*Journal of Mammalogy,* 88(2):487–494, 2007

# SPACING BEHAVIOR OF MARINE OTTERS (*LONTRA FELINA*) IN RELATION TO LAND REFUGES AND FISHERY WASTE IN CENTRAL CHILE

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The marine otter (*Lontra felina*) is a little-known South American otter of conservation concern. We report the 1st detailed information on its activity patterns, home ranges, core areas, and territoriality from 6 otters radiotracked near a fishing village in central Chile. Marine otters were solitary; females exhibited intrasexual territoriality, but there was no territoriality between males or between sexes. Home ranges were $\leq$4,134 m long and $<$110 m wide, and range size did not differ between sexes. Marine otters spent 81% of their time on land, mostly resting, with no preference for day or night. Hence, core areas were associated with resting places and dens. Otters concentrated their activity in the littoral zone associated with refuges on land and with fishing waste, which was used as a food resource. Availability of land refuges, combined with their proximity to food resources, could be a decisive factor influencing the distribution of *L. felina*.

Key words: fishery waste, home range, land refuges, *Lontra felina*, marine otter, territoriality

The marine otter (*Lontra felina*) is the smallest aquatic mammal (3.2–5.8 kg) and the most distinct species in its genus (van Zyll de Jong 1972), being the only one that is exclusively marine (Estes 1989; Ostfeld et al. 1989). It is listed as ''Endangered'' by the International Union for the Conservation of Nature and Natural Resources (IUCN, 2004, *Red List of Threatened Species*, http://www.redlist.org) and ''Vulnerable'' by the *Red Book for Terrestrial Vertebrates in Chile* (Glade 1993).

This otter must coexist with humans by inhabiting the marine littoral and exploiting the same resources from the intertidal, subtidal, and terrestrial seashore that humans exploit for food, commerce, and housing (Moreno 2001; Moreno et al. 1984; Ostfeld et al. 1989). The marine otter lives along exposed rocky seashores of the Pacific Ocean from 6°S (Perú) to 56°S near Cape Horn and Isla de los Estados in Chile and Argentina (Castilla and Bahamondes 1979; Ostfeld et al. 1989). Most research describes this species as restricted to rocky shores exposed to winds and waves of the Pacific Ocean, with its activities confined to an area not wider than 30 m on land and 150 m offshore (Castilla and Bahamondes 1979; Medina-Vogel et al. 2004, 2006; Ostfeld et al. 1989).

Previous studies have encountered problems in assessing marine otter spatial behavior and habitat use because of difficulties in recognizing individuals, lack of sexual dimorphism, and the long time that marine otters spend obscured by caves, rocks, and other terrestrial structures (Ebensperger and Castilla 1991; Medina 1995; Medina-Vogel et al. 2006; Ostfeld et al. 1989). Hence, it is not known if this otter is territorial because there is no quantitative information about home-range length and characteristics. Therefore, we used livetrapping and tagging of marine otters with radiotransmitters to assess daily movements and activity patterns. Our main questions were: Are marine otters territorial? Does use of home ranges and core areas by marine otters reflect anthropogenic food supply in terms of fishery waste? How does habitat use by marine otters relate to availability of littoral zones with different levels of human disturbance?

## MATERIALS AND METHODS

This study was conducted from April to December 2004 in Quintay, Chile (33°11′S, 71°42′W; Fig. 1), inside the limits of the 1st Chilean fishing marine management area. Exploitation of subtidal and intertidal resources in the area is restricted and kept for the cooperative of fishermen from the Quintay village

