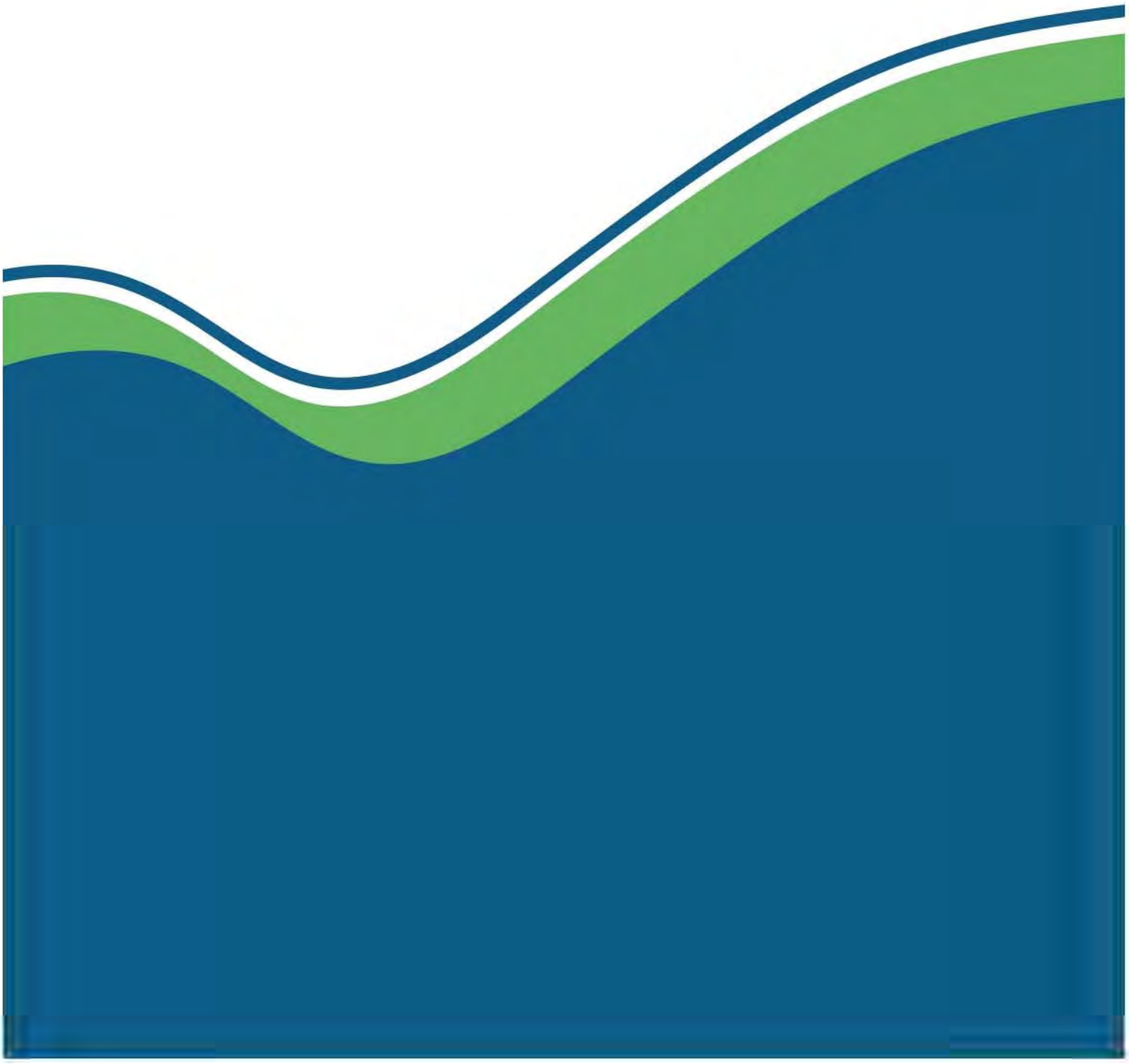
Radiological Habits Survey: Dounreay, 2013



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Final report

Radiological Habits Survey: Dounreay, 2013

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SUMMARY

This report presents the results of a survey conducted in 2013 to determine the habits and consumption patterns of people living, working and undertaking recreational activities in the vicinity of the Dounreay nuclear site. The site is undergoing decommissioning and is authorised to discharge gaseous radioactive waste via stacks to the atmosphere and liquid radioactive waste via an outfall to the Pentland Firth. The site also contains sources of direct radiation. The discharges include a minor contribution from the adjoining Vulcan Naval Reactor Test Establishment.

Three survey areas, which were likely to be most affected by the discharges and sources of radiation, were defined as:

- The aquatic survey area; which covered the Caithness coastline from Armadale Bay in the west to Dunnet Head in the east, and included Dunnet Bay and the waters offshore to a radius of approximately 20 km from the Dounreay site outfall.
- The terrestrial survey area; which included all land and watercourses within 5 km of the site centre (National Grid Reference NC 986 671).
- The direct radiation survey area; which covered the area within 1 km of the Dounreay site boundary.

The following potential exposure pathways were investigated during the survey: the consumption of foods from the aquatic survey area; occupancy of intertidal areas; handling of fishing gear and sediment; the consumption of foods from the terrestrial survey area; and occupancy within the direct radiation survey area. Particular attention was paid to the following activities at the request of the Scottish Environment Protection Agency:

- Activities undertaken at Sandside Bay which could give rise to contact with fuel fragments, how people undertaking these activities were dressed and where people spent time in the bay.
- The relative proportion of commercial fishing catches taken from two zones, 2 km - 10 km and 10 km - 20 km, of the Dounreay site outfall.

Interviews were conducted with members of the public and the data collected for 370 individuals are presented and discussed. High rates of consumption, intertidal occupancy and handling are identified using established methods comprising a ‘cut off’ to define the high-rate group, and 97.5th percentiles. The rates so identified can be used in dose assessments.

The aquatic survey area

The main commercial fishery in the survey area was creeling for brown crab and common lobster. Small amounts of velvet swimming crab were also caught in the creels. Three salmon bag-net operators were identified working in the survey area. A limited amount of commercial winkle collection took place on the shore in the survey area. Brown crab, common lobster and velvet swimming crab were mainly exported live to Portugal and also to Spain and France. Small amounts of brown crab and common lobster were also sold to local restaurants and hotels. Salmon was mainly exported to Europe and other countries around the world, although a small percentage was sold within the UK and locally to individuals and hotels. The winkles were exported to Europe, mainly to France and Spain.

Aquatic foods were consumed from the following food groups: fish, crustaceans and molluscs. The mean consumption rates for the adult high-rate groups for each of these food groups were:

- 18 kg y^{-1} for fish (comprising mainly cod, mackerel, haddock, bass, pollack and ling, caught by shore anglers, boat anglers and commercial fishermen).
- 14 kg y^{-1} for crustaceans (comprising brown crab and common lobster, caught by commercial and hobby fishermen).
- 0.3 kg y^{-1} for molluscs (comprising only winkles, collected by a non-commercial collector).

No consumption of marine plants/algae or wildfowl from the aquatic survey area was identified.

The relative contribution of the component species within each food group for the adult high-rate groups were:

- For fish; 32% cod, 18% mackerel, 13% haddock, 8% bass, 8% pollack, 5% ling and 16% a mix of brill, dab, flounder, lemon sole, plaice, saithe, salmon, sea trout and turbot.
- For crustaceans; 74% brown crab and 26% common lobster.
- For molluscs; 100% winkles.

Intertidal activities identified for adults included angling, collecting winkles, bait digging, walking, dog walking, playing, sunbathing, horse riding, sitting on the beach, picnicking, nature reserve warden duties, water sports preparation, preparing fishing gear, nature watching and jogging. The collection of seaweed for use as a fertliser or animal feed was not identified.

The mean rates for the adult high-rate group for occupancy over intertidal substrates were:

- 490 h y^{-1} over rock (for six people, whose activities included: collecting winkles at Castletown and Peedie; dog walking at Thurso East Mains and Brims Ness; and angling at Strathy Point, Brims Ness, Thurso East Mains, Scrabster and Castletown).

- 1000 h y^{-1} over sand (for three people, whose activities included: angling at Melvich, Sandside and Dunnet; bait digging at Murkle and Castletown; and dog walking at Thurso).
- 100 h y^{-1} over sand and stones (for one person who was collecting winkles at Melvich).

Gamma dose rate measurements were taken over intertidal substrates in the aquatic survey area where people were spending time.

The activities identified for adults involving handling fishing gear were handling creels and handling nets. Activities for adults involving handling sediment included collecting winkles and bait digging. The mean rates for the adult high-rate groups for handling were:

- 1400 h y^{-1} for handling fishing gear (for 12 fishermen, whose activities included: handling creels offshore from Strathy to Dunnet Head; and handling nets offshore of Murkle and Castletown).
- 430 h y^{-1} for handling sediment (for five people, whose activities included: collecting winkles at Castletown, Peedie, Melvich and Murkle; and bait digging at Murkle and Castletown).

The handling of angling equipment was not considered to be a significant pathway, and therefore, as in previous surveys, data for this pathway were not collected.

The following activities were identified taking place 'in water' in the survey area by adults: surfing, kayaking, kitesurfing and swimming. The maximum occupancy rate in water was 250 h y^{-1} for two watersport enthusiasts. The following activities were identified taking place 'on water' in the survey area by adults: creeling, charter boat skipper duties, bag-netting, angling, sailing, and paddling. The maximum occupancy rate on water was 2200 h y^{-1}, which was for four individuals who were creeling from Sandside Bay to Dunnet Head.

The results of the investigations requested by SEPA into specific activities in the aquatic survey area were:

- The main activity occurring at Sandside Bay was dog walking. Other activities included walking, playing, angling, horse riding, sitting on the beach and sunbathing. No evidence was found of long-lining from the shore. The western section of the beach was most frequently used as the main access points to the beach were in this area. The way people were dressed varied with the weather and the activity that they were undertaking and ranged from swimwear to jackets with long trousers and boots.
- For commercial fishing catches, it was estimated that 40% of the crustaceans were caught from within a zone extending from 2 km - 10 km from the pipeline outfall and 60% were caught from a zone extending from 10 km - 20 km from the outfall pipe; 10% of the salmon were caught from the 2 km - 10 km zone and 90% from the 10 km - 20 km zone; 100% of the demersal fish, squid and scallops were caught from the 10 km - 20 km zone; and 5% of the

winkles were collected in the 2 km - 10 km zone and 95% were collected in the 10 km - 20 km zone.

The terrestrial survey area

Beef cattle, lambs and sheep were produced on farms in the survey area. Winter feed for livestock in the form of hay, silage, barley, corn, oats, potatoes, swedes and turnips were produced on the majority of the farms. Farmers and their families were consuming beef and lamb produced commercially on their own farms. Additionally four farmers kept chickens for eggs, one farmer kept pigs for meat, and another farmer kept sheep for mutton, all for consumption solely by their own families and friends. No allotment sites were identified within the survey area but there were several private gardens where many varieties of fruit and vegetables were grown. One beekeeper was interviewed who kept hives in the survey area and consumed honey. Mushrooms, raspberries and blackberries were growing wild in the survey area and these were collected and consumed. Pheasant, mallard, teal, wigeon, greylag geese and grouse shot on farmland in the survey area were consumed. Spring water was used as the main domestic supply of drinking water for people at one residence and the main source of drinking water for livestock at two farms in the survey area. Livestock at many other farms were supplied with mains water for drinking but also had access to ditch or burn water.

In the terrestrial survey area, foods were consumed from 15 food groups. The mean consumption rates for the adult high-rate groups for terrestrial foods were:

- 45 kg y^{-1} for green vegetables
- 29 kg y^{-1} for other vegetables
- 20 kg y^{-1} for root vegetables
- 81 kg y^{-1} for potato
- 71 kg y^{-1} for domestic fruit
- 39 kg y^{-1} for cattle meat
- 19 kg y^{-1} for pig meat
- 23 kg y^{-1} for sheep meat
- 32 kg y^{-1} for poultry
- 21 kg y^{-1} for eggs
- 1.0 kg y^{-1} for wild/free foods
- 2.3 kg y^{-1} for rabbits/hares
- 5.9 kg y^{-1} for honey
- 5.1 kg y^{-1} for wild fungi
- 27 kg y^{-1} for venison

Control measures were used by the Dounreay site in order to limit the possibility that contamination was transferred off-site by wildlife. These included deterring rabbits from entering the site by means of a fence around the site perimeter and occasionally culling rabbits found on site.

The direct radiation survey area

The land in the direct radiation survey area was predominantly agricultural and was sparsely populated. Occupancy rates were obtained at eight residences, four of which were working farms.

The highest occupancy rates in the direct radiation survey area were as follows:

- 8700 h y^{-1} for the indoor occupancy rate (for a resident)
- 4400 h y^{-1} for the outdoor occupancy rate (for a resident who also farmed in the area)
- 8700 h y^{-1} for the total occupancy rate (for a resident)

Gamma dose rate measurements were taken indoors and outdoors at most properties where interviews were conducted. For comparison, background gamma dose rate measurements were taken at distances further than 5 km from the Dounreay site centre.

Comparisons with the previous survey

The results of the 2013 Dounreay habits survey were compared with the last habits survey undertaken in the Dounreay area in 2008.

In the aquatic survey area, the mean consumption rate for the adult high-rate group for fish in 2013 was similar to 2008, whereas the mean consumption rate for the adult high-rate group for crustaceans and molluscs decreased in 2013 when compared with 2008. In 2013, compared to 2008, the mean intertidal occupancy rate for the adult high-rate group increased for rock and for sand. In 2013, one activity was identified taking place over sand and stones, which was collecting winkles. No activities were recorded for sand and stones in 2008. The mean handling rate for the adult high-rate group for fishing gear decreased and for sediment increased significantly in 2013 compared with 2008.

In the terrestrial survey area consumption rates had increased in 2013 compared to 2008 in the following food groups: potato, domestic fruit, sheep meat, poultry, eggs, honey and wild fungi. Consumption rates had decreased in the following food groups: green vegetables, other vegetables, root vegetables, wild/free foods, rabbits/hares and venison. The consumption of cattle meat and pig meat was identified in the 2013 survey but was not identified in the 2008 survey. The consumption of goats' milk and goats' cheese was identified in the 2008 survey, but these were no longer being consumed in 2013.

In the direct radiation survey area, the highest indoor, outdoor and total occupancy rates had all increased in 2013 compared with 2008.

Suggestions for changes to the monitoring programmes

Based on the findings of this survey, the following suggestions for changes to the current environmental monitoring programmes are provided for consideration:

- Within the 'root vegetable' food group the sample of swedes (*Brassica rapa rapa*) currently monitored could be replaced by a sample of turnips (*Brassica napus*), since turnips made the highest percentage contribution to this food group.
- Within the 'domestic fruit' food group the sample of rhubarb currently monitored could be replaced by a sample of apples, since apples made the highest percentage contribution to this food group.
- Within the 'wild/free' food group the samples of rosehips could be replaced with a sample of raspberries since no consumption of rosehips was identified during the survey and raspberries were the most highly consumed food in this food group.
- The sample of goats' milk currently monitored could be stopped since no consumption of locally produced goats' milk was identified during the survey.

1 INTRODUCTION

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 routine operations: discharges of liquid radioactive waste to the aquatic environment, discharges of gaseous radioactive waste to the atmosphere, and direct radiation emanating from the site. Regulation of radioactive waste discharges in Scotland is carried out under the Radioactive Substances Act 1993, (RSA93) (UK Parliament, 1993). Authorisations granted under RSA93 set limits on the activities of specified radionuclides that are authorised to be released from the site. For discharges in Scotland, the Scottish Environment Protection Agency (SEPA) is the regulatory authority under RSA93. Sources of direct radiation from sites are regulated by the Office for Nuclear Regulation (ONR).

1.2 The representative person

Radiological protection of the public is based on the concept of a 'representative person'. This notional individual is defined as being representative of the more highly exposed members of the population. It follows that, if the dose to the representative person is acceptable when compared to relevant dose limits and constraints, members of the public generally will receive lower doses, and overall protection of the public is provided from the effects of radiation. The term 'representative person' is equivalent to, and replaces, the term 'average member of the critical group' as recommended by the International Commission on Radiological Protection (ICRP) (ICRP, 2007).

The representative person can only be established once a dose assessment using environmental monitoring data and habits survey data has been undertaken. This survey provides information to assist SEPA in determining the representative person in the Dounreay area.

1.3 Dose limits and constraints

Doses to the representative person can be compared to nationally and internationally recommended dose limits and constraints. The Radioactive Substances (Basic Safety Standards) (Scotland) Direction 2000 (Scottish Executive, 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 (CEC, 1996) and that doses should be as low as reasonably achievable (ALARA), economic and social factors being taken into account. In connection with this, 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 UK Government accepts that, in general it should be possible to operate existing facilities within the 0.3 mSv per year constraint. The ICRP recommends a dose limit of 1 mSv per year to members of the public from all anthropogenic sources.

2 THE SURVEY

2.1 Site activity

The Dounreay nuclear site is situated on the Caithness coast near Thurso. The site opened in 1955 to develop reactor technology. Three reactors were built on the site, all of which are undergoing decommissioning. The main operations currently taking place on the site are decommissioning, waste management and building of new facilities for use in restoration activities. The site is authorised to discharge gaseous radioactive waste via stacks to the atmosphere and liquid radioactive waste via an outfall to the Pentland Firth. The site contains sources of direct radiation. The site is owned by the Nuclear Decommissioning Authority (NDA). In April 2012, Babcock Dounreay Partnership (BDP) (known as Cavendish Dounreay Partnership (CDP) as of October 2013) was awarded the contract to manage the decommissioning, demolition and clean-up of the Dounreay nuclear site and became the Parent Body Organisation for Dounreay. The site licence holder is Dounreay Site Restoration Limited (DSRL).

The adjoining Vulcan Naval Reactor Test Establishment is a separate entity to the DSRL site. The Vulcan site discharges gaseous radioactive waste via stacks to the atmosphere and routes liquid radioactive waste via the DSRL outfall into the Pentland Firth. For the purpose of this report, the DSRL and Vulcan sites are considered together as one site.

2.2 Survey aims

The Centre for Environment, Fisheries & Aquaculture Science (Cefas) undertook the survey on behalf of SEPA (Cefas contract C3745 and SEPA contract R90077PUR). The aim of the survey was to obtain information on the habits of the public that might lead them to be exposed to the effects of liquid discharges, gaseous discharges and direct radiation arising from the routine activities undertaken at the Dounreay nuclear site and the adjacent Vulcan site. The survey provided comprehensive information to ensure that all potential pathways were identified.

Specifically, investigations were carried out to ascertain the following:

- The consumption of food from the aquatic survey area
- Activities and occupancy over intertidal areas
- The handling of fishing gear and sediment
- Activities and occupancy in and on water
- The use of seaweed as human or animal food or use as a fertiliser
- The consumption of food from the terrestrial survey area
- The production, use and destination of local produce

- The consumption and use of groundwater and surface water in the terrestrial survey area
- The transfer of contamination off-site by wildlife
- Activities and occupancy within the direct radiation survey area
- Any new or unusual exposure pathways

Particular attention was paid to the following activities at the request of SEPA:

- Activities undertaken at Sandside Bay which could give rise to contact with fuel fragments, how people undertaking these activities were dressed and where people spent time in the bay.
- The relative proportion of commercial fishing catches taken from two zones, 2 km - 10 km and 10 km - 20 km, of the Dounreay site outfall.

2.3 Survey areas

Three survey areas were defined to encompass the main areas potentially affected by the discharges from the Dounreay site and sources of radioactivity. These were an aquatic area relating to liquid discharges, a terrestrial area relating to the deposition of gaseous discharges, and a direct radiation area relating to ionising radiation emanating directly from the site.

The aquatic survey area, shown in Figure 1, covered the Caithness coastline from Armadale Bay in the west to Dunnet Head in the east, and included Dunnet Bay and the waters offshore to a radius of approximately 20 km from the Dounreay site outfall.

The terrestrial survey area, shown in Figure 2, included all land and watercourses within 5 km of the site centre (National Grid Reference NC 986 671).

The direct radiation survey area, also shown in Figure 2, was defined as the area within 1 km of the site boundary. For habits surveys undertaken on behalf of SEPA, the direct radiation survey area is usually defined as the area within 1 km of the site centre. However, this was extended because, owing to the large area of the site, there was relatively little land outside the site boundary within 1 km of the site centre, and it did not encompass any residential properties.

The same aquatic, terrestrial and direct radiation survey areas were used in the previous habits survey conducted by Cefas around the Dounreay site, which was in 2008 (Clyne *et al*., 2011).

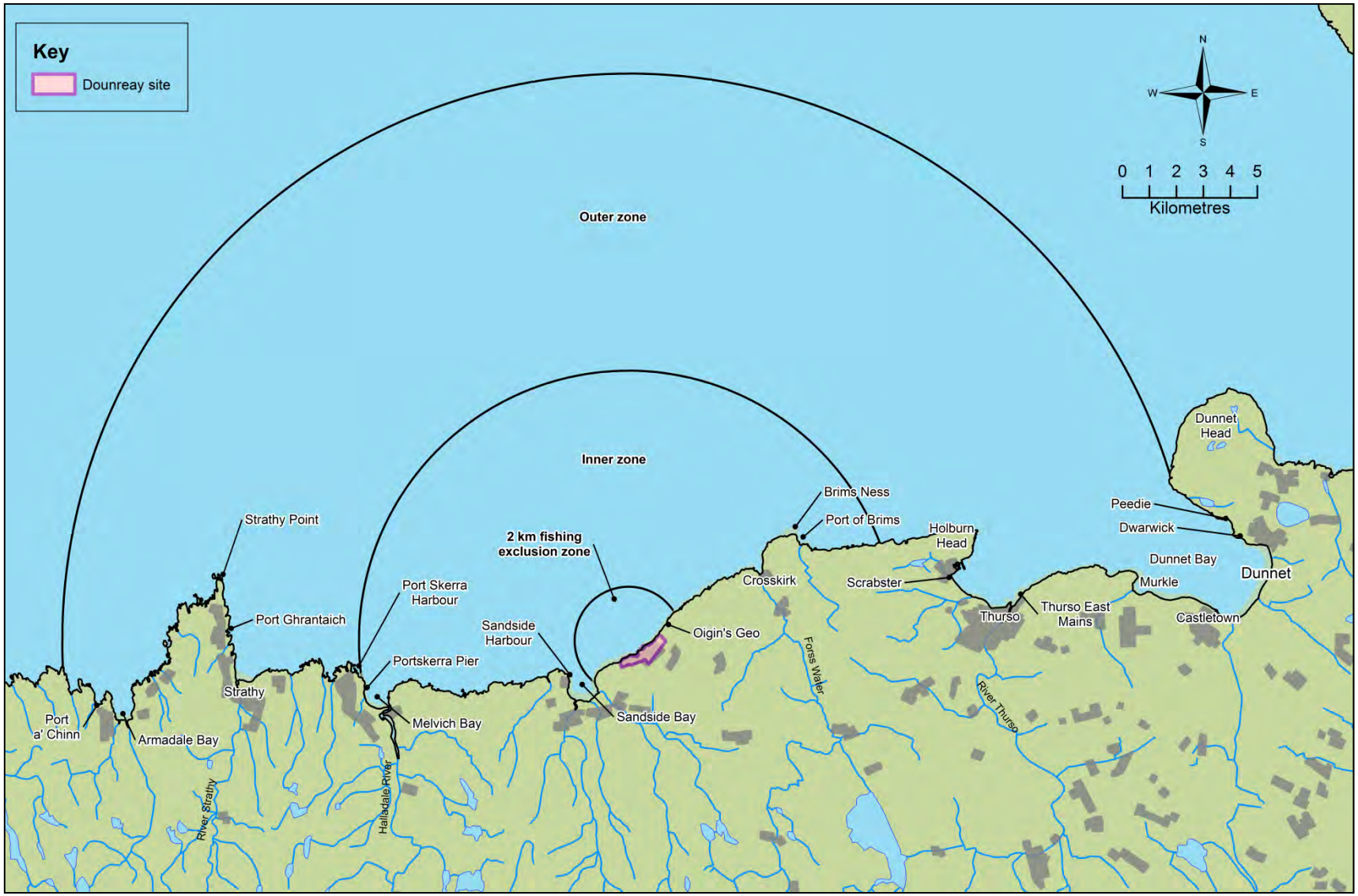

Figure 1. The Dounreay aquatic survey area

Figure 2. The Dounreay terrestrial (outer ring) and direct radiation (inner ring) survey areas

2.4 Conduct of the survey

As part of the pre-survey preparation, SEPA was contacted to identify any additional site specific requirements. Information relating to the activities of people in the aquatic and terrestrial survey areas was obtained from Internet searches, Ordnance Survey maps and from previous habits surveys undertaken at Dounreay. Prior to the fieldwork a proposed fieldwork programme was distributed to SEPA for their comment.

