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SEPA's main aim is to provide an efficient and integrated environmental protection system for Scotland which will both improve the environment and contribute to the Scottish Ministers' goal of sustainable development.

Radiological Habits Survey, Dounreay, 2003

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SUMMARY

This report presents the results of a survey, conducted in 2003, into the habits and consumption patterns of people living and working in the vicinity of the United Kingdom Atomic Energy Authority (UKAEA) Dounreay site which discharges gaseous and aqueous emissions to the atmosphere and the Pentland Firth respectively. Direct radiation is also emitted from the site. These emissions include a minor contribution from the adjoining Vulcan Naval Test Establishment which is operated by the Ministry of Defence. Potential exposure pathways to the radioactive discharges from these sites include consumption of locally sourced terrestrial and marine foods and occupancy of nearby dwellings, the surrounding area and intertidal areas. The survey investigated all of these pathways and the data obtained on the consumption and occupancy rates of individuals are presented and discussed.

Food sources included locally grown fruit and vegetables, local meat, local game, wild/free foods and seafood. Occupancy habits include those related to residences, workplaces and recreational activities within 1 km of the UKAEA site, recreation and work activities over intertidal areas and handling of commercial fishing gear and intertidal sediment. In the marine environment the main activities were the crustacean harvesting and salmon fisheries. Livestock production in the area was mainly undertaken by farmers who predominantly raised lambs and beef sucklers. Egg production in the survey area was also noted, though this was of a small scale. No dairy herds were within the survey area although some individuals kept goats for their household's milk and cheese requirements. Most farmers also produced small quantities of hay and cereals for winter livestock feed and grew vegetables for sale to the public and their personal consumption. Some individuals were identified who consumed locally produced/caught food from two and sometimes three food groups. These included terrestrial food, seafood and game.

1. BACKGROUND

1.1 Regulation of radioactive waste discharges

There are generally three main sources of radiation exposure to members of the public from nuclear sites in normal circumstances: discharges of radioactive waste to the aquatic environment, discharges to the atmosphere and direct radiation from the site. Regulation of waste discharges is carried out under the Radioactive Substances Act 1993, (RSA93). Authorisations granted under RSA93 set limits on the quantities and types of radioactivity that are permitted to be released from the site. For discharges in Scotland, the Scottish Environment Protection Agency (SEPA) is the primary regulatory authority under RSA93. Sources of direct radiation from sites are regulated by the Nuclear Installations Inspectorate (NII) of the Health and Safety Executive (HSE).

1.2 The critical group concept

Radiological protection of the public is based on the concept of a critical group. The critical group is defined as the people who, because of where they live and their habits, receive the highest radiation dose from the site and its discharges. It is the assessed radiation dose to the critical group that is compared to relevant limits and constraints. If the dose to the critical group is acceptable, it follows that the lower doses received by other members of the public will be below any limits and constraints, and overall protection of the public from the effects of the radioactivity is provided. This survey provides information to assist SEPA in determining critical groups around Dounreay.

1.3 Dose limits and constraints

Assessed radiation doses to critical groups are compared to nationally and internationally agreed dose limits, recommendations and constraints.

The Radioactive Substances (Basic Safety Standards)(Scotland) Direction 2000 directs SEPA to ensure that the sum of doses of ionising radiation to the public do not exceed the limits set out in Article 13 of Council directive 96/29/Euratom and that doses should be as low as reasonably achievable (ALARA), economic and social factors being taken into account. In connection with the latter, SEPA is directed to have regard to the following maximum doses which may result from a defined source, for use at the planning stage in radiation protection:

a) 0.3 millisieverts per year from any source from which radioactive discharges are first made on, or after 13 May, 2000: or

b) 0.5 millisieverts per year from the discharges from any single site.

Additionally, the government accepts that, in general it should be possible to operate existing facilities within the 0.3 mSv per year source constraint.

2. THE SURVEY

2.1 Survey aims

The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) undertook the survey in July 2003 on behalf of SEPA (CEFAS contract C0767 and SEPA contract 230/2350). The aim of the survey was to review habits related to public radiation exposure via aquatic, terrestrial and external exposure pathways resulting from routine radioactive emissions and direct radiation from the UKAEA Dounreay site. Also relevant, but to a much less significant extent, were the operations at the adjoining Ministry of Defence, Vulcan site. SEPA also requested that particular attention be paid to occupancy and habits in intertidal areas. Any such information gathered will be used to update a risk assessment regarding potential exposure pathways relating to fragments of irradiated nuclear fuel which have been found on the seabed and on certain beaches in the vicinity of Dounreay.

The last habits survey conducted by CEFAS in the Dounreay area was “Radiological Habits Survey, Dounreay, 1999” (Tipple *et al*, 2001). The data from this survey are currently being used for dose assessments in the Dounreay area.

Fieldwork was conducted in order to obtain site specific habits data. This data in combination with monitoring data can be used to determine local critical group(s) and identify critical exposure pathways to the local population. General habits survey information for the area was also obtained.

Investigations were carried out to ascertain the following:

- External exposure activities, including angling, mollusc collection and bait digging along the intertidal shoreline.

- Internal exposure from the consumption of food sources from the aquatic and terrestrial environments.
- The production, use and destination of local produce.
- The types, seasonality of and extent of consumption of wild foods in the area.
- The extent of occupancy within 1 km of the site.
- The extent of any unusual practices.
- The use of any natural resources from the aquatic environment (e.g. sand extraction, the use of seaweed as a fertiliser).

The survey team also collected information that could be used in the assessment of other pathways such as the inhalation of re-suspended radioactivity in sea spray, the inadvertent ingestion of contaminated seawater and contact with and/or inadvertent ingestion of contaminated sediments.

2.2 Survey areas

Different survey areas were selected to cover the aquatic, terrestrial and direct radiation pathways.

The aquatic survey area was from Dunnet Head in the east to Armadale Bay in the west (shown in Figure 1). The survey area was considered to be the sea area encompassed by a 20 km radius from the UKAEA marine discharge pipeline outlet. The survey team was requested to endeavour to apportion the fish and shellfish catch from the survey area between that which was caught within a 2 to 10 km radius of the pipeline outlet and that caught between a 10 and 20 km radius of the pipeline outlet. As was the case during the 1999

survey, all methods of fishing and shellfish collection were prohibited within a 2 km radius of the pipeline, including the foreshore.

The terrestrial survey area, shown in Figure 2, was defined as the full circle to a radius of 5 km from site centre, this area is considered to encompass the main areas of potential deposition.

For direct radiation area, again shown in Figure 2, the survey aimed to cover individuals residing and working within 1 km of the site centre. As the population density was particularly sparse around the site, additional observations were also obtained just outside this 1 km area to include the residences visited during the 1999 survey for comparison.

2.3 Conduct of the survey

The fieldwork component of the survey was carried out during the period 11th - 24th July, 2003 by 3 members of staff from the CEFAS laboratory at Lowestoft, according to techniques as described by Leonard *et al* (1982).

On 14th July a meeting was arranged between the survey team and the UKAEA environmental monitoring manager. This served to provide details about site operations, including waste disposal, and information about potential pathways and activities in the area. Further information was sought about wildlife studies and pest control measures in and immediately around the site as these animals could act as vectors for transporting radioactive materials off-site and are also potential food items for some individuals.

People with a local knowledge of the survey area were contacted for information on any aspects relevant to the exposure pathways. These included the Fisheries Officer at Scrabster, individuals connected with the local inshore fishing industry, farmers, keen gardeners and the local beekeeping organisation. Occupants of residences located within 1km of the site were interviewed about their times at home, both inside their properties and in their gardens.

Interviews were also conducted with people working and engaged in recreational activities within this area. In addition, all interviewees were asked questions relating to exposure from aquatic and terrestrial pathways. Gamma dose rate measurements were taken inside and outside most of these properties. Gamma dose measurements were also taken around the site perimeter fence. For comparison, background readings were taken from outside the 5km survey area.

Interviews were used to establish individual's consumption rates and occupancy times relevant to all pathways and to obtain any general information of possible use to the survey. Using this information, a list of occupations and activities was built up to produce a picture of potential exposure pathways. Emphasis was placed on those individuals who were likely to be in the most exposed groups. These included commercial boat owners, boat and shore anglers, bait-diggers, gardeners, estate owners, farmers and individuals living close to the site.

2.4 Site activity

At the time of the survey the main activities taking place on the Dounreay UKAEA site were those of decontamination and dismantling of selected structures (e.g. the seawater pump house and fuel pond) and other work associated with decommissioning. Plans were being made for the removal of the contaminated material from the old solid waste disposal shaft and the removal of a layer of rock from inside it that may also be contaminated. The operations of AEA Technology on site are shortly to be terminated. Activities on site were considered by UKAEA to be normal in that nothing was occurring which might create abnormal levels (greater or lesser) of direct radiation.

Past investigation of the contamination of wildlife on site has included the analysis of rabbits, earthworms and seagull droppings. The results showed insignificant levels of radionuclides in the samples. Rabbit flesh had also been analysed again just prior to this survey, when

burrowing into the solid low-level waste pits had been noticed. Again, only traces of radionuclides were detected.

3. METHODS FOR DATA ANALYSIS

3.1 Data conversion

The data collected during the fieldwork were recorded in logbooks. Information on individuals' consumption and external exposure rates was assessed and entered into a database. Each individual for whom information was obtained was given a unique identifier (the Observation Number) to assist in data sorting. Consumption data were converted to consumption rates in kilograms per year (wet weight) of locally produced food and litres per year for milk. Where interviewees were unable to provide consumption rates in weight per year, they were asked to estimate the number of units, e.g. the average number of eggs consumed per week. In a limited number of cases, annual consumption was supplied in other quantities, for example the number of plants on which the yield was grown or the length and number of rows in which the crop was grown. These data were converted to approximate consumption rates, in kilograms per year, using published produce weights (e.g. Hessayon, 1997 and Good Housekeeping, 1994), edible fraction data researched by CEFAS and information supplied by the Beef and Livestock Commission. For the purpose of data analysis, foodstuffs were aggregated into food groups; the typical food groups used in surveys are shown in Table 1. All consumption and occupancy data in the text are rounded to 2 significant figures. In the tables and annexes the data are usually presented to 1 decimal place; the exceptions are for values less than 0.05 which are presented to 2 decimal places in order to avoid them appearing as 0.0. External exposure times are quoted as integers.

3.2 Determination of critical groups

The critical group is determined by assessing doses that are representative of the most exposed individuals. The group will change according to the assessment being undertaken. Each assessment will have associated concentrations and/or dose rates distributed in space and time. This survey provides information that can be used to help define the critical group in an assessment but it does not constitute an assessment in itself.

The habits data are structured into groups of food items or substrate types with similar attributes. For example, when considering terrestrial food consumption, all types of root vegetables are grouped together in a food group called 'root vegetables'. Similarly, for aquatic food consumption, all mollusc species are grouped as 'molluscs'. For external exposure over intertidal sediments, occupancy over a common substrate, (for example, sand) is chosen. The choice of a group of activities is made when it is reasonable to assume that consistent concentrations or dose rates would apply within the group. In addition to grouping of activities, ingestion data are structured into age groups; from 0 to 1.0 y of age (called 3 months); more than 1.0 y to 2.0 y (called 1 year old); more than 2.0 y to 7.0 y (called 5 year old); more than 7.0 y to 12.0 y (called 10 year old); more than 12.0 y to 17.0 y (called 15 year old); because different dose coefficients can apply to different ages. Children over 17 are treated as adults. These age groupings are consistent with those used by the ICRP 72 (1996).

Ingestion pathways

Consumption rate data are presented for individuals and are further characterised in 2 ways to represent high rate consumers in each food and age group. Firstly, the 97.5 percentile rate is calculated from the observed data, for each of the food groups where consumption occurred, using the Excel mathematical function for calculating percentiles. This 97.5 percentile rate is calculated for all age groups where consumption was noted. Secondly, the 'cut-off' method described by Hunt *et al* (1982) is used for each age group's observations for each of the food groups where consumption occurred. In this case the rate representing high rate consumers is calculated by taking the arithmetic mean of the maximum value and all consumption rates observed within a factor of 3 of the maximum value (termed the lower threshold value). It accords with the principle expressed by ICRP (ICRP 42, 1984) that the critical group should be small enough to be reasonably homogeneous with respect to age, diet and those aspects of behaviour that affect the doses received.

In exceptional cases the 'cut-off' method can result in only 1 member in the high rate group. In this case, judgement is used as to whether to include other individuals within the group. If it is decided appropriate to include other individuals, the next highest suitable observation is used to set the lower threshold but the top value is still included in the mean. CEFAS have called the rate derived by the cut-off method the critical group rate for ease of presentation though the term is not strictly correct. This is because the critical group can only be established when doses are determined taking into account all pathways.

Consumption data for aquatic foodstuffs are presented for adults in Tables 2, 3 and 4, and for children in Tables 5 and 6 and they are summarised in Tables 7 to 11. For purpose of comparison, values for 97.5 percentile and mean consumption rates based on national data, referred to as 'generic' rates in this report, are shown for aquatic foodstuffs for adults, 15 and 10 year old children (no generic data were available for the 5 and 1 year old children). Consumption data for terrestrial foodstuffs are presented for adults in Tables 12 to 27, and for children in Tables 28 to 39. Again, for purpose of comparison, values for 97.5 percentile consumption rates based on national data are shown for terrestrial foodstuffs for adults, 15 and 10 year old children in Tables 7, 8 and 9 respectively.

The critical group rate has been calculated from the survey data for children. However, because few child consumers were identified the method should be viewed with caution. For assessment purposes, a theoretical approach may be taken where survey rate data for children's age groups are absent or limited. This involves taking the rates for adults, provided in Table 7, and scaling them by ratios shown in Table 40. The ratios have been calculated using generic 97.5 percentile consumption rates determined by MAFF and FSA (Byrom *et al* 1995 and FSA, 2002) for adults, 15 year olds, 10 year olds and children aged 6 – 12 months.

External exposure in intertidal areas

A similar approach is used for occupancy and handling rates in intertidal areas (Tables 41 and 42 respectively). 97.5 percentile rates and critical group rates are determined for groups

of activities or substrates with common attributes. In previous surveys a factor of 1.5, instead of 3, was used to define the cut-off value for intertidal occupancy and handling. However, it is now considered appropriate that the same factor as for consumption is used. The factor reflects variations in the doses likely to be received due to natural variations in the interactions of radiations with tissues caused by, for example, differences in anatomy.

Direct radiation exposure

Data for the direct radiation pathway in the 1 km zone are left in their detailed form for each individual at each location. Grouping of these data is not helpful at this stage in the assessment process when there is no definitive measurement or prediction of dose rate due to external radiation from the site. These data are presented in Table 43.

A summary of consumption, occupancy, and handling rates for adults and children are presented in Annex 1 and Annex 2 respectively.

4. AQUATIC RADIATION PATHWAYS

4.1 Aquatic survey area

Dunnet Head to Castletown

Dunnet Head is a prominent headland with cliffs in excess of 100 metres above sea level. Access to the sea is extremely limited with only a few scores (steps hewn into the rock) leading to the rocky shoreline below. In view of the dangers of descent and ascent it is doubtful whether much shore angling takes place around the base of this headland other than by boat. On the east of the headland is the village of Brough where a small natural harbour is located which was occasionally used by boat anglers and people involved with potting (termed 'creeling' in Scotland) for crabs and lobsters on a part-time basis. The inshore area around the headland was also a popular potting location for some commercial fishermen whose boats were moored in Dunnet or Scrabster harbours. Bag nets were being operated from the Dunnet salmon station.

To the west of the headland is Dunnet Bay beach which is approximately 3 km in length and composed mainly of fine sand. It was a popular venue for both tourists and local residents who used it for sunbathing, games, swimming, diving, wind surfing, canoeing, angling and bait digging. Camping for tents and caravans was available at this location. Walks around the local coastal areas were organised about twice a year by the Highland Coastal Ranger, whose lodge was located between the camping park and the beach.

West of Dunnet Bay beach is the town of Castletown which has a small harbour used by a few angling and potting boats. One registered full-time potting fisherman was operating his boat from this location during the survey period. The coastline is rocky around this locality and winkles were observed in the area. There was a licensed salmon station at Castletown but this had not been in operation so far this season.

Castletown to Thurso

The stretch of shoreline between Castletown and Thurso is approximately 9 km in extent and is mainly rocky with a small sandy beach at Murkle. With the exception of 2 or 3 rough tracks, access to the shoreline was very limited unless lengthy walks across private land were undertaken.