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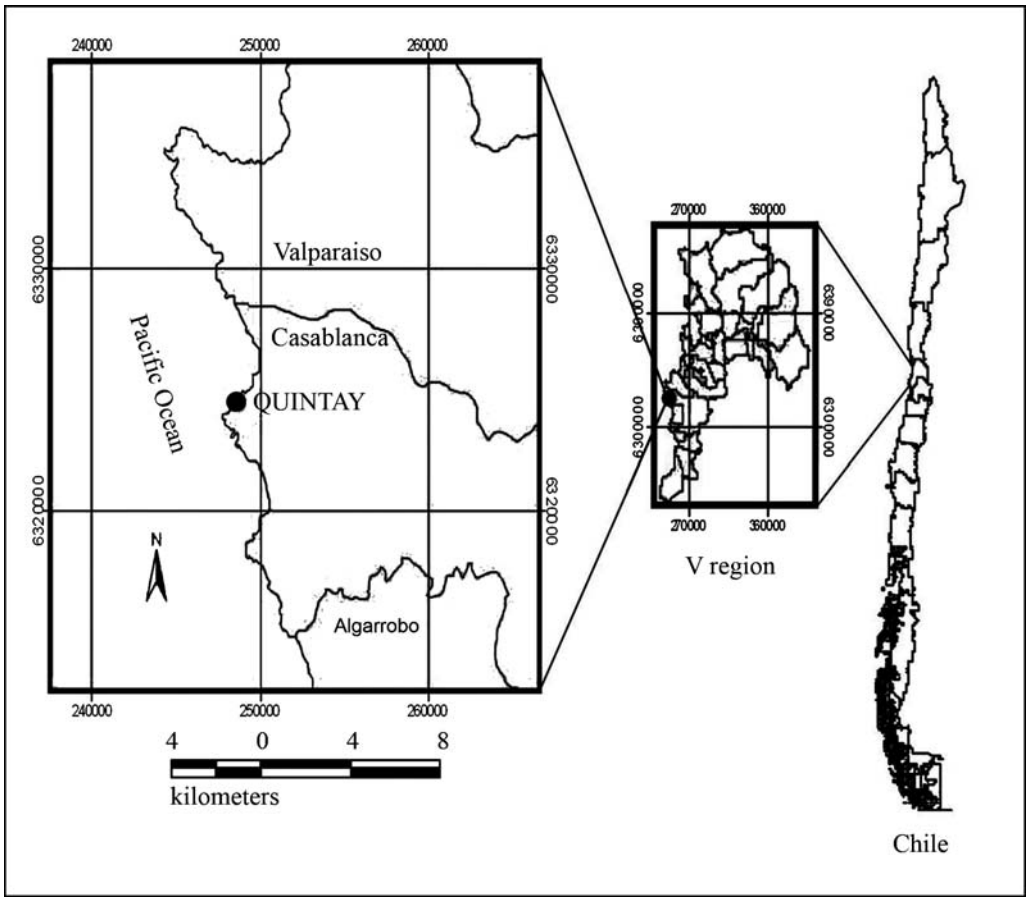



**FIG. 1.**—Geographic location of the study area.

(human population about 1,000) on the central coast of Chile. The study area was a stretch of seashore approximately 6,616 m long that extended 150 m wide on land and as far as otters went into the sea. The total length of the study area was determined by the home ranges and exploratory movements of the radiomarked otters. Fishermen exploit the intertidal and subtidal fringe of the study area and harvest both invertebrates and fish. The coastline is exposed to winds and waves, and the littoral substrate is composed of steep rocky cliffs, boulder fields, and small rocky islands near the shore. Sandy beaches were scarce. The intertidal zone is dominated by algae (*Lessonia nigrescens*, *Durvillaea Antarctica*, and *Macrocystis pyrifera*). Observed vertebrates and invertebrates included fish (*Graus nigra*, *Sebastes capensis*, *Sicyases sanguineus*, and *Aplodactylus punctatus*), crabs (*Homalopsis plana*, *Cancer edwardsi*, *Cancer setosus*, *Cancer coronatus*, and *Mursia gaudichaudii*), molluscs (*Tegula atra*, *Concholepas concholepas*, *Fissurella picta*, *Fissurella crassa*, and *Fissurella nigra*), and sea urchins (*Loxechinus albus* and *Tetrapygus niger*).

Different categories of anthropogenic influence in the study area were assessed by presence–absence of housing or any human constructions recorded during the study in a 150-m-wide stretch above the shoreline, and human activity (%) measured as the number of times people were recorded inside this 150-m-wide stretch divided by the total number of radiotracking field trips. Anthropogenic influence was classified as low (no constructions and $<33\%$ human activity), medium (permanent constructions and 34–66% human activity), or high (permanent constructions and $>67\%$ human activity). Proportions of the 3 different zones of anthropogenic influence were estimated using aerial photographs, a global positioning system, and ArcView GIS version 3.2 (ESRI, Redlands, California). Zone I (high anthropogenic influence) included 611 m (9%) of shoreline of the study area length. In this zone during September and October, daily fishery waste consisting of fish parts and small fish and crabs not commercially important was unloaded from fishing boats and dropped along a 300-m stretch beach. Zone II (medium anthropogenic influence) included 2,441 m (37%) of the study area length, and zone III (low anthropogenic influence) included 3,564 m (54%) of the study area.

