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STANDARDIZED CATCH RATES FOR ALBACORE (*Thunnus alalunga*) FROM THE SPANISH SURFACE FLEETS IN THE NORTHEAST ATLANTIC, YEARS 1981-1993.

J. Mejuto[1] and B. García[1]

ABSTRACT

Data from 19,681 individual trips carried out using traditional gears for the Spanish fishery of albacore -trolling and bait boat - from the 1981-1993 period were analyzed. Standardized age-specific catch rates were developed by means of General Linear Modelling (GLM) procedures and the available age length key, using the methodology as described in previous papers. Additional analyses age/gear-specific and in biomass units (round weight) were also developed. Information from a new re-started fishery in the fall season was also evaluated but this information was not considered appropriate for a GLM approach.

Available information: year, gear, area and month were incorporated into the models. Interactions were also considered in the preliminary runs. The variability rate (gears combined) by age explained by the model ranged between 36% and 40 %. The variability rate was 46% in the case of the biomass index (gears combined).

RESUME

Des données provenant de 19.681 sorties effectuées entre 1981 et 1993 par la flottille germonière espagnole au moyen d'engins traditionnels, ligneurs et canneurs, ont été analysées. Des taux de capture standardisés spécifiques de l'âge ont été élaborés par la méthode du modèle linéaire généralisé (GLM) et la clé âge-longueur disponible, selon la méthodologie décrite dans des travaux antérieurs. Des analyses supplémentaires spécifiques de l'âge et des engins, et en unités de biomasse (poids vif) ont également été élaborées. L'information disponible sur une pêcherie automnale qui a récemment repris est aussi évaluée, mais cette information n'a pas été jugée appropriée pour une approche par GLM.

L'information disponible : année, engin, mois, a été incorporée aux modèles. Les passages préliminaires considéraient également les interactions. Le taux de variabilité (tous engins confondus) par âge expliqué par le modèle allait de 36 % à 40 %. Le taux de variabilité était de 46 % dans le cas de l'indice de la biomasse (tous engins confondus).

RESUMEN

En este documento se analizan datos procedentes de 19681 mareas individuales realizadas entre 1981 y 1993 por la flota española dirigida al atún blanco usando artes tradicionales: curricán y cebo vivo. Se obtuvieron índices estandarizados por clases de edad usando un Modelo Lineal Generalizado (GLM) a partir de la captura por edad previamente obtenida basandose en claves talla-edad, usando la metodología descrita en documentos anteriores. Fueron tambien desarrollados análisis específicos edad/arte y en unidades de biomasa (peso vivo). La información disponible de la pesqueria otoñal recientemente re-iniciada fue evaluada, pero la información fue considerada cuantitativamente poco apropiada para su análisis por medio de esta metodología.

Las variables disponibles: año, arte, área y mes fueron incorporadas dentro del modelo. Interacciones fueron tambien introducidas en los análisis preliminares. Las tasas de variabilidad (artes combinadas) por edad explicadas por el modelo se encuentran dentro del rango de 36% a 40%. La tasa de variabilidad fue del 46% en el caso de índices de biomasa (artes combinadas).

[1] Instituto Español de Oceanografía. P.O. Box 130, 15080 La Coruña, Spain.

1. INTRODUCTION

Although all the information that comes from commercial fleet activity should be interpreted with caution, as based on the in-depth empirical knowledge of the fishery, a point in fact is that the data corresponding to catch per unit of effort (*CPUE*) from commercial fleets have frequently been used to estimate relative trends in "stock abundance", to tune virtual population analyses (VPA) and to fit production models. In most cases external indices are not available for these fisheries.

Even though this type of methodology has been the object of criticism pointing out the possible mediocrity of the results obtained (Fontenau & Bard, 1993), the generalized linear modelling technique (GLM) (Robson, 1966; Gavaris, 1980; Kimura, 1981) has proved to be a suitable methodology for arriving at relative standardized catch rates, assumed to be "relative abundance indices", when basic information is available and appropriate.

In previous papers, only size specific catch data from 1983-1992 were considered in the analyses. During the 1993-1994 period, a tireless "archaeological" task was carried out to recover the information from the period 1981-1987 (biomass by trip) which was not available in earlier analyses.

Only information that fulfilled all the requirements was entered for future analyses. Trips without sufficient identification (date, area, etc.) were omitted. These strict requirements may limit the actual possibility of going back further in time in future studies.

The purpose of this paper is to present age-specific standardized *CPUE* trends for albacore using trip-by-trip data from the traditional Spanish baitboat and trolling fleets by means of similar methodology and criteria, as in previous GLM analyses (Mejuto, Conser & Garcia 1992, Mejuto & Garcia 1993, Mejuto & Garcia 1994). Additional age/gear biomass analyses were carried out. More details on the methodology can be found in the papers previously cited.

2. DATA

Data records were taken during the landing from 19,681 trips carried out using traditional gears for the Spanish fishery of albacore in the north Atlantic -trolling (TROL) and bait boat (BB)- during the 1981-1993 period. These trip records basically contain the following data:

(1) landing date
(2) type of gear
(3) number of fishing days
(4) location of the fishing effort (5 X 5 degree square)
(5) catch in numbers
(6) catch in weight (kg)
(7) number sampled at the landing port (number >0 when sampled).
(8) sample frequency distribution of catch-at-size (FL=30 to 135, in 1 cm intervals).

3. METHODS

3.1. Ageing

The transformation of the size distributions by trip into ages (for ages 1, 2, 3, and 4) was done using a set of yearly age length key (YALKs) obtained from MULTIFAN (ICCAT 1992; Santiago, 1992; Santiago 1993; Santiago pers. communication), using data from the period 1978-1992. ALK of 1992 was carried on to ALK of 1993. Therefore the catch by age data base was created and then analyzed.

In order to obtain the largest possible comparable time series, records from the recently re-started fall fishery carried out by the Spanish fleet after the fall of 1990 in the areas around the Azores (or between Azores and Iberian Peninsula) and records from the Mediterranean Sea were excluded from the base case analysis. Therefore records from the traditional fishery were used for main analyses, although data from the new fall fishery were also considered and evaluated for possible specific analyses.

3.2. Model and Specifications.

The only two traditional gears used by the Spanish surface fleet, bait boat and trolling, were included in the analysis.

All empirical information on the seasonal migratory behavior of albacore, the fishing pattern of the Spanish fleets, and the number of trip observations available, were jointly considered to establish area and time strata for the GLM analyses, taking previous results into account.

The areas generally used in the models are shown in Figure 1, although tentative analyses have used other area definitions.

The following time strata were selected:
Q1 = January - July
Q3 = August and September (standard)
Q2 = October - December

Although indices of abundance by age were developed for ages 1, 2, 3, and 4, the fishery mostly targets ages 2-4, with the current catch being dominated by ages 2 and 3 in both gears. Biomass indices were also developed from landing records (kg. round weight).

The analyses were carried out using GLM procedures. The main effects were considered to be year, gear, area and time. The following model was defined for final runs:

(1) $\mathrm{LOG}\,(CPUE) = \mu + Y_i + G_j + A_k + Q_l + eijkl$

where the *CPUE* = the nominal *CPUE* of the observation (catch in number/weight of fish of the corresponding age/trip divided by the number of fishing days of the trip carried out in year *i*, by gear *j*, in area *k*, and time *l*).

When gear-specific analyses were developed, the gear (G_j) term was not included in the model.

μ = overall mean.
Y_i = logarithm of the effect of year *i*
G_j = logarithm of the effect of gear *j*
A_k = logarithm of the effect of area *k*
Q_l = logarithm of the effect of time *l*
e = logarithm of the normally distributed error term

Observations having values of $CPUE=0$ were omitted from the analysis.

Exploratory analyses (by age or biomass) were carried out introducing gear-area and area-time interaction terms into the model. As in previous age-specific analyses, results have indicated that they make a minor contribution to the overall sum of squares in a variety of exploratory runs by age or biomass. Because of this, interactions were excluded from the final runs.

4. RESULTS AND DISCUSSION.

A total of 19,681 trips from 1981 to 1993 were classified in spatial/temporal strata, as described above, and then analyzed. This represents a fishing effort of 179,959 fishing days, corresponding to a catch of 24,321,145 fish in number and 156,691 MT.

As in previous analyses, a "second pass" GLM procedure was defined to overcome the problems of residuals with absolute values greater than 2.5, in most cases negative (Mejuto *et al.* 1992). Records having an absolute residual value greater than 2.5 in the "first pass" were omitted from the second GLM run.

Standardized residual patterns for each age considered or for biomass in general show a normally distributed pattern when there is a suitable number of samples.

Table 1 (a-f) show data for number of observations by year, area and time strata considered in each run. The number of observations is, on the whole, acceptable, except in the case of analysis by age, gear = BB (run 1). In an attempt to improve the distribution of the observations, an additional BB 'run 2' was carried out using a new definition of areas-times. However, the statistical results did not show a significant improvement.

Table 2 is a summary of the ANOVA results subjected to these conditions. The variability rate by age explained by the model (R-squared) is between 36% and 40% when the gear effect was included, which is very close to previous results. However these variability rates by age change when gear specific analyses are done.

