

WHALE MORTALITY FROM SHIP STRIKES IN ECUADOR AND WEST AFRICA

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ABSTRACT: We document two unusual cases of a Bryde's and a sei whale struck by container cargo vessels and draped over the bow bulb, respectively in the Southeast Pacific and the Eastern Tropical Atlantic. The 207m-length *P&O Nedlloyd Pantanal* collided with an adult Bryde's whale *Balaenoptera edeni* in the southern Gulf of Guayaquil, Ecuador, on 10 December 2004. The whale showed massive dermal hematoma indicating that it was alive when struck. Similarly, the container ship *OSNA Bruck* arrived at Dakar port, Senegal, on 19 March 1998 with the fresh carcass of a juvenile sei whale *B. borealis* on its bow bulb. The collision occurred between Las Palmas, Gran Canaria and Dakar, Senegal. Freshly dead balaenopterids can hardly be picked up by ships since they sink at death and do not float until decomposition and bloating sets in. A review of previous cases show that ship strikes are rarely recorded in these regions, partly due to the lack of regulations, including no reporting obligation. However, the case studies reveal that another factor may severely augment under-reporting of ship strike mortality. In both instances the crew became aware of the collision only upon arrival at port, suggesting that whales which are hit and killed or wounded, but do not become draped over the bow bulb (if the vessel has one), go unnoticed. The probability of bow draping may be low, and modelling should be attempted. National authorities are encouraged to improve data collection and introduce regulations such as mandatory reporting. These are the first fully documented, fatal whale collisions in Ecuador and West Africa (south of the Canary Islands), and the first struck and killed Bryde's whale in the Southeast Pacific.

RESUMEN: Documentamos dos inusuales casos de ballenas atrapadas en el bulbo de proa de barcos porta contenedores en el Pacífico Sudeste y en el Atlántico tropical oriental. El 10 de diciembre de 2004, el *P&O Nedlloyd Pantanal*, un barco carguero de 207m de longitud, colisionó con una ballena de Bryde *Balaenoptera edeni* en la parte Sur del Golfo de Guayaquil, Ecuador. La ballena estaba fresca y mostraba una extensa zona de la piel con hematomas cuando fue examinada. En un encuentro similar, el 19 de marzo de 1998, el barco porta contenedores *OSNA Bruck* arribó al puerto de Dakar, Senegal, con el cuerpo de una joven ballena sei *B. borealis* sobre el bulbo de proa. La colisión ocurrió entre Las Palmas, Gran Canaria y Dakar, Senegal. Balaenopteridos recién muertos son difícilmente recogidos por los barcos debido a que al morir no flotan sino hasta ya bien avanzado el proceso de descomposición, por lo que no habría duda de que en ambos casos las ballenas estaban vivas cuando la colisión ocurrió. Una revisión de los casos de colisiones de barcos con ballenas ocurridos previamente en ambas regiones demuestra que este tipo de eventos son raramente registrados, en parte debido a la falta de regulaciones respecto a la obligatoriedad de reportarlos a las autoridades. Sin embargo, habría otro factor que explica el bajo número de reportes de ballenas muertas por colisiones; en ambos casos las tripulaciones se percataron de la colisión solo cuando llegaron a puerto, sugiriendo que las ballenas muertas o heridas producto de una colisión que no quedan atrapadas en el bulbo de proa (si es que el barco tiene uno), pasan inadvertidas. La probabilidad que ballenas queden atrapadas en esta parte del barco parecería baja, aunque un estudio de modelación ayudaría a una mejor comprensión del problema. Se recomienda a las autoridades nacionales mejorar la colección de información sobre el tema introduciendo disposiciones tendientes a hacer obligatoria su notificación. Estos son los primeros casos bien documentados de colisiones fatales para ballenas en Ecuador y África occidental (al sur de las islas Canarias) y la primera ballena de Bryde muerta por esta causa en el Pacífico Sudeste.

KEYWORDS: ship strikes, bow bulb, Bryde's whale, humpback whale, sei whale, Ecuador, Senegal, West Africa, *Balaenoptera edeni*, *Balaenoptera borealis*.

