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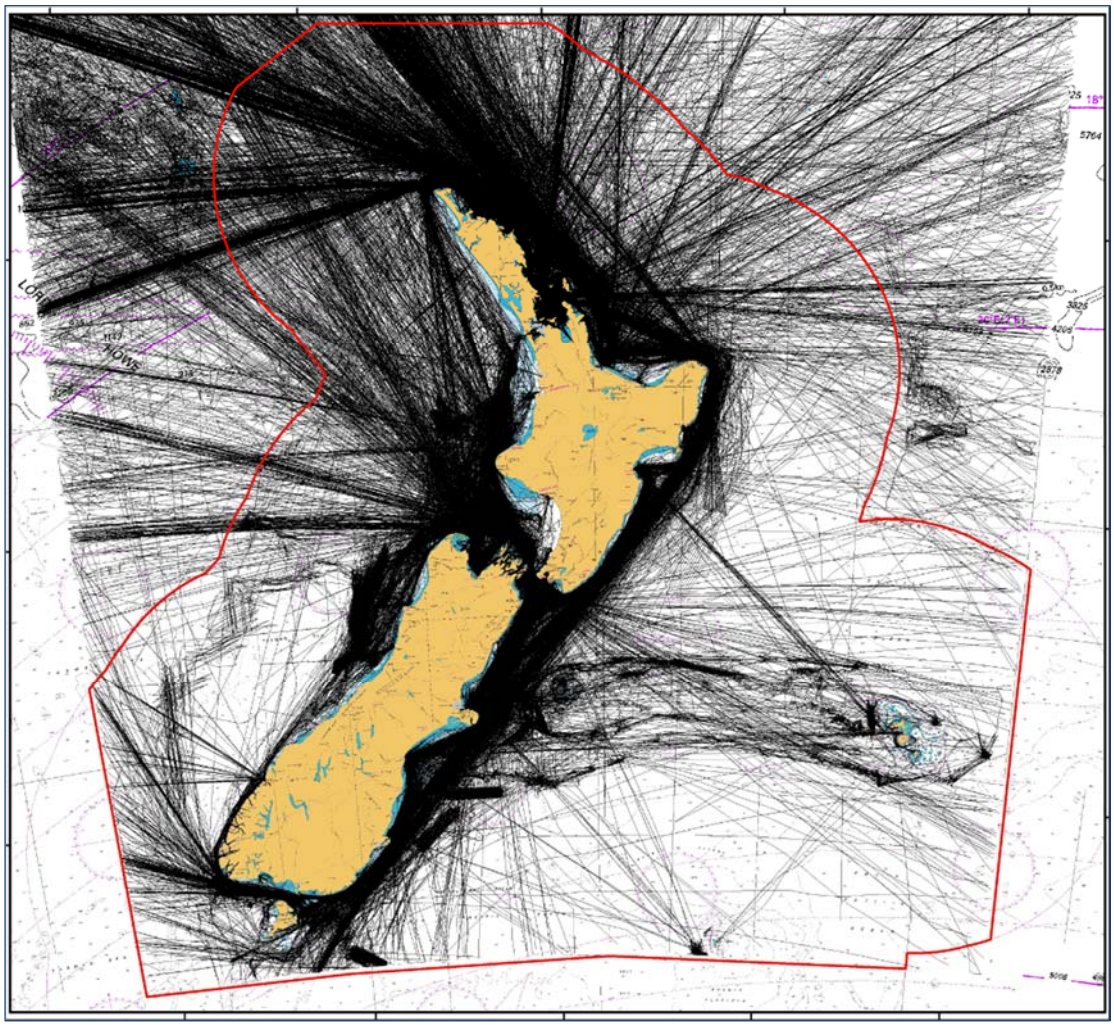
NEW ZEALAND HYDROGRAPHIC RISK ASSESSMENT - SOUTH ISLAND



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NEW ZEALAND HYDROGRAPHIC RISK ASSESSMENT - SOUTH ISLAND

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ABBREVIATIONS

Abbreviation	Detail
AMA	Aquaculture Management Area
ATBA	Area To Be Avoided. An IMO approved routeing tool, which is printed on the chart, where a sea area is close to SOLAS traffic in accordance with agreed criteria. ATBAs are normally used in sea areas of high ecological value to a coastal state, such as a marine reserve.
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
AtoN	Aid to Navigation
b	Billion
CATZOC	Category of Zone of Confidence in data, an IHO S57 attribute of the MQUAL object
CPZ	Cable Protection Zone
DG	Dangerous Goods
DOC	Department of Conservation
DQWG	Data Quality Working Group
DUKC	Dynamic Under Keel Clearance
DWT	Deadweight, a measure of a vessel's weight carrying capacity
ECDIS	Electronic Chart Display Information System
EEZ	Exclusive Economic Zone
ENC	Electronic Navigational Chart
FIGS	Freight Information Gathering System
FSA	Formal Safety Assessment
GDP	Gross Domestic Product
GIS	Geographic Information System
GRT	Gross Registered Tonnage
GT	Gross Tonnage
ha	Hectare
HW	High Water
IHO	International Hydrographic Organization
IMO	International Maritime Organisation
ISS	International Space Station
ITU	International Telecommunications Union (Marine communication standards)
JAS	Japanese Agricultural Standard
km	Kilometre

kt	Knot (unit of speed equal to one nautical mile per hour)
LAT	Lowest Astronomical Tide
LOA	Length Overall
LW	Low Water
m	Metre
M	Million
ML	Most Likely
MMSI	Maritime Mobile Service Identity. A series of nine digits, uniquely identifying a vessel, sent in digital form by an AIS transponder
MNZ	Maritime New Zealand
MPI	Ministry for Primary Industries
MQUAL	Accurate quality of data, an area within which a uniform assessment of the quality of the data exists
nm	Nautical Mile
NtoM	Notice to Mariners
PEC	Pilotage Exemption Certificate
POAL	Ports of Auckland Limited
RoRo	Roll-on / Roll-off vessel
S-AIS	Satellite (received) Automatic Identification System
SBM	Single Buoy Mooring
SOLAS	The International Convention for the Safety of Life at Sea
STCW	Standards of Training Certification and Watch keeping
T	Tonnes
T-AIS	Terrestrial (received) Automatic Identification System
TEU	Twenty Foot Equivalent Unit, based on the volume of a twenty foot container
UNCLOS	United National Convention on the Law of the Sea
VHF	Very High Frequency (radio communication)
VMS	Vessel Monitoring System
VTS	Vessel Traffic Service
WC	Worst Credible
ZOC	Zone of Confidence

1 INTRODUCTION

This report is part of four documents which report on a Hydrographic Risk Assessment for the sea area comprising the New Zealand Exclusive Economic Zone (EEZ) excluding the Sub-Antarctic islands (south of 48°S latitude) and the Kermadec Island shelf, and was carried out at the request of Land Information New Zealand (LINZ). It is important therefore to note that the views expressed in this publication do not necessarily reflect those of the New Zealand Government.

This Risk Assessment uses Geographic Information System (GIS) spatial analysis techniques to identify areas of hydrographic risk using data-based evidence. The data used is in layers (39) with a base layer of a 12 month traffic record, taken from AIS data. The study uses this comparative risk technique to assist LINZ to effectively prioritise future hydrographic surveys and charting improvements throughout the EEZ.

This Hydrographic Risk Assessment identifies important areas of benefit for charting improvements, based on the needs of contemporary shipping for the provision of accurate and adequate nautical charts. From this analysis, LINZ can develop a survey and charting development programme that will span a number of years. The prioritisation and content of the work programme will be part of the LINZ decision-making process associated with planning of its resource deployment.

The main report is in three parts: a New Zealand Overview (15NZ236-A), the North Island (15NZ236-B) and the South Island, this document. There is a separate Synopsys (15NZ236-D) – the fourth component.

This report, 15NZ236-C presents detailed results for the South Island risk assessments.

For a more complete understanding of the background information and methodology of the risk project as well as overall discussions and conclusions, the Overview Document (15NZ236-A) needs to be consulted.

1.1 BACKGROUND

The use of risk-based techniques to prioritise a hydrographic work programme provides added value to the selection of candidate areas for hydrographic survey. The LINZ Hydrographic methodology, between varieties of coastal areas, each with differing bathymetry and trading/growth characteristics. Risk is only one factor that the methodology takes into account. For example, the economic activity in an area dictates the ship types and sizes that serve the area, but information about the potential for economic growth has also been used, as realisation of that potential may result in an increase in vessel traffic volume, and possibly vessel type and size. Thus there are three

key components (risk, ship types and sizes; economic growth) that, when combined, provide the evidence required to promote one area over another for hydrographic survey prioritisation.

A location with outstanding environmental status provided the fourth factor in prioritisation; an incident in any area sensitive to environmental damage provides increased consequence impact. Environmental damage in an area with economic activity linked to environmental utility provides further consequence impact. Grounding consequence in both environment and economics is related to the release of bunkers or cargo. Environmental status is therefore attached to risk, which is linked to vessel size and type.

The maritime trade around the New Zealand coast, in common with the rest of the world, has changed dramatically in recent decades. Larger, faster cargo vessels are calling at fewer hub ports, feeder services have increased and there has been a dramatic increase in cruise ship calls, with visits by large vessels to remote locations becoming increasingly common place. This trend of growth is projected to continue.

The risks associated with the use of out of date chart data have therefore increased significantly in recent years and there is a need to systematically re-survey many areas around the NZ coast. There is both a budgetary and a practical need, though, to prioritise. This report considers a methodology to enable prioritisation. It is risk based, but combines the economic drivers with the risk considerations. This process is a crucial base for survey planning, as comprehensive statistical data was available in few areas. It was also unknown if groundings have occurred that could be directly linked to out of date or inaccurate charts, therefore the risk work was mainly proactive.

The prioritisation process is not only risk based, but transparent against set criteria. It also needs to be clearly documented, systematic and recorded in a uniform manner. To achieve this, the methodology and required input data was uniformly applied across the candidate harbours, coastal and ocean areas.

The overall severity of impacts from a marine accident on a coastal zone is dependent on a large number of factors. Areas of economic success or environmental importance can be severely affected, but severity of impact is dependent on their distance from the casualty. Longer term impacts on trade, especially tourism, are also lessened the greater the distance from the event. Severity of consequence are thus geographically relevant and the best way to assess such impacts is to employ a Geographical Information System to evaluate the risk.

This risk based result will significantly benefit hydrographic decision-making and will identify the areas that are priority candidates for charting improvements.

1.2 PROJECT SCOPE

The geographical scope comprises the development of a Hydrography Risk Assessment for the New Zealand waters within the Economic Exclusion Zone, excluding the Sub-Antarctic islands (south of 48°S latitude) and the Kermadec Island shelf. The scope includes the development of a charting benefit model to identify where areas of heightened hydrographic risk can be improved through charting re-organisation or hydrographic survey upgrades.

In more detail, this comprises: -

- Decoding, cleaning and post-processing to prepare a fused AIS data set, made up from raw Terrestrial and Satellite AIS data. AIS data is transmitted by all SOLAS ships in service over 350 gross tons and some NZ domestic registered vessels. A small number of non-SOLAS foreign vessels (e.g. superyachts) also transmit AIS data.
- Undertaking a programme of data gathering throughout New Zealand, categorised by the boundaries of each Regional Council region (stakeholders included Regional Councils, port & harbour companies). This included the development of a Data Catalogue, ordered by Regional Council jurisdiction.
- Provision of traffic analysis of all SOLAS vessel types and domestic vessels, including traffic frequency, density and type.
- Developing risk criteria appropriate to the NZ data volume and ship traffic types.
- Developing a hydrographic risk model using the developed risk criteria.
- Developing a hydrographic chart benefit model for New Zealand waters.
- Provision of a purpose-built database to catalogue and store all the data gathered.

1.3 OFFICIAL NAUTICAL CHARTS

Reliable up-to-date nautical chart information is vital for safe navigation. As the New Zealand Hydrographic Authority (NZHA), LINZ charts the country's surrounding sea and environs, from the South West Pacific to the Antarctic, as mandated by the International Hydrographic Organisation (IHO), to meet NZ's treaty law obligations under SOLAS[1].

Nautical charts and nautical publications, such as sailing directions, light lists, notices to mariners, tide tables and other nautical publications necessary for the intended voyage, are required under SOLAS Regulations to be carried on board; to be adequate and to be up to date, for all SOLAS vessels.[2]

[1] **IMO SOLAS Chapter V, Regulation 9 Hydrographic Services**

[2] **IMO SOLAS Chapter V Regulation 27 Nautical Charts and Nautical Publications**

Additionally, Maritime Rules Part 25 sets out the requirements for the carriage of charts and nautical publications on ships. It applies, with certain specified exceptions, to commercial vessels of 12m or more in length overall that operate within enclosed water limits and all commercial vessels operating outside the enclosed water limits.

The mariner must also use the largest scale chart available and suitable for the type of navigation being undertaken.

1.4 DATA USED IN THE PROJECT

1.4.1 AUTOMATIC IDENTIFICATION SYSTEM DATA (AIS)

A full 12 months record of shipping traffic using New Zealand waters has been used as a core input into the Hydrographic Risk Assessment. Traffic was broken down into ship types as transmitted by AIS transponders fitted to all internationally trading vessels ('SOLAS' vessels) and most domestic vessels carrying passengers for commercial gain (. i.e. entered into SSM or MOSS). Covering a twelve month span, this is the most comprehensive record of ship traffic used on any New Zealand based safety assessment[3], which has been corrected against ship data held by the ITU.

The terrestrially recorded AIS traffic record was supplied by Marico Marine from their national recording database. Additional data was supplied by LINZ from the NZ Government system, which assisted in a QA of the data record and infill where the reception record could be improved. Both terrestrial data sets were used to provide a database with the best records of coverage.

For areas where no terrestrial coverage was available, Satellite recorded AIS (S-AIS) data was used. The primary S-AIS data was sourced from exactEarth, with infill provided by S-AIS recorded by Orbcom in the Government system. ExactEarth satellite data was used because of its frequency of data update as well as superior recording of time in relation to a vessel's position. This improved the link between terrestrial datasets (which are real time) and satellite, which suffers some delay until the data is downloaded to a ground station, at which time the time stamp is added to the received data[4].

As any S-AIS data is not recorded real time and is intermittent in nature, tracks will be linked together by a computer, not necessarily reproducing the exact track taken by a vessel. Where data showed

[3] **The most recent coastal safety review used a three month record of AIS data.**

[4] **AIS data does have a time within it, but this is a time breakdown within a second to allow two AIS transponders in an area to synchronise transmission and reception (and thus avoid data collisions). AIS "time" does not include minutes (or hours), so remote reception needs to add those time elements when the data is received. Dependent on any delays from transmission to reception.**

tracks in obvious error (e.g. crossing land), these were manually corrected. Thus the final track database used for the project will contain some minor inaccuracies and should not be relied on as an exact record of any vessel.

1.4.2 ADDITIONAL DATA COLLECTED

A key component of the risk assessment was the gathering of location information and local data to support the identification of risk areas and provide local input to assist with prioritising future hydrographic surveys.

Harbour Masters, Councils' representatives, Port Company Operators and other key stakeholders were interviewed in each region during data gathering visits.

Statistics of vessel movements, vessel types and sizes were compiled from data supplied by stakeholders, augmented with data publically available from the internet.

Where GIS shapefiles of sensitive sites and other data sets were available from stakeholders, principally from Councils' Tier 2 Marine Oil Spill Plans, these were uploaded directly into the GIS risk model.

Shapefiles of Marine Reserves were supplied by the Department of Conservation (DOC); the Ministry for Primary Industries (MPI) supplied data sets of fishing vessel routes for the study year.

1.5 NEW ZEALAND CHARTING DEFINITIONS

Hydrographic charts have two functions: marine navigation and information sources. Most hydrographic offices have an obligation to provide nautical chart cover of their national waters and any other waters under their jurisdiction, to such an extent and on such scales as to permit safe navigation for all classes of vessel from the smallest to the largest, throughout coastal waters including large ports to minor inlets of purely local interest.

1.5.1 CHART ADEQUACY

Charting scales, extents of coverage and quality of seafloor coverage all combine to denote chart adequacy. The adequacy of nautical charts is complex but the components overall that contribute to the LINZ measure of charting adequacy can be represented by the diagram below.

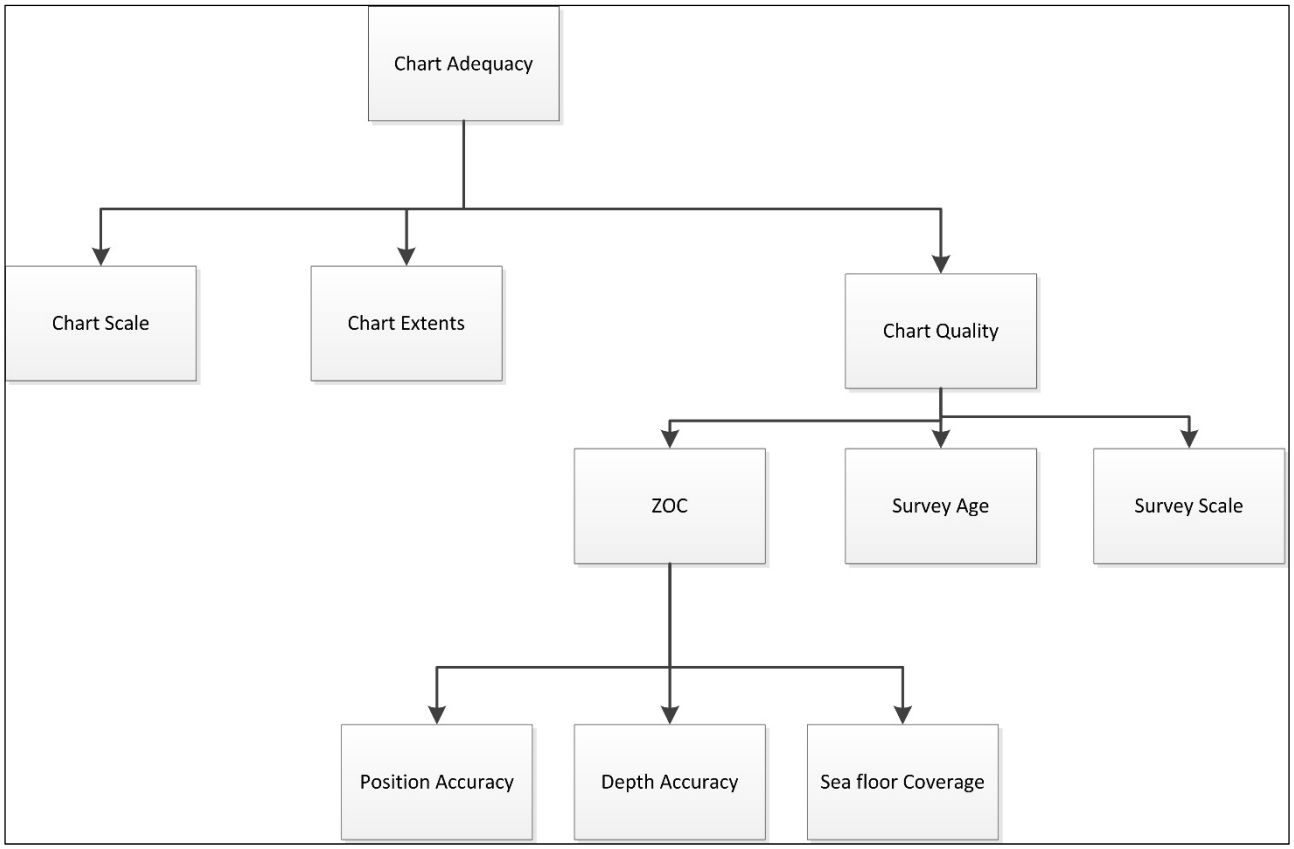


Figure 1: Chart Adequacy

1.5.2 CHART SCALE

National nautical chart series usually encompass the largest scale publications available, showing the detailed configuration of the seabed offshore. Information about the shape of the seabed is used by a variety of users other than navigators: dredging contractors, construction engineers, defence departments and so on.

The combined effect of the requirements of marine navigation and providing an information source has caused the national chart series to cover national waters in varying detail, reflected by the large scales used for port plans, and usually the existence of at least two continuous coastal series, one on a relatively large scale, the other slightly smaller.

With the advent of ECDIS (Electronic Chart Display Information System), the IHO members have agreed recommended scale ranges for

- Offshore charting
- Coastal charting
- Harbour Approach charting
- Berthing charting

The New Zealand charting area under consideration includes coastal, approach and harbour charts of scales from 1:75,000-1:4,000,000 for medium scale coastal charts, to 1:5,000-1:75,000 for large scale or harbour charts. These charts are all published on the WGS 84 geodetic datum. All New Zealand Charts for the area inside the EEZ now have depths and heights in metres. Previous versions with depths in fathoms and heights in feet have all been withdrawn.

By policy, LINZ use the following guidance for the scales of their NZ chart portfolio. A range of different scales are recommended for the stated type of navigational use, which sets the scales for printed charts. The LINZ policy is in accordance with the IHO recommendations for navigation type.

LINZ Navigational Purpose Scale Ranges (Paper Charts)			
Subfield	**Navigation**	**Purpose**	**Available Compilation Scales for ENC charts**
1	Overview	>=3,000,001	1:3,000,000
2	General	800,001 – 3M	1:3,000,000 1:1,500,000 1:700,000
3	Coastal	80,001 – 800K	1:700,000 1:350,000 1:180,000 1:90,000
4	Approach	25,001 – 80K	1:90,000 1:45,000 1:22,000
5	Harbour	8,001 –25K	1:22,000 1:12,000 1:8,000
6	Berthing	>=8K	1:8,000 1:4,000

Table 1: LINZ Paper Chart Compilation Scale

A ship's ECDIS will comply with the standard scale table (**Table 2**) when a charting range is selected on the ECDIS system. Setting the range on an ECDIS will select the chart data scale nearest to the chosen setting. For harbour approaches, the system should automatically change scale to the charting scale as recommended. This provides the mariner with a paper charts scale to ENC Scale Conversion. The paper chart compilation scale is rounded down to the nearest ENC compilation Scale (e.g. Paper Chart 20,000 = ENC 12,000).

One of the key tests in the charting benefit model is to determine if chart data is available at the right scale (as recommended by IHO) for the navigational purpose of the area in which a vessel was navigating.

Radar Range / Standard Scale Table (ENC)	
Selectable Range (in nautical miles)	**Standard Radar Scale (rounded)**
200	1:3,000,000
96	1:1,500,000
48	1:700,000
24	1:350,000
12	1:180,000
6	1:90,000
3	1:45,000
1.5	1:22,000
0.75	1:12,000
0.5	1:8,000
0.25	1:4,000

Table 2: IHO ENC Compilation Scale

1.5.3 CHART EXTENTS

LINZ produces official nautical charts for safe navigation in New Zealand waters and is in addition the charting authority for the sea areas south of New Zealand to Antarctica as well as a significant area of the South-West Pacific.

This hydrographic risk assessment covers from the NZ coast to the NZ Economic Exclusion Zone, excluding the Sub-Antarctic islands (south of 48°S latitude) and the Kermadec Island shelf.

1.5.4 CHART QUALITY

Chart quality may be said to comprise of three factors: Zone of Confidence (ZOC); survey age and survey scale. LINZ has policy to add the MQual Charting Quality CATZOC rating to its charts and has done this to almost all of its coastal charting series[5]. The CATZOC rating is of help to the navigator as well as a Hydrographic Risk assessment and presently the rollout programme extends to the Coastal Chart portfolio.

[5] **Not all Hydrographic offices have this policy, which makes LINZ a leader in this area; others are following. As Hydrographic Risk is much better informed by the ZOC rating of a chart, this LINZ policy is important.**

To date, New Zealand has provided quality indicators on all of its hydrographic charts by way of Source Data Diagrams and Diagrams of Sounding Line Density.

1.5.4.1 ZONE OF CONFIDENCE

The IHO Data Quality Working Group (DQWG) developed ZOCs as a solution for the assessment and display of hydrographic data quality to support safe and efficient navigation. Areas covered by hydrographic surveys are classified by identifying various levels of confidence with respect to depth accuracy, position accuracy, thoroughness of seafloor search, and the characteristics of the survey. Six ZOC have been developed - A1, A2, B, C, D and U. To decide on a ZOC Category, all conditions outlined in columns 2 to 4 of the table must be met.

1	2	3		4	5
ZOC[1]	**Position Accuracy[2]**	**Depth Accuracy[3]**		**Seafloor Coverage**	**Typical Survey Characteristics[5]**
A1	± 5 m + 5% depth	= 0.50 + 1%d		Full area search undertaken. Significant seafloor features detected[4] and depths measured.	Controlled, systematic survey[6] high position and depth accuracy achieved using DGPS or a minimum three high quality lines of position (LOP) and a multibeam, channel or mechanical sweep system.
		Depth (m)	Accuracy (m)		
		10 30 100 1000	± 0.6 ± 0.8 ± 1.5 ± 10.5		
A2	± 20 m	= 1.00 + 2%d		Full area search undertaken. Significant seafloor features detected[4] and depths measured.	Controlled, systematic survey[6] achieving position and depth accuracy less than ZOC A1 and using a modern survey echosounder[7] and a sonar or mechanical sweep system
		Depth (m)	Accuracy (m)		
		10 30 100 1000	± 1.2 ± 1.6 ± 3.0 ± 21.0		
B	± 50 m	= 1.00 + 2%d		Full seafloor coverage not achieved; uncharted features, hazardous to surface navigation are not expected but may exist.	Controlled, systematic survey achieving similar depth. But lesser position accuracies than ZOCA2, using a modern survey echosounder[5], but no sonar or mechanical sweep system.
		Depth (m)	Accuracy (m)		
		10 30 100 1000	± 1.2 ± 1.6 ± 3.0 ± 21.0		
C	± 500 m	= 2.00 + 5%d		Full seafloor coverage not achieved, depth	Low accuracy survey or data collected on an opportunity basis such as soundings on passage.
		Depth (m)	Accuracy (m)		

1	2	3		4	5
ZOC[1]	**Position Accuracy[2]**	**Depth Accuracy[3]**		**Seafloor Coverage**	**Typical Survey Characteristics[5]**
		10 30 100 1000	± 2.5 ± 3.5 ± 7.0 ± 52.0	anomalies may be expected.	
D	worse than ZOC C	worse than ZOC C		Full seafloor coverage not achieved, large depth anomalies may be expected.	Poor quality data or data that cannot be quality assessed due to lack of information.
U	Unassessed – The quality of the bathymetric data has yet to be assessed				

Table 3 : CATZOC Categories

The plot below shows the Zone of Confidence ratings for the LINZ portfolio in New Zealand coastal waters.

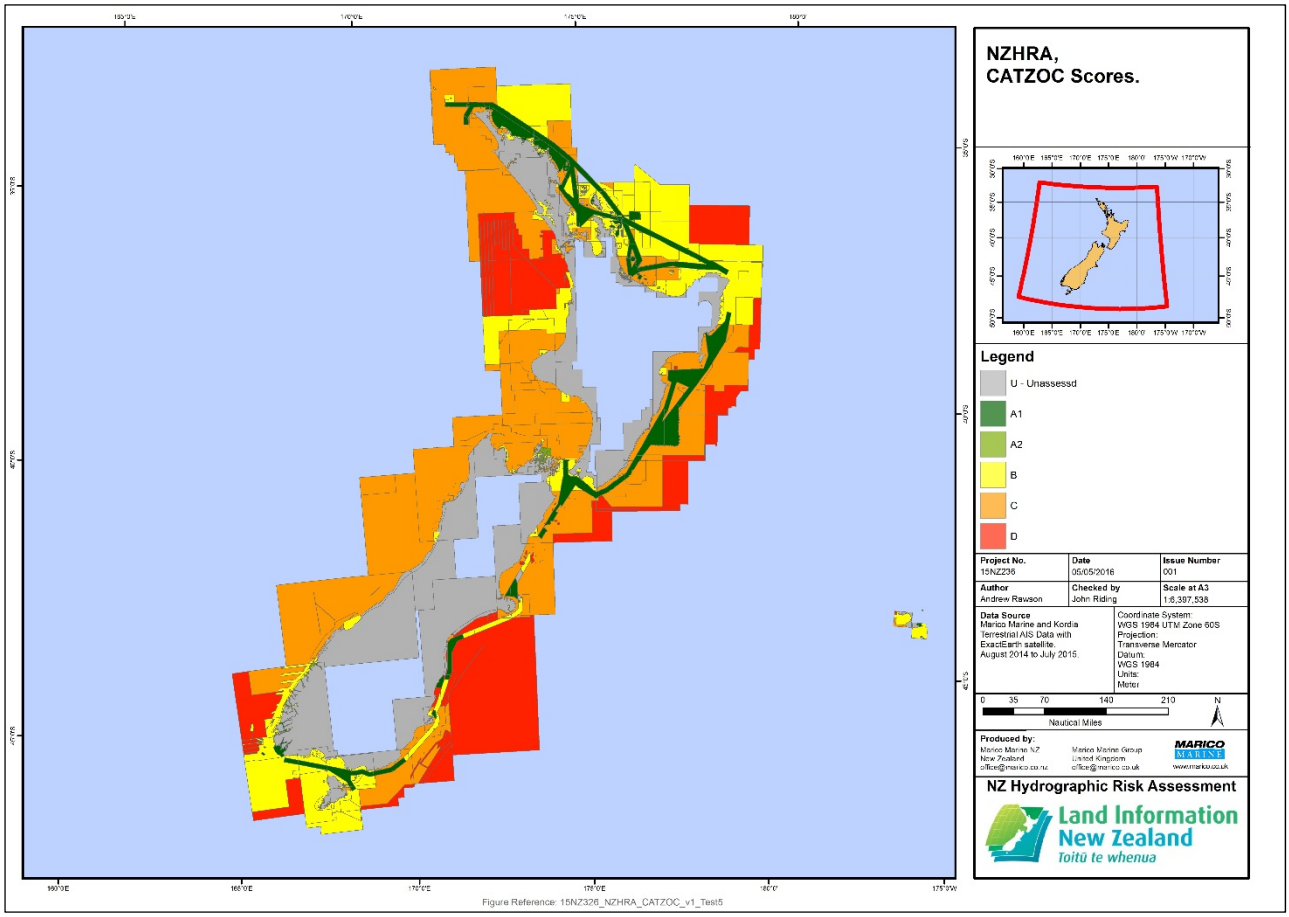


Figure 2 : Zone of Confidence for NZ Chart Portfolio

1.5.4.2 SURVEY AGE

Whilst in general, the main New Zealand ports may have been surveyed within the last 20 years, significant parts of the main ports' published charts rely on surveys conducted over 60 years ago. For example, Marlborough Sounds chart NZ 6153 has large areas of survey data dating from 1956, including sections of Tory Channel and Queen Charlotte Sound (northern approach to Picton). These routes incorporate the Cook Strait ferry services, with over 1.2M passenger transits each year, see **Figure 3,** below.

Anecdotal reports from Port operators and Harbour Masters indicate that these areas may have in fact been regularly sounded, for example by port or Harbour Master workboats, but the data has either not been passed on to LINZ for updating the charts, or has been passed on to LINZ but not incorporated into the charts. There remains concern with the underlying problem of liability associated with not updating charts.

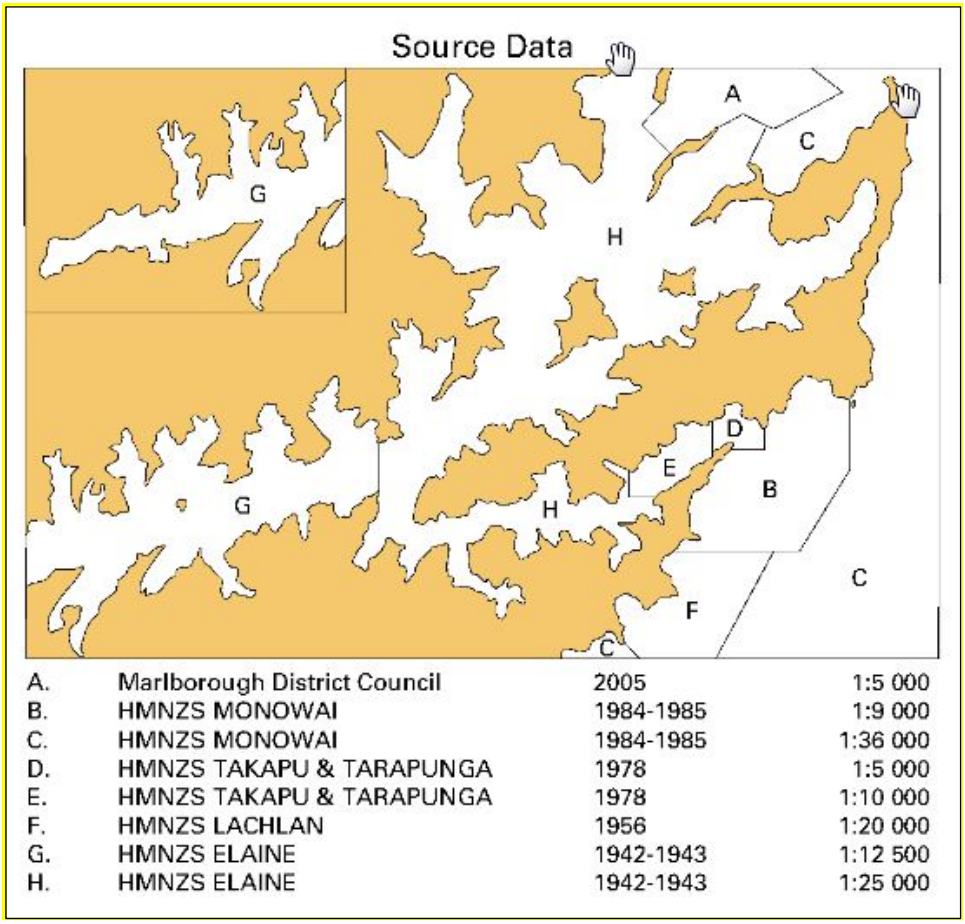
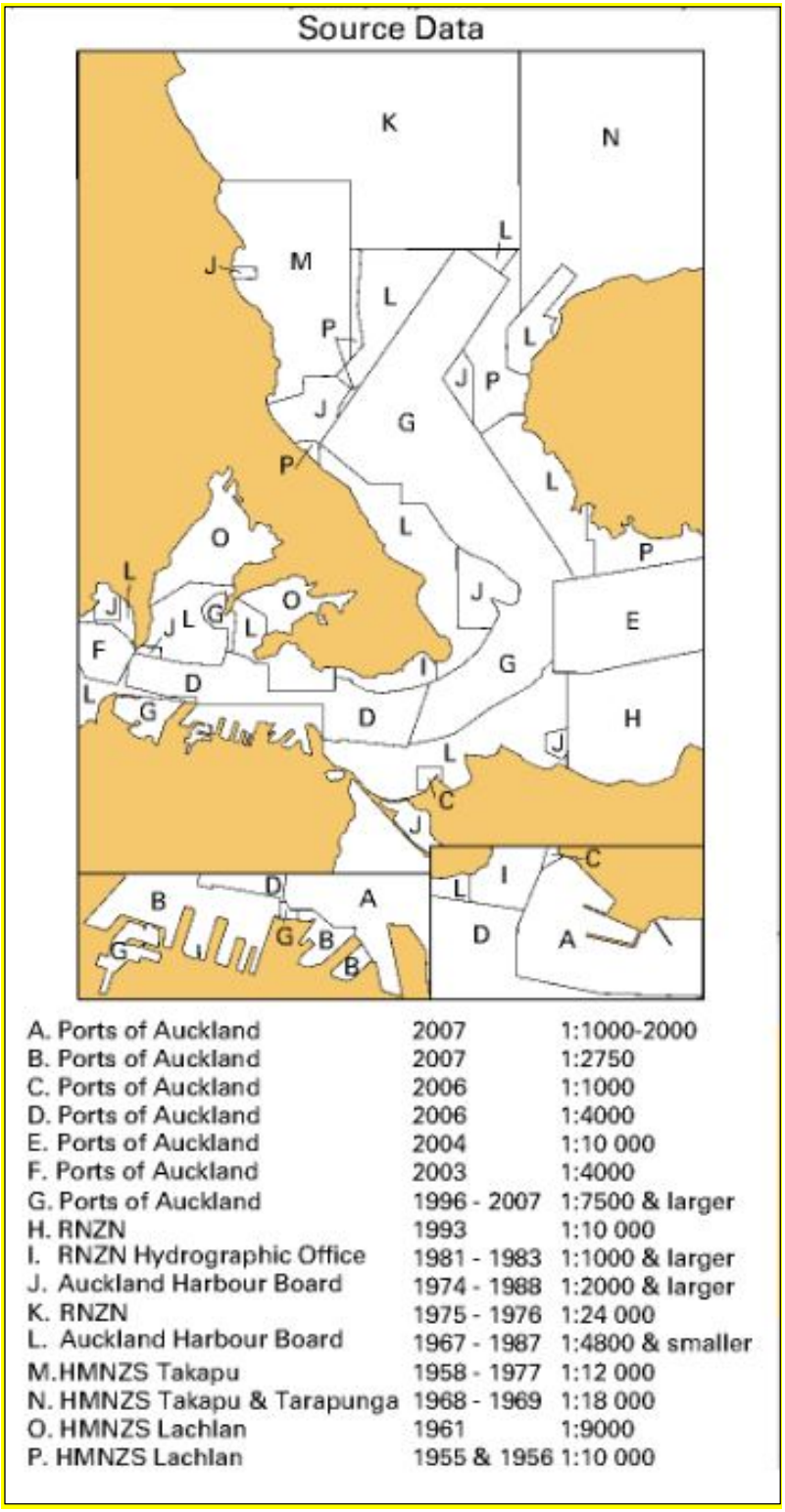


Figure 3: Chart NZ 6153 Marlborough Sounds – 1942 Source Data

Auckland Harbour East chart NZ 5322, which includes the main approach channel to the Port of Auckland (with over 1500 ship calls in 2014) shows areas adjacent to the main shipping channel, that were last surveyed in 1955. (Refer **Figure 4)**



A. Ports of Auckland	2007	1:1000-2000
B. Ports of Auckland	2007	1:2750
C. Ports of Auckland	2006	1:1000
D. Ports of Auckland	2006	1:4000
E. Ports of Auckland	2004	1:10 000
F. Ports of Auckland	2003	1:4000
G. Ports of Auckland	1996 - 2007	1:7500 & larger
H. RNZN	1993	1:10 000
I. RNZN Hydrographic Office	1981 - 1983	1:1000 & larger
J. Auckland Harbour Board	1974 - 1988	1:2000 & larger
K. RNZN	1975 - 1976	1:24 000
L. Auckland Harbour Board	1967 - 1987	1:4800 & smaller
M. HMNZS Takapu	1958 - 1977	1:12 000
N. HMNZS Takapu & Tarapunga	1968 - 1969	1:18 000
O. HMNZS Lachlan	1961	1:9000
P. HMNZS Lachlan	1955 & 1956	1:10 000

Figure 4: Chart NZ 5322 Auckland Harbour East - 1955 Source Data

The size of vessels and the accuracy of navigation now possible using satellite derived positioning are significantly different from the original intended purposes for which many existing charts were derived. The mariner is advised accordingly, both during training and by remarks on the charts and source data advice. This mitigates liability risk by providing clarity of chart limitations.

Despite this, there remains a reasonable concern that inadequate and inaccurate nautical charting could adversely affect safety of life at sea and the protection of the marine environment. It may also inhibit maritime trade, thereby adversely affecting the economy of some regions. There remains a potential for liability associated with not providing fit for purpose charts.

1.5.5 NZ CHART PORTFOLIO

The New Zealand official chart Portfolio comprises some 242 charts, including plans and insets, which fall within the IHO recommended range for navigational purpose as follows: -

Navigational Purpose Scale Range	No. of Charts
General	10
Coastal	47
Approach	70
Harbour	82
Berthing	33
Total	**242**

Table 4 : NZ Chart Portfolio

2 HYDROGRAPHIC RISK RESULTS - TASMAN REGION

2.1 INTRODUCTION – TASMAN REGION

Tasman District is administered by the Tasman District Council, a unitary authority. Tasman's coast is dominated by the large, shallow Golden Bay, with golden sand beaches and the 40 km long sands of Farewell Spit, making the district a popular destination for tourists.

Fifty eight percent of the region is covered by national parks. Sea kayaking, especially along the Abel Tasman National Park coastline, has become a major tourism business.

Golden Bay claims the best scallop beds in NZ and a growing mussel industry. The scallops are fished by towing dredges along the seabed with both recreational and commercial fishers enjoying a good harvest. Scallop spat is collected in this region and released onto the shellfish beds.

2.2 TASMAN PORTS - TARAKOHE, MOTUEKA, MAPUA, AND RIWAKA

Tasman District Council has responsibility for four small ports throughout the District. These are located at Tarakohe, Motueka, Mapua, and Riwaka. In addition, Tasman District Council owns 50% of Port Nelson Limited in a joint venture operation with Nelson City Council.

Port Tarakohe, which was once a busy coal, marble and cement port with four ships servicing the cement trade alone, now has only the *Anatoki* as a regular cargo vessel caller, to load dolomite in bulk. Tarakohe has a 61 berth recreational and commercial marina and is home to a number of commercial vessels; mostly mussel boats and boats for spat collection.

Motueka, on the western shore of Tasman Bay, was once an important trading port, with coastal scows loading horticultural products, hops, tobacco, bacon, timber and marble. In 1955, 276 vessels officially entered the port. Passenger services once operated between Riwaka, Motueka and Nelson. Talley's Group was established in 1936 and its fishery is one of the town's largest employers.

The main users of Motueka port today are Abel Tasman Sea Shuttle, the Power Boat Club, a Yacht and Cruising Club and Talley's Fisheries. The Motueka Power Boat Club has a 40 berth marina with plans to increase the total number of berths to 87 in the future.

At Mapua, a former horticultural, lime, marble and timber export port on the coastline of Tasman Bay, there is a ferry across the river which operates continuously during the summer. A tidal stream of up to 4.5 kn flows through the Mapua channel at springs and it is not normally possible to anchor in the river due to the hard cobble seafloor. There is a shallow bar at the entrance to Mapua with strong overfalls on the north-west side during ebb tide.

Other former Golden Bay Ports include Tarakohe, Waitapu, Puponga and Collingwood.

2.3 AREAS OF RISK SIGNIFICANCE – TASMAN REGION

The Tasman is home to three national parks, only one of which has coastline relevant to the hydrographic risk assessment. This is the Abel Tasman National Park, created in 1942.

There are two marine reserves in the Tasman Bay. The Tonga Island Marine Reserve (in the Abel Tasman National Park) covering an area of 1,835 ha, which extends one nm offshore from the mean high water mark of Tonga Island. The second is along the coastline between Awaroa Head and the headland separating Bark Bay and Mosquito Bay.

On the western coast of Golden Bay, Westhaven contains a marine reserve in the southern third and a wildlife reserve over the remaining two-thirds. It is the first estuary in New Zealand to be protected by a combination of marine and wildlife reserve. The reserve covers 536 ha of tidal sandflats and channels within Whanganui Inlet.

At Farewell Spit 112 bird species have been recorded – the spit sees great migrations of godwits, Mongolian dotterels, curlews, little whimbrels, grey-tailed tattlers and turnstones. It is also known for its whale strandings: in 1991, 325 whales came ashore.

Fishing is prohibited in certain areas of Tasman and Nelson district waterways including Tonga Island Marine Reserve (Abel Tasman) and Whanganui Inlet Marine Reserve (Golden Bay).

There are two operational Aquaculture Management Area (AMA) sites in Golden Bay for mussel farming, mussel spat catching and scallop spat catching; and one AMA site in Tasman Bay, also for mussel farming, mussel spat catching and scallop spat catching. At the approaches to Wainui Inlet, there is a marine farm in the shelter of the headland. This is marked on the Abel Tasman chart NZ 6144.

2.4 ECONOMIC SUMMARY – TASMAN REGION

In Golden and Tasman Bays around 6,500 ha of water space is zoned for marine farming and seasonal spat catching. Golden and Tasman Bays produce 4% of NZ's total Greenshell mussel production. The Tasman economy is based on tourism. Water Taxis are active in carrying passengers to and from locations in the Abel Tasman Park.

2.5 CHARTING INFORMATION OBSERVATIONS – TASMAN REGION

Large areas of Tasman Bay were last charted in 1957. A LIDAR survey of Mapua entrance was carried out in 2014 however the data collection standard was uncertain. Chart source data for the Mapua inset plan on NZ 614 indicates this area was last surveyed in 1986.

2.6 TRAFFIC ANALYSIS – TASMAN REGION

This section provides plots of all traffic within the Tasman Region. A plot of all vessel types recorded in the Tasman Region, for the study year 2014-15, is shown below.

Types of commercial vessels using Tasman Region include:

- General and Break-bulk
- Passenger cruise
- Charter boats and water taxis
- Offshore tugs and workboats
- Fishing vessels
- Aquaculture barges
- Research vessels
- Navy patrol

2.6.1 ALL TRAFFIC ROUTES – TASMAN REGION

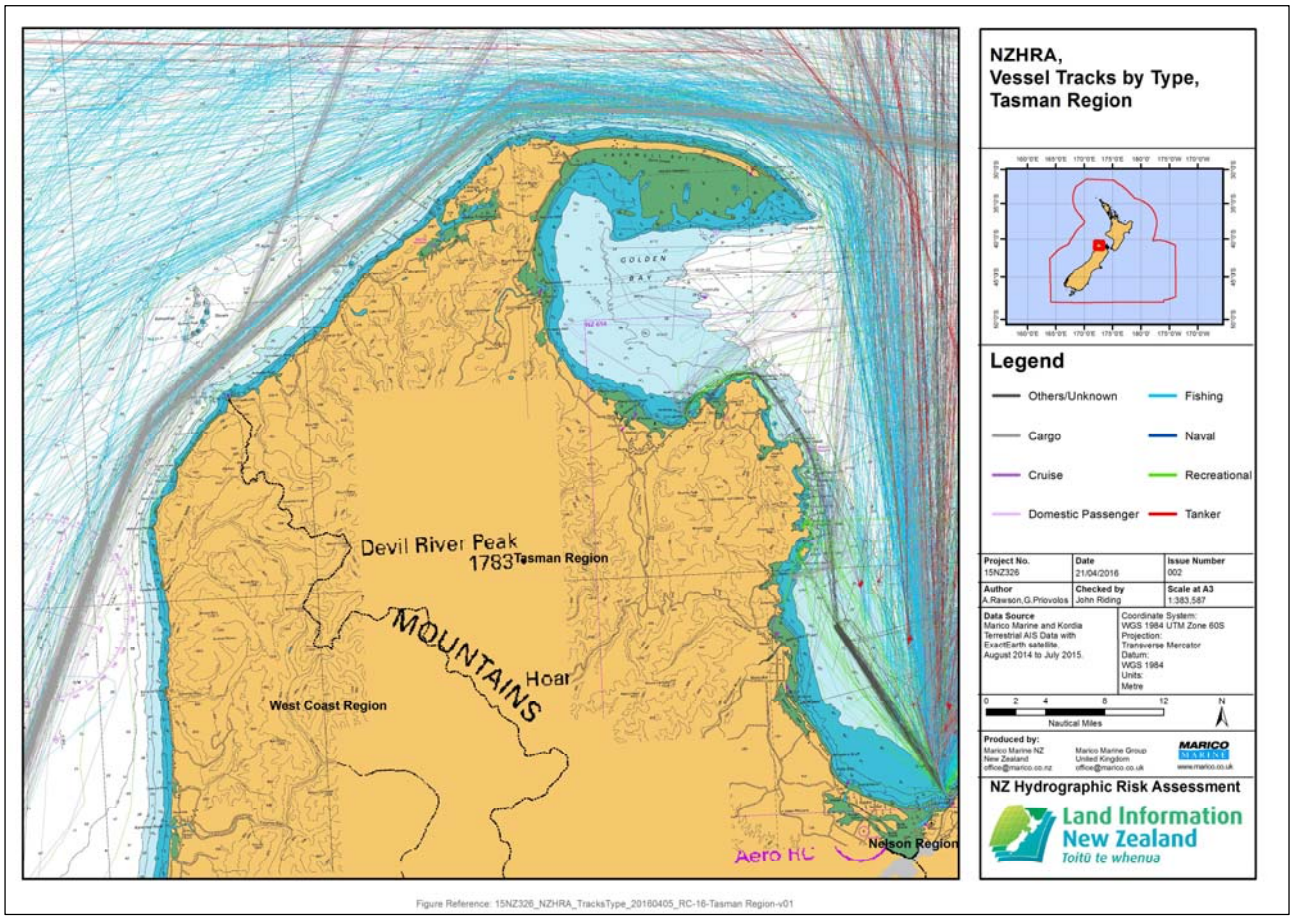


Figure 5 : Traffic Breakdown by Type - Tasman Region

Most of the commercial traffic in the Tasman region is from mussel barges and scallop dredges. Offshore tugs and workboats related to the Taranaki oil industry were recorded sheltering in Golden and Tasman Bays, during periods of inclement weather during the year. Some arrive for shelter and leave as conditions improve. Cement bulk carriers also regularly shelter in Tasman and Golden Bays waiting for favourable weather.

Water taxis are numerous and frequent, mostly operating out of Nelson in the adjacent region but travelling to Abel Tasman National Park, in the Tasman region.

A research vessel spent a considerable amount of time in the Tasman and Golden Bay areas during the project year.

2.6.2 ALL TRAFFIC - TARAKOHE HARBOUR

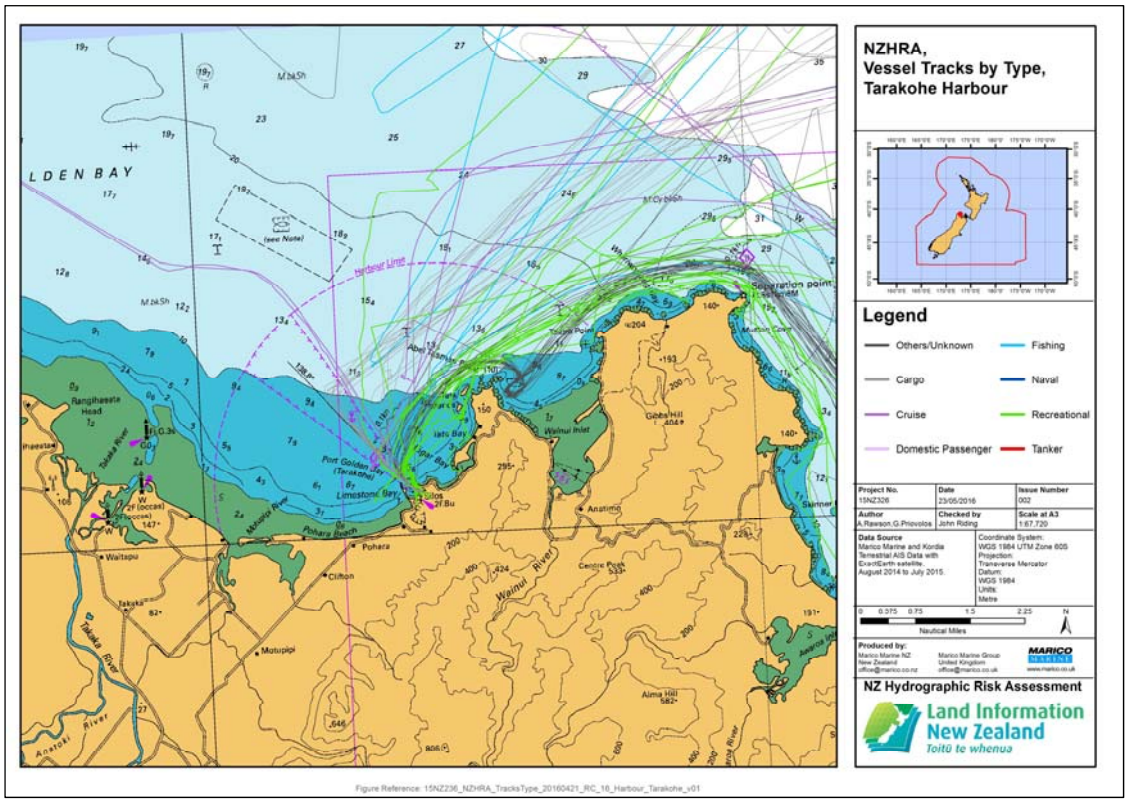


Figure 6 : Vessel Tracks by Type – Tarakohe Harbour

Tarakohe Harbour was once a busy coal, marble and cement port with four ships servicing the cement trade alone. In 2015, the AIS evidence is that *Anatoki* is the only regular cargo vessel, loading dolomite in bulk for delivery to various NZ ports. Tarakohe is also home to a number of smaller commercial vessels; mostly mussel boats and boats for spat collection. Tarakohe has developed a 61 berth recreational and commercial marina, with recreational tracks clearly evident in **Figure 6**.

In the adjacent approaches to Wainui Inlet, there is a marine farm located in the side of the bay, which is regularly attended by a marine farm vessel.

2.6.3 ALL TRAFFIC DENSITY – TASMAN REGION

As can be seen on the traffic density plot, most commercial vessel traffic transit a respectable distance offshore through Tasman waters, with most traffic transiting directly to or from Nelson and around Farewell Spit or outside D'Urville Island (Marlborough). There is a clear voting pattern for traffic, with fishing activities and a number of destination choices (inbound or outbound to NZ) causing a spread of tracks, which results in the lower density yellow. There is also considerable fishing vessel transits/activity in this offshore area.

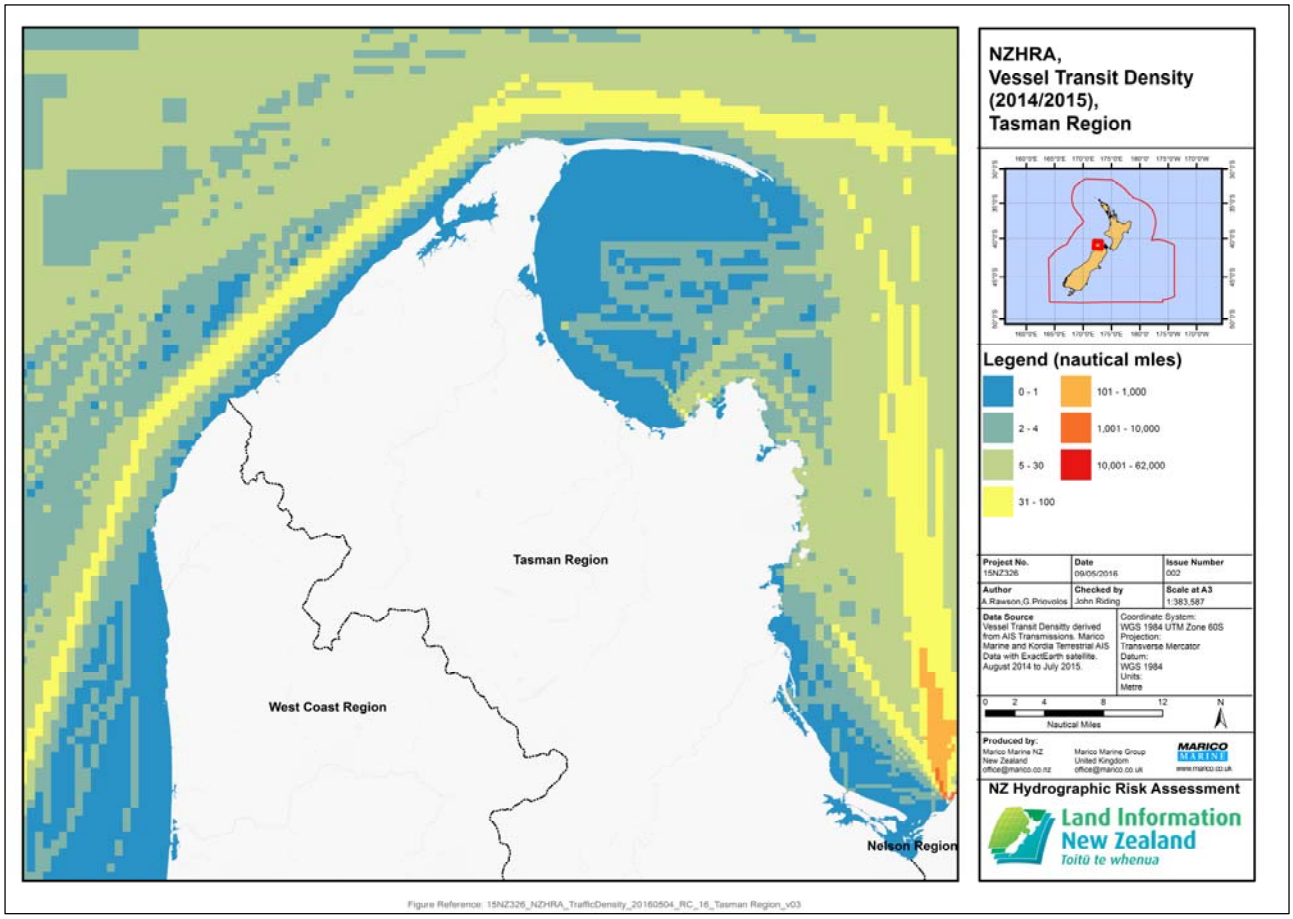


Figure 7 : Traffic Density - Tasman

2.6.4 CARGO VESSELS – TASMAN REGION

Figure 8, over the page shows that cargo vessel traffic mostly passes outside the Tasman region and there are few exceptions to this. *Anatoki,* is one of these and is a regular caller to Port Tarakohe. Cement ships also regularly anchor awaiting improved weather conditions to round Farewell Spit. To the north of Farewell Spit, a large number of vessel tracks are visible.

The vast majority of these transits are represented by three coastal vessels *Anatoki*, *Westport* and *Milburn Carrier.*

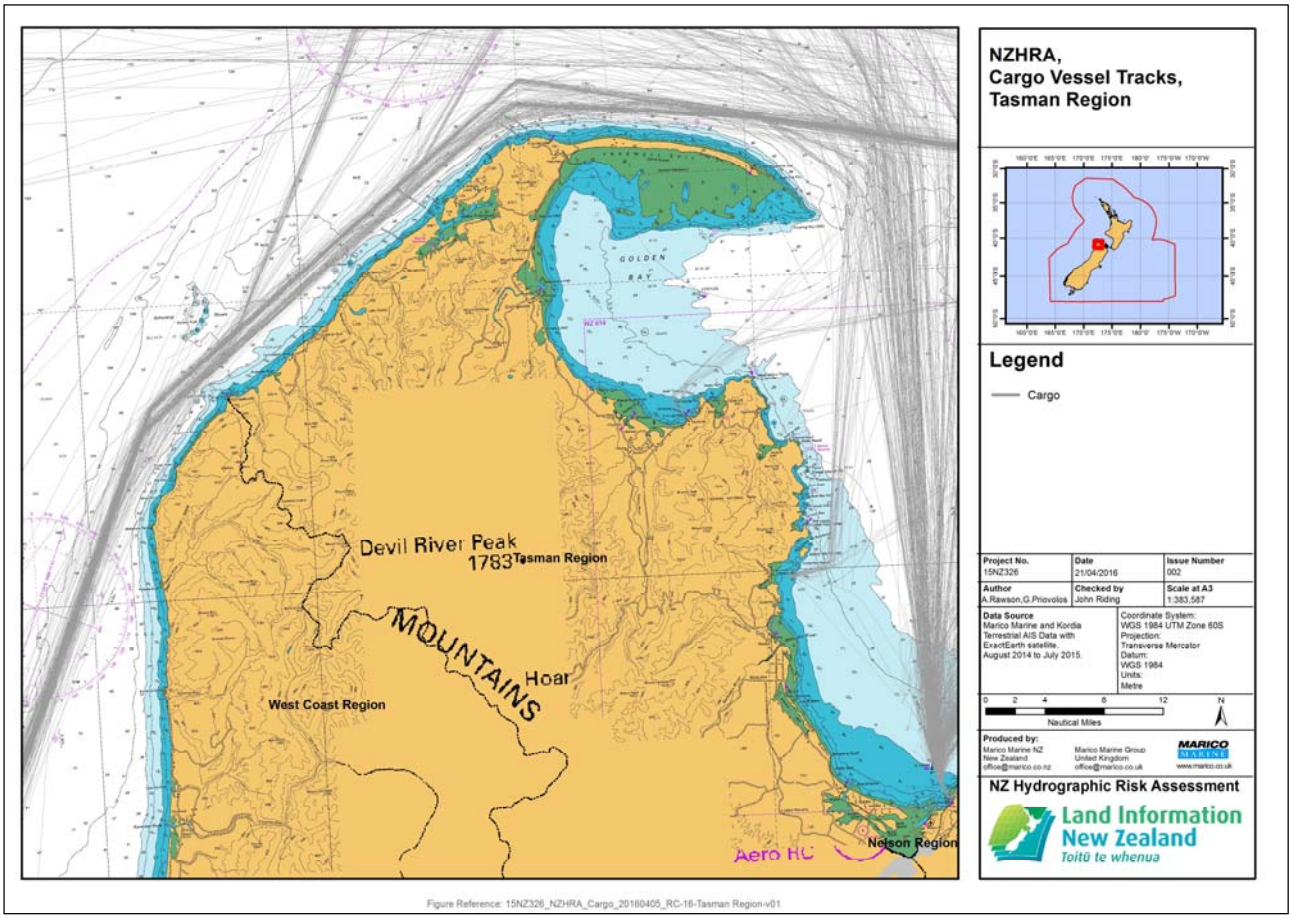


Figure 8 : Cargo Vessel Transits – Tasman Region

2.6.5 CRUISE VESSELS – TASMAN REGION

Three cruise vessels explored the Tasman Bay and Golden Bay areas, one of which was a small, boutique cruise vessel. There appear to be a small number of others that have transited the west coast of New Zealand, bound for or from Nelson and others who are heading into the Cook Strait. Some cruise vessels come north after clearing Fiordland waters.

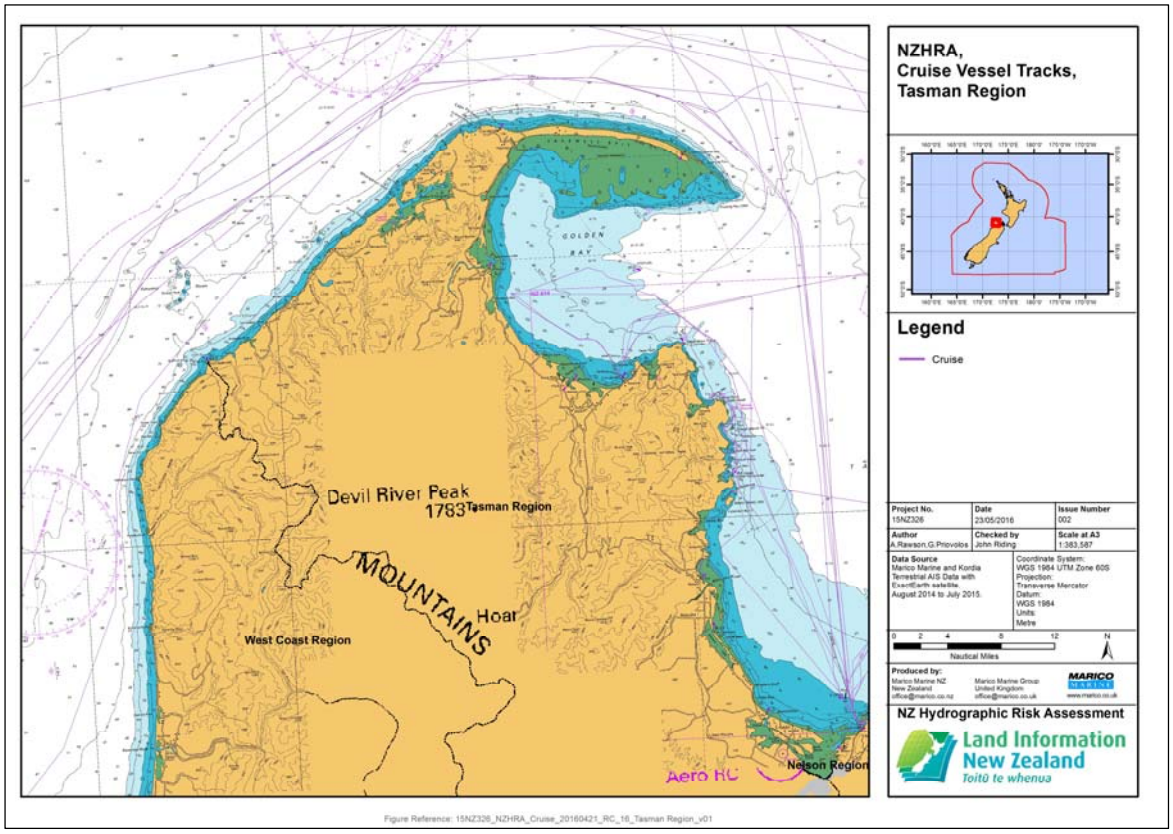


Figure 9 : Plot of Cruise Vessels – Tasman Region

2.6.6 DOMESTIC PASSENGER TRAFFIC – TASMAN REGION

Water taxis are busy especially in summer and operate mostly from Kaiteriteri and Marahau, transporting passengers around the Abel Tasman National Park.

There is no requirement for water taxis to carry AIS transponders in the Tasman region. They are thus not recorded on AIS plots, but they mostly operate from Nelson, Kaiteriteri and Marahau, along the coast of the Abel Tasman National Park.

2.6.7 TANKERS – TASMAN REGION

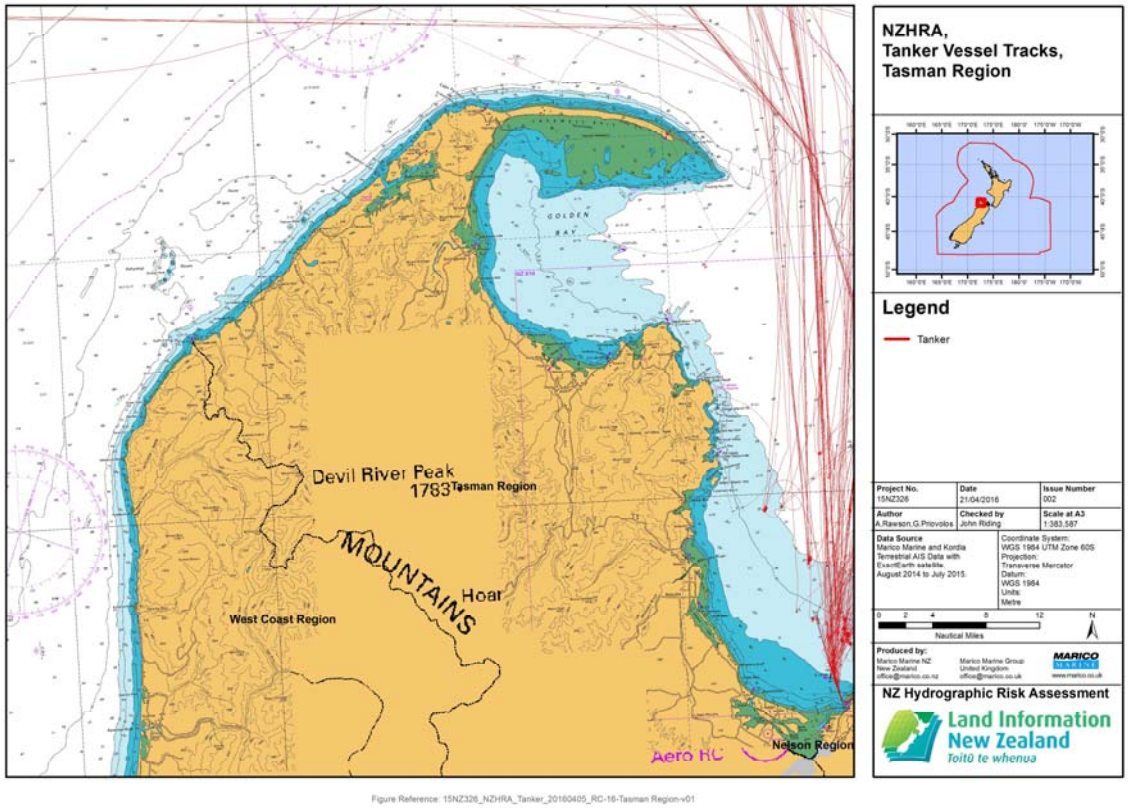


Figure Reference: 15NZ326_NZHRA_Tanker_20160405_RC-16-Tasman Region-v01

Figure 10 : Plot of Tankers – Tasman Region

Tankers anchor in the Tasman Regional waters and track patterns outside of the Nelson Harbour limits suggest they return to the same approximate area. This is either for shelter, waiting orders, or cargo logistics. Tankers do not visit Tasman ports; their tracks are coastal and apart from their use of Tasman Bay for anchoring, they remain well offshore and transit to other parts of New Zealand.

2.6.8 COMMERCIAL FISHING VESSELS – TASMAN REGION

A small number of inshore fishing vessels were tracked in Golden and Tasman Bays, but the majority appear to have transited directly out of Nelson, through Tasman Bay to their fishing grounds elsewhere. There is significant fishing vessel activity in the offshore waters of the Tasman Regional waters, with fishing vessels operating out of the adjacent ports of Westport and Nelson.

Seasonally, scallops are dredged from Tasman Bay.

There are 10 or more Greenshell mussel farm harvesters, seeding boats and work boats operating in Golden and Tasman Bays. These vessel tracks are recorded as 'Other' type on AIS. Marine Farm service vessels can also be seen on the plot of Tarakohe Harbour Traffic.

