The familiar area hypothesis and movement patterns of wild forest reindeer in Karelia, Northern Europe

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Abstract: The relevance of the familiar area hypothesis to the behaviour of the wild forest reindeer (*Rangifer tarandus fennicus* Lönnb.) was studied in a Fenno-Soviet project by radio and field tracking of these ungulates in Karelia, Northern Europe, in 1978 - 1985. This subpopulation (500 - 600 exx.) has a tradition of overwintering in a restricted area around Lake Lentua (ca. 1000 km^2). The spring migration period is shorter in length than the autumn migration. The migration routes are generally the same in autumn and spring, although exceptions occur, indicating exploratory behaviour. The large winter herds disband into small groups or lone individuals for the summertime, when this subpopulation is spread over a much wider area (ca. 5400 km^2). It is concluded that the observations made support the familiar area hypothesis in all essential points.

Key words: familiar area hypothesis, wild forest reindeer, radio-telemetry.

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Introduction

The long-distance seasonal return migrations of the woodland-tundra transition demes of *Rangifer tarandus* are often easy to detect and follow (review in Kelsall, 1968; Baker, 1978), while the movements of the woodland demes of the species are much more difficult to study. The basic movement behaviour patterns of the woodland demes can be assumed to be similar to those of their woodland-tundra and tundra counterparts, but their potential summer and winter habitats are located so close together that the pattern of their use possesses special interest, especially in the light of the familiar area hypothesis of return migration put forward by Pulliainen (1974), Baker (1978, 1982) and Pulliainen *et al.* (1983). It states that an animal may spend part of its time on one part of its familiar area (suitable during that season) and part of its time in another part of its familiar area suitable during that season. Seasonal return migration system may develop between these two areas. The purpose of the present study is to document the migration patterns of the Kuhmo subpopulation of the wild forest reindeer (*Rangifer tarandus fennicus*) in Karelia, Northern Europe, and see, if they fit the familiar area hypothesis.

Material and methods

A census of the Kuhmo subpopulation was conducted by helicopter in March - early April 1981 - 1985, when the reindeer were in or near their traditional wintering area, Lake Lentua (Pulliainen *et al.*, 1983). The reindeer herds and lone individuals were also followed by walking, skiing or driving with a snowscooter in 1981 - 85, and with the aid of radio-telemetry since 8 April 1983 (230.975 MHz, Ari-Matti Luoma Ky, Oulunsalo, Finland). The reindeer caught (all females) with the aid of a trapping corral constituted a random sample of this subpopulation (500 - 600 individuals together). Conventional methods were used to locate the reindeer.

The mean operating radius of the equipment used was ca. 15 km and attempts were made to keep 10 radio transmitters working at a time. Four field technicians were involved in this task for 5 days a week throughout the year, except that recordings were made every day during the spring migration.

