Centre for Environment Fisheries & Aquaculture Science

Cefas

Radiological Habits Survey: Sellafield Review, 2021

Review of shellfish and fish consumption, and intertidal occupancy

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1. Introduction

This report presents the results of a review of the public's shellfish and fish consumption, and intertidal occupancy, relating to liquid radioactive waste discharges from the Sellafield Ltd site in Cumbria. The review was undertaken in 2021.

Reviews are conducted annually at Sellafield, except every fifth year when a full survey (encompassing aquatic, terrestrial and direct radiation pathways) is undertaken. The last full habits survey in the vicinity of Sellafield was conducted by the Centre for Environment, Fisheries & Aquaculture Science (Cefas) in 2018 (Moore and others, 2019). The surveys are undertaken on behalf of the Environment Agency (EA), the Food Standards Agency (FSA) and the Office for Nuclear Regulation (ONR). This supports their roles in protecting the public from the effects of radiation.

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 dose limits and optimisation, then other members of the public will receive acceptable doses, and overall protection to the public is provided from the effects of radiation. Habits surveys are undertaken to collect data on the foods that people consume and time they spend in the vicinity of a nuclear site, which are combined with data on the levels of radioactivity found in locally grown or caught foods, and in the environment, to estimate the level of radiation that people may be exposed to.

This Sellafield Review survey specifically investigated the consumption of crustaceans, molluscs and fish, and occupancy over intertidal substrates, since these pathways are the major contributors to the dose of the representative person. The dose contribution is dependent upon the consumption and occupancy (habits) data, the radionuclide activity concentrations in seafood, and gamma dose rates over intertidal substrates. The annual review surveys identify any changes in consumption and occupancy rates, new individuals and activities, as well as people who have ceased consuming seafood or undertaking intertidal activities. The information and data in this report are used in radiological dose assessments as reported in the Radioactivity in Food and the Environment (RIFE) series (for example - EA, FSA, FSS, NRW, NIEA and SEPA, 2021).

This survey is also relevant to discharges from the Low Level Waste Repository (LLWR) near Drigg due to the proximity of the site, as well as the proposed Moorside nuclear scheme adjacent to the Sellafield site.

Due to the COVID-19 pandemic, an alternative survey approach was used to comply with UK government, Department for Environment, Fisheries and Rural Affairs (Defra) and Cefas COVID-19 guidance and protocols. This approach included reducing the number of days on fieldwork, undertaking face-to-face interviews outdoors only, and increasing the

number of desk-based interviews, to ensure the safety of interviewees and fieldwork staff during the collection of habits survey data.

In previous years, several of the higher rate consumers of shellfish kept a diary of their seafood consumption and intertidal occupancy for a two-week period every three months. Diaries were not sent for completion during the COVID-19 period.

2. Survey area

The aquatic survey area covered all tidal waters and intertidal areas from Parton to Tarn Bay and extended 11 km offshore. Figure 1 shows the locations within the survey area.

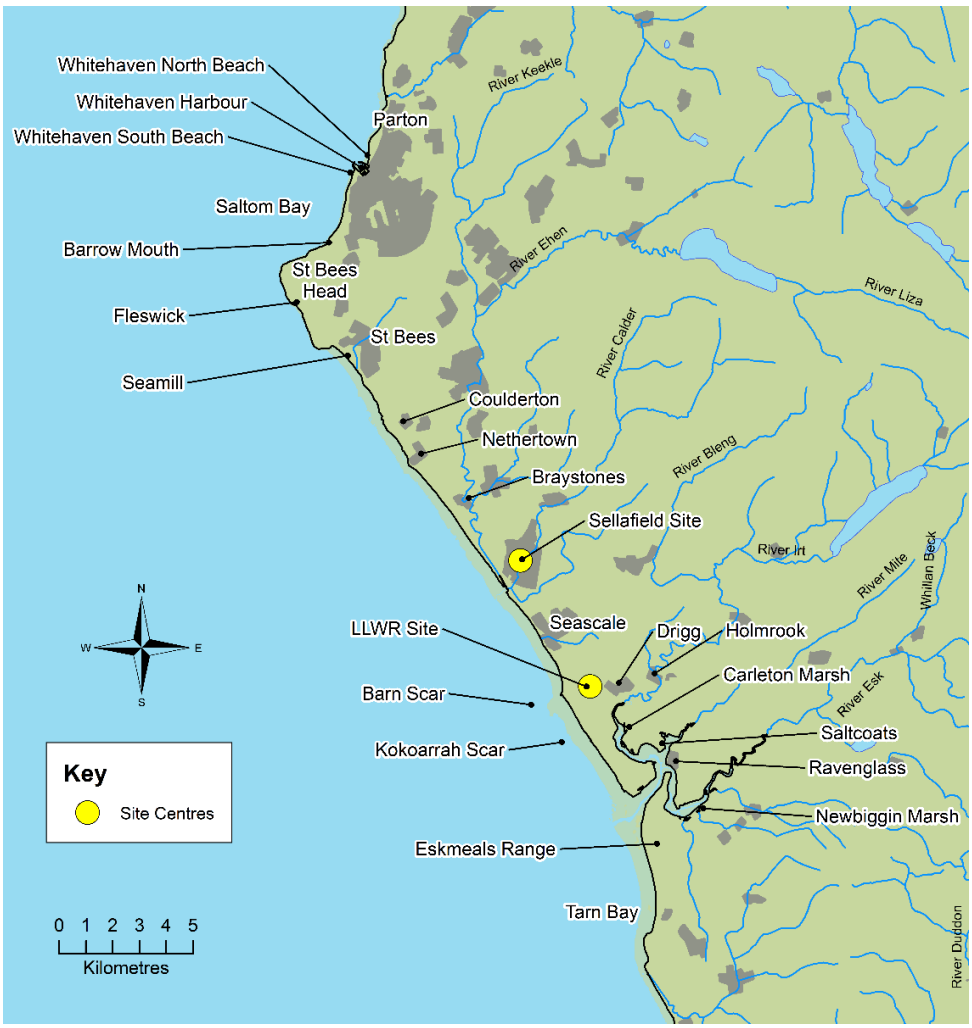

Figure 1. Aquatic survey area

3. Conduct of the survey

In 2020, an alternative habits survey method was developed to ensure that the habits surveys could be conducted safely and in compliance with government guidelines for COVID-19. This approach was also used in 2021 and included undertaking desk-based interviews by phone, reducing the fieldwork duration, and only undertaking face-to-face interviews outdoors. The survey preparation initially focussed on ensuring that the fieldwork component could be undertaken safely with COVID-19 protocols and mitigations in place. This included following government guidelines and Cefas protocols, producing risk assessments, and researching travel options.

The survey research included Internet and social media searches to identify people who consume crustaceans, molluscs or fish, and who undertake activities on intertidal areas. A list of interviewees from previous Sellafield habits surveys, including shellfish collectors, commercial fishermen and hobby fishermen, was collated. Additional research included collating age demographics for towns in the survey area, to support with assumptions of people who might undertake activities during the lockdown period.

The desk-based telephone interviews were conducted between October and December 2021. The fieldwork component was conducted from 21st to 24th June 2021, by a team of two members of Cefas staff. The number of local and national COVID-19 cases and government guidance were monitored in the lead up to the fieldwork. The fieldwork interviews were only undertaken outdoors on the beaches in the survey area and social distancing was maintained at all times. All interviewees were asked to estimate consumption rates for crustaceans, molluscs and fish from the survey area, as well as occupancy rates over intertidal areas within the survey area, for themselves and members of their families. Information was obtained about the origins of the seafood being consumed and locations of intertidal occupancy. Interviewees were also asked about their activities during the COVID-19 period and if there were any changes (increases or decreases) in their activities due to the pandemic.

4. Methods of data analysis

4.1. Data recording and presentation

Data collected during the fieldwork and during phone interviews were recorded in logbooks. All data were examined, and any notably high rates were double-checked, where possible, by way of a follow-up phone call. In cases where follow-up phone calls were not possible (for example - interviewees who wished to remain anonymous), the data were accepted at face value. The raw data were entered into a data capture application and then uploaded to the Cefas habits survey database where each individual for whom

information was obtained was given a unique identifier (the Person ID number) to assist in maintaining data quality and traceability.

The consumption and occupancy data in the text of this report are rounded to two significant figures. 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. External exposure data are quoted as integer number of hours per year.

In habits surveys, data are structured into age groups because different dose coefficients (which are, the factors which convert intakes of radioactivity into dose) can apply to different ages. The names used for the age groups, based on the recommendations in ICRP 101 (ICRP, 2007), are shown in Table 1. Although no data were collected for children or infants in the 2021 Sellafield Review, the description of age groups is retained in this report for consistency within the Sellafield Review series.

Table 1. Names of age groups and range of ages within each age group

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

4.2. Approaches for the identification of high rates

The habits data have been analysed to identify high rates of consumption and occupancy, which are suitable for use in radiological assessments. Two approaches have been used:

Firstly, the 'cut-off' method described by Hunt and others (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 aquatic food group and intertidal substrate 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 (to generate a revised cut-off value) and all observations above this were included in the high-rate group.

Secondly, the 97.5th percentile rate was calculated for each group. The use of percentiles accords with precedents used in risk assessments 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.

The results of the individuals' consumption and occupancy rates collected during the survey were grouped and presented in tables with the high-rate group members indicated in bold and with the calculated mean rates for the high-rate group and 97.5th percentile rates. The consumption rates and occupancy rates for all groups for adults are presented in Annex 1, with the high-rate group members indicated in bold text.

5. Impact of the COVID-19 pandemic on activities

5.1. Observations of public response during interviews

The public response to the survey and to the interviews was positive. Members of the public who were contacted by phone and approached in person by the survey team were happy to take part in the survey and no one declined an interview. In both the telephone and fieldwork interviews, people welcomed the conversation and showed an interest in the survey. Telephone interviews worked well but building rapport with the interviewee was more difficult compared with face-to-face interviews.

As part of the survey research, age demographics for the towns in the survey area were obtained to support assumptions about the types of activities that might be undertaken during the lockdown period. It was assumed that, as the survey area includes multiple locations where a high percentage of residents are aged 50 and over, there would be less people in this age range undertaking activities as they were in the higher risk category for COVID-19. The converse was identified during the survey. Of the 49 interviewees who spent time on intertidal areas, at least 69% were aged 50 and over. The data collected demonstrated that the age distribution was weighted towards people aged 50 and over who were continuing with their intertidal activities during the pandemic.

5.2. Number of interviewees and activities in the survey area during the pandemic

Interview data were collected for 70 adults during the 2021 Sellafield Review survey. This is reduced in comparison with the 2020 Sellafield Review, in which data were obtained for

103 adults. This was partly due to Network Rail not undertaking repair works in the survey area which has previously accounted for approximately 20 employees.

It should be noted that the Sellafield Review targets high-rate activities (for example, dog walking, commercial/hobby fishing, angling, working on the shore) and seafood consumption, since these pathways are the major contributors to the dose of the representative person. No data were recorded for the child or infant age groups in the 2021 Sellafield Review, as they do not typically undertake these high-rate activities. The full surveys (encompassing aquatic, terrestrial and direct radiation pathways) include all activities and capture activities undertaken by children, for example, playing on the beach, paddling, swimming. The activities identified in the 2021 survey during the COVID-19 pandemic were broadly representative of activities identified in previous Sellafield Review surveys.

