

Marine Scotland



The Scottish
Government
Riaghaltas na h-Alba

SHIPPING STUDY OF THE PENTLAND FIRTH AND ORKNEY WATERS

marinescotland

Halcrow



Shipping Study of the Pentland Firth and Orkney Waters

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1. INTRODUCTION

Under the Scottish Government Framework Contract for Provision of Strategic Environmental Assessment (REF: 17895), Scottish Ministers commissioned Anatec and Halcrow to provide a Shipping Study of the Pentland Firth and Orkney Waters (**PFOW**) Strategic Area.

The specific focus of the study is commercial shipping and recreational vessels. Other Marine Scotland publications which include recent shipping information that may be useful to the reader are referred to below:

- “Scotland’s Marine Atlas: Information for The National Marine Plan”, March 2011, ISBN 9870755982547, available from Marine Scotland online via: <http://www.scotland.gov.uk/Publications/2011/03/16182005/0>
- “Shipping Study of the four Major Scottish Ports: Forth, Dundee, Aberdeen and Clyde”, June 2012. This study of commercial shipping routes and volumes for these four major port areas is anticipated to be available online shortly from Marine Scotland.
- “ScotMap: the Inshore Fishing Study Pilot in Pentland Firth and Orkney Waters”, 2012. The draft report of this study of Scottish commercial fishing areas and routes is available from Marine Scotland online via: <http://www.scotland.gov.uk/Topics/marine/marineenergy/wave/rlg/pentlandorkney/draftreportonScotMapPentlandFirthandandOrkneyWater>

Other references used in this study are included in Section 11 of this report.

The Steering Group for the project consisted of the following organisations (in addition to Marine Scotland, Anatec and Halcrow):

- Maritime and Coastguard Agency (**MCA**)
- Northern Lighthouse Board (**NLB**)
- Chamber of Shipping (**CoS**)
- Royal Yachting Association (**RYA**) (Scotland)
- Scrabster Harbour Trust
- Orkney Islands Council (**OIC**) Marine Services

Marine Scotland and their consultants, Anatec and Halcrow, greatly appreciate the significant contribution made to the study by members of the Steering Group and the many respondents to the study questionnaire.

This report summarises the work carried out on the project and the key findings and recommendations.

2. OVERVIEW OF PROJECT

Marine Scotland, the part of the Scottish Government responsible for marine management in Scottish waters, has commissioned the study of shipping activity to better inform the marine spatial plan pilot for the Pentland Firth and Orkney Waters Strategic Area. The aim of this process is to ensure there is good knowledge of the use of these waters by all stakeholders so that future developments do not inadvertently impact on important existing activities.

The PFOW Strategic Area is shown in Figure 2.1. This includes the names of key islands and channels used throughout the document. (Where other place names or features are mentioned their locations have been described in a footnote.)

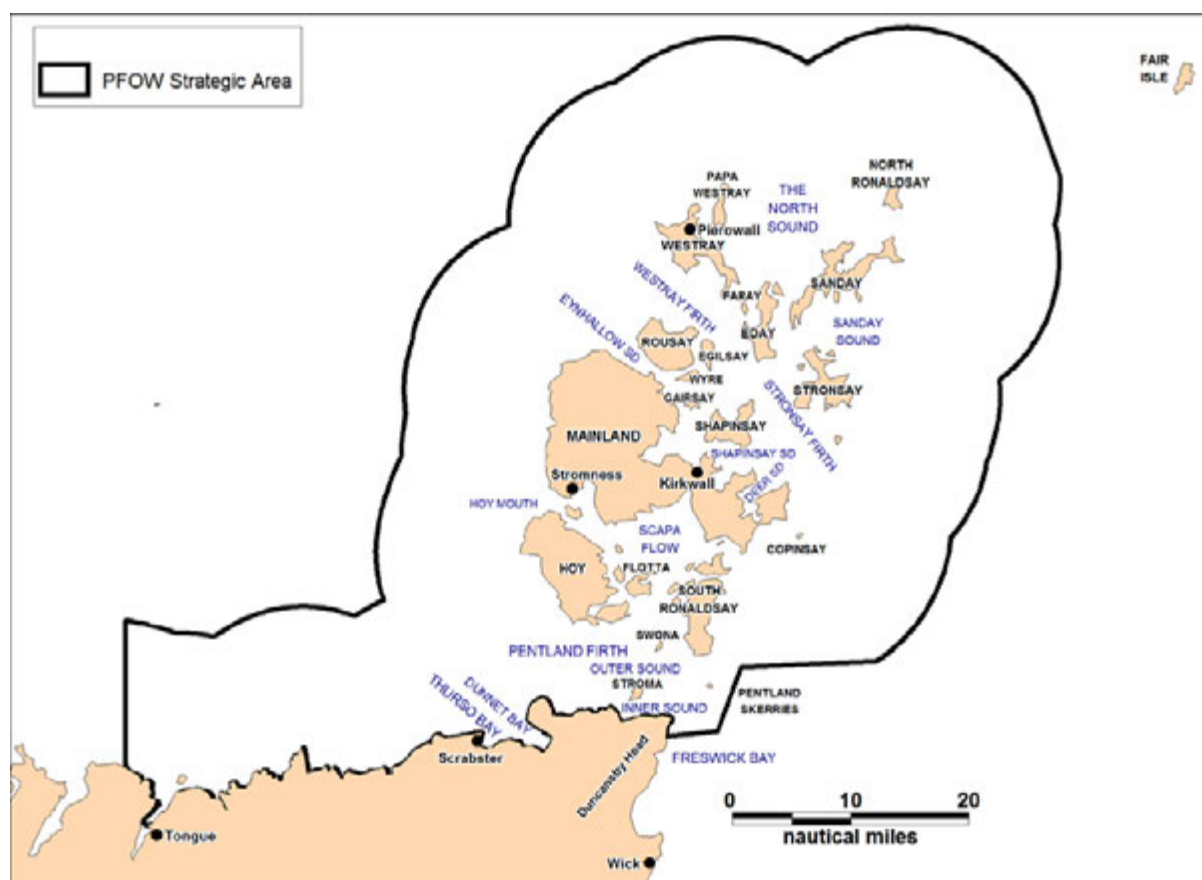


Figure 2.1 Overview of Pentland Firth and Orkney Waters Strategic Area

The study is interested in all Commercial Shipping and Recreational Vessel activity, including yachts (cruising and racing), power boats, motor cruisers, recreational and sports fishing (e.g. sea angling), wildlife cruises and recreational diving, etc.

Commercial fishing (under license) was excluded from the work as Marine Scotland has recently carried out ScotMap, a pilot study in the Pentland Firth and Orkney Waters to gain a more detailed understanding of inshore fishing activity in Scottish Territorial Waters. Military / naval vessel activity was also excluded.

Marine Scotland is planning a further study on tourism and recreation activities which will include sea kayaking, surfing and other marine-based recreational activities. Therefore, this activity was not considered in detail although kayakers were included in the questionnaire.

More generally, the study complements other research by Marine Scotland, such as Scotland's Marine Atlas (Ref. i).

3. METHODOLOGY

The main tasks carried out by the project were as follows:

- Literature review of published data
- Initial consultation with key stakeholders to identify additional data
- Taking stock of the available data
- Shipping surveys of the area – winter and summer 2012 – to gather new information (Automatic Identification System (**AIS**))
- Targeted questionnaire to fill in gaps in information
- Stakeholder consultation workshops in Orkney and Caithness

Commercial shipping (vessels of 300 gross tonnes and over) density and movements have been characterised entirely by using the AIS shipping surveys.

Small vessel activity, such as recreational vessels, is only partially covered by AIS so this was the main focus of the consultation, questionnaire and workshops.

The availability of radar data was investigated at the outset of the study. OIC Marine Services operate a Vessel Traffic Services (**VTS**) from Scapa which receives data from a number of radar scanners in the area. Discussions with the VTS Manager indicated the data available were limited to counts of vessels rather than tracks, with targets being anonymous and the data being generally time-consuming to extract and work with. However, the VTS is being upgraded during 2012 to 13 with the addition of new scanners to extend coverage. Therefore, it is a potential source of data for any future updates of this work. This is discussed in Section 10.

4. LITERATURE REVIEW

The following reference publications were reviewed:

- Admiralty Charts (Ref. ii)
- Admiralty Sailing Directions (Ref. iii).
- Clyde Cruising Club (**CCC**) Sailing Directions and Anchorages for N and NE Scotland and Orkney Islands (Ref. iv)
- Orkney Marinas' Sailing Guides (Ref. v)
- RYA Coastal Atlas (Ref. vi)
- The Cruising Almanac 2012 (Ref. vii)

The full references are included in Section 11.

Example extracts from some of these publications are provided below.

RECOMMENDATION ON NAVIGATION
Mariners intending to use the Pentland Firth should be aware of very strong tidal streams and sets within the area (see Note, TIDAL STREAMS). Difficulties can be encountered when transiting either with or against the tide. Masters should ensure that a close watch is kept at all times on the course, speed and position of their vessels.

LADEN TANKERS

Laden tankers not bound to or from Flotta and Scapa Flow should not use the Pentland Firth in restricted visibility or adverse weather. At other times there may be a case for transiting with the tide to reduce the time spent in the Firth, although masters should take account of the general navigational warning note: **RECOMMENDATION ON NAVIGATION.**

Figure 4.1 Chart Guidance for the Pentland Firth

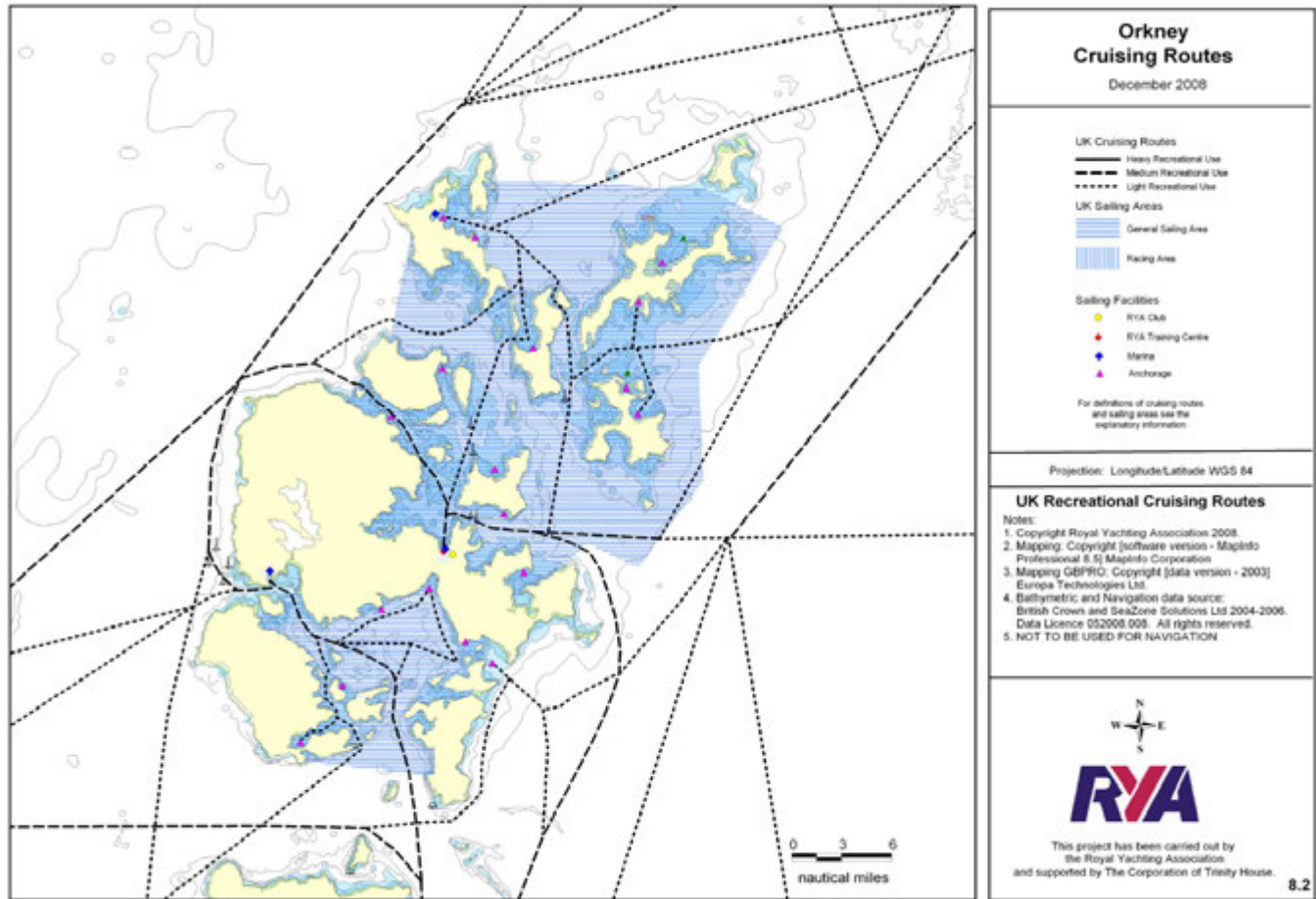


Figure 4.2 Extract from the RYA Coastal Atlas

Kirkwall to Stromness / Stromness to Kirkwall: Kirkwall to Stromness takes about 3.5 hours at 8 knots. Sailing from Stromness to Kirkwall, there is a quite a roost out of Hoy Sound¹ on the ebb during any westerly weather. Eynhallow Sound is best approached on the flood. The deepest water is between Rousay and Eynhallow but the most straightforward channel is between Eynhallow and Mainland Orkney. The tide in Eynhallow Sound turns approximately the same time as Kirkwall so Hoy Sound is reached at the first flood.

Figure 4.3 Extract from Orkney Marinas Sailing Guide

The above publications provide useful background information on recreational vessel activity in the area of interest, but the information is not as precise as required by Marine Scotland for the spatial planning work.

Further consultation was carried out with potential data providers and stakeholders to identify other information, as described in Section 5.

¹ Sound between Orkney Mainland and Hoy, west of Scapa Flow

5. CONSULTATION & DATA COLLECTION

5.1 Introduction

The following were contacted as part of the initial stakeholder consultation to help identify other data sources relevant to the project:

- Scrabster Harbour
- Wick Harbour
- OIC Marine Services
- Highland Council
- Clyde Cruising Club
- RYA (Scotland)
- Orkney Marinas Limited (**OML**)
- Marine Scotland: Salmon & Recreational Fisheries Team
- Scottish Federation of Sea Anglers
- Aberdeen Coastguard Maritime Rescue Coordination Centre (**MRCC**)

Details of some of the additional data collected are summarised below. Varying recording methods were in place at the marinas, therefore there are differences in whether the figures present destination or country of origin. Data were available for a variety of different periods therefore, in the majority of cases, data were presented for 2010 and 2011.

5.2 Scrabster Harbour

Scrabster Harbour Trust provided information on vessels callings at the harbour for 2009, 2010, 2011 and 2012 (to 31 August).

A graph of the monthly number of merchant and recreational vessels recorded for 2010 and 2011 is presented in Figure 5.1. (Note: Commercial fishing vessels data are not included in this study as explained in Section 2, and are reported in the commercial fishing study referenced in Section 1.)

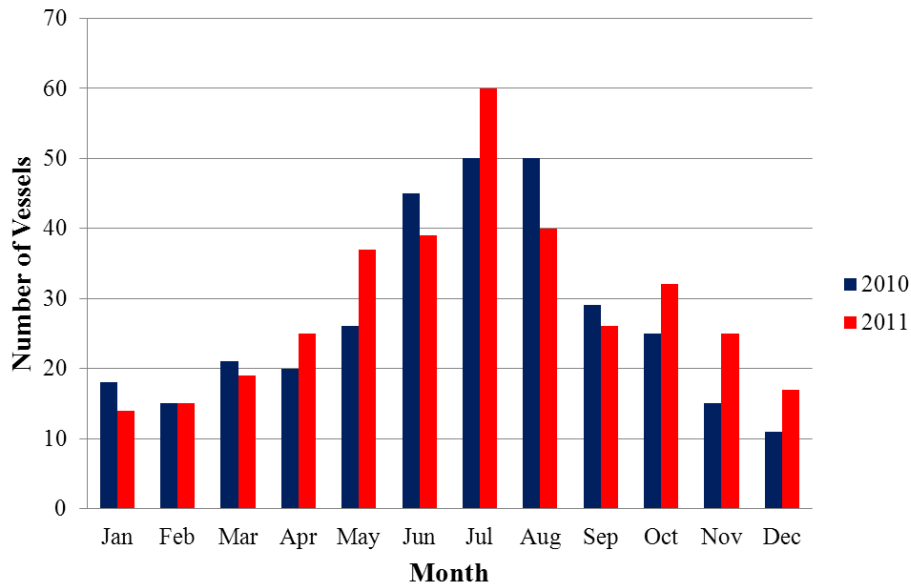


Figure 5.1 Number of Vessels Calling at Scrabster in 2010 and 2011 (exc. Fishing)

It can be seen that visiting vessels peaked in summer.

A breakdown of the types of vessels calling at Scrabster in 2010 and 2011 is presented in Figure 5.2.

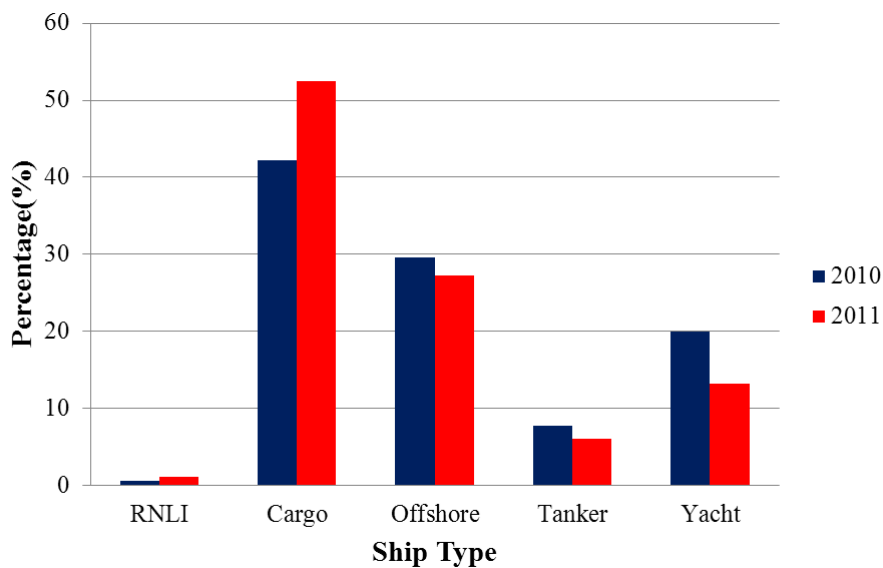


Figure 5.2 Vessel Type Distribution – Scrabster (2010-11)

Merchant vessels (cargo, offshore and tanker) represented approximately 80-85% of the visiting vessels with yachts representing 15-20%. The number of yachts dropped from 65 to 46 between 2010 and 2011. This may be related to port redevelopment work that was taking place during 2011.

Figure 5.3 presents the monthly number of yachts recorded in 2010 and 2011.

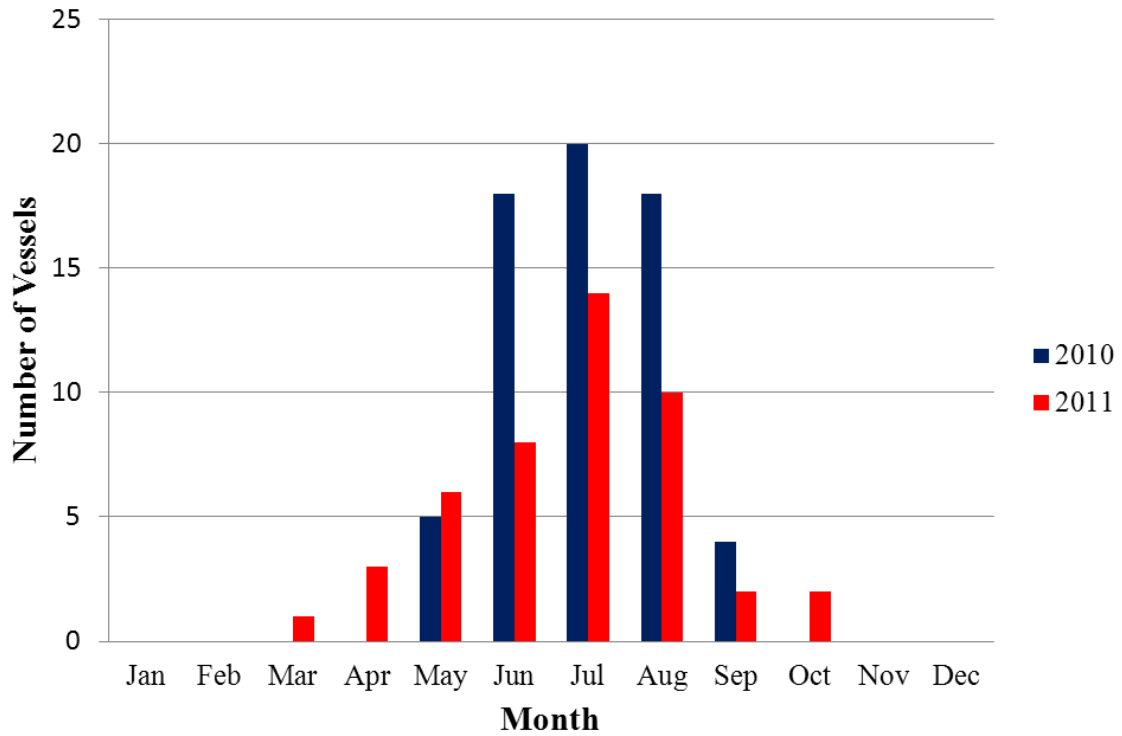


Figure 5.3 Number of Yachts Calling at Scrabster in 2010 and 2011

All yachts visited between March and October with the peak months being June, July and August.

Graphs of ship lengths and destinations for recreational vessels visiting Scrabster in 2010-11 are presented in Figure 5.4 and Figure 5.5.

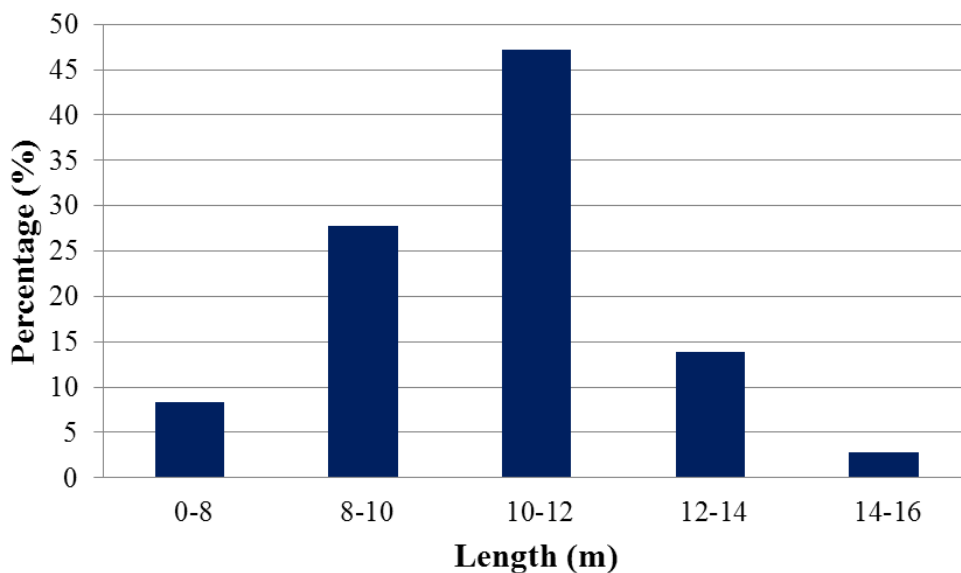


Figure 5.4 Length of Yachts Calling at Scrabster (2010-11 combined)

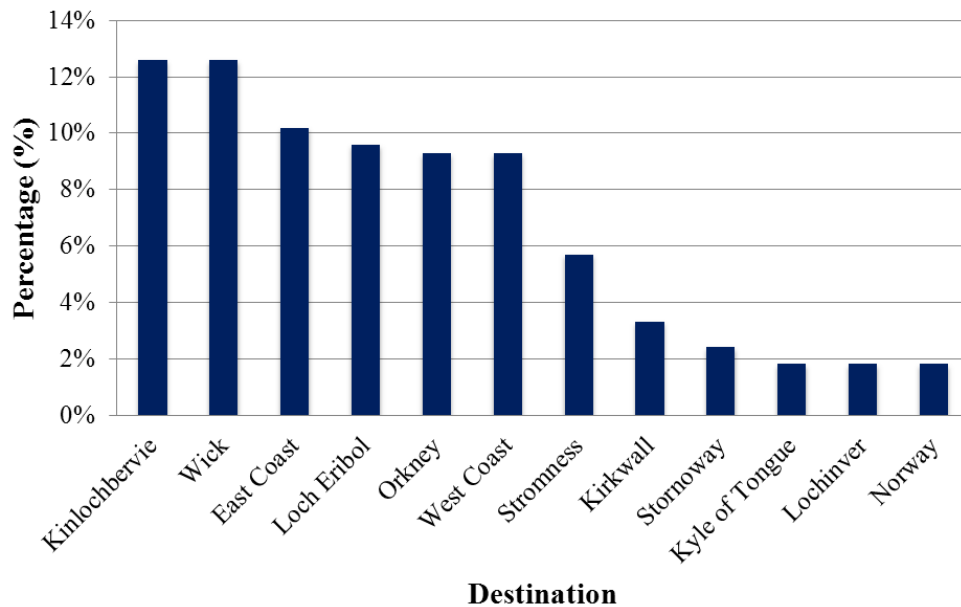


Figure 5.5 Destinations of Yachts Calling at Scrabster (2010-11 combined)

Most vessels visiting Scrabster tended to be between 8m and 14m in length. Popular destinations were eastwards to Wick (via Pentland Firth), westwards to Kinlochbervie and northwards to Orkney (crossing the Pentland Firth).

Data received for the first half of 2012 showed similar trends to the analysis above. However, it is noted that the port redevelopment mentioned above, as well as affecting the numbers in 2011, could lead to additional numbers in future as new pontoons have been installed for recreational vessels.

5.3 Orkney Marinas

Orkney Marinas Limited (OML) operates all the marina berthing facilities in Orkney. The three marinas are situated within harbours under the jurisdiction of the Orkney Islands Harbour Authority. Facilities are summarised in Table 5.1.

Table 5.1 Orkney Marinas Facilities

Facilities	Kirkwall	Stromness	Westray
Berths	95	72	17
Depths (m)	1 to 2.7	2	1 to 3
Max Length (m)	20	20	20
Access	All states of tide	All states of tide	All states of tide

Details of vessels calling at Kirkwall, Stromness and Westray Marinas were obtained from Orkney Marinas for 2010 and 2011.

The total numbers of visitors to each marina in 2010 and 2011 are summarised in Figure 5.6. It can be seen that 2011 was approximately 10-15% busier than 2010.

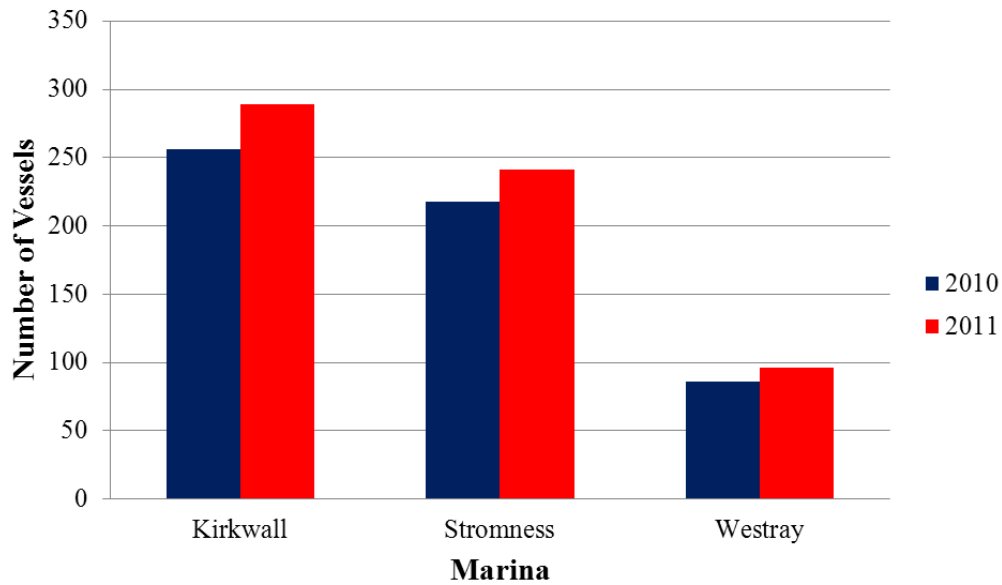


Figure 5.6 Total Visitors to Orkney Marinas – 2010 and 2011

More detailed analysis of the data for each marina is presented below.

5.3.1 Kirkwall Marina

The monthly number of vessels visiting Kirkwall Marina in 2010 and 2011 is presented in Figure 5.7.

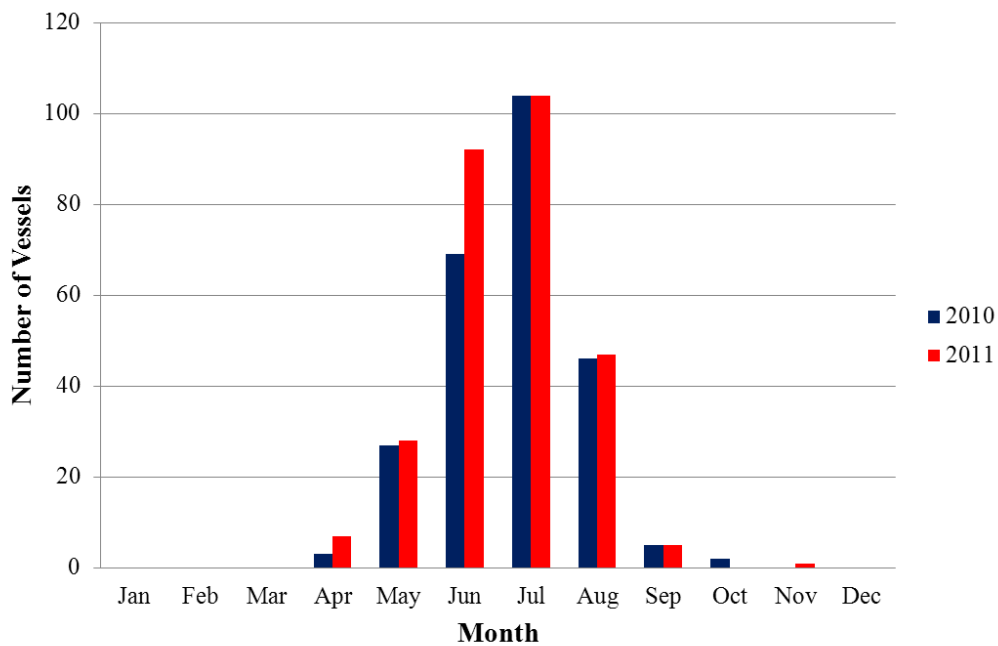


Figure 5.7 Number of Vessels Calling at Kirkwall Marina

There were a total of 545 vessels visiting Kirkwall Marina between 2010 and 2011, with most between May to August, peaking in June and July.

The length distribution of vessels visiting Kirkwall Marina in 2010 and 2011 is presented in Figure 5.8.

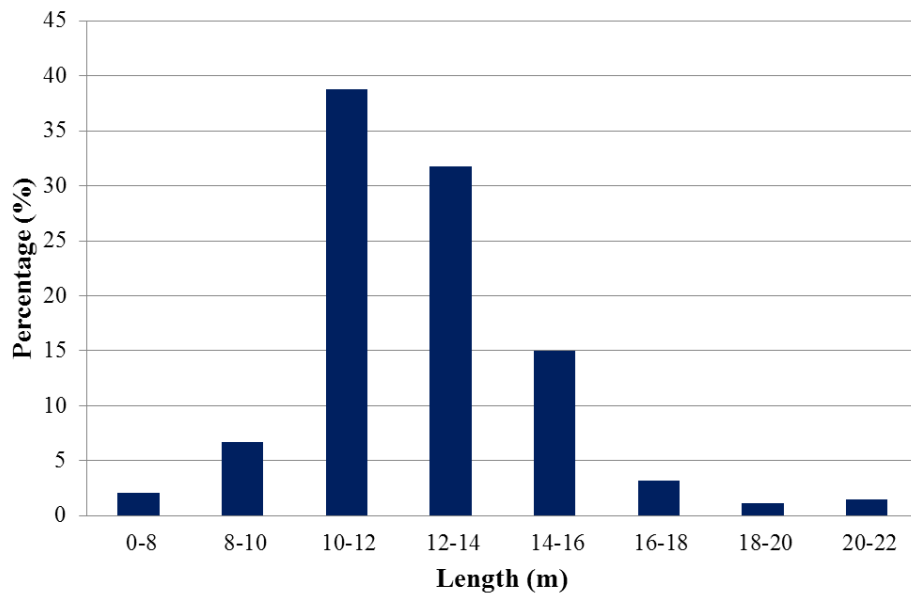


Figure 5.8 Length of Vessels visiting Kirkwall Marina (2010-11 combined)

The majority of vessels of visiting the marina were between 10-12m (39%) and 12-14m (32%). Larger vessels recorded between 20-22m were recorded 8 times visiting the marina.

An overview of the country of origin of the recorded vessels at Kirkwall during 2011 is presented in Figure 5.9. (Data were unavailable for 2010.)

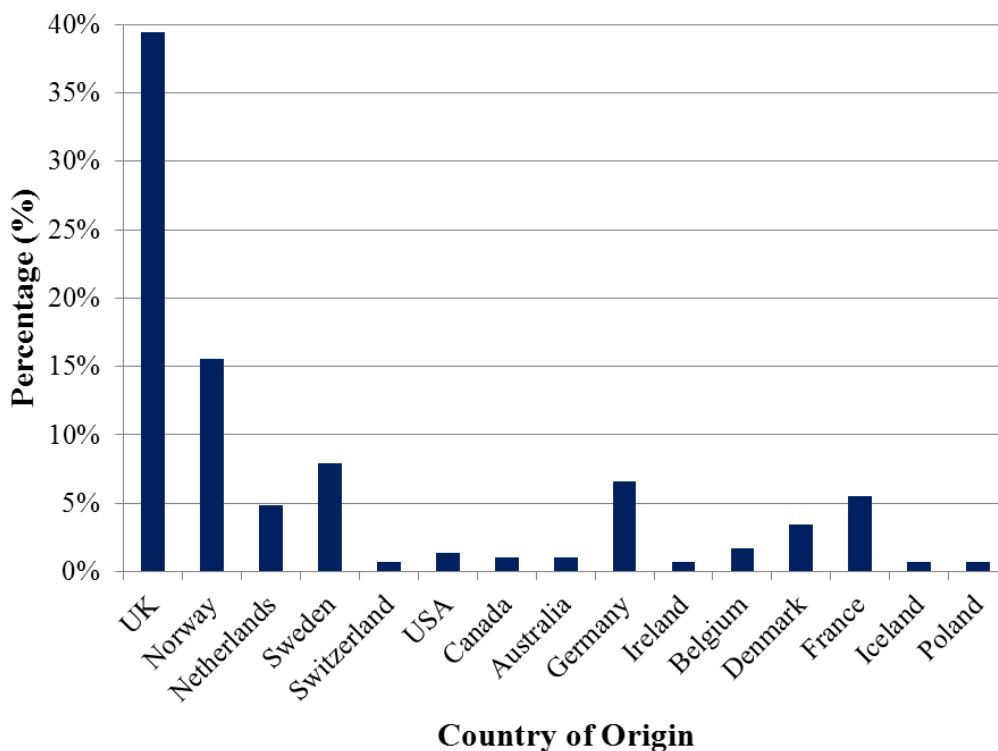


Figure 5.9 Vessel Nationalities – Kirkwall (2011)

It can be seen that whilst the UK was the most common nationality (39%) the majority of visitors were international, including Norway (16%), Sweden (8%), Germany (7%), France (6%) and The Netherlands (5%).

5.3.2 Stromness Marina

The monthly numbers of recreational vessels visiting Stromness Marina in 2010 and 2011 are presented in Figure 5.10.

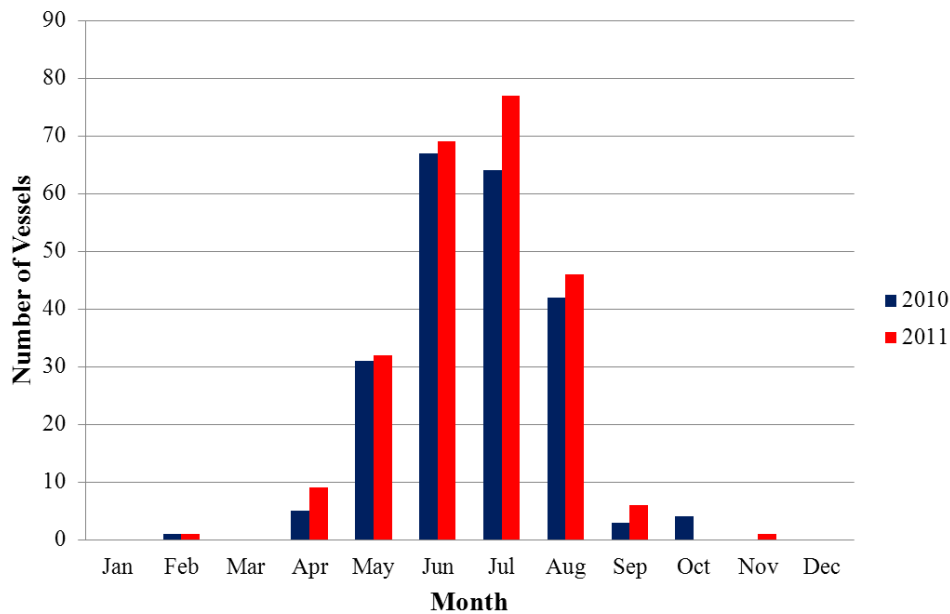


Figure 5.10 Number of Vessels Calling at Stromness in 2010 and 2011

As with Kirkwall, vessel visits were almost entirely in the spring and summer, with peaks in June and July, but there were two vessels recorded in February and one in November.

The length distribution of vessels visiting Stromness Marina is presented in Figure 5.11.

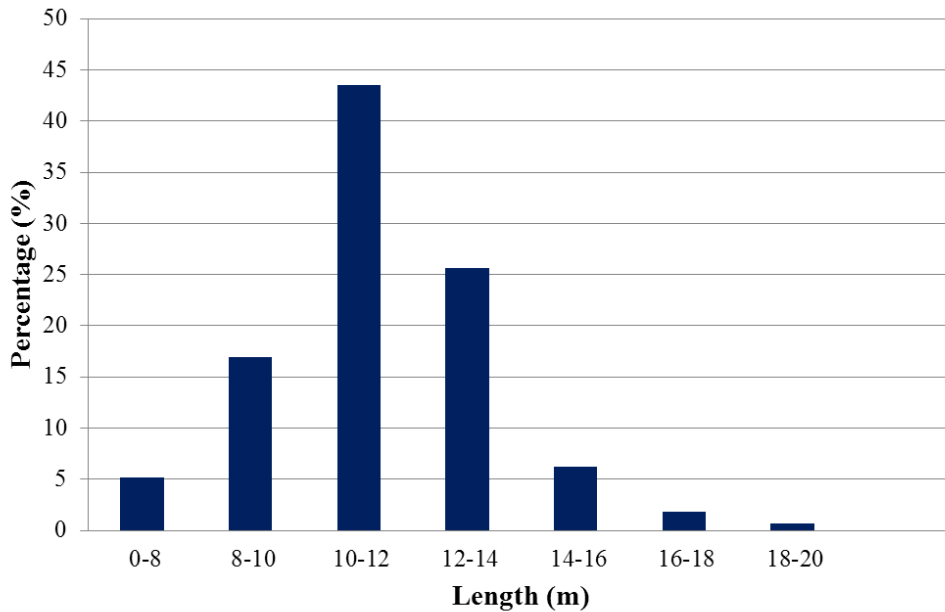


Figure 5.11 Length of Vessels visiting Stromness Marina (2010-11 combined)

The majority of vessels visiting Stromness Marina were in the range 10-12m (44%) and 12-14m (26%). There were no vessels over 20m. Overall, the lengths at Stromness tended to be smaller than at Kirkwall.

The country of origin for visitors to Stromness is presented in Figure 5.12.

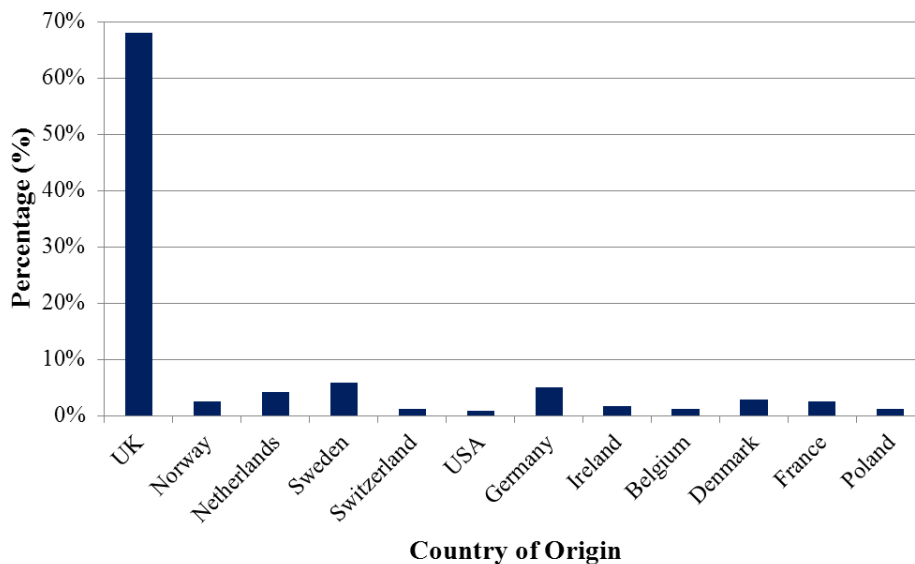


Figure 5.12 Vessel Nationalities – Stromness (2011)

Just over two-thirds were from the UK (68%), followed by Sweden (6%), Germany (5%), and other countries.

5.3.3 Westray Marina

The results of the Westray Marina visitor analysis are presented below. The findings are broadly similar to the other Orkney marinas, although it is noted that Westray is

more remote and therefore had less than half the number of visitors as Kirkwall and Stromness.

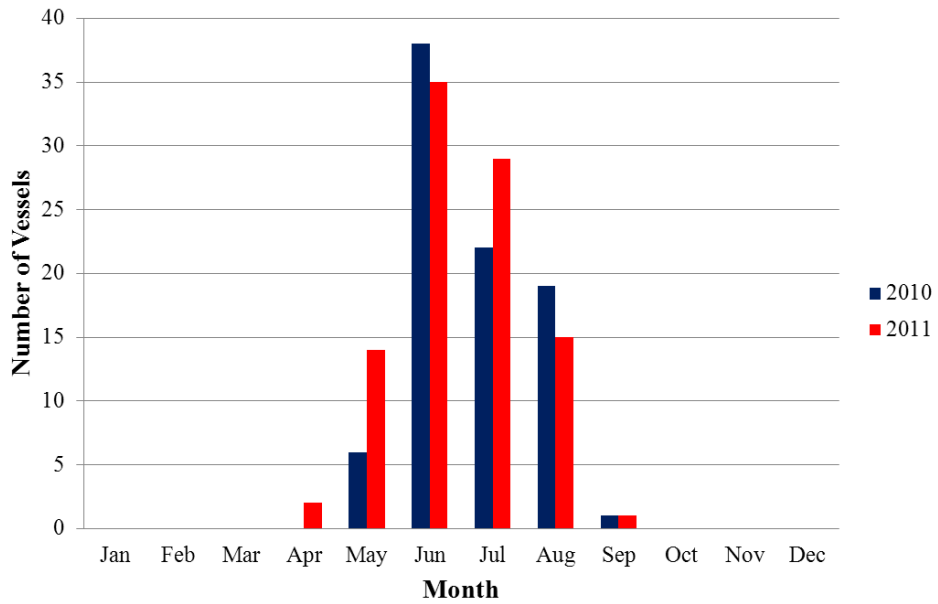


Figure 5.13 Number of Vessels Calling at Westray in 2010 and 2011

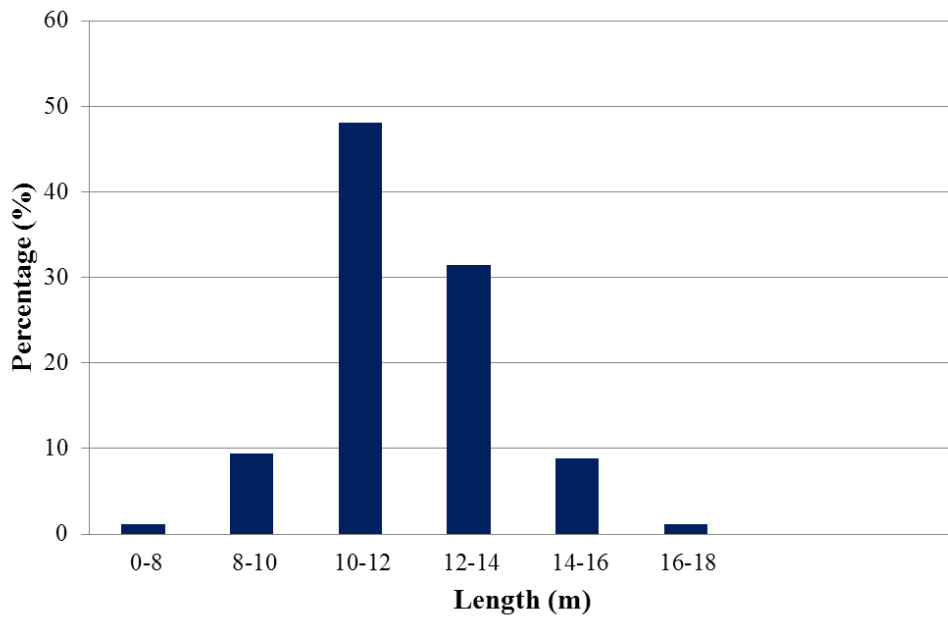


Figure 5.14 Length of vessels Visiting Westray Marina (2010-11 combined)

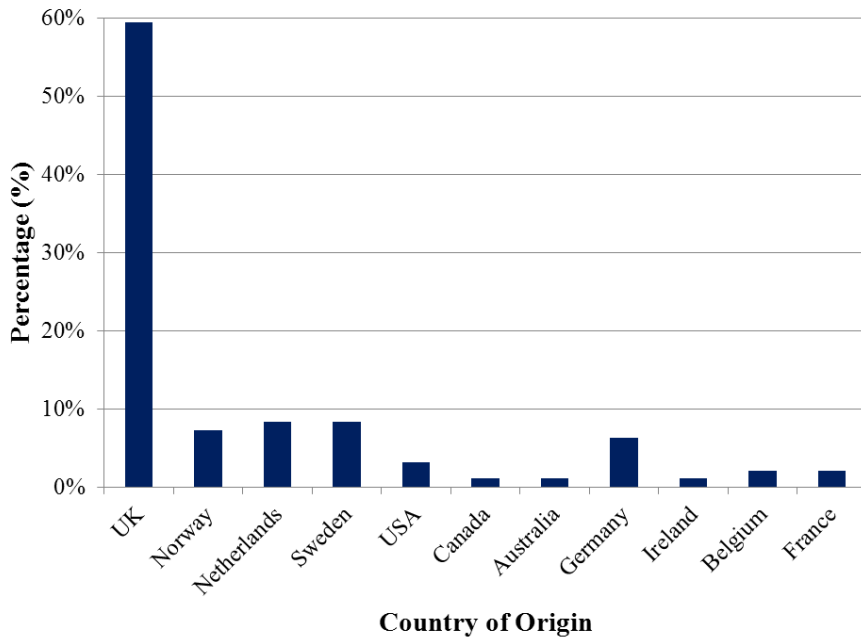


Figure 5.15 Vessel Nationalities – Westray (2011)

5.4 Wick Harbour

Summarised information on recreational visitors to the marina at Wick Harbour was obtained from the Harbour Master during the initial consultation task. This is summarised in Figure 5.16.

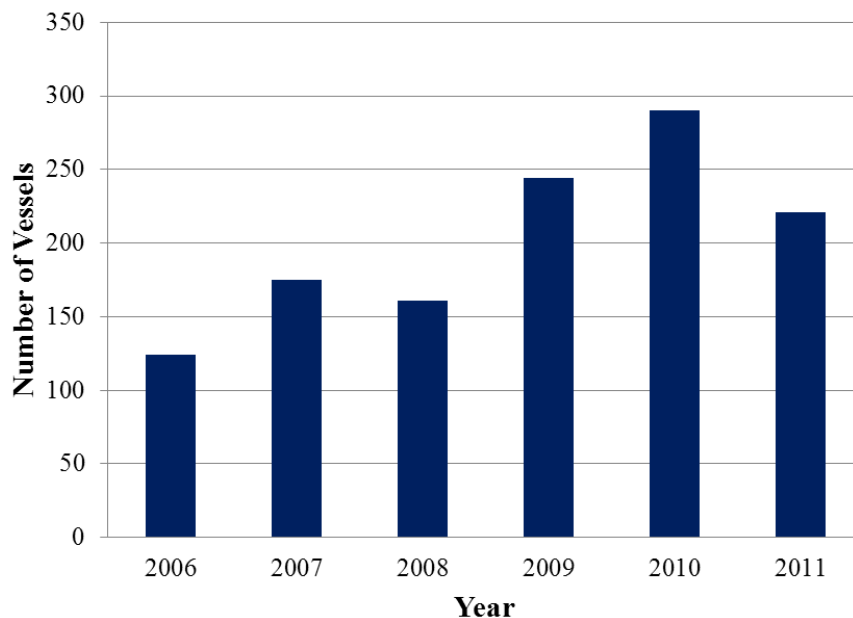


Figure 5.16 Annual Number of Recreational Vessels Calling at Wick (2006-2011)

It can be seen that there was a generally increasing trend in the total number of visiting recreational vessels from 2006 to 2010. The 2011 numbers are lower than the preceding two years, which the Harbour Master indicated was due to bad weather at the start and end of the season.

