



Radiological Habits Survey: Dumfries and Galloway Coast, 2012



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Final report

Radiological Habits Survey: Dumfries and Galloway Coast, 2012

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SUMMARY

This report presents the results of a survey conducted in 2012 to determine the habits and consumption patterns of people along the Dumfries and Galloway coast and the waters offshore, in order to determine the potential exposure pathways relating to authorised discharges of liquid radioactive waste into the Irish Sea, principally from the Sellafield nuclear site in Cumbria.

The survey area covered the Dumfries and Galloway coast from the Isle of Whithorn in the west to the Caerlaverock National Nature Reserve in the east, and included the waters offshore of this coast.

The following potential exposure pathways were investigated during the survey:

- The consumption of foods from the aquatic environment (including wildfowl and livestock grazed on salt marsh)
- Activities and occupancy over intertidal areas
- The handling of fishing gear and sediment
- Activities and occupancy in and on water (relating to the inhalation of re-suspended radioactivity in sea spray and the inadvertent ingestion of contaminated seawater)
- Intertidal land use in the area
- Any new or unusual exposure pathways
- The use of any natural resources from the aquatic environment (e.g. sand/gravel extraction, use of seaweed as a fertiliser)

Interviews were conducted with members of the public and the data collected for 415 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.

Survey findings

The commercial fisheries in the area included creeling for brown crab, common lobster, *Nephrops* and whelks; trawling and dredging for queen scallops and king scallops; gill netting for bass and grey mullet; fishing for salmon and sea trout using haaf nets, stake nets and 'net and cobble'; and collecting winkles by hand from the shore. There have been commercial cockle fisheries in the area in the past but these have been closed for several years.

SUMMARY

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

- 18 kg y⁻¹ for fish (comprising cod, bass, mackerel, grey mullet, pollack and other species, caught by shore anglers, boat anglers and commercial fishermen)
- 15 kg y⁻¹ for crustaceans (comprising brown crab, common lobster and common prawn, caught in creels by commercial fishermen)
- 19 kg y⁻¹ for molluscs (comprising winkles, cockles and mussels, collected by a commercial winkle collector)
- 31 kg y⁻¹ for wildfowl (comprising pink-footed goose, mallard, greylag goose and smaller quantities of wigeon, teal and Canada goose shot by wildfowlers)
- 36 kg y⁻¹ for salt marsh grazed cattle meat (comprising beef from farms in the survey area)
- 9.9 kg y⁻¹ for salt marsh grazed sheep meat (comprising lamb from farms in the survey area)

No consumption of marine plants/algae was identified.

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

- For fish: cod 34%; bass 18%; mackerel 14%; grey mullet 10%; pollack 7%; other species 17%
- For crustaceans: brown crab 57%; common lobster 24%; common prawn 19%
- For molluscs: winkles 54%; cockles 23%; mussels 23%
- For wildfowl: pink-footed goose 60%; mallard 18%; greylag goose 11%; a mix of wigeon, teal and Canada goose 11%
- For salt marsh grazed cattle meat: beef 100%
- For salt marsh grazed sheep meat: lamb 100%

The use of seaweed for livestock feed, fertiliser or soil conditioner was investigated during the survey but was not identified.

Intertidal activities identified for adults or children included walking, dog walking, playing, rock pooling, angling, bait digging, crab collecting, winkle collecting, mussel collecting, cockle collecting, wildfowling, stake netting, gill netting, setting nets, walking to haaf netting locations, checking moorings, fixing moorings, marsh warden duties, tending livestock, beach cleaning, inshore rescue duties, horse riding and sitting on the beach.

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

- 570 h y⁻¹ over mud (for two stake net fishermen at Balcary Bay)
- 80 h y⁻¹ over mud and sand (for 13 people whose activities included stake net fishing, collecting cockles and mussels and walking at Cardoness; bait digging at Sandgreen, Carrick Bay, Balcary Bay, Ross Bay and Carsluith; angling at Carsluith and in the Kirkcudbright Bay area; checking moorings at Isle of Whithorn; collecting winkles at Garlieston Bay; dog walking at Carsluith and gill netting on the River Nith and Urr Water)
- 25 h y⁻¹ over mud and stones (for five people who were collecting crabs from the Kirkcudbright Lifeboat Station, Manxman's Lake or Ross Bay)
- 520 h y⁻¹ over rock (for 24 people whose activities included angling at Torrs Point, Fox Craig, Cairn Head to Sandgreen, Ross Bay, Carsluith, Carrick Bay, Mosseyard Bay, Kirkcudbright Lifeboat Station, Abbey Burn Foot, Balcary Point, Rascarrel Bay and in the Kirkcudbright Bay area; collecting winkles on the shore at Rascarrel Bay and between Isle of Whithorn and Almorness Point; collecting crabs from Carsluith, Carrick Bay and Mosseyard Bay and collecting mussels in the Kirkcudbright Bay area)
- 260 h y⁻¹ over salt marsh (for 17 people whose activities included angling at Urr Water; dog walking, wildfowling, walking, tending livestock and marsh warden duties at Caerlaverock; and tending livestock at Wigtown and Creetown)
- 400 h y⁻¹ over sand (for six people: one person who was angling and dog walking at Rigg Bay; one person who was walking at Southernness and setting nets west of Southernness Point; two people who were dog walking at Rockcliffe and two people who were stake netting at Sandyhills)
- 650 h y⁻¹ over sand and stones (for one individual who was collecting winkles at Garlieston Bay)

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

Fishermen were identified handling fishing gear including creels and nets. The activities identified for adults who were handling sediment included bait digging, shellfish collecting, setting up and cleaning stake nets, wildfowling and fixing moorings. (Setting up and cleaning stake nets were classified as handling sediment rather than handling fishing gear since these activities involved close contact with sediments.) The mean rates for the adult high-rate groups for handling were:

- 1200 h y⁻¹ for handling fishing gear (for seven fishermen who were handling creels)
- 880 h y⁻¹ for handling sediment (for 15 people whose activities included collecting winkles, bait digging, wildfowling and setting up and cleaning stake nets)

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

The activities taking place 'in water' in the survey area were swimming, snorkelling, sub-aqua diving, windsurfing, water skiing and kayaking. The activities taking place 'on water' in the survey area were travelling to and from diving locations, boat angling, haaf netting, operating a rescue boat, creeling, sailing, working on a boat, conducting boat maintenance, gill netting, prawn raking, RNLI duties, pleasure cruising, fly fishing, canoeing and paddling. The maximum occupancy rate in water was 110 h y⁻¹ for two people windsurfing at Carrick Bay and one person sub-aqua diving between Garlieston Bay and Isle of Whithorn. The maximum occupancy rate on water was 2100 h y⁻¹ for a commercial fisherman who was creeling between Garlieston Bay and Isle of Whithorn.

Comparisons with the previous survey

Comparisons were made with the previous habits survey conducted in the same area in 2007. Compared with the 2007 results, the mean consumption rates for the adult high-rate group for fish and crustaceans decreased in 2012, whereas the mean consumption rates for the adult high-rate groups for molluscs, wildfowl and salt marsh grazed cattle meat increased. Most notably, the mean consumption rate for the adult high-rate group for fish decreased from 51 kg y⁻¹ to 18 kg y⁻¹, while the mean consumption rate for the adult high-rate group for molluscs increased from 5.7 kg y⁻¹ to 19 kg y⁻¹. The consumption of salt marsh grazed sheep meat was identified in 2012, but was not identified in 2007. The intertidal occupancy rates and handling rates of fishing gear and sediment were broadly similar in 2007 and 2012, with the exception of occupancy over mud and sand, which decreased from 570 h y⁻¹ in 2007 to 80 h y⁻¹ in 2012 and occupancy over salt marsh, which decreased from 670 h y⁻¹ in 2007 to 260 h y⁻¹ in 2012.

Suggestions for changes to the monitoring programme

Based on the findings of this habits survey, it is considered that SEPA's current monitoring programme provide adequate coverage for the aquatic environment along the Dumfries and Galloway coast. However, a small number of recommendations are provided for consideration to enhance the existing aquatic monitoring programme. A quarterly sample of cod could replace the current quarterly sample of plaice, since cod were consumed in higher quantities. The annual sample of limpets could be discontinued since no consumption of limpets was identified. The winkle samples which are currently collected from Southernness could be collected from locations further west, between Isle of Whithorn and Almorness Point, since most winkles were collected from this area and no winkle collection was identified at Southernness.

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).

This survey, conducted along the Dumfries and Galloway coast in Scotland, considered the effects of authorised liquid discharges from the Sellafield nuclear site in Cumbria, which releases wastes into the Irish Sea. The potential effects of these wastes are monitored in the Solway Firth, which has its northern coastline in Scotland and its southern coastline in England. As Sellafield is in England, the site discharges are regulated by the Environment Agency. SEPA's role in this case is directed at its general duty to protect the public from radiation exposure. In support of this objective, this report provides information to form the basis of assessments of radiation exposures along the Dumfries and Galloway coast and to help direct future environmental monitoring programmes.

The area studied is to the west of the area likely to be most affected by discharges from the Chapelcross nuclear site, which is the subject of separate studies.

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 for the Dumfries and Galloway coast.

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.

As the Sellafield nuclear licensed site operates in England, the appropriate regulatory authority is the Environment Agency, who operate following equivalent criteria and consult SEPA on site issues where appropriate.

2 THE SURVEY

2.1 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 review the habits of the public along the Dumfries and Galloway coast relating to potential exposure to authorised discharges of liquid radioactive waste into the Irish Sea, principally from the Sellafield nuclear site in Cumbria.

Investigations were carried out to ascertain the following:

- The consumption of foods from the aquatic environment (including wildfowl and livestock grazed on salt marsh)
- Activities and occupancy over intertidal areas
- The handling of fishing gear and sediment
- Activities and occupancy in and on water (relating to the inhalation of re-suspended radioactivity in sea spray and the inadvertent ingestion of contaminated seawater)
- Intertidal land use in the area
- Any new or unusual exposure pathways
- The use of any natural resources from the aquatic environment (e.g. sand/gravel extraction, use of seaweed as a fertiliser)

2.2 Survey area

The survey area covered the Dumfries and Galloway coast from Isle of Whithorn in the west to the Caerlaverock National Nature Reserve in the east, and included the waters offshore (Figure 1). This area was chosen to include the locations where the far-field effects of current and historic discharges from Sellafield were likely to be most pronounced.

The same survey area was used in the previous habits survey conducted by Cefas along the Dumfries and Galloway coast, which was in 2007 (Clyne *et al.*, 2011).



Figure 1. The survey area

2.4 Conduct of the survey

As part of the pre-survey preparation, SEPA was contacted in order to identify any additional requirements. Information relating to the activities of people in the survey area was obtained from internet searches, Ordnance Survey maps and from previous habits surveys undertaken along the Dumfries and Galloway coast. People with local knowledge of the survey area were contacted for information on any aspects relevant to the exposure pathways. 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 22nd July to the 5th August 2012 by three members of staff from the Cefas laboratory at Lowestoft, according to techniques described by Leonard *et al.*, (1982).

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 in the aquatic environment. These included, for example, commercial fishermen, hobby fishermen, anglers and people carrying out activities on intertidal areas. Interviews were used to establish individuals' consumption, occupancy and handling rates relevant to the survey area. Any general information of use to the survey was also obtained. Gamma dose rate measurements were taken over intertidal substrates in the survey area.

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 of foods in kilograms per year. In these circumstances, interviewees were asked to provide the information in a different format such as the number of units consumed, for example the number of crabs or lobsters. These data were converted to consumption rates, in kilograms per year, using edible weight data researched by Cefas.

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.

For internal exposure, the consumption data are structured into food groups with similar attributes. For example, all mollusc species are grouped together in a food group called 'molluscs'. Examples of typical aquatic food groups used in habits surveys are shown in Table 1. For external exposure over intertidal sediments, occupancies over the same substrate, such as sand, are grouped together.

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.

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 Description of the survey area

The survey area, shown in Figure 1, covered the Dumfries and Galloway coast from Isle of Whithorn in the west to the Caerlaverock National Nature Reserve in the east, and the waters offshore of this coastline.

The survey area included approximately 140 km of coastline along the northern shore of the Solway Firth. The coastline was dominated by a series of mostly inaccessible rocky peninsulas, interspersed with large sandy bays. At low tide, Mersehead Sands, Auchencairn Bay, Kirkcudbright Bay, Fleet Bay and Wigtown Bay, had vast areas of exposed sand and mud. Fast flowing tides limited activities at certain locations along the coast. Six main rivers flowed into this stretch of the Solway Firth. From west to east these were the River Bladnoch, River Cree, Water of Fleet, River Dee, Urr Water and River Nith.

Isle of Whithorn to Innerwell

Isle of Whithorn, a small village located on a rocky peninsular, marked the western end of the survey area. The boats based in Isle of Whithorn Harbour included four commercial creel fishing boats, sailing yachts and angling boats. A sailing club and coastguard station were also based near the harbour. Diving was popular around the wrecks offshore and a local diving club moored their rib in the harbour; a few of the club members spent time in the harbour fixing moorings. Angling was popular with local and visiting anglers, both at the harbour and on the rocks around the peninsula. A few individuals were identified bait digging on the mud and sand exposed in the harbour at low tide. A small amount of peeler crabs were collected for use as angling bait and a few individuals were identified collecting winkles for their own consumption.

Between Isle of Whithorn and Rigg Bay (also known as Cruggleton Bay), the coastline was predominantly rocky. Access to the coast was limited to tracks through farms, but despite this, it was reported that there were many popular angling spots on the rocks along this stretch of coast. The rocky headland of Cairn Head was reported to be particularly popular with anglers.

Rigg Bay (see Figure 2) was a sandy bay with scattered patches of stones and boulders, which was popular with anglers, dog walkers and families sitting on the beach and paddling. A track ran close to the shore from Rigg Bay to Garlieston although there was limited access to the beach from the track as large rocks had been placed on the upper shore as sea defences. The substrate on the lower

shore was mud, sand and stones. No activities were identified in this area during the time of the survey.



Figure 2. Rigg Bay

The upper shore of Garlieston Bay was rock, sand and stones, and the lower shore was a large expanse of sand and mud. There was easy access to the shore, with car parking and a campsite for touring caravans close by. Locals and many tourists staying at the campsite undertook activities in the bay, including boat angling, shore angling, creeling, diving, bait digging, walking, dog walking, playing and horse riding. A few individuals were collecting winkles and mussels for their own consumption and one commercial winkle collector, who worked along extensive areas of the coast, was interviewed here. Three commercial creel fishing boats and several yachts and other pleasure craft were kept at Garlieston Harbour. Two boat anglers were identified fishing off Garlieston.

The shore between Garlieston and Innerwell was predominantly rocky and there was no easy access to the shore. At Innerwell there was a small bay with rocks at either end of the beach, stones on the upper shore and mud and sand exposed at low tide (see Figure 3). The bay was reported to be a popular angling venue but only one angler was identified fishing in the area. Cockles, mussels and winkles were collected non-commercially from the shore. Two stake net stations were located close to Innerwell, but they were not in operation in 2012.



Figure 3. Innerwell

Innerwell to Carsluith

The Wigtown Bay Local Nature Reserve covered a large part of Wigtown Bay between Innerwell and Carsluith, including the Bladnoch Estuary and the Cree Estuary. It was the largest Local Nature Reserve in Britain and a Site of Special Scientific Interest. The reserve included vast mudflats and areas of salt marsh, and wildfowling was popular at various locations.

A few farmers grazed their livestock on the salt marsh along the western shore of Wigtown Bay. Apart from private farm tracks, access to the salt marsh was only possible at Wigtown, where the footpaths that led out onto the salt marsh were predominantly boardwalks raised above tidal level. The Dumfries and Galloway Council Ranger Service provided guided walks out onto the mudflats and salt marsh. The quay at Wigtown Harbour was a popular angling location, owing to easy access from a car park nearby. Wigtown Harbour was not a working harbour and no boats were observed there.

Creetown was located at the head of Wigtown Bay; here the upper shore was salt marsh with sand, stones and mud on the lower shore. Several farmers grazed their livestock on the salt marsh along the banks of the River Cree to the north of Creetown. A local wildfowling club held the rights to shoot on Creetown and Wigtown salt marsh. Net and cobble fishing (a form of seine netting) was identified on the River Cree.

The shore between Creetown and Carsluith was mud, sand and stones, interspersed with rocks and salt marsh. A few small angling boats were moored on the mud in the creeks on the salt marsh. Two boat anglers were identified fishing offshore. Angling was popular from the rocks, with one angler

collecting a small amount of peeler crabs to use as bait. Three stake net stations were located close to Creetown but they were not in operation in 2012.

At Carsluith, the shore was mud, sand and stones. Access to the beach was via a rough track and at the northern end of the beach there was a concrete jetty. Two stake net stations were in operation in the Carsluith area. Activities on the shore included dog walking, bait digging, tending stake nets and angling from the rocks. One commercial fisherman launched his boat from Carsluith and used gill nets to catch bass and grey mullet from Wigtown Bay.

Carluith to Isle Mouth

To the south-east of Carluith the shore in the area around Ringdoo Point at the mouth of Fleet Bay was rocky with small sandy coves; the rocky areas were interspersed with mud, sand and stones. Mossyard Bay (see Figure 4), located to the east of Ringdoo Point, was one of the most popular beaches in this area. Activities included angling from the rocks, collecting peeler crabs, dog walking, sitting on the beach, playing, canoeing and swimming. Throughout Fleet Bay large areas of sandflats and mudflats were exposed at low tide.



Figure 4. Mossyard Bay

Along the western shore of Fleet Bay, from Ringdoo Point to Cardoness, there were several caravan parks and access to the shore was usually through these parks. The beaches near the head of the bay were sand, mud and stones. Stake nets were located at Cardoness and were tended by two individuals. Activities in this area included walking, swimming, tending stake nets, kayaking and non-

commercial mussel and cockle collecting. Fleet Water flowed from the north through Gatehouse of Fleet into Fleet Bay.

There was no access to the shore on the eastern side of Fleet Bay between Gatehouse of Fleet and Sandgreen. At Sandgreen there was a large caravan site, which was open from March to October, with a private beach. The beach was sandy on the upper shore, mud and sand on the lower shore and was backed by rocks at either end. The beach was cleaned regularly by an employee of the caravan site and was used by people playing and for water sports such as sailing, swimming, windsurfing and kayaking. Bait digging took place at low tide and anglers fished from the rocks at high tide.

