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Radiological Habits Survey: Sellafield Review, 2020

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 2020.

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 et al., 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, 2020).

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 in 2020, and subsequent restrictions, the established habits survey method was reviewed to assess the options for undertaking the survey. This assessment involved a series of discussions with the EA, FSA and ONR to consider alternative approaches that would comply with government guidelines for COVID-19. A new survey method was agreed, which included desk-based interviews and fieldwork interviews, and ensured that the collection of habits data was safe for all interviewees and

fieldwork staff. The activities and the data collected in the 2020 habits survey were representative of previous review surveys undertaken in the Sellafield area.

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 lockdown 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 (see below) shows the locations within the survey area.

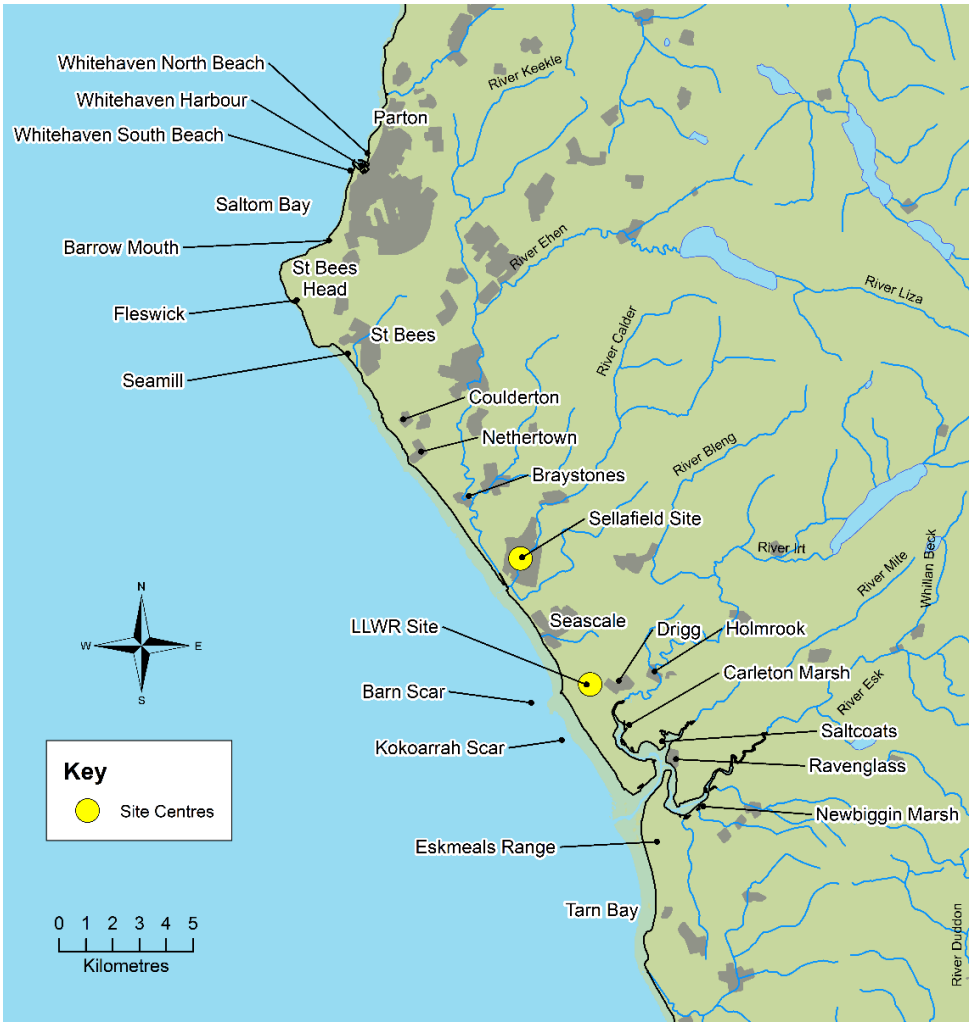

Figure 1. Aquatic survey area

3. Conduct of the survey

In 2020, an alternative habits survey method was developed to ensure that the survey could be conducted safely and in compliance with government guidelines for COVID-19. This approach 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 undertaking Internet searches 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. The Sellafield site operator, Environment Agency regulators, and the West Cumbria Site Stakeholder Group were contacted for information about new potential contacts, pathways, and local information about activities during the pandemic. Additional research was undertaken, including 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 2020. The fieldwork component was conducted from 6th to 9th October 2020, 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 (i.e. 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 below. Although no data were collected for children or infants in the 2020 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 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 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 87 interviewees who spent time on intertidal areas, at least 48% 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 103 adults during 2020 Sellafield Review survey. This is comparable with the 2019 Sellafield Review, in which data were obtained for 101 adults.

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 2020 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 2020 survey during the COVID-19 pandemic were representative of activities identified in previous Sellafield Review surveys.

All interviewees in the 2020 survey were asked if there were any changes to their activities and seafood consumption due to the pandemic. During the first lockdown, it was reported that some people had stopped their activities, but some activities continued, including dog walking, angling, setting nets, setting pots and tending to livestock. As the first 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.

It was reported that bait digging and angling had increased in popularity during the COVID-19 period. Staff at a local fishing tackle shop reported that custom had increased in 2020 due to more individuals undertaking shore angling during the lockdown period or while furloughed. Many of the dog walkers utilised their daily exercise as much as possible to allow for more time outdoors during the pandemic. 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 2020	Changes in activity due to the pandemic	Reasons for the changes in activities
Dog walking	45	Three of the 45 individuals interviewed stopped undertaking this activity during the initial lockdown in March for approximately 1 month. Most dog walkers reported that they had continued with their routine throughout lockdown.	The people who continued throughout lockdown used the activity as their daily exercise to get out of the house and to keep them busy during furlough.
Angling	17	Four of the seventeen individuals identified stopped angling during the initial lockdown in March. The other 13 continued with their angling activities as normal. There was a general increase in this activity.	It was reported by multiple sources that the beaches were busy with anglers during the lockdown period. This could be attributed to people being on furlough or working flexibly.
Bait digging	10	Two of the ten interviewees stopped bait digging during lockdown. The other interviewees did not report a change in this activity.	The interviewees stopped during lockdown due to home schooling responsibilities.
Shellfish collecting	4	The shellfish collectors identified continued their routine activity as in previous years.	NA
Setting pots and nets	4	One hobby fisherman identified in previous years stopped potting in 2020 due to the pandemic. Other hobby fisherman 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	2	It was reported that wildfowling was significantly impacted during the initial lockdown, preventing a wildfowling club from undertaking the activity in the aquatic survey area.	Restricted club activity due to lockdown.

Note: Some interviewees were undertaking multiple activities and are counted in all the relevant activities in this table. There were 87 people undertaking intertidal activities (see Table 8).

5.3. Estimates of data gaps due to COVID-19

One high-rate winkle consumer could not be contacted during the survey as they do not have a telephone or an email address (in previous years the interviews have been conducted in their home). Since other shellfish collectors continued their activities during the pandemic, it is assumed that this winkle consumer had also continued, and the 2019 consumption rates for this person will be included in the 2020 data for use in RIFE dose assessments.

