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Influence of body size and ranging patterns on delphinid sociality: associations among Commerson's dolphins

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We investigated the association patterns of 48 identifiable Commerson's dolphins (*Cephalorhynchus commersonii*) photographed 2 or more times over a 2-year period in Bahía Engaño, Chubut, Argentina. The associations among them were not different from random for short time periods (7 days) but were significantly different from random for longer periods. Lagged identification rate and lagged association rate models show that dolphins remained in the area on average 15 days and then moved away as the original groups dissolved. Commerson's dolphins appear to have a fission–fusion society, and the observed strength of their associations is in concordance with the predictions regarding their body size and ranging patterns. The dolphins seem to rely on Bahía Engaño as a core area for most of their activities, but the aggregations are labile and some individuals remain associated in a more stable manner with only a few other individuals.

Key words: association pattern, *Cephalorhynchus commersonii*, Commerson's dolphin, Patagonia, social structure

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The social structure of complex organisms is inherently linked to population dynamics, because survival and reproduction of individuals often depend on the behavior of social associates (Vucetich et al. 1997). Changes in social structure can indicate variation in the environment, including anthropogenic influences that can affect ecosystem function (Gowans et al. 2008). Conceptual models of social structure can assist in the understanding of ecological relationships among individuals, the mechanisms regulating the patterns of intraspecific competition, cooperation, and individual differences in access to resources (Whitehead 2007). Models of social structure often are proposed using well-studied species; however, it is important to test the general applicability of these models by comparing predictions made from these models for a variety of other species.

Analyzing the structure and the temporal stability of associations in cetaceans poses unique challenges, because associations are often difficult to observe (Whitehead and Dufault 1999), and cetaceans often display plasticity in their social structure (Gowans et al. 2008). Toothed whales are particularly variable, with some species recorded mainly as solitary individuals and others with schools comprising thousands of individuals (Gygax 2002). Among species within

the family Delphinidae, group stability varies from the long-term stable pods of the killer whale (*Orcinus orca*—Baird and Whitehead 2000) to the more fluid group composition of the oceanic spinner dolphin (*Stenella longirostris*—Würsig et al. 1994) and Hector's dolphin (*Cephalorhynchus hectori*—Bräger 1999). Other species have intermediate levels of group stability, including the long-finned pilot whale (*Globicephala melas*—Ottensmeyer and Whitehead 2003), the common bottlenose dolphin (*Tursiops truncatus*—Díaz López and Bernal Shirai 2008), and the Indo-Pacific humpback dolphin (*Sousa chinensis*—Karczmarski 1999). Some populations of atoll-based spinner dolphins also are intermediate in group stability (Karczmarski et al. 2005).

Two different explanations have been proposed for the evolution of the various social structures observed in delphinids. Bräger (1999) suggested that the stability of groups decreased with decreasing body size in the Delphinidae: killer whale > pilot whale > bottlenose dolphin >



spinner dolphin > Hector's dolphin. He suggested that body size itself probably was not the determinant of group stability, but it is a proxy for life span; larger and longer-lived species have more opportunity to establish and benefit from long-lasting relationships (common bottlenose dolphins [Wells et al. 1980], long-finned pilot whales [Ottensmeyer and Whitehead 2003], and killer whales [Baird and Whitehead 2000]).

Gowans et al. (2008) suggested that social structure is related to resource availability, predation, and ranging behavior. When resources, most commonly food, are predictably available year-round, individuals are expected to remain resident, leading to relatively small communities and formation of long-term bonds among individuals (e.g., common bottlenose dolphins [Connor et al. 2000] and atoll spinner dolphins [Karczmarski et al. 2005]). In contrast, many oceanic dolphins live in a habitat characterized by rare patches of prey surrounded by large areas devoid of food. The size and location of these food patches is variable in time and space, and therefore individuals must range widely to encounter a patch. Also, in the open ocean few options to reduce predation might be available, other than forming large groups. Thus, wide-ranging, large aggregations are favored in the open ocean. Although little work has been done on the social structure of oceanic dolphins, it is unlikely that long-term cohesive bonds are forming among all individuals within these groups (often >1,000 individuals—Gowans et al. 2008), even though some oceanic species are suspected of forming longer-term bonds between individuals (Pryor and Shallenberger 1991).

