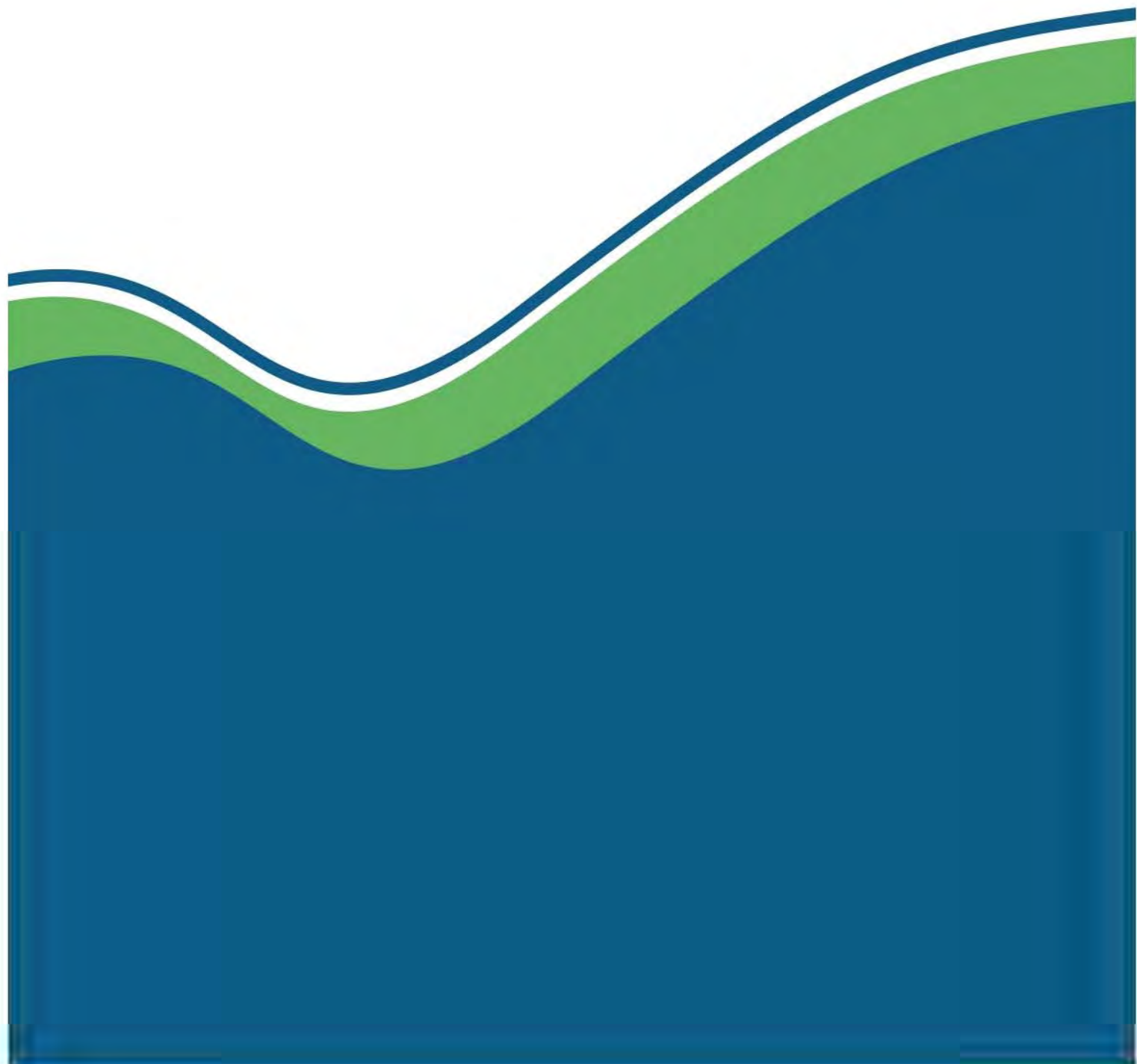


Radiological Habits Survey: Torness, 2011



Radiological Habits Survey: Torness, 2011

F.J. Clyne, C.J. Garrod and V.E. Ly

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CONTENTS

SUMMARY	7
1 INTRODUCTION	12
1.1 Regulation of radioactive waste discharges	12
1.2 The representative person	12
1.3 Dose limits and constraints	12
2 THE SURVEY	14
2.1 Site activity	14
2.2 Survey aims	14
2.3 Survey areas	15
<i>Figure 1. The Torness aquatic survey area</i>	16
<i>Figure 2. The Torness terrestrial (outer ring) and direct radiation (inner ring) survey areas</i>	17
2.4 Conduct of the survey	18
3 METHODS FOR DATA ANALYSIS	19
3.1 Data recording and presentation	19
3.2 Data conversion	19
3.3 Rounding and grouping of data	19
3.4 Approaches for the identification of high rates	20
3.5 Infant and child ratios for use in dose assessments	21
4 AQUATIC RADIATION PATHWAYS	22
4.1 Aquatic survey area	22
<i>Figure 3. Milsey Bay</i>	22
<i>Figure 4. Belhaven Bay</i>	24
<i>Figure 5. White Sands</i>	25
<i>Figure 6. Skateraw Harbour</i>	25
<i>Figure 7. Rocks near the Torness nuclear power station outfall</i>	26
<i>Figure 8. Pease Bay</i>	27
<i>Figure 9. Coldingham Bay</i>	28
4.2 Commercial fisheries	29
4.3 Destination of seafood originating from the aquatic survey area	29
4.4 Hobby fishing, angling and non-commercial shellfish collecting	29
4.5 Wildfowling	30
4.6 Other pathways	30
4.7 Internal exposure	31
<i>Table A. Summary of adults' consumption rates of foods from the aquatic survey area</i>	31
<i>Table B. Summary of children's and infants' consumption rates of foods from the aquatic survey area</i>	32
4.8 External exposure	33
<i>Table C. Summary of adults' intertidal occupancy rates</i>	33
<i>Table D. Summary of children's and infants' intertidal occupancy rates</i>	34
<i>Table E. Summary of adults' handling rates of fishing gear and sediment</i>	35
5 TERRESTRIAL RADIATION PATHWAYS	37
5.1 Terrestrial survey area	37
5.2 Land cover	38
<i>Figure 10. Land cover around Torness</i>	39
5.3 Internal exposure	40
<i>Table F. Summary of adults' consumption rates of foods from the terrestrial survey area</i>	40
<i>Table G. Summary of children's and infants' consumption rates of foods from the terrestrial survey area</i>	41

6	DIRECT RADIATION PATHWAYS	42
6.1	Direct radiation survey area	42
6.2	Occupancy rates and gamma dose rate measurements	42
7	USES OF HABITS DATA FOR DOSE ASSESSMENTS.....	44
8	COMPARISONS WITH THE PREVIOUS SURVEY	45
	<i>Table H. Comparison between 2006 and 2011 consumption rates of aquatic food groups for adults</i>	<i>45</i>
	<i>Table I. Comparison between 2006 and 2011 intertidal occupancy rates and handling rates of fishing gear and sediments for adults.....</i>	<i>46</i>
	<i>Table J. Comparison between 2006 and 2011 mean consumption rates for the adult high-rate groups for terrestrial food groups (kg y⁻¹)</i>	<i>47</i>
	<i>Table K. Comparison between 2006 and 2011 direct radiation occupancy rates (h y⁻¹).....</i>	<i>48</i>
9	MAIN FINDINGS.....	49
9.1	Survey findings.....	49
10	SUGGESTIONS FOR CHANGES TO THE MONITORING PROGRAMME.....	52
10.1	Summary of the current environmental monitoring programme	52
10.2	Suggestions for changes.....	54
11	ACKNOWLEDGEMENTS.....	55
12	REFERENCES.....	56

TABLES

Table 1	Typical food groups used in habits surveys
Table 2	Ratios for determining consumption and occupancy rates for infants and children
Table 3	Adults' consumption rates of fish from the Torness aquatic survey area (kg y ⁻¹)
Table 4	Adults' consumption rates of crustaceans from the Torness aquatic survey area (kg y ⁻¹)
Table 5	Adults' consumption rates of molluscs from the Torness aquatic survey area (kg y ⁻¹)
Table 6	Adults' consumption rates of wildfowl from the Torness aquatic survey area (kg y ⁻¹)
Table 7	Adults' consumption rates of marine plants/algae from the Torness aquatic survey area (kg y ⁻¹)
Table 8	Children's and infants' consumption rates of fish from the Torness aquatic survey area (kg y ⁻¹)
Table 9	Children's and infants' consumption rates of crustaceans from the Torness aquatic survey area (kg y ⁻¹)
Table 10	Adults' intertidal occupancy rates in the Torness aquatic survey area (h y ⁻¹)
Table 11	Children's and infants' intertidal occupancy rates in the Torness aquatic survey area (h y ⁻¹)
Table 12	Gamma dose rate measurements over intertidal substrates in the Torness aquatic survey area (μGy h ⁻¹)
Table 13	Adults' handling rates of fishing gear and sediment in the Torness aquatic survey area (h y ⁻¹)
Table 14	Adults' occupancy rates in and on water in the Torness aquatic survey area (h y ⁻¹)
Table 15	Children's and infants' occupancy rates in and on water in the Torness aquatic survey area (h y ⁻¹)
Table 16	Adults' consumption rates of green vegetables from the Torness terrestrial survey area (kg y ⁻¹)
Table 17	Adults' consumption rates of other vegetables from the Torness terrestrial survey area (kg y ⁻¹)
Table 18	Adults' consumption rates of root vegetables from the Torness terrestrial survey area (kg y ⁻¹)
Table 19	Adults' consumption rates of potato from the Torness terrestrial survey area (kg y ⁻¹)

Table 20	Adults' consumption rates of domestic fruit from the Torness terrestrial survey area (kg y ⁻¹)
Table 21	Adults' consumption rates of cattle meat from the Torness terrestrial survey area (kg y ⁻¹)
Table 22	Adults' consumption rates of sheep meat from the Torness terrestrial survey area (kg y ⁻¹)
Table 23	Adults' consumption rates of poultry from the Torness terrestrial survey area (kg y ⁻¹)
Table 24	Adults' consumption rates of eggs from the Torness terrestrial survey area (kg y ⁻¹)
Table 25	Adults' consumption rates of wild/free foods from the Torness terrestrial survey area (kg y ⁻¹)
Table 26	Adults' consumption rates of rabbits/hares from the Torness terrestrial survey area (kg y ⁻¹)
Table 27	Adults' consumption rates of honey from the Torness terrestrial survey area (kg y ⁻¹)
Table 28	Adults' consumption rates of wild fungi from the Torness terrestrial survey area (kg y ⁻¹)
Table 29	Adults' consumption rates of venison from the Torness terrestrial survey area (kg y ⁻¹)
Table 30	Children's consumption rates of other vegetables from the Torness terrestrial survey area (kg y ⁻¹)
Table 31	Children's consumption rates of root vegetables from the Torness terrestrial survey area (kg y ⁻¹)
Table 32	Children's consumption rates of potato from the Torness terrestrial survey area (kg y ⁻¹)
Table 33	Infants' consumption rates of honey from the Torness terrestrial survey area (kg y ⁻¹)
Table 34	Percentage contribution each food type makes to its terrestrial food group for adults
Table 35	Occupancy rates in the Torness direct radiation survey area for adults, children and infants
Table 36	Gamma dose rate measurements for the Torness direct radiation survey (μGy h ⁻¹)

ANNEXES

Annex 1	Adults' consumption rates (kg y ⁻¹) and occupancy rates (h y ⁻¹) in the Torness area
Annex 2	Children's and infants' consumption rates (kg y ⁻¹) and occupancy rates (h y ⁻¹) in the Torness area
Annex 3	Combinations of adult pathways for consideration in dose assessments in the Torness area

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 the Torness nuclear site. The site discharges gaseous radioactive wastes via stacks to the atmosphere, liquid radioactive wastes via an outfall into the North Sea and contains sources of direct radiation.

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 coast from North Berwick in East Lothian to Eyemouth in Berwickshire, and extended 3 km offshore.
- The terrestrial survey area; which included all land within a 5 km radius of the site centre (National Grid Reference NT 745 750).
- The direct radiation survey area; which covered the area up to 1 km from the site centre.

The following potential exposure pathways were investigated during the survey: the consumption of foods from the aquatic survey area; occupancy of intertidal areas; handling of fishing gear and sediment; the consumption of foods from the terrestrial survey area; and occupancy within the direct radiation survey area.

Interviews were conducted with members of the public and the data collected for 465 individuals are presented and discussed. High rates of consumption, intertidal occupancy and handling are identified using established methods comprising a 'cut off' to define the high-rate group, and 97.5th percentiles. The rates so identified can be used in dose assessments.

The aquatic survey area

The main commercial fishery in the survey area was creeling for brown crabs and common lobsters. Velvet swimming crabs were also caught in the creels and many of the creel fishermen did a little fishing with lines for mackerel during the summer. Commercial winkle collection took place on the shore in the survey area. Brown crabs and common lobsters were sold locally and nationally and were also exported to Europe. Velvet swimming crabs were exported to Spain and winkles were exported to France and other continental countries. Mackerel were kept by the fishermen for use as creel bait and also sold locally and nationally for human consumption.

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

- 33 kg y⁻¹ for fish (comprising cod, mackerel, bass, pollack and common ling, caught by shore anglers, boat anglers and fishermen)
- 10 kg y⁻¹ for crustaceans (comprising brown crab and common lobster, caught by commercial fishermen)
- 12 kg y⁻¹ for molluscs (comprising only winkles, collected by a commercial shellfish collector)
- 1.6 kg y⁻¹ for wildfowl (comprising unspecified species of goose and duck, shot during organised game shoots on farmland)
- 0.5 kg y⁻¹ for marine plants/algae (comprising only samphire, collected from Belhaven Bay)

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

- For fish; 46% cod, 26% mackerel, 21% bass and 7% a mix of pollack and common ling
- For crustaceans; 60% brown crab and 40% common lobster
- For molluscs; 100% winkles
- For wildfowl; 83% goose (unspecified species) and 17% duck (unspecified species)
- For marine plants/algae; 100% samphire

Seaweed removed from the cooling water intake filters at the Torness nuclear power station or cleared from recreational beaches at Dunbar, North Berwick and Milsey Bay was sent for composting. The use of seaweed as an animal feed was not identified.

Intertidal activities identified for adults included angling, collecting winkles, collecting mussels, bait digging, walking, dog walking, playing, working on the shore, jogging, sitting on the beach, sunbathing, beach cleaning, water sports preparation, lifeguard duties, horse riding, collecting samphire, metal detecting and fossil hunting.

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

- 1000 h y⁻¹ over rock (for one person who was angling at St Abb's Head, Eyemouth and near the Torness outfall, and collecting mussels for angling bait at Skateraw Harbour)
- 430 h y⁻¹ over sand (for 18 people, who were playing and walking at Ravensheugh Sands and White Sands; dog walking at North Berwick, Pease Bay, Dunbar, Milsey Bay, Eyemouth and White Sands; working on the shore between North Berwick and Thorntonloch; jogging at Belhaven Bay; and sitting on the beach at Coldingham Bay)
- 690 h y⁻¹ over sand and stones (for six people, who were collecting winkles at North Berwick, Dunbar, White Sands, Barns Ness and Skateraw Harbour)

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

The only activity identified for adults involving handling fishing gear was creeling. Activities for adults involving handling sediment included collecting winkles, collecting mussels and bait digging. The mean rates for the adult high-rate groups for handling were:

- 1500 h y⁻¹ for handling fishing gear (for 17 fishermen who were handling creels that were laid throughout the survey area)
- 700 h y⁻¹ for handling sediment (for six commercial shellfish collectors who were collecting winkles at North Berwick, Dunbar, White Sands, Barns Ness and Skateraw Harbour, one of whom also spent a small amount of time collecting mussels at Ravensheugh Sands)

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

The following activities were identified taking place 'in water' in the survey area by adults: surfing, sub-aqua diving, lifeguard duties, kayaking and swimming. The maximum occupancy rate in water was 940 h y⁻¹ for four people surfing at Belhaven Bay. The following activities were identified taking place 'on water' in the survey area by adults: being on a dive boat, angling, creeling, boat crew duties, RNLI duties, sailing and paddling. The maximum occupancy rate on water was 2300 h y⁻¹ for two commercial fishermen who were creeling and boat angling off St Abbs.

The terrestrial survey area

Farmers in the terrestrial survey area produced beef cattle, lambs and arable crops (turnips, swedes, Brussels sprouts, potatoes, barley, wheat, hay, silage and grass). Farmers and their families consumed beef and lamb that was produced on their own farms. One smallholder was identified who produced a small number of sheep and kept chickens for eggs. There were no allotment sites within the terrestrial survey area. Vegetables and fruit were grown in the gardens of many private houses and several people kept chickens for eggs for their own families' consumption. Five beekeepers were identified who kept hives in the area and consumed honey. Blackberries, hazel nuts, nettles, wild garlic, elderberries, hawthorn fruit and mushrooms were growing wild in the survey area and these were collected and consumed. Pheasant, partridge, rabbits, hares and venison shot on farmland were consumed. One household used spring water as their sole domestic supply. Livestock on five farms were supplied with spring water for drinking and some also had access to burn water. A mineral water company extracted approximately 10 million litres of water per year from boreholes in the survey area.

In the terrestrial area, foods were identified being consumed from 14 food groups. The mean consumption rates for the adult high-rate groups for terrestrial foods were:

- 15 kg y⁻¹ for green vegetables
- 26 kg y⁻¹ for other vegetables
- 26 kg y⁻¹ for root vegetables
- 79 kg y⁻¹ for potato
- 41 kg y⁻¹ for domestic fruit
- 20 kg y⁻¹ for cattle meat
- 9.4 kg y⁻¹ for sheep meat
- 6.8 kg y⁻¹ for poultry
- 9.4 kg y⁻¹ for eggs
- 3.4 kg y⁻¹ for wild/free foods
- 1.7 kg y⁻¹ for rabbits/hares
- 4.3 kg y⁻¹ for honey
- 1.8 kg y⁻¹ for wild fungi
- 6.3 kg y⁻¹ for venison

Control measures were used by the Torness site in order to limit the possibility that contamination was transferred off-site by wildlife. A pest controller regulated the numbers of rabbits and pigeons on the site by culling when necessary. A resident peregrine falcon discouraged pigeons from roosting on the site buildings.

The direct radiation survey area

Occupancy rates were obtained at six residential properties and five caravans within the direct radiation survey area.

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

- 8600 h y⁻¹ for the indoor occupancy rate (for a resident)
- 2200 h y⁻¹ for the outdoor occupancy rate (for a resident who also worked in the area)
- 8700 h y⁻¹ for the total occupancy rate (for the same resident with the highest indoor occupancy rate)

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 Torness site centre.

Comparisons with the previous survey

The results of the 2011 Torness habits survey were compared with the last habits survey undertaken at Torness in 2006.

In the aquatic survey area, the mean consumption rate for the adult high-rate group decreased for crustaceans and increased for fish and molluscs in 2011 when compared with 2006. The consumption of wildfowl and marine plants/algae was identified in 2011 but was not identified in 2006. In 2011, compared to 2006, the mean occupancy rate for the adult high-rate group decreased for sand and increased for rock and for sand and stones. In 2011, the mean rate for the adult high-rate group for handling fishing gear increased and the mean rate for the high-rate group for handling sediment was broadly similar to that in 2006.

In the terrestrial survey area, in 2011 compared with 2006, consumption rates increased in the following food groups: domestic fruit, poultry, wild/free foods, rabbits/hares, wild fungi and venison. Consumption rates decreased in the following food groups in 2011: green vegetables, other vegetables, root vegetables, potato, cattle meat, sheep meat, eggs and honey. The consumption of pig meat was recorded in the 2006 survey but was not identified in the 2011 survey. No consumption of milk, freshwater fish or cereals was identified in either 2006 or 2011.

