

Entanglements of large Cetaceans in Peru: Few records but high risk

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Abstract

Entanglements of large cetaceans with fishing gears were only recorded four times in Peru before 1995, despite the intensive use of gillnets and longlines. This work compiles recent events of large cetacean entanglement in Peru, from direct observations, local news and online graphical evidence. A total of 15 confirmed entanglements were recorded between 1995 and 2012, involving humpback whales *Megaptera novaeangliae* (n = 10), sperm whales *Physeter macrocephalus* (n = 3), an Antarctic minke whale *Balaenoptera bonaerensis* and an unidentified balaenopterid. Gillnets were involved in 80% of the entanglements, followed by longlines. The prevalence of humpback whale entanglements may be associated with the neritic location of the majority of gillnet fishing sets, interfering with the whale's migratory routes and reproductive habitat in northern Peru. The intensive use of gillnets and the increasing use of longlines in artisanal fisheries represent serious threats to the conservation of large cetaceans in Peru and the Southeast Pacific and need to be addressed by national and regional conservation authorities.

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Introduction

The rapid growth of fisheries in the past decades has impacted the conservation status of many cetacean species due to the increase in incidental captures in fishing gears. This is especially prevalent in areas where the distributions of these species overlap with areas of intensive fishing effort (IWC 1994, Clapham *et al.* 1999, Northridge 1991, 2002, Reeves *et al.* 2003).

The highly productive Humboldt Current ecosystem off Peru is home to some of the most intensive fisheries operations in the world (Bertrand *et al.* 2004, Bakun and Weeks, 2008). That same productivity also supports a large diversity of cetacean species in the region (reviewed by Reyes 2009), some of whose populations experience elevated levels of fishery-related mortality (Van Waerebeek and Reyes 1994a, Van Waerebeek *et al.* 1997, García - Godos 2007, Mangel *et al.* 2010, Tzika *et al.* 2010).

In the past decades, cetacean conservation in Peru has been mainly focused on the mortality of small cetaceans during fishing operations, which was estimated to range from 10,000 to 17,000 individuals landed annually between 1988 to 1994 (Read *et al.* 1988, Van Waerebeek and Reyes 1994a, Van Waerebeek *et al.* 1997). Now, more than twenty years after the first report of a cetacean-targeted fishery, high incidental and intentional takes of these species are still a conservation issue in Peru, mainly due to the sustained use of coastal gillnets (Van Waerebeek and Reyes 1994a, García - Godos 2007, Mangel *et al.* 2010), the most extensively deployed fishing gear in the country (Estrella *et al.* 2010, Alfaro-Shigueto *et al.* 2010).

Unlike the situation with small cetaceans, however, interactions of large cetaceans with fisheries have seldom been reported in Peru and there is almost no published information on this subject. However, since the level of entanglements of small cetaceans in Peru is very high and distributions of both large and small cetaceans roughly overlap, it is reasonable to conclude that

large cetaceans are affected by fishing gears to some extent, as occurs in other countries of the region, such as Ecuador (Alava *et al.* 2005; Félix *et al.* 2007 and 2011), Colombia (Capella *et al.* 2007) and Chile (Aguayo-Lobo 1999, Galletti and Cabrera 2007). However, only four large cetacean entanglements have been reported in Peru. The first was the entanglement and subsequent death of a humpback whale calf (*Megaptera novaeangliae*) in August 1979, off Callao, central Peru (Valdivia and Ramirez 1981). The second recorded entanglement occurred in October 1988 in San Juan de Marcona, southern Peru, when an adult humpback whale became entangled in a gillnet and was subsequently towed alive to port, resulting in its successful release with assistance from the community and compensation of the fishermen (Majluf and Reyes 1989). Another two records involved the by-catch in drift gillnets and butchering of two juvenile Antarctic minke whales (*Balaenoptera bonaerensis*) in Pucusana port, central Peru, in 1991 (Van Waerebeek and Reyes 1994b).

Here we present a compilation of new records of fishing gear entanglements of large cetaceans in Peruvian waters. This document can be a first step toward focusing attention on their conservation and on the need to implement effective entanglement mitigation measures in one of the world's most intensively exploited marine ecosystems and complements information gathered in other countries of the Southeast Pacific.

