

**PREPARATION OF DATA FROM THE SPANISH SURFACE LONGLINE FLEET : CREATION
OF BASIC FILES TO CARRY OUT ICCAT TASK II AND GLM'S BY SEX**

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SUMMARY

Based on the sampling of size (LJFL) and sex of over 140,000 swordfish between 1986 and 1996, a data base of sex ratio at size by time-area strata has been created, which has been useful in producing data bases for ICCAT Task II and individual trips by sex.

This paper presents the procedures and criteria used in the preparation of these basic files according to the recommendations by the SCRS in 1995.

RÉSUMÉ

On a créé une base de données sur le sex-ratio par taille par strate spatio-temporelle de l'espadon à partir de l'échantillonnage de taille (LJFL) et de sexe de plus de 140.000 poissons effectué entre les années 1986 et 1996. Cette base s'est avérée utile pour créer des bases pour la Tâche II de l'ICCAT et pour les sorties individuelles par sexe.

Le présent document fait état des méthodes employées et des critères suivis pour préparer ces fichiers de base conformément aux recommandations de 1995 du SCRS.

RESUMEN

Partiendo del muestreo de talla (LJFL) y el sexo de mas de 140.000 peces espada realizado entre los años 1986 y 1996, se ha creado una base de datos de sex-ratios por talla, por estratos espacio-temporales, que han servido para generar bases de datos de Tarea II de ICCAT y de mareas individuales, por sexo.

El presente documento resume los procedimientos y criterios empleados para la preparación de estos ficheros, siguiendo las recomendaciones del SCRS de ICCAT en 1995.

INTRODUCTION.

The preparation of ICCAT Task II of the Spanish surface longline fleet targeting the swordfish has undergone major qualitative changes over the years. Until 1987, data were prepared by large areas ICCAT (BIL), adopting two fractions of the traditional fleet, NW and SW Spain, and the processing of these fleets was done separately.

Starting in 1988, ICCAT Task II has been prepared jointly in the 5°x5°/month/fleet type format and submitted to the Secretary's office in this format which has been recommended repeatedly.

Moreover, the collection of data by separate trips, including information on catch, effort, sizes, position, etc. has made it possible to use these data bases in order to arrive at the standardized catch rates using GLM procedures (Mejuto, 1993; Mejuto, 1994; Mejuto & De la Serna, 1995; Hoey et al., 1995).

In addition, starting in 1986 on a preliminary level and more intensively as of 1988, data pertaining to size (LJFL) and sex of the swordfish were collected together with a series of variables which allowed for the classification of the samples in spatial-temporal strata, gear, etc. In 1996, the number of fishes sampled in the North and South Atlantic, Mediterranean Sea, Pacific and Indian Oceans has surpassed 140,000. The analyses of these data has been presented in previous papers (García & Mejuto, 1988; De la Serna et al., 1992; De la Serna et al., 1993; Mejuto et al., 1994; Mejuto et al., 1995; De la Serna et al. in press.). NW Atlantic data from other authors have been added to these files (Scott pers. comm. from Arocha et al., 1994).

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The most recent recommendations by the ICCAT SCRS (Anonymous, in press) as far as proposing new analytical approaches that take into account the differential growth by sex of the swordfish as well as the wide spatial/temporal variability found in the sex-ratio at size, require that additional data be prepared for Task II and for the GLM files which would be specific by sex. The purpose of this paper is to give an overview of these additional procedures.

MATERIAL AND METHODS.

DATA

The additional procedures are based on the use of 3 previously created basic input files, which we have named, for simplicity's sake, as follows:

GLM.DBF: contains data on catch, effort, and size by separate trips, in formats able to be used in GLM procedures by combined sexes.

CEMAPS.DBF: contains data on catch, effort, and size (ICCAT Task II) in the 5°x5°/month/fleet type format by combined sexes.