Introduction

The increase of both maritime traffic and vessel speed is cause of concern because of the high number of cetaceans involved in collisions around the world (IWC, 2002; Reeves *et al.*, 2003). In their global compilation, Jensen and Silber (2004) informed about 292 cases of ship strikes with whales between 1975 and 2002, most of them in waters of the United States. However, as cautioned by the authors, these cases would represent a small part of the total cases occurred since most collisions are unperceived or under-reported by crews. Collisions with whales occur with all types of vessels including cargo, tankers, cruise and fishing vessels, although they are more frequent with bigger and faster vessels (Laist *et al.*, 2001; Jensen and Silber, 2004).

In general, collisions occur in coastal areas where whales concentrate for feeding or breeding (Laist *et al.*, 2001). The most frequently involved mysticete species include fin (*Balaenoptera physalus*), right (*Eubalaena glacialis* and *E. australis*), humpback (*Megaptera novaeangliae*), gray (*Eschrichtius robustus*), common minke (*B. acutorostrata*) and blue whales (*B. musculus*). The sperm whale (*Physeter macrocephalus*) is the most common odontocete involved (Laist *et al.*, 2001; Jensen and Silber, 2004). The impact on whale populations is unknown, but in the case of the North Atlantic right whales (*E. glacialis*), collisions with vessels were responsible for 35.5% of total recorded mortality in the period 1970-1999 (Knowlton and Kraus, 2001). NOAA Fisheries is currently developing a strategy to reduce whale mortality by ship strikes which includes, among

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others, operational measures for vessels larger than 65ft (19.8m), such as the modification of navigation routes to avoid areas of whale concentration, speed restrictions, and a dynamic management of the area (Silber *et al.*, 2004).

Here we document two recent cases off Ecuador and off West Africa, in which two species infrequently reported in ship strikes, the Bryde's whale (*Balaenoptera edeni*) and the sei whale (*Balaenoptera borealis*) were involved. With the purpose to evaluate their frequency, we reviewed the known cases of collisions with whales in the Southeast Pacific and the Eastern Tropical Atlantic Oceans.

Ship strikes in the Southeast Pacific

The frequency of ship strikes with whales in the Southeast Pacific is poorly known, even though it is an emerging cause of concern as an unassessed, but potentially significant, source of anthropogenic mortality due to the important maritime routes across the region (Flórez *et al.*, in press). Most documented collisions in the Southeast Pacific involve humpback whales. According to Capella *et al.* (2001), at least three cases of humpback whales found dead between 1986 and 2000 in Colombia were believed to be caused by ship strikes. Photos of humpback whales in Ecuador also show wounds on the back, or tails with an entire fluke missing, likely caused by propellers (FEMM catalogue³, unpublished data). Haase and Félix (1994) informed of a 12.6m sperm whale with fractured maxillaries beached in 1991 at Punta Carnero, Ecuador, probably caused by a ship strike. In FEMM's database there are also three other anecdotal cases of ship strikes published in Ecuadorian newspapers: (1) in August 1989 the small purse-seiner *Paquín* sunk after collision with a whale, presumably a humpback whale; (2) in October 1996

the sailboat *Joel* struck a whale, possibly a sperm whale, 120nm offshore during a sailing championship between the Ecuador mainland and the Galápagos Islands; and (3) in August 2001 an open fishing boat was destroyed when it ran into a humpback whale near La Plata Island. In Peru, the NOAA's R/V *Surveyor* struck an undetermined whale 19km off Callao (Laist *et al.*, 2001; Jensen and Silber, 2004). A blue whale *B. musculus* that ran aground, bleeding, on the rocks of isla Don Martín, central Peru, in January 1997 may have collided with a ship (Van Waerebeek *et al.*, 1997). Goya *et al.* (2004) and Luis Santillán (CEPEC, unpublished data) suggested that a ship strike could be the cause of a sperm whale stranded at Paramonga, Peru.

