North Gravir
Baseline Marine Activity Assessment

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Abbreviations Table

Abbreviation	Definition
AIS	Automatic Identification System
EU	European Union
ICES	International Council for the Exploration of the Sea
nm	Nautical Miles (1nm ≡ 1,852 metres)
SOLAS	Safety of Life at Sea
VMS	Vessel Monitoring System

1 Introduction

1.1 Background

The Scottish Salmon Company is proposing the development of a fish farm site off the east coast of the Isle of Lewis. Anatec were commissioned to carry out a baseline assessment of marine activities (shipping, fishing and recreation) in the vicinity of the proposed fish farm to help inform discussions with stakeholders.

1.2 Objectives

The baseline assessment presents analysis of the proposed fish farm site with a 5km buffer as the area of study.

The baseline assessment reviews the following:

- Shipping activity (AIS);
- Fishing vessel activity (AIS and VMS);
- Recreational vessel activity (AIS); and
- Validation of 2021 AIS data by comparison to 2019 AIS data.

2 Site Overview

Figure 2.1 presents an overview of the proposed site along with the 2.5km and 5km buffers to be used, with the 5km buffer serving as the region for numerical analysis.

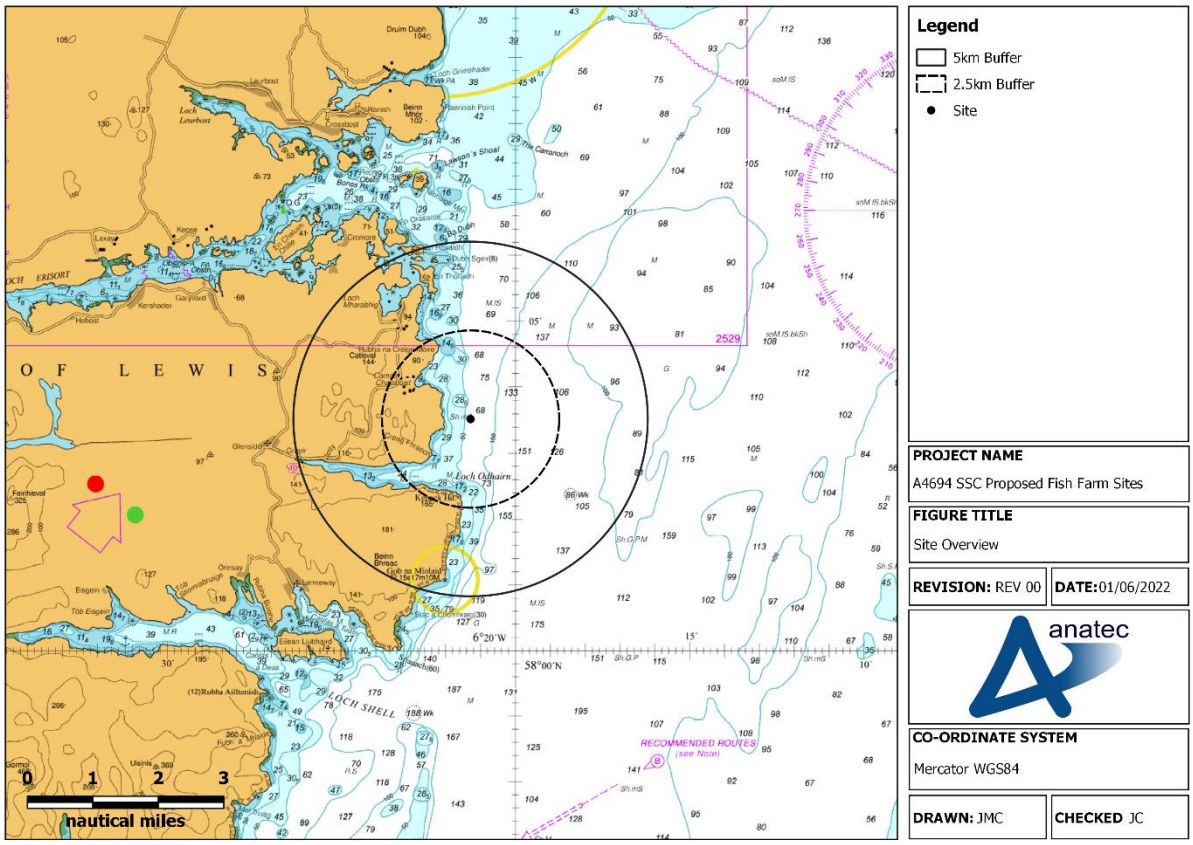

Figure 2.1 Site Overview

The proposed site is located off the east coast of the Isle of Lewis, part of the Outer Hebrides.

3 AIS Analysis

3.1 Introduction

AIS technology was created as a tool for collision avoidance and means of automatic data exchange both ship-to-ship and ship-to-shore. Complete deployment of AIS to Safety of Life At Sea (SOLAS) class vessels was required by 31 December 2004 under SOLAS Chapter V.

SOLAS requires AIS to be fitted onboard all ships of 300 gross tonnage and upwards engaged on international voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages and all passenger ships irrespective of size. UK and EU fishing vessels of 15m length and above are also required to carry AIS. Military vessels, recreational craft and smaller fishing vessels (below 15m) are not required to carry AIS but a proportion do so voluntarily, however these vessels will be under-represented in the data.

This section presents analysis of AIS data within 5km of the proposed fish farm site at the Isle of Lewis during 2021. It should be noted that vessel positions are typically broadcast every few seconds but longer time intervals due to coverage and/or class of AIS may result in slight inaccuracies when forming a track, e.g., vessel appearing to cross land if rounding a headland.

The 5km buffer is used as the study area for illustrating vessel tracks and numerical analysis.

3.2 Type Overview

AIS data during 2021 within 5km of the proposed site is presented in Figure 3.1, colour-coded by vessel type.

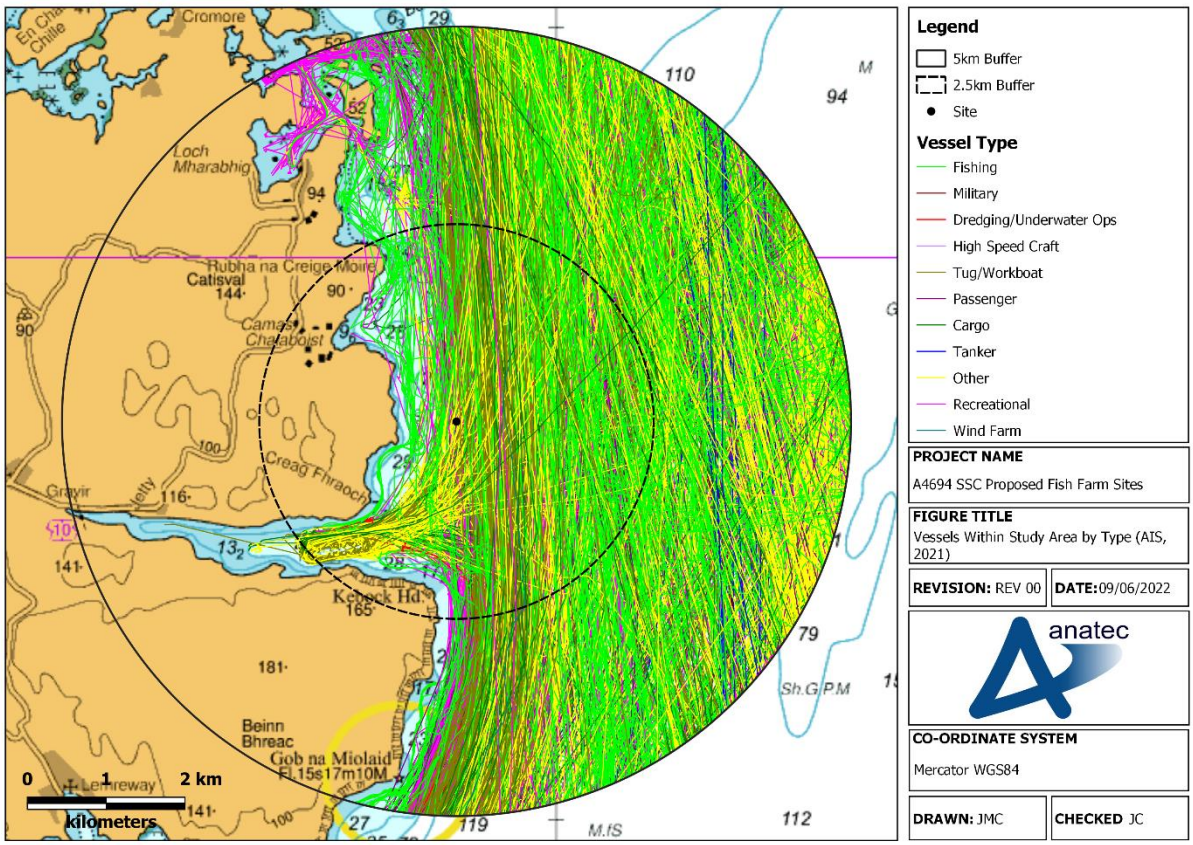

Figure 3.1 Vessels Within Study Area by Type (AIS, 2021)

The main vessel type within the study area was fishing, accounting for 31% of the data. This was followed by the "other" category (24%), which mostly consisted of fish carriers, and the tug/workboat category (20%), which included vessels supporting fish farms. This was followed by recreational (13%) and cargo (7%). Figures and information about these main types can be found in sections 3.4 to 3.8.