In the direct radiation survey area in 2011, the highest total occupancy rate, the highest indoor occupancy rate and the highest outdoor occupancy rate increased when 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:

- Within the 'other vegetable' food group the sample of pumpkin currently monitored could be replaced with a sample of broad beans.
- Within the 'wild/free' food group the samples of crab apples, rosehips and rowan berries could be replaced with a sample of elderberries.
- Within the 'poultry' food group the sample of wood pigeon currently monitored could be replaced with a sample of pheasant.
- The sample of milk currently monitored could be removed from the programme since no consumption of locally produced milk was identified during the survey.

1 INTRODUCTION

1.1 Regulation of radioactive waste discharges

There are generally three main sources of radiation exposure to members of the public from nuclear sites 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 Torness 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

The Torness nuclear power station is located on the coast of Berwickshire in east Scotland, approximately 7 km south-east of Dunbar. The station is powered by two Advanced Gas-Cooled Reactors (AGRs). It started generating electricity in 1988 and is expected to continue generation until 2023. The station is owned and operated by EDF Energy Nuclear Generation Ltd. Liquid radioactive wastes are discharged into the North Sea and gaseous discharges are made to the atmosphere, both under authorisation from SEPA. The site contains sources of direct radiation.

The day before the start of the habits survey fieldwork (28th June 2011), both reactors were taken off-line because large numbers of jellyfish were obstructing the cooling water intake screens. Both reactors came back on-line during the fieldwork; one reactor came back on-line on 1st July and the other reactor came back on-line on 5th July.

2.2 Survey aims

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

Specifically, investigations were carried out to ascertain the following:

- The consumption of food from the aquatic survey area
- Activities and occupancy over intertidal areas
- The handling of fishing gear and sediment
- Activities and occupancy in and on water
- The use of seaweed as human or animal food or use as a fertiliser
- The consumption of food from the terrestrial survey area
- The production, use and destination of local produce
- The consumption and use of groundwater and surface water in the terrestrial survey area
- The transfer of contamination off-site by wildlife
- Activities and occupancy within the direct radiation survey area
- Any new or unusual exposure pathways

2.3 Survey areas

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

The aquatic survey area, shown in Figure 1, covered the coast from North Berwick in East Lothian to Eyemouth in Berwickshire, and extended 3 km offshore.

The terrestrial survey area, shown in Figure 2, covered all land within 5 km of the site centre (National Grid Reference: NT 745 750).

The direct radiation survey area, which is also shown in Figure 2, was defined as all land within 1 km of the site centre.

The same aquatic, terrestrial and direct radiation survey areas were used in the previous habits survey conducted by Cefas around the Torness site, which was in 2006 (Tipple *et al.*, 2010).

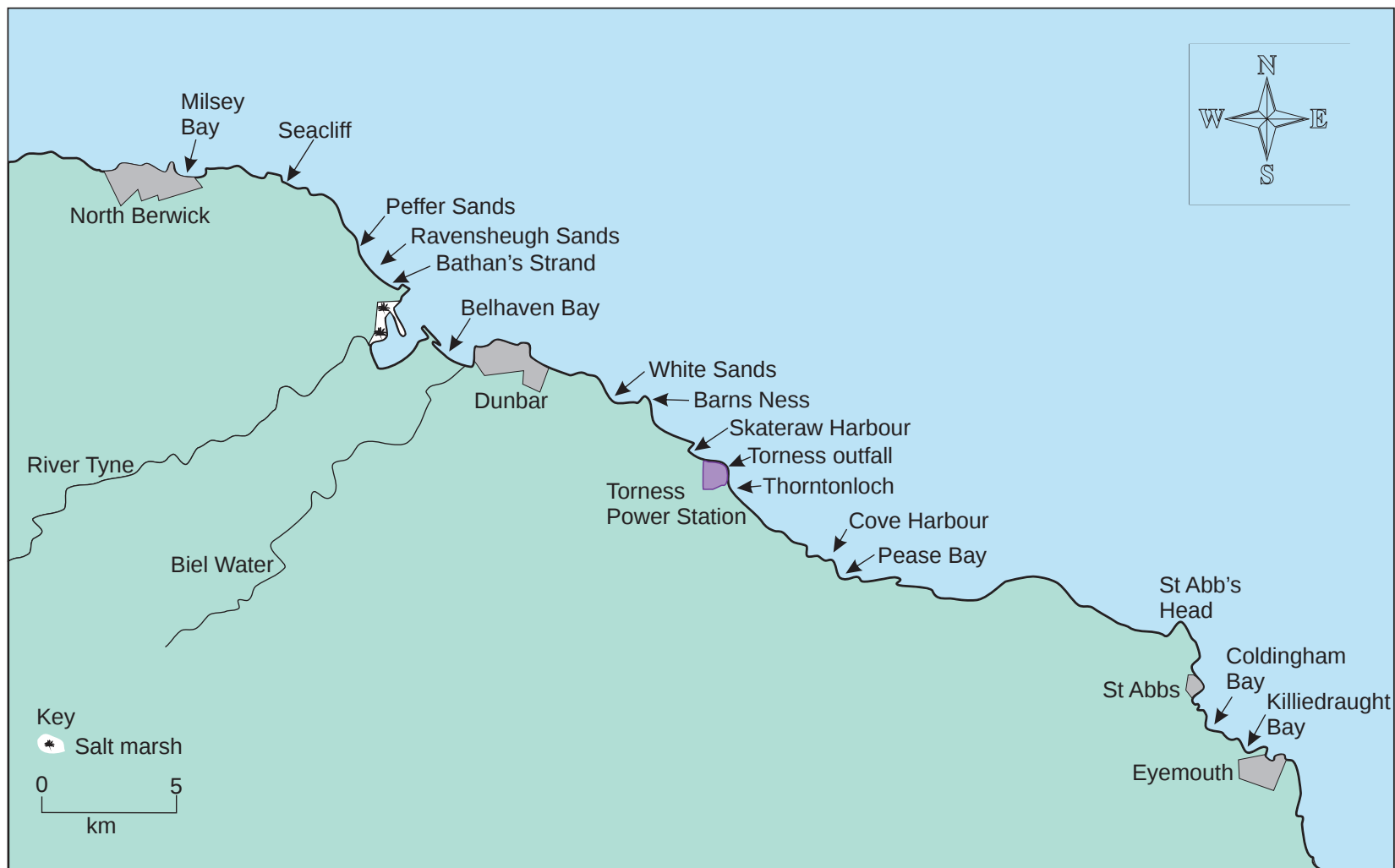


Figure 1. The Torness aquatic survey area



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

2.4 Conduct of the survey

As part of the pre-survey preparation, SEPA was contacted to identify any additional requirements. Information relating to the activities of people in the aquatic and terrestrial survey areas was obtained from internet searches, Ordnance Survey maps and from previous habits surveys undertaken at Torness. People with local knowledge of the survey area were contacted for information on any aspects relevant to the exposure pathways. These included local councils and a representative of a wildfowling 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 during the period 29th June to the 13th July 2011 by three members of staff from the Cefas laboratory at Lowestoft, according to techniques described by Leonard *et al.*, (1982). A meeting was held between the survey team and Torness site representatives. These discussions 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, fishermen, anglers, 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 also taken indoors and outdoors at most properties visited within the direct radiation area. Measurements of background gamma dose rates were taken at locations beyond 5 km from the site centre.

3 METHODS FOR DATA ANALYSIS

3.1 Data recording and presentation

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

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

3.2 Data conversion

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

3.3 Rounding and grouping of data

The consumption and occupancy data in the text of this report are rounded to two significant figures, except for values less than 1.0, which are rounded to one decimal place. This method of presentation reflects the authors' judgement on the accuracy of the methods used. In the tables and annexes, the consumption rate data are usually presented to one decimal place. Occasionally, this rounding process causes the computed values (row totals, mean rates and 97.5th percentiles), which are based on un-rounded data, to appear slightly erroneous. Consumption rates less than 0.05 kg y⁻¹ are

presented to two decimal places in order to avoid the value of 0.0 kg y⁻¹. External exposure data are quoted as integer numbers of hours per year.

The habits data are structured into groups of food items or substrate types with similar attributes. For example, when considering terrestrial food consumption, all types of root vegetables are grouped together in a food group called 'root vegetables'. Similarly, for aquatic food consumption, all crustacean species are grouped as 'crustaceans'. For external exposure over intertidal sediments, occupancies over the same substrate, such as sand, are grouped together. The typical food groups used in habits surveys are shown in Table 1.

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

Age ranges used from 2010 onwards		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, covered the coast from North Berwick in East Lothian to Eyemouth in Berwickshire, and extended 3 km offshore. The coastline was generally rocky, with steep cliffs hindering access to many parts of the shore. There were a number of sandy beaches, which were easily accessible.

North Berwick to Dunbar

North Berwick was a busy seaside town and popular tourist destination. There were sandy beaches interspersed with large outcrops of rock, either side of a walled harbour, which were popular with walkers and dog walkers. The beach at Milsey Bay, to the east of the harbour, had a tidal swimming pool (see Figure 3) and was very popular for recreational activities such as sunbathing, swimming, and family days out on the beach. Seaweed that had been washed up onto the beaches was regularly removed using a tractor rake during the summer season. Angling and winkle collecting took place from the rocky outcrops.



Figure 3. Milsey Bay

Five commercial creel fishing boats were based at North Berwick Harbour, which was also home to approximately 30 sailing yachts and a few angling boats, hobby fishing boats and other pleasure craft. Four charter boats and two high speed semi-rigid inflatable boats operated from the harbour, offering sightseeing trips, bird watching trips, diving trips and angling trips to a series of islands just offshore. There was an inshore RNLI station at the harbour and about 80 sailing dinghies were kept on a dinghy park close by. Two concrete slipways led to the beach to the west of the harbour and sailing dinghies and other small pleasure craft were launched from the beach.

At the eastern end of Milsey Bay there was a rocky headland with a car park and paths leading down the cliff to rocky ledges that were used by anglers.

The shore to the east of Milsey Bay, towards Seacliff, was for the most part inaccessible, consisting of rocky stretches backed by steep cliffs. A private road, which led to Seacliff beach, could be used by members of the public via a coin-operated barrier. The beach was a wide sandy expanse with rocky ledges and backed by a cliff at its western limit. A number of people were identified sitting on the beach, playing and swimming. A very small harbour was cut into the rock at Seacliff, where one commercial creel fishing boat was based.

South of Seacliff, there was a continuous stretch of sandy beach which included Peffer Sands, Ravensheugh Sands and Bathan's Strand. There was a small private holiday centre above the shore at Peffer Sands and no easy access to the shore for other members of the public was identified in this area. Access to Ravensheugh Sands and Bathan's Strand involved a ten minute walk to the beach from a public car park inland. In spite of this, these beaches were popular and many people were observed walking, sunbathing, sitting on the beach, playing, collecting mussels, horse riding, paddling and swimming.

A rocky headland separated Bathan's Strand from the long sandy beach at Bellhaven Bay to the south. At the northern end of Bellhaven Bay the River Tyne flowed through an area of mud flats and salt marsh before cutting across the sands to the sea. A stream, called Biel Water, flowed into the sea close to shelving rocks that marked the southern limit of the bay. The beach at Bellhaven Bay (see Figure 4) was very popular and individuals were observed horse riding, paddling, dog walking, surfing, kayaking, walking, jogging, swimming and collecting samphire. A surf school operated from a car park nearby. The area around Bellhaven Bay formed part of the John Muir Country Park and the park rangers conducted guided walks and activities along the shore of the bay. Wildfowling was permitted in some areas of the park.

The coast between Bellhaven Bay and Dunbar was steep rocky cliffs and there was no easy access to the shore.



Figure 4. Belhaven Bay

Dunbar Harbour consisted of two interconnecting harbours. The outer harbour did not dry out at low tide but the inner harbour did dry out at low tide leaving several small boats resting on the mud and sand. There were two slipways which were regularly used by members of the public for launching pleasure craft. Boats that were observed moored in the outer harbour included 15 small creel boats, six small trawlers, numerous recreational boats and a dive charter boat. The creel boats fished inside the survey area but the trawlers fished outside the survey area. A lifeboat station was located at the harbour. Immediately to the south-east of the harbour there was a sandy beach where dog-walking, walking, bait digging and playing took place. Large amounts of seaweed that washed up on the shore were frequently removed in the summer months using a tractor rake.

Dunbar to Thorntonloch

The shore between Dunbar and the Torness nuclear power station was predominantly rocky with areas of sand and stones. This stretch of coast could be accessed on foot via a coastal path and by road at White Sands (see Figure 5), Barns Ness and Skateraw Harbour (see Figure 6). There were large sandy beaches at White Sands and Skateraw Harbour and there was a beach of sand and stones at Barns Ness.



Figure 5. White Sands



Figure 6. Skateraw Harbour

Local commercial winkle collectors regularly operated on the shore between White Sands and Skateraw Harbour and one individual was identified collecting winkles for their own consumption at White Sands. The beaches at White Sands, Barns Ness and Skateraw Harbour were popular with locals and tourists due to the easy access and parking. Activities included dog walking, walking, and

playing on the beach. Bait digging was also identified at White Sands and Skateraw Harbour. One of the Dunbar lifeboats was moored in Skateraw Harbour and boat anglers were observed launching their vessels from the beach. A coastal path led from the beach at Skateraw Harbour around the Torness nuclear power station to the beach at Thorntonloch. Anglers were fishing from a walkway above the power station cooling water intake and from a wharf near the walkway. Part of the shore around the power station was a man-made embankment of large rocks.

The shelving rocky shore directly to the east of the Torness nuclear power station was very popular with anglers fishing for bass in the warm water near the station outfall (see Figure 7). South of the rocks, the large sandy beach at Thorntonloch was popular with residents from a nearby caravan park, local people and tourists, who were dog walking, playing on the beach, swimming, sunbathing, surfing and angling.



Figure 7. Rocks near the Torness nuclear power station outfall

Thorntonloch to St Abbs

Access to the shore was limited along the rocky coastline to the south-east of Thorntonloch except at Cove, where a steep track led down the cliff to a small walled harbour. Two commercial creel boats and a few pleasure craft were kept in the harbour, which was tidal. It was reported that winkles were sometimes collected from the rocks close to the harbour but this was not observed at the time of the survey.

South-east of Cove was Pease Bay (see Figure 8), which had a small sandy beach with rocks and boulders at either side. A caravan park was situated close to the beach and numerous tourists from the caravan park and other visitors used the bay for recreational activities such as sunbathing, playing, walking, dog walking, angling, paddling, swimming and surfing.



Figure 8. Pease Bay

The coast between Pease Bay and St Abbs was rocky with steep cliffs and there was no road access to the shore. One individual was identified who climbed down the cliffs to go angling from the rocks at St Abb's Head.

The shore around the village of St Abbs was rocky and at low tide an area of rock pools was exposed. The village had a walled harbour where several pleasure boats, angling boats and a few commercial creel boats were based. This stretch of coast was very popular with sub-aqua divers since it formed part of the St Abbs and Eyemouth Voluntary Marine Reserve. Four diving charter boats operated from St Abbs and some of these also took angling parties and sightseeing trips along the coast. A public slipway in the inner harbour was used for launching small pleasure boats, angling boats and privately owned diving boats. The inner harbour dried out at low tide exposing mud, sand and rock. There was an RNLI station, which had a direct slipway into the outer harbour. Angling took place from the harbour wall and from the surrounding rocks, and kayakers were observed offshore.

St Abbs to Eyemouth

The coast between St Abbs and Eyemouth was predominantly rocky with steep cliffs but there was a fine sand beach at Coldingham Bay (see Figure 9), to the south of St Abbs. The beach had blue flag status and was patrolled by lifeguards during the summer season. It was very popular with visitors for days out on the beach and also attracted surfers.



Figure 9. Coldingham Bay

A footpath ran along the cliff top between Coldingham Bay and Eyemouth but access down the cliffs to the rocky coves below was limited. There was a path down the cliff to a small sand and stone beach at Killiedraught Bay, just to the west of Eyemouth. At low tide, a large expanse of rock pools was exposed and it was reported that winkles were collected from this area, although this was not observed at the time of the survey. A caravan park was located at the top of the cliff.

Eyemouth was the southern limit of the survey area. The beach was predominantly sand with seaweed covered rocks exposed at low water. It was close to a residential area and was very popular for dog walking. There was a public slipway at the south end of the beach. Anglers fished from the piers at the harbour entrance and from rocks close by, and children were observed swimming in the sea. Eyemouth was an important fishing port but the larger boats based there all worked outside the survey area. A few very small creel boats based at the harbour fished within the survey area. Three seafood wholesalers based in Eyemouth bought fish and shellfish caught throughout the survey area. There was an RNLI station and the harbour was the base for four charter boats that offered diving

trips, angling trips and sightseeing trips. Several sailing yachts, hobby creeling boats and private angling boats also used the harbour.

4.2 Commercial fisheries

The main commercial fishery in the survey area was creeling for brown crabs and common lobsters. Velvet swimming crabs were also caught in the creels. Many of the creel fishermen also did a little fishing for mackerel with lures on lines during the summer months, but this was a secondary activity to creeling. Approximately 35 commercial creeling boats, all less than 10 m long, operated within the survey area. Many of them only fished part time. They were based mainly at Dunbar and North Berwick but also operated from Seacliff, Skateraw Harbour, Cove, St Abbs and Eyemouth. Several larger fishing boats used the harbours at Dunbar and Eyemouth, but these all fished outside the survey area, mainly trawling for *Nephrops*.

Several local people collected winkles commercially from the shore at North Berwick, Dunbar, White Sands, Barns Ness and Skateraw Harbour. There were no reports of organised gangs from outside the area collecting winkles from within the survey area in recent years.

4.3 Destination of seafood originating from the aquatic survey area

Most of the fish and shellfish caught in the survey area were sold to a seafood wholesaler based in Dunbar or three wholesalers based in Eyemouth; however, most of the winkles collected from the shore were sold to a wholesaler outside the survey area. Mackerel were kept for use as creel bait by the fishermen and also sold locally and nationally for human consumption through the wholesalers. Most of the brown crab and common lobster were exported to continental countries, including France, Spain, Belgium and Holland, but others were sold to a UK supermarket chain, to local and national retailers and to hotels and restaurants. Small amounts were sold direct to the public from the fishing boats. The velvet swimming crabs were exported to Spain and the winkles were exported to France and other continental countries.

4.4 Hobby fishing, angling and non-commercial shellfish collecting

In this report, the term 'hobby fishing' is used to describe recreational fishing on a small scale with creels, which is usually carried out from boats that do not have commercial fishing licences, and therefore, it is illegal to offer the catch for sale. A number of hobby fishermen were creeling for brown crabs and common lobsters within the survey area. They were based at North Berwick, Dunbar, St Abbs and Eyemouth. The catches of crab and lobster were consumed by the fishermen and their families and friends.

Shore angling was popular in the survey area, particularly near the Torness nuclear power station outfall where anglers fished for bass in the warm water discharged from the station. Other popular locations for shore angling included North Berwick, the rocks to the east of Milsey Bay, Dunbar, Thorntonloch, Cove, Pease Bay, St Abbs and Eyemouth.

Boat angling was also popular and occurred throughout the survey area from privately owned boats based at North Berwick, Dunbar, St Abbs and Eyemouth. Angling charter boats operated out of North Berwick, St Abbs and Eyemouth.

A few people were collecting shellfish non-commercially in the survey area. Two individuals were identified collecting mussels for their own consumption from the Ravensheugh Sands area and one individual was identified collecting winkles for their own consumption from rocks around White Sands. One person was identified that collected mussels from Skateraw Harbour for use as angling bait.

