

**THE WAHOO *ACANTHOCYBIUM SOLANDRI* FISHERY
IN THE VICINITY OF THE SAINT PETER AND SAINT PAUL
ARCHIPELAGO, BRAZIL, FROM 1998 TO 2006**

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SUMMARY

The Saint Peter and Saint Paul Archipelago (SPSPA), located in the mid-equatorial Atlantic Ocean (00°55'10"N and 029°20'35"W), at 510 nautical miles from the Brazilian coast (Rio Grande do Norte State), is an important fishing ground inside the Economic Exclusive Zone (EEZ) of northeast Brazil, with important catches of yellowfin tuna, flying-fish and wahoo. The objective of the present paper was to describe the wahoo fishery developed in the vicinity of the SPSPA. To that aim, data from 213 landings of commercial tuna fishing vessels operating around SPSPA between July 1998 and December 2006 were examined. The total catch increased from 1998 on, reaching a peak of 262 t, in 2004, and decreased after that to 192 t and 181 t, in 2005 and 2006, respectively. The main species caught were tunas (905 t; 55.7%), wahoo (333 t; 20.6%), flying-fish (208 t; 12.8%), sharks (78 t; 4.8%), and others (100 t; 6.1%). Higher catches of wahoo were observed mainly during the first and third quarter of the year.

RÉSUMÉ

L'archipel de Saint Pierre et de Saint Paul (SPSPA), situé dans l'Océan Atlantique mi-équatorial (00°55'10"N et 029°20'35"W), à 510 milles nautiques de la côte brésilienne (état de Rio Grande do Norte), est une importante zone de pêche de la Zone Economique Exclusive (ZEE) du Nord-Est brésilien, comptant de fortes prises d'albacore, d'exocets et de thazard bâtard. Le présent document visait à décrire la pêcherie de thazard bâtard développée aux alentours de SPSPA. A cet effet, on a examiné les données issues de 213 débarquements de thoniers commerciaux opérant à proximité de SPSPA, entre juillet 1998 et décembre 2006. La prise totale a augmenté à partir de 1998, avec un maximum de 262 t en 2004, diminuant par la suite pour atteindre 192 t et 181 t, en 2005 et 2006, respectivement. Les principales espèces capturées étaient des thonidés (905 t; 55,7%), des thazards bâtards (333 t; 20,6%), des exocets (208 t; 12,8%), des requins (78 t; 4,8%) et d'autres espèces (100 t; 6,1%). Les plus fortes prises de thazard bâtard ont surtout été observées au cours du premier et du troisième trimestre.

RESUMEN

El archipiélago de San Pedro y San Pablo, situado en el océano Atlántico medio-ecuatorial (00°55'10"N y 029°20'35"W), a 510 millas náuticas de la costa de Brasil (Estado de Rio Grande do Norte), es un importante caladero dentro de la Zona Económica Exclusiva (ZEE) del noreste de Brasil, con capturas importantes de rabil, peces voladores y peto. El objetivo del presente documento es describir la pesquería de peto desarrollada en las proximidades del archipiélago. Con este fin, se examinaron datos procedentes de 213 desembarques de buques pesqueros atuneros comerciales que operan alrededor del archipiélago, entre julio de 1998 y diciembre de 2006. La captura total aumentó desde 1998 en adelante, alcanzando un pico de 262 t en 2004, y descendió después hasta 192 t y 181 t en 2005 y 2006 respectivamente. Las principales especies capturadas era túnidos (905 t; 55,7%), peto (333 t; 20,6%), peces voladores (208 t; 12,8%), tiburones (78 t; 4,8%) y otros (100 t; 6,1%). Se observaron mayores capturas de peto fundamentalmente durante el primer y tercer trimestre del año.

