Long-term trends of nephropathia epidemica and geography of rodent cycles in Finland

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Background

The incidence of nephropathia epidemica (NE), a mild form of hemorrhagic fever with renal syndrome (HFRS), caused by the Puumala hantavirus, is very high in Finland, reaching up to 60/100 000 in epidemic years. The host species, bank vole *Myodes glareolus* is characterized by pronounced 3–4 year population cycles in Finland, but these cycles are not synchronous over the whole country, and clear spatio-temporal changes in the cycle synchrony have occurred. These changes have been reflected in the epidemiology of NE.

Methods

Vole cycles have been monitored twice a year at permanent study sites around Finland. Here we show vole data only for the southern half of Finland because most of the people live there and most of the NE data come from there. NE is a notifiable disease in Finland. NE data come from the infectious diseases register of the National Institute of Health and Welfare.

Results

From the late 1980`s to the late 1990’s vole cycles were asynchronous in the southern half of Finland. Eastern Finland reached the peak a year later than the central-western parts (Fig. 1). Since the late 1990’s the whole southern half of Finland has fluctuated synchronously.

During the former period, NE numbers remained stable between years (Fig. 2) because vole peaks occurred annually in different parts of the country. After the spatiotemporal change of the late 1990’s (Fig. 1), vole peaks occurred in a large area simultaneously, which was mirrored as human disease peaks covering large areas in the same year (Fig. 2). These changes are particularly pertinent in Central and Eastern Finland (Fig. 3), where asynchronous disease dynamics changed to a synchronous pattern in the late 1990’s.

