

STANDARDIZED CATCH RATES FOR YELLOWFIN TUNA (*Thunnus albacares*) FROM THE VENEZUELAN PELAGIC LONGLINE FISHERY OFF THE CARIBBEAN SEA AND THE WESTERN CENTRAL ATLANTIC

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SUMMARY

Indices of abundance of yellowfin tuna (Thunnus albacares) from the Venezuelan pelagic longline fishery are presented for the period 1991-1999. The index of number of fish per number of hooks (hundred) was estimated from numbers of yellowfin tuna caught and reported on the observer data forms recorded by scientific observers aboard longline vessels since 1991 (Pelagic Longline Observer Program). Generalized additive models (GAMs) were applied to examine the relative influence of various factors on fishery performance defined as nominal CPUE of yellowfin tuna. The standardization analysis procedure included the following variables; year, area, season, fishing operation characteristics (main line length, hook density, target species), fishing time, and fishing depth. The standardized index was estimated using Generalized Linear Mixed Models under a delta lognormal model approach.

RÉSUMÉ

Le présent document fait état des indices d'abondance de l'albacore (Thunnus albacares) dans le cadre de la pêche palangrière pélagique du Venezuela pour la période 1991-1999. L'indice du nombre de poissons par nombre de hameçons (centaine) a été estimé à partir du nombre d'albacore capturés et déclarés sur les formulaires de données remplis par des observateurs scientifiques embarqués à bord de palangriers depuis 1991 (Programme d'observateurs à bord de palangriers pélagiques). Des modèles additifs généralisés (GAM) ont été appliqués pour examiner l'influence relative de divers facteurs sur la performance de la pêcherie, définie comme étant la CPUE nominale de l'albacore. La procédure d'analyse de la standardisation a compris les variables suivantes: année, zone, saison, caractéristiques des opérations de pêche (longueur de la ligne principale, densité du hameçon, espèce-cible), époque de la pêche et profondeur de la pêche. L'indice standardisé a été estimé par le biais de modèles mixtes linéaires généralisés sous une approche de modèle delta lognormal.

RESUMEN

Se presentan índices de abundancia de rail (Thunnus albacares) de la pesquería de palangre pelágico venezolana para el período 1991-1999. El índice de número de peces por número de anzuelos (cien) se estimó basándose en el número de rabiles capturados y consignados en los formularios de datos por observadores científicos a bordo de palangreros desde el año 1991 (Programa de Observadores Pelágicos del Palangre). Se aplicaron modelos generalizados aditivos (GAM) para examinar la influencia relativa de varios factores sobre el desarrollo de la pesquería definido como CPUE nominal del rabil. El análisis de estandarización incluía las siguientes variables: año, área, temporada, características de la operación pesquera (longitud de la brazolada, densidad en anzuelos, especie objetivo, etc), duración de la pesca y profundidad de la misma. El índice estandarizadas se estimó por Modelo Lineal Generalizado bajo el enfoque de modelo delta lognormal.

KEYWORDS

Yellowfin tuna, Catch rates, Venezuelan longline fishery

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1. INTRODUCTION

Information about changes in the abundance of yellowfin tuna, *Thunnus albacares*, are necessary to tune stock assessment models that are required for the management of yellowfin tuna in the Atlantic. The utility of indices of abundance based on catch and effort data can be improved by standardizing them to remove the impact of factors such as changes over time in the efficiency of the fleet. The yellowfin tuna nominal CPUE for the Venezuelan longline fleet has declined steadily since the all time high in 1991 (Marcano, 1999). Since 1991, ICCAT's Enhanced Billfish Research Program (EBRP) started placing scientific observers on board Venezuelan pelagic longliners targeting yellowfin tuna and swordfish. Due to the difficulties in obtaining pelagic longline log book data by species, the data collected from the EBRP from the Venezuelan fleet was chosen to develop standardized catch per unit of effort (CPUE) indices of abundance for the yellowfin tuna caught by the Venezuelan fleet. The Venezuelan longline fleet operates over an important geographical area in the western central Atlantic and its main target species is yellowfin tuna, thus imposing an important fishery mortality on the stock fished in the western tropical Atlantic. The present report, review the catch and effort information from 1991 until 1999 and standardize catch rates of yellowfin tuna using a Generalized Linear Mixed Model with random factor interactions particularly for the *year* effect.

2. MATERIALS AND METHODS

The data used in this paper came from the database of the Venezuelan Pelagic Longline Observer Program (VPLOP) for the period 1991-1999. Arocha and Marcano (1999) describe the main features of the fleet and Marcano (1999) and Marcano *et al.* (1998,1999) review the available catch and effort data from the Venezuelan Pelagic Longline fishery covered by the observer program. Yellowfin tuna and swordfish are the main target species for the Venezuelan Pelagic Longline fleet. Since 1991, trained scientific observers have recorded detailed information on gear characteristics, fishing operations as well morphometric and biological information from a sub-sample of the Venezuelan longline Pelagic vessels (Arocha and Marcano, 1999).

The VPLOP surveys on average 13.3% of the Venezuela longline fleet trips (Arocha *et al.*, 2000). The data collected comprises a total of 2,941 record-sets from 1991 through 1999. Of these sets, yellowfin was reported caught in 2,047 sets (69.6%). The information collected in the VPLOP includes specifics of gear configuration such as main line material, total length; gangion and leader length; number of baskets; number of hooks between floats; distance between floats; distance between hooks. Also, specifics of fishing configuration such as depth of float line, soak time, specific targeted species, bait type and number/weight of bait per set, direction of begin set and direction of begin haul. And some general environmental information such as sea surface temperature at the beginning and end of the set and haul retrieval.

