ABERDEEN HARBOUR
EXPANSION PROJECT
November 2015

Volume 3:
Technical
Appendices

APPENDIX 21-A NIGG BAY DEVELOPMENT BASELINE ASSESSMENT FOR SHIPPING AND NAVIGATION

Nigg Bay Development
Baseline Assessment for
Shipping and Navigation

Prepared by:	Anatec Limited
Presented to:	Fugro Emu on behalf of Aberdeen Harbour Board
Date:	05/08/2015
Revision No.:	03
Reference:	A3501-FUG-TN-2

This Project has received funding from the European Union: The Content of the Document does not necessarily reflect the views or opinions of the EU Commission, and the Commission is not responsible for any use made by any party of the information contained within it.

Anatec **Aberdeen Office**
Address: 10 Exchange Street, Aberdeen, AB11 6PH, UK
Tel: 01224 253700
Fax: 0709 2367306
Email: aberdeen@anatec.com

Cambridge Office
Braemoor, No. 4 The Warren, Witchford, Ely, Cambs, CB6 2HN, UK
01353 661200
0709 2367306
cambs@anatec.com

This study has been carried out by Anatec Ltd for Fugro EMU on behalf of Aberdeen Harbour Board. The assessment represents Anatec's best judgment based on the information available at the time of preparation and the content of this document should not be edited without approval from Anatec. Any use which a third party makes of this report is the responsibility of such third party. Anatec accepts no responsibility for damages suffered as a result of decisions made or actions taken in reliance on information contained in this report.

Revision Number	Date	Summary of Change
00	01/04/2015	Initial Draft.
01	19/05/2015	Updated with AHB comments.
02	05/06/2015	Updated with Fugro comments.
03	05/08/2015	Final Version

TABLE OF CONTENTS

Table of Figures

Table of Tables

Abbreviations

AIS	-	Automatic Identification System
ALARP	-	As Low As Is Reasonably Practicable
BTA	-	British Tugowners Association
CGOC	-	Coastguard Operations Centre
ERRV	-	Emergency Response and Rescue Vessel
EU	-	European Union
FLO	-	Fishing Liaison Officer
FPSO	-	Floating Production Storage and Offloading
FSO	-	Floating Storage and Offtake
HMCG	-	Her Majesty's Coastguard
IMO	-	International Maritime Organisation
LPG	-	Liquefied Petroleum Gas
MMSI	-	Maritime Mobile Service Identity
MRCC	-	Maritime Rescue Co-ordination Centre
nm	-	Nautical Mile
NPF	-	National Planning Framework
NMOC	-	National Maritime Operations Centre
PEC	-	Pilotage Exemption Certificate
RACON	-	A radar transponder (Radar and Beacon)
RYA	-	Royal Yachting Association
SAR	-	Search and Rescue
SMS	-	Safety Management System
SOLAS	-	Safety of Life at Sea
UAL	-	Universal Africa Lines
VHF	-	Very High Frequency
VMS	-	Vessel Monitoring Service
VTS	-	Vessel Traffic Service

1. Introduction

1.1 Background

Anatec Ltd were commissioned by Fugro Emu to undertake a baseline assessment of shipping and navigation for the area surrounding the planned expansion of Aberdeen Harbour at Nigg Bay.

Aberdeen Harbour Board have proposed the design and construction of a new harbour facility at Nigg Bay, immediately south of the existing harbour. The purpose of the new facility is to complement and expand the capabilities of the existing harbour, accommodate larger vessels, retain existing custom, and attract increased numbers of vessels and vessel types to Aberdeen.

The new harbour development shall include but is not limited to:

- Dredging the existing bay to accommodate vessels up to 9m draft with additional dredge depth of 10.5m to the east quay and entrance channel;
- Construction of new north and south breakwaters to form the harbour;
- Provision of approximately 1500m of new quays and associated support infrastructure. The quay will be constructed with solid quay wall construction and suspended decks over open revetment;
- Construction of areas for development by others to facilitate the provision of fuel, bulk commodities and potable water;
- Land reclamation principally through using materials recovered from dredging operations and local sources, where possible;
- Provision of ancillary accommodation for the facility;
- Off-site highway works to the extent necessary to access the facility and to satisfy statutory obligations;
- Diversions and enabling works necessary to permit the development.

1.2 Objectives

The objectives of this assessment work are as follows:

- Assess the shipping and navigation baseline;
- Present data on past marine incidents in the vicinity of the harbour;
- Model the baseline and future collision risk;
- Consult with local and national stakeholders; and
- Determine the potential navigational impacts.

1.3 Site Overview

1.3.1 Current Harbour

Aberdeen Harbour is a strategically important port. Aberdeen Harbour Board note this in their description below:

Aberdeen Harbour is Europe's principal marine support centre for the energy sector in the North Sea and Atlantic Margin, and is the main commercial port serving North-East Scotland with shipping links to around 45 countries worldwide.

Aberdeen Harbour is a world class port annually handling around 8,000 vessel arrivals and around five million tonnes of cargo, valued at approximately £1.5 billion, for a wide range of industries.

With versatile facilities, competitive charges and diversity of traffic, it serves Scotland's third city and an extensive hinterland. Centre of activity for the offshore oil and gas industry's marine support operations in North-west Europe, it is also:

- *Principal commercial port in Northern Scotland*
- *An energy industry hub*
- *An international port for general cargo, roll-on/roll-off and container traffic*
- *Principal mainland port for freight, passenger, vehicle and livestock services to Orkney and Shetland*
- *A centre for forest product exports*
- *A gateway for agricultural products and supplies*
- *A marshalling point for exports of oilfield equipment*
- *Experienced in handling equipment for renewable energy projects*
- *A port of call for cruise ships*
- *One of the busiest Trust Ports in the UK*

An overview of the current Aberdeen Harbour is presented in Figure 1.1.

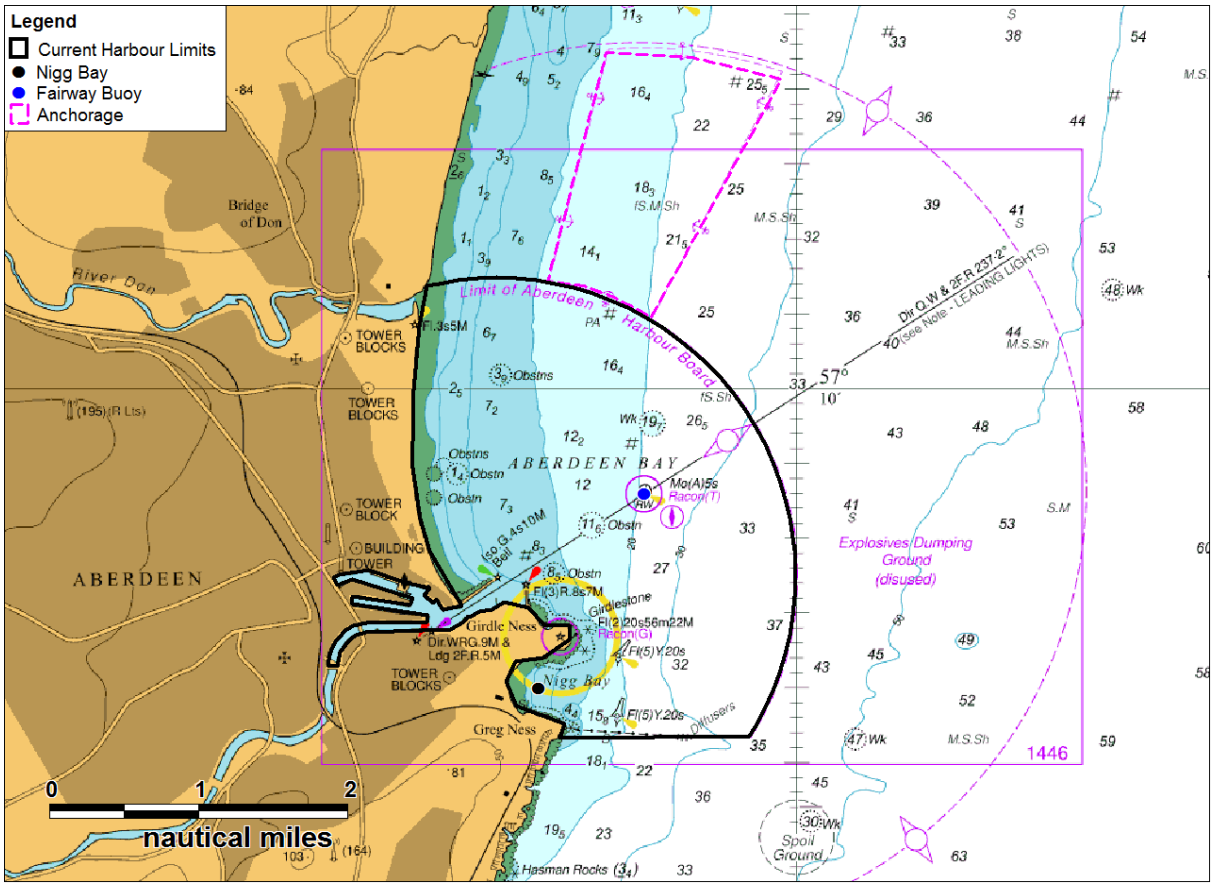

Figure 1.1 Overview of Aberdeen Harbour

The harbour operates a Vessel Traffic Service (VTS). This is a combined service providing both information and a traffic organisation service. All shipping movements within the harbour limits are controlled and monitored from the state-of-the-art VTS Centre situated at the inner end of the North Pier, in the Marine Operations Centre. The VTS centre is manned and operates 24 hours a day.

Pilotage and towage is available at the port. All vessel movements within Aberdeen Harbour must be agreed with VTS, with set pilotage procedures in place. Aberdeen has compulsory pilotage for vessels of 60 m and over in length. However, for vessels with an operational bow thruster this limit is increased to 75 m, but suitably competent deck officers can obtain a Pilotage Exemption Certificate (PEC).

A fairway buoy equipped with RACON is located approximately 1.4nm north east of the harbour. Vessels are obliged to request permission to enter the harbour limits when 3nm from the buoy. A designated anchorage is available 2nm north of the entrance to the harbour.

1.3.2 Nigg Bay Development

Aberdeen Harbour's operations are restricted by the size and shape of the port and its location at the heart of Aberdeen city. These constraints increasingly impact the ability of Aberdeen

Harbour Board to provide adequate facilities for current and predicted traffic. Following an extensive period of consultation with stakeholders, Aberdeen Harbour Board have undertaken feasibility studies in order to identify and finalise the preferred location and layout of the proposed facilities.

The identified location is Nigg Bay, an underdeveloped part of the coastline to the south of the city. Nigg Bay is located approximately 0.5nm south east of the entrance to the current port.

The preferred option is to develop, in a phased manner, approximately 1500m of new quay, which will require extensive dredging of the bay, land reclamation and breakwater construction to form the new harbour.

Aberdeen Harbour Board have procured the following in relation to the project development:

- Extensive terrestrial and marine site investigations with further planned prior to contract awards
- Traffic Impact studies
- Comprehensive Environmental Impact Assessment (partially funded by EU TEN-T grant)
- Ware modelling
- Navigation Simulation
- Physical 2D and 3D model construction (partially funded by EU Ten-T grant)

Initial works are expected to include the construction of two substantial breakwaters each over 600 metres long to the north and south. These breakwaters will have a maximum crest level of over 12 metres above admiralty chart datum. It is likely that concurrent with the breakwater construction will be the dredging of the inner basin to minus 9 metres admiralty chart datum, the western berth to minus 10.5 metres and the approach channel to minus 10.5 metres. Quay construction will begin with a 400 metre long solid quay built around the eastern side of the bay and continuing some 300 metres along the northern side. There the construction will change to an open quay to complete 500 metres on the northern side and 300 metres on the western side. The quays and paved backup areas will provide over 140,000 square metres of working space however, the south west and southern side of the bay as well as the location of Nigg bay SSSI will remain largely undeveloped.

Illumination will be provided by LED lights on columns at intervals around the site. Access and egress from the development will be via a security control area on the west side of the site secured by fencing which will comply with the international ship and port facility security code.

The traffic forecast to use Nigg Bay on an annual basis is approximately 550 commercial vessels; 1700 PSV/Offshore vessels; 40 DSV; 45 cruise ships. This is in addition to the traffic currently using the existing harbour.

A general overview of the proposed development site in Nigg Bay is presented in Figure 1.2. The chosen study areas are included in the figure.

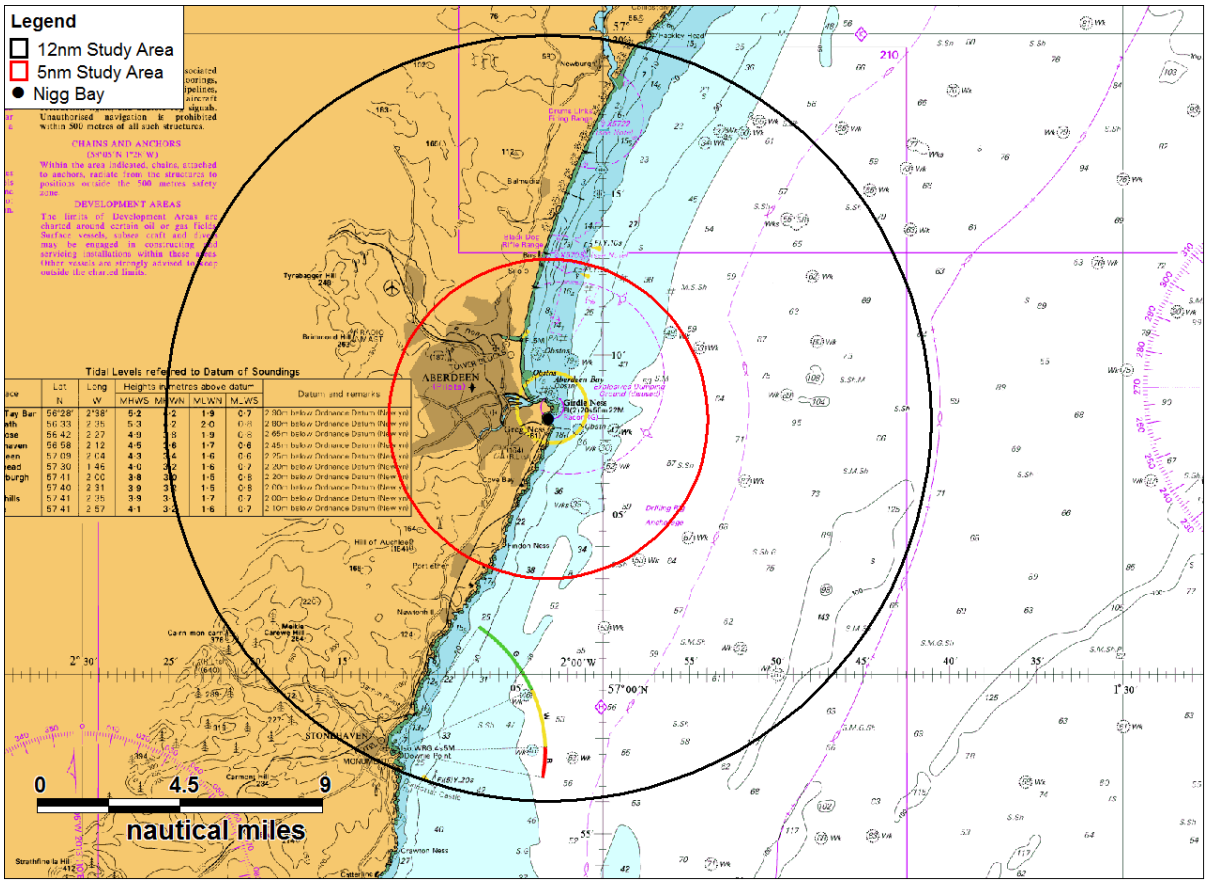

Figure 1.2 General Overview of Nigg Bay

A detailed overview of the planned development is presented in Figure 1.3.

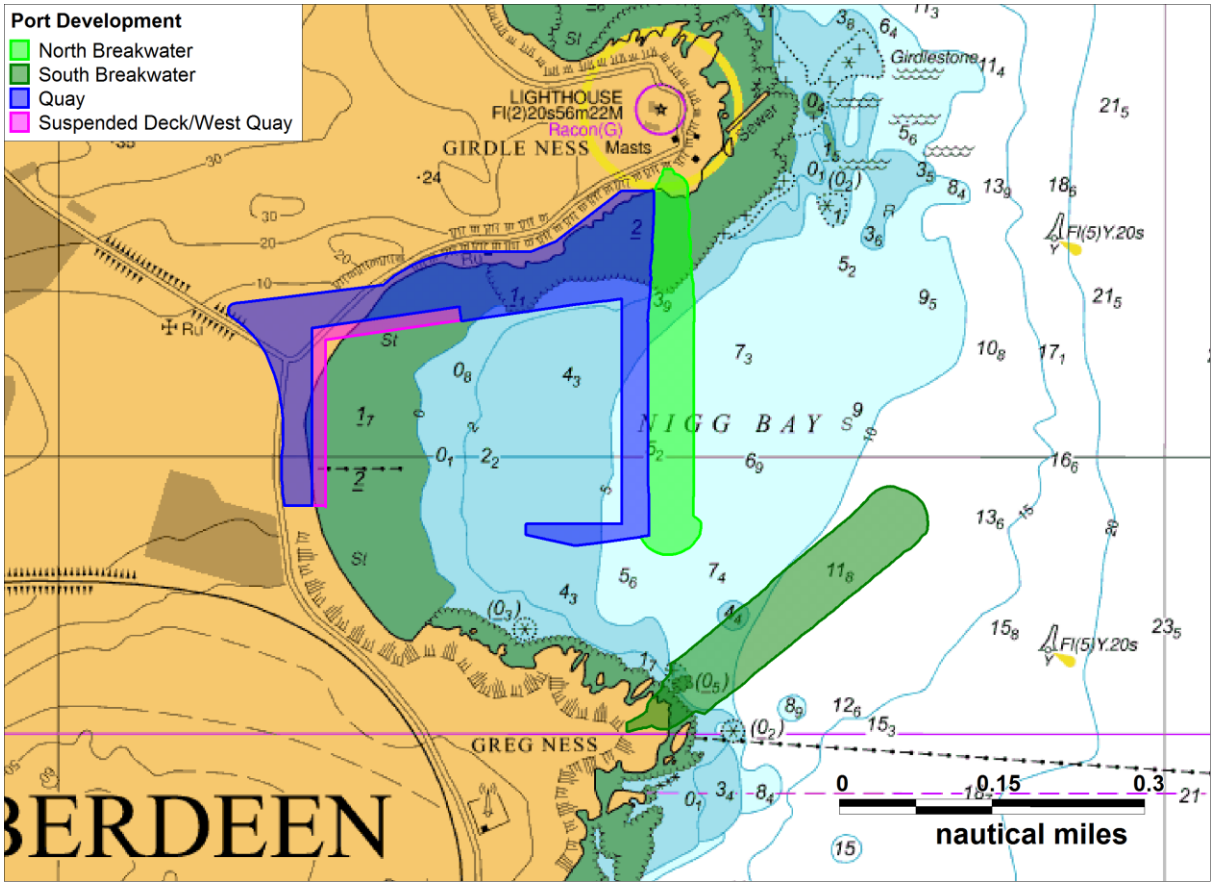

Figure 1.3 Example Layout of Nigg Bay Development

2. Baseline Assessment

2.1 Introduction

This assessment uses four months of seasonally-weighted Automatic Identification System (AIS) data from 2014 to assess the shipping activity in the vicinity of Nigg Bay. The data was analysed in terms of vessel numbers, type and size. The track from cargo vessels, tankers, passenger vessels, offshore support vessels, recreational vessels and fishing vessels have been presented individually in subsequent sections. In addition, the vessels at anchor within the data were identified to determine the behaviour of anchored vessels outside the current harbour. Finally, the AIS data was used to estimate the current collision risk and encounter rate between vessels, and the change in risk that the new development could cause.

Two study areas, one a 12nm buffer from the approximate centre point of Nigg Bay was used to assess the passing traffic and the other a 5nm buffer of the centre point was used to analyse the traffic closer to the coast and that associated with Aberdeen Harbour.

The purpose of the shipping and navigation baseline work is as follows:

- Present four months of seasonal AIS data in the vicinity of Nigg Bay;
- Determine the behaviour of the commercial shipping within the study areas;
- Identify the fishing vessel activity within the study areas;
- Identify the recreational vessel activity within the study areas; and
- Determine the anchored vessel activity within the study areas.

A general overview of the proposed development site in Nigg Bay is presented in Figure 1.2, where the study areas are displayed.

2.2 AIS Overview

2.2.1 Introduction

The majority of analysis within this report uses two months of summer AIS data and two months of winter AIS data as follows:

- Winter: January and February 2014; and
- Summer: July and August 2014.

Both summer and winter data were used to account for any seasonal variations in vessel activity around the Nigg Bay development site.

2.2.2 AIS Carriage Requirements

Regulation 19 of SOLAS Chapter V (carriage requirements for shipborne navigational systems and equipment) sets out the navigational equipment to be carried on board ships, according to ship type. In 2000, IMO adopted a new requirement (as part of a revised chapter

V) for ships to carry AIS. AIS is a system by which ships send data concerning their position, MMSI etc. on two individual VHF channels to the shore and other vessels, at very frequent intervals. The data is transmitted automatically via VHF to other vessels and coastal stations/authorities.

The regulation requires AIS to be fitted aboard 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 passenger ships irrespective of size built on or after 1 July 2002. It also applies to ships engaged on international voyages constructed before 1 July 2002, according to the following timetable:

- Passenger ships, not later than 1 July 2003;
- Tankers, not later than the first survey for safety equipment on or after 1 July 2003; and
- Ships, other than passenger ships and tankers, of 50,000 gross tonnage and upwards, not later than 1 July 2004.

An amendment adopted by the Diplomatic Conference on Maritime Security in December 2002 states that ships, other than passenger ships and tankers, of 300 gross tonnage and upwards but less than 50,000 gross tonnage, will be required to fit AIS not later than the first safety equipment survey after 1 July 2004 or by 31 December 2004, whichever occurs earlier. Ships fitted with AIS shall maintain AIS in operation at all times except where international agreements, rules or standards provide for the protection of navigational information.

As of the 31st May 2014, all EU fishing vessels of length above 15m are required to carry AIS equipment. Prior to this, from the 31st May 2013, all fishing vessels of length above 18m were obliged to carry AIS.

A proportion of smaller fishing vessels and recreational craft carry AIS but this is voluntary and they may not broadcast continuously.

2.2.3 AIS Limitations

It should be taken into consideration when viewing the following analysis that activity from smaller vessels is likely to be under-represented, particularly in the case of fishing and recreation vessels due to the carriage requirements described in the previous section. However, it can be assumed that the vessels that do transmit provide an indication of the overall activity and behaviour of these vessels. Where appropriate this has been highlighted within the analysis.

It is also worthwhile noting that vessels involved in the offshore sector (supply vessels/ERRVs/anchor handling tugs, etc.) are usually categorised as either ‘tugs’, ‘cargo’ or ‘other’ vessels by the classification available in AIS. As they are the most numerous vessels operating in proximity to the Nigg Bay development site, this study has extracted these

vessels into a separate class referred to as 'offshore vessels'. This will ensure a clearer assessment of shipping and navigation.

Some of the recorded AIS tracks were observed crossing land. This occurs when land exists between two subsequent transmitted points, and no data is available between the times those points were recorded. In some cases these tracks have been cosmetically altered where a vessels true course can be accurately estimated.

3. Shipping and Navigation Baseline

3.1 Introduction

This section provides a general overview of all shipping seen over the four months of data in terms of total vessel numbers, vessel type and vessel size. The analysis in this section covers passing traffic within the 12nm study area and localised traffic within the 5nm study area.

3.2 Summer

3.2.1 Vessel Numbers

Charts showing the number of unique vessels per day within the 5 and 12nm study areas during July and August are presented in Figure 3.1 and Figure 3.2 respectively.

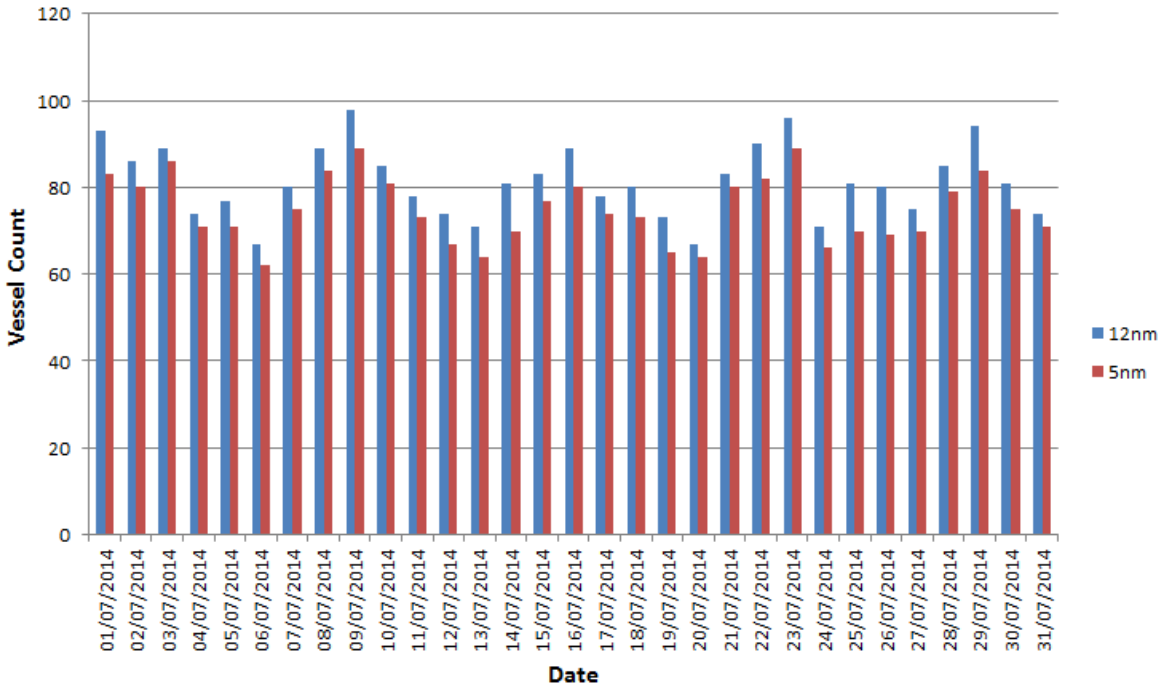

Figure 3.1 July 2014 Daily Vessel Count

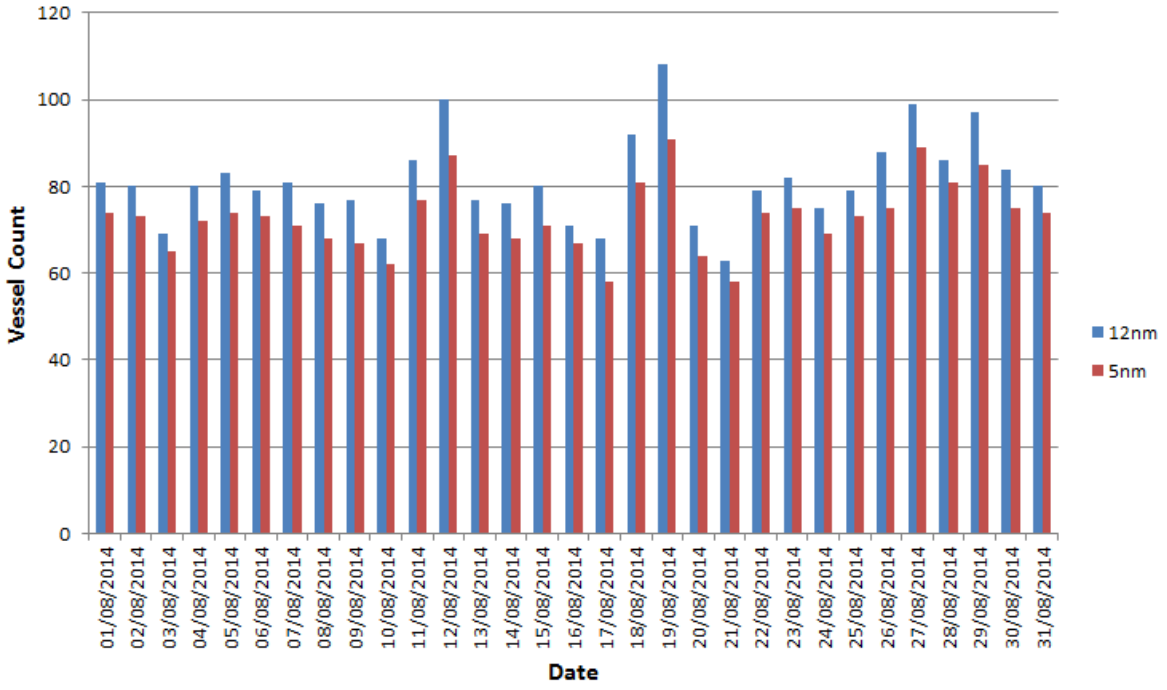

Figure 3.2 August 2014 Daily Vessel Count

During summer, an average of 81 unique vessels per day passed within 12nm of Nigg Bay. The busiest day was the 19th of August when 108 vessels unique vessels were recorded. The quietest day was the 21st of August when 63 unique vessels were recorded.

An average of 74 unique vessels a day intersected the 5nm study area. The busiest day was again the 19th August, when 91 unique vessels intersected the 5nm study area. The quietest days were the 17th and 21st August, when 58 unique vessels were recorded.

It was noted that some vessels remained berthed for multiple days within Aberdeen Harbour. If these vessels were excluded (that is, any vessels within the harbour were only included in that days count if they left the harbour), it was estimated that the average number of unique vessels per day during summer was 63 in the 12nm study area and 55 in the 5nm study area. The relatively small difference between the 12nm and 5nm vessel counts suggests that most vessels were either visiting the harbour or passing within 5nm of it. It is estimated that during summer, passing traffic accounted for less than 5% of the total.

An average of 51 tracks per day crossed the Aberdeen Harbour entrance, from an average of 40 unique vessels per day. This is inclusive of vessels entering and departing the harbour.

A plot of the busiest day during summer, the 19th August 2014, is presented in Figure 3.3.

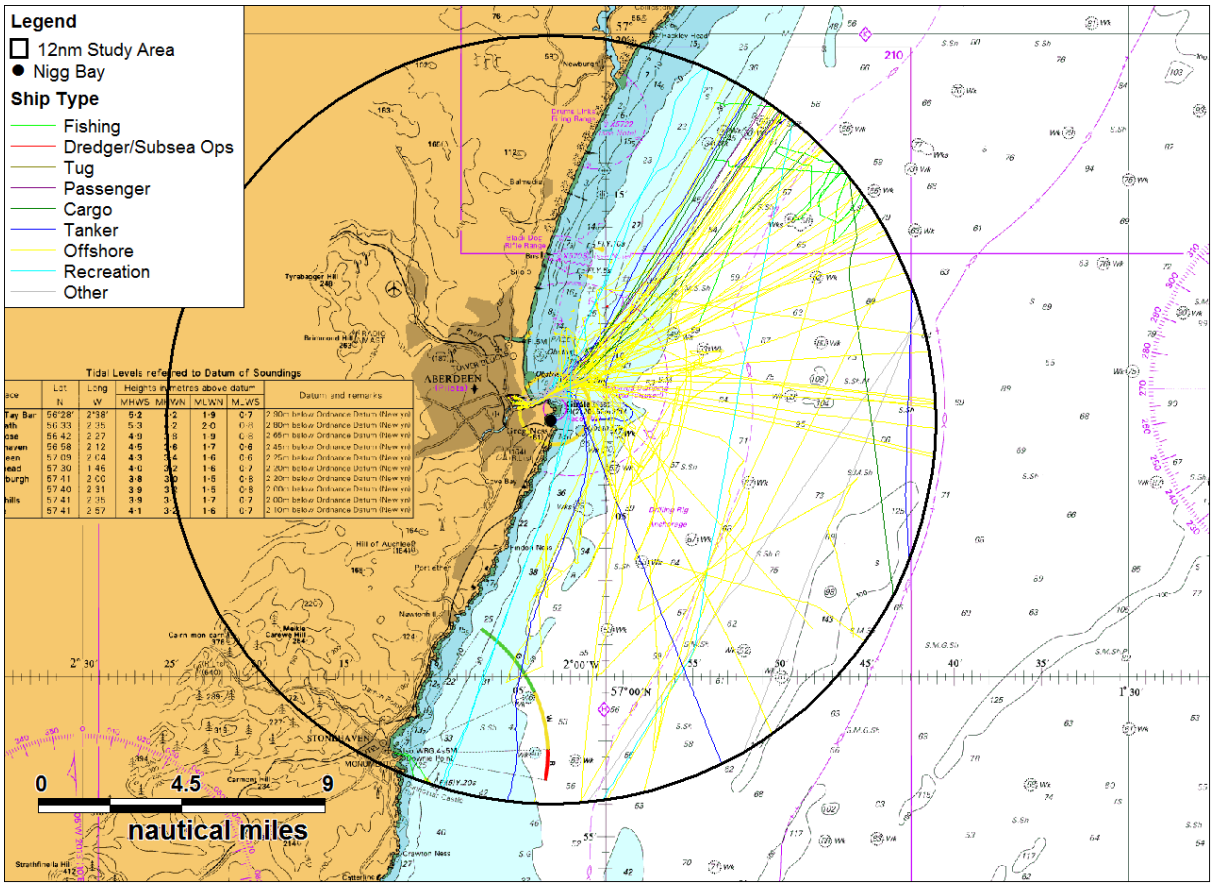

Figure 3.3 Summer AIS Busiest Day – 19/08/2014

3.2.2 Vessel Types

The AIS data, colour-coded by vessel type, within the 12nm and 5nm study areas are presented in Figure 3.4 and Figure 3.5 respectively.

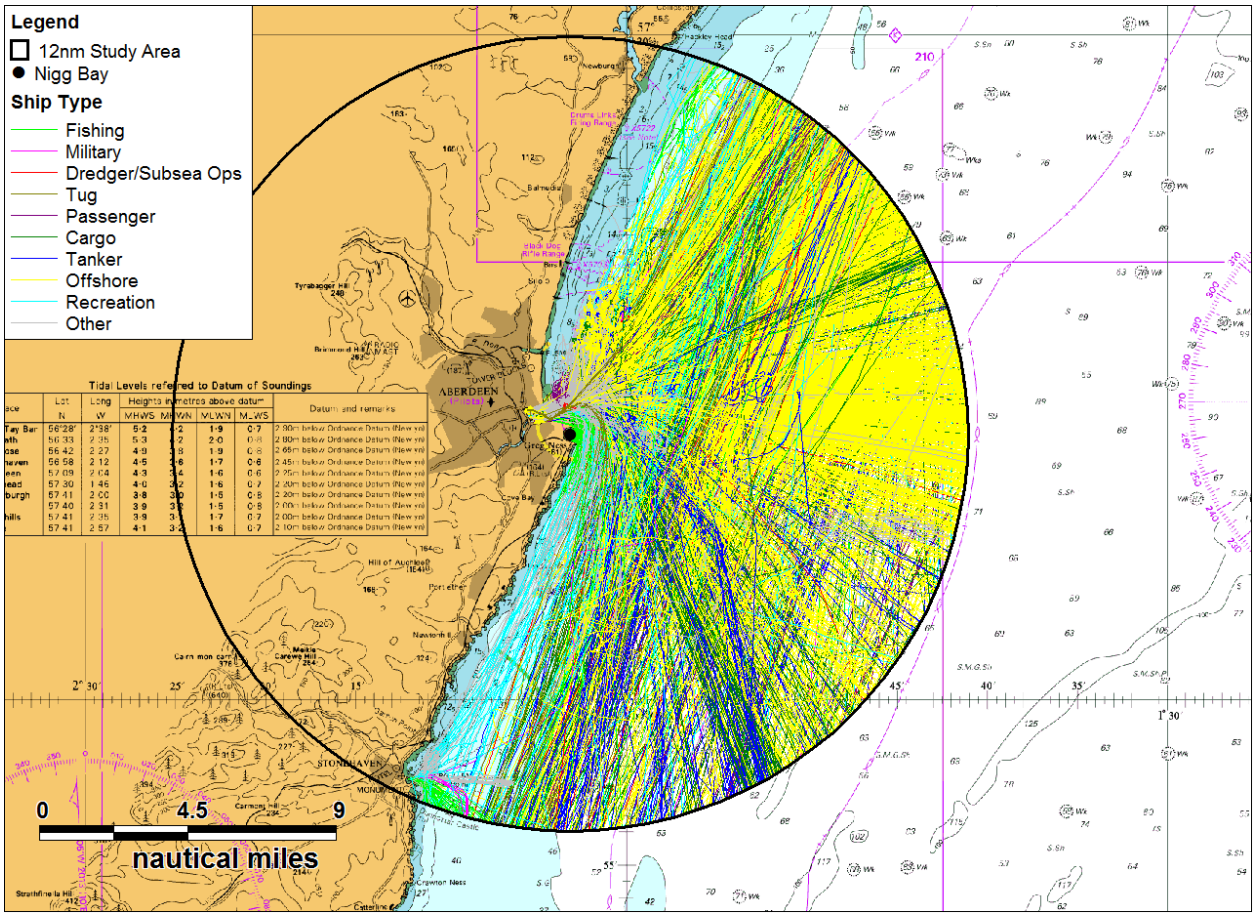

Figure 3.4 Summer AIS by Vessel Type – 12nm Study Area

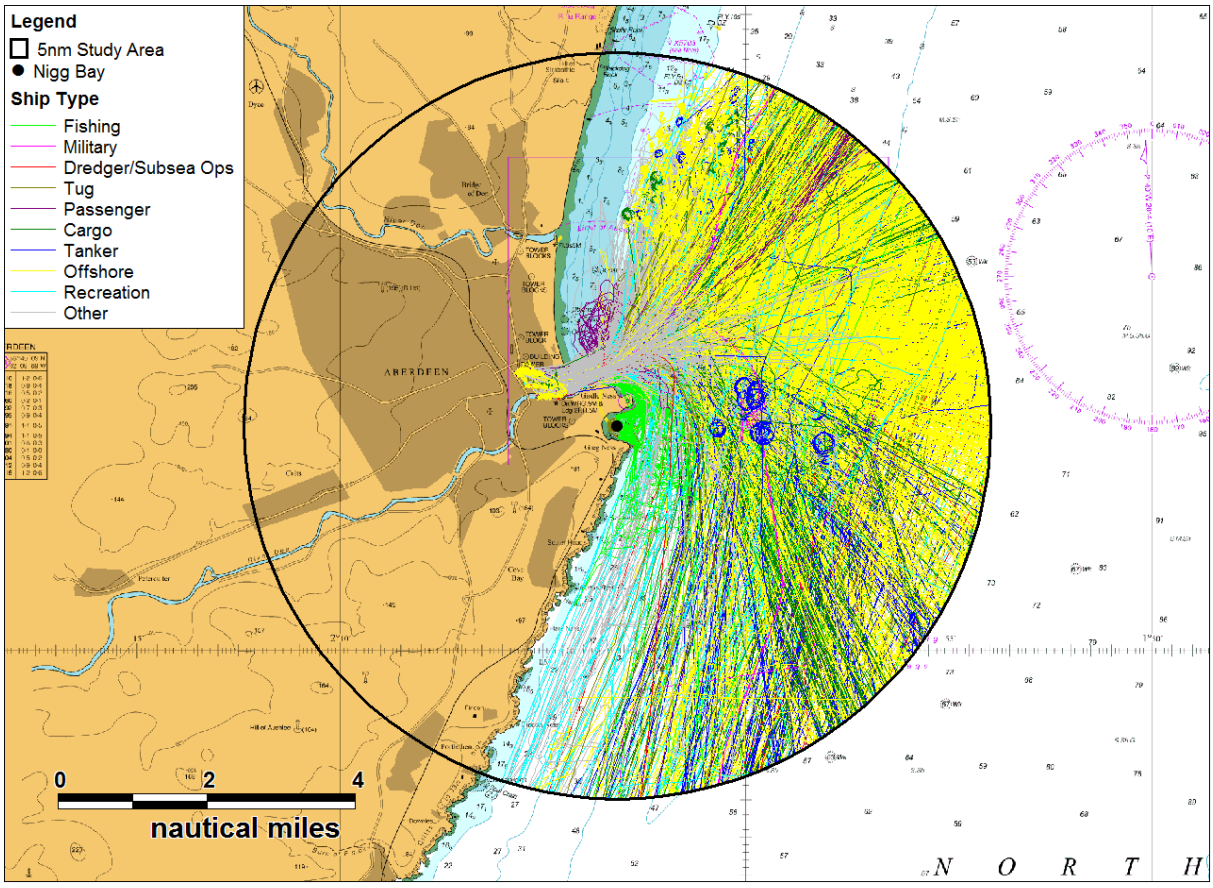

Figure 3.5 Summer AIS by Vessel Type – 5nm Study Area

It is observed that in general, south of Aberdeen Harbour, large commercial vessels remained at least 1nm east of the coast. The vessels found in closer proximity to the coastline were small recreational vessels and fishing vessels. 'Other' vessels consisted of lifeboats, research vessels, and a crew transfer vessel. North of the harbour, all vessels kept a distance of at least 0.5nm off the coast, with the exception of a lifeboat and a small passenger vessel (≤12 passengers) conducting tours of the harbour.

Anchored vessels were seen north and east of the harbour. More information on anchored vessels is available in Section 3.10.

Two vessels were seen within Nigg Bay, the *Sea Herald*, a 14m workboat (operated by Aberdeen Harbour Board) and the *Skua II*, an 8m fishing vessel (see Section 3.8 for more information on fishing vessels). The *Sea Herald* was involved in works associated with the Nigg Bay development. A zoomed in plot of Nigg Bay relative to these vessels is presented in Figure 3.6.

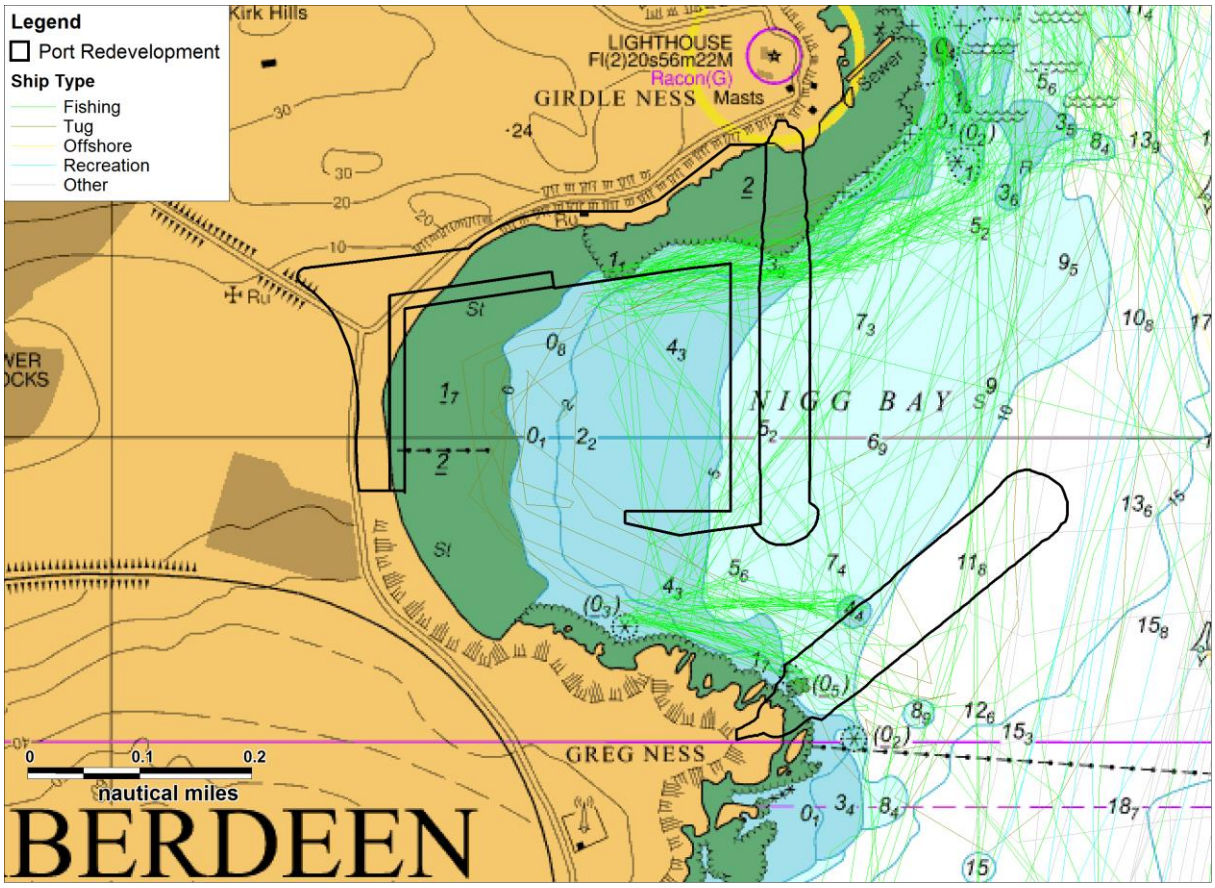

Figure 3.6 Summer Vessels within Nigg Bay

The type distribution during summer, based on unique vessels per day, is presented in Figure 3.7.

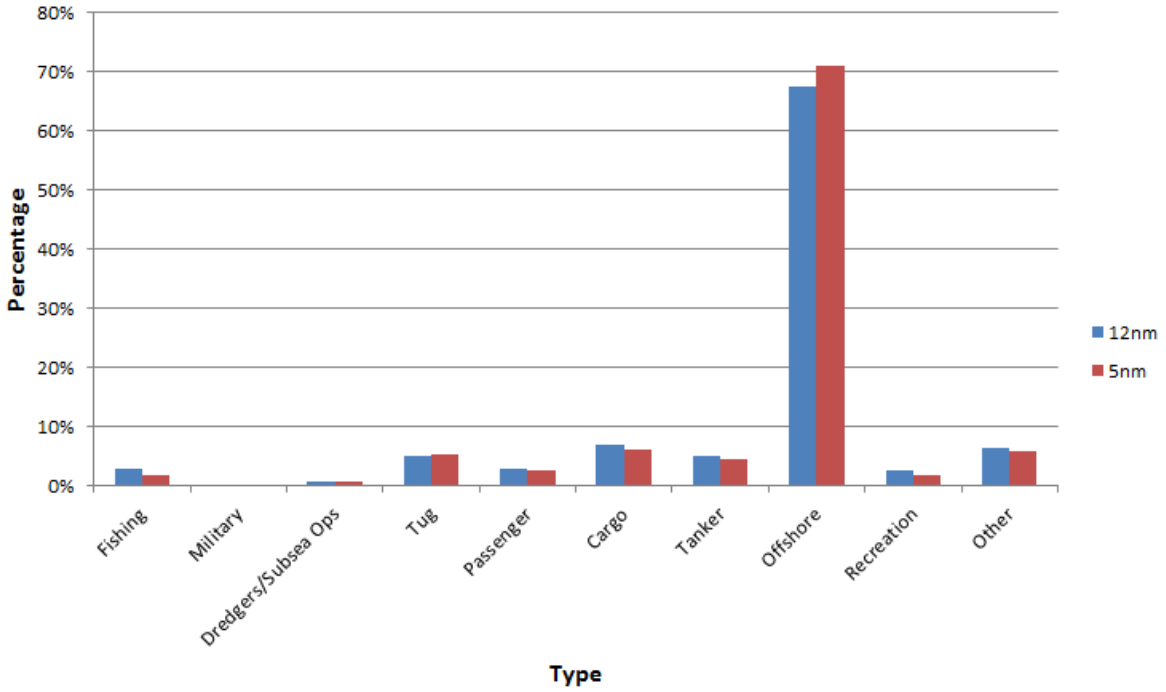

Figure 3.7 Summer AIS Type Distribution

Approximately 68% of vessels within 12nm of Nigg Bay were offshore vessels supporting the oil and gas industry in the North Sea. A further 7% were cargo vessels. 'Other' vessels and tankers contributed 6% and 5% of vessels respectively. Tugs (including workboats broadcasting their vessel type as tug) made up a total of 5% of vessel traffic.

3.2.3 Vessel Size

All tracks passing within 12nm and 5nm of Nigg Bay colour-coded by vessel length are presented in Figure 3.8 and Figure 3.9 respectively.

