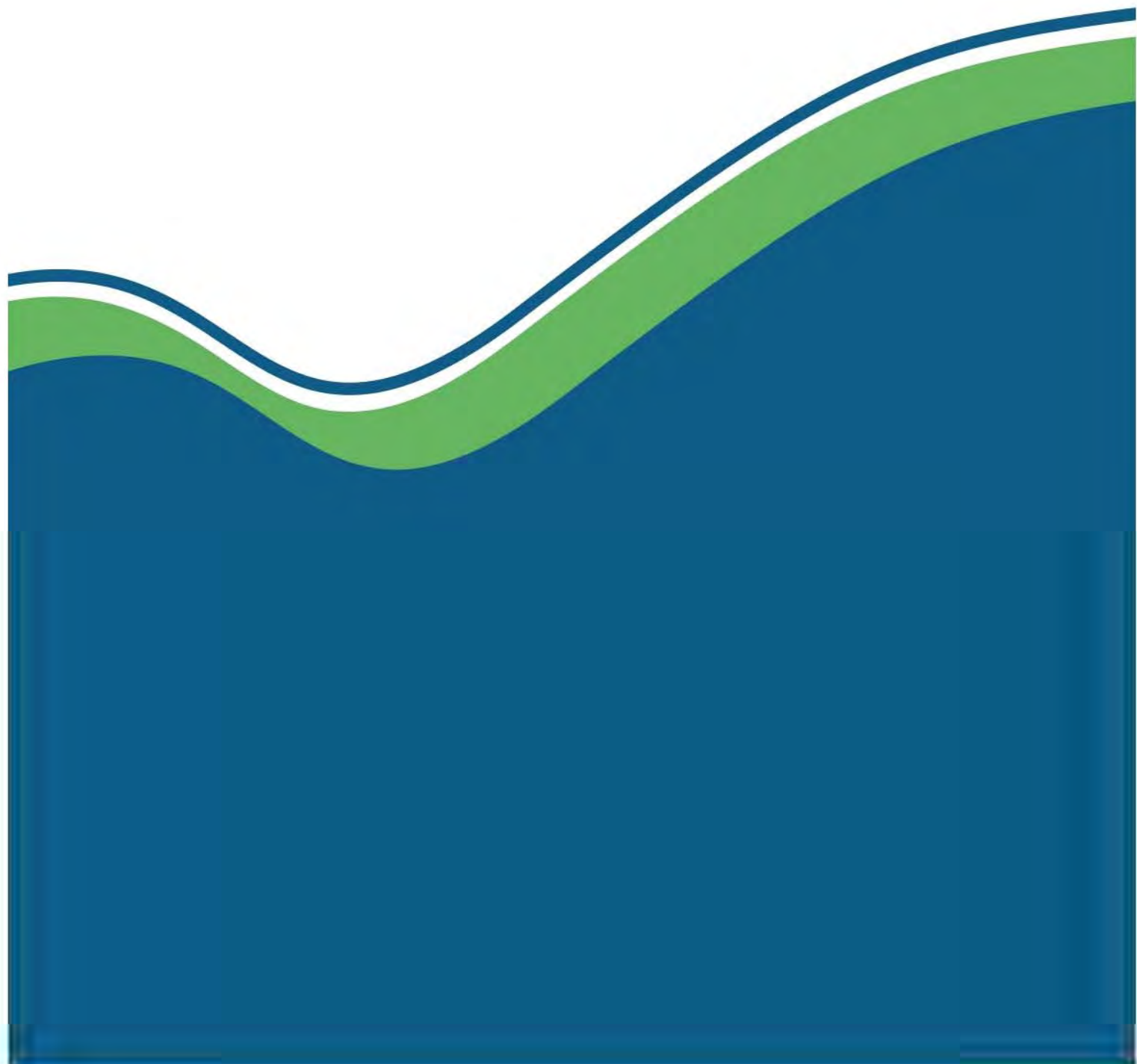


Radiological Habits Survey: Faslane, 2011



Radiological Habits Survey: Faslane, 2011

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Peer reviewed by G.J. Hunt
Approved for publication by W.C. Camplin

2013

This report should be cited as: Rumney, P., Garrod, C.J. and Clyne, F.J., 2013. Radiological Habits Survey: Faslane, 2011. RL 21/13. Cefas, Lowestoft

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SUMMARY

This report presents the results of a survey conducted in 2011 to determine the habits and consumption patterns of people living, working and undertaking recreational activities in the vicinity of Her Majesty's Naval Base Clyde, which comprises the Faslane Naval Base and the Royal Naval Armaments Depot at Coulport. The Faslane site discharges liquid radioactive waste via an outfall into Gare Loch and contains sources of direct radiation. The armaments depot at Coulport discharges gaseous radioactive waste to the atmosphere.

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 intertidal areas and waters of Gare Loch to a line at the mouth of Gare Loch, from Rosneath Point on the western side to Helensburgh Pier on the eastern side.
- The terrestrial survey area; which included all land and freshwaters within a 5 km semi circle eastwards of the Faslane site centre (taken as National Grid Reference NS 246 895), and the Rosneath Peninsula on the western side of Gare Loch.
- The direct radiation survey area; which covered the area up to 1 km from the centre of the liquid waste store at the southern end of the Faslane site.

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 sediment; the consumption of foods from the terrestrial survey area; and occupancy within the direct radiation survey area.

Interviews were conducted with members of the public and the data collected for 308 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

Gare Loch is a sea loch which is approximately 10 km long and 1.5 km wide. The southern end of the loch opens into the Firth of Clyde. The intertidal area of Gare Loch was predominantly stones on the upper shore and mud and stones on the lower shore. No netting, trawling or creeling were identified within the aquatic survey area. Two groups of commercial winkle collectors were identified collecting winkles from the shore to the east of Rhu Marina and to the south of Cairndhu Point. When asked

where the winkles were being sold, both groups responded that they were sold to various people, some of whom were local. A small amount of winkles were being consumed by the collectors. People were also collecting winkles non-commercially on the shore at Castle Bay and at Helensburgh for their own consumption. Shore angling was very popular, particularly at Rockville, Rhu Spit and Helensburgh Pier. The main species of fish caught and consumed by anglers was mackerel. An angling association had the rights to fish for sea trout on most of the shores of Gare Loch. No boat angling was identified in Gare Loch.

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

- 19 kg y⁻¹ for fish (comprising mackerel, sea trout and flounder, caught by shore anglers)
- 1.2 kg y⁻¹ for molluscs (winkles only, collected from Castle Bay and to the east of Rhu Marina)

No consumption of crustaceans, wildfowl or marine plants/algae was identified.

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

- For fish; 59% sea trout, 32% mackerel and 9% flounder
- For molluscs; 100% winkles

Two individuals were identified who collected seaweed from the shore at Shandon and Garelochhead for use as a fertiliser on their gardens. Consumption rates were obtained for fruit and vegetables that had been grown in soil fertilised with seaweed. The use of seaweed as animal feed was not identified.

Intertidal activities identified for adults included bait digging, collecting winkles, angling, walking, dog walking, playing, sitting on the beach and collecting seaweed.

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

- 70 h y⁻¹ over mud (for four bait diggers at Garelochhead, Rhu and Cairndhu Point)
- 74 h y⁻¹ over mud and stones (for 13 winkle collectors to the east of Rhu Marina, to the south of Cairndhu Point, at Helensburgh and at Castle Bay, two individuals who were angling and walking to the south of Rockville, one person walking on the shore at Blairvadach, two dog walkers at Helensburgh, one bait digger at Rhu, and one person collecting seaweed and angling at Garelochhead)
- 59 h y⁻¹ over rock (for seven anglers at Rockville and to the south of Rockville)
- 160 h y⁻¹ over sand and stones (for one angler at Rhu Spit and six dog walkers at Helensburgh and Rhu Spit)

- 150 h y⁻¹ over stones (for three anglers to the north of Clynder and two dog walkers at Rosneath)

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

Activities for adults involving sediment handling included collecting winkles, bait digging, and collecting seaweed. The mean rates for the adult high-rate groups for handling were:

- 79 h y⁻¹ for handling sediment (for 13 winkle collectors to the east of Rhu Marina, at Helensburgh, to the south of Cairndhu Point and at Castle Bay; and five bait diggers at Garelochhead, at Rhu, at Cairndhu Point, at Helensburgh and at various locations along the Gare Loch coastline)

No handling of fishing gear was identified in the survey area. 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 activities identified taking place in the water in the survey area included sub-aqua diving, kayaking and slipway maintenance. Activities taking place on the water in the survey area included sailing, canoeing, boat maintenance and cleaning mooring posts from a boat. The maximum occupancy rate in water was 290 h y⁻¹ for an adult who was teaching kayaking in Gare Loch and maintaining a slipway at Blairvadach. The maximum occupancy rate on water was 400 h y⁻¹ for three adults carrying out boat maintenance on Gare Loch.

The terrestrial survey area

Eight farms were identified where beef cattle and lambs were reared, one of the farmers also reared pigs and one farmer reared dairy cattle. The majority of the cattle feed was grown within the terrestrial survey area in the form of silage. Farmers and their families were consuming milk, beef, lamb, mutton and pork produced on their farms as well as eggs, vegetables and fruit. No allotment sites were identified within the survey area. However, interviews were conducted with members of a local horticultural society who were consuming a wide range of fruit and vegetables from their gardens. Two beekeepers were identified who kept hives within the survey area and produced honey which was sold to the public. The consumption of wild foods within the survey area included blackberries, wild raspberries, bilberries and mushrooms. Pheasants were reared in the survey area and were consumed. Pheasant, pigeon and deer were shot on farmland and were consumed. One individual occasionally shot and consumed rabbits from their garden. The consumption of brown trout and salmon was identified. Two farms did not have access to mains water and were using spring water for both human and livestock consumption. Livestock at other farms had access to stream and ditch water.

In the terrestrial survey area, foods were consumed from 18 food groups. The mean consumption rates for the adult high-rate groups for terrestrial foods were:

- 23 kg y⁻¹ for green vegetables
- 36 kg y⁻¹ for other vegetables
- 17 kg y⁻¹ for root vegetables
- 18 kg y⁻¹ for potato
- 28 kg y⁻¹ for domestic fruit
- 270 kg y⁻¹ for milk
- 53 kg y⁻¹ for cattle meat
- 51 kg y⁻¹ for pig meat
- 22 kg y⁻¹ for sheep meat
- 1.3 kg y⁻¹ for poultry
- 15 kg y⁻¹ for eggs
- 2.8 kg y⁻¹ for wild/free foods
- 0.2 kg y⁻¹ for rabbits/hares
- 15 kg y⁻¹ for honey
- 0.4 kg y⁻¹ for wild fungi
- 2.0 kg y⁻¹ for venison
- 0.9 kg y⁻¹ for freshwater fish
- 0.6 kg y⁻¹ for goat meat

The transfer of contamination off-site by wildlife was investigated. There was no specific policy for controlling or monitoring wildlife on the Faslane site.

The direct radiation survey area

The direct radiation survey area included residential and agricultural areas. Occupancy rates were obtained at 14 residences, one of which was a working farm, and one nursery school.

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

- 8100 h y⁻¹ for the indoor occupancy rate (for a resident)
- 5000 h y⁻¹ for the outdoor occupancy rate (for a resident)
- 8200 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 Faslane site.

Comparisons with the previous survey

The results of this habits survey were compared with the last habits survey undertaken in the same area in 2006 (Sherlock *et al.*, 2009).

In the aquatic survey area, the mean consumption rate for the adult high-rate group for fish was very similar in 2011 and 2006. Small quantities of crustaceans were consumed in 2006 but this was not identified in 2011. The mean consumption rate for the adult high-rate group for molluscs increased in 2011 compared to 2006, as did the total number of people consuming molluscs, from two adults in 2006 to eight adults in 2011. Four children were also identified consuming molluscs in 2011.

The mean occupancy rate for the adult high-rate group over intertidal substrates increased slightly for mud and for mud and stones in 2011 compared with 2006. There were significant decreases in the mean occupancy rates for the adult high-rate group for rock and for stones in 2011. In 2011, activities were recorded over sand and stones but no activities were recorded taking place over this substrate in 2006. The mean rate for the high-rate group for handling sediment increased in 2011 due to the identification of people collecting winkles. The handling of fishing gear was not identified in 2006 or 2011 (the handling of angling equipment is not considered to be a significant pathway so data for this pathway were not collected).

In the terrestrial survey area, the food groups showing increases in the mean consumption rates for the adult high-rate groups in 2011 were other vegetables, potato, domestic fruit, milk, cattle meat, eggs, honey and venison. The most significant increases were for milk and for honey. There were decreases in the mean consumption rates for the adult high-rate groups for green vegetables, root vegetables, sheep meat, poultry, wild/free foods, rabbits/hares and wild fungi. The consumption of pig meat, freshwater fish and goat meat was recorded in the 2011 survey but was not recorded in the 2006 survey.

In the direct radiation survey area, the highest indoor occupancy rate, the highest outdoor occupancy rate and the highest total occupancy rate had all increased slightly in 2011 compared with 2006.

Suggestions for changes to the monitoring programme

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

- The annual sample of mussel shells currently collected from Shandon could be removed from the programme since they were not identified being used as a fertiliser in 2011.
- The location of the annual winkle sample collected from Garelochhead could be changed to the bay to the east of Rhu Marina since this was the main location of winkle collection.

- A quarterly milk sample could be added to the terrestrial programme for one year for reassurance purposes.

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 during 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 Faslane 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 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

Her Majesty's Naval Base (HMNB) Clyde comprises two sites; the Faslane Naval Base and the Royal Naval Armaments Depot (RNAD) at Coulport. Babcock Marine, a subsidiary of Babcock International Group plc, operates HMNB Clyde in partnership with the MoD. Discharges of liquid radioactive waste are made into Gare Loch from Faslane and discharges of gaseous radioactive waste in the form of tritium are made to the atmosphere from Coulport under letters of agreement between SEPA and the MoD. The Faslane Naval Base contains sources of direct radiation.

The Faslane Naval Base is situated on north eastern shore of Gare Loch. At the time of the survey, the main activities at the base included those relating to the routine maintenance and support services for the nuclear submarines. The Royal Naval Armaments Depot at Coulport is situated on the eastern shore of Loch Long. The depot is used to store conventional armaments for Royal Navy vessels and is also the UK Strategic Weapon Facility for the Trident Missile System.

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 activities undertaken at HMNB Clyde. 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

No additional site-specific investigations were requested by SEPA.

2.3 Survey areas

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

The aquatic survey area (Figure 1) covered the intertidal areas and waters of Gare Loch to a line at the mouth of Gare Loch, from Rosneath Point on the western side to Helensburgh Pier on the eastern side.

The terrestrial survey area (Figure 2) included all land and freshwaters within a 5 km semi circle eastwards of the Faslane site centre (taken as National Grid Reference NS 246 895), and the Rosneath Peninsula on the western side of Gare Loch. This area was defined in consultation with SEPA. The gaseous discharges are from RNAD Coulport and the survey area takes into account the prevailing winds.

The same aquatic and terrestrial survey areas were used in the previous habits survey conducted by Cefas around HMNB Clyde, which was in 2006 (Sherlock *et al.*, 2009).

The direct radiation survey area (also shown in Figure 2) was defined as the area up to 1 km from the centre of the liquid waste store at the southern end of the Faslane site. This survey area was moved north by 0.2 km compared with the 2006 survey. This was because a more accurate location of the liquid waste store was obtained during the 2011 survey.

