SCRS/2010/161 Collect. Vol. Sci. Pap. ICCAT, 66(5): 2140-2152 (2011)

CORYPHAENA HIPPURUS AND *ACANTHOCYBIUM SOLANDRI* INCIDENTAL CATCH OFF SOUTH AND SOUTHEAST BRAZIL (1971-2009) BY SAO PAULO TUNA LONGLINERS

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SUMMARY

Incidental catches of dolphinfish, Coryphaena hippurus*, and wahoo,* Acanthocybium solandri*, by Sao Paulo tuna longline fleet off south and southeast Brazil from 1971 to 2009 were analyzed. The main change in this fleet was the substitution of traditional Japanese longline to surface longline (monofilament). Thus, it was used in the 1971-1995 and 1996-2009 data periods. The nominal annual CPUE showed a decreasing trend for both species in the entire period suggesting conservation actions.*

RÉSUMÉ

*Les prises accessoires de coryphène (*Coryphaena hippurus*) et de thazard-bâtard (*Acanthocybium solandri*) réalisées par la flottille palangrière thonière de Sao Paulo au large du Sud et du Sud-Est du Brésil entre 1971 et 2009 ont été analysées. Le principal changement qu'a connu cette flottille a été le passage de la palangre japonaise traditionnelle à la palangre de surface (monofilament). Les périodes de données de 1971-1995 et de 1996-2009 ont donc été utilisées. La CPUE nominale annuelle a présenté une tendance à la baisse pour les deux espèces pendant toute la période ce qui donne à penser que des actions de conservation ont été appliquées.*

RESUMEN

Se analizaron las capturas incidentales de lampuga, Coryphaena hippurus*, y peto,* Acanthocybium solandri*, realizadas por la flota palangrera de Sao Paulo en las aguas situadas al Sur y Sureste de Brasil desde 1971 hasta 2009. El principal cambio en esta flota fue la sustitución del palangre tradicional japonés por el palangre de superficie (monofilamento). Por tanto, se utilizaron los periodos de datos 1971-1995 y 1996-2009. La CPUE nominal anual mostraba una tendencia decreciente para las dos especies en todo el periodo, lo que sugiere que se han emprendido acciones de conservación.*

KEYWORDS

Longline fisheries, catch, dolphinfish, wahoo

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1. Introduction

The dolphinfish or mahi mahi, *Coryphaena hippurus* Linnaeus, 1758, and wahoo, *Acanthocybium solandri* (Cuvier, 1832), are pelagic species, that occurrence practically in all tropical and subtropical seas of the world (Menezes and Figueiredo, 1980; Collette and Nauen, 1983).

Off south and southeast of Brazil dolphin fish and wahoo are caught mainly by Itaipava fleet (being dolphin fish one of their major target), tuna longliners and sport fishing.

Sport fishing using rod and reel catch these species off Rio de Janeiro, Sao Paulo and Espirito Santo States during recreational tournaments (Paiva and Pires-Junior, 1983; Arfelli *et al*., 1994). A total of 139.7 t (17,401 fish) of dolphin fish and 2.6 t (155 fish) of wahoo were caught during tournaments of Yacht Club of Rio de Janeiro from 1969/70 to 1980/81 seasons (Arfelli *et al*., 1994).

Sao Paulo tuna longliners also catch dolphin fish and wahoo incidentally mainly from September to February (Amorim, 1992, Amorim and Arfelli, 1994). This fleet started operating with two boats in mid 60's, increasing gradually until a maximum of 20 boats in 1998 and 19 in 1999 and presenting a decreasing trend to14, in 2000 (Amorim and Arfelli, 1994, 2000; Amorim *et al*., 2002).

In the 1971-1999 period, the Sao Paulo fleet presented great fishing goals variation. From 1971 to 1994 all boats used to operate with the traditional Japanese longline, nevertheless from May 1994, this fleet started to change this equipment to the surface longline (monofilament with light stick attraction), directed towards swordfish (Arfelli, 1996). From 1997 on all boats were using the new equipment (Arfelli and Amorim, 2000). In the 70 decade the main target of the Sao Paulo longliners was the three species of tunas that represented about 55% of total catch and sharks less than 9% in 1973. After 1974 sharks catch gradually increased, reaching 59% in 1993. These longliners also used to catch large amounts of billfish, dolphinfish and other bony fish, as well as small quantity of wahoo, blackfin tuna and other fish (Arfelli and Amorim, 2000).

From the 70's, the tuna fleet from Sao Paulo operated in the area 20°-33°S and 39°-50°W. This area is related to the presence of school of fishes with commercial value and autonomy of the boats. In the 70's they used to fish from the beginning of May to middle of October, to the south of latitude 25°S, and to the north of latitude 27°S in the other months (Arfelli and Amorim, 1981). From 1979 on the tuna boats kept following the mentioned schedule, but also operated in non traditional areas for the season (Amorim and Arfelli, 1984). After this period the fleet expanded the fishing area to 17-35°S, 27-52°W (Arfelli, 1996).

The present report contains analyses of yield, CPUE, percentage of total catch and biological information of dolphinfish and wahoo caught by the Sao Paulo tuna fleet from 1971 to 2009, as well as data of these boats.

2. Material and methods

Data from tuna longliners settled in Santos and Guaruja Cities, Sao Paulo State, and operating at south and southeast of Brazil (17°-35°S to 27°-52°W, **Figure 1**) were obtained for the period 1971 to 2009.

Fishing effort as measured in number of hooks was obtained from logbooks collected by "Instituto de Pesca" (IP-Santos).

