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Short Communication

Is it possible to go whale watching off the coast of Peru? A case study of humpback whales

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ABSTRACT. Whale watching is the human activity of encountering cetaceans in their natural habitat for recreational and scientific purposes. Despite the high diversity of cetaceans in Peruvian waters, this activity has yet to be developed. Herein we present data regarding the distribution of humpback whales (*Megaptera novaeangliae*) off northern Peru, evaluating the possibility of extending whale watching activities in this area. Data were obtained from surveys conducted from an ecotourism boat. Humpbacks were distributed in shallow waters, usually in pairs or trios throughout the study period between late July and late September. The presence of whales off northern Peru is due to winter migration for breeding and calving purposes. A high probability of encountering humpbacks within the study area could encourage the development of a whale watching industry. As this stage in the life cycle of this species is very delicate, we suggest the adoption of the precautionary principle in the management of the activity in order to minimize the risk of negative impacts on humpback populations. Whale watching in northern Peru is feasible and could be considered an alternative to fishing.

Keywords: whale conservation, ecotourism, cetacean management, winter distribution, *Megaptera novaeangliae*, Peru.

¿Es posible hacer turismo de observación de ballenas en la costa de Perú? Un caso de estudio con ballenas jorobadas

RESUMEN. La observación de ballenas es la actividad humana de observar estos cetáceos en su hábitat natural con fines recreacionales y científicos. A pesar de la alta diversidad de cetáceos en aguas del Perú, esta actividad no ha sido desarrollada. En este estudio se presentan datos sobre la distribución de la ballena jorobada (*Megaptera novaeangliae*) en un área de la costa norte del Perú, con el objetivo de evaluar la posibilidad de extender el turismo de observación de ballenas jorobadas. La información proviene de muestreos realizados en un bote de ecoturismo. Las ballenas jorobadas se distribuyeron en aguas someras usualmente en pares o tríos y estuvieron presentes de manera permanente entre fines de julio y fines de septiembre. La presencia de esta especie en el área resulta de la migración invernal para la crianza y reproducción. La alta probabilidad de encuentro con esta especie puede fomentar el desarrollo de la industria basada en turismo de observación de ballenas. Sin embargo, como esta etapa de su ciclo de vida es muy delicada, se sugiere la adopción del principio precautorio en el manejo de esta actividad para minimizar los impactos negativos. El turismo de observación de ballenas en el norte de Perú es factible y podría ser considerado como una actividad alternativa a la pesca.

Palabras clave: conservación de ballenas, ecoturismo, manejo de cetáceos, distribución invernal, *Megaptera novaeangliae*, Perú.

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Natural ecosystems, through the functioning and species that make them, sustain and fulfill human life providing goods directly or indirectly (Botsford *et al.*, 1997; Castilla, 2001). Unfortunately, marine ecosys-

tems have been drastically and negatively impacted by humans, thus reducing several of their goods. World fisheries are in crisis and there is an urgent need to protect several marine areas and to reduce the extractive pressure of many fisheries resources (Pauly *et al*., 1998; Pauly, 2009). Besides protection, ecosystems must be used with rational and innovative approaches that minimize the negative impacts on its components (Pauly, 2009). Due to the variability associated with El Niño and the Southern Oscillation (ENSO), industrial and artisanal fisheries management in Peru have been shown to be complex and often unsustainable in long-term temporal scales (e.g. Chavez *et al*., 2008; Estrella & Swartzman, 2010). Alternative activities such as whale watching should be considered in the marine resources administration (Gerber *et al*., 2009), because is a non-extractive, low-impact use of marine ecosystem components in comparison with fisheries and former whaling (Hoyt & Hvenegaard, 2002; Hoyt, 2007).

