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# Strandings and mortality of cetaceans due to interactions with fishing nets in Ecuador, 2001 – 2017

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## ABSTRACT

This preliminary note briefly reports on cetacean strandings and interactions with fishing nets (mostly gillnets) on the Ecuadorian coast. Between June 2001 and March 2017 the carcasses of 130 cetaceans of 18 species which stranded on the coasts of Ecuador were examined. These included 59 humpback whales (*Megaptera novaeangliae*), 9 pantropical spotted dolphins (*Stenella attenuata*), 8 common dolphins (*Delphinus sp.*), and 54 individuals of 14 other species of dolphins and whales. The cause of death was diagnosed in 54 (38%) of cases, with the most frequent one being entanglement in fishing gear (n=43). The cases in which the cause of death was a confirmed interaction with fishing gear included 18 of 59 (31%) humpback whales, 7 of 9 (78%) spotted dolphins, 4 of 8 (50%) common dolphins, 3 of 6 (50%) dwarf sperm whales and 11 of 31 (22%) individuals of other species, as recorded along the Ecuadorian coast.

**Key words:** Ecuador, stranding, cetacean, interactions with fishing nets.

## INTRODUCTION

Cetacean strandings are a result of mortality that may be attributed to natural or anthropogenic factors. As such, stranding data can provide insights on spatial distribution, seasonal movements, and mortality factors pertaining to cetacean populations.

Human interactions continue to affect cetacean populations worldwide. In particular, fisheries are considered the most serious threat, which can take the form of direct fishery interactions (e.g. mortalities or injuries from fishing gear) or indirect fishery interactions (e.g. reduced prey availability).

The lethal interaction of cetaceans with fisheries is widely recognized as one of the biggest global conservation problems of recent decades (Northridge, 1985; Reeves *et al.*, 2003; Huckle-Gaete *et al.*, 2004). In Ecuador, human activities cause severe direct and indirect anthropogenic impacts on marine mammals, including fisheries interactions (Félix and Samaniego, 1994; Van Waerebeek *et al.*, 1997; Félix *et al.*, 2007; Castro and Rosero, 2009; Alava *et al.*, 2017; Jimenez *et al.*, 2018, Castro *et al.*, 2018), vessel collisions with cetaceans (Van Waerebeek *et al.*, 2007; Félix and Van Waerebeek, 2005; Félix *et al.*, 2007) and short-term impacts generated by whale-watching tourism (Scheidat *et al.*, 2004). Skin diseases have been indirectly linked to contaminants (Castro *et al.*, 2008; Van Bresseem *et al.*, 2015).

The small-scale fisheries on the Ecuadorian continental coast are represented by the Artisanal Coastal Fishery that uses small boats to fish in coastal areas, and the Artisanal Oceanic Fishery, which operates in the open sea with the support of a larger ship. Both of them capture demersal and pelagic fish (FAO, 2003). According to the Secretariat of Fisheries Resources of Ecuador (Subsecretaría de Recursos Pesqueros, SRP), there are 234 fishing communities, with a total of 19,770 artisanal boats and between 63,970 - 87,280 small-scale fishers registered as members of the current fishing population in Ecuador (Alava *et al.*, 2017). The main fishing gear presently used include: trammel or surface gillnets (*trasmallo*) of 800 m long by 3 m high, the 3200 m long cachema longline (*espinel corvintero*) with 800 hooks, the longline (*palangre*) of 36-72 m, and the purse-seine net (*red de cerco*) up to 1300 m long and 30 m deep. In Ecuador, the small-scale fishing fleet uses mainly longlines and surface gillnets (mesh sizes: 7.5-13 cm) to catch pelagic fin fish species including dorado (dolphin-fish), several tuna and billfish species and sharks (Subsecretaría de Recursos Pesqueros, 2009; Alava *et al.*, 2017). This note briefly reports on cetacean's strandings and to provide information of the target species with interactions with fishing nets on the Ecuadorian coast.

## MATERIAL AND METHODS

The information presented here was obtained by the Pacific Whale Foundation (PWF) and compiled as a database of stranding and bycatch records. Information was collected opportunistically during irregular visits to fishing ports, surrounding beaches and other coastal locations of continental Ecuador, as well as documented media reports, in the period 2001-2017. Apart from own observations, only stranding records with videos and photos where we observed fishing gear, indications of baiting, cutting, or other evidence of human manipulation, were taken into account. Condition codes of carcasses (C.C.) were determined according Geraci & Lounsbury (2005).

