CATCH COMPOSITION OF THE BAITBOAT FISHERY IN THE SOUTHWESTERN ATLANTIC

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SUMMARY

*Baitboat fishermen aim at skipjack tuna (*Katsuwonus pelamis*) in the south western Atlantic. Nevertheless, other tuna are also caught especially in mixed schools. In this paper we carried out a descriptive analysis of catch composition of the bait-boat fishery based on Task II – ICCAT dataset. There are data from 1981 to 2011. Catch per unit effort (CPUE) of skipjack were much higher than the CPUEs of yellowfin, bigeye and albacore all along the southern Brazilian coast (20ºS-34ºS). CPUEs of skipjack showed a slight increasing trend until 2010, while there is not a clear time trend in the yellowfin time series. Bigeye and albacore CPUEs were close to zero all over the years. Proportions of skipjack in the total catches were mostly high (> 90%) all along the coast. Most of the proportions of yellowfin and bigeye were low (< 5%), but few values higher than 5% were found north of 28ºS. Proportions of skipjack were high all over the years, while proportions of yellowfin have decreased after mid 1990s.*

RÉSUMÉ

Les canneurs visent le listao (Katsuwonus pelamis) *dans l'Atlantique Sud-Ouest. Néanmoins, d'autres thons sont également capturés surtout dans des bancs mixtes. Dans le présent document, nous avons effectué une analyse descriptive de la composition des captures de la pêcherie de canneurs sur la base du jeu de données de Tâche II de l'ICCAT. Il existe des données de 1981 à 2011. Les captures par unité d'effort (CPUE) du listao étaient beaucoup plus élevées que les CPUE de l'albacore, du thon obèse et du germon tout le long de la côte sud brésilienne (20ºS-34ºS). Les CPUE du listao ont montré une légère tendance à la hausse jusqu'en 2010, alors qu'il n'y a pas de tendance temporelle claire dans les séries temporelles de l'albacore. Les CPUE du thon obèse et du germon étaient proches de zéro au cours des ans. Les proportions de listao dans le total des captures étaient généralement élevées (> 90 %) tout au long de la côte. La plupart des proportions d'albacore et de thon obèse étaient faibles (< 5 %), mais peu de valeurs supérieures à 5 % ont été trouvées au Nord de 28ºS. Les proportions de listao étaient élevées tout au long des années, alors que les proportions d'albacore ont diminué après le milieu des années 90.*

RESUMEN

*En el Atlántico occidental, los pescadores de cebo vivo se dirigen al listado (*Katsuwonus pelamis*). No obstante, también se capturan otros túnidos, especialmente en cardúmenes mixtos. En este documento, se lleva a cabo un análisis descriptivo de la composición de la captura de la pesquería de cebo vivo basándose en el conjunto de datos de Tarea II-ICCAT. Los datos son de 1981 a 2011. La captura por unidad de esfuerzo (CPUE) del listado era muy superior a las CPUE del rabil, el patudo y el atún blanco a lo largo de la costa meridional de Brasil (20ºS-34ºS). Las CPUE del listado presentaban una tendencia ligeramente ascendente hasta 2010, mientras que el rabil no mostraba ninguna tendencia temporal clara. Las CPUE del patudo y el atún blanco eran cercanas a cero durante todos los años. La proporción de listado en las capturas totales era en su mayoría elevada (>90%) a lo largo de la costa. La mayoría de la proporción de rabil y patudo era baja (<5%) pero pocos valores superiores al 5% fueron hallados al norte de 28ºS. La proporción de listado era alta en todos los años, mientras que la proporción de rabil descendió después de mediados de los 90.*

KEYWORDS

Catch composition, Catch/effort, Fishery Statistics, Geographical distribution

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1. Introduction

Skipjack tuna (*Katsuwonus pelamis*) is a highly migratory species that inhabits equatorial and tropical waters of the oceans all around the world (Sund *et al*., 1981; ICCAT, 2014a). Catches of skipjack rank first among overall tuna catches (FAO, 2012). Skipjack is the main target of the bait-boat fishing fleet in the southwestern Atlantic, where most of the fish is caught by Brazilian fleet, which is based on four main harbors, namely, Rio de Janeiro, Navegantes, Itajaí and Rio Grande.