The longline fishing grounds for the Venezuelan fleet extend from northwest of Puerto Rico (22°N-68°W) to off the coast of northeastern Brazil (4°N-44°W). Three geographical areas of longline fishing were used for classification. These include: the Caribbean (CAR, area 1), the Guyana-Amazon (GUY-AMZN, area 2), and the Sargasso (SAR, area 3) (Fig. 1). Three seasons were defined to account for seasonal fishery distribution through the year (Jan-Apr, May-Aug, and Sep-Dec). Other factors included in the analyses of catch rates included: time of the set (hour-set), depth of the hooks, size of the vessel, sea surface temperature and duration of the set (soaking time).

Fishing effort is reported in terms of the total number of hooks per trip and number of set per trip, as number of hooks per set vary, catch rates were calculated as number of yellowfin tuna caught per 100 hooks.

An exploratory analysis of the relationship between catch rates for yellowfin tuna with continuous variables was performed to identify significant effects that account for variability of catch rates using General Additive Models (GAMs). GAMs have been used to analyze and standardize catch rates for

several species caught on longline gear such as swordfish and blue sharks (Kleiber and Bartoo, 1998, Bigelow *et al.*, 1999). GAMs are non-parametric generalizations of multiple linear regressions and are less restrictive in assumptions about the underlying statistical distribution of the data (Hastie and Tibshirani, 1990). Nonlinear effects were fitted with a locally weighted polynomial scatter plot smoother or *loess* smother using the S-Plus software package (Venables and Ripley, 1999). The GAM analyses were restricted to positive trips for yellowfin. GAMs derived effect for each factor was plotted and their relative magnitude of effect was judged by the relative y-axis ranges of the *loess* function (the greater the y-axis range, the larger the deviance explained by the factor considered) (Bigelow *et al.*, 1999). Significant effects were then converted from continuous variables into categorized factors so they could be incorporated into a delta lognormal model analysis. Levels within factors were chosen based on the *loess*-derived plots.

For the Venezuelan longline observer data, relative indices of abundance for yellowfin tuna were estimated by Generalized Linear Modeling approach assuming a delta lognormal model distribution. The delta model estimates separately the proportion of positive sets assuming a binomial error distribution, and the mean catch rate of sets if at least one yellowfin was caught by assuming a lognormal error distribution. The log-transformed frequency distribution of catch rates (lnCPUE) for sets that caught yellowfin tuna is shown in figure 2. The estimated proportion of successful sets per stratum is assumed to be the result of n positive sets of a total r number of sets, and each one is an independent Bernoulli-type realization. The estimated proportion is a linear function of fixed effects and interactions. The logit function was used as link between the linear factor component and the binomial error. For sets that caught at least one tuna (positive observations), estimated CPUE rates were assumed to follow a lognormal error distribution (lnCPUE) of a linear function of fixed factors and random effect interactions, particularly when the *year* effect was within the interaction.

A step-wise regression procedure was used to determine the set of systematic factors and interactions that significantly explained the observed variability. The difference of deviance between two consecutive models follows a χ^2 (Chi-square) distribution; this statistic was used to test for the significance of an additional factor in the model. The number of additional parameters associated with the added factor minus one corresponds to the number of degrees of freedom in the χ^2 test (McCullagh and Nelder, 1989, pp 393). Deviance analysis tables are presented for the data series, including the deviance for the proportion of positive observations (*i.e.*, positive sets/total sets), and the deviance for the positive catch rates. Final selection of explanatory factors was conditional to: *a*) the relative percent of deviance explained by adding the factor in evaluation (normally factors that explained more than 5 or 10% were selected) and *b*) The χ^2 test significance.

Once a set of fixed factors was specified, possible interactions were evaluated, in particular interactions between the *year* effect and other factors. Selection of the final mixed model was based on the Akaike's Information Criterion (AIC), the Schwarz's Bayesian Criterion (SBC), and a chi-square test of the difference between the -2 loglikelihood statistic of a successive model formulations (Littell *et al.*, 1996). Relative indices for the delta model formulation were calculated as the product of the *year* effect least square means (LSMeans) from the binomial and the lognormal model components. The LSMeans estimates use a weighted factor of the proportional observed margins in the input data to account for the non-balance characteristics of the data. LSMeans of lognormal positive trips were bias corrected using Lo *et al.*, (1992) algorithms. Analyses were done using the GLIMMIX and MIXED procedures from the SAS® statistical computer software (SAS Institute Inc. 1997).

3. RESULTS AND DISCUSSION

The GAM analysis of the Pelagic Observer Program was used only as an exploratory evaluation of relationships between catch rates of yellowfin tuna and diverse fishing associated factors. We opted to restrict the analysis to positive catch sets for yellowfin tuna rather than add constant positive values

to nominal CPUEs to avoid undefined logarithm transformation of zero CPUEs. *Loess* derived plots were used to determine the boundaries for the categorization of continuous variables into factor levels for the delta lognormal model. Figures 3 and 4 show the derived *loess* plots of yellowfin tuna for several factors with the 95% confidence intervals, the relative density of points for different factor values is shown by the rug plot on the x-axis. The relative magnitude of the effects of the explanatory variable is proportional to the range on the y-axis. An explanatory variable is typically non-significant if a horizontal line can be drawn through the 95% confidence band. Table 1 show that latitude, longitude, hook depth, duration of set, hour of set, sea surface temperature and month were all statistically significant. However, derived *loess* plots show that latitude, longitude, hook depth and hour of set were the factors with larger range in the transformed *loess* scale.

