Mammal Rev. 1997, Volume 27, No. 4, 177–184. *Printed in Great Britain.*

Trophic status and feeding habits of the European Polecat *Mustela putorius* L. 1758

T. LODÉ
Laboratoire d'Ecologie animale, Université d'Angers, 2Bd Lavoisier, 49045 Angers, France

ABSTRACT

The trophic status of the European Polecat *Mustela putorius* was studied through a review of the diets of 18 different populations in Europe. Rodents represented the principal prey in 10 sites (55.5%) and were a prey of secondary importance in seven sites (38.8%). Anurans prevailed in three sites (17%) but constituted the second food category in eight others (44%). The ascendant hierarchical classification showed a relatively unvarying diet in Europe. The frequency of birds and invertebrates were important in the diversification of the diet, indicated by the value of the food niche index, whereas rabbits were more significant in southern regions. The constant incidence of predation on woodland rodents and amphibians gave a particular status to the Polecat and showed it to be a generalist feeder well adapted to the mid-European region.

INTRODUCTION

One of the key-insights concerning the regulation of rodent populations by vertebrate predators was the introduction of the distinction between specialist and generalist feeders (Andersson & Erlinge, 1977). The variety of the exploited resources was often considered to reflect the opportunism in trophic strategies, and the feeding eclecticism of the European Polecat *Mustela putorius* L. 1758 was interpreted as an evidence of a generalist feeder (Walton, 1966; Libois, 1984; Erlinge *et al.*, 1982; Erlinge, 1986; Blandford, 1987). Ballarin *et al.* (1980), adding that the composition of the diet varies according to the site, agree with this idea. On the other hand, the preponderance of amphibians in the diet allowed Weber (1989) and Jedrzejewski *et al.* (1993) to conclude that the Polecat would be an anuran specialist. Conversely, Roger (1991) underlined the importance of lagomorphs in a diet without any amphibians in Camargue as well as in Touraine (France) and therefore deduced the predator's specialization for lagomorphs.

This apparent flexibility could then mean that some populations of Polecats behave as specialists, whereas some others remain generalists. Nevertheless the generalist or specialist characteristic concerning trophic strategies can only be applied to species, and not to certain animals or populations (Begon *et al.*, 1990). So, despite all the available information on the European Polecat, the trophic status of this species remains ambiguous.

This study aimed at characterizing the trophic strategies of *Mustela putorius* through a detailed analysis of the diet variation across Europe. The study of diet structure of 18 different populations was compared according to the geographical latitude, the habitat and the diversity of the diet.

MATERIAL AND METHOD

Available data

This study was based on 16 scientific articles which provided detailed quantitative information on 18 different populations of Polecats in Europe (Fig. 1, details in Table 1). The estimations of the diet composition were obtained either by the examination of the digestive tracts or through faeces analysis. The sampling method was rarely explained. The size of the samples varied from nine (De Marinis & Agnelli, 1996) to 207 stomachs (Rzebik-Kowalska, 1972) or else from 43 (Sidorovich,

Fig. 1 Distribution of sites.

