Cesium-137, Radium-226, Potassium-40 and Selected Stable Elements in Fish Populations from Great Slave Lake (N.W.T.), Louis Lake (Saskatchewan), Lake Winnipeg (Manitoba), and Experimental Lakes Area (Northwestern Ontario)

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CESIUM-137, RADIUM-226, POTASSIUM-40 AND SELECTED STABLE ELEMENTS IN FISH POPULATIONS FROM GREAT SLAVE LAKE (N.W.T.), LOUIS LAKE (SASKATCHEWAN), LAKE WINNIPEG (MANITOBA), AND EXPERIMENTAL LAKES AREA (NORTHWESTERN ONTARIO)

by

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ABSTRACT

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Activities of ^{137}Cs, resulting from globally distributed atmospheric fallout, and natural activities of ^{226}Ra and ^{40}K were determined for nine species of fish from five lakes in the Northwest Territories, Manitoba, Saskatchewan and northwestern Ontario. Sample sizes of approximately 25 fish were obtained for each species and location. Selected subsamples were also analyzed for the stable elements Ca, Zn, Cu and K. Surface water samples were collected and activities of ^{137}Cs and ^{226}Ra were determined in both dissolved and particulate fractions.

Analytical methods are given, and chemical results, total weight and fork length are tabulated for each fish. Population means and frequency distributions of ^{137}Cs and ^{226}Ra indicate activities which are specific to location and species respectively.

Key words: *Coregonus clupeaformis*, *Prosopium cylindraceum*, *Coregonus artedii*, *Salvelinus namaycush*, *Stizostedion canadense*, *Lota lota*, *Catostomus catostomus*.

RESUME

Elliott, S. E. M., C. Burns-Flett, R. H. Hesslein, G. J. Brunskill, and A. Lutz. 1981. Cesium-137, radium-226, potassium-40 and selected stable elements in fish populations from Great Slave Lake (N.W.T.), Louis Lake (Saskatchewan), Lake Winnipeg (Manitoba), and Experimental Lakes Area (Northwestern Ontario). Can. Data Rep. Fish. Aquat. Sci. 293: iv + 20 p.

Les auteurs ont déterminé l'action exercée par le ^{137}Cs (provenant de retombées atmosphériques réparties globalement), et l'action naturelle exercée par le ^{226}Ra et le ^{40}K, pour neuf espèces de poissons de cinq lacs, choisis dans les Territoires du Nord-Ouest, le Manitoba, la Saskatchewan et le nord-Ouest de l'Ontario. Ils ont prélevé environ 25 poissons de chaque espèce dans chacun des lacs. Ils ont aussi analysé des sous-échantillons du point de vue de leur teneur en Ca, Zn, Cu et K. Des échantillons d'eau superficielle furent aussi prélevés et l'on a déterminé l'action exercée par le ^{137}Cs et le ^{226}Pa tant dans des fractions dissoutes que dans celles de particules.

L'ouvrage contient les méthodes analytiques employées et il donne les résultats chimiques, le poids total et la longueur totale pour chaque poisson. Grâce aux moyennes (populations) et aux répartitions (fréquence) du ^{137}Cs et du ^{226}Ra, les auteurs ont pu relever le degré de l'action exercée dans chaque lieu et chez chaque espèce.

Mots-clés: *Coregonus clupeaformis*, *Prosopium cylindraceum*, *Coregonus artedii*, *Salvelinus namaycush*, *Stizostedion canadense*, *Lota lota*, *Catostomus catostomus*.

INTRODUCTION

Numerous investigations of ^{137}Cs bioaccumulation in fish began in the mid 1960s after major testing of thermonuclear bombs, and monitoring of the resultant atmospheric fallout of radionuclides. Concentration factors (pCi/g in fish: pCi/g in water) of from 55 (Porcella and Friend 1966) to 23,000 (Kolehmainen et al. 1966, 1968) have been reported for a wide variety of fish species. There is still concern about the mechanism of ^{137}Cs accumulation in freshwater biota since the isotope is released in the liquid waste from nuclear power station reactors. Jinks and Wrenn (1976) modelled radiocesium uptake in fish by examining accumulation both directly from water, through gills or ingestion, and indirectly from contaminated food. Kolehmainen et al. (1968) postulated four major factors governing levels of ^{137}Cs in fish: (1) ^{137}Cs activity in the water, (2) K concentration in the water, (3) ^{137}Cs activity of food sources, and (4) the biological half-time of ^{137}Cs in fish.

^{226}Ra is a naturally occurring radionuclide which is an important contributor to the total radiation dose of man. As well, waste waters from uranium mines and mills, often discharged into surrounding surface waters, may contain high activities of ^{226}Ra. Havlik (1970) reported an increase in ^{226}Ra at Elliott Lake, in an area of uranium ore exploration and mining, from <1 pCi/L to 10-222 pCi/L.

The purpose of this study was to obtain background data on the accumulation of ^{137}Cs and ^{226}Ra in several fish species. Lakes chosen for sampling received only globally distributed, atmospheric fallout of ^{137}Cs and natural inputs of ^{226}Ra. They also represented different limnological features. The west basin and McLeod and Christie Bays of Great Slave Lake (61-63°N, 110-118°W) in the Northwest Territories were sampled separately, as were the north and south basins of Lake Winnipeg (51-54°N, 96-98°W). Basic limnological information on Great Slave Lake and Lake Winnipeg can be found in Rawson (1950) and in Brunskill et al. (1980) respectively. Fish were also obtained from two Precambrian Shield Lakes in the Experimental Lakes Area, northwestern Ontario (Brunskill et al. 1971, and other papers in this volume), and from Louis Lake on the Saskatchewan-N.W.T. border (61°07'N, 104°49'W). The limnology of Louis Lake has not been studied. Although it was not possible to obtain the same species at all stations, in total nine species were analyzed: lake whitefish (Coregonus clupeaformis), round whitefish (Prosopium cylindraceum), cisco (Coregonus artedii), lake trout (Salvelinus namaycush), sauger (Stizostedion canadense), burbot (Lota lota), longnose sucker (Catostomus catostomus), northern pike (Esox lucius), and inconnu (Stenodus leucichthys).

METHODS

FISH SAMPLES

Lake and round whitefish, trout, cisco, longnose sucker, burbot, pike and inconnu from Great Slave Lake, N.W.T. were gillnetted during April and September 1978, at three stations: near Snowdrift in Christie Bay, off Fort Resolution in the West Basin and near Fort Reliance in McLeod Bay. Total weight, fork length and sex were determined in the field. The fish were then commercially dressed (head and viscera removed), frozen and shipped by air to the Freshwater Institute.

Sauger were taken in a trapnet off Elk Island in the South Basin of Lake Winnipeg in June 1979, and lake whitefish in February from commercial gillnetting operations north of Long Point in the North Basin. Whole fish were shipped to Winnipeg where they were commercially dressed before analysis. Fork lengths and total weights for saugers were taken on site; lake whitefish were measured after defrosting in our laboratory.

Lake whitefish and trout from Lakes 302S, 226SW and 223 in the Experimental Lakes Area (ELA), northwestern Ontario, were gillnetted in the fall of 1979. Lake 302S fish had heads and viscera removed in the field while the others were shipped whole to Winnipeg.

In October 1978, after an unexplained fish kill in Louis Lake, near the Saskatchewan-N.W.T. boundary, dead fish were collected from along the lake shore, frozen and shipped whole to the Institute for investigation. We included these fish in our survey although they were not sampled in the same manner, and could not be gutted due to their partially decayed state.

Fish samples were stored at -40°C and batches of samples were defrosted in a microwave oven as required. If necessary, fork lengths and total weights were measured, and heads, tails or viscera removed. Approximately 300g of the remaining tissue was chopped into 3-5 cm chunks for wet weighing and then dried for 2 days at 110°C to obtain a dry weight. Pieces of dried fish were sequentially added to boiling 16M HNO_3 in a large beaker. Trout, pike, inconnu, and burbot samples contained more fat, and required considerable care and attention to avoid excessive foaming. HNO_3 was replenished until the entire sample was digested and in solution. When brown nitrous oxide fumes ceased, the sample was allowed to evaporate to dryness. The residue in the beaker was ashed in a muffle furnace at 450°C overnight, and then 16M HNO_3 was added to the sample for another digestion and evaporation to dryness. This latter procedure was repeated until a white ash of minimal volume was obtained. The ash was transferred to plastic petri dishes, weighed and then counted with dual, 180° opposed NaI detectors to determine the activity of ^{137}Cs. A count rate for ^{40}K was obtained at the same time, and was recorded for each sample. Counting efficiencies for ^{137}Cs and ^{40}K were 19.5% and 8% respectively. Twelve fish samples were spiked with known activities of ^{134}Cs before drying and processing, and a total yield of 85-95% was obtained for the method.

The ash was then dissolved in water or dilute HCl, and activity of ^{226}Ra was determined by a charcoal extraction modification (G. Mathieu, Lamont-Doherty Geological Observatory, personal communication) of the ^{222}Rn emanation method of Broecker (1965). A more detailed methodology is given in the section entitled "Water Samples".

In addition to the above analyses, three lake trout from Lake 223 were dissected into muscle, bone, skin and viscera to determine if ^{137}Cs was concentrated in a particular fraction of the fish. Because of small sample sizes, trout with higher activities of ^{137}Cs in muscle tissue were chosen. Viscera and skin were removed and the remaining flesh microwaved so bones could be separated from the muscle. Each portion was acid digested repeatedly as described earlier and counted for ^{137}Cs on a GeLi gamma detector. A NaI detector was not used because of interference from other isotopes in the samples, which were present due to an experimental radionuclide spike in Lake 223.

After ^{222}Rn stripping, the dissolved samples were analysed for stable elements. All samples and blanks were brought up to a 200 ml volume. Ca, Zn and Cu were analysed by atomic absorption spectrometry. An aliquot of the sample was diluted with an addition of lanthanum to suppress interference in the Ca analysis. Zn and Cu measurements were done with simultaneous background correction. Cu was extracted as the diethyl dithiocarbamate complex into n-butyl acetate. K was determined by atomic emission spectrometry, and Ca was added to the standards at a level equivalent to that of the samples. Replicate analyses were done for Ca and K and standard deviations of 6% and 2.5% were obtained.

WATER SAMPLES

Surface water samples were also taken from the three stations in Great Slave Lake in September 1979, from Lake 302S in March 1980, and from the North Basin of Lake Winnipeg, near Long Point, in June 1980. Three acid-washed 55 L plastic barrels were rinsed with lake water, filled with surface water at each station, and shipped to the Freshwater Institute. Samples were centrifuged (continuous flow, 50 mL/min at 16,500 rpm) to separate the particulate from the dissolved phase. The water was then acidified to ph ~ 1 with reagent HCl, and flushed with He. The barrels were sealed and the water allowed to stand for 1-2 weeks to allow growth of ^{222}Rn from ^{226}Ra. ^{222}Rn was then stripped from the 55 L by He bubbling, trapped on a charcoal column, cooled in liquid N_2, and transferred to a counting cell. Alpha disintegrations were counted on a specially designed scintillation counter. Water samples spiked with known amounts of ^{226}Ra were used to calibrate the method. Barrel, extraction system, and counting cell blanks were routinely done. The barrel blank value was 9.1 pCi m^{-3}.

The centrifuged water samples were then spiked with ^{134}Cs and stable Cs. Total Cs was collected by cation exchange with AMP (ammonium molydophosphate, Bio-Rad AMP-1) powder added directly to the 160 L sample. Samples were allowed to stand overnight, after which the clear supernatant was siphoned off, and the AMP crystals concentrated into a small volume for drying and packing into plastic petri dishes. The AMP powder samples were counted on a GeLi gamma detector for approximately one day. Yield for ^{134}Cs tracer was 80-90%. Counting efficiencies were determined from known activities of ^{134}Cs added to AMP of the same volume and geometry as the samples. The suspended particulate matter collected from centrifuging was placed in plastic petri dishes and counted for ^{137}Cs with a GeLi detector.

STATISTICS

Means and standard deviations of total weights, fork lengths and activities of ^{137}Cs and ^{226}Ra and concentrations of stable elements were calculated for each "population" (one species from a single location) on both the "raw" data and log-transformed values. Both distributions were checked for normality with the Shapiro-Wilk's test (Shapiro and Wilk 1965), recommended for sample sizes of less than 50. In populations where the fish had been sexed, an F-test for homogeneity of variance and a t-test for equality of means were used to determine if significant differences (α = 0.05) existed between males and females in size or activities of ^{137}Cs and ^{226}Ra.

