PRELIMILARY OCCURRENCE OF ISTIOPHORIDAE LARVAE (*PERCIFORMES, XIPHIOIDEI*) IN SOUTHERN BRAZIL

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SUMMARY

The Istiophoridae, Istiophorus platypterus (sailfish) and Kajikia albida *(white marlin) are commonly caught by commercial and sport fisheries off Southern Brazil. The presence of mature gonads of these species and juvenile of sailfish were observed during summer period. In the last two years (2011/2012 and 2012/2013) 16 research cruises were made and 54 surface trawls were performed using an ichthyoplankton net. The Istiophoridae family-level larval identification was made through morphological characteristics, and the species-level identification was performed by molecular biology using multiplex-PCR with species-specific primers and PCR-RFLP techniques. Five larvae of sailfish and two of white marlin were identified on the coast off Vitoria (ES) and Rio de Janeiro (RJ) cities, southern Brazil. The occurrence of sailfish and white marlin larvae shall be further studied, so that inferences about the area and period of spawning and development of early life stages of these fish can be made more accurately. In addition, these data may contribute to the management and conservation of these species on the Southwestern Atlantic.*

RÉSUMÉ

Les istiophoridés, Istiophorus platypterus *(voiliers)* et Kajikia albida (*makaire blanc) sont couramment capturés par les pêcheries commerciales et sportives, au large du sud du Brésil. On a observé la présence de gonades matures de ces espèces et de voiliers juvéniles au cours de la période estivale. Au cours des deux dernières années (2011/2012 et 2012/2013), 16 campagnes de recherche ont été menées et 54 opérations de remorquage d'ichtyoplancton de chaluts de surface ont été réalisées. L'identification de larves au niveau de la famille Istiophoridae s'est faite par le biais de caractéristiques morphologiques, et l'identification au niveau de l'espèce a été réalisée par biologie moléculaire à l'aide de multiplex-PCR avec des amorces spécifiques aux espèces et des techniques de PCR-RFLP. Cinq larves de voiliers et deux de makaire blanc ont été identifiées sur la côte de Vitoria (ES) et les villes de Rio de Janeiro (RJ), au Sud du Brésil. La présence de larves de voiliers et de makaire blanc doit être étudiée plus avant, afin que les inférences au sujet de la zone et de la période de frai et du développement des premiers stades du cycle vital de ces poissons puissent être réalisées avec plus de précision. En outre, ces données peuvent contribuer à la gestion et la conservation de ces espèces dans l'Atlantique Sud-Ouest.*

RESUMEN

Los istiofóridos, Istiophorus platypterus *(pez vela) y* Kajikia albida *(aguja blanca), son capturados comúnmente por las pesquerías comerciales y deportivas en aguas meridionales de Brasil. Durante el verano se observó la presencia de gónadas maduras de estas especies y de juveniles de pez vela. En los dos últimos años (2011/2012 y 2012/2013) se hicieron 16 cruceros de investigación y se llevaron a cabo 54 arrastres de superficie utilizando una red de ictioplancton. La identificación larval de la familia istiofóridos se realizó mediante las características morfológicas, y la identificación de la especie se llevó a cabo mediante biología molecular utilizando multiplex-PCR con cebadores específicos de cada especie y técnicas PCR-RFLP. Se identificaron cinco larvas de pez vela y dos de aguja blanca en aguas de Vitoria (ES)*

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y Río de Janeiro, al sur de Brasil. La presencia de larvas de pez vela y aguja blanca debe estudiarse más en profundidad, para que las inferencias acerca de la zona y periodo de desove y el desarrollo de las primeras etapas del ciclo vital de estos peces puedan hacerse de una forma más precisa. Además, estos datos podrían contribuir a la conservación y ordenación de estas especies en el Atlántico sudoccidental.

