Further notes on the capture of a *Carcharhinus leucas* in a northeastern Atlantic oceanic insular shelf, the Azores Archipelago, Portugal

by

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ABSTRACT. - In March 1993, a specimen of *Carcharhinus leucas* was captured by fishermen on the south coast of Terceira Island, the Azores Archipelago. Its head was recovered and its jaws were preserved. This is the first capture of this species on an oceanic insular shelf in the Atlantic. The distribution of *C. leucas* in this ocean is commented.

RÉSUMÉ. - Note complémentaire sur la capture de *Carcharhinus leucas* (Carcharhinidae) dans une île océanique de l'Atlantique nord-est, l'archipel des Açores, Portugal.

En mars 1993, un spécimen de *Carcharhinus leucas* a été capturé par des pêcheurs sur la côte sud de l'île Terceira dans l'archipel des Açores. Sa tête a été récupérée et ses mâchoires préservées. Il s'agit de la première capture de cette espèce sur une plateforme océanique de l'Atlantique. La distribution de *C. leucas* dans cet océan est commentée.

Key words. - Carcharhinidae - *Carcharhinus leucas* - NE Atlantic - Azores Archipelago - First record.

The Azores archipelago, northeastern Atlantic, is a group of nine volcanic islands situated on the Mid-Atlantic ridge. There are few shark studies in the area, most of them are included in other works related to a commented list of the entire fish fauna from the Archipelago. In the present study, the occurrence of the bull shark, *Carcharhinus leucas* (Valenciennes, 1839), is reported from the Azorean waters, based on a single specimen caught in March 1993 in São Mateus Bay, Terceira Island (38º39'N; 27º13'W) (Fig. 1). Although this specimen has been referred in a previous checklist of Azorean marine fishes (Santos *et al.*, 1997) this note provides available information on this regard with comments on geographical distribution of this species.

The shark was sighted swimming in shallow waters and was caught by a fisherman using a hand harpoon near the surface. The shark was eviscerated and its meat commercialized while the carcass was discharged in the bay, where its head (Fig. 2) was recovered by JPB 12 hours later. The jaws (Fig. 3) were cleaned and are about to be deposited at the collection of Museu Carlos Machado, Ponta Delgada, Azores, Portugal (provisional number CARLEU 1/94/05). Additional photos of the head were taken. The characteristic blunt snout and jaws analysis (teeth counts and morphology) were sufficient to shark identification. Dental formula was 13-1-13 in upper jaws and 12-1-12 in lower jaws, with upper teeth exhibiting strong serrations and lower teeth finely but clearly serrated. Although the fishermen reported a total length of ca. 420 cm (Santos *et al*., 1997) we assume this is widely exaggerated even exceeding the maximum TL for this species (350 cm). According to the measurements of the jaws (inter-commissural distance 273 mm; upper jaw perimeter 541 mm) we estimated the specimen's size at about 250-270 cm TL since most bull sharks have a mouth

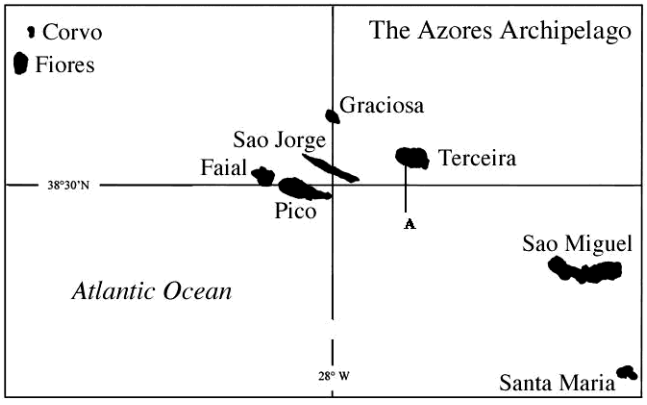

Figure 1. - Map of Terceira island in the Azores Archipelago (NE Atlantic) showing the location (A) where the specimen of *Carcharhinus leucas* was captured *[Carte de l'Île Terceira dans l'archipel des Açores (Atlantique NE) montrant la localité (A) où le spécimen de* Carcharhinus leucas *a été capturé.]*

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Figure 2. - Head of the specimen of *Carcharhinus leucas* caught off the Azores. Photo by I. Barreiros imagDOP. *[Tête du spécimen de* Carcharhinus leucas *capturé au large des Açores.]*