RESULTS

Activities of ^{137}Cs, ^{40}K and ^{226}Ra, for each fish sample analyzed, are given in Table 1. Where available, fork lengths and total weights are also shown, along with the sample weights at different stages of preparation. No significant differences were found in mean total weights, fork lengths, or activities of ^{137}Cs between males and females in any population. Therefore, sex of the fish was ignored for the population means given in the summary Table 2.

With few exceptions, the variations in fork lengths, ^{137}Cs and ^{226}Ra within each population were equally well explained by either the normal or log-normal distribution. Total weights were generally log-normal. Neither distribution described the variance in ^{137}Cs or ^{226}Ra in populations where a high proportion of the fish had activities near our lower limits of detection (cisco from Fort Resolution; trout from Snowdrift). The statistics given in Table 2 are for log-transformed data so that means, which vary by orders of magnitude, can be compared with relatively homogeneous variances.

Frequency distributions for ^{137}Cs and ^{226}Ra in each fish population are shown in Figs. 1 and 2. The total range in mean ^{137}Cs activity/weight for all populations was three orders of magnitude. Within a single species the activity of ^{137}Cs was unique to the station sampled. For example, Fig. 1 shows that there is practically no overlap in the distributions for whitefish from Louis Lake, ELA, Snowdrift and Fort Resolution. There was a smaller range of ^{226}Ra activities in these populations, and in contrast to ^{137}Cs appears to be controlled more by species than location (Fig. 2).

It was considered that variations in mean ^{137}Cs activity between species might be due to differing proportions of skin, bone and muscle in the samples. Table 3 shows the results of dissecting three trout from Lake 223 and analyzing these portions separately. Muscle was the greatest contributor to overall ^{137}Cs activity (65-80%) primarily due to its large contribution to total wet weight. As a result, the total sample activity ("combined" in Table 3) was almost identical to muscle alone.

Stable element chemistry was determined for some fish samples from each location. Concentrations of Ca, K, Cu and Zn are given in Table 4, and means and standard deviations for each population are shown in Table 5. Ratios of K: ^{137}Cs are also given because Jinks and Wrenn (1976) hypothesized that ^{137}Cs uptake in fish is inversely related to the concentration of K in water. Ratios in Table 4 are not constant but vary directly with the large range in ^{137}Cs activities. Ca: ^{226}Ra are presented because the two elements are chemically similar, and therefore, interchangeable for one another during assimilation.

Percent abundances (100 x $^{40}K/^{39}K$) of ^{40}K in the fish samples (Table 4) were relatively constant, but consistently higher than the reported natural global value of 0.0118% (Friedlander et al. 1964).

Most of the ^{137}Cs in Great Slave Lake, ELA Lake 302S, and the North Basin of Lake Winnipeg surface waters was in the "dissolved phase" (supernatant after centrifugation) and less than 20% of the total was on the particular matter (Table 6). The ^{226}Ra values in Table 6 are also for the dissolved fraction. No detectable amount was found on the particulate material.

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REFERENCES

BRUNSKILL, G. J., S. E. M. ELLIOTT, and P. CAMPBELL. 1980. Morphometry, hydrology, and watershed data pertinent to the limnology of Lake Winnipeg. Can. Fish. Mar. Serv. MS Rep. 1556: v + 32 p.

BRUNSKILL, G. J., and D. W. SCHINDLER. 1971. Geography and bathymetry of selected lake basins, Experimental Lakes Area, northwestern Ontario. J. Fish. Res. Board. Can. 28(2): 139-155.

BROECKER, W. S. 1965. An application of natural radon to problems in ocean circulation, p.116-145. In T. Ichiye (ed.) Symposium on diffusion in oceans and freshwaters. Lamont-Doherty Geological Observatory, Palisades, N.Y.

FRIEDLANDER, G., J. W. KENNEDY, and J. M. MILLER. 1964. Nuclear and radiochemistry. John Wiley and Sons, Inc., N.Y.

HAVLIK, B. 1970. Radium-226 content of water and plankton from the Chalk River area. Atomic Energy of Canada Ltd., Chalk River, Ont. AECL-3687: [29] p.

JINKS, S. M., and M. E. WRENN. 1976. Radiocesium transport in the Hudson River estuary, p.207-227. In M. W. Miller and J. N. Stannard (ed.) Environmental toxicity of aquatic radionuclides. Ann Arbor Science, Ann Arbor, Mich.

KOLEHMAINEN, S., E. HASANEN, and J. K. MIETTINEN. 1966. ^{137}Cs levels in fish of different limnological types of lakes in Finland during 1963. Health Physics 12: 917-922.

KOLEHMAINEN, S., E. HASANEN, and J. K. MIETTINEN. 1968. ^{137}Cs in the plants, plankton, and fish of the Finnish lakes and factors affecting its accumulation, p. 407-415. In Proc. of the First Internat. Congress of Radiation Protection. Pergamon Press, Oxford, U.K.

PORCELLA, D. B., and A. G. FRIEND. 1966. Field studies of specific radionuclides in freshwater. J. Water Pollut. Control Fed. 38(1): 102-110.

RAWSON, D. S. 1950. The physical limnology of Great Slave Lake. J. Fish. Res. Board Can. 8(1): 3-66.

SHAPIRO, S. S., and M. B. WILK. 1965. An analysis of variance test for normality (complete samples). Biometrika 52: 591-611.

Table 1. ^{137}Cs, ^{40}K, and ^{226}Ra activities in fish samples from Great Slave Lake, Louis Lake, Lake Winnipeg, and ELA SD = Snowdrift (fall), Christie Bay, Great Slave Lake. RF = Ft. Resolution, West Basin, Great Slave Lake. SRF = Ft. Reliance, McLeod Bay, Great Slave Lake. LL = Louis Lake. SN = Snowdrift (spring, under ice), Christie Bay. ELA 3 = ELA Lake 302S , ELA 2 = ELA Lake 226 SW. LWP = Lake Winnipeg.

SAMPLE #	SEX	FORK LENGTH (mm)	TOTAL FISH WT. (g)	SAMPLE WET WT. (g)	SAMPLE DRY WT. (g)	ASH WT. (g)	COUNT TIME (min)	^{137}Cs pCi/g (WET WT)	2*SD	^{226}Ra fCi/g (WET WT)	2*SD	^{40}K pCi/g (WET WT)	2*SD
LAKE WHITEFISH													
SD 272	F	292	350	287.64		6.628	1556.67	0.055					
SD 170	F	318	350	225.46	49.31	5.121	500.00	0.068					
SD 186	F	402	900	363.86	86.03	7.696	0.00	0.035					
SD 207	F	435	1100	300.28	75.05	6.920	341.67	0.067					
SD 102	F	395	900	332.68	90.15	5.906	1000.00	0.059	0.006			3.63	0.17
SD 209	F	439	1150	319.15	88.24	4.860	418.33	0.060	0.010	1.34	0.08	3.33	0.19
SD 181	F	360	650	293.61	101.50	5.752	1006.67	0.067	0.007			4.15	0.19
SD 84	F	291	300	184.04	45.67	3.422	931.67	0.068	0.011			4.46	0.23
SD 49	F	372	700	283.76	67.69	5.474	973.33	0.054	0.007			3.75	0.18
SD 5	F	447	1400	309.96	86.60	5.527	2411.67	0.079	0.005	1.64	0.09	3.83	0.17
SD 31	F	434	1250	267.17	82.23	4.963	1556.67	0.031		1.25	0.07	3.63	
SD 101	F	366	650	330.65	93.20	6.232	-3484.66‡	0.044				4.42	0.22
SD 71	F	376	650	281.99	69.01	5.393	1130.50	0.051	0.007			4.09	0.19
SD 326	?	221	100	69.88	16.24	1.307	426.67	0.057	0.041	0.352	0.278	5.42	0.58
SD 180	?	295	300	164.96	39.25	3.220	740.00	0.037	0.013			4.96	0.27
SD 188	M	447	1350	259.60	72.01	4.485	333.35	0.045	0.012	0.850	0.170		
SD 105	M	262	250	131.84	31.62	2.682	833.38	0.023					
SD 8	M	425	1150	314.28	86.26	4.155	1016.67	0.050					
SD 295	M	270	200	168.27	40.85	4.297	1118.33	0.056					
SD 94	M	346	500	294.28	73.97	5.234	1388.33	0.031					
SD 191	M	334	500	251.33	64.48	5.156	438.33	0.050	0.012	1.17	0.10	4.57	0.25
SD 301	M	277	250	152.33	38.56	3.349	1243.33	0.074	0.012			4.94	0.25
SD 43	M	427	1150	337.79	98.64	6.441	825.00	0.035	0.006			3.64	0.17
SD 29	M	328	450	264.79	66.58	5.097	1053.33	0.055	0.077	1.50	0.15	4.10	0.19
SD 6	M	452	1400	315.36	91.33	5.712	590.00	0.035	0.008			3.69	0.19
SD 173	M	344	500	249.38	71.08	5.055	826.67	0.053	0.009			3.99	0.20
SD 508	?			261.80		4.848	935.00	0.052					
SD 187	F	547	2500	276.28	78.29	5.383	1601.35	0.054	0.004				
SD 55	F	391	800	326.00	92.31	5.969	1125.01	0.055	0.004			3.37	0.07
SD 302	F	246	200	127.70	29.55	2.741	1465.71	0.033	0.008			3.39	0.13
SD 78	M	343	500	307.75	77.44	6.650	1459.45	0.045	0.003			3.46	0.06
RF 91	?	297	400	244.19	71.73	7.792	1415.83	0.012	0.006	2.29	0.06	4.14	0.19
RF 41	?	314	450	161.76	40.83	4.642	1537.67	0.022	0.002			4.06	0.21
RF 77	?	312	450	244.02	55.79	9.542	6995.00	0.022	0.003			4.34	0.11
RF 87	?	287	400	264.15	66.04	9.489	968.33	0.012	0.007			3.52	0.18
RF 64	?	322	550	237.91	60.46	6.061	984.67	0.009	0.008	1.41	0.11	4.10	0.20
RF 32	?	415	1150	344.07	96.93	5.837	3835.00	0.016	0.003			3.62	0.15
RF 63	?	312	400	256.19	59.93	8.838	-2872.00	0.016	0.008			4.02	0.24
RF 62	?	371	700	277.56	68.11	6.148	-3185.83	0.016	0.007			4.42	0.24
RF 47	?	408	950	407.06	103.56	10.374	-3030.84	0.016				4.28	0.21
RF 34	?	392	1000	278.78	82.88	5.174	1118.33	0.009				3.68	0.18
RF 35	?	402	1100	323.62	100.83	5.792	895.00	0.018	0.006			3.49	0.17
RF 44	?	352	700	249.31	74.09	5.423	978.33	0.007	0.008	1.41	0.11	3.62	0.18
RF 40	?	373	800	246.39	90.19	4.110	853.33	0.008	0.008			3.42	0.18
RF 52	?	384	750	281.66	67.42	7.150	800.00	0.011	0.008			4.13	0.20
RF 51	?	456	1900	288.81	88.89	5.011	653.33	0.024	0.008	0.900	0.095	3.46	0.18
RF 81	?	323	450	163.61	40.15	2.903	1041.67	0.022	0.011	0.854	0.125	3.74	0.22
RF 33	?	392	950	278.48	77.60	5.447	980.00	0.018	0.007			3.79	0.18
RF 50	?	372	850	325.97	85.33	7.904	3926.67	0.017	0.003			3.53	0.15
RF 55	?	378	800	311.00	89.89	5.725	2888.33	0.015	0.004			3.33	0.14
RF 96	?	352	600	260.98	66.61	8.555	1421.67	0.015	0.006			4.06	0.19
RF 65	?	278	350	241.62	55.20	7.792	1147.50	0.011	0.007			3.64	0.18
RF 53	?	380	800	301.94	77.53	7.172	846.67	0.011	0.007			3.96	0.19
RF 34	?	392	1000	278.78	82.88	5.174		0.019	0.006				
RF 58	?	362	750	237.73	57.60	4.718	445.00	0.016	0.012			3.85	0.23
RF 43	?	370	750	314.11	87.26	6.017	868.33	0.024	0.006			3.54	0.17
RF 39	?	430	1200	295.18	79.51	6.385	846.67	0.020	0.007			3.27	0.17
RF 36	?	340	650	244.98	80.18	5.645	845.00	0.018	0.008			3.79	0.19
RF 70	?	364	700	273.74	70.14	6.195	878.33	0.013	0.007	1.05	0.09	3.87	0.19
RF 37	?	384	800	294.98	76.67	5.616	838.33	0.007	0.007	0.696	0.062	3.67	0.18
RF 67	?	322	550	297.52	60.93	5.437	-2704.29	0.000	0.005				
SFF 302	F	405	1000	270.74	73.67	4.626	371.67	0.221	0.015			4.38	0.24
LL† 3	?	250		237.20	56.87	7.634	48.33	3.28	0.15	2.09	0.11	3.81	0.54
LL 300	?	220		130.90	33.52	4.113	181.67	1.49	0.07	2.24	0.17	4.00	0.46
LL 6	?	250		179.42	45.54	5.547	1040.00	2.28	0.10	2.82	0.18	4.52	0.23