There are a couple of papers about the historical development of the bait-boat fishery (Meneses de Lima *et al.*, 2000), the relationship between environmental variables, fishing effort, catch and catch per unit effort (CPUE) (Andrade and Garcia, 1999; Andrade, 2003; Andrade *et al.* 2005), the estimation of relative abundance indices based on catch-per-unit-effort (Andrade, 2008 and 2009), and age and growth (Vilela and Castello, 1991) in the southwestern Atlantic. There are specific and mixed tuna schools, but most of the fish caught by bait-boat in the southern Atlantic is skipjack. It is also known that when the fishermen operates on mixed schools, they catch skipjack, juveniles of other tuna species like yellowfin (*Thunnus albacares*) and bigeye (*T. obesus*), or even other pelagic species (Oliveira, 2006). Nevertheless, the catch composition was assessed only in one of the Brazilian's harbor (Itajaí-Navegantes, Santa Catarina State) for 2001 and 2002 only (Santos and Andrade, 2003). In order to expand the knowledge on the catch composition we have analyzed all the Brazilian data, which includes information for all the harbors and for the last three decades. Maps of CPUE and of proportions of tuna species in the bait-boat total catch are also provided.

2. Database and analysis

In this paper we have analyzed the information about Brazilian bait-boat fishery from 1981 to 2011 reported in Task II dataset (ICCAT, 2014b). Only national boats which are coded 003BR00, 003BR02, 003BR05, 003BR08, 003BR23 and 003BR24 were considered in the analysis. Most of the catches were reported in kilos and most fishing efforts were reported in "fishing days". Geographical location of the fishing operations are reported in 1º x 1º, 5º x 5º, 10º x 10º or 20º x 20º (latitude x longitude) grids. Only fishing sets reported in 1º x 1º grid or in 5º x 5º grid were considered in the analysis. Fishing operations in unreliable locations (e.g. too far from the Brazilian coast) were discarded. There is a small quantity of database entries concerning leased bait-boats from Japan, which have operated from 1982 to 1991, and from Portugal, which have operated in 1995 and 1996. Nevertheless, leased and national fishermen strategies were very similar all over the years, hence national and leased boats data were pooled (**Table 1**).

The objective was to show the overall temporal and spatial variability of the tuna catch composition. The analysis was descriptive. Catch per unit effort and the proportions of tuna species in total catch were mapped in 1º x 1º grid resolution. Boxplot were used to show the distribution of the CPUE per year. Proportion of the tuna species in the total catch and proportions of zero catches were also calculated for each year.

3. Results

3.1 Spatial distribution

Brazilian bait-boat fishery take place over the slope and the continental shelf along the coast from 17ºS and 35ºS (**Figure 1**). Catch per unit effort of skipjack are usually higher than 5 t/fishing day (**Figure 1A**), especially south of 26ºS. Very high CPUEs (> 15 t/fishing days) were rare and located far from the coast. Catch per unit effort of the other tuna species are lower than skipjack CPUE. Most of the CPUEs of yellowfin were lower than 0.5 t/fishing days (**Figure 1B**), but CPUEs higher than 2.5 t/fishing day appeared mostly in the very south (32ºS-35ºS) and in the north (20ºS-23ºS) of the fishing ground. Most of bigeye and albacore CPUEs were smaller than 0.05 t/fishing day all along the Brazilian coast (**Figures 1C and D**). CPUEs higher than 0.05 t/fishing appear only the center of the fishing ground (23ºS-32ºS).

Proportions of skipjack in the total catches were mostly high (> 90%) all along the coast (**Figure 2A**). Most of the proportions of yellowfin were below 10%, but a couple of proportions higher than 15% have occurred in the north part of the fishing ground (20ºS-27ºS) (**Figure 2B**). Proportions of bigeye and albacore were mostly very low (< 5%) all along the coast. However, CPUEs of bigeye higher than 5% occurred north of 26ºS.

3.2 Variation of CPUE and proportions across the years

Median of the CPUEs of skipjack showed a slight increasing trend from 1981 to 2010, but dropped down in 2011 (**Figure 3A**). The variability of the CPUE in a given year is high ranging from close to zero to more than 20 t/fishing day. Yellowfin CPUE series do not show clear time trends (**Figure 3B**). The variability is high but most of the CPUE values were lower 1 t/fishing day all over the years. Most of the CPUEs of bigeye and albacore were close to zero, hence the time series are not informative (**Figures 3C and D**).