SWOSEX.DBF: contains data of the size-sex sampling carried out between 1986 and 1996 by the Spanish Oceanography Institute. Only the samplings from surface longline were considered in subsequent analyses. Records from the NW Atlantic pertaining to the fleets from USA and Venezuela have been added (Scott pers. comm. from Arocha et al., 1994).

A general diagram of the data processing is shown in figure 1.

DEFINITION OF SPATIAL-TEMPORAL STRATA

First of all the 3 basic files were subjected to the process of assigning 22 geographic areas (STRAT_1) as defined in figure 2. This spatial definition is based on both the knowledge of the fishery and on earlier papers regarding spatial-temporal variability of the sex-ratios at size (De la Serna et al., 1992; De la Serna et al., 1993; Mejuto et al., 1994; Mejuto et al., 1995; De la Serna et al., in press).

Secondly the temporal variable (STRAT_2) was defined. In this case the data were classified in 2 semesters '01' and '02', from January to June and from July to December, respectively.

This broad temporal definition makes it possible to increase substantially the sampling of the spatial-temporal strata, which in turn allows for an increase in the number of samples of most size classes (T050 - T350, by 5 cm intervals). This criteria was based on the fact that the fishing area factor appears to have a substantially greater impact on observed sex ratio at size than year or quarter factors (Turner et al., in press). This observation had already been mentioned empirically in the papers analyzing spatial-temporal variation of the sex-ratio at size (Mejuto et al., 1994; Mejuto et al., 1995). However, it must be noted that the availability of data from a specific area usually has temporal limitations due to the frequent seasonality existing in the fishing pattern of the fleets.

DEFINITION OF THE OVERALL SEX RATIOS (SR₀) AND SEX RATIOS AT SIZE (SR_s).

The size-sex data included in SWOSEX.DBF were collected for each spatial-temporal strata defined (STRAT_1, STRAT_2) and the corresponding sex ratios were calculated as follows and included in SEXRATI.DBF (table 1):

Overall sex ratio (SR₀)= # of females sampled / Total # sampled.

Sex ratio at size (SR_s)= # of females sampled by size / Total # sampled by size, where 's' includes size values ranging from 50 to 350 by 5 cm intervals.

The number of fishes sampled in the spatial-temporal strata defined was, in general, wide-ranging enough to show consistent trends in sex-ratio at size values. However the tail ends of the distribution usually have a high erratic variability caused by the increasing scarcity of individual samples which are 'small' or 'large' in size.

After examining the joint values of sex-ratio by size obtained (SR_s) the final values were defined by default for the tails of the distribution. Thus, values of SR_s=0.500 were considered for sizes smaller or equal to 125 cm (LJFL) and values of SR_s=1,000 were considered for sizes larger or equal to 210 cm.

In order to process the possible missing records in the data bases GLM.DBF and CEMAPS.DBF (Fig. 1), 2 records were created in SEXRATI.DBF with STRAT_1='99' and STRAT_2='01','02'. Their values for SR₀ and SR_s were obtained by averaging the SR₀ and SR_s values from the SEXRATI.DBF records from the Atlantic.

The SR₀ and SR_s values obtained for each spatial-temporal strata are shown in table 1.

RESULTS

DATA BY SEX: GLMSEX.DBF, CEMASEX.DBF.

The values for sex ratio at size obtained in SEXRATI.DBF for each STRAT_1 and STRAT_2 were applied to the available files, GLM.DBF for the period 1986-1995 and CEMAPS.DBF for the period 1988-1995. Each record of these files gave rise to 3 records (males, females, males+females). The number of females was calculated by multiplying size frequencies (T050-T350) by their corresponding SR_s. The number of males was calculated by multiplying the size frequencies by (1-SR_s).

When a record of GLM.DBF or CEMAPS.DBF of a particular STRAT_1, STRAT_2 did not have a spatial temporal relation in SEXRATI.DBF, the pertinent substitutions were created taking into account the criteria of spatial temporal proximity as well as the results of spatial temporal similarity of the sex-ratios reported in previous papers (Mejuto et al., 1994; Mejuto et al., 1995).

