

# Abundance and Spatial Distribution of Commerson's Dolphin (*Cephalorhynchus commersonii*) at a Breeding Site: Ría Deseado, Patagonia, Argentina

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## Abstract

Abundance and spatial distribution of the Commerson's dolphin (*Cephalorhynchus commersonii*) during spring and summer 2002-2004 and fall/winter 2003 were estimated in the estuary Ría Deseado, Patagonia, Argentina. To estimate the abundance, photo-identification and mark-recapture (positive method) were combined. Distribution of dolphins within the estuary was studied, and their locations were recorded using a GPS to perform a Kernel Density Analysis. Adult abundance was higher during spring (34 and 35 individuals in 2002 and 2003, respectively) and decreased during fall (7 individuals) and winter (16 individuals). Sightings of 132 adults during winter, spring, and summer ( $n = 12$ ,  $n = 76$ , and  $n = 44$ , respectively) and 14 calves during spring and summer ( $n = 4$  and  $n = 10$ , respectively) were recorded; mean school size was  $2.0 \pm 1.2$ . Distribution and abundance varied seasonally. During spring, dolphins were more equally distributed through the estuary than during summer when calves and adults remained mainly inside the estuary. The presence of dolphins year-round suggested that the inhabitants are residents of the estuary. This study offers new information on the ecology of the Commerson's dolphin and confirms Ría Deseado as a breeding site for this species.

**Key Words:** Commerson's dolphin, *Cephalorhynchus commersonii*, *Tonina overa*, Patagonia, Ría Deseado, mark-recapture, photo-identification

## Introduction

Commerson's dolphins (*Cephalorhynchus commersonii*) inhabit the coast of Argentinean Patagonia from 40° 30' S to the Strait of Magellan and Malvinas Islands (Goodall et al., 1988). Even though it is considered the most coastal of the Patagonian cetaceans, sightings of this species up to 400 km offshore have been reported (Garaffo et al., 2011). Commerson's dolphins are widespread along the continental shelf, inhabiting mainly mouths of rivers and areas with high tidal flow (Goodall et al., 1988).

These dolphins are opportunistic feeders and forage mainly near the shore in coastal ecosystems (Ricciardelli et al., 2010), preying mostly on hake (*Merluccius hubbsi* and *M. australis*) and other small fishes (Bastida & Lichtschein, 1988). The coastal habitat of this species makes it especially vulnerable to human activities such as habitat degradation, incidental capture by fisheries, and tourism. Fisheries bycatch of marine mammals is common in Patagonia, and Commerson's dolphins are caught mostly by shrimp trawling fisheries (Crespo et al., 1997; Iñíguez et al., 2003).

In northern Patagonia, the Commerson's dolphin's abundance peaks during the austral winter (June and July) and decreases during summer (January and February) (Coscarella, 2005; Coscarella et al., 2010). Garaffo et al. (2011) suggested that they change their habitat preferences during colder and warmer months by moving north and south within Patagonia. Additionally, during June and July, schooling dolphins are observed offshore, but calves are not part of these groups (Gewalt, 1990). Similarly, high densities of dolphins are observed in the Strait of Magellan during June and July but no calves were

reported there either (Lescrauwaet et al., 2000). The absence of calves offshore suggests that births may occur during the summer in more sheltered areas. Specifically at Ría Deseado, Santa Cruz, the breeding season takes place during the austral spring and summer, between September and February (Iñíguez & Tossenberger, 2007).

In order to study the abundance and distribution of different cetacean species, methods such as photo-identification have been applied and have made a significant contribution to the knowledge on the biology of this group (Slooten et al., 1992). Abundance at Ría Deseado has been previously estimated using photo-identification, through which research successfully identified 26 resident individuals within the estuary (Iñíguez & Tossenberger, 2007). Iñíguez & Tossenberger (2007) focused on the dolphins around the inlet of the estuary during the months of January and February of 1986 through 1991 and 1994 through 1997.

*Cephalorhynchus commersonii* is listed in the IUCN Red List of Threatened Species as “Data Deficient” with an unknown population trend (Reeves et al., 2008). The abundance and movements of Commerson’s dolphins along the Patagonian coasts are not well understood. Also, the fact that this subspecies (*C. c. commersonii*) is endemic to Patagonia makes its conservation more important. Identifying the abundance and distribution of a species is a crucial tool for conservation.