In this study, cetacean stranding events were analyzed for different forms of human interaction (HI). Based on HI categories, stranding events were classified as: (1) *Non-HI Strandings* or strandings not caused by HI; (2) *HI-Strandings* or strandings caused by HI and (3) *CBD* (Could not Be Determined). In addition, in category (2) we determined if there is strong evidence of interaction with fisheries (2a), collision with vessels (2b), pollution or marine debris (3a) and interaction with tourism (4a) (Kirkwood *et al.* 1997).

## RESULTS AND DISCUSSION

### *Effort*

Between June 2001 and March 2017 the carcasses of 130 cetaceans of 18 species that had died along the coasts of Ecuador were examined. Based on HI categories, stranding events were classified as: (1) *Non-HI Strandings* or strandings not caused by HI (n = 8); (2) *HI-Strandings* or strandings caused by HI (n = 48); Of wich 43 carcasses exhibited evidence of interactions with fisheries; And (3) *CBD* (Could not Be Determined) or strandings (n = 74 in total).

All records have photographic evidence, still or videos. There are direct (personal observations) or indirect records (media) verified through photographs. The strandings related to fishing nets, have only taken into account the records showing traces of fishing nets, ropes, floats. Cuts of dorsal fins, caudal fin, or very visible and clear marks of interaction with nets on the body of cetaceans.

### *Geographical distribution*

The strandings occurred throughout the Ecuadorian Coast and Galapagos Islands. Of 63% (n = 78) were in the Manabi province; 18% (n = 22) in Santa Elena province and the other 19% in other coastal areas (See Fig. 1). While, most cases of incidental entanglement in fishing nets occur not far from the shore and in the shallow waters of the continental shelf. Of 72% (n = 78) were in the Manabi province; 21% (n = 22) Santa Elena province and the other 7% in other coastal areas (See Fig. 1).

Manabi and Santa Elena are the provinces in Ecuador with the greatest number of strandings with fishing interaction. Possibly because the effort has been more focused on these provinces because of the proximity to our research project base in Puerto Lopez.