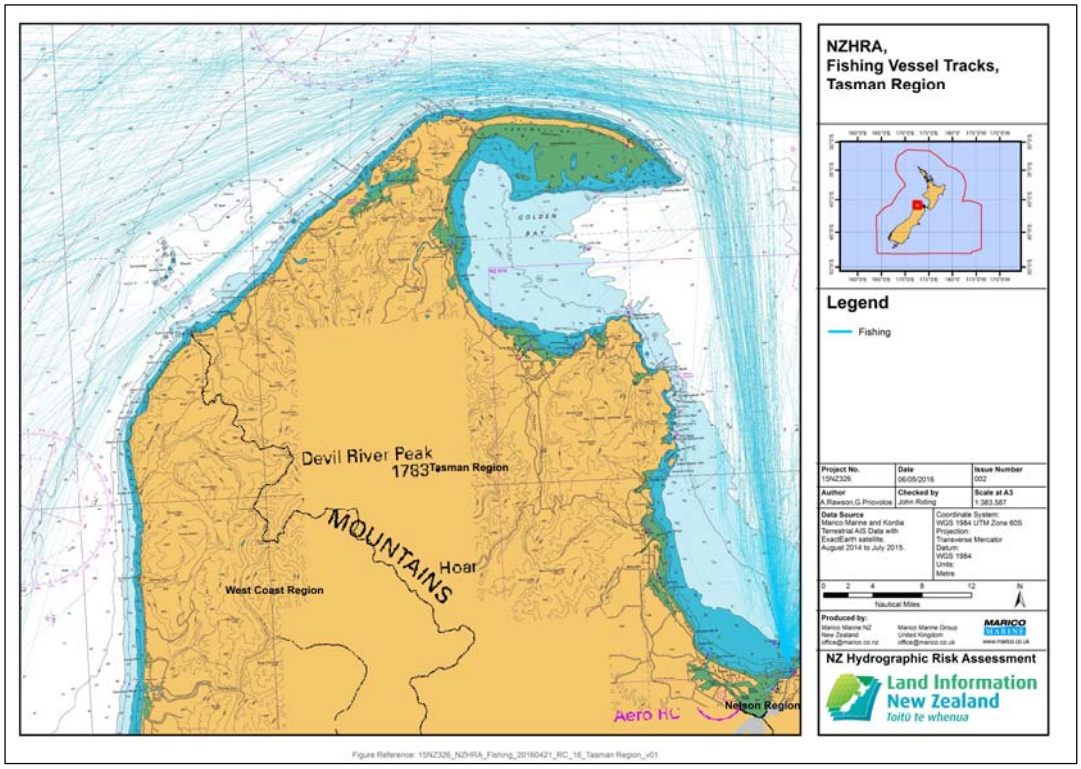


Figure 11 : Fishing Vessel Activity – Tasman Region

2.6.9 RECREATIONAL FISHING – TASMAN REGION

Tasman Bay is the main destination for Nelson-based recreational craft and fishing is the most popular recreational activity. Local small craft are launched from the many boat ramps in the area to go fishing, especially from Kaiteriteri where there is plenty of parking.

Pohara and Tarakohe are favourite launching spots for recreational fishing in Golden Bay.

2.6.10 RECREATIONAL TRAFFIC – TASMAN REGION

Sea kayaking is a very popular activity around the Abel Tasman National Park; there are many different companies hiring out sea kayaks for single or multi-day trips along the park's coastline. Marahau is the main base for renting sea kayaks.

Other types of recreational vessels include sail boats and pleasure launches, many of which come from Nelson, or from the marinas at Tarakohe and Motueka.

2.7 HYDROGRAPHIC RISK – TASMAN REGION

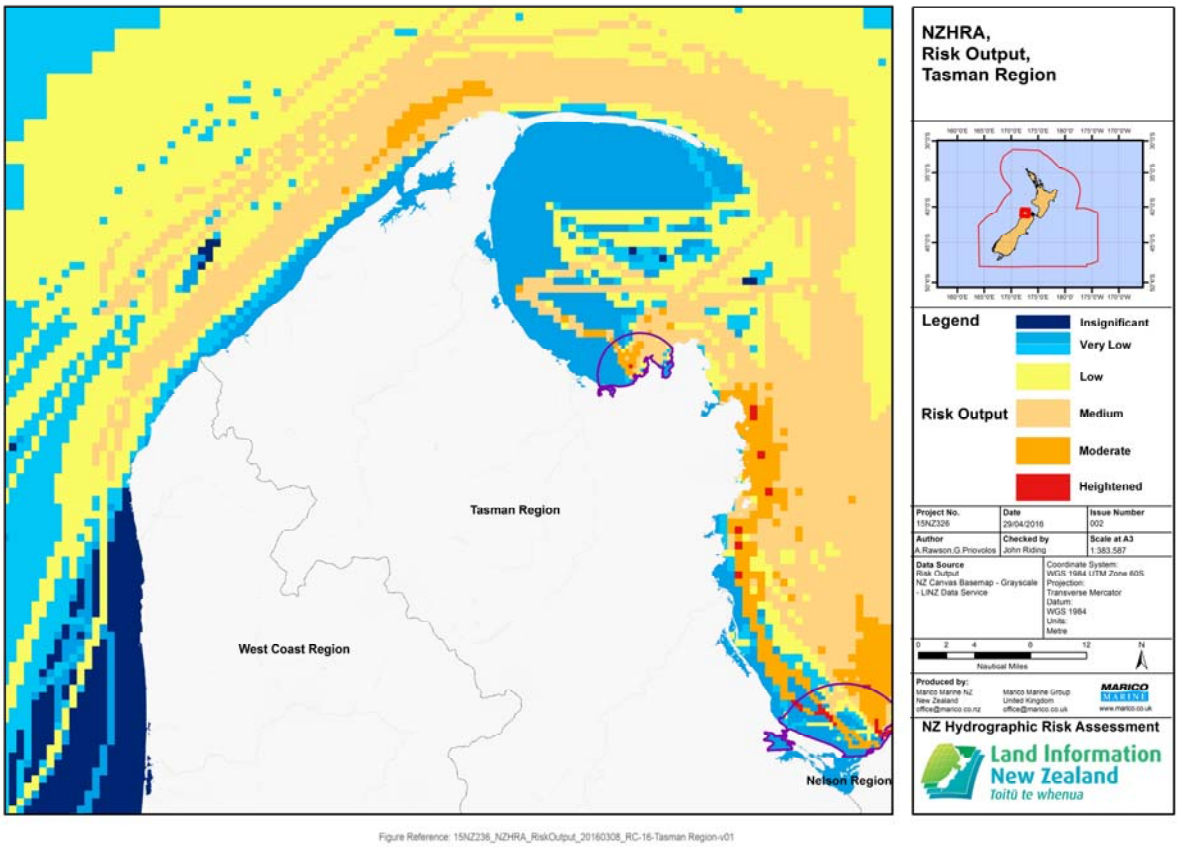


Figure Reference: 15NZ236_NZHRA_RiskOutput_20160308_RC-16-Tasman Region-v01

Figure 12 : Hydrographic Risk – Tasman Region

Hydrographic risk in the Tasman Region is generally low. Isolated cells of heightened risk show at the Abel Tasman Marine Reserves. There is a minimal area of moderate risk associated with the anchoring of tankers in Tasman Bay.

2.7.1 HYDROGRAPHIC RISK - TARAKOHE HARBOUR

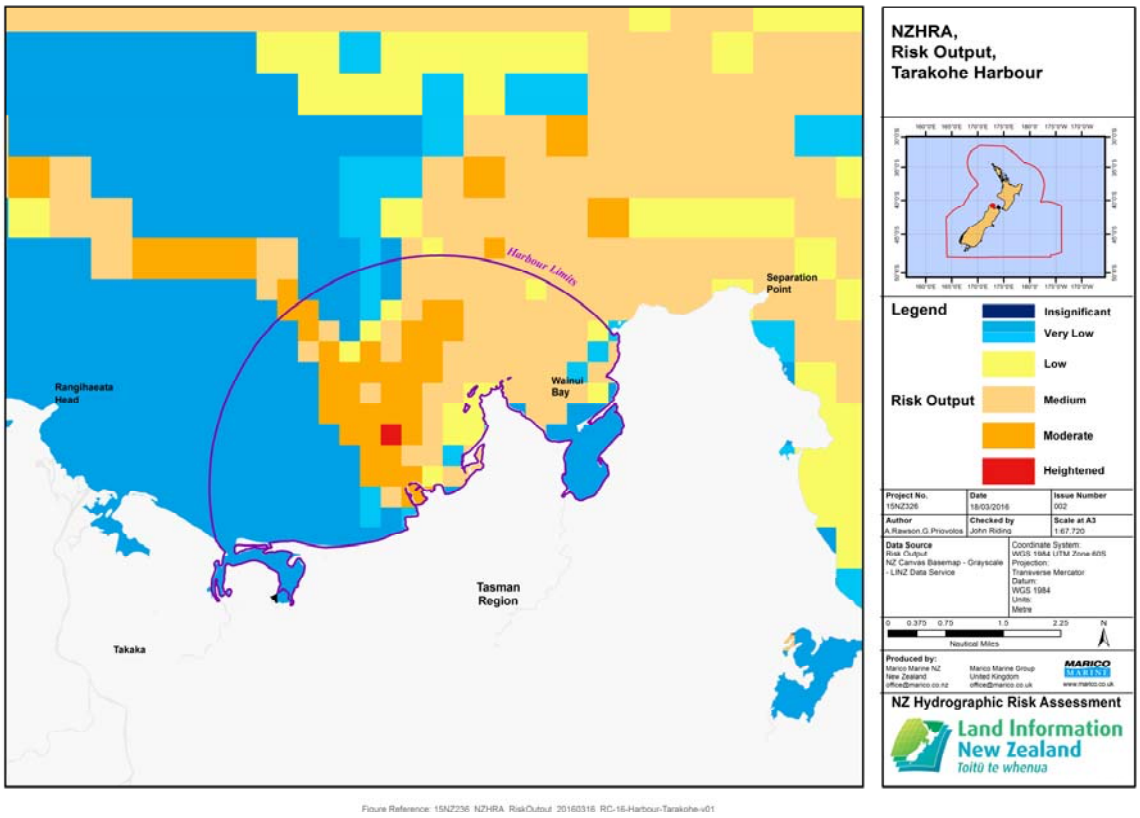


Figure Reference: 15NZ326_NZHRA_RiskOutput_20160316_RC-16-Harbour-Tarakohe-v01

Figure 13 : Hydrographic Risk – Tarakohe Harbour

Within Tarakohe Harbour Limits there is a single cell of heightened risk in the approaches to the harbour. The influencing factors of this risk are the environmental significance of the area and the proximity to charted aquaculture activity and the 1957-59 and 1986 ages of chart source data.

2.8 CHARTING BENEFIT - TASMAN REGION

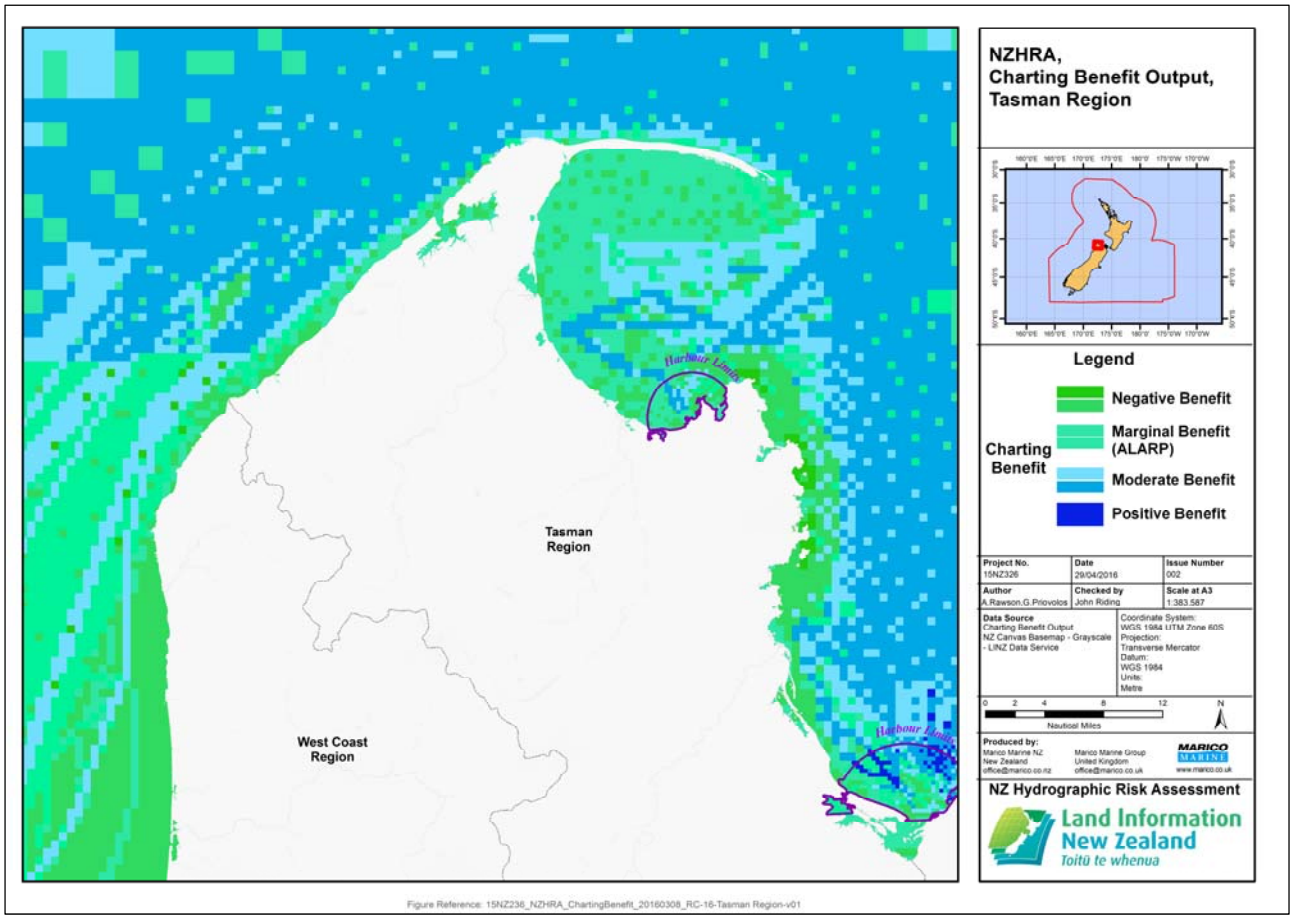


Figure 14 : Charting Benefit Plot – Tasman Region

Overall the charting benefit result shows charting in Tasman region is in good condition, with few areas where further improvements need to occur. In Tasman Bay, moderate benefit accrues in areas where Tankers use the water for its sheltered anchorages; there may be a possible need for Tasman Region to consider some designated anchorages, which have the option to be hydrographically surveyed to achieve full seafloor coverage. The other factor in the moderate charting benefit result is the volume of passengers using the water taxi routes in the Tasman Bay region.

2.8.1 CHARTING BENEFIT – TARAKOHE HARBOUR

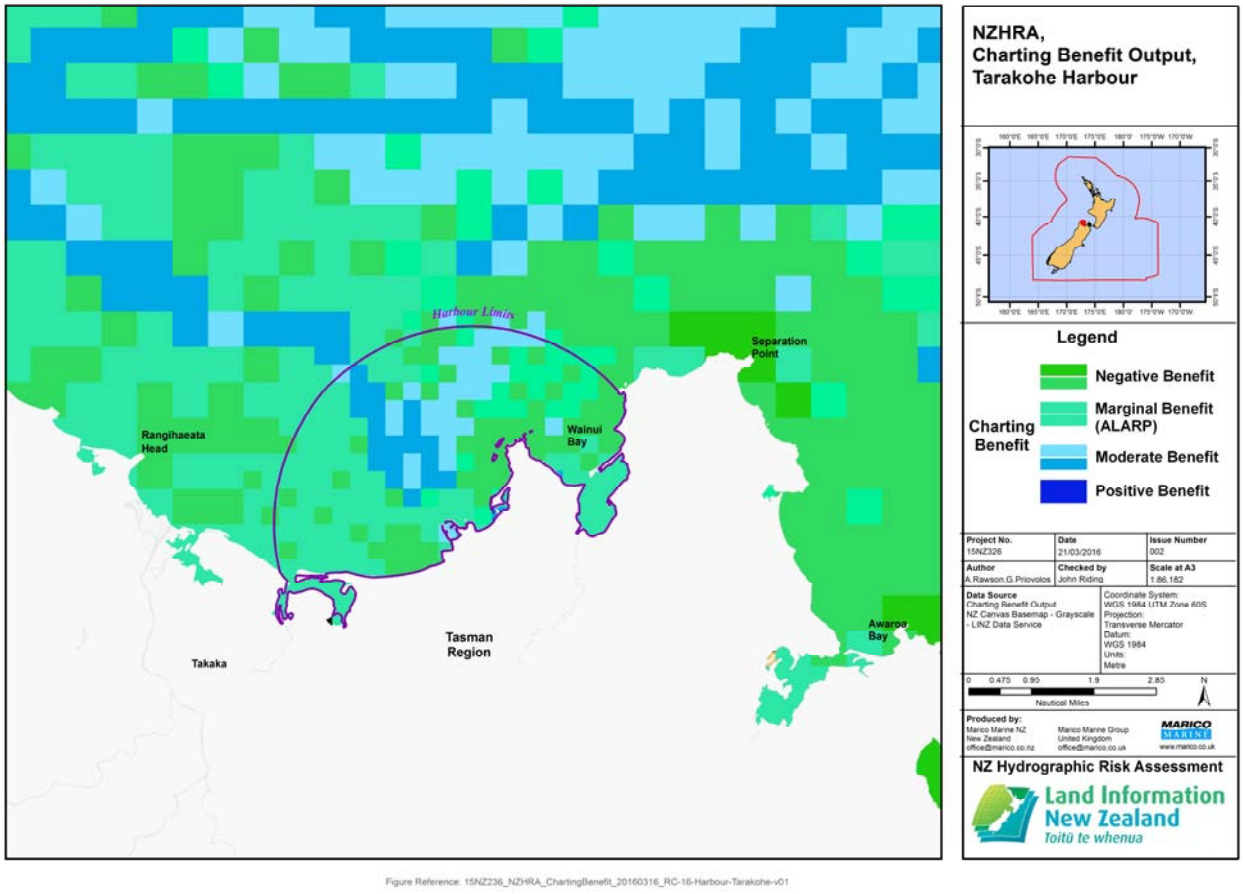


Figure Reference: 15NZ236_NZHRA_ChartingBenefit_20160316_RC-16-Harbour-Tarakohe-v01

Figure 15 : Chart Benefit Plot – Tarakohe Harbour

Tarakohe Harbour does present an area of moderate charting benefit on the routes in and out of the harbour, which seems will profit from attention being given to improving hydrographic seafloor coverage in the approaches to and within the Tarakohe Harbour Limit.

3 HYDROGRAPHIC RISK RESULTS - NELSON REGION

3.1 INTRODUCTION – NELSON REGION

As a unitary authority, Nelson City Council has the combined responsibilities and functions of both a territorial (local) and regional council, different from most other local authorities in New Zealand.

Nelson has a temperate oceanic climate, with mild winters, warm summers and one of the sunniest climates of all major New Zealand centres. As expected, winter is the stormiest time, when gales are more common. Nelson's rainfall is evenly distributed throughout the year and, as mountains surround the town to the east, west and south, the region is protected from the severest weather. As a result, Nelson is one of the country's calmest cities – just over one in four days is calm (winds of less than 1 metre/second). The predominant winds are northerly or north-easterly sea breezes followed by south-westerlies. Any winter fog mostly burns off by mid-morning.

Historically, Nelson-based fishing was relatively minor, with small boats fishing close inshore. In the 1980s deep-sea fishing changed that. Nelson's central location, close to many fishing grounds, encouraged a great expansion. Fishing for deep-water species, Orange Roughy and Hoki, was developed in the 1980s and 1990s, resulting in the NZ deep-sea fishing industry becoming a major employer. Talley's and Sealord, two of New Zealand's largest deep-water fishing companies, are based in Nelson, with Talley's head office located at Port Motueka. Nelson is the largest fishing port in Australasia and the region is the second-largest apple growing area in New Zealand.

Of the 600 marina berths in Nelson, 520 are permanent; 40 are pile berths and the remainder are visitor berths.

3.1.1 NELSON HARBOUR

Nelson Harbour entrance is protected by a natural, 13km long Boulder Bank, formed of rocks transported south from Mackay Bluff via longshore drift. The bank creates a perfect natural harbour which enticed the first settlers, although the entrance was narrow. A cut was made in the Boulder Bank in 1906 which allowed larger vessels access to the port, but left a tight turn to enter the port after clearing the cut. Haulashore Island was once connected to the Boulder Bank, but the Cut made it an unconnected island Boulder Bank. Today the Cut is 150m wide, with maintenance dredging reported every six months to maintain 10m declared channel depth. There remains a tight swing onto Nelson Harbour, resulting in a practical limit of vessel size using the port facilities.

Maximum draught are determined by the height of tide on the day concerned. A minimum under keel clearance of 10% of draught is required for a vessel in the channel, and minimum under keel clearance of 5% of draught while at a berth.

In general, the tidal streams follow the dredged channels except at the entrance where they flow across the entrance setting to the South when flooding and to the North when ebbing. At the entrance they can attain a rate of two knots at spring tides; in the harbour they may attain a rate of one to two knots.

3.1.2 PORT NELSON LIMITED

Port Nelson recorded 747 vessel arrivals (over 100GRT), handling 90,000 TEU and 2.6m tonnes of cargo. Continued demand for New Zealand logs, particularly from China, meant the port handled over 600,000 tonnes of logs in the year.

Wine volumes continue to grow and this year 160,000 tonnes of wine were handled, an increase over the 143,000 tonnes handled the year before. Fish volumes are reported to be steady with pip-fruit remaining a significant cargo. Port Nelson remains as one of the largest fishing ports in Australasia.

Ship repair has developed at the port, with a large FPSO *Raroa* repair project in 2013 led to an increase in visits by other oil industry related tender and support vessels.

3.1.3 CHARTING INFORMATION OBSERVATIONS – NELSON REGION

Keeping charts up to date with on-going dredging as a result of constantly silting channels and berth pockets, is a challenge: for example, the charted depths in the marina are reported to be incorrect. In common with many other NZ ports, the sandbanks can shift especially after storm events.

3.1.4 AREAS OF RISK SIGNIFICANCE – NELSON REGION

Fishing is prohibited in Horoirangi Marine Reserve, 12 km northeast of Nelson. Other areas of significance were taken from the Council marine response plan.

3.1.5 ECONOMIC SUMMARY – NELSON REGION

The Nelson economy is based on four key industries: seafood, horticulture, tourism and forestry. Cruise vessel crews and passengers injected $2M into the local economy.

The sub-national GDP of the Nelson region (Tasman District and Nelson City) was estimated at US$2.343b in 2003, around 2% of New Zealand's national GDP.

3.2 TRAFFIC ANALYSIS – NELSON REGION

Traffic routes in general trended north/south directly into and out of Port Nelson. A number of offshore tugs and workboats used the amenities available at Nelson, availing themselves of the

slipping and extensive repair facilities available there. One vessel servicing the Maari oil field, is based out of Nelson and responsible for all the 'Other' category of tracks.

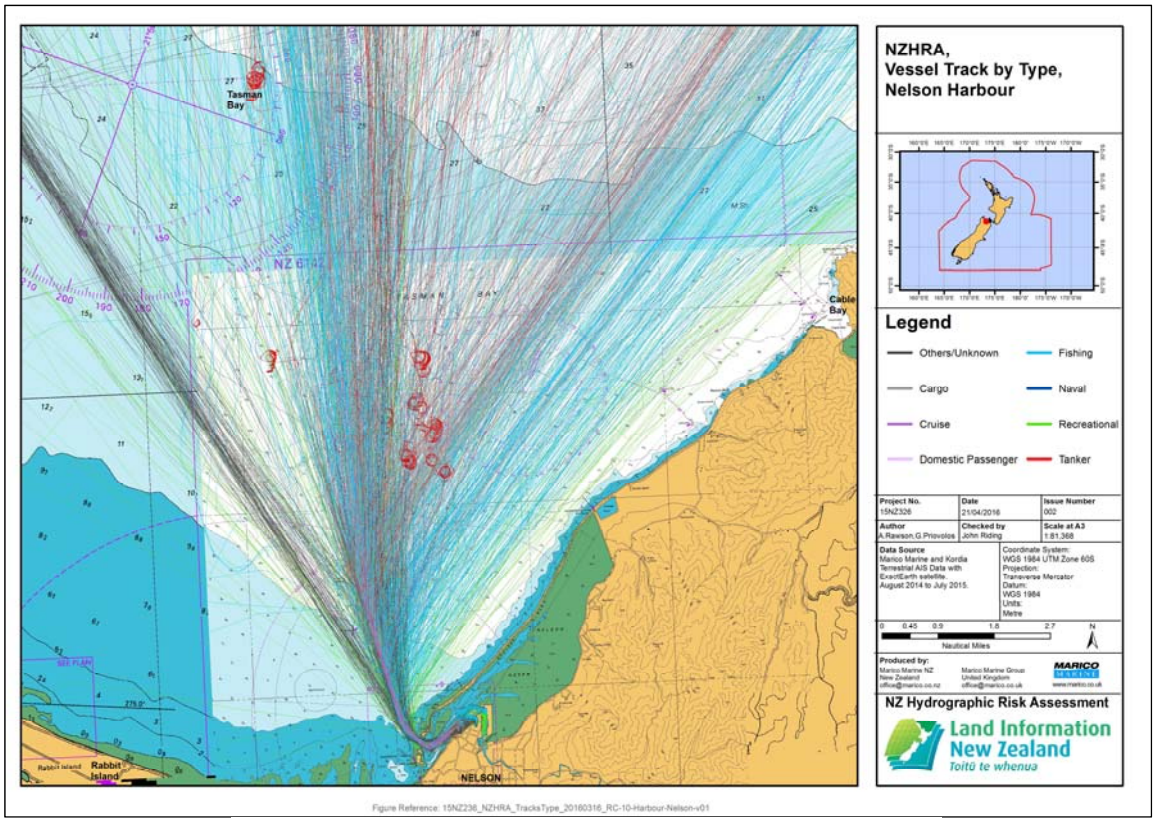


Figure 16 : Nelson Traffic Breakdown by Vessel Type

3.2.1 TRAFFIC DENSITY – NELSON REGION

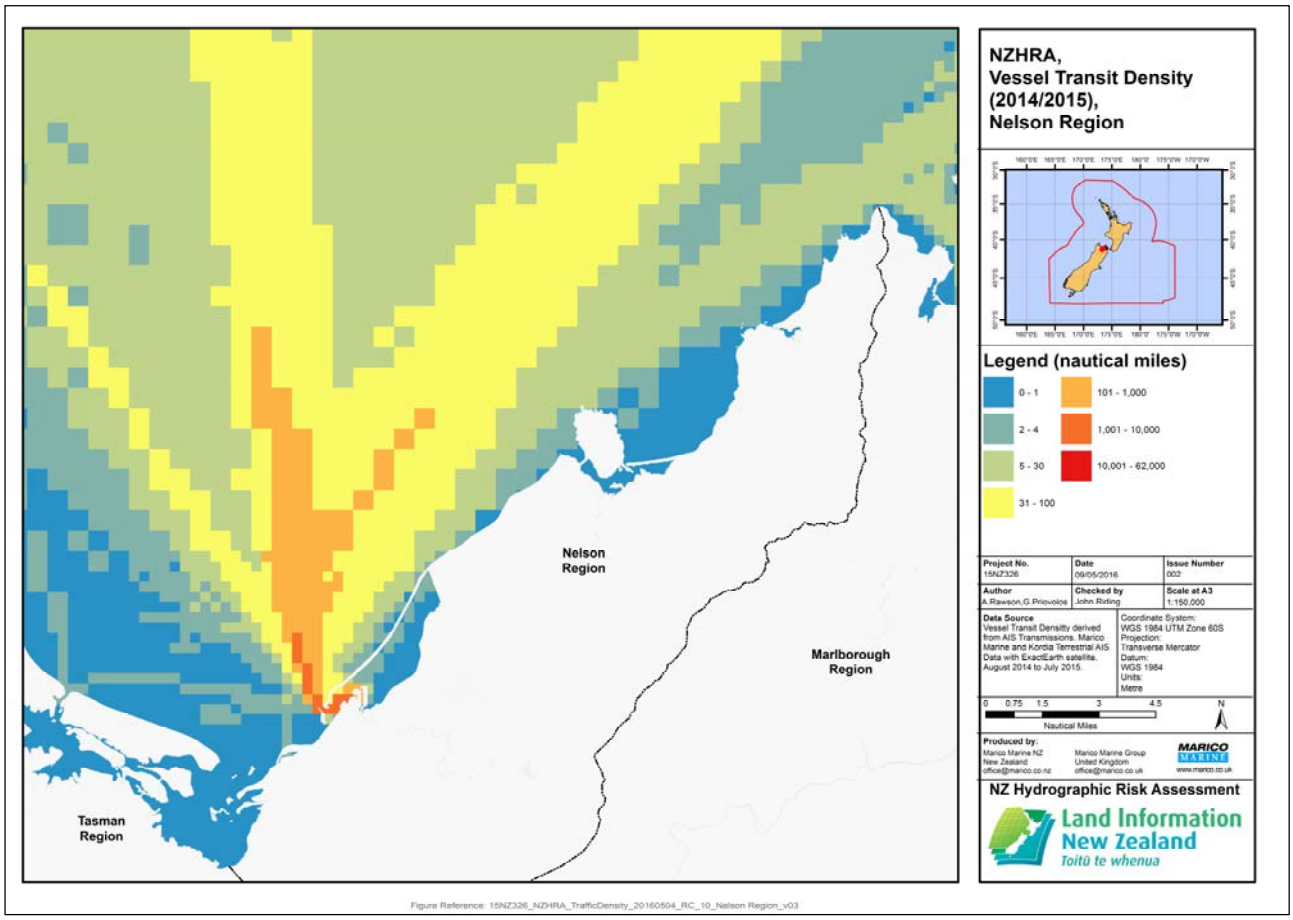


Figure 17 : Density Plot – Nelson Region

3.2.2 TRAFFIC –NELSON REGION

The types of commercial vessels using Nelson Region include:

- Container
- General and Break-bulk
- Tankers
- Passenger cruise
- Charter boats and water taxis
- Tugs and workboats
- Oil and Gas vessels
- Fishing, including factory vessels
- Military

3.2.3 CARGO VESSELS – NELSON REGION

Cargo vessels mostly transited in and out of Tasman Bay directly to the Port of Nelson, although cargo vessels are regularly observed at anchor outside the port, waiting for a berth. Also noted anchoring off Marahau in Tasman Bay, waiting for favourable weather to proceed around Farewell Spit, were the two South Island-based cement ships.

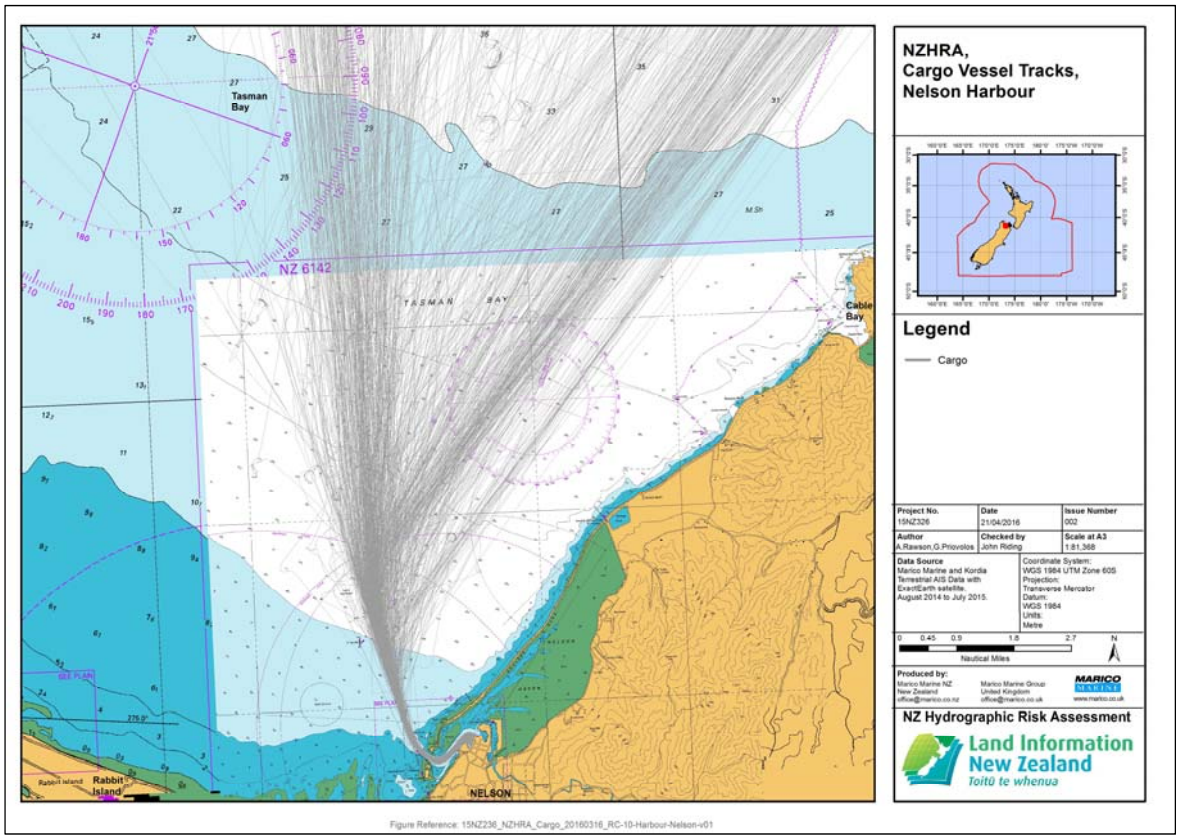


Figure 18 : Cargo Vessels Using Nelson Harbour

3.2.4 CRUISE VESSELS – NELSON REGION

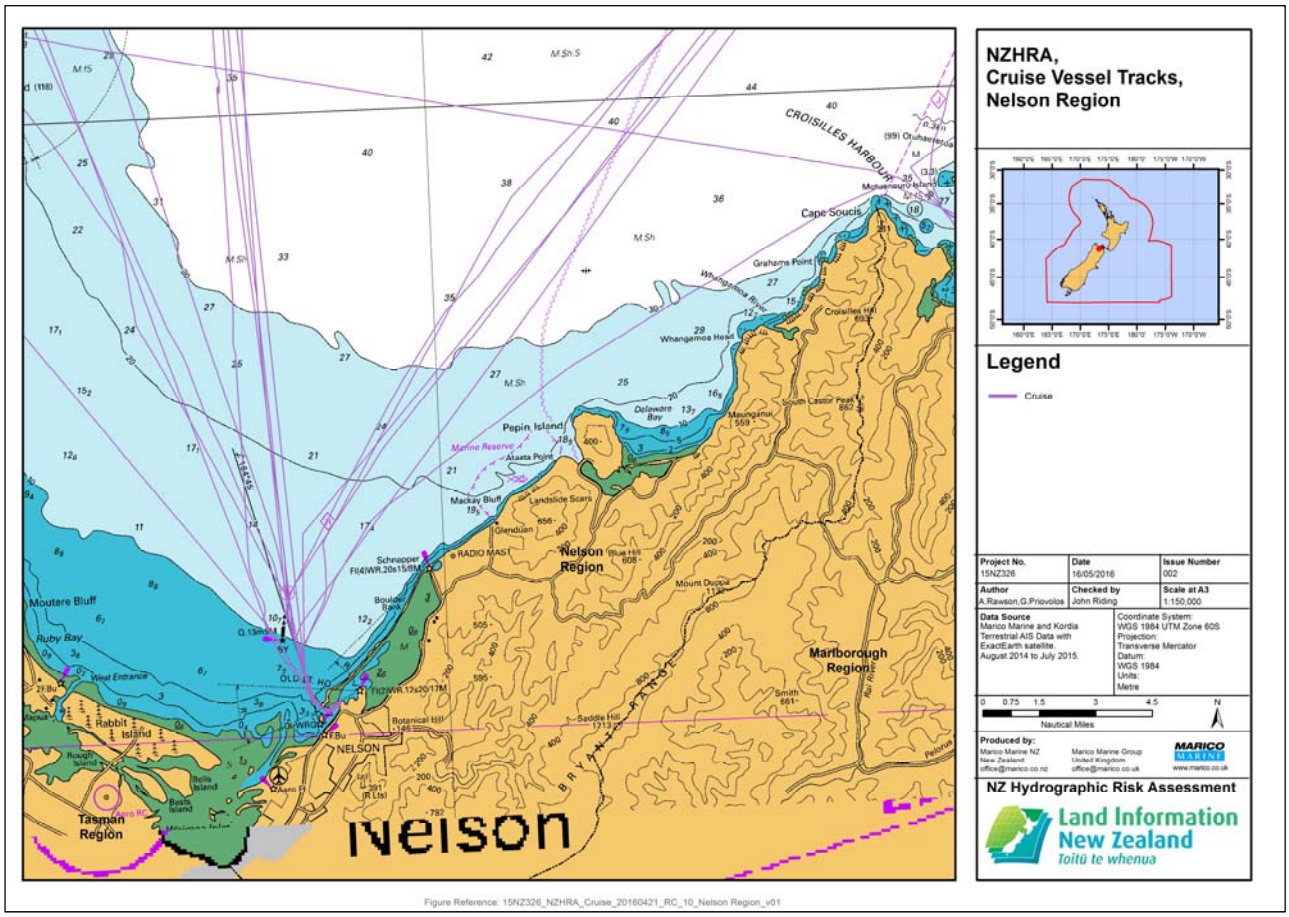
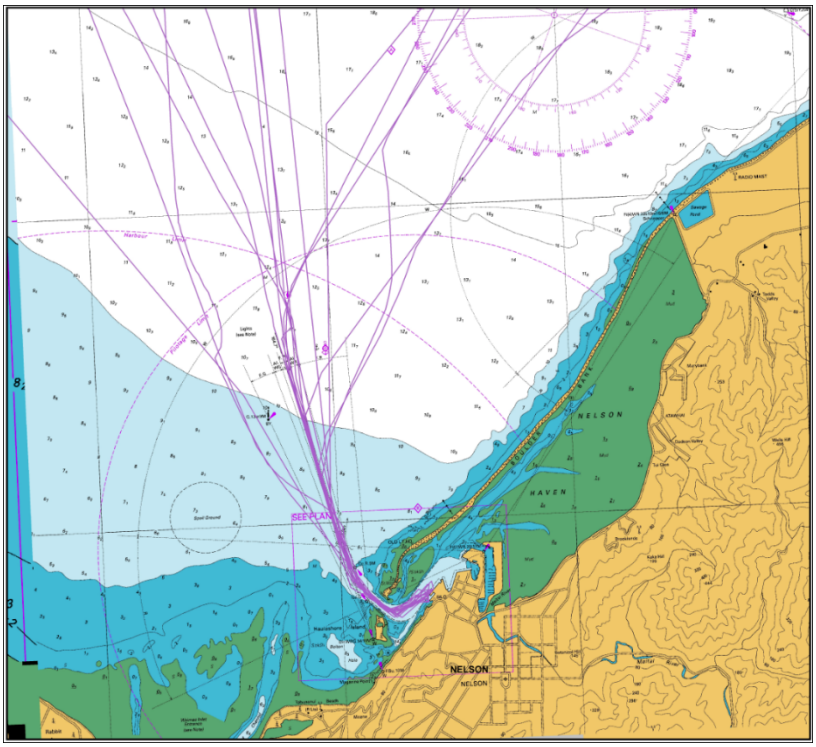


Figure 19 : Tracks of Cruise Vessels Visiting Nelson Region

Six cruise vessels visited the Nelson region in the season. A destination from Nelson for two of the cruise vessels was Abel Tasman and Golden Bay areas. However, the remainder of cruise vessels transited directly out of Tasman Bay to their next destination.



3.2.5 DOMESTIC PASSENGER TRAFFIC – NELSON REGION

Although there are a significant number of passengers using water taxi services across the Tasman, there is no requirement for the carriage of AIS transponders. There was only one record of Domestic Passenger vessel visit to Nelson in the data set. This was the RoRo ferry *Kaitaki* visiting for a refit.

3.2.6 TANKER TRAFFIC – NELSON REGION

The Port of Nelson is a fuel destination for the South Island and is visited by the coastal delivery tankers. Gas is also delivered to Nelson. In the 12 months of recorded traffic, some tankers anchored outside Port Nelson, waiting for their turn to dock at the two designated tanker berths. Tasman Bay is known to provide good holding ground for anchoring and although most used the designated anchorage close to the harbour limits, some tankers anchored at a location of choice.

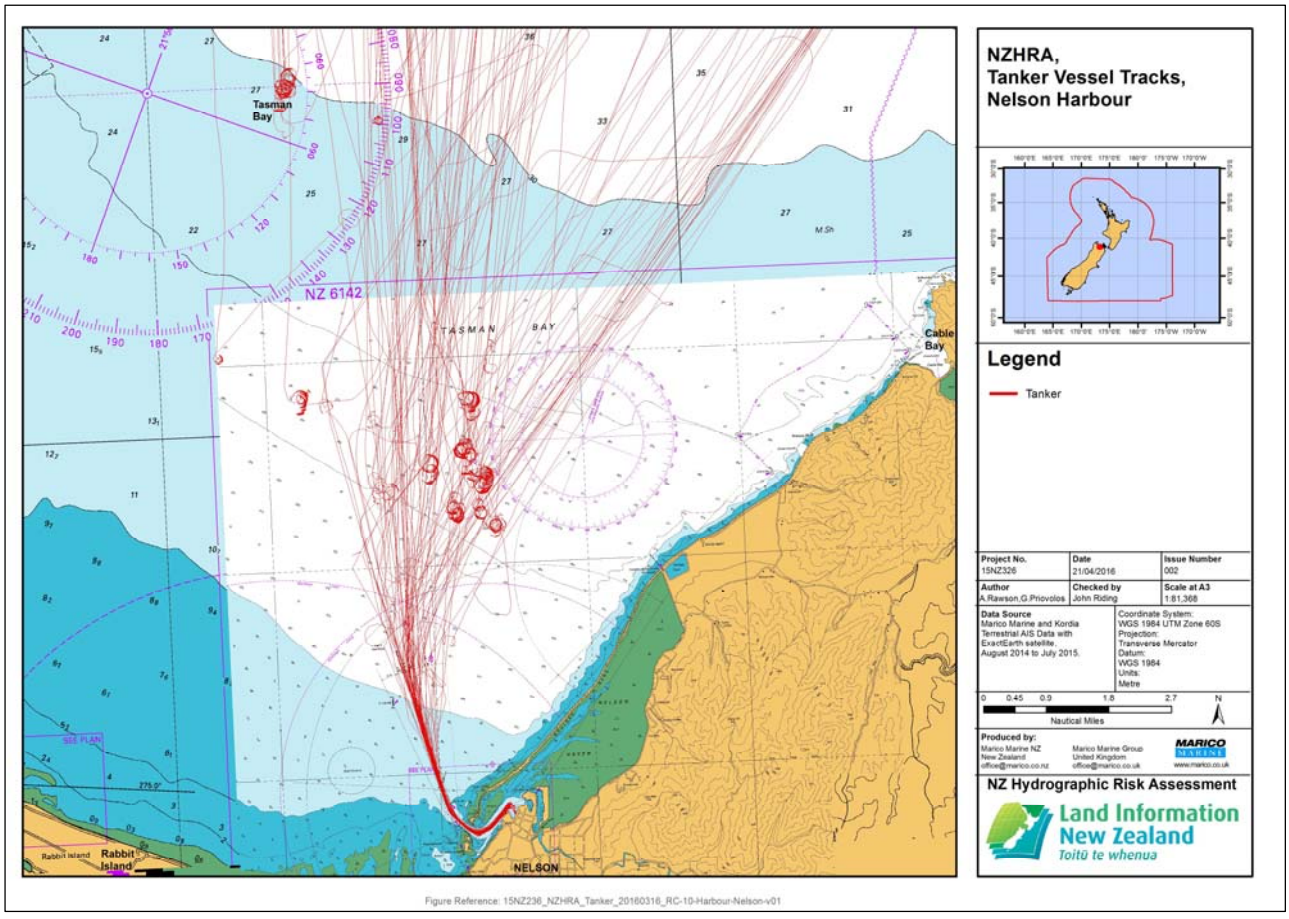


Figure 20 : Tanker Visits to Nelson Harbour – Anchorage Locations Shown

3.2.7 FISHING VESSEL TRAFFIC – NELSON REGION

A large number of commercial fishing vessels use Port Nelson as a base and for discharging their catch to the processing facilities there. Both foreign and domestic factory trawlers berth in Nelson to discharge cargo and take on supplies.

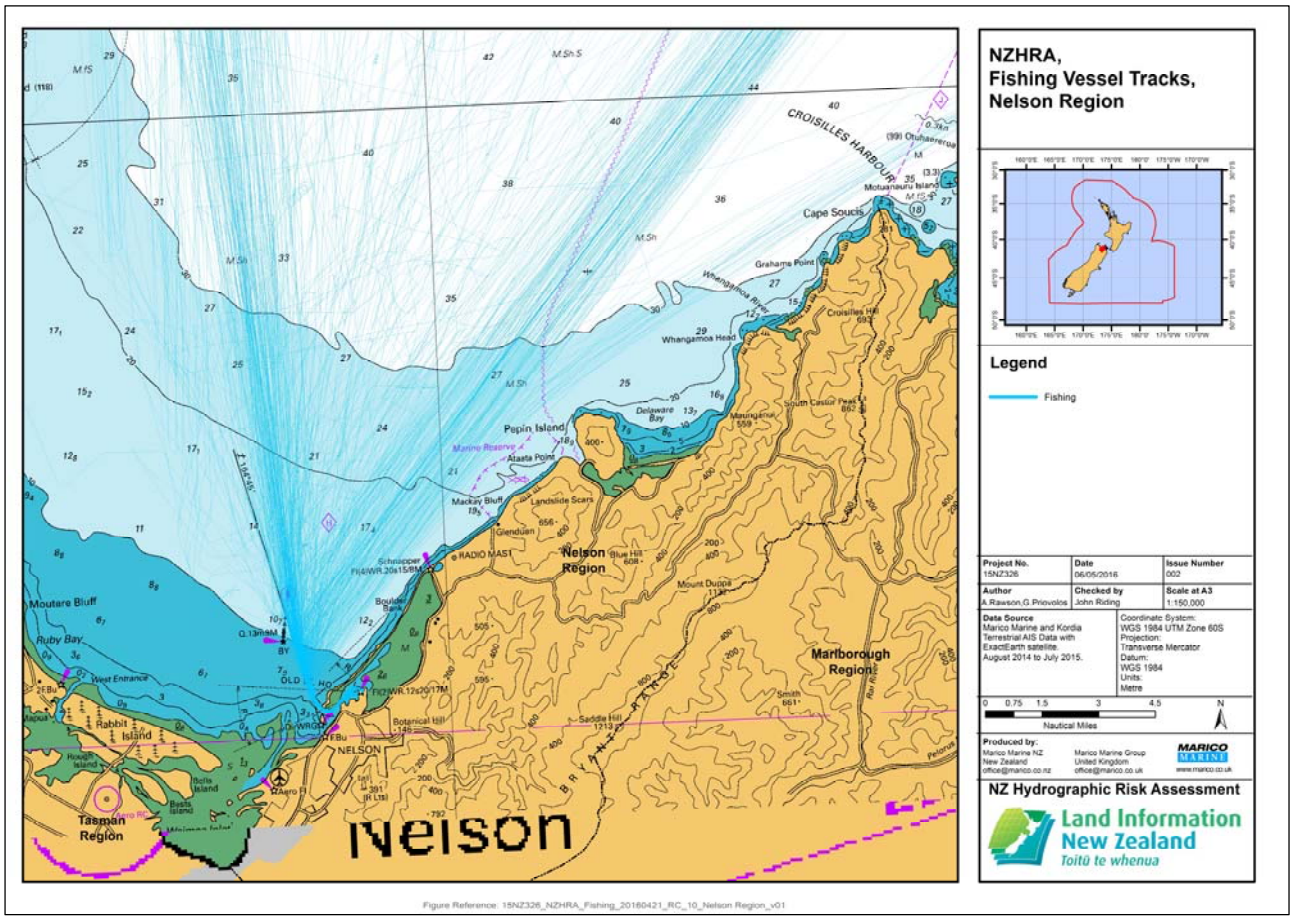


Figure 21 : Significant Fishing Vessel Traffic to Nelson

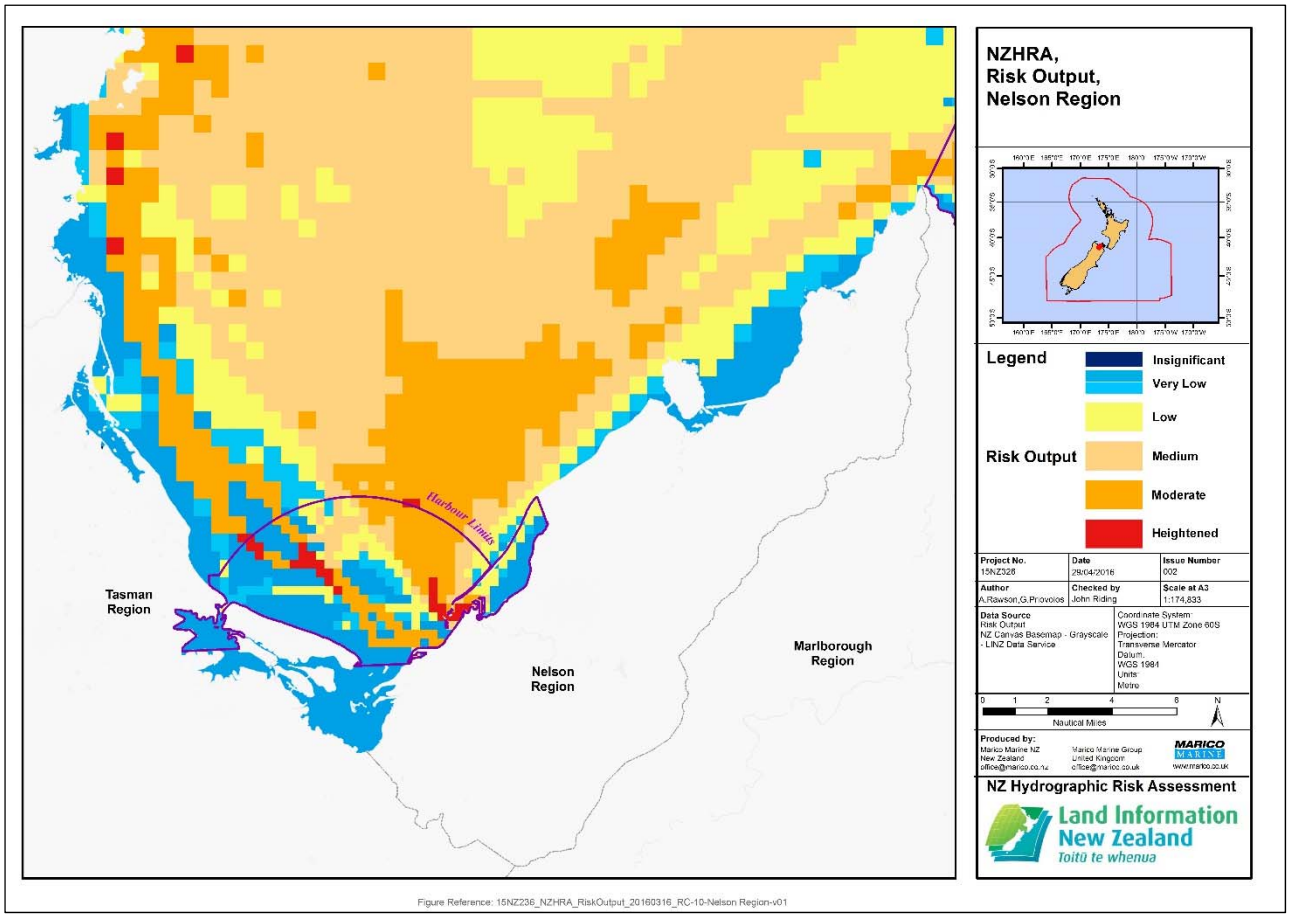
3.2.8 RECREATIONAL FISHING TRAFFIC – NELSON REGION

Fishing is the most common pastime for recreational boaters in this region, noting that there is also a significant sailing interest in the harbour. Favoured fishing spots are found nearby in Tasman and Golden Bays and around D'Urville Island and the adjacent Sounds.

3.2.9 RECREATIONAL TRAFFIC – NELSON REGION

On a day with favourable weather, up to 300 trailer boats launch at the Nelson marina to go fishing in the Sounds or around D'Urville Island. Popular destinations for Nelson-based boaties include Abel Tasman National Park or through French Pass to the Marlborough Sounds. Naturally, these do not appear on the AIS record.

3.3 HYDROGRAPHIC RISK – NELSON REGION



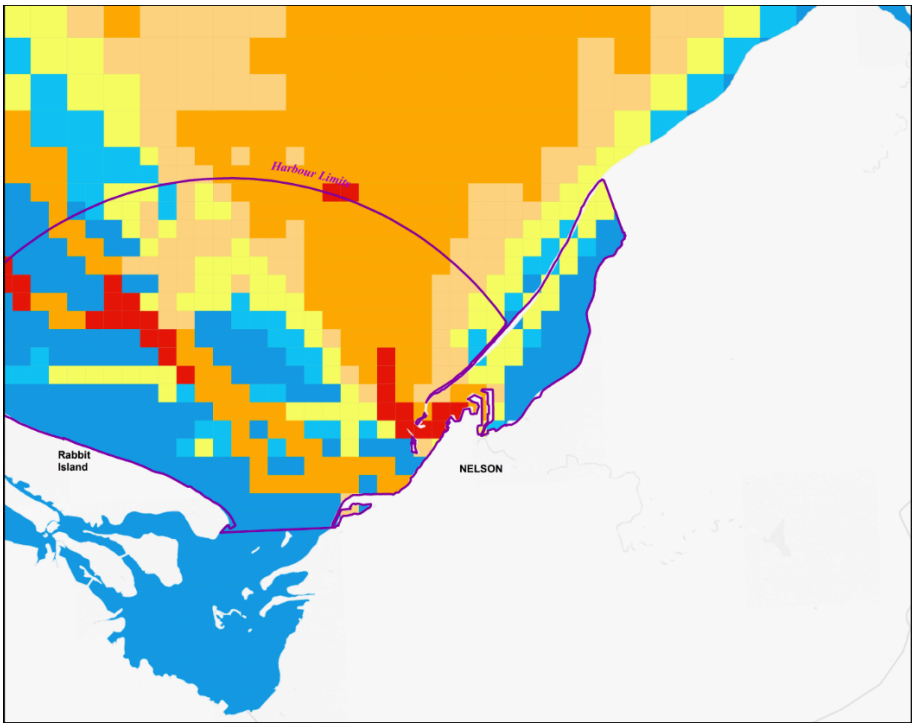


Figure 22 : Hydrographic Risk - Nelson Region

At Port Nelson's harbour entrance and its harbour channels, Nelson does produce heightened hydrographic risk. Much of this is driven by Port Nelson regularly maintaining its channels, but chart

source data is only periodically updated with the information Port Nelson promulgates on the basis that the pilots and PEC users at the port will be aware of the latest survey data. The minimal area of heightened hydrographic risk off Rabbit Island is related to the volume of passengers using water taxis, which are on a regular service to Tasman destinations, combined with their location within Nelson Harbour Limits.

3.4 CHARTING BENEFIT – NELSON REGION

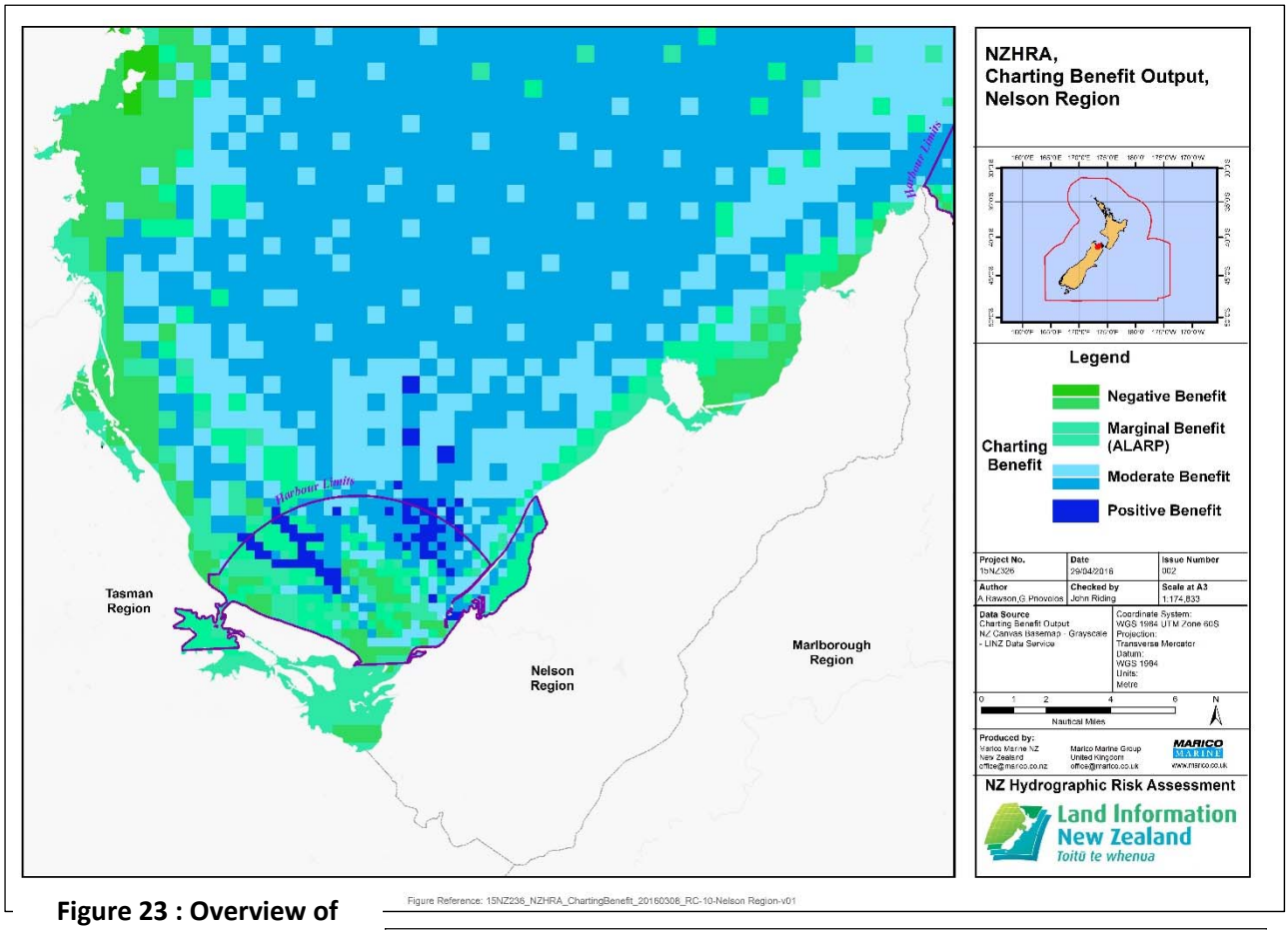
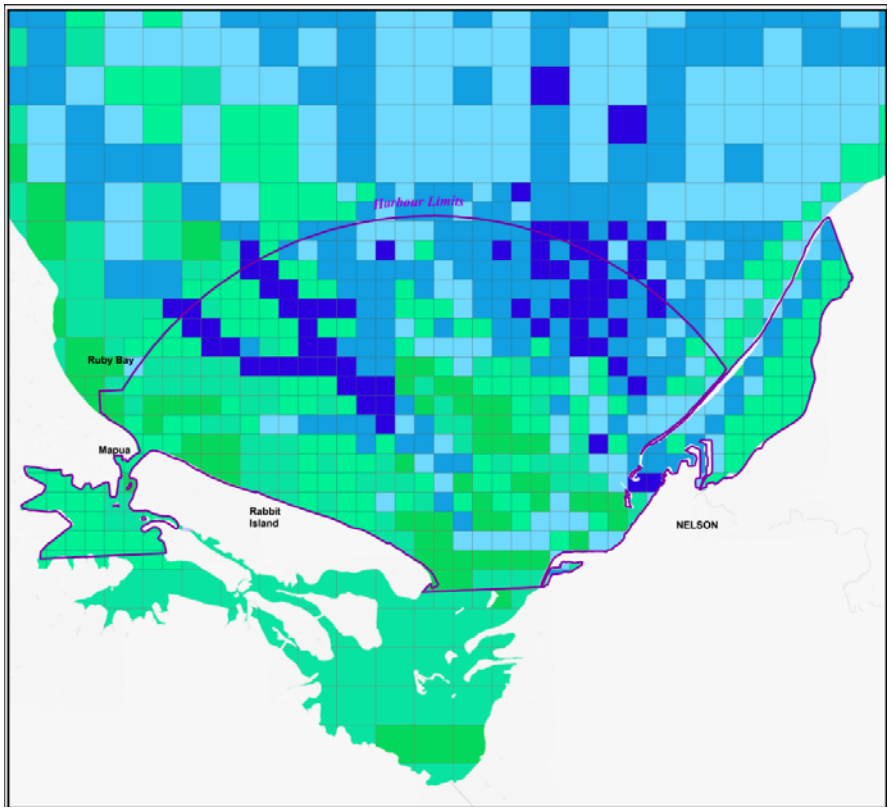


Figure 23 : Overview of Charting Benefit – Nelson Region

The Nelson region shows positive charting benefit is available for the designated ship anchorages both within Harbour limits and outside Harbour limits. There is an area of positive benefit at the Harbour Entrance and swing area, but this may be from chart data not as yet reflecting more recent survey data from the Port.



4 HYDROGRAPHIC RISK RESULTS - MARLBOROUGH REGION

4.1 INTRODUCTION – MARLBOROUGH REGION

Located at the top of the South Island, Marlborough is a sparsely populated region that enjoys high sunshine hours and a temperate climate. Marlborough is a unitary authority, being both a region and a district, and has 20% of New Zealand's coastline, as a result of the heavily indented Marlborough Sounds. Marlborough Harbour encompasses one of the largest areas of navigable harbour waterways with very diverse uses of its waterways: a high volume passenger service terminating in its main port; a growing destination for cruise vessels; heavy lift vessel rig off and on-loads; a growing aquaculture industry and high levels of recreational use.

The main port is Picton, at the head of Queen Charlotte Sound. The main small boat port is nearby Waikawa which is one of New Zealand's largest marinas and provides a base for leisure sailors and vacationers.

Marine farming, especially of salmon and mussels, is increasingly common, having started in the 1960s. Marlborough has 585 marine farms, mostly growing mussels, producing round 65,000 tonnes or 62% of New Zealand's total production of mussels each year.

New Zealand King Salmon delivers almost three quarters of the national salmon production from the Marlborough Sounds. Currently there are six operating salmon farms and additional consent is growing this industry. Salmon farms are located in Pelorus Sound, Queen Charlotte Sound and Tory Channel. Oysters are also produced in Marlborough as well as oyster spat for other regions.

The main channels of the Marlborough Sounds have calm water and are popular for sailing and fishing. Nearby Cook Strait, however, is infamous for its strong currents and rough waters. Tidal streams up to 5kn can be experienced at Tory Channel entrance during both ebb and flood streams and similar strength tidal streams can be expected at Te Aumiti / French Pass which also has several vortices.

4.1.1 PORT MARLBOROUGH

Port Marlborough New Zealand Limited operates the commercial Port activities within Picton Harbour and adjacent Shakespeare Bay. The port is located at Picton, a distance of 19nm from the northern entrance and 18nm from the alternative Tory Channel entrance. Picton is the South Island terminal port for New Zealand's inter-island passenger and freight ferries. The port is naturally deep and Waimahara Wharf at Shakespeare Bay can accommodate cargo vessels up to 13.5m draught and cruise ships up to 320m long. Waimahara Wharf is designed as a multi- purpose berth and is predominantly used for log exports and as a berth for large cruise ships. A barge ramp at the

southern end of the wharf facilitates barging of logs from the Sounds. Strong log exports which exceeded forecast volumes by large measure, resulted in the Port exporting in excess of 650,000 JAS.

Port Marlborough has three primary spheres of operation: the terminal for inter-island passenger and freight ferries at Picton; commercial berths for cruise ships and wharf facilities for servicing aquaculture, logs, commercial fishing and tourism operators; and provision of marinas. Port Marlborough is the second largest marina operator in New Zealand, with three marinas providing nearly 1,200 berths plus accommodation for a further 500 vessels in boat sheds and storage compounds. Picton marina has 207 berths; nearby Waikawa has berths for 473 boats and around 30 swing moorings, and Havelock marina can berth 369 boats.

Pilotage is compulsory for vessels over 500GT in Queen Charlotte Sound and for vessels over 350 GT in Tory Channel.

In 2014-15, Port Marlborough recorded 3,732 vessel visits from vessels greater than 500 GRT, of which 3,573 were ferries, 36 were cruise vessels and a large number of the remainder were log ships. Cement and fish comprised the other main cargoes handled at Picton.

4.1.2 HAVELOCK HARBOUR AND PELORUS

Havelock is a coastal village at the head of Pelorus Sound, and at the mouth of the Pelorus and Kaituna Rivers. Havelock is the centre for much of the New Zealand green-lipped mussel industry, and is the base of a mail boat servicing the remote communities in the Marlborough Sounds, as well as home to many fishing and recreational boats. Although a significant number of mussel barge transits occur in Pelorous Sound and surrounding areas, they are not required to carry AIS transponders. They thus do not appear in the traffic record.

Te Aumiti / French Pass is situated in the Marlborough Sounds at the top of the South Island. The water races through on each tide at up to eight knots creating whirlpools, eddies and currents. Rich upwellings from the Cook Straight provide nutrients for a wide variety of fish, seabirds, dolphins, seals and other marine life.

Port Marlborough operates wharf and port landing facilities in Elaine Bay and Port Underwood to support marine farming operators. Elaine Bay, in Pelorus Sound, hosts a small fishing and aquaculture port. Many smaller fishing vessels and large mussel boats regularly dock here. Many of the surrounding bays contain mussel farms, which are a large employer for the region. There is also a small forestry industry in Elaine Bay.

4.1.3 D'URVILLE ISLAND & ADMIRALTY BAY

Admiralty Bay provides a large and partially sheltered deep water bay in the lee of D'Urville Island, which has good anchorage holding. It is used for the offloading of oil drilling rigs and production facilities for New Zealand oil exploration.

There was one record of a heavy lift vessel into Admiralty Bay in the 12 month data period. This included accompanying support vessels.

D'Urville is a 'pinch point' for all vessel traffic, with strong tides and currents around both northern and southern ends of the island.

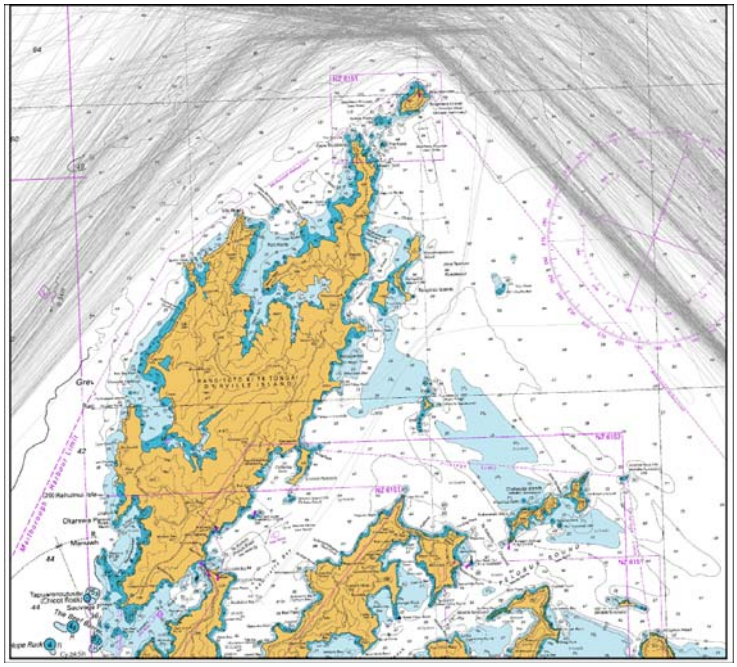


Figure 24 : Cargo Vessel Record – D'Urville & Admiralty Bay

4.1.4 PORT UNDERWOOD

Port Underwood is a sheltered harbour which forms the north-east extension of Cloudy Bay, on the east coast of the Marlborough Sounds. With a relatively narrow entrance to the south-south-east it is sheltered from almost all winds and was once the site of a whaling station. The main economic activities here are mussel, oyster farming and forestry. Two Clam dredges operate out of Port Underwood, harvesting clams from the marine farm.

A dozen swing moorings are located in Port Underwood at Oyster Bay.

Separated from the South Island by the narrow Te Aumiti / French Pass channel, D'Urville Island is the largest island in the outer Marlborough Sounds. With an area of approximately 150 km^2, it is the eighth-largest island of New Zealand.

4.1.5 CHARTING INFORMATION OBSERVATIONS – MARLBOROUGH REGION

The entire Queen Charlotte Sound and most of Tory Channel, with over one million passengers transiting each year, has source data in some areas dating from 1942. The Tory Channel Entrance to Queen Charlotte Sound was last surveyed in 1977-78. Testing for the different recommended scales for approach and harbour charts exposed a problem at the Queen Charlotte entrance. An error with the location of ZOC scorings in this area was revealed and corrected during the project.

4.1.6 AREAS OF RISK SIGNIFICANCE – MARLBOROUGH REGION

Long and Kokomohua Islands Marine Reserve is located inside the entrance to Queen Charlotte Sound. The islands are attached to each other by a largely submerged reef, which surrounds and extends northeast from Kokomohua Island for almost 500 m. The reserve is only accessible by a private or a charter boat.

The blue cod fishery in the Marlborough Sounds was closed in 2008, after NIWA survey results showed blue cod in the Marlborough Sounds area declined substantially (by an estimated average of 64%) between 1995-96 and 2004. From 2004 to 2007, the population either continued to decline or remained at low levels in the inner, middle and outer parts of Queen Charlotte and Pelorus Sounds. It has now been reopened with very low bag limits. There is a 'no-take zone' around the predator-free scientific reserve of Maud Island in Pelorus Sound.

Reserves are numerous around the Marlborough Sounds and include: parts of D'Urville Island; Chetwode Islands; Cape Lambert; Cape Koamaru; Ship Cove; Momorangi; Motuara and Pickersgill Island.