4.5 Wildfowling

Wildfowling was identified taking place on the shores of the River Tyne Estuary in the John Muir Country Park. The following information was obtained from East Lothian Council, who issue the permits to shoot in the country park. For the season 1st September 2009 to 20th February 2010, the council issued 218 permits and there were 468 visits to the country park by wildfowlers. The bag returns indicated that the wildfowlers shot a total of 44 pink-footed geese, 43 greylag geese, 2 Canada geese, 67 wigeon, 49 teal, 68 mallard and 1 goldeneye. The survey team were unable to contact any wildfowlers during the survey. However, consumption rates were obtained for wildfowl (unspecified species of goose and duck) that were shot on an organised game shoot on farmland nearby.

4.6 Other pathways

The beaches at Dunbar, North Berwick and Milsey Bay were cleaned weekly in the summer months by using a tractor rake to remove large amounts of seaweed that were washed up on the shore. The kelp obtained from the beach cleaning operations was sent for processing and was blended with other materials to make compost. The compost was sold as a garden and landscaping product. Seaweed removed from the Torness nuclear power station cooling water intake filters was also sent for composting. A gardener who was identified in the 2006 Torness habits survey collecting a large amount of seaweed to use as a fertiliser on a vegetable garden was no longer collecting seaweed in 2011.

4.7 Internal exposure

Consumption data for foods from the aquatic survey area are shown in Tables 3 to 7 for adults and in Tables 8 and 9 for children and infants.

Adults' consumption rates

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

Table A presents a summary of the consumption rates for fish, crustaceans, molluscs, wildfowl and marine plants/algae 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 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	83	18	56.1	20.2	33.2	56.1	15.0	40.0
Crustaceans	45	13	18.3	6.4	10.0	15.3	3.5	10.0
Molluscs	8	1	11.6	11.6	11.6	9.9	3.5	10.0
Wildfowl	5	5	1.6	1.6	1.6	1.6	ND	ND
Marine plants/algae	1	1	0.5	0.5	0.5	NA	ND	ND

Notes

ND – Not determined

NA – Not applicable

The predominant species of fish consumed by adults were cod, mackerel and bass. Smaller quantities of pollack, common ling, saithe and sea trout were also consumed. These fish were caught throughout the survey area. Of the fish consumed by the 18 people in the high-rate group, the percentage breakdown of species was 46% cod, 26% mackerel, 21% bass and 7% a mix of pollack and common ling.

The species of crustaceans consumed by adults were brown crab and common lobster, which were caught throughout the survey area. Of the crustaceans consumed by the 13 people in the high-rate group, the percentage breakdown of species was 60% brown crab and 40% common lobster.

The species of molluscs consumed by adults were winkles which were collected from North Berwick, Dunbar, White Sands, Barns Ness and Skateraw Harbour, and mussels which were collected from Ravensheugh Sands. The person in the high-rate group only consumed winkles.

The wildfowl consumed by adults were ducks and geese, which were shot on farmland. Of the wildfowl consumed by the five people in the high-rate group, the percentage breakdown of species was 83% goose (unidentified species) and 17% duck (unspecified species).

Only one person was in the high-rate group for marine plants/algae. They consumed samphire, which was collected from Belhaven Bay.

Children's and infants' consumption rates

Table B presents a summary of children's and infant's consumption rates of fish and crustaceans from the aquatic survey area. The table includes the mean consumption rates for the high-rate groups and the observed 97.5th percentile rates. For individuals in the child age group and the infant age group, no consumption of molluscs, wildfowl or marine plants/algae 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	10.2	5.2	7.3	9.7
Crustaceans	4	1	6.9	6.9	6.9	6.4
Infant age group (0 – 5 years old)						
Fish	4	4	4.6	3.6	4.2	4.6
Crustaceans	2	2	0.7	0.5	0.6	0.7

The species of fish consumed by the child age group were cod, mackerel, pollack, common ling, bass and saithe. The species of fish consumed by the infant age group were cod, mackerel, pollack and bass. The fish were caught throughout the survey area.

The species of crustaceans consumed by the child age group and the infant age group were brown crab and common lobster, which were caught throughout the survey area.

4.8 External exposure

Intertidal occupancy

Intertidal occupancy rates for adults are presented in Table 10 and intertidal occupancy rates for children and infants are presented in Table 11.

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.

Table C. Summary of adults' intertidal occupancy rates

Intertidal substrate	Number of observations	Number of people in the high-rate group	Maximum of the high-rate group (h y ⁻¹)	Mean of the high-rate group (h y ⁻¹)	97.5 th percentile (h y ⁻¹)
Rock	25	1	1025	1025	597
Sand	130	18	912	427	466
Sand and stones	13	6	1092	694	975

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

- For rock: angling at St Abb's Head, Eyemouth and near the Torness outfall, and collecting mussels for angling bait at Skateraw Harbour.
- For sand: playing and walking at Ravensheugh Sands and White Sands; dog walking at North Berwick, Pease Bay, Dunbar, Milsey Bay, Eyemouth and White Sands; working on the shore between North Berwick and Thorntonloch; jogging at Belhaven Bay; and sitting on the beach at Coldingham Bay.
- For sand and stones: collecting winkles at North Berwick, Dunbar, White Sands, Barns Ness and Skateraw Harbour.

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)					
Rock	3	3	40	40	40
Sand	35	22	210	141	208
Sand and stones	5	1	130	130	119
Infant age group (0 - 5 years old)					
Sand	18	8	208	141	208
Sand and stones	1	1	151	151	Not applicable

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

- For rock: angling to the east of Milsey Bay.
- For sand: walking at Pease Bay; playing at Coldingham Bay, Thorntonloch, Ravensheugh Sands, White Sands, Milsey Bay and Seacliff; and dog walking from Skateraw Harbour to Barns Ness.
- For sand and stones: walking at Dunbar.

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

- For sand: playing at Coldingham Bay, Milsey Bay, Skateraw Harbour, Ravensheugh Sands and White Sands; and dog walking at Skateraw Harbour.
- For sand and stones: walking at Dunbar.

Gamma dose rate measurements

Gamma dose rate measurements were taken over intertidal substrates to supplement those of SEPA's scheduled monitoring programme. The results are presented in Table 12. Twelve measurements taken over sand ranged from 0.045 $\mu\text{Gy h}^{-1}$ to 0.071 $\mu\text{Gy h}^{-1}$.

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 13 presents the adult handling rates of fishing gear and sediment recorded during the survey. No children or infants were identified handling fishing gear or sediment.

Adults' handling rates of fishing gear and sediment

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

Table E. Summary of adults' handling rates of fishing gear and sediment					
Handling activity	Number of observations	Number of people in the high-rate group	Maximum of the high-rate group (h y⁻¹)	Mean of the high-rate group (h y⁻¹)	97.5th percentile (h y⁻¹)
Handling fishing gear	27	17	2250	1452	2250
Handling sediment	11	6	1092	695	995

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

- For handling fishing gear: handling creels throughout the survey area.
- For handling sediment: collecting winkles at North Berwick, Dunbar, White Sands, Barns Ness and Skateraw Harbour; and collecting mussels at Ravensheugh Sands (for a small amount of time).

Most of the fishermen wore gloves when handling creels at sea but did not wear gloves when mending creels ashore.

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 14. Occupancy rates for activities taking place 'in water' and 'on water' for children and 'on water' for infants are presented in Table 15. No individuals in the infant age group were identified spending time 'in water'.

Activities taking place 'in water' in the survey area were surfing, diving, lifeguard duties, kayaking, swimming and boogie-boarding. Forty-one observations were recorded for adults and 14 observations were recorded for individuals in the child age group. The maximum occupancy rate 'in water' for adults was 940 h y⁻¹ for four people surfing at Belhaven Bay. The maximum occupancy rate 'in water' for individuals in the child age group was 52 h y⁻¹ for one individual who was boogie-boarding at Dunbar.

Activities taking place 'on water' in the survey area were being on a dive boat, angling, creeling, boat crew duties, RLNI duties, sailing and paddling. One hundred and nine observations were recorded for adults, 15 observations were recorded for individuals in the child age group and 14 observations were recorded for individuals in the infant age group. The maximum occupancy rate 'on water' for adults was 2300 h y⁻¹ for two commercial fishermen who were creeling and angling off St Abbs. The maximum occupancy rate 'on water' was the same for individuals in the child age group and for individuals in the infant age group. This was 160 h y⁻¹ for 11 children and infants in total who were paddling at Coldingham Bay.

5 TERRESTRIAL RADIATION PATHWAYS

5.1 Terrestrial survey area

The terrestrial survey area, shown in Figure 2, covered all land within 5 km of the Torness site centre. Interviews were conducted at 11 working farms that produced beef cattle, lambs and arable crops (barley, wheat, hay, silage, grass, turnips, swedes, Brussels sprouts and potatoes). No dairy farms were identified within the survey area. Beef cattle and lambs were sold to abattoirs in Anglesey, Perth, Aberdeen or Yorkshire and at livestock markets in St Boswells and Stirling. Potatoes, swedes and Brussels sprouts were distributed to a national merchant for sale in supermarkets. Wheat was sent to a national merchant for the production of bread and biscuits and was also sold for distilling for vodka. Barley was sold for malting for use in whisky and beer. Swedes, turnips, silage, grass, hay, barley and wheat were used for winter animal feed. Farmers and their families were consuming beef and lamb produced on their own farms.

One smallholding was identified, which produced a small number of sheep and kept chickens for eggs. There were no allotment sites within the terrestrial survey area. However, vegetables and fruit were grown in the gardens of many private houses. Several people kept chickens for eggs and one person kept ducks for eggs for their own families' consumption.

Five beekeepers were identified. The hives were kept near Innerwick, at Thurston, at Dunglass and on farmland to the south and south-west of the Torness site. The number of hives kept by the beekeepers ranged from one to 17 and the honey produced per hive ranged from 5 kg y⁻¹ to 14 kg y⁻¹. The honey was consumed by the beekeepers and their families and was sold at fairs and at farmers markets.

Blackberries, hazel nuts, nettles, wild garlic, hawthorn fruit, elderberries and mushrooms were growing wild in the survey area and these were collected and consumed. A private commercial game shoot took place on farmland which extended over several farms. Pheasant, partridge, rabbits, hares and venison shot on farmland were consumed.

The consumption of groundwater by humans and livestock was identified. One household situated to the south-west of the survey area used spring water as their sole domestic supply. Livestock on five farms were supplied with spring water for drinking and some also had access to burn water. A mineral water company was identified that extracted approximately 10 million litres of water per year from boreholes in the survey area. The water was bottled and distributed throughout Scotland.

The transfer of contamination off-site by wildlife was investigated as radionuclides could enter the food chain or contaminate the environment through this pathway. Control measures were used by the Torness site in order to limit the possibility that contamination is transferred off-site by wildlife. A pest controller regulated the numbers of rabbits and pigeons on the site, by culling when necessary. A resident peregrine falcon discouraged pigeons from roosting on the site buildings. No routine monitoring of wildlife was undertaken.

5.2 Land cover

Figure 10 shows the land cover in the terrestrial survey area. The figure was reproduced from a land cover map produced by Macaulay Land Use Research Institute (Macaulay Institute For Soil Research, 1988), with their consent.

A large proportion of the survey area was arable land with small areas of improved grassland, smooth grassland and undifferentiated coarse grassland. There were also small areas of coniferous and non-coniferous plantations bordering the minor waterways in the area. A large cement works and a landfill site were located approximately 3 km north-west of the Torness site and there were small areas of recreational land and urban land.

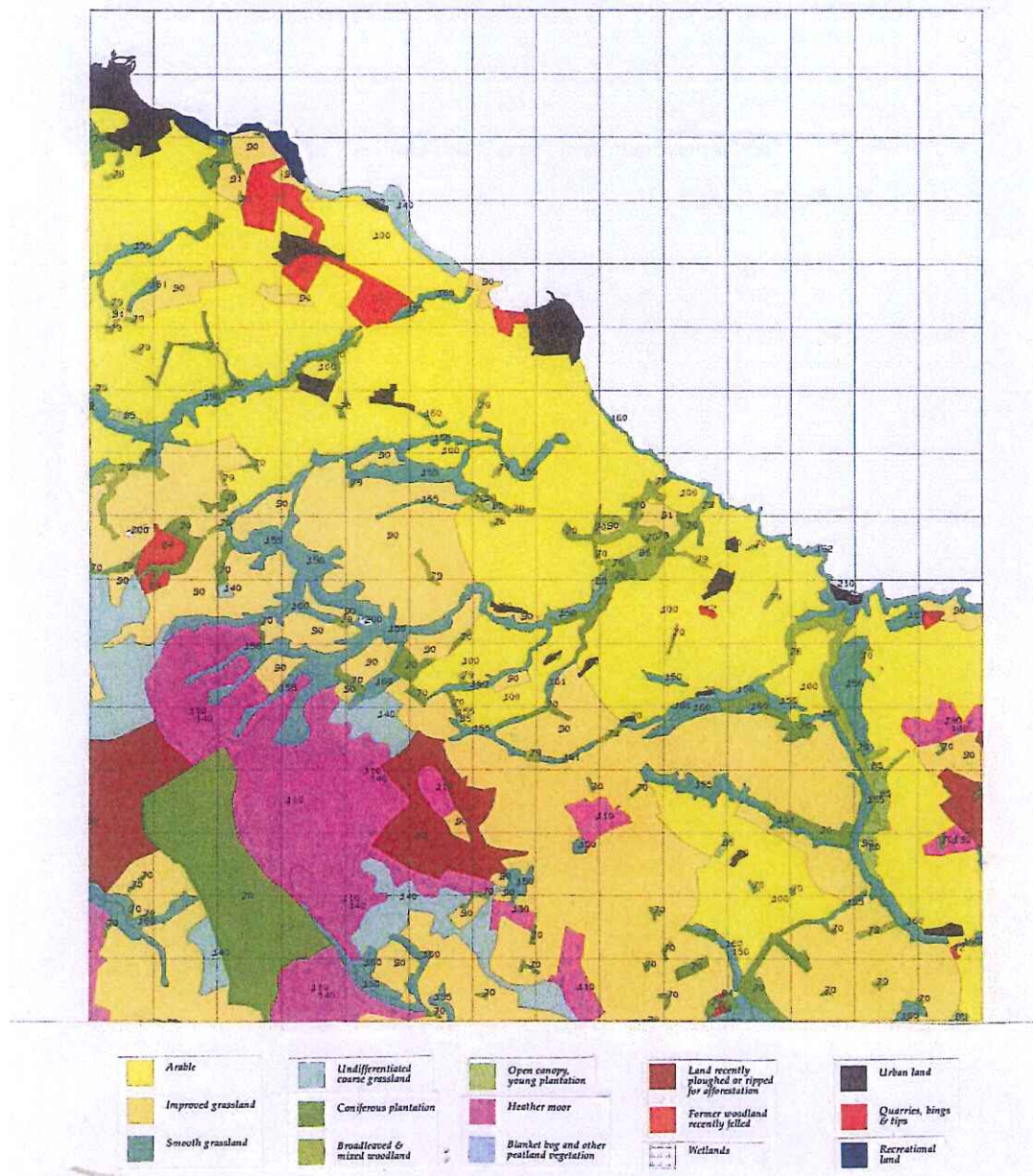


Figure 10. Land cover around Torness.

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 deposition of gaseous discharges are presented in Tables 16 to 29 for adults and Tables 30 to 33 for children and infants.

Adults' consumption rates

Consumption of foods from the terrestrial survey area were identified in the following 14 food groups: green vegetables, other vegetables, root vegetables, potato, domestic fruit, cattle meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi and venison. No consumption of locally produced milk, pig meat, freshwater fish or cereals was identified.

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

Food group	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y ⁻¹)	Observed minimum for the high-rate group (kg y ⁻¹)	Observed mean for the high-rate group (kg y ⁻¹)	Observed 97.5 th percentile (kg y ⁻¹)	Generic mean (kg y ⁻¹)	Generic 97.5 th percentile (kg y ⁻¹)
Green vegetables	28	12	27.3	9.8	14.7	27.3	15.0	45.0
Other vegetables	21	15	37.6	17.4	26.2	37.6	20.0	50.0
Root vegetables	28	9	32.5	18.9	25.8	32.5	10.0	40.0
Potato	51	16	100.1	54.6	78.8	100.1	50.0	120.0
Domestic fruit	26	6	57.0	31.9	41.2	57.0	20.0	75.0
Cattle meat	19	19	27.0	13.5	19.9	27.0	15.0	45.0
Sheep meat	19	12	12.9	4.5	9.4	12.9	8.0	25.0
Poultry	22	13	8.3	4.5	6.8	8.3	10.0	30.0
Eggs	8	6	17.8	5.9	9.4	16.2	8.5	25.0
Wild/free foods	13	7	3.8	3.0	3.4	3.8	7.0	25.0
Rabbits/hares	5	5	1.7	1.7	1.7	1.7	6.0	15.0
Honey	15	8	5.0	2.5	4.3	5.0	2.5	9.5
Wild fungi	14	10	2.3	1.5	1.8	2.3	3.0	10.0
Venison	19	12	11.5	4.9	6.3	9.6	ND	ND

Notes

ND - Not determined

No observed mean consumption rates for the high-rate group were found to be greater than the generic 97.5th percentile consumption rates. Eight observed mean consumption rates for the high-rate groups exceeded the generic mean consumption rates. These were for other vegetables, root vegetables, potato, domestic fruit, cattle meat, sheep meat, eggs and honey. No observed 97.5th percentile consumption rates exceeded the generic 97.5th percentile consumption rates. There are currently no generic consumption data available for venison so no comparisons can be made.

The percentage contribution each food type makes to its terrestrial food group, for adults, is presented in Table 34.

Children's and infants' consumption rates

Consumption rate data were obtained for individuals in the child and infant age groups. Table G presents a summary of the consumption rates for the foods consumed from the terrestrial survey area for children and infants. No generic rates have been determined for the child and the infant age groups so no comparisons with the observed rates can be made.

For the child age group, consumption of terrestrial foods was identified in the following three food groups: other vegetables, root vegetables and potato. No consumption was identified for the following food groups: green vegetables, domestic fruit, milk, cattle meat, pig meat, sheep meat, poultry, eggs, wild/free foods, rabbits/hares, honey, wild fungi, venison and freshwater fish.

For the infant age group, only the consumption of honey was identified. No consumption was identified for the following 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, wild fungi, venison and freshwater fish.

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

Food group	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y ⁻¹)	Observed maximum 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)						
Other vegetables	1	1	3.0	3.0	3.0	NA
Root vegetables	1	1	4.7	4.7	4.7	NA
Potato	1	1	6.8	6.8	6.8	NA
Infant age group (0 - 5 years old)						
Honey	3	3	4.7	4.7	4.7	4.7

Notes

NA - Not applicable

6 DIRECT RADIATION PATHWAYS

6.1 Direct radiation survey area

The direct radiation survey area, shown in Figure 2, covered the area within 1 km of the site centre.

The coastline bisected the direct radiation survey area from north-west to south-east. Skateraw Harbour, which comprised a rocky shore with a sandy beach, was located to the north-west of the Torness nuclear power station. People were dog walking, playing, bait digging, collecting winkles commercially and collecting mussels for angling bait on the beach. There was a wharf to the north of the power station and the Dunbar lifeboat was observed moored offshore of the wharf. A man-made embankment of large rocks formed a sea defence in front of the Torness nuclear power station along the shore from the north to the east. A walkway along the top of this embankment was part of a coastal path that linked Skateraw Harbour to Thorntonloch. Anglers were fishing from the wharf as well as from the walkway above the power station cooling water intake. There was access to the rocky shore near the Torness nuclear power station outfall to the east of the survey area, which was the most popular angling location in the area. A small part of a sandy beach, which was popular with dog walkers, families playing on the beach and anglers, fell within the south-eastern part of the survey area.