More detailed information on individual visitors was only available in paper form. As part of this project, a visit was made to Wick in early July 2012 to review the paper forms and create a spreadsheet of recreational visitors to allow more detailed analysis covering the period 1 January 2011 to 30 June 2012.

A graph of the monthly number of recreational vessels visiting Wick Marina in 2011 is presented in Figure 5.17.

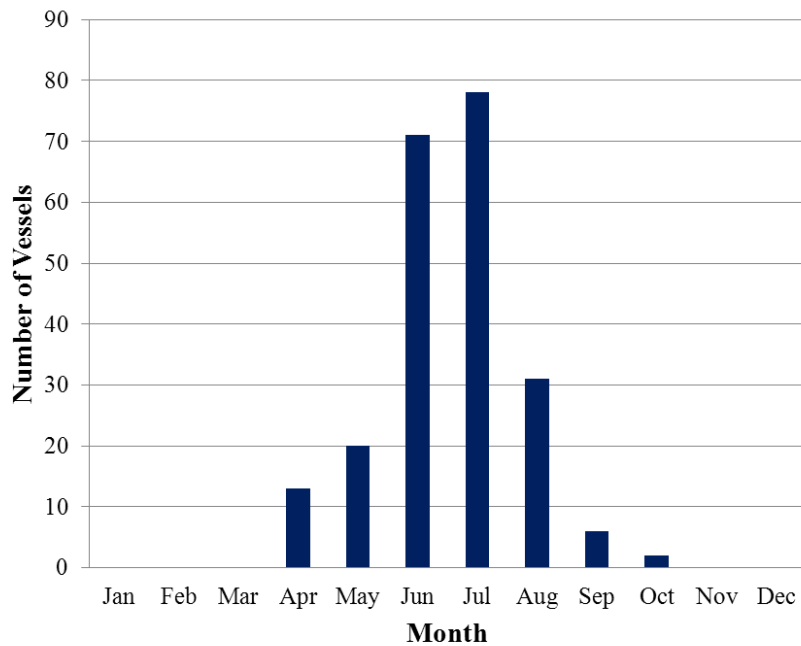


Figure 5.17 Number of Recreational Vessels Calling at Wick in 2011

Recreational vessels were recorded as visiting Wick between April and October, with numbers peaking in June and July.

An overview of the nationality of the recreational vessels recorded in 2011 is shown in Figure 5.18.

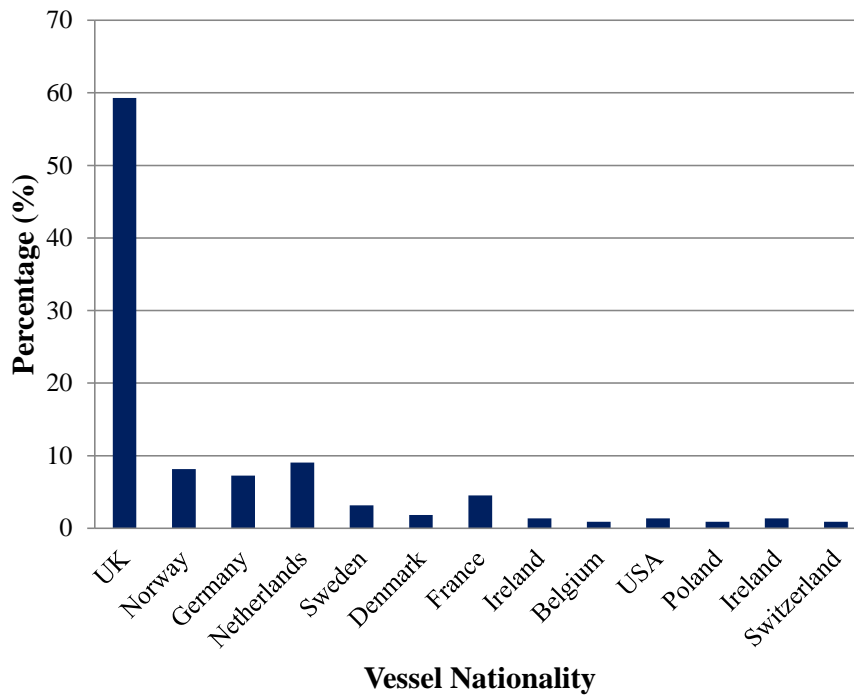


Figure 5.18 Vessel Nationalities – Wick Marina 2011

Almost 60% of all visiting recreational vessels recorded were from UK, followed by The Netherlands (9%), Norway (8%), Germany (7%) and France (almost 5%), with the rest well under 5%.

Data collected for the first 6 months of 2012 showed a similar trend with the first recreational vessels visiting the marina in April. Similar trends began to appear for April, May and June with the number of yachts visiting increasing per month as seen in 2011.

Based on the combined data set, the main departure and destination ports for callers at Wick are presented in Figure 5.19.

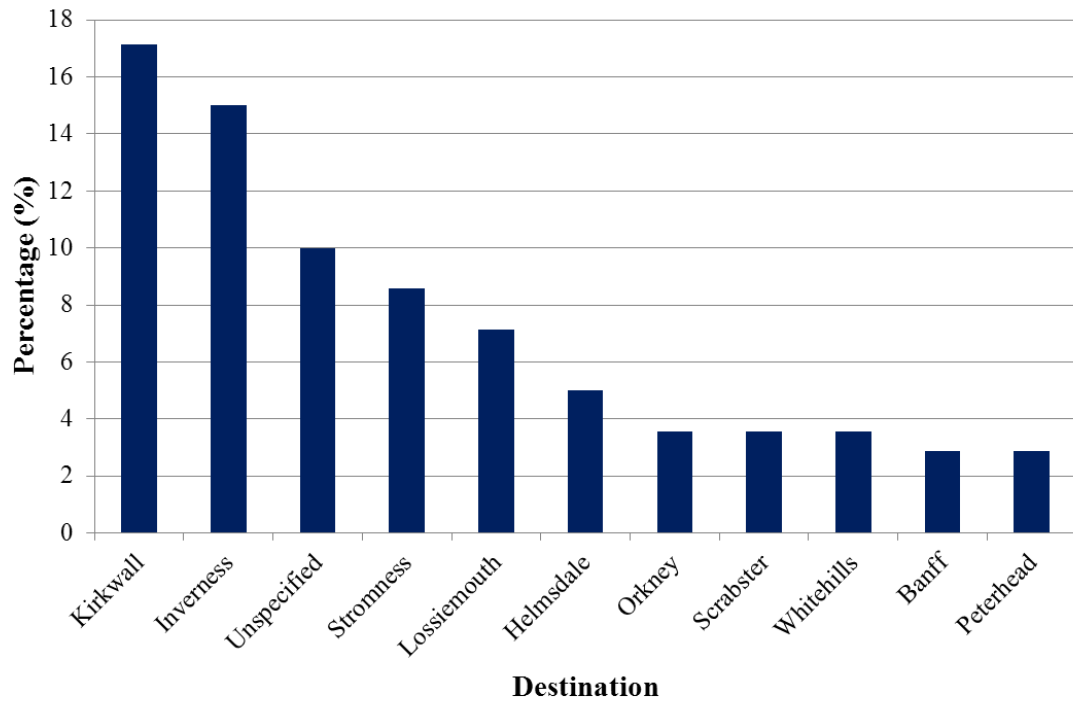


Figure 5.19 Vessel Departure / Destination Ports - Wick Marina (Jan 2011 to Jun 2012)

5.5 Highland Council Harbours

The Highland Council operates recreational craft facilities on the west coast of Scotland, at Lochinver, Kinlochbervie and Kyle of Lochalsh. As part of this project, Anatec supplied the Council with forms for logging visitors. Data were collected between April and August 2012 (inclusive).

The monthly numbers of visitors is presented in Figure 5.20.

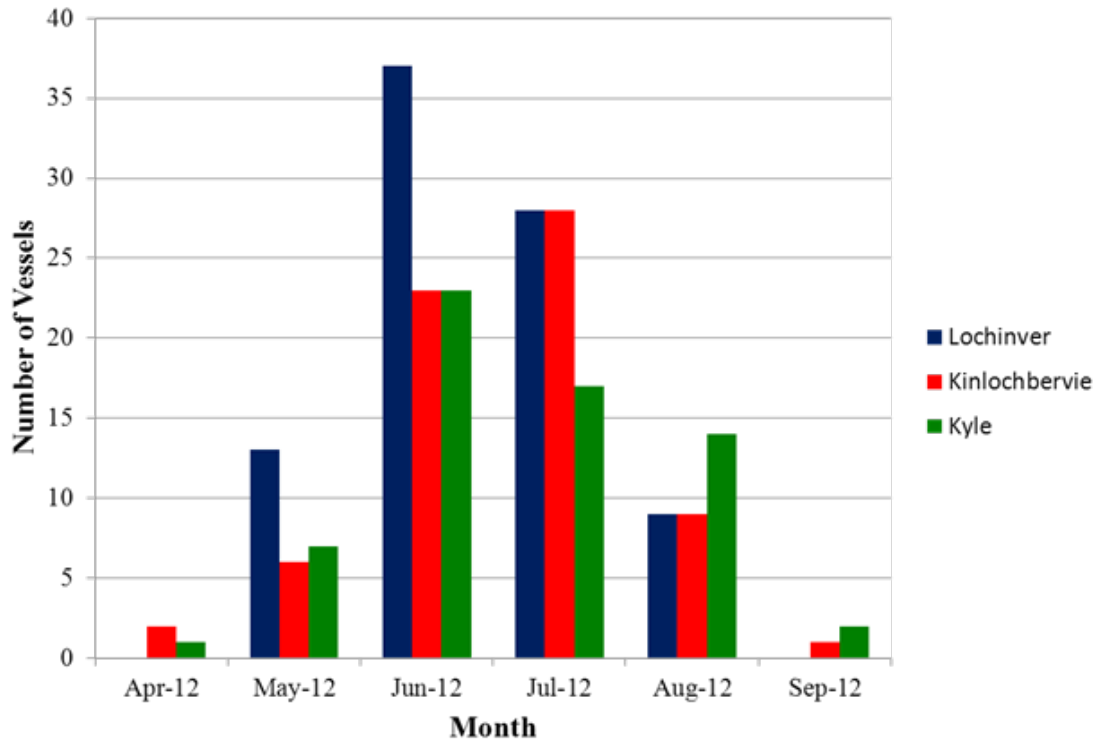


Figure 5.20 Numbers of Recreational Vessels visiting Highland Council Facilities

It can be seen there was a similar monthly trend for all the marinas, with June and July being the busiest months.

The length distribution of recreational vessels visiting each facility is presented in Figure 5.21.

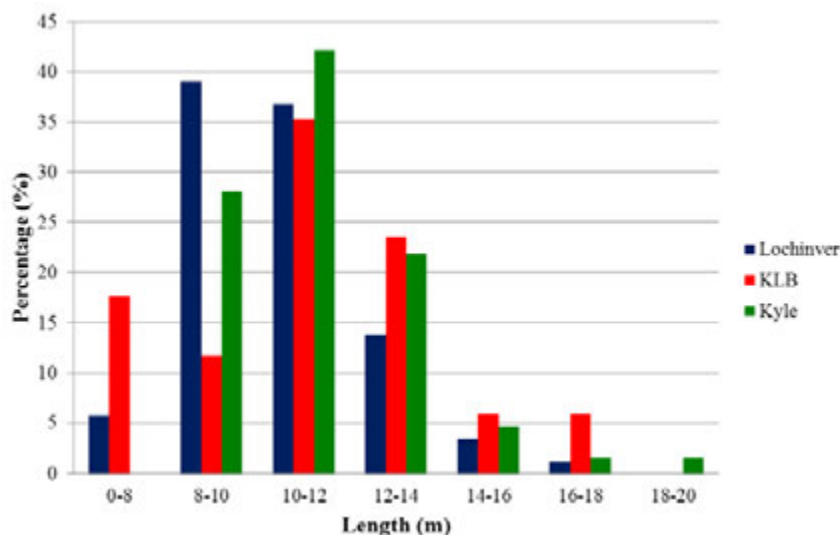


Figure 5.21 Lengths of Vessels visiting Highland Council Facilities

The majority of vessels visiting Lochinver and Kyle of Lochalsh tended to be 8-12m. Vessels visiting Kinlochbervie tended to be slightly larger with the majority being 10-14m in length, however, this is based on only a subset of the visitors.

In terms of last or next port, these tended to be fairly localised, with less than 10% indicating a port within or beyond the PFOW Strategic Area. However, vessels heading for other ports, e.g., Kyle of Lochalsh to Stornoway, may have been en route to the area of interest.

6. QUESTIONNAIRE FEEDBACK

6.1 Introduction

At the project outset it was anticipated there would be knowledge available that is relevant to the project but unpublished, particularly relating to recreational vessel activity. This was confirmed during the taking stock exercise based on the literature review and initial stakeholder consultation.

A questionnaire survey was designed, with input from the Steering Group, to help obtain this information. A full copy of the questionnaire is provided in Appendix A, and the data provided are held by Marine Scotland.

The questionnaire was mainly targeted at recreational vessel organisations and individual users of the Pentland Firth and Orkney Waters. It was directly issued to the organisations listed in Table 6.1, as well as to individuals who were known by the Project Steering Group to have potentially relevant information, such as recreational sailors.

Table 6.1 Initial Recipients

Caithness Sea Angling Association	Orkney Marinas
Clyde Cruising Club	Orkney Sailing Club
Cruising Association	Pentland Ferries
Deerness Small Boat Owners Association	Pentland Firth Yacht Club
Gill's Bay Harbour Trust	RNLI Stations (Wick, Longhope, Stromness and Kirkwall)
Highland Council Harbours	Sail Orkney Yacht Charter
Holm Sailing Club	Scrabster Harbour Trust
John O'Groats Ferries	Stromness Sailing Club
Kirkwall Small Boat Owners Association	Stromness Small Boat Users Association
NorthLink Ferries	Westray Boat Owners Association
Orkney Dive Boat Operator's Association	Westray Sailing Club
Orkney Islands Sea Angling Association	Wick Harbour Authority
Orkney Sea Kayaking Association	Kirkwall Kayakers Club
Pentland Canoe Club	Caithness Kayak Club
OIC Marine Services	Longhope Sailing Club
Wick Angling Association	

Anatec and the RYA also advertised the questionnaire on their websites to solicit further responses.

A total of 42 valid responses were received to the questionnaire which are summarised in Section 6.3. The majority were from recreational sailors or clubs, but a sizeable minority (7 in total) were from sea kayakers and kayaking clubs.

Around the same time as the questionnaire, an article in the Cruising Association magazine “Cruising, March 2012” asked for information on navigation around the Pentland Firth and Orkney waters. The question set differed slightly, therefore, the responses received are analysed separated in Section 6.9.

6.2 Question 1: Information on Response

This introductory question gathered background information on the respondents (i.e., contact details) and how they had completed the survey. The responses to the latter question are summarised in Figure 6.1.

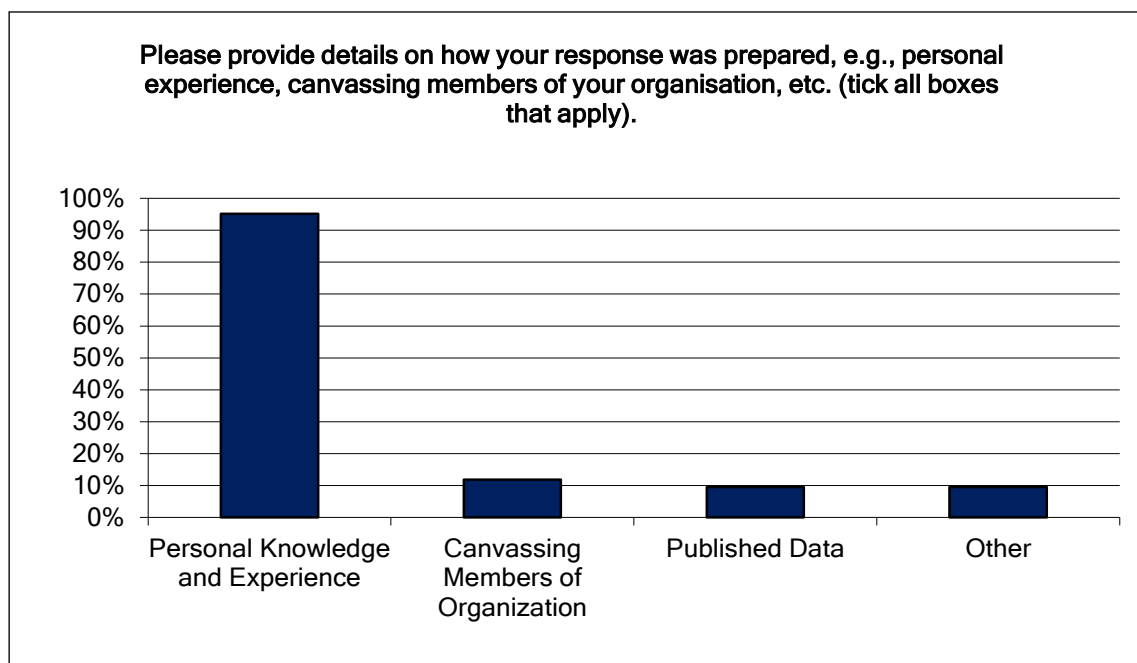


Figure 6.1 Summary of Responses to Question 1(b)

There were 20 responses representing organisations and 22 from individuals. All but one respondent indicated they would be willing to participate in further consultation. Those willing to participate further were invited to the local workshops held in July 2012 (see Section 8).

The remaining questions were generally more open-ended, allowing respondents flexibility in the information they provided about the use of the area. Not all respondents answered every question but a reasonable sample (over 20 responses) was obtained for each question. The lengths of responses varied from a few words to several paragraphs.

A summary of the questions (see Appendix A for full details) and answers are provided below. Excerpts from responses are provided but they have been kept anonymous.

6.3 Question 2: Approach to Identifying Commercial Shipping using AIS

The majority of responses commented that the planned approach to characterise commercial shipping activity using one month of data from winter and one month from summer was representative.

However, some concerns were raised surrounding “unseasonal” weather patterns, and variability of fishing and cruising activity. Selected excerpts are presented below:

ID	Feedback
10	Responding primarily for leisure users then these months would be representative.
32	I suspect both fishing and commercial cruising vessels may vary month to month. Also events such as last year’s Tall Ships race only occur in a single month.
16	Not a good idea. Orkney waters are very weather influenced and this can have an effect in seemingly unseasonable times. For example, winter can be very still and calm, this is not uncommon, while summer can be subject to sea fog (Haar) or other unfavourable conditions. Therefore surveys need to be spread over a longer, more representative period.
15	Winter month should be January to March to pick up pelagic trawlers / purse seine-netters. Specifics depend on shoaling activities of herring and especially mackerel, which are obviously variable annually. These are the deepest-draughted vessels from UK, Norway, Germany, and Netherlands regularly transiting Firth.

The comments on fishing activity were not pertinent as these vessels are not relevant to the current study having been analysed in the ScotMap project by Marine Scotland.

Cruise ship activity was considered to be well-represented by the July period, which is a peak month. The AIS data were checked against cruise ships visits reported by OIC Marine to put the data in context (see Section 7.8).

It was concluded from the responses that the approach being taken was appropriate for commercial shipping. It was also confirmed that using just two months of AIS data would not be sufficient for recreational vessel activity, only a minority of which carry AIS and which are more affected by weather and seasonal variations.

6.4 Question 3 – Description of Recreational Vessel Activity

This question was divided into six parts to obtain information on the respondents' knowledge of recreational vessel activity in the area. More details are provided below:

a) Nature of Activity:

The responses were generally divided into club activities (sailing and sea kayaking clubs) and individual activities, i.e., recreational sailors cruising in the area.

b) Vessels Involved:

Specific details of the number, type and size of vessels involved in group activities were provided by clubs. Most other responses were from owners of yachts ranging in size from 19-50 feet with the majority in the 30-40 feet range.

ID	Feedback
4	Dinghies- 15 below 18ft. Yachts – 10 varied up to around 35ft. Motor boats – various but most of them kept ashore – sizes generally less than 20ft.
7	Private yacht – 11.6m
8	Catamaran 11.3m.
10	Sailing dinghies, canoes and personal water craft – 2m to 6m, up to 25 vessels; Motor and sail cruising, day sailing – 5m to 10m (approx.); We receive on average two to three yachts per month during mid- summer – 5m to 15m approx.; Leisure fishing – 4m to 8m (approx.). During summer months there may be up to 4 vessels fishing in Thurso Bay, inshore and other bays.
23	Single 36ft yacht.
31	One 10m yacht.
33	One vessel 10.5m long keeled yacht.
40	10m ketch sailing yacht.

Selected excerpts from sea kayaker responses are provided below:

ID	Feedback
3	Very difficult to estimate, but certainly some paddlers out all year round in this area; in summer (May to August), 100s of sea kayakers around each week; lower numbers out in 'shoulder' holiday months of March / April and September / October
9	Group size can vary from 3 to 20, paddling 17 foot single kayaks and 19 foot double kayaks.
13	Numbers vary but groups of up to 10
42	The club has between 50 and 60 members and a fleet of 18 sea kayaks for use by members. Additionally a number of members have their own

ID	Feedback
	sea kayaks. Sea kayaks are in general 5.5m long and .6m in breadth. Max speed attainable by a good competent paddler with no tidal influence is 3kn.

c) Area of Activity:

Several respondents indicated the whole of the PFOW study area is within their area of activity. Other highlighted specific places or features, as indicated by the excerpts given below:

ID	Feedback
4	Dinghies mainly in Stromness Harbour but into the Bay of Ireland ² for the regatta and some other events. Yachts, generally all round Orkney, crossing the Pentland Firth, east and west coasts of Scotland, Fair Isle and Shetland. There are also trips to Norway etc.
7	Westray, Eday, Stronsay, Kirkwall. South Ronaldsay, Scapa Flow and Stromness.
8	Outer Sound, Inner Sound, Scrabster, the Orkneys as a whole.
10	Motor and sail cruising generally use Thurso bay area only or sail between bays with up to 4 vessels. Only very occasionally would vessels venture further out. Yachts require to make passage through the Firth (mostly Inner Sound) and across to Orkney. Leisure fishing in Thurso Bay, inshore and other bays.
12	Hoy, Scapa Flow, Shapinsay, Stronsay, Eday and Kirkwall Bay
13	Any coastal area around Orkney Islands typically within 1 mile of shore unless crossing between islands
23	Cape Wrath ³ – Stromness, west coast of Orkney from Stromness to Westray, Westray to Fair Isle / Shetland, Westray to Kirkwall (i.e. through the middle of the island group), Kirkwall to Wick. Intend to sail Scapa Flow (Stromness to south entrance) & leave via the Pentland Firth.
31	All indicated areas.
33	Any and all parts of the identified area could be visited; depends on weather conditions and time. Away from built up towns with facilities we would normally anchor or pick up a mooring buoy.
37	Inner Sound, Outer Sound, Scapa Flow. Eynhallow Sound, Sanday Sound.
40	Kinlochbervie via most of the Orkney Islands and down to Wick (our base is Carrick Castle, Argyll – route up the west coast of Scotland and back via the Caledonian Canal and west of Scotland again.

Kayakers highlighted particular routes often undertaken by different clubs but more generally indicated that the whole of the PFOW study area is used. It was also highlighted that additional routes commonly used by kayakers may be found in published guide books:

² Bay on Orkney Mainland to the east of Stromness

³ Most north westerly point on Scottish Mainland

ID	Feedback
3	All of the area.
9	Trips in all the south of the area and extended trips in the Orkney Isles in the north of the area.
13	Any coastal area around Orkney Islands typically within 1 mile of shore unless crossing between islands
42	The Club regularly paddles the coastline from Tongue to Duncansby Head on the north coast including the island of Stroma. Some typical trips are published in sea kayaking guide books for the area by Pesda Press.

d) Period of Activity:

The vast majority of activity takes place throughout the summer months (April to October) for all stakeholders. Examples of all-year round activity, which are restricted to suitable weather, included sailing, kayaking and leisure fishing.

e) Frequency of Activity:

Club activities, such as sailing, were the most regular activities, e.g., weekly. There were several responses from cruising yachts which typically visit the area for several weeks annually (or less frequently).

ID	Feedback
4	Dinghy sailing is active mainly once or twice a week with some training taking place in the weekends. Power boats are probably more frequent in the week and weekends, especially for fishing trips and very much weather dependant. Local yachts are busy from April to October when many are lifted out of the water for the winter. Some stay afloat in the marinas and will be active whenever the weather is good. Visiting yachts are busy during the same months with around 600 coming to Orkney on a yearly basis.
10	Sailing dinghies are used 2 or 3 times per week during summer.
11	At least weekly but not daily.
7	2010 and future.
23	Every 4 years.
31	Occasionally.
33	Currently once every four years but when there would be full time except for any time spent in Shetland, Norway or Faroes.
38	Annually until 2005.

Sea kayaking is a regular activity being carried out on a weekly or fortnightly basis by clubs, as well as individual activities.

ID	Feedback
9	We paddle weekdays, weekends and holidays averaging 30 – 40 trips annually.
13	Varies but probably fortnightly.
42	The majority of paddling trips are in the summer months at the weekends though some individuals will paddle outside of this depending on the weather and the shift patterns. There are also visiting paddlers to the area (e.g. other clubs; outdoor centres and lone recreational paddlers).

f) **Broadcast on AIS:**

Of the yacht owners who took part in the survey, a few were equipped with AIS receivers but only one had a transmitter which was not always used. It was indicated that some of the better equipped visiting vessels broadcast on AIS.

ID	Feedback
4	It is unusual for recreational craft to have AIS transmitters but a considerable number of visiting boats and probably one local do have receivers.
10	None of these vessels usually carry AIS. Very rarely some of the better founded visiting yachts may.
22	Do not broadcast on AIS at present.
31	No, but receive.
33	Yacht is fitted with an AIS transponder but we don't always switch the AIS unit on or we switch the unit on in receive only mode in busy areas.
40	Receive AIS but do not broadcast.

None of the kayakers use AIS.

6.5 Question 4: Important Areas

Several responses made it clear that the total area is important to recreational vessel activity. The clubs that took part highlighted areas used by their organisations for regular activities as well as training, e.g., Stromness and Thurso Bay.

Sailors highlighted the significance of features such as access to harbours (e.g. Kirkwall, Stromness and Pierowall), bays with good anchorage/ shelter (e.g. Loch Eriboll⁴, Freswick Bay and East Weddel Sound⁵) as well as popular transit routes, including passage through the Pentland Firth and routes between islands.

ID	Feedback
4	<p>1. For the dinghy sailors the areas close to the clubs are the important sailing grounds. These are Stromness Harbour and The Bay of Ireland, Kirkwall Bay, St Mary's Bay⁶, Longhope⁷ and Pierowall. In all these weekly points races take place plus various other events. Clubs are also being set up in Finstown using the Bay of Firth⁸ and Stronsay and using the area at Whitehall, Papa Sound⁹. 2. With respect to cruising yachts the very nature of what they are doing means that they go everywhere where the water is navigable. Most of the bays around Orkney are used as anchorages at some time depending upon weather, for overnight stays, places of interest and safety in inclement weather, for instance East Weddel Sound is a safe anchorage on the east side being safe from all wind directions. The Orkney Sailing Directions & Anchorages as published by the Clyde Cruising Club plus Admiralty Charts indicate where most of the anchorages are situated. 3. The renewables industry is not a great problem as regards anchorages as in general they are not suitable for their needs. However the approach to safe anchorages in adverse conditions is a different matter. If care is not taken in their positioning and marking they become a source of danger with the prospect of the loss of a vessel and maybe lives. This is especially so at present and into the future with the deterioration of weather patterns throughout the year due to global warming. 4. The renewables service industry may also produce a problem for recreational sailing in that they are forever requiring greater water and land space. Stromness Harbour may become overcrowded hence putting pressure onto dinghy sailing and training in the only safe area around. 5. The installation of the three marinas in Orkney has resulted in a large increase in visiting yachts many coming from Europe and Worldwide. Marinas are used as a base for conducting cruising around the islands resulting in far more frequent use of anchorages than has ever been done in the past. The current financial crisis does not appear to have resulted in a downturn of traffic which may mean that once it is over there could be a considerable increase. 6. The greatest problem facing recreational sailing will come from the aquaculture industry. They tend to use the same areas as required for dinghy sailing, training and anchorages. An instance of this is the proposal to use St Mary's Bay for shellfish farming. This bay has been used by Holm Sailing Club for what must be at least 50 years and possibly before the War, for all the above requirements plus the annual regatta.</p>

⁴ Bay on north coast of Scottish Mainland

⁵ Sound to north of Burray to east of Scapa Flow

⁶ Bay on Orkney Mainland to east of Scapa Flow

⁷ Located to north of South Walls

⁸ Bay on Orkney Mainland to west of Kirkwall

⁹ Sound between Westray and Papa Westray

7	To enjoy cruising in the area it is important to be able to visit the Orkney Islands and sail between them, either anchoring in suitable bays or using the various harbours. In particular access to / from Kirkwall and Scapa Flow from northwest, northeast and south or west respectively. Also being able to pass through the Pentland Firth in either direction is difficult enough with the very strong tides. No doubt this makes the area attractive for the sea power experiments but adequate passageways must be left for convenient transits and safety if small boats are not to be forced to use the much longer and possibly dangerous routes through or round the Islands.
10	Anchoring anywhere in the Firth is highly dangerous for any vessels and not possible for yachts and leisure craft. Most of the bays have sandy bottoms suitable for anchoring and are out of main tidal flow. Larger vessels may anchor in Thurso Bay and Dunnet Bay; yachts occasionally anchor in Thurso Bay. Vessels need to anchor in the lee of headlands and this may require them to change anchorages if swell direction changes. During incidents (say loss of steering or power) commercial vessels may need to drop anchors to slow drift or similar. As stated above, Thurso Bay is the area most used for both leisure activities and anchoring with very occasional use of Dunnet Bay for anchoring. Dinghies and smaller vessels may travel along coast and visit Thurso, Murkle ¹⁰ and Dunnet Bays. Yachts and similar travel to Orkney, through the Firth and west, and safe unobstructed passage of the Firth is essential. On behalf of the PFYC our most important activities are day sailing and dinghy racing in Thurso Bay and adjacent bays; we also support visiting yachts.
33	Access to main ports of refuge Stromness & Kirkwall is obviously important. Pierowall is also useful. I would not like to see prohibited areas which prevent access between any of the islands. If a slightly longer route has to be taken to avoid some installation at sea this is not a particular problem as the distances are generally fairly short anyway.
36	The whole area is of interest and of course in a small sailing boat it is not always that one can choose a detailed itinerary. The nature of local weather and tides makes it important to have free access to all navigable ports and safe anchorages.
39	Routes between Cape Wrath, Stromness and Westray are the most important for our activity.
40	The below routes are most important: Route Kinlochbervie to Stromness, Route Stromness to Wick, Route Kirkwall to Wick, Route Scrabster to Stromness, Route Kirkwall to Shetland, Route Stromness to Kirkwall, Routes between all the Orkney islands. Important anchorages: - Loch Eriboll, Freswick Bay. Many of the Orkney islands have visitors' moorings laid through the summer that are essential to yachtsmen.

Specific areas mentioned by kayakers included popular transit routes (e.g. the Pentland Firth and Eynhallow Sound) but the total area was also mentioned, especially areas close to the coast and areas where kayaks can be easily landed.

¹⁰ Bay between Thurso Bay and Dunnet Bay

ID	Feedback
2	It's unlikely to change in the future but we mainly kayak around the Orkney mainland. Especially barriers, east coast with Gloup ¹¹ , Scapa, west Mainland. Basically all over Mainland depending on how the weather is and the safest place for paddles. We do paddle close to the coastline unless we paddle across to other islands like Cava ¹² and so on.
3	a) Pentland Firth – for long-distance journeys by very experienced paddlers b) Coast from Tongue to Scrabster – used frequently all year round c) Orkney islands – used much in summer months – all routes between all islands. The only definite change is in an increase in sea kayaking everywhere around the Scottish coast (SCA survey, Summer 2012, and 2010 UK report on recreational activities)
9	The Pentland Firth, especially the Inner Sound and Duncansby Head, along the north coast as far as the Kyle of Tongue and Loch Eriboll. These areas provide essential training waters for our more experienced paddlers and it is a major highlight of the club to visit the islands, headlands, harbours and cliff features of this scenic and environmentally wild area. We practice in the tidal streams as appropriate to the group.
13	Scapa Flow, west Mainland, Eynhallow Sound and seas around Rousay, east of Burray ¹³ , Copinsay Pass ¹⁴ , Deer Sound, Shapinsay Sound, Gairsay Sound ¹⁵ . Typically use sheltered areas in lee of land masses for beginners & general areas and crossings for more advanced kayakers. Unlikely to change in future.
14	Close inshore along north coast of Scotland and around all Orkney islands, probably rarely more than 500m offshore, with the exception of direct crossings between islands. Kayaks can access areas that no other vessels can and we can land easily on beaches. The tide races at Eynhallow and Hoy Sound are good for advanced training.
42	The key areas are: the coastline - generally within 1000-1500m of the coast except when crossing to an island such as Eilean Nan Ron ¹⁶ / Stroma or Swona. The area on coastline which is not regularly paddled is Sandside Bay ¹⁷ to Brims Ness ¹⁸ . The Club holds weekly training sessions in Thurso / Dunnet Bay crossing from Thurso Beach to Holborn Head ¹⁹ almost weekly in the summer months during the evenings. Whilst in strong tidal areas, kayakers need to undertake careful planning and the actual route may be slightly different from that planned due to the unpredictable nature of some local currents.

In terms of future changes, on the whole the responses suggested that the areas of importance are unlikely to change in the future. However, a few respondents expressed concern about potential disruption being caused by other industries, notably renewable energy and aquaculture.

¹¹ East coast Orkney Mainland

¹² Island to the west of Scapa Flow

¹³ Island between Orkney Mainland and South Ronaldsay

¹⁴ Pass between Orkney Mainland and Copinsay

¹⁵ Sound between Gairsay and Wyre

¹⁶ Island north of Tongue

¹⁷ Bay on north coast of Scottish Mainland

¹⁸ West of Thurso Bay

¹⁹ Headland west of Thurso Bay

6.6 Question 5: Effect of Tide and Weather on Recreational Vessel Activity

Virtually all respondents emphasised that careful consideration of tidal patterns is essential due to the nature of tides around the Pentland Firth and Orkney. Certain passages are not possible when travelling against the tide, or if the tide is opposing the prevalent wind direction (e.g. entering or leaving Scapa Flow). The importance of timing a journey to coincide with tides was frequently emphasised (e.g. when transiting between Kirkwall and Stromness) and the need to be readily adaptable (i.e., change of course or prolonged sheltering) is highlighted. Force 6 is frequently mentioned as a cut-off point for dinghy sailing and many visiting yachts remain in shelter when weather conditions exceed this threshold. The need for sufficient preparation and planning and gaining accurate, up-to-date weather information was also stressed as vital.

Sample comments below:

ID	Feedback
4	Tide and weather affect the whole aspect of recreational sailing in Orkney. Although the tidal range is quite small, usually no more than 3m, the strength of the current is probably the largest in the UK reaching over 8kts at times. Due to this the tide has to be considered at all times when making passages, with some routes not being possible if the tide is against you or when you have tide against wind. Always when planning a passage make sure that the tide is with you especially when entering or leaving Scapa Flow and even then if there is a strong wind over tide avoid going. When sailing between Stromness and Kirkwall the western route is the shortest. However you need to leave Stromness by the start of the west going tide, leave it any later and if the wind is a strong westerly you will be taking green waves over the deck. You need to be at Eynhallow by the start of the flood before the race at the Reef of Burgar ²⁰ builds up. This gives 6 hours between Stromness and Eynhallow which will then give 6 hours of flood to reach Kirkwall. Similar planning needs to be taken when reversing the route. If taking the easterly route between the two towns then you have two hours to round the foot of South Ronaldsay before turning north at Old Head ²¹ . This will then give an hour or so to travel north before the tide turns against you. If the weather is turning bad you can then head for East Weddel Sound for a safe anchorage or hang around in Holm Sound until the tide turns, about 5 hours. Once the tide has turned you can then head on through the Copinsay Pass if not too rough or outside Copinsay otherwise and if night time. This will then get you through the String with a favourable tide. The above types of considerations need to be taken wherever you go in Orkney. You cannot beat the tides or the weather. The former you can make work for you. Some routes due to the tide are only possible one way such as a round tour of Hoy. This needs to be done from east to west but make sure that you reach Tor Ness before the easterly stream gets too far advanced as this is the end of The Merry Men of Mey, a tidal race which stretches all the way across the Pentland Firth.
7	Even with any significant wind a small low powered vessel will struggle to make any headway against the fierce tides. Add a force 4+ and the strongest tidal gates become impassable in the wrong direction. This will not always be wind with tide as the two opposed can often create dangerous overfalls. A small boat's ability and its skipper's skill in manoeuvring in strong currents are much more limited than in larger more

²⁰ Reef in Eynhallow Sound

²¹ Point at south of South Ronaldsay

ID	Feedback
	powerful vessels. So any new restrictions or obstructions need to be very well marked and published considerably in advance and probably for many years so as to effectively notify those who have known the area previously. Reminders through the RYA and at least Northern Yacht Clubs and nearby harbours are also likely to be effective.
8	The weather and then the tide dictate the when, where and how. We do this for fun.
10	Dinghy sailing takes place up to around Force 6 especially if offshore wind and sea flatter. Similarly for day sailing. Visiting yachts usually restrict their passages to less than force 6 due to very large sea state in Firth but obviously may get caught out in worse weather whilst on passage. There are very little winter leisure activities, just an occasional dinghy or two may venture out in calm weather. Not included here directly but the leisure fishing and small commercial fishing continues in small numbers daily throughout winter in reasonable weather – say up to force 5.
20	The tides and tidal streams affect all of Orkney including the Pentland Firth. You have to study them and ensure that the vessel can undertake the voyage safely. The tides and weather have to be studied before undertaking any cruise.
23	We don't intentionally sail if the forecast is Force 6 or more, though it is still possible to be caught out. This means that one can have to stay put in an anchorage or harbour waiting for a suitable weather window. Tides are very important throughout Orkney - we certainly need to go with the tide on any passages, or at slack to avoid overfalls etc. As we have a cruising speed of about 5 knots, we would need to use the tide rather than fight it.
25	The advice given which from bitter experience I have found to be true. Always go with the wind and tide. In a small boat (25' - 35') wind against tide produces a most uncomfortable passage. When approaching Orkney from home (Sunderland) care has to be taken to time arrive at the correct time after a passage time of 50 hours, to catch the tide to the destination, this can be particularly difficult on a sailing boat.
33	We would never go against the tide and always plan passages to make best use of the tide in Orkney. We have so far only skirted the side of Pentland Firth as there seems no need to make passage from east to west or vice versa through the Pentland Firth unless on a direct passage across the top of the mainland which we aren't when cruising. We wouldn't bother sailing in wind conditions > Force 6 outside of the protection of the islands and probably not within the islands unless seeking better shelter.
36	Tide and weather are obviously of prime importance. They will usually dictate the sailing plan. A revision or cancellation of a previously settled plan is quite normal. I left Shetland in July 2010 bound for Stornoway via Scrabster. Strong westerly winds forced me to Wick and thence to Inverness. This is not an unusual event in these waters.
39	The tidal streams and gates are major factors in timing our passages. Being a sailing vessel the wind strength and direction will determine whether the passage takes place or not. Strong headwinds of Force 5 upwards would probably mean a postponement.
40	As the tides are very strong around the Pentland Firth and the Orkney islands, great care in planning is essential. Some destinations such as Stromness can only be entered at certain states of the tide and in favourable weather conditions. It is quite normal for yachts to stand off the north west of Hoy awaiting entry to Stromness via Hoy Sound. There is a wave machine to the north of this entrance that is sufficiently out of the way of waiting vessels and when passing north from exiting Hoy Sound can be passed on the east side going north. Great care has also to be noted of the tidal stream directions as these vary around the islands.

Sea kayakers also emphasised that careful consideration of the tidal and weather patterns is essential. Force 6 is once again mentioned as a cut-off point but it is suggested that some activity may continue in these weather conditions. The ability of the group is frequently mentioned as another factor that must be taken into careful consideration.

ID	Feedback
2	It depends on how tidal and wind conditions are and how experienced the group is. Sometimes you even might set out but turn around if you realise members are struggling or the conditions are different from what you expected. Our aim is safe paddling in the 1st line within our experience. We do check tides before we paddle and also weather forecasts to help us make decisions as a group.
3	Some paddlers are competent, and also do go out, in adverse weather, high seas and all states of the tide. The Guidebooks for sea paddlers (mainly published by Pesda Press), contain very minute detail on these conditions e.g. tide races etc. Obviously, in good settled weather, there are likely to be far more groups of paddlers undertaking such trips as cross Pentland Firth, and around Orkney. In mid-summer and settled weather, there could well be up to 10 large groups of sea kayakers in this whole area. British Isles sea kayaking has both some of the most challenging conditions in the world, and also some of the most skilled sea kayakers, comparative with Australia, New Zealand, Canada, Chile etc.
9	The activity can only take place within certain limits which are well established by our most experienced coaches based on the knowledge and the feeling they have built up over the last 30 plus years. Turbines are introducing an unknown factor especially if there is increased turbulence over subsea devices or if some devices project above the surface. Have there been any studies on the effects of surface and near-surface turbulence and mixing of the water column. Our natural path across to Stroma would cut across one of the turbine arrays. We are concerned for the safety of our paddlers. There is no literature available to enable us to predict the effect of turbine or turbine arrays on sea kayakers. There is potentially a conflict between our activity and of the utilisation of the waters. Such conflict can be kept to a minimum by suitable liaison between all the interested parties.
14	Novice sea kayakers will struggle in winds of force 3-4; experienced kayakers will manage for a short time in force 6-7 but would not go out in these wind speeds by choice. Orkney is unique in that there are always sheltered areas to paddle in all but the most extreme conditions. Experienced paddlers can kayak at about 4 knots but would always plan to paddle with the tide rather than against it. Tides might dictate where we go but rarely if we paddle.
42	Trips are planned to make best use of the tide and weather. Tides: in key areas such as the Swilkie (Stroma) trips are planned to coincide with slack water. Other headline may be undertaken at slack or mid tidal cycles. Weather: in terms of wind this depends on the wind direction e.g. following a strong wind is beneficial to a trip. Also a trip is possible in a strong offshore wind using the shelter of the cliffs. For the Club, you could assume an upper level of F4/F5. Swell is another consideration. A large swell may restrict activities especially if exploring a coastline. A major consideration is the ability of the group. Individuals paddling may have different levels.

6.7 Question 6: RYA Coastal Atlas Critique

Respondents were asked to comment on the RYA Coastal Atlas map of Pentland and Orkney (see Figure 4.2).

Several responses indicated that the current map was “ok as is” and provided a “pretty reasonable set of routes”. Important routes were highlighted such as access to Kirkwall, Scapa Flow and transit through Pentland Firth.

Routes either side of Eynhallow were mentioned, but the southern route is preferred (currently only northern route is shown). The Inner Sound route via the Pentland Firth was also highlighted (currently only the Outer Sound route is shown).

It was commented that routes are indicative and vary due to tide (e.g., flood or ebb) and weather (see Question 5 responses), which is acknowledged by the RYA in their introduction to the Atlas.

Many sailors indicated that they also deviate from the main routes, making an indirect passage to explore remote locations and anchorages as well as the main harbours and marinas.

Less common routes often undertaken by sailors that could be added include Westray to Papa Westray and Eday to Rousay.

ID	Feedback
1	1. The route from Cantick Head ²² out into the Firth between Swona and Stroma thence past Duncansby Head South. This is the route recommended by the Clyde Cruising Club Pilot and is my main choice for a trip south from Orkney to Wick and Inverness. It's important to note that the Pilot recommends leaving Cantick Head with the ebb still running westward before arriving in the middle of the Firth for slack water. 2. The route from Hoxa Sound ²³ round the Lother Rock ²⁴ thence to Copinsay and Kirkwall via the String is also a recommended cruising route and one taken by many visitors.
4	The route from the Atlantic to Kirkwall via Eynhallow needs to go to the south of the island as per the Clyde Cruising Club directions. Although to the north has deeper water there is a big rock shelf sticking out into it. There is a race at the Reef of Burgar so passage should be timed for close to slack water. When rounding South Ronaldsay take the route inside the Lother Rock and keep to the north of the Liddel Eddy ²⁵ . This will avoid some very bad sea conditions. When coming south from Kirkwall for Scapa Flow down the east side don't go too fast. If you arrive at the Lother too early the seas will be boiling over the top and the calm gap between the Lother and South Ronaldsay will be quickly getting narrower and narrower.

²² Southeast point on South Walls

²³ Sound between Flotta and South Ronaldsay

²⁴ South of South Ronaldsay

²⁵ Between South Ronaldsay and Pentland Skerries

	When going South from Scapa Flow to the Scottish east coast keep close to Cantick and use the back eddy at the start of the flood and head towards Brims then shoot off to pass half way between Swona and Stroma. This will stop you being swept down towards the Pentland Skerries and you should be able to carry the tide until past Wick travelling north the route shown appears to be good. To be done on the west going stream and making sure that you pass between Swona and South Ronaldsay. When sailing west from Duncansby the Inner Sound should be taken. The routes shown are very much indicative and there should be no reliance placed on them. All routes will vary due to tide and weather with quite different one being taken depending upon the flood or the ebb.
6	We find existing charts and pilotage notes quite adequate and do not feel the need for any further information – we appreciate the challenge of exploring "uncharted" areas and for a couple of weeks, free of interference.
7	For a Cruising Yacht the most important routes are access to/from Kirkwall and Scapa Flow as well as transit through The Pentland Firth
10	These are typical passage routes only. For example there are two ways through Eynhallow Sound (either side of rocks) depending on conditions. In addition to these main passages, leisure craft may visit any of the bays of Orkney and north coast of Scottish Mainland and nearly all of the Orkney Islands have suitable anchorages or small harbours depending on conditions. So there are also minor passages between each of this other points of interest not shown on the above map. By definition leisure boats users will often go to more remote locations and anchorages as well as the main ports and harbours shown above.
15	This is generally OK as far as Pentland Firth is concerned, but Inner Sound is used by visiting small sailing vessels; the 'new' marinas at Wick and Kirkwall may increase such small-boat sailing.
33	We have sailed several of these routes but when cruising with time on your side there is a tendency to go via unconventional routes for a change and to explore. This is not without its risks but no worse here than in many other places.
36	I would add the passage south of Stroma – It is used by yachts. I have experience of using perhaps half the routes shown on the RYA chart. Some are obviously well used (e.g. passages to Kirkwall and Stromness) and others less so. I do not feel qualified to suggest amendments.
40	This marked area shows basic routes however there are many other routes between one island and another e.g. Westray to Papa Westray, Eday to Rousay, etc.

Sea kayakers indicated that as well as using the main routes presented, it is common practice for them to go further afield as they are not limited by water depth. Reference was also made to guidebooks that detail additional routes and maps for sea kayakers (Ref. viii Ref. ix).

ID	Feedback
2	For sea kayaking I would outline all the routes around the islands including southwest of Hoy, all of Shapinsay and Sanday, east coast of Rousay and so on. Since we don't rely on the depth of water we can easily go other places compared with ships / boats.
3	Sea kayaking uses all of these areas, and many various different routes.

9	Our paddling groups have used many of the routes shown in the Orkneys above, but also around Sanday and Egilsay, Wyre and Gairsay. In the Pentland Firth most of our routes are around Stroma, the Inner Sound, Duncansby Head and St John's Point ²⁶ , both close inshore and crossing the tidal streams to reach our objectives.
13	Very local anomalies occur throughout; local knowledge is invaluable to sea kayakers but any additional accurate information will always be welcome.
42	This ignores sea kayaking trips. Please speak to us directly. There are 2 sea kayaking guide books which give a flavour of some trips: Scottish Sea Kayaking: Fifty Great Sea Kayaking Voyages (Cooper & Reid, 2005). This lists 7 trips along the north coast and east Caithness coastline. The Northern Isles. Orkney & Shetland Sea Kayaking (Smith & Jex, 2007). 2 Trips in the Pentland Firth and 23 trips in Orkney. The crossing of the Pentland Firth and undertaking the "Pentland Triangle Trip" (Stroma/Skerries/Swona) is not listed as this is undertaken by experienced paddlers who plan their trip based very carefully based on a number of factors.

²⁶ Point on north coast Scottish Mainland, west of Inner Sound

6.8 Question 7: Additional Information

From the received response it is evident that consultation and liaison with the various stakeholder groups is essential, especially when planning offshore developments.

ID	Feedback
6	We enjoy the solitude of the islands and area and would not encourage others to organize our visits. If we wanted more support for our cruising we would visit areas such as the Clyde, North Wales or south Coast which provide a marina based cruising area where facilities cater for those who enjoy that sort of boating.
10	The questionnaire seems complete enough. I just would like to emphasise again the importance of keeping at least one clear passage through the Firth and not expecting yachts to be able to manoeuvre around obstructions during full tidal flow. Also the need to have guard vessels far enough clear of the ends of Firth to warn vessels before they commit. As leisure vessels are unlikely to try and make passage against the tide then one guard boat positioned well upstream should be sufficient.
36	I hope the authorities will consult with local yacht clubs and similar boating organisations (and individual yachtsmen/pleasure boaters/anglers/divers etc. if you can find them!), marinas, port authorities and other users of this wonderful stretch of water.
40	Orkney Harbours provide an excellent Harbours Handbook - essential to visitors to the islands.

Kayakers highlighted issues with cables and the importance of consultation.