There are also plans announced for the establishment of a Recreational Fishing Park in the Marlborough Sounds. This would exclude commercial fishing operations within the boundaries of the park, removing both customary and commercial quota rights.

4.1.7 ECONOMIC SUMMARY – MARLBOROUGH REGION

Nearly 6% of Marlborough's economic activity (GDP) comes from marine farming and processing. Cruise vessel visitors injected NZ$8.4M into the economy.

The sub-national GDP of the Marlborough region was estimated at US$1.193b in 2003, 1% of New Zealand's national GDP.

Traditionally Marlborough was an agricultural economy but today is renowned for its wines, particularly sauvignon blanc, with other important industries including mussel farming, forestry, aviation and tourism.

4.2 TRAFFIC ANALYSIS – MARLBOROUGH REGION

The types of commercial vessels transiting the Marlborough Region and using Port Marlborough include:

- General and Break bulk
- Charter boats and water taxis
- Passenger cruise
- Naval
- Passenger and vehicular ferries
- Tugs &Barges
- Fishing
- Tankers (Coastal Only)

4.2.1 ALL TRAFFIC - MARLBOROUGH REGION

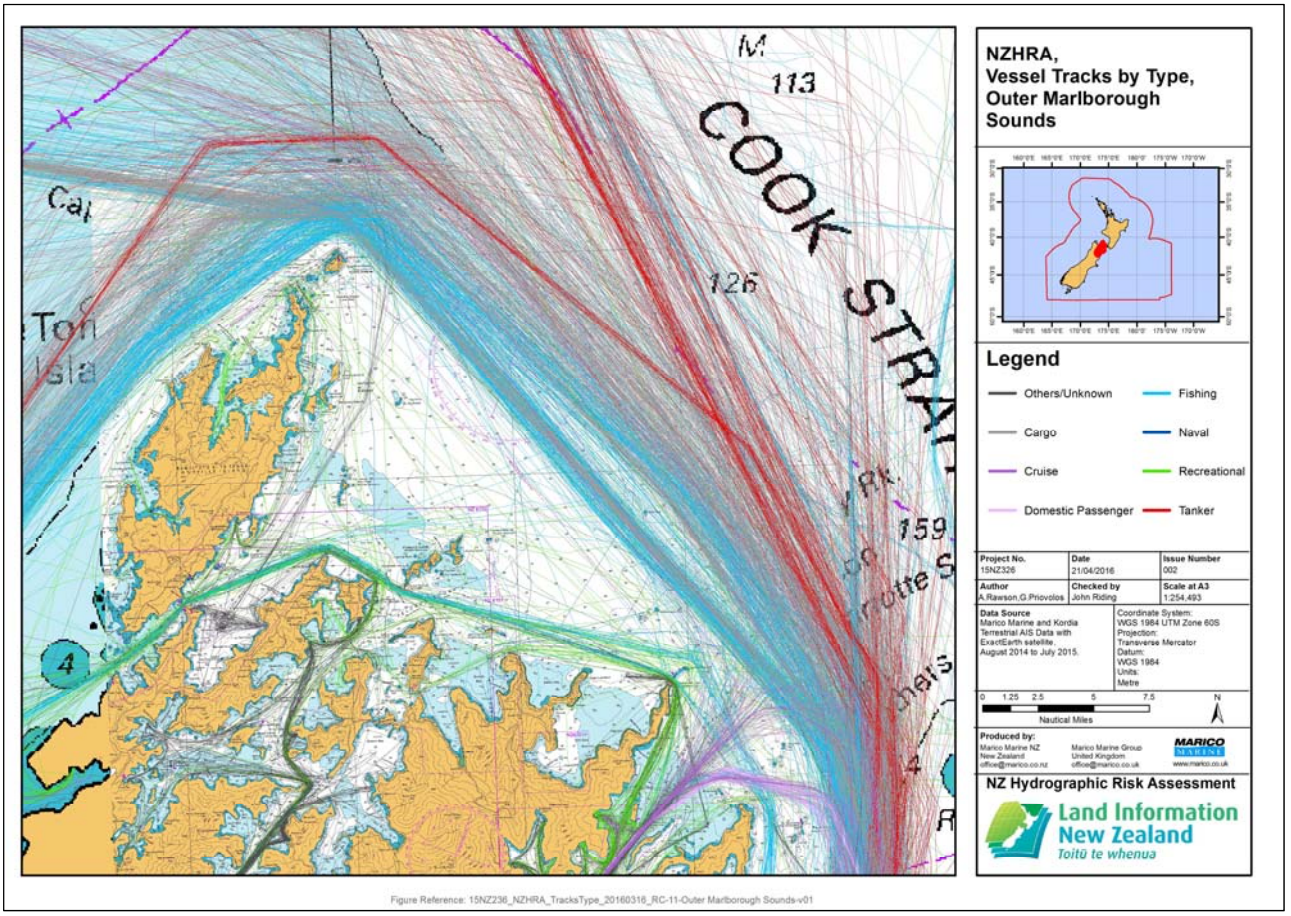


Figure Reference: 15NZ236_NZHRA_TracksType_20160318_RC-11-Outer Marlborough Sounds-v01

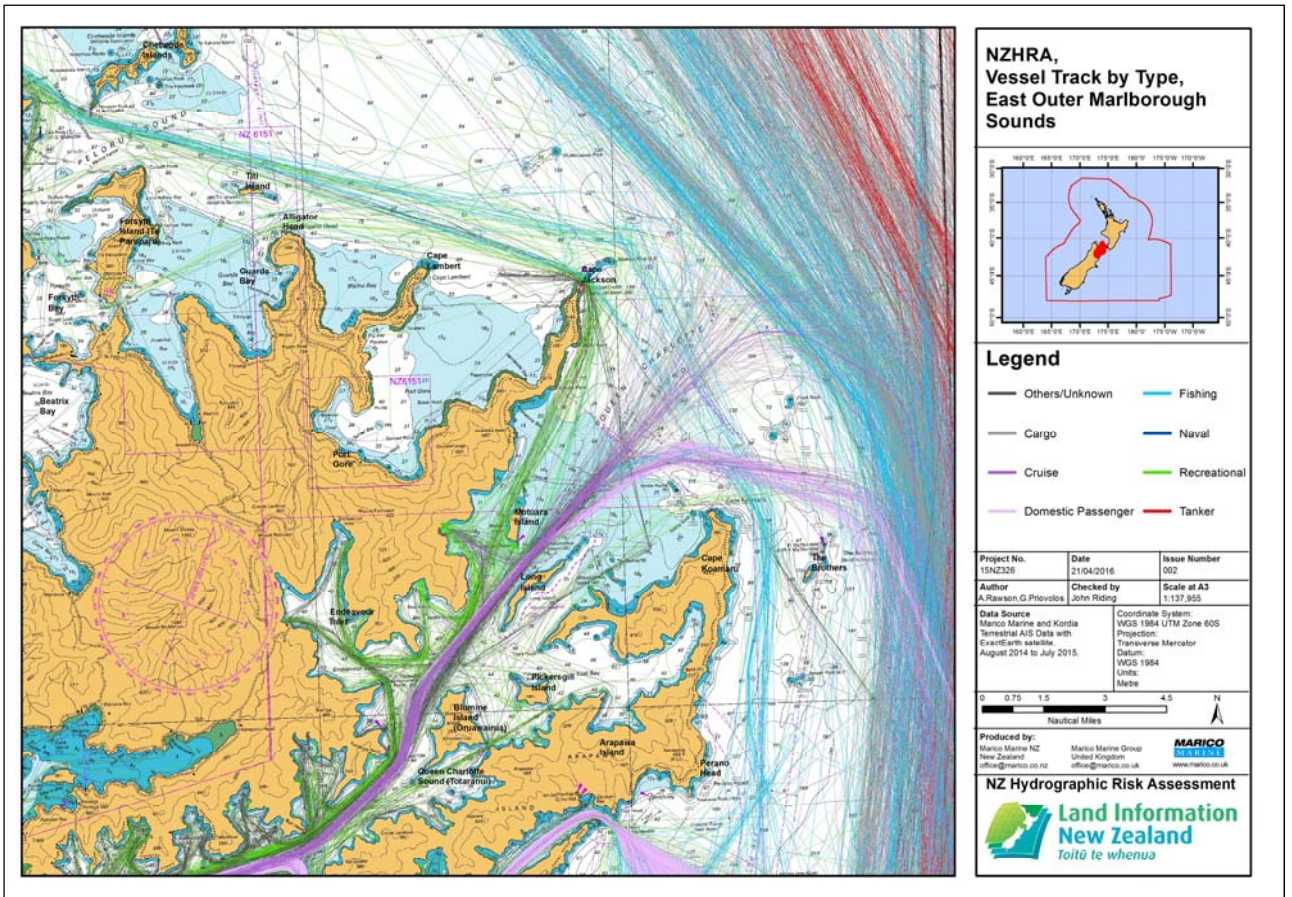


Figure 25 : Traffic By Vessel Type – Marlborough Sounds

4.2.2 TRAFFIC DENSITY – MARLBOROUGH REGION

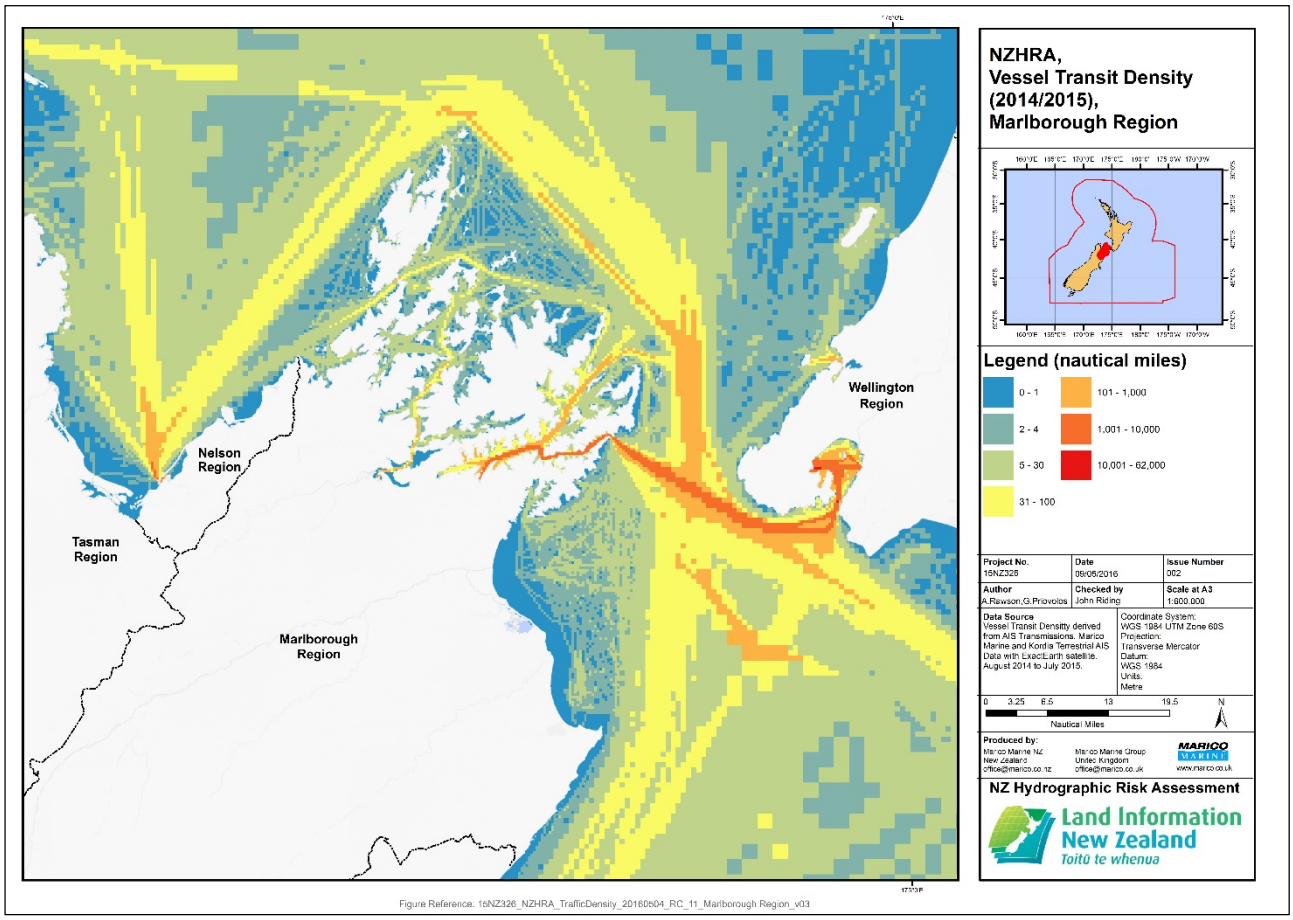


Figure 26 : Traffic Density – Marlborough Region

The traffic density plot confirms that the Cook Strait and Marlborough waters account for traffic density equal to that anywhere else in New Zealand. The RoRo ferry transits into Picton provide most of this volume, although vessels converge when transiting the waters of the Cook Strait, which extends the area of denser traffic.

4.2.3 CARGO VESSELS – MARLBOROUGH REGION

Most cargo vessels use the northern entrance to Queen Charlotte Sound, with mostly local coastal vessels using the Tory Channel entrance. From outside Queen Charlotte Sound, vessels track north to Nelson, Taranaki or Australian ports; or south through Cook Strait.

A number of cargo vessels used the charted anchorage in Cloudy Bay, with several bulk carriers anchoring in Queen Charlotte Sound.

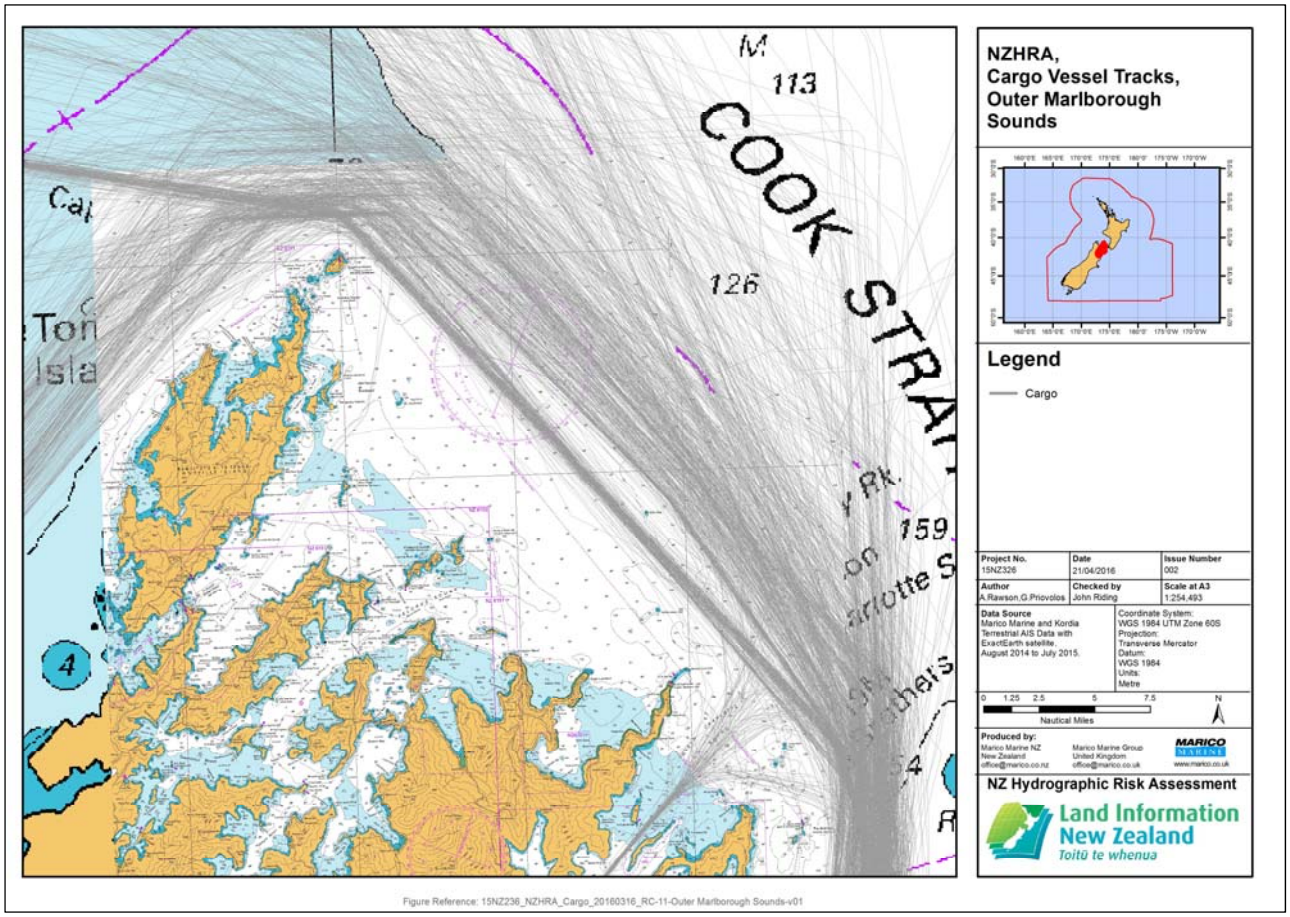
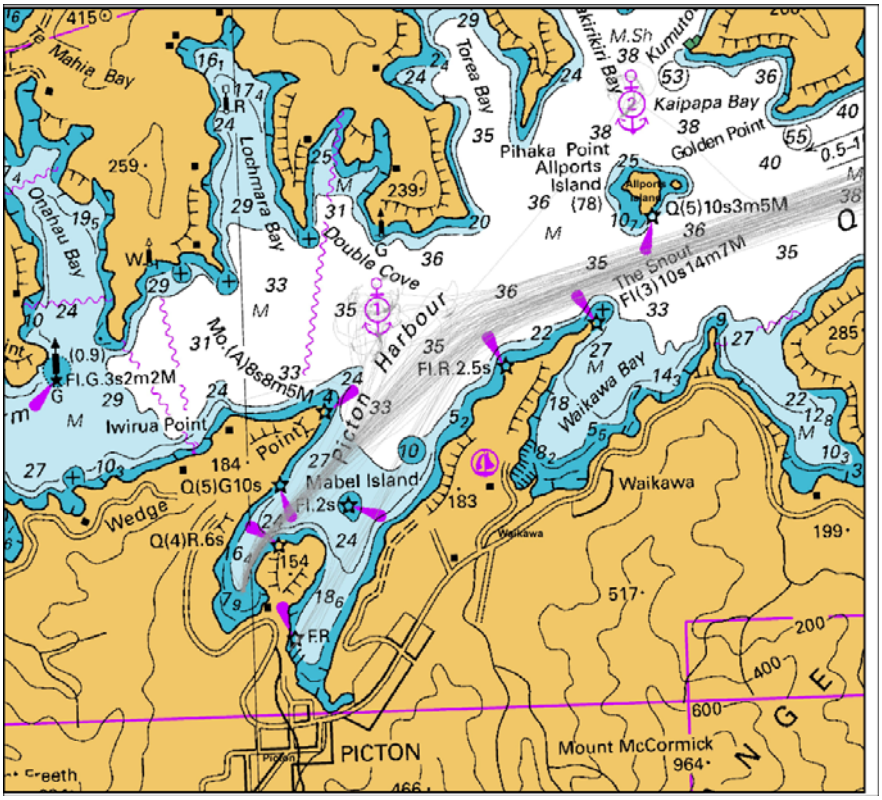


Figure 27 : Cargo Vessel Record - Marlborough Sounds and Port Picton



General cargo traffic into Marlborough Sounds is mostly Bulk or Log carriers loading at Port Picton. Almost all transit into the Shakespeare Bay wharf.

4.2.4 CRUISE VESSELS – MARLBOROUGH SOUNDS

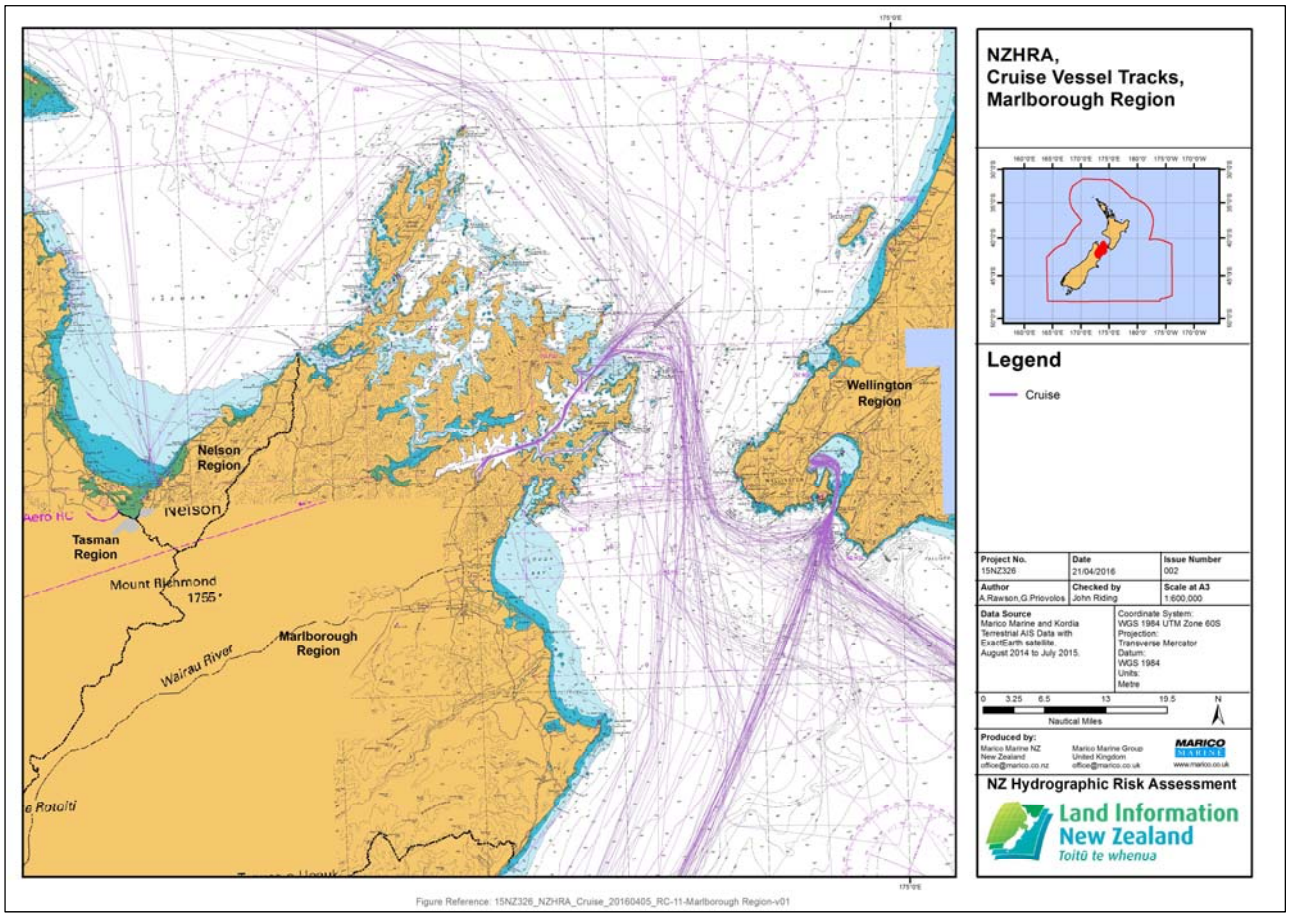


Figure 28 : Cruise Vessel Tracks – Marlborough Region

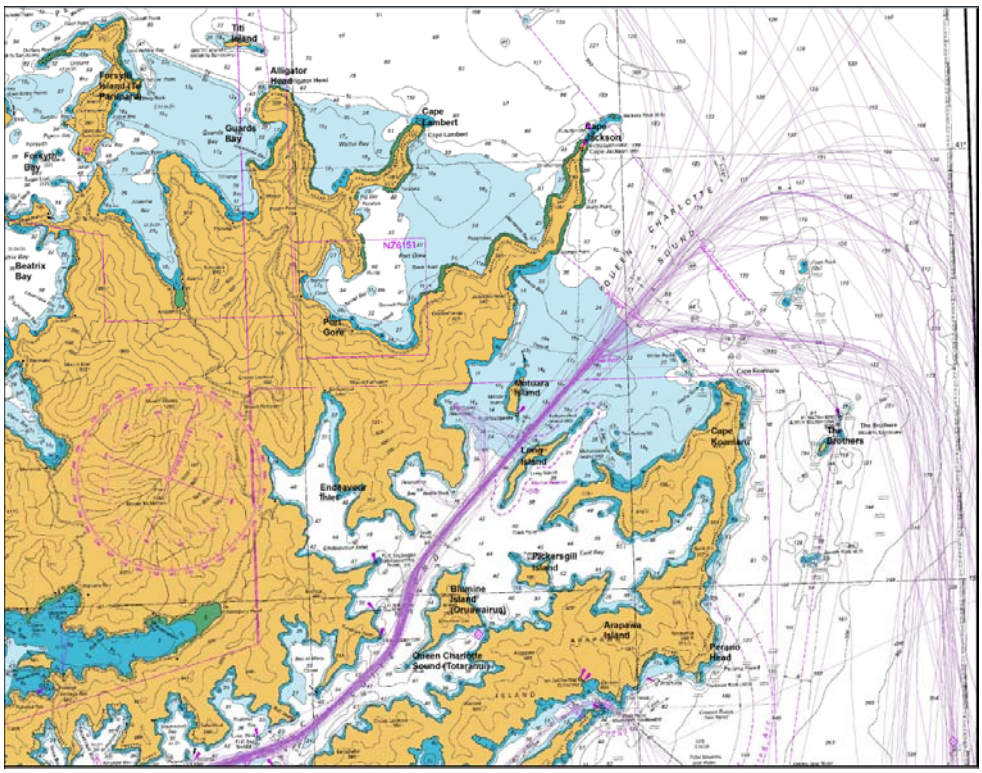


Figure 29 : Cruise Vessel in Queen Charlotte Sound Showing Visits to Ship Cove

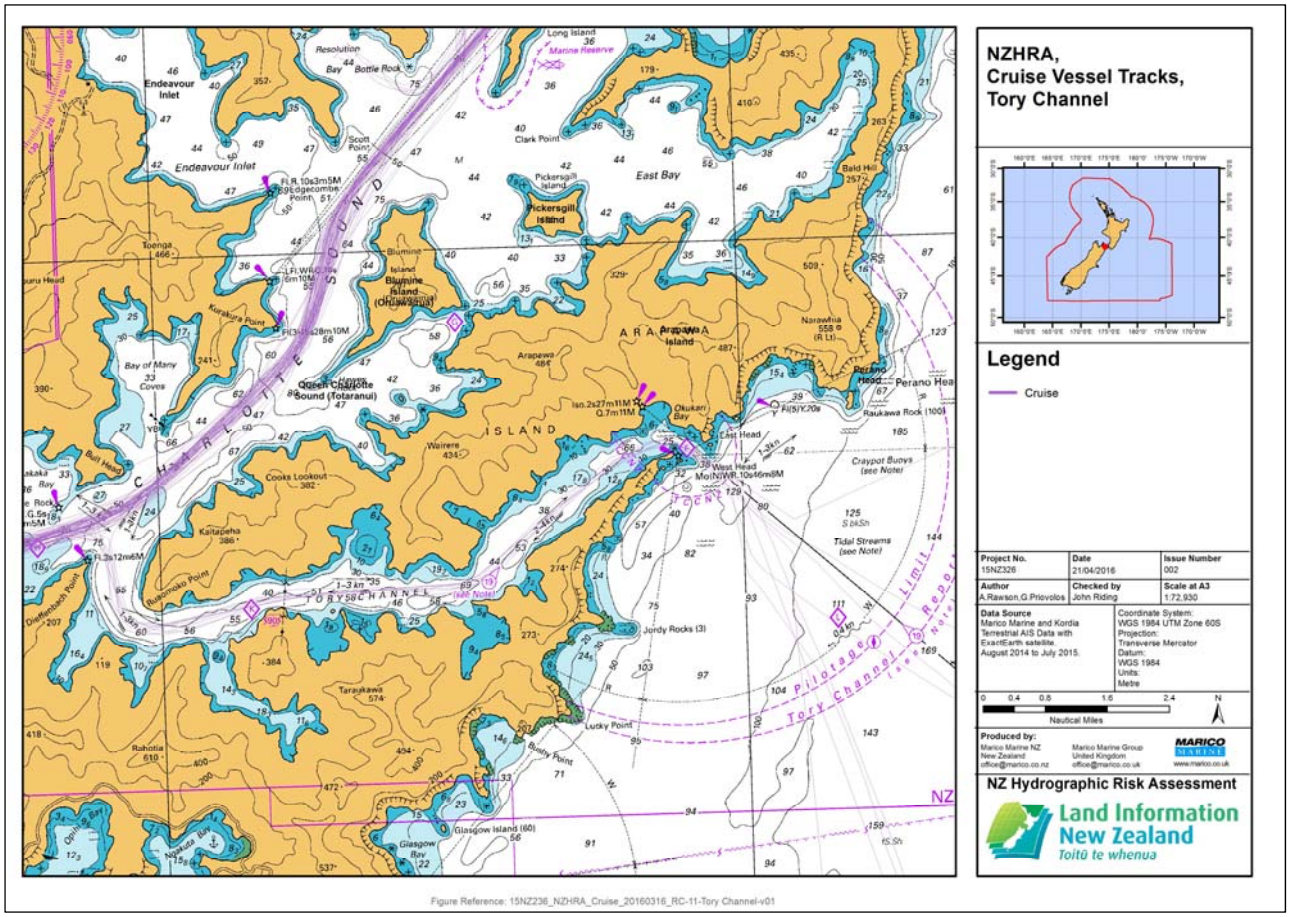
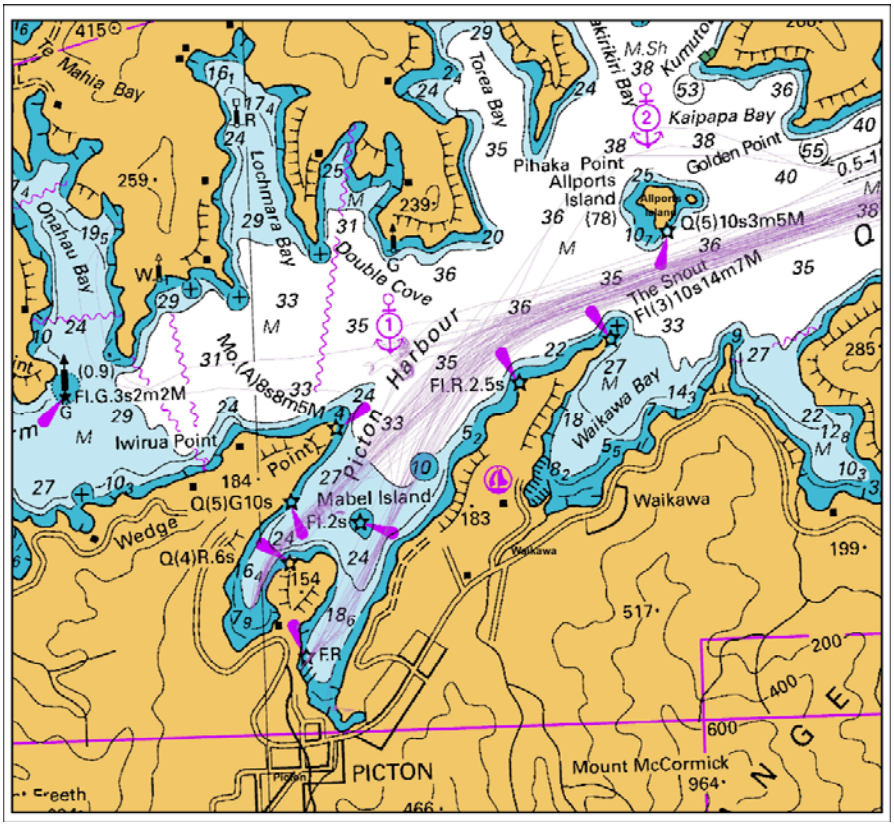


Figure 30 : Cruise Vessel Record – Marlborough Sounds



Cruise vessel visits to Marlborough Sounds have grown dramatically in numbers and from passenger feedback Picton is a popular port. Port Picton can provide deep water at Shakespeare Bay and the largest of cruise vessels visiting New Zealand are beginning to visit the Shakespeare Bay terminal.

Ship Cove is also a popular destination which is readily accessible to cruise vessels which anchor in the approaches to the cove.

4.2.5 DOMESTIC PASSENGER VESSELS – MARLBOROUGH REGION

In 2014-15, Port Marlborough recorded 3,573 Inter-island ferry visits bringing over 1.2M passengers through the port. Most ferries transited through the shorter Tory Channel, with a few ferries using the northern entrance when weather conditions dictated, or when a Pilotage Exemption for this entrance required updating. A large number of active water taxi and charter boat services operate out of Picton, taking passengers all around the Sounds to many different destinations and on fishing excursions. In any one year, passenger volumes carried by water taxis as a whole are significant, as they provide a service linking visitors to their chosen accommodation as well as facilitate trampers using the many routes available, by transporting baggage and meeting at terminations.

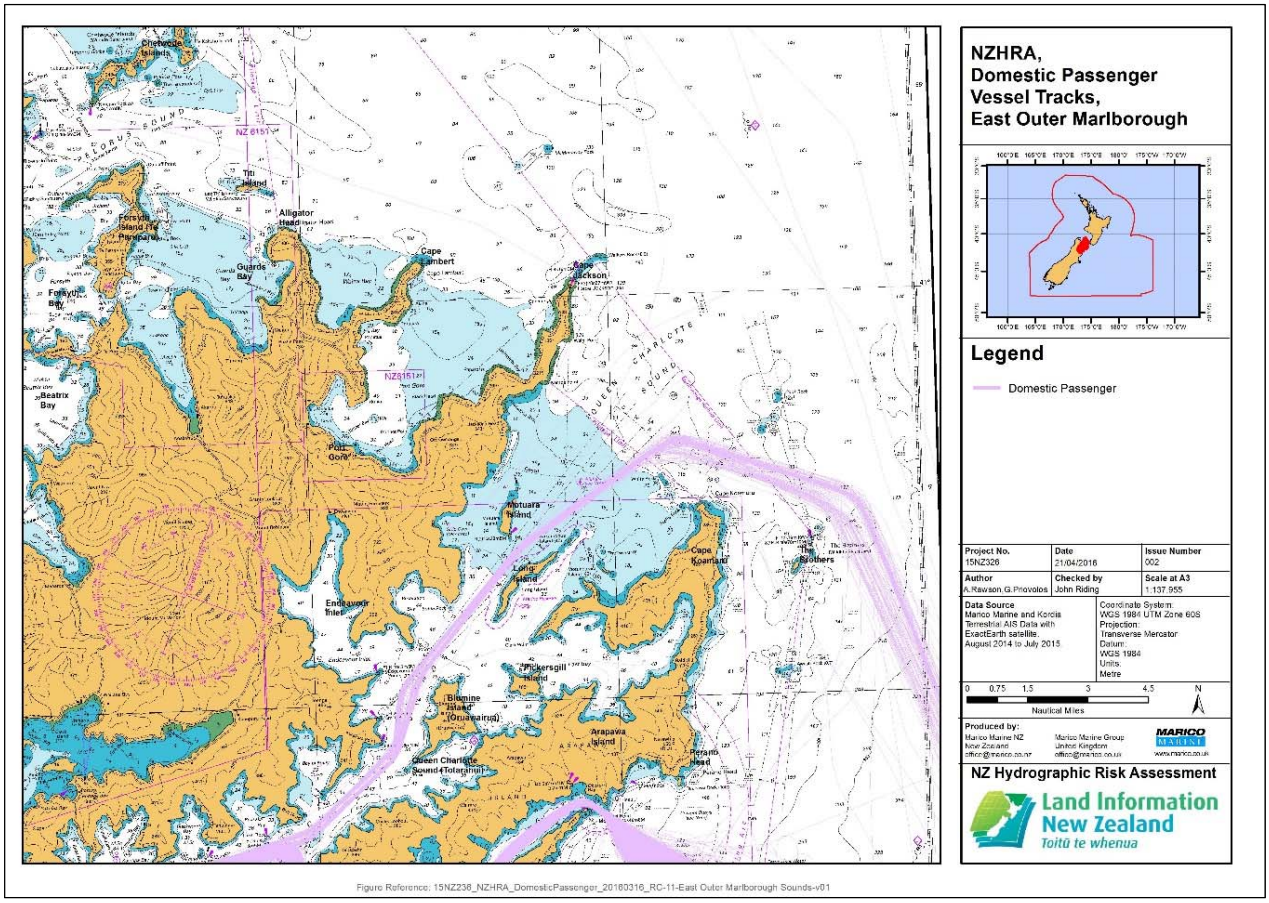


Figure 31 : Cook Strait Ferry Routes – Outer Sounds

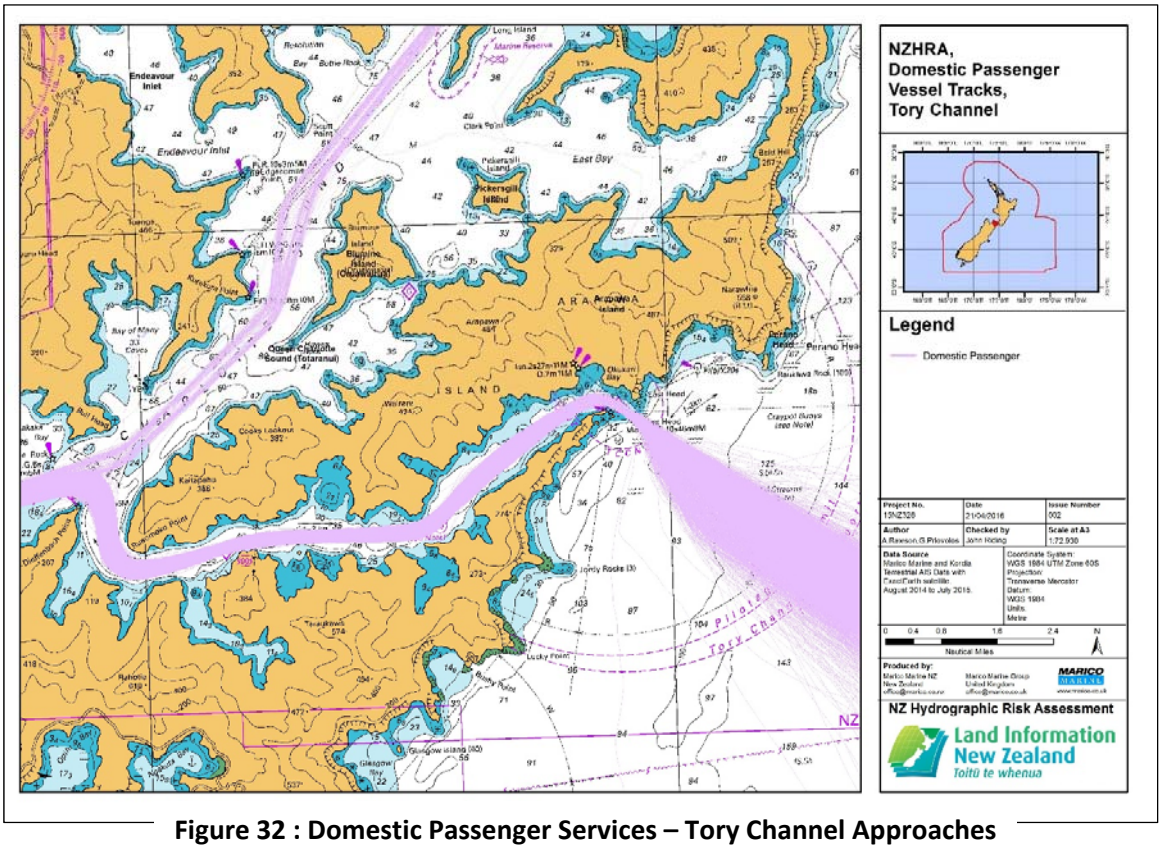


Figure 32 : Domestic Passenger Services – Tory Channel Approaches

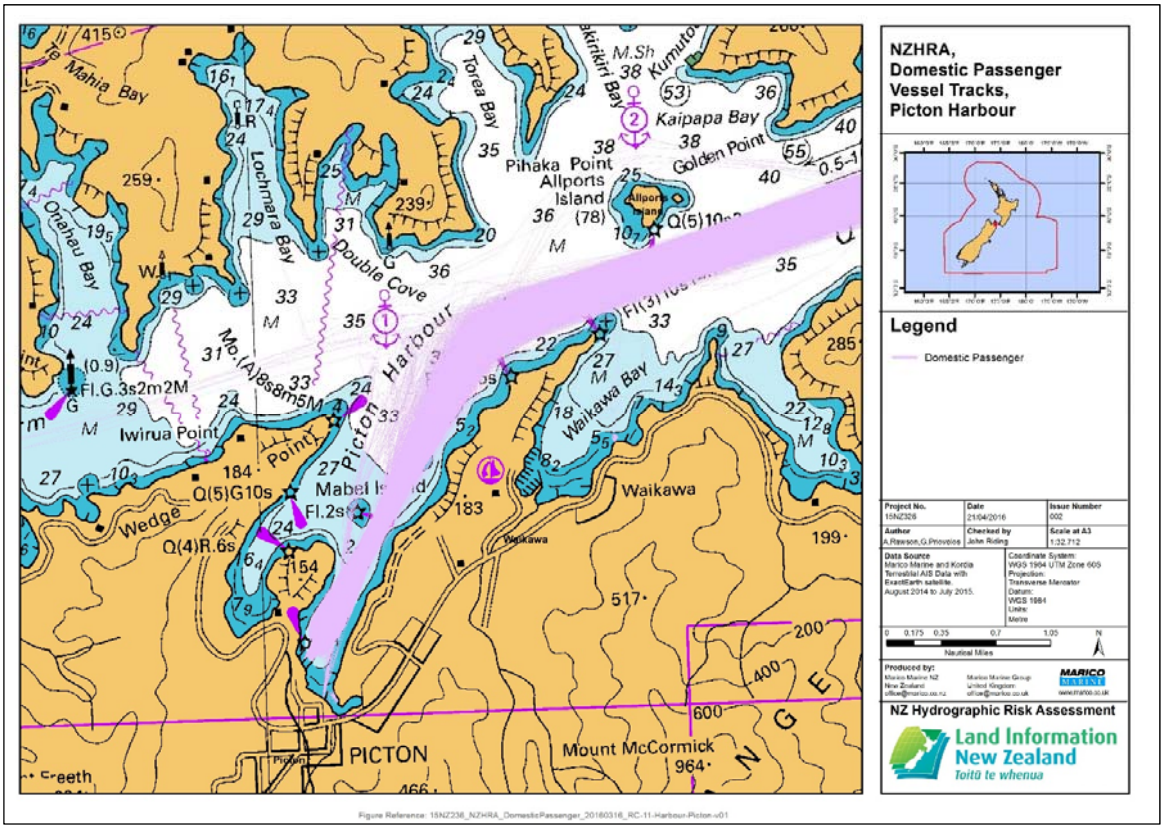


Figure 33 : Domestic Passenger Record – Picton Terminals

4.2.6 TANKER TRAFFIC - MARLBOROUGH REGION

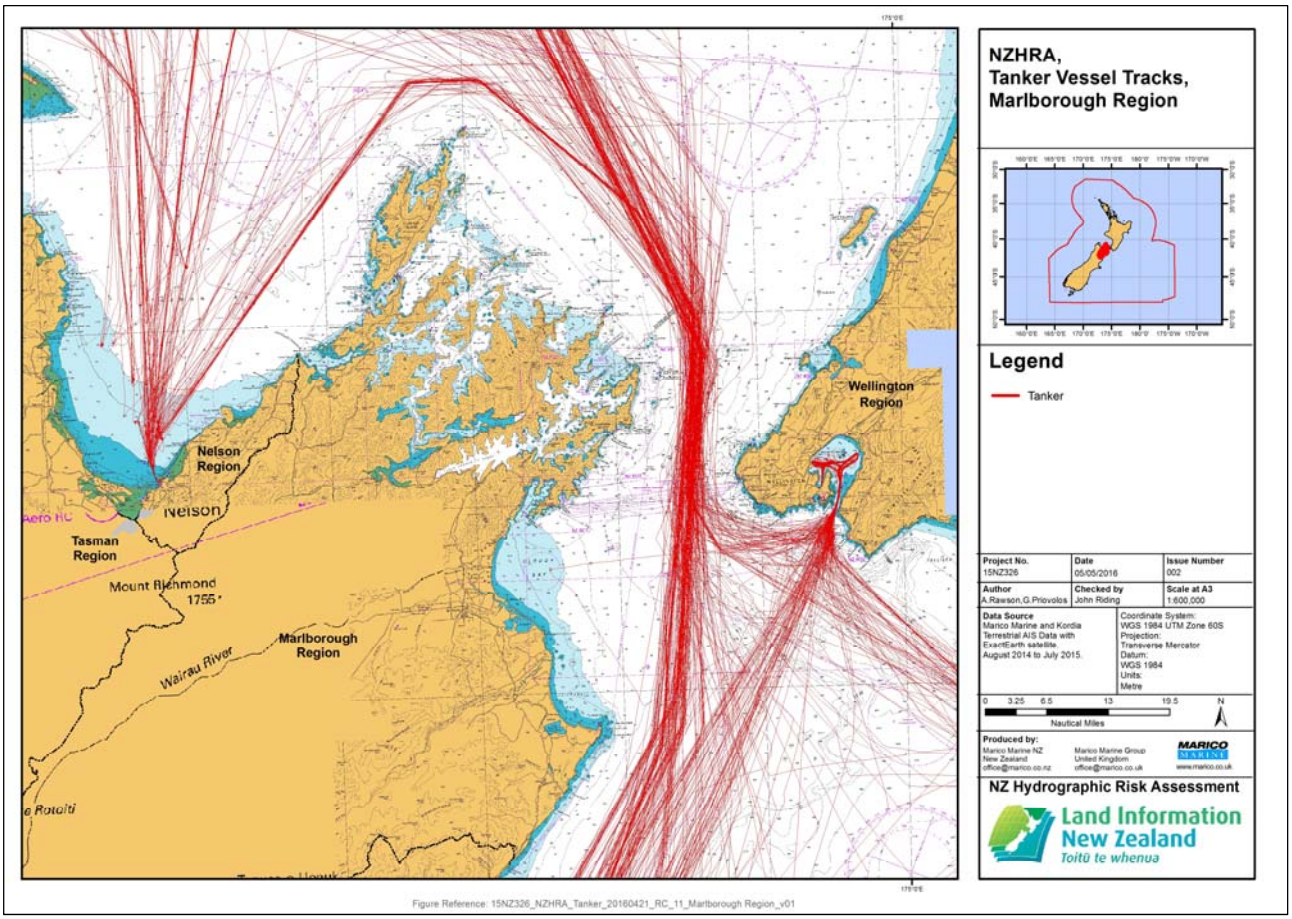


Figure 34 : Tankers – Marlborough Region

No tanker vessel tracks are recorded in Marlborough Sounds, with the exception of one that appears to have sought shelter in Cloudy Bay. All other tankers transited past the region through Cook Strait.

4.2.7 OTHER VESSELS – MARLBOROUGH REGION

Numerous 'Other' vessel AIS tracks are visible in Admiralty Bay, south of D'Urville Island, and its approaches. These are from the heavy transport ship *Blue Marlin*, carrying the semi-submersible drilling rig *Kan Tan IV* from Singapore. Support vessels are also in the record. Admiralty Bay was used as a suitable location for the rig to be floated off, which entailed the ship partially submerging using ballast tanks. The *Kan Tan IV* was then towed to Taranaki by offshore towing vessels.

4.2.8 COMMERCIAL FISHING VESSELS – MARLBOROUGH REGION

Fishing vessel activity is extensive throughout the region including through Te Aumiti / French Pass and Port Underwood, with the exception of the Pelorus Sound which has only one fishing vessel track recorded, although aqua farming craft activity throughout all the Sounds, including Pelorus Sound,

is widespread and intensive. There is reference to commercial fishing within the Marlborough Sounds being excluded in the future within a new Marlborough Sounds Marine Park area.

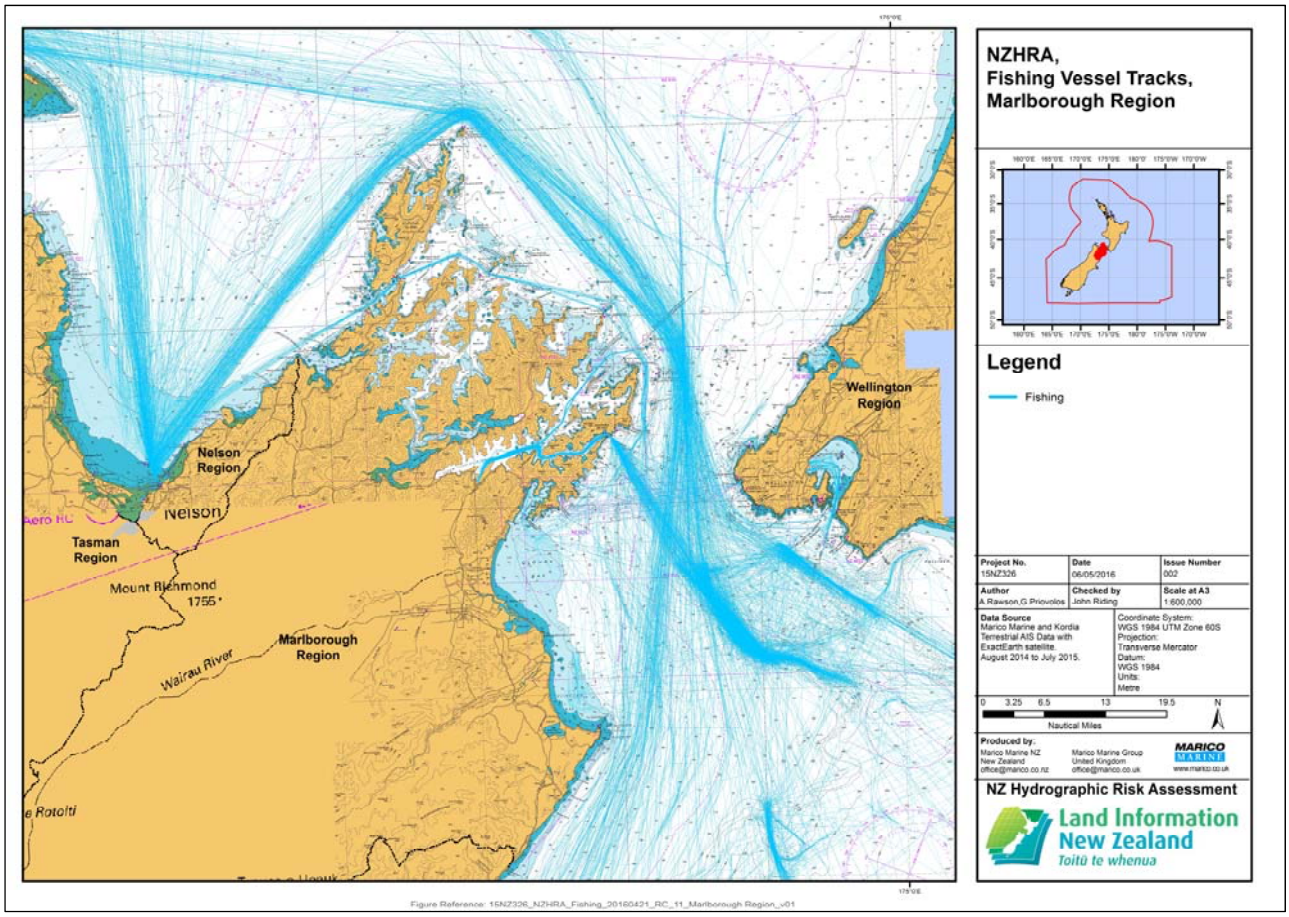


Figure 35 : Fishing Vessel Tracks – Marlborough Region

4.2.9 RECREATIONAL FISHING – MARLBOROUGH REGION

All the Marlborough Sounds are used extensively for recreational fishing. While Canterbury, Nelson / Tasman Bay and Wellington contribute significant recreational fishing effort in the Sounds, the greater proportion of fishers' usual residential location was the Marlborough region. The most preferred time of the year to go fishing in the Marlborough Sounds is the peak holiday period of December to February, with fishing from private boats by line the most preferred fishing mode.

4.2.10 RECREATIONAL CRAFT – MARLBOROUGH REGION

Marlborough Sounds has intensive recreational craft usage. Over 1,300 vessels are accommodated in marinas and on swing moorings in the Marlborough region. Apart from recreational fishing boats, other types of recreational vessels include sail boats, pleasure launches and jet skis. Their traffic patterns are random, but are intensified as expected around marina entrances and sheltered bays.

Members of the Pelorus, Waikawa and Mana Boating Clubs have access to 80 moorings owned jointly or individually by the clubs and located throughout the Marlborough Sounds, D'Urville Island and Porirua Harbour.

4.3 TRAFFIC ANALYSIS – PICTON

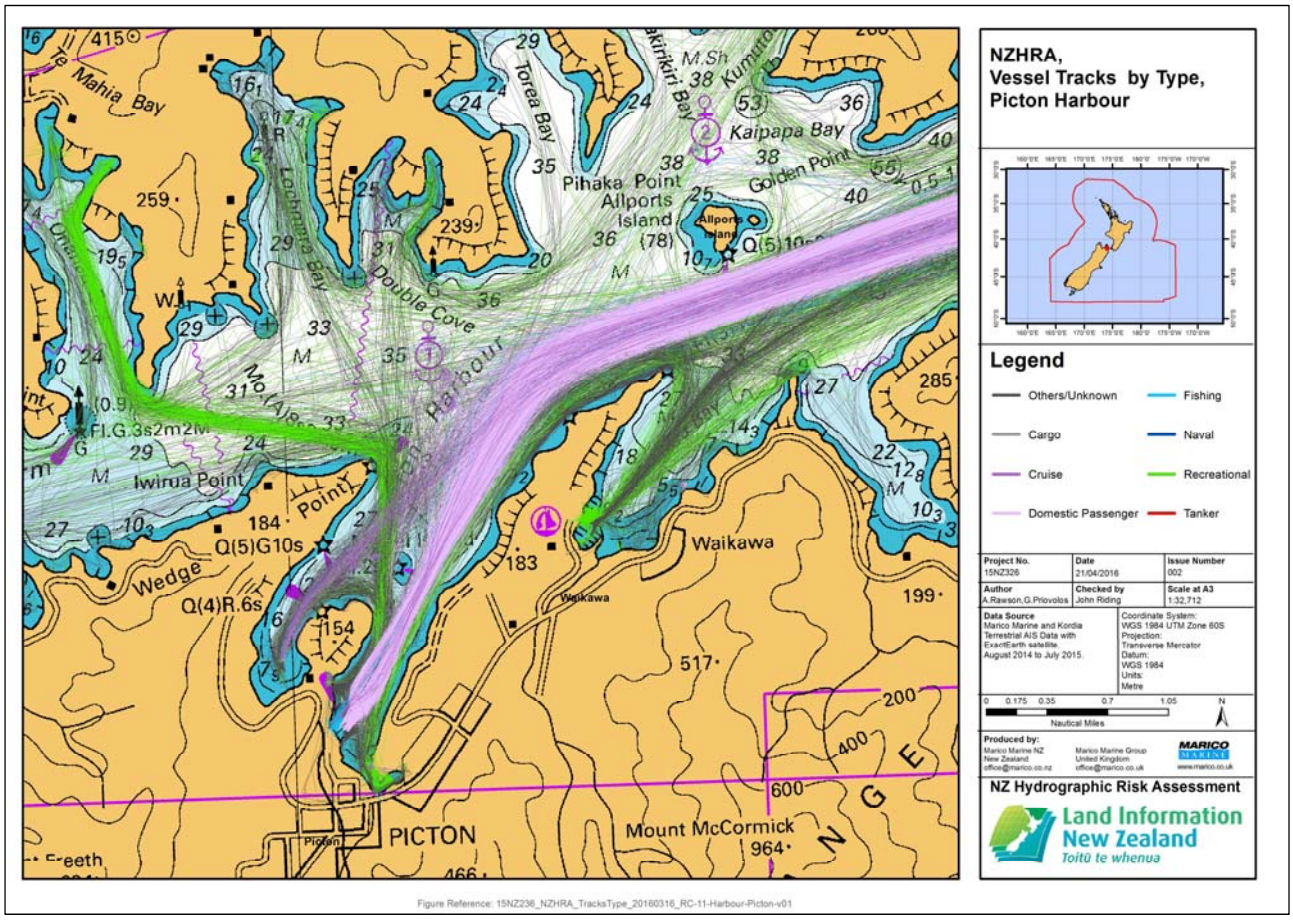


Figure 36 : Port Picton – All Traffic by Vessel Type

For what is a small port with two terminals, Port Picton is one of the more busy ports in New Zealand as far as ship movements are concerned. It has two busy marinas (Picton and Waikawa) and in the summer months a high volume of water taxis operate out of Picton.

4.3.1 CRUISE VESSELS – PORT PICTON

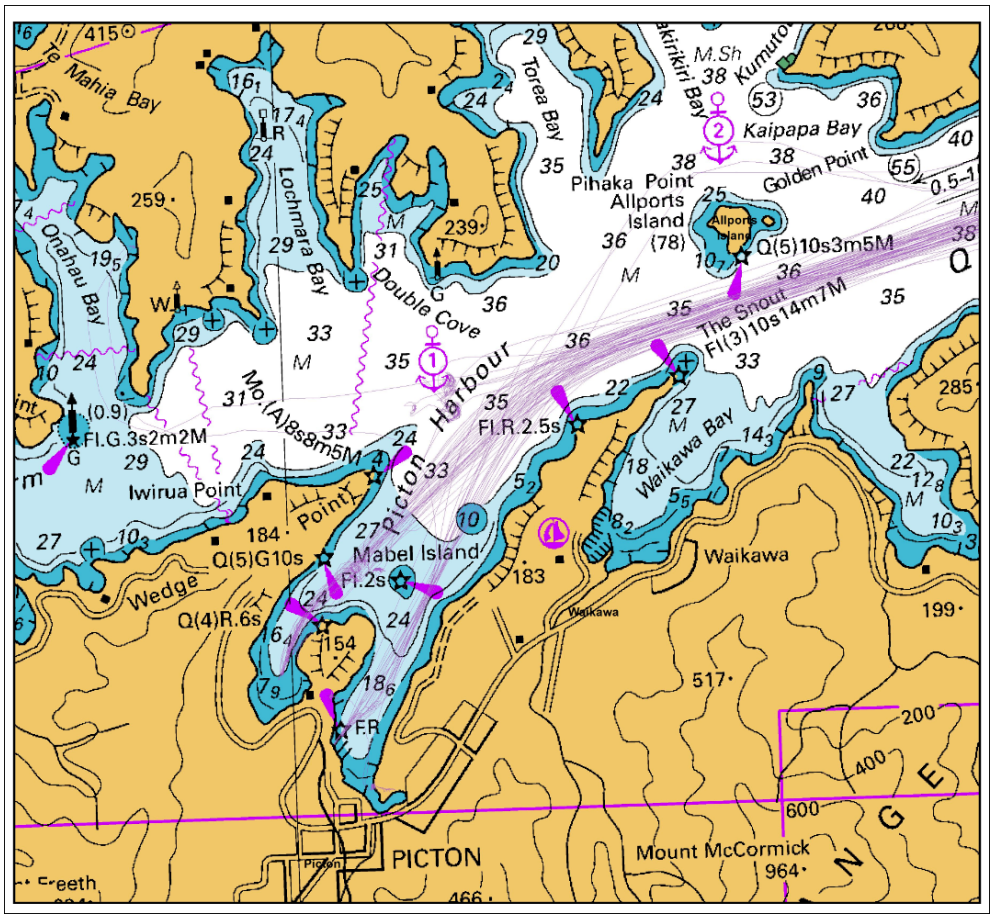


Figure 37 : Cruise Vessel Calls – Port Picton

Thirty-six cruise ships called into Picton bringing 52,000 passengers into the port in the 2014-15 season. Several cruise vessels used the Tory Channel entrance, but the majority transited via the north entrance to Queen Charlotte Sound, with one detouring into Resolution Bay and three vessels anchoring, on more than one occasion, in Ship Cove.

4.4 HYDROGRAPHIC RISK – MARLBOROUGH REGION

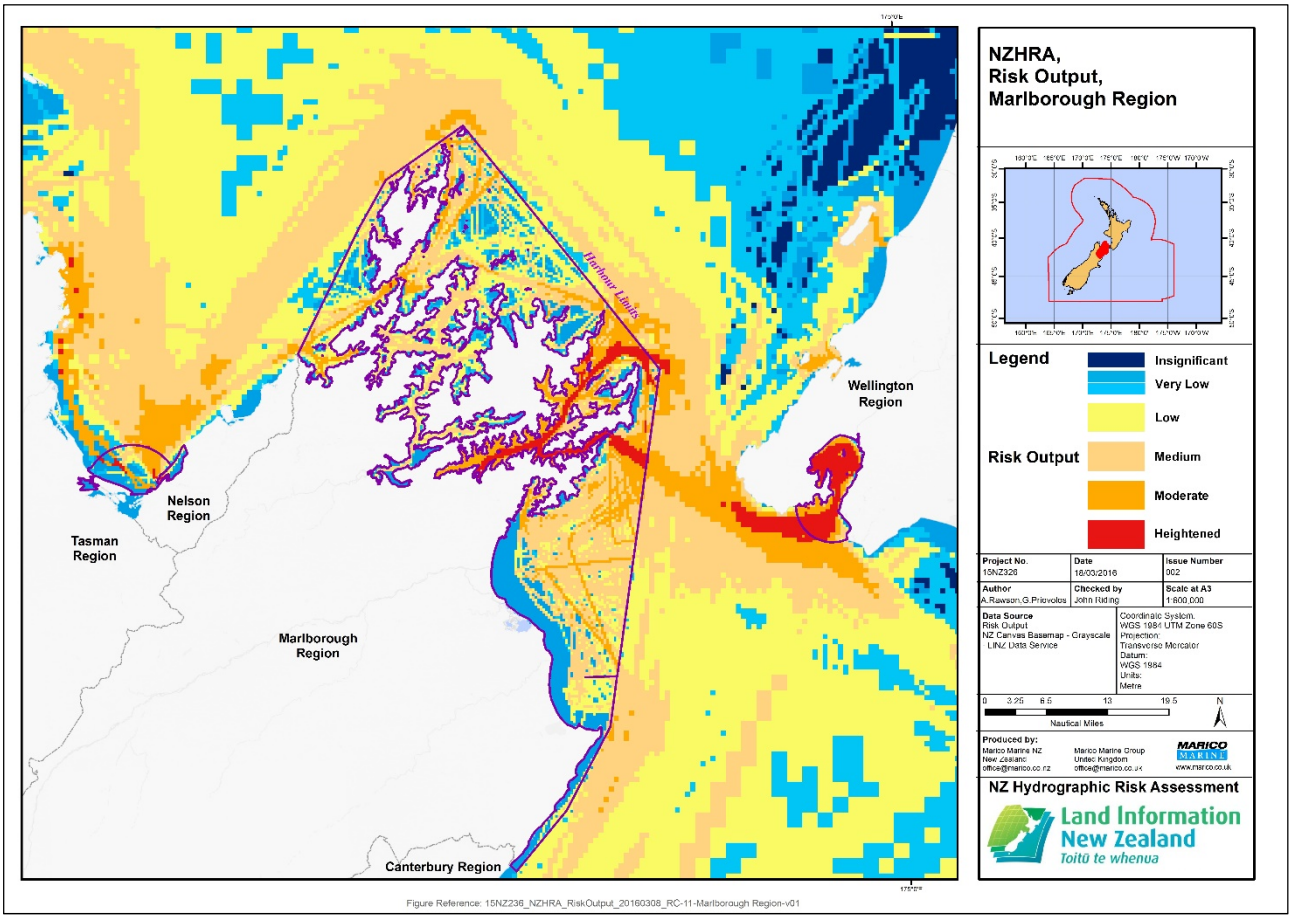
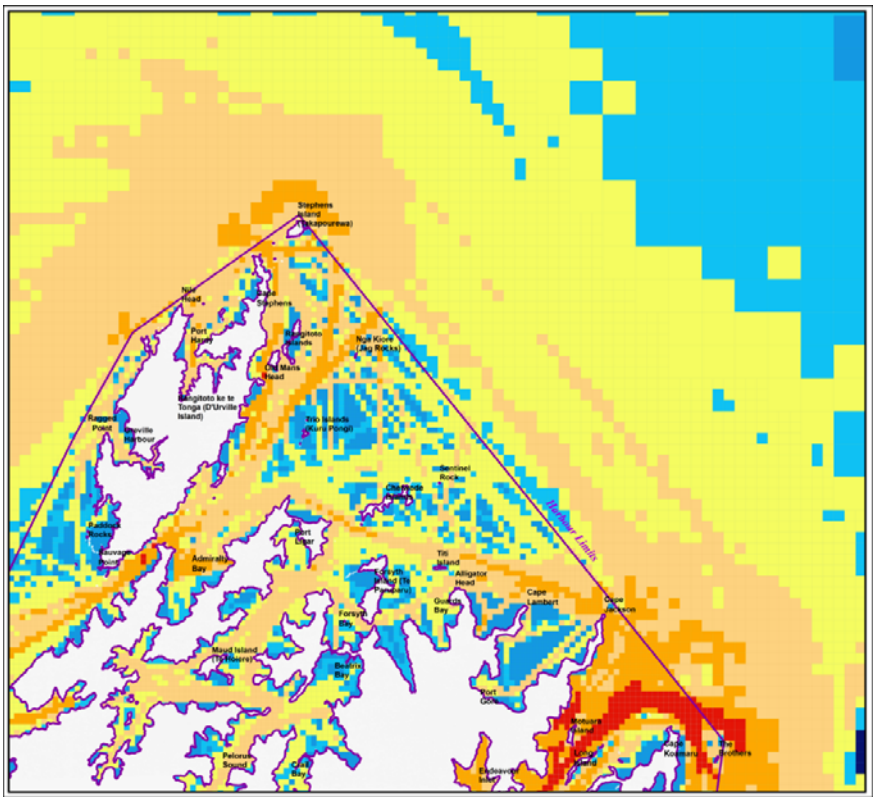


Figure 38 : Hydrographic Risk – Marlborough Region



Marlborough Region is one area of New Zealand that exhibits large areas of moderate hydrographic risk. Most of the Queen Charlotte Sound and Tory Channel routes have provided a heightened result, as have areas of the outer sounds, with medium levels of risk being provided in Pelorous Sound. Risk in Queen Charlotte Sound is arising from the high volume of passenger services as well as the age of chart source data. With such a large harbour area, providing

hydrographic surveys to modern standards in all traffic locations is challenging for a relatively small Harbour Authority system.

4.4.1 HYDROGRAPHIC RISK – OUTER MARLBOROUGH SOUNDS

The extents of heightened hydrographic risk extend into the Northern entrance of Marlborough Sounds and straddle the gazetted Harbour Limits. There are areas of high tidal currents including tidal overfalls and isolated dangers (the Brothers, Cook Rock and Northern Entrance).

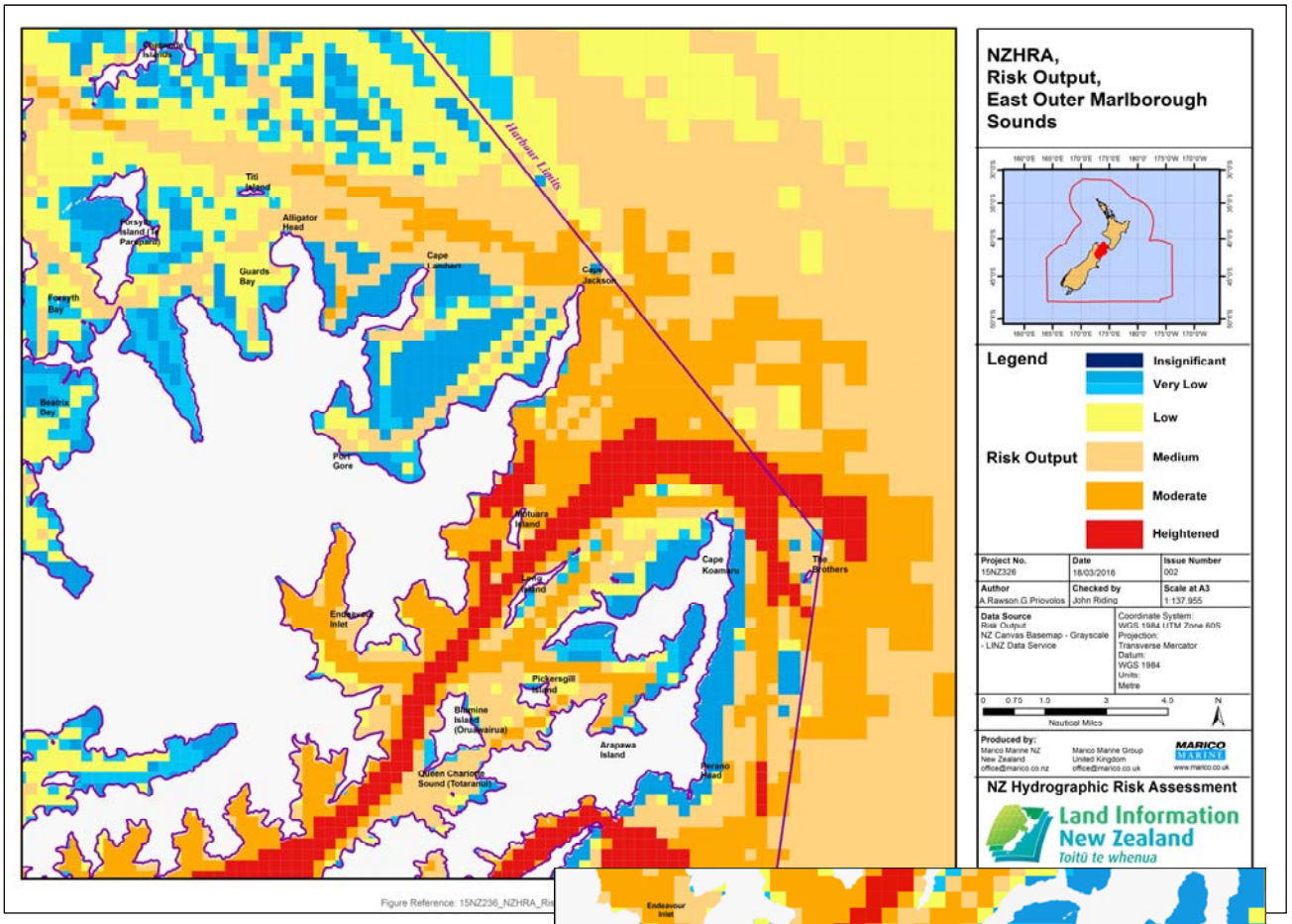


Figure 39 : Hydrographic Risk – Marlborough Sounds – East Outer Areas

Hydrographic risk is also heightened at the entrances to Marlborough Sounds because the Charting within Harbour limits does not comply with the IHO recommendations for the change of charting scales. In the Queen Charlotte Sound's Northern Entrance the

extents of charts are in need of review with a view for a chart reorganisation in the area.

