Trial 2020/21

VOLUNTARY PROTECTION ZONE FOR SHIPPING

West Coast of Haida Gwaii

# Voluntary Protection Zone for the West Coast of Haida Gwaii: Trial Evaluation 2020-2021

27 October 2022

Prepared for:

Technical Working Group and Project Committee of the
Safe Distance Offshore / Proactive Vessel Management Pilot Project on Haida Gwaii

Prepared by:

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# Executive Summary

During a Voluntary Protection Zone (VPZ) trial, commercial cargo and passenger vessels of 500 gross tonnage (GT) or greater were asked to stay at least 50 nautical miles (nm) west of Haida Gwaii when passing through the area. Exceptions set this distance at 25 nm for those trading between ports in British Columbia, Washington and Alaska and at 12 nm for cruise ships. Fishing vessels and tugs were exempted completely. Vessels movements before and during the trial were assessed using Automated Identification System data to determine the extent to which vessels would follow the requested routing. Transport Canada also administered a short questionnaire to vessels that traveled within the VPZ zones to understand the reason why.

The analysis found that commercial vessel traffic in the region was generally similar during the trial study period as compared to the 2016 data that had been considered during discussions leading to the development of the VPZ. Two changes were noted: (1) cruise ship traffic ceased in 2020 due to the pandemic, then recovered somewhat in 2021, and (2) cargo vessel transits increased by 31% from 2019 to 2020, remaining high in 2021. The latter was attributed to changes in traffic patterns after the global cap on sulphur emissions from vessels took effect at the start of 2020, after which vessels on Great Circle Route voyages between North America and Asia spent more time in the Canadian Exclusive Economic Zone. This reflected a return to traffic patterns that existed before the Emissions Control Area in the region took effect.

All vessels studied reduced entrances into the VPZ during the trial as compared to the months immediately pre-trial. Cruise ships showed the most pronounced change, with just 2% of voyages entering within 12 nm during the trial for a total of just 45 minutes. Vessels trading between British Columbia, Washington, and Alaska also made a significant change, reducing to just 4% of voyages entering within 25 nm of the west coast of Haida Gwaii. Based on survey responses and an examination of wave height data, it appears that if a vessel entered the VPZ it was most likely do so to avoid bad weather. When wave heights were higher off the coast of Haida Gwaii, vessels on the Great Circle Route were more likely to enter the VPZ or go through Hecate Strait.

While there was essentially no change to transits through the *SGaan Kinghlas*-Bowie Seamount *Gin Siigee Tl'a Damaan Kinggangs Gin K'aalaagangs* Marine Protected Area, there was an increase in transits through Hecate Strait – particularly in bad weather. This shift appears to have started at the onset of the IMO global sulphur cap in 2020 and continued, with a slight increase, during the VPZ trial.

# Acronyms

| | |
|---|---|
| AIS | Automatic Identification System |
| BC | British Columbia |
| CCG | Canadian Coast Guard |
| CHN | Council of the Haida Nation |
| ECA | Emissions Control Area |
| EEZ | Exclusive Economic Zone |
| ERA5 | European Centre for Medium-Range Weather Forecasts' Reanalysis (5th Generation) |
| ETV | Emergency Tow Vessel |
| GCR | Great Circle Route |
| GT | Gross Tons |
| IMO | International Maritime Organization |
| LNG/LPG | Liquid Natural Gas/Liquid Petroleum Gas |
| MARPOL | International Convention for the Prevention of Pollution from Ships |
| MPA | Marine Protected Area |
| nm | Nautical Mile |
| SK-B MPA | *SGaan Kinghlas*-Bowie Seamount *Gin Siigee Tl'a Damaan Kinggangs Gin K'aalaagangs* Marine Protected Area |
| VPZ | Voluntary Protection Zone (50 nm offshore) |
| VPZ-25 | Voluntary Protection Zone exception for vessels in Pacific Northwest Trade (25 nm offshore) |
| VPZ-12 | Voluntary Protection Zone exception for cruise ships (12 nm offshore) |

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# 1 Introduction

From September 2020–October 2021, a trial program assessed whether commercial cargo and passenger vessels would voluntarily stay further offshore the west coast of Haida Gwaii. The Voluntary Protection Zone (VPZ) trial was the outcome of a two-year process co-led by the Council of the Haida Nation (CHN) and Transport Canada as one of several Proactive Vessel Management pilot projects under the Government of Canada's Oceans Protection Plan.[1] As part of the pilot, CHN and Transport Canada worked closely with Canadian and US industry stakeholders through a project committee created to support dialogue and collaboration.[2]

This report answers seven sets of questions to help the project committee evaluate the results of the VPZ trial. The purpose of the evaluation is two-fold: a) to determine whether vessels would follow the voluntary measures and b) to understand the reasons when they did not.