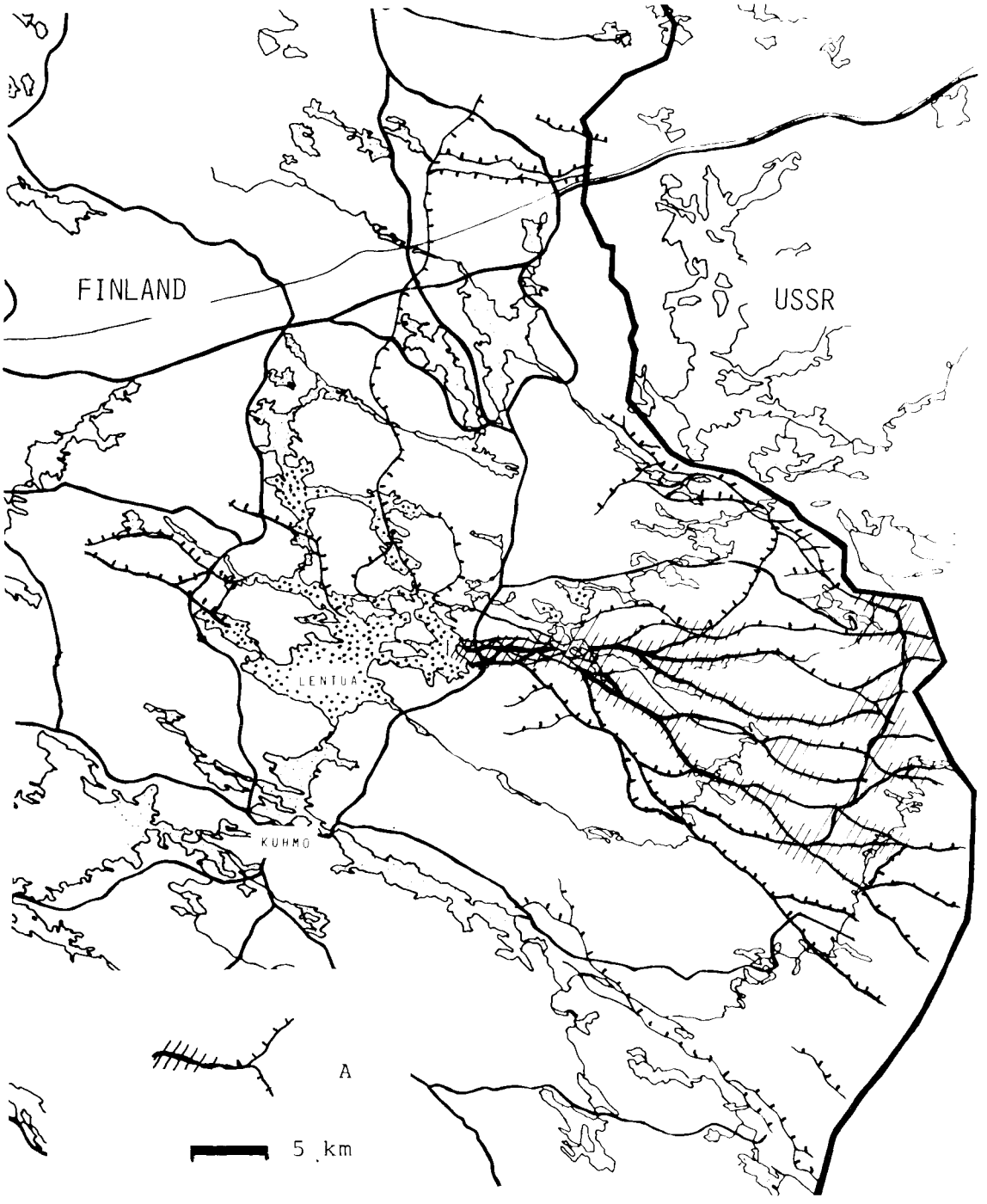

Fig. 1. Principal migration routes (A) of the wild forest reindeer of the Kuhmo subpopulation in eastern Finland in 1981 - 85. The main overwintering area is located around the Lake Lentua (stippled) and the main summer range along the border area between Finland and USSR.

Results

Radio-collared wild forest reindeer used previously documented migration routes during their spring and autumn migrations (Pulliainen *et al.*, 1983) (Fig. 1). Reindeer No. 443 represents a typical case as far as the pattern and timing of its movements are concerned (Fig. 2). However, not all individuals used the same traditional migration routes. Exploratory behaviour does occur, and reindeer No. 442 shows such a behaviour pattern in Fig. 3. The reindeer tend to choose routes along which it is easy to move (e.g., eskers, dry heaths and icy surface of bogs).

The first signs of the commencement of the spring return migration from Lake Lentua, the main overwintering area, are observed at the beginning of April, and the last migratory individuals have left this lake area by the end of the month. The early starters move at a much slower speed than the late ones (Fig. 4). The spring return migration progresses step by step, being characterized by short stops.

In spring 1984, for instance, the first period of return migration lasted about 20 days (2 - 5 April to 24 - 26 April), and this was followed by a short «stop» (30 April to 3 May), after which migration continued. The reindeer appeared in their summer range around 7 May, finally settling in that area in mid-May.