The rocky shore continued southwards from Sandgreen towards the mouth of Fleet Bay where there were small sand beaches at Carrick Bay and Isle Mouth. A band of stones ran along the upper shore above the sand at Isle Mouth. Many holiday homes were located close to the shore at Carrick Bay and there was a large grass car parking area at Isle Mouth. The beaches were very popular with visitors, who were playing, walking and dog walking. Two people were identified collecting small quantities of mussels from the rocks at either side of the beaches for their own families' consumption. Bait digging took place on the mud and sand of the lower shore. Swimming, paddling and water sports such as sailing, water skiing, kayaking, windsurfing, kite-surfing and boogie boarding were observed taking place in the area. At low tide it was possible to walk out to Ardwall Isle just offshore (see Figure 5), and the rocky shore of the island was popular with anglers.



Figure 5. Ardwall Isle from Isle Mouth

Isle Mouth to Kirkcudbright

Between Isle Mouth and the hamlet of Kirkandrews, approximately 3 km further south-east, the coastline was rocky with a few very small sand beaches that were not well used. A few visitors walked down to the small sandy coves exposed below the rocks at low tide at Kirkandrews. South-east of Kirkandrews the coastline remained rocky for a further 5 km down to Brighthouse Bay. Access to the coast along this stretch was difficult but a few anglers made the long walks across farmland in order to reach the various angling locations.

There was road access to the shore at Brighthouse Bay (see Figure 6) and a car park and a large caravan and camping site were situated close by. The upper shore of rocks and stones gave way to a wide expanse of sand at low tide. The beach was very popular with holidaymakers and the campsite had a private slipway from which jet skis and sailing dinghies were launched. People were observed swimming, paddling, canoeing and boogie boarding in the area. Two individuals were identified who collected small quantities of winkles from the rocks for their own consumption and a commercial winkle collector who worked all along the coast was interviewed at this location.



Figure 6. Brighthouse Bay

The rocky shore between Brighthouse Bay and the headland at Fox Craig, which marked the west side of the mouth of Kirkcudbright Bay, was used by anglers, who trekked across farmland to reach the fishing venues. Ross Bay, to the north of Fox Craig, could be accessed by road and limited parking was available on the verge. This small bay, with an upper shore of rocks and stones, and a lower shore of mud and sand, was used by bait diggers and people collecting peeler crabs for use as angling bait. Individuals were recorded swimming in the bay at high water.

There was no road access to the western shore of Kirkcudbright Bay between Ross Bay and Nun Mill Bay, 4 km further north, although anglers were reported to fish from the rocks to the north of Ross Bay. At Nun Mill Bay there was a sand beach flanked by rocky outcrops and a large expanse of muddy sand that stretched out into the estuary was exposed at low tide. There was a large car park close to the shore and a caravan and camping site was located close by. The bay was a popular recreational area and activities included walking, dog walking, playing and paddling.

To the north of Nun Mill Bay the estuary of the River Dee extended up towards the town of Kirkcudbright and the intertidal substrate became increasingly muddy further upstream. At high tide, anglers wearing chest waders were observed wading out over the mud to spin for bass. Cattle were observed grazing on a narrow strip of tide washed pasture on the west bank of the estuary, just south of Kirkcudbright.

Kirkcudbright was the main fishing harbour in the survey area. Two small commercial creel boats and several larger scalloping vessels were based in the harbour, but the scalloping vessels fished mainly outside the survey area. Two shellfish wholesale/processing companies were based in Kirkcudbright; one dealt mainly in scallops and the other dealt mainly in winkles. A third company was building a new seafood production facility in the town at the time of the survey. Approximately 40 yachts and 15 other pleasure craft and angling boats were berthed at floating pontoons or moored in the river at Kirkcudbright marina. Most of the moorings dried out at low tide and the vessels rested on the mud. There was a sailing club at the marina which had its own boat compound and concrete slipway. Anglers were observed fishing from the harbour wall and from salt marsh on the east bank of the River Dee to the north of the A755 road bridge. Contractors were occasionally employed to smooth the mud near the harbour wall with mechanical diggers, in order to provide a flat surface for vessels to rest on.

Kirkcudbright to Palnackie

To the south of Kirkcudbright, on the east side of the Dee Estuary, Manxman's Lake had an upper shore of rocks and stones and a lower shore of mudflats. Anglers dug for lugworms and collected peeler crabs for bait in the area. There was a bank of wild mussels in the centre of the Dee Estuary at the foot of St Mary's Isle and one person was identified that collected small quantities of the mussels for his own family's consumption. At the time of the 2007 survey a mussel farm had been under construction at the south end of St Mary's Isle, but the project had subsequently been abandoned before completion.

To the south of Manxman's Lake the rocky shores around the Lifeboat Station and Torrs Point were popular angling venues. The rocky shore continued eastwards from Torrs Point for approximately 18 km to Balcarry Point. The only places with road access to the shore along this stretch were Abbey Burn Foot and Rascarrel Bay (see Figure 7).



Figure 7. Rascarrel Bay

The Kirkcudbright Military Training Area spanned the coastline from Torrs Point in the west to Port Mary in the east. The road to Abbey Burn Foot and several footpaths passed through the training area and these were closed to the public when military exercises were in progress. Several angling venues were noted along this stretch of coast, the most popular locations being close to the road access points at Abbey Burn Foot and Rascarrel Bay. Winkle collecting was also reported to occur in several places. The rocky headland at Balcary Point (see Figure 8) could be accessed via a footpath from a car park at Balcary Bay and was a popular angling location.

The upper shore of Balcary Bay was rocky with boulders, the mid shore was sand and stones, and the lower shore was a wide expanse of mud and sand. People staying at nearby cottages and a hotel were walking and playing on the shore. One stake net station was in operation in the bay and one stake net station was disused. A narrow road extended along the western side of Auchencairn Bay, parallel to the shore, where there was limited parking in several small lay-bys. The upper shore of Auchencairn Bay was rocky with a large expanse of mud and sand below. Bait digging took place in the bay. Further east was Orchardton Bay, where there were areas of sand, mud and salt marsh between rocky outcrops around the bay. No public access to the shore was identified.



Figure 8. Balcary Point

To the north-east of Orchardton Bay, on the western bank of the Urr Estuary, vehicular access was possible via a track at South Glen, and there was space to park cars on a verge. The World Flounder Trampling Championship, which involved competitors wading out across the mudflats to catch flounders by using their bare feet, was historically held in this area, but at the time of the survey it was no longer taking place for health and safety reasons.

Palnackie was located further inland along Urr Water; the river in this area was tidal with steep sided muddy banks. The small stonewalled harbour was the nominal homeport for two fishing boats. However, they were generally fishing outside the survey area and seldom visited Palnackie. One angling club had the rights to fish for salmon and sea trout on a tidal section of Urr Water between Palnackie and Dalbeattie. Approximately 12 members of the club were noted to fish in this area and the consumption of salmon and sea trout was identified.

Palnackie to Southernness Point

Vehicular access to the eastern shore of the Urr Estuary was limited to two locations; Kippford and Rockcliffe. The village of Kippford was the main sailing centre in the survey area; facilities included a yacht club, a large compound for sailboats and dinghies, pontoons and a slipway. Many sailboats and small motorboats were moored in the estuary. Sailors who used Kippford as a base regularly sailed along Urr Water and into the Solway Firth.

Further south of Kippford, the village of Rockcliffe was a popular location for tourists. The sandy bay at Rockcliffe was interspersed with rocks, boulders and seaweed covered stones (see Figure 9). The bay was popular with families playing and at low tide local dog walkers walked out onto the mudflats of Rough Firth. Bait digging was also identified in this area. A stake net was in operation offshore of Rockcliffe near an island in Rough Firth.



Figure 9. Rockcliffe

To the east of Rockcliffe, the large sandy beach at Sandyhills Bay (see Figure 10) was a popular destination for visiting and local families and for people staying at the nearby caravan site. The bay was backed by sand dunes with rocks at both ends and there was a vast expanse of sand and mud exposed at low tide. Activities observed during the survey included playing, sunbathing, paddling and swimming. A stake net was in operation at the western end of the bay.

The sandflats at Mersehead Sands extended approximately 7 km between Sandyhills Bay and Southernness Point. A large area of the sands was part of a nature reserve, which was managed by the Royal Society for the Protection of Birds. The reserve was extremely popular with visiting bird watchers who could walk out onto the sandflats at low tide. The sandflats were backed by areas of salt marsh where cattle were grazed in the summer months.



Figure 10. Sandyhills Bay

Southernness Point was a rocky outcrop that extended out into the Solway Firth. The rocks were interspersed with sand and the shore either side of the rocks was sandy. There was a large caravan park close to the shore at Southernness and numerous visitors from the caravan park spent time on the beach. Activities identified in this area were walking, dog walking, playing and rock pooling. A hobby fisherman set nets from the shore to the west of Southernness Point in the summer months.

Southernness Point to Caerlaverock

To the north of Southernness Point, public access to the shore was possible at Carsethorn, which was located at the southern end of the Nith Estuary. The upper shore at Carsethorn was sand and stones, and there were large sand banks exposed on the lower shore at low water. Two anglers were observed at this location and two small boats were drawn up on the beach. Signs warning of strong currents were clearly visible on the beach.

The River Nith flowed from the north through Dumfries. It was reported that a small stretch of the River Nith to the south of Dumfries was a popular fly fishing location for salmon. On the lower stretches of the river there were large areas of salt marsh and tide washed grass on the banks, and large areas of mud and sand were exposed at low tide (see Figure 11). Public access along the west bank of the River Nith was difficult due to a limited number of public roads leading to the shore but access was possible at several locations along the east bank. Haaf netting was popular on the River Nith and most of the fishermen accessed the river from the eastern bank. At Glencaple there was an inshore lifeboat station and a quay which was used by anglers fishing for flat fish.

The Caerlaverock National Nature Reserve marked the eastern extent of the survey area. The reserve included a large area of salt marsh and extended onto the sandflats up to approximately 6 km offshore. The western and middle section of the reserve was managed by Scottish Natural Heritage and the eastern section was managed by the Wildfowl and Wetlands Trust. The reserve was popular with birdwatchers and tourists, who mostly spent time on the boardwalks and viewing platforms. There was no public access to the eastern section of the reserve except for guided walks. Wildfowling was permitted on the western and middle sections of the reserve, and areas of salt marsh throughout the reserve were rented to local farmers for grazing cattle in the summer months.



Figure 11. The River Nith

4.2 Commercial fisheries

The commercial fisheries in the area included creeling for brown crab, common lobster, *Nephrops* and whelks; trawling and dredging for queen scallops and king scallops; gill netting for bass and grey mullet; fishing for salmon and sea trout using haaf nets, stake nets and 'net and cobble'; and hand collecting winkles from the shore. The main harbours used by commercial fishing boats were Isle of Whithorn, Garlieston and Kirkcudbright.

Four commercial creel boats were based at Isle of Whithorn, three at Garlieston and two at Kirkcudbright. Some of the fishermen only fished on a part-time basis. The main target species were brown crab and common lobster but fishermen at Garlieston also fished for *Nephrops* and whelks. One fisherman kept common prawns, caught as a by-catch in whelk pots, for his own family's consumption.

At the time of the survey six scalloping vessels were based at Kirkcudbright. They used dredges and trawls to fish for queen scallops. During the winter months the number of commercial scalloping vessels increased significantly as more boats joined the fleet to take part in the seasonal fishery for king scallops. The scalloping vessels mainly fished outside the survey area.

A small amount of gill netting for bass and grey mullet took place at the north end of Wigtown Bay. Flounder, plaice, Dover sole and thornback ray were also caught in the nets.

Fishing for salmon and sea trout took place in the rivers and estuaries. Haaf netting was undertaken on the River Nith; stake netting in Balcarry Bay, Fleet Bay and along the north-east shore of Wigtown Bay; and net and cobble fishing in the River Cree. These fishing methods had a by-catch of bass, grey mullet and flounder. The salmon and sea trout fishing season extended from 25th February to 9th September, but most fishermen did not fish throughout the entire season.

Winkles were collected commercially by hand from extensive areas of the coastline between Isle of Whithorn and Almorness Point. It was reported that about 25 people collected winkles regularly, although many only collected on a part-time basis.

There have been commercial cockle fisheries in the area in the past but these have been closed for several years. It was reported that illegal gathering of cockles was still taking place in Fleet Bay and off Caerlaverock.

4.3 Destination of seafood originating from the aquatic survey area

Salmon and sea trout were sold through local smokehouses and wet fish shops, sent to dealers in other parts of Scotland and sold over the internet. White fish such as bass, Dover sole *etc.* were sold through local wet fish shops and sent to wholesalers outside the survey area.

Brown crabs, common lobster and *Nephrops* were sold through local retailers and restaurants or sold direct to the public. Common lobster were also sold to wholesalers in Troon and elsewhere and subsequently mainly exported to France and Spain.

Three local shellfish wholesalers bought the majority of the queen scallops, king scallops and winkles landed or collected within the area. Small quantities of queen scallops and king scallops were sold locally but the majority were distributed nationally or exported to Europe. Winkles were exported to Europe, particularly France. Whelks were bought by a wholesaler in Fleetwood and subsequently exported to the continent and the Far East.

4.4 Hobby fishing, angling and non-commercial shellfish collecting

A number of people went fishing as a hobby and kept the catch for consumption by their own families and friends. The following hobby fishing activities were identified: several people set creels to catch brown crabs and common lobsters; one person set nets from the shore at Southernness to catch bass; two people used a seine net off Garlieston Bay to catch bass and grey mullet; one person used a rake in Kirkcudbright Bay to catch common prawns; and one person used a drop net from the harbour wall at Isle of Whithorn to catch brown shrimps.

Sea angling was very popular at many places throughout the survey area, particularly at Kirkcudbright Lifeboat Station, Abbey Burn Foot, Rascarrel Bay and Balcary Point. Most shore angling took place from rocky areas but angling also took place from sand beaches, tide washed riverbanks and harbour walls. Fly fishermen were identified wading in the river at Urr Water. Several boat anglers operated out of the harbours at Isle of Whithorn, Garlieston, Kirkcudbright, and Kippford. Many of the anglers dug lugworm and ragworm or collected peeler crabs for angling bait.

Several people collected small amounts of winkles, cockles or mussels for their own families' consumption. These were available in many places in the survey area but the main places mentioned by interviewees were Isle of Whithorn, Garlieston Bay, Isle Mouth, Brighthouse Bay and Rascarrel Bay for winkles, Innerwell, Fleet Bay and Kirkcudbright Bay for cockles, and Garlieston, Fleet Bay and the Dee Estuary for mussels.

4.5 Wildfowling

Wildfowling occurred in the survey area at Caerlaverock and at the north end of Wigtown Bay. It was undertaken both by members of wildfowling clubs and by individuals not belonging to clubs. The wildfowling season extended from 1st September to 20th February. Wildfowling was allowed within the Caerlaverock National Nature Reserve and permits were issued by Scottish Natural Heritage. Seasonal and weekly permits to shoot on the Wigtown Bay Local Nature Reserve were issued by Dumfries and Galloway Council. Two wildfowling clubs were identified whose members shot in the Wigtown Bay area: one club had approximately 25 members and the other had just over 100 members. The main species being shot were pink-footed goose, mallard, teal and wigeon.

Geese are known to arrive in the Solway during mid to late September and leave the area in March or April. They generally feed on salt marsh grass for 2-4 weeks at the beginning and/or at the end of their stay, and feed inland on pasture and cereal for the remainder of the time. Pink-footed geese, the main species shot by wildfowlers in the Solway, typically feed inland for most of the time and feed on salt marsh during the last month of their stay. The geese roost on the mudflats at night and wildfowlers shoot the geese as they fly to and from the feeding grounds.

4.6 Other pathways

Eight farmers were interviewed who grazed livestock on salt marshes in the survey area. Five of the farmers grazed livestock on the salt marshes near Creetown and three of the farmers grazed livestock on the salt marshes at Caerlaverock. Three of these farms produced milk (from dairy cattle); three produced beef cattle; one produced beef and lamb; and one produced lamb. Two of the farmers and their families were consuming lamb produced on their own farms and one farmer and his family were consuming beef produced on his own farm.

4.7 The use of seaweed for livestock feed or fertiliser

The use of seaweed for human consumption, livestock feed, fertiliser or soil conditioner was investigated during the survey but was not identified.

4.8 Internal exposure

Consumption data for aquatic foods are presented in Tables 3 to 8 for adults and in Tables 9 and 10 for children and infants.

Adults' consumption rates

The main consumers were commercial fishermen, hobby fishermen, shellfish collectors, anglers, wildfowlers, farmers and families of these people. No consumption of marine plants/algae was identified.

Table A presents a summary of the consumption rates for fish, crustaceans, molluscs, wildfowl, salt marsh grazed cattle meat and salt marsh grazed sheep meat. 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 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)
Fish	89	41	30.8	10.5	18.1	30.8	15.0	40.0
Crustaceans	27	9	27.5	10.7	14.5	19.2	3.5	10.0
Molluscs	27	1	19.2	19.2	19.2	9.7	3.5	10.0
Wildfowl	18	2	31.7	30.2	30.9	31.0	ND	ND
Salt marsh grazed cattle meat	4	4	35.5	35.5	35.5	35.5	ND	ND
Salt marsh grazed sheep meat	8	4	9.9	9.9	9.9	9.9	ND	ND

Notes

ND – Not determined

The predominant species of fish consumed by adults were cod, bass, mackerel, grey mullet and pollack. Smaller quantities of whiting, salmon, plaice, flounder, thornback ray, dab, smooth hound, red gurnard and sea trout were also consumed. Of the fish consumed by the 41 people in the high-rate group, the percentage breakdown of species was 34% cod, 18% bass, 14% mackerel, 10% grey mullet, 7% pollack and 17% a mix of whiting, salmon, plaice, flounder, thornback ray, dab and smooth hound.

The fish consumed by the people in the high rate group were caught throughout the survey area by anglers and commercial fishermen.

The predominant species of crustaceans consumed by adults were brown crab, common lobster and common prawn. Smaller quantities of brown shrimps and *Nephrops* were also consumed. Of the crustaceans consumed by the nine people in the high-rate group, the percentage breakdown of species was 57% brown crab, 24% common lobster and 19% common prawn. The brown crab and common lobster consumed by the people in the high-rate group were caught by commercial creel fishermen between Isle of Whithorn and Balcary Point and the common prawns were caught in Wigtown Bay.

