

BLACKFIN TUNA (*THUNNUS ATLANTICUS*) UPDATES ON CATCH, EFFORT AND SIZE DISTRIBUTION FROM VENEZUELAN FISHERIES

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SUMMARY

Catches of blackfin tuna (Thunnus atlanticus) were reviewed from 1986 to 2015 for the Venezuelan industrial surface fleets (baitboat, purse seine) and the small scale fisheries (drift gill-net from "Playa Verde" and artisanal off-shore pelagic longline). Information on catch and effort was analyzed by gear, month and year; spatial and seasonal distribution of mature and immature fish was discussed. Regional annual catch trends were reviewed and discussed.

RÉSUMÉ

Les captures de thon à nageoires noires (Thunnus atlanticus) ont été passées en revue de 1986 à 2015 pour les flottilles de surface industrielles vénézuéliennes (canneurs et senneurs) et les pêcheries à petite échelle (filet maillant dérivant de « Playa Verde » et palangrier pélagique côtier artisanal). Les informations sur la prise et l'effort ont été analysées par engin, mois et année ; la distribution spatiale et saisonnière des poissons matures et des poissons immatures a été abordée. Les tendances de la prise annuelle régionale ont été examinées et discutées.

RESUMEN

Se revisaron las capturas de atún aleta negra (Thunnus atlanticus) desde 1986 hasta 2015 para las flotas industriales de superficie venezolanas (cebo vivo y cerco) y las pesquerías de pequeña escala (red de enmalle a la deriva de "Playa Verde" y palangre pelágico artesanal de altura). Se analizó la información sobre captura y esfuerzo por arte, mes y año; también se presentó la distribución espacial y estacional de peces maduros e inmaduros. Se revisa y debate las tendencias en la captura anual regional.

KEYWORDS

Thunnus atlanticus, blackfin tuna, catch & effort, Caribbean Sea, Venezuela

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Introduction

Blackfin tuna (*Thunnus atlanticus*) is one of the species that partially supports the industrial and artisanal fisheries in Venezuela that operate in the Caribbean Sea and adjacent waters of the North Atlantic. Venezuelan industrial fisheries such as baitboat (BB) and purse seine (PS) fleets have reported catches of blackfin tuna since 1987. In the small scale fisheries, the Venezuelan artisanal off-shore (VAOS) fleet which uses pelagic longline gear and the artisanal coastal drift-gillnet fishery, in which billfish and dolphinfish are the target species, have also reported catches of blackfin tuna. However, in the artisanal fisheries, blackfin tuna was reported as “*albacora*” (a common name used by artisanal fishers throughout the Caribbean for blackfin tuna) as reflected in the national catch statistics. This was confirmed by INSOPESCA observers in ports of the Venezuelan artisanal off-shore (VAOS) fleet and through port samplings taken place in the community of Playa Verde for the drift gill-net (GILL) fishery (Arocha *et al.*, 2009).

Data of blackfin (BLF) tuna catches and effort from the Playa Verde drift gill-net has been reported to ICCAT only for the period 2011-2014. Regarding the BLF catch from the VAOS fleet, a three year project funded by the Japanese Data & Management Improvement Program (JDMIP), was carried out to monitor this fleet, including sampling for sizes of BLF (Arocha *et al.*, 2015). Also, INSOPESCA has been keeping detailed records on spatial data of BLF from PS, BB, and some of the VAOS fleet in northeastern Venezuela. This document presents an update of total catches and effort; new information from the small scale LL (VAOS_LL) and Playa Verde GILL fisheries; spatial analysis of catch-effort for PS, BB, GILL and VAOS_LL and size of individuals sampled during the time series. Regional annual catch trends are reviewed.

Methods

The data available from Task I and II from the ICCAT database were compared with updated records from the Venezuelan national fisheries agencies (INIA and INSOPESCA).

Catch and effort statistics from the artisanal fleets (GILL and VAOS_LL), were obtained from research programs, the ICCAT Enhanced Program for Billfish Research that monitors the artisanal drift-gillnet fishery off La Guaira (Arocha *et al.*, 2009), and INIA/INSOPESCA monitoring programs for the offshore small scale longline (LL) fishery (Arocha *et al.*, 2006). The spatial distribution of catch and effort of blackfin tuna recorded in quadrants of 1°×1° was analyzed.

Blackfin tuna size structure was obtained from the surface fisheries (BB, PS) based in Cumaná and from the VAOS_LL fishery recorded by port samplers during landings from these fleets. A total of 8644 blackfin tunas were sampled from the surface fleets (PS, BB) for fish length (FL, measured with metric-tape) between 1993-2008, and 2012-2015. Sizes of 530 individuals sampled from the VAOS_LL fleet were obtained for the period 2011-2013 from the Japanese Data & Management Improvement Program (JDMIP) to monitor the VAOS_LL fleet targeting tuna and tuna-like species using pelagic longline gear only (Arocha *et al.*, 2015).

Size data (FL) was analyzed by year, and month. Spatial and temporal distribution of non-mature and mature fish was analyzed for the surface (PS, BB) and the VAOS_LL fleets. Maturity was based on a $L_{50} \geq 50$ cm FL according to estimations developed by Monte (1964) and Freire *et al.* (1998) for both sexes of *T. atlanticus* (obtaining an L_{50} starting from 50 cm of total length) and by Vieira *et al.* (2005) reporting an L_{50} of 51 cm for females.