KEYWORDS

Sailfish, White marlin, Billfish, Zooplankton, Spawning

Introduction

The billfish, sailfish (*Istiophorus platypterus*), white marlin (*Kajikia albida*), blue marlin (*Makaira nigricans*) and swordfish (*Xiphias gladius*) have been caught by commercial and sports fisheries, in their spawning season off southern Brazil from November to March (Amorim and Arfelli, 1980, 1987; Arfelli and Amorim, 1981; Arfelli *et al*. 1986, 1994; Amorim *et al.*, 2011).

The occurrence of females in different stages of gonadal development, as well as the presence of Istiophoridae larvae has been reported in the Atlantic (Voss, 1953, Yabe, 1953, Ueyanagi *et al*., 1970, Mather *et al.*, 1972, Richards, 1974, De Sylva and Breader, 1997; Post *et al*., 1997; Luthy, 2004; Luthy *et al*., 2005; Tidwell *et al*., 2008).

According to Ueyanagi et al. (1970), the ripe gonads of the white marlin in the Southwest Atlantic Ocean occurs in the area between 20ºS to 30ºS and 20ºW to 50ºW, from October to March; and also it was registered the larvae presence in 10ºS to 25ºS and 10ºW to 35ºW from November to April. In Brazil, off the Espirito Santo to Santa Catarina States, Brazil (18°S to 27°S and 40°W to 50°W) from November to March, was capturing ripping and post-spawning females according Arfelli *et al.* (1986). Spawning areas were also found on the oceanic waters in front of the Florida, Puerto Rico and the Caribbean during the months from April to June (Baglin, 1979; Arocha et al., 2005; Arocha and Ortiz, 2006).

There are two studies for the sailfish larvae with the description of its larval development for the Atlantic and Pacific Oceans, (Voss 1953 and Yabe 1953). According to Ueyanagi *et al.* (1970), the larvae presence of sailfish and swordfish in the Southwest Atlantic Ocean occurs in the area between 10ºS to 25ºS and 15ºW to 30ºW, from November to April. In Brazil, ripe gonads were observed off Espirito Santo to Santa Catarina States, Brazil, between November to February, with the peak in January (Arfelli and Amorim, 1981).

In the Atlantic sailfish reproduction in tropical and subtropical areas. Northwest were found ripe females, eggs and larvae of sailfish off Straits of Florida and adjacent areas, from April to October. Also occurs from June to December, in the Caribbean Sea, Venezuela, Guyana and Suriname. The Equatorial Atlantic (5° to 13° N), is recorded from February to September. In the eastern Atlantic, the species spawns in front of the coast of Senegal, from July to August (Limouzy and Cayre, 1981; De Sylva and Breder, 1997; Post *et al*., 1997; Luthy, 2004; Arocha and Marcano, 2006).

The aim of this study was to report the presence of Istiophoridae larvae in the Southwestern Atlantic, over the continental shelf off southern Brazil.

Materials and Methods

The research cruises occurred from October to January, during the last two years (2011/2012 and 2012/2013). Samples were collected aboard the sport fishing boats between the States of Espirito Santo and São Paulo, Brzil, with the support of the *Iate Clube do Espirito Santo*-ICES, *Iate Clube do Rio de Janeiro*-ICRJ and *Yacht Club de Ilhabela*-YCI, (**Figure 1**).

Ichthyoplankton surface trawls were performed during 10 minutes, using a conical net of 1 m wide and 2.90 m long, with 500 µm meshes and cup with 600 µm.

The samples were stored in 95% ethanol (Luthy *et al.* 2005). For better visualization, the specimens were photographed with a digital camera (*Leica*) attached to a stereomicroscope, and we have created a collection of the ichthyoplankton pictures.

The DNA purification was carried out DNeasy Blood & Tissue Kit (Quiagen). The next step for the molecular identification of larvae samples was carried out by multiplex-PCR with species-specific primers (Hanner *et al.* 2011) and PCR-RFLP (not published).

Results

Fifty-four surface trawls were performed on 16 cruises between the months from October to January, during the period from 2011 to 2013 over the continental shelf on the coast of Vitoria, Cabo Frio, Rio de Janeiro and Ilhabela Cities, Brazil, obtaining up 762 total fish larvae. There were five stations with the presence of Istiophoridae larvae. Due to the morphological characteristics of the larvae were identified 7 larvae of Istiophoridae (Luthy *et al*., 2005).