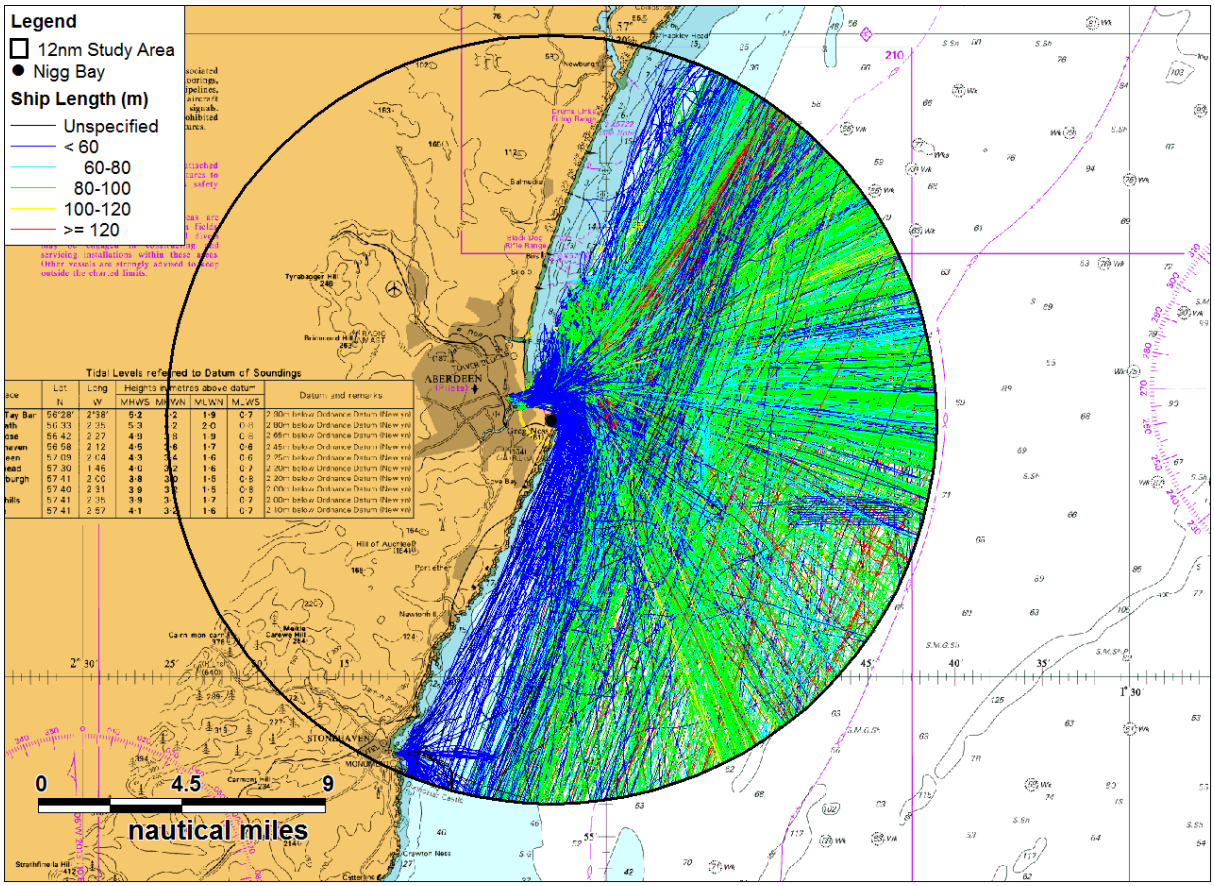

Figure 3.8 Summer AIS by Vessel Length – 12nm Study Area

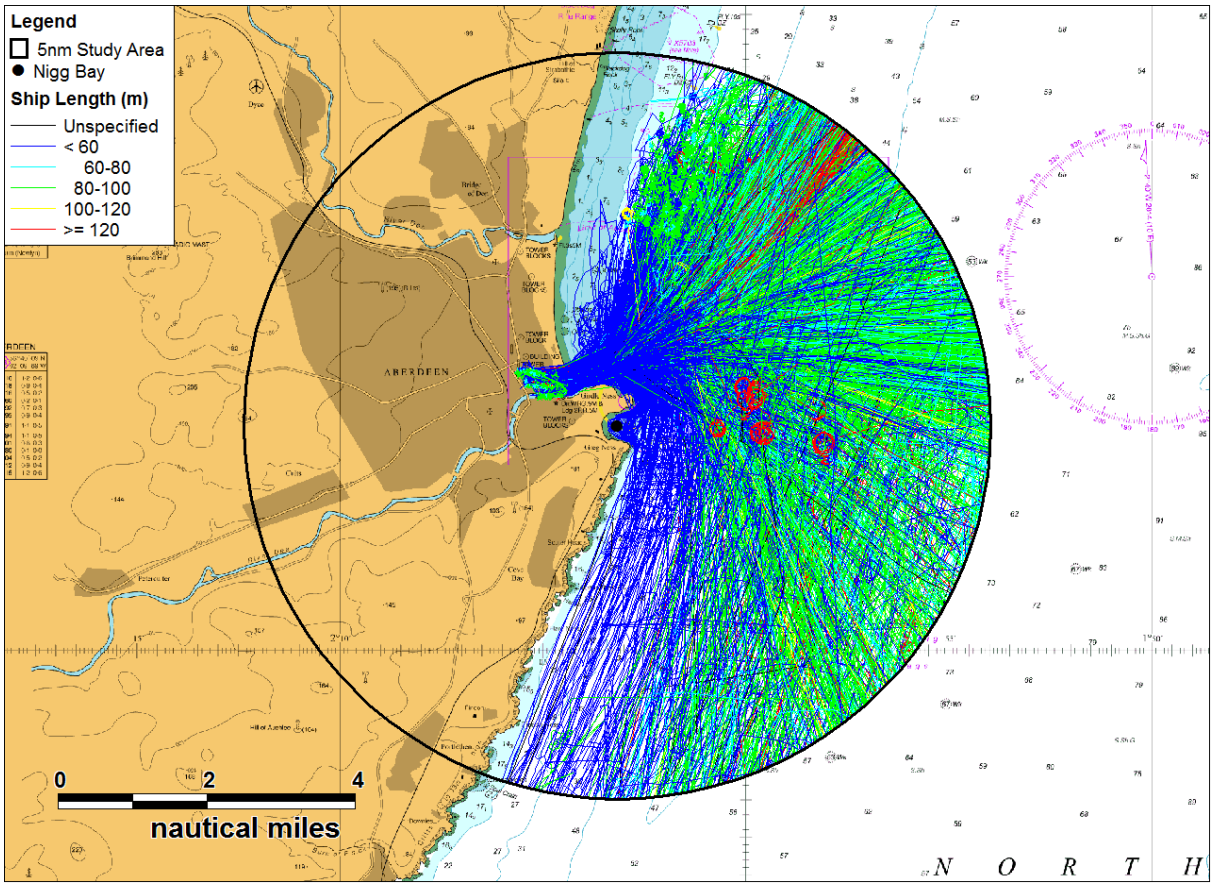

Figure 3.9 Summer AIS by Vessel Length – 5nm Study Area

It is seen that in general, larger vessels avoided coastal areas when clear of the harbour. Smaller vessels came in closer proximity to the coast south of the harbour.

The summer AIS within 12nm and 5nm of Nigg Bay colour-coded by vessel draught is presented in Figure 3.10 and Figure 3.11 respectively.

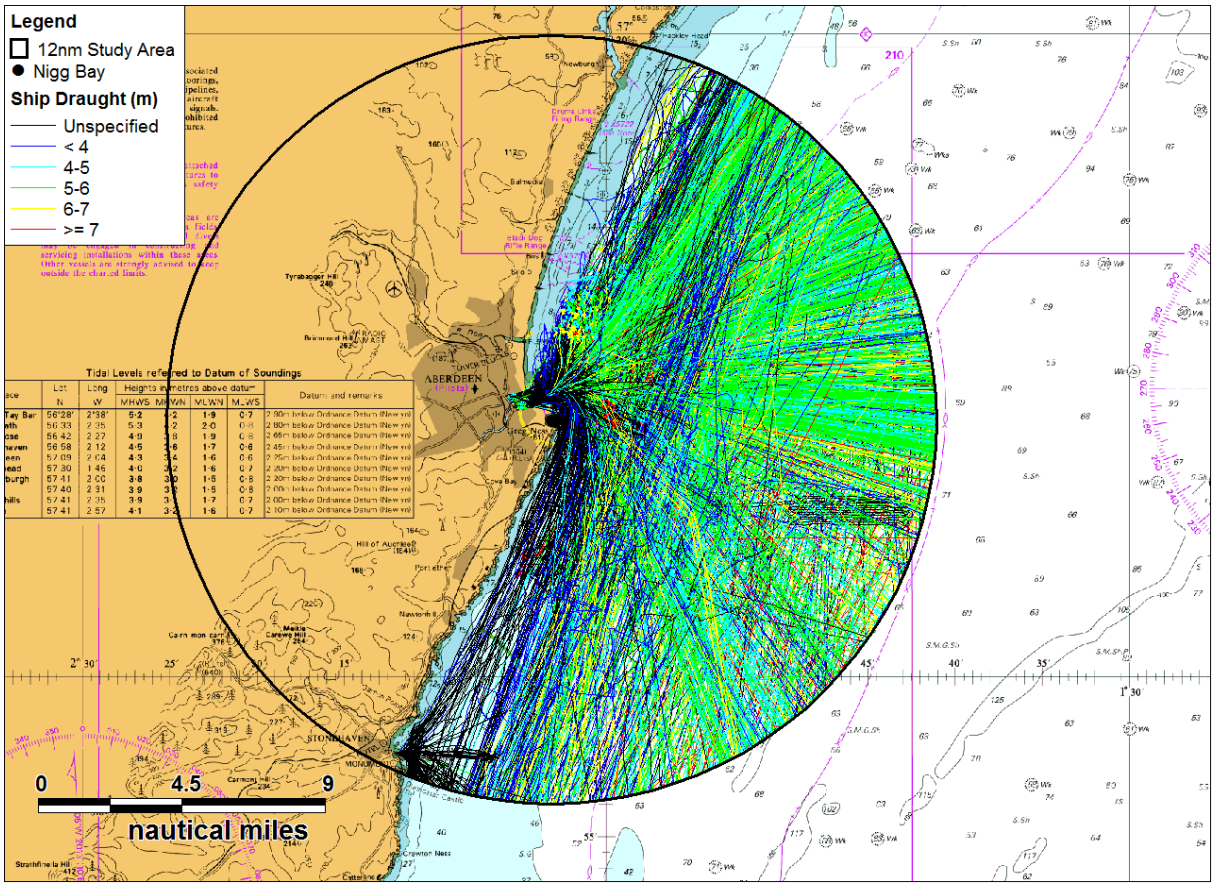

Figure 3.10 Summer AIS by Vessel Draught – 12nm Study Area

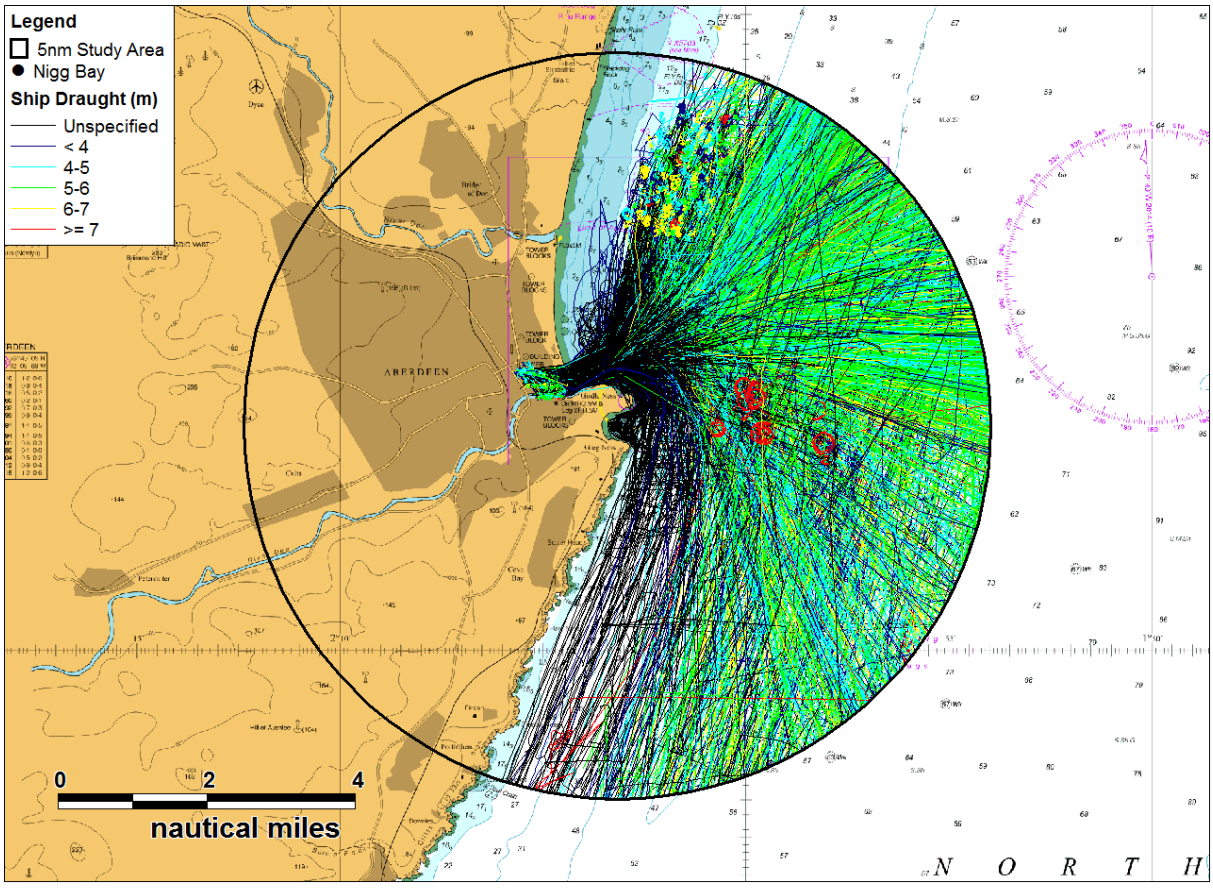

Figure 3.11 Summer AIS by Vessel Draught – 5nm Study Area

It is seen that the vessels with the deepest draughts were the large shuttle tankers at anchor east of the harbour. The majority of vessels on passage close to the coast south of the harbour did not transmit draught information (AIS Class B does not broadcast this information), however as previously discussed these vessels are small in size and are likely to have shallow draughts.

3.2.4 Destination

Approximately 63% of vessels within the 12nm study area transmitted their destination as Aberdeen, this is greater than the percentage of inbound traffic due to operator error. Either the destination on the AIS unit is not being updated or this occurs outwith the study area. While there is an element of error to some of the broadcast destinations, it is relatively small when compared to the number of destinations observed and this information remains a useful insight illustrating where the remaining vessels with updated destinations are bound for. A figure of the destinations transmitted ten times or more is presented in Figure 3.12. The analysis is based on unique vessels per day. Vessels with a destination of Aberdeen have not been shown so as to not dominate the figure.

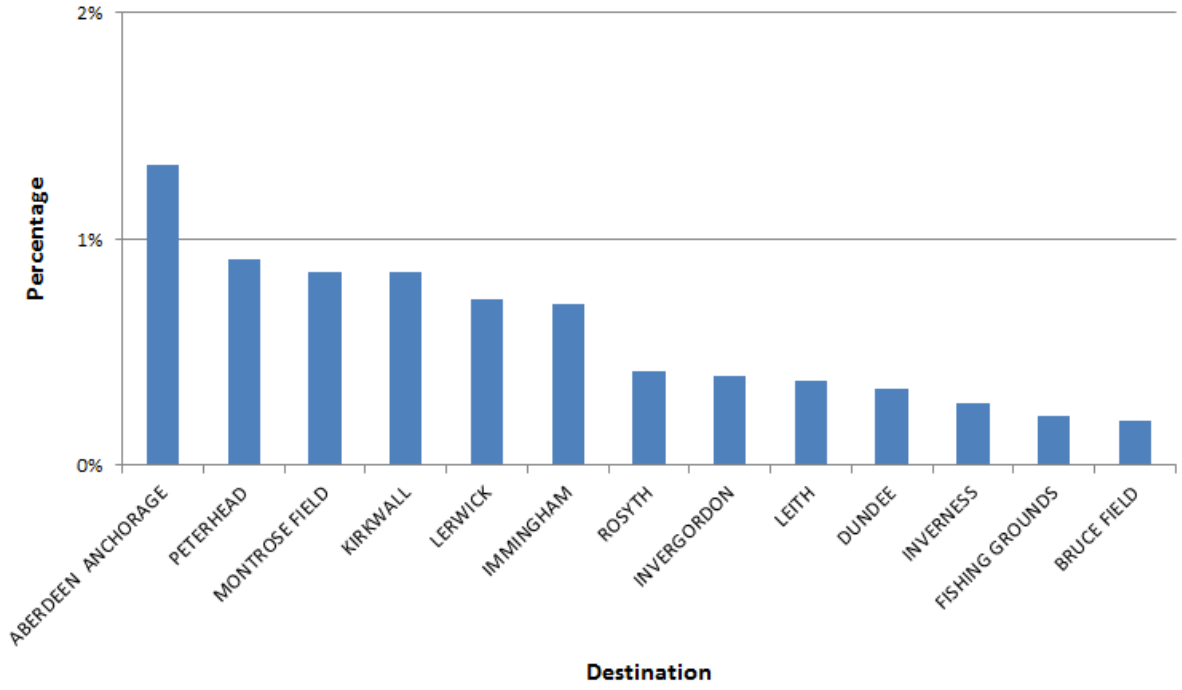

Figure 3.12 Summer AIS Main Destination Summary

The most common destination excluding Aberdeen was Aberdeen anchorage (approximately 1%). No other destination made up more than 1%.

3.2.5 Vessel Density

The summer AIS data was used as input to Anatec's Ship Density Calculator. The program calculates the number of AIS track intersects within a grid of cells, in this case using a cell size of 200m x 200m. The results are presented in Figure 3.13.

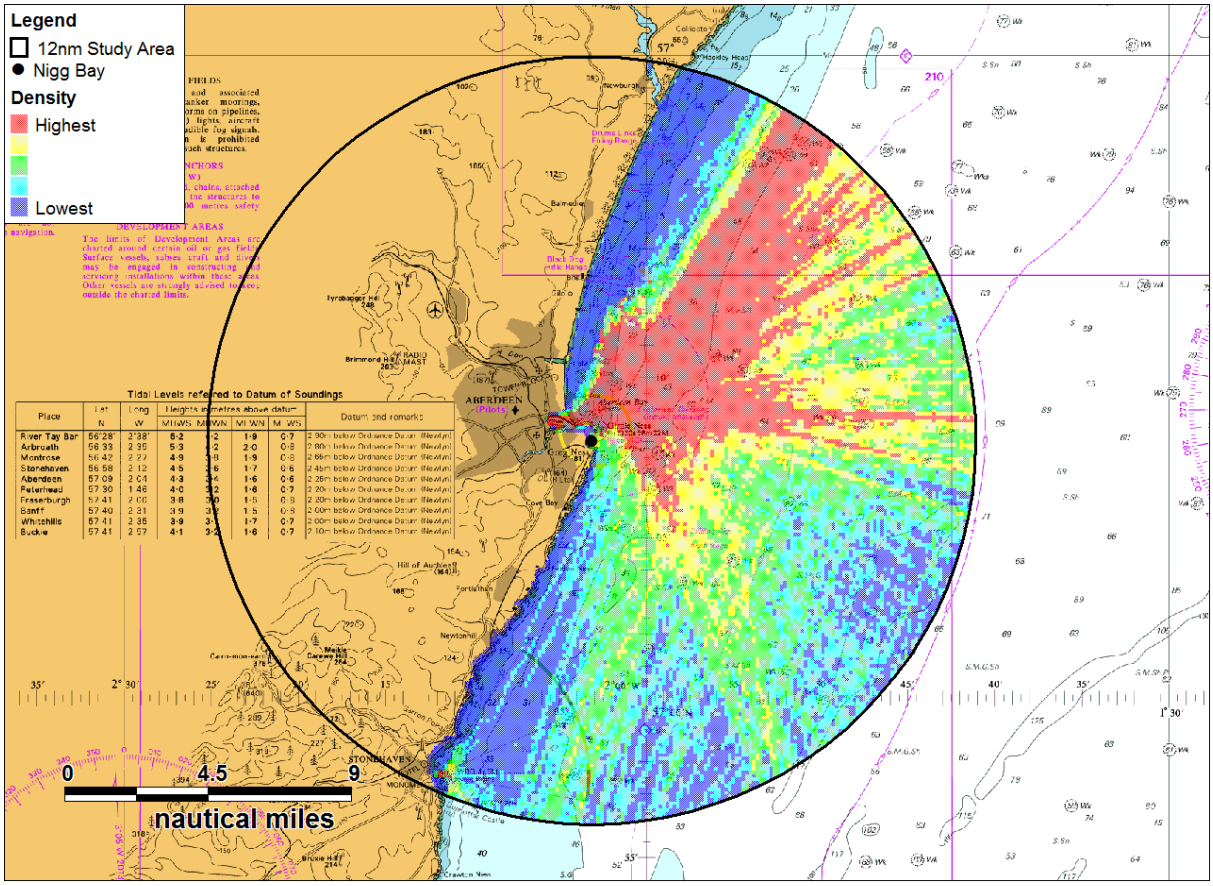

Figure 3.13 Summer AIS Shipping Density

The highest density areas (red) were caused by the offshore vessel traffic associated with Aberdeen Harbour and the passenger traffic between Aberdeen and Orkney/Shetland. Cargo vessels, offshore vessels and tanker traffic caused the areas of medium density south of the Harbour.

3.3 Winter

3.3.1 Vessel Numbers

The number of unique vessels per day passing within 12nm and 5nm of Nigg Bay during the winter 2014 survey period is presented in Figure 3.14 and Figure 3.15 respectively.

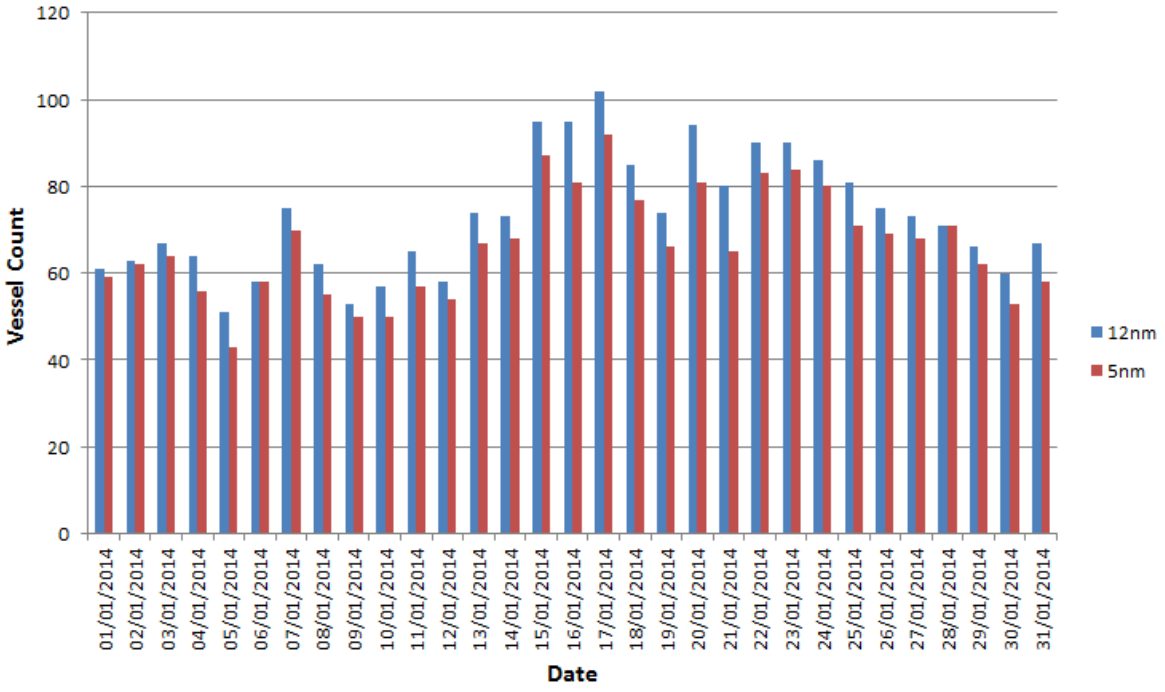

Figure 3.14 January 2014 Daily Vessel Count – 12nm Study Area

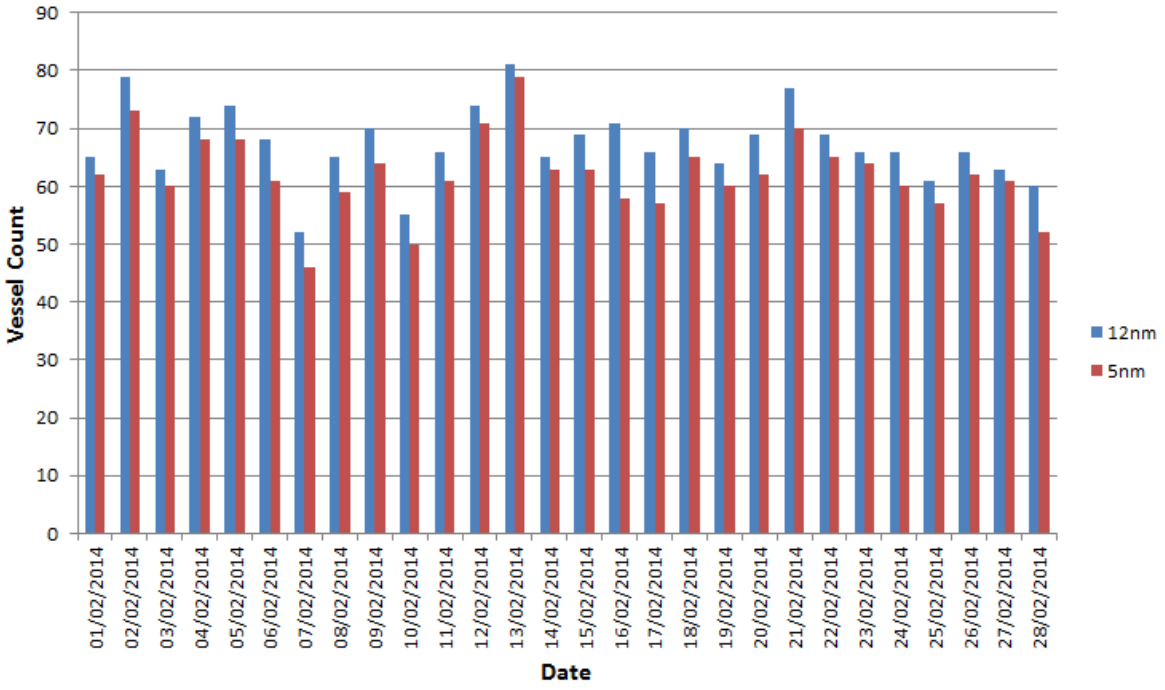

Figure 3.15 February 2014 Daily Vessel Count – 12nm Study Area

An average of 70 unique vessels per day passed within 12nm of Nigg Bay during winter. The busiest day was the 17th January, when 102 unique vessels passed through the 12nm study area. The quietest day was the 5th January when 51 unique vessels were observed.

The average number of unique vessels per day in the 5nm study area during winter was 64. The busiest day was again the 17th of January, which saw a total of 92 unique vessels pass through the 5nm study area. The quietest day was the 5th of January, when 43 unique vessels passed through.

Excluding vessels remaining within the Aberdeen Harbour boundary (see Section 3.2.1 for more information on this process), an average of 47 unique vessels per day were recorded within the 12nm study area, falling to 41 unique vessels in the 5nm study area. It is estimated that passing traffic accounted for less than 3% of the winter total.

An average of 39 AIS tracks crossed the Aberdeen Harbour entrance, from an average of 32 unique vessels a day. This is inclusive of vessels entering and departing the harbour.

A plot of the busiest day during winter, the 17th January 2014, is presented in Figure 3.16.

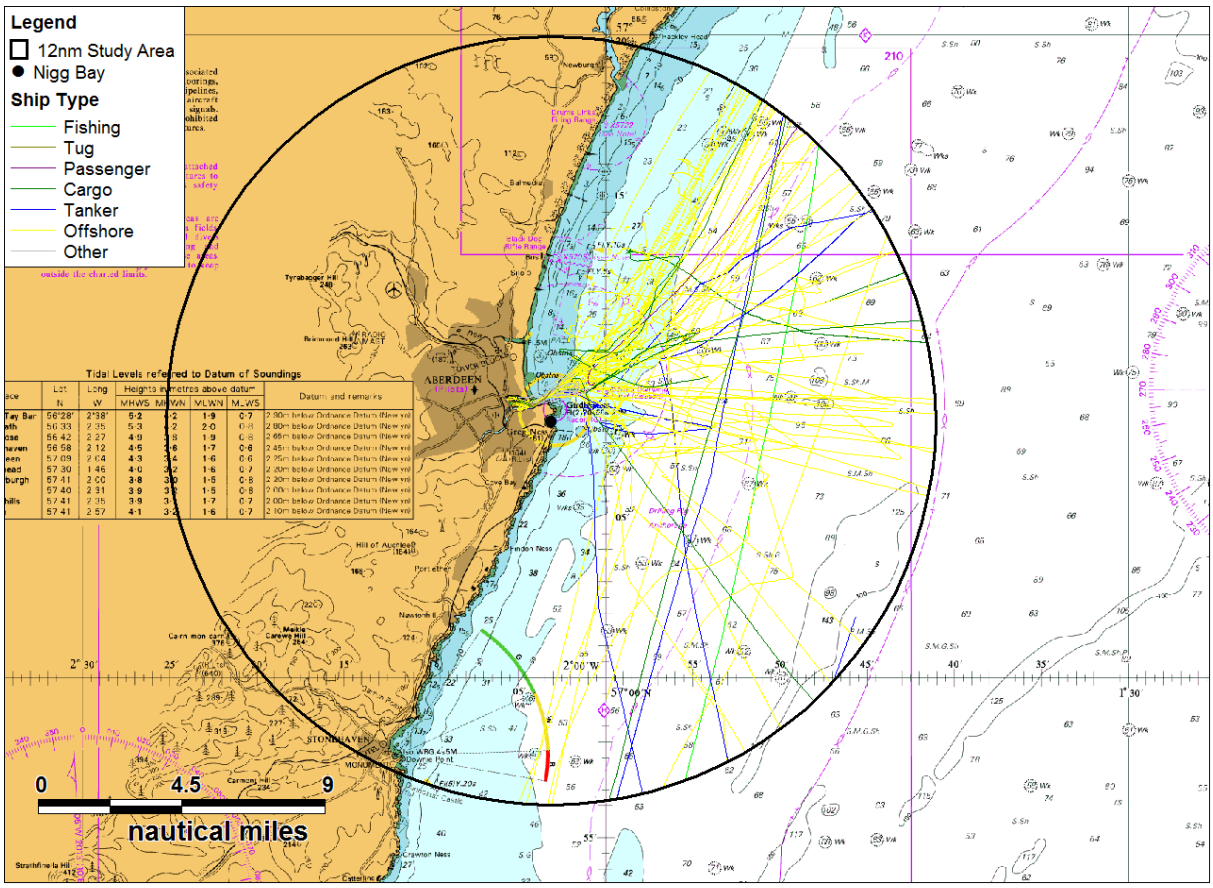

Figure 3.16 Winter AIS Busiest Day – 17/01/2014

3.3.2 Vessel Types

The tracks recorded during winter within the 12nm and 5nm study area colour-coded by vessel type are presented in Figure 3.17 and Figure 3.18 respectively.

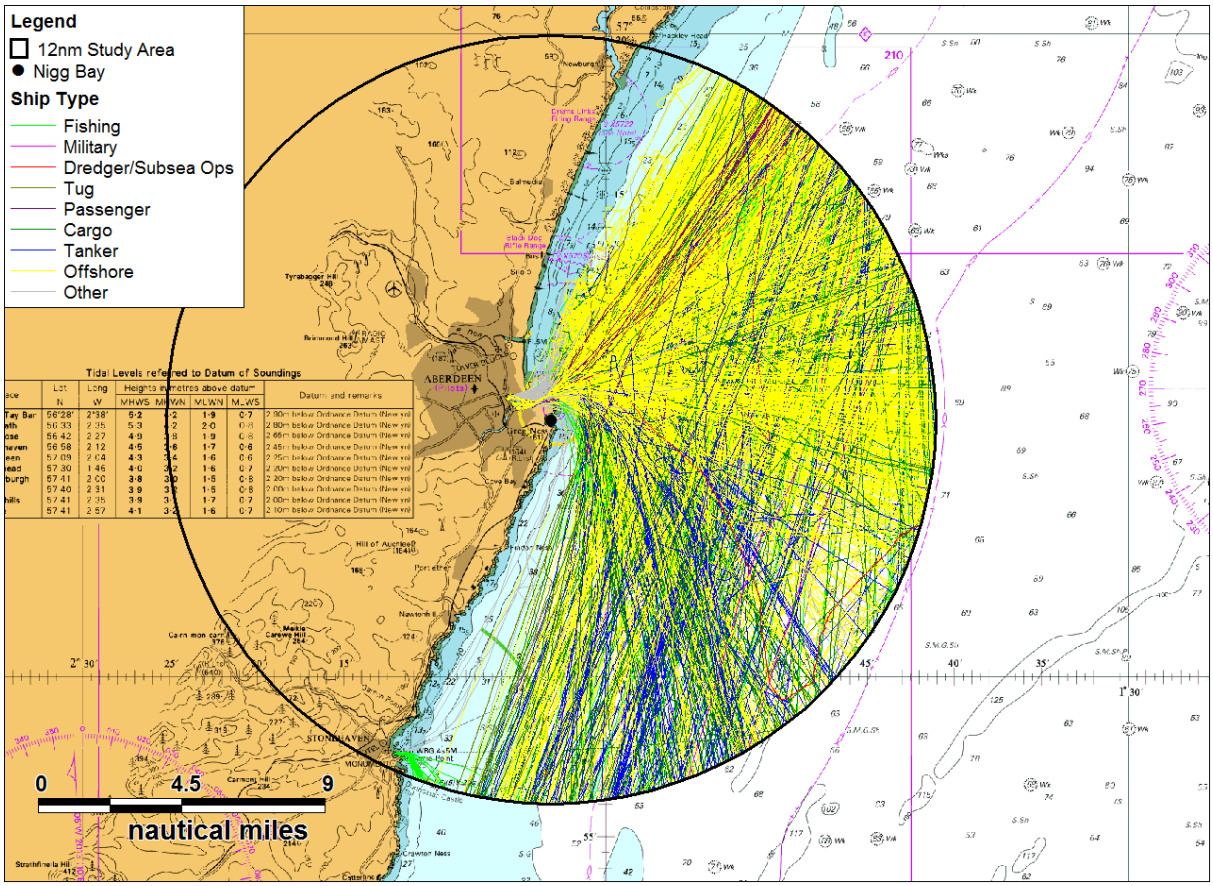

Figure 3.17 Winter AIS by Vessel Type – 12nm Study Area

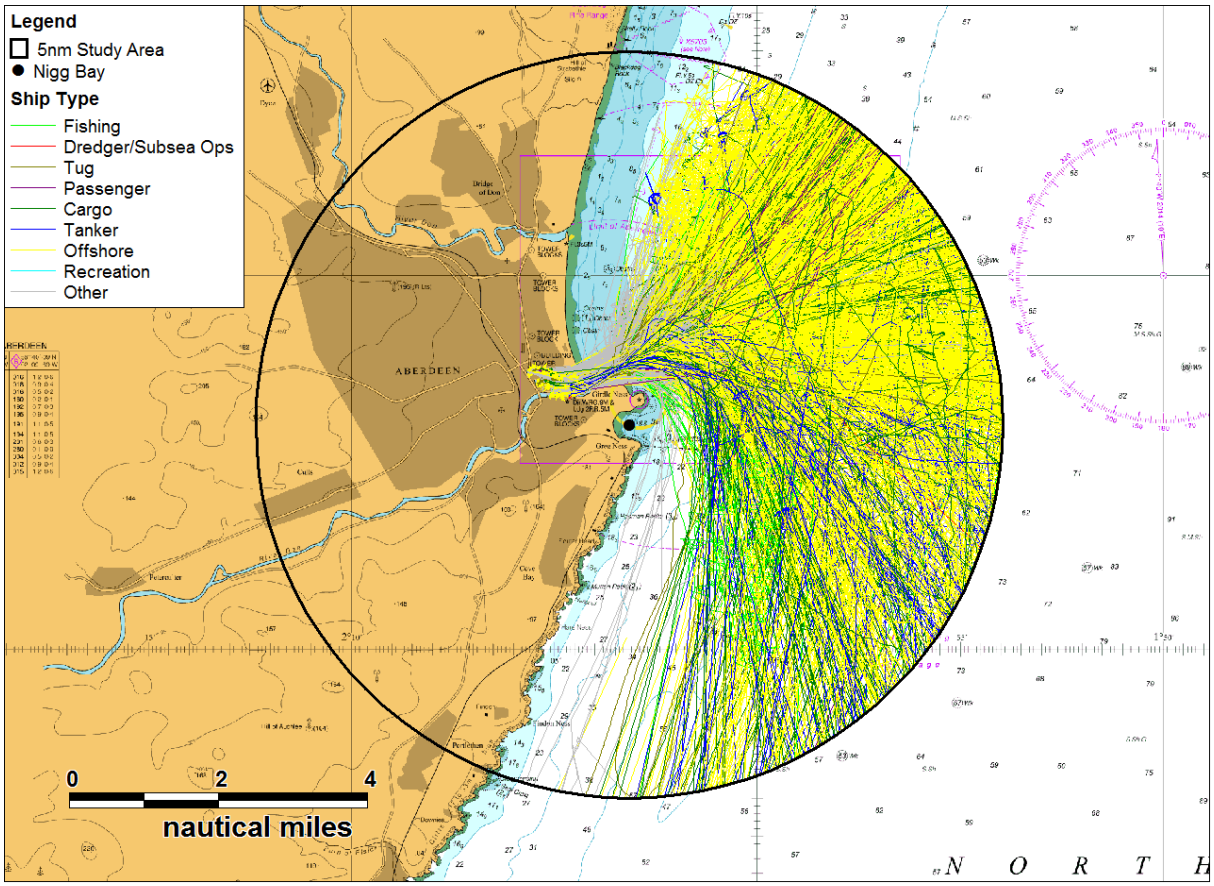

Figure 3.18 Winter AIS by Vessel Type – 5nm Study Area

Similarly to the summer data, large commercial vessels avoided the coast. Due to the seasonal influence on fishing and recreational activity, coastal activity from smaller vessels south of the harbour was less than that of summer.

As in summer, vessels were seen to be at anchor north and east of the harbour (see Section 3.10).

No vessels were observed entering Nigg Bay. The nearest passing vessel to Nigg Bay was a lifeboat. A zoomed in plot of the winter AIS relative to Nigg Bay is presented in Figure 3.19.

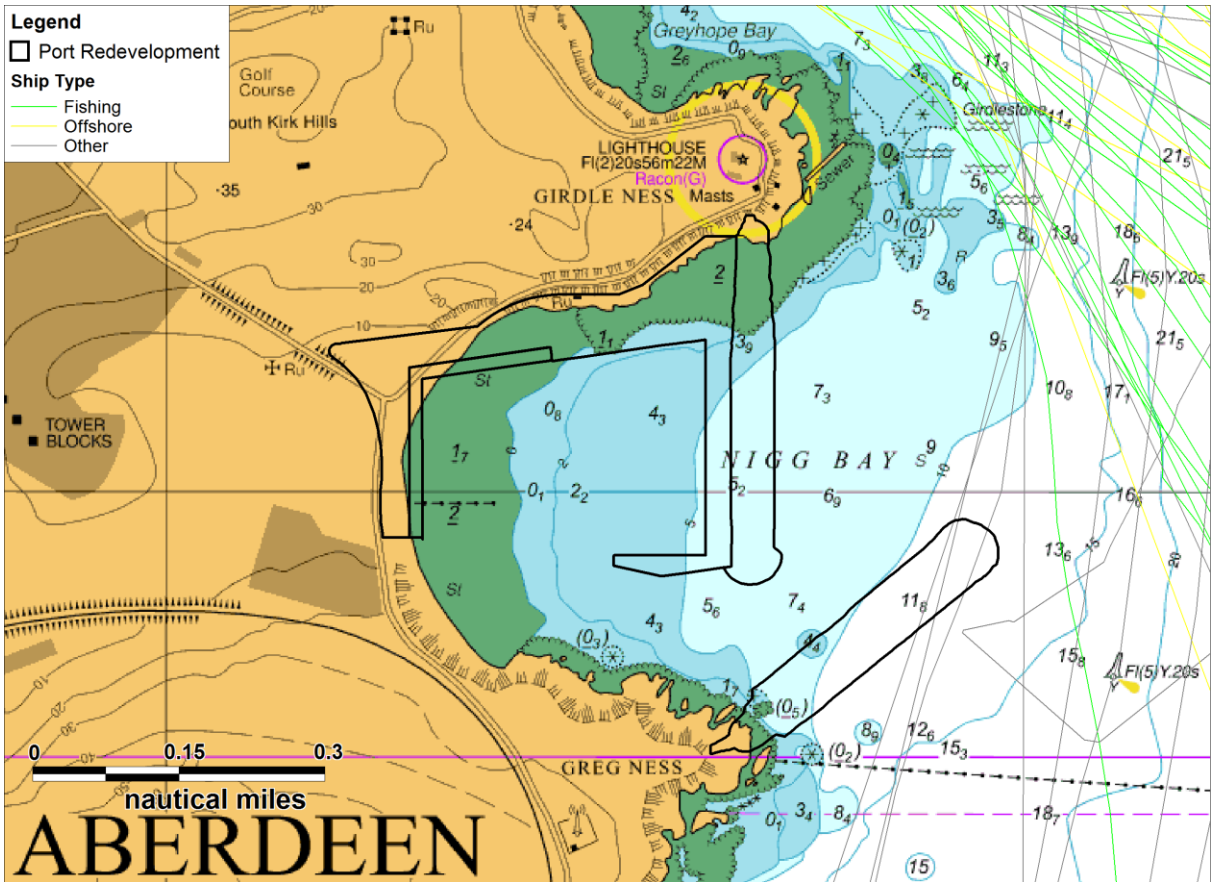

Figure 3.19 Winter AIS relative to Nigg Bay

The type distribution during winter, based on unique vessels per day, is presented in Figure 3.20.

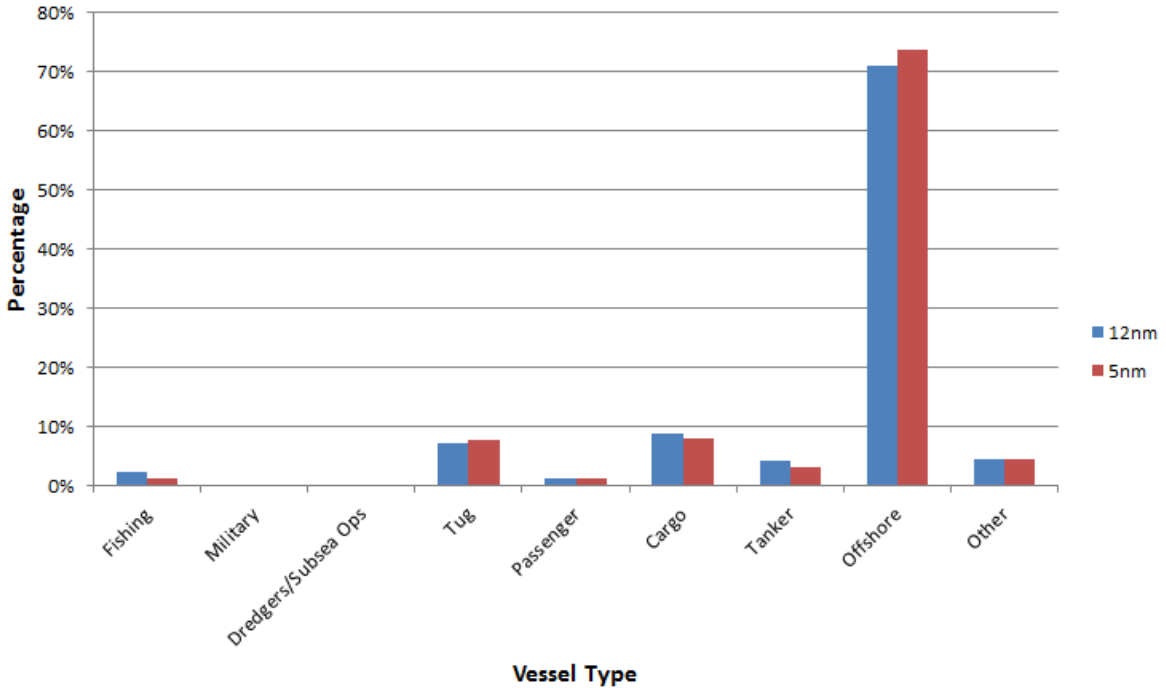

Figure 3.20 Winter AIS Type Distribution

Within the 12nm study area, as with the summer data, the most common traffic type were offshore vessels (71%), followed by cargo vessels (9%), tugs (7%), 'Other' vessels (5%) and tankers (4%).

3.3.3 Vessel Sizes

The winter AIS data within the 12nm and 5nm study area colour-coded by vessel length is presented in Figure 3.21 and Figure 3.22 respectively.

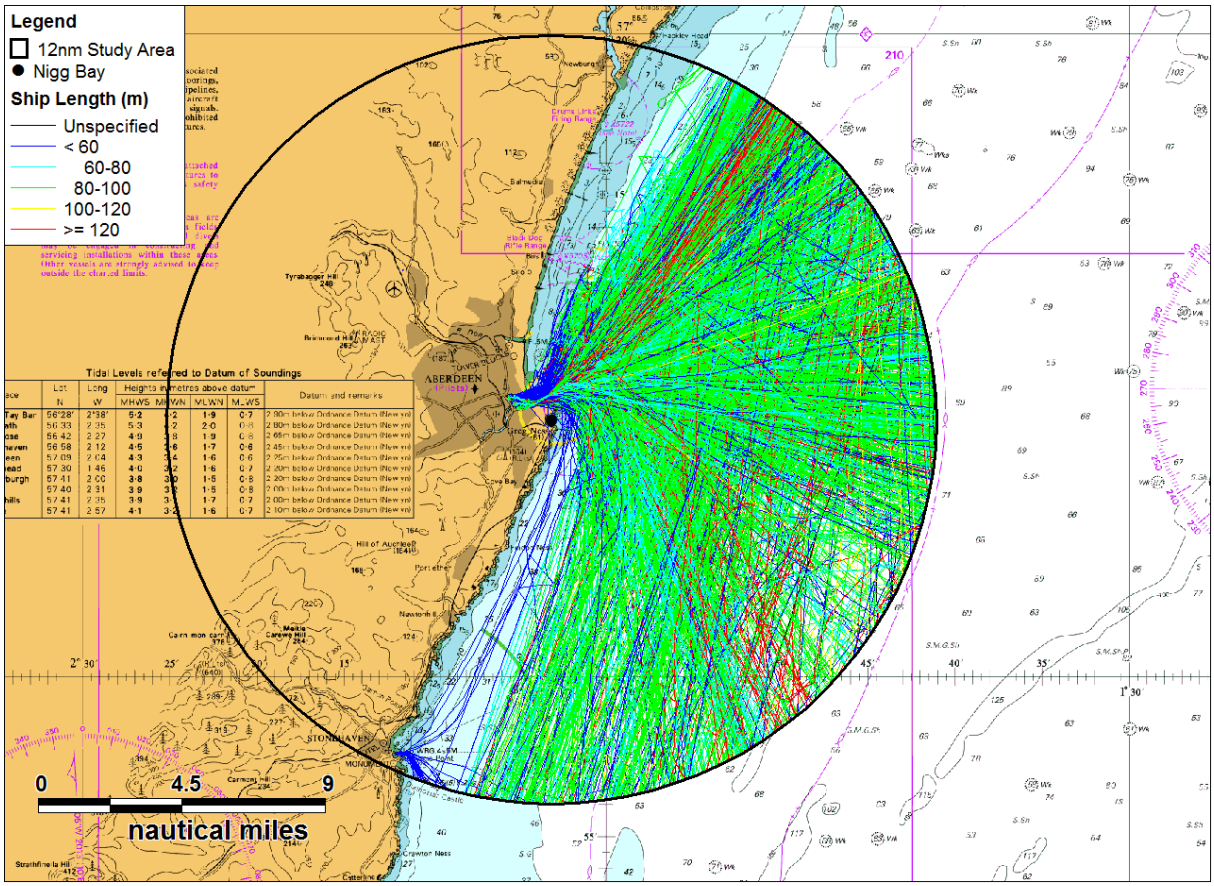

Figure 3.21 Winter AIS by Vessel Length – 12nm Study Area

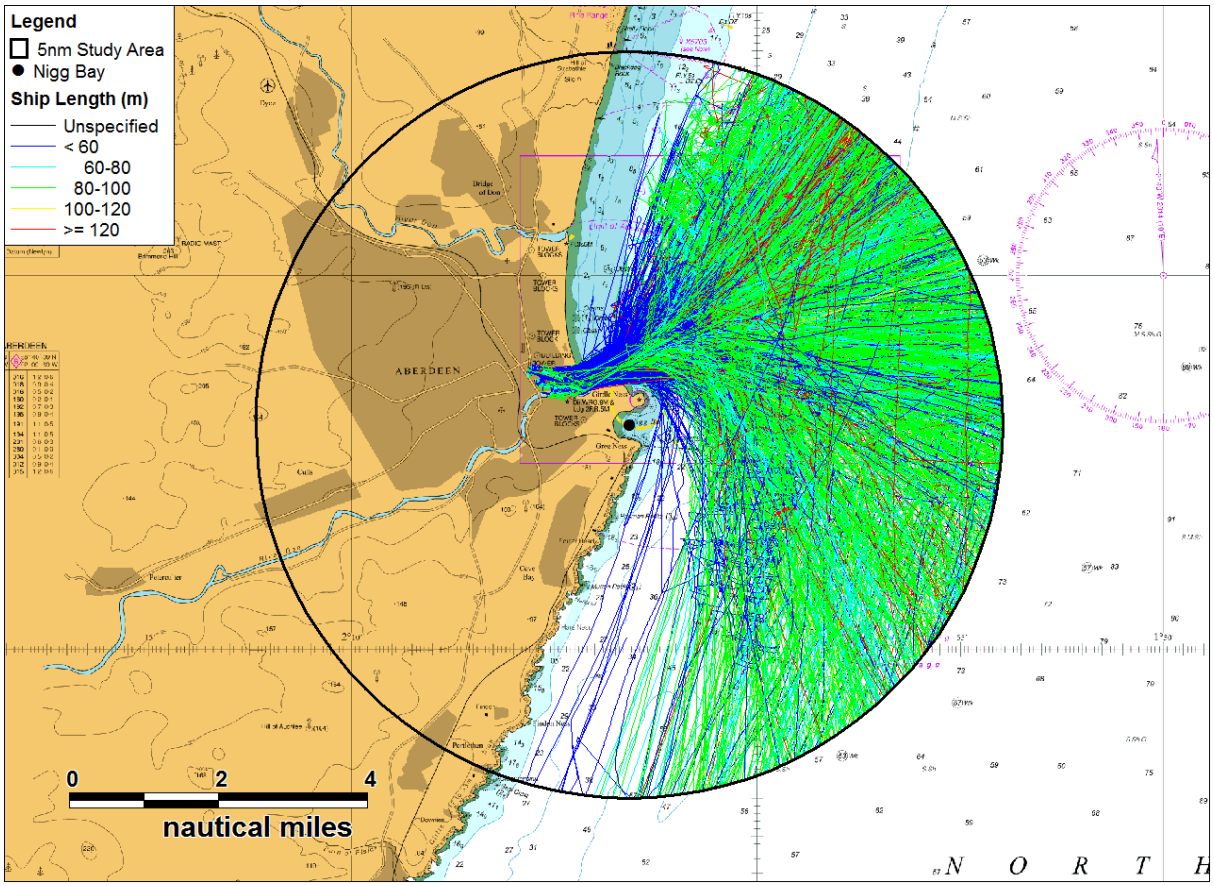

Figure 3.22 Winter AIS by Vessel Length – 5nm Study Area

Smaller vessels were seen on passage within 1nm of the coast south of the harbour, whereas larger vessels avoided the coast when clear of the harbour.