KEYWORDS

Fishing activity, fishing grounds, catch composition, catch statistics

1. Introduction

Wahoo (*Acanthocybium solandri*) is an oceanic pelagic species found in the Pacific, Indian and Atlantic oceans, including the Caribbean and Mediterranean seas (Collette and Nauem, 1983; Hogarth, 1976; Oxenford *et al.*, 2003). It inhabits tropical and subtropical waters, where it is normally found near the surface, harvesting flying-fish, squids and others preys (Collette e Nauen, 1983). A member of the Scombridae family and reaching up to 210cm and 80kg, wahoo is one of the most important species caught in tropical oceans, holding a high commercial value.

The species, found along the entire Brazilian coast, is important to both artisanal and large scale oceanic fisheries, being regularly caught off the continental shelf and around seamounts and islands (Vaske *et al.*, 2006), which are a common feature in the sea bottom relief off northeast Brazil (e.g. Fernando de Noronha Chain, the North Brazil Chain, and Saint Peter and Saint Paul Archipelago).

The Saint Peter and Saint Paul Archipelago (SPSPA) is a group of rocky islands located near the equator (00°55'10"N, 029°20'35"W), 510 nm from the Brazilian coast (Rio Grande do Norte State) and 282 nm from Fernando de Noronha archipelago. Resulting from a transversal fracture of the Mid-Atlantic Ridge, it has an emerged area of about 7,500m², distributed among 15 little islands located inside a circle of 420m of diameter. Belmonte is the large one, where the highest point of the archipelago is located, with about 18m above sea level (Campos *et al.*, 2005).

In consequence of its high biological productivity, the vicinity of SPSPA is an important fishing ground for Brazilian vessels based in the northeast Brazilian coast, (Hazin, 1993; Travassos, *et al.* 1998), having important catches of yellowfin tuna, flying-fish and wahoo. The main aim of the present paper, therefore, was to describe the wahoo fishery developed in the vicinity of SPSPA, with the hope that the information provided may contribute to the management and the conservation of this important fish resource.

2. Material and methods

The present study was based on landing data from 6 tuna fishing boats, which operated around SPSPA and unloaded their catch in Natal port, between July 1998 and December 2006 (**Table 1**). This fleet employs various fishing gears, including pelagic longline, hand-line, and trolling, the last being the one most used to catch wahoo.

Catch per Unit of Effort (CPUE) was used as an abundance index. Yearly and monthly mean CPUE were estimated in weight of fish caught by days of fishing by boat. Size data (fork length) of wahoo caught in SPSPA were obtained immediately after the fish were boarded by the commercial vessels, during scientific expeditions done to the SPSPA, to allow an *in loco* observation of the commercial fishing operations. Statistical analyses (non-parametric Kruskal-Wallis test) were made to evaluate the differences between CPUE means.

3. Results

The fishing activity in the vicinity of SPSPA is carried out within a radius of about 10 nm from the archipelago, by vessels of about 20 m in length overall, operating with longline, hand-line and trolling, depending on the target species (Vaske *et al.*, 2006). Trolling is the main gear used to fish for wahoo around SPSPA. This fishing method is used during day-time, mainly at sun rising and sunset, with each fishing boat employing commonly 5 trolled lines, about 30m long each, and cruising at low speed. The gear is composed by two segments: the first one, about 10m long, is made of a 3-mm multifilament line, whilst the second, composed of nylon monofilament, varying from 1.4 to 2.0mm in diameter, is about 20 m long. Mustad Hooks, N° 611, 612 or 616, are normally used.

The pooled yearly landings for all species caught in SPSPA increased from 1998 on, reaching a peak of 179 t in 2000, decreasing then to 139 t in 2001. A new rise was observed up to 2004, when a maximum value of 262t was recorded. In the two most recent years, 2005 and 2006, the catches decreased again, reaching 192t and 181 t, respectively (**Figure 2**). In relation to wahoo, catches remained relatively steady between 1998 and 2002, at around 30 t (except for the year of 2002, when 48t were landed). After that year on, an increasing trend was observed, reaching the maximum value of 50 t in 2006 (**Figure 2**).

