

VIDEO-DOCUMENTATION OF A KILLER WHALE (*ORCINUS ORCA*) PREDATORY ATTACK ON A GIANT MANTA (*MANTA BIROSTRIS*) IN THE GALÁPAGOS ISLANDS¹

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Killer whales (*Orcinus orca*) are one of the most widely distributed mammals worldwide (Ford *et al.*, 2000). Their prey includes a wide variety of marine animals (Ford *et al.*, 1998; Pauly *et al.*, 1998; Ford 2002). All documented accounts of killer whale predation on various species of elasmobranchs (rays and sharks) in several regions of the global ocean, including Galápagos waters, were reviewed by Fertl *et al.* (1996) and more recently by Sannino Sorisio *et al.* (2006), who provided an updated table with all known attacks on sharks. In Table 1, we provide an updated listing of all known killer whale predatory interactions with rays.

The first documented observations of killer whale predatory behavior in the Galápagos Islands involved sperm whales (*Physeter macrocephalus*) and Bryde's whales (*Balaenoptera edeni*) (Arnbom *et al.*, 1987; Brennan and Rodríguez, 1994). Since then, a review of killer whale occurrence in Galápagos has revealed not only the nearly ubiquitous (albeit highly unpredictable) presence of this species throughout the islands, but also the broad array of marine vertebrates upon which they prey, which includes teleost and elasmobranch fishes, sea turtles, otariids, and cetaceans (Merlen, 1999). Elasmobranch species taken in Galápagos waters include: Galápagos (*Carcharhinus galapagensis*) and hammerhead (*Sphyrna* spp.) sharks, as well as giant manta (*Manta*

birostris cf. *M. hamiltoni*; Grove and Lavenberg, 1997), sting (*Dasyatis* sp.), and eagle (*Myliobatis* sp.) rays (Fertl *et al.*, 1996; Merlen, 1999; Sonnino Sorisio *et al.*, 2006).

Notwithstanding the mounting evidence that elasmobranchs are an important food item in the diet of killer whales, at least in some parts of the world, the behavioral details of these predatory events are rarely observed because they occur mostly underwater. This is exemplified by the fact that no good photographs are available to better illustrate the attacks or interactions reported in the literature. Here we present the first detailed observations of killer whale predation on a giant manta in Galápagos waters, including still photographs, based on an underwater video recording. The video recording of this event was made on 4 June 2004 by a tourist (J.Lalonde⁶) traveling aboard an ecotourism vessel north of Fenandina and Isabela Islands (~ 0° 00.0'N - 91 36.7'W), relatively close to the Bolívar Channel that separates the two islands. Mr J. Lalonde kindly gave us permission to use his video for analysis.

The Lalonde video involves an underwater attack by killer whales on an unidentified large ray. The initial portion of the video shows a pod consisting of 4-5 killer whales, without adult males, in which a sub-adult or female-sized individual dives vertically from the surface toward the center of the ray's body (Figure 1a).

Table 1. Compilation of reported ray predation events worldwide by killer whales (*Orcinus orca*).

REGION	SPECIES OF RAY	SOURCE
Galápagos	Unidentified Giant manta, <i>Manta</i> sp. Eagle ray, (<i>Myliobatis</i> sp.) Stingray, (<i>Dasyatis</i> sp.) Giant manta, (<i>Manta birostris</i>)	Watson (1981) in Fertl (1996); de Roy (1993)* in Fertl (1996); Merlen (1999); and this study
Brazil	Eagle ray, (<i>Myliobatis</i> spp.)	Castello (1997) in Fertl (1996); Dalla-Rosa <i>et al.</i> (1994) in Fertl (1996)
New Guinea	Manta ray, (<i>Mobula</i> sp.)	Brown (1988) in Fertl (1996)
New Zealand	Eagle ray (<i>M. tenuicaudatus</i>) Long-tailed stingray (<i>Dasyatis thetidis</i>) Short-tailed sting ray (<i>D. brevicaudatus</i>)	Visser (1999)

* de Roy, T. (1993) Orca bull feeding on eagle ray, Santa Cruz, Galápagos. Ocean Realm, Jan/Feb. Photograph.

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⁵ WildAid-Galapagos, Calle Las Fragatas y Av. Charles Darwin, Puerto Ayora, Santa Cruz Island, Galápagos Islands, Ecuador.

⁶ Miracle on the Equator: features amazing footage of Orcas in the wild; permission use released on 7 May 2007. Available at: <http://www.jameslalonde.com/GalapagosVids.html> or from http://www.youtube.com/watch?v=_KfZJmaRW-o. Accessed on 5 May 2007.