The winter AIS data within the 12nm and 5nm study area colour-coded by vessel draught is presented in Figure 3.23 and Figure 3.24 respectively.

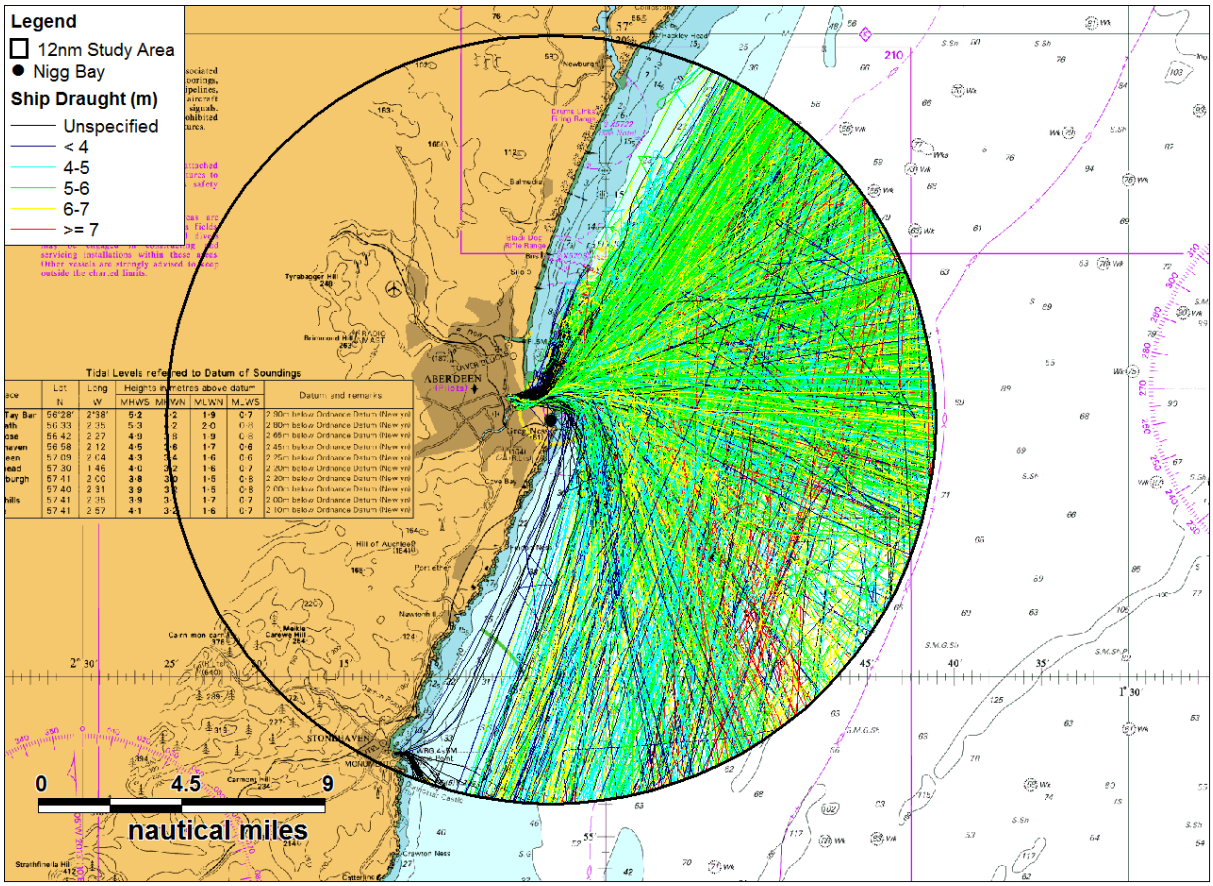

Figure 3.23 Winter AIS by Vessel Draught – 12nm Study Area

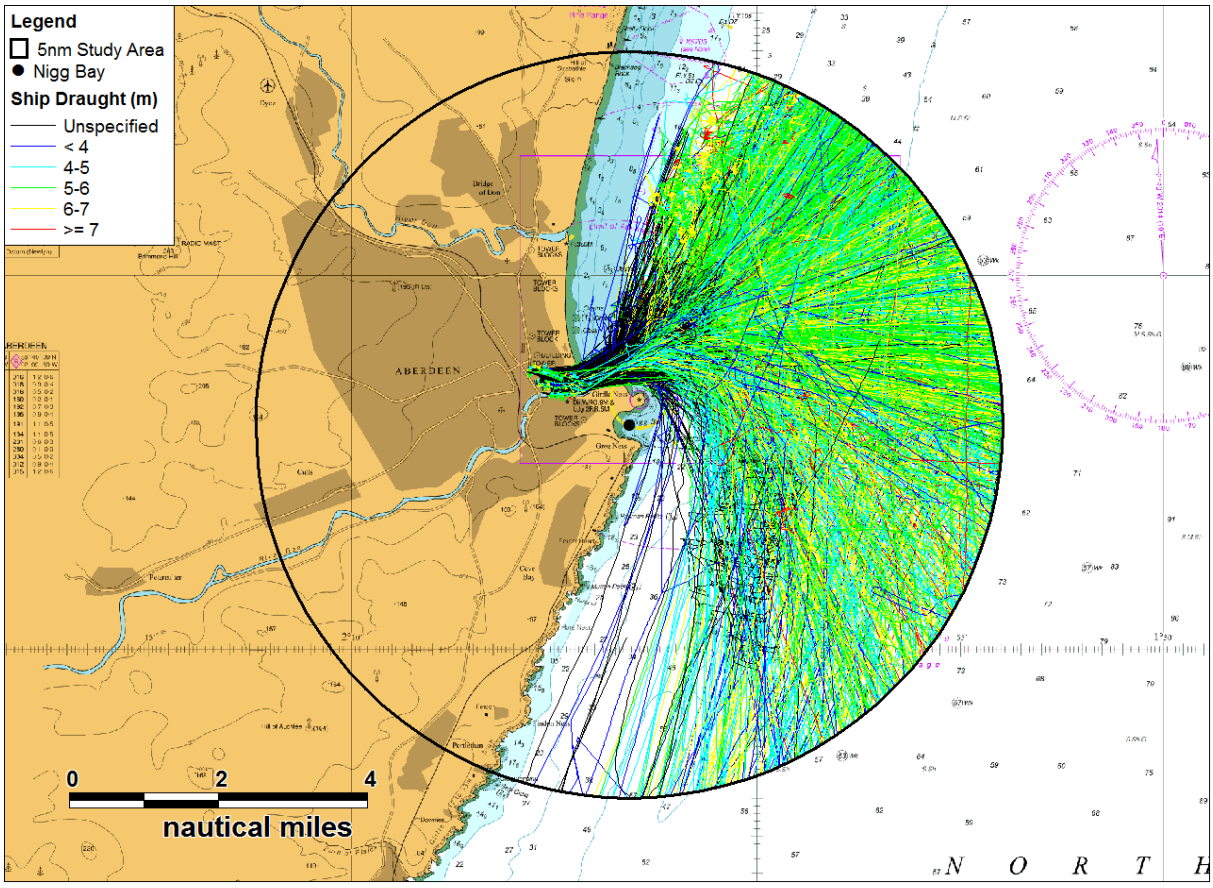

Figure 3.24 Winter AIS by Vessel Draught – 5nm Study Area

Similarly to the summer data, the smaller vessels seen near the coast did not specify draught information, however as previously discussed they are likely to have shallow draughts.

3.3.4 Destination

A figure of the destinations transmitted more than ten times (based on unique vessels per day) is presented in Figure 3.25. As in summer, the transmitted destinations were dominated by Aberdeen (72% of the total), and so vessels with this destination have not been shown on the figure.

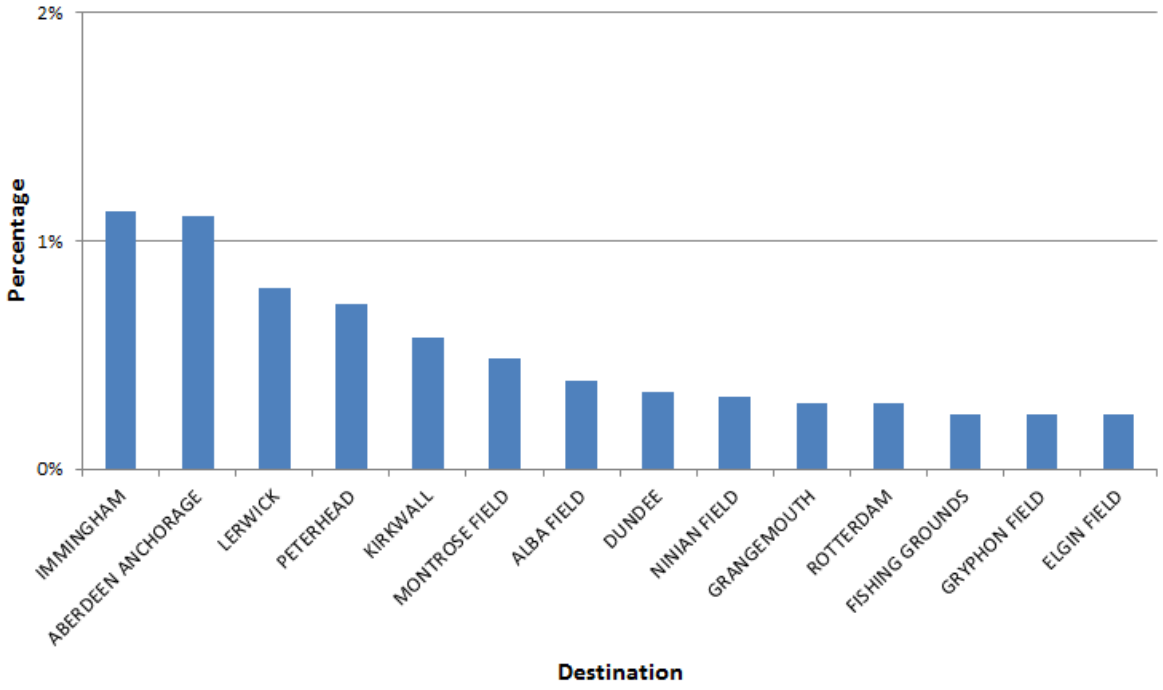

Figure 3.25 Winter AIS Main Destination Summary

Immingham and Aberdeen anchorage made up approximately 1% of the total each. All other destinations made up less than 1%.

3.3.5 Vessel Density

The winter AIS was used as input to Anatec's Ship Density Calculator (see Section 3.2.5 for more information on this model). The results are presented in Figure 3.26. The same ranges have been used in both summer and winter for ease of comparison.

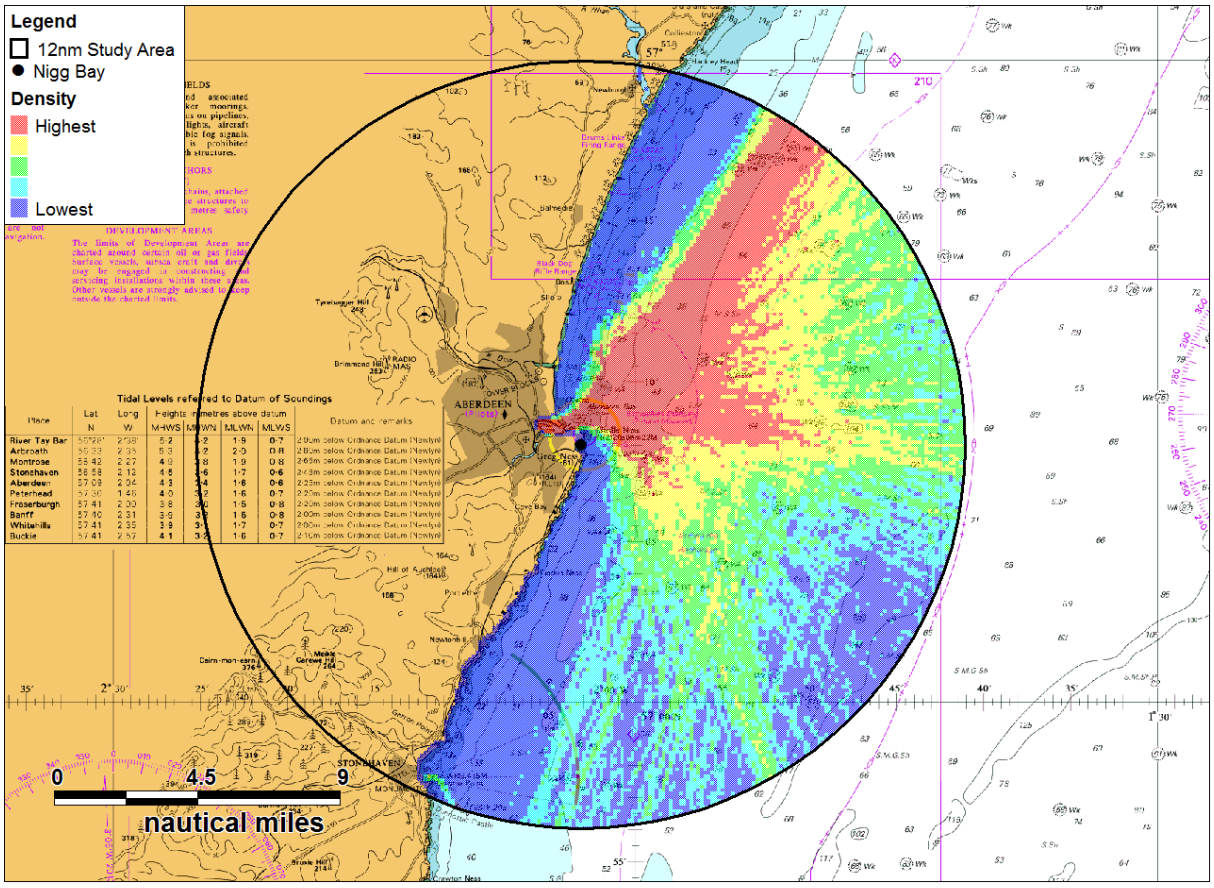

Figure 3.26 Winter AIS Shipping Density

Overall density was less in winter than it was in summer, however the overall shipping density trends were similar. As in summer, the highest density areas were caused by the offshore vessel traffic associated with Aberdeen Harbour and the passenger routes between Aberdeen and Orkney/Shetland. Medium density areas were seen from the cargo vessel and tanker traffic.

3.4 Cargo Vessel Analysis

3.4.1 Introduction

This section studies the tracks recorded within the 12nm study area from cargo vessels. The tracks were used to determine the main routes used by cargo vessels within the study area. The summer and winter tracks are assessed separately to account for seasonal variations. It should be noted that cargo vessels associated with offshore activities (supply vessels) are not included in this section and have instead been presented in the offshore vessel analysis in Section 3.7.

3.4.2 Summer

The cargo vessel tracks recorded during summer are presented in Figure 3.27.

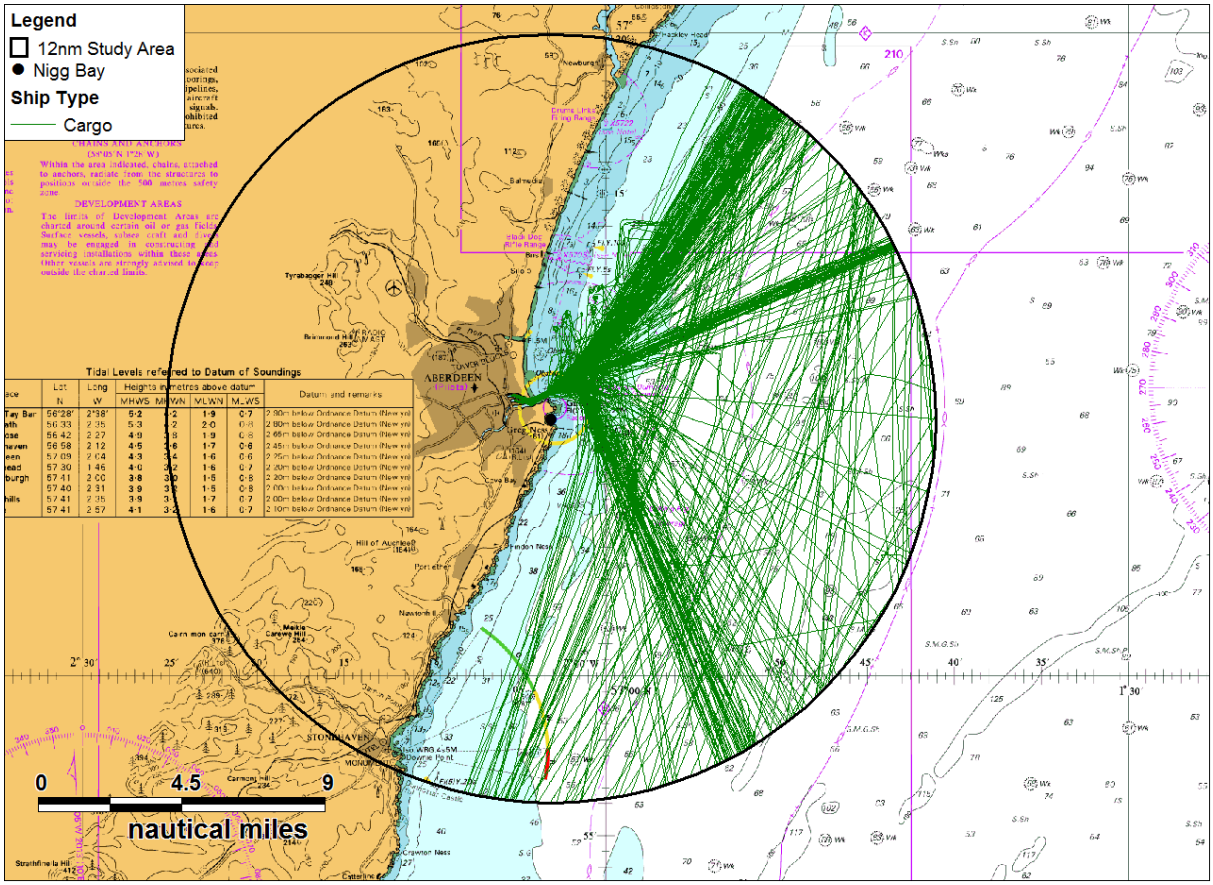

Figure 3.27 Summer AIS Cargo Vessel Tracks

The route seen headed north east from Aberdeen Harbour on the above figure is used mainly used by RO/RO cargo vessels (*Helliar* and *Hildasay*) operating between Aberdeen and the Northern Isles. On average, between one and two vessels per day were observed on this route during summer. The routes seen headed ENE and SSE from the harbour run between Aberdeen and various other European ports. On average less than one vessel per day used these routes.

Other cargo vessels were seen on a route approximately 1nm east of the coast south of the harbour between Aberdeen and other Scottish ports, and on a route passing approximately 2.8nm east of the harbour between various Scottish ports.

The largest cargo vessel seen within the 12nm study area during summer was the *Happy Dragon* with a length of 157m. It was seen anchoring in the designated anchorage north of Aberdeen Harbour.

Further information concerning cargo vessels observed utilising the designated anchorage is documented in Section 3.10.

A detailed view of the cargo vessels within the 5nm study area are presented in Figure 3.28.

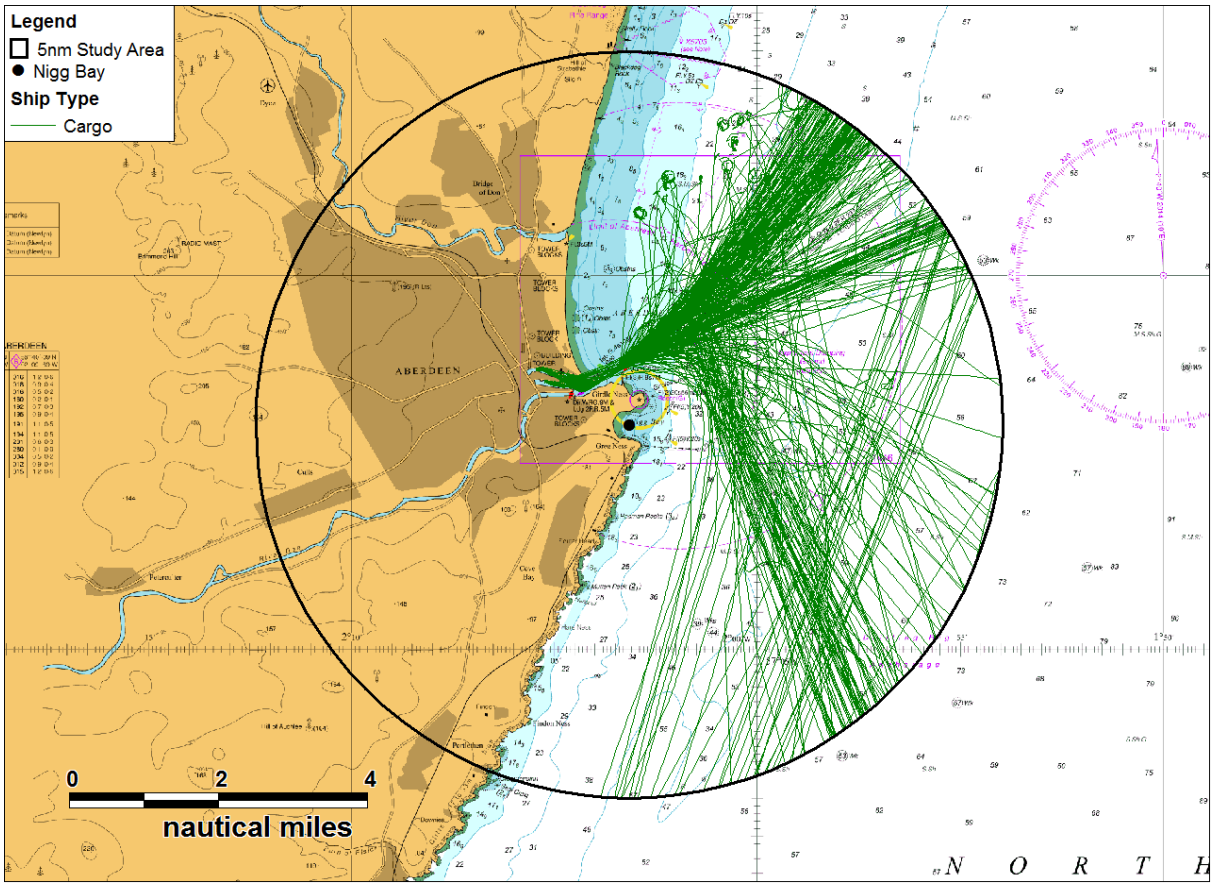

Figure 3.28 Summer AIS Cargo Vessel Tracks – Detailed View

In general, traffic on passage past the harbour did not come within 2nm of the Nigg Bay expansion boundaries, however vessels using the anchorage north of the harbour did pass as close as 0.9nm.

An average of 5 AIS tracks per day from cargo vessels crossed the Aberdeen Harbour entrance, from an average of 3 unique vessels. This is inclusive of cargo vessels both entering and departing the harbour.

The longest cargo vessels entering Aberdeen Harbour during summer were the *UAL Rodach* and the *UAL Nigeria*, both with lengths of 146m and operated by Universal Africa Lines (UAL). The *UAL Rodach* was on passage between Teesport and Aberdeen, and the *Nigeria* was transiting between Antwerp and Aberdeen.

3.4.3 Winter

The cargo vessel tracks recorded during winter are presented in Figure 3.29.

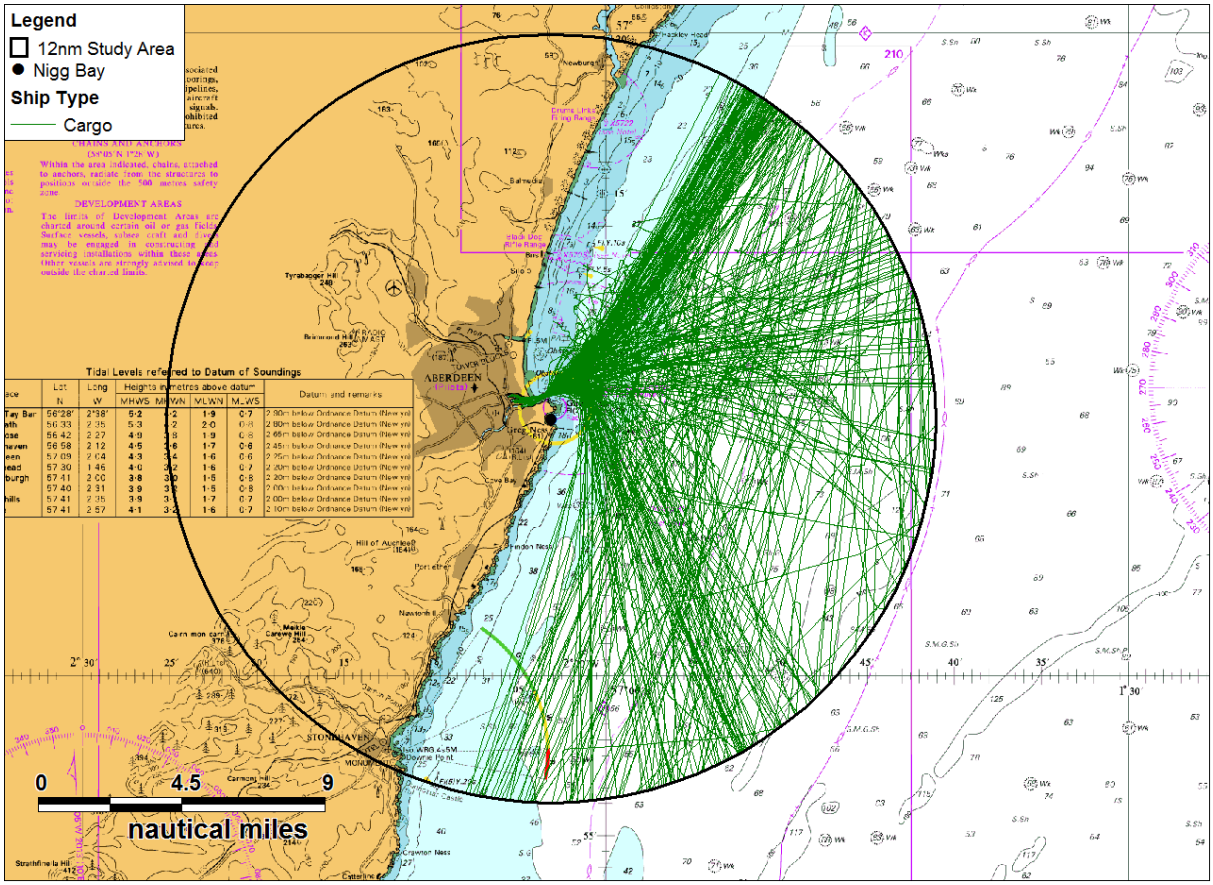

Figure 3.29 Winter AIS Cargo Vessel Tracks – 12nm Study Area

Approximately one vessel per day used the RO/RO cargo vessel route between Aberdeen and Lerwick (Route headed NE from harbour on above figure). Less than one vessel per day used the routes between Aberdeen and other mainland Europe ports (Routes headed ENE and SSE from harbour). As in summer, vessels also travelled between Aberdeen and other Scottish ports on a route south of the harbour approximately 1nm from the coast.

The longest cargo vessels within the 12nm study area during winter were the *Safmarine Shaba* and the *Safmarine Sahel*, with lengths of 161m. Both vessels called at Aberdeen Harbour.

Cargo vessels were seen to be at anchor within the anchorage north of the harbour (see Section 3.10).

A detailed view of the cargo vessels entering port is presented in Figure 3.30.

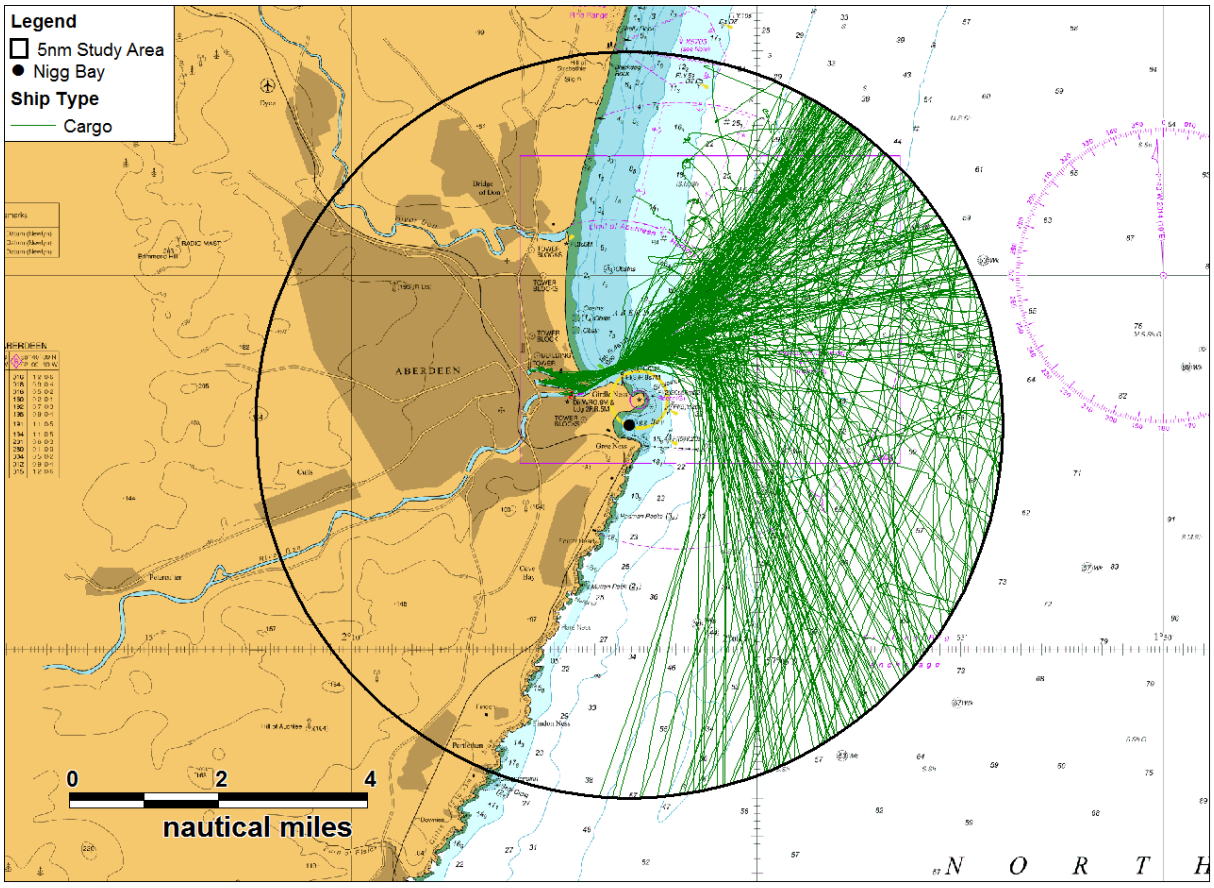

Figure 3.30 Winter AIS Cargo Vessel Tracks – 5nm Study Area

Passing traffic did not come within 1.3nm of the proposed Nigg Bay development boundaries, with vessels using the anchorage north of the harbour passing closest.

An average of four AIS tracks from cargo vessels crossed the Aberdeen Harbour entrance, from an average of three unique vessels. This is inclusive of vessels both entering and departing the harbour.

3.5 Tanker Analysis

3.5.1 Introduction

This section presents the AIS tracks recorded from tankers. There were two main types of tankers seen within the data; smaller product tankers berthing at the harbour and large shuttle tankers that anchored outside the port. To account for seasonal variations the summer and winter tracks are presented separately below. It should be noted that the large shuttle tankers are not currently accommodated by the port and this will not change with the development of Nigg Bay. This is due to the size of the vessels, which is beyond that able to enter either the current or planned harbour. These vessels instead anchor outside the harbour to await their future departure to the distant oil fields they service. At the anchorage they can be serviced by local small craft undertaking crew transfers, provision of stores etc.

3.5.2 Summer

The summer tanker tracks are presented in Figure 3.31.

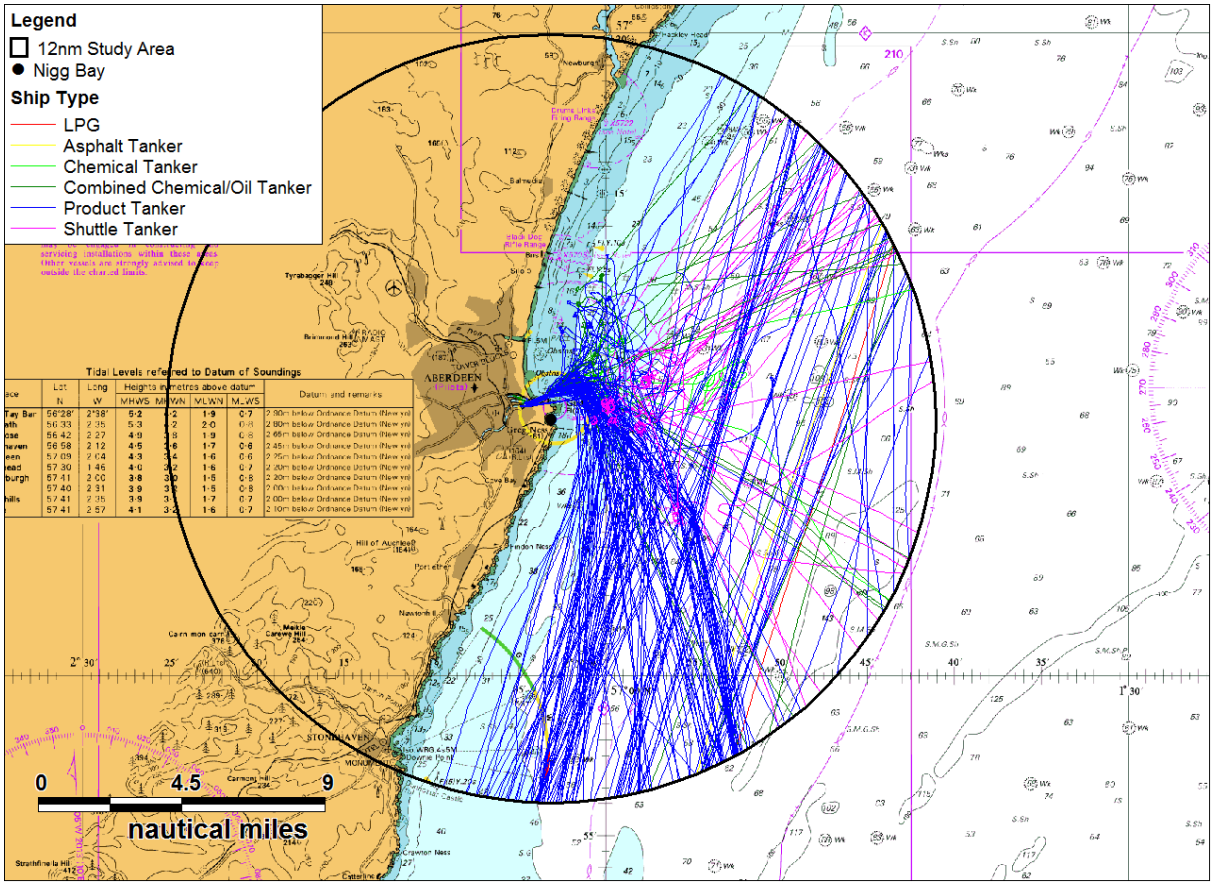

Figure 3.31 Summer AIS Tanker Tracks

A detailed view of the summer tanker tracks within the 5nm study area are presented in Figure 3.32.

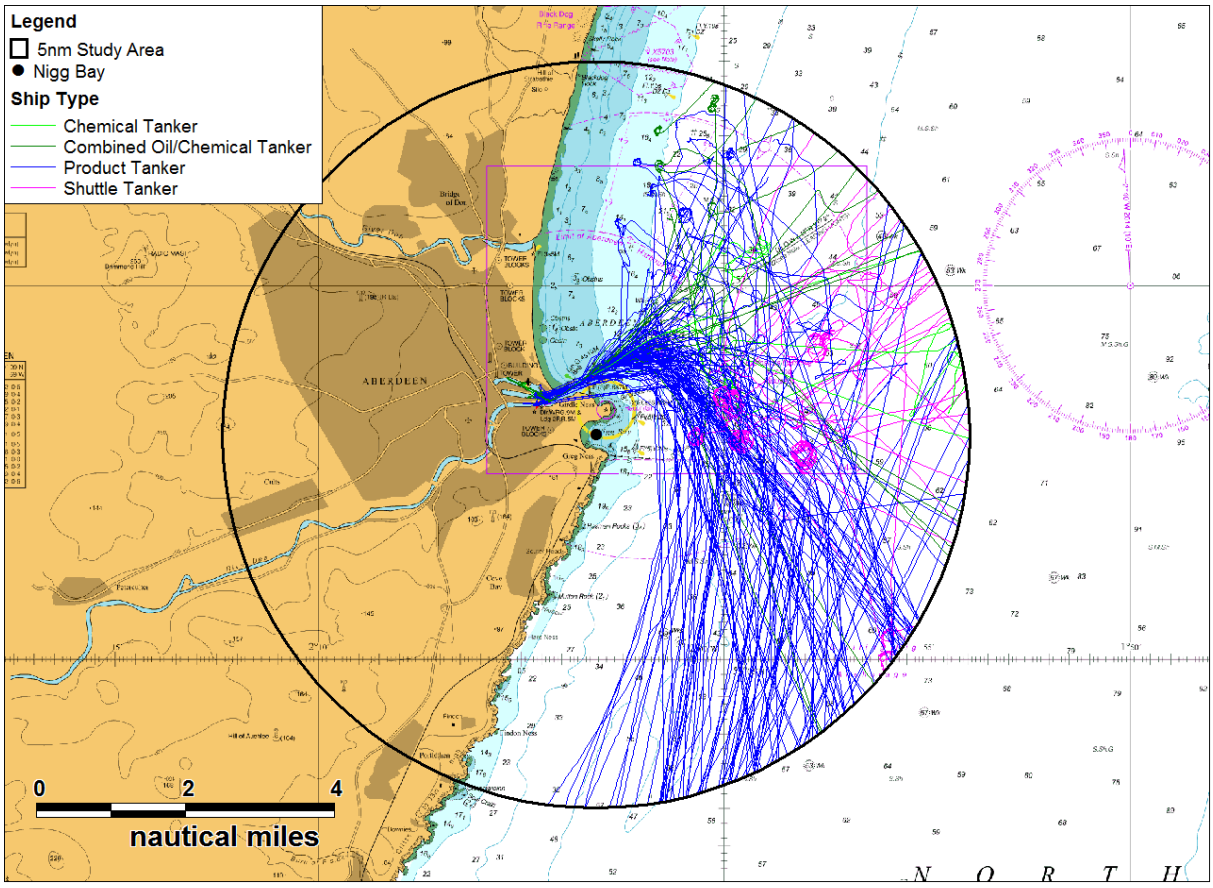

Figure 3.32 Summer AIS Tanker Tracks – Detailed View

The majority of tankers within the summer AIS data were small product tankers on routes associated with Aberdeen Harbour. Shuttle tankers associated with distant oil fields including the Gryphon, Captain, Draugen, Ross, Skarv, and Alvheim fields were also recorded within the data.

An average of two AIS tracks from tankers were observed crossing the entrance to Aberdeen Harbour, from two unique vessels. The majority of tankers entering the current harbour were product tankers. Tanker traffic passing the harbour was mainly product tankers on routes between other UK ports.

Large shuttle tankers were seen to anchor between 1 and 3nm east of Nigg Bay. These tankers are too large to berth in Aberdeen Harbour, instead anchoring while waiting to load at offshore terminals and floating installations. Smaller tankers anchored in the anchorage north of the harbour (see Section 3.10 for more information on anchored vessels).

The tanker (shuttle tanker) with the longest length during summer was the *Bodil Knutsen* with a length of 285m. The longest tanker (oil/chemical tanker) that entered Aberdeen Harbour was the *Christina*, with a length of 123m. The vessel was recorded on passage between

Aberdeen and Tjeldbergodden within the data period. Note- vessel cargo was calcium carbonate slurry.

The distribution of tanker type during summer within the 12nm study area is presented in Figure 3.33. The analysis is based on unique vessels per day.

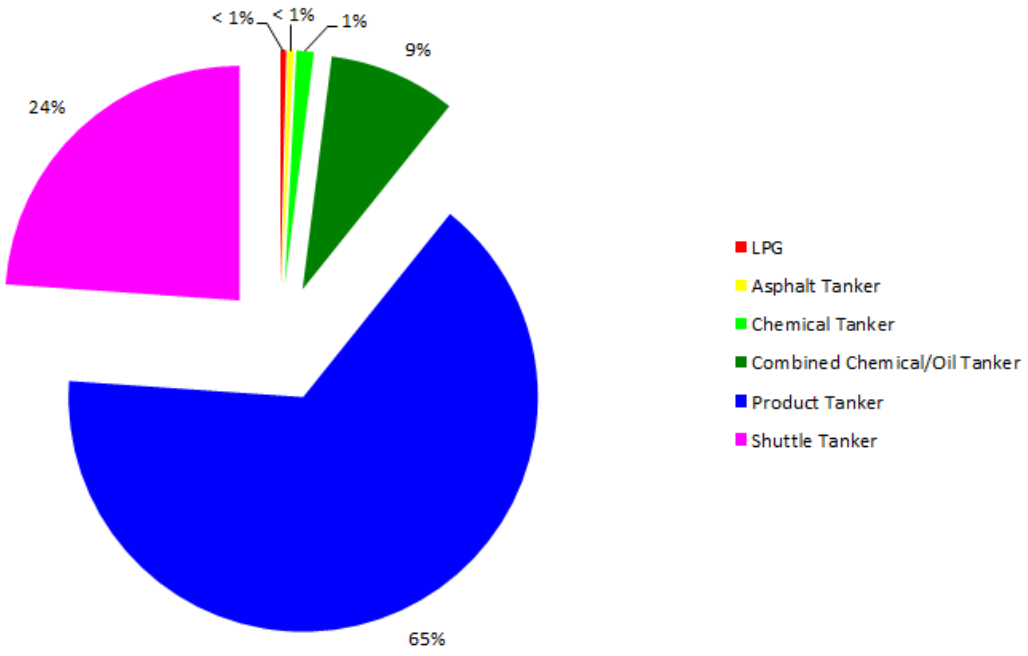

Figure 3.33 Summer AIS Tanker Type Distribution

It is seen that approximately 65% of tracks were from product tankers, and a further 24% from shuttle tankers. Combined chemical and oil tankers contributed 9%, with the remaining being split between LPG, asphalt, and chemical tankers.

3.5.3 Winter

The tanker tracks recorded during winter are presented in Figure 3.34.

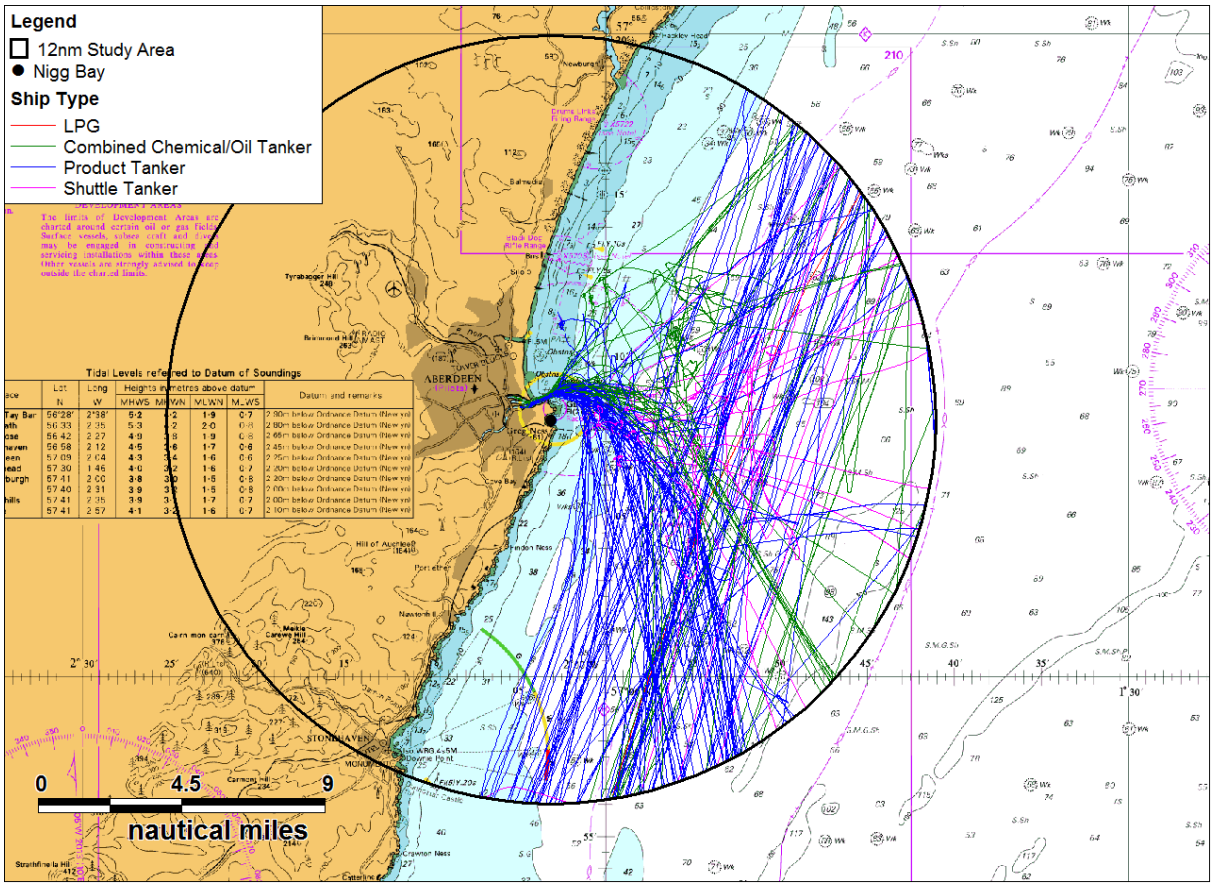

Figure 3.34 Winter AIS Tanker Tracks

A detailed view of the winter tanker tracks during winter is presented in Figure 3.35.