Material and methods

This review includes only large cetaceans (mysticetes and sperm whales). Only confirmed records of entanglement were taken into account, that is, when the fishing gear was observed or definitive signs of its presence were demonstrated (characteristic wounds of nets or longlines). Records comprise original data collected by the authors (sightings at sea and examination of stranded whale carcasses) and documented information from third parties, including reports obtained from the local news media (newspapers, internet and TV) from 1995

onwards. Four historical, published records are also included. The maturity status of whales was classified as calf, juvenile or adult, estimated from body size either from photographs or direct field observations.

Results and Discussion

There were 15 newly documented records of large cetacean entanglements in Peruvian waters between 1995 and 2012, thus 19 records in total reported since 1979 (Table 1, Figure 1). Humpback whales accounted for 66.7% (n=10), followed by sperm whales *Physeter macrocephalus* (20.0%, n=3), one Antarctic minke whale *Balaenoptera bonaerensis* (6.7%; n=1) and an unidentified balaenopterid. It is noteworthy that no interactions with other pelagic whale species common in Peruvian waters (e.g. Bryde's whale *B. edeni* and blue whale *B. musculus*, Majluf and Reyes 1989, Reyes 2009, Navarro Pardo *et al.* 2011) were recorded and that the three confirmed records of Antarctic minke whales in Peru are known from fishery interactions (Van Waerebeek and Reyes, 1994b, present paper).

<<Table 1 near here>> <<Fig. 1 near here>>

Humpback whale entanglements were concentrated in central (Figure 2) and northern Peru (Figure 1), while interactions with Antarctic minke whales occurred in two localities (Pucusana and Puerto Morin) and sperm whales stranded in southern Peru (Moquegua Region, Figure 3) and northern Peru, where a single record involved a multiple entanglement and partial release of at least three individuals that caused the loss of a part of the fishing gear (Table 1). Humpback whale entanglements off central Peru (Lima) occurred between June and December. Of ten humpback whales of known maturity status, five were adults, three were juveniles and one was a calf (Table 1). Entanglements of lactating females would also produce the subsequent death of associated calves, as likely happened with the event reported on 19 September 2009 (Table 1). The concentration of humpback whale entanglements in Tumbes, Peru's northernmost

province, reflects the southern extent of the large Southeast Pacific breeding ground centered in the shelf waters off northern Peru, Ecuador and Colombia (Flórez-Gonzalez *et al.* 2007; Pacheco *et al.* 2009). This stock has been severely affected by fishery interactions, with an estimated rate of 32 net entanglements per year in the period 2004 - 2006 in Ecuador (Félix *et al.* 2007) and a mean of 2.8 entanglements per year between 1996 and 2006 in Colombia (Capella *et al.* 2007). The wide spatial and temporal distribution of entanglements documented in Peru suggests that both breeding and migrating humpback whales are affected by entanglements, underscoring the high level of threats in coastal waters to the conservation status of the Southeast Pacific stock of the species.

<<Fig. 2 and Fig, 3 near here>>

Sperm whales affected by fishing gears in southern Peru may be part of the stock shared with Chile (García – Godos 2006), where fishery related mortality has seldom been recorded but fishery interactions through predation on the catch of the longline fishery are known to occur (Aguayo-Lobo 1999 and Galletti and Cabrera, 2007). However, in two of three cases reported here gillnets were involved in the entanglements. Sperm whales entangled off northern Peru may be part of the Ecuador - northern Peru stock, as suggested by previous sightings (García - Godos 2006).

All the fishing gears involved had been set for a variety of target fish species by the Peruvian small scale artisanal fishery, which is composed mainly of wooden boats up to 10m length and with limited storage capacity. The estimated number of fishing boats operating in 2009 was 10,385 (Estrella *et al.* 2010). Gillnets were used more frequently than any other fishing gear (33%), while longlines ranked fourth in gear use frequency (8%, Estrella *et al.* 2010). Gillnets were by far (80%) the main cause of entanglements of large cetaceans in Peru, while longlines were positively linked to only two large cetacean strandings. Additionally, encounters

of humpback whales with diving lines and ropes of scallop harvesters were described around Lobos de Tierra Island, northern Peru, with no mortality reported (García-Godos 2007).