The whale hit and dragged the ray downward, without shaking it, into deep waters (Figures 1b and 1c). Further scenes of video showed that the attack was successful as the killer whale captured and killed the ray swimming horizontally to another individual (Figure 1d). It is possible that the whale used the bottom as a physical barrier to trap and kill the ray. A second portion of the same underwater video recording shows an adult individual and a juvenile whale, along with others members of the pod, displaying, tearing apart and holding in its mouth a large piece of flesh of an unidentified prey item, presumably the ray (Figures 2d, 3a-3b). According to the observations of the video's author, the killer whale pod was 'swimming, playing, and actually killing and eating a manta ray'⁵.

The giant manta is the only large species of ray recorded and collected for Galápagos, where it is abundant and commonly seen swimming near the surface or displaying large vertical circles in the water column while feeding (Grove and Lavenberg, 1997). Giant mantas are also the most commonly observed prey item taken by killer whales in Galápagos, with a total of five individuals killed or bitten

during opportunistic observations between 1976 and 1999 (Merlen, 1999). Munk's devil ray (*Mobula munkiana*) is a less common, medium-sized ray that is rarely seen in Galápagos waters, swimming at the surface or in mixed aggregations with spotted eagle rays (*Aetobatus narinari*) (Grove and Lavenberg, 1997). It is more likely that the individual hunted by the killer whales in this case was a giant manta since the size, shape and external morphology depicted in Figure 1a closely resemble that of this species.

This is the first video illustrating predation on a giant manta by killer whales in Galápagos, confirming and supporting previous field observations of elasmobranch predation (Fertl *et al.*, 1996; Sonnino Sorrisio *et al.*, 2006). We hypothesize that Galápagos killer whales resemble a generalist-opportunistic ecotype rather than either a marine-mammal eater or an elasmobranch-specialized predator (cf. Visser, 1999). Although giant mantas appear to be an important item in the diet of Galápagos killer whales (Merlen, 1999), about 40% of sightings have been made near large Galápagos sea lion (*Zalophus wollebaeki*) colonies (Merlen, 1999), implying a kind of predator-prey association between them, as proposed by Palacios (2003). From a

