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A REPORT OF KILLER WHALES (*ORCINUS ORCA*)
FEEDING ON A CARCHARHINID SHARK IN COSTA RICA

Killer whales (*Orcinus orca*) consume a large variety of prey: marine mammals, fishes, seabirds, sea turtles, and cephalopods (*e.g.*, reviews provided by Martinez and Klinghammer 1970, Hoyt 1984, Perrin 1982, Jefferson *et al.* 1991). However, elasmobranchs (sharks, skates, and rays) are found infrequently in killer whale stomachs (Castello 1977), and few observations of killer whale predation on elasmobranchs have been reported. We present an account of a killer whale attack on an unidentified carcharhinid shark and a review of killer whale predation on sharks and other elasmobranchs.

On 2 May 1992 at 0815, a group of four killer whales was sighted 4 km from the mouth of Golfo Dulce (8°22'N, 83°12'W), in the Pacific region of southern Costa Rica. The sighting was made incidental to a study of bottlenose dolphin (*Tursiops truncatus*) ecology in the area. Sunny weather with a Beaufort sea state of 1 facilitated detailed observations of the event. The killer whales were observed from a 5-m inflatable boat for one hour and were recorded on 8-mm video tape and 35-mm slide film. From their size relative to the observation platform, the group was determined to consist of three subadult males or adult females (whales A and B were an estimated 6–7 m long, whale C was about 5 m) and one calf (about 3 m). Individuals were identified by saddle patches and natural markings on their dorsal fins (Bigg 1982). Whale A and the calf had an undetermined number of cirriped barnacles *Xenobalanus* sp. attached to their dorsal fins, making for easy identification.

The whales were first observed milling within 10 m of each other, making short duration dives (< 30 sec) with rapid turns that created surface foam. Although the whales, at that time, were not observed carrying anything in their mouths, one female magnificent frigate bird (*Fregata magnificens*) was seen dipping within 10 m of the whales. At 0819 whale A was

observed holding a fresh, entire shark (about 1.5 m in length) in its mouth. At 0826, whale A was observed carrying a mutilated portion of the shark. At this time, the calf moved to whale A's side and dove while whale A remained at the surface. Twenty seconds later whale A was observed holding a noticeably smaller portion of the shark. At 0829 the calf was observed with shreds of shark flesh trailing from its mouth. The whales began a pattern of separating (by as much as 50 m) and rejoining (< 10 m apart). In this milling pattern the calf remained within 10 m of whale A or B. The rapid turns at the surface observed earlier no longer occurred. On several occasions, whale A remained at the surface for 3–5 sec, while one or two of the other three whales dove beneath or around it. Because of the angle of view, it was not possible to observe the shark at this time. However, at 0834 whale B was observed to have the posterior third of a shark, presumably remains of the original one, in its mouth. At 0835 whale B moved away from the three other whales (milling within 20 m of each other) and remained more than 100 m from the subgroup. Whale A, which was originally seen with the shark, had nothing in its jaws at this time. At 0842 whale C was observed for the first time with a portion of shark flesh. At 0846 the milling ended, and the three-whale subgroup moved towards whale B, which was more than 100 m southwest of them. The whales were last observed at 0915 approximately 2 km southwest of the location where they were first encountered.

It is believed that one shark was captured by a single killer whale, presumably whale A (this whale was the first one seen holding the shark while it was still fresh and had the longest contact with the prey) and then subsequently shared and consumed by all members of the group. The shark was determined to be of the family Carcharhinidae, based on its rounded snout (Castro 1983). Twelve carcharhinid species have been reported for the Pacific coast of Costa Rica or neighboring countries (López and Bussing 1982). It was not possible to obtain detailed information on the fins of the shark; however, based on a photograph of the underside of its head, coloration, and body size, it was determined that the animal was either a bull (*Carcharhinus leucas*) or a lemon (*Negaprion brevirostris*) shark. Blue (*Prionace glauca*), hammerhead (*Sphyrna* sp.), Galápagos (*Carcharhinus galapagensis*), and an unidentified species of reef shark were the only carcharhinids that killer whales were previously known to prey upon (Table 1).