Proportions of skipjack were high all across the years, especially after mid 1990's, in which period most of the calculations were higher than 92% (**Figure 4A**). Most of the proportions before 1993 ranged from 82% to 88%, though there were peaks in 1986 and 1990 with values higher than 94%. Variability of the proportions of yellowfin in the total catch was high from 1981 to 1993 (**Figure 4B**). In this period there a couple of peaks and plunges, but most of the proportions were higher than 7%. Proportions of yellowfin dropped from 1992 to 1996. After 1995 most of the proportions were below 5%.

4. Discussion

Overall the catches and the proportions of skipjack are high in the southern coast of Brazil, which reflect the abundance of the skipjack schools in the area. Other tuna species are caught mainly in mixed schools. Proportion of yellowfin reaches close to 5%, but the proportions of bigeye and albacore are very low. Hence most of the mixed schools are composed of skipjack and yellowfin. Proportions and CPUEs of skipjack were high all along the coast, especially in the south part of the fishing ground. However, proportions of yellowfin higher than 5% were found only in the very north and south bounds of the fishing ground, while proportions of bigeye and albacore were not that low in the center of the fishing ground. Skipjack distribution pattern is related to the dynamics of environmental variables (e.g. sea surface temperature) and of oceanographic features (e.g. continental shelf fronts) (Andrade, 2003). Future studies on the relationship between the dynamics of oceanographically variables and yellowfin, bigeye and albacore bait-boat catches in the southern Brazilian coast may improve the knowledge on the abundance and catchability of those species in the areas. Studies on distribution and displacement of the early life juveniles of tuna in the southern coast are critical because most of the yellowfin, bigeye and albacore caught in mixed schools are small size.

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Table 1. Number of data entries with 1ºx1º geographical resolution concerning Brazilian bait-boat fleet in Task II ICCAT database. NAH – Non available home harbor; IT – Boats home based in Itajaí harbor; RG – Boats home based in Rio Grande harbor; RJ – Boats home based in Rio de Janeiro harbor; CF – Boats home based in Cabo Frio harbor; PB – Boats based in Porto Belo harbor; JPN – Boats leased from Japan; and PRT – Boats leased from Portugal.

Year	*NAH*	*IT*	*RG*	*RJ*	*CF*	*PB*	*Total*
1983	0	24	0	95	0	0	119
1984	0	0	0	135	0	0	135
1985	0	73	0	100	0	0	173
1986	0	33	0	70	0	0	103
1987	0	46	0	32	0	0	78
1988	0	31	0	42	0	0	73
1989	0	30	0	0	0	0	30
1990	0	0	0	49	0	0	49
1991	0	82	0	37	0	0	119
1992	0	0	21	75	0	0	96
1993	0	70	0	128	0	0	198
1994	0	43	90	103	0	0	236
1995	0	35	0	87	0	0	122
1996	0	22	0	76	0	0	98
1997	0	42	71	100	0	0	213
1998	52	0	0	0	0	0	52
1999	50	0	0	0	0	0	50
2001	110	0	0	0	0	0	110
2002	117	0	0	0	0	0	117
2003	0	86	0	0	0	0	86
2004	0	98	0	0	0	0	98
2005	0	136	0	0	0	0	136
2006	0	105	0	0	0	0	105
2007	0	100	0	0	0	0	100
2008	0	103	0	0	0	0	103
2009	0	122	25	3	2	0	152
2010	0	102	20	7	7	8	144
2011	0	375	45	0	0	0	420
Total	**329**	**1758**	**272**	**1139**	**9**	**8**	**3515**