The catches included 20 species belonging to 8 families of fish, among which the Scombridae family (77.0%) was the most frequent one. The most important fish caught (in weight) were tunas (55.7%), mainly yellowfin tuna, and wahoo (20.6%). Flying-fish and sharks contributed to 12.8% and 4.8% of the total catch, respectively. Other species, including rainbow runner (*Elagatis bipinnulata*), black jack (*Caranx lugubris*), dolphin fish (*Coryphaena hippurus*), billfishes (*Istiophorus albicans*, *Makaira nigricans*, *Tetrapturus albidus*), swordfish (*Xiphias gladius*), contributed with 6.1% of the total catch. The monthly distribution of wahoo landings showed highest values between July and September, corresponding to austral winter, and in January-February, during southern summer (**Figure 6**).

The yearly mean CPUE of wahoo remained relatively stable throughout the studied period, oscillating around 70 kg/ boat/ day, with a minimum of 40 kg/ boat/ day, in 1999, and a maximum of 100 kg/ boat/ day, in 2002 (Fig. 3). The yearly mean CPUE values along the period were, nevertheless, found to be significantly different (Kruskal-Wallis, $F = 3.11$; $p = 0.022$). The quarterly mean CPUE, in turn, was significantly lower during the 2nd quarter of the year, reaching the highest values during the 1st (2001, 2006) and 3rd quarters (remaining years) (Fig. 4) (Kruskal-Wallis, $F = 2.43$; $p = 0.001$) (**Figure 5**).

From January to August, a gradual increase in the size of wahoo caught in SPSPA was observed, with an apparent displacement of the size-class mode from 100-110 cm to 130-140 cm. From August on, though, the mode remained in the same size class (**Figure 7**).

4. Discussion

The fishing activity developed around SPSPA by Brazilian tuna vessels started in 1988, when some boats based in Natal began to fish tunas and tuna like-fishes using hand-line as a fishing gear and flying-fish (*Cypselurus cyanopterus*) as bait (Travassos, 1999). Presently, fishing vessels based in Natal and Recife are operating near ASPSP, having yellow-fin tuna and wahoo as their main target-species.

The yearly landings of wahoo caught in association with the SPSPA was relatively stable along the years studies, with a minor increase in 2002. The reason for that, though, is not clear from the data available, since the number of vessels operating in the area was similar to other years, while the number of landings was indeed less than those of 2003 and 2006. The relative stability of wahoo CPUE along the studied period seems to indicate a little variance of the species abundance in the area. Nevertheless, Oliveira et al. (1977), based on the catch results obtained during a research cruise, estimated a catch rate of about 264 kg/boat/ fishing day around SPSPA, a much higher value, therefore, than the highest yearly mean observed in the present work (100 kg/boat/ fishing day). This apparent reduction may have been caused by the development of the fishing activity in that area, although such a straight comparison is greatly hindered by the various differences in the dynamics of the commercial fishing fleet and a research vessel.

The monthly landings of wahoo in the SPSPA, from July 1998 to December 2006, show that the highest catches happen during winter/early spring and summer. In Canary Islands, where the wahoo is also frequently caught, catches are higher during spring and autumn (Cabrera 1973 *apud* Mena et al, 1993), with two peaks of relative abundance along the year, a situation that resembles the one found in the present study. Mena et al. (1993) also reported that, in spite of a noticeable seasonal variation of catches, the species is present in the Canary Island all year long, such as in SPSPA.

According to Oliveira et al. (1997), from 1994 through 1996, 411t of fish were caught around SPSPA. Of these, the flying-fish accounted for 41.7%, tunas for 30.6% and wahoo for only 10.8%. From 1998 on, therefore, there seemed to be a clear inversion of the predominant species, with the participation of flying-fish in the catches, by weight, dropping to only 13%, while the percentage of tunas increased to 56%. The causes for such inversion are not clear, but might be related either to a reduction in abundance/ availability of flying-fish, or to a different targeting strategy of the fishing fleet, aiming more at tunas, due to their much higher commercial value, in association with improvements in fishing technology and methods.