The summer home range may consist of several «parts», but is usually one fairly uniform area, varying in size between 15 and 200 km² (mean±S.E. 103±16). The reindeer appear to use the different parts of their summer home range fairly uniformly. The smallest home range (15 km²) belonged to a wounded animal.

The summer groups vary in both composition and size, the largest recorded being 13 individuals (Fig. 5). As the rut approaches (in mid-September), the groups become larger and movement increases (Fig. 5). Rut was over on 27 October. The autumn return migration commences towards the end of the rut or immediately after it, the first returning reindeer appearing at

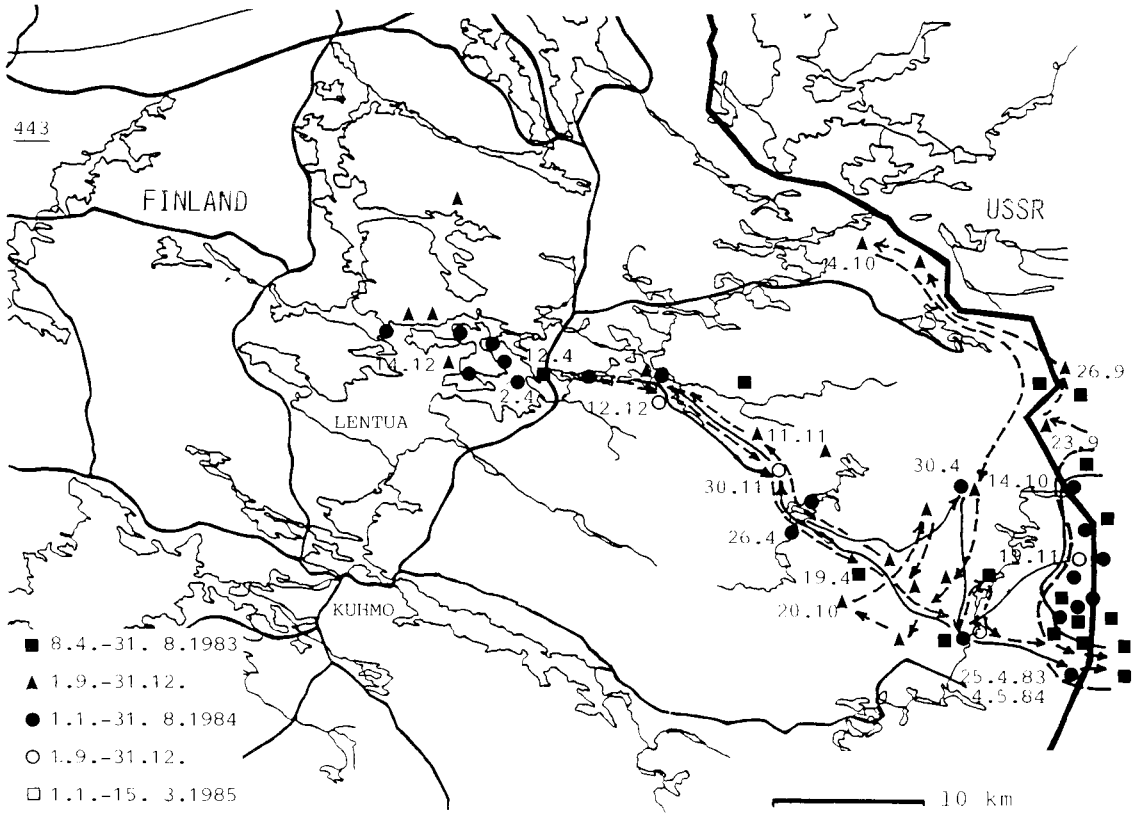

Fig. 2. Movements of wild forest reindeer No. 443 in Kuhmo and the adjacent Soviet territory in April 1983 - March 1985.