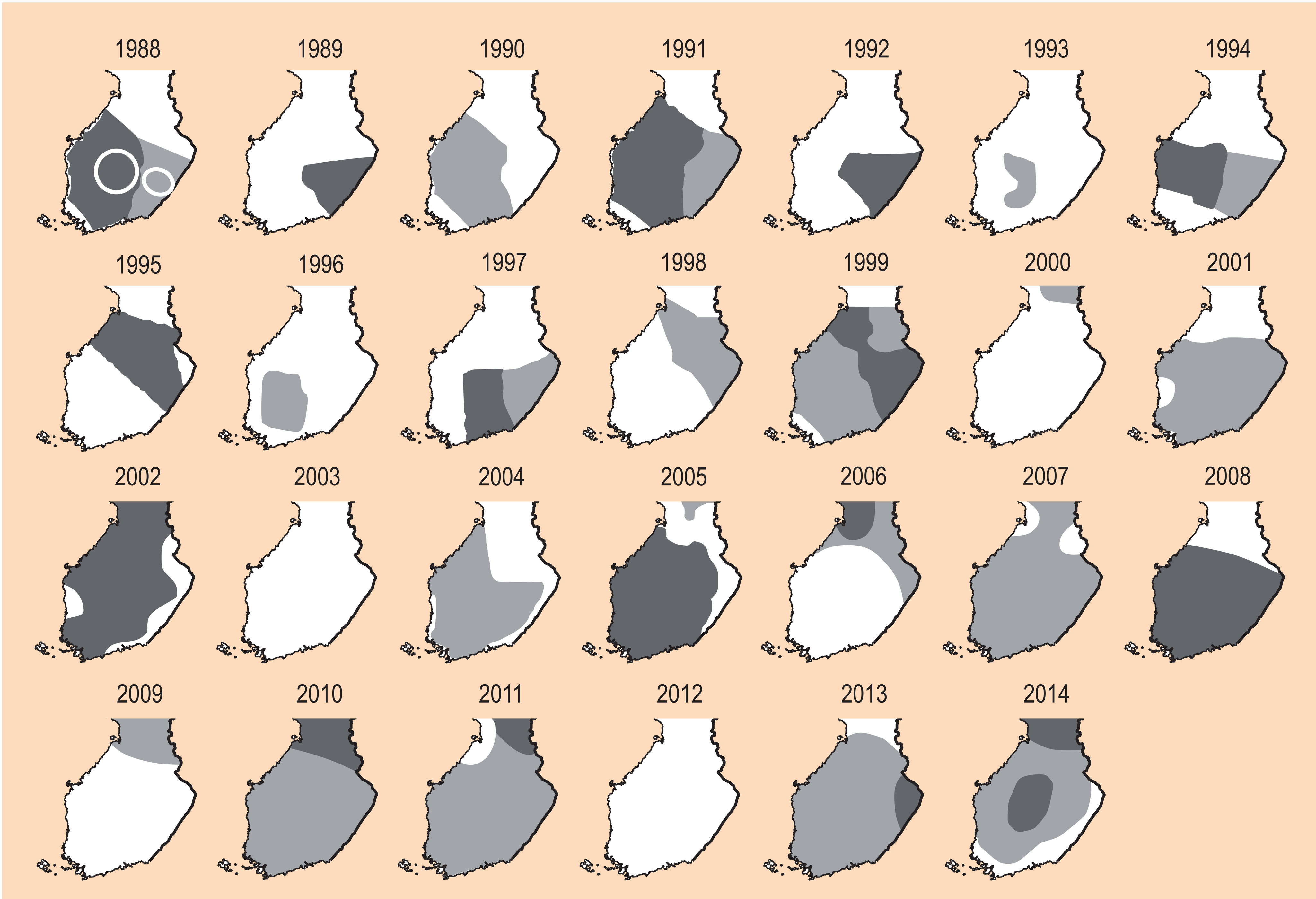

Fig. 1. Vole fluctuations in the southern half of Finland. Dark shading indicates the peak year, lighter the increase year, and colorless the low density year of the vole cycle. The two circled regions denote the provinces Central Finland and Eastern Finland (E Savo), the NE data for which are shown in Fig. 3.

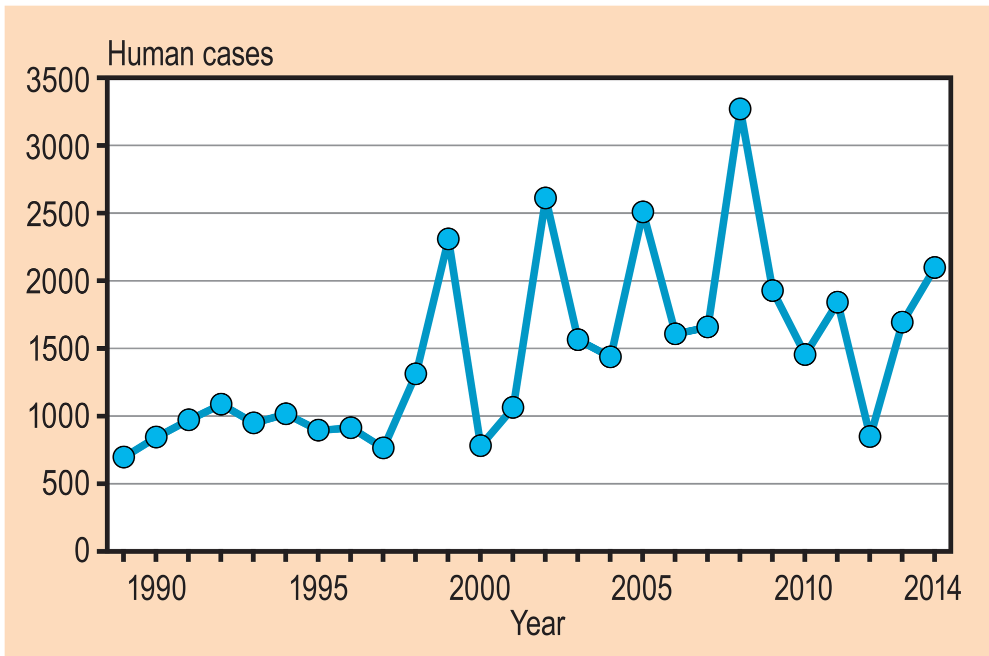

Fig. 2. The annual numbers of NE cases in Finland.