A great abundance of shark species in the vicinity of the SPSPA has been reported in the past, by several authors (Fitzroy, 1839; Ross, 1847; Niccol, 1908; Wild, 1923; Swire, 1938; Tressler et al. 1956 *apud* Edwards & Lubbock, 1980). The very small catches of sharks observed in the present work, therefore, might indicate an important reduction of the shark population in that area, due to the commercial fishing, targeting more valuable fish species, as already speculated by other studies (Edwards & Lubbock, 1980).

Information on catch composition of the fish caught in the proximity of SPSPA, including its historical changes, is very scanty. Such information, however, is crucial to assess the impact of the fishing activity on the fish stocks present in that area. Although most of the species caught are distributed over a much wider area in the Atlantic Ocean, an excessive fishing effort concentrated around the SPSPA might cause a local depletion of the exploited stocks, with undesirable ecological and socio-economic losses. Besides, for those species that spawn in the vicinity of the archipelago, the fishing mortality could have a more significant impact, since it would be affecting primarily the spawning stock biomass. Such a risk is particularly high for species with a more restricted distribution, which could then be easily wiped out from the area, as it seems to have been the case of a shark population, possibly *Carcharhinus galapagensis*, once very abundant around SPSPA, and no longer present there (Edwards & Lubbock, 1980). We hope that the results hereby presented can contribute for a more efficient management of the fishing activity around Saint Peter and Saint Paul Archipelago, in order to assure the long term sustainability of the exploited stocks, as well as of the fishery depending on them.

Acknowledgements

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Table 1. Yearly distribution of landings of fish caught by fishing boats operating in the vicinity of the Saint Peter and Saint Paul Archipelago, from July 1998 to December 2006.

<i>Boats/ Year</i>	<i>1998</i>	<i>1999</i>	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>Total</i>
Transmar I	8	11	8	12	10	12	7	9	10	87
Transmar II				8	10	9	8	7	9	51
Transmar III			3	2	1	2	4	8	7	27
Alfa			1		2	5	5		2	15
Namorado	6	15	9							30
Marlin II								2		2
Total	14	26	21	22	23	28	24	26	28	212