The northern entrance to Queen Charlotte Sound is used by cruise vessels for anchoring and ferrying passengers ashore. Inter-island ferries use this northern approach to Picton in adverse weather and when renewing their Pilotage Exemptions.

4.4.2 HYDROGRAPHIC RISK – PICTON HARBOUR

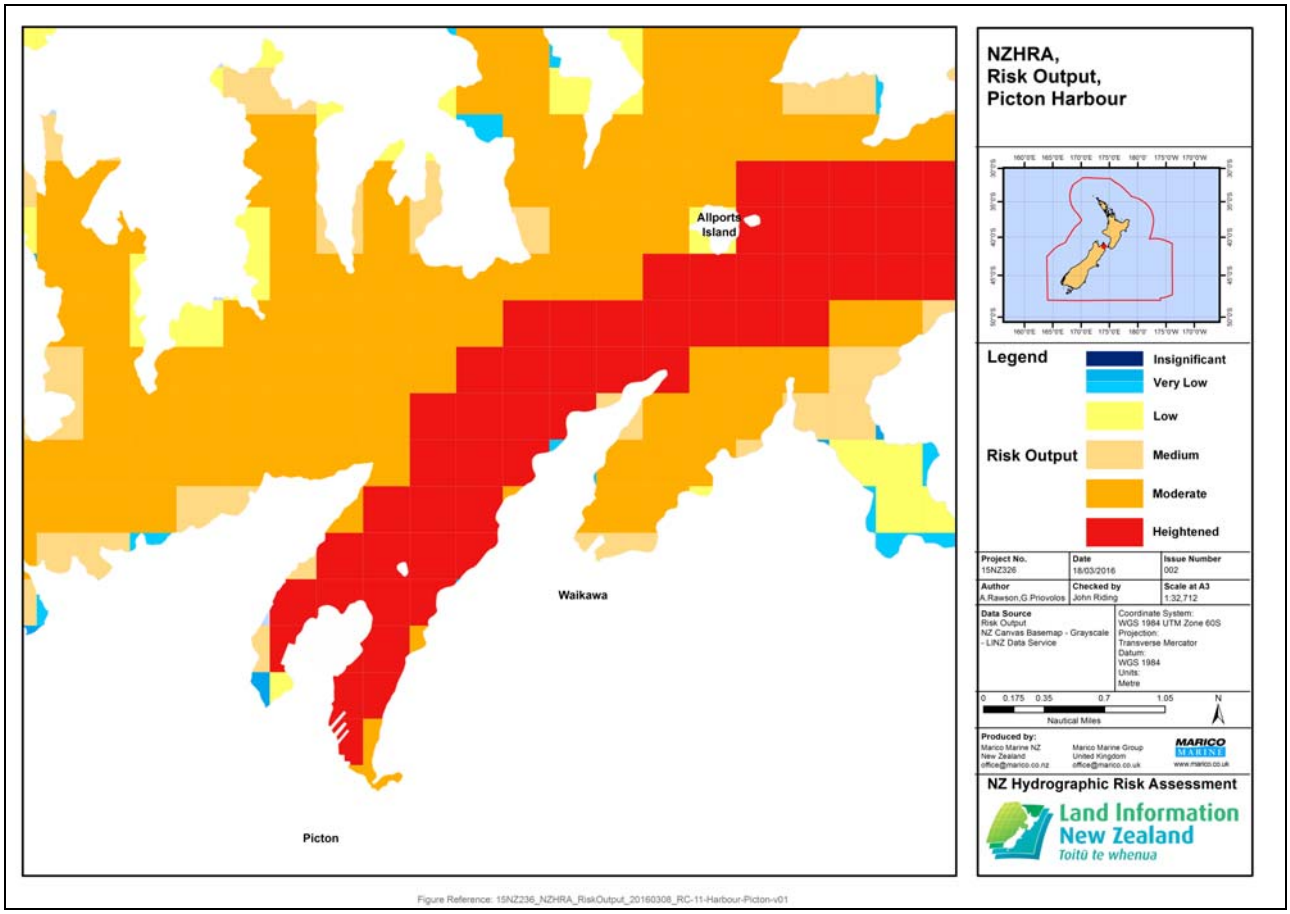


Figure 40 : Risk Output – Picton Harbour

A heightened risk is showing in Picton Harbour from the high passenger ferry traffic combined with the charting scales for the approach and berthing charts and the dates of source data.

4.5 CHARTING BENEFIT – MARLBOROUGH REGION

Large areas of Marlborough Sounds provide positive charting benefit results. A charting reorganisation appears to be necessary in the Northern Entrance, to bring the pilot boarding area into the extents of the harbour approach scale charts used at the entrance. Testing for the different recommended scales for approach and harbour charts exposed a problem at the Queen Charlotte entrance. Although an error with the location of ZOC scorings in this area was revealed and corrected during the project, the area has still provided a positive benefit result.

The other positive charting benefit influence is the age of chart source data in a number of areas of the Sounds. The Marlborough Sounds area is a candidate for professional review by hydrographic and cartography expertise.

Four different areas of the Region are discussed in more detail below.

4.5.1 CHARTING BENEFIT RESULT – D'URVILLE ISLAND

The ZOC C charting standard and the heightened risk from the age of the source data, dating from 1950's combines to produce the charting benefit. Added to this is the high volume of all types of traffic converging around this 'pinch' point. Notwithstanding these, the positive benefit here is mostly due to the charting scale, as the island is inside the Marlborough Harbour Limits. The charting scales here could beneficially be reviewed by LINZ.

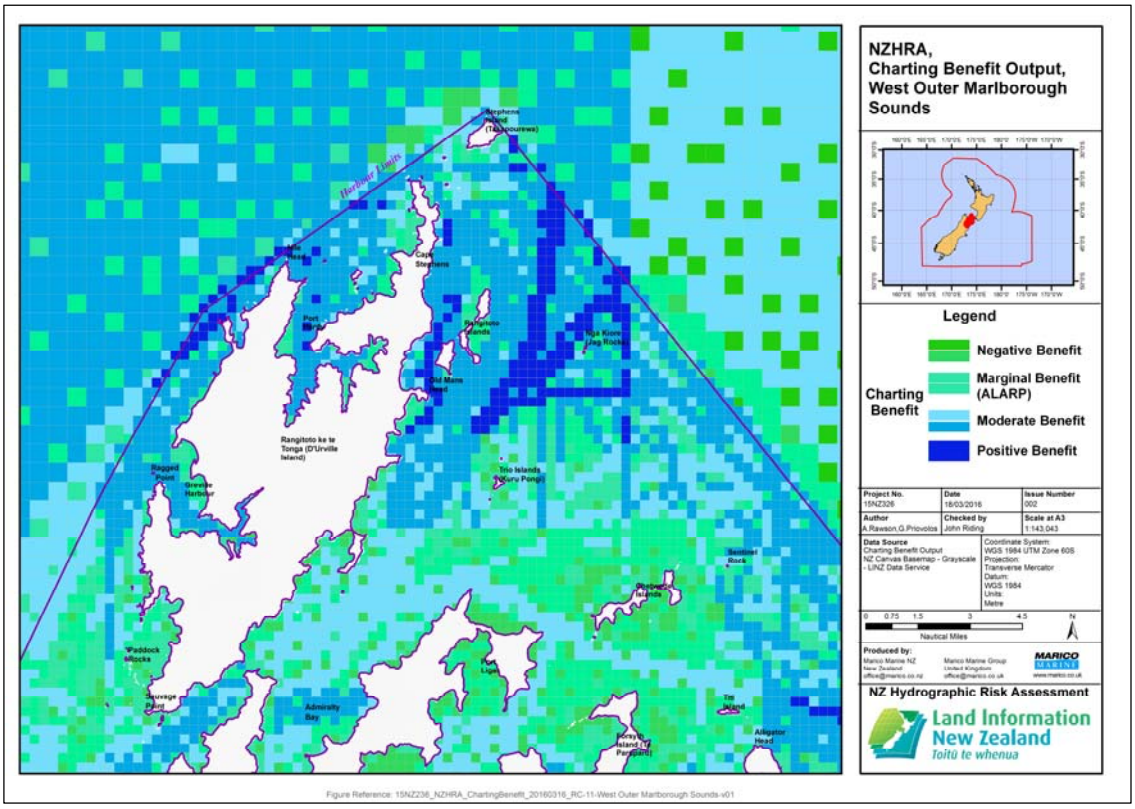


Figure 41: Charting Benefit - D'Urville Island

4.5.2 CHARTING BENEFIT RESULT – OUTER MARLBOROUGH

A charting benefit is showing in the approaches to the designated ship anchorage in Cloudy Bay and in the outer approaches to Port Underwood. The designated ship anchorage and its approaches in Cloudy Bay, along with the outer approaches to Port Underwood, are all at a Coastal scale rather than Approach scale, with no seafloor characteristics data for the designated anchorage, giving a charting benefit here.

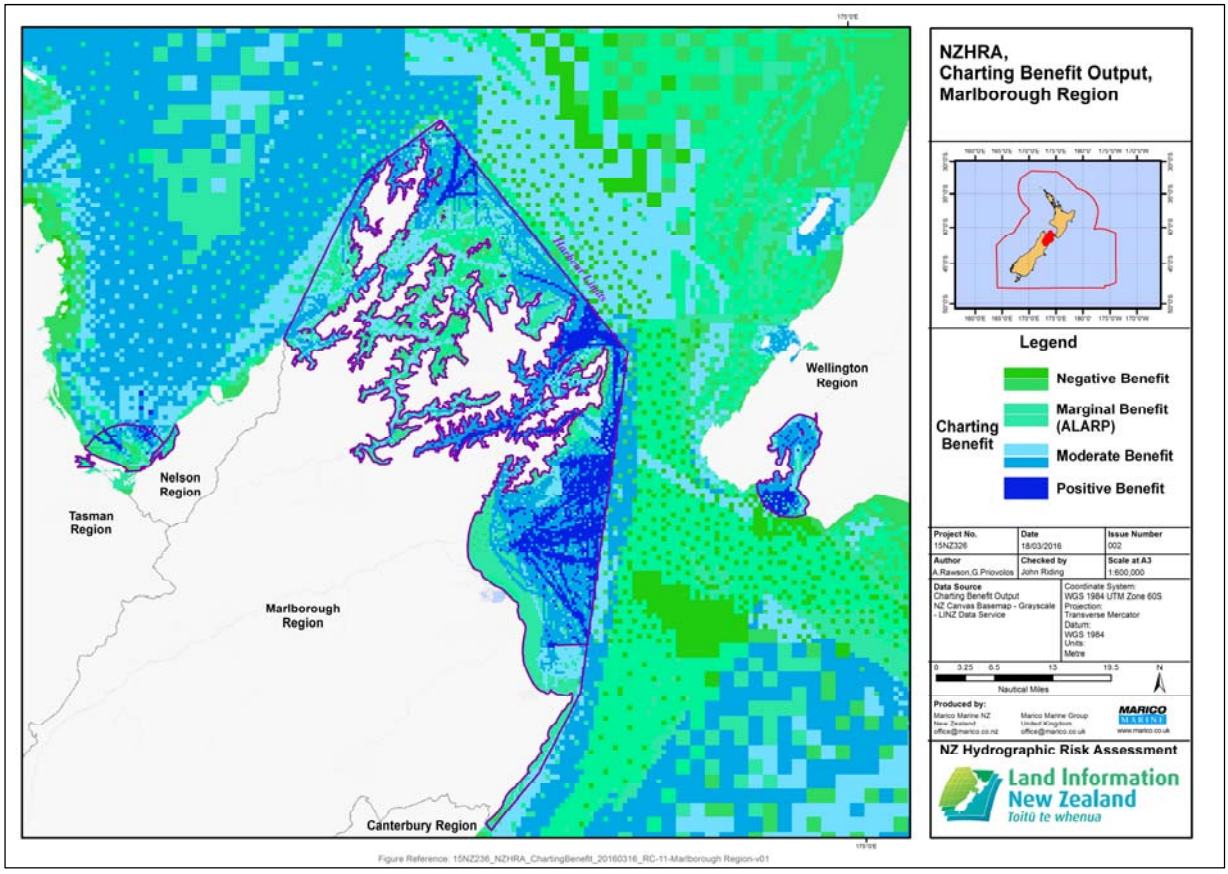


Figure 42: Charting Benefit - Outer Marlborough Sounds

4.5.3 CHARTING BENEFIT RESULT – TORY CHANNEL

Tory Channel Entrance, where ferries carrying an extremely high volume of passenger and vehicular traffic use this restricted and difficult entrance multiple times per day, was last surveyed in 1978. In 2016 a 180m LOA cruise vessel made contact with Wheki Rock (marked with a lighted starboard hand beacon), as did a 127m LOA passenger ferry in 2011.

A positive charting benefit is showing for most of Tory Channel, including the entrance.

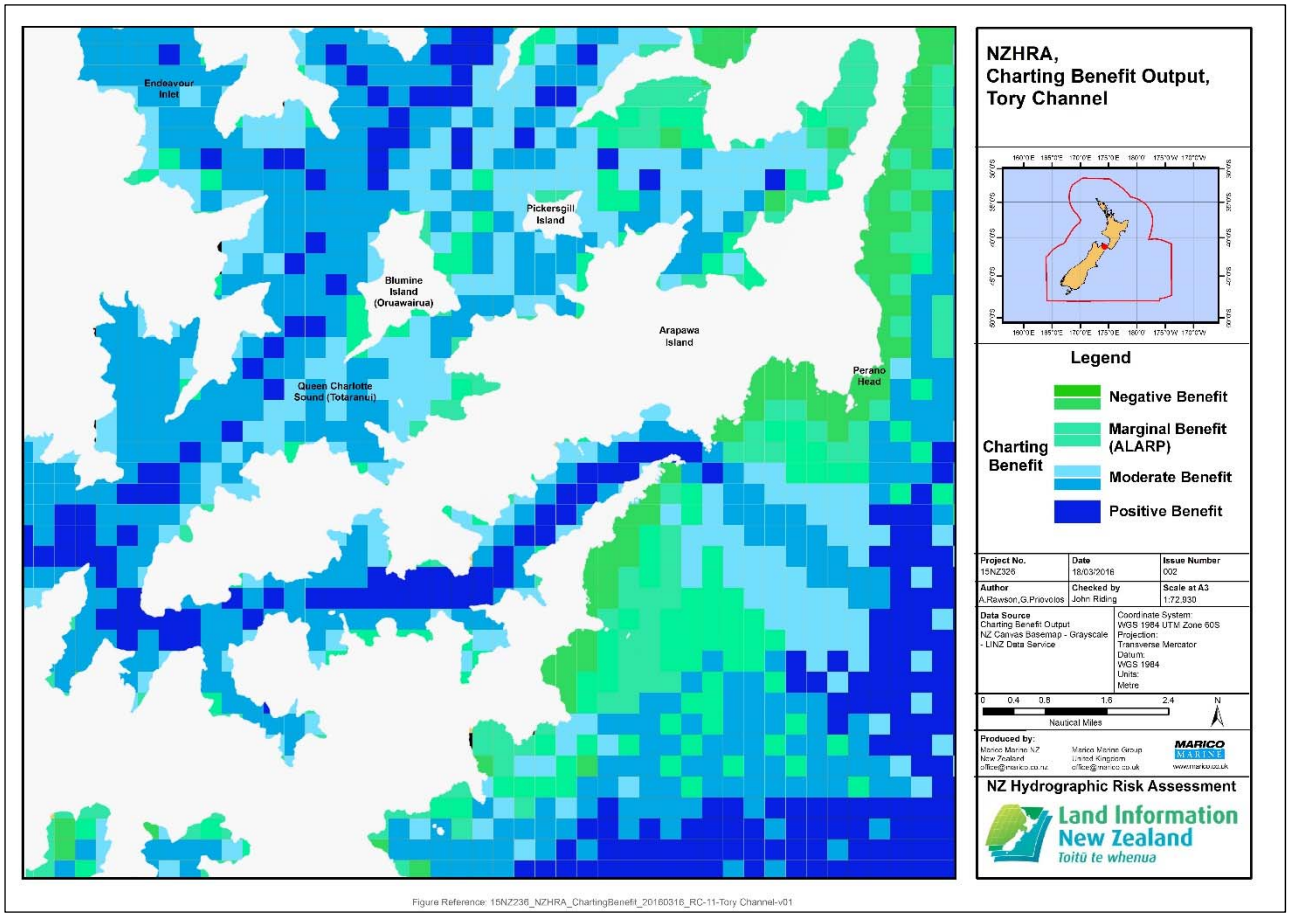


Figure 43: Charting Benefit - Tory Channel and Queen Charlotte Sound

4.5.4 CHARTING BENEFIT RESULT – PICTON

Most of the sounding data for Queen Charlotte Sound is charted as dating from 1942-1943, which combines with the ZOC C charting standard to give the positive charting benefit. Picton Wharves were last surveyed in 1978-86. Shakespeare Wharf is charted at 1:10,000, outside the recommended scales for a Berthing chart, with sounding data from 1942-43, which provides the moderate charting benefit in Shakespeare Bay.

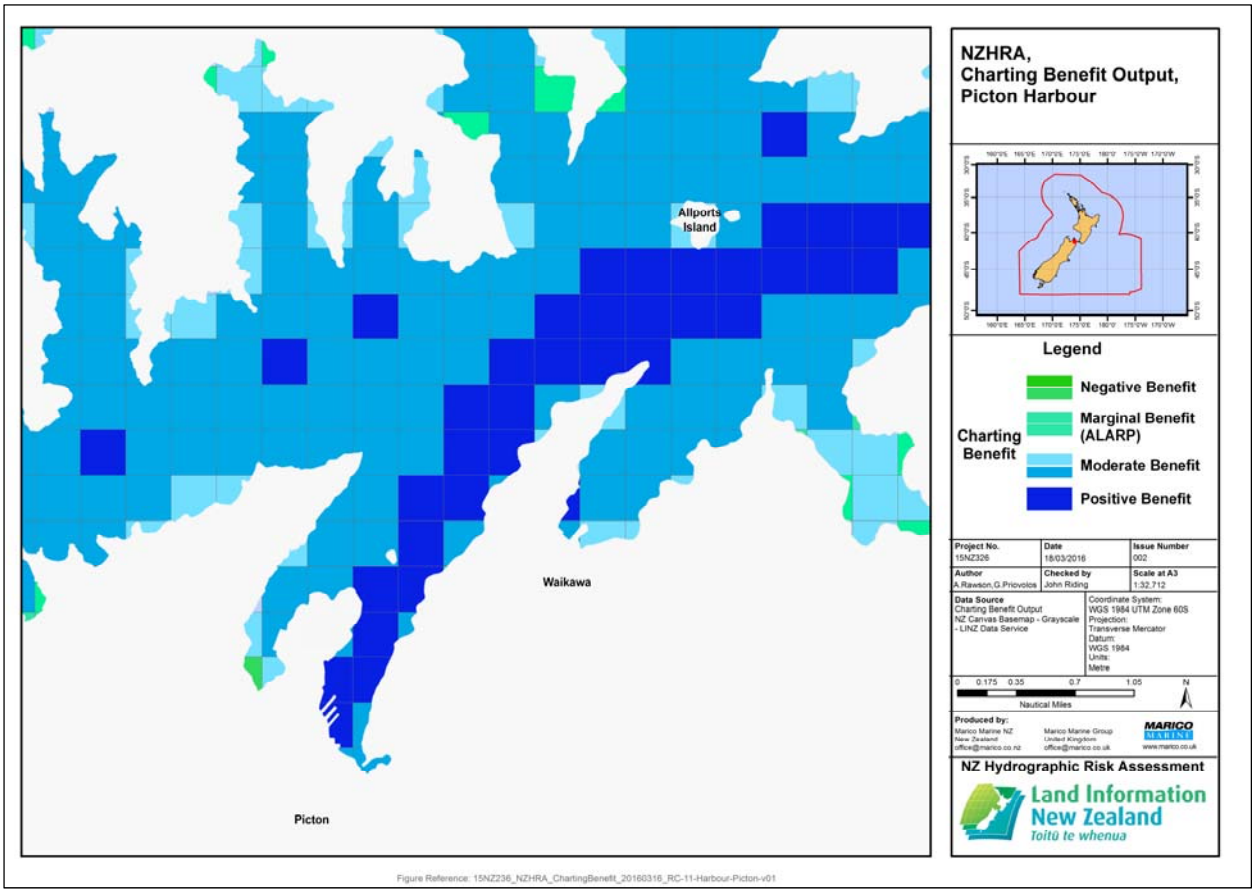


Figure 44 : Charting Benefit Result - Picton

5 HYDROGRAPHIC RISK RESULTS - CANTERBURY REGION

5.1 INTRODUCTION – CANTERBURY REGION

Canterbury Region lies halfway down the South Island, on the eastern side. Canterbury is the second most populous region in New Zealand, after Auckland and is New Zealand's largest region by area, including Kaikoura in the north and Timaru in the south. The main centre, Christchurch, is New Zealand's third largest urban area.

Canterbury is one of the country's driest regions, but there are frosts in winter, and snow in the high country. On summer days there is sometimes a hot, dry north-west wind, and a high arch of clouds in the sky, locally called the Nor'west Arch.

Marine farms may be encountered in inshore waters by vessels in this region.

5.1.1 LYTTELTON HARBOUR

Lyttelton Harbour is a good anchorage with a sheltered deep water port, 5nm in from the open sea. A natural deep harbour with a soft mud seafloor that is easily dredged, the main navigation channel is maintained to a depth of 11.9 m below chart datum which enables vessels to arrive or depart with a draught of 12.4 m on the high tide.

Pilotage is compulsory for all vessels over 500 GT or over 40m LOA. Anchorage for vessels is 1.5nm north-east of Godley Head in 16.5m of water. An alternative anchorage for vessels of 8.5m draught or less, is available in Camp Bay in 11m of water. The anchorages in the approaches are regularly used, as this plot of Tanker Traffic shows.

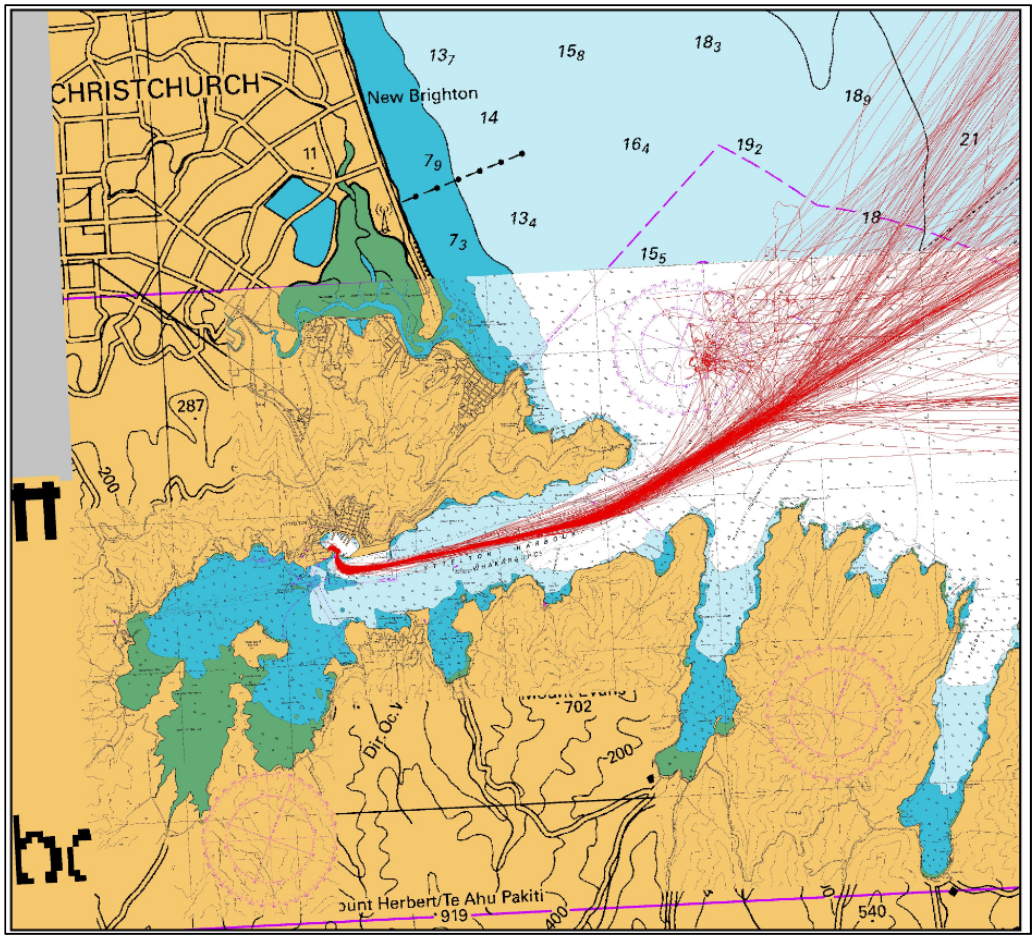


Figure 45 : Plot of Lyttelton Harbour showing Tankers and Anchorages

5.1.2 LYTTELTON PORT

Earthquakes over the 2010-11 period damaged over three quarters of the Port's wharves. Rebuilding of Cashin Quay 2 commenced in 2014 and was completed the following year.

LPC is now the South Island's largest Port and Container Terminal service and New Zealand's third largest container port, exporting 17% of New Zealand's dairy products. The Port handles over 370,000 TEUs of containerised cargo a year, using four ship-to-shore gantry cranes on Cashin Quay.

The liquid bulk terminal is owned by LPC and operated by several oil companies. Located off Godley Quay, next to the oil wharf, it provides facilities for the discharge of liquid bulk products including LPG, petroleum, aviation gas and methanol, as well as bunkering of a variety of vessels. Planning is underway to build a new oil berth. Lyttelton Port has the largest gas and oil terminal in the South Island and careful planning is required to ensure there will be uninterrupted supply during the building project.

Lyttelton is home for the country's largest coal facility and the South Island's only Dry Dock.

The inner harbour wharves handle imports of bulk fuels, fruit, fertiliser, grain, gypsum, cement, the fishing industry and log exports. LPC has two Inland Ports: the Midland Port at Rolleston, and City Depot in Woolston.

Four small cruise vessels called at Port of Lyttelton in the 2014-15 season, the small number mainly being due to earthquake repair work on the berth, however greater numbers of cruise ship visits are expected in the future.

5.1.3 AKAROA HARBOUR

After earthquake damage to the berth infrastructure, cruise vessels opted to visit Akaroa Harbour, instead of Lyttelton, which became a popular destination. The tracks record 75 cruise vessels calls at Akaroa during the 2014-15 season for the spectacular scenery. As no suitable wharves are available in Akaroa, all cruise ships anchor in the harbour and transfer their passengers ashore by tender. A number of charter boats operate from Akaroa harbour, and a number of recreational craft fitted with AIS. The traffic plot, below, shows the use of local domestic vessels to service cruise vessels at anchor.

Akaroa waters are home to the rarest and smallest marine dolphin, Hector's dolphin. In Flea Bay outside the harbour entrance is located the largest Little Blue Penguin colony on mainland New Zealand.

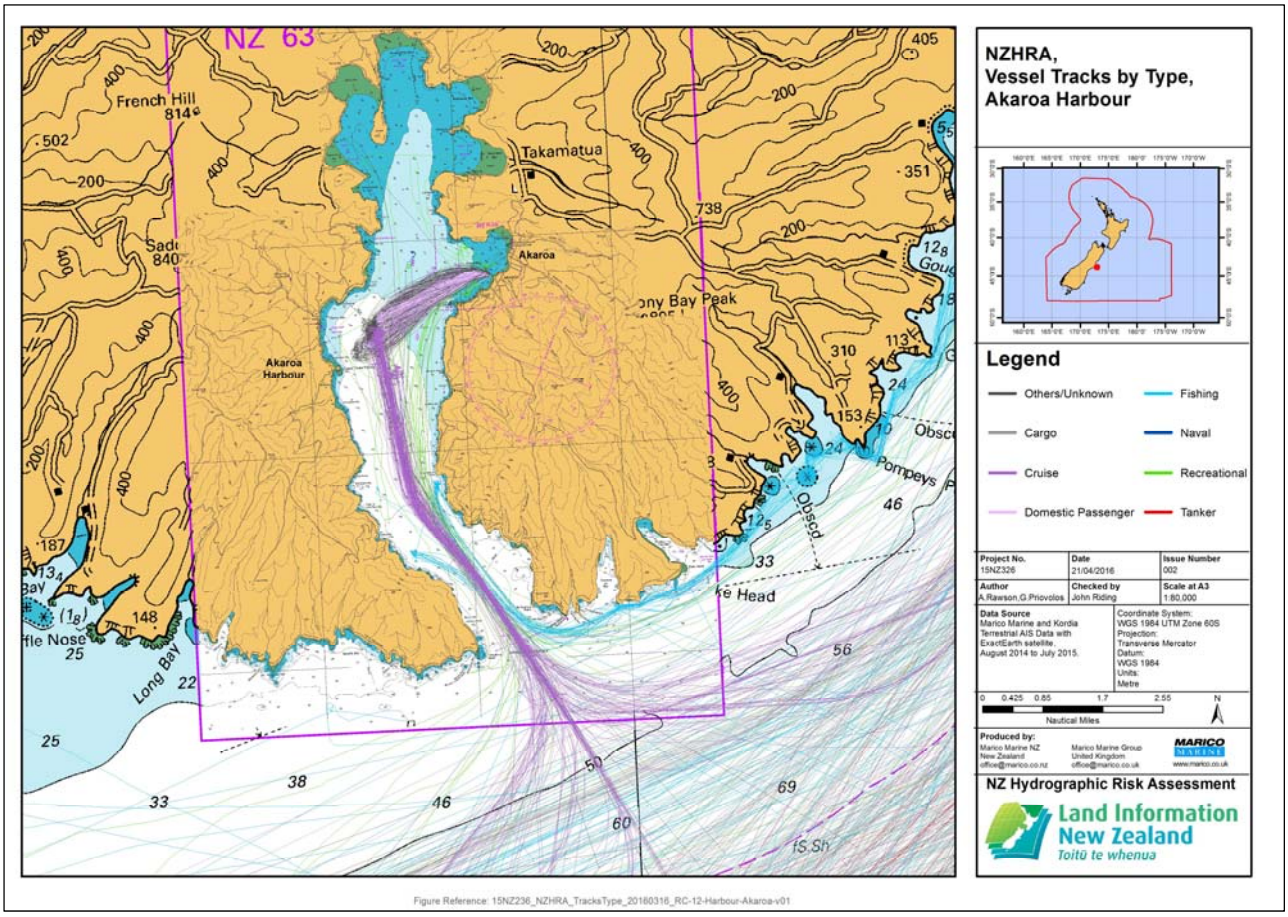


Figure 46: Cruise Vessel Call Record – Akaroa Harbour

5.1.4 KAIKOURA

The Kaikoura whale watching operation is an internationally recognised tourist attraction. The whale watching vessels operate from a small harbour, at South Bay, which is located on the South side of the Kaikoura peninsula. It has a narrow access channel in need of deepening for the increasing size of vessels using the harbour. Development plans are in train with impetus provided by a light grounding of a tourist vessel. There are also smaller dolphin/seal watching operations where wetsuits are provided for visitors to join dolphins and seals in their ocean environment. Sea-birds and many other species of marine life are accessible not only by boat, but also by air. Whale watching vessels transit considerable distances offshore, up to 30nm, dependent on the availability of whales. Different sea locations are used as the seasons change. The combined number of passengers, dolphin and whale watching, in any one year is surprising. Participation is increasing by a healthy margin year on year.

Kaikoura is renowned for its great fishing grounds and reputedly some of the best reef diving in the country.

The Kaikoura Peninsula is surrounded by a 3nm radius 'Area of Restricted Access': vessels greater than 500GRT or 40m LOA require prior permission of the Harbour Master to enter. Notwithstanding

this, twelve cruise vessels called at Kaikoura during the 2014-15 season. The Kaikoura destination is popular with passengers, but the exposed coast offers uncertain holding ground and charting or the New Zealand Pilot publication offer little advice. A larger number of cruise vessels plan to visit than actually do, as they regularly abort due to sea or weather conditions. Cruise vessels wishing to visit Kaikoura will always have to use their tenders to ferry passengers ashore to the whale watching operation. Both sides of the Kaikoura peninsula are used for this purpose, but vessels mostly tendered off South Bay as it is closer to the whale watching vessel harbour. Some cruise vessels, especially larger ones, use Lyttelton Harbour as a convenient place to land passengers, who are then bussed to Kaikoura for the whale watching excursions.

Two coastal vessels took shelter from storms behind the Kaikoura Peninsula whilst coasting in ballast: the bulk carrier *Anatoki* on two separate occasions, and the bulk cement carrier *Westport* once.

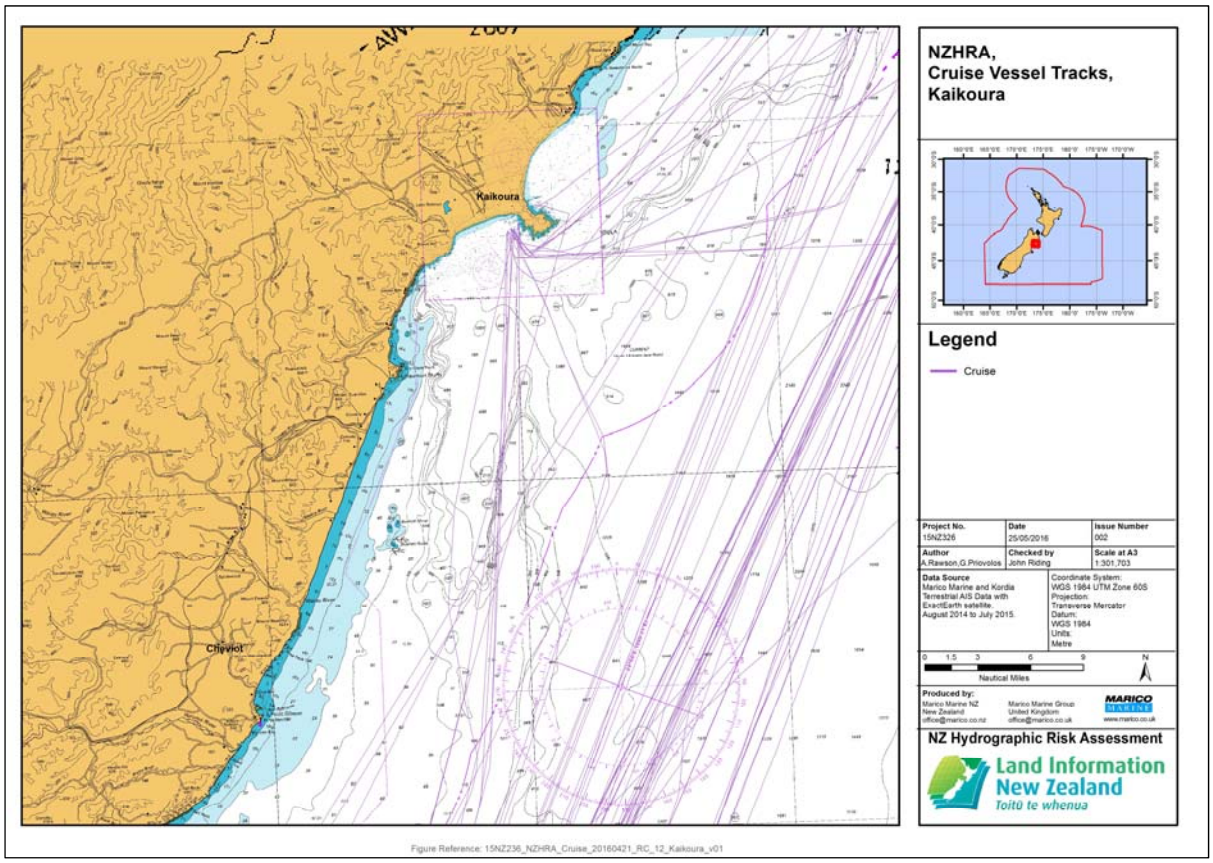


Figure 47 : Cruise Vessel Record - Kaikoura

5.1.5 CHARTING INFORMATION OBSERVATIONS – DATA GATHERING

Outside of Lyttelton harbour was charted in 1951, however a narrow lane covering most of the main shipping route north of Lyttelton and south around Banks Peninsula was surveyed by LINZ in 2012-13.

Around the Kaikoura Peninsula was surveyed in 1998, with all of Port Underwood and approaches last surveyed in 1984.

Timaru port and nearby surrounds were surveyed in 2000-2004 however the Timaru approaches where more than 10 cargo vessels and several tankers anchored, were last surveyed in 1959.

5.1.6 AREAS OF RISK SIGNIFICANCE – CANTERBURY REGION

A Kaikoura Marine Protected Area exists around the Kaikoura Peninsula. The Hikurangi Marine Reserve is located 10km south of Kaikoura, containing part of the 1,000m deep Kaikoura Canyon. It is within the new Kaikoura Marine Management Area developed to conserve Kaikoura's whales, dolphins, seals, albatrosses, rock lobster, shellfish and finfish. Also within the Marine Management Area are a whale sanctuary, a fur seal sanctuary and several local fisheries reserves.

The Akaroa Marine Reserve lies at the mouth of Akaroa Harbour and is home to many marine mammals including the world's smallest dolphin, the Hector's dolphin. Pohatu Marine Reserve, which hosts seal colonies and the largest Little Penguin colony on mainland New Zealand, is located east of Akaroa Head.

Banks Peninsula is one of New Zealand's major aquaculture areas.

In Timaru, Caroline Bay beach is a popular recreational area located close to Timaru's city centre, and close to the north of the port facilities.

5.1.7 ECONOMIC SUMMARY – CANTERBURY REGION

The sub-national GDP of the Canterbury region was estimated at US$15.074 billion in 2003, 12% of New Zealand's national GDP. Cruise vessel crews and passengers injected NZ$49.5M into the local economy.

Marine farming produced 3% of the total Greenshell mussel production and King Salmon 4% of the total production.

5.2 TIMARU HARBOUR – PRIMEPORT

Pilotage is compulsory for vessels over 500 GRT or over 40m in length. The port is open to surge, which is worse with an easterly swell. Vessels of up to 261m in length and 11m draught have regularly called at Timaru. PrimePort is 50% owned by Port of Tauranga, who operate the Timaru Container Terminal on land leased by PrimePort. With its Tauranga association, operational profit is increasing, the 2015 result being an increase of over 50% on that of 2014. The 2014-15 result reflects strong growth in bulk imports and exports, which are now the mainstay of PrimePort's direct trade. While traditional log exports have declined from their 2014 high, the reduced volume has been

countered by the increase in bulk dry products (palm kernel extract). Fertiliser levelled out during the year and fuel imports showed a significant increase.

The Timaru Container Terminal Limited's investment in new cranage reflects confidence for growth in the region. The 2015 year was the first full year of operations under the new alliance with Port of Tauranga. Overall ship numbers were up 18%, at 442 in 2015 versus 374 in 2014. The gross registered vessel tonnage at 6.4 million GRT was up a significant 31% on the 2014 year which largely reflects a resurgence in container shipping using the port. Bulk cargo handled through Timaru in 2015 was 1,295,300 tonnes, up 2% on the previous year. Bulk cargoes include liquid chemical and molasses products. Timaru is also the major export port for bulk tallow.

In June 2014, Holcim confirmed their intention to set up a cement import operation in Ports of Auckland and Timaru. This will replace the manufacturing facility at Westport. Substantial progress has been made at Timaru in building new cement facilities following the Holcim agreement. Holcim invested approximately NZ$50M to build a 30,000T storage facility, with loading and load out facilities. PrimePort is replacing No.2 Wharf with a concrete and steel structure to handle cement import, as well as the coastal feeder ships suppling the South and lower North Islands. Overall volume is expected to grow from 350,000T per year. Cargo and bulk carriers were recorded anchored outside Timaru during the year, waiting for a berth or cargo.

PrimePort is also a base for Chatham Island trade, which had the uncertainty of ongoing viability of two operators on the route.

Cruise vessel visits are a minor part of the Timaru Port trade. Four cruise ships, mostly small to medium size, visited Timaru in the 2014-15 season.

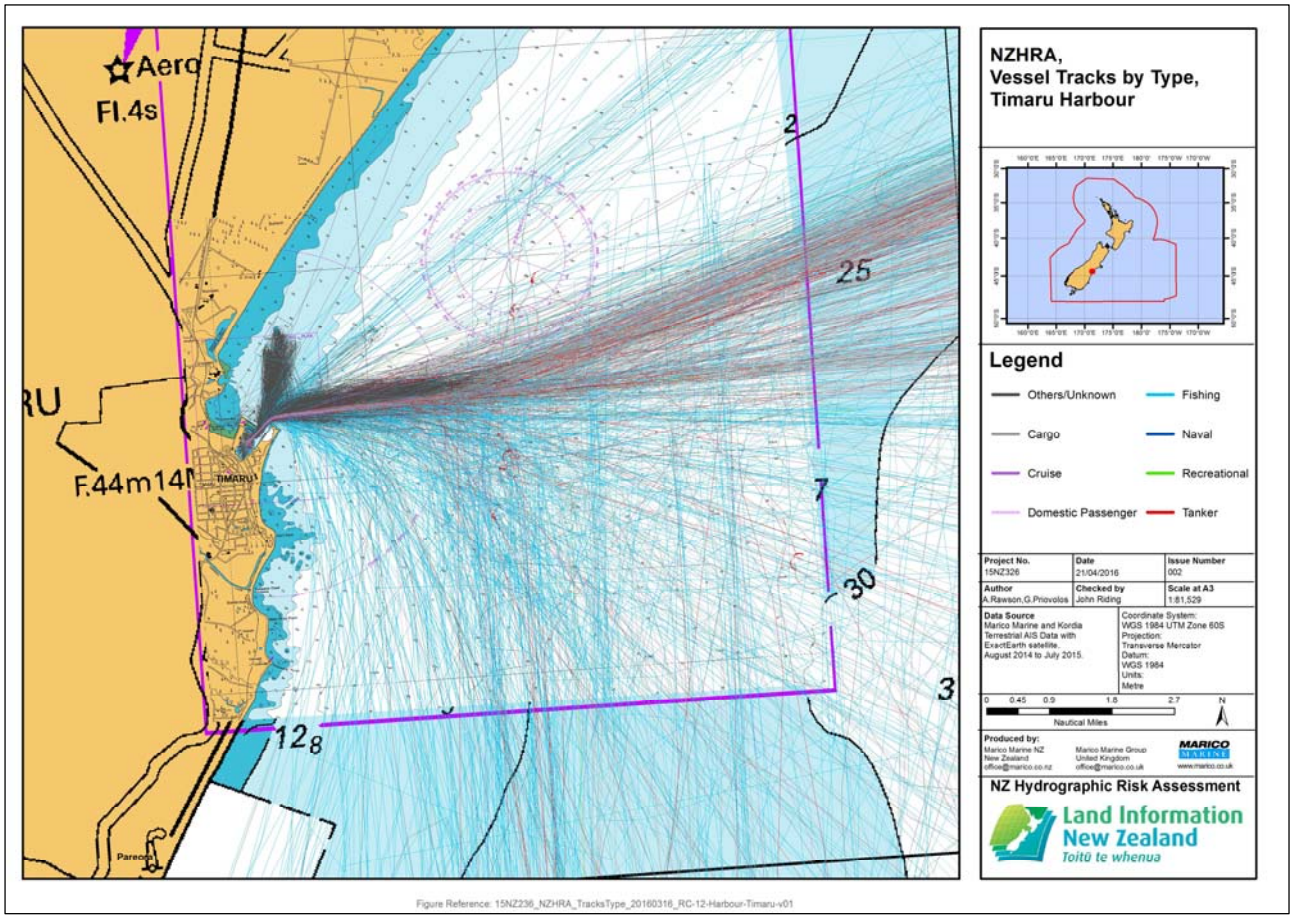


Figure 48 : Traffic Overview - Timaru

Traffic using Timaru is varied and the plot reflects its importance as a fish landing/processing facility. Tankers visit a dedicated facility in the inner harbour.

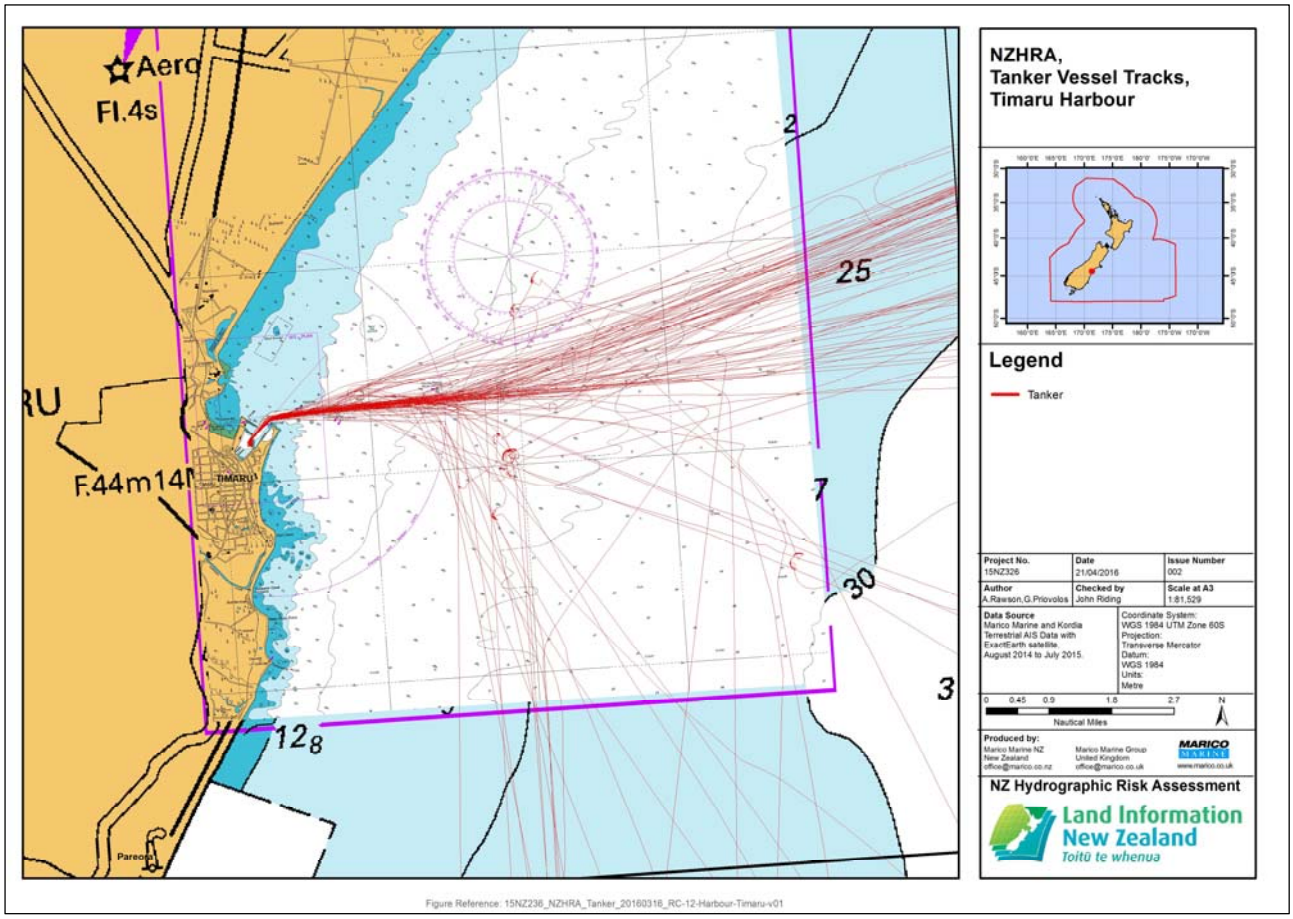


Figure 49 : Plot of Tankers Visiting Timaru, showing Chosen Anchoring Areas

Tankers mostly take a direct route into Timaru and berth at a single berth, dedicated to liquid handling. Anchorage locations offshore are apparent.

5.3 ALL TRAFFIC - CANTERBURY REGION

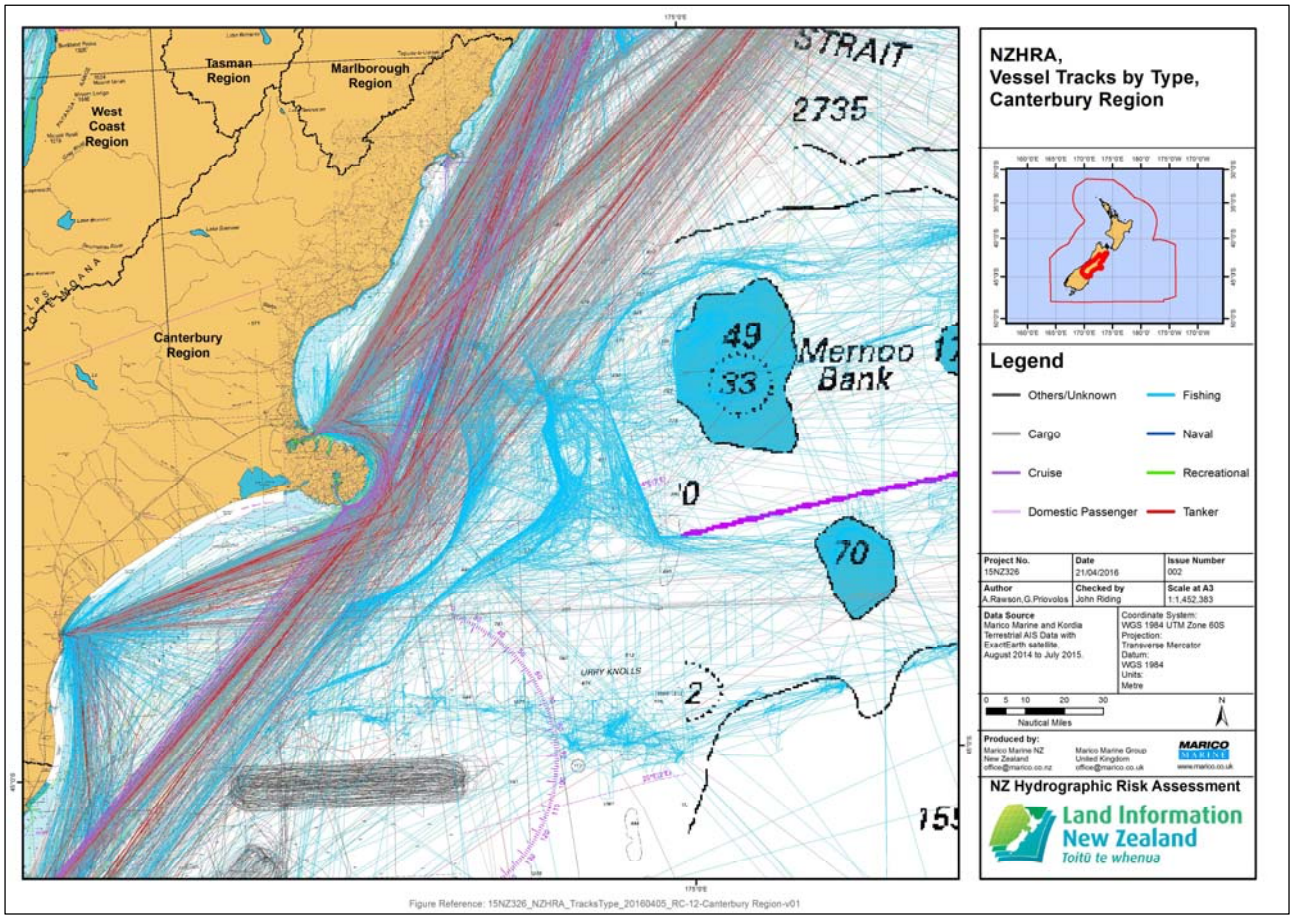


Figure 50 : All Vessels by Type: Canterbury Region

Although the South Island traffic does fall off in terms of volume, trading vessels remain quite focussed in their areas of transit offshore, with natural coastal features providing coastal focus or pinch point areas of transit. There is a significant level of fishing activity both inshore and offshore, with fishing traffic out of both Lyttelton and Timaru featuring strongly in the record.

5.3.1 TRAFFIC ANALYSIS – LYTTELTON

The types of commercial vessels using Lyttelton include

- Container
- General, Bulk and Break-bulk
- Tankers
- Car carriers
- Passenger cruise
- Tugs and workboats
- Fishing

Container ships accounted for more than half of the over 1,000 total ship visits. Traffic routes for cargo vessels once they leave the harbour is either north or south. Cargo vessels transiting between Lyttelton and ports further south pass close as near as 1nm outside Banks Peninsula, with the majority passing 2nm or more off. Several cargo vessels anchored outside Lyttelton Harbour, and more drifted off while waiting to berth, but no cargo vessels were recorded entering Akaroa Harbour. With the exception of small local coasters, the majority of cargo vessels passed 3nm or more outside Cape Campbell when transiting through Cook Strait.

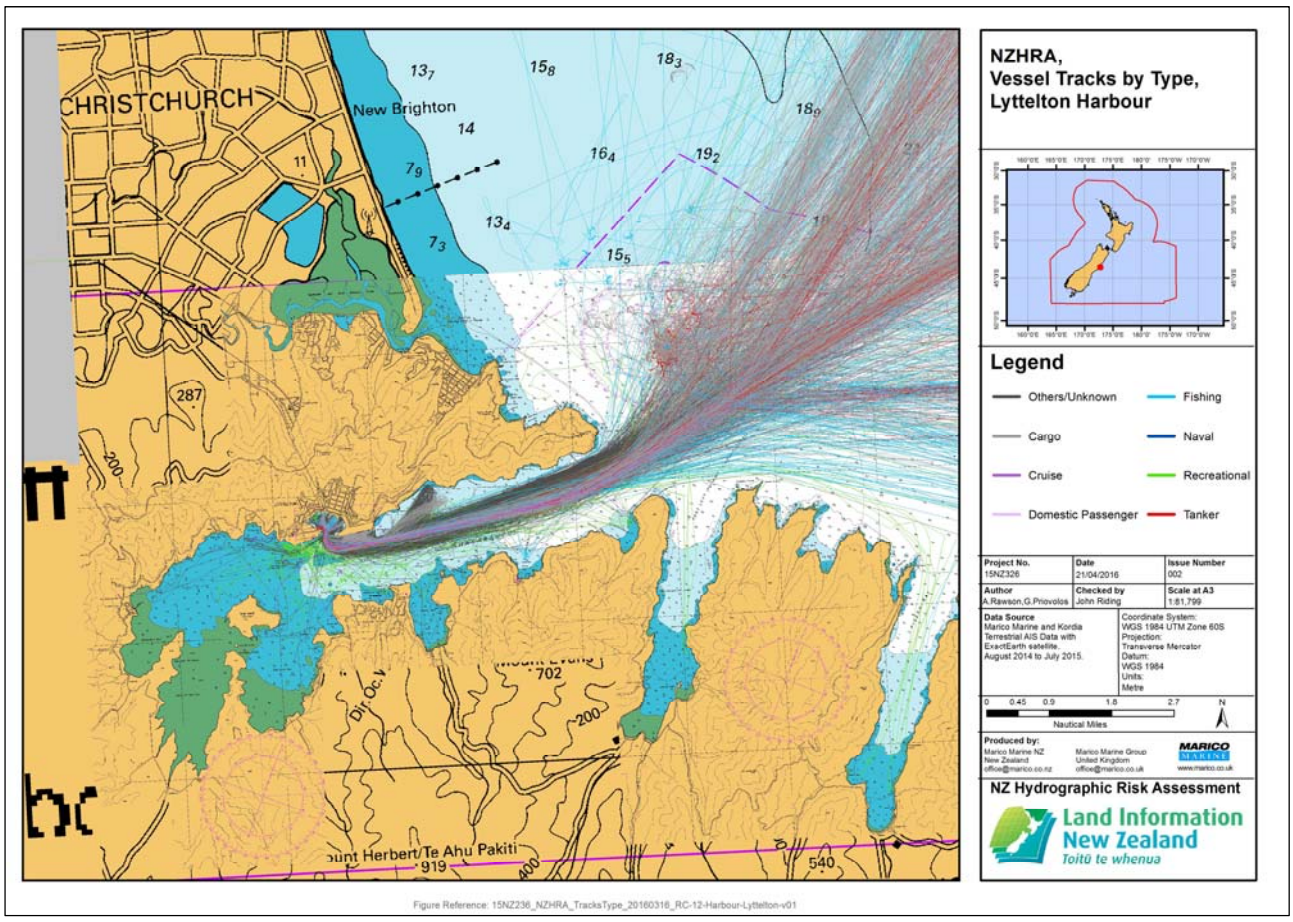


Figure 51 : Vessel Traffic Record - Lyttelton

5.3.2 TRAFFIC DENSITY – CANTERBURY REGION

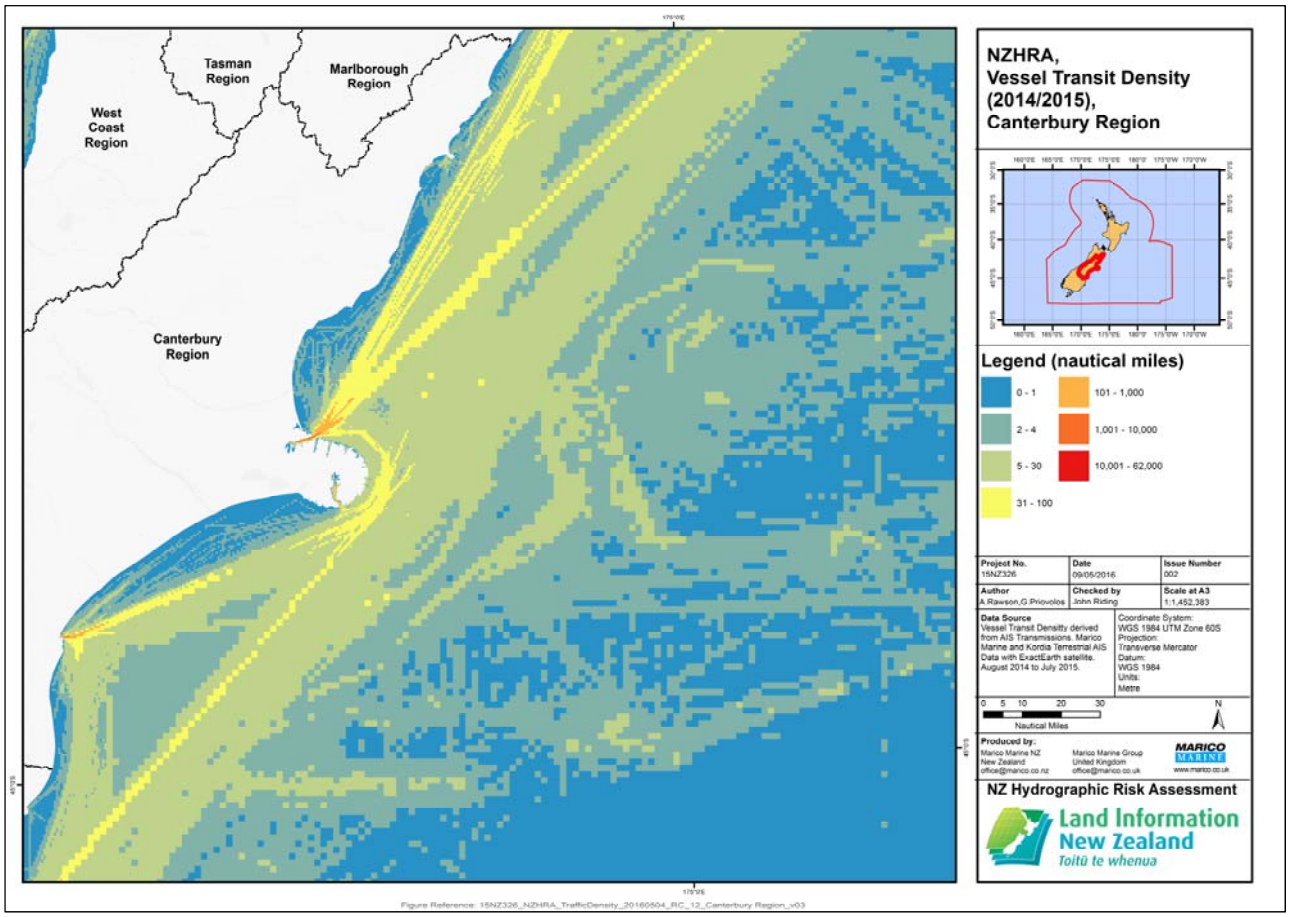


Figure 52 : Traffic Density – Canterbury Region

Marine traffic density through the Canterbury Region is relatively low and traffic is spread throughout the inshore and offshore waters. There are clear trade patterns apparent to the ports of both Timaru and Lyttelton, with moderate density traces for both ports.

Fishing, as well as survey activity, in the waters of the Chatham Rise, produces a low density result, even though there is significant fishing activity recorded.

5.3.3 CARGO VESSELS – CANTERBURY REGION

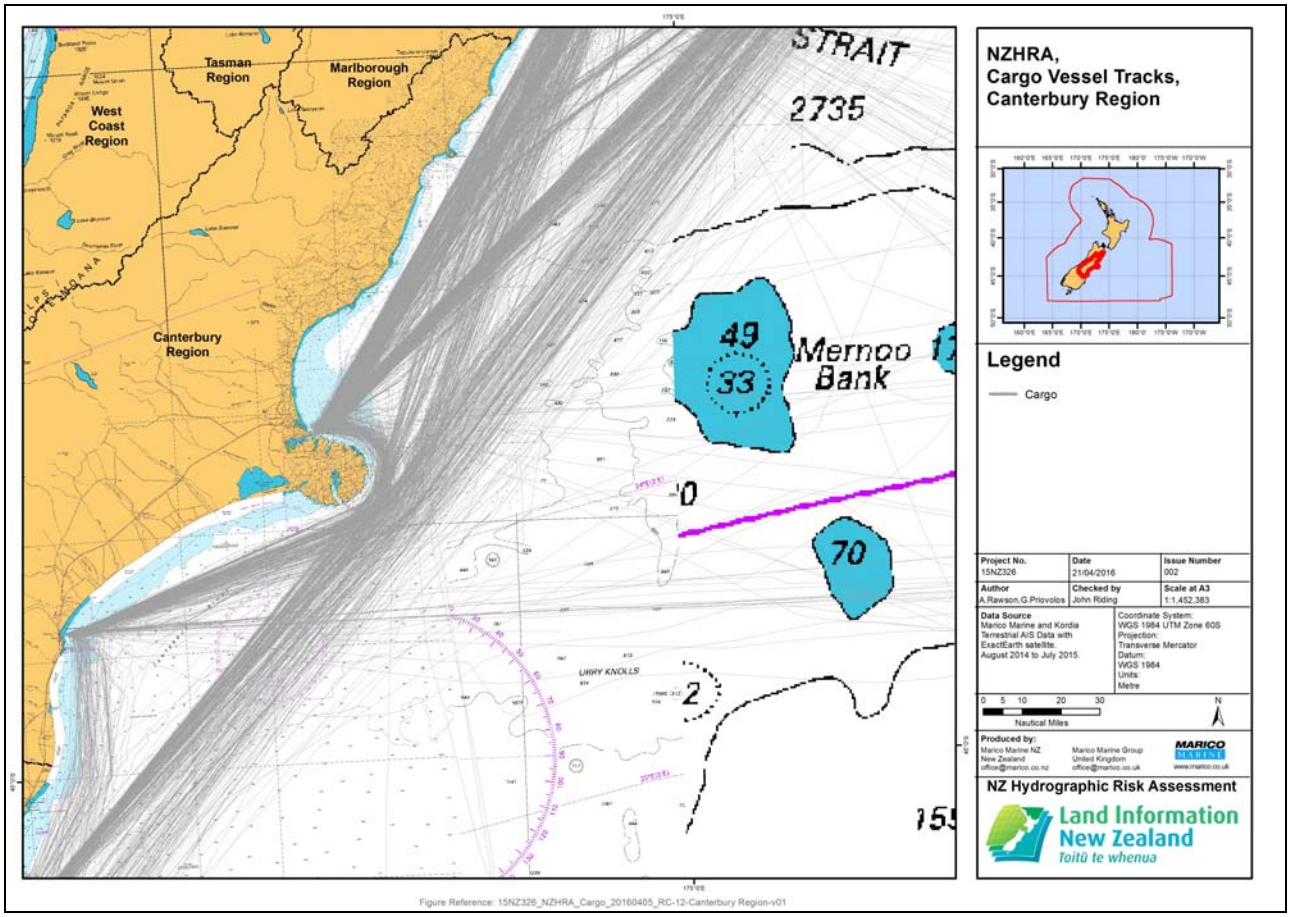


Figure 53 : Cargo Vessel Routes - Canterbury Region

Over 1,000 ship visits were recorded to the Port of Lyttelton during the year.

5.3.4 CRUISE VESSELS – CANTERBURY REGION

Cruise vessel visits to Akaroa increased after the 2012-11 earthquakes damaged the Port of Lyttelton's wharves and infrastructure. There were twelve cruise vessel calls at Kaikoura, including one that called in on the north side of the Kaikoura peninsula. Akaroa had 75 cruise ship visits, a significant number in relation to the total cruise vessels to visit New Zealand in 2014-15. Four cruise ships called at Timaru, and four cruise ships visited Lyttelton. A percentage of the cruise vessels that diverted to Akaroa subsequent to the earthquakes will probably return to Lyttelton once the wharves and services there are fully reinstated.

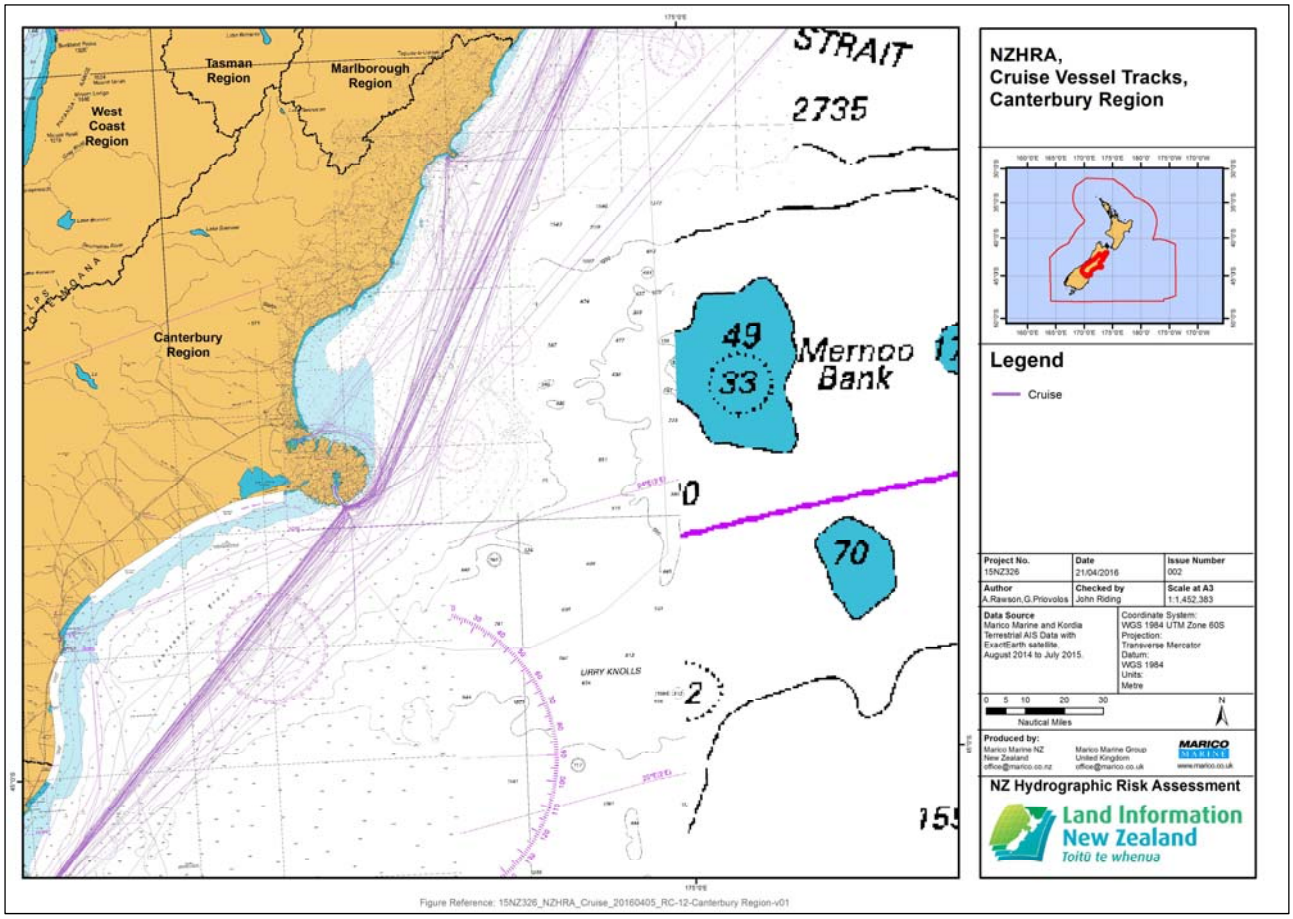


Figure 54 : Cruise Vessel tracks – Canterbury Region

5.3.5 TANKER TRAFFIC – CANTERBURY REGION

There is a significant level of tanker traffic using the Canterbury regional waters in a 12 month period, with calls to Lyttelton and Timaru, generally following the voluntary code for ships carrying oil or other harmful liquid substances in bulk[6].