## What is the Voluntary Protection Zone (VPZ)?

During the VPZ trial, vessels of 500 gross tonnage (GT) or greater were asked to stay at least 50 nautical miles (nm) west of Haida Gwaii when passing through the area, except those trading between ports in BC, Washington and Alaska, which were asked to stay 25 nm from shore (VPZ-25), and cruise ships, which were asked to stay 12 nm from shore (VPZ-12). Fishing vessels, tugs, government and research vessels, and private yachts were exempt from the VPZ trial. Participation was entirely voluntary and only expected when there was no anticipated consequence to safe navigation, the vessel, crew and passengers, or cargo.

Mariners were notified of the VPZ through the combined efforts of Transport Canada, the Canadian Coast Guard, the Canadian Hydrographic Service, Canadian and US industry participants, and the U.S. Coast Guard. Information on the VPZ was shared through navigational chart updates, notifications to mariners by both the Canadian and U.S. Coast Guards, the *Canadian Sailing Directions*, Transport Canada's Ship Safety Bulletins and shipping industry emails and newsletters.

[1] The process was conducted as a Proactive Vessel Management pilot under Canada's Ocean Protection Plan initiative.

[2] Nuka Research and Council of the Haida Nation. (2020). *Shipping Traffic Analysis and Risk Mitigation Measures for the West Coast of Haida Gwaii.* Prepared for the Technical Working Group and Project Committee of the Safe Distance Offshore / Proactive Vessel Management Pilot Project on Haida Gwaii. July.

## Research questions

The project committee's research questions for this initial evaluation of the VPZ trial are shown in the box below. Section 2 of this report provides brief background on the data sources used. Research questions are answered using those data sources in Section 3. Findings are summarized in Section 4.

**VPZ Trial Evaluation Research Questions**

1. Overall, were the types and numbers of commercial vessels transiting around Haida Gwaii in 2019, 2020, and 2021 substantially the same as in 2016?
    a. Are the 'frequent fliers' within 75 nautical miles of the west coast of Haida Gwaii substantially the same as in 2016?
2. Were there differences in traffic patterns before and after January 1, 2020, when the IMO 2020 sulphur limits for fuel came into effect?
3. Did vessels participate in the VPZ?
    a. For each trade:
        i. Were there changes in traffic patterns Pre-trial (January 1, 2019–August 30, 2020) and during the VPZ trial (September 1, 2020–October 31, 2021)?
        ii. What is the percent of tracks inside or outside the VPZ footprint?
        iii. How much time did vessels spend in the VPZ?
    b. Did frequent fliers participate in the trial?
4. What are the reasons for non-participation in the trial?
5. What were the weather conditions like in 2019, 2020, and 2021? Did weather conditions affect vessel participation in the VPZ trial?
6. Were unintended consequences observed as a result of the trial (e.g., increases in traffic through Hecate Strait and *SGaan Kinghlas*-Bowie Seamount MPA)?
7. What were tug and fishing vessel traffic patterns like on the west coast of Haida Gwaii during the trial?

# 2 Key Inputs

Three primary sources of data are used to answer the research questions to evaluate the VPZ Trial: Automatic Identification System (AIS) data, the results of a questionnaire sent to vessel operators that entered the VPZ, and sea state data used to better understand whether there is a relationship between weather conditions and vessel entries into the VPZ. This section briefly describes the data sources used.

## Voluntary Protection Zone

The VPZ generally parallels the Haida Gwaii coast at the designated distances offshore, with polygons drawn by creating a top and bottom line for the VPZ. The outside boundary of the VPZ was modified in August 2021 when it was discovered that a portion of the northwest corner of VPZ extended into US waters, leaving some ships no alternative but to enter the zone. The vessel traffic analysis in this report uses the modified VPZ. See Figure 1.