The fieldwork component of the survey was carried out from 16th to 30th July 2013, by three members of staff from the Cefas Lowestoft Laboratory, according to techniques described by Leonard *et al.,* (1982). During the fieldwork an informal meeting was held between the survey team and representatives from the Dounreay nuclear site. This discussion provided details about current site activities, local information, potential pathways and activities in the area, and the potential transfer of contamination off-site by wildlife.

Interviews were conducted with individuals who were identified from the pre-survey preparation, or encountered during the fieldwork, that had the potential to be exposed to radioactivity from the site. These included, for example, commercial fishermen, anglers, people carrying out activities on intertidal areas, farmers, gardeners, beekeepers and people living close to the site. Interviews were used to establish individuals' consumption, occupancy and handling rates relevant to the aquatic, terrestrial and direct radiation areas. Any general information of use to the survey was also obtained. Gamma dose rate measurements were taken over intertidal substrates in the aquatic area and were also taken indoors and outdoors at most properties visited within the direct radiation area. Measurements of background gamma dose rates were taken at locations beyond 5 km from the site centre.

3 METHODS FOR DATA ANALYSIS

3.1 Data recording and presentation

Data collected during the fieldwork were recorded in logbooks. On return to the laboratory, the data were examined and any notably high rates were double-checked, where possible, by way of a follow-up phone call. Where follow-up phone calls were not possible (e.g. interviewees who wished to remain anonymous), the data were accepted at face value. The raw data were entered into a purpose-built database where each individual for whom information was obtained was given a unique identifier (the observation number) to assist in maintaining data quality.

The results of the individuals' consumption, occupancy and handling rates collected during the survey were grouped and presented in tables with the high-rate group members indicated in bold print and with the calculated mean rates for the high-rate group and 97.5th percentile rates noted at the foot of each table. The consumption rates, occupancy rates and handling rates for all groups are presented in Annex 1 for adults and Annex 2 for children and infants, with the high-rate group members indicated in bold print.

3.2 Data conversion

During the interviews, people could not always provide consumption rates in kilograms per year for food or litres per year for milk. In these circumstances, interviewees were asked to provide the information in a different format. For example, some estimated the size and number of items (e.g. eggs) consumed per year, whereas others gave the number of plants in a crop or the length and number of rows in which the crop was grown per year. These data were converted into consumption rates by the database using a variety of standard conversion factors. These factors included produce weights (Hessayon, 1997 and Good Housekeeping, 1994), edible fraction data researched by Cefas, and information supplied by the Meat and Livestock Commission.

3.3 Rounding and grouping of data

The consumption and occupancy data in the text of this report are rounded to two significant figures, except for values less than 1.0, which are rounded to one decimal place. This method of presentation reflects the authors' judgement on the accuracy of the methods used. In the tables and annexes, the consumption rate data are usually presented to one decimal place. Occasionally, this rounding process causes the computed values (row totals, mean rates and 97.5th percentiles), which are based on un-rounded data, to appear slightly erroneous. Consumption rates less than 0.05 kg y^{-1} are presented to two decimal places in order to avoid the value of 0.0 kg y^{-1}. External exposure data are quoted as integer numbers of hours per year.

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 crustacean species are grouped as 'crustaceans'. For external exposure over intertidal sediments, occupancies over the same substrate, such as sand, are grouped together. The typical food groups used in habits surveys are shown in Table 1.

Data were structured into age groups because different dose coefficients (i.e. the factors which convert intakes of radioactivity into dose) can apply to different ages. The International Commission on Radiological Protection (ICRP) revised its recommendations for the age groupings to be used in radiological assessments and these recommendations were adopted in the 2010 habits survey reports. Consequently, the age ranges used in the habits survey reports prior to 2010 differ from those used currently. The age ranges used in this report and the names used for the age groups, based on the recommendations in ICRP 101 (ICRP, 2007), are listed below, together with those used in reports prior to 2010, for comparison.

Age ranges used from 2010 onwards

Name of age group	Age range in group
• Infant	0 to 5-year-old
• Child	6-year-old to 15-year-old
• Adult	16-year-old and over

Age ranges used in reports prior to 2010

Name of age group	Age range in group
• 3-month-old	Under 1-year-old
• 1-year-old	1-year-old
• 5-year-old	2-year-old to 6-year-old
• 10-year-old	7-year-old to 11-year-old
• 15-year-old	12-year-old to 16-year-old
• Adult	17-year-old and over

Since there are fewer age groups for children in the current regime, there should, in general, be more observations in each group, resulting in greater robustness in the data. However, data for children since 2010 will not be directly comparable with data for children prior to 2010, since the age ranges in the age groups will be different.

3.4 Approaches for the identification of high rates

The habits data have been analysed to indicate high rates of consumption, occupancy and handling, prior to a formal assessment being undertaken. Two approaches have been used:

Firstly, the 'cut-off' method described by Hunt *et al.,* (1982) was used. With the 'cut-off' method, the appropriate high rate was calculated by taking the arithmetic mean of the values between the maximum observed rate and one third of the maximum observed rate. In this report, the term 'high-rate group' is used to represent the individuals derived by the 'cut-off' method. The mean of the high-rate group was calculated for each food group, intertidal substrate and handling pathway

identified in the survey. In certain cases, using the 'cut-off' method resulted in only one person being in the high-rate group. In these cases, expert judgement was used to decide whether the high-rate group should remain as one individual or whether others should be included. If others were included, the second highest rate was divided by three and all observations above this were included in the high-rate group.

Secondly, 97.5th percentile rates were calculated using the Excel mathematical function for calculating percentiles. The use of percentiles accords with precedents used in risk assessment of the safety of food consumption. It should be noted that the interviewees in this study are often selected and therefore the calculated percentiles are not based on random data.

Mean and 97.5th percentile rates based on national statistics have been derived by the Ministry of Agriculture, Fisheries and Food (MAFF) (now part of Defra) and the Food Standards Agency (Byrom *et al.,* 1995 and FSA, 2002), and these are referred to as generic rates in this report. The observed rates can be compared with the generic rates.

For the direct radiation pathway, mean occupancy rates and 97.5th percentile rates have not been calculated. Such an analysis is of limited value without a detailed knowledge of the spatial extent of dose rates due to direct radiation.

3.5 Infant and child ratios for use in dose assessments

For ingestion pathways, mean rates for the high-rate groups for infants and children have been calculated from the survey data. However, because few infant and child observations were identified, the rates should be viewed with caution. For assessment purposes, an alternative approach may be taken which involves scaling the mean rates for the adult high-rate groups by ratios. These ratios are given in Table 2 and have been calculated using generic 97.5th percentile consumption rates. Note that the age ranges within the age groups in Table 2 do not correspond exactly with the age ranges within the age groups used throughout the rest of this report.

4 AQUATIC RADIATION PATHWAYS

4.1 Aquatic survey area

The aquatic survey area, shown in Figure 1, covered the Caithness coastline from Armadale Bay in the west to Dunnet Head in the east, and included Dunnet Bay and the waters offshore to a radius of approximately 20 km from the Dounreay site outfall.

The coastline was predominantly rocky, with high cliffs in places, most notably at Strathy Point, Holborn Head and Dunnet Head. Several bays with sandy beaches were interspersed along the coast including, Armadale Bay, Strathy Bay, Melvich Bay, Sandside Bay, Thurso Bay, Murkle Bay and Dunnet Bay. The main A836 road ran parallel to the coast between one and two kilometres inland. Side roads led to the shore in several places but there were large stretches of the coast with no vehicular access. The main coastal town was Thurso; with Scrabster being the main fishing port, where the majority of fishing boats were berthed. A few small fishing and angling boats operated from Port a' Chinn near Armadale Bay, Portskerra, Sandside Harbour, the river at Thurso, Murkle Bay, Castletown Harbour and Dwarwick Pier in Dunnet Bay. Three salmon bag-net operators were identified. One operator had nets set around Port a' Chinn, another operator had a single net set in Melvich Bay and the third operator had nets set around Murkle Bay and off Castletown. The bag-net stations at Murkle Bay and off Castletown were not operating at the time of the 2008 survey and a bag-net station that was in operation at the north end of Dunnet Bay in 2008 had closed in 2013. Four rivers flowed into the sea along the coast: the River Strathy, Halladale River, Forss Water and the River Thurso. Angling, mainly for salmon, occurred along sections of all these rivers.

Armadale Bay to Port Skerra

The rocky shore around Armadale Bay was difficult to access but there was a large sandy beach at the head of the bay, which was accessed by a new footpath from the village or by a footpath from the main road. The beach was infrequently used. On the west side of Armadale Bay there was a small sand and stone beach at Port a' Chinn (see Figure 3) and boats were launched from here to service bag-nets located just offshore.

Figure 3. Port a' Chinn

From Armadale Bay the rocky shore continued eastwards around Strathy Point. The shore in this area could only be accessed by a difficult descent from the top of a cliff, but despite this, anglers occasionally fished in this area and one person was identified nature watching from the rocks. A few buoys and cables were observed at a slipway at the foot of a steep gully on the east side of Strathy Point called Port Ghrantaich, despite a sign saying 'Warning dangerous slope and slipway, do not enter'. There was road access and parking at Strathy Bay although it required a demanding walk across steep sand dunes to reach the beach. The beach was used by people who were walking, dog walking, playing, sunbathing, horse riding, paddling and swimming. It was reported to be a popular surfing area, especially during the winter. The River Strathy entered the sea to the west of Strathy Bay.

Port Skerra to Sandside Bay

Port Skerra was a small natural harbour with a slipway (see Figure 4). A single angling boat was moored at Port Skerra, and several other angling and hobby boats were launched from the slipway. Between Port Skerra harbour and Melvich was Portskerra pier, where a fisherman moored the boat that he used to service a salmon bag-net in the bay. The beach at Melvich Bay (see Figure 5) was predominantly sand with patches of stones. The area was popular with anglers and other activities recorded here included walking, dog walking, playing, sunbathing, paddling, swimming and surfing. One commercial winkle collector gathered winkles from the sand and stones area at the western end of Melvich Bay (he also collected winkles from the rocks at Murkle). The River Halladale flowed into the sea to the east of Melvich Bay. Access to the coastline between Melvich Bay and Sandside

Head, a distance of approximately 7 km, was difficult, with no vehicular access and steep cliffs leading down to boulders and rocks on the shore. No activities were reported to occur in this area.

Figure 4. Port Skerra

Figure 5. Melvich Bay

Sandside Bay to Crosskirk Bay

Sandside Harbour was located on the west side of Sandside Bay. One commercial creel boat and one hobby/angling boat were based there at the time of the survey. There was a 1 km long sandy beach at Sandside Bay (see Figure 6), which had patches of stones on the mid-shore and was backed by sand dunes. The area was popular with dog walkers, and other activities recorded here included walking, playing, angling, horse riding, sitting on the beach and sunbathing. There was an official public information sign at Sandside beach stating that radioactive particles had been found on the shore and advising the public not to remove objects or materials from the beach. There was also a notice board that gave information about the DSRL beach monitoring programme for the detection of fuel fragments. The habits of people using the beach did not appear to be affected by this information. Further information on Sandside Bay is given in Section 4.6.

Figure 6. Sandside Bay

Due to the lack of public roads and footpaths, the 7 km stretch of rocky shoreline between Sandside Bay and Crosskirk Bay could only be accessed by crossing fields and barbed wire fences. The Dounreay nuclear site extended along approximately 2 km of this coastline. There were several deep clefts in the rocky coastline, known as geos, where spume entrained with organic particulate material of potential radiological significance could accumulate. Two local individuals reported that they spent a few hours per year playing on the rocks in and around Oigin's Geo.

Crosskirk Bay to Holborn Head

The river known as Forss Water entered the sea at Crosskirk Bay, where the shore substrate was mainly boulders and stones. One family was identified playing on the shore at Crosskirk Bay. Crosskirk Bay to Holborn Head covered approximately 8 km of rocky coastline and, with the exception of a farm track leading to Brims Ness, access to the shore involved long walks across private land. Angling and dog walking took place on the rocks at Brims Ness and two surfers were observed offshore. A family were playing on the rocks and swimming in a small sheltered bay to the east of Brims Ness, called Port of Brims.

Holborn Head to Thurso

Holborn Head had towering vertical cliffs and there was no access to the shore. The cliffs diminished southwards and just north of Scrabster lighthouse there was a stretch of stepped rocks that was a popular angling venue.

South of the lighthouse was the ferry terminal and major fishing port of Scrabster Harbour. Most of the catches landed at Scrabster were from large offshore vessels that fished well outside the survey area but it was also the main base for the local fishing fleet. A few yachts and other pleasure craft also used the harbour and a lifeboat was based here. Anglers fished from some of the piers, including St. Ola Pier.

Immediately south of the harbour, the sandy Scrabster beach (see Figure 7) was popular with dog walkers and other activities included walking, playing, water sports preparation, paddling and swimming. A dinghy sailing club was located at the north end of the beach and the boats were launched across the sand and sailed in Thurso Bay.

Further towards Thurso the shore substrate changed to rocks and stones and no activities were observed there at the time of the survey.

Figure 7. Scrabster beach

Thurso to Castletown

The sandy beach at Thurso (see Figure 8) was close to residential areas. It was extremely popular with dog walkers. However, it was reported that it was not very popular for family days out on the beach since there were often piles of rotting seaweed. A kayak club had a hut at the western end of the beach. The River Thurso entered the sea to the east of the beach. A few pleasure and angling boats were kept moored in the river and the Sea Cadets had a base on the quay.

East of the river towards Thurso East Mains there were patches of shell sand on the upper shore, while rocks and boulders covered the lower shore. The activities recorded at Thurso East Mains included dog walking, angling and surfing. It was reported that Thurso East Mains was a very popular surfing area in the winter, when the swells were higher.

The stretch of shoreline between Thurso East Mains and Castletown was approximately 9 km in extent and was mainly rocky with a small sandy beach at Murkle Bay. Access to the shoreline was only possible via farm tracks. A salmon bag-net station was located at Murkle Bay and the fishermen spent time on the shore preparing fishing gear and monitoring the nets. The beach at Murkle Bay was also used occasionally by families playing and bait diggers. It was reported that a few dog walkers also used the beach. The commercial winkle collector identified at Melvich also gathered winkles from the rocks at either side of Murkle Bay.

Figure 8. Thurso beach

Castletown to Dunnet Head

The small harbour at Castletown was the base for one commercial creel fishing boat and a few angling boats. The rocky shore either side of the harbour was a very popular angling venue and a small sand beach (see Figure 9) in amongst the rocks to the south of the harbour was used regularly by bait diggers. A salmon bag-net station was situated just off the rocks. Three commercial winkle collectors were identified gathering winkles from the rocks at Castletown (they also collected winkles from the rocks at Peedie).

The 3 km long sandy Dunnet beach (see Figure 10) extended northwards from Castletown and was backed by sand dunes. It was a popular venue for both tourists and local residents who used it for walking, dog walking, angling, bait digging, playing, sunbathing, sitting on the beach, picnicking, paddling, swimming, surfing, kayaking and kitesurfing. A caravan and camping site, and visitor's centre, were located at the north end of the beach. The rangers at the visitor's centre organised various events on the beach and one person was identified who collected a small amount of winkles for his own consumption from the rocks at the end of the beach. It was reported that a group of volunteers periodically collected litter from the beach.

North of Dunnet beach the shore became rocky and the cliffs started to rise towards Dunnet Head. One kilometre further north the pier and slipway at Dwarwick were used by a commercial creel fishing boat and a few small hobby and angling boats. Further north, access to the shore was only possible at a small sandy bay known locally as Peedie beach, before the cliffs rose sharply towards the towering vertical faces of Dunnet Head. The commercial winkle collectors identified at Castletown

were also collecting winkles from the rocks at Peedie. Peedie beach was also used by anglers and walkers.

Figure 9. Bait digging beach at Castletown

Figure 10. Dunnet beach

4.2 Commercial fisheries

Fishing was prohibited within a 2 km zone around the Dounreay site pipe outfall, which was located at 58º 35' 03''N, 3º 45' 21''W.

Crustaceans

The main commercial fishing activity in the survey area was creeling for brown crab and common lobster. Velvet swimming crab were also caught in the creels, but in lesser amounts. About 12 inshore commercial creel boats were operating from Scrabster Harbour at the time of the survey, with one more based at Sandside Harbour, one at Castletown Harbour and one at Dwarwick Pier. Creels were set along the rocky areas of coast throughout the aquatic survey area. Most fishermen set their creels close inshore during the summer but moved them further offshore in the winter to avoid storm damage. The more substantial inshore vessels sometimes fished out to 20 km offshore. While some fishermen worked all through the year, others only operated from April to September. In addition to the inshore fleet, Scrabster was also used by larger vivier tank crabbing vessels which mainly fished further north around Orkney and Shetland although they occasionally fished in the outer north-eastern section of the survey area.

One Scrabster creeling boat was periodically chartered by the Dounreay site to fish within the 2 km fishing exclusion zone to provide crustacean samples for analysis.

The bigger offshore vessels working outside the survey area caught a large proportion of the crustacean catch landed at Scrabster.

Fish

Very little commercial fishing for finfish took place within the survey area. The most notable fishery was the three salmon bag-net operators, with nets set around Port a' Chinn, Melvich Bay, Murkle Bay and off Castletown. These caught small quantities of sea trout, bass and grey mullet, as well as salmon. The commercial salmon and sea trout fishing season was from 26th March to 26th August. However, the nets were not usually deployed until the end of April due to unpredictable weather conditions. No fishing was allowed during weekends in order to allow the migrating salmonids to enter the rivers unobstructed.

Two Scottish fly-seine vessels working out of Scrabster occasionally fished within the survey area under charter to the Dounreay site, specifically to collect samples of fish for analysis.

It was reported that offshore trawlers from other ports very occasionally fished for haddock off Strathy Point and that a small amount of trawling for squid took place offshore between Holborn Head and Strathy Point. Some of the inshore creel boats fished for mackerel with lures, for use as creel bait.

Molluscs

A limited amount of commercial collection of winkles took place on the shore in the survey area and one person was identified that collected winkles for their own consumption. The main winkle wholesaler at Scrabster reported that only a few tonnes per year were harvested from the survey area, mainly from around Murkle Bay, Castletown and Dwarwick.

It was also reported that a few nomadic scallop dredgers from outside the survey area fished for approximately two weeks per year within the outer zone of the survey area.

4.3 Destination of seafood originating from the aquatic survey area

The crustacean catch from within the survey area was predominately exported live to Portugal, and also to France and Spain. Small amounts of brown crabs and common lobsters were sold to local restaurants and hotels. Occasionally during periods of very high landings, brown crabs were sold to operations in the UK for processing. The majority of the salmon and sea trout caught were exported to Europe and other countries around the world, although a small percentage was sold within the UK and locally to individuals and hotels. Small quantities of bass and grey mullet were also sold locally to individuals and hotels. The commercially collected winkles were exported to Europe, mainly to France and Spain.

4.4 Angling and hobby fishing

The most popular places for shore angling were at Melvich, Scrabster, Castletown and Dunnet, but angling took place at many other locations in the survey area. Fly fishing for salmon and sea trout took place on the rivers in the area. The main species caught from the shore were cod, mackerel, bass and pollack. Species caught in smaller quantities included brill, dab, flounder, plaice, salmon, sea trout and turbot.

Several private angling boats were kept at Scrabster Harbour and other small harbours, or launched from the shore. The boat anglers caught haddock, lemon sole, ling and saithe in addition to the species caught from the shore. Two charter angling boats, which took parties of local and visiting anglers, operated out of Scrabster Harbour.

In addition to boat angling, several individuals were hobby fishing with a few creels offshore of Sandside Bay, Scrabster and Dunnet Bay to catch brown crabs and common lobsters for their own consumption.

One individual collected winkles from the rocks at the end of Dunnet Bay for their own consumption.

4.5 Other pathways

No wildfowling was identified taking place within the aquatic survey area. However, wild greylag goose, mallard, teal and wigeon were shot on farmland within the terrestrial survey area. It is assumed that the birds were feeding in this area so they have been included in the poultry food group, which is a terrestrial pathway, since they are potentially affected by gaseous discharges. There were no suitable intertidal habitats within or close to the terrestrial area and so the birds are not as likely to be affected by liquid discharges.

The use of seaweed as a fertiliser or animal feed was not identified during the survey.

4.6 Specific activities investigated at the request of SEPA

Activities which could give rise to contact with fuel fragments at Sandside Bay

Sandside Bay, shown in Figure 6, was visited daily during the survey and on many of these occasions no one was observed on the beach, even on sunny days. The maximum number of people observed on the beach at one time was 10. In fine weather, the sand on the upper shore of the bay above the strandline was dry. Large areas of sand on the mid and lower shore remained wet on falling tides and in certain areas the sand remained wet because water from severel burns drained onto the beach.