[6] **Annual NtoM 10 – Shipping Routes around the NZ Coast**

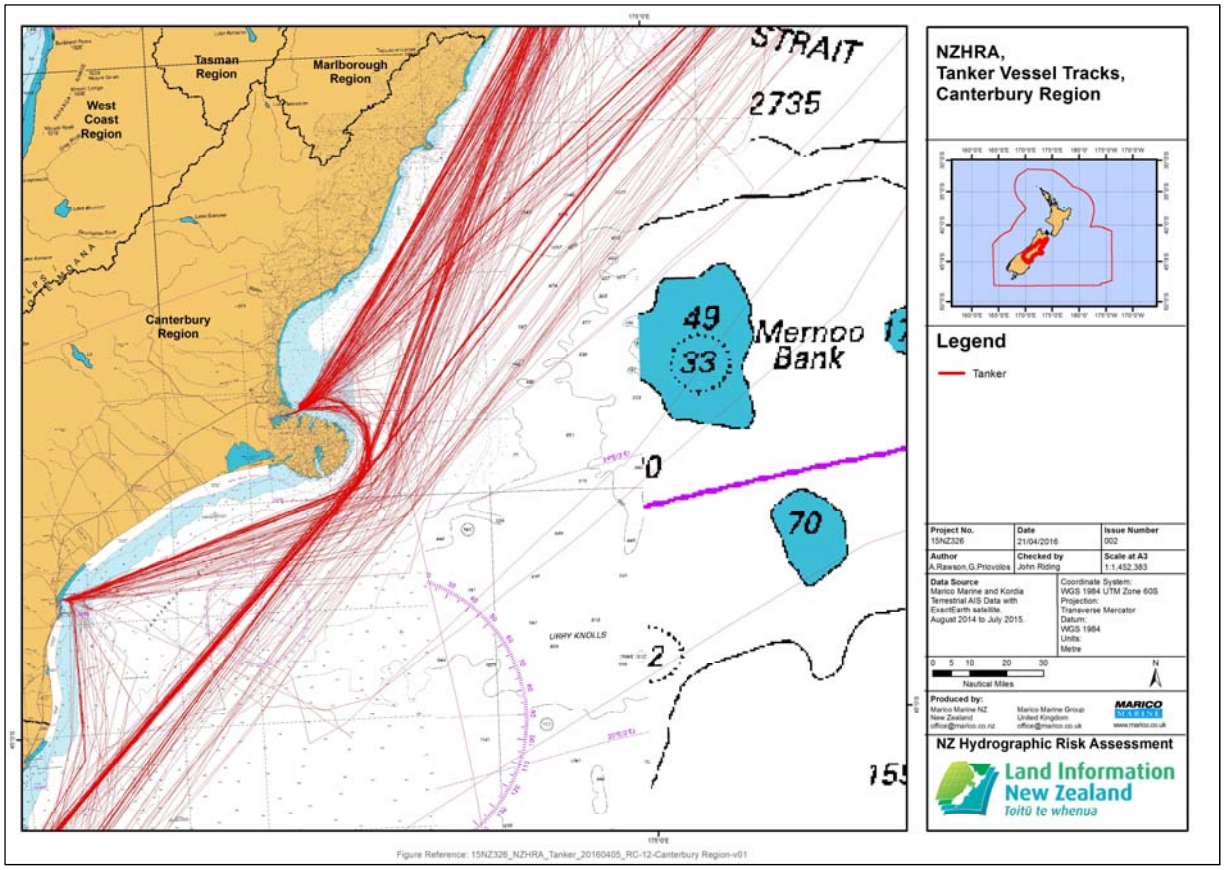


Figure 55 : Tanker Transits: Canterbury Region

5.3.6 FISHING VESSELS – CANTERBURY REGION

Twenty-four fishing vessels are based in Lyttelton with another 24 small fishing vessels based in Kaikoura. Two fishing vessels operate from Akaroa Harbour, as well as smaller barges servicing the Greenshell mussels, King Salmon, Abalone and marine algae marine farms.

Timaru is the second largest fishing port in New Zealand. Two fishing companies operate out of Timaru: Sanford with offshore fishing vessels and Talley's with an inshore fleet. Thirty-five fishing vessels of all sizes call Timaru their home port.

Fishing operations off the Canterbury Coast are significant. These follow the Chatham Rise overall, with a different track pattern evident as the year progresses (and catch quotas by type change). There are fishing vessels present offshore in some form throughout the year. The importance of Timaru and Lyttelton to fishing is evident from the track record in **Figure 56** below.

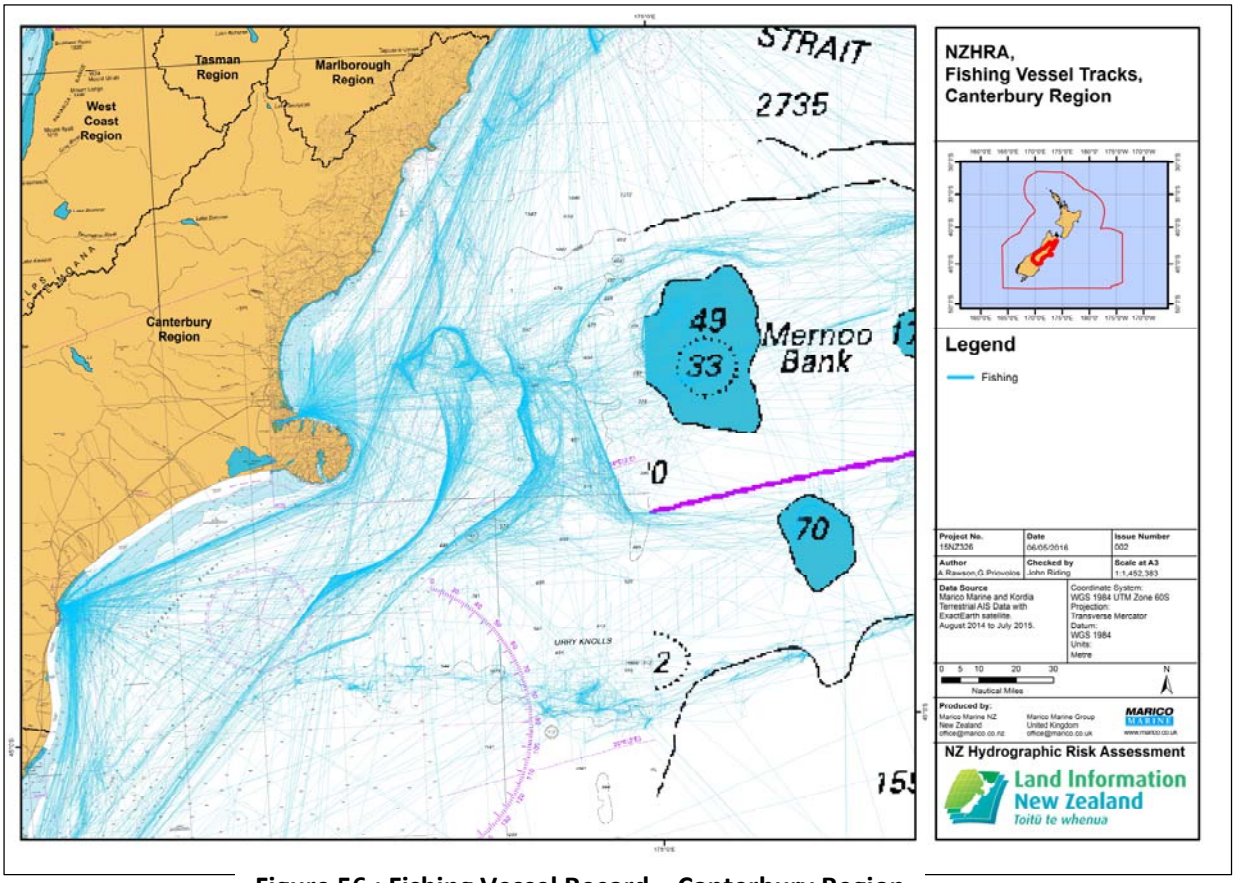


Figure 56 : Fishing Vessel Record – Canterbury Region

5.3.7 RECREATIONAL CRAFT – CANTERBURY REGION

In 2000 the Boating Industry Association estimated that residents of the Canterbury region had up to 40,000 water craft ranging from board-sailers to larger vessels. Boating was dominated by small, easily transportable craft with an estimated 20,000 to 30,000 trailer boats in Canterbury. It was estimated that 21,000 boats launched from the region's boat ramps in 2001. Fishing and sailing are popular recreational activities in Akaroa.

5.3.8 RECREATIONAL CRAFT - LYTTELTON

Recreational fishing is popular in this region, especially around Pegasus Bay and Banks Peninsula.

A 69 berth marina inside Lyttelton Harbour at Dampier Bay is controlled by LPC with berths ranging from 10m - 15m. After Lyttelton's Naval Point Magazine Bay marina was severely damaged by a storm in 2000, the local Council now have responsibility for the area of land, marina facilities, jetties extending out from Magazine Bay and the public slipway. Day-to-day maintenance of the damaged 46 marina berths is by the Naval Point Yacht Club.

5.4 HYDROGRAPHIC RISK - CANTERBURY REGION

Figure 57 shows the hydrographic risk profile for the Canterbury Region. Plots zooming into the ports and harbour of the region expand the detail of the result. It shows areas of heightened risk at Kaikoura, Lyttelton, Banks Peninsula, Akaroa and Timaru.

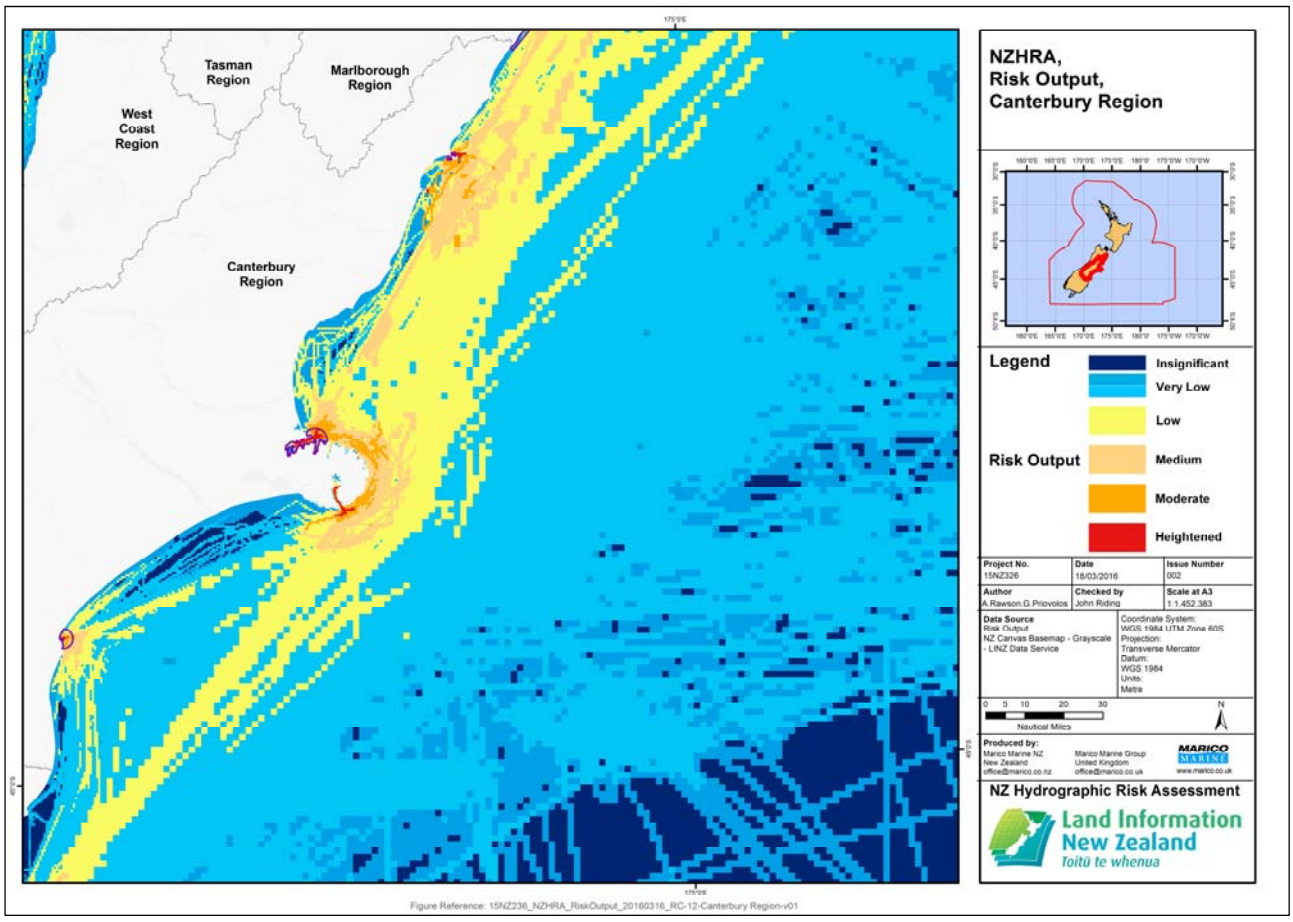


Figure 57 : Hydrographic Risk Plot – Canterbury Region

5.4.1 HYDROGRAPHIC RISK – KAIKOURA

Cruise vessels anchor near the coast in 20-30m water depth with little seafloor type information available. Permission from the Harbour Master is required to enter this Restricted Area. High passenger numbers from the domestic tourist operations watching marine mammals increase the hydrographic risk offshore from Kaikoura.

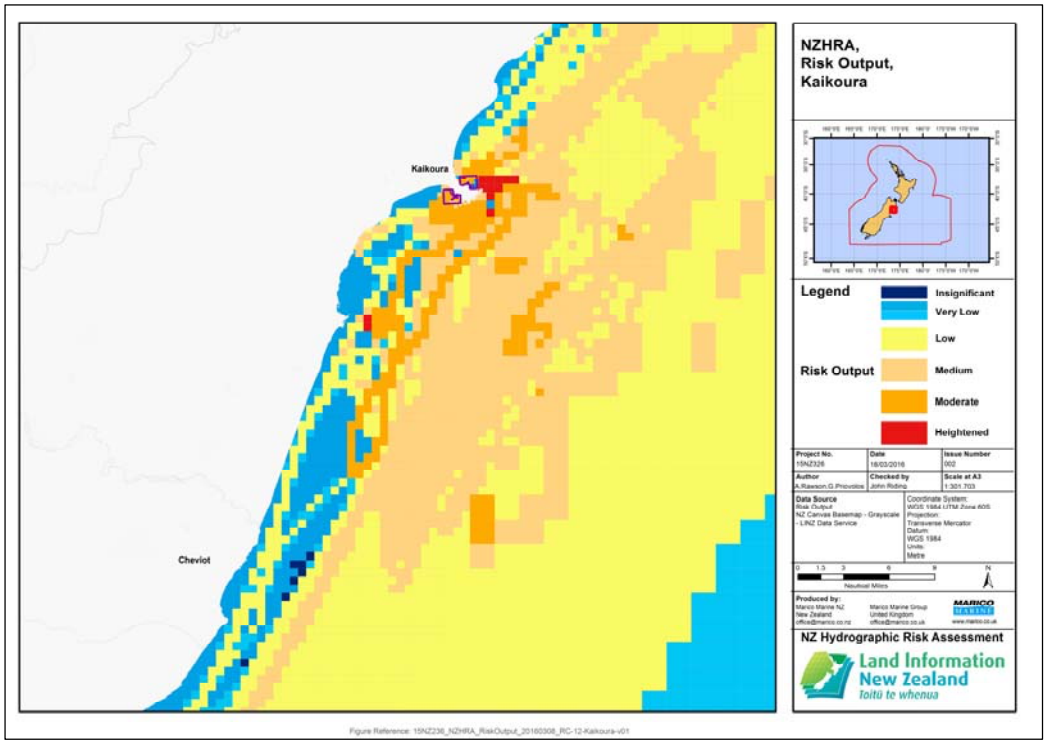


Figure 58 : Hydrographic Risk - Kaikoura

5.4.2 HYDROGRAPHIC RISK – LYTTELTON

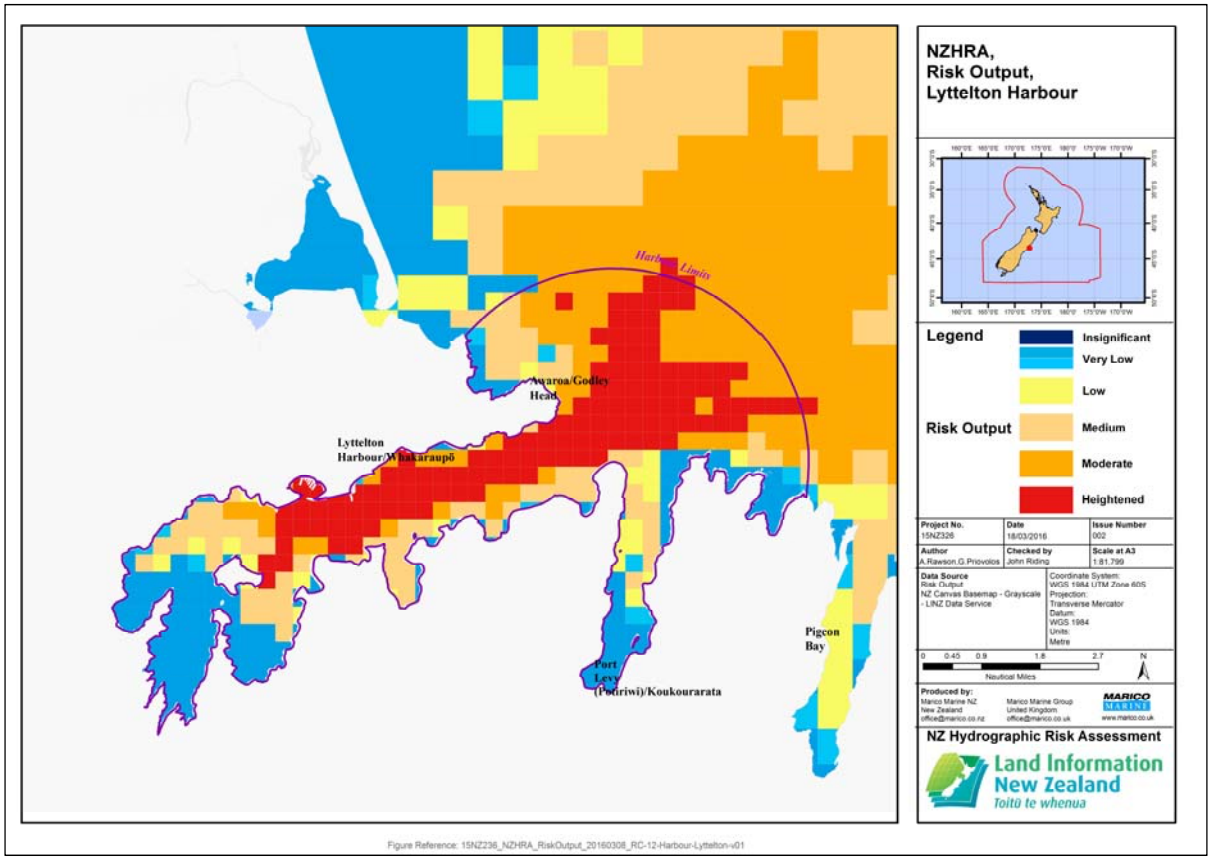


Figure 59 : Hydrographic Risk - Lyttelton Harbour

Lyttelton Inner Harbour and close approaches were last surveyed in 1998 with the shallow upper harbour and across to the passenger ferry destination of Diamond Harbour last surveyed in 1951. The Lyttelton Harbour chart has a ZOC C charting standard rating. Significant numbers of cargo, tanker and fishing vessels used Lyttelton Harbour during the project year.

The hydrographic risk result for Lyttelton is interesting. The area of heightened risk within the harbour limits needs exploring, in relation to charting scales and the date of chart source data.

5.4.3 HYDROGRAPHIC RISK – BANKS PENINSULA

A route around the outside of Banks Peninsula, based on the voluntary code in ANtoM 10, was surveyed in 2012 however numerous ship tracks show that general traffic was not restricted to these routes, regularly passing closer to the land, through areas last surveyed in 1952, with a chart rating of ZOC D indicating poor quality data, or data that cannot be assessed due to lack of information.

All types of vessels, especially fishing vessels but excepting tankers, passed close by around Banks Peninsula. Furthermore, this is an area of converging vessel tracks as all South Island's east coast traffic has to pass around this protruding peninsula. These factors combine to produce a Moderate risk around the outside of Banks Peninsula.

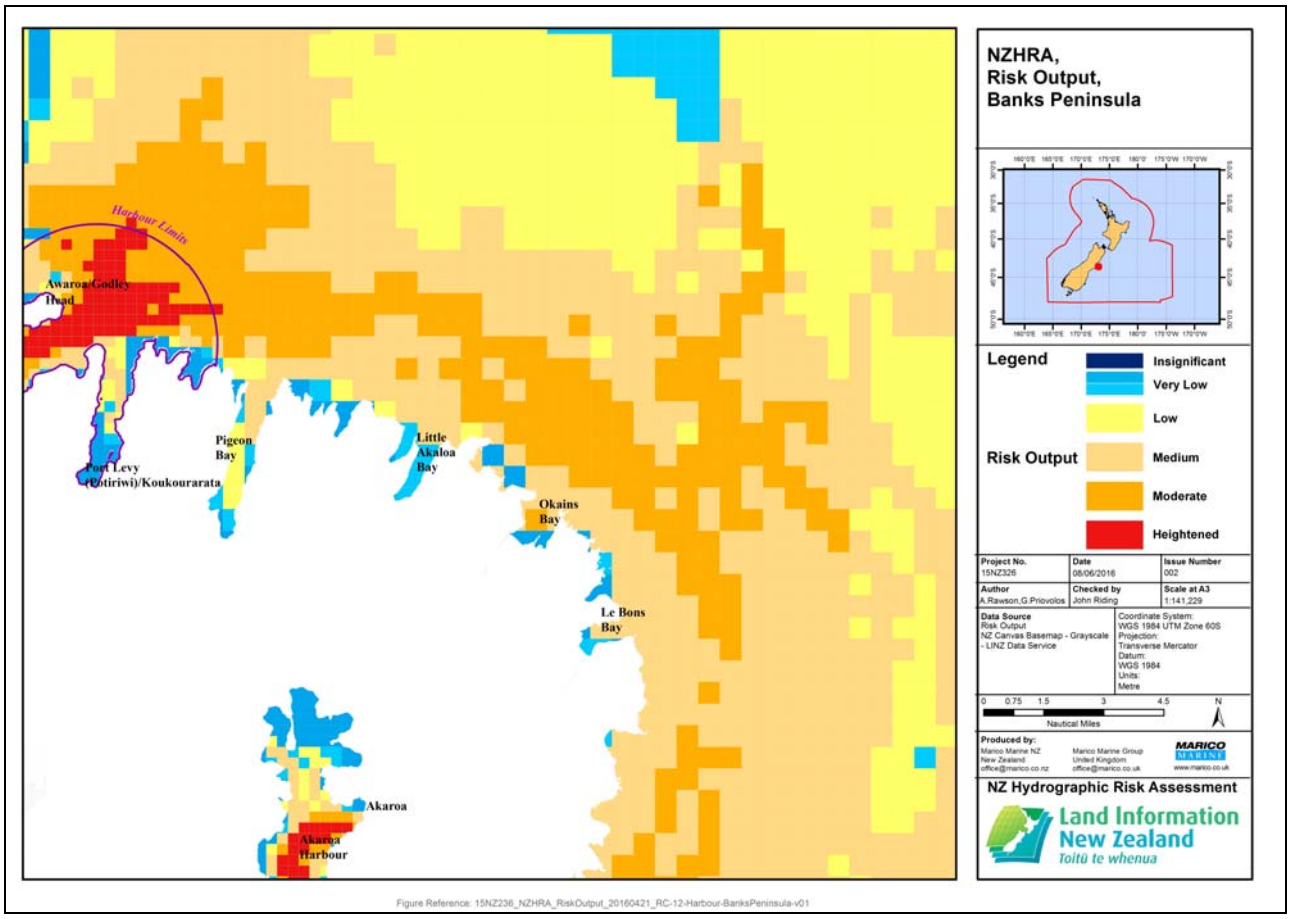


Figure 60 : Hydrographic Risk – Banks Peninsula

5.4.4 HYDROGRAPHIC RISK – AKAROA HARBOUR

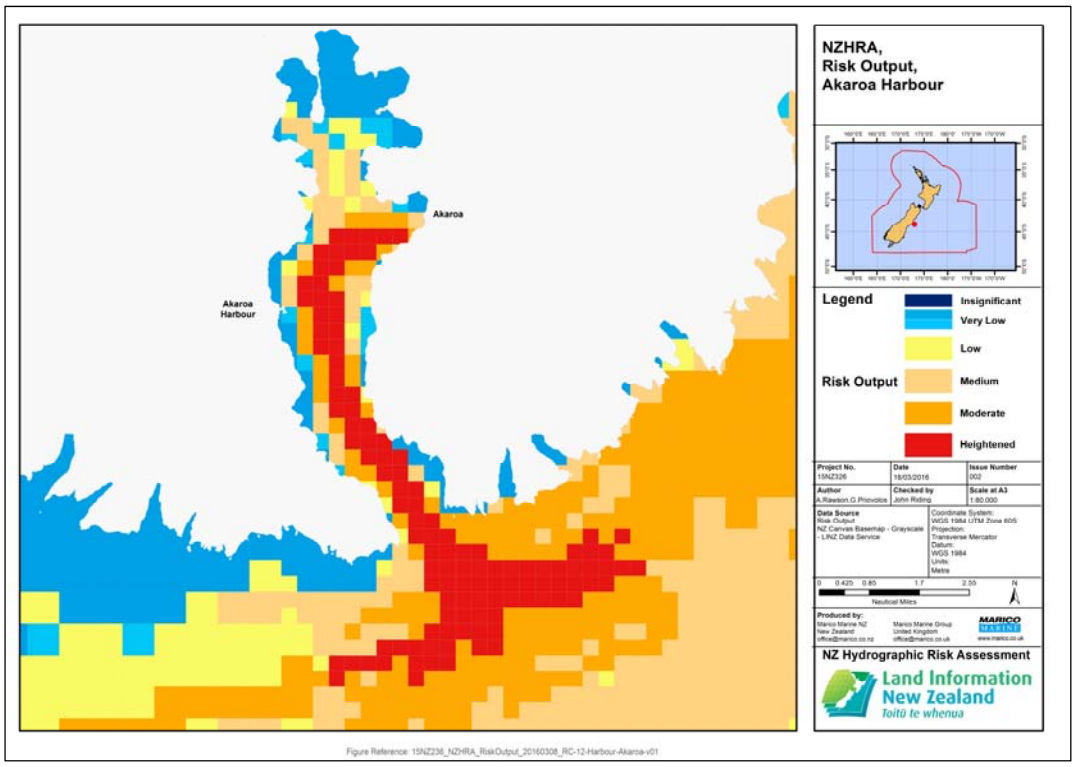


Figure 61 : Hydrographic Risk Result – Akaroa Harbour

Akaroa Harbour provides a heightened risk result of note because of the number of cruise vessels visiting, as well as the volume of passengers. Domestic vessels are also a factor, these mostly service cruise vessels. It has no charted harbour extents, but it has some harbour regulations and there is a ZOC C charting standard.

5.4.5 HYDROGRAPHIC RISK – TIMARU HARBOUR

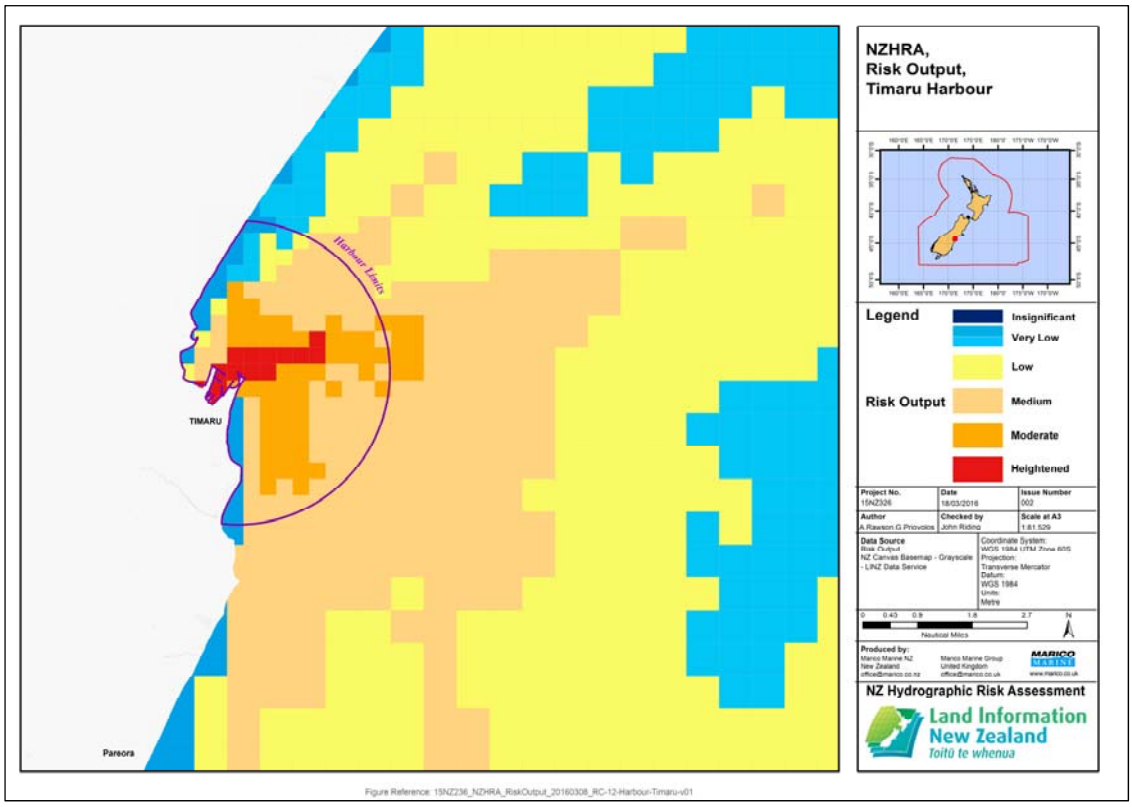


Figure 62 : Hydrographic Result – Timaru Harbour

Timaru shows heightened risk within the harbour limit and berth areas. This result is likely to be related to chart source data, which may have been surveyed by the port, but the data not necessarily incorporated into the harbour chart.

5.5 CHARTING BENEFIT – CANTERBURY REGION

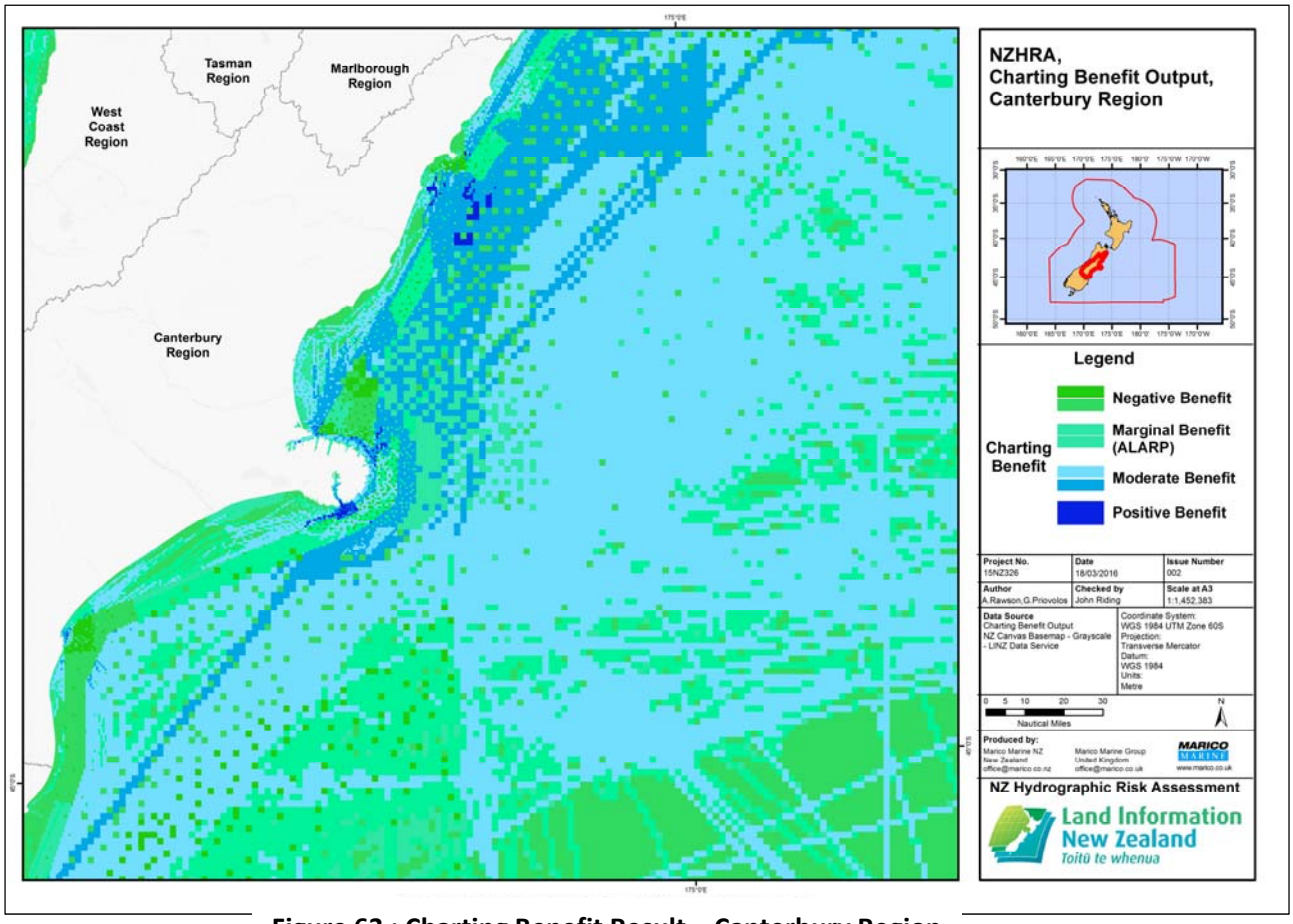


Figure 63 : Charting Benefit Result – Canterbury Region

The overview charting benefit plot for Canterbury shows that Kaikoura will benefit from review of charting in the area south of the Kaikoura peninsula. The benefit result arises from the volume of domestic passenger vessel transits engaged in whale and dolphin watching. There has already been charting upgrade work in the area offshore, which shows up as green (Negative benefit).

The area around Akaroa harbour entrance provides a positive benefit result. Areas of the inshore Akaroa coastline also provide a positive benefit result.

5.5.1 CHARTING BENEFIT RESULT – KAIKOURA

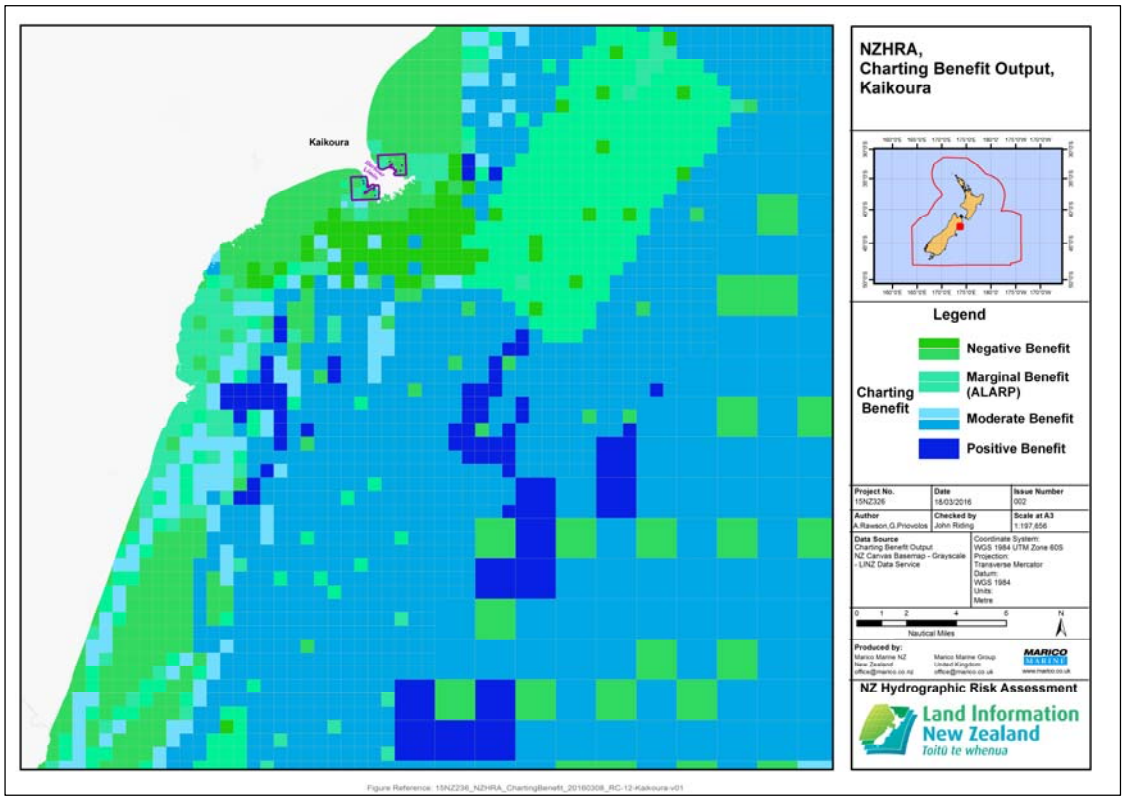


Figure 64 : Charting Benefit Result - Kaikoura

Kaikoura shows heightened risk to the north of the peninsula in the area where cruise vessels stop to deploy their tenders and transit passengers ashore. The area of positive benefit to the south is related to the most frequent location for the dolphin watch activity, whilst the positive benefit results further offshore are related to the extents of the whale watching operation. The positive benefit at Kaikoura is also due to the ZOC C charting standard and the heightened risk from the age of the source data, with the area around Kaikoura Peninsula last surveyed in 1998. The areas where charting has already been updated are clearly showing low or negative benefit results.

The Kaikoura chart scale is 1: 30,000, not appropriate for cruise ship anchoring.

5.5.2 CHARTING BENEFIT RESULT – LYTTELTON HARBOUR

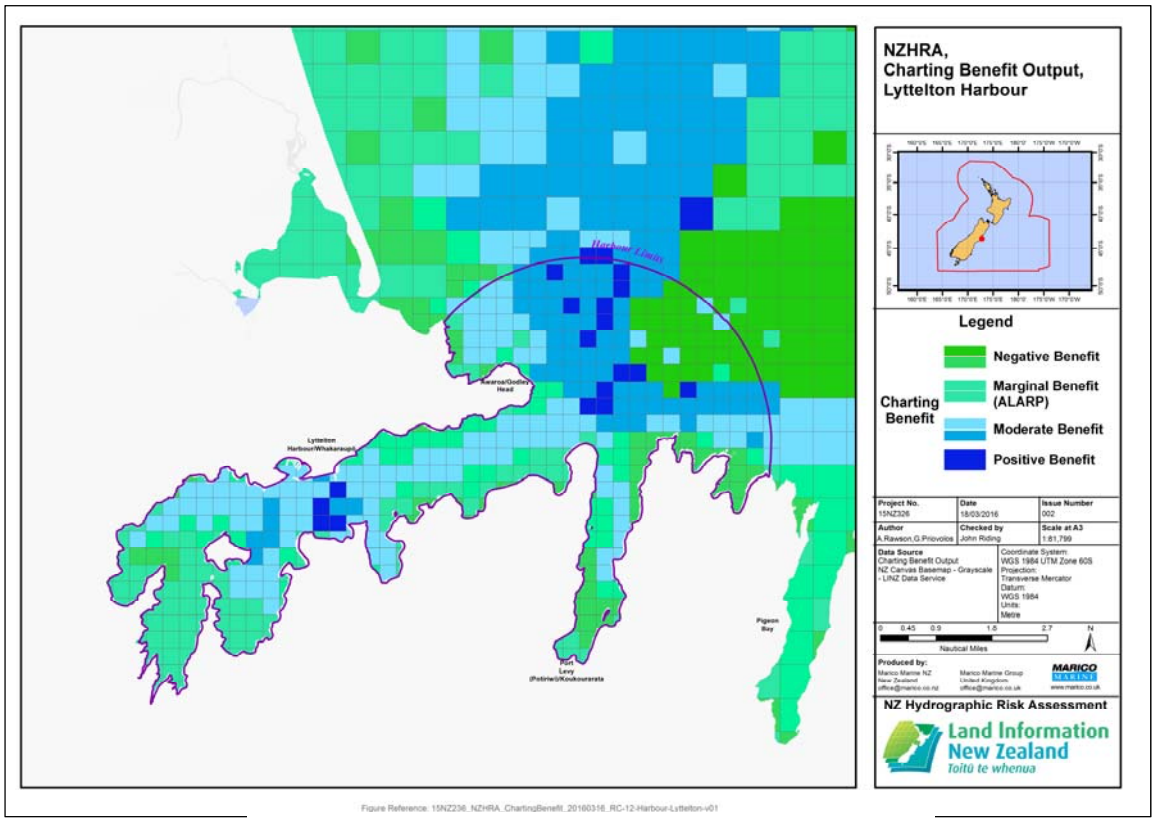


Figure 65 : Charting Benefit Result: Lyttelton Harbour

Although Lyttelton shows heightened risk, the charting benefit plot shows that charting is already provided to a good standard within the approach channel to Lyttelton Port. However, Lyttelton Inner Harbour and close approaches were last surveyed in 1998 with the shallow upper harbour and across to the passenger ferry destination of Diamond Harbour last surveyed in 1951. The Lyttelton Harbour chart has a ZOC C charting standard rating. There may be areas to review in the approaches, in locations where vessels mostly transit inbound or outbound, as well as chosen anchorage locations.

5.5.3 CHARTING BENEFIT RESULT – BANKS PENINSULA

Vessel tracks of all types pass closer to Banks Peninsula than the 2012 surveyed route around the peninsula. The coastal vessel tracks between Banks Peninsula and Cook Strait/Wellington/Wairarapa Coast show clearly on the charting benefit plot as heavy traffic areas outside the most recent surveyed (2012) route, passing through areas last surveyed in 1952.

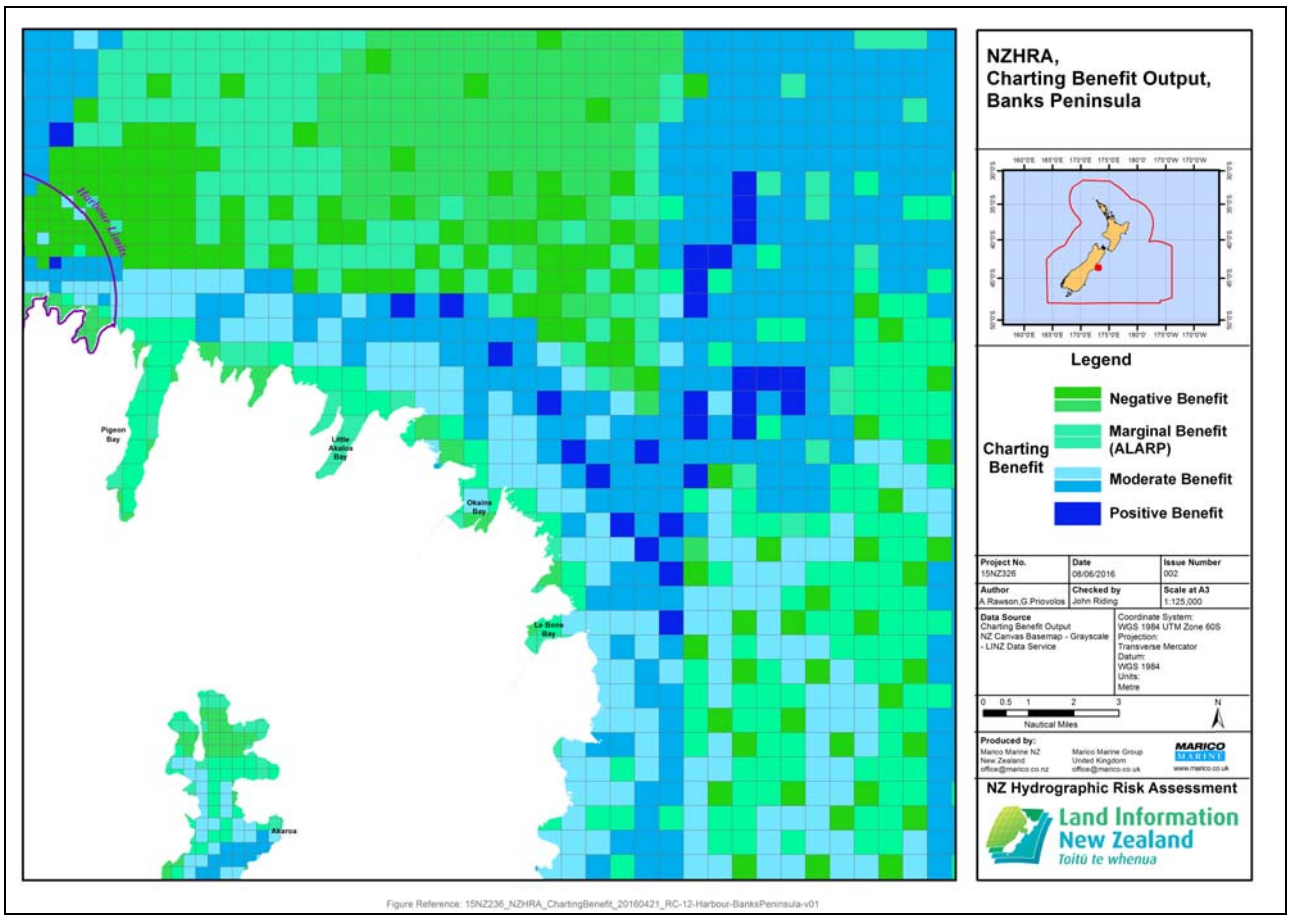


Figure 66 : Charting Benefit – Banks Peninsula

5.5.4 CHARTING BENEFIT RESULT – AKAROA HARBOUR

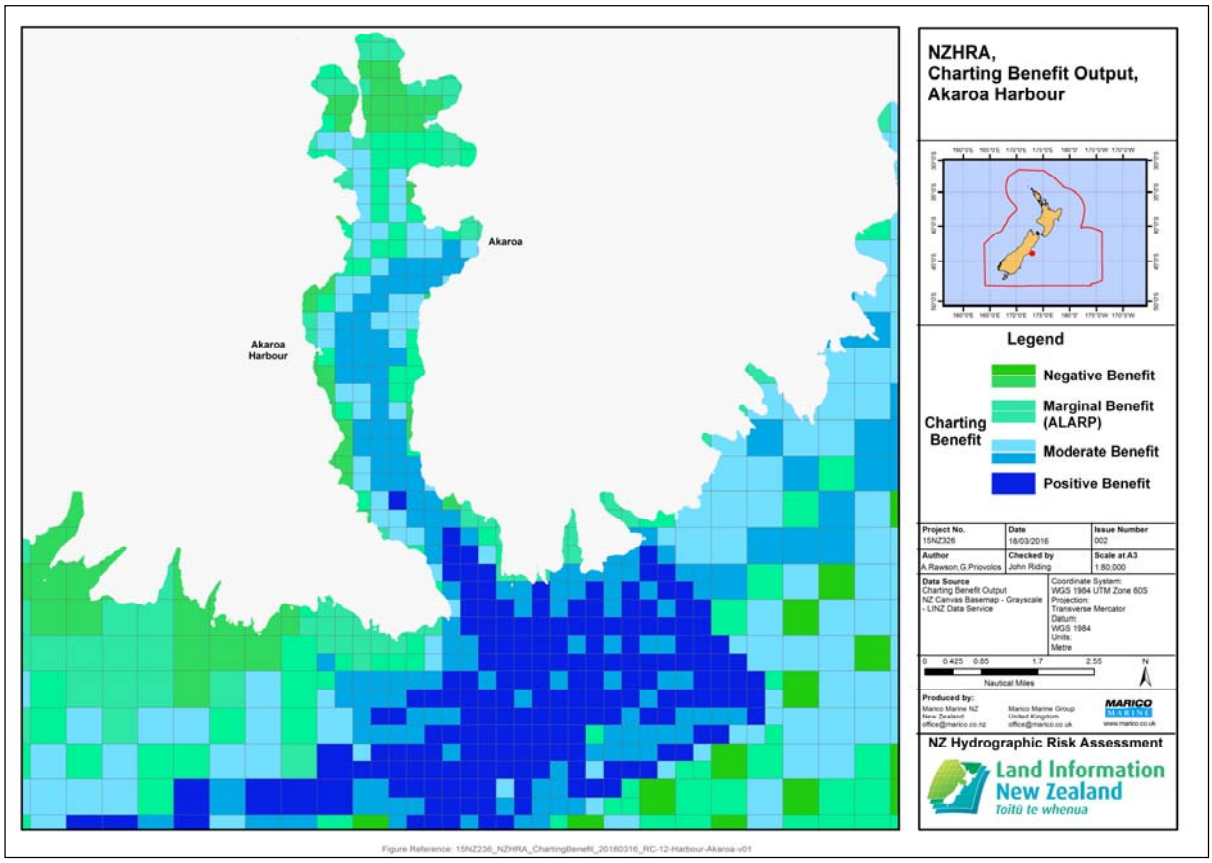


Figure 67 : Charting Benefit Result: Akaroa Harbour

There is a positive benefit result at Akaroa, reflecting the heightened risk result. Currently there is no gazetted harbour limit at Akaroa, however using Marico-derived harbour limit results in a positive benefit, reflecting the heightened risk result and missing chart scale.

Within Akaroa harbour, the heightened risk result does not translate into an area of positive charting benefit. This is because charting is already to a modern standard in this area, with recent resurvey.

5.5.5 CHARTING BENEFIT RESULT – TIMARU HARBOUR

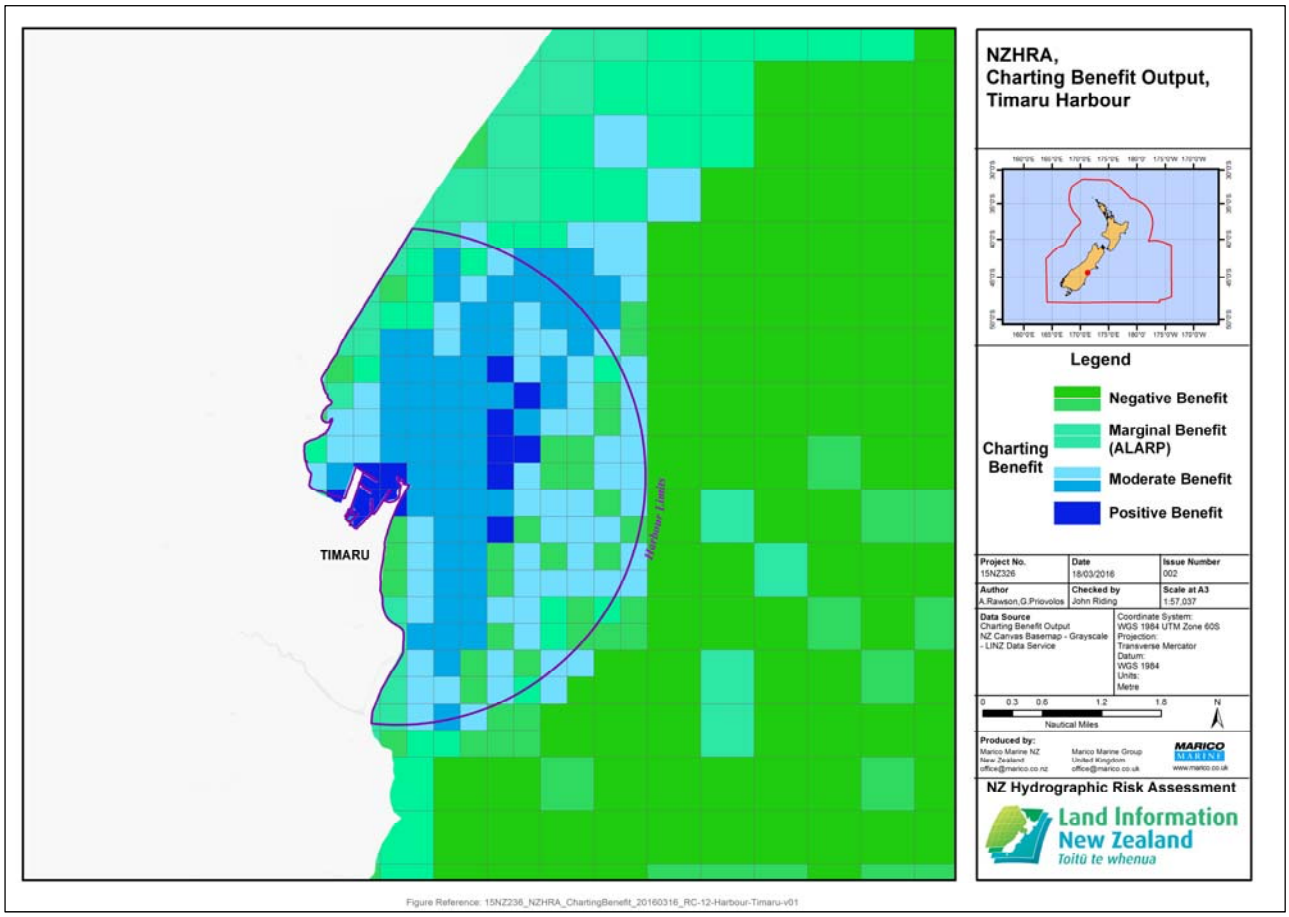


Figure 68: Charting Benefit - Timaru Harbour

Timaru Harbour provides a positive benefit result. However, the harbour is regularly surveyed, especially after storm conditions, so this is more likely to be a case of up-to-date harbour hydrographic data being available locally but not necessarily incorporated into the chart, which results in a ZOC U rating for the bathymetric data. A review of charting within the harbour limits as well as anchorage areas as demonstrated by traffic may be required. The Harbour Authority may find benefit in reviewing with Timaru Port, the need for any designated anchorages, or if holding is poor, updating the advice to mariners in the New Zealand pilot publication and chart note.

The survey data for the outer approaches to Timaru date back to 1959, giving a positive charting benefit here.

6 HYDROGRAPHIC RISK RESULTS - CHATHAM ISLANDS

6.1 INTRODUCTION – CHATHAM ISLANDS

The Chatham Islands are made up of a group of two main islands and several smaller ones, the largest being Chatham Island and Pitt Island. Chatham and Pitt are the only inhabited islands, with the remaining smaller islands being conservation reserves with restricted or prohibited access. The residents' livelihoods depend on fishing and agriculture, with the island being an exporter of coldwater crayfish, and an increasing amount of tourism.

The nearest mainland port to the Chathams is Napier, located 460nm to the north-west. Christchurch, to the west, is 470nm distant.

The town of Waitangi is the main settlement and the main shipping wharf is located here. Most freight generally arrives here by ship which takes 2-3 days sailing time from mainland NZ.

The inshore waters are dominated by fisheries for rocky reef species, particularly paua, rock lobster and blue cod. Other species fished include kina and hapuka (groper). Lobster is exported live, while paua is shucked and frozen and then exported to Christchurch for canning. Blue cod is either filleted and frozen and sent to the mainland, or gutted and chilled and sent direct to export markets in Australia. There are seafood processing facilities at Waitangi (Aotearoa Fisheries Limited: the single largest employer on the main island), Te One and Port Hutt (Waitangi Seafoods), and Owenga (Chatham Islands Food Company).

6.1.1 WAITANGI

Waitangi, the largest settlement on Chatham Island, is primarily a fishing port, the port being owned and operated locally by Chatham Islands Enterprises Trust. The NZ Government has recently approved $52m for redevelopment of the Waitangi wharf to make it an all-weather facility.

6.1.2 OTHER CHATHAMS HARBOURS

There are five harbour on the islands: three on Chatham Island and two on Pitt. Located in the same bay as Waitangi, but facing the south, Port Hutt has a sheltered harbour with good anchorage. Several miles to the west, Ocean Bay also offers a sheltered anchorage. There are several anchorages charted around Pitt Island, but weather permitting, the main freight discharge is handled at the landing at Flower Pot Bay, on the island's north-west side.

A supply ship visits Pitt Island about every three months. Carrying materials for repairs to the Pitt Island wharf increased trade temporarily for the vessel *Southern Tiare*.

6.1.3 CHARTING INFORMATION OBSERVATIONS – CHATHAM ISLANDS

The Chatham Islands surrounds are incompletely surveyed, with a note to that effect on Chart NZ 268, advising caution in depths of less than 100m. The area inside 12 miles radius around the entire island group, including the two main ports, is charted as an 'Area to be Avoided' by vessels greater than 500GRT or 40m LOA, unless permission is obtained from the Harbour Master.

In 2013 a chart re-scheme was completed, incorporating new hydrographic survey data.

6.1.4 AREAS OF RISK SIGNIFICANCE – CHATHAM ISLANDS

The islands are home to a rich bio-diversity with 11 plant species, 16 birds, 1 reptile and over 50 invertebrate species endemic to these islands. There are considerable marine resources in the surrounding ocean including penguins, whales, seals, and sharks. The islands are a breeding ground for huge flocks of seabirds.

The Chatham Islands have 41 separate nature reserves. The two largest of these are Mangere and Rainwater. These two Nature Reserves are vital for the conservation of the Chatham Islands flora, fauna and ecosystems. Free of all introduced predators and pests, these are the last remaining refuges of Chatham endemic species.

6.1.5 ECONOMIC SUMMARY – CHATHAM ISLANDS

Most of the Chatham Island economy is based on fishing, cray fishing and farming, with a growing economy in adventure tourism. Commercial catches of high-value species like paua, rock lobster, blue cod and hapuka are the main source of income for the Chatham Islands.

Estimates suggest that the Chatham Islands generated $45M in GDP, predominantly farming, forestry and fishing, with the fishing sector generating close to $17M in GDP.

In 2013, the value of fishery exports was $57M and farming exports totalled $9.7M[7]. Similar sourced data on visitor expenditure suggests that visitors to the island spent close to $1.9M in 2013.

6.2 TRAFFIC ANALYSIS – CHATHAM ISLANDS

The types of commercial vessels using Chatham Islands include

- General Cargo
- Passenger Cruise
- Fishing

[7] **Source: Fishery, MBIE, Chatham Islands Council Administrative Data**

6.2.1 TRAFFIC RECORD – CHATHAM ISLANDS

Apart from scheduled cargo and cruise vessel visits, and fishing activity, there is scarcely any other vessel traffic recorded to Chatham Islands. Data gathering interviews informed of tug and barge traffic to Pitt Island from NZ during the project year, carrying wharf repair materials.

A number of cargo vessels tracked 30 or more miles to both the north and south of the islands, as the great circle (i.e. shortest) routes from the Antipodes to the Americas pass nearby.

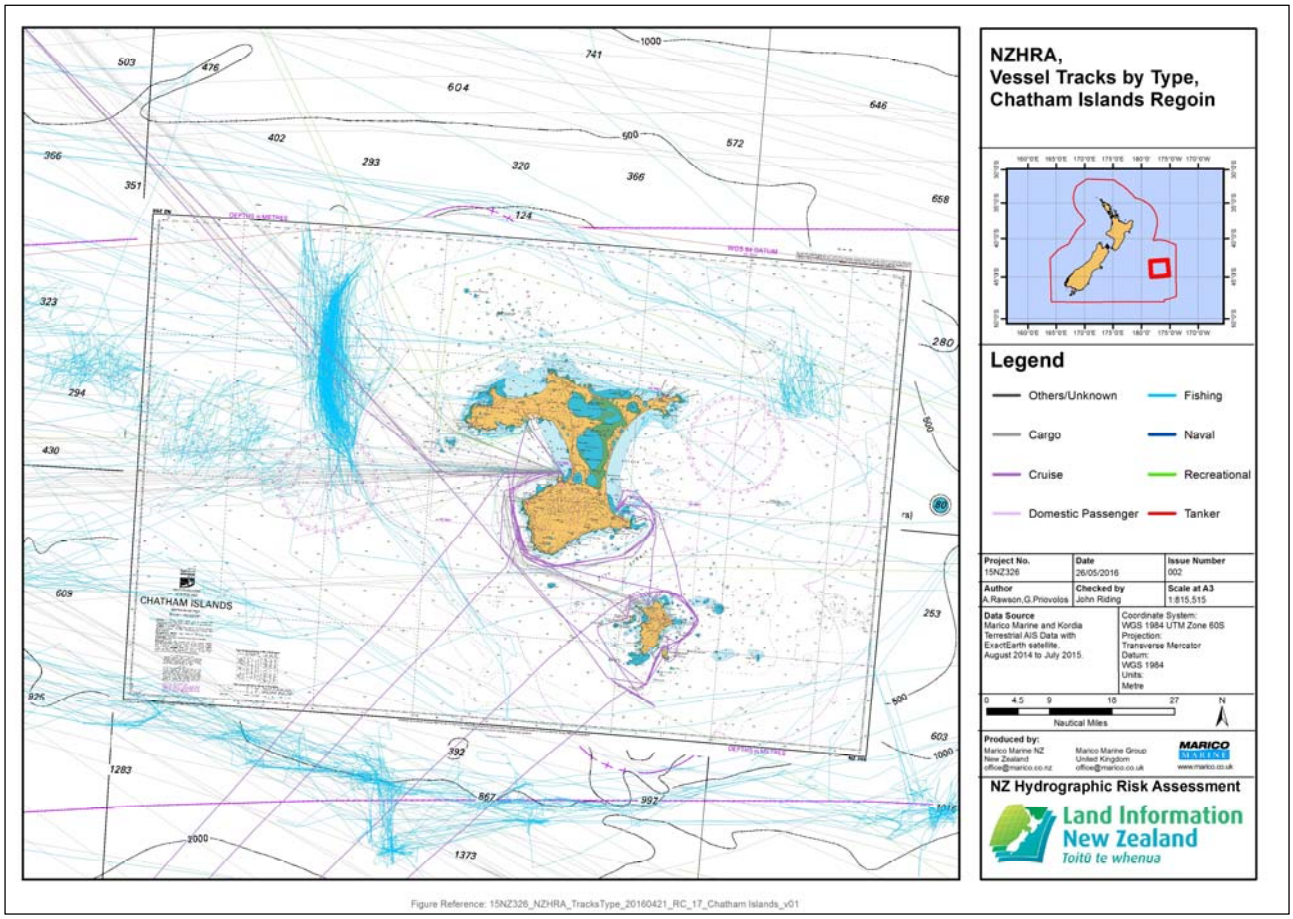


Figure 69 : Vessel Type Analysis – Chatham Islands

The Chatham Islands do have visits by some cruise vessels, but the most frequent transits are those of the cargo service to the islands from the NZ mainland. There is considerable fishing activity in the area, but outside the 12nm Territorial Sea.

6.2.2 TRAFFIC DENSITY – CHATHAM ISLANDS

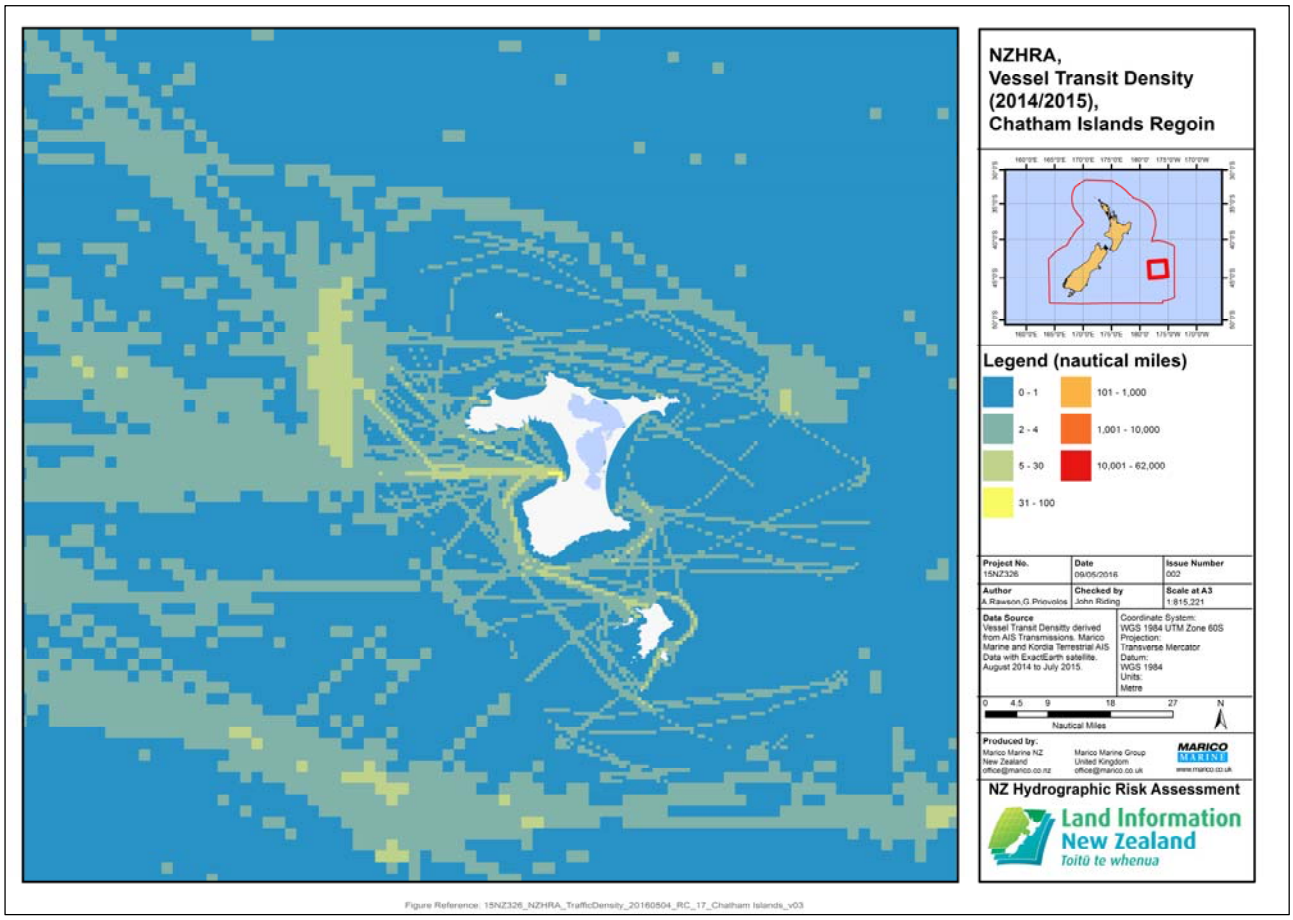


Figure 70 : Traffic Density plot – Chatham Islands

Traffic volume is low, so density is also low.

6.2.3 CARGO VESSELS – CHATHAM ISLANDS

Southern Tiare is the only cargo vessel with AIS tracks recorded during the project year, however data gathering interviews established that there was a second cargo vessel carrying freight to Chatham Islands during this time, not fitted with AIS.

The coastal freighter *Southern Tiare* provided a cargo service every 14 to 16 days between Napier, Timaru and the Chathams. The *Rangatira* provided a shipping service from Timaru and Napier to the Chatham Islands from March 2000 until August 2015. The *Norfolk Guardian* subsequently replaced *Rangatira* and included Norfolk Island in her itinerary until recently.

Freight was carried mostly to Waitangi Wharf, with at least six calls to Pitt Island to trans-ship freight.

6.2.4 CRUISE VESSELS – CHATHAM ISLANDS

Three cruise vessels visited the Chatham Islands from NZ, cruising extensively around both Chatham and Pitt Islands. These records are clearly shown in **Figure 69**

6.2.5 COMMERCIAL FISHING VESSELS – CHATHAM ISLANDS

With 64 fishing vessels based in the Chathams, there was considerable fishing activity outside the 12nm territorial limit of Chatham Islands. This activity took place with larger vessels, mostly in the waters between Chathams and mainland NZ, but also limited activity in deep water further to the east of Chatham Islands. There is fishing activity within the 12nm limit, but mostly from smaller boats.

6.2.6 RECREATIONAL FISHING VESSELS – CHATHAM ISLANDS

MPI estimate that there are up to 200 recreational fishers in Chatham Islands. As the total island population is only 600, this reflects the popularity and accessibility of fishing, seafood gathering and diving as leisure and food gathering activities.

6.2.7 RECREATIONAL CRAFT – CHATHAM ISLANDS

Apart from recreational fishing, there are few other types of recreational vessels here.