Between July (winter) and December (spring), we performed a radiotracking survey of 3 adult female and 3 adult male marine otters. Individuals were livetrapped from April to July (Table 1) using Victor leg-hold traps (1.5 Soft catch; Woodstream Corp., Lititz, Pennsylvania) checked every 6 h. Captured otters were kept in captivity during the trapping period with the intentions of livetrapping most or all of the resident otters at our study site, and also to avoid recaptures and injuries to already tagged individuals (Blundell et al. 1999). Sex was

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**Table 1.**—Characteristics of home range, core areas, and maximum distance covered within 24 h by 6 radiotracked marine otters (*Lontra felina*) at Quintay, central Chile, between August and December 2004.

| Otter no. | Sex | Survey period | No. fixes Period 1 | No. fixes Period 2 | Home range size (m) | Core area size (m) | Home range proportion (core area/home range) | Maximum distance (m) | Home range proportion (maximum distance/home range) |
|---|---|---|---|---|---|---|---|---|---|
| F1 | Female | 21 August–6 November | 164 | 328 | 1,373 | 174 | 0.12 | 2,079 | 1.51 |
| F2 | Female | 10 July–12 August | 237 | — | 1,418 | 49 | 0.03 | 1,054 | 0.74 |
| F3 | Female | 6 July–26 September | 264 | 167 | 4,043 | 398 | 0.09 | 3,214 | 0.79 |
| M1 | Male | 2 July–14 October | 280 | 267 | 4,003 | 81 | 0.02 | 3,418 | 0.85 |
| M2 | Male | 11 August–17 December | 323 | 567 | 4,134 | 495 | 0.11 | 3,082 | 0.75 |
| M3 | Male | 17 August–17 December | 474 | 456 | 3,726 | 418 | 0.11 | 2,044 | 0.55 |
| Total | | 3.8 months | 1,742 | 1,785 | | | | | |
| Average | | | 290 | 357 | 3,116 | 269 | 0.8 | 2,481 | 0.80 |

determined and individuals were implanted with radiotransmitters with an activity sensor (150.00–151.00 Mhz; Sirtrack Ltd., Havelock North, New Zealand) in their abdominal cavities. For capture and surgical placement of radiotransmitters, otters were anesthetized with a combination of ketamine (5.3 mg/kg) and medetomidine (53 μg/kg), and reversed after 45 min with atipamizole (226 μg/kg—Soto-Azat et al. 2006). Radiotransmitters were 0.4% of the mass of the animal. We then released implanted otters and repeatedly located them by triangulation from 2 mobile stations. Each station consisted of 2 observers with each carrying one 3-element Yagi antenna, 1 receiver (150.00–154.00 Mhz, TR4; Telonics, Inc., Mesa, Arizona), a handheld compass, and 1 global positioning system unit (Garmin eTrex; Garmin, Olathe, Kansas).

Signal range was up to 1,200 m. The position was estimated for each individual every 10 min for 1 continuous period of 24 h (method I), and once a month every 10 min for 1 h twice a day for 12 d until a circadian cycle was completed (method II). To avoid biases due to time in captivity, only radiolocations obtained 5 days after otters were release were incorporated in the analysis. We calculated radiolocation error by plotting the continuous visual location of an animal confirmed with a global positioning system on a universal transverse Mercator geo-oriented air photograph and comparing it with the location given by the software LOAS (Ecological Software Solutions, www.ecostats.com). Error of our radiolocation method was estimated as $\leq$10 radial meters, which was acceptable considering the aims of the study (Kauhala and Tiilikainen 2002).

We assessed home ranges using fixed kernel analyses with the reference smoothing parameter ($h$) for linear estimates of 95% home ranges (Blundell et al. 2001). Core areas were assessed by fixed adaptive kernels with least squares cross-validation (LSCV) for linear estimates of 50% core areas (Blundell et al. 2001). Thereafter, home ranges and core areas were defined as those linear sections following the seashore contour of the area determined by kernel procedures using the Animal Movement extension for ArcView GIS 3.2. The average time that it took for an otter to move from one end of its home range to the other was 47 min, and our radiolocation method concentrated locations for 24 h once per month (method I) and every 12 h (method II), so our time frame allowed us to use all locations in the model (Kernohan et al. 2001). Moreover, autocorrelation has no apparent effect on linear estimates of home range with any kernel method (Blundell et al. 2001), and data that are not statistically autocorrelated nonetheless are biologically autocorrelated because animals use knowledge of their home ranges to determine future movements (Katajisto and Moilanen 2006; Powell 2000). To avoid differences caused by any external factor not present to all animals during the same period of field data collection, only radiolocation data obtained by method II were applied to assess the use of land versus water by marine otters.