The yield of dolphinfish, wahoo and of total catch was obtained from log commercial sheet of tuna longliner fleet and is presented in live weight.

The nominal catch per unit of effort (CPUE, in kilograms per thousand hooks), is presented by month and year, from 1971 to 2009.

Due to the changes in the fishery it was considered two periods. The first period, 1971-95, was based on the traditional Japanese longline and the second, 1996-2009, was based on the surface longline (monofilament).

It was analyzed the monthly and annual fishing effort, yield, percentage of the total catch and nominal CPUE and also the monthly average yield and CPUE, for the two mentioned periods.

3. Results and discussion

The monthly fishing effort of traditional Japanese longline (first period: 1971-1995) ranged from 15,600 to 479,246 and of surface longline (second period: 1996-2009) ranged from 13,200 to 210,270 hooks. During the first period the effort showed an increasing trend until May 1994 followed by a decreasing trend. During the second period it showed an increasing trend until September 1997 followed by a decreasing trend from September 1998 on (**Figure 2**).

Figure 3 shows monthly total yield including tunas and alike of traditional Japanese longline ranged from 9.3 (March/72) to 492.8 t (September 1990) and of surface longline from 5.8 (December 2009) to 375.9 t (September 1997). They followed almost the same effort trend.

In general, effort and yield presented an increasing trend in the first period and a decreasing trend in the second period, being the values of the end of whole period (1971-2009) lower than the ones of the beginning.

3.1 Coryphaena hippurus

Besides the presence of circuntropical *Coryphaena equiselis* in Brazil based five exemplars by Zavala-Camin (1986) it was very seldom. According to Lasso and Zapata (1999) studying the *Coryphaena* in Pacific Ocean the *C. equiselis* represented less than 1% of total catch (3,505 fish) however 99% was *C. hippurus*. Probably it also happens in the studied area. The authors have not seen any *C. equiselis*.

The annual yield showed an increasing trend in the first period with peak in 1992 (141.1 t) and a decreasing in the second period, ranging from 1998 (70.3 t) to 2009 (2.7 t) observed in the **Figure 4** and follow the total yield (tuna and alike) trend (**Figure 3**). The best observed yield (141.1 t in 1992) was about five times lower than the peak of small boats, kwon as “Itaipava fleet” 711 t in 2003 showed by Dallagnolo and Andrade (2008).

The *Coryphaena hippurus* monthly yield in the second period was lower than first, with the first period showing two peaks in December 1992 (76.3 t) and December 1993 (53.6 t) as observed in **Figure 5**.

The specie was most abundant in the warm months, with an increase of the yield in September to February (**Figure 6**). The seasonal occurrence was related to the higher superficial temperature (Palko, *et al*. 1982). Nevertheless, according to Olavo *et al.* (2005) the species was most abundant during the winter time off Bahia and Rio de Janeiro State (11^{o}-23^{o}S to 35^{o}-41^{o}W).

The annual CPUE (kg per thousand hooks) (**Figure 7**) showed a light decreasing trend in the first period, ranging from 45.3 (1974) to 8.7 (1976), and a decreasing trend in the second, ranging from 34.3 (1998) to 6.5 (2009).

According to Dallagnolo and Andrade (2008) the CPUE (kg per thousand hooks) of dolphinfish caught by “Itaipava fleet” operating off southern Brazil was 585 (2001) declining to 184 (2005). It is more than 15 times the Sao Paulo longliner fleet CPUE during that period. Fishing strategy adopted by fishermen of these small longliners suggests a high degree of specialization (Dallagnolo and Andrade, 2008).

From 2001 there was an increase in exportation of dolphinfish by the fishery industry settled in Itajai City, Santa Catarina State. Most of fish come from the “Itaipava fleet” (Pimenta *et al.*, 2005; 2009).

The monthly CPUE (**Figure 8**) shows values a little higher in the first period, despite the highest value occurred in the second. Nevertheless the average monthly CPUE (**Figure 9**) of second period was higher from April to October, when the catches are low (**Figure 6**).

3.2 Acanthocybium solandri

The annual yield presented a global decreasing trend (**Figure 10**).

Viana *et al.* (2008) analyzing wahoo fishery on the island of São Pedro and São Paulo observed a stable catch from 1998 to 2006 (30 t) with a pick 48 t (2002). In this region wahoo was more abundant or with much less fishery than the studied area.

The monthly yield (**Figure 11**) presents cyclical fluctuations with peaks in November 1978 (1.8 t), December 1991 (0.8 t), April 1999 (1.5 t) and December 2004 (0.5 t). After February 2009 the species were seldom caught.

The average monthly yield in first period increased from August to November with a peak in November (0.4 t) and from December to July decreased with an average of 0.1 t. In second period the yield presented fluctuations with peaks in April (0.2 t) and December (0.1 t), showed in **Figure 12**.

The annual CPUE (kg per thousand hooks) presented a decreasing trend from 1971 (4.2) to 1981 (0.5) with peak in 1972 (6.6), followed by an average of 0.4 until 1995. The second period, showed an average of 0.6 with a peak of 1.6 in 1999 (**Figure 13**).

The monthly CPUE (kg per thousand hooks) in the first period showed an increasing trend from November 1971 (13.9) to November 1977 (13.4), with an average of 4.2. From June 1980 to December 1995 the average was 0.4. In the second period the CPUE presented three peaks, April 1999 (11.1), December 2004 (9.4) and March 2007 (10.5) showed in the **Figure 14**.