The goal of this study was to combine the photo-identification method with a mark-recapture technique

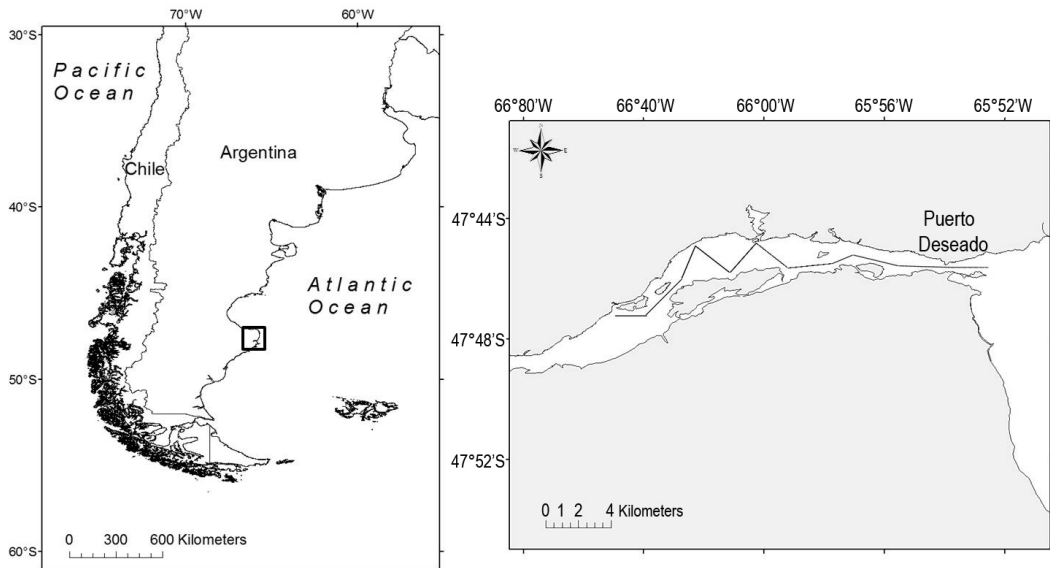
to determine the abundance of Commerson’s dolphin within the Ría Deseado. Also, this study aimed to investigate the seasonal distribution of this species within the estuary.

## Methods

### Study Area

The Ría Deseado (47° 46' S, 65° 54' W) is an estuary of the Deseado River, which is located in the northeast of Santa Cruz province in southern Patagonia, Argentina (Figure 1). Its length is 40 km, and the width at the inlet is approximately 1.5 km. It is a river bed abandoned by the Deseado River and occupied by the sea (Gandini & Frere, 1998). The average tide amplitude ranges from 2.9 to 4.2 m (Isla et al., 2004). Inside the estuary, cliffs, bays, channels, and islands are common. Water from the ocean enters through a deep channel (30 m), producing a strong current that varies with tides (Isla et al., 2004). These currents go in and out of the estuary’s inlet at an average of 2.77 m/s (Servicio de Hidrografía Naval, [www.hidro.gov.ar](http://www.hidro.gov.ar)). Approximately 30 species of shorebirds and seabirds and two species of marine mammals inhabit the estuary (Gandini & Frere, 1998).

The deep channel allows large ships to navigate to the port of Puerto Deseado, approximately 2.5 km from the mouth of the estuary. The port has high vessel traffic and is one of the most important in Patagonia.



**Figure 1.** Study area. Ría Deseado is a 40-km-long river bed abandoned and occupied by the sea, located at the northeast of the Santa Cruz Province in Patagonia. Black line indicates path used to perform census, and to mark and recapture individuals. Censuses were started from the west at low tide.