3.3 Vessel Counts

Figure 3.2 presents the breakdown of 12 months of AIS data by daily average vessel count per month and per type within the study area. Each vessel is counted no more than once per day.

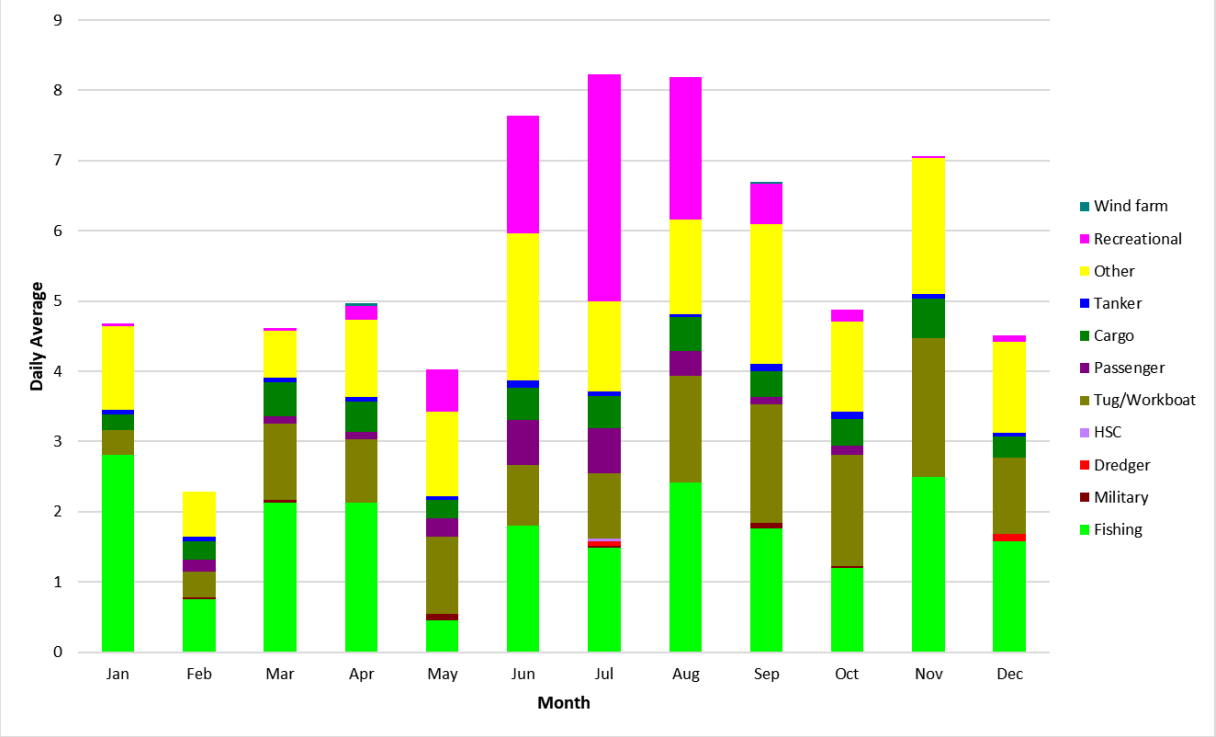

Figure 3.2 Average Number of Daily Vessels Within Study Area per Month per Type (AIS, 2021)

During 2021, an average of between five and six unique vessels was recorded each day within the study area. July and August were the busiest months, with an average of approximately eight unique vessels being recorded each day. This was largely due to an increase in recreational activity coinciding with the more favourable weather of the summer. February and May were the quietest months, with approximately two and four unique vessels being recorded per day respectively; this was largely due to a reduction in fishing activity during these months.

Figure 3.3 presents the busiest month during 2021 i.e. July.

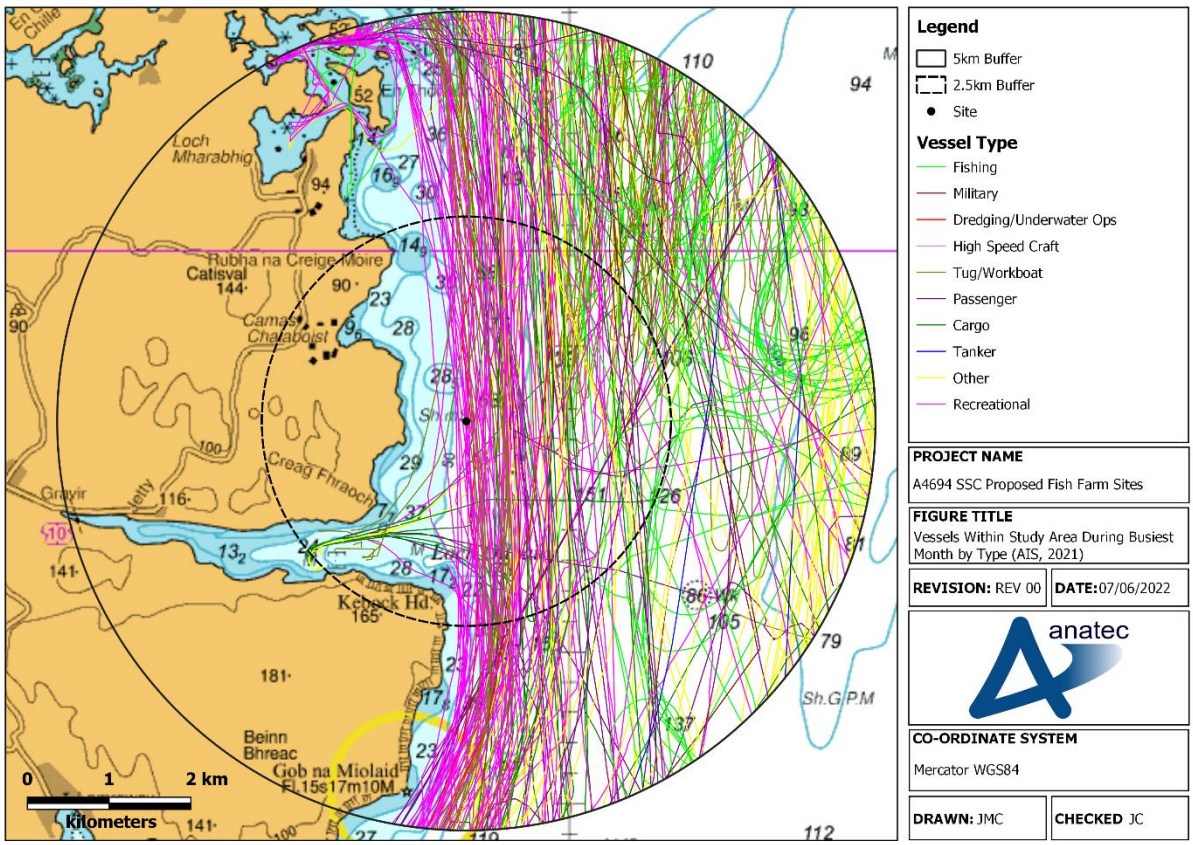

Figure 3.3 Vessels Within Study Area During Busiest Month by Type (AIS, 2021)

The most common vessel type recorded in July was recreational, accounting for 39% of the data; this traffic was in north/south transit, with one vessel entering/exiting Loch Odhairn. This was followed by fishing (18%) and vessels in the "other" category (16%), which mostly consisted of fish carriers.

3.4 Commercial Vessels

Figure 3.4 presents the AIS tracks of commercial vessels (passenger, cargo and tanker) recorded within the study area during 2021.