ID	Feedback
3	One of the most important factors that has arisen so far in relation to new energy developments is that sea kayakers often require to hug the coast, and some new works have prevented this, forcing a course further out to sea. The need for on-coast facilities to e.g. take cables ashore can be redesigned simply to take this into account. Further, and more detailed, consultation is required in the future.
9	We would have further concerns about the subsea cables and very importantly any servicing and construction work for instance on the surface. This liaison with recreational users is essential for safety, good practice and good relations.

6.9 Cruising Association Feedback

In parallel to the questionnaire, the Cruising Association requested feedback in a magazine article about the project. Three responses were received from experienced yachtsmen who had all chartered vessels in the area numerous times. The question set differed to the questionnaire, and a selection of notable quotes and a summary of the key points is provided below:

Use of Area

Orkney is a cruising area in its own right. There are many miles of sheltered waters with good safe anchorages. It also offers useful stopping places when on the way to Shetland. Scapa Flow/Stromness can be used to avoid some of the worst of the Pentland Firth especially bound west.

Weather and Tides

- The weather is changeable as expected in those latitudes, however in the late spring/summer sailing season it does not deserve being called 'stormy'. Tides need to be respected and can be used to advantage.
- Much activity, except perhaps within Scapa Flow is controlled by the tides. With wind against tide the Pentland Firth should not be attempted in winds exceeding force 4. The west facing sounds should be respected if there is an appreciable Atlantic swell coming in against a west going tide.

Special Precautions

- No special equipment is needed apart from that normally recommended for a yacht cruising up to 60M offshore. Should be prepared, with strong enough crew to make a night passage if necessary. It is strongly advised to carry UKHO tidal stream atlas, or equivalent.

Activity outside Summer Season

- I wouldn't dream of sailing those waters outside the conventional summer season. The CCC sailing directions offer guidance on this subject, which I wouldn't ignore.

Routes

- In the Pentland Firth, bound west to east, I have always used the Outer Sound between Stroma and Swona, keeping well south of the Pentland Skerries – bound northeast pass between Pentland Skerries keeping closer to the South Ronaldsay side. Eynhallow Sound can be difficult.
- On passage north from the north and west coasts of Scotland I would advocate making landfall at Stromness and then running up to Pierowall on Westray before jumping off for either Fair Isle or direct to Lerwick in Shetland; I've done both. Back from Shetland to Kirkwall via Fair Isle makes a lot of sense and works with the tides.

Anchorage

- Overnight anchorages listed included East Weddell Sound, west end of Deer Sound, Wyre Sound²⁷, Gairsay, bay on south side, Rousay Sound²⁸, Bay of Ham²⁹, Bay of Carrick³⁰, Houton Bay³¹, north of Longhope village, Pierowall Bay, Loch Eriboll, Scapa Flow, Aiker Ness³² and St Mary's Bay.

Safe Havens

- Three marinas at Kirkwall, Stromness and Westray, Deer Sound anchorage, Whitehall pier³³, Kettletoft pier³⁴, Pierowall Bay, inner bay anchorage, Houton Bay and Scrabster Harbour.

Most Valuable Area

- Whole of Orkney has a wide variety of attractions. North coast of Scotland between Scrabster and Tongue has less interesting features for the cruising yacht.

6.10 Conclusions

The main conclusions reached from the feedback are as follows:

- Characterising commercial shipping using AIS is generally appropriate
- All of the PFOW area is important to recreational users with individual areas of importance dependent on the specific user group
- The vast majority of recreational activity takes place throughout the summer months (April to October) for all stakeholders. Examples of all-year round activity include limited sailing, kayaking and leisure fishing
- Club-orientated activities are the most regular occurring on a weekly basis. Less frequent sailing trips occur on an annual or bi-annual basis
- Consideration of tide and weather conditions is imperative due to the strong nature of tides in the PFOW area with certain passages not possible in certain tidal states or weather conditions
- Few resident recreational vessels in the area are equipped with AIS. More commonly it is better equipped visiting yachts that are equipped with AIS
- RYA Coastal Atlas provides a good foundation for characterising recreational shipping
- Indicative routes do not tell the full story as individual recreational sailors like freedom to go where they please, and routes are already very variable due to tides and weather

²⁷ Sound between Wyre and Rousay

²⁸ Sound between Rousay and Egilsay

²⁹ Bay on east coast of Rousay

³⁰ Bay on northeast coast of Eday

³¹ Bay on south Orkney Mainland, Scapa Flow

³² Northeast of Westray

³³ North of Stronsay

³⁴ South of Sanday

- Kayakers are a separate, unique group that have similarities to yacht sailors but would need a separate study to fully characterise their behaviour: No kayaks carry AIS and therefore a more in depth study is required to fully understand the most commonly used routes
- Kayakers exhibit different behaviours to other recreational users: Routes taken often hug the coastline: As kayakers are not limited by depth, they are able to make use of areas other recreational users cannot: Kayakers value bays with suitable launching sites with greater importance compared to conventional marinas and anchorages.

7. COMMERCIAL SHIPPING ANALYSIS (AIS)

7.1 Introduction

This section provides background information on AIS and presents analysis of the winter and summer AIS commercial shipping survey carried out of the Pentland Firth and Orkney Waters Strategic Area.

Recreational vessel tracks have been excluded from this section as these are analysed separately in Section 8.

Other vessel types excluded are commercial fishing vessels and military vessels (as explained in Section 2, these are addressed in separate studies by Marine Scotland) and port vessels e.g., pilot vessels (as these operate to support other vessel activities).

7.2 Background Information on AIS

7.2.1 Carriage Requirements

Regulation 19 of SOLAS Chapter V – “Carriage requirements for shipborne navigational systems and equipment” - sets out navigational equipment to be carried on board ships, according to vessel type. In 2000, the IMO adopted a new requirement (as part of a revised new chapter V) for ships to carry Automatic Identification Systems (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 are 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;
- 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.

The regulation requires that AIS shall:

- provide information - including the ship's identity, type, position, course, speed, navigational status and other safety-related information - automatically to appropriately equipped shore stations, other ships and aircraft;
- receive automatically such information from similarly fitted ships; monitor and track ships;
- exchange data with shore-based facilities.

7.2.2 Data Broadcast

There are two classes of AIS system, "A" and "B", which both broadcast slightly different data. The information transmitted by ships using Class A and B is given below:

- fixed or static information, which is entered into the AIS on installation and need only be changed if the ship changes its name or undergoes a major conversion from one vessel type to another;
- dynamic information, which, apart from 'Navigational status' information, is automatically updated from the ship sensors connected to AIS; and
- voyage-related information, which might need to be manually entered and updated during the voyage (this is only broadcast on Class A).

The Class A AIS system is mandatory under Regulation 19 of SOLAS Chapter V. Class A messages are broadcasted every 2 to 10 seconds, depending on the vessel's speed and rate of turn. When a ship is static or at anchor there is an update rate of once every 3 to 6 minutes.

The following lists present the data provided via Class A AIS.

Table 7.1 Class A AIS information

Static	Dynamic	Voyage related
MMSI	Position (Lat/Long)	Draught
IMO Number	Time	Hazardous Cargo (type)
Call Sign	Course over ground	Destination
Name	Speed over ground	ETA
Length and Beam	Heading	Route Plan
Type of Vessel	Navigational Status	
Type of Nav Sensor	Rate of Turn	

Class B AIS is a less expensive system which may be used voluntarily by smaller, non-SOLAS vessels. The data broadcast are reduced but still contain the main information required for ship tracking and identification. When the vessel is travelling less than 3 knots the update rate is once every 3 minutes, and when static or at anchor there is an update rate of once every 6 minutes. The table below summarises the broadcast Class B information.

Table 7.2 Class B AIS Information

Static	Dynamic
MMSI	Position (Lat/Long)
Name	Time
Length and Beam	Course over ground
Type of Vessel	Speed over ground
	Heading

7.2.3 AIS Operational Requirements

Ships fitted with AIS are required to maintain AIS in operation at all times except where international agreements, rules or standards provide for the protection of navigational information.

If the Master believes that the continual operation of AIS might compromise the safety or security of his/her ship, the AIS may be switched off. There are no known factors that should make this necessary in the study area.

7.2.4 AIS Limitations

AIS is a passive system and will therefore not track vessels that:

- do not carry AIS;
- have turned their AIS transmitter off; or
- have a failed AIS transmitter

Based on the legal carriage requirement, the main vessels that may not carry AIS but are relevant to the study are small vessels, particularly those under 300 gross tonnes, which may include recreational craft. It is noted that although not mandatory, significant numbers of smaller vessels are electing to install AIS as good practice (see Section 8 for more analysis of this).

There is also a possibility that some AIS information could be inaccurate. The dynamic information is automatically fed into the system from the GPS Antenna (positional information) and Gyro (heading). In the event that the Gyro or GPS feed to the AIS unit fails, there will be alarm on the bridge of the vessel to highlight this failure.

Static information, e.g. Vessel Name, tends to be typed in once during the installation and setup of the AIS system on the vessel and after that largely remains untouched. Human error is therefore possible. Voyage related data are normally typed in by the officer of the watch. These fields are more prone to error as they require updating manually prior to each voyage (or more frequently in the case of a change in navigation status, such as anchoring) so can be overlooked or out of date. Studies by Dover Coastguard (Ref. x) have indicated these type of errors are still fairly rare (approx. 3%).

The accuracy of AIS has been assessed at Dover Coastguard Channel Navigation Information Service (CNIS) which monitors the Dover Strait. In a 2007 trial it was identified that the AIS data of around 3.5% of ships was in error. Of these errors, the

majority were found to relate to voyage related data, e.g., destination and draught. Less than 0.1% of errors were related to dynamic data, i.e., vessel position, course and speed.

Anatec have sought to minimise errors by checking the data and correcting inaccurate information. For example, the *Hoy Head* ferry was broadcasting a draught on AIS of 12.1m in the winter survey when its design draught is only 2.3m. Overall, the effect of inaccurate information for a small proportion of tracks is considered to be minimal.

7.3 Survey Details

The winter survey data were collected during four weeks in January to early February 2012. The summer survey data were collected over four weeks in July 2012.

Each track plotted represents one vessel movement. A track is created by joining together all the positions broadcast by a ship. A new track is automatically started:

- at midnight each day;
- if there is a time gap of over 30 minutes between position reports; and
- if the dynamic data broadcast by the ship changes, e.g., new draught, destination or navigational status.

It should be noted that the time gap used of 30 minutes means that occasionally a vessel may appear to cross land (based on a straight-line route) when in fact it rounded the land but was not tracked for a few minutes.

7.4 Vessel Type Analysis

The commercial vessel type classification was based on the International Classification of Ship Types (ICST 94), which was considered to be more useful than the type information broadcast on AIS. However, the types were further tailored the project based on discussions with the Steering Group. Seven type categories were defined as follows:

1. Tanker (Oil / Chemical / Gas Carrier)
2. Bulk/Ore Carrier
3. Cargo (including RoRo/Container)
4. Passenger (Ferry and Cruise Ship)
5. Offshore (Oil & Gas and Renewables Support Vessels)
6. Tug
7. Other³⁵

As noted previously, licensed fishing vessels, fisheries protection vessels, military vessels, harbour tugs, pilot vessels and recreational vessels are not included. It was agreed with Marine Scotland and the Steering Group that these vessels should be excluded as they are not relevant to the project. Recreational vessels are analysed separately in Section 8.

³⁵ This category includes research vessels, underwater operations vessels, light tenders, fish carriers, RNLI lifeboats and miscellaneous / other vessels.

Figure 7.1 summarises the breakdown of vessel movements (tracks) within the Pentland Firth and Orkney Waters Strategic Area by vessel type during both periods.

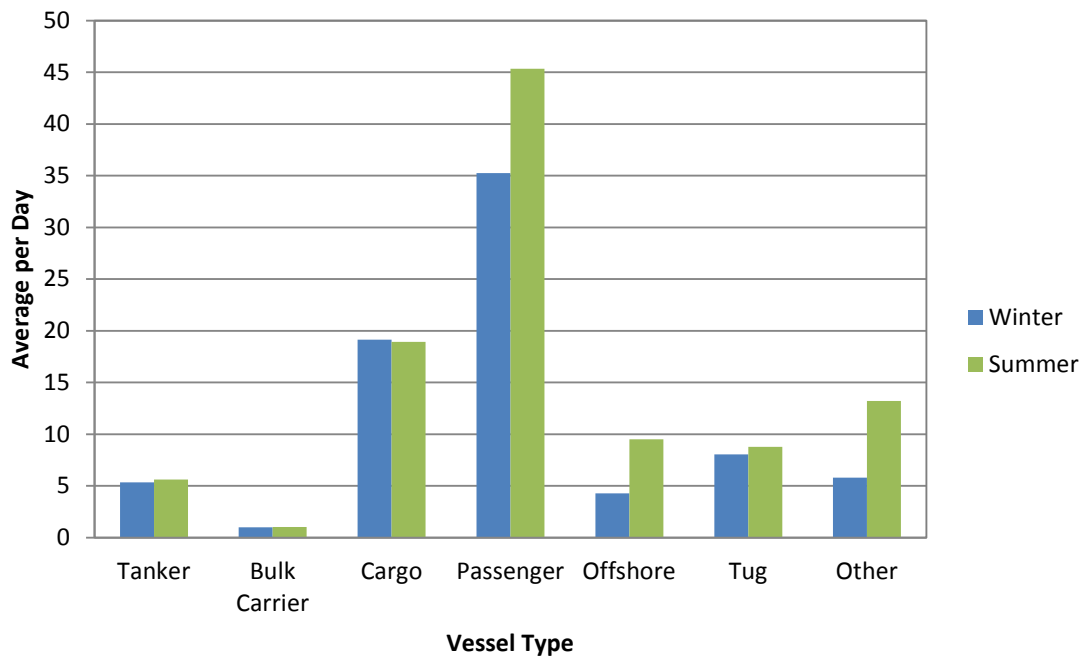


Figure 7.1 AIS Vessel Type Distribution per Season

Overall, the type distribution in summer and winter is fairly similar, with passenger vessels being the most common type followed by cargo vessels.

There was a slightly higher average number of vessels per day during the summer period for the vessel categories of passenger, offshore and other.

Over the combined survey period, 44% of vessels were passenger vessels, with 21% of vessels being cargo ships. Other significant types were ‘other’ vessels (11%), tugs (excluding harbour tugs) (9%), offshore industry vessels (8%), tankers (6%) and bulk carriers (1%).

Figure 7.2 and Figure 7.3 present the vessel tracks recorded in each period in the Pentland Firth and Orkney Waters Strategic Area, thematically mapped by vessel type. As can be seen from the figures, the commercial vessel tracks follow a number of well-defined routes within the PFOW Strategic Area, but there is also wide use of other less well-defined routes. There was little variation between the summer and winter tracks for the majority of the different vessel types. There were, however, more offshore tracks making additional routes during the summer period, both transiting the Strategic Area and working within the Orkney Islands. Further discussion of the routes taken by the different vessel types is presented in Section 7.4.

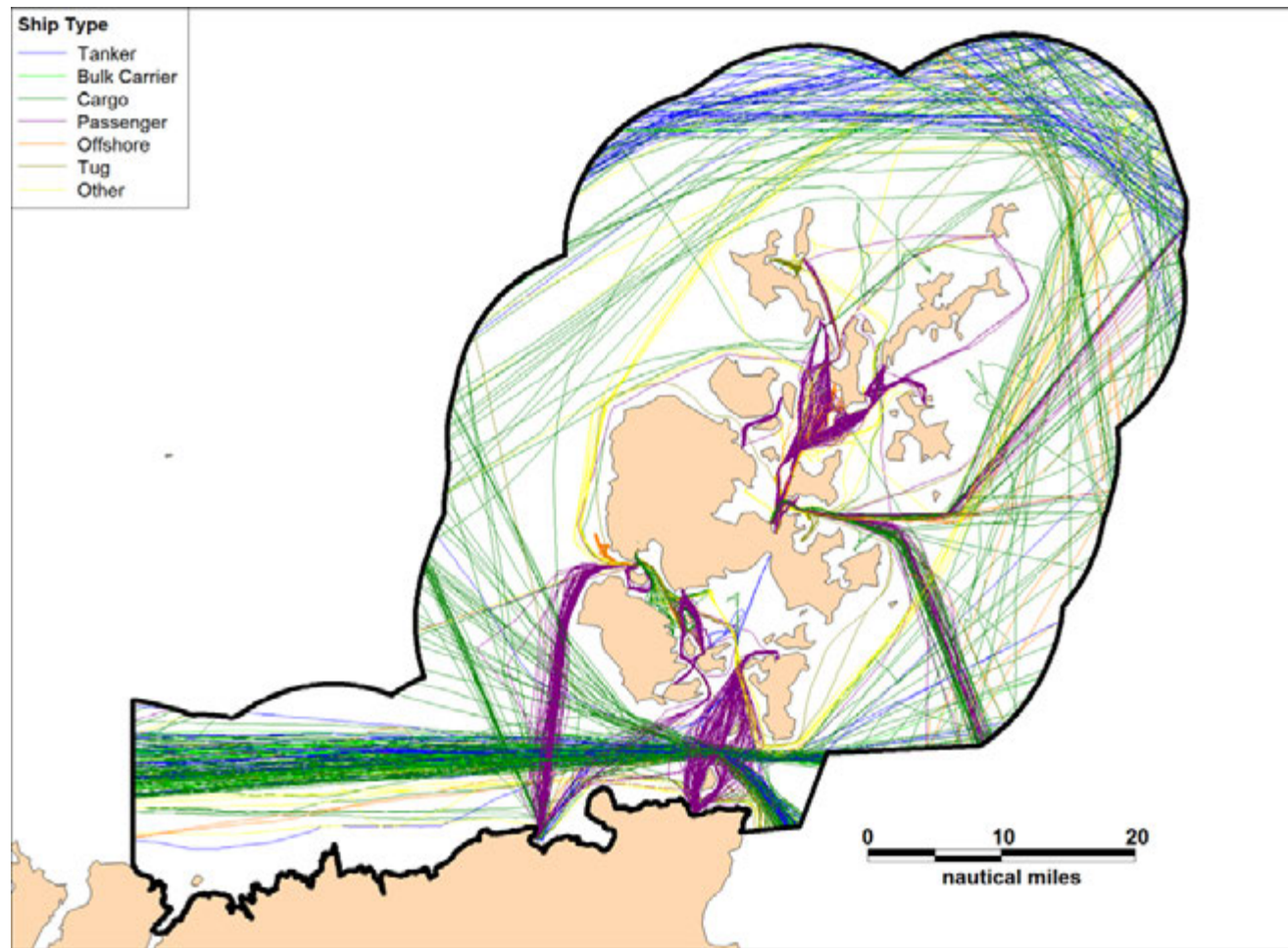


Figure 7.2 Winter 2012 AIS Track Analysis by Vessel Type

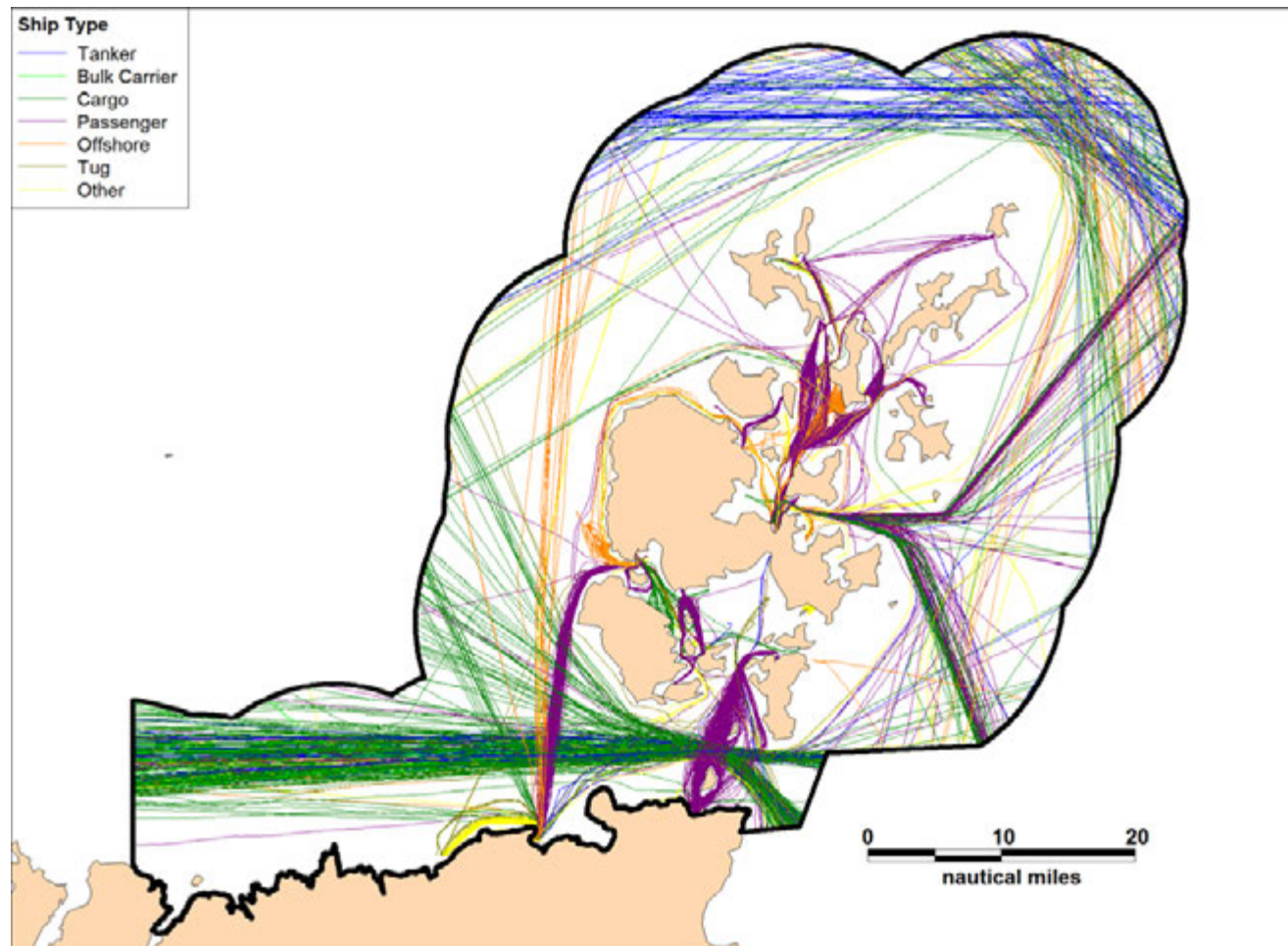


Figure 7.3 Summer 2012 AIS Track Analysis by Vessel Type

7.5 Ship Length Analysis

The length distribution for the winter and summer survey periods is presented in Figure 7.4 (excluding less than 1% of vessels with unspecified lengths which could not be identified from other sources).

Figure 7.5 and Figure 7.6 present seasonal plots of vessels within the Strategic Area, thematically mapped by vessel length.

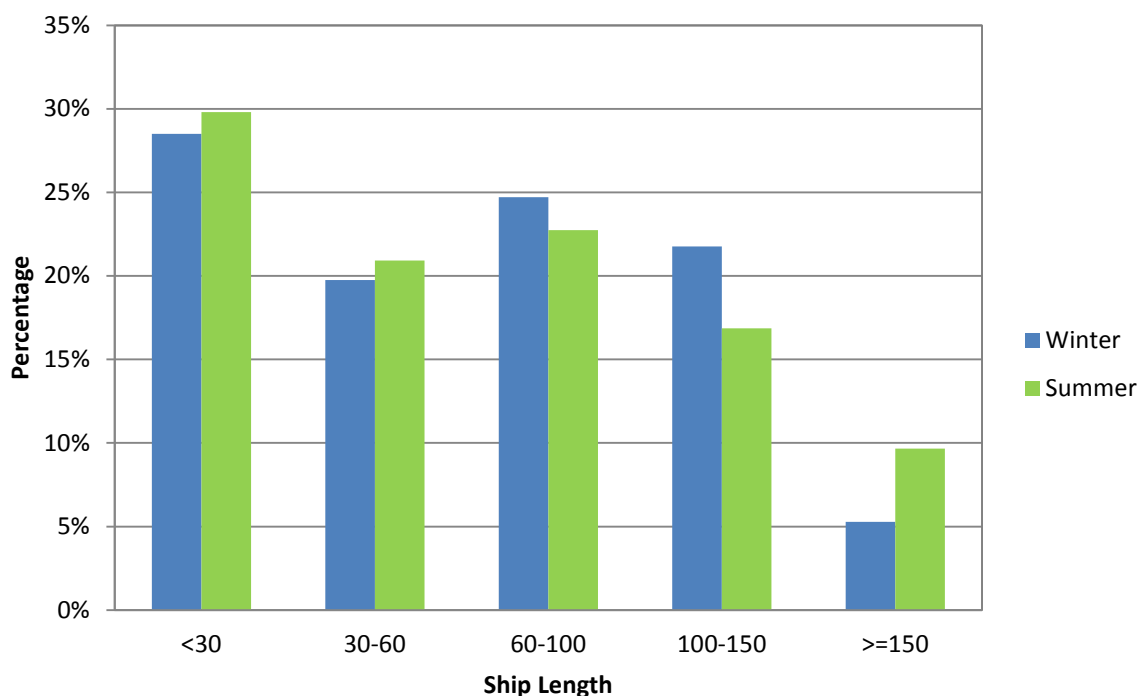


Figure 7.4 AIS 2012 Vessel Length Distribution by Season

The average vessel length in both periods equalled 73m. The most common category was lengths of less than 30m. Regular runners in this category included the Orkney Ferries inter-island passenger ferries and several tugs.

The slightly higher proportion of vessels with lengths greater than or equal to 150m in the summer period (approximately 10% compared with 5% in winter) is due to an increase in the number of large cargo vessels and passenger cruise vessels during this period.

The longest vessel was the tanker, *Fida*, at 333m, tracked to the north of the Strategic Area and en route to Hound Point marine terminal in the Firth of Forth during the summer period. The longest vessel during the winter survey was the cargo vessel, a fully cellular containership, *MSC Eleni*, at 294m. This was tracked transiting through the Outer Sound of the Pentland Firth, en route to Bremerhaven.

In terms of vessel tracks, the geographical distribution of vessels by length was similar in both periods. The longest vessels tended to be transiting the area, either passing north of Orkney via the Fair Isle Channel or south of Orkney through the Outer Sound of the Pentland Firth. During summer there were a number of vessels greater than 150m in length which called at Kirkwall. These were all passenger cruise vessels.

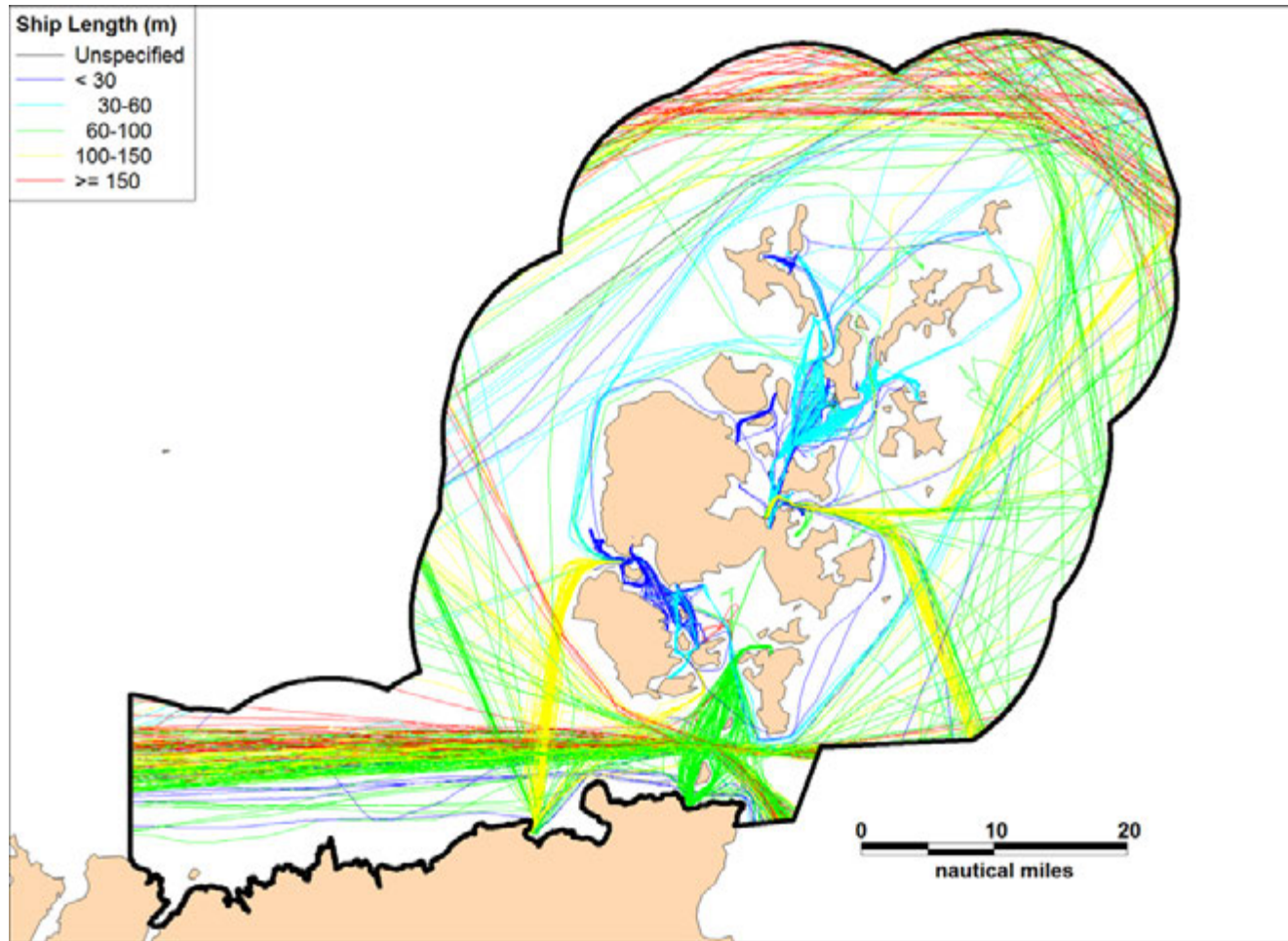


Figure 7.5 Winter 2012 AIS Track Analysis by Ship Length

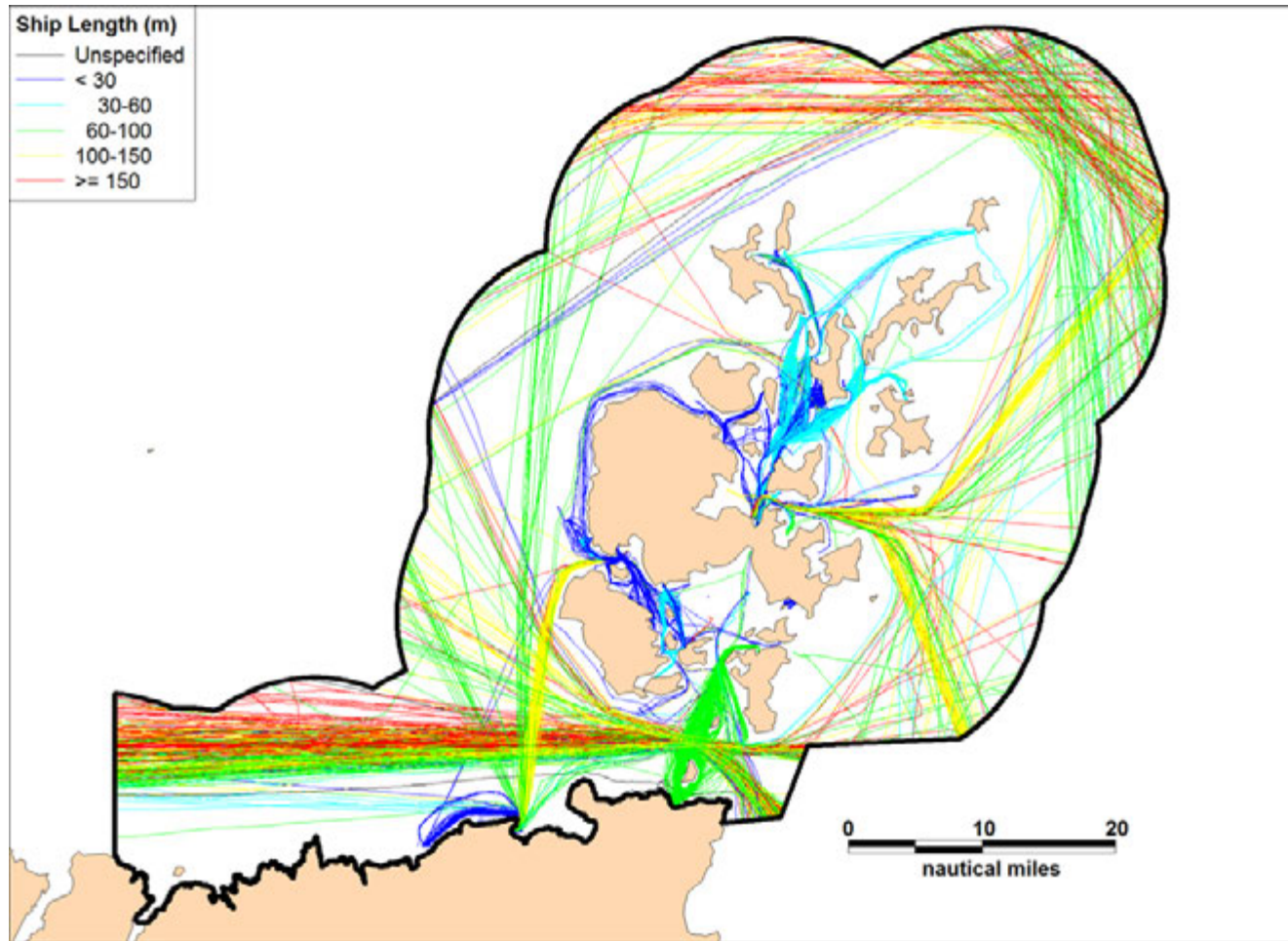


Figure 7.6 Summer 2012 AIS Track Analysis by Ship Length

7.6 Ship Draught Analysis

The draught distribution for the winter and summer survey periods is presented in Figure 7.7 (excluding 23% of vessels in both periods with unspecified draughts). (Note, draught is dynamic data, and varies per voyage, therefore it cannot be precisely researched from literature.)

Figure 7.8 and Figure 7.9 present seasonal plots of vessels within the Strategic Area, thematically mapped by vessel draught.

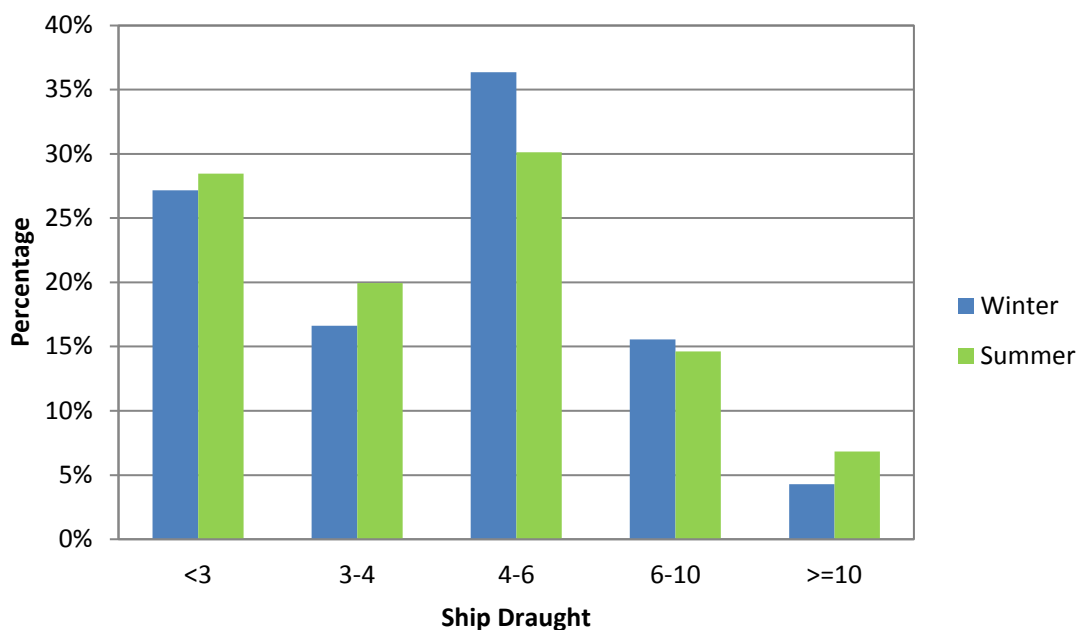


Figure 7.7 AIS 2012 Vessel Draught Distribution by Season

The average vessel draught in both periods was 4.9m. The most common category was 4-6m, comprising 36% of vessels in winter and 30% of vessels in the summer period.

As with length, there was a higher proportion of deep-draught vessels in summer compared to winter. This was mainly due to increased number of large cargo ships. The deepest draught vessel was the floating production tanker, *Petrojarl Banff*, at 25.5m draught, which was moored in Scapa Flow during the surveys. (Note, this vessel was undergoing repair and normally functions as an offshore oil installation.)

Similar to the longest vessels, the deepest draught vessels tended to be tracked transiting either the Outer Sound of the Pentland Firth or the Fair Isle Channel. Aside from the *Petrojarl Banff*, only two vessels with draughts greater than 10m were tracked within the Orkney Islands during the surveys. *Alfa Britannia*, with a draught of 12.4m, was recorded once in summer and once in the winter period, both times en route to Rotterdam. *NS Arctic*, at 13.6m draught, was recorded once en route to Wilhelmshaven. Both of these vessels were tankers associated with Flotta Marine Terminal, transiting in and out of Scapa Flow.

There were more deep-draught vessels transiting the Pentland Firth and the Fair Isle Channel during the summer period than the winter period.

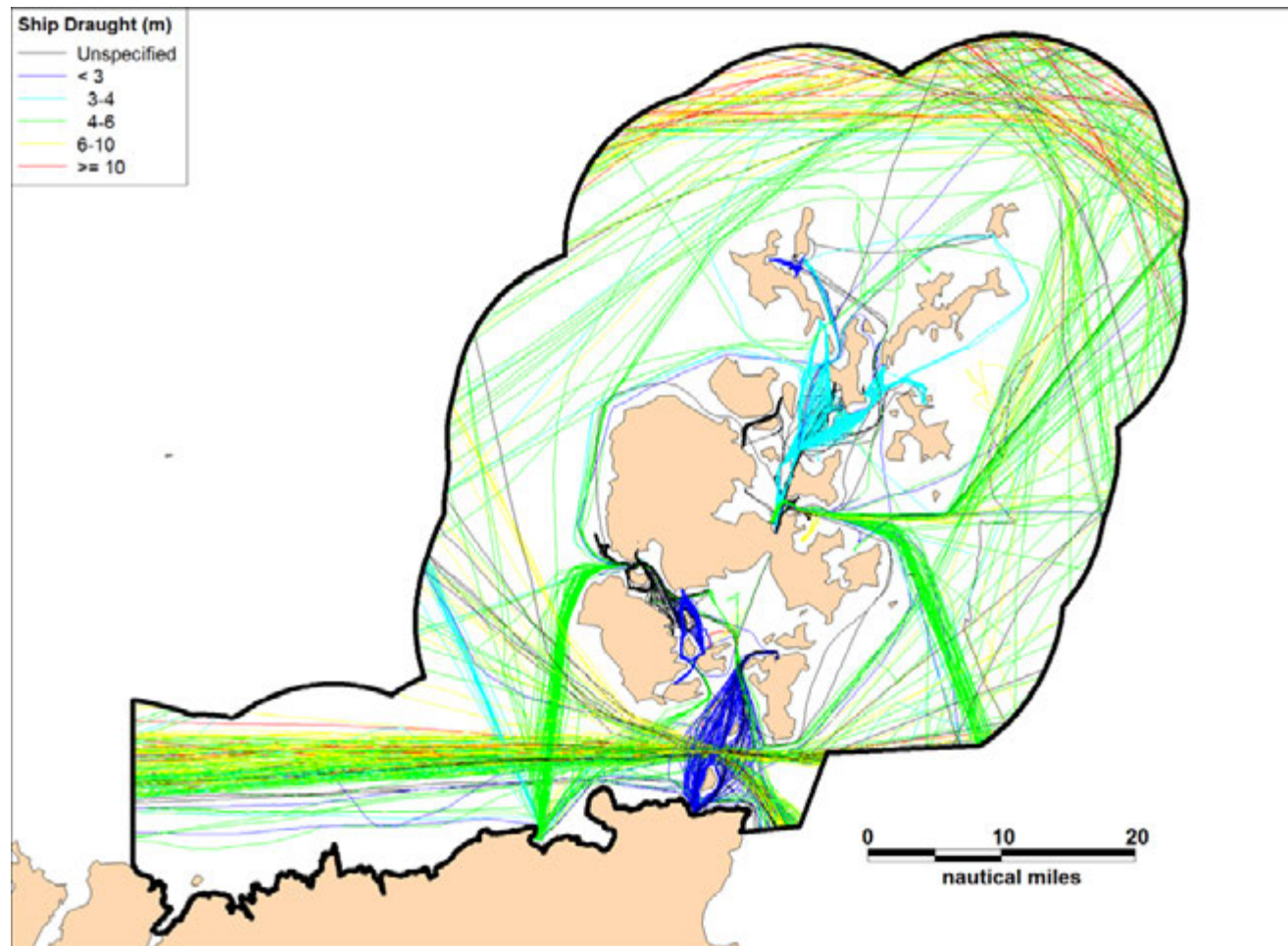


Figure 7.8 Winter 2012 AIS Track Analysis by Ship Draught

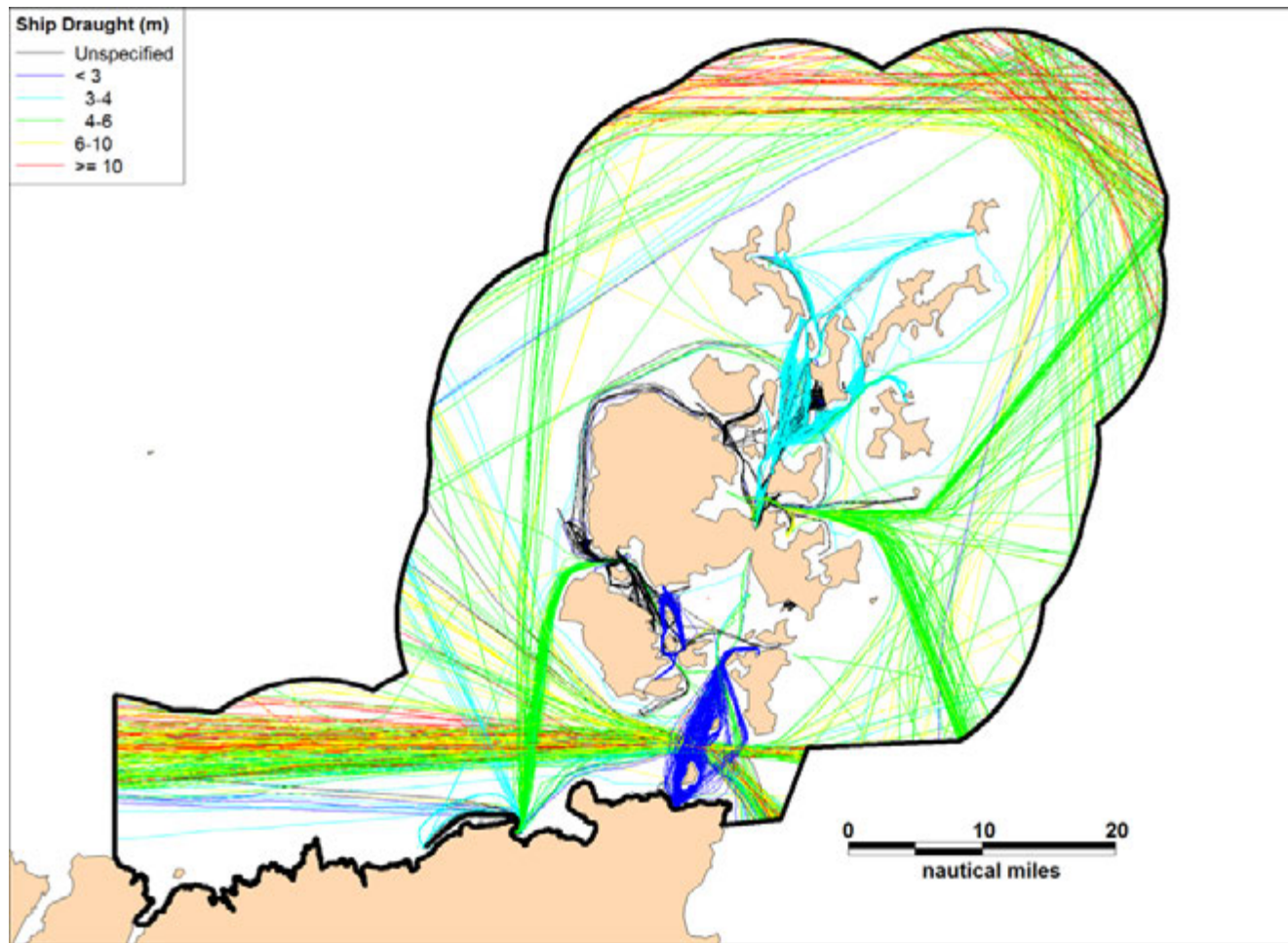


Figure 7.9 Summer 2012 AIS Track Analysis by Ship Draught

7.7 Ship Tonnage Analysis

Figure 7.11 and Figure 7.12 present seasonal plots of the vessel tracks within the PFOW Strategic Area, thematically mapped by gross tonnage (GT). (Note, tonnage information is not broadcast on AIS but was researched separately and appended to the data.)

The ship tonnage distribution recorded over the winter and summer periods is presented in Figure 7.10.

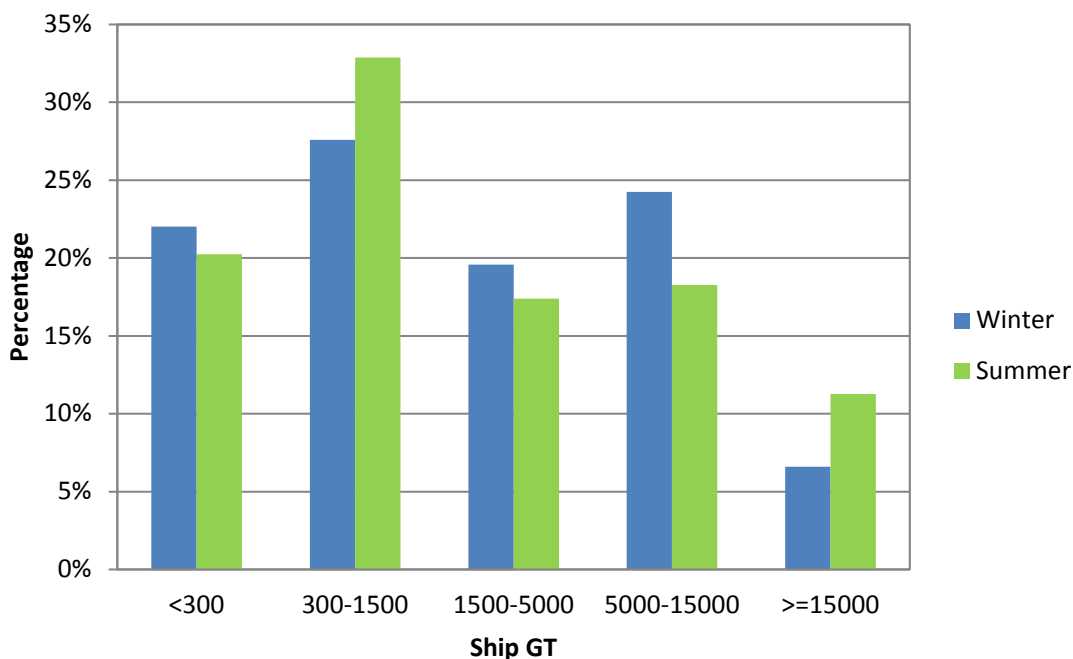


Figure 7.10 AIS 2012 Vessel GT Distribution by Season

The pattern is similar to that observed in the length and draught analysis. The most common category was 300-1,500 GT. Regular runners in this tonnage category included the *Pentalina* passenger ferry and Orkney Islands inter-island ferries.

Vessels of greater than 15,000 GT represented 11% of ships during summer and 7% in the winter survey. The higher percentage in summer was due mainly to a rise in the number of large cargo vessels and passenger cruise ships in this period.

The average GT of vessels was 5,830 GT in the winter period and 6,550 GT during the summer period.

The heaviest ship in winter was *SKS Skeena* at 81,380 tonnes. This was a 273m long 15m draught crude oil tanker en route to Portland, Maine and transiting through the Fair Isle Channel. During the summer period, the heaviest ship was *Elizabeth I.A.*, a crude oil tanker with length of 332m and draught of 11.7m. This vessel was also transiting through the Fair Isle Channel, en route to Mongstad.

The heaviest vessels were tracked transiting the Outer Sound of the Pentland Firth and the Fair Isle Channel. During the winter period, the only vessels over 15,000 GT tracked within the Orkney Islands were *Alfa Britannia*, at 56,100 GT, and *NS Arctic*,

at 62,400 GT. Both of these vessels were tankers associated with Flotta Marine Terminal, transiting in and out of Scapa Flow. *Alfa Britannia* was also tracked at Flotta Marine Terminal in the summer period. During the summer survey, there were a higher number of vessels over 15,000 GT tracked within the Orkney Islands. These were all passenger cruise vessels, calling at Kirkwall and Stromness.