All interviewees in the 2021 survey were asked if there were any changes to their activities and seafood consumption due to the pandemic. During the third lockdown between January and March 2021, it was reported that some people had stopped their activities, but some activities continued, including dog walking, angling, setting nets and tending to livestock. As the third lockdown eased, and into the summer months, it was reported that the beaches in the survey area had increased in popularity with locals and tourists, resulting in the beaches being busier compared to previous years. The increase of popularity is likely due to families remaining in the UK for their summer holidays.

Table 2 presents the number of interviewees undertaking each intertidal activity, a summary of the changes in activities due to the pandemic, and the reasons provided by the interviewees.

Table 2. Changes in activities due to the pandemic

Activity	Number of interviewees undertaking intertidal activities in 2021	Changes in activity due to the pandemic	Reasons for the changes in activities
Dog walking	24	One of the 24 individuals interviewed stopped undertaking this activity during the third lockdown between January and March for approximately 3 months.	The majority of individuals continued throughout lockdown and used the activity as their daily exercise to get out of the house and to keep them busy during lockdown.
Angling	14	Three of the 14 individuals identified stopped angling during the third lockdown between January and March. The other 11 continued with their angling activities as normal.	Fishing matches were not permitted during the third lockdown.
Bait digging	6	One of the six interviewees stopped bait digging during lockdown in 2021. The other interviewees did not report a change in this activity.	Being cautious due to COVID-19.
Shellfish collecting	1	The shellfish collector identified continued their routine activity as in previous years.	Not applicable.
Setting pots and nets	2	One hobby fisherman who had stopped setting pots in 2020 was planning to start again later in 2021. Two hobby fishermen who have previously had high rates of intertidal occupancy and fish/crustacean/mollusc consumption had decided to give up fishing due to the lockdowns. Two hobby fishermen continued with their routine activities throughout the pandemic.	Being cautious due to COVID-19.
Tending livestock	4	No change from previous year	The farmers continued their essential work to tend their livestock on the salt marshes
Wildfowling	1	The wildfowler identified continued their routine activity as in previous years.	Not applicable.

Note: Some interviewees were undertaking multiple activities and are counted in all the relevant activities in this table. There were 49 people undertaking intertidal activities (see Table 8).

5.3. Estimates of data gaps due to COVID-19

Two previously identified winkle consumers could not be contacted during the survey as they do not have a telephone number or an email address (in previous years the interviews have been conducted in their home). Consumption rates for this individual and another family member were assumed to continue and included in RIFE 26 dose assessments. However due to the time that has passed since these individuals were last able to be contacted, along with age and ill health, it is no longer viable to assume this data and it will not be included in future RIFE dose assessments.

Two individuals who have previously spent a significant amount of time on intertidal areas and consumed large qualities of seafood had decided to give up their hobby fishing (bait digging, setting pots and nets, angling, collecting shellfish and hooking for lobsters) due to repeated lockdowns.

6. Internal exposure

Consumption data for aquatic foods for adults are presented in Table 5, Table 6 and Table 7. The tables include the mean consumption rates for the high-rate groups, calculated as described in Section 4.2, and the observed 97.5th percentile rates. No children or infants were identified consuming seafood.

6.1. Crustaceans, molluscs and fish

The people consuming the greatest quantities of crustaceans, molluscs and fish from the aquatic survey area were commercial and hobby fishermen, shellfish collectors, anglers, and the families of these groups of people. Table 3 presents a summary of the adults' consumption rates of crustaceans, molluscs and fish for the 2021 Sellafield Review alongside the results from the 2020 Sellafield Review for comparison. The table includes the mean consumption rates for the high-rate groups and the observed 97.5th percentile rates.

Table 3. Summary of the consumption rates of foods from the Sellafield aquatic survey area in 2021 alongside the 2020 results for comparison

Food group	Number of observations		Number of individuals in the high-rate group		Observed maximum for the high-rate group (kg y^{-1})		Observed minimum for the high-rate group (kg y^{-1})		Observed mean for the high-rate group (kg y^{-1})		Observed 97.5th percentile (kg y^{-1})	
Adults												
	2020	**2021**	**2020**	**2021**	**2020**	**2021**	**2020**	**2021**	**2020**	**2021**	**2020**	**2021**
Crustaceans	12	14	11	7	59.1	27.6	20.5	15.3	30.1	24.9	54.2	27.6
Molluscs	9	1	2	1	17.5	5.4	9.8	5.4	13.6	5.4	16.0	N/A[a]
Fish	24	22	9	4	59.6	58.3	23.7	29.6	33.6	45.3	59.6	54.9

[a] Not applicable for one observation

6.1.1. Seafood species and seafood collection or catch locations identified in 2021

The species of crustaceans consumed by people in the adult high-rate group were brown crab, common lobster, common prawn and Nephrops. The brown crab, common lobster and Nephrops were caught offshore throughout the survey area. Brown crabs and common lobsters were also caught by setting pots from the beach at Coulderton.

The species of molluscs consumed by people in the adult high-rate group were mussels. Mussels were collected from Whitey Rock (at the northern end of Whitehaven north beach).

The species of fish consumed by people in the adult high-rate group were bass, cod, flounder, mackerel, plaice, thornback ray and whiting. The fish were caught throughout the survey area. Small quantities of these species were also consumed by people not in the high-rate group.

6.1.2. Changes in seafood consumption rates in 2021 compared with 2020

The number of people interviewed consuming crustaceans increased by two in 2021, which was a result of one newly identified individual who was collecting brown crab by hand at Whitehaven Harbour (at low tide near the outer harbour wall) and members of the public who were purchasing Nephrops from local fishermen based at Whitehaven. The number of people in the high-rate group in 2021 decreased by four because previous high-rate consumers from 2020 were no longer catching and consuming crustaceans in 2021. The maximum and mean consumption rates decreased in 2021 compared with 2020

since those individuals were no longer catching and consuming crustaceans due to the various lockdowns.

The consumption of molluscs decreased significantly in 2021 compared with 2020. Three individuals who have previously been mussel, razor shell and winkle consumers had decided to give up their hobby fishing due to repeated lockdowns. Three individuals who had previously been limpet and winkle consumers could not be contacted during the 2020 and 2021 surveys as they do not have a telephone or an email address (in previous years the interviews have been conducted in their home). Their data was carried over to 2020, however due to the time that has passed since these individuals were last able to be contacted, as well as age and ill health, it is no longer viable to assume this data for the 2021 survey. In addition, one commercial fisherman was no longer consuming a small quantity of whelks.

During interviews people were asked about winkle collection in the survey area. All reported that it used to be prevalent years ago but this has ceased and younger people have not taken it up as a hobby.

The number of interviewees consuming fish, and the consumption rates, were similar in 2021 and 2020. There were reports of increased quantities of thornback ray and fewer cod being caught.

6.2. Composition of the food groups for crustaceans, molluscs and fish, for use in dose assessments, and comparison with 2020 data

In the Sellafield Review reports prior to 2014, the adult high-rate crustacean food group comprised crabs, lobsters and Nephrops. Small quantities of brown shrimps and/or common prawns were consumed and for dose assessment purposes were included in the Nephrops group. From 2014 onwards, 'Nephrops' was replaced by 'other crustaceans' (a group including Nephrops, brown shrimps and common prawns) because brown shrimps represented a significant contribution to the consumption rates. The mollusc food group comprised winkles and 'other molluscs' and the fish group comprises cod and 'other fish'.

The percentage composition for the predominant shellfish and fish species consumed by the adult high-rate groups from the 2021 Sellafield Review, rounded to the nearest 5% for use in dose assessments, are as follows:

- Crustaceans - 65% common lobster and 35% brown crab (mean consumption rate for the adult high-rate group, 25 kg y^{-1})
- Molluscs - 100% other molluscs (mussels only) (mean consumption rate for the adult high-rate group, 5.4 kg y^{-1})

- Fish - 30% cod and 70% other fish species (mainly thornback ray, mackerel, plaice and bass, with smaller quantities of flounder and whiting) (mean consumption rate for the adult high-rate group, 45 kg y^{-1})

By comparison, the percentage composition for the predominant shellfish and fish species consumed by the adult high-rate groups from the 2020 Sellafield Review survey, used in RIFE-26 (EA, FSA, FSS, NRW, NIEA and SEPA, 2021) for dose assessments, were:

- Crustaceans - 50% common lobster, 30% brown crab, and 20% other crustaceans (including brown shrimps, Nephrops and common prawns) (mean consumption rate for the adult high-rate group, 30 kg y^{-1})

- Molluscs - 50% winkles and 50% other molluscs (including mussels and razor shells) (mean consumption rate for the adult high-rate group, 14 kg y^{-1})

- Fish - 15% cod and 85% other fish species (mainly thornback ray, plaice and turbot, with smaller quantities of bass, Dover sole and flounder) (mean consumption rate for the adult high-rate group, 34 kg y^{-1})

In 2021, compared to 2020, the mean consumption rate for the adult high-rate group for crustaceans decreased by 5.2 kg y^{-1}, the mean consumption rate for the adult high-rate group for fish increased by 12 kg y^{-1}, and the mean consumption rate for the adult high-rate group for molluscs decreased by 8.2 kg y^{-1}.

The main species of crustacean, mollusc and fish within the respective high-rate groups differed between 2020 and 2021. The main species of crustacean within the high-rate groups changed from common lobster, brown crab and brown shrimp in 2020 to common lobster and brown crab in 2021. The main species of mollusc within the high-rate groups changed from winkles, mussels and razor shells in 2020 to only mussels in 2021. The main species of fish within the high-rate groups differed between 2020 and 2021. In 2021, when compared with 2020, there was no turbot or Dover sole consumed in the high-rate group. Flounder, whiting and mackerel was consumed in the high-rate group in 2021 but not in 2020.

The percentage breakdown of species changed for crustaceans with an increase in the percentage contribution of common lobster and brown crab, but no species from the other crustaceans group (brown shrimps, common prawns and Nephrops). For molluscs, there was significant change in species consumption, with mussels being the only species consumed in 2021. A family, previously consuming a range of molluscs including winkles and limpets, were not contactable during the pandemic. Due to the time that has passed since these individuals were last able to be contacted, as well as age and ill health, it is no longer viable to assume this data for the 2021 survey. For fish, there was an increase in cod and a decrease in other fish species.

6.3. Consumption trends

The consumption rates for the adult high-rate groups for crustaceans and molluscs over the previous ten years (2011 - 2021) are shown in Figure 2 and Figure 3, respectively. These figures were plotted using the adult means for the high-rate groups distributed according to the percentage breakdowns as described in Section 6.2. The raw data are presented in Annex 3 and Annex 4.