Ecuador

At daybreak on 10 December 2004, the 207m-length cargo ship *P&O Nedlloyd Pantanal*, en route from Callao, Peru, arrived at the quarantine area of the port of Guayaquil, Ecuador, with a freshly dead Bryde's whale draped over the bow bulb. The species was identified by the diagnostic presence of three head ridges, colouration pattern and the form and size of the dorsal fin.

From information provided by the captain, on the night of 9 December, between 20:00h and 21:00h, the ship's speed dropped from 18.5 to 16.8kn without obvious reason. Engine power had to be increased to reach the entrance of the inner estuary of the Gulf of Guayaquil on schedule. At the moment when speed decreased, and presumably the collision occurred, the ship was in the southern part of the Gulf (03°34'S, 80°58'W - 03.20°S, 80°48'W), at the border between Ecuador and Peru (Figure 1). The impact was not perceived by the crew who realised the event only when the ship entered port.

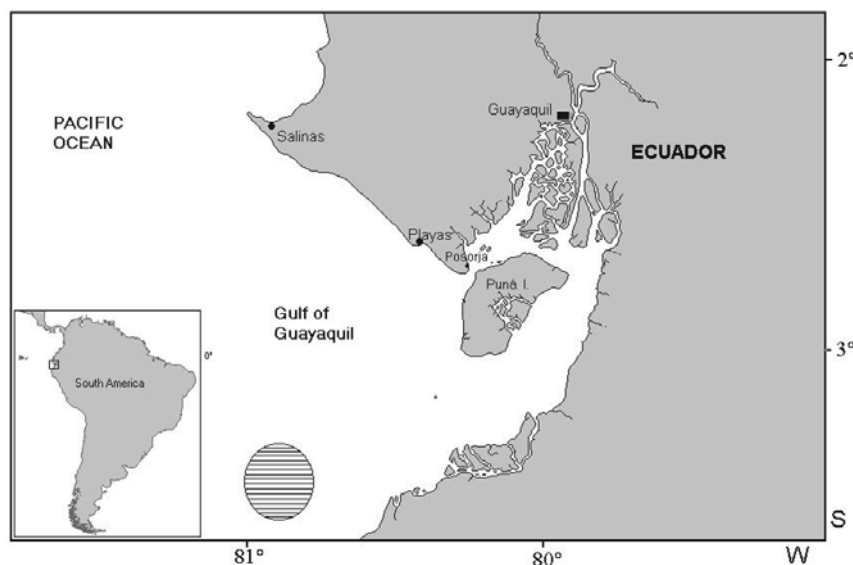


Figure 1. Area (hatched circle) at the entrance of the Gulf of Guayaquil where the collision with a Bryde's whale occurred on 9 December 2004, according to information received from the captain of the cargo ship *P&O Nedlloyd Pantanal*.

³Currently the FEMM catalogue contains photographic evidence of individual identification for around 500 different individuals.

The whale was positioned on the bow bulb on its belly, midbody out of the water (Figure 2). The area of main impact, however, was not visible because the bow's sharp edge was embedded in the left flank, so the full extent of trauma could not be evaluated. The specimen was freshly dead with most of the skin intact and retaining pigmentation: dark gray dorsally, light gray on the flanks and a white throat. On its right side, over an area of ca. 4m between the flipper and the dorsal fin, the epidermis was abraded. The exposed blubber showed massive dermal hematoma, from behind the ventral grooves rearward, beyond the dorsal fin. A smaller area of damaged epidermis and bruises extended from the ear region forward through the right side of the head. Flippers and the dorsal fin were complete, although most of the epidermis of the flippers was ripped off.

The extensive hematoma evident on the dermis indicated that the whale was alive when struck. The left-side impact, it is thought, may have broken ribs and ruptured vital inner organs, causing massive hemorrhage and the death of the whale. When hit by the bow bulb, and before being wedged between it and the sharp bow, the whale may have rolled around its axis, which would explain skin abrasion also on its right side. The specimen was an adult-sized female. No standard length could be taken, but FF measured 16.2m along the body's bended contour. The carcass was dropped off the vessel in open waters two days later.