With seven mysticeti and 25 odontoceti species of cetaceans distributed along the coast (Reyes, 2009), Peru has high potential for developing a responsible whale watching industry with subsequent benefits for coastal communities from tourism (Majluf & Reyes, 1989). Although there are some efforts for encouraging the observation of several dolphin species (Hoyt & Iñíguez, 2008), having a high diversity of cetaceans is not a strong enough argument for encouraging the activity. Sustainable whale watching in this region requires recreational and scientific observations, preferably of well known species with distribution close to the shore and for extended periods of time. Hence, choosing a good model species is necessary in order to ensure feasible whale watching activities from both points of view; the observer and the tour operator. This means that the whale-watchers recreational needs would be met by observing whales and the tour operator would have the expected economic income by doing so.

The humpback whale (*Megaptera novaeangliae*) appears to be such a model species and whale watching focused on this species in their feeding grounds and breeding distribution areas has been developed worldwide (Hoyt, 2009). In the southeastern Pacific, there is a growing whale watching industry in breeding areas off the coast of Colombia and Ecuador and also on the feeding ground in the southern region of Chile (Flórez-González *et al*., 2007). In winter breeding areas off Colombia and Ecuador humpbacks are distributed in shallow waters (< 50 m) close to the shore, or in the surrounding areas of coastal islands where it is relatively easy to encounter them for observations (Félix & Hasse, 2001; Flórez-González *et al*., 2007). Moreover, during the breeding season (early June to late October) humpbacks display a number of highly energetic behavioral activities (e.g. breaching, tail slapping) on the sea surface (Félix, 2004) making the observation a spectacular experience. Humpback whale distribution along the Peruvian coast is more offshore. However, in the north coast, humpback whales are closer to the shore as they approach this area for breeding and calving processes (Pacheco *et al*., 2009). Such distribution could encourage responsible whale watching.

In this note we report data regarding the temporal and spatial distribution of humpback whales from northern Peru. Data was obtained from a touring boat that offered marine life observation including sea birds, sea turtles, traditional fisherman rafts, dolphins and humpback whales for the first time in this region. We realized that humpback whales were the most appealing species, which further motivated the study of its spatial and temporal distribution. Based on our results we discuss the possibility of extending whale watching in the northern coast of Peru and we offer recommendations for optimal management of this activity.

Between 27 July and 28 September 2009, a total of 43 trips aboard a whale watching boat were made to study humpback whale distribution during the wintering season (June-October) along the coastal area between Los Organos and Cabo Blanco off northern Peru (Fig. 1). The boat was 6.7 m length and 2.4 m wide with twin outboard Yamaha engines (85 HP each). Trips started at 7:30 AM taking one of two routes. The first route consisted of navigation to the oil platform then heading south to Cabo Blanco, and finally returning to Los Organos bordering the coastal line (Fig. 1). The second route began with navigation to the La Perelera bank area heading further offshore to the most northwest point located at 14 km distance and then returning inland to El Ñuro and finally back to Los Organos (Fig. 1). Navigation usually finished at 11:00 AM. Once singles or groups of whales were located, they were approached maintaining approximately 30-100 m distances. The boat was situated at an adequate distance, in an attempt to avoid triggering avoidance behavior by the whales. For example, when whales were observed swimming, the boat followed them parallel in the same direction. If after a long dive the whales resurfaced closer to the boat, the engine was kept in neutral gear until the animal moved away from the boat. Observation time ranged from 10 to 40 min. During observations, information about the number of animals and geographic position (i.e. GPS recorded position) was obtained. In addition, the relative age-class size composition was recorded determined as adults