Viana *et al.* (2008) registered the stable annual CPUE anual from1998 to 2006 about 70 kg per boat per day with a minimum of 40 kg per boat per day and a maximum of 100 kg per boat per day (2002). The value was much higher than the studied area and probably different fish equipment.

The average monthly CPUE (**Figure 15**) showed higher values in the first period. The increasing in the CPUE during warm months could be due to the species habitat preference. According to Olavo *et al.* (2005), from Bahia to Rio de Janeiro, wahoo were very abundant in longliners catch of first and fourth quarters.

4. Conclusion

The nominal annual CPUE showed a decreasing trend for dolphinfish and wahoo in the whole period (1971-2009) suggesting conservation actions.

Acknowledgements

The authors wish especially to thank the tuna fisheries companies and CAPES and FAPESP scholarships agencies.

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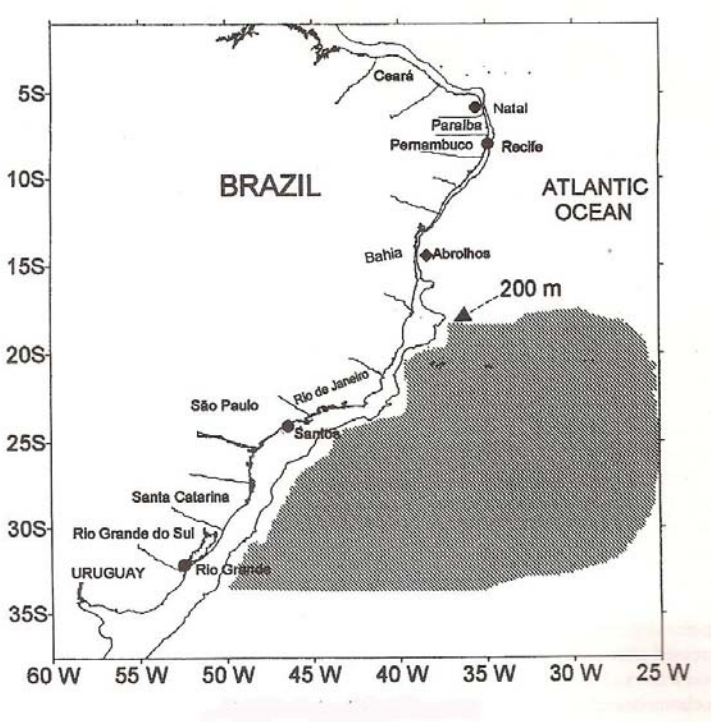

Figure 1. Sao Paulo longline fishing area, from Amorim *et al.*, 1998.

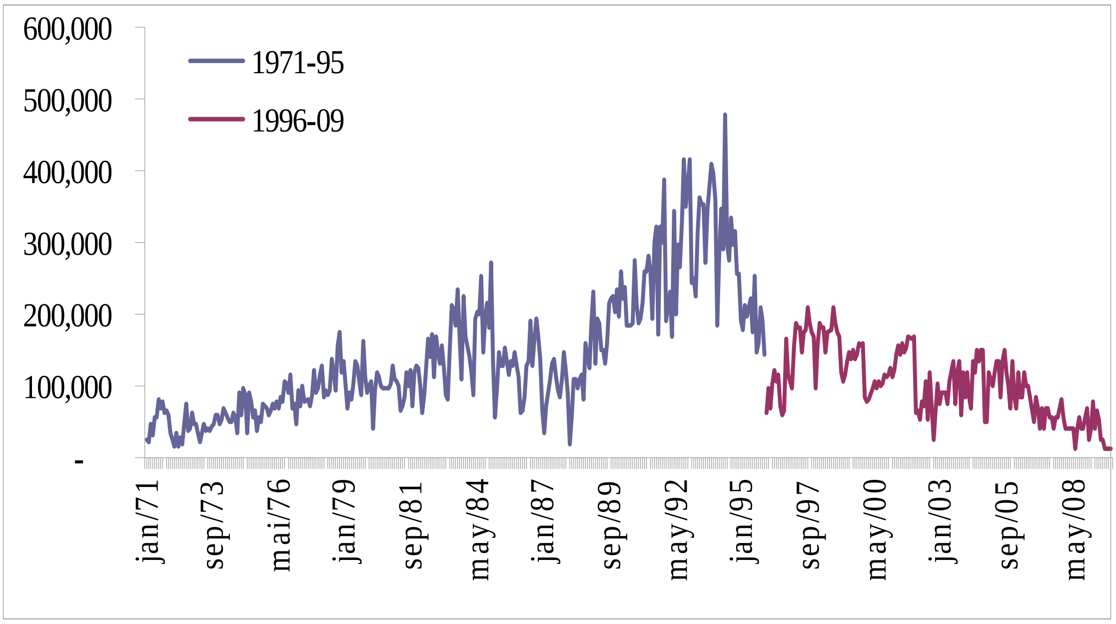

Figure 2. Monthly fishing effort of the Sao Paulo tuna longline fleet.

