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Killer whale (*Orcinus orca*) sightings and depredation on tuna and swordfish longline catches in southern Brazil

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Abstract

Observations of killer whale (*Orcinus orca*) depredation on tuna and swordfish longline fisheries in southern Brazil were made during nine cruises on board tuna boats, from August 1987 to August 1991. During the astral winter, fisheries occur in south and southeast Brazil, mainly in the latitudes between 30°S and 35°S and from November to March they are carried out off the Brazilian northeast coast. Killer whales and sharks commonly attack hooked tuna (*Thunnus* spp.) but killer whales seem to prefer the swordfish (*Xiphias gladius*) reducing the fishermen's profits. In the southern region, more than 50% of the daily swordfish catch may be lost due to killer whale depredation, and occasionally it may reach almost 100%. Killer whales avoid the head and, on some occasions, the vertebral column and fins, eating preferentially the flesh. They rip the body of the fish and leave torn borders, while sharks leave clear-cut bites which are relatively small. Killer whales were sighted in groups of one to ten animals, the solitary animals being always males.

Introduction

The longline fishery in Brazil

The Brazilian longline tuna fisheries began in the northeast region. Vessels from the commercial Japanese fleet fished in the waters of Brazil from 1956 to 1971. In 1969, the Brazilian fishery began, operating three to nine national vessels per year, until 1988. These vessels worked beyond the continental slope of the south and southeast regions of Brazil (23°S–33°S) (Zavala-Camin, 1987). From 1976 to 1992, Korean and Japanese boats were leased by Brazilian companies, which carried out their activities in the northeastern, and mainly southern region. Until 1994, both Brazilian and leased vessels accounted for 33 working vessels: 16 from the south, 15 from the southeast and 2 from the northeast region. Presently, vessels are operating only from the port of Santos (southeastern Brazil), but the fishing spots remain basically unchanged.

Throughout the austral cold months (April–October) the fishing occurs in the south and southeast, mainly in latitudes 30°S–35°S, corresponding to approximately 73% of the fishing effort for that period. In the spring and summer (November–March), vessels move up to the Atlantic equatorial region off the Brazilian northeast coast to fish in the offspring grounds of the target species (Antero Silva, 1992). Brazilian longliners operate in water depths of 500–3500 m, mainly during the third trimester, when tuna (*Thunnus* spp.) and swordfish (*Xiphias gladius*) are most abundant (Amorim & Arfelli, 1984). These national vessels remain at sea for approximately 18 days, whereas the foreign leased boats fish from four to six months, with a higher than average fishing effort (i.e. hooks per day) than the national vessels.

The killer whale

Killer whales inhabit all major oceans and seas (Dahlheim, 1981; Leatherwood & Reeves, 1983) and are considered opportunistic feeders. However, some killer whale populations are specialized in their foraging strategies (López & López, 1985; Heimlich-Boran, 1988). Diets may vary seasonally and also within a region (Dahlheim, 1981; Matkin & Leatherwood, 1986). Prey species include squid, fish, marine turtles, seabirds, small marine mammals and great whales (Caldwell & Caldwell, 1969; Baldridge, 1972; Shevchenko, 1975; Castello, 1977; Condy *et al.*, 1978; Dolphin, 1987; Lowry *et al.*, 1987; Campbell *et al.*, 1988; Heimlich-Boran, 1988; Silber *et al.*, 1989; Felleman *et al.*, 1991; Jefferson *et al.*, 1991). Studies of recognizable killer whale pods in the coastal waters of the northeastern

