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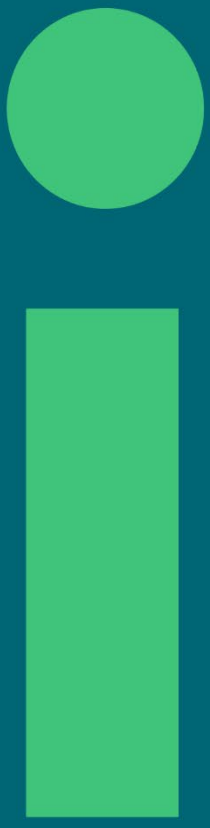
Radiological Habits Survey HMNB Clyde 2023



September 2025

Radiological Habits Survey: HMNB Clyde 2023

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List of abbreviations and definitions

BSSD	Basic Safety Standards Directive
DNSR	Defence Nuclear Safety Regulator
DORIS	Dispersion of Radionuclides into the Sea
EASR18	Environmental Authorisations (Scotland) Regulations 2018
ERL	Environmental Radioactivity Laboratory, University of Stirling
HMNB	His Majesty's Naval Base
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ILB	In-shore Lifeboat
MET	Meteorological
MoGSS	Mobile Gamma Spectrometry System
MoD	Ministry of Defence
NDAWG	National Dose Assessment Working Group
ONR	Office of Nuclear Regulation
PC-CREAM	Consequences of Releases to the Environment: Assessment Methodology
PLUME	Atmospheric dispersion model used within PC-CREAM
RESUS	The Re-Suspension Model
RIB	Rigid Inflatable Boat
RIFE	Radioactivity in Food and the Environment
RNAD	Royal Naval Armaments Depot
RNLI	Royal National Lifeboat Institute
SEPA	Scottish Environment Protection Agency
UK	United Kingdom
UKAS	United Kingdom Accreditation Service

Units

Bq	Becquerel	m	milli (one thousandth, E-3)
TBq	Terabecquerel	µ	micro (one millionth, E-6)
Gy	Gray	%	percentage
[H*(0.07)]	Directional dose equivalent at 0.07 mm skin depth	ha	hectare
Sv	Sievert	km	kilometre
mSv	milliSieverts	m	metres
µSv	microSieverts	cm	centimetre
nGy	nano Gray	y^{-1}	per year
eV	Electron volt	w^{-1}	per week
keV	kiloelectron volt	d^{-1}	per day
L	litres	h^{-1}	per hour
M	Mega (one million, E6)	Hz	hertz

Summary

This report presents the findings of the 2023 His Majesty's Naval Base (HMNB) Clyde habits survey to determine the habits, occupancy and consumption patterns of people living and undertaking recreational activities in the vicinity of HMNB Clyde, which comprises the Faslane Naval Base and the Royal Naval Armaments Depot (RNAD) at Coulport. The site has approval from the Scottish Environment Protection Agency (SEPA) to discharge both gaseous and liquid radioactive waste. There are also sources of direct radiation at this location.

The survey targeted three areas that were likely to be affected by discharges from the site, defined as:

- An aquatic survey area: covering the intertidal areas and waters of Gare Loch to the end of Rosneath Point on the western side and to Helensburgh Pier on the eastern side. This was extended to Cove on the western side of the Rosneath Peninsula.
- A terrestrial survey area: this included the 5km zone to the east of HMNB Clyde and the Rosneath Peninsula to the west of Gare Loch.
- The direct radiation survey area: extending a 1km zone of HMNB Clyde which relates to ionising radiation emanating directly from the site.

During the survey, several potential exposure pathways were investigated through methods including postal and face-to-face surveys and general observations. The survey was conducted in two parts: (i) Phase 1 - the face-to-face survey during the summer of 2023, which was undertaken within and outwith the local school holiday period; and (ii) Phase 2 - a follow up survey during winter 2023.

Data obtained during the survey included the consumption of foods produced within the terrestrial survey area; occupancy of both terrestrial areas and within the direct radiation survey area; consumption of aquatic food from within the aquatic survey area; occupancy of aquatic and intertidal areas; and the handling of equipment used within the aquatic survey area.

Interviews with members of the public were carried out over a period of 10 days and data for 238 individuals are presented and discussed for the face-to-face Phase 1

survey and a further nine individuals were re-surveyed within Phase 2. Those high-rate individuals are identified using established methods comprising a ‘cut-off’ to define the high-rate group and 97.5th percentiles for dose assessment analysis.

The aquatic survey area

The mean consumption rates for adult high-rate groups for each of these food groups were:

- 143kg y^{-1} for fish (cod, mackerel and pollock).
- 0.2kg y^{-1} for samphire.

Aquatic activities included bodyboarding, diving, outdoor swimming, Royal National Lifeboat Institute (RNLI) duties, stand-up paddleboarding, boat maintenance, canoeing, commute via boat, kayaking, power boating, sailing, sea angling and sports fishing.

Intertidal activities included sitting/picnicking/BBQ, beach clean/litter picking, beachcombing, bird surveys, collecting seaweed, dog walking, fishing, jogging, metal detecting, paddling, photography, playing, rock pooling, shore crew for RNLI, and walking. The activities found for adults involving the handling or maintenance of equipment included boats and boating equipment, clothes and overalls, diving gear, fishing gear and swimming gear.

The mean rates for the adult high-rate group for occupancy within the aquatic survey area were:

- 218h y^{-1} for activities in the water.
- 637h y^{-1} for activities on the water.
- 273h y^{-1} for handling equipment.
- 126h y^{-1} for handling sediment.

A total of 18 in-situ gamma dose rate measurements were made over intertidal surfaces during the survey period.

The terrestrial survey area

The mean consumption rates for the high-rate groups for terrestrial foods were:

- 20kg y^{-1} green vegetables.
- 19.5kg y^{-1} other vegetables.
- 21.7kg y^{-1} root vegetables.
- 113kg y^{-1} potatoes.
- 142kg y^{-1} domestic fruit.
- 18.7kg y^{-1} wild fruit.
- 3.5kg y^{-1} wild fungi.
- 6.6kg y^{-1} game (birds).
- 4kg y^{-1} game (rabbit/hare/squirrel).
- 22.7kg y^{-1} game (venison).
- 46.8kg y^{-1} beef.
- 5.5kg y^{-1} pig.
- 46.8kg y^{-1} sheep.
- 49.6kg y^{-1} eggs.
- 9.5l y^{-1} honey.
- 2 kg y^{-1} freshwater trout.

The direct radiation survey area

The highest occupancy rates in 2023, within the direct radiation area were as follows (holidays not considered):

- 8760h y^{-1} for the total occupancy rate (for a resident).
- 8760h y^{-1} for the indoor occupancy rate (for a resident).
- 2190h y^{-1} for the outdoor occupancy rate (for a resident).

Comparisons with previous surveys

The results of the HMNB Clyde 2023 Habits Survey were compared with the last habits survey carried out in 2016.

In the aquatic survey area, the overall mean consumption rate for the adult high-rate group for fish decreased in 2023 compared to 2016. The main species of fish consumed by adults in 2023 were cod, mackerel and pollock, compared with cod, mackerel, pollock, sea trout, wrasse, and dogfish in 2016. Crustaceans, molluscs,

wildfowl, and seaweed was consumed by adults in 2016 but not identified in 2023. Samphire was consumed by adults in 2023 but not identified in the 2016 survey.

The only fish species consumed by children in 2023 was mackerel compared with mackerel and pollock in the 2016 survey. No children were found to consume crustaceans, molluscs, wildfowl, or marine plants/algae in either the 2016 or 2023 habit surveys. No infants in 2023 were determined to consume aquatic foods compared with consumption of fish (mackerel and pollock), crustacean (brown crab and common lobster) and mollusc (mussels) in 2016.

The adult mean occupancy for the high-rate group for on water aquatic activities, handling of equipment and handling of sediment was found to be greater in 2016 than that determined in the 2023 survey. In water aquatic occupancy was greater in 2023 than in the 2016 survey.

The mean consumption rates for the high-rate group reported in the 2016 report were greater than those reported for 2023 for four food groups (green vegetables, root vegetables, pig meat and honey).

When compared with the 2016 survey, the 2023 total occupancy was the same, the highest indoor occupancy increased, and highest outdoor occupancy decreased.

Suggestions for changes to the monitoring programme

The following suggestion for changes to the current environmental monitoring programme are provided for consideration.

It is recommended that mussels and mushroom sampling remain as part of the monitoring programme.

1 Introduction

1.1 Regulatory context

The HMNB Clyde establishment consists of the naval base at Faslane and the Royal Naval Armaments Depot (RNAD) at Coulport. Babcock Marine, a subsidiary of Babcock International Group plc, operates HMNB Clyde, Faslane in partnership with the MOD. However, the MOD remains in control of the undertaking, through the Naval Base Commander, Clyde (NBC Clyde) in relation to radioactive waste disposal. MOD through NBC Clyde also remains in control of the undertaking at Coulport although many of the activities undertaken at Coulport have been outsourced to an industrial alliance comprising of AWE plc, Babcock and Lockheed Martin UK (known as ABL). HMNB Clyde has Letters of Approval with SEPA that provide the equivalent licensing conditions of Environmental Authorisations (Scotland) Regulations 2018 (EASR 18).

The current United Kingdom (UK) legislation, relating to radioactivity, provides uniform safety standards to protect the health of workers and members of the public. The UK's statutory obligation is now under the International Atomic Energy Agency (IAEA) Basic Safety Standard, (General Safety Requirements) Part 3, Schedule III.3 for the 1 mSv committed effective dose and 50mSv skin annual dose limit since leaving the European Union (IAEA, 2014). This lays down basic safety standards for protecting people against the impact of exposure to ionising radiation. Following the UK's departure from the European Union, the UK agreed a nuclear cooperation agreement with the European Commission (2021), ensuring both parties continue working together on civil nuclear matters including safeguards, safety, and security.

The site discharges radioactive effluent and gases into the environment that may result in the exposure of the public by two primary pathways:

(i) Discharges to the aquatic environment.
(ii) Discharges to the atmosphere.

From these pathways, members of the public may be exposed through inhalation, ingestion of locally sourced food and/or indirectly due to external exposure to contaminated materials (Smith and Jones, 2003). In addition, there may be a direct

exposure pathway (commonly referred to as direct shine) from the site which members of the public could be exposed to as they undertake their day-to-day activities.

It is also recognised that enhanced doses from external exposure due to authorised discharges and the consumption of locally sourced foods may occur because of contemporary and historical discharges accumulating in the environment (Dale et al., 2008; Tyler et al., 2013). The discharges from the site are administratively regulated by agreement between SEPA and the MoD, to ensure the public and environment are protected.

1.2 Definition of the representative person

The optimal approach for assessing doses to the public is through a combination of site-specific habit data and an environmental monitoring programme to determine ambient dose rates and concentrations in foodstuffs. In addition to the various interactions an individual may have with exposure routes, the actual doses received are also dependent upon age, size, and metabolism. Thus, the standard approach is to identify and consider these sources of variability in appropriate groups. The concept of the representative person was introduced by the International Commission on Radiological Protection (ICRP, 2006) and recommended to replace the previously used concept of the critical group in 2007 (ICRP, 2007). The representative person is the individual that represents the more highly exposed members of the public and is typically defined by a cut-off, e.g., the top 97.5% of the dose distribution within one or more routes of exposure. Within this concept, if the dose received by the representative person(s) can be demonstrated to be within the accepted dose limits and constraints, then the public are considered to be protected.

Within the scope of this report the information provided will assist SEPA in determining the representative person within the HMNB Clyde area. The representative person is established using environmental monitoring data in conjunction with habits survey data.

1.3 Dose limits and constraints

The system of dose limitation recommended by ICRP (2007), and subsequently in UK legislation, requires that: the retrospective maximum permissible dose limits do not exceed 1mSv y^{-1} from all anthropogenic sources. For prospective assessments, the maximum permissible doses or constraints used by SEPA are:

(i) 0.3mSv y^{-1} for any single source of radioactivity.
(ii) 0.5mSv y^{-1} for a single site from which radioactive discharges are made.

It is also accepted by the UK Government that it should be possible to operate existing nuclear facilities without exceeding the 0.3mSv y^{-1} constraint (Hunt et al., 1982; Leonard et al., 1982). It is therefore incumbent upon SEPA to ensure that these dose limits/constraints are not exceeded for all authorised discharges of ionising radiation to the environment.

1.4 Habits survey aim

The aim of the habits survey is to collect site-specific data to allow a bespoke assessment to be made that identifies the representative individual(s). The identification of the representative person is a result of combining known information on the consumption of local foods and occupancy times with data from SEPA's routine environmental monitoring programme. The survey aims to collect data on the consumption rates of locally grown foods and occupancy times to identify the doses to the most representative person(s). The survey also aims to identify any habits which the routine programme does not currently adequately cover and may recommend the adoption of new monitoring due to new or changing habits or the removal of monitoring that is no longer required. The survey does this by:

(i) Collecting data on a range of habits/activities by the public in the environment immediately surrounding the nuclear site and surrounding areas that might lead to exposure to radioactivity or radiation from any combination of licensed liquid or gaseous discharges, or direct radiation from on-site activities at HMNB Clyde.
(ii) Collecting information on consumption of food grown or produced (including wild and free foods) in the survey area and determining an annual rate of

consumption for each individual surveyed and household members of all ages.

This report presents the findings for the 2023 habits survey of the HMNB Clyde. All raw data can be found in Appendix A1. The previous survey was undertaken (fieldwork components) during the periods 2 – 8 May and 14 – 18 July 2016 (Dale et al., 2017).

2 The survey

2.1 Introduction

This chapter describes the site characteristics including recent and prospective site activities, and the surrounding land cover characteristics. In preparation for the survey, a teleconference meeting was held with HMNB Clyde site operators and the SEPA site inspector in May 2023.

The HMNB Clyde Habits Survey was raised at the Local Liaison Committee meeting by SEPA, however, the face-to-face fieldwork surveys were undertaken prior to the meeting taking place in August 2023.

2.2 HMNB Clyde site activity

2.2.1 Current on-site activity and changes since 2016

HMNB Clyde was initially constructed during the Second World War as a Royal Naval Base, converting to a submarine base in the 1960s and home to the UK's nuclear deterrent. HMNB Clyde, known throughout the Royal Navy as Faslane, is home to various classes of submarine and other naval vessels. The RNAD at Coulport Coulport), 8 miles from Faslane, stores, processes, maintains and issues equipment for the base. More than 6,500 civilians and naval service personnel work on the site.

HMNB Clyde is a MoD authorised site. Nuclear and radiological safety is regulated by MoD internal regular Defence Nuclear Safety Regulator (DNSR). The ONR regulates activities at this non-licensed site under the Health and Safety at Work Act 1974 and relevant statutory provisions, principally the Ionising Radiations Regulations 2017, the Radiation (Emergency Preparedness and Public Information) Regulations 2001 and the Management of Health and Safety at Work Regulations 1999 (amended 2006). The MoD has Crown Exemption from EASR18 therefore SEPA administratively apply the equivalent requirements to EASR18 under Letters of Agreement.

The MoD and SEPA have agreed discharges of liquid and gaseous radioactive materials into Gare Loch and around Coulport. Liquid and gaseous waste are

discharged from HMNB Faslane and gaseous waste from RNAD Coulport. In 2021, there were three occasions when liquid waste was discharged, in 2022, there was one occasion, and at the time of the site meeting (May 2023), it was reported that there has been one liquid waste discharge into Gare Loch. On each occasion, the discharge was made during the tidal window (one hour prior to high tide and three hours post high tide). The solid waste from HMNB Clyde consists of low-level radioactive waste and is transported offsite for authorised incineration or reprocessing. Discharge limits have been set for cobalt-60, tritium, gross alpha and gross beta at HMNB Clyde.

The Kings Harbour Master and Clyde Marine Police Unit control the movement of all non-naval vessels - leisure vessels are not permitted within the base area.

Construction for a new nuclear support hub commenced towards the end of 2016 and was completed in 2023 and is currently being commissioned. SEPA's issued a new Letter of Approval effective from 1 January 2025 which includes the NSH discharge point.

2.3 Estimated activity concentrations from discharges from HMNB Clyde and RNAD Coulport

At the time of the survey the liquid discharge limits agreed with SEPA were tritium (1.0E+12Bq y^{-1}), cobalt-60 (5.0E+8Bq y^{-1}), alpha (2.0E+8Bq y^{-1}, assessed as plutonium-239) and betas (5.0E+8Bq y^{-1}, assessed as caesium-137) from HMNB Clyde in the Radioactivity in the Food and Environment report 2021 (RIFE 27) were used to calculate aquatic activity concentrations in water using the DORIS model within PC-CREAM version 1.5.1.92 (database version 2.0.0 (Smith and Simmonds, 2009)[1]. A continuous release was assumed when modelling activity concentrations in unfiltered seawater, fish, seaweed, crustaceans, and molluscs over a 50-year period. The default values for the Faslane area in PC-CREAM were used for all element dependent parameters (e.g., sediment distribution coefficients, K_d and concentration factors), local compartment details (depth, coastline length, volumetric exchange rate, suspended sediment load, sedimentation rate, sediment density and diffusion rate) and regional model information (volume, depth, suspended sediment load, sedimentation rate, sediment density, diffusion rate).

Activity concentration values reported at 50 years for unfiltered seawater in the immediate vicinity of HMNB Clyde were estimated to be:

Tritium, 1.01E-2Bq l^{-1}

Cobalt-60, 3.55E-6Bq l^{-1}

alpha, 1.89E-6Bq l^{-1}

betas, 5.00E-6Bq l^{-1}

Estimated activity concentrations in different foodstuffs are given in Table 2.1.

Table 2.1: Estimated activity concentrations in foodstuffs

Food type	Tritium Bq kg^{-1}	Cobalt-60 Bq kg^{-1}	alpha Bq kg^{-1}	betas Bq kg^{-1}
Fish	1.01E-2	1.18E-3	9.46E-5	4.85E-4
Crustaceans	1.01E-2	1.18E-2	1.89E-4	1.46E-4
Molluscs	1.01E-2	5.90E-3	2.84E-3	1.46E-4

Atmospheric activity concentrations were modelled using the PLUME model in PC-CREAM (Smith and Simmonds, 2009). The permitted gaseous discharges from Coulport were modelled and included tritium (5.0E+10Bq y^{-1}) (RIFE 27). PLUME was set to calculate activity concentrations released from a height of 14 metres and at a range of distances from 500m to 25,000 metres. The meteorological (MET) sampling scheme was applied using the default settings. However, the data extracted for the dose rates were based on the MET Pasquill D, selected by reviewing the local meteorological data. The activity concentrations in air are presented in Table 2.2.

Table 2.2: Activity concentrations in air (Bq m^{-3}) for Coulport from a 14m stack height

Distance (m)	Tritium
500	2.41E-3
1 000	7.69E-4
5 000	5.14E-5
10 000	1.70E-5
15 000	9.07E-6
20 000	5.88E-6
25 000	4.23E-6

Within PC-CREAM 08, tritium is assumed not to deposit to ground and therefore there is no external terrestrial exposure to be given. The only dose that comes from tritium is via inhalation of the contents of the plume (2.06E-3 µSv).

Note that as of January 2025 new discharge limits have been agreed with SEPA which are substantially lower than those in place at the time of the survey.

2.4 Survey areas

Following the assessment of the radionuclide concentrations modelled by PC-CREAM within the HMNB Clyde and surrounding environment, the 2023 Habits Survey was designed to encompass the marine and terrestrial environments likely to be affected by discharges, including the area of potential direct radiation shine from ionising radiation emanating directly from HMNB Clyde. These areas are consistent with the previous habits survey (Dale et al. 2017) and are shown in Figure 2.1. A survey of the full survey area (roads and coastline) was also undertaken. The 2023 survey areas focused on:

(i) A 1km zone from the boundary of HMNB Clyde (covering housing and land-use close to the site) which relates to the ionising radiation directly from the site.

(ii) The terrestrial survey areas included a 5km radial zone from the HMNB Clyde.

(iii) The aquatic survey areas include the intertidal areas and waters of Gare Loch to the end of Rosneath Point on the western side and to Helensburgh Pier on the eastern side. The aquatic area from Rosneath Point to Cove Bay on the western side of the Rosneath Peninsula was also included.

2.5 Land cover data

The land cover is presented in Figure 2.2. HMNB Clyde is immediately surrounded by broadleaved and mixed woodland, which tends to dominate the low-lying areas surrounding Gare Loch. These are interspersed by villages, isolated buildings and small pockets of land used for arable farming or horticulture. To the west of Faslane, the Rosneath Peninsula is dominated by coniferous woodland, rough low productivity grassland and small areas of dwarf shrub heath with some improved grassland on the western side of the Peninsula. To the east of Faslane, and with increasing altitude, broadleaved woodland gives way to rough low productivity grassland, dwarf shrub heath to acid grassland and small areas of montane habitat.

Figure 2.1: The survey areas for the 2023 HMNB Clyde Habits Survey

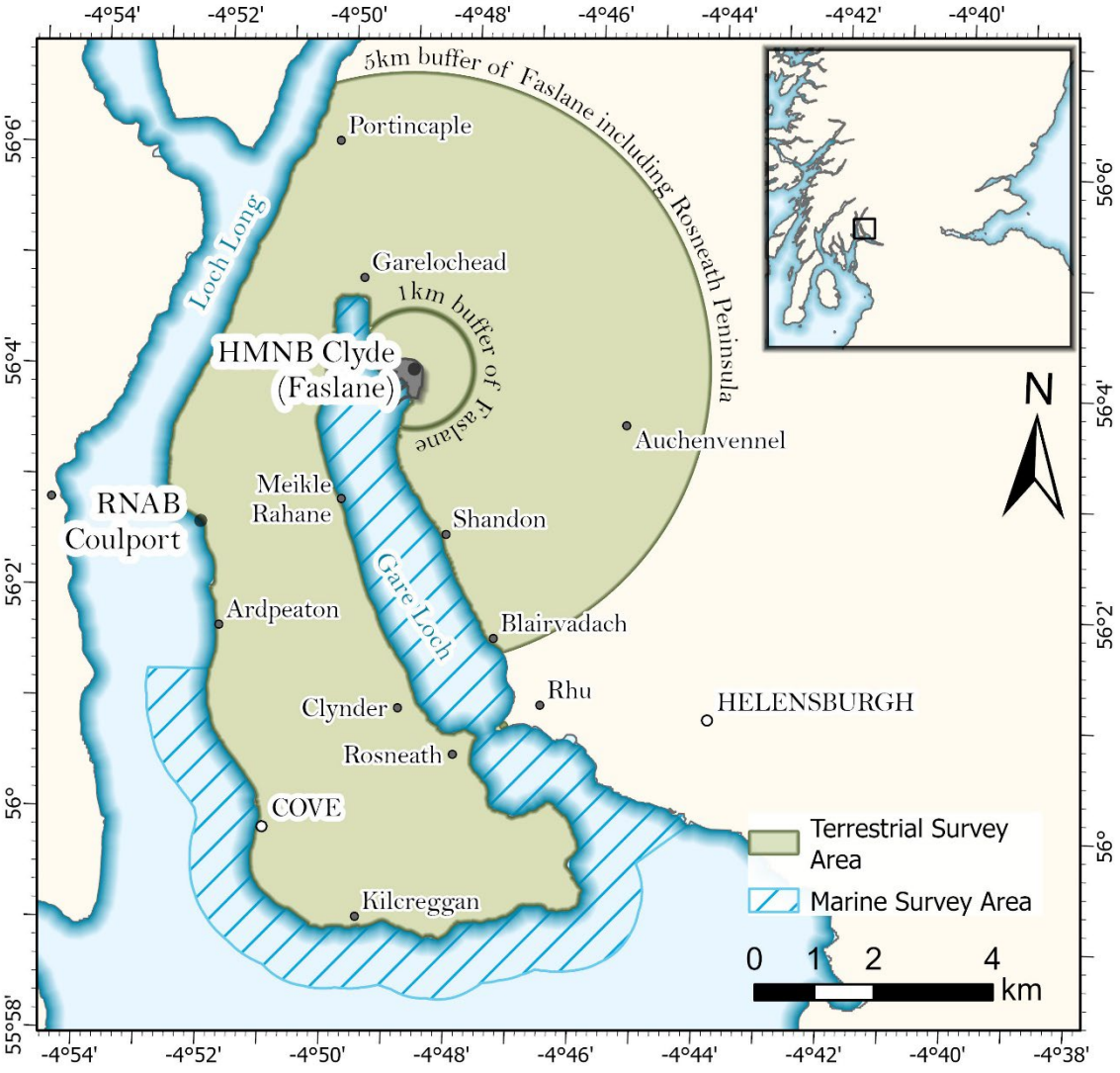
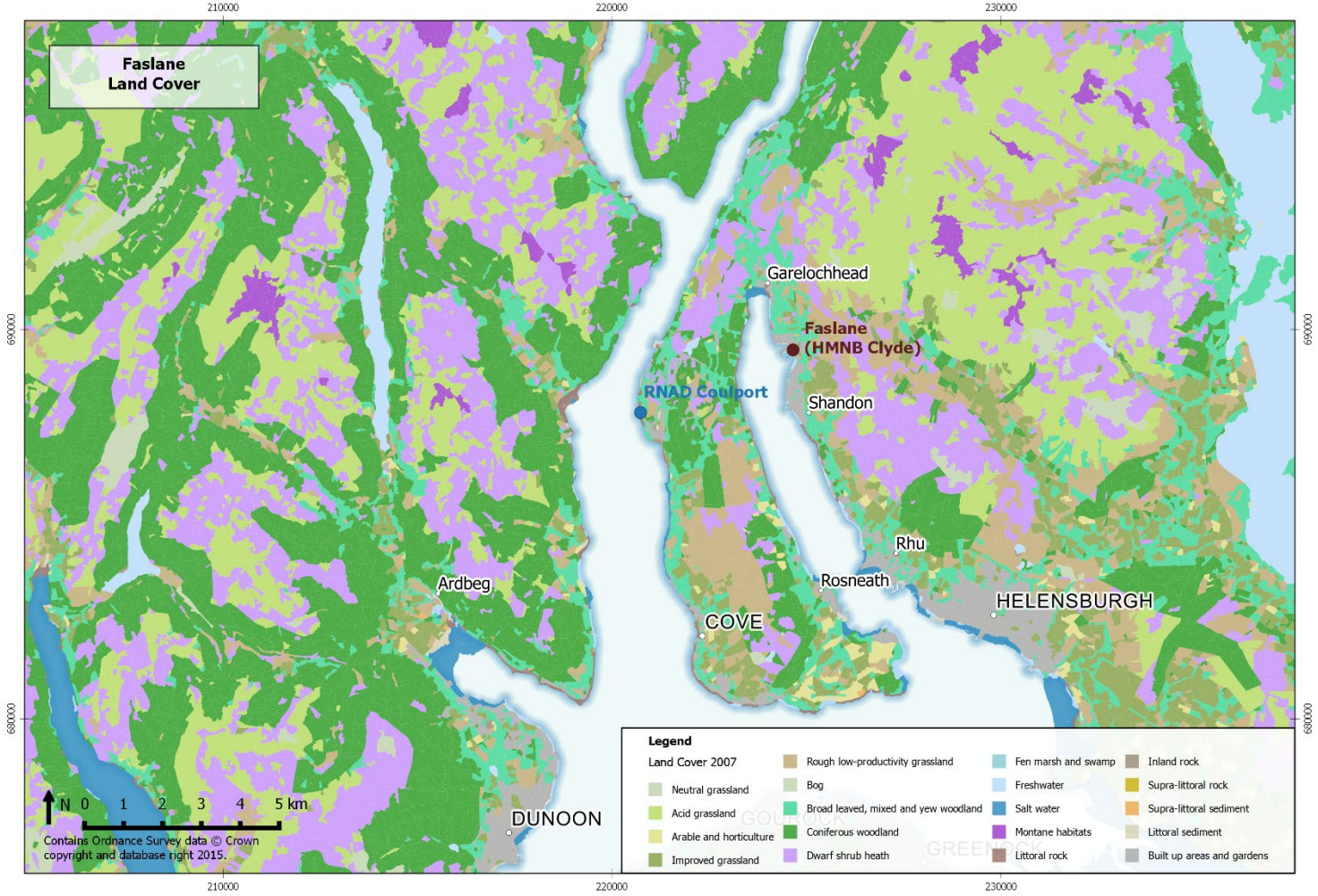


Figure 2.2: The land cover characterising the HMNB Clyde survey area and surrounds (Land Cover Map, 2007)



2.6 Soil data

The soil data are presented in Figure 2.3. The topographically low-lying parts of the survey, which have had marine influences in the past, are dominated by non-calcareous gleys and brown earths. With increasing altitude, the soil type is increasingly dominated by peaty gleys with some peaty podzols and undifferentiated peat.