### Photo-Identification

Dolphins were photographed (Würsig & Jefferson, 1990) using a Cannon EOS 500 film camera (35-80 mm optical zoom), a Sony video digital camera (12× digital zoom), and a Nikon Coolpix 2000 digital camera (5.8-17.4 mm focal range, 2.5× digital zoom, and 3.6× optical zoom). Commerson's dolphins have a characteristic small and robust body; their rounded and short dorsal fin and pectoral flippers, as well as their contrasting black and white coloration (Jefferson et al., 1993), make this species easily distinguishable. The most common identifiable marks were on the head where the color changes from black to white (Figure 2). Most individuals swam next to or under the boat, making it easier to identify individuals with marks on the head. In some cases, marks on the dorsal fin (see Coscarella, 2005) and pigmentation marks on the rest of the body were also used. Even though marks on different parts of their body (i.e., head, dorsal fin, etc.) were used for identification, each dolphin was completely photographed to avoid counting the same animal twice.

### Abundance

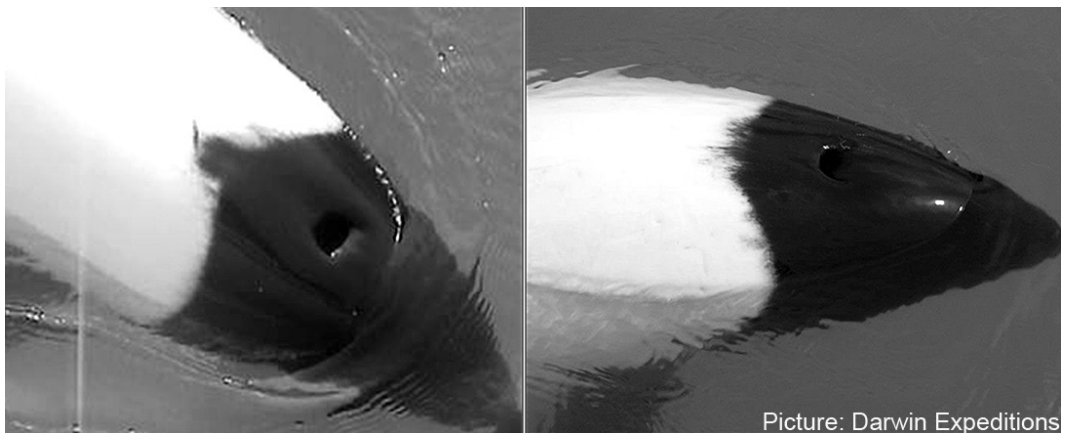
The mark-recapture technique, positive method (Jackson, 1936) was used to estimate population numbers; additionally, photo identification was used to "mark and recapture" individuals (Fearnbach et al., 2012). The dolphins were photographed at the beginning of each season. The recapture occurred at least 2 d later to ensure that individuals were mixed and had equal probability of being recaptured (Reisinger & Karczmarski, 2010). The estuary was navigated using a 4-m boat with a 40-hp outboard engine or a 7-m boat with a 150-hp outboard engine. The same route of approximately 22 km was followed each time at a constant speed

of 10 km/h (Figure 1). The total duration of each census was 2.5 h. Surveys were conducted in conditions  $\leq$  Beaufort 3. Additionally, the same tides were followed, starting in the west with low tide because this species is known to modify its behavior with tide changes (Goodall et al., 1988). Results are presented in number estimated  $\pm$  SE.

### Spatial Distribution

The spatial distribution of the dolphins was estimated by surveying the estuary in spring 2002 and 2003, summer 2003 and 2004, and winter 2003. These data were collected during the censuses and also in separate trips in which the entire estuary was navigated. Effort during each season was spring 2002 and 2003, 70 h and 40 h, respectively; summer 2003 and 2004, 103 h and 35 h, respectively; and winter 2003, 20 h. The amount of hours surveyed each season varied mainly with weather conditions.

For each dolphin sighting, the position using a GPS (Global Positioning System), number of individuals in the group, and age classes (i.e., adults, calves, and neonates) were recorded. Adults were defined as black and white individuals approximately 1.5 m in length; calves were defined as up to 1 m in length, mainly grayish without a defined color pattern; and neonates were defined as up to 70 cm long with dark grey coloration (Goodall et al., 1988; Bastida & Rodriguez, 2003). Calves and neonates were always associated with at least one adult. For the purpose of this study, calves and neonates were considered as one group. The location of each individual sighted was plotted, and a Kernel Density Analysis (KDA) was performed using *ArcGIS*, Version 9.3 ([www.esri.com](http://www.esri.com)) and Home Range Tools for *ArcGIS* (Rodgers et al., 2005). A fixed KDA using the



