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USE OF DAY RESTING PLACES BY THE EUROPEAN OTTER *(LUTRA LUTRA)* IN THE MARAIS POITEVIN (France). A radiotracking study*

by

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As in a lot of other European countries, the otter population in France is undergoing a serious decrease in numbers. Vital populations remain in the West part of the *Massif Central* and along the West coast of France. Habitats occupied by otters are mainly oligotrophic rivers, crossing uninhabited areas or eutrophic water courses, typically polder systems greatly influenced by man. Locally otters also use seashores and some islands.

Most studies on otters have been conducted in the wilder habitats. In the West of France, in the M*arais Poitevin,* there is an otter population in a polder system which is, at the present time, undergoing agricultural transformation (reallocation of land, hydraulic works,...). These works are progressively converting into large cultivated areas land which was tradi-

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* Contribution of the Otter Group of the French Mammal Society (S.F.E.P.M.).

tionally used as extensive pasturage which provided good habitat for otters. To conserve this population it was of prime importance to acquire knowledge of the animals' ecoethology.

Our objective is to understand, how the animal adapts to this man-made habitat, so as to develop a strategy for conserving the otters and associated wildlife in the *Marais Poitevin.* For this species an essential requirement is tranquil resting places; in this first paper, we describe these resting places and the way the otters use them. The other results dealing with the home range use will be published elsewhere.

STUDY AREA AND METHODS

For a general description of the study area, refer to Libois & Rosoux (1989).

During the trapping campaign which lasted from May 1989 to December 1990, and which totalled 6,760 trap-nights, we captured four otters. Two of them were fitted with a transmitter and harness under general anesthetic (Zolethil 20) (table 1).

TABLE 1

TRAPPED OTTERS			
date	sex	capture	result
22/09/89	male ad.	Hancock beaver-trap	dead (after anesthesia)
12/10/89	female juv.	By hand	not fitted (too small)
04/11/89	female ad. (Brise)	Hancock beaver-trap	fitted and followed 7 days
29/03/89	female ad. (Rosy)	Floating cage-trap	fitted and followed 188 days

Brise and Rosy, both females, were fitted with a radio transmitter harness (151 MHz) modelled on the Mitchell-Jones *et al.,* (1984) equipment (Aerial 1 otter transmitter, Holohil system, Ontario). The receiver material consists of a directional Yagi fixed on a four wheel drive car and two receivers TRX 1000 (Wildlife materials, Carbondale).

Movements were followed intensively: every night during the six first weeks after release and thereafter, one night out of two. Brise was released on the 07/11/89 and lost her equipment five days later. The period of radiocontact with Rosy lasted six months (31/03/90-05/10/90), during which pregnancy, delivery (on the 15th of August) and rearing of the cubs took place.

All the resting places were located with high precision so as to examine the factors determining the choice made by the otters. Each day resting place was described (location, type, cover and structure of the vegetation, habitat type, landscape unit, tree species, sources of disturbance, hydrological variables).

The sixty-two resting places were thus characterized by twenty seven variables. The occupation period was introduced as a supplementary variable (one value per fortnight). These data were analysed by correspondence analysis (Lebart *et al.* 1977 — Logiciel BIOMECO, Groupe Biométrie, 1988).

RESULTS

1. Resting place situation:

The home ranges of Brise and Rosy covering respectively about 600 and 2800 hectares, included portions of different landscape units:

Sector A: Bocage-habitat made up of small narrow pasture-fields surrounded by ash hedges or small woods and framed by ditches bordered by ash trees.

Sector B: Reallocated wet woodland and bocage transformed into large fields where some woodland, meadows and canals remain.

Sector C: Open field polders, formerly used as extensive pasture land and some arable fields, but drained and now transformed into large areas of cereals (maize, sunflower and wheat).

Sector D: Main drainage canals bordering sectors A and B or crossing sector C.

Tab. 2 gives the general distribution of resting places per sector as well as the duration of their utilization.