Despite the small size of the fishing boats involved in whale entanglements, the high numbers of boats and gillnets set per year in Peru has raised concerns regarding the sustainability of this fishery and the high levels of bycatch of threatened species associated with its operation (Alfaro-Shigueto *et al.* 2010). Gillnets have been identified worldwide as the main threat to cetaceans due to their low cost and flexible use both in coastal and offshore waters (IWC 1994). The total length of gillnets set in Peru was estimated at >100,000km per year (Alfaro-Shigueto *et al.* 2010), with almost 90% of fishing operations occurring less than ten nautical miles from shore (Estrella *et al.* 2010). This situation represents a risk for the more neritic large cetacean species, including humpback whales and southern right whales *Eubalaena australis* (Van Waerebeek *et al.* 2009), and perhaps some balaenopterids like Bryde's whales (*B. edeni*) and Antarctic minke whales. Although no southern right whales have so far been found entangled in Peru, the species is known to be vulnerable to net entanglement in Chile (Aguayo-Lobo 1999), raising our concern for the Critically Endangered Peru - Chile subpopulation (Reilly *et al.* 2008). Additionally, the longline fishery for elasmobranchs and dolphinfish (*Coryphaena hippurus*) is the fastest growing component of Peru's small-scale fishing fleet and typically operates beyond 10nm from shore (Alfaro-Shigueto *et al.* 2010, Estrella Arellano and Swartzman 2010). This fishery conceivably could affect more pelagic species, such as sperm whales, orquals and ziphiids.

The small number of cases of large cetacean by-catch reported in Peru, when compared with the well-documented small cetacean by-catch (Read *et al.* 1988, Van Waerebeek and Reyes 1994a, Van Waerebeek *et al.* 1997, Mangel *et al.* 2010), may in part be a consequence of low levels of awareness among fishermen and local port authorities regarding the conservation of

large cetaceans, leading to severe under-reporting of whale entanglements. In general, a false perception exists that with the end of the commercial whaling operations in Peru in 1986 the conservation of large cetaceans was assured (García - Godos 2007); in consequence, other threats such as fishery interactions, ship collisions, pollution and other human impacts have not been considered as a conservation priority in the country.

The intensive use of gillnets and longlines along the Peruvian coast and within the exclusive economic zone represents a threat to the conservation of large cetaceans in Peru and the Southeast Pacific. Given the results reported here, the humpback whale is the most vulnerable species to entanglements in Peru and the region, but attention should also be paid to resident species like Bryde's whales and other species that would use migration corridors in Peruvian waters, namely sperm whales, southern right whales, Antarctic minke whales, blue whales *Balaenoptera musculus*, fin whales *B. physalus* and Sei whales *B. borealis*.

The entanglement records presented here likely represent only a small fraction of the total entanglements that have occurred in Peruvian waters, since it is not possible to determine the real number of cases and the data collection methodology applied was largely opportunistic. Some records in institutional databases remain unpublished. However, preliminary information taken from poll surveys suggest that interactions are frequent in northern Peru (Balducci *et al.* 2012) and artisanal fishermen from Pucusana, central Peru indicated the same in interviews (pers. comm. to KVV, 9 and 10 Sept 2009). In contrast, the loss of gears following whale entanglements, while not an infrequent incident, is seldom reported to port authorities because no reimbursement policy and no reporting obligations exist.

To improve information gathering regarding large cetacean entanglements as well as mortality from ship strikes (Van Waerebeek *et al.* 2007), it is necessary the implementation of a national stranding network along the Peruvian coast, integrated at the national and regional level.

Such a network should be capable of monitoring the impacts of fisheries and shipping on populations of large cetaceans off Peru. Useful information may also be gleaned from fishermen if reporting of whale entanglements and associated gear loss is encouraged. Finally, efforts should be made to raise awareness among fishermen and coastal communities of the impacts of whale entanglements, potential preventive and mitigation measures and reporting duties. The first public attempts to implement this network are already on course.