The land within the direct radiation survey area to the south and west of the nuclear power station was predominantly agricultural and the farm fields bordered the nuclear power station perimeter fence. An area of land within the nuclear licensed site area immediately to the east of the nuclear power station was left to grow wild; this was open to the public and was used by dog walkers. The survey area was sparsely populated. The small hamlet of Thorntonloch and a caravan park were located to the south-east of the survey area near to the beach. The caravan park was open from March to October and some people were residing in their caravans for the whole season. Several residences were also located to the south and south-west of the survey area.

6.2 Occupancy rates and gamma dose rate measurements

Interviews were conducted at six residential properties and five caravans. All of the residents of the properties and caravans were adults. Children visited the occupants of two caravans. Indoor, outdoor and total occupancy rates for adults and children are presented in Table 35. The highest indoor and total occupancy rates were 8600 h y⁻¹ and 8700 h y⁻¹, respectively, for an elderly resident. The highest outdoor occupancy rate was 2200 h y⁻¹ for a resident who also worked in the area.

The activities of the employees and contractors of the Torness site, while at work on the site, 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 distances further than 5 km from the site centre 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 36 and are summarised below.

Indoor measurements

- Seven measurements taken over wood ranged from 0.055 $\mu\text{Gy h}^{-1}$ to 0.104 $\mu\text{Gy h}^{-1}$
- One measurement taken over concrete was 0.121 $\mu\text{Gy h}^{-1}$

Outdoor measurements

- Ten measurements taken over grass ranged from 0.056 $\mu\text{Gy h}^{-1}$ to 0.083 $\mu\text{Gy h}^{-1}$

Background measurements

- Three measurements taken over grass ranged from 0.062 $\mu\text{Gy h}^{-1}$ to 0.076 $\mu\text{Gy h}^{-1}$

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 Torness in 2006.

Aquatic survey

A comparison between the 2006 and 2011 adults' consumption rates of aquatic foods is presented in Table H

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

Food group	2006			2011		
	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	17	63.6	29.1	18	56.1	33.2
Crustaceans	9	43.3	21.7	13	18.3	10.0
Molluscs	9	9.0	7.8	1	11.6	11.6
Wildfowl	NC	NC	NC	5	1.6	1.6
Marine plants/algae	NC	NC	NC	1	0.5	0.5

Notes

NC – Not consumed

The mean consumption rate for the adult high-rate group increased for fish and molluscs and decreased for crustaceans in 2011 when compared with 2006. The consumption of wildfowl and marine plants/algae was identified in 2011 but was not identified in 2006.

The main species of fish consumed by the adult high-rate group in 2006 and in 2011 were cod, mackerel and bass. In 2006 and in 2011, the species of crustaceans and molluscs consumed by the adult high-rate groups were the same. The species of crustaceans were brown crab and common lobster and the only species of molluscs was winkles. The species of wildfowl consumed by the adult high-rate group in 2011 were unidentified species of duck and goose and the only species of marine plants/algae consumed by adults in 2011 was samphire.

The significant decrease in the mean consumption rate for the high-rate group for crustaceans was attributed to a creel fisherman and his family who consumed large quantities of crustaceans in 2006 but had reduced their consumption in 2011 because the fishermen had since ceased fishing and therefore had less free shellfish available for consumption by him and his family.

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

Table I. Comparison between 2006 and 2011 intertidal occupancy rates and handling rates of fishing gear and sediments for adults						
	2006			2011		
Intertidal substrate or handling pathway	Number of people in the high-rate group	Maximum occupancy or handling rate (h y⁻¹)	Mean occupancy or handling rate for the high-rate group (h y⁻¹)	Number of people in the high-rate group	Maximum occupancy or handling rate (h y⁻¹)	Mean occupancy or handling rate for the high-rate group (h y⁻¹)
Rock	10	1570	977	1	1025	1025
Sand	13	1070	467	18	912	427
Sand and stones	2	504	499	6	1092	694
Handling fishing gear	18	1450	1114	17	2250	1452
Handling sediment	6	1040	701	6	1092	695

In 2011, the mean occupancy rate for the adult high-rate group for rock increased, although there were more people in the high-rate group in 2006. Commercial winkle collectors were identified collecting over rock in 2006, whereas in 2011, they were collecting over sand and stones. The mean occupancy rate for the adult high-rate group for sand decreased in 2011, although a wider range of activities was identified in 2011 and there were more people in the high-rate group compared with 2006. The mean occupancy rate for the adult high-rate group for sand and stones increased in 2011 compared with 2006 as a result of the commercial winkle collectors spending time over sand and stones rather than over rock.

In 2011, the mean rate for the adult high-rate group for handling fishing gear increased compared with 2006. The mean rate for the adult high-rate group for handling sediment in 2011 was broadly similar to that in 2006.

Terrestrial survey

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

Table J. Comparison between 2006 and 2011 mean consumption rates for the adult high-rate groups for terrestrial food groups (kg y⁻¹)		
Food group	2006	2011
Green vegetables	14.9	14.7
Other vegetables	50.0	26.2
Root vegetables	50.0	25.8
Potato	87.7	78.8
Domestic fruit	22.3	41.2
Cattle meat	23.1	19.9
Pig meat	36.9	NC
Sheep meat	14.1	9.4
Poultry	2.4	6.8
Eggs	10.4	9.4
Wild/free foods	2.9	3.4
Rabbits/hares	1.4	1.7
Honey	10.6	4.3
Wild fungi	1.2	1.8
Venison	4.0	6.3

Notes

NC – Not consumed

In 2011, consumption rates increased in the following food groups; domestic fruit, poultry, wild/free foods, rabbits/hares, wild fungi and venison. Consumption rates decreased in the following food groups: green vegetables, other vegetables, root vegetables, potato, cattle meat, sheep meat, eggs and honey. The consumption of pig meat was recorded in the 2006 survey but was not identified in the 2011 survey. No consumption of locally produced milk, freshwater fish or cereals was identified in either 2006 or 2011.

The consumption of pork was not identified in 2011 since pigs were no longer kept at farms within the survey area. Several beekeepers reported that they had experienced low honey yields in recent years and therefore the consumption of honey decreased in 2011. No specific reasons were identified for the other changes in consumption rates.

Direct radiation survey

The activities identified in the direct radiation survey area in 2006 and 2011 were similar and included people residing, working, angling, visiting, farming and dog walking. A comparison between the 2006 and 2011 direct radiation occupancy rates is presented in Table K.

Table K. Comparison between 2006 and 2011 direct radiation occupancy rates ($h\ y^{-1}$)		
	2006	2011
Highest indoor	8500	8565
Highest outdoor	1840	2190
Highest total	8604	8656

In 2011, the highest total occupancy rate, the highest indoor occupancy rate and the highest outdoor occupancy rate increased when compared with 2006. In 2011 and in 2006, the highest total and indoor occupancy rates were for a resident. In 2006 the highest outdoor occupancy rate was for an individual who worked in the area and in 2011 the highest outdoor occupancy rate was for a resident who also worked in the area.

9 MAIN FINDINGS

9.1 Survey findings

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

- Discharges of liquid radioactive waste to the North Sea
- Discharges of gaseous radioactive waste to the atmosphere
- Emissions of direct radiation

Data were collected for 465 individuals including, for example, commercial fishermen, anglers, people spending time on intertidal substrates, farmers, allotment holders, 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).

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:

- 33 kg y⁻¹ for fish
- 10 kg y⁻¹ for crustaceans
- 12 kg y⁻¹ for molluscs
- 1.6 kg y⁻¹ for wildfowl
- 0.5 kg y⁻¹ for marine plants/algae

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

- For fish; cod, mackerel, bass and smaller quantities of pollack and common ling
- For crustaceans; brown crab and common lobster
- For molluscs; winkles

- For wildfowl; unspecified species of duck and goose
- For marine plants/algae; samphire

Seaweed removed from the cooling water intake filters at the Torness nuclear power station or cleared from recreational beaches at Dunbar, North Berwick and Milsey Bay was sent for composting. The use of seaweed as an animal feed was not identified.

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

- 1000 h y⁻¹ for rock
- 430 h y⁻¹ for sand
- 690 h y⁻¹ for sand and stones

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

- 1500 h y⁻¹ for handling fishing gear
- 700 h y⁻¹ for handling sediment

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:

- 940 h y⁻¹ for occupancy in water
- 2300 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:

- 15 kg y⁻¹ for green vegetables
- 26 kg y⁻¹ for other vegetables
- 26 kg y⁻¹ for root vegetables
- 79 kg y⁻¹ for potato
- 41 kg y⁻¹ for domestic fruit
- 20 kg y⁻¹ for cattle meat
- 9.4 kg y⁻¹ for sheep meat
- 6.8 kg y⁻¹ for poultry
- 9.4 kg y⁻¹ for eggs
- 3.4 kg y⁻¹ for wild/free foods
- 1.7 kg y⁻¹ for rabbits/hares

- 4.3 kg y⁻¹ for honey
- 1.8 kg y⁻¹ for wild fungi
- 6.3 kg y⁻¹ for venison

The consumption of groundwater by humans and livestock was identified. One household used spring water as their sole domestic supply and livestock were supplied with spring water for drinking and also had access to burn water. A mineral water company was identified that extracted approximately 10 million litres of water per year from boreholes in the survey area. The water was bottled and was predominantly distributed throughout Scotland.

Control measures were used by the Torness site in order to limit the possibility that contamination is transferred off-site by wildlife. A pest controller regulated the numbers of rabbits and pigeons on the site by culling when necessary. A resident peregrine falcon discouraged pigeons from roosting on the site buildings.

The direct radiation survey area

The highest occupancy rates by members of the public within 1 km of the centre of the Torness site were:

- 8600 h y⁻¹ for the indoor occupancy rate (for a resident)
- 2200 h y⁻¹ for the outdoor occupancy rate (for a resident who also worked in the area)
- 8700 h y⁻¹ for the total occupancy rate (for the same resident with the highest indoor 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 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
Cod	White Sands
Cod	Pipeline
Bass	Pipeline
Crabs	Torness
Lobsters	Torness
<i>Nephrops</i>	Dunbar
Winkles	Pipeline
<i>Fucus vesiculosus</i>	Pipeline
<i>Fucus vesiculosus</i>	Thorntonloch
<i>Fucus vesiculosus</i>	White Sands
<i>Fucus vesiculosus</i>	Pease Bay
<i>Fucus vesiculosus</i>	Coldingham Bay
Sediment	Dunbar
Sediment	Barns Ness
Sediment	Thorntonloch
Sediment	Heckies Hole
Sediment	Belhaven Bay
Salt marsh	Coldingham Bay
Seawater	Pipeline

Gamma dose rate measurements over intertidal sediments

Substrate	Location
Sediment	Heckies Hole
Sediment	West Meikle Pinkerton
Mud, sand and stones	Barns Ness
Salt marsh	Belhaven Bay
Mud	St Abb's Head
Sand	Dunbar Inner Harbour
Sand	Skateraw
Sand	Thorntonloch
Sand	Pease Bay

Beta dose rate measurements on fishing gear

Fishing gear	Location
Lobster pots	Torness
Nets	Dunbar Harbour

Terrestrial monitoring

- Milk
- Beetroot
- Blackberries
- Cauliflower
- Crab apples
- Onions
- Plums
- Potatoes
- Pumpkin
- Rabbit
- Rhubarb
- Rosehips
- Rowan berries
- Wood pigeon
- Grass
- Soil
- Freshwater from Hopes Reservoir, Thorter's Reservoir, Whiteadder and Thorntonloch Burn.
- Radioactivity in air near Torness; measurements taken at Innerwick and Cockburnspath.

10.2 Suggestions for changes

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

- Within the 'other vegetable' food group the sample of pumpkin currently monitored could be replaced by a sample of broad beans, since pumpkins were not being consumed and broad beans made the highest percentage contribution to this food group.
- Within the 'wild/free' food group the samples of crab apples, rosehips and rowan berries could be replaced with a sample of elderberries since no consumption of crab apples, rosehips or rowan berries was identified during the survey and elderberries were one of the most highly consumed foods in this food group after blackberries, which are currently monitored.
- Within the 'poultry' food group the sample of wood pigeon currently monitored could be replaced with a sample of pheasant, since wood pigeons were not being consumed and pheasant made the highest percentage contribution to this food group.
- The sample of milk currently monitored could be stopped since no consumption of locally produced milk was identified during the survey.

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

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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, widgeon

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 Torness aquatic survey area (kg y⁻¹)

Observation number	Bass	Cod	Common ling	Mackerel	Pollack	Saithe	Sea trout	Total
384	13.3	29.9	-	8.6	4.2	-	-	56.1
385	13.3	29.9	-	8.6	4.2	-	-	56.1
386	13.3	29.9	-	8.6	4.2	-	-	56.1
387	13.3	29.9	-	8.6	4.2	-	-	56.1
400	35.8	-	-	-	-	-	-	35.8
438	-	13.6	3.6	9.1	9.1	-	-	35.4
439	-	13.6	3.6	9.1	9.1	-	-	35.4
132	-	10.6	-	18.4	-	-	-	29.0
133	-	10.6	-	18.4	-	-	-	29.0
134	-	10.6	-	18.4	-	-	-	29.0
5	8.7	8.7	-	8.7	-	-	-	26.0
6	8.7	8.7	-	8.7	-	-	-	26.0
289	7.7	7.7	-	7.7	-	-	-	23.1
290	7.7	7.7	-	7.7	-	-	-	23.1
217	3.6	11.0	-	5.7	-	-	-	20.3
325	-	17.7	-	2.5	-	-	-	20.2
326	-	17.7	-	2.5	-	-	-	20.2
327	-	17.7	-	2.5	-	-	-	20.2
380	-	17.7	-	-	-	-	-	17.7
381	-	17.7	-	-	-	-	-	17.7
382	-	17.7	-	-	-	-	-	17.7
160	-	12.7	-	3.9	-	-	-	16.7
161	-	12.7	-	3.9	-	-	-	16.7
328	-	-	-	-	15.0	-	0.9	15.9
329	-	-	-	-	15.0	-	0.9	15.9
330	-	-	-	-	15.0	-	-	15.0
331	-	-	-	-	15.0	-	-	15.0
332	-	-	-	-	15.0	-	-	15.0
363	-	-	-	10.9	3.6	-	-	14.5
364	-	-	-	10.9	3.6	-	-	14.5
365	-	-	-	10.9	3.6	-	-	14.5
366	-	-	-	10.9	3.6	-	-	14.5
373	2.1	2.0	-	8.3	1.9	-	-	14.3
374	2.1	2.0	-	8.3	1.9	-	-	14.3
277	1.3	6.2	-	2.0	-	2.2	-	11.7
278	1.3	6.2	-	2.0	-	2.2	-	11.7
189	3.1	2.0	-	6.0	-	-	-	11.0
190	3.1	2.0	-	6.0	-	-	-	11.0
411	-	8.2	-	2.3	-	-	-	10.4
412	-	8.2	-	2.3	-	-	-	10.4
414	-	3.7	0.5	2.4	3.5	-	-	10.2
415	-	3.7	0.5	2.4	3.5	-	-	10.2
416	-	3.7	0.5	2.4	3.5	-	-	10.2
292	3.4	3.4	-	3.4	-	-	-	10.2
214	-	3.5	-	-	-	6.6	-	10.1
99	-	5.6	-	3.9	-	-	-	9.5
404	1.3	2.4	-	3.3	2.2	-	-	9.2
405	1.3	2.4	-	3.3	2.2	-	-	9.2
383	-	9.1	-	-	-	-	-	9.1
401	9.0	-	-	-	-	-	-	9.0
402	9.0	-	-	-	-	-	-	9.0
109	5.9	-	-	-	-	-	-	5.9
110	5.9	-	-	-	-	-	-	5.9
116	5.4	-	-	-	-	-	-	5.4
117	5.4	-	-	-	-	-	-	5.4

Table 3. Adults' consumption rates of fish from the Torness aquatic survey area (kg y⁻¹)

Observation number	Bass	Cod	Common ling	Mackerel	Pollack	Saithe	Sea trout	Total
392	-	2.7	-	2.7	-	-	-	5.4
393	-	2.7	-	2.7	-	-	-	5.4
394	-	2.7	-	2.7	-	-	-	5.4
215	-	2.0	-	3.4	-	-	-	5.4
216	-	2.0	-	3.4	-	-	-	5.4
3	-	3.6	-	1.1	-	-	-	4.7
4	-	3.6	-	1.1	-	-	-	4.7
301	-	-	-	4.6	-	-	-	4.6
302	-	-	-	4.6	-	-	-	4.6
303	-	-	-	4.6	-	-	-	4.6
436	-	2.2	-	2.1	-	-	-	4.3
437	-	2.2	-	2.1	-	-	-	4.3
418	-	4.1	-	-	-	-	-	4.1
420	-	4.1	-	-	-	-	-	4.1
98	-	-	-	3.9	-	-	-	3.9
291	1.1	1.1	-	1.1	-	-	-	3.4
444	-	-	-	2.7	-	-	-	2.7
446	-	-	-	2.7	-	-	-	2.7
43	-	-	-	0.8	0.8	0.8	-	2.4
45	-	-	-	0.8	0.8	0.8	-	2.4
46	-	-	-	0.8	0.8	0.8	-	2.4
47	-	-	-	0.8	0.8	0.8	-	2.4
48	-	-	-	0.8	0.8	0.8	-	2.4
1	-	-	-	2.2	-	-	-	2.2
361	-	-	-	2.0	-	-	-	2.0
447	-	-	-	1.7	-	-	-	1.7
451	-	-	-	1.7	-	-	-	1.7
407	-	-	-	1.0	-	-	-	1.0

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish based on the 18 high-rate adult consumers is 33.2 kg y⁻¹

The observed 97.5th percentile rate based on 83 observations is 56.1 kg y⁻¹

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

Observation number	Brown crab	Common lobster	Total
409	7.1	11.2	18.3
380	4.9	10.3	15.3
381	4.9	10.3	15.3
291	9.9	2.6	12.5
292	9.9	2.6	12.5
418	5.4	2.8	8.2
420	5.4	2.8	8.2
392	6.9	-	6.9
393	6.9	-	6.9
394	6.9	-	6.9
50	3.2	3.2	6.4
51	3.2	3.2	6.4
52	3.2	3.2	6.4
440	-	5.6	5.6
441	-	5.6	5.6
368	4.1	1.3	5.4
370	4.1	1.3	5.4
439	1.6	2.6	4.2
377	2.7	0.6	3.4
378	2.7	0.6	3.4
325	1.6	1.6	3.2
326	1.6	1.6	3.2
327	1.6	1.6	3.2
369	1.8	1.1	3.0
371	1.8	1.1	3.0
289	1.6	1.3	2.9
290	1.6	1.3	2.9
132	0.3	2.2	2.5
133	0.3	2.2	2.5
134	0.3	2.2	2.5
361	2.0	-	2.0
129	0.7	1.1	1.9
3	-	1.7	1.7
274	-	1.3	1.3
407	0.9	-	0.9
425	-	0.9	0.9
160	0.3	0.2	0.5
161	0.3	0.2	0.5
442	0.5	-	0.5
443	-	0.4	0.4
43	-	0.2	0.2
45	-	0.2	0.2
46	-	0.2	0.2
47	-	0.2	0.2
48	-	0.2	0.2

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of crustaceans based on the 13 high-rate adult consumers is 10.0 kg y⁻¹

The observed 97.5th percentile rate based on 45 observations is 15.3 kg y⁻¹

Table 5. Adults' consumption rates of molluscs from the Torness aquatic survey area (kg y⁻¹)

Observation number	Mussel	Winkle	Total
294	-	11.6	11.6
291	-	2.1	2.1
292	-	2.1	2.1
289	-	0.6	0.6
356	-	0.6	0.6
273	0.5	-	0.5
274	0.5	-	0.5
290	-	0.2	0.2