TABLE 2

RESTING PLACES SITUATION IN THE LARGE LANDSCAPE UNITS								
	NUMBERS				DURATION OF OCCUPATION (in days)			
	dens	?	surface lairs	total	dens	?	surface lairs	total
sector A	2	2	12	16	5	1	16	22
sector B	8	–	12	20	41	–	16	57
sector C	3	–	6	9	13	–	8,5	21,5
sector D	14	–	2	16	40	–	4,5	44,5

In that table, Rosy's data concern only the predelivery period (before the 15 August 1990).

Sectors A and B include nearly 60 % of the utilized resting places (1/3 of the dens but 3/4 of the surface lairs). The duration of resting places occupation of the sector A is very low (on average 1.38 day/resting place).

The most used sectors are B and D. The duration of occupation of resting places was, on average, respectively: 2.85 and 2.75 days. They totalled nearly 70 % of day residences of both otters.

The sector C, which represents more than half of the whole area of Rosy's home range and which she visited many times during her nocturnal travels, was apparently not favourable for her day resting places. In this sector, no resting place was discovered inside the large areas of newly cultivated fields, devoid of bushes or trees but nevertheless crossed by some canals. Eight out of nine resting places located were found beside meadows or unexploited meadows. The ninth was found at the junction of two fields, but was completely covered by blackthorn and bramble thicket.

In sector D, canals along roads may house dens for otters in the favourable habitats. However Rosy never chose dens alongside the 137 na-

tional road, even though, the banks of the canal present suitable habitats for the species. The heavy traffic was probably a considerable source of disturbance (8,000 cars/day on average).

The time spent by Rosy in these landscape units is represented in Tab. 3.

TABLE 3

DISTRIBUTION PER FORTNIGHT OF DAYS SPENT IN LARGE LANDSCAPE UNITS

	Ap1	Ap2	May 1	May2	Jun1	Jun2	Jly1	Jly 2	Aug1
sector A	5	4	3	2	3	2	1	1	1
sector B	7	7	7	11	6	5	2	4	8
sector C	4	4	5	2	3	1	1	–	–
sector D	–	–	–	1	3	7	11	11	6

A general linearized model was built to test the randomness of the pattern of use of the different sectors (GLIM, Roy. Stat. Soc., London). The test performed on the data of table 3 shows a strong dependance between the sectors and the fortnights ($p < 0.001$). A discontinuity appears between a first period from the beginning of April to mid June and the next one from mid June to mid August; each of these periods seems to be homogenous. From April to mid June, resting places are mainly chosen in the sector B and, nearly never in the sector D. Whereas from the 15 June, most of the resting places are to be found in the sector D and, rarely in A or C.

During the first monitoring period, Rosy rarely left the sector A during two consecutive days (14 cases out of 74 observations). Whereas, during the second period, she rarely left the sector D more than one day (15 cases out of 63 observations). Fig. 1 shows that the daily change of sector was more and more frequent during the first period (57 times out of 74). During the second, daily changes occurred only 30 days out of 63 (chi squared significant on the level 0.001).

We tested for regularities in the pattern of use of these sectors. The analysis was done separately on each of the two periods, then on all of the data before parturition (contingency periodogram: Legendre *et al.*, 1981). No cycle of use was found.