Thurso shares the same name as the river that flows through it. The river estuary was frequently used as a harbour by some of the boats fishing in the locality. The town has a small sandy beach that was used for the same types of activities as those identified at Dunnet Bay beach. Thurso East Mains is a small village located 0.5 km further downstream on the east shore of the estuary. A salmon drift netting station was operating here this year and commercial winkle collection was also observed here. As was the case for all the rivers in the survey area, angling on all lengths of the River Thurso (mainly for salmon) was a popular pursuit with both local and visiting anglers.

Thurso to Holburn Head

Approximately 1.5 km north west of Thurso is the fishing town of Scrabster. Between these 2 towns is another small beach area, consisting of a mixture of sand and mud. The only activities noted here were walking and dog walking. Scrabster harbour is the main base for the local fishing fleet and it is frequently used by larger offshore vessels for landing catches. Fish and crustaceans are landed here, with most of the latter being loaded directly into Spanish and French lorries on the harbourside for immediate export.

From Scrabster to Holburn Head the shoreline is natural flat stepped rock that makes the area popular with anglers.

Holburn Head to Crosskirk Bay

Holburn Head to Crosskirk Bay covers approximately 8 km of coastline. With the exception of a farm track at Middleton leading to Brims Ness, access to the shore again involved long walks across private land. The shoreline was rocky and difficult to negotiate on foot. Although nobody was observed at Brims Ness the survey team was told it was a location used by winkle collectors on occasions.

Two kilometres further west the Forss Water enters the sea in Crosskirk Bay where the shoreline substrate consisted mainly of large boulders, with a small sheltered, sandy beach. Again, salmon anglers regularly visited the river during the angling season. A commercial winkle collector was observed and interviewed here.

Crosskirk Bay to Sandside Bay

As with previous sections of coastline, access to the shoreline to the east of Sandside beach was difficult, involving crossing several fields and negotiating barbed wire fences. The coastline is again rocky and difficult to traverse and, with the exception of walking (above the foreshore), no activities were observed. The UKAEA establishment extended along approximately 1 km of this coastline. To the west and east of the site are steep cliffs containing geos (rocky clefts in the rock) where spume and sludge accumulates which could be of potential radiological significance. Again, public access to these geos was limited and would only be possible with extreme care. During the survey, Oigin's Geo was visited and no evidence was noted that would suggest frequent occupancy by members of the public. One individual interviewed said that his family fished at this location for a few hours per year. The presence of winkles was investigated but none were observed.

Inside the Dounreay site, the area of foreshore incorporates a small beach. Since 1983 sand-grain sized fragments of irradiated fuel have been regularly detected on the beach, by UKAEA staff, and offshore, by site contracted divers. These fragments were considered to pose a

realistic hazard to any individual using the beach and the immediate offshore area. In October 1997 the frequency with which these fragments of irradiated fuel were being detected prompted the then Scottish Office to impose a comprehensive fishing restriction up to a radius of 2 km from the pipeline outlet. This restriction was still in force at the time of this survey.

Three kilometres west of the UKAEA site is Sandside. Fragments of irradiated nuclear fuel have been detected and removed from this beach. Notices have been erected by the estate warning potential beach users of the possible hazard. During 2003 UKAEA were monitoring the entire beach over the course of each month, using a purpose built monitoring vehicle. At the time of this survey, 19 fragments had been found since 1st January 2003 out of a total number of 41 since the commencement of Sandside beach monitoring. At the request of SEPA, particular attention, by the survey team, was focused on public activities occurring here.

Located to the north of Sandside beach, close to the village of Fresgoe is Sandside harbour in which a commercial potting boat and an angling boat were based.

Sandside Head to Portskerra

Access to the coastline between Sandside Head and Melvich Bay (approximately 7 km) is again difficult with no vehicular access and steep cliffs to negotiate leading down to boulders and rocks. On the occasions survey staff visited this section of coastline, observations for walkers and families relaxing on Melvich beach were recorded.

Melvich Bay receives water from the Halladale River, which contained salmon and sea trout. The entire river length together with the licensed salmon fishing station at Portskerra was owned by the Sain Partnership.

Portskerra has a small natural harbour and a concrete pier, both offering shelter to the small part-time boats fishing the area. Two boats were noted working out of this location during the

survey. Portskerra harbour was another popular shore angling location as vehicular access was good. An angler who was interviewed here said that anglers fishing this spot generally had satisfactory catches.

Portskerra to Armadale Bay

The entire coastline between Portskerra and the west side of Strathy Point was particularly rugged. Some intrepid individuals do descend to the base of Strathy Point to fish, following sheep tracks and natural clefts and some angling was reported from the beach in Strathy Bay. However, few anglers were observed at these locations during the survey.

Potting is practised around the point by the boat based at Sandside harbour and another based in the natural harbour sheltered by Boursa Island. Other natural harbours are present around the point and one of these is used as a base for the boat used to operate the licensed Strathy Point salmon station.

The River Strathy, flowing into Strathy Bay, is another river in the survey area which had an annual salmon run.

From Strathy Point to the limit of the survey area, Armadale, the coastline is composed of steep cliffs which appeared inaccessible for most recreational pursuits. There was another small beach in Armadale Bay which was deserted on the occasions the survey team visited this location other than the team who operated the licensed salmon station located here.

4.2 Commercial fisheries

Crustaceans

The main commercial fishery in the survey area was fishing for edible crabs, lobsters and velvet swimming crabs using creels (pots) from fishing vessels of less than ten metres in length. Most individuals worked on a full-time basis out of Scrabster harbour although a few fishermen also operated from the smaller harbours of Boursa, Portskerra, Sandside, Castletown and Dunnet. In addition to the inshore fleet, Scrabster was also used by larger fishing vessels, which fished much further afield.

The survey team was informed by local fishermen and a member of staff at the Harbour Office that a large proportion of the crustacean catch landed at Scrabster was caught by the larger offshore boats working as far afield as the Orkney Isles. The remainder of the catch, landed by the smaller fishing vessels, probably less than 20% of the total landings, was caught in approximately equal quantities from the 2 – 10 km section of coastline and 10 – 20 km section of coastline. The favoured potting areas are shown in Figure 1.

Crustacean fishing took place all year round. During the warmer months the fishermen generally positioned their creels close inshore moving them further offshore with the approach of winter.

Fish

Very little netting or trawling for fish species occurred within the 20 km survey area because fish in commercial quantities were scarce and the density of creels inshore would have made trawling particularly difficult. It can be considered for the purposes of the survey that other than fish caught by angling and hand-lining the fish landed at Scrabster came from outside the survey area.

The commercial salmon and sea trout fishing season was from 11th February to 26th August, however the majority of nets were not deployed until April or May due to unpredictable weather conditions. No fishing was allowed during weekends in order to allow the salmonids to enter the rivers unobstructed. With the exception of the Thurso East Mains salmon station, fishing was carried out using bag nets which were set singly or as a number connected to form a line stretching seaward from the shore. The working bag net salmon stations were located at Armadale, Strathy, Portskerra, and Dunnet. Those at Sandside Bay and Castletown were not being operated during the 2003 season. The fishery at Thurso East Mains used a drift net worked between 2 fishermen in an anchored boat and another 2 on the shore. The majority of the salmon caught were sent to Aberdeen and Billingsgate for sale, although a small percentage was sold locally to individuals and hotels.

Molluscs

Commercial collection of winkles was noted in the survey area. Collectors were observed and interviewed at Thurso East Mains and Crosskirk Bay. The main winkle wholesaler in the area was interviewed and he informed the survey team that of his annual turnover for these molluscs of 100+ tonnes, only possibly 4 to 5 tonnes came from within the survey area. He said that areas where commercial collection occurred inside the survey area included Dunnet, Thurso East Mains, East Murkle and West Murkle (all in the 10 to 20 km zone). However, commercial collection was also observed at Crosskirk and the team was informed by a resident of Fresgoe, a village which overlooks Sandside Bay, that regular commercial collection occurred from the western rocky foreshore of the bay (both locations being inside the 2 to 10 km zone) . In addition to winkles, small quantities of whelks were caught in the survey area as a by-catch of the boats potting for crustaceans. These were sold to a buyer outside the survey area.

4.3 Angling

Angling was popular along most of the accessible areas of foreshore in the survey area and the rivers flowing into it. The rivers were fished mainly for salmon and sea trout. The main species caught from the foreshore were mackerel, bass, pollack and codling. In addition to shore angling there were several keen boat anglers who fished within the survey area. They caught haddock and ling in addition to the species caught from the shore. Two charter angling boats, which occasionally took out parties of visiting anglers, were birthed in Scrabster harbour.

4.4 Seafood wholesalers and retailers

Wholesalers and retailers were interviewed to assess the distribution and consumption pathways of local seafood. As stated previously, only a very small proportion of the commercially caught fish would have been caught from within the survey area. Most of the fish landed was taken to Aberdeen and Petershead for sale although some was auctioned at Scrabster for local consumption. The bulk of the crustacean catch was loaded directly into Spanish and French lorries for immediate export, although some lobsters and crabs were also retailed through local fishmongers and hotels. One wholesaler bought the majority of winkles collected in the Caithness area which he estimated was approximately 100 tonnes per year, of which only 4 to 5 tonnes would have been collected from within the survey area. These were then exported to French and Spanish companies.

4.5 Internal exposure

Adult consumption rates

N.B. Critical groups and critical group consumption rates can only be established once a dose assessment using environmental monitoring data has been undertaken. As described in section 3.2 the terms are only used here for ease of presentation.

Consumption rate data for adults of fish, crustaceans and molluscs are shown in Tables 2, 3 and 4 respectively and are summarised in Table 7. The main consumers of seafood from the Dounreay survey area were commercial fishermen and anglers together with their families.
The main species of fish consumed by adults were cod, haddock and salmon. A critical group of 14 individuals was identified with a maximum consumption rate of 52 kg/y and a mean of 30 kg/y. The observed 97.5 percentile rate based on 80 observations was 44 kg/y. This compares with the adult generic mean and 97.5 percentile consumption rates for fish of 15 kg/y and 40 kg/y respectively. Critical group fish consumption consisted of a mix of 57% cod, 24% salmon, 10% haddock, 5% sea trout, 3% ling and 1% mackerel.

The species of crustaceans consumed by adults were lobsters and edible crabs. A critical group of 12 individuals was identified with a maximum consumption rate of 14 kg/y and a mean of 8.9 kg/y. The observed 97.5 percentile rate based on 34 observations was 12 kg/y. This compares with the adult generic mean and 97.5 percentile consumption rates for crustaceans of 3.5 kg/y and 10 kg/y respectively. Critical group crustacean consumption consisted of a mix of 53% lobster and 47% edible crab.

Mollusc consumption in the survey area was minimal with only tiny amounts of mussels and winkles being eaten. A critical group of 2 individuals was identified with a maximum consumption rate of 0.70 kg/y and a mean of 0.50 kg/y. The observed 97.5 percentile rate based on 6 observations was 0.65 kg/y. This compares with the adult generic mean and 97.5 percentile consumption rates for molluscs of 3.5 kg/y and 10 kg/y respectively.

Children's consumption rates

Consumption rate data for children for fish and crustaceans are shown in Tables 5 and 6 respectively and are summarised in Tables 8 to 11. No children in the 3 month old age group

and only 1 child in the 1 year old age group were noted to be consuming locally caught seafood. No children were identified who consumed molluscs.

15 year old age group

For fish, a critical group of 2 individuals was identified with a maximum consumption rate of 30 kg/y and a mean of 30 kg/y. The observed 97.5 percentile rate based on 11 observations was 30 kg/y. This compares with the generic mean and 97.5 percentile consumption rates for fish of 6.5 kg/y and 20 kg/y respectively.

For crustaceans, a critical group of 2 individuals was identified with a maximum consumption rate of 5.4 kg/y and a mean of 3.6 kg/y. The observed 97.5 percentile rate based on 3 observations was 5.3 kg/y. This compares with the generic mean and 97.5 percentile consumption rates for crustaceans of 2.5 kg/y and 6 kg/y respectively.

10 year old age group

For fish, a critical group of 2 individuals was identified with a maximum consumption rate of 6.5 kg/y and a mean of 4.2 kg/y. The observed 97.5 percentile rate based on 2 observations was 6.4 kg/y. This compares with the generic mean and 97.5 percentile consumption rates for fish of 6 kg/y and 20 kg/y respectively.

For crustaceans, a single child was consuming at a rate of 5.7 kg/y. This compares with the generic mean and 97.5 percentile consumption rates for crustaceans of 2.5 kg/y and 7 kg/y respectively.

5 year old age group

For fish, a critical group of 3 individuals was identified with a maximum consumption rate of 12 kg/y and a mean of 6.2 kg/y. The observed 97.5 percentile rate based on 3 observations was 11 kg/y. No generic consumption rates have been derived by FSA for this age group.

For crustaceans, a single child was consuming at a rate of 5.7 kg/y. No generic consumption rates have been derived by FSA for this age group.

1 year old age group

No fish consumption was noted for this age group.

For crustaceans, a single child was consuming at a rate of 2.9 kg/y. No generic consumption rates have been derived by FSA for this age group.

The use of seaweed as a fertiliser

The survey investigated the use of seaweed as a fertiliser and soil conditioner pathway. Although some people had used it in the past for edible crops, nobody was identified who currently used it for this purpose. One individual said that she used seaweed fertiliser in small quantities on her flower garden.

4.6 External exposure

Intertidal occupancy

External exposure from artificial radiation to members of the public who frequent intertidal areas depends on the occupancy time and dose rate after subtraction of an appropriate value for natural background radiation. Dose rates over mud and saltmarsh have a potential for

being higher than those over coarser substrates due to their finer grain size and consequent ability to adsorb radioactivity to a greater extent. Consequently occupancy times over these substrates are considered to be radiologically more important than similar times over other substrates. Estimates of natural backgrounds used by CEFAS for assessing doses to individuals (EA, EHS, FSA and SEPA, 2003) are 0.05 micro Gy/h for sandy substrates, 0.07 micro Gy/h for mud and saltmarsh and 0.06 micro Gy/h for all other substrates.

The predominant substrate materials in the intertidal areas of the survey area were rock, sand and a mixture of sand and stones.

Intertidal activities observed during the survey included walking, dog walking, mollusc collection, bait digging, angling, beach combing, commercial fishing gear handling, horse riding, sunbathing, wind surfing and shore diving.

SEPA requested that the survey team pay particular attention to activities occurring on Sandside beach. It was visited every day during the survey by at least one of the team and several activities were noted. At the time of the survey prominent posters had been erected by the Sandside Estate warning the public that radioactive particles were being found there. These posters probably had a deterring effect on locals and tourists alike who would otherwise have made more frequent use of the beach for recreational purposes.

Activities noted were dog walking and walking (one local walker said that he rarely wore shoes on the beach), angling, swimming, snorkelling, sunbathing and surfing. The majority of these people were local as apposed to tourists. Two individuals were interviewed who surfed regularly from most of the local beaches including Sandside. One of them also used Sandside as a venue for swimming and snorkelling. Although not observed during the fieldwork period, the team was informed that commercial winkle collection regularly took place amongst the rocks on the west side of Sandside Bay. There were no observations of picnicking or barbequing and no children younger than 8 years old were seen at this location.

Gamma dose rate measurements were taken at selected locations, shown in Table 44, to supplement those of SEPA's scheduled monitoring programme.

Table 41 lists the intertidal occupancy rates observed, grouped by substrate. Commercial salmon netsmen and winkle collectors formed the critical group for occupancy over rocky areas. A mean time of 530 h/y was identified for 4 individuals and a maximum rate of 780 h/y for one of the mollusc collectors. An angler, dog walkers and walkers formed the critical group for occupancy over sand, with a mean rate of 300 h/y for 17 individuals and a maximum rate of 470 h/y for the angler. Dog walkers and walkers formed the critical group over sand and stones, with a mean rate of 100 h/y for 5 individuals and a maximum rate of also 100 h/y for the dog walkers.

Handling

Handling sediment while bait digging, mollusc collecting or handling commercial fishing gear can give rise to skin exposure from beta radiation. This needs consideration even though the annual dose limit for skin is a factor of 50 times higher than that for effective dose. There is also a contribution to effective dose due to skin exposure (ICRP 60, 1991).

Beta dose rate measurements were taken over salmon nets, ropes and lobster pots which had been recently brought ashore after long periods of immersion in the survey area, but no levels above background levels were detected.