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of molluscs based on the only adult consumer is 11.6 kg y⁻¹

The observed 97.5th percentile rate based on 8 observations is 9.9 kg y⁻¹

Table 6. Adults' consumption rates of wildfowl from the Torness aquatic survey area (kg y⁻¹)

Observation number	Duck (unspecified species)	Goose (unspecified species)	Total
328	0.3	1.3	1.6
329	0.3	1.3	1.6
330	0.3	1.3	1.6
331	0.3	1.3	1.6
332	0.3	1.3	1.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of wildfowl based on the 5 high-rate adult consumers is 1.6 kg y⁻¹

The observed 97.5th percentile rate based on 5 observations is 1.6 kg y⁻¹

Table 7. Adults' consumption rates of marine plants/algae from the Torness aquatic survey area (kg y⁻¹)

Observation number	Samphire
360	0.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of marine plants/algae based on the only adult consumer is 0.5 kg y⁻¹

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

Table 8. Children's and infants' consumption rates of fish from the Torness aquatic survey area (kg y⁻¹)

Child age group (6 - 15 years old)

Observation number	Age	Bass	Cod	Common ling	Mackerel	Pollack	Saithe	Total
417	13	-	3.7	0.5	2.4	3.5	-	10.2
162	6	-	6.4	-	2.0	-	-	8.3
395	12	-	2.7	-	2.7	-	-	5.4
413	8	-	4.1	-	1.1	-	-	5.2
375	10	1.1	1.0	-	-	0.9	-	3.0
376	8	1.1	1.0	-	-	0.9	-	3.0
44	13	-	-	-	0.8	0.8	0.8	2.4
49	13	-	-	-	0.8	0.8	0.8	2.4
448	15	-	-	-	1.7	-	-	1.7
449	13	-	-	-	1.7	-	-	1.7
450	11	-	-	-	1.7	-	-	1.7

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 7.3 kg y⁻¹

The observed 97.5th percentile rate based on 11 observations is 9.7 kg y⁻¹

Infant age group (0 - 5 years old)

Observation number	Age	Bass	Cod	Common ling	Mackerel	Pollack	Saithe	Total
406	4	0.6	1.2	-	1.7	1.1	-	4.6
367	5	-	-	-	2.7	1.8	-	4.5
163	2	-	3.2	-	1.0	-	-	4.2
191	2	1.0	0.7	-	2.0	-	-	3.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish for the infant age group based upon the 4 high-rate consumer is 4.2 kg y⁻¹

The observed 97.5th percentile rate based on 4 observations is 4.6 kg y⁻¹

Table 9. Children's and infants' consumption rates of crustaceans from the Torness aquatic survey area (kg y⁻¹)

Child age group (6 - 15 years old)

Observation number	Age	Brown crab	Common lobster	Total
395	12	6.9	-	6.9
162	6	0.3	0.2	0.5
44	13	-	0.2	0.2
49	13	-	0.2	0.2

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of crustaceans for the child age group based upon the only high-rate consumer is 6.9 kg y⁻¹

The observed 97.5th percentile rate based on 4 observations is 6.4 kg y⁻¹

Infant age group (0 - 5 years old)

Observation number	Age	Brown crab	Common lobster	Total
372	3	0.5	0.3	0.7
163	2	0.3	0.2	0.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of crustaceans for the infant 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 0.7 kg y⁻¹

Table 10. Adults' intertidal occupancy rates in the Torness aquatic survey area (h y⁻¹)

Observation number	Location	Activity	Rock	Sand	Sand and stones
217	St Abb's Head, Eyemouth and near Torness outfall	Angling	1025	-	-
	Skateraw Harbour	Collecting mussels for angling bait		-	-
	Skateraw Harbour	Bait digging	-	65	-
373	Dunbar and near Torness outfall	Angling	312	-	-
264	Cove and near Torness outfall	Angling	240	-	-
	North Berwick	Walking	-	48	-
268	Cove and near Torness outfall	Angling	240	-	-
293	Pease Bay and Dunbar	Angling	224	-	-
403	Near Torness outfall	Angling	208	-	-
269	Near Torness outfall	Angling	144	-	-
270	Near Torness outfall	Angling	144	-	-
400	Near Torness outfall	Angling	144	-	-
401	Near Torness outfall	Angling	144	-	-
204	Near Torness outfall	Angling	120	-	-
215	St Abbs	Angling	108	-	-
216	St Abbs	Angling	108	-	-
6	Near Torness outfall	Angling	78	-	-
	Thorntonloch	Angling	-	78	-
116	Near Torness outfall	Angling	70	-	-
118	Near Torness outfall	Angling	70	-	-
185	Near Torness outfall	Angling	48	-	-
	Skateraw Harbour	Playing and dog walking	-	80	-
205	Near Torness outfall	Angling	40	-	-
206	Near Torness outfall	Angling	40	-	-
207	Near Torness outfall	Angling	40	-	-
208	Near Torness outfall	Angling	40	-	-
447	East of Milsey Bay	Angling	40	-	-
436	North Berwick	Angling	24	-	-
278	Near Torness outfall	Angling	7	-	-
	Thorntonloch	Dog walking	-	24	-
356	White Sands	Collecting winkles	5	-	-
	Ravensheugh Sands and White Sands	Playing and walking	-	392	-
424	North Berwick	Dog walking	-	912	-
306	North Berwick to Thorntonloch	Working on the shore	-	709	-

Table 10. Adults' intertidal occupancy rates in the Torness aquatic survey area (h y⁻¹)

Observation number	Location	Activity	Rock	Sand	Sand and stones
328	Pease Bay	Dog walking	-	523	-
83	Belhaven Bay	Jogging	-	487	-
90	Milsey Bay	Dog walking	-	365	-
91	Milsey Bay	Dog walking	-	365	-
315	Dunbar	Dog walking	-	365	-
323	Eyemouth	Dog walking	-	365	-
54	Coldingham Bay	Sitting on the beach	-	364	-
55	Coldingham Bay	Sitting on the beach	-	364	-
56	Coldingham Bay	Sitting on the beach	-	364	-
57	Coldingham Bay	Sitting on the beach	-	364	-
58	Coldingham Bay	Sitting on the beach	-	364	-
59	Coldingham Bay	Sitting on the beach	-	364	-
324	Eyemouth	Dog walking	-	350	-
222	Dunbar and White Sands	Dog walking	-	334	-
223	Dunbar and White Sands	Dog walking	-	334	-
333	Pease Bay	Dog walking and sunbathing	-	280	-
334	Pease Bay	Dog walking and sunbathing	-	280	-
335	Pease Bay	Dog walking and sunbathing	-	280	-
336	Pease Bay	Dog walking and sunbathing	-	280	-
322	Eyemouth	Dog walking	-	268	-
465	Dunbar, North Berwick and Milsey Bay	Beach cleaning	-	264	-
316	Dunbar	Dog walking	-	244	-
321	Eyemouth	Dog walking	-	234	-
456	Belhaven Bay	Water sports preparation	-	234	-
457	Belhaven Bay	Water sports preparation	-	234	-
458	Belhaven Bay	Water sports preparation	-	234	-
459	Belhaven Bay	Water sports preparation	-	234	-
343	Coldingham Bay	Lifeguard duties	-	220	-
344	Coldingham Bay	Lifeguard duties	-	220	-
345	Coldingham Bay	Lifeguard duties	-	220	-
346	Coldingham Bay	Lifeguard duties	-	220	-
23	Pease Bay	Walking	-	210	-
109	Thorntonloch	Walking and angling	-	200	-
422	North Berwick	Dog walking	-	195	-
423	North Berwick	Dog walking	-	182	-

Table 10. Adults' intertidal occupancy rates in the Torness aquatic survey area (h y⁻¹)

Observation number	Location	Activity	Rock	Sand	Sand and stones
168	Ravensheugh Sands	Horse riding	-	169	-
	North Berwick	Walking	-		-
30	Pease Bay	Dog walking	-	159	-
31	Pease Bay	Dog walking	-	159	-
32	Pease Bay	Dog walking	-	159	-
74	Belhaven Bay	Dog walking	-	156	-
271	Thorntonloch and White Sands	Dog walking	-	156	-
272	Thorntonloch and White Sands	Dog walking	-	156	-
360	White Sands and Belhaven Bay	Dog walking (including collecting samphire while dog walking at Belhaven Bay)	-	155	-
147	Skateraw, White Sands and Thorntonloch	Walking	-	148	-
	Belhaven Bay	Jogging			
218	Skateraw, Barns Ness and White Sands	Walking	-	140	-
219	Skateraw, Barns Ness and White Sands	Walking	-	140	-
72	Belhaven Bay	Dog walking	-	137	-
	Barns Ness	Dog walking	-	-	137
73	Belhaven Bay	Dog walking	-	137	-
	Barns Ness	Dog walking	-	-	137
398	Thorntonloch	Dog walking	-	134	-
399	Thorntonloch	Dog walking	-	134	-
257	Thorntonloch	Playing	-	132	-
258	Thorntonloch	Playing	-	132	-
260	Thorntonloch	Playing	-	132	-
348	Milsey Bay	Playing	-	128	-
259	Thorntonloch	Playing	-	126	-
25	Pease Bay	Walking	-	122	-
26	Pease Bay	Walking	-	122	-
460	Belhaven Bay	Water sports preparation	-	117	-
461	Belhaven Bay	Water sports preparation	-	117	-
462	Belhaven Bay	Water sports preparation	-	117	-
463	Belhaven Bay	Water sports preparation	-	117	-
464	Belhaven Bay	Water sports preparation	-	117	-
189	Skateraw Harbour	Playing	-	114	-
190	Skateraw Harbour	Playing	-	114	-
425	Seacliff	Playing	-	112	-

Table 10. Adults' intertidal occupancy rates in the Torness aquatic survey area (h y⁻¹)

Observation number	Location	Activity	Rock	Sand	Sand and stones
426	Seacliff	Playing	-	112	-
339	Belhaven Bay, Thorntonloch, Pease Bay and Coldingham Bay	Water sports preparation	-	100	-
340	Belhaven Bay, Thorntonloch, Pease Bay and Coldingham Bay	Water sports preparation	-	100	-
357	Ravensheugh Sands and White Sands	Playing	-	100	-
71	Eyemouth	Dog walking	-	91	-
186	Skateraw Harbour	Playing and dog walking	-	80	-
307	North Berwick to Thorntonloch	Working on the shore	-	79	-
220	White Sands	Playing	-	78	-
195	White Sands	Playing	-	75	-
196	White Sands	Playing	-	75	-
352	Bathan's Strand	Playing	-	75	-
353	Bathan's Strand	Playing	-	75	-
183	Skateraw Harbour to Barns Ness	Dog walking	-	70	-
347	Milsey Bay	Playing	-	64	-
341	Belhaven Bay, Thorntonloch, Pease Bay and Coldingham Bay	Water sports preparation	-	62	-
200	White Sands	Playing and dog walking	-	60	-
201	White Sands	Playing and dog walking	-	60	-
81	Belhaven Bay	Walking	-	54	-
95	Bathan's Strand	Sitting on the beach	-	54	-
150	Thorntonloch	Dog walking	-	52	-
151	Thorntonloch	Dog walking	-	52	-
337	Belhaven Bay, Thorntonloch, Pease Bay and Coldingham Bay	Water sports preparation	-	50	-
338	Belhaven Bay, Thorntonloch, Pease Bay and Coldingham Bay	Water sports preparation	-	50	-
265	North Berwick	Walking	-	48	-
99	Thorntonloch	Angling	-	42	-
301	Thorntonloch	Dog walking	-	42	-
302	Thorntonloch	Dog walking	-	42	-
303	Thorntonloch	Dog walking	-	42	-
33	Pease Bay	Sitting on the beach	-	28	-
34	Pease Bay	Sitting on the beach	-	28	-

Table 10. Adults' intertidal occupancy rates in the Torness aquatic survey area (h y⁻¹)

Observation number	Location	Activity	Rock	Sand	Sand and stones
37	Pease Bay	Sitting on the beach	-	28	-
38	Pease Bay	Sitting on the beach	-	28	-
87	Milsey Bay	Sitting on the beach	-	27	-
88	Milsey Bay	Sitting on the beach	-	27	-
92	Bathan's Strand	Sitting on the beach	-	25	-
93	Bathan's Strand	Sunbathing	-	25	-
5	Thorntonloch	Dog walking	-	24	-
103	Thorntonloch	Walking	-	24	-
277	Thorntonloch	Dog walking	-	24	-
105	Thorntonloch	Walking	-	18	-
106	Thorntonloch	Walking	-	18	-
110	Thorntonloch	Walking	-	18	-
148	Skateraw Harbour, White Sands and Thorntonloch	Walking	-	18	-
169	North Berwick	Walking	-	18	-
308	North Berwick to Thorntonloch	Working on the shore	-	16	-
192	Barns Ness	Metal detecting	-	15	-
193	Barns Ness	Metal detecting	-	15	-
194	Barns Ness	Metal detecting	-	15	-
170	Seacliff	Sitting on the beach	-	12	-
171	Seacliff	Sitting on the beach	-	12	-
172	Seacliff	Sitting on the beach	-	12	-
75	Belhaven Bay	Walking	-	9	-
77	Belhaven Bay	Horse riding	-	9	-
18	Thorntonloch	Dog walking	-	8	-
	Ravensheugh Sands	Collecting mussels	-	6	-
273	Dunbar, White Sands, Barns Ness and Skateraw Harbour	Collecting winkles	-	-	513
	Ravensheugh Sands	Collecting mussels	-	6	-
274	Dunbar, White Sands, Barns Ness and Skateraw Harbour	Collecting winkles	-	-	285
379	Dunbar	Bait digging	-	2	-
129	Skateraw Harbour, Barns Ness, White Sands, Dunbar and North Berwick	Collecting winkles	-	-	1092
294	North Berwick and Dunbar	Collecting winkles	-	-	702

Table 10. Adults' intertidal occupancy rates in the Torness aquatic survey area (h y^{-1})

Observation number	Location	Activity	Rock	Sand	Sand and stones
309	North Berwick, Dunbar, White Sands, Barns Ness and Skateraw Harbour	Collecting winkles	-	-	672
310	North Berwick, Dunbar, White Sands, Barns Ness and Skateraw Harbour	Collecting winkles	-	-	672
275	Dunbar, White Sands, Barns Ness and Skateraw Harbour	Collecting winkles	-	-	513
160	Dunbar	Walking	-	-	216
	Dunbar and White Sands	Bait digging	-	-	
161	Dunbar	Walking	-	-	182
295	Barns Ness to White Sands	Fossil hunting	-	-	18
298	Barns Ness to White Sands	Fossil hunting	-	-	18

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over rock based on 1 observation is 1025 h y^{-1}

The observed 97.5th percentile rate based on 25 observations for rock is 597 h y^{-1}

The mean intertidal occupancy rate over sand based on 18 high-rate observations is 427 h y^{-1}

The observed 97.5th percentile rate based on 130 observations for sand is 466 h y^{-1}

The mean intertidal occupancy rate over sand and stones based on 6 high-rate observations is 694 h y^{-1}

The observed 97.5th percentile rate based on 13 observations for sand and stones is 975 h y^{-1}

Table 11. Children's and infants' intertidal occupancy rates in the Torness aquatic survey area (h y⁻¹)

Child age group (6 - 15 years old)

Observation number	Age (years)	Location	Activity	Rock	Sand	Sand and stones
448	15	East of Milsey Bay	Angling	40	-	-
449	13	East of Milsey Bay	Angling	40	-	-
450	11	East of Milsey Bay	Angling	40	-	-
24	8	Pease Bay	Walking	-	210	-
60	8	Coldingham Bay	Playing	-	208	-
61	8	Coldingham Bay	Playing	-	208	-
65	6	Coldingham Bay	Playing	-	208	-
66	7	Coldingham Bay	Playing	-	208	-
67	9	Coldingham Bay	Playing	-	208	-
68	10	Coldingham Bay	Playing	-	208	-
69	11	Coldingham Bay	Playing	-	208	-
70	12	Coldingham Bay	Playing	-	208	-
262	10	Thorntonloch	Playing	-	132	-
263	9	Thorntonloch	Playing	-	132	-
261	7	Thorntonloch	Playing	-	126	-
358	10	Ravensheugh Sands and White Sands	Playing	-	100	-
349	8	Milsey Bay	Playing	-	96	-
350	6	Milsey Bay	Playing	-	96	-
427	6	Seacliff	Playing	-	84	-
428	8	Seacliff	Playing	-	84	-
221	6	White Sands	Playing	-	78	-
197	13	White Sands	Playing	-	75	-
198	6	White Sands	Playing	-	75	-
199	8	White Sands	Playing	-	75	-
184	8	Skateraw Harbour to Barns Ness	Dog walking	-	70	-
354	10	Bathan's Strand	Playing	-	65	-
203	6	White Sands	Dog walking and playing	-	60	-
96	9	Bathan's Strand	Playing	-	54	-
97	9	Bathan's Strand	Playing	-	54	-
266	10	North Berwick	Walking	-	48	-
267	7	North Berwick	Walking	-	48	-
35	6	Pease Bay	Playing	-	28	-
39	11	Pease Bay	Playing	-	28	-

Table 11. Children's and infants' intertidal occupancy rates in the Torness aquatic survey area (h y^{-1})

Child age group (6 - 15 years old)

Observation number	Age (years)	Location	Activity	Rock	Sand	Sand and stones
40	10	Pease Bay	Playing	-	28	-
41	8	Pease Bay	Playing	-	28	-
42	7	Pease Bay	Playing	-	28	-
78	15	Belhaven Bay	Horse riding	-	9	-
79	15	Belhaven Bay	Horse riding	-	9	-
162	6	Dunbar	Walking	-	-	130
296	6	Barns Ness to White Sands	Fossil hunting	-	-	18
297	8	Barns Ness to White Sands	Fossil hunting	-	-	18
299	10	Barns Ness to White Sands	Fossil hunting	-	-	18
300	7	Barns Ness to White Sands	Fossil hunting	-	-	18

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over rock based on 3 observations is 40 h y^{-1}

The observed 97.5th percentile rate based on 3 observations for rock is 40 h y^{-1}

The mean intertidal occupancy rate over sand based on 22 high-rate observations is 141 h y^{-1}

The observed 97.5th percentile rate based on 35 observations for sand is 208 h y^{-1}

The mean intertidal occupancy rate over sand and stones based on 1 high-rate observation is 130 h y^{-1}

The observed 97.5th percentile rate based on 5 observations for sand and stones is 119 h y^{-1}

Table 11. Children's and infants' intertidal occupancy rates in the Torness aquatic survey area (h y^{-1})

Infant age group (0 - 5 years old)

Observation number	Age (years)	Location	Activity	Rock	Sand	Sand and stones
62	3	Coldingham Bay	Playing	-	208	-
63	4	Coldingham Bay	Playing	-	208	-
64	5	Coldingham Bay	Playing	-	208	-
351	3	Milsey Bay	Playing	-	128	-
191	2	Skateraw Harbour	Playing	-	114	-
359	5	Ravensheugh Sands and White Sands	Playing	-	100	-
187	5	Skateraw Harbour	Playing and dog walking	-	80	-
188	4	Skateraw Harbour	Playing and dog walking	-	80	-
27	2	Pease Bay	Playing	-	66	-
355	4	Bathan's Strand	Playing	-	65	-
202	4	White Sands	Dog walking and playing	-	60	-
82	2	Belhaven Bay	Walking	-	54	-
28	5	Pease Bay	Playing	-	38	-
29	1	Pease Bay	Playing	-	38	-
36	3	Pease Bay	Playing	-	28	-
89	0.5	Milsey Bay	Sitting on the beach	-	27	-
94	2	Bathan's Strand	Playing	-	25	-
76	2	Belhaven Bay	Walking	-	9	-
163	2	Dunbar	Walking	-	-	151