Boundaries for the geographical regions were defined from the longitude and latitude *loess* plots. The data suggest that for longitude there is an overall linear decreasing relationship, but there is a change in the slope of the relationship from 61°W to 68°W (Fig. 3). For latitude, from 4° to 14°N there is a linear decreasing relationship, and then from 14° to 17°N there is a change in the slope of the relationship, from 17°N continues to decrease in a linear fashion (Fig. 3). For hook depth, observations were categorized into shallow (40 m or less) and deep sets (Fig. 4). For hour of set, observations were categorized in three groups, morning sets from midnight to 10:00 am, noon sets from 10:00 to 15:00 hours, and night sets from 15:00 to midnight (Fig. 4). For duration of set, observations were categorized in three groups; short sets for 8 or less hours, medium set for 8 to 12 hours, and long sets for 12 or more hours of fishing time (Fig. 4). Sea surface temperature was excluded from consecutive analyses, as several observations have missing temperatures and most of the data fall into the 25-30° C with minimum variation on the *loess*-derived plots (Fig. 3). In addition to the previous factors, a category of boat size (based on the boat total length, horse power and operation characteristics) was included. The Venezuelan Longline fleet was divided into three categories; small boats (less than 20 m), medium boats (between 20 and 26 m), and large boats (26 m or more).

Table 2 shows the deviance analysis for yellowfin tuna from the Venezuela Longline Observer data analyses. For the proportion of positive/total sets; *area*, *hour of set* (=StarSet), and the interactions *year*boat category* (=CATBOAT), *year* hour of set*, *year*area*, and *year*fishing time* were the major factors that explained whether or not a set caught at least one fish. The explanatory factors selected explained more than 30% of the deviance. For the mean catch rate given that it is a positive set, the factors: *boat category*, *area*, and *start set*, and the interactions of *year*hour of set* and *year*boat category* were more significant. Once a set of fixed factors was selected, we evaluated first level random interaction between the *year* and other effects. Figures 5, 6 and 7 show diagnostic plots of the fitting for the mean catch rate lognormal sub model component.

Table 3 shows the results from the random test analyses for yellowfin tuna and the three-model selection criterion. For the proportion of positive/total sets, the final model included the *year*, *area*, *start set*, *boat category*, *fishing time* as main fixed factors and the random interactions between *year*area*, *year*boat category*, *year*fishing time* and *year*start set*. For the conditional mean catch rate (i.e., positive observations), the final mixed model included the *year*, *area*, *start set*, and *boat category* as fixed factor and the random interaction of *year*area*, *year*start set*, *year*boat category*, and *area*fishing time*. Although from the random test, the interactions *year*area* and *year*fishing time* reduce the residual deviance, these interactions were not statistically significant (*p* value of Chi-square test, Table 2) considering the number of additional parameters estimated in relation with the percent of deviance explained by the added interaction(s).

Standardized CPUE series for yellowfin tuna are shown in table 4 and figure 8. Overall, the final models explained about 30% of the variability within the proportion of positive /total sets for the observer yellowfin tuna data, and 39% of the variability within the mean CPUE rates of positive catch sets. Coefficients of variation range from 43 to 88%. The standardized CPUE series show that the relative abundance of yellowfin tuna caught by the observed Venezuelan longline fleet reflects a decreasing trend from 1991-1994, thereafter the standardized CPUE series increases through 1996,

drops in the following year (1997) and continue to show an irregular but stable trend in the last two years of the time series. The nominal CPUE for the first three years of the series contrasts with the standardized values. An explanation for this variation between the two series is the fact that during the first years of the VPLOP there was a large number of swordfish target trips that progressively declined after the minimum size in swordfish was fully enforced. This situation forced the longline fleet to target yellowfin and swordfish on the same trip when swordfish > 125 cm LJFL was available; otherwise the target species was yellowfin tuna. Thereafter (1994), both CPUE series vary little between them, except for the last year of the series (1999) showing an opposite trend.

Although the standardized CPUE series based on the delta lognormal model approach estimated large confidence intervals, the resulting standardized series from the VPLOP show an overall similar trend (sharp decline in the first years and an fairly even trend afterwards) to the nominal CPUE of the overall Venezuelan longline fleet through 1999 (Fig. 9). Therefore, the standardized CPUE index based on the VPLOP data could be used to reflect the overall trend in relative abundance of yellowfin tuna caught by the longline fleet in the southeastern Caribbean Sea and east of the Guianas.

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Table 1. Generalized Additive Model building for factors affecting yellowfin tuna catch rates from the Venezuelan Pelagic Longline fishery. Data restricted to the subset of trips/sets that reported catch of at least one yellowfin tuna within the 1991-1999 time series. Npar F provides the F test for non-parametric effects, in this cases the loess effect each variable, and the equivalent probability value, Pr(F).

Explanatory Variable	<i>df</i>	Npar Df	Npar F	Pr(F)
(Intercept)	1			
YEAR	8			
lo(LON)	1	2.8	4.68184	0.0035
lo(LAT)	1	3.1	58.23427	0.0000
lo(HoraSet)	1	2.5	27.88445	0.0000
lo(TempC)	1	3.6	8.99587	0.0000
lo(Duracion)	1	3.5	5.41489	0.0005
lo(MONTH)	1	2.3	20.85286	0.0000

Table 2. Deviance analysis table for yellowfin catch rates using a delta lognormal model. Proportion of positive/total trip-sets assumed a binomial error distribution; p value refers to the chi-square test between two consecutive models. The mean catch rate for positive observations assumed a lognormal error distribution

