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Short Note

First Record of the Commensal Barnacle (*Xenobalanus globicipitis*) on Common Bottlenose Dolphins (*Tursiops truncatus*) in Chile

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Several instances of association between cetaceans and cirripeds have been reported (Rajaguru & Shantha, 1992). The barnacle (*Xenobalanus globicipitis*) (Steenstrup, 1851) of the family Coronulidae is a cosmopolitan species that live as an obligate commensal on whales and dolphins (Rajaguru & Shantha, 1992; Seilacher, 2005; Kane et al., 2008). This species is commonly observed on the trailing edges of the dorsal fin, pectoral flippers, and tail fluke of the host (Seilacher, 2005; Toth-Brown & Hohn, 2007), although it has been documented attached to the rostrum and the area between the teeth (Samaras, 1989). *X. globicipitis* (hereafter *Xenobalanus*) is a suspension feeding cirriped that utilizes cetaceans for transportation purposes (phoresis). It does not receive nutrition from its host and, therefore, it is not considered a parasite (Toth-Brown & Hohn, 2007; Kane et al., 2008). It has a hermaphroditic reproduction and a 5- to 6-mo reoccurrence cycle, probably synchronized with that of its host (Van Waerebeek et al., 1993; Orams & Schuetze, 1998; Fertl, 2002). Although the larval stages of this species have not been described, similar barnacles undergo self-fertilization and release their larvae in the water column (Toth-Brown & Hohn, 2007). Different factors have been suggested to affect its settlement, including oceanographic conditions such as primary productivity, upwelling and El Niño events, water temperature and pressure, or age and swimming speed of host individuals (Van Waerebeek et al., 1993; Aznar et al., 1994; Orams & Schuetze, 1998; Fertl, 2002; Toth-Brown & Hohn, 2007; Kane et al., 2008; Bearzi & Patonai, 2010). Barnacle settlement has also been associated with unhealthy individuals that are more susceptible due to impairment of their immune system, slow movements, and/or presence of skin diseases (Brody, 1989; Aguilar & Raga, 1993; Aznar et al., 1994, 2005), suggesting that a high presence of these barnacles in cetacean populations is likely to be an indication of poor health of the host population (Aznar et al., 2005).

Xenobalanus has been reported on 34 different cetacean species worldwide and has a prevalence ranging from 0.2 to 55% of individuals in each sighting (Toth-Brown & Hohn, 2007; Kane et al., 2008). Its presence is highly variable, ranging from one to over 100 barnacles on a single host (Aznar et al., 2005; Toth-Brown & Hohn, 2007; Kane et al., 2008; Bearzi & Patonai, 2010). On the common bottlenose dolphin (*Tursiops truncatus*) (Montagu, 1821), its presence has been studied in some regions of the Pacific Ocean (Orams & Schuetze, 1998; Kane et al., 2008; Bearzi & Patonai, 2010), the Atlantic Ocean (Di Beneditto & Ramos, 2000; Toth-Brown & Hohn, 2007), and the Indian Ocean (Rajaguru & Shantha, 1992; Karuppiah et al., 2004). For the southeast Pacific Ocean, Van Waerebeek et al. (1990) reported on the presence of this barnacle on common bottlenose dolphins off Peru.

As part of an ecological investigation on bottlenose dolphins inhabiting the waters off central Chile (Díaz-Aguirre et al., 2009, 2010), we present the first record of *Xenobalanus* in Chile. Additionally, we provide preliminary information on the presence, occurrence, and prevalence of this barnacle on bottlenose dolphins within the study area.

The study area comprised the waters around Punta Curaumilla, Valparaiso region, central Chile, and extended from Punta Angeles (33°01' S, 71°38' W) to Punta Gallo (33°16' S, 71°41' W) (Figure 1). Oceanographic conditions are characterized by the presence of subantarctic waters of

the Humboldt Current, which are affected during winter by the contribution of inland water primarily from the Aconcagua River and during spring and summer by the influence of subsurface equatorial waters from coastal upwelling events off Punta Curaumilla (Pizarro, 1976; Avaria et al., 1989; Silva & Valdenegro, 2003). Sea surface temperature in the area ranged from 12.6° C in winter to 16° C during the summer months.