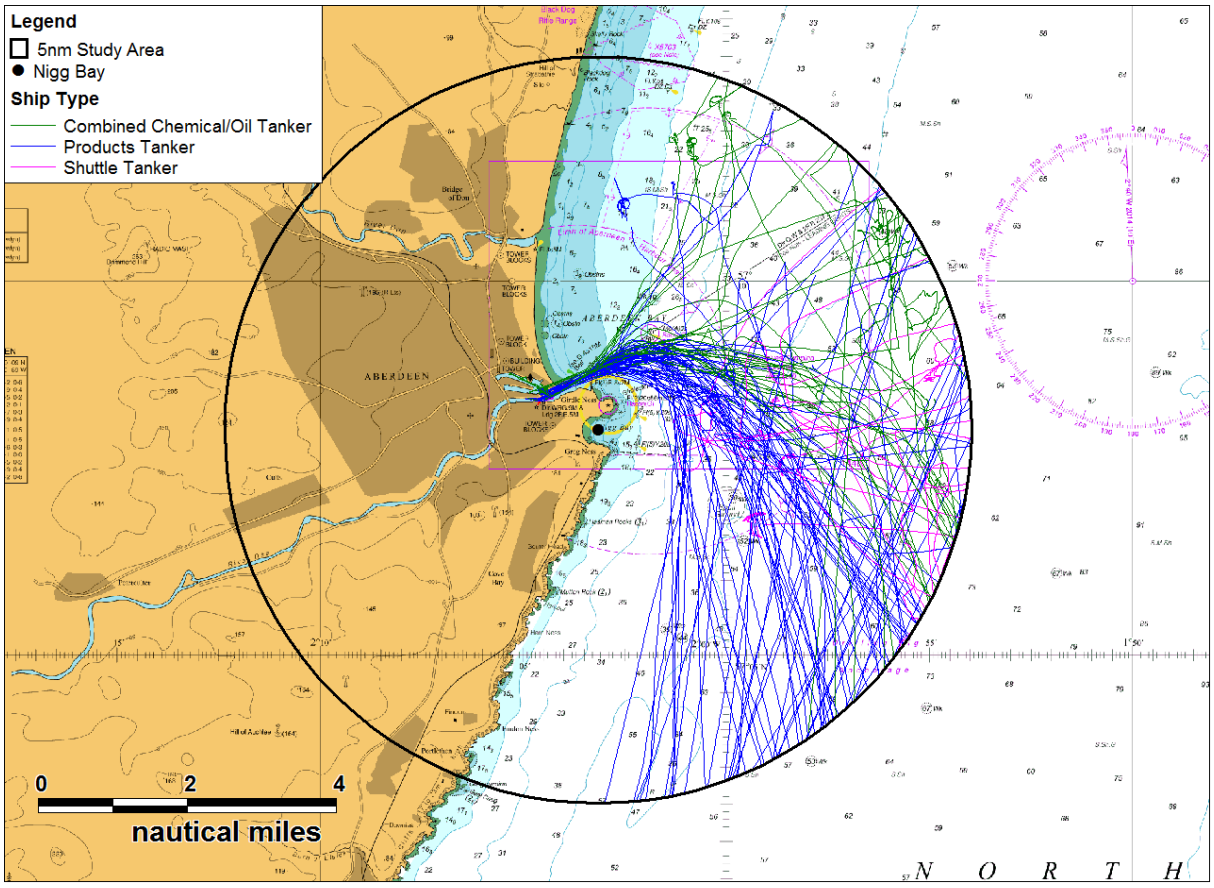

Figure 3.35 Winter AIS Tanker Tracks – Detailed View

As in summer, the majority of tracks were from product tankers transiting between Aberdeen and other UK ports, and shuttle tankers associated with various oil fields in the North Sea. The tankers passing the harbour were mainly in transit between other UK ports.

An average of one unique tanker per day crossed the Aberdeen Harbour entrance, inclusive of inbound and outbound vessels.

Large shuttle tankers were observed anchoring east of the harbour, and smaller tankers were seen to anchor in the anchorage north of the harbour (see Section 3.10 for more information on anchored vessels).

The longest tanker within the 12nm study area during winter was the *Loch Rannoch* with a length of 268m. The vessel was conducting a dynamic positioning (DP) test approximately 1.7nm east of Nigg Bay. Its transmitted destination was 'Aberdeen Anchorage'. As in summer, the longest tanker that entered Aberdeen Harbour was the *Christina*, with a length of 123m.

The distribution of tanker type during winter in the 12nm study area is presented in Figure 3.36, based on unique vessels per day.

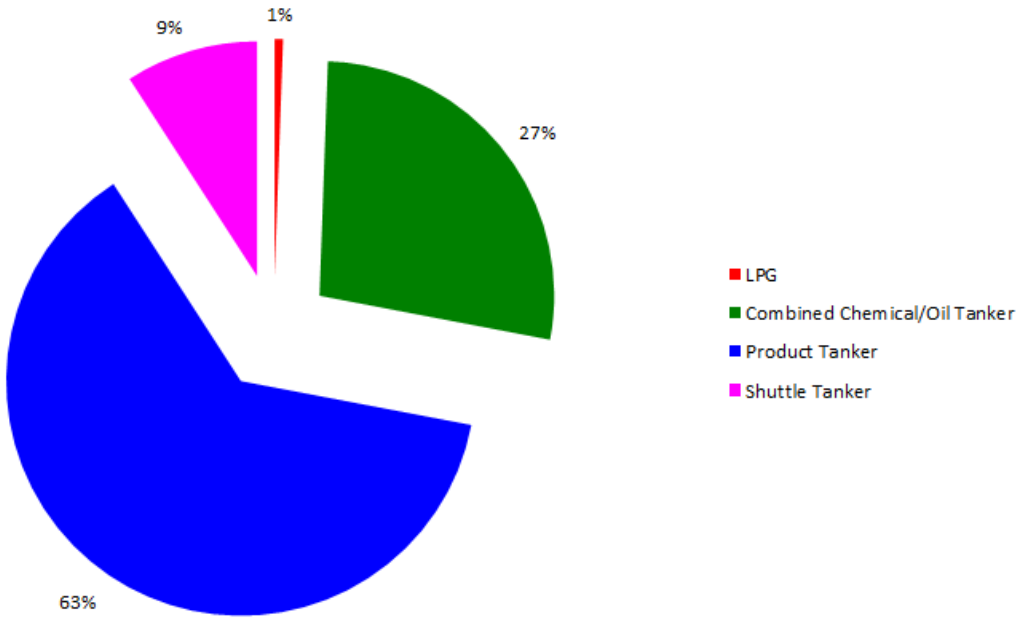

Figure 3.36 Winter AIS Tanker Type Distribution

As in summer, the majority (63%) of vessels were product tankers. A further 27% were combined chemical and oil tankers. A total of 9% were shuttle tankers, and just 1% were LPG.

3.6 Passenger Vessel Analysis

3.6.1 Introduction

This section presents the passenger vessel tracks recorded within the AIS data and the corresponding analysis. Seasonal variations of ferry timetables have been taken into account.

3.6.2 Summer

The passenger vessel tracks recorded during summer are presented in Figure 3.37.

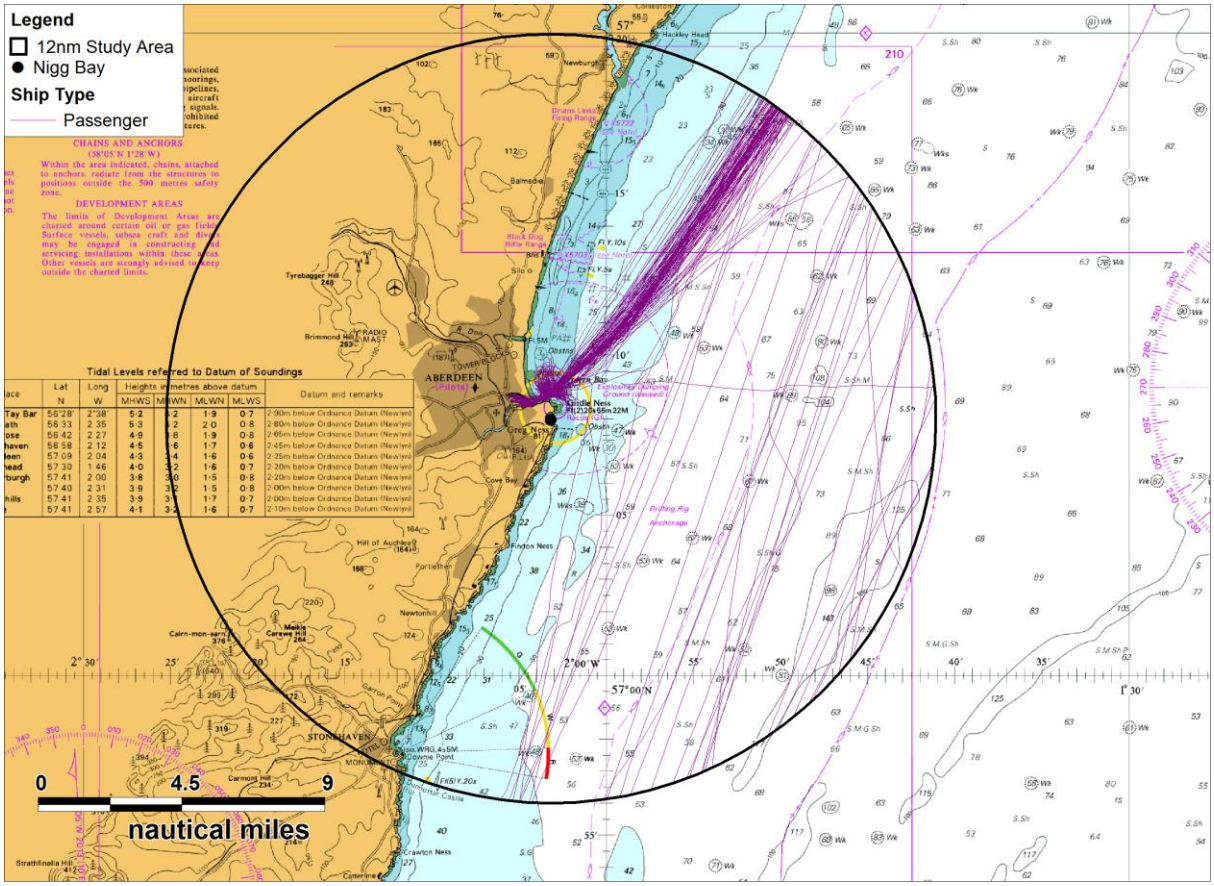

Figure 3.37 Summer AIS Passenger Vessel Tracks

A detailed overview of the summer passenger vessel tracks within the 5nm study area is presented in Figure 3.40.

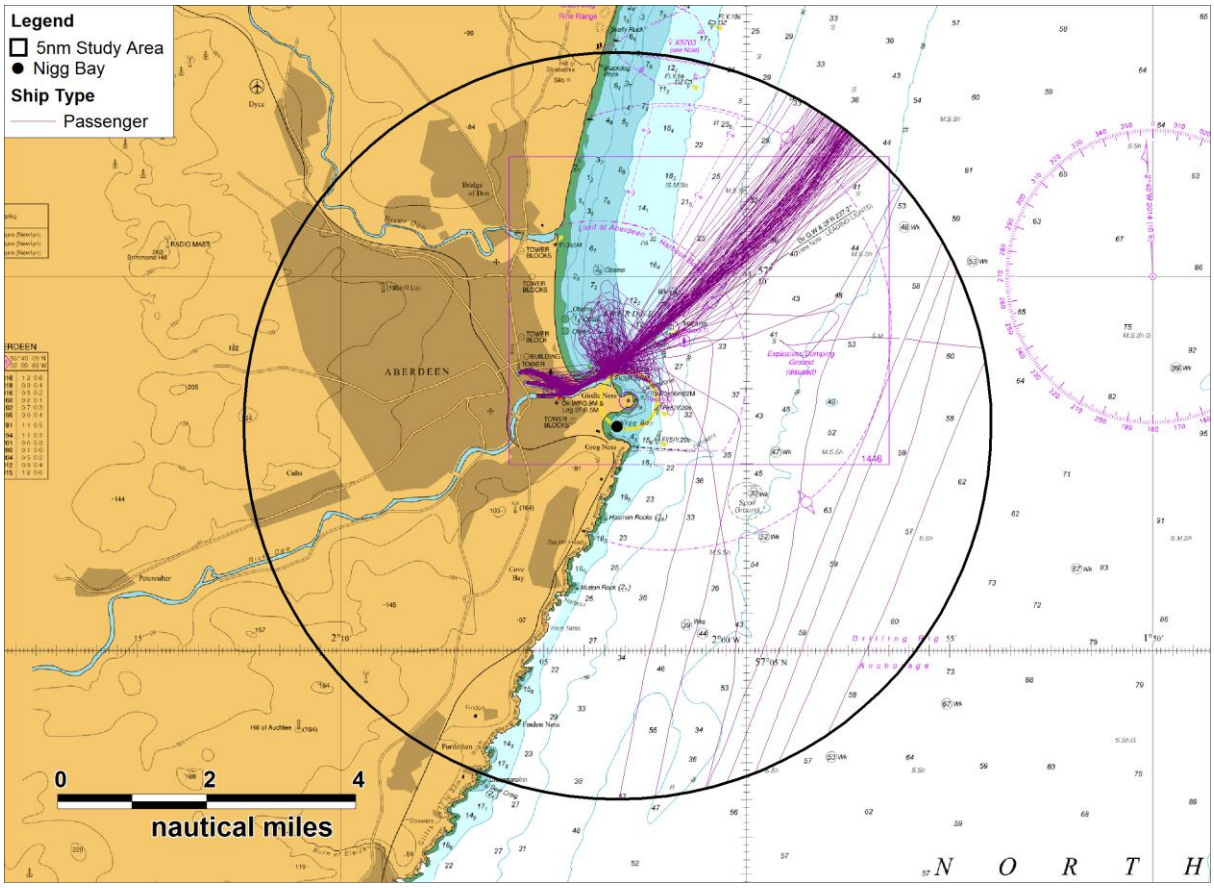

Figure 3.38 Summer AIS Passenger Vessel Tracks – Detailed View

The vast majority of passenger vessel activity was from two ferries, the *Hrossey* running between Aberdeen and Lerwick via Kirkwall, and the *Hjatland* running between Aberdeen and Lerwick. The vessels ran on alternate days and shared a route in the approach to Aberdeen Harbour, visible on the above figures. Both are operated by NorthLink Ferries. Three other passenger vessels were seen departing the harbour, the *Sea Cloud II* (a barque cruise ship) bound for Dundee and returning six days later, the *Sorlandet* (a full-rigged tall ship), and the *Vive La Vie* (superyacht).

Other passing traffic mainly consisted of passenger ships conducting cruises, none of which was considered regular traffic. A total of 27 unique passenger vessels were recorded within the 12nm study area.

The *Fencer*, a small passenger boat, conducted multiple daily tours of Aberdeen Harbour, entrance and beach front. The tracks from this vessel are visible in the above figures approximately 1nm north of Nigg Bay.

The passenger vessel with the greatest length during summer was the *Marina*, with a length of 240m. The vessel passed approximately 10nm east of Nigg Bay bound for Invergordon.

The distribution of passenger vessel type during winter in the 12nm study area is presented in Figure 3.39, based on unique vessels per day.

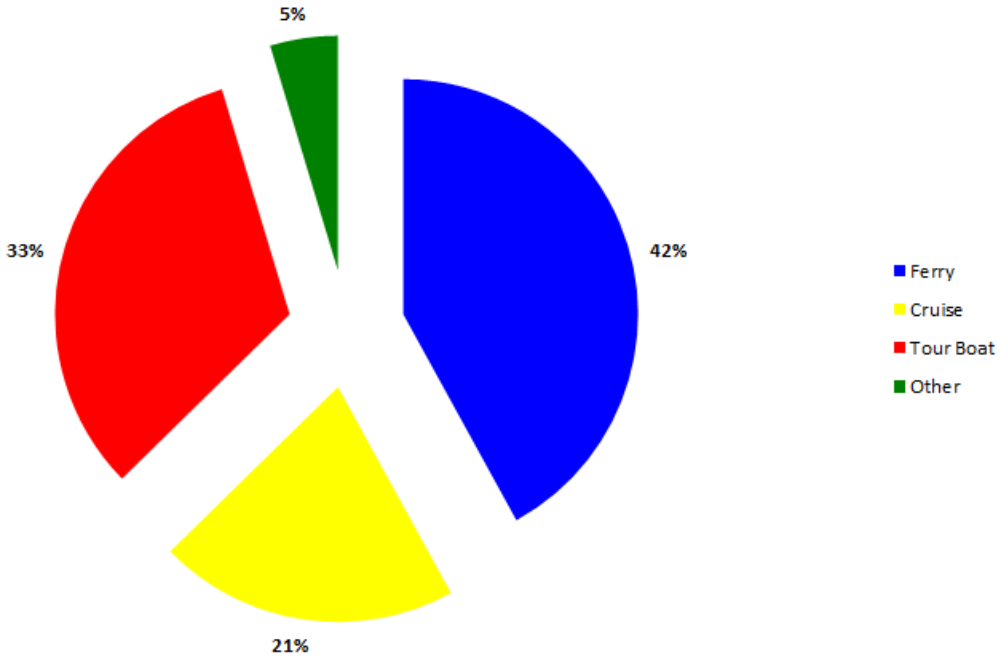

Figure 3.39 Summer AIS Passenger Vessel Type Distribution

Overall, 42% of passenger vessels were ferries, and 21% were cruise ships. The small passenger vessel conducting tours of the current Aberdeen Harbour and surrounding waters contributed 33%.

3.6.3 Winter

A general overview of the AIS tracks recorded from passenger vessels during winter is presented in Figure 3.40.

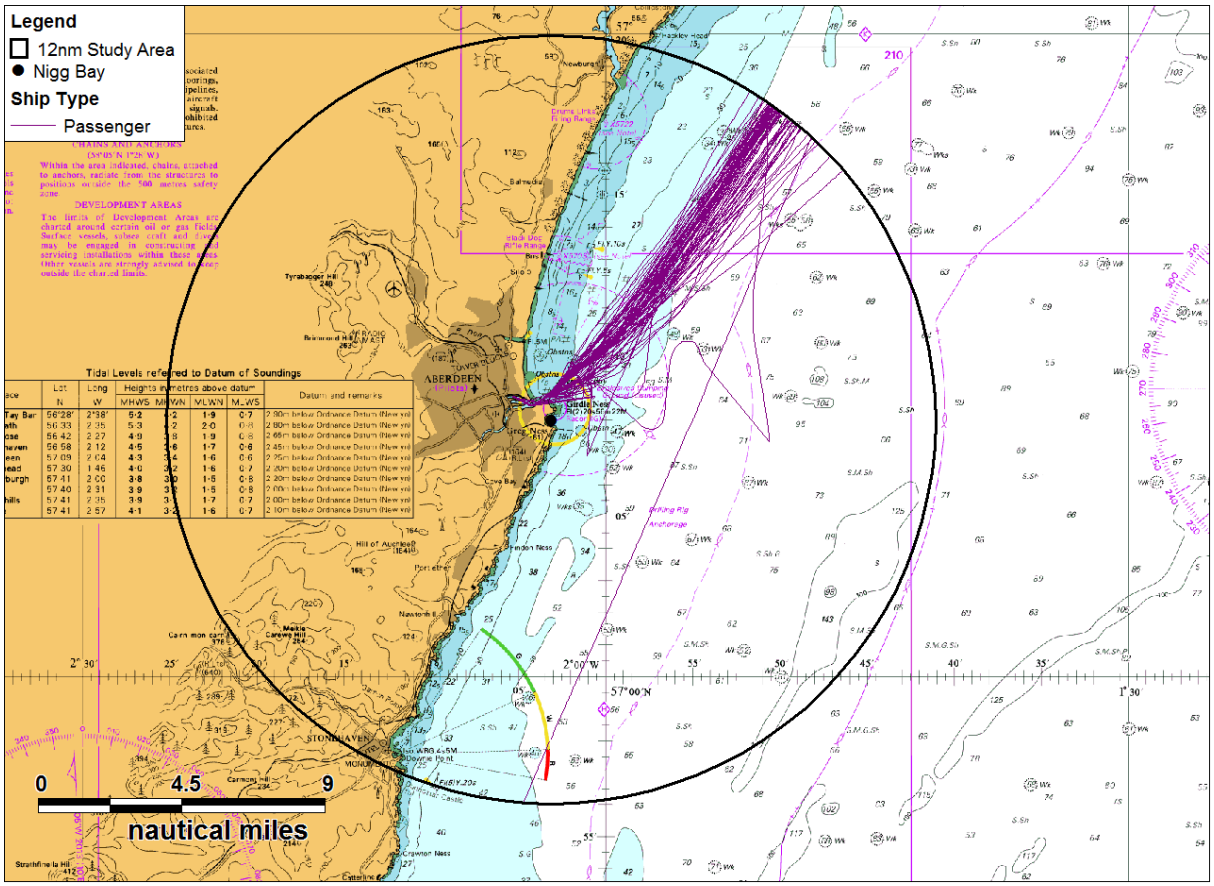

Figure 3.40 Winter AIS Passenger Vessel Tracks

A detailed overview of the winter passenger vessel tracks is presented in Figure 3.41.

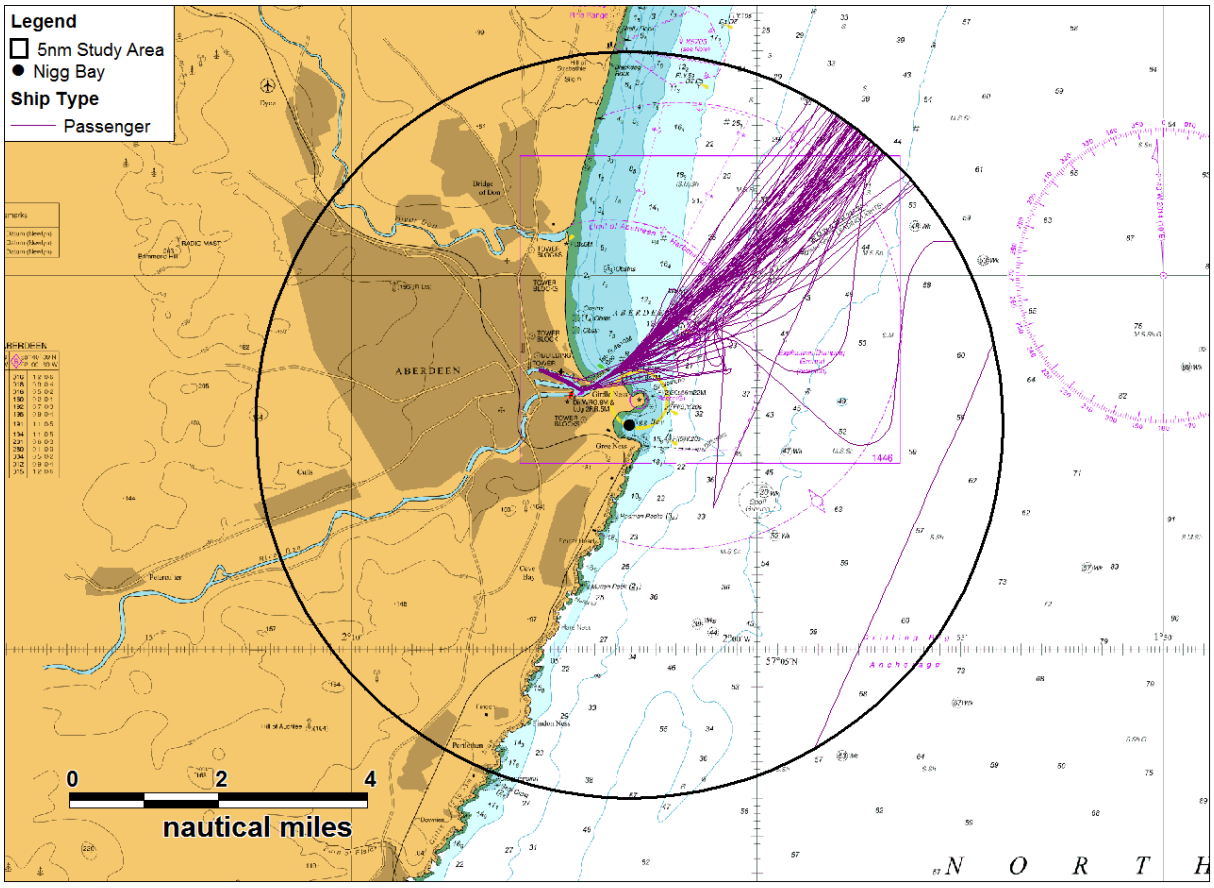

Figure 3.41 Winter AIS Passenger Vessel Tracks – Detailed View

Overall winter passenger vessel traffic was seen to be less than during summer. The timetabled service did not differ, so this is due to variation caused by planned (maintenance) or unplanned (severe weather / breakdown) disruption. The planned rolling dry dock arrangements were *Hrossey* – 1 to 19 February and *Hjatland* – 27 February to 15 March 2014. As in summer, the vast majority of passenger vessel activity was from the *Hrossey* (between Aberdeen and Lerwick via Kirkwall) and the *Hjatland* (between Aberdeen and Lerwick).

Only one other passenger vessel was noted during winter, the *Varagen*, operated by Orkney Ferries. The vessel passed approximately 4nm east of Nigg Bay and was bound for Grangemouth. This was not a regular route, the vessel usually operates as part of Orkney Ferries outer north isles service but was en route to dry-dock in Grangemouth for maintenance.

No breakdown distribution of passenger traffic is presented for the winter data because all vessels were passenger ferries. These, as noted above, were the scheduled ferries and the single transiting ferry.

3.7 Offshore Vessel Analysis

3.7.1 Introduction

This section presents the tracks recorded from offshore vessels within the study areas. It is noted in Figure 3.7 and Figure 3.20 that the majority of vessels within the AIS during both summer and winter were offshore vessels.

3.7.2 Summer

The offshore activity during summer within the 12nm study area is presented in Figure 3.42.

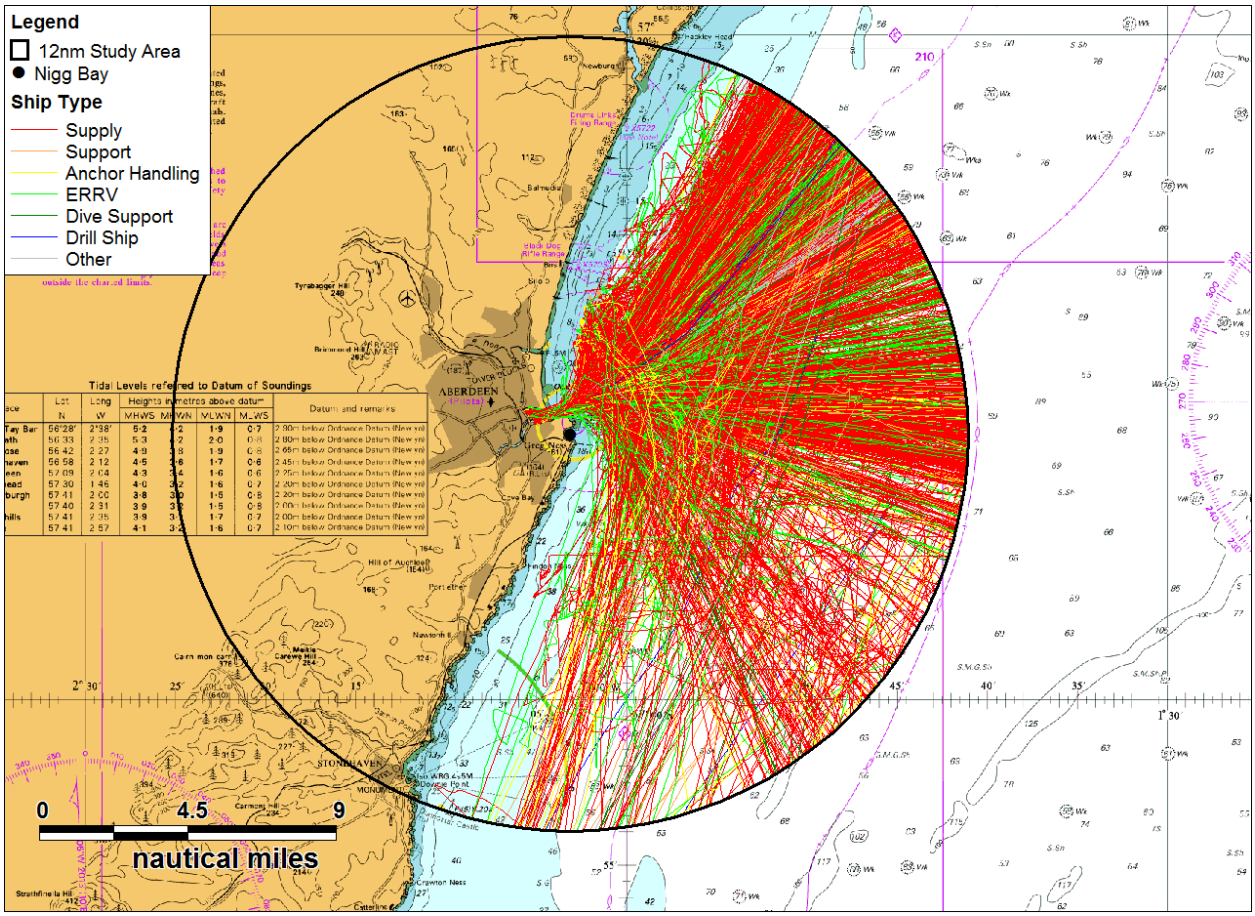

Figure 3.42 Summer AIS Offshore Vessel Tracks

A detailed overview of the summer offshore vessel tracks is presented in Figure 3.43.

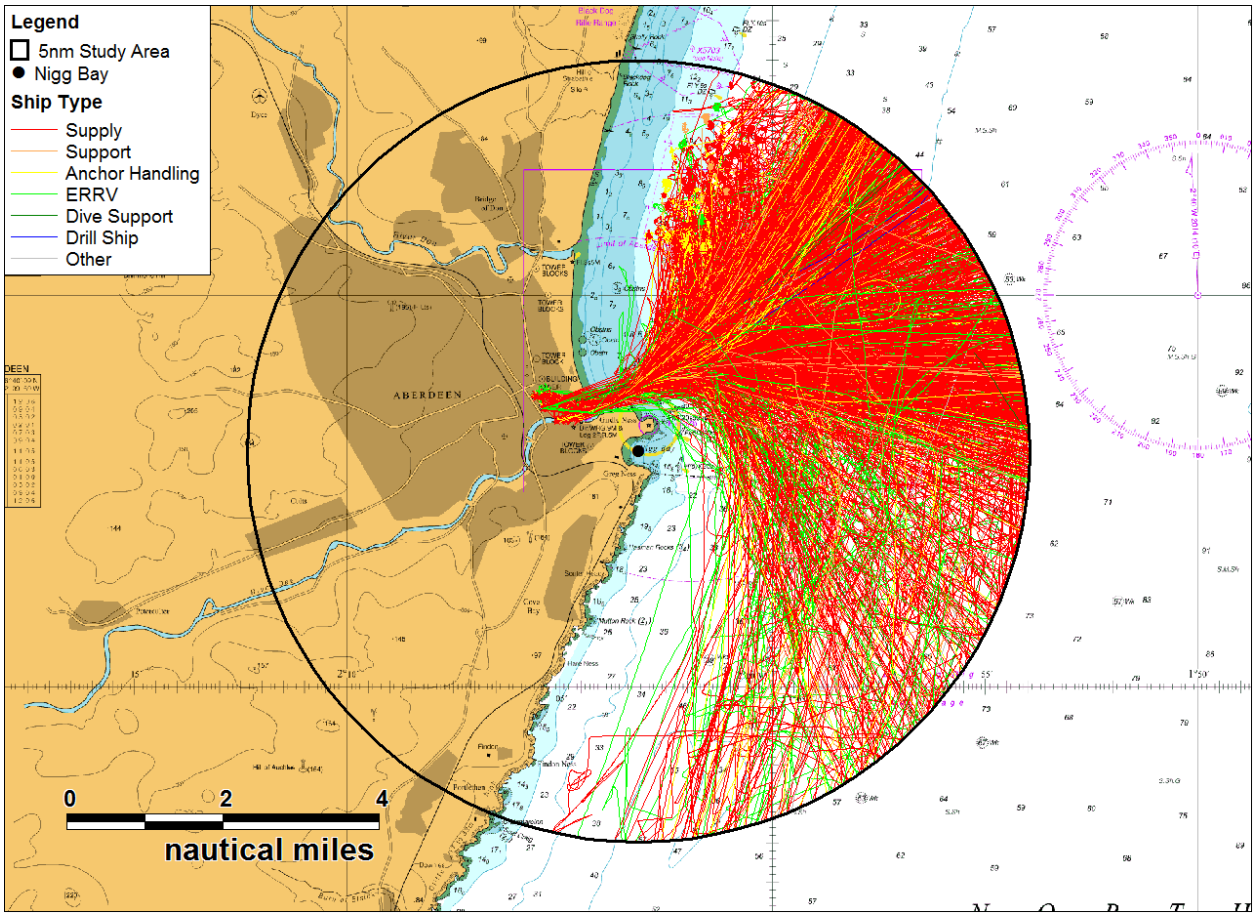

Figure 3.43 Summer AIS Offshore Vessel Tracks – Detailed View

The majority of offshore vessel activity was from vessels on passage between Aberdeen and various oil and gas fields in the North Sea. Offshore vessels were also seen using the designated anchorage north of the harbour (see Section 3.10). It was estimated from the AIS data that an average of 35 AIS tracks from offshore vessels per day crossed the entrance to the current harbour, from an average of 28 unique vessels per day (inclusive of inbound and outbound vessels). Of the vessels operating from Aberdeen, the majority were on routes bound east and north east of the harbour, with a smaller proportion of vessels on routes bound south east.

The longest offshore vessel during summer was the *Apache II*, a support vessel (pipelaying vessel) with a length of 132m, which transited through the study area. The offshore vessel with the greatest length that entered Aberdeen Harbour during summer was the *Skandi Constructor*, a support vessel (well intervention) with a length of 120m.

The majority of offshore vessels were supply vessels, with approximately 72% falling into this category.

3.7.3 Winter

The tracks from offshore vessels during winter are presented in Figure 3.44.

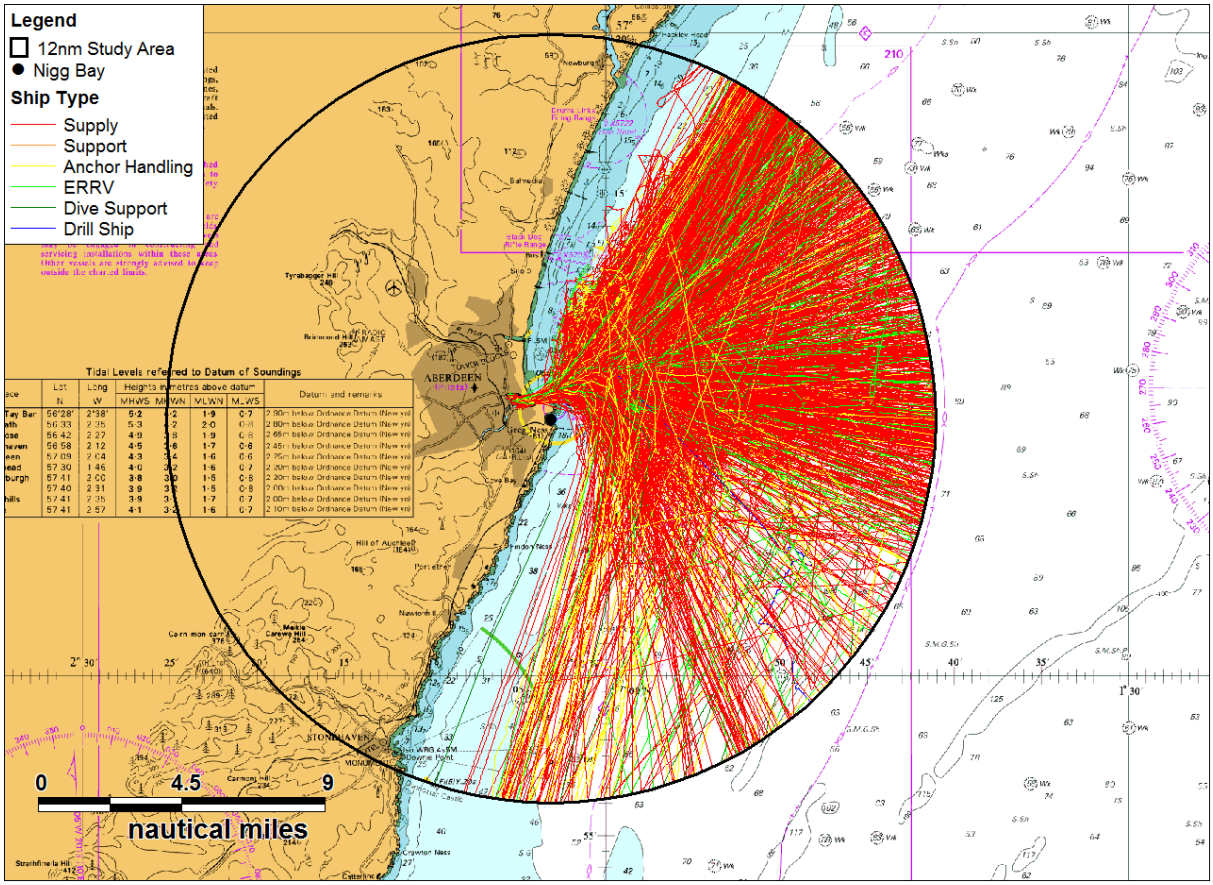

Figure 3.44 Winter AIS Offshore Vessel Tracks

A detailed overview of the offshore activity during winter is presented in Figure 3.45.

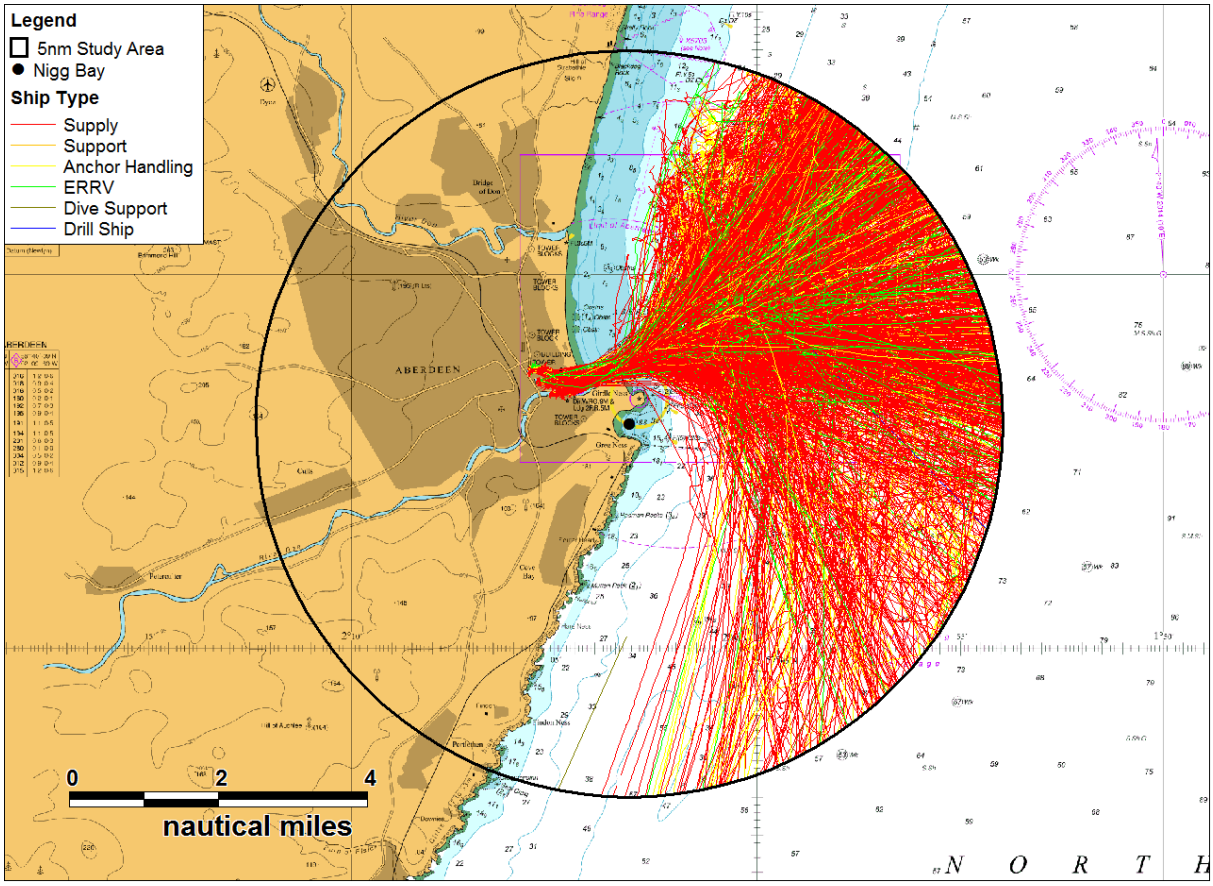

Figure 3.45 Winter AIS Offshore Vessel Tracks – Detailed View

As in summer, the majority of offshore vessel tracks were from vessels on routes between Aberdeen and various oil and gas fields in the North Sea, or from vessels at anchor north of the harbour. Routes bound north and north east of the harbour were busiest, with some vessels also on routes bound south east. An average of 28 tracks per day from offshore vessels crossed the Aberdeen Harbour entrance, from an average of 24 unique vessels per day (inclusive of inbound and outbound vessels).

The longest offshore vessel was the *Skandi Arctic*, a support vessel (dive support vessel) with a length of 156m. The *Skandi Arctic* berthed at Aberdeen Harbour.

As in summer, the majority of offshore vessels were supply vessels, approximately 76%.

3.8 Fishing Vessel Analysis

3.8.1 Introduction

This section analyses the fishing vessel tracks recorded during the four months of AIS data. As previously discussed, at the time of the winter AIS recording only fishing vessels above 18m in length were obliged to carry AIS equipment. During the summer period, all vessels above 15m were subject to the carriage requirement. As previously discussed (Section 2.2.3), activity from smaller fishing vessels is expected to be under-represented.

To initially identify the areas where fishing occurs, VMS satellite data from 2012 was used. The data consists of a grid covering UK waters, and each cell is detailed with the number of minutes spent actively fishing within their boundaries. The grid cells intersecting the 12nm study area are presented in Figure 3.46.

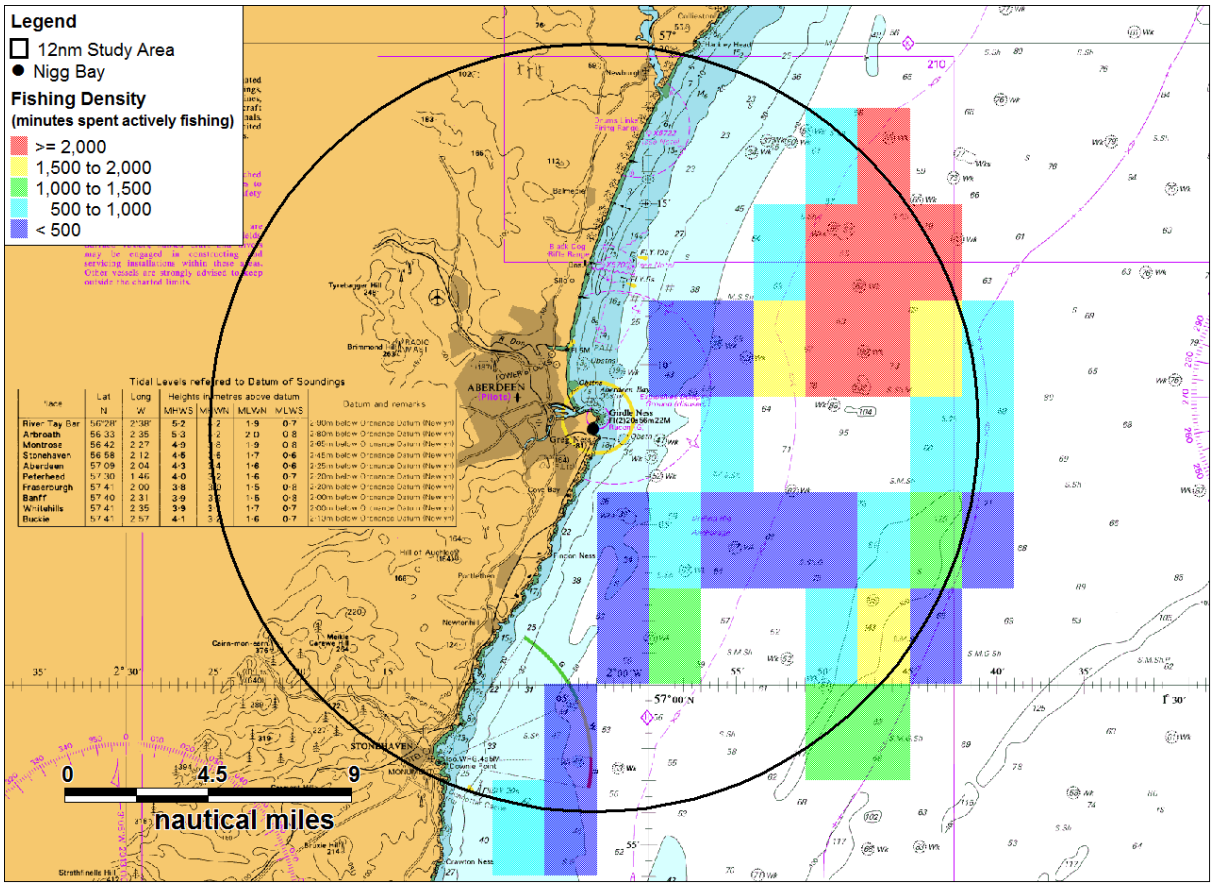

Figure 3.46 2012 VMS Satellite Data

It is seen that the majority of fishing occurred within cells between 7 and 12nm to the north east of Nigg Bay. It is noted that VMS data only covers vessels of 15m length and above.

3.8.2 Summer

The fishing tracks within the 12nm study area from the summer AIS data are presented in Figure 3.47, colour coded by gear type.

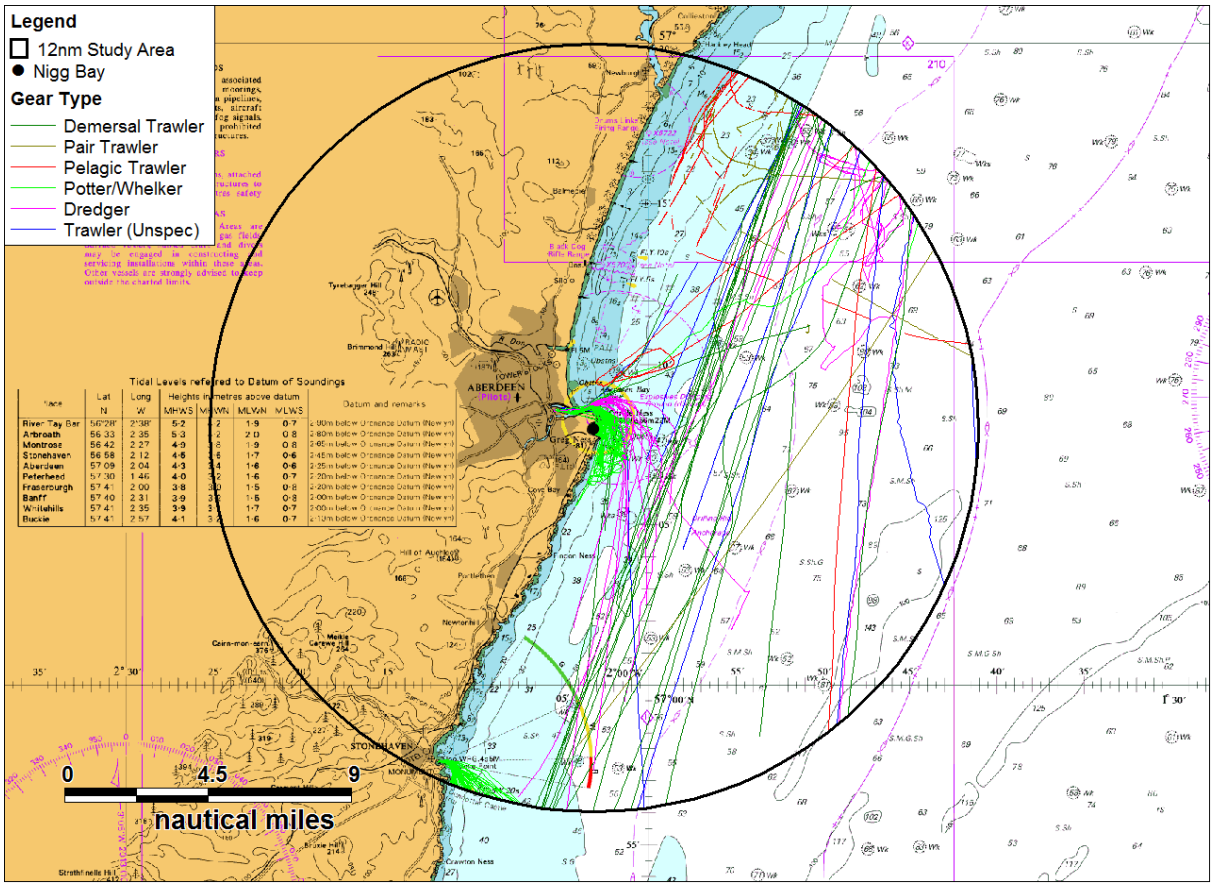

Figure 3.47 Summer AIS Fishing – 12nm Study Area

A detailed overview of the fishing vessel tracks within the 5nm study area during summer are presented in Figure 3.48.