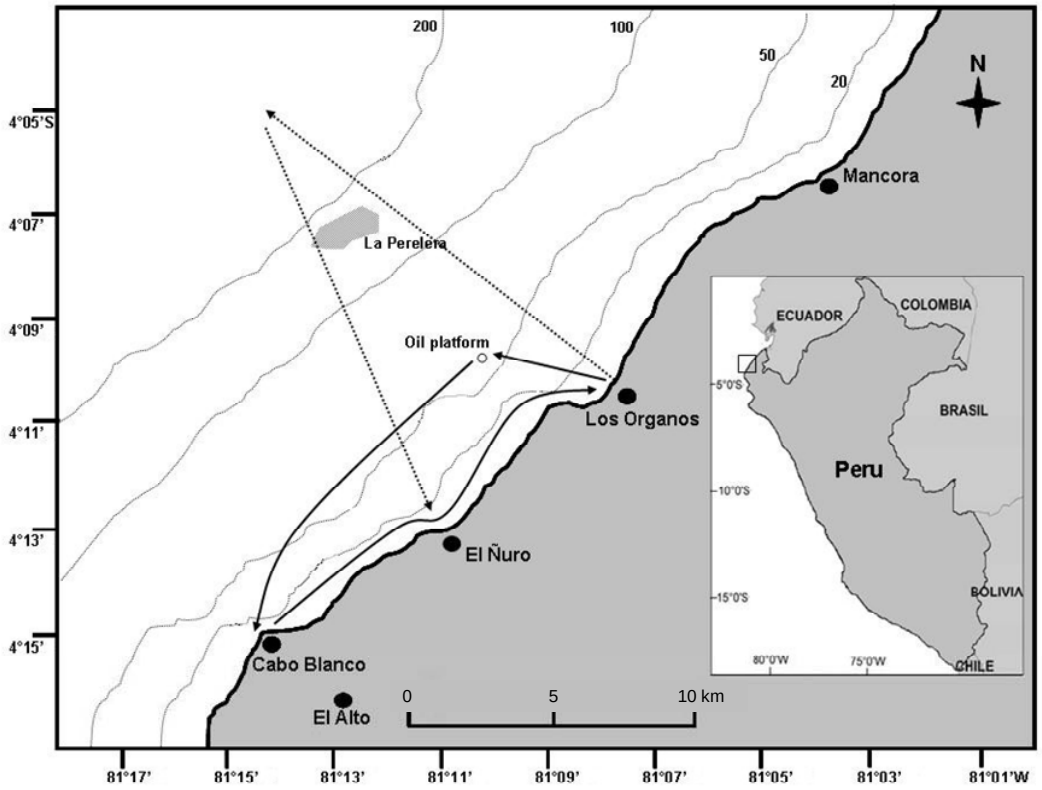

Figure 1. Study area, the coastal zone between Cabo Blanco and Organos off Piura, northern Peru and the routes used during trips (depth in meters).

Figura 1. Área de estudio, zona costera comprendida entre Cabo Blanco y Organos, frente a Piura, norte de Perú y las rutas recorridas durante los viajes (profundidades en metros).

(large size > 10 m), sub-adults (medium size, 6-10 m) or calves (small size < 6 m and always accompanied by a larger whale, presumably the mother) (Félix & Haase, 2001). Groups were classified in one of the following categories: all adults (A), all sub-adults (S), adults with sub-adults (AS), mother with calf (MC), mother with calf and escort (ME) and mother with calf and more than one escort (MCE).

Humpback whales were successfully sighted in 37 (86%) of 43 trips in waters ranging from less than 20 to 200 m depth in a study area of approximately 74 km^2. A total of 124 whales were registered in a total of 150.5 hours of navigation. Humpbacks were sighted throughout the study period in average of 3.35 individuals per trip, with two (n = 12; 32.4%) and three (n = 10; 27.0%) sighted whales as modal values. The largest number of sighted whales was eight (n = 2; 5.4%), occurring twice, on the 24 and 28 of August.

A total of 43 groups were recorded. Groups consisting of pairs (n = 31; 72.1%) were commonly observed, followed by trios (n = 9; 20.9%) and larger groups formed by more than three whales (n = 3; 7.0%). Seventeen single whales were also recorded. Both singles and groups of whales were distributed in the whole surveyed area but mainly concentrated in shallow areas between ~20 and ~60 m depth, along the coastal line (Fig. 2). A one-way analysis of variance comparing the number of whales in five different depth ranges as a fix factors (0-20, 20-50, 50-100, 100-200 and > 200 m depth) detected significant differences ($F_{(4, 46)} = 2.72$, $P < 0.05$), with ranges 20-50 and 50-100 m, accounting for the differences (Tukey test, $P < 0.05$). The largest groups were only observed offshore in the La Perelera area in waters of ~200 m depth. In terms of relative age-size class distribution, fifteen (88.2%) of the singles were adults, while only two (11.8%) whales were recognized as sub-adults. Groups were mainly formed by adults (n = 23; 53.5%) followed by mother and calf pair (n = 8; 18.6%) (Fig. 3). Groups consisting of only adults and adults plus sub-adults were widely distributed in the area including waters of 200 m depth, while sub-