We classified radiotracked otters as active or resting according to the activity sensor. Active otters were classified as moving (traveling between locations) or undetermined, because rarely was it possible to individualize activities like grooming, feeding, or socializing at the time of radiolocation. To study daily patterns of activity, data were separated into 6 groups of about 4 h each (0010–0400, 0410–0800, 0810–1200, 1210–1600, 1610–2000, and 2010–2400 h).

To test the null hypotheses of equal sizes of home ranges and core areas between sexes, we used paired $t$-tests. To examine variation in home ranges and core areas related to fishery waste, we separated the data into 2 groups: radiolocations obtained when fishery waste was absent (period 1 = July, August, November, and December); and those obtained when fishery waste was present (period 2 = September and October). Differences among these 2 periods were assessed by nonparametric Wilcoxon signed-rank tests with $\alpha \leq 0.05$ by SYSTAT, version 11 (SPSS Inc., Chicago, Illinois). To assess range overlap and territoriality among otters, we performed a static interaction analysis in which sets of locations are compared without reference to the temporal sequence of locations, because we did not perform simultaneous observations of animal locations (Fieberg and Kochanny 2005; Kernohan et al. 2001; Powell 2000). Thus, the probability that otters $i$ and $j$ were in the overlapped area was computed as:

$$I_p = \sum P_{ki} \times \sum P_{kj},$$

where $I_p$ is the simple probability index, and $P_{ki}$ and $P_{kj}$ are the independent probabilities that at any arbitrary time otter $i$ and $j$ are in the shared area (Powell 2000). Territoriality was assessed by Spearman's coefficient of rank correlation (SYSTAT, ver-

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sion 11) in which a positive $r$ reflects a significant correlation and a negative $r$ indicates avoidance between otters (Doncaster 1990; Powell 2000).

We considered individual otters the primary sampling units or replicates. We rejected the null hypothesis of use of habitat in proportion to availability by a chi-square test. Furthermore, to test the null hypothesis of proportional use in relation to the availability of each of the 3 zones with different anthropogenic influence, we employed a resource selection probability function ($w_i$), which is the proportion of the available resource that is used for each habitat category ($i$) as described by Manly et al. (2002—design II with sampling protocol A: 64–67). To test null hypotheses, we constructed Bonferroni 95% confidence intervals (95% *CI*s) for resource functions. In other words, $w_i$ and 95% *CI* greater than 1.0 for a zone meant that the otter chose the zone, because the zone was used in greater proportion than expected by its availability.

Our research was approved by the bioethical committee of the Universidad Andrés Bello, and was done under the restrictions imposed by the legal permits 1,117 (26 April 2004) and 1,763 (1 July 2004) for livetrapping and radiotagging marine otters (*L. felina* is a protected aquatic mammal by the Chilean fishing bureau [Subsecretaría de Pesca]).

## Results

Three adult female and 3 adult male marine otters were successfully livecaptured and radiotracked at our study site. Nevertheless, we were unable to trap all otters inhabiting our study site, because we recognized at least 6 untagged marine otters regularly using our study site. Thus, we estimated that our study site during our radiotracking period had an otter density of about 1.7 otters/km of seashore. We recorded an average of 290.3 ± 104.3 *SD* radiolocations per otter during the 1st period (without fishery waste) and an average of 357.0 ± 157.3 radiolocations per otter during the 2nd period (with fishery waste; Table 1). Combining data from the 2 study periods, home ranges varied from 1,373 to 4,134 m long, were less than 110 m wide, and did not differ between sexes ($t = -4.03$, $d.f. = 2$, $P = 0.06$). Core areas varied from 49 to 495 m long with no significant differences between sexes ($t = -0.76$; $d.f. = 2$, $P = 0.53$; Fig. 2; Table 1). Home ranges and the 13 identified core areas followed the seashore contours. Core areas were caves or cavities between rocks or rock cracks used as dens or resting places on land. Core areas averaged 8% of home ranges of males and females (Table 1). Otters were able to move (maximum distance) among 55–151% of their home-range extension in 24 h (Table 1). The activity of all radiotagged otters was between 102 m offshore and 30 m on land, although marine otter feces were collected up to 50 m on land in the study area. There were 10 core areas during the 1st period and 8 core areas during the 2nd period (Fig. 2). Home-range lengths were not significantly different between the study periods (2,898 m ± 1,024 *SD* and 1,841 ± 1,350 m; Wilcoxon signed-rank test $P > 0.08$; Fig. 2). Although the localizations of the core areas varied (Fig. 2), they did not significantly vary in size (193.2 ± 147.8 m to 257.7 ± 141.7 m; Wilcoxon signed-rank test $P = 0.35$) or in the percentage of their home ranges (10–11%; Wilcoxon signed-rank test $P = 0.68$).