2.7 Topographic wetness index

Catchment hydrology can be important in the redistribution of radionuclides. For example, organic soils can allow radionuclides (e.g., caesium-137 from fallout) to be transported in solution as well as in particulate form. When these hydrological flow paths cross from organic to mineral rich soils, the radionuclides can become bound to clays and oxides within the soil matrices. In extreme conditions, these areas have been shown to result in elevated concentrations of radioactivity (Tyler and Heal, 2000). Building on the soil and 50m resolution digital elevation model for Scotland using the Ordnance Survey Terrain 50 product, found at the Ordnance Survey Terrain 50, Figure 2.4 shows details of the hydrological flow paths within the survey area. The lighter area indicates low flow, water flowing away, whilst areas of increasing blueness represent wetter areas. This provides more detail of hydrological flow pathways and highlights areas where radionuclides from atmospheric fallout might accumulate.

Figure 2.3: Soil types dominating the HMNB Clyde survey area (The Macauley Institute for Soil Research)

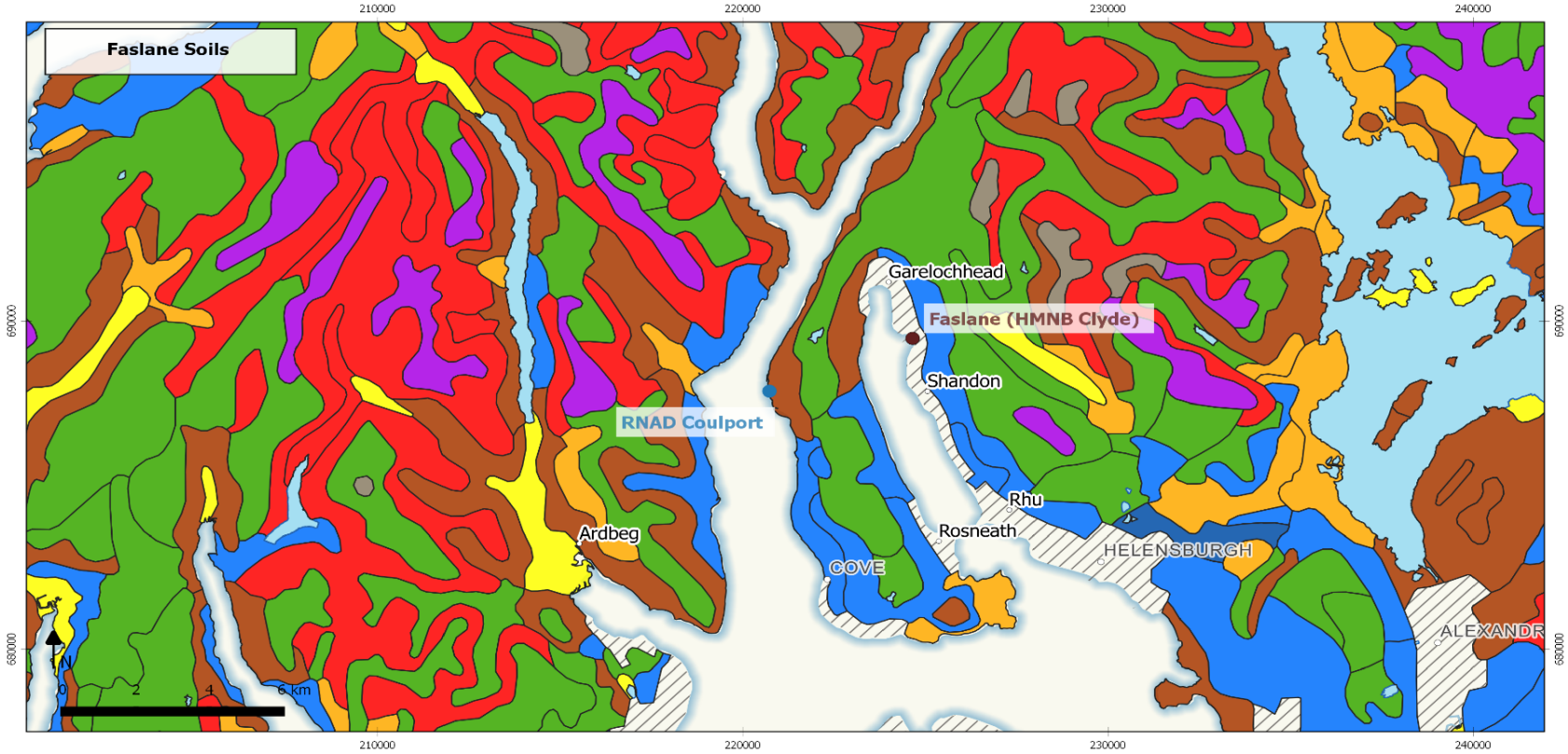
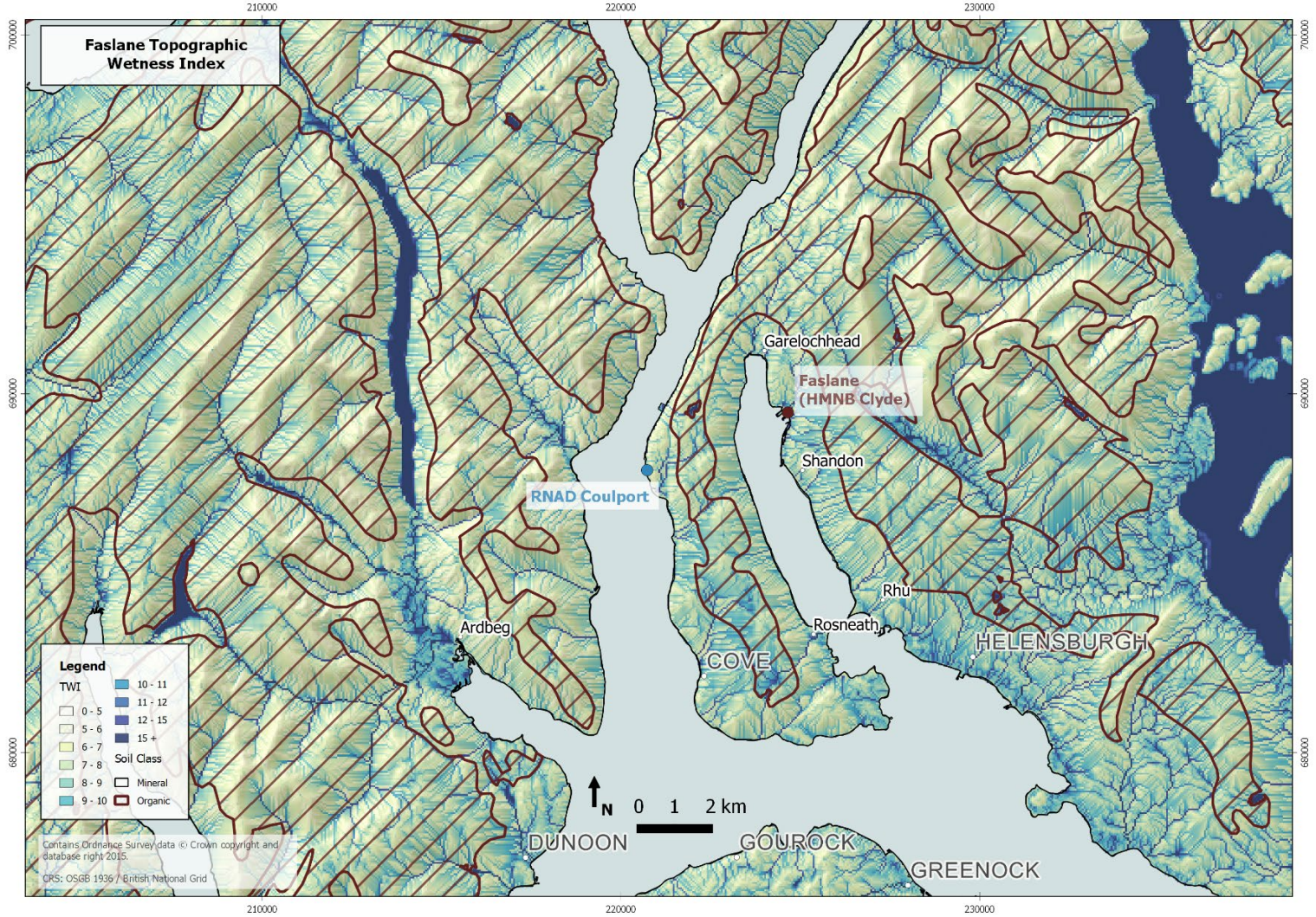


Figure 2.4: The topographic wetness index in the HMNB Clyde survey area



3 Methods

3.1 Introduction

To provide consistency and traceability to previous habit surveys, the methods employed and described in this chapter are largely based on the approach outlined in Leonard et al., (1982), Green et al., (2001) and National Dose Assessment Working Group (NDAWG) (2013). The previous habit surveys of the HMNB Clyde provided a useful frame of reference for undertaking this survey. Following the desktop study described in Chapter 2, the habit survey was defined and includes:

(i) An initial postal survey.

(ii) A mobile radiometric survey to characterise the heterogeneity of radiation in the environment surrounding the HMNB Clyde site.

(iii) Face-to-face surveys and follow-up phone calls.

(iv) A series of informal meetings during and after the face-to-face surveys to validate the data and findings.

3.2 Postal survey

To obtain a provisional assessment of the activity and food consumption habits of the local community living within the survey area, a postal questionnaire was distributed to 2000 households. The households were selected using a random sampling method and numbers varied according to the number of households found within each area. While the survey was sent to a particular individual in the household, the survey questions were designed to collect information on the habits of the people living in that household. Only one individual per household was therefore selected to receive the postal survey. The selected households included individuals living in the following geographical areas (Figure 3.1):

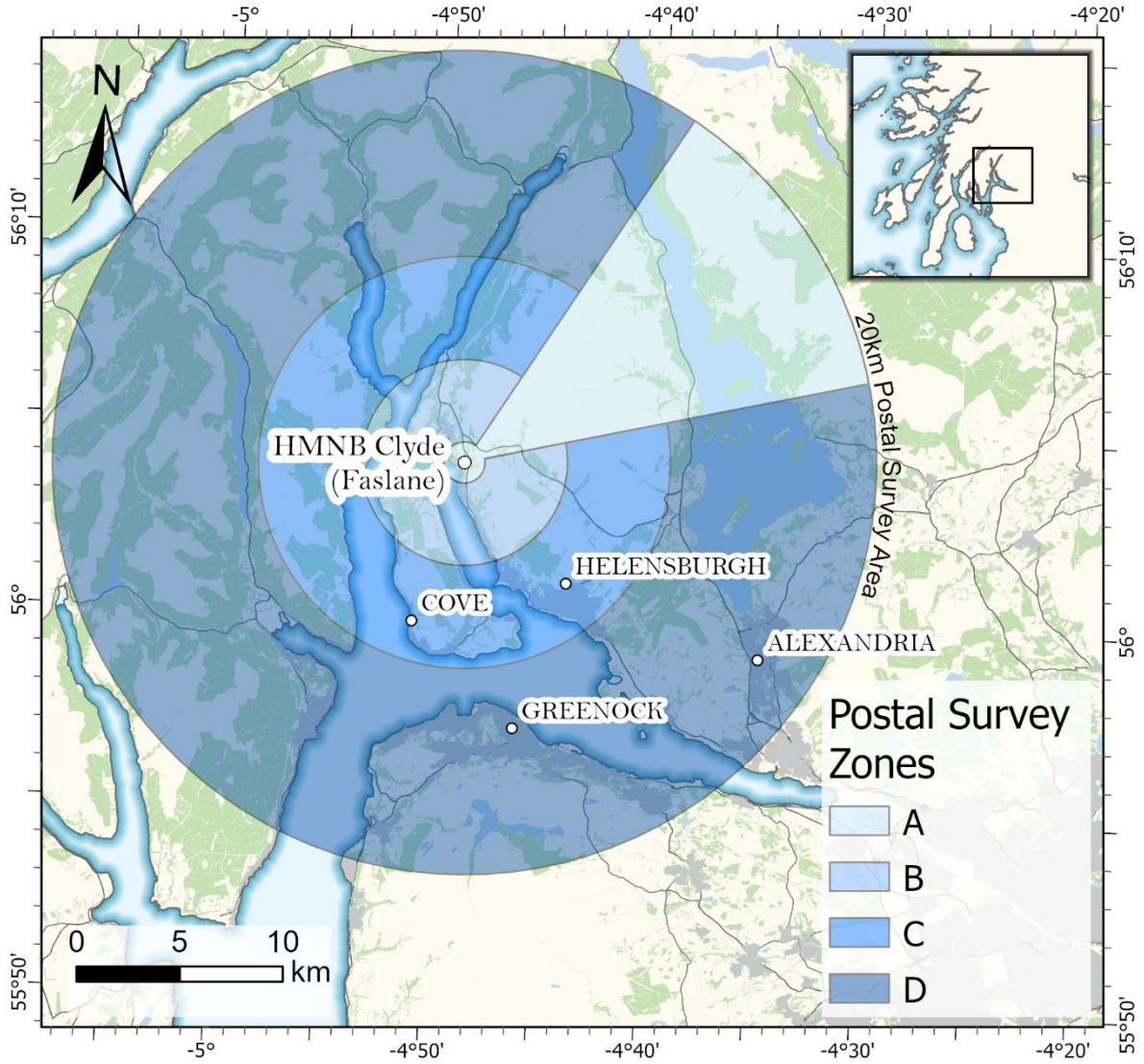
(i) Within the 1km radius surrounding the HMNB Clyde site and the geographical area within the predicted plume (Zone A).

(ii) Between 1km and 5km from the HMNB Clyde site outwith the predicted plume (Zone B).

(iii) Between 5km and 10km from the HMNB Clyde site outwith the predicted plume (Zone C).

(iv) Between 10km and 20km from the HMNB Clyde site outwith the predicted plume (Zone D).

Figure 3.1: Map showing the postal survey zones for the HMNB Clyde survey



The open electoral register was used for each of the zones of interest and contact details for households were randomly selected. Considering the reduced number of

households located under the modelled plume, surveys were randomly distributed to the houses. The following percentages reflect the total available postal addresses from the electoral roll for each zone, totalling 2000 households being randomly selected: Zone A - 50% (of available addresses within Zone A); Zone B 20% (of available addresses within Zone B); Zone C 20% (of available addresses within Zone C) and Zone D 20% (of available addresses within Zone D). The postal survey produced an independent data set from a broader cross section of the population living in the area, potentially providing the means to identify new or missed habits that might provide a useful focus to target during the face-to-face surveys or focus group discussions.

The postal survey included questions on food consumption, activities, and a map for identifying whereabouts the different activities were undertaken by household members. Further information can be found in Section 4 and Appendix A2.

3.3 Radiometric surveys

The radiometric surveys comprised a carborne and handheld gamma spectrometry survey, (Mobile Gamma Spectrometry System (MoGSS)), in-situ gamma dose rate and beta skin dose rate measurements.

3.3.1 In-situ dosimetry

The Environmental Radioactivity Laboratory (ERL) has ISO 17025:2017 accredited procedures for the deployment and recording of gamma dose rate in air using two Thermo Radeye instruments. Measurements were undertaken at all locations where occupancy or location may lead to potentially higher exposure to radioactivity because of HMNB Clyde site activities. These included areas that may have elevated radionuclide concentrations where fine sediment is known to accumulate (e.g., salt marshes and mudflats). The effective dose from terrestrial gamma radiation was calculated and reported in μSv h^{-1}. Further details of the in-situ methodology can be found in Appendix A3.

3.3.2 Beta dosimetry

A ruggedized Thermo BP19RD/Electra instrument was deployed to assess the beta dosimetry of skin dose [H'(0.07)]. The BP19RD provided a wide area monitor instrument (100cm^2) and was used to monitor item(s) that were used in the HMNB Clyde survey area and items potentially exposed to the higher radioactivity concentrations. Further details of the beta skin dosimetry can be found in Appendix A4.

3.4 Conduct of the survey

The pre-survey preparations involved:

(i) Discussions with SEPA over the requirements for the HMNB Clyde survey.
(ii) Reviewing past survey reports and maps to identify key information.
(iii) Compiling a directory of key groups involved in activities in the area from web searches and from people living in the survey area with relevant knowledge.
(iv) Agreeing the field survey programme with SEPA.
(v) University of Stirling staff conducted a carborne and handheld Mobile Gamma Spectrometry Survey (MoGSS) survey.

3.5 Meetings and informal contacts

In the 2023 survey, habits data and information were collected through a variety of approaches. This included contacting relevant parties and individuals for potential focus groups as well as 'standard' face-to-face interviews. The multi-methods approach facilitated a means to 'triangulate' (verify) the data gathered through the different approaches: e.g., to check occupancy and activity data against the 'snapshot' observations recorded over a limited number of days in one season acquired from the individual face-to-face interviews. It also provided some additional information about local produce grown and consumed by householders, garden clubs, horticulturalists and farmers and consumption of types of local food such as honey and game. Such information also aided in the development of survey data collection with individual contacts within relevant groups providing additional contacts to follow-up. These groups were approached prior to, during and after the face-to-face interviews by telephone and email.

A directory of local groups, bodies and organisations that potentially undertake relevant activities within the survey area was compiled prior to the field surveys. The directory proved an invaluable resource throughout the survey period both for contacting groups and for use as a checklist against which responses and non-responses from potentially important groups about activity, occupancy, exposure, and local food consumption could be recorded. For future surveys, the directory will provide a useful starting point and a means of monitoring any changes in group/business or other activity in the area.

3.6 Data conversion and analyses

During the face-to-face interviews, data on food consumption was recorded in units provided by respondents (e.g., pounds, grams, and ounces) and later converted into kilograms per year. The weights provided are for the fresh weight prepared and consumed. In some cases, respondents were unable to estimate food consumption in kilograms per year and instead gave the number of plants grown or the length and number of rows. These data were converted into consumption rates using conversion weights where possible e.g., one broccoli plant yields 700g (Garden Forum Horticulture, 2009; Hessayon, 2014) so that all consumption figures were reported in kilograms per year. Data for each survey were transferred to a bespoke Microsoft Access database for analysis. The figures reported from individuals are utilised within this report after the percentage of any gifting or waste deducted from the final annual figure(s).

3.7 Data rounding and grouping

All data collected from the face-to-face and postal surveys are reported to two significant figures. For the food consumption data, the total annual consumption (kg y^{-1}) of different food types were calculated by multiplying the quantity (kg) and frequency (times per year). The food items were placed into groups with similar attributes (Table 3.1). These groups are like those used in previous survey reports but with a focus on the most common encountered food types. Individuals were given the option to add any additional food items using an ‘Other’ food category.

The time (h y^{-1}) individuals spent carrying out activities was calculated by multiplying frequency (occasions per year) and duration (hours), whilst considering seasonality where appropriate. Data reported are after any holidays and working hours within their survey replies were accounted for. A ‘liquid’ category was also added to the survey for individuals who carry out aquatic activities that could result in their inadvertent ingestion of water, e.g., outdoor swimming/sailing.

The age groupings used in this report are based on ICRP recommendations and are listed below in Table 3.2.

Table 3.1: Food groups used in the HMNB Clyde Habits Survey

Food group	Example of foods within this group
Green leafy vegetables	Asparagus, broccoli, Brussel sprouts, cabbage, calabrese, cauliflower, celery, chard, herbs, kale, kohl rabi, lettuce, pak choi, rhubarb, marrow, spinach
Other domestic vegetables (legumes)	Broad beans, French bean, pea, runner beans
Root vegetables	Beetroot, carrot, celeriac, fennel, garlic, Jerusalem artichoke, leek, onion, parsnip, radish, shallot, spring onion, swede, turnip
Potato	Potato
Domestic fruit	Apple, blackberry, blackcurrant, blueberries, corn, courgette, cucumber, gooseberry, grape, pear, pepper, plum, raspberry, redcurrant, strawberry, tayberry, tomato
Milk	Milk, yoghurt, cheese
Cattle meat	Beef, buffalo
Pig meat	Pork
Sheep meat	Lamb, mutton
Poultry	Chicken, duck, goose, turkey
Eggs	Eggs
Wild/free foods	Blackberry, chestnuts, crab apples, damson, dandelion root, garlic, elderberry, elderflower, nettle, raspberry, rowanberry, sloe, strawberry
Honey	Honey
Venison	Venison
Fish	Bass, cod, Dover sole, kipper (herring), mackerel, pollock, salmon, sea trout, trout (freshwater)
Crustaceans	Brown crab, common lobster, shrimps
Molluscs	Mussels, razor clams, scallops, winkles
Wildfowl	Mallard, pink-footed goose, teal, widgeon

Food group	Example of foods within this group
Game - bird	Partridge, pheasant, quail

Table 3.2: ICRP age groups used in the dose assessment

Name of age group	Age range
Group 1 - Infant	0 to 5 year old
Group 2 - Child	6 to 15 year old
Group 3 – Adult	16 year old and over

3.8 Qualitative and quantitative observations

Whilst undertaking the face-to-face surveys, observational data were acquired on any obvious changes to each location such as new build housing, along with information on site usage and numbers of individuals undertaking specific habits. Observations were acquired over a specified time, e.g., 20 minutes, with both onshore and offshore (including intertidal) activities noted. The number of individuals, their gender and their approximate age were noted for each activity witnessed. Where large groups of people were observed, the number of individuals was estimated. After the observation period, individuals were approached where possible and subsequent face-to-face surveys conducted. Contact with individuals during face-to-face interviews frequently allowed the accuracy of observations to be checked and sometimes to be expanded, e.g., dog walkers might also engage in beachcombing and sailing at other times. Along with noting the weather conditions at the time of survey, this approach provided a basis for making a comparison with habits at different times of both day and seasons (e.g., within and outwith the period of the local school holidays).

One of the problems with this type of survey is being confident in a person's recollection of portion size/mass or occupancy/activity times. To address this, the survey team had information on what might be considered as reasonable ranges for

consumption of different foods. Where a survey individual's response was outwith these ranges, the survey team challenged and verified the response. To achieve this, visual aids of, e.g., portions of vegetables or fruit were shown to allow the individual to re-evaluate and confirm their data. With regards to occupancy, a similar approach was taken where all 'extreme' figures (identified as reasonable ranges from previous surveys) were also challenged. It is not possible to visualise 'time' so the survey individual's initial times would be calculated to a per year basis to show how this might be compared with their other daily habits and work life. If the surveyed individual confirmed the 'extreme' value, then these were recorded as this is the information the survey team were given. While the survey team's approach should minimise incorrect information from being collected, it remains possible that extreme results could still be reported and thus may be a potential source of error within the survey.

4 Postal survey

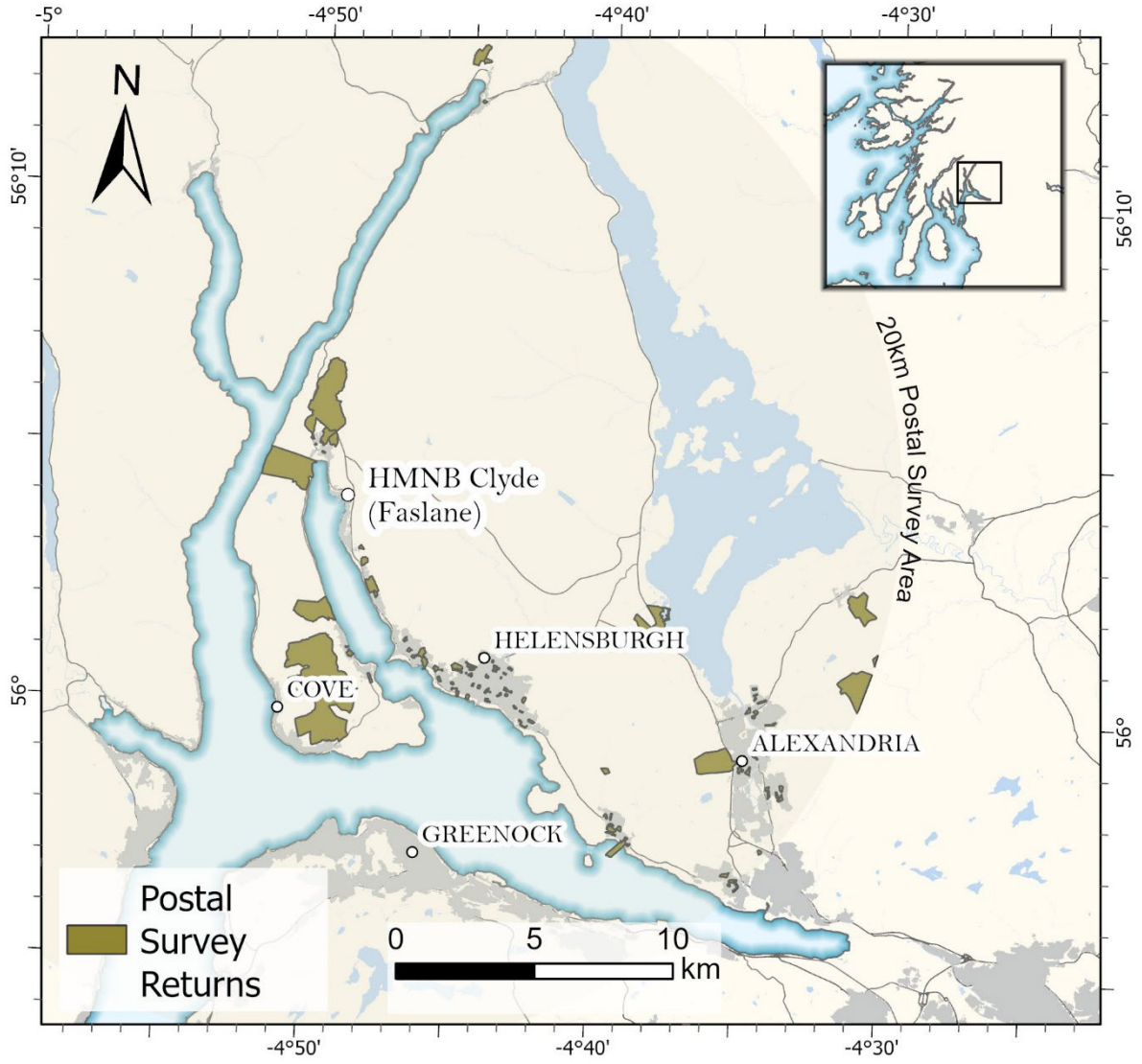
4.1 Introduction

The results from the postal survey provide an overview of the habits within an area of 20km radius centred on HMNB Clyde.

2000 postal surveys were sent out to households in the survey area and 133 postal returns were used in the analysis (Figure 4.1). This is comparable with previous habit postal surveys around the different nuclear sites across Scotland.

The postal survey proved useful for identifying where households undertook popular activities and the proximity of these activities to the HMNB Clyde site. The survey was not designed to capture the length of time individuals spent doing these activities. The postal survey results are presented in detail in Appendix A2.

Figure 4.1: **Postal survey returns density map (Zone A – 0-1km, Zone B – 1-5km, Zone C – 5-10km and Zone D – 10-20km)**



5 Aquatic radiation pathways

5.1 Introduction

Survey locations were established following the desktop review (Chapter 2) and to allow effective comparison with the previous HMNB Clyde Habits Survey in 2016 (Dale et al., 2017). The survey locations were visited throughout the survey period and observations of offshore and onshore activities were undertaken. The survey schedule ensured that each location was visited at different times of the day, reflecting the different activities occurring at each location.

5.1.1 Aquatic survey area descriptions

The survey locations were established from the analysis presented in Chapter 2 and to provide consistency with the previous HMNB Clyde Habits Survey undertaken in 2016. The aquatic survey area stretches from Helensburgh Pier in the eastern side of Gare Loch to Rosneath Point in the western side and to Garelochhead at the northern end of Gare Loch, including its intertidal areas.

The survey locations were visited throughout one survey period (26 June to 5 July 2023) for both outwith and during the school holiday period. Offshore and onshore observations were undertaken at each site.

The survey sites are reported from the western side of the survey area to the eastern side. See Appendix A5 for site descriptions and observations.

5.2 Commercial seafood operations

No trawling, creeling or net fishing was observed in the restricted channel at Rhu Narrows or in the protected or restricted areas at Faslane or Coulport. Rod fishing and fishing from a boat outwith the restricted area in the Gare Loch is permitted. No commercial winkle collection was identified during the survey fieldwork.

Anglers were identified during both the May and July face-to-face survey periods, although none of them sold their catch commercially. The main fish caught was mackerel.

Local fish sales via shop or van are sourced from outwith the survey area.

5.3 Non-commercial fishing and angling

Angling was a popular activity and non-commercial fishing took place at:

(i) Portincaple – boat.
(ii) Clynder and Gare Loch – boat and shore.
(iii) Helensburgh – pier.
(iv) Camsail Bay, Kilcreggan, Mambeg, Rhu Spit and Rosneath Peninsula – shore.

