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**EVIDENCE OF A FAILED PREDATORY ATTEMPT
BY AN ORCA, *ORCINUS ORCA* (LINNAEUS, 1758),
ON A GREAT WHITE SHARK, *CARCHARODON CARCHARIAS* (LINNAEUS, 1758)**

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Marine Sciences, University of Milano-Bicocca, Milan, Italy
E-mail: alessandrodemaddalena@gmail.com

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The first observation of a live great white shark *Carcharodon carcharias* bearing tooth rake marks by an orca *Orcinus orca* on the left flank is presented. The estimated 3.5-m shark was observed on 7 July, 2017, at Seal Island in False Bay, Western Cape, South Africa. This case provides evidence that great white sharks can survive an attack by an orca.

Keywords: great white shark, *Carcharodon carcharias*, killer whale, *Orcinus orca*, False Bay, South Africa

Orcas, or killer whales, *Orcinus orca* (Linnaeus, 1758), have been reported to feed on or attack different species of sharks, including the broadnose sevengill shark *Notorynchus cepedianus* (Péron, 1807); Pacific sleeper shark *Somniosus pacificus* Bigelow & Schroeder, 1944; whale shark *Rhincodon typus* Smith, 1828; common thresher *Alopias vulpinus* (Bonnaterre, 1788); basking shark *Cetorhinus maximus* (Gunnerus, 1765); great white shark *Carcharodon carcharias* (Linnaeus, 1758); shortfin mako *Isurus oxyrinchus* Rafinesque, 1810; tope shark *Galeorhinus galeus* (Linnaeus, 1758); grey reef shark *Carcharhinus amblyrhynchos* (Bleeker, 1856); bronze whaler, or copper shark, *Carcharhinus brachyurus* (Günther, 1870); Galapagos shark *Carcharhinus galapagensis* (Snodgrass & Heller, 1905); blue shark *Prionace glauca* (Linnaeus, 1758); scalloped hammerhead *Sphyrna lewini* (Griffith & Smith, 1834); and smooth hammerhead *Sphyrna zygaena* (Linnaeus, 1758) [Best et al., 2010, 2014; Brown, Norris, 1956; De Maddalena, Buttigieg, 2009; Engelbrecht et al., 2019; Fertl et al., 1996; Ford et al., 2011; Norris, 1958; Pyle et al., 1999; Reyes, García-Borboroglu, 2004; Sorisio et al., 2006; Ternullo et al., 1993; Towner et al., 2022; Visser, 2000a, b, 2005; Visser, Bonaccorso, 2003; Visser et al., 2000; Yukhov et al., 1975]. In the present article, the observation of a live great white shark bearing tooth rake marks by an orca is reported.

MATERIAL AND METHODS

The observation took place on 7 July, 2017, 14.8 km northeast of Simon's Town harbour, near Seal Island in False Bay, Western Cape, South Africa. The author observed the female great white shark repeatedly while cage diving off the *White Pointer II* – the 11-m boat of *Apex Shark Expeditions*. The great white shark made several passes around the boat and the cage between 8:45 and 10:35, swimming at depths ranging from the surface to 5 m, in 10-m-deep waters. It was briefly observed at 8:45; then it was observed clearly several times between 10:22 and 10:35. At 10:35, the shark succeeded in catching the bait before

it disappeared. The shark had a massive body, with a wide trunk, and it was estimated at 3.5 m in total length. Underwater visibility was about 8 m. Perhaps, the same shark was seen earlier in the morning, at 7:02, preying on a Cape fur seal, *Arctocephalus pusillus pusillus* (Schreber, 1775), in the same area, when several kelp gulls, *Larus dominicanus* Lichtenstein, 1823, were observed flying over the nearby spot attracted by the upcoming predatory event.

At least two other great white sharks were observed that morning on the same spot. One was briefly seen at 7:22 when it bit the seal-shaped decoy that was being towed behind the boat shortly after sunrise, while another one, an estimated 3-m female, was observed from the cage swimming at depths ranging from the surface to 3 m, between 10:03 and 10:04. No other species of fish were observed on that day.

In order to attract the sharks and to keep them around the cage, the crew was using a small amount of chum, made of sardines, and a few heads of salmon as the bait. It was a sunny day, with an average water temperature of +14 °C and relatively calm seas.

Photos of the sharks were taken with two cameras for subsequent analysis (Fig. 1).



Fig. 1. Estimated 3.5-m female great white shark *Carcharodon carcharias* bearing tooth rake marks by an orca *Orcinus orca* on the left side of its trunk, observed on 7 July, 2017, at Seal Island in False Bay, Western Cape, South Africa. Photos by Alessandro De Maddalena

Рис. 1. Самка большой белой акулы *Carcharodon carcharias* длиной около 3,5 м со следами зубов ко-сатки *Orcinus orca* на левой стороне туловища, обнаруженная 7 июля 2017 г. у острова Сил, в заливе Фолс-Бей, Западный Кейп, Южная Африка. Фото Алессандро Де Маддалена

RESULTS AND DISCUSSION

Careful observation of the photos, showing the parallel marks seen on the left posterolateral region of the trunk of the great white shark, led the author to conclude that they are consistent with tooth rake marks of an orca. This was also confirmed by following examination of a large number of photos which the author was able to take on twelve past expeditions to observe orcas in the winter season in the areas of Bodø, Kaldfjord, and Skjervoy (Norway) since January 2014. Photos published in Ford *et al.* [2000] were also useful for additional comparison. Sixteen parallel scratches can be observed. The scratches are divided into twelve on the left and four on the right, separated by a small gap. The marks could have been caused by the teeth in the lower jaw of an orca trying to grab the shark from above. Orcas have ten to twelve large, recurved teeth in each half of both jaws, which are oval in cross section [Jefferson *et al.*, 1993]. The twelve scratches on the left match the twelve teeth in the orca's left half of the lower jaw, and the four scratches on the right match the first four teeth in the cetacean's right half of the lower jaw, while the small gap in between matches the space at the mandibular symphysis (Fig. 2). The appearance of the scratches seems to indicate that they were inflicted with significant force. It is likely, the marks were enhanced by the vigorous movement that the shark may have made in order to escape the attack of the large cetacean.