Table 42 shows the observations made during this survey for times spent handling sediment and commercial fishing gear.

A mean critical group sediment handling rate of 760 h/y was identified for 2 individuals, who were winkle collectors, with a maximum rate of 780 h/y. A mean critical group fishing gear handling rate of 1500 h/y was identified for 9 individuals, with a maximum rate of 2000 h/y.

These provide quantitative data that might be of use in the probabilistic assessment of dose and/or risk to individuals via radiological pathways. Pathways to consider include individuals who may inhale re-suspended radioactivity in sea spray, inadvertently ingest contaminated seawater and/or have contact with and/or inadvertently ingest contaminated sediments while undertaking coastal area activities such as angling, walking, sailing, bait digging and water sports.

5. TERRESTRIAL RADIATION PATHWAYS

5.1 Terrestrial survey area and local produce

Farms and residences were visited in the 5 km area shown circled in Figure 2. Farming in the area was predominantly beef and lamb production, with one farmer also producing 50 chickens per year. Seven farmers and their families were found to retain and consume lamb. One of these families also consumed beef. The farmer rearing chickens killed 12 per year for the household's consumption. Most lambs and cattle were sold at the local market in Thurso to buyers from outside the survey area. With the exception of small amounts of beef bought by a butcher in Thurso, the remainder was sold to markets in Aberdeen, Perth and Quoybrae as well as to private farmers around Aberdeen and the Borders. Several farms kept hens for egg production. The eggs were either consumed by the family or sold directly from the farm to local customers. No dairy herds or pig farms were identified.

The crops produced on farms were mainly used for winter feed for the livestock. Typically these were grass (for grazing, hay and silage), swedes, turnips, barley and oats. A few farmers sold crops for animal feed to other farmers in the area. Potatoes were grown on a commercial basis at one farm and these were sold both directly to local customers and to a grocer in Thurso. Two farmers sold oats for milling to a company in Wick. Many farmers also grew cabbages and carrots which they consumed themselves, together with some of their potatoes, swedes and turnips.

Private houses growing fruit and vegetables were noted. In addition to the more commonly grown potatoes, swede and turnips, domestic crops such as soft fruits, varieties of beans, onions, salad vegetables, herbs and apples were grown. A few households or smallholdings were consuming chicken eggs and in one case chicken meat.

Although it had been used in the past, no evidence was found of seaweed currently being used as fertiliser for edible crops.

Seven beekeepers were identified within the survey area. The number of hives per beekeeper ranged from 1 to 15 and the average hive produced about 18 kg of honey per year. Excess honey was sold locally or given to family and friends.

Consumption of wild foods by individuals interviewed during the survey was limited. Mushrooms, blackberries, rowanberries and elderflower were consumed on a small scale. Elderflowers were consumed in such small quantities, they have not been considered further in the report. Nine households were found to be consuming game including pheasants, grouse, woodcock, duck, goose, rabbit and venison.

One household was identified which drank from a private spring-fed well and another household used well water for watering their vegetable garden. At three farms in the area, livestock had access to spring, stream or well water in addition to mains water.

Freshwater fish (brown trout) were consumed by two consumers on a small scale.

Butchers, bakers and grocers in Thurso were visited. One butcher sold some local honey.

5.2 Novel radiation pathways

The survey team spent time investigating unusual pathways such as peat cutting, tide washed turf cutting, the use of seaweed and beach sand and unusual food types. Nothing of note was identified. No livestock were observed on the foreshore at any location, therefore it is very unlikely that seaweed would be part of their diet.

5.3 Land cover

Figure 3 shows the land cover in the survey area. The figure is reproduced from a land cover map produced by Macaulay Land Use Research Institute, with their consent.

A large proportion of the area was improved grassland containing areas of smooth grassland to support sheep and cattle for meat production. Near the coast, east and west of the site were strips of undifferentiated coarse grassland. There were also pockets of heather moor, peatland vegetation, coniferous and deciduous woodland and a small patch of wetland contained within the improved grassland.

5.4 Internal exposure

Farms and homes visited during the survey are shown in Figure 2. The percentage contribution each food type makes to its terrestrial food group (where they have multiple species) for adults is shown in Table 45. No consumption of local cereal crops was identified.

Adult consumption rates

Consumption rate data for adults are shown in the food groups where consumption occurred in Tables 12 to 27 and are summarised in Table 7. Consumption of terrestrial foods in the following 16 food groups was identified: green vegetables, other vegetables, root vegetables, potatoes, domestic fruit, milk (goat), cattle meat, sheep meat, poultry, eggs, wild/free foods, honey, wild fungi, rabbits/hares, venison and freshwater fish (brown trout). No consumption was identified for pig meat.

Six critical group mean consumption rates exceeded the generic 97.5 percentile rates. These were for green vegetables, other vegetables, root vegetables, domestic fruit, sheep meat and eggs. A further 5 critical group mean consumption rates exceeded the generic means. These were for potatoes, milk (goat), cattle meat, poultry and honey. Four critical group mean consumption rates were less than the generic means. These were for wild/free foods, rabbits/hares, wild fungi and freshwater fish. The observed 97.5 percentile consumption rates for green vegetables, other vegetables, root vegetables, potatoes, domestic fruit, cattle meat, sheep meat, poultry, eggs and honey exceeded the generic 97.5 percentile consumption rates. There are currently no generic consumption data available for venison.

Children's consumption rates

Consumption rate data for children are shown in Tables 28 to 39 and are summarised in Tables 8 to 10. No children in the 3 month or 1 year old age groups were identified as consuming local terrestrial foods.

15 year old age group

Four children in this age group were identified to be eating locally produced terrestrial food. Consumption of terrestrial foods was identified in the following 9 food groups: other vegetables, root vegetables, potatoes, domestic fruit, sheep meat, poultry, eggs, rabbits/hares and wild fungi. No consumption was identified for the following food groups: green vegetables, milk, cattle meat, pig meat, wild/free foods, honey, venison and freshwater fish. No critical group mean consumption rates exceeded the generic 97.5 percentile consumption rates. The critical group mean consumption rates for other vegetables and potatoes were higher than their respective generic mean consumption rates. No observed 97.5 percentile consumption rate exceeded the generic 97.5 percentile consumption rate. No generic consumption rates had been determined by FSA for this age group for rabbits/hares.

10 year old age group

Five children in this age group were identified to be eating locally produced terrestrial food. Consumption of terrestrial foods was identified in the following 8 food groups: other vegetables, root vegetables, potatoes, domestic fruit, milk (goat), eggs, rabbits/hares and freshwater fish (brown trout). No consumption was identified for the following food groups: green vegetables, cattle meat, pig meat, sheep meat, poultry, wild/free foods, honey, wild fungi and venison. No critical group mean consumption rates exceeded the generic 97.5 percentile consumption rates. The critical mean consumption rates for milk (goat) and eggs were higher than their respective generic mean consumption rates. Only the observed 97.5

percentile consumption rate of eggs exceeded the generic 97.5 percentile consumption rate. No generic consumption rates had been determined by FSA for this age group for rabbits/hares.

5 year old age group

Three children in this age group were identified to be eating locally produced terrestrial food. Consumption of terrestrial foods was identified in the following 5 food groups: green vegetables, other vegetables, root vegetables, potatoes and eggs. No consumption was identified for the following food groups: domestic fruit, milk, cattle meat, pig meat, sheep meat, poultry, wild/free foods, rabbits/hares, honey, wild fungi, venison and freshwater fish. No generic consumption rates had been determined by FSA for this age group

5.5 Direct Radiation

The direct radiation survey sought to obtain information on the amount of time spent (indoors and outdoors) in hours per year of people living and/or working and/or pursuing leisure activities within 1km of the site centre. Occupancy due to employment associated with operations at Dounreay was not considered. These data are presented in Table 43. Associated gamma dose rates were also measured.

Direct radiation area characteristics

The Dounreay site is positioned on the coast, approximately 12 km west of Thurso. The area surrounding the site, with the exception of the rocky foreshore, was used for grazing of livestock. No public access to the foreshore in front of the site was possible, with the exception of experienced rock climbers or people travelling there by boat, because the perimeter fence went right to the edges of the steep rocky cliff face. A small number of dwellings and farms were located within the direct radiation survey area. The Dounreay visitors centre and an adjoining café were located approximately 600 metres from the site

perimeter. Commercial activities noted to take place within the 1 km direct radiation area were farming and staff working in a post office, the visitors centre and the cafe. The only leisure activities noted was that of flying model aircraft on the disused runway adjacent to the site by a local club on Sundays and 3 anglers who fished from rocks near Oigin's Geo for a few hours per year.

Occupancy times

Local residents and individuals were interviewed and their occupancy times within the 1km direct radiation survey area were recorded (Table 43). Data obtained included occupancy rates for the following activities: residential occupancy, farming, working in the visitors centre and the adjoining café and a post office, model aircraft enthusiasts using the disused runway next to the site and anglers. Most of the residents interviewed spent large amounts of time at home, or in the immediate vicinity. The greatest occupancy times recorded were 3 of 8500 h/y. These were for the 2 people working and living in the post office and another elderly resident living in the same village. Three other individuals had occupancy times in excess of 8000 h/y.

Gamma dose rate measurements

Gamma dose rate measurements, also shown in Table 43, were taken at most of the residences both inside and outside the properties, at intervals around the site perimeter fence, and also at remote locations from the site to obtain background dose rates. The measurements were generally low and almost indistinguishable from background.

The maximum site perimeter gamma dose rate measured was 0.132 micro Gy/h. The mean of the 11 gamma dose rate readings taken around the site perimeter was 0.105 micro Gy/h. This compares to the mean of the 3 background measurements taken remote from the site of 0.095 micro Gy/h. The maximum residential gamma dose rate measured inside a property was also 0.132 micro Gy/h and the maximum rate outside a property was 0.104 micro Gy/h.

6. COMBINED PATHWAYS

In determining habits data for the purposes of assessing radiological doses to the public, it may be necessary to consider a combination of pathways. CEFAS have provided data in Annexes 1 and 2 so that the full effect of combining pathways can be assessed for individual observations, given the concentrations and dose rates from a particular assessment. In some circumstances it will be possible to make simplifying assumptions, and define the consumption and external exposure rates appropriate to a series of potential critical groups. Such assumptions will depend on the assessment in question but some initial observations are provided here as a starting point for those undertaking assessments.

On the basis of the information in Annex 1, the most extensive combinations of pathways for adult dose assessment are shown in Table 46.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Survey findings

Exposure pathways were investigated for approximately 340 individuals. The survey considered pathways relating to 3 potential sources of exposure:

- Discharges of liquid radioactive waste to the Pentland Firth
- Discharges of gaseous radioactive waste to the atmosphere
- External radiation emitted directly from the site

The adult critical group mean consumption rates of seafood were:

- 30 kg/y for fish
- 8.9 kg/y for crustaceans
- 0.50 kg/y for molluscs

The main aquatic species consumed were cod, salmon, haddock, edible crabs and lobsters. Only very small amounts of molluscs (winkles and mussels) were eaten.

The critical group mean occupancy times over intertidal areas were:

- 530 h/y for rock
- 300 h/y for sand
- 100 h/y for sand and stones

Both fishing gear and sediment handling times were recorded; the critical group means were 1500 h/y and 760 h/y respectively.

The adult critical group mean consumption rates of terrestrial foods were:

- 53 kg/y for green vegetables
- 73 kg/y for other vegetables
- 69 kg/y for root vegetables
- 120 kg/y for potatoes
- 120 kg/y for domestic fruit
- 220 l/y for milk
- 35 kg/y for cattle meat
- 34 kg/y for sheep meat
- 19 kg/y for poultry
- 26 kg/y for eggs
- 1.6 kg/y for wild/free foods
- 4.5 kg/y for rabbits and hares
- 7.2 kg/y for honey
- 0.79 kg/y for wild fungi
- 43 kg/y for venison
- 0.35 kg/y for freshwater fish

The main terrestrial foods consumed were all 3 vegetable groups, potatoes, domestic fruit, sheep meat, poultry, eggs, honey and venison. Goat milk and cattle meat were also consumed in significant quantities, although by a small number of people. The percentage contribution each terrestrial food type made to its food group, which contain multiple species, is shown in Table 45.

Occupancy times of members of the public within 1km of the site were recorded. The highest occupancy times (indoor plus outdoor) were 8500 h/y.

7.2 Comparisons with previous surveys

The critical group mean consumption rates from within the survey area show an increase in the consumption rate for fish and a decrease in the consumption rates for crustaceans and molluscs when compared to the critical group mean consumption rates obtained from the 1999 survey. These were fish, 19 kg/y, crustaceans, 14 kg/y and molluscs 2.2 kg/y, compared to this survey's consumption rates of fish 30 kg/y, crustaceans 8.9 kg/y and molluscs 0.50 kg/y.

The 1999 survey identified a critical group mean intertidal occupancy over sand and rock substrates of 430 h/y. In this report the 2 substrates have been considered separately, occupancy rates of 530 and 300 h/y were identified for rock and sand respectively. The critical group over sand was composed of people doing similar activities to those of the 1999 critical group i.e. angling, walking and dog walking. Activities over rock this survey were commercial winkle collection and salmon netting. This survey also identified an occupancy rate over a mixture of sand and stones of 100 h/y. The 1999 survey critical group mean fishing gear handling time was 1800 h/y, compared to this survey's rate of 1500 h/y, and the critical group mean sediment handling time was 15 h/y, compared to this survey's rate of 760 h/y. The large increase in the latter pathway was due to 2 commercial winkle collectors being identified spending large amounts of time engaged in this activity.

For terrestrial food groups, the critical group consumption rates (kg/y) in the 2003 survey are tabulated below, together with those of the 1999 survey for ease of comparison:

	1999	2003
• Green vegetable	22	53
• Other vegetables	22	73
• Root vegetables	42	69
• Potatoes	110	120
• Domestic fruit	35	120

• Milk (goat)	280	220
• Cattle meat	50	35
• Pig meat	24	Nil
• Sheep meat	12	34
• Poultry	40	19
• Eggs	22	26
• Wild/free foods	3.2	1.6
• Rabbits/hares	8.3	4.5
• Honey	2.0	7.2
• Wild fungi	3.4	0.79
• Venison	66	43
• Freshwater fish	Nil	0.35

Consumption rates had increased in the following food groups: green vegetables, other vegetables, root vegetables, potatoes, domestic fruit, sheep meat, eggs, honey and freshwater fish (nil in 1999). Consumption rates had decreased in the following food groups: goat milk, cattle meat, pig meat (nil in 2003), poultry, wild/free foods, rabbits/hares, wild fungi and venison.

The food groups showing the most significant increases in consumption rates since 1999 were the green vegetables, other vegetables, root vegetables, domestic fruit, sheep meat and honey. The most significant decreases in consumption rates were noted for pig meat, poultry and venison.

In common with the 1999 direct radiation survey, this survey identified several individuals living in the Dounreay area who spent significant times within 1km of the site.

7.3 Recommendations for environmental monitoring

One important objective of habits surveys is to recommend any changes needed to the environmental monitoring programme.

The monitoring programme as reported in Radioactivity in Food and the Environment, 2002 (EA, EHS, FSA and SEPA, 2003) comprised sampling of sediments, seawater, seaweeds, spume and various seafoods (including crabs winkles and mussels) for aquatic pathways. Grass, soil and various foodstuffs (including wheat, potatoes, cabbage, nettles, cattle meat and sheep meat) were sampled for terrestrial pathways. Gamma dose rate measurements were taken at Sandside Bay (sand and mussel beds), Oigin's Geo (spume/sludge), Melvich (saltmarsh and sand), Strathy (sand), Thurso (riverbank), Achreregan Hill (soil), Strathy Park, Archvarasdal, Thurso Park (soil), Borrowston Mains (soil), east of Dounreay (soil) and Castletown harbour. Beta dose rate measurements were taken at Sandside Bay (sediment), Oigin's Geo (surface sediment) and Brimms Ness (surface sediment).

In view of the report's findings it is recommended that:

- The existing aquatic surveillance programme provides adequate coverage of the pathways identified in this survey with the exception of a marine fish species. An addition that could be considered for inclusion is an angler caught cod or haddock sample.
- Other additions for consideration are a whelk sample from a local potter and a mussel sample from the Thurso East Mains area.
- For research purposes, analysis of a sample of milk taken from 1 of the goat herds should be considered.
- For the terrestrial surveillance programme, adding a sample of game (venison and/or rabbits and/or pheasants) should be considered.