The two white marlin larvae were caught off the coast of Rio de Janeiro City, while the five sailfish larvae were caught off the coast of Vitoria City.

The white marlin larvae were caught in front of Rio de Janeiro, RJ (23°S/42° W), in locations with 196 and 129 meters deep. They were found both in November, but in different seasons (2011/2012 and 2012/2012). The first larvae 11.6mm TL caught at 10:30 a.m. and the second 3.81mm at 2:30 p.m., the sea surface temperature (SST) was around 23.0°C.

The sailfish larvae were caught on the coast of Vitoria City, ES (20°S/39°W), three larvae at the same station, with 53 meters deep and the other two larvae at different stations, with 100 meters deep. The larvae were caught in January 2013, during the same scientific cruise, but at different stations. The first three specimens (4.46; 5.89 and 5.73mm) were taken at 08:40 a.m. (SST 25.4ºC), the fourth (8.09mm) and the fifth (4.89mm) at 1:55 p.m. and 2:20 p.m. (SST 25.5ºC for both).

Discussion

Through cooperation between anglers and researchers, it was possible to carry out an investigative sampling, which 762 fish larvae were caught, seven of them Istiophoridae. The trawls were performed during training and tournament days in traditional areas of fishing. Therefore, it is suggested that the sampling area may be expanded aiming to find more larvae, as well as the other species *Makaira nigrican* and *Xiphias gladius* (Amorim and Arfelli, 1980, 1987).

Ueyanagi *et al.* (1970) had previously reported the presence of Istiophoridae larvae in oceanic areas of the southwestern Atlantic. However there were no additional studies detailing these larvae occurrence on the Brazilian coast. According to Arfelli and Amorim (1981), sailfish females were observed with mature gonads in southeastern and southern Brazil from November to February, then Arfelli *et al.* (1986) also found white marlin mature females in the southeast and south Brazil, from November to March. Also according to Amorim *et al*. (2011) different sizes of juvenile sailfish were found off southern Brazil. Therefore, with the identification of these larvae we can now infer that the area on the present study may be a spawning ground to sailfish and white marlin. The study will continue with new samplings.

According to Mourato *et al*. (2009), the southeast Brazilian coast seems to be an important spawning area for the sailfish species, with the spawning season happening mainly from December to February. The vast majority of females caught in this area, during this period of the year, were either ripe or spent, with high values of gonad indices. Mature specimens of billfish were previously reported in this area by Arfelli and Amorim (1981) and Pimenta *et al*. (2005).

Evidence on spatial catch prediction maps and size distribution composition for the western South Atlantic, suggests that the larger sailfishes depart to more oceanic areas after the spawning season. Probably the sailfish after spawning activity in southeast Brazilian coast are driven eastward, following the south Atlantic Gyre, in order to return to the tropical western tropical Atlantic area (Peterson and Stramma, 1991). Beardsley (1980) also founded the largest sailfish in the eastern south Atlantic off African coast. It is possible, therefore, that the sailfish, after the spawning season off southern Brazil, move as far as the eastern side of the South Atlantic.

According to Myers and Worm (2003), the highest levels of mortality of Istiophoridae occur due to incidental take in longline fisheries targeting other pelagic fish. Its cause a drastic decline with overfishing continuing to push these declines further in some billfish species. The definition of the area and spawning season of white marlin and sailfish, can contribute to the authority to set a better protection of them. The prohibition on the marketing of white marlin along Brazilian coast (*Instrução Normativa* Nº12, SEAP, 14/06/2005) will contribute to conservation, but new measures should be taken in spite of confirming period and area of sailfish and white marlin spawning.

The finding of two white marlin and five sailfish larvae supports the hypothesis of reproduction of this species off southern Brazil.