The predominant species of molluscs consumed by adults were winkles, mussels and cockles. Smaller quantities of king scallops and queen scallops were also consumed. The percentage breakdown of species consumed by the only person in the high-rate group was 54% winkles, 23% mussels and 23% cockles. The molluscs consumed by the person in the high-rate group were collected by a commercial winkle collector who worked along the coast from Isle of Whithorn to Almorness Point.

The predominant species of wildfowl consumed by adults were pink-footed goose, mallard and greylag goose. Smaller quantities of Canada goose, golden plover, pintail, teal and wigeon were also consumed. Of the wildfowl consumed by the two people in the high-rate group, the percentage breakdown of species was 60% pink-footed goose, 18% mallard, 11% greylag goose and 11% a mix of wigeon, teal and Canada goose. The wildfowl consumed by the people in the high-rate group were shot at Caerlaverock and the north end of Wigtown Bay.

Adults' consumption of salt marsh grazed cattle meat and salt marsh grazed sheep meat was identified. The cattle and sheep had grazed on the east bank of the River Cree.

Children's and infants' consumption rates

Table B presents a summary of children's and infants' consumption rates of fish and crustaceans from the 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, marine plants/algae, salt marsh grazed cattle meat or salt marsh grazed sheep meat was identified. For individuals in the infant age group, no consumption of crustaceans 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 survey area

Food group	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y ⁻¹)	Observed minimum for the high-rate group (kg y ⁻¹)	Observed mean for the high-rate group (kg y ⁻¹)	Observed 97.5 th percentile (kg y ⁻¹)
Child age group (6 – 15 years old)						
Fish	13	6	21.5	8.7	11.5	18.6
Crustaceans	2	2	1.5	1.5	1.5	1.5
Infant age group (0 – 5 years old)						
Fish	1	1	2.6	2.6	2.6	NA

Notes

NA – Not applicable

The species of fish consumed by the child age group were bass, cod, dab, flounder, grey mullet, mackerel, plaice, pollack, salmon, smooth hound, thornback ray and whiting. The species of fish consumed by the infant age group were bass, cod, dab, mackerel and whiting. The fish were caught throughout the survey area.

The species of crustaceans consumed by the child age group were brown crab, common lobster and *Nephrops* which were caught in Wigtown Bay.

4.8 External exposure

Intertidal occupancy

Intertidal occupancy rates for adults are presented in Table 11 and intertidal occupancy rates for children and infants are presented in Table 12.

Adults' intertidal occupancy rates

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

Intertidal substrate	Number of observations	Number of people in the high-rate group	Maximum of the high-rate group (h y⁻¹)	Mean of the high-rate group (h y⁻¹)	97.5th percentile (h y⁻¹)
Mud	32	2	565	565	565
Mud and sand	23	13	149	80	125
Mud and stones	8	5	38	25	36
Rock	60	24	860	519	771
Salt marsh	33	17	530	264	448
Sand	108	6	743	402	333
Sand and stones	9	1	648	648	546

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

- For mud: stake netting at Balcary Bay.
- For mud and sand: stake netting, collecting cockles and mussels and walking at Cardoness; bait digging at Sandgreen, Carrick Bay, Balcary Bay, Ross Bay and Carsluith; angling at Carsluith and in the Kirkcudbright Bay area; checking moorings at the Isle of Whithorn; collecting winkles at Garlieston Bay; dog walking at Carsluith and gill netting on the River Nith and Urr Water.
- For mud and stones: collecting crabs from the Kirkcudbright Lifeboat Station, Manxman's Lake or Ross Bay.

- For rock: angling at Torrs Point, Fox Craig, Cairn Head to Sandgreen, Ross Bay, Carsluith, Carrick Bay, Mossyard Bay, Kirkcudbright Lifeboat Station, Abbey Burn Foot, Balcary Point, Rascarrel Bay and in the Kirkcudbright Bay area; collecting winkles on the shore at Rascarrel Bay and between Isle of Whithorn and Almorness Point; collecting crabs from Carsluith, Carrick Bay and Mossyard Bay and collecting mussels in the Kirkcudbright Bay area.
- For salt marsh: angling at Urr Water; dog walking, wildfowling, walking, tending livestock and marsh warden duties at Caerlaverock; and tending livestock at Wigtown and Creetown.
- For sand: angling and dog walking at Rigg Bay; walking at Southernness; setting nets west of Southernness Point; dog walking at Rockcliffe and stake netting at Sandyhills.
- For sand and stones: collecting winkles at Garlieston Bay.

Children's and infants' intertidal occupancy rates

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

Table D. Summary of children's and infants' intertidal occupancy rates					
Intertidal substrate	Number of observations	Number of people in the high-rate group	Maximum of the high-rate group (h y⁻¹)	Mean of the high-rate group (h y⁻¹)	97.5th percentile (h y⁻¹)
Child age group (6 - 15 years old)					
Mud and sand	4	3	78	78	78
Mud and stones	1	1	6	6	Not applicable
Rock	12	2	184	158	170
Salt marsh	1	1	24	24	Not applicable
Sand	53	18	190	109	190
Infant age group (0 - 5 years old)					
Sand	12	7	156	96	146

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

- For mud and sand: walking at Cardoness.
- For mud and stones: collecting crabs at Manxman's Lake and Kirkcudbright Lifeboat Station.
- For rock: angling at Sandgreen, Mossyard Bay, Torrs Point, Kirkcudbright Lifeboat Station, Abbey Burn Foot and Rascarrel Bay.
- For salt marsh: angling from the east bank of the River Dee.
- For sand: walking at Isle Mouth and Carrick Bay; playing at Southernness, Isle Mouth, Brighthouse Bay, Carrick Bay, Balcary Bay, Rockcliffe, Sandyhills and Nun Mill Bay, dog walking at Southernness and horse riding at Garlieston Bay.

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

- For sand: playing at Sandyhills, Brighthouse Bay, Carrick Bay, Nun Mill Bay, Balcary Bay, Rockcliffe and Southerness; and dog walking at Southerness.

Gamma dose rate measurements

Gamma dose rate measurements were taken over intertidal substrates to supplement those of SEPA's scheduled monitoring programme. All measurements were taken at a height of 1 metre above the substrate. The results are presented in Table 13 and are summarised below.

- Two measurements taken over grass ranged from 0.067 $\mu\text{Gy h}^{-1}$ to 0.075 $\mu\text{Gy h}^{-1}$
- Ten measurements taken over mud ranged from 0.069 $\mu\text{Gy h}^{-1}$ to 0.091 $\mu\text{Gy h}^{-1}$
- Eight measurement taken over mud and sand ranged from 0.057 $\mu\text{Gy h}^{-1}$ to 0.080 $\mu\text{Gy h}^{-1}$
- Two measurements taken over mud and stones ranged from 0.081 $\mu\text{Gy h}^{-1}$ to 0.083 $\mu\text{Gy h}^{-1}$
- Two measurements taken over salt marsh ranged from 0.066 $\mu\text{Gy h}^{-1}$ to 0.074 $\mu\text{Gy h}^{-1}$
- Eight measurements taken over sand ranged from 0.053 $\mu\text{Gy h}^{-1}$ to 0.086 $\mu\text{Gy h}^{-1}$
- One measurement taken over sand and stones was 0.084 $\mu\text{Gy h}^{-1}$
- Two measurements taken over stones ranged from 0.075 $\mu\text{Gy h}^{-1}$ to 0.110 $\mu\text{Gy h}^{-1}$

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.

Handling rates of fishing gear and sediment for adults are presented in Table 14 and handling rates of sediment for children are presented in Table 15. No children were identified handling fishing gear and no 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.

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)	97.5 th percentile (h y ⁻¹)
Handling fishing gear	25	7	1750	1180	1600
Handling sediment	64	15	1503	879	1154

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

- For handling fishing gear: handling creels in the area between Isle of Whithorn and Balcarly Point.
- For handling sediment: collecting winkles at Rascarrel Bay, Garlieston Bay and from Isle of Whithorn to Almorness Point, wildfowling at Wigtown Bay, bait digging at Auchencairn Bay and setting up and cleaning stake nets at Balcarly Bay. (Setting up and cleaning stake nets were classified as handling sediment rather than handling fishing gear since these activities involved close contact with sediments.)

Children's handling rates of sediment

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

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)	97.5 th percentile (h y ⁻¹)
Handling sediment	3	2	21	20	21

The activity undertaken by the children in the child high-rate group for handling sediment was bait digging at Rockcliffe, Ross Bay and Sandgreen.

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 16 and for children and infants are presented in Table 17.

The activities taking place 'in water' in the survey area were swimming, snorkelling, sub-aqua diving, windsurfing, water skiing and kayaking. Thirty observations were recorded for adults, 13 observations were recorded for individuals in the child age group and one individual in the infant age group. The maximum occupancy rate 'in water' for adults was 110 h y⁻¹ for two people windsurfing at Carrick Bay and one person diving between Garlieston Bay and Isle of Whithorn. The maximum occupancy rate 'in water' for individuals in the child age group was 22 h y⁻¹ for three children who were swimming and kayaking at Cardoness. The maximum occupancy rate 'in water' for the only individual in the infant age group, who was swimming at Rockcliffe, Sandyhills and Southernness, was 3 h y⁻¹.

The activities taking place 'on water' in the survey area were travelling to and from diving locations, boat angling, haaf netting, operating a rescue boat, creeling, sailing, working on a boat, conducting boat maintenance, gill netting, prawn raking, RNLI duties, pleasure cruising, fly fishing, canoeing and paddling. One hundred and thirteen observations were recorded for adults, 32 observations were recorded for individuals in the child age group and four observations were recorded for individuals in the infant age group. The maximum occupancy rate 'on water' for adults was 2100 h y⁻¹ for a commercial fisherman who was creeling between Garlieston Bay and the Isle of Whithorn. The maximum occupancy rate 'on water' for individuals in the child age group was 140 h y⁻¹ for 12 children who were sailing off the Isle of Whithorn. The maximum occupancy rate 'on water' for the individuals in the infant age group was 40 h y⁻¹ for one infant paddling at Brighthouse Bay, Carrick Bay, Nun Mill Bay and Balcary Bay.

5 USE 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 15 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 15 listed combinations.

6 COMPARISONS WITH THE PREVIOUS SURVEY

The results from this 2012 survey can be compared with results from the last habits survey, undertaken along the Dumfries and Galloway coast in 2007.

A comparison between the 2007 and 2012 adults' consumption rates of aquatic foods is presented in Table G.

Table G. Comparison between 2007 and 2012 consumption rates of aquatic food groups for adults

Food group	2007			2012		
	Number in high-rate group	Maximum consumption rate (kg y ⁻¹)	Mean consumption rate for the high-rate group (kg y ⁻¹)	Number in high-rate group	Maximum consumption rate (kg y ⁻¹)	Mean consumption rate for the high-rate group (kg y ⁻¹)
Fish	8	67.6	50.8	41	30.8	18.1
Crustaceans	11	29.1	15.1	9	27.5	14.5
Molluscs	6	8.8	5.7	1	19.2	19.2
Wildfowl	3	35.4	21.5	2	31.7	30.9
Salt marsh grazed cattle meat	5	31.0	31.0	4	35.5	35.5
Salt marsh grazed sheep meat	Not identified			4	9.9	9.9

Compared with the 2007 survey, the mean consumption rate for the adult high-rate group decreased for fish and crustaceans in 2012, whereas the mean consumption rate for the adult high-rate group increased for molluscs, wildfowl and salt marsh grazed cattle meat in 2012. The consumption of salt marsh grazed sheep meat was identified in 2012 but was not identified in 2007. The most significant changes in 2012 compared with 2007 were a decrease in the mean consumption rate for the adult high-rate group for fish, from 51 kg y⁻¹ to 18 kg y⁻¹, and an increase in the mean consumption rate for the adult high-rate group for molluscs from 5.7 kg y⁻¹ to 19 kg y⁻¹. The decrease in the consumption rate of fish was mainly attributable to the crew of a fishing boat, who had been high rate consumers in 2007, no longer fishing in the area in 2012. The increase in the consumption rate of molluscs was attributable to the identification of a single high rate consumer in 2012, who was not identified in 2007.

The main species of fish consumed by the adult high-rate group in 2007 were cod, bass, mackerel, pollack and whiting, and in 2012 were cod, bass, mackerel, pollack and grey mullet. The species of crustaceans consumed by the adult high-rate group changed from brown crab, common lobster and *Nephrops* in 2007 to brown crab, common lobster and common prawns in 2012. The main species of molluscs consumed by the adult high-rate group in 2007 were mussels and cockles and in 2012 were winkles, mussels and cockles. The main species of wildfowl consumed by the adult high-rate group in 2007 were goose (unspecified) and duck (unspecified) and in 2012 were pink-footed goose, mallard and greylag goose.

A comparison between the 2007 and 2012 aquatic external exposure pathways for adults is presented in Table H.

Table H. Comparison between 2007 and 2012 intertidal occupancy rates and handling rates of fishing gear and sediments for adults

Intertidal substrate or handling pathway	2007			2012		
	Number of people in the high-rate group	Maximum occupancy or handling rate (h y ⁻¹)	Mean occupancy or handling rate for the high-rate group (h y ⁻¹)	Number of people in the high-rate group	Maximum occupancy or handling rate (h y ⁻¹)	Mean occupancy or handling rate for the high-rate group (h y ⁻¹)
Mud	4	1120	775	2	565	565
Mud and sand	4	1035	570	13	149	80
Mud and stones	Not identified			5	38	25
Rock	10	960	669	24	860	519
Salt marsh	4	857	665	17	530	264
Sand	13	608	306	6	743	402
Sand and stones	Not identified			1	648	648
Handling fishing gear	8	2228	1309	7	1750	1180
Handling sediment	10	1050	815	15	1503	879

The mean occupancy rates for the adult high-rate groups in 2012, compared to 2007, decreased for occupancy over mud, mud and sand, rock and salt marsh, and increased for occupancy over sand. Occupancy over mud and stones, and over sand and stones, was identified in 2012 but not in 2007. The most significant changes between 2007 and 2012 were a decrease in occupancy over mud and sand, from 570 h y⁻¹ to 80 h y⁻¹, and a decrease in occupancy over salt marsh, from 670 h y⁻¹ to 260 h y⁻¹. The decrease in occupancy over mud and sand was mainly attributable to a decrease in stake netting, owing to declining catches, and the cessation of commercial cockling. The decrease in the occupancy over salt marsh was mainly attributable to a decrease in marsh warden duties.

In 2012, the mean rate for the adult high-rate group for handling fishing gear decreased slightly compared with 2007, while the mean rate for the adult high-rate group for handling sediment increased slightly in 2012 compared with 2007.

7 MAIN FINDINGS

The survey investigated the habits and consumption patterns of people along the Dumfries and Galloway coast and the waters offshore, in order to determine their potential exposure pathways relating to authorised discharges of liquid radioactive waste into the Irish Sea, principally from the Sellafield nuclear site in Cumbria.

Data were collected for 415 individuals including, for example, commercial fishermen, anglers and people spending time on intertidal substrates. These people were targeted because their habits 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 survey area 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 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:

- 18 kg y⁻¹ for fish
- 15 kg y⁻¹ for crustaceans
- 19 kg y⁻¹ for molluscs
- 31 kg y⁻¹ for wildfowl
- 36 kg y⁻¹ for salt marsh grazed cattle meat
- 9.9 kg y⁻¹ for salt marsh grazed sheep meat

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

- For fish; cod, bass, mackerel, grey mullet and pollack
- For crustaceans; brown crab, common lobster and common prawns
- For molluscs; winkles, mussels and cockles
- For wildfowl; pink-footed goose, mallard and greylag goose
- For salt marsh grazed cattle meat; beef
- For salt marsh grazed sheep meat; lamb

No consumption of marine plants/algae was identified.

The use of seaweed for livestock feed, fertiliser or soil conditioner was investigated during the survey but was not identified.

MAIN FINDINGS

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

- 570 h y⁻¹ for mud
- 80 h y⁻¹ for mud and sand
- 25 h y⁻¹ for mud and stones
- 520 h y⁻¹ for rock
- 260 h y⁻¹ for salt marsh
- 400 h y⁻¹ for sand
- 650 h y⁻¹ for sand and stones

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

- 1200 h y⁻¹ for handling fishing gear
- 880 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 maximum occupancy rates for adults for water based activities were:

- 110 h y⁻¹ for occupancy in water
- 2100 h y⁻¹ for occupancy on water

8 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 monitoring programme. A summary of the current environmental monitoring programme is provided below, followed by the suggestions for changes to the programme.

8.1 Summary of the current environmental monitoring programme

The 2011 SEPA environmental monitoring programme for Dumfries and Galloway, which is published in the RIFE report (EA, FSA, NIEA and SEPA 2012), included the samples and measurements listed below. The location names, foods and substrate classifications are taken directly from that publication.

Aquatic monitoring

Sample	Location
Plaice	Kirkcudbright
Scallops	Kirkcudbright
Queens	Kirkcudbright
Limpets	Kirkcudbright
Winkles	Southernness
Crabs	North Solway coast
Lobsters	North Solway coast
Winkles	North Solway coast
Cockles	North Solway coast
Mussels	North Solway coast
<i>Fucus vesiculosus</i>	Garlieston
<i>Fucus vesiculosus</i>	Auchencairn
Sediment	Garlieston
Sediment	Innerwell
Sediment	Carluith
Sediment	Skyreburn
Sediment	Kirkcudbright
Sediment	Rascarrel Bay
Sediment	Palnackie Harbour
Sediment	Gardenburn
Sediment	Kippford Slipway
Sediment	Kippford Merse
Sediment	Southernness
Sediment	Kirkconnell Merse

Gamma dose rate measurements over intertidal sediments

Substrate	Location
Mud	Garlieston
Mud	Innerwell
Mud	Bladnoch
Mud	Carsluith
Salt marsh	Skyreburn Bay (Water of Fleet)
Salt marsh	Kirkcudbright
Winkle bed	Cutters Pool
Winkle bed	Rascarrel Bay
Salt marsh	Gardenburn
Mud	Palnackie Harbour
Mud	Kippford – Slipway
Mud	Kippford – Merse
Winkle bed	Southernness
Salt marsh	Kirkconnell Marsh

8.2 Suggestions for changes

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

- Within the 'fish' food group the quarterly sample of plaice currently monitored could be replaced with a quarterly sample of cod, since this species was consumed in far greater amounts. Cod should be available from the same source that provided plaice.
- Within the 'mollusc' food group the annual sample of limpets currently monitored could be discontinued since no consumption of limpets was identified.
- Within the 'mollusc' food group the quarterly sample of winkles currently monitored, which is collected from Southernness, could be replaced with a quarterly sample of winkles collected from the area between Isle of Whithorn and Almorness Point, since no collection of winkles was noted from Southernness but the areas further west were popular winkle collecting areas. Samples could be collected from, for example, Isle of Whithorn, Garlieston Bay, Isle Mouth, Brighthouse Bay or Rascarrel Bay.