Commerson's dolphin (*Cephalorhynchus commersonii*) represents a model species for investigating the way these 2 explanations might complement each other. Commerson's dolphins are among the smallest dolphins and therefore according to Bräger (1999) should display relatively fluid patterns of association. In Argentina Commerson's dolphins display intermediate ranging patterns (i.e., 250 km—Coscarella 2005; Mora 2002). Considering this ranging pattern, according to Gowans et al. (2008) Commerson's dolphins should form relatively small groups with few if any long-term bonds between individuals, similar to humpback dolphins (Karczmarski 1999).

Commerson's dolphins are encountered routinely at Bahía Engaño, an open bay at the northern edge of the species' distribution (Fig. 1). Approximately 230 dolphins use this bay regularly (Coscarella 2005). Usually the dolphins are encountered to the south of the mouth of the Chubut River in small clusters over a wide area and rarely display coordinated movements (Coscarella et al. 2003). The small clusters are composed of 2–5 dolphins, and >20% of the aggregations contain >20 dolphins (Coscarella et al. 2010). These dolphins have been subjected to increasing levels of dolphin-watching operations since 1997 in Bahía Engaño and potentially in other locations (e.g., Bahía Camarones; Fig. 1) where individuals from Bahía Engaño also were sighted (Coscarella 2005; Coscarella et al. 2003). Dolphin-watching activities are carried out year-round, but dolphins are more abundant in the area during the cold months (Coscarella et al. 2010).

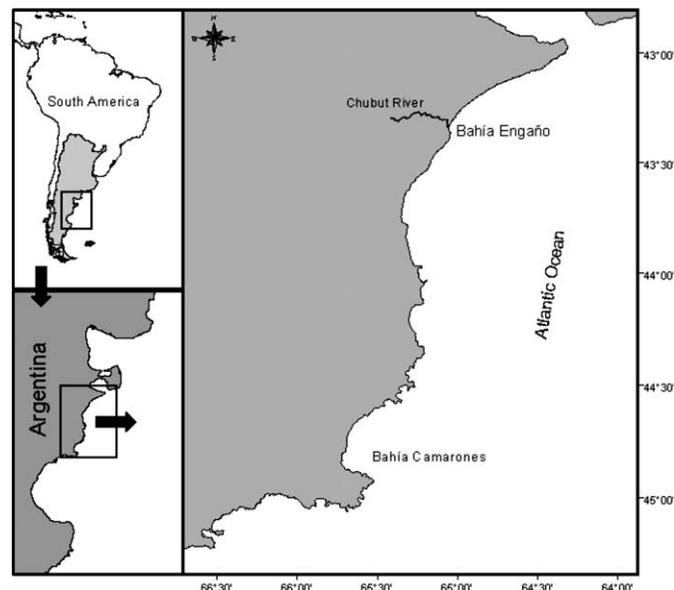


FIG. 1.—Main sampling area (Bahía Engaño) and secondary sampling area (Bahía Camarones).

We used quantitative methods to examine social structure of Commerson's dolphins at Bahía Engaño, discussing some ecological factors leading to the evolution of delphinid sociality. We provide information useful in managing the growing dolphin-watching industry, examining the importance of Bahía Engaño as a critical habitat for Commerson's dolphins in Patagonia.