8. ACKNOWLEDGEMENTS

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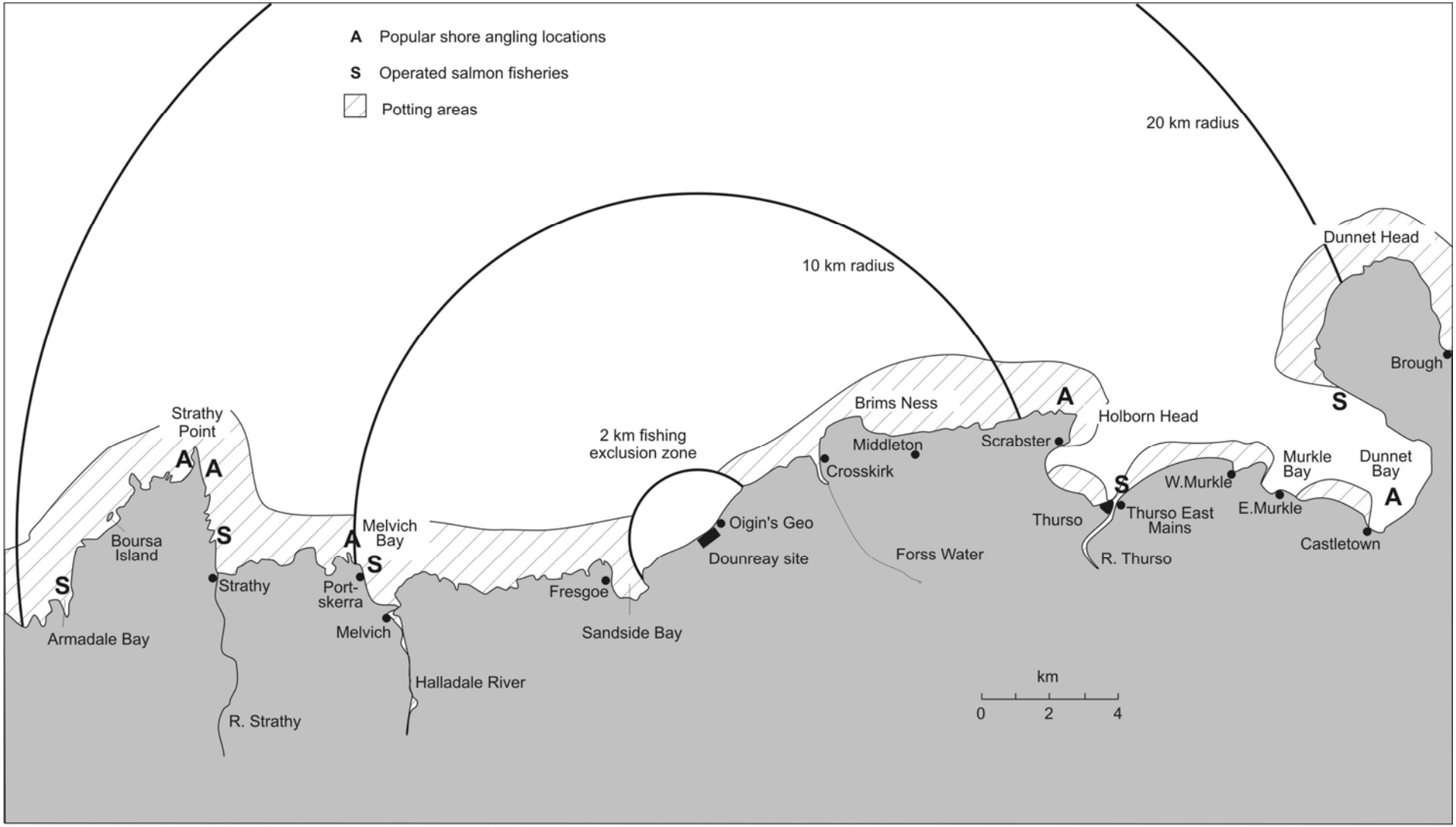

Figure 1. The Dounreay aquatic survey area.

Figure 2. The Dounreay terrestrial and direct radiation areas.

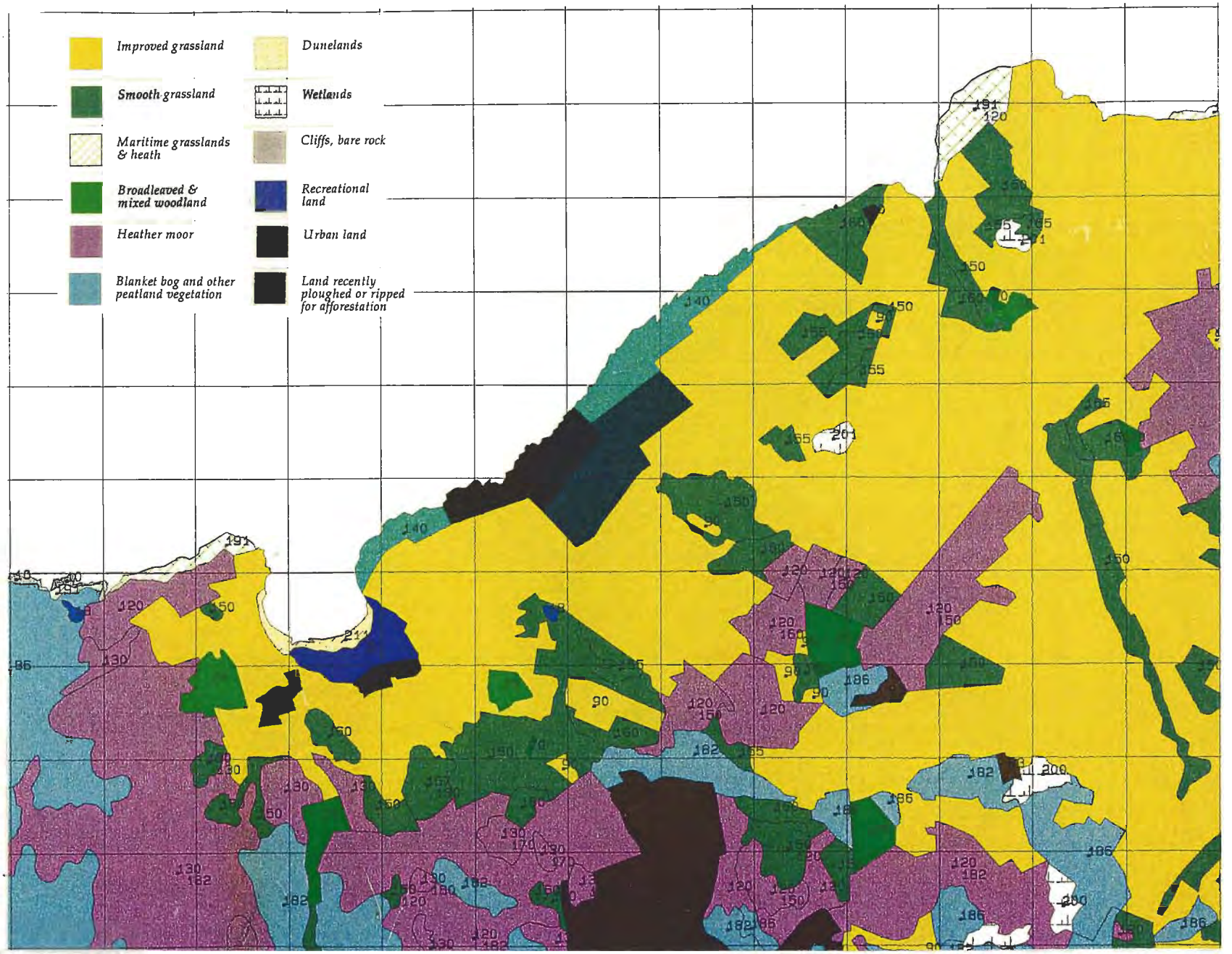

Figure 3. Land cover of survey area.

Base scale is 1:50000

Table 1. Typical food groups used in habits surveys

Green vegetables	Globe artichoke, asparagus, broccoli, brussel sprout, cabbage, calabrese, cauliflower, chard, courgettes, cucumber, gherkin, herbs, kale, leaf beet, lettuce, marrow, spinach
Other vegetables	Aubergine, broad bean, chilli pepper, french bean, mangetout, pea, pepper, runner bean, sweetcorn, tomato
Root vegetables	Jerusalem artichoke, beetroot, carrot, celeriac, celery, chicory, fennel, garlic, kohl rabi, leek, onion, parsnip, radish, shallot, spring onion, swede, turnip
Potato	
Domestic fruit	Apple, apricot, blackberry, blackcurrant, boysenberry, cherry, damson, fig, gooseberry, grapes, greengages, huckleberry, loganberry, melon, nectarines, peach, pear, plum, pumpkin, raspberry, redcurrants, rhubarb, rowanberry, strawberry, tayberry, whitecurrant
Milk	Milk, butter, cream, cheese, yoghurt, goats milk
Cattle meat †	
Pig meat †	
Sheep meat †	
Poultry	Chicken, duck, goose, grouse, guinea fowl, partridge, pheasant, pigeon, snipe, turkey, woodcock
Eggs	Chicken egg, duck egg, goose egg
Wild/free foods	Blackberry, blackcurrant, chestnut, crab apple, damson, dandelion root, elderberry, nettle, raspberry, rowanberry, samphire, sloe, strawberry, watercress, wild apple
Honey	
Wild Fungi	Mushrooms
Rabbits/Hare	Hare, rabbit
Venison †	
Fish (sea)	Bass, brill, cod, common ling, dab, Dover sole, flounder, gurnard, haddock, hake, herring, lemon sole, mackerel, monkfish, mullet, plaice, pollack, witch, saithe, salmon, sea trout, squid*, cuttlefish*, rays, turbot, whitebait, whiting
Fish (fresh water)	Brown trout, rainbow trout, perch, pike, salmon (river), eels
Crustaceans	Brown crab, spider crab, crawfish, lobster, *Nephrops*, squat lobster, prawn, shrimp
Molluscs	Cockles, limpets, mussels, oysters, queen scallop, razor shell, whelks, winkles

Notes:

* Although squid and cuttlefish are molluscs, radiologically they are more akin to fish.

† Including offal.

Table 2. Adult consumption rates (kg/y) of fish in the Dounreay area

Observation number	Bass	Cod	Ling	Haddock	Lemon Sole	Mackerel	Mixed fish	Plaice	Pollack	Saithe	Salmon	Sea Trout	Total
96		**29.5**									**22.0**		**51.5**
162		**33.0**	**6.0**	**1.0**		**0.6**					**3.9**		**44.5**
163		**33.0**	**6.0**	**1.0**							**3.9**		**43.9**
14		**31.1**									**2.6**		**33.7**
129 - 132		**9.8**		**9.8**							**9.8**		**29.5**
66, 92											**14.4**	**10.4**	**24.8**
99		**19.1**											**19.1**
79		**17.7**											**17.7**
55 - 56		**15.6**	**1.1**			**0.9**							**17.6**
222, 228											15.7		15.7
104 - 107				13.6							2.0		15.6
124 - 125											14.0		14.0
258				8.0	3.1								11.1
52 - 53							10.2						10.2
75 - 76							10.2						10.2
294 - 296		7.0		2.4		0.2							9.6
325 - 326								4.0			2.0	2.8	8.7
139											8.6		8.6
72 - 73	7.7												7.7
86 - 87		7.5											7.5
215									6.7				6.7
67 - 70		5.9											5.9
21 - 23											4.6		4.6
136 - 138									4.5				4.5
54											3.9		3.9
61 - 65											3.9		3.9
223 - 224				3.6									3.6
10 - 11						3.5							3.5
302		3.3											3.3
308 - 310											3.3		3.3
46		2.2				0.3				0.6			3.2
297 - 301				0.3							2.4		2.7

Table 2. Adult consumption rates (kg/y) of fish in the Dounreay area

Observation number	Bass	Cod	Ling	Haddock	Lemon Sole	Mackerel	Mixed fish	Plaice	Pollack	Saithe	Salmon	Sea Trout	Total
191											2.6		2.6
170 - 171											2.3		2.3
199 - 200				0.5		0.2					1.5		2.2
312											1.3		1.3
314 - 316											1.3		1.3
122 - 123		0.7				0.3							1.0
192												0.6	0.6

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the 14 highest adult consumers is 29.5 kg/y

The observed 97.5 percentile rate based on 80 observations is 43.9 kg/y

Table 3. Adult consumption rates (kg/y) of crustaceans in the Dounreay area

Observation number	Crab	Lobster	Total
79	**4.3**	**9.7**	**14.0**
80, 82	**5.4**	**6.1**	**11.5**
54, 61	**4.6**	**5.9**	**10.5**
67 - 70	**3.8**	**4.1**	**7.9**
71	**6.0**		**6.0**
258	**2.7**	**3.2**	**5.9**
139	**1.6**	**3.8**	**5.4**
90 - 91	3.6		3.6
51	2.0		2.0
325 - 326	0.5	1.3	1.8
328	1.6		1.6
239 - 241	1.1	0.2	1.4
99	0.8		0.8
122 - 123	0.4	0.3	0.7
162 - 163	0.7		0.7
66	0.3	0.3	0.7
92	0.3	0.3	0.7
294 - 296		0.3	0.3
14, 81, 94	0.3		0.3

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of crustaceans based on the 12 highest adult consumers is 8.9 kg/y
The observed 97.5 percentile rate based on 34 observations is 11.9 kg/y

Table 4. Adult consumption rates (kg/y) of molluscs in the Dounreay area

Observation number	Mussel	Winkle	Total
108	**0.7**		**0.7**
328		**0.3**	**0.3**
329		0.2	0.2
330		0.2	0.2
331		0.2	0.2
332		0.2	0.2

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of molluscs based on the 2 highest adult consumers is 0.5 kg/y
The observed 97.5 percentile rate based on 6 observations is 0.6 kg/y

Table 5. Children's consumption rates (kg/y) of fish in the Dounreay area

15 year old age group

Observation number	Age	Cod	Ling	Haddock	Mackerel	Mixed fish	Plaice	Salmon	Sea Trout	Total
134	**15**	**9.8**		**9.8**				**9.8**		**29.5**
133	**13**	**9.8**		**9.8**				**9.8**		**29.5**
327	12						4.0	2.0	2.8	8.7
141	12							8.6		8.6
57	13	7.8	0.3		0.2					8.3
89	15	7.5								7.5
88	12	7.5								7.5
16	13	2.9						1.6		4.4
311	14							3.3		3.3
17	14	2.9								2.9
201	14			0.5	0.2			1.3		2.0

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the 2 highest 15 year old age group consumers is 29.5 kg/y

The observed 97.5 percentile rate based on 11 observations is 29.5 kg/y

10 year old age group

Observation number	Age	Cod	Ling	Haddock	Mackerel	Mixed fish	Plaice	Salmon	Sea Trout	Total
58	**10**	**6.2**	**0.1**		**0.2**					**6.5**
202	**9**			**0.5**	**0.2**			**1.3**		**2.0**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the 2 highest 10 year old age group consumers is 4.2 kg/y

The observed 97.5 percentile rate based on 2 observations is 6.4 kg/y

Table 5. Children's consumption rates (kg/y) of fish in the Dounreay area

5 year old age group

Observation number	Age	Cod	Ling	Haddock	Mackerel	Mixed fish	Plaice	Salmon	Sea Trout	Total
135	**2**	**3.9**		**3.9**				**3.9**		**11.8**
77	**4**					**3.4**				**3.4**
78	**2**					**3.4**				**3.4**

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of fish based on the 3 highest 5 year old age group consumers is 6.2 kg/y

The observed 97.5 percentile rate based on 3 observations is 11.4 kg/y

Table 6. Children's consumption rates (kg/y) of crustaceans in the Dounreay area

15 year old age group

Observation number	Age	Crab	Lobster	Total
141	**12**	**1.6**	**3.8**	**5.4**
327	**12**	**0.5**	**1.3**	**1.8**
95	14	0.3		0.3

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of crustaceans based on the 2 highest 15 year old age group consumers is 3.6 kg/y
The observed 97.5 percentile rate based on 3 observations is 5.3 kg/y

10 year old age group

Observation number	Age	Crab	Lobster	Total
83	**7**	**2.7**	**3.0**	**5.7**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of crustaceans based on the highest 10 year old age group consumer is 5.7 kg/y