Particular attention was paid to the activities in Sandside Bay at the request of SEPA, due to the potential of public exposure to fuel fragments originating from the Dounreay site. The main activity that occurred on the beach was dog walking. Many local people reported that they walked their dogs on Sandside beach on a regular basis. Other activites observed on the beach at Sandside included walking, playing, angling, horse riding, sitting on the beach and sunbathing. One commercial creel boat was operating from Sandside Harbour, and one hobby fisherman had a few creels to catch brown crabs and common lobsters in Sandside Bay.

The weather conditions and the activities being undertaken had a direct bearing on how people were dressed. The dog walkers and anglers routinely wore walking boots or wellington boots, long trousers and tops, ranging from t-shirts to jackets, depending on the weather. The people sunbathing on warm sunny days wore swimwear and were either bare footed or wearing flip flops. It was noted that people often had sand on their footwear and clothing, and dogs had sand on their fur, as they left the beach.

The western side of the beach was most frequently used as the beach could be easily accessed from two small parking areas via footpaths through the sand dunes. There was also a larger car park near Sandside Harbour but it was difficult to access the sandy beach from this location as the shore was rocky. A burn was draining onto the western side of the beach, and at high tide the water was too deep to cross unless wearing wellies or barefoot. Most local dog walkers followed regular routes on the western side of the beach, although some would occasionally walk the length of the beach.

Local people reported that they had seen people bait digging in Sandside Harbour and winkle collecting on the rocks on either side of Sandside beach. Members of the Cefas survey team did not observe anyone bait digging or collecting winkles during their visits to Sandside Bay. No evidence was found of long-lining from the shore.

Commercial fishing catches taken from the two zones within 20 km of the Dounreay pipe outfall

Esitmates of the relative proportion of commercial fishery catches taken from two zones within 20 km of the Dounreay pipe outfall were made based on information from fisherman and fisheries officers. The inner zone was from 2 km - 10 km from the pipe outfall and the outer zone extended from 10 km - 20 km from the pipe outfall including Dunnet Bay (see Figure 1). Seafood collected from the shore was included in the analysis. The estimates are provided in Table A. Fishing was not permitted within 2 km of the pipe outfall.

Table A. Estimates of the relative proportion of the commercial fishery catches taken from the 2 km - 10 km zone and the 10 km - 20 km zone

Fishery	Main species caught	Precentage of the catch from within the 2 km - 10 km zone	Percentage of the catch from within the 10 km - 20 km zone	Comments
Creels	Brown crab, common lobster, velvet swimming crab	40%	60%	The main fishery in the survey area
Salmon bag-net	Salmon	10%	90%	
Trawl	Haddock and squid	0%	100%	Low catch
Scallop dredge	Scallop	0%	100%	Low catch
Winkle collection from the shore	Winkle	5%	95%	Estimate of a few tonnes per year taken within the survey area

4.7 Internal exposure

Adults' consumption data for foods from the aquatic survey area are shown in Tables 3 to 5. Children's and infants' consumption data for foods from the aquatic survey area are shown in Tables 6 and 7.

Adults' consumption rates

The main consumers of seafood from the aquatic survey area were commercial fishermen, anglers, shellfish collectors and their families.

Table B presents a summary of the consumption rates for fish, crustaceans and molluscs from the aquatic survey area. No consumption of marine plants/algae or wildfowl from the aquatic survey area was identified. The table includes the mean consumption rates for the high-rate groups and the observed 97.5th percentile rates. For comparison, the table also includes mean consumption rates and 97.5th percentile consumption rates based on national data, which are referred to as 'generic' data in this report.

Table B. Summary of adults' consumption rates of foods from the aquatic survey area

Food group	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y^{-1})	Observed minimum for the high-rate group (kg y^{-1})	Observed mean for the high-rate group (kg y^{-1})	Observed 97.5th percentile (kg y^{-1})	Generic mean (kg y^{-1})	Generic 97.5th percentile (kg y^{-1})
Fish	89	24	35.4	11.8	17.8	30.8	15.0	40.0
Crustaceans	37	12	16.6	10.9	13.6	16.6	3.5	10.0
Molluscs	1	1	0.3	0.3	0.3	NA	3.5	10.0

Notes
NA = Not applicable

The predominant species of fish consumed by adults were bass, cod, haddock, mackerel and pollack, with smaller quantities of brill, dab, flounder, grey gurnard, lemon sole, lesser spotted dogfish, ling, plaice, saithe, salmon, sea trout and turbot. These fish were caught throughout the survey area. Of the fish consumed by the 24 people in the high-rate group, the percentage breakdown of species were, 32% cod, 18% mackerel, 13% haddock, 8% bass, 8% pollack, 5% ling and 16% a mix of brill, dab, flounder, lemon sole, plaice, saithe, salmon, sea trout and turbot.

The species of crustaceans consumed by adults were brown crab and common lobster. These crustaceans were mainly caught between Sandside Bay and Dunnet Head but were also caught between Strathy Point and Sandside Bay. Of the crustaceans consumed by the 12 people in the

high-rate group, the percentage breakdown of species was 74% brown crab and 26% common lobster.

The only molluscan species that was being consumed was winkles. Only one individual was identified consuming winkles, which were collected from the rocks at either end of Dunnet beach.

Children's and infants' consumption rates

Table C presents a summary of children's and infants' consumption rates of fish and crustaceans from the aquatic survey area. The table includes the mean consumption rates for the high-rate groups and the observed 97.5th percentile rates. For the child and infant age groups, no consumption of molluscs, wildfowl or marine plants/algae was identified. For the child age group, no consumption of crustaceans was identified. The age group names and their relevant age ranges are listed in Section 3.3.

Table C. Summary of children's and infants' consumption rates of foods from the aquatic survey area

Food group	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y^{-1})	Observed minimum for the high-rate group (kg y^{-1})	Observed mean for the high-rate group (kg y^{-1})	Observed 97.5th percentile (kg y^{-1})
Child age group (6 – 15 years old)						
Fish	7	5	11.8	5.4	7.9	11.6
Infant age group (0 – 5 years old)						
Fish	1	1	1.1	1.1	1.1	NA
Crustaceans	1	1	2.5	2.5	2.5	NA

Notes
NA = Not applicable

The predominant species of fish consumed by individuals in the child age group were bass, cod, haddock, mackerel and pollack, with smaller quantities of grey gurnard, lesser spotted dogfish, ling, saithe and turbot. These fish were caught throughout the survey area. The only species of fish consumed by the individual in the infant age group was salmon caught from Melvich.

The only species of crustaceans consumed by the individual in the infant age group was brown crab which was caught from Sandside Bay.

4.8 External exposure

Intertidal occupancy

Intertidal occupancy rates for adults are presented in Table 8 and for children and infants are presented in Table 9. It should be noted that there are often more than one substrate at one named location and that substrates at a given location are liable to change over time. Activities were assigned to the predominant substrate over which they were taking place.

Adults' intertidal occupancy rates

Table D presents a summary of the adults' intertidal occupancy rates in the aquatic survey area. The table includes the mean occupancy rates for the high-rate groups and the observed 97.5th percentile rates.

Table D. Summary of adults' intertidal occupancy rates

Intertidal substrate	Number of observations	Number of people in the high-rate group	Maximum of the high-rate group (h y^{-1})	Mean of the high-rate group (h y^{-1})	97.5th percentile (h y^{-1})
Rock	33	6	550	492	550
Sand	157	3	1500	1008	438
Sand and stones	1	1	104	104	NA

Notes
NA = Not applicable

The activities undertaken by people in the adult high-rate groups for occupancy over the following intertidal substrates included:

- For rock: collecting winkles at Castletown and Peedie; dog walking at Thurso East Mains and Brims Ness; and angling at Strathy Point, Brims Ness, Thurso East Mains, Scrabster and Castletown.
- For sand: angling at Melvich, Sandside and Dunnet; bait digging at Murkle and Castletown; and dog walking at Thurso.
- For sand and stones: collecting winkles at Melvich.

Children's and infants' intertidal occupancy rates

Table E presents a summary of the children's and infants' intertidal occupancy rates in the aquatic survey area. The table includes the mean occupancy rates for the high-rate groups and the observed 97.5th percentile rates.

Table E. Summary of children's and infants' intertidal occupancy rates					
Intertidal substrate	**Number of observations**	**Number of people in the high-rate group**	**Maximum of the high-rate group (h y^{-1})**	**Mean of the high-rate group (h y^{-1})**	**97.5th percentile (h y^{-1})**
Child age group (6 - 15 years old)					
Rock	8	1	78	1	67
Sand	49	6	260	163	169
Infant age group (0 - 5 years old)					
Rock	3	1	16	16	15
Sand	27	2	219	147	125

The activities undertaken by individuals in the child age group high-rate groups for occupancy over the following intertidal substrates included:

- For rock: angling at Scrabster
- For sand: dog walking at Strathy and Sandside; walking at Melvich; and playing at Strathy, Melvich, Scrabster and Dunnet.

The activities undertaken by individuals in the infant age group high-rate groups for occupancy over the following intertidal substrates included:

- For rock: playing at Port of Brims.
- For sand: dog walking at Scrabster; and playing at Thurso and Dunnet.

Gamma dose rate measurements

Gamma dose rate measurements were taken over intertidal substrates to supplement those of SEPA's scheduled monitoring programme. These measurements are presented in Table 10 and are summarised below.

- Eleven measurements taken over sand ranged from 0.045 µGy h^{-1} to 0.073 µGy h^{-1}
- Two measurements taken over sand and stones ranged from 0.075 µGy h^{-1} to 0.106 µGy h^{-1}
- One measurement taken over stones and rock was 0.142 µGy h^{-1}

Handling fishing gear and sediment

Handling fishing gear that has become entrained with fine sediment particles, or handling sediment while undertaking activities such as bait digging or mollusc collecting, can potentially give rise to skin exposure from beta radiation. Doses to the skin need consideration, as there is a separate dose limit for skin for members of the public. There is also a contribution to effective dose due to skin exposure (ICRP, 1991). The handling of angling equipment was not considered to be a significant pathway. Therefore, as in previous surveys, data for this pathway were not collected.

Table 11 presents the adults' handling rates of fishing gear and sediment recorded during the survey and Table 12 presents the children's handling rates of sediment recorded during the survey. No individuals in the infant age group were identified handling sediment at the time of the survey and no individuals in the child or infant age group were identified handling fishing gear.

Adults' handling rates of fishing gear and sediment

Table F presents a summary of the handling rates of fishing gear and sediment for adults. The table includes the mean handling rates for the high-rate groups and the observed 97.5th percentile rates.

Table F. Summary of adults' handling rates of fishing gear and sediment

Handling activity	Number of observations	Number of people in the high-rate group	Maximum of the high-rate group (h y^{-1})	Mean of the high-rate group (h y^{-1})	97.5th percentile (h y^{-1})
Handling fishing gear	26	12	2300	1414	2075
Handling sediment	16	5	550	432	550

The activities undertaken by the people in the adult high-rate groups for handling included:

- For handling fishing gear: handling creels offshore from Strathy to Dunnet Head; and handling nets offshore of Murkle and Castletown.
- For handling sediment: collecting winkles at Castletown, Peedie, Melvich and Murkle; and bait digging at Murkle and Castletown.

Most of the creel fishermen interviewed wore gloves while operating the gear but did not wear gloves while mending the creels. Most of the bag-net fishermen wore gloves while operating the gear but not while mending the nets. However, one bag-net fisherman was identified who did not wear gloves at any time. None of the winkle collectors or bait diggers interviewed were wearing gloves.

Children's handling rates of sediment

Table G presents the handling rates of sediment recorded during the survey for the child age group. The table includes the mean handling rate for the high-rate group.

Table G. Summary of children's handling rates of sediment

Number of observations	Number of people in the high-rate group	Maximum of the high-rate group (h y^{-1})	Mean of the high-rate group (h y^{-1})	97.5th percentile (h y^{-1})
Child age group (6 – 15 years old)				
1	1	5	5	NA

Notes
NA = Not applicable

The activity undertaken by the only individual in the child age group high-rate group for handling sediment was bait digging at Castletown.

Water based activities

Activities taking place in or on the water can potentially lead to ingestion of water and/or inhalation of spray. These pathways are generally considered to be minor in comparison with other exposure pathways such as the ingestion of foods produced in the vicinity of a nuclear site. However, relevant data have been collected for consideration in dose assessments. Mean occupancy rates and 97.5th percentile rates have not been calculated. Activities where there is a high potential of the individual's face submersing under the water have been classified as activities 'in water' since they are likely to lead to ingestion of water. All other activities have been classified as activities 'on water'.

Occupancy rates for activities taking place 'in water' and 'on water' in the survey area for adults are presented in Table 13. Occupancy rates for activities taking place 'in water' and 'on water' in the survey area for the child age group and the infant age group are presented in Table 14.

Activities taking place in the water in the aquatic survey area included surfing, kayaking, kitesurfing and swimming. Twelve observations were recorded for occupancy in the water for adults. The highest occupancy rate in water for adults was 250 h y^{-1} for two watersport enthusiasts. The highest occupancy rate in water for individuals in the child age group was 48 h y^{-1} for two children who were swimming at Melvich. The highest occupancy rate in water for individuals in the infant age group was 12 h y^{-1} for an infant who was swimming at Strathy and Melvich.

Activities taking place on the water in the survey area included creeling, charter boat skipper duties, bag-netting, angling, sailing, and paddling. Sixty-four observations were recorded for adults. The highest occupancy rate on water for adults was 2200 h y^{-1}, which was for four individuals who were creeling offshore, from Sandside Bay to Dunnet Head. Of the 11 individuals in the child age group, the highest occupancy rate was 15 h y^{-1} for two children who were paddling at Thurso. Of the 10 individuals in the infant age group, the highest occupancy rate was 15 h y^{-1} for an infant who was paddling at Thurso.

5 TERRESTRIAL RADIATION PATHWAYS

5.1 Terrestrial survey area

The terrestrial survey area covered all land within 5 km of the Dounreay site centre, as shown in Figure 2. Interviews were conducted at 19 farms in the area; 14 produced beef cattle and lambs (one of these also produced sheep), four produced beef cattle only, and one produced lamb only. No dairy farms were identified in the survey area. Crops including hay, grass for silage, barley, corn, oats, potatoes, swedes and turnips, were grown on the farms for use as winter feed for the livestock. Beef cattle and lambs were sold through livestock markets at Wick, Carlisle and Dingwall, sent to abattoirs in Aberdeenshire and Ayr and sold to Mey Selections, which is a local food marketing company. Live cattle were exported from one farm, via Aberdeenshire, for slaughter in Italy. A small number of lambs were sold privately from one farm and sheep were sold privately from another farm.

Farmers and their families were consuming beef and lamb produced commercially on their own farms. Four farmers kept chickens for eggs, one farmer kept pigs for meat, and another farmer kept sheep for mutton, all for consumption solely by their own families' and friends. Many farming families grew vegetables such as potatoes, swedes, turnips, radish and beetroot, for their own consumption. No allotment sites were identified within the survey area but there were several private gardens where many varieties of fruit and vegetables were grown, and one household was self sufficient in fruit and vegetables. At the time of the last habits survey, in 2008, one household kept goats and consumed goats' milk and goats' cheese. They still kept goats to control the growth of grass in 2013 but they had ceased milking in 2012 and no longer consumed goats' milk or cheese.

One beekeeper was identified who kept six hives within the survey area. The honey produced was consumed by the beekeeper and their family and friends. Three other beekeepers identified during the 2008 survey could not be contacted.

A large part of the survey area near the coast was particularly weather beaten and barren, and therefore, very little wild food was available. A small amount of blackberries and raspberries growing in the wild were collected and consumed. Wild fungi was collected from farm fields and consumed.

Eight households were consuming game and wild birds, including venison, rabbits, grouse, pheasant, greylag goose, mallard, teal and wigeon, which were shot on farmland within the terrestrial survey area. Wild greylag goose, mallard, teal and wigeon are usually included in the wildfowl food group, which is an aquatic pathway, since they spend time on intertidal areas and are potentially affected by liquid discharges. However, in this instance they have been included in the poultry food group, which is a terrestrial pathway, since it is assumed that they were feeding in the terrestrial area and are potentially affected by gaseous discharges. There were no suitable intertidal habitats within or close

to the terrestrial area and so the birds are not as likely to be affected by liquid discharges. Pheasants were reared on an estate for private game shoots on the estate's land, where both pheasant and grouse were shot. Red deer, roe deer and grouse were also shot on the estate and were sold to a game wholesaler. Only part of the estate's land was in the survey area.

Spring water was used as the main domestic supply of drinking water for people at one residence and the main source of drinking water for livestock at two farms in the survey area. Livestock at many other farms were supplied with mains water for drinking but also had access to ditch or burn water.

The transfer of contamination off-site by wildlife was investigated as radionuclides could enter the food chain or contaminate the environment through this pathway. The site's wildlife management policy included deterring rabbits from entering the site by means of a fence around the site perimeter and occasionally culling rabbits found on site. No monitoring of wildlife found on site was undertaken.

5.2 Land cover

Figure 11 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, to the south-west and to the north-east of the site, there 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.

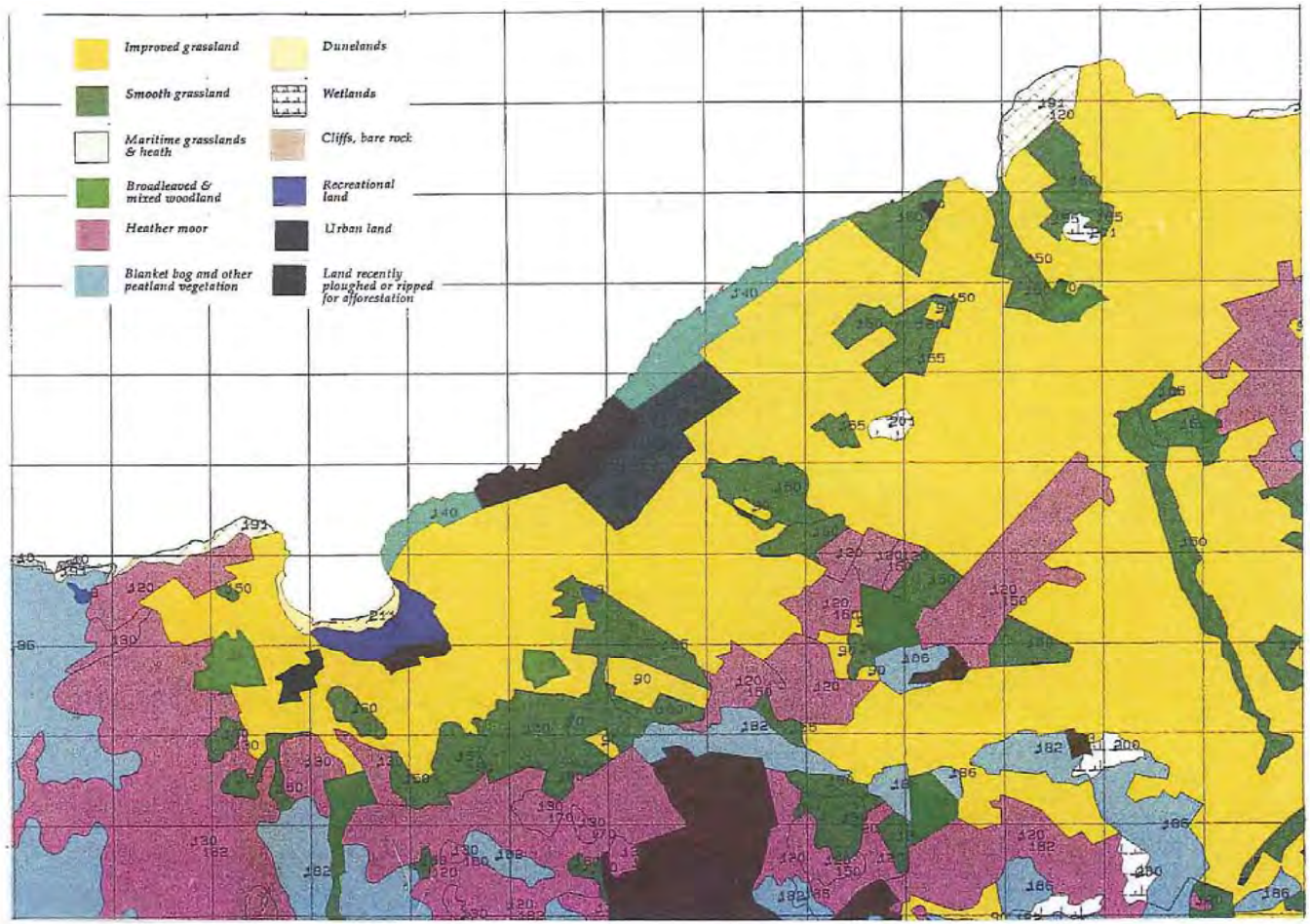

Figure 11. Land cover in the Dounreay area

5.3 Internal exposure

Consumption data for locally produced foodstuffs potentially affected by gaseous discharges are presented in Tables 15 to 29 for adults and Tables 30 to 32 for children and infants.

Adults' consumption rates

Consumption of locally produced foods was identified in the following 15 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, cattle meat, pig meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi and venison. No consumption of locally produced milk or cereals was identified.

Table H presents a summary of the consumption rates for the foods consumed from the terrestrial survey area for adults. The table includes the mean consumption rates for the high-rate groups and the observed 97.5th percentile rates. For comparison, the table also includes mean consumption rates and 97.5th percentile consumption rates based on national data, which are referred to as 'generic' data in this report.

Table H. Summary of adults' consumption rates of foods from the terrestrial survey area

Food group	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y^{-1})	Observed minimum for the high-rate group (kg y^{-1})	Observed mean for the high-rate group (kg y^{-1})	Observed 97.5th percentile (kg y^{-1})	Generic mean (kg y^{-1})	Generic 97.5th percentile (kg y^{-1})
Green vegetables	19	2	44.9	44.9	44.9	44.9	15.0	45.0
Other vegetables	14	6	43.0	22.5	29.4	43.0	20.0	50.0
Root vegetables	26	15	27.5	13.8	20.0	27.5	10.0	40.0
Potato	22	8	100.0	62.0	80.9	100.0	50.0	120.0
Domestic fruit	25	6	91.2	58.7	71.1	91.2	20.0	75.0
Cattle meat	4	4	47.3	31.5	39.4	47.3	15.0	45.0
Pig meat	2	2	19.0	19.0	19.0	19.0	15.0	40.0
Sheep meat	8	4	33.9	11.3	22.6	33.9	8.0	25.0
Poultry	13	2	31.8	31.8	31.8	31.8	10.0	30.0
Eggs	18	5	31.2	13.9	20.9	31.2	8.5	25.0
Wild/free foods	5	1	1.0	1.0	1.0	0.9	7.0	25.0
Rabbits/hares	2	2	2.3	2.3	2.3	2.3	6.0	15.0
Honey	8	2	5.9	5.9	5.9	5.9	2.5	9.5
Wild fungi	11	3	6.3	2.7	5.1	6.3	3.0	10.0
Venison	13	4	31.8	21.3	26.5	31.8	ND	ND

Notes
ND = Not determined

One observed mean consumption rate for the adult high-rate groups was found to be greater than the generic 97.5th percentile consumption rates, this was for poultry. Twelve observed mean consumption rates for the high-rate groups exceeded the generic mean consumption rates. These were for green vegetables, other vegetables, root vegetables, potato, domestic fruit, cattle meat, pig meat, sheep meat, poultry, eggs, honey and wild fungi. Five observed 97.5th percentile consumption rates exceeded the generic 97.5th percentile consumption rates. These were for domestic fruit, cattle meat, sheep meat, poultry and eggs. There are currently no generic consumption data available for venison so no comparisons can be made.