MATERIALS AND METHODS

Fieldwork.—Data were gathered near Rawson Harbour in Bahía Engaño (43°20'S, 65°02'W) from several rigid-hulled inflatable boats ranging from 5 to 12.5 m (Fig. 1). These vessels were part of the commercial dolphin-watching fleet. Between October 1999 and December 2001 a total of 65 commercial trips were used to take photographs of Commerson's dolphins. Ten additional trips were made onboard a research vessel to photograph dolphins. On 3 days more than 1 trip was completed per day, each trip lasting about 1 h. The mean time spent with the dolphins (photo session) was 44 min ($SE = 30$ min). The study site comprised an area of ~ 100 km² in waters averaging 15 m in depth. When sighted, dolphins were usually attracted to the boat and remained around it for several minutes (Coscarella et al. 2003). During this time as many photographs of dolphins as possible were taken; however, these photographic surveys might not have recorded all dolphins present (Coscarella 2005). Once dolphins moved away further contact was sought, although it was impossible in the field to determine if the same dolphins were resighted.

During an encounter with dolphins it was possible to observe a number of small clusters dispersed over a wide area. These small clusters were ephemeral and changed in individual composition at an unknown rate (Coscarella et al.

2003). Although it was not possible to estimate this rate, it seemed to be high, and it was not possible to assign individuals to clusters within the larger group. All individuals photographed during the same trip were defined as members of the same group, but this definition does not imply any lifelong bond or permanent membership.

Photographs were taken and analyzed according to the methodology described in Coscarella (2005), very similar to the methods described by Slooten et al. (1992). Only adult or full-colored subadult dolphins were included in the analysis. Subjective scales of photograph quality (Q: 0–3) and distinctiveness (D: 0–3) were used to decide whether an individual should be included in the data set: Q = 0, useless photograph; Q = 3, photograph sharply focused and perpendicular to dorsal fin; D = 0, with no visible mark; D = 3, nicks that have an excellent probability of being identified by photographs. Only photographs with $Q \geq 2$ and $D \geq 2$ were included in the analysis. Dolphins bearing marks accounted for 50% of photographed dolphins (Coscarella 2005).

Associations and temporal analysis.—The strength of relationships between dyads was represented using the half-weight index (HWI). This association index uses the frequency of co-occurrences of 2 identified individuals and seems to be the most suitable index for defining association in studies involving photo-identification (Bejder et al. 1998). To assess the association patterns only individuals sighted more than once were included in the analyses (Bejder et al. 1998); this reduced the number of usable trips to 42. Individuals were considered to be associated with each other if they were both photographed on the same trip. If a pair of individuals was photographed in 2 separate trips on the same day, this only counted as 1 association.

All identified individuals were included in permutation tests used to assess whether association patterns observed were different from what might be expected at random over a 7-day period, given the number of groups in which each individual was observed during that 7-day period (Bejder et al. 1998; Whitehead 1999). This time period was used to remove demographic effects that result from patterns of residence in the study area (Whitehead 1999). An observed value of the HWI that was significantly smaller than those from the permuted data set was considered as evidence of preferred companionship within the sample period, because if preferred–avoided associations existed within sampling periods in the real data, proportionally more pairs of individuals repeatedly grouped within sampling periods than expected would have been observed (Whitehead 2008a). Further, an observed *SD* of the HWI that was significantly larger than those from permuted data sets was evidence that individuals preferred some companions over others across the study period (Whitehead 1999), because if some pairs of animals were associated or avoiding each other in different sampling periods more often than by chance, this would increase the *SDs* of the association indexes. To ensure that obtained *P*-values were stable we doubled the number of permutations in each run until the difference in *P*-values was <0.01 , ensuring

that the decision (at 0.05 level) was not affected by the *P*-value variance (Lettevall et al. 2002).

Social differentiation (S) was calculated to indicate variation within the social system. Small values of S indicate a homogenous social system, with all individuals behaving similarly, and high values of S indicate social heterogeneity with a few individuals forming strong bonds whereas most individuals form relatively weak bonds (Whitehead 2009). Along with S, the Pearson correlation coefficient (*r*) between the true and estimated association indexes can be used to assess the number of observations required to confidently reject the null hypothesis of no preferred or avoided companionship (Whitehead 2008b).