Total catches of Venezuela are compared with those of other countries that report catches of blackfin tuna in the following ICCAT areas: Northwest Atlantic (NW), West Tropical Atlantic (WTRO), Southwest Atlantic (SW), West Atlantic (WEST) and Gulf of Mexico (GOFM). These catches are presented in percentages.

Results and discussion

Blackfin tuna highest catch values were observed for the years 1991 (2,148 t) and 2001 (1,902 t), showing a decreasing trend for the last four years, even with the new inclusion of landings from the GILL fishery that operates off the Community of “Playa Verde” and of those catches from the VAOS_LL fishery for the recent years (**Figure 1**). This could possibly be explained in part for the decreasing trend observed in effort from the tuna surface fleets (PS, BB, obtained from Task II data), and VAOS fleet, although it was not observed for the GILL fishery (**Figure 2**). Although, a revision of the Task II data showed some discrepancies in the catch with respect to the Task I data, the discrepancies will be investigated in the future. However, the standardized CPUE estimated by Arocha *et al.* (2011) also reflects a declining in relative abundances of blackfin tuna for at least until 2010, the last year for which estimation was done.

Seasonal trend in catch and effort were usually higher at the end of the year for the surface fleets (PS, BB), while they were higher during the first trimester of the year for the VAOS_LL fleet and the GILL fishery (**Figure 3**), although effort remained relatively stable in the GILL fishery.

When considering catches of blackfin tuna spatially, they were higher in the central coast of Venezuela for the baitboat and purse seine fleets, and most of them were in the Caribbean Sea around the offshore islands, while for the artisanal off-shore (VAOS_LL), blackfin tuna catch and effort was higher in the eastern area of Venezuela, extending more towards the Atlantic Oceans (**Figure 4**), which is basically where most of the VAOS_LL fleet operates.

Regarding sizes, the minimum FL has been higher for the last three years in the BB fishery (**Table 1**), showing almost no differences over the months for the surface fleets but more variation within months for VAOS_LL samples (**Figure 5**). Since 1993 until 2015 most of the yearly lengths were in the upper 50 cm FL (**Figure 6**), which has been reported as the length in which at least 50% of population individuals of blackfin tuna have reached maturity (Monte, 1964; Freire *et al.* 1998).

The spatial distribution of mature and non-mature blackfin tuna (BLF) is presented in (**Figure 7**). In general, most of the blackfin tuna catch from all fleets (surface and VAOS_LL) indicate a mayor proportion of mature blackfin tuna across seasons and throughout the area, with very few exceptions. The higher proportion of non-mature BLF's was observed in the first and second trimester in all sampled fleets (PS, BB, VAOS_LL), but important proportions of non-mature fish were observed towards the western area from the surface fleets; while the important proportions of non-mature fish in the eastern area was attributed to the VAOS_LL fleet. However, the few occasions when the surface fleets operation in the Atlantic, an important proportion of the BLF catch during the first two trimesters of the year were of non-mature fish.

Venezuela has the largest proportion of aggregated catches of BLF for the period of 1986-2015 (**Figure 8**), followed by EU-France and the U.S.A. However, the historical trend of the time series reviewed (1986-2015) for the countries with the highest BLF catch (more that 10% of the total catch for 4 consecutive years), indicate that during the early period (1986-2000) most of the catch was from Venezuela and EU-France (**Figure 9**). However, in the later period (2001-2015), several changes were observed, for one, EU_France appeared to have stopped reporting, but resumed at the end of the series with very low catches. Another change noticed was the increase in catches from the U.S.A. and Grenada, followed by temporal spikes in the catches from Brazil. In contrast, the Venezuelan catch show a decreasing trend, particularly during the last 4 years. This trend becomes evident when the proportion of the Venezuelan catch is compared with the rest of the countries catching BLF (**Figure 10**), when after 2000 a partially steady decreasing trend is observed in the Venezuelan catch, in contrast to the partially steady increasing trend in the catch of BLF for the rest of the countries. Coincidentally, the high catches in Venezuela for this time period correspond to the low catches of the rest of the country, with no clear explanation to may cause it.

In general, the Venezuelan catches of blackfin tuna were mostly represented by mature individuals in all fleets analyzed in the present document. However, the declining trend observed in the catches during the last four years is cause for concern. The limited knowledge on the life history of blackfin tuna throughout its distribution range poses some questions that need answers. One is stock ID, there is no clear understanding of stock differentiation across its range, nor on its reproductive dynamics, and growth. This insufficient knowledge suggests that a more detailed and extensive evaluation of this important fishery resource is needed.