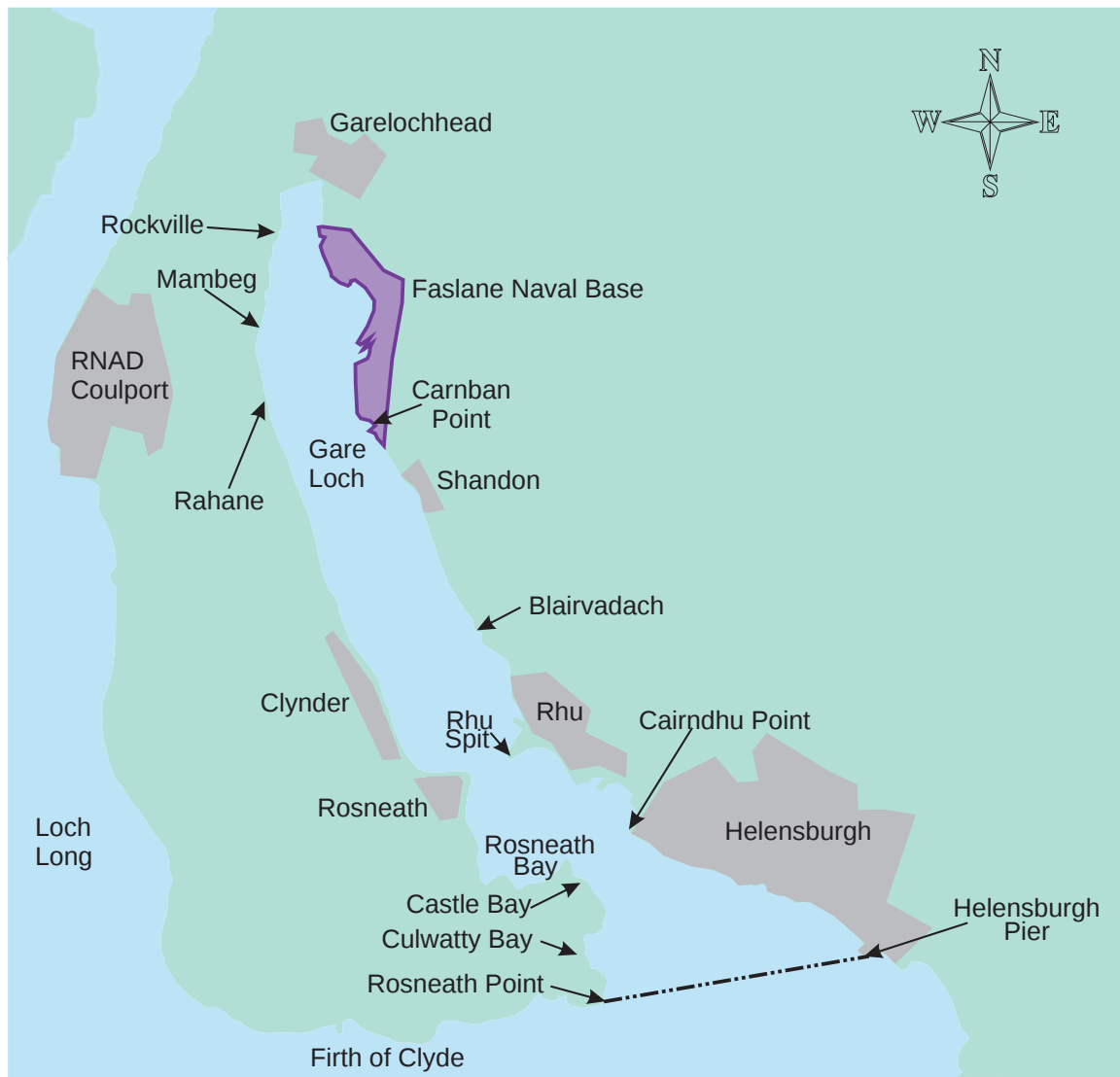


Figure 1. The aquatic survey area.

----- Aquatic survey area limit



Figure 2. The terrestrial and direct radiation survey areas.

— Limit of direct radiation survey area.

— Limit of terrestrial survey area.

2.4 Conduct of the survey

As part of the pre-survey preparation, SEPA was contacted to confirm the basic requirements and any additional ones. 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 Faslane. People with local knowledge of the survey area were contacted for information on any aspects relevant to the exposure pathways. These included members of a beekeeping society, a horticultural society, water sports centres, sailing clubs, a boat yard and an angling club. 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 1st to 10th August 2011, by three members of staff from the Cefas laboratory at Lowestoft, 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 Faslane 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, anglers, sailors, people carrying out activities on intertidal areas, farmers, gardeners, beekeepers and people living or working 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 taken indoors and outdoors at most properties visited within the direct radiation area. Measurements of background gamma dose rates were taken at locations further than 5 km from the Faslane site.

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		Age ranges used in reports prior to 2010	
Name of age group	Age range in group	Name of age group	Age range in group
• Infant	0 to 5-year-old	• 3-month-old	Under 1-year-old
		• 1-year-old	1-year-old
		• 5-year-old	2-year-old to 6-year-old
• Child	6-year-old to 15-year-old	• 10-year-old	7-year-old to 11-year-old
		• 15-year-old	12-year-old to 16-year-old
• Adult	16-year-old and over	• 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, page 17) covered the intertidal areas and waters of Gare Loch to a line at the mouth of Gare Loch, from Rosneath Point on the western side to Helensburgh Pier on the eastern side.

Gare Loch is a sea loch which is approximately 10 km long and 1.5 km wide. The southern end of the loch opens into the Firth of Clyde. The intertidal area of Gare Loch was predominantly stones on the upper shore and mud and stones on the lower shore. There were large areas of mussel shells at certain locations along the shore. There were access points onto the shore around most of Gare Loch with the exception of the shore at the Faslane Naval Base. Throughout Gare Loch there were many moorings for pleasure craft. No commercial or hobby netting, trawling or creeling was identified taking place within the survey area.

Rosneath Point, Culwatty Bay, Castle Bay and Rosneath Bay

Rosneath Point is a rocky promontory at the southern end of the Rosneath Peninsula. The area consisted of large terraced rocks and stones on the upper shore with large areas of mud and patches of stones on the lower shore. The shore was accessible by a footpath through woods alongside Culwatty Bay. Culwatty Bay had a stony beach, with large areas of mud and patches of stones on the lower shore. No activities were identified on the shore at Rosneath Point and Culwatty Bay. A large caravan park, which included a water sports centre, stretched from Castle Bay to Rosneath Bay. Guests at the caravan park were angling, sailing, kayaking and windsurfing in Rosneath Bay. The substrate along the shore of Castle Bay and Rosneath Bay was stones with mud and stones revealed at low tide. Two adults and two children were observed collecting winkles in front of the caravan park at Castle Bay (see Figure 3).



Figure 3. Castle Bay

Rosneath, Clynder, Rahane, Mambeg and Rockville

The intertidal substrate from Rosneath to Rockville was mainly stones with mud and stones exposed at low water. A road ran parallel to the shore between Rosneath and Rockville. There were several lay-bys along this road, which anglers used for parking, and there was access to the shore from the road. The exception was along the stretch of road between Rahane and to the south of Rockville, where there was no off-road parking and no direct access from the road to the shore due to thick vegetation.

The shore at Rosneath was popular with anglers and dog walkers. Several people were observed kayaking offshore. There were two boat yards located at Rosneath with many moorings for pleasure craft. There were several slipways near Clynder which were used to launch vessels. The main activity taking place between Clynder and Rockville was shore angling. One angler was accompanied by his children who were playing on the stone beach to the south of Rockville and one person was sitting on the beach at Mambeg.

To the north of Rockville there were several parking places along the road and the shore was easily accessible from the road. Angling was especially popular on the shore around Rockville where there were rocky outcrops (see Figure 4).



Figure 4. South of Rockville

Garelochhead and Faslane

Garelochhead was located at the head of the loch. The intertidal substrate was mud and stones on the upper shore with mud and patches of stones on the lower shore. There was easy access onto the shore and there was a slipway. Activities identified at Garelochhead included dog walking, collecting seaweed to use as a fertiliser and bait digging. It was reported that the number of worms had decreased in recent years, and therefore, the area was not as popular for bait digging as it once was. There were approximately 20 offshore moorings for pleasure craft in the loch around Garelochhead and small dinghies used to access the offshore moorings were kept on the shore.

To the south of Garelochhead, the Faslane Naval Base occupied over 2 km of shoreline and there was no public access onto the shore in this area. No fishing or swimming was permitted within 100 metres of the base and within 150 metres of vessels. The southern limit of the naval base was south of Carnban Point, where public access to the shore was possible.

Shandon and Rhu

Between Shandon and Rhu Spit the substrate was stones, with mud and stones exposed at low water. The beach at Shandon was popular with local walkers and it was reported to be popular with dog walkers. One individual was interviewed who was collecting seaweed from the shore at Shandon to use as a soil fertiliser. Kayaking was popular with a few residents who lived in Shandon. Between Shandon and Rhu there were several slipways where people could launch their vessels. It was reported that anglers fished from these areas at high tide.

To the south of Shandon, an outdoor education centre was located at Blairvadach which provided sailing, canoeing and kayaking courses in the loch for adults and children and educational walks on the shore for children. One individual was identified who spent time sitting on the beach at Blairvadach.

To the south of Blairvadach, a sailing club was based at Rhu Spit and members kept their sail boats moored on the northern shore of the spit. Most of the club members had large sail boats that they predominantly sailed outside of the aquatic survey area. Rhu Spit extended approximately 500 metres into Gare Loch. The shore of the spit was sand and stones and it was particularly popular with anglers (see Figure 5). One individual was identified spending time sitting on the beach. Local walkers and dog walkers spent time on the shore at Rhu and at Rhu Spit.



Figure 5. Rhu Spit

Between Rhu Spit and Cairndhu Point there were two large bays where the substrate was a mixture of mud, sand and stones. Rhu Marina was located at the eastern end of the first bay. The marina included approximately 250 berths occupied by yachts and motor cruisers, a coastguard station and an RNLI station. A team of commercial divers were also based at the marina.

The second bay was popular with winkle collectors (see Figure 6). The winkles were collected commercially for four months of the year and were sold to various people, some of whom were local. A small amount of winkles were being consumed by the collectors. A sailing club was based in this

area and approximately 50 sailing boats were moored offshore. The club members raced sailing dinghies in Gare Loch throughout the year.



Figure 6. East of Rhu Marina

Helensburgh

There was good access and parking at Cairndhu Point, which was located at the western end of Helensburgh. There was a large area of mud with patches of stones exposed at low tide. The shore was popular with bait diggers. One group of commercial winkle collectors, who were in the area for over two months per year, were identified collecting winkles to the south of Cairndhu Point. The winkles were sold to various people, some of whom were local. The Helensburgh seafront, which extended approximately 3 km to the south of Cairndhu Point, was sand and stones on the upper shore with mud and stones on the lower shore. This area was popular with winkle collectors, walkers and dog walkers. Helensburgh Pier marked the end of the survey area and this was a popular angling location.

4.2 Commercial fisheries

There were fishing restrictions in Gare Loch as a result of the activities at the Faslane Naval Base. The Clyde Dockyard Port of Gare Loch and Loch Long Order prohibited fishing from taking place within 100 metres of the Faslane base and within 150 metres of vessels. There were also restricted fishing areas which covered much of the north-eastern part of the loch and a navigation channel

between Rhu and Helensburgh. In these areas, permission from the Queen's harbour master was required for any fishing activity including the cultivation of fish or shellfish.

There was only a small area of the loch where fishing was permitted but no commercial netting, trawling or creeling was identified taking place during the survey.

The commercial collection of winkles was identified taking place on the shore to the east of Rhu Marina by large group of people who visited the area for approximately four months per year and to the south of Cairndhu Point by another group of people who were in the area for over two months per year.

4.3 Destination of seafood originating from the aquatic survey area

The only seafood being collected commercially within the aquatic survey area was winkles. When asked where the winkles were being sold, the two groups of collectors responded that they were sold to various people, some of whom were local. No anglers were identified who sold their catch.

4.4 Angling and shellfish collecting

Shore angling was particularly popular at Helensburgh Pier, Rhu Spit and to the south of Rockville. Other locations included Rosneath, the north of Clynder and Garelochhead. Most of the anglers who were interviewed were fishing for mackerel and a small amount also caught sea trout and flounder. All three fish species were being consumed. Many anglers were interviewed who were fishing for the first time. An angling association had the rights to fish for sea trout around most of the shore of the loch. Mackerel and sea trout are migratory fish and therefore do not reside permanently in the loch. Mackerel migrate from the sea into the loch for a few months per year during the summer and spend the rest of the year at sea. Sea trout might reside in the loch for a short time to feed or might pass through the loch, either on the way upstream to spawn, or downstream out to sea to their feeding grounds.

4.5 Wildfowling

No wildfowling was identified because there was no suitable habitat within the aquatic survey area for wildfowl.

4.6 Other pathways

One person was identified collecting seaweed (reported to be bladder wrack) from Garelochhead to use as a soil fertiliser on their vegetable garden. One person collected seaweed (unspecified

species) from Shandon to use as a soil fertiliser on their fruit and vegetable garden and occasionally collected mussel shells to mix with chicken feed for their chickens. The use of seaweed for animal feed was not identified

4.7 Internal exposure

Consumption data for foods from the aquatic survey area are shown in Tables 3 and 4 for adults and Tables 5 and 6 for children and infants. Adults' consumption data for vegetables and fruit grown in soil that had been fertilised with seaweed are shown in Table 7.

Adults' consumption rates

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

Table A presents a summary of the consumption rates for fish and molluscs from the aquatic survey area. No consumption of crustaceans, marine plants/algae or wildfowl 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 A. 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	46	4	25.1	12.4	18.7	23.5	15.0	40.0
Molluscs	8	7	2.4	0.9	1.2	2.2	3.5	10.0

The predominant species of fish consumed by adults were sea trout and mackerel. Smaller quantities of flounder were also consumed. These fish were mainly caught from Rockville, Rhu Spit, Rosneath and Clynder. Of the fish consumed by the four people in the high-rate group, the percentage breakdown of species was 59% sea trout, 32% mackerel and 9% flounder.

The only species of mollusc consumed by adults were winkles, which were collected at Castle Bay, to the south of Cairndhu Point, to the east of Rhu Marina and at Helensburgh.

Two adults were identified consuming vegetables and fruit grown in fertiliser made with seaweed collected from Shandon and two adults were consuming vegetables grown in fertiliser made with seaweed collected from Garelochhead. Table 7 presents the consumption rates of vegetables and fruit consumed. These foods are included in the aquatic section of this report as the exposure pathway is sea to land transfer and the source of potential exposure is liquid discharges from the Faslane Naval Base. These foods were grown in the terrestrial survey area and they are also potentially subject to deposition from gaseous discharges. Therefore, they are also included in the terrestrial food groups and are included once in Annex 1 as terrestrial foods.

Children's and infants' consumption rates

Table B presents a summary of children's and infants' consumption rates of fish and molluscs 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 individuals in the child age group, no consumption of crustaceans, marine plants/algae or wildfowl was identified. For individuals in the infant age group, no consumption of fish, crustaceans, marine plants/algae or wildfowl was identified. The age group names and their relevant age ranges are listed in Section 3.3.

Table B. 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	11	4	6.0	3.9	4.4	5.5
Molluscs	2	2	1.8	1.4	1.6	1.8
Infant age group (0 – 5 years old)						
Molluscs	2	2	0.6	0.3	0.5	0.6

The only species of fish consumed by individuals in the child age group was mackerel, which were caught to the south of Rockville and to the north of Clynder.

The only species of molluscs consumed by individuals in the child age group was winkles. These were collected at Castle Bay and to the east of Rhu Marina.

The only species of molluscs consumed by individuals in the infant age group was winkles, which were collected at Castle Bay.

4.8 External exposure

Intertidal occupancy

Intertidal occupancy rates for adults are presented in Table 8 and intertidal occupancy rates 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 C 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.