Table 1 Source of data and characteristics of the studied sites

No	Locality	Habitat	Material analysed	Season	Source
1	Wales 1, W. GB	farmland	28 stomachs	All the year	Walton (1968)
2	Wales 2, W. GB	farmland	558 faeces	All the year	Blandford (1987)
3	Wallonia, Belgium	farmland	13 stomachs	All the year	Libois (1984)
4	Northern Netherlands	reed-bed	41 stomachs	Summer/Winter	Brugge (1977)
5	Central Germany	farmland, villages	57 stomachs	All the year	Goethe (1939)
6	Southern Poland	farmland, villages	260 stomachs	All the year	Rzebik-Kowalska (1972)
7	Moravia, Czech Republic	farmland	35 stomachs	All the year	Kratochvil (1952)
8	St-Petersburg, Russia	wooded farmland	68 faeces	Summer/Winter	Danilov & Rusakov (1969)
9	Karelia, N. Russia	wooded marshes & peat-bogs	23 faeces	Summer/Winter	Danilov & Rusakov (1969)
10	Grand-Lieu, W. France	wooded marshes	928 faeces	All the year	Lodé (1994)
11	Poitou, mid W. France	marshes	161 faeces	All the year	Lodé (1990)
12	Touraine, central France	farmland	149 faeces	All the year	Roger (1991)
13	Camargue, S. France	marshes	438 faeces	All the year	Roger (1991)
14	Central Italy	farmland	9 stomachs	Winter/Spring	De Marinis & Agnelli (1996)
15	Jura, N. W. Switzerland	mountain & valley	285 faeces	Summer/Winter	Weber (1989)
16	Bialowieza, E. Poland	primeval forest	222 faeces	Winter	Jedrzejewski *et al.* (1993)
17	Lovat river, N.E. Belarus	forest brook meadow	43 faeces	All the year	Sidorovich (1992)
18	Kama river, central Russia	meadow	563 faeces	Winter	Grigoriev & Teplov (1939)

1992) to 928 faeces (Lodé, 1994). There was no quantified information available concerning the most southern regions, except Camargue, France and Italy, although Ballarin *et al.* (1980) had analysed 120 stomachs in Spain. Danilov & Rusakov's analysis (1969) in Karelia constituted the most northern study available because Nilsson's data (1978), on which Erlinge *et al.* (1983) had based their work, were partly published only. Several notes based on small samples or on the results of studies which were completed later, were not taken into account (Jensen & Jensen, 1972; Labhardt, 1980; Herrenschmidt, 1982; Mermod *et al.*, 1983; Lodé, 1988, Jedrzejewski *et al.*, 1989). In the same way, when authors studied sites in the same geographical area, e.g. by Roger (1991) in Touraine and Rambouillet, the data were neither included nor pooled in order to avoid the possible autocorrelations. And finally, the study focused on the natural area of Polecats (Palaearctic), excluding the data for the ferret in New Zealand (Roser & Lavers, 1976). In most studies, the structure of the diet was quantified as occurrence frequency; the items of one feeding category were viewed in terms of the number of stomachs or faeces analysed. In a few cases (Roger, 1991; Jedrzejewski *et al.*, 1993), an evaluation of the biomass consumed, calculated with a correction coefficient, completed the analysis. Although the level of identification of non-digested remains often reached the species for certain zoological classes, such as the mammals, the results were generally expressed by gathering food items into polyspecific categories, such as rodents, amphibians, birds and invertebrates. Unfortunately, seasonal dietary variations were only known for six sites: Karelia, Russia (Danilov & Rusakov, 1969), Saint-Petersburg, NW Russia (Danilov & Rusakov, 1969), Jura, Switzerland (Weber, 1989), Grand-Lieu, France (Lodé, 1994), Poitou, France (Lodé, 1990) and Lovat River, Belarus (Sidorovich, 1992). A comparative analysis was made between summer (March–September) and winter (October–February) for these sites.

Data processing

The data concerning the 18 sites chosen were homogenized according to the relative occurrence frequency – each item being compared with the total number of items – and classified into eight food categories, ecologically relevant, as the proportions of rodents, lagomorphs, other mammals, birds, amphibians, invertebrates, fishes and carrion. The food niche breadth index $B = 1/\Sigma Pi^2$ (Simpson, 1949) was calculated for each site.

An ordinal classification of the 18 sites was performed according to their latitude in order to test this influence. A stepwise regression analysis was made to estimate the contribution of different food categories according to two criteria, the niche index and the latitude. An ascendant hierarchical classification (mean Euclidean distance) was performed to express the similarity among the diets of the 18 populations studied. A rough description of the characteristics of the habitats (woods, wooded farmlands, open fields) and the frequented watercourses (brooks or rivers, marshes) was carried out. An analysis of correlations was performed relating the habitat type on the one hand, to the first and the second food category.