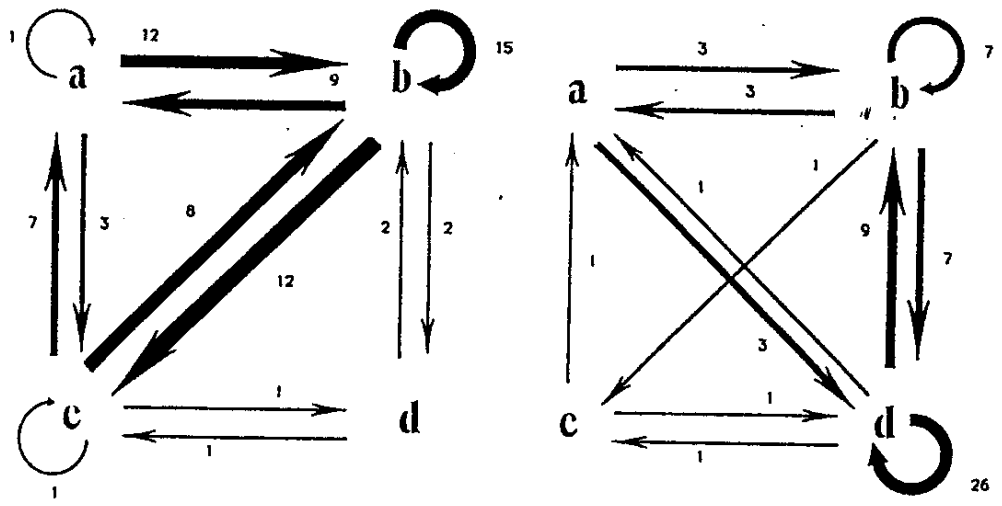

Fig. 1. Schematic view of the day to day shifts in the day resting places localization between the four major landscape units (A, B, C, D).

2. The pattern of use of the resting places:

During seven monitoring days, Brise occupied four different resting places of which only one was used on two consecutive days.

Once in her resting place in the morning, Rosy never left before the twilight. Only three times, did we record a diurnal activity with a resting place change (3/189). To study the pattern of the diurnal resting place occupation, the predelivery period (138 days) must be separated from that which concerns the raising of the cubs.

During the first period, 56 different resting places were used of which 34 were used only once (Fig. 2). Before delivery, the bitch changed her resting place nearly every day. She rarely occupied the same resting place on two or three consecutive days (respectively 9 and 4 observations).

The most occupied resting places are dens, Rosy took shelter twice as often in dens as in lairs (Tab. 2). None of these lairs was visited more than four times, most of them (22 out of 30) were only used once.

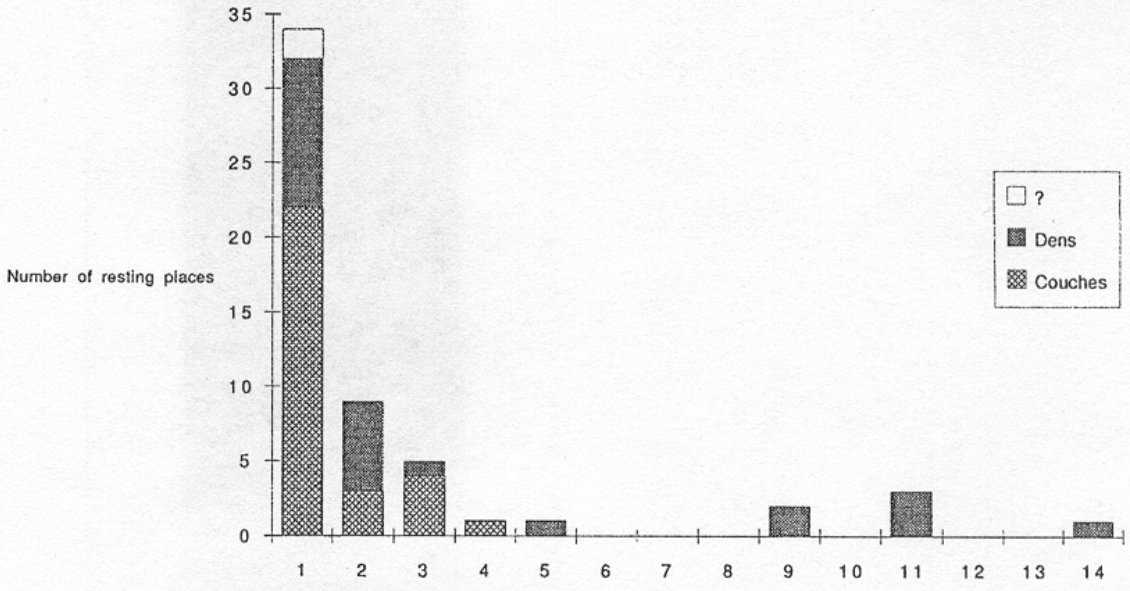

Fig. 2. Day resting places utilization frequency by Rosy.

