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SHORT NOTE

SIZE OF YELLOWFIN TUNA (*Thunnus albacares*) CAUGHT BY POLE-AND-LINE FLEET IN THE SOUTHWESTERN ATLANTIC OCEAN

MAYER, F.P.[1] & ANDRADE, H.A.[2]

[1] UNIVALI/CTTMar – Grupo de Estudos Pesqueiros (GEP)
C.P. 360 – 88302-202 – Itajaí (SC) – Brasil – fernandomayer@gmail.com
[2] UFSC – INE/CTC
C.P. 476 – 88010-970 – Florianópolis (SC) – Brasil – humber@inf.ufsc.br

Brazilian pole-and-line fleet aims at skipjack tuna (*Katsuwonus pelamis*) in the southwest Atlantic ocean, but yellowfin tuna (*Thunnus albacares*) have been caught as well when boats hit mixed schools. Regarding the fleet based at Itajaí (SC) harbor (south of Brazil), skipjack landings reach up to 90% of the total catch, while yellowfin ranks second (6,5% of the total catch) among tuna species (Santos & Andrade, 2003).

Yellowfin is a migratory and cosmopolitan species, hence a single stock for the whole Atlantic is the most acceptable hypothesis (ICCAT, 2004a). Because the species inhabits the Exclusive Economic Zone (EEZ) of several countries, an international institution deals with the fishery management. Recommendations and fishery guidelines for the Atlantic ocean are discussed and suggested regularly by the International Commission for the Conservation of Atlantic Tunas (ICCAT). The "Recommendation by ICCAT on a Yellowfin Size Limit [ICCAT Rec. 72-01]" of 1972 (hereafter just mentioned as ICCAT Rec. 72-01) states 3,2 kg minimum weight for yellowfin, with 15% tolerance in number of fish landed. Actually yellowfin lighter than 3,2 kg can be considered as juvenile (ICCAT, 2006). However, juveniles of yellowfin and bigeye (*Thunnus obesus*) tunas are very similar. So, ICCAT Rec. 72-01 turned out impractical. Hence, in 1979 the "Recommendation by ICCAT on a Bigeye Tuna Size Limit [ICCAT Rec. 79-01]" (hereafter called ICCAT Rec. 79-01) also stated 3,2 kg minimum weight for bigeye tuna. Those recommendations were the motivations for the Brazilian regulatory actions "Portaria SUDEPE n. 87" (1973) and "Portaria SUDEPE n. 07" (1981), respectively.

In order to investigate size structure of yellowfin caught in the southwest of the Atlantic ocean, we analyzed length frequency of fish landed by pole-and-line fleet based at Itajaí (SC) harbor from 2000 to 2006. To assess the effectiveness of ICCAT Rec. 72-01, we analyzed the proportion of small yellowfin in the total catch. Yellowfin length data were also confronted to those of the skipjack, which is the most abundant species in the landings.

Data presented in this paper were gathered from a sampling program that began in the end of 1990's (see PEREZ *et al.*, 1998). Furcal lengths of skipjack and yellowfin were measured to the nearest centimeter. Sample size per month and year are shown in Table 1.

In order to estimate the amount of ligth yellowfin (< 3,2 kg), lengths (*L*) (cm) of male and female fish

Table 1 - Number of yellowfin tuna (YFT), *Thunnus albacares*, and skipjack tuna (SKJ), *Katsuwonus pelamis*, sampled by year and month in the landings of Itajai (SC) based pole-and-line fleet.

Year	Month	YFT	SKJ
2000	7	370	456
	11	67	130
2001	1	121	250
	2	35	587
	3	84	533
	4	30	277
	5	187	144
	6	350	411
	8	20	298
	12	82	229
2002	1	147	216
	2	119	205
	7	204	211
	8	543	567
	12	209	345
2003	2	284	200
	5	83	280
	10	34	187
	11	264	336
2004	5	24	380
	7	187	328
2005	1	147	278
	2	10	284
2006	3	48	433

were converted to weight (W) (kg) according to the following equation as published by Costa *et al.* (2005):

$$W = 2.10^{-5} \times L^{2,932} \quad (1)$$

We have selected the above solution among others because those authors also analyzed yellowfin caught in the southwestern Atlantic ocean.