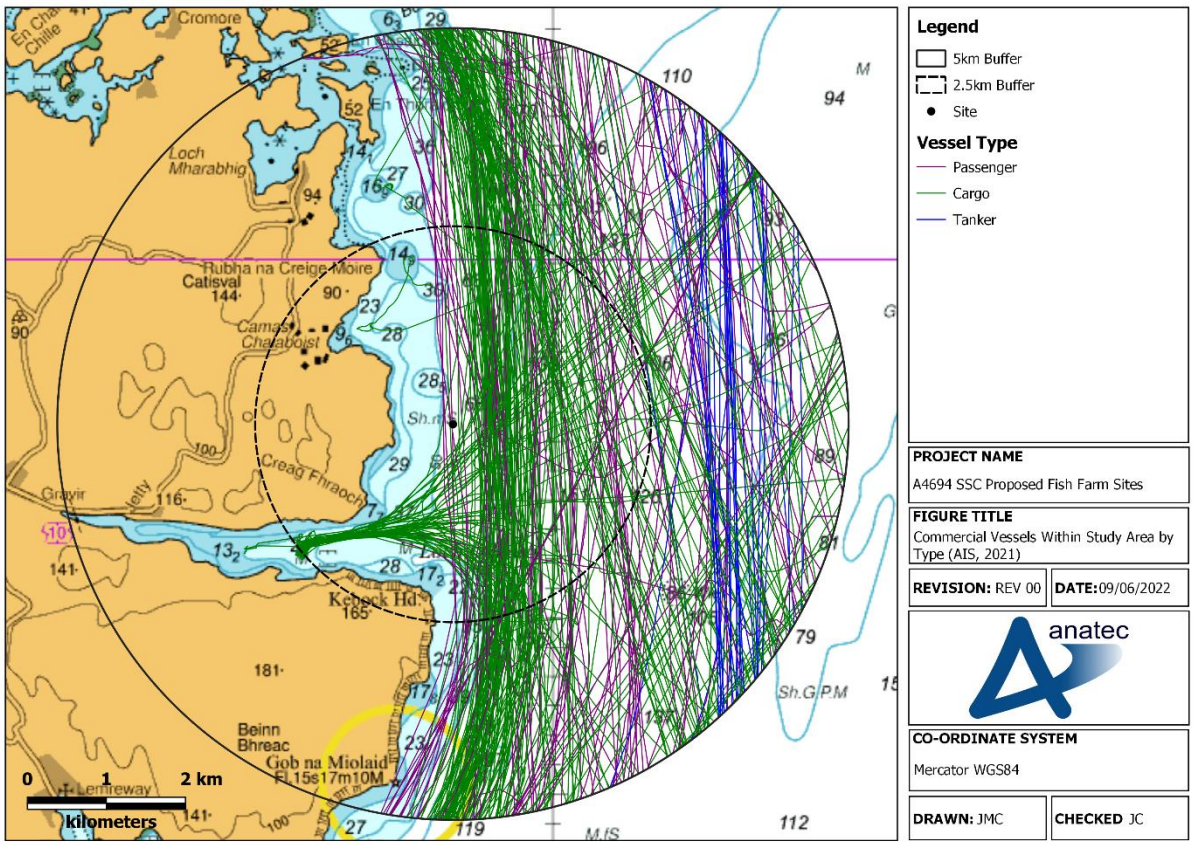

Figure 3.4 Commercial Vessels Within Study Area by Type (AIS, 2021)

Cargo vessels accounted for the majority of the commercial vessel traffic recorded in the study region during 2021, accounting for 58% of the data. This was followed by passenger, which accounted for 31%, with tankers accounting for the remaining 11%. The average length of commercial vessels recorded was 65m.

Cargo vessels were generally seen in north/south transit to the east of the site; it is noted that three unique cargo vessels were broadcasting Gravir and fish farms as their destinations while entering/exiting Loch Odhairn.

Tankers and passenger vessels were also mainly recorded in north/south transit, with tankers being further from the coast and passenger vessels being recorded a variety of distances from the coast.

3.5 Tugs/Workboats

Figure 3.5 presents the AIS tracks of tugs or workboats recorded within the study area during 2021.

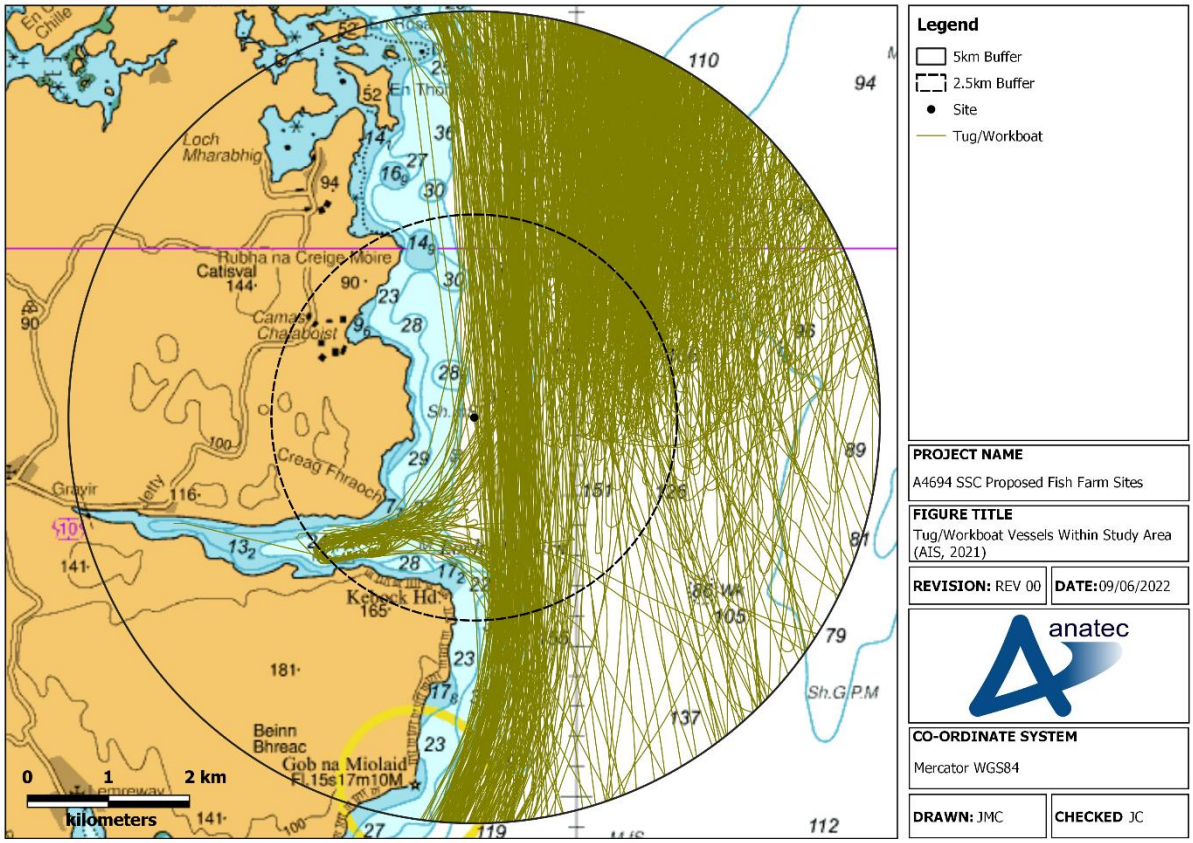

Figure 3.5 Tug/Workboat Vessels Within Study Area (AIS, 2021)

The average length of tugs/workboats recorded was 43m.

Tugs/workboats were generally recorded in north/south transit along a similar route as the cargo vessels seen in section 3.4, with Stornoway and fish farms being a common destination. Many of the vessels entered Loch Odhairn for fish farm related work. In addition, an emergency towing vessel was recorded patrolling the sea throughout the year in the northeast region of the study area.

3.6 Fishing Vessels

The AIS data recorded during 2021 for fishing vessels within the study area, colour-coded by speed, is presented in Figure 3.6.