## Automatic Identification System (AIS) analysis

The discussions to develop the VPZ relied in large part on building a shared understanding of vessel traffic around Haida Gwaii. This was based on the expertise of project committee members as well as extensive analysis of vessel movements based on AIS signals. The details of this method, results of that earlier analysis, and limitations of AIS are described in a 2020 report.[3]

AIS data were processed to be able to visualize and count tracks of different vessel types within the study area. The study area encompasses the waters from Hecate Strait and extends seaward to the western edge of the Exclusive Economic Zone (see Figure 1). This captures many, but not all, vessels transiting the Pacific Ocean to and from the Strait of Juan de Fuca and other North American ports.

Vessels are included in the analysis only if they were identified by their AIS signals as crossing one of the "passage lines" shown in Figure 1. Passage lines and polygons are used to count the number of vessels or vessel tracks (a single vessel may make many tracks on repeat voyages) across a particular line or enter a particular polygon. For example, to answer questions about VPZ adherence, the number of vessel tracks entering the VPZ is compared to the total number of vessels tracks entering the "West Haida Gwaii polygon" in Figure 1. Different passage lines

[3] Nuka Research and Council of the Haida Nation, *Shipping Traffic Analysis and Risk Mitigation Measures for the West Coast of Haida Gwaii.*

and polygons are used to answer the research questions. The analysis described in this report also relies heavily on AIS data using largely the same methods as in the 2020 report. AIS data from 2016, 2019, 2020, and January–October 2021 are used in the VPZ trial evaluation.[4] The additional step of counting the percentage of tracks that entered the VPZ was added to the earlier method and is described with the appropriate research questions.

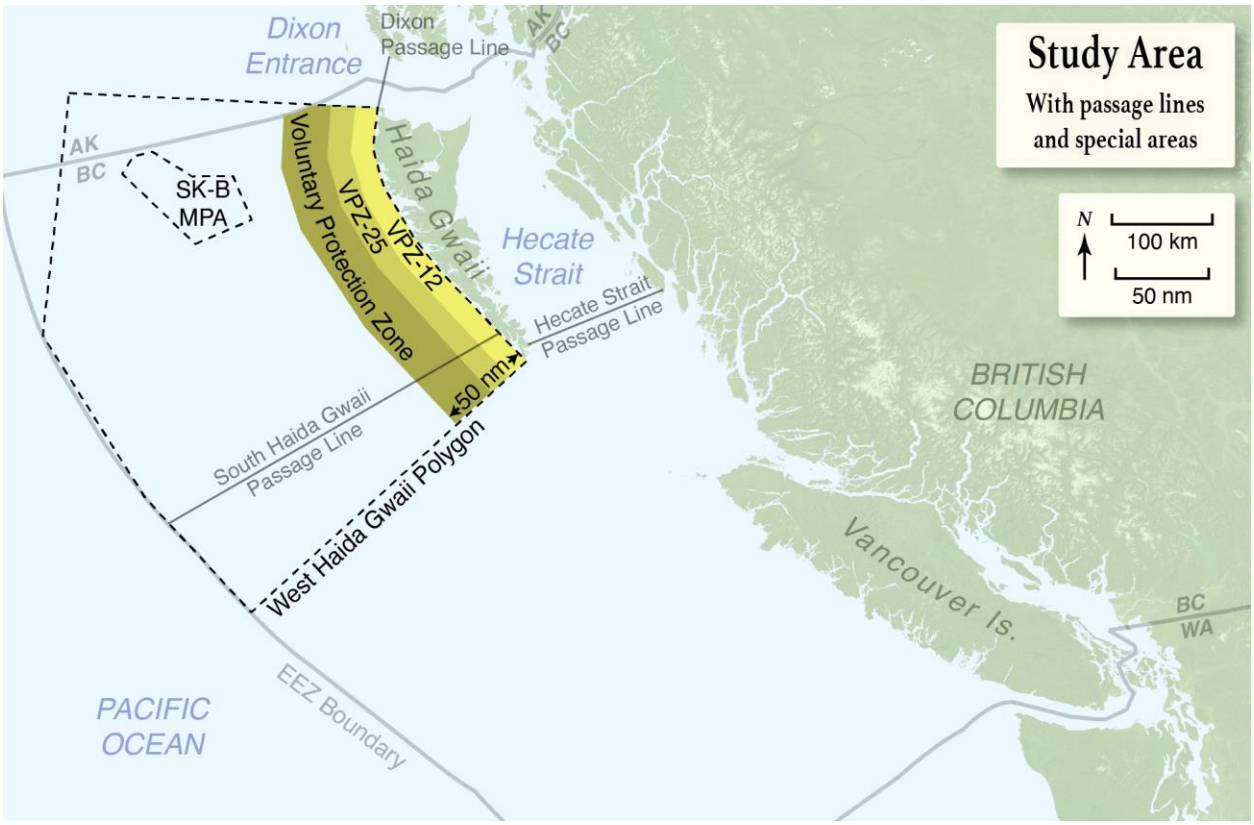


*Figure 1 – Study area including the VPZ, passage lines, and other areas relevant to the analysis*

## Vessel types and trades

To understand vessel traffic for the purpose of evaluating the VPZ trial, vessel tracks from the AIS data are organized in two ways: vessel type (the kind of vessel) and trade (generally where it is going as determined by the trade in which it is engaged).