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)
Mud	5	4	104	70	101
Mud and stones	25	20	112	74	112
Rock	16	7	90	59	88
Sand and stones	19	7	263	158	262
Stones	24	5	192	151	192

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

- For mud; bait digging, which was undertaken at Garelochhead, at Rhu, along the Gare Loch coastline and at Cairndhu Point (Helensburgh).
- For mud and stones; collecting winkles to east of Rhu Marina, to the south of Cairndhu Point, at Helensburgh and at Castle Bay, angling and walking to the south of Rockville, walking at Blairvadach, dog walking at Helensburgh, angling and collecting seaweed at Garelochhead, and bait digging at Rhu.
- For rock; angling, which took place to the south of Rockville and at Rockville.
- For sand and stones; dog walking at Helensburgh and Rhu Spit and angling at Rhu Spit.
- For stones; angling to the north of Clynder and dog walking at Rosneath.

Children's and infants' intertidal occupancy rates

Table D 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 D. 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)					
Mud and stones	11	8	105	87	105
Rock	7	3	90	80	90
Sand and stones	6	2	54	36	50
Stones	5	3	72	72	72
Infant age group (0 - 5 years old)					
Mud and stones	1	1	42	42	NA

Notes

NA = Not applicable

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

- For mud and stones; collecting winkles to the south of Cairndhu Point and at Castle Bay, angling at Rockville and to the south of Rockville and walking to the south of Rockville.
- For rock; angling at Rockville and to the south of Rockville.
- For sand and stones; angling at Rhu Spit.
- For stones; angling to the north of Clynder.

Only one individual was identified in the infant age group for occupancy over intertidal substrates. This individual was collecting winkles with their family at Castle Bay over mud and stones.

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.

- Three measurements taken over stones ranged from 0.062 $\mu\text{Gy h}^{-1}$ to 0.078 $\mu\text{Gy h}^{-1}$
- Three measurements taken over mud and stones ranged from 0.059 $\mu\text{Gy h}^{-1}$ to 0.068 $\mu\text{Gy h}^{-1}$
- Two measurements taken over sand and stones ranged from 0.059 $\mu\text{Gy h}^{-1}$ to 0.074 $\mu\text{Gy h}^{-1}$
- One measurement taken over mud, sand and stones was 0.062 $\mu\text{Gy h}^{-1}$

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 since angling equipment does not generally become entrained with sediment. Therefore, as in previous surveys, data for this pathway were not collected.

Table 11 presents the adults' handling rates of sediment recorded during the survey and Table 12 presents the children's and infants' handling rates of sediment. No handling of fishing gear was identified during the survey.

Adults' handling rates of sediment

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

Table E. Summary of adults' handling rates of 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 sediment	23	18	112	79	112

The activities undertaken by the people in the adult high-rate group for handling sediment were collecting winkles and bait digging. Winkles were collected on the shore to the east of Rhu Marina, at Helensburgh, to the south of Cairndhu Point and at Castle Bay. Bait digging took place at Garelochhead, Rhu, at various locations along the Gare Loch coastline, at Cairndhu Point and at Helensburgh. None of the winkle collectors and bait diggers were wearing gloves at the time of the interview.

Children's and infants' handling rates of sediment

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

Table F. Summary of children's and infants' 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)				
5	4	105	89	105
Infant age group (0 – 5 years old)				
1	1	42	42	NA

Notes

NA = Not applicable

The activity undertaken by the individuals in the child age group high-rate group for handling sediment was collecting winkles to the south of Cairndhu Point and at Castle Bay. The activity undertaken by individuals in the infant age group high-rate group was collecting winkles with their family at Castle Bay.

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 'on water' in the survey area for individuals in the child age group are presented in Table 14. No individuals in the child age group were identified spending time 'in water' and no individuals in the infant age group were identified spending time 'in water' or 'on water' in the survey area.

Activities taking place in the water in the aquatic survey area included sub-aqua diving, kayaking and maintenance of a slipway. Thirteen observations were recorded for occupancy in the water. The

highest occupancy rate in water for adults was 290 h y^{-1} for a person who spent their time maintaining a slipway and teaching kayaking.

Activities taking place on the water in the survey area included boat maintenance, sailing, canoeing, and cleaning mooring posts from a dinghy. Forty-one observations were recorded for adults and children. The highest occupancy rate on water for adults was 400 h y^{-1} . This was for three individuals who were carrying out boat maintenance in Gare Loch. There were two individuals in the child age group who were canoeing on Gare Loch for 26 h y^{-1} .

5 TERRESTRIAL RADIATION PATHWAYS

5.1 Terrestrial survey area

The terrestrial survey area (see Figure 2, page 18) included all land and freshwaters within a 5 km semi circle eastwards of the Faslane site centre (taken as National Grid Reference NS 246 895), and the Rosneath Peninsula on the western side of Gare Loch. Eight working farms were identified in the terrestrial survey area. Of these, three working farms were identified in the eastern section of the survey area and five working farms were identified in the western section of the survey area on the Rosneath Peninsula. The farmers in the survey area all produced lambs and beef cattle. One of these farmers also produced milk from dairy cattle and another farmer also produced pigs. One farmer based outside the terrestrial survey area rented land within the terrestrial survey area and kept beef cattle on the land for eight months of the year. Crops such as beet, cereals and silage were produced for animal feed and were used by the farmers for their own animals.

Beef cattle and lambs were sold through a livestock market and on to an abattoir at Stirling. Pigs were sold to an abattoir in Ayrshire. Lamb and beef were sold at one butcher shop and lamb was also sold at another butcher shop, both of which were within the survey area. Milk produced was sold to a national dairy company.

Farmers and their families were consuming beef, lamb, mutton, milk and pork that were produced on their farms as well as chicken eggs, duck eggs, goat meat, vegetables and fruit.

No allotment sites were identified within the survey area. However, interviews were conducted with members of a local horticultural society who were consuming a wide range of fruit and vegetables from their gardens. Three people were identified who kept chickens and consumed chicken eggs; one of these people also kept ducks for eggs.

Two beekeepers were identified with hives in the survey area. One beekeeper kept eight hives within the survey area on the Rosneath Peninsula. The other beekeeper kept five hives in Shandon. The honey produced per hive ranged from 4.0 kg y⁻¹ to 20 kg y⁻¹. The honey was consumed by the beekeepers and their families; any excess was sold directly to friends or work colleagues.

The consumption of wild foods from within the terrestrial survey area included blackberries, bilberries, wild raspberries and mushrooms. Pheasants which were reared in the survey area were consumed by members of a shooting syndicate and were sold to a game dealer. Pheasant, pigeon and deer were shot on farmland and were consumed. One individual occasionally shot and consumed rabbits from their garden.

A freshwater reservoir, which was stocked with brown trout, was located to the south of the Rosneath Peninsula. The reservoir was regularly fished by a local angling club and the club members were consuming brown trout. Brown trout was also consumed from a stocked private pond on the Rosneath Peninsula. A river flowed through the eastern part of the terrestrial survey area and flowed into Loch Lomond. This was a popular river with anglers for game fishing and one angler was identified who caught and consumed small quantities of salmon from the river.

The consumption of groundwater by humans and livestock was identified. Two farms were using spring water as their sole domestic supply and as drinking water for livestock. Livestock at other farms had access to ditch and stream 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. A representative from the Faslane site reported that there was no specific policy for monitoring or controlling wildlife at the naval base.

5.2 Land cover

Figure 7 shows the soil types in the area around the Faslane site. 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 heather moor and bracken with smaller areas of coarse and improved grassland. There were also areas of blanket bog, peatland vegetation, open canopy young plantation and broadleaved and mixed woodland. On the western side of Gare Loch there were large areas of coniferous plantation and smaller areas of land recently ripped for afforestation. The main urban areas were at the northern tip and the east side of the loch.

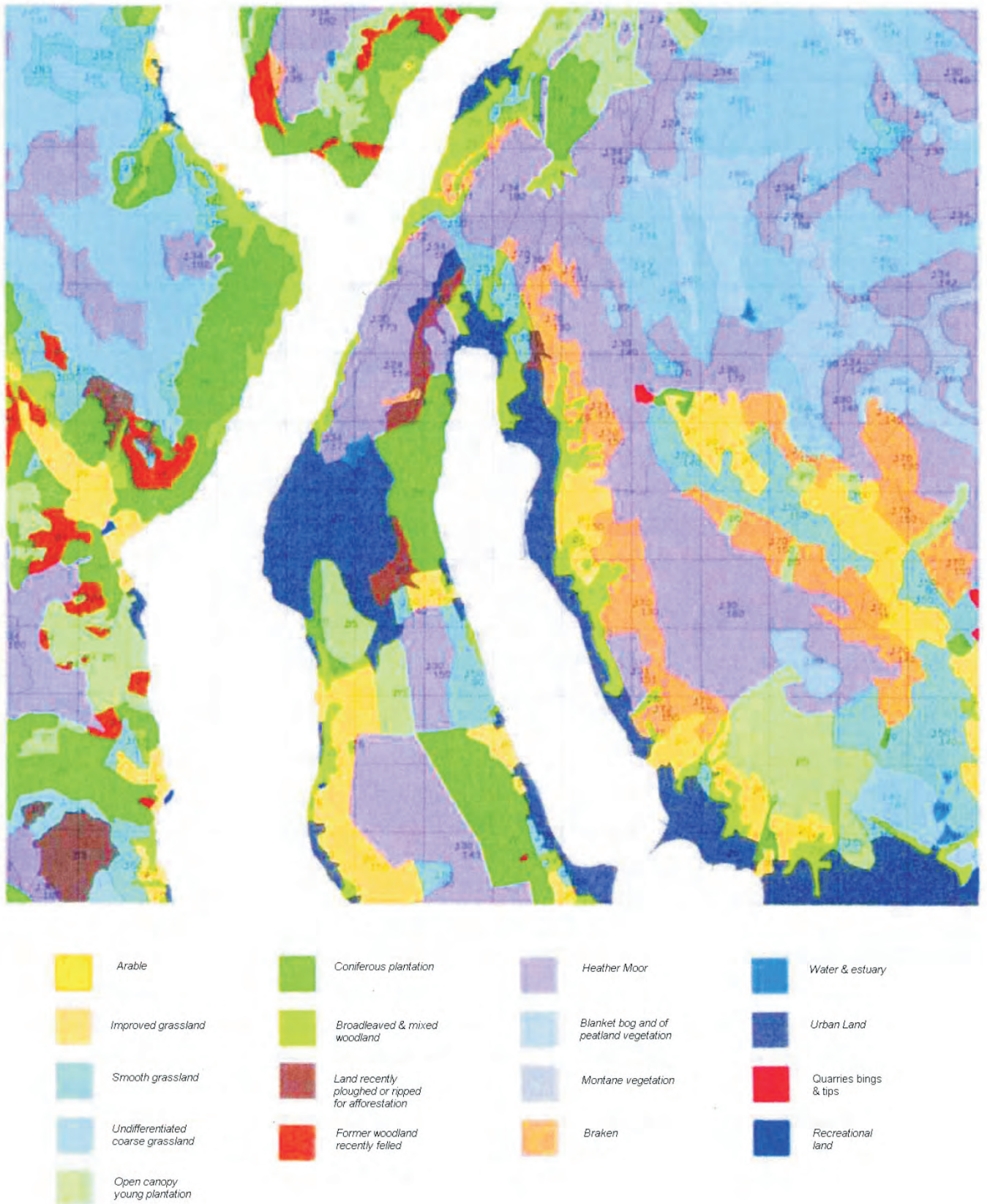


Figure 7. Land cover around HMNB Clyde

Reproduced with the permission of the Macaulay Institute for Soil Research, Aberdeen.
Base scale is 1:50000

5.3 Internal exposure

Consumption data for locally produced foodstuffs potentially affected by gaseous discharges are presented in Tables 15 to 32 for adults and Tables 33 to 38 for children. No individuals in the infant age group were identified consuming foods from the terrestrial survey area.

Adults' consumption rates

Consumption of locally produced foods was identified in the following 18 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, milk, cattle meat, pig meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi, venison, freshwater fish and goat meat. Table G 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 G. 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 or l y ⁻¹)	Observed minimum for the high-rate group (kg y ⁻¹ or l y ⁻¹)	Observed mean for the high-rate group (kg y ⁻¹ or l y ⁻¹)	Observed 97.5 th percentile (kg y ⁻¹ or l y ⁻¹)	Generic mean (kg y ⁻¹ or l y ⁻¹)	Generic 97.5 th percentile (kg y ⁻¹ or l y ⁻¹)
Green vegetables	25	11	33.1	15.3	22.6	33.1	15.0	45.0
Other vegetables	20	6	61.5	28.4	36.1	48.4	20.0	50.0
Root vegetables	22	9	25.0	13.2	16.6	25.0	10.0	40.0
Potato	22	13	28.4	10.0	18.1	28.4	50.0	120.0
Domestic fruit	24	6	29.8	27.1	28.3	29.8	20.0	75.0
Milk	2	2	365.0	182.5	273.8	360.4	95.0	240.0
Cattle meat	14	7	75.5	37.8	52.6	73.9	15.0	45.0
Pig meat	6	6	50.6	50.6	50.6	50.6	15.0	40.0
Sheep meat	24	7	35.4	16.5	22.2	35.4	8.0	25.0
Poultry	9	3	1.3	1.3	1.3	1.3	10.0	30.0
Eggs	20	14	17.7	10.2	15.3	17.7	8.5	25.0
Wild/free foods	22	9	3.5	1.4	2.8	3.5	7.0	25.0
Rabbits/hares	2	2	0.2	0.2	0.2	0.2	6.0	15.0
Honey	4	1	15.0	15.0	15.0	14.1	2.5	9.5
Wild fungi	11	11	0.5	0.3	0.4	0.5	3.0	10.0
Venison	7	3	2.0	2.0	2.0	2.0	ND	ND
Freshwater fish	14	8	1.1	0.7	0.9	1.1	15.0	40.0
Goat meat	6	6	0.6	0.6	0.6	0.6	ND	ND

Notes

ND = Not determined

Four observed mean consumption rates for the adult high-rate groups were found to be greater than the generic 97.5th percentile consumption rates. These were for milk, cattle meat, pig meat and honey. Ten observed mean consumption rates for the high-rate groups exceeded the generic mean consumption rates. These were for green vegetables, other vegetables, root vegetables, domestic fruit, milk, cattle meat, pig meat, sheep meat, eggs and honey. Five observed 97.5th percentile consumption rates exceeded the generic 97.5th percentile consumption rates. These were for milk, cattle meat, pig meat, sheep meat and honey. There is currently no generic consumption data available for venison and goat meat so no comparisons can be made.

The percentage contribution each food type makes to its terrestrial food group, for adults, is presented in Table 39.

Children's consumption rates

Consumption rate data were obtained for individuals in the child age group. Table H presents a summary of the consumption rates for the foods consumed from the terrestrial survey area for individuals in the child age group. No generic rates have been determined for this age group so no comparisons with the observed rates can be made. For the child age group, consumption of terrestrial foods was identified in the following six food groups: green vegetables, other vegetables, root vegetables, potato, eggs and wild/free foods. No consumption was identified for the following food groups: domestic fruit, milk, cattle meat, pig meat, sheep meat, poultry, rabbits/hares, honey, wild fungi, venison, freshwater fish and goat meat.

Table H. Summary of children's 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 97.5 th percentile (kg y ⁻¹)
Child age group (6 - 15 years old)						
Green vegetables	2	2	0.1	0.1	0.1	0.1
Other vegetables	2	2	0.1	0.1	0.1	0.1
Root vegetables	2	2	0.1	0.1	0.1	0.1
Potato	2	2	0.6	0.6	0.6	0.6
Eggs	2	2	0.9	0.9	0.9	0.9
Wild/free foods	4	4	0.2	0.1	0.1	0.2

6 DIRECT RADIATION PATHWAYS

6.1 Direct radiation survey area

The direct radiation survey area (see Figure 2, page 18) covered the area within 1 km of the main source of direct radiation which was taken to be the centre of the liquid waste store at the southern end of the Faslane Naval Base.