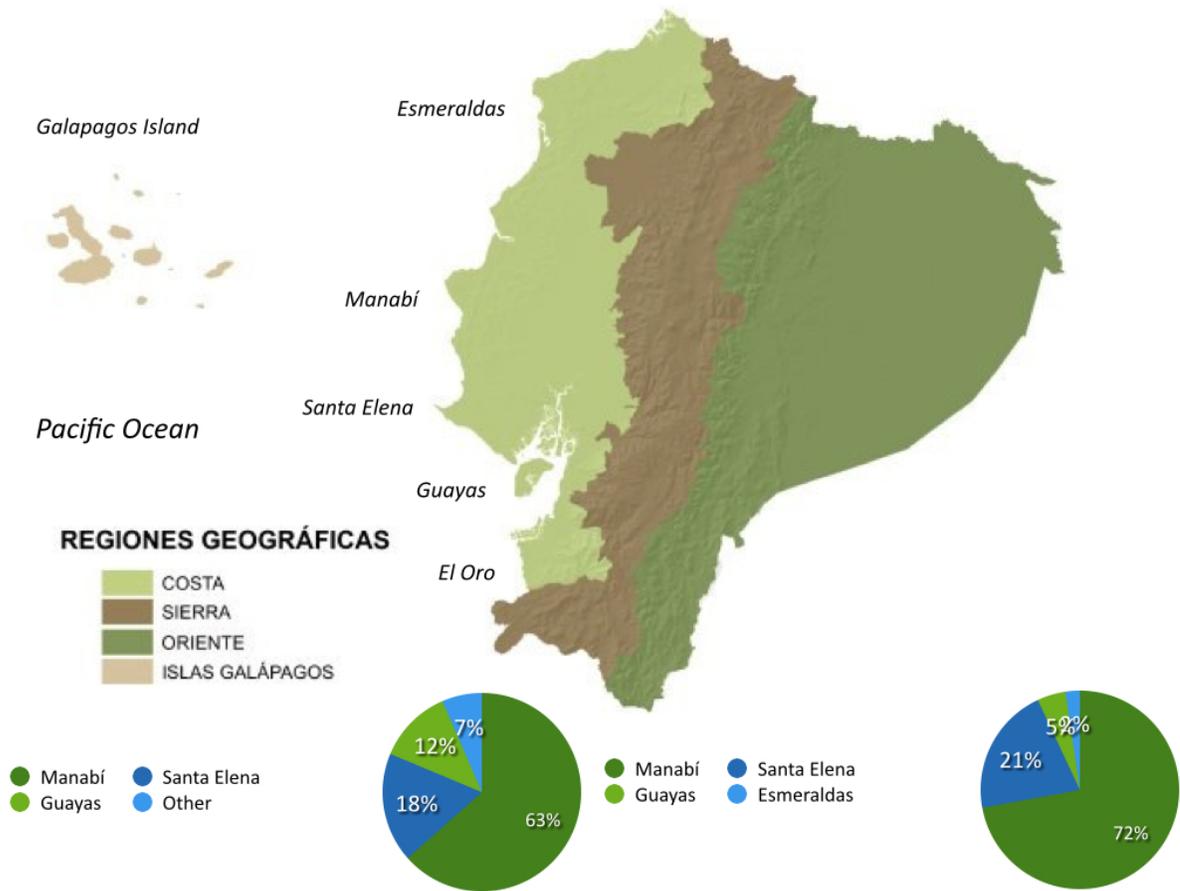


Fig. 1. Geographical distribution of the strandings in Ecuador. In general and with fishing nets interactions.

### The Strandings

We recorded 59 humpback whales (*Megaptera novaeangliae*); 9 spotted dolphin (*Stenella attenuata*); 8 common dolphins (*Delphinus sp.*); 6 short-finned pilot whales (*Globicephala macrorhynchus*), 6 sperm whale (*Physeter macrocephalus*), 6 dwarf sperm whales (*Kogia sima*) and 34 individuals of 11 other species of dolphins and whales stranded on the Ecuadorian coast (Figure No. 2). The cause of death was diagnosed in 54 (38%) of them. The most frequent cause of death was entanglement in fishing gear (n=43) (Figure No. 3).