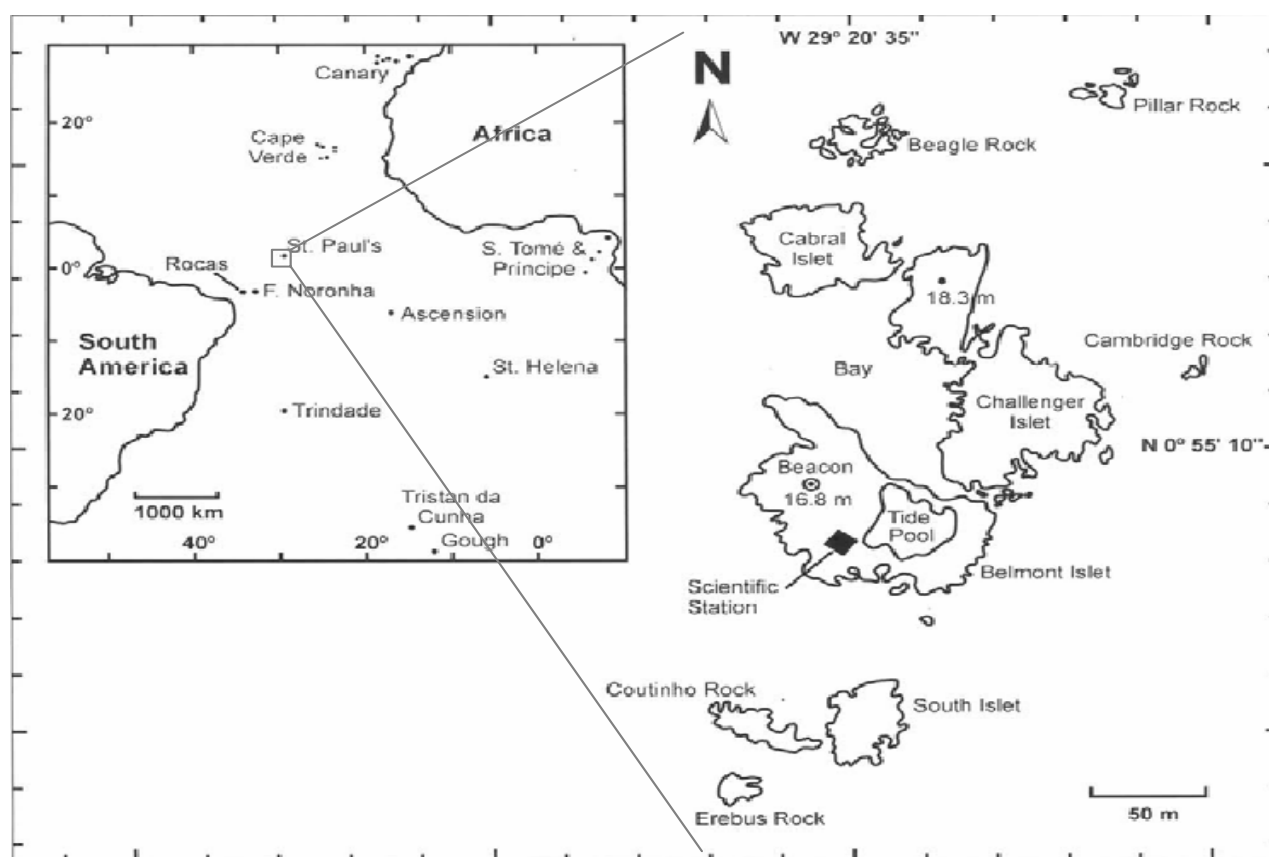


Figure 1. Geographical location of the Archipelago of Saint Peter and Saint Paul.

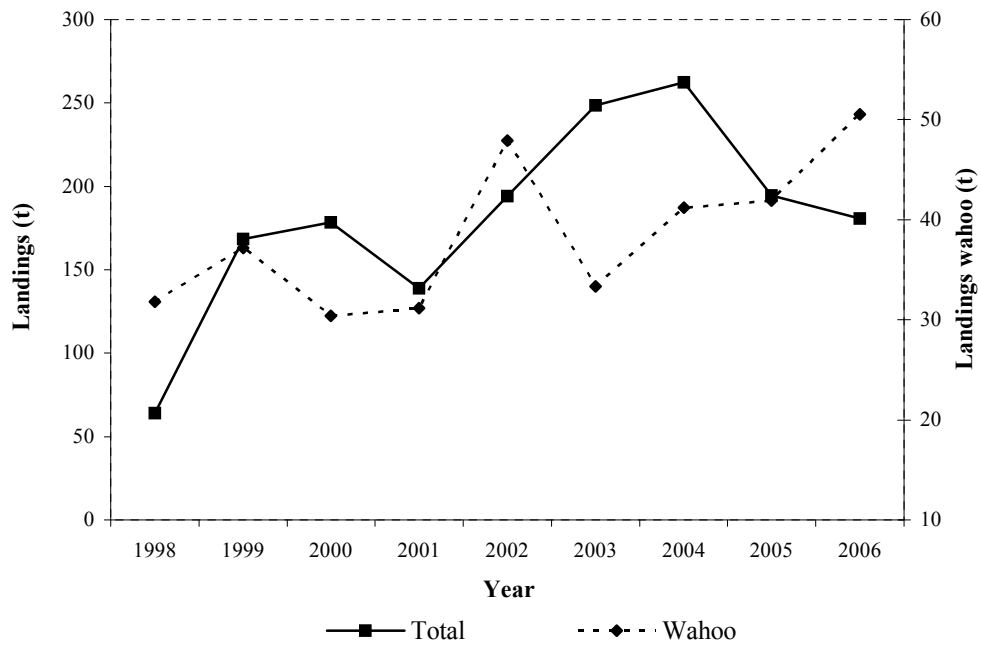


Figure 2. Yearly landings of all species combined and of wahoo, caught in the vicinity of the Saint Peter and Saint Paul Archipelago, from July 1998 to December 2006.

