Spanish Institute of Oceanography
Department of tuna and tuna-like species (Large Pelagic Fish)

Ministry of Science and Innovation

IOTC-2011-WPBF09-23

STANDARDIZED CATCH RATES FOR THE SWORDFISH (*Xiphias gladius*) CAUGHT BY THE SPANISH LONGLINE IN THE INDIAN OCEAN DURING THE PERIOD 2001-2010

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DATA:

Spanish longline fleet

Data analysed from 2001 to 2010

Number of observations: 13,080

Standardized log(CPUE) analyses were done using GLM procedures (SAS 9.2)

base case (run 1): $LOG(CPUE) = u + Y + T + A + R + G + T*A + e$

u = overall mean, Y =effect year, T =effect time, A = effect area, R = effect ratio, G = effect gear, e = logarithm of the normal distributed error term.

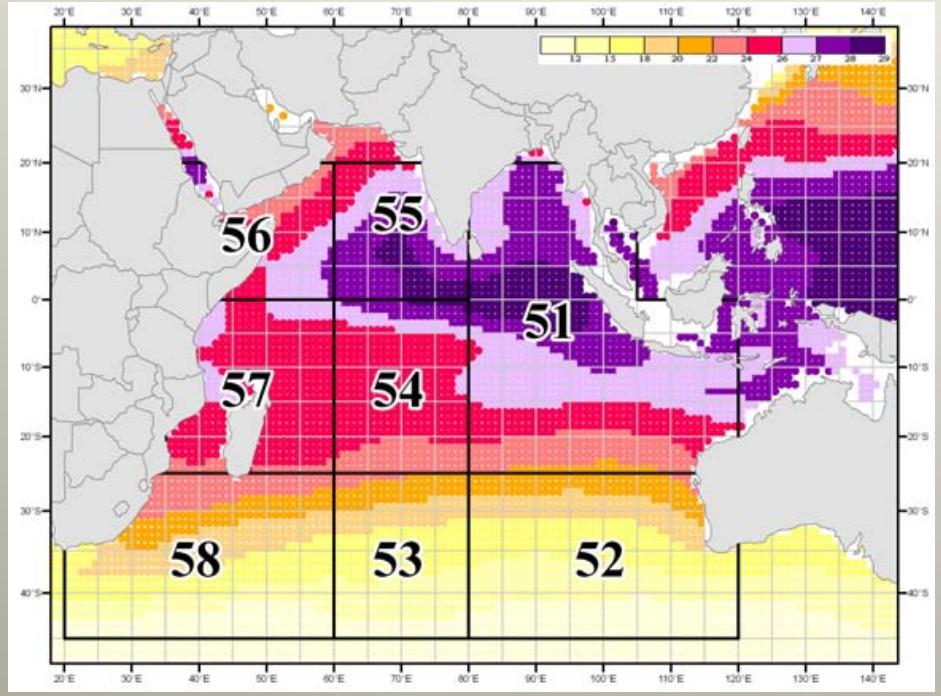
Table 2. List and details of each run considered: run number, model used, R-squred, relevant comments and area definition used

Run #	Model	R^2	Comments	Area definition
Run1	YR SM AR RT GR SM*AR	0.495	Semester, ratio	Mejuto *et al.*, 2008
Run2	YR SM AR GR SM*AR	0.152	Semester, no ratio	Mejuto *et al*., 2008
Run3	YR QT AR RT GR QT*AR	0.533	Quarter, ratio	Semba & Nishida 2008
Run4	YR QT AR GR QT*AR	0.204	Quarter, no ratio	Semba & Nishida 2008
Run5	YR QT AR RT GR QT*AR	0.447	Quarter, ratio	SW:subareas Semba & Nishida 2008
Run6	YR QT AR GR QT*AR	0.089	Quarter, no ratio	SW:subareas Semba & Nishida 2008
Run7	YR MN RT GR	0.455	Month, ratio	Area closure (25-35ºS / 30-55ºE)
Run8	YR MN GR	0.094	Month, no ratio	Area closure (25-35ºS / 30-55ºE)
Run9	YR SM AR PG GR SM*AR	0.169	Semester, C_BSH	Mejuto *et al.*, 2008
Run10	YR QT AR PG GR QT*AR	0.221	Quarter, C_BSH	Semba & Nishida 2008
Run11	YR QT AR PG GR QT*AR	0.097	Quarter, C_BSH	SW:subareas Semba & Nishida 2008
Run12	YR MN PG GR	0.104	Month, C_BSH	Area closure (25-35ºS / 30-55ºE)