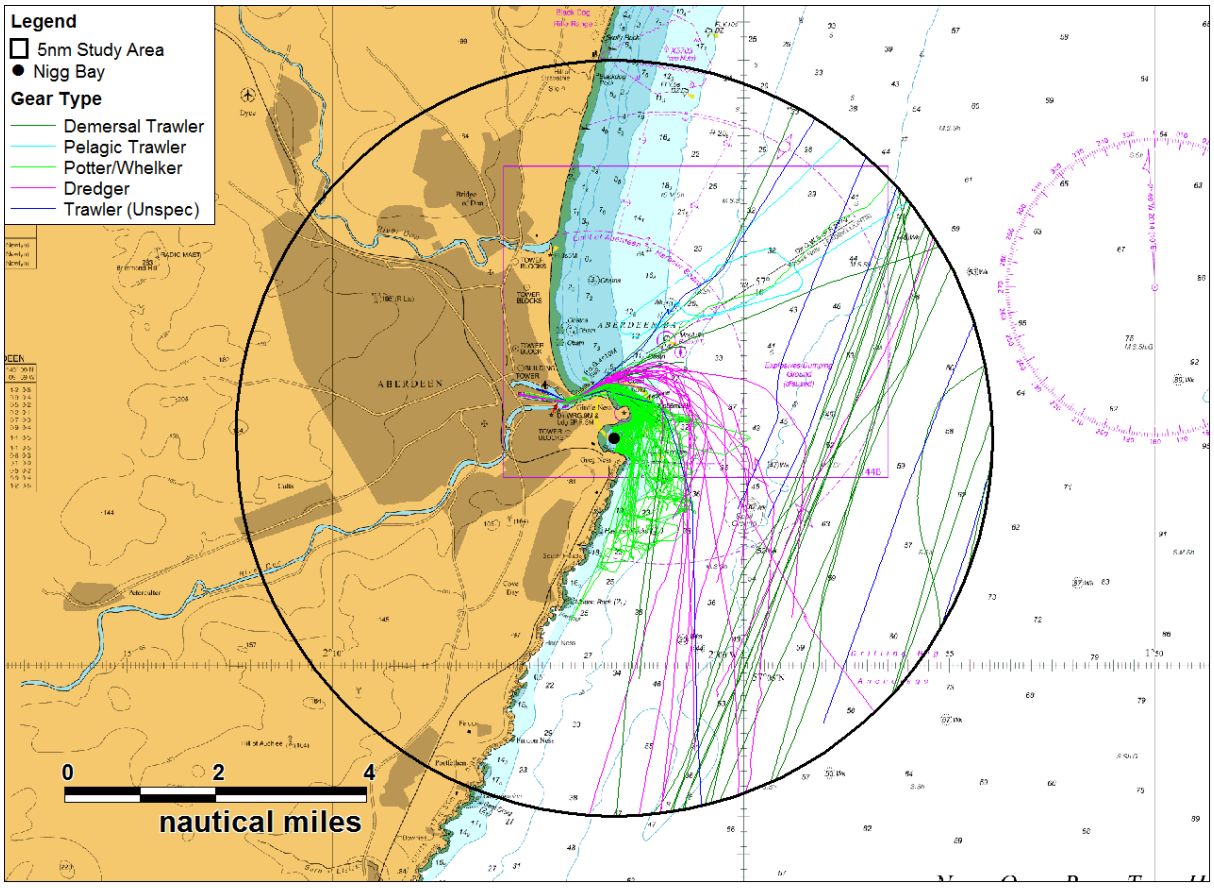

Figure 3.48 Summer AIS Fishing – 5nm Study Area

One vessel was seen to fish frequently within Nigg Bay, the *Skua II*, an 8m long potter. This was the only fishing vessel noted within the bay, however as previously discussed it should be taken into consideration that smaller fishing vessels are not obliged to transmit AIS, and activity may be under-represented. The *Skua II* berthed at Aberdeen Harbour, and was also seen fishing further south of Nigg Bay, along the coast.

It is seen in Figure 3.47 that potting activity occurred at Stonehaven, approximately 11nm south of Nigg Bay. This activity was from the *Dalwhinnie*, a vessel with a length of 12m.

Active dredging activity was noted in a similar area to the high density fishing cells seen in Figure 3.46.

Seven unique fishing vessels were seen entering the current Aberdeen Harbour. Details of these vessels are presented in Table 3.1.

Table 3.1 Fishing Vessels Berthing at Aberdeen Harbour - Summer

Name	Length (m)	Gear Type
Aquinis	18	Dredger
Emerald Dawn	24	Demersal Trawler
Fredwood	Unknown	Dredger
Georgia Dawn	18	Dredger
Pilot Star	16	Potter
Prolific	19	Trawler
Skua II	8	Potter

A total of 25 other fishing vessels were also seen within the 12nm study area, likely to be associated with other fishing ports on the Scottish coast.

The gear type distribution during summer based on unique vessels per day is presented in Figure 3.49. It should be noted that the potting activity around Stonehaven only occurred in the 12nm study area.

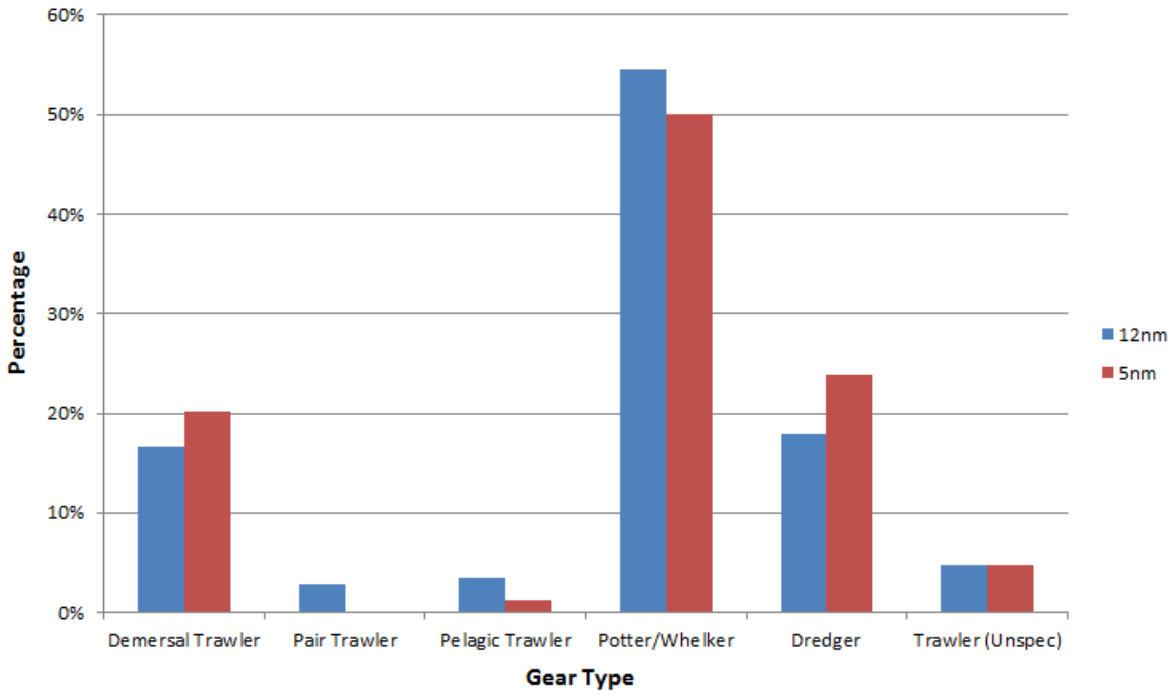

Figure 3.49 Summer AIS Fishing Gear Type Distribution

Within the 12nm study area, approximately 54% of fishing vessels were potters. Dredgers and demersal trawlers made up 18% and 17% respectively. The remaining vessels were unspecified trawlers (5%), pelagic trawlers (3%), and pair trawlers (3%).

3.8.3 Winter

The AIS tracks from fishing vessels recorded during winter in the 12nm study area are presented in Figure 3.50 colour coded by gear type.

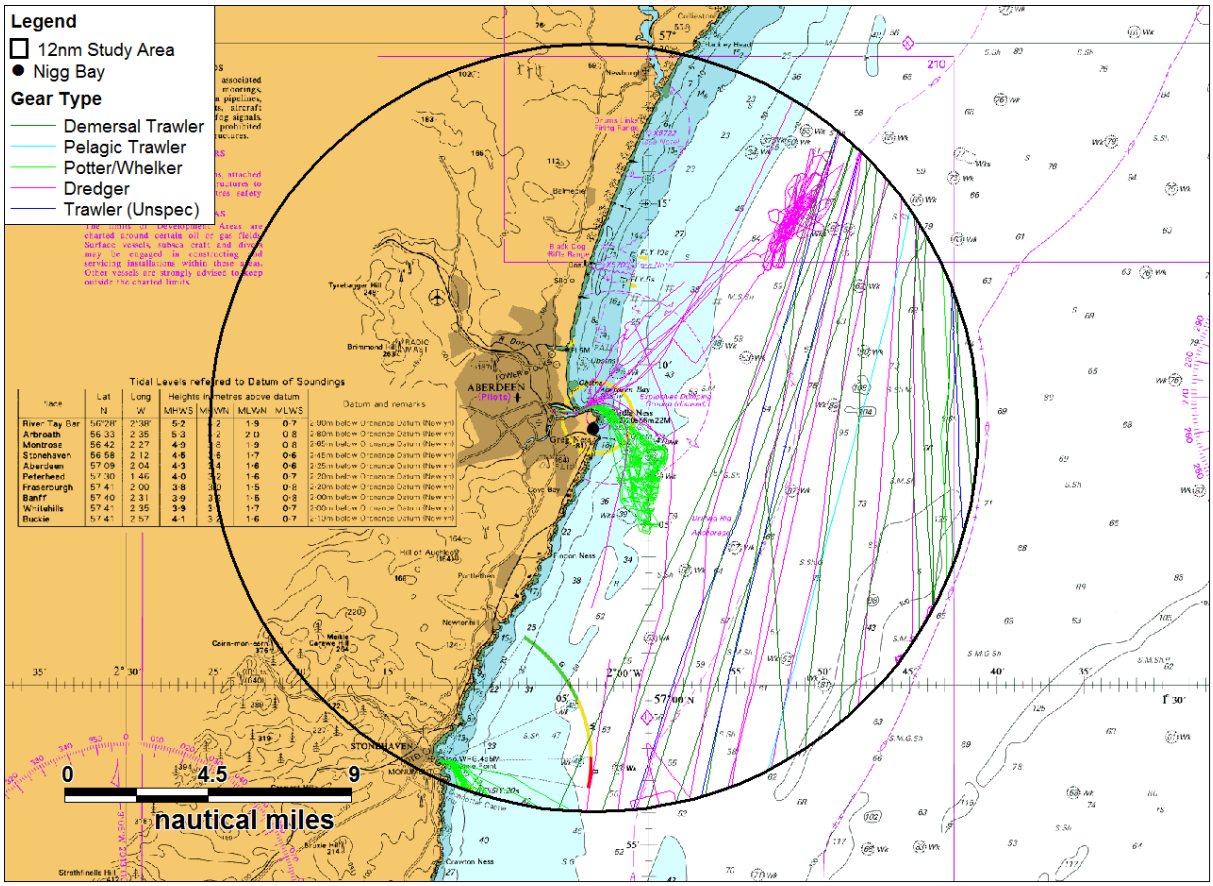

Figure 3.50 Winter AIS Fishing – 12nm Study Area

The AIS tracks from fishing vessels recorded during winter in the 5nm study area are presented in Figure 3.51, colour coded by gear type.

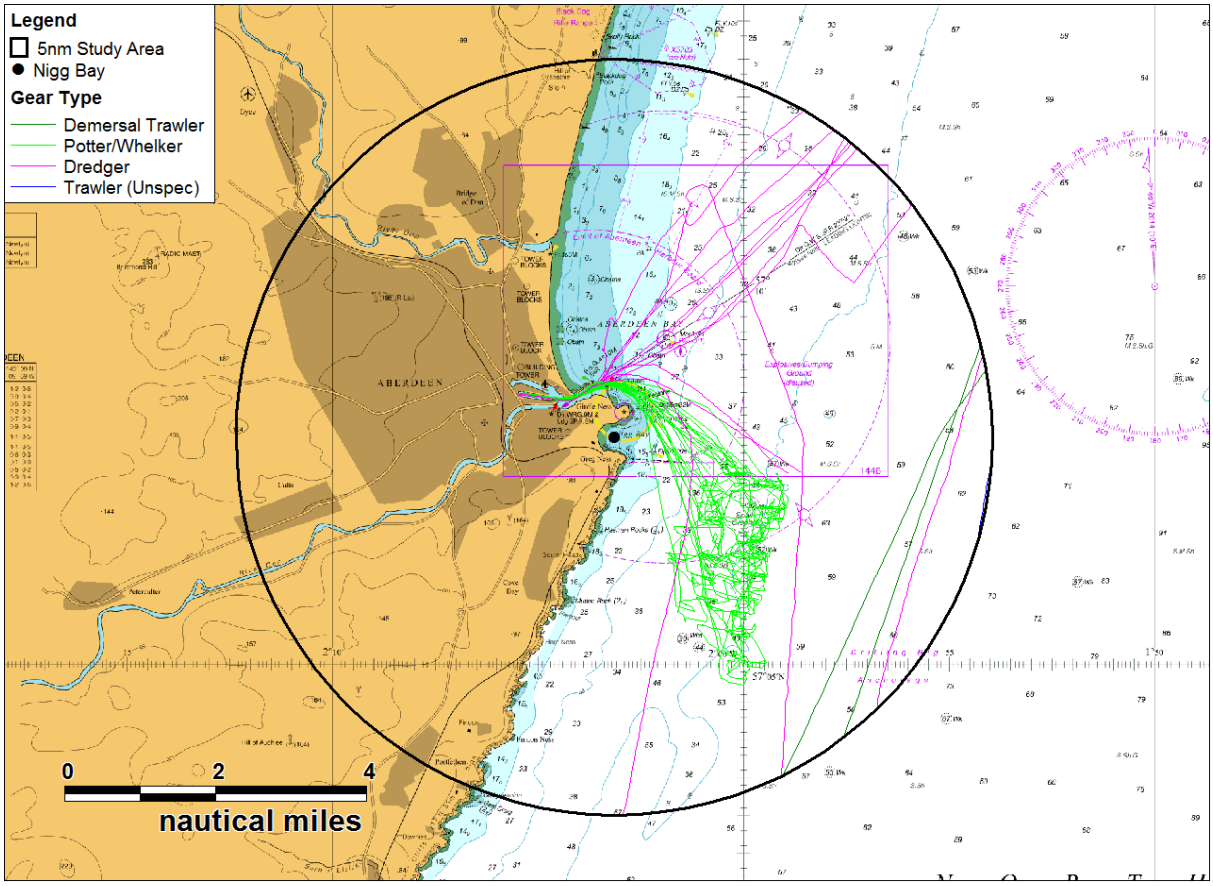

Figure 3.51 Winter AIS Fishing – 5nm Study Area

No fishing vessels were recorded within Nigg Bay during winter. The *Skua II* was still seen within the data however it did not enter Nigg Bay, instead fishing further south. Active dredging activity was also noted occurring approximately 7nm to 10nm north east of Nigg Bay (visible in Figure 3.50). This correlated well with the satellite data (Figure 3.46).

As in summer, potting activity was noted from the *Dalwhinnie* at Stonehaven.

Five fishing vessels were seen to enter Aberdeen Harbour (compared to seven in summer). Details of these vessels are presented in Table 3.2.

Table 3.2 Fishing Vessels Berthing at Aberdeen Harbour - Winter

Name	Length	Type
Calisha	26	Dredger
Cordelia-K	40	Dredger
Georgia Dawn	18	Dredger
Skua II	8	Potter

The gear type distribution during winter based on unique vessels per day is presented in Figure 3.52. As previously discussed, the potting activity at Stonehaven only occurred within the 12nm study area.

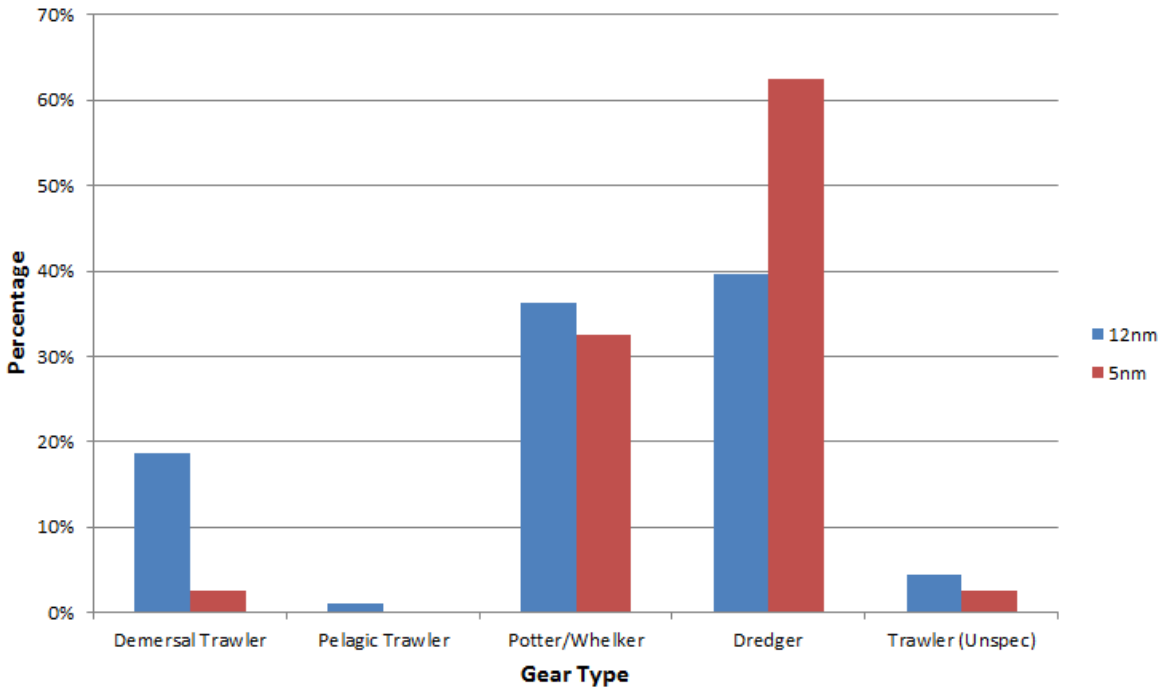

Figure 3.52 Winter AIS Fishing Gear Type Distribution

Within the 12nm study area, approximately 40% of fishing vessel activity was from dredgers, 36% was from potters, and a further 19% was from demersal trawlers. Unspecified trawlers (4%) and pelagic trawlers (1%) made up the remaining vessels.

3.9 Recreational Vessel Analysis

3.9.1 Introduction

This section presents the tracks recorded from recreational vessels during the four months of AIS. It should be noted that in general recreational vessel activity is highly seasonal, with the majority of activity occurring during summer. No recreational vessels were recorded during the winter period within the AIS data. The limitations associated with tracking recreational vessel activity on AIS are noted in Section 2.2.3.

The recreational cruising routes based on the RYA Coastal Atlas (RYA, 2009) are presented in Figure 3.53.

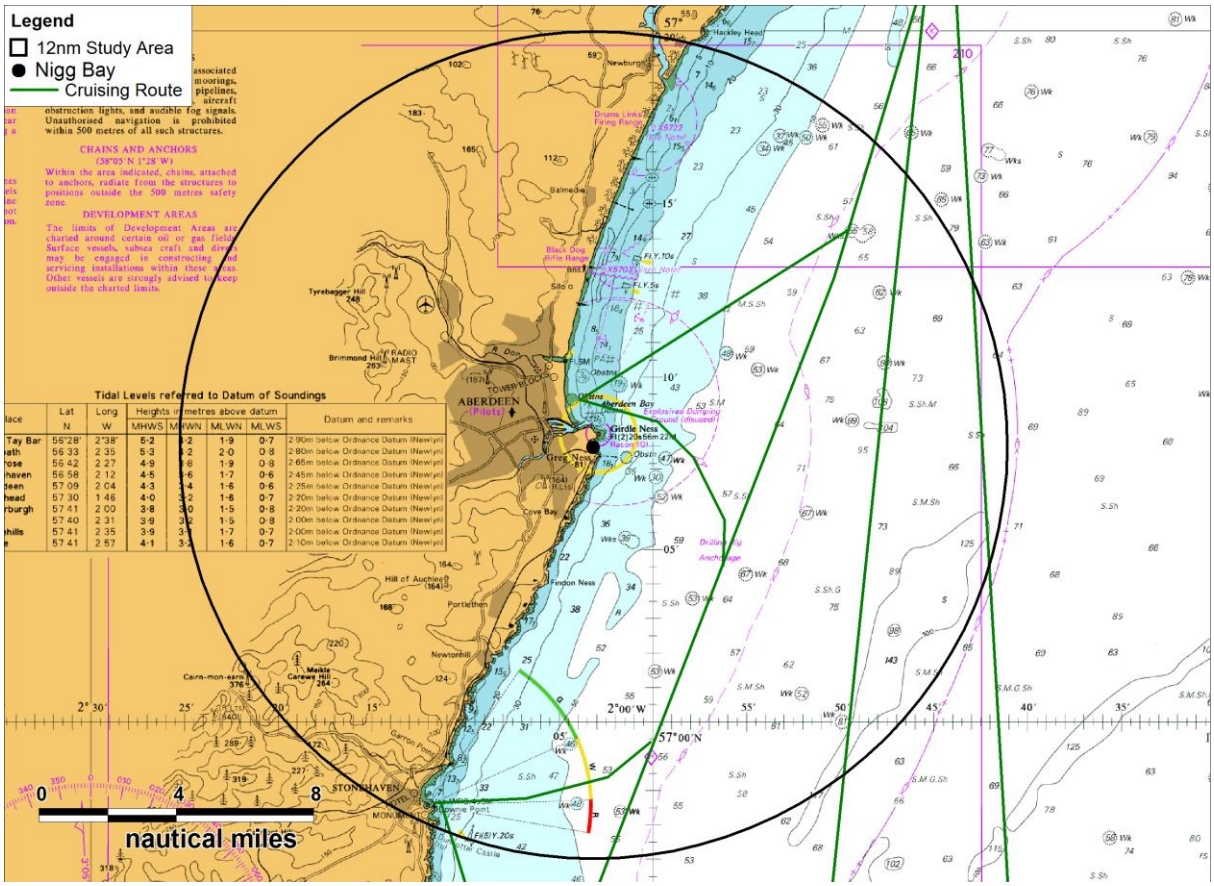

Figure 3.53 RYA Cruising Routes

There are eight routes intersecting the 12nm study area, two of which are associated with Aberdeen. All eight routes are classed as 'medium use', which is defined within the Coastal Atlas as a popular route on which some recreational craft will be seen at most times during summer daylight hours.

3.9.2 Summer

The summer recreational vessel data within the 12nm study area is presented in Figure 3.54.

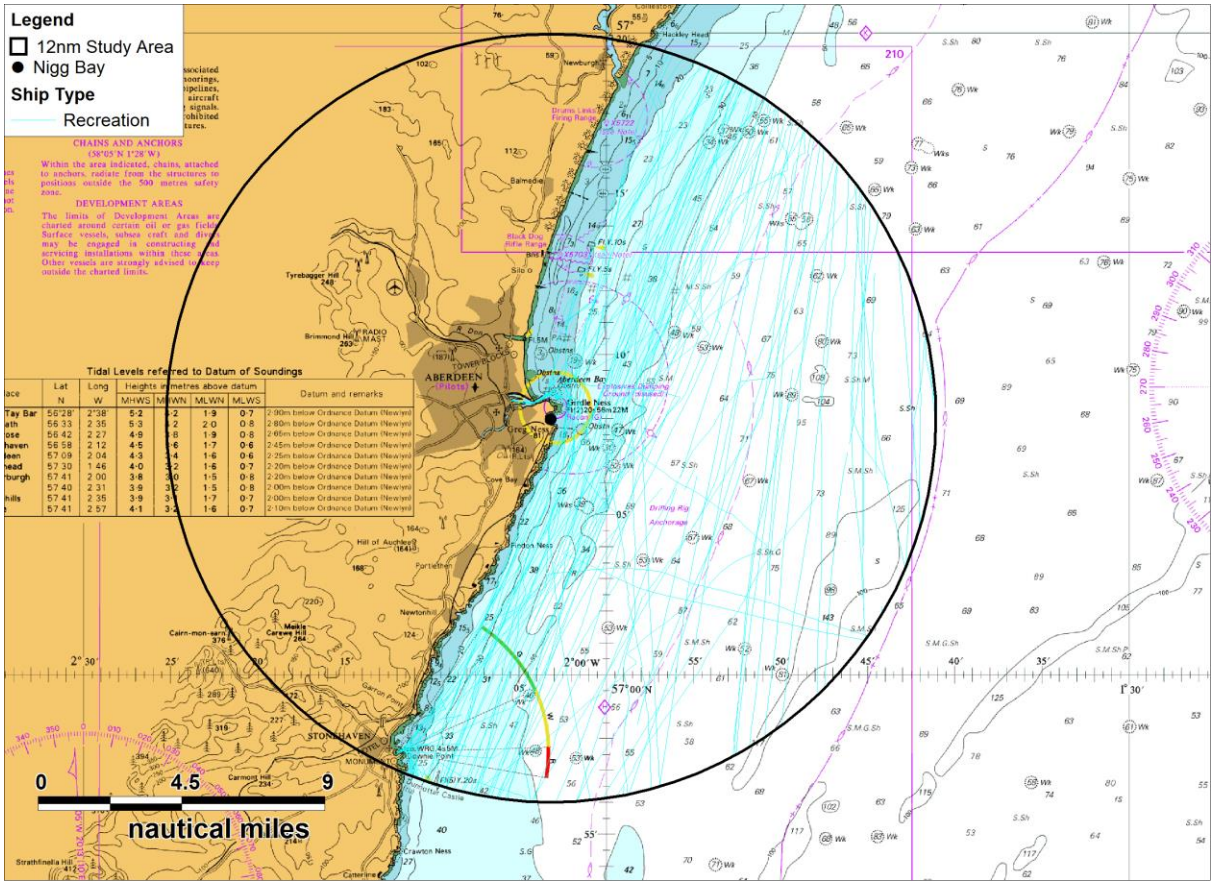

Figure 3.54 Summer AIS Recreational Vessel Tracks – 12nm Study Area

The recreational vessel activity within the 5nm study area is presented in Figure 3.55.

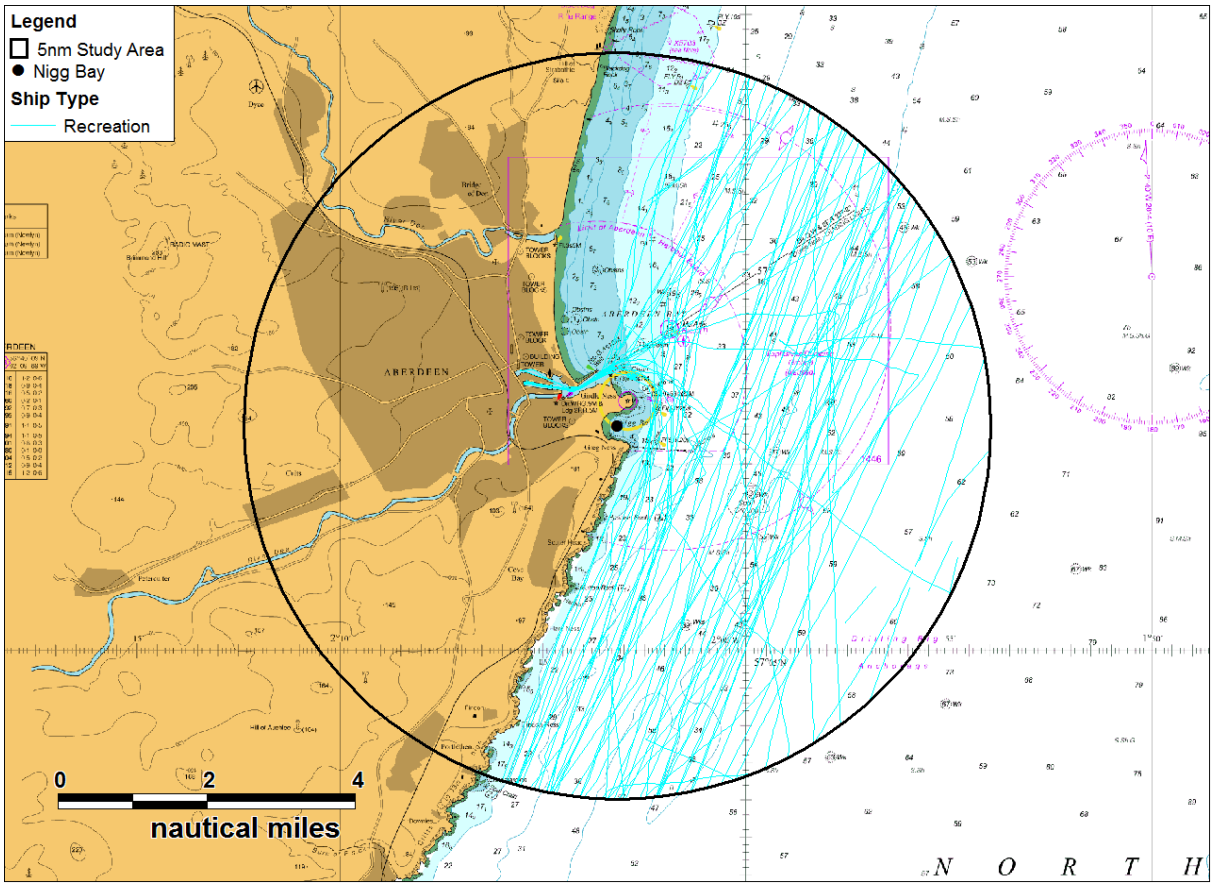

Figure 3.55 Summer AIS Recreational Vessel Tracks – 5nm Study Area

A total of 80 unique recreational vessels were seen within the 12nm study area, all of which were less than 25m in length.

The majority of recreation vessels were noted to be passing traffic. A total of 12 unique recreational vessels were seen crossing the Aberdeen Harbour entrance.

3.10 Anchored Vessel Analysis

3.10.1 Introduction

This section presents the tracks from vessels seen to be at anchor in the vicinity of Nigg Bay during both summer and winter. The anchorage areas relative to the study areas are presented in Figure 3.56.

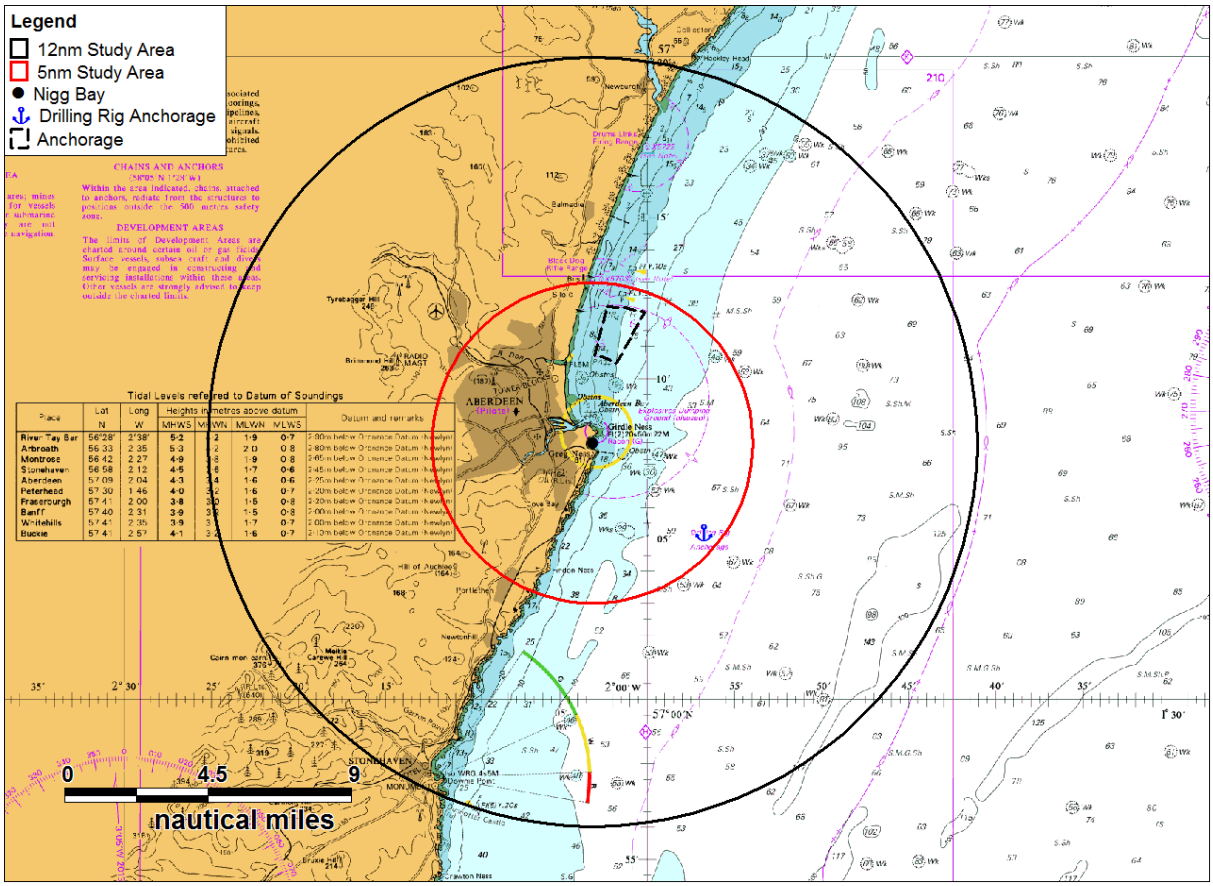

Figure 3.56 Anchorage Area North of the Harbour

There is a designated anchorage area in the vicinity of the harbour, located north of Aberdeen Harbour (to the north of Aberdeen VTS limits, between the port limits and the three nautical mile radio reporting point). An anchorage designated for drilling rigs is located 5nm south east of Nigg Bay. The North Sea Pilot Book (UKHO, 2009) states of Aberdeen Harbour that 'anchorage can be made in any part of it on a regular sandy bottom'. However, the bay is exposed to E winds'. It is also noted in the Aberdeen Harbour Marine Safety Management System (SMS) that 'anchoring within Aberdeen Harbour VTS limits is prohibited, except in an emergency, or with the express permission of VTS' (AH, 2014).

3.10.2 Anchoring Methodology

Vessels can transmit their navigation status via AIS, however they do not always do so in a timely manner. All AIS tracks from vessels within the AIS data that transmitted their navigation status as 'At Anchor' were checked to ensure their behaviour matched that of an anchored vessel. AIS tracks from vessels which transmitted a navigation status other than 'At Anchor' were used as input to Anatec's Speed Analysis model. The program uses a predefined set of parameters to detect any tracks that may be from an anchored vessel based on their speed and course. This output is then manually checked, and any tracks that can be confirmed as coming from an anchored vessel are added to the tracks from the first step.

3.10.3 Summer

The vessels that anchored within the 12nm study area during summer are presented in Figure 3.57.

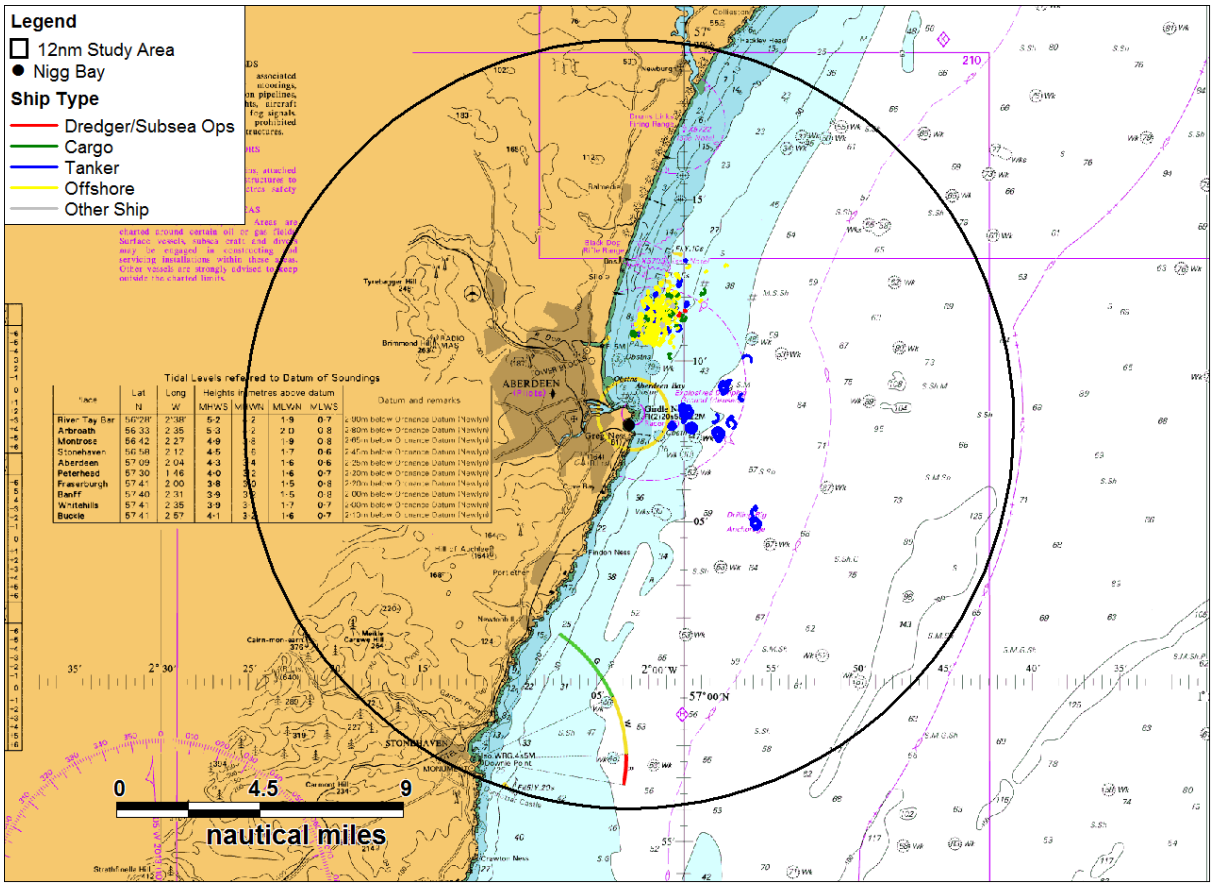

Figure 3.57 Summer Anchored Vessels – 12nm Study Area

A detailed overview of the summer anchoring activity relative to the 5nm study area is presented in Figure 3.58.

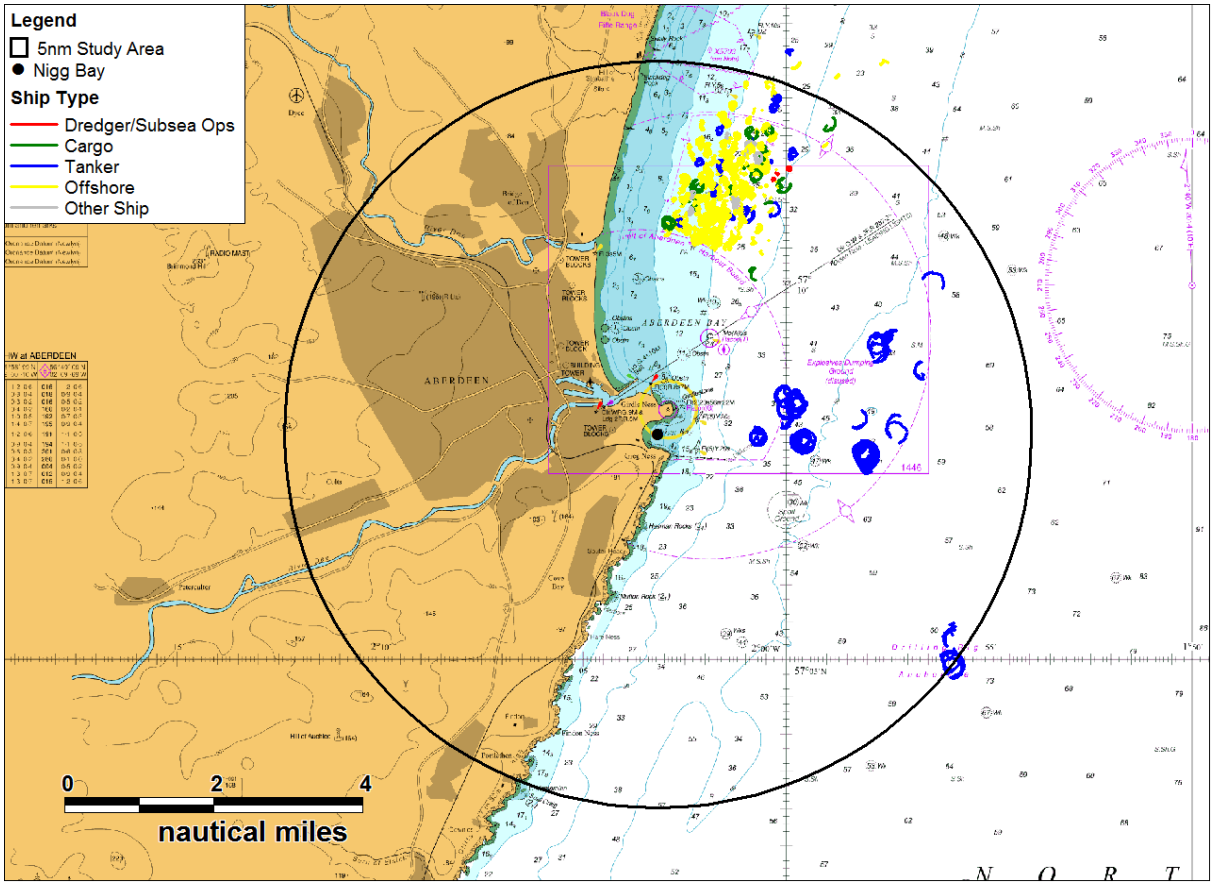

Figure 3.58 Summer Anchored Vessels – 5nm Study Area

It is seen that the vast majority of anchoring occurred within the designated anchorage north of the harbour, where on average 11 vessels a day were recorded as being at anchor. A total of seven large shuttle tankers were also recorded at anchor east of the harbour during this period, the closest approximately 1.2nm from Nigg Bay. One shuttle tanker was also seen anchoring at the drilling rig anchorage.

The type distribution of vessels anchored during summer (based on unique vessels per day) is presented in Figure 3.59.

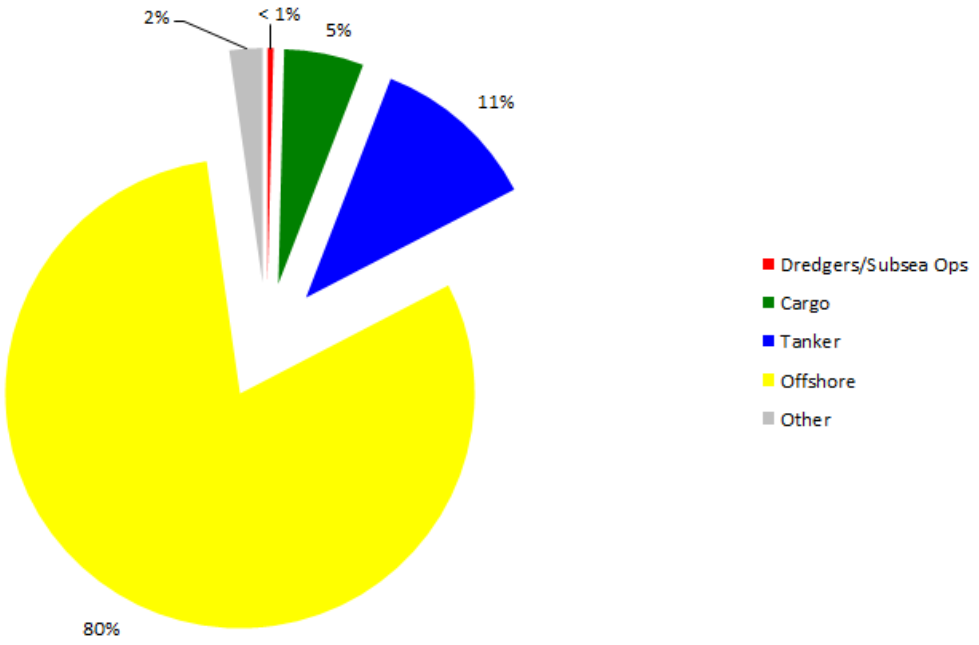

Figure 3.59 Anchored Vessel Type Distribution – Summer

The majority (80%) of anchored vessels were offshore vessels anchored north of the harbour. Tankers and cargo vessels made up 11% and 5% respectively.

3.10.4 Winter

The vessels at anchor during winter in the 12nm study area are presented in Figure 3.60.

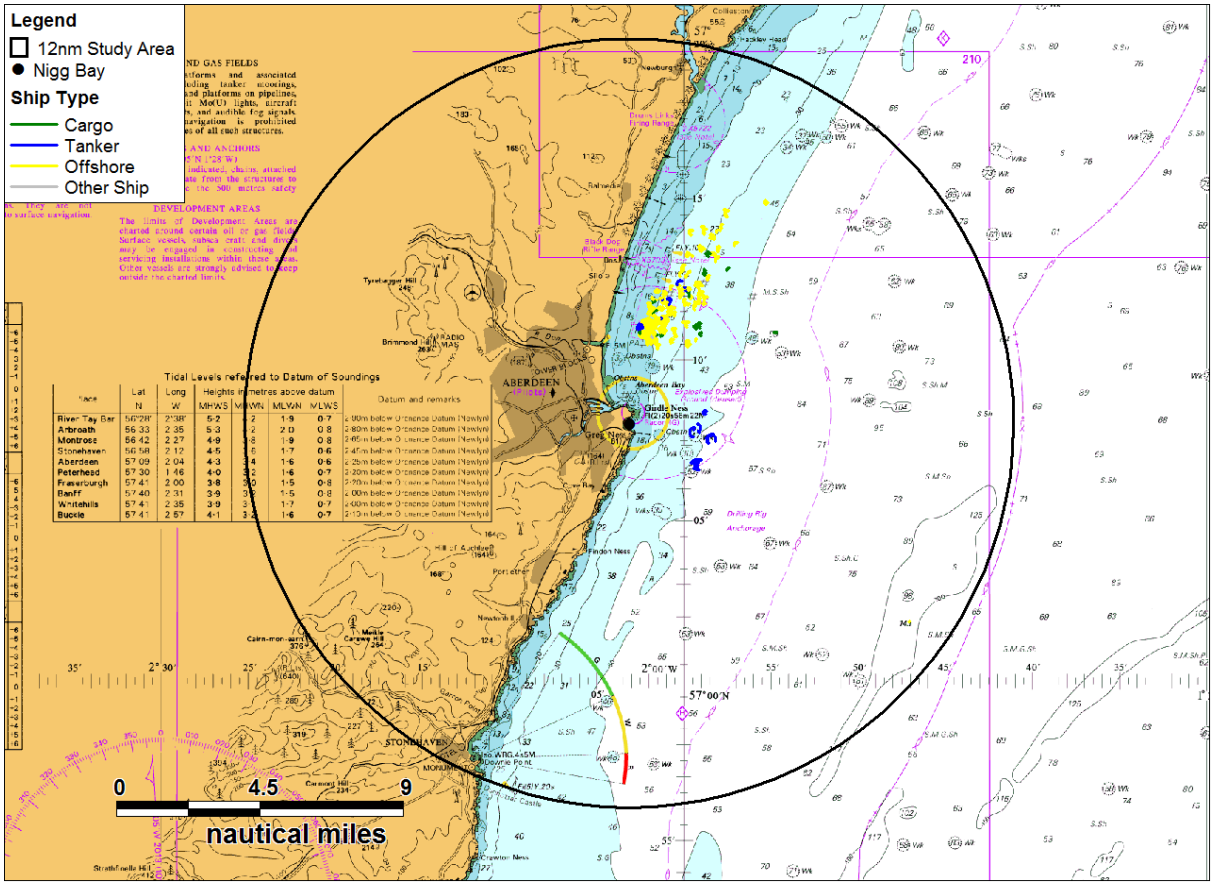

Figure 3.60 Winter Anchored Vessels – 12nm Study Area

The vessels at anchor during winter relative to the 5nm study area are presented in Figure 3.61.