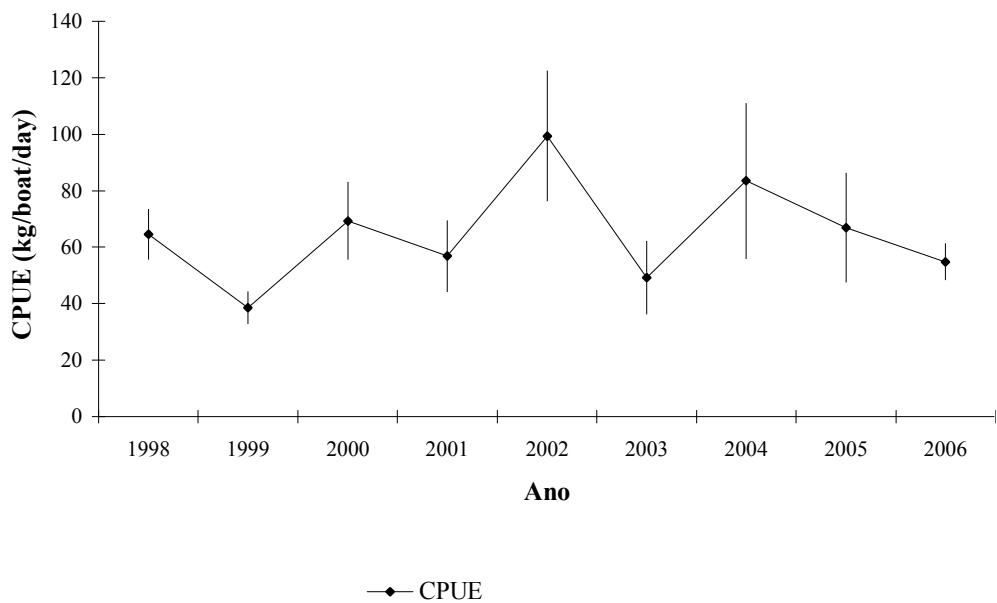


Figure 3. Yearly mean CPUE of wahoo caught in the vicinity of the Saint Peter and Saint Paul Archipelago, from July 1998 to December 2006 (vertical bars indicate standard deviation).

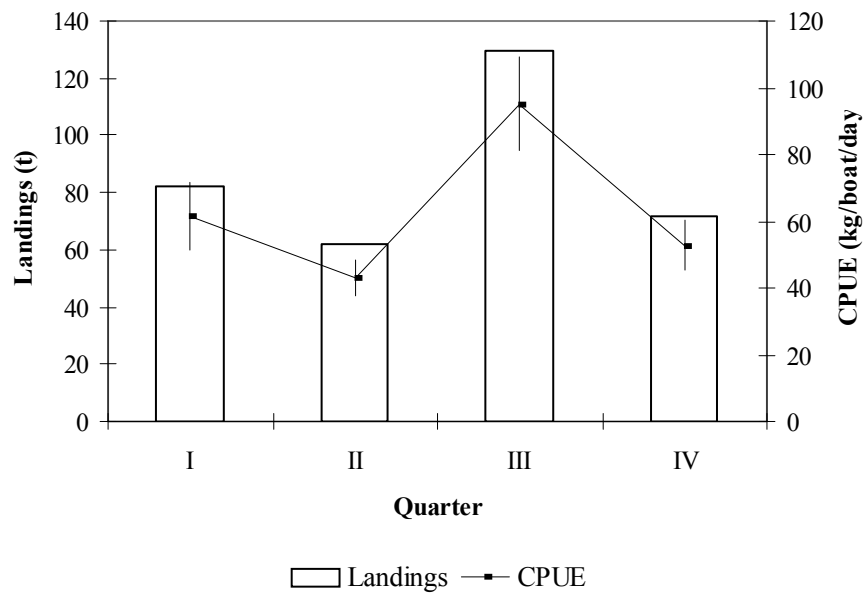


Figure 4. Quarterly distribution of landings of wahoo caught in the vicinity of the Saint Peter and Saint Paul Archipelago, from July 1998 to December 2006 (vertical bars indicate standard deviation).