Tables 3 to 7 supply information on estimated parameters, their standard error, the relative *CPUE* and upper and lower 95% confidence limits considered by age or in biomass, for different runs.

Figures 2, 3, 4 show trends obtained for ages 1, 2, 3 and 4, respectively. This catch-rate is contingent upon a number of factors such as availability in the area/time strata as well as the results obtained from the fishery among ages. Thus trends obtained for ages 1 (especially) and 4 (TROL) should not be interpreted strictly in terms of abundance.

Age 1 (Fig. 2, 3, 4) show trends that could be interpreted as exhibiting wide yearly fluctuation which could be justified based on the different strength of the recruits. However, we must remember again that age 1 is not usually a target catch (in some cases even avoided) for the traditional fleets and its schools are normally well distinguished from other age-schools.

Age 4 is not very frequent in trolling catches although it is more frequent in the case of the bait boat. This explains the statistics obtained when gear-specific analyses are developed.

The resulting indices for ages 2 and 3 (for both gears) and age 4 (for BB) are probably less affected by similar problems. Ages 2 and 3 are highly represented in the catches of both gears and make up the majority of the targets of their activity.

The results of the analyses by gear (in number and biomass) occasionally show conflicting trends between the two. On an empirical level, this would be expected, as each gear used a different fishing strategy. The catchability of the trolling gear is influenced by a great number of relatively known factors. However its fishing system, based on pseudo randomness, is somewhat less affected by the degree of dispersion-concentration of the schools than the baitboat.

The technological improvements carried out by the bait boat fleet especially during mid 1980's might explain the sharp increase seen in the baitboat biomass index during this period (Fig. 5,c). We would have expected this trend to level off afterward, as in the case of trolling (Fig. 5,b); this however did not occur.

5. ACKNOWLEDGMENTS

We would like to thank to Dr. Josu Santiago for providing the age length keys used for ageing and useful comments. Dr. Victoria Ortiz has been untiring in her participation in the joint work to create the data bases of most recent years. We would especially like to thank Dr. Ramon J. Conser for helping us to create methodological bases for this analysis.

Span.N.Atl. ALB CPUEs 1981-1993, YALK 81-92 (93 esti. <-- 92)
Trol & Bait boat gears used as effect into the GLM model.

TABLE 1 OF AREA BY QTR
CONTROLLING FOR YR=81

AREA Frequency	QTR 1	2	3	Total
1	1	2	15	18
2	2	0	22	24
3	4	0	0	4
4	7	0	3	10
Total	14	2	40	56

TABLE 2 OF AREA BY QTR
CONTROLLING FOR YR=82

AREA Frequency	QTR 1	2	3	Total
1	19	1	48	68
2	5	1	28	34
3	4	0	1	5
4	18	0	9	27
Total	46	2	86	134

TABLE 3 OF AREA BY QTR
CONTROLLING FOR YR=83

AREA Frequency	QTR 1	2	3	Total
1	2	3	44	49
2	1	17	27	45
3	0	0	0	0
4	27	0	20	47
Total	30	20	91	141

TABLE 4 OF AREA BY QTR
CONTROLLING FOR YR=84

AREA Frequency	QTR 1	2	3	Total
1	12	0	29	41
2	3	0	12	15
3	0	0	0	0
4	24	0	30	54
Total	39	0	71	110

TABLE 5 OF AREA BY QTR
CONTROLLING FOR YR=85

AREA Frequency	QTR 1	2	3	Total
1	0	10	18	28
2	21	2	52	75
3	2	0	0	2
4	28	0	14	42
Total	51	12	84	147

TABLE 6 OF AREA BY QTR
CONTROLLING FOR YR=86

AREA Frequency	QTR 1	2	3	Total
1	1	23	48	72
2	2	13	15	30
3	35	0	3	38
4	17	0	24	41
Total	55	36	90	181

TABLE 7 OF AREA BY QTR
CONTROLLING FOR YR=87

AREA Frequency	QTR 1	2	3	Total
1	0	10	15	25
2	1	4	6	11
3	5	0	3	8
4	15	0	17	32
Total	21	14	41	76

TABLE 8 OF AREA BY QTR
CONTROLLING FOR YR=88

AREA Frequency	QTR 1	2	3	Total
1	6	22	54	82
2	6	28	48	82
3	31	0	9	40
4	16	0	34	50
Total	59	50	145	254

TABLE 9 OF AREA BY QTR
CONTROLLING FOR YR=89

AREA Frequency	QTR 1	2	3	Total
1	7	40	74	121
2	17	23	54	94
3	47	0	3	50
4	52	10	77	139
Total	123	73	208	404

TABLE 10 OF AREA BY QTR
CONTROLLING FOR YR=90

AREA Frequency	QTR 1	2	3	Total
1	2	32	27	61
2	15	34	90	139
3	64	0	4	68
4	60	0	72	132
Total	141	66	193	400

TABLE 11 OF AREA BY QTR
CONTROLLING FOR YR=91

AREA Frequency	QTR 1	2	3	Total
1	3	1	23	27
2	13	47	75	135
3	84	1	2	87
4	64	0	114	178
Total	164	49	214	427

TABLE 12 OF AREA BY QTR
CONTROLLING FOR YR=92

AREA Frequency	QTR 1	2	3	Total
1	5	2	50	57
2	42	29	86	157
3	53	2	2	57
4	56	0	46	102
Total	156	33	184	373

TABLE 13 OF AREA BY QTR
CONTROLLING FOR YR=93

AREA Frequency	QTR 1	2	3	Total
1	4	2	26	32
2	26	8	125	159
3	94	1	2	97
4	25	2	52	79
Total	149	13	205	367

Table 1.a. Number of trips (number of observations) by year, area and time strata used in the analyses, years 1981-1993. GEAR effect included in the model (TROLL and BB).

TABLE 1 OF AREA BY QTR
CONTROLLING FOR YR=81

AREA QTR

Frequency	1	2	3	Total
1	1	0	7	8
2	2	0	8	10
3	4	0	0	4
4	7	0	3	10
Total	14	0	18	32

TABLE 2 OF AREA BY QTR
CONTROLLING FOR YR=82

AREA QTR

Frequency	1	2	3	Total
1	18	0	31	49
2	5	0	11	16
3	4	0	1	5
4	17	0	9	26
Total	44	0	52	96

TABLE 3 OF AREA BY QTR
CONTROLLING FOR YR=83

AREA QTR

Frequency	1	2	3	Total
1	1	1	22	24
2	0	0	19	19
3	0	0	0	0
4	27	0	20	47
Total	28	1	61	90

TABLE 4 OF AREA BY QTR
CONTROLLING FOR YR=84

AREA QTR

Frequency	1	2	3	Total
1	12	0	10	22
2	3	0	4	7
3	0	0	0	0
4	24	0	30	54
Total	39	0	44	83

TABLE 5 OF AREA BY QTR
CONTROLLING FOR YR=85

AREA QTR

Frequency	1	2	3	Total
1	0	6	9	15
2	17	0	24	41
3	2	0	0	2
4	24	0	13	37
Total	43	6	46	95

TABLE 6 OF AREA BY QTR
CONTROLLING FOR YR=86

AREA QTR

Frequency	1	2	3	Total
1	1	9	26	36
2	1	7	8	16
3	34	0	2	36
4	12	0	22	34
Total	48	16	58	122

TABLE 7 OF AREA BY QTR
CONTROLLING FOR YR=87

AREA QTR

Frequency	1	2	3	Total
1	0	3	2	5
2	0	1	2	3
3	2	0	1	3
4	13	0	10	23
Total	15	4	15	34

TABLE 8 OF AREA BY QTR
CONTROLLING FOR YR=88

AREA QTR

Frequency	1	2	3	Total
1	6	14	40	60
2	3	11	26	40
3	29	0	7	36
4	15	0	30	45
Total	53	25	103	181

TABLE 9 OF AREA BY QTR
CONTROLLING FOR YR=89

AREA QTR

Frequency	1	2	3	Total
1	7	16	30	53
2	12	8	30	50
3	43	0	1	44
4	41	10	55	106
Total	103	34	116	253

TABLE 10 OF AREA BY QTR
CONTROLLING FOR YR=90

AREA QTR

Frequency	1	2	3	Total
1	2	28	17	47
2	11	24	60	95
3	64	0	4	68
4	56	0	67	123
Total	133	52	148	333

TABLE 11 OF AREA BY QTR
CONTROLLING FOR YR=91

AREA QTR

Frequency	1	2	3	Total
1	3	1	17	21
2	12	37	46	95
3	78	0	1	79
4	57	0	109	166
Total	150	38	173	361

TABLE 12 OF AREA BY QTR
CONTROLLING FOR YR=92

AREA QTR

Frequency	1	2	3	Total
1	5	0	40	45
2	36	22	43	101
3	53	2	2	57
4	54	0	46	100
Total	148	24	131	303

TABLE 13 OF AREA BY QTR
CONTROLLING FOR YR=93

AREA QTR

Frequency	1	2	3	Total
1	4	2	24	30
2	17	4	72	93
3	94	1	2	97
4	25	2	52	79
Total	140	9	150	299

Table 1.b. Number of trips (number of observations) by year, area and time strata used in the analyses, years 1981-1993. GEAR = TROLLING.