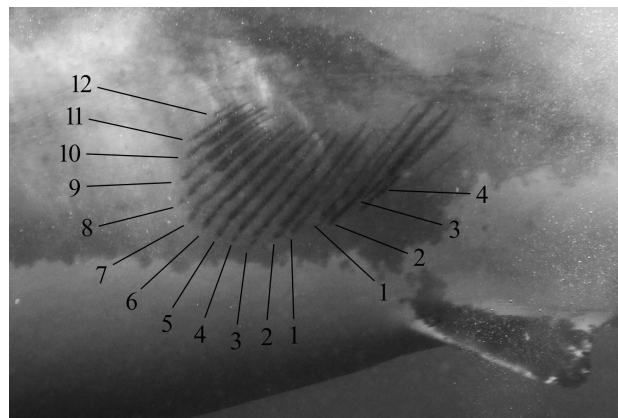


Fig. 2. Close-up of the tooth rake marks on the left side of the estimated 3.5-m female great white shark observed on 7 July, 2017, at Seal Island in False Bay, South Africa. The numbers indicate the twelve scratches on the left matching the twelve teeth in the orca's left half of the lower jaw and the four scratches matching the first four teeth in the orca's right half of the lower jaw. Photo by Alessandro De Maddalena

Рис. 2. Крупный план следов зубов на левой стороне тела самки большой белой акулы длиной около 3,5 м, наблюдавшейся 7 июля 2017 г. у острова Сил, в заливе Фолс-Бей, Западный Кейп, Южная Африка. Цифрами обозначены следы, соответствующие двенадцати зубам в левой половине нижней челюсти косатки, и царапины, соответствующие первым четырём зубам в правой половине нижней челюсти косатки. Фото Алессандро Де Маддалена

Predation on great white sharks by orcas is very rare. Only two cases were recorded to date outside South Africa, the first of them occurring on 4 October, 1997, at Southeast Farallon Island, California [Pyle *et al.*, 1999], and the second occurring on 2 February, 2015, at the Neptune Islands, South Australia [Fisher, 2015]. In South Africa, a few cases have been reported. The first case was recorded on 15 March, 2002, in Plettenberg Bay [Best *et al.*, 2010]. In 2015, a pair of male orcas, known as Port and Starboard and easily recognizable because of their collapsed dorsal fins, were recorded preying on broadnose sevengill sharks in False Bay [Engelbrecht *et al.*, 2019]. More recently, Towner *et al.* [2022] reported five cases of predation on great white sharks by the same pair of male orcas near Gansbaai, Western Cape, South Africa, recorded between February and June in 2017. Great white sharks moved from the area following these predatory events and in response to more sightings of the same orcas and other orcas. Gansbaai is located approximately 100 km east of False Bay. The fact that

the observation reported herein occurred in July 2017, immediately after the above-mentioned series of predatory events, suggests that the same pair of orcas may have attempted to prey on the great white shark described in this article, but this time without success. Apart from the rake marks, the shark appeared to be perfectly fine, swimming normally and being very active and fast.

The arrival or the departure of large predators at the top of the pyramid of biomass at any site can rapidly induce changes at lower trophic levels. Orca predation on great white sharks induces emigration of sharks from a given site. Individual great white sharks may not return for weeks or months, and in their absence the number of other sharks, such as bronze whalers and broadnose sevengills, may temporarily increase on that site [Andrew Fox, personal communication; Jorgensen et al., 2019; Pyle et al., 1999; Towner et al., 2022].

Conclusion. To the best of the author's knowledge, the observation of a live great white shark bearing tooth rake marks by an orca described in this article is the first case of its kind reported in the scientific literature. This observation is especially interesting because it represents the evidence that great white sharks can survive an attack by an orca, and it does not necessarily have to succumb in the confrontation between the two species. We should expect more such cases to be reported from the observation area in the future.

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**СВИДЕТЕЛЬСТВО НЕУДАЧНОЙ АТАКИ
КОСАТКОЙ *ORCINUS ORCA* (LINNAEUS, 1758)
БОЛЬШОЙ БЕЛОЙ АКУЛЫ *CARCHARODON CARCHARIAS* (LINNAEUS, 1758)**

А. Де Маддалена

Международная программа «Морские науки», Миланский университет Бикокка, Милан, Италия
E-mail: alessandrodemaddalena@gmail.com

Представлено первое наблюдение живой большой белой акулы *Carcharodon carcharias* со следами зубов косатки *Orcinus orca* на левом боку. Акула длиной около 3,5 м была замечена 7 июля 2017 г. у острова Сил, в заливе Фолс-Бей, Западный Кейп, Южная Африка. Данное наблюдение свидетельствует о том, что большие белые акулы могут пережить нападение косатки.

Ключевые слова: большая белая акула, *Carcharodon carcharias*, косатка, *Orcinus orca*, Фолс-Бей, ЮАР