SCRS/1996/115 Col.Vol.Sci.Pap. ICCAT, 46 (2) : 118-121 (1997)

STANDARDIZED BLUEFIN TUNA CPUE FOR SPANISH TRAP

Ortíz de Urbina, J.M., J.M. de la Serna[1]

Preliminary Estimation of Abundance Indices

Material and methods

Data were obtained from the Spanish trap fishery for bluefin tuna in the south of Spain. Information on catches in number of individuals, size composition, effort, environmental factors and trap characteristics was collected from 1982 to 1995.

Model development

A General Linear Modeling (GLM) approach to analysis of variance was used to examine logged catch rates (catch in number of individuals per day of bunt set between consecutive net lifting operations) for differences among the effects of year, month, and trap. Environmentalmental factors could not be directly implemented as independent factors in the model (it was not possible to finish data base updating).

The fitting of GLM was performed through computer software SPSS statistical package for Windows (release 6.0).

The general multiplicative model (Gavaris 1980, 1988) used was as follows:

$$\text{Log (CPUE)} = \mu + Y_i + M_j + C_k + M_i{*}T_k + e_{ijk}$$

where

Log	: natural logarithm
μ	: intercept
CPUE	: catch rate
Y_i	: effect of factor year
M_j	: effect of factor month
T_k	: effect of factor trap
$M_i{*}T_k$ ...	: interaction term between month and trap
e_{ijk}	: error term N $(0, \sigma^2)$

[1] Instituto Español de Oceanografía (IEO-Spain).

Annual abundance indices were obtained from marginal means (least squares mean stimates), adjusted for the GLM statistically significant terms.

Results

The final model, class level information and F-test are given in *Table 1*. Both factors, month and trap, and corresponding interaction were statistically significant at the 1 % level. R^2 is about 20 %. The distributions of standardized residuals at each level of the main effects and for the whole model (*Figure 1*) do not appear to be far from expected. Standardized annual indices of abundance are shown in *Table 2*. Standardized CPUE with 95 % upper and lower confidence limits are shown in *Figure 2*.

Literature cited

Gavaris, S. 1980. Use of a multiplicative model to estimate catch rate and effort from commercial data. *Can. J. Fish. Aquat. Sci. 37: 2272 2275.*

Gavaris, S. 1988. Abundance indices from commercial fishing. *Collected papers on stock assessment methods. CAFSAC Res. Doc. 88/61.* 167 p.

Table 1.- Results of GLM, 1982-1995

General Linear Model
Class information
Class

	Levels	14													
YEAR	**Values**	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Labels	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
	Freq.	96	75	55	93	86	87	108	86	112	99	96	85	80	72
	Levels	3													
MONTH	**Values**	1	2	3											
	Labels	april	may	june											
	Levels	4													
TRAP	**Values**	1	2	3	4										
	Labels														

Number of observations 1230
Dependent variable LCPU

Source	DF	Sum of Squares	Mean Square	F value	Pr > F
Model	24	991.59	41.32	13.38	.000
Error	1205	3721.76	3.09		
Corrected Total	1229	4713.35			

R- square	C.V.	Root MSE	Dependent Mean
0.210	74.72346	1.7578396	2.35246

Source	DF	Sum of Squares	Mean Square	F value	Pr > F
YEAR	13	272.88	20.99	6.80	.000
MONTH	2	142.21	71.10	23.02	.000
TRAP	3	460.74	153.58	49.72	.000
MONTH BY TRAP	6	115.76	19.29	6.25	.000