No simple model (e. g. semi log.) does fit well to the cumulative curve showed in Fig. 3 (Kolmogorov test not significant) even when the observations are split into two or three distinct phases. Nevertheless, during the first monitoring month, the number of new resting places increased quickly: nearly one new resting place each day then, decreased regularly until mid June.

After this period, the curve rose again and the occurrence of a new resting place was nearly three times faster than between the beginning of May and mid June. This tendency was particularly obvious during the second fortnight of June and July. At the end of July, the curve decreased again and flattened out after the birth of the young.

The evolution per fortnight of the different occupied resting places was characterized by three phases (Fig. 4): a rapid decrease until mid May and a slow increase till mid July and after that another rapid decrease until the delivery.

The birth of the cubs was on the 16 August, in a holt (Den A) situated in the bank of a large collector canal (sector D). Four days later, the cubs were carried to another holt (Den B) 250 meters from the birth holt and the young stayed there for five days. Carried back to A, the young stayed in

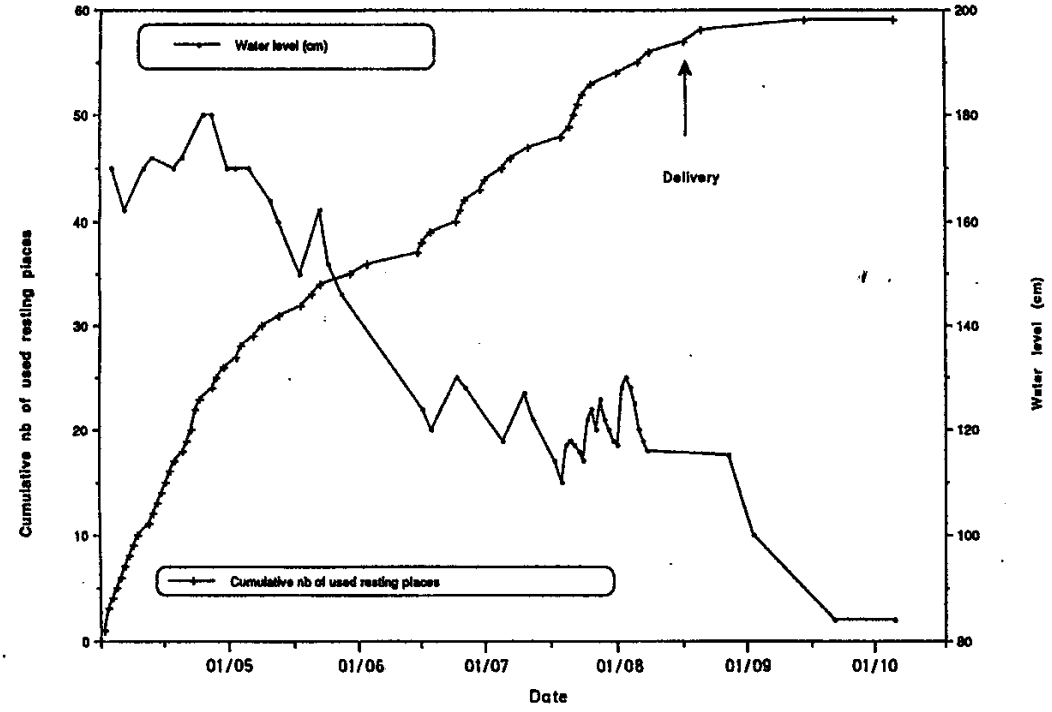

Fig. 3. Relationship between each new resting site and the length of radiocontact with Rosy. Fluctuations of the water level during the experiment are also shown.