References

- Arocha, F., Larez, A., Marcano, J., Barrios, A., Gutierrez, X., Debrot, D. and Ortiz, M. 2006, Standardized catch rates for white marlin (*Tetrapturus albidus*) from the Venezuelan artisanal pelagic longline fishery off the Caribbean Sea and adjacent areas: Period 1992-2003. ICCAT, Collect. Vol. Sci. Pap., 59: 315-322.
- Arocha, F., Ortiz, M., Bárrios, A., Debrot, D. and Marcano, L.A. 2009. Catch rates for sailfish (*Istiophorus albicans*) from the small scale fishery off La Guaira, Venezuela: Period 1991-2007. ICCAT, Collect. Vol. Sci. Pap., 64: 1844-1853.
- Arocha, F., A. Barrios, J. Marcano, X. Gutierrez. 2012. Blackfin tuna (*Thunnus atlanticus*) in the Venezuelan fisheries. ICCAT, Col. Vol. Sci. Pap., 68: 1253-1260.
- Arocha, F., Pazos, A., Larez, A., Marcano, J., Gutierrez, X. 2015. Enhanced monitoring of large pelagic fishes caught by the Venezuela artisanal off-shore fleet targeting tuna and tuna-like species in the Caribbean Sea and adjacent northwestern Atlantic waters: Final analysis. ICCAT, Coll. Vol. Sci. Pap., 71: 2316-2333.
- Freire, K., Lins, Lessa, R. 1998. Aspectos reprodutivos da Albacorinha (*Thunnus atlanticus*) no Nordeste do Brasil. II Workshop REVIZEE Nordeste. Univ.Federal de Pernambuco, Pag: 93.
- Monte, S. 1964. Observações sobre a estrutura histológica das gônadas da albacorinha, *Tinos atlanticus* (Lesson, 1831), no Nordeste do Brasil. Biol. Inst. Mar. UFRN, 1: 17-31.
- Vieira, K., Lins, J., Barbalho, M., Garcia, J. 2005. Reproductive characteristics of blackfin tuna *Thunnus atlanticus* (Lesson, 1831), in northeast Brazil. ICCAT, Col. Vol. Sci. Pap., 58(5): 1629-1634.

Table 1. Mean, minimum value (Min), maximum value (Max) and number of observations (n) of blackfin tuna sizes (FL) for the three types of gears (purse seine PS, baitboat BB, VAOS_LL) during the years sampled for Venezuelan fleets. No sample sizes were reported for the years 2009-2011 (BB, PS).

Year	PS				BB				VAOS_LL			
	Mean	Min	Max	n	Mean	Min	Max	n	Mean	Min	Max	n
1993	53,83	32	75	657	62,00	52	77,5	65	-	-	-	-
1994	53,67	33	77	535	53,99	40,5	86,5	99	-	-	-	-
1995	54,80	32,5	72	641	53,88	40	73,5	155	-	-	-	-
1996	52,55	33,5	69,5	740	53,67	40,5	74	239	-	-	-	-
1997	52,29	40	68,5	236	54,28	45	71	43	-	-	-	-
1998	54,33	39	90	612	51,49	42	66,5	165	-	-	-	-
1999	55,28	36	71,5	329	58,66	46	74	76	-	-	-	-
2000	56,26	36,5	95,5	400	52,35	46	62	23	-	-	-	-
2001	51,65	36	73,5	389	58,65	33,5	78	266	-	-	-	-
2002	51,57	35	64	158	60,82	45	79,5	295	-	-	-	-
2003	52,63	40	67,5	178	54,99	46	65	39	-	-	-	-
2004	52,41	33	66	297	53,56	45	66,5	80	-	-	-	-
2005	52,97	43	63,5	103	54,40	43,5	73,5	55	-	-	-	-
2006	54,25	40	65	164	55,63	49	65,5	19	-	-	-	-
2007	54,37	44,5	68	352	56,50	51	68	7	-	-	-	-
2008	55,29	42,5	73	72	53,67	49	56	3	-	-	-	-
2009	54,51	41	67	219	49	49	49	1	-	-	-	-
2010	-	-	-	-	58,31	42	72	184	-	-	-	-
2011	-	-	-	-	-	-	-	-	61,06	43	75	49
2012	57,28	39	75	315	55,94	21	70	97	60,87	22	100	417
2013	-	-	-	-	63,85	61	67	4	55,47	43	70	64
2014	59,17	47	67	63	54,18	55	69	17	-	-	-	-
2015	57,20	42	74	122	58,50	54	65	4	-	-	-	-