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over sand based on 8 high-rate observations is 141 h y^{-1}

The observed 97.5th percentile rate based on 18 observations for sand is 208 h y^{-1}

The mean intertidal occupancy rate over sand and stones based on 1 high-rate observation is 151 h y^{-1}

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

Table 12. Gamma dose rate measurements over intertidal substrates in the Torness aquatic survey area ($\mu\text{Gy h}^{-1}$)

Location	NGR	Substrate	Gamma dose rate at 1 metre ^a
North Berwick	NT 551 854	Sand	0.062
Milsey Bay	NT 563 853	Sand	0.059
Seacliff	NT 605 845	Sand	0.057
Bathan's Strand	NT 633 812	Sand	0.052
Bellhaven Bay	NT 660 789	Sand	0.057
Dunbar	NT 681 789	Sand	0.057
White Sands	NT 711 773	Sand	0.045
Skateraw Harbour	NT 737 755	Sand	0.051
Thorntonloch	NT 752 745	Sand	0.045
Pease Bay	NT 793 710	Sand	0.060
Coldingham Bay	NT 916 665	Sand	0.058
Eyemouth	NT 943 644	Sand	0.071

Notes

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

Table 13. Adults' handling rates of fishing gear and sediment in the Torness aquatic survey area (h y⁻¹)

Observation number	Location	Activity	Fishing gear	Sediment
392	Off St Abbs	Handling creels	2250	-
393	Off St Abbs	Handling creels	2250	-
325	Off Cove	Handling creels	2110	-
442	Off North Berwick	Handling creels	1872	-
418	Dunbar to Torness	Handling creels	1560	-
419	Dunbar to Torness	Handling creels	1560	-
444	Off North Berwick	Handling creels	1404	-
380	Dunbar to Skateraw Harbour	Handling creels	1400	-
440	Off North Berwick	Handling creels	1352	-
441	Off North Berwick	Handling creels	1352	-
368	Dunbar to Torness	Handling creels	1200	-
369	Dunbar to Torness	Handling creels	1200	-
407	Off Dunbar	Handling creels	1200	-
408	Off Dunbar	Handling creels	1200	-
409	Off Dunbar	Handling creels	1170	-
361	Pease Bay to Eyemouth	Handling creels	800	-
362	Pease Bay to Eyemouth	Handling creels	800	-
50	Off St Abbs	Handling creels	720	-
53	Off St Abbs	Handling creels	720	-
445	Off North Berwick	Handling creels	702	-
396	Off St Abbs	Handling creels	670	-
397	Off St Abbs	Handling creels	670	-
377	Off Dunbar	Handling creels	364	-
410	Off Dunbar	Handling creels	230	-
132	Off Dunbar	Handling creels	132	-
438	Off North Berwick	Handling creels	30	-
3	Off Thorntonloch	Handling creels	12	-
129	North Berwick, Dunbar, White Sands, Barns Ness and Skateraw Harbour	Collecting winkles	-	1092
294	North Berwick and Dunbar	Collecting winkles	-	702
309	North Berwick, Dunbar, White Sands, Barns Ness and Skateraw Harbour	Collecting winkles	-	672
310	North Berwick, Dunbar, White Sands, Barns Ness and Skateraw Harbour	Collecting winkles	-	672
273	Dunbar, White Sands, Barns Ness and Skateraw Harbour	Collecting winkles (including a small amount of time collecting mussels at Ravensheugh Sands)	-	519
275	Dunbar, White Sands, Barns Ness and Skateraw Harbour	Collecting winkles	-	513
274	Dunbar, White Sands, Barns Ness and Skateraw Harbour	Collecting winkles	-	291
	Ravensheugh Sands	Collecting mussels	-	
217	Skateraw Harbour	Bait digging and collecting mussels	-	130
160	Dunbar and White Sands	Bait digging	-	34
356	White Sands	Collecting winkles	-	5
379	Dunbar	Bait digging	-	2

Notes

Emboldened observations are the high-rate individuals

The mean fishing gear handling rate based on 17 high-rate observations is 1452 h y⁻¹

The observed 97.5th percentile rate based on 27 observations for fishing gear is 2250 h y⁻¹

The mean sediment handling rate based on 6 high-rate observations is 695 h y⁻¹

The observed 97.5th percentile rate based on 11 observations for sediment is 995 h y⁻¹

Table 14. Adults' occupancy rates in and on water in the Torness aquatic survey area (h y⁻¹)

Observation number	Location	Activity	In water	On water
456	Belhaven Bay	Surfing	936	-
457	Belhaven Bay	Surfing	936	-
458	Belhaven Bay	Surfing	936	-
459	Belhaven Bay	Surfing	936	-
339	Belhaven Bay, Thorntonloch, Pease Bay and Coldingham Bay	Surfing	600	-
340	Belhaven Bay, Thorntonloch, Pease Bay and Coldingham Bay	Surfing	600	-
460	Belhaven Bay	Surfing	468	-
461	Belhaven Bay	Surfing	468	-
462	Belhaven Bay	Surfing	468	-
463	Belhaven Bay	Surfing	468	-
464	Belhaven Bay	Surfing	468	-
341	Belhaven Bay, Thorntonloch, Pease Bay and Coldingham Bay	Surfing	400	-
318	St Abbs and off Eyemouth	Sub-aqua diving	375	-
		On dive boat	-	750
337	Belhaven Bay, Thorntonloch, Pease Bay and Coldingham Bay	Surfing	300	-
338	Belhaven Bay, Thorntonloch, Pease Bay and Coldingham Bay	Surfing	300	-
83	Belhaven Bay	Surfing	243	-
317	St Abbs and off Eyemouth	Sub-aqua diving	112	-
		On dive boat	-	225
343	Coldingham Bay	Lifeguard duties	110	-
344	Coldingham Bay	Lifeguard duties	110	-
345	Coldingham Bay	Lifeguard duties	110	-
346	Coldingham Bay	Lifeguard duties	110	-
85	Belhaven Bay	Surfing	95	-
86	Belhaven Bay	Surfing	95	-
342	Eyemouth to North Berwick	Kayaking	75	-
80	Belhaven Bay	Kayaking	72	-
84	Belhaven Bay	Surfing	70	-
335	Pease Bay	Swimming	40	-
336	Pease Bay	Swimming	40	-
429	Eyemouth to North Berwick	Kayaking	24	-
319	St Abbs and off Eyemouth	Sub-aqua diving	8	-
		On dive boat	-	15
320	St Abbs and off Eyemouth	Sub-aqua diving	8	-
		On dive boat	-	15
37	Pease Bay	Swimming	7	-
38	Pease Bay	Swimming	7	-
93	Bathan's Strand	Swimming	5	-
95	Bathan's Strand	Swimming	5	-
108	Thorntonloch	Swimming	4	-
170	Seacliff	Swimming	3	-
171	Seacliff	Swimming	3	-
172	Seacliff	Swimming	3	-
98	Thorntonloch	Swimming	2	-
	Thorntonloch to Dunbar	Angling	-	42
99	Thorntonloch	Swimming	2	-
	Thorntonloch to Dunbar	Angling	-	42
392	Off St Abbs	Creeling and angling	-	2250
393	Off St Abbs	Creeling and angling	-	2250
325	Off Cove	Creeling	-	2240

Table 14. Adults' occupancy rates in and on water in the Torness aquatic survey area (h y⁻¹)

Observation number	Location	Activity	In water	On water
407	Off Dunbar	Creeling	-	1920
408	Off Dunbar	Creeling	-	1920
442	Off North Berwick	Creeling	-	1755
380	Dunbar to Skateraw Harbour	Creeling and angling	-	1750
444	Off North Berwick	Creeling	-	1404
390	Eyemouth to Dunbar	Charter boat crew	-	1350
391	Eyemouth to Dunbar	Charter boat crew	-	1350
418	Dunbar to Torness	Creeling and angling	-	1350
419	Dunbar to Torness	Creeling and angling	-	1350
409	Off Dunbar	Creeling	-	1274
368	Dunbar to Torness	Creeling	-	1200
369	Dunbar to Torness	Creeling	-	1200
440	Off North Berwick	Creeling	-	1040
441	Off North Berwick	Creeling	-	1040
361	Pease Bay to Eyemouth	Creeling	-	900
362	Pease Bay to Eyemouth	Creeling	-	900
396	St Abbs to Torness	Creeling	-	884
	Off St Abbs	Angling	-	
397	St Abbs to Torness	Creeling	-	884
	Off St Abbs	Angling	-	
438	Off North Berwick	Creeling and charter boat crew	-	840
421	St Abbs and off Eyemouth	Charter boat crew	-	800
289	Between Dunbar and Barns Ness	Angling	-	756
290	Between Dunbar and Barns Ness	Angling	-	756
50	Off St Abbs	Creeling	-	720
53	Off St Abbs	Creeling	-	720
445	Off North Berwick	Creeling	-	702
388	Eyemouth to St Abb's Head	Sightseeing boat crew	-	624
389	Eyemouth to St Abb's Head	Sightseeing boat crew	-	624
439	Off North Berwick	Charter boat crew	-	390
384	North Berwick to Torness	Angling	-	364
377	Off Dunbar	Creeling	-	352
430	Off North Berwick	Sightseeing boat crew	-	350
431	Off North Berwick	Sightseeing boat crew	-	350
432	Off North Berwick	Sightseeing boat crew	-	350
433	Off North Berwick	Sightseeing boat crew	-	350
434	Off North Berwick	Sightseeing boat crew	-	350
435	Off North Berwick	Sightseeing boat crew	-	350
173	North Berwick	Sightseeing boat crew	-	279
174	North Berwick	Sightseeing boat crew	-	279
175	North Berwick	Sightseeing boat crew	-	279
132	Off Dunbar	Creeling and angling	-	264
304	Bass Rock to Torness	RNLI crew	-	261
305	Bass Rock to Torness	RNLI crew	-	261
410	Off Dunbar	Creeling	-	255
224	Bass Rock to Torness	RNLI crew	-	198
225	Bass Rock to Torness	RNLI crew	-	198
226	Bass Rock to Torness	RNLI crew	-	198
227	Bass Rock to Torness	RNLI crew	-	198
228	Bass Rock to Torness	RNLI crew	-	198
229	Bass Rock to Torness	RNLI crew	-	198
230	Bass Rock to Torness	RNLI crew	-	198
231	Bass Rock to Torness	RNLI crew	-	198
232	Bass Rock to Torness	RNLI crew	-	198

Table 14. Adults' occupancy rates in and on water in the Torness aquatic survey area (h y⁻¹)

Observation number	Location	Activity	In water	On water
233	Bass Rock to Torness	RNLI crew	-	198
234	Bass Rock to Torness	RNLI crew	-	198
235	Bass Rock to Torness	RNLI crew	-	198
236	Bass Rock to Torness	RNLI crew	-	198
237	Bass Rock to Torness	RNLI crew	-	198
238	Bass Rock to Torness	RNLI crew	-	198
239	Bass Rock to Torness	RNLI crew	-	198
240	Bass Rock to Torness	RNLI crew	-	198
241	Bass Rock to Torness	RNLI crew	-	198
242	Bass Rock to Torness	RNLI crew	-	198
243	Bass Rock to Torness	RNLI crew	-	198
244	Bass Rock to Torness	RNLI crew	-	198
245	Bass Rock to Torness	RNLI crew	-	198
246	Bass Rock to Torness	RNLI crew	-	198
247	Bass Rock to Torness	RNLI crew	-	198
248	Bass Rock to Torness	RNLI crew	-	198
249	Bass Rock to Torness	RNLI crew	-	198
250	Bass Rock to Torness	RNLI crew	-	198
251	Bass Rock to Torness	RNLI crew	-	198
252	Bass Rock to Torness	RNLI crew	-	198
253	Bass Rock to Torness	RNLI crew	-	198
254	Bass Rock to Torness	RNLI crew	-	198
255	Bass Rock to Torness	RNLI crew	-	198
411	Eyemouth to North Berwick	Angling	-	144
414	Eyemouth to North Berwick	Angling	-	144
363	Off Eyemouth	Angling	-	130
364	Off Eyemouth	Angling	-	130
160	Dunbar and Torness	Angling	-	104
452	Off North Berwick	Sailing	-	80
453	Off North Berwick	Sailing	-	80
404	Off Dunbar	Angling	-	60
6	Off Thorntonloch	Angling	-	52
189	Skateraw to Dunbar	Angling	-	42
256	Between Dunbar and Bass Rock	Sailing	-	40
301	Off Torness	Angling	-	30
303	Off Torness	Angling	-	30
3	Off Thorntonloch	Angling	-	28
278	Off Thorntonloch	Angling	-	25
81	Belhaven Bay	Paddling	-	18
33	Pease Bay	Paddling	-	7
34	Pease Bay	Paddling	-	7
23	Pease Bay	Paddling	-	6
259	Thorntonloch	Paddling	-	6
92	Bathan's Strand	Paddling	-	5
185	Skateraw Harbour	Paddling	-	4
186	Skateraw Harbour	Paddling	-	4
87	Milsey Bay	Paddling	-	3
88	Milsey Bay	Paddling	-	3

Table 15. Children's and infants' occupancy rates in and on water in the Torness aquatic survey area (h y⁻¹)

Observation number	Age	Location	Activity	In water	On water
Child age group (6 - 15 years old)					
162	6	Dunbar	Boogie-boarding	52	-
349	8	Milsey Bay	Swimming	32	-
350	6	Milsey Bay	Swimming	32	-
354	10	Bathan's Strand	Swimming	10	-
39	11	Pease Bay	Swimming	7	-
40	10	Pease Bay	Swimming	7	-
41	8	Pease Bay	Swimming	7	-
42	7	Pease Bay	Swimming	7	-
96	9	Bathan's Strand	Swimming	5	-
97	9	Bathan's Strand	Swimming	5	-
107	9	Thorntonloch	Swimming	4	-
197	13	White Sands	Swimming	4	-
198	6	White Sands	Swimming	4	-
199	8	White Sands	Swimming	4	-
60	8	Coldingham Bay	Paddling	-	156
61	8	Coldingham Bay	Paddling	-	156
65	6	Coldingham Bay	Paddling	-	156
66	7	Coldingham Bay	Paddling	-	156
67	9	Coldingham Bay	Paddling	-	156
68	10	Coldingham Bay	Paddling	-	156
69	11	Coldingham Bay	Paddling	-	156
70	12	Coldingham Bay	Paddling	-	156
454	14	Off North Berwick	Sailing	-	80
455	12	Off North Berwick	Sailing	-	80
427	6	Seacliff	Paddling	-	28
428	8	Seacliff	Paddling	-	28
35	6	Pease Bay	Paddling	-	7
24	8	Pease Bay	Paddling	-	6
261	7	Thorntonloch	Paddling	-	6
Infant age group (0 - 5 years old)					
62	3	Coldingham Bay	Paddling	-	156
63	4	Coldingham Bay	Paddling	-	156
64	5	Coldingham Bay	Paddling	-	156
27	2	Pease Bay	Paddling	-	33
163	2	Dunbar	Paddling	-	31
28	5	Pease Bay	Paddling	-	19
29	1	Pease Bay	Paddling	-	19
82	2	Belhaven Bay	Paddling	-	18
355	4	Bathan's Strand	Paddling	-	10
36	3	Pease Bay	Paddling	-	7
94	2	Bathan's Strand	Paddling	-	5
187	5	Skateraw Harbour	Paddling	-	4
188	4	Skateraw Harbour	Paddling	-	4
89	0.5	Milsey Bay	Paddling	-	3

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

Observation number	Artichoke	Broccoli	Brussel sprout	Cabbage	Cauliflower	Courgette	Cucumber	Herbs	Kale	Lettuce	Marrow	Rocket	Total
5	-	-	11.3	-	-	12.9	2.1	1.0	-	-	-	-	27.3
6	-	-	11.3	-	-	12.9	2.1	1.0	-	-	-	-	27.3
180	5.9	3.0	-	3.3	-	-	3.4	-	1.7	-	-	-	17.3
181	5.9	3.0	-	3.3	-	-	3.4	-	1.7	-	-	-	17.3
135	-	3.7	-	3.0	1.9	5.5	2.6	-	-	-	-	0.3	17.0
279	-	-	-	8.5	-	-	-	-	-	2.1	-	-	10.6
154	-	-	-	3.0	3.7	-	-	0.0	-	-	3.6	-	10.4
155	-	-	-	3.0	3.7	-	-	0.0	-	-	3.6	-	10.4
149	-	-	-	-	-	6.1	2.6	-	-	1.2	-	-	9.8
182	-	-	-	-	-	6.1	2.6	-	-	1.2	-	-	9.8
136	-	1.9	-	1.5	0.9	2.8	2.6	-	-	-	-	0.2	9.8
137	-	1.9	-	1.5	0.9	2.8	2.6	-	-	-	-	0.2	9.8
284	-	-	3.4	5.1	-	-	-	-	-	-	-	-	8.5
285	-	-	3.4	5.1	-	-	-	-	-	-	-	-	8.5
147	-	-	-	-	-	6.1	-	-	-	0.9	-	0.9	7.9
148	-	-	-	-	-	6.1	-	-	-	0.9	-	0.9	7.9
130	-	-	-	-	1.0	-	2.6	-	-	2.0	-	-	5.6
131	-	-	-	-	1.0	-	2.6	-	-	2.0	-	-	5.6
127	-	-	-	-	-	-	1.7	-	-	-	-	-	1.7
128	-	-	-	-	-	-	1.7	-	-	-	-	-	1.7
280	-	-	-	1.2	-	-	-	-	-	0.3	-	-	1.5
281	-	-	-	1.2	-	-	-	-	-	0.3	-	-	1.5
282	-	-	-	1.2	-	-	-	-	-	0.3	-	-	1.5
283	-	-	-	1.2	-	-	-	-	-	0.3	-	-	1.5
143	-	-	1.4	-	-	-	-	-	-	-	-	-	1.4
144	-	-	1.4	-	-	-	-	-	-	-	-	-	1.4
103	-	-	1.4	-	-	-	-	-	-	-	-	-	1.4
104	-	-	1.4	-	-	-	-	-	-	-	-	-	1.4

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of green vegetables based on the 12 high-rate adult consumers is 14.7 kg y⁻¹

The observed 97.5th percentile rate based on 28 observations is 27.3 kg y⁻¹

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

Observation number	Aubergine	Broad bean	Chilli pepper	French bean	Mangetout	Pea	Pepper	Runner bean	Squash	Sweetcorn	Tomato	Total
5	9.2	-	-	-	-	8.5	1.8	-	-	3.1	15.0	37.6
6	9.2	-	-	-	-	8.5	1.8	-	-	3.1	15.0	37.6
135	-	11.4	-	-	-	11.3	1.5	-	-	-	10.8	34.9
154	-	3.4	-	-	-	3.0	-	6.8	-	-	18.0	31.2
155	-	3.4	-	-	-	3.0	-	6.8	-	-	18.0	31.2
149	1.0	-	0.1	-	-	6.8	0.5	2.4	-	-	16.2	27.0
182	1.0	-	0.1	-	-	6.8	0.5	2.4	-	-	16.2	27.0
180	-	2.9	-	1.0	-	-	-	3.7	-	-	19.4	27.0
181	-	2.9	-	1.0	-	-	-	3.7	-	-	19.4	27.0
130	-	-	-	-	-	7.9	1.0	-	-	-	10.8	19.7
131	-	-	-	-	-	7.9	1.0	-	-	-	10.8	19.7
284	-	5.9	-	-	-	13.5	-	-	-	-	-	19.4
285	-	5.9	-	-	-	13.5	-	-	-	-	-	19.4
136	-	5.7	-	-	-	5.6	0.7	-	-	-	5.4	17.4
137	-	5.7	-	-	-	5.6	0.7	-	-	-	5.4	17.4
147	-	-	-	-	1.4	-	-	4.1	6.1	-	-	11.5
148	-	-	-	-	1.4	-	-	4.1	6.1	-	-	11.5
127	-	-	-	-	-	-	-	-	-	-	10.8	10.8
128	-	-	-	-	-	-	-	-	-	-	10.8	10.8
156	-	-	-	-	-	3.0	-	-	-	-	-	3.0
157	-	-	-	-	-	3.0	-	-	-	-	-	3.0