Temporal aspects of the social structure were analyzed by means of the standardized lagged association rate (SLAR). The SLAR is the probability that any 2 individuals sighted together at time 0 were still together at a later time (τ = time lag from time 0—Whitehead 1995).

The SLAR was compared at all time lags with the null association rate, which is the expected association rate if all individuals were associated randomly (Whitehead 1995). The observed SLAR was fitted to different models of constant decay presented by Whitehead (1995). The *SE* of the estimated parameter was obtained by the jackknife technique (Manly 1997). Fitting of the models was evaluated by the Akaike information criterion (AIC) or the quasi Akaike information criterion (QAIC) when overdispersion was suggested (Ottensmeyer and Whitehead 2003; Whitehead 2007). Models with $\Delta QAIC > 2$ from the best-fit model have considerably less support, and therefore conclusions were derived from the selected best-fit model (Burnham and Anderson 2002). The value at which the SLAR crosses the y-axis in the selected model is the inverse of the estimated number of companions of any chosen individual minus 1. Consequently, the level at which the SLAR stabilizes can be interpreted as the mean proportion of the constant companions (Whitehead 2009).

The mean residence time in the sampling area was modeled by means of the lagged identification rate (LIR—Whitehead 2001). The LIR estimates the probability that an individual identified in the study area at time $t = 0$ would be reidentified during an encounter some time lag (τ) later. This analysis is similar in structure to the SLAR analysis presented above (Whitehead 2001). Also, a family of models can be fitted to the observed LIR, and they can be evaluated by using the likelihood methods as described by Whitehead (2001). A sharp fall of the LIR at a lag of $\tau = T$ units indicates that many animals are leaving the study area after a residence period of duration *T* (Whitehead 2001). All of the described analyses of association were performed using SOCPROG version 2.4 (Whitehead 2009).

RESULTS

A total of 2,142 photographs of $Q \geq 2$ was taken, from which we identified 169 individuals. Seventy-two identified dolphins were present in photographs of $Q \geq 2$ and $D \geq 2$.

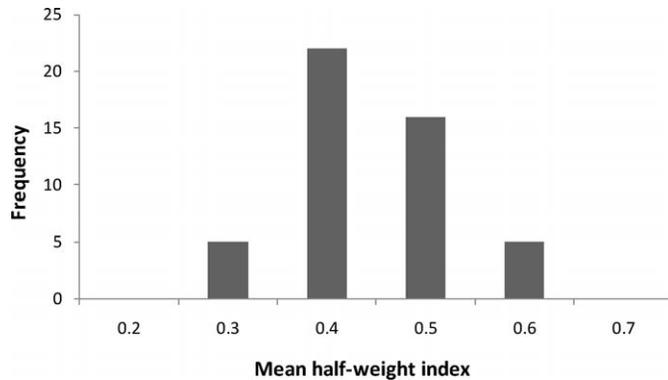


FIG. 2.—Frequency distribution of the mean half-weight index (HWI—Bejder et al. 1998) for nonzero associations among the 48 dolphins sighted at least twice at Bahía Engaño.

From these, a total of 48 dolphins were sighted at least twice on 42 different sampling occasions (trips) and were used in the analysis. One individual was photographed on 7 different dates. Most of the association indexes can be considered as low–medium intensity (Fig. 2), excluding indexes of value 0 (dyads never seen together). Of the 48 individuals considered in the analysis 14 (29.2%) were linked to another individual by an HWI > 0.5.

No preferred companions were found within a 7-day period, given that the probability of the value of the HWI of the observed data set did not differ significantly from the permuted data set ($P = 0.485$). However, it is possible to reject the null hypothesis that the individuals associate randomly across a 7-day sampling period because the probability of the SD of the observed association indexes differed significantly from that of chance ($P = 0.018$).

