	GBR	ELL	AG2	ELL	AG1	LL	AG1
LL	IDN	LL	AG1	LL	AG1	LL	AG1
LL	IND	LL	AG2	LL	AG1	LL	AG1
LL	IRN	LL	AG2	LL	AG1	LL	AG1
LL	JPN	LL	AG3	LL	AG2	LL	AG2
LL	KOR	LL	AG4	LL	AG2	LL	AG2
LL	LKA	LL	AG2	LL	AG2	LL	AG2
LL	MDG	LL	AG5	LL	AG2	LL	AG2
LL	MUS	ELL	AG2	ELL	AG1	LL	AG1
LL	NEI-DFRZ	LL	AG1	LL	AG1	LL	AG1
LL	OMN	LL	AG2	LL	AG1	LL	AG1
LL	PHL	LL	AG1	LL	AG1	LL	AG1
LL	PRT	ELL	AG2	ELL	AG1	LL	AG1
LL	SUN	LL	AG1	LL	AG1	LL	AG1
LL	SYC	LL	AG1	LL	AG1	LL	AG1
LL	THA	LL	AG3	LL	AG2	LL	AG2
LL	TWN	LL	AG1	LL	AG1	LL	AG1
LL	TZA	LL	AG1	LL	AG1	LL	AG1
LL	ZAF	ELL	AG3	ELL	AG1	LL	AG1
LLD	PRT	ELL	AG2	ELL	AG1	LL	AG1
LLEX	ESP	ELL	AG2	ELL	AG1	LL	AG1
LLEX	IND	LL	AG2	LL	AG1	LL	AG1
OTHER	TZA	OTHER	AG1	OTHER	AG1	GILL	AG1
PSS	TZA	BB	AG1	BB	AG1	SURF	AG1
SLL	PRT	ELL	AG2	ELL	AG1	LL	AG1
SLL	ZAF	ELL	AG3	ELL	AG1	LL	AG1
SPOR	ZAF	HAND	AG2	HAND	AG1	LL	AG1
TLL	NEI-DFRZ	ELL	AG3	ELL	AG1	LL	AG1
TLL	ZAF	ELL	AG3	ELL	AG1	LL	AG1
TRAW	IND	OTHER	AG1	OTHER	AG1	GILL	AG1
TROL	FRA-REU	TROL	AG1	TROL	AG1	SURF	AG1
TROL	FRAT	TROL	AG1	TROL	AG1	SURF	AG1
TROL	IND	TROL	AG3	TROL	AG1	SURF	AG1
TROL	KEN	TROL	AG2	TROL	AG1	SURF	AG1
TROL	LKA	TROL	AG3	TROL	AG1	SURF	AG1
TROL	TZA	TROL	AG2	TROL	AG1	SURF	AG1
UNCL	LKA	SURF	AG1	SURF	AG1	SURF	AG1

