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Battle for the Top: Killer Whales vs. White Sharks

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Killer whales displace white sharks when they interact due to direct predation or out-competition.

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White sharks and killer whales are both oceanic apex predators that sometimes share ocean waters and menus. During late fall months in the Farallon Islands both predators share a common food source: elephant seal pups. This overlap creates the perfect situation to examine how these apex predators interact as predator-prey or competitors, as this interaction is not well understood.

In order to study this, Jorgensen et al. tagged white sharks with acoustic tags (2006-2013) and conducted long-term surveys of killer whales (1987-2013) at Southeast Farallon Islands. The goals were to collect data on overall seal pup predation rates, killer whale attacks on pups, white shark attacks on pups, and any interactions between killer whales and white sharks. In order to determine predation rates on pups, haul-outs, or when seals exit the water, and the total number of pups were recorded. This allowed researchers to calculate the predation rate on pups by comparing the haul out numbers for each consecutive day. Roughly 1000-1600 surveys were conducted every year during the study.

The surveys and tagging confirmed that killer whales and white shark populations both reached a peak during the late fall-early winter period when elephant seal pups are molting and beginning to venture into the water. During this period, predation rates of both killer whales and white sharks on elephant seal pups also peaked. Interestingly, data from acoustic tags revealed an abrupt and consistent flight pattern of the white sharks from Southeast Farallon Islands to Año Nuevo Island. Within a two-day period, the majority of the tagged white sharks left Southeast Farallon Islands and made the 55-mile journey to Año Nuevo Island. Visual surveys showed that the white shark flight pattern corresponded to the arrival of killer whale pods near Southeast Farallon Islands. This confirmed that there is interaction between killer whales and white sharks. The abrupt nature of the white shark disappearance likely means that killer whales are either hunting the white sharks or out-competing them. The research team set out to figure out which was occurring.

To determine if killer whales were acting as predators or competitors, Jorgenson et al. looked at the main food source for the killer whales, their ecotype, and visual surveys of any interactions. There are three established ecotypes for killer whales: transient, offshore, or resident. Each ecotype has a distinct habitat range and diet that influences if the killer whales are acting as predators or competitors. Transient killer whales that predate on mammals are direct competitors of the white sharks. However, transient killer whales have also been recorded predating on the white sharks. Offshore killer whales act as predators towards white sharks. Resident killer whales are a weak competitor with the white sharks.

Overall, the researchers found that killer whales act as both predators and competitors towards white sharks. The preferred food source for each ecotype showed that if killer whales regularly consume fish, especially sharks, they are more likely to act as predators towards white sharks. Regardless if killer whales acted as a predator or competitor towards white sharks, the effect of these interactions was the same: the white sharks avoid killer whales and will quickly leave the area when killer whales arrive. This study shows that killer whales will fight off any threat to being on the top.

Citation: Jorgensen, S. J., Anderson, S., Ferretti, F., Tietz, J. R., Chapple, T., Kanive, P., … Block, B. A. (2019). Killer whales redistribute white shark foraging pressure on seals. Scientific Reports, 9(1).