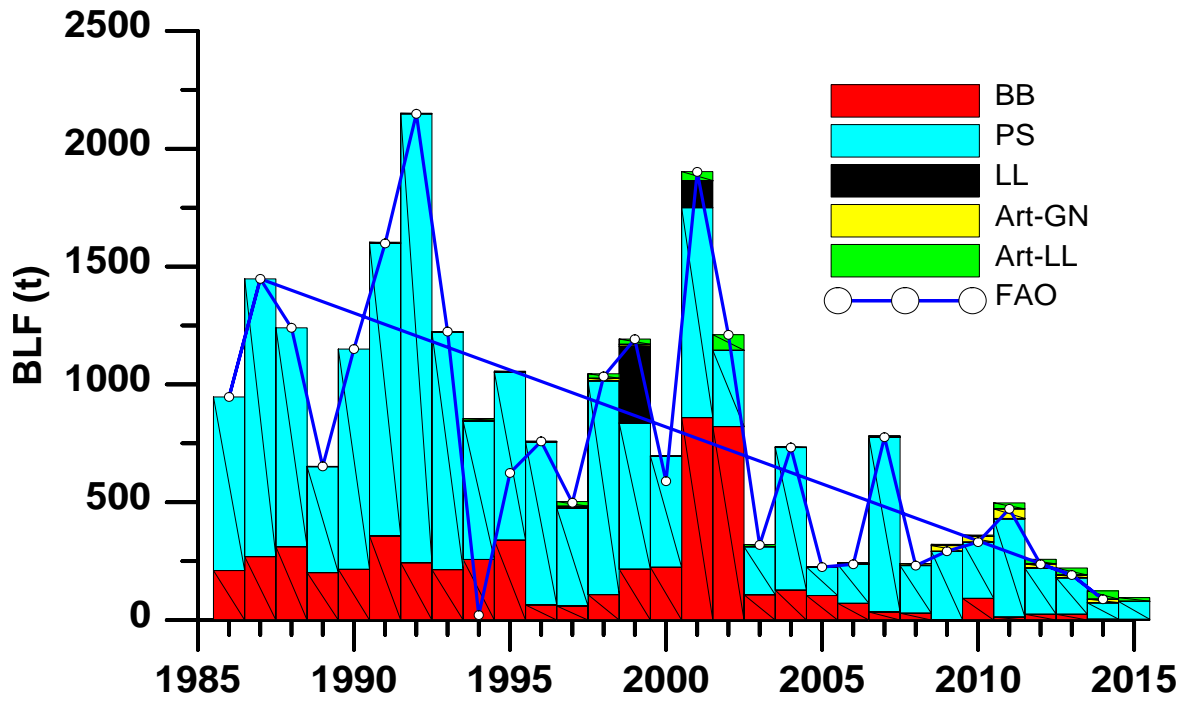


Figure 1. Updated total catches (t) of *Thunnus atlanticus* (blackfin tuna, BLF) by gear from Venezuelan fisheries 1986-2015.

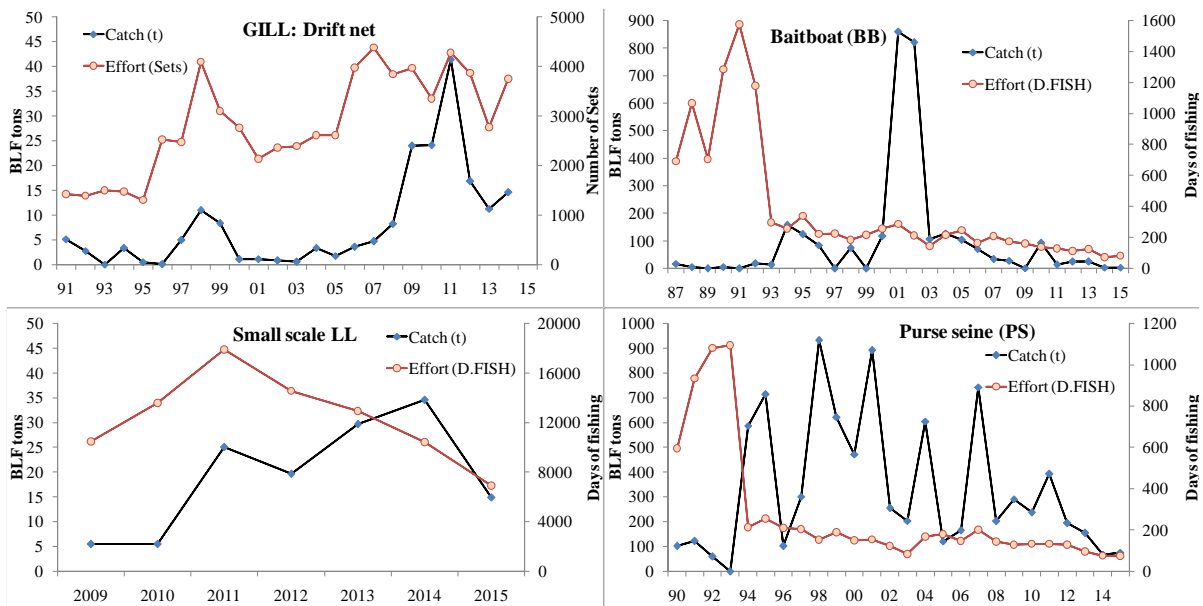


Figure 2. Blackfin tuna (BLF) catches and effort by year for the drift gill-net (GILL, Playa Verde), baitboat (BB), small scale longline (=VAOS_LL), and purse seine (PS) fleets from Venezuela during period 1987-2015.

