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Radiocesium in Migratory Bird Species in Northern Ireland Following the Chernobyl Accident

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Radioactive fallout arising form the nuclear reactor accident at Chernobyl on 26 April 1986 reached Northern Ireland in early May and was deposited in rain (Smith and Clarke 1989). However, the subsequent contamination of food supplies in Northern Ireland were well below national and international levels at which any action would be considered necessary and presented no risks to health.

In addition to the direct contamination of food supplies with radionuclides in the form of fallout following the Chernobyl incident another potential source of radioactive contamination entering the human food chain was through the arrival of migratory species of game birds. Each autumn and winter many thousands of birds migrate to Northern Ireland from Northern and Eastern Europe and some of these could have been contaminated as a result of being directly affected by the fallout from Chernobyl.

The purpose of this work was to examine the extent of radionuclide contamination in such species and a number of samples were obtained for analyses during the autumn/winter periods in 1986/87 and 1987/88. The results obtained are outlined below.

MATERIALS AND METHODS

The wild fowl species examined included a wide range of ducks [pochard (*Aythya ferina*), teal (*Anas crecca*), pintail (*Anas acuta*), shoveler (*Anas clypeata*), mallard (*Anas platyrhynchos*), widgeon (*Anas penelope*), tufted (*Aythya fuligula*) and golden-eye ducks (*Bucephala clangula*)] and the waders, woodcock (*Scolopax rusticola*), snipe (*Capella gallinago*) and Jack snipe (*Lymnocryptes minimus*). The dates and locations of sampling are indicated in Tables 1, 2 and 3. On arrival in the laboratory the birds were dissected and the edible parts (breast muscle and leg muscle) removed for the determination of their radiocesium content; the sample size was 100 g. Cesium-137 and cesium-134 determinations were carried out by high resolution gamma-spectroscopy using an EG & G Ortec gamma-spectrometer fitted with a high-purity germanium Gamma-X detector. The limit of detection was dependent on the counting time and for most samples was < 1 Bq

for both cesium-137 and cesium-134. Precision and reproducability were ensured by using mixed radionuclide gamma reference standards with high and low (<5 Bq cesium-137 and cesium-134) levels of activity; in all cases the results obtained did not differ significantly from the stated certified values. The resultant spectra were analysed on a DEC Professional 350 computer using EG & G Ortec Omnigam analysis software.

RESULTS AND DISCUSSION

The data given in Table 1 show the radiocesium contents determined for 3 species of waders. These data also show the geographical range of the sampling which covered most of Northern Ireland. Radiocesium (both ^{137}Cs and ^{134}Cs) were detected in all of the samples tested and the ratio of these 2 isotopes would indicate that the radiocesium was of Chernobyl origin. Generally speaking higher values were obtained in woodcock than in either snipe or Jack snipe. In woodcock the highest values noted were for 3 birds obtained from Co Fermanagh in December 1986 and January 1987 and 1 sample obtained in Co Londonderry also in January 1987. Only 1 of these samples exceeded the EC limit of 600 Bq radiocesium/kg but this is not considered significant because the consumption of muscle tissue from woodcock would only represent a small intake of radiocesium. The origins of this migratory species are Northern Britain and also northern continental Europe and it seems likely that the most contaminated samples obtained were from birds who migrated from continental Europe although this cannot be proved. The radiocesium values obtained for both snipe and Jack snipe were generally lower than those of woodcock. Snipe migrate to Northern Ireland from Great Britain, Iceland, the Faeroe Islands and countries fringing the Baltic Sea; the origins of Jack snipe are not known as precisely but probably arise from Scandinavia.

Table 1. Radiocesium levels (Bq kg^{-1}) in the muscle tissue of species of waders (winter 1986/87)

Species	Date of sample	Sampling site	^{137}Cs	^{134}Cs	Total
Woodcock	01.11.86	Kesh, Co Fermanagh	9.7	<7.0	<16.7
(*Scolopax*	08.11.86	Seskinore, Co Tyrone	74.2	33.5	107.7
rusticola)	08.11.86	Waterside, Co Londonderry	72.6	31.7	104.3
	15.11.86	Killagen, Upper Maine, Ballymena, Co Antrim	46.5	21.4	67.9
	17.11.86	Derrygonnelly, Co Fermanagh	43.4	20.1	63.5
	18.11.86	Castlearchdale, Co Fermanagh	23.1	10.6	33.7
	24.11.86	Fintona, Co Tyrone	46.9	19.1	66.0