Ship strikes in the Eastern Tropical Atlantic

The oldest report is of a sperm whale that was struck halfway between Dakar and Cap Verde Islands on 9 June 1955 which seriously damaged the bow of the vessel (Cadenat, 1956); it is unclear what happened to the whale. The only other area off West Africa for which data are available is the Canary Islands. Tregenza *et al.* (2002) compiled 21 probable instances of lethal collisions in six species of cetaceans between 1985 and February 2002. Since the introduction of fast ferries in 1999, a significant increase of fatal collisions occurred, especially with sperm whales.

On 19 March 1998, a dead juvenile sei whale was brought into quay no.2 of the port of Dakar, Senegal, draped over the bow bulb of the German container ship *OSNA Bruck* (Group Somico-Smith and Kraft).⁴ Its body length was about 12m, and its body weight 9,960kg, as weighed at Dakar port facilities (Figure 2). The absence of bloating, all baleen plates attached to the palate and largely intact skin suggested that the whale had not been dead for more than two days when photographed. Although the collision was not registered by the crew and there is no direct evidence that the whale was killed by the impact, the very fresh state of the carcass virtually excludes that the animal was scooped up dead. Sei whales, like all balaenopterids, sink immediately after death and rise to the surface only after decomposition and bloating sets in (Fraser, 1937; Slijper, 1979).

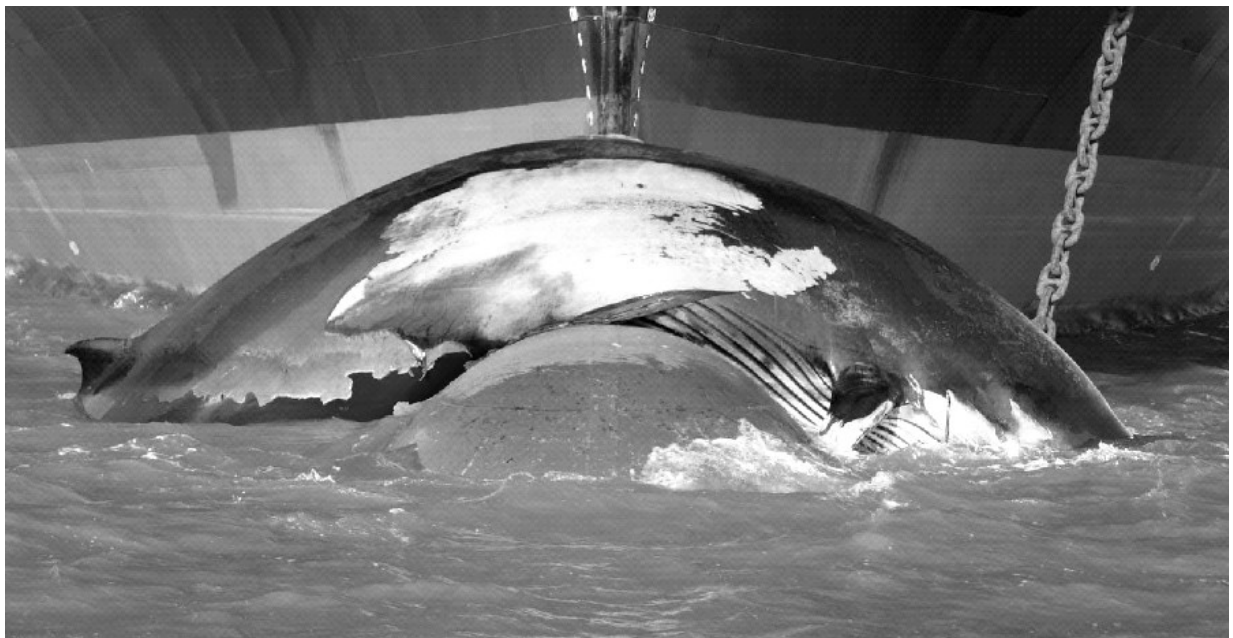


Figure 2. Adult Bryde's whale draped over the bow bulb of container vessel *P&O Nedlloyd Pantanal*, in Guayaquil port, Ecuador. Note extensive dermal hematoma on the lower mid-body, indicating antemortem trauma.