Picture: Darwin Expeditions

**Figure 2.** Examples of pictures taken for photo-identification of Commerson's dolphin (*Cephalorhynchus commersonii*); besides using fins, the color pattern of the head was also used. The contrasting black and white allowed for the easy identification of individuals.

least-squares-cross-validation method to calculate the smoothing factor (Worton, 1989) was calculated based on the locations recorded for each season (spring, summer, and winter; fall was excluded from the analysis due to the low number of positions recorded). The core areas were determined by 50 and 95% utilization distribution (UD). Additionally, the overlap of the UD during spring and summer was calculated. School sizes were expressed as mean  $\pm$  SD

## Results

### *Abundance*

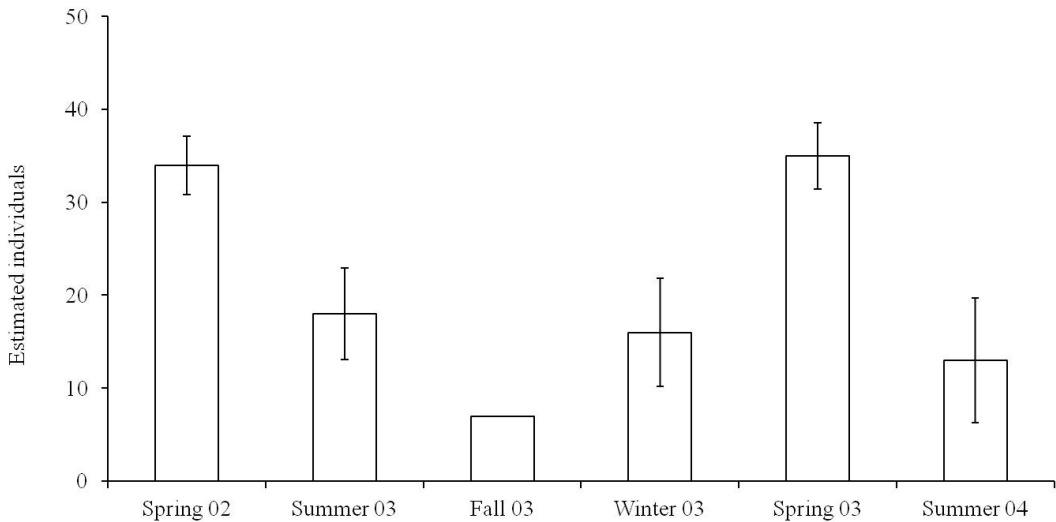
A total of seven individual dolphins were photographed (to use as marked individuals) in spring

2002; seven each in summer, fall, and winter 2003; and eight in spring 2003 and in summer 2004. A total of 32 censuses were carried out throughout the study (Table 1).

There was a high fluctuation in population numbers throughout the year (Figure 3). Commerson's dolphin abundance was higher during spring than in all other seasons (2002 =  $34 \pm 3.1$  individuals, 2003 =  $35 \pm 3.6$  individuals), and the lowest numbers were recorded in the fall (7 individuals). It was not possible to calculate SE for the fall due to the low number of censuses performed during that season. The number of dolphins during winter was estimated to be  $16 \pm 5.8$  individuals, similar to those during summer ( $18 \pm 4.9$  and  $13 \pm 6.7$  individuals in 2003 and 2004, respectively).

**Table 1.** Total of censuses performed during the course of this study; first individuals were marked (number is indicated for each season). "Total captured" indicates the number of dolphins (marked + unmarked) observed during each census; "No. recaptured" includes only the marked individuals observed in each census.