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 2020 Sellafield Review alongside the results from the 2019 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 2020 alongside the 2019 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												
	2019	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**	**2019**	**2020**
Crustaceans	17	12	5	11	59.1	59.1	24.2	20.5	36.1	30.1	51.8	54.2
Molluscs	11	9	2	2	17.5	17.5	7.3	9.8	12.4	13.6	14.9	16.0
Fish	22	24	11	9	59.7	59.6	21.9	23.7	40.0	33.6	59.7	59.6

6.1.1. Seafood species and seafood collection or catch locations identified in 2020

The species of crustaceans consumed by people in the adult high-rate group were brown crab, brown shrimp, 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 at Drigg by hooking them out from amongst the crevices at low water and by setting pots from the beach at Whitehaven north beach, Seascale and Drigg. Brown shrimps were caught at Seascale and Drigg by pushing a net through shallow water and in pots that were set from the shore. Small quantities of common prawns were also caught in pots that were set from the shore.

The species of molluscs consumed by people in the adult high-rate group were winkles, mussels and razor shells. Winkles were collected from Nethertown, Coulderton, St Bees and Whitehaven north beach; mussels were collected from Whitey Rock (at the northern end of Whitehaven north beach) and razor shells were collected from Whitehaven north beach. Whelks were caught as a by-catch in pots set offshore and limpets collected from the shore at Whitehaven north beach, both of which were consumed in small quantities.

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

6.1.2. Changes in seafood consumption rates in 2020 compared with 2019

The number of people interviewed consuming crustaceans decreased by five in 2020, which was a result of hobby fishermen stopping fishing due to concerns about COVID-19. The number of people in the high-rate group in 2020 increased due to fishermen consuming higher quantities of their catch than in previous years. The maximum and mean consumption rates decreased in 2019 compared with 2020 due to changes in consumption that were unrelated to the pandemic.

The consumption of molluscs was similar in both 2020 and 2019 as shellfish collection continued throughout the COVID-19 period. There was a slight increase in the mean rate for the high-rate group in 2020 which was a natural change in eating habits rather than a result of the pandemic.

The number of interviewees consuming fish and the consumption rates were similar in 2020 and 2019. There were reports of increases in people angling in 2020 but there is an increase in catch and release rather than taking fish for consumption.

6.2. Composition of the food groups for crustaceans, molluscs and fish, for use in dose assessments, and comparison with 2019 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 comprises 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 2020 Sellafield Review, rounded to the nearest 5% for use in dose assessments, are as follows:

- 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})

By comparison, the percentage composition for the predominant shellfish and fish species consumed by the adult high-rate groups from the 2019 Sellafield Review survey, used in RIFE-25 (EA, FSA, FSS, NRW, NIEA and SEPA, 2020) for dose assessments, were:

- Crustaceans - 40% common lobster, 20% brown crab, and 40% other crustaceans (including brown shrimps, *Nephrops* and common prawns) (mean consumption rate for the adult high-rate group, 36 kg y^{-1})
- Molluscs - 50% winkles and 50% other molluscs (including mussels and razor shells) (mean consumption rate for the adult high-rate group, 12 kg y^{-1})
- Fish - 30% cod and 70% other fish species (mainly thornback ray, plaice and turbot, with smaller quantities of bass, Dover sole, flounder and mackerel) (mean consumption rate for the adult high-rate group, 40 kg y^{-1})

In 2020, compared to 2019, the mean consumption rate for the adult high-rate group for crustaceans decreased by 6 kg y^{-1}, the mean consumption rate for the adult high-rate group for fish decreased by 6 kg y^{-1}, and the mean consumption rate for the adult high-rate group for molluscs increased by 2 kg y^{-1}.

The main species of crustaceans and molluscs within the respective high-rate groups were the same in 2020 and 2019. The main species of fish within the high-rate groups differed

between 2019 and 2020. In 2020, when compared with 2019, mackerel was not consumed in the high-rate group.

The percentage breakdown of species changed for crustaceans with an increase in the percentage contribution of lobster and crab, primarily due to fishermen consuming higher quantities of their catch than in previous years. For molluscs, there was an increase in the percentage contribution of mussels due to an increase in consumption from a high-rate consumer compared with previous surveys. For fish, there was a significant decrease in cod and a significant increase in other fish species. The quantities of cod being consumed in 2020 had decreased and there were reports of a reduced availability of stocks in the local cod fishery.

6.3. Consumption trends

The consumption rates for the adult high-rate groups for crustaceans and molluscs over the previous ten years (2010 - 2020) 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.

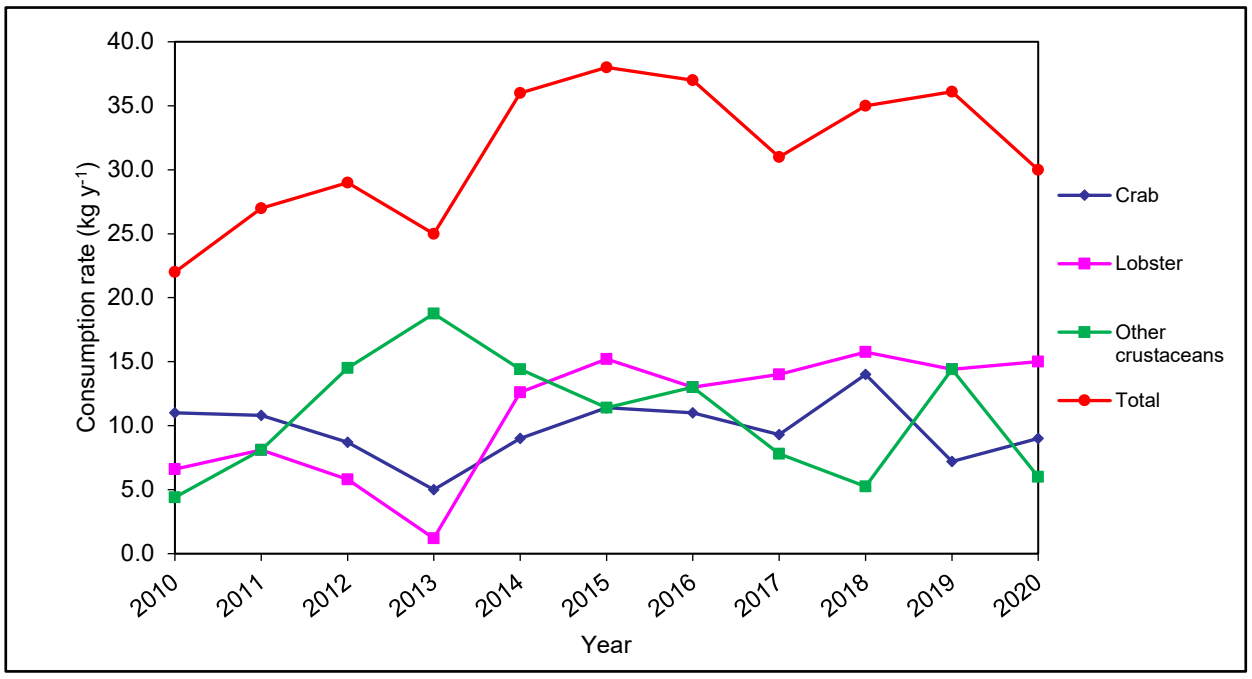

Figure 2. Consumption rates (kg y^{-1}) for the adult high-rate group for crustaceans, 2010 – 2020

