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Killer Whale (*Orcinus orca)* Predation on Sharks in Patagonia, Argentina: A First Report

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Abstract

On 21 December 1998, four killer whales (an adult male, two females or immature males, and one juvenile) attacked a group of sevengill sharks (*Notorhynchus cepedianus*) off the coast of Caleta Malaspina, Chubut, Argentina. Persecution, catches, and tossing behavior were performed by the two females or immature males in the inlet. Next day, carcasses of several sharks were found on the beach adjacent to the attack area. Seven of them were intact and sized approximately 2.5 m in length. The presence of complete sevengill shark carcasses on the beach suggests that they were attempting to avoid capture by the killer whales by stranding on the beach. Attacks on sevengills by killer whales in Caleta Malaspina are frequent in some years, especially from mid-December to mid-January when the sevengill seems to use the inlet as a nursery ground. The observation of the same male feeding both on pinnipeds in Peninsula Valdes and on sharks in Caleta Malaspina may indicate that at least some groups in the Southwestern Atlantic could regularly feed on both fish and marine mammals. This is the first report of an attack of killer whales on sharks off the coast of Patagonia, and the first report of tossing behavior in sharks.

Key Words: Killer whale, *Orcinus orca*, attack, tossing behavior, sevengill shark, Patagonia, Argentina

Introduction

Killer whales (*Orcinus orca*) prey on a wide range of marine animals: baleen whales, sperm whales, dolphins, seals, fishes, squids, sea turtles, and seabirds (Hoyt, 1990; Jefferson et al., 1991; Martinez & Klinghammer, 1970; Perrin, 1982); however, predation on sharks rarely has been reported worldwide (Fertl et al., 1996; Hoyt, 1990; Pyle et al., 1999). This is the first report of an attack of killer whales on sharks off the coast of Patagonia. It supports the suggestion by Fertl et al. (1996) that killer whales may take elasmobranchs more often than reported.

Materials and Methods

The observations took place off the coast of Bahía Bustamante (45º 08' S, 66º 32' W), and in Caleta Malaspina (45º 11' S, 66º 30' W) in northern Golfo San Jorge, Patagonia, Argentina (Figure 1). Caleta Malaspina is a 7-km long inlet with a narrow mouth; seven islands; islets that support two breeding rookeries and a haul-out site of southern sea lion (*Otaria flavescens*) (Reyes et al., 1999); and several colonies of seabirds, including magellanic penguins (*Spheniscus magellanicus*), three species of gulls (*Larus* spp.), cormorants (*Phalacrocorax* spp.), terns (*Sterna* spp.), and other waterbirds (Yorio et al., 1998). Running along the southern margin of the inlet there is a channel where the maximum depth is 17 m. There are strong tidal currents in the inlet.

Observations at Bahía Bustamante were made opportunistically by two observers (L. M. R. and P. G. B.) from land by naked-eye and by using 10 x 50 binoculars. Observations at Caleta Malaspina also were made from land, 100-200 m from the whales. In addition, one observer (M. Rojo) and three divers were onboard a 6-m boat in Caleta Malaspina as described below and registered details of the event. The composition of the killer whale group was determined from the individual relative size and shape of the dorsal fin.

Results

On 21 December 1998 at 1530 h, four killer whales were sighted off the coast of Bahía Bustamante. The rising tide (3 h 30 min before high tide) and good weather (Beaufort Sea State of 1) allowed detailed observations. The group was comprised of an adult male, two females (or immature males),

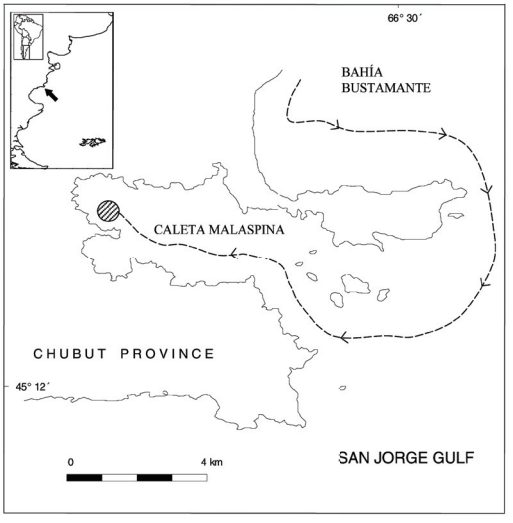

Figure 1. Map of Bahía Bustamante and Caleta Malaspina, Argentina, showing the trajectory followed by the killer whale group and the area of tossing and milling activity (circle)

and one juvenile. The male remained approximately 150 m away from the other three whales, 200-250 m offshore. The females and the juvenile were observed swimming slowly at 50 m parallel to the coastline, making a coordinated series of four short dives separated by 15-30 sec, followed by a more prolonged dive (3-4 min). After approximately 30 min, the three whales turned offshore, joined the male, and moved out of the bay. At approximately 1820 h, 40 min before high tide, the killer whales were resighted at Caleta Malaspina. The animals swam straight into the channel, and in the middle of the inlet, they submerged, disappearing from view. After 4-5 min, they emerged and continued swimming at a faster speed heading towards the back of the inlet. One observer (M. Rojo) was onboard a boat in the inlet and could see a shark swimming at high speed just below the surface, pursued by the killer whales. Moments later, at 150-200 m from the coast, a female killer whale emerged holding a shark by its back and continued swimming into shallower waters. A second female surfaced with another shark held crosswise in her mouth. Then, both whales tossed their prey into the air with their tails. The whales continued tossing the sharks for about 15-20 min. All four whales remained within a 2.5 ha area for the next 30 min. During the following 30 min, the killer whale group remained milling within an area of approximately 2.5 ha, making a series of slow nondirectional swimming as described in Jacobsen (1986) and Osborne (1986), followed by fast nondirectional, erratic swimming, including series of fast turns and rolls at the surface. No more tossing behavior was observed within this 30 min period. Even though no blood or organs could be observed in the water, a group of kelp gulls (*Larus dominicanus*) followed the killer whales and appeared to be feeding on the surface or just underneath it. Finally, at 1910 h, 10 min after the slack tide, the killer whales left the area, swimming back into the channel heading to the mouth of the inlet. The whole chase and attack event lasted about 50 min and occurred during the slack tide.