Table 1 (continued)

Species	Date of sample	Sampling site	^{137}Cs	^{134}Cs	Total
	03.12.86	Florencecourt, Co Fermanagh	90.0	35.2	125.2
	03.12.86	Florencecourt, Co Fermanagh	183.2	75.3	258.5
Species	Date of sample	Sampling site	^{137}Cs	^{134}Cs	Total
	03.12.86	Florencecourt, Co Fermanagh	22.1	8.6	30.7
	09.12.86	Killeter, Co Fermanagh	374.6	133.9	508.5
	10.12.86	Seskinore, Co Tyrone	7.1	2.0	9.1
	13.12.86	Kesh, Co Fermanagh	10.3	5.7	16.0
	20.12.86	Omagh, Co Tyrone	26.7	11.8	38.5
	01.01.87	Castlearchdale, Co Fermanagh	33.8	12.8	46.6
	06.01.87	Seskinore, Co Tyrone	39.2	17.4	56.6
	07.01.87	Dromore Forest, Co Tyrone	52.9	19.9	72.8
	09.01.87	Castlederg, Co Tyrone	565.5	206.4	771.9
	12.01.87	Dromore Forest, Co Tyrone	7.3	2.3	9.6
	12.01.87	Dromore Forest, Co Tyrone	12.1	3.9	16.0
	12.01.87	Dromore Forest, Co Tyrone	8.1	2.3	10.4
	12.01.87	Claudy, Co Londonderry	335.0	124.0	459.0
	27.01.87	Not known	12.5	7.1	19.6
	27.01.87	Not known	6.2	3.9	10.1
Snipe (*Capella gallinago*)	19.12.86	Glenwherry, Co Antrim	16.9	5.4	22.3
	19.12.86	Glenwherry, Co Antrim	6.1	3.3	9.4
	12.01.87	Glenwherry, Co Antrim	3.6	1.0	4.6
Jack snipe (*Lymnocryptes minimus*)	09.12.86	Killeter, Co Fermanagh	9.3	3.9	13.2
	10.01.87	Templepatrick, Co Antrim	4.0	3.4	7.4

The data in Table 2 are for 8 duck species, samples of which were obtained across the whole of Northern Ireland during the winter of 1986/1987. It can be seen that although there were measurable levels of radiocesium these values were generally low and on the whole lower than those obtained for woodcock. In some cases the values were extremely low or even non-detectable (widgeon sampled in Co Londonderry). This may reflect the migratory pattern of widgeon because this

species migrates to Northern Ireland from Iceland, Scandinavia and Siberia. The migratory origins of the other duck species are:

teal - Scandinavia and the Baltic states
golden eye duck - Northern Sweden, Finland, Norway and the former USSR
tufted duck - Scotland, Iceland, Scandinavia, The Netherlands and Baltic states
mallard - Great Britain and some from the continent of Europe in addition to birds which remain in Northern Ireland throughout the year
shoveler - Iceland, Scandinavia, northern reaches of Great Britain and the former USSR
pochard - Large areas of northern Europe
pintail - Iceland and the former USSR.

Table 2. Radiocesium levels (Bq kg^{-1}) in the muscle tissue of ducks (winter 1986/87)

Species	Date of sample	Sampling site	^{137}Cs	^{134}Cs	Total
Teal (*Anas crecca*)	18.10.86	Portglenone, Co Londonderry	18.0	7.1	25.1
	08.11.86	Waterside, Co Londonderry	<16.2	<13.2	<29.4
	13.11.86	Strangford Lough, Co Down	<19.6	<14.3	<33.9
	26.11.86	Strangford Lough, Co Down	14.6	5.0	19.6
	15.12.86	Lisnaskea, Co Fermanagh	6.4	2.2	8.6
Tufted Duck (*Aythya fuligula*)	04.11.86	Ardmore Point, Lough Neagh	18.7	8.2	26.9
Golden Eye Duck (*Bucephala clangula*)	04.11.86	Ardmore Point, Lough Neagh	8.9	5.2	14.1
	26.11.86	Strangford Lough, Co Down	15.9	4.4	20.3
Widgeon (*Anas penelope*)	04.10.86	Lough Foyle, Co Londonderry	<22.0	<18.0	<40.0
	14.10.86	Greysteel, Lough Foyle, Co Londonderry	1.2	ND	1.2
	14.10.86	Greysteel, Lough Foyle, Co Londonderry	ND	ND	0.6
	14.10.86	Greysteel, Lough Foyle, Co Londonderry	0.6	ND	0.4
	14.10.86	Greysteel, Lough Foyle, Co Londonderry	0.4	ND	ND