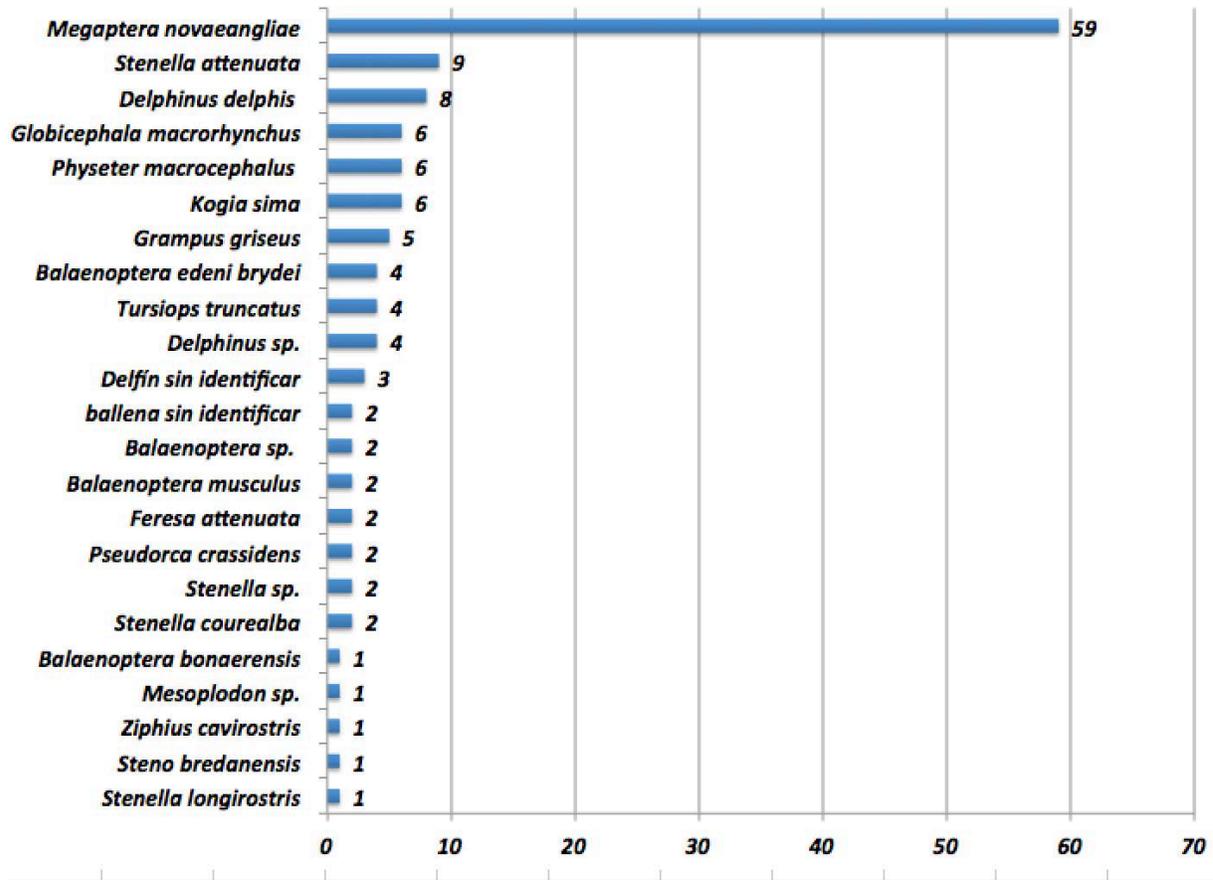


Fig. 2. No. Cases of cetacean strandings in Ecuador from 2001 – 2017.

*Interactions with fishing nets*

In total 43 carcasses of 10 species of cetaceans exhibited evidence of interactions with fisheries. Humpback whale also represented the major part of cases. The pantropical spotted dolphin was the second most commonly stranded species with relation to fishing nets.

Of the cases in which the cause of death was interactions with fishing nets, 18 (31%) of 59 humpback whales, 7 (78%) of 9 pantropical spotted dolphins, 4 (50%) of 8 common dolphin, 3 (50%) of 6 dwarf sperm whale and eleven (22% per cent) of 31 individuals of other species had been bycaught, recorded in different places around the Ecuadorian Coast (Figure No. 3). The majority of the events were in Manabi province (Figure No. 1).

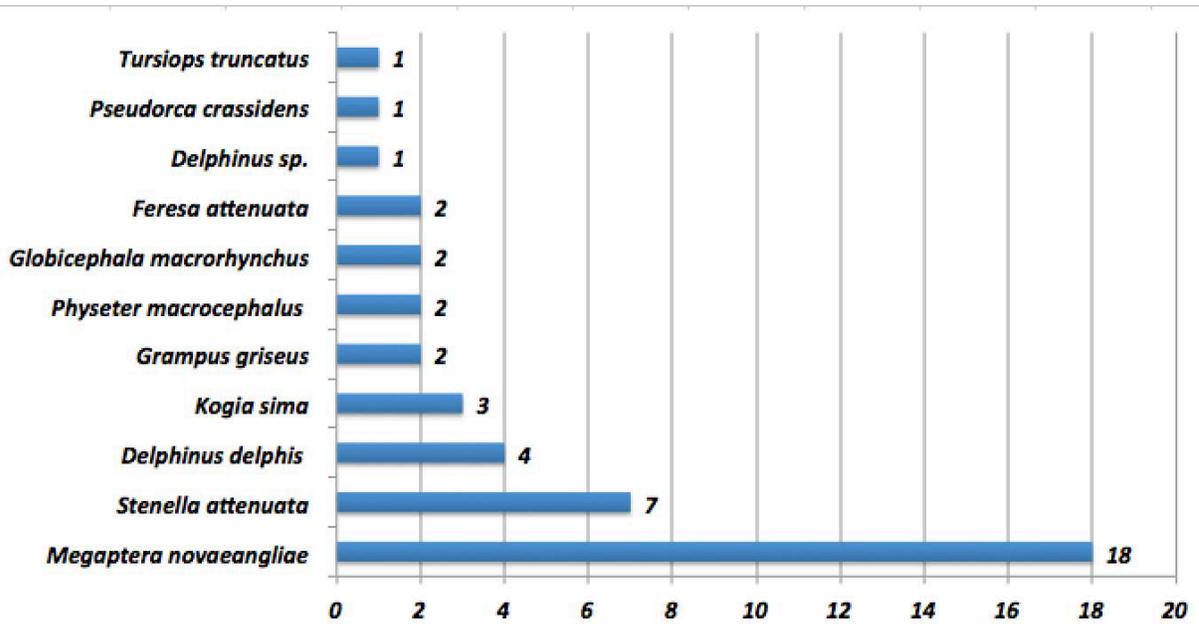


Fig. 3. No. Cases of cetacean stranding in Ecuador with interaction with fishing nets from 2001 – 2017.