No bait digging or non-commercial fishing of molluscs and crustaceans was determined within the survey area.

Fishing was identified at Lindowan Reservoir and Mill Dam in the south of the Rosneath Peninsula.

5.4 Wildfowling

No wildfowling was identified within the survey area.

5.5 Royal National Lifeboat Institute (RNLI)

His Majesty's Coastguard and the RNLI are located at Rhu Marina. The lifeboat at Rhu Marina is a small in-shore lifeboat (ILB) and, from a volunteer crew of 18 to 20 people. A crew of four go out on the ILB when there is a call out and requires a shore crew for launching. The lifeboat crews have weekly training exercises for one to one and a half hours per session. Up to July 2023, at the time of survey, the lifeboat had been called out on approximately 20 occasions (consisting largely of towing for breakdowns).

5.6 Sailing and rowing

Within the aquatic survey area there are several sailing clubs that provide race meetings and training for members. The Sea Cadets launch from Faslane Naval Base and the Clyde Off-Site Centre with a membership for both adults and children.

Leisure boating is permitted outwith the restricted area from Faslane Naval Base.

5.7 Professional dog walkers

Professional dog walkers work within the survey area. Generally, these individuals are active along the coastal strip for longer periods. As dogs can enter the water and the route of walks often encompasses muddy and sandy areas, the group may potentially have greater exposure to intertidal substrates.

5.8 Animals grazing

Cows and sheep were observed grazing in several fields within and around the survey area. No cattle/sheep were observed grazing on seaweed or within intertidal areas anywhere within the survey area.

5.9 Seaweed foraging

Six individuals interviewed reported to collect seaweed from Garelochhead, north of Cove Bay towards Ardpeaton, Clynder, and the shore by Shandon for use on their garden which was used to grow vegetables. Three individuals rinsed the seaweed before application, and three individuals applied the seaweed directly to the soil with no rinsing.

5.10 Internal exposure – phase 1

5.10.1 Adults' consumption rates

Table 5.1 presents a summary of the consumption rates for aquatic food types including fish, crustaceans, molluscs, and wildfowl. Mean adult consumption rates for the high-rate groups and the observed 97.5th percentile rates are included in Table 5.1. The high-rate group was determined using a 'cut-off' method described by Hunt et al., (1982). This 'cut-off' method calculates the high-rate value by taking the mean of the values between the maximum observed rate and one third of the maximum observed rate. Therefore, the 'cut-off' method within this report is represented as the individuals derived to obtain the 'high-rate group'. The table also

includes mean consumption rates and 97.5th percentile rates based on the full dataset.

Table 5.1: Summary of adults' consumption rates of foods from the aquatic survey area

Food Group	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y $^{-1}$)	Observed minimum for the high-rate group (kg y^{-1})	Observed mean for the high-rate group (kg y^{-1})	Observed 97.5th percentile for the high-rate group (kg y^{-1})	Full dataset – Observed mean (kg y^{-1})	Full dataset – 97.5th percentile (kg y^{-1})	National Data mean (kg y^{-1})	National data 97.5th percentile (kg y^{-1})
Fish	43	2	180	106	143	178	14	104	15	40
Samphire	1	1	0.2	0.2	0.2	NA	0.2	NA	ND	ND

NA – not applicable

ND – not determined

The generic mean and generic 97.5th percentile rates based on National Habit Data is also included (Smith and Jones, 2003). The national data are used to compare the high-rate mean and high-rate maximum consumers within the habits survey. During the HMNB Clyde habits survey it became apparent that the national data do not consider any extreme habits of consumption. For example, there may be regional or local differences in habits which may result in very different rates of consumption for fish (Table 5.1), which is vastly greater than the national mean and may represent an important local pathway. It may be necessary to consider that the national data cannot capture local or regional variations in habits, which may have local significance within habits-based assessments.

Adults consumed cod (1 individual), mackerel (43 individuals) and pollock (3 individuals), all sourced from within the aquatic survey area. It should be noted that some adults consumed more than one fish type (flat and/or round). The observed maximum consumption (quantity times frequency) of fish was 180kg y^{-1} and this individual consumed mackerel that was all self-caught from within the survey area. The mean fish consumption for the adult high-rate group was 143kg y^{-1}.

No adult consumption of crustacean, mollusc or wildfowl was determined within the survey area.

5.10.2 Children's consumption rates

Table 5.2 presents a summary of children's consumption rates of fish from the aquatic survey area. Mean consumption rates for the high-rate groups and the observed 97.5th percentile rates are included in Table 5.2.

There was no consumption determined for crustacean, mollusc or wildfowl within the child age group and no aquatic consumption determined for the infant age group.

For the child age group, mackerel (six individuals) was consumed by children. The observed maximum consumption was by two individuals each consuming 5.2kg y^{-1} self-caught from within the survey area by a family member.

Table 5.2: Summary of children's consumption rates of foods from the aquatic survey area

Age Group	Food Group	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y^{-1})	Observed minimum for the high-rate group (kg y^{-1})	Observed mean for the high-rate group (kg y^{-1})	Observed 97.5th percentile for the high-rate group (kg y^{-1})	Full dataset – Observed mean (kg y^{-1})	Full dataset – 97.5th percentile (kg y^{-1})
Child (6 to 15 years)	Fish	6	6	5.2	4.5	4.7	5.2	4.7	5.2

5.11 External exposure – phase 1

Occupancy rates for adults in intertidal activities are presented in Table 5.3 and occupancy rates for adult's aquatic (in water), aquatic (on water), handling rates of equipment and handling rates of sediment are presented in Table 5.4.

The activities undertaken by adults in the high-rate group over the following intertidal substrates included:

Rock: fishing at Helensburgh Pier.

Sand: beachcombing at Helensburgh beach.

Sand and stones: beachcombing at Helensburgh beach and Cove beach; litter picking at Helensburgh beach and Cove beach; dog walking at Cove beach, Helensburgh beach and Garelochhead; and beach clean at Garelochhead.

Stones: dog walking at Faslane beach, Kilcreggan beach, Rosneath Bay; beachcombing at Faslane beach; walking at Rosneath Bay; sitting/picnicking/BBQ at Rosneath Bay; and fishing at Camsail Bay, Rosneath and Mambeg.

Intertidal activities for adults included sitting/picnicking/BBQ, beach clean/litter picking, beachcombing, bird surveys, collecting seaweed, dog walking, fishing, jogging, metal detecting, paddling, photography, playing, rock pooling, shore crew for RNLI, and walking. The highest intertidal occupancy rate was 730h y^{-1} for an individual who spent time dog walking on sand and stone substrate within the survey area. The highest occupancy on rock substrate was 416h y^{-1} for an individual who spent time fishing within the survey area. The highest occupancy on sand substrate was 78h y^{-1} for an individual who spent time beachcombing within the survey area. The highest occupancy on stone substrate was 365h y^{-1} for an individual who spent time dog walking within the survey area.

Table 5.3: Summary of adults' external exposure for intertidal substrates

Intertidal Substrate	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (h y^{-1})	Observed minimum for the high-rate group (h y^{-1})	Observed mean for the high-rate group (h y^{-1})	Observed 97.5th percentile	Observed mean for the full dataset (h y^{-1})	Observed 97.5th percentile for the full dataset (h y^{-1})
Rock	9	1	416	416	416	NA	66	340
Sand	4	1	78	78	78	NA	27	74
Sand and stones	54	7	730	260	509	730	101	688
Stones	48	8	365	130	267	365	67	355

Activities in the water included bodyboarding, diving, outdoor swimming, RNLI duties and stand-up paddleboarding. The highest occupancy rate for adults in the water was 293h y^{-1} for an individual who spends time stand-up paddleboarding within the survey area. Activities on the water included boat maintenance, canoeing, commute via boat, kayaking, power boating, RNLI duties, sailing, sea angling and sports fishing. The highest occupancy rate for adults on water was 806h y^{-1} for an individual who spends time kayaking (468h y^{-1}) and sea angling (33h y^{-1}). Adults handled equipment within the survey area and the activities for adults involved; handling boats, and boating equipment, handling clothes and overalls and fishing gear. The highest level of handling equipment was 416h y^{-1}. This individual spent time handling fishing gear.

The highest level of handling sediment was 171h y^{-1}, and this is for an individual who spends time beachcombing (113h y^{-1}) and litter picking (58h y^{-1}). The occupancy data for intertidal activities were used for estimating the external gamma dose rate. Selected relevant intertidal activity occupancy data were also used to derive the handling sediment category which was then used for estimating the beta skin dose rate. Intertidal activities comprised: sitting/picnicking/BBQ, beach clean/litter picking, beachcombing, collecting seaweed, metal detecting, paddling, playing, rock pooling and shore crew for RNLI.

Table 5.4: Summary of adults' external exposure for aquatic (in water and on water), handling of equipment and handling of sediment

Activity	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (h y^{-1})	Observed minimum for the high-rate group (h y^{-1})	Observed mean for the high-rate group (h y^{-1})	Observed 97.5th percentile for the high-rate group (h y^{-1})	Observed mean for the full dataset (h y^{-1})	Observed 97.5th percentile for the full dataset (h y^{-1})
Aquatic (in water)	21	3	293	180	218	287	46.4	236
Aquatic (on water)	21	2	806	468	637	798	108	637
Handling equipment	50	5	416	144	273	411	51.7	335
Handling sediment	35	8	171	72	126	168	41.3	158

Occupancy rates for children and infants for intertidal activities are presented in Table 5.5 and occupancy rates for adults' aquatic (in water), aquatic (on water) activities, handling rates of equipment and handling rates of sediment are presented in Table 5.6.

Intertidal activities for children included sitting/picnicking/BBQ, beachcombing, dog walking, fishing, paddling, and playing.

The activities undertaken by children in the high-rate group over the following intertidal substrates included:

Sand and stones: fishing at Rhu Spit.

Stones: dog walking at Rosneath Bay; fishing at Camsail Bay; sitting/picnicking/BBQ at Mambeg; and, paddling at Mambeg.

The highest intertidal occupancy rate for children was 208h y^{-1} for an individual who spent time on stone substrate fishing within the survey area. The highest occupancy on sand and stone substrate was 1.5h y^{-1} for an individual who spent time fishing within the survey area.

Intertidal activities for infants included fishing and playing.

The activities undertaken by infants in the high-rate group over the following intertidal substrates included:

Stones: fishing at Camsail Bay; and playing at Rhu Spit.

The highest intertidal occupancy was 208h y^{-1} for an infant who spent time on stone substrate fishing within the survey area.

Table 5.5: Summary of children's and infants' external exposure for intertidal activities

Age group	Substrate	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group ($h\ y^{-1}$)	Observed minimum for the high-rate group ($h\ y^{-1}$)	Observed mean for the high-rate group ($h\ y^{-1}$)	Observed 97.5th percentile for the high-rate group ($h\ y^{-1}$)	Observed mean for the full dataset ($h\ y^{-1}$)	97.5th percentile for the full dataset ($h\ y^{-1}$)
Child (6 to 15 years)	Sand and stones	2	2	1.5	1.5	1.5	1.5	1.5	1.5
Child (6 to 15 years)	Stones	9	4	208	114	157	207	82	205
Infant (0 to 5 years old)	Stones	2	1	208	208	208	NA	106	203

Children's activities in the water included outdoor swimming, sea cadets and stand-up paddleboarding. The highest in water occupancy was 39h y^{-1} for one individual who spent time in the water with sea cadet activities within the survey area. Children's activities on the water included kayaking, powerboating, rowing, and sailing. The highest occupancy rate was 234h y^{-1} for three children, each spending time powerboating within the survey area. The highest level of handling of equipment for children was 234h y^{-1} for three individual who spent time handling boats. The highest level of handling sediment for children was 114h y^{-1} for one individual who spent time playing and sitting/picnicking/BBQ within the survey area.

The highest level of handling of equipment for an infant was 208h y^{-1} for an individual who spent time handling fishing gear. The highest level of handling sediment for an infant was 3h y^{-1} who spent time playing within the survey area. There were no occupancy rates for in water and on water activities determined for infants.

The occupancy data for intertidal activities were used for estimating the external gamma dose rate for both children and infants. Selected relevant intertidal activity occupancy data were also used to derive the handling sediment category which was then used for estimating the beta skin dose rate. Intertidal activities comprised: sitting/picnicking/BBQ, beachcombing, paddling, and playing.

Gamma dose rate measurements over different substrates within the survey area can be found in Chapter 7.

Table 5.6: Summary of children's and infants' external exposure for aquatic (in water and on water activities), handling of equipment and handling sediment

Age Group	Activity	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group ($h\ y^{-1}$)	Observed minimum for the high-rate group ($h\ y^{-1}$)	Observed mean for the high-rate group ($h\ y^{-1}$)	Observed 97.5th percentile for the high-rate group ($h\ y^{-1}$)	Observed mean for the high-rate group ($h\ y^{-1}$)	Observed 97.5th percentile for the high-rate group ($h\ y^{-1}$)
Child (6 to 15 years)	Aquatic (in water)	5	4	39	19.5	28.5	38.8	23.6	38.7
Child (6 to 15 years)	Aquatic (on water)	5	3	234	234	234	234	154	234
Child (6 to 15 years)	Handling equipment	8	4	234	208	228	234	116	234
Child (6 to 15 years)	Handling sediment	4	2	114	114	114	114	71.6	114
Infant (0 to 5 years)	Handling equipment	1	1	208	208	208	NA	208	NA
Infant (0 to 5 years)	Handling sediment	1	1	3	3	3	NA	3	NA

6. Terrestrial radiation pathways

6.1 Introduction

Chapter 6 reports on inland routes of exposure immediately adjacent to HMNB Clyde (Faslane), coastal and intertidal areas (Figure 2.1). This chapter reports private food production details and the results from the face-to-face consumption levels for privately produced food stuffs.

6.1.1 Terrestrial survey area

The terrestrial survey area consisted largely of the Rosneath Peninsula to the west of Gare Loch. Much of the land within the survey area is agricultural with either cattle or crops. The terrestrial survey also included Glen Fruin, which had several houses and farms scattered throughout the 5km radius north and east from HMNB Clyde. The Glenn Fruin area was characterised by small conurbations with communities ranging from as small as single houses within the farming areas to villages.

The survey sites are reported from west to east. Site descriptions and observations can be seen in Appendix A5.

6.2 Private food production

No allotments were identified within the 5km terrestrial survey area of HMNB Clyde. During the habit survey many individuals were found to produce a wide variety of fruit and vegetables. Of those individuals interviewed, some were specific with the yield of their products, many of whom maintained detailed records of the crop grown and the respective yield. Face-to-face interviews indicated that much of the produce on the survey list was produced by one or more individual and the food grown was consumed by their families and friends. Over the survey period, 38 individuals grew their own fruit and vegetables within their own home gardens and land. These individuals yielded data of sufficient quality for quantitative estimates of food quantities grown and consumed. A total of 12 individuals surveyed reported keeping chickens and consuming their eggs.

6.3 Commercial food production

Businesses were contacted, and it was determined one business sourced and sold some beef and lamb produced locally from within the terrestrial survey area. All other meat and produce were sourced from outwith the terrestrial survey area.

6.4 Wild foods

Within the terrestrial survey area wild food consumption was reported by 40 individuals. A breakdown of the foods, number of individuals, consumption and locations are detailed in Table 6.1.

6.5 Production of honey

Beekeepers are not required to be a member of a bee keeping association or to be registered therefore the precise numbers in the survey area are unknown, however, if honey is to be sold commercially then a licence is required.

Three beekeepers that keep apiaries within the 5km survey area were identified and interviewed. Beekeepers were found to consume, sell, and gift honey produced. Apiaries varied from one to six hives with apiary yields varying from between 18kg and 136kg.

Table 6.1: Wild food summary of total number of individuals, highest annual consumption, and locations

Food type	Total number of individuals	Maximum individual consumption (kg y^{-1})	Location of maximum consumption foraged	Other locations of foraging
Apple	2	20	Shandon	-
Blackberry	25	2.5	Shandon	Whistlefield, Portincaple, Rosneath, Castle Bay
Bramble tips	3	1.3	Garelochhead	-
Elderflower	5	4	Clynder	Shandon
Garlic leaves	26	1	Near Faslane	Whistlefield, Shandon, Castle Bay, Portincaple
Gorse flower	3	1.3	Garelochhead	-
Elder	1	0.05	Near Faslane	-
Hazelnuts	5	0.6	Portincaple	-
Mushrooms	4	5	Shandon	Whistlefield
Oak leaves	3	1.3	Garelochhead	-
Raspberry	3	2	Stuckenduff	-
Rosehips	2	0.25	Near Faslane	-
Strawberry	1	0.2	Stuckenduff	-

6.6 Farms

Within the HMNB Clyde terrestrial survey area seven working farms were identified however only three farms agreed, or were available, to provide information. Farming

included cattle and sheep. Water was supplied from the mains water supply and a borehole for human consumption. Cattle and sheep water consumption was from mains water, ditch/burn water and borehole. One farm consumed game, and one farm consumed animal produce from their farm. No farm reported to keep chickens/ducks.

6.7 Internal exposure – phase 1

6.7.1 Internal exposure adult consumption rate

Consumption data for locally produced foodstuffs potentially affected by atmospheric releases from HMNB Clyde are presented in Table 6.2 for adults.

The table presents the adult consumption rates summarising the number of observations made, the number of people in the high-rate consumer group, the minimum and maximum observed consumption rates for the high-rate consumer group and the observed 97.5th percentile consumption rate. The table contains the mean consumption rate for both the high-rate consumer group and the whole dataset collected from around HMNB Clyde. The table also provides the mean and 97.5th percentile consumption rates from national data (Smith and Jones, 2003) for comparison. The national data are used to compare the high-rate mean and high-rate maximum consumers within the habits survey. During the HMNB Clyde habits survey it became apparent that the national consumption data do not consider any extreme habits, and this may be an area for further research. For example, there may be regional or local differences in habits which may result in different rates of consumption, (Table 6.2), with many of the food groups showing greater consumption than the national mean and may represent an important local pathway. It may be necessary to consider that the national data (which is aggregated and is useful as a broad comparison) cannot capture local or regional variations in habits, which may have significance.

Consumption of locally produced foods was identified, and the data are presented in Table 6.2.

Table 6.2: Summary of adult consumption rate of foods from the terrestrial survey area

Food type	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y^{-1} or l y^{-1})	Observed minimum for the high-rate group (kg y^{-1} or l y^{-1})	Observed mean for the high-rate group (kg y^{-1} or l y^{-1})	Observed 97.5th percentile for high-rate group (kg y^{-1} or l y^{-1})	Full dataset – Observed mean (kg y^{-1} or l y^{-1})	Full dataset – 97.5th percentile (kg y^{-1} or l y^{-1})	National mean (kg y^{-1} or l y^{-1})	National 97.5th percentile (kg y^{-1} or l y^{-1})
Green vegetables	37	12	26.6	16	20	26.6	8	26.6	15	45
Other vegetables	27	8	33	13	19.5	33	7.3	33	20	50
Root vegetables	34	5	36.8	16.7	21.7	34.9	5	21.5	10	40
Potatoes	31	3	139	100	113	137	14.2	110	50	120
Fruit domestic	47	4	216	107	142	209	33	123	20	75

Food type	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y^{-1} or l y^{-1})	Observed minimum for the high-rate group (kg y^{-1} or l y^{-1})	Observed mean for the high-rate group (kg y^{-1} or l y^{-1})	Observed 97.5th percentile for high-rate group (kg y^{-1} or l y^{-1})	Full dataset – Observed mean (kg y^{-1} or l y^{-1})	Full dataset – 97.5th percentile (kg y^{-1} or l y^{-1})	National mean (kg y^{-1} or l y^{-1})	National 97.5th percentile (kg y^{-1} or l y^{-1})
Fruit wild	33	2	27.4	10	18.7	27	2.8	13.4	7	25
Wild fungi	4	2	5	2	3.5	4.9	1.8	4.8	3	10
Meat game (birds)	3	3	8.1	3.5	6.6	8.1	6.6	8.1	ND	ND
Meat game (rabbit/hare/squirrel)	1	1	4	4	4	NA	4	NA	6	15
Meat game (venison)	12	3	24	20	22.7	24	7.4	24	ND	ND

Food type	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y^{-1} or l y^{-1})	Observed minimum for the high-rate group (kg y^{-1} or l y^{-1})	Observed mean for the high-rate group (kg y^{-1} or l y^{-1})	Observed 97.5th percentile for high-rate group (kg y^{-1} or l y^{-1})	Full dataset – Observed mean (kg y^{-1} or l y^{-1})	Full dataset – 97.5th percentile (kg y^{-1} or l y^{-1})	National mean (kg y^{-1} or l y^{-1})	National 97.5th percentile (kg y^{-1} or l y^{-1})
Meat beef	3	1	46.8	46.8	46.8	NA	21.2	44.9	15	45
Meat pig	2	2	5.5	5.5	5.5	5.5	5.5	5.5	15	40
Meat sheep	3	1	46.8	46.8	46.8	NA	20.4	44.8	8	25
Eggs	27	5	63.5	36.2	49.6	63.5	16	63.5	8.5	25
Honey	14	2	13.6	5.4	9.5	13.4	3	11	2.5	9.5
Freshwater trout	2	2	2	2	2	2	2	2	15	40

NA – not applicable

ND – not determined

One observed mean consumption rate for the high-rate consumer group was found to be greater than the national 97.5th percentile value. This was for domestic fruit. The high domestic fruit consumption was checked and validated by the individual and the fruit processed and consumed. All high figures were checked with individuals for verification. Ten observed mean consumption rates for the high-rate consumer group were found to exceed the national mean consumption rates. These were for green vegetables, root vegetables, potatoes, domestic fruit, wild fruit, wild fungi, eggs, honey, beef, and sheep meat. Five observed 97.5th percentile consumption rates for the high-rate consumer exceeded the national 97.5th percentile consumption rates. These were potatoes, domestic fruit, wild fruit, eggs, and honey.

6.7.2 Children and infant's consumption rates

Table 6.3 presents a summary of the children and infant's consumption rates. The table summarises the number of observations made, the number of people in the high-rate consumer group, the minimum and maximum observed consumption rates for the high-rate consumer group and the observed 97.5th consumption rate. The table also contains the mean consumption rate for both the high-rate consumer group and the whole dataset collected from around HMNB Clyde.

Children's consumption of locally produced foods was identified, and all data are presented in Table 6.3. No observed mean consumption rate for the high-rate consumer group was found to be greater than the 97.5th percentile value for the full dataset. Four observed mean consumption rates for the high-rate consumer group were found to exceed the national mean consumption rates. These were for root vegetables, potatoes, domestic fruit, and wild fruit. Infant's consumption of locally produced foods was identified for eggs only.

Table 6.3: Summary of children and infant consumption rates

Age Group	Food type	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y^{-1} or l y^{-1})	Observed minimum for the high-rate group (kg y^{-1} or l y^{-1})	Observed mean for the high-rate group (kg y^{-1} or l y^{-1})	Observed 97.5th percentile for high-rate group (kg y^{-1} or l y^{-1})	Full dataset – Observed mean (kg y^{-1} or l y^{-1})	Full dataset – 97.5th percentile (kg y^{-1} or l y^{-1})
Child (6 to 15 years)	Green vegetables	4	2	7.5	7.5	7.5	7.5	4	7.5
Child (6 to 15 years)	Other vegetables	4	3	1	0.5	0.8	1	0.7	1
Child (6 to 15 years)	Root vegetables	5	2	18.3	18.3	18.3	18.3	7.6	18.3
Child (6 to 15 years)	Potatoes	4	3	4.6	1.7	3.6	4.6	3	4.6
Child (6 to 15 years)	Domestic fruit	6	3	38.3	24.2	33.6	38.3	19	38.3
Child (6 to 15 years)	Fruit wild	6	4	3	2	2.5	3	2.8	3

Age Group	Food type	Number of observations	Number of people in the high-rate group	Observed maximum for the high-rate group (kg y^{-1} or l y^{-1})	Observed minimum for the high-rate group (kg y^{-1} or l y^{-1})	Observed mean for the high-rate group (kg y^{-1} or l y^{-1})	Observed 97.5th percentile for high-rate group (kg y^{-1} or l y^{-1})	Full dataset – Observed mean (kg y^{-1} or l y^{-1})	Full dataset – 97.5th percentile (kg y^{-1} or l y^{-1})
Child (6 to 15 years)	Egg	4	4	9	8	8.7	9	8.7	9
Infant (0 to 5 year)	Eggs	1	1	8.5	8.5	8.5	NA	8.5	NA

7 External exposure

7.1 Introduction

Gamma dose rate can vary markedly over short distances for example because of direct shine from nuclear power plant activities. An understanding of the spatial variation in dose rate is important for determining the implications of the habits of the local population. A mobile (both handheld and carborne, see section 7.2) and in-situ gamma dose rate survey (section 7.3) was therefore undertaken. To achieve large-scale coverage, MoGSS was used to measure the dose rates for the natural occurring gamma emitting radionuclides (potassium-40 and the uranium-238 and thorium-232 decay series) alongside estimates for anthropogenic caesium-137. However, this approach is unable to assess the occurrence of the most abundant radionuclide released from HMNB Clyde, namely tritium.

Beta dosimetry (section 7.4) was undertaken on sailing boats in the HMNB Clyde area to estimate the skin dose associated with radioactivity in the environment.

7.2 Mobile Gamma Spectrometry Survey (MoGSS)

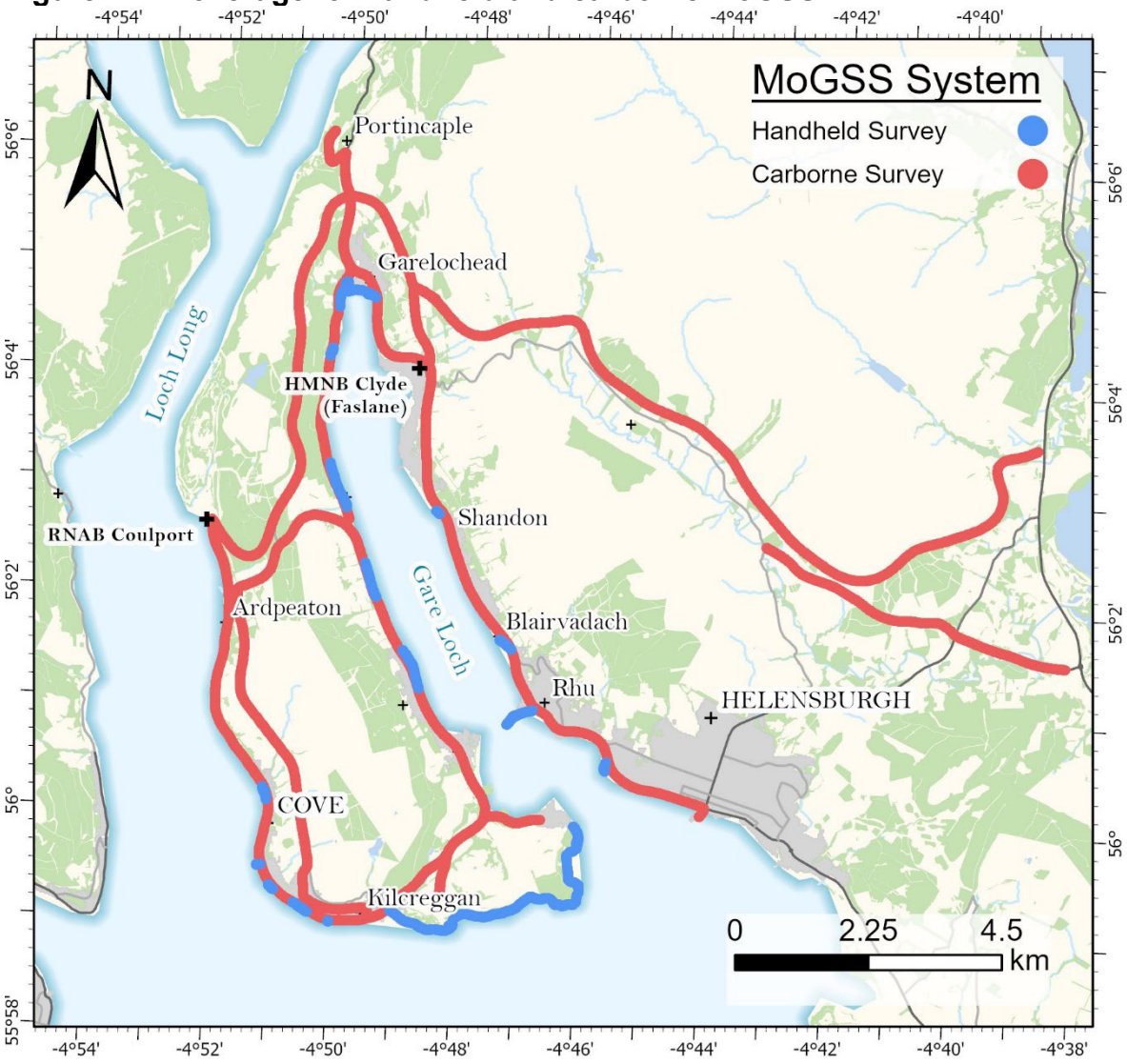
MoGSS was utilised to measure the dose estimations for the natural radioelements (potassium-40 and the uranium-238 and thorium-232 series) alongside estimates for anthropogenic caesium-137. The ability to separate dose contributors is especially important given that any potential contributions from caesium-137 could be identified from the spatially variable background element concentrations, particularly on beaches close to the site.