6.3 HYDROGRAPHIC RISK – CHATHAM ISLANDS

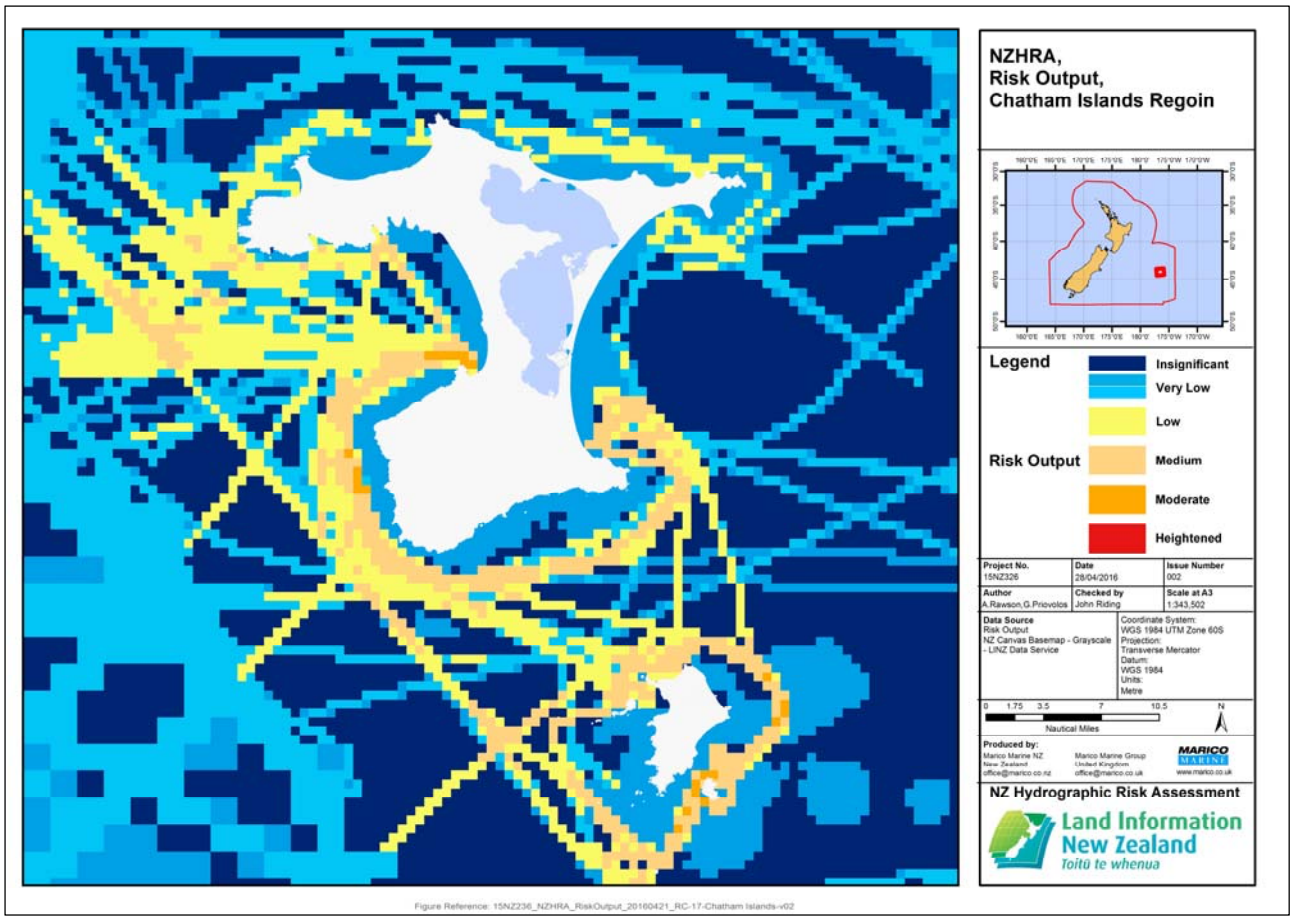


Figure 71 : Hydrographic Risk Result – Chatham Islands

The Chatham Islands show only limited areas of medium risk, which is associated with cruise vessel activity.

6.4 CHARTING BENEFIT – CHATHAM ISLANDS

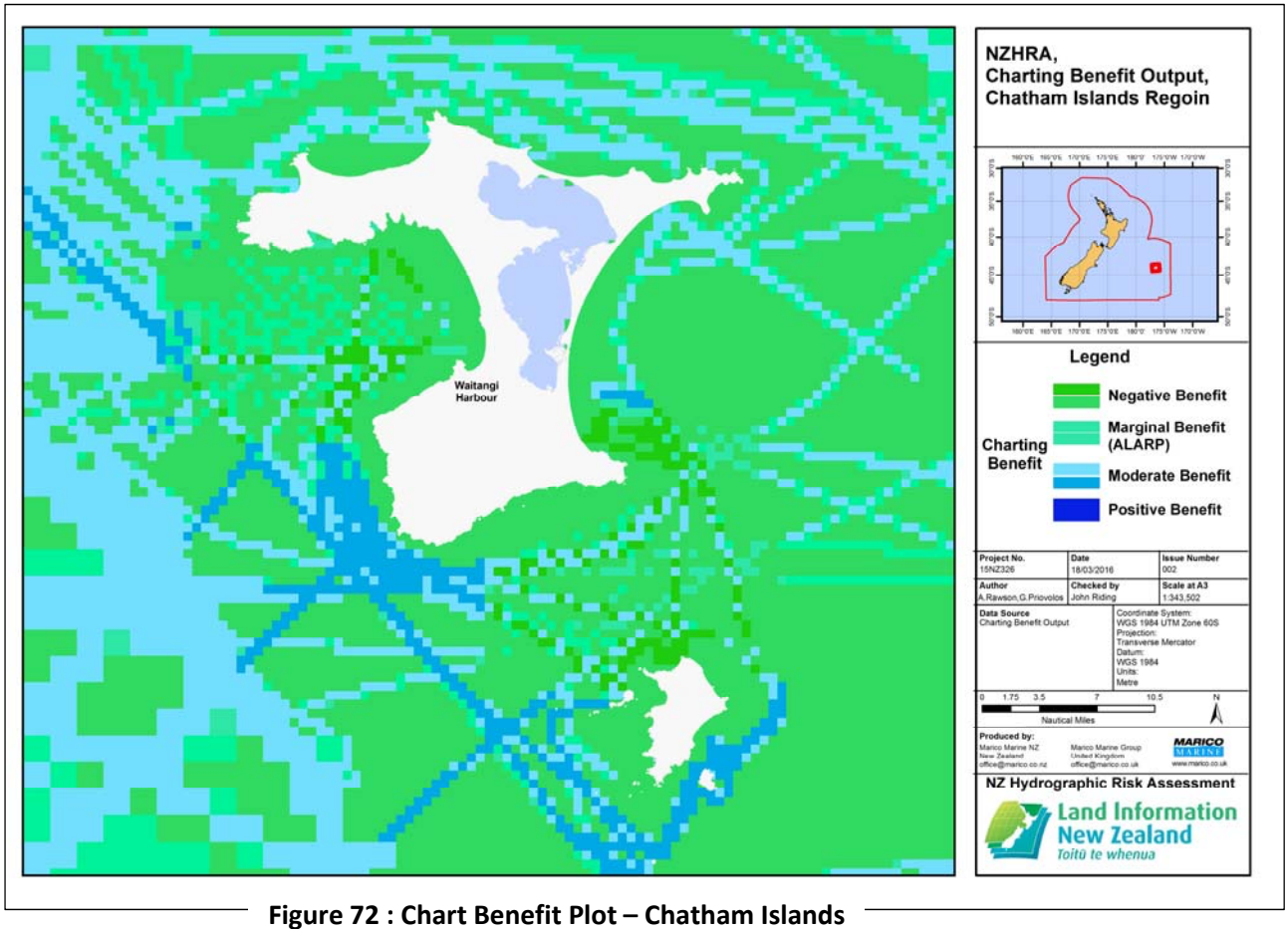


Figure 72 : Chart Benefit Plot – Chatham Islands

The Chatham Islands do show some limited areas of moderate benefit which may profit from a review, but the harbour areas where the domestic services transit are all charted to an adequate standard, according to the result.

7 HYDROGRAPHIC RISK RESULTS - OTAGO REGION

7.1 INTRODUCTION – OTAGO REGION

Otago region has approximately 4.7% of New Zealand's total population, with just over half of the population residing in the Dunedin urban area. Other significant urban centres in Otago include Queenstown, Oamaru and Wanaka. It has an extensive area of low population coastline, with maritime expertise being concentrated in the Port Otago organisation.

7.1.1 DUNEDIN HARBOUR

The entrance to Otago Harbour is situated in the bay between Heyward Point and Taiaroa Head. Two Pilot boarding positions Alpha and Bravo are marked on chart NZ 661. Safe anchorage is available in close proximity, with Taiaroa Head lighthouse bearing 160°(T) and Heyward light tower bearing 220°(T).

Otago Harbour consists of a long, much-indented stretch of generally navigable water separating the Otago Peninsula from the mainland. It is home to Dunedin's deep water port facilities on its western shores in the suburb of Port Chalmers.

Port Chalmers is located 6 nm from the harbour mouth, accessed by a narrow channel. The channel along the western side of the harbour is regularly dredged, allowing vessels with a draught of 13.0m to berth at the container terminal at Port Chalmers.

The eastern side of the harbour is shallow, with large sandbanks exposed at low tide. The harbour is tidal, and shallow and is popular for water sports such as yachting and windsurfing.

The upper harbour's Victoria Channel, a further 7nm from Port Chalmers to Dunedin, is maintained by Port Otago Limited, who keep it dredged to a depth of 7.5m, allowing ships of up to 40,000 tonnes deadweight or 190m LOA to travel up the harbour to Dunedin City wharves.

Rough and confused seas may be experienced in the harbour entrance channel during north-easterly weather, particularly when combined with an ebbing tide. A red flashing light at Taiaroa Head can be activated to signify that the bar at the entrance to the Otago Harbour is breaking or when seas are considered dangerous to small craft.

7.1.2 PORT OTAGO LIMITED

Port Otago Limited is located on the Otago Harbour. Port Otago operates two wharf systems within Otago Harbour: Port Chalmers and Dunedin. Port Chalmers has three berths, suitable for handling containerised, multipurpose, and conventional vessels. At Dunedin's upper harbour berths, tankers, fishing vessels, bulk carriers and smaller conventional vessels are the principal users.

The Dunedin wharves are adjacent to the cold storage industry established to service the meat, dairy, fishing and horticultural exports of the region. Much of the Victoria Channel's larger cargoes are oil, chemicals and fertiliser to and from Ravensbourne's fertiliser works.

In addition to meat, dairy and forestry, Port Otago handles significant exports of fish, apples, and other agriculturally based products. There is also a growing demand for processed timber produced from the fast growing, sustainable pine plantations in Otago's catchment.

The project year saw 508 vessel arrivals into Port Otago and 1.4M tonnes of conventional cargo handled, with a total cargo throughput of 3.8M tonnes. The 172,800 containers transferred was 5% down on the previous year. Log exports were a record 840,000 tonnes, up 6% on the previous year.

Port Otago has commenced work to deepen the shipping channel to Port Chalmers to 15m, first deepening to 13.5m by December 2015 and 14m by December 2016. By utilising the port's own dredge, *New Era*, to complete the work and with more than 50% of the existing channel already at 14m, the cost of $8M to complete the first stage is projected to be substantially cheaper than other similar port dredging projects. The port plans to purchase a new tug and split-hopper barge to support the dredging activity and future maintenance dredging particularly in the upper harbour. This new tug will be available to support the port's towage capability.

Port Otago Limited has established an independent company (Fiordland Pilot Services Limited) to provide pilotage services to the cruise industry in Fiordland.

7.1.3 CAREY'S BAY – OTAGO HARBOUR

Carey's Bay provides a small marina, mooring and servicing area for inshore fishing vessels. There are also some facilities for the shipbuilding and repair industries.

7.1.4 OAMARU HARBOUR

Oamaru Harbour is a small enclosure on the Otago coastline, which is no longer used as a port for the shipping of freight, because of its size. Oamaru Harbour Board was abolished in 1978 and commercial users now include charter fishing and tourist operations. Recreational users include fishing, rowing and yachting.

Viewing of the blue penguin colony near the port has become a significant tourist attraction.

Under the current Oamaru Harbour Development Strategy, effort is being made to improve the facilities in the harbour for commercial and recreational users, including dredging of harbour entrance and repairs to the breakwater. Only one fishing vessel track was recorded visiting Oamaru Harbour; otherwise no vessels of any type were recorded using this port.

7.1.5 ECONOMIC SUMMARY – OTAGO REGION

The sub-national GDP of the Otago region was estimated at US$5.411b in 2003, 4% of New Zealand's national GDP. Cruise passengers and crews injected $35.9M into the local economy.

7.1.6 AREAS OF SIGNIFICANCE – OTAGO REGION

There are currently no marine reserves in Otago Region, however Taiaroa Head, at the tip of the Otago Peninsula, is home to a colony of northern royal albatrosses, the only such close to a city in the world. The bay and peninsula provide a critical habitat for Hooker's sea lions and New Zealand fur seal. Bird species which visit the harbour include two species of penguins, little penguin and yellow-eyed penguins.

7.1.7 CHARTING INFORMATION OBSERVATIONS – OTAGO REGION

The Otago Harbour channel was surveyed in 2001-02, with the approaches and ship anchorage areas surveyed in 1986-87. Some beacons are reported to be in different locations than those charted.

7.2 TRAFFIC ANALYSIS – OTAGO REGION

The types of commercial vessels using Port Otago include

- Container
- General and Break-bulk
- Tankers
- Passenger cruise
- Tugs and workboats

7.2.1 TRAFFIC BREAKDOWN BY TYPE – OTAGO REGION

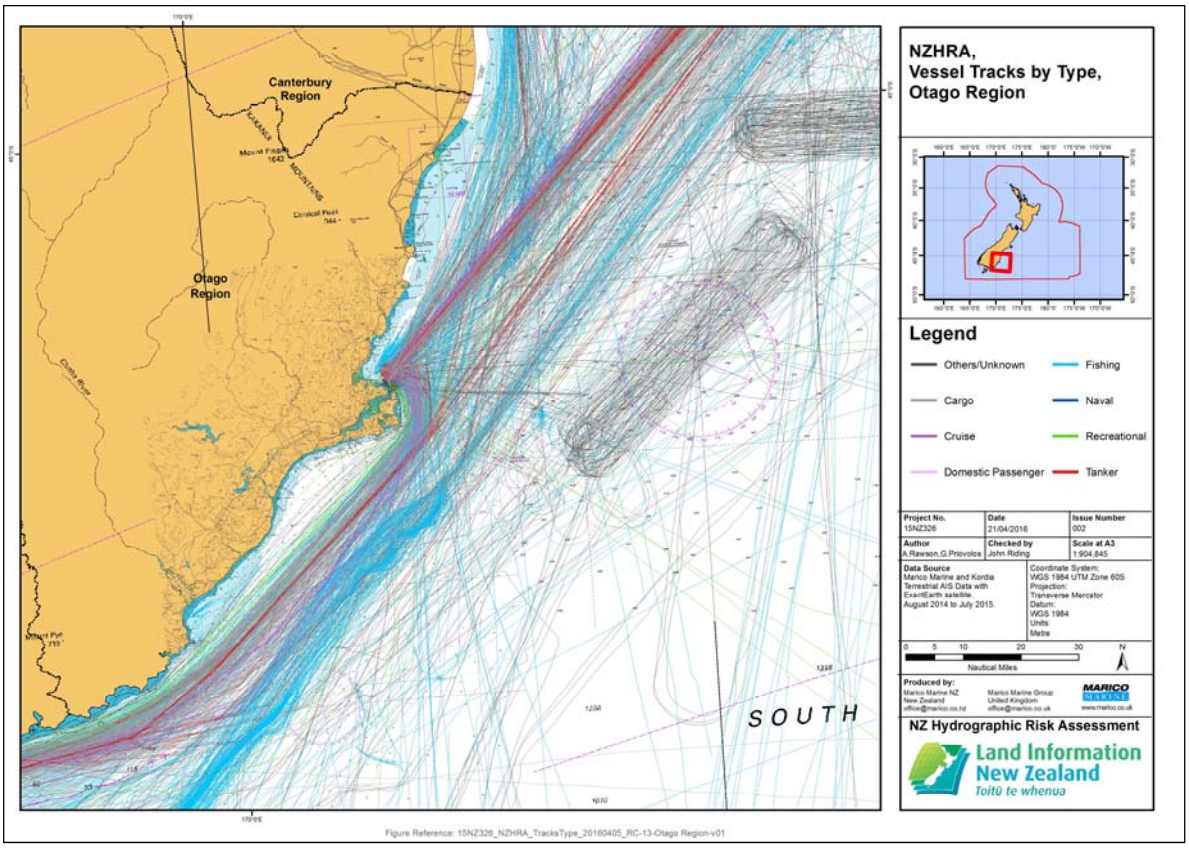


Figure 73 : Vessel Type Analysis – Otago Region

Otago region has the full range of traffic passing through its waters. A number of cargo vessels using Port Otago also used Timaru, Lyttelton and/or Wellington. South of Otago, the majority of vessels transited through Foveaux Strait with a minority passing south of Stewart Island.

7.2.2 TRAFFIC DENSITY – OTAGO REGION

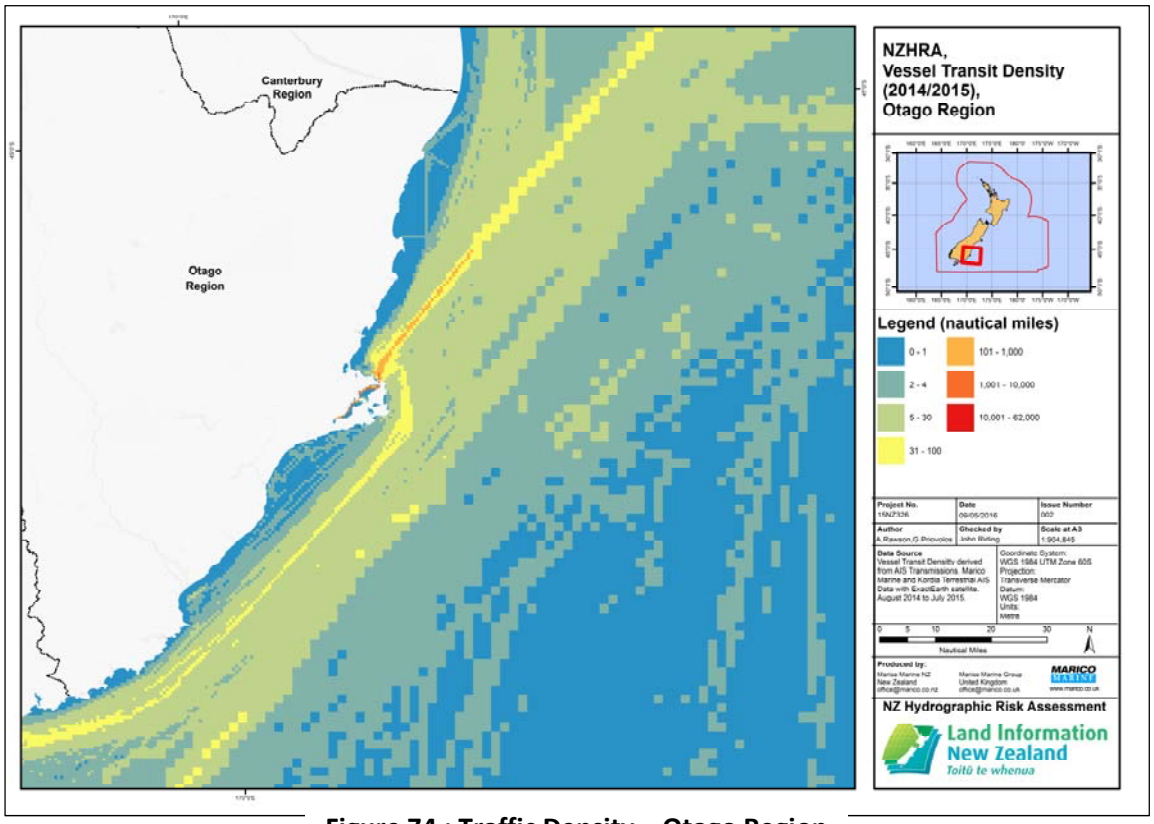


Figure 74 : Traffic Density – Otago Region

7.2.3 CARGO VESSELS – OTAGO REGION

A considerable number of cargo vessels anchored north of Port Otago or drifted in the shelter of the land, waiting for a berth.

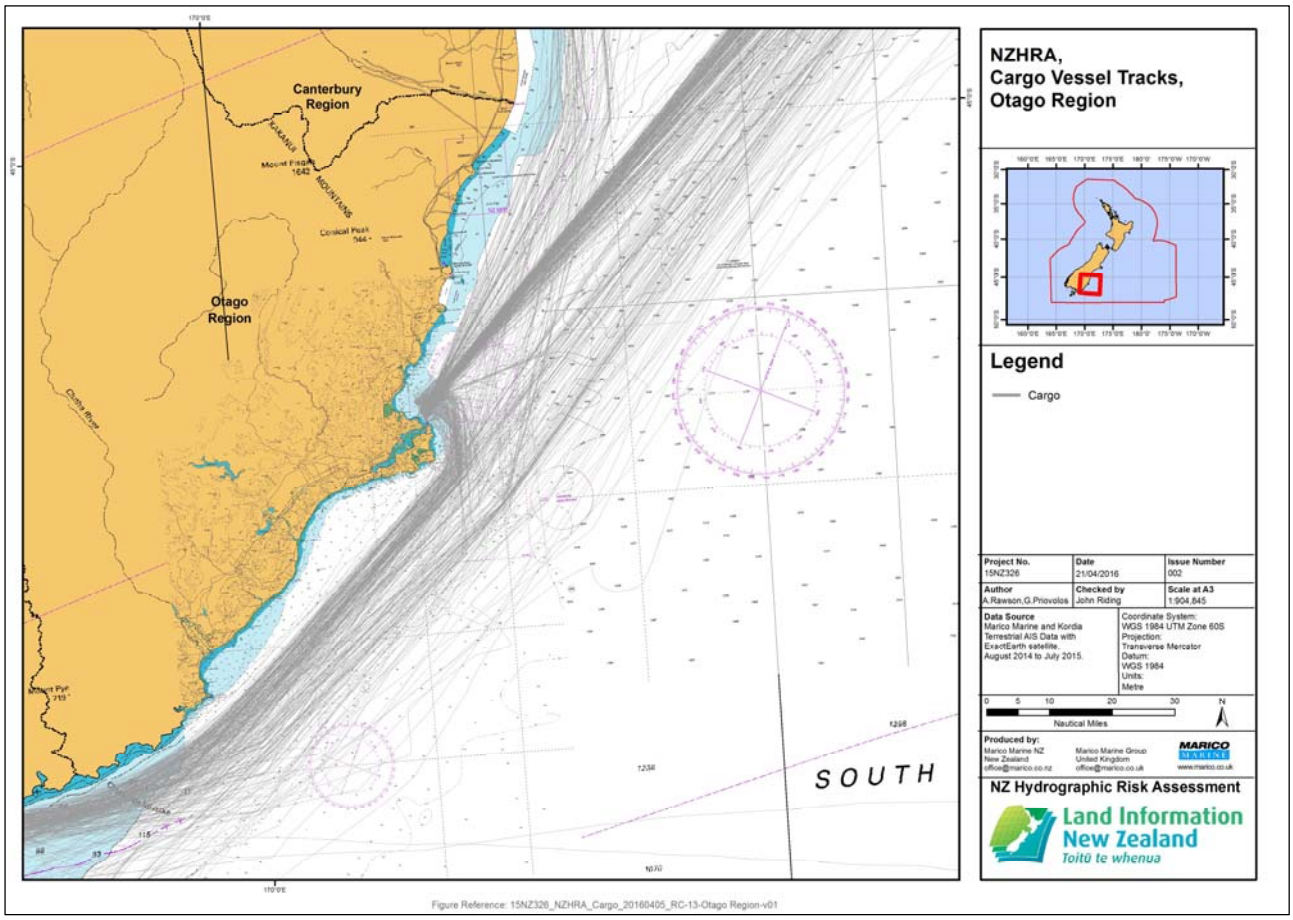
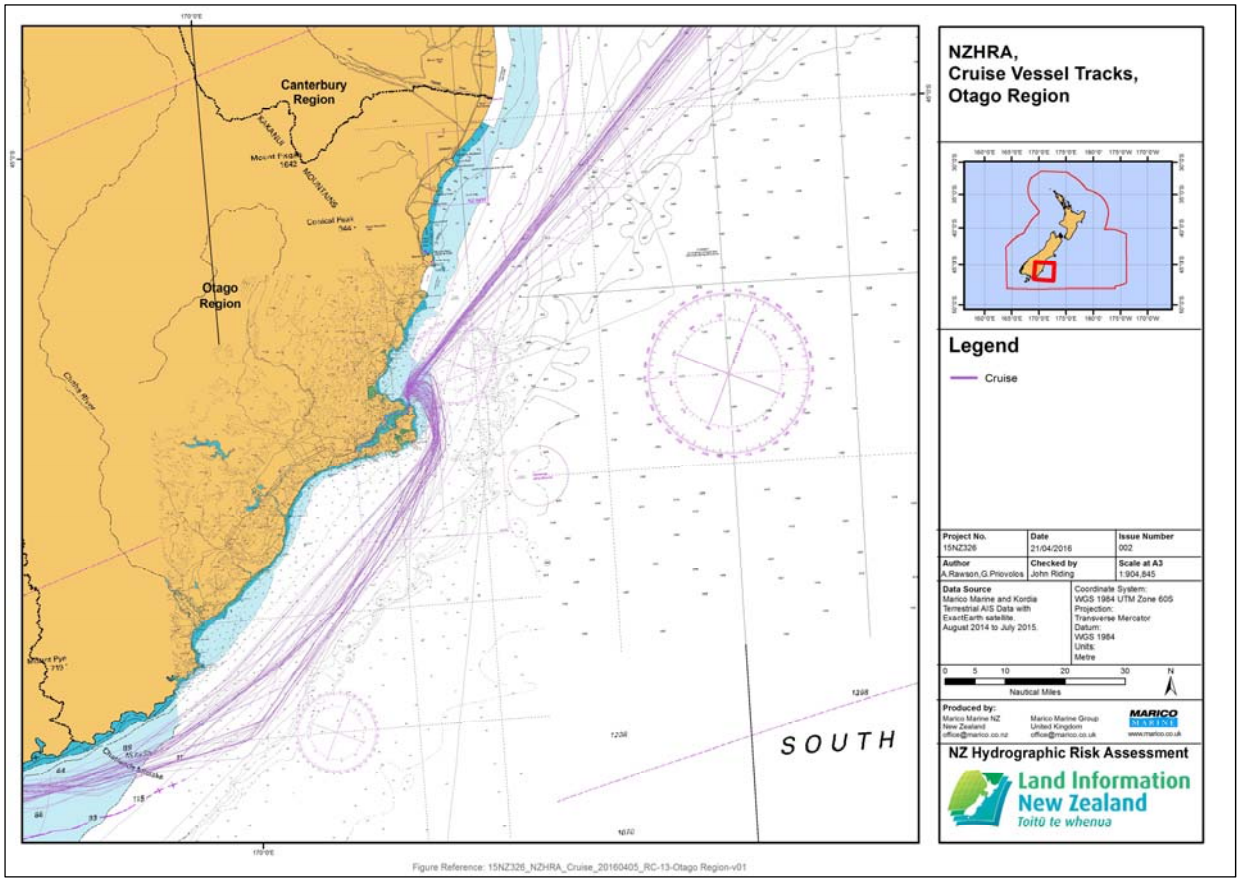


Figure 75 : Cargo Vessel Routes – Otago Region

7.2.4 CRUISE VESSELS – OTAGO REGION

Port Otago hosted 76 cruise vessels, with the majority of cruise ships berthing at Port Chalmers. However, there were some smaller (boutique) cruise vessels berthed in Dunedin at the city wharves. No cruise vessels anchored outside Port Otago, and only two cruise vessels bypassed the port on their coastal transit. Cruise vessels transiting the Fordland waters under the Southlands agreement nearly all embark a pilot at Otago Harbour and this call at the Port Otago facilities in some way.



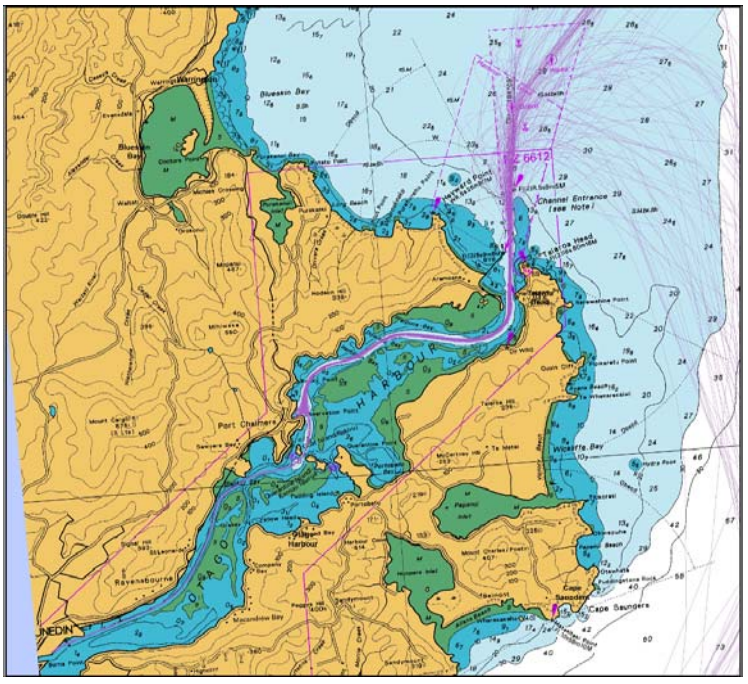


Figure 76 : Cruise Vessel Track Record – Otago Region

7.2.5 TANKER TRAFFIC – OTAGO REGION

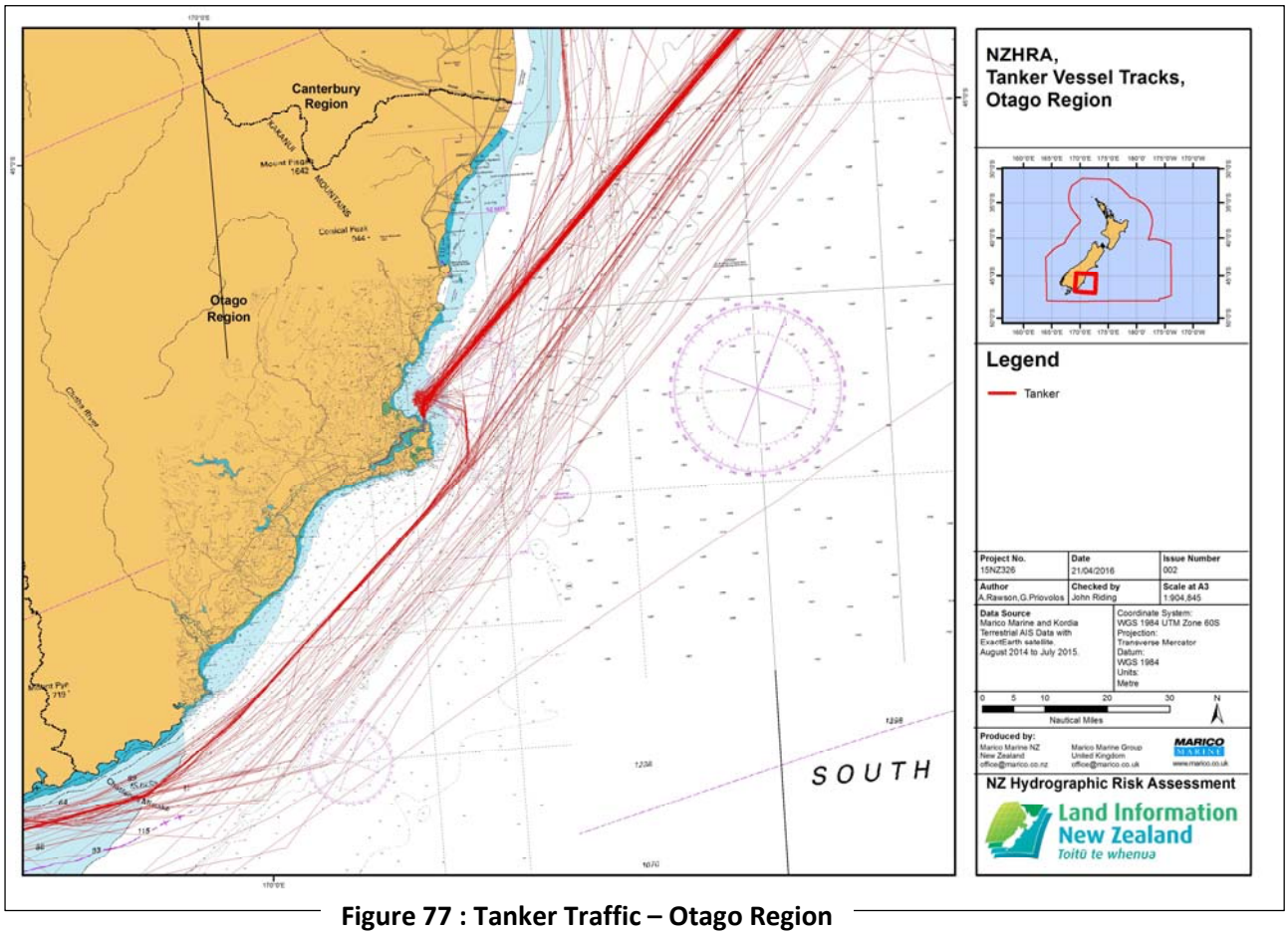


Figure 77 : Tanker Traffic – Otago Region

The plot suggests that most, but not all tankers transiting the Otago Regional waters are delivering cargo into Otago harbour. The concentration of tanker tracks is related to the coastal fuel delivery tankers. As can be seen in the traffic plot above, tankers frequently anchored to the north of Port Otago.

7.2.6 DOMESTIC PASSENGER TRAFFIC – OTAGO REGION

One small passenger vessel, not fitted with AIS, operates tours within the harbour, travelling as far as the Taiaroa Heads.

7.2.7 COMMERCIAL FISHING VESSELS – OTAGO REGION

Forty-eight fishing vessels are based in this region: mostly inshore trawlers, crayfish and paua boats.

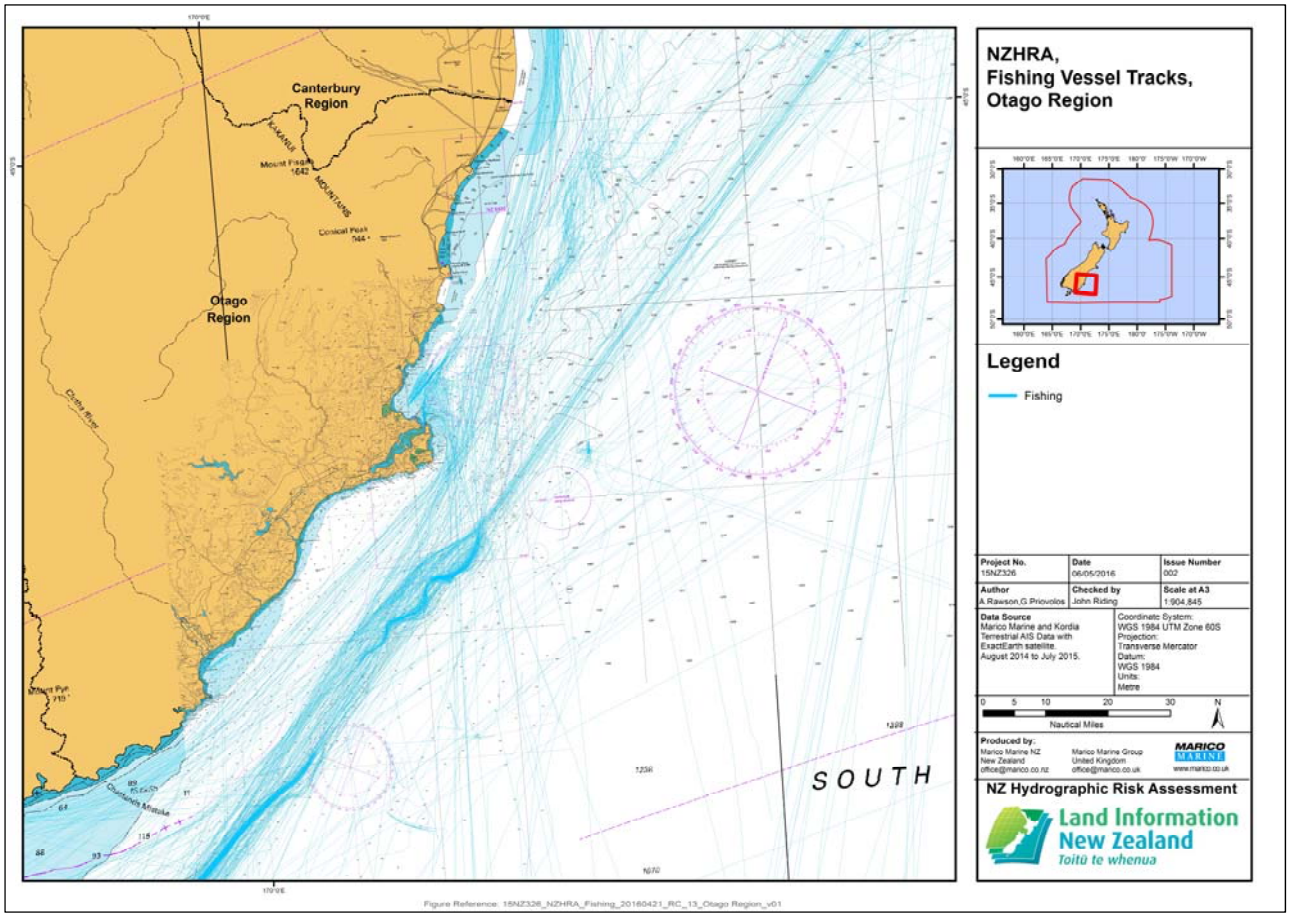


Figure 78 : AIS Fishing Vessel Record – Otago Region

7.2.8 RECREATIONAL FISHING VESSELS – OTAGO REGION

Carey's Bay provides moorings and launching facilities for the many recreational fishing craft that frequent the area. In fine weather, a few of these craft transit out of the harbour to fish in open waters, however the majority tend to fish within the harbour.

7.2.9 RECREATIONAL CRAFT – OTAGO REGION

Sailing and boating is popular in the harbour, with a sheltered yacht harbour near the city providing launching, mooring, haul-out and berthing facilities. Small craft moorings are provided at Ravensbourne and Back Beach, with additional marina berths and swing moorings at Deborah Bay.

There are seven public boat ramps within the harbour and another seven public landing sites, as well as some public jetties, however for the stretch from Dunedin to Port Chalmers there are few places offering easy access to the water and there are no launching facilities. For a large number of Dunedin boat-owners the Back Beach and Carey's Bay ramps are in big demand as are parking and rigging areas.

7.3 PORT OTAGO TRAFFIC

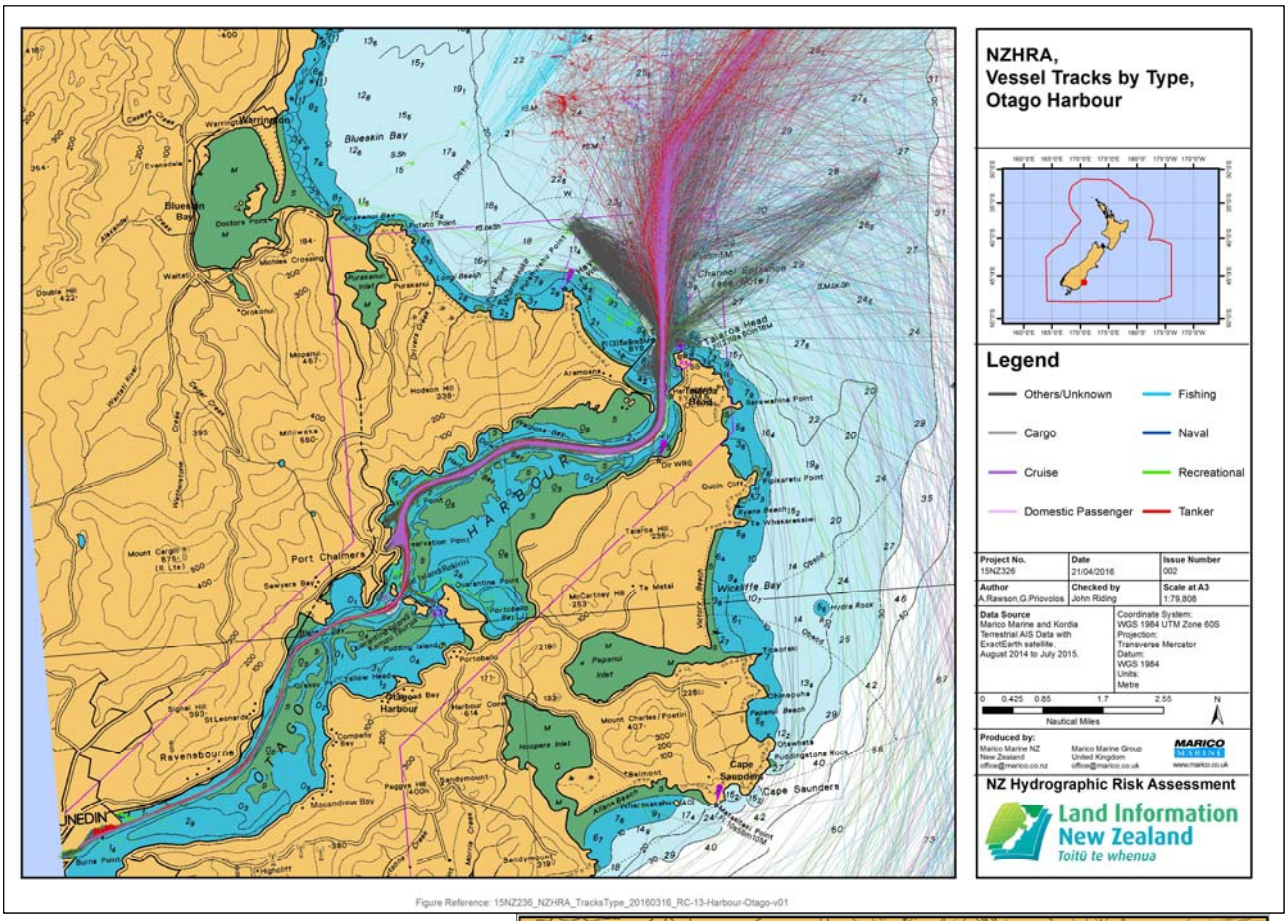
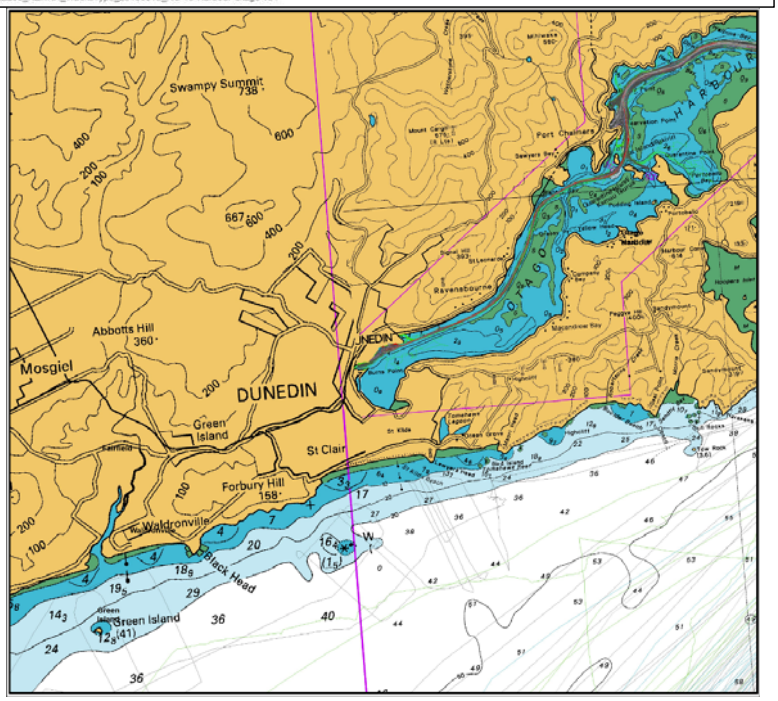


Figure 79 : Traffic Breakdown by Type – Otago Harbour



A considerable number of cargo vessels, including tankers anchored north of the port or drifted in the shelter of the land, waiting for a berth. The locations of these are apparent from the plot above. It is understood that the offshore area is exposed, and vessels are often advised to slow steam. The Otago Harbour access channel for large vessels is maintained by Port Otago. A programme of channel deepening was underway, completing in 2015. Official Nautical Charting in the area may need updating with the new maintained depth.

7.4 HYDROGRAPHIC RISK – OTAGO REGION

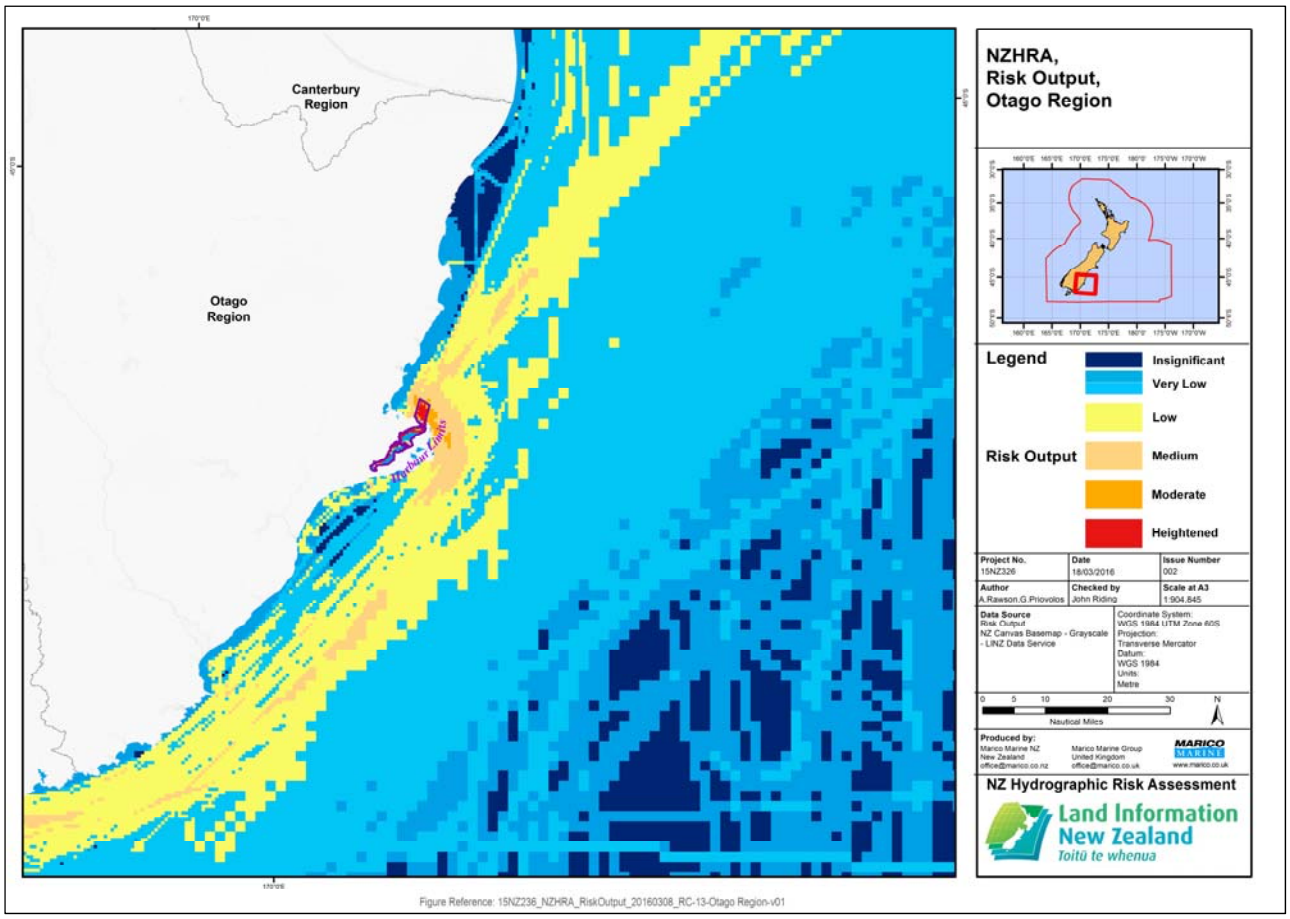


Figure 80 : Hydrographic Risk – Otago Region

Hydrographic risk in Otago regional waters is generally low, with some limited areas of medium risk where vessel transits converge. The exception is the waters of Otago Harbour, as show in the figure below. The harbour approaches and internal harbour waters through to Dunedin berths provide a heightened risk result. Much of this is driven by Port Otago regularly maintaining its channels, but chart source data is only periodically updated with the information Port Otago promulgates.

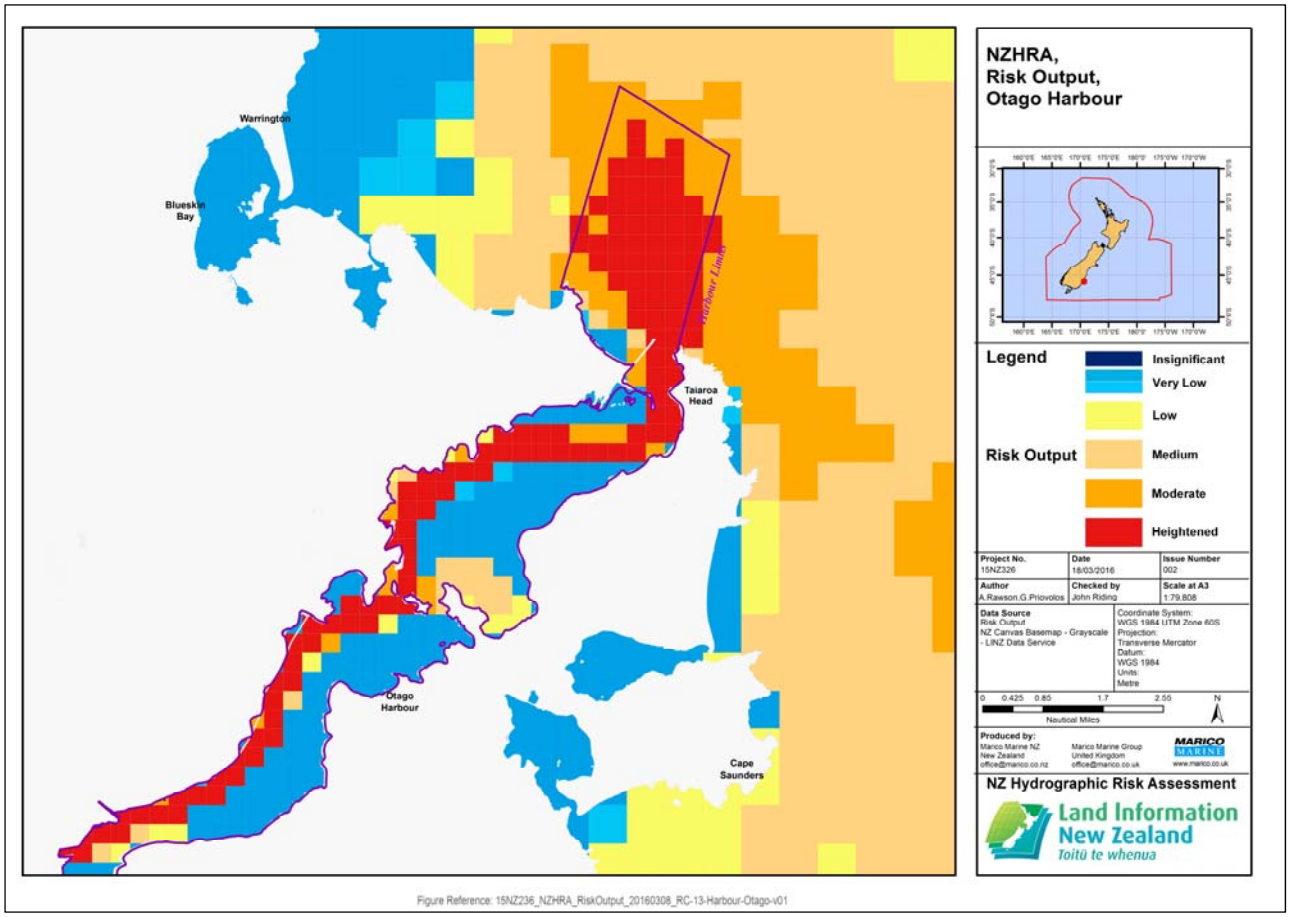


Figure 81 : Hydrographic Risk Result – Otago Harbour

7.5 CHARTING BENEFIT – OTAGO REGION

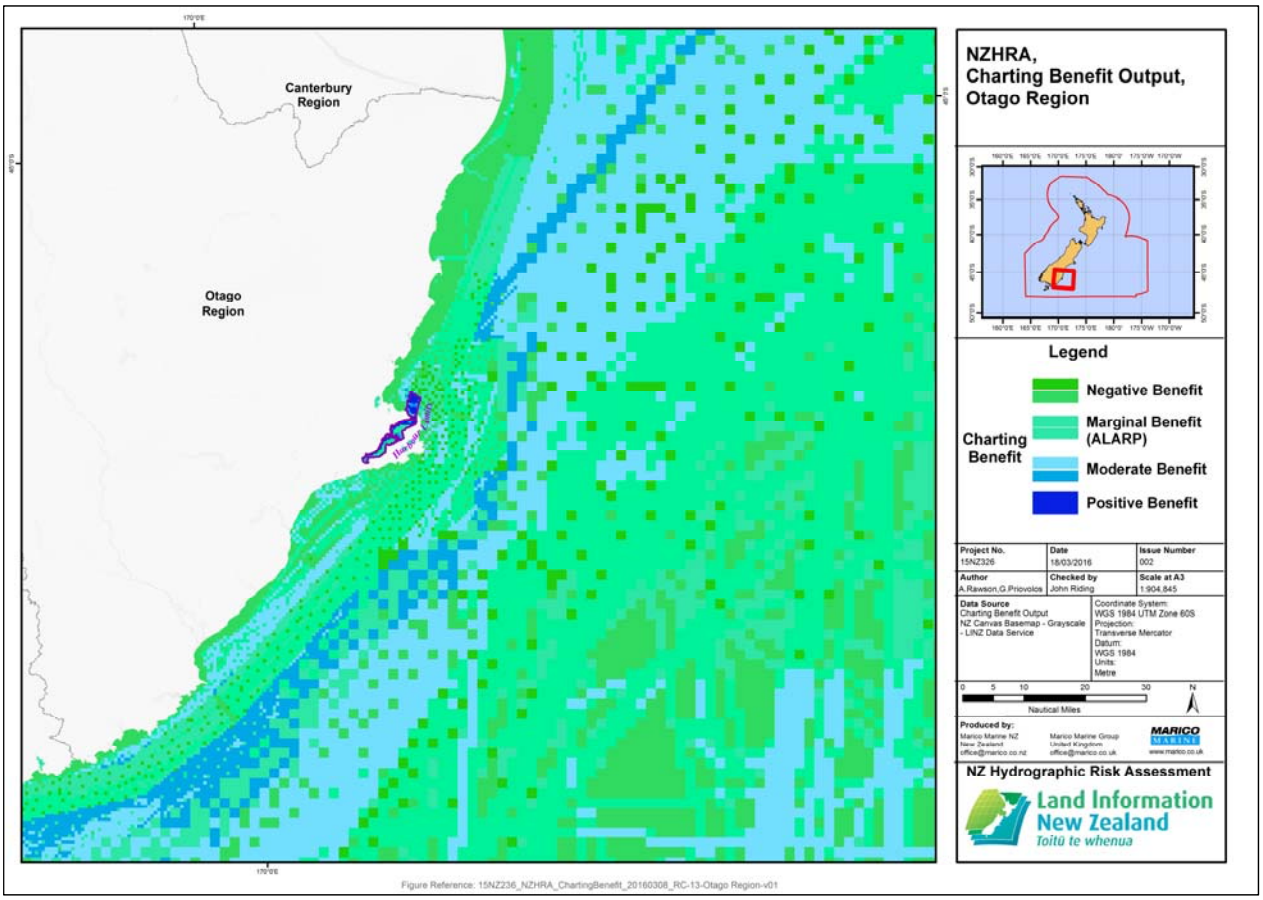
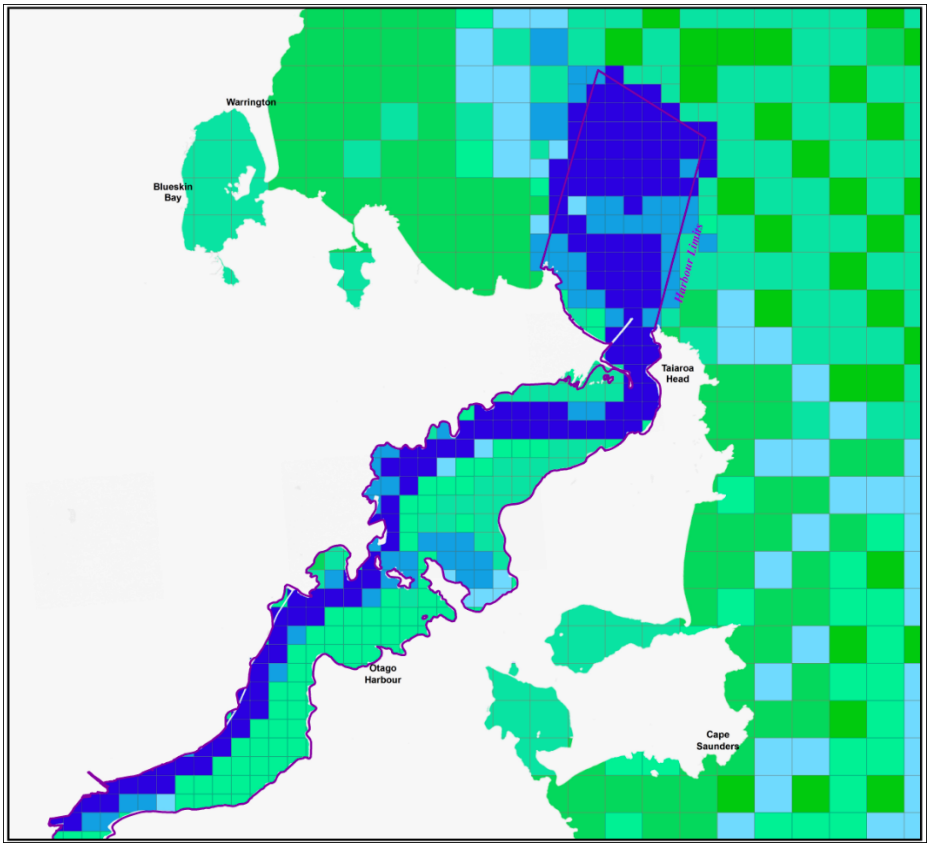


Figure 82 : Charting Benefit Results for Otago Region



The Charting Benefit result follows the risk result, suggesting review of the charting in the harbour approaches, but within harbour limits may be worthwhile. Given that Port Otago is diligent in maintaining and sounding its channels, the benefit result is more likely to be because the Official Chart source data is older in the areas where Port Otago is declaring a maintained channel depth.

8 HYDROGRAPHIC RISK RESULTS - SOUTHLAND REGION

8.1 INTRODUCTION – SOUTHLAND REGION

Southland Region includes Fiordland and Stewart Island (Rakiura). It is one of New Zealand's most sparsely populated areas, the sizable western part of Fiordland being almost empty of permanent human inhabitation. Covering some 13% of New Zealand's area, Southland is home to just over 2% of its population.

Southland lies exposed to the 'Roaring Forties' with a prevailing westerly weather flow. Areas around Foveaux Strait frequently experience strong winds, due in part to the funnelling effect of the topography. The western ranges of Fiordland are among the wettest places in the world with annual rainfall totals over 8000mm. In contrast, Southland's drier eastern lowlands and hills have annual totals between 800 and 1200mm.

Off the coast of Southland lies the Great South Basin which stretches over 500,000 km^2 covering an area 1.5 times New Zealand's land mass. It is one of the country's largest undeveloped offshore petroleum basins with prospects for both oil and gas.

Southland produces over half of New Zealand's blue cod catch. The blue cod fishery is mostly inshore. Larger offshore fishing vessels catch tuna, hoki, dory, squid, monkfish and hake in great numbers, particularly off the coast of Fiordland. Blue cod is the most sought after recreational fish here.

Southland has the largest rock lobster (crayfish) fishery in New Zealand, returning more than $30M in annual exports, mostly sending crayfish live to Hong Kong. The most productive waters are in Fiordland, but lobster processing companies also operate from Bluff, Riverton and Stewart Island. Crayfish are the region's second most important recreational fishery making up 5% of the total regional catch. The Bluff oyster commercial catch is around 7M oysters.

The commercial take of blackfoot paua in Southland is one third of the national total, with most of that coming from Stewart Island and Fiordland.

Green-lipped mussel and salmon are farmed at Stewart Island and processed in Bluff.

8.1.1 SOUTH PORT LIMITED

Located in Bluff Harbour, at the southern tip of New Zealand's South Island, South Port is New Zealand's southernmost commercial deep water port, based on a 40ha man-made Island Harbour.

South Port is a tidal port and major shipping movements occur at slack water. Tidal flow in the entrance channel is reported to vary from 4-5kn on average peaking at 7kn on high spring tides,

although only an ebb/flood stream of only 2kn is marked on the harbour chart outside Channel Rocks, with maximum 4.3kn during Spring tides in the narrows at the tidal diamond three cables distant.

Pilotage is compulsory for all vessels over 100 GRT. Pilots are available for Stewart Island pilotage district. There is also a cruise ship piloting service for Fiordland provided by South Port. The maximum vessel draught is 9.7m with up to 10.0m handled at high water spring tides. Maximum vessel length is 225m and beam, 34m.

Bulk cargo activity is a major influence resulting in a 5% cargo increase providing a record volume of 2.86M tonnes. The growth was largely driven by fertiliser, stock food and dairy-related product. South Port operates a separate dedicated fuel berth at Bluff Town Wharf as well as providing the Tiwai Wharf facility to New Zealand Aluminium Smelter Limited.

Container volumes registered a record at 35,800 TEU in the 2014-15 data year. Stock food imports continued to climb; log volumes were similar level to the previous year's record tonnage. Overall forest products of logs, chips and sawn timber dipped slightly but still represented 22% of the total for South Port. The direct export of logs from South Port recommenced after over a decade of absence from the Port.

The smelter berth at Tiwai has a ship alongside for 3 – 4 days per week to discharge alumina and load aluminium ingots from the smelter. South Port has a 1050 tonne ship Syncrolift situated on the Island Harbour, which facilitates a ship repair industry.

8.1.2 FIORDLAND

Fiordland is New Zealand's largest national park, with 14 fiords or sounds indenting the coastline. Fiordland has World Heritage Status.

A range of companies offer short excursions that explore the fiords of the Fiordland region with tours mainly to Milford Sound, Doubtful Sound, Dusky Sound, Preservation Inlet and Stewart Island.

Milford Sound has clear, deep water and in Milford's Piopiotahi Marine Reserve there is an Underwater Observatory where unusual sea creatures and rare black coral may be viewed at 10m depth.

8.1.3 STEWART ISLAND (RAKIURA)

Fishing has been, historically, the most important element of the economy of Stewart Island, and while it remains important, tourism is now the main source of income for islanders.

A scheduled passenger ferry service runs between Bluff and Oban; a ferry/barge service for vehicles also runs to the island.

An inshore fishing fleet is based in Oban, targeting crayfish and paua.

There are salmon and mussel farms on the island's east coast at Big Glory Bay, in Paterson Inlet, with accompanying service barges. The Southland region produces 19% of the total production of New Zealand King Salmon and 2% of New Zealand Mussels.

Charter fishing and diving vessels operate out of Oban. Apart from a few private fishing boats kept on swing moorings in Oban and Paterson Inlet, recreational vessels here are mostly small trailer boats: there are several boat launching ramps in Oban.

8.1.4 ECONOMIC SUMMARY – SOUTHLAND REGION

Tourism spending is a major factor of the Southland economy, with NZ$368 million being spent by visitors in 2003, of which almost one third was spent by over half a million domestic passengers in the Fiordland area. Cruise ship visitors injected a further $7.1M into the region's economy. The aluminium smelter is a key economic asset for Southland.

8.1.5 CHARTING INFORMATION OBSERVATIONS – SOUTHLAND REGION

The shipping channel through the centre of Foveaux Strait was surveyed in 2001-03 with most of the Sounds last surveyed in 1997-99. Around Stewart Island, where 15 cargo, three tanker and three cruise vessels anchored, surveys were variously carried out in 1980-99.

Milford, Dusky, Breaksea, Doubtful and Thompson Sounds were all surveyed in 2007 with new editions reprinted in larger scale to cover the main cruise ship routes.

8.1.6 AREAS OF RISK SIGNIFICANCE – SOUTHLAND REGION

More than half of Southland's land area is administered by the Department of Conservation including Fiordland and Rakiura National Parks. The former covers 7,860km^2; making it New Zealand's largest national park. The Rakiura National Park covers 85% of Stewart Island. Approximately 78% of the Southland region's coastline is adjacent to land administered by the Department of Conservation.

Fiordland is one of the southern hemisphere's great wilderness regions, with World Heritage Status. Thirty protected areas in the Southland coastal area cover a total area of 1,405,687ha and include two national parks, 26 scenic reserves and two scientific reserves.

There are also 10 marine reserves in Fiordland, including Piopiotahi Marine Reserve in Milford Sound which is one of the most popular places in Fiordland to dive and see the black corals for which the fiords are famous. In addition, there are dolphin management areas within the Fiordland Sounds (which were taken account of in the Hydrographic risk assessment). Fiordland has a number of pest-

free islands that are of international significance. Some of these islands have never had rats or mice present.

Ulva Island Marine Reserve is located in the outer portion of Paterson Inlet, on Stewart Island's east coast. This reserve was established in 2004 and covers 1075ha or 15% of Paterson Inlet adjoining Ulva Island.

Codfish Island, west of Stewart Island, is a nature reserve with landing prohibited.

8.2 TRAFFIC ANALYSIS – SOUTHLAND REGION

In a 12 month period, Southland experiences moderate levels of traffic of many vessels types. Of note is the number of cruise vessels passing through these waters in the summer months and the transits by fishing vessels.

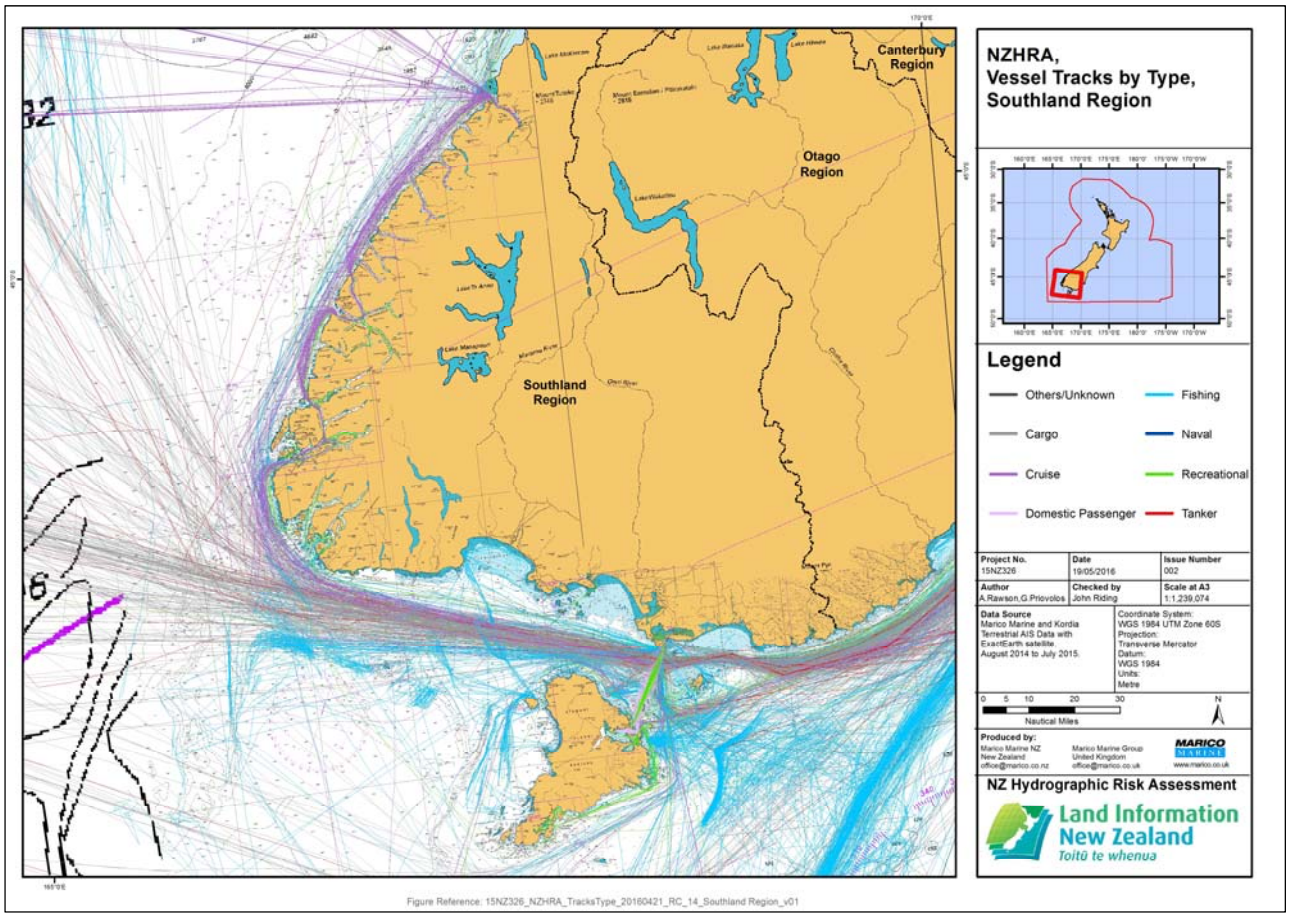


Figure 83 : Vessel Traffic Breakdown by Vessel Type – Southland Region

8.2.1 TRAFFIC DENSITY – SOUTHLAND REGION

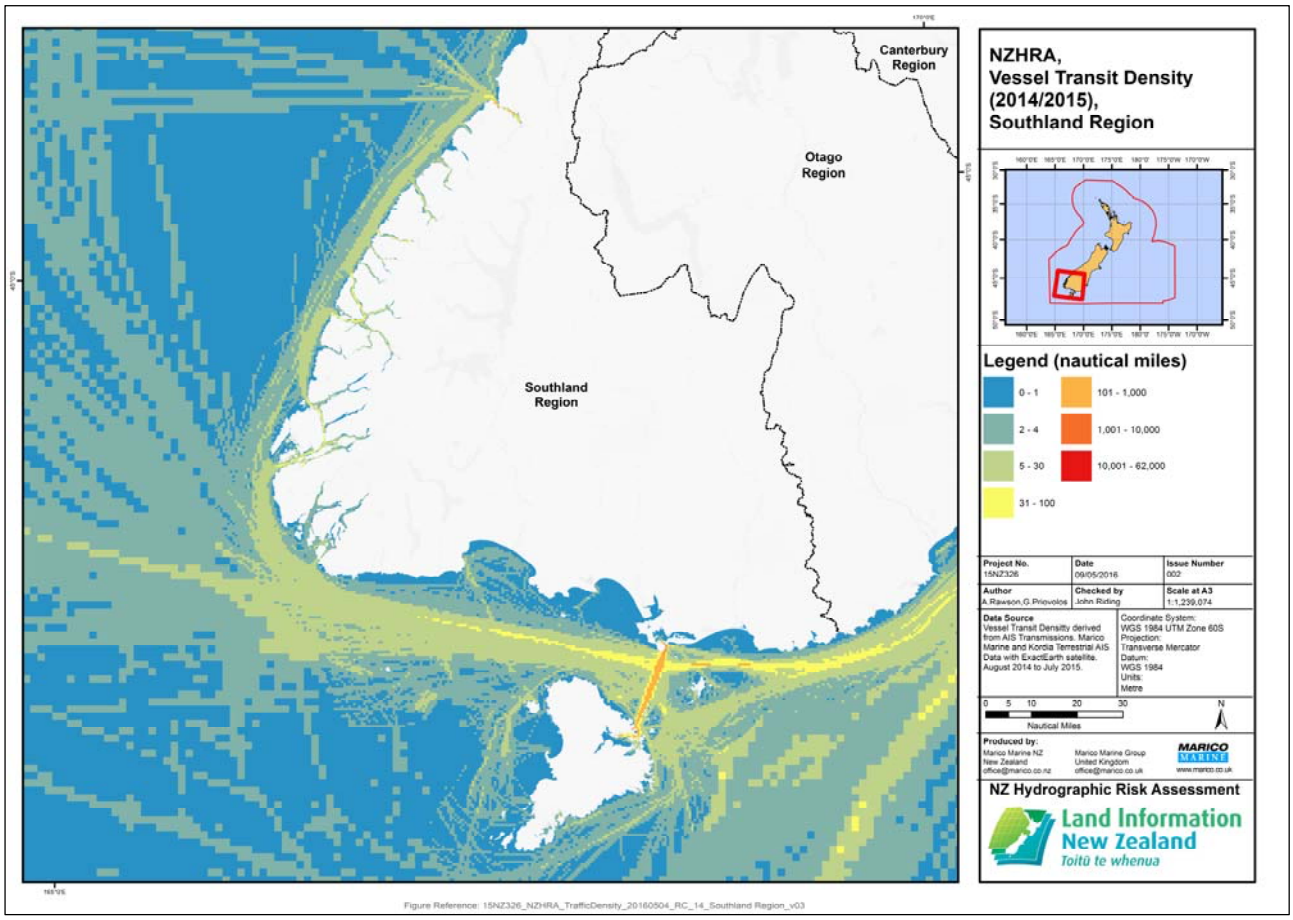


Figure 84 : Traffic Density – Southland Region

In comparison to other areas of the New Zealand coastline, Southland in general has low traffic density. However, both the Stewart Island route and Milford Sound (circular traffic) have comparable increased traffic densities, arising from domestic passenger vessel services and their associated passenger volumes.