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N°	Species	Date	Locality	Position	Reproductive Status	Condition	Gear involved	Source	Observations
1	<i>Megaptera novaeangliae</i>	Aug 1979	Callao	12°3.435'S 7°59.724'W	Calf	Dead	Gillnet	Valdivia and Ramirez, 1981	
2	<i>Megaptera novaeangliae</i>	Oct 1988	San Juan	15°21.314'S 77°09.690'W	ND	Alive, at sea	Gillnet	Majluf and Reyes, 1989	Whale was released by fishermen by cutting net after compensation was guaranteed.
3	<i>Balaenoptera bonaerensis</i>	27-Sep-1991	Pucusana	12°28.992'S 76°48.056'W	Juvenile	Landed dead	Gillnet	Van Waerebeck and Reyes, 1994	Landed by artisanal fishermen at Pucusana port. Animal entangled in net some 20 miles offshore. Used for human consumption.
4	<i>Balaenoptera bonaerensis</i>	30-Oct-1991	Pucusana	12°28.992'S 76°48.056'W	Calf	Landed dead	Gillnet	Van Waerebeck and Reyes, 1994	Landed by artisanal fishermen at Pucusana port. Reportedly captured nearshore. Used for human consumption.
5	<i>Megaptera novaeangliae</i>	1-Dec-1995	Chancay	11°35.000'S 77°16.310'W	Juvenile	Dead	Gillnet	Instituto del Mar del Perú (unpub. report)	Voucher data; photos archived at CEPEC
6	<i>Balaenoptera bonaerensis</i>	1-Jun-2002	Pto. Morín	8°24.987'S 78°54.306'W	Juvenile	Dead	Gillnet	IGG, this work	Incidental catch, butchered by fishermen
7	<i>Megaptera novaeangliae</i>	23-Nov-2005	El Bendito	3°28.654'S 80°21.965'W	Adult	Dead	Gillnet	<i>Diario Correo</i> , Tumbes, 23 Nov. 2005	Gillnet wrapped around entire body of whale
8	<i>Megaptera novaeangliae</i>	27-Jun-2007	Punta Mero	3°53.887'S 80°52.138'W	Adult	Dead	Gillnet	<i>Somos</i> magazine N° 553, year 11:32-35, Lima.	Incidentally entangled. Whale hauled on beach by fishermen on 27 June 1997, died 30 June.
9	<i>Megaptera novaeangliae</i>	24-Jul-2007	Tumbes	3°38.104'S 80°34.9705'W	Calf	Alive	Gillnet	<i>América TV News</i> , broadcasted 27 July 2007	
10	<i>Megaptera novaeangliae</i>	9-Jun-2009	Paramonga	10°48.805'S 77°57.642'W	Adult	Alive	Gillnet	IGG - on board survey vessel, this work	A gillnet around the head, thorax and flippers. Tired swimming, raised the head above water for breathing
11	<i>Physeter macrocephalus</i>	5-Jul-2009	Ilo - Pto de Lizas beach	17°41.571'S 71°21.6291'W	Adult	Alive	Gillnet	JAS, this work	Whale beached with gillnet around the body. Fig. 3
12	<i>Megaptera novaeangliae</i>	30-Aug-2009	Huarmey	10°23.008'S 78°32.611'W	Adult	Alive, at sea	Gillnet	IGG - on board survey vessel, this work	A gillnet around the body, calm swimming, long dives
13	<i>Megaptera novaeangliae</i>	8-Aug-2009	Pucusana	12°28.992'S 76°48.056'W	Juvenile	Alive, at sea	Gillnet	KVW, this work	Gillnet wrapped around tailstock and flukes; KVW partially cut floatline but failed to release animal due to falling of night. Fig. 2
14	<i>Megaptera novaeangliae</i>	19-Sep-2009	Canoas	3°52.060'S 80°51.775'W	Adult	Dead	Longline	<i>América TV News</i> , broadcasted 21 September 2009	A calf stranded a few days later close to Canoas, likely the calf of this whale
15	<i>Megaptera novaeangliae</i>	27-Oct-2010	Los Órganos	4°10.391'S 81°07.673'W	Juvenile	Dead	Gillnet	<i>Diario El Comercio</i> , Lima, 27 Oct. 2010	Signs of emaciation, sighted at sea several days before
16	<i>Balaenoptera</i> sp.	20 Jan 2012	Punta Sal	3°58.871'S 80°58.872'W	ND	Dead	ND	RPP news/ReporteroW.com, published on line 20 Jan. 2012	A rope tangled around tail stock.
17	<i>Physeter macrocephalus</i>	15-Feb-2012	Mollendo	17°02.470'S 71°59.772'W	Calf	Dead	Longline	Amateur video posted on Youtube.com on 03 March 2012	Evident marks of lines around the body.
18	<i>Physeter macrocephalus</i>	24-Jun-2012	Lambayeque	06°58.500'S 81°07.100'W	Two adults and a juvenile	Alive, at sea	Gillnet	Vídeo taken on board fishing vessel, sent to JAS by fishermen involved, published on Youtube.com	Fishermen cut a part of the net and let the whales go with it. The extension of entanglement is unknown.
19	<i>Megaptera novaeangliae</i>	1-Jul-2012	Eten	06°59.900'S 79°48.270'W	Juvenile	Dead	Gillnet	RPP news, published on line 02 July 2012	Slight marks on the back, indicating gillnet entanglement.