Vessel types included in analysis are:

[4] Data from 2016 was purchased from exactEarth and provided by Clear Seas for the previous phase of the project documented in the 2020 report. January 2019–August 2021 data were purchased from exactEarth for the analysis reported here. September–October 2021 data were provided by Transport Canada. All data is satellite-based AIS, meaning the vessels' AIS signals are captured by satellites.

- Cargo vessels (container ships, bulk carriers, vehicle carriers, and other cargo ships),
- Cruise ships, and
- Tankers.

Fishing vessels and tugs are examined for research question #7 although they are exempt from the VPZ trial. Private vessels such as yachts, research vessels, and government vessels are also exempted from the trial and are not included in the analysis.

In addition to knowing the type of vessel and where it is operating, it is also relevant to understand the trade in which the vessel is engaged. The tracks of vessels that entered waters around Haida Gwaii out to the Exclusive Economic Zone (EEZ) and associated with one of the vessel types included in the study were categorized into four trades depicted in Figure 2:

- **Cruise Ship trade:** Cruise vessels traveling through the area between southeast Alaska and southern BC and northwestern U.S. ports. *These vessels are asked to stay outside the VPZ-12.*

- **Pacific Northwest trade:** Vessels traveling among ports southern BC ports or Washington and ports in northern BC or Alaska. *These vessels are asked to stay outside the VPZ-25.*

- **Northern BC trade:** Cargo vessels and tankers calling at ports in Northern BC such as Prince Rupert and Kitimat. *These vessels are asked to stay outside the VPZ (50 nm).*

- **Great Circle Route (GCR) trade:** Vessels trading between East Asian and North American ports out of the Strait of Juan de Fuca. Vessels that call in Prince Rupert on a Great Circle voyage are included in the Northern BC trade. It is not uncommon, however, for vessels assigned to the Great Circle Route trade to travel through Hecate Strait and Dixon Entrance without stopping in a port in northern BC. *These vessels are asked to stay outside the VPZ (50 nm).*