APPENDIX VI

Swordfish: Length-age key used to convert CAS into CAA

FL_Low	FL_High	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15+
	<30	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	33	**0.99**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
33	36	**0.99**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36	39	**0.99**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
39	42	**0.98**	**0.02**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
42	45	**0.97**	**0.03**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45	48	**0.96**	**0.04**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	51	**0.94**	**0.06**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
51	54	**0.92**	**0.08**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
54	57	**0.90**	**0.10**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
57	60	**0.87**	**0.13**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	63	**0.83**	**0.17**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
63	66	**0.79**	**0.21**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
66	69	**0.75**	**0.25**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
69	72	**0.70**	**0.30**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
72	75	**0.65**	**0.35**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75	78	**0.60**	**0.39**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
78	81	**0.55**	**0.43**	**0.02**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
81	84	**0.50**	**0.47**	**0.03**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
84	87	**0.45**	**0.50**	**0.05**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
87	90	**0.40**	**0.52**	**0.08**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90	93	**0.35**	**0.52**	**0.12**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
93	96	**0.31**	**0.51**	**0.17**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
96	99	**0.26**	**0.48**	**0.24**	**0.02**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
99	102	**0.22**	**0.45**	**0.30**	**0.03**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102	105	**0.18**	**0.40**	**0.36**	**0.05**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
105	108	**0.15**	**0.35**	**0.42**	**0.08**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
108	111	**0.13**	**0.30**	**0.45**	**0.11**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
111	114	**0.10**	**0.25**	**0.47**	**0.16**	**0.02**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
114	117	**0.08**	**0.21**	**0.47**	**0.21**	**0.03**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117	120	**0.07**	**0.17**	**0.44**	**0.27**	**0.04**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
120	123	**0.06**	**0.14**	**0.40**	**0.33**	**0.07**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
123	126	**0.04**	**0.11**	**0.35**	**0.38**	**0.11**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
126	129	**0.04**	**0.08**	**0.28**	**0.42**	**0.16**	**0.02**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
129	132	**0.03**	**0.06**	**0.22**	**0.44**	**0.21**	**0.04**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132	135	**0.02**	**0.04**	**0.16**	**0.43**	**0.28**	**0.06**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
135	138	**0.02**	**0.03**	**0.11**	**0.40**	**0.34**	**0.09**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
138	141	**0.01**	**0.02**	**0.07**	**0.35**	**0.39**	**0.14**	**0.02**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
141	144	**0.01**	**0.01**	**0.04**	**0.29**	**0.42**	**0.19**	**0.04**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
144	147	**0.01**	**0.01**	**0.02**	**0.22**	**0.42**	**0.25**	**0.06**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147	150	0.00	**0.01**	**0.01**	**0.16**	**0.41**	**0.31**	**0.09**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
150	153	0.00	0.00	**0.01**	**0.11**	**0.36**	**0.35**	**0.13**	**0.03**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
153	156	0.00	0.00	0.00	**0.07**	**0.31**	**0.38**	**0.18**	**0.04**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00
156	159	0.00	0.00	0.00	**0.04**	**0.25**	**0.39**	**0.23**	**0.07**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00	0.00
159	162	0.00	0.00	0.00	**0.03**	**0.19**	**0.38**	**0.28**	**0.10**	**0.02**	0.00	0.00	0.00	0.00	0.00	0.00	0.00
162	165	0.00	0.00	0.00	**0.01**	**0.13**	**0.35**	**0.32**	**0.14**	**0.04**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00
165	168	0.00	0.00	0.00	**0.01**	**0.09**	**0.30**	**0.35**	**0.19**	**0.06**	**0.01**	0.00	0.00	0.00	0.00	0.00	0.00
168	171	0.00	0.00	0.00	0.00	**0.06**	**0.24**	**0.36**	**0.23**	**0.09**	**0.02**	0.00	0.00	0.00	0.00	0.00	0.00
171	174	0.00	0.00	0.00	0.00	**0.03**	**0.19**	**0.34**	**0.28**	**0.12**	**0.03**	0.00	0.00	0.00	0.00	0.00	0.00
174	177	0.00	0.00	0.00	0.00	**0.02**	**0.14**	**0.31**	**0.31**	**0.16**	**0.05**	0.00	0.00	0.00	0.00	0.00	0.00
177	180	0.00	0.00	0.00	0.00	**0.01**	**0.09**	**0.27**	**0.33**	**0.21**	**0.08**	**0.01**	0.00	0.00	0.00	0.00	0.00
180	183	0.00	0.00	0.00	0.00	**0.01**	**0.06**	**0.22**	**0.33**	**0.25**	**0.12**	**0.01**	0.00	0.00	0.00	0.00	0.00
183	186	0.00	0.00	0.00	0.00	0.00	**0.04**	**0.17**	**0.31**	**0.29**	**0.16**	**0.03**	0.00	0.00	0.00	0.00	0.00
186	189	0.00	0.00	0.00	0.00	0.00	**0.02**	**0.12**	**0.28**	**0.31**	**0.20**	**0.05**	**0.01**	0.00	0.00	0.00	0.00
189	192	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.08**	**0.23**	**0.32**	**0.24**	**0.09**	**0.02**	0.00	0.00	0.00	0.00
192	195	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.05**	**0.18**	**0.30**	**0.27**	**0.14**	**0.04**	**0.01**	0.00	0.00	0.00
195	198	0.00	0.00	0.00	0.00	0.00	0.00	**0.03**	**0.14**	**0.26**	**0.28**	**0.20**	**0.07**	**0.02**	0.00	0.00	0.00
198	201	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**	**0.09**	**0.22**	**0.28**	**0.25**	**0.10**	**0.03**	**0.01**	0.00	0.00
201	204	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.06**	**0.17**	**0.26**	**0.29**	**0.15**	**0.05**	**0.01**	0.00	0.00
204	207	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.04**	**0.12**	**0.22**	**0.30**	**0.20**	**0.08**	**0.03**	**0.01**	0.00
207	210	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**	**0.09**	**0.18**	**0.29**	**0.24**	**0.12**	**0.05**	**0.01**	0.00
210	213	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.06**	**0.14**	**0.26**	**0.26**	**0.16**	**0.07**	**0.03**	**0.01**
213	216	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.04**	**0.11**	**0.20**	**0.26**	**0.20**	**0.11**	**0.05**	**0.02**
216	219	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**	**0.07**	**0.16**	**0.25**	**0.24**	**0.15**	**0.07**	**0.03**
219	222	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.05**	**0.11**	**0.22**	**0.25**	**0.19**	**0.11**	**0.05**
222	225	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.03**	**0.07**	**0.18**	**0.25**	**0.23**	**0.15**	**0.08**
225	228	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**	**0.04**	**0.13**	**0.23**	**0.25**	**0.20**	**0.12**
228	231	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.02**	**0.09**	**0.19**	**0.27**	**0.24**	**0.17**
231	234	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.01**	**0.06**	**0.16**	**0.25**	**0.28**	**0.23**