During the 1st period without fishery waste, there was no overlap in home ranges between otters M1 and M3 or between otters F2 and M3. For other otters, simple probability index values provided evidence of extensive home-range overlap with no difference within sexes (28–91%) versus between sexes (18–100%), or between both groups and study periods (Wilcoxon signed-rank test $P > 0.25$; Table 2). Furthermore, Spearman's $r$ values showed no avoidance between otters as a group after combining both study periods (Table 2). However, when analyzed separately for each study period, females exhibited home-range overlap but nonetheless had negative values of Spearman's $r$, indicating avoidance during the 1st period without fishing waste (Table 2). In contrast, males showed correlations with males and females during all of the study and had extensive overlap, especially among males (Table 2). The pattern was different for core areas in which simple probability index values during the 1st study period averaged 0.29 ± 0.16 *SD*, and the Spearman's $r$ was −0.31, indicating avoidance between otters. During the 2nd period, males and females did not overlap with otters of the same sex, and between sexes only 2 cases were recorded with a simple probability index of 0.27 ± 0.26 SD (Fig. 2). However, average home-range sizes, as well as overlaps and differences between sexes, may have been slightly larger, because only F1, M2, and M3 were radiotracked for more than 4 months (Table 1) and therefore recorded enough radiolocations to reach an asymptote (when comparing number of radiolocations with home-range size by a rarefaction curve).

Radiotagged marine otters significantly chose zone I during the period without fishery waste ($w_i = 2.44$; 95% $CI = 1.85$–$3.03$), and this selection was more pronounced during the periods with fishery waste ($w_i = 3.38$; 95% $CI = 2.79$–$3.97$). In contrast, zone II only was significantly chosen during the period with fishery waste ($w_i = 1.43$; 95% $CI = 1.27$–$1.59$). In fact, 8 of the 13 identified core areas were located within or on the borders of zone I (Fig. 2). The preference for this zone with high anthropogenic influence during periods with presence of fishery waste was especially evident because of habitat selection by F1 ($w_i = 3.18$; 95% $CI = 2.02$–$4.35$), M1 ($w_i = 3.43$; 95% $CI = 2.07$–$4.78$), M2 ($w_i = 3.20$; 95% $CI = 2.01$–$4.40$), and M3 ($w_i = 4.64$; 95% $CI = 3.34$–$5.94$). Moreover, during the period of availability of fishery waste, distance from the center of the stretch of beach where waste was deposited to tagged otters was significantly reduced (Wilcoxon signed ranks test $P < 0.01$). During the period without fishery waste, only F3 ($w_i = 1.08$; 95% $CI = 0.74$–$1.41$) and M3 ($w_i = 1.37$; 95% $CI = 1.14$–$1.60$) slightly chose zone III.

On several occasions, otters with or without transmitters were observed simultaneously sharing a group of rock cavities in an area not larger than 100 $m^2$. However, within our sample of radiotracked otters, there were no records of family groups, breeding behaviors or mating, cooperative feeding, or groups of otters moving or resting together in the same den or feeding patches at sea. When fishery waste was available, untagged otters and radiotracked otters (outside the tracking periods) were