The shore of Gare Loch bisected the direct radiation survey area from north to south-east. The western half of the survey area was covered by the waters of the loch. The Faslane Naval Base occupied approximately 1 km of the shoreline from the north of the survey area and extended inland to approximately 0.5 km in places. The land to the east of the Faslane site was predominantly agricultural.

The main concentration of residential properties was in the east and south-east of the survey area. This included a cluster of houses to the south-east and a road of residential properties that stretched from the south-east to the east. Two residential properties were located to the north-east, one of which was identified as a working farm. A nursery school was located in the south-east of the survey area.

6.2 Occupancy rates and gamma dose rate measurements

Interviews were conducted at 14 residences, one of which was a working farm. An interview was also conducted at the nursery school. Three of the residential properties were occupied by families with children and infants. Indoor, outdoor and total occupancy rates for adults, children and infants are presented in Table 40. The highest indoor occupancy rate was 8100 h y⁻¹, the highest outdoor occupancy rate was 5000 h y⁻¹ and the highest total occupancy rate was 8200 h y⁻¹. These rates were all for residents.

It should be noted that the activities of the employees and contractors of the Faslane Naval Base, while at work, were not considered in the direct radiation survey.

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 at beyond the outer limit of the terrestrial survey area to obtain background dose rates. All measurements were taken at a height of 1 metre above the substrate. It should be noted that the indoor and outdoor measurements have not been adjusted for natural background dose rates.

The results are presented in Table 41 and are summarised below:

Indoor measurements

- Twelve gamma dose rate measurements taken over wood ranged from 0.061 $\mu\text{Gy h}^{-1}$ to 0.110 μGy^{-1}
- Two gamma dose rate measurements taken over concrete ranged from 0.076 $\mu\text{Gy h}^{-1}$ to 0.108 μGy^{-1}

Outdoor measurements

- Fifteen gamma dose rate measurements taken over grass ranged from 0.064 $\mu\text{Gy h}^{-1}$ to 0.094 $\mu\text{Gy h}^{-1}$

Background measurements

- The background measurements taken over grass ranged from 0.056 $\mu\text{Gy h}^{-1}$ to 0.068 $\mu\text{Gy h}^{-1}$

It should be noted that 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 20 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 20 listed combinations.

8 COMPARISONS WITH THE PREVIOUS SURVEY

The results from this 2011 survey can be compared with results from the last habits survey, undertaken at HMNB Clyde in 2006. The aquatic and terrestrial survey areas in the 2011 survey were the same as those in the 2006 survey. The direct radiation survey area was changed slightly in the 2011 survey compared with the 2006 survey, since a more accurate location was obtained for the liquid waste store, which was taken as the centre of the survey area. Therefore, the centre of the direct radiation survey area was moved by 0.2 km to the north in 2011.

The aquatic survey area

A comparison between the 2006 and 2011 consumption rates of aquatic foods for adults is presented in Table I.

Table I. Comparison between 2006 and 2011 consumption rates of aquatic food groups for adults

	2006			2011		
Food group	Number of people in the high-rate group	Maximum consumption rate (kg y ⁻¹)	Mean consumption rate for the high-rate group (kg y ⁻¹)	Number of people in the high-rate group	Maximum consumption rate (kg y ⁻¹)	Mean consumption rate for the high-rate group (kg y ⁻¹)
Fish	7	25.3	18.8	4	25.1	18.7
Crustacean	1	0.2	0.2	NC	NC	NC
Molluscs	1	0.2	0.2	7	2.4	1.2

Notes

NC = Not consumed

The mean consumption rate for the adult high-rate group for fish was similar in 2011 when compared with 2006. The species of fish consumed by the adult high-rate group in 2006 were sea trout, mackerel, cod, dab and flounder, and in 2011 were sea trout, mackerel and flounder. The consumption of crustaceans was identified in 2006 but was not identified in 2011. The mean consumption rate for the adult high-rate group for molluscs increased from 0.2 kg y⁻¹ in 2006 to 1.2 kg y⁻¹ in 2011. In 2006, the only species of molluscs consumed by the adult high-rate group was mussels, and in 2011 the only species of mollusc consumed was winkles.

A comparison between the 2006 and 2011 aquatic external exposure pathways for adults is presented in Table J.

Table J. Comparison between 2006 and 2011 intertidal occupancy rates and handling rates of sediments for adults

Intertidal substrate or handling pathway	2006			2011		
	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)
Mud	20	30	28	4	104	70
Mud and stones	7	96	64	20	112	74
Rock	7	780	476	7	90	59
Sand and stones	Not identified			7	263	158
Stones^a	2	936	663	5	192	151
Handling sediment^a	5	72	37	18	112	79

Notes

^aIn the 2006 survey report, the data for intertidal occupancy and handling were presented for adults and children combined. The high-rate groups that included children were for intertidal occupancy over stones and for handling sediment, and therefore, the mean rate for the high-rate group for these pathways have been recalculated for adults only, for use in this comparison.

In 2011, compared to 2006, the mean intertidal occupancy rate for the adult high-rate group increased slightly for mud and for mud and stones and decreased significantly for rock and for stones. In 2011, activities were identified taking place over sand and stones but no activities were recorded taking place over this substrate in 2006. Changes in occupancy rates on various substrates may be partially attributable to substrates at given locations changing over time. The decrease in the mean intertidal occupancy rate for the adult high-rate group over rock and over stones was the result of a decrease in the number of hours anglers were spending time fishing on these substrates. The range of intertidal activities observed in 2011 was broadly similar to those in 2006. Additionally, coastguard duties were identified only in 2006 and winkle collecting was identified only in 2011.

In 2011, the mean rate for the adult high-rate group for handling sediment increased slightly compared with 2006, which was due to the identification of individuals collecting winkles.

The terrestrial survey area

A comparison between the 2006 and 2011 mean consumption rates for the adult high-rate groups for terrestrial foods is presented in Table K.

<i>Table K. Comparison between 2006 and 2011 mean consumption rates for the adult high-rate groups for terrestrial food groups (kg y⁻¹ or l y⁻¹)</i>		
Food group	2006	2011
Green vegetables	33.7	22.6
Other vegetables	30.8	36.1
Root vegetables	25.6	16.6
Potato	16.2	18.1
Domestic fruit	18.1	28.3
Milk	207.4	273.8
Cattle meat	39.0	52.6
Pig meat	Not identified	50.6
Sheep meat	23.3	22.2
Poultry	2.7	1.3
Eggs	10.8	15.3
Wild/free foods	4.0	2.8
Rabbits/hares	0.50	0.2
Honey	0.9	15.0
Wild fungi	2.3	0.4
Venison	1.0	2.
Freshwater fish	Not identified	0.9
Goat meat	Not identified	0.6

In 2011, consumption rates had increased in the following food groups: other vegetables, potato domestic fruit, milk, cattle meat, eggs, honey and venison. Consumption rates had decreased in the following food groups: green vegetables, root vegetables, sheep meat, poultry, wild/free foods, rabbits/hares and wild fungi.

A family, who were not identified in the 2006 survey, were identified in the 2011 survey consuming pig meat, freshwater fish and goat meat.

The direct radiation survey area

The activities that were identified in the direct radiation survey area in 2006 and 2011 were similar and included people residing, farming and attending nursery school. There were slight differences due to the change in the position of the centre of the direct radiation survey area in 2011, which was moved by 0.2 km. Three residential properties and a peace camp were included in the 2006 survey, but as a result of the change in the area, they fell just outside the survey area in 2011. A business which was included in the 2006 survey was no longer in operation in 2011.

A comparison between the 2006 and 2011 direct radiation occupancy rates is presented in Table L.

<i>Table L. Comparison between 2006 and 2011 direct radiation occupancy rates ($h\ y^{-1}$)</i>		
	2006	2011
Highest indoor	7200	8100
Highest outdoor	4100	5000
Highest total	7900	8200

In 2011 the highest indoor, highest outdoor and highest total occupancy rates had all increased slightly when compared with 2006. The highest occupancy rates both years were all for residents.

9 MAIN FINDINGS

9.1 Survey findings

The survey investigated three potential sources of public radiation exposure from HMNB Clyde, which comprises the Faslane Naval Base and the Royal Naval Armaments Depot at Coulport. The potential sources were:

- Discharges of liquid radioactive waste into Gare Loch from Faslane
- Discharges of gaseous radioactive waste to the atmosphere from Coulport
- Emissions of direct radiation from Faslane

Data were collected for 308 individuals including, anglers, sailors, people spending time on intertidal substrates, farmers, gardeners, beekeepers and people spending time within the direct radiation survey area. 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. The consumption and occupancy rates presented in this section are for adults only. However, consumption and occupancy rates were also obtained for individuals in the child age group (6 - 15 years old), and in the infant age group (0 - 5 years old). No individuals in the infant age group were identified consuming foods from the terrestrial survey area.

The aquatic survey area

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

- 19 kg y⁻¹ for fish
- 1.2 kg y⁻¹ for molluscs

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

- For fish; sea trout, mackerel and flounder
- For molluscs; winkles

The consumption of crustaceans, wildfowl and marine plants/algae were not identified.

Two people were identified collecting seaweed from the shore at Gare Loch, which was used as a fertiliser on soil where vegetables and fruit were grown. One of these people also occasionally collected mussel shells to mix in with chicken feed. The use of seaweed for animal feed was not identified.

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

- 70 h y⁻¹ for mud
- 74 h y⁻¹ for mud and stones
- 59 h y⁻¹ for rock
- 160 h y⁻¹ for sand and stones
- 150 h y⁻¹ for stones

The mean rate for the adult high-rate group for handling was:

- 79 h y⁻¹ for handling sediment

The handling of fishing gear was not identified. 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 adult maximum occupancy rates for water based activities were:

- 290 h y⁻¹ for occupancy in water
- 400 h y⁻¹ for occupancy on water

The 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:

- 23 kg y⁻¹ for green vegetables
- 36 kg y⁻¹ for other vegetables
- 17 kg y⁻¹ for root vegetables
- 18 kg y⁻¹ for potato
- 28 kg y⁻¹ for domestic fruit
- 270 kg y⁻¹ for milk
- 53 kg y⁻¹ for cattle meat
- 51 kg y⁻¹ for pig meat
- 22 kg y⁻¹ for sheep meat
- 1.3 kg y⁻¹ for poultry
- 15 kg y⁻¹ for eggs
- 2.8 kg y⁻¹ for wild/free foods

- 0.2 kg y⁻¹ for rabbits/hares
- 15 kg y⁻¹ for honey
- 0.4 kg y⁻¹ for wild fungi
- 2.0 kg y⁻¹ for venison
- 0.9 kg y⁻¹ for freshwater fish
- 0.6 kg y⁻¹ for goat meat

Two farms used spring water as their sole domestic supply and as drinking water for livestock. Livestock at other farms had access to ditch and stream water.

The transfer of contamination off-site by wildlife was investigated. There was no specific policy for controlling or monitoring wildlife on the Faslane site.

The direct radiation survey area

The highest occupancy rates within the direct radiation survey area were all for residents and were:

- 8100 h y⁻¹ for the indoor occupancy rate
- 5000 h y⁻¹ for the outdoor occupancy rate
- 8200 h y⁻¹ for the total occupancy rate

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 environmental monitoring programme is provided below, followed by the suggestions for changes to the programme.

10.1 Summary of the current environmental monitoring programme

The 2010 SEPA environmental monitoring programme, which is published in the RIFE report (EA, FSA, NIEA and SEPA 2011) 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

Sample	Location
<i>Fucus vesiculosus</i>	Rhu
Mussel shells	Shandon
Mussels	Shandon
Winkles	Garelochhead
Sediment	Carnban Boatyard
Seawater	Carnban Boatyard

Gamma dose rate measurements

Substrate	Location
Mud, sand and stones	Garelochhead
Sand and stones	Gulley Bridge Pier
Gravel	Rhu
Sand	Helensburgh
Gravel	Carnban Boatyard

Terrestrial monitoring

Sample	Location
Beef muscle	Faslane
Grass	Auchengaich
Soil	Auchengaich
Freshwater	Lochan Ghlas Laoigh
Freshwater	Helensburgh Reservoir

(Terrestrial monitoring continued)

Freshwater	Loch Finlas
Freshwater	Auchengaich
Freshwater	Loch Eck
Freshwater	Loch Lomond

10.2 Suggestions for changes

It is considered that SEPA's current monitoring programme provides adequate coverage. However, based on the findings of this habits survey, and also taking into account the potential radiological significance of the various pathways that were identified, the following suggestions are presented for consideration:

Aquatic monitoring

- In the 2006 survey, one person was identified collecting mussels shells to use as a fertiliser but this person had moved away from the area in 2011 and the use of mussel shells as a fertiliser was not identified. In 2011, one person occasionally collected mussel shells to add to chicken feed. However, sea to land transfer is now considered to be a very minor pathway for radiological exposure. Reported radionuclide concentrations are consistently measured below the limits of detection, with minimal dose from the resultant consumption of grown foods from this pathway. Therefore, it is suggested that the annual sample of mussel shells from Shandon is removed from the programme.
- The annual winkle sample from Garelohead could be re-located. In the 2011 survey, winkles were collected for consumption from a bay to the east of Rhu Marina, south of Cairndhu Point, Helensburgh and Castle Bay but were not collected from Garelohead. The majority of winkles were collected from the bay to the east of Rhu Marina. Therefore, it is suggested that the annual winkle sample is collected to the east of Rhu Marina (NGR NS 276 833).

Terrestrial monitoring

- It is suggested that a quarterly milk sample is collected for up to one year to assess any possible transfer of radionuclides to the identified milk herd. It might then be appropriate to reduce the frequency or cease this milk sample collection once this pathway has been assessed.

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

11 ACKNOWLEDGEMENTS

Gratitude is expressed to representatives of local authorities and associations and members of the public who offered helpful advice and information during the survey. This survey was undertaken on behalf of the Scottish Environment Protection Agency, who provided the funding for this study.

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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, kohlrabi, 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, <i>Nephrops</i> , prawn, shrimp, spider crab, squat lobster, velvet swimming crab
Molluscs	Cockles, limpets, mussels, oysters, razor clam, scallops, whelks, winkles
Wildfowl ^b	Canada goose, greylag goose, mallard, pink-footed goose, pintail, shoveler, teal, wigeon

Notes

^a Including offal

^b Domesticated ducks and geese are classified as poultry. Wild ducks and geese are classified as wildfowl.

^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 sediments	0.030	0.500

Notes

^aExcepting 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.

^bRatios were derived from Smith and Jones, (2003) which presented data for infants and children of unspecified ages.

^cRatios were derived from FSA data for wild fruit and nuts for infants and 10-year-old children.

^dGame includes rabbits/hares and venison.