5 year old age group

Observation number	Age	Crab	Lobster	Total
84	**5**	**2.7**	**3.0**	**5.7**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of crustaceans based on the highest 5 year old age group consumer is 5.7 kg/y

1 year old age group

Observation number	Age	Crab	Lobster	Total
85	**1**	**1.4**	**1.5**	**2.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of crustaceans based on the highest 1 year old age group consumer is 2.9 kg/y

Table 7. Summary of adult's consumption rates (kg/y or l/y) in the Dounreay area

Food group	Number of observations	No. higher rate consumers	Observed maximum critical consumption rate	Observed lower critical consumption rate	Observed critical group mean consumption rate	Observed 97.5 %ile consumption rate	Generic mean consumption rate	Generic 97.5 %ile consumption rate
Fish	80	14	51.5	17.6	29.5	43.9	15.0	40.0
Crustaceans	34	12	14	5.4	8.9	11.9	3.5	10.0
Molluscs	6	2	0.7	0.3	0.5	0.6	3.5	10.0
Green vegetables	32	6	70.2	41.7	53.3	70.2	15.0	45.0
Other vegetables	26	4	97.0	48.5	72.8	97.0	20.0	50.0
Root vegetables	71	9	114.4	50.8	68.7	74.2	10.0	40.0
Potato	84	40	165.6	60.7	119.7	165.6	50.0	120.0
Domestic fruit	40	4	152.7	93.6	123.1	93.6	20.0	75.0
Milk (goat)	4	4	225.6	207.4	216.5	225.6	95.0	240.0
Cattle meat	4	4	47.3	23.6	35.4	47.3	15.0	45.0
Pig meat	NC	NC	NC	NC	NC	NC	15.0	40.0
Sheep meat	25	2	33.9	33.9	33.9	33.9	8.0	25.0
Poultry	30	11	36.1	12.3	18.9	36.1	10.0	30.0
Eggs	21	10	44.5	14.8	25.8	44.5	8.5	25.0
Wild/free foods	4	4	2.3	0.9	1.6	2.3	7.0	25.0
Rabbits/hares	13	11	7.9	2.7	4.5	7.9	6.0	15.0
Honey	27	9	13.6	4.5	7.2	13.6	2.5	9.5
Wild fungi	14	9	1.0	0.5	0.8	1.0	3.0	10.0
Venison	20	15	83.2	29.5	42.6	83.2	ND	ND
Fish (freshwater)	2	2	0.5	0.2	0.4	0.5	15.0	40.0

ND = not determined
NC = not consumed

Table 8. Summary of 15 year old children's consumption rates (kg/y or l/y) in the Dounreay area

Food group	Number of observations	No. higher rate consumers	Observed maximum critical consumption rate	Observed lower critical consumption rate	Observed critical group mean consumption rate	Observed 97.5 %ile consumption rate	Generic mean consumption rate	Generic 97.5 %ile consumption rate
Fish	11	2	29.5	29.5	29.5	29.5	6.5	20.0
Crustaceans	3	2	5.4	1.8	3.6	5.3	2.5	6.0
Green vegetables	NC	NC	NC	NC	NC	NC	9.0	25.0
Other vegetables	1	1	12.0	12.0	12.0	NA	10.0	30.0
Root vegetables	1	1	5.8	5.8	5.8	NA	7.5	20.0
Potato	2	2	100.0	42.5	71.2	98.6	60.0	130.0
Domestic fruit	1	1	5.7	5.7	5.7	NA	15.0	50.0
Milk (goat)	NC	NC	NC	NC	NC	NC	110.0	260.0
Cattle meat	NC	NC	NC	NC	NC	NC	15.0	35.0
Pig meat	NC	NC	NC	NC	NC	NC	10.0	30.0
Sheep meat	1	1	5.1	5.1	5.1	NA	5.5	15.0
Poultry	1	1	3.7	3.7	3.7	3.7	6.5	20.0
Eggs	1	1	3.0	3.0	3.0	NA	7.0	25.0
Wild/free foods	NC	NC	NC	NC	NC	NC	3.0	13.0
Rabbits/hares	1	1	0.2	0.2	0.2	NA	ND	ND
Honey	NC	NC	NC	NC	NC	NC	2.0	5.0
Wild fungi	1	1	0.8	0.8	0.8	NA	2.0	5.5
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Fish (freshwater)	NC	NC	NC	NC	NC	NC	6.5	20.0

ND = not determined
NC = not consumed
NA = not applicable

Table 9. Summary of 10 year old children's consumption rates (kg/y or l/y) in the Dounreay area

Food group	Number of observations	No. higher rate consumers	Observed maximum critical consumption rate	Observed lower critical consumption rate	Observed critical group mean consumption rate	Observed 97.5 %ile consumption rate	Generic mean consumption rate	Generic 97.5 %ile consumption rate
Fish	2	2	6.5	2	4.2	6.4	6.0	20.0
Crustaceans	1	1	5.7	5.7	5.7	NA	2.5	7.0
Green vegetables	NC	NC	NC	NC	NC	NC	6.0	20.0
Other vegetables	1	1	0.3	0.3	0.3	NA	8.0	25.0
Root vegetables	1	1	1.7	1.7	1.7	NA	6.0	20.0
Potato	1	1	25.4	25.4	25.4	NA	45.0	85.0
Domestic fruit	1	1	5.7	5.7	5.7	NA	15.0	50.0
Milk (goat)	1	1	207.4	207.4	207.4	NA	110.0	240.0
Cattle meat	NC	NC	NC	NC	NC	NC	15.0	30.0
Pig meat	NC	NC	NC	NC	NC	NC	8.5	25.0
Sheep meat	NC	NC	NC	NC	NC	NC	4.0	10.0
Poultry	NC	NC	NC	NC	NC	NC	5.5	15.0
Eggs	2	2	20.8	3.0	11.9	20.4	6.5	20.0
Wild/free foods	NC	NC	NC	NC	NC	NC	3.0	11.0
Rabbits/hares	1	1	0.2	0.2	0.2	NA	ND	ND
Honey	NC	NC	NC	NC	NC	NC	2.0	7.5
Wild fungi	NC	NC	NC	NC	NC	NC	1.5	4.5
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Fish (freshwater)	1	1	0.5	0.5	0.5	NA	6.0	20.0

ND = not determined
NC = not consumed
NA = not applicable

Table 10. Summary of 5 year old children's consumption rates (kg/y or l/y) in the Dounreay area

Food group	Number of observations	No. higher rate consumers	Observed maximum critical consumption rate	Observed lower critical consumption rate	Observed critical group mean consumption rate	Observed 97.5 %ile consumption rate	Generic mean consumption rate	Generic 97.5 %ile consumption rate
Fish	3	3	11.8	3.4	6.2	11.4	ND	ND
Crustaceans	1	1	5.7	5.7	5.7	NA	ND	ND
Green vegetables	1	1	2.0	2.0	2.0	NA	ND	ND
Other vegetables	1	1	0.3	0.3	0.3	NA	ND	ND
Root vegetables	2	2	7.6	1.7	4.7	7.5	ND	ND
Potato	1	1	25.4	25.4	25.4	NA	ND	ND
Domestic fruit	NC	NC	NC	NC	NC	NC	ND	ND
Milk (goat)	NC	NC	NC	NC	NC	NC	ND	ND
Cattle meat	NC	NC	NC	NC	NC	NC	ND	ND
Pig meat	NC	NC	NC	NC	NC	NC	ND	ND
Sheep meat	NC	NC	NC	NC	NC	NC	ND	ND
Poultry	NC	NC	NC	NC	NC	NC	ND	ND
Eggs	1	1	11.9	11.9	11.9	NA	ND	ND
Wild/free foods	NC	NC	NC	NC	NC	NC	ND	ND
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	NC	NC	NC	NC	NC	NC	ND	ND
Wild fungi	NC	NC	NC	NC	NC	NC	ND	ND
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Fish (freshwater)	NC	NC	NC	NC	NC	NC	ND	ND

ND = not determined
NC = not consumed
NA = not applicable

Table 11. Summary of 1 year old children's consumption rates (kg/y or l/y) in the Dounreay area

Food group	Number of observations	No. higher rate consumers	Observed maximum critical consumption rate	Observed lower critical consumption rate	Observed critical group mean consumption rate	Observed 97.5 %ile consumption rate	Generic mean consumption rate	Generic 97.5 %ile consumption rate
Crustaceans	1	1	2.9	2.9	2.9	NA	ND	ND
Green vegetables	NC	NC	NC	NC	NC	NC	ND	ND
Other vegetables	NC	NC	NC	NC	NC	NC	ND	ND
Root vegetables	NC	NC	NC	NC	NC	NC	ND	ND
Potato	NC	NC	NC	NC	NC	NC	ND	ND
Domestic fruit	NC	NC	NC	NC	NC	NC	ND	ND
Milk (goat)	NC	NC	NC	NC	NC	NC	ND	ND
Cattle meat	NC	NC	NC	NC	NC	NC	ND	ND
Pig meat	NC	NC	NC	NC	NC	NC	ND	ND
Sheep meat	NC	NC	NC	NC	NC	NC	ND	ND
Poultry	NC	NC	NC	NC	NC	NC	ND	ND
Eggs	NC	NC	NC	NC	NC	NC	ND	ND
Wild/free foods	NC	NC	NC	NC	NC	NC	ND	ND
Rabbits/hares	NC	NC	NC	NC	NC	NC	ND	ND
Honey	NC	NC	NC	NC	NC	NC	ND	ND
Wild fungi	NC	NC	NC	NC	NC	NC	ND	ND
Venison	NC	NC	NC	NC	NC	NC	ND	ND
Fish (freshwater)	NC	NC	NC	NC	NC	NC	ND	ND

ND = not determined
NC = not consumed
NA = not applicable

Table 12. Adult consumption rates (kg/y) of green vegetables in the Dounreay area

Observation number	Artichoke	Asparagus	Broccoli	Brussel sprout	Cabbage	Calabrese	Cauliflower	Chard	Courgettes	Cucumber	Herbs	Kale	Lettuce	Marrow	Rocket	Spinach	Water-cress	Total
66	**9.1**	**3.4**	**6.0**	**9.1**	**4.9**	**6.0**	**6.8**	**2.6**	**1.8**		**1.1**	**5.1**	**6.9**	**1.8**	**4.8**		**1.0**	**70.2**
92	**9.1**	**3.4**	**6.0**	**9.1**	**4.9**	**6.0**	**6.8**	**2.6**	**1.8**		**1.1**	**5.1**	**6.9**	**1.8**	**4.8**		**1.0**	**70.2**
222			**10.2**		**17.0**						**0.5**	**18.2**	**2.0**					**47.9**
228			**10.2**		**17.0**						**0.5**	**18.2**	**2.0**					**47.9**
217			**6.8**	**9.1**			**6.8**			**17.0**			**2.0**					**41.7**
220			**6.8**	**9.1**			**6.8**			**17.0**			**2.0**					**41.7**
162	3.6								0.5	8.5			2.0		0.8			15.3
163	3.6								0.5	8.5			2.0		0.8			15.3
122					15.0													15.0
123					15.0													15.0
93					9.7								0.7					10.4
97					9.7								0.7					10.4
98					9.7								0.7					10.4
206													4.5			5.1		9.6
262					8.5													8.5
263					8.5													8.5
214													6.0					6.0
216													6.0					6.0
227					5.1													5.1
233					5.1													5.1
264													3.0					3.0
265													3.0					3.0
256													2.4					2.4
257													2.4					2.4
242							2.0											2.0
243							2.0											2.0
244							2.0											2.0
268													0.6					0.6
269													0.6					0.6
270													0.6					0.6
47											0.2							0.2
48											0.2							0.2

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of green vegetables based on the 6 highest adult consumers is 53.3 kg/y

The observed 97.5 percentile rate based on 32 observations is 70.2 kg/y

Table 13. Adult consumption rates (kg/y) of other vegetables in the Dounreay area

Observation number	Broad bean	Chilli pepper	French bean	Mangetout	Pea	Pepper	Runner bean	Sweetcorn	Tomato	Total
66	**6.8**	**0.9**	**1.8**	**7.3**	**14.4**	**2.0**	**13.6**	**3.5**	**46.8**	**97.0**
92	**6.8**	**0.9**	**1.8**	**7.3**	**14.4**	**2.0**	**13.6**	**3.5**	**46.8**	**97.0**
162	**3.6**					**4.9**			**40.0**	**48.5**
163	**3.6**					**4.9**			**40.0**	**48.5**
222	0.6					0.5			19.8	20.9
228	0.6					0.5			19.8	20.9
264	7.5				10.4		1.0			18.9
265	7.5				10.4		1.0			18.9
81									12.0	12.0
94									12.0	12.0
122									11.3	11.3
123									11.3	11.3
31									10.8	10.8
34									10.8	10.8
168									10.2	10.2
250									5.4	5.4
251									5.4	5.4
217						1.5			3.6	5.1
220						1.5			3.6	5.1
223									1.1	1.1
224									1.1	1.1
268									0.8	0.8
269									0.8	0.8
270									0.8	0.8
246					0.3					0.3
247					0.3					0.3

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of other vegetables based on the 4 highest adult consumers is 72.8 kg/y

The observed 97.5 percentile rate based on 26 observations is 97.0 kg/y

Table 14. Adult consumption rates (kg/y) of root vegetables in the Dounreay area

Observation number	Artichoke	Beetroot	Carrot	Celeriac	Celery	Chicory	Garlic	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
66, 92	**54.3**	**3.6**	**10.8**	**4.8**	**12.6**	**2.7**	**5.3**	**7.2**	**8.6**	**2.9**			**1.6**			**114.4**
1 - 3															**60.8**	**60.8**
222, 228	**13.6**		**8.5**					**2.3**	**4.4**	**3.6**		**2.3**		**18.2**		**52.8**
266 - 267														**50.8**		**50.8**
264 - 265		2.3	2.6				0.6		11.0	2.7				13.7		32.8
239 - 241			13.6											14.6		28.2
252 - 253														25.4		25.4
214, 216		9.0						9.0				6.4				24.4
254 - 255			12.7						5.7					4.5		22.9
174, 176, 177			12.0						9.6							21.6
122 - 123														20.0		20.0
262 - 263			2.0				0.2		1.4			0.7		13.7		17.9
166, 169			7.2					3.6	5.8							16.6
170 - 171												14.4				14.4
206			6.8							5.4						12.2
112 - 121															10.0	10.0
168								10.0								10.0
217, 220			1.3						5.5		1.5					8.2
242 - 244			1.7											5.9		7.6
227, 233														7.3		7.3
93, 97, 98									5.8		0.3		0.7			6.7
162 - 163		1.1	0.9					3.0	0.9				0.4			6.3
198														5.8		5.8
203, 205, 207														5.8		5.8
256 - 257								2.4	2.6							5.0
225 - 226															2.1	2.1
24 - 26															1.8	1.8
246 - 247		0.6	0.6					0.6								1.7
28, 29, 32															1.1	1.1

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of root vegetables based on the 9 highest adult consumers is 68.7 kg/y

The observed 97.5 percentile rate based on 71 observations is 74.2 kg/y

Table 15. Adult consumption rates (kg/y) of potato in the Dounreay area

Observation number	Potato
198	**165.6**
203	**165.6**
205	**165.6**
207 - 213	**165.6**
227	**165.6**
233	**165.6**
239 - 241	**165.6**
250 - 251	**165.6**
264 - 265	**165.6**
206	**109.2**
222	**101.0**
228	**101.0**
66	**95.6**
92	**95.6**
174	**84.8**
176 - 177	**84.8**
266 - 267	**76.2**
1 - 7	**69.3**
168	**65.3**
24 - 26	**60.7**
195 - 197	50.8
252 - 255	50.8
262 - 263	50.8
112 - 123	50.0
81	42.5
94	42.5
170 - 171	41.0
166	29.1
169	29.1
162 - 163	25.5
246 - 247	25.4
28 - 29	18.2
32	18.2
214	18.2
216	18.2
256 - 257	4.5
257	4.5
97 - 98	3.6
268 - 270	0.8

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of potato based on the 40 highest adult consumers is 119.7 kg/y