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
Fish	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 ^a , squid ^a
Crustaceans	Brown crab, common lobster, crawfish, <i>Nephrops</i> , common prawn, brown shrimp, spider crab, squat lobster, velvet swimming crab
Molluscs	Cockles, king scallops, limpets, mussels, oysters, queen scallops, whelks, winkles
Wildfowl	Canada goose, greylag goose, mallard, pink-footed goose, pintail, shoveler, teal, wigeon

Notes

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

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

Group	Ratio	
	Infant ^a /adult	Child ^a /adult
Fish ^b	0.050	0.200
Crustaceans ^b	0.050	0.250
Molluscs ^b	0.050	0.250
External exposure over intertidal substrates	0.030	0.500

Notes

^aNote 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.

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

Table 3. Adults' consumption rates of fish (kg y⁻¹)

Observation number	Bass	Cod	Dab	Flounder	Grey mullet	Mackerel	Plaice	Pollack	Red gurnard	Salmon	Sea trout	Smooth hound	Thornback ray	Whiting	Total
282	-	23.6	-	-	-	7.3	-	-	-	-	-	-	-	-	30.8
283	-	23.6	-	-	-	7.3	-	-	-	-	-	-	-	-	30.8
284	-	23.6	-	-	-	7.3	-	-	-	-	-	-	-	-	30.8
285	-	23.6	-	-	-	7.3	-	-	-	-	-	-	-	-	30.8
179	6.4	12.0	0.6	-	-	5.5	-	-	-	-	-	-	-	1.3	25.8
180	6.4	12.0	0.6	-	-	5.5	-	-	-	-	-	-	-	1.3	25.8
173	5.5	5.5	1.1	1.1	-	4.4	1.1	-	-	-	-	-	-	3.3	22.1
170	5.5	5.5	1.1	1.1	-	4.4	1.1	-	-	-	-	-	-	3.3	22.1
171	5.5	5.5	1.1	1.1	-	4.4	1.1	-	-	-	-	-	-	3.3	22.1
172	5.5	5.5	1.1	1.1	-	4.4	1.1	-	-	-	-	-	-	3.3	22.1
133	-	5.2	-	1.5	2.1	1.7	1.5	4.9	-	-	-	-	4.5	-	21.5
134	-	5.2	-	1.5	2.1	1.7	1.5	4.9	-	-	-	-	4.5	-	21.5
135	-	5.2	-	1.5	2.1	1.7	1.5	4.9	-	-	-	-	4.5	-	21.5
45	7.0	-	-	-	7.0	-	7.0	-	-	-	-	-	-	-	21.0
187	4.6	5.5	-	-	-	3.7	0.9	1.8	-	-	-	-	-	1.8	18.4
188	4.6	5.5	-	-	-	3.7	0.9	1.8	-	-	-	-	-	1.8	18.4
189	4.6	5.5	-	-	-	3.7	0.9	1.8	-	-	-	-	-	1.8	18.4
190	4.6	5.5	-	-	-	3.7	0.9	1.8	-	-	-	-	-	1.8	18.4
191	4.6	5.5	-	-	-	3.7	0.9	1.8	-	-	-	-	-	1.8	18.4
192	4.6	5.5	-	-	-	3.7	0.9	1.8	-	-	-	-	-	1.8	18.4
405	1.3	-	-	-	4.3	-	-	-	-	12.2	-	-	-	-	17.8
407	1.3	-	-	-	4.3	-	-	-	-	12.2	-	-	-	-	17.8
312	-	-	-	-	-	1.5	-	9.9	-	5.9	-	-	-	-	17.3
356	9.4	-	-	-	7.1	-	-	-	-	-	-	-	-	-	16.5
357	9.4	-	-	-	7.1	-	-	-	-	-	-	-	-	-	16.5
163	4.3	5.7	0.6	0.9	-	2.8	-	-	-	-	-	0.7	-	-	14.9
164	4.3	5.7	0.6	0.9	-	2.8	-	-	-	-	-	0.7	-	-	14.9
156	5.2	5.2	-	-	-	-	-	1.5	-	-	-	-	-	2.9	14.7
157	5.2	5.2	-	-	-	-	-	1.5	-	-	-	-	-	2.9	14.7

Table 3. Adults' consumption rates of fish (kg y⁻¹)

Observation number	Bass	Cod	Dab	Flounder	Grey mullet	Mackerel	Plaice	Pollack	Red gurnard	Salmon	Sea trout	Smooth hound	Thornback ray	Whiting	Total
108	-	-	-	-	12.5	-	-	-	-	-	-	-	-	-	12.5
109	-	-	-	-	12.5	-	-	-	-	-	-	-	-	-	12.5
160	3.5	3.5	0.6	0.6	1.2	2.4	-	-	-	-	-	-	-	-	11.8
162	3.5	3.5	0.6	0.6	1.2	2.4	-	-	-	-	-	-	-	-	11.8
286	-	11.8	-	-	-	-	-	-	-	-	-	-	-	-	11.8
287	-	11.8	-	-	-	-	-	-	-	-	-	-	-	-	11.8
58	3.6	1.3	0.3	0.3	2.4	1.6	-	0.9	0.6	-	-	-	-	-	11.1
60	3.6	1.3	0.3	0.3	2.4	1.6	-	0.9	0.6	-	-	-	-	-	11.1
146	2.2	3.1	-	-	-	-	-	3.0	-	-	-	-	-	2.3	10.7
147	2.2	3.1	-	-	-	-	-	3.0	-	-	-	-	-	2.3	10.7
59	3.6	1.3	-	-	2.4	1.6	-	0.9	0.6	-	-	-	-	-	10.5
61	3.6	1.3	-	-	2.4	1.6	-	0.9	0.6	-	-	-	-	-	10.5
347	0.5	-	-	2.8	-	-	-	6.2	-	-	-	-	-	-	9.5
349	0.5	-	-	2.8	-	-	-	6.2	-	-	-	-	-	-	9.5
1	0.6	4.4	-	-	-	2.0	-	1.7	-	-	-	-	-	-	8.7
2	0.6	4.4	-	-	-	2.0	-	1.7	-	-	-	-	-	-	8.7
3	0.6	4.4	-	-	-	2.0	-	1.7	-	-	-	-	-	-	8.7
248	-	5.9	-	-	-	-	-	-	-	-	-	-	-	2.7	8.6
181	2.7	5.2	-	-	-	-	-	-	-	-	-	-	-	-	7.9
182	2.7	5.2	-	-	-	-	-	-	-	-	-	-	-	-	7.9
399	-	-	-	-	-	-	-	-	-	7.8	-	-	-	-	7.8
400	-	-	-	-	-	-	-	-	-	7.8	-	-	-	-	7.8
410	-	4.0	-	-	-	-	-	3.7	-	-	-	-	-	-	7.7
411	-	4.0	-	-	-	-	-	3.7	-	-	-	-	-	-	7.7
412	-	4.0	-	-	-	-	-	3.7	-	-	-	-	-	-	7.7
413	-	4.0	-	-	-	-	-	3.7	-	-	-	-	-	-	7.7
408	0.4	-	-	-	1.4	-	-	-	-	4.1	-	-	-	-	5.9
409	0.4	-	-	-	1.4	-	-	-	-	4.1	-	-	-	-	5.9
126	1.8	1.9	-	-	-	-	-	-	-	-	-	-	-	1.7	5.4

Table 3. Adults' consumption rates of fish (kg y⁻¹)

Observation number	Bass	Cod	Dab	Flounder	Grey mullet	Mackerel	Plaice	Pollack	Red gurnard	Salmon	Sea trout	Smooth hound	Thornback ray	Whiting	Total
152	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4
153	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish based on the 41 high-rate adult consumers is 18.1 kg y⁻¹

The observed 97.5th percentile rate based on 89 observations is 30.8 kg y⁻¹

Table 4. Adults' consumption rates of crustaceans (kg y⁻¹)

Observation number	Brown shrimp	Common prawn	Brown crab	Common lobster	<i>Nephrops</i>	Total
45	-	-	10.7	16.8	-	27.5
282	-	-	10.7	4.1	-	14.8
283	-	-	10.7	4.1	-	14.8
286	-	-	10.7	3.1	-	13.8
287	-	-	10.7	3.1	-	13.8
106	-	12.1	-	-	-	12.1
107	-	12.1	-	-	-	12.1
284	-	-	10.7	-	-	10.7
285	-	-	10.7	-	-	10.7
11	-	-	0.8	2.5	-	3.3
12	-	-	0.8	2.5	-	3.3
133	-	2.3	0.2	0.3	-	2.8
27	-	-	0.7	1.1	-	1.8
28	-	-	0.7	1.1	-	1.8
126	-	-	1.0	0.3	0.2	1.5
127	-	-	1.0	0.3	0.2	1.5
130	-	-	1.0	0.3	0.2	1.5
131	-	-	1.0	0.3	0.2	1.5
132	-	-	1.0	0.3	0.2	1.5
288	-	-	0.7	0.6	-	1.3
290	-	-	0.7	0.6	-	1.3
56	-	-	-	0.9	-	0.9
57	-	-	-	0.9	-	0.9
9	-	-	0.3	0.4	-	0.7
10	-	-	0.3	0.4	-	0.7
134	-	-	0.2	0.3	-	0.4
2	0.3	-	-	-	-	0.3

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of crustaceans based on the 9 high-rate adult consumers is 14.5 kg y⁻¹

The observed 97.5th percentile rate based on 27 observations is 19.2 kg y⁻¹

Table 5. Adults' consumption rates of molluscs (kg y⁻¹)

Observation number	Cockle	King scallop	Mussel	Queen scallop	Winkle	Total
248	4.4	-	4.4	-	10.4	19.2
282	-	0.5	3.6	0.5	-	4.6
283	-	0.5	3.6	0.5	-	4.6
284	-	0.5	3.6	0.5	-	4.6
285	-	0.5	3.6	0.5	-	4.6
270	0.9	-	0.9	-	-	1.8
271	0.9	-	0.9	-	-	1.8
2	0.9	-	-	-	0.2	1.1
56	-	0.5	0.2	-	-	0.8
57	-	0.5	0.2	-	-	0.8
11	-	0.7	-	-	-	0.7
12	-	0.7	-	-	-	0.7
246	-	-	-	-	0.6	0.6
247	-	-	-	-	0.6	0.6
288	-	-	0.5	-	-	0.5
290	-	-	0.5	-	-	0.5
9	-	0.4	-	-	-	0.4
10	-	0.4	-	-	-	0.4
133	0.2	-	0.2	-	-	0.3
134	0.2	-	0.2	-	-	0.3
126	0.1	-	0.1	-	-	0.3
127	0.1	-	0.1	-	-	0.3
249	-	-	0.3	-	-	0.3
250	-	-	0.3	-	-	0.3
253	-	-	0.3	-	-	0.3
81	0.1	-	0.1	-	-	0.2
82	0.1	-	0.1	-	-	0.2

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of molluscs based on the only adult consumer is 19.2 kg y⁻¹

The observed 97.5th percentile rate based on 27 observations is 9.7 kg y⁻¹

Table 6. Adults' consumption rates of wildfowl (kg y⁻¹)

Observation number	Canada goose	Golden plover	Greylag goose	Mallard	Pink-footed goose	Pintail duck	Teal	Wigeon	Total
151	0.7	-	6.6	2.3	17.0	-	1.6	3.5	31.7
312	-	-	-	9.0	20.4	-	0.8	-	30.2
152	-	-	-	1.6	2.6	-	0.2	0.5	4.8
153	-	-	-	1.6	2.6	-	0.2	0.5	4.8
60	-	0.1	-	-	1.4	0.3	0.4	1.7	3.8
61	-	0.1	-	-	1.4	0.3	0.4	1.7	3.8
62	-	-	-	-	1.4	0.3	0.4	1.7	3.7
64	-	-	-	-	1.4	0.3	0.4	1.7	3.7
63	-	-	-	-	1.4	0.3	0.4	1.7	3.7
58	-	-	-	-	1.3	0.3	0.4	1.6	3.5
59	-	-	-	-	1.3	0.3	0.4	1.6	3.5
359	0.5	-	-	1.2	0.6	-	0.4	-	2.8
360	0.5	-	-	1.2	0.6	-	0.4	-	2.8
362	-	-	-	-	1.7	-	0.1	0.3	2.1
363	-	-	-	-	1.7	-	0.1	0.3	2.1
111	-	-	-	0.9	-	-	0.3	0.7	1.9
110	-	-	-	0.9	-	-	0.3	0.7	1.9
144	-	-	-	-	-	-	0.5	1.1	1.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of wildfowl based on the 2 high-rate adult consumers is 30.9 kg y⁻¹

The observed 97.5th percentile rate based on 18 observations is 31.0 kg y⁻¹

Table 7. Adults' consumption rates of salt marsh grazed cattle meat (kg y⁻¹)

Observation number	Salt marsh grazed beef
41	35.5
42	35.5
43	35.5
44	35.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of salt marsh grazed cattle meat based on the 4 high-rate adult consumers is 35.5 kg y⁻¹

The observed 97.5th percentile rate based on 4 observations is 35.5 kg y⁻¹

Table 8. Adults' consumption rates of salt marsh grazed sheep meat (kg y⁻¹)

Observation number	Salt marsh grazed lamb
41	9.9
42	9.9
43	9.9
44	9.9
36	2.8
37	2.8
38	2.8
39	2.8

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of salt marsh grazed sheep meat based on the 4 high-rate adult consumers is 9.9 kg y⁻¹

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

Table 9. Children's and infants' consumption rates of fish (kg y⁻¹)

Child age group (6 - 15 years old)

Observation number	Age	Bass	Cod	Dab	Flounder	Grey mullet	Mackerel	Plaice	Pollack	Salmon	Smooth hound	Thornback ray	Whiting	Total
136	6	-	5.2	-	1.5	2.1	1.7	1.5	4.9	-	-	4.5	-	21.5
161	11	3.5	3.5	0.6	0.6	1.2	2.4	-	-	-	-	-	-	11.8
348	13	0.5	-	-	2.8	-	-	-	6.2	-	-	-	-	9.5
165	6	2.6	3.4	0.3	0.5	-	1.7	-	-	-	0.4	-	-	8.9
5	11	0.6	4.4	-	-	-	2.0	-	1.7	-	-	-	-	8.7
4	6	0.6	4.4	-	-	-	2.0	-	1.7	-	-	-	-	8.7
129	13	1.8	1.9	-	-	-	-	-	-	-	-	-	1.7	5.4
128	6	1.8	1.9	-	-	-	-	-	-	-	-	-	1.7	5.4
185	7	1.0	1.9	0.1	-	-	0.8	-	-	-	-	-	0.2	4.0
83	14	1.1	-	-	-	1.1	-	-	-	1.6	-	-	-	3.8
84	14	1.1	-	-	-	1.1	-	-	-	1.6	-	-	-	3.8
85	12	1.1	-	-	-	1.1	-	-	-	1.6	-	-	-	3.8
175	10	0.4	-	-	-	-	0.9	-	-	-	-	-	-	1.3

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish for the child age group based upon the 6 high-rate consumers is 11.5 kg y⁻¹

The observed 97.5th percentile rate based on 13 observations is 18.6 kg y⁻¹

Infant age group (0 - 5 years old)

Observation number	Age	Bass	Cod	Dab	Flounder	Grey mullet	Mackerel	Plaice	Pollack	Salmon	Smooth hound	Thornback ray	Whiting	Total
186	4	0.7	1.2	0.1	-	-	0.6	-	-	-	-	-	0.1	2.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish for the infant age group based upon the only high-rate consumer is 2.6 kg y⁻¹

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

Table 10. Children's consumption rates of crustaceans (kg y⁻¹)

Child age group (6 - 15 years old)

Observation number	Age	Brown crab	Common lobster	<i>Nephrops</i>	Total
129	13	1.0	0.3	0.2	1.5
128	6	1.0	0.3	0.2	1.5

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of crustaceans for the child age group based upon the 2 high-rate consumers is 1.5 kg y⁻¹

The observed 97.5th percentile rate based on 2 observations is 1.5 kg y⁻¹

Table 11. Adults' intertidal occupancy rates (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Rock	Salt marsh	Sand	Sand and stones
356	Balcary Bay	Stake netting	565	-	-	-	-	-	-
	Rascarrel Bay	Collecting winkles	-	-	-	860	-	-	-
	Urr Water	Angling	-	-	-	-	260	-	-
	Auchencairn Bay	Bait digging	-	-	-	-	-	78	-
357	Balcary Bay	Stake netting	565	-	-	-	-	-	-
	Rascarrel Bay	Collecting winkles	-	-	-	860	-	-	-
	Urr Water	Angling	-	-	-	-	260	-	-
	Auchencairn Bay	Bait digging	-	-	-	-	-	78	-
359	River Nith	Walking to a haaf netting location	98	-	-	-	-	-	-
	Caerlaverock	Wildfowling		-	-	-	-	-	-
	Caerlaverock	Dog walking and walking	-	-	-	-	104	-	-
288	Dee Estuary	Fixing moorings	48	-	-	-	-	-	-
	Dee Estuary	Collecting mussels	-	4	-	-	-	-	-
358	Nun Mill Bay and Sandyhills	Dog walking	-	-	-	-	-	104	-
152	Balcary Bay	Stake netting	45	-	-	-	-	-	-
	Wigtown Bay	Wildfowling	44	-	-	-	-	-	-
289	Rigg Bay	Angling and dog walking	-	-	-	-	-	305	-
362	Dee Estuary	Fixing moorings	36	-	-	-	-	-	-
	River Nith	Walking to a haaf netting location	30	-	-	-	-	-	-
	Glencaple	Inshore rescue duties		-	-	-	-	-	-
144	Caerlaverock	Dog walking and marsh warden duties	-	-	-	-	530	-	-
151	Creetown	Wildfowling	24	-	-	-	-	-	-
	Wigtown Bay	Wildfowling	15	-	-	-	-	-	-
291	Garlieston Bay	Collecting winkles	-	-	-	-	-	-	648
292	Kirkcudbright Harbour	Moving sediments with digger	12	-	-	-	-	-	-
369	River Nith	Walking to a haaf netting location	11	-	-	-	11	-	-
370	River Nith	Walking to a haaf netting location	11	-	-	-	11	-	-
371	River Nith	Walking to a haaf netting location	11	-	-	-	11	-	-
372	River Nith	Walking to a haaf netting location	11	-	-	-	11	-	-
373	River Nith	Walking to a haaf netting location	11	-	-	-	11	-	-
313	Glencaple	Inshore rescue boat duties	9	-	-	-	-	-	-
314	Glencaple	Inshore rescue boat duties	9	-	-	-	-	-	-
315	Glencaple	Inshore rescue boat duties	9	-	-	-	-	-	-
316	Glencaple	Inshore rescue boat duties	9	-	-	-	-	-	-
317	Glencaple	Inshore rescue boat duties	9	-	-	-	-	-	-