RESULTS

In Europe, the diet of the Polecat is mainly composed of rodents (36.4% in average) and amphibians (21.9%). Lagomorphs (13.2%), birds (9.8%) and carrion (7.4%) complete the diet (Table 2). Other mammals, some invertebrates, and a few fishes are found in small quantities. The rodents eaten were mostly Bank Voles *Clethrionomys glareolus* accompanied by Common Voles *Microtus arvalis*, Wood Mice *Apodemus sylvaticus* and Brown Rats *Rattus norvegicus*. A few insectivores, mostly shrews (*Sorex* sp.), were also commonly cited. Among the lagomorphs, the Wild Rabbit *Oryctolagus cuniculus* was the most common species. The amphibians consumed were mostly anurans, principally terrestrial and nocturnal (*Rana dalmatina*, *R. temporaria*, *R. arvalis*, *Bufo bufo*, *B. viridis*), although other species could also appear in the diet (*R. esculenta*, *R. lessonae*, *Discoglossus pictus*).

Table 2 Dietary patterns of Polecats in 18 sites in Europe (based on Wales 1, Great Britain: Walton, 1968; Wales 2, Great Britain: Blandford, 1987; Wallonia, Belgium: Libois 1984; Northern Netherlands: Brugge, 1977; Central Germany. Goethe 1939; Southern Poland: Rzebik-Kowalska 1972; Moravia, Czech Republic: Kratochvil, 1952; St-Petersburg, Russia: Danilov & Rusakov 1969; Karelia, Russia: Danilov & Rusakov, 1969; Grand-Lieu, France: Lodé, 1994; Poitou, France: Lodé, 1990; Touraine, France: Roger, 1991; Camargue, France: Roger, 1991; Central Italy: De Marinis & Agnelli, 1996; Jura, Switzerland: Weber, 1989; Bialowieza, Poland: Jedrzejewski *et al.*, 1993; Lovat river, Belarus: Sidorovich, 1992; Kama river, central Russia: Grigoriev & Teplov, 1939)

	Food types									
Locality	Rodents	Lago-morphs	Other mammals	Birds	Amphi-bians	Inver-tebrates	Fish	Carrion	Other	Niche breadth
Wales I, Great Britain	35.0	0.0	15.0	0.0	26.0	24.0	0.0	0.0	0.0	3.700
Wales II, Great Britain	32.3	36.5	0.0	19.3	6.0	0.0	0.0	5.9	0.0	3.554
Wallonia, Belgium	60.1	0.0	26.7	6.7	0.0	0.0	0.0	0.0	6.7	2.265
Northern Netherlands	24.5	30.0	5.5	20.0	20.0	0.0	0.0	0.0	0.0	4.291
Central Germany	37.0	4.0	0.0	17.0	18.0	10.0	0.0	14.0	0.0	4.359
Southern Poland	16.5	2.8	12.3	23.6	13.7	3.2	0.0	10.2	17.6	6.249
Moravia, Czech Republic	33.3	9.8	13.7	13.7	17.6	11.7	0.0	13.5	0.0	4.526
St-Petersburg, Russia	46.5	0.0	6.0	3.0	26.8	0.0	0.0	17.7	0.0	3.088
Karelia, N Russia	38.5	3.8	3.8	19.0	23.5	0.0	0.0	11.4	0.0	3.915
Gd-Lieu, W France	61.7	6.1	3.7	2.8	21.3	2.5	1.9	0.0	0.0	2.309
Poitou, Mid W France	46.5	3.6	0.5	1.0	41.0	0.0	0.0	7.4	0.0	2.540
Touraine, Central France	40.7	50.8	0.0	8.7	0.0	0.0	0.0	0.0	0.0	2.327
Camargue, S France	8.5	84.2	0.0	4.6	0.0	0.0	0.0	2.7	0.0	1.391
Central Italy	43.7	6.3	18.8	12.5	0.0	18.8	0.0	0.0	0.0	3.556
Jura NW Switzerland	23.9	0.0	0.0	4.0	49.4	3.1	0.0	19.6	0.0	2.923
Bialowieza, E. Poland	16.2	0.0	5.0	1.5	73.7	0.0	2.6	1.0	0.0	1.745
Lovat river, NE Belarus	34.1	0.0	0.0	7.3	40.0	5.8	0.0	12.8	0.0	3.318
Kama river, central Russia	56.3	0.0	0.0	11.2	17.0	0.0	0.0	15.5	0.0	1.608