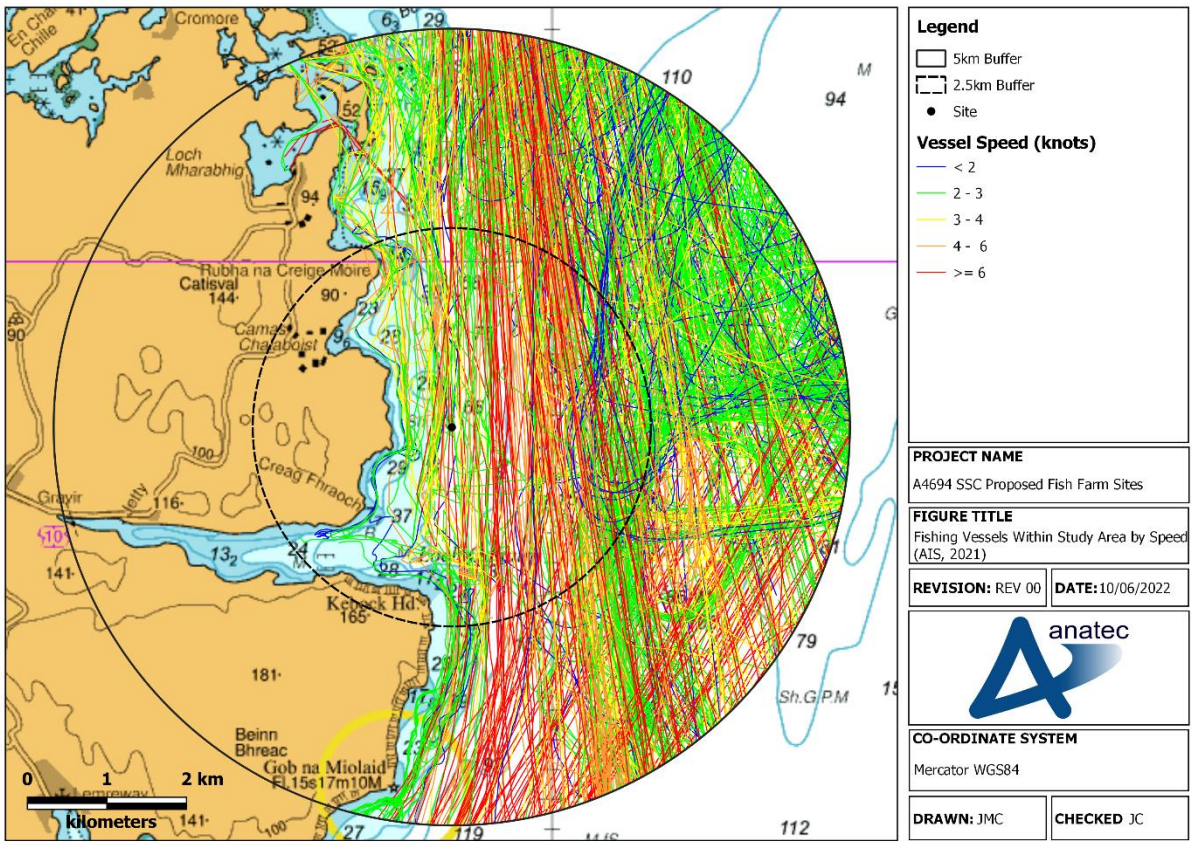

Figure 3.6 Fishing Vessels Within Study Area by Speed (AIS, 2021)

An average of between one and two unique fishing vessels was recorded each day within the study area during 2021.

Over three-quarters of the vessels exhibited average speeds of less than six knots and were therefore potentially engaged in fishing. In particular, various fishing vessels could be seen exhibiting potential fishing activity to the east of the study area.

Fishing vessels that were recorded in transit were generally travelling along a north/south route or a northeast/southwest route to the southeast of the study area.

The AIS data recorded during 2021 for fishing vessels within the study area, colour-coded by length, is presented in Figure 3.7.

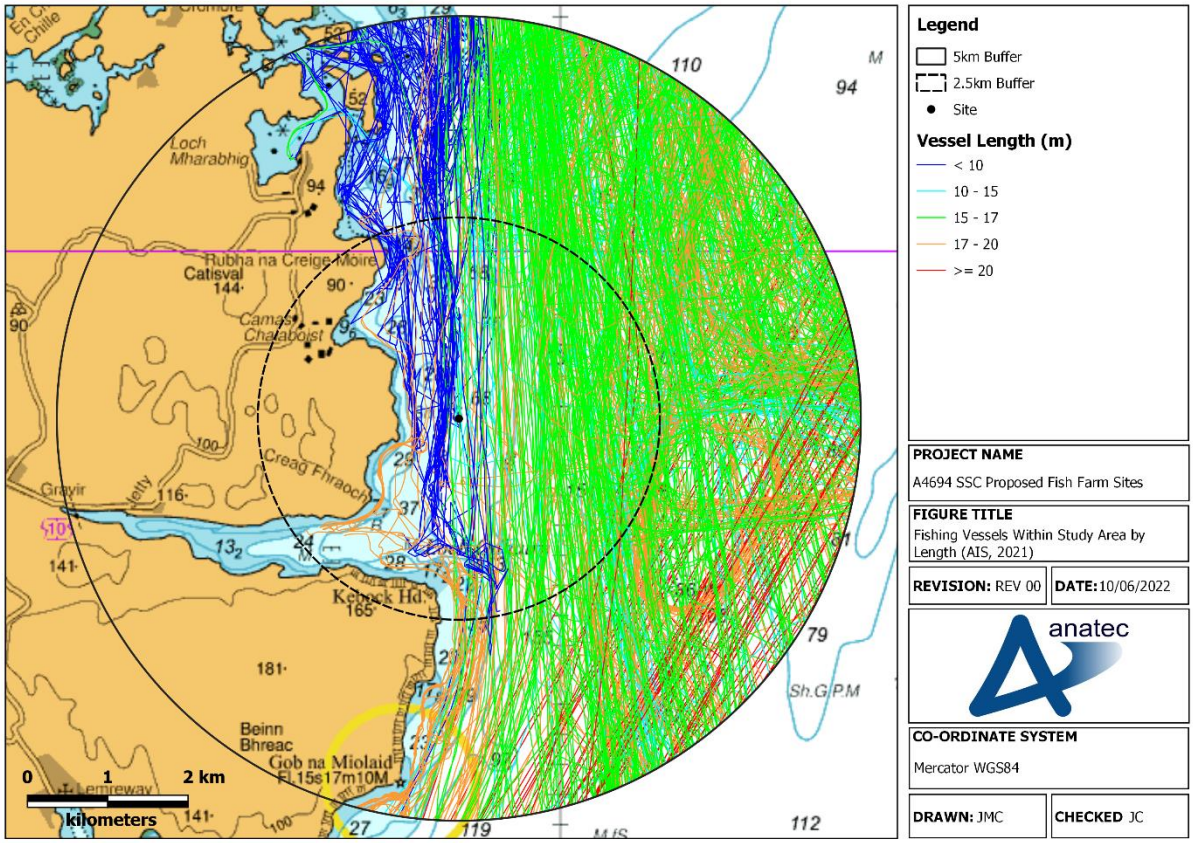

Figure 3.7 Fishing Vessels Within Study Area by Length (AIS, 2021)

The average length of fishing vessels recorded was 17m. The longest fishing vessels recorded were 70m long; one of these was registered with the Faroe Islands and the other was registered with Denmark.

Approximately 87% of the tracks of fishing vessels of length less than ten metres were from a single 8m long vessel that stayed close to the coast.

Approximately 22% of fishing vessels recorded were less than 15m in length (the minimum length for mandatory AIS broadcast).

The most common length of fishing vessel was between 15m and 17m, accounting for 47% of the data. The largest fishing vessels (of length at least 20m) were generally recorded in northeast/southwest transit in the south-eastern region of the study area.

The density of fishing vessels recorded on AIS within the study area during 2021 is presented in a grid of cells of size 250m x 250m in Figure 3.8.