| Season                             | No. of censuses | Total captured (observed) | No. recaptured |
|------------------------------------|-----------------|---------------------------|----------------|
| Spring 2002 (7 marked individuals) | 1               | 17                        | 3              |
|                                    | 2               | 17                        | 3              |
|                                    | 3               | 20                        | 2              |
|                                    | 4               | 20                        | 3              |
|                                    | 5               | 10                        | 2              |
|                                    | 6               | 24                        | 4              |
| Summer 2003 (7 marked individuals) | 1               | 14                        | 3              |
|                                    | 2               | 9                         | 3              |
|                                    | 3               | 8                         | 3              |
|                                    | 4               | 7                         | 2              |
|                                    | 5               | 7                         | 1              |
|                                    | 6               | 5                         | 2              |
|                                    | 7               | 7                         | 1              |
|                                    | 8               | 3                         | 0              |
| Fall 2003 (7 marked individuals)   | 1               | 9                         | 3              |
|                                    | 2               | 6                         | 2              |
|                                    | 3               | 4                         | 0              |
| Winter 2003 (7 marked individuals) | 1               | 16                        | 4              |
|                                    | 2               | 11                        | 3              |
|                                    | 3               | 11                        | 2              |
|                                    | 4               | 10                        | 1              |
| Spring 2003 (8 marked individuals) | 1               | 11                        | 2              |
|                                    | 2               | 16                        | 3              |
|                                    | 3               | 9                         | 3              |
|                                    | 4               | 15                        | 3              |
|                                    | 5               | 13                        | 2              |
| Summer 2004 (8 marked individuals) | 1               | 14                        | 6              |
|                                    | 2               | 7                         | 2              |
|                                    | 3               | 8                         | 1              |
|                                    | 4               | 11                        | 3              |
|                                    | 5               | 13                        | 2              |
|                                    | 6               | 5                         | 0              |



**Figure 3.** Abundance of Commerson's dolphin at Deseado estuary; numbers were calculated using the mark-recapture technique, positive method (Jackson, 1936). Error bars represent SE. It was not possible to calculate SE during fall due to the low number of censuses carried out.

In the spring, the mean group size observed was  $2.0 \pm 1.2$  ( $n = 76$ , ranging from 1 to 10 individuals). Similarly, during summer, the group size was  $2.0 \pm 1.0$  ( $n = 44$ , ranging from 1 to 7 individuals). No differences were found between summer and spring in group size ( $t$  test = 0.21;  $p > 0.1$ ).

#### Spatial Distribution

A total of 132 sightings were recorded during winter, spring, and summer ( $n = 12$ ,  $n = 76$ , and  $n = 44$ , respectively). During winter and summer, dolphins mostly used the western part of the estuary (73% and 61% of total sightings, respectively). However, during spring, dolphins were evenly distributed through the area: 27 (36%) of the sightings occurred at the west end of the estuary, 22 (28%) in the middle, and 27 (36%) in the mouth of the estuary. In spring, UD polygons of 50 and 95% included 2.4 and 7.1 km<sup>2</sup>, respectively (Figure 4). Even though the number of individuals in the estuary was lower during the summer, the 50% UD was also 2.0 km<sup>2</sup> (95% UD = 5.5 km<sup>2</sup>) (Figure 4). During winter, 50 and 95% UD were 0.5 and 1.3 km<sup>2</sup>, respectively (Figure 4). The 50 and 95% UD used during summer only overlapped 0.22 km<sup>2</sup> and 0.66 km<sup>2</sup>, respectively, with the spring areas.