A well-differentiated population with most individuals having relatively weak bonds while a few individuals form relatively strong associations is reflected by the value of social differentiation of the community ($S = 0.922$). The correlation

coefficient between the true and estimated associations was 0.39 ($SE = 0.084$, 100 bootstrap replications with $n = 1,128$ for each replicate), and the mean number of associations per individual was 9.88.

Over a short timescale (at approximately 15 days) the SLAR fell abruptly (Fig. 3). After this period, at approximately 100 days, increased variation in SLAR occurred. The model that best fit the data set is a model of 2 levels of associates, casual (short-term) and constant (long-term) companions:

$$g(\tau) = a_2 + a_3 e^{(-a_1 \tau)}.$$

The maximum-likelihood estimated parameters are $a_1 = 0.049$ ($SE = 0.015$), $a_2 = 0.021$ ($SE = 0.014$), and $a_3 = 0.068$ ($SE = 0.043$), and the QAIC for this model was 734.78. The 2nd-best model was simpler and considers only casual acquaintances; its QAIC was 736.86. The selected model had a QAIC value >2 units below that of the 2nd-best model, which disregards the additive effect of long-term bonds.

On average, pairs of dolphins remained together for approximately 15 days, and over longer time frames they had largely disassociated from most of their companions. This is shown by the fall of the LIR until approximately 15 days in the best-fit model (Fig. 4). The exception was a small number of individuals that remained as constant companions. In the analyzed data set 6 dyads were resighted over periods >180 days.

Based on the definition of a group (all dolphins photographed during the same trip), the probability of a dolphin remaining within the same group for a single photographic session is 1. The value at which the SLAR crosses the y-axis (0.0864; Fig. 3) indicates that the number of marked dolphins in a group is 12 animals. The best-fit model for SLAR stabilizes at 24.6% of its maximum (0.0214), corresponding approximately to 3 marked dolphins as constant companions. Assuming that unmarked dolphins behave and relate to each other in the same way, the estimated group size is 24

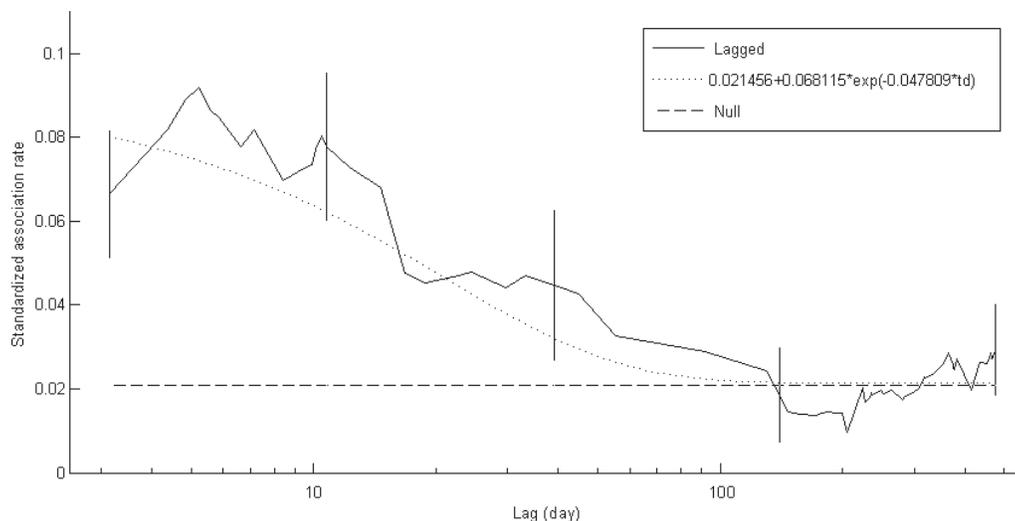


FIG. 3.—Standardized lagged association rate (SLAR—Whitehead 1995) for all individuals identified at Bahía Engaño. The moving average over 400 associations is shown. The maximum-likelihood best-fit model represents associations with casual acquaintances and constant companion. Vertical bars represent SEs .