Table 1. cont'd

SAMPLE #	SEX	FORK LENGTH (mm)	TOTAL FISH WT. (g)	SAMPLE WET WT. (g)	SAMPLE DRY WT. (g)	ASH WT. (g)	COUNT TIME (min)	^{137}Cs pCi/g(WET WT)	2*SD	^{226}Ra pCi/g(WET WT)	2*SD	^{40}K pCi/g(WET WT)	2*SD
LL 310	?	285		265.87	73.27	8.712	1013.33	1.35	0.06	1.95	0.08	4.10	0.20
LL 7	?	230		166.42	42.90	4.944	628.33	2.42	0.10	2.54	0.11	4.20	0.26
LL 7	?	260		207.78	50.72	6.945	135.00	1.83	0.08	1.69	0.12	4.30	0.39
LL 23	?	140		24.96	6.90	0.754	813.67	1.37	0.10	2.18	0.50	4.75	1.05
LL 5	?	270		189.63	49.11	5.702	115.00	3.09	0.14	1.59	0.17	4.73	0.46
LL 9	?	300		239.06	58.96	7.438	81.67	2.07	0.10	2.64	0.07	3.73	0.42
LL 18	?	240		192.74	46.35	5.753	95.00	2.04	0.10	2.34	0.10	3.94	0.47
LL 22	?	270		213.61	51.69	6.235	161.83	2.78		2.10	0.14	3.94	0.35
LL 10	?	290		218.83	53.51	7.011	65.00	2.55	0.12	1.77	0.11	4.45	0.52
LL 13	?	260		171.81	40.82	5.263	173.33	3.12	0.14	1.55	0.17	4.37	0.40
LL 21	?	290		160.17	38.47	4.387	106.67	2.81	0.13	2.13	0.11	4.16	0.52
LL 1	?	205		111.55	26.45	3.108	200.00	1.90	0.10	2.61	0.19	4.06	0.52
LL 19	?	250		177.69	44.40	5.223	1466.67	1.33	0.06	2.54	0.12	4.37	0.22
LL 16	?	270		177.34	44.03	5.034	93.33	1.73	0.09	1.43	0.12	4.21	0.51
LL 11	?	250		166.08	38.90	5.127	116.67	1.83	0.09	1.63	0.09	4.47	0.19
LL 2	?	250		174.29	44.16	5.464	166.68	2.17	0.10	2.42	0.11	4.30	0.41
LL 4	?	250		213.46	53.95	6.749	79.17	3.64	0.14	2.95	0.08	4.31	0.48
LL 14	?	235		191.60	48.13	5.926	76.67	2.50	0.12	2.08	0.11	4.57	0.53
LL 15	?	200		136.69	33.72	5.049	1216.67	1.93	0.09	2.58	0.12	4.98	0.26
LL 301	?			203.13	48.42	6.402	131.67	2.81	0.12			4.03	0.39
LL 9	?			136.52	34.49	4.643	492.50	1.52	0.07	3.58	0.17	3.67	0.30
ELA 3 1	?	160*	258	244.60	63.87	5.941	274.43	1.20	0.02	1.67	0.10	3.60	0.13
ELA 3 2	?	200*	427	405.80	97.17	12.533	-234.68	1.58	0.02			3.30	0.24
ELA 3 3	?	185*	358	237.09	77.62	9.992	102.26	2.04	0.03	4.27	0.14	4.12	0.23
ELA 3 4	?	170*	237	181.59	48.83	4.366	113.93	1.24	0.03	2.34	0.12	3.65	0.28
ELA 3 5	?	160*	213	203.10	52.98	5.566	108.36	1.41	0.03	2.49	0.12	3.57	0.26
ELA 3 6	?	170*	326	261.54	59.62	5.558	164.41	1.52	0.02	1.76	0.08	3.88	0.16
ELA 3 7	?	205*	360	341.36	83.75	8.917	-245.64	1.82	0.02			2.87	0.29
ELA 3 8	?	185*	302	286.43	66.45	8.376	-196.54	2.42	0.03				
ELA 3 9	?	180*	340	288.15	73.90	7.408	87.46	1.84	0.03	2.87	0.08	6.61	0.36
ELA 3 10	?	150*	150	143.86	35.02	3.377	134.65	0.681	0.030	2.40	0.17	3.21	0.32
ELA 3 11	?	180*	330	310.84	80.61	7.987	73.10	1.18	0.03			3.66	0.20
ELA 3 12	?	190*	386	364.70	86.65	9.772	-247.35	2.22	0.02			3.24	0.27
ELA 3 13	?	185*	361	345.72	91.07	9.893	-260.56	2.02	0.02	0.89	0.07	3.39	0.28
ELA 3 14	?	145*	165	155.61	39.96	3.727	352.21	1.07	0.02	2.12	0.10	3.18	0.19
ELA 3 15	?	135*	118	111.69	25.77	2.493	123.96	0.693	0.038	2.51	0.15	2.75	0.43
ELA 2 16	?	391		318.34	89.03	7.657	240.00	0.521	0.069				
ELA 2 17	?	414		380.51	97.57	9.256	240.00	1.07	0.13				
ELA 2 18	?	375		245.03	64.77	6.520	240.00	1.69	0.18				
ELA 2 19	?	413		379.80	95.14	9.356	-480.00	0.892	0.146				
ELA 2 20	?	405		388.01	98.36	9.206	240.00	1.32	0.13				
ELA 2 21	?	420		397.62	103.55	10.047	-480.00	0.985	0.134				
ELA 2 22	?	400		483.95	124.34	11.731	-480.00	0.843	0.122				
ELA 2 23	?	315		227.41	56.15	5.333	240.00	1.72	0.19				
ELA 2 24	?	335		303.11	72.96	6.743	240.00	0.957	0.117				
ELA 2 25	?	320		274.85	68.80	6.401	-480.00	2.38	0.29				
ELA 2 26	?	290		204.72	48.57	4.646	-480.00	0.818	0.200				
ELA 2 27	?	250		124.16	29.36	3.115	240.00	1.36	0.23				
ELA 2 28	?	265		151.85	34.96	3.688	240.00	1.50	0.18				
ELA 2 29	?	255		125.85	29.77	3.077	240.00	2.12	0.21				
ELA 2 30	?	310		260.66	68.47	6.633	240.00	1.57	0.20				
ELA 2 31	?	280		144.43	35.55	3.649	240.00	2.22	0.22				
ELA 2 32	?	230		92.53	22.22	2.230	240.00	1.53	0.23				
ELA 2 33	?	220		83.82	18.58	1.760	240.00	1.16	0.20				
ELA 2 34	?	230		94.39	20.39	2.197	240.00	0.831	0.203				
ELA 2 35	?	225		95.21	22.92	2.067	240.00	1.08	0.19				
ELA 2 36	?	230		97.68	22.83	2.240	240.00	1.05	0.19				
ELA 2 37	?	225		91.09	20.74	1.984	240.00	1.44	0.22				
LWP 150	?	360	710	374.55	120.85	9.440	1313.71	0.027	0.003			2.69	0.05
LWP 151	?	360	710	329.98	92.37	9.140	-2399.46	0.032	0.007			3.11	0.12
LWP 152	?	390	890	288.61	74.99	7.850	-1880.83	0.024	0.018				
LWP 153	?	390	848	364.77	91.49	10.540	-2000.00	0.032	0.015				
LWP 154	?	370	788	358.18	104.53	8.820	1000.00	0.020	0.008				
LWP 155	?	380	870	360.82	99.25	6.010	-2895.66	0.021	0.006			3.12	0.09
LWP 156	?	370	765	301.70	71.86	7.750	1156.45	0.019	0.004			2.96	0.07
LWP 157	?	350	805	296.49	87.39	8.020	-3332.98	0.014	0.006			2.96	0.11
LWP 158	?	400	750	310.37	79.51	4.770	-2439.50	0.021	0.011			2.94	0.11
LWP 159	?	395	808	316.58	72.37	8.500	2909.48	0.083	0.002			3.13	0.04
LWP 160	?	370	630	274.43	76.72	7.210	-2360.59	0.020	0.008			3.18	0.14