From May 2005 to December 2007, we conducted boat-based surveys within the study area about once every 2 mo (n = 19, weather permitting). Surveys were conducted parallel to the coastline at a distance from 1 to 8 km offshore, and the position was recorded using a portable GPS at 10-min intervals. Groups of bottlenose dolphins were photo-identified using Canon single lens reflex cameras equipped with 100-300 and 100-400 mm zoom lenses. Dorsal fin photographs were sorted within sightings by individual, using distinguishing characteristics such as notches, scars, and dorsal fin shape. Images of dolphin dorsal fins taken during photo-identification studies are a valuable tool to assess the presence of barnacles (Speakman et al., 2006). Identification of *Xenobalanus* was confirmed by comparison of photographs with published diagrams, photographs, and descriptions (Rajaguru & Shantha, 1992; Karuppiah et al., 2004; Seilacher, 2005; Toth-Brown & Hohn, 2007; Bearzi & Patonai, 2010). We recorded barnacle occurrence (number of sightings in which the barnacle was present) and presence (number of barnacles on the dorsal fin of an individual dolphin). In addition, barnacle prevalence for each sighting was determined by dividing the number of photo-identified dolphins carrying one or more barnacles by the total number of dolphins photo-identified in that sighting (Kane et al., 2008; Bearzi & Patonai, 2010). In these analyses, we only consider those individuals carrying the barnacle on the dorsal fin.

Eleven bottlenose dolphin groups were photo-identified and evaluated for the presence of the barnacle. A total of 536 photographs were taken during the study period, of which 211 were used in the analyses. *Xenobalanus* occurred on seven sightings (63.6%; Figure 1). Fourteen distinct individual dolphins were observed carrying the