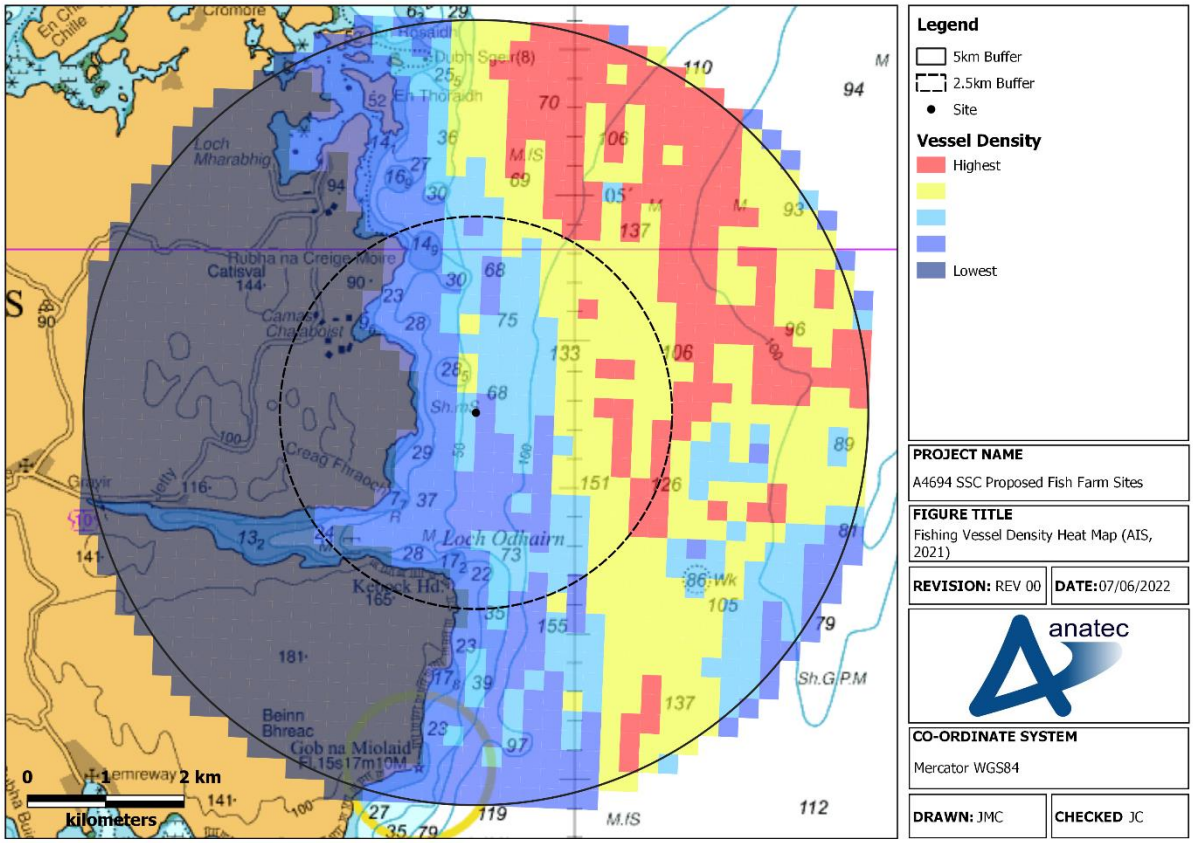

Figure 3.8 Fishing Vessel Density Heat Map (AIS, 2021)

It can be seen that fishing vessel activity becomes more concentrated the further from the coast, with many of these vessels potentially engaged in active fishing. There were also fishing vessels in transit, most of which were travelling to/from Stornoway.

It is noted that AIS does not fully represent fishing activity as any fishing vessels under 15m in length in the area are not obligated to broadcast on AIS; such vessels may however be at least 12m in length and would therefore be represented on VMS. More information about fishing vessels recorded on VMS can be found in Section 4. However, it is noted that there may be a number of fishing vessels, such as shellfish potters, which are not recorded on VMS or AIS.

3.7 Recreational Vessels

The tracks of recreational vessels recorded on AIS during 2021 are presented in Figure 3.9.

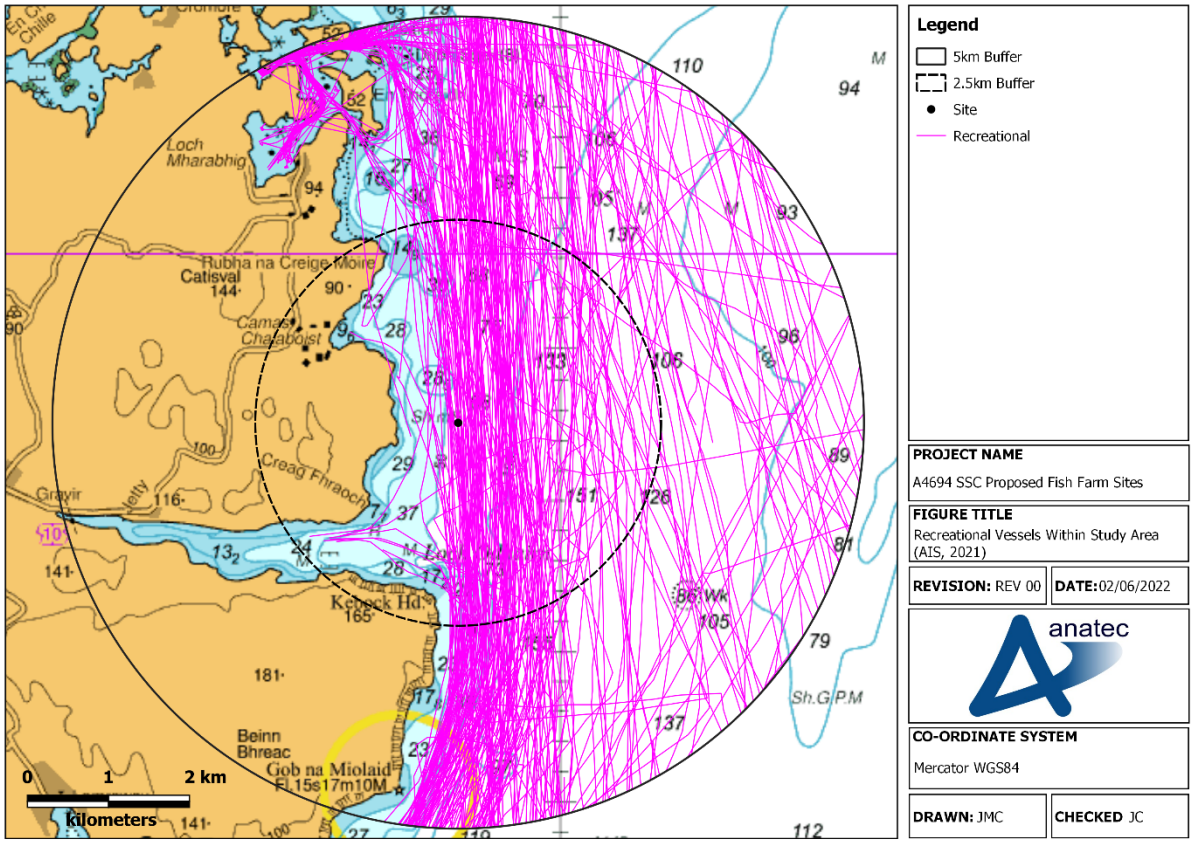

Figure 3.9 Recreational Vessels Within Study Area (AIS, 2021)

The average length of recreational vessels recorded within the study area during 2021 was 12m. The longest recreational craft recorded was 24m. It should be noted that vessels broadcasting as recreational were instead classed as passenger if they were longer than 24m, due to an EU directive definition that defines recreational craft as being no longer than 24m.

The majority of recreational traffic was recorded in north/south transit through the centre of the study area where the site is located; many of these vessels were travelling to/from Stornoway and the Shiant Islands.

3.8 All Others

The tracks for all other vessel types during 2021, coloured by type, are presented in Figure 3.10. Due to the large number of fish carrier tracks, fish carriers have taken out of the “other” category and given their own colour.