Spam. N.Atl. ALB CPUEs 1981-1993, BB , YALK 81-92 (93 est por 92)
(four areas, three times).

TABLE 1 OF AREA BY QTR
CONTROLLING FOR YR=81

AREA / QTR Frequency	1	2	3	Total
1	0	2	8	10
2	0	0	14	14
3	0	0	0	0
4	0	0	0	0
Total	0	2	22	24

TABLE 2 OF AREA BY QTR
CONTROLLING FOR YR=82

AREA / QTR Frequency	1	2	3	Total
1	1	1	17	19
2	0	1	17	18
3	0	0	0	0
4	1	0	0	1
Total	2	2	34	38

TABLE 3 OF AREA BY QTR
CONTROLLING FOR YR=83

AREA / QTR Frequency	1	2	3	Total
1	1	2	22	25
2	1	17	8	26
3	0	0	0	0
4	0	0	0	0
Total	2	19	30	51

TABLE 4 OF AREA BY QTR
CONTROLLING FOR YR=84

AREA / QTR Frequency	1	2	3	Total
1	0	0	19	19
2	0	0	8	8
3	0	0	0	0
4	0	0	0	0
Total	0	0	27	27

TABLE 5 OF AREA BY QTR
CONTROLLING FOR YR=85

AREA / QTR Frequency	1	2	3	Total
1	0	4	9	13
2	4	2	28	34
3	0	0	0	0
4	4	0	1	5
Total	8	6	38	52

TABLE 6 OF AREA BY QTR
CONTROLLING FOR YR=86

AREA / QTR Frequency	1	2	3	Total
1	0	14	22	36
2	1	6	7	14
3	1	0	1	2
4	5	0	2	7
Total	7	20	32	59

TABLE 7 OF AREA BY QTR
CONTROLLING FOR YR=87

AREA / QTR Frequency	1	2	3	Total
1	0	7	13	20
2	1	3	4	8
3	3	0	2	5
4	2	0	7	9
Total	6	10	26	42

TABLE 8 OF AREA BY QTR
CONTROLLING FOR YR=88

AREA / QTR Frequency	1	2	3	Total
1	0	8	14	22
2	3	17	22	42
3	2	0	2	4
4	1	0	4	5
Total	6	25	42	73

TABLE 9 OF AREA BY QTR
CONTROLLING FOR YR=89

AREA / QTR Frequency	1	2	3	Total
1	0	24	44	68
2	5	15	24	44
3	4	0	2	6
4	11	0	22	33
Total	20	39	92	151

TABLE 10 OF AREA BY QTR
CONTROLLING FOR YR=90

AREA / QTR Frequency	1	2	3	Total
1	0	4	10	14
2	4	10	30	44
3	0	0	0	0
4	4	0	5	9
Total	8	14	45	67

TABLE 11 OF AREA BY QTR
CONTROLLING FOR YR=91

AREA / QTR Frequency	1	2	3	Total
1	0	0	6	6
2	1	10	29	40
3	6	1	1	8
4	7	0	5	12
Total	14	11	41	66

TABLE 12 OF AREA BY QTR
CONTROLLING FOR YR=92

AREA / QTR Frequency	1	2	3	Total
1	0	2	10	12
2	6	7	43	56
3	0	0	0	0
4	2	0	0	2
Total	8	9	53	70

TABLE 13 OF AREA BY QTR
CONTROLLING FOR YR=93

AREA / QTR Frequency	1	2	3	Total
1	0	0	2	2
2	9	4	53	66
3	0	0	0	0
4	0	0	0	0
Total	9	4	55	68

Table 1.c. **Number of trips (number of observations) by year, area and time strata used in the analyses, years 1981-1993. GEAR = BAIT BOAT run 1.**

TABLE 1 OF AREA BY QTR
CONTROLLING FOR YR=81

AREA / QTR Frequency	1	2	3	Total
1	123	29	303	455
2	201	43	596	840
3	7	0	4	11
4	47	0	23	70
Total	378	72	926	1376

TABLE 2 OF AREA BY QTR
CONTROLLING FOR YR=82

AREA / QTR Frequency	1	2	3	Total
1	206	71	530	807
2	125	24	432	581
3	13	0	1	14
4	132	0	29	161
Total	476	95	992	1563

TABLE 3 OF AREA BY QTR
CONTROLLING FOR YR=83

AREA / QTR Frequency	1	2	3	Total
1	83	21	465	569
2	36	485	339	860
3	2	0	1	3
4	236	0	98	334
Total	357	506	903	1766

TABLE 4 OF AREA BY QTR
CONTROLLING FOR YR=84

AREA / QTR Frequency	1	2	3	Total
1	54	1	315	370
2	5	13	60	78
3	2	0	1	3
4	149	3	194	346
Total	210	17	570	797

TABLE 5 OF AREA BY QTR
CONTROLLING FOR YR=85

AREA / QTR Frequency	1	2	3	Total
1	74	223	151	448
2	211	131	623	965
3	132	0	0	132
4	161	1	133	295
Total	578	355	907	1840

TABLE 6 OF AREA BY QTR
CONTROLLING FOR YR=86

AREA / QTR Frequency	1	2	3	Total
1	10	159	456	625
2	12	51	267	330
3	275	0	37	312
4	138	0	184	322
Total	435	210	944	1589

TABLE 7 OF AREA BY QTR
CONTROLLING FOR YR=87

AREA / QTR Frequency	1	2	3	Total
1	0	54	103	157
2	15	28	91	134
3	61	0	8	69
4	28	1	73	102
Total	104	83	275	462

TABLE 8 OF AREA BY QTR
CONTROLLING FOR YR=88

AREA / QTR Frequency	1	2	3	Total
1	22	283	417	722
2	74	461	394	929
3	143	0	23	166
4	54	0	128	182
Total	293	744	962	1999

TABLE 9 OF AREA BY QTR
CONTROLLING FOR YR=89

AREA / QTR Frequency	1	2	3	Total
1	21	332	335	688
2	70	207	306	583
3	103	0	3	106
4	182	43	284	509
Total	376	582	928	1886

TABLE 10 OF AREA BY QTR
CONTROLLING FOR YR=90

AREA / QTR Frequency	1	2	3	Total
1	36	170	162	368
2	57	277	339	673
3	119	0	7	126
4	214	9	270	493
Total	426	456	778	1660

TABLE 11 OF AREA BY QTR
CONTROLLING FOR YR=91

AREA / QTR Frequency	1	2	3	Total
1	14	13	105	132
2	17	347	440	804
3	248	1	12	261
4	171	2	331	504
Total	450	363	888	1701

TABLE 12 OF AREA BY QTR
CONTROLLING FOR YR=92

AREA / QTR Frequency	1	2	3	Total
1	14	39	229	282
2	174	167	614	955
3	112	2	3	117
4	171	0	142	313
Total	471	208	988	1667

TABLE 13 OF AREA BY QTR
CONTROLLING FOR YR=93

AREA / QTR Frequency	1	2	3	Total
1	27	10	142	179
2	129	43	417	589
3	179	1	3	183
4	72	13	179	264
Total	407	67	741	1215

Table 1.d. Number of trips (number of observations) by year, area and time strata used in the BIOMASS analyses, years 1981-1993. GEAR effect included in the model (TROLL and BB).

TABLE 1 OF AREA BY QTR
CONTROLLING FOR YR=81

AREA / Frequency	QTR 1	2	3	Total
1	101	0	117	218
2	109	1	318	428
3	7	0	4	11
4	42	0	20	62
Total	259	1	459	719

TABLE 2 OF AREA BY QTR
CONTROLLING FOR YR=82

AREA / Frequency	QTR 1	2	3	Total
1	134	0	258	392
2	69	0	171	240
3	13	0	1	14
4	112	0	29	141
Total	328	0	459	787

TABLE 3 OF AREA BY QTR
CONTROLLING FOR YR=83

AREA / Frequency	QTR 1	2	3	Total
1	42	1	205	248
2	28	12	102	142
3	2	0	1	3
4	166	0	92	258
Total	238	13	400	651

TABLE 4 OF AREA BY QTR
CONTROLLING FOR YR=84

AREA / Frequency	QTR 1	2	3	Total
1	49	0	77	126
2	5	0	26	31
3	2	0	1	3
4	149	3	189	341
Total	205	3	293	501

TABLE 5 OF AREA BY QTR
CONTROLLING FOR YR=85

AREA / Frequency	QTR 1	2	3	Total
1	53	113	60	226
2	157	50	297	504
3	118	0	0	118
4	118	0	132	250
Total	446	163	489	1098

TABLE 6 OF AREA BY QTR
CONTROLLING FOR YR=86

AREA / Frequency	QTR 1	2	3	Total
1	6	90	308	404
2	2	24	117	143
3	212	0	15	227
4	88	0	179	267
Total	308	114	619	1041

TABLE 7 OF AREA BY QTR
CONTROLLING FOR YR=87

AREA / Frequency	QTR 1	2	3	Total
1	0	10	10	20
2	12	1	30	43
3	22	0	2	24
4	21	1	40	62
Total	55	12	82	149