YR= year, SM=semester, QT= quarter, MN= month, AR= area, RT= ratio, GR= gear, PG= blue shark catch.

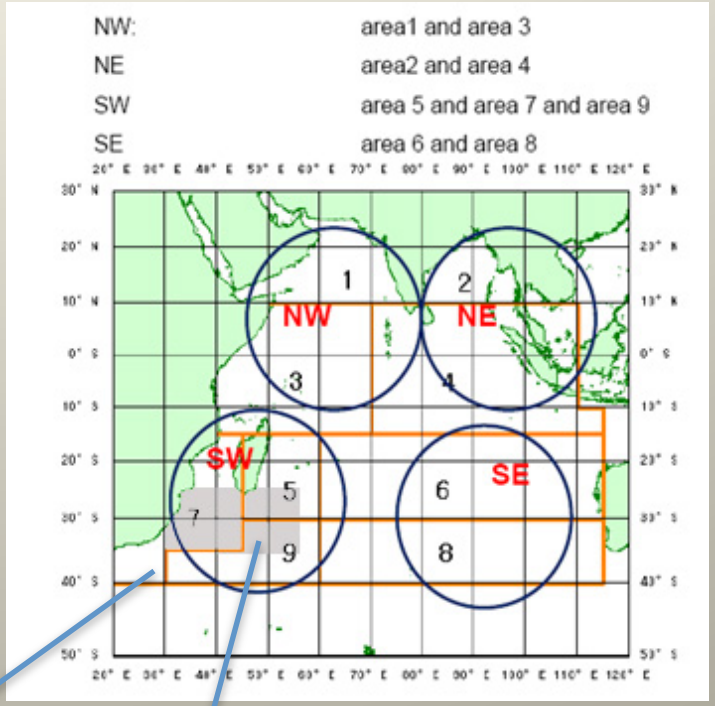
Figures 1 and 2. Definition of the areas considered for GLM analyses.

Base case (run 1 and 2) and Run 9



(Mejuto *et al*., 2008)

Run 3, 4 and 10



(Semba & Nishida 2008)

SW region:
Run 5, 6 and 11

Area closure: color grey (25ºS-35ºS / 30ºE-55ºE)
Run 7, 8 and 12

Table 3. Summary of the ANOVA for base case (run 1 and 2).

Figure 3. Annual changes in the standardized catch rates

Summary of ANOVA

Proc.GLM (run 1 base case):

Variable dependiente: cpue1

Fuente	DF	Suma de cuadrados	Cuadrado de la media	F-Valor	Pr > F
Modelo	32	3179.207940	99.350248	399.31	**<.0001**
Error	13047	3246.180906	0.248807		
Total corregido	13079	6425.388847			

R-cuadrado	Coef Var	Raíz MSE	cpue1 Media
0.494788	8.032397	0.498805	6.209918

Fuente	DF	Tipo III SS	Cuadrado de la media	F-Valor	Pr > F
YR	9	241.691901	26.854656	107.93	<.0001
sem	1	0.049270	0.049270	0.20	0.6563
area	6	200.947470	33.491245	134.61	<.0001
ratio	9	2202.345256	244.705028	983.51	<.0001
gear	1	196.147930	196.147930	788.35	<.0001
sem*area	6	78.585971	13.097662	52.64	<.0001