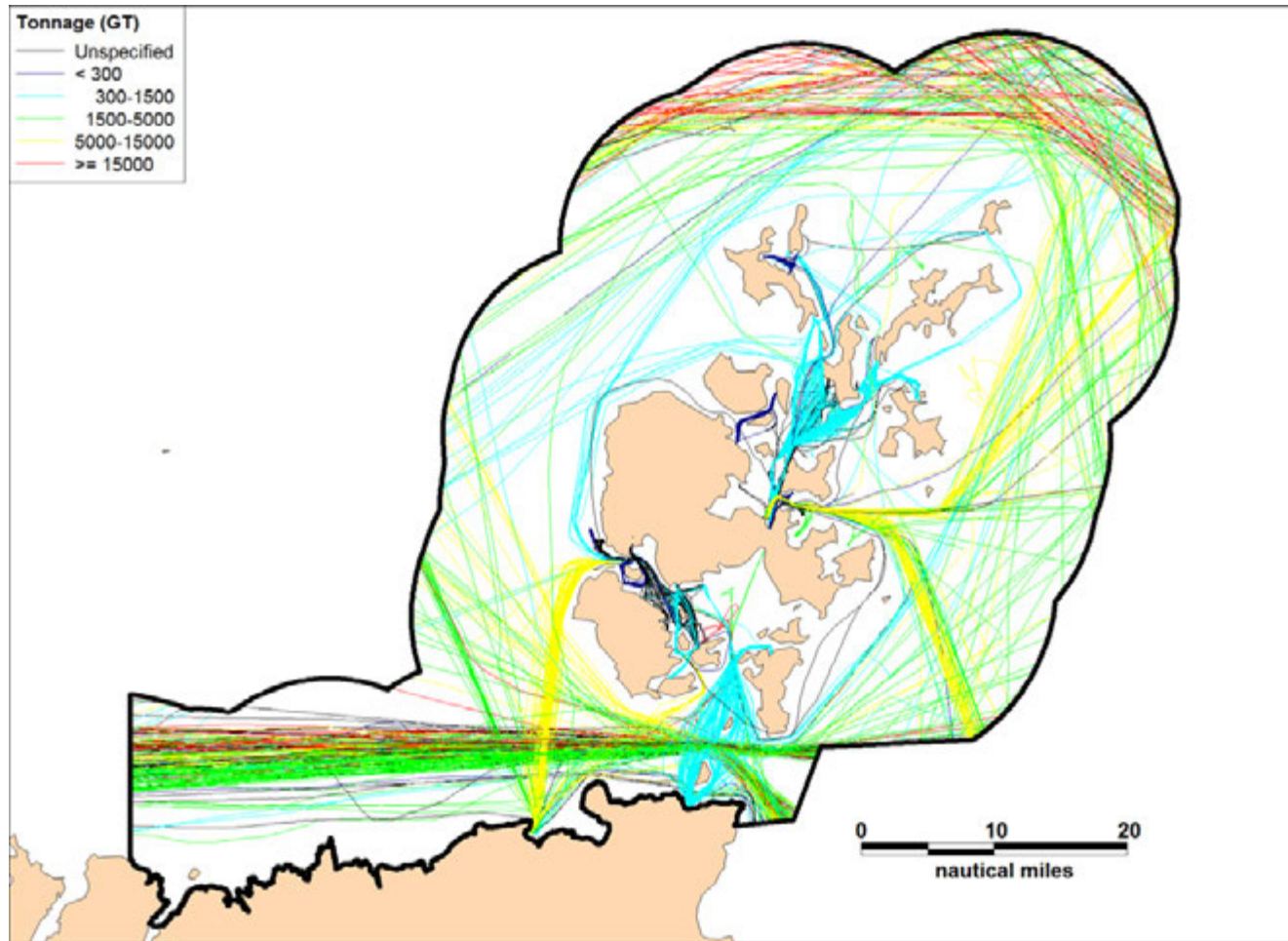


Figure 7.11 Winter 2012 AIS Track Analysis by Gross Tonnage

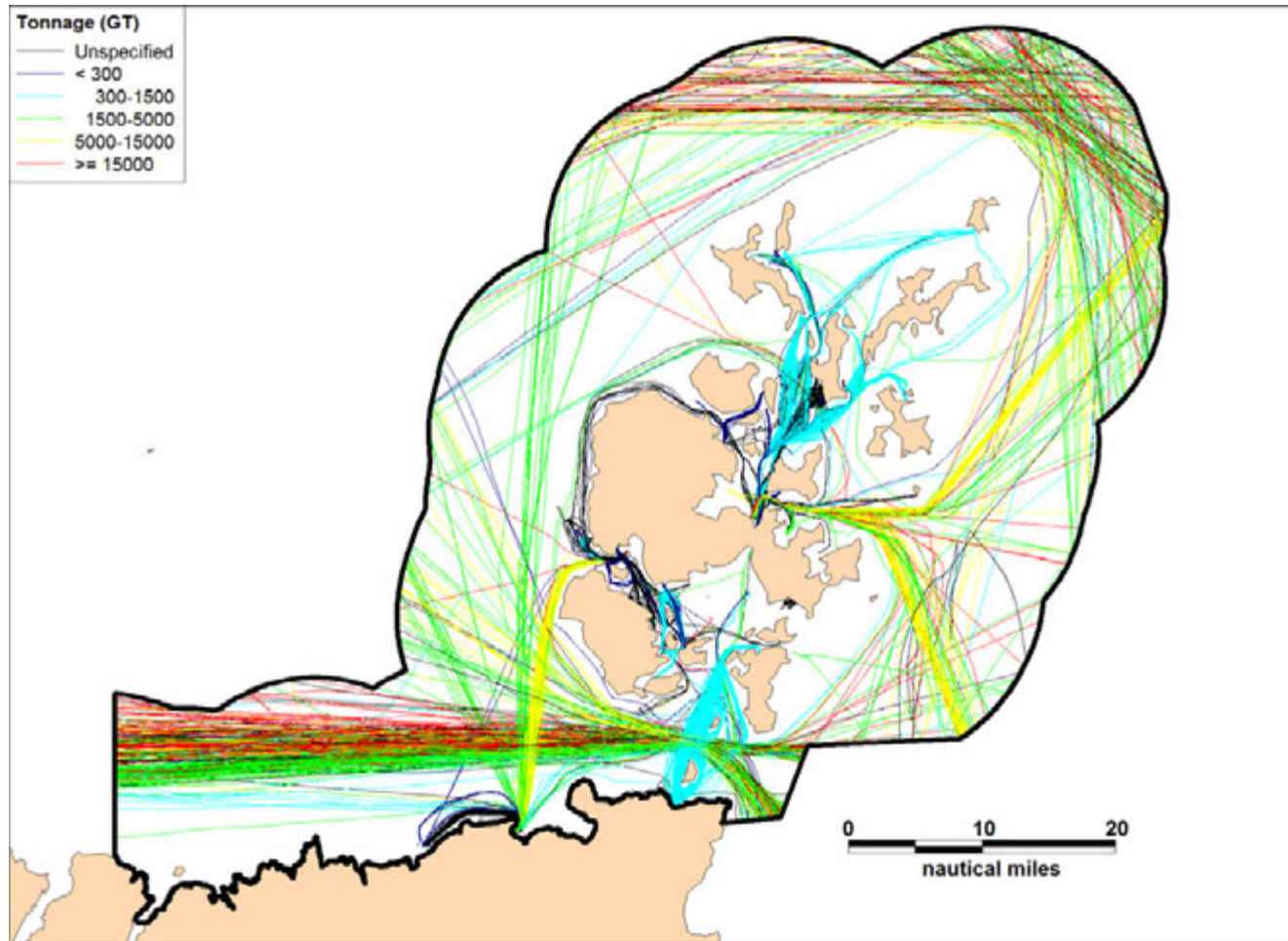


Figure 7.12 Summer 2012 AIS Track Analysis by Gross Tonnage

7.8 Combined Track Analysis

Seven vessel type categories were defined (as explained in Section 7.4) as follows:

1. Tanker (Oil / Chemical / Gas Carrier)
2. Bulk/Ore Carrier
3. Cargo (including RoRo/Container)
4. Passenger (Ferry and Cruise Ship)
5. Offshore (Oil & Gas and Renewables Support Vessels)
6. Tug
7. Other³⁶

These type categories are analysed in further detail in the following sections.

7.8.1 Tankers

Figure 7.13 presents the tankers and gas tankers recorded within the Strategic Area during the combined 56 day survey period. Overall, 145 unique tankers were tracked. Four of these were gas tankers and 141 were tankers.

The majority of tankers were transiting the Strategic Area, either east / west through the Outer Sound of the Pentland Firth, east / west to the north of the Strategic Area through the Fair Isle Channel or north / south to the east of the Strategic Area, to a variety of destinations.

Six unique tankers were tracked calling at harbours within the Strategic Area (Scrabster, Kirkwall, Flotta Oil Terminal and Scapa Bay).

Four unique gas carriers were recorded during the 56 day period, all of these transiting the Strategic Area (not visiting a port). One track was made to the north of Orkney and four were to the south via the Outer Sound of the Pentland Firth.

7.8.2 Bulk/Ore Carriers

Bulk/ore carriers were tracked transiting the Outer Sound of the Pentland Firth and through the Fair Isle Channel to the north of the Strategic Area. Destinations were all outwith the Strategic Area, with no vessels calling at ports within the Area.

7.8.3 Cargo Vessels

Three-hundred and thirty-five unique cargo vessels were recorded within the Strategic Area during the 56 days combined period. These are presented in Figure 7.14.

Most cargo vessels transited the Strategic Area, east / west through the Pentland Firth and continuing through the Pentland Firth or rounding to the west of the Orkney Islands, east / west through the Fair Isle Channel to the north of the Strategic Area, north / south to the east of the Strategic Area and northeast / southwest to the west of the Strategic Area. Several transits were made northeast / southwest through the Orkney Islands.

³⁶ This category includes research vessels, underwater operations vessels, light tenders, fish carriers, RNLI lifeboats and miscellaneous / other vessels.

Ports of call within the Strategic Area included Kirkwall, Scrabster, Pierowall and Sanday. One vessel was tracked serving the *Petrojarl Banff* in Scapa Flow. The cargo vessel recorded within the Orkney Islands between Stromness, the south coast of Orkney Mainland, the northeast coast of Hoy and south of Burray was *Flamborough Light* which was operating at a number of fish farms.

7.8.4 Passenger Vessels

Forty-one unique passenger vessels were tracked in the Pentland Firth and Orkney Waters Strategic Area during the combined survey period. These were both passenger vessels and cruise ships.

Figure 7.15 presents the passenger vessels during the 56 days survey period.

Fifteen vessels were regular passenger ships. Four of these operated between the Scottish Mainland and Orkney. These were Pentland Ferries' *Pentalina* (operating between Gills Bay³⁷ and St Margaret's Hope³⁸) and Serco NorthLink's *Hamnavoe* (Scrabster to Stromness) and *Hjaltland* and *Hrossey* (serving the Aberdeen / Kirkwall / Lerwick route). Eight were inter-island ferries operated by Orkney Island Council. Three were vessels transporting personnel between the Flotta Marine Oil Terminal and Flotta, Lyness³⁹ and Houton.

Twenty-five cruise vessels were tracked in the Strategic Area, all during the summer survey. Seventeen of these were recorded calling at harbours on Orkney, with eight transiting through the Strategic Area. The only cruise vessel to be tracked calling at a port in the Strategic Area, other than Kirkwall or Stromness, was the *Hebridean Princess*. July is the peak month for cruise ship callings at Orkney, therefore, the summer survey represents this seasonal activity.

As can be seen in the figure, passenger vessels have very defined tracks and ports of call. There are tracks between the south of the Strategic Area, on the Scottish mainland (Scrabster, Gills Bay and Aberdeen), to the Orkney Islands (Stromness, St Margaret's Hope and Kirkwall) and tracks between Kirkwall and the north of the Strategic Area (Lerwick). In addition to these, there are a number of tracks between the Orkney Islands with ports of call on the majority of the Orkney Islands. Cruise vessels were tracked both transiting the Strategic Area and calling at ports on Orkney, mainly Kirkwall.

7.8.5 Offshore Industry Vessels

Forty-nine unique offshore industry vessels were recorded within the Strategic Area during the 56 days combined period. These are presented in Figure 7.16.

Thirty-four of these vessels were oil and gas industry related vessels. These were tracked transiting the Inner and Outer Sound of the Pentland Firth, transiting east of the Strategic Area to / from Aberdeen and a number of oil fields, bound to / from Kirkwall and offshore fields, and to / from Scrabster, and Stena Carron and Clair Oil Field (both to the west of Shetland).

³⁷ Bay on north coast of Scottish Mainland

³⁸ Bay to north of South Ronaldsay

³⁹ East coast of Hoy

Fifteen vessels were identified to be undertaking offshore renewables work in the Strategic Area. These vessels were associated with the European Marine Energy Centre (EMEC) sites at Fall of Warness (tidal test site) and Billia Croo (wave test site). Vessels working at Fall of Warness were mainly based at Kirkwall and Eday, whereas vessels working at Billia Croo used both Kirkwall and Stromness.

Most oil and gas support vessels operate between the ports of Aberdeen, Kirkwall and Scrabster and their offshore destinations. At present, the majority of renewables vessels are based at Kirkwall, Stromness and Eday and operate close to shore in western and central Orkney waters.

More offshore vessel tracks were made during the summer survey than the winter survey. There was an increase in the number of tracks made by both oil and gas vessels and renewables vessels during the summer period.

7.8.6 Tugs

All tugs recorded within the Strategic Area called at harbours within the Area and were not simply transiting. This is due to them performing more localised work than other vessel types and being likely to be operating within the Area. Destinations within the Strategic Area included Kirkwall, Scrabster, Westray Stromness, Scapa Flow and the northern and southern Orkney Islands.

7.8.7 Other Vessels

Other vessels were both transiting between harbours within the Strategic Area and making passage through the Strategic Area east / west through the Pentland Firth, east / west through the Fair Isle Channel to the north of the Strategic Area, north / south to the east of the Strategic Area and northeast / southwest to the west of the Strategic Area.

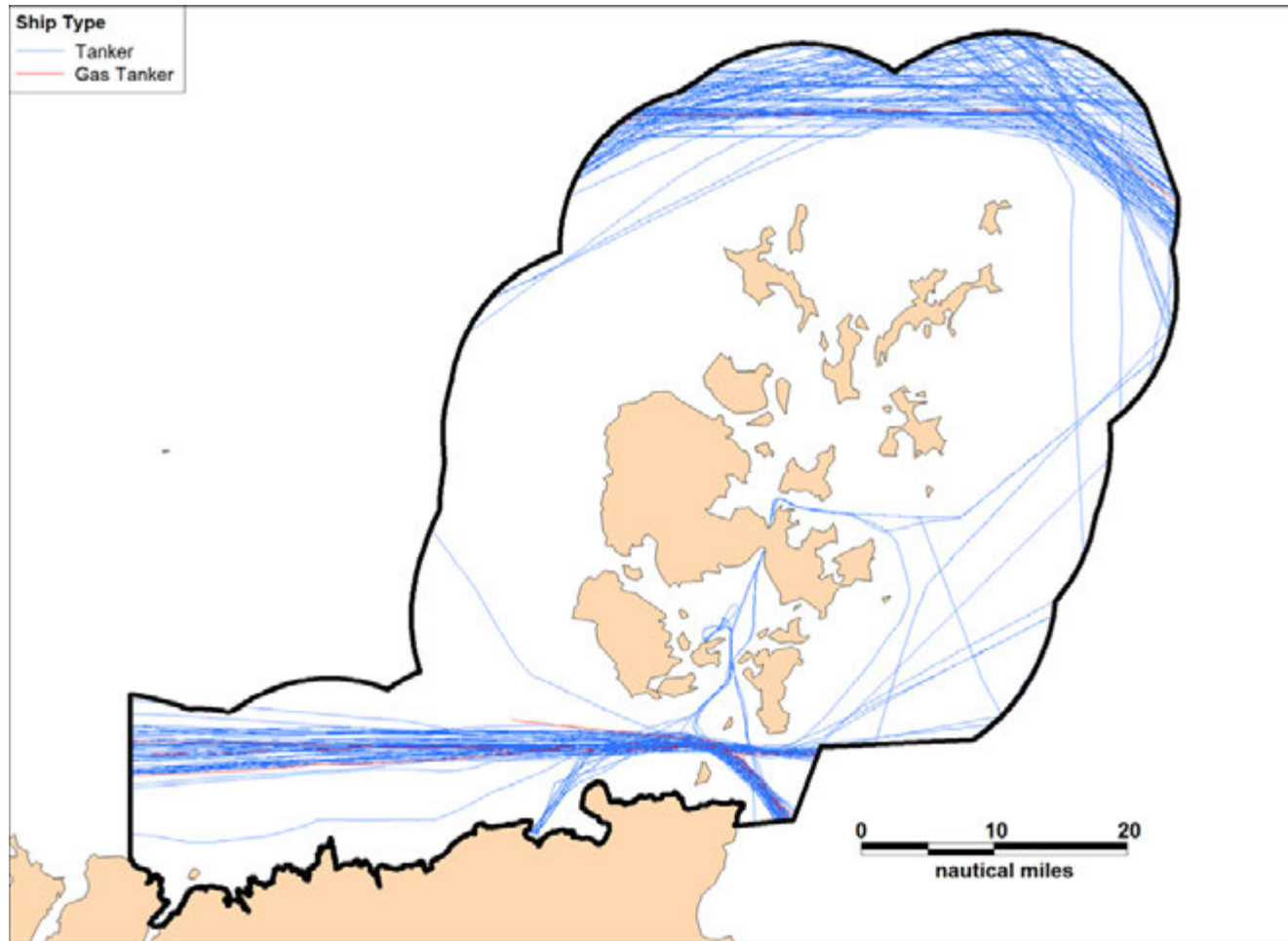


Figure 7.13 Combined 2012 AIS Track Analysis – Tankers & Gas Tankers

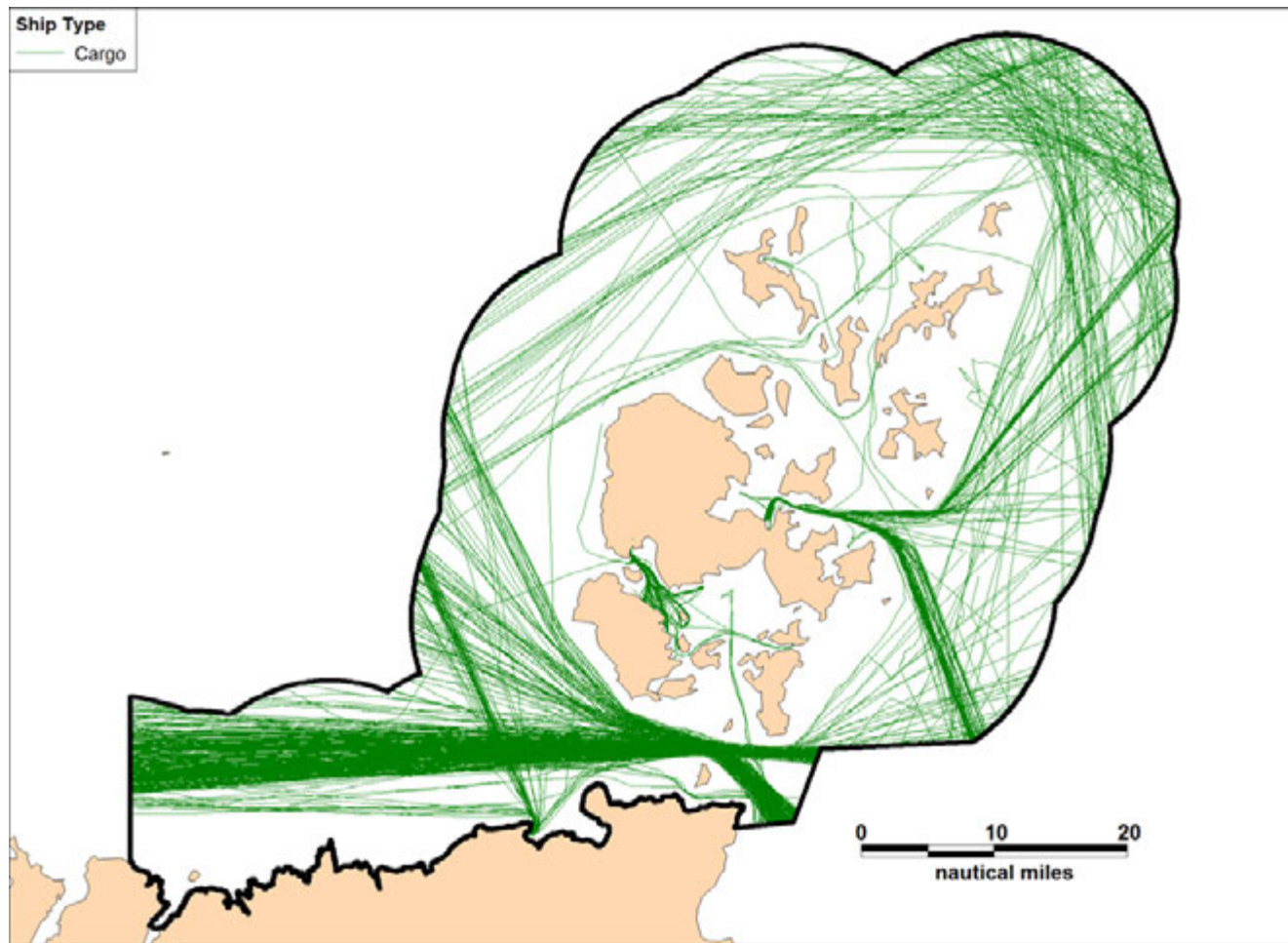


Figure 7.14 Combined 2012 AIS Track Analysis – Cargo Vessels

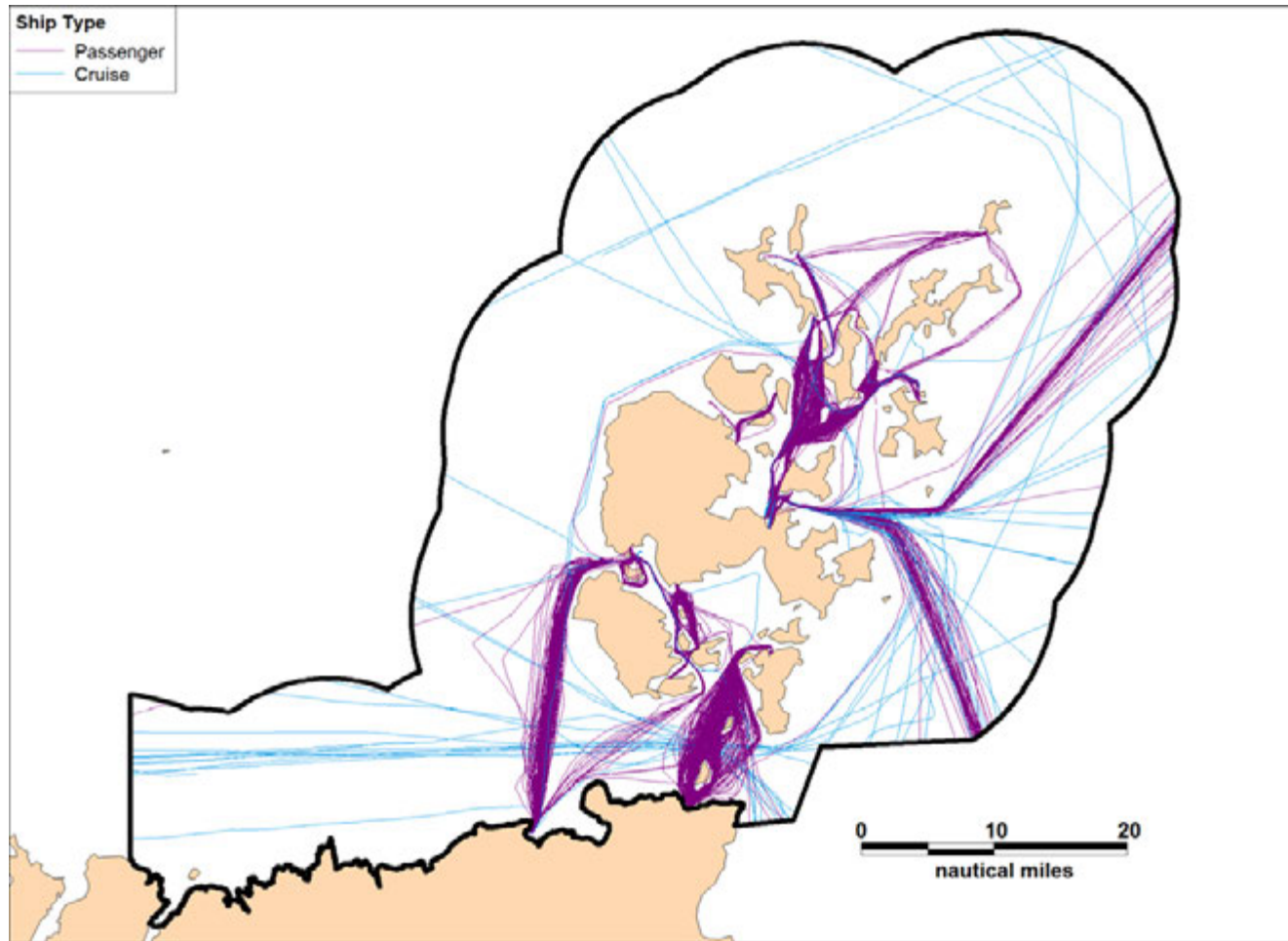


Figure 7.15 Combined 2012 AIS Track Analysis – Passenger and Cruise Vessels



Figure 7.16 Combined 2012 AIS Track Analysis – Offshore Oil & Gas / Renewables Vessels

7.9 Weather and Tidal Routeing Analysis

It was identified in the questionnaire that recreational sailing in the area is strongly influenced by weather and tide. Although this is not as big an influence on commercial shipping, it can still be seen from the AIS analysis that weather and tidal routeing is used, in particular by passenger vessels, to reduce delay and improve passenger comfort during periods of bad weather and/or strong tides.

An example is presented in Figure 7.17 which shows tracks of the Pentland Ferries' *Pentalina* and Serco NorthLink Ferries' *Hamnavoe*, crossing the Pentland Firth.

Pentalina, when transiting between Gills Bay and St. Margaret's Hope, most frequently uses the shortest route west of Stroma, which can be seen from the AIS data. Wind and tidal conditions, however, influence the choice of route taken. In easterlies, the ferry will tend to pass west of Stroma, whilst in westerlies the route east of Stroma is preferred. If there is a flood tide and strong southeast winds, then the Master will keep further off Stroma to the west to avoid the risk of drifting towards shore (also, the tide pushes them back on course). If there is an ebb tide and southeast winds then they keep closer to the westerly course of Stroma. In strong westerly winds, the reverse of this would be the case, and they would pass to the east and closer to Stroma in a flood tide and keep further out in an ebb tide.

The *Hamnavoe*, which serves the Scrabster to Stromness route, usually transits west of Hoy and via Hoy Mouth⁴⁰. However, there is an alternative route via Scapa Flow taken for the comfort of passengers, particularly when heading northbound to Stromness during strong westerlies and ebb tide.

A further example is presented in Figure 7.18 which shows tracks of Orkney Ferries' *Earl Thorfinn*, between Kirkwall and the outer North Isles, transiting via the Westray Firth. It can be seen the ferry normally navigates close to the islands of Eday or Egilsay to obtain shelter from the weather and tide. When sea conditions and tide are favourable, the vessel takes a more direct route through the Westray Firth.

⁴⁰ Between Orkney Mainland and Hoy

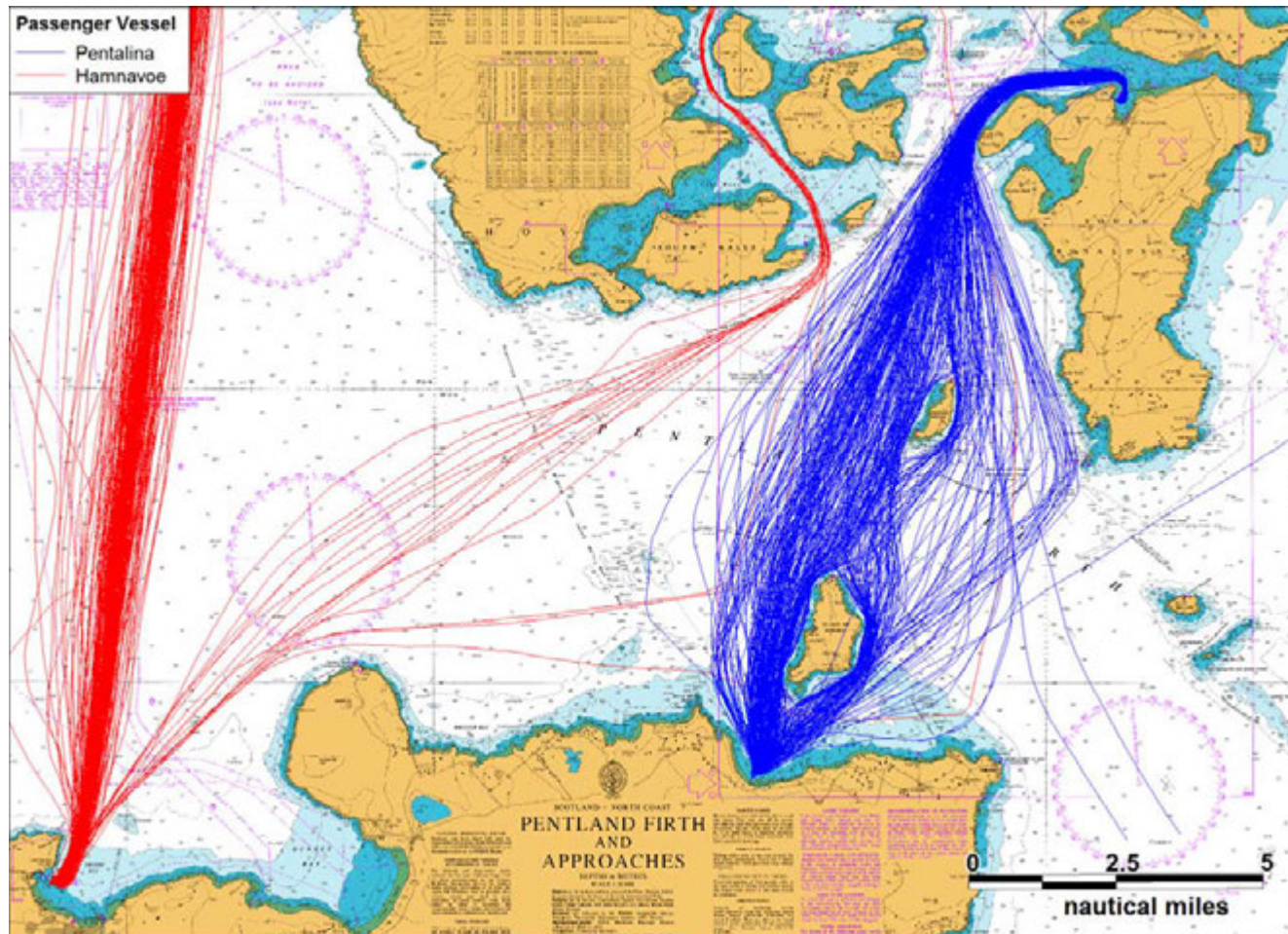


Figure 7.17 *Hamnavoe* and *Pentalina* Routeing based on Combined 2012 AIS Track Analysis

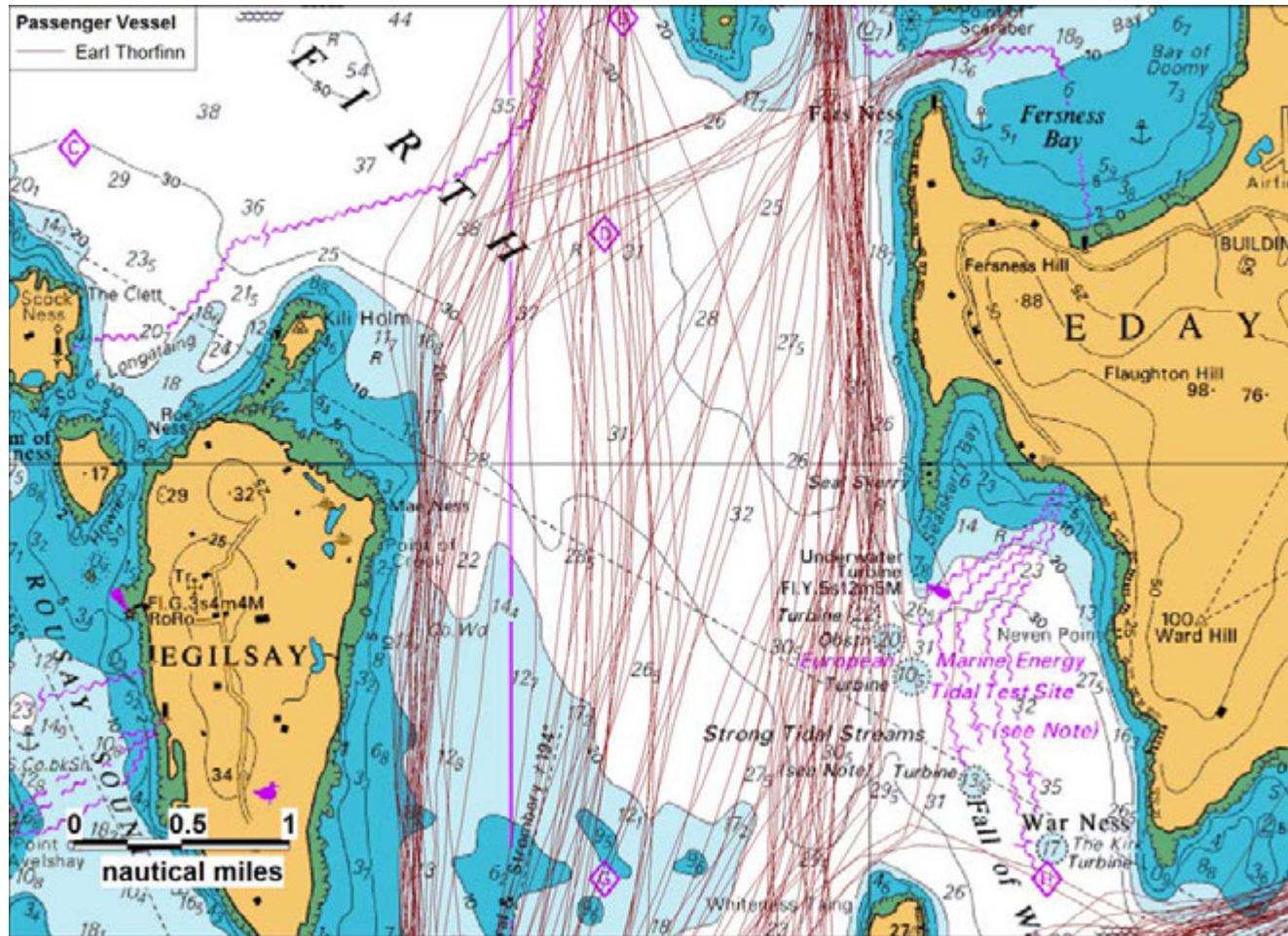


Figure 7.18 *Earl Thorfinn* Routing based on Combined 2012 AIS Track Analysis

7.10 Destination Analysis

Excluding 26% of vessels which had an unspecified destination, the most common destinations of vessels within the Strategic Area are presented in Figure 7.19.

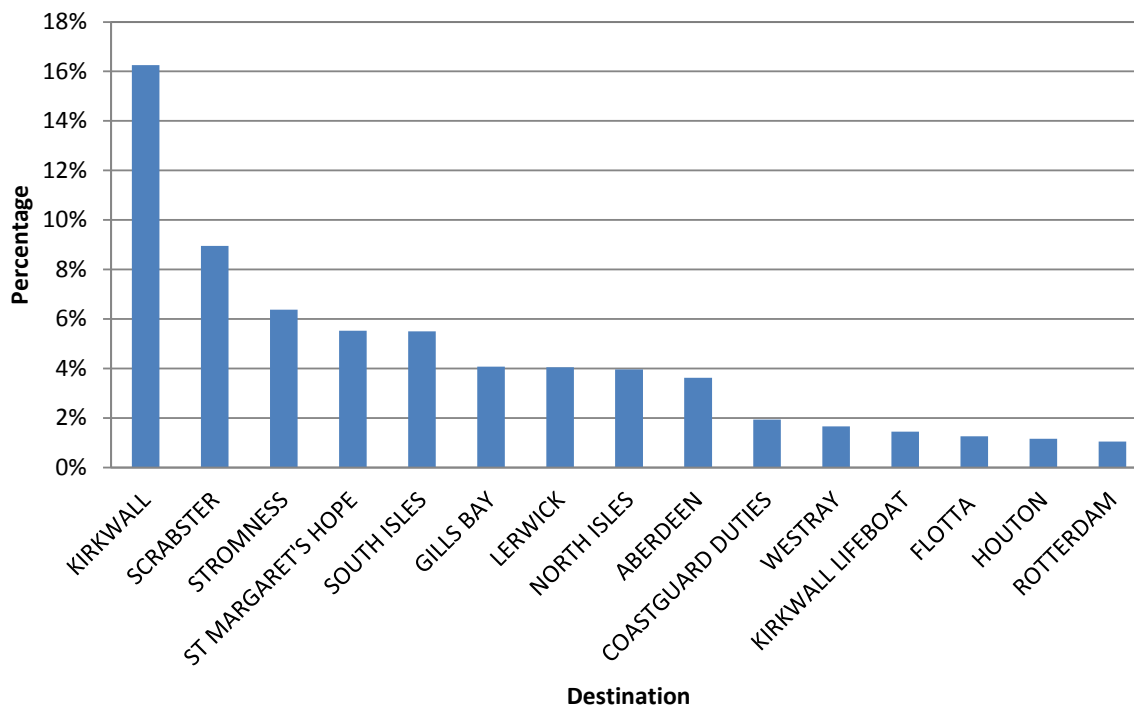


Figure 7.19 AIS 2012 Vessel Destination

Kirkwall was the most recorded destination of vessels within the area (16%), followed by Scrabster (9%) and Stromness (6%). These are all visited by regular ferry services. Many of the other popular destinations are also used by ferries, such as St. Margaret's Hope on South Ronaldsay and Gills Bay (Pentland Ferries). Of the most common destinations, tankers visited Lerwick, Scrabster and Rotterdam. Bulk carriers and cargo vessels were recorded most frequently broadcasting Kirkwall, Scrabster, Aberdeen, Lerwick and Rotterdam as their destinations. From the above list, offshore vessels principally called at Kirkwall, Aberdeen, Stromness and Scrabster.

Lerwick (4%) and Aberdeen (4%) were the most common destinations beyond the PFOW Strategic Area, which is mainly due to the regular ferry service linking Kirkwall with these ports.

It should be noted that AIS destinations listed as 'South Isles' and 'North Isles' were broadcast by Orkney Ferries' vessels. South Isles destinations included Flotta, Houton, Longhope and Lyness. North Isles included Eday, Kirkwall, North Ronaldsay, Papa Westray, Pierowall, Sanday, Stronsay and Westray. In addition to this, the Orkney Ferries vessels *Eynhallow*, *Graemsay* and *Shapinsay* did not broadcast a destination. *Eynhallow* serves Egilsay, Rousay, Tingwall and Wyre, *Graemsay* calls at Graemsay, North Hoy and Stromness, and *Shapinsay* serves Kirkwall and Shapinsay. The above destinations may, therefore, be under-represented in Figure 7.19.

7.11 Anchoring

There was limited ship anchoring within the Strategic Area during the combined survey period. Due to the duration and seasonality of the survey periods, it is likely that this is representative of ship anchoring at all times.

- The floating production tanker, *Petrojarl Banff*, was at anchor in Scapa Flow during the whole period. Also anchoring within Scapa Flow were two tankers and a tug.
- Two cruise ships used the Cairston Road anchorage area near Stromness, during the summer period.
- On two occasions, the *Hebridean Princess* passenger cruise vessel used the anchorage area at Tankerness Reef, at the entrance to Deer Sound. Two cargo vessels also anchored here.
- The emergency towing vessels *Anglian Sovereign* (in winter) and *Herakles* (in summer) were recorded at anchor in the Bay of Kirkwall and Inganess Bay.
- Bay of Kirkwall was also used by a cruise vessel and a cargo vessel. The cargo vessel also anchored just south of the anchorage area at the Bay of Isbister.
- In the Northern Isles, the *Hebridean Princess* anchored in a number of locations.

7.12 Ship Hazardous Cargo Analysis

On AIS, certain vessel types (e.g., Passenger, Cargo, Tanker and Other) can indicate whether they are carrying hazardous cargo of the following types:

- Dangerous Goods (DG);
- Harmful Substances (HS); and
- Marine Pollutants (MP).

Four categories are used based on MARPOL Annex II *Regulations for the control of pollution by noxious liquid substances in bulk*. These are:

- **Category X:** Noxious Liquid Substances which, if discharged into the sea from tank cleaning or deballasting operations, are deemed to present a major hazard to either marine resources or human health and, therefore, justify the prohibition of the discharge into the marine environment;
- **Category Y:** Noxious Liquid Substances which, if discharged into the sea from tank cleaning or deballasting operations, are deemed to present a hazard to either marine resources or human health or cause harm to amenities or other legitimate uses of the sea and therefore justify a limitation on the quality and quantity of the discharge into the marine environment;
- **Category Z:** Noxious Liquid Substances which, if discharged into the sea from tank cleaning or deballasting operations, are deemed to present a minor hazard to either marine resources or human health and therefore justify less

stringent restrictions on the quality and quantity of the discharge into the marine environment; and

- **Other Substances:** substances which have been evaluated and found to fall outside Category X, Y or Z because they are considered to present no harm to marine resources, human health, amenities or other legitimate uses of the sea when discharged into the sea from tank cleaning or deballasting operations. The discharge of bilge or ballast water or other residues or mixtures containing these substances are not subject to any requirements of MARPOL Annex II.

Figure 7.20 and Figure 7.21 present winter and summer plots of vessels that were broadcasting the fact they were carrying hazardous cargoes.

Vessels carrying hazardous cargo tended to be tankers and cargo vessels transiting the Outer Sound and also north of the Strategic Area.

During the winter period, 48% of vessels were tracked carrying the most hazardous category of cargo, Category X, compared with 75% of vessels in summer.

Within the Orkney Islands, several vessels were recorded carrying Category X hazardous cargo. The *Havila Fortress* cargo vessel was tracked in Scapa Flow carrying Category X hazardous cargo to and from *Petrojarl Banff* during the winter period. The cargo ship *Flinterbirka* transited to Kirkwall on 24 January 2012, anchored in Kirkwall Bay, and then made way to Scrabster on 26 January 2012. During the winter period, the Serco NorthLink cargo vessels *Helliar* and *Hildasay* were tracked 11 and 25 times, respectively, transiting between Aberdeen / Kirkwall / Lerwick and on all occasions calling at Kirkwall, broadcasting that they were carrying Category X hazardous cargo. During the summer period, *Hildasay* was recorded 27 times carrying Category X hazardous cargo on the above route. The passenger and cargo ro-ro vessel, *Hjaltland*, was tracked 3 times in this period broadcasting that it was carrying Category X hazardous cargo, also on the above route. In terms of vessels carrying other categories of hazardous cargo within the Orkney Islands, *Hildasay* was recorded transiting to Kirkwall then on to Lerwick on 25 January 2012, carrying Other Substances. The product tanker *Sarnia Liberty*, carrying Category Z hazardous cargo, was tracked en route to Kirkwall then on to Lerwick on 05 July 2012. On 23 July it was bound for Scapa Flow and returned to Immingham the same day. It was also recorded leaving Kirkwall for Stornoway 30 July.

The only additional port within the Strategic Area where vessels were recorded carrying hazardous cargoes (both Category X and Category Y) was Scrabster. During the winter period, the general cargo vessel *Flinterbirka* was tracked transiting to Scrabster on 26 January 2012, carrying Category X hazardous cargo. The offshore supply cargo vessel *Far Service*, carrying Category Y hazardous cargo, was recorded transiting to Scrabster on 2 February 2012, before making way to Foinaven Field the same day. In the summer survey, the chemical tanker *Lizrix* transited to Scrabster on 03 July and made way to Hull the same day. It returned to Scrabster on 12 July 2012 before transiting to Immingham the following day. On 28 July 2012 it returned to Scrabster. On all these occasions it was carrying Category X hazardous cargo.

With the exception of Kirkwall, Scrabster and *Petrojarl Banff*, no vessels carrying Category X hazardous cargo were tracked visiting any other destinations within the Strategic Area. The only additional destination where a vessel was recorded carrying hazardous cargo (Category Z) within the Strategic Area was Scapa Flow. No vessels carrying hazardous cargo were tracked transiting through the waters close to the west of the Orkney Islands.

The waters around Orkney (excluding the Pentland Firth and Scapa Flow) are categorised by the IMO as an Area to be Avoided (ATBA). To avoid the risk of pollution and damage to the environment, all vessels over 5,000 GT carrying oil or other liquid hazardous cargoes in bulk, should avoid this area. During the survey periods, no tankers were tracked within the ATBA broadcasting on AIS as carrying hazardous cargoes.

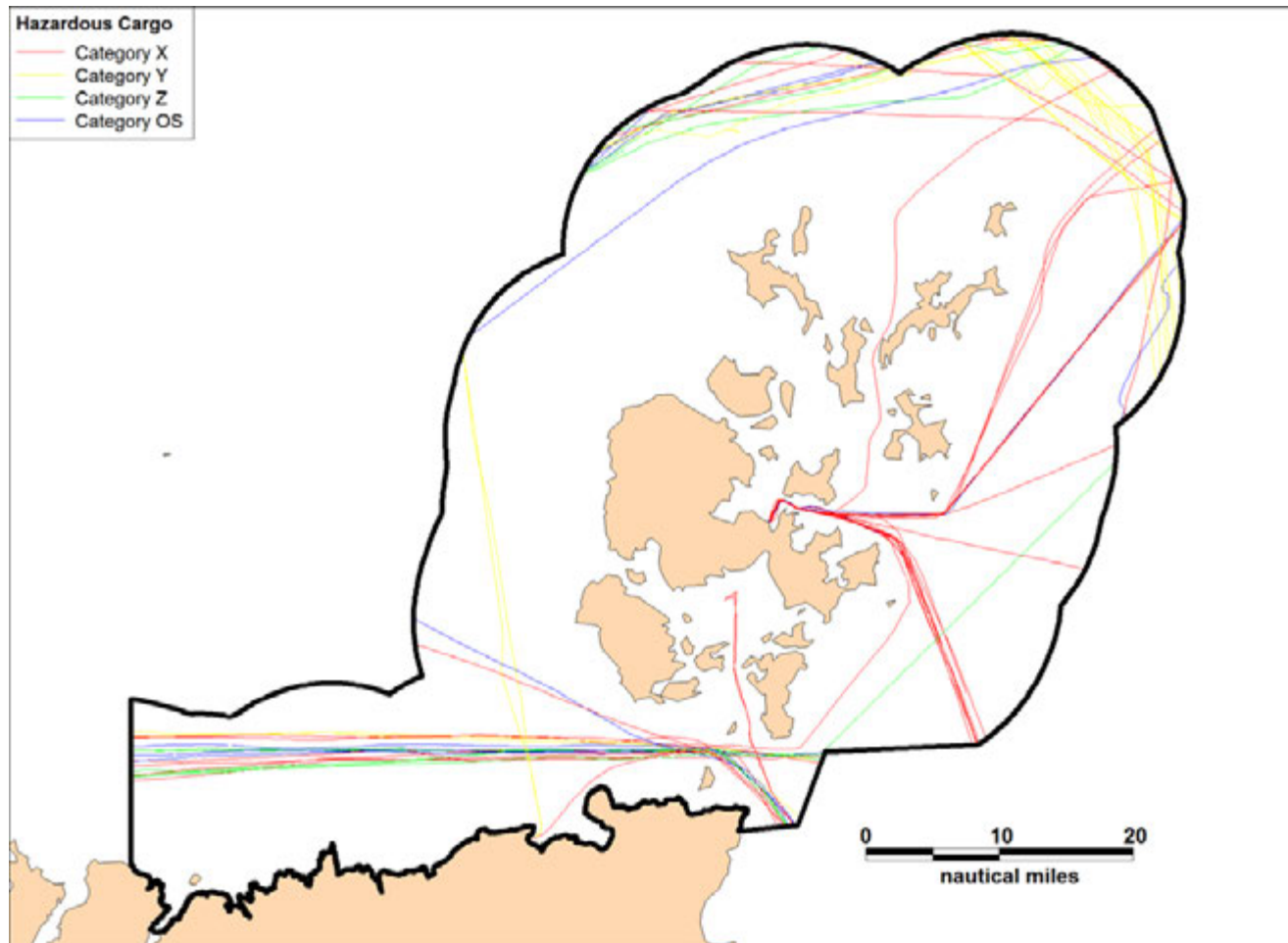


Figure 7.20 Winter 2012 AIS Track Analysis by Hazardous Cargo Category

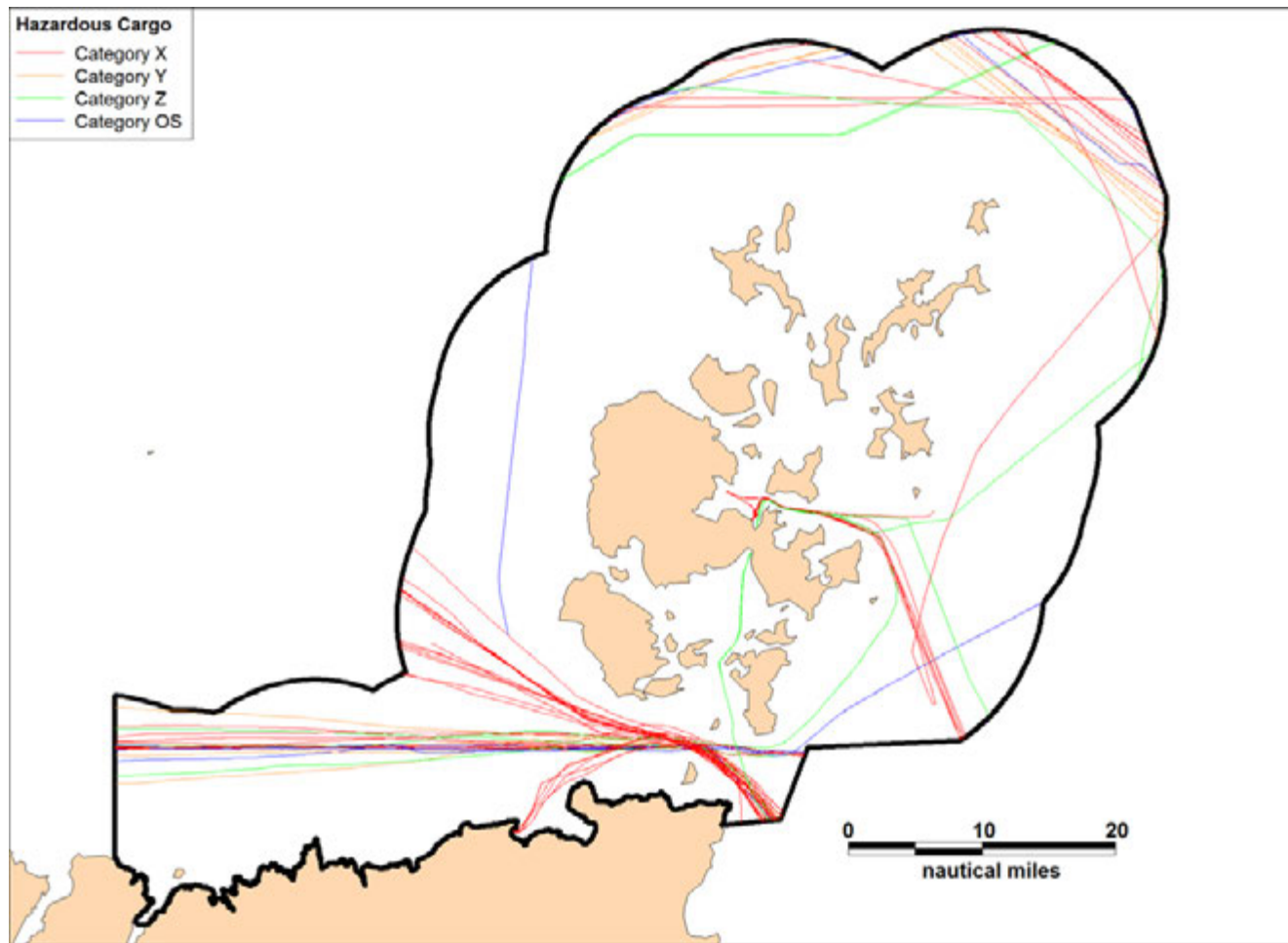


Figure 7.21 Summer 2012 AIS Track Analysis by Hazardous Cargo Category

7.13 Validation of AIS Data using Coastguard Records

The Pentland Firth Reporting System is a voluntary reporting system for laden vessels to report to the Coastguard on VHF Channel 16 at least 1 hour before Estimated Time of Arrival and on final departure of the Pentland Firth.