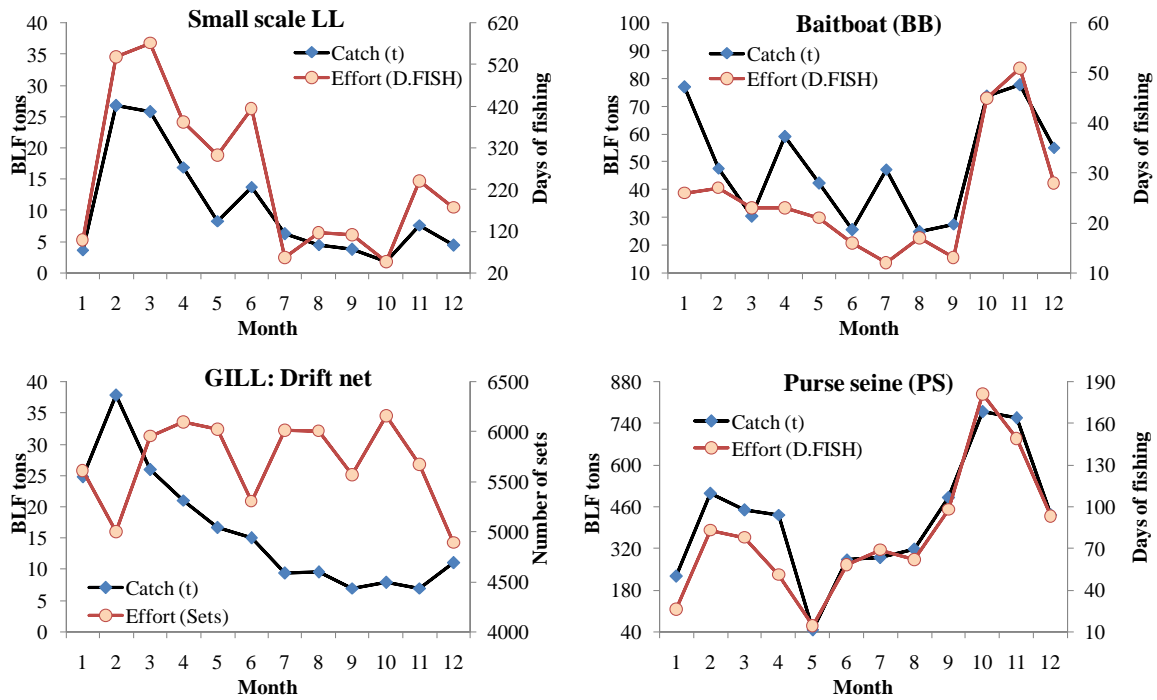


Figure 3. Seasonal (aggregated by month) blackfin tuna (BLF) catch and effort for the drift gill-net fishery (GILL, Playa Verde), baitboat (BB), small scale longline (VAOS_LL), and purse seine (PS) fleets from Venezuela during period 1987-2015.

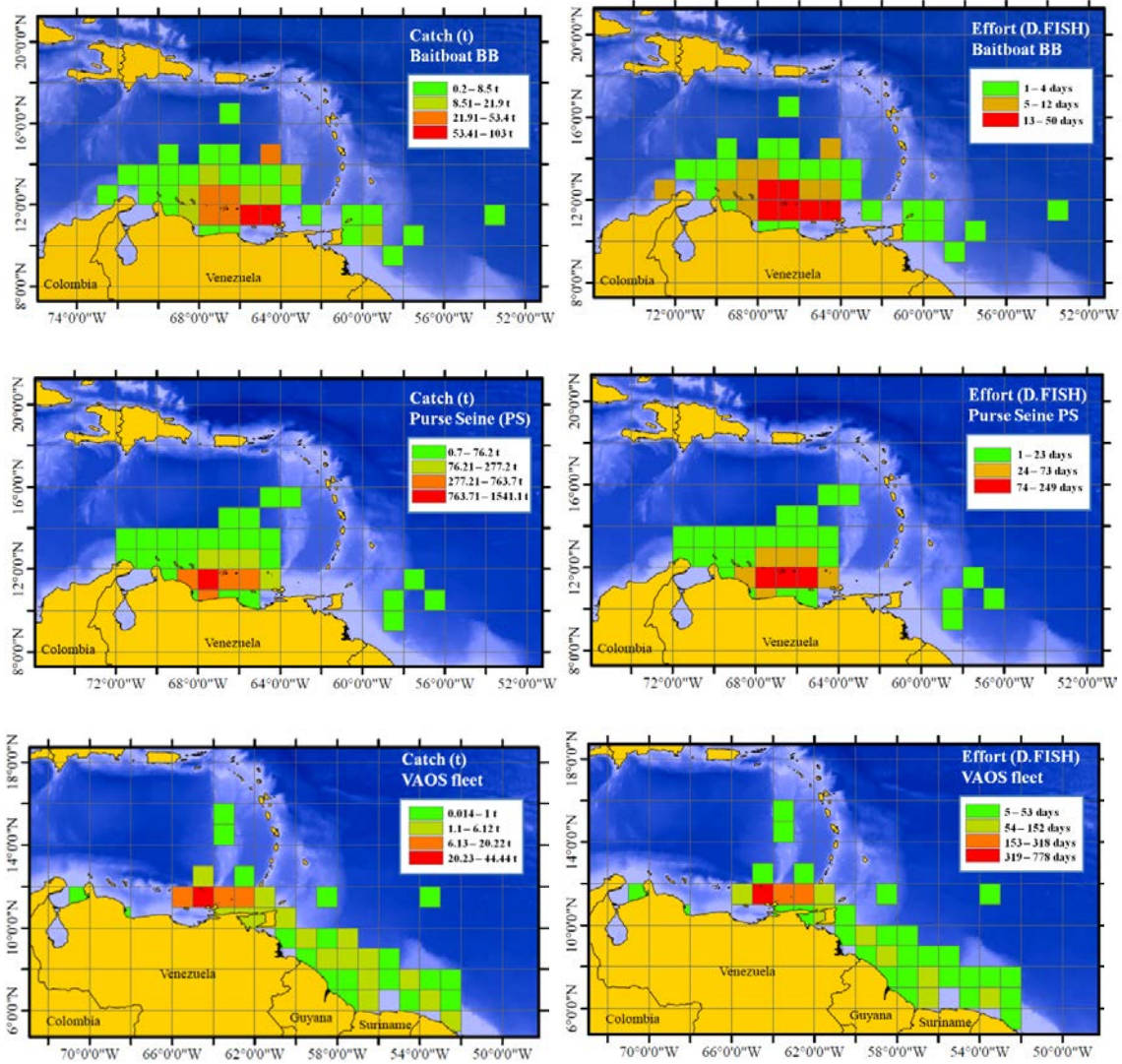


Figure 4. Overall spatial catches and effort of blackfin tuna (BLF) by fleet (baitboat BB, purse seine PS, and small scale longline, VAOS_LL) in 1° x 1° with respect to the bathymetry of the study area for all the years sampled.