The observed 97.5 percentile rate based on 84 observations is 165.6 kg/y

Table 16. Adult consumption rates (kg/y) of domestic fruit in the Dounreay area

Observation number	Apple	Black-berry	Black-currant	Cherry	Fig	Goose-berry	Grapes	Pear	Plum	Rasp-berry	Red-currant	Rhubarb	Straw-berry	White-currant	Total
66, 92	**2.7**	**4.0**	**36.3**	**4.5**	**1.4**	**61.3**		**2.3**	**17.0**	**10.9**	**4.5**	**4.0**	**3.8**		**152.7**
162 - 163	**65.9**					**6.4**	**5.7**			**6.1**		**2.0**	**7.5**		**93.6**
222, 228	3.6		5.7							0.7	4.5	2.3	25.2	4.5	46.5
264 - 265			2.5			5.0				2.5		5.0	15.0		30.0
122 - 123	11.3												5.7		17.0
254 - 255			2.3									6.8	4.5		13.6
170 - 171			5.7							0.7			7.1		13.5
166, 169													11.9		11.9
252 - 253		1.4					4.5					2.3	2.3		10.4
24 - 26			1.1			0.7				8.5					10.3
93, 97, 98			3.8			1.4					1.5	1.2			7.9
256 - 257										3.4			3.4		6.8
199 - 200			2.8							2.8					5.7
28, 29, 32			0.7			0.4				2.5					3.6
223 - 224						1.4						1.8			3.2
268 - 270										0.8			0.5		1.2
250 - 251						0.5						0.5			0.9
262 - 263													0.7		0.7

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of domestic fruit based on the 4 highest adult consumers is 123.1 kg/y

The observed 97.5 percentile rate based on 40 observations is 152.7 kg/y

Table 17. Adult consumption rates (l/y) of milk in the Dounreay area

Observation number	Goat milk
254	**225.6**
255	**225.6**
236	**207.4**
237	**207.4**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of milk based on the 4 highest adult consumers is 216.5 l/y
The observed 97.5 percentile rate based on 4 observations is 225.6 l/y

Table 18. Adult consumption rates (kg/y) of cattle meat in the Dounreay area

Observation number	Cattle meat
162	**47.3**
163	**47.3**
122	**23.6**
123	**23.6**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of cattle meat based on the 4 highest adult consumers is 35.4 kg/y
The observed 97.5 percentile rate based on 4 observations is 47.3 kg/y

Table 19. Adult consumption rates (kg/y) of sheep meat in the Dounreay area

Observation number	Lamb meat
250 - 251	**33.9**
122 - 123	**11.3**
162 - 163	**11.3**
227, 233	**11.3**
252 - 253	**11.3**
264 - 265	**11.3**
198, 203, 205	5.1
207 - 213	5.1
239 - 241	3.8

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of sheep meat based on the 12 highest adult consumers is 15.1 kg/y
The observed 97.5 percentile rate based on 25 observations is 33.9 kg/y

Table 20. Adult consumption rates (kg/y) of poultry in the Dounreay area

Observation number	Chicken	Duck	Goose	Grouse	Pheasant	Woodcock	Total
122		**6.8**	**18.1**		**11.3**		**36.1**
123		**6.8**	**18.1**		**11.3**		**36.1**
162					**23.4**	**2.3**	**25.7**
163					**23.4**		**23.4**
112		**0.9**	**4.4**		**5.4**	**1.6**	**12.3**
113		**0.9**	**4.4**		**5.4**	**1.6**	**12.3**
114		**0.9**	**4.4**		**5.4**	**1.6**	**12.3**
115		**0.9**	**4.4**		**5.4**	**1.6**	**12.3**
116		**0.9**	**4.4**		**5.4**	**1.6**	**12.3**
117		**0.9**	**4.4**		**5.4**	**1.6**	**12.3**
118		**0.9**	**4.4**		**5.4**	**1.6**	**12.3**
119		0.9	4.4		5.4		10.7
120		0.9	4.4		5.4		10.7
121		0.9	4.4		5.4		10.7
21		1.5	3.7		3.0		8.2
22		1.5	3.7		3.0		8.2
23		1.5	3.7		3.0		8.2
264	7.5						7.5
265	7.5						7.5
100		3.0			3.0		6.0
159		3.0			3.0		6.0
160		3.0			3.0		6.0
81	3.0		0.7				3.7
94	3.0		0.7				3.7
66				1.8	1.1		2.9
92				1.8	1.1		2.9
166					0.5		0.5
169					0.5		0.5
252					0.5		0.5
253					0.5		0.5

Notes

Emboldened observations are the critical group consumers

The critical group consumption rate of poultry based on the 11 highest adult consumers is 18.9 kg/y

The observed 97.5 percentile rate based on 30 observations is 36.1 kg/y

Table 21. Adult consumption rates (kg/y) of eggs in the Dounreay area

Observation number	Chicken egg
264 - 265	**44.5**
236	**41.6**
234, 235, 237	**20.8**
162 - 163	**17.8**
250 - 251	**14.8**
1 - 3, 271 - 272	11.9
266 - 267	8.9
227, 229, 230, 233	3.0

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of eggs based on the 10 highest adult consumers is 25.8 kg/y
The observed 97.5 percentile rate based on 21 observations is 44.5 kg/y

Table 22. Adult consumption rates (kg/y) of wild/free foods in the Dounreay area

Observation number	Blackberry	Rowanberry	Total
66, 92		**2.3**	**2.3**
162 - 163	**0.9**		**0.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of wild/free foods based on the 4 highest adult consumers is 1.6 kg/y
The observed 97.5 percentile rate based on 4 observations is 2.3 kg/y

Table 23. Adult consumption rates (kg/y) of honey in the Dounreay area

Observation number	Honey
256 - 257	**13.6**
206	**6.8**
30, 33	**5.7**
66, 92	**5.0**
35 - 36	**4.5**
19 - 20	3.4
214, 216	2.0
162 - 163	1.4
254 - 255	1.1
164 - 165	0.5
262 - 263	0.5
93, 97, 98	0.3
268 - 270	0.3

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of honey based on the 9 highest adult consumers is 7.2 kg/y
The observed 97.5 percentile rate based on 27 observations is 13.6 kg/y

Table 24. Adult consumption rates (kg/y) of wild fungi in the Dounreay area

Observation number	Mushrooms
264 - 265	**1.0**
252, 253, 268	**0.9**
81, 94	**0.8**
229 - 230	**0.5**
1 - 3	0.3
250 - 251	0.2

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of wild fungi based on the 9 highest adult consumers is 0.8 kg/y
The observed 97.5 percentile rate based on 14 observations is 1.0 kg/y

Table 25. Adult consumption rates (kg/y) of rabbits/hares in the Dounreay area

Observation number	Rabbit
66, 92	**7.9**
100, 159, 160	**5.3**
215	**4.5**
112 - 116	**2.7**
229 - 230	0.2

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of rabbits/hares based on the 11 highest adult consumers is 4.5 kg/y
The observed 97.5 percentile rate based on 13 observations is 7.9 kg/y

Table 26. Adult consumption rates (kg/y) of venison in the Dounreay area

Observation number	Venison
100, 159, 160	**83.2**
122	**47.2**
123	**47.2**
112 - 121	**29.5**
21 - 23	7.6
162 - 163	5.0

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of venison based on the 15 highest adult consumers is 42.6 kg/y
The observed 97.5 percentile rate based on 20 observations is 83.2 kg/y

Table 27. Adult consumption rates (kg/y) of fish (freshwater) in the Dounreay area

Observation number	Brown Trout
8	**0.5**
192	**0.2**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of fish (freshwater) based on the 2 highest adult consumers is 0.4 kg/y
The observed 97.5 percentile rate based on 2 observations is 0.5 kg/y

Table 28. Children's consumption rates (kg/y) of green vegetables in the Dounreay area

5 year old age group

Observation number	Age	Cauliflower
245	**2**	**2.0**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of green vegetables based on the highest 5 year old age group consumer is 2.0 kg/y

Table 29. Children's consumption rates (kg/y) of other vegetables in the Dounreay area

15 year old age group

Observation number	Age	Pea	Tomato	Total
95	**14**		**12.0**	**12.0**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of other vegetables based on the highest 15 year old age group consumer is 12.0 kg/y

10 year old age group

Observation number	Age	Pea	Tomato	Total
248	**7**	**0.3**		**0.3**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of other vegetables based on the highest 10 year old age group consumer is 0.3 kg/y

5 year old age group

Observation number	Age	Pea	Tomato	Total
249	**5**	**0.3**		**0.3**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of other vegetables based on the highest 5 year old age group consumer is 0.3 kg/y

Table 30. Children's consumption rates (kg/y) of root vegetables in the Dounreay area

15 year old age group

Observation number	Age	Beetroot	Carrot	Leek	Swede	Total
204	**12**				**5.8**	**5.8**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of root vegetables based on the highest 15 year old age group consumer is 5.8 kg/y

10 year old age group

Observation number	Age	Beetroot	Carrot	Leek	Swede	Total
248	**7**	**0.6**	**0.6**	**0.6**		**1.7**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of root vegetables based on the highest 10 year old age group consumer is 1.7 kg/y

5 year old age group

Observation number	Age	Beetroot	Carrot	Leek	Swede	Total
245	**2**		**1.7**		**5.9**	**7.6**
249	**5**	**0.6**	**0.6**	**0.6**		**1.7**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of root vegetables based on the 2 highest 5 year old age group consumers is 4.7 kg/y
The observed 97.5 percentile rate based on 2 observations is 7.5 kg/y

Table 31. Children's consumption rates (kg/y) of potato in the Dounreay area

15 year old age group

Observation number	Age	Potato
204	**12**	**100.0**
95	**14**	**42.5**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of potato based
on the 2 highest 15 year old age group consumers is 71.2 kg/y
The observed 97.5 percentile rate based on 2 observations is 98.6 kg/y

10 year old age group

Observation number	Age	Potato
248	**7**	**25.4**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of potato based
on the highest 10 year old age group consumer is 25.4 kg/y

5 year old age group

Observation number	Age	Potato
249	**5**	**25.4**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of potato based
on the highest 5 year old age group consumer is 25.4 kg/y

Table 32. Children's consumption rates (kg/y) of domestic fruit in the Dounreay area

15 year old age group

Observation number	Age	Blackcurrant	Raspberry	Total
201	**14**	**2.8**	**2.8**	**5.7**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of domestic fruit based on the highest 15 year old age group consumer is 5.7 kg/y

10 year old age group

Observation number	Age	Blackcurrant	Raspberry	Total
202	**9**	**2.8**	**2.8**	**5.7**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of domestic fruit based on the highest 10 year old age group consumer is 5.7 kg/y

Table 33. Children's consumption rates (l/y) of milk in the Dounreay area

10 year old age group

Observation number	Age	Goat milk
238	**7**	**207.4**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of milk based on the highest 10 year old age group consumer is 207.4 l/y

Table 34. Children's consumption rates (kg/y) of sheep meat in the Dounreay area

15 year old age group

Observation number	Age	Lamb meat
204	**12**	**5.1**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of sheep meat based on the highest 15 year old age group consumer is 5.1 kg/y

Table 35. Children's consumption rates (kg/y) of poultry in the Dounreay area

15 year old age group

Observation number	Age	Chicken	Goose	Total
95	**14**	**3.0**	**0.7**	**3.7**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of poultry based
on the highest 15 year old age group consumer is 3.7 kg/y

Table 36. Children's consumption rates (kg/y) of eggs in the Dounreay area

15 year old age group

Observation number	Age	Chicken egg
231	**15**	**3.0**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of eggs based
on the highest 15 year old age group consumer is 3.0 kg/y

10 year old age group

Observation number	Age	Chicken egg
238	**7**	**20.8**
232	**10**	**3.0**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of eggs based
on the 2 highest 10 year old age group consumers is 11.9 kg/y
The observed 97.5 percentile rate based on 2 observations is 20.4 kg/y

5 year old age group

Observation number	Age	Chicken egg
274	**6**	**11.9**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of eggs based
on the highest 5 year old age group consumer is 11.9 kg/y

Table 37. Children's consumption rates (kg/y) of wild fungi in the Dounreay area

15 year old age group

Observation number	Age	Mushrooms
95	**14**	**0.8**

Notes

Emboldened observations are the critical group consumers
The critical group consumption rate of wild fungi based
on the highest 15 year old age group consumer is 0.8 kg/y

Table 38. Children's consumption rates (kg/y) of rabbits/hares in the Dounreay area

15 year old age group

Observation number	Age	Rabbit
231	**15**	**0.2**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of rabbits/hares based on the highest 15 year old age group consumer is 0.2 kg/y

10 year old age group

Observation number	Age	Rabbit
232	**10**	**0.2**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of rabbits/hares based on the highest 10 year old age group consumer is 0.2 kg/y

Table 39. Children's consumption rates (kg/y) of fish (freshwater) in the Dounreay area

10 year old age group

Observation number	Age	Brown trout
9	**10**	**0.5**

Notes
Emboldened observations are the critical group consumers
The critical group consumption rate of fish (freshwater) based on the highest 10 year old age group consumer is 0.5 kg/y

Table 40. Ratios for determining consumption rates for children

Food Group	Ratio child/adult		
	6 - 12 months	10 yr old	15 yr old
Green Vegetables	0.222	0.444	0.556
Other Vegetables	0.2	0.5	0.6
Root Vegetables	0.375	0.5	0.5
Potatoes	0.292	0.708	1.083
Domestic Fruit	0.467	0.667	0.667
Milk	1.333	1	1.083
Cattle Meat	0.222	0.667	0.778
Sheep Meat	0.12	0.4	0.6
Pig Meat	0.138	0.625	0.75
Poultry	0.183	0.5	0.667
Eggs	0.6	0.8	1
Wild/free foods	0.072	0.44	0.52
Rabbits & Hares	ND	ND	ND
Woodcock & Snipe	ND	ND	ND
Venison	ND	ND	ND
Honey	0.789	0.789	0.526
Wild Fungi	0.15	0.45	0.55
Fish	0.375	0.5	0.5
Crustaceans	0.525*	0.7	0.6
Molluscs	0.525*	0.7	0.6

ND - No data

* No MAFF (1998) data were available for these rates. Ratios were derived by scaling the 10 year olds crustaceans and mollusc consumption data

Table 41. Intertidal occupancy rates (h/y) in the Dounreay area

Observation number	Location	Activity	rock	sand	sand and stones
218	**Local beaches**	**Shellfish collecting**	**780**		
158	**Thurso Mains**	**Shellfish collecting**	**730**		
12	**Dunnet beach**	**Angling and bait digging**		**468**	
222	**Sandside beach**	**Dog walking**		**410**	
228	**Sandside beach**	**Dog walking**		**410**	
59	**Sandside beach**	**Dog walking**		**350**	
146	**Castletown beach**	**Dog walking**		**350**	
147	**Castletown beach**	**Dog walking**		**350**	
191	**Melvich beach**	**Dog walking**		**350**	
192	**Melvich beach**	**Dog walking**		**350**	
193	**Melvich beach**	**Dog walking**		**350**	
101	**Thurso Mains**	**Salmon netting**	**300**		
102	**Thurso Mains**	**Salmon netting**	**300**		
175	**Dunnet beach**	**Dog walking**		**300**	
93	**Local beaches**	**Walking**		**250**	
97	**Local beaches**	**Walking**		**250**	
275	**Local beaches**	**Walking**		**240**	
173	**Dunnet beach**	**Dog walking**		**225**	
96	**Local beaches and Sandside harbour**	**Walking and angling usually barefooted**		98	
157	**Scrabster beach**	**Dog walking**		**182**	
103	Scrabster, Dunnet beach, Dunnet beach	Angling, bait digging and dog walking	24	155	
254	**Sandside beach**	**Dog walking**		**156**	
255	**Sandside beach**	**Dog walking**		**156**	
185	Thurso beach	Dog walking		150	
136	Strathy	Angling	130		
199	Local beaches	Walking		123	
200	Local beaches	Walking		123	
201	Local beaches	Walking		123	
202	Local beaches	Walking		123	
49	Sandside beach	Dog walking and beach combing		122	
294	Portskerra harbour	Angling	120		
295	Portskerra harbour	Angling	120		
60	Sandside beach	Dog walking		118	

