Radiocaesium in Faroese Lakes after the Chernobyl Accident.

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Abstract.
In order to follow the content and ecological decay of radiocaesium in brown trout, samples of trout were taken in july 1987 - july1990 in three Faroese lakes, each with a nonmigratory stock of brown trout.Stomach contents indicated different diets in the three lakes. Trout from Stóravatn, Toftavatn and Leitisvatn respectively had a descending order of trophism, which coincided with a decreasing level of ^{137}Cs - contamination. Length vs ^{137}Cs - activity distribution shifted from a nondescript pattern in 1987, to correlation in 1989 and 1990. Ecological half lives were comparable in lakes Stóravatn and Leitisvatn, with $t_{½}$ around 430 days. Radiocaesium activity decreased rapidly in lake Toftavatn 1987-88, then much slower 1988-90, with $t_{½}$= 895 days.

The lakes

	Leitisvatn	Toftavatn	Stóravatn
Altitude	32 m	15 m	26 m
Surface area	3.42 km^2	0.509 km^2	0.160 km^2
Max depth	59 m	22 m	1.8 m
Volume	$81.6 \cdot 10^6 m^3$	$2.11 \cdot 10^6 m^3$	$0.150 \cdot 10^6 m^3$
Deposition of ^{137}Cs (1) from Chernobyl	1880 Bqm^{-2}		1680 Bq^{m-2}

Stóravatn has an almost uniform depth, Leitisvatn which is oblong is gradually descending towards a center line, and Toftavatn concists of a shallow northern half with max. depth 3.5 m and a southern half with almost circular isolines. Each lake has a stock of nonmigratory brown trout Salmo Trutta.

Methods

Brown trout were sampled with 20 mm mesh nets, filleted,muscle homogenized and measured in a Ge-detector (Canberra 7229P-1819). Stomach content was preserved with 80% ethanol and classified.

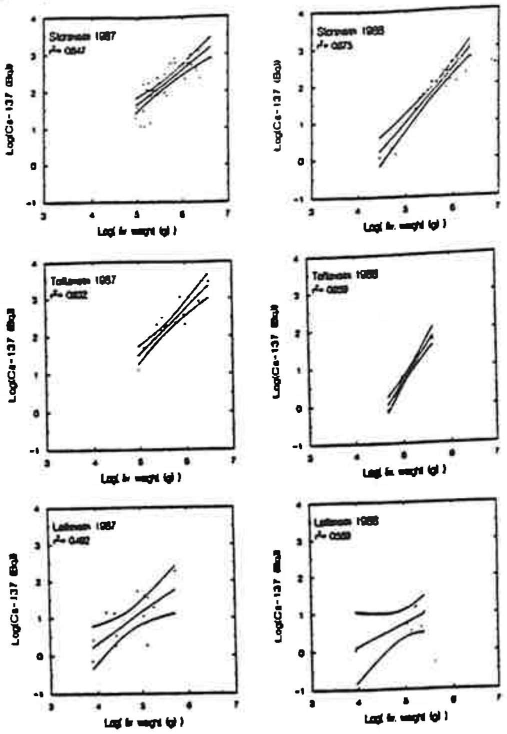
Results

Mean $^{134}Cs/^{137}Cs$ - ratios from 0.338 in Stóravatn,0.356 in Toftavatn to 0.389 in Leitisvatn in july 1987 indicate that almost all the ^{137}Cs - contamination in brown trout originated from Chernobyl.

There is a log-log relationship between 137Cs - activity in the trout and their live weigth.It suggests contamination mainly by ingestion (2).**Fig 1** shows the regression lines with their 95% confidence intervals.

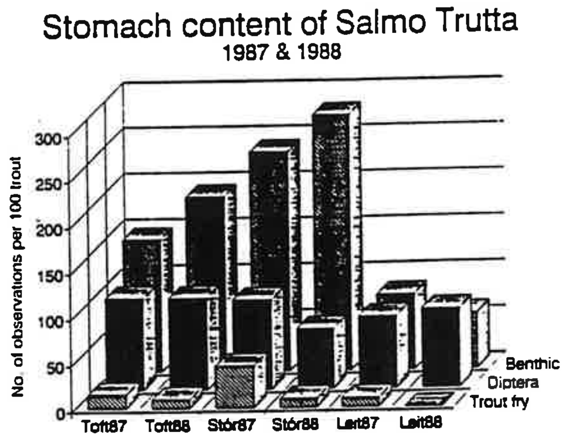
Fig 1

log(^{137}Cs activity (Bq))
vs log(live Weigth (g))



The diet of the trout vary in the three lakes as would be expected from their varied physical data. Stóravatn would be expected to have most benthic fauna available to the trout and Leitisvatn the least.Besides scores of zooplankton- which were not counted-the trout from 1987 and 1988 contained these amounts of recognizable prey, grouped in three classes:

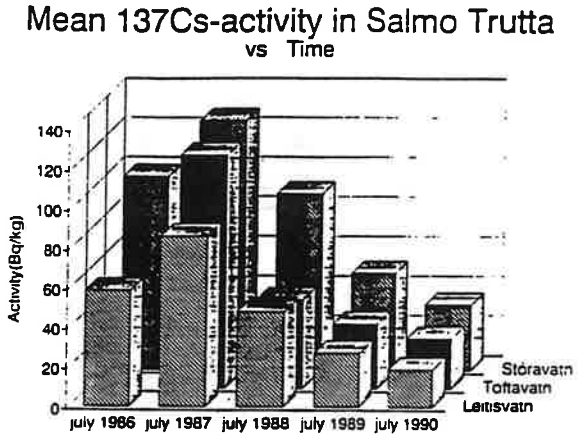
Fig 2



Trout from all three lakes consume similar amounts of Diptera but consumptions of benthic fauna varies greatly.Trout from Leitisvatn had an approximate 1:1 ratio between

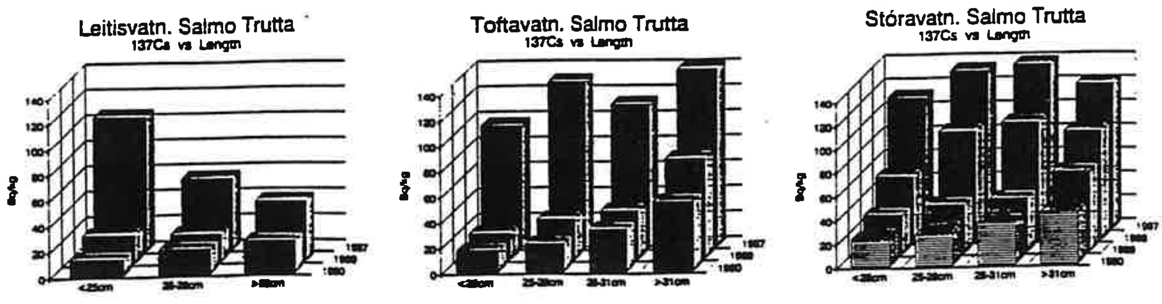
Diptera and benthic animals. Trout from Toftavatn and Stóravatn had ratios of 1:2 and 1:5 respectively. This suggests an ascending proportion of zooplankton in the trout diet from Stóravatn to Toftavatn to Leitisvatn. Zooplankton responds rapidly to radiocaesium contamination (3) followed by a rapid decrease as radiocaesium is transferred from the water column to sediment.Fish who feed mainly on zooplankton will show a faster incorporation of radiocaesium the first months after the fallout (i.e. summer of 1986) whereas those who feed mainly on species from a higher trophic level will show a delayed but more persistant incorporation(4).This could cause the ^{137}Cs levels in trout to be highest in lake Stóravatn from july 87 onwards and lowest in lake Leitisvatn(Fig3).Also it would shift the age(length) vs ^{137}Cs - activity distribution, from high activity in young trout in (86)87 compared to older ones, towards an increasingly higher activity in old trout(Fig4abc).

Fig 3



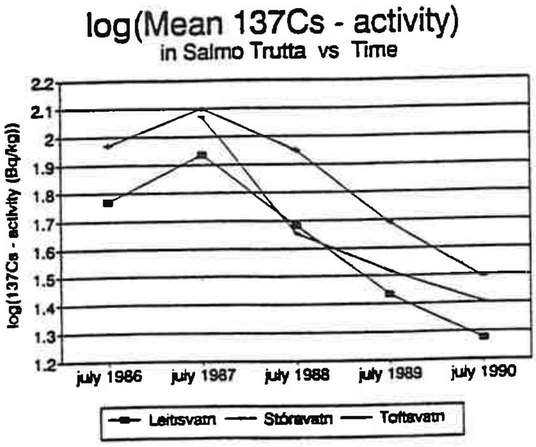
We received 1 trout from Leitisvatn and 4 from Stóravatn 1986 from local anglers, and if they are anything to go by, ^{137}Cs -incorporation reached its maximum in 1987 and decreased ever after.

Fig 4



After 1989 there is an obvious correlation between length and ^{137}Cs activity, but not so in 1987.

Fig 5



<u>Fig5</u> indicates an ecological half life time of 430 days for 1987-89 in lake Leitisvatn and a sligthly higher $t_{½}$ 1989-90. In Toftavatn a rapid decrease in 1987-1988 was followed by a much slower one in 1988-1990 with a $t_{½}$= 895 days. The $t_{½}$ in lake Stóravatn was fairly constant 1987-90, fluctuating around the value for Leitisvatn.

Acknowledgements

We would like to thank Arne Nørrevang and Finn Lutzen for advice on discerning one invertibrate from another.

References

(1) Aarkrog, A et al (1988): Environmental Radioactivity in the North Atlanti Region Including Faroe Islands and Greenland. 1986

(2) Elliott, J.M.():The Energetics of Feeding, Metabolism and Growth of Brown Trout(Salmo Trutta) in Relation to Body Weigth, Water temperatures and Ration Size

(3) Meili, M (1988): Radioactive Caesium in Swedish Forest Lake Ecosystemsafter Chernobyl. Fifth Nordic Workshop on Radioecology 1988, Rattvik, Sweden

(4) Anderson, E. (1989): Incorporation of Cs - 137 into fishes and other organisms. Proceedings of the XVth Regional Congress of IRPA Visby, Gotland, Sweden, 1989