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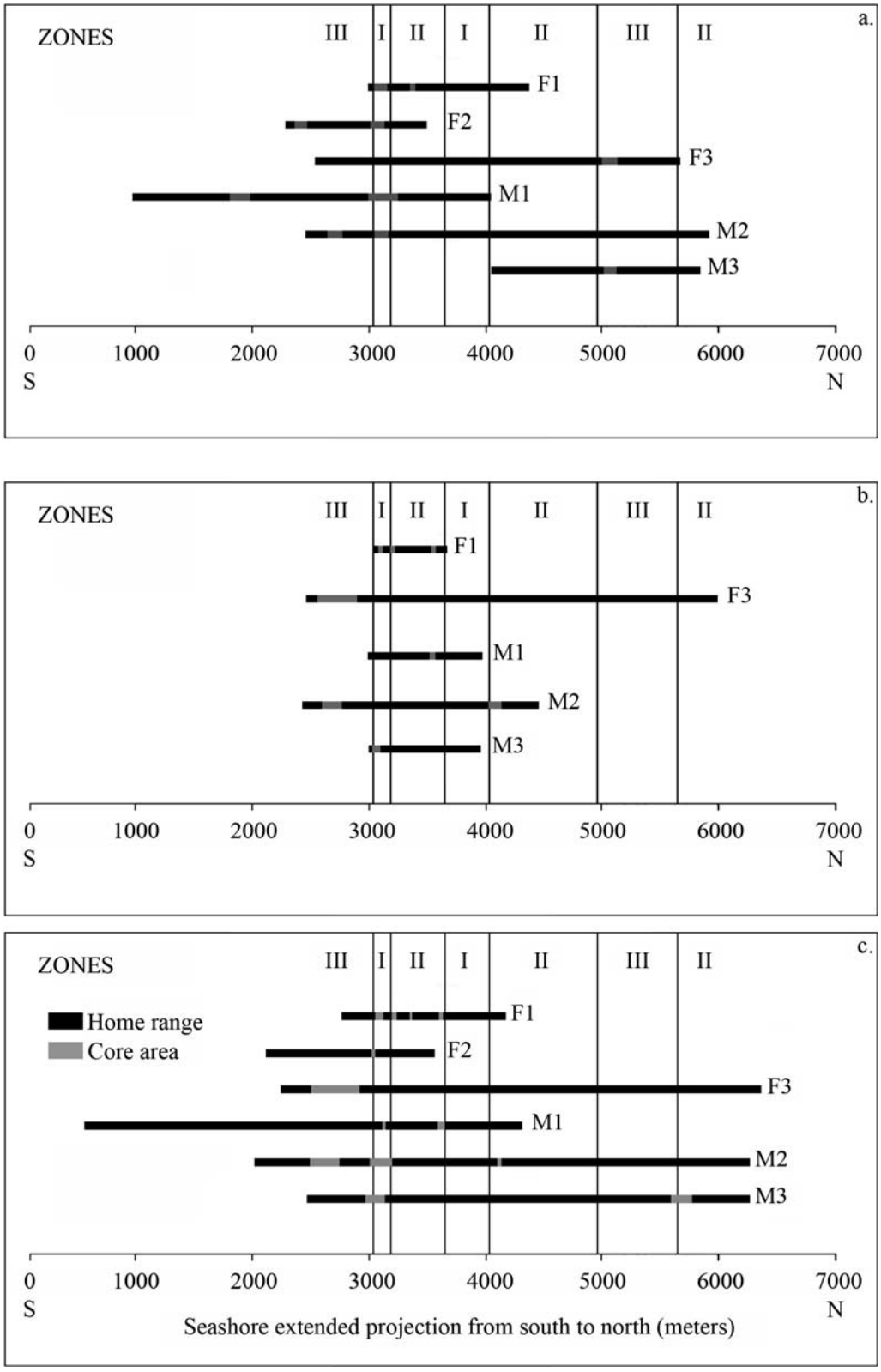



**Fig. 2.**—Linear projection of home range and core area during the period a) without fishery waste, b) with fishery waste, and c) both periods included of 6 radiotracked marine otters (*Lontra felina*) in Quintay, central Chile, between July and December 2004. Zone I: high anthropogenic influence; zone II: medium anthropogenic influence; zone III: low anthropogenic influence.

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**Table 2.**—Simple probability index ($I_p$) and Spearman's rank correlation ($r$) for home range overlap of 6 radiotracked marine otters (*Lontra felina*) at Quintay, central Chile, between August and December 2004.

| | Period 1 | | | Period 2 | | | Both study periods | | |
|---|---|---|---|---|---|---|---|---|---|
| Sex and overlap | $n$ | Probability index ($\bar{X} \pm SD$) | Spearman's $r$ | $n$ | Probability index ($\bar{X} + SD$) | Spearman's $r$ | $n$ | Probability index ($\bar{X} + SD$) | Spearman's $r$ |
| Females–females | 3 | 0.31 ± 0.06 | −1.00 | 1 | 0.25 ± – | — | 3 | 0.42 ± 0.22 | 0.00 |
| Males–males | 2 | 0.63 ± 0.45 | 1.00 | 3 | 0.54 ± 0.31 | 0.50 | 3 | 0.63 ± 0.28 | 1.00 |
| Males–females | 8 | 0.41 ± 0.25 | 0.14 | 6 | 0.52 ± 0.30 | 0.82 | 9 | 0.58 ± 0.27 | 0.21 |
| Total | 13 | 0.42 ± 0.26 | 0.12 | 10 | 0.50 ± 0.28 | 0.25 | 15 | 0.56 ± 0.26 | 0.12 |

observed together feeding on waste and sometimes being persecuted by street dogs, which were abundant at the fishermen's village.