FL_Low	FL_High	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15+
234	237	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.04**	**0.12**	**0.23**	**0.30**	**0.30**
237	240	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**	**0.09**	**0.21**	**0.32**	**0.36**
240	243	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.06**	**0.18**	**0.32**	**0.42**
243	246	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.04**	**0.15**	**0.32**	**0.48**
246	249	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.03**	**0.12**	**0.30**	**0.55**
249	252	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**	**0.10**	**0.29**	**0.59**
252	255	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.08**	**0.27**	**0.64**
255	258	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.06**	**0.24**	**0.69**
258	261	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.05**	**0.22**	**0.72**
261	264	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.03**	**0.20**	**0.77**
264	267	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.03**	**0.18**	**0.79**
267	270	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.02**	**0.16**	**0.82**
270	273	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.14**	**0.85**
273	276	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.12**	**0.87**
276	279	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.11**	**0.88**
279	282	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**	**0.10**	**0.89**
282	285	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.08**	**0.92**
285	288	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.07**	**0.93**
288	291	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.06**	**0.94**
291	294	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.05**	**0.95**
294	297	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.05**	**0.95**
297	300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.04**	**0.96**
>=300		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**

APPENDIX VII

Swordfish: Total catches estimated, in number of fish and weight, by fishery (1950-07)