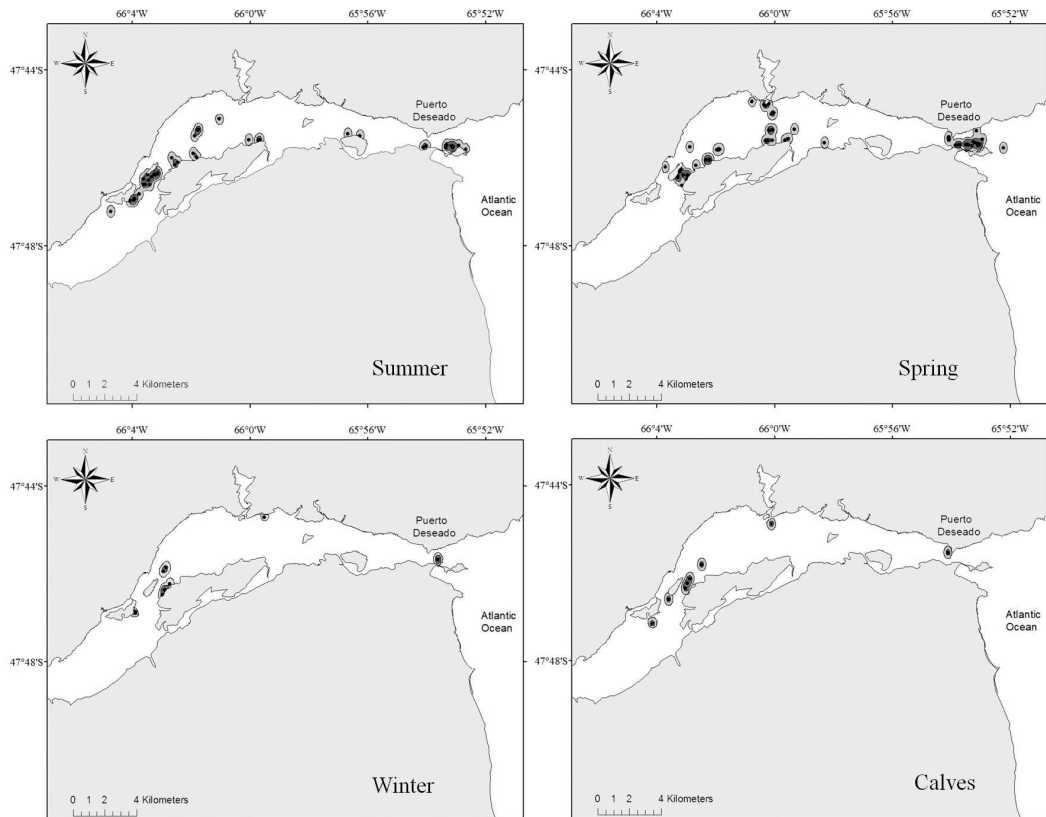
Fourteen calves were observed. Eleven (78%) calf sightings occurred during January and February, while the other three (22%) occurred during October and November. The locations of only eight calves were recorded due to their behavior of avoiding boat traffic. Kernel core areas occurred mainly at the west end of the estuary (77% of the 95% UD; Figure 4)

#### Discussion

Given the findings presented in this study, Ría Deseado is one of the primary reproductive sites for this species, most likely because it offers quiet and secluded waters for reproduction. Behavioral adaptations in dolphin species are commonly caused by predators; therefore, distribution may be a response to predation pressures (Ballance, 2002). Killer whales (*Orcinus orca*) are the main predators of cetaceans in Patagonia (Jefferson et al., 1991; Heithaus et al., 2008). The dolphins may choose the Ría Deseado to reproduce because the estuary offers protection from these predators.

Newborn calves were observed mainly in January and February. This observation is consistent with the suggestion by Iñíguez & Tossenberger (2007) that neonates at Ría Deseado are born from September to February. Based on the present results, the austral summer is believed to be the time when the main birth season takes place. Also, calf distribution is more dense in the western end of the estuary where water is shallow and turbid, and the speed of the currents decreases significantly due to the geology of the area (Isla et al., 2004)

The abundance of Commerson's dolphin at Ría Deseado varied between seasons. During the spring, numbers increased. During the summer, numbers decreased despite the fact that during the summer was when most of the calves were observed. In contrast, in northern Patagonia, dolphin numbers decrease during spring and summer, and the larger pods are recorded during winter



**Figure 4.** Fixed Kernel Density Analysis (KDA) for Commerson's dolphin adults and calves at Deseado estuary through the year; spring includes 76 locations, summer includes 44 locations, and winter includes 12 locations. Calf presence was recorded during summer and spring (total: 8 locations). Dark grey: 50% Utilization Distribution (UD); light grey: 95%UD. Black dots indicate each position recorded.

(Coscarella & Crespo, 2010). As a possible explanation for seasonal movements in Commerson's dolphin, Coscarella (2005) suggested that dolphins move south in the summer when water temperature reaches 15° C. Several species of dolphins undergo seasonal migrations to fulfill their needs such as foraging or reproduction (Bräger et al., 2003). It is possible that the individuals go to the Ría Deseado estuary for courtship and mating during spring and summer and leave the estuary during fall and winter. The fact that population numbers decreased during summer could be attributed to the fact that the dolphins go to the estuary only for courtship and mating, and afterwards leave the area to return to open waters. During winter, estimated numbers were similar to those from summer; this was attributed to the fact that data were collected during late winter due to climatic conditions.