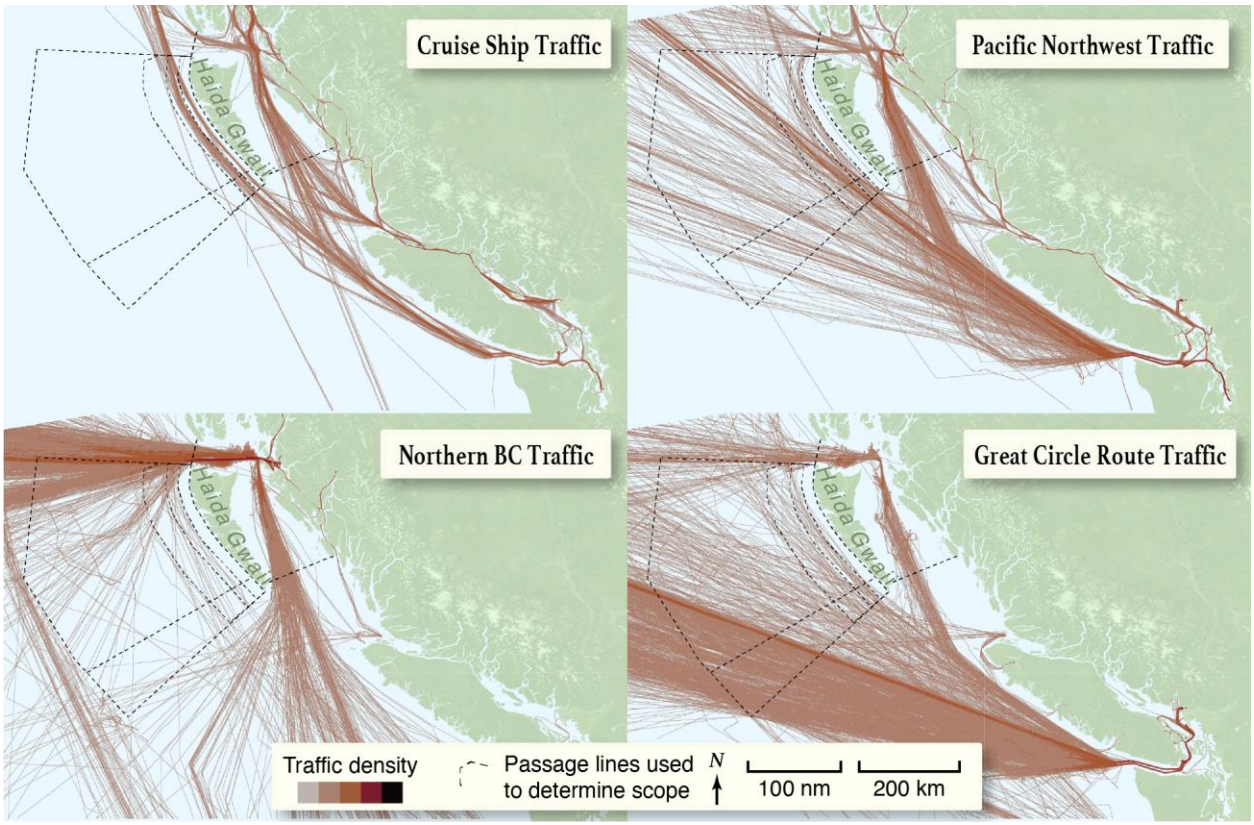


*Figure 2 – Vessel tracks included in the study that were associated with each of four trades analyzed*

## Questionnaire to vessel operators

Beginning in May 2021, Transport Canada sent a questionnaire to vessel operators identified as having entered the VPZ to better understand the factors influencing their routing decisions. Operators were asked if they were aware of the VPZ and whether their route inside the VPZ was due to weather or other considerations, such as convenience or fuel savings. Of the 96 questionnaires sent from May 2021–January 7, 2022, Transport Canada received 63 responses. These responses were used to answer re research question #4 (see results in Section 3).

## Sea state data

Discussions with industry participants and commercial weather routing services indicated that weather as far west as Japan can influence routing on the eastern side of the Pacific Ocean for vessels travelling on a Great Circle Route.[5]

[5] Nuka Research and Council of the Haida Nation, *Shipping Traffic Analysis and Risk Mitigation Measures for the West Coast of Haida Gwaii.*

ERA5 wave height data for two locations was used in conjunction with AIS data to answer research question #5. Wave height is one weather condition that is highly relevant to navigational safety and decision-making. ERA5 is a dataset of historic weather modelled across the globe based on compiled observational data. It includes hourly estimates of wave height (along with many other parameters) with data presented in a global grid. The European Centre for Medium-range Weather Forecasts develops and implements the model, and the dataset is then validated and made available to the European Union's Copernicus Climate Change Service.[6]

[6] Copernicus Climate Change Service. (2022). ERA5 hourly data on single levels from 1979 to present. https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-single-levels?tab=overview

# 3 Analysis Results

This section answers the seven sets of questions developed to evaluate the VPZ trial. Together, the questions address the general traffic patterns for the vessel types of interest during the more recent (2019–2021) years of data as compared to the data considered during discussions exploring a potential VPZ, the impact of new global air emissions requirements on vessel routes, overall adherence to the VPZ distances by trade, reasons vessels entered the VPZ (including weather), and unintended consequences related to vessel routing. Although fishing vessels and tugs were excluded from the VPZ, the project committee was interested in understanding their movements as well.

## Research question #1

***Overall, were the types and numbers of commercial vessels transiting around Haida Gwaii in 2019, 2020, and 2021 substantially the same as in 2016?***

With this question, the project committee sought to understand whether there were broader changes to the traffic in Canadian waters off Haida Gwaii before delving into the specific changes that may be attributed to the VPZ. This question does not consider where vessels travelled but rather the volume of transits through the area.

This question is answered by vessel type for cargo, passenger, and tanker vessels based on AIS data in Table 1 and Figure 3. Data are presented as monthly averages. Cruise vessel activity dropped substantially in 2020 due to Covid-19 restrictions, recovering slightly in 2021. Cargo vessel activity increased substantially between 2019 and 2020, decreasing slightly in 2021. This change is assumed to be driven at least in part by changes in international requirements related to the use of low-sulphur fuels (see research question #2). Tanker activity also increased from 2020–2021, driven by an increase in LNG/LPG carriers.