7.2.1 Survey area

A carborne gamma spectrometry survey of the study area was undertaken supplemented by a handheld gamma spectrometry system along some of the intertidal sections between Helensburgh Pier and the Rosneath Peninsula. Areas of particular focus were within 5km radius of the HMNB Clyde site and around intertidal areas that are accessible by the public. The roads surveyed covered more than 50km.

To obtain as broad a spatial sample as possible and to investigate as many environments as possible, two systems operating MoGSS were deployed. Firstly, one large volume sodium iodide detector was mounted in a box on top of a car, which was driven along the roads within the area of interest (Varley et al., 2020). The system, with a detector volume of 4 litres, has high counting efficiency but was restricted to areas of vehicular access and thus could only be used on roads and carparks. Secondly, to focus in on smaller areas not accessible by vehicle and to cover accessible coastline areas, a handheld system comprising a 71 × 71mm sodium iodide detector was used. All MoGSS units produced a differential energy spectra recorded at one second integration times alongside high accuracy (<0.6m) differential Global Positioning System readings. Coverage of the handheld and carborne MoGSS are shown in Figure 7.1.

Figure 7.1: Coverage for handheld and carborne MoGSS



7.2.2. Carborne and handheld results

Overall, 14421 spectral measurements were made (~5463 – carborne; ~8958 – handheld).

Dose rates typically ranged from 0.01μGy h^{-1} (10nGy h^{-1}) to more than 0.04μGy h^{-1} (40nGy h^{-1}). Higher values between 0.04μGy h^{-1} and 0.1μGy h^{-1} may be attributable to elevated natural radiation, for example high concentrations of 40K from road and building construction materials.

7.3 In-situ gamma dosimetry

The ERL has ISO 17025:2017 accredited procedures for the deployment and recording of gamma dose rate in air, using ISO 17025:2017 accredited, United Kingdom Accreditation Service, (UKAS) calibrations for two Thermo Radeye instruments. Measurements were taken at all locations where occupancy or location may lead to higher exposure to radioactivity or radiation because of site activities.

Eighteen in-situ gamma dose rate measurements were collected at intertidal sites during the survey. A UKAS accredited procedure was followed to estimate the terrestrial gamma dose rate. Since most of the dose contribution was thought to be from naturally occurring radionuclides, a radium-226 calibration was used to estimate dose rate for all gamma dose rate measurements. Radium-226 occurs naturally in the environment and emits several gamma-rays spanning the environmentally relevant energy spectrum (0-2204keV).

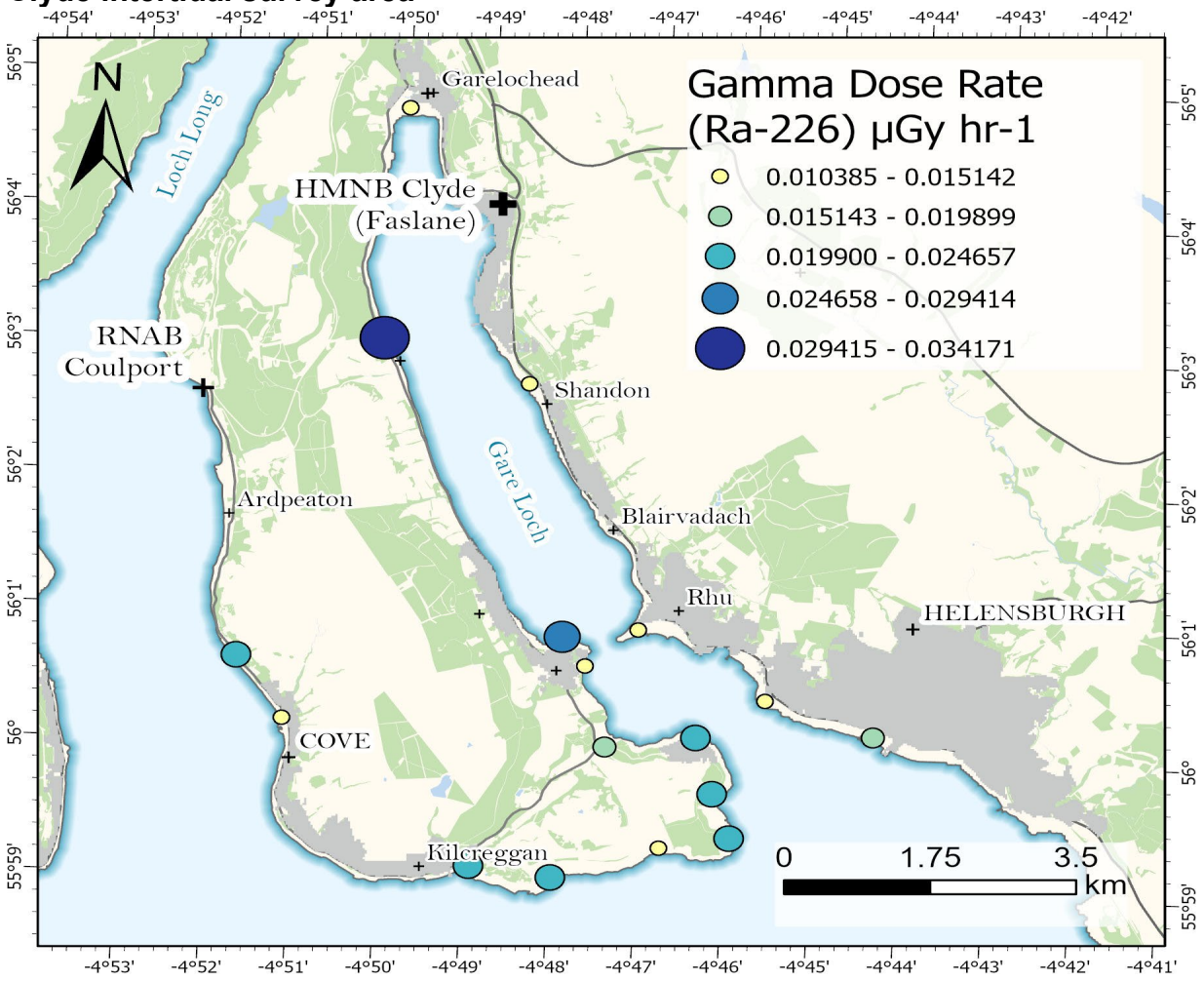
A summary of the dose rate measurements made across the survey area for intertidal areas can be found in Table 7.1. Notice that most of the higher readings are made over mud and stone. Lower readings tended to be recorded on sandier areas. Spatially (Figure 7.2), there was little evidence to link patterns in dose rates to the HMNB Clyde site.

Table 7.1: Summary of gamma dose rate measurements collected across the HMNB Clyde intertidal survey area

Site	Surface	Eastings	Northings	Dose (μGy h^{-1})	2σ Uncertainty (μGy h^{-1})
Garelochhead	Sand/stone/seaweed	2236	6910	0.012	0.0034
Mambeg	Stoney/rocks	2233	6899	0.022	0.0036
Rahane	Stone/rocks/seaweed	2233	6878	0.034	0.0040
Clynder	Stone and shell	2255	6836	0.026	0.0037
Helensburgh beach	Stone/sand	2292	6822	0.018	0.0035
Cairndu Point	Sand/shells/pebbles	2279	6827	0.010	0.0034
Rhu Spit	Mud/sand/stone	2264	6837	0.0106	0.0034
Shandon	Mud/sand/stone	2251	6871	0.015	0.0035
Cove Bay	Pebbles/shingle/rocks	2221	6825	0.012	0.0034
Knockderry beach	Pebbles/shingle/rocks	2216	6834	0.021	0.0036
Kilcreggan	Pebbles/shingle	2243	6805	0.022	0.0036
Rosneath Bay	Pebbles	2257	6832	0.012	0.0034
Rosneath Point	Rocky/mud	2275	6808	0.023	0.0037
Culwatty Bay	Pebbles/rocky/mud	2273	6814	0.022	0.0037

Site	Surface	Eastings	Northings	Dose (μGy h^{-1})	2σ Uncertainty (μGy h^{-1})
Castle Bay/Castle Point	Shingle	2271	6822	0.022	0.0036
Camsail Bay	Shingle/sand	2260	6821	0.015	0.0035
Meikleross Bay	Rock/stone/sand	2266	6807	0.012	0.0034
Portkil Bay	Stone	2253	6803	0.023	0.0037

Figure 7.2: Summary of the gamma dose rate measurements across the HMNB Clyde intertidal survey area



7.4 In-situ beta dosimetry

Beta dosimetry of skin dose [H*(0.07)] was measured on sailing boats that were situated close to the coast. Three in-situ beta dose measurements were collected at one intertidal site during the survey. The results were below the 0.2µSv h^{-1} per cm^{-2} detection limit.

7.5 Occupancy rates

7.5.1 Occupancy data for the survey area

Phase 1 interviews revealed that individuals take part in a range of terrestrial, aquatic, and intertidal activities within the survey area (Table 7.2). For terrestrial activities, the most popular activity was gardening (65 individuals) with the highest

occupancy spending 3094h y^{-1}near Blairvadach. Gardening was also the activity with the overall maximum occupancy for terrestrial activities. For the aquatic activities, outdoor swimming was the most popular (16 individuals) and the individual with the highest occupancy spent 180h y at Camsail Bay. The aquatic activity with the overall maximum occupancy was for kayaking spending 468h y^{-1} on Gare Loch. For the intertidal activities, fishing was the most popular (40 individuals) with the highest individual occupancy being 130h y^{-1} at Rosneath, Rhu Spit and Mambeg. The intertidal activity with the overall maximum occupancy was for a dog walker spending 730h y^{-1} on Garelochhead intertidal substrate.

Table 7.2: Summary of the activities and total number of individuals that take part in the activities. The location of the maximum occupancy is also given

Activity type	Activity	Number of Individuals	Maximum Occupancy (h y^{-1})	Location of Maximum Occupancy (if provided)
Terrestrial	Working	1	520	Rosneath
Terrestrial	At peace camp	1	960	Peace camp
Terrestrial	Beekeeping	3	91	Garelochhead
Terrestrial	Bird/nature watching	6	730	Rhu
Terrestrial	Camping	1	60	Rosneath Peninsula
Terrestrial	Collecting wild produce	25	39	Shandon
Terrestrial	Cycling	15	250	Garelochhead
Terrestrial	Dog walking	32	1095	Rhu/Shandon
Terrestrial	Education/research	1	24	Ardpeaton
Terrestrial	Farming	1	2600	Meikle-Rahane
Terrestrial	Fishing	1	104	Mill Dam
Terrestrial	Gardening	65	3094	Blairvadach

Activity type	Activity	Number of Individuals	Maximum Occupancy ($h\ y^{-1}$)	Location of Maximum Occupancy (if provided)
Terrestrial	Golfing	1	9	Shandon
Terrestrial	Groundworks	1	980	Rosneath
Terrestrial	In hot tub	5	156	Within survey area
Terrestrial	Jogging	9	129.5	Kilcreggan
Terrestrial	Looking after hens	4	13	Shandon
Terrestrial	Playing	6	274	Garelochhead
Terrestrial	Rambling/walking	63	559	Portincaple
Terrestrial	Shooting	3	860	Shandon
Terrestrial	Sitting/picnicking/BBQ	23	1170	Portincaple
Terrestrial	Sports	1	234	Helensburgh
Intertidal	Sitting/picnicking/BBQ	12	36	Mambeg
Intertidal	Beach clean/litter picking	14	58	Helensburgh beach/Cove
Intertidal	Beachcombing	9	130	Near Faslane
Intertidal	Bird surveys	2	12	Rhu Spit
Intertidal	Collecting seaweed	1	1.5	Garelochhead
Intertidal	Dog walking	29	730	Garelochhead
Intertidal	Fishing	40	130	Rosneath/Rhu Spit/Mambeg
Intertidal	Jogging	2	12	Helensburgh beach
Intertidal	Metal detecting	1	72	Rosneath/Cove
Intertidal	Paddling	2	78	Mambeg

Activity type	Activity	Number of Individuals	Maximum Occupancy ($h\ y^{-1}$)	Location of Maximum Occupancy (if provided)
Intertidal	Photography	1	1.5	Helensburgh beach
Intertidal	Playing	4	24	Cove Bay
Intertidal	Rock pooling	1	7	Portincaple
Intertidal	Sea angling	2	24	Rosneath
Intertidal	Shore crew for RNLI	1	156	Rhu Spit
Intertidal	Walking	21	294	Rosneath
Aquatic	Boat maintenance	1	4.5	Portincaple
Aquatic	Body boarding	1	12	Gare Loch
Aquatic	Canoeing	3	18	Kilcreggan
Aquatic	Commute via boat	1	58.5	Gare Loch
Aquatic	Diving	2	0.75	Cove
Aquatic	Kayaking	12	468	Gare Loch
Aquatic	Outdoor swimming	16	180	Camsail Bay
Aquatic	Power boating	7	234	Castle Bay
Aquatic	RNLI duties	1	57	Gare Loch
Aquatic	Rowing	1	6.5	Gare Loch
Aquatic	Sailing	4	128	Gare Loch
Aquatic	Sea angling	6	338	Gare Loch
Aquatic	Sea cadets	1	39	Gare Loch
Aquatic	Sport fishing	1	26	Gare Loch
Aquatic	Stand-up paddleboarding	8	292.5	Gare Loch

7.5.2 Occupancy rates within one kilometre of HMNB Clyde (inside/outside work or home)

Individuals living or working within the immediate area of HMNB Clyde were asked to estimate how much time they spend inside and outside their home or workplace. The results presented in Table 7.3 show the time spent indoors and outdoors on an annual basis. A total of one individual interviewed worked within 1km of the HMNB Clyde. The highest amount of time spent indoors at work for this individual was 2920h y^{-1} with no individual determined to spend time working outdoors within 1km of the HMNB Clyde site. Twelve individuals were interviewed who lived within 1km of HMNB Clyde. The highest amount of time spent indoors for one individual, spending 8760h y^{-1} indoors, and the highest amount of time spent in the immediate area outside their house was 2190h y^{-1} for two individuals. All figures consider any holiday period away from home with all figures checked and confirmed by the individuals. The highest total occupancy living within 1km of HMNB Clyde was 8760h y^{-1} for one individual.

Table 7.3: Occupancy rates of those individuals working or living within 1km of HMNB Clyde

Observation ID	Indoors at home ($h\ y^{-1}$)	Outdoors at home ($h\ y^{-1}$)	Indoors at work ($h\ y^{-1}$)	Outdoors at work ($h\ y^{-1}$)
46	2184	60	0	0
107	5824	120	0	0
218	2002	364	0	0
110	5096	1274	0	0
111	5096	910	0	0
112	5096	546	0	0
62	5475	546	0	0
178	8760	0	0	0
30	3650	1825	0	0
183	2920	2190	2920	0
184	5475	2190	0	0
13	7300	730	0	0

8 Phase 2 survey results

8.1 Introduction

There were three aims of the Phase 2 surveys conducted. These were to i) validate the Phase 1 face-to-face surveys, ii) identify any major changes to internal/external exposure paths and iii) identify any new pathways within a select group of individuals. To determine the individuals selected, the total dose from all exposure pathways for each individual was estimated. This was used to identify three individuals from different parts of the dose distribution (e.g., the top third, middle third and bottom third of the distribution). It was agreed with SEPA that the Phase 2 survey should target nine individuals. Additional considerations affecting selection were that some individuals (when asked during Phase 1) said they did not want to be contacted again, for some individuals we had incorrect contact details, or individuals did not respond to approaches made by the survey team during the Phase 2 surveys. For HMNB Clyde, follow up surveys were made in January 2024. Of the individuals contacted within each part of the distribution, follow up surveys were completed for three individuals from the high (A, B, and C), medium (D, E, and F) and low (G, H, and I) group (a total of nine individuals).

8.2 Phase 2 internal exposure

8.2.1 Internal terrestrial

Terrestrial food group consumption (all locally sourced within 5km) reported by each individual is detailed in Tables 8.1, 8.2 and 8.3.

Within the high group, individuals A, B and C consumed terrestrial produce within the Phase 1 survey, and this was reported with the same consumption rates within the Phase 2 survey. Individual A however reported to consume venison within the Phase 1 survey but reported that within the Phase 2 survey that they now did not consume any from within the survey area. Individuals A and B reported that they consumed locally source chicken eggs which was not identified within the Phase 1 survey.

Within the medium group, individuals E and F reported no change in their consumption of locally sourced produce. However individual E reported a change in quantities and produce collected within the wild food group. The individual reported a lower consumption of some of the wild food group produce due to a poorer season when picking the produce however, they reported collecting two different wild food types (rosehip and sloe berries) which they had decided to 'try' collecting. The total consumption of the wild food group (1kg y^{-1}) for this individual however did not change during the Phase 2 survey. Individual D reported a reduction in consumption of root vegetables and domestic fruit in the Phase 2 survey due to a poorer yield than expected.

Within the low group, individuals G and H both reported the consumption of locally sourced chicken eggs in the Phase 2 survey. This was not determined within the Phase 1 survey.

Table 8.1: Survey comparison of terrestrial consumption (kg y^{-1}) for the high consumption group individuals (A - C)

Food type	A Phase 1 (kg y^{-1})	A Phase 2 (kg y^{-1})	B Phase 1 (kg y^{-1})	B Phase 2 (kg y^{-1})	C Phase 1 (kg y^{-1})	C Phase 2 (kg y^{-1})
Green leafy vegetables	17	17	17	17	8	8
Other vegetables	-	-	-	-	18	18
Root vegetables	-	-	-	-	3	3
Potato	-	-	-	-	-	-
Domestic fruit	54	54	54	54	216	216
Eggs	60	-	60	-	-	-

Food type	A Phase 1 (kg y^{-1})	A Phase 2 (kg y^{-1})	B Phase 1 (kg y^{-1})	B Phase 2 (kg y^{-1})	C Phase 1 (kg y^{-1})	C Phase 2 (kg y^{-1})
Venison	2	-	-	-	-	-

Table 8.2: Survey comparison of terrestrial consumption (kg y^{-1}) for the medium consumption group individuals (D - F)

Food type	D Phase 1 (kg y^{-1})	D Phase 2 (kg y^{-1})	E Phase 1 (kg y^{-1})	E Phase 2 (kg y^{-1})	F Phase 1 (kg y^{-1})	F Phase 2 (kg y^{-1})
Green leafy vegetables	3	3	15	15	-	-
Other vegetables	-	-	2	2	-	-
Root vegetables	2	1	36.6	36.6	-	-
Potato	4.6	4.6	4.6	4.6	-	-
Domestic fruit	40	24	76.6	76.6	-	-
Wild food	-	-	1	1	-	-
Honey	-	-	-	-	5.4	5.4
Beef meat	-	-	-	-	46.8	46.8
Sheep meat	-	-	-	-	46.8	46.8

Table 8.3: Survey comparison of terrestrial consumption (kg y^{-1}) for the low consumption group individuals (G - H)

Food type	G Phase 1 (kg y^{-1})	G Phase 2 (kg y^{-1})	H Phase 1 (kg y^{-1})	H Phase 2 (kg y^{-1})
Eggs	-	20.8	-	20.8

8.2.2 Aquatic – internal

Table 8.4 summarises reported changes in aquatic food consumption. Individual D reported consuming fish within the Phase 1 survey but did not report any fish consumption within the Phase 2 survey. The individual reported that they had been unable to spend time fishing from the shore and therefore had not caught any fish as they had intended.

Table 8.4: Survey comparison of an aquatic consumption (kg y^{-1}) for the medium consumption group individual (D)

Food type	Phase 1 (kg y^{-1})	Phase 2 (kg y^{-1})
Fish	4.1	-

8.3 Phase 2 external exposure

8.3.1 Terrestrial activities

Some individuals completing Phase 2 surveys reported some changes regarding terrestrial activities (Tables 8.5, 8.6 and 8.7). Within the high occupancy group, individuals A and B reported some changes in terrestrial occupancy in Phase 2 from what was reported in Phase 1. Individual A reported a reduction in occupancy hours shooting and freshwater fishing due to spending reduced time undertaking these activities. However, Individual A did report a greater occupancy undertaking gardening and dog walking in Phase 2 than was reported in Phase 1. Individual B reported undertaking gardening in the Phase 2 survey which was not reported in the Phase 1 survey, and they reported a greater occupancy undertaking dog walking in the Phase 2 survey which was not reported in the Phase 1 survey.

Within the medium occupancy group Individual D reported differences in the Phase 2 survey from what was reported in the Phase 1 survey. There was no explanation for this. Individual E reported a decrease in most activities in the Phase 2 survey however dog walking occupancy increased due to increase in dog walking habits. Individual F reported the same occupancy within both the Phase 1 and Phase 2 survey.

Within the low occupancy group Individual's G, H and I reported some changes in occupancy. Individual I reported photography in the Phase 2 survey due to this not being an activity undertaken in the Phase 1 survey.

Table 8.5: Survey comparison of terrestrial activity times (h y^{-1}) for the high occupancy group individuals A and B

Terrestrial activities	A Phase 1 (h y^{-1})	A Phase 2 (h y^{-1})	B Phase 1 (h y^{-1})	B Phase 2 (h y^{-1})
Cycling	26	26	-	-
Gardening	365	547	-	547
Fishing (freshwater)	104	18	-	-
Dog walking	182.5	850	182.5	850
Shooting	182.5	130	-	-

Table 8.6: Survey comparison of terrestrial activity times (h y^{-1}) for the medium occupancy group individuals (D – F)

Terrestrial activities	D Phase 1 (h y^{-1})	D Phase 2 (h y^{-1})	E Phase 1 (h y^{-1})	E Phase 2 (h y^{-1})	F Phase 1 (h y^{-1})	F Phase 2 (h y^{-1})
Cycling	78	39	78	52	-	-
Gardening	3094	520	390	287	-	-
Rambling/walking	71.5	416	260	20	-	-
Sitting/picnicking/BBQ	19.5	19.5	1170	9	-	-
Collecting wild produce	-	-	10	10	-	-
Dog walking	-	-	-	365	-	-
Sitting in hot tub	-	-	156	52	-	-
Farming	-	-	-	-	2600	2600
Work outdoors	-	-	-	-	520	520

Table 8.7: Survey comparison of terrestrial activity times (h y^{-1}) for the low occupancy group of the individuals (G – I)

Terrestrial activities	G Phase 1 (h y^{-1})	G Phase 2 (h y^{-1})	H Phase 1 (h y^{-1})	H Phase 2 (h y^{-1})	I Phase 1 (h y^{-1})	I Phase 2 (h y^{-1})
Dog walking	275	183	52	183	183	156
Running	104	104	104	104	-	-
Photography	-	-	-	-	-	8.3

8.3.2 Intertidal and aquatic activities

Within the high occupancy group (Table 8.8), Individuals A and B reported a greater occupancy dog walking within the Phase 2 survey. Individual A however reported less occupancy metal detecting than was reported in the Phase 1 survey.

Within the medium occupancy group (Table 8.9), Individual D reported a reduced occupancy within the Phase 2 survey for intertidal occupancy and handling boating equipment/fishing gear due to not being able to undertake any fishing since the Phase 1 survey. Individual E reported intertidal and on water occupancy in the Phase 2 survey and this was not reported in the Phase 1 survey.

Within the low occupancy group (Table 8.10), there was no change in occupancy for Individual G. Individual H reported a decrease in outdoor swimming (the individual has reduced their time spent swimming). Individual I reported a slight increase in intertidal occupancy in the Phase 2 survey due to now spending more time undertaking photography.

Table 8.8: Survey comparison of intertidal and aquatic activity times (h y^{-1}) for the high group individuals A and B

Intertidal and aquatic activities	A Phase 1 (h y^{-1})	A Phase 2 (h y^{-1})	B Phase 1 (h y^{-1})	B Phase 2 (h y^{-1})
Occupancy on sand and stones	98	283	183	241
Handling sediment	72	42	-	-

Table 8.9: Survey comparison of intertidal and aquatic activity times (h y^{-1}) for the medium group individuals D and E

Intertidal and aquatic activities	D Phase 1 (h y^{-1})	D Phase 2 (h y^{-1})	E Phase 1 (h y^{-1})	E Phase 2 (h y^{-1})
Occupancy on sand and stones	51	19.5	-	-
Occupancy on stones	-	-	-	17.2
Occupancy on water	9	9	-	-
Occupancy in water	-	-	-	52
Handling equipment/fishing gear	19.6	4.6	-	-

Table 8.10: Survey comparison of intertidal and aquatic activity times (h y^{-1}) for the low group individuals (G – I)

Intertidal and aquatic activities	G Phase 1 (h y^{-1})	G Phase 2 (h y^{-1})	H Phase 1 (h y^{-1})	H Phase 2 (h y^{-1})	I Phase 1 (h y^{-1})	I Phase 2 (h y^{-1})
Occupancy on sand and stones	-	-	-	-	4.5	15.8
Occupancy on stones	365	183	365	183	-	-
Occupancy in water	-	-	6.6	3	-	-
Handling sediment	-	-	-	-	3	3

8.4 Living and working within 1km

Only one individual from the Phase 2 survey lived within 1km of the site, and this is presented in Table 8.11.

Table 8.11: Survey comparison of occupancy (h y^{-1}) within 1km of the site within the high group individual C

Living and working within 1km	C Phase 1 (h y^{-1})	C Phase 2 (h y^{-1})
Occupancy indoors within 1km – living	5475	5475
Occupancy outdoors within 1km – living	3285	3285

9 Post Covid-19 habit analysis

It was discussed with SEPA that due to the pandemic individuals' habits may have somewhat changed for different reasons. Individuals were asked if any of their habits (terrestrial, intertidal, and aquatic) had changed since the Covid-19 pandemic. Within the survey a total of 189 individuals provided a definitive answer to whether there had been any changes to habits. Figures 9.1 to 9.4 show individuals' habits post Covid-19.

Figure 9.1 shows that a total of 106 individuals reported that there had been no changes to their habits, 55 individuals reported that they now spent more time outdoors (some individuals indicated that as a family they all spent more time outdoors), ten individuals reported that they now spent less time outdoors and 18 individuals reported that their habits had changed due to 'other' reasons. Figures 9.2, 9.3 and 9.4 provide a breakdown of each category within Table 9.1. Although more individuals reported no change to their habits, a significant number of individuals did report to spending more time outdoors.