The next day, carcasses of 17 sharks were found on the beach located adjacent to the attack area. Prey were identified as the sevengill shark, *Notorhynchus cepedianus* (Elasmobranchii: Hexanchiidae). Seven of these animals were intact and sized approximately 2.5 m in length. The rest of the carcasses showed killer whale bite marks on the back part of their bodies, and part of the belly area, including the liver, was bitten off.

Discussion

According to local workers (M. Rojo, H. Hernández), attacks on sevengills by killer whales in Caleta Malaspina are relatively frequent from mid-December to mid-January in some years. The unique human activity in the inlet is the artisanal collection of commercial algae by scuba divers. The presence of whales always interrupts the work of the scuba divers until the animals leave the area. According to their testimony, carcasses of stranded sevengills and the remains of sharks are frequently found on the beach after the attacks.

The sevengill is one of the most common species of large sharks in temperate coastal waters of the Northwestern and of the Southwestern Pacific, and of the South Atlantic (Ebert, 1996; Guzmán & Campodónico, 1976). The species reaches more than 2.6 m in length and uses bays as nursery grounds (Ebert, 1986, 1989). Studies on the movement patterns of sevengills carried out in South Africa suggested that they return to the same grounds for breeding between late spring and summer (Ebert, 1996). Caleta Malaspina is known locally for the abundance of this species during these seasons. Even if little is known about the habits of sevengills, Hexanchiids are apparently slow-moving bottom dwellers (Tinker & DeLuca, 1973). In fact, in Caleta Malaspina, sevengills are never seen on the surface. If this is the case, whales might be looking for these sharks at the bottom of the channel, and once they are found, they are chased towards shallower waters. Benthic foraging has been reported for killer whales feeding on stingrays (Visser, 1999), but on those occasions killer whales were observed with mud on their

heads. Killer whales were not seen with mud on their heads in our case—maybe because they do not need to dig in the muddy bottom of Caleta Malaspina to look for sharks.

Cooperative herding of prey to trap them against physical barriers such as the bottom of the channel or the coast has been reported for killer whales (Heimlich-Boran, 1988; Hoelzel, 1993; Visser, 1999). Rays were observed trying to escape by jumping out of the water and even proceeding some distance from the coastline (Visser, 1999). This could explain the presence of complete sevengill shark carcasses on the beach, assuming they were attempting to avoid capture by the killer whales by stranding on the beach. On the other hand, the finding of partially eaten sharks could be related to selective feeding on energy-rich portions, a common tactic in killer whales (Heithaus & Dill, 2002).

Killer whales have been reported tossing dolphins (Constantine et al., 1998; Frost et al., 1992), penguins, pinnipeds (Guinet, 1992), and rays (Visser, 1999) during attacks. This is the first report of killer whales tossing sharks. The function of tossing behavior is unclear, but it has been suggested as a strategy to tenderize the prey, debilitate dangerous prey and complete the kill, or even train calves or juveniles in hunting techniques (Ford et al., 1998; Heithaus & Dill, 2002).

Fast, nondirectional swimming behavior was interpreted by several authors as an indication of killer whale feeding because it was always seen when an interaction with fish prey occurred (Hoelzel, 1993). Hoelzel reported that this swimming behavior was more frequent during milling than during other sightings, suggesting that some proportion of time spent in milling was spent feeding. The observation of milling associated with feeding behavior during slack tide is consistent with Felleman (1986), who concluded that killer whale milling behavior was more common during slack tide when fishes also tend to mill.

The habits, diet, and composition of killer whale groups in Patagonia are poorly known. It is not clear if the groups usually sighted in northern Patagonia are the same ones observed in Caleta Malaspina, about 500 km south; however, a male photographed in Caleta Malaspina, that was involved in shark attacks, had been previously identified by his obvious dorsal-fin deformity in Península Valdés (Juan Carlos López, pers. comm.). This male usually participates in attacks on pinnipeds at Península Valdés. Killer whales capture southern sea lions and southern elephant seals (*Mirounga leonina*) from the coasts of Península Valdés mainly during February and March (Hoelzel, 1991; Iñiguez, 2001; López & López, 1985). During these months, pups learn to swim, and they spend their time swimming near the coastline, where they are caught by attacking killer whales. That we observed a member of a killer whale group feeding both on pinnipeds and on sharks may indicate that at least some groups in the Southwestern Atlantic could regularly feed on both fish and marine mammals, as observed in Crozet Island (Guinet, 1992). In that case, killer whales in Patagonia might be exploiting different food sources according to their spatial and temporal predictability.

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