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of other vegetables based on the 15 high-rate adult consumers is 26.2 kg y⁻¹

The observed 97.5th percentile rate based on 21 observations is 37.6 kg y⁻¹

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

Observation number	Beetroot	Carrot	Celery	Leek	Onion	Parsnip	Radish	Shallot	Spring onion	Swede	Turnip	Total
154	6.8	2.0	2.7	6.8	2.7	2.7	-	4.8	-	-	4.1	32.5
155	6.8	2.0	2.7	6.8	2.7	2.7	-	4.8	-	-	4.1	32.5
149	6.8	6.8	-	-	6.5	-	2.7	5.8	3.0	-	-	31.4
182	6.8	6.8	-	-	6.5	-	2.7	5.8	3.0	-	-	31.4
279	-	-	-	6.3	-	-	-	-	-	9.5	7.6	23.4
5	-	-	-	15.0	-	4.5	2.3	-	-	-	-	21.8
6	-	-	-	15.0	-	4.5	2.3	-	-	-	-	21.8
284	-	2.7	-	-	16.2	-	-	-	-	-	-	18.9
285	-	2.7	-	-	16.2	-	-	-	-	-	-	18.9
135	-	2.3	-	-	2.8	-	-	-	-	-	2.7	7.7
180	-	1.2	-	-	-	1.6	-	-	-	3.7	-	6.5
181	-	1.2	-	-	-	1.6	-	-	-	3.7	-	6.5
130	-	0.4	-	-	-	-	-	4.5	-	-	-	4.9
131	-	0.4	-	-	-	-	-	4.5	-	-	-	4.9
156	-	2.0	-	-	2.7	-	-	-	-	-	-	4.7
157	-	2.0	-	-	2.7	-	-	-	-	-	-	4.7
143	-	-	-	-	-	-	-	-	-	4.1	-	4.1
144	-	-	-	-	-	-	-	-	-	4.1	-	4.1
136	-	1.1	-	-	1.4	-	-	-	-	-	1.4	3.9
137	-	1.1	-	-	1.4	-	-	-	-	-	1.4	3.9
16	-	-	-	-	-	-	-	-	-	-	3.6	3.6
17	-	-	-	-	-	-	-	-	-	-	3.6	3.6
280	-	-	-	0.9	-	-	-	-	-	1.4	1.1	3.3
281	-	-	-	0.9	-	-	-	-	-	1.4	1.1	3.3
282	-	-	-	0.9	-	-	-	-	-	1.4	1.1	3.3
283	-	-	-	0.9	-	-	-	-	-	1.4	1.1	3.3
147	1.4	-	-	-	-	-	-	-	-	-	-	1.4
148	1.4	-	-	-	-	-	-	-	-	-	-	1.4

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of root vegetables based on the 9 high-rate adult consumers is 25.8 kg y⁻¹

The observed 97.5th percentile rate based on 28 observations is 32.5 kg y⁻¹

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

Observation number	Potato
16	100.1
17	100.1
18	100.1
19	100.1
20	100.1
21	100.1
22	100.1
284	88.7
285	88.7
7	54.6
8	54.6
9	54.6
10	54.6
11	54.6
12	54.6
13	54.6
176	29.3
177	29.3
178	29.3
179	29.3
127	27.3
128	27.3
279	25.5
135	22.8
149	22.8
182	22.8
103	17.0
104	17.0
136	11.4
137	11.4
286	10.9
287	10.9
288	10.9
130	10.6
131	10.6
5	7.5
6	7.5
154	6.8
155	6.8
156	6.8
157	6.8
180	4.9
181	4.9
280	3.6
281	3.6
282	3.6
283	3.6
98	3.0
99	3.0
143	1.8
144	1.8

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of potato based on the 16 high-rate adult consumers is 78.8 kg y⁻¹

The observed 97.5th percentile rate based on 51 observations is 100.1 kg y⁻¹

Table 20. Adults' consumption rates of domestic fruit from the Torness terrestrial survey area (kg y⁻¹)

Observation number	Apple	Blackberry	Blackcurrant	Cherry	Gooseberry	Loganberry	Melon	Peach	Pear	Plum	Raspberry	Redcurrant	Rhubarb	Strawberry	Whitecurrant	Total
180	18.4	-	-	-	-	-	-	-	12.2	17.0	3.7	-	3.1	2.6	-	57.0
181	18.4	-	-	-	-	-	-	-	12.2	17.0	3.7	-	3.1	2.6	-	57.0
5	7.5	-	-	-	1.5	-	7.8	-	1.5	7.5	4.5	4.5	-	-	-	34.8
6	7.5	-	-	-	1.5	-	7.8	-	1.5	7.5	4.5	4.5	-	-	-	34.8
130	9.1	-	-	-	-	-	-	-	-	11.9	4.1	-	-	6.8	-	31.9
131	9.1	-	-	-	-	-	-	-	-	11.9	4.1	-	-	6.8	-	31.9
149	7.5	-	-	2.7	1.5	-	-	1.5	1.0	1.0	-	1.3	1.0	-	0.3	17.7
182	7.5	-	-	2.7	1.5	-	-	1.5	1.0	1.0	-	1.3	1.0	-	0.3	17.7
143	1.4	0.2	-	-	2.0	-	-	-	-	6.8	2.0	0.2	-	2.0	-	14.8
144	1.4	0.2	-	-	2.0	-	-	-	-	6.8	2.0	0.2	-	2.0	-	14.8
135	-	-	-	-	-	-	2.6	-	-	-	3.4	-	-	2.4	-	8.4
147	3.4	-	-	-	-	-	-	-	3.4	-	0.2	-	-	-	-	7.0
148	3.4	-	-	-	-	-	-	-	3.4	-	0.2	-	-	-	-	7.0
127	-	0.6	-	-	-	0.6	-	-	-	-	2.5	-	-	2.5	-	6.1
128	-	0.6	-	-	-	0.6	-	-	-	-	2.5	-	-	2.5	-	6.1
276	-	-	1.8	-	1.8	-	-	-	-	-	-	-	-	1.8	-	5.4
98	1.1	0.7	-	-	-	-	-	-	-	1.1	0.2	-	-	1.0	-	4.2
99	1.1	0.7	-	-	-	-	-	-	-	1.1	0.2	-	-	1.0	-	4.2
136	-	-	-	-	-	-	1.3	-	-	-	1.7	-	-	1.2	-	4.2
137	-	-	-	-	-	-	1.3	-	-	-	1.7	-	-	1.2	-	4.2
16	0.3	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	0.7
17	0.3	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	0.7
18	0.3	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	0.7
19	0.3	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	0.7
154	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6
155	-	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 41.2 kg y⁻¹

The observed 97.5th percentile rate based on 26 observations is 57.0 kg y⁻¹

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

Observation number	Beef
7	27.0
8	27.0
9	27.0
10	27.0
11	27.0
12	27.0
13	27.0
122	18.9
123	18.9
124	18.9
125	18.9
126	18.9
16	13.5
17	13.5
18	13.5
19	13.5
20	13.5
21	13.5
22	13.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of cattle meat based on the 19 high-rate adult consumers is 19.9 kg y⁻¹

The observed 97.5th percentile rate based on 19 observations is 27.0 kg y⁻¹

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

Observation number	Lamb
7	12.9
8	12.9
9	12.9
10	12.9
11	12.9
12	12.9
13	12.9
122	4.5
123	4.5
124	4.5
125	4.5
126	4.5
16	1.6
17	1.6
18	1.6
19	1.6
20	1.6
21	1.6
22	1.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of sheep meat based on the 12 high-rate adult consumers is 9.4 kg y⁻¹

The observed 97.5th percentile rate based on 19 observations is 12.9 kg y⁻¹

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

Observation number	Partridge	Pheasant	Total
130	2.3	6.1	8.3
131	2.3	6.1	8.3
122	3.0	4.5	7.5
123	3.0	4.5	7.5
124	3.0	4.5	7.5
125	3.0	4.5	7.5
126	3.0	4.5	7.5
328	1.5	4.5	6.0
329	1.5	4.5	6.0
330	1.5	4.5	6.0
331	1.5	4.5	6.0
332	1.5	4.5	6.0
159	-	4.5	4.5
119	0.9	1.4	2.3
120	0.9	1.4	2.3
121	0.9	1.4	2.3
127	-	2.0	2.0
128	-	2.0	2.0
16	-	0.6	0.6
17	-	0.6	0.6
18	-	0.6	0.6
19	-	0.6	0.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of poultry based on the 13 high-rate adult consumers is 6.8 kg y⁻¹

The observed 97.5th percentile rate based on 22 observations is 8.3 kg y⁻¹

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

Observation number	Chicken egg	Duck egg	Total
6	17.8	-	17.8
127	8.9	-	8.9
128	8.9	-	8.9
5	3.0	5.9	8.8
14	5.9	-	5.9
15	5.9	-	5.9
154	0.5	-	0.5
155	0.5	-	0.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of eggs based on the 6 high-rate adult consumers is 9.4 kg y⁻¹

The observed 97.5th percentile rate based on 8 observations is 16.2 kg y⁻¹

Table 25. Adults' consumption rates of wild/free foods from the Torness terrestrial survey area (kg y⁻¹)

Observation number	Blackberry	Elderberry	Hawthorn	Hazel nut	Nettle	Wild garlic	Total
119	3.0	-	-	0.8	-	-	3.8
120	3.0	-	-	0.8	-	-	3.8
121	3.0	-	-	0.8	-	-	3.8
3	3.4	-	-	-	-	-	3.4
4	3.4	-	-	-	-	-	3.4
149	-	2.5	0.5	-	-	-	3.0
182	-	2.5	0.5	-	-	-	3.0
284	1.3	-	-	-	-	-	1.3
285	1.3	-	-	-	-	-	1.3
147	0.2	0.2	-	-	0.5	0.2	1.1
148	0.2	0.2	-	-	0.5	0.2	1.1
180	1.0	-	-	-	-	-	1.0
181	1.0	-	-	-	-	-	1.0

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of wild/free foods based on the 7 high-rate adult consumers is 3.4 kg y⁻¹

The observed 97.5th percentile rate based on 13 observations is 3.8 kg y⁻¹

Table 26. Adults' consumption rates of rabbits/hares from the Torness terrestrial survey area (kg y⁻¹)

Observation number	Hare	Rabbit	Total
328	0.6	1.1	1.7
329	0.6	1.1	1.7
330	0.6	1.1	1.7
331	0.6	1.1	1.7
332	0.6	1.1	1.7

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of rabbits/hares based on the 5 high-rate adult consumers is 1.7 kg y⁻¹

The observed 97.5th percentile rate based on 5 observations is 1.7 kg y⁻¹

Table 27. Adults' consumption rates of honey from the Torness terrestrial survey area (kg y⁻¹)

Observation number	Honey
311	5.0
312	5.0
313	5.0
314	5.0
138	4.7
139	4.7
145	2.5
146	2.5
143	0.6
144	0.6
127	0.2
128	0.2
122	0.2
123	0.2
124	0.2

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of honey based on the 8 high-rate adult consumers is 4.3 kg y⁻¹

The observed 97.5th percentile rate based on 15 observations is 5.0 kg y⁻¹

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

Observation number	Mushrooms
147	2.3
148	2.3
122	1.8
123	1.8
124	1.8
125	1.8
126	1.8
119	1.5
120	1.5
121	1.5
3	0.5
4	0.5
277	0.5
278	0.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of wild fungi based on the 10 high-rate adult consumers is 1.8 kg y⁻¹

The observed 97.5th percentile rate based on 14 observations is 2.3 kg y⁻¹

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

Observation number	Venison
159	11.5
16	7.3
17	7.3
18	7.3
19	7.3
7	4.9
8	4.9
9	4.9
10	4.9
11	4.9
12	4.9
13	4.9
130	3.0
131	3.0
328	2.0
329	2.0
330	2.0
331	2.0
332	2.0

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of venison based on the 12 high-rate adult consumers is 6.3 kg y⁻¹

The observed 97.5th percentile rate based on 19 observations is 9.6 kg y⁻¹

Table 30. Children's consumption rates of other vegetables from the Torness terrestrial survey area (kg y⁻¹)**Child age group (6 - 15 years old)**

Observation number	Age	Pea
158	8	3.0

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of other vegetables for the child age group based upon the only high-rate consumer is 3.0 kg y⁻¹

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

Table 31. Children's consumption rates of root vegetables from the Torness terrestrial survey area (kg y⁻¹)**Child age group (6 - 15 years old)**

Observation number	Age	Carrot	Onion	Total
158	8	2.0	2.7	4.7

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of root vegetables for the child age group based upon the only high-rate consumer is 4.7 kg y⁻¹

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

Table 32. Children's consumption rates of potato from the Torness terrestrial survey area (kg y⁻¹)**Child age group (6 - 15 years old)**

Observation number	Age	Potato
158	8	6.8

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of potato for the child age group based upon the only high-rate consumer is 6.8 kg y⁻¹

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

Table 33. Infants' consumption rates of honey from the Torness terrestrial survey area (kg y⁻¹)

Infant age group (0 - 5 years old)

Observation number	Age	Honey
140	2	4.7
141	2	4.7
142	4	4.7

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of honey for the infant age group based upon the 3 high-rate consumers is 4.7 kg y⁻¹

The observed 97.5th percentile rate based on 3 observations is 4.7 kg y⁻¹

Table 34. Percentage contribution each food type makes to its terrestrial food group for adults

Green vegetables Courgette 25.9 % Cabbage 18.0 % Brussel sprout 14.8 % Cucumber 13.7 % Broccoli 5.7 % Cauliflower 5.6 % Artichoke 5.0 % Lettuce 4.9 % Marrow 3.1 % Kale 1.5 % Rocket 1.0 % Herbs 0.9 %	Potato Potato 100.0 % Domestic fruit Apple 26.3 % Plum 24.7 % Raspberry 11.1 % Strawberry 9.8 % Pear 9.7 % Melon 5.6 % Redcurrant 3.2 % Gooseberry 3.2 % Rhubarb 2.2 % Cherry 1.5 % Blackberry 1.1 % Peach 0.8 % Blackcurrant 0.5 % Loganberry 0.3 % Whitecurrant 0.1 %	Wild/free foods Blackberry 67.4 % Elderberry 17.6 % Hazel nut 7.3 % Hawthorn fruit 3.2 % Nettle 2.9 % Wild garlic 1.5 %
Other vegetables Tomato 45.5 % Pea 24.3 % Broad bean 10.6 % Runner bean 7.7 % Aubergine 4.6 % Squash 2.7 % Pepper 2.1 % Sweetcorn 1.4 % Mangetout 0.6 % French bean 0.4 % Chilli pepper 0.0 %	Cattle meat Beef 100.0 %	Rabbits/hares Rabbit 62.8 % Hare 37.2 %
Root vegetables Onion 19.8 % Leek 17.1 % Carrot 11.1 % Turnip 10.5 % Swede 9.8 % Shallot 9.7 % Beetroot 9.5 % Parsnip 5.7 % Radish 3.2 % Spring onion 1.9 % Celery 1.7 %	Sheep meat Lamb 100.0 %	Honey Honey 100.0 %
	Poultry Pheasant 70.8 % Partridge 29.2 %	Wild fungi Mushrooms 100.0 %
	Eggs Chicken egg 89.7 % Duck egg 10.3 %	Venison Venison 100.0 %

Notes

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

Milk, crab apples, pumpkin, rosehips, rowan berries, wood pigeon, 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 35. Occupancy rates in the Torness 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					
100	F	83	8565	91	8656
5	F	49	7230	1095	8325
276	F	91	8179	132	8311
98	F	61	6265	1218	7483
104	M	58	6940	260	7200
103	F	59	6548	364	6912
6	M	54	4346	2190	6536
150	M	53	5094	234	5328
151	F	52	5094	234	5328
99	M	59	4680	624	5304
1	F	69	4480	784	5264
165	F	56	4230	1008	5238
4	F	64	4388	784	5172
164	M	57	3276	1890	5166
3	M	65	4376	784	5160
152	M	21	4912	104	5016
153	M	20	4912	104	5016
277	F	61	2330	192	2522
278	M	65	2241	256	2497
105	M	67	1600	242	1842
106	F	67	1696	146	1842
304	M	U	-	1058	1058
305	M	U	-	1058	1058
217	M	30	-	706	706
301	M	42	470	182	652
302	F	40	470	182	652
303	M	20	470	182	652
109	M	63	-	382	382
108	M	U	274	42	316
403	M	61	-	208	208
111	M	U	-	168	168
112	M	U	-	168	168
113	M	U	-	168	168
114	M	U	-	168	168
115	M	U	-	168	168
373	M	35	-	156	156
269	M	U	-	144	144
270	M	U	-	144	144
400	M	54	-	144	144
401	M	40	-	144	144
398	M	45	-	134	134
399	F	45	-	134	134
185	M	39	-	132	132
257	M	74	-	132	132
258	F	70	-	132	132
259	M	35	-	132	132
260	F	32	-	132	132
204	M	24	-	120	120
264	M	38	-	120	120
268	M	34	-	120	120
189	M	50	-	114	114
190	F	48	-	114	114
215	M	24	-	108	108
216	M	26	-	108	108
209	M	U	-	100	100
210	M	U	-	100	100
211	M	U	-	100	100
212	M	U	-	100	100
213	M	U	-	100	100
214	M	32	-	100	100
101	F	U	90	1	91

Table 35. Occupancy rates in the Torness 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)
116	M	28	-	84	84
118	M	U	-	84	84
186	F	37	-	84	84
224	M	U	-	78	78
225	M	U	-	78	78
226	M	U	-	78	78
227	M	U	-	78	78
228	M	U	-	78	78
229	M	U	-	78	78
230	M	U	-	78	78
231	M	U	-	78	78
232	M	U	-	78	78
233	M	U	-	78	78
234	M	U	-	78	78
235	M	U	-	78	78
236	M	U	-	78	78
237	M	U	-	78	78
238	M	U	-	78	78
239	M	U	-	78	78
240	M	U	-	78	78
241	M	U	-	78	78
242	M	U	-	78	78
243	M	U	-	78	78
244	M	U	-	78	78
245	M	U	-	78	78
246	M	U	-	78	78
247	M	U	-	78	78
248	M	U	-	78	78
249	M	U	-	78	78
250	M	U	-	78	78
251	M	U	-	78	78
252	M	U	-	78	78
253	M	U	-	78	78
254	M	U	-	78	78
255	M	U	-	78	78
271	M	U	-	78	78
272	F	U	-	78	78
119	M	59	-	62	62
205	M	41	-	40	40
206	M	37	-	40	40
207	M	40	-	40	40
208	M	36	-	40	40
102	M	U	-	24	24
110	F	60	-	18	18
18	F	U	-	8	8
Child and infant observations					
166	F	14	560	280	840
167	F	6	560	280	840
107	M	9	480	154	634
2	F	14	427	70	497
261	M	7	-	132	132
262	F	10	-	132	132
263	F	9	-	132	132
191	F	2	-	114	114
187	F	5	-	84	84
188	F	4	-	84	84

Notes

U - Unknown

Table 36. Gamma dose rate measurements for the Torness direct radiation survey ($\mu\text{Gy h}^{-1}$)