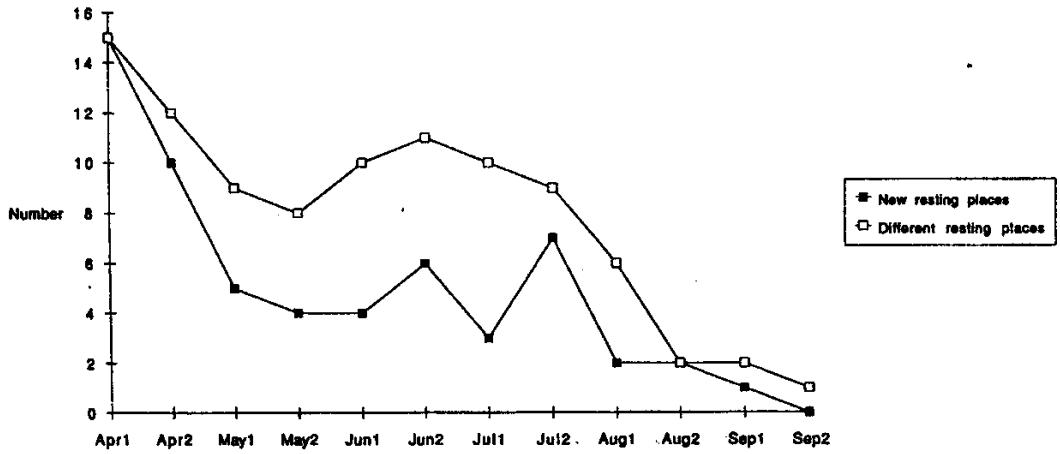

Fig. 4. Day resting places occupation: number of used places per fortnight (Rosy).

the same place for 19 days and after that, they were removed to holt C, 75 meters from B, where they remained at least until the end of the monitoring period (at least twenty two days).

None of these three holts, localized on the same canal (Ceinture des Hollandais) had ever been used before as a day resting place.