Table 11. Adults' intertidal occupancy rates (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Rock	Salt marsh	Sand	Sand and stones
318	Glencaple	Inshore rescue boat duties	9	-	-	-	-	-	-
319	Glencaple	Inshore rescue boat duties	9	-	-	-	-	-	-
320	Glencaple	Inshore rescue boat duties	9	-	-	-	-	-	-
321	Glencaple	Inshore rescue boat duties	9	-	-	-	-	-	-
322	Glencaple	Inshore rescue boat duties	9	-	-	-	-	-	-
110	Wigtown Bay	Wildfowling	8	-	-	-	-	-	-
111	Wigtown Bay	Wildfowling	8	-	-	-	-	-	-
202	Kirkcudbright Marina	Fixing moorings	4	-	-	-	-	-	-
266	Kirkcudbright Marina	Fixing moorings	3	-	-	-	-	-	-
268	Kirkcudbright Marina	Fixing moorings	3	-	-	-	-	-	-
81	Cardoness	Collecting cockles and mussels, stake netting and walking	-	149	-	-	-	-	-
179	Sandgreen, Carrick Bay, Balcary Bay, Ross Bay	Bait digging	-	105	-	-	-	-	-
	Kirkcudbright Lifeboat Station and Ross Bay	Collecting crabs	-	-	38	-	-	-	-
	Abbey Burn Foot, Rascarrel Bay, Balcary Point, Torrs Point, Fox Craig	Angling	-	-	-	450	-	-	-
133	Kirkcudbright Bay area	Angling	-	98	-	-	-	-	-
	Kirkcudbright Bay area	Angling and collecting a small amount of mussels	-	-	-	296	-	-	-
	Kirkcudbright Bay and Carrick Bay	Bait digging	-	-	-	-	-	26	-
9	Isle of Whithorn Harbour	Checking moorings	-	91	-	-	-	-	-
	Carrick Bay, Sandgreen and Ross Bay	Bait digging	-	78	-	-	-	-	-
170	Manxman's Lake and Kirkcudbright Lifeboat Station	Collecting crabs	-	-	30	-	-	-	-
	Rascarrel Bay, Abbey Burn Foot, Torrs Point, Kirkcudbright Lifeboat Station, and Ross Bay	Angling	-	-	-	312	-	-	-
82	Cardoness	Walking	-	78	-	-	-	-	-
126	Garlieston Bay	Collecting winkles	-	75	-	-	-	-	-
	Innerwell	Collecting mussels	-	-	-	6	-	-	-
		Collecting cockles	-	-	-	-	-	6	-
45	Carsluith	Bait digging, dog walking and angling	-	70	-	-	-	-	
86	Cardoness	Stake netting	-	67	-	-	-	-	
148	River Nith and Urr Water	Gill netting	-	60	-	-	-	-	
149	River Nith and Urr Water	Gill netting	-	60	-	-	-	-	
150	River Nith and Urr Water	Gill netting	-	60	-	-	-	-	

Table 11. Adults' intertidal occupancy rates (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Rock	Salt marsh	Sand	Sand and stones
181	Sandgreen, Carrick Bay, Balcary Bay, Ross Bay	Bait digging	-	53	-	-	-	-	-
	Kirkcudbright Lifeboat Station and Ross Bay	Collecting crabs	-	-	19	-	-	-	-
	Abbey Burn Foot, Rascarrel Bay, Balcary Point, Torrs Point, Fox Craig	Angling	-	-	-	225	-	-	-
160	Ross Bay and Sandgreen	Bait digging	-	38	-	-	-	-	-
	Manxman's Lake and Kirkcudbright Lifeboat Station	Collecting crabs	-	-	12	-	-	-	-
	Torrs Point, Kirkcudbright Lifeboat Station, Abbey Burn Foot, Rascarrel Bay	Angling	-	-	-	368	-	-	-
183	East bank of River Dee	Angling	-	-	-	-	48	-	-
	Sandgreen, Carrick Bay, Balcary Bay, Ross Bay	Bait digging	-	35	-	-	-	-	-
	Kirkcudbright Lifeboat Station and Ross Bay	Collecting crabs	-	-	13	-	-	-	-
163	Abbey Burn Foot, Rascarrel Bay, Balcary Point, Torrs Point, Fox Craig	Angling	-	-	-	150	-	-	-
	Carrick Bay	Bait digging	-	26	-	-	-	-	-
	Kirkcudbright Lifeboat Station	Collecting crabs	-	-	28	-	-	-	-
166	Rascarrel Bay, Balcary Point, Ross Bay and Abbey Burn Foot	Angling	-	-	-	156	-	-	-
	Carrick Bay, Sandgreen and Ross Bay	Bait digging	-	26	-	-	-	-	-
167	Rascarrel Bay, Balcary Point, Ross Bay and Abbey Burn Foot	Angling	-	-	-	156	-	-	-
	Carrick Bay, Sandgreen and Ross Bay	Bait digging	-	26	-	-	-	-	-
168	Rascarrel Bay, Balcary Point, Ross Bay and Abbey Burn Foot	Angling	-	-	-	156	-	-	-
	Carrick Bay, Sandgreen and Ross Bay	Bait digging	-	26	-	-	-	-	-
169	Rascarrel Bay, Balcary Point, Ross Bay and Abbey Burn Foot	Angling	-	-	-	156	-	-	-
	Carrick Bay, Sandgreen and Ross Bay	Bait digging	-	26	-	-	-	-	-
286	Ross Bay	Bait digging	-	9	-	-	-	-	-
	Kirkcudbright Lifeboat Station	Collecting crabs	-	-	9	-	-	-	-
	Abbey Burn Foot, Balcary Point and Rascarrel Bay	Angling	-	-	-	36	-	-	-
	Carrick Bay	Bait digging	-	-	-	-	-	96	-
11	Brighthouse Bay and Nun Mill Bay	Walking	-	-	-	-	-	-	-
11	Isle of Whithorn Harbour	Fixing moorings	-	8	-	-	-	-	-

Table 11. Adults' intertidal occupancy rates (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Rock	Salt marsh	Sand	Sand and stones
158	Manxman's Lake and Kirkcudbright Lifeboat Station	Collecting crabs	-	-	12	-	-	-	-
	Kirkcudbright Lifeboat Station, Torrs Point and Rascarrel Bay	Angling	-	-	-	104	-	-	-
248	Isle of Whithorn to Almorness Point	Collecting winkles and collecting a small amount of mussels	-	-	-	672	-	-	-
		Collecting winkles and collecting a small amount of cockles	-	-	-	-	-	224	-
270	Isle of Whithorn to Almorness Point	Collecting winkles and collecting a small amount of mussels	-	-	-	588	-	-	-
		Collecting winkles	-	-	-	-	-	196	-
272	Isle of Whithorn to Almorness Point	Collecting winkles	-	-	-	588	-	-	-
			-	-	-	-	-	196	-
273	Isle of Whithorn to Almorness Point	Collecting winkles	-	-	-	588	-	-	-
			-	-	-	-	-	196	-
274	Isle of Whithorn to Almorness Point	Collecting winkles	-	-	-	588	-	-	-
			-	-	-	-	-	196	-
275	Isle of Whithorn to Almorness Point	Collecting winkles	-	-	-	588	-	-	-
			-	-	-	-	-	196	-
276	Isle of Whithorn to Almorness Point	Collecting winkles	-	-	-	588	-	-	-
			-	-	-	-	-	196	-
277	Isle of Whithorn to Almorness Point	Collecting winkles	-	-	-	588	-	-	-
			-	-	-	-	-	196	-
278	Isle of Whithorn to Almorness Point	Collecting winkles	-	-	-	588	-	-	-
			-	-	-	-	-	196	-
279	Isle of Whithorn to Almorness Point	Collecting winkles	-	-	-	588	-	-	-
			-	-	-	-	-	196	-
280	Isle of Whithorn to Almorness Point	Collecting winkles	-	-	-	588	-	-	-
			-	-	-	-	-	196	-
281	Isle of Whithorn to Almorness Point	Collecting winkles	-	-	-	588	-	-	-
			-	-	-	-	-	196	-
13	Sandgreen and Mossyard Bay	Angling	-	-	-	462	-	-	-
102	Cairn Head to Sandgreen	Angling	-	-	-	384	-	-	-
	Garlieston Bay	Bait digging	-	-	-	-	-	-	75
103	Cairn Head to Sandgreen	Angling	-	-	-	384	-	-	-
	Garlieston Bay	Bait digging	-	-	-	-	-	-	75

Table 11. Adults' intertidal occupancy rates (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Rock	Salt marsh	Sand	Sand and stones
156	Abbey Burn Foot, Balcary Point and Rascarrel Bay	Angling	-	-	-	350	-	-	-
146	Carsluith, Carrick Bay and Mosseyard Bay	Collecting crabs and angling	-	-	-	300	-	-	-
147	Carsluith, Carrick Bay and Mosseyard Bay	Collecting crabs and angling	-	-	-	300	-	-	-
404	Kirkcudbright Lifeboat Station	Angling	-	-	-	156	-	-	-
310	Balcary Point	Angling	-	-	-	96	-	-	-
311	Balcary Point	Angling	-	-	-	96	-	-	-
410	Balcary Point	Angling	-	-	-	96	-	-	-
412	Balcary Point	Angling	-	-	-	96	-	-	-
413	Balcary Point	Angling	-	-	-	96	-	-	-
411	Balcary Point	Angling	-	-	-	96	-	-	-
347	Balcary Point	Angling	-	-	-	60	-	-	-
	Rockcliffe	Bait digging	-	-	-	-	-	21	-
154	Cairn Head and Innerwell	Angling	-	-	-	50	-	-	-
155	Cairn Head and Innerwell	Angling	-	-	-	50	-	-	-
375	Balcary Point	Angling	-	-	-	42	-	-	-
374	Balcary Point	Angling	-	-	-	42	-	-	-
414	Balcary Point	Angling	-	-	-	42	-	-	-
415	Balcary Point	Angling	-	-	-	42	-	-	-
	Carrick Bay	Collecting mussels	-	-	-	35	-	-	-
282	Carrick Bay	Collecting mussels	-	-	-	-	-	190	-
	Nun Mill Bay	Dog walking	-	-	-	-	-	-	-
309	Southernness	Rock pooling	-	-	-	27	-	-	-
		Playing	-	-	-	-	-	81	-
310	Southernness	Rock pooling	-	-	-	27	-	-	-
		Playing	-	-	-	-	-	81	-
174	Rascarrel Bay	Angling	-	-	-	24	-	-	-
177	Rascarrel Bay	Angling	-	-	-	24	-	-	-
		Rock pooling	-	-	-	18	-	-	-
323	Southernness	Playing	-	-	-	-	-	18	-
		Rock pooling	-	-	-	18	-	-	-
324	Southernness	Playing	-	-	-	-	-	18	-
	Brighthouse Bay	Collecting winkles	-	-	-	6	-	-	-
246	Brighthouse Bay, Carrick Bay and Nun Mill Bay	Walking	-	-	-	-	-	80	-

Table 11. Adults' intertidal occupancy rates (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Rock	Salt marsh	Sand	Sand and stones
247	Brighthouse Bay	Collecting winkles	-	-	-	6	-	-	-
	Brighthouse Bay, Carrick Bay and Nun Mill Bay	Walking	-	-	-	-	-	80	-
249	Isle Mouth	Collecting mussels	-	-	-	4	-	-	-
		Playing	-	-	-	-	-	96	-
1	Isle of Whithorn	Collecting crabs	-	-	-	3	-	-	-
	Isle of Whithorn harbour	Bait digging	-	-	-	-	-	-	-
	Garlieston Bay	Angling	-	-	-	-	-	57	-
	Rigg Bay	Dog walking	-	-	-	-	-	-	-
	Garlieston Bay and Isle of Whithorn	Collecting winkles	-	-	-	-	-	-	5
3	Innerwell	Collecting cockles	-	-	-	-	-	-	-
	Isle of Whithorn	Collecting crabs	-	-	-	3	-	-	-
	Isle of Whithorn	Bait digging	-	-	-	-	-	40	-
	Garlieston Bay	Angling	-	-	-	-	-	-	-
312	Caerlaverock	Wildfowling and walking	-	-	-	-	428	-	-
145	Wigtown	Tending livestock	-	-	-	-	360	-	-
296	Caerlaverock	Tending livestock	-	-	-	-	273	-	-
401	Caerlaverock	Tending livestock	-	-	-	-	245	-	-
402	Caerlaverock	Tending livestock	-	-	-	-	245	-	-
403	Caerlaverock	Tending livestock	-	-	-	-	245	-	-
297	Caerlaverock	Tending livestock	-	-	-	-	231	-	-
29	Wigtown	Tending livestock	-	-	-	-	210	-	-
30	Wigtown	Tending livestock	-	-	-	-	210	-	-
293	Caerlaverock	Marsh warden duties	-	-	-	-	210	-	-
294	Caerlaverock	Marsh warden duties	-	-	-	-	210	-	-
295	Caerlaverock	Marsh warden duties	-	-	-	-	210	-	-
40	Creetown	Tending livestock	-	-	-	-	180	-	-
41	Creetown	Tending livestock	-	-	-	-	180	-	-
35	East bank of River Cree	Tending livestock	-	-	-	-	147	-	-
36	East bank of River Cree	Tending livestock	-	-	-	-	147	-	-
361	Caerlaverock	Marsh warden duties	-	-	-	-	65	-	-
60	Wigtown Bay	Wildfowling	-	-	-	-	60	-	-
33	West bank of River Cree	Tending livestock	-	-	-	-	36	-	-
34	West bank of River Cree	Tending livestock	-	-	-	-	36	-	-
58	Wigtown Bay	Wildfowling	-	-	-	-	27	-	-
31	West bank of River Cree	Tending livestock	-	-	-	-	24	-	-
32	West bank of River Cree	Tending livestock	-	-	-	-	24	-	-

Table 11. Adults' intertidal occupancy rates (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Rock	Salt marsh	Sand	Sand and stones
300	West of Southerness Point	Setting nets	-	-	-	-	-	743	-
	Southerness	Walking	-	-	-	-	-	-	-
340	Rockcliffe	Dog walking	-	-	-	-	-	365	-
341	Rockcliffe	Dog walking	-	-	-	-	-	365	-
405	Sandyhills	Stake netting	-	-	-	-	-	318	-
406	Sandyhills	Stake netting	-	-	-	-	-	318	-
230	Isle Mouth and Carrick Bay	Walking	-	-	-	-	-	190	-
108	Carluith	Stake netting	-	-	-	-	-	178	-
242	Sandgreen	Beach cleaning	-	-	-	-	-	170	-
208	Nun Mill Bay and Brighthouse Bay	Playing and walking	-	-	-	-	-	162	-
209	Nun Mill Bay and Brighthouse Bay	Playing and walking	-	-	-	-	-	162	-
234	Isle Mouth and Carrick Bay	Walking	-	-	-	-	-	160	-
240	Nun Mill Bay	Dog walking	-	-	-	-	-	156	-
336	Sandyhills	Playing	-	-	-	-	-	156	-
337	Sandyhills	Playing	-	-	-	-	-	156	-
283	Nun Mill Bay	Dog walking	-	-	-	-	-	150	-
210	Brighthouse Bay, Carrick Bay, Nun Mill Bay and Balcary Bay	Playing	-	-	-	-	-	120	-
290	Nun Mill Bay and Sandyhills	Dog walking	-	-	-	-	-	104	-
253	Isle Mouth	Playing	-	-	-	-	-	100	-
250	Isle Mouth	Playing	-	-	-	-	-	100	-
380	Rockcliffe, Sandyhills and Southerness	Playing	-	-	-	-	-	91	-
381	Rockcliffe, Sandyhills and Southerness	Playing	-	-	-	-	-	91	-
224	Nun Mill Bay	Dog walking	-	-	-	-	-	90	-
301	Southerness	Playing and dog walking	-	-	-	-	-	90	-
225	Isle Mouth and Carrick Bay	Dog walking	-	-	-	-	-	89	-
226	Isle Mouth and Carrick Bay	Dog walking	-	-	-	-	-	89	-
227	Isle Mouth and Carrick Bay	Dog walking	-	-	-	-	-	89	-
228	Isle Mouth and Carrick Bay	Dog walking	-	-	-	-	-	89	-
287	Brighthouse Bay and Nun Mill Bay	Walking	-	-	-	-	-	87	-
46	Mossyard Bay	Dog walking	-	-	-	-	-	84	-
47	Mossyard Bay	Dog walking	-	-	-	-	-	84	-
112	Garlieston Bay	Horse riding	-	-	-	-	-	80	-
115	Garlieston Bay	Horse riding	-	-	-	-	-	80	-
239	Nun Mill Bay	Playing	-	-	-	-	-	78	-
219	Nun Mill Bay and Brighthouse Bay	Playing	-	-	-	-	-	78	-