*Humpback whales*

The first recorded stranding of a humpback whale in Ecuador was an immature male found in 1994 (Felix *et al.* 1997). Eighteen humpback whales were found stranded between July 2001 to November 2016 with evidence of fisheries interaction (Table 1); fifteen whales were found with gillnets wrapped around some part their body. Three individuals had no tail or showed deep cuts on the body or fins.



Photo 1. Humpback whale (Case #14) found in Isla de la Plata, Machalilla National Park, September, 14, 2013. The whale had green nylon rope (gillnets) wrapped around its body. Also, it carried many epizoots. Photos PWF.



Photo 2. Humpback whale calf (Case #10) found on Las Tunas, Puerto López, July 22, 2012. The whale had green multifilament nylon rope (gillnet) firmly tied to its flipper . Photos PWF.



Photo 3. Humpback whale (Case #15) found in Punta Blanca, Manabí, August 18, 2015. The whale had several cuts in the caudal fin. The peduncle was detached and perfect cuts are observed between the peduncle and the tail, made with some sharp object, possibly to remove a fishing net. The whale showed a massive infestation of whale lice (Cyamidae), suggesting a protracted period of restraint in movements. Photos PWF.



Photo 4. Humpback whale (Case #18) found in Puerto López, Manabí, November 04, 2018, with gillnet wrapped around its body. The fishermen and park ranger try to remove it. The whale has a deviation in the spine. In this link we can see the whale underwater. Photos PWF.

No.	Fecha	Especie	Lugar	Provincia	No. Ind.	Madurez	Sexo	Longitud (m)	Estado	Interaccion pesca	Causas naturales
1	23/07/2001	Megaptera novaeangliae	Libertador Bolívar	S. Elena	1	juvenil		14	muerto, semi descompuesto	X	cortes y sin aleta pectoral
2	02/08/2001	Megaptera novaeangliae	Punta Carnero	S. Elena	1	juvenil			muerto, fresco	X	Tiene enmalle en la cola
3	08/09/2002	Megaptera novaeangliae	Playas	Guayas	1	adulto	hembra	16,2	muerto, descompuesto	X	enmalle de color verde
4	18/08/2004	Megaptera novaeangliae	Rinconada	S. Elena	1	adulto	macho	15	muerto, semi descompuesto	X	enmalle
5	07/10/2006	Megaptera novaeangliae	Los Cerezos San	Manabí	1	adulto		15	muerto, semi descompuesto	X	enmalle
6	02/07/2009	Megaptera novaeangliae	Pedernales	Manabí	1	juvenil		11	vivo, murió luego	x	enmalle
7	07/09/2011	Megaptera novaeangliae	Ayamgue	S. Elena	1	cria			muerto, fresco	X	enmalle red negra
8	10/09/2011	Megaptera novaeangliae	Palmas	Esmeraldas	1	cria		4	muerto, semi descompuesto	X	enmalle sin cola
9	21/10/2011	Megaptera novaeangliae	Crucita	Manabí	1				muerto, descompuesto	X	con pedazos de soga
10	22/07/2012	Megaptera novaeangliae	Las Tunas	Manabí	1	cria			muerto, descompuesto	X	interaccion con redes de pesca
11	03/08/2012	Megaptera novaeangliae	Montañita	S. Elena	1	adulto	macho		muerto, semi descompuesto	X	enmalle
12	21/08/2012	Megaptera novaeangliae	Punta Napo, Briseño	Manabí	1	cria		4,5	vivo	X	tenia redes en el cuerpo, algo parecido anzuelos.
13	18/09/2012	Megaptera novaeangliae	Piedra Larga	Manabí	1	cria	hembra		muerto, semi descompuesto	X	enmalle aleta caudal
14	14/09/2013	Megaptera novaeangliae	Isla de la Plata	Manabí	1	cria			muerto, semi descompuesto	X	enmalle
15	18/08/2015	Megaptera novaeangliae	Punta Blanca	S. Elena	1	adulto		10	muerto, fresco	X	enmalle aleta caudal
16	10/09/2015	Megaptera novaeangliae	Curia	Manabí	1	adulto	hembra	9,7	vivo, murió luego	X	herida profunda en aleta derecha
17	01/09/2016	Megaptera novaeangliae	Punta Napo	Manabí	1	adulto	macho	11,41	muerto, semi descompuesto	X	enmalle aleta caudal
18	04/11/2016	Megaptera novaeangliae	Puerto López	Manabí	1	adulto		8	muerto, fresco	X	enmalle, columna quebrada

Table 1. Details of humpback whale strandings showing evidence of interactions with fishing nets in Ecuador, 2001 – 2017.