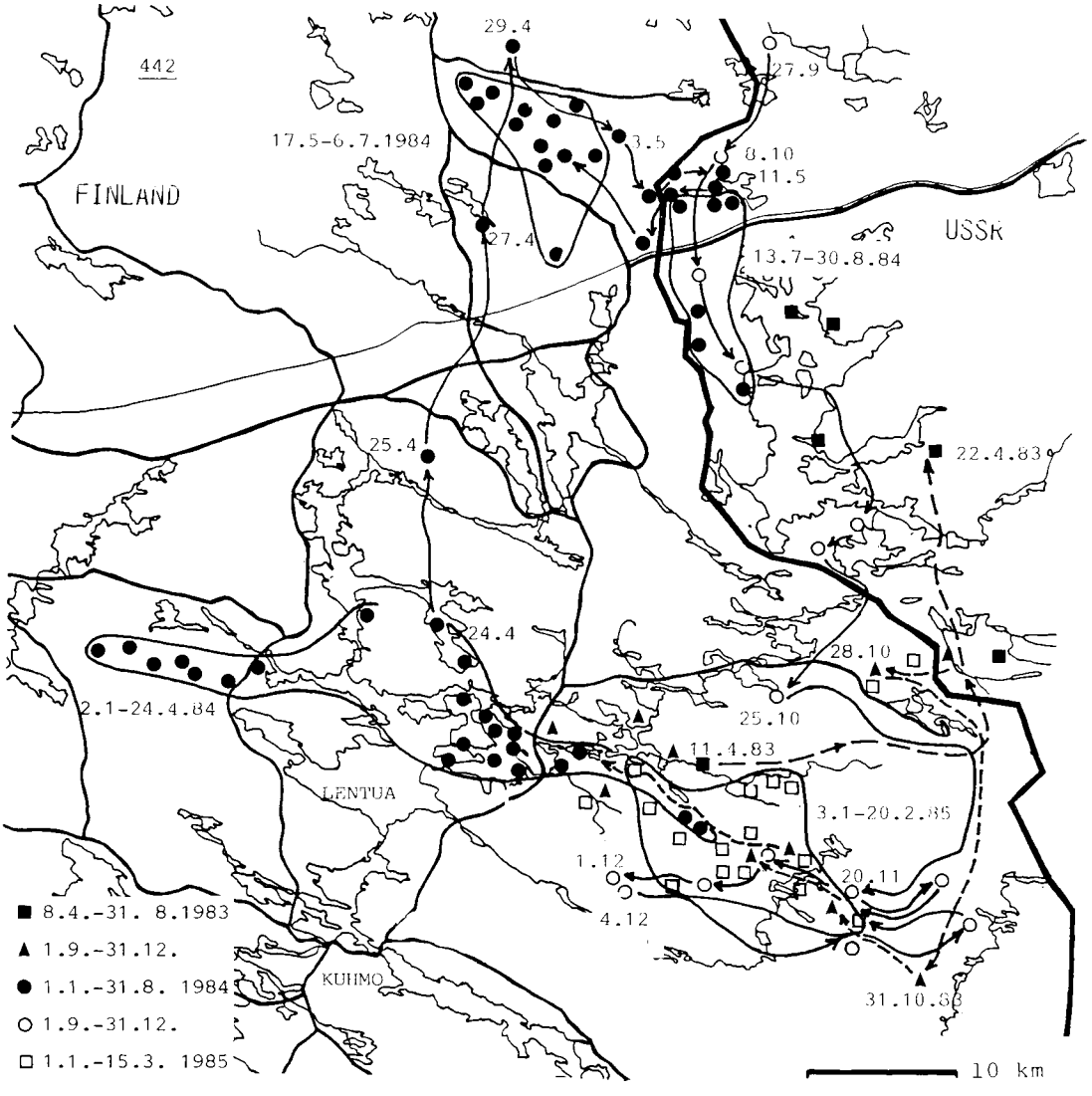

Fig. 3. Movements of wild forest reindeer No. 442 in Kuhmo and the adjacent Soviet territory in April 1983 - March 1985.