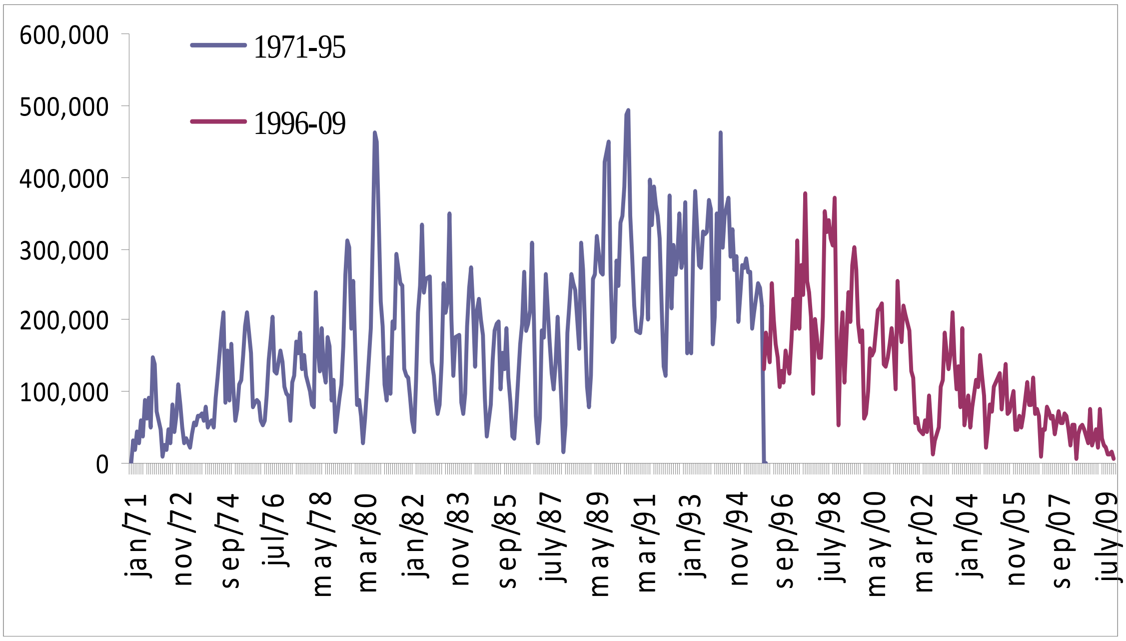

Figure 3. Monthly total yield (kg) catch of the Sao Paulo tuna longline fleet.

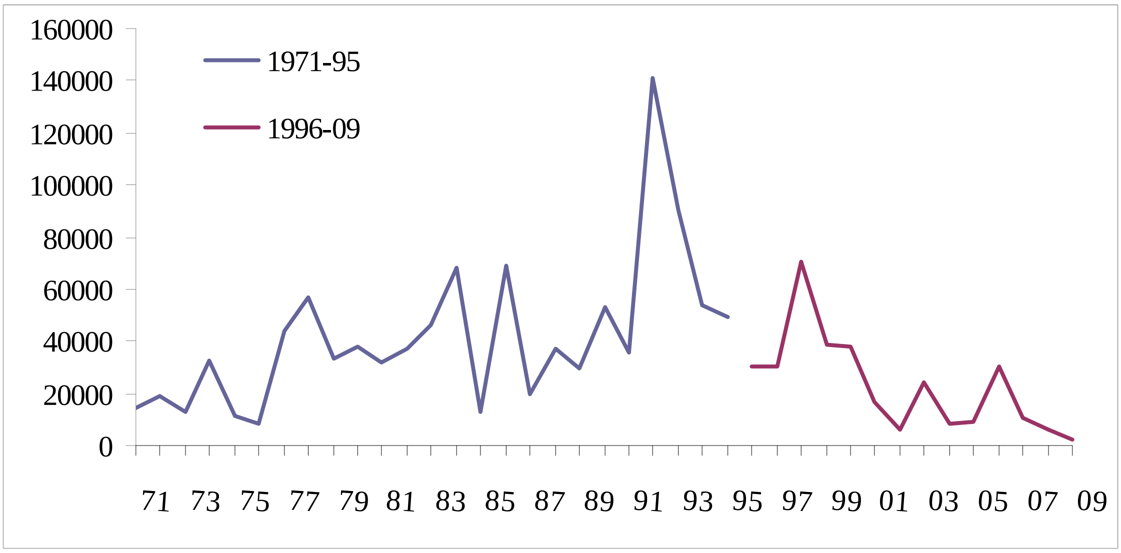

Figure 4. Annual dolphinfish catch (kg) of the Sao Paulo tuna longline fleet.

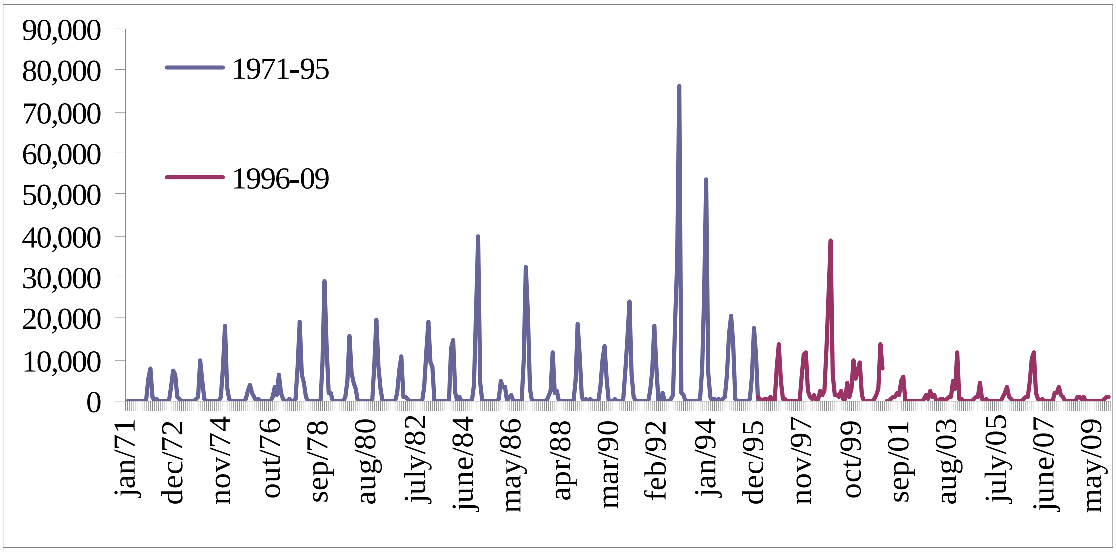

Figure 5. Monthly dolphinfish catch (kg) of the Sao Paulo tuna longline fleet.