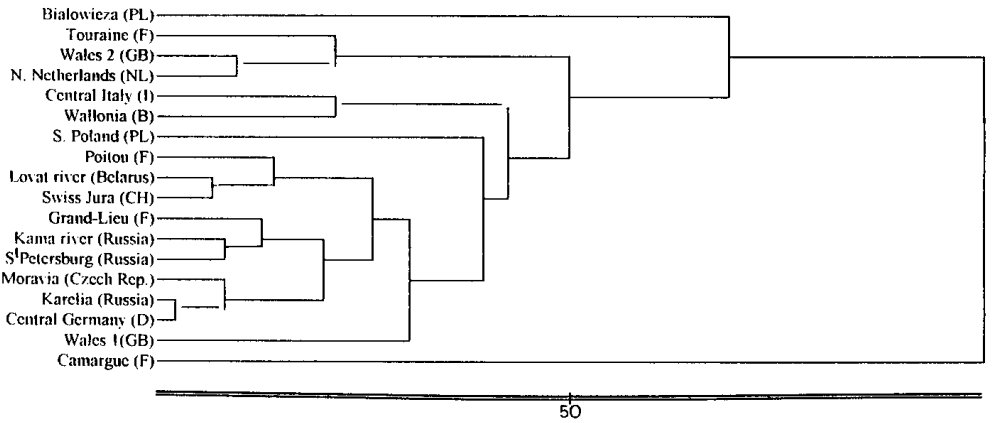

Fig. 2 Dendogram resulting from the cluster analysis of dietary patterns of European Polecats. Wales 1, Great-Britain: Walton, 1968; Wales 2, Great-Britain: Blandford, 1987; Wallonia, Belgium: Libois 1984; Northern Netherlands: Brugge, 1977; Central Germany. Goethe 1939; Southern Poland: Rzebik-Kowalska 1972; Moravia, Czech Republic: Kratochvil, 1952; St-Petersburg, Russia: Danilov & Rusakov 1969; Karelia, Russia: Danilov & Rusakov, 1969; Grand-Lieu, France: Lodé, 1994; Poitou, France: Lodé, 1990; Touraine, France: Roger, 1991; Camargue, France: Roger, 1991; Central Italy: De Marinis & Agnelli, 1996; Jura, Switzerland: Weber, 1989; Bialowieza, Poland: Jedrzejewski *et al.*, 1993; Lovat river, Belarus: Sidorovich, 1992; Kama river, central Russia: Grigoriev & Teplov, 1939).

The average niche index was 3.27 (SD 1.18), indicating a not very specialized diet. The consumption of rodents was noted in 100% of the sites ($n = 18$). Birds, amphibians and carrion were, respectively, eaten in 94.4% of the sites ($n = 17$), 77.8% ($n = 14$) and 66.7% ($n = 12$). Finally lagomorphs (61.1%) and 'other mammals' (61.1%) were present in half of the sites or more. Yet rodents were the main prey in 55.5% of the sites ($n = 10$) and the secondary prey in 38.8% ($n = 7$), whereas anurans were eaten as the main prey in 16.7% of the sites only ($n = 3$) and in eight cases (44.4%) as a secondary prey. The lagomorphs were the main prey in 22.2% ($n = 4$) and never found as second prey.