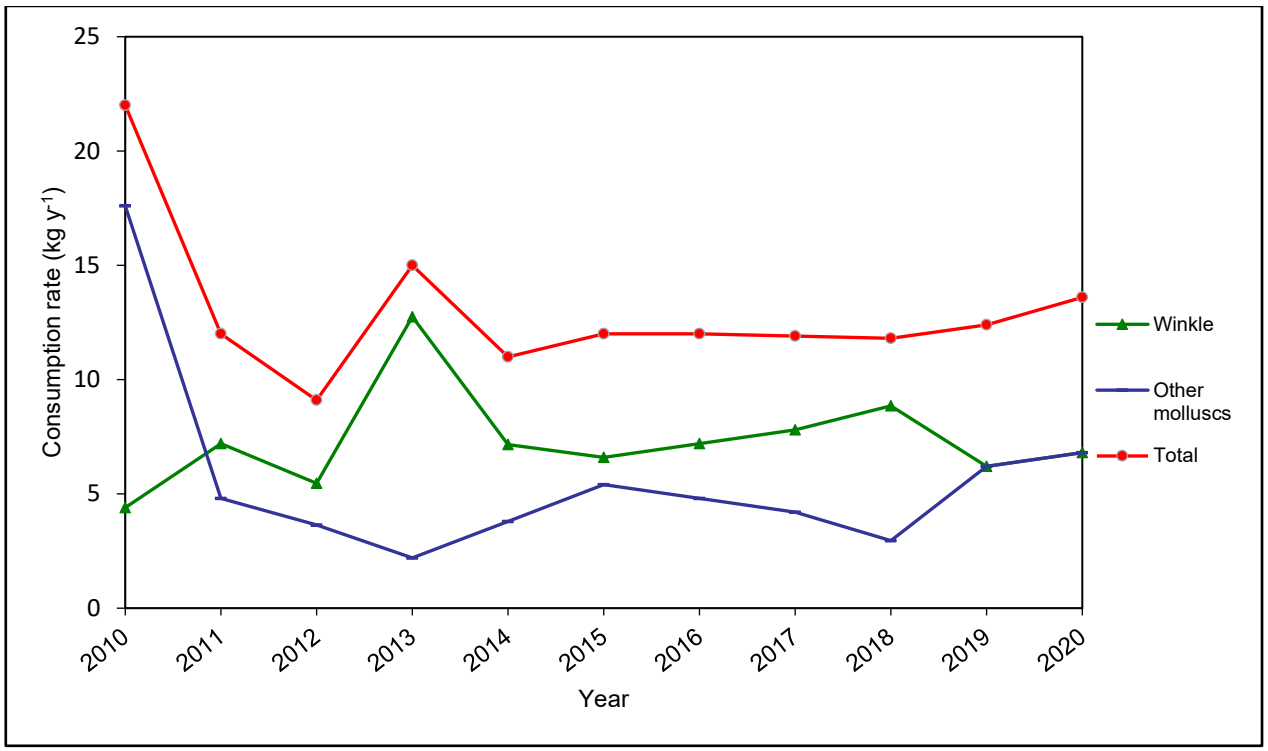

Figure 3. Consumption rates (kg y^{-1}) for the adult high-rate group for molluscs, 2010 – 2020

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 2020 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 2019 Sellafield Review data are included for comparison. A comparison between the 2019 and 2020 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 2020 Sellafield Review survey alongside the 2019 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})	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Mud and sand	1	2	1	1	24	144	24	144	Not applicable	141
Mud, sand and stones	11	12	6	3	548	1252	369	823	548	1092
Rock	4	2	2	1	156	135	146	135	155	132
Salt marsh	9	9	7	5	274	912	188	511	274	840
Sand	46	49	10	5	1277	1460	673	792	819	707
Sand and stones	36	13	18	10	480	510	401	510	480	510
Stones	11	23	9	5	660	587	627	390	660	465

The following activities were undertaken by people in the adult high-rate groups for occupancy over intertidal substrates in the 2020 Sellafield Review:

- For mud and sand: bait digging at Whitehaven outer harbour
- For mud, sand and stones: dog walking at Parton and Ravenglass
- For rock: hooking for crab and lobsters at Drigg
- For salt marsh: dog walking and tending livestock at Saltcoats
- For sand: bait digging at Braystones; setting nets at Braystones and Seascale; setting pots at Whitehaven north beach, Seascale and Drigg; collecting razor shells at Whitehaven north beach; dog walking at Sellafield, Seascale and Drigg
- For sand and stones: working on the shore at Parton
- For stones: angling at Nethertown, St Bees and Coulderton; dog walking at St Bees and Seamill

Brown shrimps were caught using a push net at Drigg and Whitehaven north beach, but since this involved wading out into shallow water, it was not classed as an intertidal activity. Therefore, this activity does not appear in the intertidal occupancy table. However, in a full Sellafield habits survey, push netting would be considered as an activity in the 'in and on water' occupancy table.

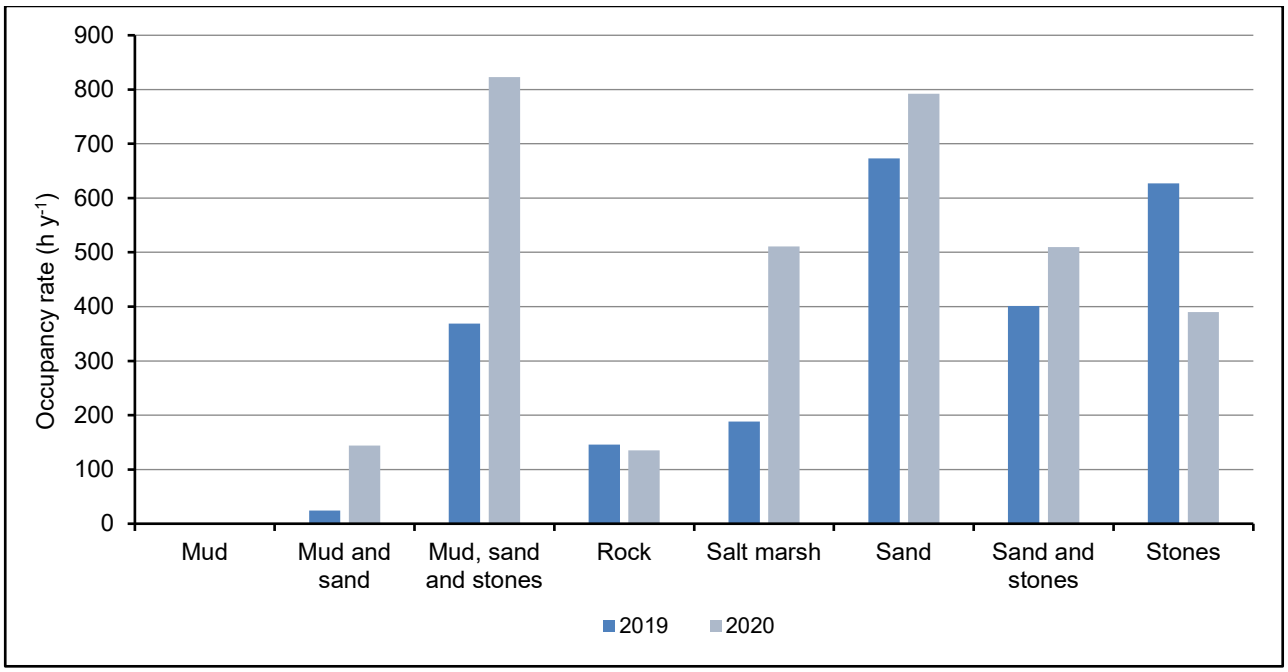

Figure 4. Comparison between the 2019 and 2020 mean rates of the high-rate groups for occupancy over each intertidal substrate