Model factors proportion of positive/total observations	d.f.	Residual deviance	Change in deviance	% of total deviance	p
1	1	3612.7			
YEAR	8	3463.7	149.02	15.8%	< 0.001
YEAR CATBOAT	2	3454.6	9.12	1.0%	0.010
YEAR CATBOAT Area	2	3119.5	335.08	35.5%	< 0.001
YEAR CATBOAT Area Season	2	3117.6	1.92	0.2%	0.383
YEAR CATBOAT Area Season StartSet	2	2844.3	273.27	29.0%	< 0.001
YEAR CATBOAT Area Season StartSet FishTime	2	2826.3	18.03	1.9%	< 0.001
YEAR CATBOAT Area Season StartSet FishTime Depth	1	2814.8	11.52	1.2%	< 0.001
YEAR CATBOAT Area Season StartSet FishTime Depth YEAR:CATBOAT	11	2669.8	144.93	15.4%	< 0.001
YEAR CATBOAT Area Season StartSet FishTime Depth YEAR:Area	12	2748.0	66.74	7.1%	< 0.001
YEAR CATBOAT Area Season StartSet FishTime Depth YEAR:Season	15	2758.6	56.16	6.0%	< 0.001
YEAR CATBOAT Area Season StartSet FishTime Depth YEAR:StartSet	16	2671.4	143.40	15.2%	< 0.001
YEAR CATBOAT Area Season StartSet FishTime Depth YEAR:FishTime	16	2715.8	98.96	10.5%	< 0.001
YEAR CATBOAT Area Season StartSet FishTime Depth YEAR:Depth	8	2802.8	11.93	1.3%	0.154

Model factors positive catch rates	d.f.	Residual deviance	Change in deviance	% of total deviance	p
1	1	2495.6			
Year	8	2335.9	159.67	13.0%	< 0.001
Year Catboat	2	2021.5	314.45	25.6%	< 0.001
Year Catboat Season	2	2015.1	6.36	0.5%	0.042
Year Catboat Season Area	2	1771.9	243.24	19.8%	< 0.001
Year Catboat Season Area Startset	2	1666.2	105.64	8.6%	< 0.001
Year Catboat Season Area Startset Fishtime	2	1663.9	2.33	0.2%	0.311
Year Catboat Season Area Startset Fishtime Depth	1	1631.8	32.10	2.6%	< 0.001
Year Catboat Season Area Startset Fishtime Depth Year:Catboat	10	1571.4	60.41	4.9%	< 0.001
Year Catboat Season Area Startset Fishtime Depth Year:Catboat Year:Area	12	1516.8	54.61	4.4%	< 0.001
Year Catboat Season Area Startset Fishtime Depth Year:Catboat Year:Area Year:Season	15	1474.0	42.75	3.5%	< 0.001
Year Catboat Season Area Startset Fishtime Depth Year:Catboat Year:Area Year:Season Year:Startset	16	1382.0	91.98	7.5%	< 0.001
Year Catboat Season Area Startset Fishtime Depth Year:Catboat Year:Area Year:Season Year:Startset Year:Fishtime	16	1363.7	18.38	1.5%	0.302
Year Catboat Season Area Startset Fishtime Depth Year:Catboat Year:Area Year:Season Year:Startset Year:Fishtime Year:Depth	8	1304.4	59.23	4.8%	< 0.001
Year Catboat Season Area Startset Fishtime Depth Year:Catboat Year:Area Year:Season Year:Startset Year:Fishtime Year:Depth Area:Catboat	2	1266.1	38.30	3.1%	< 0.001

Table 3. Delta lognormal mixed models and corresponding random interactions evaluation for both the proportion of positive/total trip-set sub model and the mean catch rate of positive observations sub model. Likelihood ratio test is the Chi-square test for the difference of deviance between two nested models.

Proportion Positives Generalized Linear Mixed Models	Num Obs	-2 REM Log likelihood	Akaike's Information Criterion	Schwart'z Bayesian Criterion	Likelihood Ratio Test	
Year Area StartSet Catboat Fishtime	183	780.7956	-391.398	-392.954		
Year Area StartSet Catboat Fishtime Year*Area	183	768.1776	-386.089	-389.201	12.618	0.0004
Year Area StartSet Catboat Fishtime Year*Area Year*Catboat	183	760.162	-383.081	-387.749	8.0156	0.0046
Year Area StartSet Catboat Fishtime Year*Area Year*Catboat Year*StartSet	183	747.3508	-377.675	-383.899	12.8112	0.0003
Year Area StartSet Catboat Fishtime Year*Area Year*Catboat Year*Fishtime Year*StartSet	183	708.5409	-359.27	-367.05	38.8099	0.0000
Year Area StartSet Catboat Fishtime Year*Area Year*Catboat Year*Fishtime Year*StartSet Area*Catboat	183	708.8761	-360.438	-369.774	-0.3352	N/A

Positives observations Generalized Linear Mixed Models	Num Obs	-2 REM Log likelihood	Akaike's Information Criterion	Schwart'z Bayesian Criterion	Likelihood Ratio Test	
Year Area StartSet Catboat	2047	5476.061	-2739.03	-2741.84		
Year Area StartSet Catboat Year*Area	2047	5429.017	-2716.51	-2722.13	47.044	0.0000
Year Area StartSet Catboat Year*Area Year*StartSet	2047	5327.92	-2666.96	-2675.39	101.097	0.0000
Year Area StartSet Catboat Year*Area Year*StartSet Year*Catboat	2047	5300.912	-2654.46	-2665.69	27.008	0.0000
Year Area StartSet Catboat Year*Area Year*StartSet Year*Catboat Area*Catboat	2047	5267.053	-2638.53	-2652.57	33.859	0.0000

Table 4. Nominal and standardized CPUE (Number of fish / 100 hooks) series for yellowfin tuna catch rates from the Venezuelan Pelagic Longline fishery.