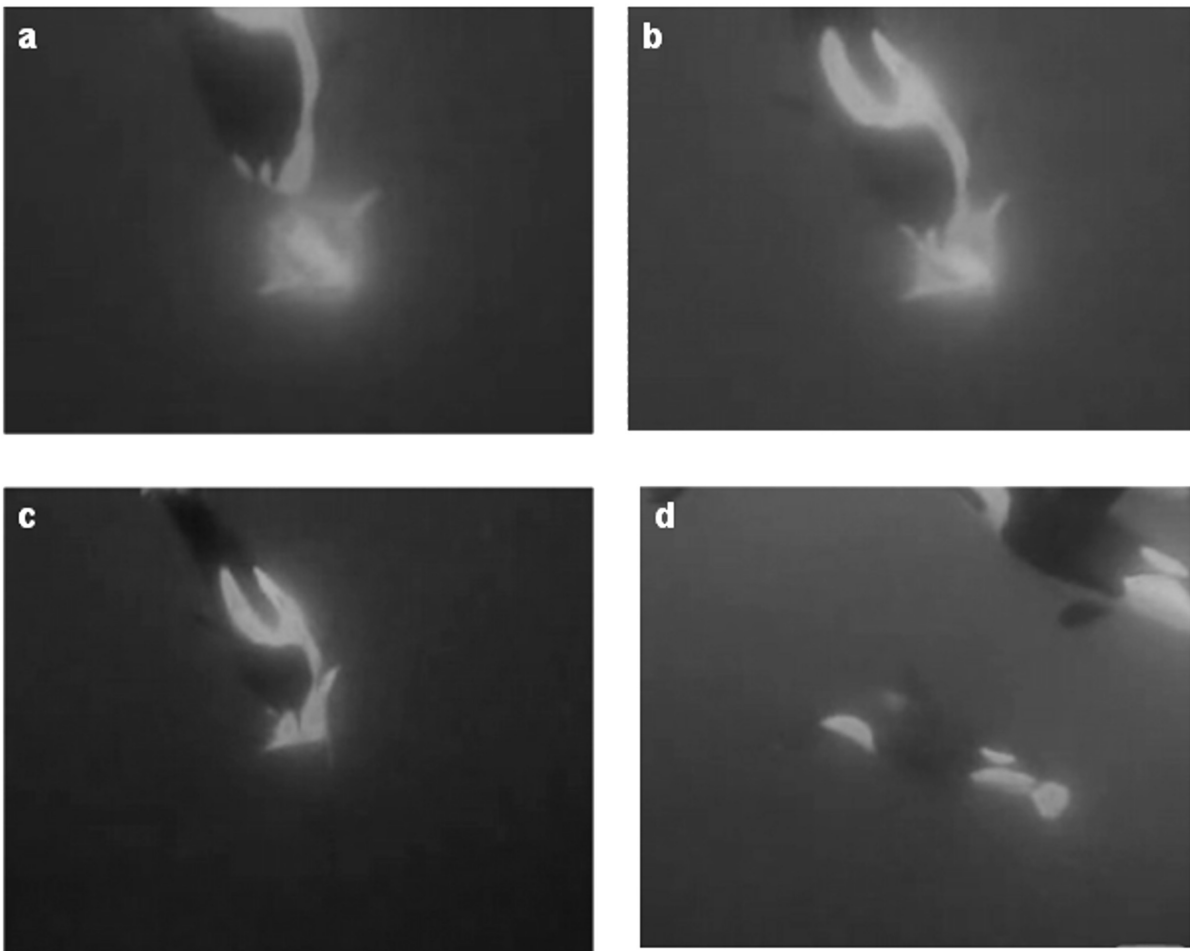


Figure 1. Scenes of the underwater video by J. Lalonde (2004) showing the killer whale predatory attack on a giant manta, (*Manta birostris*) in Galápagos waters: a) a killer whale diving from the surface and approaching the ray; b - c) the killer whale using its snout to force the ray into deeper waters, and d) carrying the prey.

behavioral ecology standpoint, killer whale predation on manta rays may provide energetic benefits relative to the hunting costs. Since these rays swim at low speeds and presumably show little resistance to predation compared to other potential prey (e.g., otariids or cetaceans), the energy expenditure to detect, attack and eat these elasmobranchs may be minimized. The choice to feed on manta rays may also be linked to training and social learning processes of younger animals that later participate later in coordinated hunting. Indeed, during the underwater video observations, juvenile and subadult animals participated actively during the hunting (Figures 2a-b).

Understanding the foraging ecology and behavior of killer whales requires studies at both regional and seasonal scales in order to assess dietary habits and their potential impacts on prey populations (Matkin *et al.*, 2007). Although a photo-identification catalog for killer whales from the eastern tropical Pacific has recently become available, ecotypes have yet to be defined and recognized (Olson and Gerrodette, 2008). More photo-identification surveys, behavioral ecology research, population genetic structure, and studies of acoustic communication and vocal behavior are required to improve our understanding of Galápagos killer whales.

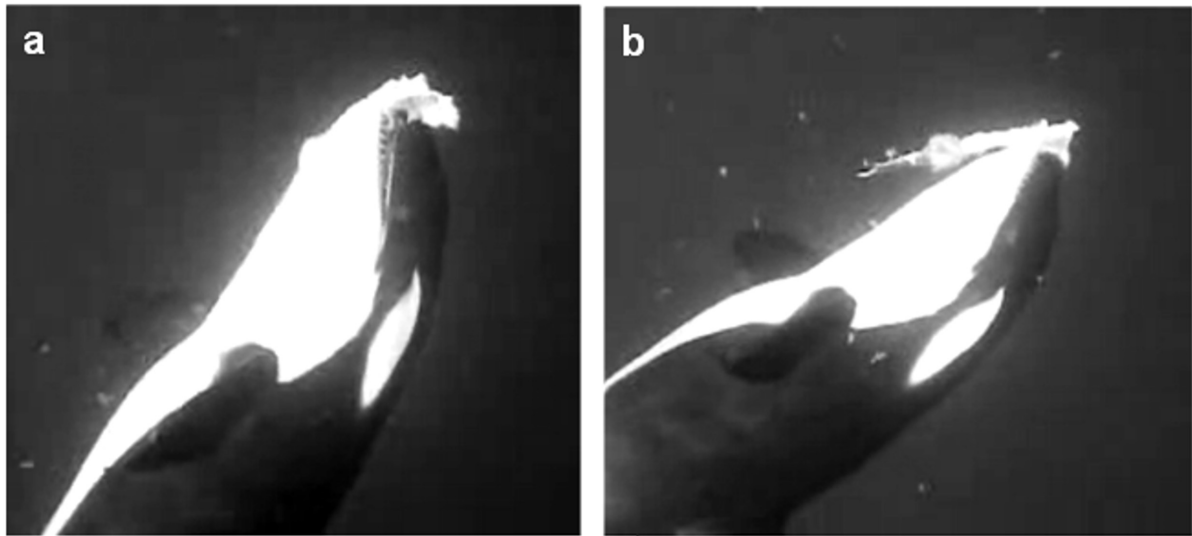


Figure 2. Scenes of a young individual a) tearing apart a piece of leftover flesh; and b) holding and carrying a piece of flesh.

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