Figure 9.1: Post Covid-19 changes identified from individuals surveyed

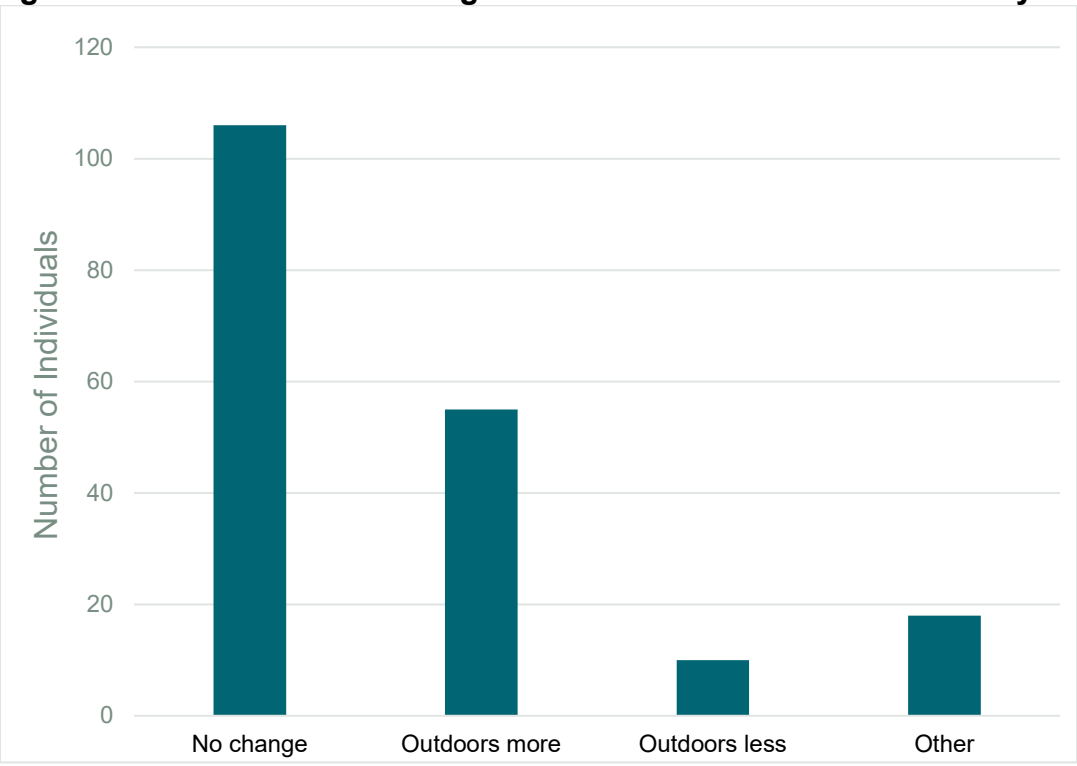


Figure 9.2: Breakdown of habits individuals reported post Covid-19 for those individuals reporting more time spent outdoors

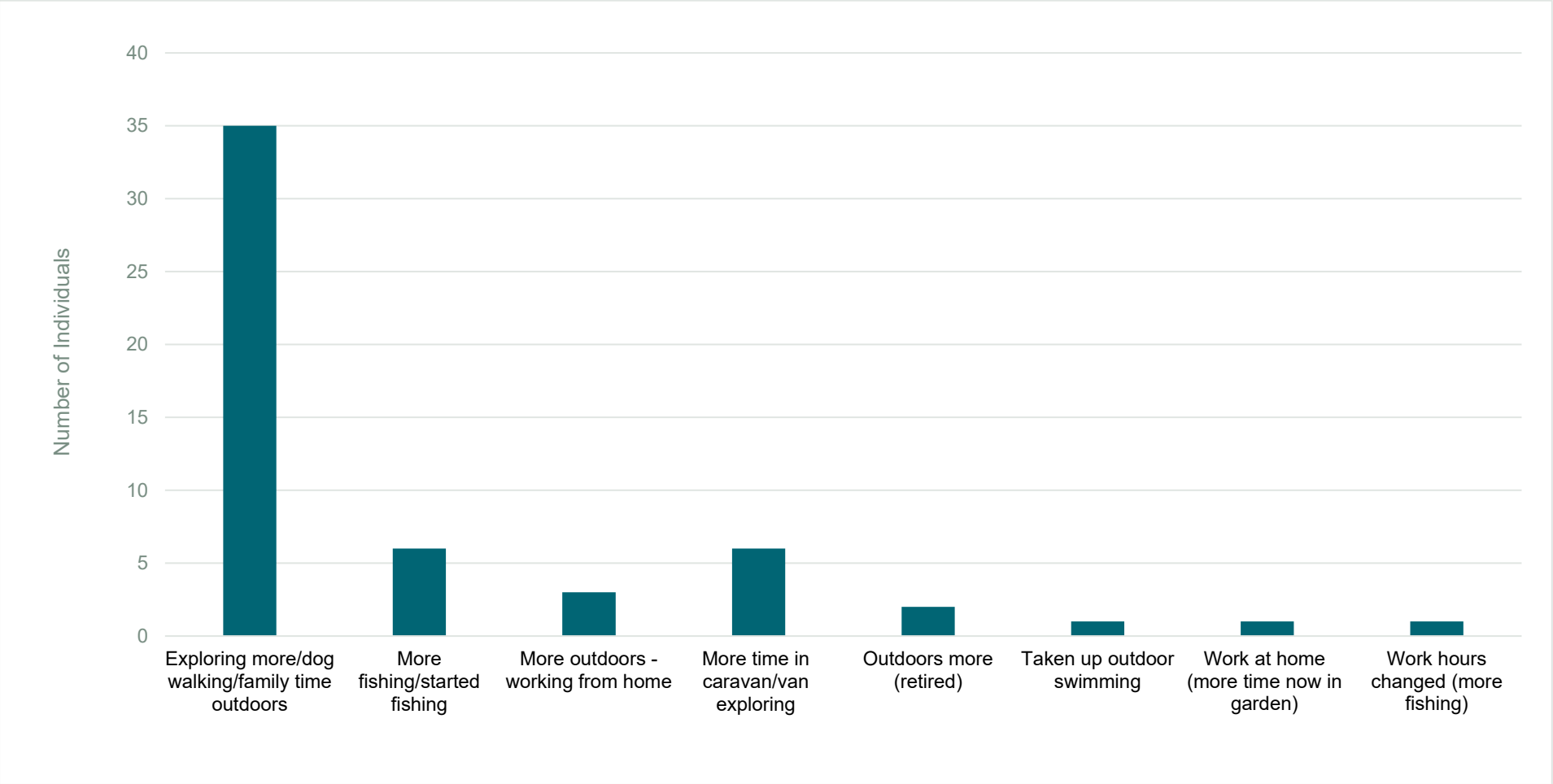


Figure 9.3: Breakdown of habits individuals reported post Covid-19 for those individuals reporting less time spent outdoors

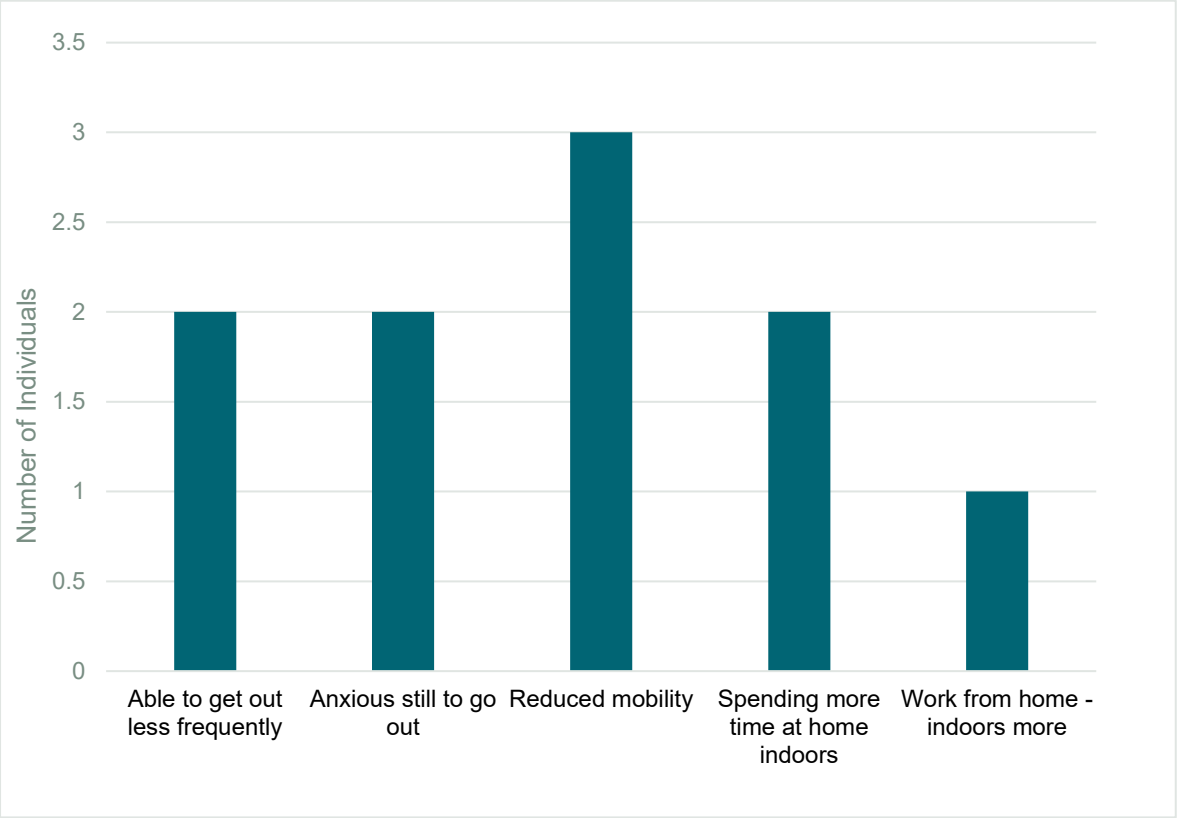
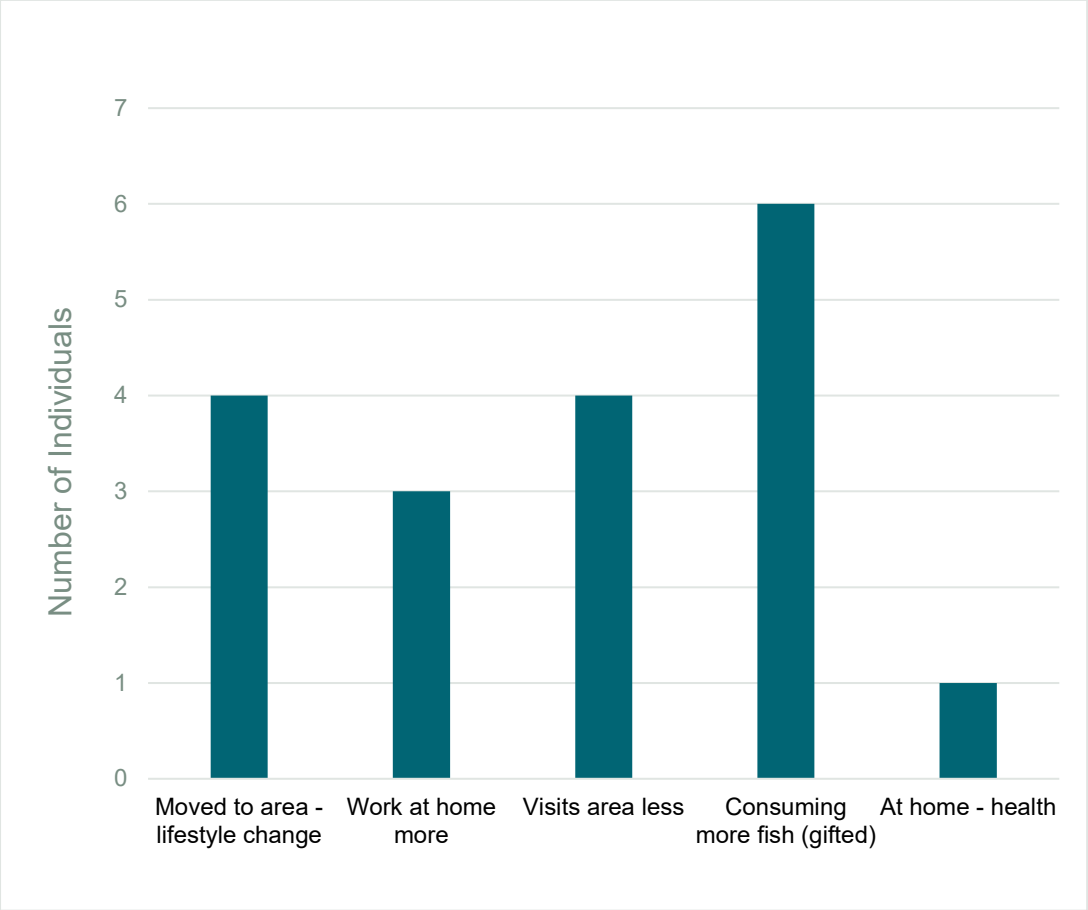


Figure 9.4: Breakdown of 'Other' contributors to post Covid-19 habit changes



10 Comparisons with the previous survey

10.1 Introduction

The results from the 2023 HMNB Clyde Habits Survey have been reported in Chapters 5-7 for both the postal survey and the face-to-face Phase 1 survey. These results can be compared with results from the previous habits survey, undertaken in HMNB Clyde in 2016 by the University of Stirling (Dale et al., 2017).

The aquatic and terrestrial face-to-face survey area in the 2023 survey extended (for the aquatic survey) from Helensburgh Pier on the eastern side of Gare Loch to Rosneath Point on the western side and to Garelochhead at the northern end of Gare Loch, including its intertidal areas. The terrestrial survey area within a 5km radius from HMNB Clyde consisting largely of the Rosneath Peninsula to the west of Gare Loch and included Glen Fruin to the east. The postal survey area covered a 20km radius from the HMNB Clyde site. This is consistent with the 2016 survey.

10.2 Aquatic survey

10.2.1 Phase 1 - adult consumption rates – internal exposure

In 2023 the mean consumption rate for the adult high-rate group in the face-to-face interviews decreased for fish compared with 2016. The main species of fish consumed by the adult high-rate group was mackerel in 2023 compared with mackerel and pollock in 2016. In 2023 adults fish consumption included mackerel, pollock and cod compared with the consumption of cod, mackerel, pollock, sea trout, wrasse, and dogfish in 2016. The consumption of crustaceans, molluscs, wildfowl, and seaweed was not identified in 2023 compared with consumption in all aquatic food groups in 2016. Samphire was consumed in 2023 but not identified in the 2016 survey.

A comparison between 2023 and 2016 adult consumption rates of aquatic foods in the face-to-face interviews is presented in Table 10.1. The table also provides the mean consumption rates from national data (Smith and Jones, 2003) for comparison. Refer to Section 5.11.1 for further details.

Table 10.1: Comparison between 2016 and 2023 adult consumption rates of aquatic foods

Food Group	2016 Number of people in the high-rate group	2016 Maximum consumption rate (kg y^{-1})	2016 Mean consumption rate for the high-rate group (kg y^{-1})	2023 Number of people in the high-rate group	2023 Maximum consumption rate (kg y^{-1})	2023 Mean consumption rate for the high-rate group (kg y^{-1})	National data mean (kg y^{-1})
Fish	1	201	201	2	180	143	15.00
Crustaceans	1	13	13	ND	ND	ND	4.00
Molluscs	1	0.9	0.9	ND	ND	ND	4.00
Wildfowl	1	1	1	ND	ND	ND	ND
Seaweed	1	4	4	ND	ND	ND	ND
Samphire	ND	ND	ND	1	0.2	0.2	ND

ND – not determined

10.2.2 Phase 1 - children and infant's consumption rates – internal exposure

The consumption of fish within the children's high-rate group increased in 2023 compared to 2016. The children's high-rate group consumed only mackerel in 2023 compared with mackerel and pollock in 2016. No children were found to consume crustaceans, molluscs, wildfowl, or marine plants/algae in either the 2016 or 2023 habit surveys. No infants in 2023 were determined to consume aquatic foods compared with consumption of fish (mackerel and pollock), crustacean (brown crab and common lobster) and mollusc (mussels) in 2016.

A comparison between 2016 and 2023 of children and infant consumption rates of aquatic foods in the face-to-face interviews is presented in Table 10.2.

Table 10.2: Comparison between 2016 and 2023 children and infant consumption rates of aquatic foods

Age Group	Food Group	2016 Number of people in the high-rate group	2016 Maximum consumption for the high-rate group (kg y^{-1})	2016 Mean consumption for the high-rate group (kg y^{-1})	2023 Number of people in the high-rate group	2023 Maximum consumption for the high-rate group (kg y^{-1})	2023 Mean consumption for the high-rate group (kg y^{-1})
Child (6 to 15 years)	Fish	9	0.5	0.33	6	5.2	4.7
Infant (0 to 5 years)	Fish	4	0.33	0.33	ND	ND	ND
Infant (0 to 5 years)	Crustaceans	4	0.33	0.33	ND	ND	ND
Infant (0 to 5 years)	Molluscs	4	0.17	0.17	ND	ND	ND

10.2.3 Phase 1 - adult intertidal/aquatic occupancy – external exposure

External marine exposure was divided into five groups: intertidal activities, aquatic in water activities, aquatic on water activities, handling of equipment, and handling of sediment.

The highest total intertidal occupancy in 2023 was 730h y^{-1} for an individual who spent time dog walking on a sand and stone substrate. This is decreased when compared with the 2016 survey with the highest total intertidal occupancy of 1369h y^{-1} for an individual who spent time dog walking and horse riding.

In 2023, there was an increased occupancy for aquatic in water activities compared with 2016 and a decreased occupancy for aquatic on water activities, handling equipment and handling sediment compared with the 2016 survey. A comparison is shown in Table 10.3.

Table 10.3: Comparison of the 2016 and 2023 aquatic external exposure pathways for adults

Activity	2016 Number of people in the high-rate group	2016 Maximum occupancy for the high-rate group (h y^{-1})	2016 Mean occupancy for the high-rate group (h y^{-1})	2023 Number of people in the high-rate group	2023 Maximum occupancy for the high-rate group (h y^{-1})	2023 Mean occupancy for the high-rate group (h y^{-1})
Aquatic (in water)	2	120	105	3	293	218
Aquatic (on water)	4	1872	1232	2	806	637
Handling equipment	8	1027	568	5	406	273
Handling sediment	14	1095	549	8	171	126

10.2.4 Phase 1 – children and infant intertidal/aquatic occupancy – external exposure

External marine exposure is divided into five groups: intertidal activities, aquatic in water activities, aquatic on water activities, handling of equipment, and handling of sediment.

The highest total intertidal occupancy in 2023 was 208h y^{-1} for a child who spent time fishing on a stone substrate. This is increased when compared with the 2016 survey with the highest total intertidal occupancy of 52h y^{-1} for two children who spent time playing and paddling.

No children were found to undertake in water activities in 2016 however, in water occupancy was determined within the 2023 survey. On water activity occupancy and handling sediment increased in 2023 compared with 2016 whilst handling equipment decreased in 2023 compared with the 2016 survey.

The highest total intertidal occupancy in 2023 was 208h y^{-1} for an infant who spent time fishing on a stone substrate. This is greater than the 104h y^{-1} reported in 2016.

No occupancy for in water activities was determined in either 2023 or 2016 for infants. No infants in 2023 were found to undertake on water activities compared with the highest occupancy of 39h y^{-1} in the 2016 survey. The highest occupancy for handling equipment was 208h y^{-1} in 2023 compared with no infant handling equipment in the 2016 survey. Handling sediment occupancy decreased in 2023 compared with the 2016 survey (3h y^{-1} and 104h y^{-1} respectively).

A comparison is shown in Table 10.4.

Table 10.4: Comparison of the 2016 and 2023 aquatic external exposure pathways for children and infants

Age Group	Activity	2016 Number of people in the high-rate group	2016 Maximum occupancy for the high-rate group (h y^{-1})	2016 Mean occupancy for the high-rate group (h y^{-1})	2023 Number of people in the high-rate group	2023 Maximum occupancy for the high-rate group (h y^{-1})	2023 Mean occupancy for the high-rate group (h y^{-1})
Child (6 to 15 years)	Aquatic (in water)	ND	ND	ND	4	39	28.5
Child (6 to 15 years)	Aquatic (on water)	5	72	41.6	3	234	234
Child (6 to 15 years)	Handling equipment	1	351	351	4	234	228
Child (6 to 15 years)	Handling sediment	7	52	46.6	2	114	114
Infant (0 to 5 years)	Aquatic (on water)	1	39	39	ND	ND	ND
Infant (0 to 5 years)	Handling equipment	ND	ND	ND	1	208	208
Infant (0 to 5 years)	Handling sediment	2	104	104	1	3	3

ND – not determined

10.3 Terrestrial survey

10.3.1 Phase 1 – adult consumption rates – internal exposure

Consumption rates of locally produced food items have increased in the 2023 survey in other vegetables, potatoes, domestic fruit, wild fruit, wild fungi, game, beef, sheep meat and eggs compared to the 2016 survey.

Consumption rates of locally produced food items have decreased in the 2023 survey in green vegetables, root vegetables, pig meat and honey compared to the 2016 survey.

No consumption for poultry or spring water was determined in 2023 with consumption determined for these food groups in 2016.

No consumption of milk was determined in both the 2016 and 2023 survey.

A comparison between the 2016 and 2023 mean consumption rates for adult consumption of the terrestrial food groups is presented in Table 10.5. The table also provides the mean consumption rates from national data (Smith and Jones, 2003) for comparison.

10.3.2 Phase 1 – children and infant consumption rates - internal exposure

Consumption rates of locally produced food items for children have increased in the 2023 survey in the green vegetables, other vegetables, root vegetables, domestic fruit, wild fruit, and eggs in comparison to the 2016 survey.

Consumption rates for children decreased in the 2023 survey in the potatoes food group in comparison to the 2016 survey.

No consumption for beef or honey was determined for children in 2023 with consumption determined for these food groups in 2016.

No consumption of wild fungi, game, pig meat, sheep meat, poultry, milk, or spring water was determined for children in both the 2016 and 2023 survey.

A comparison between the 2016 and 2023 mean consumption rates for child consumption of the terrestrial food groups is presented in Table 10.6. The table also provides the mean consumption rates from national data (Smith and Jones, 2003) for comparison.

Consumption rates of locally produced food items for infants decreased in the 2023 survey for eggs in comparison to the 2016 survey.

No consumption for green vegetables, other vegetables, root vegetables, potatoes and domestic fruit was determined for infants in 2023 with consumption determined for these food groups in 2016.

No consumption of wild fruit, wild fungi, game, beef, pig meat, sheep meat, poultry, honey, milk, or spring water was determined for infants in both the 2016 and 2023 survey.

Table 10.5: **Comparison between 2016 and 2023 mean consumption rates of local terrestrial food groups for adults (kg y^{-1} or l y^{-1})**

Food group	2016 Mean consumption rate for the high-rate group (kg y^{-1} or l y^{-1})	2023 Mean consumption rate for the high-rate group (kg y^{-1} or l y^{-1})	National mean
Green vegetables	29.9	20	15.0
Other vegetables	16.9	19.5	20.0
Root vegetables	43.7	21.7	10.0
Potatoes	99	113	50.0
Domestic fruit	106	142	20.0
Wild fruit	12	18.7	7
Wild mushrooms	1	3.5	3
Meat game (birds)	-	6.6	ND

Food group	2016 Mean consumption rate for the high-rate group (kg y^{-1} or l y^{-1})	2023 Mean consumption rate for the high-rate group (kg y^{-1} or l y^{-1})	National mean
Meat game (venison)	-	22.7	ND
Meat game (rabbit/hare)	-	4	6
Meat game (all)	22	-	ND
Meat poultry	3.8	ND	10
Meat beef	28.8	46.8	15.0
Meat pig	ND	5.5	10.0
Meat sheep	29	46.8	8
Honey	40	9.5	2.50
Eggs	17.7	49.6	8.5
Water (spring)	662	ND	ND
Freshwater trout	ND	2	15

ND – not determined

Table 10.6: Comparison between 2016 and 2023 mean consumption rates of local terrestrial food groups for children (kg y^{-1} or l y^{-1})

Food group	2016 Mean consumption rate for the high-rate group (kg y^{-1} or l y^{-1})	2023 Mean consumption rate for the high-rate group (kg y^{-1} or l y^{-1})	National mean
Green vegetables	3	7.5	15.0
Other vegetables	0.48	0.8	20.0
Root vegetables	1.5	18.3	10.0
Potatoes	15	3.6	50.0

Food group	2016 Mean consumption rate for the high-rate group (kg y^{-1} or l y^{-1})	2023 Mean consumption rate for the high-rate group (kg y^{-1} or l y^{-1})	National mean
Domestic fruit	5.5	33.6	20.0
Wild fruit	0.1	2.5	7
Meat beef	2.5	ND	15.0
Honey	0.8	ND	2.50
Eggs	7.2	8.7	8.5

ND – not determined

A comparison between the 2016 and 2023 mean consumption rates for infant consumption of the terrestrial food groups is presented in Table 10.7. The table also provides the mean consumption rates from national data (Smith and Jones, 2003) for comparison.

Table 10.7: Comparison between 2016 and 2023 mean consumption rates of local terrestrial food groups for infants (kg y^{-1} or l y^{-1})

Food group	2016 Mean consumption rate for the high-rate group (kg y^{-1} or l y^{-1})	2023 Mean consumption rate for the high-rate group (kg y^{-1} or l y^{-1})
Green vegetables	4	ND
Other vegetables	0.33	ND
Root vegetables	5.5	ND
Potatoes	9.08	ND
Domestic fruit	25	ND
Eggs	9	8.5

ND – not determined

10.4 Occupancy living/working within 1km of HMNB Clyde

Table 10.8 presents the comparisons between the 2016 and 2023 survey occupancy rates within the direct radiation survey area (h y^{-1}). The table displays the time spent indoors and outdoors of their home (living) and for those who work and spend time indoors and outdoors within 1km of the HMNB Clyde (HMNB Clyde site workers were not included in either survey). In 2023, the total occupancy was the same compared with 2016, with indoor occupancy increased and outdoor occupancy decreased from 2016. Indoor occupancy for individuals working within 1km of the HMNB Clyde site increased in 2023 from the 2016 report with no outdoor occupancy working determined within the 2023 survey compared to occupancy working outdoor within 1km of the HMNB Clyde site in 2016.

Table 10.8: Comparison between 2016 and 2023 occupancy rates for people living and working within the direct radiation area (h y^{-1})

Occupancy	2016	2023
Highest total	8760	8760
Highest indoor at home	8578	8760
Highest outdoor at home	5616	3285
Highest indoor at work	1920	2920
Highest outdoor at work	470	ND

11 Recommendations and suggestions for monitoring programme changes

11.1 Introduction

The Habits Survey presents results for occupancy, activity, and food consumption from three main sources of community engagement: (i) Postal questionnaire (n = 133); (ii) face-to-face surveys (n = 238); and (iii) several meetings and informal contacts. These data have been supplemented with radiometric surveys including: (i) a carborne and handheld gamma spectrometry survey (n = 5463 (carborne); n = 8958 (handheld); (ii) in situ gamma dose rate (n = 18 intertidal); and (iv) Beta skin dose assessments (n = 3).

11.2 Ongoing monitoring

The Radioactivity in Food and the Environment (RIFE) report demonstrates a comprehensive set of monitoring undertaken annually around the HMNB Clyde site encompassing a range of food types and environmental substrates. The gamma dose rates reported by RIFE are generally higher than those reported here because the RIFE data include the cosmic contribution to dose. This assessment reports the terrestrial gamma dose rate only. When taking this into account, the results are similar. Samples taken and reported by SEPA are provided within RIFE 2022 (published 2023: pp239-249) and covered shellfish, seawater, seaweed (Fucus vesiculosus), sediment, meat, blackberries, honey, water, grass and soil sampling.

11.3 Conclusions and recommendations

Information collected between Phase 1 and 2 surveys demonstrates that there can be differences in data due to a change in habits over the course of a year and/or there is an over or underestimating when reporting of information on consumption and occupancy. This is despite extensive steps taken to check the validity of the results collected during the face-to-face questions.

In some cases, there are differences in the surveyed individual responses between Phases 1 and 2. These differences may be genuine, e.g., a real change in

consumption or occupancy between the different parts of the year when the Phase 1 and 2 surveys were conducted, or they may be due to different estimates of their consumption/activities, e.g., Phase 2 surveys are conducted via pre-arranged telephone interviews and the survey individuals may be able to better prepare for the questions than when they are approached in the survey area at random.

Overall, for HMNB Clyde the results of the Phase 2 surveys largely demonstrate that they provide confidence in the representativeness of the data collected throughout the Phase 1 surveys. It is anticipated that some work can still be done to explain the differences between Phase 1 and 2 surveys e.g., by establishing whether they are due to seasonal/weather conditions, or an over/under-estimating on the part of the survey individual. The survey team will consider additional ways to evaluate this in further surveys.

The 2023 survey results show differences in some food groups between this and previous surveys, it is therefore recommended that consideration be given to the following within future monitoring programmes:

It is recommended that mussel sampling remain as part of the monitoring programme.

It is recommended that mushrooms continue to be sampled within the routine monitoring programme. Mushrooms were identified to being foraged and consumed within the terrestrial survey area and it is recommended they be included in the routine monitoring programme annually from Shandon area.