TABLE 8 OF AREA BY QTR
CONTROLLING FOR YR=88

AREA / Frequency	QTR 1	2	3	Total
1	19	114	194	327
2	46	221	259	526
3	76	0	11	87
4	42	0	105	147
Total	183	335	569	1087

TABLE 9 OF AREA BY QTR
CONTROLLING FOR YR=89

AREA / Frequency	QTR 1	2	3	Total
1	21	95	128	244
2	65	64	211	340
3	98	0	1	99
4	137	43	165	345
Total	321	202	505	1028

TABLE 10 OF AREA BY QTR
CONTROLLING FOR YR=90

AREA / Frequency	QTR 1	2	3	Total
1	33	103	76	212
2	43	97	172	312
3	113	0	6	119
4	142	8	178	328
Total	331	208	432	971

TABLE 11 OF AREA BY QTR
CONTROLLING FOR YR=91

AREA / Frequency	QTR 1	2	3	Total
1	11	9	45	65
2	15	228	234	477
3	199	0	7	206
4	118	2	260	380
Total	343	239	546	1128

TABLE 12 OF AREA BY QTR
CONTROLLING FOR YR=92

AREA / Frequency	QTR 1	2	3	Total
1	10	4	136	150
2	124	101	306	531
3	105	2	3	110
4	142	0	142	284
Total	381	107	587	1075

TABLE 13 OF AREA BY QTR
CONTROLLING FOR YR=93

AREA / Frequency	QTR 1	2	3	Total
1	8	10	78	96
2	66	12	228	306
3	179	1	3	183
4	71	13	173	257
Total	324	36	482	842

Table 1.e. Number of trips (number of observations) by year, area and time strata used in the BIOMASS analyses, years 1981-1993. GEAR = TROLLING.

TABLE 1 OF AREA BY QTR
CONTROLLING FOR YR=81

AREA / Frequency (QTR)	1	2	3	Total
1	22	29	186	237
2	92	42	278	412
3	0	0	0	0
4	5	0	3	8
Total	119	71	467	657

TABLE 2 OF AREA BY QTR
CONTROLLING FOR YR=82

AREA / Frequency (QTR)	1	2	3	Total
1	72	71	272	415
2	56	24	261	341
3	0	0	0	0
4	20	0	0	20
Total	148	95	533	776

TABLE 3 OF AREA BY QTR
CONTROLLING FOR YR=83

AREA / Frequency (QTR)	1	2	3	Total
1	41	20	260	321
2	8	473	237	718
3	0	0	0	0
4	70	0	6	76
Total	119	493	503	1115

TABLE 4 OF AREA BY QTR
CONTROLLING FOR YR=84

AREA / Frequency (QTR)	1	2	3	Total
1	5	1	238	244
2	0	13	34	47
3	0	0	0	0
4	0	0	5	5
Total	5	14	277	296

TABLE 5 OF AREA BY QTR
CONTROLLING FOR YR=85

AREA / Frequency (QTR)	1	2	3	Total
1	21	110	91	222
2	54	81	326	461
3	14	0	0	14
4	43	1	1	45
Total	132	192	418	742

TABLE 6 OF AREA BY QTR
CONTROLLING FOR YR=86

AREA / Frequency (QTR)	1	2	3	Total
1	4	69	148	221
2	10	27	150	187
3	63	0	22	85
4	50	0	5	55
Total	127	96	325	548

TABLE 7 OF AREA BY QTR
CONTROLLING FOR YR=87

AREA / Frequency (QTR)	1	2	3	Total
1	0	44	93	137
2	3	27	61	91
3	39	0	6	45
4	7	0	33	40
Total	49	71	193	313

TABLE 8 OF AREA BY QTR
CONTROLLING FOR YR=88

AREA / Frequency (QTR)	1	2	3	Total
1	3	169	223	395
2	28	240	135	403
3	67	0	12	79
4	12	0	23	35
Total	110	409	393	912

TABLE 9 OF AREA BY QTR
CONTROLLING FOR YR=89

AREA / Frequency (QTR)	1	2	3	Total
1	0	237	207	444
2	5	143	95	243
3	5	0	2	7
4	45	0	119	164
Total	55	380	423	858

TABLE 10 OF AREA BY QTR
CONTROLLING FOR YR=90

AREA / Frequency (QTR)	1	2	3	Total
1	3	67	86	156
2	14	180	167	361
3	6	0	1	7
4	72	1	92	165
Total	95	248	346	689

TABLE 11 OF AREA BY QTR
CONTROLLING FOR YR=91

AREA / Frequency (QTR)	1	2	3	Total
1	3	4	60	67
2	2	119	206	327
3	49	1	5	55
4	53	0	71	124
Total	107	124	342	573

TABLE 12 OF AREA BY QTR
CONTROLLING FOR YR=92

AREA / Frequency (QTR)	1	2	3	Total
1	4	35	93	132
2	50	66	308	424
3	7	0	0	7
4	29	0	0	29
Total	90	101	401	592

TABLE 13 OF AREA BY QTR
CONTROLLING FOR YR=93

AREA / Frequency (QTR)	1	2	3	Total
1	19	0	64	83
2	63	31	189	283
3	0	0	0	0
4	1	0	6	7
Total	83	31	259	373

Table 1.f. Number of trips (number of observations) by year, area and time strata used in the BIOMASS analyses, years 1981-1993. GEAR = BAIT BOAT.

Table 2. **Number of observations, R-square, mean square error (root) and F statistics for each age or biomass and gear/s considered in the analyses.**

GEAR	AGE	# OBSERV.	R-SQUARE	RMSE	F-STAT.
TR & BB	1	2829	0.3892	1.2190	99.48
	2	2955	0.4020	0.9642	109.65
	3	2958	0.3883	0.8406	103.65
	4	2929	0.3605	1.0310	91.11
TR	1	2153	0.4081	1.0445	86.58
	2	2206	0.5161	0.8455	137.31
	3	2199	0.3687	0.7998	74.92
	4	2167	0.0642	1.0302	8.67
BB (RUN 1)	1	685	0.3394	1.6689	20.15
	2	746	0.2253	1.1798	12.45
	3	766	0.2085	0.8860	11.59
	4	762	0.2061	0.9807	11.36
BB (RUN 2)	1	685	0.3270	1.6806	23.25
	2	748	0.1662	1.2362	10.44
	3	760	0.1617	0.8657	10.26
	4	759	0.1815	0.9781	11.78
TR & BB BIOMASS		19085	0.4572	0.6439	892.33
TR BIOMASS		10814	0.3984	0.5711	420.63
BB BIOMASS		8243	0.1448	0.6486	81.92

NOTE: BB (run 1):Four areas and three time periods were considered in the analyses as in the TR & BB, TR and BIOMASS runs.
BB (run 2): Two areas and two time periods were considered in the analyses.

Table 3. Estimated parameters, standard error, relative CPUEs (TROL & BB) and upper and lower 95% confidence limits, obtained in the final run, North Atlantic Spanish albacore fishery. GEAR effect included into the model.

Year	LSMEAN	STDERR	UCPU1	CPU1	LCPU1
AGE 1 (second pass)					
93	3.20661	0.07165	28.4917	24.7588	21.5149
92	3.16538	0.07094	27.3012	23.7574	20.6736
91	3.54584	0.06531	39.4875	34.7429	30.5684
90	2.73387	0.06715	17.5971	15.4271	13.5246
89	2.30208	0.06735	11.4313	10.0176	8.7787
88	3.11682	0.08041	26.5137	22.6475	19.3451
87	-0.02463	0.18438	1.4244	0.9924	0.6914
86	2.43721	0.09801	13.9309	11.4961	9.4869
85	2.86545	0.10967	21.8985	17.6629	14.2465
84	2.54993	0.12546	16.5056	12.9073	10.0935
83	1.33682	0.12315	4.8830	3.8359	3.0133
82	0.32137	0.12801	1.7868	1.3904	1.0818
81	3.05208	0.16731	29.7850	21.4575	15.4582

Year	LSMEAN	STDERR	UCPU2	CPU2	LCPU2
AGE 2 (second pass)					
93	3.80172	0.05652	50.1036	44.8498	40.1470
92	3.88514	0.05639	54.4488	48.7512	43.6498
91	4.08243	0.05168	65.6970	59.3687	53.6499
90	3.61688	0.05245	41.3083	37.2727	33.6313
89	3.34316	0.05191	31.3822	28.3465	25.6045
88	3.74955	0.06377	48.2584	42.5886	37.5849
87	3.67568	0.11145	49.4191	39.7215	31.9269
86	3.49768	0.07483	38.3650	33.1313	28.6115
85	2.95078	0.08612	22.7209	19.1919	16.2109
84	3.27121	0.09885	32.1317	26.4721	21.8094
83	3.44438	0.08499	37.1353	31.4372	26.6134
82	3.60255	0.08998	43.9461	36.8405	30.8839
81	3.31325	0.13587	36.1901	27.7290	21.2461