The data bases GLMSEX.DBF were later processed with growth equations by sex (Ehrhardt et al., in press) or sex combined (Anonymous, 1989) using a modified version of the procedure previously used for processing combined sexes (Restrepo, pers. comm.) The resulting file named GLSEXAGE.DBF was used as an input file to obtain standardized catch rates by age and sex or sex combined (SCRS 96/141), as per recommendations by the SCRS in 1995.

Moreover, the CEMASEX.DBF file contains data of catch, effort and size in a 5°x5°/month/fleet type format (Task II by sex), in keeping with the request by the SCRS in 1995.

DISCUSSION

In the preparation of these data it has been assumed that, in the variability of sex ratio by size, the spatial effect is noticeably more important than other possible effects that may be involved, such as year or month. However, it would seem that the gear variable also has an important effect on the sex ratios obtained even for the same area. In keeping with this, Mejuto et al., 1994, makes a comparison of the sex ratios by size obtained in the same area using two fishing gears, driftnet and longline, with considerable differences being found between the two gears.

Therefore, the SRs (sex ratios at size) values appear to be substantially influenced by the 'selectivity' of each gear. This highlights the fact that it would not be highly advisable to extrapolate the sex ratio values presented in this paper to other fleets operating with different fishing gears, with a different fishing pattern or targeting different species. The effect of such substitutions could lead to a major bias in the matrix of sizes by sex.

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LITERATURE CITED.

- Anonymous, 1989. Second ICCAT Swordfish workshop. ICCAT. Col. Vol. Sci. Pap. Vol XXIX:71-162.
- Anonymous, in press. Resumen Ejecutivo del pez espada, versión final. ICCAT. SCRS 1995. Vers. en español.
- Arocha, F., D.W. Lee, J.R. Grubich, 1994. Observations on sex ratio, maturity stages, and fecundity estimates of the swordfish, *Xiphias gladius*, in the Northwest Atlantic Ocean. ICCAT. Col. Vol. Sci. Pap. Vol.XLII(1):309-318.
- De la Serna, J.M., E. Alot, J. Mejuto, 1992. Análisis preliminar del sex-ratio por clase de talla del pez espada (*Xiphias gladius*) en el área Atlántica próxima al Estrecho de Gibraltar. ICCAT Col. Vol. Sci. Pap. Vol. XXXIX(2):514-521.
- De la Serna, J.M., E. Alot, M.D. Godoy, 1993. Análisis preliminar del sex-ratio por clase de talla del pez espada (*Xiphias gladius*) capturado con palangre de superficie en el Mediterraneo Occidental. ICCAT Col. Vol. Sci. Pap. Vol XL(1):141-148.
- De la Serna, J.M., J.M. Ortiz de Urbina, D. Macías, in press. Observations on sex-ratio, maturity and fecundity by length class for swordfish (*Xiphias gladius*) captured with surface longline in the western Mediterranean. ICCAT. SCRS 95/45.
- Ehrhardt, N.M., R.J. Robbins, F. Arocha, 1996. Age validation and growth of swordfish, *Xiphias gladius*, in the Northwestern Atlantic. ICCAT. Vol. XLV(2):358-367.
- García, B., J. Mejuto, 1988. Primeros datos sobre la biología de la reproducción del pez espada (*Xiphias gladius L.*) de las áreas 35°-45° N, 10°-40° W (BIL-94). ICCAT. Col. Vol. Sci. Pap. Vol. XXVII:164-177.
- Hoey, J.J., J. Mejuto, J.M. Porter, H.H. Stone, Y. Uozumi, 1995. An updated biomass index of abundance for North Atlantic swordfish, 1963-1993. ICCAT. Col. Vol. Sci. Pap. Vol. XLIV(3):187-196.
- Mejuto, J. 1993. "Age" specific standardized indices of abundance for swordfish (*Xiphias gladius*) from the Spanish longline fleet in the Atlantic, 1983-1991. ICCAT. Col. Vol. Sci. Pap. Vol. XL(1):375-392.
- Mejuto, J. 1994. Standardized indices of abundance at age for swordfish (*Xiphias gladius*) from the Spanish longline fleet in the Atlantic, 1983-1992. ICCAT. Col. Vol. Sci. Pap. Vol. XLII(2):322-327.
- Mejuto, J., J.M. de la Serna, B. García, M. Quintans, E. Alot, 1994. Sex ratio at size of the swordfish (*Xiphias gladius L.*) in the Atlantic and Mediterranean Sea: Similarity between different spatial-temporal strata. ICCAT. Col. Vol. Sci. Pap. Vol. XLII(2):328-334.
- Mejuto, J., J.M. de la Serna, 1995. Standardized catch rates by age and length groups for swordfish (*Xiphias gladius*) from the Spanish longline fleet in the Atlantic, 1983-93. ICCAT. Col. Vol. Sci. Pap. Vol. XLIV(3):114-125.
- Mejuto, J., J.M. de la Serna, B. García, 1995. An overview of the sex-ratio at size of the swordfish (*Xiphias gladius L.*) around the world: similarity between different strata. ICCAT. Col. Vol. Sci. Pap. Vol. XLIV(3):197-205.
- Turner, S.C., F. Arocha, G.P. Scott, in press. U.S. swordfish catch at age by sex. ICCAT. SCRS 95/101.