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Appendices

Appendix A

Appendix A1: Raw data

Table A1.1: Phase 1 adult fish consumption

Observation number	Food type	Sum of consumption (kg y^{-1})
206	Mackerel	7.2
216	Mackerel	4
219	Mackerel	11
225	Cod	2.3
225	Mackerel	1. 4
227	Mackerel	16.4
229	Mackerel	0.8
207	Mackerel	24
235	Mackerel	1.2
236	Mackerel	1.25
7	Mackerel	5.2
8	Mackerel	8
12	Mackerel	0.5
26	Mackerel	2.4
26	Pollock	8
29	Mackerel	4.5
32	Mackerel	4.1
39	Mackerel	1.6
40	Mackerel	106

Observation number	Food type	Sum of consumption (kg y^{-1})
45	Mackerel	54.6
47	Mackerel	1.4
57	Trout (freshwater)	2
60	Mackerel	4.5
61	Mackerel	10.2
78	Mackerel	4.1
78	Pollock	0.6
81	Mackerel	1.25
82	Mackerel	1.25
83	Mackerel	1.25
84	Mackerel	1.25
85	Mackerel	1.25
86	Mackerel	1.25
87	Mackerel	1.2
93	Mackerel	0.4
94	Mackerel	0.4
95	Mackerel	180
102	Mackerel	54.6
103	Mackerel	11
108	Mackerel	4
113	Mackerel	7.2
114	Mackerel	1.4
162	Mackerel	4.1

Observation number	Food type	Sum of consumption (kg y^{-1})
170	Trout (freshwater)	2
172	Mackerel	4.5
177	Mackerel	10.2
184	Mackerel	0.5
187	Mackerel	4.1
187	Pollock	0.6
16	Mackerel	5.2

Table A1.2: Phase 1 children fish consumption

Observation number	Food type	Sum of consumption (kg y^{-1})
21	Mackerel	5.2
19	Mackerel	5.2
176	Mackerel	4.5
175	Mackerel	4.5
174	Mackerel	4.5
173	Mackerel	4.5

Table A1.3: Phase 1 adult in water activities

Observation number	Aquatic activity	Occupancy (h y^{-1})
208	Stand-up paddle boarding	20
211	Body boarding	12
215	Stand-up paddle boarding	2
215	RNLI duties	1
219	Outdoor swimming	48

Observation number	Aquatic activity	Occupancy (h y^{-1})
219	Stand-up paddle boarding	36
231	Outdoor swimming	28
1	Outdoor swimming	4
6	Outdoor swimming	180
35	Outdoor swimming	0.44
40	Outdoor swimming	9
46	Diving	0.75
49	Outdoor swimming	52
50	Outdoor swimming	0.33
54	Outdoor swimming	0.6
65	Stand-up paddle boarding	293
104	Stand-up paddle boarding	36
107	Diving	0.75
107	Outdoor swimming	6
114	Outdoor swimming	26
156	Outdoor swimming	6.6
15	Outdoor swimming	180
199	Outdoor swimming	26

Table A1.4: Phase 1 children in water activities

Observation number	Aquatic activity	Occupancy (h y^{-1})
91	Outdoor swimming	4
106	Stand-up paddle boarding	36

Observation number	Aquatic activity	Occupancy (h y^{-1})
126	Stand-up paddle boarding	19.5
125	Stand-up paddle boarding	19.5
122	Sea cadets - in water	39

Table A1.5: Phase 1 infant in water activities

Observation number	Aquatic activity	Occupancy (h y^{-1})
92	Outdoor swimming	4

Table A1.6: Phase 1 adult on water activities

Observation number	Aquatic activity	Occupancy (h y^{-1})
211	Commute via boat	58.5
211	Sport fishing	26
215	Power boating	54
215	RNLI duties	32
215	RNLI duties	24
216	Canoeing	12.5
216	Sea angling	12.5
219	Kayaking	48
8	Boat maintenance	4.5
8	Canoeing	4
8	Sea angling	32
32	Kayaking	9
32	Kayaking	9
42	Sea angling	6
43	Sailing	18
43	Sea angling	0.5
44	Kayaking	6
62	Power boating	18

Observation number	Aquatic activity	Occupancy (h y^{-1})
70	Canoeing	18
70	Kayaking	48
77	Kayaking	468
78	Kayaking	468
78	Sea angling	312
78	Sea angling	26
96	Kayaking	8
96	Sailing	18
96	Sea angling	0.5
101	Kayaking	6
104	Kayaking	48
127	Sailing	128
162	Kayaking	9
162	Kayaking	9
179	Power boating	117
179	Power boating	117
197	Kayaking	48
199	Kayaking	48

Table A1.7: Phase 1 children on water activities.

Observation number	Aquatic activity	Occupancy (h y^{-1})
106	Kayaking	48
182	Power boating	117

Observation number	Aquatic activity	Occupancy (h y^{-1})
182	Power boating	117
181	Power boating	117
181	Power boating	117
180	Power boating	117
180	Power boating	117
125	Power boating	6.5
125	Rowing	6.5
125	Sailing	6.5

Table A1.8: Phase 1 adult intertidal activities

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
6	Sitting/picnicking/BBQ	0	0	0	0	21	0
7	Sitting/picnicking/BBQ	0	0	0	0	36	0
7	Fishing	0	0	0	0	78	0
8	Dog walking	0	0	0	600	0	0
8	Rock pooling	0	0	0	0	7	0
8	Sitting/picnicking/BBQ	0	0	0	0	7	0
9	Fishing	0	0	0	0	3	0
10	Dog walking	0	0	0	0	365	0
13	Fishing	0	0	0	0	2	0
13	Collecting seaweed	0	0	0	1.5	0	0
15	Sitting/picnicking/BBQ	0	0	0	0	21	0
16	Sitting/picnicking/BBQ	0	0	0	0	36	0
22	Beachcombing	0	0	78	78	0	0

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
23	Walking	0	0	2	0	0	0
24	Dog walking	0	0	0	730	0	0
26	Fishing	0	0	0	0	12	0
26	Fishing	0	0	0	0	12	0
26	Fishing	0	0	0	0	12	0
27	Sitting/picnicking/BBQ	0	0	0	0	1	0
27	Dog walking	0	0	0	0	24	0
28	Sitting/picnicking/BBQ	0	0	0	0	14	0
28	Walking	0	0	0	0	294	0
29	Sea Angling	0	0	0	0	0	12
30	Walking	0	0	0	12	0	0
30	Dog walking	0	0	0	12	0	0
32	Walking	0	0	0	19.5	0	0
32	Fishing	0	0	0	12	0	0

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
32	Walking	0	0	0	19.5	0	0
34	Fishing	0	0	0	0	3	0
39	Fishing	0	0	0	22	0	0
40	Fishing	0	0	0	0	26	0
40	Fishing	0	0	0	0	52	0
40	Fishing	0	0	0	0	52	0
41	Fishing	0	0	0	2	0	0
42	Fishing	0	0	0	0	0	0.5
43	Litter picking	0	0	0	0	1.5	0
44	Dog walking	0	0	0	39	0	0
45	Fishing	0	0	0	0	64	0
46	Litter picking	0	0	0	8	0	0
47	Fishing	0	0	0	52	0	0
50	Walking	0	0	0	1.5	0	0

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
50	Walking	0	0	0	39	0	0
53	Fishing	0	0	0	0	208	0
57	Metal detecting	0	0	0	36	0	0
57	Metal detecting	0	0	0	36	0	0
57	Dog walking	0	0	0	26	0	0
58	Paddling	0	0	0	0	3	0
58	Walking	0	0	0	0	12	0
59	Walking	0	0	0	6	0	0
60	Fishing	0	0	0	0	12	0
61	Fishing	0	0	0	0	6	0
62	Beach Clean	0	0	0	0	4.5	0
65	Dog walking	0	0	0	730	0	0
66	Fishing	0	0	0	0	4	0
67	Sitting/picnicking/BBQ	0	0	0	0	14	0

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
67	Walking	0	0	0	0	294	0
68	Sea Angling	0	0	24	0	0	0
74	Beach Clean	0	0	0	24	0	0
75	Dog walking	0	0	0	5	0	0
76	Dog walking	0	0	0	130	0	0
77	Beach Clean	0	0	0	6	0	0
77	Beach Clean	0	0	0	6.24	0	0
77	Walking	0	0	0	12	0	0
77	Walking	0	0	0	12	0	0
78	Dog walking	0	0	0	547.5	0	0
78	Beach Clean	0	0	0	8	0	0
79	Fishing	0	0	0	3	0	0
80	Walking	0	0	0	3	0	0
87	Fishing	0	0	0	0	21	0

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
87	Fishing	0	0	0	0	0	28
88	Beachcombing	0	0	0	0	20	0
88	Beachcombing	0	0	0	0	20	0
88	Beachcombing	0	0	0	20	0	0
88	Beachcombing	0	0	0	0	20	0
88	Beachcombing	0	0	0	20	0	0
89	Bird Surveys	0	0	0	12	0	0
90	Fishing	0	0	0	5.5	0	0
96	Litter picking	0	0	0	0	1.5	0
98	Playing	0	0	0	0	24	0
102	Fishing	0	0	0	0	64	0
104	Dog walking	0	0	0	0	192	0
107	Litter picking	0	0	0	8	0	0
109	Dog walking	0	0	0	0	52	0

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
110	Jogging	0	0	0	13	0	0
115	Fishing	0	0	0	52	0	0
116	Fishing	0	0	0	52	0	0
118	Litter picking	0	0	0	12	0	0
124	Dog walking	0	0	0	0	24	0
129	Fishing	0	0	0	1.5	0	0
132	Walking	0	0	0	1.5	0	0
133	Walking	0	0	0	1.5	0	0
134	Dog walking	0	0	0	52	0	0
144	Fishing	0	0	0	4	0	0
144	Dog walking	0	0	0	52	0	0
152	Walking	0	0	0	120	0	0
153	Fishing	0	0	0	0	3	0
154	Fishing	0	0	0	0	3	0

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
155	Fishing	0	0	0	0	3	0
156	Dog walking	0	0	0	0	365	0
162	Walking	0	0	0	19.5	0	0
162	Walking	0	0	0	19.5	0	0
163	Sitting/picnicking/BBQ	0	0	0	0	3	0
166	Fishing	0	0	0	0	3	0
167	Walking	0	0	0	1.5	0	0
167	Walking	0	0	0	39	0	0
170	Dog walking	0	0	0	182.5	0	0
171	Walking	0	0	0	6	0	0
177	Fishing	0	0	0	0	6	0
183	Walking	0	0	0	12	0	0
187	Beach Clean	0	0	0	8	0	0
187	Dog walking	0	0	0	365	0	0

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
189	Beach Clean	0	0	0	6	0	0
189	Walking	0	0	0	12	0	0
189	Beach Clean	0	0	0	31.2	0	0
189	Walking	0	0	0	12	0	0
191	Walking	0	0	3	0	0	0
202	Beachcombing	0	0	0	0	34.32	0
202	Litter picking	0	0	0	12	0	0
203	Walking	0	0	0	1.5	0	0
204	photography	0	0	0	1.5	0	0
204	Litter picking	0	0	0	3	0	0
206	Fishing	0	0	0	0	0	35
207	Walking	0	0	0	78	0	0
208	Dog walking	0	0	0	0	24	0
216	Walking	0	0	0	0	52	0

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
216	Shore crew for RNLI	0	0	0	156	0	0
216	Walking	0	0	0	0	24	0
218	Jogging	0	0	0	1	0	0
219	Dog walking	0	0	0	0	72	0
221	Dog walking	0	0	0	0	26	0
222	Beachcombing	0	0	0	0	130	0
222	Dog walking	0	0	0	0	130	0
223	Beachcombing	0	0	0	0	52	0
225	Fishing	0	0	0	0	0	36
225	Playing	0	0	0	0	24	0
227	Dog walking	0	0	0	312	0	0
227	Fishing	0	0	0	0	0	27
228	Fishing	0	0	0	0	0	416
233	Beachcombing	0	0	0	20	0	0

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
233	Beachcombing	0	0	0	0	20	0
233	Beachcombing	0	0	0	20	0	0
233	Beachcombing	0	0	0	0	20	0
233	Beachcombing	0	0	0	0	20	0
235	Fishing	0	0	0	0	21	0
235	Fishing	0	0	0	0	0	28
236	Fishing	0	0	0	0	0	10
238	Bird Surveys	0	0	0	12	0	0
1	Beachcombing	0	0	0	104	0	0
1	Litter picking	0	0	0	52	0	0
1	Dog walking	0	0	0	0	9	0
1	Beachcombing	0	0	0	0	9	0
1	Litter picking	0	0	0	0	6	0
1	Dog walking	0	0	0	104	0	0

Observation number	Intertidal activity	Occupancy on mud (h y^{-1})	Occupancy on saltmarsh (h y^{-1})	Occupancy on Sand (h y^{-1})	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})	Occupancy on rock (h y^{-1})
2	Sitting/picnicking/BBQ	0	0	0	48	0	0
2	Dog walking	0	0	0	72	0	0
2	Beachcombing	0	0	0	72	0	0

Table A1.9: Phase 1 children intertidal activities

Observation number	Intertidal activity	Occupancy on sand and stone (h y^{-1})	Occupancy on stone (h y^{-1})
122	Beachcombing	0	34.32
126	Dog walking	0	24
125	Dog walking	0	24
106	Dog walking	0	192
21	Paddling	0	78
19	Paddling	0	78
99	Playing	0	24
21	Sitting/picnicking/BBQ	0	36
19	Sitting/picnicking/BBQ	0	36
131	Fishing	1.5	0
130	Fishing	1.5	0
165	Fishing	0	3
91	Fishing	0	208

Table A1.10: Phase 1 infant intertidal activities

Observation number	Intertidal activity	Occupancy on stone (h y^{-1})
92	Fishing	208
164	Playing	3

Table A1.11: Phase 1 adult handling sediment activities

Observation number	Sum of handling sediment (h y^{-1})
202	46.3
204	3
216	156
222	130
223	52
225	24
223	100
1	171
2	120
6	21
7	36
8	14
13	1.5
22	156
27	1
43	1.5
46	8
57	72
58	3
62	4.5
67	14
74	24
77	12

Observation number	Sum of handling sediment (h y^{-1})
78	8
88	100
96	1.5
98	24
107	8
118	12
163	3
187	8
189	37.2
15	21
16	36
28	14

Table A1.12: Phase 1 children handling sediment activities

Observation number	Sum of handling sediment (h y^{-1})
19	114
21	114
99	24
122	34.3

Table A1.13: Phase 1 infant handling sediment activities

Observation number	Sum of handling sediment (h y^{-1})
164	3

Table A1.14: Phase 1 adult handling equipment activities

Observation number	Sum of handling equipment (h y^{-1})
7	78
8	40.6
9	3
13	2
26	36
29	12
32	19. 6
34	3
39	23
40	132.7
41	2
42	7
43	60.5
45	69
47	52
53	208
60	12
61	6
62	18
66	4
68	24
70	18
77	3

Observation number	Sum of handling equipment (h y^{-1})
78	365
79	3
87	51
90	5.5
96	0.5
102	69
115	52
116	52
127	144
129	1.5
144	4
153	3
154	3
155	3
162	4.6
166	3
177	6
179	234
206	35.5
211	38
215	58.5
216	64
225	42
227	28

Observation number	Sum of handling equipment (h y^{-1})
228	416
235	51
236	11.7

Table A1.15: Phase 1 children handling equipment activities

Observation number	Sum of handling equipment (h y^{-1})
91	208
125	13
130	1.5
131	1.5
165	3
180	234
181	234
182	234

Table A1.16: Phase 1 infant handling equipment activities

Observation number	Sum of handling equipment (h y^{-1})
92	208

Table A1.17: Phase 1 adult terrestrial activities

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
144	Dog walking	365
144	Gardening	730
151	Gardening	104
151	Rambling/walking	30

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
151	Jogging	16.5
151	Camping	60
152	Cycling	78
152	Jogging	26
202	Gardening	156
202	Rambling/walking	365
202	Collecting wild produce	1
204	Dog walking	182.5
205	Sitting/picnicking/BBQ	456
207	Gardening	4015
208	Dog walking	156
208	Gardening	208
208	Rambling/walking	156
208	Sitting/picnicking/BBQ	39
208	Collecting wild produce	4
208	Looking after hens	13
209	Gardening	84
210	Gardening	252
211	Dog walking	18
211	Rambling/walking	18
212	Rambling/walking	365
213	Gardening	104
213	Rambling/walking	26
214	Cycling	234

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
214	Gardening	3
215	Dog walking	1.5
217	Dog walking	208
217	Sitting/picnicking/BBQ	182.5
217	Sitting/picnicking/BBQ	52
218	Gardening	60
218	Jogging	13
219	Cycling	48
219	Collecting wild produce	3
221	Sitting/picnicking/BBQ	182
221	Collecting wild produce	39
222	Bee keeping	84
222	Cycling	104
222	Gardening	1248
222	Collecting wild produce	24
222	Shooting	52
223	Rambling/walking	208
224	Dog walking	240.9
224	Rambling/walking	240.9
226	Gardening	819
226	Rambling/walking	130
226	Groundworks	980
231	Dog walking	1095
231	Gardening	547.5

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
231	Golfing	9
233	Gardening	40
233	Rambling/walking	50
234	Jogging	129.48
237	Gardening	1825
238	Gardening	468
238	Rambling/walking	384
3	Dog walking	700
3	Gardening	700
4	Rambling/walking	546
4	Rambling/walking	13
4	Collecting wild produce	4
6	Gardening	117
8	Gardening	456
10	Dog walking	275
10	Running	52
10	Running	52
12	Rambling/walking	104
17	Bird/nature watching	182.5
17	Gardening	1095
17	Rambling/walking	104
17	Sitting/picnicking/BBQ	365
24	Dog walking	912.5
29	Sitting/picnicking/BBQ	1

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
30	Dog walking	365
30	Gardening	1095
30	Sitting/picnicking/BBQ	1095
30	Collecting wild produce	2
30	Collecting wild produce	2
32	Cycling	78
32	Gardening	390
32	Gardening	2704
32	Rambling/walking	13
32	Rambling/walking	26
32	Rambling/walking	26
32	Rambling/walking	6.5
32	Sitting/picnicking/BBQ	19.5
33	Cycling	78
33	Gardening	390
33	Rambling/walking	260
33	Sitting/picnicking/BBQ	1170
33	Collecting wild produce	10
33	In hot tub in garden	156
35	Education/Research	24
38	Gardening	1095
44	Cycling	52
44	Dog walking	182.5
44	Rambling/walking	182.5

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
44	Collecting wild produce	4
46	Cycling	260
46	Gardening	52
46	Rambling/walking	18
46	Sitting/picnicking/BBQ	18
47	Bee keeping	52
47	Gardening	182
47	Rambling/walking	52
48	Gardening	26
48	Gardening	156
48	Rambling/walking	26
48	Collecting wild produce	6
49	Bird/nature watching	390
49	Gardening	1820
49	Collecting wild produce	3
50	Rambling/walking	6
50	Rambling/walking	2
51	Rambling/walking	18
52	Dog walking	547.5
52	Gardening	1460
52	Rambling/walking	24
53	Playing	104
53	Rambling/walking	104
54	Dog walking	365

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
55	Rambling/walking	78
56	Farming	2600
56	Working	520
57	Cycling	13
57	Cycling	13
57	Dog walking	182.5
57	Gardening	365
57	Fishing	104
57	Shooting	182.5
58	Cycling	24
58	Cycling	24
58	Gardening	27
58	Rambling/walking	72
58	At peace camp	960
59	Rambling/walking	48
62	Gardening	548
62	Rambling/walking	60
63	Rambling/walking	18
64	Dog walking	547.5
64	Sitting/picnicking/BBQ	92
65	Gardening	97.5
67	Gardening	52
67	Gardening	312
67	Jogging	516

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
69	Bird/nature watching	96
70	Bird/nature watching	365
70	Gardening	156
72	Bird/nature watching	730
72	Dog walking	1095
73	Dog walking	312
73	Sports	234
74	Gardening	130
75	Gardening	1096
76	Dog walking	182.5
76	Dog walking	182.5
77	Cycling	78
77	Cycling	13
77	Gardening	822
77	Rambling/walking	26
77	Rambling/walking	26
77	Collecting wild produce	0.5
77	Collecting wild produce	0.5
78	Bee keeping	91.25
78	Dog walking	730
78	Gardening	274
88	Gardening	40
88	Rambling/walking	40
89	Gardening	468

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
89	Rambling/walking	384
97	Dog walking	52
97	Rambling/walking	52
98	Gardening	819
98	Rambling/walking	130
101	Dog walking	120.45
107	Rambling/walking	36
107	Sitting/picnicking/BBQ	36
109	Gardening	208
109	Sitting/picnicking/BBQ	52
109	Sitting/picnicking/BBQ	182.5
110	Gardening	730
110	Jogging	26
114	Gardening	26
114	Rambling/walking	52
114	Collecting wild produce	7
117	Gardening	65
117	Gardening	13
118	Rambling/walking	52
119	Rambling/walking	52
120	Rambling/walking	52
121	Rambling/walking	52
123	Sitting/picnicking/BBQ	365
124	Dog walking	156

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
124	Gardening	208
124	Rambling/walking	156
124	Sitting/picnicking/BBQ	39
124	Collecting wild produce	4
124	Looking after hens	13
128	Gardening	52
134	Dog walking	365
134	Gardening	104
137	Gardening	1095
138	Dog walking	365
138	Gardening	547.5
156	Dog walking	52
156	Running	104
157	Rambling/walking	104
158	Cycling	78
158	Gardening	390
158	Rambling/walking	260
158	Sitting/picnicking/BBQ	1170
158	Collecting wild produce	10
158	In hot tub in garden	156
159	Gardening	390
159	Rambling/walking	260
159	Sitting/picnicking/BBQ	1170
159	Collecting wild produce	10

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
159	In hot tub in garden	156
162	Gardening	52
162	Gardening	390
162	Rambling/walking	26
162	Rambling/walking	26
162	Rambling/walking	26
162	Rambling/walking	6.5
162	Sitting/picnicking/BBQ	19.5
167	Rambling/walking	6
167	Rambling/walking	2
168	Rambling/walking	18
170	Dog walking	182.5
171	Rambling/walking	365
183	Dog walking	365
183	Gardening	1095
183	Sitting/picnicking/BBQ	1095
183	Collecting wild produce	2
183	Collecting wild produce	2
184	Dog walking	36
184	Gardening	468
185	Rambling/walking	365
186	Gardening	13
187	Gardening	274
189	Gardening	822

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
189	Rambling/walking	26
189	Rambling/walking	26
189	Collecting wild produce	0.5
189	Collecting wild produce	0.5
14	Rambling/walking	546
14	Rambling/walking	13
14	Collecting wild produce	4
15	Gardening	117
25	Rambling/walking	936
28	Gardening	312
28	Gardening	52
28	Jogging	516
28	Shooting	860
197	Bird/nature watching	365
197	Gardening	156
220	Cycling	234
220	Gardening	3

Table A1.18: Phase 1 children terrestrial activities

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
91	Playing	104
91	Rambling/walking	104
99	Rambling/walking	130
122	Gardening	156
122	Rambling/walking	365

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
125	Dog walking	156
125	Gardening	52
125	Gardening	52
125	Playing	156
125	Rambling/walking	156
125	Sitting/picnicking/BBQ	39
125	Collecting wild produce	4
125	Looking after hens	13
126	Dog walking	156
126	Playing	156
126	Rambling/walking	156
126	Sitting/picnicking/BBQ	39
126	Collecting wild produce	4
126	Looking after hens	13
160	Cycling	117
160	Rambling/walking	195
160	Sitting/picnicking/BBQ	1170
160	Collecting wild produce	10
160	In hot tub in garden	156
161	Cycling	117
161	Rambling/walking	195
161	Sitting/picnicking/BBQ	1170
161	Collecting wild produce	10
161	In hot tub in garden	156

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
18	Rambling/walking	546
18	Rambling/walking	13
18	Collecting wild produce	4

Table A1.19: Phase 1 infant terrestrial activities

Observation number	Terrestrial activity	Sum of occupancy (h y^{-1})
188	Playing	274
92	Playing	104
20	Rambling/walking	559
92	Rambling/walking	104
20	Collecting wild produce	4

Table A1.20: Phase 1 adult green vegetable consumption

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
13	Lettuce	10.8
13	Brussel sprouts	3
13	Kale	3
13	Cabbage	1.5
32	Rhubarb	3
32	Lettuce	0.3
33	Spinach	0.3
33	Rhubarb	0.8
33	Lettuce	5.4
33	Kale	1
38	Rhubarb	2
44	Rhubarb	2
47	Rhubarb	0.2
48	Rhubarb	1

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
52	Lettuce	9
52	Cauliflower	10
57	Pak choi	2.5
57	Cauliflower	1.5
57	Brussel sprouts	2
57	Lettuce	11.3
70	Rhubarb	5
70	Chard	2.25
70	Lettuce	4.5
70	Kale	5
70	Pak choi	6.3
70	Broccoli	3.5
77	Lettuce	6.8
77	Rhubarb	10
100	Rhubarb	2
101	Rhubarb	2
110	Celery	0.4
110	Kale	0.5
111	Kale	0.5
111	Celery	0.4
114	Rhubarb	0.2
114	Kale	1
115	Rhubarb	0.2
116	Rhubarb	0.2
117	Rhubarb	1
117	Rhubarb	0.2
118	Kale	0.2
119	Rhubarb	0.2
119	Kale	0.2
1120	Rhubarb	0.2
120	Kale	0.2

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
121	Rhubarb	0.2
121	Kale	0.2
134	Lettuce	3
134	Brussel sprouts	1
134	Rhubarb	10
134	Cauliflower	1.5
134	Cabbage	0.5
134	Pak choi	1
144	Cabbage	0.5
144	Lettuce	3
144	Rhubarb	10
144	Cauliflower	1.5
144	Pak choi	1
158	Rhubarb	0.8
158	Kale	1
158	Spinach	0.3
158	Lettuce	5.4
159	Rhubarb	0.8
159	Lettuce	5.4
159	Spinach	0.3
159	Kale	1
162	Rhubarb	3
162	Lettuce	0.3
170	Brussel sprouts	2
170	Cauliflower	1.5
170	Pak choi	2.5
170	Lettuce	11.3
184	Brussel sprouts	3
184	Cabbage	1.5
184	Kale	3
184	Lettuce	10.8

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
189	Lettuce	6.8
189	Rhubarb	10
197	Rhubarb	5
197	Pak choi	6.3
197	Chard	2.3
197	Lettuce	4.5
197	Broccoli	3.5
197	Kale	5
199	Rhubarb	5
199	Broccoli	3.5
199	Pak choi	6.3
199	Lettuce	4.5
199	Chard	2.3
199	Kale	5
202	Rhubarb	0.2
202	Kale	0.2
207	Lettuce	5.4
207	Rhubarb	2
218	Celery	0.4
218	Kale	0.5
232	Rhubarb	2
232	Cabbage	6

Table A1.21: Phase 1 children green vegetable consumption

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
112	Kale	0.5
112	Celery	0.4
122	Rhubarb	0.2
122	Kale	0.1

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
160	Spinach	0.3
160	Rhubarb	0.8
160	Lettuce	5.4
160	Kale	1
161	Spinach	0.3
161	Rhubarb	0.8
161	Lettuce	5.4
161	Kale	1

Table A1.22: Phase 1 adult other vegetable consumption

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
33	Pea	0.999
47	Broad bean	0.6
47	French bean	1.1
47	Pea	4.8
47	Runner Bean	6.8
52	Broad bean	6
52	Pea	3.33
52	Runner Bean	9
70	Runner Bean	4.5
77	Broad bean	12
77	French bean	3.32
77	Runner Bean	18
89	Pea	0.16
89	Runner Bean	1.14

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
110	Broad bean	0.3
111	Broad bean	0.3
114	French bean	1.1
114	Pea	4.8
114	Runner Bean	6.8
114	Broad bean	0.6
115	Pea	4.8
115	Broad bean	0.6
115	Runner Bean	6.8
115	French bean	1.1
116	Pea	4.8
116	Broad bean	0.6
116	French bean	1.1
116	Runner Bean	6.8
118	Runner Bean	0.33
118	Broad bean	0.1
118	Mushrooms	0.05
119	Broad bean	0.1
119	Mushrooms	0.05
119	Runner Bean	0.33
1220	Runner Bean	0.33
120	Broad bean	0.1
120	Mushrooms	0.05
121	Mushrooms	0.05

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
121	Runner Bean	0.33
121	Broad bean	0.1
134	Runner Bean	8.3
134	Broad bean	0.64
144	Broad bean	0.64
144	Runner Bean	8.3
158	Pea	0.999
159	Pea	0.999
189	Broad bean	12
189	French bean	3.32
189	Runner Bean	18
197	Runner Bean	4.5
199	Runner Bean	4.5
202	Mushrooms	0.05
202	Broad bean	0.1
202	Runner Bean	0.33
211	Pea	1
218	Broad bean	0.3
232	Runner Bean	18
238	Pea	0.16
238	Runner Bean	1.14

Table A1.23: Phase 1 children other vegetable consumption

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
113	Broad bean	0.3

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
122	Mushrooms	0.05
122	Runner Bean	0.33
122	Broad bean	0.1
160	Pea	0.999
161	Pea	0.999

Table A1.24: Phase 1 adult root vegetable consumption

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
13	Onion	1.2
32	Onion	2
33	Onion	17.6
33	Carrot	0.7
38	Leek	16.7
44	Spring Onion	0.03
44	Shallot	0.2
47	Beetroot	0.6
47	Onion	3.4
47	Leek	0.2
52	Carrot	36
52	Spring Onion	0.8
58	Radish	0.1
70	Leek	1.8
70	Beetroot	2
98	Onion	0.5
100	Spring Onion	0.03