The stepwise regression analysis showed that the index of diet diversity was dependent on the proportion of birds in the diet (multiple correlation coefficient 0.945, $F = 9.1$, d.f. = 17, $P < 0.001$). Although lagomorphs tended to be eaten more in southern habitats (r, Spearman = –0.545 $P = 0.02$), there was no other significant link between the different dietary categories and latitude.

The study of the similarity of the diet structure between the different sites showed that one site, the Camargue, clearly diverged from the others ($D = 88.7$, Fig. 2) and this was principally due to the preponderance of the Wild Rabbit in the diet. A second site (Bialowieza) also showed a strong difference ($D = 65.1$), mainly linked to the importance of the anurans in the diet. All the other diets were associated ($D = 50.1$), although three clusters were noticeable. The first group corresponded to 10 diets which clearly converged ($D = 34.7$). The second one groups together three sites with a weaker structure ($D = 28.4$). The third cluster consisted of central Italy and Wallonia, Belgium ($D = 28.4$), and was linked to south Poland ($D = 42.4$). In fact, far distant sites in Europe could show very similar diets – for example, between Karelia and Germany ($D = 12.6$); Belarus and

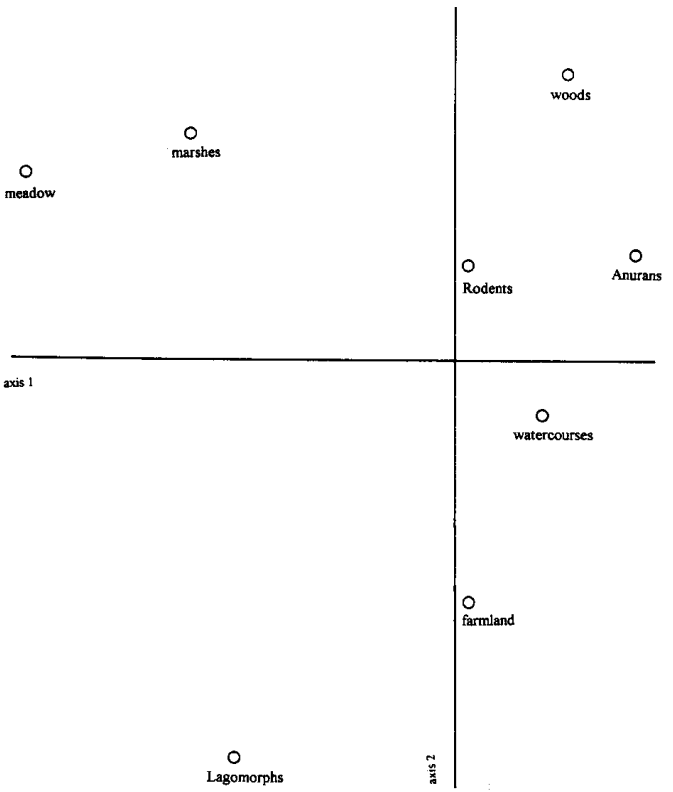

Fig. 3 Projection of eight main variables (habitats: 1, woods; 2, meadows; 3, farmland; 4, watercourses; 5, marshes; first prey: 6, rodents; 7, lagomorphs; 8, anurans) resulting from multiple correspondence analysis.

Table 3 Dietary variations in winter and summer based on six sites: Karelia (K), Russia (Danilov & Rusakov, 1969); Saint-Petersbourg (SP), Russia (Danilov & Rusakov, 1969); Jura (J), Switzerland (Weber, 1989); Grand-Lieu (GL), France (Lodé, 1994); Poitou (P), France (Lodé, 1990); Lovat River (L), Belarus (Sidorovich, 1992)