The percentage contribution each food type makes to its terrestrial food group, for adults, is presented in Table 33.

Children's and infants' consumption rates

Table I presents a summary of the children's and infants' consumption rates for the foods consumed from the terrestrial survey area. The table includes the mean consumption rates for the high-rate groups and the observed 97.5th percentile rates. There are currently no generic consumption data available for the child or infant age groups.

Individuals in the child age group were identified consuming domestic fruit only. No consumption of foods from the following food groups was identified: green vegetables, other vegetables, root vegetables, potato, milk, cattle meat, pig meat, sheep meat, poultry, eggs, wild/free foods, honey, wild fungi, venison and cereals.

Individuals in the infant age group were identified consuming foods from the following food groups: potato, domestic fruit and eggs. No consumption of foods from the following food groups was identified: green vegetables, other vegetables, root vegetables, milk, cattle meat, pig meat, sheep meat, poultry, wild/free foods, honey, wild fungi, venison and cereals.

Table I. Summary of children's and infants' consumption rates of foods from the terrestrial survey area

Food group	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y^{-1})	Observed minimum for the high-rate group (kg y^{-1})	Observed mean for the high-rate group (kg y^{-1})	Observed 97.5th percentile (kg y^{-1})
Child age group (6 - 15 years old)						
Domestic fruit	2	2	0.3	0.3	0.3	0.3
Infant age group (0 - 5 years old)						
Potato	1	1	6.3	6.3	6.3	NA
Domestic fruit	1	1	1.4	1.4	1.4	NA
Eggs	1	1	8.9	8.9	8.9	NA

Notes
NA = Not applicable

6 DIRECT RADIATION PATHWAYS

6.1 Direct radiation survey area

The direct radiation survey area, shown in Figure 2, covered all land within 1 km of the Dounreay licensed site boundary. For habits surveys undertaken on behalf of SEPA, the direct radiation survey area is usually defined as the area within 1 km of the site centre. However, this was extended because, owing to the large area of the site, there was relatively little land outside the site boundary within 1 km of the site centre, and it did not encompass any residential properties.

The direct radiation survey area was bisected from the south-west to the north-east by the rocky coastline. The shore comprised shelving rocks and deep clefts and could only be accessed by crossing farm fields. The Dounreay site extended for approximately 2 km along the shoreline and this part of the shore was relatively inaccessible. Commercial fishing, both at sea and from the shore, was prohibited in the direct radiation survey area due to a 2 km fishing exclusion zone around the site outfall. The land within the direct radiation survey area was agricultural, with the exception of a disused airfield to the east of the site and a newly constructed low level waste facility to the north-east of the site. The survey area was sparsely populated. There were 11 residences, four of which were farms, and three unoccupied properties. The main concentration of houses was to the east of the site at Buldoo.

6.2 Occupancy rates and gamma dose rate measurements

Interviews were conducted at eight residences, four of which were working farms. Three of the residential properties were occupied by families with children. Indoor, outdoor and total occupancy rates for adults, children and infants are presented in Table 34. A summary of occupancy rates in the direct radiation survey area is presented in Table J. The highest indoor occupancy rate and total occupancy rate was for a resident, and the highest outdoor occupancy rate was for a resident who also farmed in the area.

Table J. Summary of direct radiation occupancy rates

Number of observations	Highest indoor occupancy ($h\ y^{-1}$)	Highest outdoor occupancy ($h\ y^{-1}$)	Highest total occupancy ($h\ y^{-1}$)
23	8720	4351	8724

Gamma dose rate measurements were taken both indoors and outdoors at most properties where interviews were conducted. Outdoor measurements were taken approximately 5 to 10 metres from

the nearest building. Gamma dose rate measurements over rough grass were taken at locations further than 5 km from the Dounreay site centre to obtain background dose rates. All measurements were taken at a height of 1 metre above the substrate.

The results are presented in Table 35 and are summarised below. The indoor and outdoor measurements have not been adjusted for background dose rates.

Indoor measurements

- Seven gamma dose rate measurements taken over concrete ranged from 0.098 µGy h^{-1} to 0.125 µGy h^{-1}

Outdoor measurements

- Eight gamma dose rate measurements taken over grass ranged from 0.089 µGy h^{-1} to 0.103 µGy h^{-1}

Background measurements

- Four background measurements taken over grass ranged from 0.049 µGy h^{-1} to 0.092 µGy h^{-1}, giving a mean background of 0.081 µGy h^{-1}.

The underlying geology may cause variations in the gamma dose measurement readings. The geology of the areas where measurements were taken during this survey was not investigated. The gamma dose rate measurements were taken at varying times of the day.

7 USES OF HABITS DATA FOR DOSE ASSESSMENTS

In determining habits data for the purposes of assessing radiological doses to the public, it may be necessary to consider a combination of pathways. Data are provided in Annex 1 and Annex 2 so that the full effect of combining pathways can be assessed for individual observations, given the concentrations and dose rates for a particular assessment. The rates for individuals in the high-rate groups are emboldened and are therefore apparent. 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 high-rate groups.

The most extensive combinations of pathways for adult dose assessment are shown in Annex 3. Each of the 25 combinations shown in this table represents an actual individual (or individuals) from Annex 1 who has positive data (irrespective of the magnitude), for each pathway marked with a cross. It should be noted that combination numbers in Annex 3 do not correlate directly with observation numbers in Annex 1. Other individuals from Annex 1 have combinations that are not listed in Annex 3 because they have fewer pathways and a dose assessment for them would be adequately covered by one of the 25 listed combinations.

8 COMPARISONS WITH THE PREVIOUS SURVEY

The results from this 2013 survey can be compared with results from the last habits survey undertaken at Dounreay, which was conducted in 2008. The aquatic, terrestrial and direct radiation survey areas in the 2013 survey were the same as those in the 2008 survey.

Aquatic survey

A comparison between the 2008 and 2013 consumption rates of aquatic foods for adults is presented in Table K.

Table K. Comparison between 2008 and 2013 consumption rates of aquatic food groups for adults

	2008			2013		
Food group	**Number in high-rate group**	**Maximum consumption rate (kg y^{-1})**	**Mean consumption rate for the high-rate group (kg y^{-1})**	**Number in high-rate group**	**Maximum consumption rate (kg y^{-1})**	**Mean consumption rate for the high-rate group (kg y^{-1})**
Fish	17	29.5	18.4	24	35.4	17.8
Crustaceans	3	36.6	20.9	12	16.6	13.6
Molluscs	2	2.7	2.1	1	0.3	0.3

The mean consumption rate for the adult high-rate group for fish in 2013 was very similar to 2008, whereas the mean consumption rate for the adult high-rate group for crustaceans and molluscs decreased in 2013 when compared with 2008.

The species of fish consumed by the adult high-rate group in 2008 were bass, cod, dab, haddock, lemon sole, mackerel, monkfish, plaice, pollack, salmon and sea trout. Monkfish were no longer being consumed by the adult high-rate group in 2013, and in addition to the species consumed in 2008, brill, flounder, ling, saithe and turbot were being consumed by the adult high-rate group in 2013. The species of crustaceans consumed by the adult high-rate group in 2008 were brown crab, common lobster and velvet swimming crab, whereas in 2013 only brown crab and common lobster were consumed by the adult high-rate group. In 2008, the species of molluscs consumed by the adult high-rate group were quahog clams and winkles. In 2013, only winkles were being consumed by the adult high-rate group.

The decrease in the consumption rate of crustaceans was due to a single very high-rate consumer who was identified in 2008 having moved away from the area in 2013. The decrease in the consumption rate of molluscs was partly because the individual who was identified consuming quahog clams in 2008 had stopped consuming them in 2013, since he had experimented with many ways of cooking them but had not found a recipe that he liked.

A comparison between the 2008 and 2013 aquatic external exposure pathways for adults is presented in Table L.

Table L. Comparison between 2008 and 2013 intertidal occupancy rates and handling rates of fishing gear and sediment for adults

	2008			2013		
Intertidal substrate or handling pathway	**Number of people in the high-rate group**	**Maximum occupancy or handling rate (h y^{-1})**	**Mean occupancy or handling rate for the high-rate group (h y^{-1})**	**Number of people in the high-rate group**	**Maximum occupancy or handling rate (h y^{-1})**	**Mean occupancy or handling rate for the high-rate group (h y^{-1})**
Rock	1	330	330	6	550	492
Sand	15	913	471	3	1500	1008
Sand and stones	-	-	-	1	104	104
Handling fishing gear	10	1960	1666	12	2300	1414
Handling sediment	6	55	30	5	550	432

In 2013, compared to 2008, the mean intertidal occupancy rate for the adult high-rate group increased for rock and for sand. Activities were identified taking place over sand and stones in 2013 but not in 2008. The increase in the occupancy over rock was mainly due to to commercial winkle collectors being identified in 2013, who were not identified in 2008. The increase in the occupancy rate over sand was attributed to the identification in 2013 of two individuals who spent very high times angling and bait digging.

The mean rates for the adult high-rate group for handling fishing gear decreased slightly in 2013 compared with 2008. The mean rate for the adult high-rate group for handling sediment increased significantly in 2013 compared with 2008. This was mainly due to commercial winkle collectors being identified in 2013, who were not identified in 2008.

Terrestrial survey

A comparison between the 2008 and 2013 mean consumption rates for the adult high-rate groups for terrestrial foods is presented in Table M.

Table M. Comparison between 2008 and 2013 mean consumption rates for the adult high-rate groups for terrestrial food groups (kg y^{-1} or l y^{-1})

Food group	2008	2013
Green vegetables	62.0	44.9
Other vegetables	73.6	29.4
Root vegetables	78.1	20.0
Potato	70.7	80.9
Domestic fruit	40.7	71.1
Goats' milk	172.9	No consumption identified
Goats' cheese	7.9	No consumption identified
Cattle meat	No consumption identified	39.4
Pig meat	No consumption identified	19.0
Sheep meat	17.7	22.6
Poultry	6.1	31.8
Eggs	14.3	20.9
Wild/free foods	3.7	1.0
Rabbits/hares	4.2	2.3
Honey	4.2	5.9
Wild fungi	3.0	5.1
Venison	55.8	26.5

In 2013, consumption rates had increased in the following food groups: potato, domestic fruit, sheep meat, poultry, eggs, honey and wild fungi. The consumption of cattle meat and pig meat was identified in the 2013 survey but was not identified in the 2008 survey. Consumption rates had decreased in 2013 for the following food groups: green vegetables, other vegetables, root vegetables, wild/free foods, rabbits/hares and venison. The consumption of goats' milk and goats' cheese was identified in the 2008 survey, but had ceased in 2013.

The decreases in the mean consumption rates for the high-rate groups for green vegetables, other vegetables and root vegetables were due mainly to reduced consumption by one couple. The mean consumption rate for the high-rate group for domestic fruit consumption increased in 2013 compared to 2008 because two couples had increased their consumption, and another couple with high consumption had moved to the area and therefore were not interviewed in 2008. The consumption of goats' milk and goats' cheese in 2008 was by three consumers at one property who kept goats. They were re-interviewed in 2013 but were no longer producing goats' milk or goats' cheese. The large increase in poultry consumption in 2013 was attributed to two individuals who were interviewed in

2013, but not interviewed in 2008. No specific reasons were identified for the other changes in consumption rates.

Direct radiation survey

The activities that were identified in the direct radiation survey area in 2008 and 2013 were similar and included people residing and farming.

A comparison between the 2008 and 2013 direct radiation occupancy rates is presented in Table N.

Table N. Comparison between 2008 and 2013 highest direct radiation occupancy rates (h y^{-1})

	2008	**2013**
Highest indoor	7083	8720
Highest outdoor	2639	4351
Highest total	8508	8724

In 2013 the highest indoor, outdoor and total occupancy rates had all increased when compared with 2008.

The increases in the highest indoor and total occupancy rates were attributed to one resident who, due to health reasons, spent an increased amount of time at their property when compared to 2008. The highest outdoor occupancy rate increase was attributed to a farmer who had increased their farming activities since 2008.

9 MAIN FINDINGS

The survey investigated three potential sources of public radiation exposure from the Dounreay site, which were:

- Discharges of liquid radioactive waste to the Pentland Firth
- Discharges of gaseous radioactive waste to the atmosphere
- Direct radiation emanating from the site

Data were collected for 370 individuals including, commercial fishermen, anglers, shellfish collectors, people spending time on intertidal substrates, farmers, gardeners, beekeepers and people spending time within 1 km of the Dounreay licensed site boundary. These people were targeted because their habits or where they live may cause them to be exposed to radioactivity or radiation from the site. However, it should be noted that the most exposed people could only be defined with the outcome of a dose assessment.

All consumption rates recorded are only for foods produced, collected or caught from within the aquatic and terrestrial survey areas as defined in Section 2.3.

Aquatic survey area

The mean consumption rates for the adult high-rate groups (as defined in Section 3.4) for the separate aquatic consumption pathways for foods potentially affected by liquid discharges were:

- 18 kg y^{-1} for fish
- 14 kg y^{-1} for crustaceans
- 0.3 kg y^{-1} for molluscs

The predominant foods consumed by the high-rate groups were:

- For fish: bass, cod, haddock, mackerel and pollack
- For crustaceans: brown crab and common lobster
- For molluscs: winkles

The consumption of marine plants/algae andwildfowl from the aquatic survey area was not identified.

The mean occupancy rates for adult high-rate groups over the separate intertidal substrates were:

- 490 h y^{-1} for rock
- 1000 h y^{-1} for sand
- 100 h y^{-1} for sand and stones

The mean rates for the adult high-rate groups for handling were:

- 1400 h y^{-1} for handling fishing gear (creels and nets)
- 430 h y^{-1} for handling sediment

The adult maximum occupancy rates for water based activities were:

- 250 h y^{-1} for occupancy in water
- 2200 h y^{-1} for occupancy on water

The results of the investigations requested by SEPA into specific activities in the aquatic survey area were:

- The main activity occurring at Sandside Bay was dog walking. Other activities included walking, playing, angling, horse riding, sitting on the beach and sunbathing. No evidence was found of long-lining from the shore. The western section of the beach was most frequently used as the main access points to the beach were in this area. The way people were dressed varied with the weather and the activity that they were undertaking and ranged from swimwear to jackets with long trousers and boots.
- For commercial fishing catches, it was estimated that 40% of the crustaceans were caught from within a zone extending from 2 km - 10 km from the pipeline outfall and 60% were caught from a zone extending from 10 km - 20 km from the outfall pipe; 10% of the salmon were caught from the 2 km - 10 km zone and 90% from the 10 km - 20 km zone; 100% of the demersal fish, squid and scallops were caught from the 10 km - 20 km zone; and 5% of the winkles were collected in the 2 km - 10 km zone and 95% were collected in the 10 km - 20 km zone.

Terrestrial survey area

The mean consumption rates for the adult high-rate groups for the separate consumption pathways for foods potentially affected by gaseous discharges were:

- 45 kg y^{-1} for green vegetables
- 29 kg y^{-1} for other vegetables
- 20 kg y^{-1} for root vegetables
- 81 kg y^{-1} for potato
- 71 kg y^{-1} for domestic fruit
- 39 kg y^{-1} for cattle meat
- 19 kg y^{-1} for pig meat
- 23 kg y^{-1} for sheep meat
- 32 kg y^{-1} for poultry
- 21 kg y^{-1} for eggs
- 1.0 kg y^{-1} for wild/free foods
- 2.3 kg y^{-1} rabbits/hares
- 5.9 kg y^{-1} for honey
- 5.1 kg y^{-1} for wild fungi
- 27 kg y^{-1} for venison

No consumption of locally produced milk or cereals from the survey area was identified. The consumption of foodstuffs from the terrestrial survey area by children and infants was also recorded.

Spring water was used as the main domestic supply of drinking water for people at one residence and the main source of drinking water for livestock at two farms in the survey area. Livestock at many other farms were supplied with mains water for drinking but also had access to ditch or burn water.

The site's wildlife management policy included keeping rabbits out of the site by means of a fence around the site perimeter and occasionally culling rabbits found on site.

Direct radiation survey area

The highest occupancy rates within the direct radiation survey area were:

- 8700 h y^{-1} for the indoor occupancy rate (for a resident)
- 4400 h y^{-1} for the outdoor occupancy rate (for a resident who also farmed in the area)
- 8700 h y^{-1} for the total occupancy rate (for a resident)

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10 SUGGESTIONS FOR CHANGES TO THE MONITORING PROGRAMME

Information collected during this habits survey can be used to make suggestions for changes to the current SEPA environmental monitoring programme. A summary of the current programme is provided below, followed by the suggestions for changes to the programme.

10.1 Summary of the current environmental monitoring programme

The 2012 SEPA environmental monitoring programme, which is published in the RIFE report (EA, FSA, NIEA and SEPA 2013) included the samples and measurements listed below. The location names, foods and substrate classifications are taken directly from that publication. Some of the samples and measurements taken for the monitoring programme may be from outside the survey area used for this habits survey.

Aquatic monitoring

Aquatic samples

Sample	***Location***
Cod	Scrabster
Crabs	Pipeline inner zone
Crabs	Pipeline outer zone
Crabs	Strathy
Crabs	Kinlochbervie
Crabs	Melvich Bay
Winkles	Brims Ness
Winkles	Sandside Bay
Mussels	Echnaloch Bay
Mussels	Thurso East Mains
Fucus vesiculosus	Kinlochbervie
Fucus vesiculosus	Brims Ness
Fucus vesiculosus	Sandside Bay
Fucus vesiculosus	Burwick Pier
Sediment	Oigin's Geo
Sediment	Brims Ness
Sediment	Sandside Bay
Sediment	Rennibester
Seawater	Brims Ness
Seawater	Sandside Bay
Spume	Oigin's Geo

Gamma dose rate measurements over intertidal sediments

Substrate	*Location*
Sand	Sandside Bay
Winkle bed	Sandside Bay
Spume/sludge	Oigin's Geo
Shingle and stones	Brims Ness
Salt marsh	Melvich
Sand	Melvich
Sand	Strathy
Riverbank	Thurso
Soil	Achreregan Hill
Soil	Thurso Park
Soil	Borrowston Mains
Soil	East of Dounreay
Sand	Castletown Harbour
Sand	Dunnet

Beta dose rate measurements over intertidal sediments

Substrate	*Location*
Sediment	Sandside Bay
Surface sediment	Oigin's Geo
Riverbank	Thurso
Surface sediment	Castletown Harbour

Terrestrial monitoring

Terrestrial samples

Beef muscle
Beef offal
Carrots
Goats' milk
Grouse
Lamb muscle
Oats
Pheasants
Potatoes
Rabbit
Rhubarb
Rosehips
Swede
Wild blackberries
Wild mushrooms
Grass
Soil
Freshwater from Loch Calder, Loch Shurrey, Loch Baligill and Heldale Water.
Radioactivity in air near Dounreay; measurements taken at Shebster, Reay and Balmore.

10.2 Suggestions for changes

It is considered that SEPA's current environmental monitoring programme provides adequate coverage. However, based on the findings of this habits survey, the following suggestions are presented for consideration:

- Within the 'root vegetable' food group the sample of swedes (*Brassica rapa rapa*) currently monitored could be replaced by a sample of turnips (*Brassica napus*), since turnips made the highest percentage contribution to this food group.
- Within the 'domestic fruit' food group the sample of rhubarb currently monitored could be replaced by a sample of apples, since apples made the highest percentage contribution to this food group.
- Within the 'wild/free' food group the samples of rosehips could be replaced with a sample of raspberries since no consumption of rosehips was identified during the survey and raspberries were the most highly consumed foods in this food group.
- The sample of goats' milk currently monitored could be stopped since goats' milk is no longer produced in the survey area.

It is recommended that all other samples currently monitored remain unchanged.

11 ACKNOWLEDGEMENTS

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Table 1. Typical food groups used in habits surveys

Food group	Examples of foods within the group
Green vegetables	Asparagus, broccoli, Brussels sprout, cabbage, calabrese, cauliflower, chard, courgette, cucumber, gherkin, globe artichoke, herbs, kale, leaf beet, lettuce, marrow, spinach
Other vegetables	Aubergine, broad bean, chilli pepper, French bean, kohl rabi, mangetout, pea, pepper, pumpkin, runner bean, sweetcorn, tomato
Root vegetables	Beetroot, carrot, celeriac, celery, chicory, fennel, garlic, Jerusalem artichoke, leek, onion, parsnip, radish, shallot, spring onion, swede, turnip
Potato	Potato
Domestic fruit	Apple, apricot, blackberry, blackcurrant, boysenberry, cherry, damson, fig, gooseberry, grape, greengage, huckleberry, loganberry, melon, nectarine, peach, pear, plum, raspberry, redcurrant, rhubarb, rowanberry, strawberry, tayberry, whitecurrant
Milk	Cows' milk, cream, goats' milk, yoghurt
Cattle meat[a]	Beef
Pig meat[a]	Pork
Sheep meat[a]	Lamb, mutton
Poultry[b]	Chicken, duck, goose, grouse, guinea fowl, partridge, pheasant, pigeon, turkey, woodcock
Eggs	Chicken egg, duck egg, goose egg
Wild/free foods	Blackberry, chestnut, crab apple, damson, dandelion root, elderberry, nettle, rowanberry, sloe
Honey	Honey
Wild fungi	Mushrooms, other edible fungi
Rabbits/Hares	Hare, rabbit
Venison[a]	Venison
Fish (sea)	Bass, brill, cod, common ling, dab, Dover sole, flounder, gurnard, haddock, hake, herring, lemon sole, mackerel, monkfish, mullet, plaice, pollack, rays, saithe, salmon, sea trout, sprat, turbot, whitebait, whiting, witch, cuttlefish[c], squid[c]
Fish (freshwater)	Brown trout, eel (river), perch, pike, rainbow trout, salmon (river)
Crustaceans	Brown crab, common lobster, crawfish, *Nephrops* , prawn, shrimp, spider crab, squat lobster, velvet swimming crab
Molluscs	Cockles, limpets, mussels, oysters, razor clam, scallops, whelks, winkles
Wildfowl	Canada goose, greylag goose, mallard, pink-footed goose, pintail, shoveler, teal, wigeon

Notes

[a] Including offal

[b] Domesticated ducks and geese are included in the poultry food group, which is a terrestrial pathway. Wild ducks and geese are usually included in the wildfowl food group, which is an aquatic pathway, since they spend time on intertidal areas and are potentially affected by liquid discharges. However, in the Dounreay habits survey they have been included in the poultry food group since they were shot on farmland in the terrestrial survey area. It is assumed that the wild birds were feeding in this area and were potentially affected by gaseous discharges. There were no suitable intertidal habitats within or close to the terrestrial area and so the birds are not as likely to be affected by liquid discharges.