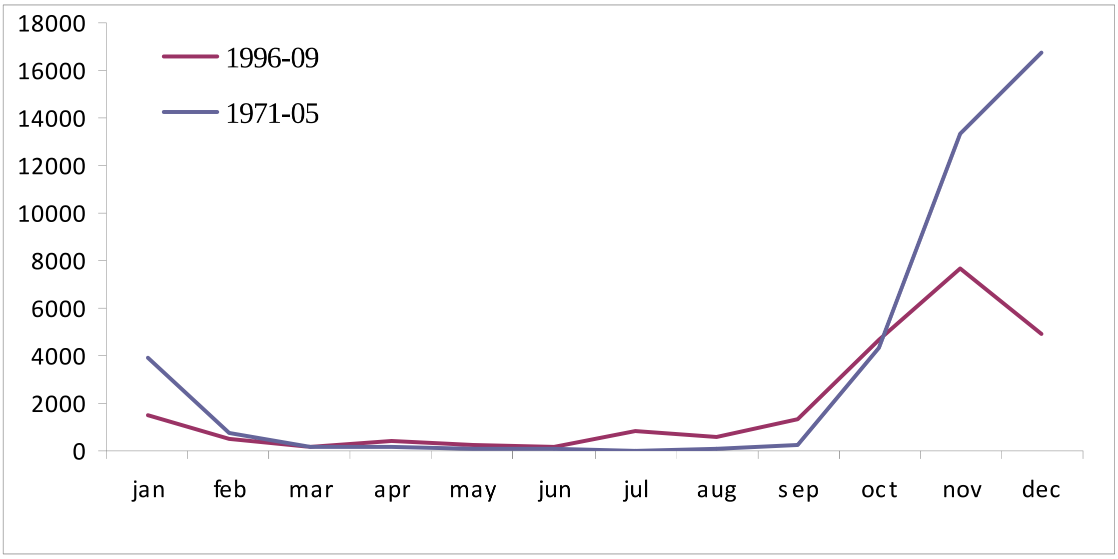

Figure 6. Average monthly dolphinfish catch (kg) of the Sao Paulo tuna longline fleet.

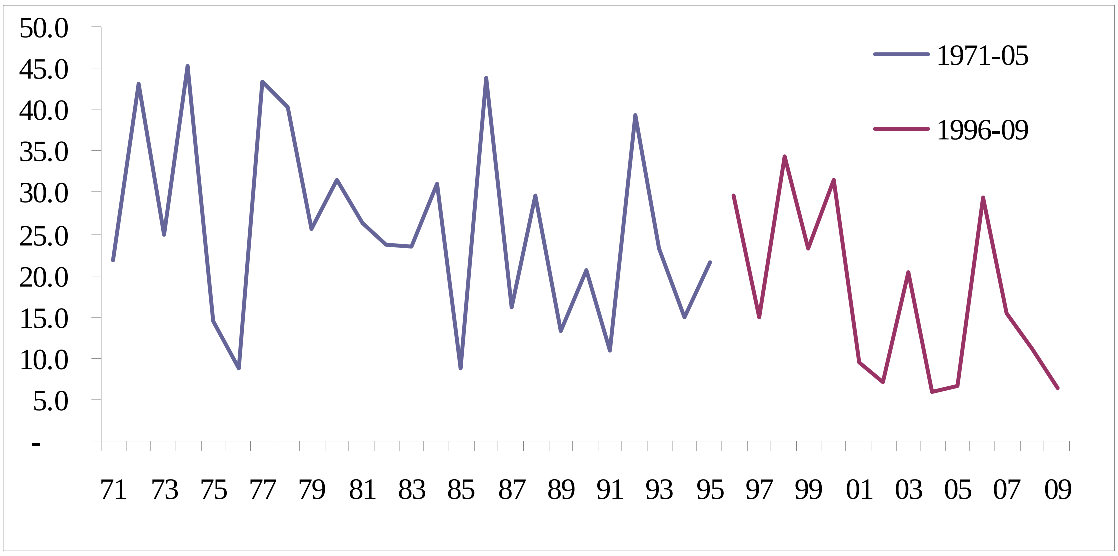

Figure 7. Annual dolphinfish CPUE (kg per thousand hooks) of the Sao Paulo tuna longline fleet.