Year	N Obs	Nominal CPUE	Standard CPUE	Upp 95% CI	Low 95% CI	SE	CV
1991	98	0.929	0.562	1.430	0.221	0.277	49%
1992	266	0.678	0.304	1.040	0.089	0.206	68%
1993	461	0.510	0.179	0.814	0.039	0.157	88%
1994	136	0.153	0.199	0.873	0.045	0.170	85%
1995	455	0.357	0.441	1.332	0.146	0.264	60%
1996	365	0.483	0.439	1.097	0.176	0.212	48%
1997	378	0.320	0.248	0.953	0.065	0.188	76%
1998	425	0.427	0.414	0.940	0.182	0.177	43%
1999	357	0.679	0.318	0.932	0.109	0.184	58%

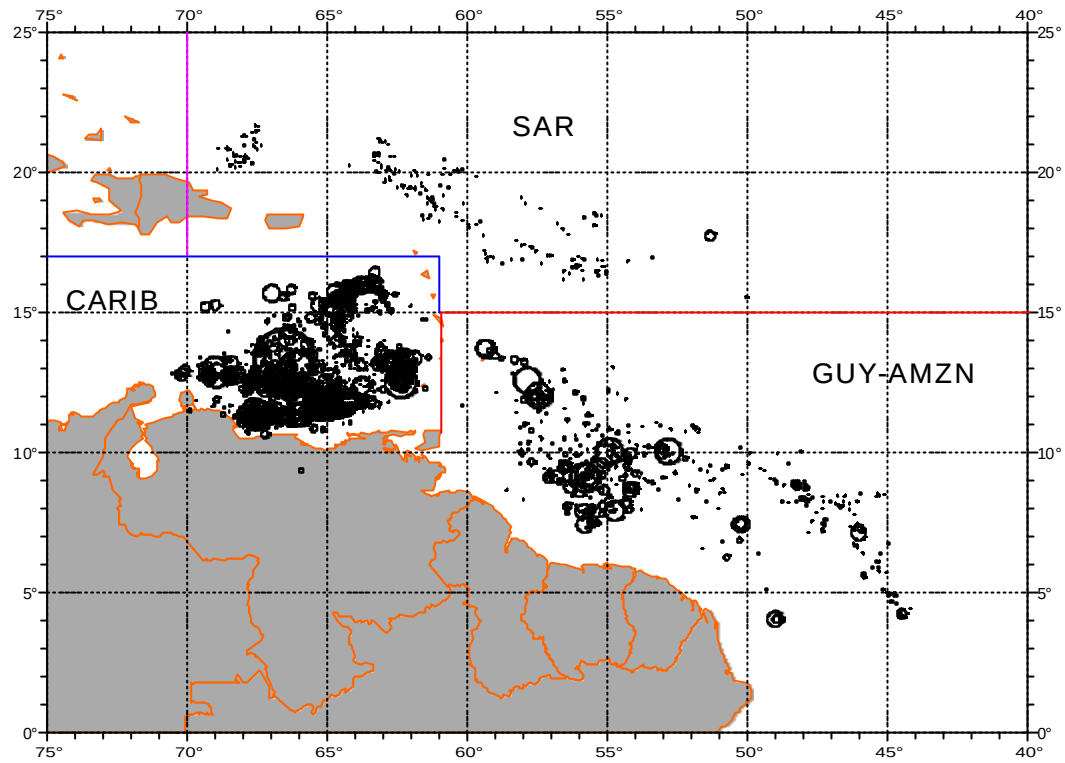


Figure 1. Spatial distribution of proportional nominal CPUE of YFT (numbers/100 hooks) caught by the Venezuelan longline fleet during 1991-1999 and recorded by the Venezuelan Pelagic Longline Observer Program (VPLOP). The divisions correspond to the fishing areas derived from the *loess* plots.

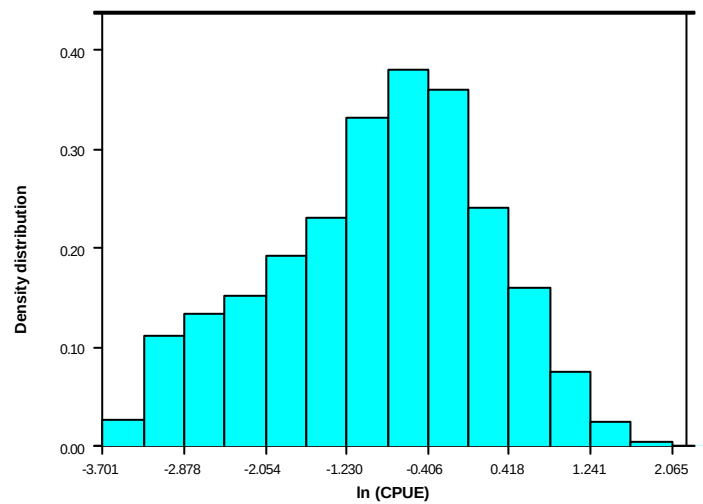


Figure 2. Frequency distribution of log-transformed nominal CPUE of positive set/trip for yellowfin tuna from the Venezuelan Pelagic Longline Observer Program data.

