

ARTICULO ORIGINAL

REPORTS OF BOTTLENOSE DOLPHIN DEATHS IN THE WILDLIFE REFUGE LANZANILLO-PAJONAL-FRAGOSO, CUBA

Reportes de muertes de delfines mulares en el Refugio de Vida Silvestre Lanzanillo-Pajonal-Fragoso, Cuba

Julio Rodríguez-González¹, Eddy García-Alfonso², Leandro Rodríguez-Viera^{1*}

¹ Center for Marine Research,
University of Havana, La
Havana, Cuba

² Refugio de Fauna
Lanzanillo- Pajonal-Fragoso,
Empresa Provincial para la
Protección de la Flora y la
Fauna, Villa Clara, Cuba.

* Autor para correspondencia:
leandro@cim.uh.cu,
leokarma@gmail.com

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ABSTRACT

Dolphins are among the most charismatic and peculiar organisms that inhabit marine-coastal ecosystems. Their populations have been affected in recent decades by commercial exploitation, nature tourism, poaching and the use of nonspecific fishing gear with the subsequent bycatch; being the last two, causing multiple deaths in the natural populations of these organisms. The objective of this study is to alert the scientific community and resident populations about the behavior of deaths and stranding of dolphins *Tursiops truncatus* in locations of the Lanzanillo-Pajonal-Fragoso Wildlife Refuge, Cuba. Cadaver samples were collected between years 2005-2017. The dead bodies were classified according to the decomposition period in fresh, decomposed, or dry bones. Data were collected about the probable cause of death and the location of the stranding. The year with the highest number of dead bodies found (four) was 2007, followed by the years 2005 and 2014, each with three bodies. The locality that reported the highest number of dead bodies was Bahía de Nazabal (eight), in accordance with the high productivity and fishing effort that it presents. A total of 15 dead bodies were found in the studied period, of these it was determined that five individuals were slaughtered for consumption, eight were accidentally entanglement in fishing nets and for two specimens it was not possible to determine the cause of death. The results obtained in this work contribute directly to the management and conservation of the natural populations of dolphins, as well as to the implementation of programs that involve the community.

KEY WORDS: *Tursiops truncatus*, stranding, death, bycatch, Cuba

RESUMEN

Los delfines se encuentran entre los organismos más carismáticos y peculiares que habitan los ecosistemas marino-costeros. Sus poblaciones se han visto afectadas en las últimas décadas por la explotación comercial, el turismo de naturaleza, la caza furtiva y el uso de artes de pesca inespecíficos que propician las capturas incidentales; siendo los dos últimos, causantes de múltiples muertes en las poblaciones naturales de estos organismos. El objetivo de este estudio es alertar a la comunidad científica y las poblaciones locales sobre el comportamiento de las muertes y varamientos del delfín mular *Tursiops truncatus* en áreas del Refugio de Vida Silvestre Lanzanillo-Pajonal-Fragoso, Cuba. Los reportes de cadáveres fueron tomados entre los años 2005-2017. Los cadáveres se clasificaron de acuerdo con el período de descomposición en cadáver fresco, descompuesto, y hueso seco. Se compilaron datos sobre la causa probable de muerte y la ubicación de los varamientos. El año con el mayor número de cadáveres encontrados (cuatro) fue 2007, seguido de los años 2005 y 2014, cada uno con tres cadáveres. La localidad que reportó el mayor número de cadáveres fue Bahía de Nazabal (ocho), de acuerdo con la alta productividad y el esfuerzo de pesca que presenta. Un total de 15 cadáveres se encontraron en el período de estudio, de los cuales se determinó que cinco individuos fueron sacrificados para el consumo, ocho fueron atrapados accidentalmente en hamacas y para dos especímenes no fue posible determinar la causa de la muerte. Los resultados obtenidos en este trabajo contribuyen directamente al manejo y conservación de las poblaciones naturales de delfines, así como a la implementación de programas que involucren a la comunidad.