Swordfish catches by fishery in number of fish

Year	TWLL	TWFL	JPLL	AUEL	EUEL	ISEL	ALGI	Total
1950		0					3	3
1951		0					11	11
1952		0	155				13	168
1953		0	475				13	489
1954	383	0	2,563				15	2,960
1955	1,202	0	2,579				15	3,797
1956	2,443	0	6,904				17	9,364
1957	2,429	0	4,886				17	7,333
1958	2,688	0	7,944				15	10,648
1959	4,348	0	7,994				16	12,358
1960	3,572	0	9,609				15	13,197
1961	4,475	0	10,972				15	15,463
1962	5,606	0	13,421				20	19,047
1963	8,692	0	9,835				22	18,549
1964	10,311	0	12,911				23	23,245
1965	8,539	0	16,667				27	25,234
1966	6,327	1	17,074				31	23,432
1967	4,042	1	24,921				33	28,996
1968	14,091	1	16,710				32	30,833
1969	16,240	1	20,481				32	36,753
1970	24,726	1	21,908				363	46,998
1971	17,900	1	22,752				22	40,675
1972	16,207	1	23,819				263	40,289
1973	10,458	1	22,172				32	32,664
1974	16,732	326	17,372				450	34,879
1975	18,516	498	24,989				320	44,323
1976	14,411	376	16,784				491	32,063
1977	14,701	377	11,576				742	27,396
1978	10,115	521	30,624				778	42,039
1979	26,255	871	28,257				966	56,348
1980	23,571	1,044	15,974		126		521	41,237
1981	21,726	1,355	20,571		169		179	44,000
1982	22,651	1,209	26,014		197		216	50,285
1983	33,775	649	26,984		315		199	61,922
1984	27,434	866	23,056				326	51,682
1985	35,374	909	32,607				389	69,280
1986	56,227	399	26,077				3,135	85,837
1987	80,620	928	19,584				4,920	106,052
1988	147,904	3,680	24,783				13,237	189,603
1989	122,202	35,555	15,886	1,559			8,088	183,291
1990	90,670	22,997	19,252				11,165	144,084
1991	95,922	19,470	13,797	41		37	11,336	140,604
1992	180,971	23,255	27,182	474		1,390	16,197	249,468
1993	214,556	23,067	18,751	6,464	5,349	9,087	110,934	388,208
1994	256,439	28,402	42,187	1,897	16,689	13,320	65,124	424,058
1995	509,329	34,730	37,020	1,063	292	14,112	59,310	655,856
1996	548,091	48,272	58,375	397	447	31,324	76,922	763,829
1997	449,355	53,040	49,723	944	11,603	41,319	55,065	661,051
1998	421,413	36,792	46,069	8,028	39,637	63,749	53,768	669,456
1999	451,049	43,933	18,851	22,476	42,134	55,937	62,350	696,732
2000	525,689	51,404	32,121	32,295	21,110	41,335	125,507	829,461
2001	426,566	51,828	30,760	44,704	51,215	35,298	164,303	804,675
2002	389,084	53,941	21,933	19,109	107,561	20,698	174,202	786,528
2003	410,909	97,680	31,086	29,023	125,913	25,080	144,231	863,921
2004	334,201	63,724	58,545	6,974	187,427	32,851	72,791	756,512
2005	157,818	41,529	41,915	4,768	246,165	41,868	45,103	579,166
2006	153,318	37,377	39,001		228,898	36,807	55,402	550,803
2007	163,978	38,319	70,198		191,744	42,815	96,904	603,958

Swordfish catches by fishery in weight (tonnes)

Year	TWLL	TWFL	JPLL	AUEL	EUEL	ISEL	ALGI	Total
1950		0					0	0
1951		0					0	0
1952		0	10				0	10
1953		0	31				0	31
1954	19	0	162				0	182
1955	63	0	179				0	242
1956	119	0	460				0	579
1957	136	0	278				0	414
1958	150	0	482				0	632
1959	249	0	484				0	734
1960	200	0	577				0	777
1961	251	0	683				0	934
1962	301	0	839				0	1,140
1963	453	0	637				1	1,090
1964	547	0	843				1	1,390
1965	460	0	1,058				1	1,518
1966	344	0	1,124				1	1,469
1967	248	0	1,590				1	1,839
1968	744	0	1,172				1	1,917
1969	825	0	1,335				1	2,161
1970	1,302	0	1,380				8	2,690
1971	918	0	1,217				1	2,135
1972	916	0	1,054				6	1,976
1973	638	0	961				1	1,600
1974	963	17	1,033				10	2,024
1975	954	26	1,313				7	2,301
1976	867	20	991				11	1,889
1977	886	20	1,018				17	1,941
1978	592	27	1,758				18	2,395
1979	1,112	41	1,128				22	2,303
1980	1,257	51	936		8		12	2,264
1981	1,092	59	1,143		11		4	2,310
1982	1,452	68	1,263		14		5	2,802
1983	1,916	38	1,451		22		5	3,432
1984	1,735	48	1,441				7	3,231
1985	2,012	42	2,200				9	4,263
1986	3,459	25	1,382				69	4,935
1987	4,107	54	1,442				97	5,700
1988	6,217	166	1,559				311	8,254
1989	4,655	967	1,081	37			187	6,927
1990	4,668	1,263	1,098				213	7,242
1991	5,623	1,196	935	3		2	235	7,994
1992	10,428	1,502	1,801	32		65	327	14,155
1993	19,514	1,471	1,495	189	207	278	1,985	25,139
1994	16,087	2,090	3,714	115	694	729	919	24,348
1995	23,764	1,725	2,391	62	19	793	936	29,689
1996	25,325	2,275	3,180	22	29	1,474	1,015	33,321
1997	22,709	2,803	3,485	44	549	1,811	1,349	32,749
1998	24,676	2,199	2,501	337	1,892	2,918	976	35,500
1999	21,859	2,491	1,575	1,360	2,307	2,544	1,131	33,267
2000	21,482	1,935	1,727	1,798	1,212	2,066	2,869	33,089
2001	17,735	1,568	1,347	2,900	3,115	1,954	2,211	30,830
2002	16,885	2,251	1,327	1,343	6,506	1,141	2,248	31,700
2003	17,924	3,889	1,220	1,766	7,671	1,477	2,383	36,331
2004	15,883	3,745	1,580	370	10,819	1,726	2,300	36,422
2005	10,170	2,706	1,773	301	12,739	2,165	1,143	30,997
2006	9,779	2,400	2,216		11,090	1,777	1,878	29,141
2007	10,146	2,393	2,593		10,041	1,731	2,988	29,892