Table 1. cont'd

SAMPLE #		SEX	FORK LENGTH (mm)	TOTAL FISH WT. (g)	SAMPLE WET WT. (g)	SAMPLE DRY WT. (g)	ASH WT. (g)	COUNT TIME (min)	^{137}Cs pCi/g (WET WT)	2*SD	^{226}Ra pCi/g (WET WT)	2*SD	^{40}K pCi/g (WET WT)	2*SD
TROUT														
SD	222	F	730	5150	329.93	101.75	4.133	250.00	0.251	0.016			3.93	0.23
SD	335	F	477	1400	319.93	95.37	4.737	263.38	0.132	0.013	0.260	0.043	3.65	0.23
SD	10	F	615	3200	329.51	100.10	3.538	151.67	0.189	0.018			3.05	0.24
SD	213	F	695	5100	343.59	105.64	3.854	175.00	0.221	0.017	0.204	0.038	3.41	0.24
SD	214	F	754	6950	359.33	118.27	3.835	200.00	0.176	0.015			3.41	0.22
SD	109	F	773	6850	337.08	108.83	3.203	276.67	0.168	0.013			3.25	0.20
SD	106	F	666	3650	359.05	108.84	5.031	250.00	0.186					
SD	127	F	669	3450	310.88	93.47	2.116	246.67	0.095					
SD	199	F	585	2950	296.27	123.04	3.548	140.00	0.206	0.020			3.20	0.28
SD	121	F	697	4650	402.22	121.25	4.163	145.17	0.174	0.015			3.32	0.23
SD	298	F	413	750	361.32	88.30	5.021	386.67	0.075	0.009	0.016	0.049	3.62	0.20
SD	79	F	352	500	243.22	52.09	3.536	1041.67	0.141	0.010	0.049	0.057	4.34	0.21
SD	114	F	780	5550	310.86	94.68	3.464	198.33	0.210	0.017	0.026	0.035	3.48	0.24
SD	122	F	844	8300	364.26	114.18	4.298	323.33	0.245	0.014			3.53	0.20
SD	126	F	617	3300	331.90	103.16	4.312	1131.67	0.177	0.009			3.85	0.18
SD	334	F	596	3250	373.23	118.81	5.223	176.67	0.177	0.015			3.84	0.24
SD	197	F	478	1150	313.41	82.24	4.583	355.00	0.143	0.012			3.90	0.22
SD	335	F	477	1400	319.93	95.37	4.737	263.38	0.134					
SD	112	F	769	5900	253.40	75.86	2.336	216.67	0.153	0.018	-0.173‡	0.060	2.55	0.24
SD	100	F	454	1150	328.72	90.57	4.933	183.33	0.145	0.015			3.89	0.26
SD	201	F	590	2400	295.04	86.74	3.918	238.83	0.211	0.017			3.91	0.25
SD	333	F	440	1000	343.73	89.74	4.735	191.67	0.112	0.014			3.87	0.25
SD	217	F	792	6200	341.75	110.01	3.821	211.67	0.230	0.016	0.093	0.064	3.08	0.21
SD	124	F	706	4300	267.05	97.32	2.112	210.00	0.152	0.017	-0.031	0.052	2.32	0.23
SD	260	?	399	700	274.47	61.04	4.250	186.67	0.171					
SD	89	M	465	1150	313.41	83.83	2.933	1121.67	0.052					
SD	205	M	451	1050	291.34	64.90	3.910	196.67	0.170	0.017			3.62	0.26
SD	193	M	435	1050	246.83	71.18	3.518	221.67	0.159	0.018			4.01	0.28
SD	125	M	620	2900	392.45	123.14	4.271	215.00	0.154	0.013			3.46	0.21
SD	97	M	496	1600	376.56	99.78	5.263	246.67	0.122	0.012	0.082	0.040	4.12	0.23
SD	115	M	638	3700	292.76	87.53	3.265	203.33	0.153	0.016	-0.010	0.256	3.67	0.26
SD	143	M	572	2200	300.00	128.50	3.962	183.35	0.171	0.017			3.98	0.27
SFF	75	F	901	10100	340.81	113.76	3.181	158.33	0.239	0.018			2.68	0.23
SFF	36	F	480	1200	198.54	50.52	3.013	80.00	0.953	0.057			4.34	0.50
SFF	65	F	735	5500	359.42	114.39	4.283	213.50	0.303	0.018			3.50	0.22
SFF	47	F	571	2400	255.35	67.43	3.296	161.68	0.733	0.038	0.071	0.106	4.10	0.31
SFF	37	F	656	4250	344.56	116.83	4.064	175.00	0.575	0.029	-0.147	0.286	3.26	0.23
SFF	40	F	360	600	279.16	70.08	4.109	135.00	1.27	0.06	-0.144	0.037	4.36	0.32
SFF	73	F	762	4700	240.50	80.39	2.511	163.33	0.243	0.023			3.25	0.30
SFF	28	F	710	4000	311.99	102.14	3.151	206.67	0.187	0.016	0.039	0.044	2.96	0.22
SFF	100	F	877	8700	364.91	98.20	4.791	78.33	0.828	0.043			3.61	0.31
SFF	76	F	819	8700	428.64	143.24	4.632	1303.33	0.175	0.008			2.97	0.13
SFF	78	F	811	8100	372.62	122.24	3.791	121.67	0.217	0.016			3.01	0.25
SFF	31	F	490	1000	160.39	40.85	2.580	103.33	1.35	0.07			4.77	0.54
SFF	92	F	546	2300	188.53	43.94	2.846	226.67	0.479	0.031			4.03	0.33
SFF	74	F	835	9000	221.01	105.11	4.084	90.00	1.51	0.07			6.37	0.50
SFF	25	F	585	2800	242.84	82.42	3.092	145.00	0.761	0.040	0.109	0.142	3.26	0.31
SFF	6	F	560	2200	205.38	57.02	2.365	193.33	0.370	0.027			3.44	0.32
SFF	2	F	462	1000	201.36	49.70	3.015	133.33	1.19	0.06	0.039	0.096	4.75	0.41
SFF	24	F	528	1650	205.21	58.50	2.935	81.67	1.01	0.06			4.19	0.48
SFF	55	M	668	3500	329.21	90.30	3.634	161.67	0.377	0.023			3.46	0.25
SFF	93	M	536	2000	225.70	60.44	3.620	168.33	1.28	0.06	0.031	0.073	4.31	0.34
SFF	30	M	480	1200	194.20	47.25	2.873	158.33	0.791	0.044			4.28	0.30
SFF	91	M	566	2100	155.53	39.97	2.372	173.33	1.07	0.06			3.53	0.41
SFF	88	M	493	1400	183.86	50.07	2.957	130.00	2.11	0.10	-0.110	0.065	4.29	0.43
SFF	99	M	519	1300	159.66	43.65	2.416	143.33	0.767	0.048			4.27	0.46
SFF	95	M	528	2000	224.90	67.36	3.288	168.33	0.545	0.033			4.03	0.33
SFF	72	M	900	11000	391.31	106.86	4.572	126.67	0.342	0.021			3.39	0.29
SFF	96	M	717	4900	277.83	86.17	4.419	168.33	0.978	0.046	0.157	0.103	3.96	0.29
SFF	81	M	580	2900	141.85	37.10	1.925	213.33	0.774	0.040			4.1[illegible]	0.4[illegible]
SFF	90	M	580	2500	203.15	47.17	3.217	916.21	1.62	0.01			4.02	0.07
SN	65	F	290	250	191.67	45.84	3.[illegible]40	666.67	0.109					
SN	96	F	664	4100	294.92	94.77	3.561	[illegible]	0.28[illegible]					
SN	95	F	369	700	296.30	79.1[illegible]	4.2[illegible]	[illegible]	[illegible]29					
[illegible]	[illegible]	[illegible]	[illegible]78	2750	272.30	140.30	2.290	1016.67	0.113					

Table 1 cont'd

SAMPLE #	SEX	FORK LENGTH (mm)	TOTAL FISH WT. (g)	SAMPLE WET WT. (g)	SAMPLE DRY WT. (g)	ASH WT. (g)	COUNT TIME (min)	^{137}Cs pCi/g (WET WT)	2*SD	^{226}Ra pCi/g (WET WT)	2*SD	^{40}K pCi/g (WET WT)	2*SD
SN 69	M	597	2400	281.44	80.41	3.958	370.00	0.160					
SN 60	F	525	2250	286.63	81.96	3.716	291.77	0.117					
SN 52	M	653	3450	250.06	77.46	2.680	166.67	0.247					
SN 81	M	505	1600	255.54	72.57	3.395	393.33	0.120					
CISCO													
SD 35	F	298	250	132.14	33.28	3.081	1095.00	0.129	0.015	1.07	0.15	5.07	0.20
SD 154	F	354	550	234.30	97.82	4.552	1228.33	0.070	0.008	1.36	0.07	3.92	0.19
SD 50	F	261	200	321.43	29.85	3.145	913.50	0.129	0.008	2.26	0.12	1.55	0.10
SD 304	F	260	300	168.01	48.90	3.375	1285.00	0.067				4.11	0.21
SD 77	F	295	300	152.43	38.65	3.475	174.91	0.122	0.018	1.78	0.10	3.99	0.08
SD 343	F	310	450	232.05	67.83	5.038	1224.00	0.108	0.010			3.13	0.05
SD 253	F	257	200	116.83	50.39	3.312	844.80	0.069	0.012			3.57	0.09
SD 284	F	266	200	141.24	33.93	3.193	1387.23	0.104	0.007	1.03	0.59	3.70	0.07
SD 59	F	367	200	141.22	35.64	2.981	438.48	0.042	0.013			3.72	0.13
SD 252	F	271	250	150.38	37.56	4.183	1463.01	0.078	0.007	2.56	0.12	3.69	0.06
SD 324	F	259	150	101.62	26.09	2.391	5714.85	0.054	0.006	0.717	0.136	2.10	0.03
SD 249	F	302	250	140.40	32.59	2.594	1424.85	0.058	0.007	0.669	0.093	3.73	0.07
SD 25	M	260	200	248.18	87.52	6.247	1228.33	0.059	0.007	1.46	0.14	4.60	0.21
SD 51	M	206	100	71.13				0.026		2.26	0.12		
SD 254	M	268	200	155.83	43.59	3.836	1041.67	0.095	0.012	2.19	0.15	4.21	0.23
SD 68	M	264	200	110.38	25.48	2.321	403.33	0.025	0.011			1.65	0.16
SD 279	M	272	250	165.14	43.72	3.649	1163.33	0.075	0.011	1.42	0.12	4.24	0.22
SD 309	M	295	300	185.44	46.65	4.474	975.45	0.074	0.007			3.29	0.07
SD 248	M	310	350	202.11	52.44	4.125	974.65	0.101	0.006	0.826	0.084	3.82	0.07
SD 62	M	308	350	200.27	55.43	3.682	908.36	0.125	0.007			3.12	0.06
SD 85	M	292	300	143.36	38.93	2.659	944.50	0.112	0.009	0.477	0.091	3.65	0.08
SD 293	M	275	200	144.58	35.67	4.042	1209.01	0.089	0.008	1.65	0.11	3.89	0.07
SD 294	M	273	200	144.16	38.35	4.580	371.53	0.049	0.014	3.29	0.16	3.55	0.13
SD 297	M	237	150	107.48	27.16	2.984	443.60	0.066	0.016	1.11	0.18	3.62	0.13
SD 310	M	261	200	102.31	23.77	2.549	1380.08	0.085	0.011			3.85	0.09
SD 306	M	313	350	229.48	64.20	5.075	1070.41	0.135	0.005	1.07	0.09	3.65	0.06
SD 266	M	328	450	267.17	72.00	6.317	1650.38	0.083	0.004	0.706	0.127	2.76	0.04
SD 321	M	270	200	135.10	35.86	2.737	1560.38	0.101	0.007	1.15	0.98	3.70	0.07
SD 36	M	244	150	94.41	20.84	2.659	1433.81	0.120	0.010	1.11	0.18	3.22	0.08
SD 303	F	328	400	230.15	61.62	5.877	1176.61	0.153	0.005	1.77	0.86	4.11	0.06
SD 251	F	275	250	88.17	21.41	2.023	968.01	0.075	0.013	1.06	0.29	3.15	0.10
SD 283	M	389	350	215.38	59.47	5.841	1461.70	0.079	0.005	2.90	0.12	3.63	0.05
SD 322	M	273	200	127.71	31.24	3.229	1464.28	0.525	0.010	1.56	0.25	3.75	0.07
SD 158	M	350	400	227.20	59.82	6.063	1445.30	0.046	0.005	0.979	0.066	3.42	0.05
RF 103	?	294	750	251.78	65.05	4.909	1226.26	0.004	0.004			3.60	0.05
RF 106	?	340	550	283.94	68.74	5.074	991.75	0.006	0.004			3.76	0.06
RF 117	?	421	1000	353.68	96.52	6.388	1654.35	0.008	0.003			3.32	0.04
RF 112	?	374	800	257.23	64.53	5.215	995.58	0.004	0.005	1.71	0.15	3.26	0.06
FF 122	?	374	750	236.60	64.89	4.205	996.61	0.022	0.005			3.28	0.06
RF 118	?	383	800	250.77	64.20	4.331	2589.35	0.008	0.003	0.938	0.049	3.15	0.03
RF 120	?	354	600	226.11	58.66	4.246	1714.05	0.006	0.004			3.22	0.04
RF 101	?	405	900	292.02	69.91	6.431	1589.98	0.015	0.003			2.97	0.04
FF 121	?	373	800	266.35	71.93	4.512	1583.81	0.014	0.004			3.09	0.04
RF 114	?	370	650	249.90	68.64	4.180	968.90	0.004	0.005			3.44	0.06
RF 119	?	398	950	297.14	79.10	4.897	628.40	0.013	0.005			2.96	0.06
RF 113	?	382	600	266.47	58.17	5.291	1406.90	0.007	0.004			3.09	0.05
RF 105	?	355	550	250.73	65.08	6.521	1421.36	0.005	0.004			2.52	0.04
RF 107	?	318	400	223.60	57.90	4.675	991.55	0.000	0.005	0.706	0.109	3.39	0.10
RF 123	?	385	650	215.02	52.41	4.337	992.18	0.000	0.005			3.22	0.10
RF 104	?	406	600	197.33	39.50	6.127	1442.78	0.000	0.005	1.77	0.08	3.07	0.05
RF 109	?	245	250	165.33	46.00	4.460	1435.31	0.000	0.006			4.05	0.06
RF 115	?	323	450	134.04	33.09	3.718	1280.43	0.000	0.007			3.50	0.13
RF 111	?	404	850	308.14	71.61	5.943	853.23	0.000	0.004			6.39	0.08
RF 102	?	388	800	238.94	60.46	4.672	1306.26	0.000	0.004			1.20	0.07
RF 108	?	274	350	122.29	28.96	3.083	1383.20	0.000	0.008			3.18	0.07
FF 116	?	357	600	236.32	56.91	3.551	3805.56	0.025	0.003			3.24	0.03
FF 110	?	450	1350	367.72	110.17	3.240	1429.51	0.011	0.003			1.46	0.03
SFF 123	F	330	400	206.76	50.12	3.932	1000.36	0.523	0.007			3.64	0.06
SFF 116	F	303	250	142.56	32.13	2.544	182.76	0.302	0.026	0.638	0.082	5.03	0.24
SFF 118	F	300	300	142.79	34.94	3.246	997.21	0.489	0.011	2.68	0.13	3.95	0.08
SFF 119	F	298	250	158.14	39.40	2.948	950.70	0.602	0.010			4.34	0.09