PALABRAS CLAVE: *Tursiops truncatus*, varamientos, muerte, captura incidental, Cuba

INTRODUCTION

Dolphins are among the most charismatic and peculiar organisms that inhabit marine-coastal ecosystems. Their populations have been affected in recent decades by

commercial exploitation, tourism, poaching and the use of nonspecific fishing gear; being the last two, causing multiple deaths in the natural populations of these organisms (Nowacek & Wells, 2001; Buck *et al.*, 2006; Kumar & Deepthi, 2006; López, 2007; Read, 2008; Reeves, *et al.*, 2013; Kennelly, 2014). *Tursiops truncatus* (Montagu, 1821) is especially vulnerable to hunting, incidental catch, and habitat degradation (Curry & Smith, 1997), due to their physical proximity to people and because of population abundance is typically low. In Cuba, populations of *T. truncatus* are frequently associated with shallow ecosystems, where they coexist with fishing communities that use fishing as a means of livelihood in natural foraging areas of the species (Silva, 1977; Pérez-Cao *et al.*, 2009). This spatial overlap has brought about interactions between fishers and their fishing gear, with dolphin populations (D'Lima *et al.*, 2013). The main outcome of these encounters is the incidental capture (bycatch) of cetaceans and other species, which are not targeted by fisheries (Lewison *et al.*, 2004). Bycatch has been identified elsewhere as the major threat to coastal bottlenose dolphins (Hammond *et al.*, 2012; Reeves *et al.*, 2013). Bycatches and other lethal takes in small cetaceans are notoriously difficult to detect, particularly if it is illegal (Read, 2008). At sea, carcasses are frequently thrown into the water, dragged by currents and later deposited on the shore by the tides (Peltier *et al.*, 2016). However, not all dead bodies are dragged to the edges, so they are not accounted for in their entirety (Peltier *et al.*, 2013). Sometimes they are used onboard as bait, or alternatively, may be clandestinely landed for food (Costello & Baker, 2011; Robards & Reeves, 2011; Lewison & Moore, 2012). This practice is carried out mainly in countries with low

economic development, high food deficiencies, impoverished fishing stocks and inefficient regulatory policies (Alverson *et al.*, 1994, Leeney *et al.*, 2015). Bycatches and some direct takes of *T. truncatus* have long been known to occur in the Caribbean and the contiguous western central Atlantic, mostly in gillnets but also in beach seine nets (Vidal *et al.*, 1994, Romero *et al.*, 1997, 2001, IWC, 2006; Van Waerebeek *et al.*, 2006) This context causes the populations of bottlenose dolphins to be very vulnerable to illegal subsistence captures.

In 2003, the Cuban CITES administrative authority indicated that the illegal capture and bycatch of *T. truncatus* is practically zero because there is no tradition of (dolphin meat) in Cuba and no conflict exists with fisheries in areas where this species occurs (CITES, 2003 in Van Waerebeek *et al.*, 2006). The Cuban government has approved since 1976 laws and regulations that involve the species or give some protection to its populations. Among them are Law No. 81, the Environment Law of July 11, 1997 and Resolution No. 87 of September 2, 1996 of the Ministry of Science, Technology and Environment (CITMA) (López, 2007). Other decree indirectly protect the species, among which are Law No. 164 of 1996, for the establishment of fisheries regulations and the law for the National System of Protected Areas, which involve all the biota associated in areas with some category of management. Since 1990, Cuba has been part of a regional project for the protection and sustainable development of the marine environment for the Greater Caribbean, with the subscription to the SPAW protocol relating to areas, flora and fauna, and use of marine mammal populations. This agreement is ratified in the years 1999, 2001, and 2003, based on a limited knowledge of the

populations. Other international and regional agreements, such as the Convention for the Conservation of Migratory species and the Convention for the Biological Diversity of which Cuba forms part, provide a basis for the conservation of marine mammals in our region. (López, 2007)

Yet, it is stated that whenever there is fishing activity there will be some level of bycatch causing injuries (lethal or not) in these species (Van Waerebeek *et al.*, 2006; Luksenburg, 2014). Even in countries with strict control and monitoring of marine areas, fisheries-caused mortality of common bottlenose dolphins occurs (Van Waerebeek *et al.*, 2006). In addition, in most cases fishermen do not report negative interactions with this species, so it is likely that more interactions occur but are overlooked (Northridge, 1984). In general, there are few studies in the Caribbean region that address the interactions of small cetaceans with human activities and their consequences (Van Waerebeek *et al.*, 2006; Luksenburg, 2014). On the other hand, population studies are also scarce in most marine cetacean species and/or refer to specific populations. All this makes it difficult to assess the conservation status and threat levels for marine mammals.