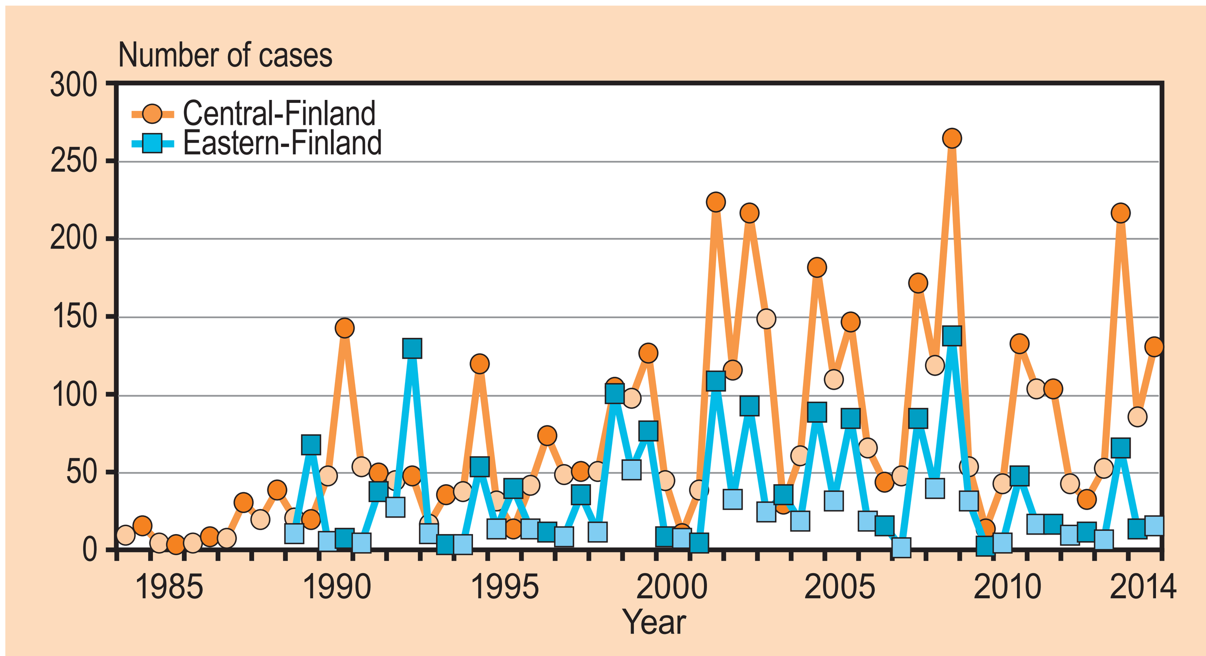

Fig. 3. The long-term and seasonal dynamics of NE in Central and Eastern Finland. The two annual data points indicate the number of NE from Oct to Mar (winter, darker symbol), and Apr to Sep (summer, lighter symbol). The phase of the vole cycle and the vole density in the autumn determines the number of NE cases in the main epidemic season in winter.

The Finnish national rodent surveillance serves as an excellent early warning system in a country with the highest incidence of hantaviral disease in the European Union. Our VOLE REPORT is published twice a year, and the hanta predictions are widely covered in the media.

Conclusions

The increasing trend in disease occurrence in the 2000’s was due to an increase in the magnitude of vole cycles. Furthermore, the declining trend in recent years reflects the weakening of the cycle. The long-term increasing trend until the late 2000’s (Fig. 2) may also be partly based on better awareness and diagnostics of the disease. It is of special interest that natural long-term increasing and declining trends in vole dynamics, and hence in NE patterns, become visible only with long-term surveillance data. This has significance in interpreting short-term data sets e.g. with respect to climate change.

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