Table 1. cont'd

SAMPLE #	SEX	FORK LENGTH (mm)	TOTAL FISH WT. (g)	SAMPLE WET WT. (g)	SAMPLE DRY WT. (g)	ASH WT. (g)	COUNT TIME (min)	^{137}Cs pCi/g (WET WT)	2*SD	^{226}Ra fCi/g (WET WT)	2*SD	^{40}K pCi/g (WET WT)	2*SD
SFF 136	F	275	200	125.03	31.43	2.538	305.55	0.450	0.022	0.591	0.114	4.89	0.18
SFF 122	F	350	500	267.64	67.27	5.519	844.80	0.791	0.006			3.68	0.06
SFF 124	F	325	350	207.99	52.13	4.860	208.33	0.443	0.015	2.22	0.08	3.46	0.16
SFF 117	F	302	300	154.58	39.18	2.912	1056.00	0.371	0.009			3.95	0.08
SFF 105	F	320	400	224.36	60.97	4.297	157.05	0.533	0.016	1.03	0.08	3.58	0.16
SFF 106	F	357	550	275.44	64.80	5.092	461.53	0.554	0.007			3.96	0.09
SFF 114	F	460	650	214.99	59.38	4.832	957.91	1.03	0.01	0.346	0.070	4.29	0.07
SFF 110	F	325	350	143.59	34.40	2.988	939.95	0.685	0.012			4.17	0.09
SFF 108	F	346	500	184.72	46.88	3.596	101.15	1.02	0.04	1.47	0.08	3.89	0.24
SFF 112	F	330	350	185.19	42.28	3.899	134.55	0.660	0.025	1.35	0.15	3.88	0.20
SFF 113	F	315	300	195.78	49.38	3.416	121.10	0.599	0.024			4.04	0.20
SFF 138	F	308	350	185.14	44.65	4.265	98.18	0.606	0.028			3.31	0.22
SFF 126	F	320	300	150.72	35.50	2.899	125.20	0.552	0.029	1.43	0.12	4.04	0.24
SFF 109	F	276	200	109.82	25.25	1.793	255.68	0.363	0.024	0.689	0.120	3.67	0.18
SFF 115	F	325	350	147.52	36.03	2.734	99.06	0.294	0.031	1.65	0.21	3.98	0.27
SFF 111	M	337	400	211.13	48.48	4.618	139.91	0.468	0.018	1.80	0.08	3.24	0.17
SFF 128	M	253	100	84.74	21.62	1.465	137.05	0.435	0.056			2.67	0.28
SFF 101	M	309	250	161.85	37.80	2.786	163.05	0.647	0.024	0.728	0.088	3.51	0.19
SFF 102	M	355	500	252.82	67.92	4.524	422.43	0.596	0.009			3.79	0.09
SFF 133	M	266	200	115.33	30.81	2.502	189.71	0.542	0.033	0.727	0.047	3.74	0.22
SFF 125	M	300	300	169.90	44.19	2.974	153.03	0.627	0.025	0.249	0.074	4.26	0.20
SFF 121	M	255	100	95.65	19.94	1.757	168.86	0.233	0.033			4.41	0.28
SFF 120	M	295	200	122.19	27.05	2.020	177.70	0.565	0.029			3.69	0.21
SFF 137	F	305	300	194.26	46.55	3.934	221.67	0.406	0.028	0.584	0.215	3.71	0.32
LONG NOSE SUCKER													
SD 227	?	468	650	269.11	71.52	4.615	315.00	0.057	0.013			3.73	0.23
SD 354	M	373	650	311.27	70.54	5.968	513.58	0.046	0.009	1.81	0.11	3.95	0.20
SD 229	?	289	250	149.22	36.21	3.444	1246.67	0.060	0.011	1.48	0.19	4.08	0.23
SD 244	?	340	600	285.34	62.70	4.761	844.80	0.035	0.005			3.96	0.07
SD 235	?	315	400	246.53	55.80	6.439	832.72	0.043	0.005			3.48	0.10
SD 243	?	349	500	231.29	49.06	4.202	1122.23	0.040	0.005	1.19	0.07	3.48	0.06
SD 236	?	331	500	223.32	51.07	4.410	1306.06	0.028	0.005	1.43	0.11	3.15	0.06
SD 39	M	358	600	263.74	59.50	4.700	2651.23	0.033	0.003			3.01	0.03
SD 149	?	382	750	284.03	59.93	6.072	1560.98	0.029	0.004	1.38	0.09	3.12	0.04
SD 359	F	373	650	303.38	69.55	6.546	2633.90	0.042	0.003			3.40	0.03
SD 234	?	396	900	285.96	70.75	6.941	1447.88	0.009	0.004	1.62	0.09	2.24	0.05
SD 361	?	269	250	114.59	22.93	2.031	1903.41	0.028	0.007			3.15	0.12
SD 80	F	374	800	384.85	89.66	6.685	1591.35	0.024	0.002			2.51	0.03
SD 246	?	310	350	188.13	39.52	3.213	1531.90	0.009	0.006			3.47	0.05
SD 245	?	391	700	320.25	71.77	6.031	822.36	0.040	0.004			3.34	0.06
SD 232	?	376	750	313.08	73.64	5.779	1151.68	0.039	0.004			3.09	0.05
SD 242	?	365	600	296.90	70.01	5.671	1411.98	0.042	0.004			3.64	0.07
SD 247	?	340	500	202.34	44.66	5.033	1418.20	0.013	0.005			3.76	0.09
SD 358	F	287	250	131.25	26.84	2.598	1514.61	0.047	0.007			3.36	0.11
SD 237	?	352	650	314.94	72.44	6.057	1039.65	0.047	0.004			3.45	0.05
SD 241	?	285	300	178.29	38.95	4.462	1427.93	0.054	0.006			3.10	0.08
SD 242	?	365	600	296.90	70.01	5.671	1411.98	0.042	0.003			3.64	0.05
SD 40	M	350	600	61.04	61.04	4.661	1478.15	0.048	0.003			3.40	0.06
SD 355	M	368	750	369.04	81.39	6.570	1606.58	0.045	0.003			3.11	0.04
SD 228	M	276	250	108.15	24.64	2.427	1342.25	0.041	0.009			3.30	0.14
SD 340	M	398	1000	343.39	74.97	5.890	1414.23	0.055	0.003			3.64	0.04
SD 238	F	385	750	306.50	69.00	6.212	2158.23	0.042	0.003			3.52	0.04
SD 60	?	359	700	282.80	62.85	4.617	1104.33	0.044	0.004			3.30	0.06
SD 353	F	385	750	359.38	76.44	7.139	-2589.48	0.069	0.002			3.07	0.09
SD 233	?	412	850	348.63	80.71	6.466	-3038.31	0.042	0.002			3.50	0.08
CURECT													
SD 261	F	604	1260	365.01	71.66	5.114	1594.98	0.118	0.003			3.09	0.05
SD 365	F	523	1050	377.61	66.43	4.788	1434.95	0.078	0.003			2.89	0.05
SD 366	F	490	800	262.71	48.09	3.470	1329.15	0.059	0.004			2.91	0.07
SD 260	F	620	1650	380.76	66.72	2.553	450.00	0.073					
SD 363	M	484	750	260.42	68.67	3.346	1333.33	0.057	0.007			3.22	0.16
SD 367	F	425	750	296.13	56.02	3.943	1567.38	0.112	0.004			2.56	0.06
SD 148	M	505	850	321.75	57.40	4.028	1715.76	0.081	0.003			2.62	0.05
SD 258	M	515	850	366.52	67.52	5.357	1528.63	0.076	0.003			2.70	0.05
SD 259	M	493	850	295.16	55.65	3.636	1366.18	0.048	0.004			2.81	0.06
KF 211	?	595	1350	258.79	44.10	3.211	1265.00	0.047	0.007			3.36	0.16

Table 1. cont'd

SAMPLE #	SEX	FORK LENGTH (mm)	TOTAL FISH WT. (g)	SAMPLE WET WT. (g)	SAMPLE DRY WT. (g)	ASH WT. (g)	COUNT TIME (min)	^{137}Cs fCi/g (WET WT)	2*SD	^{226}Ra fCi/g (WET WT)	2*SD	^{40}K fCi/g (WET WT)	2*SD
RF 212	?	685	2100	277.39	51.66	3.075	973.33	0.030	0.007			3.26	0.16
RF 202	?	542	900	237.92	45.21	6.776	1462.10	0.015	0.004	2.13	0.13	2.55	0.04
RF 203	?	416	500	357.91	75.86	7.712	1439.15	0.021	0.003	1.70	0.06	2.44	0.03
RF 221	?	625	1300	248.38	41.96	3.011	1433.41	0.027	0.004			3.11	0.05
RF 215	?	630	1500	326.91	59.55	4.003	1486.38	0.072	0.003			3.07	0.04
RF 226	?	665	1700	396.45	73.43	4.827	2589.33	0.079	0.002	0.382	0.079	3.05	0.03
RF 227	?	620	1300	400.49	75.20	5.047	1379.28	0.059	0.003			3.27	0.04
RF 209	?	598	1200	239.31	41.08	2.632	1428.00	0.018	0.004	0.198	0.076	2.80	0.06
RF 213	?	605	1650	354.48	69.08	4.340	1494.51	0.074	0.003			3.15	0.04
RF 214	?	700	2000	360.07	69.15	4.463	1331.25	0.045	0.003			2.91	0.04
RF 220	?	590	1200	327.17	58.80	4.028	1434.31	0.043	0.003			2.79	0.04
RF 219	?	670	1850	369.18	67.10	4.585	1783.80	0.045	0.003			2.94	0.04
RF 218	?	525	850	291.42	55.25	6.778	1479.40	0.013	0.003			2.63	0.05
RF 217	?	350	250	196.90	40.24	4.079	1203.51	0.005	0.005			2.52	0.08
RF 210	?	621	1600	419.23	76.92	5.041	1407.38	0.053	0.003	0.313	0.056	3.18	0.04
RF 228	?	390	350	244.77	47.45	5.310	1569.03	0.000	0.004	2.72	0.11	2.73	0.06
RF 225	?	580	1200	263.11	49.54	3.256	1512.40	0.016	0.004			3.17	0.05
RF 224	?	666	1800	412.74	65.86	4.533	1441.65	0.024	0.002			2.59	0.04
RF 201	?	650	1750	297.71	48.23	3.246	1199.85	0.032	0.004			2.12	0.05
RF 216	?	632	1500	359.78	62.18	3.958	1350.21	0.024	0.003			2.79	0.04
NORTHERN PIKE													
SD 256	F	590	1500	339.31	75.76	6.940	315.16	0.113	0.007			3.66	0.13
SD 328	F	523	1250	295.42	65.95	5.455	440.10	0.102	0.007			3.90	0.12
SD 336	F	755	4200	376.90	86.91	6.172	230.00	0.118	0.012			3.79	0.22
SD 146	F	566	1350	310.08	70.22	5.826	1518.65	0.140	0.004			3.58	0.04
SD 147	F	641	2200	371.06	81.87	7.142	-1539.81	0.133	0.009			3.92	0.15
SD 145	F	570	1350	366.86	77.59	6.993	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]
SD 220	M	571	1500	370.20	79.01	7.241	970.50	0.129	0.004			3.69	0.07
SD 351	M	570	1500	346.51	87.17	7.056	1280.53	0.104	0.004			3.48	0.06
RF 154	?	600	1550	392.60	92.53	9.855	0.00	0.046	0.004	0.488	0.073	3.31	0.09
SRF 401	M	618	2100	301.16	65.34	5.756	132.51	0.638	0.018	0.386	0.045	3.49	0.15
SRF 402	F	591	1800	396.21	98.21	8.113	65.10	0.599	0.021	0.831	0.045	3.45	0.19
INCONNU													
RF 222	F	746	5200	448.61	166.42	6.366	1553.21	0.024	0.002	0.091	0.063	2.77	0.03
RF 207	?	323	350	152.92	32.85	4.431	2840.83	0.026	0.007			3.71	0.18
RF 223	M	608	2500	323.11	92.19	5.376	1353.65	0.040	0.003			3.49	0.05
SAUGER													
LWP 99	?	301	300	133.44	35.90	5.598	1393.71	0.090	0.007			2.89	0.11
LWP 96	?	222	140	72.80	17.95	2.579	1408.40	0.052	0.013			2.57	0.20
LWP 98	?	236	160	85.66	21.47	3.306	1498.66	0.078	0.012			2.80	0.16
LWP 100	?	260	180	95.88	25.97	3.974	1532.36	0.116	0.011			2.99	0.14
LWP 81	?	280	260	136.49	34.27	5.422	1379.93	0.066	0.007			2.82	0.11
LWP 82	?	284	240	119.23	30.18	4.904	1432.75	0.094	0.008			3.18	0.12
LWP 84	?	290	280	162.92	45.88	6.496	-2264.29	0.074	0.013			2.88	0.20
LWP 86	?	320	320	175.69	44.39	7.492	-2387.41	0.066	0.010			2.31	0.15
LWP 91	?	250	160	73.73	17.11	3.119	1467.98	0.110	0.015			3.09	0.19
LWP 92	?	238	120	88.19	22.27	3.638	1317.31	0.175	0.011			3.08	0.17
LWP 93	?	242	140	67.19	18.62	2.904	1008.61	0.072	0.019			3.34	0.25
LWP 95	?	250	140	77.32	20.55	3.406	1298.25	0.080	0.014			3.08	0.19
LWP 96	?	222	140	72.80	17.95	2.579	1637.15	0.032	0.012			2.67	0.18
LWP 101	?	260	180	109.96	26.01	[illegible]	1671.05	0.065	0.008			3.01	0.12
LWP 103	?	226	120	75.33	19.92	3.264	1414.65	0.060	0.015			2.62	0.19
LWP 2	?			166.54	40.49	7.251	1032.36	0.078	0.007			2.91	0.10