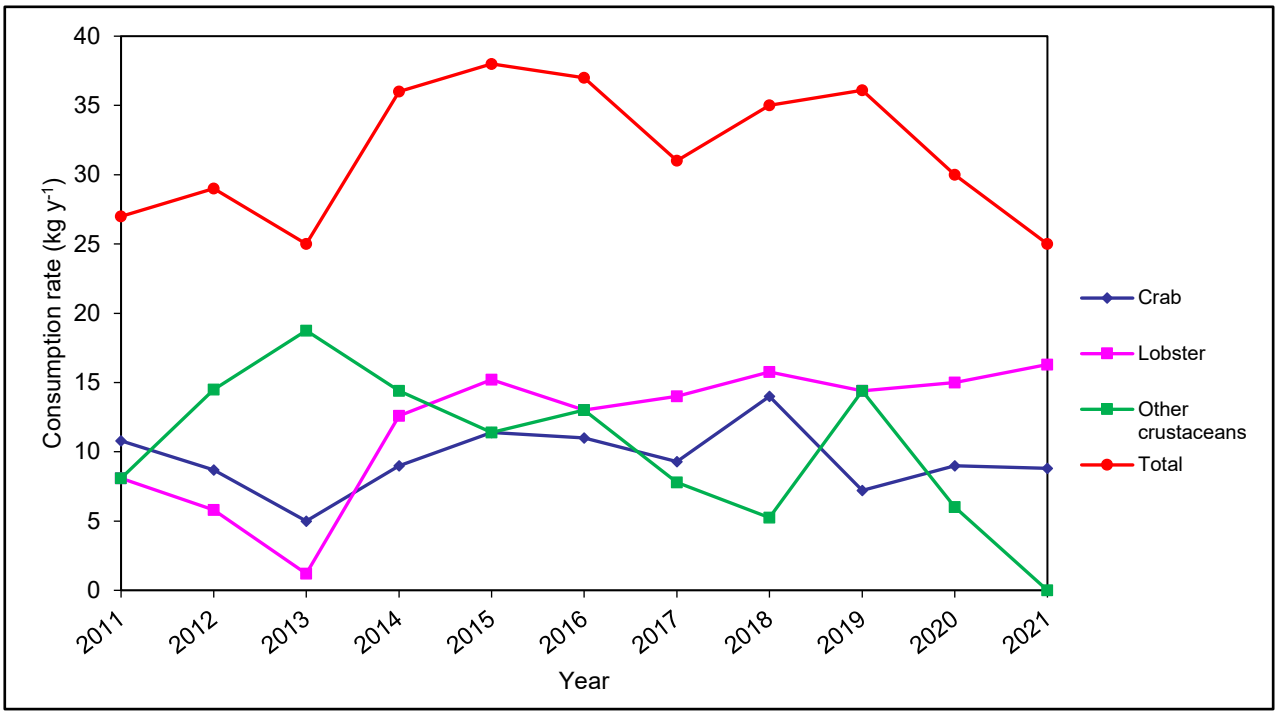

Figure 2. Consumption rates (kg y^{-1}) for the adult high-rate group for crustaceans, 2011 – 2021

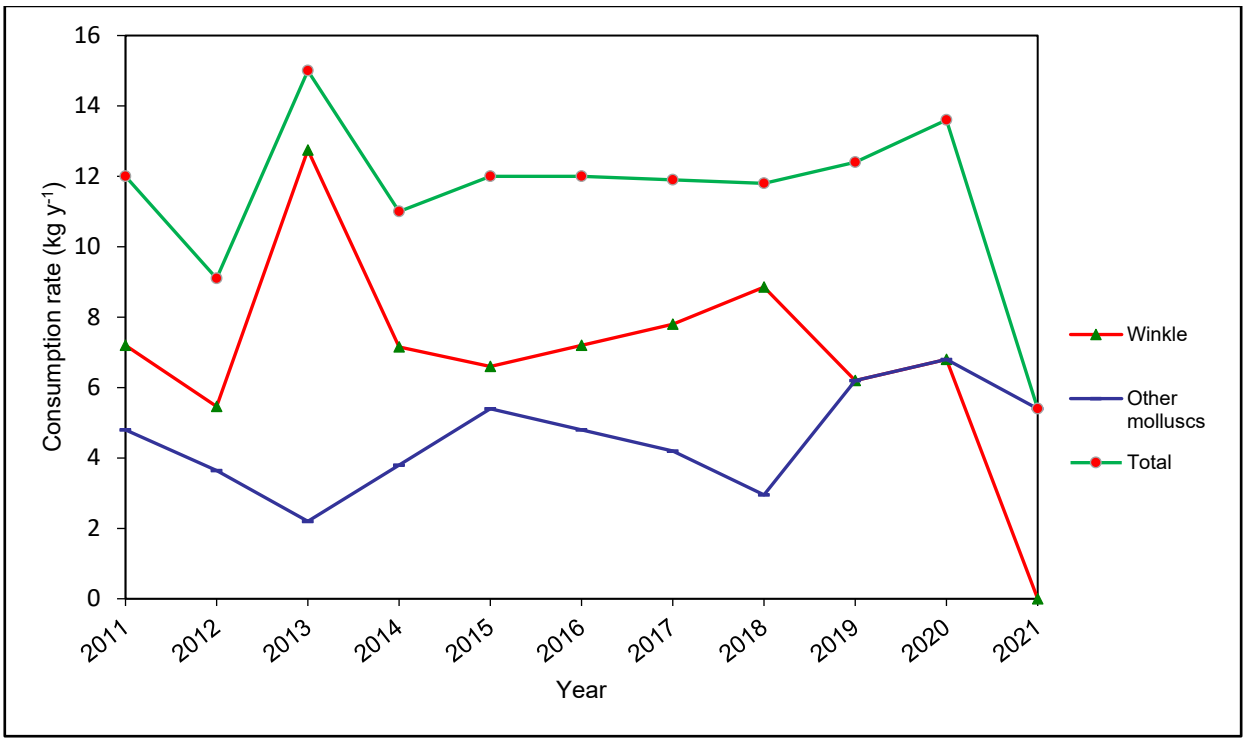

Figure 3. Consumption rates (kg y^{-1}) for the adult high-rate group for molluscs, 2011 – 2021

7. External exposure

Intertidal occupancy rates for adults are presented in Table 8. It should be noted that there is often more than one substrate at one named location and that substrates at a given location are liable to change over time. Activities were assigned to the predominant substrate over which they were taking place. There were no children or infants that were undertaking activities in intertidal areas in the families of the interviewees, so no intertidal occupancy rates were obtained for these age groups.

7.1. Intertidal occupancy

Table 4 presents a summary of the 2021 adults' intertidal occupancy rates in the Sellafield aquatic survey area, by substrate. The table includes the mean occupancy rates for the high-rate groups and the observed 97.5th percentile rates. The 2020 Sellafield Review data are included for comparison. A comparison between the 2020 and 2021 mean rates of the high-rate groups for occupancy over each intertidal substrate is also shown in Figure 4.

Table 4. Summary of adults' intertidal occupancy rates for the 2021 Sellafield Review survey alongside the 2020 results for comparison

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})	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
Mud	N/I[a]	2	N/I[a]	1	N/I[a]	104	N/I[a]	104	N/I[a]	102
Mud and sand	2	2	1	2	144	131	144	105	141	130
Mud, sand and stones	12	6	3	4	1252	912	823	632	1092	890
Rock	2	1	1	1	135	54	135	54	132	N/A[b]
Salt marsh	9	2	5	2	912	730	511	639	840	725
Sand	49	34	5	20	1460	730	792	497	707	730
Sand and stones	13	4	10	2	510	529	510	421	510	513
Stones	23	1	5	1	587	20	390	20	465	N/A[b]

[a] No activities identified taking place on mud in 2020

[b] Not applicable for one observation

The following activities were undertaken by people in the adult high-rate groups for occupancy over intertidal substrates in the 2021 Sellafield Review:

- For mud: dog walking along the River Esk
- For mud and sand: bait digging, walking and collecting crabs for consumption and bait at Whitehaven Outer Harbour
- For mud, sand and stones: dog walking and beachcombing at Parton
- For rock: angling at Parton
- For salt marsh: dog walking and tending livestock at Saltcoats
- For sand: Angling at St Bees, Sellafield, Coulderton, Nethertown, Braystones, Seascale, Drigg and Ravenglass, tending livestock at Drigg, beachcombing at Braystones, Seascale and Drigg, dog walking at St Bees, Seascale, Drigg and Sellafield, walking at St Bees, Seascale and Drigg and playing at Nethertown and Braystones
- For sand and stones: angling at Braystones, Parton, Drigg and Ravenglass and dog walking at Coulderton
- For stones: collecting seaweed at Nethertown

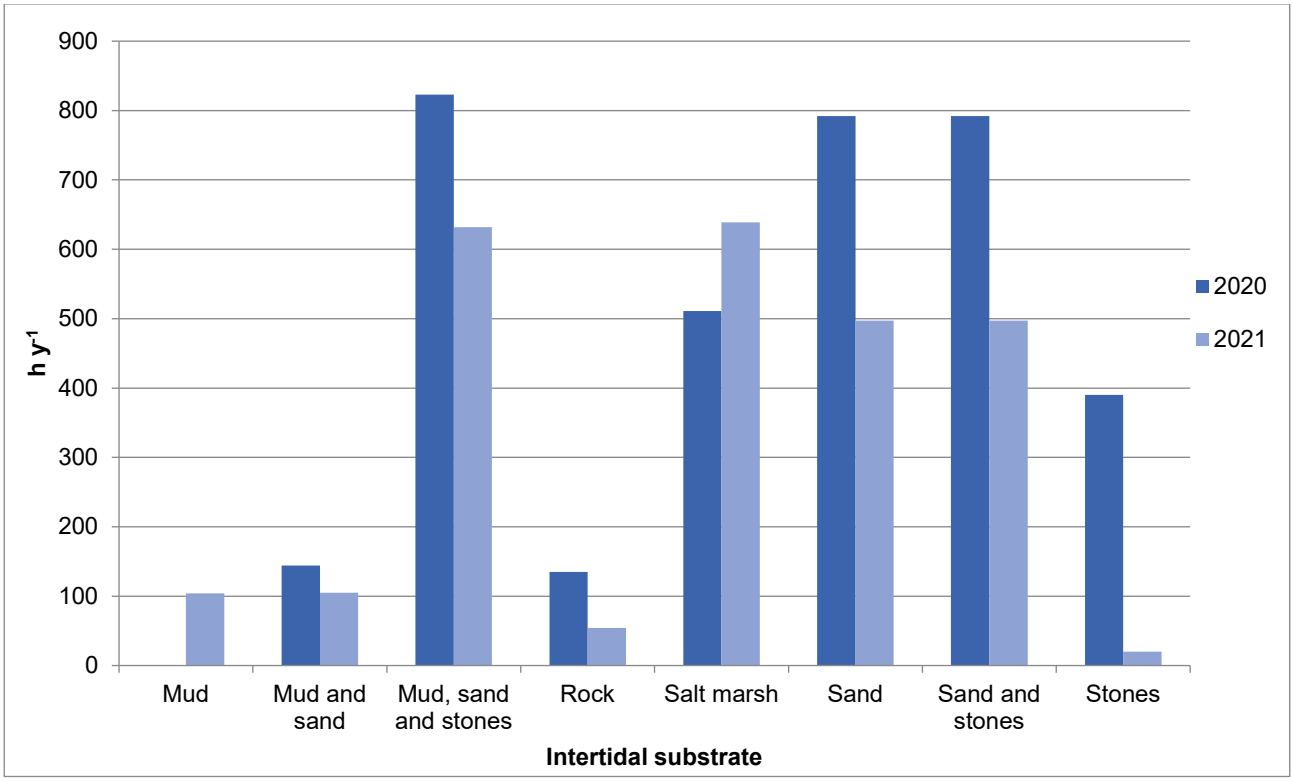

Figure 4. Comparison between the 2020 and 2021 mean rates of the high-rate groups for occupancy over each intertidal substrate

In 2021, compared with 2020, there were increases in the following mean intertidal occupancy rate for the high-rate groups (data rounded to two significant figures):

- For salt marsh; from 510 h y^{-1} to 640 h y^{-1}

There were increases in occupancy over saltmarsh due to increased time spent tending to livestock at Saltcoats.