Lake Lentua during the second week of December. If the snow conditions are exceptionally favourable (thin layer of soft snow; as in the winter of 1984/85) the majority of the reindeer may not return at all, but stay to feed on the dry heaths of the eskers which otherwise constitute their migration route. On 6 - 7 March 1985, only 17 reindeer were found on the islands and shores of Lake Lentua.

The wild forest reindeer do not stop in one part of their winter range, but are in an almost continuous state of movement within that area. The pastures of this overwintering area are relatively heavily grazed (Lindgren *et al.*, 1983), and it is this that may promote such a continuous pattern of exploratory behaviour. The overall mean size of the winter home ranges is ca. 155 km^2.

The area of the main overwintering range of the forest reindeer (with Lake Lentua in the middle) is ca. 1000 km^2, while the corresponding summer range is much more extensive, ca. 5400 km^2.

A small portion (1 - 2%) of this subpopulation did not migrate at all. It stayed on the islands of Lake Lentua throughout the year. It consisted mainly of bulls and yearlings, a summer group of a bull and a yearling being a typical unit. Some groups consisting of a female with her calf have also been seen on the islands in summer.

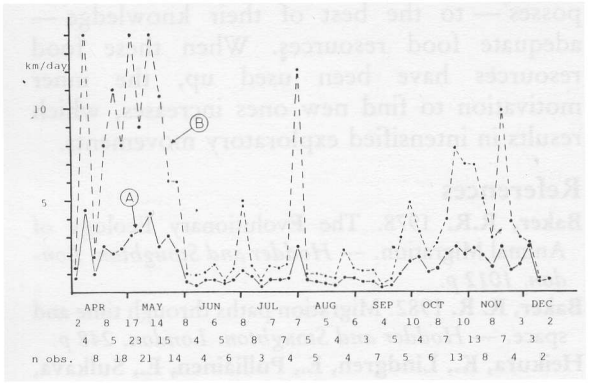

Fig. 4. Mean daily moving speeds (A) of radio-tracked wild forest reindeer in Kuhmo in April - November. The values are calculated as means of distances (on map) between consecutive radiolocations during 5-day periods and they thus represent, in fact, minimum average speed (km/day). B shows the maximum speed recorded during each 5-day period.

Discussion

The familiar area hypothesis of return migration states that an animal that becomes familiar with an area may find that some habitats are more suitable on one part of its range at one time but others thar are more suitable at another time (see also Baker, 1978). In a seasonal environment this means that the animal spends one season in one part of its familiar area and another season in another part. Seasonal return migrations are performed between these parts.

The migratory behaviour patterns of northern ungulates should be dependent on population density and the distance between the winter and summer pastures. When the winter and summer pastures are situated side by side, no real migration occurs, just as the need for migrations disappears when the population density is low (see also Yazan, 1961; Pulliainen, 1974). Once a migration tradition has developed, small portion of the population usually remains resident. In the case of the moose (*Alces alces*), resident individuals may occur in the winter range in summer (Loisa and Pulliainen, 1968). About 1 - 2% of the present Kuhmo subpopulation of the wild forest reindeer remained on the island or shores of Lake Lentua (i.e. in the winter habitats) consuming the food resources there (Sulkava *et al.*, 1983), while the major part of the extensive summer area was empty of reindeer in wintertime (perhaps because the snow was too deep there).

It has been suggested that the migration system of ungulates has a genetic background (Baker, 1982), migrants having a lower migration threshold than residents. A proximate factor here would be the condition of the habitat; i.e. whether or not an animal migrates depends on whether the condition of its habitat exceeds its threshold. Such a system also allows individuals