AREA STRAT_1	TIME STRAT_2	SRo	SRs																	
			T125	T130	T135	T140	T145	T150	T155	T160	T165	T170	T175	T180	T185	T190	T195	T200	T205	T210
01	01	0.49609	0.50000	0.37615	0.24359	0.48598	0.38136	0.38532	0.44860	0.50476	0.54430	0.53030	0.65789	0.73810	0.92105	0.88095	1.00000	1.00000	1.00000	1.00000
01	02	0.47491	0.50000	0.37113	0.46237	0.42718	0.40000	0.43529	0.47191	0.52459	0.52273	0.46667	0.53125	0.73684	0.72723	0.80000	0.77778	1.00000	1.00000	1.00000
02	01	0.49042	0.50000	0.36111	0.48387	0.46429	0.40000	0.28125	0.45161	0.48148	0.48485	0.50000	0.70000	0.62500	0.60000	0.62500	0.87500	0.87500	1.00000	1.00000
02	02	0.53319	0.50000	0.57426	0.54639	0.54255	0.50505	0.53846	0.45133	0.51429	0.54412	0.50000	0.51351	0.55556	0.74194	0.61905	0.84615	0.92857	0.88889	1.00000
03	01	0.37129	0.50000	0.34483	0.38889	0.20000	0.09756	0.46667	0.30769	0.36842	0.46667	0.38462	0.50000	0.66667	1.00000	0.57143	1.00000	1.00000	0.66667	1.00000
03	02	0.49670	0.50000	0.46341	0.36000	0.43056	0.55224	0.43056	0.48571	0.52941	0.50000	0.56000	0.20000	0.87500	0.72727	0.83333	0.92857	0.71429	1.00000	1.00000
04	01	0.55984	0.50000	0.49408	0.49143	0.51768	0.57639	0.56575	0.65021	0.60558	0.62712	0.69880	0.67883	0.76636	0.78947	0.81707	0.82143	0.84314	0.79310	1.00000
04	02	0.61706	0.50000	0.50476	0.56501	0.59194	0.63591	0.65591	0.71827	0.71069	0.66129	0.72917	0.73932	0.77202	0.79558	0.78689	0.83146	0.91071	0.97959	1.00000
05	01	0.58350	0.50000	0.50781	0.61207	0.65625	0.64773	0.76190	0.76471	0.82812	0.78261	0.85714	0.79310	0.94286	0.91667	1.00000	1.00000	0.86364	0.80000	1.00000
05	02	0.62383	0.50000	0.52191	0.58042	0.65473	0.67553	0.74242	0.76568	0.78472	0.79909	0.79255	0.81818	0.84000	0.88350	0.90000	0.90769	0.97590	0.96296	1.00000
06	01	0.59076	0.50000	0.55920	0.58991	0.58162	0.67524	0.62171	0.65261	0.65498	0.67885	0.73936	0.73981	0.73180	0.79724	0.87013	0.91000	0.92466	0.91379	1.00000
06	02	0.65806	0.50000	0.61818	0.58872	0.65789	0.68061	0.70408	0.70445	0.76096	0.76355	0.78812	0.80317	0.79292	0.84815	0.89520	0.86747	0.94886	0.97015	1.00000