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
100	Shallot	0.2
101	Shallot	0.2
101	Spring Onion	0.03
110	Spring Onion	0.03
110	Beetroot	0.5
110	Onion	0.133
111	Beetroot	0.52
111	Spring Onion	0.03
111	Onion	0.1
114	Onion	3.4
114	Beetroot	0.6
114	Leek	0.2
115	Leek	0.2
115	Onion	3.4
115	Beetroot	0.6
116	Beetroot	0.6
116	Leek	0.2
116	Onion	3.4
118	Beetroot	0.1
118	Shallot	0.1
118	Leek	0.1
118	Onion	0.1
119	Shallot	0.1
119	Leek	0.1

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
119	Beetroot	0.1
119	Onion	0.1
120	Shallot	0.1
120	Onion	0.1
120	Leek	0.1
120	Beetroot	0.1
121	Beetroot	0.1
121	Onion	0.1
121	Leek	0.1
121	Shallot	0.1
134	Parsnip	2
134	Leek	2
134	Turnip	2.4
134	Garlic	0.08
134	Beetroot	1.4
144	Leek	2
144	Turnip	2.4
144	Parsnip	2
144	Garlic	0.08
144	Beetroot	1.4
158	Onion	17.6
158	Carrot	0.7
159	Carrot	0.7
159	Onion	17.6

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
162	Onion	2
184	Onion	1.2
197	Leek	1.8
197	Beetroot	2
199	Leek	1.8
199	Beetroot	2
202	Beetroot	0.1
202	Shallot	0.1
202	Onion	0.1
202	Leek	0.1
207	Beetroot	1.1
207	Spring Onion	0.1
218	Spring Onion	0.03
218	Beetroot	0.5
218	Onion	0.1
226	Onion	0.5
232	Carrot	3

Table A1.25: Phase 1 children root vegetable consumption

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
99	Onion	0.5
112	Spring Onion	0.03
112	Onion	0.1
112	Beetroot	0.5
122	Shallot	0.1
122	Onion	0.1
122	Leek	0.1
122	Beetroot	0.1
160	Onion	17.6
160	Carrot	0.7
161	Onion	17.6
161	Carrot	0.7

Table A1.26: Phase 1 adult potato consumption

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
32	Potatoes	4.6
22	Potatoes	4.6
47	Potatoes	5.7
48	Potatoes	6.2
52	Potatoes	139
58	Potatoes	2
70	Potatoes	3.9
77	Potatoes	7.7

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
89	Potatoes	1.2
110	Potatoes	0.8
111	Potatoes	0.8
114	Potatoes	5.7
115	Potatoes	5.7
116	Potatoes	5.7
117	Potatoes	6.2
118	Potatoes	1.7
119	Potatoes	1.7
120	Potatoes	1.7
121	Potatoes	1.7
134	Potatoes	100
144	Potatoes	100
152	Potatoes	1
158	Potatoes	4.6
159	Potatoes	4.6
162	Potatoes	4.6
189	Potatoes	7.7
197	Potatoes	3.9
199	Potatoes	3.9
202	Potatoes	1.7
218	Potatoes	0.8
238	Potatoes	1.2

Table A1.27: Phase 1 children potato consumption

Observation number	Vegetable type	Sum of consumption (kg y^{-1})
11	Potatoes	0.77
122	Potatoes	1.7
160	Potatoes	4.62
161	Potatoes	4.62

Table A1.28: Phase 1 adult fruit consumption

Observation number	Fruit type	Sum of consumption (kg y^{-1})
13	Tomato	16
13	Apple	27
32	Loganberry	2.7
32	Blackcurrant	4.5
32	Gooseberry	6
32	Apple	13.5
32	Apple	13.5
33	Courgettes	17.3
33	Strawberry	9
3338	Tomato	12
38	Apple	54
38	Blackcurrant	9
38	Gooseberry	8
44	Strawberry	3.2
44	Gooseberry	1.3
44	Raspberry	5
44	Redcurrant	4

Observation number	Fruit type	Sum of consumption (kg y^{-1})
44	Blackcurrant	3
44	Blueberries	0.7
47	Courgettes	1.1
47	Cherries	0.6
47	Loganberry	0.6
47	Pear	2.35
47	Tomato	0.6
47	Plum	1.1
47	Apple	1.1
47	Peach	3
47	Strawberry	0.6
47	Cucumber	2.3
47	Tayberry	0.6
52	Plum	24
52	Tomato	40
52	Pepper	10
52	Courgettes	28.8
52	Strawberry	2.25
52	Pear	18
53	Redcurrant	4
53	Chillies	0.2
53	Strawberry	2.7
53	Gooseberry	4
53	Tomato	28

Observation number	Fruit type	Sum of consumption (kg y^{-1})
53	Blackberry	4.5
53	Pepper	6
53	Blackcurrant	4.5
70	Raspberry	1
70	Tomato	10
70	Gooseberry	2
70	Plum	1.1
70	Sloe berries	0.5
70	Blackberry	1.4
70	Blueberries	0.7
70	Apple	13.5
77	Plum	0.3
77	Apple	27
77	Tomato	6
77	Blackcurrant	11.3
77	White currants	4
77	Cucumber	2.5
77	Gooseberry	8
77	Redcurrant	6
77	Courgettes	4.3
78	Apple	9
78	Cherries	0.5
78	Blueberries	0.5
88	Apple	2.5

Observation number	Fruit type	Sum of consumption (kg y^{-1})
89	Apple	10
89	Elderflower	0.2
89	Blackcurrant	4.5
89	Plum	1.1
100	Strawberry	3.2
100	Raspberry	5
100	Blackcurrant	3
100	Redcurrant	4
100	Gooseberry	1.3
101	Gooseberry	1.3
101	Redcurrant	4
101	Raspberry	5
101	Blackcurrant	3
101	Strawberry	3.2
110	Pepper	1
110	Tomato	2
111	Tomato	2
111	Pepper	1
114	Plum	1.1
114	Peach	3
114	Courgettes	1.1
114	Tayberry	0.6
114	Blueberries	0.7
114	Cucumber	2.3

Observation number	Fruit type	Sum of consumption (kg y^{-1})
114	Apple	1.1
114	Strawberry	0.6
114	Pear	2.3
114	Cherries	0.6
114	Tomato	0.6
114	Loganberry	0.6
115	Blueberries	0.7
115	Peach	0.3
115	Courgettes	1.1
115	Pear	2.3
115	Plum	1.1
115	Apple	1.1
115	Strawberry	0.6
115	Loganberry	0.6
115	Cherries	0.6
115	Tomato	0.6
115	Tayberry	0.6
115	Cucumber	2.3
116	Cucumber	2.3
116	Apple	1.1
116	Plum	1.1
116	Strawberry	0.6
116	Pear	2.3
116	Courgettes	1.1

Observation number	Fruit type	Sum of consumption (kg y^{-1})
116	Loganberry	0.6
116	Tomato	0.6
116	Cherries	0.6
116	Tayberry	0.6
116	Blueberries	0.7
116	Peach	0.3
118	Strawberry	0.04
118	Raspberry	0.1
118	Courgettes	0.3
118	Blueberries	0.2
118	Apple	1.5
118	Cherries	0.2
118	Blackcurrant	0.2
118	Blackberry	0.1
119	Blackberry	0.1
119	Courgettes	0.3
119	Raspberry	0.1
119	Blackcurrant	0.2
119	Apple	1.5
119	Strawberry	0.04
119	Cherries	0.2
119	Blueberries	0.2
120	Blackberry	0.1
120	Courgettes	0.3

Observation number	Fruit type	Sum of consumption (kg y^{-1})
120	Raspberry	0.1
120	Apple	1.5
120	Blueberries	0.2
120	Strawberry	0.04
120	Cherries	0.2
120	Blackcurrant	0.2
121	Blueberries	0.2
121	Blackcurrant	0.2
121	Blackberry	0.1
121	Courgettes	0.3
121	Apple	1.5
121	Strawberry	0.04
121	Cherries	0.2
121	Raspberry	0.1
124	Courgettes	1
124	Strawberry	2
124	Tomato	3
124	Blackberry	1
124	Pear	0.8
124	Cherries	0.3
124	Plum	0.3
124	Apple	7.5
134	White currants	2
134	Blackcurrant	6.8

Observation number	Fruit type	Sum of consumption (kg y^{-1})
134	Plum	1.1
134	Apple	2.7
134	Grape	9
134	Courgettes	8.6
134	Raspberry	12
134	Apple	70
134	Tomato	10
144	Plum	1.1
144	Courgettes	8.6
144	Blackcurrant	6.8
144	White currants	2
144	Grape	9
144	Apple	70
144	Tomato	10
152	Tomato	0.5
158	Courgettes	17.3
158	Tomato	12
158	Strawberry	9
159	Strawberry	9
159	Tomato	12
159	Courgettes	17.3
162	Blackcurrant	4.5
162	Apple	13.5
162	Apple	13.5

Observation number	Fruit type	Sum of consumption (kg y^{-1})
162	Loganberry	2.7
162	Gooseberry	6
170	Strawberry	2.7
170	Blackcurrant	4.5
170	Redcurrant	4
170	Pepper	6
170	Gooseberry	4
170	Blackberry	4.5
170	Chillies	0.2
170	Tomato	28
184	Tomato	16
184	Apple	27
187	Blueberries	0.5
187	Cherries	0.5
187	Apple	9
189	Cucumber	2.5
189	Blackcurrant	11.3
189	White currants	4
189	Plum	0.25
189	Apple	27
189	Redcurrant	6
189	Courgettes	4.3
189	Gooseberry	8
189	Tomato	6

Observation number	Fruit type	Sum of consumption (kg y^{-1})
197	Gooseberry	2
197	Plum	1.1
197	Blueberries	0.7
197	Blackberry	1.4
197	Tomato	10
197	Apple	13.5
197	Raspberry	1
197	Sloe berries	0.5
199	Plum	1.1
199	Apple	13.5
199	Blueberries	0.7
199	Tomato	10
199	Gooseberry	2
199	Sloe berries	0.5
199	Blackberry	1.4
199	Raspberry	1
202	Blackberry	0.1
202	Cherries	0.2
202	Strawberry	0.04
202	Blackcurrant	0.2
202	Courgettes	0.3
202	Blueberries	0.2
202	Apple	1.5
202	Raspberry	0.1

Observation number	Fruit type	Sum of consumption (kg y^{-1})
207	Apple	1
207	Tomato	12
208	Plum	0.3
208	Apple	7.5
208	Strawberry	2
208	Blackberry	1
208	Pear	0.8
208	Tomato	3
208	Courgettes	1
208	Cherries	0.3
209	Tomato	8
211	Strawberry	0.5
211	Apple	20
211	Tomato	24
211	Courgettes	1
211	Pear	20
212	Strawberry	1
212	Raspberry	1
218	Pepper	1
218	Tomato	2
232	Apple	54
232	Blueberries	8.2
232	Pear	9
232	Pepper	2

Observation number	Fruit type	Sum of consumption (kg y^{-1})
232	Raspberry	3
232	Redcurrant	4
232	Tomato	120
232	Cherries	16
233	Apple	2.5
238	Apple	10
238	Blackcurrant	4.5
238	Elderflower	0.2
238	Plum	1.1

Table A1.29: Phase 1 children fruit consumption

Observation number	Fruit type	Sum of consumption (kg y^{-1})
112	Pepper	1
112	Tomato	2
122	Blueberries	0.2
122	Raspberry	0.1
122	Strawberry	0.04
122	Cherries	0.2
122	Courgettes	0.3
122	Blackcurrant	0.2
122	Blackberry	0.1
122	Apple	1.5
125	Blackberry	1
125	Apple	7.5
125	Courgettes	1

Observation number	Fruit type	Sum of consumption (kg y^{-1})
125	Apple	7.5
125	Plum	0.3
125	Courgettes	1
125	Tomato	3
125	Cherries	0.25
125	Strawberry	2
125	Pear	0.8
126	Pear	0.8
126	Strawberry	2
126	Plum	0.3
126	Cherries	0.3
126	Blackberry	1
126	Tomato	3
160	Courgettes	17.3
160	Strawberry	9
160	Tomato	12
161	Courgettes	17.3
161	Strawberry	9
161	Tomato	12

Table A1.30: Phase 1 adult wild foods consumption

Observation number	Wild food type	Sum of consumption (kg y^{-1})
202	Blackberry	0.1
202	Garlic Leaves	0.04
208	Blackberry	1.5

Observation number	Wild food type	Sum of consumption (kg y^{-1})
208	Garlic Leaves	0.5
219	Blackberry	0.3
219	Garlic Leaves	0.8
221	Mushrooms	5
222	Blackberry	2.5
222	Elderflower	2
222	Raspberry	2
222	Strawberry	0.2
222	Mushrooms	2
222	Apple	20
222	Garlic Leaves	0.5
232	Blackberry	2
8	Apple	10
13	Garlic Leaves	1
30	Blackberry	1.5
30	Rosehips	0.3
33	Blackberry	0.4
33	Garlic Leaves	0.4
33	Hazelnuts	0.6
43	Blackberry	0.5
43	Raspberry	0.5
44	Oak leaves	1.3
44	Bramble tips	1.3
44	Gorse flower	1.3

Observation number	Wild food type	Sum of consumption (kg y^{-1})
47	Elderflower	4
48	Mushrooms	0.2
48	Garlic Leaves	0.01
58	Wild Garlic	0.05
58	Ground Elder	0.05
96	Blackberry	0.5
96	Raspberry	0.5
100	Oak leaves	1.3
100	Bramble tips	1.3
100	Gorse flower	1.3
101	Oak leaves	1.3
101	Bramble tips	1.3
101	Gorse flower	1.3
103	Blackberry	0.3
103	Garlic Leaves	0.8
104	Blackberry	0.3
104	Garlic Leaves	0.8
105	Blackberry	0.3
105	Garlic Leaves	0.8
114	Elderflower	4
115	Elderflower	4
116	Elderflower	4
117	Mushrooms	0.2
117	Garlic Leaves	0.01

Observation number	Wild food type	Sum of consumption (kg y^{-1})
118	Blackberry	0.1
118	Garlic Leaves	0.04
119	Blackberry	0.1
119	Garlic Leaves	0.04
120	Blackberry	0.1
120	Garlic Leaves	0.04
121	Blackberry	0.1
121	Garlic Leaves	0.04
124	Blackberry	1.5
124	Garlic Leaves	0.5
158	Blackberry	2
158	Garlic Leaves	0.4
158	Hazelnuts	0.6
159	Blackberry	2
159	Garlic Leaves	0.4
159	Hazelnuts	0.6
183	Blackberry	1.5
183	Rosehips	0.3
184	Garlic Leaves	1

Table A1.31: Phase 1 children wild foods consumption

Observation number	Wild food type	Sum of consumption (kg y^{-1})
160	Blackberry	2
161	Blackberry	2
122	Blackberry	0.1

Observation number	Wild food type	Sum of consumption (kg y^{-1})
125	Blackberry	1.5
126	Blackberry	1.5
160	Garlic Leaves	0.4
161	Garlic Leaves	0.4
226	Garlic Leaves	0.8
122	Garlic Leaves	0.04
125	Garlic Leaves	0.5
126	Garlic Leaves	0.5
160	Hazelnuts	0.6
161	Hazelnuts	0.6

Table A1.32: Phase 1 adult beef consumption

Observation number	Meat	Sum of consumption (kg y^{-1})
48	Beef	8.4
56	Beef	46.8
117	Beef	8.4

Table A1.33: Phase 1 adult lamb consumption

Observation number	Meat	Sum of consumption (kg y^{-1})
48	Lamb	7.2
56	Lamb	46.8
117	Lamb	7.2

Table A1.34: Phase 1 adult game consumption

Observation number	Meat	Sum of consumption (kg y^{-1})
13	Wild venison	24
43	Wild venison	2
57	Wild venison	2
96	Wild venison	2
109	Wild venison	0.6
110	Wild venison	3.7
111	Wild venison	3.7
184	Wild venison	24
205	Wild venison	3
217	Wild venison	0.3
218	Wild venison	3.7
222	Wild venison	20
222	Squirrel	2
222	Rabbit	2
222	Pheasant	1.5
222	Pigeon	2
144	Pheasant	8.1
134	Pheasant	8.1

Table A1.35: Phase 1 adult honey consumption

Observation number	Honey	Sum of consumption (kg y^{-1})
40	Honey	0.9
47	Honey	3.4
49	Honey	2.3

Observation number	Honey	Sum of consumption (kg y^{-1})
56	Honey	5.5
78	Honey	2.5
103	Honey	0.3
109	Honey	0.5
114	Honey	3.4
115	Honey	3.4
116	Honey	3.4
187	Honey	2.5
217	Honey	0.5
219	Honey	0.3
222	Honey	13.6

Table A1.36: Phase 1 adult wild fungi consumption

Observation number	Wild fungi	Sum of consumption (kg y^{-1})
48	Mushrooms	0.15
117	Mushrooms	0.15
221	Mushrooms	5
222	Mushrooms	2

Table A1.37: Phase 1 adult egg consumption

Observation number	Eggs	Sum of consumption (kg y^{-1})
4	Chicken eggs	8.5
14	Chicken eggs	8.5
38	Chicken eggs	4.2
40	Duck eggs	0.6
47	Chicken eggs	63.5

Observation number	Eggs	Sum of consumption (kg y^{-1})
48	Chicken eggs	1
57	Chicken eggs	18
65	Chicken eggs	0.3
78	Chicken eggs	42
114	Chicken eggs	63.5
117	Chicken eggs	1
118	Chicken eggs	8
119	Chicken eggs	3
120	Chicken eggs	8
121	Chicken eggs	8
124	Chicken eggs	9
134	Chicken eggs	4.5
144	Chicken eggs	4.5
170	Chicken eggs	18
187	Chicken eggs	42.3
202	Chicken eggs	8
207	Chicken eggs	18
208	Chicken eggs	9
209	Chicken eggs	18
211	Chicken eggs	36
222	Chicken eggs	18
231	Chicken eggs	4.2

Table A1.38: Phase 1 children egg consumption

Observation number	Eggs	Sum of consumption (kg y^{-1})
18	Chicken eggs	8.5
122	Chicken eggs	8
125	Chicken eggs	9
126	Chicken eggs	9

Table A1.39: Phase 1 infant egg consumption

Observation number	Eggs	Sum of consumption (kg y^{-1})
20	Chicken eggs	8.5

Appendix A2: Postal survey

The postal survey produced an independent data set from a broad cross section of the population living in the area potentially providing the means to identify new or missed habits to target during the face-to-face surveys or focus group discussions.

The postal survey helped refine and revise the face-to-face survey plans and identify optimal geographic areas to target during the face-to-face surveys. It provided additional information on potential sites for the collection of observational data and indicated the optimum timings to visit each survey location. Furthermore, the postal survey provided contacts for individuals and groups to follow up with and a wider list of activities that merited further investigation in the later face to face survey work. Follow up with contacts was only undertaken if specific permission was granted by the survey respondent(s).

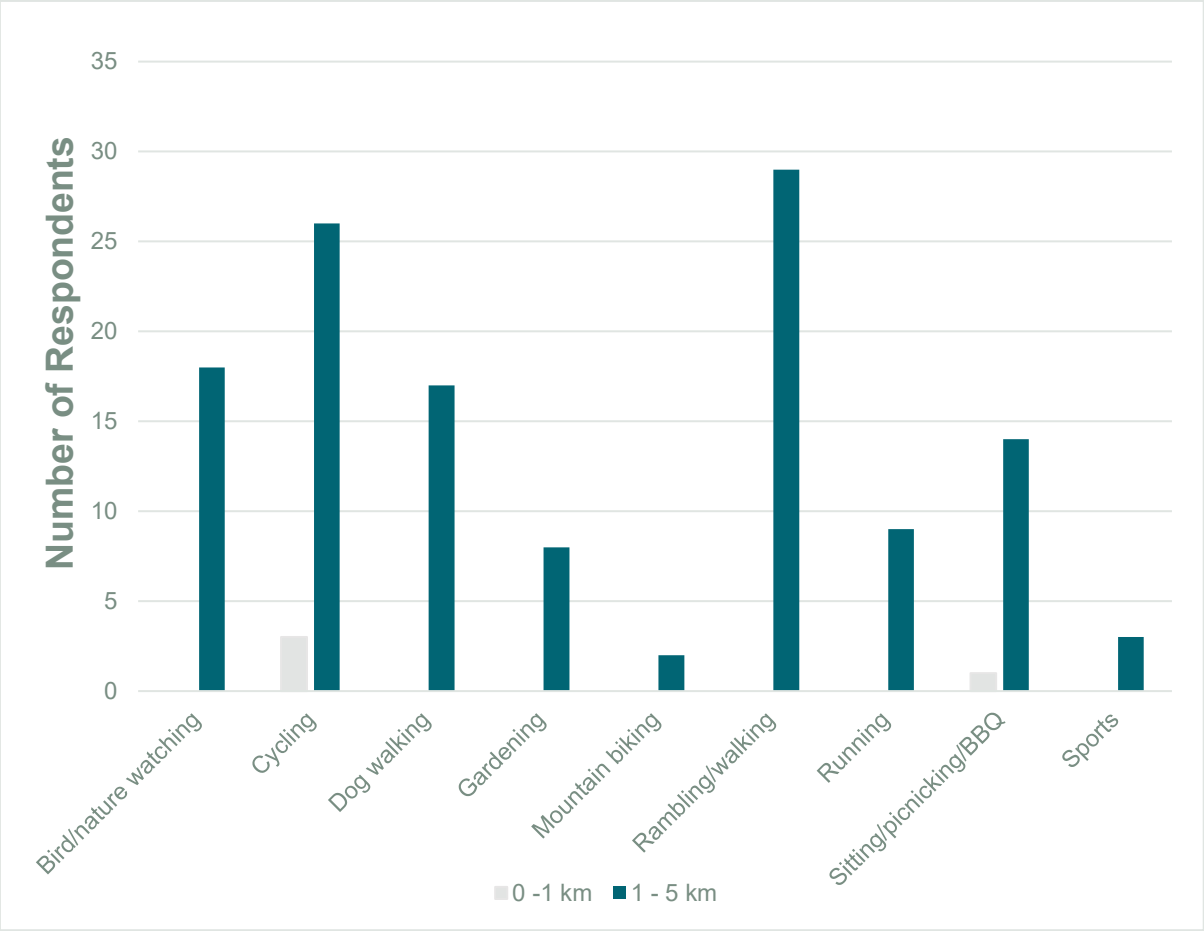
A2.1 Postal survey results

A2.1.1 Terrestrial external exposure

Several households reported undertaking a range of terrestrial activities within 5km of the HMNB Clyde site (Figure A2i).

Within 1km of the site cycling was the most popular activity (three respondents) and sitting/picnicking/BBQ (one respondent).

Figure A2i. Overview of the number of households participating in terrestrial activities in the 1km and 5km survey areas



Within 5km of the site rambling/walking was the most popular activity (29 respondents) followed by cycling (26 respondents) and bird/nature watching (18 respondents).

Dog walking, sitting/picnicking/BBQ, running and gardening all appeared to be relatively popular within 5km. The terrestrial activities undertaken by respondents at each location are as follows:

Bird/nature watching: All over 5km, Ardpeaton, Between Ardpeaton and Cove, Between Blairvadach and Shandon, Clynder, Coulport, East of Faslane outwith 1km, In countryside between Auchenvennel and Faslane, Kilcreggan, Near Auchengaich Reservoir, Peaton Hill, Portkil, Countryside north and east of Cove, Garelochead, Garelochead, Near Blairvadach, Portincaple.

Cycling: All over 5km, Ardpeaton, Around Allt Darach, Around Faslane, Between Blairvadach and Shandon, Between Kilcreggan and Coulport, Blairvadach, Between Rosneath and Meikle, Auchenvennel, Garelochead to Achenvennel, Garelochead to Blairvadach, In countryside within

1km, Kilcreggan, Within 5km, Near Glen Fruin Memorial, Outwith 1km near Faslane, Rosneath, Shandon, Countryside north and east of Cove.

Dog walking: Between Ardpeaton and Cove, Between Blairvadach and Shandon, Clynder, Coulport, Cove, Countryside east of Garelochead and A814, Kilcreggan, Meikle, Within 5km but not peninsula, Peaton Hill, Peaton Hill Conservation Reserve, Rhu, Shandon, Countryside north and east of Cove, Garelochead, Tom na h'Airidh, Garelochead, Portincaple.

Gardening: Clynder, Coulport, Kilcreggan, Meikle, Rosneath, Shandon, Garelochead, Tom na h'Airidh, Garelochead.

Mountain biking: Between Ardpeaton and Cove, Between Garelochead to Portincaple.

Rambling/walking: Around Allt Darach, Between Ardpeaton and Cove, Between Blairvadach and Shandon, Inland between Coulport and Mambeg, Clynder, Coulport, Cove, East of Haul Road to 5km buffer, Countryside east of Garelochead and A814, Near Fruin Water, Between Meikle and Clynder, Within 5km, Within 5km but not peninsula, Peaton Hill Conservation Reserve, Portkil, Rosneath, Shandon, Countryside north and east of Cove, Garelochead, Tom na h'Airidh, Garelochead, Inland of Blairvadach within 5km, Near Blairvadach, Portincaple, South of Glen Fruin Memorial.

Running: Around Allt Darach, Around Faslane, Inland between Coulport and Mambeg, Blairvadach, Between Rosneath and Meikle, Between Garelochead to Portincaple, East of Haul Road to 5km buffer, Shandon, South of Glen Fruin Memorial.

Sitting/picnicking/BBQ: Between Ardpeaton and Cove, Between Blairvadach and Shandon, Cove, Between Garelochead to Portincaple, In countryside within 1km, Kilcreggan, Meikle, Near Ardpeaton, Portkil, Rhu, Rosneath, Shandon, Inland of Blairvadach within 5km, Near Blairvadach.

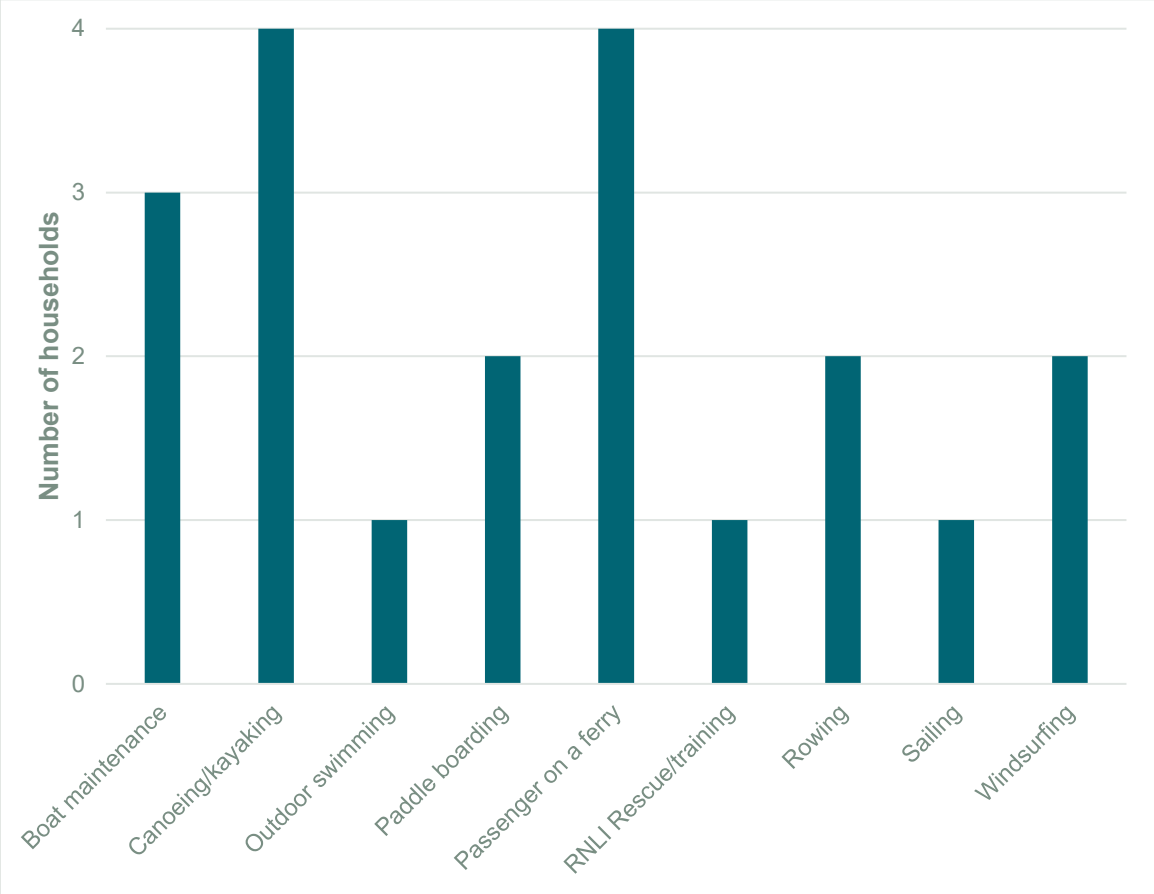
Sports: Around Allt Darach, Inland between Coulport and Mambeg, South of Glen Fruin Memorial.