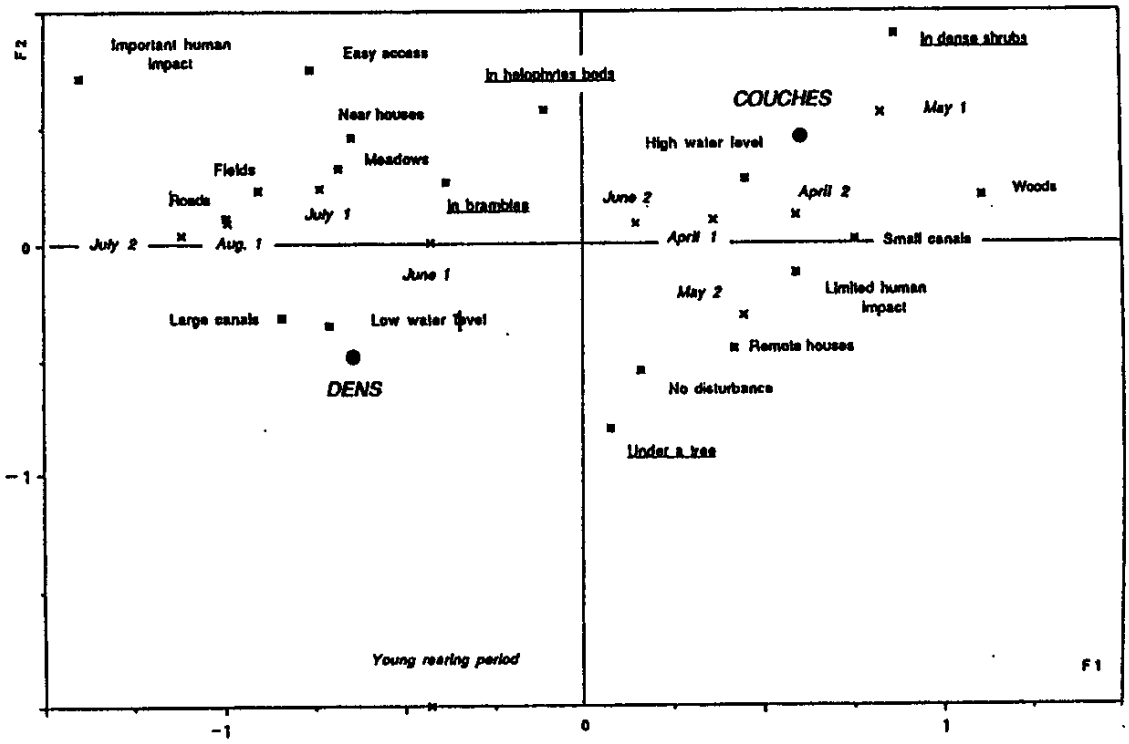

Fig. 5. Correspondence analysis: projection of the most important variables on the factorial axes F1 and F2. Crosses and names in italic refer to supplementary variables.

3. The occupation pattern of resting places and the characteristics of the habitat:

The simplified results of the correspondence analysis are given in Figures 5 and 6. The first two axes respectively represent 16.6 and 8.4 per cent of the variance in the whole data set.

We shall limit our interpretation to these two axes.

Most of the variation (Axis F1) is related to a gradient in the degree of closure of the landscape. In the upper left hand quarter appears the open

field habitat (mainly covered with meadows and arable fields). This suffers the most human influence. On the top right hand quarter are situated the wooded areas (*«terrées»*) crossed by small canals. This habitat is not easily accessible to people, because of the density of trees and bushes.

The central zone of the diagram corresponds to intermediate habitats situated between the two other types of habitat. In this ordination (Axis F1,

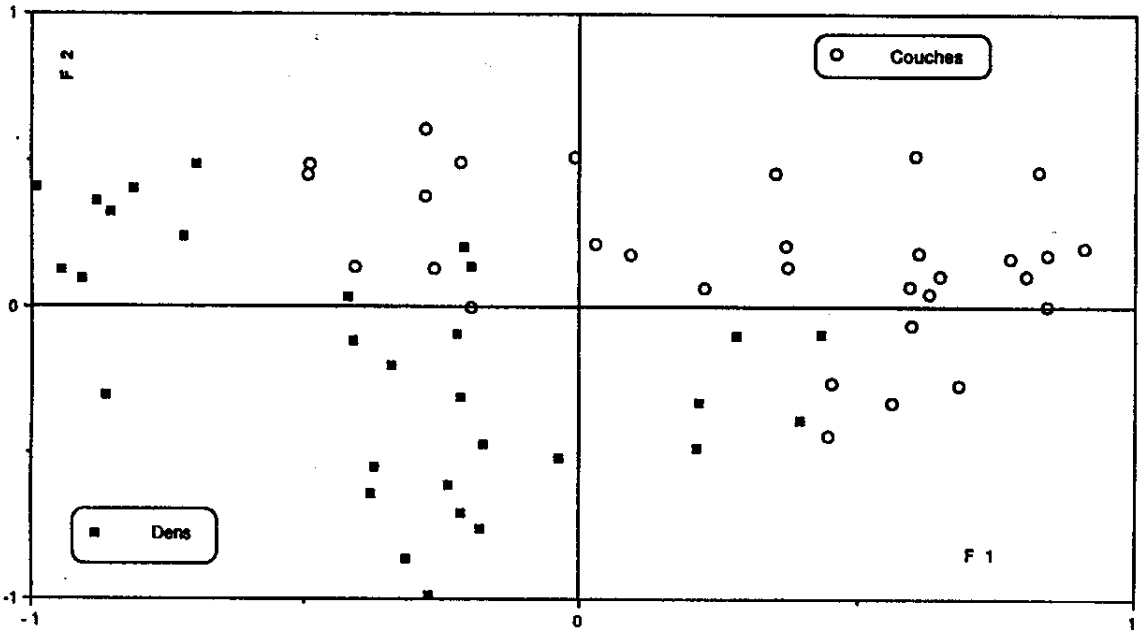

Fig. 6. Correspondence analysis: projection of the coordinates of the resting places factorial axes F1 and F2.