^eNote 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 aquatic survey area (kg y⁻¹)

Observation number	Flounder	Mackerel	Sea trout	Total
199	3.5	-	21.6	25.1
200	3.5	-	21.6	25.1
56	-	11.8	0.6	12.4
57	-	11.8	0.6	12.4
230	-	8.3	-	8.3
231	-	8.3	-	8.3
279	-	8.3	-	8.3
244	-	8.0	-	8.0
246	-	8.0	-	8.0
304	-	7.5	-	7.5
280	-	6.9	-	6.9
303	-	6.9	-	6.9
263	-	5.0	-	5.0
264	-	5.0	-	5.0
265	-	5.0	-	5.0
266	-	5.0	-	5.0
267	-	5.0	-	5.0
268	-	5.0	-	5.0
237	-	3.9	-	3.9
238	-	3.9	-	3.9
250	-	3.5	-	3.5
229	-	2.8	-	2.8
258	-	2.2	-	2.2
259	-	2.2	-	2.2
260	-	2.2	-	2.2
261	-	2.2	-	2.2
262	-	2.2	-	2.2
190	-	-	1.6	1.6
207	-	1.4	-	1.4
208	-	1.4	-	1.4
209	-	1.4	-	1.4
210	-	1.4	-	1.4
211	-	1.4	-	1.4
44	-	1.1	-	1.1
45	-	1.1	-	1.1
242	-	1.0	-	1.0
64	-	0.9	-	0.9
65	-	0.9	-	0.9
66	-	0.9	-	0.9
67	-	0.9	-	0.9
68	-	0.9	-	0.9
43	-	0.7	-	0.7
232	-	0.7	-	0.7
233	-	0.7	-	0.7
193	-	0.3	-	0.3
194	-	0.3	-	0.3

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish based on the 4 high-rate adult consumers is 18.7 kg y⁻¹

The observed 97.5th percentile rate based on 46 observations is 23.5 kg y⁻¹

Table 4. Adults' consumption rates of molluscs from the aquatic survey area (kg y⁻¹)

Observation number	Winkle
23	2.4
48	1.4
160	0.9
161	0.9
162	0.9
163	0.9
164	0.9
229	0.2

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of molluscs based on the 7 high-rate adult consumers is 1.2 kg y⁻¹

The observed 97.5th percentile rate based on 8 observations is 2.2 kg y⁻¹

Table 5. Children's consumption rates of fish from the aquatic survey area (kg y⁻¹)**Child age group (6 - 15 years old)**

Observation number	Age	Mackerel
245	13	6.0
239	15	3.9
240	12	3.9
241	11	3.9
251	10	1.4
252	8	1.4
46	14	1.1
47	11	1.1
243	14	1.0
234	14	0.7
235	12	0.7

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish for the child age group based upon the 4 high-rate consumers is 4.4 kg y⁻¹

The observed 97.5th percentile rate based on 11 observations is 5.5 kg y⁻¹

Table 6. Children's and infants' consumption rates of molluscs from the aquatic survey area (kg y⁻¹)**Child age group (6 - 15 years old)**

Observation number	Age	Winkle
25	9	1.8
49	15	1.4

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of molluscs for the child age group based upon the 2 high-rate consumers is 1.6 kg y⁻¹

The observed 97.5th percentile rate based on 2 observations is 1.8 kg y⁻¹

Infant age group (0 - 5 years old)

Observation number	Age	Winkle
26	3	0.6
27	1	0.3

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of molluscs for the infant age group based upon the 2 high-rate consumers is 0.5 kg y⁻¹

The observed 97.5th percentile rate based on 2 observations is 0.6 kg y⁻¹

Table 7. Adults' consumption rates of vegetables grown on land where seaweed has been used as a fertiliser (kg y⁻¹)

Observation number	Green vegetables									Other vegetables							Root vegetables									Domestic fruit						TOTAL
	Broccoli	Brussel sprout	Calabrese	Chard	Courgette	Cucumber	Kale	Lettuce	Spinach	Aubergine	Broad bean	French bean	Pea	Pepper	Runner bean	Tomato	Beetroot	Carrot	Leek	Onion	Radish	Shallot	Spring onion	Turnip	Potato	Blackcurrant	Blueberry	Gooseberry	Raspberry	Redcurrant	Rhubarb	
56	3.6	2.2	3.6	-	4.6	1.5	3.1	0.5	-	-	4.1	-	-	-	3.1	1.9	6.2	5.5	-	4.4	1.4	3.9	1.0	2.6	28.4	-	-	-	-	-	-	81.6
57	3.6	2.2	3.6	-	4.6	1.5	3.1	0.5	-	-	4.1	-	-	-	3.1	1.9	6.2	5.5	-	4.4	1.4	3.9	1.0	2.6	28.4	-	-	-	-	-	-	81.6
62	-	-	-	7.2	4.1	-	-	4.8	6.3	2.0	-	0.9	1.1	1.8	-	6.8	-	-	13.5	-	-	-	-	-	20.2	2.3	1.1	1.1	1.1	0.9	5.8	81.0
63	-	-	-	7.2	4.1	-	-	4.8	6.3	2.0	-	0.9	1.1	1.8	-	6.8	-	-	13.5	-	-	-	-	-	20.2	2.3	1.1	1.1	1.1	0.9	5.8	81.0

Notes

These foods are included in the aquatic section of this report as the exposure pathway is sea to land transfer and the source of potential exposure is liquid discharge. However, these foods were grown in the terrestrial survey area and they are also potentially subject to gaseous discharges. Therefore they are also included in the terrestrial food groups and are included in Annex 1 as terrestrial foods.

Table 8. Adults' intertidal occupancy rates in the aquatic survey area (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and stones	Rock	Sand and stones	Stones
184	Garelochhead and Rhu	Bait digging	104	-	-	-	-
199	Gare Loch Coastline	Bait digging	72	-	-	-	-
158	Cairndhu Point (Helensburgh)	Bait digging	52	-	-	-	-
159	Cairndhu Point (Helensburgh)	Bait digging	52	-	-	-	-
211	Rhu	Bait digging	24	-	-	-	-
	Rhu Spit	Angling	-	-	-	260	-
160	East of Rhu Marina	Collecting winkles	-	112	-	-	-
161	East of Rhu Marina	Collecting winkles	-	112	-	-	-
162	East of Rhu Marina	Collecting winkles	-	112	-	-	-
163	East of Rhu Marina	Collecting winkles	-	112	-	-	-
164	East of Rhu Marina	Collecting winkles	-	112	-	-	-
50	Helensburgh	Collecting winkles	-	105	-	-	-
51	South of Cairndhu Point	Collecting winkles	-	105	-	-	-
52	South of Cairndhu Point	Collecting winkles	-	105	-	-	-
233	South of Rockville	Angling and walking	-	78	-	-	-
		Angling	-	-	26	-	-
1	Blairvadach	Walking	-	56	-	-	-
29	Helensburgh	Dog walking	-	54	-	-	-
	Rhu Spit		-	-	-	96	-
30	Helensburgh	Dog walking	-	54	-	-	-
	Rhu Spit		-	-	-	96	-
56	Garelochhead	Collecting seaweed and angling	-	50	-	-	-
230	East of Rhu Marina	Collecting winkles	-	50	-	-	-
	South of Rockville	Angling	-	-	50	-	-
231	East of Rhu Marina	Collecting winkles	-	50	-	-	-
	South of Rockville	Angling	-	-	50	-	-
242	Rhu	Bait digging	-	48	-	-	-
	Rhu Spit	Angling	-	-	-	36	-
	North of Clynder		-	-	-	-	36

Table 8. Adults' intertidal occupancy rates in the aquatic survey area (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and stones	Rock	Sand and stones	Stones
23	Castle Bay	Collecting winkles	-	42	-	-	-
24	Castle Bay	Collecting winkles	-	42	-	-	-
28	Castle Bay	Collecting winkles	-	42	-	-	-
232	South of Rockville	Angling and walking	-	39	-	-	-
		Angling	-	-	13	-	-
2	Blairvadach	Walking	-	35	-	-	-
229	Helensburgh	Collecting winkles	-	24	-	-	-
	South of Rockville	Angling	-	-	30	-	-
48	East of Rhu Marina	Collecting winkles	-	18	-	-	-
31	Garelochhead	Dog walking	-	6	-	-	-
15	Garelochhead	Walking	-	5	-	-	-
303	South of Rockville	Angling	-	-	90	-	-
250	South of Rockville	Angling	-	-	84	-	-
244	South of Rockville	Angling	-	-	60	-	-
280	Rockville	Angling	-	-	48	-	-
304	South of Rockville	Angling	-	-	18	-	-
281	South of Rockville	Angling	-	-	12	-	-
282	South of Rockville	Angling	-	-	12	-	-
283	South of Rockville	Playing	-	-	12	-	-
284	South of Rockville	Playing	-	-	12	-	-
285	South of Rockville	Angling	-	-	12	-	-
43	North of Rockville	Angling	-	-	4	-	-
157	Helensburgh	Dog walking	-	-	-	263	-
206	Rhu Spit and Helensburgh	Dog walking	-	-	-	183	-
191	Rhu Spit	Dog walking	-	-	-	104	-
192	Rhu Spit	Dog walking	-	-	-	104	-
179	Rhu Spit	Angling	-	-	-	80	-
188	Rhu Spit	Angling	-	-	-	56	-
189	Rhu Spit	Angling	-	-	-	56	-

Table 8. Adults' intertidal occupancy rates in the aquatic survey area (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and stones	Rock	Sand and stones	Stones
181	Rhu Spit	Angling	-	-	-	54	-
190	Rhu Spit	Angling	-	-	-	49	-
182	Rhu Spit	Walking	-	-	-	39	-
207	Rhu Spit	Angling	-	-	-	14	-
208	Rhu Spit	Angling	-	-	-	14	-
204	Rhu Spit	Dog walking	-	-	-	12	-
176	Rhu Spit	Angling	-	-	-	8	-
39	Rhu Spit	Dog walking	-	-	-	6	-
305	North of Clynder	Angling	-	-	-	-	192
306	North of Clynder	Angling	-	-	-	-	192
257	Rosneath	Dog walking	-	-	-	-	180
269	Rosneath	Dog walking	-	-	-	-	120
237	North of Clynder	Angling	-	-	-	-	72
263	Rosneath	Angling	-	-	-	-	48
264	Rosneath	Angling	-	-	-	-	48
265	Rosneath	Angling	-	-	-	-	48
266	Rosneath	Angling	-	-	-	-	48
267	Rosneath	Angling	-	-	-	-	48
268	Rosneath	Angling	-	-	-	-	48
205	Mambeg, Blairvadach and Rhu	Sitting on the beach	-	-	-	-	40
247	Rosneath Bay	Water sports preparation	-	-	-	-	28
248	Rosneath Bay	Water sports preparation	-	-	-	-	28
249	Rosneath Bay	Water sports preparation	-	-	-	-	28
64	Shandon	Walking	-	-	-	-	24
65	Shandon	Walking	-	-	-	-	24
66	Shandon	Walking	-	-	-	-	24
67	Shandon	Walking	-	-	-	-	24
68	Shandon	Walking	-	-	-	-	24

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

Observation number	Location	Activity	Mud	Mud and stones	Rock	Sand and stones	Stones
258	Rosneath	Angling	-	-	-	-	15
259	Rosneath	Angling	-	-	-	-	15
62	Shandon	Collecting seaweed	-	-	-	-	6

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over mud based on 4 high-rate observations is 70 h y^{-1}

The observed 97.5th percentile rate based on 5 observations for mud is 101 h y^{-1}

The mean intertidal occupancy rate over mud and stones based on 20 high-rate observations is 74 h y^{-1}

The observed 97.5th percentile rate based on 25 observations for mud and stones is 112 h y^{-1}

The mean intertidal occupancy rate over rock based on 7 high-rate observations is 59 h y^{-1}

The observed 97.5th percentile rate based on 16 observations for rock is 88 h y^{-1}

The mean intertidal occupancy rate over sand and stones based on 7 high-rate observations is 158 h y^{-1}

The observed 97.5th percentile rate based on 19 observations for sand and stones is 262 h y^{-1}

The mean intertidal occupancy rate over stones based on 5 high-rate observations is 151 h y^{-1}

The observed 97.5th percentile rate based on 23 observations for stones is 192 h y^{-1}

Table 9. Children's and infants' intertidal occupancy rates in the aquatic survey area (h y⁻¹)

Child age group (6 - 15 years old)

Observation number	Age	Location	Activity	Mud and stones	Rock	Sand and stones	Stones
53	15	South of Cairndhu Point	Collecting winkles	105	-	-	-
54	14	South of Cairndhu Point	Collecting winkles	105	-	-	-
55	13	South of Cairndhu Point	Collecting winkles	105	-	-	-
277	12	Rockville and south of Rockville	Angling	90	-	-	-
				-	90	-	-
278	11	Rockville and south of Rockville	Angling	90	-	-	-
				-	90	-	-
234	14	South of Rockville	Angling and walking	78	-	-	-
			Angling	-	26	-	-
235	12	South of Rockville	Angling and walking	78	-	-	-
			Angling	-	26	-	-
25	9	Castle Bay	Collecting winkles	42	-	-	-
49	15	East of Rhu Marina	Collecting winkles	18	-	-	-
17	11	Garelochhead	Walking	5	-	-	-
18	8	Garelochhead	Walking	5	-	-	-
245	13	South of Rockville	Angling	-	60	-	-
286	8	South of Rockville	Playing	-	12	-	-
287	6	South of Rockville	Playing	-	12	-	-
180	13	Rhu Spit	Angling	-	-	54	-
243	14	Rhu Spit	Angling	-	-	18	-
		North of Clynder		-	-	-	18
177	10	Rhu Spit	Angling	-	-	8	-
178	7	Rhu Spit	Angling	-	-	8	-
41	7	Rhu Spit	Dog walking	-	-	6	-
42	10	Rhu Spit	Dog walking	-	-	6	-
239	15	North of Clynder	Angling	-	-	-	72
240	12	North of Clynder	Angling	-	-	-	72
241	11	North of Clynder	Angling	-	-	-	72
270	6	Rosneath	Playing	-	-	-	8

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over mud and stones based on 8 high-rate observations is 87 h y⁻¹

The observed 97.5th percentile rate based on 11 observations for mud and stones is 105 h y⁻¹

The mean intertidal occupancy rate over rock based on 3 high-rate observations is 80 h y⁻¹

The observed 97.5th percentile rate based on 7 observations for rock is 90 h y⁻¹

The mean intertidal occupancy rate over sand and stones based on 2 high-rate observations is 36 h y⁻¹

The observed 97.5th percentile rate based on 6 observations for sand and stones is 50 h y⁻¹

The mean intertidal occupancy rate over stones based on 3 high-rate observations is 72 h y⁻¹

The observed 97.5th percentile rate based on 5 observations for stones is 72 h y⁻¹

Infant age group (0 - 5 years old)

Observation number	Age	Location	Activity	Mud and stones	Rock	Sand and stones	Stones
26	3	Castle Bay	Collecting winkles	42	-	-	-

Notes

The emboldened observation is the high-rate individual

The mean intertidal occupancy rate over mud and stones based on 1 high-rate observation is 42 h y⁻¹

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

Table 10. Gamma dose rate measurements over intertidal substrates in the aquatic survey area ($\mu\text{Gy h}^{-1}$)

Location	NGR	Substrate	Gamma dose rate at 1 metre ^a
Castle Bay	NS 271 822	Stones	0.066
Rosneath	NS 258 832	Stones	0.062
North of Clynder	NS 242 856	Stones	0.078
South of Rockville	NS 233 899	Mud and stones	0.062
Garelohead	NS 238 910	Mud and stones	0.059
Rhu Spit	NS 262 886	Sand and stones	0.059
East of Rhu Marina	NS 276 834	Mud and stones	0.068
Cairndhu Point	NS 278 827	Mud, sand and stones	0.062
Helensburgh	NS 288 823	Sand and stones	0.074

Notes

^a These measurements have not been adjusted for natural background dose rates.