In 2020, compared with 2019, there were increases in the following mean intertidal occupancy rates for the high-rate groups (data rounded to two significant figures):

- For mud and sand; from 24 h y^{-1} to 140 h y^{-1}
- For mud, sand and stones; from 370 h y^{-1} to 820 h y^{-1}
- For salt marsh; from 190 h y^{-1} to 510 h y^{-1}
- For sand; from 670 h y^{-1} to 790 h y^{-1}
- For sand and stones; from 400 h y^{-1} to 510 h y^{-1}

There were significant increases in occupancy over mud and sand, over mud, sand and stones, and over saltmarsh. The occupancy over mud and sand increased by almost 6-fold and was due to a new bait digger being identified. The increase in occupancy over mud, sand and stones was 2-fold and the increase over salt marsh was nearly 3-fold. Both of these increases were due to people having more time available and undertaking activities on the beaches where possible during the pandemic. There were smaller increases over sand, and over sand and stones.

In 2020, compared with 2019, there were decreases in the following mean intertidal occupancy rates for the high-rate groups (data rounded to two significant figures):

- For rock; from 150 h y^{-1} to 140 h y^{-1}
- For stones; 630 h y^{-1} to 390 h y^{-1}

There was a slight decrease in the occupancy over rock, and a larger decrease over stones. The decrease in occupancy over stones was due to people identified working on the shore for less time in 2020 compared with 2019.

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 2912/1/1 is in the high-rate group for fish, crustaceans, molluscs, occupancy over sand and occupancy over sand and 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 2020 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, 2020).

As in previous years, since several individuals were undertaking activities over multiple substrates, the occupancy rates over five substrates (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 690 h y^{-1}. For comparison, the mean rate for the high-rate group for the reclassified 'mud and sand' substrate in 2019 was 830 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 2020 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 2020 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 and 2020 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 and 2020 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-26 dose assessments

The survey investigated the consumption of shellfish and fish, and intertidal occupancy, relating to liquid discharges from the Sellafield nuclear site using a new method due to the COVID-19 pandemic. The 2020 results are representative of previous Sellafield Review 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 2020 Sellafield Review are as follows:

- Crustaceans 30 kg y^{-1}
- Molluscs 14 kg y^{-1}
- Fish 34 kg y^{-1}
- Occupancy over mud and sand 140 h y^{-1}
- Occupancy over mud, sand and stones 820 h y^{-1}
- Occupancy over rock 140 h y^{-1}

- Occupancy over salt marsh 510 h y^{-1}
- Occupancy over sand 790 h y^{-1}
- Occupancy over sand and stones 510 h y^{-1}
- Occupancy over stones 390 h y^{-1}

In 2020, compared to 2019, the mean consumption rate for the adult high-rate group for crustaceans decreased by 6 kg y^{-1}, the mean consumption rate for the adult high-rate group for fish decreased by 6 kg y^{-1}, and the mean consumption rate for the adult high-rate group for molluscs increased by 2 kg y^{-1}. For occupancy over intertidal substrates, the mean rates for the adult high-rate groups increased in 2020 compared to 2019 by 120 h y^{-1} for mud and sand, by 450 h y^{-1} for mud, sand and stones, by 320 h y^{-1} for salt marsh, by 120 h y^{-1} for sand and by 110 h y^{-1} for sand and stones; and decreased by 11 h y^{-1} for rock and by 240 h y^{-1} stones.

The following recommendations for data to be used in RIFE-26 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 34 kg y^{-1}, comprising 15% cod and 85% other fish (mainly thornback ray, plaice and turbot, with smaller quantities of bass, Dover sole, flounder and mackerel)
- Crustaceans 30 kg y^{-1}, comprising 50% common lobster, 30% brown crab and 20% other crustaceans (including brown shrimps, Nephrops and common prawns)
- Molluscs 14 kg y^{-1}, comprising 50% winkles and 50% other molluscs (including mussels and razor shells)
- Occupancy over an intertidal substrate termed 'mud and sand' (mud and sand; mud, sand and stones; sand; sand and stones; and stones combined) 690 h y^{-1}

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

- Cod 16 kg y^{-1}
- Other fish 30 kg y^{-1}
- Crabs 10 kg y^{-1}
- Lobsters 14 kg y^{-1}
- Other crustaceans 9.3 kg y^{-1}
- Winkles 7.4 kg y^{-1}
- Other molluscs 5.0 kg y^{-1}
- Occupancy over an intertidal substrate termed 'mud and sand' (mud and sand; mud, sand and stones; sand; sand and stones; and stones combined) 760 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	Brown shrimp	Common lobster	Common prawn	*Nephrops*	Total
2912/1/1	**8.1**	**30.8**	**18.4**	**1.8**	**-**	**59.1**
2912/2/1	**8.1**	**23.6**	**7.5**	**1.8**	**-**	**41.0**
2912/3/1	**8.1**	**8.8**	**14.9**	**-**	**-**	**31.8**
2865/1/1	**10.7**	**-**	**16.8**	**-**	**-**	**27.6**
2865/2/1	**10.7**	**-**	**16.8**	**-**	**-**	**27.6**
2865/3/1	**10.7**	**-**	**16.8**	**-**	**-**	**27.6**
2865/4/1	**10.7**	**-**	**16.8**	**-**	**-**	**27.6**
2863/1/1	**7.2**	**-**	**16.8**	**-**	**0.2**	**24.2**
2863/2/1	**7.2**	**-**	**16.8**	**-**	**0.2**	**24.2**
2864/1/1	**6.3**	**-**	**13.0**	**1.2**	**-**	**20.5**
2864/2/1	**6.3**	**-**	**13.0**	**1.2**	**-**	**20.5**
2890/1/1	6.0	-	4.7	-	-	10.6

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of crustaceans for adults based on the 11 high-rate consumers is 30.1 kg y^{-1}

The observed 97.5th percentile rate based on 12 observations is 54.2 kg y^{-1}

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

Person ID number	Limpet	Mussel	Razor shell	Whelk	Winkle	Total
2912/1/1	-	**7.5**	**1.5**	-	**8.5**	**17.5**
2912/2/1	-	**2.5**	**3.0**	-	**4.3**	**9.8**
2909/2/1	3.0	-	-	-	1.1	4.1
2863/1/1	-	2.7	-	-	-	2.7
2912/3/1	-	-	1.5	-	-	1.5
2909/1/1	0.4	-	-	-	-	0.4
2909/3/1	-	-	-	-	0.3	0.3
2864/1/1	-	-	-	0.1	-	0.1
2864/2/1	-	-	-	0.1	-	0.1