In 2021, compared with 2020, there were decreases in the following mean intertidal occupancy rates for the high-rate groups (data rounded to two significant figures):

- For mud and sand: from 140 h y^{-1} to 100 h y^{-1}
- For mud, sand and stones: from 820 h y^{-1} to 630 h y^{-1}
- For rock: from 140 h y^{-1} to 55 h y^{-1}
- For sand: from 790 h y^{-1} to 500 h y^{-1}
- For sand and stones: from 510 h y^{-1} to 420 h y^{-1}
- For stones: 390 h y^{-1} to 20 h y^{-1}

There was a slight decrease in occupancy over mud and sand. There was a large decrease in occupancy over mud, sand and stones. There was a large decrease in the occupancy over rock due to a hobby fisherman who was no longer hooking for crab and lobster in 2021. The decrease in occupancy over sand was partly due to another hobby

fisherman who was no longer bait digging, setting nets and pots and collecting razor shells in 2021 compared with 2020. The decrease in occupancy over stones was due to Network Rail not undertaking any repair works in the survey area in 2021 which in previous years have taken place on stones.

In 2020 there was nobody identified spending time on mud, whereas in 2021 one individual spent time walking their dog over the mud along the River Esk.

8. Use of habits data for dose assessments

8.1. Aquatic combinations for adults in the Sellafield area

Table 9 presents the consumption rates and occupancy rates for people who appear in at least one of the high-rate groups for fish, crustaceans, molluscs or intertidal substrates. The table shows that several individuals are members of multiple high-rate groups. For example, Person ID number 3265/1/1 is in the high-rate group for fish and occupancy over sand, and occupancy over stones. This supports the continuation of assessing the dose to the representative person based on a combination of internal and external pathways. Therefore, the Radioactivity in Food and the Environment (RIFE) dose assessments for the 'Cumbrian coastal community' for 2022 will be based on combinations of consumption and intertidal occupancy pathways. In RIFE, the 'Cumbrian coastal community' are described as being exposed to radioactivity resulting from both current and historical discharges from the Sellafield site and naturally occurring radioactivity discharged from the former phosphate processing works at Whitehaven, near Sellafield (EA, FSA, FSS, NRW, NIEA and SEPA, 2021).

As in previous years, since several individuals were undertaking activities over multiple substrates, the occupancy rates over six substrates (mud; mud and sand; mud, sand and stones; sand; sand and stones; stones) have been combined into a single substrate called 'mud and sand'. Rock and salt marsh are not included in the combined substrate since rock is not assessed and salt marsh is assessed separately. The mean rate for the high-rate group for the reclassified 'mud and sand' substrate is 530 h y^{-1}. For comparison, the mean rate for the high-rate group for the reclassified 'mud and sand' substrate in 2020 was 690 h y^{-1}.

8.2. Habits data for source specific assessments

Annex 2 to Annex 6 show the historic consumption and occupancy rates, updated with the 2021 data, for use in source specific assessments for the RIFE reports. Annex 2 to

Annex 5 show the data for single year assessments and Annex 6 shows the data for the 5-year average assessments.

Prior to 2015, for Sellafield Reviews and full Sellafield habits surveys, the consumption rates of crustaceans and molluscs, and intertidal occupancy rates, were updated annually in these annexes using the Sellafield Review data or full survey data, as applicable. The fish consumption rates were only updated when a full habits survey was conducted. However, since 2015, the annexes have been updated with the consumption rates of fish from the current year's survey, since the relative contribution to doses arising from fish consumption has increased.

Handling rates of sediment and fishing gear are not obtained during Sellafield Reviews. Therefore, for assessments purposes, the mean handling rates for the high-rate groups for fishing gear and sediment will be retained from the 2018 full Sellafield habits survey.

8.3. Profiled habits data for total dose assessments

The matrix for the 2021 Sellafield adults' profiled habits data is presented in Annex 7. It is based on data from the 2018 Sellafield full habits survey (aquatic, terrestrial and direct radiation pathways), which has been updated with data from the 2019, 2020 and 2021 annual Sellafield Reviews. All pathways and observations from the original 2018 profiled habits matrix were retained, and for the subsequent years' profiles, only data asked about during the subsequent years' reviews were updated; that is, intertidal occupancy and consumption of crustaceans, molluscs and fish. If data were collected for new interviewees, these were added as new observations, and if it was known that an individual who had been interviewed in previous years had stopped their activity, then their data was deleted. Because the profiles have been created using the data from the 2018, 2019, 2020 and 2021 surveys, the profiled data shown in Annex 7 are not comparable with the data presented in Annex 1.

9. Summary and recommended data for use in RIFE-27 dose assessments

The survey investigated the consumption of shellfish and fish, and intertidal occupancy, relating to liquid discharges from the Sellafield nuclear site using the same method as in 2020 due to the continued COVID-19 pandemic. There was a significant decrease in the mollusc consumption rate in 2021 when compared with previous Sellafield Review surveys. Winkles, whelks, razor clams and limpets were no longer being consumed. Crustacean consumption decreased slightly and brown shrimps were no longer being caught and consumed. Fish consumption had increased in 2021 but was similar in comparison to 2020 and other previous surveys.

The consumption and occupancy rates in this section are presented to two significant figures.

The mean rates for the adult high-rate groups from the 2021 Sellafield Review are as follows:

- Crustaceans 25 kg y^{-1}
- Molluscs 5.4 kg y^{-1}
- Fish 45 kg y^{-1}
- Occupancy over mud 100 h y^{-1}
- Occupancy over mud and sand 110 h y^{-1}
- Occupancy over mud, sand and stones 630 h y^{-1}
- Occupancy over rock 54 h y^{-1}
- Occupancy over salt marsh 640 h y^{-1}
- Occupancy over sand 500 h y^{-1}
- Occupancy over sand and stones 420 h y^{-1}
- Occupancy over stones 20 h y^{-1}

In 2021, compared to 2020, the mean consumption rate for the adult high-rate group for crustaceans decreased by 5.2 kg y^{-1}, the mean consumption rate for the adult high-rate group for fish increased by 12 kg y^{-1}, and the mean consumption rate for the adult high-rate group for molluscs decreased by 8.2 kg y^{-1}. For occupancy over intertidal substrates, the mean rates for the adult high-rate groups increased in 2021 compared to 2020 by 130 h y^{-1} for salt marsh, and decreased by 40 h y^{-1} for mud and sand, by 190 h y^{-1} for mud, sand and stones, by 81 h y^{-1} for rock, by 300 h y^{-1} for sand, by 90 h y^{-1} for sand and stones and by 370 h y^{-1} for stones. In 2020 there was nobody identified spending time on mud, whereas in 2021 one individual spent 100 h y^{-1} over mud along the River Esk.

The following recommendations for data to be used in RIFE-27 dose assessments are for the adult age group only. For the ‘Cumbrian coastal community’ dose assessment, the mean consumption rates for the adult high-rate groups and species breakdown are:

- Fish 45 kg y^{-1}, comprising 30% cod and 70% other fish (mainly thornback ray, mackerel, plaice and bass, with smaller quantities of flounder and whiting)
- Crustaceans 25 kg y^{-1}, comprising 65% common lobster and 35% brown crab (no brown shrimps, Nephrops or common prawns were consumed)
- Molluscs 5.4 kg y^{-1}, comprising 100% other molluscs (mussels only) (no winkles were consumed)
- Occupancy over an intertidal substrate termed ‘mud and sand’ (mud; mud and sand; mud, sand and stones; sand; sand and stones; and stones combined) 530 h y^{-1}

For the ‘Cumbrian coastal community 5-year average’ dose assessments:

- Cod 15 kg y^{-1}
- Other fish 27 kg y^{-1}
- Crabs 9.7 kg y^{-1}
- Lobsters 15 kg y^{-1}
- Other crustaceans 6.7 kg y^{-1}
- Winkles 6.0 kg y^{-1}
- Other molluscs 5.1 kg y^{-1}
- Occupancy over an intertidal substrate termed ‘mud and sand’ (mud; mud and sand; mud, sand and stones; sand; sand and stones; and stones combined) 700 h y^{-1}

For the ‘Fisherman’s Nets and Pots’ dose assessment:

- Handling fishing gear 1400 h y^{-1} (mean rate for the high-rate group retained from the 2018 Sellafield habits survey)

For the ‘Bait Digging and Mollusc Collection’ dose assessment:

- Handling sediment 510 h y^{-1} (mean rate for the high-rate group retained from the 2018 Sellafield habits survey)

10. References

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

Person ID number	Brown crab	Common lobster	Common prawn	Nephrops	Total
3264/1/1	**10.7**	**16.8**	**-**	**-**	**27.6**
3264/2/1	**10.7**	**16.8**	**-**	**-**	**27.6**
3264/3/1	**10.7**	**16.8**	**-**	**-**	**27.6**
3264/4/1	**10.7**	**16.8**	**-**	**-**	**27.6**
3262/1/1	**7.2**	**16.8**	**-**	**0.2**	**24.2**
3262/2/1	**7.2**	**16.8**	**-**	**0.2**	**24.2**
3286/2/1	**6.0**	**9.3**	**-**	**-**	**15.3**
3263/1/1	3.1	-	2.0	-	5.1
3263/2/1	3.1	-	2.0	-	5.1
3281/1/1	3.7	-	-	-	3.7
3269/1/1	-	-	-	2.7	2.7
3269/2/1	-	-	-	2.7	2.7
3266/1/1	0.8	-	-	-	0.8
3266/2/1	0.8	-	-	-	0.8

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of crustaceans for adults based on the 7 high-rate consumers is 24.9 kg y^{-1}

The observed 97.5th percentile rate based on 14 observations is 27.6 kg y^{-1}

Table 6. Adults' consumption rates of molluscs from the Sellafield aquatic survey area (kg y^{-1})

Person ID number	Mussel
3262/1/1	**5.4**

Notes

Emboldened observation is the high-rate consumer

The mean consumption rate of molluscs for adults based on the only high-rate consumer is 5.4 kg y^{-1}

The observed 97.5th percentile is not applicable for 1 observation

Table 7. Adults' consumption rates of fish from the Sellafield aquatic survey area (kg y^{-1})