Year	LSMEAN	STDERR	UCPU3	CPU3	LCPU3
AGE 3 (second pass)					
93	3.31849	0.04940	30.4635	27.6524	25.1007
92	3.22274	0.04946	27.6852	25.1275	22.8062
91	2.84953	0.04627	18.9401	17.2981	15.7984
90	3.13132	0.04635	25.1093	22.9287	20.9376
89	3.15843	0.04389	25.6724	23.5562	21.6145
88	3.34958	0.05469	31.7620	28.5333	25.6327
87	3.79955	0.09717	54.3114	44.8927	37.1073
86	3.27206	0.06417	29.9607	26.4200	23.2978
85	3.12757	0.07315	26.4066	22.8796	19.8237
84	3.29343	0.08565	31.9756	27.0340	22.8560
83	3.80810	0.07380	52.2207	45.1878	39.1021
82	3.82060	0.07745	53.2714	45.7687	39.3226
81	3.31178	0.11632	34.6929	27.6201	21.9892

Year	LSMEAN	STDERR	UCPU4	CPU4	LCPU4
AGE 4 (second pass)					
93	2.26089	0.06064	10.8220	9.6093	8.5325
92	2.45707	0.06049	13.1636	11.6919	10.3848
91	2.08421	0.05685	9.0002	8.0512	7.2024
90	2.26207	0.05688	10.7527	9.6184	8.6038
89	2.08407	0.05466	8.9593	8.0492	7.2314
88	2.56523	0.06788	14.8883	13.0336	11.4100
87	2.04152	0.12071	9.8296	7.7587	6.1240
86	2.72106	0.07888	17.7924	15.2437	13.0601
85	2.12255	0.09021	10.0085	8.3864	7.0273
84	2.61166	0.10442	16.8066	13.6961	11.1613
83	2.69778	0.09051	17.8013	14.9077	12.4845
82	2.38625	0.09537	13.1671	10.9222	9.0600
81	1.73781	0.14022	7.5570	5.7411	4.3615

Table 4. **Estimated parameters, standard error, relative CPUEs (TROL) and upper and lower 95% confidence limits, obtained in the final run, North Atlantic Spanish albacore fishery. GEAR = TROLLING.**

Year	LSMEAN	STDERR	UCPU1	CPU1	LCPU1
AGE 1 (second pass)					
93	2.94253	0.06595	21.6276	19.0051	16.7007
92	2.93801	0.06469	21.4748	18.9177	16.6651
91	3.29475	0.05909	30.3355	27.0178	24.0630
90	2.35117	0.06003	11.8299	10.5167	9.3494
89	2.03437	0.07203	8.8300	7.6673	6.6577
88	2.91049	0.08104	21.5982	18.4261	15.7199
87	0.55631	0.24072	2.8780	1.7955	1.1202
86	2.50696	0.09755	14.9232	12.3261	10.1810
85	2.47908	0.11653	15.0938	12.0116	9.5588
84	2.22627	0.12042	11.8170	9.3326	7.3706
83	0.70208	0.13166	2.6348	2.0355	1.5726
82	0.42741	0.12904	1.9911	1.5461	1.2006
81	3.26612	0.18715	38.4918	26.6725	18.4824

Year	LSMEAN	STDERR	UCPU3	CPU3	LCPU3
AGE 3 (second pass)					
93	2.58322	0.05125	14.6579	13.2571	11.9901
92	2.56247	0.05136	14.3601	12.9849	11.7414
91	2.24165	0.04744	10.3373	9.4194	8.5830
90	2.34558	0.04666	11.4514	10.4507	9.5374
89	2.42004	0.05235	12.4785	11.2617	10.1635
88	2.73280	0.06119	17.3676	15.4046	13.6635
87	2.97598	0.13856	25.9753	19.7979	15.0897
86	2.59560	0.07465	15.5599	13.4420	11.6124
85	2.52352	0.08596	14.8160	12.5186	10.5775
84	2.72054	0.09247	18.2845	15.2536	12.7252
83	3.34760	0.08842	33.9473	28.5458	24.0037
82	3.26438	0.08690	11.9901	26.2628	22.1500
81	2.81588	0.14565	22.4647	16.8859	12.6926

Year	LSMEAN	STDERR	UCPU2	CPU2	LCPU2
AGE 2 (second pass)					
93	3.23747	0.05368	28.3356	25.5060	22.9590
92	3.50416	0.05349	36.9820	33.3012	29.9867
91	3.69111	0.04793	44.0891	40.1355	36.5364
90	3.12707	0.04873	25.1226	22.8342	20.7541
89	2.79113	0.05702	18.2563	16.3259	14.5996
88	3.35365	0.06636	32.6520	28.6699	25.1734
87	3.16190	0.14644	31.8057	23.8701	17.9144
86	3.27966	0.07956	31.1486	26.6510	22.8029
85	2.54299	0.09307	15.3288	12.7728	10.6430
84	3.04780	0.09765	25.6348	21.1695	17.4821
83	2.97935	0.09385	23.7525	19.7618	16.4416
82	3.29291	0.09264	32.4202	27.0368	22.5473
81	3.17093	0.15637	32.7740	24.1227	17.7551

Year	LSMEAN	STDERR	UCPU4	CPU4	LCPU4
AGE 4 (second pass)					
93	1.45883	0.06601	4.9056	4.3103	3.7872
92	1.68045	0.06632	6.1266	5.3798	4.7240
91	1.39150	0.06097	4.5397	4.0284	3.5746
90	1.43849	0.06015	4.7503	4.2220	3.7524
89	1.28895	0.06874	4.1622	3.6376	3.1791
88	1.81776	0.07954	7.2198	6.1776	5.2858
87	1.02087	0.18102	4.0231	2.8215	1.9787
86	1.89740	0.09607	8.0874	6.6994	5.5495
85	1.22143	0.11176	4.2491	3.4133	2.7419
84	1.80179	0.12050	7.7309	6.1046	4.8205
83	2.00321	0.11443	9.3376	7.4615	5.9624
82	1.55734	0.11314	5.9626	4.7767	3.8266
81	0.85589	0.18474	3.4385	2.3940	1.6668

Table 5. **Estimated parameters, standard error, relative CPUEs (BB) and upper and lower 95% confidence limits, obtained in the final run, North Atlantic Spanish albacore fishery. GEAR = BAITBOAT run 1.**

Year	LSMEAN	STDERR	UCPU1	CPU1	LCPU1
AGE 1 (second pass)					
93	3.28254	0.25424	45.2937	27.5185	16.7190
92	2.66304	0.24156	23.7044	14.7643	9.1959
91	3.37754	0.21976	46.1737	30.0146	19.5106
90	3.25699	0.23921	42.7113	26.7251	16.7223
89	2.32178	0.16907	14.4031	10.3406	7.4239
88	3.05352	0.21582	33.1093	21.6891	14.2080
87	-0.48810	0.33149	1.2418	0.6485	0.3386
86	1.25353	0.26149	6.0511	3.6245	2.1710
85	3.07366	0.26779	37.8786	22.4101	13.2585
84	2.53966	0.39038	29.4004	13.6790	6.3644
83	2.29074	0.29635	18.4580	10.3259	5.7766
82	-0.76283	0.35793	1.0028	0.4972	0.2465
81	2.24643	0.37203	21.0060	10.1313	4.8864

Year	LSMEAN	STDERR	UCPU3	CPU3	LCPU3
AGE 3 (second pass)					
93	3.75895	0.13203	56.0610	43.2788	33.4112
92	3.39316	0.12796	38.5580	30.0044	23.3485
91	2.73335	0.11707	19.4860	15.4902	12.3141
90	3.97512	0.12770	68.9620	53.6925	41.8039
89	3.72957	0.08617	49.5100	41.8163	35.3180
88	3.55626	0.11367	44.0580	35.2591	28.2171
87	4.39875	0.14058	108.2210	82.1572	62.3706
86	3.64851	0.12506	49.4740	38.7190	30.3017
85	3.32503	0.13828	36.8040	28.0668	21.4036
84	2.64864	0.19219	20.9850	14.3983	9.8791
83	3.62116	0.13824	49.4850	37.7399	28.7827
82	3.77862	0.16031	60.6840	44.3215	32.3709
81	3.14337	0.19320	34.4910	23.6185	16.1731

Year	LSMEAN	STDERR	UCPU2	CPU2	LCPU2
AGE 2 (second pass)					
93	4.36381	0.17779	113.0800	79.8076	56.3251
92	3.94627	0.17453	73.9630	52.5361	37.3163
91	3.96522	0.15765	72.7220	53.3914	39.1991
90	4.05295	0.16488	80.6180	58.3549	42.2401
89	3.85699	0.11787	60.0380	47.6527	37.8226
88	3.83684	0.15316	63.3550	46.9260	34.7572
87	4.06965	0.18739	86.0120	59.5732	41.2610
86	3.26784	0.17144	37.2830	26.6431	19.0395
85	3.00575	0.18835	29.7450	20.5628	14.2152
84	2.35859	0.26549	18.4340	10.9554	6.5109
83	3.68482	0.18626	58.3960	40.5351	28.1373
82	3.37238	0.21749	45.7090	29.8455	19.4873
81	2.85783	0.26281	30.1890	18.0358	10.7753