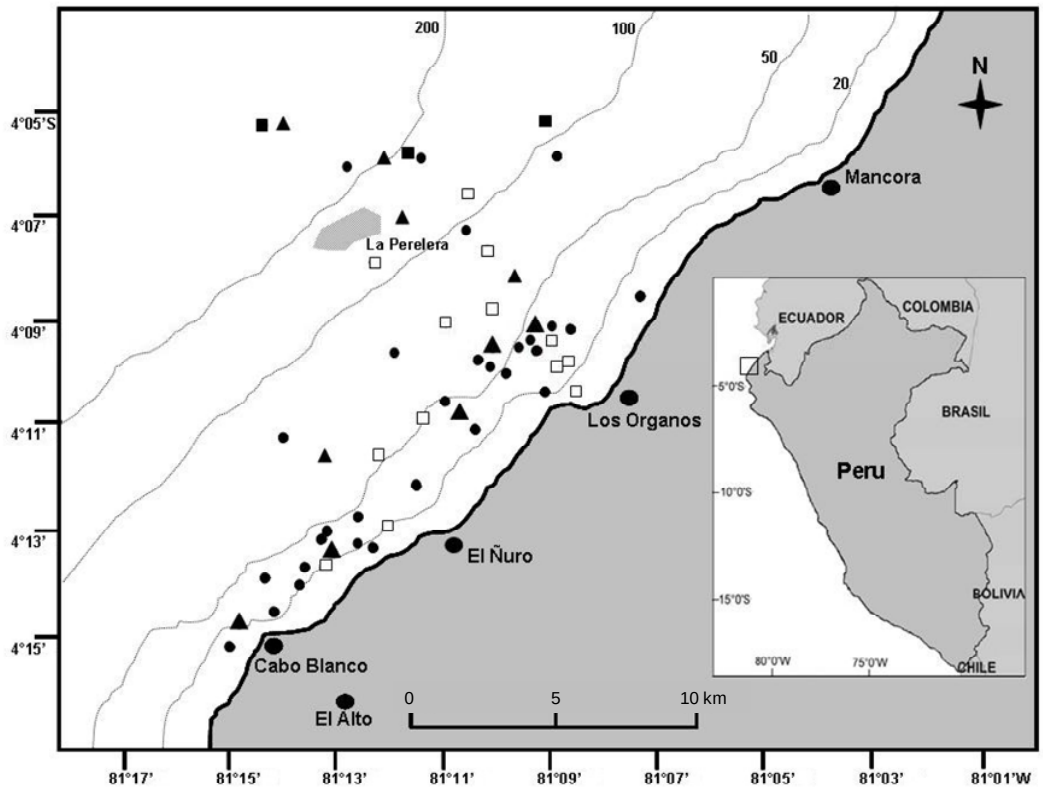

Figure 2. Distribution of groups within the survey area with indication of group size: single (□), pair (●), trio (▲), larger than three (■). Dots indicate the location of GPS-positioned sightings recorded during the study period (depth in meters).

Figura 2. Distribución de los grupos en el area recorrida, indicando el tamaño del grupo: individuo (□), par (●), trío (▲), más de tres (■). Los puntos indican la posición de los avistamientos registrados con GPS durante el periodo de estudio (profundidades en metros).

adults, and mother and calf pair were exclusively encountered in shallow waters close to the shoreline (Fig. 3).