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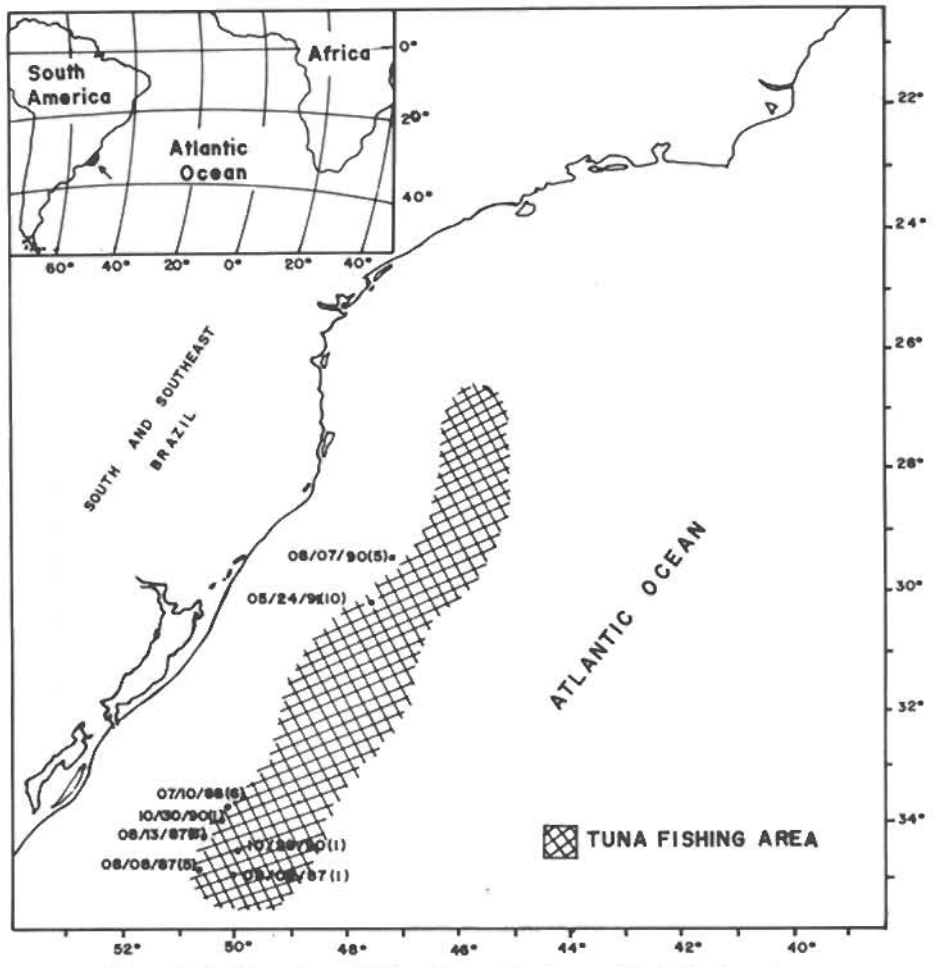

Figure 1. Sighting points of killer whales with dates and individual numbers.

Discussion

Sivasubramanian (1965) states that killer whales are often found around tuna longline boats in the Indian Ocean where, together with sharks, they damage up to 4% of the annual catch and may scare fish away from, or into, the hooks. Leatherwood *et al.* (1991) pointed out that the behavior of orcas described by Sivasubramanian (1965) is typically displayed by false killer whales (*Pseudorca crassidens*) in many areas. The possibility that false killer whales are also taking hooked fish in southern Brazil is not discarded. At the same time, in all opportunities in which killer whales were sighted near the vessel, damaged fish were hauled up.

Sasaki (1985) (mentioned by Dahlheim, 1988), Nemoto (1968) and Nakamura (1985) reported tuna longline interactions with killer whales in the northern Atlantic. Matkin (1986), Matkin *et al.* (1987*a*) and Dahlheim (1988) pointed out that the killer whale depredation on the longline fisheries of Pacific blackcod (*Anoplopoma fimbria*) in Alaskan waters may reduce their commercial value. In those cases, fish showed extensive rake marks made be killer whale teeth. Fishermen attempted to resolve this problem by moving to other areas, using sonic waves, momentarily stopping fishing operations, discharging electric currents and shooting or throwing explosives to frighten the killer whales away from their gear. Occasionally, fishermen will also change their target species which seems to show the best results.

Although Nakamura (1985) has considered it very improbable that the killer whale would commonly prey on large pelagic fish in the environment, it is known that *Orcinus* preys on bluefin tuna regularly in the northwest Atlantic (T. Jefferson, pers. comm.). Nevertheless, longline hooked fish