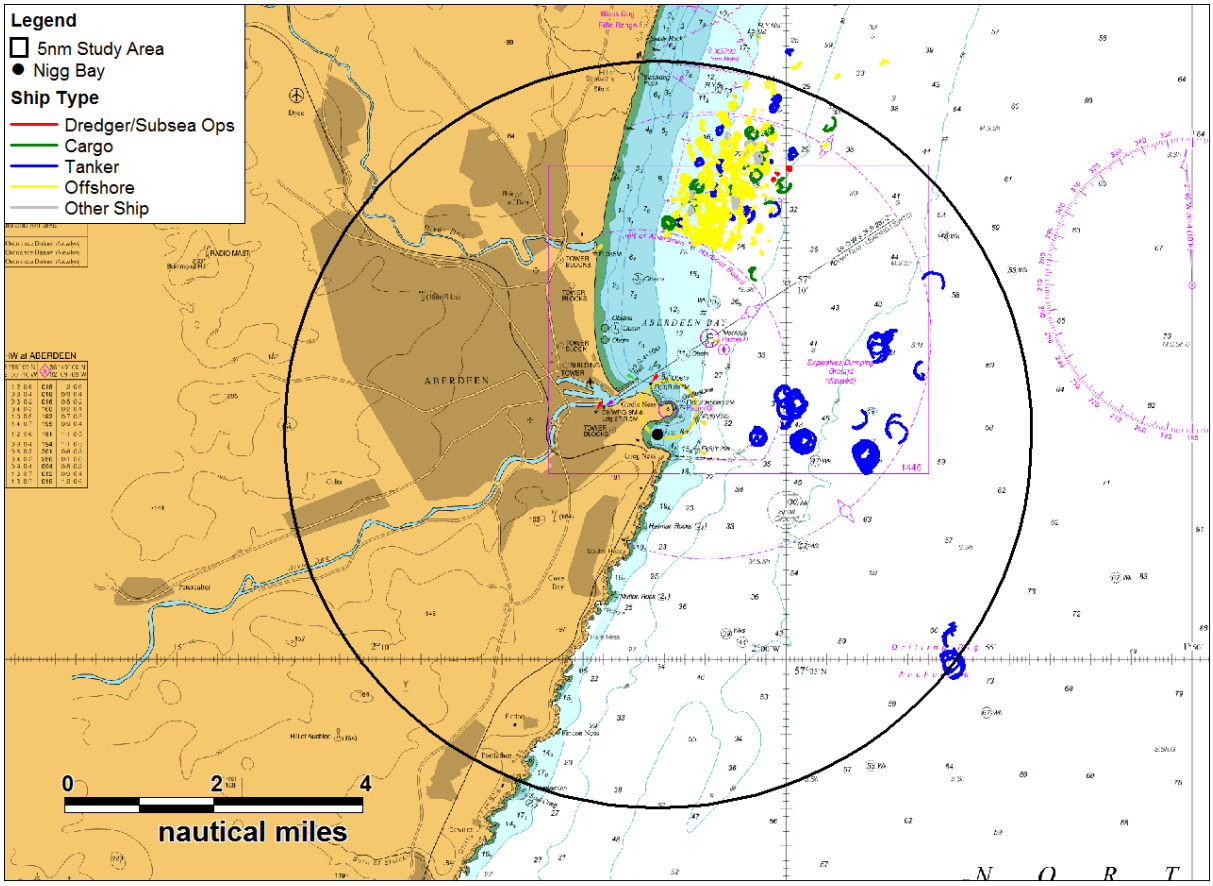

Figure 3.61 Winter Anchored Vessels – 5nm Study Area

Again, the majority of anchoring during winter occurred in the designated anchorage north of the harbour, however an average of four vessels per day were seen to use the anchorage compared to 11 in summer. Four shuttle tankers were recorded anchoring east of the harbour, with the closest being approximately 1.9nm from Nigg Bay.

The type distribution of anchored vessels in winter (based on unique vessels per day) is presented in Figure 3.62.

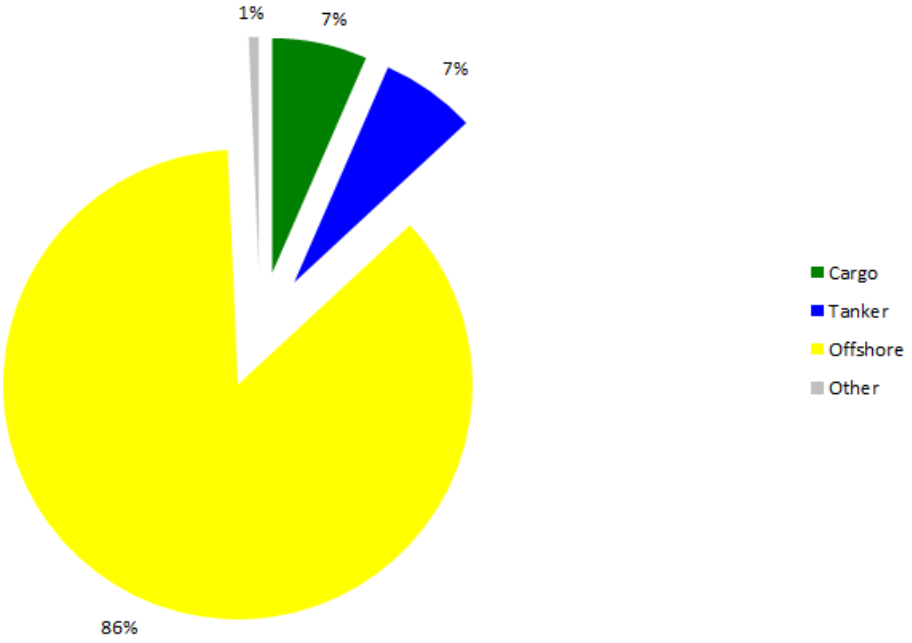

Figure 3.62 Anchored Vessel Type Distribution – Winter

Approximately 86% of anchored vessels were offshore vessels. Cargo vessels and tankers made up 7% each, with the remaining 1% being 'other' vessels.

4. Maritime Incidents

4.1 Introduction

This section presents data on maritime incidents recorded as occurring within the 12nm study area. Three data sources were used in the analysis, the Marine Accident Investigation Branch (MAIB), the Royal National Lifeboat Institution (RNLI), and internal reports created by Aberdeen Harbour Board.

4.2 MAIB

Incident data was available from the Marine Accident Investigation Branch (MAIB) for the 10 year period between 2004 and 2013. All UK commercial vessels are required to report to MAIB. Non-UK vessels are not obliged to report unless they are in a UK port or are within the UK 12nm territorial limit and carrying passengers to a UK port. There are no requirements for non-commercial recreational craft to report accidents to MAIB. MAIB aim for 97% accuracy when reporting the locations of incidents.

A plot of the number of recorded incidents per year within the 12nm study area between 2004 and 2013 is presented in Figure 4.1.

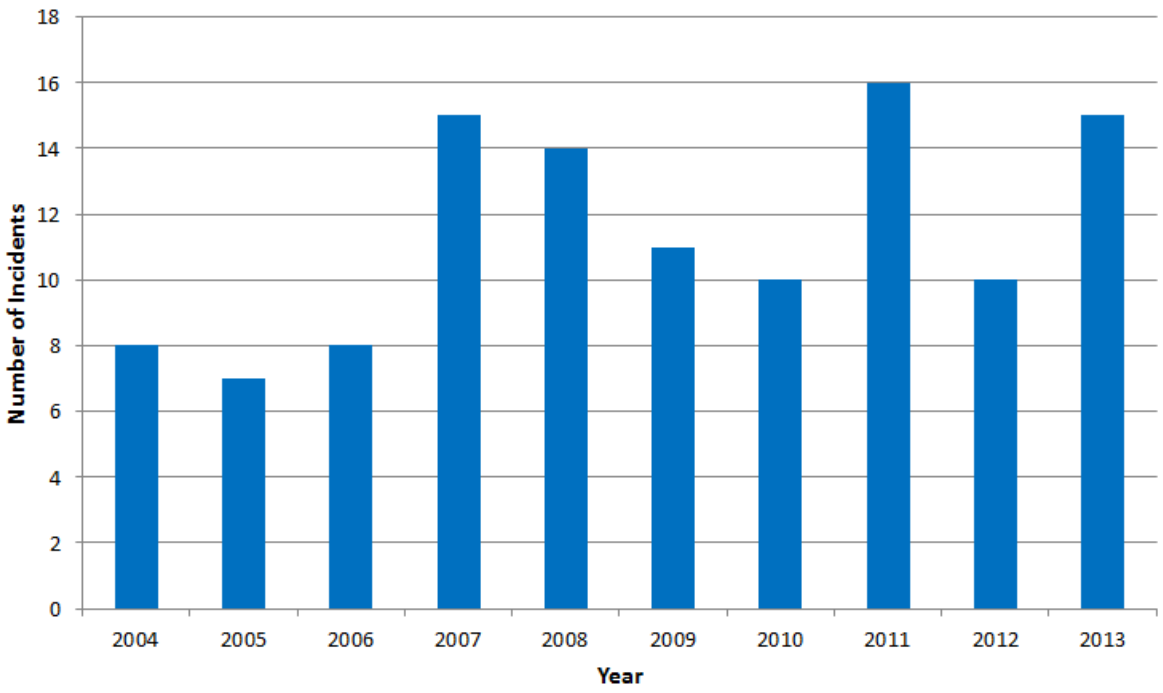

Figure 4.1 MAIB incident numbers – 2004 to 2013

An average of 11 incidents per year were recorded within the study area between 2004 and 2013.

The MAIB incident data recorded within the 12nm study area is presented in Figure 4.2. Inland (river) incidents have been excluded.

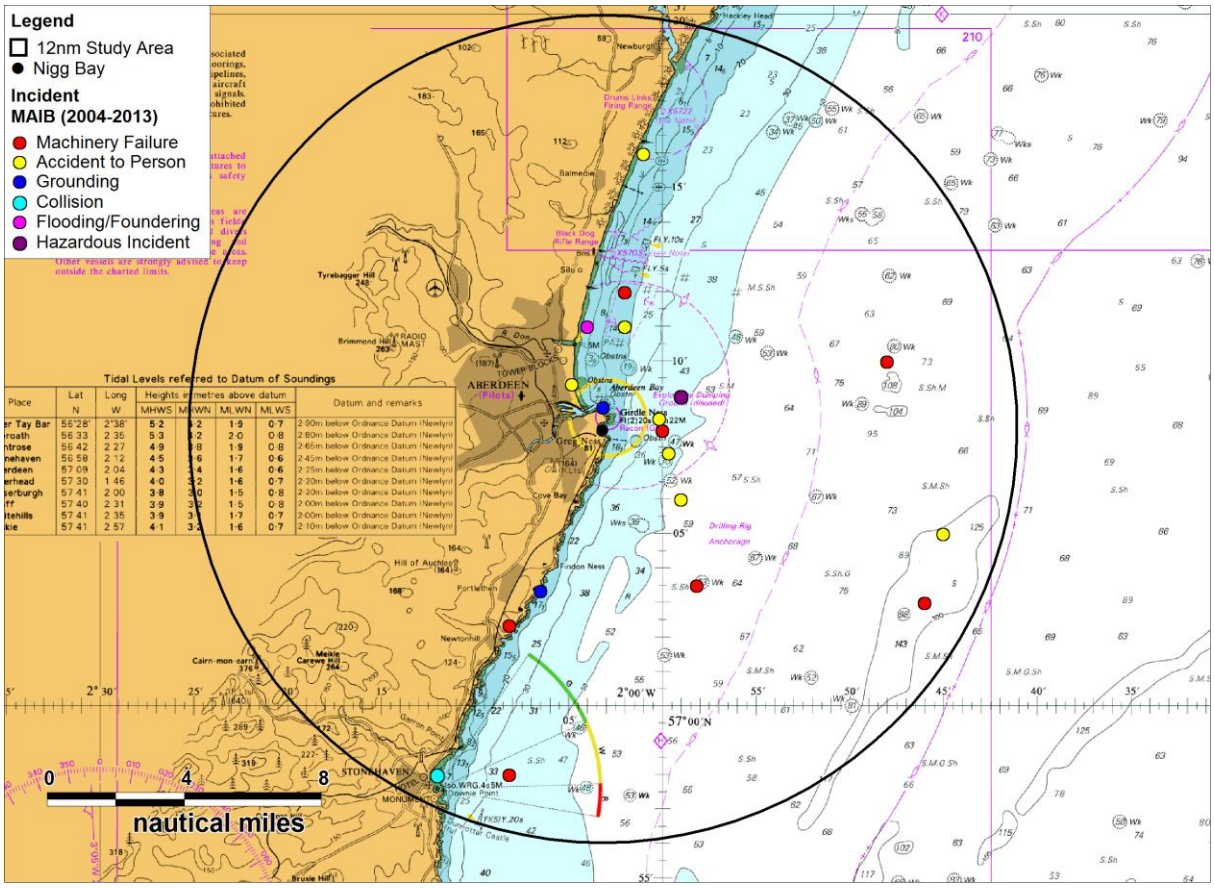

Figure 4.2 MAIB Recorded Incidents 2004 to 2013

It is noted that the majority (89 out of 91) of incidents recorded as occurring within the 'Port/Harbour Area' were grouped by MAIB into one geographical location just outside the current harbour. This is a limitation of the MAIB data, where the specific location is sometimes grouped to a nearby point. These incidents have been excluded from the above figure. The distribution of the types of the excluded incidents is presented in Figure 4.3.

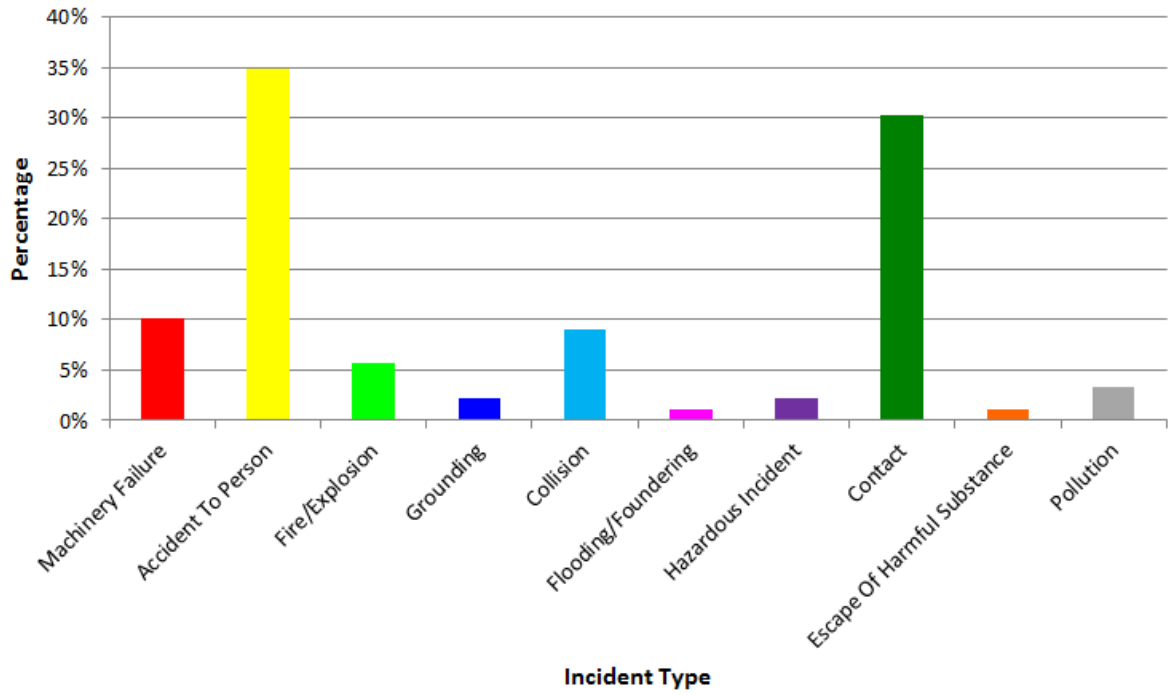

Figure 4.3 MAIB Incident Distribution within Aberdeen Harbour 2004 to 2013

The distribution of all incidents by type is presented in Figure 4.4. This figure is inclusive of the incidents occurring in the 'Port/Harbour Area'.

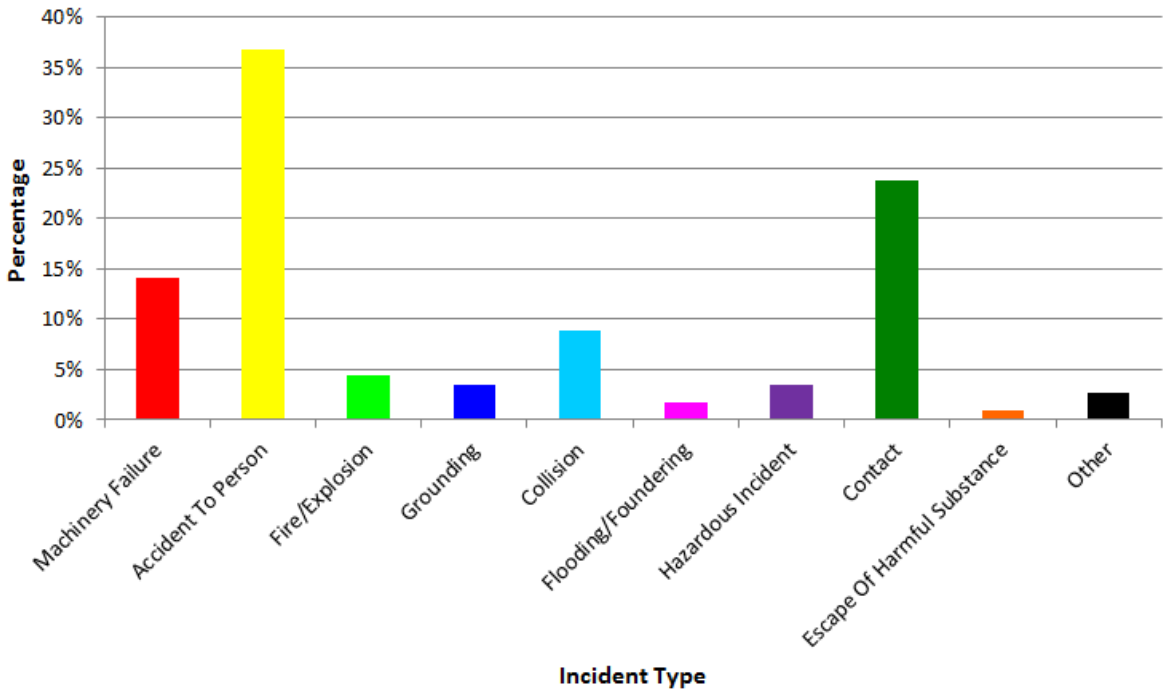

Figure 4.4 MAIB Incident Distribution 2004 to 2013

Approximately 37% of incidents were recorded as an 'accident to person', and a further 24% as 'contact'. Contact refers to a ship making contact with a static object. 'Machinery failure' was responsible for 14% of incidents, and 'collision' a further 9%, where collision involves two moving objects. No other type represented more than 5% of incidents.

4.3 RNLI

RNLI incident data was analysed between 2001 and 2010, which was the latest available to the study. Incidents occurring inland (river) have been excluded in the following analysis. Incidents occurring within the internal part of the current harbour have also been excluded, however incidents occurring in the vicinity of the current breakwaters have not.

The number of incidents per year between 2001 and 2010 are presented in Figure 4.5.

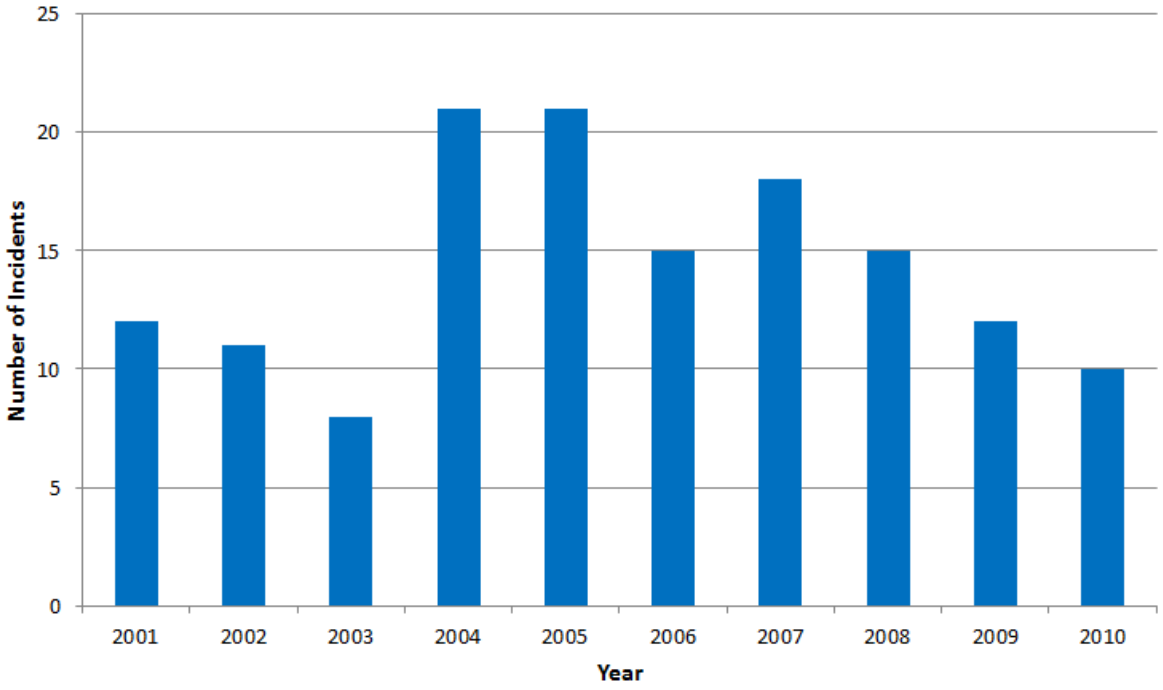

Figure 4.5 RNLI incident numbers – 2001 to 2010

The incidents recorded within the 12nm study area are presented in Figure 4.6.

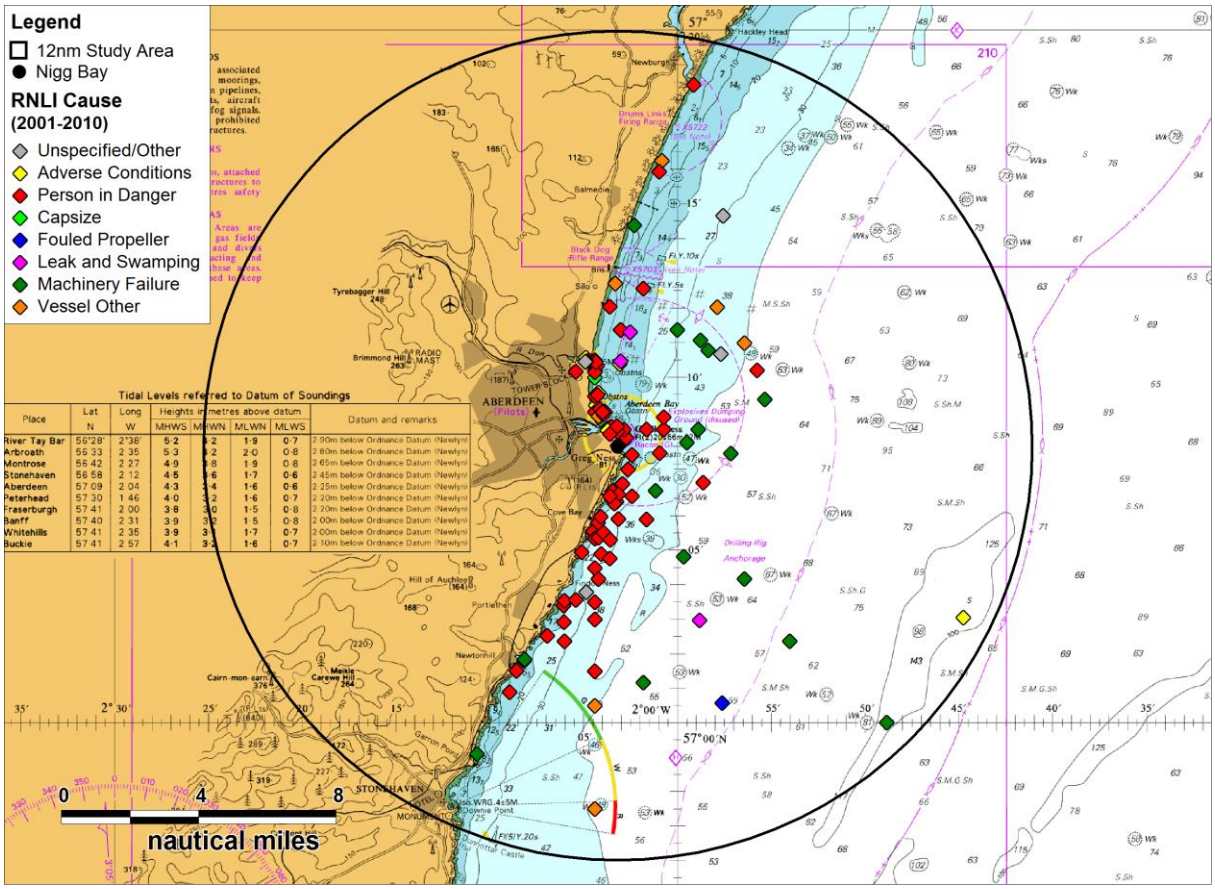

Figure 4.6 RNLI Recorded Incidents 2001 to 2010 – 12nm Study Area

The locations of incidents recorded in the vicinity of the current harbour were reported more accurately within the RNLI data than in the MAIB data. A zoomed in plot of the incidents recorded in the 5nm study area is presented in Figure 4.7.

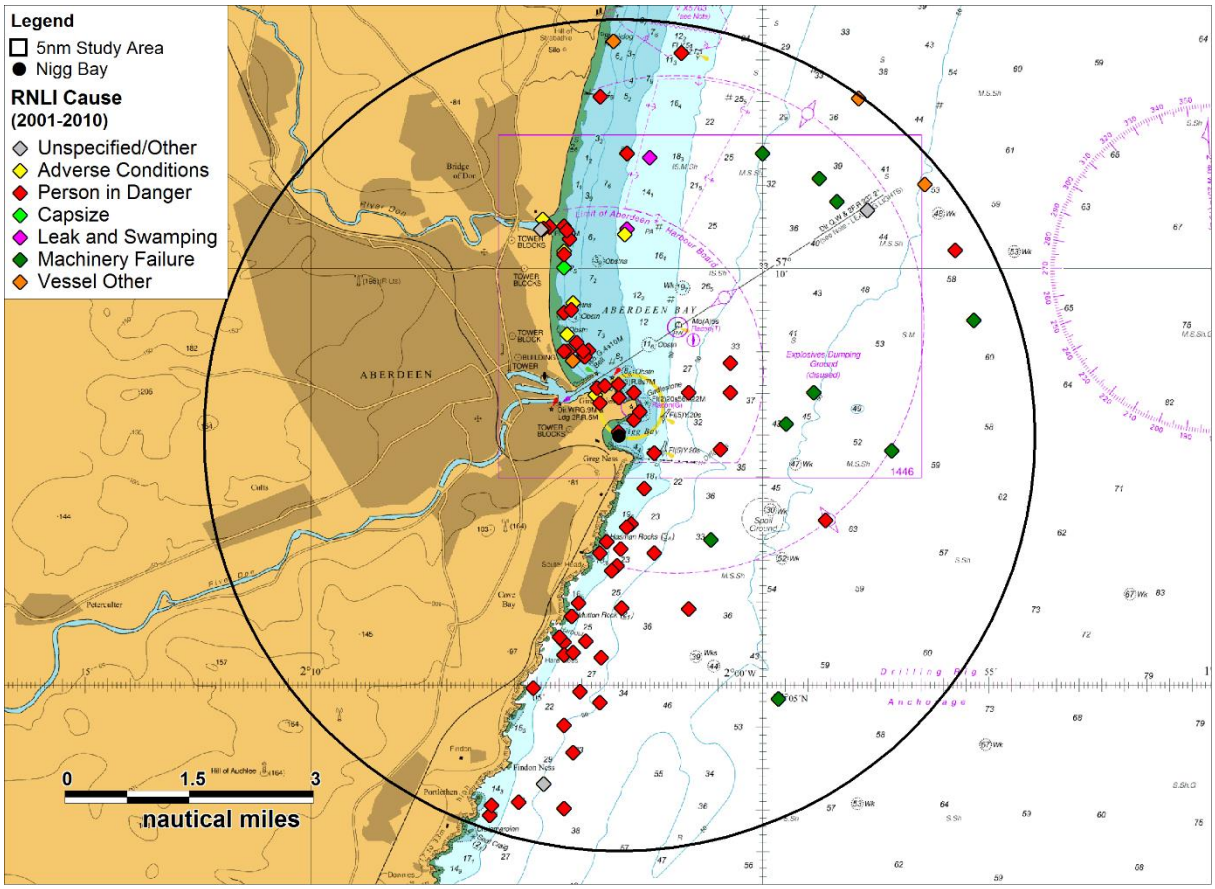

Figure 4.7 RNLI Recorded Incidents 2001 to 2010 – 5nm Study Area

The distribution of incidents by cause is presented in Figure 4.8.

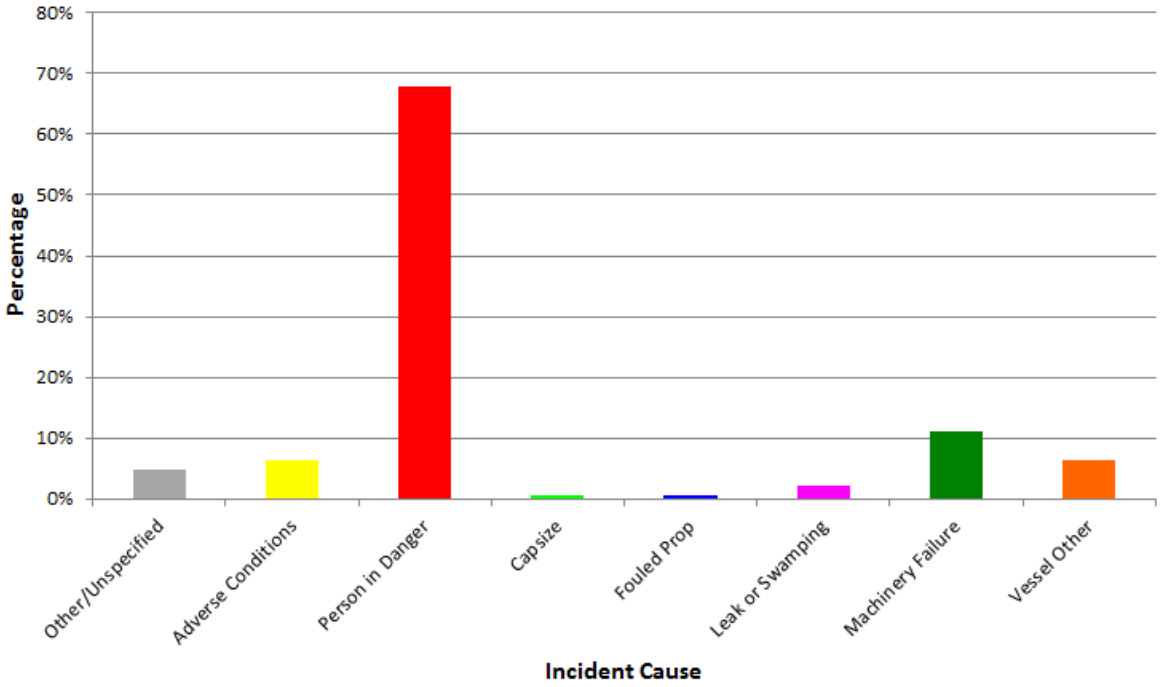

Figure 4.8 RNLI Incident Cause Distribution 2001 to 2010

Similarly to the MAIB data, the most common incident type was 'person in danger', with approximately 68% of incidents falling into this category, although in the case of the RNLI data set many of these incidents involved people rather than vessels, e.g. 'person in danger' incidents related to individuals rather than vessels. A further 11% of incidents occurred as a result of 'machinery failure'. 'Adverse conditions' and 'vessel other' each represented 6% of incidents.

4.4 Aberdeen Harbour Incident Assessment

It is noted that safety constitutes a major part of Aberdeen Harbour Board's strategic plan. The level of compliance goes above and beyond that required by UK Health and Safety legislation and the Port Marine Safety Code. Both collective and individual responsibility is guided by the Marine Safety Management System, ensuring compliance on safety issues.

The harbour incident baseline is low. Details of the number of incidents per 1,000 vessel movements are contained in Table 4.1. A port accident study (PSS, 2012) is regularly conducted by Port Skills and Safety (a UK port membership organisation). This analyses the incident frequency for thirteen participating UK ports including Aberdeen Harbour. The Aberdeen Harbour ratio is consistently beneath the annual average for this group of ports.

Table 4.1 Average Number of Incidents (*per 1,000 vessel movements)

Year	Aberdeen Incidents*	UK Port Study*
2008	1.07	1.88
2009	1.31	
2010	0.77	1.75
2011	0.60	1.19
2012	0.96	1.08
2013	1.14	

Incident records are classified by type, those relevant to shipping and navigation are reproduced in Table 4.2 below. This indicates that incidents with the potential for severe consequences (grounding/fire/explosion) are in the minority when compared to the other incident causes.

Table 4.2 Breakdown of Incident Cause (only relevant incidents)

Year	Grounding	Hard Landing / Berthing	Machinery / Equipment Failure	Fire / Explosion	Close Quarters / Near Miss
2008	7%	56%	18%	4%	7%
2009	-	28%	21%	3%	21%
2010	11%	63%	5%	-	16%
2011	6%	44%	12%	-	13%
2012	15%	37%	30%	-	7%
2013	7%	40%	33%	-	4%

While the new harbour development does present a number of variations to the current harbour (potential for larger vessels etc.), it is expected to have the same structured safety culture and compliance system.

5. Vessel Encounters

5.1 Introduction

The AIS data was analysed to identify all vessel 'encounters'. An encounter was classed as occurring when two vessels passed within 500m of each other in the same minute. These tracks were then assessed in terms of density, vessel numbers, and ship type.

Anchored vessels and pilot vessels have been excluded from the encounters analysis. Vessels within the current harbour, up to the breakwaters, have also been excluded.

5.2 Density of Encounters

The density of recorded encounters is presented in Figure 5.1.

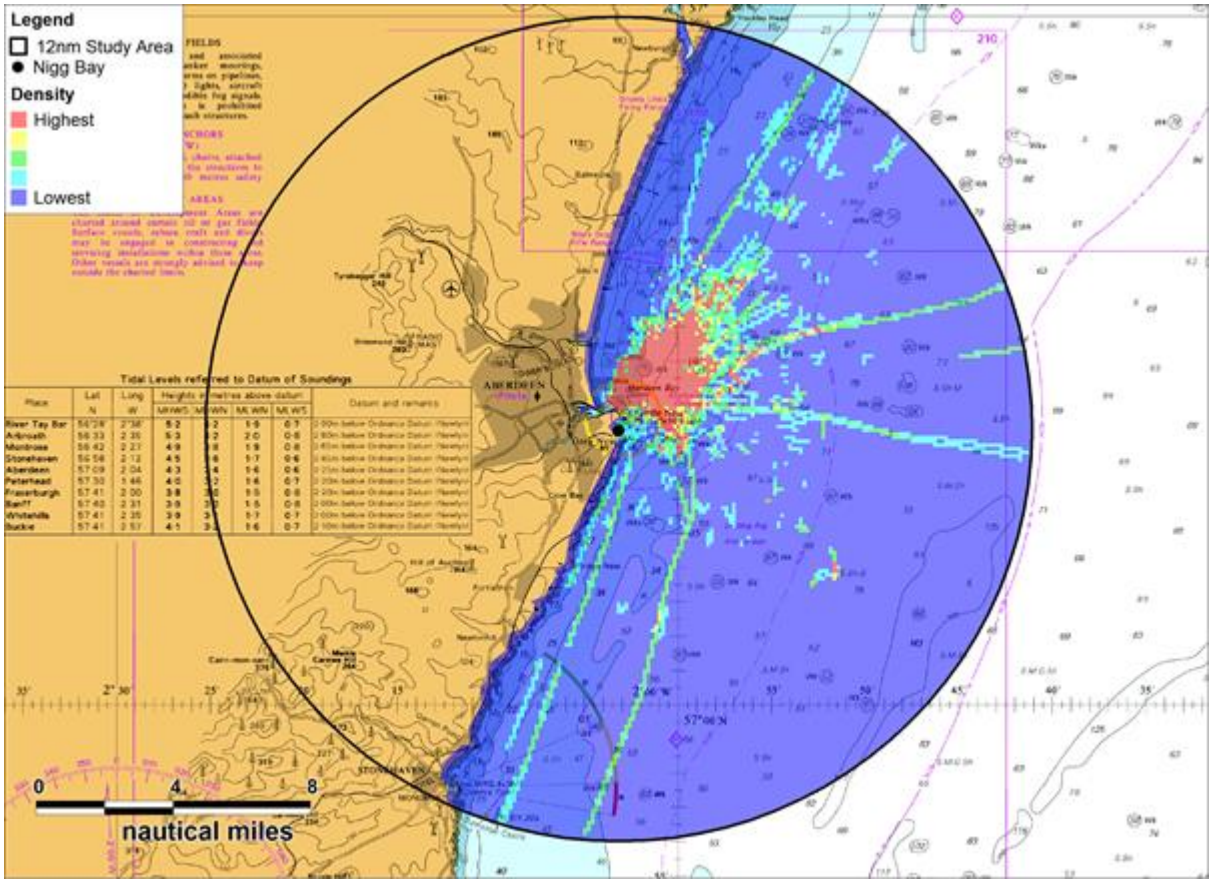

Figure 5.1 Encounters Density (2014)

It is seen that the most significant area in terms of vessel encounters is just north of the harbour, in an area extending approximately 2nm east of Nigg Bay, and 3nm north. The density was generally very low in all other parts of the study area.

5.3 Encounter Numbers

A total of 1,645 encounters were recorded over the four months, 1,087 in summer and 558 in winter. Daily counts of encounters are presented for January, February July and August in Figure 5.2, Figure 5.3, Figure 5.4, and Figure 5.5 respectively.

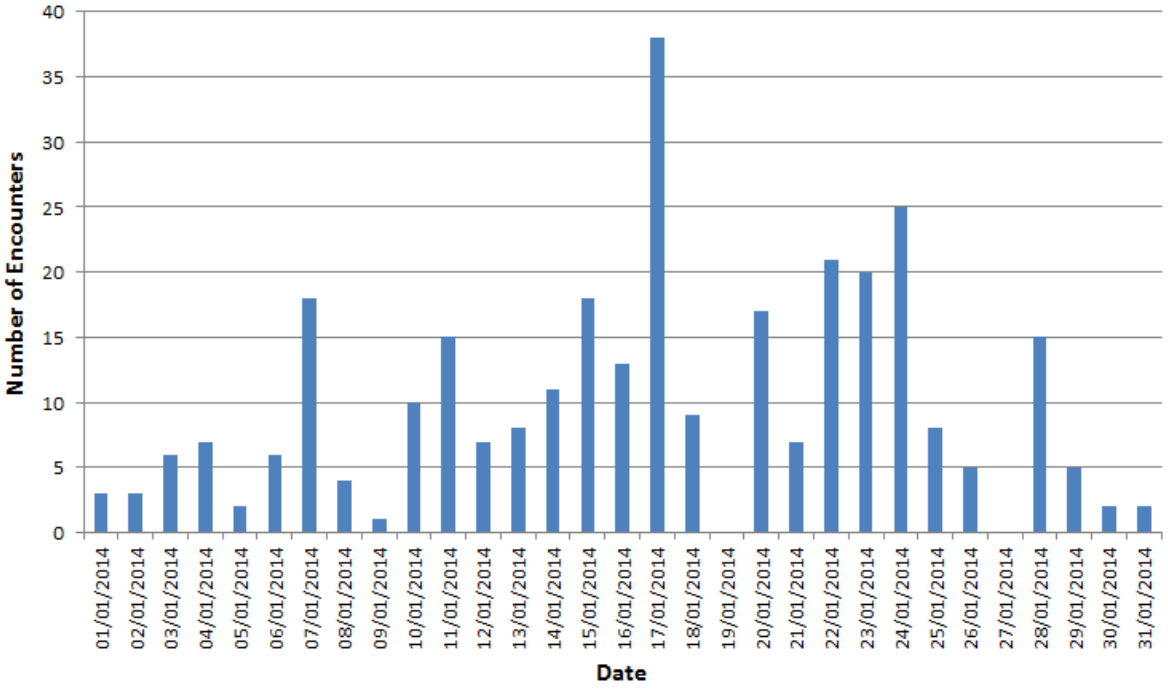

Figure 5.2 January Daily Encounters

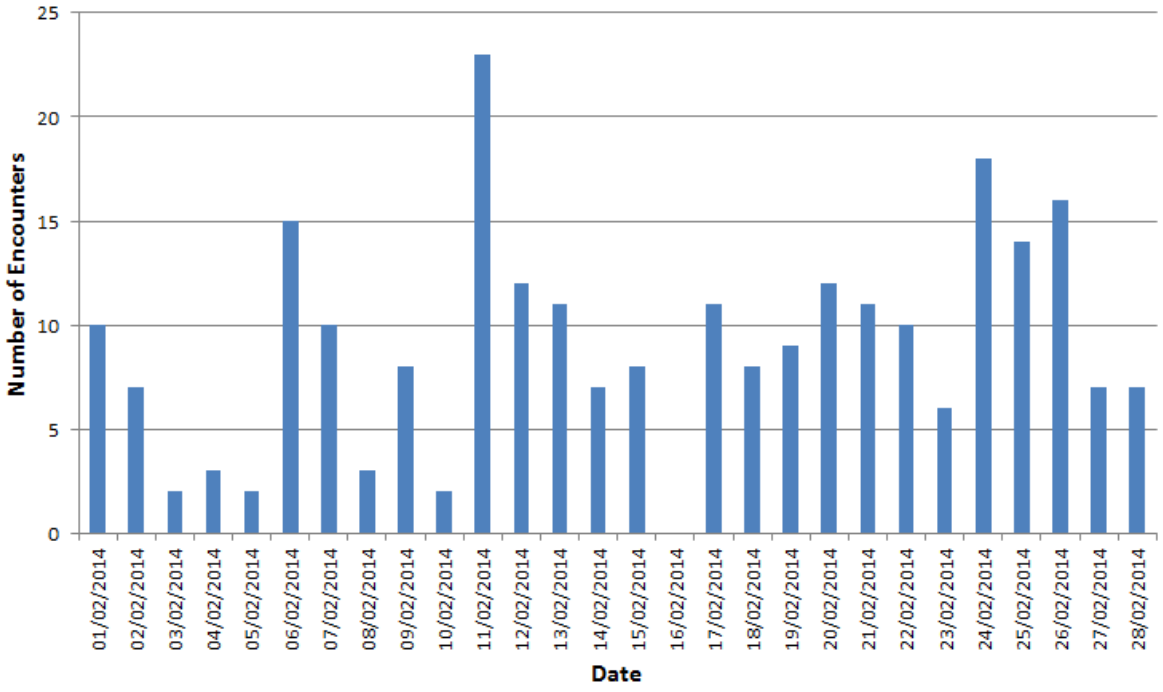

Figure 5.3 February Daily Encounters

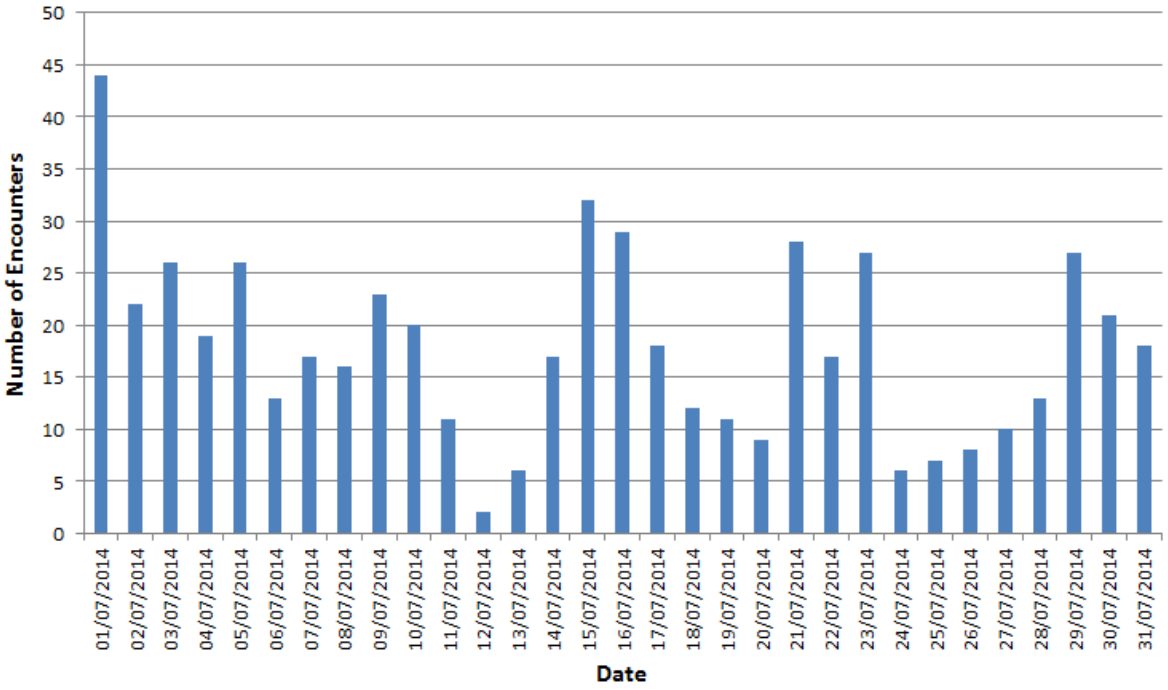

Figure 5.4 July Daily Encounters

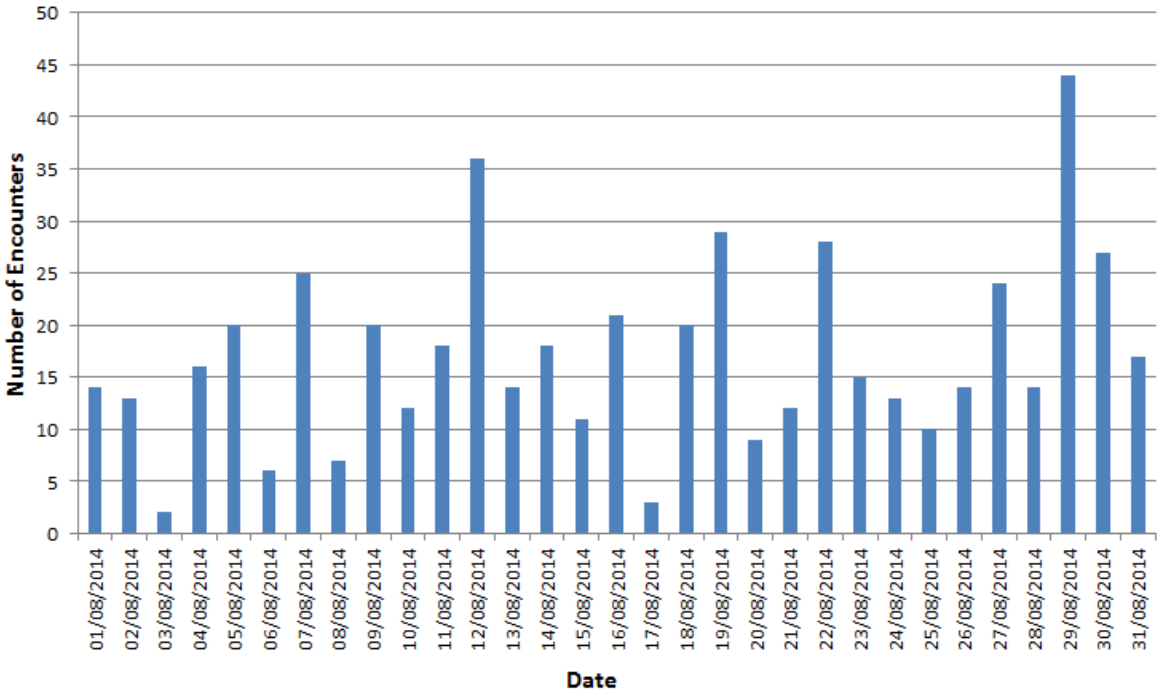

Figure 5.5 August Daily Encounters

There was an average of 14 encounters per day recorded over the combined summer/winter period (18 on average in summer, and 9 in winter). The busiest days were both recorded in summer, when 44 encounters were recorded on the 1st July and the 29th August.

5.4 Encounters by Vessel Type

The locations of the recorded encounters (vessel tracks when encountering each other) are presented in Figure 5.6.