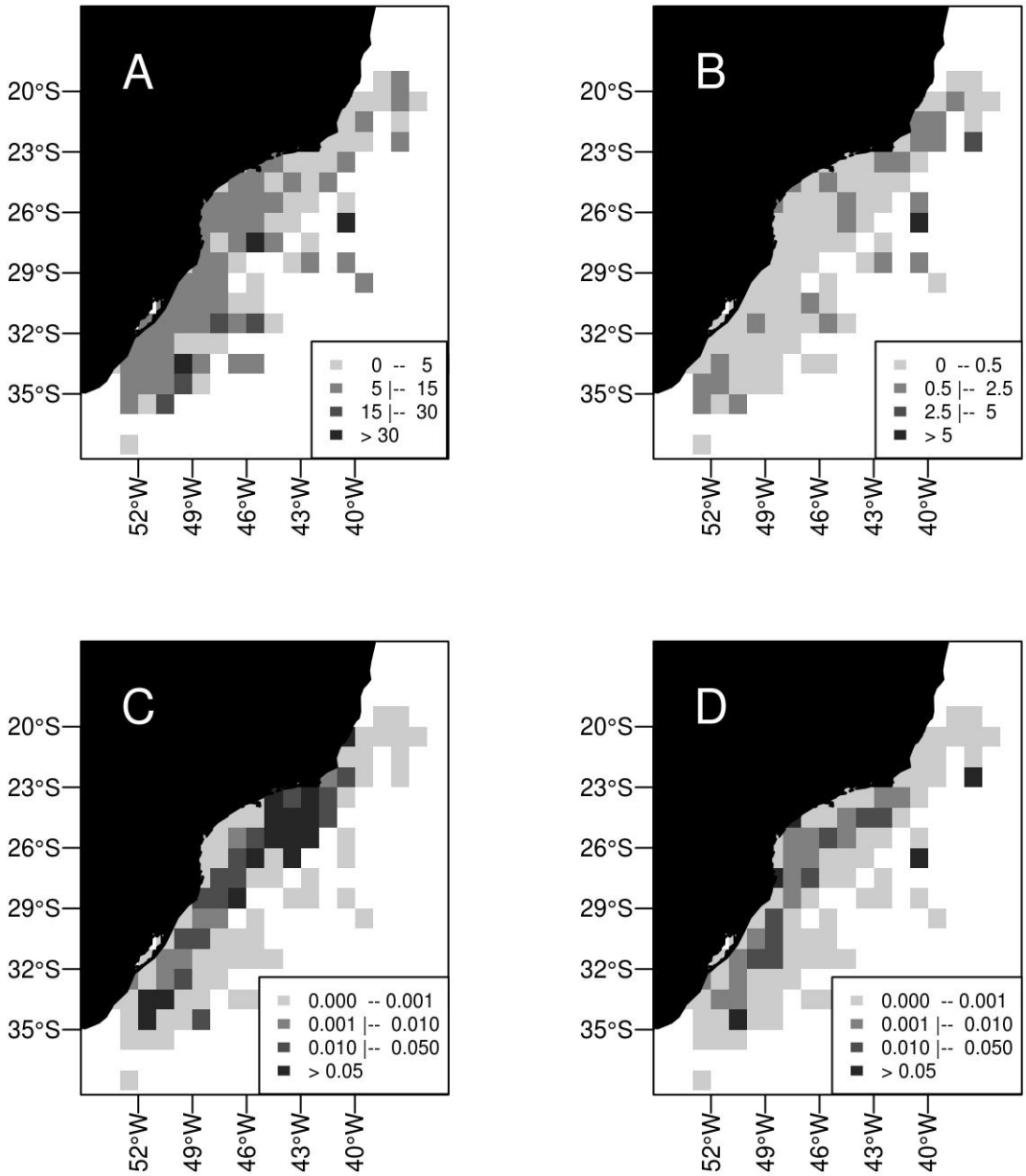

Figure 1. Overall catch per unit effort (t/fishing days) of skipjack (A), yellowfin (B), bigeye (C) and albacore (D) caught by Brazilian baitboat fleet from 1981 to 2011 as reported in Task II – ICCAT database (ICCAT, 2014b).

