DYNAMIC INTERACTIONS IN THE EURASIAN OTTER (*LUTRA LUTRA*): A CASE STUDY IN SOUTHERN PORTUGAL

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INTRODUCTION

Dynamic interactions (Doncaster, 1990) between individuals may define social relationships in animal populations (Böhm *et al.*, 008) and influence space use patterns (Powell, 2000; Kernohan *et al.*, 001). They can be quantified in radio - tracking studies, by recording simultaneously or near simultaneously the location of tagged animals (Böhm *et al.*, 008).

The Mustelid sub - familie Lutrinae is highly variable in its social structure and behavior (Johnson *et al.*, 000; Kruuk, 2006). Species can be strongly gregarious like *Enhydra lutris*(Pearson & Davis, 2005; Kruuk, 2006), form family cooperative groups as *Pteronura brasiliensis* (Leuchtenberger & Mourão, 2008) or monogamous couples (*Lontra felina*, Ostfeld *et al.*, 989). Finally, sex - biased group formation is documented in *Aonyx capensis* (Arden - Clarke, 1986) and *Lontra canadensis* (Melquist and Hornocker, 1983; Blundell *et al.*, 004; Gorman *et al.*, 006).

The Eurasian otter (*Lutra lutra*) has the wider geographic range of the group (Kruuk, 2006) and its ecology has been studied by many authors (see Kruuk, 2006). However, knowledge on social interactions of this species is scarce (Kruuk, 2006) and completely absent in Mediterranean environments. It has been considered mainly a solitary species (Erlinge, 1967; Chanin, 1985; Mason & Macdonald, 1986), showing a strong intra - sexual territoriality (Erlinge, 1968), which is a common pattern in Mustelids (Powell, 1979) and other carnivore families (Sandell, 1989). Nonetheless, the formation of female group ranges in coastal areas of Scotland (Kruuk, 2006) suggests that its social behavior may vary intra - specifically, as already known for other carnivore species (Gompper *et al.*, 996), and geographycally, as noticed in *Lontra canadensis* (Blundell *et al.*, 004; Gorman *et al.*, 006). Additionally, some authors have already shown complex social organization of apparently solitary species (e.g. Macdonald *et al.*, 987: Kruuk & Moorhouse, 1991).

OBJECTIVES

In the present work we used a subset of four dyads of radio - tagged Eurasian otters from an ongoing ecological project in Southern Portugal to quantify the dynamic interactions (Doncaster, 1990) among them, in order to provide preliminary data on otter social behavior in a Mediterranean area.

MATERIAL AND METHODS

Study Area

Our study area is located around Évora, Alentejo region, southern Portugal, comprising several rivers, streams, ponds and small and medium - sized reservoirs belonging to the Sado and Guadiana river basins. The climate is typically Mediterranean, with floods occurring in the winter and extended droughts during summer, when almost all smaller streams become reduced to intermittent pools.

Radio - Tracking

We captured otters and a veterinarian surgically implanted radio transmitters (Telonics, Inc., Mesa, Arizona) inside their peritoneal cavity (e.g. Fernandez - Moran *et al.*, 001). Radio - locations of the animals were recorded either by triangulation (White & Garrot, 1990) or "homing in on the animal" (Mech, 1983) techniques. Locations were collected in intervals of 36 hours, covering day and night time with the same frequency, in order to have a homogeneous sampling protocol.

Interaction Analysis

We quantified dynamic interactions for 4 dyads of otters that showed partial home range overlap for at least 3 months. One dyad was composed by two young males, M5 and M8. The other dyads were composed by adult male - female pairs (M2 - F1; M2 - F3; M4 - F3. M4 was captured and had an overlapping home range with F3 after M2's death). Simultaneous locations were defined as those at which two otters were recorded within 12 hours during day - time (if both were inactive, see also Gehrt & Fritzell, 1998), and within 60 min (Gorman *et al.*, 006) during the

night phase. We assumed a critical distance ≤200 m to classify the animals as being close to each other in a positive interaction. This choice was made considering our estimated telemetry errors and map resolution scales (Quaglietta *et al.*, npublished data), since we can't estimate the distance at which two otters are aware of each other's presence (as Gehrt & Fritzell, 1998). A non - parametric method suggested by Doncaster (1990) was used to evaluate if interactions between dyads were positive or negative, based on the frequency distribution of real observed distances between locations and simulated location distances, which would be expected by chance. The simulated distances were obtained measuring the possible distances between all locations of a dyad, using ArcGis 9 (ESRI, Ca).

RESULTS AND DISCUSSION

The male dyad, M5 - M8, was tracked simultaneously for six months (November 2008 - April 2009), when they shared the same home range (about 7 km of river length). They had an observed proportion of close locations of 30% (N=56), which was higher than the proportion of close simulated locations (12%, N=1806). The dynamic interaction test thus revealed a positive and significant interaction for these two animals (X^2=11,32; p <0,001). During this period, they were found several times sharing the same resting sites and travelling together. After April, male M8 abandoned its natal range, probably starting its dispersal, never having been found again in the previous area with M5. Before these two animals, female F1 lived in the same area (her radio signal was lost in September 2008). Our field impression together with preliminary results from a DNA study suggest that F1 could be the mother of M5, and therefore probably M8, but we still don't have analysis results for this animal.

The dyad M2 - F1 was tracked from August 2007 until M2's death in March 2008. They were found near each other in 25% of the locations (N=81), whilst in the simulation the proportion was 9% (N=6479). This revealed a highly positive interaction (X^2=21,72; p <0,0001). In the same period, M2 also had an overlapping home - range with female F3, which was captured in November 2007. The proportion of observed near locations between them was 33% (N=22) and the simulated was 24% (N=462). Nevertheless these results were not significant, possibly due to the low number of locations.

Finally, for dyad M4 - F3 the proportion of observed close locations was 46% and the simulated one 23%, which gives a significant positive association (X^2 = 5,9; p <0,025).

CONCLUSION

The positive interaction in the male dyad, which is in contrast with the known pattern of Mustelid social organization of intrasexual territoriality (Powell, 1979), could be explained by their likely relatedness as brothers and the fact that they were still in their mother's home range.

Interactions between M2 and the two females, F1 and F3, is instead in agreement with the usual pattern of male overlapping territories with females (Powell, 1979). Although we don't have much data for interactions with F3 as with F1, it seems that M2 spent much more time in association with the latter female. Male spatial patterns are known to be conditioned by the distribution of females (Sandell, 1989). However, in this case we believe that M2's association higher with F1 than F3 could be also explained by a better availability of resources (like food and suitable habitat) within F1's range, according to our preliminary results from prey sampling (Quaglietta *et al.*, unpublished data). Male M4 was captured two months after M2's death, inside the latter's previous home range. It spent a large part of the time in F3's area, having a more positive interaction with her than had M2. Preliminary DNA analysis (Quaglietta *et al.*, npublished data) excludes the possibility that they are mother and son. Therefore, again we have a case of another male interacting with a female inside its home range.

These findings show that males and females of Eurasian otter do not only encounter for mating. They may indeed spend a lot of time together, also within the same sex (although more male - male dydas are needed), and even resting in the same refuge. In this regard we report an observed case of a mother simultaneously sharing a resting site with her cubs and an adult male (Quaglietta, Pers. Obs.), which is actually far enough from what usually reported in literature (Kruuk, 2006).

To our knowledge, these are the first analysis on dynamic interactions for this species and the first preliminary data regarding the social organization of the same in a Mediterranean area. Giving the limits of our sample, further researches on this topic are encouraged.

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