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GRAY WHALES WITH LOSS OF FLUKES ADAPT AND SURVIVE

J. URBÁN R.
V. FLORES DE SAHAGÚN
Departamento de Biología Marina,
Universidad Autónoma de Baja California Sur, Km 5.5,
Carrtera al Sur, La Paz, B.C.S., Mexico 23081
E-mail: jurban@uabcs.mx

M. L. JONES
S. L. SWARTZ
Cetacean Research Associates,
7665 SW 171 Street, Miami, Florida 33157, U.S.A.

B. MATE
Hatfield Marine Science Laboratory,
Oregon State University, Newport, Oregon, U.S.A.

A. GÓMEZ-GALLARDO
M. GUERRERO-RUÍZ
Departamento de Biología Marina,
Universidad Autónoma de Baja California Sur,
Km 5.5, Carrtera al Sur, La Paz, B.C.S., Mexico 23081

Gray whales (*Eschrichtius robustus*), like all cetaceans, use their axial muscles to move their tail and flukes in a dorso-ventral plane to swim. Epaxial muscles bend the vertebral column dorsally in an upstroke; hypaxial muscles bend the vertebral column ventrally in a downstroke. In so doing, the muscles generate thrust forces that are delivered to the water by the flukes, which are considered the main source of propulsive power (reviewed in Pabst *et al.* 1999). Here we report observations of gray whales that have lost their flukes most likely because of entanglement in fishing gear.

Whale-watchers visiting Laguna San Ignacio during the 1982 winter reported seeing a whale without flukes accompanied by a newborn calf. Two of the authors (Jones and Swartz) subsequently photographed this whale in San Ignacio lagoon in February 1982 (Fig. 1). B. Reitherman[1] photographed this fluke-less gray whale in the same lagoon in March 1982. To swim, this animal would rise to the surface normally to blow, then sloping its head downward to dive, roll approximately 90° to one side, and swing the broad side of its tail peduncle laterally, from side to

[1] Personal communication from Bruce Reitherman, Summerland, California, U.S.A., May 2002.

Figure 1. Left side of the peduncle of a fluke-less whale photographed in 1997 at Laguna San Ignacio, B.C.S. Photograph by V. Flores de Sahagún.

side. The presence of a normal calf accompanying this whale indicated that it was a female and apparently capable of reproducing. Another observation of a whale without flukes accompanied by a calf, probably the same sighted at San Ignacio, was also photographed in Magdalena Bay the same year.[2] In March 1983, another author (Mate) photographed a solitary fluke-less gray whale during a field trip to Laguna San Ignacio to tag gray whales with VHF-radio transmitters, but it is not clear whether it was the same animal seen in 1982.

During the winter of 1997, three additional observations of a fluke-less gray whale were made in Laguna San Ignacio. On 24 February, we observed an adult whale for about 30 min. The distal tip of the caudal peduncle was scarred indicating that the wound was not recent (Fig. 1). Initially, this animal was in the company of two adult gray whales, which were swimming behind it. Although all three whales swam at a speed typical for gray whales in the lagoon (approximately 4–5 km/h), the whale without flukes demonstrated an unusual surfacing and diving behavior. When surfacing to breathe, the whale lifted its head above the surface of the water showing its entire gape and sometimes exposing its eyes. When diving, the fluke-less whale always lifted the terminal end of its caudal peduncle above the surface of the water. On 26 February and 3 March this fluke-less whale was resighted swimming alone. We could not confirm that the animal photographed in 1982 and 1983 and on multiple occasions in 1997 was the same whale.

Local fishermen in Laguna San Ignacio recalled seeing gray whales without flukes during the winters of 1976, 1989, and 1992.[3] However, the total number of animals is uncertain. We can only speculate on how these whales may have lost their flukes. However, if the flukes were severed by collision with a vessel, as suggested

[2] Personal communication from S. Lawson, Irvine, California, U.S.A., May 2002.

[3] Personal communication from F. Mayoral, Domicilio conocido, Laguna San Ignacio, B.C.S., Mexico, February 1998.

by Gilmore (1959), the trauma from such a collision, and the loss of blood from the severing of the large arteries that supply blood to the flukes, would likely have been fatal. The extensive scarring present on the terminal distal tip of the caudal peduncle of the fluke-less whale(s) suggest that the loss of the flukes was the result of a more gradual process. Presumably, these animals became entangled in fishing gear and/or lines that became wrapped around the caudal peduncle, and the action of swimming combined with the drag of the gear/lines gradually cut through the tail tissue resulting in the severing of blood vessels, connective tissue, and nerves. This slow process would result in devitalization and necrosis of the flukes and associated tissues, and their ultimate loss.

Gilmore (1959) documented a gray whale "without any trace of flukes" in San Diego Bay on February 1958, and another one near Kodiak Island on May of the same year. Patten *et al.* (1980) reported several living gray whales without flukes including: one in March 1979 off Ensenada, Baja California; and another in March 1980 south of Boca de Soledad, Baja California Sur.

Commercial fishing was permitted within the portions of Laguna San Ignacio utilized by gray whales during the 1970s and 1980s, and included the use of gill nets and lobster-pot gear. On at least four occasions during this period, we observed gray whales and their calves that were carrying nets and float lines wrapped around their tails or through their mouths. More recently, we observed four gray whales with ropes wrapped around their peduncles: one calf in Santo Domingo channel in 1992, one calf and one adult in Laguna San Ignacio in 1999, and one adult in Ballenas Bay outside Laguna San Ignacio in 2001.

The fluke-less whales observed in Laguna San Ignacio apparently are able to swim sufficiently well to undertake an annual migration to the breeding lagoons of Baja California, and in at least one instance, able to reproduce. Recently, in December 2002, a humpback whale with loss of flukes and a very similar scar at the end of the peduncle was observed several times at the Bahia de Banderas, Nayarit, on the Pacific mainland coast of Mexico (Lugo and Rodriguez, 2003), indicating that gray whales are not the only whale species subject to these kinds of injuries.

These observations also suggest that entanglement in fishing gear, while not causing the death of these whales, results in significant disfigurement and likely painful wounds and trauma over prolonged periods. In the Gulf of California, where in only a few regions systematic surveys are being done, there are seven records of whales killed by different kinds of fishing nets between October 2000 and September 2003: four of sperm whales, including three mothers with calf (Gallo-Reynoso, 2003); two of humpback whales; and one blue whale (J. Urbán, unpublished data). We can only wonder how many whales are killed by entanglement in fishing gear and lines each year.

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