Proc.GLM (run 2 base case):

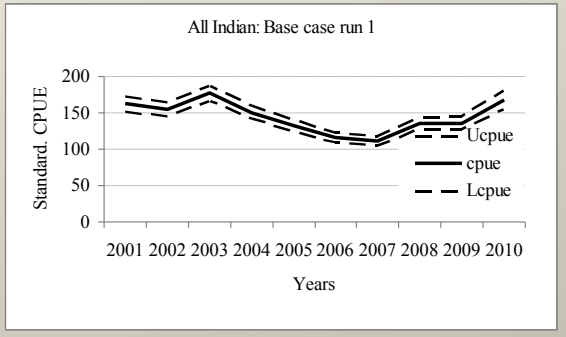
Variable dependiente: cpue1

Fuente	DF	Suma de cuadrados	Cuadrado de la media	F-Valor	Pr > F
Modelo	23	976.862685	42.472291	101.77	**<.0001**
Error	13056	5448.526162	0.417320		
Total corregido	13079	6425.388847			

R-cuadrado	Coef Var	Raíz MSE	cpue1 Media
0.152032	10.40276	0.646003	6.209918

Fuente	DF	Tipo III SS	Cuadrado de la media	F-Valor	Pr > F
YR	9	330.5133313	36.7237035	88.00	<.0001
sem	1	9.8672241	9.8672241	23.64	<.0001
area	6	36.8542837	6.1423806	14.72	<.0001
gear	1	294.5896945	294.5896945	705.91	<.0001
sem*area	6	36.9961587	6.1660265	14.78	<.0001