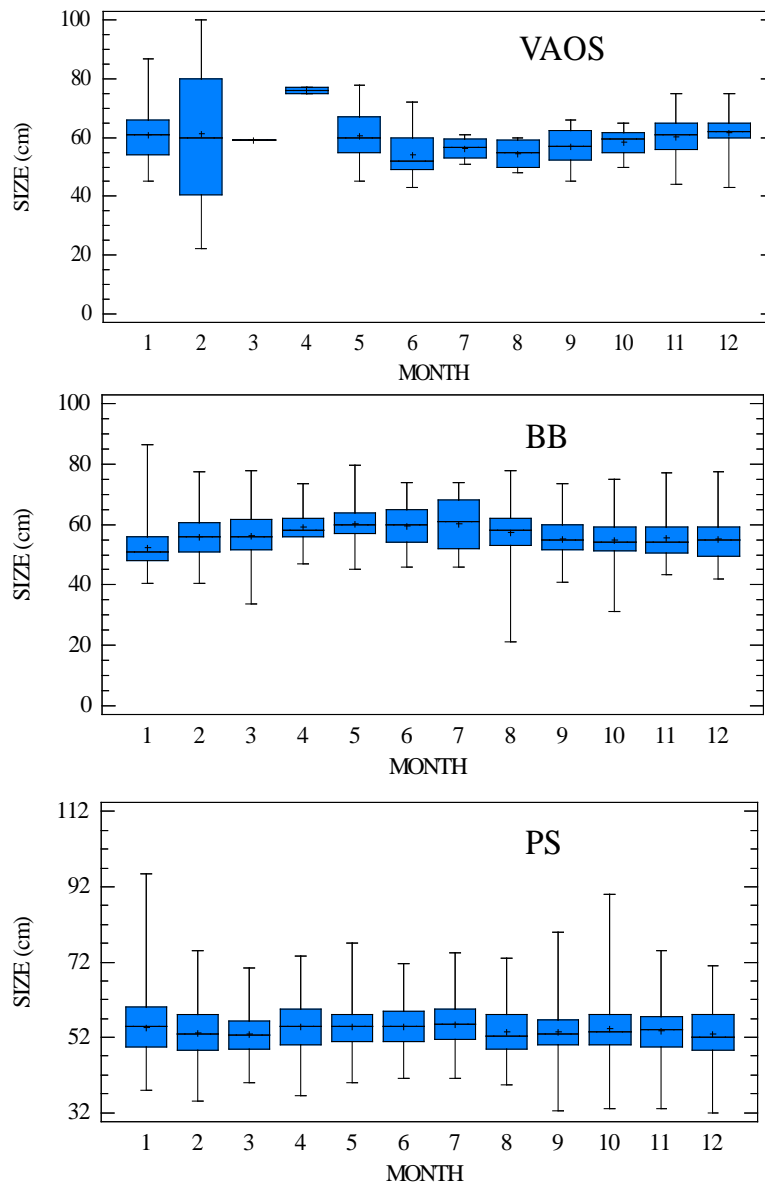


Figure 5. Fork length sizes (cm) of blackfin tuna (BLF) from the Venezuelan Artisanal Off-shore fleet (VAOS_LL, November 2011-Jun 2013), baitboat (BB, April 1993 - December 2015) and purse seine (PS, January 1993- December 2015) aggregated by month for all years combined.

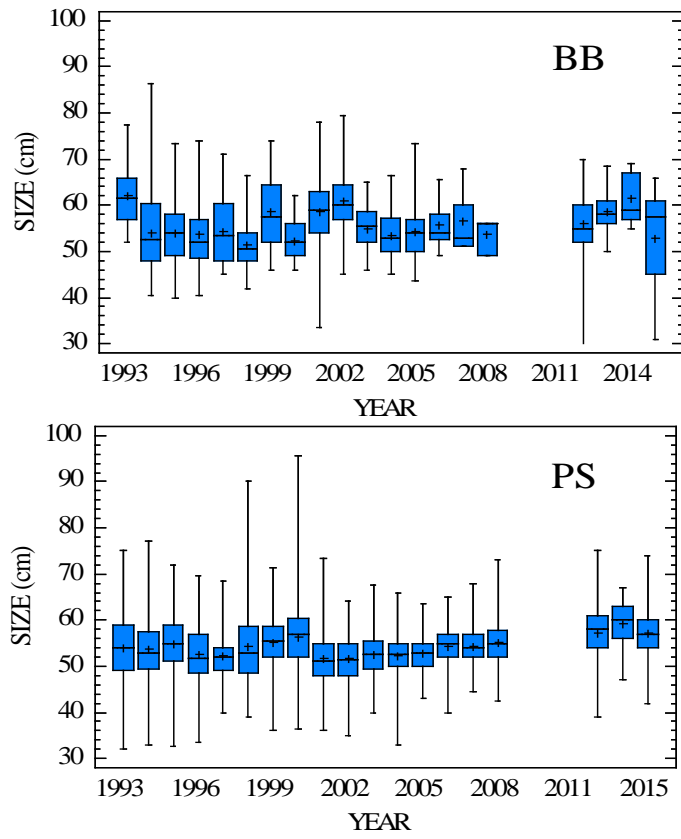


Figure 6. Fork length sizes (cm) of blackfin tuna (BLF) from baitboat (BB, April 1993 - December 2015) and purse seine (PS, January 1993- December 2015) aggregated by years.