### *Pantropical spotted dolphins*

Seven pantropical spotted dolphins were found stranded between August 2009 to December 2016. Six cases had gillnets on their body. One of the cases had no tail, apparently following partial amputation and severe necrosis (See photo 5). It is the second most affected species by fisheries after the humpback whale.



Photo 5. Pantropical spotted dolphin (heavily spotted coastal form *S. attenuata graffmani*) found in Barbasquillo, Manta on December 07, 2016. Tail flukes were necrotized with evidence of nets. Photos MAE - PWF.

***Risso's dolphin***

Two Risso's dolphins were found stranded between July 2009 and November 2011. One individual had pieces of gillnet on its body. The second case had the flukes and the distal part of the tailstock missing (See photo No. 6).



Photo 6. Risso's dolphin found in Crucita, Manabí on November 04, 2011. Note the missing tail. Photo PWF.

***Pygmy Killer Whale***

Pygmy killer whales were found stranded between December 2015 to September 2016. Two cases were registered. One individual was found with a fraction of a gillnet around its body. Another one had tail flukes missing (See photo No. 7).



Photo 7. Pygmy killer whale found in Valdivia, Santa Elena on December 01, 2015. Note the missing flukes. Some linear scars were present on the body. Photo PWF.

***Common dolphin***

Four common dolphins were found stranded from May 2009 to December 2016. Two individuals had pieces of gillnet attached to their body. Two were found with missing tail.

***Dwarf sperm whale***

Three cases of dwarf sperm whale were found stranded between December 2015 to September 2016. One individual was found entangled with a gillnet fragment. Two individuals had their tail severed (See photo No. 8).



Photo 8. Dwarf sperm whale found in Puerto López, Manabí on July 09, 2014. Note the severed flukes . Two cuts in the tail. Photo PWF.

**DISCUSSION**

Eighteen species of small cetaceans and whales were found stranded on the Ecuadorian coast. In 74 cases the cause of stranding and death could not be determined (*CBD*) but many of these were suspected bycatches. Three species were registered for the first time for continental coastal waters: Rough-toothed dolphin (*Steno bredanensis*), dwarf sperm whale (*Kogia sima*) and spinner dolphin (*Stenella longirostris*). Prior to this study, they had only been registered in Galapagos and insular waters.

Ten species of cetaceans were demonstrated to have stranded after evident interaction (entanglement) with fishing nets. The present study demonstrates that the artisanal gillnets are the main threat and cause of mortality for small cetaceans and whales in Ecuadorian waters. The humpback whale (*Megaptera novaeangliae*) represented a major part of confirmed cases. Due to the fact that humpback whales frequent coastal waters in the breeding season (June to September) they are more exposed to various types of fishing gear deployed in shelf waters close to the coast.

Almost 78% of pantropical spotted dolphin (*Stenella attenuata*) strandings were related to fishing nets, which makes it a more sensitive species susceptible to fisheries. The common dolphin (*Delphinus delphis*) and dwarf sperm whale (*Kogia sima*) show a high interaction and mortality rate with fishing (50% of stranded animals, but

samples were small). The finding of deep water species stranded along the coast may be related to the small-scale fishermen having expanded their fishing zones towards more distant, deeper waters, since coastal areas have been overexploited.

In order to reduce the important cetacean bycatch in Ecuador, fisheries authorities may need introduce new national regulations on bycatch mitigation and re-evaluate the types of permitted fishing gear and fishing techniques, fishing seasons, amongst others. The potentially significant impact of fisheries on small cetaceans and whales is not in accordance with the new rules and regulations of the US Marine Mammal Protection Act (MMPA) regarding the provisions related to implement import restrictions of fish and fish products from fisheries that have incidental or intentional mortality and serious injury of marine mammals (Federal Register 80 FR 54390 on August 15, 2016, Department of Commerce National Marine Fisheries Service, National Oceanic and Atmospheric Administration). This further highlights the need to implement a regulatory program in compliance with the US MMPA regulations and reduce cetacean bycatch in Ecuador. Fisheries and environmental authorities must be vigilant and enforce existing marine fisheries regulations to proactively mitigate anthropogenic impacts and promote environmental education activities in fishing communities to conserve vulnerable cetacean species in Ecuador's waters.

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