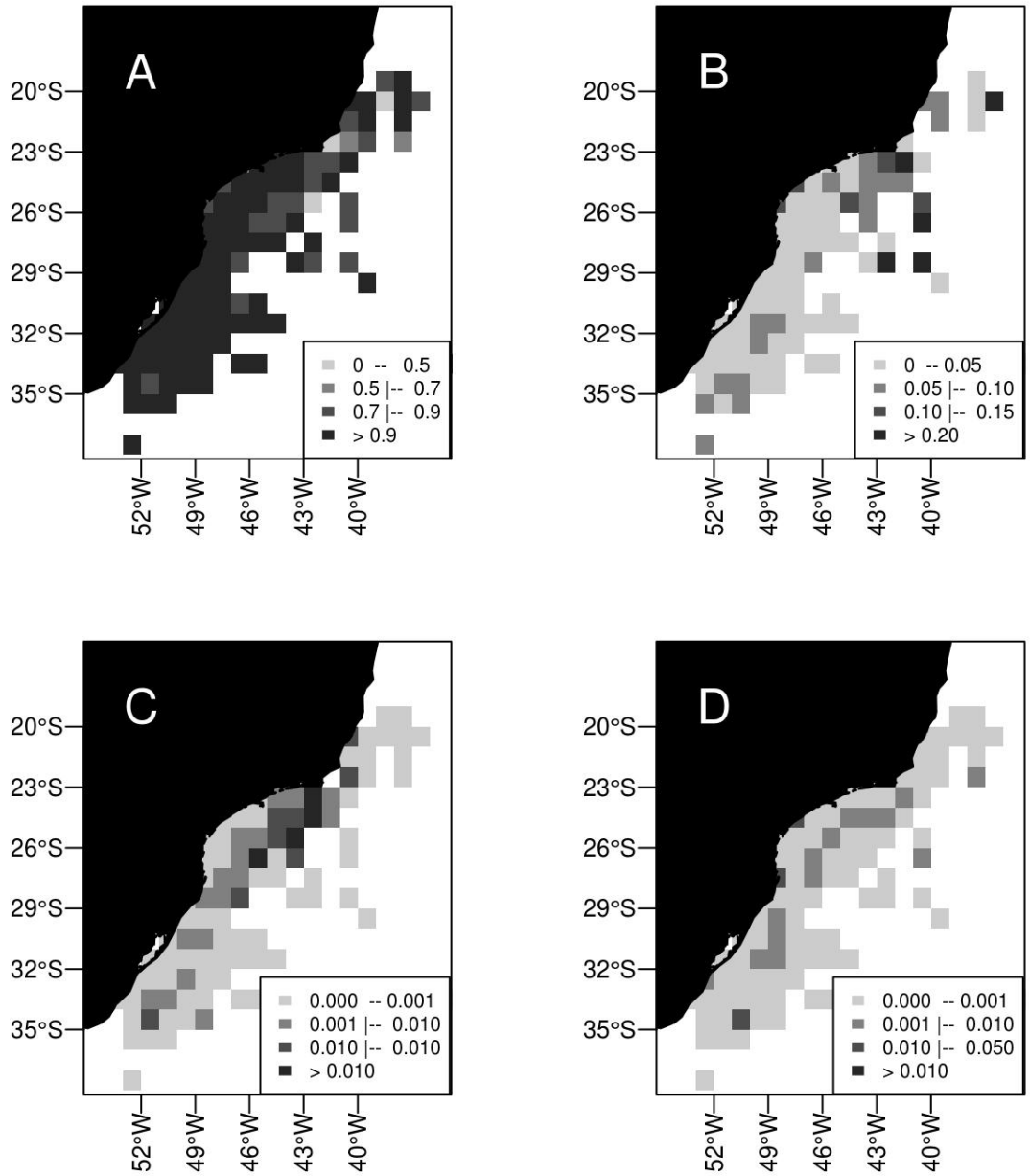

Figure 2. Proportion of skipjack (A), yellowfin (B), bigeye (C) and albacore (D) in the total catch of the Brazilian bait-boat from 1981 to 2011 as reported in Task II – ICCAT database (ICCAT, 2014b).