Coastguard / MCA records represent a subset of the AIS records; therefore studies of commercial vessel movements are likely to be more representative if they are based on AIS data. These records are useful for validation of vessel movements and also for more specific cargo information.

Reports were obtained from the MCA to validate the AIS data of vessels transiting the Pentland Firth, corresponding to the time periods of the AIS surveys.

One day per week was selected (8 days in total) and vessels were matched by name. It was confirmed that the AIS survey included all the vessels logged by the Coastguard. Additionally, it was found that the AIS surveys had logged extra vessels as shown in Figure 7.22.

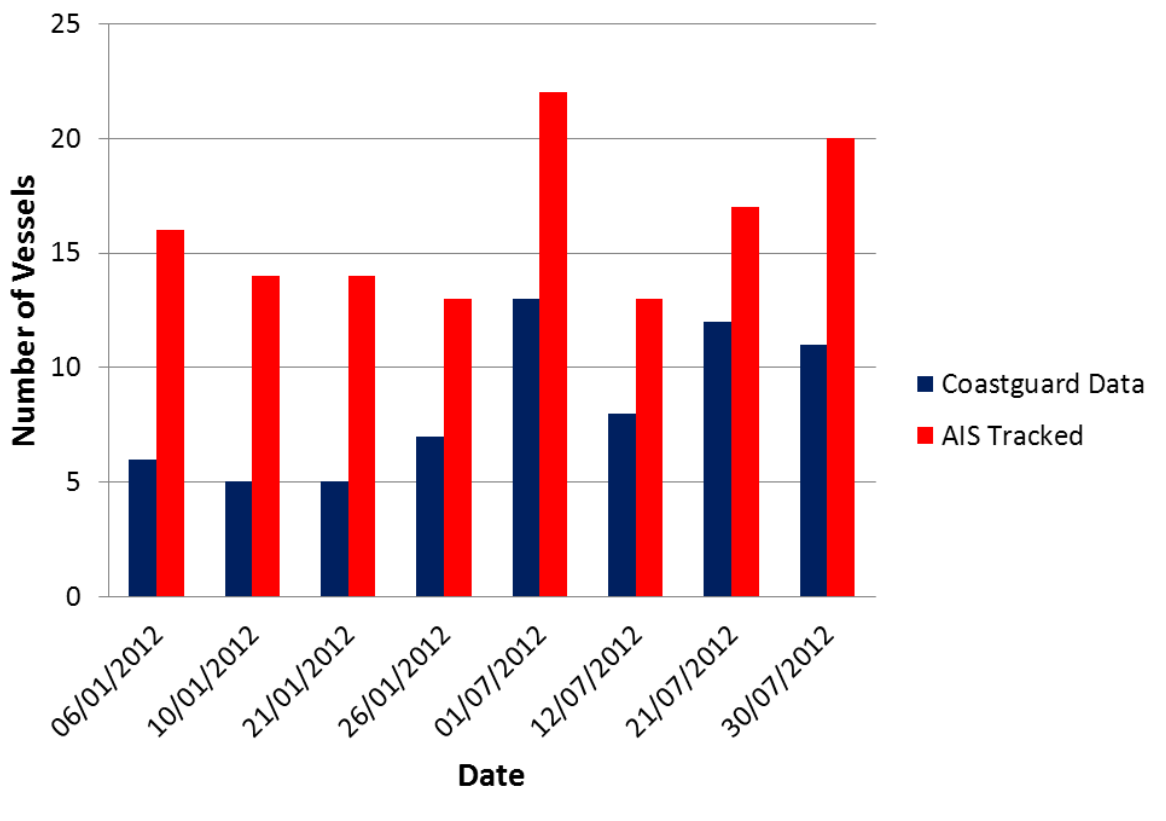


Figure 7.22 Comparison of AIS and Coastguard Vessels for Selected Dates

Most of the additional vessels are not covered by the Pentland Firth Reporting System, such as fishing and leisure vessels.

There were a small proportion of commercial ships which did not report to the Coastguard, presumably because they were not laden or decided not to take part in the voluntary scheme.

The MCA data provided more specific information on vessel cargoes which is not contained within the AIS data. A summary of the cargo information for the vessels transiting the Pentland Firth reporting to the Coastguard comparison of vessel numbers is Figure 7.23.

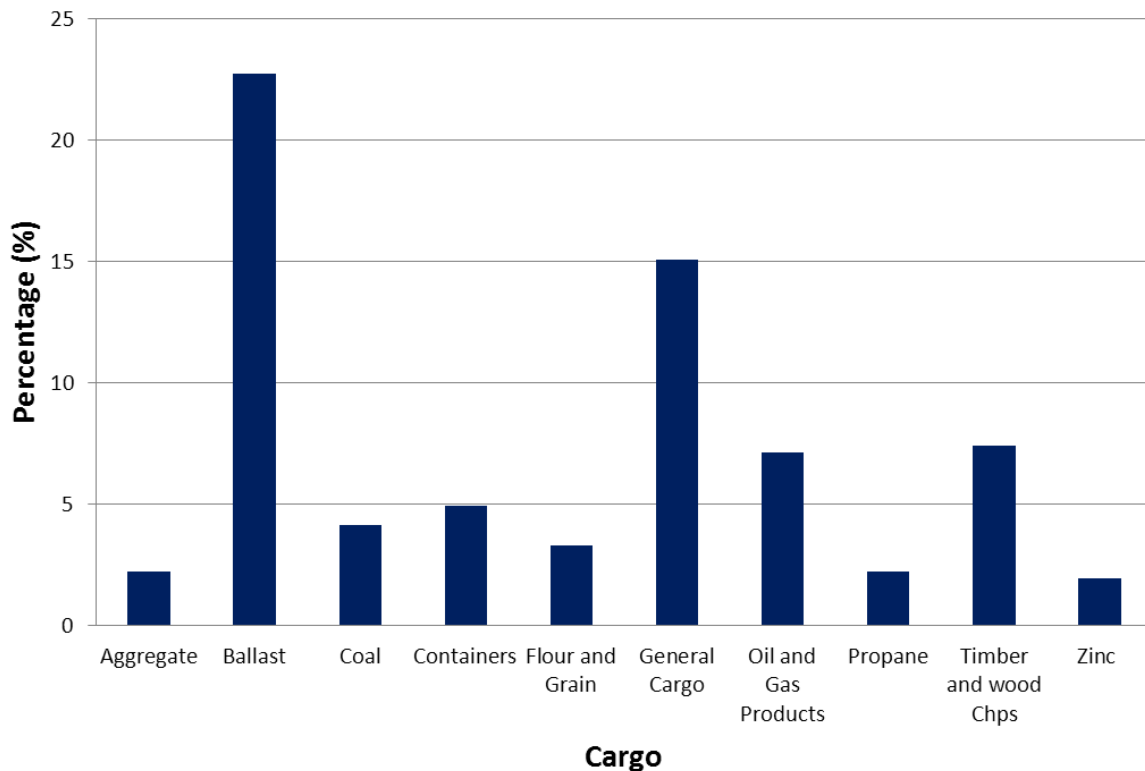


Figure 7.23 Cargoes of Vessels reporting to Coastguard heading via Pentland Firth

It can be seen that the majority of vessels were laden, carrying a mixture of cargoes, but a minority of vessels in ballast reported to the Coastguard (approximately 22%).

7.14 Ship Density Analysis

Figure 7.24 and Figure 7.25 present seasonal plots of the ship density in the PFOW Strategic Area. This is based on a grid of cells 1nm x1nm covering the Strategic Area. The number of AIS tracks crossing each cell has been counted and the grid thematically mapped from lowest density to highest density, where each track corresponds to one vessel movement, based on the relative traffic density levels.

Figure 7.26 presents the change in ship density from winter to summer. The red areas show where there was a significant increase in traffic during summer (at least 20% more tracks) while the blue areas show where winter was busier (20%+). It can be seen that overall, summer was busier than winter which reflects increased passenger vessel movements as well as offshore, other, etc.

Following this, Figure 7.27 to Figure 7.32 present more detailed plots of the seasonal ship density in selected key areas in the PFOW Strategic Area. This is based on a grid of cells of 0.5nm x 0.5nm.

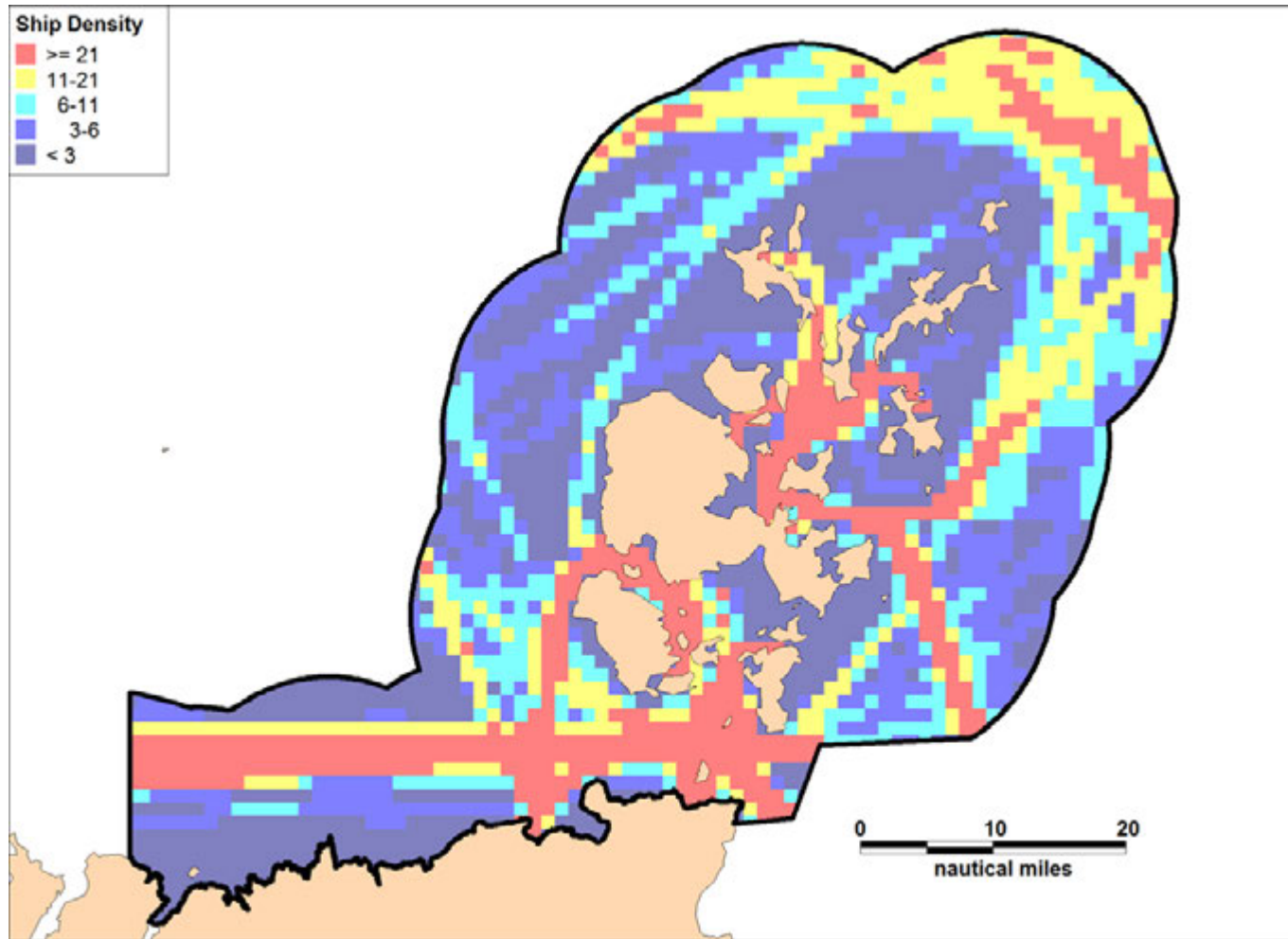


Figure 7.24 Winter 2012 AIS Track Analysis by Overall Ship Density

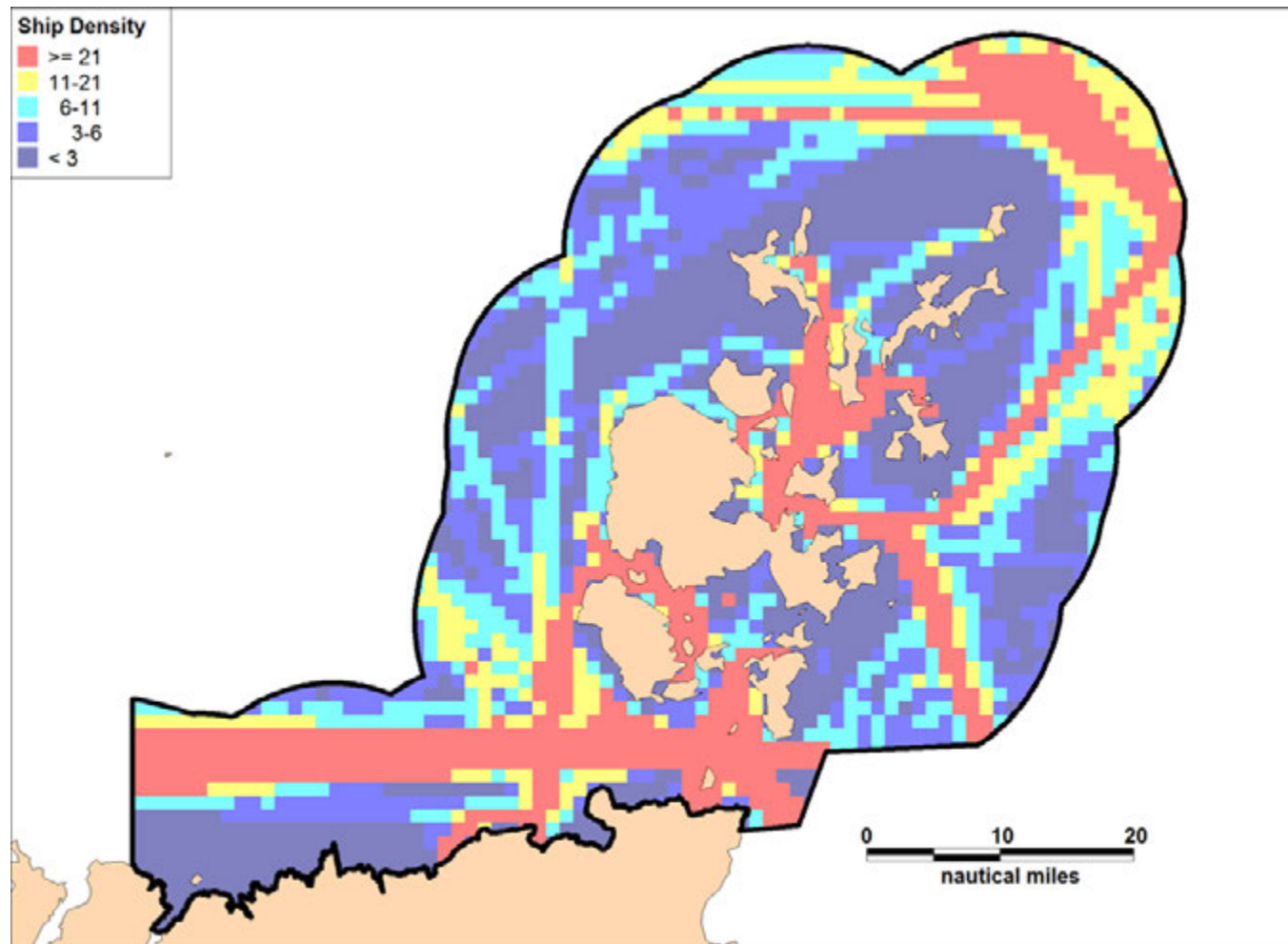


Figure 7.25 Summer 2012 AIS Track Analysis by Overall Ship Density

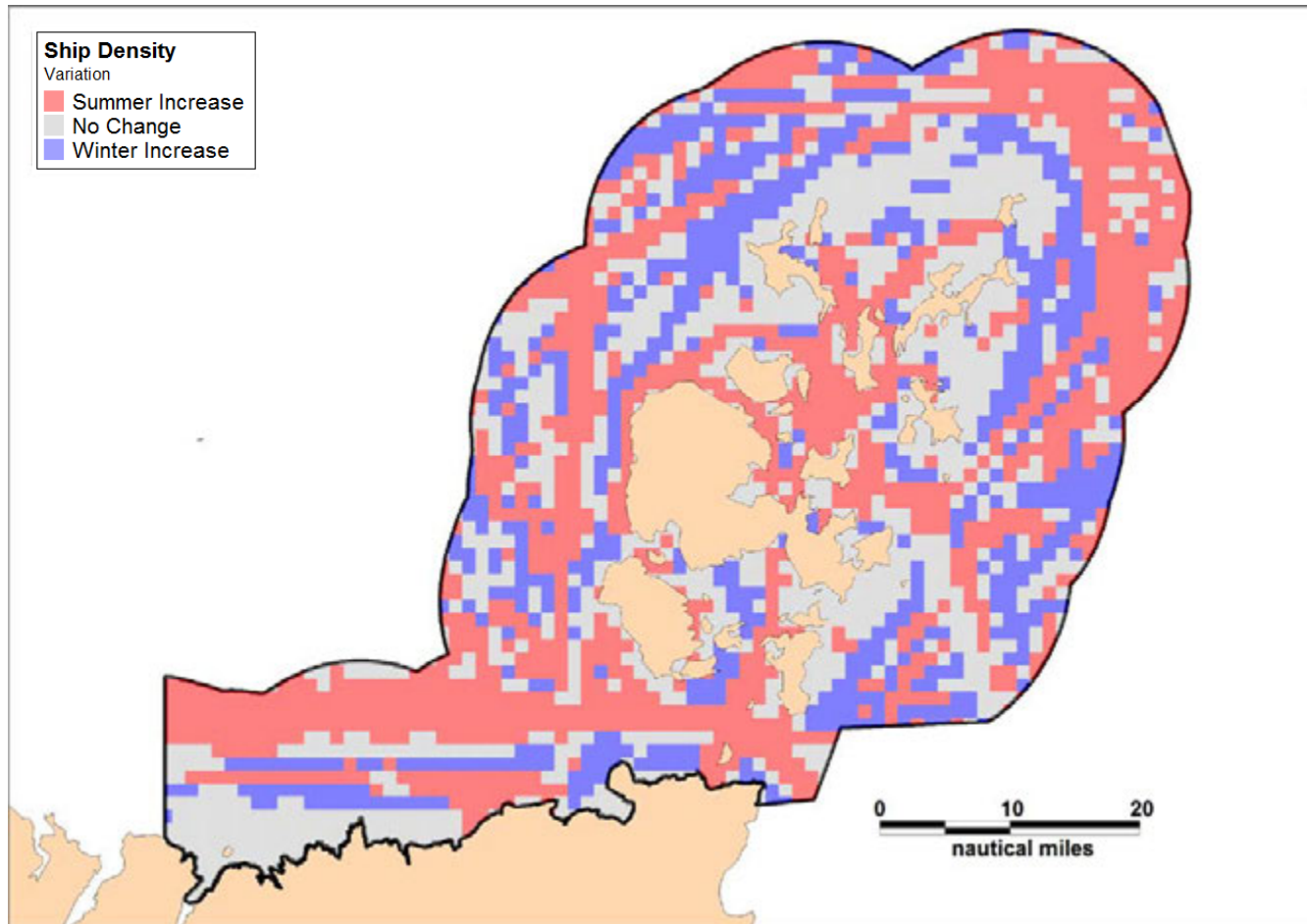


Figure 7.26 2012 AIS Track Analysis by Change in Overall Ship Density

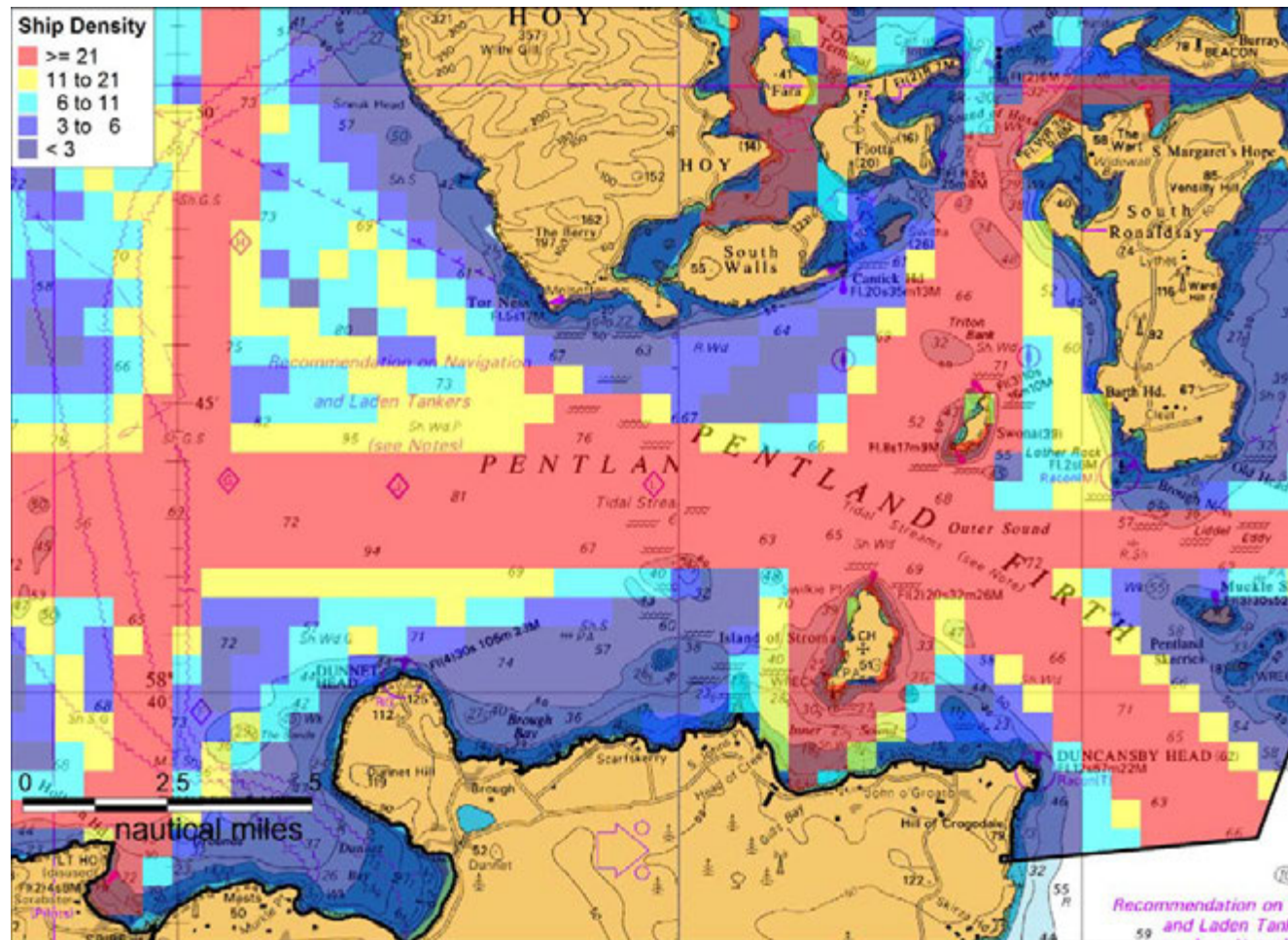


Figure 7.27 Pentland Firth Winter 2012 AIS Track Analysis by Overall Ship Density

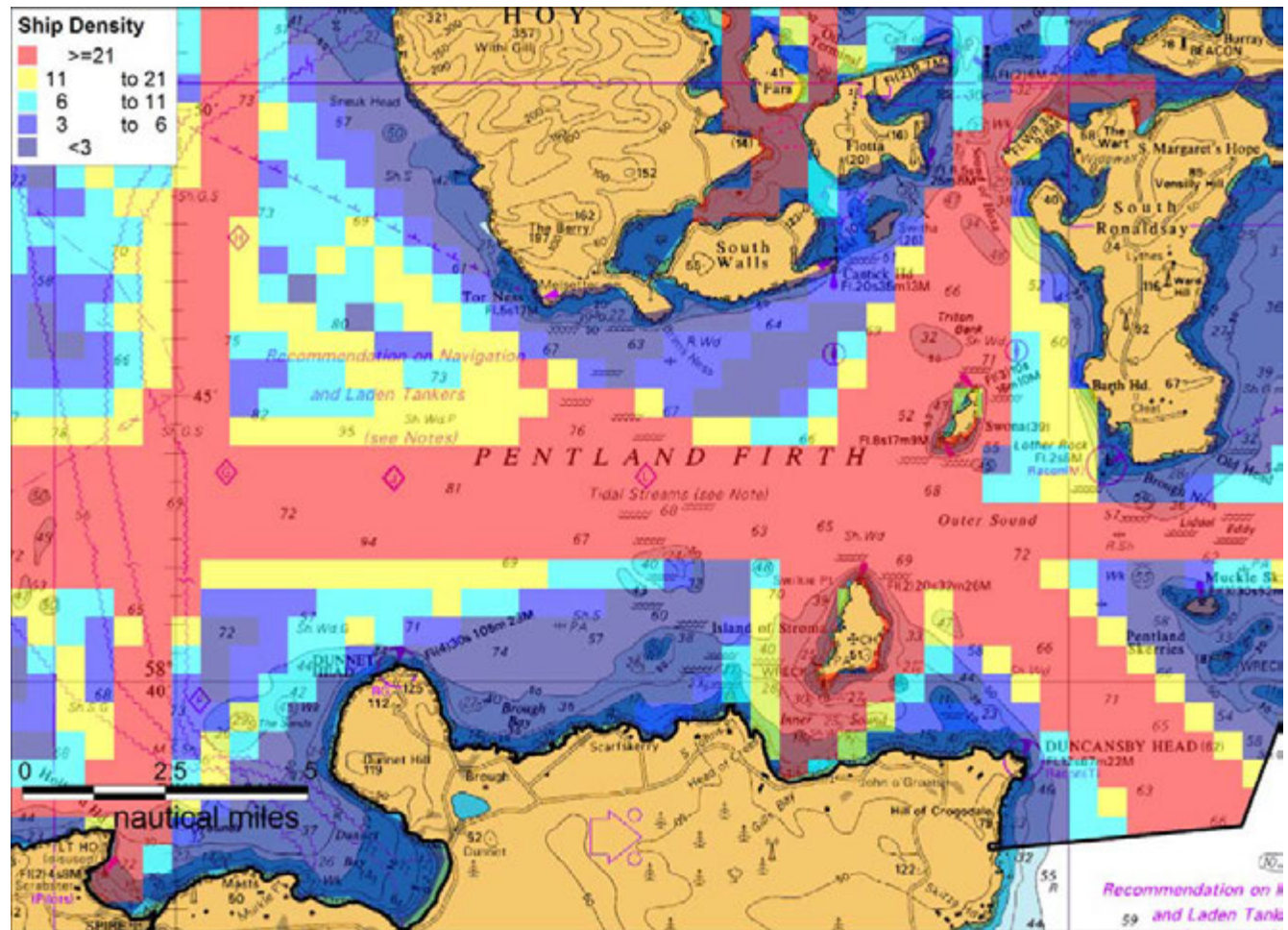


Figure 7.28 Pentland Firth Summer 2012 AIS Track Analysis by Overall Ship Density

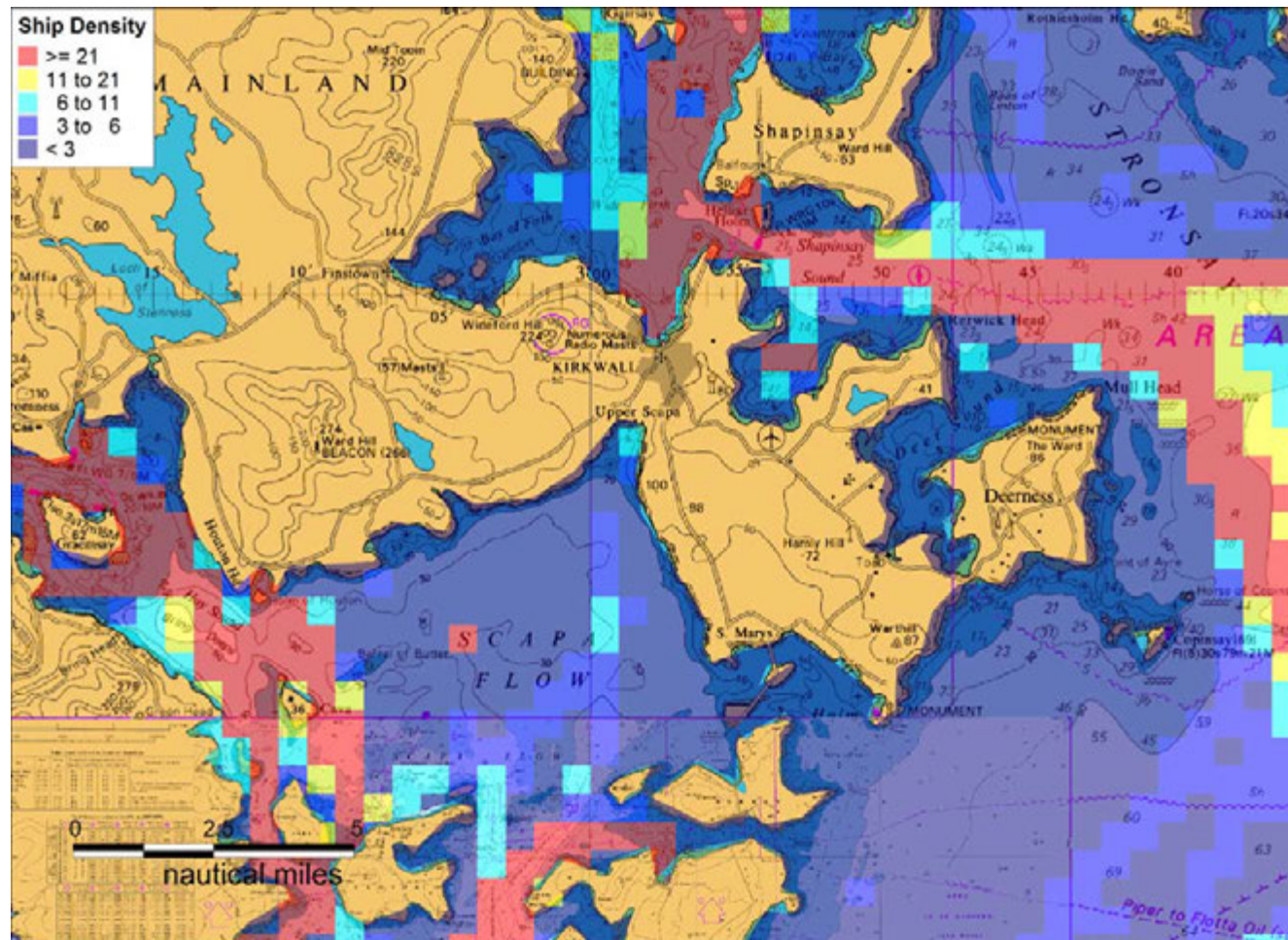


Figure 7.29 Kirkwall Winter 2012 AIS Track Analysis by Overall Ship Density

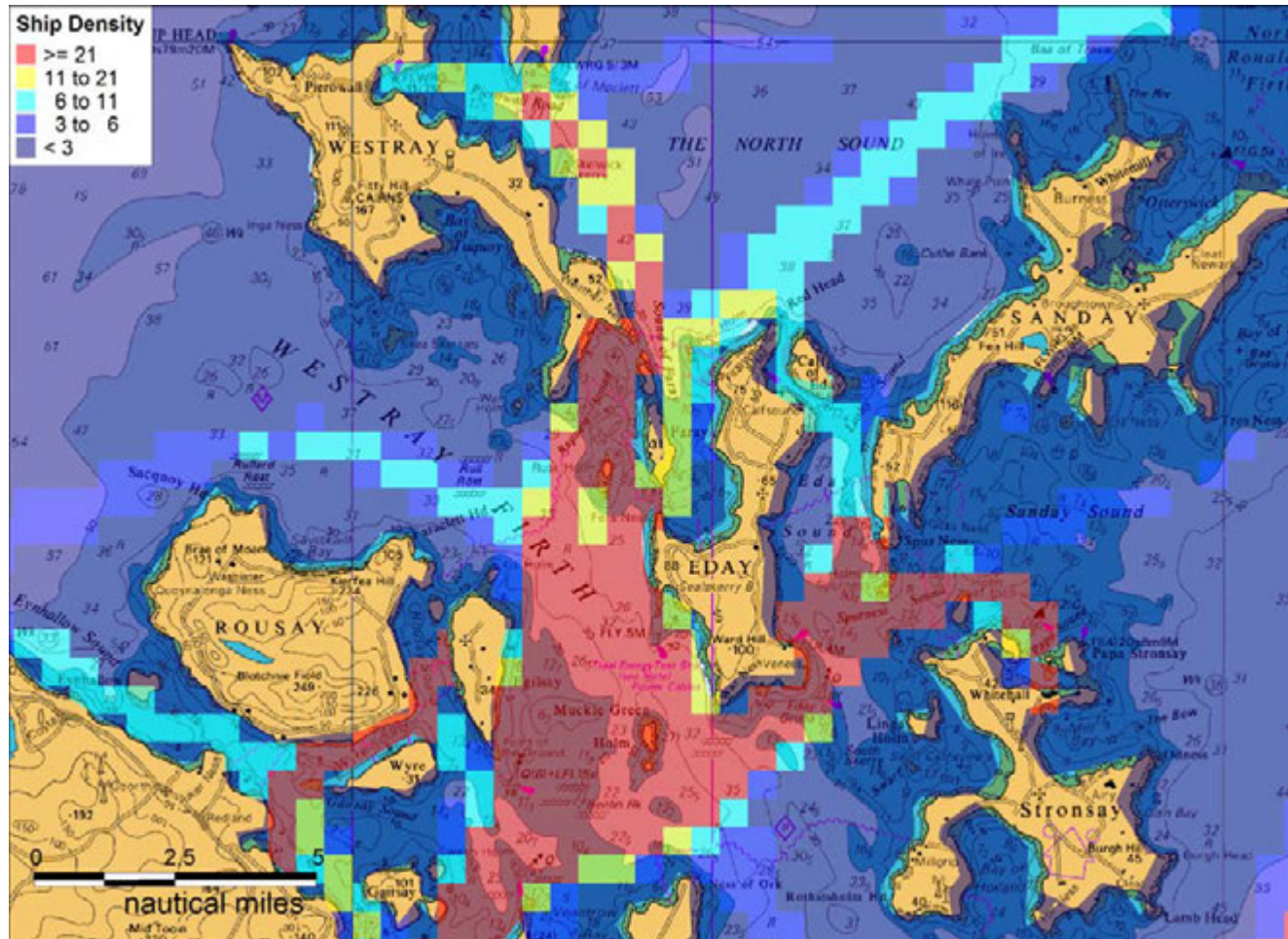


Figure 7.31 Outer Orkney Islands Winter 2012 AIS Track Analysis by Overall Ship Density

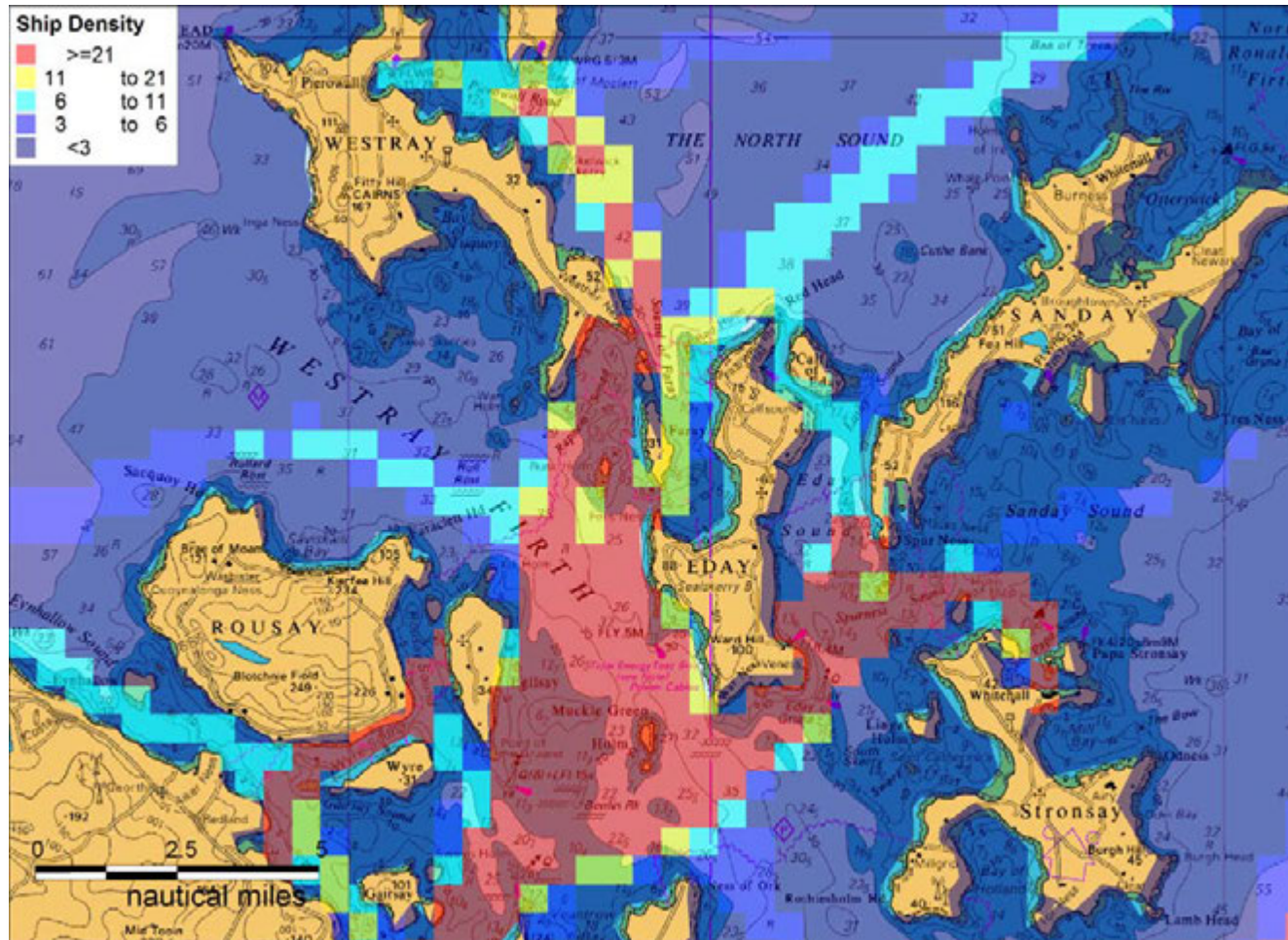


Figure 7.32 Outer Orkney Summer 2012 AIS Track Analysis by Overall Ship Density

Areas of high ship density throughout both summer and winter include routes to and from the main harbours of Kirkwall and Stromness. The east/west transit of the Pentland Firth is also a high density route and could be considered as a key corridor throughout the PFOW Strategic Area. Other key routes and areas of high density include numerous routes throughout the Outer Orkney Islands and routes transiting northwards to Shetland. Areas of relatively low density shipping include west of Mainland Orkney and directly north of the Outer Orkney Islands.

Generally the key routes identified do not change between summer and winter. The trend is for a general increase in shipping density along these key routes in summer compared to winter. This could be due to the increase in passenger and recreational vessels throughout the summer months compared to winter (Section 7.4). However, subtle variations are present between summer and winter and can be seen in Figure 7.26:

- The northeast/southwest route from Brough Head¹ is only in use throughout the winter months.
- The route bearing north from Hoy Mouth is only in use throughout summer.
- The transit of Eynhallow Sound is only in use throughout summer.
- The northeast / southwest route from Stronsay Firth has a higher level of use throughout summer compared to winter.
- The southeast / northwest transit located at the very north of the PFOW Strategic Area has a higher level of use throughout summer compared to winter.

¹ West coast of Orkney Mainland

8. RECREATIONAL VESSEL ACTIVITY ANALYSIS

8.1 Introduction

After the taking stock exercise and analysis of the questionnaire responses, the following further actions were taken to finalise the characterisation of recreational vessel activity:

- AIS track analysis
- Further analysis of marina data
- Detailed review / critique of RYA Coastal Atlas routes
- Local workshops (Orkney and Caithness)
- Further consultation with experts
- Definition of 90% lanes

Details of these tasks and the final outcomes are presented in the following subsections.

8.2 AIS Data and Marina Comparison

As discussed in Section 7.2, carriage of AIS is not mandatory on recreational vessels. However, a growing proportion of recreational vessels carry AIS voluntarily. One reason for this is that it increases their visibility to other shipping.

The 28 days summer 2012 data contained a relatively high number of recreational vessel tracks, whereas the winter data had much fewer tracks. This reflects the seasonal variations identified in the questionnaire feedback (see Section 6).

To enhance the usefulness of the AIS survey data for recreational vessels, additional data for summer 2012 and summer 2011 were accessed. Overall, this provided approximately 5 months of AIS data, four months of which was during summer (May to August).

By cross-checking marina visitor data for summer 2011 with AIS data for the same period, it was estimated what proportion of recreational vessels were broadcasting on AIS. The results are illustrated in Figure 8.1.

Overall, 17% of recreational vessels visiting the local marinas were on AIS. This is likely to be an upper limit as local vessels based on anchorages, may not appear in the marina lists and are considered less likely to carry AIS. This is partly compensated by the fact that a proportion of the recreational vessels included in the AIS track analysis were tall ships which are too large to call at the marinas.

The percentage of vessels calling at marinas and carrying AIS is presented by length category in Figure 8.2 (excluding Scrabster which does not record vessel length). This indicates that smaller recreational vessels (below 10m) are less likely to carry AIS whilst larger vessels (10m+) are more likely to carry AIS.

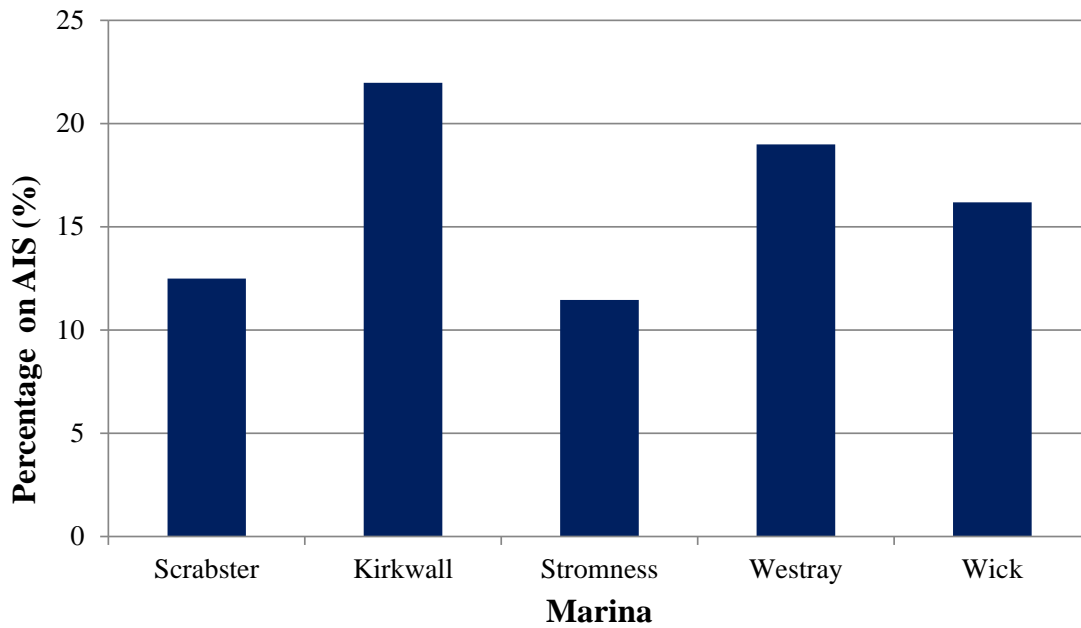


Figure 8.1 Percentage of Recreational Vessel Visitors Broadcasting on AIS

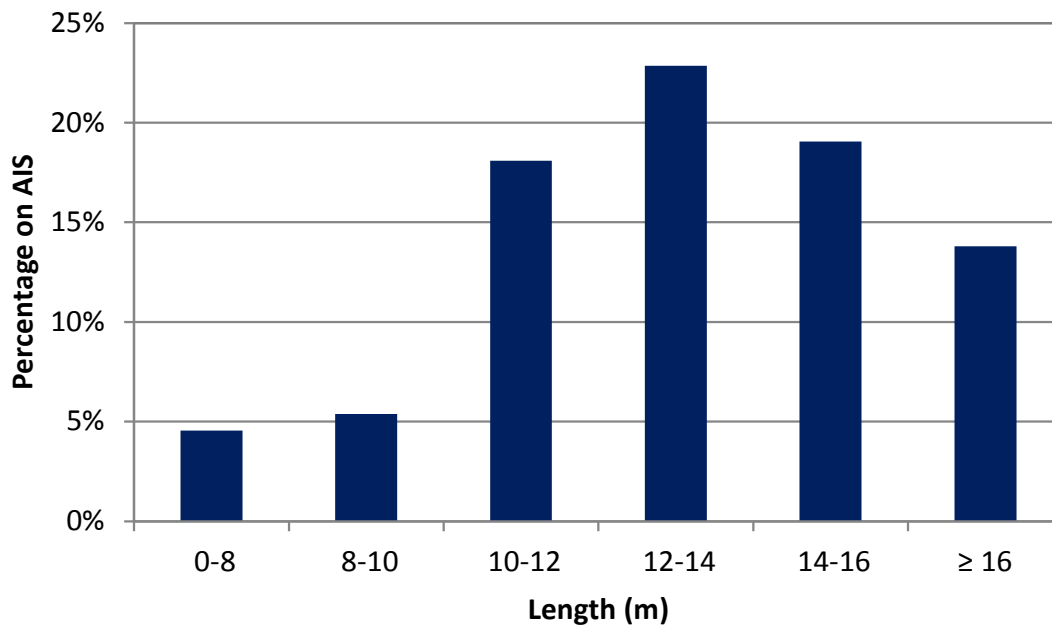


Figure 8.2 Percentage of Vessels Broadcasting on AIS by Length Category

8.3 AIS Activity Analysis and Comparison with RYA Coastal Atlas

This section presents analysis of the extended AIS survey data for recreational vessels. When reviewing the plots, the limitations identified above, i.e., that AIS only cover about one in six recreational vessels, and this is weighted towards larger vessels, should be kept in mind.

Figure 8.3 presents a combined plot of all the recreational vessel tracks colour-coded by length. A density plot of the recreational vessels is presented in Figure 8.4.

Following this, Figure 8.5 to Figure 8.10 present more detailed charts of the AIS tracks overlaid with the RYA Coastal Atlas indicative cruising routes in different parts of the Strategic Area.

From visual inspection of the figures, it is clear that the vast majority of the PFOW area is used by recreational users. Key routes are present to and from all major marinas and ports in the area as well as commonly used bays and anchorages. Other minor routes that are used frequently by recreational users are also illustrated. However, the overriding theme throughout all the figures is the highly variable nature of routes taken by recreational users throughout the PFOW area.