Swordfish: Total catches estimated, in number of fish and weight, by area (1950-07)

Swordfish catches by area in number of fish					
Year	NW	SW	NE	SE	Total
1950	1		2		3
1951	1		11		11
1952	1		140	28	168
1953	1		404	84	489
1954	56	13	2,688	203	2,960
1955	1,357	203	2,161	75	3,797
1956	3,786	355	4,670	553	9,364
1957	2,122	345	4,424	442	7,333
1958	2,661	456	6,043	1,489	10,648
1959	3,788	1,213	4,466	2,892	12,358
1960	3,885	1,327	4,971	3,013	13,197
1961	4,137	2,272	5,815	3,238	15,463
1962	5,649	4,799	6,269	2,330	19,047
1963	4,629	3,753	6,547	3,620	18,549
1964	7,676	6,325	6,722	2,521	23,245
1965	7,918	3,417	9,516	4,382	25,234
1966	11,256	4,038	5,718	2,419	23,432
1967	10,298	4,492	10,366	3,840	28,996
1968	15,602	3,508	7,977	3,746	30,833
1969	16,650	6,351	11,863	1,889	36,753
1970	12,618	9,661	17,486	7,233	46,998
1971	15,650	6,012	11,947	7,065	40,675
1972	18,428	9,182	10,675	2,004	40,289
1973	7,893	15,204	6,021	3,546	32,664
1974	11,029	6,747	9,887	7,216	34,879
1975	13,214	5,735	20,004	5,369	44,323
1976	5,437	8,044	14,120	4,462	32,063
1977	7,142	5,355	11,495	3,405	27,396
1978	17,922	5,009	12,913	6,194	42,039
1979	14,666	12,772	22,367	6,543	56,348
1980	4,855	7,745	24,538	4,099	41,237
1981	9,836	7,452	21,134	5,579	44,000
1982	18,439	11,729	17,148	2,970	50,285
1983	17,271	9,037	30,596	5,017	61,922
1984	10,086	11,368	25,551	4,677	51,682
1985	17,341	12,061	33,042	6,836	69,280
1986	37,245	9,482	35,142	3,969	85,837
1987	36,412	8,729	49,241	11,670	106,052
1988	89,167	16,507	65,963	17,966	189,603
1989	48,990	8,223	109,039	17,039	183,291
1990	43,917	31,593	55,237	13,338	144,084
1991	70,345	19,091	43,900	7,268	140,604
1992	59,036	124,137	50,674	15,620	249,468
1993	60,391	152,639	153,988	21,190	388,208
1994	87,133	171,379	136,502	29,044	424,058
1995	134,312	331,471	144,540	45,533	655,856
1996	243,236	218,893	213,512	88,189	763,829
1997	278,744	127,211	181,659	73,436	661,051
1998	223,814	193,942	189,816	61,885	669,456
1999	156,487	182,984	281,378	75,882	696,732
2000	216,008	250,662	282,919	79,872	829,461
2001	190,157	145,142	323,182	146,194	804,675
2002	266,726	133,184	275,315	111,303	786,528
2003	325,985	67,702	316,867	153,367	863,921
2004	262,051	113,348	229,871	151,242	756,512
2005	193,539	173,479	116,455	95,692	579,166
2006	174,743	158,974	154,586	62,501	550,803
2007	198,096	148,109	160,676	97,077	603,958