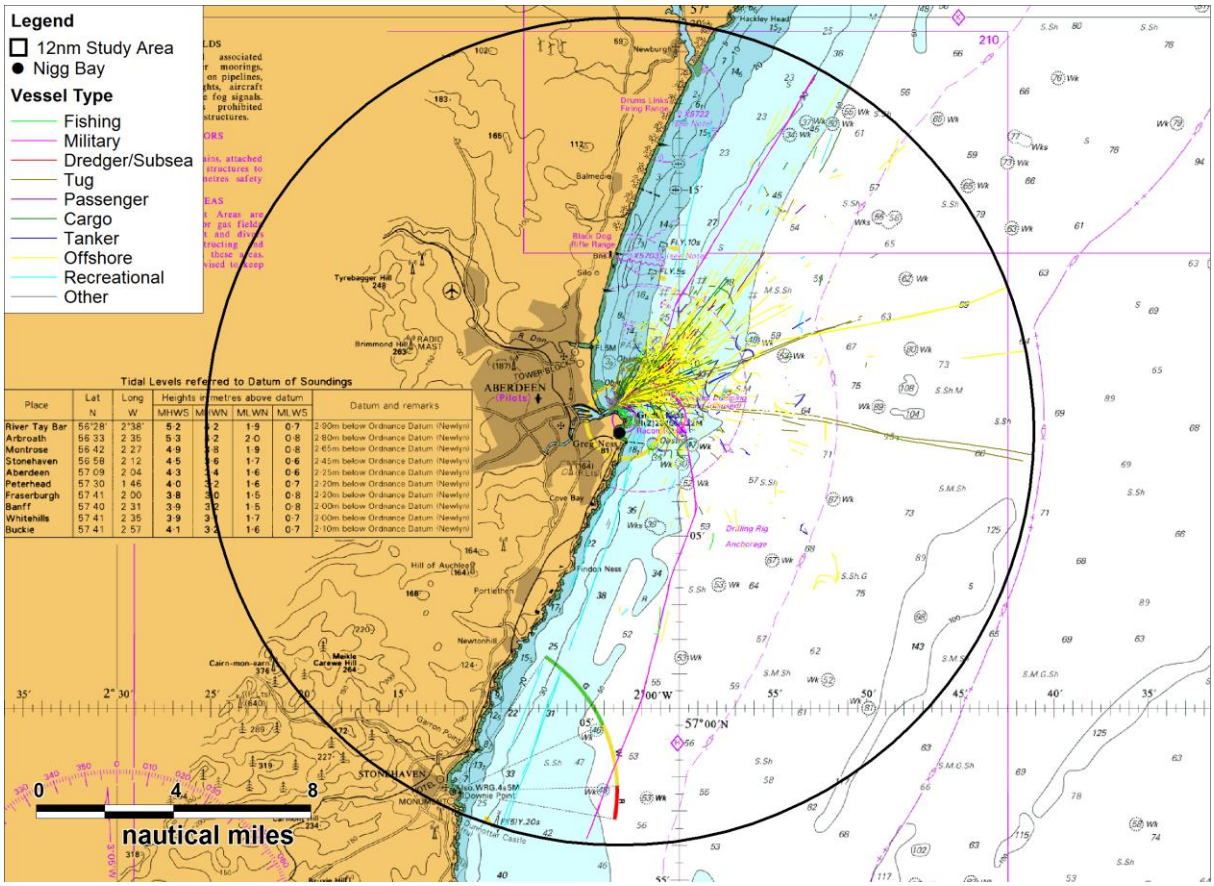

Figure 5.6 Encounters by Vessel Type

The type distribution within the encounters is presented in Figure 5.7.

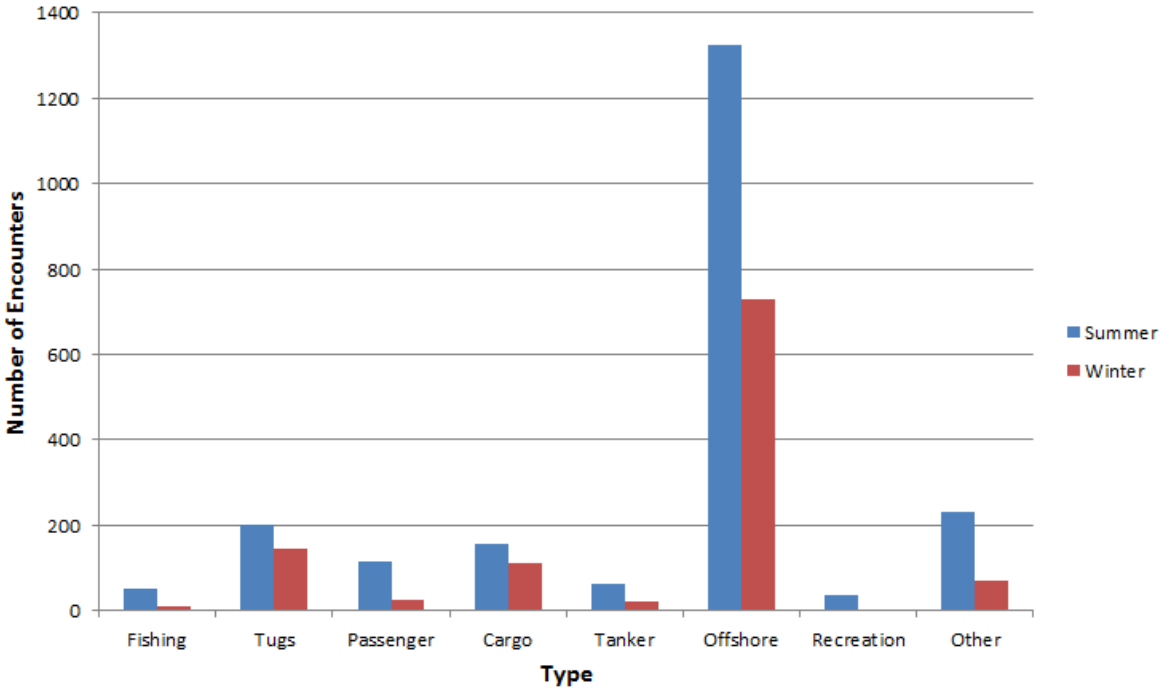

Figure 5.7 Encounter Type Distribution

The majority of vessel encounters involved offshore vessels (61% of vessels in summer and 65% in winter). Other significant categories were tugs (9% in summer and 13% in winter), 'other' (11% in summer and 6% in winter) and cargo (7% in summer and 10% in winter).

These proportions are in line with the proportions of traffic identified by the shipping and navigation baseline (section 3).

6. Ship to Ship Collision Risk

6.1 Introduction

The 'Ship to Ship' model within Anatec's COLLRISK software was used to estimate the current risk of a vessel to vessel collision in the vicinity of Aberdeen Harbour. The future case was then assessed, based on projections on the rise in shipping as a result of the new development.

The AIS data was used to identify the regular shipping routes used by vessels within the 5nm study area. The number of vessels using each route, broken down by vessel type and size, was then estimated. This information was used by the Ship to Ship model to estimate the collision frequency. Recreational vessels, fishing vessels, and any temporary or non-routine traffic were not included in this route analysis.

The 5nm boundary was decided on after consideration of the shipping and navigation baseline data. This boundary would capture the vessels associated with the harbour and those transiting nearby ensuring that the results are relevant to Nigg Bay and not distorted by more distant traffic passing through the area at a greater distance, in open water and not impacting on or being impacted by the coastal traffic. While the 12nm limit was useful in the shipping and navigation baseline to ensure that the assessment established all the traffic in the area, the distant passing traffic is screened out of the encounters modelling.

6.2 Methodology

The Ship to Ship model uses a durations grid to estimate the collision frequency within an area of interest. Each cell of a durations grid contains details of the number of hours annually that vessels spent on passage in 12 course groups (each spanning 30°) within the cell boundaries. The model uses these groups and the corresponding durations (broken down by vessel type and size) to estimate the number of head on, overtaking, and crossing encounters expected in each cell, and the types and sizes of the vessels involved. Encounters are defined as follows:

- Head-on: two vessels on reciprocal or nearly reciprocal courses (60° either side of head-on);
- Overtaking: one vessel coming up with another vessel with a course difference of less than 60°; and
- Crossing: all other encounters.

The number of collisions is then calculated based on the following factors, which have been calibrated within the model based on an internal analysis performed on 20 years of historical collision data in UK waters:

- Vessel types;
- Vessel sizes;

- Vessel speeds;
- Encounter situation (head-on, overtaking, crossing)
- Visibility

6.3 Base Case

The mean positions of the main routes identified within the base case are presented in Figure 6.1.

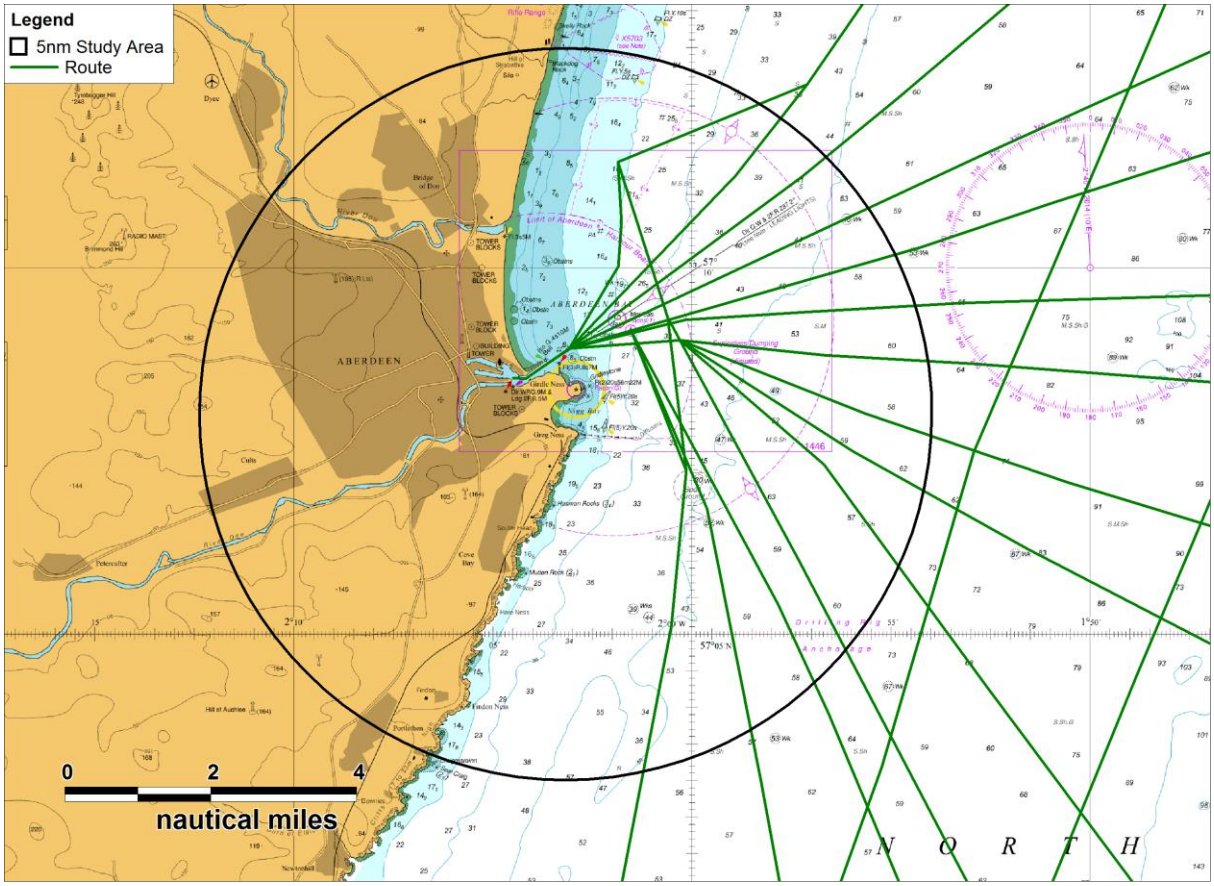

Figure 6.1 Base Case Route Centrelines

The total ship to ship collision risk was estimated to be 8.39 x 10^{-3}, which corresponds to a return period of 119 years, that is, a vessel will be involved in a collision once per 119 years. The results of the base case model run are presented graphically in Figure 6.2.

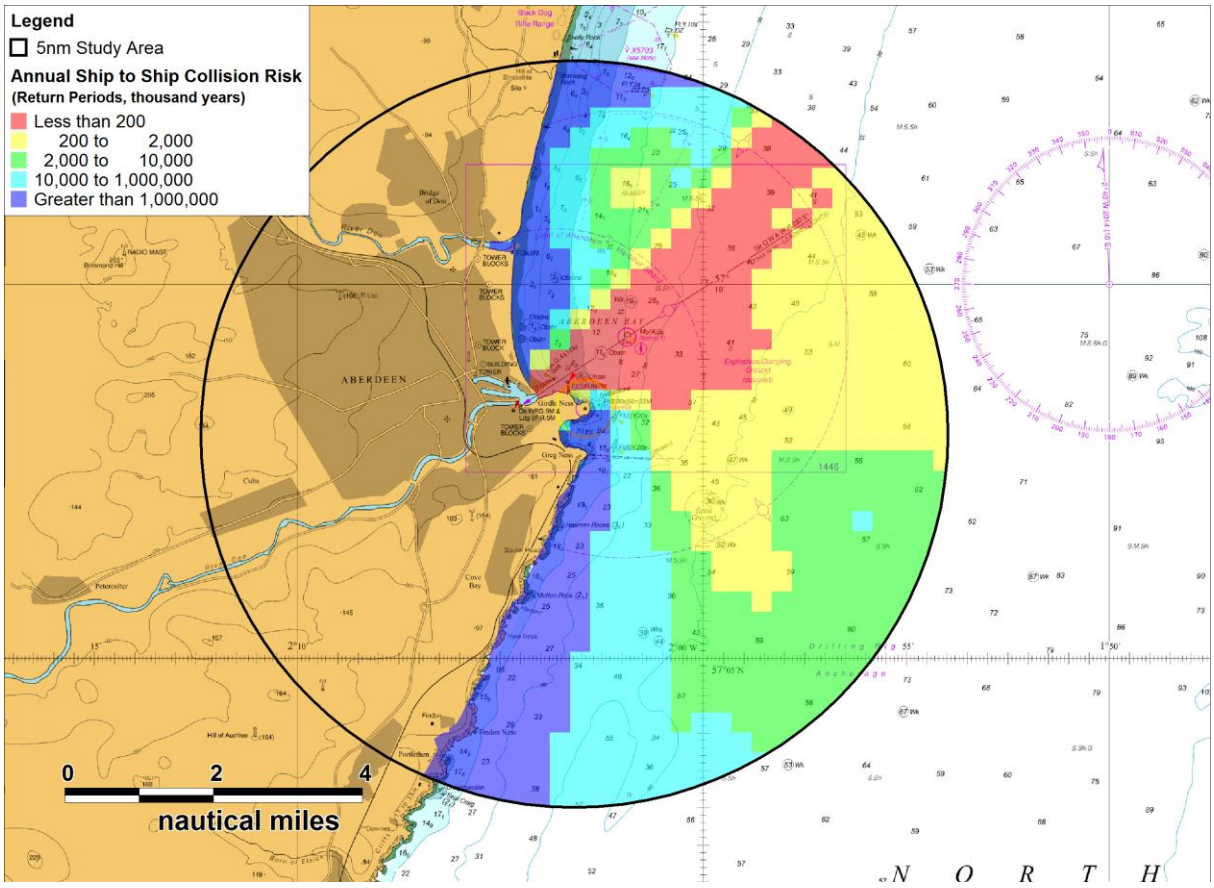

Figure 6.2 Ship to Ship Collision Risk Results

It is seen that the significant ship to ship risk was caused by vessels on routes bound NE from the current harbour. Medium risk was also noted in the approach from the east, with lower risk in the SE approach. The lowest areas of risk were in coastal regions, including Nigg Bay.

6.4 Future Case

In order to assess the impact of the new harbour development on ship to ship collision risk, increases in shipping traffic in the vicinity of Nigg Bay were estimated and used to create a future case route set. It is noted that future traffic levels and distributions are difficult to predict. For this reason the assumptions made in the future case modelling are based on a realistic worst case scenario. The assumptions made are as follows:

- There will not be a decrease in traffic to the current harbour;
- The new harbour will cause an increase of 50% in the current level of traffic associated with Aberdeen Harbour;
- Because the current harbour is at capacity all of the new future traffic will berth in Nigg Bay (this still accounts for the switching of traffic, like for like, between the harbours);

- Vessels bound for Nigg Bay will continue to use the designated anchorage before entering Nigg Bay;
- Cruise ships (or equivalent passenger vessels) will call at Nigg Bay (equivalent to a single call per fortnight, accounting for peak calls during the summer);
- With the exception of passenger vessels (new cruise ship capacity), type distributions to the new development will remain similar to those at the current harbour;
- Vessel sizes using the new routes will increase compared to the base case (as larger vessels can now be accommodated); and
- Passing traffic (vessels not associated with Aberdeen Harbour) will increase by 10%.

The new routes associated with Nigg Bay are presented in Figure 6.3 relative to the base case routes.

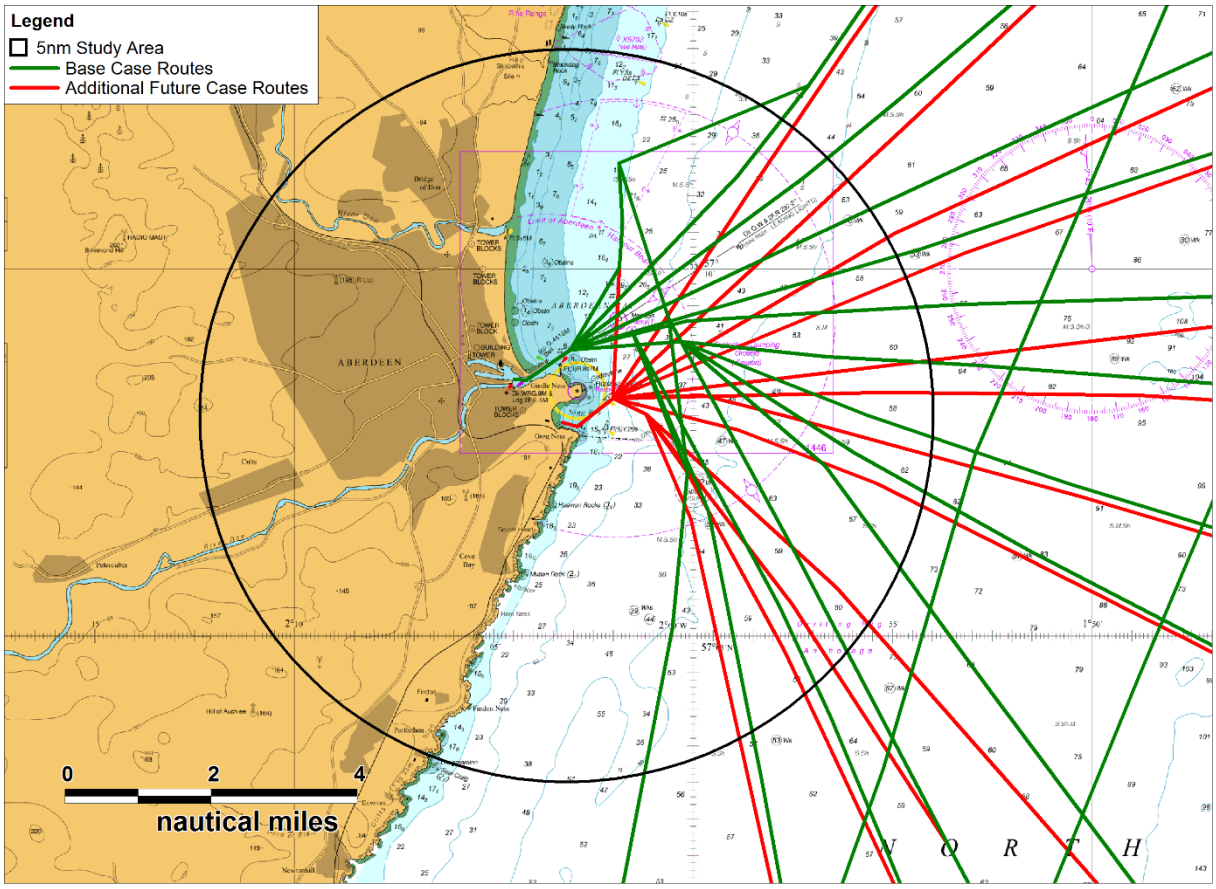

Figure 6.3 Future Case Routes

The Ship to Ship model was run using the future case route set. The annual frequency of a vessel being involved in a collision was estimated to be 1.71 x 10^{-2}, corresponding to a return period of 59 years (per vessel). The results are presented graphically in Figure 6.4.

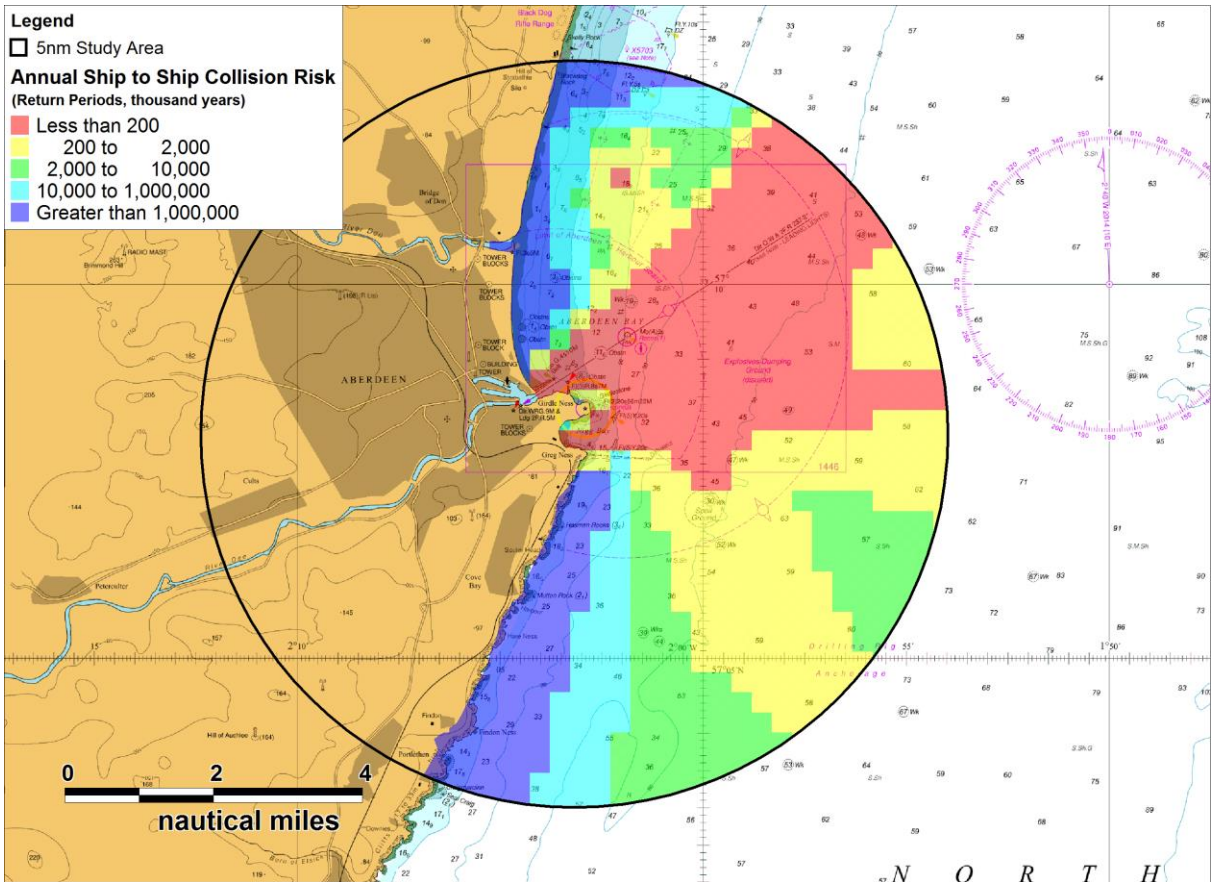

Figure 6.4 Ship to Ship Collision Risk Results – Future Case

The area of significant risk extended further south in the future case due to the predicted Nigg Bay traffic. Traffic on routes from the east and south east also caused higher risk than in the base case, as did the routes associated with the anchorage. This is illustrated in Figure 6.5, which shows the change in risk between the base and future cases.

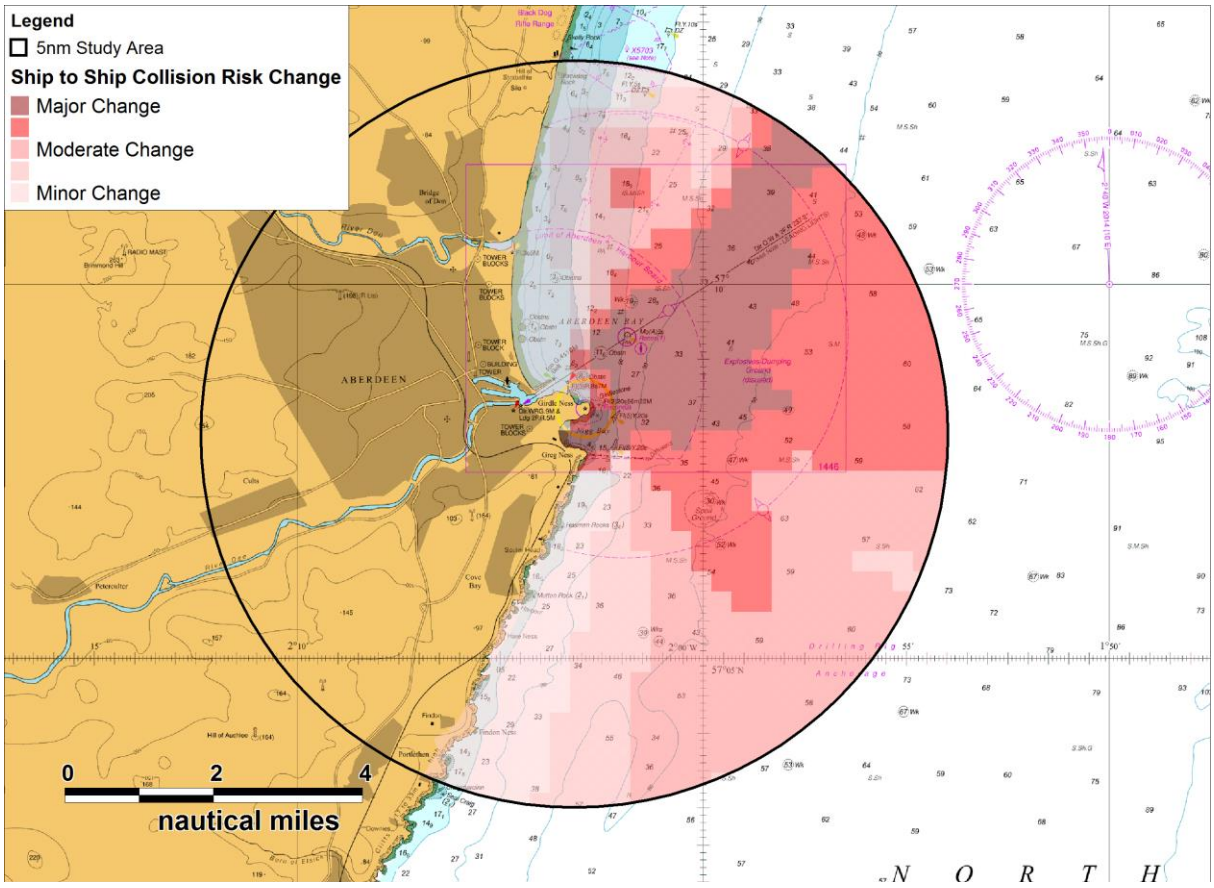

Figure 6.5 Ship to Ship Collision Risk Frequency Change in Risk between the Base and Future Cases

Table 6.1 Future Case Variation

	Frequency	Return Period (years)
Base Case	8.39×10^{-3}	119
Future Case	1.71×10^{-2}	59
Difference	8.67×10^{-3}	115
% Difference		103% (increase)

The increase is greater, as noted in Table 6.1, than the rise in traffic associated with the development. This is due to a number of factors, these include:

- The new routes associated with Nigg Bay as a new destination;
- An increase in the size of vessels associated with the extra capacity and quay size; and
- Vessel interactions rise at a nonlinear rate as the number of vessels rise.

6.5 VTS

The model, while influenced by, does not take account of the VTS operation and the influence this would have over the waters within the VTS limits. A study from the MCA (MCA, 1998) noted, in respect of the Dover Strait, that the overall effect of VTS reduced the possibility of collision by 40%. This is in line with other studies of VTS, where the reduction of collisions ranged from 10% to 40%.

The risk would be further reduced should the boundaries be expanded as part of the new development.

7. Stakeholder Consultation

This section details the key marine navigational stakeholders have been consulted as part of the baseline assessment and their responses.

7.1 Stakeholders consulted as part of the Navigational Risk Assessment process

Consultation has been carried out with local and national stakeholders, both to assist in reviewing the baseline and to discuss the potential impacts of the development and appropriate controls.

The following stakeholders have been consulted for assessment within this technical document; this list does not show the entire stakeholder consultation list for the project, i.e. those not relevant to the NRA.

Primary Stakeholders (national stakeholders and statutory consultees):

- Aberdeen Harbour Board (AHB);
- Maritime & Coastguard Agency (MCA);
- Northern Lighthouse Board (NLB);
- Chamber of Shipping (CoS);
- Scottish Fishermen's Federation (SFF); and
- Royal Yachting Association Scotland (RYA Scotland).

Local and regional stakeholders:

- Local RNLI and Coastguard.
- Vessel operators including regular runners.
    - Shipping.
        - Ferry operator/Passenger/Freight.
            - Northlink Ferries.
            - Clyde Cruises (harbour tours).
            - Mclachlan Marine Services (crew transfer).
            - Greenhowe Marine Services (crew transfer).
        - Offshore vessels.
            - Marine Safety Forum (as representative of many of the offshore vessel operators on the matter of safety).
        - Tankers.
            - Knutsen OAS Shipping AS (shuttle tankers).
            - Whitaker Tankers.
            - Stolt Tankers.
            - James Fisher and Sons.

- Commercial Fishing.
  - Aberdeen Fish Producers Organisation (AFPO).
  - Greenhowe Marine Services (fishing).
- Recreational.
  - Cruising Association (CA).
  - Aberdeen Sea Scouts.
  - Aberdeen Kayaking Club.
  - Integrate Paddling.
  - Aberdeen and Stonehaven Yacht Club.
  - Aberdeen University Yacht Club.
  - Aberdeen Sailing Trust.

7.2 Key Points and Observations

Table 7.1 Summary of shipping and navigation consultation

Consultee	Overview of key points and observations
MSF	This consultation was raised in the next meeting of the MSF steering group. (No concerns were forthcoming).
AFPO	• The AFPO has one vessel member based in Aberdeen and historically we have used the harbour facilities on a regular basis. • We currently have 14 member vessels from Aberdeen to Buckie and focus predominantly on whitefish species with some Nephrops landings as well as smaller vessels prosecuting shellfish species. • The main grounds our vessels fish are in the North Sea with some activity on the seas to the West of Scotland. • The vessels in membership are mainly of the pair seine and twin rig type. These vessels range in size from 9m to 45m. • The Nigg Bay area is a well-known shellfish area and one where some of our members operate in and around. • I would firstly like to note that their vessels are not fitted with VMS and as such their movements will not be recorded in any official way and their data is not included in your analysis of movements within Nigg Bay. • They do, however, move from the Portlethen area up to the Nigg bay area where they have gear set. The Bay is well known for being a relatively shallow area being in the order of 2 /3 fathoms in parts. • Your report shows the vessels which berth within Aberdeen Harbour but it must be noted that other vessels operate in the Nigg

Consultee	Overview of key points and observations
	Bay area but berth elsewhere and their activity is also not included in your report. • The vessels operating in that area have a number of concerns relating to the direct impact on their ability to continue to operate in that area which would have a direct impact on the viability of their business. • Increased marine traffic would have a risk of interaction with fishing gear causing a hazard as well as a possible financial loss to the gears owner. • The development itself will also change the benthic habitat and this is also of concern to those operating in that area not least because there is a lack of scientific data in that area. A baseline is required at the very least. (Other comments specific to commercial fishing passed to the FLO These are detailed within the commercial fisheries technical report and ES Chapter.)
RYA Scotland	• Note our submitted scoping comments to Marine Scotland. • RYA are not aware of any use being made of Nigg Bay for recreational sailing although there may be some informal windsurfing. Unfortunately the update to the UK Atlas of Recreational Boating, the cruising routes atlas, has been delayed. The existing atlas shows routes into and out of Aberdeen although rather few recreational craft actually go there, for obvious reasons. Those that do are mainly the type of vessel that would transmit an AIS signal. The atlas predates the development of the Peterhead marina, which is a popular stopping off point, much more so than Stonehaven. The distance of the route offshore at Aberdeen marked on the atlas is about right. Recreational craft on passage, particularly at night, will tend to be far enough offshore to avoid getting mixed up in in shipping traffic from Aberdeen or vessels at anchor outside. • The Sailing Directions for the East Coast are being re-edited by combining two of the existing books, and the revised pilot is scheduled for publication by Imray in time for Christmas 2016. Depending on the status of the project it may be appropriate to include a note about the development of Nigg Bay. • As mentioned in our scoping response, if some harbour activities are relocated to Nigg Bay the existing Aberdeen Harbour would make an excellent place for a small marina as there is good access to local facilities as well as the railway station and the airport, which could be important for crew changes. Work is ongoing into making the east coast more of a destination for cruising sailors rather than just a

Consultee	Overview of key points and observations
	coast to be transited rapidly on the way to somewhere else. Comments from the scoping request are detailed below: • RYA Scotland recognises the need for the development of Aberdeen harbour and that Nigg Bay is the obvious location for it. • Nigg Bay is only occasionally used by recreational craft as an anchorage. • Most visiting boats use Stonehaven or Peterhead. • As far as we are aware, no RYA affiliated clubs make use of Nigg Bay; The Aberdeen and Stonehaven Yacht Club is based at Stonehaven.
SFF	• We have no concerns that the planned development at Nigg Bay will affect our members during the construction phase. • Many of our members would be transiting in the vicinity. We would recommend regular updates to the Kingfisher Fortnightly Bulletin on planned in-field vessels which would keep the local fishermen updated. • We have no concerns with additional construction vessels expected on site as an increased risk to navigation, given the current levels of vessel activity around Aberdeen Harbour entrance.
Greenhowe Marine Services	• I fish Nigg Bay with the fishing vessel Skua A17. The fishing for Lobsters is seasonal and I have fished here for 20 years. The coast from Aberdeen to Stonehaven is heavily fished with creels with boats from various ports I.E. Cove, Portlethen, Newtonhill and Stonehaven. Due to the high volume of creels worked by other commercial fishing vessels in the summer months, all down the coast, I have chosen to work Nigg Bay (full time basis for 8 Years/200 creels). • The fishing grounds also run parallel north and south off the lighthouse and out to 1.5 miles running SE off the lighthouse. The navigation channel will also run ENE on the heading into the new port and there will be no way the fishing grounds between the existing port and the new harbour will be fishable any more due to traffic and safety for all users. (Other concerns specific to commercial fishing passed to the FLO. These are detailed within the commercial fisheries technical report and ES Chapter.)
F/V Boy	• Both the Boy Gordon and Jonny II fish (potting) within Nigg Bay.

Consultee	Overview of key points and observations
Gordon	• No AIS carried (no carriage requirement). • Buoyed pots were currently laid in Nigg Bay and surrounding waters (snagging hazard if unseen). (Other concerns specific to commercial fishing passed to the FLO)
CA	• We can confirm that very little yachting takes place in the area during winter periods. Aberdeen is not a yachting port although a few yachts, including CA boats, are kept there. The main nearby yachting port is Peterhead. • Little or no day-sailing takes place with almost all yachts undertaking long distance coastal passages. • Yachts on passage between places further south, in England, will be out of sight of land when going north and will traditionally make their landfall near Aberdeen with the intention of stopping at Peterhead. • Coasting yachts will normally make passage directly from headland to headland. They will thus be closest to land at Buchan Ness and Girdle Ness while keeping outside of the Fairway buoy. • Anchorages (commercial shipping) are invariably avoided by a reasonable distance. • Yachts could anchor safely, in offshore winds, anywhere along this coast but normally have no reason to do so, usually preferring to go directly to Peterhead. • We are slightly surprised that the survey revealed some yachts coasting closer in than 1nm but can confirm that most will be within 5nm of the coast. • We are not able to comment authoritatively on carriage of AIS by yachts in this area but believe it is about 25 per cent (many do not switch AIS on when coasting in good visibility). • The tracks of yachts as surveyed however should be indicative of the tracks followed by most other yachts without AIS. • The whole area can be a difficult one for yachts in any winds with an easterly component since these can produce extremely uncomfortable seas and swells inshore. • The existing Aberdeen harbour has no modern facilities for yachts and they are rightly not encouraged due to its small size and great activity. It is regarded as a difficult, even dangerous, harbour in strong onshore winds with a notorious scend (push or surge caused by waves) in its entrance. • CA has been asked if facilities for yachts could be provided at Aberdeen and we take the opportunity to suggest that a corner of the Nigg Bay proposal may serve this purpose. Similarly, there is no

Consultee	Overview of key points and observations
	harbour of refuge for small craft along this coast or safe places for use in emergency except perhaps Peterhead which is a considerable distance away. Incorporation of an all-weather entrance to Nigg Bay and some berths for small craft for use in emergency only could therefore serve a very useful purpose. • Very little day-sailing takes place. The majority of yachts near the proposed development are likely to be on long distance passages (more than 100 nm). They will normally be well-equipped and crewed by very experienced people. • The increase in shipping which can be expected from the development will be on well-defined passages and apart from the harbour approaches not constrained in any way. Yachting is increasing in the area but we conclude that recreational craft will not be strongly affected by the proposal.
HM Coastguard Aberdeen MRCC	• From a coastguard point of view, we see no major issues. We will respond to any Search & Rescue as we already do within the area. (This note is from the local MRCC and further consultation comments may be received from the MCA)
CoS	• No Comments from the UK Chamber of Shipping.

8. Navigational Impact Assessment

8.1 Introduction

This section contains the details of the hazard workshop and the hazards identified there, along with the formal safety assessment

8.2 Hazard Workshop

8.2.1 Introduction

A hazard workshop was held at the Marine Operations Centre in Aberdeen on the 12th of March 2015. It was attended by maritime stakeholders in order to gain local knowledge of the area and identify the key navigational safety concerns relative to the development. This allowed the identification and discussion of potential hazards created by the new harbour development in Nigg Bay, in terms of shipping and navigation. The results of the hazard workshop will inform the impact assessment and selection of mitigation measures.

8.2.2 Hazard Workshop Attendees

The following persons were present at the workshop:

Table 8.1 Hazard Workshop Attendees

Attendee	Company/Organisation
Ray Shaw (RS)	Aberdeen Harbour Board
Jeff Gaskin (JG)	Aberdeen Harbour Board
Tom Westwood (TW)	Anatec Ltd.
Adam Foster (AF)	Anatec Ltd.
Craig Watson (CW)	DOF Management
Colin MacRonald (CM)	MacRon Marine Services (adviser to AHB)
Philip Watson (PW)	North Star (Craig Group)
Peter Douglas (PD)	Northern Lighthouse Board
John Strathearn (JS)	Northlink Ferries

8.2.3 Invitees (unable to attend)

The following organisations were invited but were unable to attend on the day:

- Maritime and Coastguard Agency;
- Aberdeen Coastguard;
- Aberdeen RNLI;
- Atlantic Offshore;
- MacLachan Marine Services;
- Greenhowe Marine Services;
- The Royal Yachting Association Scotland;
- Cruising Association;

- Scottish Fishermen's Federation;
- Clyde Cruises;
- Knutsen OAS Shipping AS;
- Whitaker Tankers; and
- Stolt Tankers.

It is noted that there were no fishing or recreational representatives able to attend the workshop, however these stakeholders are included in the consultation process and were contacted prior to the workshop for comment.

8.2.4 Hazard Workshop Process

As part of the workshop, key maritime hazards associated with the harbour development were discussed and noted. Where appropriate, vessel types were considered separately to ensure the risk levels were assessed for each and the control options could be identified on a type-specific basis, e.g. risk control measures for construction vessels sometimes differ to those for commercial vessels. Other general hazards associated with the construction and operational phases, such as an incident involving a person in the water, both during a construction activity and during crew transfers were also discussed. The workshop identified 16 hazards.

During the workshop, the risks associated with the hazards were ranked based on the discussions held and mitigation measures were identified. The overall risk ranking (frequency vs. consequence) determined the hazard's position within the risk matrix shown in Table 8.2.

Table 8.2 Example Risk Matrix

Consequences					Frequency				
					1	2	3	4	5
Severity rating	People	Property	Environment	Business	Negligible	Extremely Unlikely	Remote	Reasonably Probable	Frequent
1 Negligable	Zero injury	Zero damage	Zero effect	Zero impact					
2 Minor	Minor injury	Minor damage	Minor effect	Minor impact					
3 Moderate	Major injury	Moderate damage	Moderate effect	Considerable impact					
4 Serious	Single fatality	Major damage	Major effect	Major national impact					
5 Major	Multiple fatalities	Extensive damage	Extensive effect	Major international impact					

	Broadly Acceptable (low risk)
	Tolerable (intermediate risk)
	Unacceptable (high risk)

The consequences bands used during the hazard workshop are noted above in Table 8.2, while the detail of the frequency bands are noted in Table 8.3.

Table 8.3 Hazard Workshop Frequency Bands

Rank	Description	Definition
1	Negligible	< 1 occurrence per 10,000 years.
2	Extremely Unlikely	1 per 100 to 10,000 years
3	Remote	1 per 10 to 100 years
4	Reasonably Probable	1 per 1 to 10 years
5	Frequent	Yearly

8.2.5 Risk Regions

The three risk regions are described below:

- Unacceptable Region (High Risk) - Generally regarded as unacceptable whatever the level of benefit associated with the activity.
- Tolerable Region (Moderate Risk) - Typical of the risks from activities which people are prepared to tolerate to secure benefits. There is however an expectation that such risks are properly assessed, appropriate control measures are in place, residual risks are As Low As Is Reasonably Practicable (ALARP) and that risks are periodically reviewed to see if further controls are appropriate.
- Broadly Acceptable Region (Low Risk) - Generally regarded as acceptable and adequately controlled. None the less the law still requires further risk reductions if it is reasonably practicable. However, at these levels the opportunity for further risk reduction is much more limited.

Details of the hazard workshop outputs are noted in the Hazard Log (Appendix 1).

8.2.6 Tolerability of Risks

The most likely outcome of the hazards, assuming that appropriate embedded mitigation measures are put in place, included seven of the hazards ranked at a broadly acceptable level and nine at a tolerable level. The realistic worst case, again including the use of embedded mitigations, were also assessed. This noted five of the hazards ranked at a broadly acceptable level and eleven at a tolerable level. These hazards will form the basis for the impacts reviewed within the formal safety assessment.

Figure 8.1 summarises the hazard rankings.

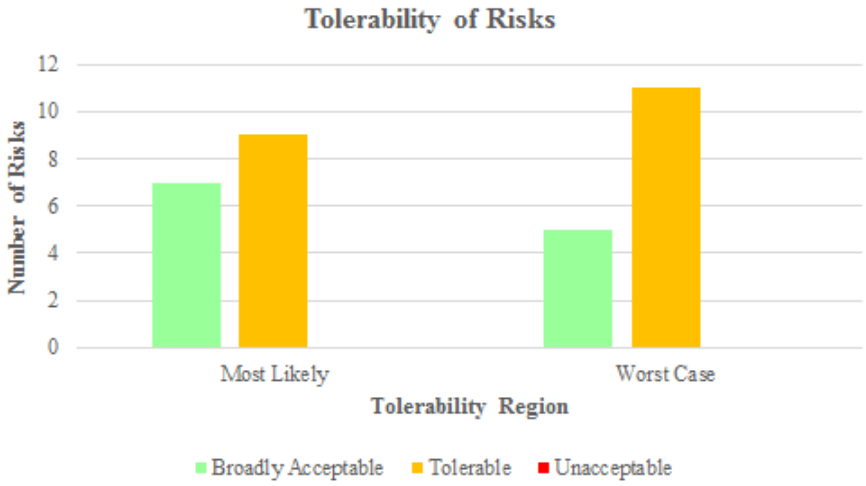

Figure 8.1 Tolerability of Risks

8.3 Potential Cumulative and In-combination Projects

Cumulative and in-combination effects have been considered for the proposed Nigg Bay development, including the impacts on shipping and navigation arising from other proposed development and the impacts arising from other marine activities or users of the sea area. These effects are defined as follows:

- **Cumulative effects** - refers to impacts on shipping and navigation arising from any planned and/or consented port development (and their associated activities).

- **In-combination effects** - refers to impacts on shipping and navigation arising from different types of development projects (e.g. impacts from a renewable energy project in-combination with impacts from a port development) or marine activities.

8.3.1 Cumulative Projects

Peterhead Harbour Development

Peterhead harbour is located 24nm to the north of Nigg Bay. There are plans for a £47 million investment and redevelopment of the harbour. This will focus on upgrading the facilities for the fishing industry in the harbour. The harbour is significant in supporting the commercial industry, the greatest quantity and value of fish landings take place there, greater than any other port in the UK.

The project plans to develop the facility into a fully integrated, state-of-the-art fishing hub by the end of 2016. A number of harbour improvements will take place at the same time.

This development is not expected to impact upon Nigg Bay due to the distance from the new harbour and that the planned construction phases will only coincide for one year, in 2016, if the construction activities are completed as planned.

8.3.2 In-combination Projects

European Offshore Wind Deployment Centre

The European Offshore Wind Deployment Centre (EUWDC, Aberdeen Offshore Wind Farm, AOWF) site is located approximately 5nm to the north of Nigg Bay. The project is consent authorised and it is planned that construction will begin in 2015. The site will consist of 11 turbines over an area of approximately 7km^2, and there will be a maximum of four export cables, with a planned landfall point approximately 3nm to the north of Nigg Bay.

The impact this poses would be conditional on the project progressing on the planned timescale. It is widely reported in the local press that there is a legal challenge taking place and issues surround some onshore elements of the project, these may yet delay the construction period of the development.

Should the construction period of this development coincide with the development of Nigg Bay then there would be an in-combination increase in construction related traffic in the area. But due to the current capacity of Aberdeen Harbour it is unlikely that construction vessels from this development would be able to operate from here. This would reduce the impact to Nigg Bay, ensuring that there is no impact in proximity to the harbour development. This, when evaluated within the open waters around these developments would indicate that any impact would be small.

Kincardine Offshore Wind Farm

The Kincardine Offshore Wind Farm is still in the consent process. If consent is granted then construction is proposed to begin in 2016, with the project fully operational by 2017. The site is located approximately 8nm to the south east of Nigg Bay, and covers an area of 5 by 7km. The exact number of floating turbines is not yet defined, but the current plan is to install between 5 and 10 turbines. Export cabling consisting of two transmission lines was proposed to land within Nigg Bay, however due to the Aberdeen Harbour development an alternate landfall is planned further south.

The impact this poses would be conditional on the project progressing on the planned timescale. The stated date for the final investment decision is expected to be made in Q2 2015. Therefore more information is expected to be forthcoming shortly.

Again, should the construction period of this development coincide with the development of Nigg Bay then there would be an in-combination increase in construction related traffic in the area. Similarly, due to the current capacity of Aberdeen Harbour it is unlikely that construction vessels from this development would be able to operate from here. This would reduce the impact to Nigg Bay, ensuring that there is no impact in proximity to the harbour development. This, when evaluated within the open waters around these developments would indicate that any impact would be small.

Hywind Scotland Pilot Park

The Hywind Scotland Pilot Park is to be located approximately 30nm to the north east of Nigg Bay, east of Peterhead. The offshore phase of construction is to begin in 2016, and the park is planned to be fully operational in 2017. The site will consist of 5 turbines, and the export cable will run to a landfall point to be located north of Peterhead. These floating turbines are to be manufactured onshore before being transported to a deep water staging area near the coast, where they will be upended and final assembly task will take place, before their tow to the Hywind Scotland Pilot Park for commissioning.

This development is not expected to impact upon Nigg Bay due to the distance from the new harbour. It is possible that the deep water staging area is to the south of the site, but this would still be a significant distance away. If there is to be passing construction traffic, transiting to the deep water staging area, then this will take place in the open waters outwith the coast and only pose a small impact.

8.4 Formal Safety Assessment

This section details the impacts identified in the hazard workshop, along with the additional mitigation methods identified to reduce them to ALARP. The rankings are the **Realistic Worst Case** scenarios, which are considered with the embedded mitigations (as detailed in Section 9.2) already in place. This is due to the nature of marine safety and risk reduction measures, where many mitigations and safeguards are already in place or are expected to take place. The **Realistic Worst Case** scenarios will have a greater consequence and occur less frequently than the **Most Likely Consequences**.

8.4.1 Construction Phase

Vessel allision with exposed partially constructed breakwater / quayside

During the construction phase there could be an increased risk of vessels alliding with the partially constructed breakwater / quayside, due to the fact that navigational aids (e.g. lights and markings) may not all be present.

This impact would have a **Moderate** level of consequence due to the potential for damage/injury and the limited ability of a vessel to adapt to the partially exposed (possibly submerged at different states of the tide) breakwater/quayside. The impact will be localised to the extent of the breakwater/quayside construction within Nigg Bay and present for the three year construction period. The frequency of occurrence would be **Extremely Unlikely** due to the embedded mitigation measures in place and low level of traffic in proximity to Nigg Bay, giving the impact an overall ranking of **Tolerable**.

The following additional mitigation measures have been identified to reduce the impact:

- Appointment of dedicated Construction Marine Coordinator to liaise with VTS;
- Advanced promulgation of information (to specific receptors) – see explanation in section 9.3.2;

- Planning so as to not impact adverse weather approaches; and
- VTS (at a suitable level).