Person ID number	Bass	Cod	Flounder	Mackerel	Plaice	Thornback ray	Whiting	Total
3277/1/1	**12.6**	**17.6**	**-**	**16.3**	**11.8**	**-**	**-**	**58.3**
3265/1/1	**5.4**	**35.5**	**5.4**	**-**	**5.4**	**-**	**-**	**51.8**
3262/1/1	**-**	**1.9**	**-**	**-**	**4.1**	**35.5**	**-**	**41.5**
3279/1/1	**8.5**	**3.4**	**-**	**8.4**	**-**	**-**	**9.3**	**29.6**
3263/1/1	-	8.0	-	-	1.8	8.0	-	17.7
3263/2/1	-	8.0	-	-	1.8	8.0	-	17.7
3278/1/1	-	-	-	15.1	-	-	-	15.1
3280/2/1	-	-	-	-	7.7	-	-	7.7
3280/2/2	-	-	-	-	7.7	-	-	7.7
3280/2/3	-	-	-	-	7.7	-	-	7.7
3260/1/1	1.3	3.0	1.3	-	1.3	-	-	6.8
3260/2/1	1.3	3.0	1.3	-	1.3	-	-	6.8
3262/2/1	-	1.9	-	-	4.1	-	-	6.0
3268/1/1	-	4.9	-	-	1.0	-	-	5.9
3268/2/1	-	4.9	-	-	1.0	-	-	5.9
3276/1/1	1.2	1.2	-	-	1.2	1.2	-	4.8
3276/2/1	1.2	1.2	-	-	1.2	1.2	-	4.8
3269/1/1	-	0.2	-	-	2.7	0.3	-	3.2
3269/2/1	-	0.2	-	-	2.7	0.3	-	3.2
3279/2/1	-	-	-	3.1	-	-	-	3.1
3279/3/1	-	-	-	3.1	-	-	-	3.1
3286/2/1	-	-	-	2.7	-	-	-	2.7

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish for adults based on the 4 high-rate consumers is 45.3 kg y^{-1}

The observed 97.5th percentile rate based on 22 observations is 54.9 kg y^{-1}

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

Person ID number	Location	Activity	Mud	Mud and sand	Mud, sand and stones	Rock	Salt marsh	Sand	Sand and stones	Stones
3248/1/1	**River Esk**	**Dog walking**	**104**	-	-	-	-	-	-	-
3267/1/1	River Mite, River Irt and River Esk	Wildfowling and dog walking	20	-	-	-	-	-	-	-
3280/1/1	**Whitehaven Outer Harbour**	**Bait digging**	-	**131**	-	-	-	-	-	-
3281/1/1	**Whitehaven Outer Harbour**	**Collecting crabs (for consumption and bait)**	-	**78**	-	-	-	-	-	-
3249/1/1	Ravenglass Estuary	Dog walking	-	-	182	-	-	-	-	-
	Saltcoats	**Tending livestock and dog walking**	-	-	-	-	**730**	-	-	-
3265/1/1	Ravenglass	Bait digging and collecting seaweed	-	-	150	-	-	-	-	-
	St Bees, Sellafield, Coulderton, Nethertown, Braystones, Seascale and Ravenglass	**Angling**	-	-	-	-	-	**521**	-	-
	Drigg	Bait digging	-	-	-	-	-	130	-	-
	Nethertown	**Collecting seaweed**	-	-	-	-	-	-	-	**20**
3270/1/1	**Parton**	**Dog walking**	-	-	**912**	-	-	-	-	-
3271/1/1	**Parton**	**Dog walking**	-	-	**730**	-	-	-	-	-
3272/1/1	**Parton**	**Beachcombing**	-	-	**521**	-	-	-	-	-
3273/1/1	**Parton**	**Dog walking**	-	-	**365**	-	-	-	-	-
3277/1/1	**Parton**	**Angling**	-	-	-	**54**	-	-	-	-
3249/6/1	**Saltcoats**	**Tending livestock**	-	-	-	-	**548**	-	-	-

Person ID number	Location	Activity	Mud	Mud and sand	Mud, sand and stones	Rock	Salt marsh	Sand	Sand and stones	Stones
3285/1/1	Drigg	Tending livestock	-	-	-	-	32	-	-	-
			-	-	-	-	-	548	-	-
3285/2/1	Drigg	Tending livestock	-	-	-	-	32	-	-	-
			-	-	-	-	-	548	-	-
3252/1/1	Sellafield	Dog walking	-	-	-	-	-	730	-	-
3252/2/1	Sellafield	Dog walking	-	-	-	-	-	730	-	-
3251/1/1	Seascale and Drigg	Dog walking	-	-	-	-	-	718	-	-
3275/1/1	St Bees	Dog walking	-	-	-	-	-	708	-	-
3266/2/1	St Bees and Drigg	Angling	-	-	-	-	-	626	-	-
3283/1/1	St Bees	Dog walking	-	-	-	-	-	548	-	-
3284/1/1	St Bees	Dog walking	-	-	-	-	-	548	-	-
3265/2/1	St Bees, Sellafield, Coulderton, Nethertown, Braystones, Seascale and Ravenglass	Angling	-	-	-	-	-	521	-	-
3256/1/1	Nethertown and Braystones	Playing	-	-	-	-	-	469	-	-
3246/1/1	Braystones, Seascale and Drigg	Beachcombing	-	-	-	-	-	417	-	-
3246/2/1	Braystones, Seascale and Drigg	Beachcombing	-	-	-	-	-	417	-	-
3253/1/1	St Bees, Seascale and Drigg	Walking	-	-	-	-	-	391	-	-
3253/2/1	St Bees, Seascale and Drigg	Walking	-	-	-	-	-	391	-	-
3255/1/1	Sellafield	Dog walking	-	-	-	-	-	365	-	-
3264/1/1	Sellafield, Seascale and Drigg	Dog walking	-	-	-	-	-	365	-	-
3274/1/1	St Bees	Dog walking	-	-	-	-	-	365	-	-
3282/1/1	St Bees	Angling	-	-	-	-	-	365	-	-
3247/1/1	Seascale and Drigg	Dog walking	-	-	-	-	-	348	-	-

Person ID number	Location	Activity	Mud	Mud and sand	Mud, sand and stones	Rock	Salt marsh	Sand	Sand and stones	Stones
3254/1/1	**Seascale and Drigg**	**Dog walking**	**-**	**-**	**-**	**-**	**-**	**261**	**-**	**-**
3269/1/1	St Bees and Whitehaven Harbour Beach	Dog walking	-	-	-	-	-	116	-	-
3269/2/1	St Bees and Whitehaven Harbour Beach	Dog walking	-	-	-	-	-	116	-	-
3276/1/1	Braystones	Setting nets	-	-	-	-	-	108	-	-
	Braystones	**Angling**	**-**	**-**	**-**	**-**	**-**	**-**	**313**	**-**
3277/1/1	Seascale and Drigg	Angling	-	-	-	-	-	108	-	-
3257/1/1	Parton and St Bees	Dog walking	-	-	-	-	-	104	-	-
	Seascale	Bait digging	-	-	-	-	-	4	-	-
	Parton	Angling	-	-	-	-	-	-	10	-
3261/1/1	Drigg	Dog walking and horse riding	-	-	-	-	-	73	-	-
3260/1/1	Eskmeals and Tarn Bay	Bait digging	-	-	-	-	-	66	-	-
	St Bees, Braystones and Drigg	Angling	-	-	-	-	-		-	-
3260/2/1	Eskmeals and Tarn Bay	Bait digging	-	-	-	-	-	66	-	-
	St Bees, Braystones and Drigg	Angling	-	-	-	-	-		-	-
3286/1/1	Coulderton	Setting nets	-	-	-	-	-	66	-	-
3258/1/1	Seascale and Drigg	Dog walking	-	-	-	-	-	52	-	-
3258/2/1	Seascale and Drigg	Dog walking	-	-	-	-	-	52	-	-
3250/1/1	Nethertown and Braystones	Angling	-	-	-	-	-	24	-	-
3250/2/1	Nethertown and Braystones	Angling	-	-	-	-	-	24	-	-
3259/2/1	**Parton, Drigg and Ravenglass**	**Angling**	**-**	**-**	**-**	**-**	**-**	**-**	**529**	**-**
3286/2/1	**Coulderton**	**Dog walking**	**-**	**-**	**-**	**-**	**-**	**-**	**459**	**-**
3259/1/1	Parton, Drigg and Ravenglass	Angling	-	-	-	-	-	-	30	-

Notes for Table 8

Emboldened observations are the high-rate individuals
The mean intertidal occupancy rate over mud for adults based on 1 high-rate observations is 104 h y^{-1}
The observed 97.5th percentile rate based on 2 observations is 102 h y^{-1}
The mean intertidal occupancy rate over mud and sand for adults based on 2 high-rate observations is 105 h y^{-1}
The observed 97.5th percentile rate based on 2 observations is 130 h y^{-1}
The mean intertidal occupancy rate over mud, sand and stones for adults based on 4 high-rate observations is 632 h y^{-1}
The observed 97.5th percentile rate based on 6 observations is 890 h y^{-1}
The mean intertidal occupancy rate over rock for adults based on 1 high-rate observation is 54 h y^{-1}
The observed 97.5th percentile is not applicable for 1 observation
The mean intertidal occupancy rate over salt marsh for adults based on 2 high-rate observations is 639 h y^{-1}
The observed 97.5th percentile rate based on 2 observations is 725 h y^{-1}
The mean intertidal occupancy rate over sand for adults based on 20 high-rate observations is 497 h y^{-1}
The observed 97.5th percentile rate based on 34 observations is 730 h y^{-1}
The mean intertidal occupancy rate over sand and stones for adults based on 2 high-rate observations is 421 h y^{-1}
The observed 97.5th percentile rate based on 4 observations is 513 h y^{-1}
The mean intertidal occupancy rate over stones for adults based on 1 high-rate observation is 20 h y^{-1}
The observed 97.5th percentile is not applicable for 1 observation

Table 9. Aquatic combinations for adults in the Sellafield aquatic survey area

Person ID number	Consumption rates (kg y^{-1})			Intertidal occupancy rates (h y^{-1})					
	Fish	Crustaceans	Molluscs	Mud	Mud and sand	Mud, sand and stones	Sand	Sand and stones	Stones
3277/1/1	**58.3**	-	-	-	-	-	108	-	-
3265/1/1	**51.8**	-	-	-	-	150	**652**	-	**20**
3262/1/1	**41.5**	**24.2**	**5.4**	-	-	-	-	-	-
3279/1/1	**29.6**	-	-	-	-	-	-	-	-
3262/2/1	6.0	**24.2**	-	-	-	-	-	-	-
3276/1/1	4.8	-	-	-	-	-	108	**313**	-
3286/2/1	2.7	**15.3**	-	-	-	-	-	**459**	-
3264/1/1	-	**27.6**	-	-	-	-	**365**	-	-
3264/2/1	-	**27.6**	-	-	-	-	-	-	-
3281/1/1	-	3.7	-	-	**78**	-	-	-	-
3266/2/1	-	0.8	-	-	-	-	**626**	-	-
3248/1/1	-	-	-	**104**	-	-	-	-	-
3280/1/1	-	-	-	-	**131**	-	-	-	-
3271/1/1	-	-	-	-	-	**912**	-	-	-
3252/1/1	-	-	-	-	-	-	**730**	-	-
3259/2/1	-	-	-	-	-	-	-	**529**	-