We found that size of yellowfin caught from 2000 to 2006 ranged from 41 to 121 cm, while skipjack tuna ranged from 32 to 80 cm (Figure 1). Length frequencies

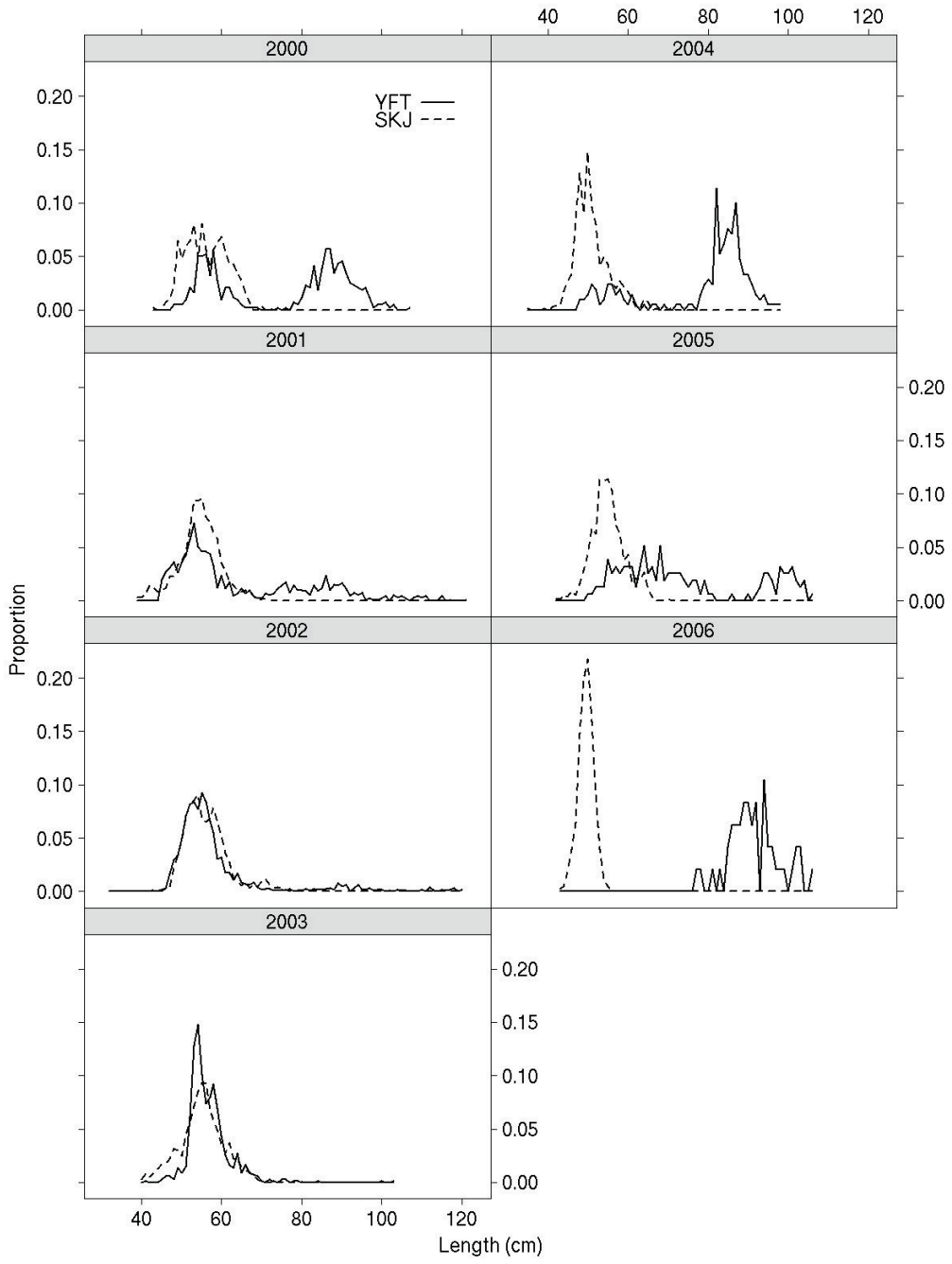

Figure 1 - Length frequency distribution for yellowfin tuna (YFT), *Thunnus albacares,* and skipjack tuna (SKJ), *Katsuwonus pelamis*, caught from 2000 to 2006 by the pole-and-line fleet based at Itajai (SC) harbor.

of yellowfin were usually bi-modal, while skipjack showed one mode. Except for 2003 and 2006, two groups of yellowfin are noticeable, one with mode close to 55 cm, and another with mode close to 85-90 cm (Figure 1). Those modes of yellowfin are probably related to different age groups and stages of life cycle. Perhaps the two groups are mainly caught in different seasons. While data is not ideal (*e. g.* small samples per month or quarter), the above considerations remain speculative.