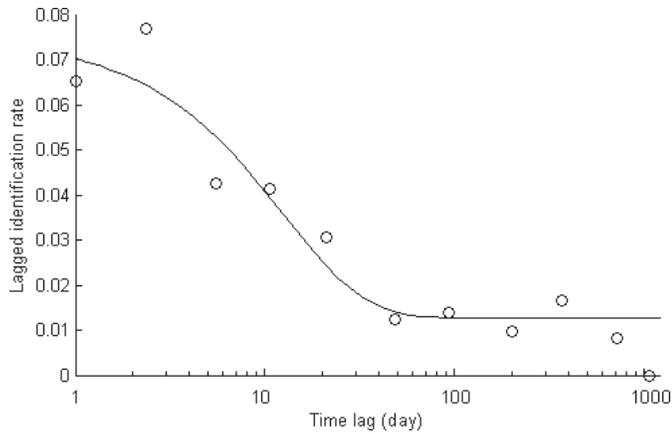


FIG. 4.—Lagged identification rate (LIR—Whitehead 2001) for all individuals identified at Bahía Engaño. The selected fitted model represents emigration and reimmigration.

individuals while the constant companions would be approximately 6 dolphins.

The analysis of the LIR indicates that the data set supported 2 models of movement in and out of the study area (Table 1). The 1st supported model includes the number of animals in the study area at any given time, the number of days the dolphins spend in the study area, and the amount of time they are outside it (AIC = 1,602.399). The 2nd supported model has the same parameters plus an estimation of the mortality rate (AIC = 1,603.934). The estimation of mortality adds little to the explanatory power of the model because the point estimate is small and its confidence interval includes 0 (Table 1); hence, the simpler, most-parsimonious model is preferred. The fitted selected model stabilizes at a value above 0, indicating that permanent emigration from the area might not be the case. Both models indicate that at any given time approximately 13 marked individuals are found that spend on average approximately 15 days in Bahía Engaño. They spend on average about 73 days at a time outside the area before returning; however, much greater variability exists in the time they spend outside the study area. The LIR also decreases sharply between 10 and 20 days (Fig. 4).

DISCUSSION

This work is the 1st attempt to understand the social structure of Commerson’s dolphin using photographically

identified individuals. At Bahía Engaño this species seems to live in a fission–fusion society that is typical of small odontocetes (Bräger 1999). Most individuals have brief fluid associations; however, a few individuals had more stable partners (Fig. 3). Although the number of observations per individual was relatively small, the high degree of social differentiation in this population indicates that the observations represent the true social structure well, with a reasonable power to accept the results of the permutation tests (Whitehead 2008b).

Although a previous study on Commerson’s dolphins at the Kerguelen Islands failed to find any stable association among the 16 marked animals (de Buffrénil et al. 1989), the social organization of this species is probably more structured than that of the related Hector’s dolphin (Bräger 1999; Pichler et al. 2001). The association indexes for Hector’s dolphins are consistently lower than reported here, and a fluid social system was found for several populations (Bejder et al. 1998; Bräger 1999; Slooten et al. 1993). It is likely that association indexes reported here are negatively biased because of the incomplete photographic coverage during encounters with larger groups. In this situation it is difficult to distinguish between the absence of an individual in a group and the failure to capture it photographically, but if anything, the unbiased indexes should be higher, leading to an even more structured society. Also, other factors such as sex, age, or reproductive status could affect the social structure (de Stephanis et al. 2008; Rogers et al. 2004), but these aspects cannot be addressed in this work because sex or age class cannot be determined in the field.