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of molluscs for adults based on the 2 high-rate consumers is 13.6 kg y^{-1}

The observed 97.5th percentile rate based on 9 observations is 16.0 kg y^{-1}

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

Person ID number	Bass	Cod	Dover sole	Flounder	Mackerel	Plaice	Sea trout	Thornback ray	Turbot	Total
2912/1/1	**3.0**	**3.0**	**3.0**	-	-	**14.9**	-	**20.8**	**14.9**	**59.6**
2912/3/1	**3.0**	**3.0**	**3.0**	-	-	**14.9**	-	**20.8**	**14.9**	**59.6**
2912/2/1	**1.5**	**1.5**	**1.5**	-	-	**8.5**	-	**11.9**	**8.5**	**33.4**
2863/1/1	-	**0.04**	-	-	-	**4.1**	-	**24.5**	-	**28.6**
2867/1/1	**4.8**	**11.8**	-	**4.8**	-	**4.8**	-	-	-	**26.2**
2908/1/1	-	**4.4**	-	-	-	-	-	**19.2**	-	**23.7**
2908/2/1	-	**4.4**	-	-	-	-	-	**19.2**	-	**23.7**
2896/1/1	-	**11.8**	-	-	-	**11.8**	-	-	-	**23.7**
2896/2/1	-	**11.8**	-	-	-	**11.8**	-	-	-	**23.7**
2864/1/1	-	8.0	-	-	-	1.8	-	8.0	-	17.7
2864/2/1	-	8.0	-	-	-	1.8	-	8.0	-	17.7
2890/1/1	-	5.2	-	-	5.2	-	-	5.2	-	15.6
2890/2/1	-	5.2	-	-	5.2	-	-	5.2	-	15.6
2862/1/1	1.1	3.8	-	-	3.8	1.1	1.1	-	-	10.9
2863/2/1	-	0.04	-	-	-	4.1	-	-	-	4.1
2851/1/1	-	1.9	-	-	-	-	-	1.9	-	3.9
2904/1/1	1.2	1.2	-	-	-	-	-	-	-	2.4
2902/1/1	-	-	-	-	1.6	-	-	-	-	1.6
2902/2/1	-	-	-	-	1.6	-	-	-	-	1.6
2902/3/1	-	-	-	-	1.6	-		-	-	1.6
2902/4/1	-	-	-	-	1.6	-	-	-	-	1.6
2902/5/1	-	-	-	-	1.6	-	-	-	-	1.6
2848/1/1	-	0.8	-	-	-	-	-	-	-	0.8
2848/2/1	-	0.8	-	-	-	-	-	-	-	0.8

Notes

Emboldened observations are the high-rate consumers

The mean consumption rate of fish for adults based on the 9 high-rate consumers is 33.6 kg y^{-1}

The observed 97.5th percentile rate based on 24 observations is 59.6 kg y^{-1}

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

Person ID number	Location	Activity	Mud and sand	Mud, sand and stones	Rock	Salt marsh	Sand	Sand and stones	Stones
2857/1/1	**Whitehaven Outer Harbour**	**Bait digging**	**144**	-	-	-	-	-	-
2848/1/1	Whitehaven Outer Harbour	Bait digging	7	-	-	-	-	-	-
	Braystones	Angling	-	-	-	-	148	-	-
2850/1/1	**Parton**	**Dog walking**	-	**1252**	-	-	-	-	-
2851/1/1	**Parton**	**Dog walking**	-	**668**	-	-	-	-	-
2883/1/1	**Ravenglass**	**Dog walking**	-	**548**	-	-	-	-	-
	Drigg		-	-	-	-	**548**	-	-
2852/1/1	Parton	Dog walking	-	365	-	-	-	-	-
2873/1/1	Ravenglass	**Dog walking**	-	304	-	-	-	-	-
	Seascale and Drigg		-	-	-	-	**608**	-	-
2884/1/1	Ravenglass	Walking	-	104	-	-	-	-	-
2884/2/1	Ravenglass	Walking	-	104	-	-	-	-	-
2867/1/1	Ravenglass	Bait digging and collecting seaweed	-	104	-	-	-	-	-
	Nethertown, Seascale and Drigg	Angling	-	-	-	-	239	-	-
	Drigg	Bait digging	-	-	-	-		-	-
	Braystones	Angling	-	-	-	-	-	-	52
	Nethertown	Collecting seaweed	-	-	-	-	-	-	20
2882/1/1	Ravenglass	Dog walking	-	78	-	-	-	-	-
	Drigg		-	-	-	-	78	-	-
2882/2/1	Ravenglass	Dog walking	-	78	-	-	-	-	-
	Drigg		-	-	-	-	78	-	-
2899/1/1	Ravenglass	Dog walking	-	61	-	-	-	-	-
2883/2/1	Ravenglass	Dog walking	-	26	-	-	-	-	-
	Drigg		-	-	-	-	26	-	-
2912/3/1	**Drigg**	**Hooking for crabs and lobsters**	-	-	**135**	-	-	-	-

Person ID number	Location	Activity	Mud and sand	Mud, sand and stones	Rock	Salt marsh	Sand	Sand and stones	Stones
2912/1/1	Whitehaven North Beach	Collecting mussels	-	-	26	-	-	-	-
	Whitehaven North Beach, Nethertown, Braystones, Seascale and Drigg	**Bait digging, setting nets and pots, and collecting razor shells**	-	-	-	-	**613**	-	-
	Whitehaven North Beach, St Bees and Nethertown	Collecting winkles	-	-	-	-	-	18	-
2902/1/1	**Saltcoats**	**Tending livestock and dog walking**	-	-	-	**912**	-	-	-
2902/3/1	**Saltcoats**	**Tending livestock**	-	-	-	**548**	-	-	-
2902/2/1	**Saltcoats**	**Dog walking**	-	-	-	**365**	-	-	-
2902/4/1	**Saltcoats**	**Dog walking**	-	-	-	**365**	-	-	-
2902/5/1	**Saltcoats**	**Dog walking**	-	-	-	**365**	-	-	-
2874/1/1	River Irt	Tending livestock	-	-	-	132	-	-	-
	Drigg		-	-	-	-	87	-	-
2874/2/1	River Irt	Tending livestock	-	-	-	132	-	-	-
	Drigg		-	-	-	-	87	-	-
2905/1/1	River Irt and River Mite	Wildfowling	-	-	-	20	-	-	-
2903/1/1	River Irt and River Mite	Wildfowling	-	-	-	10	-	-	-
2888/1/1	**Drigg**	**Dog walking**	-	-	-	-	**1460**	-	-
2878/1/1	**Sellafield, Seascale and Drigg**	**Dog walking**	-	-	-	-	**730**	-	-
2856/1/1	**St Bees and Seamill**	**Dog walking**	-	-	-	-	365	-	-
			-	-	-	-	-	-	**365**
2856/2/1	**St Bees and Seamill**	**Dog walking**	-	-	-	-	365	-	-
			-	-	-	-	-	-	**365**
2865/2/1	Sellafield, Seascale and Drigg	Dog walking	-	-	-	-	365	-	-
2904/1/1	St Bees	Angling	-	-	-	-	344	-	-
	Seascale	Bait digging	-	-	-	-		-	
	Nethertown	**Angling**	-	-	-	-	-	-	**320**
2889/1/1	Drigg	Dog walking	-	-	-	-	313	-	-
2889/2/1	Drigg	Dog walking	-	-	-	-	313	-	-