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	0.121	Grass	0.083
Property 2	Not recorded	Not recorded	Grass	0.076
Property 3	Not recorded	Not recorded	Grass	0.081
Property 4	Wood	0.104	Grass	0.076
Property 5	Wood	0.077	Grass	0.072
Property 6	Wood	0.066	Grass	0.065
Property 7	Wood	0.058	Grass	0.067
Property 8	Wood	0.064	Grass	0.068
Property 9	Wood	0.055	Grass	0.056
Property 10	Wood	0.074	Grass	0.072

Backgrounds

	Location	NGR	Substrate	Background gamma dose rate at 1 metre
Background 1	John Muir Country Park	NT 650 787	Grass	0.062
Background 2	Elmscleugh Wood	NT 693 713	Grass	0.074
Background 3	Inland from Pease Bay	NT 793 705	Grass	0.076
Mean background =				0.071

Notes

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

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Marine plants/algae	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
1	F	69	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4480	784
3	M	65	4.7	1.7	-	-	-	-	-	-	-	-	-	-	-	-	3.4	-	-	0.5	-	-	-	12	-	-	-	28	4376	784
4	F	64	4.7	-	-	-	-	-	-	-	-	-	-	-	-	-	3.4	-	-	0.5	-	-	-	-	-	-	-	-	4388	784
5	F	49	26.0	-	-	-	-	27.3	37.6	21.8	7.5	34.8	-	-	-	8.8	-	-	-	-	-	-	24	-	-	-	-	-	7230	1095
6	M	54	26.0	-	-	-	-	27.3	37.6	21.8	7.5	34.8	-	-	-	17.8	-	-	-	-	-	78	78	-	-	-	-	52	4346	2190
7	M	61	-	-	-	-	-	-	-	-	54.6	-	27.0	12.9	-	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-
8	F	57	-	-	-	-	-	-	-	-	54.6	-	27.0	12.9	-	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-
9	M	32	-	-	-	-	-	-	-	-	54.6	-	27.0	12.9	-	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-
10	F	32	-	-	-	-	-	-	-	-	54.6	-	27.0	12.9	-	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-
11	F	24	-	-	-	-	-	-	-	-	54.6	-	27.0	12.9	-	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-
12	M	25	-	-	-	-	-	-	-	-	54.6	-	27.0	12.9	-	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-
13	M	28	-	-	-	-	-	-	-	-	54.6	-	27.0	12.9	-	-	-	-	-	-	4.9	-	-	-	-	-	-	-	-	-
14	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	M	U	-	-	-	-	-	-	-	3.6	100.1	0.7	13.5	1.6	0.6	-	-	-	-	-	7.3	-	-	-	-	-	-	-	-	-
17	F	U	-	-	-	-	-	-	-	3.6	100.1	0.7	13.5	1.6	0.6	-	-	-	-	-	7.3	-	-	-	-	-	-	-	-	-
18	F	U	-	-	-	-	-	-	-	-	100.1	0.7	13.5	1.6	0.6	-	-	-	-	-	7.3	-	8	-	-	-	-	-	-	8
19	M	U	-	-	-	-	-	-	-	-	100.1	0.7	13.5	1.6	0.6	-	-	-	-	-	7.3	-	-	-	-	-	-	-	-	-
20	M	U	-	-	-	-	-	-	-	-	100.1	-	13.5	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	M	U	-	-	-	-	-	-	-	-	100.1	-	13.5	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	M	U	-	-	-	-	-	-	-	-	100.1	-	13.5	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	M	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	210	-	-	-	-	-	6	-	-
25	M	47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	122	-	-	-	-	-	-	-	-
26	F	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	122	-	-	-	-	-	-	-	-
30	F	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	159	-	-	-	-	-	-	-	-
31	F	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	159	-	-	-	-	-	-	-	-

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Marine plants/algae	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
32	F	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	159	-	-	-	-	-	-	-
33	F	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	7	-	-
34	M	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	-	7	-	-
37	M	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	7	-	-	-
38	F	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-	7	-	-	-
43	M	32	2.4	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	M	60	2.4	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46	F	41	2.4	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47	F	61	2.4	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
48	M	19	2.4	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	M	37	-	6.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	720	-	-	720	-	-
51	M	70	-	6.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	F	70	-	6.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	720	-	-	720	-	-
54	F	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	364	-	-	-	-	-	-	-
55	F	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	364	-	-	-	-	-	-	-
56	F	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	364	-	-	-	-	-	-	-
57	F	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	364	-	-	-	-	-	-	-
58	F	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	364	-	-	-	-	-	-	-
59	M	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	364	-	-	-	-	-	-	-
71	M	58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	91	-	-	-	-	-	-	-
72	M	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	137	137	-	-	-	-	-	-
73	F	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	137	137	-	-	-	-	-	-
74	M	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	156	-	-	-	-	-	-	-
75	F	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-
77	F	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area[illegible]

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

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Marine plants/algae	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
138	F	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.7	-	-	-	-	-	-	-	-	-	-	-
139	M	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.7	-	-	-	-	-	-	-	-	-	-	-
143	M	67	-	-	-	-	-	1.4	-	4.1	1.8	14.8	-	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-
144	F	67	-	-	-	-	-	1.4	-	4.1	1.8	14.8	-	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-
145	M	64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-
146	F	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	-	-	-	-	-	-	-	-	-	-	-
147	F	47	-	-	-	-	-	7.9	11.5	1.4	-	7.0	-	-	-	-	1.1	-	-	2.3	-	-	148	-	-	-	-	-	-	-
148	M	56	-	-	-	-	-	7.9	11.5	1.4	-	7.0	-	-	-	-	1.1	-	-	2.3	-	-	18	-	-	-	-	-	-	-
149	M	41	-	-	-	-	-	9.8	27.0	31.4	22.8	17.7	-	-	-	-	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-
150	M	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52	-	-	-	-	-	5094	234
151	F	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52	-	-	-	-	-	5094	234
152	M	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4912	104
153	M	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4912	104
154	M	76	-	-	-	-	-	10.4	31.2	32.5	6.8	0.6	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
155	F	76	-	-	-	-	-	10.4	31.2	32.5	6.8	0.6	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
156	F	47	-	-	-	-	-	-	3.0	4.7	6.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
157	M	47	-	-	-	-	-	-	3.0	4.7	6.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
159	M	36	-	-	-	-	-	-	-	-	-	-	-	4.5	-	-	-	-	-	11.5	-	-	-	-	-	-	-	-	-	-
160	M	49	16.7	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	216	-	34	-	104	-	-
161	F	40	16.7	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	182	-	-	-	-	-	-
164	M	57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3276	1890
165	F	56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4230	1008
168	F	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	169	-	-	-	-	-	-	-
169	F	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-
170	M	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	3	-	-	-
171	M	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	3	-	-	-

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Marine plants/algae	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
172	F	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	-	-	-	-	-	-	-
173	M	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	279	-	-
174	M	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	279	-	-
175	F	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	279	-	-
176	M	U	-	-	-	-	-	-	-	-	29.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
177	F	U	-	-	-	-	-	-	-	-	29.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
178	M	U	-	-	-	-	-	-	-	-	29.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
179	M	U	-	-	-	-	-	-	-	-	29.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
180	M	65	-	-	-	-	-	17.3	27.0	6.5	4.9	57.0	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-
181	F	64	-	-	-	-	-	17.3	27.0	6.5	4.9	57.0	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-
182	F	40	-	-	-	-	-	9.8	27.0	31.4	22.8	17.7	-	-	-	-	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-
183	M	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70	-	-	-	-	-	-	-
185	M	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48	80	-	-	-	-	4	-	132
186	F	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	-	-	-	-	4	-	84
189	M	50	11.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	114	-	-	-	-	42	-	114
190	F	48	11.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	114	-	-	-	-	-	-	114
192	M	68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-
193	F	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-
194	F	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-
195	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-	-	-	-	-
196	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-	-	-	-	-
200	M	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	-	-	-	-	-	-	-
201	F	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	-	-	-	-	-	-	-
204	M	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120	-	-	-	-	-	-	-	120
205	M	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-	-	-	-	40
206	M	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-	-	-	-	40

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

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Marine plants/algae	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
234	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
235	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
236	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
237	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
238	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
239	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
240	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
241	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
242	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
243	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
244	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
245	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
246	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
247	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
248	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
249	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
250	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
251	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
252	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
253	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
254	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
255	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	198	-	78
256	M	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-	-
257	M	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	132	-	-	-	-	-	132
258	F	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	132	-	-	-	-	-	-	132
259	M	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	126	-	-	-	-	6	-	132

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area[illegible]

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Marine plants/algae	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
291	M	68	3.4	12.5	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
292	F	U	10.2	12.5	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
293	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	224	-	-	-	-	-	-	-	-
294	M	60	-	-	11.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	702	-	702	-	-	-	-
295	M	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-
298	M	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-
301	M	42	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42	-	-	-	-	30	470	182
302	F	40	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42	-	-	-	-	-	470	182
303	M	20	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42	-	-	-	-	30	470	182
304	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	261	-	1058
305	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	261	-	1058
306	U	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	709	-	-	-	-	-	-	-
307	U	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	79	-	-	-	-	-	-	-
308	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-
309	M	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	672	-	672	-	-	-	-
310	M	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	672	-	672	-	-	-	-
311	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	-	-	-	-	-	-	-	-	-	-	-	-
312	U	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	-	-	-	-	-	-	-	-	-	-	-	-
313	U	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	-	-	-	-	-	-	-	-	-	-	-	-
314	U	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0	-	-	-	-	-	-	-	-	-	-	-	-
315	M	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	365	-	-	-	-	-	-	-
316	M	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	244	-	-	-	-	-	-	-
317	M	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112	225	-	-
318	M	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	375	750	-	-
319	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	15	-	-
320	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	15	-	-

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Marine plants/algae	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
321	M	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	234	-	-	-	-	-	-	-
322	F	53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	268	-	-	-	-	-	-	-
323	M	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	365	-	-	-	-	-	-	-
324	F	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350	-	-	-	-	-	-	-
325	M	56	20.2	3.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2110	-	-	2240	-	-
326	F	55	20.2	3.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
327	F	83	20.2	3.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
328	M	66	15.9	-	-	1.6	-	-	-	-	-	-	-	-	6.0	-	-	1.7	-	-	2.0	-	523	-	-	-	-	-	-	-
329	F	65	15.9	-	-	1.6	-	-	-	-	-	-	-	-	6.0	-	-	1.7	-	-	2.0	-	-	-	-	-	-	-	-	-
330	F	38	15.0	-	-	1.6	-	-	-	-	-	-	-	-	6.0	-	-	1.7	-	-	2.0	-	-	-	-	-	-	-	-	-
331	F	42	15.0	-	-	1.6	-	-	-	-	-	-	-	-	6.0	-	-	1.7	-	-	2.0	-	-	-	-	-	-	-	-	-
332	F	34	15.0	-	-	1.6	-	-	-	-	-	-	-	-	6.0	-	-	1.7	-	-	2.0	-	-	-	-	-	-	-	-	-
333	M	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	280	-	-	-	-	-	-	-
334	F	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	280	-	-	-	-	-	-	-
335	F	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	280	-	-	-	40	-	-	-
336	M	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	280	-	-	-	40	-	-	-
337	M	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	-	-	-	300	-	-	-
338	M	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	-	-	-	300	-	-	-
339	M	55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-	600	-	-	-
340	M	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-	600	-	-	-
341	M	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62	-	-	-	400	-	-	-
342	M	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	75	-	-	-
343	M	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	220	-	-	-	110	-	-	-
344	M	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	220	-	-	-	110	-	-	-
345	M	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	220	-	-	-	110	-	-	-
346	F	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	220	-	-	-	110	-	-	-

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

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area[illegible]

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Marine plants/algae	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
412	F	32	10.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
414	M	45	10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	144	-	-
415	F	46	10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
416	F	17	10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
418	M	46	4.1	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1560	-	-	1350	-	-
419	M	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1560	-	-	1350	-	-
420	F	60	4.1	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
421	M	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	800	-	-
422	M	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	195	-	-	-	-	-	-
423	F	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	182	-	-	-	-	-	-
424	M	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	912	-	-	-	-	-	-
425	F	61	-	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112	-	-	-	-	-	-
426	F	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112	-	-	-	-	-	-
429	M	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-	-	-
430	M	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350	-	-
431	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350	-	-
432	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350	-	-
433	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350	-	-
434	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350	-	-
435	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350	-	-
436	M	39	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-	-	-	-	-	-	-	-
437	F	65	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
438	M	53	35.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-	840	-	-
439	F	55	35.4	4.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	390	-	-
440	M	37	-	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1352	-	-	1040	-	-
441	M	35	-	5.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1352	-	-	1040	-	-

Annex 1. Adults' consumption rates (kg y⁻¹) and occupancy rates (h y⁻¹) in the Torness area

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Marine plants/algae	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
442	M	64	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1872	-	-	1755	-	-
443	F	50	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
444	M	54	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1404	-	-	1404	-	-
445	M	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	702	-	-	702	-	-
446	F	55	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
447	M	42	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-	-	-	-	-
451	F	41	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
452	M	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	-	-
453	F	37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	-	-
456	M	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	234	-	-	-	936	-	-	-
457	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	234	-	-	-	936	-	-	-
458	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	234	-	-	-	936	-	-	-
459	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	234	-	-	-	936	-	-	-
460	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117	-	-	-	468	-	-	-
461	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117	-	-	-	468	-	-	-
462	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117	-	-	-	468	-	-	-
463	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117	-	-	-	468	-	-	-
464	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117	-	-	-	468	-	-	-
465	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	264	-	-	-	-	-	-	-

Notes

U - Unknown

Emboldened observations are the high-rate individuals

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Other vegetables	Root vegetables	Potato	Honey	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Occupancy in water	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)															
2	F	14	-	-	-	-	-	-	-	-	-	-	-	427	70
24	F	8	-	-	-	-	-	-	-	210	-	-	6	-	-
35	M	6	-	-	-	-	-	-	-	28	-	-	7	-	-
39	M	11	-	-	-	-	-	-	-	28	-	7	-	-	-
40	F	10	-	-	-	-	-	-	-	28	-	7	-	-	-
41	F	8	-	-	-	-	-	-	-	28	-	7	-	-	-
42	F	7	-	-	-	-	-	-	-	28	-	7	-	-	-
44	M	13	2.4	0.2	-	-	-	-	-	-	-	-	-	-	-
49	M	13	2.4	0.2	-	-	-	-	-	-	-	-	-	-	-
60	M	8	-	-	-	-	-	-	-	208	-	-	156	-	-
61	M	8	-	-	-	-	-	-	-	208	-	-	156	-	-
65	F	6	-	-	-	-	-	-	-	208	-	-	156	-	-
66	F	7	-	-	-	-	-	-	-	208	-	-	156	-	-
67	F	9	-	-	-	-	-	-	-	208	-	-	156	-	-
68	F	10	-	-	-	-	-	-	-	208	-	-	156	-	-
69	F	11	-	-	-	-	-	-	-	208	-	-	156	-	-
70	F	12	-	-	-	-	-	-	-	208	-	-	156	-	-
78	F	15	-	-	-	-	-	-	-	9	-	-	-	-	-
79	F	15	-	-	-	-	-	-	-	9	-	-	-	-	-
96	M	9	-	-	-	-	-	-	-	54	-	5	-	-	-
97	M	9	-	-	-	-	-	-	-	54	-	5	-	-	-
107	M	9	-	-	-	-	-	-	-	-	-	4	-	480	154
158	M	8	-	-	3.0	4.7	6.8	-	-	-	-	-	-	-	-
162	M	6	8.3	0.5	-	-	-	-	-	-	130	52	-	-	-

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

[illegible]

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Other vegetables	Root vegetables	Potato	Honey	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
417	F	13	10.2	-	-	-	-	-	-	-	-	-	-	-	-
427	F	6	-	-	-	-	-	-	-	84	-	-	28	-	-
428	M	8	-	-	-	-	-	-	-	84	-	-	28	-	-
448	M	15	1.7	-	-	-	-	-	40	-	-	-	-	-	-
449	F	13	1.7	-	-	-	-	-	40	-	-	-	-	-	-
450	M	11	1.7	-	-	-	-	-	40	-	-	-	-	-	-
454	F	14	-	-	-	-	-	-	-	-	-	-	80	-	-
455	M	12	-	-	-	-	-	-	-	-	-	-	80	-	-
Infant age group															
27	M	2	-	-	-	-	-	-	-	66	-	-	33	-	-
28	M	5	-	-	-	-	-	-	-	38	-	-	19	-	-
29	F	1	-	-	-	-	-	-	-	38	-	-	19	-	-
36	M	3	-	-	-	-	-	-	-	28	-	-	7	-	-
62	F	3	-	-	-	-	-	-	-	208	-	-	156	-	-
63	F	4	-	-	-	-	-	-	-	208	-	-	156	-	-
64	F	5	-	-	-	-	-	-	-	208	-	-	156	-	-
76	M	2	-	-	-	-	-	-	-	9	-	-	-	-	-
82	M	2	-	-	-	-	-	-	-	54	-	-	18	-	-
89	F	0.5	-	-	-	-	-	-	-	27	-	-	3	-	-
94	M	2	-	-	-	-	-	-	-	25	-	-	5	-	-
140	M	2	-	-	-	-	-	4.7	-	-	-	-	-	-	-
141	M	2	-	-	-	-	-	4.7	-	-	-	-	-	-	-
142	M	4	-	-	-	-	-	4.7	-	-	-	-	-	-	-
163	F	2	4.2	0.5	-	-	-	-	-	-	151	-	31	-	-
187	F	5	-	-	-	-	-	-	-	80	-	-	4	-	84

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Other vegetables	Root vegetables	Potato	Honey	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey area	Outdoor occupancy within the direct radiation survey area
188	F	4	-	-	-	-	-	-	-	80	-	-	4	-	84
191	F	2	3.6	-	-	-	-	-	-	114	-	-	-	-	114
202	F	4	-	-	-	-	-	-	-	60	-	-	-	-	-
351	F	3	-	-	-	-	-	-	-	128	-	-	-	-	-
355	F	4	-	-	-	-	-	-	-	65	-	-	10	-	-
359	F	5	-	-	-	-	-	-	-	100	-	-	-	-	-
367	F	5	4.5	-	-	-	-	-	-	-	-	-	-	-	-
372	F	3	-	0.7	-	-	-	-	-	-	-	-	-	-	-
406	F	4	4.6	-	-	-	-	-	-	-	-	-	-	-	-

Notes

U - Unknown

Emboldened observations are the high-rate individuals

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

Combination number	Fish	Crustaceans	Molluscs	Marine plants/algae	Wildfowl	Green vegetables	Other vegetables	Root vegetables	Potato	Domestic fruit	Cattle meat	Sheep meat	Poultry	Eggs	Wild/free foods	Rabbits/hares	Honey	Wild fungi	Venison	Intertidal occupancy over rock	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water	Indoor occupancy within the direct radiation survey	Outdoor occupancy within the direct radiation survey
1	X	X													X			X					X			X	X	X
2	X					X	X	X	X	X				X						X	X					X	X	X
3								X	X	X	X	X	X						X		X							
4									X	X	X	X	X						X		X							X
5	X								X	X									X			X			X	X	X	X
6		X	X																		X	X		X				
7													X		X			X										X
8											X	X	X				X	X										
9						X	X		X	X			X	X			X											
10	X	X																				X		X		X		
11						X	X	X	X	X			X						X									
12						X		X	X	X							X											
13						X	X	X		X					X			X			X							
14						X	X	X	X	X					X													
15	X																			X	X			X				X
16	X																	X		X	X					X	X	X
17	X	X	X																							X		
18	X				X								X			X			X		X							
19			X																	X	X			X				
20				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; fish, crustaceans, wild/free foods, wild fungi, handling fishing gear, occupancy on water, indoor occupancy within the direct radiation survey area, and outdoor occupancy within the direct radiation survey area.