Swordfish catches by area in weight (tonnes)					
Year	NW	SW	NE	SE	Total
1950	0		0		0
1951	0		0		0
1952	0		8	2	10
1953	0		26	5	31
1954	3	1	165	12	182
1955	96	14	127	4	242
1956	257	21	268	34	579
1957	127	22	238	27	414
1958	158	25	348	101	632
1959	243	60	245	185	734
1960	254	66	272	185	777
1961	285	115	333	202	934
1962	336	317	336	151	1,140
1963	261	249	343	238	1,090
1964	437	403	379	172	1,390
1965	460	221	525	312	1,518
1966	709	256	333	171	1,469
1967	692	279	611	256	1,839
1968	970	232	454	261	1,917
1969	955	446	620	141	2,161
1970	700	578	994	418	2,690
1971	841	239	631	425	2,135
1972	804	480	565	127	1,976
1973	410	668	314	208	1,600
1974	577	450	543	454	2,024
1975	544	380	1,026	351	2,301
1976	420	483	691	295	1,889
1977	635	404	675	226	1,941
1978	986	360	678	371	2,395
1979	477	635	844	348	2,303
1980	289	499	1,200	276	2,264
1981	664	377	927	341	2,310
1982	943	670	963	225	2,802
1983	783	660	1,620	369	3,432
1984	480	911	1,510	331	3,231
1985	795	1,291	1,882	295	4,263
1986	2,052	609	2,133	141	4,935
1987	2,208	899	2,160	433	5,700
1988	4,170	999	2,408	676	8,254
1989	2,115	612	3,655	545	6,927
1990	2,108	1,723	2,730	681	7,242
1991	3,929	1,185	2,356	525	7,994
1992	3,103	7,550	2,534	968	14,155
1993	5,500	13,253	5,364	1,022	25,139
1994	4,855	11,916	5,736	1,840	24,348
1995	5,824	16,709	5,109	2,047	29,689
1996	11,927	9,496	7,537	4,361	33,321
1997	13,980	5,874	8,126	4,769	32,749
1998	12,133	10,463	9,129	3,774	35,500
1999	8,453	8,772	12,278	3,764	33,267
2000	8,724	10,859	8,599	4,907	33,089
2001	7,669	8,782	7,396	6,982	30,830
2002	11,758	7,555	6,350	6,037	31,700
2003	14,631	3,931	9,010	8,759	36,331
2004	11,861	6,441	9,112	9,008	36,422
2005	10,546	9,299	5,696	5,456	30,997
2006	9,854	8,420	7,247	3,620	29,141
2007	9,914	7,348	7,540	5,091	29,892