Notes

Values in high-rate groups are emboldened

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

Person ID number	Age	Gender	Fish	Crustaceans	Molluscs	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud, sand and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over stones
3246/1/1	62	M	-	-	-	-	-	-	-	-	-	-	417
3246/2/1	61	F	-	-	-	-	-	-	-	-	-	-	417
3247/1/1	73	M	-	-	-	-	-	-	-	-	-	-	348
3248/1/1	79	M	-	-	-	-	-	104	-	-	-	-	-
3249/1/1	63	M	-	-	-	-	0.5	-	-	182	-	730	-
3249/2/1	60	F	-	-	-	-	0.5	-	-	-	-	-	-
3249/3/1	29	F	-	-	-	-	0.5	-	-	-	-	-	-
3249/4/1	32	F	-	-	-	-	0.5	-	-	-	-	-	-
3249/6/1	40	M	-	-	-	-	-	-	-	-	-	548	-
3250/1/1	27	M	-	-	-	-	-	-	-	-	-	-	24
3250/2/1	31	M	-	-	-	-	-	-	-	-	-	-	24
3251/1/1	72	M	-	-	-	-	-	-	-	-	-	-	718
3252/1/1	57	F	-	-	-	-	-	-	-	-	-	-	730
3252/2/1	83	F	-	-	-	-	-	-	-	-	-	-	730
3253/1/1	41	F	-	-	-	-	-	-	-	-	-	-	391
3253/2/1	62	M	-	-	-	-	-	-	-	-	-	-	391
3254/1/1	65	F	-	-	-	-	-	-	-	-	-	-	261

Person ID number	Age	Gender	Fish	Crustaceans	Molluscs	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud, sand and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over stones
3255/1/1	U	M	-	-	-	-	-	-	-	-	-	-	365
3256/1/1	62	M	-	-	-	-	-	-	-	-	-	-	469
3257/1/1	54	M	-	-	-	-	-	-	-	-	-	-	108
3258/1/1	53	M	-	-	-	-	-	-	-	-	-	-	52
3258/2/1	51	F	-	-	-	-	-	-	-	-	-	-	52
3259/1/1	33	M	-	-	-	-	-	-	-	-	-	-	-
3259/2/1	41	M	-	-	-	-	-	-	-	-	-	-	-
3260/1/1	73	M	6.8	-	-	-	-	-	-	-	-	-	66
3260/2/1	18	M	6.8	-	-	-	-	-	-	-	-	-	66
3261/1/1	62	F	-	-	-	-	-	-	-	-	-	-	73
3262/1/1	82	M	41.5	24.2	5.4	-	-	-	-	-	-	-	-
3262/2/1	83	F	6.0	24.2	-	-	-	-	-	-	-	-	-
3263/1/1	56	M	17.7	5.1	-	-	-	-	-	-	-	-	-
3263/2/1	56	F	17.7	5.1	-	-	-	-	-	-	-	-	-
3264/1/1	59	F	-	27.6	-	-	-	-	-	-	-	-	365
3264/2/1	62	M	-	27.6	-	-	-	-	-	-	-	-	-
3264/3/1	25	M	-	27.6	-	-	-	-	-	-	-	-	-
3264/4/1	23	M	-	27.6	-	-	-	-	-	-	-	-	-
3265/1/1	69	M	51.8	-	-	-	-	-	-	150	-	-	652
3265/2/1	U	M	-	-	-	-	-	-	-	-	-	-	521
3266/1/1	85	M	-	0.8	-	-	-	-	-	-	-	-	-

Person ID number	Age	Gender	Fish	Crustaceans	Molluscs	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud, sand and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over stones
3266/2/1	62	M	-	0.8	-	-	-	-	-	-	-	-	626
3267/1/1	78	M	-	-	-	2.2	-	20	-	-	-	-	-
3267/2/1	55	F	-	-	-	2.2	-	-	-	-	-	-	-
3268/1/1	64	M	5.9	-	-	-	-	-	-	-	-	-	-
3268/2/1	65	F	5.9	-	-	-	-	-	-	-	-	-	-
3269/1/1	52	M	3.2	2.7	-	-	-	-	-	-	-	-	116
3269/2/1	52	F	3.2	2.7	-	-	-	-	-	-	-	-	116
3270/1/1	68	F	-	-	-	-	-	-	-	521	-	-	-
3271/1/1	71	M	-	-	-	-	-	-	-	912	-	-	-
3272/1/1	U	F	-	-	-	-	-	-	-	365	-	-	-
3273/1/1	83	M	-	-	-	-	-	-	-	730	-	-	-
3274/1/1	38	F	-	-	-	-	-	-	-	-	-	-	365
3275/1/1	U	F	-	-	-	-	-	-	-	-	-	-	708
3276/1/1	35	M	4.8	-	-	-	-	-	-	-	-	-	108
3276/2/1	35	F	4.8	-	-	-	-	-	-	-	-	-	-
3277/1/1	47	M	58.3	-	-	-	-	-	-	-	54	-	108
3278/1/1	62	M	15.1	-	-	-	-	-	-	-	-	-	-
3279/1/1	70	M	29.6	-	-	-	-	-	-	-	-	-	-
3279/2/1	U	F	3.1	-	-	-	-	-	-	-	-	-	-
3279/3/1	U	M	3.1	-	-	-	-	-	-	-	-	-	-
3280/1/1	43	M	-	-	-	-	-	-	131	-	-	-	-

Person ID number	Age	Gender	Fish	Crustaceans	Molluscs	Intertidal occupancy over mud	Intertidal occupancy over mud and sand	Intertidal occupancy over mud, sand and stones	Intertidal occupancy over rock	Intertidal occupancy over salt marsh	Intertidal occupancy over sand	Intertidal occupancy over sand and stones	Intertidal occupancy over stones
3280/2/1	U	U	7.7	-	-	-	-	-	-	-	-	-	-
3280/2/2	U	U	7.7	-	-	-	-	-	-	-	-	-	-
3280/2/3	U	U	7.7	-	-	-	-	-	-	-	-	-	-
3281/1/1	28	M	-	3.7	-	-	-	-	78	-	-	-	-
3282/1/1	56	M	-	-	-	-	-	-	-	-	-	-	365
3283/1/1	31	F	-	-	-	-	-	-	-	-	-	-	548
3284/1/1	35	M	-	-	-	-	-	-	-	-	-	-	548
3285/1/1	71	M	-	-	-	-	-	-	-	-	-	32	548
3285/2/1	41	M	-	-	-	-	-	-	-	-	-	32	548
3286/1/1	32	M	-	-	-	-	-	-	-	-	-	-	66
3286/2/1	60	M	2.7	15.3	-	-	-	-	-	-	-	-	-

Notes

U = Unknown

Emboldened observations are the high-rate individuals

Annex 2. Cumbrian Coastal Community fish consumption data reported in AEMR and RIFE (kg y^{-1})

Year (report)	FISH					
	Species Composition	Total	Cod	Plaice	Other fish	Source of habits data
1994 (AEMR 45)	Plaice and Cod (50%:50%)	26	13.0	13.0	0	1993/94 Survey
1995 (RIFE 1)	Plaice and Cod (50%:50%)	26	13.0	13.0	0	1995 Review (crust and moll) and 1993/4 survey (fish)
1996 (RIFE 2)	Plaice and Cod (50%:50%)	25	12.5	12.5	0	1995 Review (crust and moll) and 1996 logging data (fish)
1997 (RIFE 3)	Plaice and Cod (25%:75%)	37	27.8	9.3	0	1997 Review
1998 (RIFE 4)	Plaice and Cod (50%:50%)	45	22.5	22.5	0	1998 Survey
1999 (RIFE 5)	Plaice and Cod (50%:50%)	43	21.5	21.5	0	1999 Review
2000 (RIFE 6)	Cod and other fish (40%:60%)	31	12.4	0	18.6	2000 Review
2001 (RIFE 7)	Cod and other fish (40%:60%)	31	12.4	0	18.6	2001 Review
2002 (RIFE 8)	Cod and other fish (40%:60%)	51	20.4	0	30.6	2002 Review
2003 (RIFE 9)	Cod and other fish (60%:40%)	41	24.6	0	16.4	2003 Survey
2004 (RIFE 10)	Cod and other fish (60%:40%)	41	24.6	0	16.4	2004 Review (crust and moll) and 2003 Survey (fish)
2005 (RIFE 11)	Cod and other fish (60%:40%)	41	24.6	0	16.4	2005 Review (crust and moll) and 2003 Survey (fish)
2006 (RIFE 12)	Cod and other fish (60%:40%)	41	24.6	0	16.4	2006 Review (crust and moll) and 2003 Survey (fish)

Year (report)	FISH					
	Species Composition	Total	Cod	Plaice	Other fish	Source of habits data
2007 (RIFE 13)	Cod and other fish (60%:40%)	41	24.6	0	16.4	2007 Review (crust and moll) and 2003 Survey (fish)
2008 (RIFE 14)	Cod and other fish (25%:75%)	40	10.0	0	30.0	2008 Survey
2009 (RIFE 15)	Cod and other fish (25%:75%)	40	10.0	0	30.0	2009 Review (crust & moll) 2008 Survey (fish)
2010 (RIFE 16)	Cod and other fish (25%:75%)	40	10.0	0	30.0	2010 Review (crust & moll) 2008 Survey (fish)
2011 (RIFE 17)	Cod and other fish (25%:75%)	40	10.0	0	30.0	2011 Review (crust & moll) 2008 Survey (fish)
2012 (RIFE 18)	Cod and other fish (25%:75%)	37	9.3	0	27.8	2012 LLWR Habits Survey
2013 (RIFE 19)	Cod and other fish (40%:60%)	56	22.4	0	33.6	2013 Survey
2014 (RIFE 20)	Cod and other fish (40%:60%)	56	22.4	0	33.6	2014 Review (crust and moll) 2013 Survey (fish)
2015 (RIFE 21)	Cod and other fish (25%:75%)	64	16.0	0	48.0	2015 Review
2016 (RIFE 22)	Cod and other fish (25%:75%)	60	15.0	0	45.0	2016 Review
2017 (RIFE 23)	Cod and other fish (40%:60%)	54	21.6	0	32.4	2017 Review
2018 (RIFE 24)	Cod and other fish (60%:40%)	41	24.6	0	16.4	2018 Survey
2019 (RIFE 25)	Cod and other fish (30%:70%)	40	12.0	0	28.0	2019 Review
2020 (RIFE 26)	Cod and other fish (15%:85%)	34	5.1	0	28.9	2020 Review
2021 (RIFE 27)	Cod and other fish (30%:70%)	45	13.5	0	31.5	2021 Review

Annex 3. Cumbrian Coastal Community crustacean consumption data reported in AEMR and RIFE (kg y^{-1})