Radiotracked otters spent more time on land (81%) inside narrow and deep caves or rock cracks than in the water (18%) or on reef rocks (1%; Wilcoxon signed-rank test $P < 0.03$). This distribution pattern did not differ between sexes or between periods with or without fishery waste. Otters spent significantly more time resting (71%) than moving (17%) or involved in undetermined activities (12%; Wilcoxon signed-rank test $P < 0.03$). There were no differences in activity between sexes, or between periods with or without fishery waste. During the radiotracking periods, tagged otters were recorded feeding only 9 times.

Of the 573 radiolocations on land, 501 (87%) corresponded to otters resting. For the 206 (29%) radiolocations of active otters; 72 (34%) radiolocations were on land and 134 (65%) radiolocations were in the water or on reef rocks, with no differences between periods with or without fishery waste. Of the radiolocations when otters were in the water, 61% were during the night (2010–0800 h). However, there were no significant preferences for active otters to be in the water during the night, day, or any specific group of hours or study period.

## Discussion

Marine otters in our study had small home ranges, females exhibited intrasexual territoriality, and males showed no territoriality. However, combining all results, the otters in this study showed extensive home-range overlap and no avoidances, like other otter species such as *Aonyx capensis* (Arden-Clarke 1986), *Lutrogale perspicillata* (Hussain and Choudhury 1995), *Hydrictis maculicollis* (Perrin and D'Inzillo 1999), *Enhydra lutris* (Garshelis and Garshelis 1984), and *Lontra canadensis* (Blundell et al. 2002). The animals in this study were solitary, which contrasts with *E. lutris*, a fundamentally group-living otter (Bekoff et al. 1984), and *L. canadensis*, which in marine conditions forms mixed-sex groups that forage cooperatively (Blundell et al. 2002). Furthermore, in our study, otters exhibited an opposite spatial behavior to that described for *Lutra lutra* in marine conditions in which females live in groups and males are solitary, rarely overlapping their home ranges and their core areas, which are associated with holes on land and with freshwater pools (Kruuk 1995; Kruuk and Moorhouse 1991).

Territorial and nonterritorial organizations are 2 basic patterns of animal distribution that are influenced by resource characteristics. As resources vary, so will the cost and benefits of territorial defense and group living (Johnson et al. 2002; Sandell 1989). In addition, aquatic mammals have to deal with heat loss imposed by their cold environment (Scholander et al. 1950). Previous studies based only on direct observations describe different values for the time spent on feeding by marine otters: 54.7–83% (Ostfeld et al. 1989), 63–70% (Medina 1995), and 54% (Medina-Vogel et al. 2006). However, as Medina-Vogel et al. (2006) demonstrated, studies without tagged marine otters do not consider the time marine otters are out of view, so they are likely to be biased in favor of foraging. Moreover, dives mostly take <65 s and the average length of feeding bouts varies depending on diet and prey size. Small prey items are eaten quickly on the sea surface, and medium to large prey are brought to shore (Medina 1995; Medina-Vogel et al. 2004; Ostfeld et al. 1989). Thus, our method of recording radiolocations likely missed most of the feeding events. Nevertheless, considering data from the activity sensors, otters in our study surely spent <30% of their daily time feeding. Sea otters that spend that amount of time feeding have been associated with populations at or below equilibrium density (Estes et al. 1982; Ostfeld et al. 1989; Reidman and Estes 1988). Even so, it is likely that in our study area and during our study months (July–December), availability of inland refuges close to fishing waste were critical for females to display intrasexual territorial behavior (Powell 2000; Sandell 1989).

Shifts from territorial to nonterritorial behavior can happen when a species alternates between decisive resources. For example, if one resource is critical during winter and another one during summer, and if the resources have different characteristics, then changes in relative importance of the resources with season should induce seasonal changes in the social organization of a species (Erlinge and Sandell 1986; Powell 1993). Thus, the spatial distribution and ephemeral nature of a limited number of females in estrus could favor nonterritorial behavior among males (Erlinge and Sandell 1986; Sandell 1989). However, there are contradictions in defining the mating season for marine otters. Although Larivière (1998) described the mating season for marine otters to occur between December and January, and parturition to occur from January to March, Medina-Vogel et al. (2006) recorded pups year-round, with a peak in numbers between September and November. In our study, 1 lactating female was recorded between May and July. We assume that our data do not correspond to a period when otters are in lactation because the female otters that we radiotracked were not lactating.