Table 11. Adults' handling rates of sediment in the aquatic survey area (h y^{-1})

Observation	Location	Activity	Sediment
160	East of Rhu Marina	Collecting winkles	112
161	East of Rhu Marina	Collecting winkles	112
162	East of Rhu Marina	Collecting winkles	112
163	East of Rhu Marina	Collecting winkles	112
164	East of Rhu Marina	Collecting winkles	112
50	Helensburgh	Collecting winkles	105
51	South of Cairndhu Point	Collecting winkles	105
52	South of Cairndhu Point	Collecting winkles	105
184	Garelochhead and Rhu	Bait digging	104
199	Gare Loch Coastline	Bait digging	72
158	Cairndhu Point	Bait digging	52
159	Cairndhu Point	Bait digging	52
230	East of Rhu Marina	Collecting winkles	50
231	East of Rhu Marina	Collecting winkles	50
242	Helensburgh and Rhu	Bait digging	48
23	Castle Bay	Collecting winkles	42
24	Castle Bay	Collecting winkles	42
28	Castle Bay	Collecting winkles	42
211	Rhu	Bait digging	24
229	Helensburgh	Collecting winkles	24
48	East of Rhu Marina	Collecting winkles	18
62	Shandon	Collecting seaweed	6
56	Garelochhead	Collecting seaweed	2

Notes

Emboldened observations are the high-rate individuals

The mean sediment handling rate based on 18 high-rate observations is 79 h y^{-1}

The observed 97.5th percentile rate based on 23 observations for sediment is 112 h y^{-1}

Table 12. Children's and infants' handling rates of sediment in the aquatic survey area (h y^{-1})**Child age group (6 - 15 years old)**

Observation number	Age	Location	Activity	Sediment
53	15	South of Cairndhu Point	Collecting winkles	105
54	14	South of Cairndhu Point	Collecting winkles	105
55	13	South of Cairndhu Point	Collecting winkles	105
25	9	Castle Bay	Collecting winkles	42
49	15	East of Rhu Marina	Collecting winkles	18

Notes

Emboldened observations are the high-rate individuals

The mean sediment handling rate based on 4 high-rate observations is 89 h y^{-1}

The observed 97.5th percentile rate based on 5 observations for sediment is 105 h y^{-1}

Infant age group (0 - 5 years old)

Observation number	Age	Location	Activity	Sediment
26	3	Castle Bay	Collecting winkles	42

Notes

The emboldened observation is the high-rate individual

The mean sediment handling rate based on 1 observation is 42 h y^{-1}

The observed 97.5th percentile is not applicable for 1 observation

Table 13. Adults' occupancy rates in and on water in the aquatic survey area (h y⁻¹)

Observation number	Location	Activity	In water	On water
1	Blairvadach and Gare Loch	Slipway maintenance and kayaking	290	-
		Sailing, boat maintenance and cleaning mooring posts	-	308
2	Gare Loch	Kayaking	187	-
		Canoeing and sailing	-	373
64	Near Shandon	Kayaking	48	-
65	Near Shandon	Kayaking	48	-
66	Near Shandon	Kayaking	48	-
3	Blairvadach	Slipway maintenance	32	-
		Cleaning mooring posts and boat maintenance	-	34
247	Rosneath Bay	Kayaking	30	-
		Sailing and canoeing	-	110
248	Rosneath Bay	Kayaking	30	-
		Sailing and canoeing	-	110
249	Rosneath Bay	Kayaking	30	-
		Sailing and canoeing	-	110
195	Rhu Marina	Diving	28	-
		Boat maintenance	-	77
196	Rhu Marina	Diving	28	-
		Boat maintenance	-	77
197	Rhu Marina	Diving	28	-
		Boat maintenance	-	77
198	Rhu Marina	Diving	28	-
		Boat maintenance	-	77
288	Gare Loch	Boat maintenance	-	400
289	Gare Loch	Boat maintenance	-	400
290	Gare Loch	Boat maintenance	-	400
166	Gare Loch	Sailing	-	240
167	Gare Loch	Sailing	-	240
168	Gare Loch	Sailing	-	240
169	Gare Loch	Sailing	-	240
170	Gare Loch	Sailing	-	240
171	Gare Loch	Sailing	-	240
172	Gare Loch	Sailing	-	240
173	Gare Loch	Sailing	-	240
174	Gare Loch	Sailing	-	240
175	Gare Loch	Sailing	-	240
236	Gare Loch	Sailing	-	104
165	Gare Loch	Sailing	-	77
299	Gare Loch	Sailing	-	72
300	Gare Loch	Sailing	-	72
301	Gare Loch	Sailing	-	72
302	Gare Loch	Sailing	-	72
183	Gare Loch	Sailing	-	72
295	Gare Loch	Sailing	-	48
296	Gare Loch	Sailing	-	48
297	Gare Loch	Sailing	-	48
298	Gare Loch	Sailing	-	48
233	Gare Loch	Canoeing	-	26
291	Gare Loch	Sailing	-	24
292	Gare Loch	Sailing	-	24
293	Gare Loch	Sailing	-	24
294	Gare Loch	Sailing	-	24
215	Gare Loch	Sailing	-	20
232	Gare Loch	Canoeing	-	13
7	Gare Loch	Sailing	-	3
8	Gare Loch	Sailing	-	3

Table 14. Children's occupancy rates on water in the aquatic survey area (h y⁻¹)

Age	Observation number	Location	Activity	On water
Child age group (6 - 15 years old)				
14	234	Gare Loch	Canoeing	26
12	235	Gare Loch	Canoeing	26

Table 15. Adults' consumption rates of green vegetables from the terrestrial survey area (kg y⁻¹)

Observation number	Broccoli	Brussel sprout	Cabbage	Calabrese	Cauliflower	Chard	Courgette	Cucumber	Herbs	Kale	Lettuce	Pak choi	Rocket	Spinach	Total
255	6.8	-	8.5	-	6.8	-	11.0	-	-	-	-	-	-	-	33.1
256	6.8	-	8.5	-	6.8	-	11.0	-	-	-	-	-	-	-	33.1
193	1.2	-	2.3	-	2.5	-	6.6	-	2.0	4.0	1.8	1.6	2.0	2.3	26.4
194	1.2	-	2.3	-	2.5	-	6.6	-	2.0	4.0	1.8	1.6	2.0	2.3	26.4
62	-	-	-	-	-	7.2	4.1	-	-	-	4.8	-	-	6.4	22.5
63	-	-	-	-	-	7.2	4.1	-	-	-	4.8	-	-	6.4	22.5
56	3.6	2.2	-	3.6	-	-	4.6	1.5	-	3.1	0.5	-	-	-	19.0
57	3.6	2.2	-	3.6	-	-	4.6	1.5	-	3.1	0.5	-	-	-	19.0
275	3.0	1.2	2.4	-	1.5	-	7.3	-	0.1	-	-	-	-	-	15.5
253	-	7.3	2.6	5.4	-	-	-	-	-	-	-	-	-	-	15.3
254	-	7.3	2.6	5.4	-	-	-	-	-	-	-	-	-	-	15.3
276	1.5	0.6	1.2	-	0.7	-	3.6	-	0.1	-	-	-	-	-	7.7
37	-	-	-	-	-	-	1.8	-	-	4.6	-	-	-	-	6.4
38	-	-	-	-	-	-	1.8	-	-	4.6	-	-	-	-	6.4
35	-	-	-	-	-	-	-	4.3	-	-	-	-	-	-	4.3
36	-	-	-	-	-	-	-	4.3	-	-	-	-	-	-	4.3
64	-	-	-	-	-	-	1.5	-	-	-	-	-	-	-	1.5
65	-	-	-	-	-	-	1.5	-	-	-	-	-	-	-	1.5
66	-	-	-	-	-	-	1.5	-	-	-	-	-	-	-	1.5
67	-	-	-	-	-	-	1.5	-	-	-	-	-	-	-	1.5
68	-	-	-	-	-	-	1.5	-	-	-	-	-	-	-	1.5
33	-	-	-	-	-	-	-	-	-	-	1.0	-	-	-	1.0
34	-	-	-	-	-	-	-	-	-	-	1.0	-	-	-	1.0
15	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	0.1
16	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	0.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of green vegetables based on the 11 high-rate adult consumers is 22.6 kg y⁻¹

The observed 97.5th percentile rate based on 25 observations is 33.1 kg y⁻¹

Table 16. Adults' consumption rates of other vegetables from the terrestrial survey area (kg y⁻¹)

Observation number	Aubergine	Broad bean	Chilli pepper	French bean	Mangetout	Pea	Pepper	Runner bean	Tomato	Total
275	-	6.0	-	2.4	6.0	3.0	-	20.4	23.8	61.5
276	-	3.0	-	1.2	3.0	1.5	-	13.5	11.9	34.0
35	-	-	0.5	-	-	-	-	2.0	29.7	32.2
36	-	-	0.5	-	-	-	-	2.0	29.7	32.2
253	-	-	-	-	-	6.8	-	-	21.6	28.4
254	-	-	-	-	-	6.8	-	-	21.6	28.4
193	-	-	-	4.9	-	-	-	5.5	9.7	20.1
194	-	-	-	4.9	-	-	-	5.5	9.7	20.1
255	-	-	-	1.4	2.3	-	-	12.2	-	16.0
256	-	-	-	1.4	2.3	-	-	12.2	-	16.0
62	2.0	-	-	0.9	-	1.1	1.8	-	6.8	12.7
63	2.0	-	-	0.9	-	1.1	1.8	-	6.8	12.7
37	-	-	-	-	-	0.2	-	12.2	-	12.5
38	-	-	-	-	-	0.2	-	12.2	-	12.5
56	-	4.1	-	-	-	-	-	3.1	1.9	9.1
57	-	4.1	-	-	-	-	-	3.1	1.9	9.1
33	-	-	-	-	-	0.5	-	1.5	-	2.0
34	-	-	-	-	-	0.5	-	1.5	-	2.0
15	-	-	-	-	-	0.1	-	0.1	-	0.1
16	-	-	-	-	-	0.1	-	0.1	-	0.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of other vegetables based on the 6 high-rate adult consumers is 36.1 kg y⁻¹

The observed 97.5th percentile rate based on 20 observations is 48.4 kg y⁻¹

Table 17. Adults' consumption rates of root vegetables from the terrestrial survey area (kg y⁻¹)

Observation number	Beetroot	Carrot	Garlic	Leek	Onion	Radish	Shallot	Spring onion	Turnip	Total
56	6.2	5.5	-	-	4.4	1.4	3.9	1.0	2.6	25.0
57	6.2	5.5	-	-	4.4	1.4	3.9	1.0	2.6	25.0
253	-	3.4	-	6.8	5.4	-	-	-	-	15.5
254	-	3.4	-	6.8	5.4	-	-	-	-	15.5
193	-	3.0	-	-	-	2.4	-	1.4	7.3	14.1
194	-	3.0	-	-	-	2.4	-	1.4	7.3	14.1
62	-	-	-	13.5	-	-	-	-	-	13.5
63	-	-	-	13.5	-	-	-	-	-	13.5
275	-	-	0.3	4.5	7.1	-	1.3	-	-	13.2
276	-	-	0.2	2.2	3.6	-	0.6	-	-	6.6
255	-	-	0.6	-	5.5	-	-	-	-	6.1
256	-	-	0.6	-	5.5	-	-	-	-	6.1
215	-	-	-	2.5	2.5	-	-	-	-	5.0
216	-	-	-	2.5	2.5	-	-	-	-	5.0
217	-	-	-	2.5	2.5	-	-	-	-	5.0
218	-	-	-	2.5	2.5	-	-	-	-	5.0
33	-	3.4	0.2	-	-	-	-	-	-	3.6
34	-	3.4	0.2	-	-	-	-	-	-	3.6
37	-	0.5	-	-	-	-	-	-	-	0.5
38	-	0.5	-	-	-	-	-	-	-	0.5
15	-	-	-	-	0.1	-	-	-	-	0.1
16	-	-	-	-	0.1	-	-	-	-	0.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of root vegetables based on the 9 high-rate adult consumers is 16.6 kg y⁻¹

The observed 97.5th percentile rate based on 22 observations is 25.0 kg y⁻¹

Table 18. Adults' consumption rates of potato from the terrestrial survey area (kg y⁻¹)

Observation number	Potato
56	28.4
57	28.4
255	25.0
256	25.0
62	20.2
63	20.2
35	17.7
36	17.7
275	13.3
215	10.0
216	10.0
217	10.0
218	10.0
253	7.1
254	7.1
276	6.7
193	5.7
194	5.7
37	1.6
38	1.6
15	0.6
16	0.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of potato based on the 13 high-rate adult consumers is 18.1 kg y⁻¹

The observed 97.5th percentile rate based on 22 observations is 28.4 kg y⁻¹

Table 19. Adults' consumption rates of domestic fruit from the terrestrial survey area (kg y⁻¹)

Observation number	Apple	Blackcurrant	Blueberry	Fig	Gooseberry	Grapes	Pear	Plum	Raspberry	Redcurrant	Rhubarb	Strawberry	Total
255	4.5	-	-	-	-	-	-	13.6	-	-	3.5	8.2	29.8
256	4.5	-	-	-	-	-	-	13.6	-	-	3.5	8.2	29.8
56	12.0	3.1	-	-	-	2.2	-	4.3	-	-	5.4	1.0	28.0
57	12.0	3.1	-	-	-	2.2	-	4.3	-	-	5.4	1.0	28.0
62	6.8	2.3	1.1	1.1	1.1	-	-	6.8	1.1	0.9	5.8	-	27.1
63	6.8	2.3	1.1	1.1	1.1	-	-	6.8	1.1	0.9	5.8	-	27.1
33	-	5.7	-	-	4.1	-	-	-	-	-	-	-	9.8
34	-	5.7	-	-	4.1	-	-	-	-	-	-	-	9.8
193	-	-	-	-	-	-	-	-	7.3	-	2.1	-	9.4
194	-	-	-	-	-	-	-	-	7.3	-	2.1	-	9.4
275	1.5	0.6	-	-	1.5	1.2	1.2	1.5	-	-	1.5	-	9.0
253	-	5.7	-	-	-	-	-	-	-	-	-	1.1	6.8
254	-	5.7	-	-	-	-	-	-	-	-	-	1.1	6.8
185	4.5	-	-	-	-	-	-	-	-	-	-	-	4.5
186	4.5	-	-	-	-	-	-	-	-	-	-	-	4.5
276	0.7	0.3	-	-	0.7	0.6	0.6	0.7	-	-	0.7	-	4.5
37	0.5	-	-	-	-	-	0.5	0.5	-	-	-	-	1.4
38	0.5	-	-	-	-	-	0.5	0.5	-	-	-	-	1.4
58	-	-	-	-	-	-	-	-	0.3	-	0.3	-	0.7
59	-	-	-	-	-	-	-	-	0.3	-	0.3	-	0.7
60	-	-	-	-	-	-	-	-	0.3	-	0.3	-	0.7
61	-	-	-	-	-	-	-	-	0.3	-	0.3	-	0.7
69	-	-	-	-	-	-	-	-	0.6	-	-	-	0.6
70	-	-	-	-	-	-	-	-	0.6	-	-	-	0.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of domestic fruit based on the 6 high-rate adult consumers is 28.3 kg y⁻¹

The observed 97.5th percentile rate based on 24 observations is 29.8 kg y⁻¹

Table 20. Adults' consumption rates of milk from the terrestrial survey area (l y⁻¹)

Observation number	Milk
212	365.0
214	182.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of milk based on the 2 high-rate adult consumers is 273.8 l y⁻¹

The observed 97.5th percentile rate based on 2 observations is 360.4 l y⁻¹

Table 21. Adults' consumption rates of cattle meat from the terrestrial survey area (kg y⁻¹)

Observation number	Beef
273	75.5
271	70.8
272	70.8
58	37.8
59	37.8
60	37.8
61	37.8
274	18.9
223	15.8
224	15.8
225	15.8
226	15.8
227	15.8
228	15.8

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of cattle meat based on the 7 high-rate adult consumers is 52.6 kg y⁻¹

The observed 97.5th percentile rate based on 14 observations is 73.9 kg y⁻¹

Table 22. Adults' consumption rates of pig meat from the terrestrial survey area (kg y⁻¹)

Observation number	Pork
223	50.6
224	50.6
225	50.6
226	50.6
227	50.6
228	50.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of pig meat based on the 6 high-rate adult consumers is 50.6 kg y⁻¹

The observed 97.5th percentile rate based on 6 observations is 50.6 kg y⁻¹

Table 23. Adults' consumption rates of sheep meat from the terrestrial survey area (kg y⁻¹)