Year	LSMEAN	STDERR	UCPU4	CPU4	LCPU4
AGE 4 (second pass)					
93	2.63396	0.14624	18.7517	14.0786	10.5700
92	2.71940	0.13875	20.1052	15.3179	11.6706
91	1.99106	0.13471	9.6230	7.3900	5.6752
90	2.82540	0.13774	22.3060	17.0285	12.9996
89	2.58226	0.09475	15.9980	13.2865	11.0345
88	2.94319	0.12762	24.5688	19.1315	14.8974
87	2.77816	0.15746	22.1799	16.2901	11.9643
86	3.26957	0.13917	34.8837	26.5560	20.2163
85	2.71724	0.15285	20.6662	15.3163	11.3513
84	2.76305	0.20510	24.1935	16.1850	10.8275
83	2.87346	0.15283	24.1597	17.9060	13.2711
82	2.92893	0.17717	26.8932	19.0035	13.4284
81	2.15259	0.21369	13.3866	8.8059	5.7927

Table 6. **Estimated parameters, standard error, relative CPUEs (BB) and upper and lower 95% confidence limits, obtained in the final run, North Atlantic Spanish albacore fishery. GEAR = BAITBOAT run 2.**

Year	LSMEAN	STDERR	UCPU1	CPU1	LCPU1
AGE 1 (second pass)					
93	3.21615	0.22952	40.1391	25.5973	16.3238
92	2.59893	0.22276	21.3352	13.7872	8.9096
91	3.16050	0.21836	37.0519	24.1514	15.7425
90	3.14771	0.22810	37.3674	23.8964	15.2817
89	2.15082	0.16747	12.0986	8.7132	6.2751
88	2.95133	0.21527	29.8574	19.5799	12.8401
87	-0.71765	0.33747	1.0007	0.5165	0.2666
86	1.18390	0.25940	5.6179	3.3789	2.0322
85	2.98913	0.25226	33.6284	20.5107	12.5099
84	2.49844	0.38022	27.5488	13.0753	6.2059
83	2.27178	0.29221	17.9430	10.1196	5.7073
82	-0.83059	0.34821	0.9162	0.4630	0.2340
81	2.18056	0.36444	19.3223	9.4590	4.6305

Year	LSMEAN	STDERR	UCPU2	CPU2	LCPU2
AGE 2 (second pass)					
93	4.48383	0.16674	124.5300	89.8130	64.7745
92	4.05094	0.16601	80.6490	58.2485	42.0698
91	4.21504	0.16218	94.2610	68.5928	49.9144
90	4.16180	0.16351	89.6260	65.0506	47.2135
89	3.89965	0.11942	62.8560	49.7387	39.3591
88	3.75418	0.15792	58.9200	43.2351	31.7258
87	4.18395	0.19846	98.7540	66.9299	45.3614
86	3.14306	0.17439	33.1180	23.5297	16.7176
85	3.10128	0.18370	32.4020	22.6045	15.7698
84	2.49323	0.26829	21.2230	12.5437	7.4140
83	3.57263	0.18949	52.5620	36.2551	25.0075
82	3.51184	0.21687	52.4800	34.3074	22.4276
81	2.79854	0.26242	28.4260	16.9959	10.1616

Year	LSMEAN	STDERR	UCPU3	CPU3	LCPU3
AGE 3 (second pass)					
93	3.94498	0.11600	65.3050	52.0243	41.4442
92	3.56694	0.11422	44.5830	35.6400	28.4911
91	2.98126	0.11499	24.8600	19.8433	15.8392
90	4.16166	0.11799	81.4420	64.6264	51.2830
89	3.78299	0.08252	51.8390	44.0973	37.5119
88	3.60490	0.10998	45.9020	37.0010	29.8262
87	4.48308	0.13896	117.3430	89.3656	68.0585
86	3.71311	0.12012	52.2360	41.2776	32.6184
85	3.53351	0.12755	44.3300	34.5238	26.8870
84	2.91838	0.18120	26.8420	18.8177	13.1924
83	3.69060	0.13081	52.2240	40.4132	31.2735
82	3.99459	0.15000	73.6890	54.9181	40.9290
81	3.34440	0.18375	41.3240	28.8263	20.1083

Year	LSMEAN	STDERR	UCPU4	CPU4	LCPU4
AGE 4 (second pass)					
93	2.76238	0.13143	20.6687	15.9749	12.3470
92	2.82435	0.12735	21.8032	16.9872	13.2350
91	1.95928	0.13313	9.2913	7.1573	5.5135
90	2.96138	0.13206	25.2529	19.4938	15.0481
89	2.57209	0.09377	15.8043	13.1509	10.9429
88	2.95054	0.12671	24.7032	19.2704	15.0324
87	2.70401	0.15972	20.6936	15.1313	11.0641
86	3.29964	0.13720	35.8006	27.3593	20.9083
85	2.79930	0.14316	21.9802	16.6025	12.5405
84	2.91527	0.19776	27.7279	18.8181	12.7713
83	2.96631	0.14822	26.2538	19.6347	14.6845
82	3.04424	0.16993	29.7174	21.2993	15.2658
81	2.26588	0.20811	14.8118	9.8506	6.5511

Table 7. **Estimated parameters, standard error, relative BIOMASS CPUEs (TROL & BB) and upper and lower 95 % confidence limits, obtained for North Atlantic Spanish albacore fishery, for TROL & BB (GEAR effect included), TROL and BB,** respectively.

Year	LSMEAN	STDERR	UCPU2	CPU2	LCPU2
TROL & BB					
93	6.69194	0.01938	837.236	806.035	775.997
92	6.61559	0.01706	772.144	746.755	722.201
91	6.52932	0.01647	707.501	685.025	663.262
90	6.66480	0.01634	809.940	784.410	759.685
89	6.43153	0.01537	640.200	621.197	602.758
88	6.71720	0.01509	851.410	826.595	802.504
87	6.82636	0.03039	978.863	922.257	868.924
86	6.54869	0.01679	721.795	698.430	675.821
85	6.52028	0.01600	700.485	678.854	657.890
84	6.58860	0.02408	762.102	726.976	693.468
83	6.67992	0.01628	822.176	796.360	771.354
82	6.67955	0.01805	824.765	796.092	768.416
81	6.39094	0.01917	619.373	596.529	574.527

Year	LSMEAN	STDERR	UCPU2	CPU2	LCPU2
TROL					
93	6.11531	0.02071	471.591	452.832	434.819
92	6.14404	0.01870	483.410	466.012	449.241
91	6.12097	0.01803	471.763	455.381	439.567
90	5.99504	0.01886	416.619	401.503	386.936
89	5.73634	0.01837	321.345	309.981	299.019
88	6.21636	0.01788	518.825	500.957	483.705
87	6.13399	0.04706	506.404	461.782	421.091
86	6.12226	0.01849	472.795	455.972	439.748
85	6.00273	0.01819	419.284	404.598	390.427
84	6.15218	0.02726	495.704	469.915	445.467
83	6.28177	0.02401	560.657	534.889	510.305
82	6.21224	0.02261	521.548	498.943	477.319
81	5.90712	0.02353	385.100	367.746	351.174

Year	LSMEAN	STDERR	UCPU2	CPU2	LCPU2
BB					
93	6.93949	0.03733	1111.36	1032.96	960.09
92	6.73884	0.03046	896.95	844.97	796.00
91	6.65274	0.02890	820.41	775.23	732.53
90	7.17520	0.02690	1377.84	1307.09	1239.97
89	6.97531	0.02463	1123.15	1070.22	1019.78
88	7.02532	0.02342	1177.91	1125.06	1074.59
87	7.24632	0.03756	1511.18	1403.93	1304.28
86	6.70452	0.02899	864.17	816.43	771.33
85	6.75471	0.02707	905.18	858.40	814.04
84	6.53149	0.04155	745.30	687.01	633.28
83	6.88019	0.02287	1017.68	973.07	930.41
82	6.86336	0.02755	1010.04	956.94	906.63
81	6.58869	0.02945	770.34	727.14	686.36

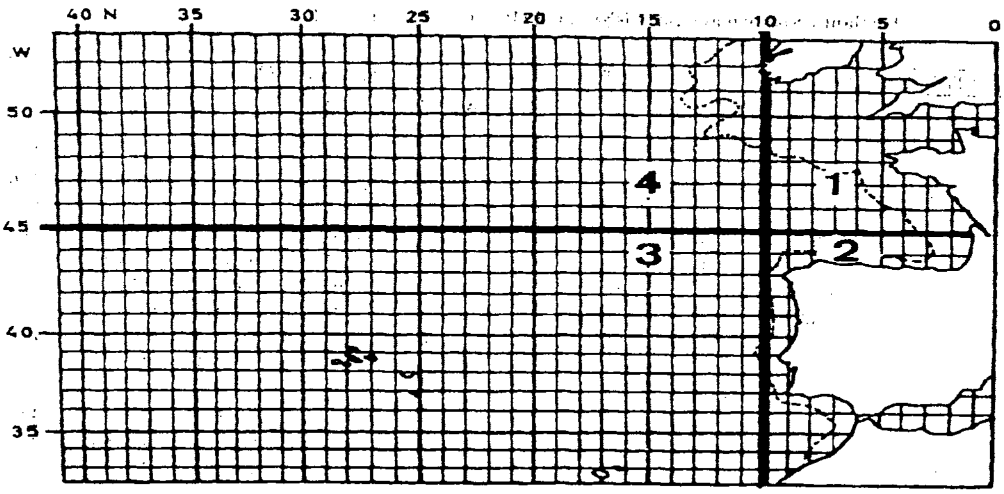


Fig. 1. Geographical area division used for the GLM analyses (base cases) for the Spanish north Atlantic albacore catch and effort data, 1981-1993.