⁴ Information was collected by Dr. Papa Ndiaye, Laboratoire Biologie Marine, Institut Fondamental d'Afrique Noire (IFAN), Dakar, as part of the UNEP/CMS WAFCE-1 Project (Van Waerebeek *et al.*, 2000).



Figure 3. Young sei whale brought into Dakar port, Senegal, on 23 March 1998, on the bow of the German container ship *OSNA Bruck*. A full set of baleen still in the palate, mostly intact skin and the lack of bloating suggested that the whale had died within the past two days, presumably from impact with the vessel. Photos by Dr P. Ndiaye, IFAN (CMS/UNEP WAF CET-1 Project).

On Monday 23 March 1998, the Dakar daily *Le Soleil* published a photo of the whale draped over the ship's bow bulb and reported that it was struck close to Gorée Island, a few nautical miles off Dakar. However, according to the captain of the *OSNA Bruck*, the ship had departed Las Palmas, Gran Canaria, Canary Islands, some two days earlier and the crew became aware of the dead whale only after passing Gorée Island. The captain indicated that the collision may have occurred earlier, en route from Las Palmas.

Dr. Papa Ndiaye photographed and collected the specimen, however no necropsy was performed. The carcass was trucked to Sangalkam and buried, destined for future retrieval of the skeleton⁵. No samples were taken except for two apical baleen plates, deposited at IFAN collection, which were all-black with very fine, white bristles (examined by KVV). The arched rostrum with downturned tip, a single central but no auxiliary rostral ridges, overall dark grey colouration, a high falcate dorsal fin and the baleen were diagnostic for *B. borealis*. One flipper measured 156cm.

Port Captain Mr. Edouard Sarr claimed that this was the third whale found in Dakar waters 'over a short period'. One had stranded at poste 17, and a second

whale had found its end north of the port'. No dates were available for these cases. Ndiaye thought these were also sei whales, but without voucher samples their specific identity cannot be confirmed.

Discussion

The collision of the container ship *P&O Nedlloyd Pantanal* with a Bryde's whale is the first formally recorded case of this type of incidental mortality in Ecuador and the first time this species is recorded killed by a ship strike in the Southeast Pacific. However, similar cases probably have occurred in open waters, were not noticed or reported, so the magnitude of ship collisions with cetaceans is unassessed in this region. Crews of large cargo vessels generally are unaware of collisions (Jensen and Silber, 2004; this paper) and typically notice the kill only when the whale becomes stuck on the bow. Another reason for limited number of records would be the lack of regulations (or enforcement) regarding ship strikes with whales, including no reporting obligation in countries bordering the Southeast Pacific. In Peru, proposals⁶ for the construction of a mega port (Hub Port) at Isla San Lorenzo-Callao to accommodate ULCS (Ultra Large Container Ships), SPPS (Super Post Panamax Ship) and SCS (Super

⁵ The skeleton was abandoned since its burial site was developed for urbanization (P. Ndiaye, pers.comm. to KVV).

⁶ See 'Proyecto Ciclópico' in Peruvian weekly *CARETAS* Edición 1860, 10 February 2005. www.caretas.com.pe.

Cruiser Ships) greater than 300,000 MT, and additional projects for major port expansion at Bayovar, Eten, San Juan and Ilo, are an increasing cause of concern for both resident and migrating whales off Peru's coast.

The situation is very similar in the Eastern Tropical Atlantic. The ship strike with a sei whale, so far we know, is the first fully documented case off West Africa. However, high potential for shipping-caused mortality exists in the northern Gulf of Guinea, and specifically in the Bight of Benin. Expanding merchant shipping to and from Cotonou, Benin, and shipping lanes which cross the breeding area of a northern Gulf of Guinea humpback whale stock (Van Waerebeek *et al.*, 2001, 2002) pose increasing risks and endangers slow-moving mother/calf pairs in particular. A second container port is planned along Benin's coast and heavy shipping traffic is linked to Nigerian (Lagos, Port Harcourt), Ghanaian (Tema, Sekondi-Takoradi) and Cameroon (Douala) ports. Under current circumstances ship collisions with cetaceans off West Africa may often remain formally unreported, and mortality unaccounted for. National authorities are encouraged to improve data collection and introduce regulations including obligatory reporting.