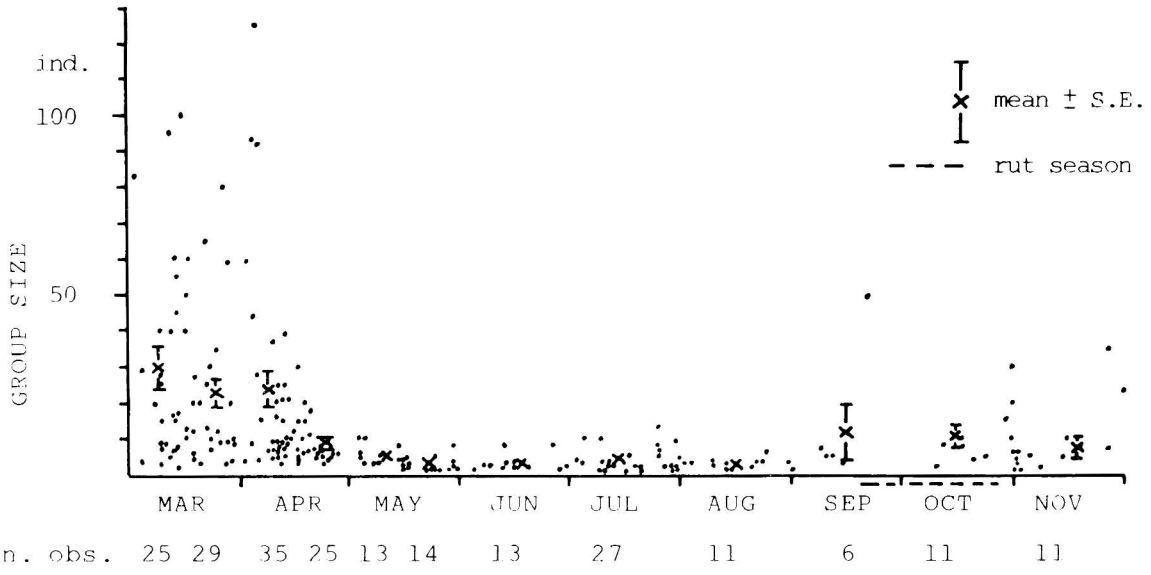

Fig. 5. Sizes of wild forest reindeer groups (individual groups) seen in Kuhmo in March - November 1984. Each spot indicates one sight observation.

to switch between being migrants or residents from one year to another. This phenomenon is well known among birds. The overwintering of waxwings (*Bombycilla garrulus*) in Finland, for instance, depends on the amount of rowan berries (*Sorbus aucuparia*) available. The above explanation can be thought to be valid in the case of the wild forest reindeer as well in the light of the present data.

Baker (1982) has suggested that in general females have a lower migration threshold than males. This statement also seems to be valid in this case, since the bulk of the individuals staying on the islands in Lake Lentua throughout the summer are bulls and yearlings, which may also move together. Only a few non-migratory females with their calves have been observed there so far.

Considering energy alone a resident mode of life would be more advantegous than a migratory one. Especially in the spring, when the wild forest reindeer are not in the best physical condition, speedy migration under variable snow and «water» conditions must consume a great deal of energy. The benefits obtained from migration must nevertheless be obviously greater than the costs incurred. It is likely that the reindeer have a negative nitrogen and mineral balance in wintertime, as is the case with their semi-domesticated relatives living on a lichen-rich diet (Steen, 1968), and must then engage in nitrogen recycling (Valtonen, 1979). A rapid recovery after the long period of lichen consumption during the winter belongs to the system. The wild forest reindeer look for nitrogen and mineral-rich food on the mires in early summer (Montonen, 1974; Pulliainen *et al.*, 1981, and later observations), where the nutrient content of some «key plants» (e.g., *Menyanthes trifoliata*) is remarkably high (Isotalo, 1971). Few nutrient-rich plants are available on the islands, although there is some *Epilobium angustifolium*.

Wild forest reindeer generally follow traditional migration routes (Fig. 2), although some exploratory movements may occur (Fig. 3). As with the moose (Pulliainen, 1974), the calves of the wild forest reindeer follow their mothers at least during their first year of life (Heikura *et al.*, 1983) and thus have the opportunity to learn the traditional migration routes. By moving with their mothers within the familiar area calves are ensured of finding summer and winter areas that posses — to the best of their knowledge — adequate food resources. When these food resources have been used up, the inner motivation to find new ones increases, which results in intensified exploratory movements.

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