Observation number	Lamb	Mutton	Total
271	35.4	-	35.4
272	35.4	-	35.4
273	18.9	-	18.9
219	10.0	6.5	16.5
220	10.0	6.5	16.5
221	10.0	6.5	16.5
222	10.0	6.5	16.5
215	5.7	-	5.7
216	5.7	-	5.7
217	5.7	-	5.7
218	5.7	-	5.7
58	-	5.2	5.2
59	-	5.2	5.2
60	-	5.2	5.2
61	-	5.2	5.2
274	4.7	-	4.7
223	3.8	-	3.8
224	3.8	-	3.8
225	3.8	-	3.8
226	3.8	-	3.8
227	3.8	-	3.8
228	3.8	-	3.8
5	1.5	-	1.5
6	1.5	-	1.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of sheep meat based on the 7 high-rate adult consumers is 22.2 kg y⁻¹

The observed 97.5th percentile rate based on 24 observations is 35.4 kg y⁻¹

Table 24. Adults' consumption rates of poultry from the terrestrial survey area (kg y⁻¹)

Observation number	Pheasant	Pigeon	Total
212	1.0	0.3	1.3
213	1.0	0.3	1.3
214	1.0	0.3	1.3
223	0.2	0.1	0.2
224	0.2	0.1	0.2
225	0.2	0.1	0.2
226	0.2	0.1	0.2
227	0.2	0.1	0.2
228	0.2	0.1	0.2

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of poultry based on the 3 high-rate adult consumers is 1.3 kg y⁻¹

The observed 97.5th percentile rate based on 9 observations is 1.3 kg y⁻¹

Table 25. Adults' consumption rates of eggs from the terrestrial survey area (kg y⁻¹)

Observation number	Chicken egg	Duck egg	Total
223	11.9	5.9	17.7
224	11.9	5.9	17.7
225	11.9	5.9	17.7
226	11.9	5.9	17.7
227	11.9	5.9	17.7
228	11.9	5.9	17.7
69	6.3	9.9	16.2
255	14.3	-	14.3
256	14.3	-	14.3
185	4.1	9.5	13.6
186	4.1	9.5	13.6
62	13.0	-	13.0
63	13.0	-	13.0
70	5.7	4.5	10.2
253	2.1	-	2.1
254	2.1	-	2.1
15	0.9	-	0.9
16	0.9	-	0.9
275	0.7	-	0.7
276	0.7	-	0.7

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of eggs based on the 14 high-rate adult consumers is 15.3 kg y⁻¹

The observed 97.5th percentile rate based on 20 observations is 17.7 kg y⁻¹

Table 26. Adults' consumption rates of wild/free foods from the terrestrial survey area (kg y⁻¹)

Observation number	Bilberry	Blackberry	Raspberry	Total
64	-	-	3.5	3.5
65	-	-	3.5	3.5
66	-	-	3.5	3.5
67	-	-	3.5	3.5
68	-	-	3.5	3.5
212	-	1.0	1.0	2.0
213	-	1.0	1.0	2.0
214	-	1.0	1.0	2.0
1	0.5	0.5	0.5	1.4
56	-	0.9	-	0.9
57	-	0.9	-	0.9
69	-	0.8	-	0.8
70	-	0.8	-	0.8
193	-	0.6	-	0.6
194	-	0.6	-	0.6
219	0.3	0.3	-	0.5
220	0.3	0.3	-	0.5
221	0.3	0.3	-	0.5
222	0.3	0.3	-	0.5
37	-	0.5	-	0.5
38	-	0.5	-	0.5
15	-	0.2	-	0.2

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of wild/free foods based on the 9 high-rate adult consumers is 2.8 kg y⁻¹

The observed 97.5th percentile rate based on 22 observations is 3.5 kg y⁻¹

Table 27. Adults' consumption rates of rabbits/hares from the terrestrial survey area (kg y⁻¹)

Observation number	Rabbit
56	0.2
57	0.2

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of rabbits/hares based on the 2 high-rate adult consumers is 0.2 kg y⁻¹

The observed 97.5th percentile rate based on 2 observations is 0.2 kg y⁻¹

Table 28. Adults' consumption rates of honey from the terrestrial survey area (kg y⁻¹)

Observation number	Honey
69	15.0
70	2.7
255	0.9
256	0.9

Notes

The emboldened observation is the high-rate consumer

The mean consumption rate of honey based on the only high-rate adult consumer is 15.0 kg y⁻¹

The observed 97.5th percentile rate based on 4 observations is 14.1 kg y⁻¹

Table 29. Adults' consumption rates of wild fungi from the terrestrial survey area (kg y⁻¹)

Observation number	Mushrooms
56	0.5
57	0.5
193	0.5
194	0.5
64	0.4
65	0.4
66	0.4
219	0.3
220	0.3
221	0.3
222	0.3

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of wild fungi based on the 11 high-rate adult consumers is 0.4 kg y⁻¹

The observed 97.5th percentile rate based on 11 observations is 0.5 kg y⁻¹

Table 30. Adults' consumption rates of venison from the terrestrial survey area (kg y⁻¹)

Observation number	Venison
212	2.0
213	2.0
214	2.0
219	0.5
220	0.5
221	0.5
222	0.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of venison based on the 3 high-rate adult consumers is 2.0 kg y⁻¹

The observed 97.5th percentile rate based on 7 observations is 2.0 kg y⁻¹

Table 31. Adults' consumption rates of freshwater fish from the terrestrial survey area (kg y⁻¹)

Observation number	Brown trout	Salmon	Total
307	1.1	-	1.1
308	1.1	-	1.1
56	-	1.0	1.0
57	-	1.0	1.0
215	0.7	-	0.7
216	0.7	-	0.7
217	0.7	-	0.7
218	0.7	-	0.7
223	0.2	-	0.2
224	0.2	-	0.2
225	0.2	-	0.2
226	0.2	-	0.2
227	0.2	-	0.2
228	0.2	-	0.2

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of freshwater fish based on the 8 high-rate adult consumers is 0.9 kg y⁻¹

The observed 97.5th percentile rate based on 14 observations is 1.1 kg y⁻¹

Table 32. Adults' consumption rates of goat meat from the terrestrial survey area (kg y⁻¹)

Observation number	Goat meat
223	0.6
224	0.6
225	0.6
226	0.6
227	0.6
228	0.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of goat meat based on the 6 high-rate adult consumers is 0.6 kg y⁻¹

The observed 97.5th percentile rate based on 6 observations is 0.6 kg y⁻¹

Table 33. Children's consumption rates of green vegetables from the terrestrial survey area (kg y⁻¹)**Child age group (6 - 15 years old)**

Observation number	Age	Lettuce
17	11	0.1
18	8	0.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of green vegetables for the child age group based upon the 2 high-rate consumers is 0.1 kg y⁻¹

The observed 97.5th percentile rate based on 2 observations is 0.1 kg y⁻¹

Table 34. Children's consumption rates of other vegetables from the terrestrial survey area (kg y⁻¹)**Child age group (6 - 15 years old)**

Observation number	Age	Pea	Runner bean	Total
17	11	0.1	0.1	0.1
18	8	0.1	0.1	0.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of other vegetables for the child age group based upon the 2 high-rate consumers is 0.1 kg y⁻¹

The observed 97.5th percentile rate based on 2 observations is 0.1 kg y⁻¹

Table 35. Children's consumption rates of root vegetables from the terrestrial survey area (kg y⁻¹)**Child age group (6 - 15 years old)**

Observation number	Age	Onion
17	11	0.1
18	8	0.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of root vegetables for the child age group based upon the 2 high-rate consumers is 0.1 kg y⁻¹

The observed 97.5th percentile rate based on 2 observations is 0.1 kg y⁻¹

Table 36. Children's consumption rates of potato from the terrestrial survey area (kg y⁻¹)**Child age group (6 - 15 years old)**

Observation number	Age	Potato
17	11	0.6
18	8	0.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of potato for the child age group based upon the 2 high-rate consumers is 0.6 kg y⁻¹

The observed 97.5th percentile rate based on 2 observations is 0.6 kg y⁻¹

Table 37. Children's consumption rates of eggs from the terrestrial survey area (kg y⁻¹)**Child age group (6 - 15 years old)**

Observation number	Age	Chicken egg
17	11	0.9
18	8	0.9

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of eggs for the child age group based upon the 2 high-rate consumers is 0.9 kg y⁻¹

The observed 97.5th percentile rate based on 2 observations is 0.9 kg y⁻¹

Table 38. Children's consumption rates of wild/free foods from the terrestrial survey area (kg y⁻¹)**Child age group (6 - 15 years old)**

Observation number	Age	Blackberry
17	11	0.2
18	8	0.2
41	7	0.1
42	10	0.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of wild/free foods for the child age group based upon the 4 high-rate consumers is 0.1 kg y⁻¹

The observed 97.5th percentile rate based on 4 observations is 0.2 kg y⁻¹

Table 39. Percentage contribution each food type makes to its terrestrial food group for adults

Green vegetables		Domestic fruit		Wild/free foods	
Courgette	26.1 %	Apple	23.5 %	Raspberry	64.6 %
Cabbage	10.6 %	Plum	21.0 %	Blackberry	31.0 %
Broccoli	9.7 %	Rhubarb	14.8 %	Bilberry	4.5 %
Kale	8.1 %	Blackcurrant	13.7 %		
Cauliflower	7.3 %	Strawberry	8.2 %	Rabbits/hares	
Brussel sprout	7.2 %	Raspberry	7.7 %	Rabbit	100.0 %
Calabrese	6.3 %	Gooseberry	5.1 %		
Spinach	6.1 %	Grapes	2.4 %	Honey	
Lettuce	5.7 %	Pear	1.1 %	Honey	100.0 %
Chard	5.0 %	Fig	0.9 %		
Cucumber	4.0 %	Blueberry	0.9 %		
Herbs	1.5 %	Redcurrant	0.7 %		
Rocket	1.4 %				
Pak choi	1.1 %				
Other vegetables		Milk		Wild fungi	
Tomato	48.4 %	Cows' milk	100.0 %	Mushrooms	100.0 %
Runner bean	29.7 %				
Pea	6.0 %	Cattle meat		Venison	
French bean	5.0 %	Beef	100.0 %	Venison	100.0 %
Broad bean	4.8 %				
Mangetout	3.7 %	Pig meat		Freshwater fish	
Aubergine	1.1 %	Pork	100.0 %	Brown trout	76.9 %
Pepper	1.0 %			Salmon	23.1 %
Chilli pepper	0.3 %				
Root vegetables		Sheep meat		Goat meat	
Leek	29.1 %	Lamb	79.6 %	Goat meat	100.0 %
Onion	26.2 %	Mutton	20.4 %		
Carrot	16.0 %				
Turnip	10.1 %	Poultry			
Beetroot	6.3 %	Pheasant	76.3 %		
Shallot	5.0 %	Pigeon	23.7 %		
Radish	3.8 %				
Spring onion	2.4 %				
Garlic	1.1 %				
Potato		Eggs			
Potato	100.0 %	Chicken egg	69.0 %		
		Duck egg	31.0 %		

Notes

Food types in emboldened italics were monitored by SEPA in 2010 (EA, FSA, NIEA and SEPA, 2011).

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 40. Occupancy rates in the direct radiation survey area for adults, children and infants (h y⁻¹)

Observation number	Sex	Age (years)	Indoor occupancy (h y ⁻¹)	Outdoor occupancy (h y ⁻¹)	Total occupancy (h y ⁻¹)
Adult observations					
156	M	85	7055	1194	8249
35	M	66	7357	720	8077
13	M	76	3024	5040	8064
155	F	85	6815	1194	8009
38	F	72	8087	138	7941
37	M	71	7015	926	7941
7	M	72	4831	2688	7519
20	F	46	7220	252	7472
4	M	58	3104	4360	7464
39	F	45	6867	331	7198
15	F	44	6812	233	7044
186	F	85	6677	76	6753
185	M	87	5935	732	6667
34	F	62	6407	159	6566
33	M	65	5981	520	6501
187	F	66	5786	644	6430
154	F	60	6254	34	6288
8	F	70	5820	393	6213
19	M	53	5086	152	5238
69	M	42	4402	770	5172
70	F	43	4256	520	4776
36	F	67	4597	29	4626
40	M	48	3548	189	3737
14	F	76	2846	538	3384
16	M	49	2743	57	2800
22	M	17	1722	126	1848
71	F	U	1775	45	1820
72	F	U	1137	683	1820
73	F	U	1137	683	1820
74	F	U	1137	683	1820
75	F	U	1137	683	1820
76	F	U	1137	683	1820
77	F	U	1137	683	1820
78	F	U	1137	683	1820
79	F	U	1137	683	1820
80	F	U	1137	683	1820
81	F	U	1137	683	1820
82	F	U	1137	683	1820
83	F	U	1137	683	1820
84	F	U	910	683	1593
85	F	U	910	683	1593
86	F	U	910	683	1593
87	F	U	910	683	1593
88	F	U	910	683	1593
89	F	U	910	683	1593
90	F	U	910	683	1593
91	F	U	682	683	1365
201	F	53	500	500	1000
202	M	58	500	500	1000
203	M	60	500	500	1000
11	F	40	154	14	168
12	M	40	154	14	168
32	F	52	29	1	30
1	M	59	-	2	2
Child and infant observations					
41	M	7	6153	489	6643
42	F	10	6153	489	6643
17	F	11	6378	218	6596

Table 40. Occupancy rates in the direct radiation survey area for adults, children and infants (h y⁻¹)

Observation number	Sex	Age (years)	Indoor occupancy (h y ⁻¹)	Outdoor occupancy (h y ⁻¹)	Total occupancy (h y ⁻¹)
18	F	8	6378	218	6596
92	F	1	1608	743	2351
93	M	1	1608	743	2351
21	M	14	1722	126	1848
94	M	1	742	743	1485
95	M	1	742	743	1485
96	M	1	742	743	1485
97	M	1	742	743	1485
98	M	1	742	743	1485
99	M	1	742	743	1485
100	M	1	742	743	1485
101	F	1	742	743	1485
102	F	1	742	743	1485
103	F	1	742	743	1485
104	F	1	742	743	1485
105	F	2	742	743	1485
106	F	2	742	743	1485
107	F	2	742	743	1485
108	F	2	742	743	1485
109	F	2	742	743	1485
110	F	2	742	743	1485
111	F	2	742	743	1485
112	F	2	742	743	1485
113	F	2	742	743	1485
114	M	2	742	743	1485
115	M	2	742	743	1485
116	M	2	742	743	1485
117	M	2	742	743	1485
118	M	2	742	743	1485
119	M	2	742	743	1485
120	M	2	742	743	1485
121	M	2	742	743	1485
122	M	3	618	743	1361
123	M	3	618	743	1361
124	M	3	618	743	1361
125	M	3	618	743	1361
126	M	3	618	743	1361
127	M	3	618	743	1361
128	F	3	618	743	1361
129	F	3	618	743	1361
130	F	3	618	743	1361
131	F	3	618	743	1361
132	F	3	618	743	1361
133	F	3	618	743	1361
134	M	4	618	743	1361
135	M	4	618	743	1361
136	M	4	618	743	1361
137	M	4	618	743	1361
138	M	4	618	743	1361
139	M	4	618	743	1361
140	M	5	618	743	1361
141	M	5	618	743	1361
142	M	5	618	743	1361
143	M	5	618	743	1361
144	M	5	618	743	1361
145	M	5	618	743	1361
146	F	4	618	743	1361
147	F	4	618	743	1361
148	F	4	618	743	1361

Table 40. Occupancy rates in the direct radiation survey area for adults, children and infants (h y⁻¹)

Observation number	Sex	Age (years)	Indoor occupancy (h y ⁻¹)	Outdoor occupancy (h y ⁻¹)	Total occupancy (h y ⁻¹)
149	F	4	618	743	1361
150	F	5	618	743	1361
151	F	5	618	743	1361
152	F	5	618	743	1361
153	F	5	618	743	1361
9	F	6	435	141	576
10	F	6	435	141	576

Notes

U - Unknown

Table 41. Gamma dose rate measurements taken in the direct radiation survey area ($\mu\text{Gy h}^{-1}$)

Properties

Location	Indoor substrate	Indoor gamma dose rate at 1 metre ^a	Outdoor substrate	Outdoor gamma dose rate at 1 metre ^a
Property 1	Concrete	0.076	Grass	0.068
Property 2	Wood	0.109	Grass	0.065
Property 3	Wood	0.104	Grass	0.066
Property 4	Wood	0.068	Grass	0.068
Property 5	Wood	0.106	Grass	0.072
Property 6	Wood	0.079	Grass	0.074
Property 7	Wood	0.082	Grass	0.094
Property 8	Wood	0.110	Grass	0.072
Property 9	Not recorded	Not recorded	Grass	0.072
Property 10	Wood	0.089	Grass	0.079
Property 11	Wood	0.087	Grass	0.064
Property 12	Wood	0.061	Grass	0.070
Property 13	Wood	0.070	Grass	0.071
Property 14	Concrete	0.108	Grass	0.076
Property 15	Wood	0.088	Grass	0.071

Backgrounds

	Location	NGR	Substrate	Background gamma dose rate at 1 metre
Background 1	Glen Fruin	NS 310 850	Grass	0.068
Background 2	Glen Douglas	NN 273 001	Grass	0.056
Mean background				0.062

Notes

^a These measurements have not been adjusted for natural background dose rates.