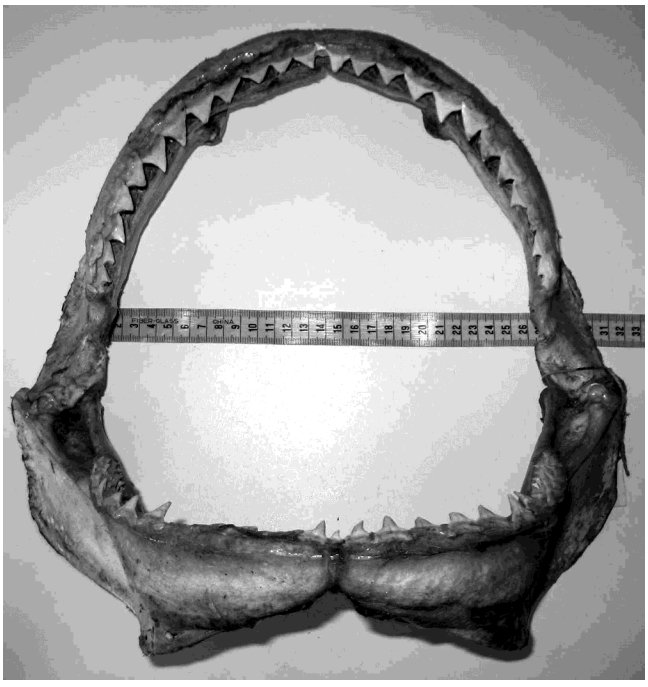

Figure 3. - Jaw of the specimen of *Carcharhinus leucas* caught off the Azores and preserved in CARLEU, catalogue number: 1/94/05. Photo by JPB imagDOP. *[Mâchoires du spécimen de* Carcharhinus leucas *capturé au large des Açores.]*

width corresponding to 9.5 to 10% of TL (Bigelow and Schroeder, 1948; Bass *et al*., 1973).

The bull shark is a large Carcharhinidae commonly associated to coastal, estuarine and even freshwaters of tropical regions (Compagno, 1984). The known distribution in the eastern Atlantic includes just the African coast (Morocco, Senegal to Angola, Gambia e Gabon) (Compagno, 1984). The occurrence and distribution of this species in European Atlantic and Mediterranean are controversial and no previous studies record this shark in this area (Garrick, 1982; Garcia-Moreno, 1982; Moreno, 1995). According to Moreno-Garcia (1982), a dusky shark, *Carcharhinus obscu - rus* (Lesueur, 1818), cited to Alicante, Spain (Lozano-Rey, 1928) was misidentified as *C. commersoni* (synonymy of *C. leucas*). Tortonese (1956) affirms that the bull shark reported by Guichenot (1850) in Algerian waters is a specimen of *C. plumbeus* (Nardo, 1827). The bull shark resembles in many characters, the Java shark, *C. amboinensis* (Müller and Henle, 1839), that occurs in Nigeria, southeastern Atlantic, and shows a more restrict distribution and range (Compagno, 1984). It is possible that many other data on the occurrence of bull sharks in continental shelves of western Africa, Europe and Mediterranean can be related to the difficulties of identifying some large *Carcharhinus* species with similar general morphology, as the above mentioned sharks.

There is no data concerning the occurrence of the bull shark in insular platforms of small oceanic islands in the Atlantic Ocean, such as the Azores. In the Saint Peter/Saint Paul Archipelago, located southward also at the Mid-Atlantic ridge, in the equatorial central Atlantic, this species was never found (Vaske Jr. *et al*., 2005). In fact, the bull shark is not an insular species associated to oceanic areas, as reported to *C. galapagensis* (Snodgrass and Heller, 1905), a species recorded both in the Azores and in Saint Peter/Saint Paul Archipelagos. Despite the very higher number of oceanic islands along the Pacific Ocean, there are a few records of this species in such habitats (New Caledonia, Fiji, Rangiroa Atoll (Tuamotu Archipelago), The Philippines) (Compagno, 1984).

Unfortunately, the scarcity of environmental data do not allow a more consistent explanation about the factors related to so an unusual occurrence. It would be expected that a coastal tropical shark could visit Azorean waters during the northern hemisphere summer, when the Azores Current (from the Gulf Stream) arrives bringing some tropical faunistic elements from the western North Atlantic, namely the Caribbean. Also its cosmopolitan distribution could lead some individuals to stop in oceanic islands during trans-oceanic migrations.

The Atlantic distribution of the bull shark may suggest that its appearance in the Azores is closely related to the Gulf Stream path associated to ocean circulation of the subtropical gyre in the northern hemisphere (Juliano, 2003; Juliano and Alves, 2006). Known occurrences are in

coastal areas that border the external circulation path of the subtropical gyre in the west north Atlantic. According to Compagno (1984) they stretch from the Caribbean, Gulf of Mexico, Florida with a northern limit in Massachusetts, USA, (ca. 42ºN, 71ºW). Therefore, this could be the most plausible hypothesis for the species appearance in the Azores. Another hypothesis could be dispersion through equatorial currents. However, the species absence in central equatorial regions makes it doubtful. Nevertheless, the ocean circulation of the subtropical gyre would make it probable for *C. leucas* to occur in the Canaries and Madeira, something that has never been detected up to now (see Brito, 1991).

Some anomalous environmental conditions could have been the major cause to explain the occurrence of this specimen in the Azores. Although a correlation of known occurrences of *C. leucas* with physical oceanographic patterns is very difficult, a recent study by Volkov (2005) about the inter-annual variability of surface ocean circulation in the North Atlantic has shown that the Gulf Stream was indeed subjected to considerable meridional displacements (within a 2º latitude band) from 1983 to 2001. Its northernmost position happened between 1993 and 1995 and our specimen was captured in 1993. This same work also concludes that the eddy kinetic energy associated to the Azores Current reached its peak in 1993-95 with positive geostrophic velocity anomalies. The Azores Current nucleus stayed in a more northern position during this same period.

The present report adds information regarding the occurrence of the bull shark in the Azores and refers to the world highest latitudinal (South or North) record of this species in an oceanic island and the northernmost record in the NE Atlantic. More accurate procedures to *Carcharhinus* shark species identification along the oceanic insular shelves around the world could reveal the sporadic occurrence of the bull shark in these areas.

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