The distribution of humpback whales within the surveyed area reflected the pattern previously observed in other breeding areas; whales present in shallow waters close to the shore or surrounding islands/banks which are the preferred areas for breeding and calving (Craig & Herman, 2000; Félix & Hasse, 2001, 2005; Zerbini *et al*., 2004). In particular, this habitat was preferred for mother and calf pairs as these waters provide refuge against predators and minimizes harassment from sexually active males (Craig & Herman, 2000; Félix & Hasse, 2001, 2005; Zerbini *et al*., 2004). However, adults were also common in deeper waters reflecting segregated distribution within the area (e.g. Johnston *et al*., 2000). From the whale watching point of view, this pattern of distribution is rather advantageous as it would be relatively easy to find humpbacks for observation close to the shore. A short distance trip might imply a relatively low cost of boat operation and fuel, which could help to set a tour price that is accessible to visitors coming from all different economic levels. Eventually, land observers could spot whales and direct the boat crew which would help to save time.

An eighty six percent rate of successful sightings is encouraging however this value can be considered preliminary and rather conservative. As the season progressed, our knowledge of areas preferred by the whales also increased and by the end of the season (i.e. end of October, data not shown), we reached a ninety three percent success rate. Yet the data presented here set up a probability of whale encounters of 0.86 which is very high. Such values can provide a strong argument for tour operators willing to start whale watching trips. However, it must be taken into consideration that humpbacks in their wintering areas are in a delicate phase of their life cycle, and irresponsible whale watching can produce undesirable impacts (Garrod & Fennell, 2004).

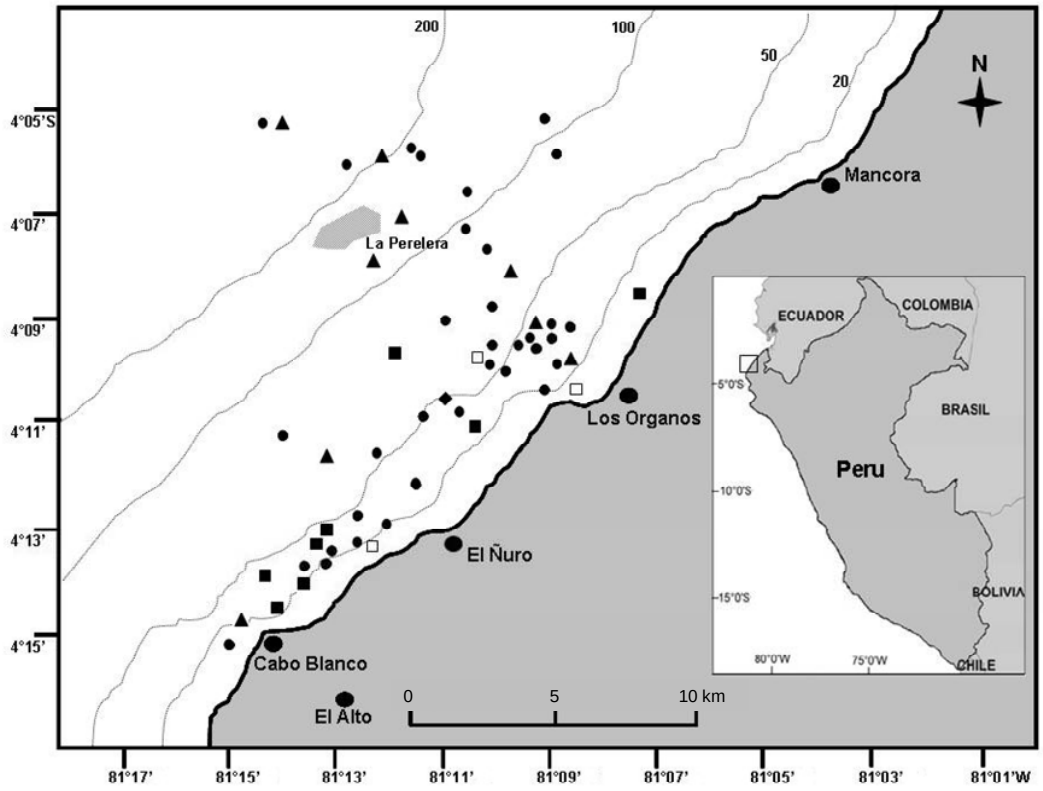

Figure 3. Relative age and sex-class distribution of humpback whales in the study area. Symbols refer to GPS-positioned sightings during the studied period. Adults (●), subadults (□), adults and subadults (▲), mother and calf (■), indetermined (♦) (depth in meters).