Conclusion

The occurrence of sailfish and white marlin larvae shall be further studied, so that inferences about the area and period of spawning and development of early life stages of these fish can be more accurate. In addition, these data may contribute to the management and conservation of these species on the Southwestern Atlantic.

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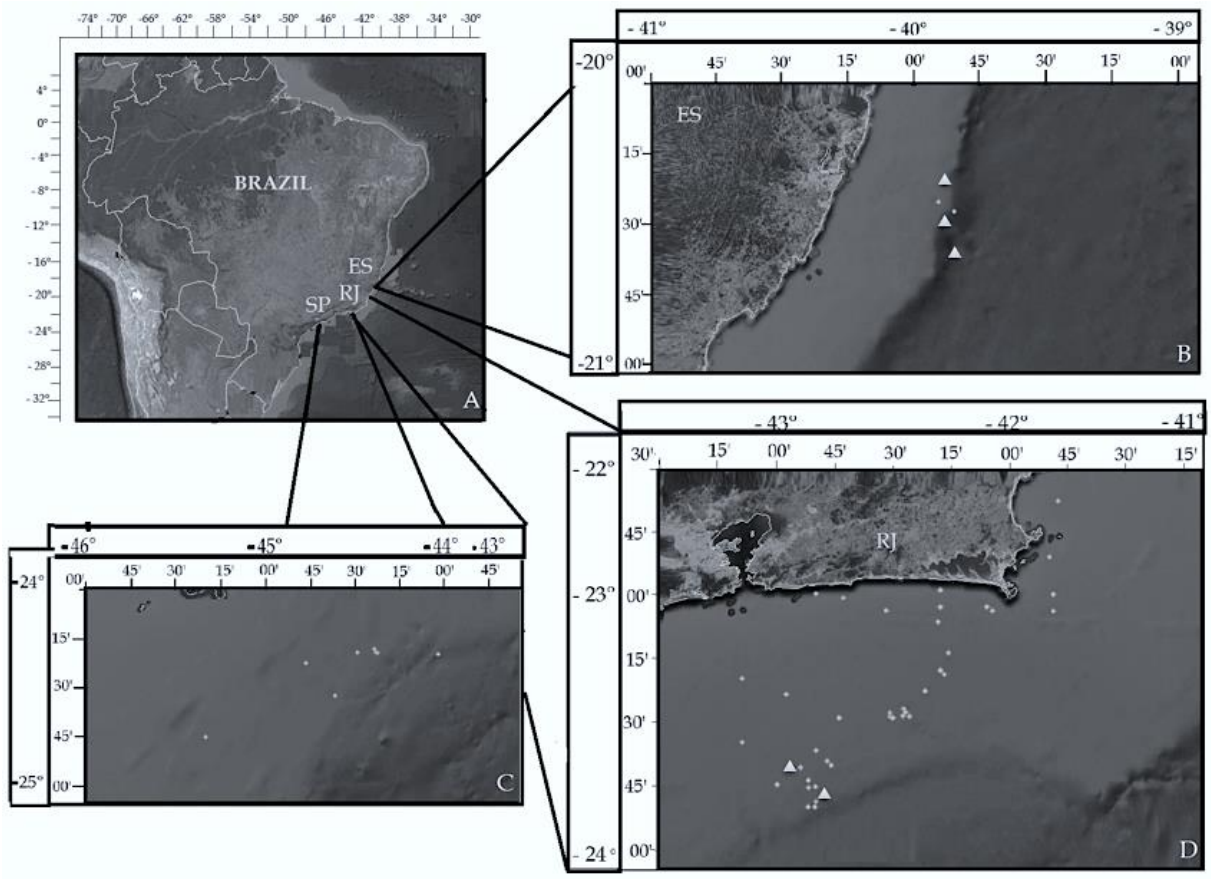

Figure 1. Ichthyoplankton sample area from November to January (2011/2013). Circle points indicate the sample trawls and triangle points the samples stations with Istiophoridae larvae presence. Trawls performed off Espirito Santo (B – where sailfish larvae was caught), São Paulo (C) and Rio de Janeiro (D – where white marlin larvae was caught).