07	01	0.16330	0.50000	0.10526	0.06311	0.05650	0.04348	0.02076	0.03597	0.06681	0.15902	0.22275	0.38028	0.56364	0.78667	0.88889	1.00000	1.00000	1.00000	1.00000
07	02	0.15174	0.50000	0.09302	0.00000	0.02817	0.02532	0.04673	0.04950	0.03191	0.16667	0.27586	0.65385	0.81250	0.90000	0.88095	0.90323	1.00000	1.00000	1.00000
08	01	0.30496	0.50000	0.11429	0.12329	0.09524	0.07831	0.14907	0.11111	0.17188	0.27523	0.35714	0.58882	0.74419	0.85106	0.91176	1.00000	0.93548	1.00000	1.00000
08	02	0.32255	0.50000	0.09524	0.09402	0.06289	0.06542	0.09158	0.11157	0.11245	0.23958	0.37821	0.48951	0.70370	0.76923	0.90361	0.90000	0.95918	0.97619	1.00000
09	01	0.45065	0.50000	0.21795	0.25191	0.35714	0.33858	0.26786	0.35398	0.29530	0.39041	0.49558	0.53968	0.57547	0.75000	0.78261	0.91803	0.95745	1.00000	1.00000
09	02	0.52641	0.50000	0.28295	0.35780	0.38874	0.38404	0.35629	0.36342	0.40177	0.50495	0.53211	0.61690	0.70846	0.85338	0.85356	0.96000	0.96196	0.97321	1.00000
10	01	0.34552	0.50000	0.00000	0.24000	0.21154	0.15385	0.35385	0.41463	0.39286	0.66667	0.57143	0.31579	0.75000	1.00000	0.66667	0.75000	0.87500	1.00000	1.00000
10	02	0.63550	0.50000	0.52016	0.44554	0.60896	0.61560	0.65499	0.63487	0.68966	0.72819	0.75839	0.71161	0.75000	0.77838	0.82468	0.86957	0.93976	0.94203	1.00000
11	01	0.51351	0.50000	0.33333	0.45454	0.42857	0.37500	0.12500	0.48387	0.40000	0.25000	0.45161	0.46667	0.47368	0.71429	0.62500	0.66667	0.91667	0.90909	1.00000
11	02	0.62543	0.50000	0.57843	0.56962	0.51240	0.55294	0.69167	0.64815	0.54808	0.65957	0.54286	0.50000	0.82228	0.70492	0.66667	0.72917	0.80000	0.93750	1.00000
12	01	0.48462	0.50000	0.36905	0.39326	0.33696	0.29060	0.29730	0.31646	0.33146	0.30392	0.34634	0.48958	0.43564	0.45902	0.60403	0.66393	0.71667	0.86076	1.00000
12	02	0.62563	0.50000	0.44000	0.59091	0.68650	0.40000	0.53333	0.52381	0.63636	0.50000	0.62963	0.67857	0.58333	0.73913	0.75000	0.88889	0.90909	0.70000	1.00000
20	01	0.49917	0.50000	0.37113	0.50000	0.64865	0.72222	0.68750	0.67647	0.75000	0.69231	0.83333	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
20	02	0.50769	0.50000	0.40767	0.49541	0.49754	0.50495	0.66667	0.66129	0.78378	0.80000	0.72222	0.77778	0.70000	0.66667	0.80000	1.00000	1.00000	1.00000	1.00000