Shandon reported the widest range of activities with six differing activities. Rambling/walking and cycling were the two activities undertaken at more sites than any other activity, 26 and 24 locations respectively.

A2.1.2 Aquatic external exposure

Several households reported they engaged in aquatic activities within the survey area. The total number of respondents undertaking each aquatic activity, either in or on the water are presented in Figure A2ii.

Figure A2ii. Summary of the number of households undertaking aquatic activities within 20km of Faslane



Across the whole aquatic survey area, travelling as a passenger on the ferry and canoeing/kayaking were the most popular (four respondents) followed by boat maintenance (three respondents) and paddle boarding, rowing, and windsurfing (each with two respondents).

In terms of activity locations, Garelochhead and Rhu reported respondents reported the highest range of activities. The aquatic activities undertaken by respondents at each location are as follows:

Boat maintenance: Rhu, Off Rhu spit, Rosneath.

Canoeing/kayaking: Culwatty Bay, Garelochhead, Kilcreggan.

Outdoor swimming: Clynder.

Sailing: Gare Loch around peninsula into Loch Long.

Paddleboarding: Garelochhead, Rhu.

Passenger on a ferry: Kilcreggan.

RNLI Rescue/training: Rhu.

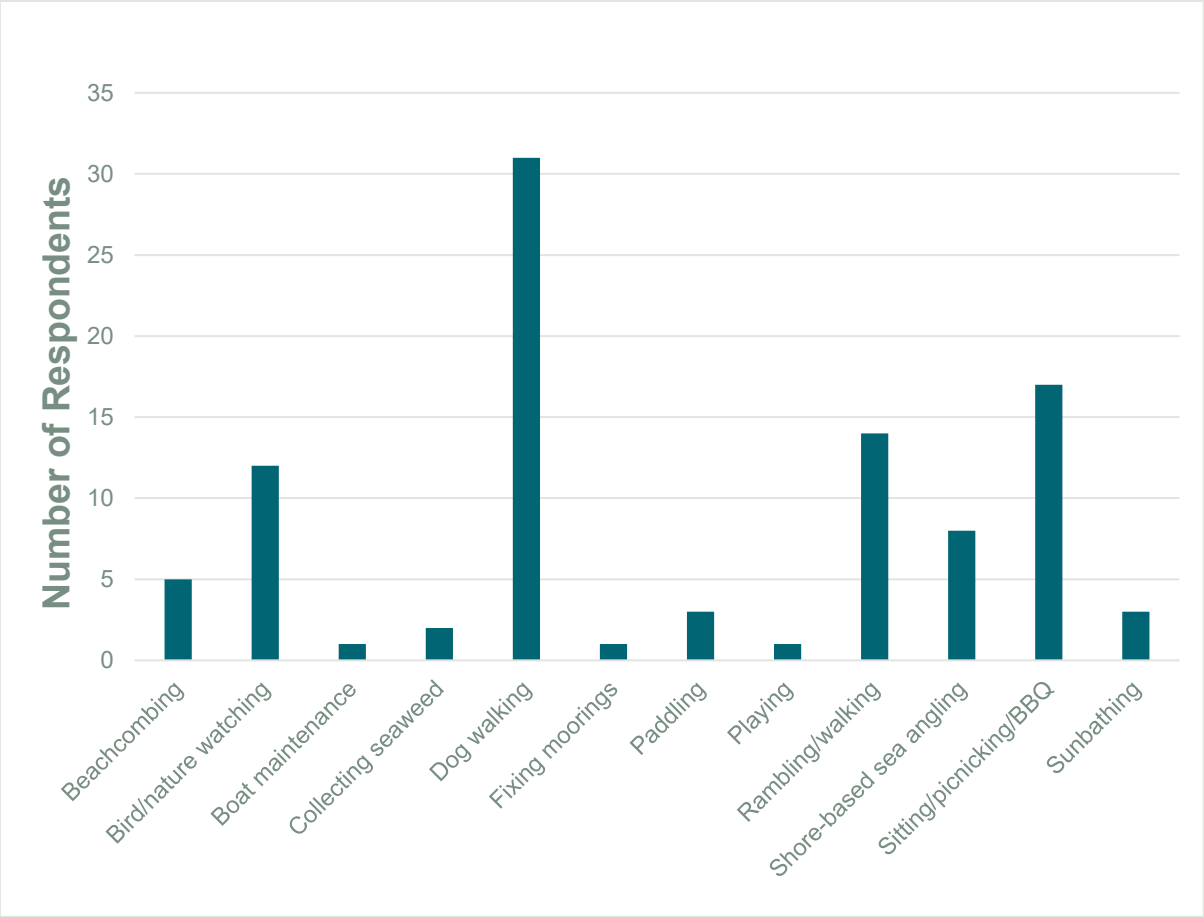
Rowing: Rhu, Shandon.

Windsurfing: Garelochhead, Helensburgh.

A2.1.3 External intertidal exposure

Several households carry out activities in the intertidal zone within the survey area. The total number of respondents undertaking each intertidal activity are presented in Figure A2iii. The activity with the highest number of respondents was dog walking (31 respondents) followed by sitting/picnicking/BBQ, rambling/walking and bird/nature watching (17, 14 and 12 respondents respectively).

Figure A2iii Summary of number of households undertaking intertidal activities within 20km of Faslane



Intertidal activities were reported throughout the survey zone. Helensburgh beach reported the highest number of differing activities with Cove, Rosneath, Rhu Spit and Shandon intertidal areas proving relatively popular. The intertidal activities undertaken by respondents at each location are as follows:

Beachcombing: Cove, Helensburgh beach, Portkil Bay.

Bird/nature watching: Between Cove and Ardpeaton, Blairvadach, Clynder, Cove, Garelochead, Helensburgh beach, Kilcreggan, Kilcreggan Bay, Rosneath.

Boat maintenance: Rosneath.

Collecting seaweed: Helensburgh beach, Kilcreggan Bay.

Dog walking: Between Cove and Ardpeaton, Camsail Bay, Clynder, Cove, Culwatty Bay, Garelochead, Helensburgh beach, Kilcreggan, Rhu shoreline, Rhu Spit, Rosneath, Shandon.

Fixed Moorings: Shandon.

Rambling/walking: Between Cove and Ardpeaton, Camsail Bay, Helensburgh beach, Kilcreggan, Rhu Spit, Rosneath, Shandon.

Shore-based Sea angling: Camsail Bay, Cove, Meikle, Rhu Spit, Rosneath, Shandon, Pier near Faslane.

Sitting/picnicking/BBQ: Between Cove and Ardpeaton, Camsail Bay, Clynder, Cove, Helensburgh beach, Meikle, Near Mambeg intertidal, Rhu shoreline, Rhu Spit, Shandon, Pier near Faslane.

Sunbathing: Cove, Helensburgh beach, Kilcreggan.

Paddling: Garelochead, Helensburgh beach, Rhu Spit.

Playing: Helensburgh beach.

A2.1.4 Internal exposure

Respondents were asked to provide information on where they sourced their food. A summary of the results (Figure A2iv) shows the origins of where respondents sourced their food as a percentage. Results show that the respondents bought most of their food sourced from local shops or supermarkets within and outwith the terrestrial (5km) and marine (20km) survey area. This was consistent across all food groups reflecting the low numbers of respondents that sourced local produce. Fish was the highest of locally sourced produce (36 respondents) compared with 116 respondents sourcing ‘most foods’ from a supermarket and/or local shop.

Figure A2iv Source of food consumed by postal survey respondents

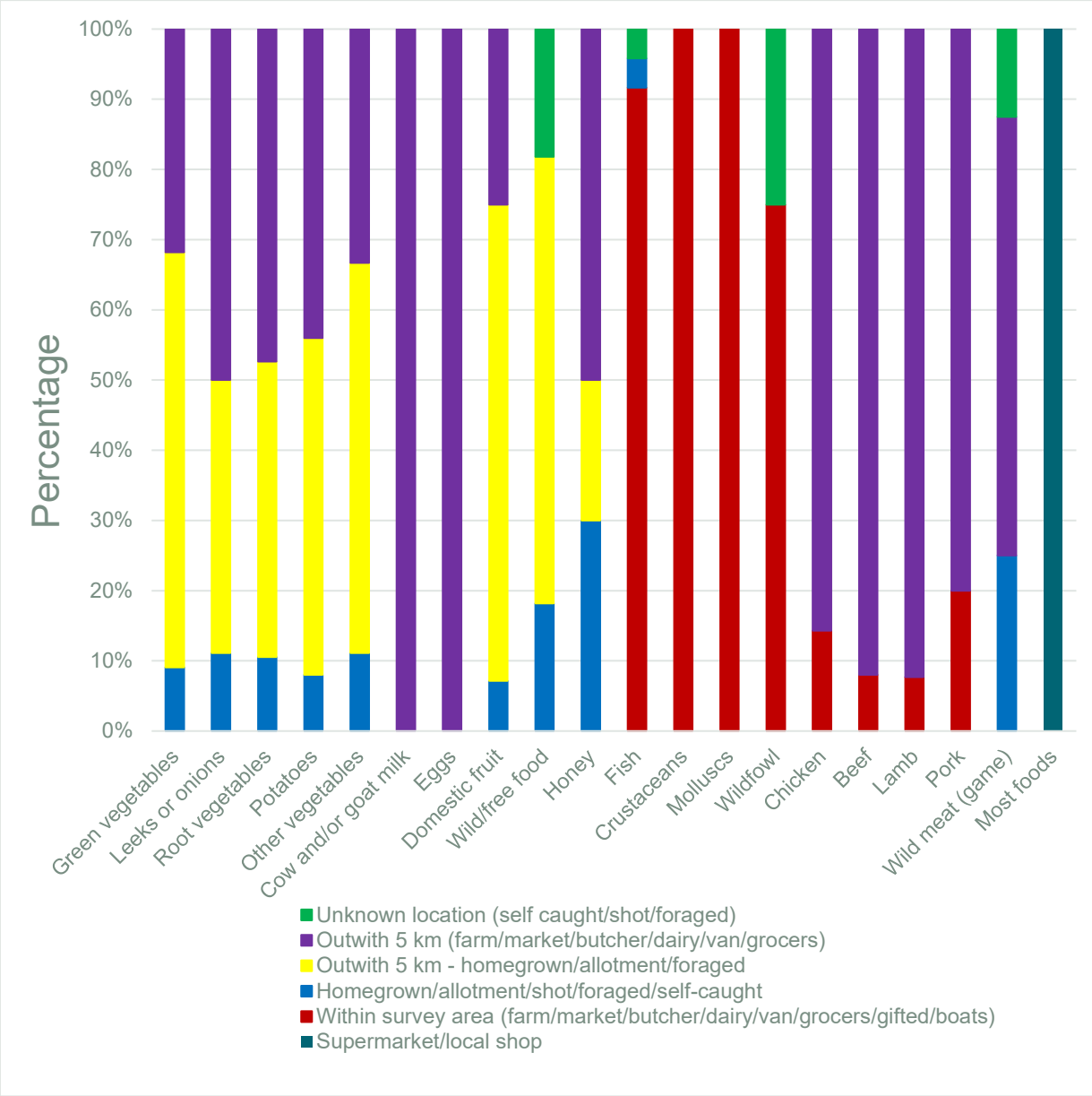


Figure A2v Number of respondents sourcing food from food groups

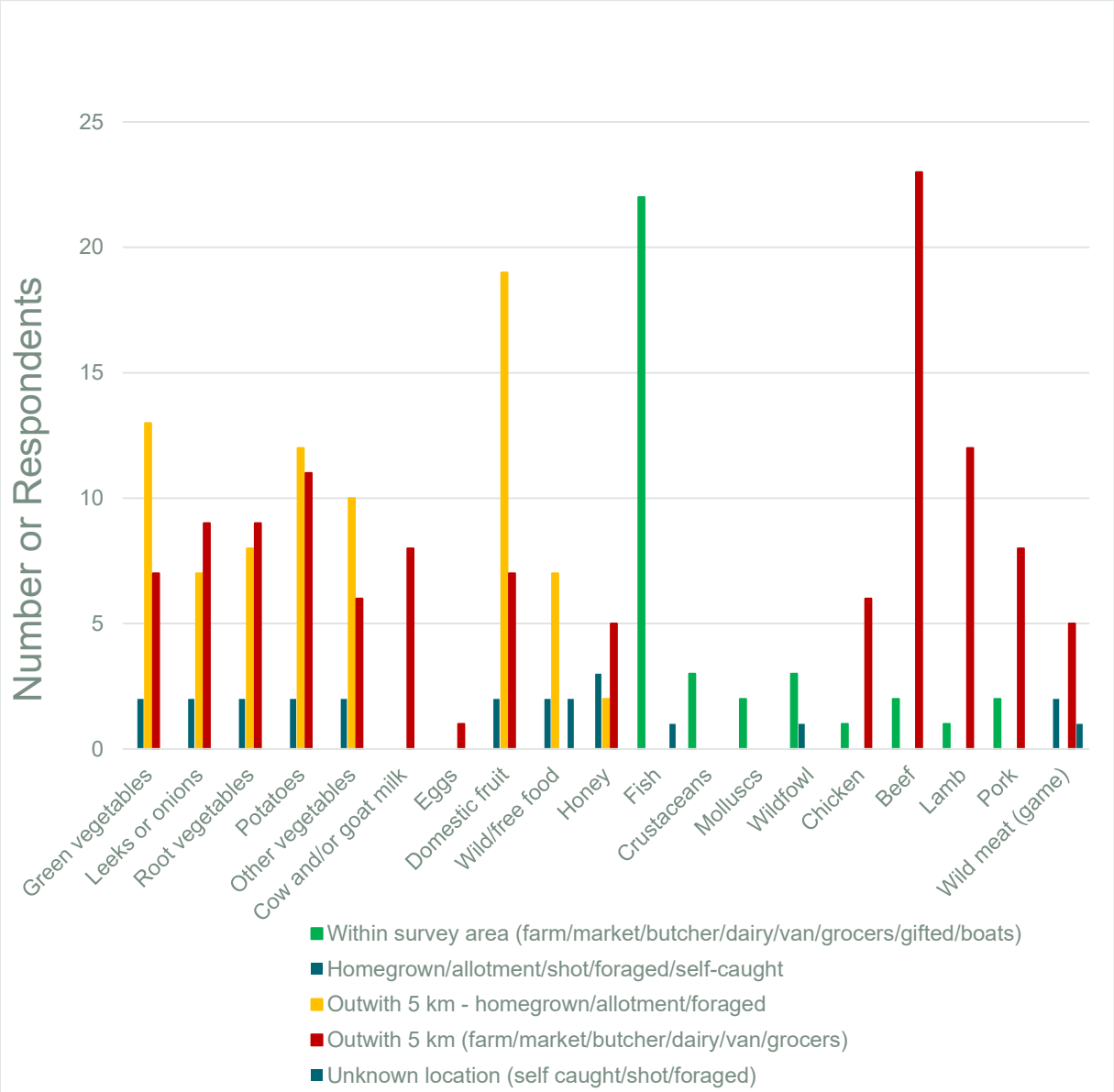


Figure A2v shows the number of respondents sourcing food from each food group locally sourced, homegrown/allotment/shot/foraged/self-caught and outwith the survey area. Food sourced from within the survey area showed the largest number of respondents (22) to source fish from a market/fish van/gifted or off boats. Beef was sourced by 23 respondents from a outwith 5km from a farm/market/butcher and 19 respondents reported to sourcing domestic fruit from outwith 5km either homegrown/allotment or foraged. A very small number of respondents sourced locally homegrown produce, honey, and wild meat. Table A2i provides an overview of where local produce within the survey area was sourced.

Table A2i: Summary of locally produced food

Food Group	Number of individuals	Locally home grown/foraged/caught/shot
Green vegetables	2	Kilcreggan and Shandon
Leeks or onions	2	Kilcreggan and Shandon
Root vegetables	2	Kilcreggan and Shandon
Potatoes	2	Kilcreggan and Shandon
Other vegetables	2	Kilcreggan and Shandon
Domestic fruit	2	Kilcreggan and Shandon
Wild/free food	2	Shandon and one unknown location within the survey area
Honey	3	Garelochead (2 individuals) and Clynder
Fish	1	Self-caught unknown location
Wildfowl	1	Self-caught unknown location
Wild meat (game)	2	Unknown locations

Appendix A3: In-situ gamma dose rate measurements

The protocol requires the detector's probe to be positioned 1 m above the surface and counts acquired over a 600 second integration time. The cosmic and intrinsic components to the measurement are then subtracted. The protocol also requires persons operating the detector to be at least 5m from the probe during the count. Both instruments are calibrated using radium-226 and caesium-137 sources (the calibration being chosen to reflect naturally occurring or anthropogenic radionuclide sources respectively). Here, gamma dose rates were dominated by the natural background, so all results are reported with the radium-226 calibration and reported as μGy h^{-1}.

For the dose assessment tool, gamma dose rates were converted to Effective Dose (μSv h^{-1}) using a conversion factor of 0.85, which assumes an individual is standing and exposed to terrestrial derived gamma radiation. This conversion factor is used for most statutory monitoring programmes (Punt et al., 2011). All survey measurements are reported as terrestrial gamma dose measurements as they have had the cosmic and intrinsic component subtracted.

Appendix A4: Beta skin dosimetry measurements

The instrument was calibrated under UKAS accreditation against strontium-90 and yttrium-90; chlorine-36 and carbon-14 (and put inside a file poly-pocket to protect the system from the weather). A 12mm Perspex shield was used to shield out any beta emissions and so enable the gamma contribution to the instrument to be established. All measurements were made with a 20 second integration time and in duplicate, with and without the 12mm Perspex shield, enabling the net beta contribution to skin dose rate to be estimated (effective dose, or ambient dose equivalent) and reported in μSv h^{-1}. The system is estimated to have a detection limit of around 0.2μSv h^{-1}.

Appendix A5: Site descriptions and observations

A5.1 Cove Bay, Kilcreggan Bay, Portkil Bay and Mieklecross Bay

Cove Bay is the most western point of the aquatic survey area, and it includes the southern-most part of the Rosneath peninsula where Loch Long meets the Firth of Clyde. Offshore activities observed outwith the school holiday period included five individuals dog walking, three individuals walking, two individuals picnicking and one jogger at Cove Bay. Cove Sailing Club is located on the shores of Loch Long with eight sailing yachts moored on hardstanding at the club. One motorboat and one pleasure yacht were observed sailing offshore. The substrate at this site is primarily pebbles and rock with the shoreline stretching along to Kilcreggan Bay where the pebbly substrate in the upper shore changes to rocks with boulders and seaweed on the lower shore. A small stream flows into the Firth of Clyde from Kilcreggan. At this site five individuals were walking/dog walking, and one jogger was observed on the intertidal substrate. Offshore, 11 pleasure boats, four motorboats and three Rigid Inflatable Boats (RIBs) were sailing. Within the school holiday survey period one individual sitting at Cove Bay and one pleasure boat sailing offshore were observed. A dog walker along with two additional walkers were observed at Kilcreggan Bay. Six individuals dog walking, one beachcomber, two walkers and one photographer were observed at Kilcreggan Bay with one pleasure boat sailing offshore.

Figure A5i Kilcreggan Bay (June 2023)

Kilcreggan is served by a popular ferry that regularly crosses the Clyde to Gourock and is accessed via a well-maintained pier.

Continuing from Kilcreggan Bay to Portkil Bay and Meikleross Bay, the intertidal substrate at Portkil Bay is of pebble and sand on the upper shore to large pebbles, rocks and some boulders towards the low tide line. There were no onshore or offshore activities observed at this site outwith the school holiday period. Within the school holiday period two dog walkers observed on the shore at Portkil Bay with no offshore activities observed.

The intertidal substrate at Meikleross Bay is mainly sand and pebbles. No intertidal activities were observed outwith the school holidays with only one motorboat observed offshore at this site. No onshore or offshore activities were observed within the school holiday period.

The shoreline between Meikleross Bay and Rosneath Bay is dominated by rocky outcrops covered in seaweed, with areas of saltmarsh vegetation on the upper shore. Wooded areas and gorse were present in the area behind the beach.

No spume was observed at these sites either outwith or within the school holiday period.

A5.2 Rosneath Point, Culwatty Bay, Castle Bay and Rosneath Bay

Rosneath Point is a rocky promontory with much of it covered by seaweed. It is accessed either from Castle Bay Caravan Park in the east along a private road and through a wooded area or from Meikleross Bay in the west. One individual dog walking was observed both outwith and within the school holiday period. Offshore activities, one motorboat and two sailing yachts, were observed outwith the school holiday period only.

Figure A5ii Rosneath Point (June 2023)

Eastwards from Rosneath Point is Culwatty Bay and the substrate at this site is predominantly pebble, rock and mud with seaweed, and rocks and sand apparent within the upper shore. A small stream flows into Culwatty Bay. One bird watcher was noted in the woodland beside the shore at this site. No onshore or offshore activities were observed either outwith or within the school holiday period.

There is a coastal path and road leading from Castle Bay to Rosneath Bay. The intertidal environment here is dominated by shingle mixed with finer silty sediment and the foreshore was enclosed by small areas of saltmarsh. Two individuals were swimming at Castle Bay and one sailboat, six motorboats and one RIB were moored offshore outwith the school holiday period. Within the school holiday period one individual windsurfing and one motorboat offshore sailing were observed.

Extending round to Rosneath Bay (including Camsail Bay) outwith the school holiday period shore fishing was popular with approximately 20 individuals (including two children) were fishing, one individual sitting/picnicking, two families walking/playing, two individuals

beachcombing. Offshore one motorboat and one yacht were sailing offshore, and one individual swimming were observed. Within the school holiday period the sites here were less populated with one adult and three children shore fishing and one family dog walking. No offshore activities were observed at Rosneath Bay within the school holiday period.

No spume was observed at these sites either outwith or within the school holiday period.

A5.3 Rosneath, Clynder, Rahane, Mambeg and Rockville

The intertidal substrate between Rosneath and Rockville is predominantly rock and pebble, with seaweed and large expanses of mud and rocks exposed at low tide. The shore in this area is accessible from numerous points, many of which were associated with lay-bys. Some stretches of the shore, particularly between Mambeg (Figure A5iii) to Rockville, were difficult to access from the road due to thick vegetation.

Figure A5iii Mambeg (June 2023)

No activities were observed onshore or offshore at Rosneath shore either outwith or within the school holiday period. Moorings for pleasure craft and boat maintenance was available within a local boat yard, including areas of hard standing occupied by a range of pleasure boats.

Multiple lay-bys and slipways are located between Clynder and Rahane allowing access to the shore. Six sail boats were anchored offshore at Clynder with ten dinghies sitting on the hard standing by a slipway. Four individuals were shore fishing at Clynder with one yacht, three motorboats and one dredger offshore outwith the school holiday period. Within the school holiday period onshore activities included one individual dog walking, two individuals beachcombing one individual walking, two individuals shore fishing and two individuals kayaking. At Rahane, fishing was observed both outwith and within the school holiday periods and offshore three sailing boats were moored outwith the school holiday period. From Rahane

to Mambeg there are again multiple lay-bys allowing access to the shore. Outwith the school holiday period intertidal activities included 13 individuals fishing off rocks and shore, one individual walking and one dinghy and one yacht sailing offshore. Within the school holiday period fishing was popular with approximately 40 – 50 individuals fishing from the rocks and shore. Much of the area immediately behind the foreshore from Mambeg is covered with thick vegetation and trees. North of Mambeg to Rockville and Garelochhead two adults and two children were shore fishing within the school holiday period. No other onshore or offshore activities were observed during the survey period.

No spume was observed at these sites either outwith or within the school holiday period.

A5.4 Garelochhead

Garelochhead is situated at the northern end of the Gare Loch and is a well populated residential area. There is good access to the shore from Garelochhead with a large grassy area and footpath joining the east and west side. A footbridge was situated over a small stream which flowed into the Gare Loch and a small stream also flowed into the Gare Loch at the eastern side. The substrate consists of some sand, silt pebbles and mud, with a significant proportion of the intertidal environment covered in seaweed. The upper shore was heavily covered with seaweed, and the western side of the bay was backed by salt marsh. Onshore activities outwith the school holiday period observed included 12 dog walkers, one family beachcombing, two families walking and one family (two adults and one infant) fishing. Offshore one RIB was sailing, and seven boats were moored in the Gare Loch. Within the school holiday survey period one individual walking and one individual sitting/picnicking were observed on the intertidal substrate and three motorboats sailing and four kayakers were observed offshore. Seven boats remained moored offshore, which rest on the intertidal substrate when the tide is out, within the school holiday period.

No spume was observed at this site outwith or within the school holidays.

A5.5 Faslane naval base

HMNB Clyde is situated to the south of Garelochhead and borders approximately 2km of the surrounding shoreline. This area is inaccessible to the public. Individuals are not permitted to fish (from the shore or boat) or swim within 150 metres of any walls, slipways, roadways, or boundaries of HMNB Clyde (Faslane).

A foot and cycle path around the perimeter of the site are accessible on the roadside of the base.

Please refer to Chapter 2 for further details.

A5.6 Shandon and Rhu

Shandon is a small residential conurbation and includes the Faslane Peace Camp. The occupancy of the Faslane Peace Camp can vary from as few as 11 individuals to over 100 individuals. The shore at Shandon (Figure A5v) is easily accessible by several slips with the foreshore being dominated by sand, single and shells. The substrate from Shandon to Rhu Spit consists predominantly of pebbles, shingle and sand on the upper shore and pebbles/stones and mud exposed at low tide. Seaweed is prevalent. During the survey period only one individual fishing was observed within the school holiday period at the Shandon foreshore. No other onshore or offshore activities were observed either outwith or within the school holiday periods.

Figure A5v Shandon beach (June 2023)

South of Shandon, at Blairvadach, an outdoor education centre provides water activities on Gare Loch (sailing, power boating, canoeing/kayaking and bike and walking within the survey area). Continuing south, The Royal Northern and Clyde Yacht Club is situated at Rhu Spit. South of Rhu Spit is Rhu Marina which provides deep water berths, swinging moorings and an in-shore storage area for boats. His Majesty's Coastguard and the Royal National Lifeboat Institute (RNLI) are located at Rhu Marina, and the marina provides a Royal Yacht Association

(RYA) Active marina with events organised for customers with diving available. A powerboat training and sailing school is also available at Rhu Marina.

Rhu Spit was a popular area for locals and visitors both outwith and within the school holiday period. Outwith the school holiday period intertidal activities included 19 adults and children dog walking and three individuals walking. Offshore activities included five individuals kayaking, two yachts sailing one RIB and two dredgers. Within the school holiday period intertidal activities included approximately 30 individuals dog walking, 13 individuals walking, one individual jogging and approximately 30 individuals fishing. Offshore activities observed included one RIB and one yacht sailing and seven individuals (three adults and four children) paddling.

On Rhu beach which extended south from Rhu Spit only four adults and three children were observed fishing from the shore outwith the school holiday period. One local education facility reported they provided arranged trips to the beach for infants and children to spend a few hours playing and beachcombing.

Within this section of coastline spume was only observed along the shoreline at Rhu Spit within the school holiday period.

A5.7 Cairndhu Point and Helensburgh beach

Continuing south to Cairndhu Point there is a grassed area behind a beach wall. This area was popular with individuals cycling, playing, walking and dog walking. There were no intertidal observations outwith the school holiday period and within the school holiday period three dog walkers and one bait digger were observed.

Helensburgh Sailing Club is situated on this shoreline and operates a training school for children during the summer and autumn period. There is a rocky shore area adjacent to the sailing club leading to a substrate of pebbles, shingles, and sand with seaweed. Offshore, approximately 30 sail yachts and boats were moored both outwith and within the school holiday period. Five individuals launching sail yachts at the slip were observed within the school holiday period.

Figure A5vi Helensburgh beach (June 2023)

The Helensburgh seafront (Figure A5vi) extends from Cairndhu Point approximately 3km south to the Helensburgh Pier. Since the previous habit survey in 2016 a new public sports facility has been built with a large area for parking provided on the south side of the pier. The foreshore at Helensburgh beach is composed of shingle and shells with pebbles/rocks and seaweed on the upper shore. Outwith the school holiday period intertidal activities included four individuals dog walking, one individual beachcombing, one family walking, one individual sitting on the rocks and two individuals fishing from the shore. Offshore several RIBs were observed.

Within the school holiday period intertidal activities included ten dog walkers, two individuals walking, one individual flying a kite, and one individual fishing from the shore. Offshore, three windsurfers and one paddleboarder were observed. On Helensburgh Pier, it was observed that, outwith and within the school holiday period, there were individuals fishing off the pier (five and three individuals respectively).

No spume was noted outwith or within the school holiday period.

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