In Cuba, research on marine mammals is scarce, in particular about *T. truncatus*, they have been focused on morphological, clinical and demographic aspects in some regions of the northern coast of Cuba (Blanco & Olachea, 2000; Guevara *et al.*, 2003; Pérez-Cao, 2004, Pérez-Cao *et al.*, 2009; Cruz, 2006; López, 2007; Alvarez-Alemán *et al.*, 2009; López *et al.*, 2013), but these continue to be insufficient to guarantee their adequate conservation and sustainable use. Especially considering that unfortunately, Cuba remains capturing live

dolphins for commercial exploitation (Van Waerebeek *et al.*, 2006). To date, there is no study that reports dead dolphins in Cuban waters by interaction with human activities, like fisheries and/or boat traffic. In the following work we analyze for the first time the occurrence of dolphin mortality by interaction with human activities in Lanzanillo-Pajonal-Fragoso Wildlife Refuge, Cuba.

MATERIALS AND METHODS

STUDY AREA

Lanzanillo-Pajonal-Fragoso Wildlife Refuge is a marine-coastal area that includes the succession of keys to the north of the

municipalities of Encrucijada, Camajuaní and Caibarién, which are part of the Sabana-Camagüey archipelago, Cuba (Ruíz, 2017) (Fig. 1). This area consists of a long, narrow and oriented coastal marine territory from east to west and covers an area of 87,070 hectares (76,490 marine hectares and 10,580 hectares of land), that includes water reservoirs on the insular platform, numerous keys, where the emergent lands are evidently minority. It has a high diversity of habitats, the most significant are mangrove swamps (in rivers, streams and channels), and channels between cays, such environmental combinations favor a remarkable