[c] Although squid and cuttlefish are molluscs, radiologically they are more akin to fish.

Table 2. Ratios for determining consumption and occupancy rates for infants and children

Group	Ratio[a]	
	Infant[e]/adult	Child[e]/adult
Fish[b]	0.050	0.200
Crustaceans[b]	0.050	0.250
Molluscs[b]	0.050	0.250
Green vegetables	0.222	0.444
Other vegetables	0.200	0.500
Root vegetables	0.375	0.500
Potatoes	0.292	0.708
Domestic fruit	0.467	0.667
Milk	1.333	1.000
Cattle meat	0.222	0.667
Pig meat	0.138	0.625
Sheep meat	0.120	0.400
Poultry	0.183	0.500
Eggs	0.600	0.800
Wild/free foods[c]	0.110	0.490
Game[d]	0.140	0.500
Honey	0.789	0.789
Wild fungi	0.150	0.450
Freshwater fish[b]	0.050	0.250
External exposure over intertidal substrates	0.030	0.500

Notes

[a]Excepting notes b and c, consumption ratios were derived from Byrom et al., (1995) which presented data for infants aged 6 to 12 months and children aged 10 to 11 years.

[b]Ratios were derived from Smith and Jones, (2003) which presented data for infants and children of unspecified ages.

[c]Ratios were derived from FSA data for wild fruit and nuts for infants and 10-year-old children (Tossell, 1996)

[d]Game includes rabbits/hares and venison.

[e]Note that the age ranges within the age groups in this table do not correspond exactly with the age ranges within the age groups used throughout the rest of this report.

Table 3. Adults' consumption rates of fish from the Dounreay aquatic survey area (kg y^{-1})

Observation number	Bass	Brill	Cod	Dab	Flounder	Grey gurnard	Haddock	Lemon sole	Lesser spotted dogfish	Ling	Mackerel	Plaice	Pollack	Saithe	Salmon	Sea trout	Turbot	Total
202	**-**	**-**	**9.1**	**1.8**	**-**	**-**	**9.1**	**1.8**	**-**	**-**	**-**	**4.5**	**9.1**	**-**	**-**	**-**	**-**	**35.4**
203	**-**	**-**	**9.1**	**1.8**	**-**	**-**	**9.1**	**1.8**		**-**	**-**	**4.5**	**9.1**	**-**	**-**	**-**	**-**	**35.4**
232	**-**	**0.7**	**14.7**	**0.9**	**0.9**	**-**	**14.7**	**-**	**-**	**-**	**-**	**0.9**	**-**	**-**	**-**	**-**	**-**	**32.9**
238	**-**	**-**	**4.5**	**1.4**	**-**	**-**	**4.5**	**-**	**-**	**-**	**1.8**	**1.4**	**4.5**	**4.5**	**-**	**-**	**-**	**22.7**
239	**-**	**-**	**4.5**	**1.4**	**-**	**-**	**4.5**	**-**	**-**	**-**	**1.8**	**1.4**	**4.5**	**4.5**	**-**	**-**	**-**	**22.7**
240	**-**	**-**	**4.5**	**1.4**	**-**	**-**	**4.5**	**-**	**-**	**-**	**1.8**	**1.4**	**4.5**	**4.5**	**-**	**-**	**-**	**22.7**
5	**3.7**	**-**	**3.7**	**-**	**-**	**-**	**3.7**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3.7**	**3.7**	**-**	**18.5**
6	**3.7**	**-**	**3.7**	**-**	**-**	**-**	**3.7**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3.7**	**3.7**	**-**	**18.5**
186	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**17.0**	**-**	**-**	**-**	**-**	**-**	**-**	**17.0**
187	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**17.0**	**-**	**-**	**-**	**-**	**-**	**-**	**17.0**
178	**-**	**-**	**8.2**	**-**	**-**	**-**	**-**	**-**	**-**	**6.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**15.0**
179	**-**	**-**	**8.2**	**-**	**-**	**-**	**-**	**-**	**-**	**6.8**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**15.0**
201	**6.4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**6.4**	**-**	**-**	**-**	**-**	**2.3**	**-**	**15.0**
190	**-**	**-**	**14.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**14.2**
191	**-**	**-**	**14.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**14.2**
192	**-**	**-**	**14.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**14.2**
193	**-**	**-**	**14.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**14.2**
135	**0.9**	**-**	**2.7**	**-**	**-**	**-**	**-**	**-**	**-**	**2.7**	**3.6**	**-**	**0.9**	**-**	**-**	**-**	**0.9**	**11.8**
136	**0.9**	**-**	**2.7**	**-**	**-**	**-**	**-**	**-**	**-**	**2.7**	**3.6**	**-**	**0.9**	**-**	**-**	**-**	**0.9**	**11.8**
137	**0.9**	**-**	**2.7**	**-**	**-**	**-**	**-**	**-**	**-**	**2.7**	**3.6**	**-**	**0.9**	**-**	**-**	**-**	**0.9**	**11.8**
196	**3.6**	**-**	**-**	**1.8**	**-**	**-**	**-**	**-**	**-**	**-**	**4.5**	**1.8**	**-**	**-**	**-**	**-**	**-**	**11.8**
198	**5.9**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5.9**	**-**	**-**	**-**	**-**	**-**	**-**	**11.8**
199	**5.9**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5.9**	**-**	**-**	**-**	**-**	**-**	**-**	**11.8**
197	**3.6**	**-**	**-**	**1.8**	**-**	**-**	**-**	**-**	**-**	**-**	**4.5**	**1.8**	**-**	**-**	**-**	**-**	**-**	**11.8**
213	2.3	-	2.7	-	1.4	-	-	-	-	-	2.7	-	2.3	-	-	-	-	11.3
214	2.3	-	2.7	-	1.4	-	-	-	-	-	2.7	-	2.3	-	-	-	-	11.3
253	-	-	-	-	-	-	3.2	-	-	-	4.5	-	-	3.2	-	-	-	10.9
255	-	-	-	-	-	-	3.2	-	-	-	4.5	-	-	3.2	-	-	-	10.9
252	-	-	-	-	-	-	3.2	-	-	-	4.5	-	-	3.2	-	-	-	10.9
254	-	-	-	-	-	-	3.2	-	-	-	4.5	-	-	3.2	-	-	-	10.9
256	-	-	-	-	-	-	3.2	-	-	-	4.5	-	-	3.2	-	-	-	10.9
170	-	-	7.7	-	-	-	3.1	-	-	-	-	-	-	-	-	-	-	10.8
171	-	-	7.7	-	-	-	3.1	-	-	-	-	-	-	-	-	-	-	10.8
291	3.1	-	-	-	-	-	-	-	-	-	6.0	-	-	-	-	-	-	9.2
292	3.1	-	-	-	-	-	-	-	-	-	6.0	-	-	-	-	-	-	9.2
293	3.1	-	-	-	-	-	-	-	-	-	6.0	-	-	-	-	-	-	9.2
294	3.1	-	-	-	-	-	-	-	-	-	6.0	-	-	-	-	-	-	9.2
295	3.1	-	-	-	-	-	-	-	-	-	6.0	-	-	-	-	-	-	9.2
296	3.1	-	-	-	-	-	-	-	-	-	6.0	-	-	-	-	-	-	9.2

Table 3. Adults' consumption rates of fish from the Dounreay aquatic survey area (kg y^{-1})

Observation number	Bass	Brill	Cod	Dab	Flounder	Grey gurnard	Haddock	Lemon sole	Lesser spotted dogfish	Ling	Mackerel	Plaice	Pollack	Saithe	Salmon	Sea trout	Turbot	Total
257	-	-	3.0	-	-	-	-	-	-	2.2	1.7	-	2.2	-	-	-	-	9.1
109	-	-	-	-	-	-	-	-	-	-	3.6	-	1.8	1.8	-	-	-	7.3
110	-	-	-	-	-	-	-	-	-	-	3.6	-	1.8	1.8	-	-	-	7.3
164	-	-	1.4	-	-	-	0.9	-	-	0.9	1.4	0.9	0.9	0.9	-	-	-	7.3
165	-	-	1.4	-	-	-	0.9	-	-	0.9	1.4	0.9	0.9	0.9	-	-	-	7.3
169	-	-	1.4	-	-	-	0.9	-	-	0.9	1.4	0.9	0.9	0.9	-	-	-	7.3
168	-	-	1.4	-	-	-	0.9	-	-	0.9	1.4	0.9	0.9	0.9	-	-	-	7.3
166	-	-	1.4	-	-	-	0.9	-	-	0.9	1.4	0.9	0.9	0.9	-	-	-	7.3
167	-	-	1.4	-	-	-	0.9	-	-	0.9	1.4	0.9	0.9	0.9	-	-	-	7.3
47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.2	-	-	7.2
48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.2	-	-	7.2
181	-	-	-	-	-	-	-	-	-	-	6.8	-	-	-	-	-	-	6.8
182	-	-	-	-	-	-	-	-	-	-	6.8	-	-	-	-	-	-	6.8
183	-	-	-	-	-	-	-	-	-	-	6.8	-	-	-	-	-	-	6.8
184	-	-	-	-	-	-	-	-	-	-	6.8	-	-	-	-	-	-	6.8
185	-	-	-	-	-	-	-	-	-	-	6.8	-	-	-	-	-	-	6.8
298	1.9	-	-	-	-	-	-	-	-	-	2.6	-	-	-	-	1.6	-	6.0
299	1.9	-	-	-	-	-	-	-	-	-	2.6	-	-	-	-	1.6	-	6.0
61	-	-	-	-	-	-	-	-	-	-	2.1	-	1.5	-	-	2.3	-	6.0
62	-	-	-	-	-	-	-	-	-	-	2.1	-	1.5	-	-	2.3	-	6.0
215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.9	-	-	5.9
216	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.9	-	-	5.9
247	-	-	-	-	-	0.5	-	-	0.9	-	-	-	2.3	2.3	-	-	-	5.9
248	-	-	-	-	-	0.5	-	-	0.9	-	-	-	2.3	2.3	-	-	-	5.9
249	-	-	-	-	-	0.5	-	-	0.9	-	-	-	2.3	2.3	-	-	-	5.9
250	-	-	-	-	-	0.5	-	-	0.9	-	-	-	2.3	2.3	-	-	-	5.9
350	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.9	-	-	5.9
325	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.6	5.6
326	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.6	5.6
222	1.3	-	-	-	-	-	-	-	-	-	2.8	-	-	-	-	-	-	4.0
223	1.3	-	-	-	-	-	-	-	-	-	2.8	-	-	-	-	-	-	4.0
194	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.6	-	-	3.6
209	-	-	-	-	-	-	-	-	-	-	3.5	-	-	-	-	-	-	3.5
212	-	-	-	-	-	-	-	-	-	-	3.5	-	-	-	-	-	-	3.5
230	1.8	-	-	-	0.9	-	-	-	0.7	-	-	-	-	-	-	-	-	3.4
231	1.8	-	-	-	0.9	-	-	-	0.7	-	-	-	-	-	-	-	-	3.4
280	-	-	-	-	-	-	-	-	-	-	3.1	-	-	-	-	-	-	3.1
281	-	-	-	-	-	-	-	-	-	-	3.1	-	-	-	-	-	-	3.1
139	-	-	0.9	-	-	-	-	-	-	0.9	0.9	-	-	-	-	-	-	2.7

Table 3. Adults' consumption rates of fish from the Dounreay aquatic survey area (kg y^{-1})

Observation number	Bass	Brill	Cod	Dab	Flounder	Grey gurnard	Haddock	Lemon sole	Lesser spotted dogfish	Ling	Mackerel	Plaice	Pollack	Saithe	Salmon	Sea trout	Turbot	Total
242	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-	2.0
246	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-	2.0
195	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	-	-	1.6
220	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	-	1.4
221	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.4	-	1.4
132	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1
133	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1
134	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1
41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1	-	-	1.1
42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1	-	-	1.1
43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1	-	-	1.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish based on the 24 high-rate adult consumers is 17.8 kg y^{-1}

The observed 97.5th percentile rate based on 89 observations is 30.8 kg y^{-1}

Table 4. Adults' consumption rates of crustaceans from the Dounreay aquatic survey area (kg y^{-1})

Observation number	Brown crab	Common lobster	Total
190	**12.8**	**3.8**	**16.6**
191	**12.8**	**3.8**	**16.6**
192	**12.8**	**3.8**	**16.6**
193	**12.8**	**3.8**	**16.6**
39	**4.2**	**9.6**	**13.8**
40	**4.2**	**9.6**	**13.8**
178	**8.8**	**3.8**	**12.6**
179	**8.8**	**3.8**	**12.6**
166	**10.9**	**-**	**10.9**
167	**10.9**	**-**	**10.9**
168	**10.9**	**-**	**10.9**
169	**10.9**	**-**	**10.9**
194	3.3	2.2	5.5
181	3.3	-	3.3
182	3.3	-	3.3
183	3.3	-	3.3
184	3.3	-	3.3
185	3.3	-	3.3
41	2.5	0.3	2.8
82	2.7	-	2.7
84	2.7	-	2.7
368	1.4	1.1	2.5
42	2.5	-	2.5
43	2.5	-	2.5
195	0.5	0.3	0.9
346	0.7	0.2	0.8
347	0.7	0.2	0.8
174	0.8	-	0.8
175	0.8	-	0.8
265	0.4	-	0.4
266	0.4	-	0.4
49	0.3	-	0.3
50	0.3	-	0.3
1	-	0.3	0.3
2	-	0.3	0.3
47	0.3	-	0.3
48	0.3	-	0.3

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of crustaceans based on the 12 high-rate adult consumers is 13.6 kg y^{-1}

The observed 97.5th percentile rate based on 37 observations is 16.6 kg y^{-1}

Table 5. Adults' consumption rates of molluscs from the Dounreay aquatic survey area (kg y^{-1})

Observation number	Winkle
38	**0.3**

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of molluscs based on the only adult consumer is 0.3 kg y^{-1}

The observed 97.5th percentile rate is not applicable for 1 observation

Table 6. Children's and infants' consumption rates of fish from the Dounreay aquatic survey area (kg y^{-1})

Child age group (6 - 15 years old)

Observation number	Age	Bass	Cod	Grey gurnard	Haddock	Lesser spotted dogfish	Ling	Mackerel	Pollack	Saithe	Salmon	Turbot	Total
138	**10**	**0.9**	**2.7**	**-**	**-**	**-**	**2.7**	**3.6**	**0.9**	**-**	**-**	**0.9**	**11.8**
172	**14**	**-**	**7.7**	**-**	**3.1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**10.8**
251	**15**	**-**	**-**	**0.5**	**-**	**0.9**	**-**	**-**	**2.3**	**2.3**	**-**	**-**	**5.9**
200	**6**	**2.7**	**-**	**-**	**-**	**-**	**-**	**2.7**	**-**	**-**	**-**	**-**	**5.4**
173	**14**	**-**	**3.8**	**-**	**1.6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**5.4**
210	14	-	-	-	-	-	-	3.5	-	-	-	-	3.5
211	10	-	-	-	-	-	-	3.5	-	-	-	-	3.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish for the child age group based upon the 5 high-rate consumers is 7.9 kg y^{-1}

The observed 97.5th percentile rate based on 7 observations is 11.6 kg y^{-1}

Infant age group (0 - 5 years old)

Observation number	Age	Bass	Cod	Grey gurnard	Haddock	Lesser spotted dogfish	Ling	Mackerel	Pollack	Saithe	Salmon	Turbot	Total
44	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.1**	**-**	**1.1**

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish for the infant age group based upon the only high-rate consumer is 1.1 kg y^{-1}

The observed 97.5th percentile rate is not applicable for 1 observation

Table 7. Infants' consumption rates of crustaceans from the Dounreay aquatic survey area (kg y^{-1})

Infant age group (0 - 5 years old)

Observation number	Age	Brown crab
44	**3**	**2.5**

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of crustaceans for the infant age group based upon the only high-rate consumer is 2.5 kg y^{-1}

The observed 97.5th percentile rate is not applicable for 1 observation

Table 8. Adults' intertidal occupancy rates in the Dounreay aquatic survey area (h y^{-1})

Observation number	Location	Activity	Rock	Sand	Sand and stones
233	**Castletown and Peedie**	**Collecting winkles**	**550**	-	-
234	**Castletown and Peedie**	**Collecting winkles**	**550**	-	-
235	**Castletown and Peedie**	**Collecting winkles**	**550**	-	-
95	**Thurso East Mains**	**Dog walking**	**525**	-	-
201	**Strathy Point, Brims Ness and Thurso East Mains**	**Angling**	**500**	-	-
	Melvich, Sandside and Dunnet	**Angling**	**-**	**1000**	-
109	**Brims Ness, Scrabster and Castletown**	**Angling**	**275**	-	-
	Brims Ness	**Dog walking**		-	-
	Sandside and Dunnet	Dog walking	-	30	-
279	Murkle	Collecting winkles	104	-	-
	Melvich	**Collecting winkles**	-	-	**104**
198	Scrabster and Castletown	Angling	80	-	-
	Dunnet	Angling	-	96	-
	Castletown	Bait digging	-		-
96	Thurso East Mains	Dog walking	75	-	-
	Thurso	Dog walking	-	150	-
97	Thurso East Mains	Dog walking	75	-	-
	Thurso	Dog walking	-	75	-
110	Brims Ness	Dog walking	75	-	-
	Sandside and Dunnet	Dog walking	-	30	-
161	Murkle and Castletown	Monitoring bag-nets	65	-	-
	Murkle	Preparing fishing gear	-	45	-
247	Strathy Point and Scrabster	Angling	60	-	-
	Melvich	Angling	-	30	-
248	Strathy Point and Scrabster	Angling	60	-	-
	Melvich	Angling	-	30	-
196	Scrabster	Angling	50	-	-
	Sandside and Dunnet	Angling	-	176	-
	Dunnet	Bait digging	-		-
242	Strathy	Nature watching and angling	48	-	-
	Dunnet	Nature reserve warden duties, angling and bait digging	-	90	-
222	Scrabster and Thurso	Angling	28	-	-
113	Port of Brims	Playing	16	-	-
	Murkle	Playing	-	8	-
114	Port of Brims	Playing	16	-	-
	Murkle	Playing	-	8	-

Table 8. Adults' intertidal occupancy rates in the Dounreay aquatic survey area (h y^{-1})

Observation number	Location	Activity	Rock	Sand	Sand and stones
249	Scrabster	Angling	15	-	-
	Melvich	Angling	-	8	-
250	Scrabster	Angling	15	-	-
	Melvich	Angling	-	8	-
135	Castletown	Angling	15	-	-
	Castletown	Bait digging	-	5	-
280	Scrabster	Angling	9	-	-
	Armadale and Dunnet	Dog walking	-	373	-
111	Scrabster	Angling	9	-	-
112	Scrabster	Angling	9	-	-
257	Scrabster	Angling	8	-	-
342	Approximately 200m west of Oigin's Geo	Playing	6	-	-
128	Crosskirk	Playing	3	-	-
129	Crosskirk	Playing	3	-	-
38	Dunnet	Collecting winkles	2	-	-
	Dunnet	Walking	-	60	-
224	Thurso	Playing	2	-	-
	Thurso	Playing	-	4	-
225	Thurso	Playing	2	-	-
	Thurso	Playing	-	4	-
226	Thurso	Playing	2	-	-
	Thurso	Playing	-	4	-
232	**Murkle and Castletown**	**Bait digging**	-	**1500**	-
	Dunnet	**Angling**	-		-
229	**Thurso**	**Dog walking**	-	**525**	-
300	Sandside, Thurso and Dunnet	Dog walking	-	463	-
241	Melvich, Sandside, Scrabster and Dunnet	Dog walking	-	450	-
118	Thurso	Dog walking	-	440	-
65	Scrabster	Dog walking	-	438	-
119	Thurso	Dog walking	-	415	-
281	Armadale and Dunnet	Dog walking	-	373	-
39	Strathy and Sandside	Dog walking	-	365	-
40	Strathy and Sandside	Dog walking	-	365	-
56	Sandside	Dog walking	-	338	-
89	Thurso and Dunnet	Dog walking	-	312	-
120	Thurso	Dog walking	-	274	-

Table 8. Adults' intertidal occupancy rates in the Dounreay aquatic survey area (h y^{-1})

Observation number	Location	Activity	Rock	Sand	Sand and stones
258	Dunnet	Dog walking	-	260	-
363	Strathy and Sandside	Dog walking	-	260	-
237	Sandside, Scrabster and Dunnet	Dog walking	-	208	-
267	Melvich	Playing and walking	-	192	-
268	Melvich	Playing and walking	-	192	-
236	Thurso	Dog walking	-	180	-
310	Thurso	Dog walking	-	177	-
	Strathy	Sunbathing	-		-
301	Sandside	Dog walking	-	175	-
99	Thurso	Dog walking and playing	-	174	-
365	Sandside	Dog walking	-	173	-
366	Sandside	Dog walking	-	173	-
333	Sandside	Dog walking	-	165	-
334	Sandside	Dog walking	-	165	-
26	Thurso	Dog walking	-	156	-
53	Armadale	Dog walking	-	156	-
85	Dunnet	Dog walking	-	155	-
320	Strathy and Melvich	Playing	-	151	-
	Thurso	Dog walking	-		-
61	Sandside and Dunnet	Angling	-	130	-
87	Dunnet	Dog walking	-	130	-
88	Dunnet	Dog walking	-	130	-
303	Sandside	Dog walking	-	130	-
304	Sandside	Dog walking	-	130	-
213	Dunnet and Peedie	Angling	-	129	-
	Castletown	Bait digging	-		-
214	Dunnet and Peedie	Angling	-	129	-
	Castletown	Bait digging	-		-
316	Strathy, Melvich, Scrabster and Dunnet	Playing	-	128	-
317	Strathy, Melvich, Scrabster and Dunnet	Playing	-	128	-
63	Scrabster	Dog walking	-	104	-
64	Scrabster	Dog walking	-	104	-
121	Strathy, Scrabster, Thurso and Dunnet	Walking	-	104	-
51	Sandside	Dog walking	-	93	-
348	Melvich and Sandside	Dog walking	-	77	-
349	Melvich and Sandside	Dog walking	-	77	-

Table 8. Adults' intertidal occupancy rates in the Dounreay aquatic survey area (h y^{-1})