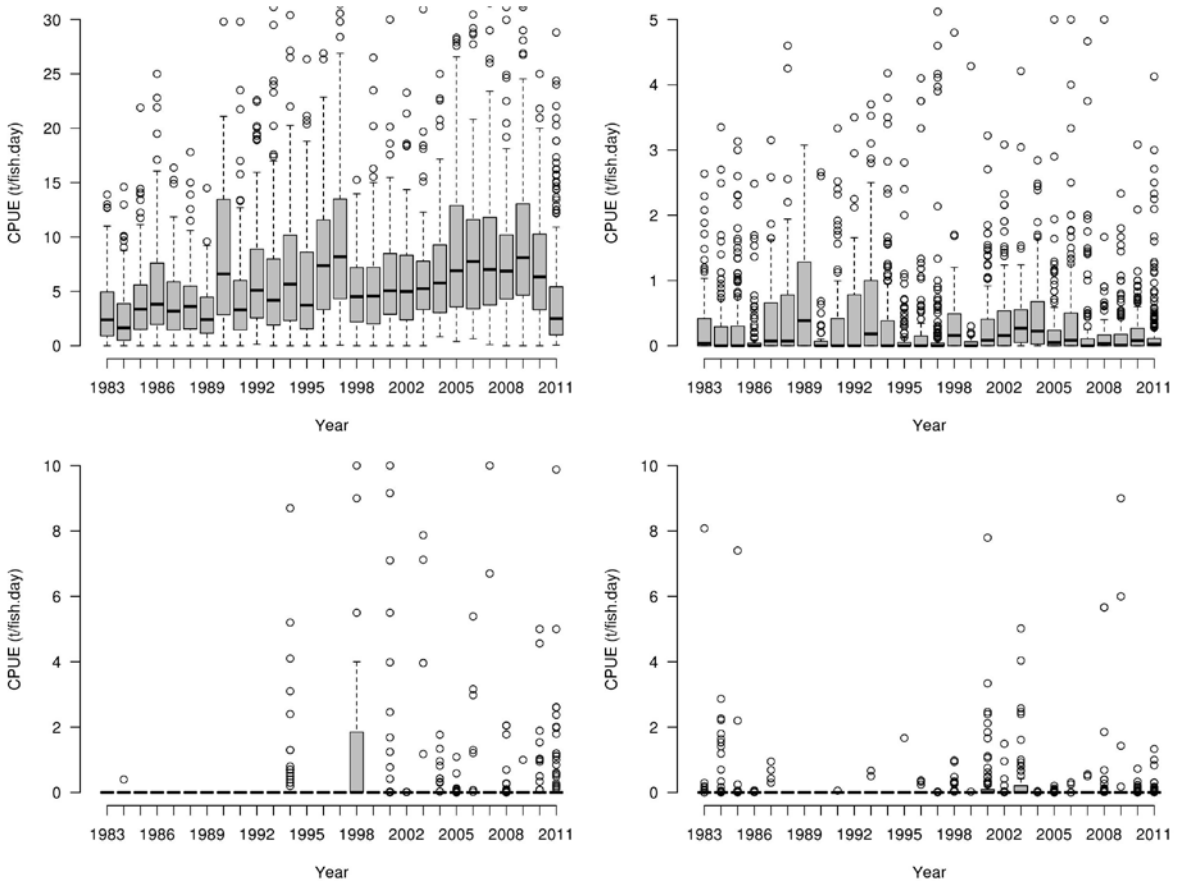

Figure 3. Catch per unit effort of the skipjack (A), yellowfin (B), bigeye (C) and albacore (D) caught by Brazilian bait-boat fishery as reported in Task II – ICCAT database (ICCAT, 2014b).

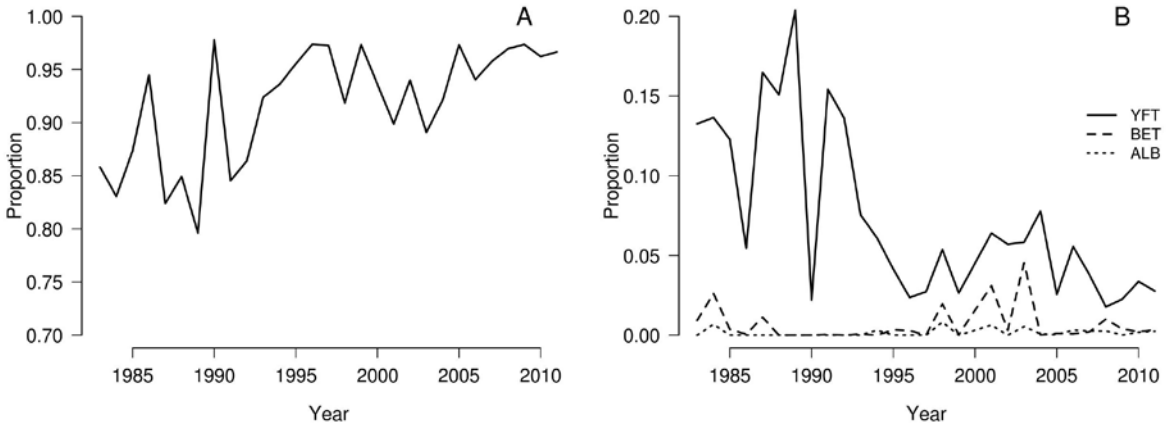

Figure 4. Proportion of skipjack in (A) and of yellowfin (YFT), bigeye (BET) and albacore (ALB) (B) caught by Brazilian baitboat fleet as reported in Task II – ICCAT database (ICCAT, 2014b).