Person ID number	Location	Activity	Mud and sand	Mud, sand and stones	Rock	Salt marsh	Sand	Sand and stones	Stones
2908/2/1	Drigg	**Angling**	-	-	-	-	313	-	-
	St Bees		-	-	-	-	-	-	**313**
2890/1/1	Coulderton	Setting nets	-	-	-	-	286	-	-
2860/1/1	St Bees	Dog walking	-	-	-	-	274	-	-
			-	-	-	-	-	-	91
2879/1/1	Seascale	Dog walking	-	-	-	-	274	-	-
2905/2/1	St Bees	Dog walking	-	-	-	-	274	-	-
2875/1/1	Seascale and Drigg	Dog walking	-	-	-	-	235	-	-
2875/2/1	Seascale and Drigg	Dog walking	-	-	-	-	235	-	-
2862/2/1	Seascale and Drigg	Dog walking	-	-	-	-	341	-	-
	Nethertown and Braystones		-	-	-	-		-	-
			-	-	-	-	-	-	114
2862/3/1	Seascale and Drigg	Dog walking	-	-	-	-	341	-	-
	Nethertown and Braystones		-	-	-	-		-	-
			-	-	-	-	-	-	114
2877/1/1	Tarn Bay	Dog walking	-	-	-	-	183	-	-
2877/2/1	Tarn Bay	Dog walking	-	-	-	-	183	-	-
2881/1/1	Seascale	Dog walking	-	-	-	-	183	-	-
2855/1/1	Braystones	Dog walking	-	-	-	-	182	-	-
			-	-	-	-	-	-	182
2859/1/1	St Bees	Dog walking	-	-	-	-	182	-	-
2876/1/1	Seascale	Dog walking	-	-	-	-	122	-	-
2862/1/1	Nethertown	Angling, setting nets and walking	-	-	-	-	104	-	-
		Angling and walking	-	-	-	-	-	-	52
2870/1/1	Tarn Bay	Angling	-	-	-	-	104	-	-
2870/2/1	Tarn Bay	Angling	-	-	-	-	104	-	-
2885/1/1	Tarn Bay	Dog walking	-	-	-	-	104	-	-

Person ID number	Location	Activity	Mud and sand	Mud, sand and stones	Rock	Salt marsh	Sand	Sand and stones	Stones
2885/2/1	Tarn Bay	Dog walking	-	-	-	-	104	-	-
2869/1/1	Tarn Bay	Dog walking	-	-	-	-	91	-	-
2877/3/1	Tarn Bay	Dog walking	-	-	-	-	76	-	-
2877/4/1	Tarn Bay	Dog walking	-	-	-	-	76	-	-
2909/1/1	Eskmeals	Bait digging	-	-	-	-	48	-	-
	Coulderton and Nethertown	Collecting winkles	-	-	-	-	-	28	-
2858/1/1	St Bees	Dog walking	-	-	-	-	39	-	-
2887/1/1	Seascale and Drigg	Dog walking	-	-	-	-	39	-	-
2868/1/1	Tarn Bay	Angling and bait digging	-	-	-	-	30	-	-
2868/2/1	Tarn Bay	Angling and bait digging	-	-	-	-	30	-	-
2872/1/1	Seascale	Dog walking	-	-	-	-	13	-	-
2872/2/1	Seascale	Dog walking	-	-	-	-	13	-	-
2880/1/1	Sellafield and Seascale	Angling	-	-	-	-	13	-	-
2893/1/1	Whitehaven North Beach and Whitehaven South Beach	Angling	-	-	-	-	-	36	-
	Parton and Nethertown	Angling	-	-	-	-	-	-	36
2911/2/1	**Parton**	**Working on the shore**	-	-	-	-	-	**510**	-
2911/2/2	**Parton**	**Working on the shore**	-	-	-	-	-	**510**	-
2911/2/3	**Parton**	**Working on the shore**	-	-	-	-	-	**510**	-
2911/2/4	**Parton**	**Working on the shore**	-	-	-	-	-	**510**	-
2911/2/5	**Parton**	**Working on the shore**	-	-	-	-	-	**510**	-
2911/2/6	**Parton**	**Working on the shore**	-	-	-	-	-	**510**	-
2911/2/7	**Parton**	**Working on the shore**	-	-	-	-	-	**510**	-
2911/2/8	**Parton**	**Working on the shore**	-	-	-	-	-	**510**	-
2911/2/9	**Parton**	**Working on the shore**	-	-	-	-	-	**510**	-
2911/2/10	**Parton**	**Working on the shore**	-	-	-	-	-	**510**	-
2890/2/1	**Coulderton**	**Angling**	-	-	-	-	-	-	**587**
2911/1/1	St Bees	Working on the shore	-	-	-	-	-	-	105
2911/1/2	St Bees	Working on the shore	-	-	-	-	-	-	105
2911/1/3	St Bees	Working on the shore	-	-	-	-	-	-	105
2911/1/4	St Bees	Working on the shore	-	-	-	-	-	-	105

Person ID number	Location	Activity	Mud and sand	Mud, sand and stones	Rock	Salt marsh	Sand	Sand and stones	Stones
2911/1/5	St Bees	Working on the shore	-	-	-	-	-	-	105
2911/1/6	St Bees	Working on the shore	-	-	-	-	-	-	105
2911/1/7	St Bees	Working on the shore	-	-	-	-	-	-	105
2911/1/8	St Bees	Working on the shore	-	-	-	-	-	-	105
2854/2/1	Braystones	Angling	-	-	-	-	-	-	33
2854/1/1	Braystones	Angling	-	-	-	-	-	-	21
2853/1/1	Braystones	Beach combing	-	-	-	-	-	-	18

Notes

Emboldened observations are the high-rate individuals

The mean intertidal occupancy rate over mud and sand for adults based on 1 high-rate observation is 144 h y^{-1}

The observed 97.5th percentile rate based on 2 observations is 141 h y^{-1}

The mean intertidal occupancy rate over mud, sand and stones for adults based on 3 high-rate observations is 823 h y^{-1}

The observed 97.5th percentile rate based on 12 observations is 1092 h y^{-1}

The mean intertidal occupancy rate over rock for adults based on 1 high-rate observation is 135 h y^{-1}

The observed 97.5th percentile rate based on 2 observations is 132 h y^{-1}

The mean intertidal occupancy rate over salt marsh for adults based on 5 high-rate observations is 511 h y^{-1}

The observed 97.5th percentile rate based on 9 observations is 840 h y^{-1}

The mean intertidal occupancy rate over sand for adults based on 5 high-rate observations is 792 h y^{-1}