APPENDIX VIII
Swordfish: Total numbers of fish estimated by age class and year

Swordfish total number of fish by age group																	
Year	Age0	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9	Age10	Age11	Age12	Age13	Age14	Age15+	Total
1950																	
1951		4	4														8
1952	9	11	16	20	18	17	16	15	13	11	9	7	4	3	2	1	172
1953	18	24	36	48	53	56	55	50	42	32	25	18	12	9	7	5	490
1954	133	191	233	321	357	328	295	270	227	173	125	97	72	54	44	42	2,962
1955	142	218	298	410	457	423	377	340	292	228	167	127	101	80	69	67	3,796
1956	319	529	764	1,085	1,187	1,061	934	842	716	552	389	287	225	180	150	139	9,359
1957	254	439	686	947	1,067	966	766	595	455	333	230	166	126	101	94	111	7,336
1958	389	602	941	1,327	1,442	1,278	1,061	900	728	555	409	307	227	171	148	162	10,647
1959	411	695	1,086	1,512	1,750	1,591	1,276	1,019	801	601	434	320	245	197	187	227	12,352
1960	460	785	1,179	1,631	1,867	1,624	1,317	1,086	875	663	482	355	263	205	188	221	13,201
1961	524	864	1,314	1,880	2,167	1,869	1,527	1,299	1,076	826	598	441	327	253	225	271	15,461
1962	663	1,041	1,486	2,427	2,971	2,456	1,861	1,516	1,243	950	682	495	365	281	254	358	19,049
1963	656	1,075	1,477	2,159	2,728	2,548	2,028	1,577	1,205	884	626	451	326	252	233	317	18,542
1964	726	1,225	1,736	2,731	3,525	3,204	2,519	1,991	1,559	1,156	812	581	422	332	309	412	23,240
1965	855	1,375	1,993	2,944	3,606	3,308	2,635	2,153	1,747	1,335	963	696	500	373	330	423	25,236
1966	659	1,104	1,720	2,784	3,384	3,041	2,438	2,023	1,645	1,254	905	679	517	414	379	485	23,431
1967	854	1,331	2,161	3,496	4,012	3,490	2,899	2,527	2,134	1,681	1,265	940	684	511	444	560	28,989
1968	897	1,528	2,153	3,417	4,532	4,199	3,284	2,648	2,153	1,666	1,234	905	661	509	461	582	30,829
1969	969	1,693	2,722	3,767	4,905	5,613	4,989	3,805	2,697	1,857	1,222	772	514	404	386	440	36,755
1970	1,947	2,964	3,674	5,064	6,503	6,631	5,447	4,127	3,039	2,231	1,668	1,220	824	573	495	589	46,996
1971	1,971	2,782	3,813	4,931	5,758	5,481	4,532	3,552	2,662	1,867	1,182	708	442	318	298	376	40,673
1972	2,928	4,136	4,265	5,203	5,315	4,373	3,519	2,927	2,352	1,775	1,266	798	471	313	284	357	40,282
1973	1,838	2,906	4,969	4,445	3,721	3,613	3,122	2,382	1,703	1,194	833	560	371	291	303	413	32,664
1974	1,423	2,135	3,218	4,278	4,820	4,369	3,470	2,787	2,239	1,718	1,256	912	683	531	470	570	34,879
1975	2,799	3,957	4,547	5,409	5,582	4,965	4,204	3,693	3,089	2,207	1,252	711	511	445	446	503	44,320
1976	1,924	2,531	2,677	3,089	3,813	4,075	3,667	2,854	2,052	1,432	967	663	495	444	524	859	32,066
1977	953	1,408	1,828	2,371	3,019	3,156	2,850	2,463	2,049	1,623	1,246	1,050	930	830	780	849	27,405
1978	1,405	2,252	3,765	5,526	6,089	5,451	4,629	3,840	2,845	1,908	1,161	821	630	525	504	684	42,035
1979	2,660	4,102	6,720	10,796	10,652	7,581	5,647	3,777	2,029	922	310	234	270	268	219	149	56,336
1980	1,305	2,125	3,007	4,675	6,550	6,600	5,341	3,880	2,647	1,694	979	667	507	418	401	440	41,236
1981	1,497	2,918	4,434	6,031	7,065	6,354	4,534	3,013	2,196	1,719	1,349	919	612	451	407	492	43,991