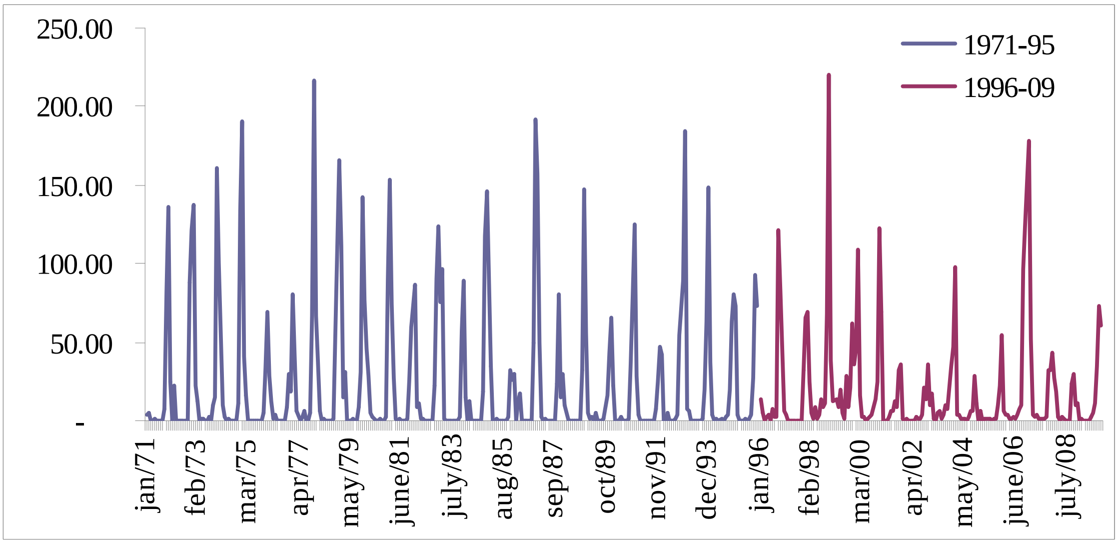

Figure 8. Monthly dolphinfish CPUE (kg per thousand hooks) of the Sao Paulo tuna longline fleet.

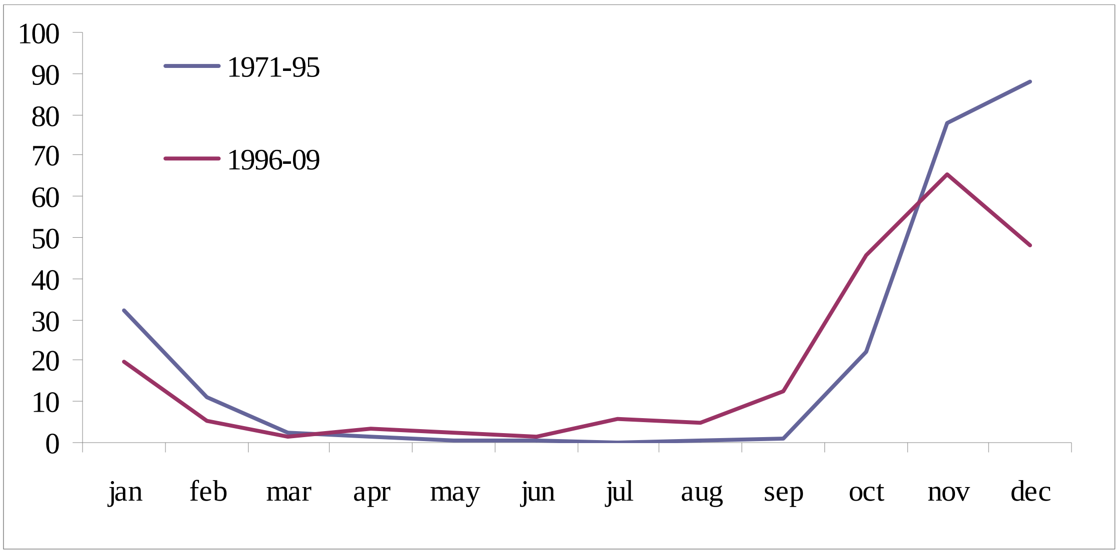

Figure 9. Average monthly dolphinfish CPUE (kg per thousand hooks) of the Sao Paulo tuna longline fleet.

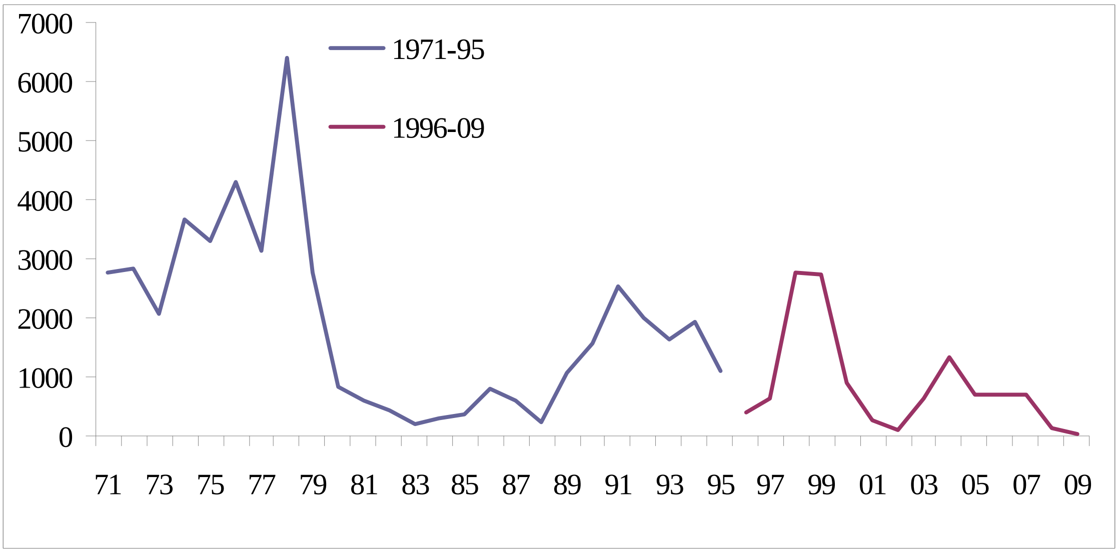

Figure 10. Annual wahoo catch (kg) of the Sao Paulo tuna longline fleet.

