1871
ИнБЮМ – IBSS

Морской биологический журнал
Marine Biological Journal
2023, vol. 8, no. 1, pp. 51–55
https://marine-biology.ru

UDC 599.537-15:597.311

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

© 2023 **A. De Maddalena**

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

Received by the Editor 09.08.2022; after reviewing 28.09.2022;
accepted for publication 20.10.2022; published online 14.03.2023.

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 salmons 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

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.

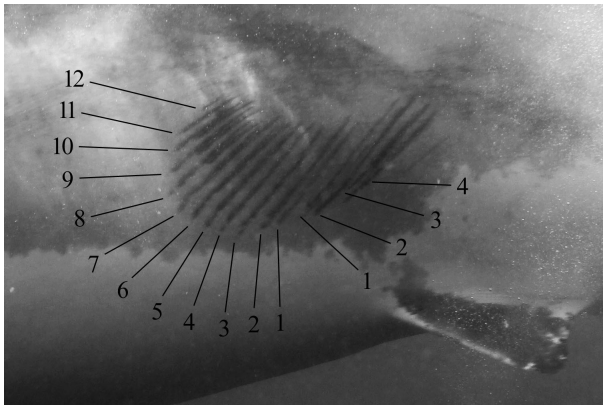

Fig. 2. Close-up of the tooth rake marks on the left side of the estimated 3.5-m female great white shark observed on 7 July, 2017, at Seal Island in False Bay, South Africa. The numbers indicate the twelve scratches on the left matching the twelve teeth in the orca's left half of the lower jaw and the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

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.

Acknowledgement. The author wishes to thank Eric Glenn Haenni for taking the time to edit the text; Chris Fallows, Monique Fallows, the crew of *Apex Shark Expeditions*, and our guests for making it possible to observe the case reported in this article; Olav Magne Strömsholm, Pierre Robert de Latour, and the rest of the crew of *Orca Norway* for making it possible to collect the photographic documentation of orcas in Norway; Alessandra, Antonio, and Phoebe for their support and love.

REFERENCES

1. Best P. B., Meÿer M. A., Lockyer C. Killer whales in South African waters – A review of their biology. *African Journal of Marine Science*, 2010, vol. 32, iss. 2, pp. 171–186. https://doi.org/10.2989/1814232X.2010.501544
2. Best P. B., Meÿer M. A., Thornton M., Kotze P. G. H., Seakamela S. M., Hofmeyr G. J. G., Wintner S., Weland C. D., Steinke D. Confirmation of the occurrence of a second killer whale morphotype in South African waters. *African Journal of Marine Science*, 2014, vol. 36, iss. 2, pp. 215–224. https://doi.org/10.2989/1814232X.2014.923783
3. Brown D. H., Norris K. S. Observations of captive and wild cetaceans. *Journal of Mammalogy*, 1956, vol. 37, iss. 3, pp. 311–326. https://doi.org/10.2307/1376730
4. De Maddalena A., Buttigieg A. *Pesci martello / Hammerhead Sharks.* Formello : IRECO, 2009, 128 p.
5. Engelbrecht T. M., Kock A. A., O'Riain M. J. Running scared: When predators become prey. *Ecosphere*, 2019, vol. 10, iss. 1, art. no. e02531 (8 p.). https://doi.org/10.1002/ecs2.2531
6. Fertl D., Acevedo-Gutierrez A., Darby F. L. A report of killer whales (*Orcinus orca*) feeding on a carcharhinid shark in Costa Rica. *Marine Mammal Science*, 1996, vol. 12, iss. 4, pp. 606–611. http://dx.doi.org/10.1111/j.1748-7692.1996.tb00075.x
7. Fisher H. Killer whale kills great white. In: *Port Lincoln Times* : [site]. URL: https://www.portlincolntimes.com.au/story/2861721/killer-whale-kills-great-white-photos) [accessed: 19.07.2022].
8. Ford J. K. B., Ellis G. M., Balcomb K. C. *Killer Whales. The Natural History and Genealogy of Orcinus Orca in British Columbia and Washington.* 2nd edition. Vancouver, Canada : UBC Press ; Seattle, Washington : University of Washington Press, 2000, 104 p.
9. Ford J. K. B., Ellis G. M., Matkin C. O., Wetklo M. H., Barrett-Lennard L. G., Withler R. E. Shark predation and tooth wear in a population of northeastern Pacific killer whales. *Aquatic Biology*, 2011, vol. 11, no. 3, pp. 213–224. https://doi.org/10.3354/AB00307
10. Jefferson T. A., Leatherwood S., Webber M. A. *Marine Mammals of the World.* Rome : FAO, 1993, 320 p. (FAO species identification guide).
11. Jorgensen S. J., Anderson S., Ferretti F., Tietz J. R., Chapple T., Kanive P., Bradley R. W., Moxley J. H., Block B. A. Killer whales redistribute white shark foraging pressure on seals. *Scientific Reports*, 2019, vol. 9, art. no. 6153 (9 p.). https://doi.org/10.1038/s41598-019-39356-2