Contrary to the results of the present study, Iñíguez & Tossenberger (2007) suggested that

there are 26 resident Commerson's dolphins inhabiting the estuary year-round. We believe that this number is overestimated because, during fall and winter, the number of dolphins within the estuary was between 7 and 16, which is obviously lower than the 26 reported by Iñíguez & Tossenberger (2007). Additionally, the individuals marked during these seasons were also sighted during spring and summer (Blanco, 2005). Therefore, if there is a resident population, it is composed of those individuals that were recorded in the estuary during fall and winter. The concept of a resident group of dolphins inhabiting the estuary is supported by the fact that several species of dolphins have shown residency to estuaries or bays (Simões-Lopes & Fabian, 1999; Bejder & Dawson, 2001; Keith et al., 2002; Rayment et al., 2011). Bejder & Dawson (2001) discussed the model of a small resident population of Hector's dolphins (*Cephalorhynchus hectori*) that is visited by individuals from other populations. This idea is supported by the repeated

sighting of some individuals through the years and the presence of individuals sighted only occasionally (Bejder & Dawson, 2001). This may be the case for Commerson's dolphins inhabiting the Deseado estuary all year in which some individuals sighted during fall and winter were observed repeatedly over the years of study, but others were sighted only during spring and summer (Blanco, 2005)

The majority of cetaceans reside in large groups (Ballance, 2002). Coscarella et al. (2010) described groups of over 20 Commerson's dolphins in northern Patagonia. However, during the period of this study, no large groups of dolphins were registered in the estuary (mean group size  $X \pm SD = 2 \pm 1$ ), and this number did not vary between seasons. The mean group size reported here is similar to those reported for this species in other areas of Patagonia (Goodall et al., 1988; Iñíguez & Tossenberger, 2007; Coscarella et al., 2010).

The use of the estuary was clearly more uniform during spring, where courtship behavior was commonly observed (Righi, unpub. data). The mouth of the estuary (east) where the highest current speeds are produced (Iantanos et al., 2002) was frequently used during that time of the year. Dolphin distribution is commonly influenced by tides (Ribeiro et al., 2007). The fact that this population of Commerson's dolphins used the mouth of the estuary could be attributed to prey species getting to the estuary in a "bottleneck" with rising tides. In contrast, during summer, the area most frequently used was the west part of the estuary, which was consistent with the presence of calves during that season. Therefore, it is suggested that dolphins choose more secluded areas, far from the inlet, for calving. This is also supported by the fact that the utilization areas of the dolphins between spring and summer did not have a large overlap. For that reason, it is likely that the dolphins were involved in different behaviors in the spring when they were near the eastern part of the estuary than in the summer when they were mostly found in the western part of the estuary.

Little is known about Commerson's dolphins' population and ecology. This species is listed as "Data Deficient" by the IUCN (2010). The main threat for cetaceans in Patagonia is incidental capture in fishing nets (Goodall et al., 1988; Crespo et al., 1997; Iñíguez et al., 2003). Sources of entanglement are mid-water trawl nets (Crespo et al., 1997) and gill nets (Iñíguez et al., 2003). Even though no industrial or artisanal fishing occurs inside the estuary, based on the results of this study, this population is probably transiting through fishing areas during seasonal migrations.

The Ría Deseado is a nursery for several species of seabirds and shorebirds, with approximately

75% of all the seabird species in Patagonia breeding there (Gandini & Frere, 1998). Additionally, the area has been described as a nursery for the broadnose seven-gill shark (*Notorynchus cepedianus*) (Cedrola et al., 2009). The fact that Commerson's dolphins reproduce there also underlines the ecological importance of the area and highlights the need for conservation of this biodiversity hot spot.

More research must be done to understand the complex ecology of Commerson's dolphin in Patagonia. To date, there are only a few studies on this species, and those have focused their attention in north Patagonia (Crespo et al., 1997; Coscarella & Crespo, 2010; Coscarella et al., 2011) or Tierra del Fuego (Goodall et al., 1988). In order to better understand the status of this species, research must be expanded to other geographic areas and must include both breeding areas and nonbreeding environments.

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