Axis F2) the lairs and dens form two distinctive groups of points of which the edges hardly cross. The lairs are all associated with wet woodland and are used when the water level is at its highest but after the spring flooding period.

In the open field landscape, the resting places are usually dens. These sites are occupied in July and August when the small canals are dry, due to the exceptional drought of the last summer. The otter can equally dwell there in the open air but in this habitat her lairs were hidden under blackthorn or in a reed bed (positive values on Axis F2). In the absence of blackthorn or thick bushes, the resting places were generally sheltered under a tree or under roots. Slightly hidden by vegetation, they are situated far from hu-

man disturbance. The holts reserved for parturition and raising the cubs represent the extreme case of selection of this type of den.

DISCUSSION

The data of Brise are not discussed because the monitoring took place over too a short period. However, they do not contradict the information obtained on Rosy.

The pattern of habitat use revealed by this study of the use of day resting places can be summarized as follows:

— during the first period (from release to mid-June), the animal rested principally in the bocage and most often in surface lairs in very closed habitat, impenetrable to people. This period is characterized by a high water level, after the spring floods. All the canals and ditches around the fields of the bocage are underwater. This first period is divided in two: April and May-June. In April, Rosy used a new resting place, almost every day. We don't know if this behaviour resulted from her capture or from the water level which was close to a flood. In May, the rate of appearance of new resting places declined until the moment the water level dropped sharply so that no water remained in the bocage (mid June).

— from this time, the use of space pattern changed completely as though the otter, no longer able to use the dry ditches of the bocage, began to search for other potential resting places. She rested now principally in dens in the banks of the principal canals.

— at the beginning of August, the rate of appearance of new resting places declined but Rosy switched regularly between daytime resting places.

— the birth of the young made the mother completely sedentary: she returned every day to the holt.

Before the birth of her young, Rosy showed extreme mobility in her use of resting places but she always stayed within a sharply defined home

range whose principal limits coincided with those of the floodable bocage and with some large canals.

Melquist & Hornocker (1981) have also noticed the use of a large number of different resting places by a single otter (88 in 16 months) but the only precise information so far published on the pattern of use are given by Green *et al.* (1984). Our observations confirm theirs on the following points:

* many resting places are used by one animal;
* two successive days are spent in the same resting place only exceptionally;
* many resting places are used only once;
* a few resting places make up a large number of stays.

The general pattern of use in the *Marais Poitevin is* therefore probably not specific to this type of landscape.

In fact, it looks very similar to the ones of other mustelids like the stone marten or the pine marten, though more mobile (Labrid, 1986, Skirnisson, 1986, Marchesi, 1989).

CONCLUSIONS

Within her sharply defined home range, Rosy was always mobile in her use of day resting sites. The pattern of use of these places was very dependent on the fluctuations of the water level. In all circumstances, Rosy sought security: her surface lairs were far from houses. Otherwise, she spent the daytime in underground shelters protected by brambles or hidden in the roots of riverside trees.

As long as food remains available, the otter can therefore survive in the *Marais Poitevin* so long as certain vegetation structures are maintained: trees, thickets or bramble patches in the edge of canals, aquatic macrophyte beds, wooded patches. The potential day resting sites are still abundant except in the large cultivated fields where the ditches have been filled in or dredged and all the woody vegetation and reeds removed. Over the whole of the Marais Poitevin, the countryside is, unfortunately, changing in this way.

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