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ANALYSIS OF ONE HUNDRED OTTERS KILLED BY ACCIDENTS IN CENTRAL FINLAND

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Abstract: This is a preliminary report of otters brought to Kuopio Museum, 1967 - 1991. The population living in North Savo, Central Finland seems to be relatively healthy. However, there are some reasons for concern. 108 otters were analysed. Cause of death, sex ratio, reproductive status, age, weight, radiation and heavy metal levels, and stomach contents are reviewed.

This is a preliminary report of otters brought to Kuopio Museum, 1967 - 1991. The population living in North Savo, Central Finland seems to be relatively healthy. However, there are some reasons for concern.

MATERIALS AND METHODS

108 otters were brought to the museum in 1967 - 1991 This material was roughly classified as follows: Age group I, juveniles. Coronal suture visible (5♂♂, 8♀♀; means 2,8 and 2,0 kg). Age group II, subadults. Edges of parietale and frontale appear as two more or less parallel lines along the developing crista sagitallis (22♂♂, 20♀♀; means 4,1 and 3,4 kg). Age group III, adults. Sagittal crest forms the base of a 'Y'-figure. All specimens in this group were classified as matures (25♂♂ , 18♀♀ means 7,9 and 5,1 kg).

The radiation level was measured in the laboratory for foodstuffs in Iisalmi with a "Mini-Assay" analyzer. The skull, tail, paws and the alimentary canal were removed from the skinned carcass which was then cut into pieces to fill the counting chamber to about two litres. The levels of some metals were determined in the laboratory of the Department of Environmental Conservation at the University of Helsinki using the method described in Nuorteva (1990). For prey analysis the content of the stomach was washed, dried and examined under a stereomicroscope. The present material includes the demographic data published in Skarén (1987).

CAUSES OF DEATH

In seven cases no comments are available on the cause of death. In the remaining 101 animals the figures are as follows: traffic 42, fish traps 41, no visible cause 7, shot 3, mink or muskrat traps 3, dog 2, killed otherwise by humans 3.

The most dangerous period is from October to February: 50 otters were killed by cars and fish traps. In October-January 29 otters (69 % of all the 42 deaths to traffic) occurred. This is somewhat astonishing because more cars are used in summer when speeds are also higher. February seems to be the record period for deaths in fish traps: 12 otters (29,3 % of 41) were drowned. This may reflect local difficulties in catching fish, because there is least open water in February.

The proportion of cars as otter killers has rapidly increased during the last three years: more otters have been killed by traffic than in the preceding 20 years. This difference is clear (Chi-square - 6.76; $P < 0,01$) when comparing the two main causes of death: In 1967 - 1988 cars vs fishtraps was 19 (38 %) : 31 (62 %). In 1989 - 1991 the ratio was 23 (70 %) : 10 (30 %l. This may be related to the increase in number of cars in Finland. Unaccountably otters seem often to climb onto the road, even at places where there is a concrete tube under it. Possibly some animals fear these tubes, as where there is an ordinary bridge, otters cross the road under it.

Some otters may have also been poached. On occasions I have seen large fox traps put on the otter tracks. But possibly this is a minor cause of death.

SEX RATIO

Sex ratio was even in the entire sample : 58 males and 50 females ($P > 0.05$). The same is true in mature animals (28 males, 20 females). This is possibly a surprise, because adult males are often believed to be more active than others.

AGE CLASSES

There are many young animals in the sample suggesting that the otter population is reproductively active (See Material and Methods). The proportion of young (juveniles and subadults) in the sample during the past six years (35:35) did not differ significantly from that during the previous six years (18:10). The periods compared were 1980 - 85 and 1986 - 91.

WEIGHT

Mean weights of the age classes are given in Material and Methods. Thus far no very large (> 10 kg) males have been found. Some old females were relatively lean possibly owing to famine. On the other hand there are a few juvenile males which may gain weight rapidly, e.g. one Finnish male otter which was found on 23 August as a small (800 g) cub weighed 5 kg six months later. However, it was reared in the room by humans (Sulkava & Sulkava 1989).

REPRODUCTION

According to epididymal smears six adult males had spermatids in spring (16.II. - 1 .IV) or in autumn (24.IX - 30.X). The lightest baculum of such a male weighed 1 g after boiling in water and cleaning. Seven large adult males with big bacula did not have spermatids. One was killed in June, the others in October-March.

There were only two pregnant females in this material. One (28 June 1991) contained a large 70 g embryo. The other killed on 1 2 November 1991 contained two 37 mm embryos. Apparently few lactating females are killed in accidents. A female with thick mammary gland tissue and two placental scars died on 13 October 1986. One year later a car killed another lactating female. She had three elongated mammae, but no placental scars. I do not know how long the scars are visible in otters after parturition. Probably both these females had given birth in late summer or early autumn.

Most juveniles (11) were killed in October-January. Only two died at some other time. According to these figures most otters seem to have been born in the summer.