Annex 1. Adults' consumption rates (kg y⁻¹ or l y⁻¹) and occupancy rates (h y⁻¹)

Observation number	Sex	Age (years)	Fish	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Goat meat	Intertidal occupancy over mud	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over stones	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area	
43	M	66	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	
44	F	44	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
45	M	44	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
48	F	22	-	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	18	-	-	-	-	
50	F	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105	-	-	-	105	-	-	-	-	
51	F	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105	-	-	-	105	-	-	-	-	
52	M	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105	-	-	-	105	-	-	-	-	
56	M	66	12.4	-	19.0	9.1	25.0	28.4	28.0	-	-	-	-	-	-	0.9	0.2	-	0.5	-	1.0	-	-	-	50	-	-	-	2	-	-	-	-
57	F	67	12.4	-	19.0	9.1	25.0	28.4	28.0	-	-	-	-	-	-	0.9	0.2	-	0.5	-	1.0	-	-	-	-	-	-	-	-	-	-	-	
58	M	64	-	-	-	-	-	-	0.7	-	37.8	-	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
59	F	62	-	-	-	-	-	-	0.7	-	37.8	-	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
60	M	38	-	-	-	-	-	-	0.7	-	37.8	-	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
61	M	32	-	-	-	-	-	-	0.7	-	37.8	-	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
62	M	78	-	-	22.5	12.7	13.5	20.2	27.1	-	-	-	-	-	13.0	-	-	-	-	-	-	-	-	-	-	-	6	6	-	-	-	-	
63	F	74	-	-	22.5	12.7	13.5	20.2	27.1	-	-	-	-	-	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
64	M	U	0.9	-	1.5	-	-	-	-	-	-	-	-	-	-	3.5	-	-	0.4	-	-	-	-	-	-	-	24	-	48	-	-	-	
65	M	U	0.9	-	1.5	-	-	-	-	-	-	-	-	-	-	3.5	-	-	0.4	-	-	-	-	-	-	-	24	-	48	-	-	-	
66	M	U	0.9	-	1.5	-	-	-	-	-	-	-	-	-	-	3.5	-	-	0.4	-	-	-	-	-	-	-	24	-	48	-	-	-	
67	F	U	0.9	-	1.5	-	-	-	-	-	-	-	-	-	-	3.5	-	-	-	-	-	-	-	-	-	-	24	-	-	-	-	-	
68	F	U	0.9	-	1.5	-	-	-	-	-	-	-	-	-	-	3.5	-	-	-	-	-	-	-	-	-	-	24	-	-	-	-	-	
69	M	42	-	-	-	-	-	-	0.6	-	-	-	-	-	16.2	0.8	-	15.0	-	-	-	-	-	-	-	-	-	-	-	-	4402	770	
70	F	43	-	-	-	-	-	-	0.6	-	-	-	-	-	10.2	0.8	-	2.7	-	-	-	-	-	-	-	-	-	-	-	-	4256	520	
71	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1775	45	
72	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1137	683	
73	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1137	683	
74	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1137	683	
75	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1137	683	
76	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1137	683	
77	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1137	683	
78	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1137	683	
79	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1137	683	
80	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1137	683	

Annex 1. Adults' consumption rates (kg y⁻¹ or l y⁻¹) and occupancy rates (h y⁻¹)[illegible]

Annex 1. Adults' consumption rates (kg y⁻¹ or l y⁻¹) and occupancy rates (h y⁻¹)

Observation number	Sex	Age (years)	Fish	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Goat meat	Intertidal occupancy over mud	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over stones	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
175	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	240	-	-	
176	M	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-
179	M	57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	-	-	-	-	-	-	-
181	M	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54	-	-	-	-	-	-	-
182	F	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39	-	-	-	-	-	-	-
183	M	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72	-	-	
184	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	104	-	-	-	104	-	-	-	-	-	-
185	M	87	-	-	-	-	-	4.5	-	-	-	-	-	-	13.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5935	732
186	F	85	-	-	-	-	-	4.5	-	-	-	-	-	-	13.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6677	76
187	F	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5786	644
188	M	47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56	-	-	-	-	-	-	-
189	M	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56	-	-	-	-	-	-	-
190	M	31	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49	-	-	-	-	-	-	-
191	M	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	104	-	-	-	-	-	-	-
192	F	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	104	-	-	-	-	-	-	-
193	M	U	0.3	-	26.4	20.1	14.1	5.7	9.4	-	-	-	-	-	-	0.6	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
194	F	U	0.3	-	26.4	20.1	14.1	5.7	9.4	-	-	-	-	-	-	0.6	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
195	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	77	-	-
196	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	77	-	-
197	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	77	-	-
198	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	77	-	-
199	M	U	25.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72	-	-	-	72	-	-	-	-	-	-
200	F	U	25.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
201	F	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	500	500	
202	M	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	500	500	
203	M	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	500	500	
204	M	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-
205	M	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-	-	-
206	M	57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	183	-	-	-	-	-	-	-
207	M	28	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-
208	M	31	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-
209	F	U	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Annex 1. Adults' consumption rates (kg y⁻¹ or l y⁻¹) and occupancy rates (h y⁻¹)

Observation number	Sex	Age (years)	Fish	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Goat meat	Intertidal occupancy over mud	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over stones	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area		
210	F	U	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
211	M	U	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-	-	260	-	24	-	-	-	-	-	
212	M	41	-	-	-	-	-	-	-	365.0	-	-	-	1.3	-	2.0	-	-	-	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	
213	M	41	-	-	-	-	-	-	-	-	-	-	-	1.3	-	2.0	-	-	-	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	
214	F	62	-	-	-	-	-	-	-	182.5	-	-	-	1.3	-	2.0	-	-	-	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	
215	M	46	-	-	-	-	5.0	10.0	-	-	-	-	5.7	-	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	20	-	-	-	
216	M	45	-	-	-	-	5.0	10.0	-	-	-	-	5.7	-	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-	-	
217	F	83	-	-	-	-	5.0	10.0	-	-	-	-	5.7	-	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-	-	
218	F	85	-	-	-	-	5.0	10.0	-	-	-	-	5.7	-	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-	-	
219	M	58	-	-	-	-	-	-	-	-	-	-	16.5	-	-	0.5	-	-	0.3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	
220	M	26	-	-	-	-	-	-	-	-	-	-	16.5	-	-	0.5	-	-	0.3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	
221	M	25	-	-	-	-	-	-	-	-	-	-	16.5	-	-	0.5	-	-	0.3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	
222	M	19	-	-	-	-	-	-	-	-	-	-	16.5	-	-	0.5	-	-	0.3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	
223	M	60	-	-	-	-	-	-	-	-	15.8	50.6	3.8	0.2	17.7	-	-	-	-	-	0.2	0.6	-	-	-	-	-	-	-	-	-	-	-	
224	F	55	-	-	-	-	-	-	-	-	15.8	50.6	3.8	0.2	17.7	-	-	-	-	-	0.2	0.6	-	-	-	-	-	-	-	-	-	-	-	
225	M	30	-	-	-	-	-	-	-	-	15.8	50.6	3.8	0.2	17.7	-	-	-	-	-	0.2	0.6	-	-	-	-	-	-	-	-	-	-	-	
226	M	25	-	-	-	-	-	-	-	-	15.8	50.6	3.8	0.2	17.7	-	-	-	-	-	0.2	0.6	-	-	-	-	-	-	-	-	-	-	-	
227	F	34	-	-	-	-	-	-	-	-	15.8	50.6	3.8	0.2	17.7	-	-	-	-	-	0.2	0.6	-	-	-	-	-	-	-	-	-	-	-	
228	F	26	-	-	-	-	-	-	-	-	15.8	50.6	3.8	0.2	17.7	-	-	-	-	-	0.2	0.6	-	-	-	-	-	-	-	-	-	-	-	
229	F	45	2.8	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	30	-	-	24	-	-	-	-	-	
230	M	58	8.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	50	-	-	50	-	-	-	-	-	
231	M	24	8.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	50	-	-	50	-	-	-	-	-	
232	M	43	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39	13	-	-	-	-	13	-	-	-	
233	F	41	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	78	26	-	-	-	-	26	-	-	-	
236	M	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	104	-	-	-	
237	M	50	3.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72	-	-	-	-	-	-	
238	F	33	3.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	36	36	48	-	-	-	-	-	-
242	M	50	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	-	-	-	-	-	-	-	-	
244	M	36	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
246	F	34	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
247	M	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	30	110	-	-	-	
248	F	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	30	110	-	-	-	

Annex 1. Adults' consumption rates (kg y⁻¹ or l y⁻¹) and occupancy rates (h y⁻¹)

Observation number	Sex	Age (years)	Fish	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Goat meat	Intertidal occupancy over mud	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over stones	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
249	F	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	30	110	-	-	
250	M	47	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	84	-	-	-	-	-	-	-	
253	M	80	-	-	15.3	28.4	15.5	7.1	6.8	-	-	-	-	-	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
254	F	80	-	-	15.3	28.4	15.5	7.1	6.8	-	-	-	-	-	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
255	M	57	-	-	33.1	16.0	6.1	25.0	29.8	-	-	-	-	-	14.3	-	-	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	
256	F	51	-	-	33.1	16.0	6.1	25.0	29.8	-	-	-	-	-	14.3	-	-	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	
257	F	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	-	-	-	-	-	
258	M	34	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	
259	M	24	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	
260	M	62	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
261	F	60	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
262	F	33	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
263	M	30	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	-	-	-	-	
264	M	31	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	-	-	-	-	
265	M	35	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	-	-	-	-	
266	M	38	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	-	-	-	-	
267	M	33	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	-	-	-	-	
268	M	36	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	-	-	-	-	
269	M	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	-	-	-	-	-	
271	M	68	-	-	-	-	-	-	-	-	70.8	-	35.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
272	F	68	-	-	-	-	-	-	-	-	70.8	-	35.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
273	M	59	-	-	-	-	-	-	-	-	75.5	-	18.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
274	F	56	-	-	-	-	-	-	-	-	18.9	-	4.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
275	F	78	-	-	15.5	61.5	13.2	13.3	9.0	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
276	M	82	-	-	7.7	34.0	6.6	6.7	4.5	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
279	M	70	8.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
280	M	49	6.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	-	-	-	-	-	-	
281	M	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	
282	M	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	
283	M	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	
284	F	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	
285	F	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-	

Annex 1. Adults' consumption rates (kg y⁻¹ or l y⁻¹) and occupancy rates (h y⁻¹)

Observation number	Sex	Age (years)	Fish	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Goat meat	Intertidal occupancy over mud	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over stones	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
288	M	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400	-	-	
289	M	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400	-	-	
290	M	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400	-	-	
291	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-	-	
292	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-	-	
293	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-	-	
294	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-	-	
295	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	-	
296	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	-	
297	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	-	
298	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	-	-	
299	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72	-	-	
300	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72	-	-	
301	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72	-	-	
302	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72	-	-	
303	M	55	6.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	90	-	-	-	-	-	-	-	-
304	M	48	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-	-
305	M	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	192	-	-	-	-	-	-
306	M	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	192	-	-	-	-	-	-
307	M	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1	-	-	-	-	-	-	-	-	-	-	-	-
308	F	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1	-	-	-	-	-	-	-	-	-	-	-	-

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)

Observation number	Sex	Age (years)	Fish	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Eggs	Wild/free foods	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over stones	Handling sediment	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
Child age group (6 - 15 years old)																		
9	F	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	435	141
10	F	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	435	141
17	F	11	-	-	0.1	0.1	0.1	0.6	0.9	0.2	5	-	-	-	-	-	6378	218
18	F	8	-	-	0.1	0.1	0.1	0.6	0.9	0.2	5	-	-	-	-	-	6378	218
21	M	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1722	126
25	M	9	-	1.8	-	-	-	-	-	-	42	-	-	-	42	-	-	-
41	M	7	-	-	-	-	-	-	-	0.1	-	-	6	-	-	-	6153	489
42	F	10	-	-	-	-	-	-	-	0.1	-	-	6	-	-	-	6153	489
46	M	14	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47	M	11	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
49	M	15	-	1.4	-	-	-	-	-	-	18	-	-	-	18	-	-	-
53	F	15	-	-	-	-	-	-	-	-	105	-	-	-	105	-	-	-
54	M	14	-	-	-	-	-	-	-	-	105	-	-	-	105	-	-	-
55	M	13	-	-	-	-	-	-	-	-	105	-	-	-	105	-	-	-
177	M	10	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-
178	M	7	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-
180	M	13	-	-	-	-	-	-	-	-	-	-	54	-	-	-	-	-
234	F	14	0.7	-	-	-	-	-	-	-	78	26	-	-	-	26	-	-
235	M	12	0.7	-	-	-	-	-	-	-	78	26	-	-	-	26	-	-
239	M	15	3.9	-	-	-	-	-	-	-	-	-	-	72	-	-	-	-
240	M	12	3.9	-	-	-	-	-	-	-	-	-	-	72	-	-	-	-
241	F	11	3.9	-	-	-	-	-	-	-	-	-	-	72	-	-	-	-

Annex 2. Children's and infants' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹)

[illegible]

Annex 2. Children's and infants' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹)

[illegible]

Annex 2. Children's and infants' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹)

[illegible]

Annex 2. Children's and infants' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹)

Observation number	Sex	Age (years)	Fish	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Eggs	Wild/free foods	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over stones	Handling sediment	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
149	F	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	618	743
150	F	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	618	743
151	F	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	618	743
152	F	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	618	743
153	F	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	618	743

Notes

U - Unknown

Emboldened observations are the high-rate individuals

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

Combination number	Fish	Molluscs	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Milk	Cattle meat	Pig meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Freshwater fish	Goat meat	Intertidal occupancy over mud	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over sand and stones	Intertidal occupancy over stones	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area	
1														X								X					X	X		X	
2																												X		X	X
3							X		X		X																				
4			X	X	X	X							X	X								X								X	X
5	X	X																				X	X				X				
6	X																					X		X	X						
7			X	X	X	X	X							X																X	X
8																								X						X	X
9	X		X	X	X	X	X							X	X		X					X					X				
10			X	X	X	X	X						X													X	X				
11	X		X											X			X								X		X				
12							X						X	X		X													X	X	
13	X																				X			X		X					
14								X				X		X				X													
15					X	X					X									X								X			
16											X			X			X	X													
17									X	X	X	X	X							X	X										
18	X																					X	X					X			
19																									X		X	X			
20			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 1 represents an individual (or individuals) from Annex 1 who had positive data in the following pathways; wild/free foods, intertidal occupancy over mud and stones, occupancy in water, occupancy on water and outdoor occupancy within the direct radiation survey area.