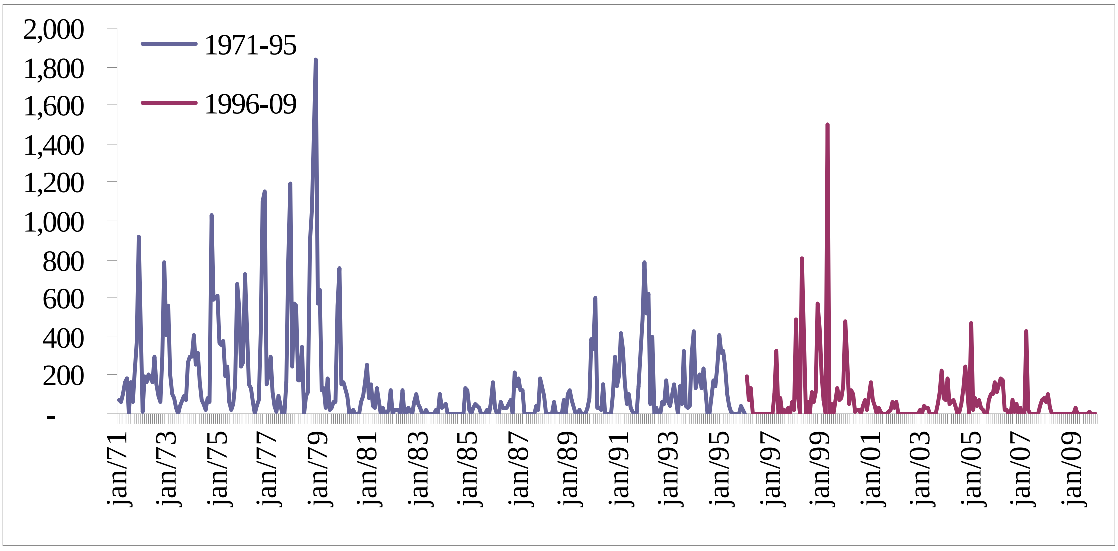

Figure 11. Monthly wahoo catch (kg) of the Sao Paulo tuna longline fleet.

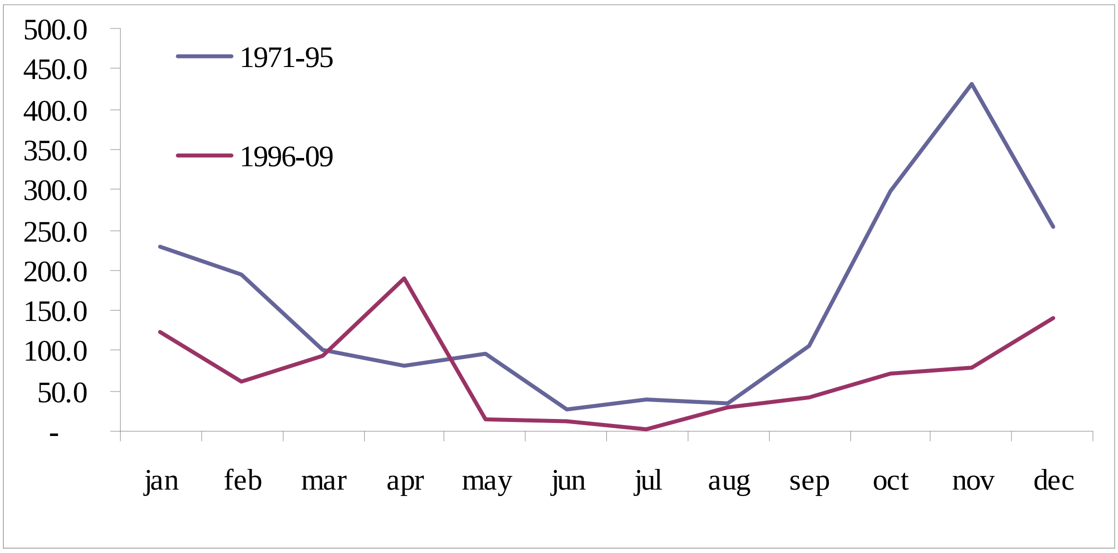

Figure 12. Average monthly yield (kg) wahoo of the Sao Paulo tuna longline fleet.

