Tiedonantoja • Brief reports

Effect of highway traffic on tetraonid densities

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In 1977 the total length of public roads in Finland was about 74000 km. If the width of an average road, including the roadsides, is 20 m, their total area is 1500 km², or 0.5 % of the Finnish land area. However, wildlife may be disturbed over a greater area, owing to noise, traffic deaths, lights of vehicles at night, etc. A study of the effect of highway traffic on tetraonid populations was started in 1978 and some preliminary results are reported here.

Transects describing 1-km squares were censused by highways in 100 localities in the administrative provinces of Vaasa, Kuopio and Oulu, between 10 July and 10 September 1978. One side of the square was always parallel to the highway, at a distance of 25 m from it. The highways studied had relatively intense traffic (700—3000 private cars per 24 h), and all the transects were located in approximately homogeneous forest areas. The total length of the transects was 400 km. Some of the rectangular areas described by the transects were not truly square, but, as a separate analysis showed, no bias was thus introduced.

Tetraonids at all distances were recorded as "observation units". Each unit comprised all the birds of a single species flushed at a single site. In other words, broods and flocks of adults were counted as single observations regardless of brood or flock size. The distances of each observation from the highway and the transect were recorded. Altogether 62 observations were made; the species observed were Capercaillie *Tetrao urogallus* (19 observations), Black Grouse *Lyrurus tetrix* (16), Hazel Hen *Tetrastes bonasia* (23) and Willow Grouse *Lagopus lagopus* (4).

As no tetraonids were observed beyond the road during censusing, some bias may have been caused, because the area surveyed from the side of the square nearest the road was thus effectively smaller. As 79 % of the observations were made within 25 m of the transect, this bias cannot be important. An increase of less than 0.1 observations/10 km was calculated to be a sufficient correction (this slight correction is not considered below). A possible source of error is differences in the flushing distances of the birds near the highway and farther away, but when I examined my data in this respect, no significant differences emerged.

The observations were divided between four zones of 250 m running parallel to the highway (Fig. 1). As the first and fourth zones were censused more extensively than the middle zones, the difference between the densities of the extreme zones are especially noteworthy (the trend was statistically significant, $P < 0.005$ in a χ^2 test). A reduction of tetraonid densities by about 2/3 was observed within 250 m of the highways studied, and densities were apparently lower up to 500 m.

Different species did not show exactly the same trends, though the data are too scanty for reliable conclusions. The preliminary data suggested that the "highway effect" was most pronounced in *Tetrastes bonasia* and in males of *Tetrao urogallus*, while it was smaller in *Lyrurus tetrix*, *Lagopus lagopus* and females of *Tetrao urogallus* (but in all three cases minimum density was observed in the zone of 0—250 m).

The total effect of highway traffic on tetraonid populations cannot be estimated at present. For example, less intense traffic may have less striking effects on tetraonid populations. It seems that the general downward trend of Finnish tetraonids (e.g. Sammalisto 1977) may be partially caused by the effects of highway traffic, but the contribution of other factors is certainly great.

The causal mechanism underlying the "highway effect" is not known. Tetraonids may simply avoid the neighbourhood of highways; for example, traffic noise may disturb and interrupt display activities (Hjorth 1977). Traffic deaths may also deplete tetraonid populations, though tetraonids seldom occur in lists of birds killed on highways (e.g. Hietanen 1972, Salonen 1973). Moilanen (1978) suggested that the individuals of *Lyrurus tetrix* and *Tetrastes bonasia* killed annually by traffic

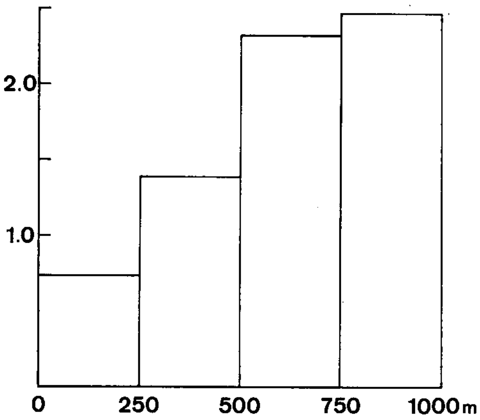

FIG. 1. Abundance of tetraonids (ordinate, as observations/10 km) in relation to distance from the highway (abscissa).

in Finland number 500—1000. If this estimate is of the correct order of magnitude, traffic deaths evidently play a minor role in the above trend. Additional factors of possible importance are telegraph wires, effects of outdoor activities, etc., but definite conclusions cannot yet be drawn.

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Selostus: **Maantieliikenteen vaikutus metsäkanalintujen kantoihin**

Neliönmuotoisia koeruutuja laskettiin Vaasan, Kuopion ja Oulun lääneissä 10.7.—10.9.1978, jotta voitaisiin selvittää maantieliikenteen mahdollinen vaikutus metsäkanalintuihin. Linjoja kertyi 400 km, ja ne suunniteltiin karttojen perusteella mahdollisimman tasalaatuiseen metsämaastoon verraten vilkkaasti liikennöityjen maanteiden (700—3000 henkilöautoyksikköä/vrk) varteen. Tehdyt 62 havaintoa osoittavat tilastollisesti merkitsevän vaikutuksen ($P < 0.005$): tiheydet olivat 2/3 alhaisemmat lähellä maantietä kuin kauempana (kuva 1). Pakoetäisyyksissä ei todettu eroja etäisyysvyöhykkeiden välillä.

Lajikohtaiset tiedot ovat toistaiseksi liian suppeat, mutta kootussa aineistossa vaikutus ilmeni jyrkimmin pyyssä ja ukkometsossa. Ilmiö tuskin merkittävässä määrin johtuu maantiekuolemien kantaa harventavasta vaikutuksesta, mutta maanteiden aiheuttama häiriö voi vaikuttaa suuresti (melu voi mm. pahasti haitata metson soidinta). Maantieliikenteen vaikutus on voinut osittain johtaa metsäkanalintujen taantumaan, mutta yleiseen katoon ovat varmasti johtaneet myös muut syyt. Kirjoittaja (os. Ympäristönsuojelun laitos, Helsingin yliopisto, 00710 Helsinki 71) ottaa kiitollisena vastaan täydentäviä tietoja maantieliikenteen vaikutuksista metsäkanalintuihin.

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Goldcrests *Regulus regulus* roosting in the snow

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Winter is a critical period for small northern birds. Cold increases heat loss, which leads to increased energy consumption, and heat loss is relatively greater in smaller birds. In other words, the smaller the bird the more food per unit weight is needed to maintain con-