Costa *et al*. (2005) found that most of yellowfin caught by longline fleet based on Brazilian southeast coast ranged from 80 to 150 cm, but fishes with lengths between 90 and 140 cm were more frequent. Bi-modal distributions were also observed in some years (1971-1995). Comparison between our results and those found by Costa *et al.* (2005) points that the fractions of stock exploited by pole-and-line and longline fishing fleets are different. Yellowfin caught by pole-and-line is usually smaller than that caught by longline fleet. In fact, other authors have already described that surface gears, like pole-and-line, tends to capture small yellowfin, while longliners catches large ones (*e. g.* ICCAT, 2004b).

There are at least three hypotheses about the differences in the size of fish caught by the two fleets: (a) Pole-and-line explores shallower and coastal, while longline explores oceanic, offshore areas; (b) Selectivity of the two gears; and (c) Yellowfin displaces in the water column according to size.

Usually juveniles of yellowfin are in the superior epipelagic zone, but adult fish can be found in deep waters (Zavala-Camin, 1982). Because pole-and-line fishermen operate in superficial waters, they catch mainly young yellowfin that live near the surface in mixed schools with skipjack tuna. Longliners can work at coastal areas, but they operate mainly offshore. Moreover, the longline fleet as analyzed by Costa *et al.* (2005) used the traditional multifilament lines, with hooks setted between 50 and 150 m depth (Arfelli, 1996). Therefore, size of yellowfin caught depend on the depth of the hook.

Size structure of skipjack did not change much across the years (Figure 1), but yellowfin size structure did. In 2003 the mode of large fish (> 80 cm) was absent, while in 2006 only large fish showed up in the samples. Because time series is short, the pattern mentioned above still need to be further studied in the future.

In all years analyzed (2000-2006) proportions of undersized yellowfin tuna in the catches of pole-and-line fleet were always higher than the 15% tolerance of ICCAT Rec. 72-01 (Figure 2). Fish lighter than 3,2 kg summed up to 30% of total catch in 2000, but that proportion increased up to 80% in 2003. In 2004 and 2005, the amounts of light yellowfin were close to 20%. The proportion equal to zero found in 2006 is probably a consequence of the small sample size. Therefore, overall landings of pole-and-line fleet in Brazil were not in accordance with ICCAT Rec. 72-01.

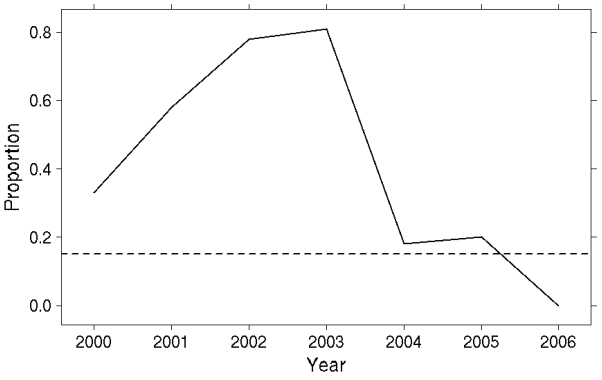

Figure 2 - Proportion of light yellowfin tuna (< 3,2 kg) caught from 2000 to 2006 by the pole-and-line fleet based at Itajai (SC) harbor. Dashed line stands for maximum limit of undersized fish on landings (15%) according to ICCAT Recommendation 72-01.

One point against ICCAT Rec. 72-01 is that it is difficult for fishermen to avoid catching small yellowfin in mixed schools (ICCAT, 2006). Actually Brazilian fishermen do not aim at yellowfin, but they are caught as well together with skipjack. To fish only over uni-specific skipjack tuna schools would be the solution, but that seems not feasible in practice.

Brazilian fleet was not the unique that did not accomplish the regulation. Catch of undersized yellowfin have been reported for other several fisheries all over the Atlantic ocean (*e. g.* Coan & Weber, 1981; ICCAT, 2004a). Actually, ICCAT have reported the overall proportion of undersized fish have been between 40% and 82% since 1997 (ICCAT, 2004a and 2007). Therefore, the commission recognized that minimum size restrictions have not been practical for reducing mortality of juvenile yellowfin, thus the recommendation 72-01 was withdraw in 2006 (ICCAT, 2006).

No alternative was provided to replace ICCAT Rec. 72-01 in order to reduce catches of juvenile yellowfin. In contrast, ICCAT Rec. 79-01 was replaced by "Recommendation by ICCAT on a Multi-year Conservation and Management Program for Bigeye tuna [ICCAT Rec. 04-01]" to provide time/area closures for bigeye fishery. That recommendation shall provide the reduction of juveniles of bigeye, but probably not of yellowfin.

Alternative management measures should be evaluated in the future in order to prevent catches of small yellowfin in the pole-and-line fishery. Therefore studies about reducing juvenile catches have been encouraged by ICCAT. To find out an alternative is a big challenge because regulation concerning yellowfin will affect catches of skipjack, which is among the top five fish landings worldwide.

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