Annual changes in the standardized CPUE



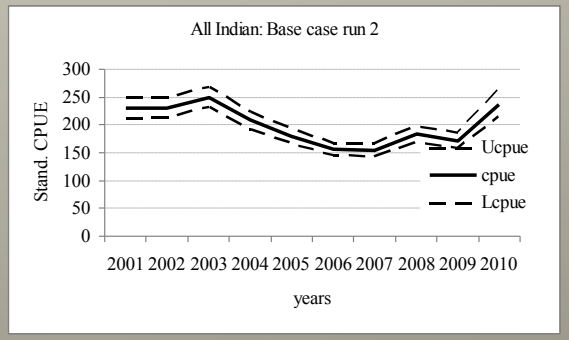
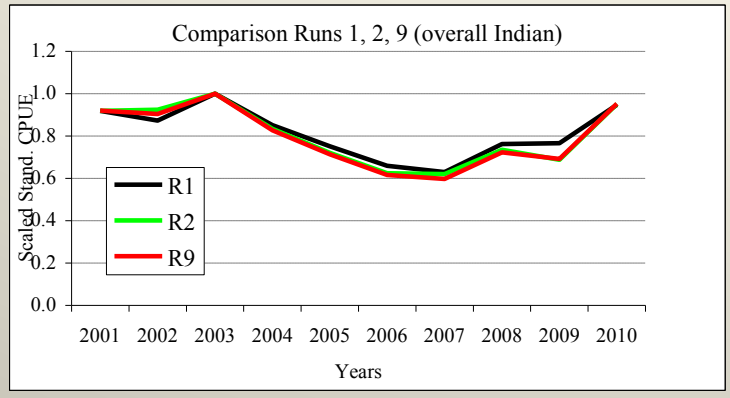
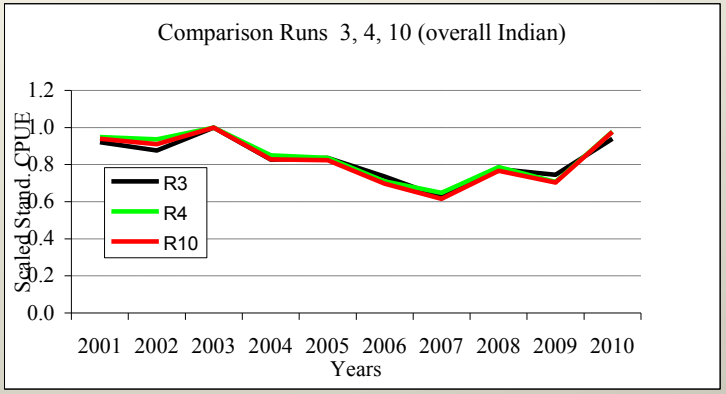
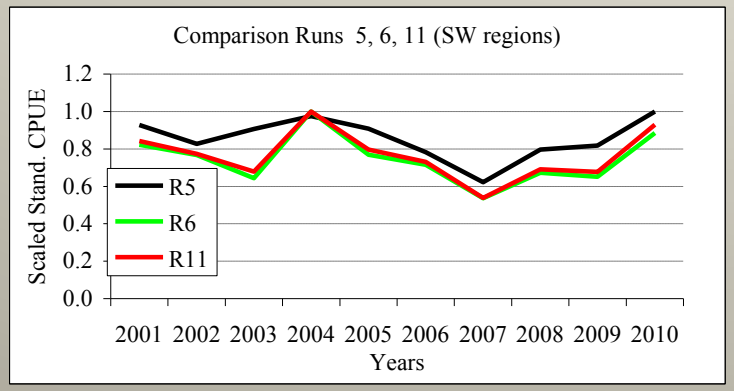
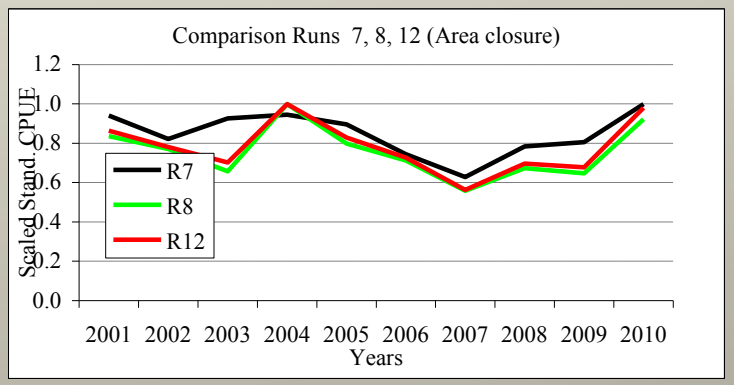


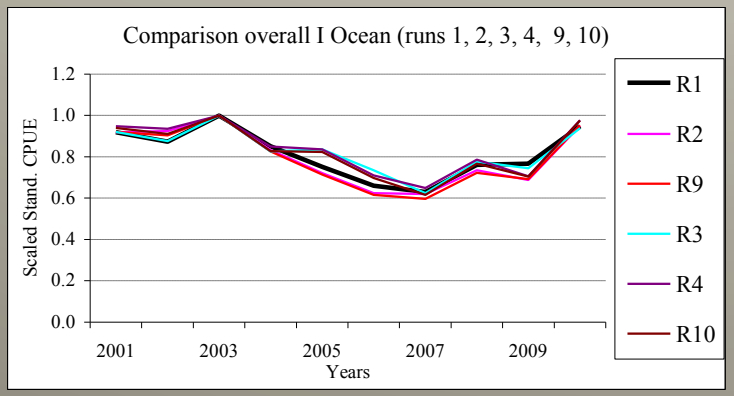
Figure 4. Comparison between standardized CPUE trends obtained (scaled values) for the difefrent runs-models with equal area definitions or area groups











Conclusions:

The predicted CPUE trends are very similar over time.

The highest CPUE value was predicted in all Indian Ocean runs for the year 2003. A decline was predicted until 2007, followed by an increase until 2010, with values which almost reached the highest level predicted for 2003.

Similar trends are obtained when the SW region or the area clousure runs are compared.


Thanks for your attention