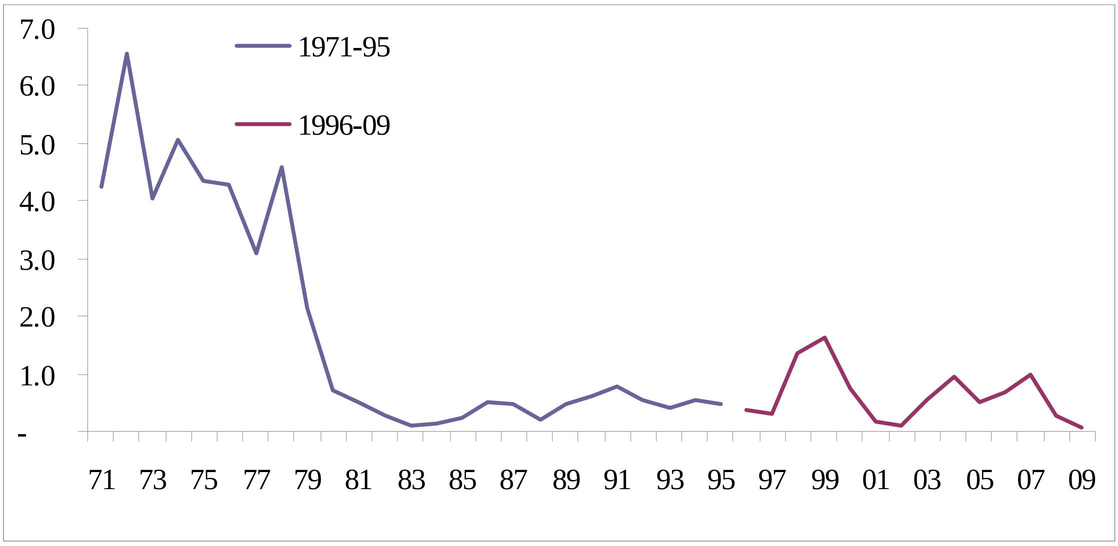

Figure 13. Annual wahoo CPUE (kg per thousand hooks) of the Sao Paulo tuna longline fleet.

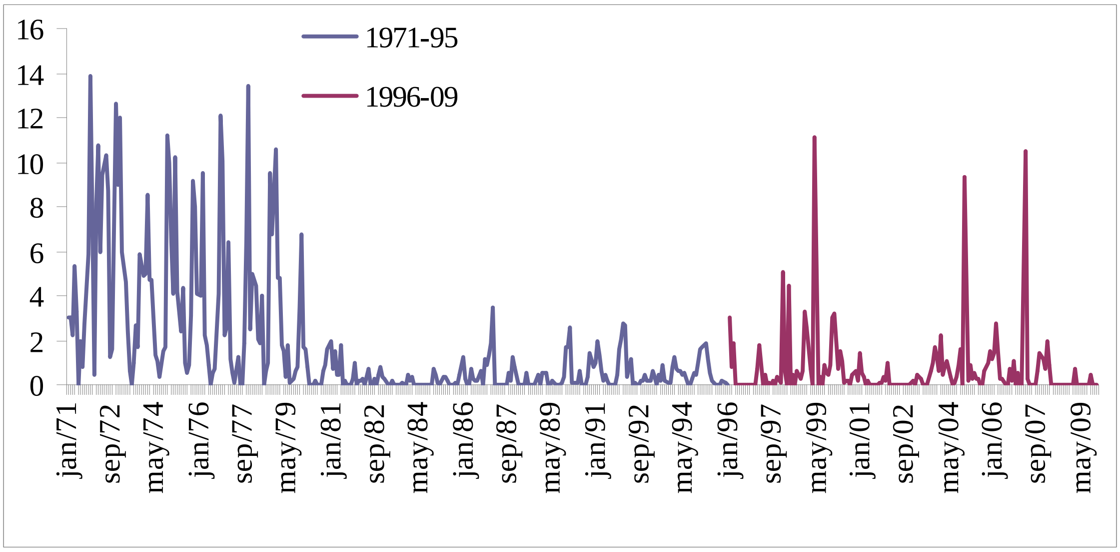

Figure 14. Monthly wahoo CPUE (kg per thousand hooks) of the Sao Paulo tuna longline fleet.

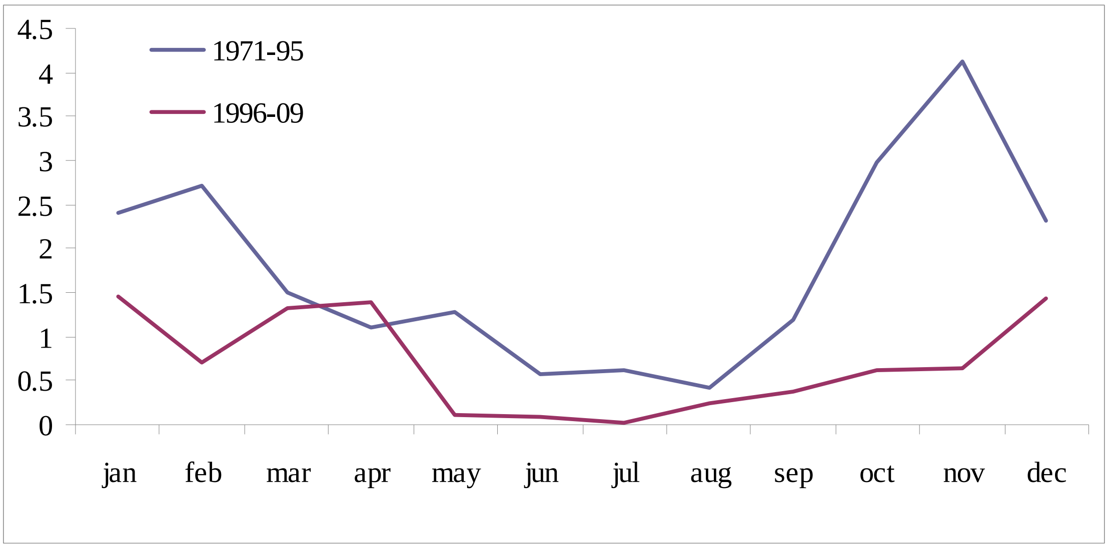

Figure 15. Average monthly wahoo CPUE (kg per thousand hooks) of the Sao Paulo tuna longline fleet.