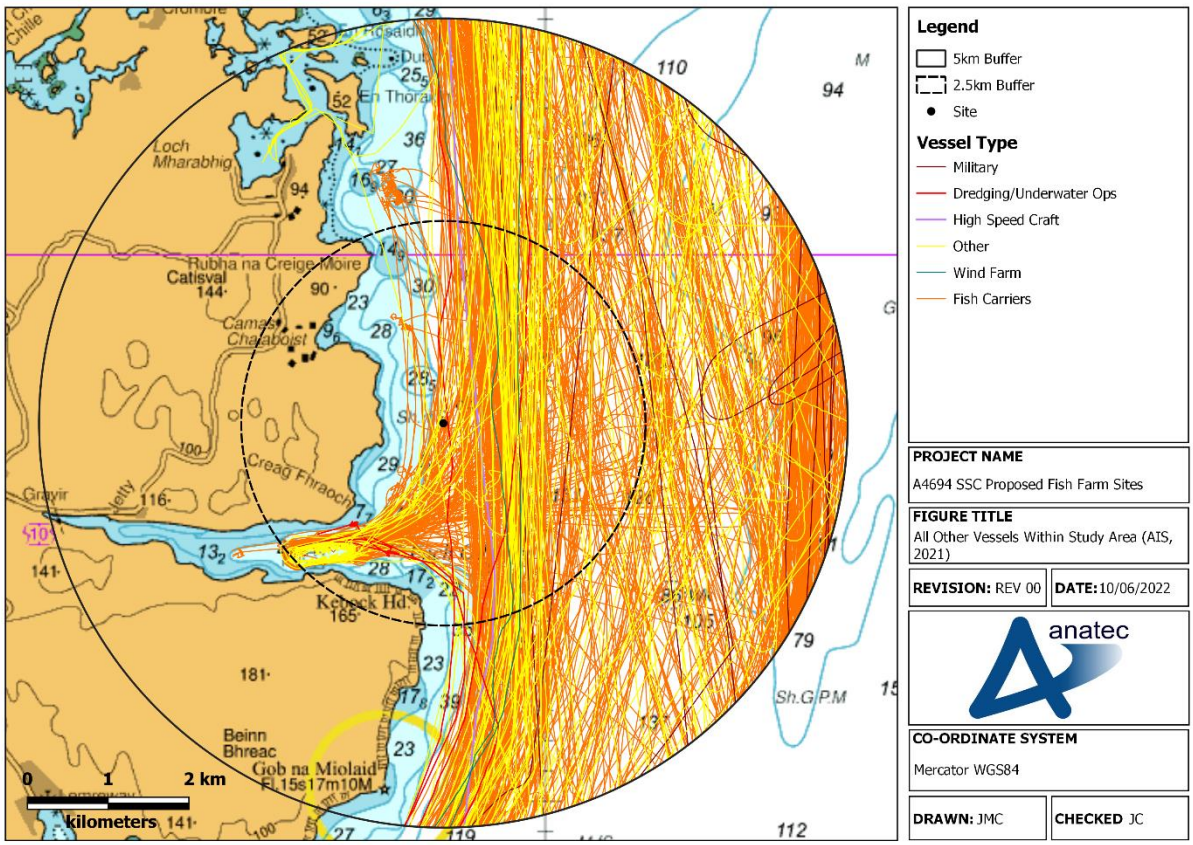

Figure 3.10 All Other Vessels Within Study Area (AIS, 2021)

The average length recorded for miscellaneous vessel types was 58m. The longest vessel recorded was a 190m long military vessel. On average, between one and two unique miscellaneous vessels were recorded passing within the study area each day.

Stornoway was the main destination for fish carriers and the rest of the vessels in the “other” category. Most of the vessels were fish carriers, accounting for 76% of all miscellaneous vessels. Eight military vessels, two dredgers, a high-speed craft and two wind farm vessels were also recorded within the study area. These vessels were also mainly in north/south transit to/from Stornoway, with the exception of a dredger that turned into Loch Odhairn and a military vessel that was travelling in a variety of directions to the east of the study area.

4 VMS Analysis

4.1 Introduction

This section summarises the analysis of 12 months of Vessel Monitoring System (VMS) fishing satellite data. It is noted that VMS covers vessels 12m in length and over (compared to 15m and over for AIS); this means that fishing vessels that may not have been broadcasting on AIS may have been recorded on VMS, and thus VMS data in conjunction with AIS data can provide a more comprehensive overview of fishing compared to AIS data on its own. It is also noted that vessel positions are received approximately once every 1 to 2 hours, compared to every few seconds as is typically the case for AIS.

The data is provided in statistical rectangles defined by the International Council for Exploration of the Seas (ICES) and was obtained from Marine Scotland. Most of the vessel information, including name and gear type, is redacted to ensure the vessel remains anonymous.

4.2 Speed

Figure 4.1 presents the 2021 VMS data points within the 5km buffer, colour-coded by speed. The 5km buffer intersects the ICES rectangle 45E3.

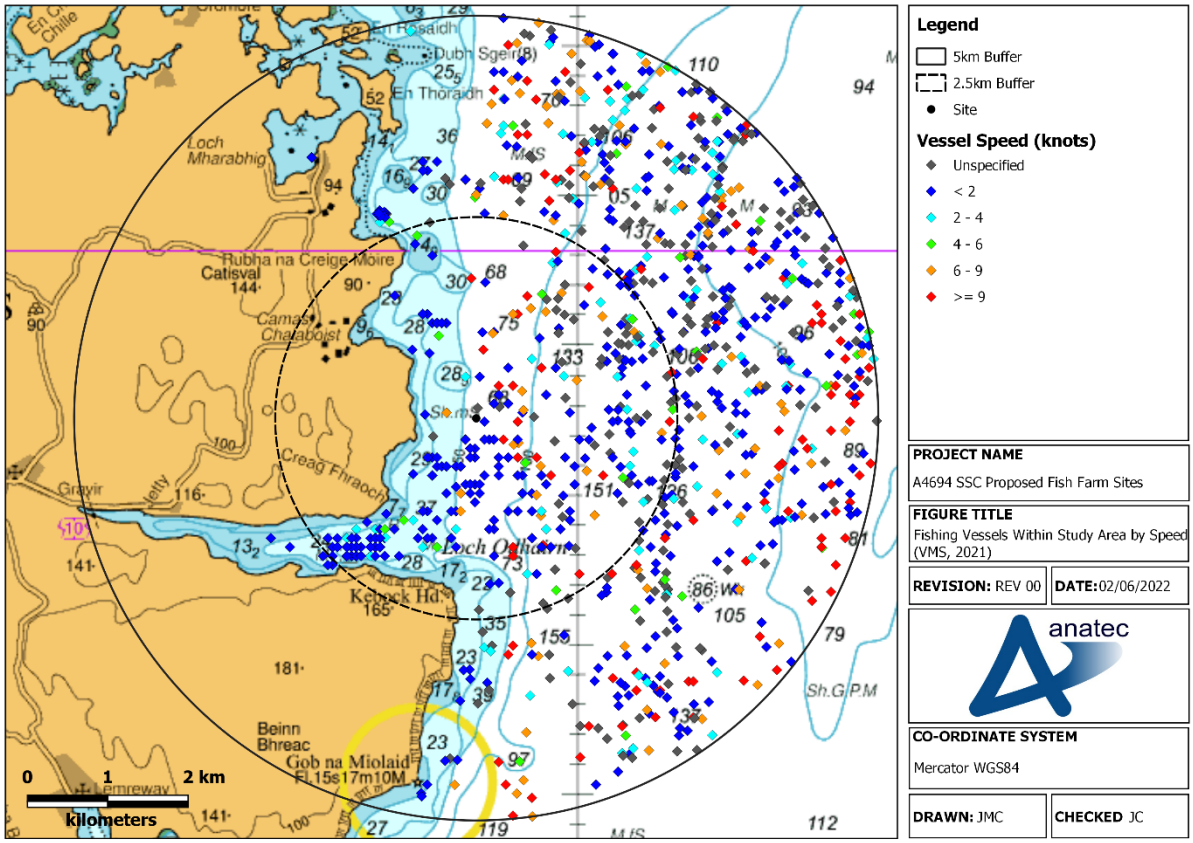

Figure 4.1 Fishing Vessels Within Study Area by Speed (VMS, 2021)

Unspecified speeds accounted for 18% of the data points. Excluding these, the majority of VMS speeds were of less than two knots and accounted for 57%.

81% of speeds were of less than six knots, indicating that the vessels were potentially engaged in fishing.

4.3 Dataset Comparison

Figure 4.2 presents the AIS fishing tracks from 2021 overlaid with VMS data points over the same period, with VMS being coloured by nationality.