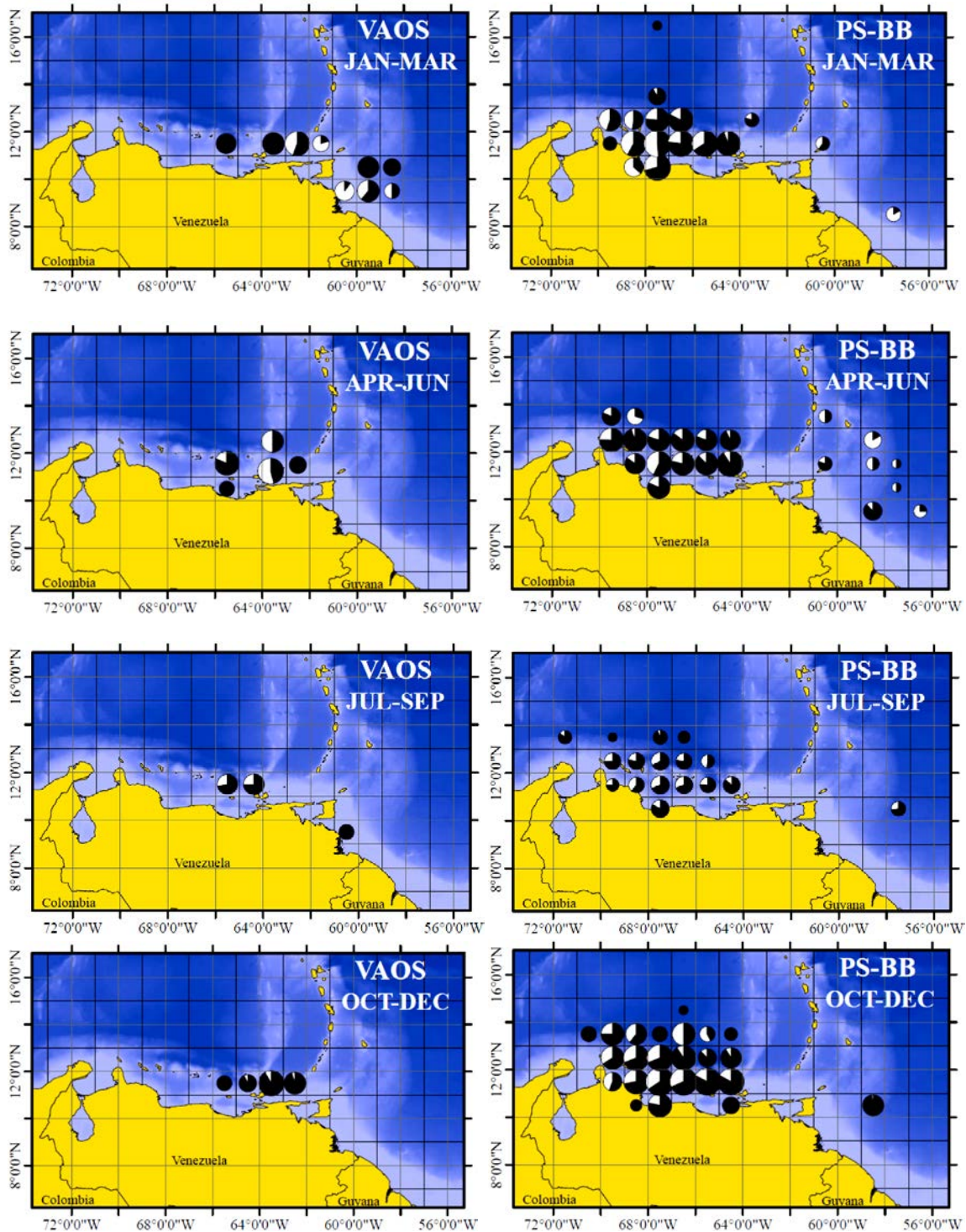


Figure 7. Overall and seasonal (trimester) capture location of proportional numbers of mature (≥ 50 cm FL, black) and non-mature (< 50 cm FL, white) of blackfin tuna (*Thunnus atlanticus*) sampled catch from the Venezuelan Artisanal off-shore longline fleet (VAOS_LL) and industrial surface fleets (PS, BB) in $1^\circ \times 1^\circ$ with respect to the bathymetry of the study area. The size of the pie charts is proportional to the numbers of individuals sampled during the period of 2011-2013 (VAOS_LL) and 1993-2015 (PS, BB).