Table 11. Adults' intertidal occupancy rates (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Rock	Salt marsh	Sand	Sand and stones
220	Nun Mill Bay and Brighthouse Bay	Playing	-	-	-	-	-	78	-
235	Nun Mill Bay	Playing	-	-	-	-	-	78	-
121	Rigg Bay	Sitting on the beach	-	-	-	-	-	75	-
122	Rigg Bay	Sitting on the beach	-	-	-	-	-	75	-
109	Carsluith	Stake netting	-	-	-	-	-	68	-
243	Nun Mill Bay	Dog walking	-	-	-	-	-	65	-
52	Mosseyard Bay	Sitting on the beach	-	-	-	-	-	60	-
53	Mosseyard Bay	Sitting on the beach	-	-	-	-	-	60	-
376	Rockcliffe	Playing	-	-	-	-	-	56	-
328	Southernness	Playing	-	-	-	-	-	56	-
329	Southernness	Playing	-	-	-	-	-	56	-
377	Rockcliffe	Playing	-	-	-	-	-	56	-
241	Nun Mill Bay	Dog walking	-	-	-	-	-	52	-
229	Isle Mouth and Carrick Bay	Dog walking	-	-	-	-	-	49	-
244	Nun Mill Bay	Dog walking	-	-	-	-	-	45	-
355	Southernness	Dog walking	-	-	-	-	-	42	-
331	Sandyhills	Playing	-	-	-	-	-	42	-
332	Sandyhills	Playing	-	-	-	-	-	42	-
204	Nun Mill Bay and Brighthouse Bay	Playing	-	-	-	-	-	42	-
205	Nun Mill Bay and Brighthouse Bay	Playing	-	-	-	-	-	42	-
214	Brighthouse Bay, Carrick Bay, Nun Mill Bay and Balcary Bay	Playing	-	-	-	-	-	40	-
342	Rockcliffe	Playing	-	-	-	-	-	36	-
343	Rockcliffe	Playing	-	-	-	-	-	36	-
48	Mosseyard Bay	Sitting on the beach	-	-	-	-	-	35	-
49	Mosseyard Bay	Sitting on the beach	-	-	-	-	-	35	-
87	Mosseyard Bay	Playing	-	-	-	-	-	30	-
88	Mosseyard Bay	Playing	-	-	-	-	-	30	-
117	Garlieston Bay	Walking	-	-	-	-	-	30	-
118	Garlieston Bay	Walking	-	-	-	-	-	30	-
216	Brighthouse Bay	Playing	-	-	-	-	-	30	-
215	Brighthouse Bay	Playing	-	-	-	-	-	30	-
15	Garlieston Bay	Playing	-	-	-	-	-	29	-
16	Garlieston Bay	Playing	-	-	-	-	-	29	-
6	Garlieston Bay	Angling	-	-	-	-	-	20	-
8	Garlieston Bay	Angling	-	-	-	-	-	20	-

Table 11. Adults' intertidal occupancy rates (h y⁻¹)

Observation number	Location	Activity	Mud	Mud and sand	Mud and stones	Rock	Salt marsh	Sand	Sand and stones
21	Rigg Bay	Playing	-	-	-	-	-	20	-
20	Rigg Bay	Playing	-	-	-	-	-	20	-
2	Rigg Bay	Dog walking	-	-	-	-	-	17	-
298	Southernness	Angling	-	-	-	-	-	15	-
	Carsethorn		-	-	-	-	-	-	15
299	Southernness	Angling	-	-	-	-	-	15	-
	Carsethorn		-	-	-	-	-	-	15
23	Rigg Bay	Dog walking	-	-	-	-	-	15	-
24	Rigg Bay	Sitting on the beach	-	-	-	-	-	15	-
116	Garlieston Bay	Walking	-	-	-	-	-	15	-
91	Mossyard Bay	Dog walking	-	-	-	-	-	13	-
55	Garlieston Bay	Dog walking	-	-	-	-	-	-	140
56	Garlieston Bay	Collecting mussels	-	-	-	-	-	-	2
57	Garlieston Bay	Collecting mussels	-	-	-	-	-	-	2

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over mud based on 2 high-rate observations is 565 h y⁻¹

The observed 97.5th percentile rate based on 32 observations for mud is 565 h y⁻¹

The mean intertidal occupancy rate over mud and sand based on 13 high-rate observations is 80 h y⁻¹

The observed 97.5th percentile rate based on 23 observations for mud and sand is 125 h y⁻¹

The mean intertidal occupancy rate over mud and stones based on 5 high-rate observations is 25 h y⁻¹

The observed 97.5th percentile rate based on 8 observations for mud and stones is 36 h y⁻¹

The mean intertidal occupancy rate over rock based on 24 high-rate observations is 519 h y⁻¹

The observed 97.5th percentile rate based on 60 observations for rock is 771 h y⁻¹

The mean intertidal occupancy rate over salt marsh based on 17 high-rate observations is 264 h y⁻¹

The observed 97.5th percentile rate based on 33 observations for salt marsh is 448 h y⁻¹

The mean intertidal occupancy rate over sand based on 6 high-rate observations is 402 h y⁻¹

The observed 97.5th percentile rate based on 108 observations for sand is 333 h y⁻¹

The mean intertidal occupancy rate over sand and stones based on 1 observation is 648 h y⁻¹

The observed 97.5th percentile rate based on 9 observations for sand and stones is 546 h y⁻¹

Table 12. Children's and infants' intertidal occupancy rates (h y⁻¹)

Child age group (5 - 15 years old)

Observation number	Age	Location	Activity	Mud and sand	Mud and stones	Rock	Salt marsh	Sand
83	14	Cardoness	Walking	78	-	-	-	-
84	14	Cardoness	Walking	78	-	-	-	-
85	12	Cardoness	Walking	78	-	-	-	-
		Ross Bay and Sandgreen	Bait digging	19	-	-	-	-
161	11	Torrs Point, Kirkcudbright Lifeboat Station, Abbey Burn Foot, Rascarrel Bay	Angling	-	-	184	-	-
		East bank of River Dee	Angling	-	-	-	24	-
159	12	Manxman's Lake and Kirkcudbright Lifeboat Station	Collecting crabs	-	6	-	-	-
		Kirkcudbright Lifeboat Station, Torrs Point and Rascarrel Bay	Angling	-	-	52	-	-
14	11	Sandgreen and Mossyard Bay	Angling	-	-	132	-	-
348	13	Balcary Point	Angling	-	-	60	-	-
		Rockcliffe	Bait digging	-	-	-	-	21
305	12	Southernness	Rock pooling	-	-	27	-	-
		Southernness	Playing	-	-	-	-	81
306	10	Southernness	Rock pooling	-	-	27	-	-
		Southernness	Playing	-	-	-	-	81
307	8	Southernness	Rock pooling	-	-	27	-	-
		Southernness	Playing	-	-	-	-	81
175	10	Rascarrel Bay	Angling	-	-	24	-	-
178	10	Rascarrel Bay	Angling	-	-	24	-	-
325	13	Southernness	Rock pooling	-	-	18	-	-
		Southernness	Playing	-	-	-	-	18
327	10	Southernness	Rock pooling	-	-	18	-	-
		Southernness	Playing	-	-	-	-	18
326	8	Southernness	Rock pooling	-	-	18	-	-
		Southernness	Playing	-	-	-	-	18
231	15	Isle Mouth and Carrick Bay	Walking	-	-	-	-	190
232	13	Isle Mouth and Carrick Bay	Walking	-	-	-	-	190
233	8	Isle Mouth and Carrick Bay	Walking	-	-	-	-	190
338	7	Sandyhills	Playing	-	-	-	-	156

Table 12. Children's and infants' intertidal occupancy rates (h y⁻¹)

Child age group (5 - 15 years old)

Observation number	Age	Location	Activity	Mud and sand	Mud and stones	Rock	Salt marsh	Sand
211	11	Brighthouse Bay, Carrick Bay, Nun Mill Bay, Balcary Bay	Playing	-	-	-	-	120
212	6	Brighthouse Bay, Carrick Bay, Nun Mill Bay, Balcary Bay	Playing	-	-	-	-	120
382	10	Rockcliffe, Sandyhills and Southernness	Playing	-	-	-	-	91
383	7	Rockcliffe, Sandyhills and Southernness	Playing	-	-	-	-	91
302	8	Southernness	Dog walking and playing	-	-	-	-	90
303	6	Southernness	Dog walking and playing	-	-	-	-	90
114	14	Garlieston Bay	Horse riding	-	-	-	-	80
113	13	Garlieston Bay	Horse riding	-	-	-	-	80
251	13	Isle Mouth	Playing	-	-	-	-	80
252	10	Isle Mouth	Playing	-	-	-	-	80
236	8	Nun Mill Bay	Playing	-	-	-	-	78
125	12	Rigg Bay	Playing	-	-	-	-	60
54	11	Mosseyard Bay	Playing	-	-	-	-	60
124	10	Rigg Bay	Playing	-	-	-	-	60
221	9	Nun Mill Bay and Brighthouse Bay	Playing	-	-	-	-	60
222	8	Nun Mill Bay and Brighthouse Bay	Playing	-	-	-	-	60
123	6	Rigg Bay	Playing	-	-	-	-	60
378	9	Rockcliffe	Playing	-	-	-	-	56
330	6	Southernness	Playing	-	-	-	-	56
379	6	Rockcliffe	Playing	-	-	-	-	56
333	12	Sandyhills	Playing	-	-	-	-	42
334	7	Sandyhills	Playing	-	-	-	-	42
335	6	Sandyhills	Playing	-	-	-	-	42
51	9	Mosseyard Bay	Playing	-	-	-	-	40
50	7	Mosseyard Bay	Playing	-	-	-	-	40
344	10	Rockcliffe	Playing	-	-	-	-	36
345	6	Rockcliffe	Playing	-	-	-	-	36
206	9	Nun Mill Bay and Brighthouse Bay	Playing	-	-	-	-	32
207	7	Nun Mill Bay and Brighthouse Bay	Playing	-	-	-	-	32
89	13	Mosseyard Bay	Playing	-	-	-	-	30

Table 12. Children's and infants' intertidal occupancy rates (h y^{-1})

Child age group (5 - 15 years old)

Observation number	Age	Location	Activity	Mud and sand	Mud and stones	Rock	Salt marsh	Sand
90	10	Mosseyard Bay	Playing	-	-	-	-	30
119	8	Garlieston Bay	Playing	-	-	-	-	30
217	6	Brighthouse Bay	Playing	-	-	-	-	30
18	13	Garlieston Bay	Playing	-	-	-	-	29
17	10	Garlieston Bay	Playing	-	-	-	-	29
19	8	Garlieston Bay	Playing	-	-	-	-	29
22	11	Rigg Bay	Playing	-	-	-	-	20
7	13	Rigg Bay	Dog walking	-	-	-	-	17
5	11	Rigg Bay	Dog walking	-	-	-	-	17
4	6	Rigg Bay	Dog walking	-	-	-	-	17
26	11	Rigg Bay	Playing	-	-	-	-	10
25	7	Rigg Bay	Playing	-	-	-	-	10

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over mud and sand based on 3 high-rate observations is 78 h y^{-1}

The observed 97.5th percentile rate based on 4 observations for mud and sand is 78 h y^{-1}

The mean intertidal occupancy rate over mud and stones based on the only high-rate observation is 6 h y^{-1}

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

The mean intertidal occupancy rate over rock based on 2 high-rate observations is 158 h y^{-1}

The observed 97.5th percentile rate based on 12 observations for rock is 170 h y^{-1}

The mean intertidal occupancy rate over salt marsh based on the only high-rate observation is 24 h y^{-1}

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

The mean intertidal occupancy rate over sand based on 18 high-rate observations is 109 h y^{-1}

The observed 97.5th percentile rate based on 53 observations for sand is 190 h y^{-1}

Table 12. Children's and infants' intertidal occupancy (h y⁻¹)

Infant age group (0 - 5 years old)

Observation number	Age	Location	Activity	Mud and sand	Mud and stones	Rock	Salt marsh	Sand
339	4	Sandyhills	Playing	-	-	-	-	156
213	4	Brighthouse Bay, Carrick Bay, Nun Mill Bay, Balcary Bay	Playing	-	-	-	-	120
384	5	Rockcliffe, Sandyhills and Southernness	Playing	-	-	-	-	91
304	5	Southernness	Dog walking and playing	-	-	-	-	90
237	5	Nun Mill Bay	Playing	-	-	-	-	78
238	3	Nun Mill Bay	Playing	-	-	-	-	78
223	5	Nun Mill Bay and Brighthouse Bay	Playing	-	-	-	-	60
346	4	Rockcliffe	Playing	-	-	-	-	36
218	2	Brighthouse Bay	Playing	-	-	-	-	30
120	1	Garlieston Bay	Playing	-	-	-	-	30
93	5	Mosseyard Bay	Playing	-	-	-	-	13
92	3	Mosseyard Bay	Playing	-	-	-	-	13

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over sand based on 7 high-rate observations is 96 h y⁻¹

The observed 97.5th percentile rate based on 12 observations for sand is 146 h y⁻¹

Table 13. Gamma dose rate measurements over intertidal substrates ($\mu\text{Gy h}^{-1}$)

Location	NGR	Substrate	Gamma dose rate at 1 metre ^a
Isle of Whithorn	NX 477 363	Mud and sand	0.080
Rigg Bay	NX 476 446	Sand	0.070
Garlieston Bay	NX 478 462	Mud and sand	0.075
Garlieston Bay	NX 478 468	Mud and sand	0.069
Innerwell	NX 479 493	Mud	0.091
Near Wigtown Harbour	NX 439 543	Mud	0.069
Near Wigtown Harbour	NX 439 543	Salt marsh	0.066
Carsluith	NX 486 543	Mud and sand	0.066
Mossyard Bay	NX 551 518	Sand	0.086
Sandgreen	NX 575 521	Mud and sand	0.065
Isle Mouth	NX 574 499	Mud and sand	0.057
Isle Mouth	NX 575 500	Sand	0.058
Brighthouse Bay	NX 635 455	Sand	0.053
Ross Bay	NX 652 445	Mud and sand	0.065
Nun Mill Bay	NX 658 485	Sand	0.063
West bank of Dee Estuary	NX 666 497	Mud	0.081
East bank of River Dee	NX 685 514	Salt marsh	0.074
Kirkcudbright Marina	NX 680 511	Mud	0.070
Manxman's Lake	NX 680 475	Mud	0.084
Manxman's Lake	NX 681 475	Mud and stones	0.081
Kirkcudbright Lifeboat Station	NX 675 464	Mud and stones	0.083
Abbey Burn Foot	NX 742 444	Stones	0.075
Rascarrel Bay	NX 801 477	Stones	0.110
Balcary fisheries	NX 820 499	Mud	0.078
Balcary Bay	NX 822 495	Sand and stones	0.084
Balcary Bay	NX 822 495	Mud	0.086
South Glen	NX 832 552	Mud	0.084
Offshore of Rockcliffe	NX 845 532	Mud	0.070
Sandyhills	NX 891 552	Sand	0.061
Southernness	NX 977 542	Sand	0.058
Carsethorn	NX 993 597	Sand	0.070
Carsethorn	NX 994 598	Mud and sand	0.071
East bank of the River Nith	NX 993 694	Tide washed grass	0.075
East bank of the River Nith	NX 993 694	Mud	0.075
East bank of the River Nith	NY 004 660	Tide washed grass	0.067

Notes

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

Table 14. Adults' handling rates of fishing gear and sediment (h y^{-1})

Observation number	Location	Activity	Fishing gear	Sediment
27	Garlieston Bay to Isle of Whithorn	Handling creels	1750	-
282	Ringdoo Point to Balcary Point	Handling creels	1500	-
	Carrick Bay	Collecting mussels	-	75
126	Wigtown Bay	Handling creels	1350	-
	Garlieston Bay	Collecting winkles	-	87
	Innerwell	Collecting cockles and mussels	-	-
286	Ringdoo Point to Balcary Point	Handling creels	960	-
	Carrick Bay and Ross Bay	Bait digging	-	27
	Kirkcudbright Lifeboat Station	Collecting crabs	-	-
9	Wigtown Bay	Handling creels	900	-
10	Wigtown Bay	Handling creels	900	-
106	Wigtown Bay	Handling creels	900	-
300	West of Southernness Point	Handling set-nets	428	-
45	Wigtown Bay	Handling gill nets	180	-
	Carsluith	Bait digging	-	10
369	River Nith	Handling haaf nets	140	-
370	River Nith	Handling haaf nets	140	-
371	River Cree	Handling haaf nets	140	-
372	River Nith	Handling haaf nets	140	-
373	River Nith	Handling haaf nets	140	-
362	River Nith	Handling haaf nets	105	-
359	River Nith	Handling haaf nets	88	-
	Caerlaverock	Wildfowling	-	88
405	Sandyhills	Mending stake nets	61	-
		Setting up and cleaning stake nets	-	318
406	Sandyhills	Mending stake nets	61	-
		Setting up and cleaning stake nets	-	318
60	Off Garlieston Bay	Handling seine nets	60	-
	Wigtown Bay	Wildfowling	-	60

Table 14. Adults' handling rates of fishing gear and sediment (h y^{-1})

Observation number	Location	Activity	Fishing gear	Sediment
58	Off Garlieston Bay	Handling seine nets	60	-
	Wigtown Bay	Wildfowling	-	27
148	River Nith and Urr Water	Handling gill nets	60	-
149	River Nith and Urr Water	Handling gill nets	60	-
150	River Nith and Urr Water	Handling gill nets	60	-
312	River Nith	Handling haaf nets	12	-
	Caerlaverock	Wildfowling	-	50
133	Kirkcudbright Bay area	Handling prawn rake	7	-
	Kirkcudbright Bay area	Collecting cockles and mussels	-	27
	Kirkcudbright Bay and Carrick	Bait digging	-	-
356	Balcary Bay	Setting up and cleaning stake nets	-	-
	Auchencairn Bay	Bait digging	-	1503
	Rascarrel Bay	Collecting winkles	-	-
357	Balcary Bay	Setting up and cleaning stake nets	-	-
	Auchencairn Bay	Bait digging	-	1503
	Rascarrel Bay	Collecting winkles	-	-
248	Isle of Whithorn to Almorness Point	Collecting winkles	-	896
270	Isle of Whithorn to Almorness Point	Collecting winkles	-	784
272	Isle of Whithorn to Almorness Point	Collecting winkles	-	784
273	Isle of Whithorn to Almorness Point	Collecting winkles	-	784
274	Isle of Whithorn to Almorness Point	Collecting winkles	-	784
275	Isle of Whithorn to Almorness Point	Collecting winkles	-	784
276	Isle of Whithorn to Almorness Point	Collecting winkles	-	784
277	Isle of Whithorn to Almorness Point	Collecting winkles	-	784
278	Isle of Whithorn to Almorness Point	Collecting winkles	-	784
279	Isle of Whithorn to Almorness Point	Collecting winkles	-	784
280	Isle of Whithorn to Almorness Point	Collecting winkles	-	784
281	Isle of Whithorn to Almorness Point	Collecting winkles	-	784

Table 14. Adults' handling rates of fishing gear and sediment (h y^{-1})