Table 1. Records of large cetaceans entangled in fishing gears in Peru, including four cases before 1995. ND: Not determined.

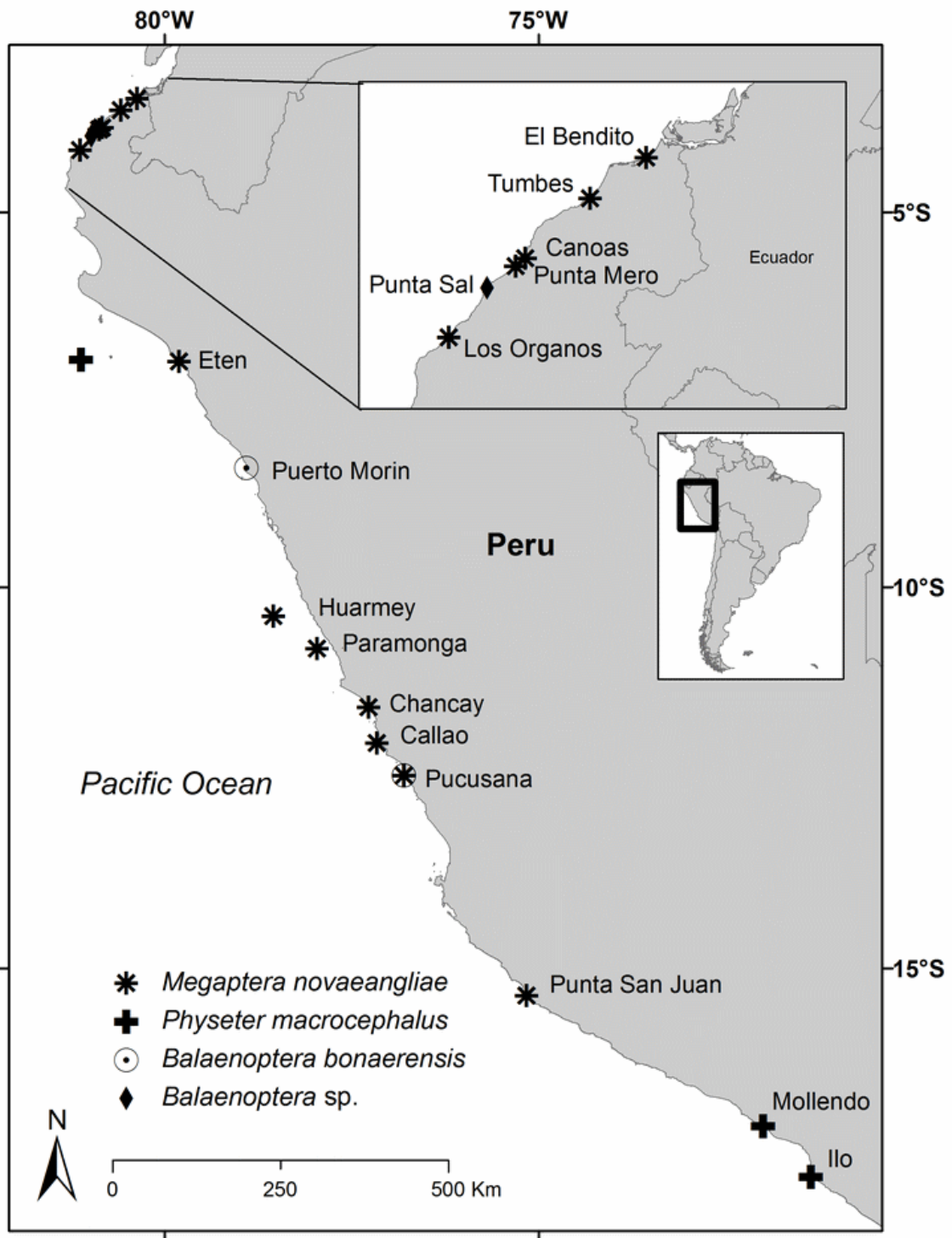


Figure 1. Location of large cetacean entanglements in fishing gears in Peru.



Figure 2. Humpback whale entangled off Pucusana, central Peru, towing the net corkline.



Figure 3. Sperm whale entangled in a gillnet and stranded alive in Pozo de Lisas beach, Ilo, southern Peru.

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