21	01	0.49947	0.50000	0.47036	0.52941	0.65079	0.68750	0.63478	0.72449	0.69880	0.71831	0.82759	0.70833	0.90000	0.90909	1.00000	0.50000	1.00000	1.00000	1.00000
21	02	0.49083	0.50000	0.44654	0.52874	0.58553	0.60082	0.70701	0.64138	0.77311	0.77273	0.89286	0.81081	0.80952	0.95652	0.90909	1.00000	0.87500	1.00000	1.00000
40	02	0.56308	0.50000	0.48062	0.55039	0.60204	0.63934	0.72549	0.61702	0.72340	0.60000	0.64151	0.67568	0.52381	0.39535	0.44898	0.52941	0.63889	0.61111	1.00000
50	01	0.37376	0.50000	0.16055	0.14304	0.15710	0.19700	0.24718	0.38376	0.46512	0.54783	0.62759	0.75490	0.79327	0.89041	0.92035	0.94186	0.97101	1.00000	1.00000
50	02	0.34877	0.50000	0.15789	0.18750	0.16549	0.19920	0.26852	0.33529	0.45669	0.64646	0.64474	0.76364	0.85000	0.88889	0.93333	1.00000	1.00000	1.00000	1.00000
91	01	0.64404	0.50000	0.51515	0.51327	0.59848	0.53846	0.59211	0.49451	0.53448	0.64286	0.69231	0.74324	0.69492	0.87719	0.78378	0.96875	0.96296	0.93939	1.00000
91	02	0.72101	0.50000	0.73358	0.67808	0.69203	0.70629	0.69847	0.67901	0.69469	0.74866	0.79769	0.83439	0.88393	0.86667	0.89535	0.96203	0.91803	0.91667	1.00000
92	01	0.44008	0.50000	0.33333	0.35979	0.30102	0.22535	0.28495	0.30496	0.29375	0.27742	0.33333	0.35606	0.45669	0.60194	0.68000	0.82258	0.82353	0.95000	1.00000
92	02	0.45518	0.50000	0.37069	0.42727	0.39080	0.28947	0.31667	0.32353	0.36364	0.51351	0.52174	0.74074	0.54167	0.60000	0.66667	0.80000	0.83333	0.75000	1.00000
93	01	0.57045	0.50000	0.36170	0.51429	0.60870	0.46154	0.47222	0.62500	0.61538	0.79487	0.82353	0.53846	0.75000	0.86667	0.91667	1.00000	0.88889	0.60000	1.00000
93	02	0.53900	0.50000	0.53333	0.40000	0.46000	0.45714	0.66667	0.62963	0.50000	0.71795	0.66667	0.82609	0.69565	0.80000	0.66667	0.87500	1.00000	1.00000	1.00000
99	01	0.50051	0.50000	0.38981	0.41298	0.43454	0.40763	0.44029	0.46589	0.47828	0.53049	0.56480	0.60384	0.69163	0.79040	0.78555	0.88145	0.91276	0.91433	1.00000
99	02	0.50051	0.50000	0.38981	0.41298	0.43454	0.40763	0.44029	0.46589	0.47828	0.53049	0.56480	0.60384	0.69163	0.79040	0.78555	0.88145	0.91276	0.91433	1.00000