During each trip in Bahía Engaño the sighted aggregation of Commerson’s dolphins was not cohesive, as different clusters within the group could be engaged in different behaviors or be dispersed over a variety of spatial scales, or both. Having used mainly commercial dolphin-watching boats as platforms, we could not always control the direction of the boat or the duration of the trip. These were the main reasons for having failed to photograph all dolphins present. Nevertheless, use of commercial dolphin-watching boats allowed us to distribute the photo sessions evenly in time, reducing temporal bias in sampling.

Field observations indicated movement of individuals among clusters (i.e., ephemeral groups—Coscarella et al. 2003) during the day. The SLAR analysis reinforces this observation, and the lack of significant associations within short periods could be a consequence of this grouping behavior. The results indicate that some individuals have

TABLE 1.—Estimated residency parameters for Commerson’s dolphins in Bahía Engaño. Model descriptions can be found in Whitehead (2001).

Model	Parameter	Estimated parameter	SE
Closed: emigration + reimmigration	a ₁ = N	13.337	2.616
	a ₂ = time in	15.064	6.425
	a ₃ = time out	73.763	30.495
Emigration + reimmigration +mortality	a ₁ = N	13.496	2.246
	a ₂ = time in	15.684	5.952
	a ₃ = time out	86.411	45.200
	a ₄ = mortality	−0.000355	0.000663

preferred companions and that these companionships exist beyond demographic effects (individuals associating with the other individuals present in the bay at the same time—Whitehead 1999). The number of constant companions was estimated to be 3 marked dolphins. The individuals in such associations were probably part of groups that later largely dissociated from one another. Given the variation observed for the SLAR and the social differentiation of this population, the number of constant companions and casual acquaintances for any specific dolphin is difficult to predict. The fall of the SLAR below the null association rate could reflect 3 situations: a high variability in the number of dolphins comprising the groups, or a prolonged separation between dolphins that are associated (Ottensmeyer and Whitehead 2003), or stochastic variation due to data quality. In the case of Commerson's dolphins in Bahía Engaño the 1st option seems more plausible, because the number of dolphins comprising a group changes seasonally in the sampling area (Coscarella et al. 2003, 2010), but stochastic variation also is a possibility. As discussed above, the failure to photograph each individual present in the area during a trip also could have affected the SLAR estimates for periods of >100 days. Incomplete photo coverage also could have resulted in real relationships being overlooked because they were not recorded in the field.

The selected LIR model does not consider mortality. Although mortality likely occurred during the study period, the data set is not of sufficient resolution to estimate this parameter. The estimated mean time for the persistence of a group (about 15 days) is in agreement with the findings for other species of cetaceans, including Hector's dolphin (Slooten et al. 1993), the long-finned pilot whale (Ottensmeyer and Whitehead 2003), and female and male sperm whales (*Physeter macrocephalus*—Whitehead 1995). The LIR analysis estimated that dolphins spend about 20% of their time in Bahía Engaño, indicating that this area is an important part of the habitat for a population of several hundred dolphins inhabiting the northern portion of Patagonian shores (Pedraza 2008). The time they spend in the area is remarkably close to the time the SLAR model predicts the dolphins remain together in a group. This could mean that individuals within a group dissociate as they leave the area, while others join it. Within this scenario, dolphins in the group leave (or arrive in) the area along with very few other dolphins (i.e., constant companions), and while they are in the bay they associate at random with the other dolphins present.

Commerson's dolphins could disperse to several areas along the northern Patagonian coast after being in Bahía Engaño. Several dolphins identified in the study area also were sighted in Bahía Camarones (Coscarella 2005; Mora 2002). This bay is located about 250 km south of Bahía Engaño. Some were sighted subsequently in Bahía Engaño. The shortest time elapsed between consecutive sightings of an individual in both bays was 5 days (Coscarella 2005). Recorded movements of Commerson's dolphins at Kerguelen Island are much more restricted, ranging from 0.5 to 24 km (de Buffrénil et al. 1989). Hector's dolphins at Bank's Peninsula moved an average of

31 km along the coast (Bräger et al. 2002). Along-shore movements for the Heaviside's dolphin (*Cephalorhynchus heavisidii*) averaged 36.6 km (Elwen et al. 2006).