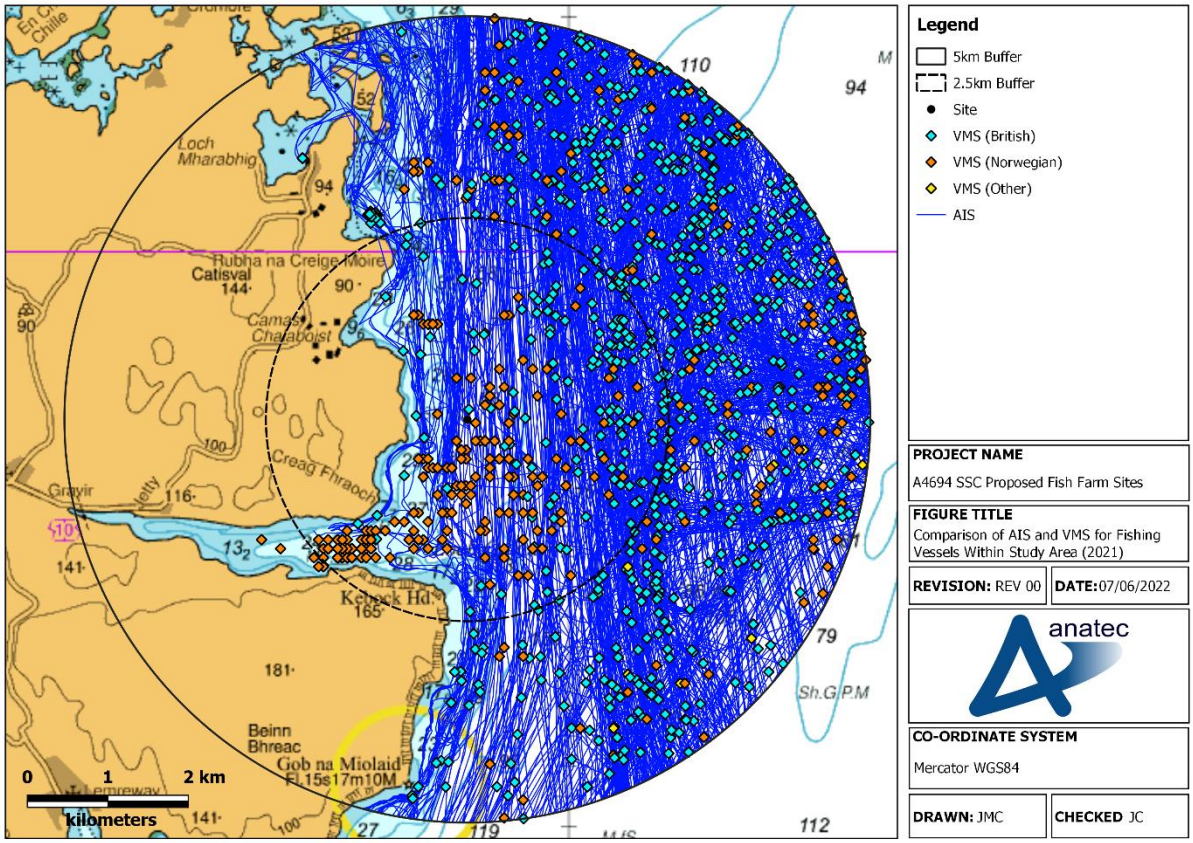

Figure 4.2 Comparison of AIS and VMS for Fishing Vessels Within Study Area (2021)

It can be seen that there is some agreement between the positions of the AIS tracks and VMS data points. The main difference is in the number of positions recorded within Loch Odhairn.

54% of fishing vessel VMS points were of British nationality and 45% were of Norwegian nationality. The remaining 1% comprised of Irish, French and Spanish nationalities. This is at odds with the nationality distribution of fishing vessels recorded on AIS, for which British accounted for 92%. This can be largely explained by the presence of Norwegian fish carriers which were removed from the AIS fishing dataset (and placed in “other”) but may have been included within the VMS dataset; indeed, most of the Norwegian data points are located within Loch Odhairn where fish carriers were recorded on AIS.

Figure 4.3 presents a comparison between the count distribution of AIS tracks and VMS data points within the study area during 2021.

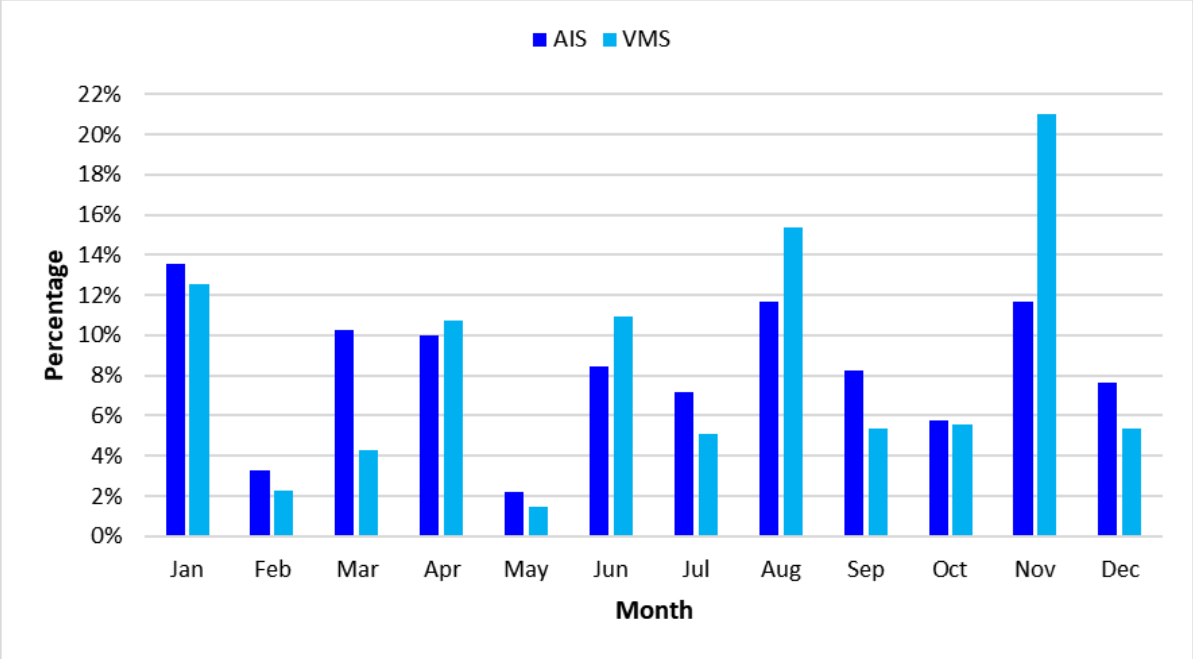

Figure 4.3 Comparison of AIS Track and VMS Data Point Counts for Fishing Vessels Within Study Area (2021)

It can be seen that there is a degree of correlation between the counts for each of the datasets, although differences can be seen. The month with the most notable disparity is November; this could be partly attributed to the aforementioned Norwegian fish carriers, as this was the month during which they were most commonly recorded.

AIS counts can be higher than VMS counts due to the higher rate of broadcast of AIS; in particular, it is possible for a vessel to be recorded on AIS but not recorded at all on VMS. This may happen if the vessel spends less time in the study area than the interval of time between VMS position broadcasts.

VMS counts can be higher than AIS counts due to the different length requirements between the two data types (12m versus 15m), as well as the fact that the same vessel may have been counted more than once on a single day with VMS (due to the redaction of identifying information from VMS). Another reason could also be that there are vessels recorded on VMS but are not classed as fishing in the AIS dataset, such as fish carriers. Periods of downtime for AIS feeds may also affect AIS numbers.

5 Validation (2019)

5.1 Type Overview

AIS data from 2019 (12 months) is presented in this section to show the traffic trends have remained generally consistent.

An overview of vessels recorded on AIS during 2019, coloured by type, is presented in Figure 5.1.