Table 1.- Values of overall sex ratio (SRo) and sex ratio at size (SRs), for each spatial temporal strata defined. SRs= 0.500 for sizes smaller or equal to 125 cm (LJFL). SRs=1.000 for sizes larger or equal to 210 cm.

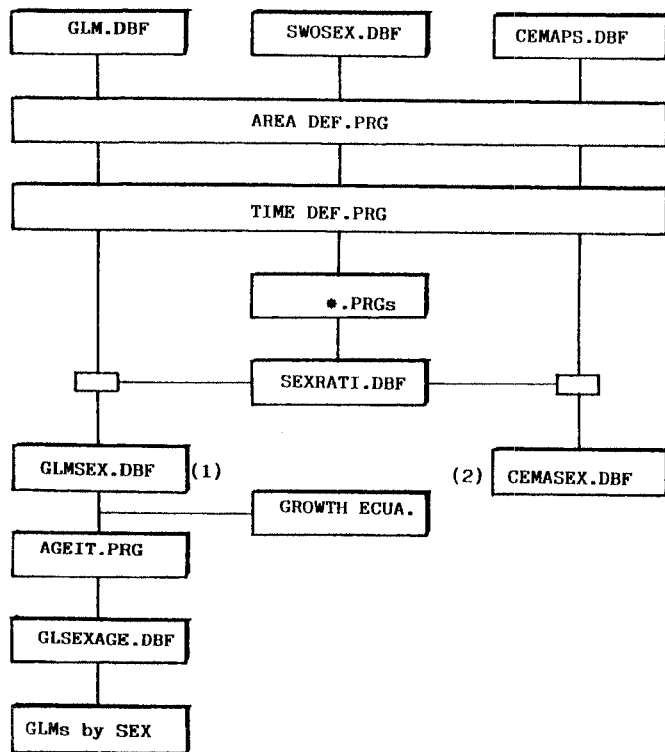


Figure 1.- General diagram of the data processing for the preparation of data bases by sex.

Input files.

Area definition

Time definition.

Area-time accumulation, etc.

Sex ratio by area-time : SRo, SRs.

Output by sex: (1) Data trip by sex. (2) Task II by sex.

Ehrhardt et al., 1996 (SCRS/95/99) / Anonymous 1989, growth models.

Procedure used for converting sizes into ages (Restrepo pers. comm.)

Data base by trip, age and sex.

GLM procedures by sex (SCRS/ 96/141).

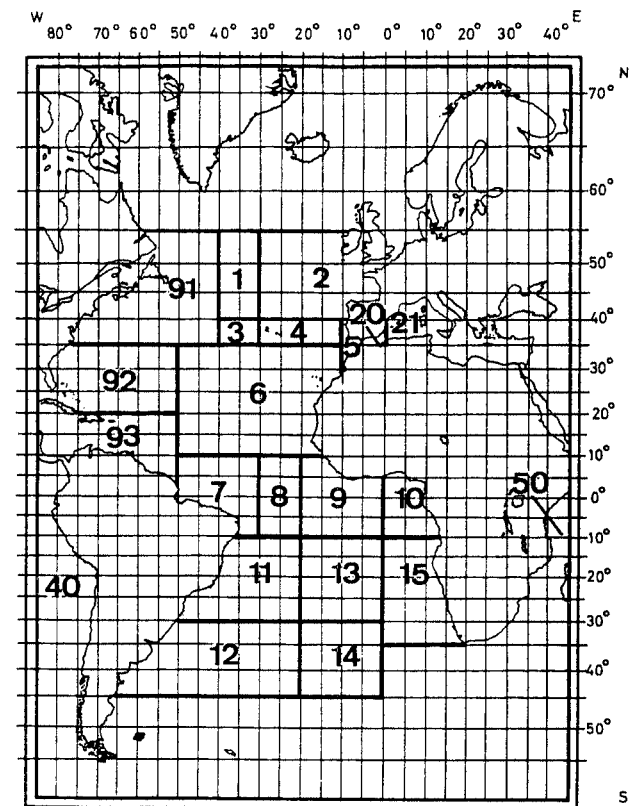


Figure 2.- Definition of spatial strata for the preparation of data by sex.