Among the adult females were individuals which apparently had not reproduced e.g. in May-June four large adults were killed without signs of reproduction. One could expect to find small embryos at this time. In many small rodents it is exceptional to find mature females which do not reproduce in the main breeding season.

RADIATION LEVELS

In 1986 before and after the Chernobyl accident, the cesium levels of two adult otters from the present study area were determined. The contents in the leg muscle were 270 and 1810 Bq/kg, respectively. Later (11 October 1987 - 16 February 1990) the total radiation levels of 20 otters wEre calculated in Bq/kg:

Age Group	Range	M ±	SEM	n
I	933-1662	1244±	217	3
II	246-2116	246±	2116	7
III	18 - 734	276±	92	10

Radiation level seems to be lower in the older animals. There is a significant difference between the age groups I and III: t = 4, 10, P < 0,01. This is hardly due to different original fall-outs, because two of these juveniles were found in the area of least radiation.

Twelve of these animals were found in the area of a moderate (3 - 20 kBq/m^2) Cs 137 fall-out. The other eight originated from areas of less than 3 kBq/m^2. However, this may not be very important, because the animals had time to migrate from one area to another.

METALS

Mercury

There seems to be a positive correlation in Hg-levels and age (ppm in fresh weight of liver):

Age Group	Range	M	±	SEM	n
I	0,05 - 2,50	1,32	±	0,67	8
II	0,97 -4,10	2,55	±	0,25	24
III	2,30-31.0	8,99	±	1.26	28

The difference between the two young age groups is not significant (t = 1,73; P > 0,05), but there is a clear difference between the groups II and III : t = 5,0; P < 0,01.

For comparison 29 hair samples were also analyzed. Most of these were taken from otters with known liver contents (Table 1). The increasing tendency to accumulate Hg with age is significant also in the hair samples (t-test, P < 0,01 between all the groups). But the values are 2,3 - 3,9 times higher than those in the livers of these same animals. There were some surprisingly high levels (60 ppm) in the hair samples. In human hair Hg contents over 50 ppm may cause a central nervous disease (Nuorteva 1 976), but we do not know how much an otter can endure.

Table 1: Mercury contents of otters in ppm of fresh weight.
A = hair, all specimens. B = hair, specimens with liver data, too.
C = Hg contents in livers of the same specimens as in B.
M = mean, SEM = standard error of mean.

	A				B				C			
	Range	**M**	**± SEM**	**n**	**Range**	**M**	**± SEM**	**n**	**Range**	**M**	**± SEM**	**n**
I	1,7 - 5,8	3,6 ±	0,84	4	3,4 - 5,8	4,23 ±	0,79		0,7 - 2,5	1,85 ±	0,59	3
II	2,7 - 18,0	9,7 ±	1,20	17	2,7 - 18,0	9,12 ±	1,26		0,5 - 5,7	2,37 ±	0,34	15
III	17 - 60	33,2 ±	3,17	18	17 - 59	32,17 ±	3,39		2,5 - 3,1	10,59 ±	2,08	14

Other Metals

In addition to the mercury, some other metals were determined in the livers of 12 otters. This sample consisted of (our juveniles, two subadults and six adults. The results were pooled (n = 12), because no apparent correlation with age could be seen. The values are in mg/kg of fresh weight:

	Range	M	±	SEM
Fe	120 - 420	208,33	±	23,12
Zn	22 - 75	40,08	±	11,58
Cu	4,9 - 32	15,53	±	2,34
Mn	1,6 - 6,5	3,42	±	0,43
Cd	0,01 - 0,23	0,08	±	0,02
Pb	< 0,1 - 0,2		-	

Aluminium and nickel were also analyzed, but the contents were below the detection levels: <10 ppm (Al) and <0,5 ppm (Ni). Possibly these levels are not dangerous to otters.

FOOD

Of 71 stomachs examined, 34 were empty. The other 37 were from otters killed in different seasons. Contents are summarised in Table 2.

Table 2: Per cent frequency of prey in 37 stomachs from Finland

	n	%
Mollusca	1	2,7
Crayfish	4	10,8
Mammalia	4	10,8
Rana sp.	10	27,0
Pisces	35	94,6
- *Perca*	17	45,9
- Cyprinidae	12	32,4
- *Acerina*	4	10,8
- *Lota*	4	10,8
- *Esox*	4	10,8
- *Cottus* sp.	2	5,4
- Salmonidae	3	8,1

Fish was the main prey. Apparently the relatively high levels of mercury must originate especially from *Perca*, *Acerina*, *Esox* and *Lota*. The other prey animals were of minor importance. Frogs were found in ten stomachs, but in low contents. Crayfish and mammals (*Neomys fodiens*. *Ondatra zibethica*) were both found in four animals. One stomach included remains of *Anodonta* clams, possibly as a prey of muskrats.

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