8.2.2 CARGO VESSELS – SOUTHLAND REGION

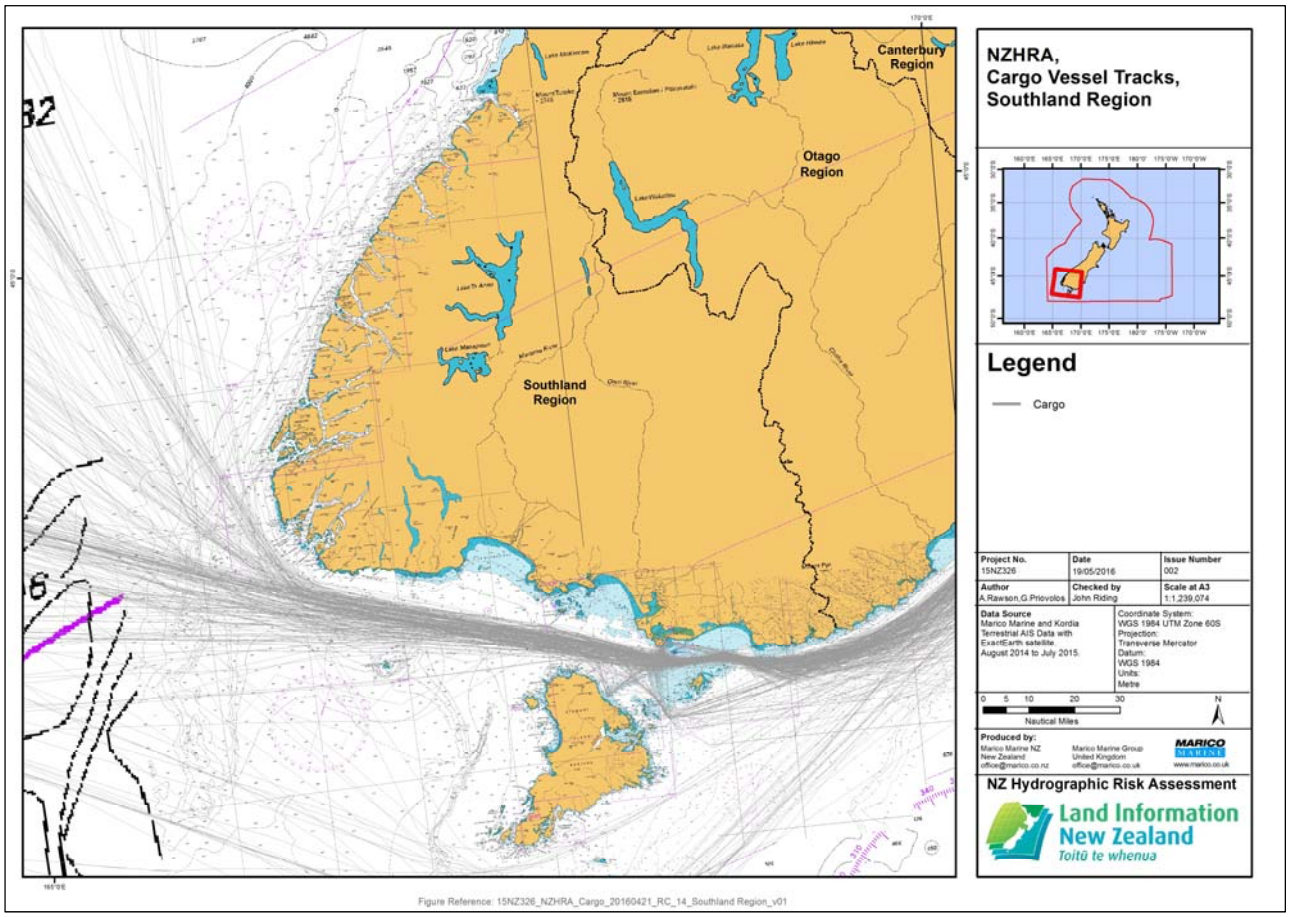


Figure 85 : Cargo Vessels - Southland Region

Cargo vessels take a similar transit round the south coast of New Zealand to that of tankers, with large numbers of cargo vessels transiting through Foveaux Strait on their way to or from Australia, or trading to Bluff. Over 40 cargo vessels passed south of Stewart Island instead of transiting through Foveaux Strait. Around 15 cargo vessels anchored off the north-east coast of Stewart Island, most likely sheltering from westerly weather.

More than 40 more cargo vessels transited through the Rakiura Gap, between Mutton Bird Islands and Ruapuke Island, to the north-east of Oban.

Most cargo vessels stay well clear of the Fiordland coast and in deep water as far as Hydrographic Risk is concerned. Two general cargo vessels were recorded transiting to Deep Cove around 20nm inside Doubtful Sound. These were delivering project cargo to the electrical generator.

8.2.3 TANKERS – SOUTHLAND REGION

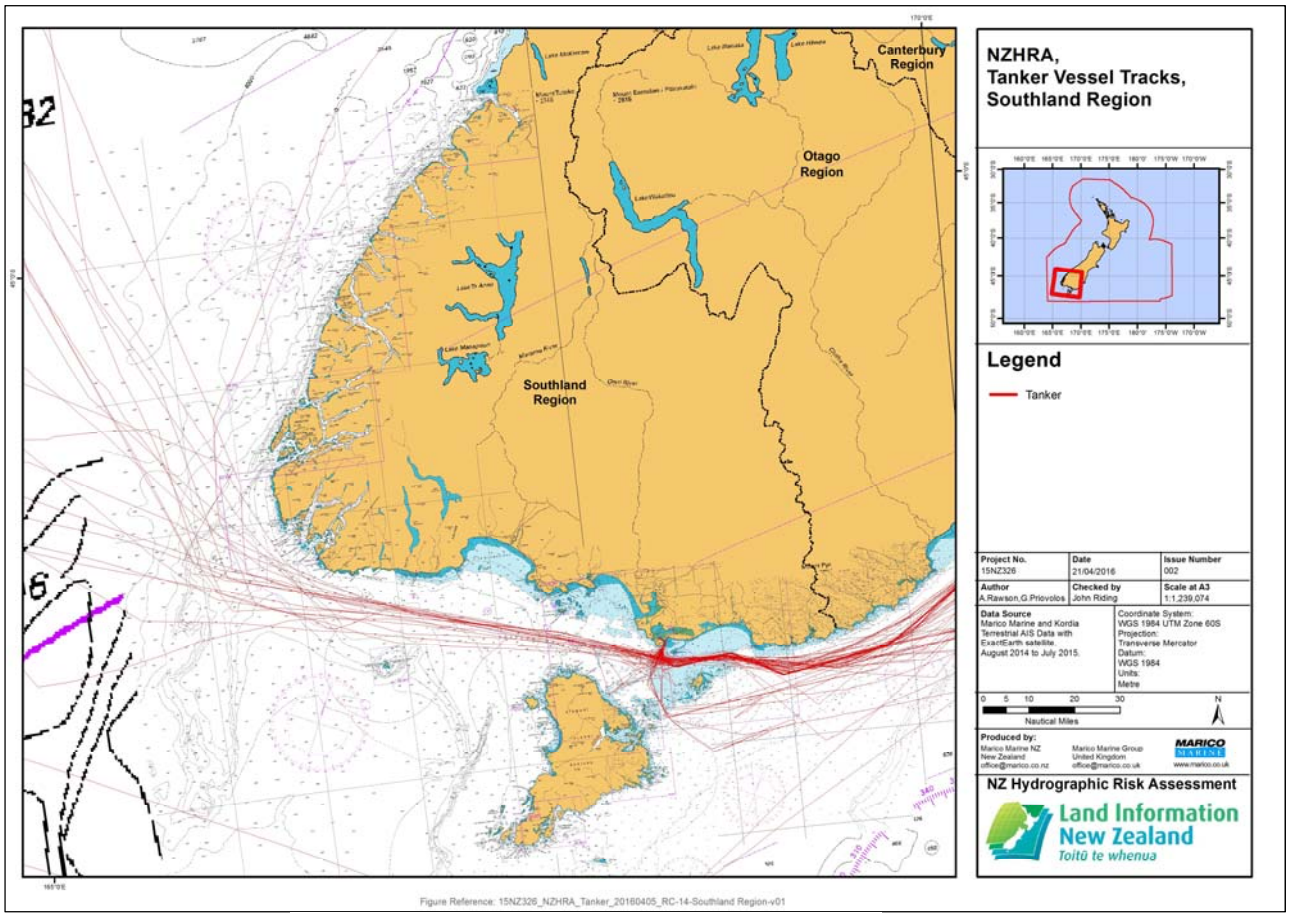


Figure 86 : Tanker Routes – Southland Region

Tankers transiting around the south of New Zealand comprise either those in the domestic fuel delivery service, which trade to Bluff Harbour, or tankers taking the southern NZ coastal route bound for ports on the south Australian coast. Three tankers were recorded anchoring in the shelter of Stewart Island in the data period.

8.2.4 DOMESTIC PASSENGER VESSELS – SOUTHLAND REGION

A passenger ferry runs between Bluff and Stewart Island; a freight ferry also operates on the route. There are a large number of domestic passenger vessels in service in Fiordland waters and especially Milford Sound. Passenger volumes recorded taking the trip around Milford Sound are surprisingly high, with recent annual growth estimated at 20-25%. There are at least six tourist excursion operators working from Milford Sound and a large fleet of charter vessels, some with large passenger capacity.

There is no requirement for fitment of AIS transponders, so the hydrographic risk assessment result for Milford Sound Harbour is in part based on reported schedules and annual passenger volumes.

During the summer season, the Fiords can be very busy, with up to 100 tourist vessel and cruise ship movements a day.

8.2.5 COMMERCIAL FISHING VESSELS – SOUTHLAND REGION

Approximately 130 fishing vessels are based around the Southland region with fleets based at Bluff, Riverton, Waikawa, Doubtful Sound, Milford Sound and Oban on Stewart Island. Fishing activity takes place around all the islands in Foveaux Strait and extensively around Fiordland, as well as further offshore. Fishing vessels from Bluff and Riverton frequently travel to Stewart Island and Fiordland.

An extensive commercial charter fishing and diving fleet operates out of Milford Sound.

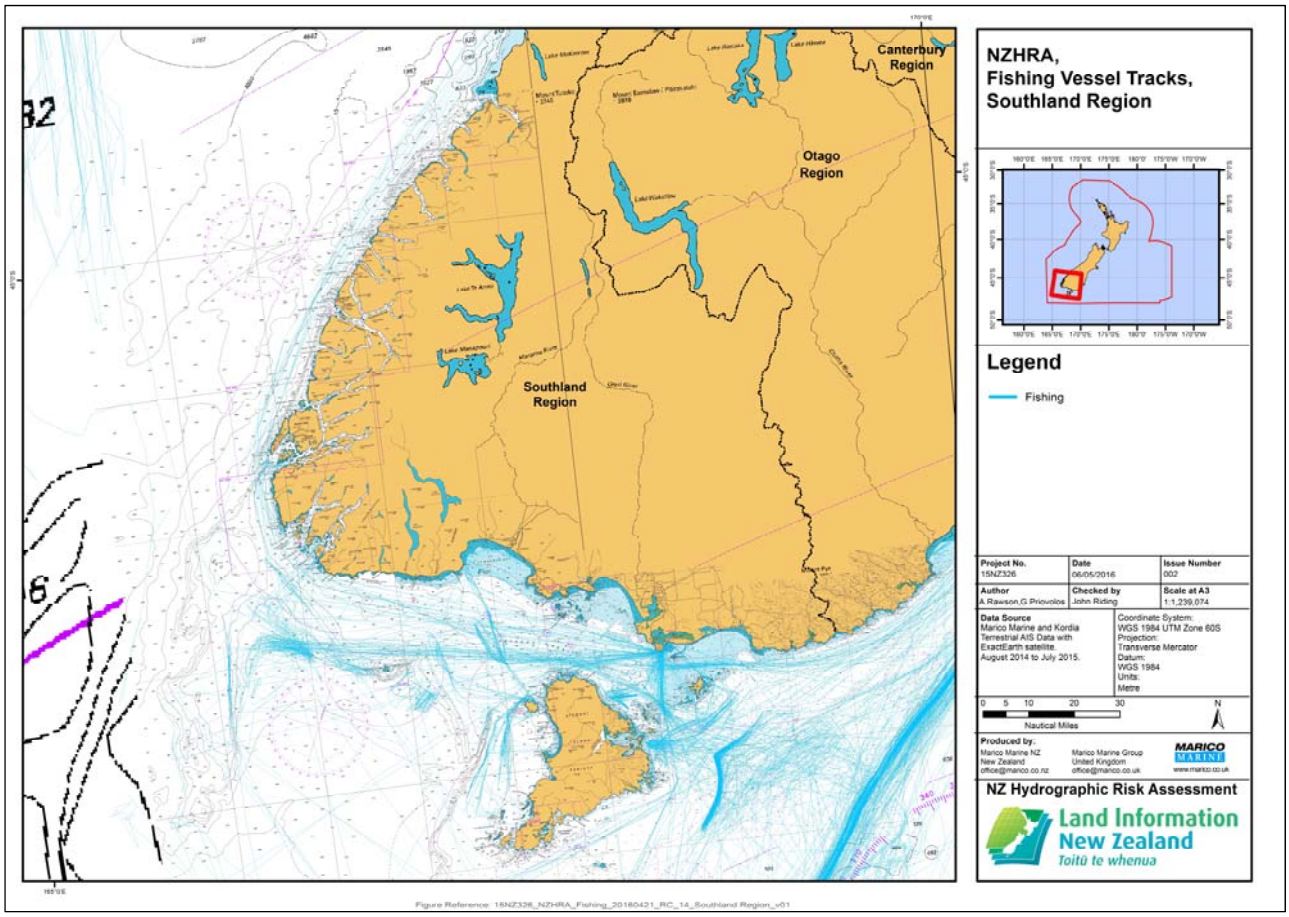


Figure 87 : Fishing Vessels - Southland Region

8.2.6 RECREATIONAL FISHING VESSELS – SOUTHLAND REGION

Recreational fishing vessels are mostly small trailer boats in this region, mostly along the south coast. Fishing and diving is popular on fine days. The recreational estimate is that 70 – 100 vessels took under half a million Bluff oysters and the customary catch estimate was a quarter of a million oysters. The recreational and customary paua fisheries make up 10% of the total regional catch.

8.2.7 RECREATIONAL CRAFT – SOUTHLAND REGION

Up to 12 small trailer boats may launch on a nice day from the boat ramp at Bluff harbour but the harsh weather conditions here are not conducive to large numbers of recreational boats.

8.3 TRAFFIC ANALYSIS – SOUTHLAND REGION

The types of commercial vessels using Southland Region include

- Container
- General and Break-bulk
- Tankers – petrol, fuel oil tankers, tallow, bitumen, chemical products
- Passenger cruise
- Passenger and vehicular ferries
- Fishing

During the 2014-15 year there were 301 ship calls to Bluff Harbour's South Port, not including small vessels such as fishing boats.

The recreational route from Bluff to Stewart Island is clearly identifiable on the Bluff traffic plot.

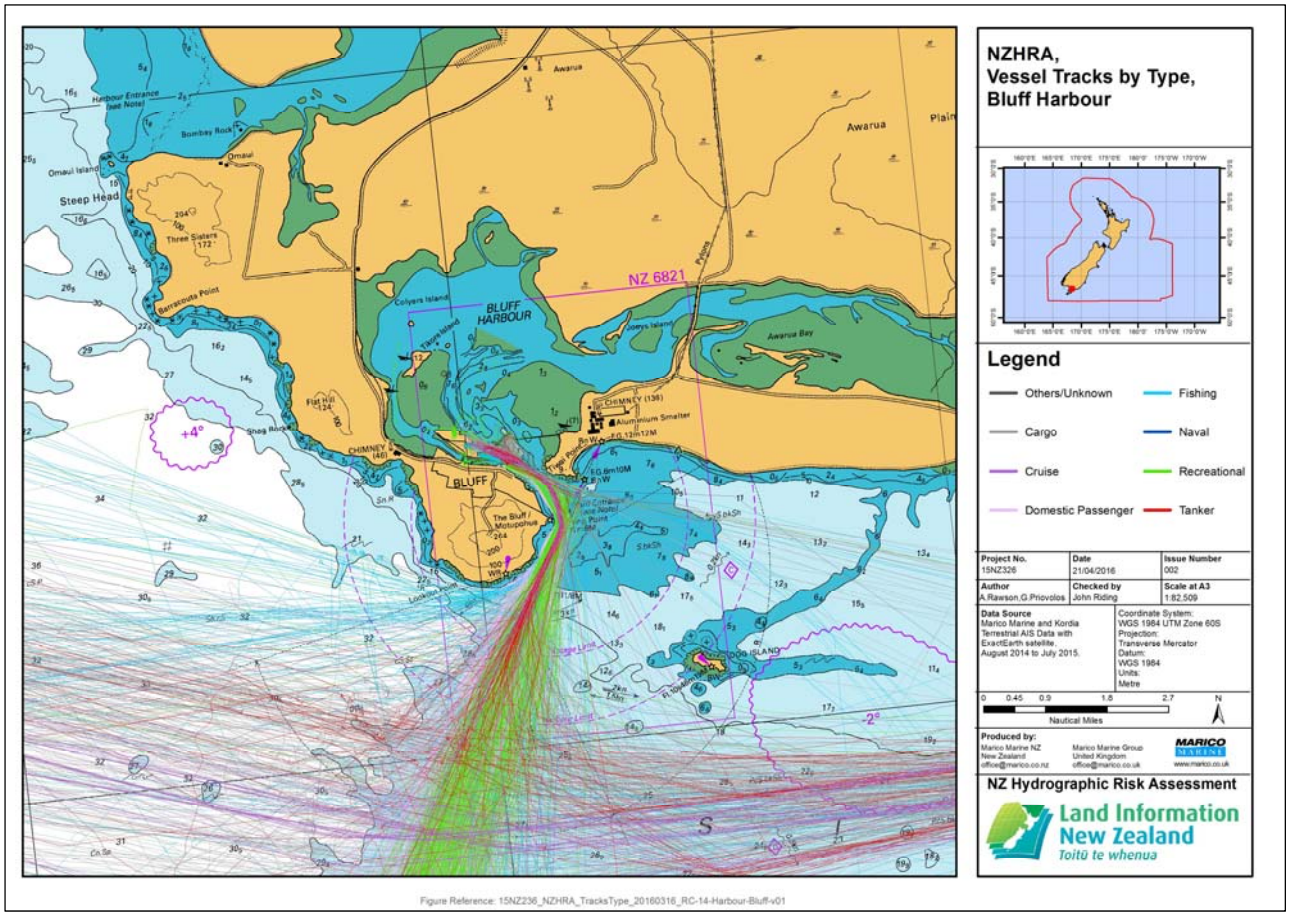


Figure 88 : Traffic Plot by Vessel Type – Bluff Harbour & Approaches

8.4 TRAFFIC ANALYSIS – STEWART ISLAND

Stewart Island experiences significant amounts of domestic passenger traffic courtesy of the ferry. Domestic excursion boats frequent Paterson Inlet, as can be seen from the traffic plot below.

Paterson Inlet, with its marine farms and two marine reserves, is a popular cruise ship anchorage.

Approximately 20 cargo vessels, mostly bulk carriers, anchored in the shelter of Stewart Island's north-east coast at Murray Beach and Saddle Beach, mostly waiting for a berth or cargo in Bluff.

Cruise vessels preferred to anchor on the east coast of Stewart Island, with six anchoring in Half Moon Bay (Oban) and 15 cruise ships recorded anchoring in Paterson Inlet. Three cruise vessels anchored north of Chew Tobacco Point.

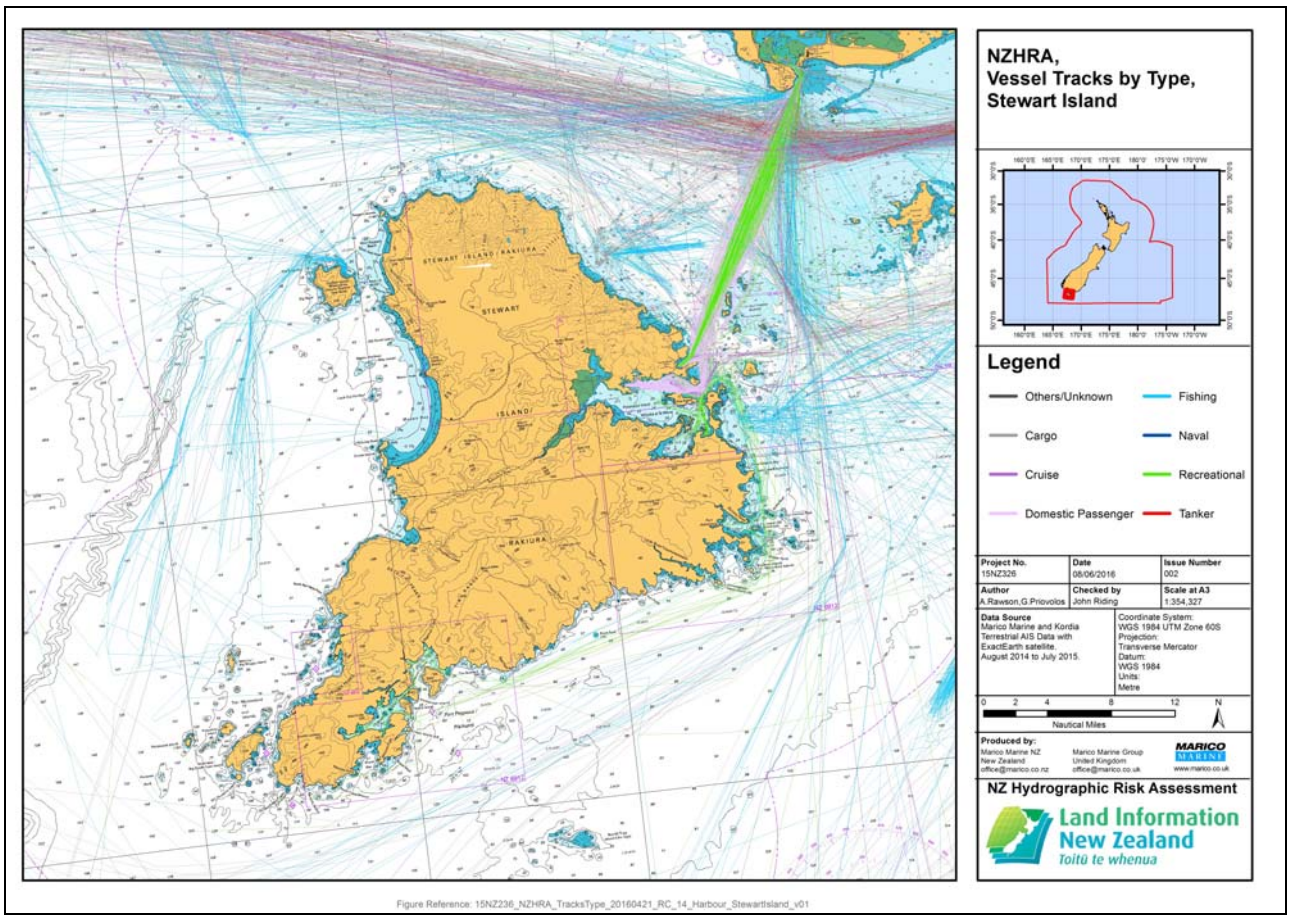


Figure 89 : Traffic Plot Stewart Island – All Vessel Types

8.5 TRAFFIC ANALYSIS - FIORDLAND

8.5.1 CRUISE VESSELS - FIORDLAND

Cruise vessels require special analysis for the Fiordland aspect of the risk assessment. All aspects of the tourist trade is growing in Fiordland, Milford Sound especially. The opening up of Fiordland to cruise vessels has resulted in a steady increase. About 80% of cruise vessels visiting New Zealand complete their transit by a cruise through the Fiordland waterways. They have a predominant influence on the hydrographic risk in this part of New Zealand.

Seventy-four cruise vessels visited Fiordland during the season. Southland's Regional Council (Environment Southland) has negotiated a 'Deed of Agreement' with cruise lines, facilitating access for cruising through the fiords and providing income to manage navigational safety. This has defined extents of transit and limits access. Most fiords had visits from at least one cruise vessel during the season. Twelve cruise ships cancelled due to weather.

Sixteen cruise vessels visited Stewart Island, with three anchoring off Paterson Inlet. Several cruise vessels visited the sub-Antarctic Snares Islands, 100kms south-west of Stewart Island.

Three boutique passenger vessels visited Bluff, on more than one occasion. South Port provides some pilotage for the passenger vessels visiting Fiordland.

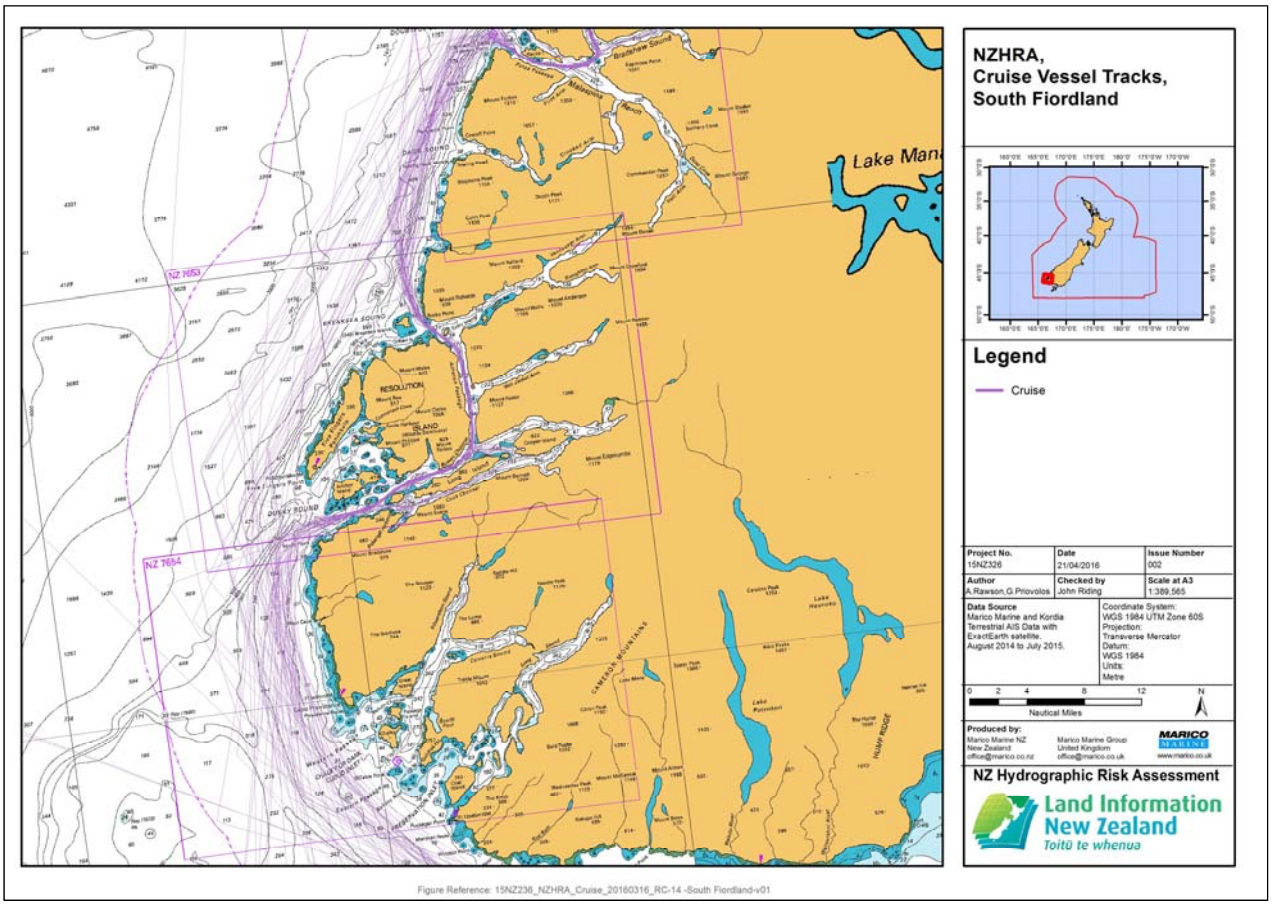


Figure 90 : Cruise Vessel tracks – Southern Fiordland

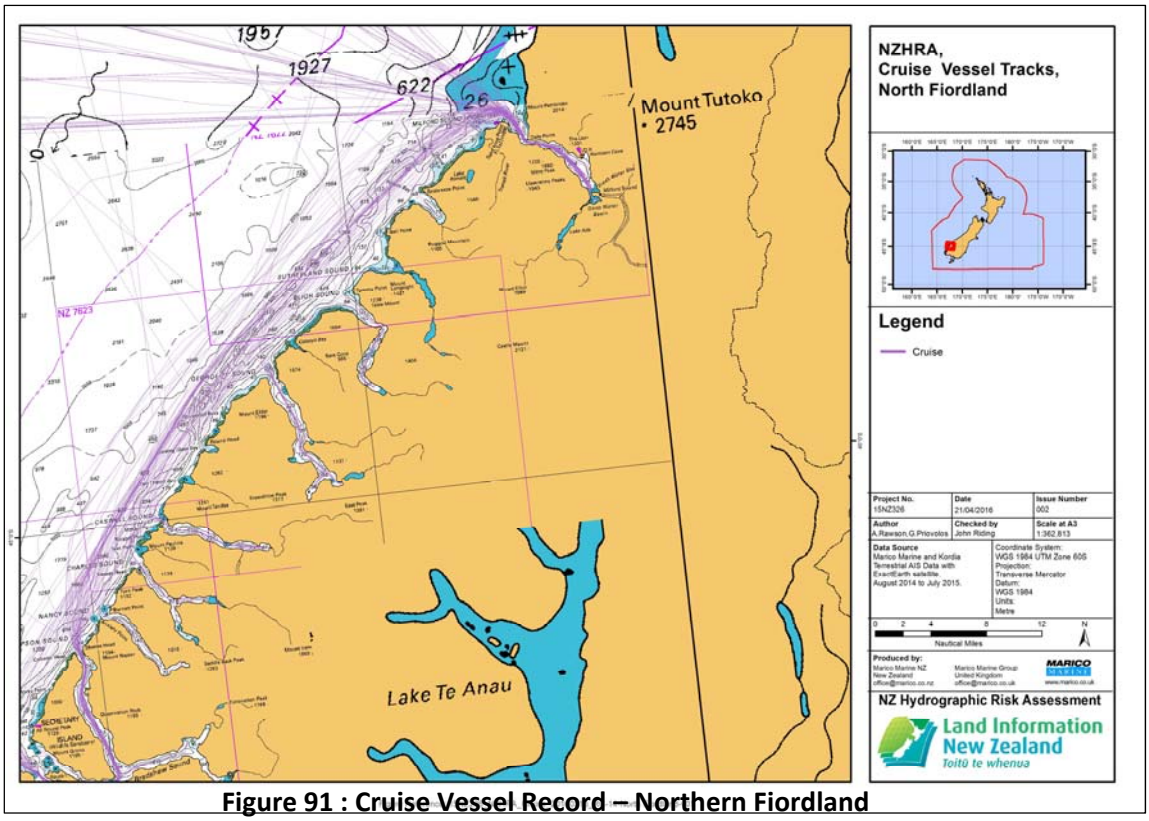


Figure 91 : Cruise Vessel Record – Northern Fiordland

8.5.2 CRUISE VESSELS - MILFORD SOUND HARBOUR

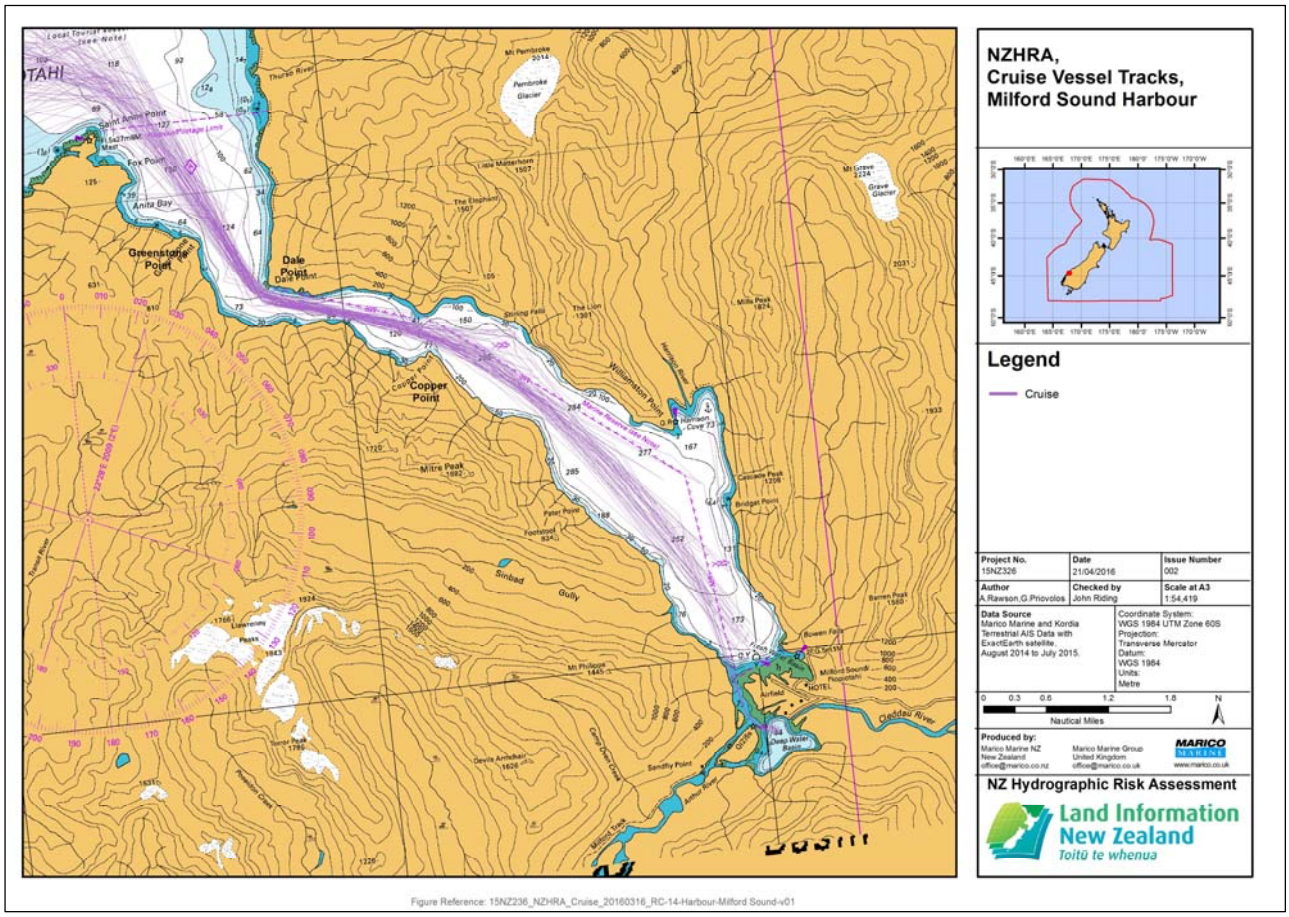


Figure 92 : Cruise Vessel Record – Milford Sound Harbour

8.6 HYDROGRAPHIC RISK – BLUFF HARBOUR

The heightened hydrographic risk in Bluff Harbour and its Approaches is a combination of the vessel traffic and strong tidal flows, and the date of last survey for much of this area being 1984.

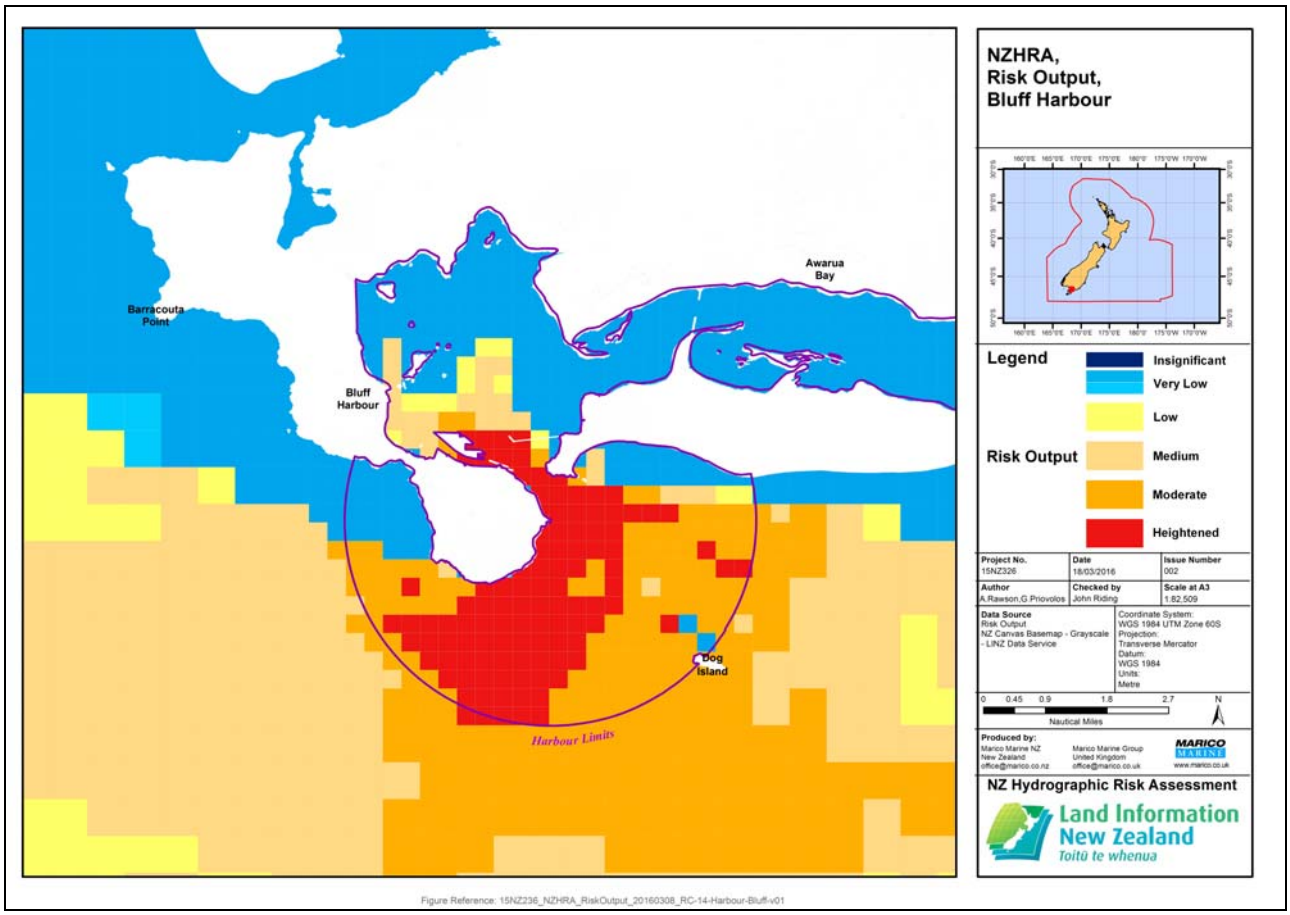


Figure 93 : Hydrographic Risk – Bluff Harbour

8.7 HYDROGRAPHIC RISK – STEWART ISLAND

In the 2014-2015 data period, approximately 20 cargo vessels, mostly bulk carriers, anchored in the shelter of Stewart Island's north-east coast, outside the Pilotage Limit for Stewart Island and in a designated ship anchorage at Murray Beach. The charted survey data dates to 1981 with no sea floor type data. A moderate hydrographic risk is thus present in this location.

These waters are all charted at 1:100,000 or Coastal scale, which is not recommended for vessel anchoring.

15 cruise ships anchored north of Ulva Island in Paterson Inlet, inside the pilotage limits. They were using the designated anchorages on the chart. To get there, they all passed through a Marine Reserve, resulting in heightened risk in Paterson Inlet.

The three cruise vessels that anchored north of Chew Tobacco Point were anchored in waters last surveyed in 1951, inside Pilotage waters, charted at 1:40,000, giving a heightened risk here.

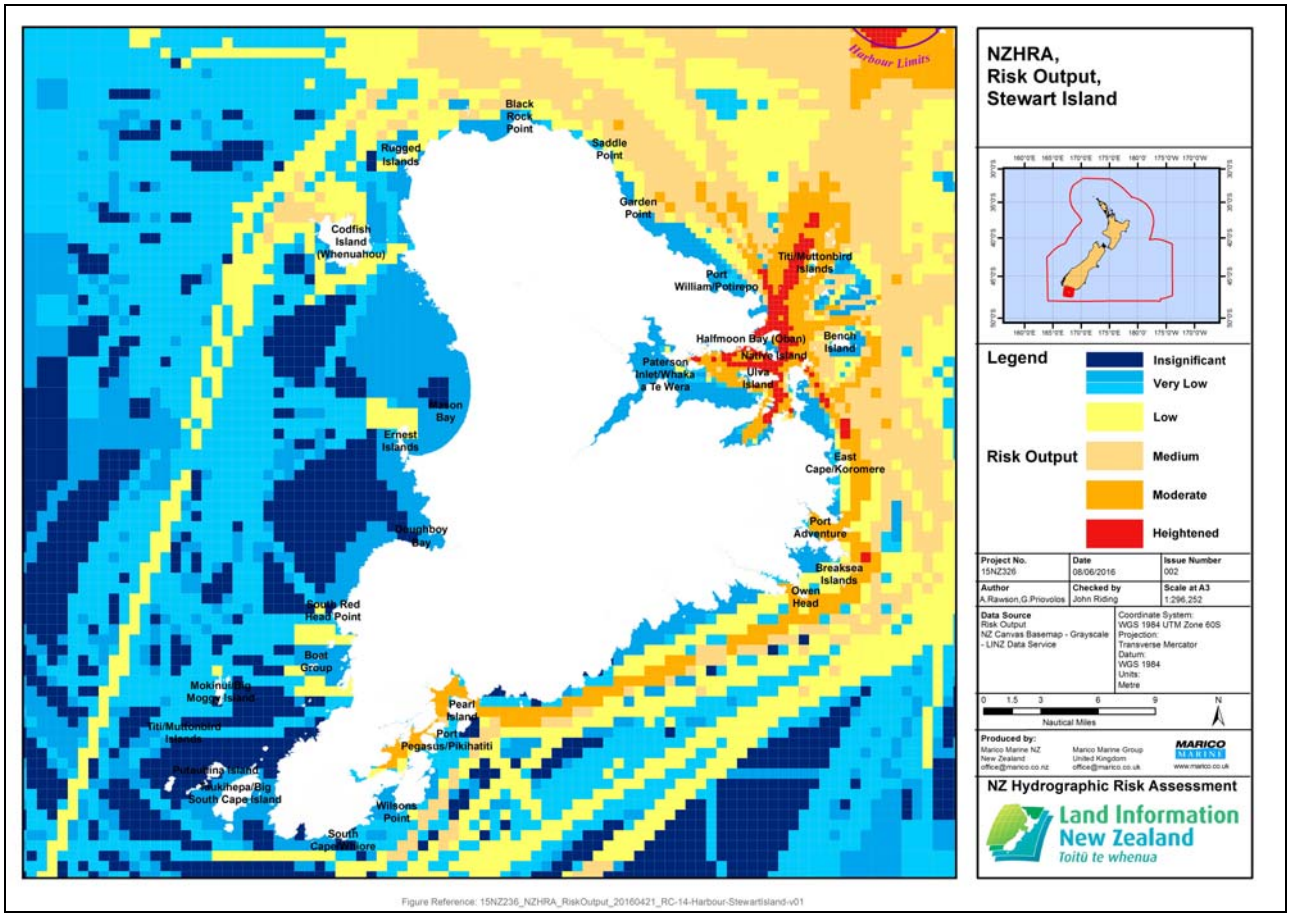


Figure 94 : Hydrographic Risk – Stewart Island

8.8 HYDROGRAPHIC RISK – FIORDLAND REGION

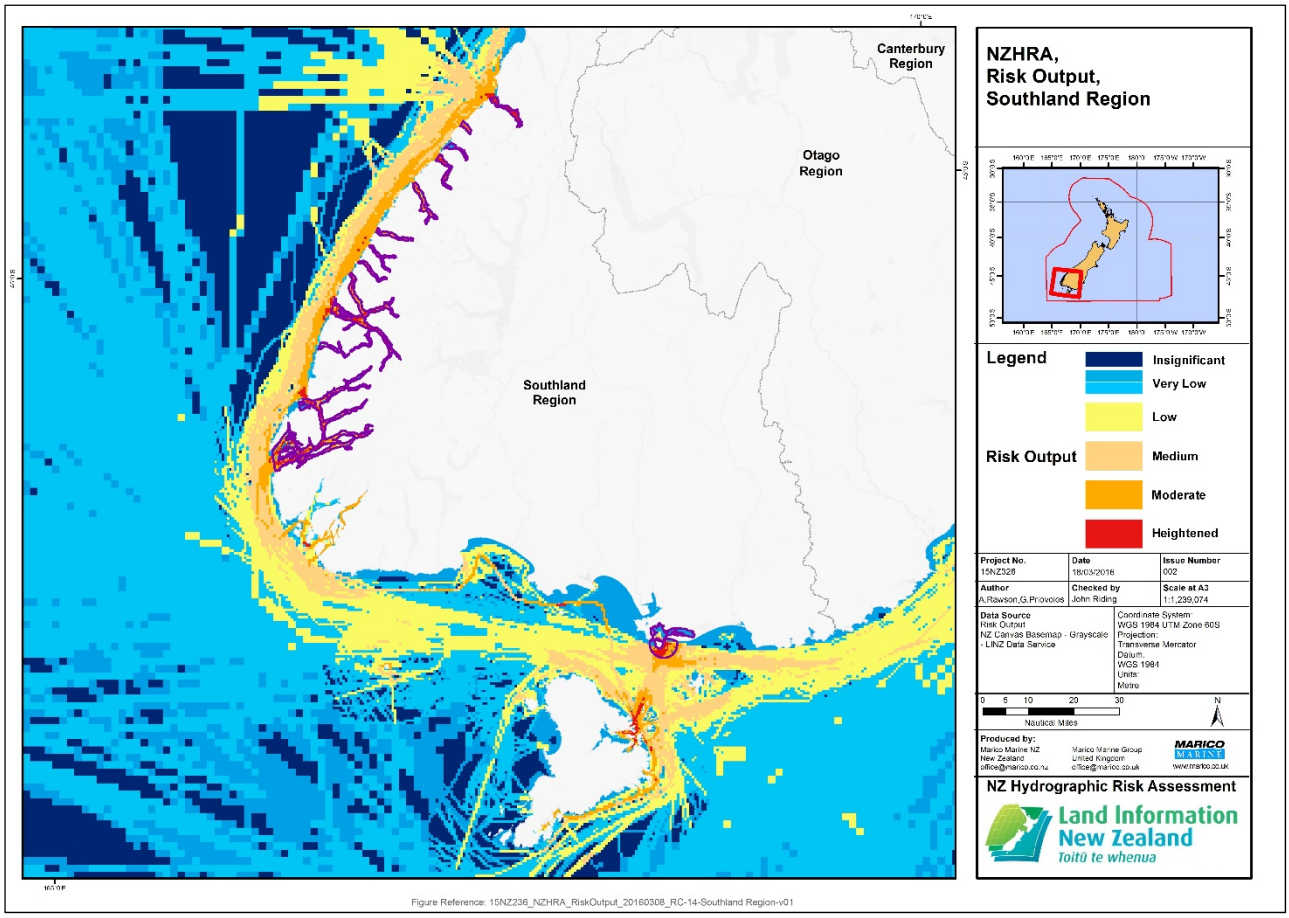


Figure 95 : Hydrographic Risk Result - Southland Region

Fiordland provides an interesting if not challenging hydrographic risk result. The coastal area provides a medium to moderate risk result, although a number of Sounds provide a heightened risk result. The plots below show these areas are related both to the areas where cruise vessels ply, as well as those used by domestic passenger services. Stewart Island provides the same heightened result, which is in part related to the passenger services to the island.

Milford Sound also provides a heightened hydrographic risk result, which is related to the very high volume of passengers using the domestic passenger vessels within Milford Sound, as well as it being a call for every cruise vessel transiting Fiordland.

8.8.1 HYDROGRAPHIC RISK RESULT - SOUTHERN FIORDLAND

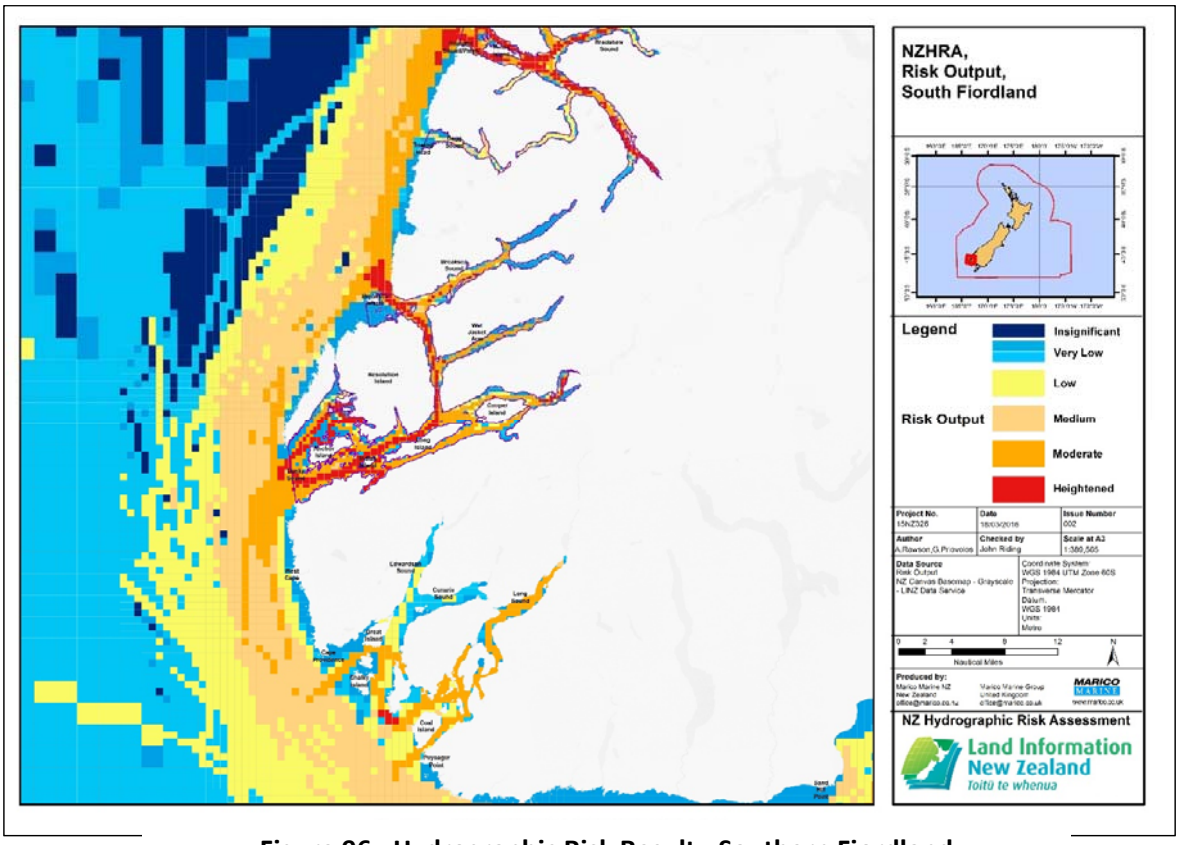


Figure 96 : Hydrographic Risk Result - Southern Fiordland

8.8.2 HYDROGRAPHIC RISK RESULT - NORTHERN FIORDLAND

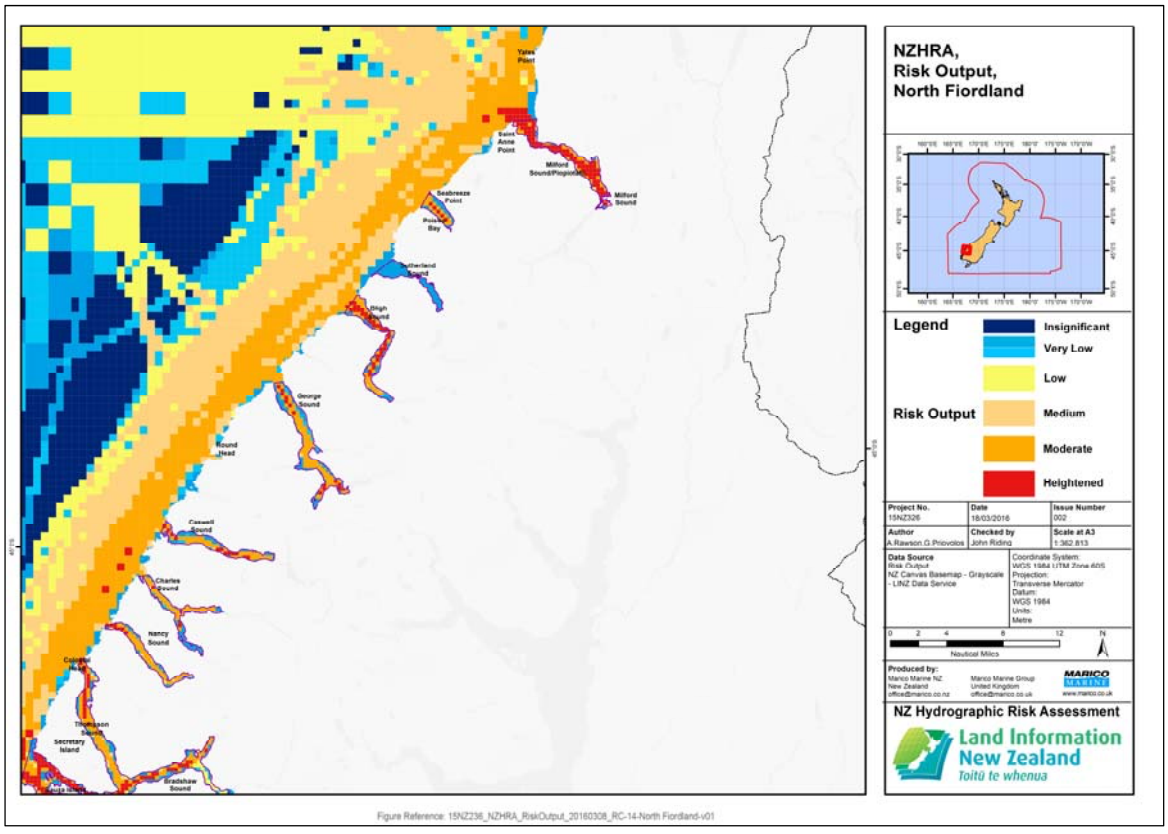


Figure 97 : Hydrographic Risk Result - Northern Fiordland

8.9 CHARTING BENEFIT – SOUTHLAND REGION

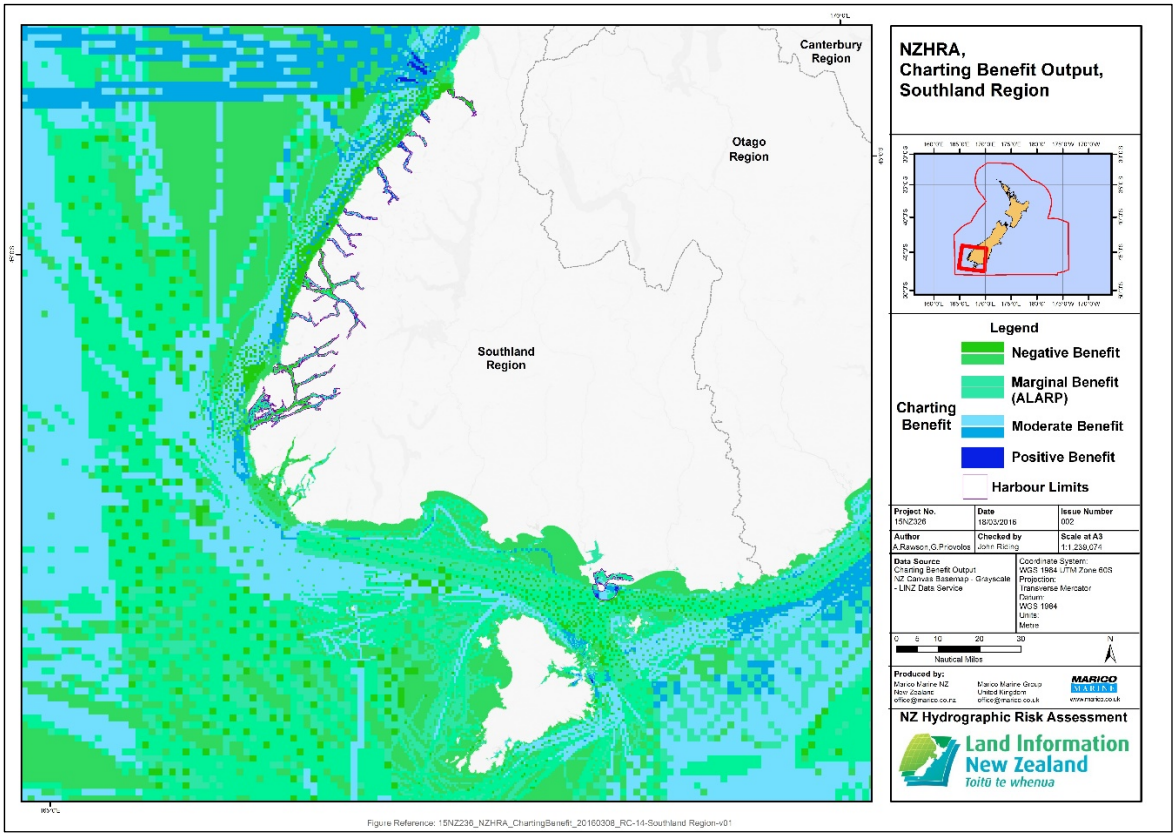


Figure 98 : Charting Benefit Result – Southland Region

The charting benefit results for Southland show charting to be in good condition overall, despite some of the heightened risk results.

It appears that some of the Northern Fiords are in need of charting review. The Sounds are gazetted as having individual Harbour/Pilotage Limits and if the IHO recommendations are applied, there would be more harbour scale charts created if a charting reorganisation was considered. Milford Sound is the busiest and there appears benefit in a review of the waters in its domestic vessel harbour enclosure.

8.9.1 CHARTING BENEFIT RESULT – BLUFF APPROACHES

The Bluff harbour entrance itself shows little charting benefit, however the result for Bluff Approaches shows that the charting scales for the outer harbour area may benefit from review. This positive charting benefit is due to inappropriate charting scale for the harbour approach area against the IHO recommendations: an approach scale chart could be considered for this area, as it is currently charted at 1:100,000 scale, more appropriate for general navigation. Contributing to the result is the age of some of the source data, from 1984.

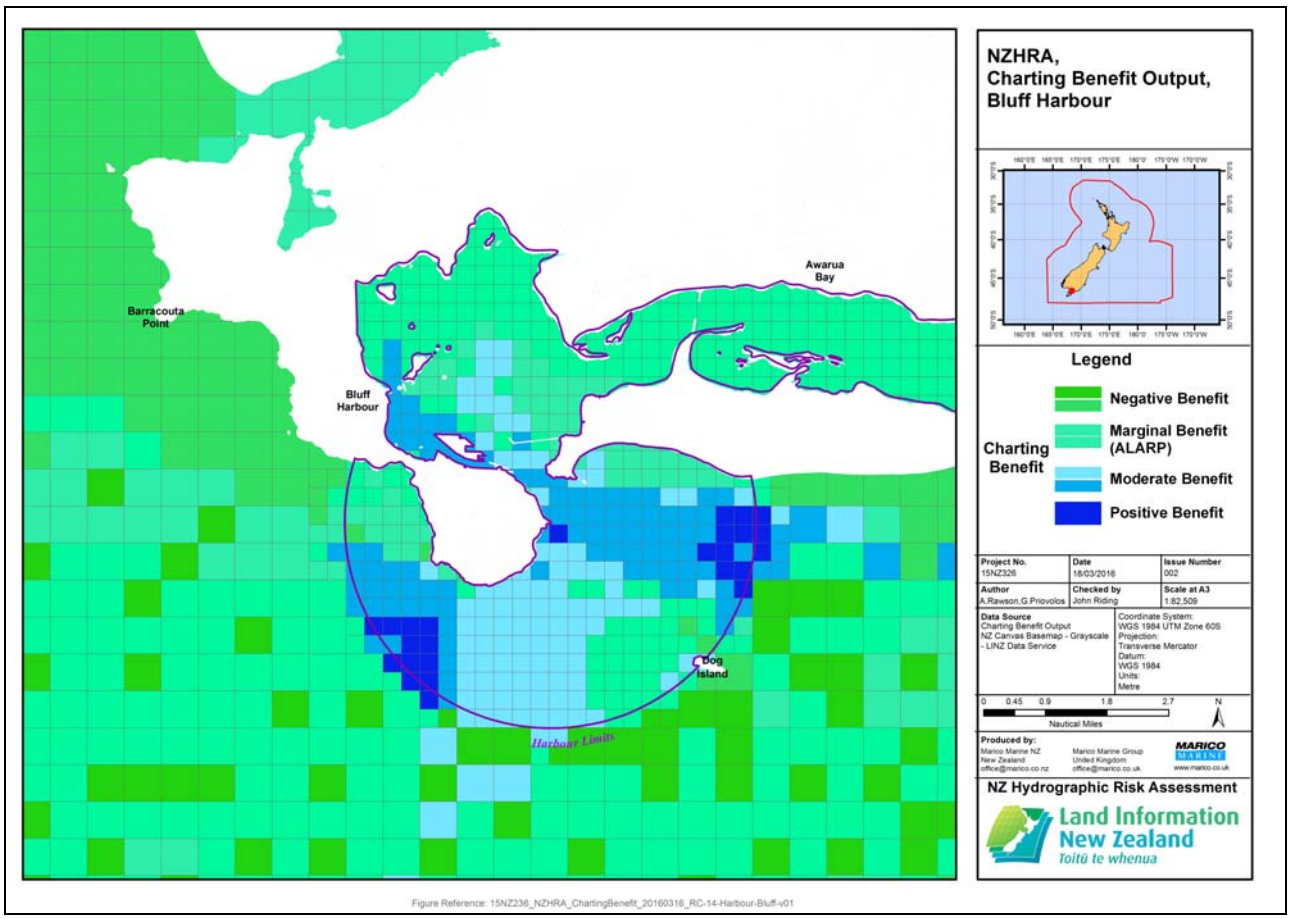


Figure 99 : Charting Benefit – Bluff Approaches

8.9.2 CHARTING BENEFIT RESULT – STEWART ISLAND

Half Moon Bay and Paterson Inlet show heightened risk but no charting benefit, reflecting up to date charting. The areas of positive charting benefit result for Stewart Island overall arises predominantly from charting age, which dates from 1981 around the designated anchorages off Murray Beach, to 1951 for areas north of Chew Tobacco Point. Chew Tobacco Point has occasional cruise vessels visits, which anchor, but it is mostly used by fishing vessels. The ZOC C charting standard contributes to benefit result.

Cruise ships anchoring north of Ulva Island in Paterson Inlet and inside pilotage limits passed through a Marine Reserve, resulting in heightened risk in parts of this Inlet. This underlies the benefit result.

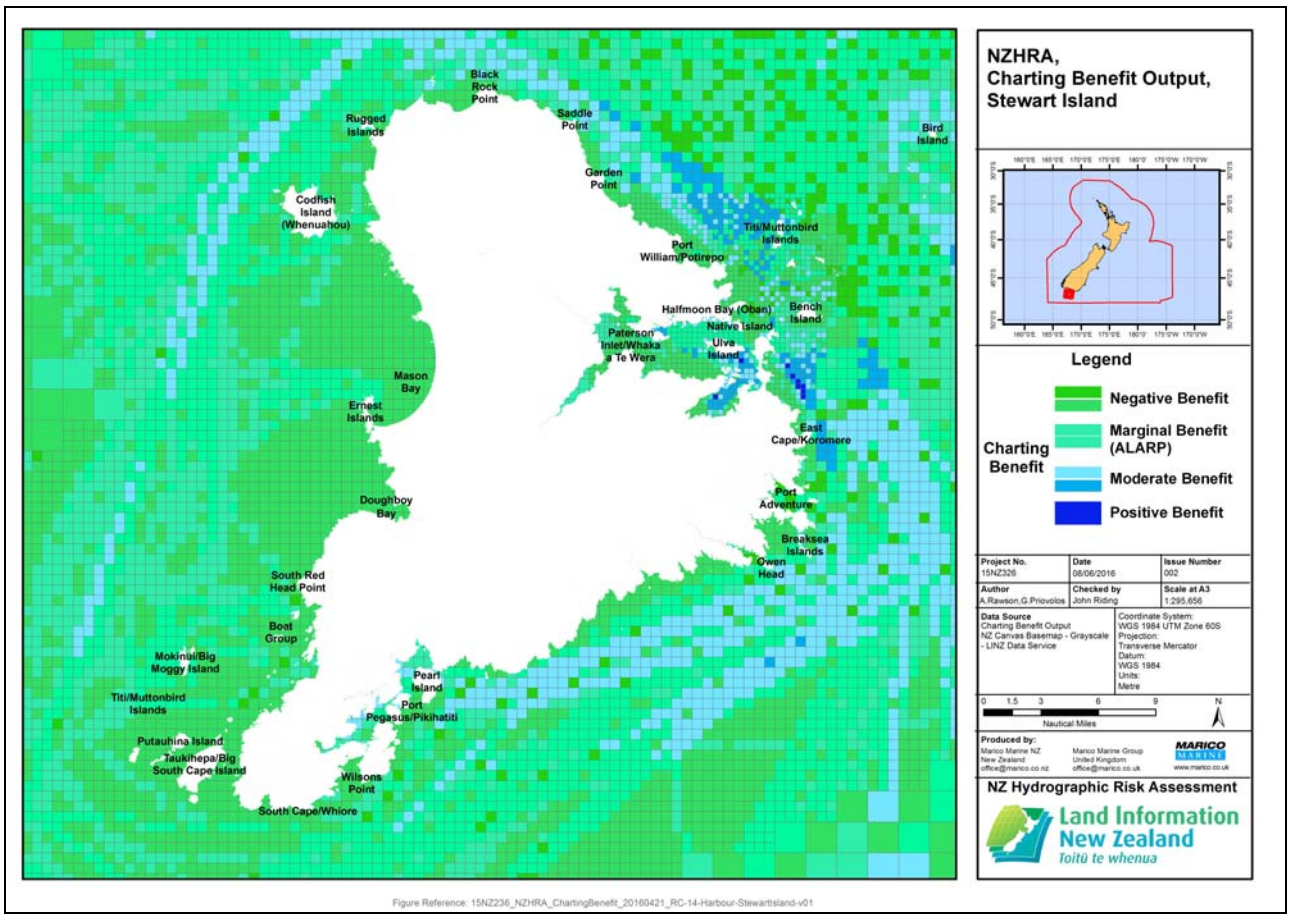


Figure 100 : Charting Benefit – Stewart Island

In the 2014-2015 data period, approximately 20 cargo vessels anchored in the shelter of Stewart Island's north-east coast. These were outside the Pilotage Limit for Stewart Island and in a designated ship anchorage at Murray Beach. Charted survey was in 1981 with no sea floor type data. A moderate hydrographic risk is present in this location. These waters are all charted at 1:100,000 or Coastal scale, which is not recommended for vessel anchoring.