The observed 97.5th percentile rate based on 49 observations is 707 h y^{-1}

The mean intertidal occupancy rate over sand and stones for adults based on 10 high-rate observations is 510 h y^{-1}

The observed 97.5th percentile rate based on 13 observations is 510 h y^{-1}

The mean intertidal occupancy rate over stones for adults based on 5 high-rate observations is 390 h y^{-1}

The observed 97.5th percentile rate based on 23 observations is 465 h y^{-1}

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 and sand	Mud, sand and stones	Sand	Sand and stones	Stones
2912/1/1	**59.6**	**59.1**	**17.5**	-	-	**613**	18	-
2912/3/1	**59.6**	**40.9**	1.5	-	-	-	-	-
2912/2/1	**33.4**	**31.9**	**9.8**	-	-	-	-	-
2863/1/1	**28.6**	**24.2**	2.7	-	-	-	-	-
2867/1/1	**26.2**	-	-	-	103	239	-	71
2908/2/1	**23.7**	-	-	-	-	313	-	**313**
2864/1/1	17.7	**20.5**	0.1	-	-	-	-	-
2890/2/1	15.6	-	-	-	-	-	-	**587**
2863/2/1	4.1	**24.2**	-	-	-	-	-	-
2851/1/1	3.9	-	-	-	**668**	-	-	-
2904/1/1	2.4	-	-	-	-	344	-	**320**
2865/2/1	-	**27.6**	-	-	-	365	-	-
2909/1/1	-	-	0.4	-	-	48	**28**	-
2857/1/1	-	-	-	**144**	-	-	-	-
2883/1/1	-	-	-	-	**548**	**548**	-	-

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 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
2848/1/1	38	M	0.8	-	-	7	-	-	-	148	-	-
2848/2/1	38	F	0.8	-	-	-	-	-	-	-	-	-
2850/1/1	**68**	**M**	-	-	-	-	**1252**	-	-	-	-	-
2851/1/1	**73**	**M**	3.9	-	-	-	**668**	-	-	-	-	-
2852/1/1	U	F	-	-	-	-	365	-	-	-	-	-
2853/1/1	77	M	-	-	-	-	-	-	-	-	-	18
2854/1/1	64	M	-	-	-	-	-	-	-	-	-	21
2854/2/1	61	M	-	-	-	-	-	-	-	-	-	33
2855/1/1	59	M	-	-	-	-	-	-	-	182	-	182
2856/1/1	**45**	**F**	-	-	-	-	-	-	-	365	-	**365**
2856/2/1	**18**	**F**	-	-	-	-	-	-	-	365	-	**365**
2857/1/1	**U**	**M**	-	-	-	**144**	-	-	-	-	-	-
2858/1/1	59	M	-	-	-	-	-	-	-	39	-	-
2859/1/1	70	F	-	-	-	-	-	-	-	182	-	-
2860/1/1	U	M	-	-	-	-	-	-	-	274	-	91
2862/1/1	U	U	10.9	-	-	-	-	-	-	104	-	52
2862/2/1	U	M	-	-	-	-	-	-	-	341	-	114
2862/3/1	U	F	-	-	-	-	-	-	-	341	-	114
2863/1/1	**81**	**M**	**28.6**	**24.2**	2.7	-	-	-	-	-	-	-
2863/2/1	**82**	**F**	4.1	**24.2**	-	-	-	-	-	-	-	-
2864/1/1	**55**	**M**	17.7	**20.5**	0.1	-	-	-	-	-	-	-

Person ID number	Age	Gender	Fish	Crustaceans	Molluscs	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
2864/2/1	**55**	**F**	17.7	**20.5**	0.1	-	-	-	-	-	-	-
2865/1/1	**61**	**M**	-	**27.6**	-	-	-	-	-	-	-	-
2865/2/1	**58**	**F**	-	**27.6**	-	-	-	-	-	365	-	-
2865/3/1	**23**	**M**	-	**27.6**	-	-	-	-	-	-	-	-
2865/4/1	**25**	**M**	-	**27.6**	-	-	-	-	-	-	-	-
2867/1/1	**68**	**M**	**26.2**	-	-	-	103	-	-	239	-	71
2868/1/1	53	M	-	-	-	-	-	-	-	30	-	-
2868/2/1	49	M	-	-	-	-	-	-	-	30	-	-
2869/1/1	74	M	-	-	-	-	-	-	-	91	-	-
2870/1/1	41	M	-	-	-	-	-	-	-	104	-	-
2870/2/1	65	M	-	-	-	-	-	-	-	104	-	-
2872/1/1	26	F	-	-	-	-	-	-	-	13	-	-
2872/2/1	28	F	-	-	-	-	-	-	-	13	-	-
2873/1/1	**44**	**F**	-	-	-	-	304	-	-	**608**	-	-
2874/1/1	70	M	-	-	-	-	-	-	132	87	-	-
2874/2/1	40	M	-	-	-	-	-	-	132	87	-	-
2874/3/1	72	F	-	-	-	-	-	-	-	-	-	-
2874/4/1	43	F	-	-	-	-	-	-	-	-	-	-
2875/1/1	65	M	-	-	-	-	-	-	-	235	-	-
2875/2/1	62	F	-	-	-	-	-	-	-	235	-	-
2876/1/1	31	F	-	-	-	-	-	-	-	122	-	-
2877/1/1	53	M	-	-	-	-	-	-	-	183	-	-
2877/2/1	55	F	-	-	-	-	-	-	-	183	-	-

Person ID number	Age	Gender	Fish	Crustaceans	Molluscs	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
2877/3/1	20	F	-	-	-	-	-	-	-	76	-	-
2877/4/1	19	F	-	-	-	-	-	-	-	76	-	-
2878/1/1	**65**	**F**	-	-	-	-	-	-	-	**730**	-	-
2879/1/1	47	M	-	-	-	-	-	-	-	274	-	-
2880/1/1	73	F	-	-	-	-	-	-	-	13	-	-
2881/1/1	84	F	-	-	-	-	-	-	-	183	-	-
2882/1/1	62	M	-	-	-	-	78	-	-	78	-	-
2882/2/1	56	F	-	-	-	-	78	-	-	78	-	-
2883/1/1	**58**	**F**	-	-	-	-	**548**	-	-	**548**	-	-
2883/2/1	74	M	-	-	-	-	26	-	-	26	-	-
2884/1/1	60	F	-	-	-	-	104	-	-	-	-	-
2884/2/1	60	M	-	-	-	-	104	-	-	-	-	-
2885/1/1	69	M	-	-	-	-	-	-	-	104	-	-
2885/2/1	58	F	-	-	-	-	-	-	-	104	-	-
2887/1/1	57	F	-	-	-	-	-	-	-	39	-	-
2888/1/1	**72**	**F**	-	-	-	-	-	-	-	**1460**	-	-
2889/1/1	55	F	-	-	-	-	-	-	-	313	-	-
2889/2/1	56	M	-	-	-	-	-	-	-	313	-	-
2890/1/1	59	M	15.6	10.6	-	-	-	-	-	286	-	-
2890/2/1	**31**	**M**	15.6	-	-	-	-	-	-	-	-	**587**
2893/1/1	**U**	**M**	-	-	-	-	-	-	-	-	36	36
2896/1/1	**63**	**M**	**23.7**	-	-	-	-	-	-	-	-	-
2896/2/1	**64**	**F**	**23.7**	-	-	-	-	-	-	-	-	-