	K	SP	J	GL	P	L
Winter						
Rodents	31.0	44.0	31.5	71.1	72.0	60.5
Lagomorphs.	7.7	0.0	0.0	7.1	02.0	0.0
Other mammals	0.0	4.3	0.0	6.3	0.0	11.3
Anurans	7.7	22.9	34.1	6.8	16.0	27.6
Birds	22.9	3.3	3.9	1.8	0.0	4.8
Invertebrates	0.0	0.0	2.6	3.4	0.0	3.2
Carrion	23.1	19.1	18.5	3.6	0.0	0.0
Others	7.7	5.4	9.5	0.0	10.0	2.2
Niche breadth	4.552	3.468	3.832	1.916	1.804	2.185
Summer						
Rodents	50.1	48.4	15.2	50.5	27.0	22.1
Lagomorphs	0.0	0.0	0.0	4.9	2.3	0.0
Other mammals	6.3	3.5	0.0	0.5	0.0	5.6
Anurans	31.3	31.9	66.7	38.4	69.4	44.4
Birds	12.5	6.9	4.2	4.2	1.2	13.8
Invertebrates	0.0	0.0	3.6	1.4	0.0	11.1
Carrion	0.0	0.0	2.5	0.0	0.0	0.0
Others	0.0	10.3	7.7	0.0	0.0	2.8
Niche breadth	2.713	2.887	2.094	2.443	1.801	3.555

Switzerland ($D = 16.0$); Grand-Lieu and Kama ($D = 21$). Therefore, the diet of Polecats exhibited a very homogeneous composition across Europe.

The two first axes of the multiple correspondence analysis concerning the major prey and the rough habitat category explained 62% of the cumulated inertia. The study revealed that rodents and anurans were generally associated with damp woods, whereas lagomorph consumption was somewhat linked to farmland (Fig. 3).

The niche breadth did not vary significantly between winter (2.959) and summer (2.582) for the six analysed sites ($U = 15$, NS). However, dietary composition clearly differed because the amphibians were significantly consumed more in summer while carrion was mainly exploited in winter (Table 3).

DISCUSSION

This study revealed how important it was to refer to different populations occupying the whole distribution to understand the trophic status of one species. Thus, the Polecat's food was mainly composed of two principal food categories, rodents ($n = 18$ sites) and anurans ($n = 14$ sites). The different specializations mentioned (Jedrzejewski *et al.*, 1989; Weber, 1989; Roger, 1991) probably corresponded to adjustments to abundance of food resources locally available, as revealed by the ascendant hierarchical analysis. The Polecat's diet remained flexible as the niche index showed, and the predator could integrate birds as well as carrion into its diet. The trophic status of the species corresponded to a generalist polyphagous feeder according to Begon *et al.*'s (1990) definition. In the same way, a tendency to consume more lagomorphs appeared in the more southern regions. But in fact, and despite its dietary eclecticism, the Polecat could concentrate its predation upon a particular food category such as rodents, amphibians or lagomorphs. Such a trophic tactic reflects without doubt the predator's opportunism in feeding strategy, but the Polecat seemed preferentially to exploit woodland rodents such as *Clethrionomys glareolus* and *Apodemus sylvaticus* or aquatic

rodents such as *Rattus norvegicus*, *Arvicola terrestris* and *Ondatra zibethicus*. Furthermore the Polecat's assiduous predation upon anurans conferred it a distinctive position among the predators of the Palaearctic. The Polecat even presents an ethological adaptation to the consumption of a venomous prey such as the Common Toad (Lodé, 1989, 1994; Weber, 1989). The hunting strategies of this mustelid were characterized by the capture of small nocturnal and terrestrial prey. In fact, the diet diversity revealed an alternation in prey consumption and was often associated with habitat changes (Ballarin *et al.*, 1980; Lodé, 1994) or with modifications in the general activity (Lodé, 1995). However, severe winters could complicate both the capture of anurans and the frequenting of damp habitats involving the consumption of carrion in particular (Danilov & Rusakov, 1969; Rzebik-Kowalska, 1972; Weber, 1989).