Parameter		Estimate	Std. error of Estimate	t-value for H0: parameter = 0	P >
INTERCEPT		1.99073054	0.06444	30.89289	0.000
YEAR	1	0.896378448	0.27786	3.22597	0.001
	2	0.536607736	0.29335	1.82922	0.068
	3	1.02863349	0.31808	3.23393	0.001
	4	0.387648112	0.27906	1.38913	0.165
	5	0.006251672	0.28343	0.02206	0.982
	6	0.063712261	0.2816	0.22625	0.821
	7	0.584352469	0.26819	2.17891	0.030
	8	0.538311888	0.28297	1.90237	0.057
	9	0.514104403	0.26688	1.92638	0.054
	10	0.108998116	0.27495	0.39643	0.692
	11	0.132439852	0.27518	0.48129	0.630
	12	0.05741928	0.28274	0.20308	0.839
	13	-0.5977087	0.287	-2.08262	0.037
	14	0.0000000			
MONTH	1	-0.57554784	0.13925	-4.1331	0.000
	2	0.00000000			
	3	-0.77174528	0.14589	-5.29008	0.000
TRAP	1	0.00000000			
	2	-1.30441040	0.18055	-7.2248	0.000
	3	-0.79240823	0.1758	-4.50747	0.000
	4	-0.19063135	0.15812	-1.20557	0.228
MONTH BY TRAP	1 1	0.00000000			
	1 2	1.36334651	0.41057	3.32064	0.001
	1 3	1.54522199	0.37794	4.08849	0.000
	1 4	1.03944009	0.34205	3.03881	0.002
	2 1	0.00000000			
	2 2	0.00000000			
	2 3	0.00000000			
	2 4	0.00000000			
	3 1	0.00000000			
	3 2	1.57825948	0.38442	4.10551	0.000
	3 3	0.171232595	0.40764	0.42006	0.675
	3 4	0.91121202	0.36384	2.5044	0.012

Table 2.- Indices of abundance for bluefin tuna.

YEAR	NOMINAL CPUE	LSMEAN	STD. ERR	95% CI UCPU	Mean CPU	95% CI LCPU
1982	3.125	2.5271	0.0423	13.6262032013	12.5283571251	11.5189631284
1983	2.8951	2.2763	0.0442	10.6491153183	9.7500929666	8.9278608525
1984	3.4706	2.7678	0.0495	17.6057424606	15.9430839174	14.4360005517
1985	2.7065	2.118	0.0386	8.98399786687	8.32068830186	7.70558183598
1986	1.9878	1.5292	0.052	5.12459757505	4.62072675962	4.16681518748
1987	2.0474	1.5864	0.0527	5.43352799063	4.89291697967	4.40653490597
1988	2.5787	2.1617	0.0488	9.58012576723	8.6962397536	7.89469267173
1989	2.3866	1.9637	0.0552	7.96393735381	7.13650756407	6.39504530854
1990	2.3471	2.0004	0.0501	8.17397237077	7.40129514877	6.70165831183
1991	1.9349	1.5556	0.0529	5.26983580225	4.74456240277	4.27121873692
1992	2.0739	1.6016	0.0537	5.526981607	4.96812171932	4.46577086248
1993	2.0996	1.6045	0.0554	5.56298358309	4.98301226169	4.46350610769
1994	1.579	0.9763	0.0553	2.96812085852	2.65867810164	2.38149643666
1995	1.9815	1.4976	0.0644	5.09354310623	4.48022684415	3.94036626638

Figure 2.- Indices of abundance for bluefin tuna. 1982-1995

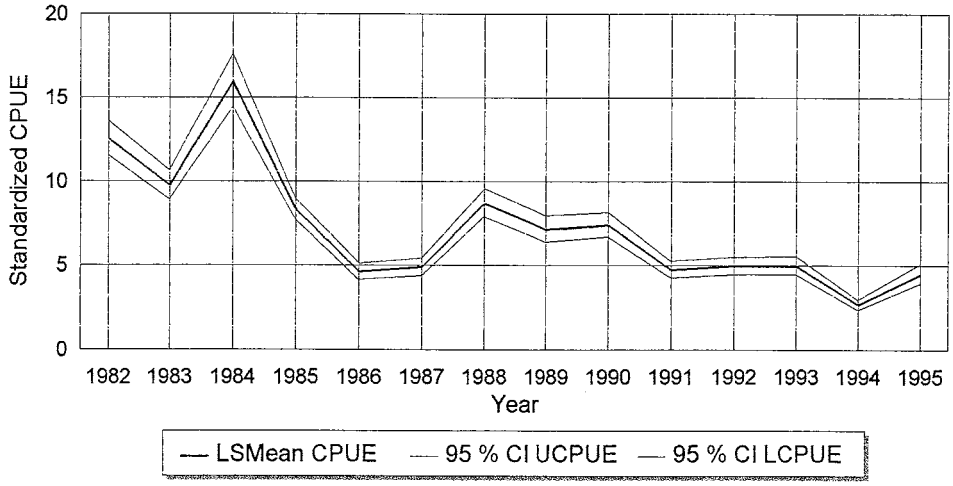

Figure 1.- Frequency distribution of standardized residuals by levels of factors.