A number of discrepancies are noticeable between the RYA suggested routes and the AIS data. These are discussed further in Section 8.5.4.

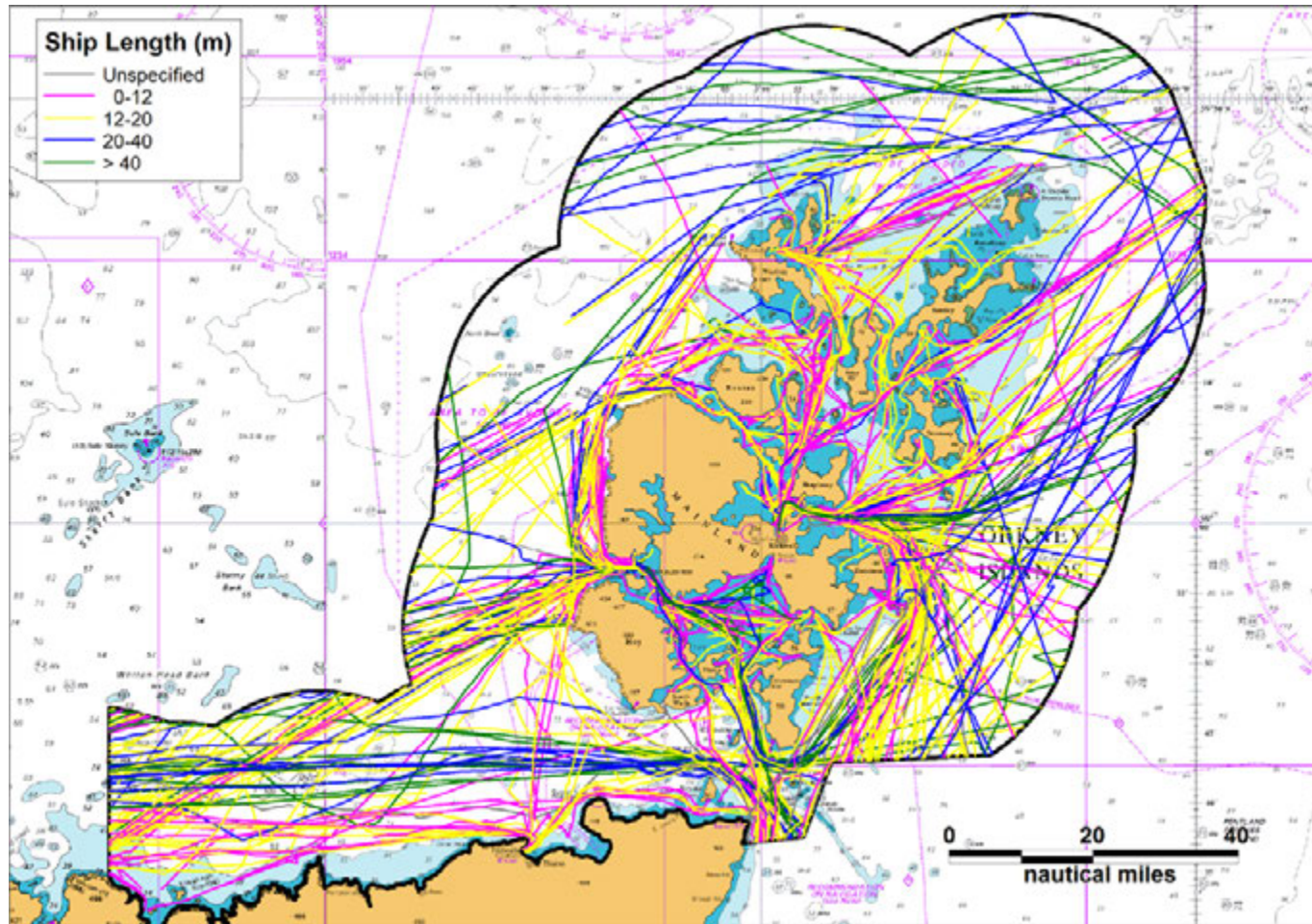


Figure 8.3 Overview of Recreational Vessel Tracks by Length (based on AIS data)

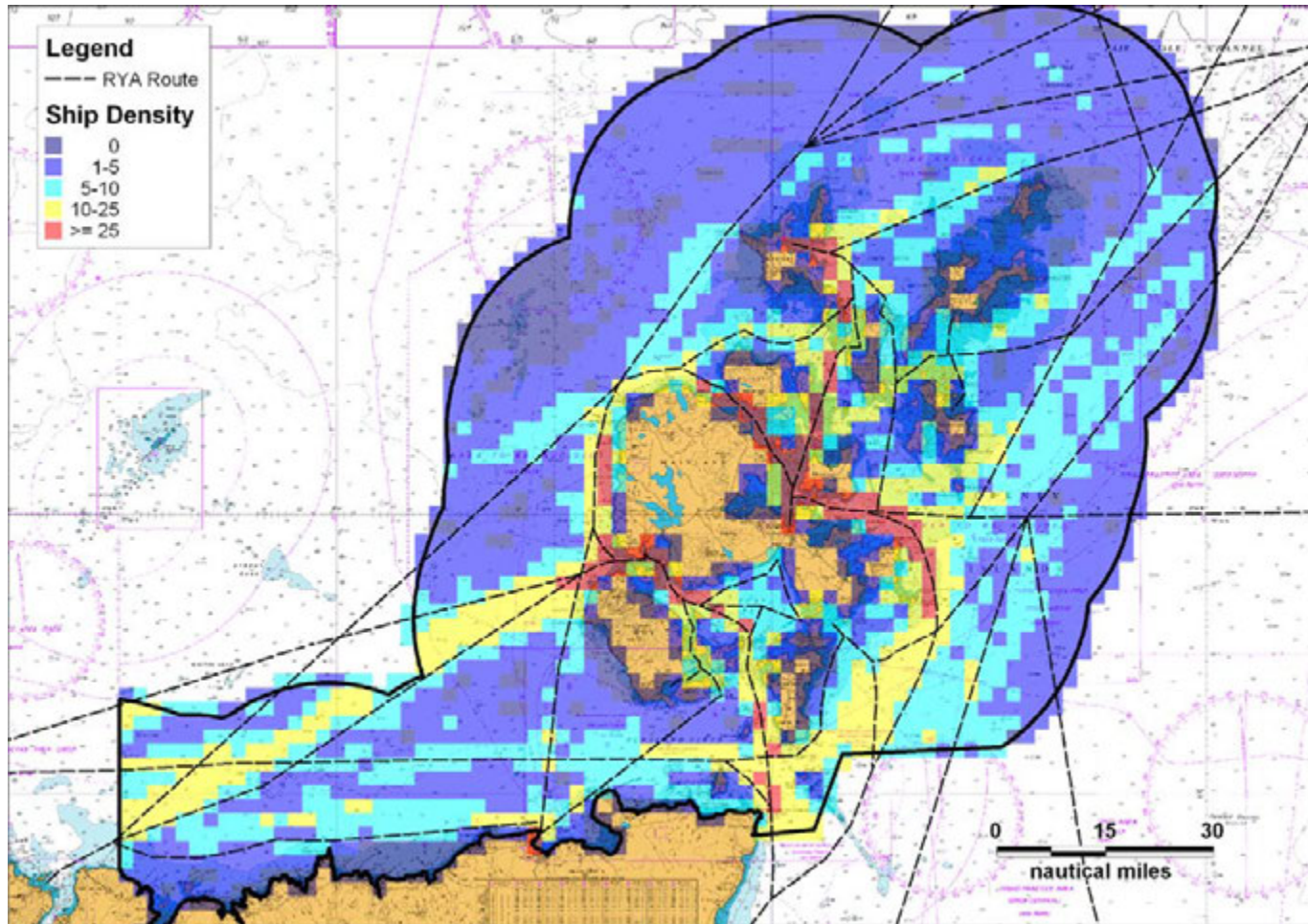


Figure 8.4 Recreational Vessel Density Plot (based on AIS data)

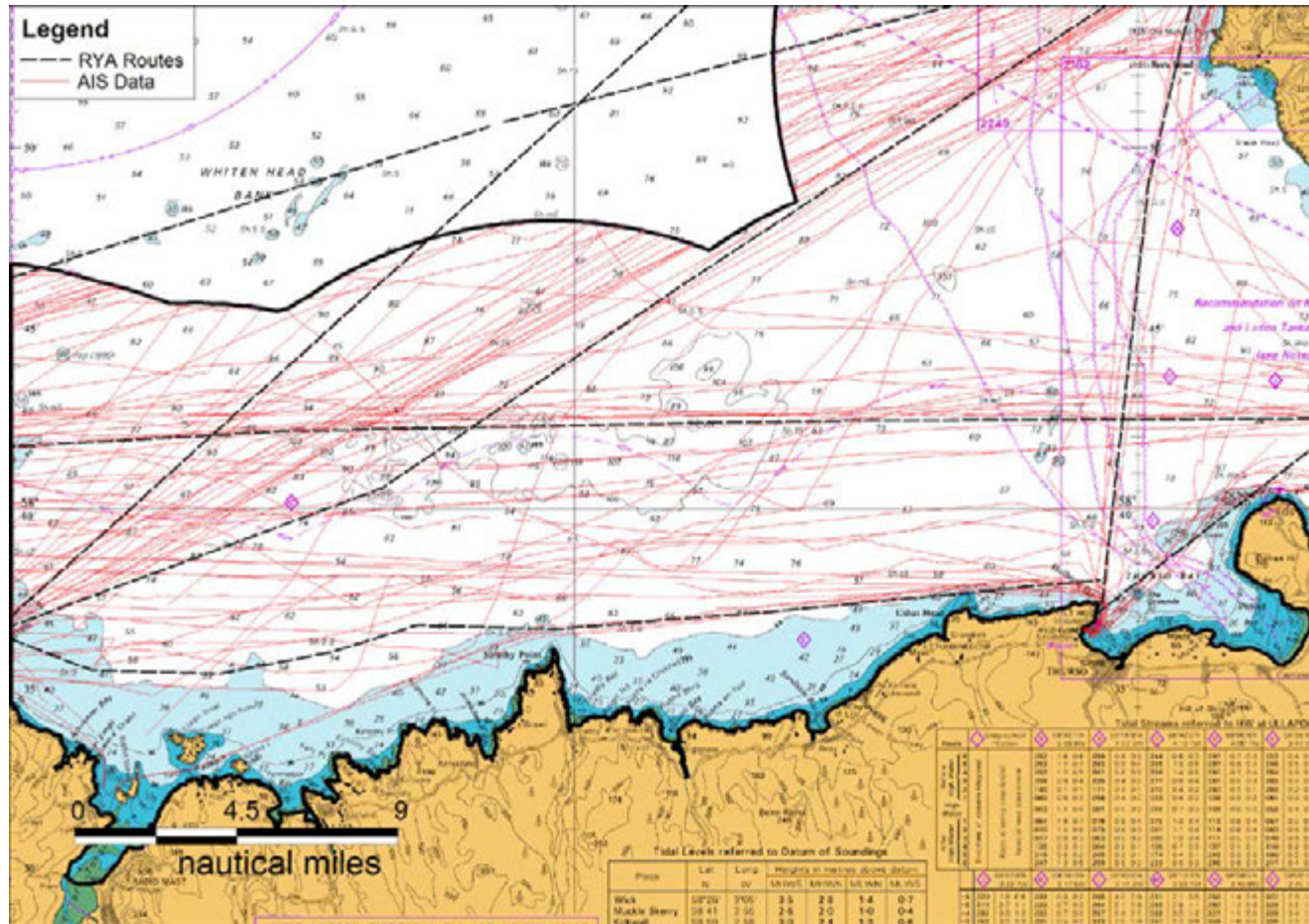


Figure 8.5 Recreational Vessel Tracks versus RYA – Northwest Scotland

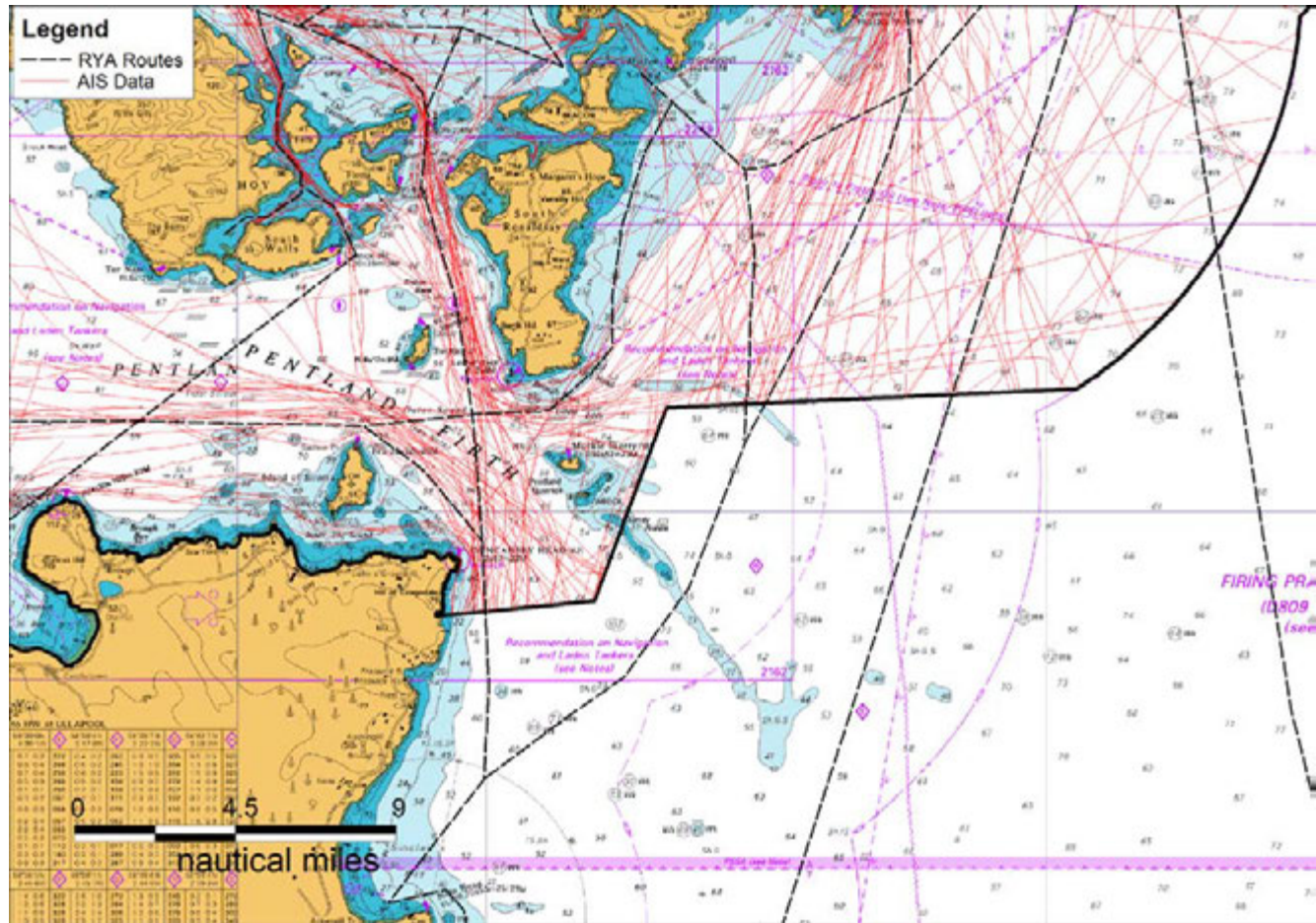


Figure 8.6 Recreational Vessel Tracks versus RYA – Pentland Firth

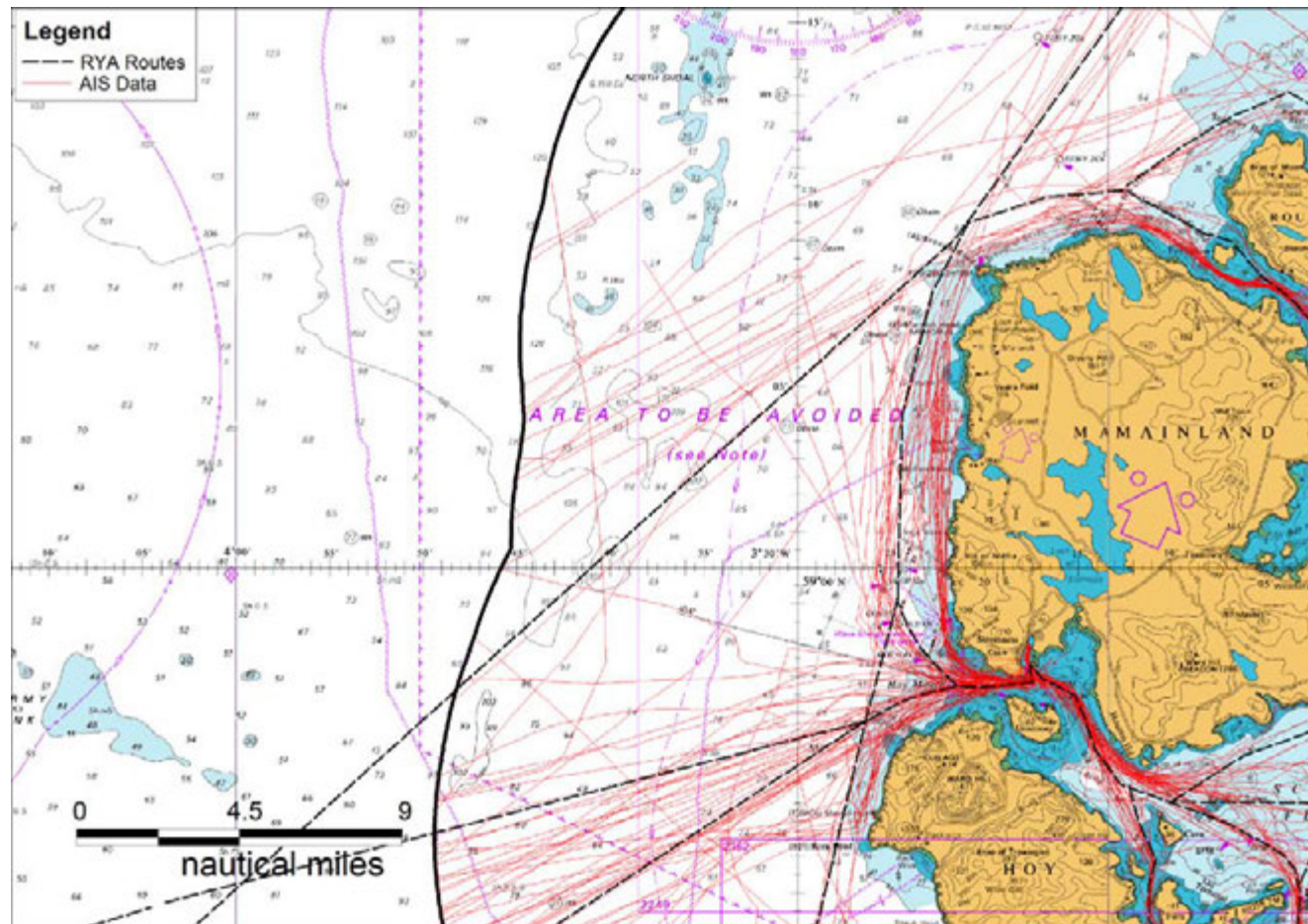


Figure 8.7 Recreational Vessel Tracks versus RYA – Hoy and West Coast of Mainland

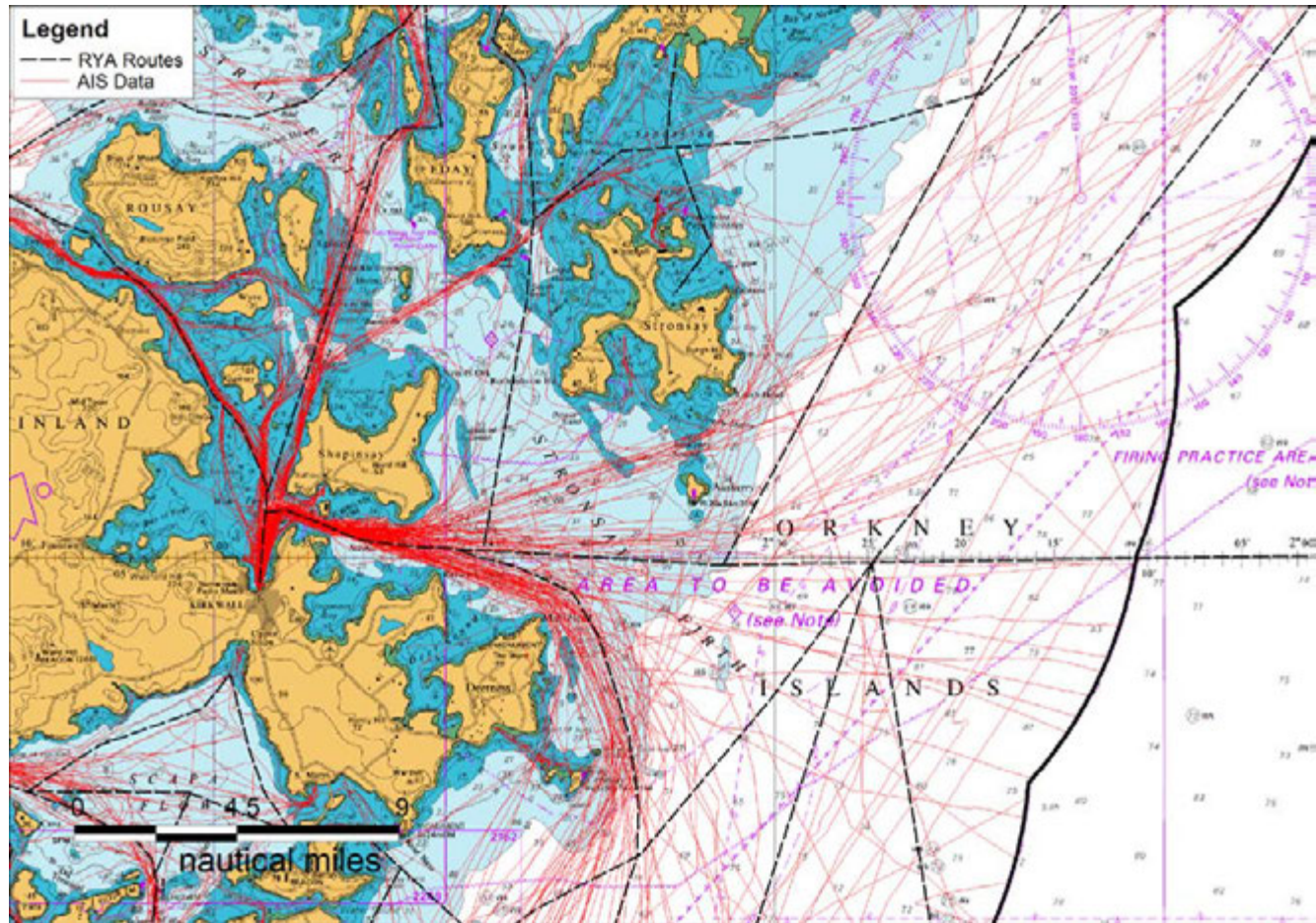


Figure 8.8 Recreational Vessel Tracks versus RYA – Kirkwall

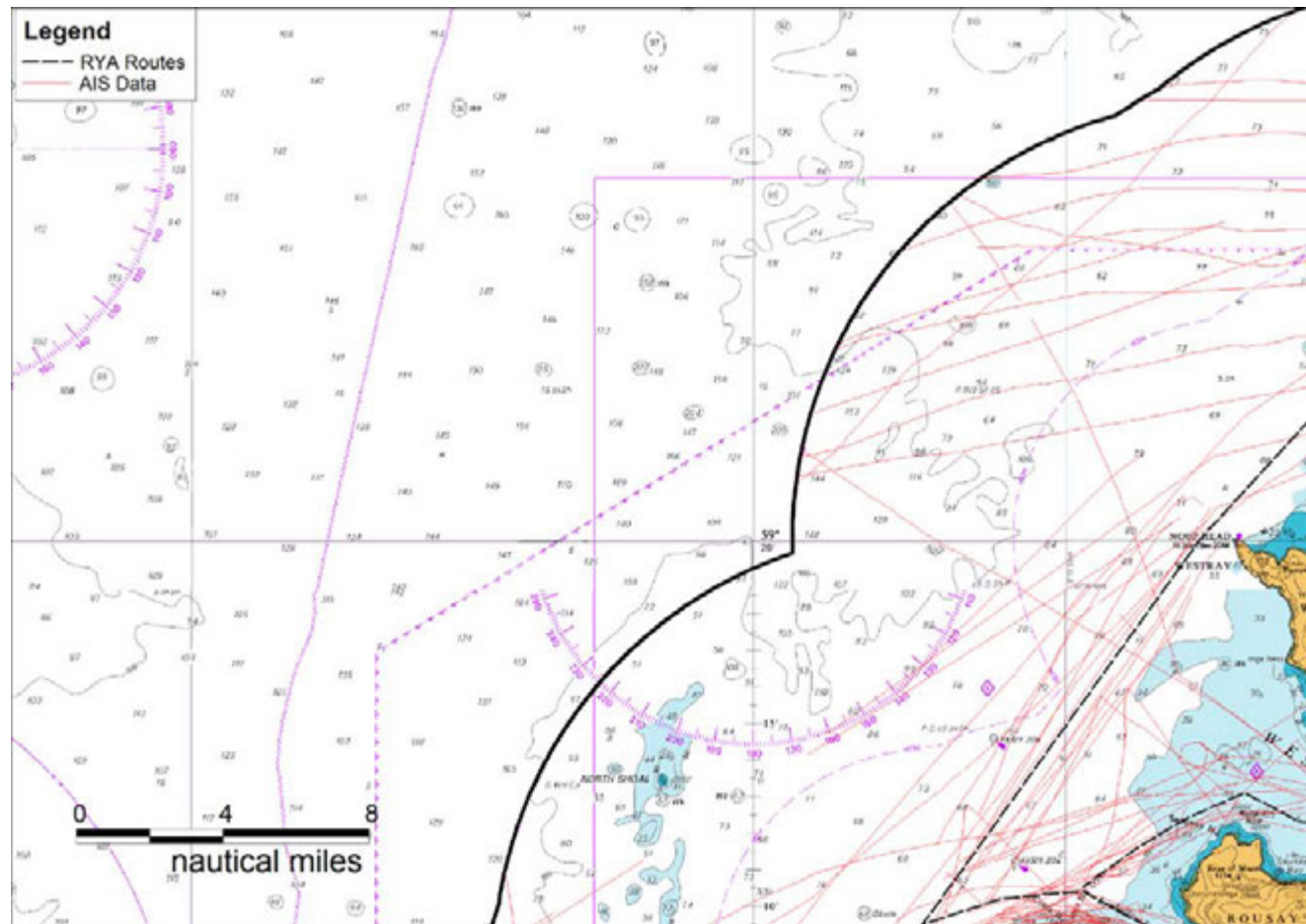


Figure 8.9 Recreational Vessel Tracks versus RYA – Northwest Orkney

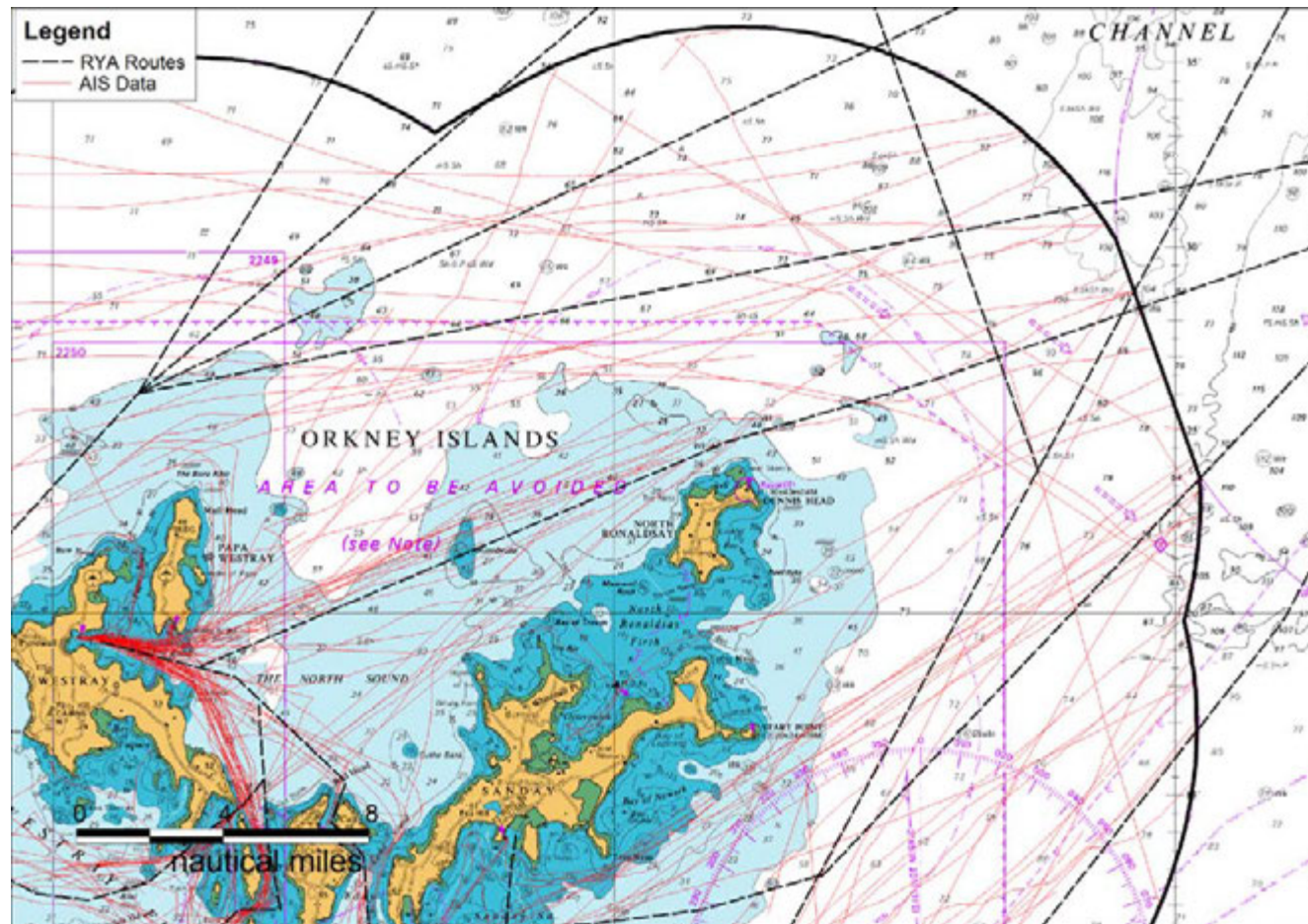


Figure 8.10 Recreational Vessel Tracks versus RYA – Orkney Islands

8.4 Local Workshops

Workshops were held at the OIC Marine Services Harbour Authority Building in Scapa, Orkney on 3rd July and at Scrabster Harbour on 4th July 2012 to discuss recreational vessel routeing with local stakeholders.

Marine Scotland, RYA Scotland and Anatec attended both meetings. Invitations were sent to all the respondents to the questionnaire. Attendance numbers on the day were low, but those who attended each meeting were able to provide a great deal of local knowledge and experience covering the entire PFOW Strategic Area.

At each meeting, the literature review, marina data and questionnaire responses were presented to provide background information. Following this, the AIS tracks were presented overlaid with the RYA Coastal Atlas tracks and nautical charts. This was carried out in a GIS to allow zooming in on specific areas of interest during the discussion. The limitations of AIS were discussed, i.e., minority of vessels with a tendency towards larger vessels, therefore, a key focus of the meetings was to obtain local feedback on routes favoured by smaller vessels.

Where the AIS data differed from the RYA track, the local experts were asked which matched their experience or whether there were in fact alternative routes.

Specific changes required to the RYA Coastal Atlas identified at the meetings were as follows:

1. Inner Sound, south of Stroma, transiting east-west
2. Eynhallow, south of
3. Cantick Head to Duncansby Head crossing Pentland Firth
4. South Ronaldsay inside Lother Rock
5. West of Orkney mainland, inside Billia Croo test site
6. Copinsay Pass, inside Copinsay

A plot of these suggested amendments is presented in Figure 8.11. Most of these were verified by the AIS tracks, although in the case of (3) and (6), there were only a handful of AIS tracks. This suggests these routes may be more commonly used by smaller recreational craft with local knowledge, which are not fitted with AIS. (This may also be the case with other routes that are not evident from the AIS data.)

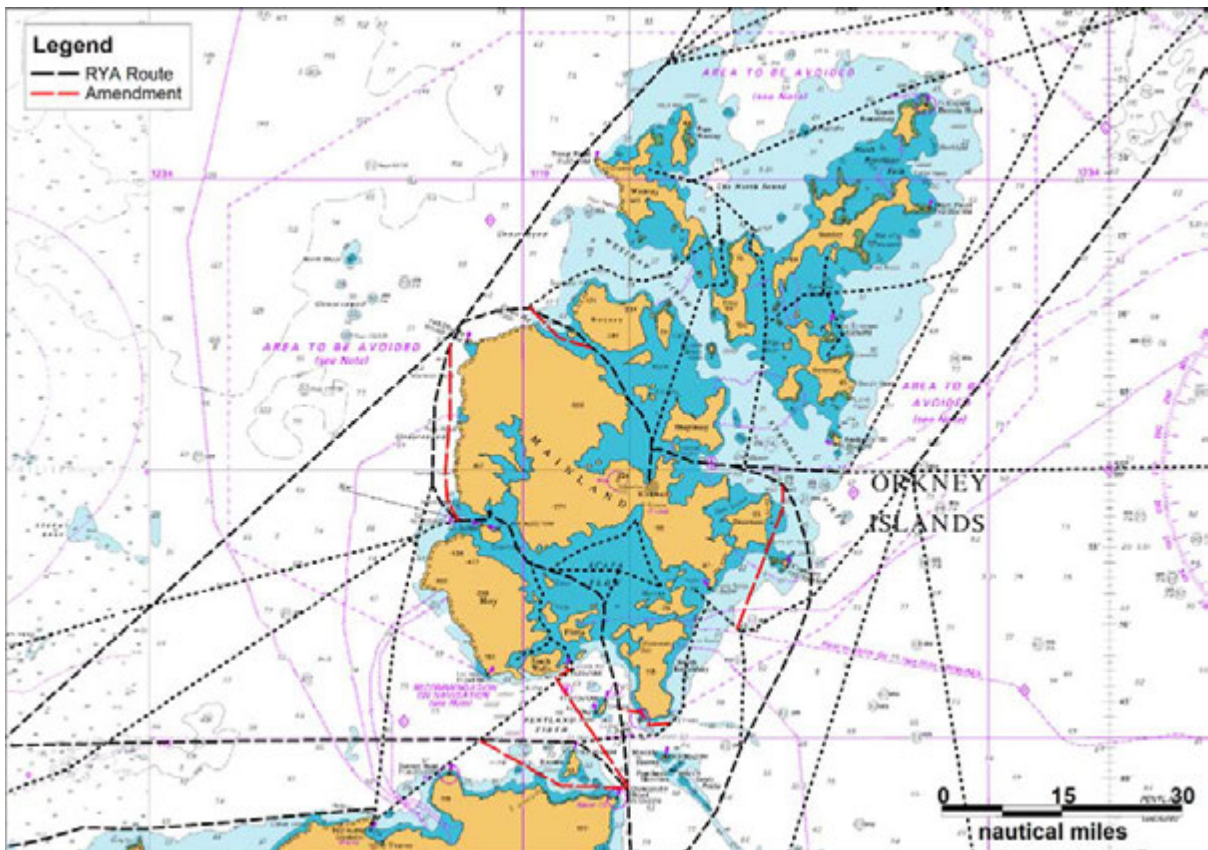


Figure 8.11 Amendments identified to RYA Coastal Atlas Routes

Generally, it was agreed that the AIS tracks provided helpful new information on where recreational vessels go. Unlike the RYA routes, they also demonstrate the diversity of vessel tracks chosen by masters, which vary due to weather, tide, time available, individual preference, etc.

8.5 Lane Analysis

8.5.1 Introduction

From the discussions and research, it was agreed that it would be useful to characterise recreational vessel routes as lanes rather than centre-lines, with the widths of the lanes based on analysis of the lateral distribution of the tracks using the route.

The lane analysis was based on the 90% lane width which has been adopted in many traffic analyses studies for offshore wind farms in the UK, following publication of the MCA Offshore Windfarm Shipping Route Template (Ref. xi). The 90% boundary is illustrated in Figure 8.12.

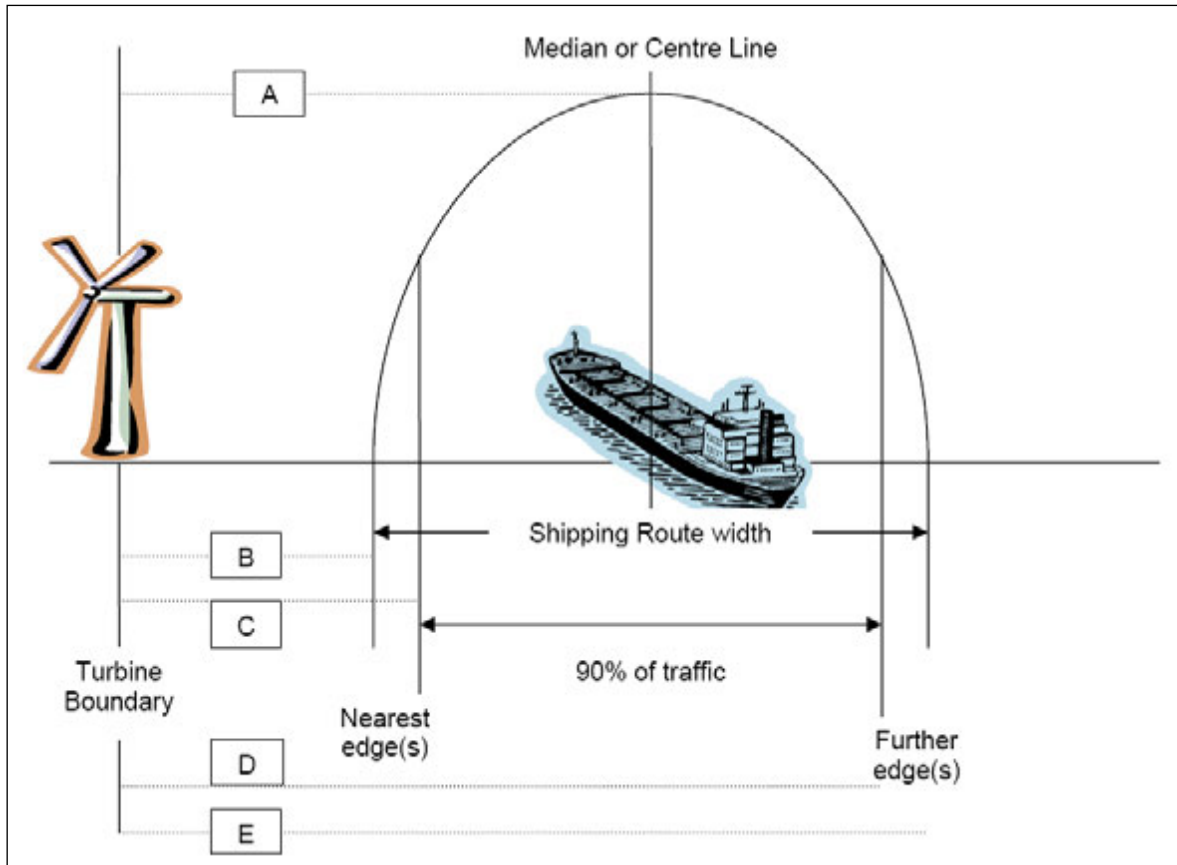


Figure 8.12 Potential Shipping Lane Boundaries, including 90% Width

- A – Turbine boundary to the shipping route median or centre line
- B – Turbine boundary to nearest shipping route edge
- C – Turbine boundary to nearest shipping 90% traffic level*
- D – Turbine boundary to further shipping 90% traffic level*
- E – Turbine boundary to further shipping route edge

(* - or another percentage to be determined)

8.5.2 Methodology

The recreational vessel tracks on identified routes were grouped and analysed to estimate the 90% lane widths, i.e., the width within which 90% of the traffic passes on that route.

Reference points along the route were defined by taking points approximately equidistant along the route and where the route was at its widest point, and the closest point of approach (CPA) of each track to the reference point was calculated. An example of the reference points used for the route between Kirkwall and Eynhallow Sound is presented in Figure 8.13.

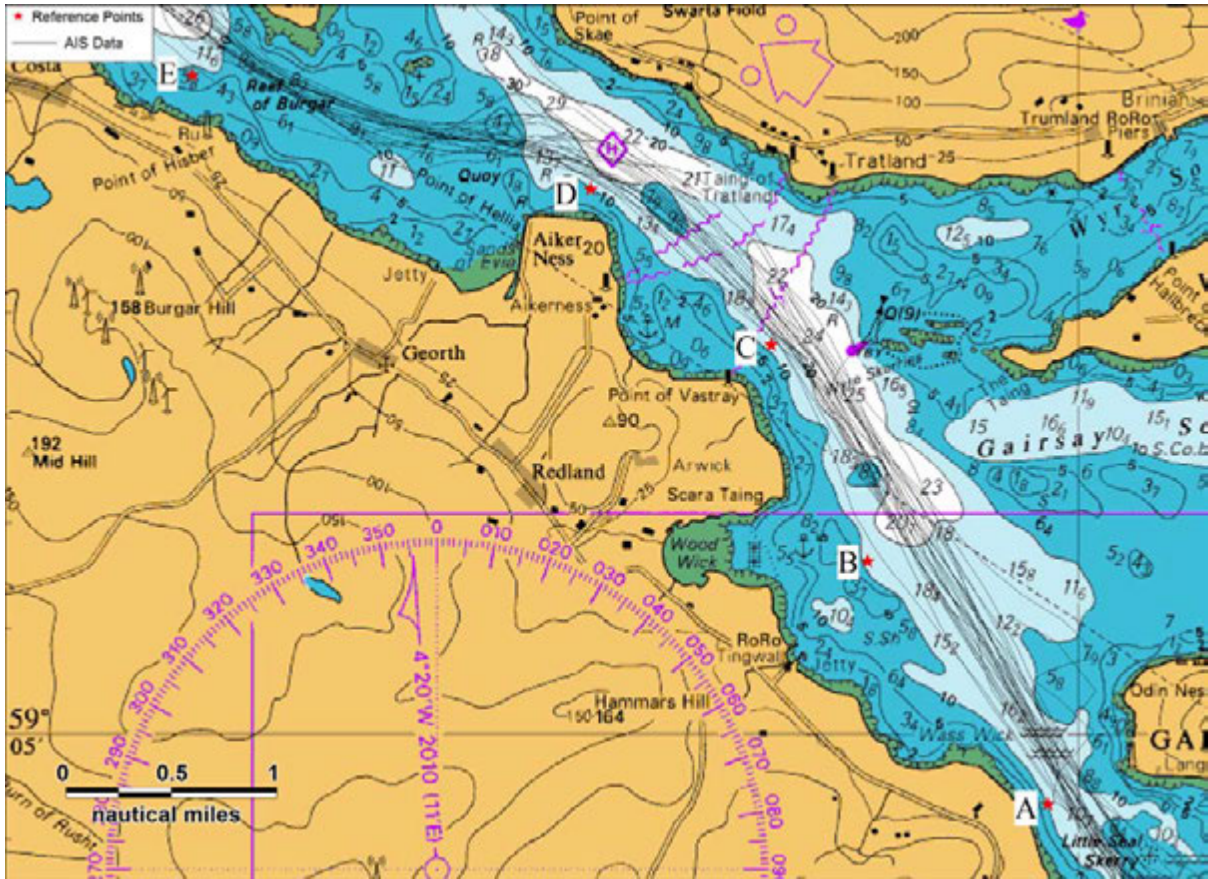


Figure 8.13 Reference Points adjacent to Tracks

The resultant CPA distributions for four of the reference locations (Points A-D) are presented below. It can be seen that for most of the points the traffic conforms reasonably closely to a bell-shaped (normal) distribution.

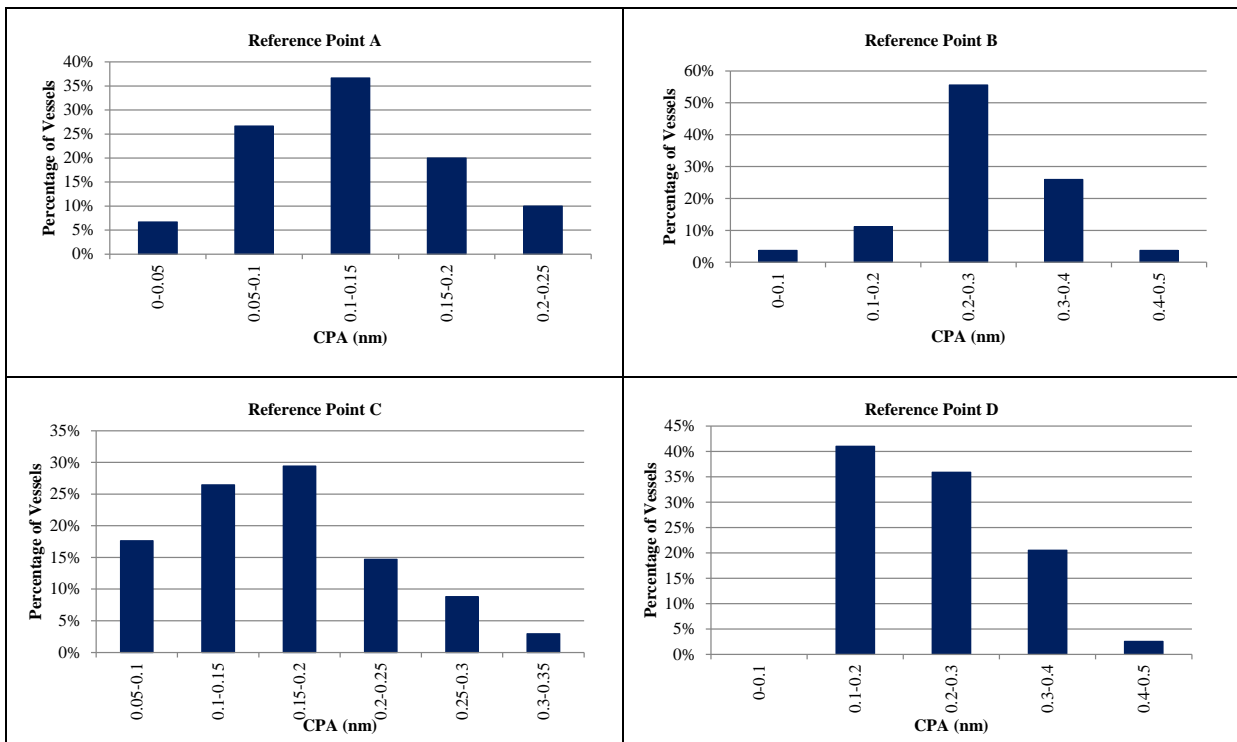


Figure 8.14 Track Closest Points of Approach (CPA) to selected Reference Points

The table below summarises the results of the lane width analysis for the route.

Table 8.1 Lane Analysis for Kirkwall-Eynhallow

Parameter	Reference Point				
	A	B	C	D	E
Min and Max CPA (mid-90%)	0.06–0.21	0.17–0.38	0.03–0.22	0.05–0.28	0.14–0.27
90% Width	0.14	0.21	0.19	0.24	0.13

Therefore, the width of the lane increases slightly from southeast to northwest before narrowing again for the passage south of Eynhallow Sound.

A plot of the 90% lane boundaries overlaid on the survey tracks using this route is presented in Figure 8.15.

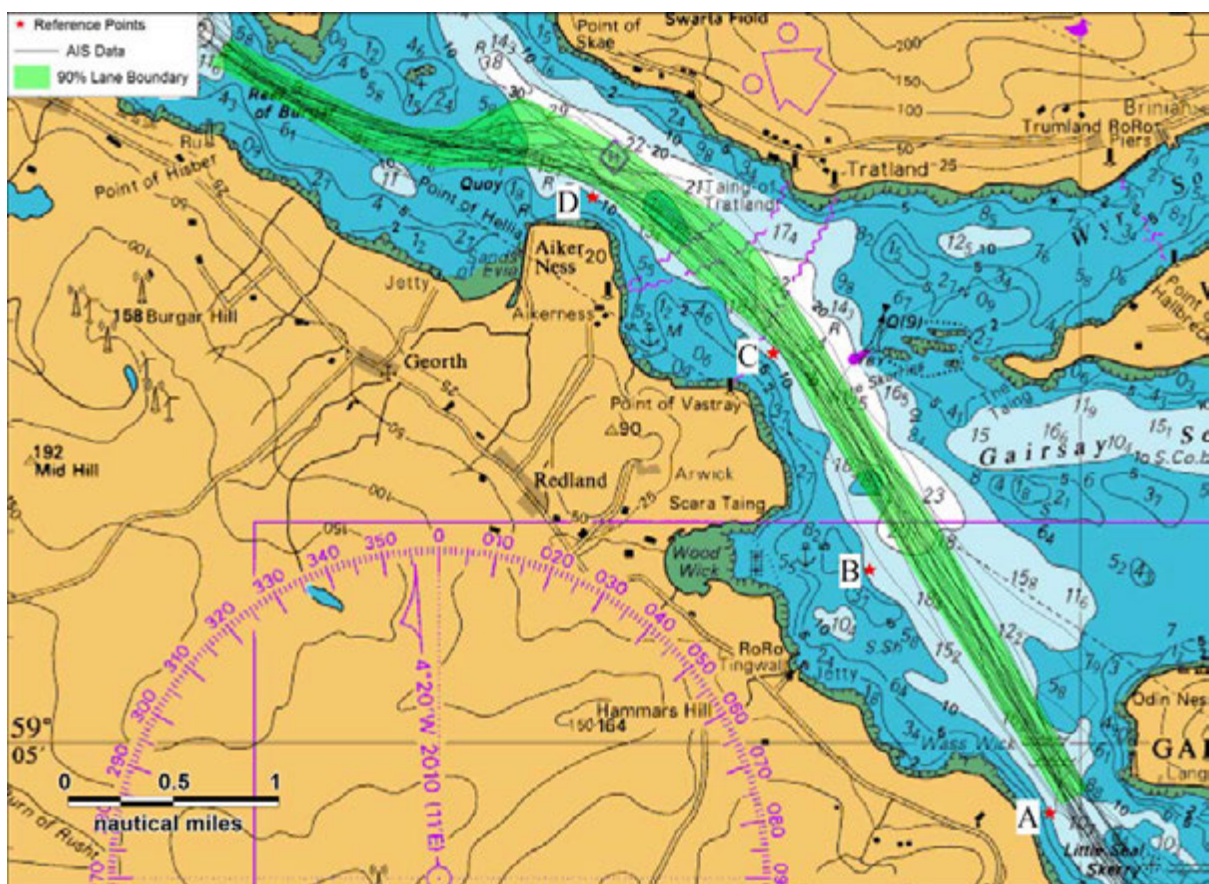


Figure 8.15 Kirkwall-Eynhallow Recreational 90% Lane Boundaries

A similar methodology was used to identify the lane boundaries encompassing 90% of the traffic for other key routes, including:

- Longhope to Stromness
- Loch Eriboll to Stromness

- Inner Sound of Pentland Firth
- Sound of Hoxa to Stromness
- Shapinsay Sound
- Hoy Mouth to Eynhallow Sound

Elsewhere, due to inconsistency in AIS tracking, it was necessary to use visual inspection of the AIS data to identify routes and estimate the lane boundaries, extrapolating in some cases.