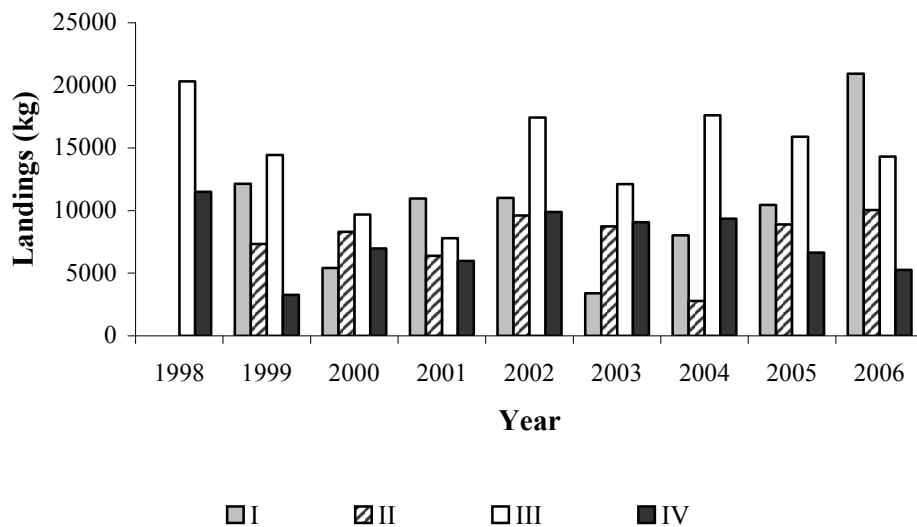


Figure 5. Quarterly distribution, per year, of landings of wahoo caught in the vicinity of the Saint Peter and Saint Paul Archipelago, from July 1998 to December 2006 (vertical bars indicate standard deviation).

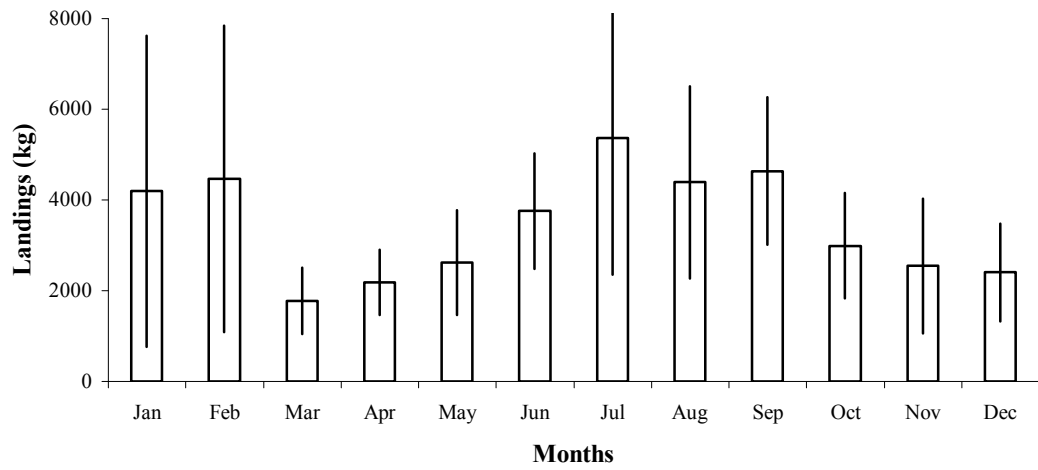


Figure 6. Monthly distribution of landings of wahoo caught in the vicinity of the Saint Peter and Saint Paul Archipelago, from July 1998 to December 2006 (vertical bars indicate standard deviation).