Vessel-to-vessel collision due to avoidance of the site (Construction Phase)

Displaced traffic increases congestion outside of the site during construction. This can lead to an increase in vessel-to-vessel encounters (passing or crossing traffic) and the possibility of collisions.

This impact would have a **Serious** level of consequence due to the potential for major damage/injury. The impact will be localised to Nigg Bay and near coastal waters where construction activities are taking place. The frequency of occurrence would be **Negligible** due to the embedded mitigation measures in place and level of traffic in close proximity to Nigg Bay, giving the impact an overall ranking of **Tolerable**.

The following additional mitigation measures have been identified to reduce the impact:

- Appointment of dedicated Construction Marine Coordinator to liaise with VTS.

Vessel-to-vessel collision due to construction / support vessels in the area

An increased number of vessels involved in construction activities may cause congestion outside of the site. This can lead to an increase in vessel-to-vessel encounters (passing or crossing traffic) and the possibility of collisions.

This impact would have a **Serious** level of consequence due to the potential for major damage/injury. The impact will be localised beyond Nigg Bay as far as construction vessels are active, which may be near coastal for the majority of vessels, but may extend further for vessels bringing materials to the development. The frequency of occurrence would be **Negligible** due to the embedded mitigation measures in place, level of traffic in proximity to Nigg Bay and the duration of the construction phases, giving the impact an overall ranking of **Tolerable**.

The following additional mitigation measures have been identified to reduce the impact:

- All work vessels required to carry AIS regardless of size;
- Appointment of dedicated Construction Marine Coordinator to liaise with VTS on the construction plans daily; and
- Installation of CCTV within Nigg Bay.

A collision as a result of cumulative increase in construction vessel activity from nearby developments

An increased number of vessels involved in cumulative developments in the vicinity causes a collision between construction vessels.

This impact would have a **Moderate** level of consequence due to the potential for damage/injury. The impact will be localised in the open waters outwith the coast. The

frequency of occurrence would be **Negligible** due to the embedded mitigation measures in place and the low probability of operating in the close proximity (during transit only/no capacity at Aberdeen/construction timelines may not occur at the same time), giving the impact an overall ranking of **Broadly Acceptable**.

No additional mitigation measures have been identified to reduce this impact.

Fishing gear interaction with subsurface structure

Fishing vessel snags gear on subsea structure (breakwater/quay foundation) during construction phase.

This impact would have a **Moderate** level of consequence due to the potential for damage/injury. The impact will be localised to Nigg Bay. The frequency of occurrence would be **Negligible** due to the embedded mitigation measures in place and the low level of fishing (potting only) occurring within Nigg Bay. Commercial fishing boats would be aware of the hazard during construction activities and would not fish where pots would be damaged and lost, giving the impact an overall ranking of **Broadly Acceptable**.

The following additional mitigation measures have been identified to reduce the impact:

- Advanced promulgation of information (to specific receptors); and
- Liaison with fishermen.

Construction vessel allision with the development

Construction vessel allides with the development during construction activities at the site.

This impact would have a **Serious** level of consequence due to the potential for major damage/injury. The impact will be localised to the extent of the breakwater/quayside construction within Nigg Bay and present for the three year construction period. The frequency of occurrence would be **Remote** due to the embedded mitigation measures in place and high level of traffic movements associated with construction activities within Nigg Bay, giving the impact an overall ranking of **Tolerable**.

The following additional mitigation measures have been identified to reduce the impact:

- Appointment of dedicated Construction Marine Coordinator to liaise with VTS;
- Advanced promulgation of information (to specific receptors);
- Planning so as to not impact adverse weather approaches; and
- VTS (at a suitable level).

Construction vessel collision with another construction vessel

Construction vessel collision whilst undertaking construction activities at the site.

This impact would have a **Serious** level of consequence due to the potential for major damage/injury. The impact will be localised to the extent of the construction activities within

Nigg Bay and present for the three year construction period. The frequency of occurrence would be **Negligible** due to the embedded mitigation measures in place, the area of available water and slow speed of vessels conducting works activates, giving the impact an overall ranking of **Tolerable**.

The following additional mitigation measures have been identified to reduce the impact:

- All work vessels required to carry AIS regardless of size; and
- Appointment of dedicated Construction Marine Coordinator to liaise with VTS on the construction plans daily.

Person in water (man overboard) at the site during construction activities

Worker falls overboard undertaking construction activities at the site.

This impact would have a **Serious** level of consequence due to the potential for loss of life. The impact will be localised to the extent of the construction activities within Nigg Bay, this may extend further for vessels delivering materials and present for the three year construction period. The frequency of occurrence would be **Extremely Unlikely** due to the embedded mitigation measures in place, giving the impact an overall ranking of **Tolerable**.

The following additional mitigation measures have been identified to reduce the impact:

- Aberdeen Harbour buoyancy aid procedures to be adhered to;
- Rescue boat present at all times (with trained personnel on site); and
- Regular safety checks from Aberdeen Harbour representative.

Construction vessels snagging on fishing pots

A workboat becomes entangled / disabled by the buoyed line attached to a pot.

This impact would have a **Minor** level of consequence due to the potential for minor damage/injury. The impact will be localised to near coastal waters (due to potting/construction activities) and present for the three year construction period. The frequency of occurrence would be **Negligible** due to the embedded mitigation measures in place and the low level of fishing (potting only) occurring within Nigg Bay. Commercial fishing boats would be aware of the hazard during construction activities and would not fish where pots would be damaged and lost, giving the impact an overall ranking of **Broadly Acceptable**.

The following additional mitigation measures have been identified to reduce the impact:

- Construction vessel transit routes made known; and
- Liaison with fishermen.

Person in water (man overboard) during a vessel to vessel transfer

A person is lost overboard (man overboard) while transferring from a crew transfer vessel to a work vessel during the construction phase.

This impact would have a **Serious** level of consequence due to the potential for loss of life. The impact will be localised to the extent of the area used for crew transfer activities around Nigg Bay and present for the three year construction period. The frequency of occurrence would be **Extremely Unlikely** due to the embedded mitigation measures in place, giving the impact an overall ranking of **Tolerable**.

The following additional mitigation measures have been identified to reduce the impact:

- Checking of PPE on all vessels involved in crew transfer; and
- Correct training for all transfer vessels as detailed by MCA.

8.4.2 Construction and Operational Phase

Commercial vessel (powered) allision with the development

A commercial vessel (e.g. cargo ship, passenger ship or tanker) allides with the development when under power (steaming).

This impact would have a **Moderate** level of consequence due to the potential for damage/injury. The impact will be localised to the extent of the breakwater/quayside within Nigg Bay. The frequency of occurrence would be **Extremely Unlikely** due to the embedded mitigation measures in place, the sheltered nature of the harbour (within Nigg Bay) and the low level of traffic transiting in close proximity to Nigg Bay, giving the impact an overall ranking of **Tolerable**.

The following additional mitigation measures have been identified to reduce the impact:

- Pilotage training (different requirements to current harbour);
- Expansion of VTS (pre-construction) to cover new harbour limits; and
- Appointment of dedicated Construction Marine Coordinator to liaise with VTS.

Drifting vessel allision with the development

Vessel loses power and drifts with wind and / or tide into the development.

This impact would have a **Serious** level of consequence due to the potential for major damage/injury, due to the slow potential speed, low energy of the impact and the size of vessels anchoring nearby (shuttle tankers). The impact will be localised to the extent of the breakwater/quayside within Nigg Bay. The frequency of occurrence would be **Extremely Unlikely** due to the embedded mitigation measures in place, the sheltered nature of the harbour (within Nigg Bay) and the low level of traffic transiting in close proximity to Nigg Bay and utilising the good holding ground to anchor, giving the impact an overall ranking of **Tolerable**.

The following additional mitigation measures have been identified to reduce the impact:

- Shuttle tanker anchorage area moved during construction.

Fishing vessel allision with the development

A fishing vessel allides with the development whilst fishing in the area or steaming in transit.

This impact would have a **Minor** level of consequence due to the potential for damage/injury and low energy of the impact. The impact will be localised to the extent of the breakwater / quayside within Nigg Bay. The frequency of occurrence would be **Negligible** due to the embedded mitigation measures in place, the sheltered nature of the harbour (within Nigg Bay) and the very low level of commercial fishing traffic transiting in close proximity to Nigg Bay, giving the impact an overall ranking of **Broadly Acceptable**.

The following additional mitigation measures have been identified to reduce the impact:

- Advanced promulgation of information (to specific receptors); and
- Liaison with fishermen.

Recreational craft allision with the development

Recreational craft allides with the development.

This impact would have a **Minor** level of consequence due to the potential for damage/injury and low energy of the impact. The impact will be localised to the extent of the breakwater/quayside within Nigg Bay. The frequency of occurrence would be **Extremely Unlikely** due to the embedded mitigation measures in place, the sheltered nature of the harbour (within Nigg Bay) and the low level of recreational traffic transiting in close proximity to Nigg Bay, giving the impact an overall ranking of **Broadly Acceptable.**

The following additional mitigation measures have been identified to reduce the impact:

- Use of works vessel as guard vessel;
- CCTV installed in Nigg Bay; and
- Advanced promulgation of information to specific receptors (contact with recreational facilities and clubs).

8.4.3 Operational Phase

Vessel allision with fixed (fully constructed) structure

Due to the presence of fixed structures (breakwater/quayside) there could be an increased risk of vessel allisions with these structures.

This impact would have a **Moderate** level of consequence due to the potential for damage/injury, the slow potential speed/low energy of the impact of vessels entering/departing the harbour. The impact will be localised to the extent of the

breakwater/quayside within Nigg Bay. The frequency of occurrence would be **Extremely Unlikely** due to the embedded mitigation measures in place, the sheltered nature of the harbour (within Nigg Bay) and the low level of traffic transiting in close proximity to Nigg Bay, giving the impact an overall ranking of **Tolerable**.

The following additional mitigation measures have been identified to reduce the impact:

- Pilotage training (different competence requirements to current harbour);
- Pilot exemption and vessel specification considered against the implication to safety; and
- Expansion of VTS upon completion to cover new harbour limits.

Vessel-to-vessel collision due to avoidance of the site (Operational Phase)

Displaced traffic increases congestion outside of the site during the operational phase. This can lead to an increase in vessel-to-vessel encounters (passing or crossing traffic) and the possibly of collisions.

This impact would have a **Serious** level of consequence due to the potential for major damage/injury. The impact will be localised to the near coastal waters. The frequency of occurrence would be **Negligible** due to the embedded mitigation measures in place, giving the impact an overall ranking of **Tolerable**.

The following additional mitigation measures have been identified to reduce the impact:

- Expansion of VTS upon completion to cover new harbour limits.

8.5 Emergency Response Overview

8.5.1 Introduction

The following section outlines the current facilities in place within the UK provided by emergency response organisations relative to the Nigg Bay development.

8.5.2 MCA Including HM Coastguard

The Coastguard (HMCG) co-ordinates Search and Rescue (SAR) through a network of Coastguard Operations Centres (CGOC), previously called Maritime Rescue Co-ordination Centres (MRCCs). There is a CGOC stationed within the current Aberdeen Harbour.

The HMGC is currently introducing a new scheme which will see the overall number of MRCCs reduced to ten, in addition to the National Maritime Operations Centre (NMOC). A number of these MRCCs are currently being upgraded to better manage the SAR workload. This will result in the operational workloads being redistributed on a national basis rather than the current system which is more localised. The rescue resources themselves will not be reduced, and the Aberdeen CGOC is to remain in place.

8.5.3 SAR Helicopters

Bristow Helicopters Ltd. was awarded a ten year UK SAR contract by the Department for Transport in March 2013. A total of ten helicopter bases are planned by Bristow, with the first two going operational on the 1st April 2015, and the remaining eight introduced at a later date. Of the ten bases, four are in range of Nigg Bay. The nearest is Inverness, located approximately 75nm WNW. The Inverness base is one of the initial two bases. The other three with a radius of action covering Nigg Bay are Prestwick (130nm SW), Stornoway (150nm WNW), and Sumburgh (170nm N).

The Inverness and Prestwick bases will be equipped with AW189 AgustaWestland helicopters. These have a range of 200nm, and air speeds of 145 knots. The Stornoway and Sumburgh bases will be equipped with S92 Sikorsky helicopters, with radius of action of 250nm, and air speeds of 145 knots. Both types of helicopter operate to a dedicated readiness level, being able to launch within 15 minutes between the hours of 08:00 and 22:00, and within 45 minutes between the hours of 22:00 and 08:00.

Based on the above information, a helicopter sent from Inverness would reach Nigg Bay in approximately 46 minutes during the 15 minute response period (day) and 1 hour 1 minute during the 45 minute response period (night).

The locations of the four bases in range of Nigg Bay are presented in Figure 8.2.

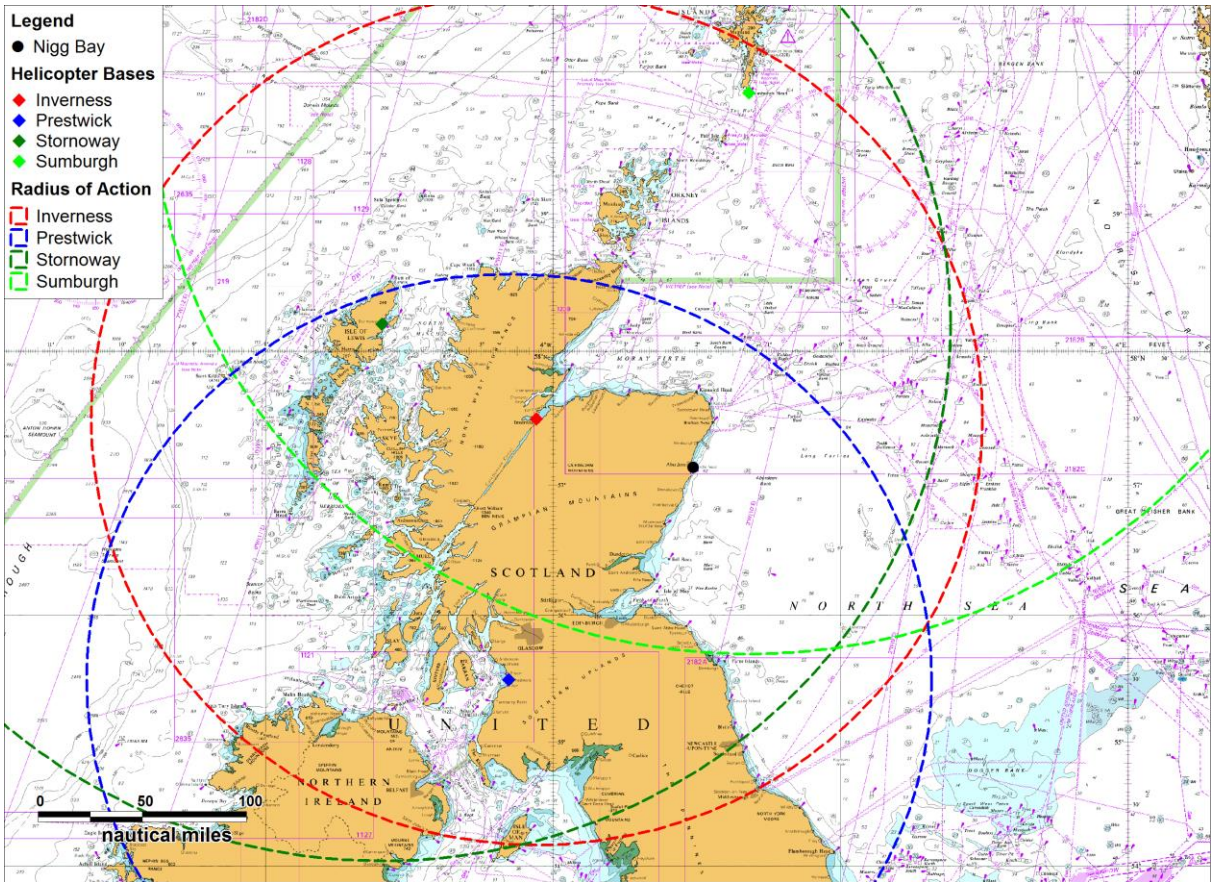

Figure 8.2 Bristow Helicopter Bases relative to Nigg Bay

8.5.4 Emergency Towing Vessels

Where there is a serious risk of harm to persons or property, or a significant risk of pollution, it may be necessary to initiate emergency towing arrangements. Such arrangements should be unambiguous, agreed by all parties where possible, and activated as swiftly as practicable.

The MCA has a framework agreement with the British Tugowners Association (BTA) for emergency chartering arrangements for harbour tugs. The agreement covers activation, contractual arrangements, liabilities and operational procedures, should the MCA request assistance from any local harbour tug as part of the response to an incident. Modern harbour tugs are often capable of providing an effective emergency service in all but the worst weather conditions, and to the largest vessels. The availability of towage is noted in Section 8.5.6, where it is expected to be readily available due to the nature of vessel operating locally.

8.5.5 RNLI Lifeboats

The Royal National Lifeboat Institution maintains an active fleet of over 340 lifeboats (of various types ranging from 3.8m to 17m in length) and a relief fleet of around 100 boats at 236 stations round the coast of the UK and Ireland.

There is an RNLI launch station located in Aberdeen Harbour. The location of the station relative to Nigg Bay is presented in Figure 8.3.

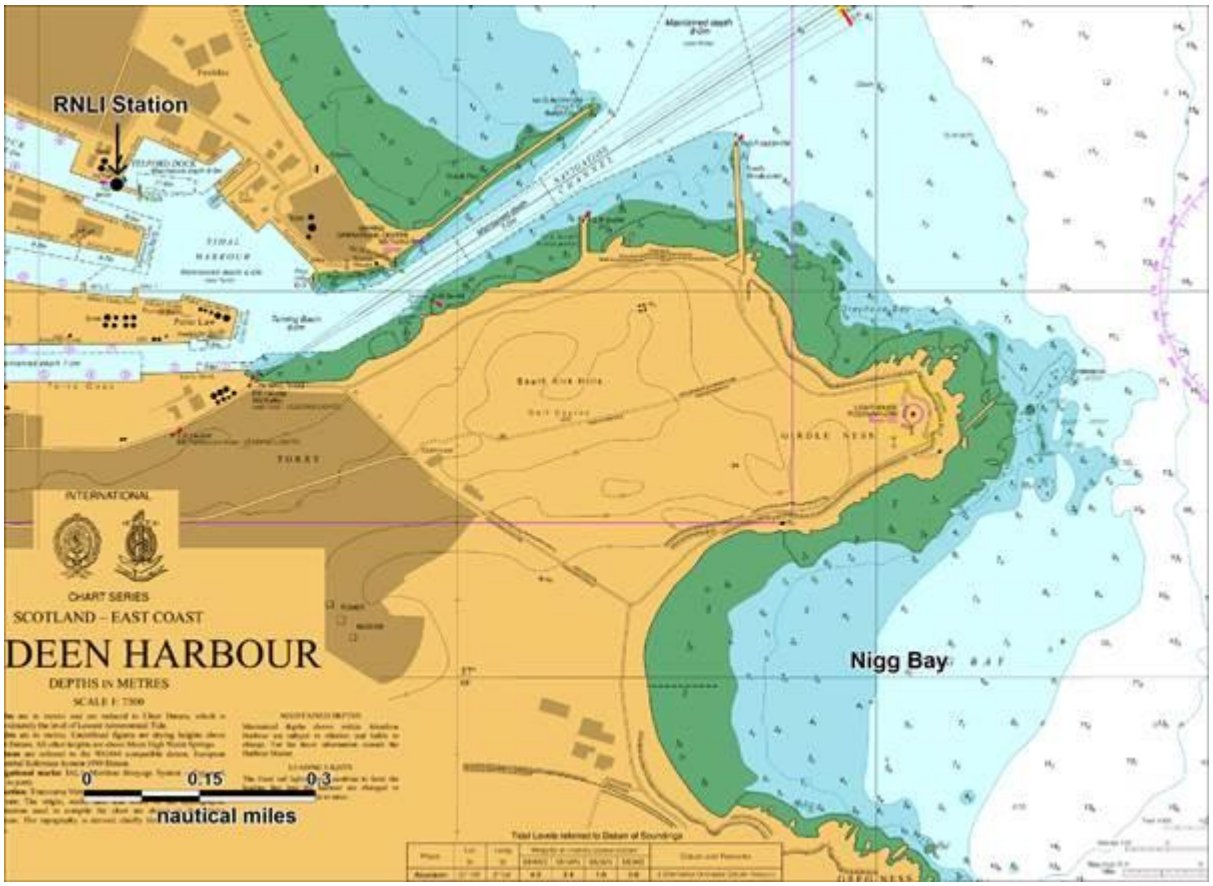

Figure 8.3 Aberdeen RNLI Launch Station

There are two lifeboats at the Aberdeen RNLI station, the *Bon Accord*, which is a Severn class lifeboat (All Weather Lifeboat), and the *James Bissett Simpson*, a D class lifeboat (Inshore Lifeboat). Further details of the capability of these lifeboats is contained in Table 8.4.

Table 8.4 Lifeboat Capability

Lifeboat	Class	Max Speed	Range	Survivor Capacity
Bon Accord	Severn class (ALB)	25 knots	250nm	28/124
James Bissett Simpson	D class (ILB)	25 knots	3 hours	5

It is estimated, from departing the berth, that either class of lifeboat could be at Nigg Bay in approximately 5 minutes in good conditions based on the above information. This estimation is based on the distance to transit and the maximum speed of the craft attending. This does

not include the time taken to muster the crew and receive approval for the response as this will vary.

8.5.6 Port Capability

The port also has a planned and exercised capability to assist in the event of an incident. The harbour authority is responsible for managing (AH, 2014) the overall response to any incident within the harbour limits. The responsibilities are noted within the Marine Safety Management System. HM Coastguard will still manage the Search and Rescue phased of the incident, as they do outside the harbour limits, but will co-ordinate with Aberdeen VTS.

The harbour, like similar harbour authorities, has an advanced level of preparedness for incidents, maintaining plans for incidents, training and exercising staff, as well as documenting this process.

Person in Water (Man Overboard)

The Pilot Cutter and crew are experienced in this incident response requirement and undertake regular exercises in the recovery of a person from the water. The Pilot Cutter is also equipped with recovery equipment.

Towage

Towage capability is available from either the tugs that operate at the harbour or suitable offshore vessels by arrangement (Lloyd's Open Form etc.) during an incident. These are highly likely to be available during an emergency situation due to the high volume of suitable vessels operating in the area involved in towage and the oil and gas industry.

Pollution

The port has both equipment and trained staff to respond to pollution incidents within harbour limits, as required by the Oil Pollution Preparedness Response and Co-operation Convention. The Aberdeen Harbour Oil Spill Response Contingency Plan is approved by the MCA and meets the requirements of the convention. In the instance of a large pollution incident the MCA would assist with the response in line with the UK National Contingency Plan.

9. Mitigation Measures Review

9.1 Introduction

This section details the mitigation measures that have been identified during the production of this baseline assessment, both from good-industry practice and specific mitigation measures highlighted during consultation and at the hazard review workshop.

9.2 Proposed Embedded Mitigation Measures

- Promulgation of information (including Notice to Mariners and/or radio warnings;
- MCA guidance;
- IALA guidance;
- Safety or Precautionary Zones;
- Construction Design and Management Regulations;
- Industry best practices;
- Vessels to comply with international conventions (SOLAS/COLREGS etc.);
- The Port Marine Safety Code and guidance;
- Processes in place for direct liaison between VTS and any marine contractors (planned vessel movements);
- Permanent and temporary/phased aids to navigation;
- Health Safety and Environment Compliance; and
- Works vessel planning and coordination to ensure that construction vessels do not pose a hazard to other users.

9.3 Additional Mitigation Measures

9.3.1 Construction Marine Coordinator (CMC)

Appointment of a dedicated Construction Marine Coordinator. This individual will maintain a complete overview of current and planned construction activities, liaise with VTS on the construction plans daily and ensure compliance by construction works vessels with the standards set by Aberdeen Harbour Board. This compliance can take place though regular safety checks and be verified by an Aberdeen Harbour representative.

9.3.2 Advanced promulgation of information

Planning advanced promulgation of information to specific receptors would go beyond the embedded process. Specifically targeting both local and national/international clubs and associations with safety information. This can highlight the hazard present, detail the construction vessel transit routes and warn of any delicate operations or exclusion zones in force. This is of particular use for fishing and recreational receptor, but may also benefit some elements of the commercial shipping receptors (e.g. shuttle tankers).

9.3.3 Accommodating vessel routing

The planning of activities so as to not impact adverse weather approaches.

9.3.4 CCTV

The installation of CCTV within Nigg Bay would allow for remote surveillance activities and provide an opportunity to oversee safety and compliance, as well as monitor passing traffic.

9.3.5 VTS

Current VTS coverage and operation would be reviewed and could be utilised (at a suitable level) to further the benefits to safety for Nigg Bay. This should be planned so as to not impact the current operation of VTS. This review could also include an assessment of the benefit of the expansion of VTS upon completion to cover the new harbour limits and any changes required (staffing etc.).

9.3.6 Pilotage training

Pilotage training will be revised to include the different competence requirements for Nigg Bay. Where required, this will include revisions to the pilot exemption/experience requirement. Vessel specification will be considered against the implication to safety.

9.3.7 AIS

The use of AIS is well established and the benefits to both collision avoidance and monitoring of vessels is accepted. Therefore this should be extended to all vessels involved in construction activities regardless of carriage requirements or size.

9.3.8 Shuttle tanker anchorage

The anchorage area preferred by shuttle tankers east of Nigg Bay could be moved further from operations during construction activities. It is understood that this is outside the current harbour jurisdiction, so this would need to be approached through liaison with the vessel operators. Options around creating a temporary designated anchorage a safe distance from Nigg Bay could be discussed with the MCA as part of this process.

9.3.9 Guard vessel

The use of a works vessel as guard vessel during construction activities would ensure compliance with any exclusion zone utilised and ensure that a guard vessel was prepared to intervene in any developing situation where this would be beneficial.

9.3.10 AHB Procedures used by construction vessels/crews

The requirement for relevant Aberdeen Harbour procedures (e.g. use of buoyancy aids) will be extended to vessels and crews involved in construction activities, and compliance checks put in place to ensure that they are adhered to.

9.3.11 Dedicated rescue boat

Planned provision of a rescue boat on site during active phases of construction, with the presence of trained personnel on site. This ensures that the site has some self rescue capability and a fast response

9.3.12 Crew transfer checks

All vessels involved in crew transfer operations will undertake a compliance check against the relevant MCA standard to ensure that the vessel and crew meet the standard and in particular the correct PPE is carried onboard/the crew are suitably trained and experienced.

9.3.13 SAR liaison

Liaison with the local Coastguard and Maritime and Coastguard Agency will ensure all parties are aware of the plan for construction (duration/phases), parties involved (estimated number of workers) and local capabilities (self rescue). This allows for planning of both search and rescue or other emergencies where their involvement or oversight may be required. A plan can be established considering the capacity for self-help capability in an emergency and when or where further assistance may be required, or notification given.

As an example, the plan should include company details and contact details (for routine and emergency situations), co-operation arrangements between development site and the local CGOC (if self rescue facilities/assets are available then these should be noted), details on how information would be passed on during emergency situations (liaison/nominated manager), details of what is to be built (plans for the phases), information about vessels and activities on-site (updated when they change), contact details for the CGOC, information about nearby SAR facilities including surface craft rescue resources and airborne rescue resources and planned response to pollution events.

9.3.14 Simulation Exercises

The use of simulations is a practical method to ensure safety through experience and the testing of the port's design ensuring that potential problems are identified and resolved. It can also be utilised as an advanced training tool to ensure competence and familiarity for the port's pilots, so as to ensure they have the opportunity to build on their current experience and gain insight into undertaking the navigation of the new harbour. It is noted that HR Wallingford (HRW, 2013 and HRW, 2014) have undertaken a number of simulations already. These will assist in the preparation of vessel and weather limits, which will inform the Marine Safety Management System, under the Port Marine Safety Code.

10. Summary

10.1 Baseline Shipping Assessment

Four months of 2014 AIS data were used to analyse the shipping in the vicinity of the proposed Aberdeen Harbour development in Nigg Bay. Two months of winter data and two months of summer data were used to account for any seasonal variations in the shipping activity.

The only activity observed within Nigg Bay was from the 14m workboat operated by Aberdeen Harbour Board, *Sea Herald* and the 8m fishing vessel *Skua II*.

During summer, an average of 81 unique vessels a day passed within 12nm of Nigg Bay, of which 74 also passed within 5nm. The majority of vessels during summer were offshore associated vessels, with 59% of vessels within 12nm of Nigg Bay falling into this category, rising to 62% of vessels within 5nm.

During winter, an average of 70 unique vessels a day passed within 12nm of Nigg Bay, falling to 64 unique vessels within 5nm. As in summer, the majority of vessels were offshore related, with 60% of vessels within 12nm falling into this category, rising to 63% within 5nm.

Fishing activity was recorded in Nigg Bay by an 8m long potter, the *Skua II*, within the summer data. In winter the same vessel was seen actively fishing, but not within the bay.

Recreational activity, based on the minority of vessels carrying AIS on board, within the area was only active in the summer study period, when 80 unique recreational vessels were observed. The majority of vessels were transiting north/south and vice versa. A total of 14 of these recreational vessels called at Aberdeen Harbour.

Vessels anchored in three areas, the majority in the designated anchorage area north of Aberdeen Harbour. This was followed by the area east of Nigg Bay (1.2nm) where a number of shuttle tankers anchored during the study period. These vessels were not calling at Aberdeen Harbour, instead anchoring while waiting to load offshore, at distant oil fields. The final anchorage, south east (5nm) of Nigg Bay, is marked on the chart as a designated drilling rig anchorage, where a single shuttle tanker was recorded at anchor. During summer, 80% of anchored vessels were offshore related, rising to 86% in winter.

10.2 Maritime Incidents

Three data sources were used to assess the historical maritime incidents recorded in the vicinity of the harbour, Marine Accident Investigation Branch data between 2004 and 2013, Royal National Lifeboat Institution data between 2001 and 2010, and internal reports created by Aberdeen Harbour Board between 2008 and 2013.

On average, there were 11 incidents recorded per year in the MAIB incident data (2004-2013). The most common incident type within the MAIB data was ‘accident to person’ with

37% of incidents falling into this category. The majority of incidents occurred within the 'Port/Harbour Area', but it is noted that these incidents were not given exact coordinates.

An average of 14 incidents per year were recorded within the RNLI historical data (2001-2010). Similarly to the MAIB data, the most common incident type was 'person in danger', with 68% of incidents falling into this category.

The Aberdeen Harbour Board reports indicated that an average of 0.98 incidents occurred per 1,000 vessel movements. The most frequently occurring incidents during the period analysed related hard land / berthing, followed by machinery / equipment failure.

10.3 Vessel Encounters

Anatec's Encounter software was used to estimate the number of vessel encounters occurring over the study period. An encounter was classed as two vessels passing within 500m of each other within the same minute.

A total of 1,645 vessel encounters were estimated to occur within the 2014 AIS data, 1,087 in summer and 558 in winter. This corresponded to an average of 18 per day in summer and 9 per day in winter.

The highest density of encounters was in the approach to the current harbour, and the majority involved offshore vessels (61% in summer and 65% in winter). This was as a result of the large number of offshore vessels associated with Aberdeen Harbour.

10.4 Ship to Ship Collision Risk

Anatec's Ship to Ship model was used to estimate the frequency of a ship to ship collision occurring within 5nm of Nigg Bay. The model was initially run for a base case, using current traffic levels as an indicator of the overall vessel density. It was estimated that an incident will occur once every 119 years (per vessel) based on current shipping levels.

Future shipping levels were then estimated and used to assess the collision risk following the completion of the new development. An incident was estimated to occur once every 59 years (per vessel) based on the projected future traffic.

As noted in section 6.5, VTS has a positive impact on the reduction of collision. Whether VTS remains as it is or is extended (9.3.5), it is practical to expect the instance of collision to be lower than the worst case modelled in this assessment.

10.5 Stakeholder Consultation

Consultation on the issues surrounding the Nigg Bay development and shipping and navigation were undertaken with both primary stakeholders (national stakeholders and statutory consultees) and local and regional stakeholders. Eight responses concerning the development were received from stakeholders, providing further insight to their interests and

Nigg Bay. No stakeholder raised any serious shipping and navigation safety issues, instead providing further details regarding their marine activity.

This work with stakeholders was continued with their involvement in the hazard workshop.

10.6 Navigational Impact Assessment

The hazard workshop gave stakeholders the opportunity to discuss hazards and mitigations measures. While the harbour and commercial shipping were well represented no commercial fishing or recreational stakeholders were able to attend the workshop. Instead their consultation representations were discussed along with these stakeholder specific hazards. These hazards are noted in the Hazard Log (Appendix 1). A total of sixteen hazards were identified and quantified with a risk matrix, after which further potential mitigations were noted.

These hazards formed the basis for the formal safety assessment. Sixteen impacts have been evaluated and the risk ranked, five were assessed as being at a broadly acceptable level and eleven at a tolerable level. The process identified a number of additional mitigation measures and the impacts they influence, these are further detailed in Section 9.3.

11. References

AH, 2014. *Marine Safety Management System*. Version 4.5. Aberdeen: Aberdeen Harbour.

HRW, 2013. *Aberdeen harbour expansion – Wave agitation modelling – Option comparison*. Wallingford: HR Wallingford.

HRW, 2014. *Aberdeen harbour expansion – Navigation Study*. Wallingford: HR Wallingford.

MCA, 1998. *UK Coastguard Agency – Risk Analysis of Spills of Bunker Fuel Oils, Refined Products and Vegetable Oils in UK Waters*. Southampton: UK Coastguard Agency.

PSS, 2012. *Marine Accident Data Study*. London: Port Skills and Safety.

RYA, 2009. *UK Coastal Atlas of Recreational Boating*. Updated 2010. Hamble: Royal Yachting Association.

UKHO, 2009. *Admiralty Sailing Directions - North Sea (West) Pilot*. Eighth Edition. Taunton: The United Kingdom Hydrographic Office.

Appendix 1

Nigg Bay Development

Hazard Workshop Log

Prepared by:	Anatec Limited
Presented to:	Fugro Emu on behalf of Aberdeen Harbour Board
Date:	05/08/2015
Revision No.:	01
Reference:	A3501-FUG-HL-1

Anatec **Aberdeen Office**
Address: 10 Exchange Street, Aberdeen, AB11 6PH, UK
Tel: 01224 253700
Fax: 0709 2367306
Email: aberdeen@anatec.com

Cambridge Office
Braemoor, No. 4 The Warren, Witchford, Ely, Cambs, CB6 2HN, UK
01353 661200
0709 2367306
cambs@anatec.com

Ref No.	Phase (C or O)	Receptors	Hazard Title	Hazard Detail	Possible Causes	Embedded Mitigations (See note 1.)	Most Likely Consequence (with embedded mitigations)	Realistic Worst Case Consequence (with embedded mitigations)	Most Likely						Worst Case						Additional Mitigations Risk Reduction Measures (The risk assessment was undertaken assuming industry standard mitigation are in place, therefore this column highlights mitigations above that level that could be considered by the project).	Remarks / Questions
									People	Property	Environment	Business	Frequency	Risk	People	Property	Environment	Business	Frequency	Risk		
1	C	All vessels.	Vessel allision with exposed partially constructed breakwater / quayside.	During the construction phase there could be an increased risk of vessels alliding with the partially constructed breakwater / quayside, due to the fact that navigational aids (e.g. lights and markings) may not all be present.	Adverse weather / fatigue / human error / lack of awareness / lack of experience / mechanical failure / poor passage planning / poor visibility / vessel NUC / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Liaison between VTS and marine contractors / Phased aids to navigation / HSE Compliance / Works vessel planning and coordination.	Damage to the vessels. Minor injuries to crew members. Minor damage / disruption to the development.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member. Localised severe damage to the breakwater / quayside/oil spill	2	2	2	2	3	Broadly Acceptable.	3	3	3	3	2	Tolerable.	Appointment of dedicated Construction Marine Coordinator to liaise with VTS / advanced promulgation of information (to specific receptors) / planning so as to not impact adverse weather approaches / VTS (at a suitable level).	Highest risk from construction vessels as other vessels should avoid the development due to the use of an exclusion zone. As construction is in three phases, each phase could see a reduction in the risk to receptors as their experience of the development increases.
2	O	All vessels.	Vessel allision with fixed (fully constructed) structure	Due to the presence of fixed structures (breakwater / quayside) there could be an increased risk of vessel allisions with these structures.	Adverse weather / fatigue / human error / lack of awareness / lack of experience / mechanical failure / poor passage planning / poor visibility / vessel NUC / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Liaison between VTS and marine contractors / Phased aids to navigation / HSE Compliance / Works vessel planning and coordination.	Damage to the vessels. Minor injuries to crew members. Minor damage / disruption to the development.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member. Localised severe damage to the breakwater / quayside/oil spill	2	2	2	2	4	Tolerable.	3	3	3	3	2	Tolerable.	Pilotage training (different competence requirements to current harbour) / pilot exemption and vessel specification considered against the implication to safety / expansion of VTS upon completion to cover new harbour limits.	
3a	C	All vessels.	Vessel-to-vessel collision due to avoidance of the site (Construction Phase)	Displaced traffic increases congestion outside of the site during construction. This can lead to an increase in vessel-to-vessel encounters (passing or crossing traffic) and the possibly of collisions.	Adverse weather / fatigue / failure to comply with COLREGS / human error / lack of awareness / lack of experience / poor visibility / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Liaison between VTS and marine contractors / Phased aids to navigation / HSE Compliance / Works vessel planning and coordination.	Damage to the vessels. Minor injuries to crew members. Minor damage / disruption to the development.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member. Localised severe damage to the breakwater / quayside/oil spill	3	3	3	3	2	Tolerable.	4	4	4	4	1	Tolerable.	Appointment of dedicated Construction Marine Coordinator to liaise with VTS / installation of CCTV within Nigg Bay.	
3b	O	All vessels.	Vessel-to-vessel collision due to avoidance of the site (Operational Phase)	Displaced traffic increases congestion outside of the site during the operational phase. This can lead to an increase in vessel-to-vessel encounters (passing or crossing traffic) and the possibility of collisions.	Adverse weather / fatigue / failure to comply with COLREGS / human error / lack of awareness / lack of experience / poor visibility / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Liaison between VTS and marine contractors / Phased aids to navigation / HSE Compliance / Works vessel planning and coordination.	Damage to the vessels. Minor injuries to crew members. Minor damage / disruption to the development.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member.	3	3	3	3	2	Tolerable.	4	4	4	4	1	Tolerable.	Expansion of VTS upon completion to cover new harbour limits.	Passing traffic currently avoids Nigg Bay, this is expected to continue after construction.
4	C	All vessels.	Vessel-to-vessel collision due to construction / support vessels in the area	An increased number of vessels involved in construction activities may cause congestion outside of the site. This can lead to an increase in vessel-to-vessel encounters (passing or crossing traffic) and the possibility of collisions.	Adverse weather / fatigue / failure to comply with COLREGS / human error / lack of awareness / lack of experience / poor visibility / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Liaison between VTS and marine contractors / Phased aids to navigation / HSE Compliance / Works vessel planning and coordination.	Damage to the vessels. Minor injuries to crew members. Minor disruption to the development works.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member. Oil spill	3	3	3	3	2	Tolerable.	4	4	4	4	1	Tolerable.	All work vessels required to carry AIS regardless of size / appointment of dedicated Construction Marine Coordinator to liaise with VTS on the construction plans daily / installation of CCTV within Nigg Bay.	The most likely scenario is of a collision between two construction vessels, as other vessels are expected to avoid the site.
5	C and O	Commercial Vessels	Commercial vessel (powered) allision with the development	A commercial vessel (e.g. cargo ship, passenger ship or tanker) allides with the development when under power (steaming).	Adverse weather / fatigue / human error / lack of awareness / lack of experience / mechanical failure / poor passage planning / poor visibility / vessel NUC / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Phased aids to navigation.	Damage to the vessels. Minor injuries to crew members. Minor damage / disruption to the development.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member. Localised severe damage to the breakwater / quayside/oil spill	2	2	2	2	4	Tolerable.	3	3	3	3	2	Tolerable.	Pilotage training (different requirements to current harbour) / expansion of VTS upon completion to cover new harbour limits / appointment of dedicated Construction Marine Coordinator to liaise with VTS.	
6	C and O	Commercial Vessels	Drifting vessel allision with the development	Vessel loses power and drifts with wind and / or tide into the development.	Adverse weather / fatigue / human error / lack of awareness / lack of experience / mechanical failure / poor passage planning / poor visibility / vessel NUC / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Phased aids to navigation.	Damage to the vessels. Minor injuries to crew members. Minor damage / disruption to the development.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member. Localised severe damage to the breakwater / quayside/oil spill	3	3	3	3	2	Tolerable.	4	4	4	4	1	Tolerable.	Shuttle tanker anchorage area moved during construction.	Anchoring not occurring within or near Nigg Bay, so anchor dragging not considered an likely hazard. Biggest issue is considered to be vessels suffering engine failure when approaching or within port entrance.
7	C	Constructio n or Support Vessels	A collision as a result of cumulative increase in construction vessel activity from nearby developments	An increased number of vessels involved in cumulative developments in the vicinity causes a collision between construction vessels.	Adverse weather / fatigue / failure to comply with COLREGS / human error / lack of awareness / lack of experience / poor visibility / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Liaison between VTS and marine contractors / Phased aids to navigation / HSE Compliance / Works vessel planning and coordination.	Damage to the vessels. Minor injuries to crew members. Minor disruption to the development works.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member. Oil spill	2	2	2	2	2	Broadly Acceptable.	3	3	3	3	1	Broadly Acceptable.		There is not expected to be a significant cumulative impact from other developments.

Ref No.	Phase (C or O)	Receptors	Hazard Title	Hazard Detail	Possible Causes	Embedded Mitigations (See note 1.)	Most Likely Consequence (with embedded mitigations)	Realistic Worst Case Consequence (with embedded mitigations)	Most Likely						Worst Case						Additional Mitigations Risk Reduction Measures (The risk assessment was undertaken assuming industry standard mitigation are in place, therefore this column highlights mitigations above that level that could be considered by the project).	Remarks / Questions
									People	Property	Environment	Business	Frequency	Risk	People	Property	Environment	Business	Frequency	Risk		
8	C and O	Commercial Fishing Vessels	Fishing vessel allision with the development	A fishing vessel allides with the development whilst fishing in the area or steaming in transit.	Adverse weather / fatigue / human error / lack of awareness / lack of experience / mechanical failure / poor passage planning / poor visibility / vessel NUC / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Phased aids to navigation.	Damage to the vessels. Minor injuries to crew members. Minor damage / disruption to the development.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member. Localised moderate damage to the breakwater / quayside	1	1	1	1	1	Broadly Acceptable.	2	2	2	2	1	Broadly Acceptable.	Advanced promulgation of information (to specific receptors) / liaison with fishermen.	Low levels of fishing overall.
9	C	Commercial Fishing Vessels	Fishing gear interaction with subsurface structure	Fishing vessel snags gear on subsea structure (breakwater / quay foundation) during construction phase.	Fishing in proximity to the development.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Phased aids to navigation.	Minor damage to fishing gear / minor damage to subsea structure	Fishing gear lost / moderate damage to subsea structure	2	2	2	2	1	Broadly Acceptable.	3	3	3	3	1	Broadly Acceptable.	Advanced promulgation of information (to specific receptors) / liaison with fishermen.	The low level of fishing and the types of gear used make this scenario unlikely. Only a hazard during the construction phase before the surface construction is completed.
10	C and O	Recreational Craft	Recreational craft allision with the development	Recreational craft allides with the development.	Adverse weather / fatigue / human error / lack of awareness / lack of experience / mechanical failure / poor passage planning / poor visibility / vessel NUC / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Phased aids to navigation.	Damage to vessels / minor injuries to crew / minor damage or disruption to development.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member. Localised moderate damage to the breakwater / quayside	1	1	1	1	1	Broadly Acceptable.	2	2	2	2	2	Broadly Acceptable.	Use of works vessel as guard vessel / CCTV installed in Nigg Bay / advanced promulgation of information to specific receptors (contact with recreational facilities and clubs).	The level of recreational activity was low. Potential issue of 'curious' vessels looking in harbour during construction, which is more of an issue at night when they may not be observed clearly.
11	C	Construction or Support Vessels	Construction vessel allision with the development	Construction vessel allides with the development during construction activities at the site.	Adverse weather / fatigue / human error / lack of awareness / lack of experience / mechanical failure / poor passage planning / poor visibility / vessel NUC / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Liaison between VTS and marine contractors / Phased aids to navigation / HSE Compliance / Works vessel planning and coordination.	Damage to the vessels. Minor injuries to crew members. Minor damage / disruption to the development.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member. Localised severe damage to the breakwater / quayside/oil spill	2	2	2	2	4	Tolerable.	4	4	4	4	3	Tolerable.	Appointment of dedicated Construction Marine Coordinator to liaise with VTS / advanced promulgation of information (to specific receptors) / planning so as to not impact adverse weather approaches / VTS (at a suitable level).	
12	C	Construction or Support Vessels	Construction vessel collision with another construction vessel	Construction vessel collision whilst undertaking construction activities at the site.	Adverse weather / fatigue / failure to comply with COLREGS / human error / lack of awareness / lack of experience / poor visibility / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Liaison between VTS and marine contractors / Phased aids to navigation / HSE Compliance / Works vessel planning and coordination.	Damage to the vessels. Minor injuries to crew members. Minor disruption to the development works.	Penetration damage to the vessel resulting in severe damage. Possibly resulting in severe injury to a crew member. Oil spill	2	2	2	2	3	Broadly Acceptable.	4	4	4	4	1	Tolerable.	All work vessels required to carry AIS regardless of size / appointment of dedicated Construction Marine Coordinator to liaise with VTS on the construction plans daily.	
13	C	Construction or Support Vessels	Person in water (man overboard) at the site during construction activities	Worker falls overboard undertaking construction activities at the site.	Accident / adverse weather / human error / lack of experience.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Liaison between VTS and marine contractors / Phased aids to navigation / HSE Compliance / Works vessel planning and coordination.	Minor injury to crew member.	Fatality	3	3	3	3	2	Tolerable.	4	4	4	4	2	Tolerable.	Aberdeen Harbour buoyancy aid procedures to be adhered to / rescue boat present at all times (with trained personnel on site) / regular safety checks from Aberdeen Harbour representative.	
14	C	Construction or Support Vessels	Construction vessels snagging on fishing pots	A workboat becomes entangled / disabled by the buoyed line attached to a pot.	Human error / lack of awareness / poor visibility / watchkeeping failure.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Liaison between VTS and marine contractors / Phased aids to navigation / HSE Compliance / Works vessel planning and coordination.	Minor damage to vessel / vessel entangled / loss of pot	Moderate damage to vessel / vessel entangled and disabled / loss of pot	1	1	1	1	2	Broadly Acceptable.	2	2	2	2	1	Broadly Acceptable.	Construction vessel transit routes made known / liaison with fisherman.	
15	C	Crew Transfer Vessels	Person in water (man overboard) during a vessel to vessel transfer	A person is lost overboard (man overboard) while transferring from a crew transfer vessel to a work vessel during the construction phase.	Adverse weather / human error / lack of experience / personal injury / poor visibility.	Promulgation of information / MCA guidance / IALA guidance / Safety or Precautionary Zones / Industry best practices / Vessels to comply with international conventions (SOLAS / COLREGS etc.) / The Port Marine Safety Code and guidance; / Liaison between VTS and marine contractors / Phased aids to navigation / HSE Compliance / Works vessel planning and coordination.	Minor injury to crew member.	Fatality	3	3	3	3	2	Tolerable.	4	4	4	4	2	Tolerable.	Checking of PPE on all vessels involved in crew transfer / correct training for all transfer vessels as detailed by MCA.	Any operators of crew transfer vessels are expected to have good knowledge of harbour. MCA training for transfer vessels is available locally.

Notes

Note that throughout this process the following industry standard risk reduction measures are assumed to be in place:

- Promulgation of information (including Notice to Mariners and / or radio warnings;
- MCA guidance;
- IALA guidance;
- Safety or Precautionary Zones;
- Construction Design and Management Regulations;
- Industry best practices;
- Vessels to comply with international conventions (SOLAS / COLREGS etc.);
- The Port Marine Safety Code and guidance;
- Processes in place for direct liaison between VTS and any marine contractors (planned vessel movements);
- Permanent and temporary / phased aids to navigation;
- Health Safety and Environment Compliance; and
- Works vessel planning and coordination to ensure that construction vessels do not pose a hazard to other users.

Consequences					Frequency				
					1	2	3	4	5
Severity rating	**People**	**Property**	**Environment**	**Business**	**Negligible**	**Extremely Unlikely**	**Remote**	**Reasonably Probable**	**Frequent**
1 Negligable	Zero injury	Zero damage	Zero effect	Zero impact					
2 Minor	Minor injury	Minor damage	Minor effect	Minor impact					
3 Moderate	Major injury	Moderate damage	Moderate effect	Considerable impact					
4 Serious	Single fatality	Major damage	Major effect	Major national impact					
5 Major	Multiple fatalities	Extensive damage	Extensive effect	Major international impact					

	Broadly Acceptable (low risk)
	Tolerable (intermediate risk)
	Unacceptable (high risk)