Person ID number	Age	Gender	Fish	Crustaceans	Molluscs	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
2899/1/1	52	F	-	-	-	-	61	-	-	-	-	-
2902/1/1	**63**	**M**	1.6	-	-	-	-	-	**912**	-	-	-
2902/2/1	**59**	**F**	1.6	-	-	-	-	-	**365**	-	-	-
2902/3/1	**39**	**M**	1.6	-	-	-	-	-	**548**	-	-	-
2902/4/1	**28**	**F**	1.6	-	-	-	-	-	**365**	-	-	-
2902/5/1	**31**	**F**	1.6	-	-	-	-	-	**365**	-	-	-
2903/1/1	**76**	**M**	-	-	-	-	-	-	10	-	-	-
2904/1/1	**32**	**M**	2.4	-	-	-	-	-	-	344	-	**320**
2905/1/1	64	M	-	-	-	-	-	-	20	-	-	-
2905/2/1	65	F	-	-	-	-	-	-	-	274	-	-
2908/1/1	**84**	**M**	**23.7**	-	-	-	-	-	-	-	-	-
2908/2/1	**61**	**M**	**23.7**	-	-	-	-	-	-	313	-	**313**
2909/1/1	**U**	**M**	-	-	0.4	-	-	-	-	48	28	-
2909/2/1	U	F	-	-	4.1	-	-	-	-	-	-	-
2909/3/1	U	F	-	-	0.3	-	-	-	-	-	-	-
2911/1/1	U	M	-	-	-	-	-	-	-	-	-	105
2911/1/2	U	M	-	-	-	-	-	-	-	-	-	105
2911/1/3	U	M	-	-	-	-	-	-	-	-	-	105
2911/1/4	U	M	-	-	-	-	-	-	-	-	-	105
2911/1/5	U	M	-	-	-	-	-	-	-	-	-	105
2911/1/6	U	M	-	-	-	-	-	-	-	-	-	105
2911/1/7	U	M	-	-	-	-	-	-	-	-	-	105
2911/1/8	U	M	-	-	-	-	-	-	-	-	-	105

Person ID number	Age	Gender	Fish	Crustaceans	Molluscs	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
2911/2/1	**U**	**M**	-	-	-	-	-	-	-	-	**510**	-
2911/2/2	**U**	**M**	-	-	-	-	-	-	-	-	**510**	-
2911/2/3	**U**	**M**	-	-	-	-	-	-	-	-	**510**	-
2911/2/4	**U**	**M**	-	-	-	-	-	-	-	-	**510**	-
2911/2/5	**U**	**M**	-	-	-	-	-	-	-	-	**510**	-
2911/2/6	**U**	**M**	-	-	-	-	-	-	-	-	**510**	-
2911/2/7	**U**	**M**	-	-	-	-	-	-	-	-	**510**	-
2911/2/8	**U**	**M**	-	-	-	-	-	-	-	-	**510**	-
2911/2/9	**U**	**M**	-	-	-	-	-	-	-	-	**510**	-
2911/2/10	**U**	**M**	-	-	-	-	-	-	-	-	**510**	-
2912/1/1	**72**	**M**	**59.6**	**59.1**	**17.5**	-	-	26	-	**613**	18	-
2912/2/1	**71**	**F**	**33.4**	**40.9**	**9.8**	-	-	-	-	-	-	-
2912/3/1	**46**	**M**	**59.6**	**31.9**	1.5	-	-	**135**	-	-	-	-

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)
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

Year (report)	FISH					
	Species Composition	Total	Cod	Plaice	Other fish	Source of habits data
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

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
2003 (RIFE 9)	Crabs, Lobsters and *Nephrops* (80%:10%:10%)	27	21.6	2.7	2.7	2003 Survey

Year (report)	CRUSTACEANS					
	Species Composition	Total	Crab	Lobster	*Nephrops* or other crustaceans	Source of habits data
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)
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

Year (report)	CRUSTACEANS					
	Species Composition	Total	Crab	Lobster	*Nephrops* or other crustaceans	Source of habits data
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

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)
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

Year (report)	MOLLUSCS				
	Species Composition	Total	Winkles	Other molluscs	Source of habits data
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

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
2008 (RIFE 14)	Mud and sand	930	2008 Survey

Year (report)	INTERTIDAL OCCUPANCY		
	Substrate	h y^{-1}	Source of habits data
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

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	30.1	33.8	10.1	14.4	9.3	12.4	7.4	5.0	756

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

Profile Name	Number of individuals		Pathway Name																											
			Crustacea	Direct	Eggs	Fish - Freshwater	Fish - Sea	Fruit - Domestic	Fruit and nuts - Wild	Gamma ext - salt marsh	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	**15**		**29.6**	0.27	-	-	24.6	-	0.06	-	71	-	-	-	-	-	-	-	-	2.1	0.13	-	-	290	-	5	20	-	-	0.33	-
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	**27**		10.0	0.11	-	-	**35.5**	0.04	-	-	120	-	-	-	-	0.06	-	-	-	1.3	-	-	-	41	-	3	4	0.12	0.12	0.17	0.14
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 Salt marsh	**17**		-	-	-	-	0.47	-	-	**470**	12	-	-	-	-	-	-	-	-	-	-	-	<1	2	-	-	-	-	-	-	-
Occupants over Sediment	**44**		1.3	0.11	-	-	3.9	1.8	0.01	-	**720**	-	-	-	-	0.49	-	-	-	0.68	-	-	<1	3	5	2	17	1.0	1.5	0.89	1.2
Honey Consumers	**2**		-	-	-	4.2	-	-	5.0	-	-	**2.3**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5	38.9	10.0	2.5
Consumers of Marine Plants and Algae	**1**		-	-	-	-	-	-	-	-	220	-	**0.45**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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	2	330	0.18	-	1.0	3.5	**20.1**	1.0	0.27	-	-	-	-	-	-	-	-	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	**3**		33.4	-	-	-	31.0	-	-	-	450	-	-	-	-	-	-	-	-	**13.3**	-	-	-	8	-	-	-	-	-	-	-
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 growing 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 - 0.25km)	**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 - 0.5km)	**1**		-	1.00	24.2	-	-	-	-	-	-	-	-	-	-	-	39.5	-	-	-	-	-	-	-	-	**8510**	-	-	-	-	-
Local Inhabitants (0.5 - 1km)	**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

1. Expressed as the proportion of the profile members who are exposed to direct radiation.
2. Gamma ext - salt marsh only includes occupancy over salt marsh.
3. Gamma ext - sediments represents occupancy over mud; mud and sand; mud, sand and stones; sand; sand and stones.
4. Game meat includes venison and rabbits/hares.
5. Plume times are the sum of individuals' indoor and outdoor times.

The data used for these profiles is the 2018 Sellafield Habits Survey data updated with the 2019 and 2020 Sellafield Review data.

The means of the high-rate groups are determined by the 'cut-off' method and are emboldened on the diagonal.

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