8.5.3 Lane Boundaries

Figure 8.16 presents the estimated lane boundaries for recreational routes identified in the PFOW overlaid on the AIS tracks and the RYA routes (with amendments identified in Section 8.4).

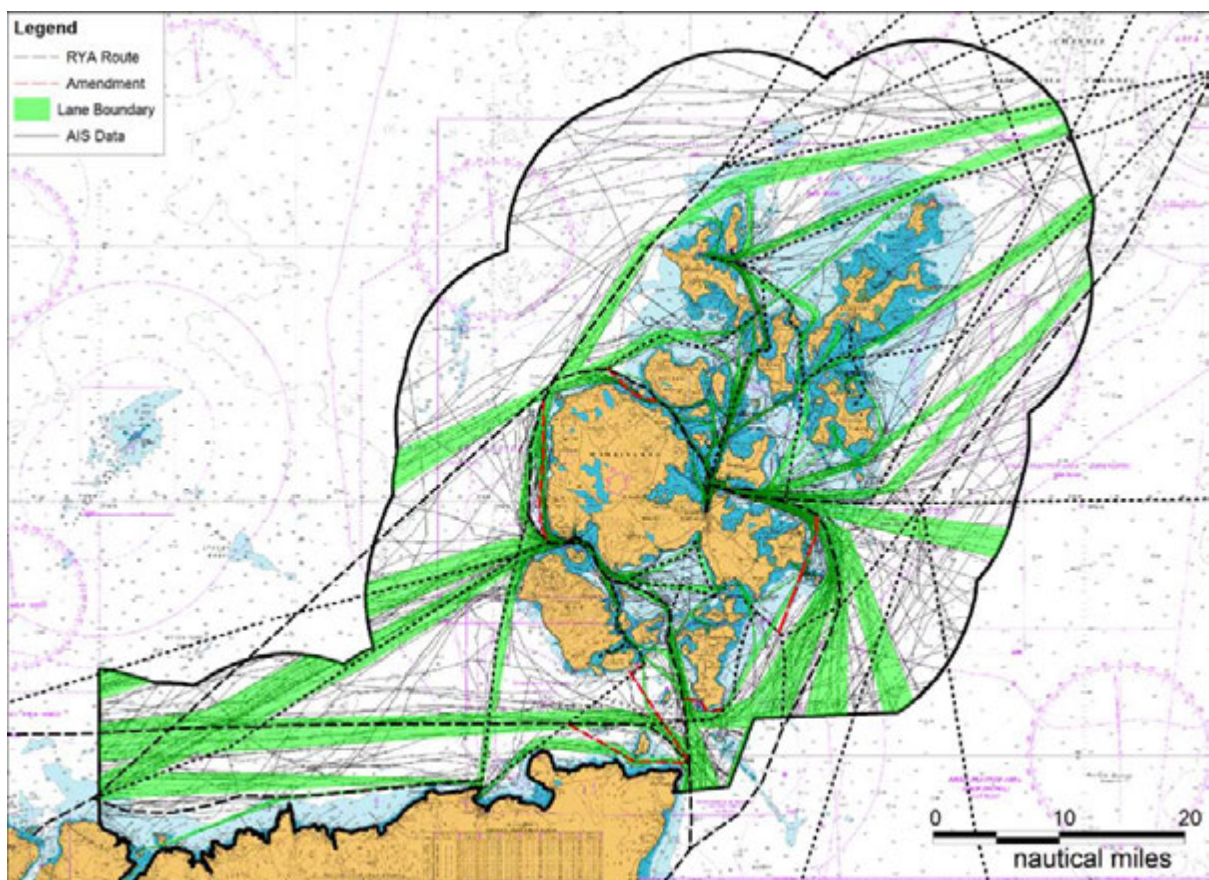


Figure 8.16 PFOW Recreational Lane Boundaries overlaid on AIS Tracks and RYA Routes (with Amendments)

It should be noted that the traffic using each lane varies. Recognising that the AIS data only represents a minority of vessels, it was not considered appropriate to assign weightings to the different lanes. In general, the busier areas tended to be in the approaches to Kirkwall and Stromness. The density map presented in Figure 8.4 gives an indication of the relative density of recreational traffic on AIS within the PFOW Strategic Area.

8.5.4 Lane Discussion and Comparison with RYA Coastal Atlas

More detailed charts of the lane boundaries are presented below (working from southwest to northeast), overlaid with the RYA Coastal Atlas routes and the AIS survey tracks for ease of comparison. Comments are given below each chart.

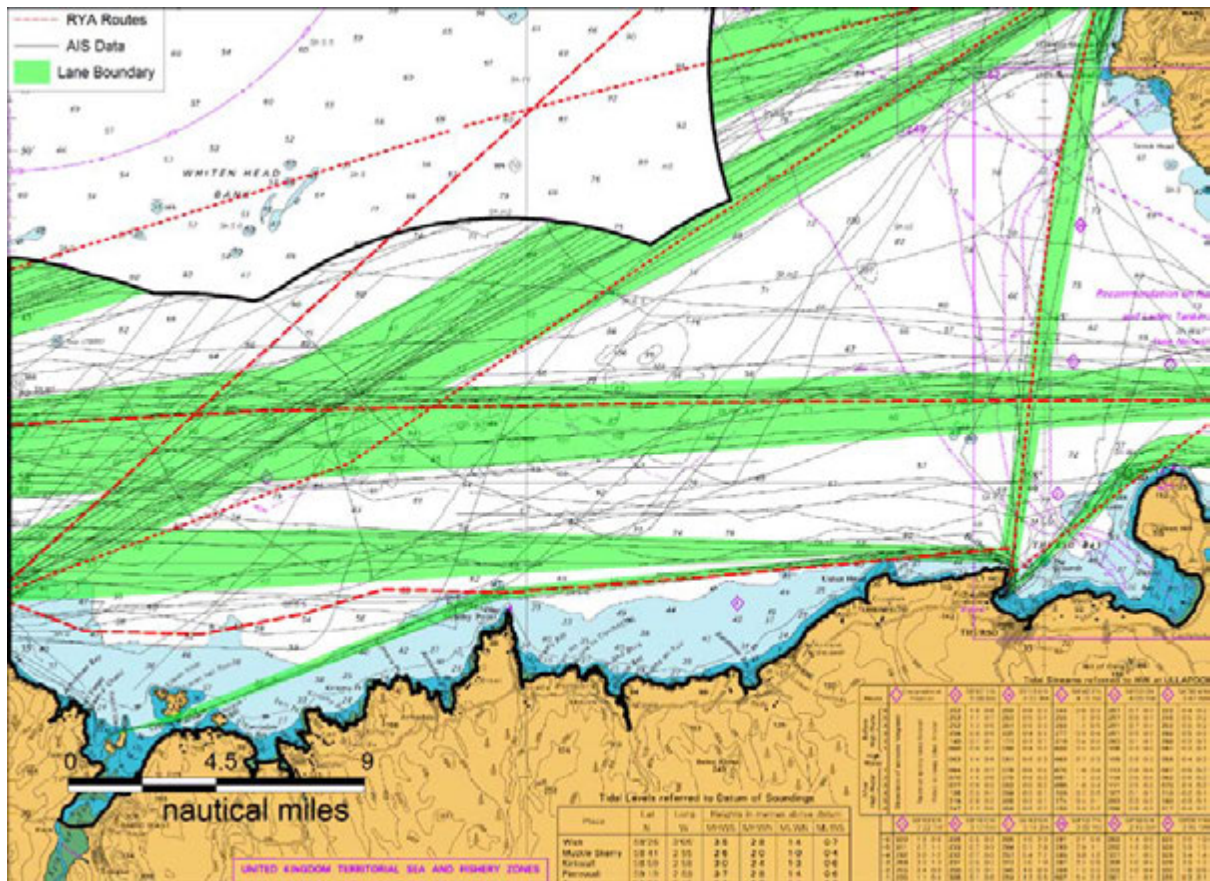


Figure 8.17 Northwest Scotland Recreational Routes and Lane Boundaries

There is generally good agreement between the difference sources in this area.

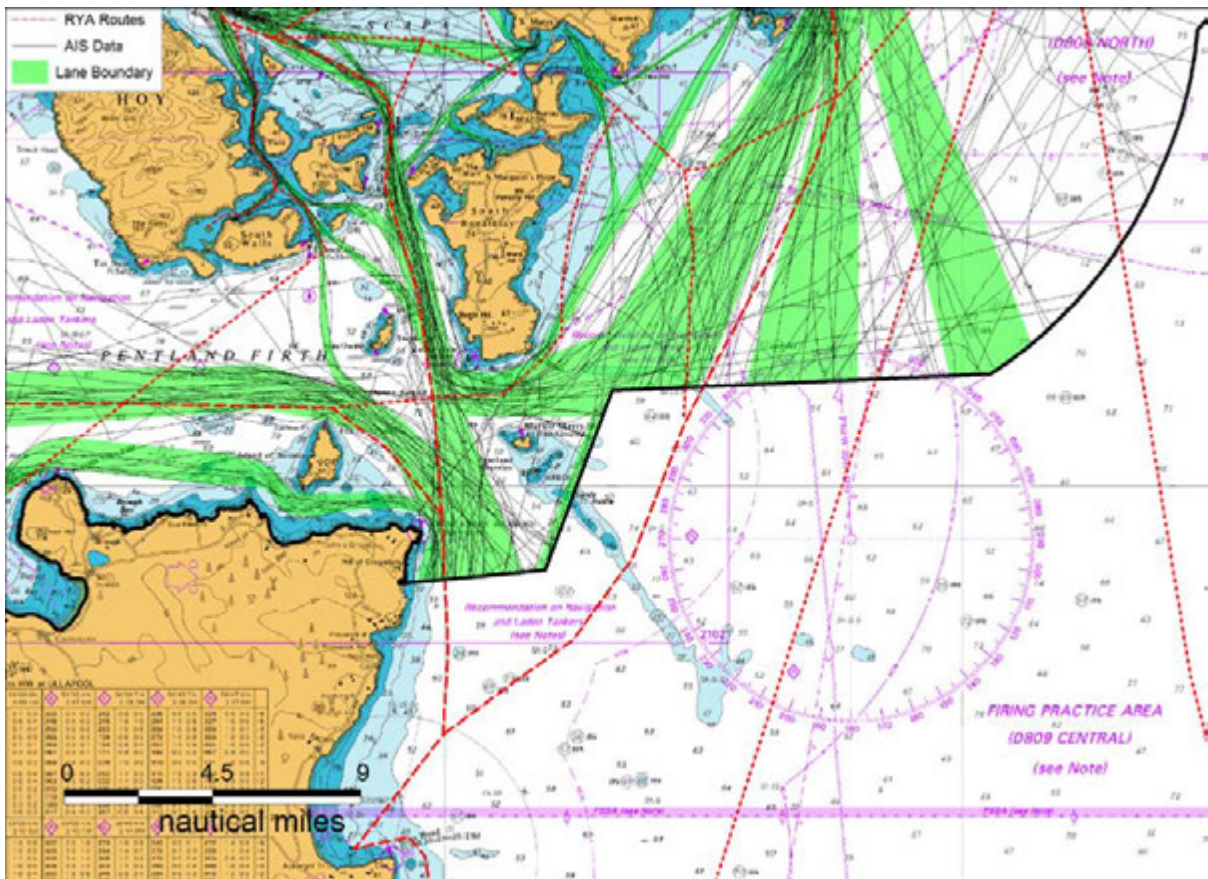


Figure 8.18 Pentland Firth Recreational Routes and Lane Boundaries

There is generally good agreement with the main differences to the RYA routes noted below:

- Addition of an east/west transit route through the Inner Sound, south of the Island of Stroma in the Pentland Firth.
- Addition of a route between Flotta and Switha⁴².
- Addition of a route between Cantick Head and Duncansby (identified in consultation).
- RYA have extra route from Cantick to Scrabster

⁴² Island south of Flotta

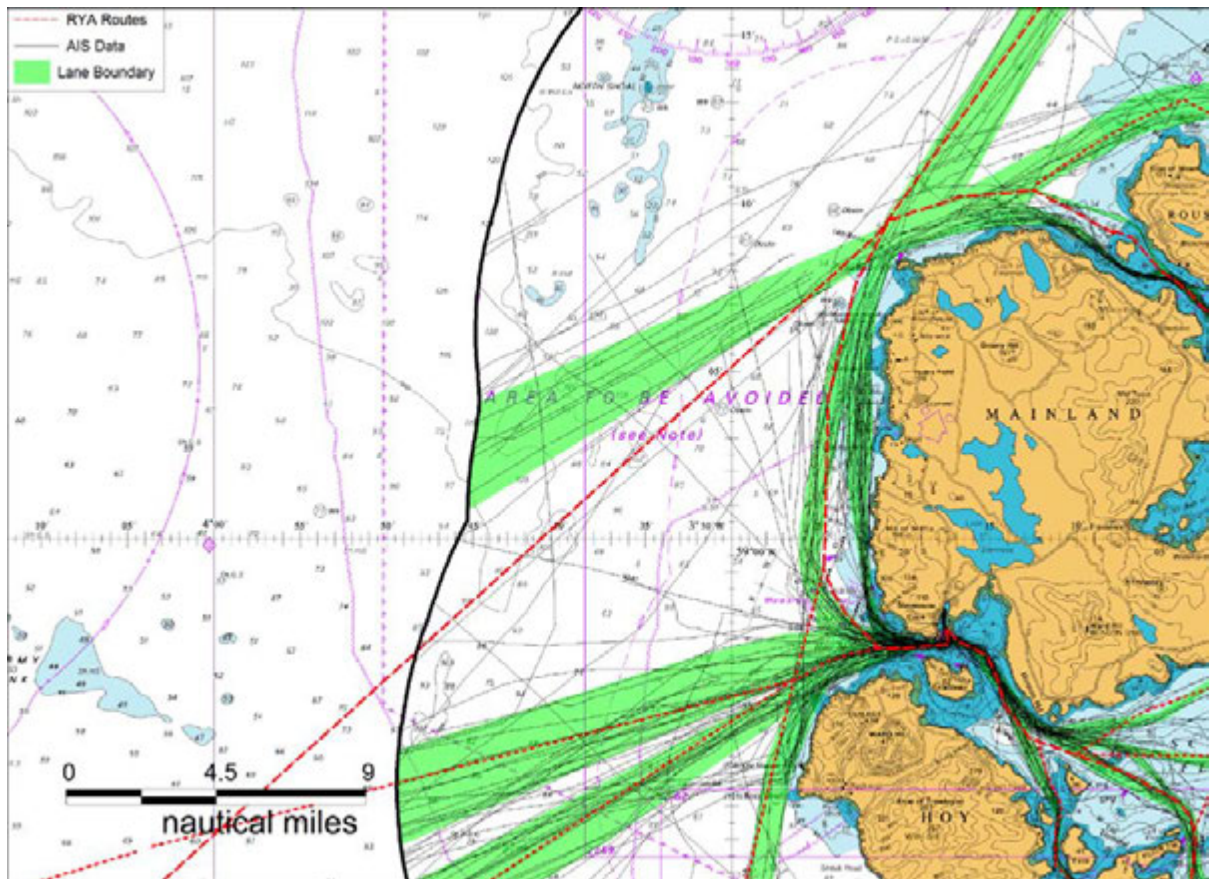


Figure 8.19 Hoy and West Coast of Mainland Orkney Recreational Routes and Lane Boundaries

Overall there is good agreement on the main recreational routes. Differences include:

- Addition of a north/south transit route to the east of the Billia Croo wave energy test site.
- Addition of the passage south of Eynhallow when transiting Eynhallow Sound.
- Addition of a more direct route between Cape Wrath and Brough Head.
- RYA have extra route from Loch Eriboll to Brough Head.

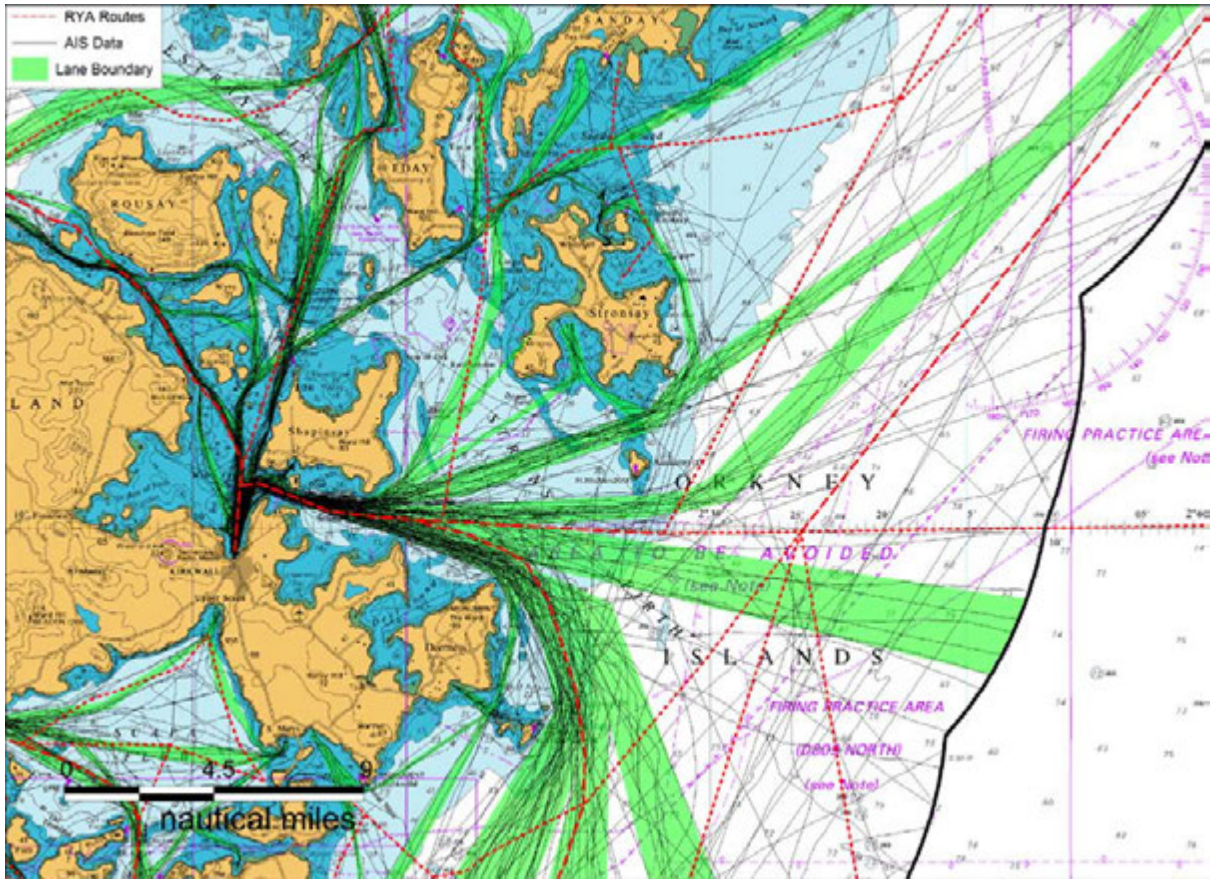


Figure 8.20 Kirkwall Recreational Routes and Lane Boundaries

There is a general agreement between recreational routes in most of this area. The differences between the lanes and the RYA indicative routes are summarised below:

- Addition of two distinct routes around Grass Holm⁴³. One to the east passing Shapinsay and one to the west passing Gairsay.
- Addition of a route from Kirkwall passing to the west of West Skerries and Puldrite Skerry⁴⁴.
- Addition of an east / west route transiting Gairsay Sound.
- Addition of an east / west route transiting Wyre Sound.
- Addition of a north / south route transiting Rousay Sound.
- Additional of an east / west route passing between Auskerry⁴⁵ and Stronsay.
- Addition of routes to and from Bay of Holland⁴⁶.
- Addition of route transiting Copinsay Pass.
- Addition of a route from Galt Ness⁴⁷ to southeast tip of Edray.

⁴³ Island to west of Shapinsay

⁴⁴ Skerries between Orkney Mainland and Shapinsay

⁴⁵ Island south of Stronsay

⁴⁶ Bay to south of Stronsay

⁴⁷ Northwest tip of Shapinsay

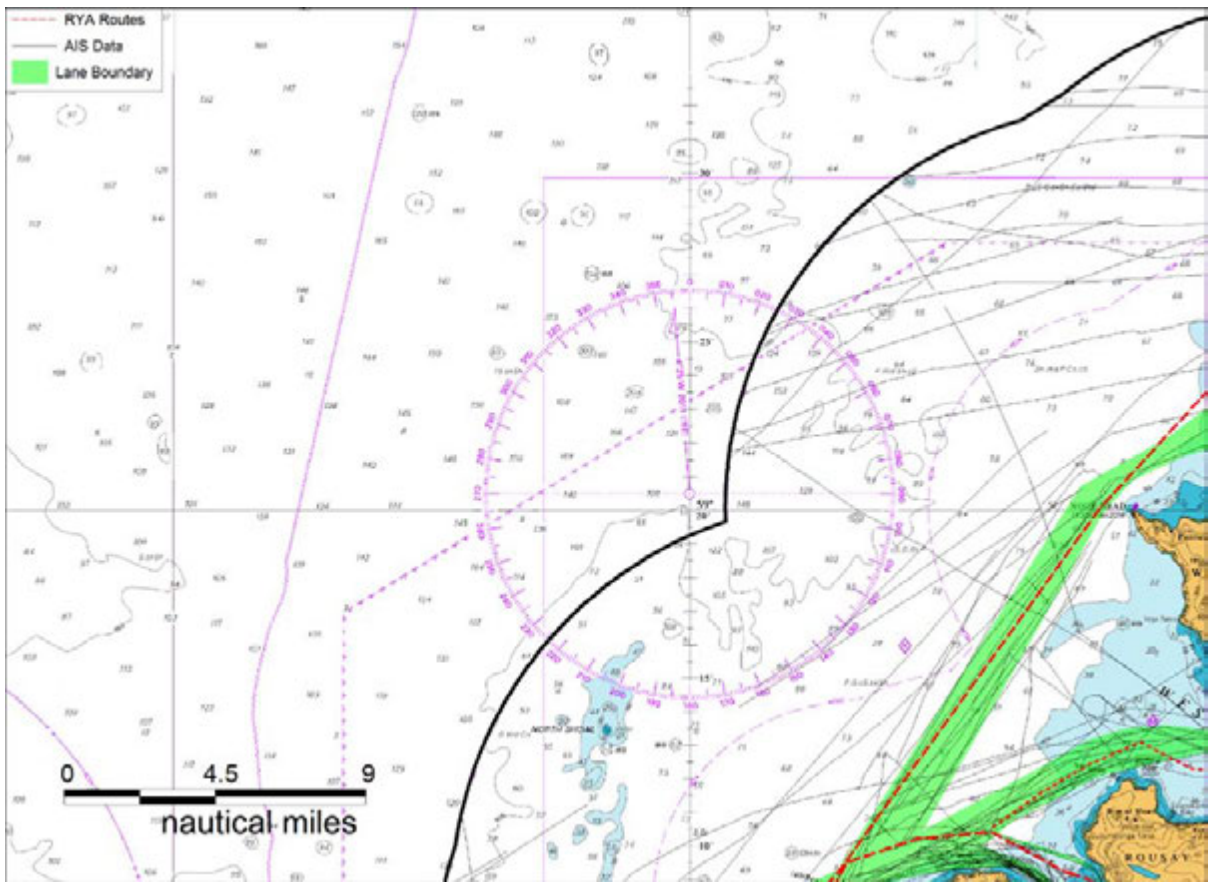


Figure 8.21 Northwest Orkney Recreational Routes and Lane Boundaries

There is good agreement between the lanes and RYA indicative routes in this area.

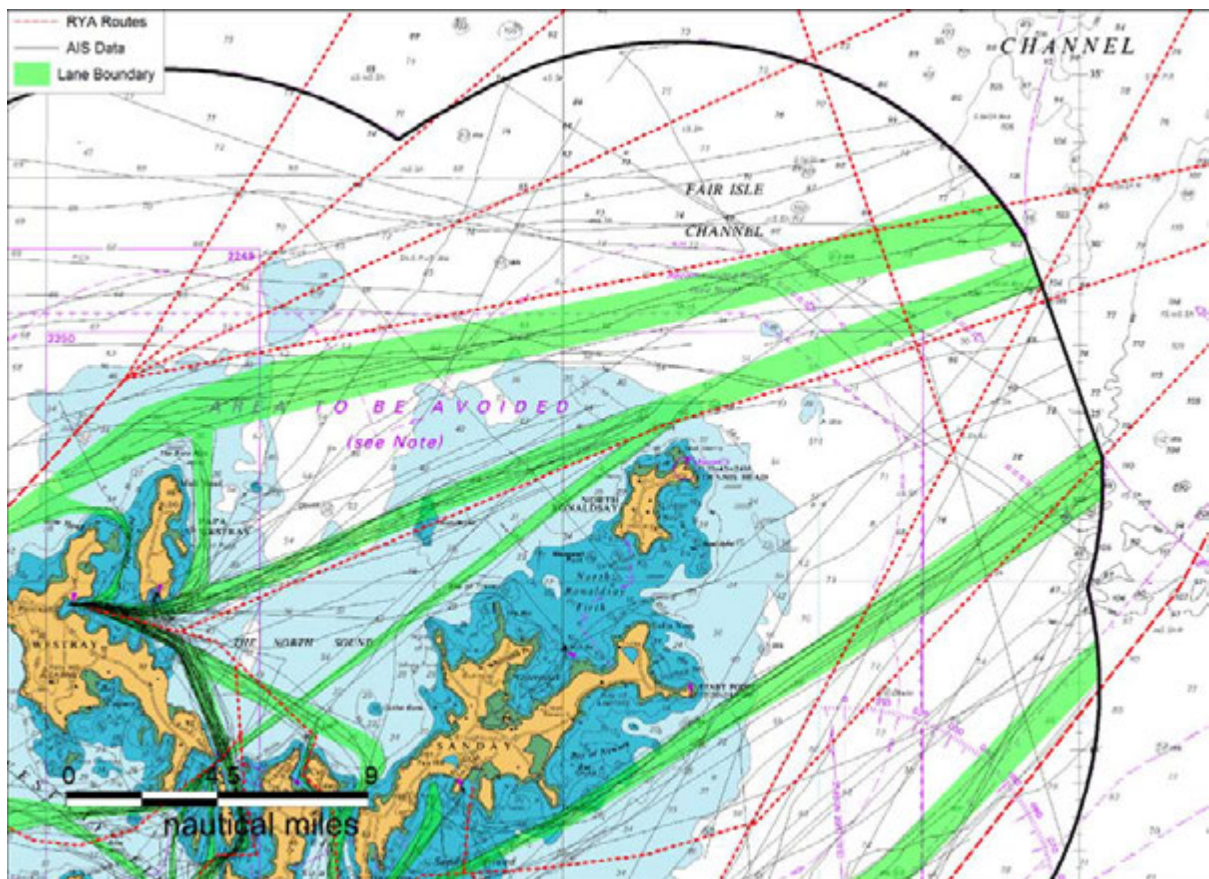


Figure 8.22 Northern Orkney Islands Recreational Routes and Lane Boundaries

It is noted the AIS tracks are sparser in this area, which corresponds with the marina analysis which showed Westray had fewer visitors than Kirkwall and Stromness.

There is reasonable agreement between the routes with the main differences being:

- Addition of route passing between Sanday and Calf of Eday⁴⁸.
- Route from Fersness Bay⁴⁹ to Pierowall passes closer to coast of Faray and Westray.
- Addition of route passing between Rusk Holm⁵⁰ and Faray.
- Addition of route transiting across the North Sound from Weatherness Sound⁵¹ to North Ronaldsay.
- Addition of route transiting Papa Sound.
- Addition of north/south route transiting Westray Firth (West of Rusk Holm).

8.6 Anchorages

Anchorage used by recreational vessels are plotted in Figure 8.23, with their locations indicated by red dots. These were identified from a combination of the following sources:

⁴⁸ Island to northeast of Eday

⁴⁹ Bay on west coast of Eday

⁵⁰ Island to west of Faray

⁵¹ Sound between Westray and Faray

- RYA Coastal Atlas
- Clyde Cruising Club Sailing Directions
- Questionnaire Responses
- Cruising Association Survey
- Local Workshops
- Other Consultation

It should be noted that other anchorages are used though less frequently.

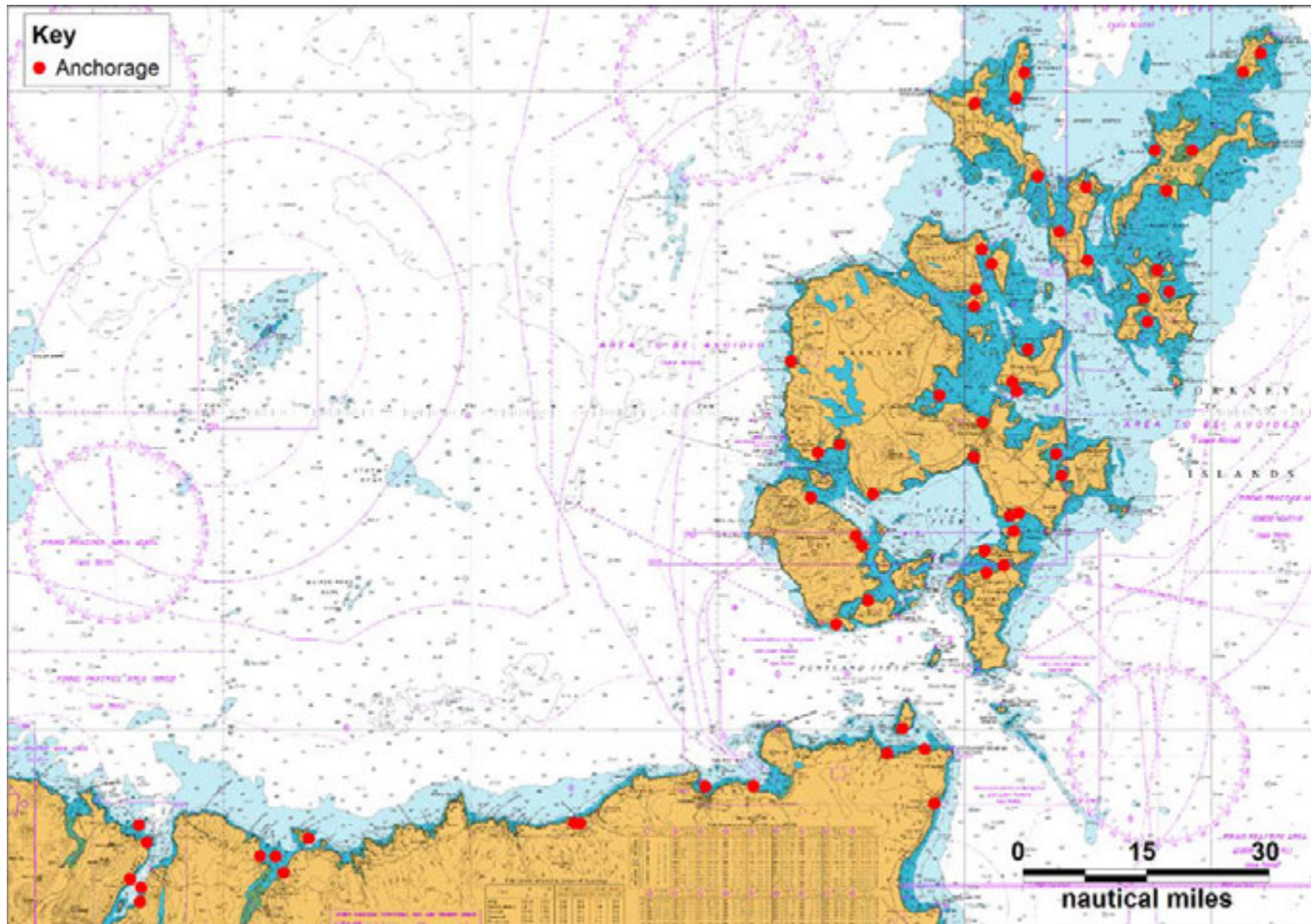


Figure 8.23 Recreational Vessel Anchorage

9. OTHER RECREATIONAL ACTIVITY

9.1 Introduction

This section presents details on other recreational vessel activity which is not fully covered by the previous assessment which focused mainly on sailing vessels. Also, in the course of the study some information was obtained on fish farm vessels, which has been reported below.

9.2 Dive Boats

There are a number of diving boats based in Orkney available for charter for recreational diving trips and less frequently for recreational angling and sight-seeing trips. The majority are members of the Orkney Dive Boat Operators Association (ODBOA).

The 8-10 active vessels within ODBOA spend the majority of their time visiting the numerous wrecks in Scapa Flow from a base in Stromness. Only about four of the larger vessels transit further afield, including trips to the northern isles of Orkney and beyond. All vessels are similar carrying approximately 12 passengers and 2-3 crew.

Two of the dive vessels were recorded in AIS during the survey. The combined tracks are presented in Figure 9.1.

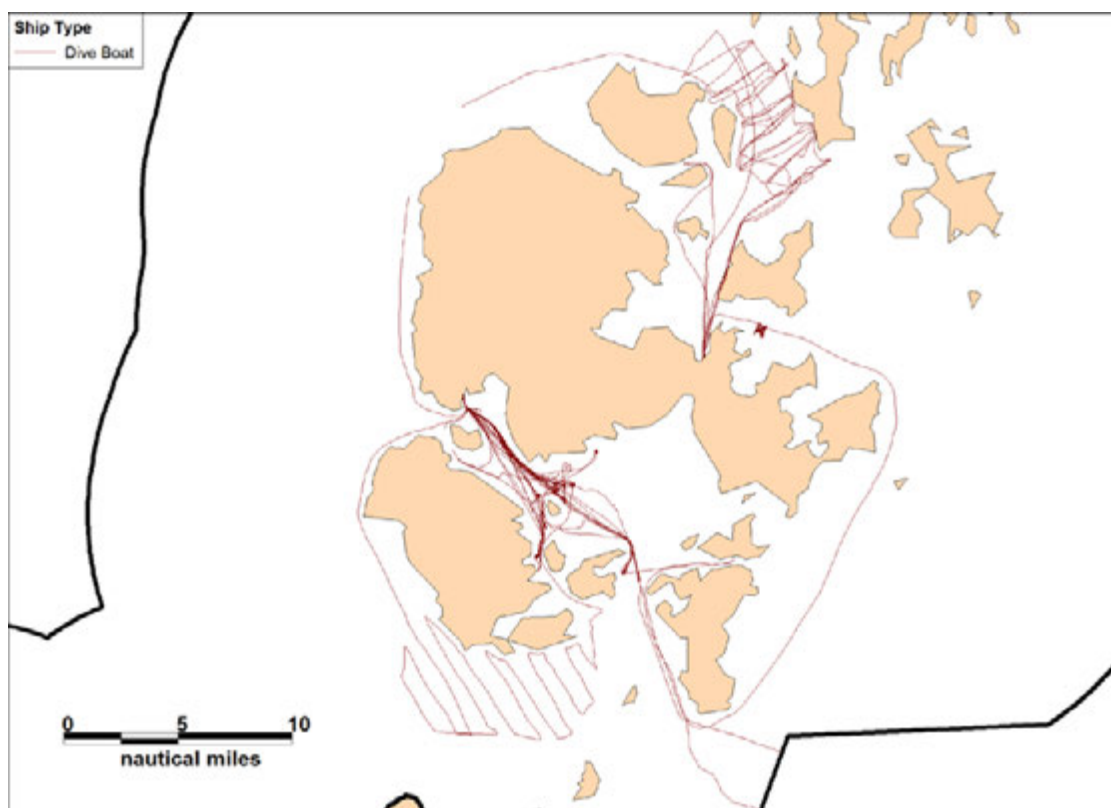


Figure 9.1 Dive Vessel Tracks (Combined Winter & Summer 2012)

In addition to activities by the two vessels on AIS within Scapa Flow, which are likely to be recreational diving, one of the vessels appeared to be carrying out work on behalf of renewable energy developments south of Hoy and west of Eday.

Caithness Diving Club based in Thurso has a 6.5m RIB which carries up to 8-10 divers. Dive sites listed on the club website are predominantly off the Caithness and Sutherland coast, between Lochinver and Dunbeath. It is expected this vessel may also cross the Pentland Firth on trips to Scapa Flow.

9.3 Fish Farm Vessels

Tracks of fish carrier vessels recorded during the AIS surveys are presented in Figure 9.2.

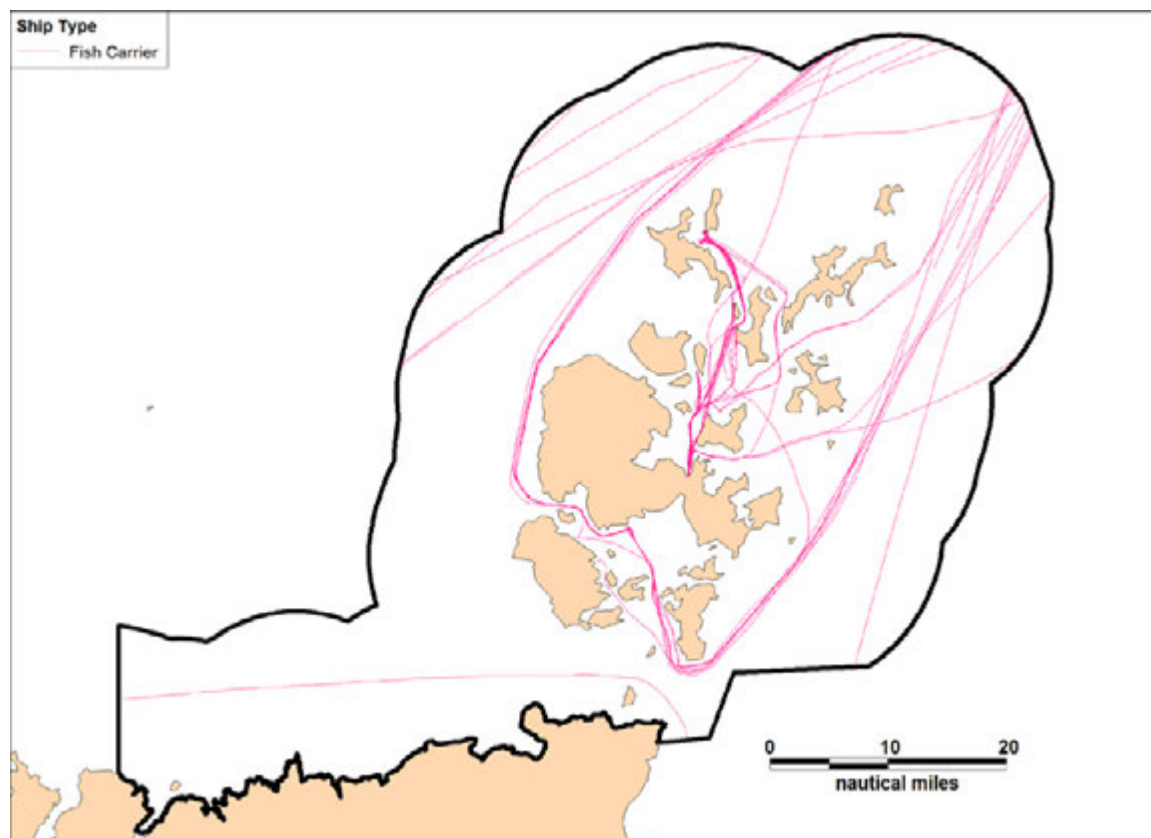


Figure 9.2 Fish Carrier Vessels on AIS (Combined Winter & Summer 2012)

There were seven unique fish carrier vessels tracked over the combined survey period. The most regular were *Ronja Settler*, transiting mainly between Scalloway in Shetland and the fish farm at Toy Ness⁵² in Orkney, and *Island Senior* transiting between Kirkwall and various fish farms on Orkney.

Further information was obtained on fish farm support vessel activities in the area by contacting two of the main operators, Scottish Sea Farms and Meridian. The locations of farms operated by these companies are presented in Figure 9.3.

⁵² South coast Orkney Mainland, Scapa Flow

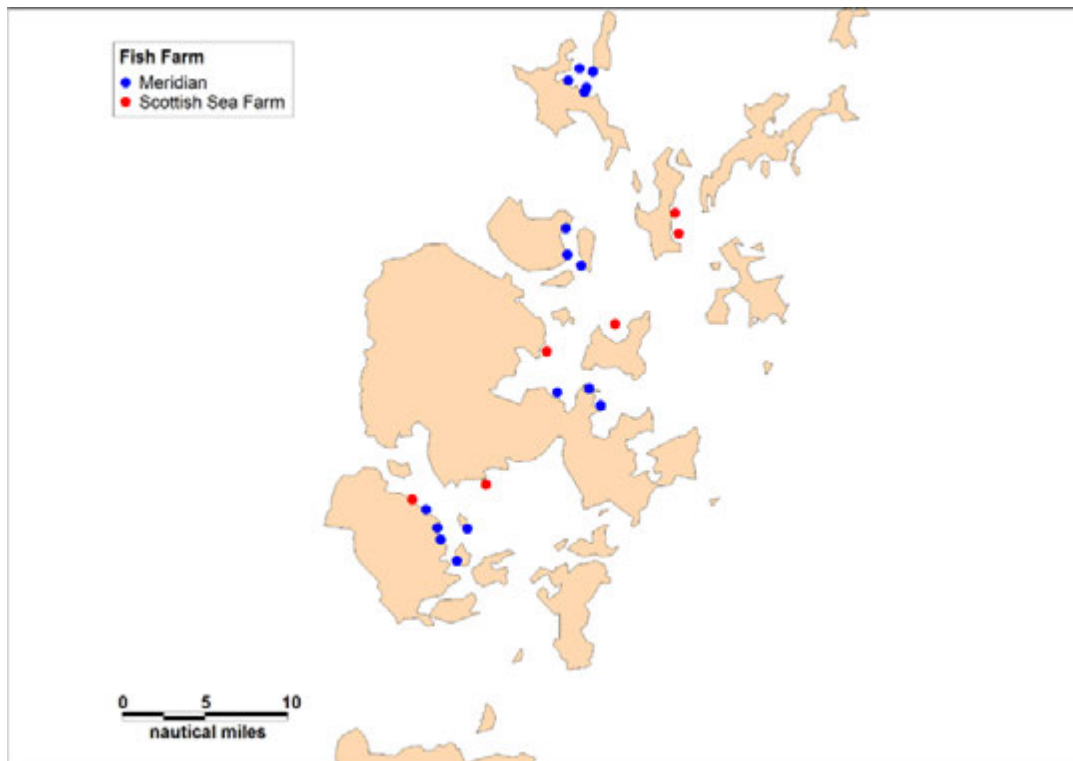


Figure 9.3 Selected Fish Farm Locations

Brief details were provided by Scottish Sea Farms indicating that support vessels visit the sites daily. The Scapa Flow sites are serviced from Stromness and Houton. Puldrute and Shapinsay are serviced from Kirkwall. The Eday sites are relatively new and information was not available.

Meridian Salmon Farms provided information on vessels based in the vicinity and the ports they operate from. It operates sites on Westray, Rousay, Hoy and at Kirkwall. Details of the vessels used are presented in Table 9.1.

Table 9.1 Meridian Salmon Farms Vessels

Site	Vessel Name	Length (m)	Net Tonnes	Draught (m)	Base Port
Westray	Crissanne	11.64	34.75	1.37	Pierowall
Westray	Debi L	15	29	0.88	Pierowall
Westray	Mauy	14.5	59.48	0.96	Pierowall
Westray	Shoormal	14	32.6	0.65	Pierowall
Rousay	Grafter	10.5	17.37	0.76	Trumland ⁵³
Rousay	Lady Jean	15.8	52.92	0.87	Kirkwall
Hoy	Colleen	11.64	34.75	1.37	Lyness
Hoy	Prosperous	11.35	19.95	1.3	Lyness
Hoy	Salmain	14.4	61.71	0.96	Lyness

⁵³ South coast of Rousay

Site	Vessel Name	Length (m)	Net Tonnes	Draught (m)	Base Port
Hoy	Island Junior	14.9	116.94	3.03	Stromness / Houton / Scapa Pier
Hoy	Emma	19.95	63.25	1.99	Scapa / Stromness
Kirkwall	Ardlamont	12.5	40.75	2.03	Kirkwall
Kirkwall	Keri	11.64	34.75	2.03	Kirkwall
Kirkwall	Salmon Lander	14	32.6	0.65	Kirkwall
Kirkwall	Annalie	13.64	59.6	2.54	Kirkwall

Vessels operating at the Westray sites make around six to seven return transits each week to the sites. In addition, each vessel will visit Kirkwall on an infrequent basis.

Vessels serving Rousay sites make 6-7 return transits each week from site to base port.

Six to seven return transits per week are also made by vessels operating at Hoy sites and based at Lyness.

Emma carries out maintenance and grid work at all sites in Scapa Flow. *Annalie*, serving Kirkwall sites, goes between all these sites, also carrying out maintenance and grid work.

The larger vessels also transit the Pentland Firth en route to Macduff on an annual basis.

In addition, harvesting is subcontracted to one of two vessels which are based in Kirkwall or Stromness dependent on requirements and will visit sites on a daily basis whilst carrying out harvesting. Details of these vessels are presented in Table 9.2.

Table 9.2 Meridian Salmon Farms Harvesting Vessels

Vessel Name	Length (m)	Net Tonnes	Draught (m)
Conquest	18.95	129	3.5
Island Senior	28	335	3.6

9.4 Sailing Clubs

All the sailing clubs identified in the area were requested to complete the questionnaire. Of these, responses were received from Stromness and Pentland. The contribution of RYA Scotland's representative on the Steering Group for this study was very helpful in covering issues not addressed by individual respondents. Alternative means of engagement with sailing clubs, such as attendance at one of their main events or AGM, may be beneficial in obtaining their input to future replications of this or similar studies. Details on these clubs and the others from more general research are presented below:

- **Orkney Sailing Club:**
Based in Kirkwall, Orkney Sailing Club is one of the principal sailing clubs of the Orkney Islands. Currently there are about 200 members with racing (in Wayfarer and Pico vessels) taking place twice weekly throughout the conventional summer season (May to September). Training takes place regularly once a week and occasionally at weekends also. Both training and racing occur at the club's Hatston base. The club is a recognised RYA Training Establishment providing a variety of courses.
- **Holm Sailing Club:**
Based in St. Mary's, a small bay on the eastern side of Scapa Flow. Club facilities include a pier and slipway that allows launching of boats at most tidal states. The club operates "one design racing" with all boats used belonging to International Snipe Class. Racing takes place every Tuesday evening throughout the summer season and an annual regatta (open to all types of sailing craft) is held by the club.
- **Stromness Sailing Club:**
Based at the Ness Point end of Stromness Harbour, Stromness Sailing Club is a small club with membership comprising a mixture of competitive and recreational sailors. The snipe is the main class of dinghy used and 13 of these are based at the club. Racing takes place on a weekly basis in Stromness harbour and the club holds an annual regatta. Basic training is also offered by the club to beginners by several RYA-trained instructors.
- **Pentland Firth Yacht Club:**
Based in Scrabster Harbour, Pentland Firth Yacht Club primarily sails in Thurso Bay, providing a large deep-water sheltered sailing area with few restrictions. Sailing typically takes place twice weekly with Thursday evenings directed at training for less experienced members and Sunday afternoons focused on club racing. Typical group size is roughly 10-15 vessels. Activity is limited to the summer season.

- **Westray Sailing Club:**
Westray Sailing Club sails twice weekly (Tuesday and Thursday) throughout the summer season typically using skiff vessels. Numerous club competitions are held throughout the course of the year as well as a club annual regatta which attracts around 50 boats per year.
- **Longhope Sailing Club:**
Based in Longhope, this club holds an annual regatta and is known to operate several yoles.
- **Orkney Yole Association:**
Formed in 2000, Orkney Yole Association aims to preserve and promote the use of this historic vessel type. The club frequently holds events to refurbish yoles back to seaworthy condition. Frequent sailing events of the eight remaining seaworthy yoles occur throughout the summer season. The club also participates in numerous regattas held throughout the course of the year around Orkney.

9.5 Sea Angling

The following sea angling associations were targeted in the questionnaire but did not respond.