Observation number	Location	Activity	Rock	Sand	Sand and stones
123	Thurso and Dunnet	Playing	-	75	-
124	Thurso and Dunnet	Playing	-	75	-
125	Thurso and Dunnet	Playing	-	75	-
126	Thurso and Dunnet	Playing	-	75	-
98	Thurso	Playing	-	70	-
230	Dunnet	Angling	-	66	-
	Castletown	Bait digging	-		-
158	Strathy, Sandside, Scrabster and Dunnet	Walking	-	65	-
159	Strathy, Sandside, Scrabster and Dunnet	Walking	-	65	-
67	Scrabster, Thurso and Dunnet	Dog walking and playing	-	62	-
68	Scrabster, Thurso and Dunnet	Dog walking and playing	-	62	-
71	Scrabster, Thurso and Dunnet	Dog walking and playing	-	62	-
72	Scrabster, Thurso and Dunnet	Dog walking and playing	-	62	-
160	Scrabster	Dog walking	-	60	-
321	Strathy and Melvich	Playing	-	60	-
322	Strathy and Melvich	Playing	-	60	-
78	Scrabster	Playing	-	50	-
86	Dunnet	Dog walking	-	50	-
132	Dunnet	Angling	-	45	-
	Castletown	Bait digging	-		-
162	Murkle	Preparing fishing gear	-	45	-
163	Murkle	Preparing fishing gear	-	45	-
152	Dunnet and Sandside	Sitting on the beach	-	42	-
153	Dunnet and Sandside	Sitting on the beach	-	42	-
271	Strathy, Melvich, Scrabster, Thurso and Dunnet	Playing	-	42	-
272	Strathy, Melvich, Scrabster, Thurso and Dunnet	Playing	-	42	-
243	Dunnet	Nature reserve warden duties	-	40	-
220	Dunnet	Angling	-	36	-
282	Armadale	Sunbathing	-	36	-
283	Armadale	Sunbathing	-	36	-
103	Thurso	Jogging and playing	-	35	-
148	Dunnet	Playing	-	35	-
149	Dunnet	Playing	-	35	-
286	Strathy and Melvich	Playing	-	33	-
287	Strathy and Melvich	Playing	-	33	-
276	Melvich	Playing	-	30	-

Table 8. Adults' intertidal occupancy rates in the Dounreay aquatic survey area (h y^{-1})

Observation number	Location	Activity	Rock	Sand	Sand and stones
277	Melvich	Playing	-	30	-
325	Sandside	Angling	-	30	-
326	Sandside	Angling	-	30	-
259	Scrabster	Water sports preparation	-	28	-
260	Scrabster	Water sports preparation	-	28	-
261	Scrabster	Water sports preparation	-	28	-
262	Scrabster	Water sports preparation	-	28	-
263	Scrabster	Water sports preparation	-	28	-
264	Scrabster	Water sports preparation	-	28	-
308	Sandside	Sunbathing	-	28	-
309	Sandside	Sunbathing	-	28	-
328	Strathy, Melvich and Sandside	Dog walking	-	26	-
329	Strathy, Melvich and Sandside	Dog walking	-	26	-
330	Strathy, Melvich and Sandside	Dog walking	-	26	-
311	Strathy	Sunbathing	-	24	-
312	Strathy	Sunbathing	-	24	-
54	Melvich and Sandside	Dog walking	-	23	-
	Sandside	Angling	-		-
27	Thurso	Walking	-	23	-
313	Strathy, Melvich and Dunnet	Sunbathing and walking	-	22	-
314	Strathy, Melvich and Dunnet	Sunbathing and walking	-	22	-
315	Strathy, Melvich and Dunnet	Sunbathing and walking	-	22	-
29	Dunnet	Sitting on the beach	-	20	-
140	Dunnet	Playing	-	20	-
141	Dunnet	Playing	-	20	-
142	Dunnet	Playing	-	20	-
244	Dunnet	Nature reserve warden duties	-	20	-
245	Dunnet	Nature reserve warden duties	-	20	-
12	Thurso	Sitting on the beach	-	18	-
13	Thurso	Sitting on the beach	-	18	-
30	Strathy, Thurso, Dunnet and Peedie	Walking	-	18	-
31	Strathy, Thurso, Dunnet and Peedie	Walking	-	18	-
143	Dunnet	Playing	-	18	-
144	Dunnet	Playing	-	18	-
154	Dunnet	Playing	-	18	-
155	Dunnet	Playing	-	18	-

Table 8. Adults' intertidal occupancy rates in the Dounreay aquatic survey area (h y^{-1})

Observation number	Location	Activity	Rock	Sand	Sand and stones
156	Dunnet	Playing	-	16	-
7	Thurso	Sitting on the beach	-	14	-
188	Dunnet	Angling and bait digging	-	14	-
189	Dunnet	Angling and bait digging	-	14	-
14	Thurso and Dunnet	Picnicking	-	14	-
15	Thurso and Dunnet	Picnicking	-	14	-
16	Thurso and Dunnet	Picnicking	-	14	-
17	Thurso and Dunnet	Picnicking	-	14	-
18	Thurso and Dunnet	Picnicking	-	14	-
19	Thurso and Dunnet	Picnicking	-	14	-
327	Sandside	Dog walking	-	13	-
122	Strathy, Scrabster, Thurso and Dunnet	Walking	-	12	-
75	Scrabster and Dunnet	Playing	-	9	-
105	Thurso	Playing	-	9	-
34	Strathy, Thurso and Dunnet	Playing	-	9	-
35	Strathy, Thurso and Dunnet	Playing	-	9	-
28	Dunnet	Sitting on the beach	-	8	-
57	Sandside	Playing	-	8	-
367	Strathy	Walking	-	6	-
90	Murkle	Playing	-	4	-
91	Murkle	Playing	-	4	-
336	Sandside	Horse riding	-	3	-

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over rock based on 6 high-rate observations is 492 h y^{-1}

The observed 97.5th percentile rate based on 33 observations for rock is 550 h y^{-1}

The mean intertidal occupancy rate over sand based on 3 high-rate observations is 1008 h y^{-1}

The observed 97.5th percentile rate based on 157 observations for sand is 438 h y^{-1}

The mean intertidal occupancy rate over sand and stones based on 1 observation is 104 h y^{-1}

The observed 97.5th percentile rate is not applicable for 1 observation

Table 9. Children's and infants' intertidal occupancy rates in the Dounreay aquatic survey area (h y^{-1})

Child age group (6 - 15 years old)

Observation number	Age	Location	Activity	Rock	Sand
297	**15**	**Scrabster**	**Angling**	**78**	-
		Sandside	Angling	**-**	78
115	11	Port of Brims	Playing	16	-
		Murkle	Playing	-	8
116	9	Port of Brims	Playing	16	-
		Murkle	Playing	-	8
251	15	Scrabster	Angling	15	-
		Melvich	Angling	-	8
138	10	Castletown	Angling	15	-
		Castletown	Bait digging	-	5
343	15	Approximately 200 m west of Oigin's Geo	Playing	6	-
227	10	Thurso	Playing	2	-
		Thurso	Playing	-	4
228	9	Thurso	Playing	2	-
		Thurso	Playing	-	4
364	**12**	**Strathy and Sandside**	**Dog walking**	-	**260**
302	**8**	**Sandside**	**Dog walking**	-	**175**
269	**10**	**Melvich**	**Playing and walking**	-	**144**
270	**14**	**Melvich**	**Playing and walking**	-	**144**
318	**9**	**Strathy, Melvich, Scrabster and Dunnet**	**Playing**	-	**128**
319	**7**	**Strathy, Melvich, Scrabster and Dunnet**	**Playing**	-	**128**
69	9	Scrabster, Thurso and Dunnet	Dog walking and playing	-	62
70	7	Scrabster, Thurso and Dunnet	Dog walking and playing	-	62
73	12	Scrabster, Thurso and Dunnet	Dog walking and playing	-	62
74	10	Scrabster, Thurso and Dunnet	Dog walking and playing	-	62
100	12	Thurso	Playing	-	55
101	6	Thurso	Playing	-	55
79	6	Scrabster	Playing	-	50
107	13	Strathy and Thurso	Sunbathing	-	50
108	12	Strathy and Thurso	Sunbathing	-	50
323	6	Strathy and Melvich	Playing	-	48
273	13	Strathy, Melvich, Scrabster, Thurso and Dunnet	Playing	-	42
274	11	Strathy, Melvich, Scrabster, Thurso and Dunnet	Playing	-	42
275	8	Strathy, Melvich, Scrabster, Thurso and Dunnet	Playing	-	42
288	8	Strathy and Melvich	Playing	-	33
289	7	Strathy and Melvich	Playing	-	33
150	8	Dunnet	Playing	-	30
284	12	Armadale	Playing	-	27
285	14	Armadale	Playing	-	27
307	6	Sandside	Dog walking	-	26
331	13	Strathy, Melvich and Sandside	Horse riding	-	26
332	11	Strathy, Melvich and Sandside	Horse riding	-	26
278	12	Melvich	Playing	-	24
32	12	Strathy, Thurso, Dunnet and Peedie	Walking	-	18
33	15	Strathy, Thurso, Dunnet and Peedie	Walking	-	18
145	10	Dunnet	Playing	-	18
146	9	Dunnet	Playing	-	18
22	8	Thurso and Dunnet	Picnicking	-	14
23	8	Thurso and Dunnet	Picnicking	-	14
24	9	Thurso and Dunnet	Picnicking	-	14
25	12	Thurso and Dunnet	Picnicking	-	14
76	10	Scrabster and Dunnet	Playing	-	9
77	7	Scrabster and Dunnet	Playing	-	9
58	14	Sandside	Playing	-	8
92	7	Murkle	Playing	-	4
337	11	Sandside	Horse riding	-	3
338	8	Sandside	Horse riding	-	3

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over rock based on 1 high-rate observation is 78 h y^{-1}

The observed 97.5th percentile rate based on 8 observations for rock is 67 h y^{-1}

The mean intertidal occupancy rate over sand based on 6 high-rate observations is 163 h y^{-1}

The observed 97.5th percentile rate based on 49 observations for sand is 169 h y^{-1}

Table 9. Children's and infants' intertidal occupancy rates in the Dounreay aquatic survey area (h y^{-1})

Infant age group (0 - 5 years old)

Observation number	Age	Location	Activity	Rock	Sand
117	**5**	**Port of Brims**	**Playing**	**16**	-
		Murkle	Playing	**-**	8
130	3	Crosskirk	Playing	3	-
131	0.5	Crosskirk	Playing	3	-
66	**4**	**Scrabster**	**Dog walking**	-	**219**
127	**1**	**Thurso and Dunnet**	**Playing**	-	**75**
102	4	Thurso	Playing	-	55
80	5	Scrabster	Playing	-	50
81	3	Scrabster	Playing	-	50
324	5	Strathy and Melvich	Playing	-	48
151	2	Dunnet	Playing	-	35
290	5	Strathy and Melvich	Playing	-	33
305	3	Sandside	Dog walking	-	26
306	2	Sandside	Dog walking	-	26
147	2	Dunnet	Playing	-	18
157	3	Dunnet	Playing	-	16
8	1	Thurso	Sitting on the beach	-	14
9	2	Thurso	Sitting on the beach	-	14
10	3	Thurso	Sitting on the beach	-	14
11	4	Thurso	Sitting on the beach	-	14
20	2	Thurso and Dunnet	Picnicking	-	14
21	3	Thurso and Dunnet	Picnicking	-	14
104	2	Thurso	Playing	-	9
106	3	Thurso	Playing	-	9
36	3	Strathy, Thurso and Dunnet	Playing	-	9
37	1	Strathy, Thurso and Dunnet	Playing	-	9
59	3	Sandside	Playing	-	8
60	3	Sandside	Playing	-	8
93	3	Murkle	Playing	-	4
94	5	Murkle	Playing	-	4

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over rock based on 1 high-rate observation is 16 h y^{-1}

The observed 97.5th percentile rate based on 3 observations for rock is 15 h y^{-1}

The mean intertidal occupancy rate over sand based on 2 high-rate observations is 147 h y^{-1}

The observed 97.5th percentile rate based on 27 observations for sand is 125 h y^{-1}

Table 10. Gamma dose rate measurements over intertidal substrates in the Dounreay aquatic survey area (µGy h^{-1})

Location	National Grid Reference	Substrate	Gamma dose rate at 1 metre[a]
Armadale	NC 794 645	Sand	0.048
Strathy	NC 839 660	Sand	0.049
Melvich	NC 887 650	Sand	0.057
Sandside	NC 958 655	Sand	0.052
Oigin's Geo	NC 994 682	Stones and rock	0.142
Crosskirk Bay	ND 028 699	Sand and stones	0.106
Port of Brims	ND 043 711	Sand	0.073
Scrabster	ND 099 699	Sand	0.060
Thurso	ND 117 687	Sand	0.063
Thurso East Mains	ND 123 688	Sand and stones	0.075
Murkle	ND 168 692	Sand	0.052
Castleton	ND 199 684	Sand	0.055
Dunnet (south)	ND 205 683	Sand	0.045
Dunnet (north)	ND 218 704	Sand	0.053

Notes

[a] These measurements have not been adjusted for background dose rates.

Table 11. Adult's handling rates of fishing gear and sediment in the Dounreay aquatic survey area (h y^{-1})

Observation number	Location	Activity	Fishing gear	Sediment
178	**Sandside Bay to Dunnet Head**	**Handling creels**	**2300**	-
176	**Sandside Bay to Dunnet Head**	**Handling creels**	**1940**	-
177	**Sandside Bay to Dunnet Head**	**Handling creels**	**1940**	-
180	**Sandside Bay to Dunnet Head**	**Handling creels**	**1900**	-
190	**Sandside Bay to Dunnet Head**	**Handling creels**	**1700**	-
368	**Strathy to Scrabster**	**Handling creels**	**1352**	-
174	**Sandside Bay to Dunnet Head**	**Handling creels**	**1200**	-
82	**Sandside Bay to Dunnet Head**	**Handling creels**	**1000**	-
161	**Murkle and Castletown**	**Handling nets**	**935**	-
162	**Murkle and Castletown**	**Handling nets**	**935**	-
163	**Murkle and Castletown**	**Handling nets**	**935**	-
370	**Strathy to Scrabster**	**Handling creels**	**832**	-
164	Holborn Head	Handling creels	660	-
165	Holborn Head	Handling creels	660	-
215	Port a' Chinn	Handling nets	660	-
216	Port a' Chinn	Handling nets	660	-
217	Port a' Chinn	Handling nets	660	-
218	Port a' Chinn	Handling nets	660	-
219	Port a' Chinn	Handling nets	660	-
83	Sandside Bay to Dunnet Head	Handling creels	225	-
181	Holborn Head to Dunnet Head	Handling creels	180	-
182	Holborn Head to Dunnet Head	Handling creels	150	-
194	Melvich Bay	Handling nets	145	-
252	Brims Ness to Dunnet Head	Handling creels	73	-
195	Melvich Bay	Handling nets	36	-
39	Sandside Bay	Handling creels	20	-
233	**Castletown and Peedie**	**Collecting winkles**	-	**550**
234	**Castletown and Peedie**	**Collecting winkles**	-	**550**
235	**Castletown and Peedie**	**Collecting winkles**	-	**550**
232	**Murkle and Castletown**	**Bait digging**	-	**300**
279	**Melvich and Murkle**	**Collecting winkles**	-	**208**
196	Dunnet	Bait digging	-	26
198	Castletown	Bait digging	-	20
213	Castletown	Bait digging	-	13
214	Castletown	Bait digging	-	13
242	Dunnet	Bait digging	-	10
132	Castletown	Bait digging	-	9
230	Castletown	Bait digging	-	6
135	Castletown	Bait digging	-	5
188	Dunnet	Bait digging	-	2
189	Dunnet	Bait digging	-	2
38	Dunnet	Collecting winkles	-	2

Notes

Emboldened observations are the high-rate individuals

The mean fishing gear handling rate based on 12 high-rate observations is 1414 h y^{-1}

The observed 97.5th percentile rate based on 26 observations for fishing gear is 2075 h y^{-1}

The mean sediment handling rate based on 5 high-rate observations is 432 h y^{-1}

The observed 97.5th percentile rate based on 16 observations for sediment is 550 h y^{-1}

Table 12. Children's handling rates of sediment in the Dounreay aquatic survey area (h y^{-1})

Child age group (6 - 15 year old)

Observation number	Age	Location	Activity	Sediment
138	10	Castletown	Bait digging	5

Notes

Emboldened observations are the high-rate individuals

The mean sediment handling rate based on 1 high-rate observation is 5 h y^{-1}

The observed 97.5th percentile rate is not applicable for 1 observation

Table 13. Adults' occupancy rates in and on water in the Dounreay aquatic survey area (h y^{-1})

Observation number	Location	Activity	In water	On water
280	Melvich Bay and Dunnet Bay	Surfing	249	-
	Strathy Point to Dunnet Head	Kayaking		-
	Dunnet Bay	Kitesurfing and swimming		-
281	Melvich Bay and Dunnet Bay	Surfing	249	-
	Strathy Point to Dunnet Head	Kayaking		-
	Dunnet Bay	Kitesurfing and swimming		-
95	Thurso East Mains	Surfing	208	-
236	Strathy Point to Dunnet Head	Surfing	100	-
28	Dunnet Bay	Kitesurfing	12	-
286	Strathy and Melvich	Swimming	8	-
	Strathy and Melvich	Paddling	-	8
287	Strathy and Melvich	Swimming	8	-
	Strathy and Melvich	Paddling	-	8
113	Port of Brims and Murkle	Swimming	6	-
114	Port of Brims and Murkle	Swimming	6	-
271	Strathy, Melvich, Scrabster, Thurso, and Dunnet	Swimming	4	-
272	Strathy, Melvich, Scrabster, Thurso, and Dunnet	Swimming	4	-
310	Strathy	Swimming	3	-
176	Sandside Bay to Dunnet Head	Creeling	-	2200
177	Sandside Bay to Dunnet Head	Creeling	-	2200
178	Sandside Bay to Dunnet Head	Creeling	-	2200
180	Sandside Bay to Dunnet Head	Creeling	-	2200
190	Sandside Bay to Dunnet Head	Creeling	-	1800
174	Sandside Bay to Dunnet Head	Creeling	-	1500
82	Sandside Bay to Dunnet Head	Creeling	-	1200
368	Strathy Point to Scrabster	Creeling	-	1100
370	Strathy Point to Scrabster	Creeling	-	1100
202	Sandside Bay to Dunnet Head	Charter boat skipper duties	-	840
164	Holborn Head	Creeling	-	660
165	Holborn Head	Creeling	-	660
161	Murkle and Castletown	Bag-netting	-	640
162	Murkle and Castletown	Bag-netting	-	640
163	Murkle and Castletown	Bag-netting	-	640
215	Port a' Chinn	Bag-netting	-	360

Table 13. Adults' occupancy rates in and on water in the Dounreay aquatic survey area (h y^{-1})

Observation number	Location	Activity	In water	On water
216	Port a' Chinn	Bag-netting	-	360
217	Port a' Chinn	Bag-netting	-	360
218	Port a' Chinn	Bag-netting	-	360
219	Port a' Chinn	Bag-netting	-	360
181	Holborn Head to Dunnet Head	Creeling	-	300
182	Holborn Head to Dunnet Head	Creeling	-	300
252	Brims Ness to Dunnet Head	Angling and creeling	-	292
83	Sandside Bay to Dunnet Head	Creeling	-	275
232	Dunnet Bay	Angling	-	180
213	Sandside Bay to Dunnet Head	Angling	-	174
214	Sandside Bay to Dunnet Head	Angling	-	174
204	Sandside Bay to Dunnet Head	Charter boat skipper duties	-	170
205	Sandside Bay to Dunnet Head	Angling	-	160
206	Sandside Bay to Dunnet Head	Angling	-	160
194	Melvich Bay	Bag-netting	-	145
170	Sandside Bay to Dunnet Head	Angling	-	144
259	Scrabster	Sailing	-	140
260	Scrabster	Sailing	-	140
261	Scrabster	Sailing	-	140
262	Scrabster	Sailing	-	140
263	Scrabster	Sailing	-	140
264	Scrabster	Sailing	-	140
135	Dunnet Bay	Angling	-	120
136	Dunnet Bay	Angling	-	120
238	Holborn Head	Angling	-	120
207	Sandside Bay to Dunnet Head	Angling	-	64
208	Sandside Bay to Dunnet Head	Angling	-	64
291	Strathy Point to Dunnet Head	Angling	-	55
292	Strathy Point to Dunnet Head	Angling	-	55
293	Strathy Point to Dunnet Head	Angling	-	55
294	Strathy Point to Dunnet Head	Angling	-	55
295	Strathy Point to Dunnet Head	Angling	-	55
296	Strathy Point to Dunnet Head	Angling	-	55
39	Sandside Bay	Angling	-	40

Table 13. Adults' occupancy rates in and on water in the Dounreay aquatic survey area (h y^{-1})

Observation number	Location	Activity	In water	On water
195	Melvich Bay	Bag-netting	-	36
61	Strathy and Melvich	Angling	-	18
196	Dunnet Bay	Angling	-	12
316	Strathy, Melvich, Scrabster and Dunnet	Paddling	-	9
317	Strathy, Melvich, Scrabster and Dunnet	Paddling	-	9
257	Holborn Head	Angling	-	8
7	Thurso	Paddling	-	4
143	Dunnet	Paddling	-	2
144	Dunnet	Paddling	-	2
156	Dunnet	Paddling	-	2
34	Strathy, Thurso and Dunnet	Paddling	-	2
35	Strathy, Thurso and Dunnet	Paddling	-	2

Table 14. Children's and infants' occupancy rates in and on water in the Dounreay aquatic survey area (h y^{-1})

Observation number	Age	Location	Activity	In water	On water
Child age group (6 - 15 years old)					
269	10	Melvich	Swimming	48	-
270	14	Melvich	Swimming	48	-
323	6	Strathy and Melvich	Swimming	12	-
288	8	Strathy and Melvich	Swimming	8	-
		Strathy and Melvich	Paddling	-	8
289	7	Strathy and Melvich	Swimming	8	-
		Strathy and Melvich	Paddling	-	8
115	11	Port of Brims and Murkle	Swimming	6	-
116	9	Port of Brims and Murkle	Swimming	6	-
278	12	Melvich	Swimming	6	-
284	12	Armadale	Swimming	5	-
		Armadale	Paddling	-	5
285	14	Armadale	Swimming	5	-
		Armadale	Paddling	-	5
273	13	Strathy, Melvich, Scrabster, Thurso and Dunnet	Swimming	4	-
274	11	Strathy, Melvich, Scrabster, Thurso and Dunnet	Swimming	4	-
275	8	Strathy, Melvich, Scrabster, Thurso and Dunnet	Swimming	4	-
100	12	Thurso	Paddling	-	15
101	6	Thurso	Paddling	-	15
318	9	Strathy, Melvich, Scrabster and Dunnet	Paddling	-	9
319	7	Strathy, Melvich, Scrabster and Dunnet	Paddling	-	9
150	8	Dunnet	Paddling	-	5
145	10	Dunnet	Paddling	-	2
146	9	Dunnet	Paddling	-	2
Infant age group (0 - 5 years old)					
324	5	Strathy and Melvich	Swimming	12	-
290	5	Strathy and Melvich	Swimming	8	-
		Strathy and Melvich	Paddling	-	8
117	5	Port of Brims and Murkle	Swimming	6	-
102	4	Thurso	Paddling	-	15
8	1	Thurso	Paddling	-	4
9	2	Thurso	Paddling	-	4
10	3	Thurso	Paddling	-	4
11	4	Thurso	Paddling	-	4
147	2	Dunnet	Paddling	-	2
157	3	Dunnet	Paddling	-	2
36	3	Strathy, Thurso and Dunnet	Paddling	-	2
37	1	Strathy, Thurso and Dunnet	Paddling	-	2