Observation number	Location	Activity	Fishing gear	Sediment
151	Garlieston Bay	Collecting winkles	-	663
	Wigtown Bay	Wildfowling	-	
108	Carluith	Setting up and cleaning stake nets	-	178
179	Kirkcudbright Lifeboat Station and Ross Bay	Collecting crabs	-	143
	Sandgreen, Carrick Bay, Balcary Bay and Ross Bay	Bait digging	-	
170	Manxman's Lake and Kirkcudbright Lifeboat Station	Collecting crabs	-	108
	Carrick Bay, Sandgreen and Ross Bay	Bait digging	-	
102	Garlieston Bay	Bait digging	-	75
103	Garlieston Bay	Bait digging	-	75
181	Kirkcudbright Lifeboat Station and Ross Bay	Collecting crabs	-	71
	Sandgreen, Carrick Bay, Balcary Bay and Ross Bay	Bait digging	-	
81	Cardoness	Setting up and cleaning stake nets and collecting cockles and mussels	-	71
109	Carluith	Setting up and cleaning stake nets	-	68
86	Cardoness	Setting up and cleaning stake nets	-	67
163	Kirkcudbright Lifeboat Station	Collecting crabs	-	54
	Carrick Bay	Bait digging	-	
288	Dee Estuary	Collecting mussels and fixing moorings	-	52
160	Manxman's Lake and Kirkcudbright Lifeboat Station	Collecting crabs	-	50
	Ross Bay and Sandgreen	Bait digging	-	
183	Kirkcudbright Lifeboat Station and Ross Bay	Collecting crabs	-	48
	Sandgreen, Carrick Bay, Balcary Bay and Ross Bay	Bait digging	-	
358	Balcary Bay	Setting up and cleaning stake nets	-	45
152	Wigtown Bay	Wildfowling	-	44
289	Dee Estuary	Fixing moorings	-	36
1	Isle of Whithorn Harbour	Bait digging and collecting crabs	-	28
	Garlieston Bay and Isle of Whithorn	Collecting winkles	-	
	Innerwell	Collecting cockles	-	
166	Carrick Bay, Sandgreen and Ross Bay	Bait digging	-	26
167	Carrick Bay, Sandgreen and Ross Bay	Bait digging	-	26

Table 14. Adults' handling rates of fishing gear and sediment (h y^{-1})

Observation number	Location	Activity	Fishing gear	Sediment
168	Carrick Bay, Sandgreen and Ross Bay	Bait digging	-	26
169	Carrick Bay, Sandgreen and Ross Bay	Bait digging	-	26
144	Creetown	Wildfowling	-	24
3	Isle of Whithorn	Bait digging and collecting crabs	-	23
347	Rockcliffe	Bait digging	-	21
146	Carsluith, Carrick Bay and Mosseyard Bay	Collecting crabs	-	20
147	Carsluith, Carrick Bay and Mosseyard Bay	Collecting crabs	-	20
158	Manxman's Lake and Kirkcudbright Lifeboat Station	Collecting crabs	-	12
11	Isle of Whithorn Harbour	Fixing moorings	-	8
110	Wigtown Bay	Wildfowling	-	8
111	Wigtown Bay	Wildfowling	-	8
246	Brighthouse Bay	Collecting winkles	-	6
247	Brighthouse Bay	Collecting winkles	-	6
202	Kirkcudbright Marina	Fixing moorings	-	4
249	Isle Mouth	Collecting mussels	-	4
266	Kirkcudbright Marina	Fixing moorings	-	3
268	Kirkcudbright Marina	Fixing moorings	-	3
56	Garlieston Bay	Collecting mussels	-	2
57	Garlieston Bay	Collecting mussels	-	2

Notes

Emboldened observations are the high-rate individuals

The mean fishing gear handling rate based on 7 high-rate observations is 1180 h y^{-1}

The observed 97.5th percentile rate based on 25 observations for fishing gear is 1600 h y^{-1}

The mean sediment handling rate based on 15 high-rate observations is 879 h y^{-1}

The observed 97.5th percentile rate based on 64 observations for sediment is 1154 h y^{-1}

Table 15. Children's handling rates of sediment (h y^{-1})

Child age group (6 - 15 years old)

Observation number	Age	Location	Activity	Sediment
348	13	Rockcliffe	Bait digging	21
161	11	Ross Bay and Sandgreen	Bait digging	19
159	12	Manxman's Lake and Kirkcudbright Lifeboat Station	Collecting crabs	6

Notes

Emboldened observations are the high-rate individuals

The mean sediment handling rate for the child age group based on 2 high-rate observations is 20 h y^{-1}

The observed 97.5th percentile rate based on 3 observations for sediment is 21 h y^{-1}

Table 16. Adults' occupancy rates in and on water (h y⁻¹)

Observation number	Location	Activity	In water	On water
254	Carrick Bay	Windsurfing	105	-
255	Carrick Bay	Windsurfing	105	-
11	Garlieston Bay to Isle of Whithorn	Sub-aqua diving	105	-
		Travelling to and from diving locations	-	280
46	Mossyard Bay	Swimming	63	-
		Canoeing	-	28
137	Isle of Whithorn	Sub-aqua diving	39	-
		Travelling to and from diving locations	-	140
138	Isle of Whithorn	Sub-aqua diving	34	-
		Travelling to and from diving locations	-	120
362	River Nith and Urr Water	Water skiing	24	-
	River Nith and Solway Firth	Operating rescue boat	-	-
	River Nith	Haaf netting	-	187
	Kirkcudbright, Dundrennan and Kipford	Boat angling	-	-
366	River Nith and Urr Water	Water skiing	24	-
367	River Nith and Urr Water	Water skiing	24	-
368	River Nith and Urr Water	Water skiing	24	-
81	Cardoness	Swimming and kayaking	22	-
82	Cardoness	Swimming and kayaking	22	-
94	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
95	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
96	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
97	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
98	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
99	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
100	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
101	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
139	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
140	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
141	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
142	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
143	Isle of Whithorn	Sub-aqua diving	15	-
		Travelling to and from diving locations	-	45
245	Ross Bay	Swimming	10	-
376	Rockcliffe	Swimming	8	-
377	Rockcliffe	Swimming	8	-
380	Rockcliffe, Sandyhills and Southernness	Swimming	3	-
381	Rockcliffe, Sandyhills and Southernness	Swimming	3	-

Table 16. Adults' occupancy rates in and on water (h y⁻¹)

Observation number	Location	Activity	In water	On water
27	Garlieston Bay to Isle of Whithorn	Creeling	-	2100
282	Ringdoo Point to Balcary Point	Creeling and boat angling	-	1950
126	Wigtown Bay	Creeling	-	1600
286	Ringdoo Point to Balcary Point	Creeling	-	1280
106	Wigtown Bay	Creeling	-	1200
103	Off Creetown	Boat angling	-	1152
102	Off Creetown	Boat angling	-	1152
9	Wigtown Bay	Creeling	-	900
10	Wigtown Bay	Creeling	-	900
	Kirkcudbright Bay area	Sailing	-	
288	Kirkcudbright Harbour and the Dee Estuary	Working on a boat	-	872
289	Kirkcudbright Harbour and the Dee Estuary	Working on a boat	-	768
	Kirkcudbright Marina	Boat maintenance	-	
202	Kirkcudbright Bay and Wigtown Bay	Sailing	-	364
	Kirkcudbright Marina	Boat maintenance	-	
203	Kirkcudbright Bay and Wigtown Bay	Sailing	-	364
357	Urr Water	Boat angling	-	312
356	Urr Water	Boat angling	-	312
	Kirkcudbright Marina	Boat maintenance	-	
198	Kirkcudbright Bay and Wigtown Bay	Sailing	-	312
269	Throughout the survey area	Sailing	-	300
268	Throughout the survey area	Sailing	-	300
267	Throughout the survey area	Sailing	-	300
266	Throughout the survey area	Sailing	-	300
8	Isle of Whithorn	Boat angling	-	238
6	Isle of Whithorn	Boat angling	-	238
3	Isle of Whithorn	Boat angling	-	238
1	Isle of Whithorn	Boat angling	-	238
189	Throughout the survey area	Boat angling	-	234
188	Throughout the survey area	Boat angling	-	234
187	Throughout the survey area	Boat angling	-	234
394	Urr Water and Solway Firth	Sailing	-	208
393	Urr Water and Solway Firth	Sailing	-	208
392	Urr Water and Solway Firth	Sailing	-	208
391	Urr Water and Solway Firth	Sailing	-	208
390	Urr Water and Solway Firth	Sailing	-	208
389	Urr Water and Solway Firth	Sailing	-	208
388	Urr Water and Solway Firth	Sailing	-	208
387	Urr Water and Solway Firth	Sailing	-	208
386	Urr Water and Solway Firth	Sailing	-	208
385	Urr Water and Solway Firth	Sailing	-	208
45	Wigtown Bay	Gill netting	-	180
373	River Nith	Haaf netting	-	140
372	River Nith	Haaf netting	-	140
371	River Nith	Haaf netting	-	140
370	River Nith	Haaf netting	-	140
369	River Nith	Haaf netting	-	140
68	Isle of Whithorn	Sailing	-	140
67	Isle of Whithorn	Sailing	-	140
66	Isle of Whithorn	Sailing	-	140
65	Isle of Whithorn	Sailing	-	140

Table 16. Adults' occupancy rates in and on water (h y⁻¹)

Observation number	Location	Activity	In water	On water
133	Kirkcudbright Bay area	Boat angling and prawn raking	-	138
201	Kirkcudbright Bay and Wigtown Bay	Sailing	-	117
200	Kirkcudbright Bay and Wigtown Bay	Sailing	-	117
199	Kirkcudbright Bay and Wigtown Bay	Sailing	-	117
265	Throughout the survey area	RNLI duties	-	105
264	Throughout the survey area	RNLI duties	-	105
263	Throughout the survey area	RNLI duties	-	105
262	Throughout the survey area	RNLI duties	-	105
261	Throughout the survey area	RNLI duties	-	105
260	Throughout the survey area	RNLI duties	-	105
259	Throughout the survey area	RNLI duties	-	105
258	Throughout the survey area	RNLI duties	-	105
257	Throughout the survey area	RNLI duties	-	105
256	Throughout the survey area	RNLI duties	-	105
359	River Nith	Haaf netting	-	88
347	Rockcliffe	Boat angling	-	72
60	Off Garlieston Bay	Boat angling	-	60
58	Off Garlieston Bay	Boat angling	-	60
354	Urr Water	Sailing	-	48
353	Urr Water	Sailing	-	48
351	Urr Water	Sailing	-	44
350	Urr Water	Sailing	-	44
210	Brighthouse Bay, Carrick Bay, Nun Mill Bay and Balcary Bay	Paddling	-	40
322	River Nith and Solway Firth	Operating an inshore rescue boat	-	39
321	River Nith and Solway Firth	Operating an inshore rescue boat	-	39
320	River Nith and Solway Firth	Operating an inshore rescue boat	-	39
319	River Nith and Solway Firth	Operating an inshore rescue boat	-	39
318	River Nith and Solway Firth	Operating an inshore rescue boat	-	39
317	River Nith and Solway Firth	Operating an inshore rescue boat	-	39
316	River Nith and Solway Firth	Operating an inshore rescue boat	-	39
315	River Nith and Solway Firth	Operating an inshore rescue boat	-	39
314	River Nith and Solway Firth	Operating an inshore rescue boat	-	39
313	River Nith and Solway Firth	Operating an inshore rescue boat	-	39
194	Throughout the survey area	Pleasure cruising	-	38
193	Throughout the survey area	Pleasure cruising	-	38
105	Garlieston Bay	Boat angling	-	32
104	Garlieston Bay	Boat angling	-	32
399	Urr Water	Fly fishing	-	30
398	Urr Water	Fly fishing	-	30
397	Urr Water	Fly fishing	-	30
396	Urr Water	Fly fishing	-	30
395	Urr Water	Fly fishing	-	30
312	Urr Water and Brighthouse Bay	Boat angling	-	30
	River Nith	Haaf netting	-	
47	Mossyard Bay	Canoeing	-	28
239	Nun Mill Bay	Paddling	-	13
235	Nun Mill Bay	Paddling	-	13
332	Sandyhills	Paddling	-	4
331	Sandyhills	Paddling	-	4

Table 17. Children's and infants' occupancy rates in and on water (h y⁻¹)

Child age group (6 - 15 years old)

Observation number	Age	Location	Activity	In water	On water
83	14	Cardoness	Swimming and kayaking	22	-
84	14	Cardoness	Swimming and kayaking	22	-
85	12	Cardoness	Swimming and kayaking	22	-
211	11	Brighouse Bay, Carrick Bay, Nun Mill Bay and Balcary Bay	Swimming	20	-
		Brighouse Bay, Carrick Bay, Nun Mill Bay and Balcary Bay	Paddling	-	20
251	13	Isle Mouth	Snorkelling	20	-
252	10	Isle Mouth	Snorkelling	20	-
54	11	Mossyard Bay	Swimming	18	-
51	9	Mossyard Bay	Swimming	13	-
50	7	Mossyard Bay	Swimming	13	-
378	9	Rockcliffe	Swimming	8	-
379	6	Rockcliffe	Swimming	8	-
382	10	Rockcliffe, Sandyhills and Southernness	Swimming	3	-
383	7	Rockcliffe, Sandyhills and Southernness	Swimming	3	-
69	15	Isle of Whithorn	Sailing	-	140
70	15	Isle of Whithorn	Sailing	-	140
71	15	Isle of Whithorn	Sailing	-	140
72	15	Isle of Whithorn	Sailing	-	140
75	12	Isle of Whithorn	Sailing	-	140
76	12	Isle of Whithorn	Sailing	-	140
79	12	Isle of Whithorn	Sailing	-	140
80	12	Isle of Whithorn	Sailing	-	140
73	10	Isle of Whithorn	Sailing	-	140
74	10	Isle of Whithorn	Sailing	-	140
77	10	Isle of Whithorn	Sailing	-	140
78	10	Isle of Whithorn	Sailing	-	140
348	13	Rockcliffe	Angling	-	72
352	15	Urr Water	Sailing	-	44
212	6	Brighouse Bay, Carrick Bay, Nun Mill Bay and Balcary Bay	Paddling	-	40
195	9	Throughout the survey area	Pleasure cruising	-	38
196	8	Throughout the survey area	Pleasure cruising	-	38
197	6	Throughout the survey area	Pleasure cruising	-	38
221	9	Nun Mill Bay and Brighouse Bay	Paddling	-	18
222	8	Nun Mill Bay and Brighouse Bay	Paddling	-	18
125	12	Rigg Bay	Paddling	-	15
124	10	Rigg Bay	Paddling	-	15
123	6	Rigg Bay	Paddling	-	15
236	8	Nun Mill Bay	Paddling	-	13
206	9	Nun Mill Bay and Brighouse Bay	Paddling	-	10
207	7	Nun Mill Bay and Brighouse Bay	Paddling	-	10
26	11	Rigg Bay	Paddling	-	5
25	7	Rigg Bay	Paddling	-	5
333	12	Sandyhills	Paddling	-	4
334	7	Sandyhills	Paddling	-	4
335	6	Sandyhills	Paddling	-	4

Table 17. Children's and infants' occupancy rates in and on water (h y⁻¹)**Infant age group (0 - 5 years old)**

Observation number	Age	Location	Activity	In water	On water
384	5	Rockcliffe, Sandyhills and Southernness	Swimming	3	-
213	4	Brighthouse Bay, Carrick Bay, Nun Mill Bay and Balcary Bay	Paddling	-	40
223	5	Nun Mill Bay and Brighthouse Bay	Paddling	-	18
237	5	Nun Mill Bay	Paddling	-	13
238	3	Nun Mill Bay	Paddling	-	13

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
1	M	U	8.7	-	-	-	-	-	-	-	-	3	-	57	5	-	28	-	238
2	F	U	8.7	0.3	1.1	-	-	-	-	-	-	-	-	17	-	-	-	-	-
3	M	U	8.7	-	-	-	-	-	-	-	-	3	-	40	-	-	23	-	238
6	M	U	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	238
8	M	U	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	238
9	M	U	2.3	0.7	0.4	-	-	-	-	91	-	-	-	-	-	900	-	-	900
10	M	U	2.3	0.7	0.4	-	-	-	-	-	-	-	-	-	-	900	-	-	900
11	M	U	-	3.3	0.7	-	-	-	-	8	-	-	-	-	-	-	8	105	280
12	F	U	-	3.3	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	M	U	-	-	-	-	-	-	-	-	-	462	-	-	-	-	-	-	-
15	M	U	-	-	-	-	-	-	-	-	-	-	-	29	-	-	-	-	-
16	F	U	-	-	-	-	-	-	-	-	-	-	-	29	-	-	-	-	-
20	M	46	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	-
21	M	70	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	-
23	M	U	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-
24	F	U	-	-	-	-	-	-	-	-	-	-	-	15	-	-	-	-	-
27	M	49	1.6	1.8	-	-	-	-	-	-	-	-	-	-	-	1750	-	-	2100
28	M	45	1.6	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	M	U	-	-	-	-	-	-	-	-	-	-	210	-	-	-	-	-	-
30	M	U	-	-	-	-	-	-	-	-	-	-	210	-	-	-	-	-	-
31	M	U	-	-	-	-	-	-	-	-	-	-	24	-	-	-	-	-	-
32	M	U	-	-	-	-	-	-	-	-	-	-	24	-	-	-	-	-	-

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
33	M	U	-	-	-	-	-	-	-	-	-	-	36	-	-	-	-	-	-
34	M	U	-	-	-	-	-	-	-	-	-	-	36	-	-	-	-	-	-
35	M	U	-	-	-	-	-	-	-	-	-	-	147	-	-	-	-	-	-
36	M	U	-	-	-	-	-	2.8	-	-	-	-	147	-	-	-	-	-	-
37	M	U	-	-	-	-	-	2.8	-	-	-	-	-	-	-	-	-	-	-
38	M	U	-	-	-	-	-	2.8	-	-	-	-	-	-	-	-	-	-	-
39	F	U	-	-	-	-	-	2.8	-	-	-	-	-	-	-	-	-	-	-
40	M	U	-	-	-	-	-	-	-	-	-	-	180	-	-	-	-	-	-
41	M	U	-	-	-	-	35.5	9.9	-	-	-	-	180	-	-	-	-	-	-
42	F	U	-	-	-	-	35.5	9.9	-	-	-	-	-	-	-	-	-	-	-
43	M	U	-	-	-	-	35.5	9.9	-	-	-	-	-	-	-	-	-	-	-
44	F	U	-	-	-	-	35.5	9.9	-	-	-	-	-	-	-	-	-	-	-
45	M	U	21.0	27.5	-	-	-	-	-	70	-	-	-	-	-	180	10	-	180
46	F	U	-	-	-	-	-	-	-	-	-	-	-	84	-	-	-	63	28
47	M	U	-	-	-	-	-	-	-	-	-	-	-	84	-	-	-	-	28
48	M	U	-	-	-	-	-	-	-	-	-	-	-	35	-	-	-	-	-
49	F	U	-	-	-	-	-	-	-	-	-	-	-	35	-	-	-	-	-
52	F	U	-	-	-	-	-	-	-	-	-	-	-	60	-	-	-	-	-
53	M	U	-	-	-	-	-	-	-	-	-	-	-	60	-	-	-	-	-
55	F	78	-	-	-	-	-	-	-	-	-	-	-	-	140	-	-	-	-
56	M	U	2.9	0.9	0.8	-	-	-	-	-	-	-	-	-	2	-	2	-	-
57	M	U	2.9	0.9	0.8	-	-	-	-	-	-	-	-	-	2	-	2	-	-