Ship strikes with both Bryde's and sei whales are considered uncommon. The NOAA database contains only three cases for each of these species world-wide (Jensen and Silber, 2004). Unpublished reports exist of Bryde's whales struck and killed by ships travelling to or from Auckland's busy commercial port, in the Hauraki Gulf, New Zealand (Alan N. Baker, pers. comm.). Perhaps part of the explanation is that these species are among the fastest moving baleen whales (Slijper, 1979). Their smaller size, compared to other more frequently affected species, such as fin and right whales, also reduces the probability to be struck.

Vessel speed seems the most relevant factor driving ship strikes: 90% of cases in which the speed was known, vessels moved at 10kn or higher, with the highest rate of incidence between 13 and 18kn (Jensen and Silber, 2004). The cruise speed of the *P&O Nedlloyd Pantanal* is even higher. Considering the 'hull speed'⁷ of a vessel is directly proportional to the square root of its waterline length, collision frequency must also be a function of ship size. Modelling of ship strike dynamics may offer valuable insights.

A large proportion of ship strike records in the NOAA database are from carcasses of beached animals, which show signs of cuts by propellers, as well as fractures of skull and ribs (Jensen and Silber, 2004). According to Laist *et al.* (2001), 58 of 407 beached whales (14%) recorded in the USA east coast between 1975 and 1996 could have been caused by ship strikes. Diagnosing death from ship

strike is difficult, but the careful analysis of whale carcasses will provide an important line of evidence to estimate strike frequencies and the species involved. It would be desirable that environmental authorities in coastal nations issue regulations to deal with beached whales and systematically conduct necropsies. Moreover, national legislation should be reviewed as to include obligatory reporting by ships. In June 2005, the Conservation Committee of the International Whaling Commission (IWC) recognised the relevance of these issues and instated an *ad hoc* Ship Strikes Working Group (SSWG) to examine scientific, technical and policy aspects, and where necessary to recommend action. It was agreed that special attention be paid to critical areas where high density shipping channels are over-laid with known whale aggregation areas (IWC, 2005)⁸.

Uncertainty exists regarding the population identity and status of sei whales off West Africa. On geographic grounds, they would tentatively form part of the Eastern North Atlantic stock (*sensu* Jonsgård and Darling, 1977; Donovan, 1991). Allen (1916) claimed that sei whales were rarely seen south of the Straits of Gibraltar, contradicted by Anonymus (1914, *in* Jonsgård and Darling, 1977) who indicated that sei whales were observed, sometimes in large numbers, in the area that stretches southward from the Madeira Islands, past the Canary toward the Cape Verde Islands. Ingebrigtsen (1929) argued that sei whales stay in the southern part of the North Atlantic during the winter and their northward migrations seem to take place offshore. Kirpichnikov (1950) reported on three sightings in May 1948 off West Africa, the southernmost record being at 06°30'N, 18°20'W. However, Jonsgård (1966) warned that in this area Bryde's whales sighted may easily be confused with sei whales. Maigret (1981) reported on a stranding of an 11m *B. borealis* in February 1981 in the Baie du Lévrier, Mauritania. In Senegal a series of nine baleen plates diagnostic for a sei whale were recovered from a tiger shark stomach landed at Joal in July 1949 (Cadenat, 1955). The present specimen is the first documented case in Senegal for half a century and apparently only the third authenticated specimen record for West Africa. No evidence of sei whales has been found in The Gambia and Guinea-Bissau (Van Waerebeek *et al.*, 2000).

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⁷The maximum speed a given hull can attain in a displacement vessel (i.e. not planing vessels).

⁸International Whaling Commission (2005) Report of the Conservation Committee. IWC/57/Rep 5, IWC Annual Meeting, Ulsan, Korea, May-June 2005.

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