Year (report)	CRUSTACEANS					
	Species Composition	Total	Crab	Lobster	Nephrops or other crustaceans	Source of habits data
1994 (AEMR 45)	Crabs and Lobsters (65%:35%)	12	7.8	4.2	0	1993/94 Survey
1995 (RIFE 1)	Crabs and Lobsters (75%:25%)	8.6	6.5	2.2	0	1995 Review (crust and moll) and 1993/4 survey (fish)
1996 (RIFE 2)	Crabs and Lobsters (60%:40%)	12	7.2	4.8	0	1995 Review (crust and moll) and 1996 logging data (fish)
1997 (RIFE 3)	Crabs, Lobsters and Nephrops (50%:40%:10%)	17	8.5	6.8	1.7	1997 Review
1998 (RIFE 4)	Crabs and Lobsters (85%:15%)	28	23.8	4.2	0	1998 Survey
1999 (RIFE 5)	Crabs and Lobsters (80%:20%)	24	19.2	4.8	0	1999 Review
2000 (RIFE 6)	Crabs, Lobsters and Nephrops (40%:40%:20%)	20	8.0	8.0	4.0	2000 Review
2001 (RIFE 7)	Crabs, Lobsters and Nephrops (40%:40%:20%)	20	8.0	8.0	4.0	2001 Review
2002 (RIFE 8)	Crabs, Lobsters and Nephrops (50%:30%:20%)	16	8.0	4.8	3.2	2002 Review

Year (report)	CRUSTACEANS					
	Species Composition	Total	Crab	Lobster	Nephrops or other crustaceans	Source of habits data
2003 (RIFE 9)	Crabs, Lobsters and Nephrops (80%:10%:10%)	27	21.6	2.7	2.7	2003 Survey
2004 (RIFE 10)	Crabs, Lobsters and Nephrops (50%:40%:10%)	25	12.5	10.0	2.5	2004 Review (crust and moll) and 2003 Survey (fish)
2005 (RIFE 11)	Crabs, Lobsters and Nephrops (60%:20%:20%)	20	12.0	4.0	4.0	2005 Review (crust and moll) and 2003 Survey (fish)
2006 (RIFE 12)	Crabs, Lobsters and Nephrops (50%:20%:30%)	20	10.0	4.0	6.0	2006 Review (crust and moll) and 2003 Survey (fish)
2007 (RIFE 13)	Crabs, Lobsters and Nephrops (50%:30%:20%)	20.4	10.2	6.1	4.1	2007 Review (crust and moll) and 2003 Survey (fish)
2008 (RIFE 14)	Crabs, Lobsters and Nephrops (70%:20%:10%)	16.8	11.8	3.4	1.7	2008 Survey
2009 (RIFE 15)	Crabs, Lobsters and Nephrops (30%:50%:20%)	16	4.8	8	3.2	2009 Review (crust & moll) 2008 Survey (fish)
2010 (RIFE 16)	Crabs, Lobsters and Nephrops (50%:30%:20%)	22	11.0	6.6	4.4	2010 Review (crust & moll) 2008 Survey (fish)
2011 (RIFE 17)	Crabs, Lobsters and Nephrops (40%:30%:30%)	27	10.8	8.1	8.1	2011 Review (crust & moll) 2008 Survey (fish)

Year (report)	CRUSTACEANS					
	Species Composition	Total	Crab	Lobster	Nephrops or other crustaceans	Source of habits data
2012 (RIFE 18)	Crabs, Lobsters and Nephrops (30%:20%:50%)	29	8.7	5.8	14.5	2012 LLWR Habits Survey
2013 (RIFE 19)	Crabs, Lobsters and Nephrops (20%:5%:75%)	25	5.0	1.2	18.8	2013 Survey
2014 (RIFE 20)	Crabs, Lobsters and other crustaceans (25%:35%:40%)	36	9.0	12.6	14.4	2014 Review (crust and moll) 2013 Survey (fish)
2015 (RIFE 21)	Crabs, Lobsters and other crustaceans (30%:40%:30%)	38	11.4	15.2	11.4	2015 Review
2016 (RIFE 22)	Crabs, Lobsters and other crustaceans (30%:35%:35%)	37	11.0	13.0	13.0	2016 Review
2017 (RIFE 23)	Crabs, Lobsters and other crustaceans (30%:45%:25%)	31	9.3	14.0	7.7	2017 Review
2018 (RIFE 24)	Crabs, Lobsters and other crustaceans (40%:45%:15%)	35	14.0	15.8	5.3	2018 Survey
2019 (RIFE 25)	Crabs, Lobsters and other crustaceans (20%:40%:40%)	36	7.2	14.4	14.4	2019 Review
2020 (RIFE 26)	Crabs, Lobsters and other crustaceans (30%:50%:20%)	30	9.0	15.0	6.0	2020 Review
2021 (RIFE 27)	Crabs, Lobsters and other crustaceans (35%:65%:0%)	25	8.8	16.2	0.0	2021 Review

Annex 4. Cumbrian Coastal Community mollusc consumption data reported in AEMR and RIFE (kg y^{-1})

Year (report)	MOLLUSCS				
	Species Composition	Total	Winkles	Other molluscs	Source of habits data
1994 (AEMR 45)	Winkles and other molluscs (85%:15%)	9.7	8.2	1.5	1993/94 Survey
1995 (RIFE 1)	Winkles and other molluscs (50%:50%)	12	6.0	6.0	1995 Review (crust and moll) and 1993/4 survey (fish)
1996 (RIFE 2)	Winkles and other molluscs (60%:40%)	12	7.2	4.8	1995 Review (crust and moll) and 1996 logging data (fish)
1997 (RIFE 3)	Winkles and other molluscs (40%:60%)	4.2	1.7	2.5	1997 Review
1998 (RIFE 4)	Winkles and other molluscs (30%:70%)	15	4.5	10.5	1998 Survey
1999 (RIFE 5)	Winkles and other molluscs (50%:50%)	25	12.5	12.5	1999 Review
2000 (RIFE 6)	Winkles and other molluscs (50%:50%)	17	8.5	8.5	2000 Review
2001 (RIFE 7)	Winkles and other molluscs (50%:50%)	17	8.5	8.5	2001 Review
2002 (RIFE 8)	Winkles and mussels (60%:40%)	29	17.4	11.6	2002 Review
2003 (RIFE 9)	Winkles and other molluscs (40%:60%)	34	13.6	20.4	2003 Survey
2004 (RIFE 10)	Winkles and other molluscs (50%:50%)	34	17.0	17.0	2004 Review (crust and moll) and 2003 Survey (fish)
2005 (RIFE 11)	Winkles and other molluscs (60%:40%)	33	19.8	13.2	2005 Review (crust and moll) and 2003 Survey (fish)
2006 (RIFE 12)	Winkles and other molluscs (50%:50%)	40	20.0	20.0	2006 Review (crust and moll) and 2003 Survey (fish)

Year (report)	MOLLUSCS				
	Species Composition	Total	Winkles	Other molluscs	Source of habits data
2007 (RIFE 13)	Winkles and other molluscs (60%:40%)	28.9	17.3	11.6	2007 Review (crust and moll) and 2003 Survey (fish)
2008 (RIFE 14)	Winkles and other molluscs (50%:50%)	31.4	15.7	15.7	2008 Survey
2009 (RIFE 15)	Winkles and other molluscs (60%:40%)	28	16.8	11.2	2009 Review (crust & moll) 2008 Survey (fish)
2010 (RIFE 16)	Winkles and other molluscs (20%:80%)	22	4.4	17.6	2010 Review (crust & moll) 2008 Survey (fish)
2011 (RIFE 17)	Winkles and other molluscs (60%:40%)	12	7.2	4.8	2011 Review (crust & moll) 2008 Survey (fish)
2012 (RIFE 18)	Winkles and other molluscs (60%:40%)	9.1	5.5	3.6	2012 LLWR Habits Survey
2013 (RIFE 19)	Winkles and other molluscs (85%:15%)	15	12.8	2.2	2013 Survey
2014 (RIFE 20)	Winkles and other molluscs (65%:35%)	11	7.2	3.8	2014 Review (crust and moll) 2013 Survey (fish)
2015 (RIFE 21)	Winkles and other molluscs (55%:45%)	12	6.6	5.4	2015 Review
2016 (RIFE 22)	Winkles and other molluscs (60%:40%)	12	7.2	4.8	2016 Review
2017 (RIFE 23)	Winkles and other molluscs (65%:35%)	12	7.8	4.2	2017 Review
2018 (RIFE 24)	Winkles and other molluscs (75%:25%)	12	9.0	3.0	2018 Survey
2019 (RIFE 25)	Winkles and other molluscs (50%:50%)	12	6.0	6.0	2019 Review
2020 (RIFE 26)	Winkles and other molluscs (50%:50%)	14	7.0	7.0	2020 Review
2021 (RIFE 27)	Winkles and other molluscs (0%:100%)	5.4	0.0	5.4	2021 Review

Annex 5. Cumbrian Coastal Community intertidal occupancy data reported in AEMR and RIFE (h y^{-1})

Year (report)	INTERTIDAL OCCUPANCY		
	Substrate	h y^{-1}	Source of habits data
1994 (AEMR 45)	-	0	-
1995 (RIFE 1)	-	0	-
1996 (RIFE 2)	-	0	-
1997 (RIFE 3)	-	0	-
1998 (RIFE 4)	Sand and mollusc beds	1100	1998 Survey
1999 (RIFE 5)	Sand and mollusc beds	1000	1999 Review
2000 (RIFE 6)	Sand and mollusc beds	1000	2000 Review
2001 (RIFE 7)	Sand and mollusc beds	900	2001 Review
2002 (RIFE 8)	Mud and sand	1200	2002 Review
2003 (RIFE 9)	Mud and sand	870	2003 Survey
2004 (RIFE 10)	Mud and sand	1000	2004 Review
2005 (RIFE 11)	Mud and sand	790	2005 Review
2006 (RIFE 12)	Mud and sand	580	2006 Review
2007 (RIFE 13)	Mud and sand	830	2007 Review

Year (report)	INTERTIDAL OCCUPANCY		
	Substrate	h y^{-1}	Source of habits data
2008 (RIFE 14)	Mud and sand	930	2008 Survey
2009 (RIFE 15)	Mud and sand	960	2009 Review
2010 (RIFE 16)	Mud and sand	870	2010 Review
2011 (RIFE 17)	Mud and sand	840	2011 Review
2012 (RIFE 18)	Mud and sand	850	2012 LLWR Habits Survey
2013 (RIFE 19)	Mud and sand	760	2013 Survey
2014 (RIFE 20)	Mud and sand	1100	2014 Review
2015 (RIFE 21)	Mud and sand	1000	2015 Review
2016 (RIFE 22)	Mud and sand	790	2016 Review
2017 (RIFE 23)	Mud and sand	770	2017 Review
2018 (RIFE 24)	Mud and sand	700	2018 Survey
2019 (RIFE 25)	Mud and sand	830	2019 Review
2020 (RIFE 26)	Mud and sand	690	2020 Review
2021 (RIFE 27)	Mud and sand	530	2021 Review