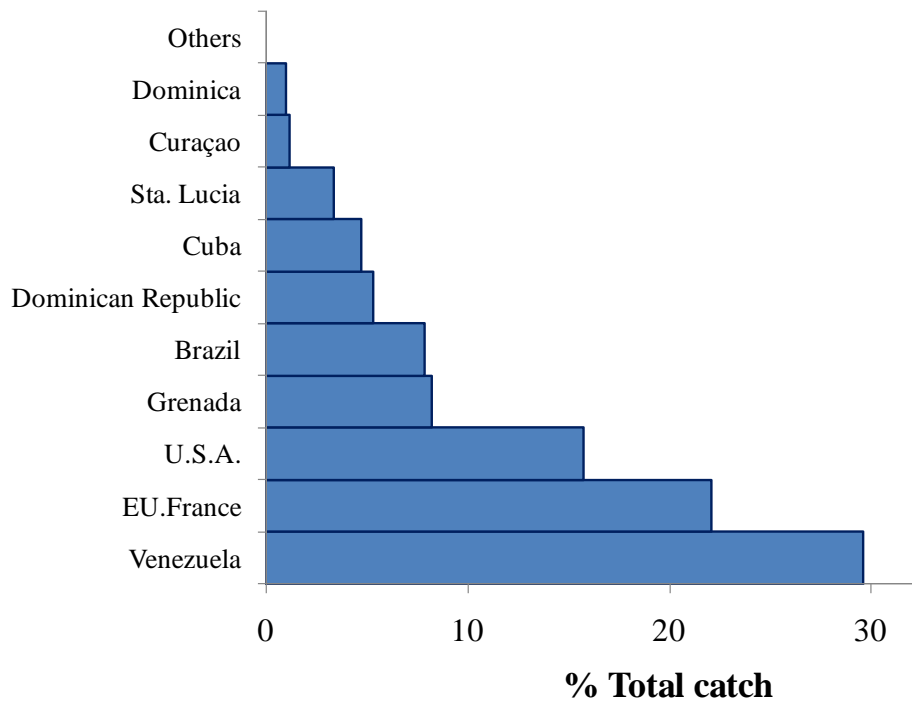


Figure 8. Percentages of blackfin tuna (BLF) catch reported to ICCAT by countries with respect to the total catch, and aggregated for the period 1986-2015.

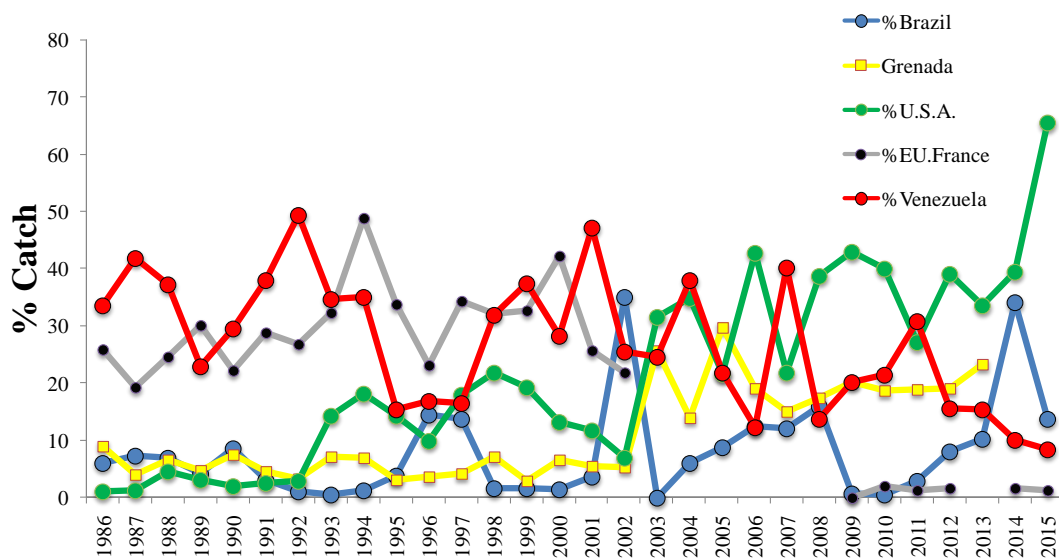


Figure 9. Catches of blackfin tuna (BLF) in percentage per year from Task I (ICCAT) for the four countries with overall highest catches in the west Atlantic area during the period 1986-2015.

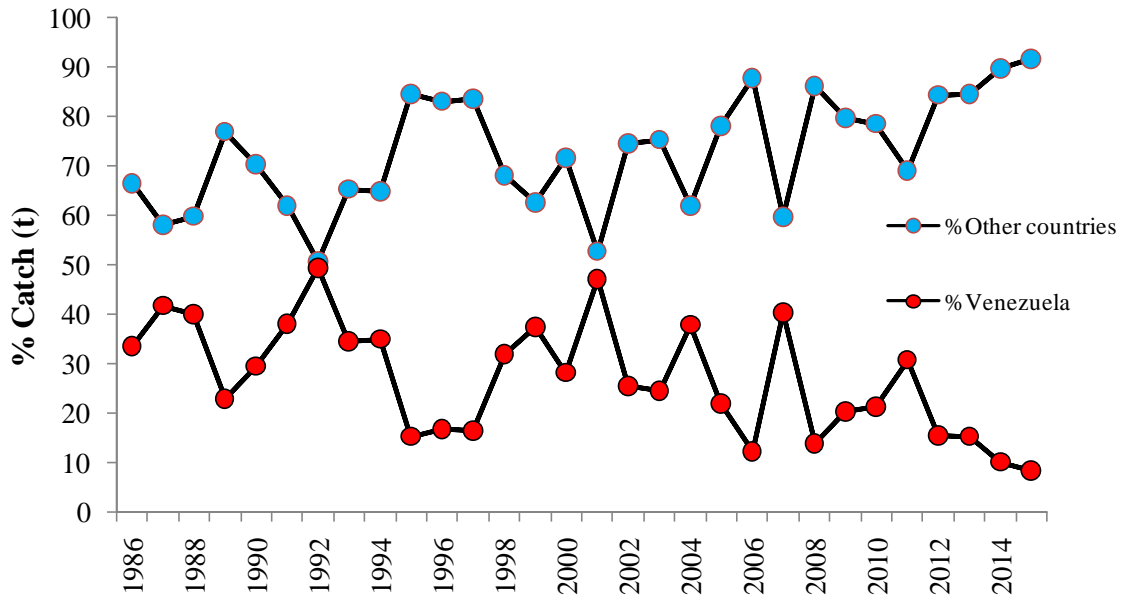


Figure 10. Annual percentage of total catches of blackfin tuna (*Thunnus atlanticus*) from Task I (ICCAT) aggregated for all other countries with catches in west Atlantic, contrasted with those from Venezuela.