This predilection for amphibians and woodland rodents showed that the Polecat is a mustelid typically adapted to wooded mid-European regions. The dietary patterns in Polecats are characterized by the alternation of rodent and anuran preys. Polecat populations have suffered a decline over large areas of Europe (Langley & Yalden, 1977; Libois, 1984; Birks, 1993; Saint-Girons *et al.*, 1993). Although the return of the Polecat seems to be beginning in Switzerland (Weber, 1988) and in Great Britain (Birks, 1993), the peculiarities of its trophic ecology could have a decisive role in the maintenance of populations.

ACKNOWLEDGEMENTS

I am very grateful to B. Jedrzejewska and D. W. Yalden for their helpful comments.

REFERENCES

Andersson, M. & Erlinge, S. (1977) Influence of predation on rodent populations. *Oikos*, **29**, 591–597.

Ballarin, I., Garzon, J., Palacios, P., Cuesta, L. & Castroviejo, J. (1980) On the diet of Polecats (*Mustela putorius* L. 1758) in Spain. *Reunion Iberoamericana de Zoologica Vertebrata*, **1**, 625–627.

Begon, M., Harper, J.L. & Townsend, C.R. (1990) *Ecology: Individuals, Populations and Communities*. Blackwell Scientific Publications, Oxford.

Birks, J. (1993) The return of the Polecat. *British Wildlife*, **5**, 16–25.

Blandford, P.R.S. (1987) Biology of the Polecat *Mustela putorius*: a literature review. *Mammal Review*, **17**, 155–198.

Brugge, T. (1977) Prooidierkeuze van wezel, hermelijn en bunzing in relatie tot geslacht en lichaamsgrootte. *Lutra*, **19**, 39–49.

Danilov, P.I. & Rusakov, O.S. (1969) [Peculiarities of the ecology of *Mustela putorius* in North West districts of the european part of the USSR]. *Zoological Zhurnal*, **48**, 1383–1394 (in Russian).

De Marinis, A.M. & Agnelli, P. (1996) First data on the winter diet of the polecat, *Mustela putorius* (Carnivora, Mustelidae) in Italy. *Mammalia*, **60**, 144–146.

Erlinge, S. (1986) Specialists and generalists among the mustelids. *Lutra*, **29**, 5–11.

Erlinge, S., Göransson, G., Hansson, L., Högstedt, G., Liberg, O., Nilsson, I.N., Nilsson, T., Schantz Von, T. & Sylven, M. (1983) Predation as regulating factor on small rodent populations in southern Sweden. *Oikos*, **40**, 36–52.

Erlinge, S., Göransson, G., Högstedt, G., Liberg, O., Loman, J., Nilsson, L., Nilsson, T., von Schantz, T. & Sylven, M. (1982) Factors limiting numbers of vertebrate predators in a predator prey community. *International Congress Game Biology*, **14**, 261–268.

Goethe, F. (1939) Untersuchungen über die Winternahrung des Iltisses nebst einigen weiternen biologischen Feststellungen. *Wild und Hund*, **43**, 720–722.

Grigoriev, N.D. & Teplov, V.P. (1939) [Results of dietary investigations of fur mammals in Volga-Kama region]. *Memory of Society Nature Kazan University*, **1/2**, 1–127 (in Russian).

Herrenschmidt, V. (1982) Note sur les déplacements et le rythme d'activité d'un putois *Mustela putorius* L. suivi par radiotracking. *Mammalia*, **46**, 554–556.

Jedrzejewski, W., Jedrzejewska, B. & Brzezinski, M. (1993) Winter habitat selection and feeding habits of Polecats (*Mustela putorius*) in the Bialowieza National Park, Poland. *Zeitschrift für Säugetierkunde*, **58**, 75–83.

Jedrzejewski, W., Jedrzejewska, B. & Szymura, A. (1989) Food niche overlaps in a winter community of predators in the Bialowieza primeval forest, Poland. *Acta theriologica*, **34**, 487–496.