Figura 3. Distribución relativa de edad y sexo de ballenas jorobadas en el área de estudio. Los símbolos representan los lugares de avistamiento registrados con GPS durante el periodo de estudio. Adultos (●), subadultos (□), adultos and subadultos (▲), madre con cría (■), indeterminado (♦) (profundidades en metros).

Irresponsible whale watching has been reported to have impacts in many ecological and behavioral aspects. Humpback whales may react against observers by interrupting natural behavior, avoiding vessels, increasing swimming speed, displaying annoyance, staying down longer (Scheidat *et al*., 2004; Hoyt, 2009), expending more energy which could affect individual fitness and eventually population parameters (Au & Green, 2000; Weinrich & Corbelli, 2008). In breeding regions humpback physiologically relies upon their blubber reserve as they do not feed during the wintering season. Energy is used for social interaction mating, breeding, calving and overall reproductive activities. Thus, as a vessel disturbs a mother and calf pair, it might produce avoidance reactions of the mother, reducing calf sucking time and affecting its body development and also learned social behavior. These effects could be worse in areas where several vessels are operating simultaneously. Nevertheless, these short-term impacts contrast with some long-term studies reporting no negative whale watching effects in migration destination, birth and population growth rates (e.g. Weinrich & Corbelli, 2008; Hoyt, 2009). There is also the risk of collision accidents with resurfacing whales or in cases of abrupt changes of swimming direction nonetheless, the number of accidents is quite small considering the millions of people that go whale watching every year. Whale watching is largely considered safe for both people and whales (Hoyt, 2009).

Our data does not allow inferences whether boat observations produced these effects, although we observed both situations; avoidance and humpbacks curiously approaching the boat. Strictly speaking, whale-watching impact observations require a design where an individual or population parameter is recoded from whales with and without the observing vessel (IWC, 2004). Alternatively, a before, during and after strategy could be adopted, but obtaining

conclusive evidence is not always straightforward. Scheidat *et al*. (2004) found significant increases of whale speed when disturbed by a whale watching boat but were unable to conclude unequivocally changes in path direction taken by humpbacks after the encounter with the boat. There is always the risk of confounding effects of whale movements as it is difficult to visually predict a movement pattern that is mainly acoustic oriented for whales (Scheidat *et al*., 2004). Regardless of the ability of detecting whale watching impacts or its magnitude, it is necessary to adopt strategies ensuring safe trips for both whales and humans.

Based on our early experience we suggest that responsible whale watching focused on humpback whales is feasible in the northern coast of Peru. Foremost, the activity must be recognized as such among all stakeholders, from tourist authorities to general public. The fact that whale watching in Peru is still in its infancy offers the opportunity to develop an orderly industry that minimizes the risk of adverse impacts. There are no generalized conduct codes for whale watching activities (Garrod & Fennell, 2004) and most likely management would be progressively adapted in accordance to the local requirements (IWC, 2004). However, as suggested by the International Whaling Commission, a precautionary approach must be adopted in which three main factors must be controlled; the number of observing vessels, the observation time and the distance between cetaceans and the vessel (Fig. 4). Table 1 provides a list of rules to be considered during humpback observation expeditions in the northern coast of Peru. Port authorities must allow departures of certificated whale watching vessels only, fulfilling standard onboard safety procedures and including a naturalist interpreter. Naturalists are essential in the conservation role as their ability to explain the actions and manner of the whales and the marine environment is valued (Hoyt, 2009). This is particularly important in the case of our tour excursions, where not only whales were observed but also the general biodiversity of the area.