Table 1. cont'd

SAMPLE #	SEX	FORK LENGTH (mm)	TOTAL WT. (g)	WET WT. (g)	DRY WT. (g)	ASH WT. (g)	COUNT TIME (min)	137CS pCi/g (WET WT)	2*SD	RADIUM fCi/g (WET WT)	2*SD	40K pCi/g (WET WT)	2*SD
ROUND WHITEFISH													
SD 320	F	356	450	289.75	72.00	6.856	458.33	0.054	0.010			4.57	0.24
SD 312	F	347	450	279.27	65.10	6.537	1166.67	0.059	0.007			4.57	0.21
SD 338	F	400	650	369.75	86.78	8.726	366.67	0.068	0.009			4.22	0.22
SD 347	F	365	550	311.43	75.15	7.047	1010.00	0.054	0.007			4.32	0.20
SD 153	F	379	600	258.71	64.84	5.325	428.37	0.079	0.012			4.71	0.25
SD 82	F	336	400	228.21	57.82	4.630	1341.67	0.064	0.008			4.66	0.22
SD 157	M	391	650	293.36	80.83	7.069	1033.33	0.072	0.007			4.04	0.19
SD 268	M	393	700	332.09	93.16	8.292	1531.83	0.052	0.005			4.10	0.18
SD 270	M	361	500	318.66	84.79	7.666	373.33	0.030	0.010			2.20	0.16
SD 264	M	420	800	281.06	69.27	6.093	753.33	0.044					
SD 269	M	355	550	341.37	89.59	9.141	1541.56	0.020	0.003	3.30	0.08	3.42	0.04
SD 344	F	427	900	307.79	73.10	7.213	1410.98	0.026	0.003	2.34	0.15	3.49	0.04
SD 83	M	338	450	278.57	67.16	6.691	1253.31	0.037	0.004	2.84	0.18	3.75	0.05
SD 262	F	420	950	232.51	72.02	4.654	1488.91	0.044	0.005	1.07	0.11	3.50	0.05
SD 54	M	372	550	302.00	82.76	7.113	1434.05	0.057	0.004	1.37	0.11	3.81	0.05
SD 58	M	356	500	303.88	74.76	7.366	1455.25	0.045	0.003	1.01	0.14	3.90	0.05
SD 341	M	384	650	425.58	120.97	11.306	1413.91	0.039	0.003	2.33	0.11	3.64	0.04
SD 346	F	403	750	339.48	89.43	6.679	2089.16	0.060	0.003			3.56	0.03
SD 349	M	404	700	441.78	110.10	9.250	1015.58	0.180	0.004			4.45	0.05
SD 63	M	352	450	273.12	68.69	7.951	1511.90	0.037	0.004	3.01	0.09	3.53	0.05
SD 65	M	387	600	281.65	70.20	6.600	1189.95	0.051	0.004			3.60	0.05
SD 265	F	380	600	400.38	107.46	10.690	1254.16	0.060	0.003			3.66	0.04
SD 337	F	427	900	324.73	86.20	6.941	1277.50	0.067	0.004			3.70	0.05
SD 350	M	401	650	382.41	103.43	9.682	3163.08	0.117	0.002	1.07	0.07	3.24	0.03
SD 314	M	393	900	398.14	107.55	8.448	-5494.36	0.051	0.003			3.99	0.06
SD 316	F	278	600	353.32	94.72	8.335	-2565.78	0.050	0.005			3.55	0.08
SD 311	M	400	750	313.78	85.03	6.509	-2971.76	0.066	0.006			5.87	0.09
SD 348	M	371	600	388.79	106.13	8.168	-2528.86	0.048	0.003			3.66	0.08
SD 263	M	366	500	253.20	97.07	8.007	-2528.41	0.070	0.006			5.39	0.13
SD 270	M	361	500	318.66	84.79	7.666	-1733.83	0.031	0.011			3.02	0.22
SD 315	M	380	600	388.84	107.14	9.248	-2608.78	0.058	0.004			4.10	0.07
SD 313	F	396	600	314.29	78.27	7.836	1161.68	0.062	0.004			3.80	0.05
SFF 205	F	408	600	185.62	42.85	4.558	1907.17	0.082	0.008	1.50	0.16	4.74	0.22
SFF 210	F	415	700	211.78	52.07	4.449	346.17	0.311		2.17	0.09	4.67	0.29
SFF 203	F	368	550	158.16	40.90	3.208	1839.02	0.104				5.20	0.25
SFF 211	F	202	50	49.81	11.81	1.353	1490.00	0.189		3.50	0.32	6.98	0.49
SFF 217	F	295	300	160.71	40.49	3.722	1204.17	0.198		1.97	0.18	5.64	0.27
SFF 204	F	370	500	267.17	69.10	4.967	1370.00	0.083				4.03	0.19
SFF 202	F	351	500	244.57	58.22	4.802	323.67	0.398				4.83	0.28
SFF 207	F	385	600	239.14	44.62	4.174	2788.67	0.076				3.71	0.16
SFF 212	?	227	50	75.47	18.94	2.278	981.70	0.177				6.18	0.42
SFF 215	M	338	400	259.68	65.44	5.764	1909.17	0.304	0.014	2.15	0.08	4.71	0.21
SFF 216	M	315	400	192.71	50.45	3.764	1209.00	0.250	0.014			5.11	0.24
SFF 209	M	305	300	206.08	50.33	4.023	980.18	0.371				4.94	0.24
SFF 213	M	260	100	123.05	31.58	3.549	1457.50	0.178		5.27	0.32	5.34	0.28

Footnotes:

* The length measurement for these fish is dorsal fin to fork of tail.

† The Louis Lake fish were received whole and partly decayed. Heads were removed, but gut contents were included in the sample counted.

‡ A minus (-) sign is a denotation that this datum is a sum of two separately analyzed portions of the fish sample.

ǂ Not detectable above background ^{226}Ra.

Table 2. Means and one standard deviation errors for activities of ^{137}Cs and ^{226}Ra and for total wet weight and fork length of fish populations from Great Slave Lake, Louis Lake, Lake Winnipeg and ELA. All statistics were done on log-transformed data. The number in brackets is the sample size (n). The sample size given for ^{137}Cs also applies to total weight and fork length.

Location	Date of Sampling	Species	Mean Total Weight g	$\times\div$ 1S.D.	Mean Fork Length mm	$\times\div$ 1S.D.	Mean ^{137}Cs pCi/kg wet	$\times\div$ 1S.D.	Mean ^{226}Ra pCi/kg wet	$\times\div$ 1S.D.
1. Great Slave Lake, NWT										
a) West Basin (Ft. Resolution)	Apr-Sept 1978	Lake whitefish	708	1.48	359	1.13	14.4	1.43 (29)	1.14	1.49 (7)
		Cisco	655	1.45	361	1.15	3.4	3.27 (23)	1.19	1.57 (4)
		Burbot	1180	1.76	579	1.21	25.9	2.70 (21)	0.785	3.10 (6)
b) Christie Bay (Snowdrift)	Apr-Sept 1978	Lake whitefish	611	2.10	359	1.24	49.6	1.35 (28)	0.979	1.71 (6)
		Round whitefish	609	1.26	377	1.09	53.0	1.51 (32)	1.84	1.63 (9)
		Cisco	249	1.45	286	1.14	83.0	1.72 (34)	1.33	1.65 (24)
		Longnose sucker	554	1.51	351	1.14	36.3	1.64 (30)	1.47*	1.15 (6)
		Lake trout (Sept)	2480	2.18	580	1.27	157.0	1.39 (32)	0.068	1.91 (10)
		Lake trout (Apr)	1660	2.56	505	1.34	149.0	1.46 (8)		
c) McLeod Bay (Ft. Reliance)	Apr-Sept 1978	Round whitefish	294	2.53	319	1.25	181	1.80 (13)	2.52	1.57 (6)
		Cisco	302	1.56	314	1.13	521	1.40 (28)	0.938*	1.95 (16)
		Lake trout	3160	2.40	613	1.26	642	2.02 (29)	0.062	1.54 (9)
2. Louis Lake, Sask. & N.W.T. Border	Oct 1978	Lake whitefish			246	1.18	2150	1.35 (24)	2.18	1.26 (23)
3. Lake Winnipeg, Man.	Feb 1980	Lake whitefish	776	1.11	376	1.04	25.2	1.59 (11)	1.37	1.47
	June 1979	Sauger	182	1.40	257	1.12	77.8	1.45 (16)		
4. Experimental Lakes Area, Ont.										
a) Lake 302S		Lake whitefish	272	1.47			1430	1.47 (15)	2.18	1.50 (10)
b) Lake 226SW		Lake whitefish			301	1.27	1240	1.46 (22)		

* Not detectable

Table 3. ^{137}Cs activities in muscle, bone, skin, and viscera of three lake trout from Lake 223 ELA. Viscera includes gut and internal organs.

Sample #	Fork Length (mm)	Total Weight (g)	Fraction	Fraction Wet Weight (g)	^{137}Cs pCi/g Wet	% of Total ^{137}Cs for Sample
38	310	515	Muscle	241	0.87 ± 0.042	79.4
			Bone	11.9	1.57 ± 0.39	7.1
			Skin	32.4	0.40 ± 0.087	4.9
			Viscera	41.8	0.55 ± 0.072	8.7
			Combined	327.1	0.81	
39	235	175	Muscle	51.3	0.68 ± 0.067	64.4
			Bone	6.7	1.02 ± 0.39	12.7
			Skin	11.7	0.43 ± 0.16	9.3
			Viscera	15.7	0.47 ± 0.16	13.6
			Combined	85.4	0.63	
40	290	195	Muscle	68.2	0.73 ± 0.057	69.0
			Bone	7.8	0.74 ± 0.33	8.0
			Skin	17.7	0.59 ± 0.15	14.5
			Viscera	18.7	0.33 ± 0.14	8.6
			Combined	112.4	0.64	

Table 4. Concentrations of calcium, potassium, copper and zinc, ratios of Ca:^{226}Ra and K:^{137}Cs, and percent abundance of ^{40}K (100 ^{40}K/K) in fish samples from Great Slave Lake (SD = Snowdrift, Christie Bay, RF = Ft. Resolution, West Basin, SRF = Ft. Reliance, McLeod Bay), Louis Lake (LL), and Lake 302S, Experimental Lakes Area (ELA).