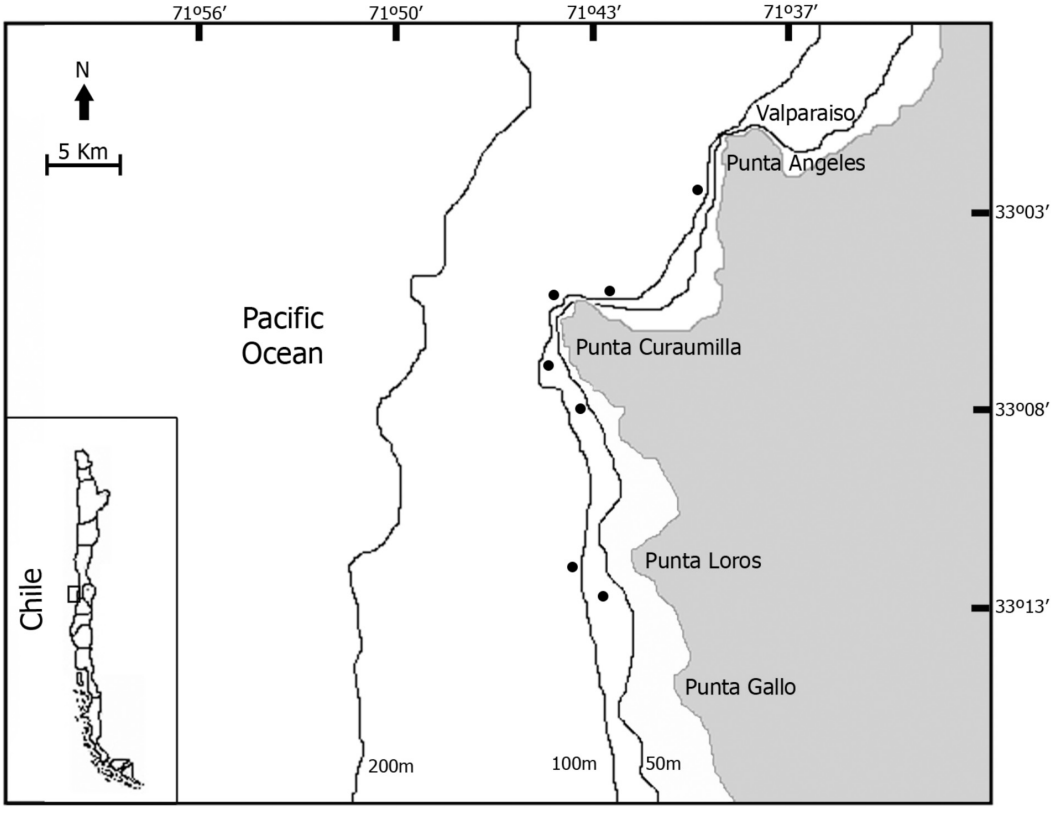

Figure 1. Study area; dots (•) indicate initial GPS coordinates of sightings with *Xenobalanus* observed on bottlenose dolphins off central Chile.

barnacle, all attached on top of their dorsal fins (Figure 2). These dolphins were always found with only one barnacle along the trailing edge of the dorsal fin. Mean prevalence of *Xenobalanus* per sighting was 0.09 (SE ± 0.007; range = 0.076 to 0.130; n = 7). Additionally, we recorded five individuals carrying the barnacle on the tail fluke (mean number of barnacles 3.2; SE ± 0.73; range = 1.0 to 5.0).

This study represents the first published record of *Xenobalanus* in Chile. The occurrence of the barnacle on dorsal fins of bottlenose dolphins off central Chile was high in comparison to other regions of the Pacific Ocean: our study – 63.6%, northeast Pacific – 29% (Bearzi & Patonai, 2010), eastern tropical Pacific – less than 10% (Kane et al., 2008); and it was similar to values reported in the northwest Atlantic Ocean – 64% (Toth-Brown & Hohn, 2007). However, the prevalence of *Xenobalanus* off central Chile was lower in comparison to the Atlantic Ocean: our study – 9% vs New Jersey – 55% (Toth-Brown & Hohn, 2007), and it was similar to the Pacific Ocean: northeast Pacific – 5% (Bearzi & Patonai, 2010) and eastern tropical Pacific – 0.2% (Kane et al., 2008). Differences in barnacle occurrence and prevalence compared to other regions may be related to distinctive habitat use by each host population (Kane et al., 2008). However, it is important to take into account that this result represents preliminary comparisons due to the small sample size of our dataset.

Barnacle presence on dorsal fins of bottlenose dolphin off central Chile was similar to that reported in other areas worldwide (Orams &