Table 2 (continued)

Species	Date of sample	Sampling site	^{137}Cs	^{134}Cs	Total
	08.11.86	Strangford Lough, Co Down	<48.0	<34.0	<82.0
	12.11.86	Strangford Lough, Co Down	<28.2	<22.0	<50.2
	12.11.86	Ballinderry, Co Antrim	<16.8	<12.5	<29.3
	12.11.86	Ballinderry, Co Antrim	<17.6	<14.7	<32.3
	12.11.86	Lough Beg, Co Fermanagh	<13.0	<10.0	<23.0
	23.11.86	Killyleagh, Co Down	6.5	4.0	10.5
	23.11.86	Killyleagh, Co Down	9.0	2.9	11.9
	23.11.86	Killyleagh, Co Down	17.6	8.4	26.0
	26.11.86	Strangford Lough, Co Down	13.8	4.4	18.2
	15.12.86	Lisnaskea, Co Fermanagh	12.4	<9.5	<21.9
Mallard	21.09.86	Blacks Brae, Co Londonderry	<21.7	<17.8	<39.5
(*Anas platyrhynchos*)	30.09.86	Longfield, Lough Foyle, Co Londonderry	<22.3	<18.4	<40.7
	15.11.86	Lisnaskea, Co Fermanagh	<13.8	<4.9	<18.7
Shoveler (*Anas clypeater*)	26.11.86	Strangford Lough, Co Down	11.0	3.0	14.0
Pintail (*Anas acura*)	10.12.86	Strangford Lough, Co Down	5.7	1.1	6.8
Pochard (*Aythya ferina*)	18.10.86	Portglennone, Co Londonderry	10.9	<7.9	<18.8

ND Not detected

It is clear from the above that a number of species migrate to Northern Ireland from areas that were directly contaminated by fallout from Chernobyl. Despite this the radiocesium values obtained in the samples of birds analysed were low. These data are similar to the values reported for the thrush (*Turdus philomelus*) which migrates from Scandinavian countries and central and eastern Europe to Spain (Ruiz *et al.* 1988; Moreno *et al.* 1991) but substantially greater than the values observed in teal, mallard and woodcock in Spain during the period October 1986 - January 1987 (Baeza *et al.* 1988).

Table 3 gives the results for woodcock in the period November 1987/January 1988. The results obtained were much lower than for the winter of 1986/1987 for this species and for that reason monitoring was not continued further.

Table 3. Muscle radiocesium levels (Bq kg^{-1}) in Woodcock (winter 1987/88)

Date of sample	Sampling site	^{137}Cs	^{134}Cs	Total
20.11.87	Gosford, Co Armagh	118.5	31.5	150.0
26.11.87	Seskinore, Co Tyrone	24.3	3.8	28.1
08.12.87	Castlecaldwell, Co Fermanagh	18.2	7.7	25.9
10.12.87	Knockmany Forest, Co Tyrone	9.8	<2.4	<12.2
21.01.88	Seskinore, Co Tyrone	11.1	<6.7	<17.8
29.01.88	Castlearchdale, Co Fermanagh	22.0	3.5	25.5

The values obtained for radiocesium content in the muscle tissue of birds in Northern Ireland were compared with the results obtained for similar species during the period 1980-1984 in the Ravenglass estuary which is affected by radionuclide contamination from Sellafield (Lowe 1991). The values obtained for widgeon, mallard and Shelduck at Ravenglass were substantially greater than those seen in the present study.

In summary, the results obtained indicate that migratory species of game birds in Northern Ireland during the period 1986-1988 were contaminated by radiocesium of Chernobyl origin. However, the extent of the contamination was low and was far below levels at which any action would have been considered necessary. It is also pertinent that the values obtained for radiocesium contamination were generally much lower than those observed in similar species in the Ravenglass estuary which is affected by radionuclide discharges from Sellafield.

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