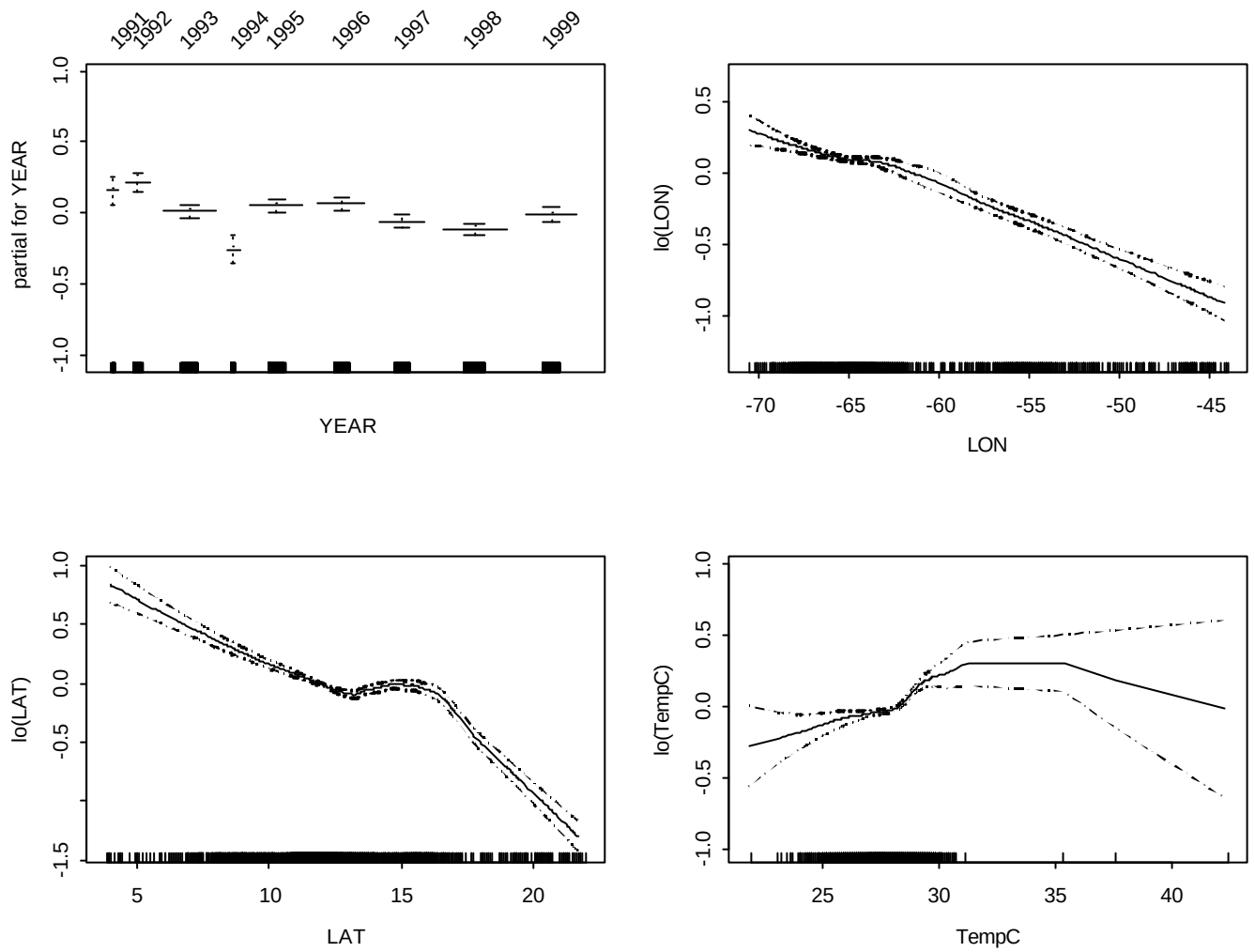


Figure 3. Generalized additive model (GAM) derived effects of *longitude* (LON), *latitude* (LAT) and *sea surface temperature* (TempC) on yellowfin tuna nominal log CPUE deviances (log transformed) for positive observations from the Venezuelan Pelagic Longline Observer Program data. *Year* is a fixed factor in the GAM. Dashed lines indicated 95% confidence bands, and the ‘rug’ plot on the x-axis is the relative density of data points.