Annex 6. Cumbrian Coastal Community 5-year average consumption and intertidal occupancy rates (kg y^{-1} and h y^{-1})

5-year period	FISH				CRUSTACEANS				MOLLUSCS			EXTERNAL
	Total fish	Cod	Plaice	Other fish	Total crustaceans	Crab	Lobster	*Nephrops* or other crustaceans	Total molluscs	Winkles	Other molluscs	Intertidal occupancy
1994-98	31.8	17.8	14.1	0.0	15.5	10.8	4.4	0.3	10.6	5.5	5.1	1100
1995-99	35.2	19.5	15.8	0.0	17.9	13.0	4.6	0.3	13.6	6.4	7.3	1050
1996-00	36.2	19.3	13.2	3.7	20.2	13.3	5.7	1.1	14.6	6.9	7.8	1033
1997-01	37.4	19.3	10.7	7.4	21.8	13.5	6.4	1.9	15.6	7.1	8.5	1000
1998-02	40.2	17.8	8.8	13.6	21.6	13.4	6.0	2.2	20.6	10.3	10.3	1040
1999-03	39.4	18.3	4.3	16.8	21.4	13.0	5.7	2.8	24.4	12.1	12.3	994
2000-04	39.0	18.9	0.0	20.1	21.6	11.6	6.7	3.3	26.2	13.0	13.2	994
2001-05	41.0	21.3	0.0	19.7	21.6	12.4	5.9	3.3	29.4	15.3	14.1	952
2002-06	43.0	23.8	0.0	19.2	21.6	12.8	5.1	3.7	34.0	17.6	16.4	888
2003-07	41.0	24.6	0.0	16.4	22.5	13.3	5.4	3.9	34.0	17.5	16.4	814
2004-08	40.8	21.7	0.0	19.1	20.4	11.3	5.5	3.7	33.5	18.0	15.5	826
2005-09	40.6	18.8	0.0	21.8	18.6	9.8	5.1	3.8	32.3	17.9	14.3	818
2006-10	40.4	15.8	0.0	24.6	19.0	9.6	5.6	3.9	30.1	14.8	15.2	834
2007-11	40.2	12.9	0.0	27.3	20.4	9.7	6.4	4.3	24.5	12.3	12.2	886
2008-12	39.4	9.9	0.0	29.6	22.2	9.4	6.4	6.4	20.5	9.9	10.6	890
2009-13	42.6	12.3	0.0	30.3	23.8	8.1	5.9	9.8	17.2	9.3	7.9	856
2010-14	45.8	14.8	0.0	31.0	27.8	8.9	6.9	12.0	13.8	7.4	6.4	884
2011-15	50.6	16.0	0.0	34.6	31.0	9.0	8.6	13.4	11.8	7.8	4.0	910
2012-16	54.6	17.0	0.0	37.6	33.0	9.0	9.6	14.4	11.8	7.8	4.0	900
2013-17	58.0	19.5	0.0	38.5	33.4	9.1	11.2	13.0	12.4	8.3	4.1	884
2014-18	55.0	19.9	0.0	35.1	35.4	10.9	14.1	10.3	11.8	7.6	4.2	872
2015-19	51.8	17.8	0.0	34.0	35.4	10.6	14.5	10.3	12.0	7.3	4.7	818
2016-20	45.8	15.7	0.0	30.3	33.8	10.1	14.4	9.3	12.4	7.4	5.0	756
2017-21	42.8	15.4	0	27.4	31.4	9.7	15.1	6.7	11.1	6.0	5.1	704

Annex 7. Summary of profiles for adults in the Sellafield area for use in the assessment of total dose

Profile Name	Pathway Name / Number of Individuals		Crustacea	Direct	Eggs	Fish - Fresh	Fish - Sea	Fruit - Domestic	Fruit and nuts - Wild	Gamma ext - Saltmarsh	Gamma ext - Sediments	Honey	Marine plants/algae	Meat - Cow	Meat - Game	Meat - Poultry	Meat - Sheep	Meat - Wildfowl	Milk	Mollusca	Mushrooms	Mushrooms grown on salt marsh	Occupancy IN water	Occupancy ON water	Plume (IN; 0-0.25 km)	Plume (MID; 0.25-0.5 km)	Plume (OUT; 0.5-1 km)	Vegetables - Green	Vegetables - Other Domestic	Vegetables - Potatoes	Vegetables - Root
		Notes		1						2	3				4										5	5	5				
		Units	kg	-	kg	kg	kg	kg	kg	h	h	kg	kg	kg	kg	kg	kg	kg	l	kg	kg	kg	h	h	h	h	h	kg	kg	kg	kg
Crustacean Consumers	14		24.4	0.29	-	-	14.7	-	0.06	-	64	-	-	-	-	-	-	-	-	0.39	0.14	-	-	560	-	5	22	-	-	0.36	-
Occupants for Direct Radiation	162		0.73	1.00	0.54	-	1.0	0.73	0.09	-	56	<0.01	-	1.3	0.05	0.42	0.89	-	3.7	<0.01	0.07	-	<1	11	290	130	1420	0.82	1.4	0.98	1.0
Egg Consumers	6		-	0.17	26.9	-	-	6.8	0.15	-	4	-	-	-	-	-	19.8	-	-	-	-	-	-	-	-	1420	-	1.2	5.4	9.5	1.3
Freshwater Fish Consumers	2		-	-	-	4.2	-	-	5.0	-	-	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5	38.9	10.0	2.5
Sea Fish Consumers	24		5.8	0.13	-	-	36.5	0.05	-	-	140	-	-	-	-	0.07	-	-	-	0.35	-	-	-	18	-	3	5	0.14	0.13	0.19	0.16
Domestic Fruit Consumers	10		0.09	0.10	1.9	-	0.19	37.7	0.75	-	58	-	-	-	-	0.29	1.1	-	34.6	0.06	0.19	-	-	-	-	-	73	8.4	18.9	16.9	14.3
Wild Fruit and Nut Consumers	13		0.61	0.15	0.95	0.65	0.15	10.9	2.9	-	2	0.35	-	7.7	1.3	2.3	8.2	0.10	26.6	0.05	0.32	-	-	-	1210	-	-	2.1	6.4	5.2	4.1
Occupants over Saltmarsh	15		-	-	-	-	-	-	-	470	26	-	0.03	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Occupants over Sediment	57		0.02	0.09	-	-	2.6	1.4	<0.01	1	710	-	-	-	-	0.41	-	-	-	0.22	-	-	<1	8	4	2	13	0.85	1.2	0.72	1.0
Honey Consumers	2		-	-	-	4.2	-	-	5.0	-	-	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5	38.9	10.0	2.5
Consumers of Marine Plants and Algae	5		-	-	-	-	-	-	-	150	81	-	0.49	-	-	-	-	-	-	-	-	-	2	3	-	-	-	-	-	-	-
Cattle Meat Consumers	12		-	0.42	2.7	-	-	1.1	0.63	-	2	-	-	33.1	-	0.07	7.5	-	-	-	0.23	-	-	-	2560	-	150	-	0.42	-	0.42
Game Meat Consumers	1		7.0	-	-	-	-	-	3.0	-	-	-	-	-	17.4	28.3	-	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-
Poultry Meat Consumers	5		1.4	0.40	3.3	-	2.6	1.8	1.0	-	330	0.18	-	1.0	3.5	20.1	1.0	0.71	-	-	-	-	-	-	-	-	3110	4.2	5.2	4.8	4.9
Sheep Meat Consumers	14		-	0.43	6.1	-	1.2	1.6	0.96	-	-	-	-	7.1	-	1.0	23.4	-	-	-	0.19	-	-	2	1120	610	680	0.03	1.9	5.7	0.36
Wildfowl Consumers	1		-	-	-	-	-	-	-	2	14	-	-	-	-	-	-	39.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Milk Consumers	15		-	0.13	1.5	-	-	3.3	0.20	-	<1	0.20	-	-	-	-	-	-	202.1	-	0.19	-	-	-	-	-	350	1.9	3.1	-	0.07
Mollusc Consumers	2		12.1	-	-	-	20.8	-	-	-	370	-	-	-	-	-	-	-	-	9.0	-	-	-	-	-	-	-	-	-	1.3	-
Mushroom Consumers	11		-	0.45	1.1	-	0.79	2.8	0.77	-	13	-	-	9.1	-	0.12	3.6	-	35.5	-	1.6	-	<1	-	1430	-	270	2.9	9.4	10.8	4.2
Consumers of Mushrooms grown on Salt Marsh	5		-	-	-	-	-	-	-	27	-	-	-	-	-	-	-	-	-	-	-	1.1	-	-	-	-	-	-	-	-	-
Occupants In Water	4		-	-	-	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	-	-	940	3	-	-	-	-	-	-	-
Occupants On Water	8		11.5	-	-	-	1.5	-	0.06	-	-	-	-	-	-	-	-	-	-	-	0.13	-	-	1650	-	-	-	-	-	-	-
Local Inhabitants (0 - 0.25 km)	6		-	1.00	4.3	-	-	1.8	0.83	-	3	-	-	28.7	-	-	8.4	-	-	-	0.45	-	-	-	6080	-	-	-	0.83	-	0.83
Local Inhabitants (0.25 - 0.5 km)	1		-	1.00	24.2	-	-	-	-	-	-	-	-	-	-	-	39.5	-	-	-	-	-	-	-	-	8510	-	-	-	-	-
Local Inhabitants (0.5 - 1 km)	24		0.05	1.00	0.68	-	0.68	1.3	0.24	-	25	0.04	-	0.21	0.36	2.6	1.5	-	14.5	<0.01	0.07	-	-	3	-	-	6330	0.89	1.9	0.67	0.20
Green Vegetable Consumers	15		-	0.27	0.59	-	1.7	15.8	0.03	-	110	-	-	-	-	1.5	-	-	-	-	0.33	-	-	-	-	-	96	30.5	24.5	45.8	20.0
Other Domestic Vegetable Consumers	19		-	0.37	1.8	0.47	1.4	15.5	0.55	-	120	0.24	-	-	-	1.2	-	-	-	-	0.26	-	-	-	-	-	480	14.3	31.1	16.8	16.9
Potato Consumers	31		-	0.03	0.29	-	-	6.6	-	-	-	-	-	2.6	-	0.20	1.8	-	10.1	-	0.16	-	-	-	-	-	18	10.6	6.5	86.1	7.6
Root Vegetable Consumers	18		0.05	0.33	-	-	1.5	22.1	0.30	-	110	-	-	-	-	1.3	0.59	-	19.2	0.03	0.36	-	-	-	-	-	110	22.6	23.0	35.7	23.4

Notes for Annex 7

This annex is based on data from the 2018 Sellafield full habits survey (aquatic, terrestrial and direct radiation pathways), which has been updated with data from the 2019, 2020 and 2021 annual Sellafield Reviews.

1. Direct radiation is expressed as proportion of group who are present within 1 km of site perimeter
2. Gamma ext - Salt marsh represents occupancy over salt marsh only
3. Gamma ext - Sediments represents occupancy over all substrates except rock and saltmarsh
4. Meat - Game includes consumption of venison and rabbits/hares
5. Plume times are the sum of individuals' indoor and outdoor times

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