8.9.3 CHARTING BENEFIT RESULT – SOUTHERN FIORDLAND

8.9.3.1 DUSKY SOUND

Most of the Sounds are gazetted as having Harbour/Pilotage Limits and according to IHO recommendations would be charted at harbour charting scales of 1:8,001 – 25,000.

Small areas of positive charting benefit show in Dusky Sound. The positive charting benefit for the Dusky Sound inlet east of Five Fingers Peninsula is due to the 1994-95 survey data combined with the Marine Reserve in this area which has heightened the risk here. Although there is only one passenger cruise vessel track recorded here, there is significant domestic passenger traffic going deep into Facile Harbour and Earshell Cove, as well as through the narrow passage between Anchor and Petrel Islands.

Routes through the centre of Dusky Sound were surveyed in 2008. However, cruise ship tracks show traffic was not restricted to these routes. Traffic regularly transited areas last surveyed in 1994-1995. At least five cruise ship transits occurred though the narrow (200 metres wide) Paget Passage (2014-2015).

The passages north, south and east of Cooper Island that show a charting benefit, have significant domestic passenger traffic exploring the upper reaches of this Sound, right into Supper Cove. These vessel tracks run off the 1:25,000 scale Dusky Sound chart NZ 7656 and onto the 1:60,000 scale chart NZ 7653, which indicates a review of the charting extent here would be beneficial.

The positive benefit shown for Doubtful Sound is from the significant amount of domestic traffic, combined with the age of the source data (the approaches were last surveyed in 1998). The significant route through Te Awaatu Channel was surveyed in 1985 (a 91m cruise vessel transited three times through the Marine Reserve's narrow channel). Te Awaatu Channel (The Gut) on the south side of Secretary Island) is less than 100m wide with no minimum depth charted, but less than 20m water depth is charted. The charting benefit result for Doubtful Sound's southeast arm near Deep Cove is due to the charting extents, with the inner reaches of Doubtful Sound being charted at 1:60,000 scale, combined with the presence of a Marine Reserve.

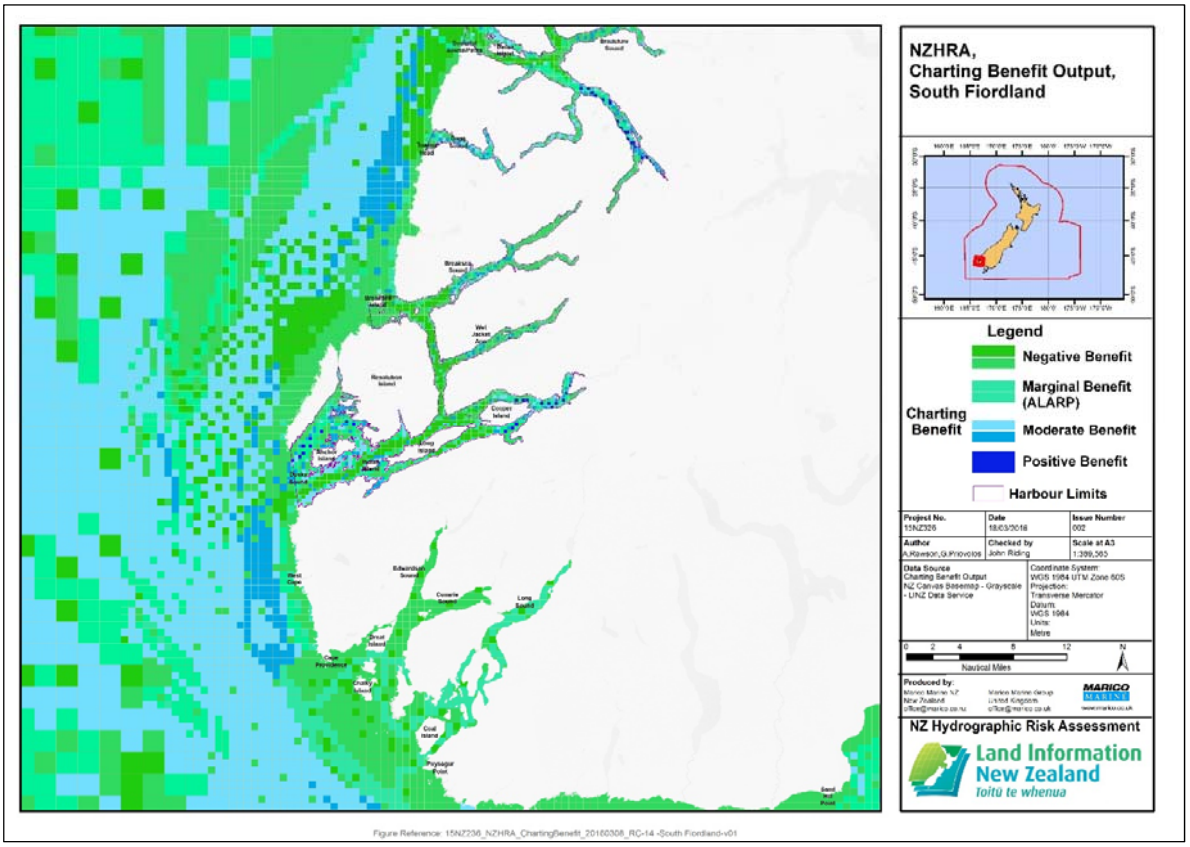


Figure 101 : Charting Benefit Result – Southern Fiordland

8.9.3.2 DOUBTFUL SOUND

A number of larger cruise vessels visited Doubtful Sound, with a few anchoring in Bradshaw Sound. However, most vessels circumnavigated Secretary Island through Thompson Sound. A 91m cruise vessel transiting three times through the Marine Reserve's. This is narrow, less than 100 metres wide, with no minimum charted depth. There is less than 20m water depth in Te Awaatu Channel (The Gut), on the south side of Secretary Island.

The positive benefit shown for Doubtful Sound is from the significant amount of domestic traffic here, combined with the age of the source data, (the approaches were last surveyed in 1998) with the afore-mentioned Te Awaatu Channel last being surveyed in 1985.

However the charting benefit shown for the southeast arm near Deep Cove is due to the charting extents, with the inner reaches of Doubtful Sound being charted at 1:60,000 scale, combined with the Marine Reserve in this area.

8.9.4 CHARTING BENEFIT RESULT – NORTHERN FIORDLAND

The northern Sounds reflect similar charting benefits to the southern Sounds: extents/scale or age of charting combined with significant passenger traffic and marine reserves results in charting

benefits in Caswell, Charles, Nancy, George, Bligh Sounds, Poison Bay and Milford Sound. These areas are referenced individually below.

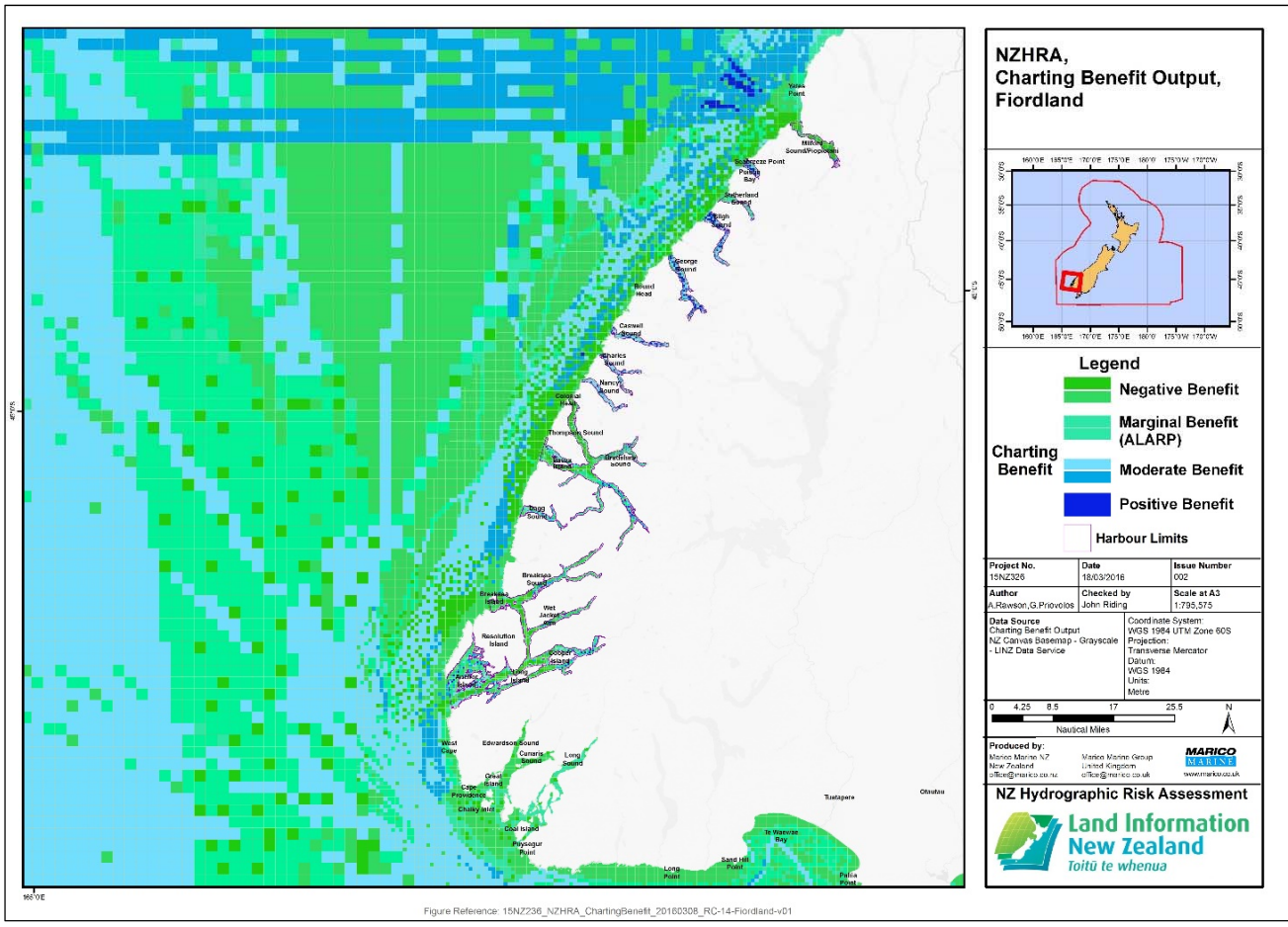


Figure 102 : Charting Benefit Result – Northern Fiordland

8.9.4.1 CASWELL, CHARLES AND NANCY SOUNDS

The positive benefit for Caswell, Charles and Nancy Sounds, is mainly due to the charting scale. The entire area in all three Sounds was last surveyed in 1997-1998 at 1:50,000 scale, a scale more suitable for approach charting than harbour charting. All three Sounds have designated Harbour/Pilotage Limits so each requires Harbour scale charting.

Charles Sound has a Marine Reserve at Friendship Head, which has increased charting benefit.

One boutique cruise ship made at least nine separate visits to Caswell Sound and five trips through Charles Sound during the season. It appears this was to anchor.

8.9.4.2 GEORGE SOUND

The positive benefit for George Sound, Fiordland, comes again from charting scale. The entire Sound was last surveyed in 1998 to 1:50,000 scale, more suitable for approach charting. George Sound has designated Harbour/Pilotage Limits so if a decision is taken to adopt the IHO recommendations for charting scales, a Harbour scale chart would be needed. At least one boutique cruise ship anchored multiple times in both of the arms of George Sound in the 2014-2015 cruise season.

8.9.4.3 BLIGH SOUND

Bligh Sound has a Marine Reserve, combined with traffic, providing increased risk. The Sound was last surveyed in 1998, to 1:50,000 scale, more suitable for approach charting. This Sound has designated Harbour/Pilotage Limits, so a harbour scale chart would be recommended. At least one boutique cruise ship anchored at the head of this Sound, on more than one occasion.

8.9.4.4 POISON BAY

The positive benefit at Poison Bay, Fiordland, is due to charting scale differences to IHO recommendations. The entire area was last surveyed in 1998 to 1:50,000 scale, more suitable for approach charting. Poison Bay has designated Harbour/Pilotage Limits so under the recommendations would be a Harbour scale chart. Cruise vessel traffic into Poison Bay is less than in other nearby Sounds, with only two cruise ship calls, 2014-1015.

8.9.5 CHARTING BENEFIT RESULT – MILFORD SOUND

Milford Sound shows an area of positive benefit mainly due to the high passenger traffic in Fresh Water Basin, see **Figure 104**. The shallow/drying areas in the south of Fresh Water Basin were surveyed in 1996 but the navigable waters were surveyed last in 2008 to ZOC A standard. Significant domestic passenger traffic is recorded as far upstream as Sandfly Point on the Arthur River, where the shallow waters upstream of the jetty and island were surveyed in 1996 and which shows a positive charting benefit here. The chart insert showing Fresh Water Basin and Sandfly Point is at 1:10,000 scale.

The area between Fresh Water Basin and Sandfly Point shows moderate charting benefit.

A large portion of Milford Sound is a 16km long Marine Reserve, a popular place to view rare black corals, resulting in a heightened risk, with frequent large cruise vessels visiting and the very high domestic passenger traffic volume.

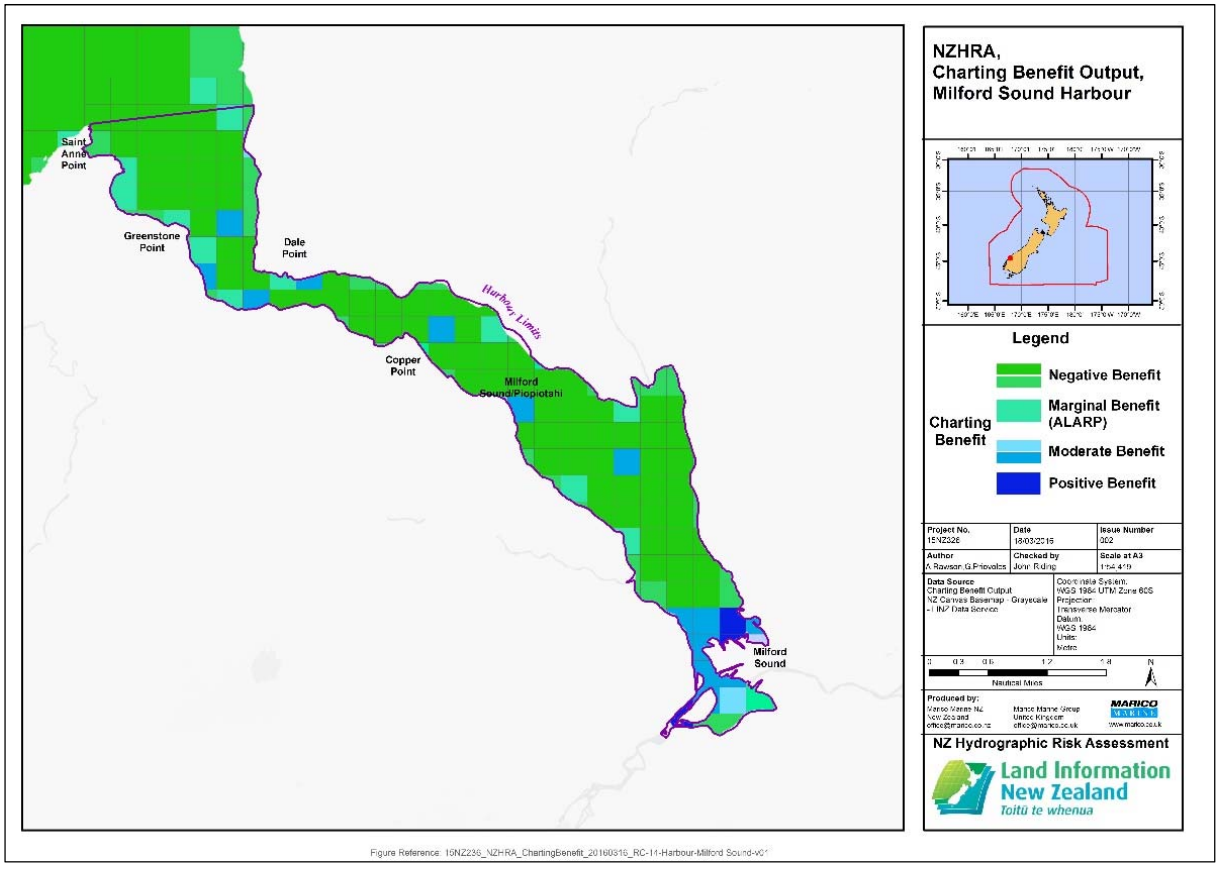


Figure 103 : Charting Benefit – Milford Sound

8.9.6 CHARTING BENEFIT RESULT – MILFORD SOUND APPROACHES

The outer approaches to Milford Sound also show areas of positive charting benefit. The inner approaches to Milford Sound were largely surveyed in 1994 – 1998 and show only moderate risk, however outside 2-3nm offshore in the outer approaches was last surveyed in 1981. These offshore cells of risk show a positive charting benefit and reflect the international cruise vessel routes to and from Australian cruise destinations. This area has a ZOC C low accuracy standard. Additionally, long stretches of coastline to the north of Milford Sound remain unsurveyed, although no charting benefit has resulted here as there is no recorded traffic.

Milford Sound outer approaches are an extremely busy area for cruise ship activity, and vessel traffic through this area is predicted to continue increasing.

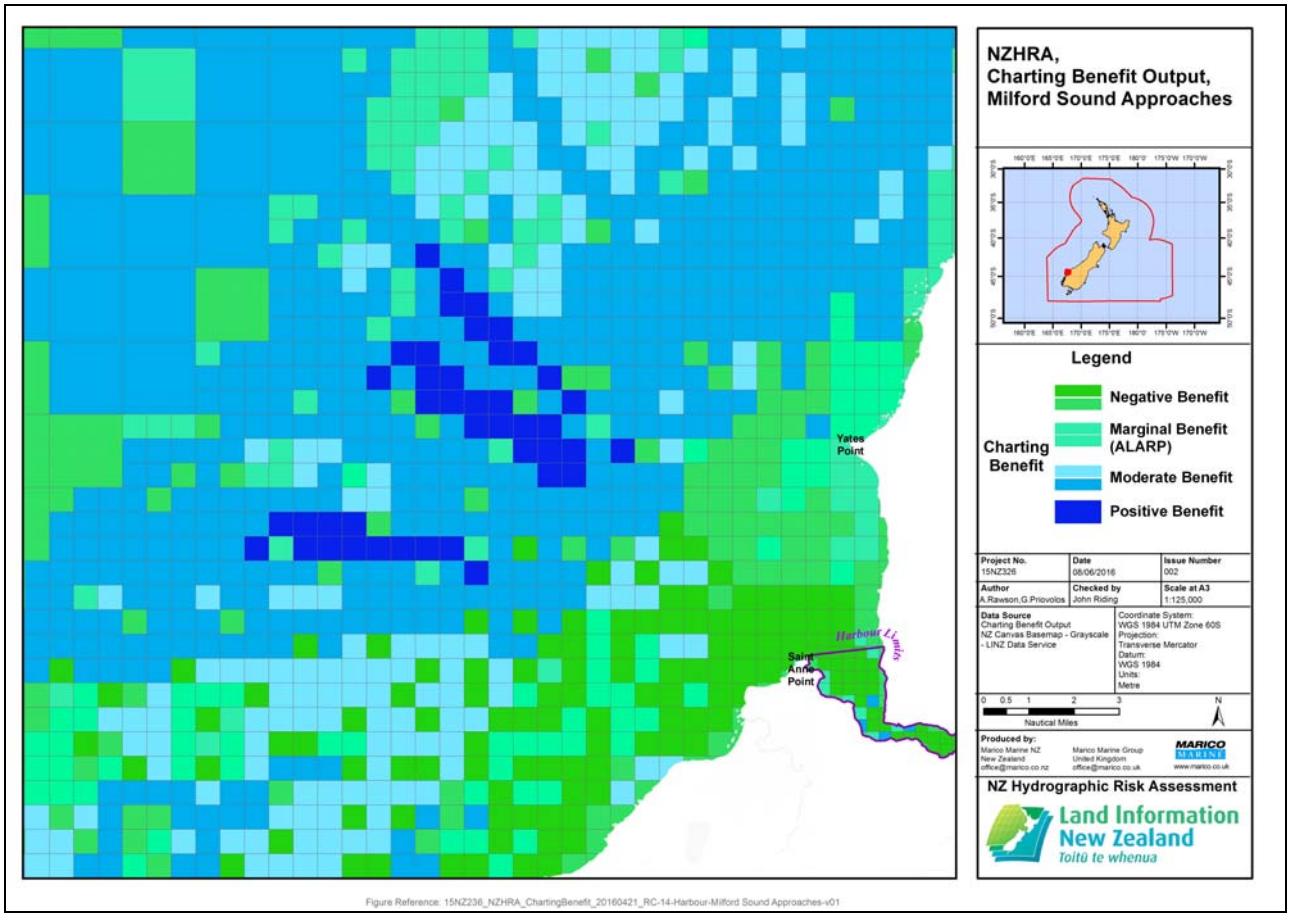


Figure 104 : Charting Benefit – Milford Sound Approaches

9 HYDROGRAPHIC RISK RESULTS - WEST COAST REGION

9.1 INTRODUCTION - WEST COAST REGION

The West Coast Region includes Buller, Grey and Westland Districts. The region is sparsely populated, especially in the south. It has a very high rainfall due to the prevailing northwesterly wind pattern and the location of the Southern Alps, which give rise to heavy orographic rain. The few harbours on this exposed coast have bar entrances.

9.1.1 WESTPORT HARBOUR LIMITED

Westport Harbour Limited is a fully owned subsidiary of Buller Holdings Limited and has managed the assets of the harbour since 1 September 2010. Buller Holdings Limited is a Buller District Council holding company. Westport Harbour, located at the mouth of the Buller River, provides services for fishing and leisure boats, supplying pilotage, towage, berthage and marine services. The Harbour has facilities for the handling of coal, cement, bulk cargo and general cargo with the potential to expand. The port operates its own dredger, which keeps the river access to the berths navigable.

Until recently, the port's main source of income was transporting Holcim's cement weekly on the bulk cement ships *Milburn Carrier II* and *Westport*.

The Bar at the port's entrance can extend up to half a nautical mile off. The 'run' in the river peaks 12-18 hours after heavy rain in the mountains and can reach 8-10kn when the river is in flood. With heavy swells or strong winds, the current set across the Bar entrance can reach 5kn, with the danger of any vessel crossing the bar being pushed into nearby breaking shallows. Swells of 4m are not uncommon. There is a tidal range that can reach 3.6m at spring tides.

The Bar is sounded by the port on a regular basis, at least once weekly. The port maintains a bar depth greater than 2.8m at chart datum by dredging and provides an average river depth in the main navigation channel of 3.8m at chart datum. Vessels of more than 3.0m draught require a pilot.

Fish are landed at Westport where after initial processing, they are transported by road to larger facilities.

9.1.2 GREYMOUTH

The Port of Greymouth is a river port entered across a bar between breakwaters. The Greymouth bar can be located anywhere from between the breakwaters to half a nautical mile off the breakwaters. Long periods of dry weather with southerly swells can push the bar inshore between the breakwaters. A 'run' or flood in the river can push the bar to up to half a mile off-shore. The bar is usually short and steep and occasionally two bars form. The run in the river peaks 6-12 hours after

heavy rain in the mountains and can exceed 10kn in flood. With heavy swells or strong winds, the set across the Bar entrance can reach 3-4kn.

A quick flashing blue light may be shown from the signal mast on the south breakwater to warn that the bar is considered dangerous to cross. The bar is sounded by the Grey District Council every six to eight weeks.

Vessel traffic at Greymouth may include tug and barge units; small coastal cargo vessels; medium size and small fishing vessels, as well as a number of recreational fishing boats. Up to 20 commercial fishing vessels are based in Greymouth, both inshore and offshore vessels.

The Westfleet and Talley's fisheries operations provide ice and discharge facilities to the fishing fleets based here.

9.1.3 JACKSON BAY

Jackson Bay is a natural ocean harbour 24km wide, located 35km south of Haast at the end of the West Coast roading network, offering vessels shelter from the prevailing winds.

A wharf at the fishing village of Jackson Bay is mainly used as a fish landing facility for commercial crayfish and wet-fish fishermen, as well as the many recreation fishermen who have discovered the excellent sea fishing available in the area. There are 10 commercial inshore fishing vessels based here.

Jackson Bay is considered a destination for Cruise vessels after leaving Fiordland. Cruise vessels do occasionally anchor in the bay, but only in limited numbers according to that AIS data 2014-2015.

The Bay is also one of only two known areas in South Westland regularly used as a nursery by the rare Hector dolphin.

9.1.4 CHARTING INFORMATION OBSERVATIONS - WEST COAST REGION

With the exception of the approaches to the west coast ports, much of the inshore coast from Karamea to Westport to Jackson Bay and beyond to Milford Sound remains unsurveyed. Notes on the relevant charts state that mariners should exercise caution particularly when approaching the coast in depths of less than 50m. Jackson Bay, where a cruise vessel anchored in 8m of water, was last surveyed in 1980-1981.

9.1.5 AREAS OF RISK SIGNIFICANCE - WEST COAST REGION

There are four Marine Reserves in the West Coast region: Punakaiki Marine Reserve; Waiau Glacier Coast Marine Reserve; Tauparikaka Marine Reserve; and Hautai Marine Reserve. In the coastal

region also are National Parks and a New Zealand World Heritage Area. Tourism has some destinations in this area, such as Cape Foulwind with its large fur seal colony.

9.1.6 ECONOMIC SUMMARY – WEST COAST REGION

Relevant industries on the West Coast include cement, coal, dairy, forestry, fishing and tourism. Total freight generated for the year was 5.5M tonnes. The sub-national GDP of the region was estimated at US$779M in 2003, 1% of national GDP.

Cruise passengers were estimated by Cruise NZ to have injected NZ$0.6M into the local economy.

9.2 TRAFFIC ANALYSIS – WEST COAST REGION

The significance of the fishing industry to the West Coast of New Zealand leaps out of the traffic record plot.

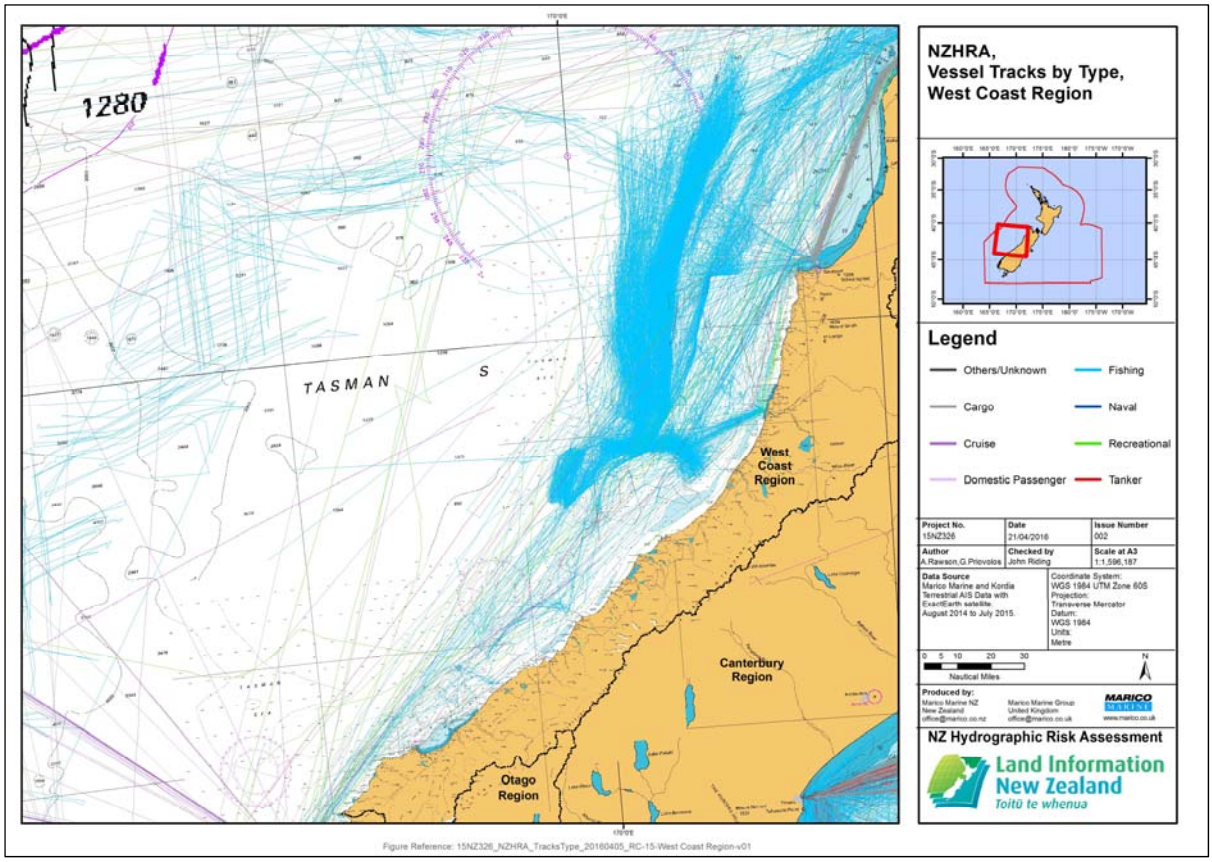


Figure 105 : Vessel Tracks by Type – West Coast Region

9.2.1 CARGO VESSELS - WEST COAST REGION

Cargo vessel traffic is light in this region, with the exception of Westport coastal traffic, reflecting the (then) cement trade and the coastal bulk carrier service.

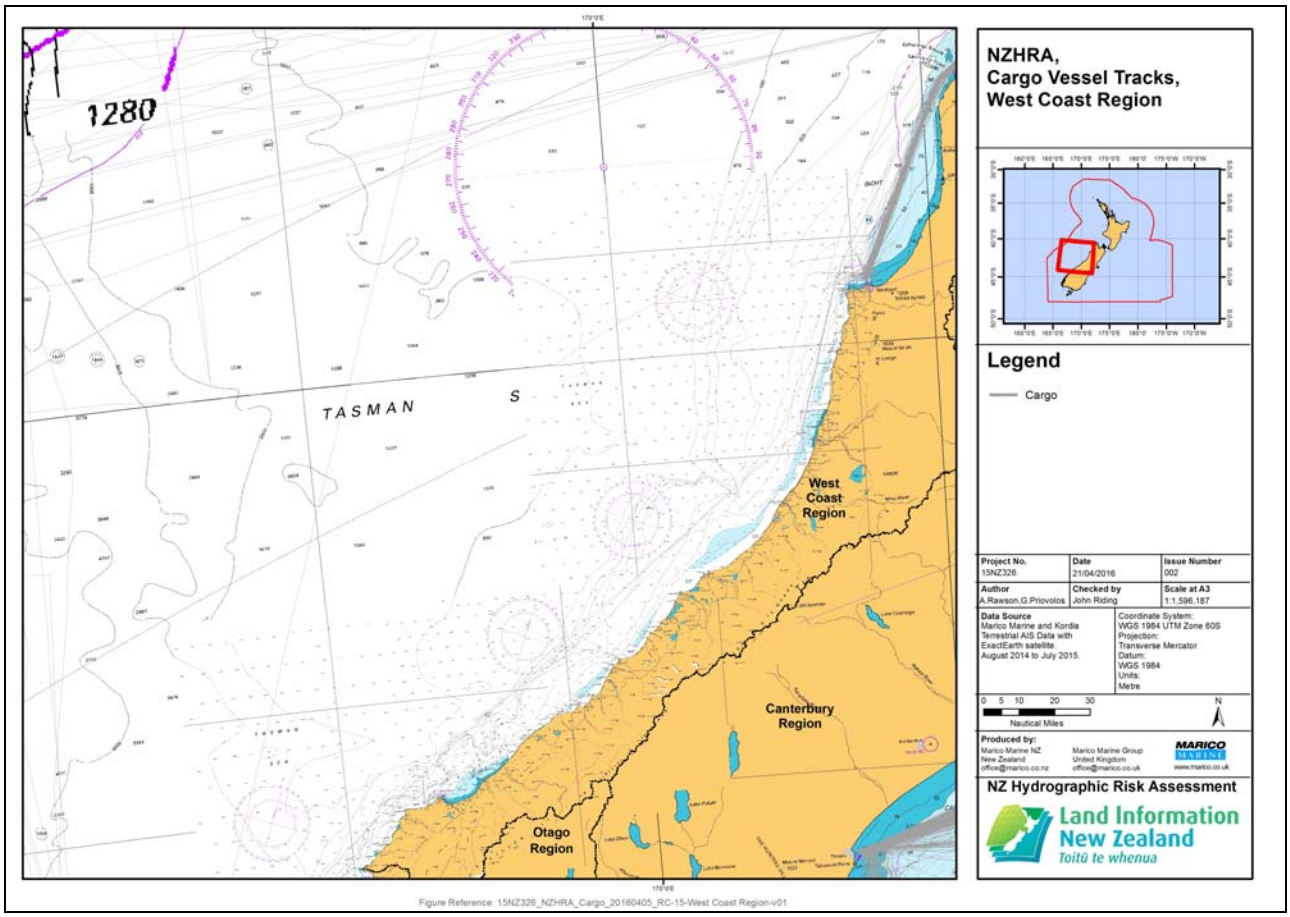


Figure 106 : West Coast Region – Cargo Vessel Tracks

9.2.2 CRUISE VESSELS - WEST COAST REGION

Jackson Bay is considered a destination for Cruise vessels after leaving Fiordland. In the data period, only a single boutique cruise vessel anchored in 8m water depth at Jackson Bay. With a 100-passenger capacity, this vessel was also the only cruise ship to visit the West Coast Region. There were some other cruise vessels transiting past the west coast, but these mostly stayed well offshore. There was one exception of a vessel which cruised within 5-10nm offshore for the entire length of the west coast, but without stopping.

9.2.3 COMMERCIAL FISHING VESSELS - WEST COAST REGION

Nine inshore fishing vessels are based in Westport, with a further 10 based at Jackson Bay. Most fishing vessel traffic stayed outside 12nm off the coast in deeper waters, where there was abundant fishing vessel traffic recorded. One 65m and one 17m fishing trawler called in to Jackson Bay, most

likely seeking shelter, as did a fisheries protection vessel. Otherwise, Westport and Greymouth were the only ports in the region visited by fishing vessels.

9.2.4 RECREATIONAL CRAFT - WEST COAST REGION

There are not great numbers of recreational craft that venture to sea in this region. A modest amount of recreational fishing and diving takes place, mostly out of Westport or Greymouth. Much of the recreational fishing activity takes place in the lakes and rivers, or surf casting off the beaches.

9.3 TRAFFIC ANALYSIS – WESTPORT REGION

The types of commercial vessels using Westport include

- Coastal bulk carrier
- Tankers (mainly bulk cement until this year)
- Fishing
- Tug and barge

9.3.1 CARGO VESSELS – WESTPORT

One visit to Westport was made by coastal freighter *Anatoki* during the data period (July 2014-2015), which also visited Greymouth. Weekly trips from Westport were made by the coastal cement carriers, who generally transited north from Westport, with the exception of one trip south-about around Southland by the *Milburn Carrier II*.

No other cargo vessels visited the region.

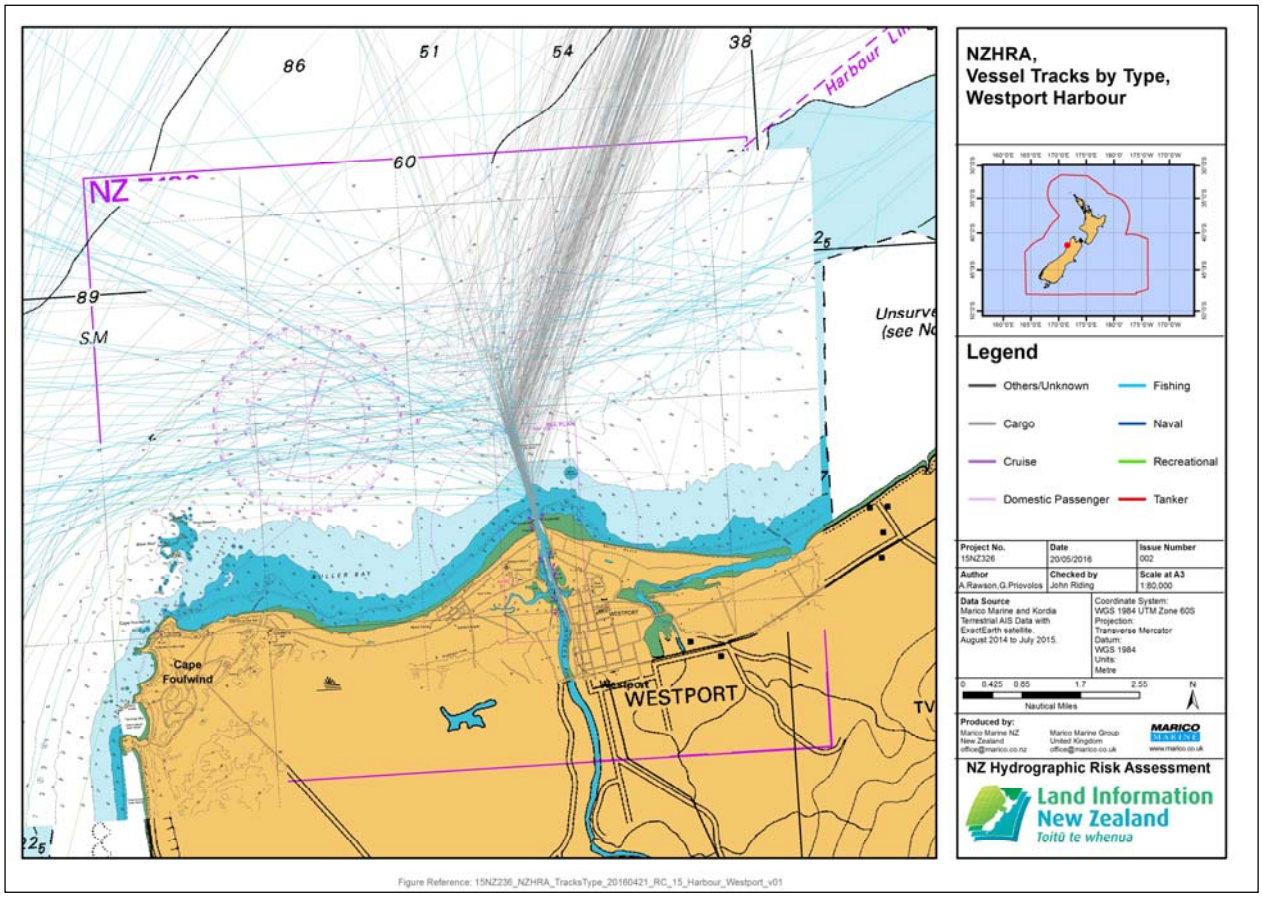


Figure 107 : Traffic Analysis by Ship Type – WestPort Approaches

9.4 TRAFFIC ANALYSIS – GREYMOUTH

The types of commercial vessels using Greymouth include

- Coastal bulk carrier (one visit)
- Fishing
- Tug and barge

One visit to Greymouth was made by coastal freighter *Anatoki,* which also visited Westport.

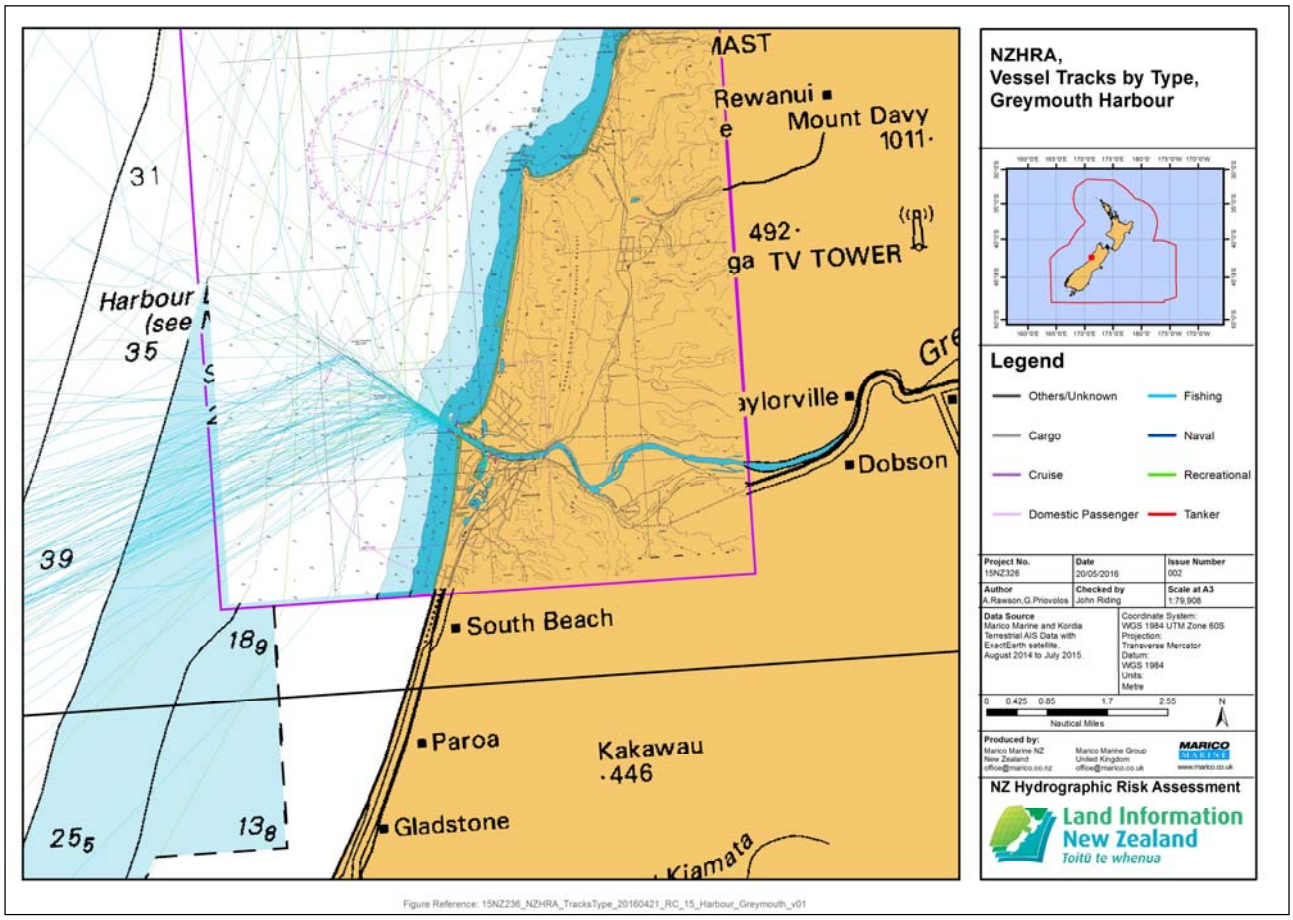


Figure 108 : Traffic Analysis by Type - Greymouth

9.5 HYDROGRAPHIC RISK RESULTS – WEST COAST REGION

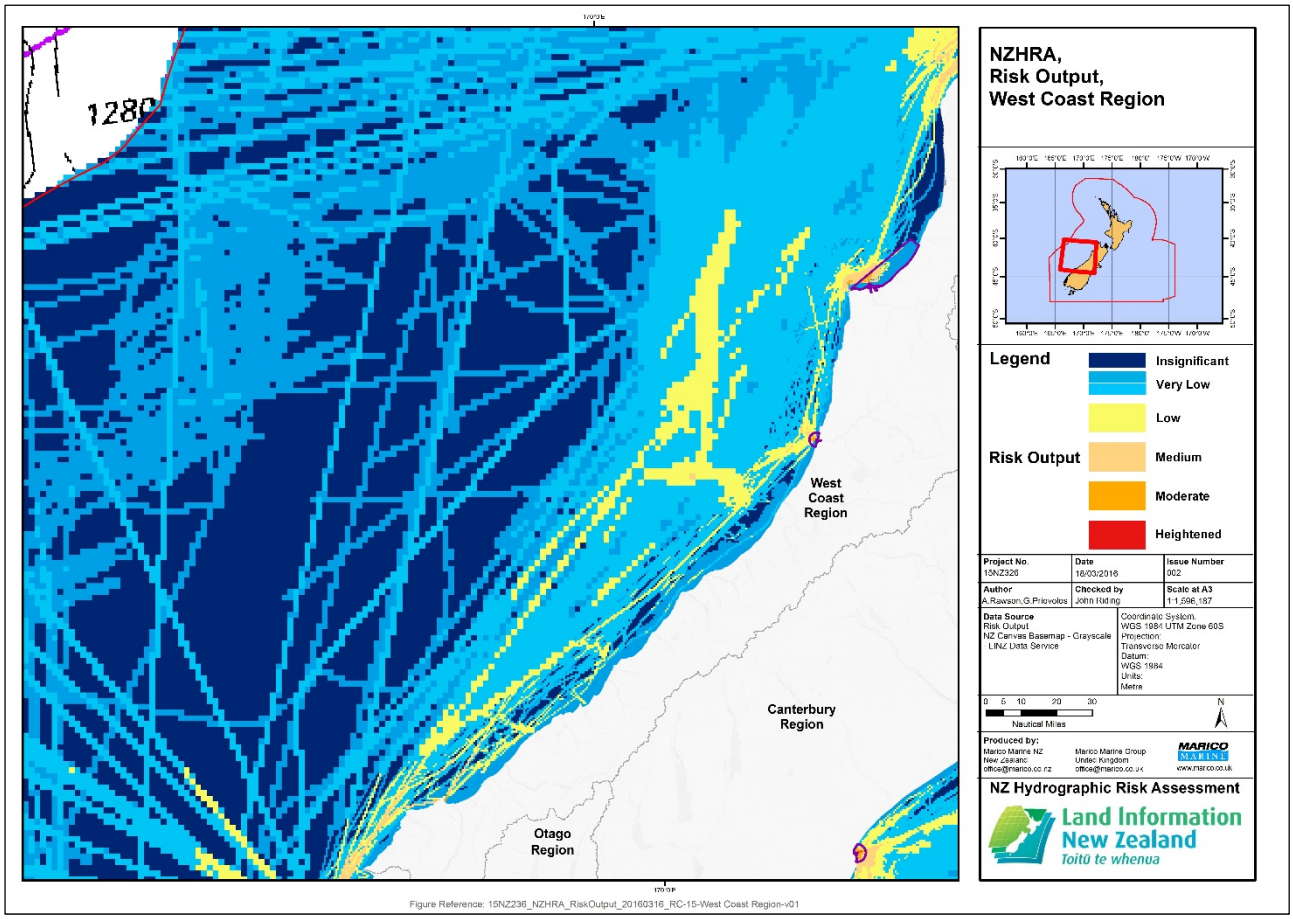


Figure 109 : Hydrographic Risk – West Coast Region

Hydrographic risk in this region is low overall, with pockets of increased risk result around harbour approaches and entrance channels. Westport and Greymouth harbour authorities regularly conduct surveys to monitor the location of the bar entrances to their harbours and to monitor harbour depths. This information is provided to LINZ who issue appropriate Notices to Mariners, so that mariners may have access to recent information about these frequently changing bar entrances and harbour depths.

9.5.1 HYDROGRAPHIC RISK – WESTPORT HARBOUR

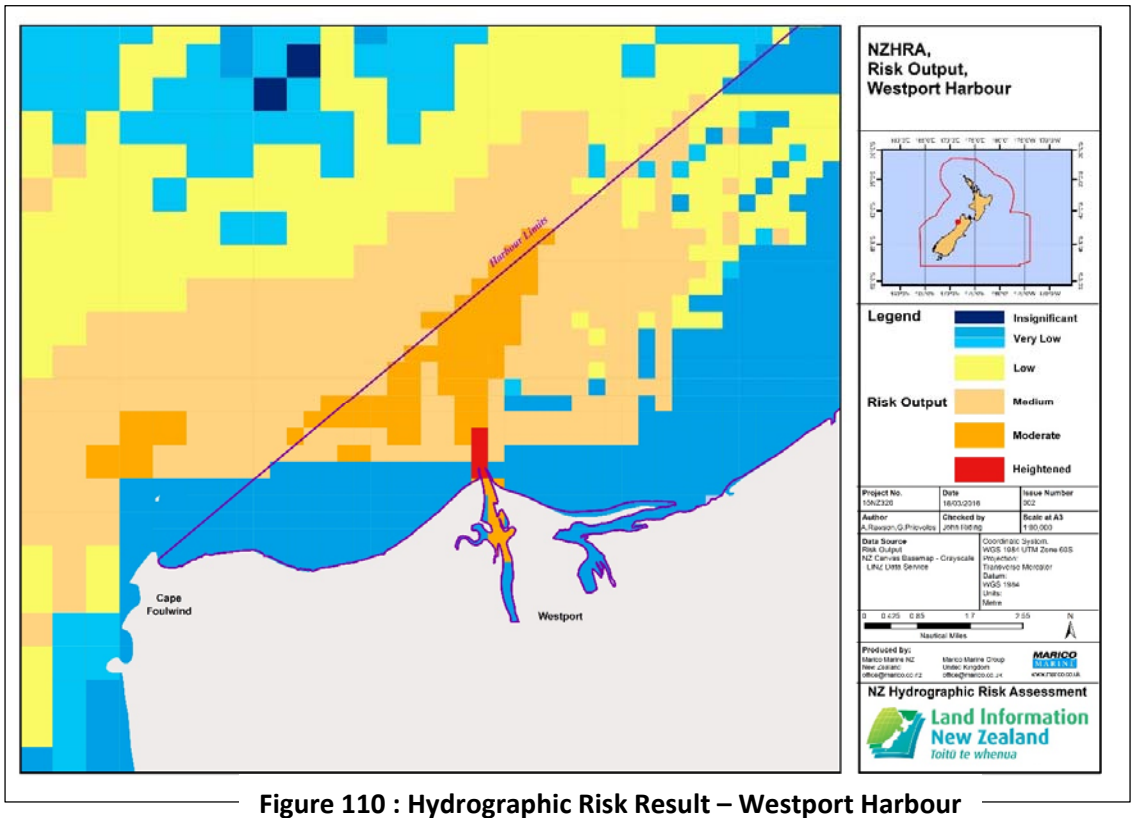


Figure 110 : Hydrographic Risk Result – Westport Harbour

Due to its difficult entrance, Westport produces an isolated area of heightened Hydrographic Risk.

9.5.2 HYDROGRAPHIC RISK - GREYMOUTH HARBOUR

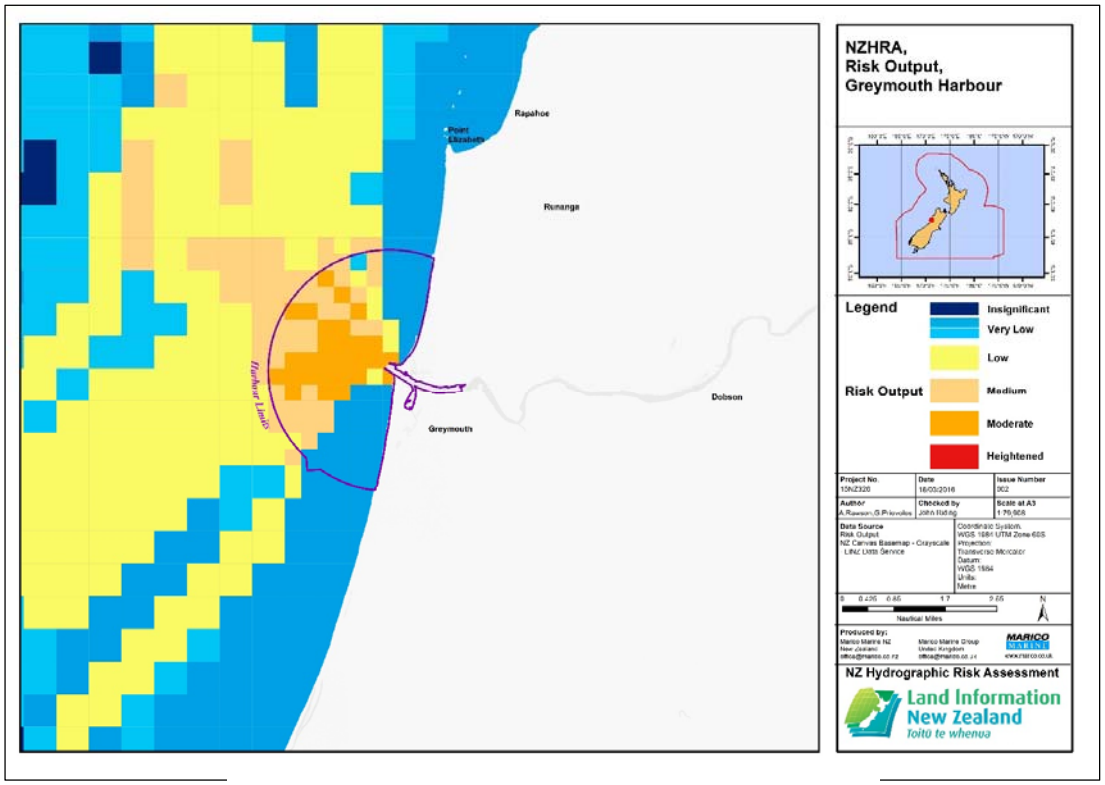


Figure 111 : Hydrographic Risk Result - Greymouth

9.6 CHARTING BENEFIT - WEST COAST REGION

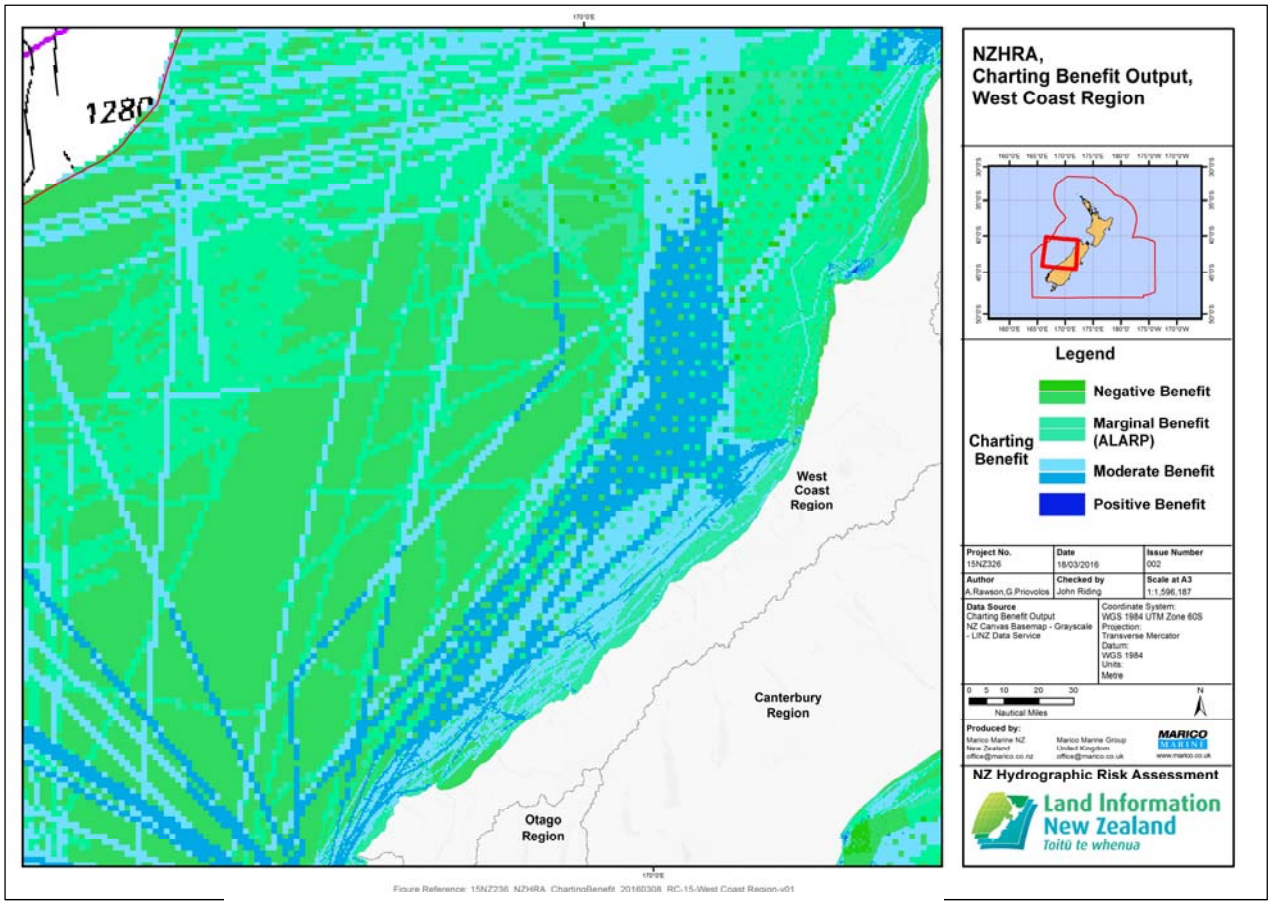


Figure 112 : Charting Benefit Result - West Coast Region

9.6.1 CHARTING BENEFIT RESULT - WESTPORT

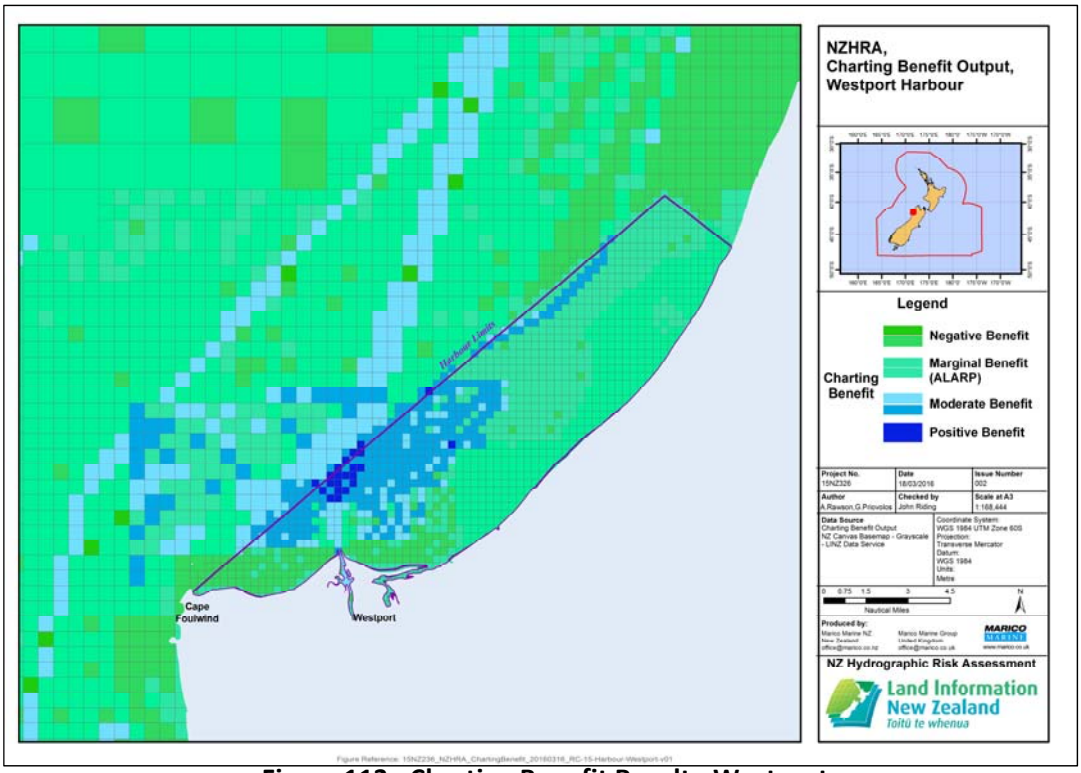


Figure 113 : Charting Benefit Result - Westport

Westport produces a charting benefit result in its outer approaches due to chart source data dating back to 1958.

9.6.2 CHARTING BENEFIT RESULT - GREYMOUTH

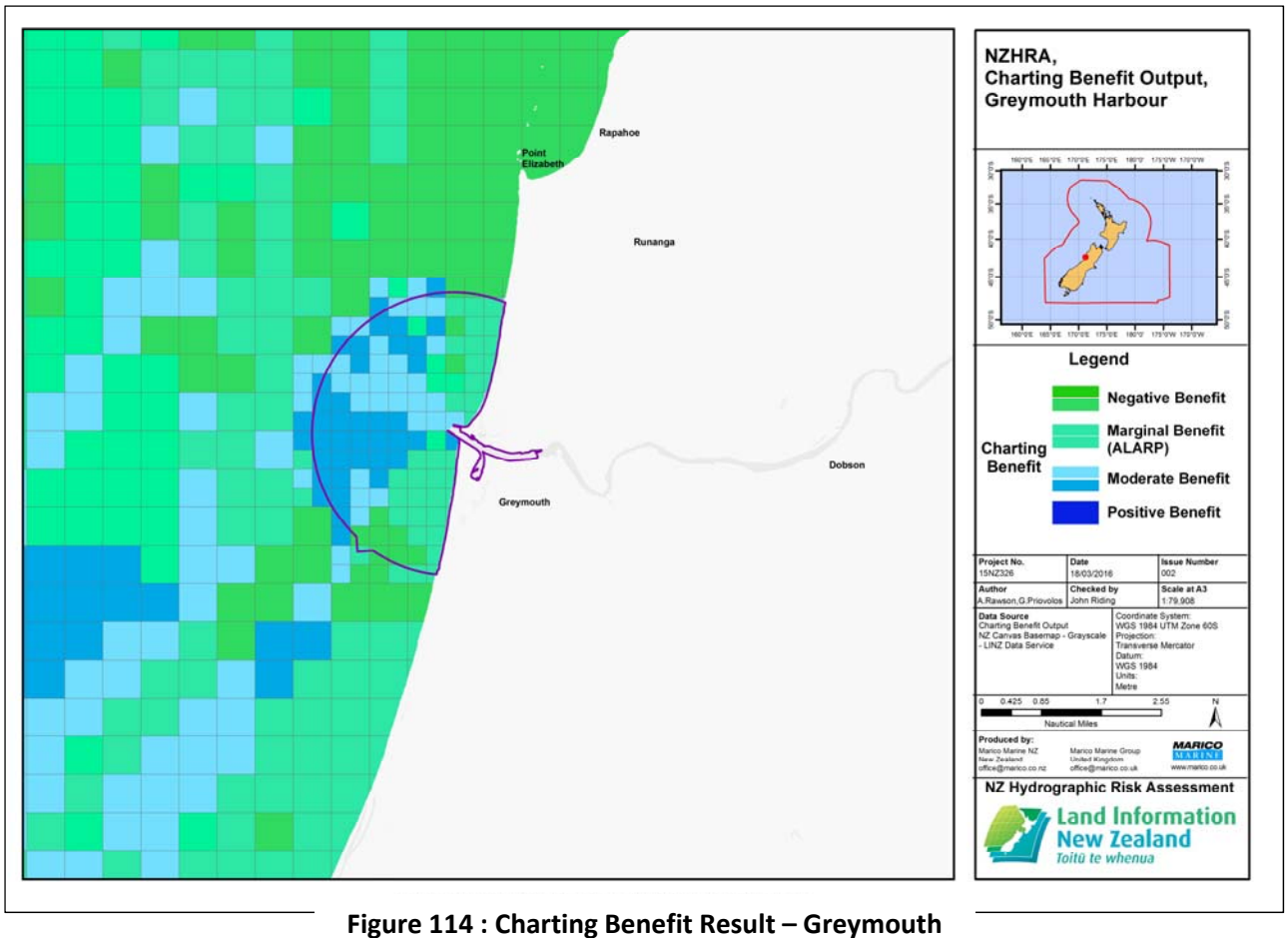


Figure 114 : Charting Benefit Result – Greymouth

Due to the age of chart source data of 1993, an area of moderate risk and moderate benefit accrues outside the Greymouth harbour limits. The West Coast region overall shows some marginal charting benefit is available in the areas where fishing activity is the most dense. The scale for Greymouth Harbour and Berths is 1:10,000, outside the recommended scale for a berthing chart.

10 DISCUSSION – SOUTH ISLAND

The Overview Document (15NZ236A) should be consulted for the NZ National results, which provide a necessary overview. This work allows LINZ to develop a work programme to be delivered over a number of years, the content and scope of which only LINZ can decide as part of its function as Charting Authority for NZ Waters. As such, this report cannot come to conclusions other than what is presented in each Regional Council area.

1. Although the project has provided some challenge to deliver a Hydrographic Risk Analysis for the whole of the New Zealand EEZ, a charting benefit assessment of the navigable waters by Hydrographic Risk has been achieved. A charting benefit model, based on the combination of the risk result per GIS cell and the available margin of charting improvements possible in that GIS cell, had to be developed. The resulting output does provide a clear indication of charting benefit that allows a survey and charting updating plan to be developed.
2. The South Island presents a good result overall for the present standard of hydrography and charting.
3. In total, twenty-one South Island important areas that would benefit from charting improvements were identified from the Risk Assessment:
    - Tasman – Rabbit Island
    - Nelson Approaches
    - D'Urville Island
    - Marlborough Sounds & Approaches
    - Kaikoura
    - Lyttelton Harbour
    - Banks Peninsula
    - Akaroa Approaches
    - Timaru Harbour & Approaches
    - Otago Harbour & Approaches
    - Bluff Approaches
    - Stewart Island – East Coast
    - Dusky Sound
    - Doubtful Sound
    - Caswell, Charles & Nancy Sounds
    - George Sound
    - Bligh Sound
    - Poison Bay

- Milford Sound – Fresh Water Basin / Sandfly Point
- Milford Sound Approaches
- Westport Approaches

4. LINZ has policy to add the MQual Charting Quality CATZOC rating to its charts and has done this to almost all of its coastal charting series. The CATZOC rating is of help to the navigator using ECDIS and it is also a key input into a Hydrographic Risk Assessment. The rollout of CATZOC has to date extended into the Coastal Chart portfolio, but not into the offshore series of charts. Therefore, it is worthwhile LINZ considering extension into all of the LINZ portfolio within the NZ EEZ, so that the LINZ macro scale international charts are given a rating reflecting their seafloor coverage and quality overall. This will assist in a future review of the GIS based risk model. As this is offshore deep water, there is little or no reputational risk posed to LINZ by adding MQual CATZOC to all of its Official Nautical Charting portfolio.
5. It is practically impossible to update all of the source data used in a chart at one time. This produces some scattering of charting benefit result in the plots. In the LINZ portfolio, there is chart source data in parts of some charts dating back to the 1930s. These areas will provide limited seafloor coverage information. Where charting benefit results are also positive it makes sense to have policy to prioritise these areas over others.
6. The updating of charting in the areas of maintained channels within harbour areas was a subject of feedback during data gathering. In some cases, source data for maintained channels may not be updated for 10-15 years, e.g. Port Otago in practice undertakes maintenance dredging annually. Whilst piloted vessels do not necessarily need to rely on official nautical charts (Pilots have access to local survey results), those navigating pilot exempt vessels do not. As the risk assessment methodology also shows these areas as providing benefit from Charting Upgrade, setting policy for charting update in this area would be of help to planning.
7. Changes to Harbour responsibility in New Zealand Harbour Waters occurred in the 1990s. This has resulted in navigational responsibilities being delivered through regional council systems, who do take jurisdiction both inside and outside Harbour Limits. Harbour Limits can thus be seen as of lower importance in NZ waters, but they are internationally recognised (and harbour liability case law is fundamental to such limits). Not all harbour limits appear on all of the LINZ charts and the risk assessment needed to manually add these in some cases. In the South Island Akaroa Harbour is an example. Accordingly, this is a worthwhile area of policy review.
8. There is evidence from traffic analysis of large cargo vessels and one tanker passing close to Brothers Islands in Cook Strait, with large numbers of cargo vessels passing only 1nm off Stephens Island. These types of geographical ‘corners’ or ‘pinch’ points feature in the charting benefit results, as do a number of harbour approaches.
9. Areas that appear to be important for vessels anchoring outside of designated anchorages in South Island are the outer Queen Charlotte Sound, Marlborough, Lyttelton approaches, Bluff Approaches and parts of Fiordland. A review of the seafloor characteristics or charting in these areas would be beneficial.
10. The project identified that Marlborough Sounds Approaches and Queen Charlotte Sound entrance would have navigational benefit from a charting reorganisation (in terms of scale and extents). The designated ship anchorage in Cloudy Bay and its approaches, along with

the outer approaches to Port Underwood, are at a Coastal scale rather than Approach scale, and are another South Island example of a positive charting benefit.

11. In common with other areas, the positive benefit for Queen Charlotte Sound is partly due to the high passenger traffic, but also the charting scale being an Approach scale where a Berthing scale may be more appropriate.

12. Most of the Queen Charlotte Sound is charted as dating from 1942-43, which combines with the ZOC C charting standard to give the positive benefit. Picton Wharves were last surveyed in 1978-86.

13. Tory Channel Entrance is charted on source data dating back to 1978. Ferries carry a high volume of passenger and vehicular traffic transit this restricted and difficult entrance. There have been two strikes of Wheki Rock by passenger vessels in the past 10 years.

14. A few ZOC-U (unassessed) areas remain around the South Island coast, as do some close inshore un-charted areas.