Jensen, A. & Jensen, B. (1972) Ilderen (*Putorius putorius*) og Ilderjagten i Danmark 1969/70. *Danske Vildundersogelser*, **18**, 1–32.

Kratochvil, J. (1952) La nourriture et les races de putois (*Putorius putorius* L.). *Acta Universitatis Agriculturae Facultas Sylviculturae*, **1**, 1–18.

Labhardt, F. (1980) Zur Fütterungstätigkeit und über einige Verhaltensweisen einer freilebenden Iltisfähe, *Mustela putorius* Linné, 1758. *Säugetierkunde Mittle*, **28**, 247–251.

Langley, P.J.W. & Yalden, D.W. (1977) The decline of the rarer carnivores in Great Britain during the nineteenth century. *Mammal Review*, **7**, 95–116.

Libois, R. (1984) Atlas des Mammifères de Wallonie, le genre *Mustela* en Belgique. *Cahiers Ethologie Appliquée*, **4**, 281–287.

Lodé, T. (1988) Note préliminaire sur la biologie du comportement du putois dans les bocages humides de l'ouest de la France. *Bulletin de la Société des Sciences Naturelles de l'Ouest de la France*, **10**, 58–67.

Lodé, T. (1989) Le comportement de mise en réserve alimentaire des proies chez le Putois *Mustela putorius*. *Cahiers Ethologie Appliquée*, **9**, 19–30.

Lodé, T. (1990) Variations saisonnières de l'alimentation d'un petit carnivore, le putois dans le marais Poitevin. *Annales de la Société des Sciences Naturelles (Charente-Maritime)*, **7**, 1073–1080.

Lodé, T. (1994) Environmental factors influencing habitat exploitation by the Polecat *Mustela putorius* in western France. *Journal of Zoology, London*, **234**, 75–88.

Lodé, T. (1995) Activity pattern of Polecats *Mustela putorius* L. in relation to food habits and prey activity. *Ethology*, **100**, 295–308.

Mermod, C., Debrot, S., Marchesi, P. & Weber, J.M. (1983) Le Putois (*M. putorius* L.) en Suisse romande. *Revue Suisse de Zoologie*, **90**, 487–856.

Nilsson, T. (1978) Home-range utilization and movements in the Polecat *Mustela putorius* during autumn. *International Theriological Congress Brno*, 173.

Roger, M. (1991) Régime et disponibilités alimentaires chez le putois *Mustela putorius* L. *Revue d' Ecologie (Terre Vie)*, **46**, 245–261.

Roser, R.G. & Lavers, R.B. (1976) Food habits of the ferret (*Mustela putorius furo* L.) at Pukepuke lagoon. NZ. *New Zealand Journal of Zoology*, **3**, 269–275.

Rzebik-Kowalska, B. (1972) Badania nad pokarmen ssakow drapieznych w Polsce. *Acta Zoologica Cracoviensia*, **17**, 416–506.

Saint-Girons, M.C., Maurin, H., Rosoux, R. & Keith, P. (1993) *Les mammifères d'eau douce, leur vie, leurs relations avec l'homme*. Ministère de l'environnement, Ministère de l'agriculture et de la pêche et SFEPM, Paris.

Sidorovich, V.E. (1992) [The diet of Forest Polecats]. *Institut of Zoology of Minsk*, 2–13 (in Russian).

Simpson, E.H. (1949) Measurement of diversity. *Nature*, **163**, 688.

Walton, K.C. (1966) Polecats. *Nature in Wales*, **10**, 65–68.

Walton, K.C. (1968) *Studies on the biology of the polecat* Putorius putorius *(L.)*. MSc thesis, University of Durham.

Weber, D. (1988) Die aktuelle Verbreitung des Iltisses (*Mustela putorius* L.) in der Schweiz. *Revue suisse de Zoologie*, **95**, 1041–1056.

Weber, D. (1989) The diet of Polecats (*Mustela putorius* L.). *Zeitschrift für Säugetierkunde*, **54**, 157–171.