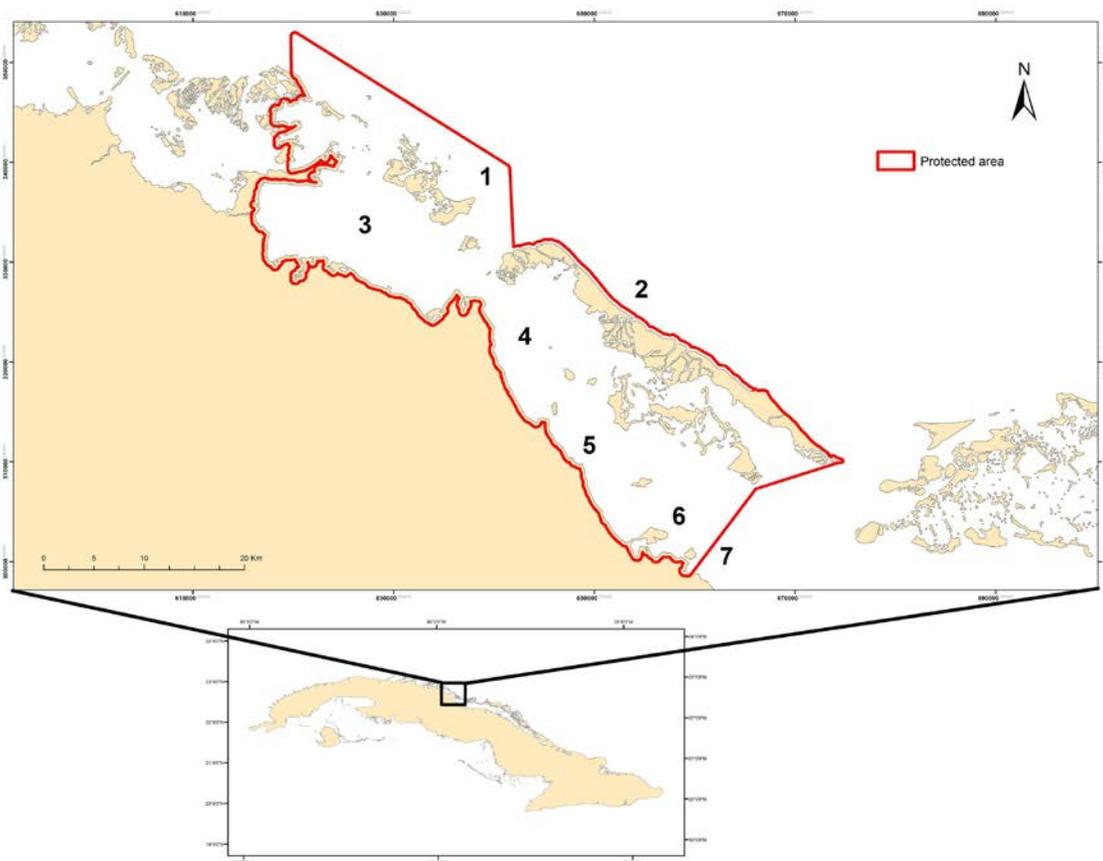


Fig. 1. Map showing the study area in the Lanzanillo-Pajonal-Fragoso Wildlife Refuge, Cuba. Locations where dead dolphins were reported: (1) Punta del Pino; (2) Cayo Fragoso; (3) Bahía de Nazábal; (4) Juan Francisco; (5) Ginaguayabo; (6) Cayo Conuco; (7) Puesto de Guardiafronteras .

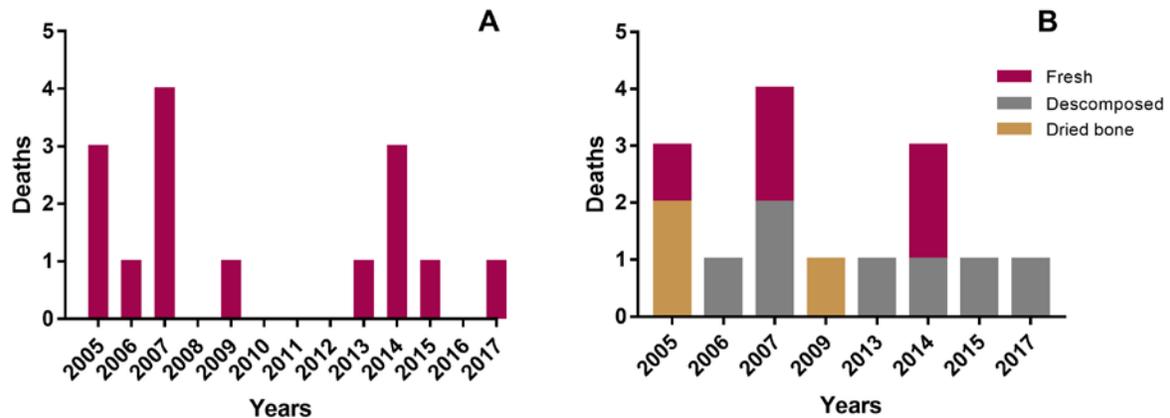


Fig. 2. Number of dolphin dead bodies found per year (A) and the decomposition status of the corpse (B) in the Lanzanillo-Pajonal-Fragoso Wildlife Refuge.

range of ecosystems that is reflected in the diversity of flora and fauna.

SAMPLING AND DATA COLLECTION

Monthly observation surveys were conducted from 2005 to 2017 to detect stranded animals, along the coast bordering the protected area. The goal was to establish an information system involving the the Manatí Biological Station's staff, sports fishermen, costal guards and forest ranger. When a dead dolphin was found, a necropsy analysis was conducted and samples were taken (if the carcass condition allowed) to determine the possible cause of death. Dolphin dead bodies were classified according to the decomposition level in fresh body, decomposed, or dry bones. Data were collected about the probable cause of death and the location of stranding.

RESULTS AND DISCUSSION

During the period studied, a total of 15 dead dolphins were found. The year with the highest number of dead bodies found (four) was 2007, followed by the years 2005 and 2014, each with three dead bodies (Fig

2A). If we consider the small area of study and the category of protection it has, the values found are not negligible, and are not only the product of natural death, but also even bycatch. In addition, only data from stranding have been quantified in the present study, therefore the captures or dead bodies that do not reach the coasts of the protected area are not contemplated. To estimate the proportion of floating and sinking bycaught dolphins, an experiment was carried out between 2004 and 2009 with tagged carcasses (Peltier *et al.*, 2012). A total number of 100 dolphins that were caught in fishing vessels, were marked and their carcasses released back into the Bay of Biscay (France), at a known time and place. Of the 100 bodies released at sea, it was predicted that approximately 62 would have to reach the coast, but only 8 bodies were found stranded representing only 8% of the total dead dolphins released. Similar proportions were obtained by Williams *et al.* (2011), 2% in the Gulf of Mexico; and 10.5% in Brazilian fisheries targeting white croakers (Prado *et al.*, 2013). Even when patterns of marine