- Caithness Sea Angling Association
- Orkney Islands Sea Angling Association

From research and consultation, Orkney Islands Sea Angling Association own and charter out the *Welcome Home* (12.5m length) based in Stromness. As well as fishing, she is available for charter for bird and seal watching and pleasure trips. It is understood most trips are relatively short day or part-day trips staying close to Stromness, e.g., to west of Hoy, west of Orkney Mainland and Scapa Flow.

The *Silver Line* sea angling vessel is berthed in Scrabster. The charterer attended the Scrabster workshop and indicated he mainly carries out trips in the surrounding area off the north coast, e.g., Brough Bay and west of Thurso. The *Hebridean Warrior* is also based in Scrabster for sea fishing trips off the north coast, e.g., Brough Bay, and advertises summer trips to Orkney.

9.6 Boat Trips and Wildlife Cruises

John O'Groats Ferries operate the *Pentland Venture*. This vessel does not carry AIS but the operator took part in the questionnaire. The ferry operates 2-3 return trips per day between John O'Groats and Burwick, Orkney between 1st May and 30th September 2011. It also carries out afternoon wildlife cruises daily between June and August. The particular route for the cruise depends on the prevailing tide and weather conditions, however, the two main routes are around Stroma or east past the Duncansby Head lighthouse and Stacks of Duncansby.

Details of other boat trip companies that were identified from research are presented below (note, list may not be exhaustive and is changeable).

- Seaorkney: Wildlife tours, such as sight-seeing and whale watching on the *Nicky Tam*. This also carries out fishing trips.
- Pettlandssker Boat Trips: Boat trips to the Pentland Skerries or Swona departing from Burwick Harbour, South Ronaldsay. Depending on weather conditions, boat lands on Muckle Skerry or Swona. The vessel *Pettlandssker* is an ex RNLI Lifeboat.
- Dawn Star Boat Trips: *Dawn Star II* (7.5m length motor boat) operates boat trips from Holm Pier, St. Mary's into Scapa Flow. Also sea angling can be arranged in Scapa Flow.
- Orkan Adventures Scapa Flow Boat Trips: *Sheila C* (7m length) scallop dive boat operates sightseeing and fishing trips all year round, weather permitting,
- *M/V Lady Rose* Boat Tours: Converted fishing vessel offering short trips on Scapa Flow from Stromness. Sea Angling in Scapa Flow or offshore, round trips to the islands of Orkney and Shetland or cruises further afield are also available.
- *MV Stormdrift II*: Fishing boat for charter or hire out of Scrabster.
- Wild Sea Charters: Wildlife and sailing trips onboard a renovated ketch rigged fishing trawler from Scrabster to the Pentland Firth.
- Sail Orkney Yacht Charter operates from Kirkwall Marina and charters one yacht, *Catherine J*.

9.7 Sea Kayaking

The following sea kayaking clubs based in Orkney and Caithness were included in the questionnaire circulation.

- Orkney Sea Kayaking Association
- Kirkwall Kayakers Club
- Caithness Kayak Club
- Pentland Canoe Club

A number of individual kayakers also took part in the questionnaire.

Overall, the responses were of a high quality (see excerpts in Section 6) and the information has been forwarded to Marine Scotland, to be included in a future study on tourism and recreation activities which will include sea kayaking, and other marine-based recreational activities.

10. CONCLUSIONS

10.1 Context

This report summarises the study of commercial shipping and recreational vessel movements in the Pentland Firth and Orkney Waters (PFOW) Strategic Area (Figure 10.1).

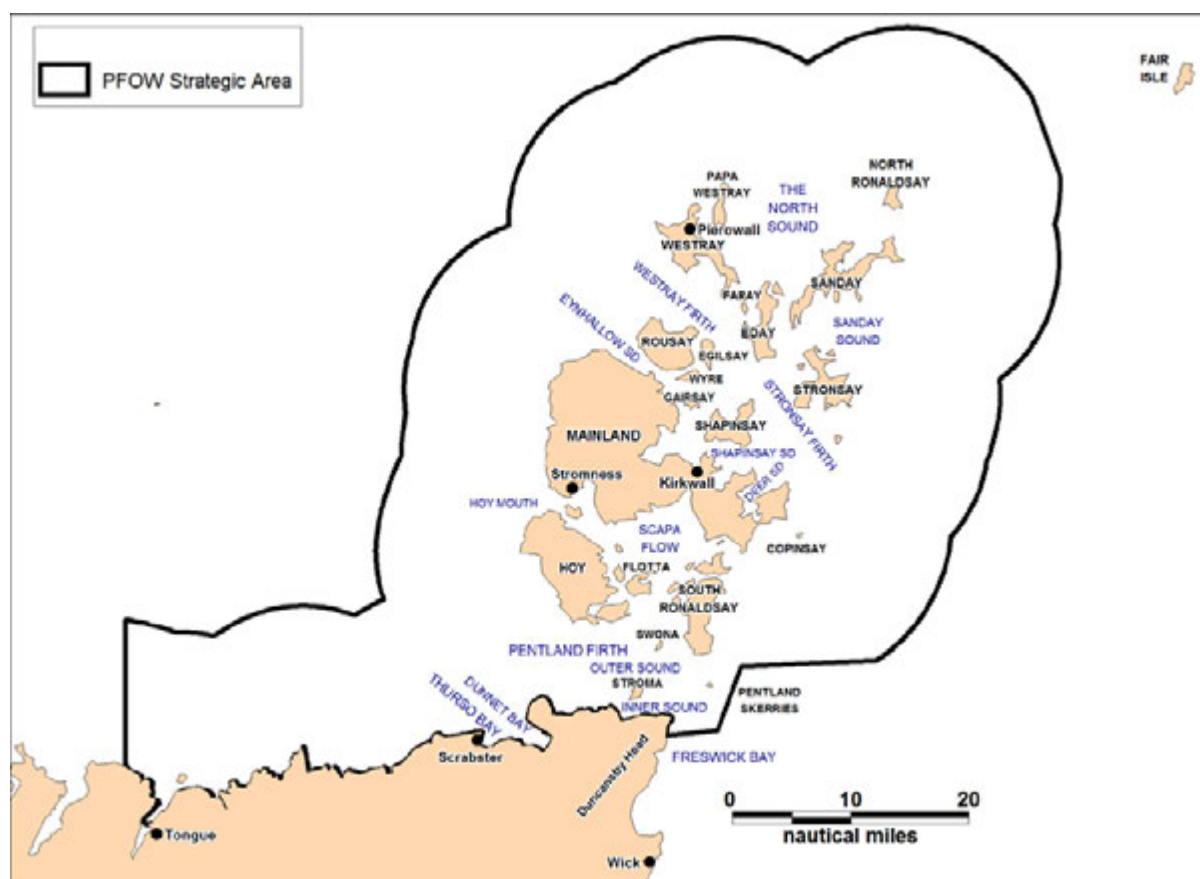


Figure 10.1 Overview of Pentland Firth and Orkney Waters Strategic Area

The study provides mapping, data and other information to inform the marine spatial plan pilot being undertaken by Marine Scotland for the PFOW Strategic Area. Given the international importance of the Pentland Firth as a shipping route, as well as the popularity of recreational sailing in Orkney waters, good quality information is needed to underpin the plan. This study is one of the studies being carried out in stage 2 of the pilot, to fill gaps identified by the combined stage 1 document⁵⁴ and the Regional Locational Guidance, available from Scottish Government via:

<http://www.scotland.gov.uk/Topics/marine/marineenergy/wave/rlg/pentlandorkney>

The study complements Marine Scotland's other work on commercial fishing vessel activity and military vessel movements, and future work planned on tourism and recreation activities, as well as initiatives such as Scotland's Marine Atlas. Background information on the study is provided in Sections 1 to 3 and 6.

⁵⁴ Particularly pages 32 to 34, 41 to 42, 92 to 97 and 145 to 148.

This study has mapped commercial shipping and recreational vessel routes and collated related data, to help in marine spatial planning and in assessing the siting of proposed wave and tidal renewables developments in order to avoid or reduce interference or displacement of shipping and recreational vessel activities. The study:

- refreshes existing maps and information based on Automatic Identification System (**AIS**) data, and provides more up-to-date information to improve understanding of temporal variations in shipping activity;
- presents new data on commercial vessel movements, including ferries and vessels less than 300 Gross Tonnage (**GT**);
- presents new data on recreational vessels, many of which are not tracked by AIS, but for which more representative data were required before the study.

The data include numbers of vessels, vessel types, tonnages and draughts for commercial shipping; tracks and destinations; and ports, harbours and anchorages used in the area. The data include vessels in internal Orkney waters, which were not included in the stage 1 document referred to above. The data collection has included the available AIS data, and stakeholder consultation (via questionnaire and local consultation) and by Steering Group participation in the study. The time periods over which data were gathered include summer and winter, to identify any related temporal variations. Consideration was given to routes used during bad weather, and anchoring areas were identified.

Sections 4 and 5 present details on the initial tasks carried out to gather data for the study, which involved a literature review and consultation with stakeholders, including use of a questionnaire and local workshops.

10.2 Commercial Shipping

The questionnaire also validated the approach being taken to characterise commercial shipping in the study area through detailed analysis of AIS data. This analysis is presented in Section 7. In total, eight weeks of AIS data was collected, four weeks in winter and four weeks in summer 2012, which ensured seasonal variations were taken into account. The AIS information was also checked against MCA reports for ships transiting the Pentland Firth to confirm it was comprehensive.

From the plotted tracks and the ship density (heat maps) produced, the busiest areas for commercial shipping were the Pentland Firth especially Outer Sound, approaches to Scrabster, Scapa Flow, Kirkwall and Stromness, Fair Isle Channel (north of Orkney Islands) and routes transited by the regular ferries in the area (Orkney Ferries, Serco NorthLink and Pentland Ferries).

A range of ship types were observed to be using the area with the main ones being:

- passenger vessels;
- cargo ships;
- tugs;
- tankers; and
- offshore vessels (working for the oil & gas and renewables industries).

Vessels varied in size from relatively small local ferries to large tankers calling at Flotta Terminal in Scapa Flow. Section 7 presents summary data and information on

vessel type, length, draught and tonnage. The commercial shipping assessment also reviewed destinations, anchoring locations, hazardous cargoes and weather and tidal routing.

Much can be gained from viewing the data presented in the graphs and commercial shipping maps in Section 7, but key conclusions include:

- Distribution of vessel types is similar in winter and summer, with passenger vessels being the most common type, followed by cargo vessels. There was a slightly higher average number of vessels per day during the summer period for the vessel categories of passenger, offshore and other. Commercial shipping in the Strategic Area tended to follow very defined tracks for the different vessel types. Figure 10.2 presents vessel tracks by type recorded in the summer period.

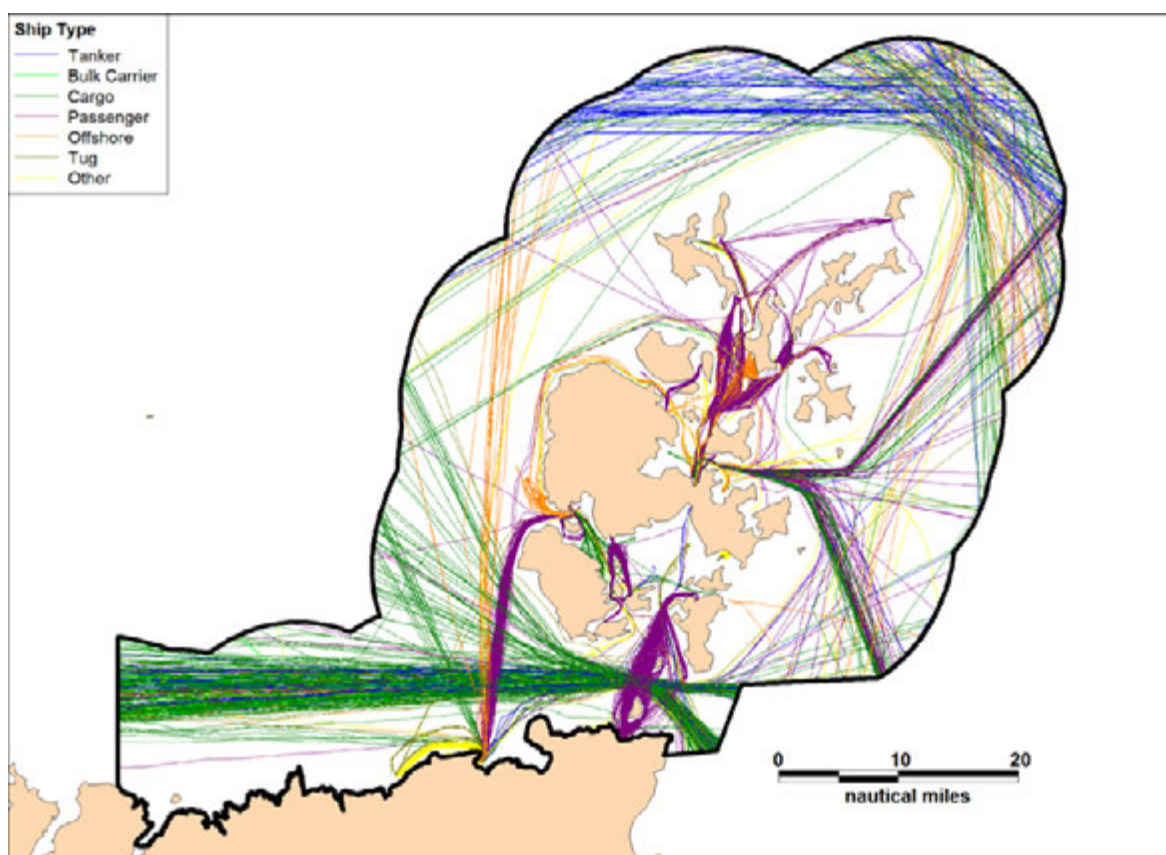


Figure 10.2 Summer 2012 AIS Track Analysis by Vessel Type

- The most common category of vessel length was <30m, comprised of mainly Orkney Ferries inter-island ferries and several tugs. There was a slightly higher proportion of vessels with lengths greater than 150m in the summer period due to an increase in the number of large cargo vessels and passenger cruise vessels in this period. The longest vessels tended to transit the area, either passing north of Orkney via the Fair Isle Channel or through the Outer Sound of the Pentland Firth, with the exception of passenger cruise vessels which called at Kirkwall during the summer period. Figure 10.3 presents vessel tracks by length as recorded during the summer survey.

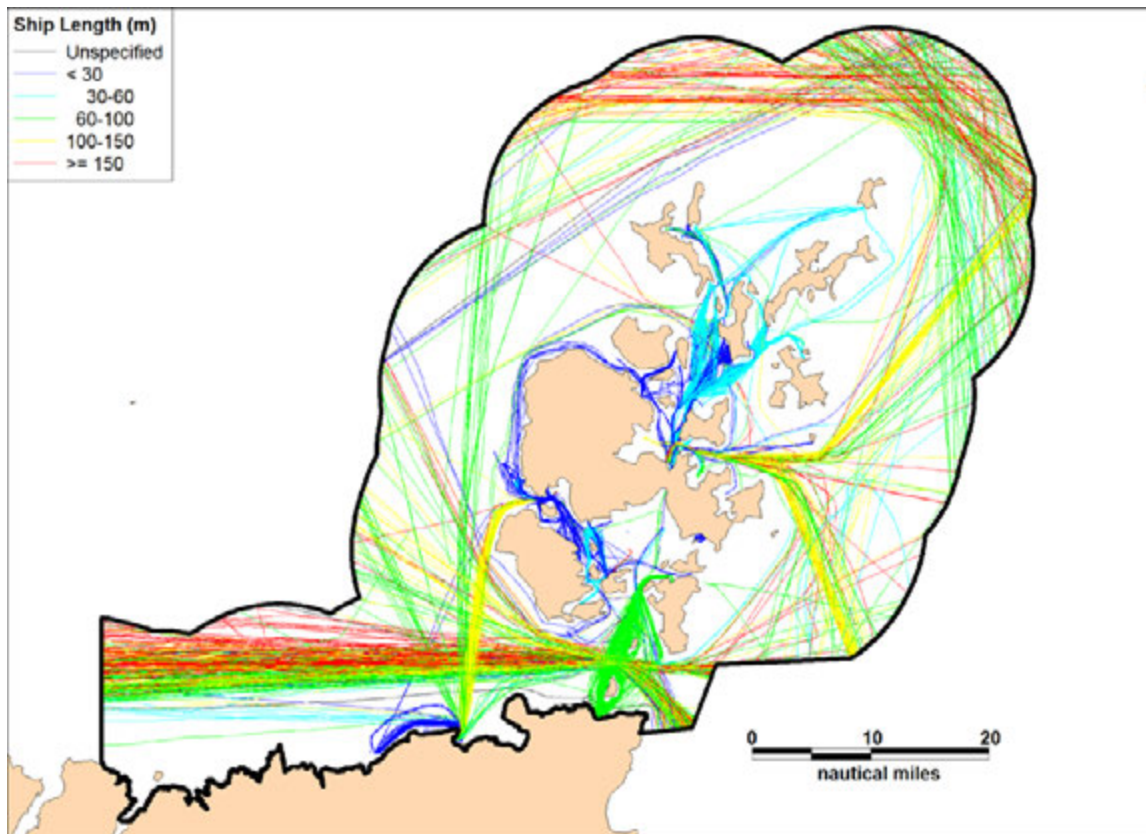


Figure 10.3 Summer 2012 AIS Track Analysis by Vessel Length

- The most common category of vessel draught was 4-6m. There was a higher proportion of deep-draught vessels in summer compared to winter, due to an increase in the number of large cargo ships. As with length, the deepest draught vessels tended to be transiting the Outer Sound of the Pentland Firth or the Fair Isle Channel. Figure 10.4 presents summer tracks by ship draught.

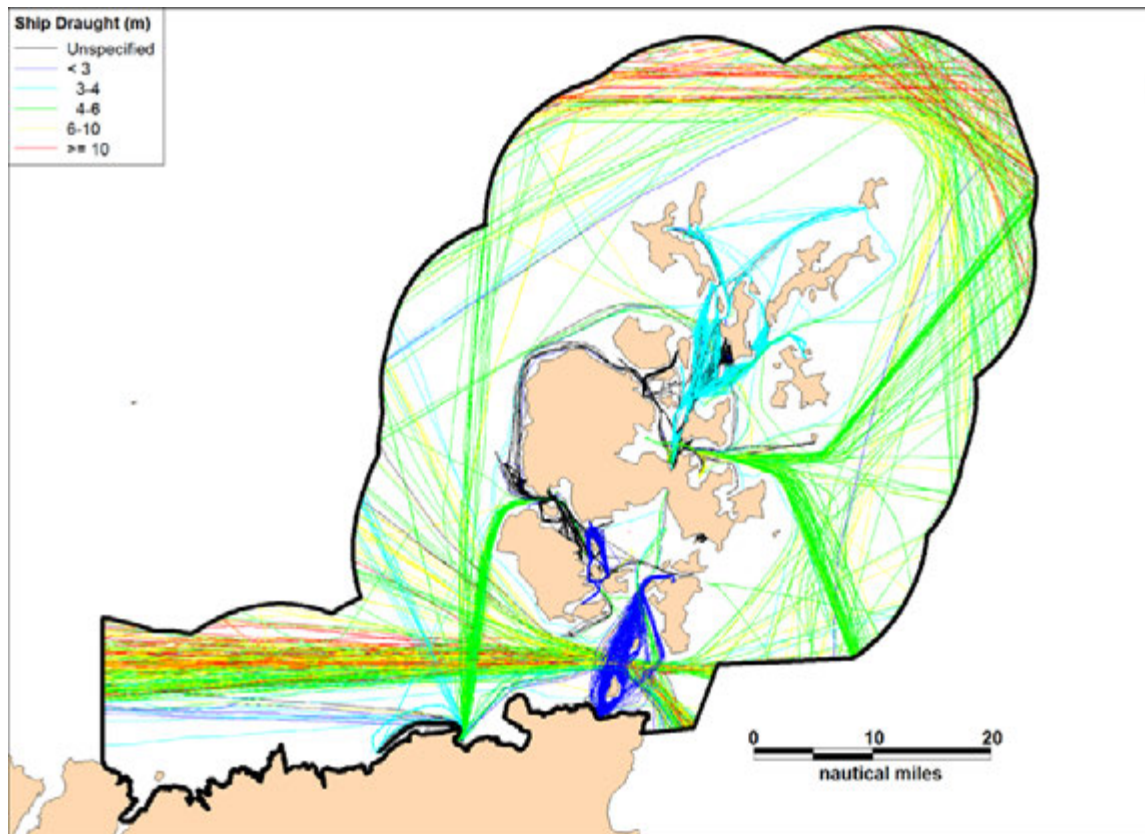


Figure 10.4 Summer 2012 AIS Track Analysis by Vessel Draught

- The pattern of vessel tonnage is similar to that observed in length and draught analysis. The most common category was 300-1,500 GT, with regular runners in this category including the *Pentalina* passenger ferry and Orkney Islands inter-island ferries. The heaviest vessels transited the Outer Sound and the Fair Isle Channel. Vessels over 15,000 GT tracked within the Orkney Islands were passenger cruise vessels and tankers associated with Flotta Marine Terminal.
- Tankers and gas tankers tracked within the Strategic Area were mainly transiting through the Outer Sound or through the Fair Isle Channel to a variety of destinations. Six tankers were tracked at harbours within the Strategic Area (Scrabster, Kirkwall, Flotta Marine Terminal and Scapa Bay).
- Bulk/ore carriers transited the Outer Sound and through the Fair Isle Channel. Destinations were all outside the Strategic Area.
- Cargo vessels both transited the Area and called at ports within the Area, including Kirkwall, Scrabster, Pierowall and Sanday.
- There were 15 regular passenger vessels working in the Strategic Area. These were inter-island ferries, ferries operating between the Scottish Mainland, Orkney and Shetland, and vessels transporting personnel to Flotta Marine Oil Terminal. These vessels all had well-defined passages. Twenty-five cruise vessels were tracked during the summer period, with 17 calling at harbours on Orkney and 8 transiting the Area. Figure 10.5 presents passenger vessels tracked during the 56 days combined survey period. Section 7.8 presents tracks of other vessel types.

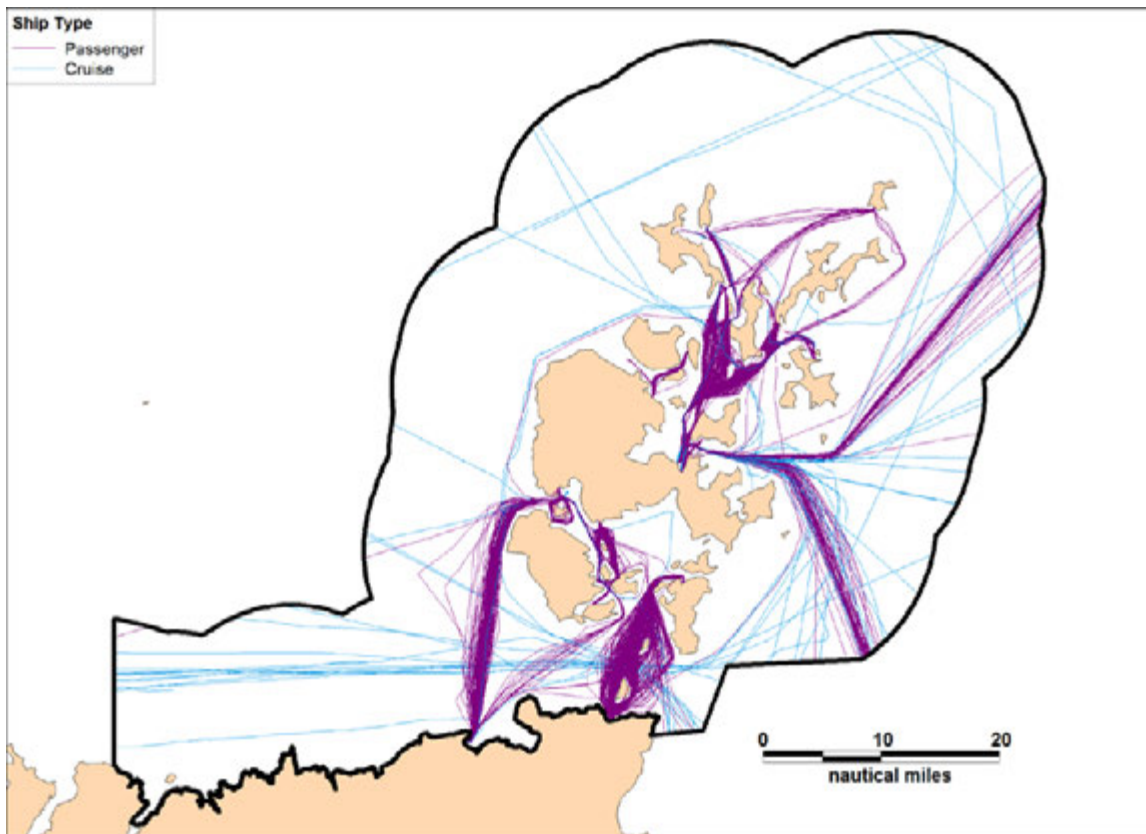


Figure 10.5 Combined 2012 AIS Track Analysis – Passenger Vessels

- Offshore industry vessels operating in the Area served both the oil and gas and renewables industries. Oil and gas vessels transited between the ports of Aberdeen, Scrabster and Kirkwall and their offshore destinations. Vessels undertaking offshore renewables work were associated with EMEC sites, and based at Kirkwall, Stromness and Eday.
- All tugs tracked called at harbours within the Area and were generally involved in local work rather than transiting. Destinations included Kirkwall, Scrabster, Westray, Stromness, Scapa Flow and the northern and southern Orkney Islands.
- Weather and tidal routeing is used by several passenger vessels in the Strategic Area. *Pentalina*, *Hamnavoe* and the Northern Isles ferries were identified to make bad weather routeing alterations. Figure 10.6 presents an example of bad weather routeing.

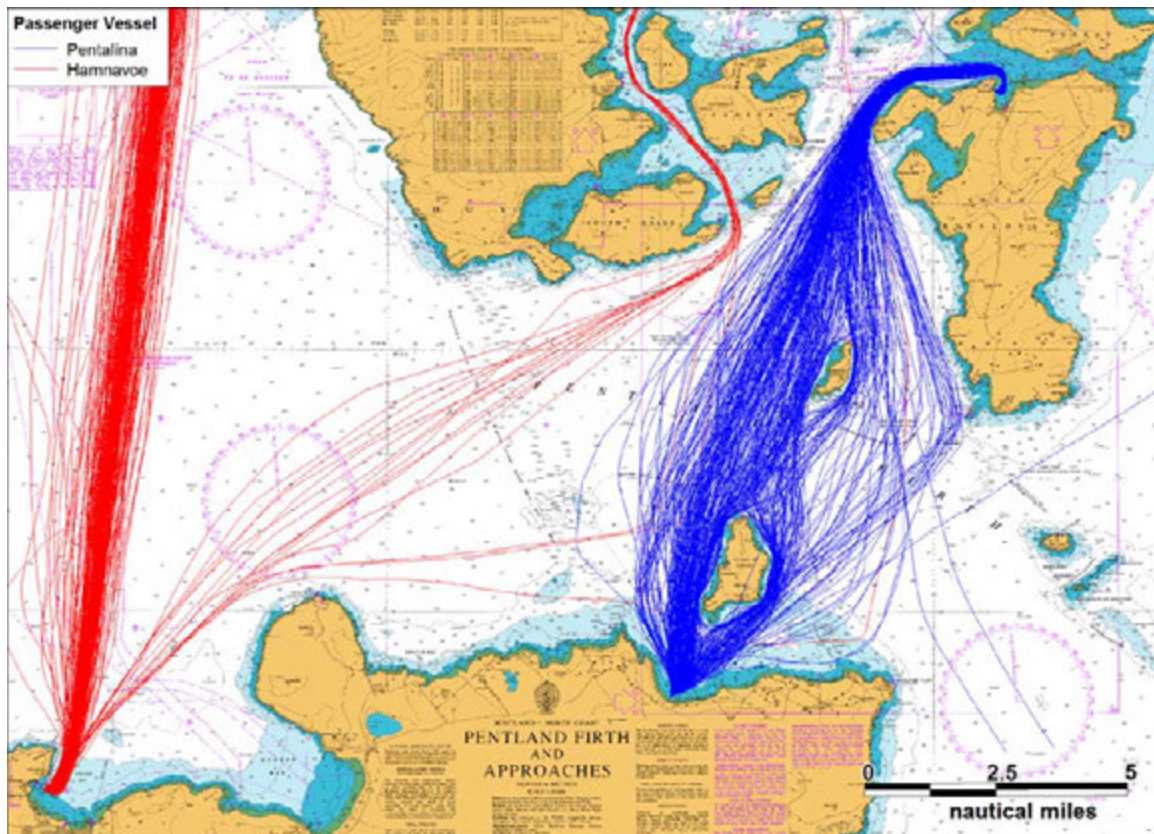


Figure 10.6 *Hamnavoe and Pentalina* Routeing based on Combined 2012 AIS Track Analysis

- The most common destinations of vessels tracked within the Strategic Area were Kirkwall, Scrabster and Stromness. Lerwick and Aberdeen were the most common destinations beyond the Strategic Area.

10.3 Recreational Vessels

Major components of the literature review and consultation were the collection and analysis of recreational vessel data calling at local harbours and marinas, including Scrabster, Wick, Kirkwall, Stromness and Westray. These clearly indicate the main period of activity for recreational vessels is summer, with very few visitors outside the period April to September. The majority of yachts tend to be from the UK but a large proportion are from overseas, particularly northern and western Europe.

Following a taking stock exercise, a questionnaire was designed and issued to individuals and organisations identified to have an interest in the area with the aim of filling in gaps in information, especially relating to small recreational vessel activity. The questionnaire was also made available online and advertised by the RYA and Cruising Association. A good level of participation was achieved with a total of 42 respondents. The feedback received is summarised in Section 6. It was identified that many recreational sailors consider the whole area to be important although particular key areas, such as marinas, harbours and anchorages were highlighted. The responses also made it clear that tide and weather are vital influencing factors on recreational vessel activity in the PFOW strategic area. The information was more qualitative than quantitative when it came to defining key routes, although useful feedback on the RYA Coastal Atlas indicative routes was provided.

The AIS data also formed a major component of the recreational vessel activity analysis presented in Section 8, although it was noted that AIS carriage is not mandatory for these vessels and therefore provided limited information. The AIS tracks provided helpful new information on the movements of recreational vessels. Unlike the RYA route information, they demonstrate the diversity of vessel tracks chosen by masters, which vary due to weather, tide, time available, individual preference, etc. By cross-referencing the AIS and marina data it was estimated that 17% of recreational vessels using the area broadcast on AIS. A length comparison indicated AIS was more common on larger yachts (10m and above in length). To increase the usefulness of the AIS data for smaller vessels, additional summer periods from 2011 to 2012 were added to give a total of approximately five months of tracking data.

Workshops were held in Orkney and Scrabster to review the AIS and RYA data with local stakeholders. A key focus was identifying alternative routes used by smaller vessels not on AIS. Potential amendments to the RYA Coastal Atlas routes were also discussed (in Section 8.4) and a plot of the suggested amendments presented in Figure 8.11.

Following the workshops and some additional consultation, estimates have been made of the 90% lane boundaries of recreational vessel routes and presented in Section 8.5, using a combination of statistical analysis in discrete locations / channels and visual inspection. These lanes more usefully characterise recreational vessel routes rather than centre-lines, with the widths of the lanes based on analysis of the lateral distribution of the tracks using that route. The maps presented generally show good agreement between these lanes and the RYA routes, whilst noting some key differences. ((This will assist the RYA in their ongoing discussions about how to revise and update the routes.))

Much can be gained from viewing the data presented in the graphs in Section 5 and the recreational vessel maps in Sections 8 and 9, but key conclusions include:

- The majority of recreational activity is constrained to the typical summer season (April to September) with very little activity taking place outside of this. Figure 10.7 presents a recreational vessel density plot for the Strategic Area.

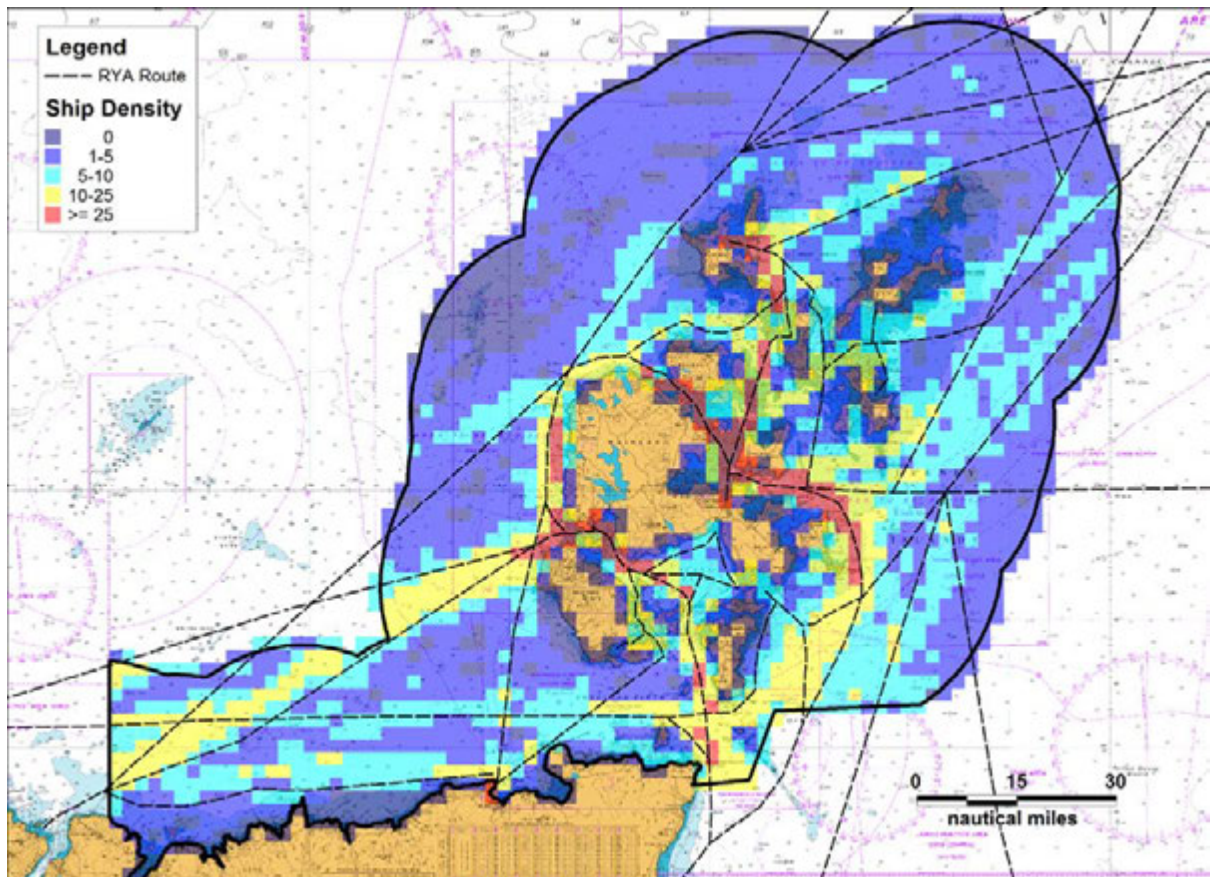


Figure 10.7 Recreational Vessel Density Plot

- Examples of year-round recreational activity, which are restricted to periods of suitable weather, include sailing, kayaking and leisure fishing.
- Tidal state and the prevailing weather conditions greatly influence recreational activity with some passages not possible given certain conditions.
- Thorough planning and the need to be readily adaptable are required in order to successfully navigate the waters around the PFOW Strategic Area.
- Overall the routes indicated by the RYA Coastal Atlas are indicative of true recreational routes used.
- However in parts the recommended routes are an over simplification and are not an accurate representation.
- Possible amendments that would increase the overall accuracy of the RYA Coastal Atlas recommended routes are included in detail in Section 8.5.4, and shown in Figure 10.8.
- Figure 10.8 also shows the lane boundaries that were estimated for recreational routes based primarily on the AIS survey data. These are presented overlaid on the survey tracks, RYA routes and amendments.

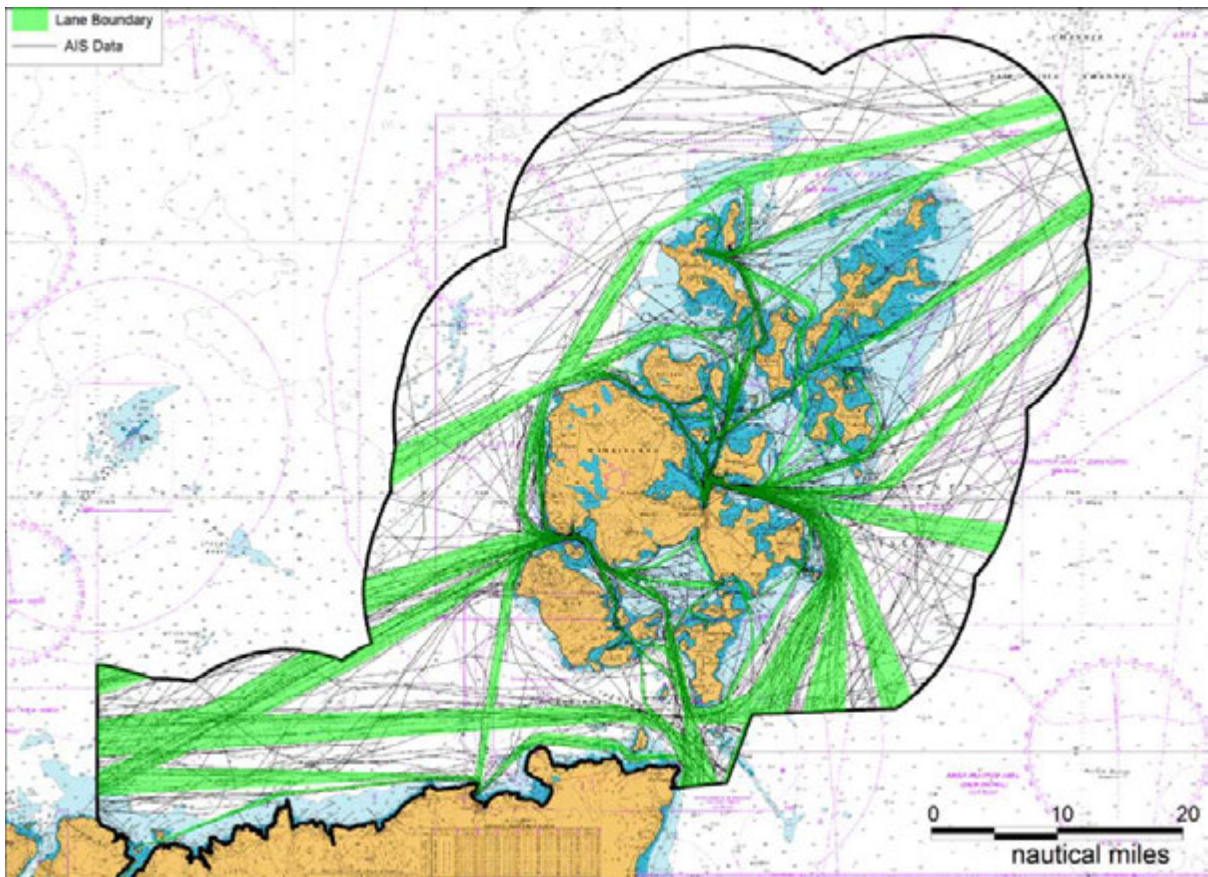


Figure 10.8 PFOW Recreational Routes and Lane Boundaries

10.4 Other Findings and Lessons Learned

Findings about other recreational activity are reviewed in Section 9 - covering dive boats, sailing clubs, sea angling, boat trips (tourism / sight-seeing / wildlife cruises) and sea kayaking – along with information collected during the course of the study on fish farm vessels (but note that commercial fishing is addressed fully in a separate Marine Scotland study). These findings noted that Kayakers are a separate, unique group that have some similarities to yacht sailors, but would benefit from further study to fully characterise their behaviours, activities and needs, e.g. in relation to sub-sea cable and other works in the nearshore.

The work, particularly stakeholder contributions, confirmed that commercial and recreational vessel activity is dynamic (e.g. economic and industry changes, current and future marina developments, impacts of ‘signposting’ by Visit Scotland, etc) and therefore it is recommended the study be updated periodically to take account of changes. Also, radar data were not accessible for this study but the consultation identified that OIC Marine Services Scapa VTS is being currently being upgraded and new radar scanners added to extend coverage. If possible, any future updates should incorporate radar survey data of smaller vessels, which would remove some of the limitations encountered in mapping recreational vessel movements. Integrating this data with the other sources would improve the accuracy of future work.

A key lesson learned was the benefit to the knowledge, its interpretation and gap-filling from the combination of Marine Scotland and the Steering Group involvement in the study’s technical discussions, in combination with data analysis and

consultation with local stakeholders. To obtain more input from some local stakeholders (e.g. local associations, diving clubs and sea anglers, etc.) in replications of this or similar studies, other means of consultation may be of help in the scope of work, e.g. attendance at one of their main events or AGM, or - if they make significant use of social networks (like Facebook) - this offers an alternative medium to engage them.

11. REFERENCES

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- iii Admiralty Sailing Directions, North Coast of Scotland Pilot, NP 52
- iv Clyde Cruising Club Sailing Directions and Anchorages for N and NE Scotland and Orkney Islands
- v Orkney Marinas website, www.orkneymarinas.co.uk/sailing_orkney.asp
- vi RYA, UK Coastal Atlas of Recreational Boating, Recreational Cruising Routes, Sailing and Racing Areas around the UK Coast, Second Edition, 2008.
- vii Cruising Association, The Cruising Almanac 2012.
- viii Scottish Sea Kayaking: Fifty Great Sea Kayaking Voyages, Cooper & Reid, 2005.
- ix The Northern Isles: Orkney & Shetland Sea Kayaking, Smith & Jex, 2007.
- x Training and Technology Onboard Ship: How seafarers learned to use the shipboard AIS, Lloyd's Register Educational Trust Research Unit, Seafarers International Research Centre (SIRC), July 2008.
- xi MCA Windfarm: Shipping Route Template from MGN 371.

Halcrow



Shipping Study of the Pentland Firth and Orkney Waters

Appendix A - Questionnaire

Prepared by:	Anatec Limited and Halcrow
Presented to:	Marine Scotland
Date:	23 November 2012
Revision No.:	04 (FINAL REPORT)
Ref.:	A2765-MS-TN-1 (App A)

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1. Questionnaire

This appendix presents a copy of the survey questionnaire that was sent to recreational vessel organisations and key individual users of the Pentland Firth and Orkney waters.

Recipients included the organisations listed in Table 1. The questionnaire was also advertised online (by Anatec and RYA) and was sent to others on the recommendation of the initial set of recipients.

Table 1 Recipient Organisations

Caithness Sea Angling Association	Orkney Marinas
Clyde Cruising Club	Orkney Sailing Club
Cruising Association	Pentland Ferries
Deerness Small Boat Owners Association	Pentland Firth Yacht Club
Gill's Bay Harbour Trust	RNLI Stations
Highland Council Harbours	Sail Orkney Yacht Charter
Holm Sailing Club	Scrabster Harbour Trust
John O'Groats Ferries	Stromness Sailing Club
Kirkwall Small Boat Owners Association	Stromness Small Boat Users Association
NorthLink Ferries	Westray Boat Owners Association
Orkney Dive Boat Operator's Association	Westray Sailing Club
Orkney Islands Sea Angling Association	Wick Harbour Authority

Q1. Information about Your Response

(a) Your Contact Details:

Name:

Email address:

Contact number:

Organisation (if applicable):

Role (if applicable):

Vessel Name (if applicable):

(b) Please provide details on how your response was prepared, e.g. personal experience, canvassing members of your organisation, etc. (tick all boxes that apply).

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

Personal Knowledge and Experience

Canvassing Members of Organisation

Published Data

Other (please comment below)

Please provide any additional information about your response below:

(c) Following a review of the responses, further consultation is planned with the aim of characterising recreational vessel activity in the study area in a standardised format.

Would you be willing to take part in further consultation: Yes / No

Is there someone else (e.g. based outside the UK, or a particularly knowledgeable member of your organisation) that you recommend we contact (not listed in Table 1):
Yes / No

If "Yes", please provide their name and contact details:

If any of the following questions are not applicable to you / your organisation, please answer "N/A" and skip to the next question.

Q2. Commercial Shipping (AIS)

Please answer the questions below on commercial shipping activity, i.e., cargo ships, tankers, passenger ferries, etc. (If not applicable to your activity, please skip this question)

(a) Please comment on the planned approach of using one month of summer (e.g., July 2012) and one month of winter AIS data (e.g., Jan 2012) to characterise commercial shipping activity, e.g. would these two months be representative for your organisation / yourself? If not, why not?

(b) Please provide details of any seasonal or occasional commercial shipping activity that takes place that may not be covered by the above two months of AIS data, such as bad weather routing, or occasional areas used for shelter / anchorage, or if 2012 is not a typical year for your activities, etc.

Q3. Recreational Vessel Activity – Description

Please describe the recreational vessel activities you (or your organisation) are involved in or have knowledge about, including:

- a. Nature of activity, e.g. racing, motor cruising, day-sailing, diving, wildlife tourism, sea kayaking, sea angling, etc.
- b. Numbers, types and sizes (e.g. length) of vessels involved
- c. Area(s) of activity (refer to Figure 1)
- d. Period of activity per area (e.g. all-year, summer only, holiday, week-days, week-ends, etc.)
- e. Frequency and intensity of activity per area (daily, weekly, monthly, annually, occasionally such as “The Tall Ships”, etc.)
- f. Do any of the vessels involved broadcast on AIS?

(Please use additional pages as needed. Where convenient, attach additional information or references, e.g. charts, website links, etc.)

Q4. Important Areas

With respect to your organisation or personal use, please identify the sea areas you consider most important for recreational vessel activity, e.g. training areas, anchorage areas, etc.

Please state why and for which type(s) of activity these areas are most important, and if you believe this is likely to change in future (or not).

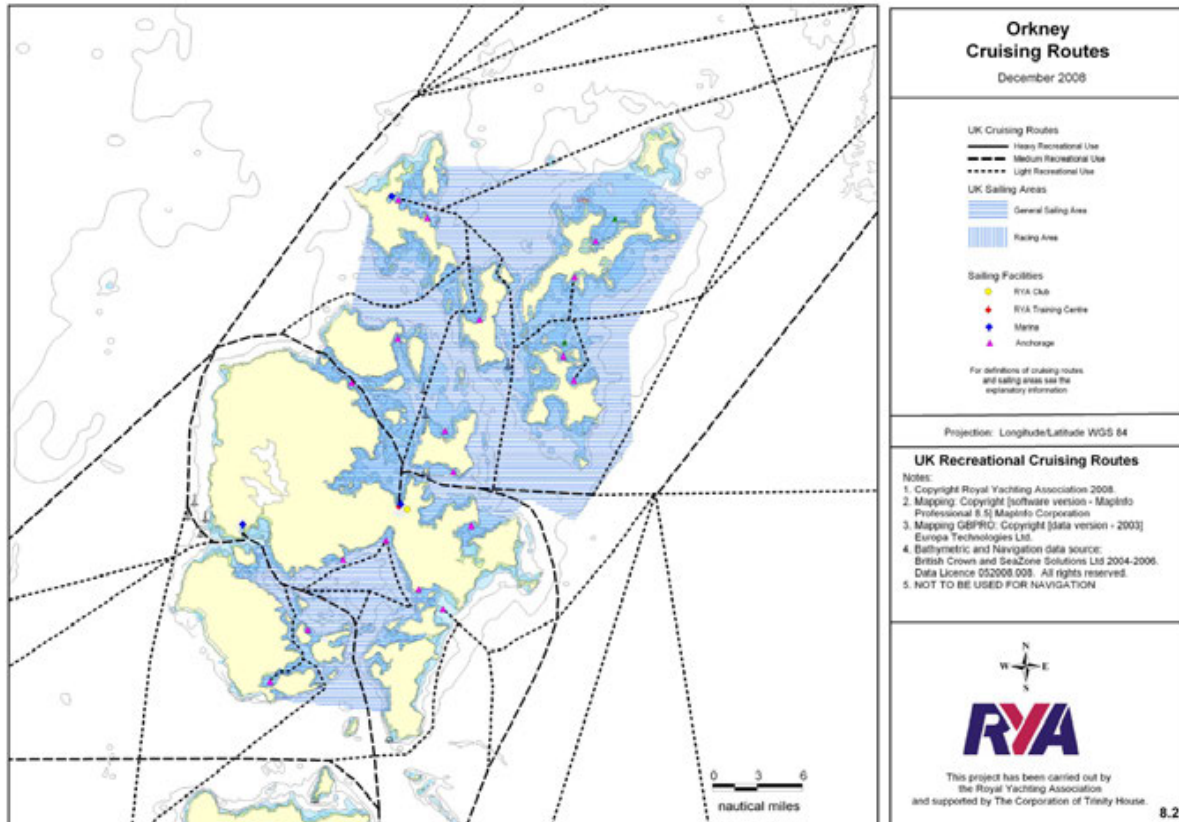
Q5. Recreational Vessel Activity – Effect of Tide and Weather

Tidal and weather conditions are known to be major influencing factors on recreational vessel activity in the Pentland Firth and Orkney Waters. Please comment below how tide and weather affects your activity, e.g. when might it be cancelled, or how do conditions affect the area used or routes taken?

Q6. Recreational Vessel Activity – RYA Coastal Atlas

The *RYA Coastal Atlas* publishes information on the main cruising routes, sailing and racing area for the whole UK, and is a valuable reference source for this work. However, information is known to be lacking in places (e.g. Pentland Firth and Eynhallow Sound).

Please provide comments on the map below, e.g., where routes or areas could be edited, removed or added for greater accuracy, and provide a basis for recommended changes.



Please comment below (use additional pages as necessary):

Q7. Further Input

Please use the space below to provide any further input you believe is relevant to this work (e.g. issues not covered by the previous questions).



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