The information presented in this study suggests that Commerson's dolphins along the northern edge of the species' distribution are composed of several aggregations, with a home range extending for at least 250 km along the coast of Chubut Province. These aggregations are composed mainly of individuals that remain together in Bahía Engaño for between 10 and 20 days but that largely disaggregate after this period, joining other dolphins and forming new groups. At any time these groups contain approximately 25 dolphins, based on the proportion of dolphins bearing marks (Coscarella 2005). This number seems high when compared with previous reports for the species but agree with observations made in the area using different methodologies (Coscarella et al. 2003, 2010). Although these short-term groups disband, smaller associations of approximately 8 dolphins tend to remain together for longer periods. This scheme should be visualized as a continuous process, in which dolphins move from one group to another, rather than a discrete process. This constant flux of individuals within a group at times can be accelerated by the merging of 2 or more groups, the occasions when recorded group size is >50 individuals (Coscarella et al. 2003). Also, because the dolphins spend a variable number of days outside of the study area, the number of dolphins present in Bahía Engaño changes over time. Relative abundance of dolphins in the area also changes seasonally, mainly due to a relationship with temperature of the sea surface (Coscarella et al. 2010).

This study confirms the pattern suggested by Bräger (1999), who proposed that group stability of delphinids decreased with body size. Body size and group stability of Commerson's dolphin fit between those of common bottlenose and Hector's dolphins. Some similarities to the social structure of offshore spinner dolphins can be seen, in which many individuals appear to form short-term associations, and only a few individuals form longer-term associations (Pryor and Shallenberger 1991). Nevertheless, this does not exclude the influence of ecological factors that could shape the social structure (Gowans et al. 2008). Bahía Engaño is a well-known nursery ground for many species, and the area sustains a trawl coastal fishery that operates year-round (Van der Molen and Caille 2001; Van der Molen et al. 1998). The diet of Commerson's dolphins is composed mainly of the same species sought by the fisheries (Koen Alonso 1999). These findings also fit with the conceptual framework proposed by Gowans et al. (2008), in which predictability of resources leads to formation of small, relatively stable groups. Hence, both body size (or longevity) and resource predictability should be taken into account in future works addressing the factors that shape the stability of groups.

This study provides data on the temporal residency in a bay that, in addition to data derived from movements along the coast, is important for the understanding of population dynamics and the management of dolphin-watching and other anthropogenic activities (such as fishing). New permits for

other locations (such as Camarones) should be granted only after considering the movements of dolphins and the time they spend in each area. Bahía Engaño itself represents an important part of the home range of Commerson's dolphins, and its management and conservation could be important to sustaining the population.

RESUMEN

Investigamos los patrones de asociación de 48 toninas overas (*Cephalorhynchus commersonii*) identificadas individualmente, que fueron fotografiadas 2 o más veces durante un período de más de 2 años en Bahía Engaño, Chubut, Argentina. Las asociaciones entre los delfines no fue distinta de la esperada por azar para períodos cortos (7 días) pero resultó significativamente distinta de la esperada por azar para períodos más largos. Los modelos de tasa de identificación retardada y la tasa de asociación retardada mostraron que los delfines permanecen en promedio de 15 días en el área y posteriormente se alejan ésta al mismo tiempo que los grupos originales se disuelven. Las toninas overas presentarían una sociedad del tipo fusion-fisión, y la intensidad de las asociaciones observadas se encuentra en concordancia con las predicciones respecto de su tamaño corporal y patrones de desplazamiento. La Bahía Engaño parecería ser un área núcleo en la que los delfines desarrollan la mayor parte de sus actividades, pero las agregaciones observadas son lábiles y sólo algunos individuos permanecen asociados de manera más estable.

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