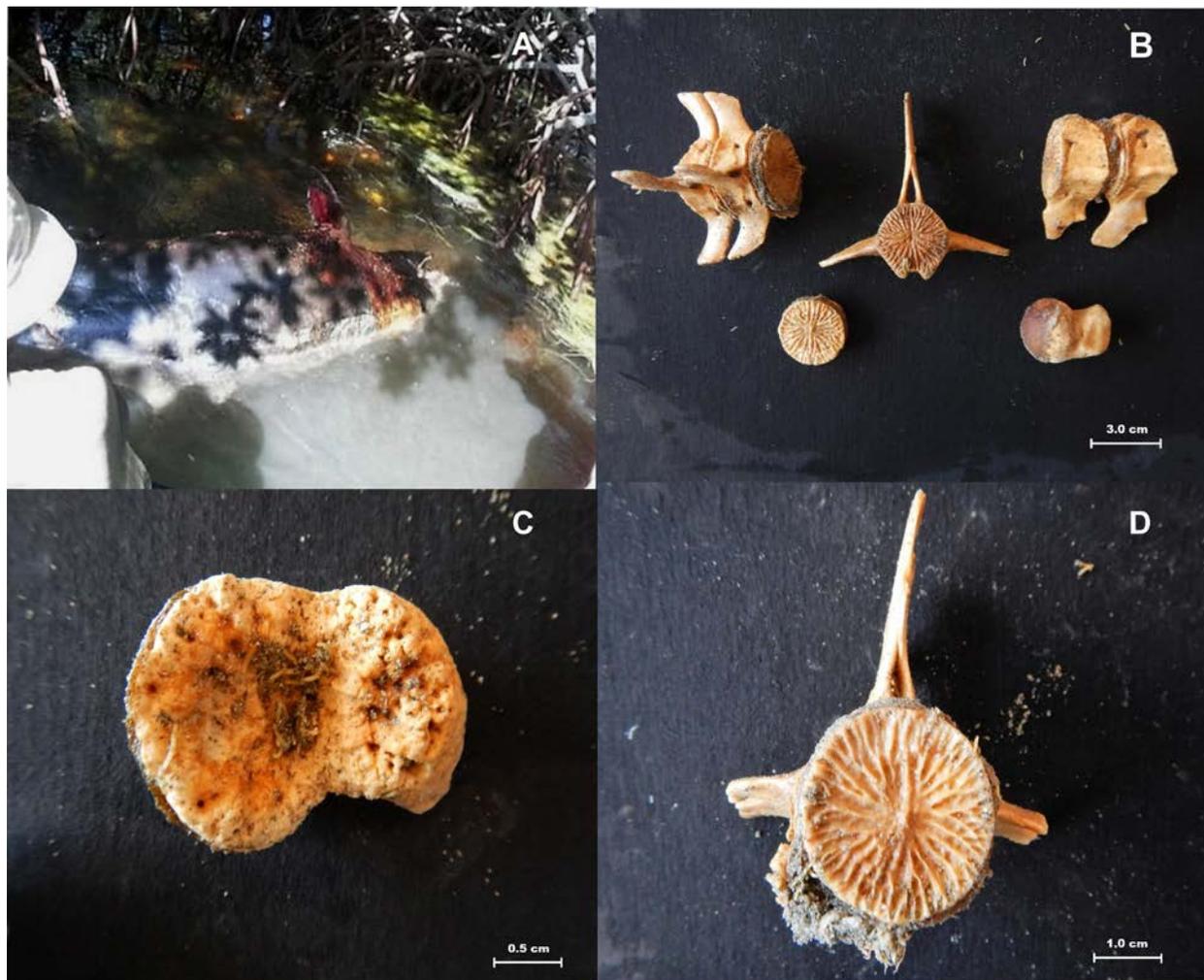


Fig. 3. Dead dolphins found in Nazabal Bay of in 2007, the corpse was found with drowning marks and in an initial state of decomposition (A). Advanced decomposing bones of a dead dolphin found at Nazabal Bay in 2017 (B, C, D).

currents in Cuba are different in comparison with the study areas used by those authors, it is easy to predict that the number of carcasses sampled in the present work, represents only a portion of the real number of dolphins affected by fisheries in coastal areas of the Wildlife Refuge Lanzanillo-Pajonal-Fragoso. The analysis of the state of the bodies revealed that only five individuals were found stranded freshly, seven had some state of decomposition and in three individuals only dry bones of the skeleton were

found (Fig. 2B). The fact that there is a greater number of individuals in some state of decomposition or only the bones are found (Fig. 3), indicates that the time that elapses between the capture and death of the animal, until it is reported and registered by the stranding network in the protected area, it is sometimes several days or weeks. This pattern suggests that the patrols carried out by the staff of the area, are still insufficient or do not have enough personnel to reach all the geography of the place.