Although killer whales have been studied in many locations worldwide, in some cases for longer than 20 yr (Bigg 1982), few accounts of killer whale predation on elasmobranchs have been reported (Table 1). Since most of these episodes appear to take place in the open ocean, the rarity of reports may be related to the fact that few behavioral observations of killer whales are made in those waters. For example, this is the first report of killer whales in waters close to Costa Rica. Our review supports this line of reasoning and suggests that elasmobranchs may be taken on more occasions than originally considered.

Table 1. Accounts of killer whale predation on elasmobranchs.

Species	Location	Evidence	Source
Rays and skates			
long-tailed sting ray (<i>Dasyatis thetidis</i>)	Bay of Islands, New Zealand	feeding	I. Visser, personal communication ^a
short-tailed sting ray (<i>Dasyatis brevicaudatus</i>)	Bay of Islands, New Zealand	feeding	I. Visser, personal communication ^a
eagle ray (<i>Myliobatis tenuicaudatus</i>)	Bay of Islands, New Zealand	feeding	I. Visser, personal communication ^a
manta ray (<i>Manta hamiltoni</i>)	Galápagos Islands	feeding	D. Palacios, personal communication ^b
manta ray (<i>Manta</i> sp.)	Galápagos Islands	feeding	Watson 1981
manta ray (<i>Mobula</i> sp.)	New Guinea	feeding	Brown 1988
eagle ray (<i>Myliobatis</i> sp.)	Brazil	teeth in stomach, stingers in jaw	Castello 1977
eagle ray (<i>Myliobatis</i> sp.)	Brazil	stinger in mouth	Dalla-Rosa <i>et al.</i> 1994
eagle ray (<i>Myliobatis</i> sp.)	Galápagos Islands	feeding	de Roy 1993
electric ray (<i>Torpedo californica</i>)	off southern Catalina Island, California, USA	feeding	Norris and Prescott 1961
unid. skate	?	stomach	Tomilin 1957
Sharks			
reef shark	New Guinea	feeding	Brown 1988
basking shark (<i>Cetorhinus maximus</i>)	Dunedin, New Zealand	feeding	S. Dawson, personal communication ^c
basking shark (<i>Cetorhinus maximus</i>)	southern California, USA	feeding	Brown and Norris 1956, Norris 1958

Table 1. Continued.

Species	Location	Evidence	Source
basking shark (<i>Cetorhinus maximus</i>)	“south subtropics”	stomach	Yukhov <i>et al.</i> 1975
hammerhead shark (<i>Sphyrna</i> sp.)	Kimbe Bay, New Guinea	feeding	Skinner 1994
Galápagos shark (<i>Carcharhinus galapagensis</i>)	Galápagos Islands	feeding	T. Pusser, personal communication ^d
blue shark (<i>Prionace glauca</i>)	Big Sur, California, USA	feeding	T. Norris, personal communication ^e
blue shark (<i>Prionace glauca</i>)	Monterey Bay, California, USA	feeding	Ternullo <i>et al.</i> 1993
blue shark (<i>Prionace glauca</i>)	southeast Brazil	feeding	E. Secchi, personal communication ^f
blue shark (<i>Prionace glauca</i>)	Bay of Islands, New Zealand	feeding	I. Visser, personal communication ^a
whale shark (<i>Rhiniodon typus</i>)	Gulf of California, Mexico	feeding	video (copy courtesy of R. Snodgrass, Scripps Institute, San Diego, Calif., USA)
whale shark (<i>Rhiniodon typus</i>)	Gulf of California, Mexico	feeding	C. Salinas, personal communication ^g
carcharhinid shark	California, USA	stomach	Rice 1968
carcharhinid shark	Golfo Dulce, Costa Rica	feeding	this report
unid. sharp sp.	Puerto Gato, Gulf of California, Mexico	feeding	T. Norris, personal communication ^e
unid. shark sp.	?	stomach	Tomilin 1957
unid. shark sp.	southern California, USA	feeding	Cousteau and Cousteau 1970

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