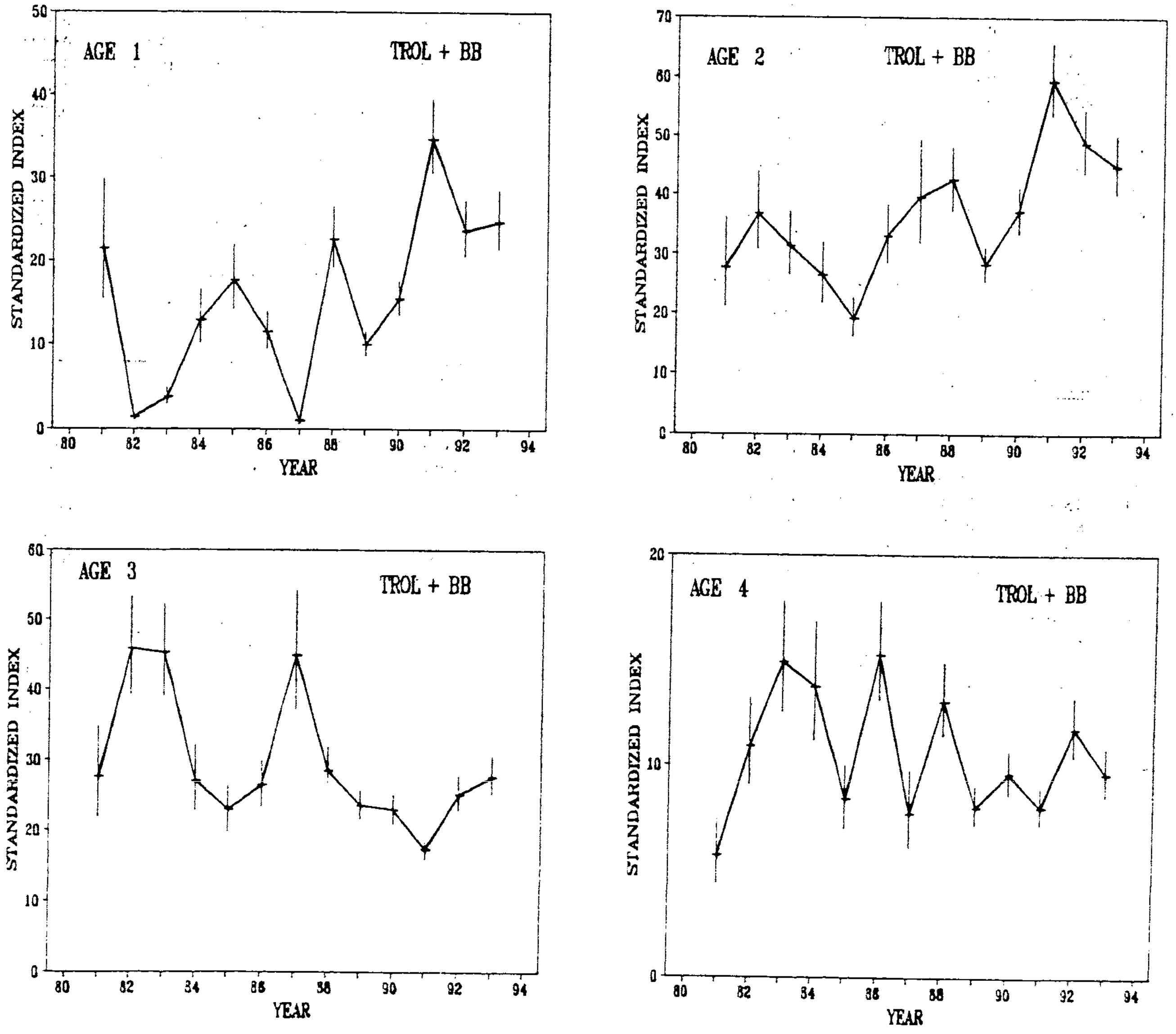


Fig. 2. Annual change of standardized CPUE (TROL & BB), in number, by age class 1, 2, 3 and 4. GEAR effect was included in the model. North Atlantic Spanish albacore fisheries. (Bars represent 95% Confidence intervals.)

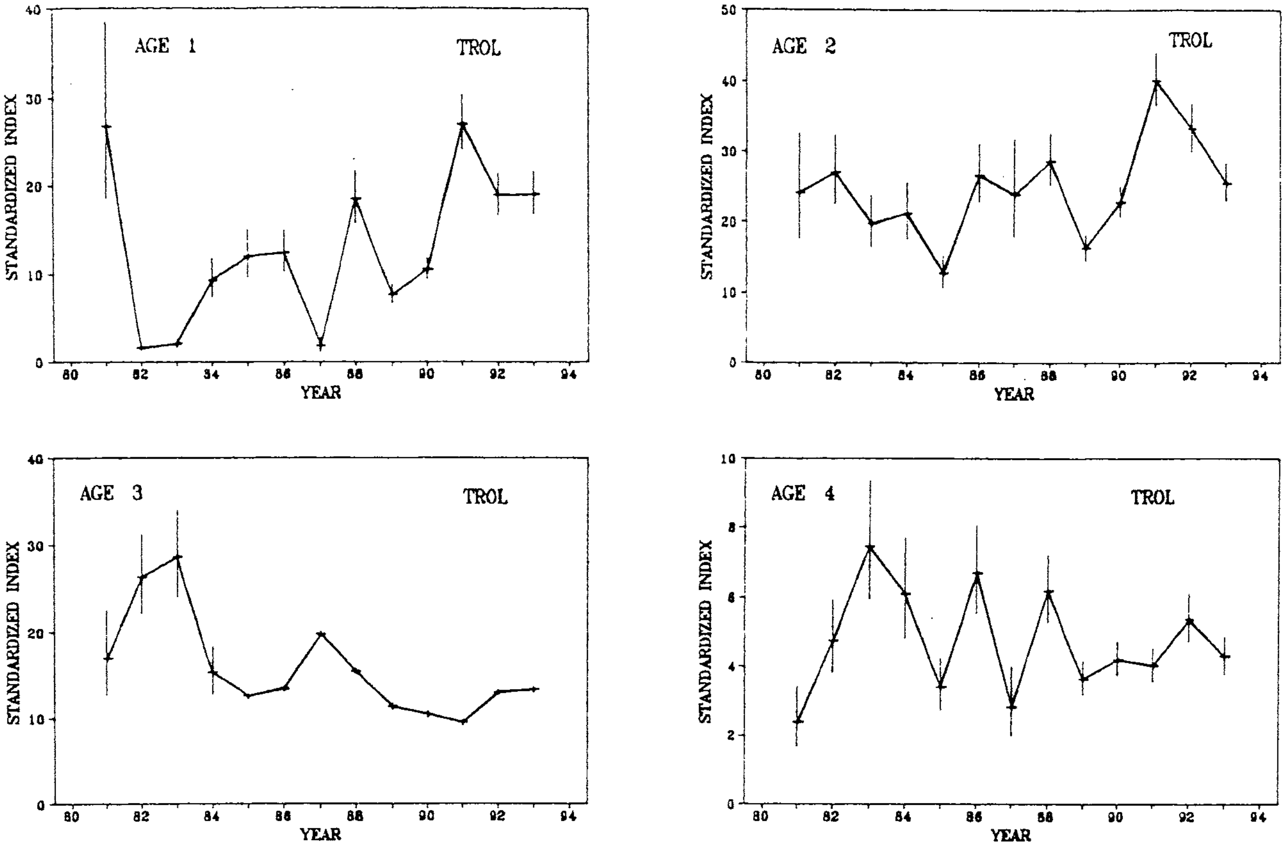


Fig. 3. Annual change of standardized CPUE (TROL), in number by age class 1, 2, 3 and 4. GEAR = TROLLING. North Atlantic Spanish albacore fisheries. (Bars represent 95% Confidence intervals.)