Table 41. Intertidal occupancy rates (h/y) in the Dounreay area

Observation number	Location	Activity	rock	sand	sand and stones
72	Dunnet beach	Angling and bait digging		118	
149	Castletown beach and Dunnet beach	Angling and bait digging		117	
150	Castletown beach and Dunnet beach	Angling and bait digging		117	
167	Dunnet beach	Horse riding		104	
219	Sandside beach	Dog walking		104	
236	**Crosskirks**	**Dog walking**			**104**
237	**Crosskirks**	**Dog walking**			**104**
238	**Crosskirks**	**Dog walking**			**104**
253	Local beaches	Dog walking		104	
288	Thurso beach	Dog walking		104	
289	Thurso beach	Dog walking		104	
47	**Local beaches**	**Walking**			**100**
48	**Local beaches**	**Walking**			**100**
142	Dunnet beach	Walking		100	
143	Dunnet beach	Walking		100	
144	Dunnet beach	Walking		100	
145	Dunnet beach	Walking		100	
172	Dunnet beach	Walking		100	
190	Thurso beach	Dog walking		100	
10	Scrabster	Angling	78		
325	Scrabster and Dunnet beach	Angling/Walking	30	45	
55	Sandside Head	Dog walking	33	33	
56	Sandside Head	Dog walking	33	33	
57	Sandside Head	Dog walking	33	33	
58	Sandside Head	Dog walking	33	33	
151	Castletown beach	Walking		65	
152	Castletown beach	Walking		65	
153	Castletown beach	Walking		65	
154	Castletown beach	Walking		65	
46	Scrabster and local beaches	Angling and dog walking	12	52	
286	Local beaches	Angling		64	
287	Local beaches	Angling		64	
262	Dunnet beach	Walking		60	

Table 41. Intertidal occupancy rates (h/y) in the Dounreay area

Observation number	Location	Activity	rock	sand	sand and stones
263	Dunnet beach	Walking		60	
276	Sandside beach	Dog walking		60	
277	Sandside beach	Dog walking		60	
278	Sandside beach	Dog walking		60	
109	Sandside beach	Walking		52	
110	Sandside beach	Walking		52	
111	Sandside beach	Walking		52	
259	Strathy	Walking		52	
260	Strathy	Walking		52	
74	Dunnet beach	Angling and bait digging		49	
268	Sandside beach	Walking		48	
271	Local beaches	Walking		48	
272	Local beaches	Walking		48	
273	Local beaches	Walking		48	
274	Local beaches	Walking		48	
326	Dunnet beach	Walking		45	
99	Dunnet beach	Angling and bait digging		39	
290	Strathy	Sunbathing		32	
291	Strathy	Sunbathing		32	
292	Strathy	Sunbathing		32	
293	Strathy	Sunbathing		32	
317	Local beaches	Walking		28	
318	Local beaches	Walking		28	
319	Local beaches	Walking		28	
320	Local beaches	Walking		28	
321	Local beaches	Walking		28	
155	Scrabster beach	Walking		26	
156	Scrabster beach	Walking		26	
258	Local beaches	Walking		26	
307	Strathy	Walking		25	
52	Scrabster	Angling	24		
269	Sandside beach	Walking		24	
50	Sandside beach and Scrabster	Beach combing, shore diving, sunbathing, walking		23	

Table 41. Intertidal occupancy rates (h/y) in the Dounreay area

Observation number	Location	Activity	rock	sand	sand and stones
215	Port of Brims	Angling	18		
302	Strathy	Playing on beach		15	
303	Strathy	Playing on beach		15	
304	Strathy	Playing on beach		15	
305	Strathy	Playing on beach		15	
306	Strathy	Playing on beach		15	
327	Dunnet beach	Water sports preparation		15	
148	Dunnet beach	Walking		14	
312	Local beaches	Walking		14	
313	Local beaches	Walking		14	
19	Sandside harbour	Walking	12		
20	Sandside harbour	Walking	12		
44	Local beaches	Walking		12	
45	Local beaches	Walking		12	
66	Local beaches	Walking		12	
92	Local beaches	Walking		12	
166	Local beaches	Walking		12	
169	Local beaches	Walking		12	
279	Melvich beach	Sunbathing		12	
280	Melvich beach	Sunbathing		12	
281	Melvich beach	Sunbathing		12	
282	Melvich beach	Sunbathing		12	
283	Melvich beach	Sunbathing		12	
284	Melvich beach	Sunbathing		12	
285	Melvich beach	Sunbathing		12	
322	Strathy	Walking		12	
323	Strathy	Walking		12	
324	Strathy	Walking		12	
81	Oigins Geo	Angling	8		
94	Oigins Geo	Angling	8		
95	Oigins Geo	Angling	8		
214	Melvich beach	Walking		6	
216	Melvich beach	Walking		6	

Table 41. Intertidal occupancy rates (h/y) in the Dounreay area

Observation number	Location	Activity	rock	sand	sand and stones
308	Local beaches	Walking		6	
31	Local beaches	Walking		5	
34	Local beaches	Walking		5	
178	Dunnet beach	Walking		4	
179	Dunnet beach	Walking		4	
180	Thurso beach	Playing on beach		4	
181	Thurso beach	Playing on beach		4	
182	Thurso beach	Playing on beach		4	
183	Thurso beach	Playing on beach		4	
184	Thurso beach	Playing on beach		4	
170	Local beaches	Walking		3	
171	Local beaches	Walking		3	
217	Local beaches	Walking		3	
220	Local beaches	Walking		3	
186	Thurso beach	Walking		2	
187	Thurso beach	Walking		2	
188	Thurso beach	Walking		2	
189	Thurso beach	Walking		2	

Notes

Emboldened observations are the critical group members

The critical group intertidal occupancy rate over rock based on 4 observations is 527.5 h/y

The critical group intertidal occupancy rate over sand based on 17 observations is 302.8 h/y

The critical group intertidal occupancy rate over sand and stones based on 5 observations is 102.4 h/y

The observed 97.5 percentile rate based on 22 observations for rock is 753.8 h/y

The observed 97.5 percentile rate based on 130 observations for sand is 350.0 h/y

The observed 97.5 percentile rate based on 5 observations for sand and stones is 104.0 h/y

Table 42. Handling of commercial fishing gear and sediment rates (h/y) in the Dounreay area

Observation number	Location	Activity	Gear	Sediment
51	**Scrabster**	**Gear handling**	**2040**	
80	**Scrabster**	**Gear handling**	**2000**	
258	**Sandside**	**Gear handling**	**1680**	
261	**Sandside**	**Gear handling**	**1680**	
67	**Castletown**	**Gear handling**	**1500**	
90	**Scrabster**	**Gear handling**	**1500**	
86	**Scrabster**	**Gear handling**	**1232**	
75	**Scrabster**	**Gear handling**	**1000**	
79	**Scrabster**	**Gear handling**	**1000**	
218	**Various**	**Shellfish collecting**		**780**
158	**Thurso Mains**	**Shellfish collecting**		**730**
124	Strathy	Gear handling	575	
126	Strathy	Gear handling	575	
139	Armadale	Gear handling	471	
140	Armadale	Gear handling	471	
71	Dunnet Head	Gear handling	402	
127	Strathy	Gear handling	380	
128	Strathy	Gear handling	380	
101	Thurso Mains	Gear handling	300	
102	Thurso Mains	Gear handling	300	
104	Portskerra Harbour	Gear handling	200	
141	Armadale	Gear handling	150	
54	Dunnet Head	Gear handling	90	
12	Dunnet Beach	Bait digging		78
149	Dunnet Beach	Bait digging		26
150	Dunnet Beach	Bait digging		26
103	Dunnet Beach	Bait digging		25
72	Dunnet Beach	Bait digging		12
99	Dunnet Beach	Bait digging		12
74	Dunnet Beach	Bait digging		7

Notes

Emboldened observations are the critical group members

The critical group gear handling rate based on 9 observations is 1514.7 h/y

The critical group sediment handling rate based on 2 observations is 755.0 h/y

The observed 97.5 percentile rate based on 21 observations for gear is 2020.0 h/y

The observed 97.5 percentile rate based on 9 observations for sediment is 770.0 h/y

Table 43. Occupancy times (h/y) and gamma dose rates (micro Gy/h) within 1 km of the Dounreay area

Observation number	Sex	Age in Years (U if unknown)	Location	Indoor occupancy (h/y)	Outdoor occupancy (h/y)	Total occupancy (h/y)	Gamma dose rate in the property (micro Gy/h)	Gamma dose rate outside property (micro Gy/h)
Adult observations								
1	M	60	Residence	4407	3833	8240	0.115	0.093
2	F	57	Residence	8114	78	8192	"	"
3	F	20	Residence	5172	104	5276	"	"
81	M	51	Residence	4335	1456	5791	0.127	0.096
94	F	48	Residence	5094	1456	6550	"	"
194	M	68	Residence	5552	1082	6634	0.110	0.104
258	M	39	Residence	4776	936	5712	0.088	0.098
259	F	34	Residence	5393	754	6147	"	"
219	M	67	Residence	7092	468	7560	0.091	0.089
221	F	64	Residence	7508	52	7560	"	"
14	F	65	Residence	7586	888	8474	NM	NM
18	F	30	Residence	6257	340	6597	"	"
37	F	63	Tea rooms	298	46	344	0.079	0.084
38	F	70	Tea rooms	238	34	272	"	"
246	M	U	Post Office	4868	3640	8508	0.108	0.085
247	F	U	Post Office	7234	1274	8508	"	"
39	M	20	Visitor centre	414	18	432	0.120	0.084
40	F	23	Visitor centre	414	18	432	"	"
41	F	35	Visitor centre	414	18	432	"	"
42	F	42	Visitor centre	414	18	432	"	"
168	M	87	Residence	7969	183	8152	0.132	0.092
333-338	M	U	Airfield	0	200	200	NA	0.098
81, 94, 95	M	U	Oigin's Geo	0	8	8	NA	0.159

NM = Not measured
NA = Not applicable

Table 43. Occupancy times (h/y) and gamma dose rates (micro Gy/h) within 1 km of the Dounreay area

Observation number	Sex	Age in Years	Location	Indoor occupancy (h/y)	Outdoor occupancy (h/y)	Total occupancy (h/y)	Gamma dose rate in the property (micro Gy/h)	Gamma dose rate outside property (micro Gy/h)
Child observations								
249	M	5	Post Office	5215	1820	7035	"	"
248	F	7	Post Office	5079	1820	6899	0.108	0.085
260	F	8	Residence	4516	1274	5790	0.088	0.098
15	M	10	Residence	6410	740	7150	NM	NM
16	M	13	Residence	6410	740	7150	"	"
17	F	14	Residence	6410	740	7150	"	"
95	M	14	Residence	4928	1575	6503	0.127	0.096

NM = Not measured

Perimeter fence gamma doses

Location		**micro Gy/h**
NC 993 677	Perimeter fence, UKAEA TLD posn. 2	0.081
NC 993 673	Perimeter fence, UKAEA TLD posn. 3	0.098
NC 992 672	Perimeter fence, UKAEA TLD posn. 4	0.114
NC 991 671	Perimeter fence, UKAEA TLD posn. 5	0.101
NC 990 670	Perimeter fence, UKAEA TLD posn. 6	0.101
NC 989 669	Perimeter fence, UKAEA TLD posn. 7	0.101
NC 988 668	Perimeter fence, UKAEA TLD posn. 8	0.132
NC 988 669	Perimeter fence, UKAEA TLD posn. 9	0.116
NC 985 668	Perimeter fence, UKAEA TLD posn. 11	0.104
NC 988 666	Perimeter fence, UKAEA TLD posn. 12	0.095
NC 981 667	Perimeter fence, UKAEA TLD posn. 13	0.108

Background gamma doses

NGR	**Location and substrate**	**micro Gy/h**
ND 033 684	Forss Hotel - in field over grass	0.102
NC 017 636	Shebster - in field over grass	0.100
NC 975 641	Near Reay - in field over grass	0.084

Table 44. Gamma dose rates (micro Gy/h) in the Dounreay aquatic survey area

NGR	Location	Substrate	micro Gy/h
NC 960 655	Sandside Beach, posn. 1	Sand	0.067
NC 959 655	Sandside Beach, posn. 2	Sand	0.063
NC 888 651	Melvich Beach	Sand	0.057
ND 203 683	Castletown Beach	Sand and rocks	0.075
ND 217 705	Dunnet Beach	Sand	0.063
ND 124 690	Thurso East Mains	Rock	0.111
NC 994 683	Oigin's Geo, posn. 1	Rock	0.164
NC 994 684	Oigin's Geo, posn. 2	Rock	0.154

Table 45. Percentage contribution each terrestrial food type makes to its food group for adults

Domestic fruit	
Strawberry	19.9
Apple	19.0
Gooseberry	17.7
Blackcurrant	14.4
Raspberry	10.1
Rhubarb	6.0
Plum	3.9
Redcurrants	2.6
Grapes	2.3
Blackberry	1.2
Whitecurrant	1.0
Cherry	1.0
Pear	0.5
Fig	0.3

Green vegetables	
***Cabbage**	27.2
Lettuce	11.8
Cucumber	10.6
Kale	9.7
Broccoli	9.6
Brussel sprout	7.6
Cauliflower	6.9
Artichoke	5.3
Calabrese	2.5
Rocket	2.3
Asparagus	1.4
Chard	1.1
Spinach	1.1
Courgettes	1.0
Marrow	0.8
Herbs	0.7
Watercress	0.4

Root vegetables	
Swede	28.5
Turnip	21.5
Carrot	13.2
Onion	10.0
Artichoke	9.9
Leek	4.8
Shallot	3.5
Beetroot	2.4
Celery	1.8
Parsnip	1.7
Garlic	0.9
Celeriac	0.7
Spring onion	0.4
Chicory root	0.4
Radish	0.3

Other vegetables	
Tomato	66.1
Pea	10.6
Broad bean	7.8
Runner bean	6.1
Pepper	3.7
Mangetout	3.1
Sweetcorn	1.5
French Bean	0.8
Chilli pepper	0.4

Poultry	
Pheasant	46.6
Goose	29.7
Duck	11.5
Chicken	6.7
Woodcock	4.3
Grouse	1.1

Wild/free foods	
Rowanberry	71.4
Blackberry	28.6

Notes:

Food types asterisked and emboldened were monitored by SEPA in 2002 (EA, EHS, FSA and SEPA, 2003)
Other foods monitored were cattle meat, sheep meat, potatoes, wheat and nettles
Percentages are based on the consumption of all adults in the survey consuming
that particular food group

Table 46. Combinations of adult groups for consideration in dose assessments in the Dounreay area

Combination number	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
1						*	*						*				*								*	*
2	*																		*		*					
3	*	*																		*	*					
4	*	*																			*			*		
5	*	*																			*		*		*	*
6																*				*						
7	*	*		*	*	*	*	*		*	*	*	*	*		*		*								
8	*	*		*	*	*	*	*				*		*	*	*					*					
9				*																		*					
10		*			*		*					*					*			*					*	*
11						*	*					*			*			*								
12																				*			*			
13																				*	*			*		
14		*	*																							
15					*	*	*																		*	*
16	*														*					*						
17													*		*		*									
18									*				*									*				
19				*	*	*	*	*			*	*	*				*									
20						*	*	*			*	*					*				*					
21						*	*	*	*							*					*					
22				*	*		*	*								*	*				*					
23													*								*					

Annex 1. Adult consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
1	M	60						**60.8**	**69.3**						11.9				0.3								4407	3833
2	F	57						**60.8**	**69.3**						11.9				0.3								8114	78
3	F	20						**60.8**	**69.3**						11.9				0.3								5172	104
4	M	U							**69.3**																			
5	M	U							**69.3**																			
6	M	U							**69.3**																			
7	F	U							**69.3**																			
8	M	48																			**0.5**							
10	M	35	3.5																			78						
11	F	34	3.5																									
12	M	40																					**468**			78		
14	F	65	**33.7**	0.3																							7586	888
18	F	30																									6257	340
19	M	76																3.4				12						
20	F	76																3.4				12						
21	M	55	4.6											8.2						7.6								
22	F	54	4.6											8.2						7.6								
23	M	28	4.6											8.2						7.6								
24	F	U						1.8	**60.7**	10.3																		
25	M	U						1.8	**60.7**	10.3																		
26	F	U						1.8	**60.7**	10.3																		
28	M	U						1.1	18.2	3.6																		
29	M	U						1.1	18.2	3.6																		
30	M	U																**5.7**										
31	m	65					10.8																5					
32	M	U						1.1	18.2	3.6																		
33	F	U																**5.7**										
34	F	65					10.8																5					
35	M	U																**4.5**										
36	F	U																**4.5**										
37	F	63																									298	46
38	F	70																									238	34