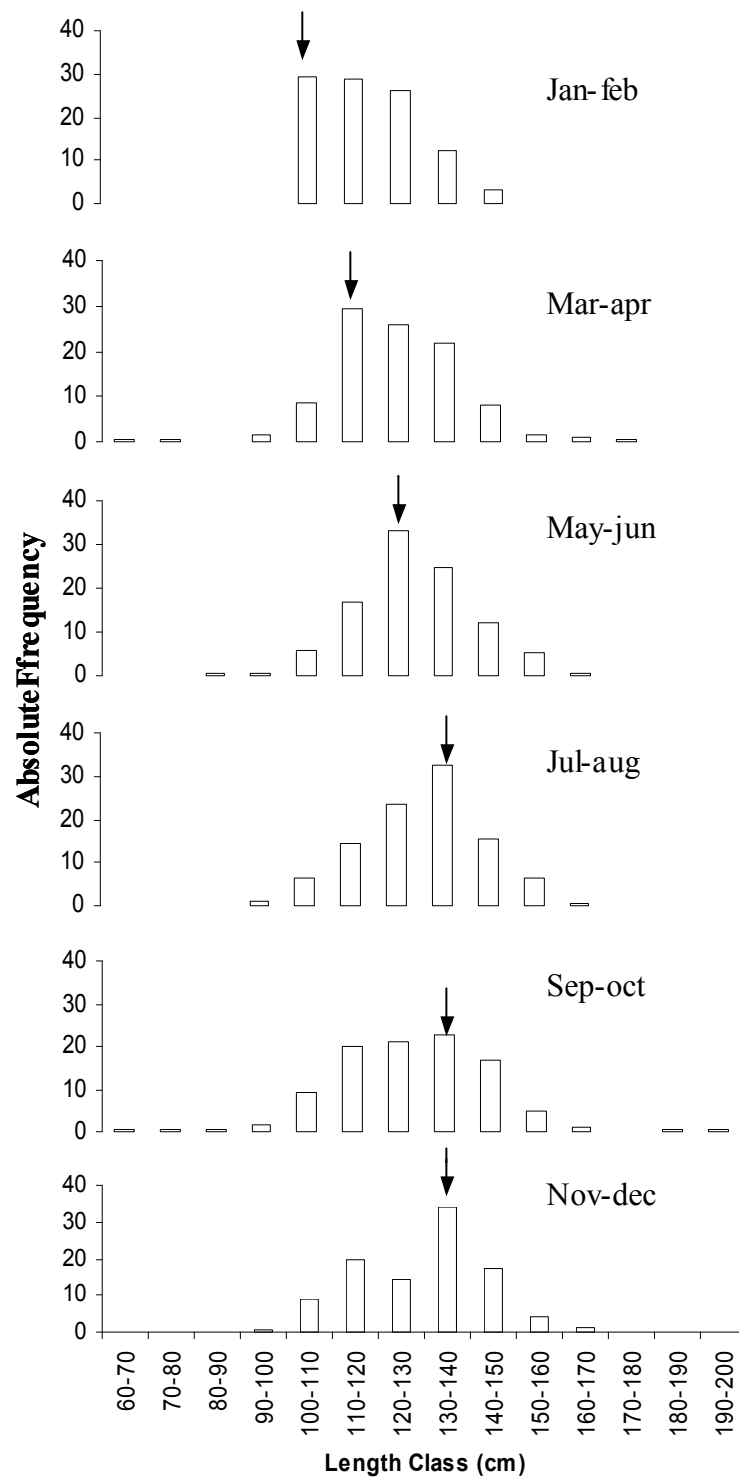


Figure 7. Bimonthly length frequency (ZL) distribution of wahoo specimens caught in the vicinity of the Saint Peter and Saint Paul Archipelago, from July 1998 to December 2006 (n= 1,500 specimens)(arrow indicates the mode).