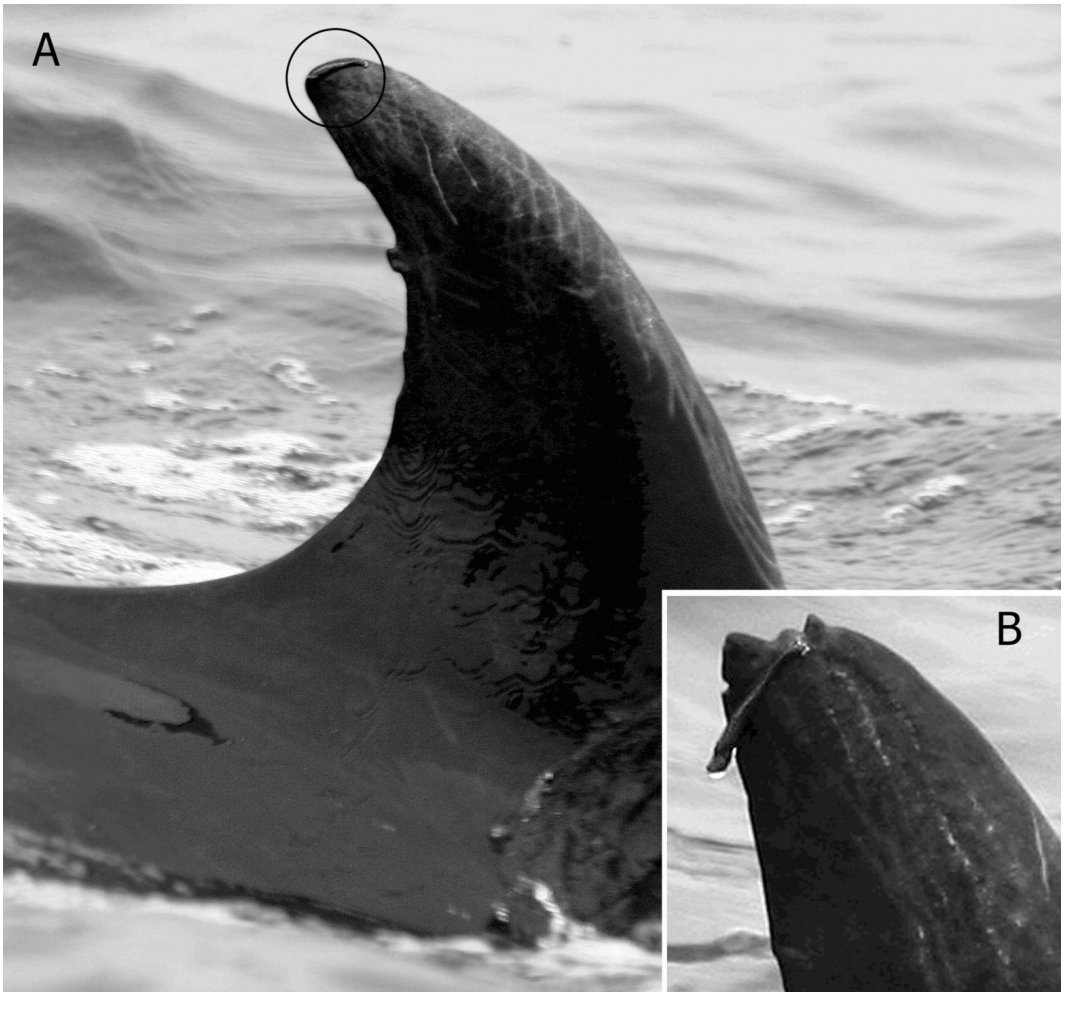

Figure 2. (A) *Xenobalanus* specimen on top of the dorsal fin of a bottlenose dolphin photographed off central Chile; and (B) detailed view of the barnacle on a distinct individual dolphin.

Schuetze, 1998; Di Beneditto & Ramos, 2000; Kane et al., 2008; Bearzi & Patonai, 2010) but lower in comparison to the Atlantic Ocean where over ten barnacles on dorsal fins per individual have been documented (Toth-Brown & Hohn, 2007). All barnacles recorded in this study were observed attached on top and along the trailing edge of the dorsal fin. As has been suggested by Bearzi & Patonai (2010), it is possible that barnacles prefer to attach on top of the dorsal fin when present in low quantity, but they may also spread to other fin segments when they are abundant (Toth-Brown & Hohn, 2007).

The waters around Punta Curaumilla are characterized by the presence of seasonal upwelling events which may increase primary production (Pizarro, 1976; Avaria et al., 1989; Silva & Valdenegro, 2003). As has been suggested previously, the occurrence of this species has been associated with these oceanographic phenomena due to the filter-feeding requirements of this barnacle (Kane et al., 2008). Van Waerebeek et al. (1993) found seasonal peaks of occurrence of *Xenobalanus* on dusky dolphins (*Lagenorhynchus obscurus*) off Peru, which they associated with periods of the strongest upwelling and the subsequent increase in nutrient levels. In this study, we recorded barnacles all year-round, but the small sample size does not allow us to make comparisons between seasons or years.

Long-term systematic photo-identification surveys within the study area could reveal interesting aspects of dolphin-barnacle ecological interactions, particularly within upwelling dominated ecosystems. For example, during spring-summer, the occurrence and prevalence of this barnacle could increase (perhaps in particular age or sex classes) in response to higher levels of primary productivity due to wind-driven upwelling off Punta Curaumilla. Additionally, as has been suggested by Aznar et al. (2005), long-term monitoring of the occurrence and prevalence of this barnacle may be of relevance for monitoring the overall health of dolphin populations and consequently that of the coastal ecosystem off central Chile.

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