The locality that reported the highest number of dead bodies was Bahía de Nazabal (eight) (Fig. 4A), in accordance with the high productivity and fishing effort that it presents. It is very common to find in the literature, the direct relationship between the availability of food and the presence of dolphins as temporary or permanent residents in the area (Delgado, 2002, Morteo *et al.*, 2004, López *et al.*, 2013). However, a large number of fish brings an increase of artisanal fishermen in the area, with an increase in fishing effort. This phenomenon implies the existence of more interactions between the dolphin populations and the fishermen, who use the same areas and the same trophic resources. Otherwise, when there are no large catches by fishermen due to the fact that fishery resources are depressed, as is the case of the entire Cuban platform (Baisre, 2000), it is possible to find an incidental capture transfer, with the subsequent release or discarding, towards an intentional catch, with the exploitation and consumption of the species that were previously part of the bycatch (Leeney *et al.*, 2015). This transition may be occurring with this species, based on

the fact that of the 15 dead dolphins found in the area, 5 had clear evidence of having been hunted. Studies on the Antillean manatee indicate that pollution, drowning after entanglement in trawls and other nets, and hunting are the main threats that the species presents in the northwestern region of Cuba (Alvarez-Alemán *et al.*, 2018). Interviews made by these authors to local fishermen reveal that "poaching was rare before 1990, because the economic environment was better and the fishing communities received more support from the government. However, these fishermen reported an increase in poaching when economic conditions worsen" (Alvarez-Alemán *et al.*, 2018). Alvarez-Alemán *et al.* (2018) find that poaching is emphasized as a substantial threat only in interviews conducted after 2000. It would not be unreasonable to expect that this trend is happening with bottlenose dolphins populations, and that the economic difficulties that affected Cuba since the 1990s (Alvarez-Alemán *et al.*, 2018), would lead to a transition which would have driven people to illegally harvest dolphins as an alternative source of protein.

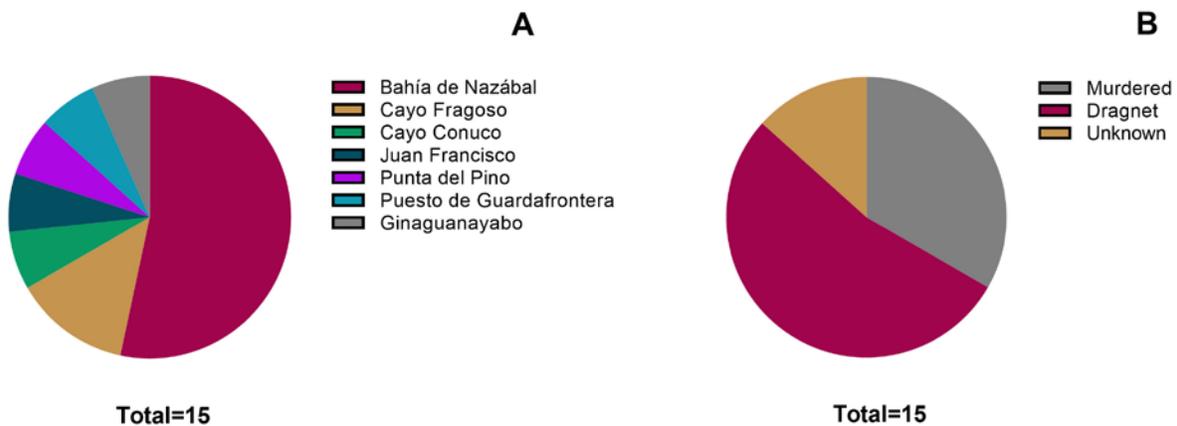


Fig. 4. Number of stranding dolphins by location (A) and probable causes of death (B).