12. Norris K. S. Facts and tales about killer whales. *Pacific Discovery*, 1958, January, pp. 24–27.
13. Pyle P., Schramm M. J., Keiper C., Anderson S. D. Predation on a white shark (*Carcharodon carcharias*) by a killer whale (*Orcinus orca*) and a possible case of competitive displacement. *Marine Mammal Science*, 1999, vol. 15, iss. 2, pp. 563–568. https://doi.org/10.1111/j.1748-7692.1999.tb00822.x
14. Reyes L. M., García-Borboroglu P. Killer whale (*Orcinus orca*) predation on sharks in Patagonia, Argentina: A first report. *Aquatic Mammals*, 2004, vol. 30, iss. 3, pp. 376–379. http://dx.doi.org/10.1578/AM.30.3.2004.376
15. Sorisio L. S., De Maddalena A., Visser I. Interaction between killer whales (*Orcinus orca*) and hammerhead sharks (*Sphyrna* sp.) in Galápagos waters. *Latin American Journal of Aquatic Mammals*, 2006, vol. 5, no. 1, pp. 69–71. https://doi.org/10.5597/lajam00095
16. Ternullo R. L., Black N. A., Baldridge A., Shearwater D. Occurrence, distribution and predation behavior of killer whales (*Orcinus orca*) in Monterey Bay, California. In: *Tenth Biennial Conference on the Biology of Marine Mammals* : Abstracts, Galveston, Texas, U. S. A., November 11–15, 1993. Galveston : Society for Marine Mammalogy, 1993, p. 105.
17. Towner A. V., Watson R. G. A., Kock A. A., Papastamatiou Y., Sturup M., Gennari E., Baker K., Booth T., Dicken M., Chivell W., Elwen S., Kaschke T., Edwards D., Smale M. J. Fear at the top: Killer whale predation drives white shark absence at South Africa's largest aggregation site. *African Journal of Marine Science*, 2022, vol. 44, iss. 2, pp. 139–152. https://doi.org/10.2989/1814232X.2022.2066723
18. Visser I. N. Killer whale (*Orcinus orca*) interactions with longline fisheries in New Zealand waters. *Aquatic Mammals*, 2000a, vol. 26, iss. 3, pp. 241–252.
19. Visser I. N. *Orca (Orcinus Orca) in New Zealand Waters.* PhD dissertation. Auckland : University of Auckland, 2000b, 194 p.
20. Visser I. N. First observations of feeding on thresher (*Alopias vulpinus*) and hammerhead (*Sphyrna zygaena*) sharks by killer whales (*Orcinus orca*) specializing on elasmobranch prey. *Aquatic Mammals*, 2005, vol. 31, iss. 1, pp. 83–88. http://dx.doi.org/10.1578/AM.31.1.2005.83
21. Visser I. N., Bonaccorso F. J. New observations and a review of killer whale (*Orcinus orca*) sightings in Papua New Guinea waters. *Aquatic Mammals*, 2003, vol. 29, iss. 1, pp. 150–172.
22. Visser I. N., Berghan J., van Meurs R., Fertl D. Killer whale (*Orcinus orca*) predation on a shortfin mako shark (*Isurus oxyrinchus*) in New Zealand waters. *Aquatic Mammals*, 2000, vol. 26, iss. 3, pp. 229–231.
23. Yukhov V. L., Vinogradova E. K., Medvedev L. P. Ob"ekty pitaniya kosatok (*Orcinus orca* L.) v Antarktike i sopredel'nykh vodakh. In: *Morskie mlekopitayushchie* : materialy VI Vsesoyuznogo soveshchaniya, Kyiv, October, 1975 / E. G. Agarkov (Ed.). Kyiv : Naukova dumka, 1975, pt. 2, pp. 183–185.

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