Tour operators offering whale watching excursions must receive advice by experts from governmental or non-governmental scientific institutions and ideally they should act as platforms for individual and collaborative research (e.g. photo identifications studies). The union between whale watching and researchers has been proven to be successful and our general knowledge about cetacean's life history has benefited from such cooperation (Hoyt, 2009). Following the suggested whale watching rules and adopting a precautionary principle could lead to the establishment of a responsible ecotourism industry based on humpback whale and dolphin observation in the coast off northern Peru. It is also suggested that this activity could be a good alternative to fishing.

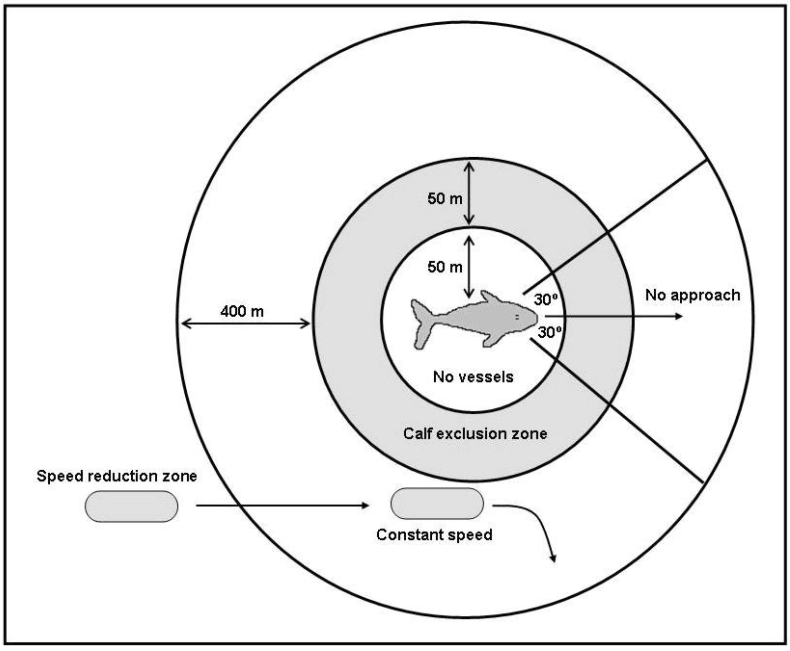

Figure 4. Diagram of approach distances for individual or groups of whales.

Figura 4. Diagrama de las distancias de aproximación a individuos o grupos de ballenas.

Table 1. List of proposed rules during whale watching trips (adapted from Félix, 2005 and Carlson, 2008).

Tabla 1. Lista de reglas propuestas durante los viajes de observación de ballenas (adaptado de Félix, 2005 y Carlson, 2008).

- Observations should last no more than 25 min.
- There should be a time interval of 30 min between departing boats.
- No more than three vessels can be observing the same group of whales; vessels must stay close to each other during observations.
- Vessels must approach whales in parallel position and in the same direction as whales. Frontal approach is not permitted as it could potentially block their movements.
- When vessels stop to enable the passengers to watch a cetacean, the engine should be placed in the neutral position.
- Reduced and constant speed when reaching 400 m distance between the vessel and whales. Abrupt changes in vessel direction and speed can produce behavioral changes thus making watching difficult.
- Maintain a distance of 100 m between vessel and whales during observation. If whales spontaneously approach the boat, stop running and set the engine in neutral gear until the animals move away voluntarily.
- If whales are swimming consistently over 4 knots, stop following them after 10 min. Navigation in circles around cetaceans is forbidden.
- Approaching groups of whales with calf or mother and calf pair must be carefully done. Always keep 100 m distance with such groups and do not interpose the vessel between the mother and calf. Young whales are curious and occasionally they may approach the boats. Mother can interpret this as harassment and react badly.
- After ending the observation vessels must leave in the opposite direction of the whale, speed should gradually increase when approaching the 400 m limit.
- Swimming or diving with the animals is forbidden.
- No rubbish, sewage or other polluting substances (including oil) or food should be disposed during whale watching trips.

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