Annex 1. Adult consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
39	M	20																									414	18
40	F	23																									414	18
41	F	35																									414	18
42	F	42																									414	18
44	M	31																					12					
45	F	18																					12					
46	F	24	3.2																			12	52					
47	M	68				0.2																		**100**				
48	F	68				0.2																		**100**				
49	M	64																					122					
50	M	23																					23					
51	M	45		2.0																					**2040**			
52	M	U	10.2																			24						
53	F	U	10.2																									
54	M	41	3.9	**10.5**																					90			
55	M	42	**17.6**																			33	33					
56	F	39	**17.6**																			33	33					
59	F	U																					**350**					
60	M	U																					118					
61	F	U	3.9	**10.5**																								
62	M	U	3.9																									
63	M	U	3.9																									
64	F	U	3.9																									
65	F	U	3.9																									
66	M	68	**24.8**	0.7		**70.2**	**97.0**	**114.4**	**95.6**	**152.7**				2.9		**2.3**	**7.9**	**5.0**					12					
67	M	U	5.9	**7.9**																					**1500**			
68	F	U	5.9	**7.9**																								
69	M	U	5.9	**7.9**																								
70	M	U	5.9	**7.9**																								
71	M	65		**6.0**																					402			
72	M	60	7.7																				118			12		
73	F	60	7.7																									

Annex 1. Adult consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
74	M	U																					49			7		
75	M	45	10.2																						**1000**			
76	F	U	10.2																									
79	M	31	**17.7**	**14.0**																					**1000**			
80	M	U		**11.5**																					**2000**			
81	M	51		0.3			12.0		42.5					3.7					**0.8**			8					4335	1456
82	F	U		**11.5**																								
86	M	U	7.5																						**1232**			
87	F	U	7.5																									
90	M	U		3.6																					**1500**			
91	M	U		3.6																								
92	F	60	**24.8**	0.7		**70.2**	**97.0**	**114.4**	**95.6**	**152.7**				2.9		**2.3**	**7.9**	**5.0**					12					
93	M	51				10.4		6.7	3.6	7.9								0.3					**250**					
94	F	48		0.3			12.0		42.5					3.7					**0.8**			8					5094	1456
96	M	35	**51.5**																				98					
97	F	51				10.4		6.7	3.6	7.9								0.3					**250**					
98	F	21				10.4		6.7	3.6	7.9								0.3										
99	M	51	**19.1**	0.8																			39			12		
100	M	50												6.0			**5.3**			**83.2**								
101	M	U																				**300**			300			
102	M	U																				**300**			300			
103	M	29																				24	155			25		
104	M	39	15.6																						200			
105	F	38	15.6																									
106	F	U	15.6																									
107	M	U	15.6																									
108	F	55			**0.7**																							
109	M	59																					52					
110	F	58																					52					
111	M	U																					52					
112	M	55						10.0	50.0					**12.3**			**2.7**			**29.5**								
113	F	U						10.0	50.0					**12.3**			**2.7**			**29.5**								

Annex 1. Adult consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
114	F	U						10.0	50.0					**12.3**			**2.7**			**29.5**								
115	M	U						10.0	50.0					**12.3**			**2.7**			**29.5**								
116	M	U						10.0	50.0					**12.3**			**2.7**			**29.5**								
117	M	U						10.0	50.0					**12.3**						**29.5**								
118	F	U						10.0	50.0					**12.3**						**29.5**								
119	M	U						10.0	50.0					10.7						**29.5**								
120	F	U						10.0	50.0					10.7						**29.5**								
121	M	U						10.0	50.0					10.7						**29.5**								
122	M	56	1.0	0.7		15.0	11.3	20.0	50.0	17.0		**23.6**	**11.3**	**36.1**						**47.2**								
123	F	55	1.0	0.7		15.0	11.3	20.0	50.0	17.0		**23.6**	**11.3**	**36.1**						**47.2**								
124	M	51	14.0																						575			
125	F	U	14.0																									
126	M	U																							575			
129	M	44	**29.5**																									
130	F	43	**29.5**																									
131	F	U	**29.5**																									
132	M	U	**29.5**																									
136	M	22	4.5																			130						
137	M	U	4.5																									
138	F	U	4.5																									
139	M	52	8.6	**5.4**																					471			
140	M	U																							471			
142	M	U																					100					
143	M	U																					100					
146	M	U																					**350**					
147	F	U																					**350**					
148	M	35																					14					
151	M	35																					65					
152	F	35																					65					
155	M	40																					26					
156	F	39																					26					
157	F	U																					**182**					

Annex 1. Adult consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
158	M	65																				**730**				**730**		
159	F	U												6.0			**5.3**			**83.2**								
160	M	U												6.0			**5.3**			**83.2**								
162	M	U	**44.5**	0.7		15.3	**72.8**	6.3	25.5	**93.6**		**47.3**	**11.3**	**25.7**	**17.8**	**0.9**		1.4		5.0								
163	F	U	**43.9**	0.7		15.3	**72.8**	6.3	25.5	**93.6**		**47.3**	**11.3**	**23.4**	**17.8**	**0.9**		1.4		5.0								
164	M	73																0.5										
165	F	71																0.5										
166	M	59						16.6	29.1	11.9				0.5									12					
167	F	U																					104					
168	M	87					10.2	10.0	**65.3**																	7969	183
169	F	59						16.6	29.1	11.9				0.5									12					
170	M	65	2.3					14.4	41.0	13.5													3					
171	F	65	2.3					14.4	41.0	13.5													3					
172	M	48																					100					
173	F	48																					**225**					
174	F	72						21.6	**84.8**																			
175	M	77																					**300**					
176	M	78						21.6	**84.8**																			
177	M	42						21.6	**84.8**																			
178	M	32																					4					
179	F	28																					4					
180	M	32																					4					
181	F	29																					4					
185	M	75																					150					
186	M	40																					2					
187	F	34																					2					
190	M	72																					100					
191	M	70	2.6																				**350**					
192	F	58	0.6																		**0.2**		**350**					
194	M	68																								5552	1082
195	M	56							50.8																			
196	F	54							50.8																			

Annex 1. Adult consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
197	M	27							50.8																			
198	M	U						5.8	**165.6**				5.1															
199	M	49	2.2							5.7													123					
200	F	47	2.2							5.7													123					
203	F	U						5.8	**165.6**				5.1															
205	M	U						5.8	**165.6**				5.1															
206	M	56				9.6		12.2	**109.2**									**6.8**										
207	F	U						5.8	**165.6**				5.1															
208	F	U							**165.6**				5.1															
209	M	U							**165.6**				5.1															
210	F	U							**165.6**				5.1															
211	M	U							**165.6**				5.1															
212	F	U							**165.6**				5.1															
213	M	U							**165.6**				5.1															
214	M	54				6.0		24.4	18.2									2.0					6					
215	M	72	6.7														**4.5**					18						
216	F	51				6.0		24.4	18.2									2.0					6					
217	F	41				**41.7**	5.1	8.2															3					
218	M	U																				**780**				**780**		
219	M	67																					104				7092	468
220	M	46				**41.7**	5.1	8.2															3					
221	F	64																									7508	52
222	M	64	15.7			**47.9**	20.9	**52.8**	**101.0**	46.5													**410**					
223	F	48	3.6				1.1			3.2																		
224	M	48	3.6				1.1			3.2																		
225	M	U						2.1																				
226	F	U						2.1																				
227	M	U				5.1		7.3	**165.6**				**11.3**		3.0													
228	F	60	15.7			**47.9**	20.9	**52.8**	**101.0**	46.5													**410**					
229	M	U													3.0		0.2		**0.5**									
230	F	U													3.0		0.2		**0.5**									
233	M	U				5.1		7.3	**165.6**				**11.3**		3.0													

Annex 1. Adult consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
234	M	52													**20.8**													
235	F	53													**20.8**													
236	M	27									**207.4**				**41.6**									**104**				
237	F	30									**207.4**				**20.8**									**104**				
239	M	57		1.4				28.2	**165.6**				3.8															
240	F	57		1.4				28.2	**165.6**				3.8															
241	M	82		1.4				28.2	**165.6**				3.8															
242	M	69				2.0		7.6																				
243	M	35				2.0		7.6																				
244	F	29				2.0		7.6																				
246	M	U					0.3	1.7	25.4																		4868	3640
247	F	U					0.3	1.7	25.4																		7234	1274
250	F	53					5.4		**165.6**	0.9			**33.9**		**14.8**				0.2									
251	M	53					5.4		**165.6**	0.9			**33.9**		**14.8**				0.2									
252	M	58						25.4	50.8	10.4			**11.3**	0.5					**0.9**									
253	F	55						25.4	50.8	10.4			**11.3**	0.5					**0.9**				104					
254	F	56						22.9	50.8	13.6	**225.6**							1.1					**156**					
255	M	57						22.9	50.8	13.6	**225.6**							1.1					**156**					
256	M	67				2.4		5.0	4.5	6.8								**13.6**										
257	F	66				2.4		5.0	4.5	6.8								**13.6**										
258	M	39	11.1	**5.9**																			26		**1680**		4776	936
259	F	34																					52				5393	754
261	M	22																							**1680**			
262	M	56				8.5		17.9	50.8	0.7								0.5					60					
263	F	56				8.5		17.9	50.8	0.7								0.5					60					
264	F	45				3.0	18.9	32.8	**165.6**	30.0			**11.3**	7.5	**44.5**				**1.0**									
265	M	45				3.0	18.9	32.8	**165.6**	30.0			**11.3**	7.5	**44.5**				**1.0**									
266	M	89						**50.8**	**76.2**						8.9													
267	M	54						**50.8**	**76.2**						8.9													
268	M	66				0.6	0.8		0.8	1.2								0.3	**0.9**				48					
269	F	42				0.6	0.8		0.8	1.2								0.3					24					
270	M	18				0.6	0.8		0.8	1.2								0.3										

Annex 1. Adult consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
271	M	37													11.9								48					
272	F	42													11.9								48					
275	M	28																					**240**					
276	M	U																					60					
277	M	U																					60					
278	F	U																					60					
279	F	U																					12					
280	F	17																					12					
281	F	17																					12					
286	M	28																					64					
287	F	26																					64					
288	M	55																					104					
290	M	44																					32					
291	F	43																					32					
292	M	75																					32					
293	F	73																					32					
294	M	42	9.6	0.3																		120						
295	M	74	9.6	0.3																		120						
296	F	60	9.6	0.3																								
297	M	63	2.7																									
298	M	U	2.7																									
299	M	U	2.7																									
300	F	U	2.7																									
301	F	U	2.7																									
302	M	24	3.3																				15					
306	F	24																					15					
307	F	U																					25					
308	F	44	3.3																				6					
309	M	U	3.3																									
310	M	20	3.3																									
312	M	19	1.3																				14					
313	F	19																					14					

Annex 1. Adult consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex (U if unknown)	Age in years (U if unknown)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
314	M	17	1.3																									
315	M	21	1.3																									
316	M	45	1.3																									
317	M	U																					28					
318	F	U																					28					
322	M	27																					12					
323	F	33																					12					
325	M	47	8.7	1.8																		30	45					
326	F	45	8.7	1.8																			45					
328	M	U		1.6	**0.3**																							
329	M	U			0.2																							
330	M	U			0.2																							
331	F	U			0.2																							
332	F	U			0.2																							
333	M	U																										200
334	M	U																										200
335	M	U																										200
336	M	U																										200
337	M	U																										200
338	M	U																										200

Annex 2. Children's consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex	Age in years	Fish	Crustaceans	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Sheep meat	Poultry	Eggs	Rabbits/hares	Wild fungi	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
15 year old age group																							
88	F	12	7.5																				
141	M	12	8.6	**5.4**																150			
193	F	12																**350**					
204	F	12					**5.8**	**100.0**			**5.1**												
283	M	12																12					
284	M	12																12					
321	M	12																28					
327	M	12	8.7	**1.8**														15					
16	M	13	4.4																			6410	740
57	F	13	8.3														33	33					
133	M	13	**29.5**																				
282	F	13																12					
320	F	13																28					
17	F	14	2.9																			6410	740
95	M	14		0.3		**12.0**		**42.5**				**3.7**			**0.8**		8					4928	1575
127	M	14							**5.7**											380			
201	F	14	2.0															123					
311	M	14	3.3																				
89	M	15	7.5																				
128	F	15																		380			
134	M	15	**29.5**																				
149	M	15																117			26		
150	M	15																117			26		
231	F	15											**3.0**	**0.2**									
319	F	15																28					

Annex 2. Children's consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex	Age in years	Fish	Crustaceans	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Sheep meat	Poultry	Eggs	Rabbits/hares	Wild fungi	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
10 year old age group																							
83	F	7		**5.7**																			
153	F	7																65					
238	F	7								**207.4**			**20.8**						**104**				
248	F	7				**0.3**	**1.7**	**25.4**														5079	1820
154	F	8																65					
260	F	8																52				4516	1274
273	F	8																48					
285	F	8																12					
144	F	9																100					
202	M	9	**2.0**						**5.7**									123					
9	M	10														**0.5**							
15	M	10																				6410	740
58	F	10	**6.5**														33	33					
188	F	10																2					
232	F	10											**3.0**	**0.2**									
289	F	10																104					
304	M	10																15					
145	M	11																100					
303	M	11																15					

Annex 2. Children's consumption rates (kg/y or l/y) and occupancy times (h/y) in the Dounreay area

Observation number	Sex	Age in years	Fish	Crustaceans	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Sheep meat	Poultry	Eggs	Rabbits/hares	Wild fungi	Fish (freshwater)	Intrtidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Indoors occupancy	Outdoors occupancy
5 year old age group																							
78	F	2	**3.4**																				
135	F	2	**11.8**																				
245	F	2			**2.0**		**7.6**																
305	M	2																15					
324	M	2																12					
182	F	3																4					
183	F	3																4					
189	M	3																2					
77	F	4	**3.4**																				
84	M	5		**5.7**																			
249	M	5				**0.3**	**1.7**	**25.4**														5215	1820
184	M	6																4					
274	M	6											**11.9**					48					
1 year old age group																							
85	F	1		**2.9**																			

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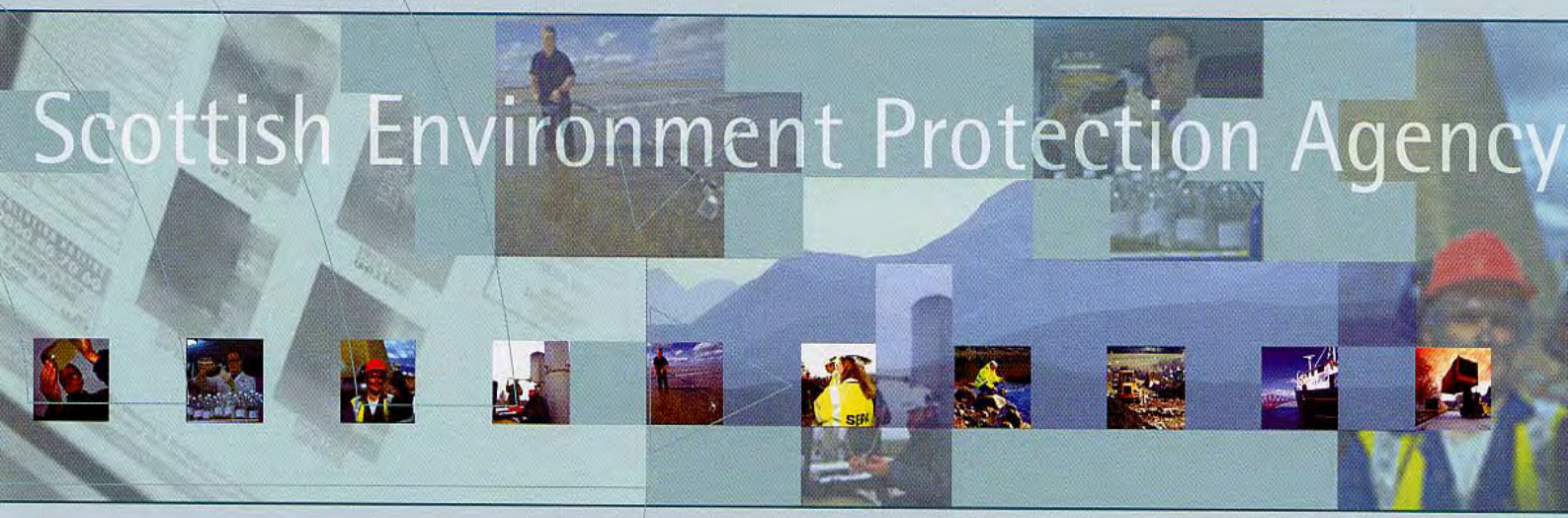

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