Sample #	Wet Wt. (g)	Ca	K	Cu	Zn	Ca:^{226}Ra	K:^{137}Cs	% ^{40}K*
		μMoles/g wet weight				μMoles/fCi		
Lake whitefish								
SD 209	319.15	44.9	78.0		0.10	33.5	1.30	0.0152
SD 5	309.96	62.3	85.4		0.11		1.08	0.0160
SD 31	267.17	62.3	85.7		0.11	49.9	2.76	0.0151
SD 326	69.88		90.3		0.12		1.58	0.0214
SD 188	259.60		72.6		0.14		1.61	
SD 191	251.33	77.3	99.7		0.13	66.1	1.99	0.0164
SD 29	264.79	69.8	94.1		0.14	46.6	1.71	0.0155
SD 78	307.75	77.3	95.1		0.14		2.11	0.0130
RF 91	244.19		91.0		0.11		7.59	0.0162
RF 64	237.91		94.1		0.089		10.5	0.0155
RF 44	249.31		74.9		0.092		10.7	0.0172
RF 51	288.81		82.1		0.083		3.42	0.0150
RF 81	163.61		86.4		0.067		3.93	0.0154
RF 70	273.74		94.4		0.087		7.26	0.0146
RF 37	294.98		69.3		0.066		9.90	0.0189
LL 3	237.20	195.	90.3		0.25	93.1	0.028	0.0151
LL 300	130.90		83.6		0.32		0.056	0.0171
LL 6	179.42		91.3		0.29		0.040	0.0177
LL 310	265.87		85.4		0.28		0.067	0.0171
LL 7-A	166.42	168.	87.7		0.24	66.2	0.036	0.0171
LL 7-B	207.78		87.0		0.38		0.048	0.0176
LL 23	24.96		67.3		0.47		0.049	0.0252
LL 5	189.63	92.3			0.31	58.0		
LL 9	239.06		83.1		0.30		0.040	0.0160
LL 18	192.74		85.7		0.35		0.042	0.0164
LL 22	213.61		92.1		0.29		0.033	0.0153
LL 10	218.83		89.8		0.39		0.035	0.0177
LL 13	171.81		97.4		0.28		0.031	0.0160
LL 21	160.17		73.9		0.36		0.026	0.0201
LL 1	111.55		78.0		1.16		0.041	0.0186
LL 19	177.69		91.6	0.011	0.30		0.069	0.0170
LL 16	177.34		93.4		0.35		0.054	0.0161
LL 11	166.08		86.3		0.31		0.048	0.0180
LL 2	174.29		85.2	0.011	0.30		0.039	0.0180
LL 4	213.46		87.2		0.31		0.024	0.0176
LL 14	191.60	165.	86.2		0.32	79.1	0.035	0.0189
LL 15	136.69		88.2		0.36		0.046	0.0201
LL 9	136.52		79.0		0.35		0.052	0.0166
Round whitefish								
SD 269	341.37	127.	103.		0.14	38.5	5.14	0.0119
SD 344	307.79	105.	102.		0.14	44.8	3.93	0.0122
SD 83	278.57	112.	107.		0.13	39.5	2.90	0.0125
SD 262	232.51	74.8	104.		0.11	69.9	2.37	0.0120
SD 54	302.00	97.3	112.		0.13	71.0	1.96	0.0122
SD 58	303.88	67.3	107.		0.11	66.7	2.38	0.0130
SD 341	425.58	94.8	106.		0.11	40.7	2.71	0.0123
SD 63	273.12	157.	101.		0.16	52.2	2.73	0.0125
SD 350	382.41	122.	99.5		0.16	114.	0.85	0.0116
SRF 205	185.62	112.	105.		0.17	74.8	1.28	0.0161
SRF 210	211.78	77.3	108.		0.13	35.6	0.35	0.0154
SRF 211	49.81	117.	88.5		0.21	33.5	0.47	0.0282
SRF 217	160.71	94.8	117.		0.15	48.1	0.59	0.0172
SRF 215	259.68		91.3		0.13		0.30	0.0184
SRF 213	123.05	135.	111.		0.18	25.6	0.63	0.0171

Table 4. Cont'd.

Sample #	Wet Wt. (g)	Ca	K	Cu	Zn	Ca:^{226}Ra	K:^{137}Cs	% ^{40}K*
		μMoles/g wet weight				μMoles/fCi		
Trout								
SD 335	319.93	29.9	88.5		0.086	115.	0.67	0.0155
SD 213	343.59	12.2	71.4		0.086	59.8†	0.32	0.0171
SD 79	243.22	24.9	94.1	0.005		509. †	0.67	0.0165
SD 114	310.86	8.98	70.8		0.081	345.	0.34	0.0175
SD 335	319.93	29.9	88.5		0.095		0.66	
SD 217	341.75	10.2	68.3		0.095	107.	0.30	0.0161
SD 124	267.05		49.9		0.029		0.33	0.0166
SD 125	392.45	14.5	75.4		0.10	177. †	0.49	0.0164
SD 115	292.76		78.3		0.09		0.51	0.0167
SRF 47	255.35		82.4		0.15		0.11	0.0178
SRF 37	344.56		70.3		0.095		0.12	0.0165
SRF 40	279.16		73.4		0.13		0.06	0.0212
SRF 73	240.50		67.5	0.004	0.049		0.28	0.0172
SRF 28	311.99		65.5		0.058		0.35	0.0161
SRF 100	364.91		51.3		0.20		0.10	0.0155
SRF 25	242.84		68.0		0.09		0.089	0.0172
SRF 2	201.36		98.2		0.11		0.083	0.0173
SRF 93	225.10		88.2		0.10		0.069	0.0174
SRF 88	183.86	37.4	94.1		0.11	†	0.045	0.0163
SRF 96	277.83		83.1		0.13		0.085	0.0171
Cisco								
SD 35	132.14		87.7		0.31		0.69	0.0206
SD 154	234.30		88.7		0.13		1.27	0.0158
SD 50	124.63		84.4		0.24		0.65	0.0066
SD 77	152.43		92.1		0.25		0.76	0.0155
SD 343	232.05		80.3		0.13		0.74	0.0139
SD 284	141.24		87.7		0.32		0.84	0.0151
SD 252	150.38		93.4		0.34		1.20	0.0141
SD 324	101.62		84.9		0.20		1.57	0.0088
SD 249	140.40	58.8	57.0		0.36	85.7	1.60	0.0144
SD 25	248.18	92.1	67.1		0.21	61.5	1.85	0.0151
SD 254	155.83	105.	90.8		0.29	47.8	0.96	0.0165
SD 279	165.14	79.8	97.7		0.35	56.2	1.30	0.0155
SD 248	202.11		93.6		0.21		0.93	0.0146
SD 85	143.36		85.9		0.13		0.77	0.0152
SD 293	144.58		90.5		0.23		1.02	0.0153
SD 294	144.16		89.3		0.31		1.82	0.0142
SD 297	107.48		88.7		0.32		1.34	0.0146
SD 306	229.48		89.8		0.17		0.67	0.0145
SD 266	267.17		88.5		0.18		1.07	0.0111
SD 321	135.10		79.8		0.17		0.79	0.0165
SD 36	94.41		74.4		0.18		0.62	0.0154
SD 303	230.15		94.4		0.29		0.62	0.0155
SD 251	88.17		81.1		0.14		0.11	0.0139
SD 283	215.38		92.3		0.16		1.17	0.0140
SD 322	127.71		89.0		0.30		0.17	0.0150
SD 158	227.20		98.7		0.18		2.15	0.0124
RF 112	257.23	84.4	47.4		0.14	48.1	19.2	0.0151
RF 118	250.77		82.9		0.11		10.4	0.0136
RF 107	223.60	97.3	87.2		0.16	138.	†	0.0139
RF 104	197.33		68.3		0.15		†	0.0160
SRF 116	142.56	52.4	96.4	0.007	0.22	82.3	0.32	0.0186
SRF 118	142.79		95.1		0.23		0.20	0.0148
SRF 136	125.03		91.6		0.22		0.20	0.0191
SRF 124	207.99		94.9		0.21		0.21	0.0130
SRF 105	224.36		87.5		0.25		0.16	0.0146
SRF 114	214.99	81.8	69.1	0.006	0.34		0.11	0.0136
SRF 108	184.72		98.2		0.22		0.096	0.0141

Table 4. Cont'd.

Sample #	Wet Wt. (g)	Ca	K	Cu	Zn	Ca:^{226}Ra	K:^{137}Cs	% ^{40}K*
		μMoles/g wet weight				μMoles/fCi		
SRF 112	185.19		104.		0.28		0.16	0.0133
SRF 126	150.72		86.4		0.29		0.16	0.0167
SRF 109	109.82	47.4	90.3	0.007	0.23	68.8	0.25	0.0145
SRF 115	147.52		89.8		0.22		0.31	0.0158
SRF 111	211.13		86.2		0.24		0.18	0.0134
SRF 101	161.85	49.9	93.4		0.25	68.5	0.14	0.0134
SRF 133	115.33		79.8		0.28		0.055	0.0167
SRF 125	169.90		94.1		0.23		0.11	0.0162
SRF 120	122.19		80.3		0.25		0.14	0.0164
Longnose sucker								
SD 354	311.27	62.3	87.7		0.16	34.4	1.91	0.0161
SD 229	149.22	89.8	89.0		0.11	60.7	1.48	0.0164
SD 243	231.29	54.9	85.9		0.13	46.1	2.15	0.0145
SD 236	223.32	69.8	87.7		0.17	48.8	3.13	0.0128
SD 149	284.03	54.9	80.8		0.12	39.8	2.79	0.0138
SD 234	285.96	110.	85.9		0.13	67.7	9.55	0.0093
Burbot								
RF 202	237.92		65.5		0.16		4.36	0.0139
RF 203	357.91	87.3	65.0		0.14	51.3	3.09	0.0134
RF 226	396.45		74.9		0.095		0.95	0.0145
RF 209	239.31		68.5		0.070		3.81	0.0146
RF 210	419.23		77.0	0.004	0.090		1.45	0.0147
RF 228	244.77	105.	68.0		0.18	38.5 †		0.0143
RF 216	359.78		63.2		0.070		2.63	0.0158
Northern pike								
SD 336	376.90		71.4		0.11		0.61	0.0190
RF 154	392.00		80.1	0.003	0.14		1.67	0.0148
SRF 401	301.16		83.4		0.14		0.13	0.0149
SRF 402	390.21	77.3	97.4		0.17	93.0	0.16	0.0126
Inconnu								
RF 222	448.01		73.8		0.11		3.15	0.0131
RF 223	323.11		88.5		0.10		2.21	0.0141
Lake whitefish								
ELA3 5	203.10		85.2		0.20		0.060	0.0150
ELA3 6	261.54		86.7		0.093		0.057	0.0160
ELA3 9	288.15		95.1		0.19		0.052	0.0248
ELA3 13	345.72		40.2		0.12		0.020	0.0301
ELA3 14	155.61		80.8		0.17		0.076	0.0140
ELA3 15	111.69		70.3		0.17		0.10	0.0140

* Percent natural abundance of ^{40}K is 0.0118 (Friedlander et al. 1964)

† ^{226}Ra near or below detection limits.

Table 5. Means and one standard deviation for concentrations of calcium, potassium, copper and zinc in fish populations from Great Slave Lake, Louis Lake and Lake 302S Experimental Lakes Area. Means and standard deviations are from log-transformed data. The number of fish analyzed is shown in brackets.

Location	Species	µmoles/g Wet Weight Ca	K	Cu	Zn
1. Great Slave Lake					
a) West Basin (Ft. Resolution)	Lake whitefish		84.1 ×÷ 1.13 (9)		0.084 ×÷ 1.21 (7)
	Cisco	89.5 ×÷ 1.13 (2)	78.5 ×÷ 1.11 (4)		0.122 ×÷ 1.35 (4)
	Burbot	95.5 ×÷ 1.14 (2)	68.8 ×÷ 1.08 (7)	0.0004 (1)	0.109 ×÷ 1.47 (7)
b) Christie Bay (Snowdrift)	Lake whitefish	64.6 ×÷ 1.22 (6)	87.2 ×÷ 1.11 (8)		0.119 ×÷ 1.15 (8)
	Round whitefish	103. ×÷ 1.30 (9)	105. ×÷ 1.04 (9)		0.131 ×÷ 1.17 (9)
	Cisco	81.0 ×÷ 1.29 (4)	89.3 ×÷ 1.08 (26)		0.214 ×÷ 1.40 (26)
	Longnose sucker	71.1 ×÷ 1.32 (6)	86.2 ×÷ 1.03 (6)		0.135 ×÷ 1.16 (6)
	Trout	16.7 ×÷ 1.67 (7)	74.9 ×÷ 1.21 (9)		0.080 ×÷ 1.51 (8)
c) McLeod Bay (Ft. Reliance)	Round whitefish	105. ×÷ 1.24 (5)	103. ×÷ 1.12 (6)		0.159 ×÷ 1.23 (6)
	Cisco	56.1 ×÷ 1.27 (4)	89.4 ×÷ 1.10 (16)	0.007 ×÷ 1.13 (3)	0.245 ×÷ 1.14 (16)
	Trout	37.4 (1)	78.8 ×÷ 1.15 (11)	0.004 (1)	0.099 ×÷ 1.41 (11)
2. Louis Lake, Sask. & N.W.T. Border	Lake whitefish	149. ×÷ 1.39 (4)	85.7 ×÷ 1.09 (22)	0.011 ×÷ 1.01 (2)	0.336 ×÷ 1.36 (23)
3. Lake 302S, ELA, Ont.	Lake whitefish	-	73.7 ×÷ 1.37 (6)		0.153 ×÷ 1.35 (6)

Table 6. Activities of ^{137}Cs and ^{226}Ra in surface water samples from Great Slave Lake stations and ELA Lake 302S and Lake Winnipeg. Particulate matter from the 160 L water sample was separated by continuous-flow centrifugation.