It was determined that of the 15 dead dolphins found, five were slaughtered for consumption, eight were caught accidentally by fishing gear, while it was not possible to determine the cause of death of two individuals (Fig. 4B). In all cases, it is possible to observe that regardless of the intention of the catches, the majority fishing gear used is the gillnet. Although the study area is a wildlife refuge, with a certain level of protection and where fishing should be prohibitive; this is a protected area with sustainable use of natural resources allowing commercial fishing on a smaller scale (Resolution No.133/2017) (see below). The five individuals captured for consumption, showed deep cut marks, from which portions of meat were extracted, which evidenced the intentionality of the capture and the used of the bodie. The eight individuals who showed visible marks of interaction with gillnet, presented the body without any mutilation, for which it is possible to infer that it was only incidental capture, without subsequent use for consumption. Some of them still had parts of the fishing gear used entangled in the fins. In this area, not only dolphins carcasses are found, but also manatees and turtles are frequently found entanglement in trawls and other nets (*in situ* observations of one of the authors; Alvarez-Alemán *et al.*, 2018). In these cases it is also common to find animals stranded with fishing gear marks or with mutilations resulting from the extraction of meat for consumption. Indeed, it is adjudge that poaching as a major cause of mortality in *Trichechus manatus manatus* (Alvarez-Alemán *et al.*, 2018). Such is the case, that in 2017 the Ministry of the Food Industry issues a special resolution (Resolution No.133/2017) aimed at the protection of the Antillean

manatee in the Bahía de Nazabal; reducing to six, the number of boats authorized to fish within the area and only in the months between May and October. Although insufficient, these measures are a step forward in the protection of marine mammals in the study area.

GENERAL CONSIDERATIONS AND RECOMMENDATION FOR THE MANAGEMENT

Interactions between marine mammals and fisheries occurs for centuries and have increased in frequency and intensity during the last decades (Read, 2008; Kiszka *et al.*, 2009; Weir, 2012; Luksenburg, 2014; Alvarez-Alemán *et al.*, 2018). The bycatch of marine mammals, particularly dolphins caught in seine, trawl and gillnets have been global conservation issues for decades (Read *et al.*, 2006; Read, 2008; Reeves *et al.*, 2013, Gray & Kennelly, 2018). On the other hand, knowledge about the relative abundance and distribution and life history in marine mammals is scarce and in consequence, the conservation status of many species of marine mammals is of great concern (Reeves *et al.*, 2013, Gray & Kennelly, 2018). The Caribbean, and particularly Cuba are not an exception in this context (Van Waerebeek *et al.*, 2006; Alvarez Alemán *et al.*, 2018).

In general, studies on bottlenose dolphins are scarce in Cuba (see above), and the little information that exists has not been included in the plan for systematic research, monitoring, and management that will ensure the survival of this specie in Cuba. *Tursiops truncatus* is not only a charismatic species, it also plays an important role in trophic plots, being considered among the top predators of the food chain. However, artisanal fishermen are probably not familiar with the ecological

significance of the species, so its use as a resource for consumption is more related to nutritional deficiencies (supplied with the consumption of meat) (Moore *et al.*, 2010) and economic (which can supplement the meat trade) (Read, 2008). The fact that this practice is being carried out in a protected area of this magnitude implies that the regulatory policies for the protection of the species and the ecosystem where it lives are insufficient or not being applied in an appropriate manner. This work constitutes the first report of the deaths of dolphins *Tursiops truncatus* in the Lanzanillo-Pajonal-Fragoso Wildlife Refuge and may constitute a precedent for studies in other areas with some category of protection or in unprotected natural environments.

We can make four key recommendations: 1) It is imperative to implement and carry out programs to study the abundance and distribution of bottlenose dolphin populations, not only in the Lanzanillo-Pajonal-Fragoso Wildlife Refuge, but in the entire Cuban platform; 2) likewise it is necessary to evaluate the effects of bycatch, pollution and other threats (like poaching or commercial capture), habitat degradation, stock structure, and genetic analysis to determine the status of bottlenose dolphins in Cuba. 3) It is necessary that the laws that protect this species are implemented or enforced properly; where MPAs (the most important governmental strategies for conservation, [Alvarez-Alemán *et al.*, 2018]) play a role in reducing poaching and entanglement in fishing nets; 4) Finally, it is necessary to implement programs that involve the communities in the management and conservation of the natural populations of dolphins.

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