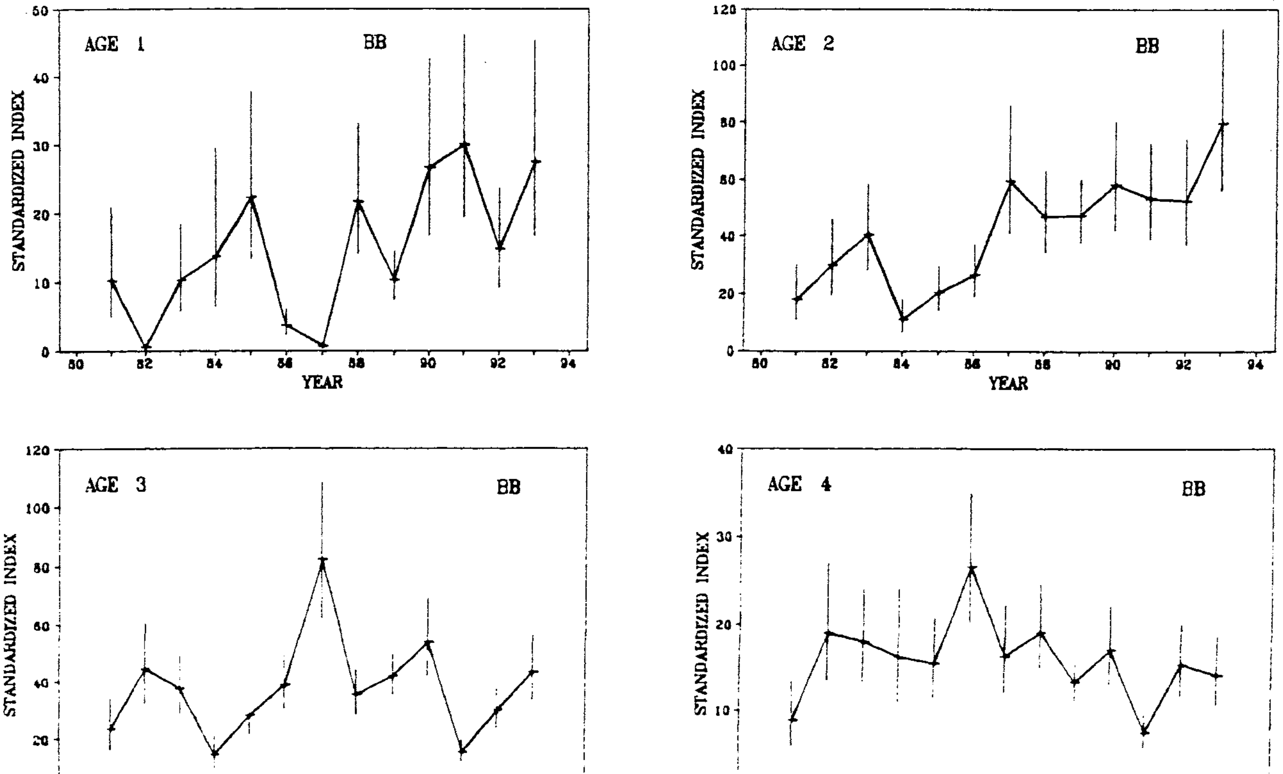
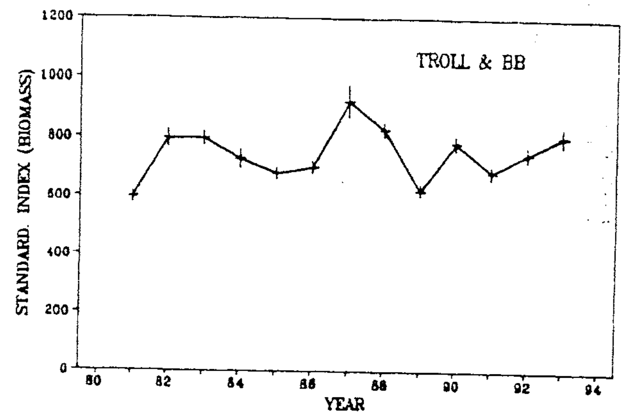
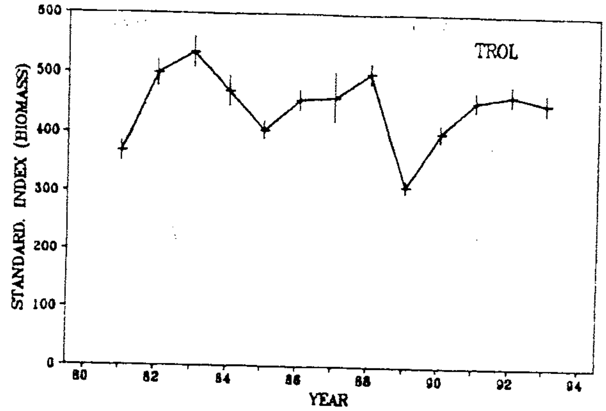


Fig. 4. Annual change of standardized CPUE (BB run 1), in number by age class 1, 2, 3 and 4. GEAR = BAIT BOAT. North Atlantic Spanish albacore fisheries. (Bars represent 95% Confidence intervals.)

A) GEAR effect into the model.



B) GEAR = TROLLING.



C) GEAR = BAIT BOAT.

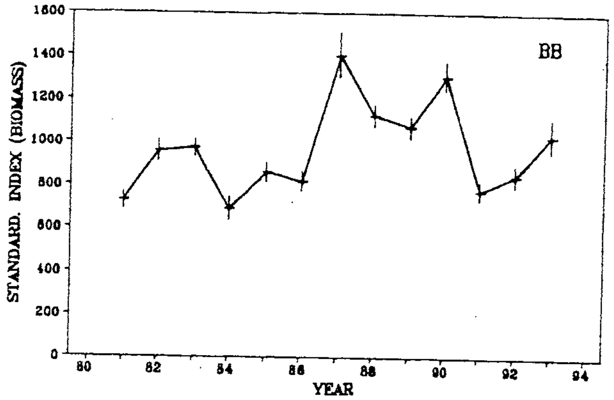


Fig. 5. Annual change of standardized CPUE in BIOMASS (kg. round weight). North Atlantic Spanish albacore fisheries.

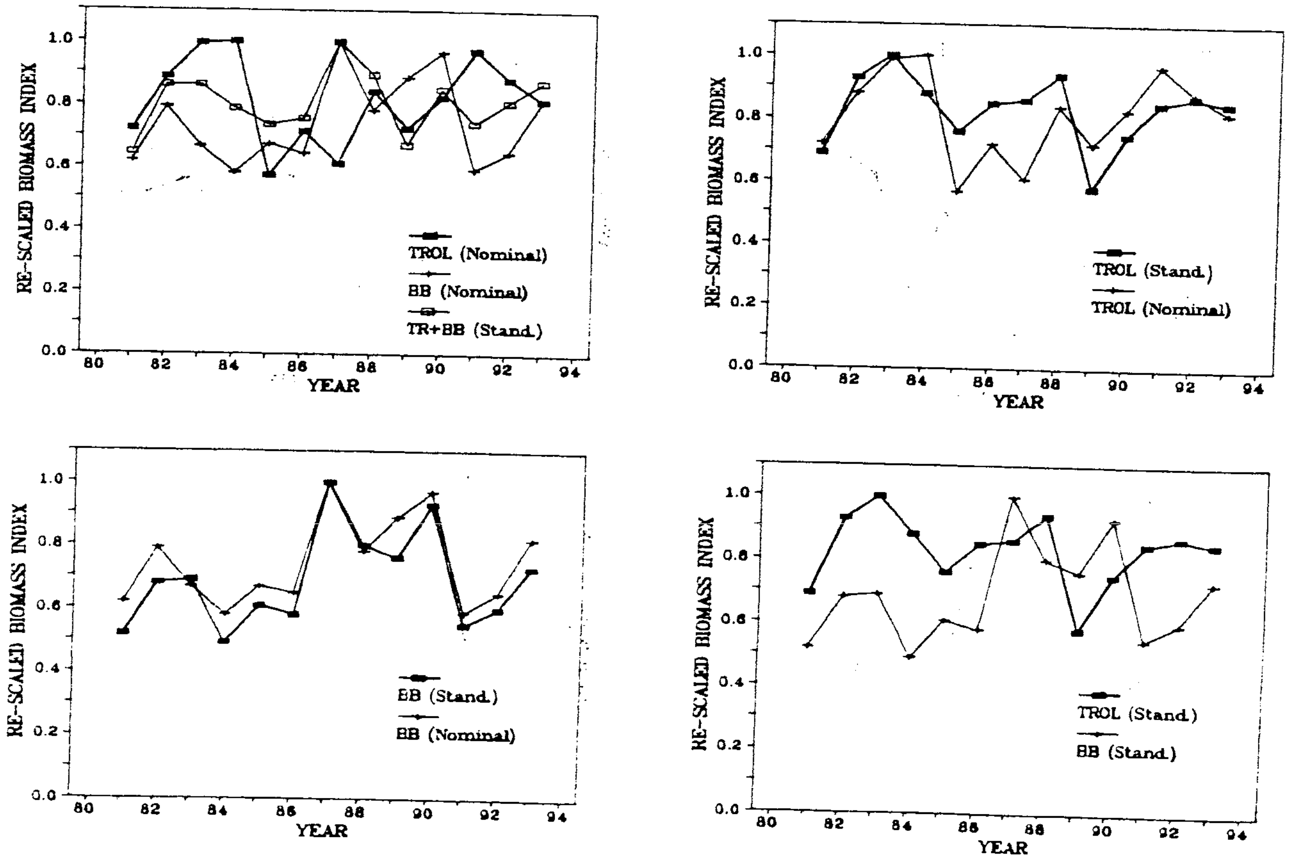


Fig. 6. Comparison among standardized and nominal BIOMASS index obtained. Values were re-scaled to one for comparison. North Atlantic Spanish albacore fisheries. (Bars represent 95% Confidence intervals.)