Table 15. Adults' consumption rates of green vegetables from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Artichoke	Broccoli	Brussel sprout	Cabbage	Cauliflower	Chard	Courgette	Cucumber	Kale	Lettuce	Rocket	Spinach	Total
48	**-**	**8.6**	**8.6**	**8.6**	**-**	**6.7**	**-**	**-**	**-**	**8.4**	**4.2**	**-**	**44.9**
47	**-**	**8.6**	**8.6**	**8.6**	**-**	**6.7**	**-**	**-**	**-**	**8.4**	**4.2**	**-**	**44.9**
344	2.7	-	-	-	-	7.3	-	-	-	-	2.0	2.2	14.1
345	2.7	-	-	-	-	7.3	-	-	-	-	2.0	2.2	14.1
39	-	-	-	10.0	-	-	-	-	1.0	-	-	-	11.0
40	-	-	-	10.0	-	-	-	-	1.0	-	-	-	11.0
49	-	-	-	2.7	4.1	-	-	-	-	1.4	-	-	8.1
50	-	-	-	2.7	4.1	-	-	-	-	1.4	-	-	8.1
351	-	-	-	4.3	0.4	-	-	-	-	-	-	-	4.7
352	-	-	-	4.3	0.4	-	-	-	-	-	-	-	4.7
353	-	-	-	4.3	0.4	-	-	-	-	-	-	-	4.7
348	-	-	-	3.0	-	-	-	-	-	1.5	-	-	4.5
349	-	-	-	3.0	-	-	-	-	-	1.5	-	-	4.5
346	-	-	-	-	-	-	1.8	1.4	-	-	-	-	3.2
347	-	-	-	-	-	-	1.8	1.4	-	-	-	-	3.2
61	-	-	-	-	-	-	-	-	1.8	0.9	-	-	2.7
62	-	-	-	-	-	-	-	-	1.8	0.9	-	-	2.7
354	-	-	-	-	-	-	-	-	-	1.4	-	-	1.4
355	-	-	-	-	-	-	-	-	-	1.4	-	-	1.4

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of green vegetables based on the 2 high-rate adult consumers is 44.9 kg y^{-1}

The observed 97.5th percentile rate based on 19 observations is 44.9 kg y^{-1}

Table 16. Adults' consumption rates of other vegetables from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Broad bean	French bean	Pea	Runner bean	Tomato	Total
47	**6.5**	**15.0**	**6.5**	**6.5**	**8.5**	**43.0**
48	**6.5**	**15.0**	**6.5**	**6.5**	**8.5**	**43.0**
348	**-**	**-**	**12.0**	**10.8**	**-**	**22.8**
349	**-**	**-**	**12.0**	**10.8**	**-**	**22.8**
344	**-**	**-**	**-**	**-**	**22.5**	**22.5**
345	**-**	**-**	**-**	**-**	**22.5**	**22.5**
61	-	-	-	8.7	-	8.7
62	-	-	-	8.7	-	8.7
49	-	-	-	-	5.4	5.4
50	-	-	-	-	5.4	5.4
346	-	-	-	-	2.5	2.5
347	-	-	-	-	2.5	2.5
354	-	-	1.5	-	-	1.5
355	-	-	1.5	-	-	1.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of other vegetables based on the 6 high-rate adult consumers is 29.4 kg y^{-1}

The observed 97.5th percentile rate based on 14 observations is 43.0 kg y^{-1}

Table 17. Adults' consumption rates of root vegetables from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Beetroot	Carrot	Garlic	Jerusalem artichoke	Leek	Onion	Parsnip	Radish	Spring onion	Swede	Turnip	Total
344	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**12.5**	**15.0**	**27.5**
345	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**12.5**	**15.0**	**27.5**
47	**1.3**	**3.8**	**3.3**	**2.3**	**3.4**	**6.6**	**6.5**	**-**	**-**	**-**	**-**	**27.0**
48	**1.3**	**3.8**	**3.3**	**2.3**	**3.4**	**6.6**	**6.5**	**-**	**-**	**-**	**-**	**27.0**
45	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**21.6**	**21.6**
46	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**21.6**	**21.6**
1	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**19.5**	**-**	**19.5**
2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**19.5**	**-**	**19.5**
348	**4.1**	**6.8**	**-**	**-**	**-**	**-**	**5.4**	**-**	**-**	**-**	**-**	**16.3**
349	**4.1**	**6.8**	**-**	**-**	**-**	**-**	**5.4**	**-**	**-**	**-**	**-**	**16.3**
351	**-**	**7.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**8.5**	**16.0**
352	**-**	**7.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**8.5**	**16.0**
353	**-**	**7.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**8.5**	**16.0**
49	**-**	**5.4**	**-**	**-**	**4.1**	**3.0**	**-**	**-**	**1.4**	**-**	**-**	**13.8**
50	**-**	**5.4**	**-**	**-**	**4.1**	**3.0**	**-**	**-**	**1.4**	**-**	**-**	**13.8**
354	3.3	1.4	-	-	-	1.7	-	-	0.6	-	-	6.9
355	3.3	1.4	-	-	-	1.7	-	-	0.6	-	-	6.9
61	-	-	-	-	2.0	-	3.8	-	-	-	-	5.8
62	-	-	-	-	2.0	-	3.8	-	-	-	-	5.8
5	-	-	-	-	-	-	-	-	-	-	4.2	4.2
6	-	-	-	-	-	-	-	-	-	-	4.2	4.2
3	2.6	-	-	-	-	-	-	0.6	-	-	-	3.2
4	2.6	-	-	-	-	-	-	0.6	-	-	-	3.2
367	-	-	-	-	-	-	-	-	-	-	2.5	2.5
368	-	-	-	-	-	-	-	-	-	-	2.5	2.5
369	-	-	-	-	-	-	-	-	-	-	2.5	2.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of root vegetables based on the 15 high-rate adult consumers is 20.0 kg y^{-1}

The observed 97.5th percentile rate based on 26 observations is 27.5 kg y^{-1}

Table 18. Adults' consumption rates of potato from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Potato
47	**100.0**
48	**100.0**
348	**87.4**
349	**87.4**
360	**86.6**
351	**62.0**
352	**62.0**
353	**62.0**
344	20.0
345	20.0
367	10.0
368	10.0
369	10.0
3	8.7
4	8.7
55	6.8
56	6.8
41	6.4
42	6.4
43	6.4
5	2.0
6	2.0

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of potato based on the 8 high-rate adult consumers is 80.9 kg y^{-1}

The observed 97.5th percentile rate based on 22 observations is 100.0 kg y^{-1}

Table 19. Adults' consumption rates of domestic fruit from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Apple	Blackberry	Blackcurrant	Blueberry	Fig	Gooseberry	Grapes	Pear	Plum	Raspberry	Redcurrant	Rhubarb	Rowanberry	Strawberry	Total
47	**15.0**	**15.3**	**15.0**	**-**	**0.4**	**15.0**	**-**	**5.0**	**-**	**-**	**-**	**-**	**3.0**	**22.5**	**91.2**
48	**15.0**	**15.3**	**15.0**	**-**	**0.4**	**15.0**	**-**	**5.0**	**-**	**-**	**-**	**-**	**3.0**	**22.5**	**91.2**
344	**25.0**	**-**	**-**	**-**	**-**	**20.0**	**1.0**	**-**	**12.5**	**-**	**-**	**5.0**	**-**	**-**	**63.5**
345	**25.0**	**-**	**-**	**-**	**-**	**20.0**	**1.0**	**-**	**12.5**	**-**	**-**	**5.0**	**-**	**-**	**63.5**
61	**22.7**	**-**	**13.6**	**-**	**-**	**7.9**	**-**	**-**	**-**	**-**	**6.8**	**5.7**	**-**	**2.0**	**58.7**
62	**22.7**	**-**	**13.6**	**-**	**-**	**7.9**	**-**	**-**	**-**	**-**	**6.8**	**5.7**	**-**	**2.0**	**58.7**
348	-	-	6.6	-	-	1.8	-	-	-	2.3	-	1.2	-	5.2	17.1
349	-	-	6.6	-	-	1.8	-	-	-	2.3	-	1.2	-	5.2	17.1
354	2.3	-	3.2	1.6	-	0.8	-	-	-	3.2	-	-	-	3.2	14.2
355	2.3	-	3.2	1.6	-	0.8	-	-	-	3.2	-	-	-	3.2	14.2
55	-	-	2.7	-	-	2.7	-	-	-	-	1.4	-	-	-	6.8
56	-	-	2.7	-	-	2.7	-	-	-	-	1.4	-	-	-	6.8
360	-	-	-	-	-	-	-	-	-	-	-	6.8	-	-	6.8
45	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	6.0
46	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	6.0
39	-	-	-	-	-	-	-	-	-	-	-	-	-	2.3	2.3
40	-	-	-	-	-	-	-	-	-	-	-	-	-	2.3	2.3
41	-	-	-	-	-	-	-	-	-	-	-	1.4	-	-	1.4
42	-	-	-	-	-	-	-	-	-	-	-	1.4	-	-	1.4
43	-	-	-	-	-	-	-	-	-	-	-	1.4	-	-	1.4
265	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	0.6
266	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	0.6
346	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5
347	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5
336	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of domestic fruit based on the 6 high-rate adult consumers is 71.1 kg y^{-1}

The observed 97.5th percentile rate based on 25 observations is 91.2 kg y^{-1}

Table 20. Adults' consumption rates of cattle meat from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Beef
358	47.3
359	47.3
344	31.5
345	31.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of cattle meat based on the 4 high-rate adult consumers is 39.4 kg y^{-1}

The observed 97.5th percentile rate based on 4 observations is 47.3 kg y^{-1}

Table 21. Adults' consumption rates of pig meat from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Pork
344	19.0
345	19.0

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of pig meat based on the 2 high-rate adult consumers is 19.0 kg y^{-1}

The observed 97.5th percentile rate based on 2 observations is 19.0 kg y^{-1}

Table 22. Adults' consumption rates of sheep meat from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Lamb	Mutton	Total
346	**33.9**	-	**33.9**
347	**33.9**	-	**33.9**
45	**11.3**	-	**11.3**
46	**11.3**	-	**11.3**
1	6.0	-	6.0
358	-	3.3	3.3
359	-	3.3	3.3
2	0.6	-	0.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of sheep meat based on the 4 high-rate adult consumers is 22.6 kg y^{-1}

The observed 97.5th percentile rate based on 8 observations is 33.9 kg y^{-1}

Table 23. Adults' consumption rates of poultry from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Greylag goose	Grouse	Mallard	Pheasant	Teal	Wigeon	Total
45	**5.4**	**-**	**6.6**	**6.6**	**6.6**	**6.6**	**31.8**
46	**5.4**	**-**	**6.6**	**6.6**	**6.6**	**6.6**	**31.8**
1	2.2	-	0.5	3.0	-	-	5.7
2	2.2	-	0.5	3.0	-	-	5.7
344	-	2.8	-	2.3	-	-	5.1
345	-	2.8	-	2.3	-	-	5.1
356	-	-	1.8	2.3	-	-	4.1
357	-	-	1.8	2.3	-	-	4.1
346	2.2	-	-	1.0	-	-	3.2
347	2.2	-	-	1.0	-	-	3.2
360	-	-	-	1.4	-	-	1.4
358	-	-	0.5	0.5	0.2	-	1.1
359	-	-	0.5	0.5	0.2	-	1.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of poultry based on the 2 high-rate adult consumers is 31.8 kg y^{-1}

The observed 97.5th percentile rate based on 13 observations is 31.8 kg y^{-1}

Table 24. Adults' consumption rates of eggs from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Chicken egg
346	**31.2**
347	**31.2**
344	**14.4**
354	**13.9**
355	**13.9**
41	8.9
42	8.9
43	8.9
345	6.2
39	5.9
368	5.4
369	5.4
5	4.9
6	4.9
358	3.1
359	3.1
350	2.1
360	2.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of eggs based on the 5 high-rate adult consumers is 20.9 kg y^{-1}

The observed 97.5th percentile rate based on 18 observations is 31.2 kg y^{-1}

Table 25. Adults' consumption rates of wild/free foods from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Blackberry	Raspberry	Total
360	**-**	**1.0**	**1.0**
344	-	0.1	0.1
345	-	0.1	0.1
358	0.1	-	0.1
359	0.1	-	0.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of wild/free foods based on the only high-rate adult consumer is 1.0 kg y^{-1}

The observed 97.5th percentile rate based on 5 observations is 0.9 kg y^{-1}

Table 26. Adults' consumption rates of rabbits/hares from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Rabbit
356	**2.3**
357	**2.3**

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of rabbits/hares based on the 2 high-rate adult consumers is 2.3 kg y^{-1}

The observed 97.5th percentile rate based on 2 observations is 2.3 kg y^{-1}

Table 27. Adults' consumption rates of honey from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Honey
354	**5.9**
355	**5.9**
348	1.5
344	0.6
345	0.6
349	0.5
47	0.5
48	0.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of honey based on the 2 high-rate adult consumers is 5.9 kg y^{-1}

The observed 97.5th percentile rate based on 8 observations is 5.9 kg y^{-1}

Table 28. Adults' consumption rates of wild fungi from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Mushrooms
47	**6.3**
48	**6.3**
360	**2.7**
346	1.5
347	1.5
344	1.0
345	1.0
265	0.6
266	0.6
49	0.3
50	0.3

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of wild fungi based on the 3 high-rate adult consumers is 5.1 kg y^{-1}

The observed 97.5th percentile rate based on 11 observations is 6.3 kg y^{-1}

Table 29. Adults' consumption rates of venison from the Dounreay terrestrial survey area (kg y^{-1})

Observation number	Venison
1	**31.8**
2	**31.8**
45	**21.3**
46	**21.3**
344	10.0
356	7.2
357	7.2
39	6.0
40	6.0
346	6.0
347	6.0
358	0.9
359	0.9

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of venison based on the 4 high-rate adult consumers is 26.5 kg y^{-1}

The observed 97.5th percentile rate based on 13 observations is 31.8 kg y^{-1}

Table 30. Infants' consumption rates of potato from the Dounreay terrestrial survey area (kg y^{-1})

Infant age group (0 - 5 years old)

Observation number	Age	Potato
44	**3**	**6.4**

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of potato for the infant age group based upon the only high-rate consumer is 6.4 kg y^{-1}

The observed 97.5th percentile rate is not applicable for 1 observation

Table 31. Children's and infants' consumption rates of domestic fruit from the Dounreay terrestrial survey area (kg y^{-1})

Child age group (6 - 15 years old)

Observation number	Age	Apple	Rhubarb	Total
337	**11**	**0.3**	**-**	**0.3**
338	**8**	**0.3**	**-**	**0.3**

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of domestic fruit for the child age group based upon the 2 high-rate consumers is 0.3 kg y^{-1}

The observed 97.5th percentile rate based on 2 observations is 0.3 kg y^{-1}

Infant age group (0 - 5 years old)

Observation number	Age	Apple	Rhubarb	Total
44	**3**	**-**	**1.4**	**1.4**

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of domestic fruit for the infant age group based upon the only high-rate consumer is 1.4 kg y^{-1}

The observed 97.5th percentile rate is not applicable for 1 observation

Table 32. Infants' consumption rates of eggs from the Dounreay terrestrial survey area (kg y^{-1})

Infant age group (0 - 5 years old)

Observation number	Age	Chicken egg
44	**3**	**8.9**

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of eggs for the infant age group based upon the only high-rate consumer is 8.9 kg y^{-1}

The observed 97.5th percentile rate is not applicable for 1 observation

Table 33. Percentage contribution each food type makes to its terrestrial food group for adults

Green vegetables	
Cabbage	31.64 %
Chard	14.38 %
Lettuce	13.93 %
Brussel sprout	8.82 %
Broccoli	8.82 %
Rocket	6.34 %
Cauliflower	4.80 %
Kale	2.91 %
Artichoke	2.80 %
Spinach	2.28 %
Courgette	1.90 %
Cucumber	1.39 %

Other vegetables	
Tomato	36.59 %
Runner bean	24.40 %
Pea	18.78 %
French bean	14.11 %
Broad bean	6.11 %

Root vegetables	
Turnip	33.02 %
Swede	18.45 %
Carrot	16.43 %
Parsnip	9.04 %
Beetroot	6.52 %
Onion	6.46 %
Leek	5.45 %
Garlic	1.89 %
Artichoke	1.30 %
Spring onion	1.12 %
Radish	0.33 %

Potato	
Potato	100.00 %

Domestic fruit	
Apple	26.69 %
Gooseberry	18.12 %
Blackcurrant	15.43 %
Strawberry	13.62 %
Rhubarb	6.48 %
Blackberry	5.72 %
Plum	4.69 %
Redcurrant	3.06 %
Raspberry	2.04 %
Pear	1.88 %
Rowanberry	1.13 %
Blueberry	0.60 %
Grapes	0.38 %
Fig	0.16 %

Cattle meat	
Beef	100.00 %

Pig meat	
Pork meat	100.00 %

Sheep meat	
Lamb meat	93.72 %
Mutton	6.28 %

Poultry	
Pheasant	31.56 %
Greylag goose	19.12 %
Mallard	18.02 %
Teal	13.08 %
Wigeon	12.77 %
Grouse	5.44 %

Eggs	
Chicken egg	100.00 %

Wild/free foods	
Raspberry	85.71 %
Blackberry	14.29 %

Honey	
Honey	100.00 %

Wild fungi	
Mushrooms	100.00 %

Rabbits/hares	
Rabbit	100.00 %

Venison	
Venison	100.00 %

Notes

Food types in emboldened italics were monitored by SEPA in 2012 (EA, FSA, NIEA and SEPA, 2013).
Goats' milk, rosehips, oats, grass, soil and freshwater were also monitored.
Percentages are based on the consumption of all adults in the survey consuming that particular food group.

Table 34. Occupancy rates in the Dounreay direct radiation survey area for adults, children and infants

Observation number	Sex	Age (years)	Indoor occupancy (h y^{-1})	Outdoor occupancy (h y^{-1})	Total occupancy (h y^{-1})
Adult observations					
52	F	75	8720	4	8724
340	F	52	6708	1638	8346
51	M	78	8162	182	8344
41	F	76	7283	963	8246
360	M	70	5240	2944	8184
336	F	34	7064	956	8020
49	M	61	4522	3468	7989
50	F	58	6347	1643	7989
335	M	32	3314	4351	7665
42	M	20	6550	1040	7590
362	F	23	6270	208	6478
367	F	44	6378	59	6437
368	M	49	5337	746	6083
342	F	17	5473	510	5983
361	M	24	5496	299	5795
369	F	18	5196	68	5264
341	M	58	1803	900	2703
43	F	40	960	936	1896
Child and infant observations					
339	F	2	7064	956	8020
337	F	11	6314	956	7270
338	F	8	6314	956	7270
343	M	15	6037	455	6492
44	M	3	960	936	1896

Table 35. Gamma dose rate measurements taken in the Dounreay direct radiation survey (μGy h^{-1})

Residences

Location	Indoor substrate	Indoor gamma dose rate at 1 metre[a]	Outdoor substrate	Outdoor gamma dose rate at 1 metre[a]
Residence 1	Concrete	0.102	Grass	0.097
Residence 2	Concrete	0.119	Grass	0.089
Residence 3	Concrete	0.125	Grass	0.101
Residence 4	Concrete	0.100	Grass	0.100
Residence 5	Concrete	0.102	Grass	0.099
Residence 6	Concrete	0.098	Grass	0.100
Residence 7	-	-	Grass	0.103
Residence 8	Concrete	0.103	Grass	0.091

Notes

[a] These measurements have not been adjusted for background dose rates.