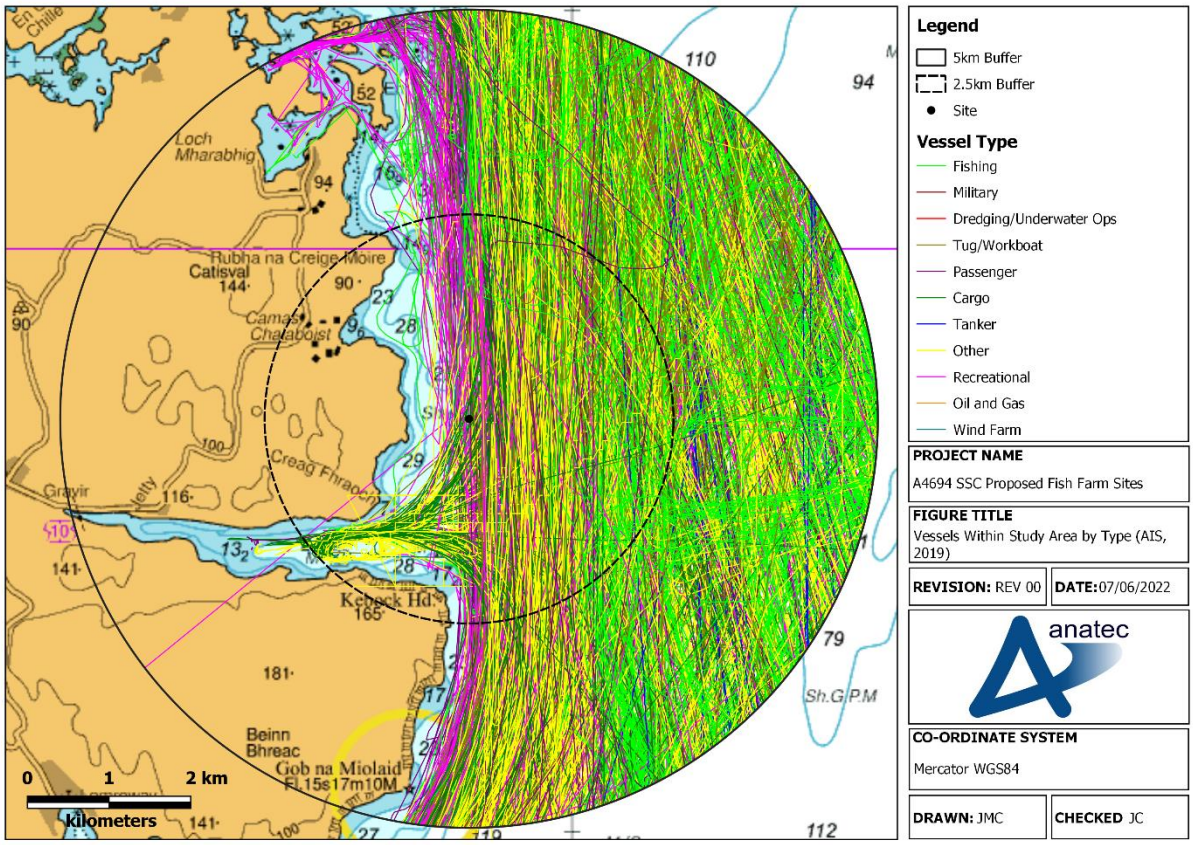

Figure 5.1 Vessels Within Study Area by Type (AIS, 2019)

It can be seen when the AIS data of 2019 (Figure 5.1) is compared to the AIS data of 2021 (Figure 3.1), that some general trends have remained fairly consistent in terms of both level of traffic and the distribution of traffic. There was a 40% increase in tug/workboat traffic levels from 2019 to 2021, as well as an increase in fishing vessel traffic levels (which is discussed more in section 5.2). A feed carrier was also recorded frequently entering into Loch Odhairn during 2019, which wasn't recorded during 2021.

5.2 Fishing Vessels

Figure 5.2 presents the AIS tracks of fishing vessels recorded within the study area during 2019.

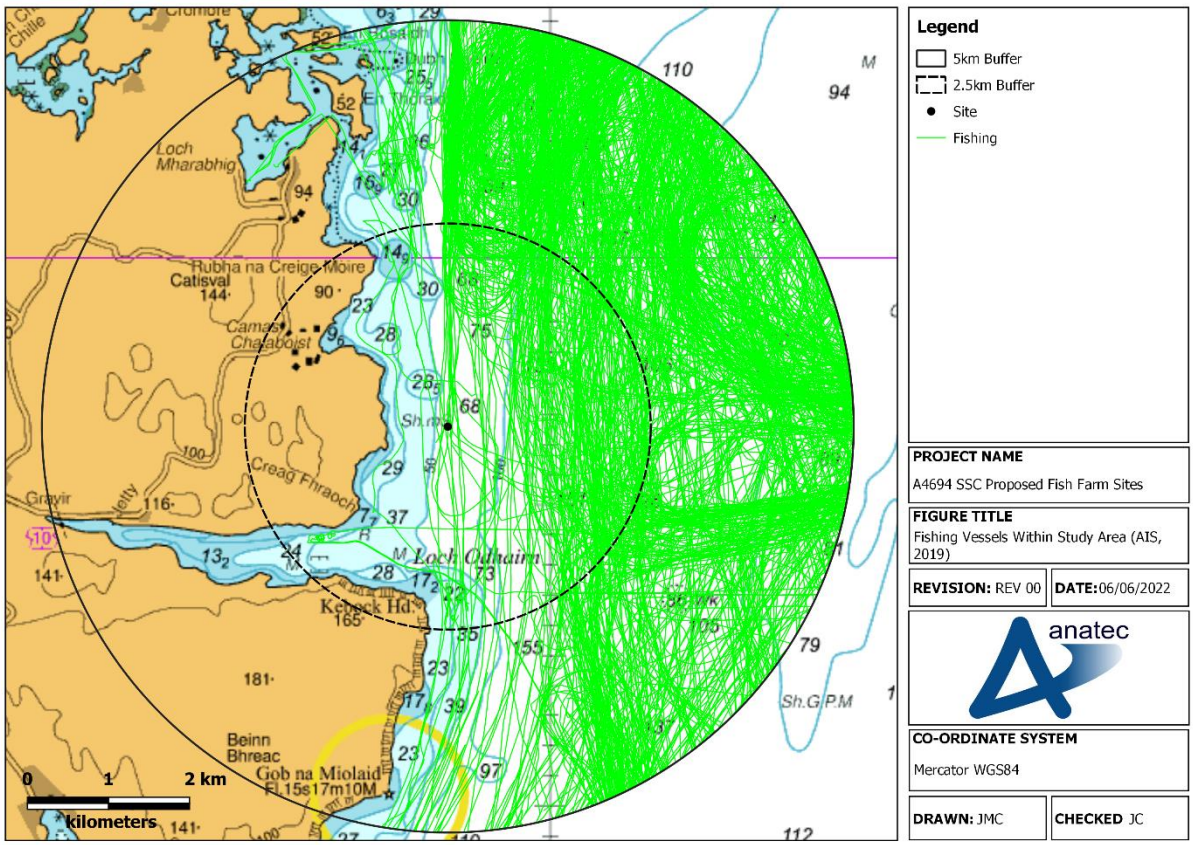

Figure 5.2 Fishing Vessels Within Study Area (AIS, 2019)

There was approximately a 34% increase in the level of fishing vessel traffic from 2019 to 2021, and there was more fishing vessel activity closer to the coast in 2021 compared to in 2019. Changes in fishing activity can depend on various influencing factors such as fish stocks and behaviour, quotas, Brexit, COVID-19 etc.

6 Conclusions

During 2021, an average of between five and six unique vessels per day were recorded on AIS within the study area. Fishing vessels, vessels in the "other" category (which mainly comprised of fish carriers) and tug/workboats were among the most common vessel types, with recreational activity also being prominent during the summer months (which were also the busiest months overall).

The majority of commercial traffic consisted of cargo vessels, accounting for 58% of the data. This was followed by passenger, which accounted for 31%, with tankers accounting for the remaining 11%. Destinations included Gravir, Stornoway and fish farms. The average length of commercial vessels within the study area was 65m.

Tug and workboat vessels, some of which do fish farm related work, were recorded mainly along the same route used by the cargo traffic. An emergency towing vessel was also recorded patrolling the sea to the northeast of the site throughout the year. The average length of these tug/workboat vessels was 43m.

Potential fishing activity was recorded to the east of the site, with transiting vessels mainly travelling to/from Stornoway. The longest recorded were 70m long; one being registered with the Faroe Islands and one being registered with Denmark. The average length was 17m. Approximately 22% of fishing vessels recorded were less than 15m in length. An average of between one and two unique fishing vessels was recorded each day within the study area during 2021. It is however noted that fishing vessel activity is highly likely to be underestimated on AIS given that smaller vessels are not required to have AIS installed, although such vessels may broadcast on AIS voluntarily. It is also noted that, based on surveys which Anatec have carried out, fishing vessels on occasion also switch off their AIS transmission.

The majority of recreational traffic was recorded in north/south transit through the centre of the study area where the site is located; many of these vessels were travelling to/from Stornoway and the Shiant Islands. The average length was 12m and the longest was 24m. The average length of miscellaneous vessels was 58m and the longest was 190m. Miscellaneous traffic mainly consisted of fish carriers, comprising 76% of the data.

There was some disparity between the nationalities of fishing vessels recorded on AIS and the nationalities on VMS; 54% of VMS points were British whereas 92% of AIS tracks were British. However, this can be explained by the presence of Norwegian fish carriers that were removed from the AIS fishing dataset. There was some agreement between the two datasets with regards to monthly counts, although differences could be seen which could be accounted for by various factors such as vessels being counted more than once per day on VMS and the higher rate of broadcast of AIS.

There was a higher level of tug/workboat vessel activity recorded in 2021 compared to in 2019. Fishing vessel activity was also higher in 2021, which could be due to various influencing factors such as fish stocks and behaviour, quotas, Brexit, COVID-19 etc.