1982	1,878	2,768	4,259	6,380	7,683	7,366	5,936	4,328	2,966	1,963	1,242	800	558	495	628	1,027	50,277
1983	2,621	3,254	4,000	6,935	9,169	9,591	8,264	6,060	4,006	2,594	1,687	1,130	764	584	566	693	61,918
1984	1,480	2,040	3,216	5,873	8,062	8,130	6,692	4,988	3,410	2,156	1,240	891	742	694	744	1,324	51,682
1985	2,571	4,324	6,339	8,654	9,730	9,226	7,164	5,155	3,845	2,895	2,131	1,525	1,141	1,036	1,227	2,311	69,274
1986	3,420	5,130	7,169	11,078	13,467	12,757	9,574	6,380	4,205	2,791	1,800	1,261	1,068	1,261	1,807	2,679	85,847
1987	4,577	7,915	11,554	14,213	16,032	15,022	11,426	7,407	4,420	2,695	1,771	1,545	1,509	1,574	1,757	2,636	106,053
1988	10,125	14,556	17,384	27,452	34,644	31,037	21,666	13,737	8,343	4,766	2,351	1,321	832	579	438	379	189,610
1989	13,525	19,879	22,787	28,745	34,057	28,111	16,997	8,750	4,237	1,991	820	479	379	467	753	1,313	183,290
1990	6,510	10,366	14,206	18,740	21,369	21,485	18,551	12,826	7,379	3,890	1,865	1,164	907	967	1,411	2,440	144,076
1991	3,785	5,624	9,475	15,666	22,840	25,013	20,653	13,803	7,991	4,401	2,368	1,637	1,248	1,215	1,699	3,178	140,596
1992	10,517	11,916	15,326	25,672	34,204	35,435	33,544	28,808	21,078	13,648	7,910	4,387	2,108	1,215	1,323	2,374	249,465
1993	33,679	46,725	40,054	43,325	35,961	25,717	21,883	20,912	18,331	14,928	11,941	12,337	13,621	14,619	15,803	18,371	388,207
1994	31,554	37,019	36,210	45,066	52,887	50,212	42,233	33,529	25,219	17,797	11,585	7,888	6,042	5,896	7,780	13,144	424,061
1995	30,557	38,581	54,287	89,134	120,072	113,866	84,593	55,616	33,683	18,467	8,133	4,110	2,169	1,202	750	627	655,847
1996	47,181	51,641	79,387	113,245	126,037	115,808	89,586	61,013	37,510	20,698	9,204	4,718	2,698	1,752	1,513	1,827	763,818
1997	20,849	36,322	56,459	88,695	108,685	102,388	85,549	64,993	43,365	25,374	12,019	6,123	3,478	2,436	2,079	2,233	661,047
1998	30,624	39,453	57,816	81,314	91,807	94,393	89,251	70,057	44,662	24,557	11,245	6,948	5,628	5,883	7,025	8,801	669,464
1999	31,074	50,081	74,426	104,938	115,640	101,531	77,745	52,474	31,375	17,128	8,206	5,315	4,641	5,525	7,258	9,373	696,730
2000	71,027	90,203	102,654	137,191	133,602	99,562	70,170	47,608	29,525	16,706	8,375	5,223	3,522	3,159	4,235	6,689	829,451
2001	88,052	120,873	99,307	120,131	110,866	81,381	58,478	43,560	30,260	18,713	9,838	6,018	3,929	3,010	3,546	6,710	804,672
2002	74,766	95,848	83,573	114,758	118,836	95,787	70,530	49,424	32,894	20,202	10,692	6,155	3,883	2,805	2,633	3,741	786,527
2003	66,871	82,202	72,290	135,198	155,450	121,634	82,686	55,887	37,184	22,852	11,977	6,922	4,448	3,138	2,506	2,672	863,917
2004	36,424	45,673	44,576	59,587	75,005	87,679	88,366	75,483	55,540	36,194	20,600	12,238	7,380	4,785	3,649	3,796	656,975
2005	31,937	40,725	42,913	61,520	73,855	77,459	72,875	60,791	44,156	28,730	16,776	10,343	6,316	4,133	3,245	3,401	579,175
2006	19,222	30,689	46,787	66,276	76,091	79,334	73,047	58,713	40,734	24,973	13,031	7,759	5,078	3,597	2,792	2,682	550,805
2007	43,884	49,553	48,327	65,793	77,810	82,361	73,603	58,550	41,593	26,320	14,144	8,330	5,279	3,559	2,595	2,246	603,947