Lake & Station	Date	Suspended Particulate Matter	^{137}Cs in Filtered Water, pCi m^{-3}	^{137}Cs in Suspended Particulate Matter		^{226}Ra in Water, pCi m^{-3}
		mg/L	$\pm 2\sigma$	pCi m^{-3}	pCi g^{-1} dry	± 1 S.D.*
Great Slave Lake						
Ft. Resolution (West Basin)	Sept. 1979	79	34 ± 20	8.6 ± 6	0.11 ± .07	59 ± 5
Snowdrift (Christie Bay)	"	1.4	51 ± 20	12 ± 9	9 ± 7	76 ± 3
Ft. Reliance (McLeod Bay)	"	0.78	98 ± 20	9.0 ± 8	11 ± 9	21 ± 4
Lake 302S	March 1980	0.37	668 ± 50	6.8 ± 6	19 ± 17	≈100†
Lake Winnipeg North Basin		1.1	33 ± 19	N.D.‡	N.D.	43

* The radium data given are averages of measurements of three different 55 L samples at each station. The 2σ counting error was much less than the differences between the replicate samples, so 1 standard deviation of the triplicate sample is given.

† Estimated from data from nearby lakes.

‡ N.D. not detectable ($\leq$7 pCi/g).

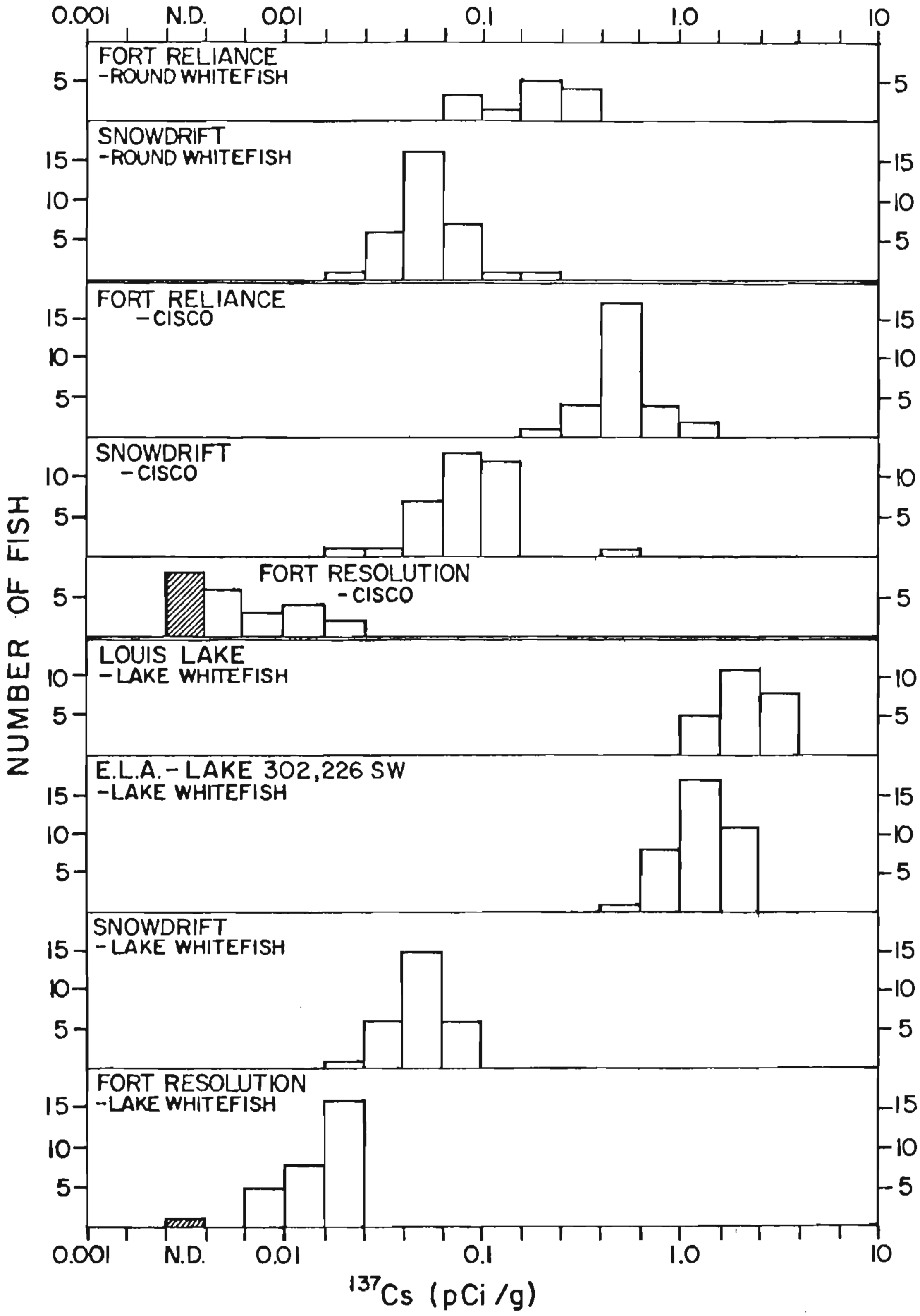

Figure 1. Frequency distribution of ^{137}Cs within each population sampled.

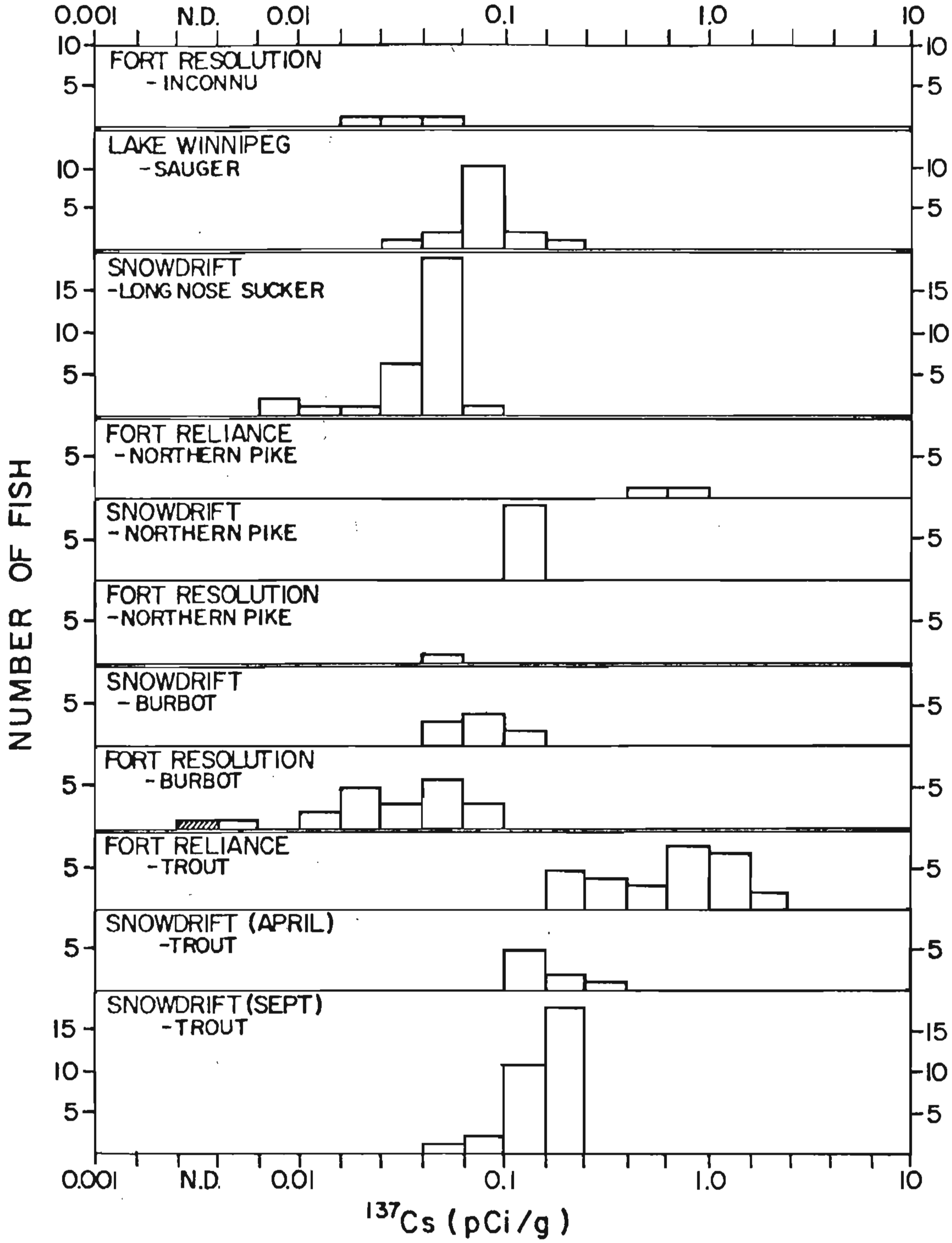

Figure 1. cont'd

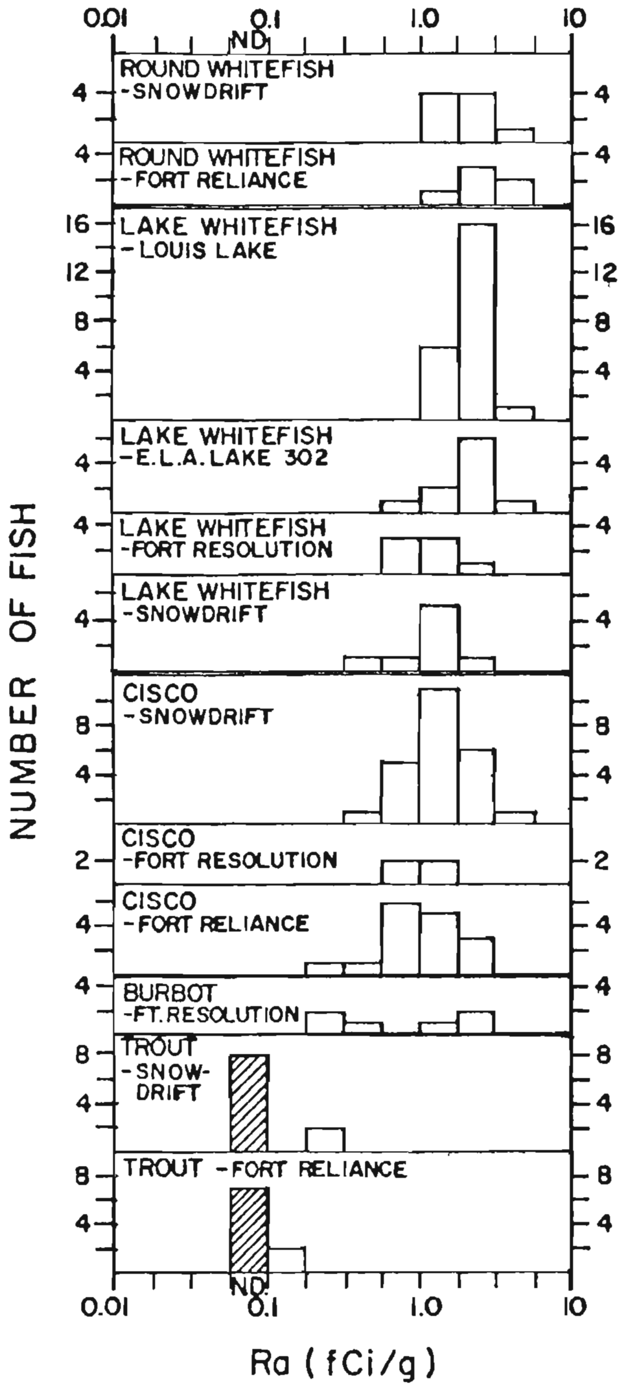

Figure 2. Frequency distribution of ^{226}Ra within each population sampled.