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Although the finding of pups present throughout the year by Medina-Vogel et al. (2006) could be a result of females in estrus during different seasons, a simultaneous study conducted in the same study area but based on continuous direct observation also recorded 3 cases of mating behavior among marine otters in November. Thus, presence of females in estrus during our study is a possibility to consider and could explain the nonterritorial behavior of males and the intrasexual territoriality of females in our study. Marine otters did not vary in the degree of home-range overlap between study periods and kept high intrasexual territoriality in their core areas, which was stronger during the period with fishing waste.

This study demonstrated that marine otters can coexist with humans. These otters have been observed living inside wharfs, cracks, and ship wrecks near densely populated residential areas. Our study also reported evidence that marine otters interact with dogs, which can kill otters and possibly facilitate disease transmission (Butler et al. 2004; Davis et al. 1972; Funk et al. 2001; Kimber and Kollias 2000). Indeed, we observed 2 street dog attacks that resulted in 2 mortalities of marine otters in an area north of our study site. Thus, given the amount of time marine otters spend inside their resting places or dens, the choice of a warm or well-insulated and secure resting place could be important, especially because we demonstrated that otters drastically reduce their activity during this period. For example, *L. lutra* in marine habitats concentrates activity close to holes and dens with freshwater pools that have been associated with maintenance of the insulating and thermoregulatory capacities of the fur (Kruuk 1995; Kruuk and Moorhouse 1991). Therefore, along seashores intensively used by humans, the equilibrium between optimal resting sites and dens and their distance to appropriate levels of food availability could be decisive resources for marine otters, and consequently influence the distribution of the species as individuals balance risks and net energy gain (Buskirk 1984; Weber 1989). At our site, prey and fishing waste were predictable resources; dry and comfortable rock cracks and caves close to food resources were limited, and were more valuable the closer they were to the food resource. In fact, the otters in our study showed low levels of core area overlap and avoidance especially during the 2nd period with availability of fishery waste, suggesting that appropriate land refuges were a limited resource that might lead to territoriality. This, combined with the possibility that some females otters were in estrus, allowed for intrasexual territoriality behavior among females and incomplete intrasexual territoriality behavior among males (Powell 2000). Therefore, we encourage further studies using radiotransmitters with longer battery life, and sampling over greater areas of seashore to assess variations in the marine otter's spatial behavior in relation to changes in availability of appropriate land refuges, seasonality in food resources, and to changes during the mating season and pup rearing.

## Resumen

La nutria marina (*Lontra felina*) es una nutria sudamericana poco conocida y con problemas de conservación. Se presentan aquí la primera información detallada sobre su actividad diaria, ámbitos de hogar, áreas centrales y territorialidad, desde datos obtenidos mediante la radiotelemetría de 6 individuos en el litoral marino asociado a una caleta de pescadores en la región central de Chile. Las nutrias marinas fueron solitarias, las hembras exhibieron territorialidad intrasexual no así los machos o entre machos y hembras, los ámbitos de hogar se extendieron hasta los 4,134 m de longitud y no superaron los 110 m de ancho sin diferencias entre sexos. Las nutrias marinas permanecieron un 81% del tiempo en tierra, la mayor parte inactivas sin preferencias por la noche o el día, por lo que las áreas centrales estuvieron asociadas a sitios de descanso y madrigueras. Las nutrias concentraron su actividad en la zona del litoral asociada a refugios en tierra y desechos pesqueros, los cuales fueron utilizados como un recurso alimenticio. La combinación de refugios en tierra con la cercanía a una apropiada oferta alimenticia, pueden ser elementos decisivos para *L. felina*, y por lo tanto influir en la distribución de la especie.

## Acknowledgments

This research was part of the Project ''Assessment of the human interactive effect with environmental variables, spatial behavior and habitat use by marine otter (*Lontra felina*) in Central Chile'' funded by the Dirección de Investigación of the Universidad Andrés Bello and The Rufford Small Grant for Nature Conservation. We are also very grateful to the Earthwatch Institute (Otters of Chile Project) and IDEA WILD for equipment and funding support. We thank the Zoo of the Parque Metropolitano de Santiago, Chile, especially Dr. M. Fabry and Dr. P. Pascual, and the CIMARQ-UNAB (Centro de Investigaciones Marinas de Quintay) for their contribution, equipment, and logistical support. We also extend our thanks to E. Mora and R. Monsalve for their help in the field; K. and J. Brind for proofreading the manuscript; and Dr. H. Kruuk, Dr. S. Riley, Dr. R. L. Schooley (Buddy reviewer), and 2 anonymous reviewers for important comments and suggestions to the manuscript.

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*Submitted 8 March 2006. Accepted 28 September 2006.*

*Associate Editor was Roger A. Powell.*

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