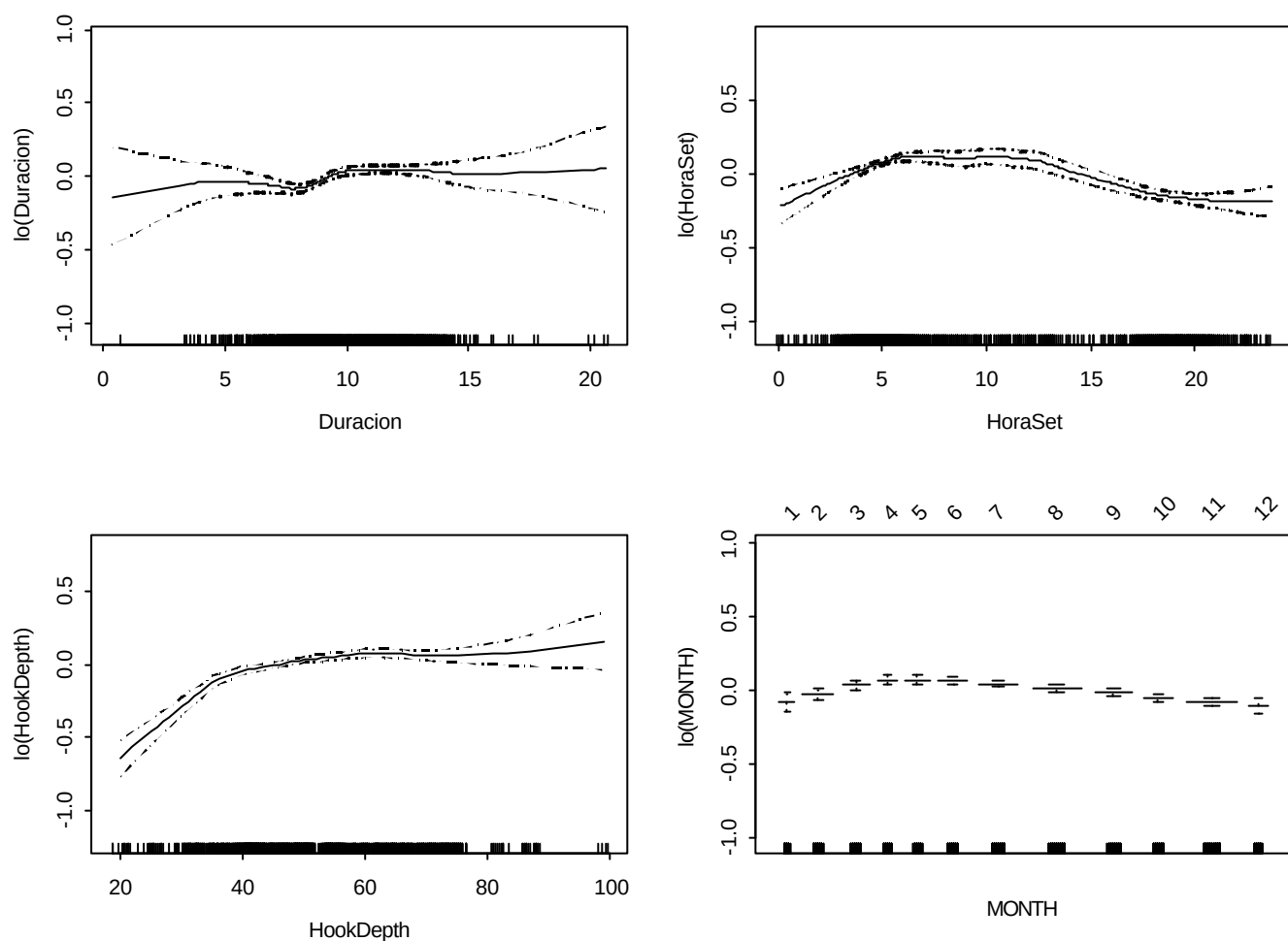


Figure 4. Generalized additive model (GAM) derived effects of *soaking time* (Duracion), *hour set* (HoraSet), *hook depth* (HookDepth) and *month* on yellowfin tuna nominal log CPUE deviances (log transformed) for positive observations from the Venezuelan Pelagic Longline Observer Program data. Dashed lines indicated 95% confidence bands, and the ‘rug’ plot on the x-axis is the relative density of data points

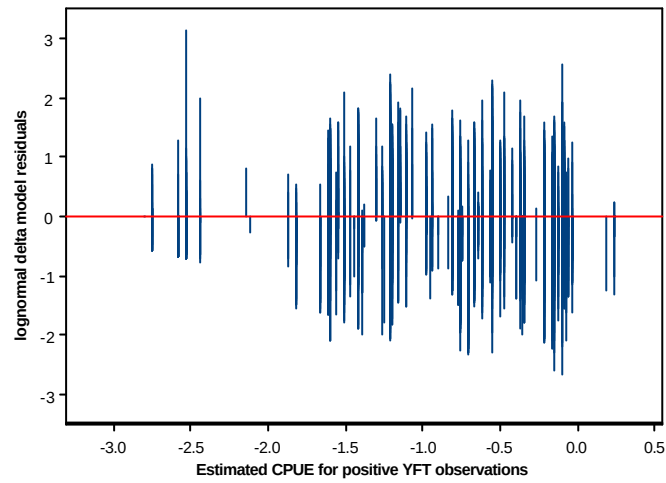


Figure 5. Plot of residuals and fitted values of the lognormal delta model component for the positive set/trip for yellowfin tuna.

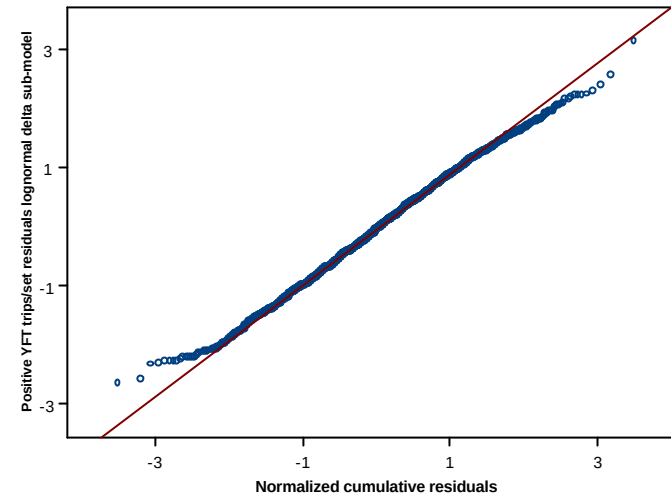


Figure 6. Normalized cumulative residual plot or qq-plot for the lognormal delta model component.

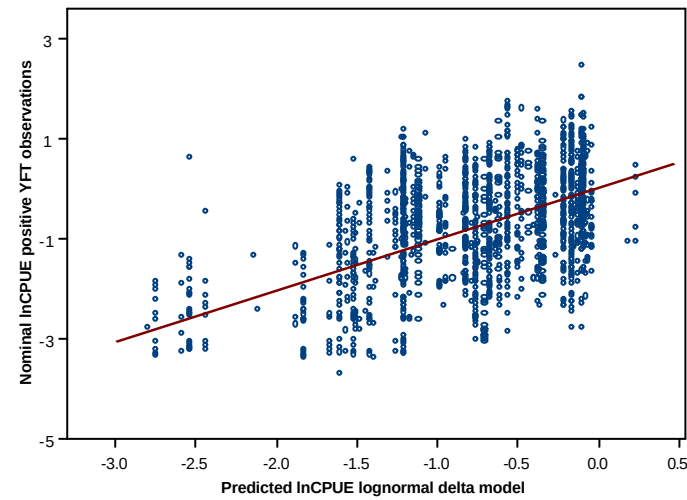


Figure 7. Observed vs fitted values of the lognormal delta model component for the positive set/trip of yellowfin tuna data.