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
130	F	22	5.4	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
131	F	19	5.4	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
132	M	17	5.4	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
133	M	47	21.5	2.8	0.3	-	-	-	-	98	-	296	-	26	-	7	27	-	138
134	F	50	21.5	0.4	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
135	M	18	21.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
137	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39	140
138	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	34	120
139	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	32
140	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	28
141	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	24
142	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	24
143	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	24
144	M	U	-	-	-	1.5	-	-	24	-	-	-	-	-	-	-	24	-	-
145	M	U	-	-	-	-	-	-	-	-	-	-	360	-	-	-	-	-	-
146	M	56	10.7	-	-	-	-	-	-	-	-	300	-	-	-	-	20	-	-
147	M	22	10.7	-	-	-	-	-	-	-	-	300	-	-	-	-	20	-	-
148	M	U	1.9	-	-	-	-	-	-	60	-	-	-	-	-	60	-	-	-
149	M	U	1.9	-	-	-	-	-	-	60	-	-	-	-	-	60	-	-	-
150	F	U	1.9	-	-	-	-	-	-	60	-	-	-	-	-	60	-	-	-
151	M	U	-	-	-	31.7	-	-	15	-	-	-	-	-	648	-	663	-	-
152	M	U	0.4	-	-	4.8	-	-	44	-	-	-	-	305	-	-	44	-	-

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
153	F	U	0.4	-	-	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-
154	M	U	-	-	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-
155	M	U	-	-	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-
156	M	40	14.7	-	-	-	-	-	-	-	-	350	-	-	-	-	-	-	-
157	F	39	14.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
158	M	59	-	-	-	-	-	-	-	12	104	-	-	-	-	-	12	-	-
160	M	38	11.8	-	-	-	-	-	-	38	12	368	48	-	-	-	50	-	-
162	F	38	11.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
163	M	21	14.9	-	-	-	-	-	-	26	28	156	-	-	-	-	54	-	-
164	F	32	14.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
166	M	U	-	-	-	-	-	-	-	26	-	156	-	-	-	-	26	-	-
167	M	U	-	-	-	-	-	-	-	26	-	156	-	-	-	-	26	-	-
168	M	U	-	-	-	-	-	-	-	26	-	156	-	-	-	-	26	-	-
169	M	U	-	-	-	-	-	-	-	26	-	156	-	-	-	-	26	-	-
170	M	25	22.1	-	-	-	-	-	-	78	30	312	-	-	-	-	108	-	-
171	M	55	22.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
172	F	53	22.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
173	F	28	22.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
174	M	42	1.3	-	-	-	-	-	-	-	-	24	-	-	-	-	-	-	-
176	F	40	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
177	M	38	-	-	-	-	-	-	-	-	-	24	-	-	-	-	-	-	-
179	M	47	25.8	-	-	-	-	-	-	105	38	450	-	-	-	-	143	-	-

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
180	F	42	25.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
181	M	24	7.9	-	-	-	-	-	-	53	19	225	-	-	-	-	71	-	-
182	F	23	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
183	M	36	5.3	-	-	-	-	-	-	35	13	150	-	-	-	-	48	-	-
184	F	36	5.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
187	M	47	18.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	234
188	M	44	18.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	234
189	M	21	18.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	234
190	F	46	18.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
191	F	43	18.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
192	F	17	18.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
193	M	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38
194	F	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38
198	M	66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	312
199	F	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117
200	M	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117
201	F	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117
202	M	51	-	-	-	-	-	-	4	-	-	-	-	-	-	-	4	-	364
203	F	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	364
204	M	36	-	-	-	-	-	-	-	-	-	-	-	42	-	-	-	-	-
205	F	35	-	-	-	-	-	-	-	-	-	-	-	42	-	-	-	-	-
208	M	67	-	-	-	-	-	-	-	-	-	-	-	162	-	-	-	-	-

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
209	F	65	-	-	-	-	-	-	-	-	-	-	-	162	-	-	-	-	-
210	F	37	-	-	-	-	-	-	-	-	-	-	-	120	-	-	-	-	40
214	M	40	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-	-
215	M	28	-	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-
216	F	29	-	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-
219	M	37	-	-	-	-	-	-	-	-	-	-	-	78	-	-	-	-	-
220	F	37	-	-	-	-	-	-	-	-	-	-	-	78	-	-	-	-	-
224	F	56	-	-	-	-	-	-	-	-	-	-	-	90	-	-	-	-	-
225	M	46	-	-	-	-	-	-	-	-	-	-	-	89	-	-	-	-	-
226	F	46	-	-	-	-	-	-	-	-	-	-	-	89	-	-	-	-	-
227	M	19	-	-	-	-	-	-	-	-	-	-	-	89	-	-	-	-	-
228	M	17	-	-	-	-	-	-	-	-	-	-	-	89	-	-	-	-	-
229	F	33	-	-	-	-	-	-	-	-	-	-	-	49	-	-	-	-	-
230	F	44	-	-	-	-	-	-	-	-	-	-	-	190	-	-	-	-	-
234	M	48	-	-	-	-	-	-	-	-	-	-	-	160	-	-	-	-	-
235	F	30	-	-	-	-	-	-	-	-	-	-	-	78	-	-	-	-	13
239	F	55	-	-	-	-	-	-	-	-	-	-	-	78	-	-	-	-	13
240	F	41	-	-	-	-	-	-	-	-	-	-	-	156	-	-	-	-	-
241	M	43	-	-	-	-	-	-	-	-	-	-	-	52	-	-	-	-	-
242	M	U	-	-	-	-	-	-	-	-	-	-	-	170	-	-	-	-	-
243	F	43	-	-	-	-	-	-	-	-	-	-	-	65	-	-	-	-	-
244	F	56	-	-	-	-	-	-	-	-	-	-	-	45	-	-	-	-	-

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
245	F	62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-
246	M	63	-	-	0.6	-	-	-	-	-	-	6	-	80	-	-	6	-	-
247	F	60	-	-	0.6	-	-	-	-	-	-	6	-	80	-	-	6	-	-
248	M	58	8.6	-	19.2	-	-	-	-	-	-	672	-	224	-	-	896	-	-
249	M	44	-	-	0.3	-	-	-	-	-	-	4	-	96	-	-	4	-	-
250	F	42	-	-	0.3	-	-	-	-	-	-	-	-	100	-	-	-	-	-
253	F	67	-	-	0.3	-	-	-	-	-	-	-	-	100	-	-	-	-	-
254	F	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105	-
255	F	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105	-
256	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105
257	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105
258	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105
259	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105
260	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105
261	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105
262	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105
263	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105
264	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105
265	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	105
266	M	U	-	-	-	-	-	-	3	-	-	-	-	-	-	-	3	-	300
267	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300
268	M	U	-	-	-	-	-	-	3	-	-	-	-	-	-	-	3	-	300

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
269	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300
270	M	50	-	-	1.8	-	-	-	-	-	-	588	-	196	-	-	784	-	-
271	F	46	-	-	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
272	M	U	-	-	-	-	-	-	-	-	-	588	-	196	-	-	784	-	-
273	M	U	-	-	-	-	-	-	-	-	-	588	-	196	-	-	784	-	-
274	M	U	-	-	-	-	-	-	-	-	-	588	-	196	-	-	784	-	-
275	M	U	-	-	-	-	-	-	-	-	-	588	-	196	-	-	784	-	-
276	M	U	-	-	-	-	-	-	-	-	-	588	-	196	-	-	784	-	-
277	M	U	-	-	-	-	-	-	-	-	-	588	-	196	-	-	784	-	-
278	M	U	-	-	-	-	-	-	-	-	-	588	-	196	-	-	784	-	-
279	M	U	-	-	-	-	-	-	-	-	-	588	-	196	-	-	784	-	-
280	M	U	-	-	-	-	-	-	-	-	-	588	-	196	-	-	784	-	-
281	M	U	-	-	-	-	-	-	-	-	-	588	-	196	-	-	784	-	-
282	M	49	30.8	14.8	4.6	-	-	-	-	-	-	35	-	190	-	1500	75	-	1950
283	F	47	30.8	14.8	4.6	-	-	-	-	-	-	-	-	150	-	-	-	-	-
284	M	26	30.8	10.7	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
285	F	22	30.8	10.7	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
286	M	U	11.8	13.8	-	-	-	-	-	9	9	36	-	96	-	960	27	-	1280
287	F	U	11.8	13.8	-	-	-	-	-	-	-	-	-	87	-	-	-	-	-
288	M	54	3.6	1.3	0.5	-	-	-	48	4	-	-	-	104	-	-	52	-	872
289	M	U	-	-	-	-	-	-	36	-	-	-	-	-	-	-	36	-	768
290	F	U	3.6	1.3	0.5	-	-	-	-	-	-	-	-	104	-	-	-	-	-

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
355	F	60	-	-	-	-	-	-	-	-	-	-	-	42	-	-	-	-	-
356	M	U	16.5	-	-	-	-	-	565	-	-	860	260	78	-	-	1503	-	312
357	M	U	16.5	-	-	-	-	-	565	-	-	860	260	78	-	-	1503	-	312
358	M	U	-	-	-	-	-	-	45	-	-	-	-	-	-	-	45	-	-
359	M	U	3.3	-	-	2.8	-	-	98	-	-	-	104	-	-	88	88	-	88
360	F	U	3.3	-	-	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-
361	M	U	-	-	-	-	-	-	-	-	-	-	65	-	-	-	-	-	-
362	M	U	3.2	-	-	2.1	-	-	30	-	-	-	530	-	-	105	-	24	187
363	F	U	3.2	-	-	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-
364	M	U	3.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
365	F	U	3.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
366	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-
367	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-
368	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24	-
369	M	U	-	-	-	-	-	-	11	-	-	-	11	-	-	140	-	-	140
370	M	U	-	-	-	-	-	-	11	-	-	-	11	-	-	140	-	-	140
371	M	U	-	-	-	-	-	-	11	-	-	-	11	-	-	140	-	-	140
372	M	U	-	-	-	-	-	-	11	-	-	-	11	-	-	140	-	-	140
373	M	U	-	-	-	-	-	-	11	-	-	-	11	-	-	140	-	-	140
374	M	38	-	-	-	-	-	-	-	-	-	42	-	-	-	-	-	-	-
375	M	40	-	-	-	-	-	-	-	-	-	42	-	-	-	-	-	-	-
376	M	35	-	-	-	-	-	-	-	-	-	-	-	56	-	-	-	8	-

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
377	F	31	-	-	-	-	-	-	-	-	-	-	-	56	-	-	-	8	-
380	M	40	-	-	-	-	-	-	-	-	-	-	-	91	-	-	-	3	-
381	F	40	-	-	-	-	-	-	-	-	-	-	-	91	-	-	-	3	-
385	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208
386	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208
387	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208
388	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208
389	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208
390	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208
391	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208
392	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208
393	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208
394	F	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	208
395	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30
396	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30
397	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30
398	M	U	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30
399	M	U	7.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30
400	F	U	7.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
401	M	U	-	-	-	-	-	-	-	-	-	-	245	-	-	-	-	-	-
402	M	U	-	-	-	-	-	-	-	-	-	-	245	-	-	-	-	-	-
403	M	U	-	-	-	-	-	-	-	-	-	-	245	-	-	-	-	-	-

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
404	M	26	-	-	-	-	-	-	-	-	-	156	-	-	-	-	-	-	-
405	M	66	17.8	-	-	-	-	-	-	-	-	-	-	318	-	61	318	-	-
406	M	U	-	-	-	-	-	-	-	-	-	-	-	318	-	61	318	-	-
407	F	U	17.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
408	F	39	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
409	M	38	5.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
410	M	36	7.7	-	-	-	-	-	-	-	-	96	-	-	-	-	-	-	-
411	M	32	7.7	-	-	-	-	-	-	-	-	96	-	-	-	-	-	-	-
412	M	34	7.7	-	-	-	-	-	-	-	-	96	-	-	-	-	-	-	-
413	M	34	7.7	-	-	-	-	-	-	-	-	96	-	-	-	-	-	-	-
414	M	25	-	-	-	-	-	-	-	-	-	42	-	-	-	-	-	-	-
415	M	24	-	-	-	-	-	-	-	-	-	42	-	-	-	-	-	-	-

Notes

Emboldened observations are the high-rate individuals

U = Unknown

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Handling sediment	Occupancy in water	Occupancy on water
Child age group (6 - 15 years old)												
129	F	13	5.4	1.5	-	-	-	-	-	-	-	-
136	M	6	21.5	-	-	-	-	-	-	-	-	-
159	M	12	-	-	-	6	52	-	-	6	-	-
161	M	11	11.8	-	19	-	184	24	-	19	-	-
165	M	6	8.9	-	-	-	-	-	-	-	-	-
175	M	10	1.3	-	-	-	24	-	-	-	-	-
178	M	10	-	-	-	-	24	-	-	-	-	-
185	F	7	4.0	-	-	-	-	-	-	-	-	-
195	M	9	-	-	-	-	-	-	-	-	-	38
196	F	8	-	-	-	-	-	-	-	-	-	38
197	M	6	-	-	-	-	-	-	-	-	-	38
206	F	9	-	-	-	-	-	-	32	-	-	10
207	F	7	-	-	-	-	-	-	32	-	-	10
211	F	11	-	-	-	-	-	-	120	-	20	20
212	F	6	-	-	-	-	-	-	120	-	-	40
217	M	6	-	-	-	-	-	-	30	-	-	-
221	M	9	-	-	-	-	-	-	60	-	-	18
222	M	8	-	-	-	-	-	-	60	-	-	18
231	F	15	-	-	-	-	-	-	190	-	-	-
232	F	13	-	-	-	-	-	-	190	-	-	-
233	M	8	-	-	-	-	-	-	190	-	-	-
236	M	8	-	-	-	-	-	-	78	-	-	13
251	M	13	-	-	-	-	-	-	80	-	20	-
252	F	10	-	-	-	-	-	-	80	-	20	-
302	F	8	-	-	-	-	-	-	90	-	-	-
303	F	6	-	-	-	-	-	-	90	-	-	-
305	M	12	-	-	-	-	27	-	81	-	-	-
306	M	10	-	-	-	-	27	-	81	-	-	-
307	F	8	-	-	-	-	27	-	81	-	-	-
325	F	13	-	-	-	-	18	-	18	-	-	-
326	F	8	-	-	-	-	18	-	18	-	-	-
327	M	10	-	-	-	-	18	-	18	-	-	-
330	F	6	-	-	-	-	-	-	56	-	-	-
333	F	12	-	-	-	-	-	-	42	-	-	4
334	F	7	-	-	-	-	-	-	42	-	-	4
335	M	6	-	-	-	-	-	-	42	-	-	4
338	F	7	-	-	-	-	-	-	156	-	-	-

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

Observation number	Sex	Age (years)	Fish	Crustaceans	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Handling sediment	Occupancy in water	Occupancy on water
Child age group (6 - 15 years old)												
344	M	10	-	-	-	-	-	-	36	-	-	-
345	F	6	-	-	-	-	-	-	36	-	-	-
348	M	13	9.5	-	-	-	60	-	21	21	-	72
352	M	15	-	-	-	-	-	-	-	-	-	44
378	F	9	-	-	-	-	-	-	56	-	8	-
379	F	6	-	-	-	-	-	-	56	-	8	-
382	M	10	-	-	-	-	-	-	91	-	3	-
383	M	7	-	-	-	-	-	-	91	-	3	-
Infant age group (0 - 5 years old)												
92	M	3	-	-	-	-	-	-	13	-	-	-
93	F	5	-	-	-	-	-	-	13	-	-	-
120	F	1	-	-	-	-	-	-	30	-	-	-
186	M	4	2.6	-	-	-	-	-	-	-	-	-
213	M	4	-	-	-	-	-	-	120	-	-	40
218	F	2	-	-	-	-	-	-	30	-	-	-
223	F	5	-	-	-	-	-	-	60	-	-	18
237	F	5	-	-	-	-	-	-	78	-	-	13
238	F	3	-	-	-	-	-	-	78	-	-	13
304	F	5	-	-	-	-	-	-	90	-	-	-
339	F	4	-	-	-	-	-	-	156	-	-	-
346	F	4	-	-	-	-	-	-	36	-	-	-
384	F	5	-	-	-	-	-	-	91	-	3	-

Notes

Emboldened observations are the high-rate individuals

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

Combination number	Fish	Crustaceans	Molluscs	Wildfowl	Salt marsh grazed cattle meat	Salt marsh grazed sheep meat	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Handling fishing gear	Handling sediment	Occupancy in water	Occupancy on water
1	X									X		X	X		X		X
2	X	X	X					X		X		X		X	X		X
3		X	X					X							X	X	X
4					X	X					X						
5												X				X	X
6	X	X	X										X		X		
7	X			X			X				X			X	X		X
8	X		X					X							X	X	
9				X			X						X		X		
10	X			X			X					X			X		
11	X							X	X	X	X				X		
12	X	X	X				X	X				X			X		X
13	X	X						X	X	X		X		X	X		X
14	X						X			X	X	X			X		X
15	X			X			X				X			X		X	X

Notes

The food groups and external exposure pathways marked with a cross are combined for the corresponding combination number. For example, combination number 1 represents an individual (or individuals) from Annex 1 who had positive data in the following pathways; fish, intertidal occupancy over rock, intertidal occupancy over sand, intertidal occupancy over sand and stones, handling sediment, and occupancy on water.