Backgrounds

	Location	National Grid Reference	Substrate	Background gamma dose rate at 1 metre
Background 1	Crosskirk Bay	ND 029 698	Grass	0.092
Background 2	Lythmore Strath	ND 047 661	Grass	0.092
Background 3	Ceargaraidh Mhor	NC 903 597	Grass	0.091
Background 4	Between Strathy and Portskerra	NC 861 655	Grass	0.049
			Mean background	0.081

Annex 1. Adults' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
1	M	65	-	0.3	-	-	-	**19.5**	-	-	-	-	6.0	5.7	-	-	-	-	-	**31.8**	-	-	-	-	-	-	-	-	-
2	F	64	-	0.3	-	-	-	**19.5**	-	-	-	-	0.6	5.7	-	-	-	-	-	**31.8**	-	-	-	-	-	-	-	-	-
3	M	60	-	-	-	-	-	3.2	8.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	F	60	-	-	-	-	-	3.2	8.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	M	64	**18.5**	-	-	-	-	4.2	2.0	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	F	54	**18.5**	-	-	-	-	4.2	2.0	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	F	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	4	-	-
12	F	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-
13	F	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-
14	M	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-
15	M	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-
16	F	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-
17	F	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-
18	F	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-
19	F	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-
26	F	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	156	-	-	-	-	-	-	-
27	F	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23	-	-	-	-	-	-	-
28	M	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	12	-	-	-
29	F	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	-	-	-
30	M	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-
31	F	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-
34	F	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	2	-	-
35	M	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	2	-	-
38	M	72	-	-	**0.3**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	60	-	-	-	-	-	-	-
39	M	52	-	**13.8**	-	11.0	-	-	-	2.3	-	-	-	-	5.9	-	-	-	-	6.0	-	365	-	20	-	-	40	-	-
40	F	49	-	**13.8**	-	11.0	-	-	-	2.3	-	-	-	-	-	-	-	-	-	6.0	-	365	-	-	-	-	-	-	-
41	F	76	1.1	2.8	-	-	-	-	6.4	1.4	-	-	-	-	8.9	-	-	-	-	-	-	-	-	-	-	-	-	7283	963
42	M	20	1.1	2.5	-	-	-	-	6.4	1.4	-	-	-	-	8.9	-	-	-	-	-	-	-	-	-	-	-	-	6550	1040
43	F	40	1.1	2.5	-	-	-	-	6.4	1.4	-	-	-	-	8.9	-	-	-	-	-	-	-	-	-	-	-	-	960	936
45	M	65	-	-	-	-	-	**21.6**	-	6.0	-	-	**11.3**	**31.8**	-	-	-	-	-	**21.3**	-	-	-	-	-	-	-	-	-
46	F	65	-	-	-	-	-	**21.6**	-	6.0	-	-	**11.3**	**31.8**	-	-	-	-	-	**21.3**	-	-	-	-	-	-	-	-	-
47	M	78	7.2	0.3	-	**44.9**	**43.0**	**27.0**	**100.0**	**91.2**	-	-	-	-	-	-	-	0.5	**6.3**	-	-	-	-	-	-	-	-	-	-
48	F	70	7.2	0.3	-	**44.9**	**43.0**	**27.0**	**100.0**	**91.2**	-	-	-	-	-	-	-	0.5	**6.3**	-	-	-	-	-	-	-	-	-	-

Annex 1. Adults' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
49	M	61	-	0.3	-	8.1	5.4	**13.8**	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	4522	3468
50	F	58	-	0.3	-	8.1	5.4	**13.8**	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	6347	1643
51	M	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	93	-	-	-	-	-	8162	182
52	F	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8720	4
53	F	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	156	-	-	-	-	-	-	-
54	M	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23	-	-	-	-	-	-	-
55	M	90	-	-	-	-	-	-	6.8	6.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56	F	80	-	-	-	-	-	-	6.8	6.8	-	-	-	-	-	-	-	-	-	-	-	338	-	-	-	-	-	-	-
57	F	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-
61	M	54	6.0	-	-	2.7	8.7	5.8	-	**58.7**	-	-	-	-	-	-	-	-	-	-	-	130	-	-	-	-	18	-	-
62	F	55	6.0	-	-	2.7	8.7	5.8	-	**58.7**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	M	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	104	-	-	-	-	-	-	-
64	F	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	104	-	-	-	-	-	-	-
65	F	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	438	-	-	-	-	-	-	-
67	M	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62	-	-	-	-	-	-	-
68	F	47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62	-	-	-	-	-	-	-
71	M	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62	-	-	-	-	-	-	-
72	F	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62	-	-	-	-	-	-	-
75	F	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-
78	F	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-
82	M	31	-	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1000**	-	-	1200	-	-
83	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	225	-	-	275	-	-
84	M	65	-	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
85	F	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	155	-	-	-	-	-	-	-
86	M	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-
87	M	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	130	-	-	-	-	-	-	-
88	F	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	130	-	-	-	-	-	-	-
89	F	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	312	-	-	-	-	-	-	-
90	M	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-
91	F	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-
95	M	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**525**	-	-	-	-	208	-	-	-
96	F	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	150	-	-	-	-	-	-	-
97	M	47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	75	-	-	-	-	-	-	-

Annex 1. Adults' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
98	M	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70	-	-	-	-	-	-	-
99	F	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	174	-	-	-	-	-	-	-
103	F	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35	-	-	-	-	-	-	-
105	F	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-
109	M	70	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**275**	30	-	-	-	-	-	-	-
110	F	59	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	30	-	-	-	-	-	-	-
111	M	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-
112	M	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-
113	M	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	8	-	-	-	6	-	-	-
114	F	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	8	-	-	-	6	-	-	-
118	F	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	440	-	-	-	-	-	-	-
119	M	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	415	-	-	-	-	-	-	-
120	F	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	274	-	-	-	-	-	-	-
121	F	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	104	-	-	-	-	-	-	-
122	M	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-
123	M	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-	-	-	-	-
124	F	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-	-	-	-	-
125	M	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-	-	-	-	-
126	F	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-	-	-	-	-
128	M	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
129	F	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
132	M	22	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45	-	-	9	-	-	-	-
133	M	68	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
134	M	42	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
135	M	48	**11.8**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	5	-	-	5	-	120	-	-
136	M	U	**11.8**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	-	-
137	F	16	**11.8**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
139	F	41	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
140	M	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	-	-	-
141	F	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	-	-	-
142	F	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	-	-	-
143	F	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	2	-	-
144	F	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	2	-	-

Annex 1. Adults' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
148	M	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35	-	-	-	-	-	-	-
149	F	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35	-	-	-	-	-	-	-
152	M	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42	-	-	-	-	-	-	-
153	F	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42	-	-	-	-	-	-	-
154	M	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-
155	M	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-
156	F	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-	2	-	-
158	F	69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65	-	-	-	-	-	-	-
159	M	69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65	-	-	-	-	-	-	-
160	F	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	-	-	-	-	-	-	-
161	M	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65	45	-	**935**	-	-	640	-	-
162	M	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45	-	**935**	-	-	640	-	-
163	M	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45	-	**935**	-	-	640	-	-
164	M	55	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	660	-	-	660	-	-
165	M	16	7.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	660	-	-	660	-	-
166	F	90	7.3	**10.9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
167	F	53	7.3	**10.9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
168	M	69	7.3	**10.9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
169	M	57	7.3	**10.9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
170	M	48	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	144	-	-
171	F	47	10.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
174	M	39	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1200**	-	-	1500	-	-
175	F	33	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
176	M	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1940**	-	-	2200	-	-
177	M	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1940**	-	-	2200	-	-
178	M	65	**15.0**	**12.6**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2300**	-	-	2200	-	-
179	F	68	**15.0**	**12.6**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
180	M	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1900**	-	-	2200	-	-
181	M	65	6.8	3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	-	-	300	-	-
182	M	36	6.8	3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150	-	-	300	-	-
183	F	59	6.8	3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
184	F	42	6.8	3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
185	F	39	6.8	3.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Annex 1. Adults' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
186	M	55	**17.0**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
187	F	54	**17.0**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
188	M	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	2	-	-	-	-
189	M	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	2	-	-	-	-
190	M	50	**14.2**	**16.6**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1700**	-	-	1800	-	-
191	F	48	**14.2**	**16.6**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
192	M	20	**14.2**	**16.6**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
193	M	18	**14.2**	**16.6**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
194	M	42	3.6	5.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	145	-	-	145	-	-
195	M	26	1.6	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36	-	-	36	-	-
196	M	71	**11.8**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	176	-	-	26	-	12	-	-
197	F	67	**11.8**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
198	M	29	**11.8**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	96	-	-	20	-	-	-	-
199	F	28	**11.8**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
201	M	40	**15.0**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**500**	**1000**	-	-	-	-	-	-	-
202	M	58	**35.4**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	840	-	-
203	F	42	**35.4**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
204	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	170	-	-
205	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	160	-	-
206	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	160	-	-
207	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64	-	-
208	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	64	-	-
209	M	41	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
212	F	40	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
213	M	64	11.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	129	-	-	13	-	174	-	-
214	F	52	11.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	129	-	-	13	-	174	-	-
215	M	60	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	660	-	-	360	-	-
216	M	22	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	660	-	-	360	-	-
217	M	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	660	-	-	360	-	-
218	M	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	660	-	-	360	-	-
219	M	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	660	-	-	360	-	-
220	M	U	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36	-	-	-	-	-	-	-
221	F	U	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Annex 1. Adults' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
222	M	33	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	-	-	-	-
223	F	32	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
224	M	69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4	-	-	-	-	-	-	-
225	M	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4	-	-	-	-	-	-	-
226	F	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4	-	-	-	-	-	-	-
229	M	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**525**	-	-	-	-	-	-	-
230	M	56	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	66	-	-	6	-	-	-	-
231	F	67	3.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
232	M	47	**32.9**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1500**	-	-	**300**	-	180	-	-
233	M	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**550**	-	-	-	**550**	-	-	-	-
234	M	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**550**	-	-	-	**550**	-	-	-	-
235	M	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**550**	-	-	-	**550**	-	-	-	-
236	F	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	-	-	-	100	-	-	-
237	M	80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208	-	-	-	-	-	-	-
238	M	30	**22.7**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	-	-
239	M	58	**22.7**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
240	F	57	**22.7**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
241	M	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	450	-	-	-	-	-	-	-
242	M	47	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	90	-	-	10	-	-	-	-
243	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-	-	-	-
244	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	-	-	-
245	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	-	-	-
246	F	48	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
247	M	51	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	30	-	-	-	-	-	-	-
248	M	51	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	30	-	-	-	-	-	-	-
249	F	51	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	8	-	-	-	-	-	-	-
250	F	45	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	8	-	-	-	-	-	-	-
252	M	21	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	73	-	-	292	-	-
253	M	59	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
254	F	55	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
255	F	19	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
256	F	16	10.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
257	M	56	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	8	-	-

Annex 1. Adults' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
258	M	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	260	-	-	-	-	-	-	-
259	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	140	-	-
260	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	140	-	-
261	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	140	-	-
262	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	140	-	-
263	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	140	-	-
264	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	140	-	-
265	M	68	-	0.4	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-
266	F	U	-	0.4	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-
267	F	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	192	-	-	-	-	-	-	-
268	M	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	192	-	-	-	-	-	-	-
271	M	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42	-	-	-	4	-	-	-
272	F	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42	-	-	-	4	-	-	-
276	M	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-	-	-
277	F	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-	-	-
279	M	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	104	-	**104**	-	**208**	-	-	-	-
280	M	30	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	373	-	-	-	249	-	-	-
281	F	29	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	373	-	-	-	249	-	-	-
282	M	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36	-	-	-	-	-	-	-
283	F	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36	-	-	-	-	-	-	-
286	M	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33	-	-	-	8	8	-	-
287	F	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33	-	-	-	8	8	-	-
291	M	69	9.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	-	-
292	M	43	9.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	-	-
293	M	50	9.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	-	-
294	M	45	9.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	-	-
295	M	60	9.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	-	-
296	M	62	9.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	-	-
298	F	U	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
299	M	U	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
300	M	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	463	-	-	-	-	-	-	-
301	F	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	175	-	-	-	-	-	-	-
303	M	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	130	-	-	-	-	-	-	-

Annex 1. Adults' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
304	F	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	130	-	-	-	-	-	-	-
308	M	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	-	-	-
309	F	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	-	-	-
310	M	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	177	-	-	-	3	-	-	-
311	F	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-	-	-	-	-	-	-
312	F	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-	-	-	-	-	-	-
313	M	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	-	-	-	-	-	-	-
314	F	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	-	-	-	-	-	-	-
315	F	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	-	-	-	-	-	-	-
316	M	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	128	-	-	-	-	9	-	-
317	F	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	128	-	-	-	-	9	-	-
320	F	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	151	-	-	-	-	-	-	-
321	F	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	-	-	-	-	-	-	-
322	M	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	-	-	-	-	-	-	-
325	M	58	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-	-	-
326	M	61	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-	-	-
327	M	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	-	-	-	-	-	-	-
328	F	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26	-	-	-	-	-	-	-
329	M	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26	-	-	-	-	-	-	-
330	F	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26	-	-	-	-	-	-	-
333	M	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	165	-	-	-	-	-	-	-
334	F	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	165	-	-	-	-	-	-	-
335	M	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3314	4351
336	F	34	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	7064	956
340	F	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6708	1638
341	M	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1803	900
342	F	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	5473	510
344	M	U	-	-	-	14.1	**22.5**	**27.5**	20.0	**63.5**	**31.5**	**19.0**	-	5.1	**14.4**	**0.1**	-	0.6	1.0	10.0	-	-	-	-	-	-	-	-	-
345	F	U	-	-	-	14.1	**22.5**	**27.5**	20.0	**63.5**	**31.5**	**19.0**	-	5.1	6.2	**0.1**	-	0.6	1.0	-	-	-	-	-	-	-	-	-	-
346	M	64	-	0.8	-	3.2	2.5	-	-	0.5	-	-	**33.9**	3.2	**31.2**	-	-	-	1.5	6.0	-	-	-	-	-	-	-	-	-
347	F	62	-	0.8	-	3.2	2.5	-	-	0.5	-	-	**33.9**	3.2	**31.2**	-	-	-	1.5	6.0	-	-	-	-	-	-	-	-	-
348	M	67	-	-	-	4.5	**22.8**	**16.3**	**87.4**	17.1	-	-	-	-	-	-	-	1.5	-	-	-	77	-	-	-	-	-	-	-
349	F	66	-	-	-	4.5	**22.8**	**16.3**	**87.4**	17.1	-	-	-	-	-	-	-	0.5	-	-	-	77	-	-	-	-	-	-	-

Annex 1. Adults' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
350	M	U	5.9	-	-	-	-	-	-	-	-	-	-	-	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
351	M	U	-	-	-	4.7	-	**16.0**	**62.0**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
352	M	U	-	-	-	4.7	-	**16.0**	**62.0**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
353	F	U	-	-	-	4.7	-	**16.0**	**62.0**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
354	M	78	-	-	-	1.4	1.5	6.9	-	14.2	-	-	-	-	**13.9**	-	-	**5.9**	-	-	-	-	-	-	-	-	-	-	-
355	F	76	-	-	-	1.4	1.5	6.9	-	14.2	-	-	-	-	**13.9**	-	-	**5.9**	-	-	-	-	-	-	-	-	-	-	-
356	M	59	-	-	-	-	-	-	-	-	-	-	-	4.1	-	-	**2.3**	-	-	7.2	-	-	-	-	-	-	-	-	-
357	F	58	-	-	-	-	-	-	-	-	-	-	-	4.1	-	-	**2.3**	-	-	7.2	-	-	-	-	-	-	-	-	-
358	M	50	-	-	-	-	-	-	-	-	**47.3**	-	3.3	1.1	3.1	**0.1**	-	-	-	0.9	-	-	-	-	-	-	-	-	-
359	F	50	-	-	-	-	-	-	-	-	**47.3**	-	3.3	1.1	3.1	**0.1**	-	-	-	0.9	-	-	-	-	-	-	-	-	-
360	M	70	-	-	-	-	-	-	**86.6**	6.8	-	-	-	1.4	2.1	**1.0**	-	-	**2.7**	-	-	-	-	-	-	-	-	5240	2944
361	M	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5496	299
362	F	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6270	208
363	M	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	260	-	-	-	-	-	-	-
365	M	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	173	-	-	-	-	-	-	-
366	F	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	173	-	-	-	-	-	-	-
367	F	44	-	-	-	-	-	2.5	10.0	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	-	6378	59
368	M	49	-	2.5	-	-	-	2.5	10.0	-	-	-	-	-	5.4	-	-	-	-	-	-	-	-	**1352**	-	-	1100	5337	746
369	F	18	-	-	-	-	-	2.5	10.0	-	-	-	-	-	5.4	-	-	-	-	-	-	-	-	-	-	-	-	5196	68
370	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**832**	-	-	1100	-	-

Notes

Emboldened observations are the high-rate individuals

U = Unknown

Annex 2. Children's and infants' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Potato	Domestic fruit	Eggs	Intertidal occupancy over rock	Intertidal occupancy over sand	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
Child age group (6 - 15 years old)														
22	M	8	-	-	-	-	-	-	14	-	-	-	-	-
23	F	8	-	-	-	-	-	-	14	-	-	-	-	-
24	F	9	-	-	-	-	-	-	14	-	-	-	-	-
25	F	12	-	-	-	-	-	-	14	-	-	-	-	-
32	F	12	-	-	-	-	-	-	18	-	-	-	-	-
33	M	15	-	-	-	-	-	-	18	-	-	-	-	-
58	F	14	-	-	-	-	-	-	8	-	-	-	-	-
69	M	9	-	-	-	-	-	-	62	-	-	-	-	-
70	M	7	-	-	-	-	-	-	62	-	-	-	-	-
73	F	12	-	-	-	-	-	-	62	-	-	-	-	-
74	M	10	-	-	-	-	-	-	62	-	-	-	-	-
76	M	10	-	-	-	-	-	-	9	-	-	-	-	-
77	M	7	-	-	-	-	-	-	9	-	-	-	-	-
79	M	6	-	-	-	-	-	-	50	-	-	-	-	-
92	F	7	-	-	-	-	-	-	4	-	-	-	-	-
100	M	12	-	-	-	-	-	-	55	-	-	15	-	-
101	F	6	-	-	-	-	-	-	55	-	-	15	-	-
107	F	13	-	-	-	-	-	-	50	-	-	-	-	-
108	F	12	-	-	-	-	-	-	50	-	-	-	-	-
115	M	11	-	-	-	-	-	16	8	-	6	-	-	-
116	M	9	-	-	-	-	-	16	8	-	6	-	-	-
138	M	10	**11.8**	-	-	-	-	15	5	**5**	-	-	-	-
145	M	10	-	-	-	-	-	-	18	-	-	2	-	-

Annex 2. Children's and infants' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Potato	Domestic fruit	Eggs	Intertidal occupancy over rock	Intertidal occupancy over sand	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
146	F	9	-	-	-	-	-	-	18	-	-	2	-	-
150	F	8	-	-	-	-	-	-	30	-	-	5	-	-
172	M	14	**10.8**	-	-	-	-	-	-	-	-	-	-	-
173	M	14	**5.4**	-	-	-	-	-	-	-	-	-	-	-
200	M	6	**5.4**	-	-	-	-	-	-	-	-	-	-	-
210	M	14	3.5	-	-	-	-	-	-	-	-	-	-	-
211	F	10	3.5	-	-	-	-	-	-	-	-	-	-	-
227	M	10	-	-	-	-	-	2	4	-	-	-	-	-
228	F	9	-	-	-	-	-	2	4	-	-	-	-	-
251	F	15	**5.9**	-	-	-	-	15	8	-	-	-	-	-
269	F	10	-	-	-	-	-	-	**144**	-	48	-	-	-
270	M	14	-	-	-	-	-	-	**144**	-	48	-	-	-
273	F	13	-	-	-	-	-	-	42	-	4	-	-	-
274	F	11	-	-	-	-	-	-	42	-	4	-	-	-
275	F	8	-	-	-	-	-	-	42	-	4	-	-	-
278	M	12	-	-	-	-	-	-	24	-	6	-	-	-
284	M	12	-	-	-	-	-	-	27	-	5	5	-	-
285	F	14	-	-	-	-	-	-	27	-	5	5	-	-
288	M	8	-	-	-	-	-	-	33	-	8	8	-	-
289	M	7	-	-	-	-	-	-	33	-	8	8	-	-
297	M	15	-	-	-	-	-	**78**	78	-	-	-	-	-
302	M	8	-	-	-	-	-	-	**175**	-	-	-	-	-
307	F	6	-	-	-	-	-	-	26	-	-	-	-	-
318	M	9	-	-	-	-	-	-	**128**	-	-	9	-	-

Annex 2. Children's and infants' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Potato	Domestic fruit	Eggs	Intertidal occupancy over rock	Intertidal occupancy over sand	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
319	M	7	-	-	-	-	-	-	**128**	-	-	9	-	-
323	M	6	-	-	-	-	-	-	48	-	12	-	-	-
331	F	13	-	-	-	-	-	-	26	-	-	-	-	-
332	F	11	-	-	-	-	-	-	26	-	-	-	-	-
337	F	11	-	-	-	**0.3**	-	-	3	-	-	-	6314	956
338	F	8	-	-	-	**0.3**	-	-	3	-	-	-	6314	956
343	M	15	-	-	-	-	-	6	-	-	-	-	6037	455
364	M	12	-	-	-	-	-	-	**260**	-	-	-	-	-
Infant age group (0 - 5 years old)														
8	F	1	-	-	-	-	-	-	14	-	-	4	-	-
9	F	2	-	-	-	-	-	-	14	-	-	4	-	-
10	M	3	-	-	-	-	-	-	14	-	-	4	-	-
11	M	4	-	-	-	-	-	-	14	-	-	4	-	-
20	M	2	-	-	-	-	-	-	14	-	-	-	-	-
21	F	3	-	-	-	-	-	-	14	-	-	-	-	-
36	M	3	-	-	-	-	-	-	9	-	-	2	-	-
37	M	1	-	-	-	-	-	-	9	-	-	2	-	-
44	M	3	**1.1**	**2.5**	**6.4**	**1.4**	**8.9**	-	-	-	-	-	960	936
59	M	3	-	-	-	-	-	-	8	-	-	-	-	-
60	M	3	-	-	-	-	-	-	8	-	-	-	-	-
66	M	4	-	-	-	-	-	-	**219**	-	-	-	-	-
80	M	5	-	-	-	-	-	-	50	-	-	-	-	-
81	M	3	-	-	-	-	-	-	50	-	-	-	-	-
93	F	3	-	-	-	-	-	-	4	-	-	-	-	-

Annex 2. Children's and infants' consumption rates (kg y^{-1}) and occupancy rates (h y^{-1}) in the Dounreay area

Observation number	Sex	Age (years)	Fish	Crustaceans	Potato	Domestic fruit	Eggs	Intertidal occupancy over rock	Intertidal occupancy over sand	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
94	M	5	-	-	-	-	-	-	4	-	-	-	-	-
102	F	4	-	-	-	-	-	-	55	-	-	15	-	-
104	M	2	-	-	-	-	-	-	9	-	-	-	-	-
106	M	3	-	-	-	-	-	-	9	-	-	-	-	-
117	M	5	-	-	-	-	-	**16**	8	-	6	-	-	-
127	M	1	-	-	-	-	-	-	**75**	-	-	-	-	-
130	F	3	-	-	-	-	-	3	-	-	-	-	-	-
131	M	0.5	-	-	-	-	-	3	-	-	-	-	-	-
147	F	2	-	-	-	-	-	-	18	-	-	2	-	-
151	M	2	-	-	-	-	-	-	35	-	-	-	-	-
157	F	3	-	-	-	-	-	-	16	-	-	2	-	-
290	F	5	-	-	-	-	-	-	33	-	8	8	-	-
305	M	3	-	-	-	-	-	-	26	-	-	-	-	-
306	M	2	-	-	-	-	-	-	26	-	-	-	-	-
324	F	5	-	-	-	-	-	-	48	-	12	-	-	-
339	F	2	-	-	-	-	-	-	-	-	-	-	7064	956

Notes

Emboldened observations are the high-rate individuals

U = Unknown

Annex 3. Combinations of adult pathways for consideration in dose assessments in the Dounreay area

Combination number	Fish	Crustaceans	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within 1 km of the licensed site boundary	Outdoor occupancy within 1 km of the licensed site boundary
1		X				X					X	X						X									
2	X					X	X						X														
3		X		X				X					X					X		X		X			X		
4	X																		X	X				X			
5			X																X	X			X				
6	X	X					X	X					X													X	X
7						X		X			X	X						X									
8	X	X		X	X	X	X	X								X	X										
9		X		X	X	X											X									X	X
10								X												X						X	X
11				X	X	X	X	X								X				X							
12	X			X	X	X		X												X					X		
13	X																		X	X			X		X		
14																			X	X		X			X		
15	X	X																				X			X		
16																			X		X		X				
17																				X				X	X		
18																			X							X	X
19				X	X	X	X	X	X	X		X	X	X		X	X	X									
20		X		X	X			X			X	X	X				X	X									
21												X			X			X									
22									X		X	X	X	X				X									
23							X	X				X	X	X			X									X	X
24						X	X													X						X	X
25		X				X	X						X									X			X	X	X

Notes

The food groups and external exposure pathways marked with a cross are combined for the corresponding combination number. For example, combination number 3 represents an individual (or individuals) from Annex 1 who had positive data in the following pathways; crustaceans, green vegetables, domestic fruit, eggs, venison, intertidal occupancy over sand, handling fishing gear, and occupancy on water.