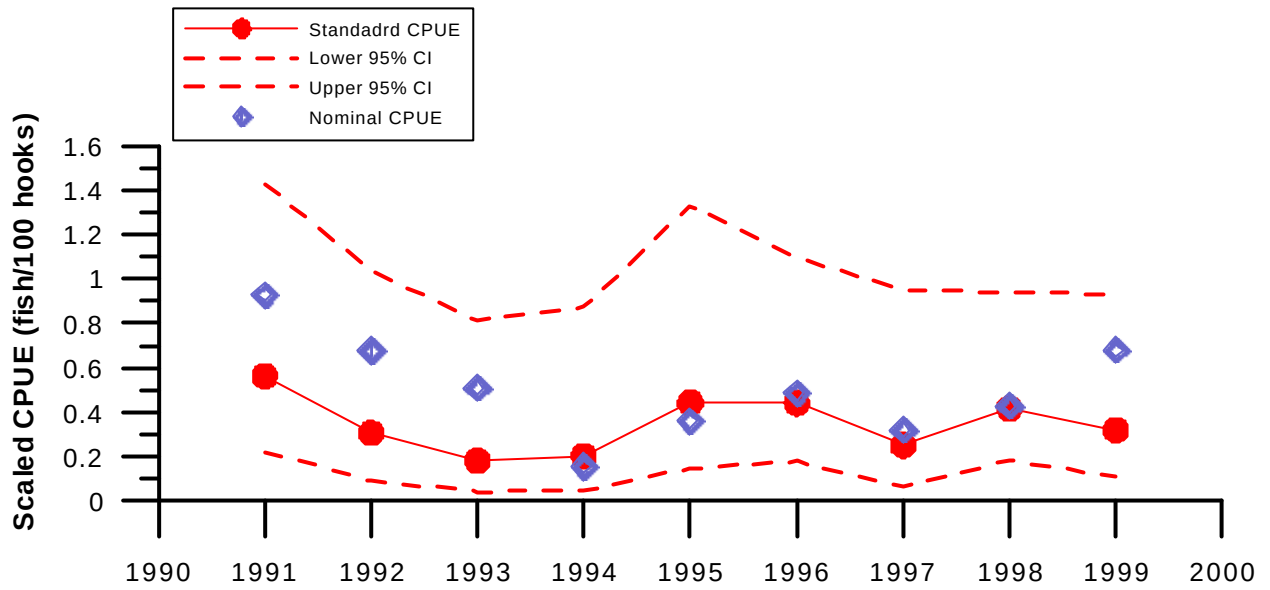


Figure 8. Nominal and standardized catch rates for yellowfin tuna from the Venezuelan Pelagic Longline Observer Program. Standardized CPUEs were estimated by a delta lognormal mixed model, error bars represent the 95% confidence band.

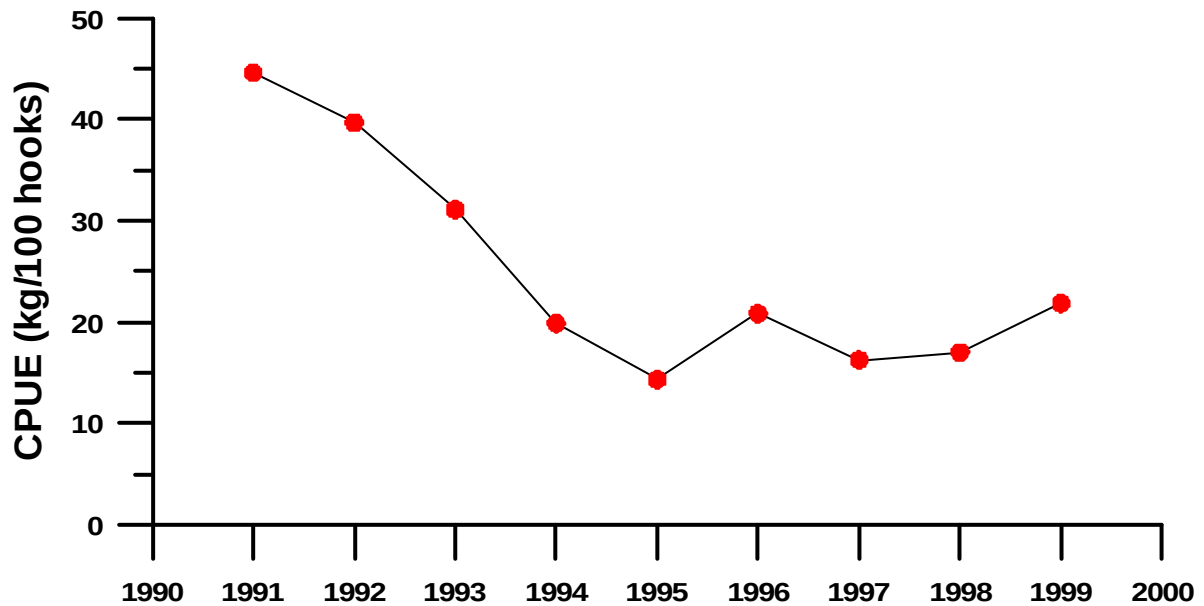


Figure 9. Nominal catch rates (kg/100 hooks) for yellowfin tuna from the Venezuelan pelagic longline fleet obtained from reported logbook information from 1991-1999.