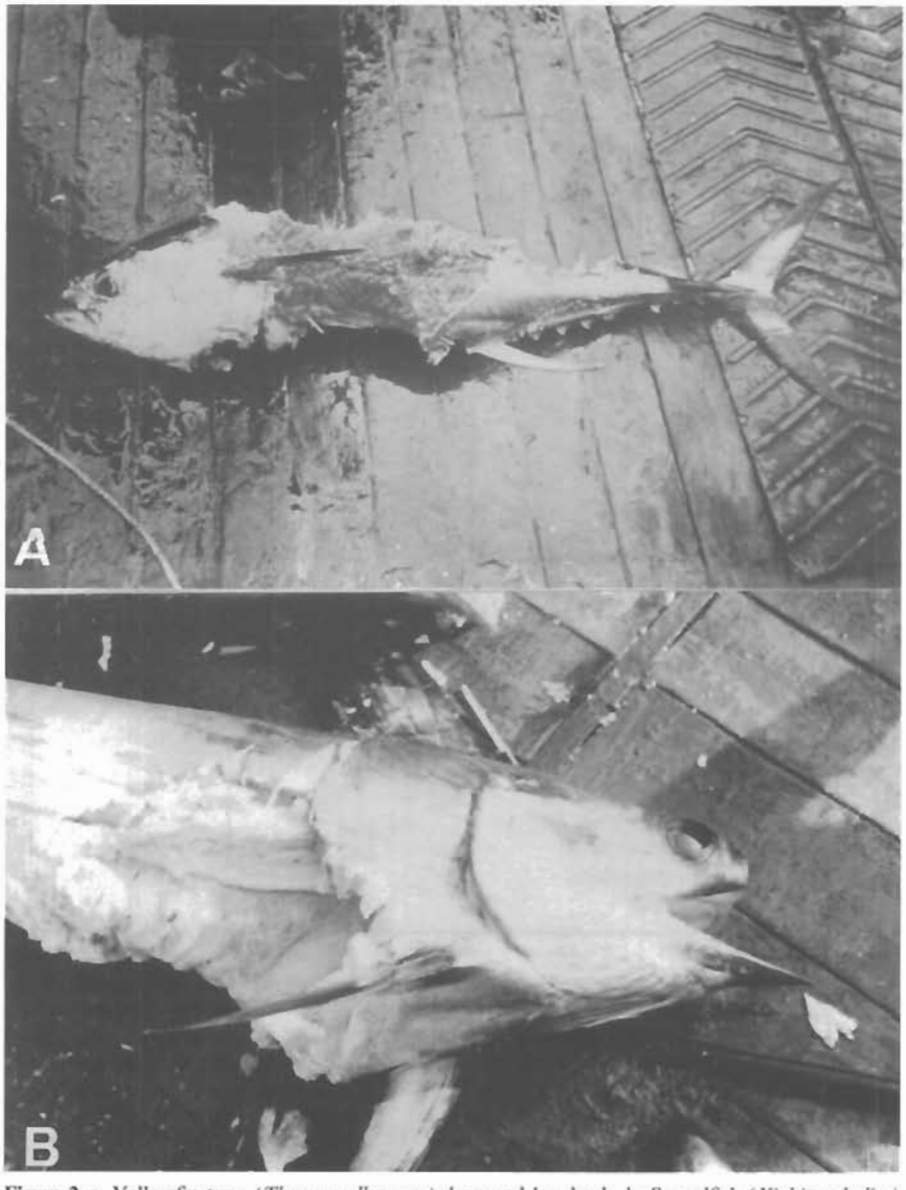

Figure 2. a. Yellowfin tuna (*Thunnus albacares*) damaged by shark. b. Swordfish (*Xiphias gladius*) damaged by killer whale.

would likely be a new and effortless food option to the predator. This interaction is an example of how a new fishing gear introduced in southern Brazilian waters, affects the food supply of another member of the ecosystem, although interfering with fisheries.

The attacks are particularly noticeable toward swordfish, but it is difficult to know if the damage does not occur significantly on tuna. Because these fish do not have the 'sword' of *X. gladius*, killer whales may eat the tuna whole, without leaving evidence. Losses may not be confined just to fish damage. When a predator is present on the fishing ground the target species may be frightened away, forcing fishermen to change location, looking for areas where attacks do not occur. This displacement wastes time, fuel and food supplies for the crew. Further studies on killer whale depredation on the tuna longline fishery is necessary to verify the extent to which the killer whales have been responsible for the decline in the hooked rate of fish and to

Figure 3. Solitary male killer whale swimming near longline vessel in Southern Brazil.

investigate methods that aim to minimize or prevent losses.

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