**Table 1 - Average voyages per month in Canadian waters west of Haida Gwaii**

| Vessel Type | 2016 | 2019 | 2020 | 2021 (Jan-Oct only) |
|---|---|---|---|---|
| **Cargo** | 172.3 | 174.4 | 239.5 | 226.1 |
| **Passenger** | 67.1 | 78.4 | 0.1 | 17.7 |
| **Tanker** | 30.1 | 29.8 | 30.4 | 40.3 |
| **Total** | 269.5 | 282.6 | 270.0 | 284.1 |

***Are the frequent fliers within 75 nautical miles of the west coast of Haida Gwaii substantially the same as in 2016?***

Vessels included in the study that made more than three trips inside of 75 nm of the west coast of Haida Gwaii were considered 'frequent fliers' for the purpose of answering this question. These were generally vessels involved in the Pacific Northwest trade. While there were some changes over the years, the five most frequent vessels remained the same in the study period. Table 2 shows the portion of voyages inside of 75 nm that were made by frequent flier vessels.

**Table 2 – Number of voyages within 75 nm of west coast of Haida Gwaii**

| Vessel Type | 2016 | 2019 | 2020 | 2021 (Jan-Oct only) |
|---|---|---|---|---|
| **All included vessels** | 923 | 1,018 | 831 | 765 |
| **Frequent fliers only** | 580 | 635 | 410 | 399 |
| **% of total** | 57% | 62% | 49% | 52% |

## Research question #2

***Were there differences in traffic patterns before and after January 1, 2020, when the IMO 2020 sulphur limits for fuel came into effect?***

During project committee discussions leading up to the trial, consideration of AIS data from 2014–2016 revealed a significant shift in GCR traffic through western Canadian waters that occurred between 2015 and 2016. This shift was attributed to the implementation of a North American Emissions Control Area (ECA) limiting the sulphur content of vessel fuels to a maximum of 0.1% within the western Canadian EEZ as of 2015[7]. When this sulphur content threshold took effect, many GCR ships shifted their voyages to minimize time spent burning more expensive fuel within the ECA to meet the emissions requirements. Instead, as of 2015, more GCR vessels started taking a more direct route to the Strait of Juan de Fuca from the EEZ in the south. This shift, which meant GCR vessels were more likely to be past the EEZ when passing Haida Gwaii in the north, is depicted in a Clear Seas' Centre for Responsible Marine

[7] The North American ECA, which also includes both Canadian and U.S. waters on the east and west coasts (and Hawaii), is part of an IMO approach to reducing air emissions impacts in coastal areas. International Maritime Organization (2010). *Information on North American Emission Control Area Under MARPOL Annex V,* Ref. T5/1.01, MEPC.1/Circ. 7231, 3 May 2010.

Shipping report released in December 2020.[8] Because of this change, there were fewer GCR vessels in the area of interest for this project in 2015 and 2016 as compared to 2014.

A subsequent IMO measure related to shipping air emissions took effect January 1, 2020. The "IMO 2020" global sulphur cap set a new *global* standard of 0.5% sulphur content for shipping fuel used worldwide.[9] While the ECA remained in effect as well, the project committee wondered if the new global cap would cause vessels to shift back to taking the shortest trans-Pacific route and thus spending more time in the EEZ off Haida Gwaii. Analysis of AIS tracks from 2019 and 2020 indicates that this appears to have been the case: within 2019, 329 cargo vessels identified in the GCR trade crossed the Southern Haida Gwaii passage line, while in 2020 this number increased to 824.[10] See Figures 3 and 4.

[8] Clear Seas Centre for Responsible Marine Shipping (2020). *Vessel Traffic in Canada's Pacific Region.* December. Retrieved from: https://clearseas.org/wp-content/uploads/2021/02/VTA-Pacific-Final-Report-EN.pdf

[9] International Maritime Organization. (2020*). IMO 2020 - cleaner shipping for cleaner air: Global limit on sulphur in ships' fuel oil reduced from 01 January 2020*. Retrieved from: https://www.imo.org/en/MediaCentre/PressBriefings/Pages/34-IMO-2020-sulphur-limit-.aspx

[10] As previously noted, this reflects only the number of vessels that entered the EEZ west of Haida Gwaii, so the shift does not correlate to a change in port calls or cargo movements

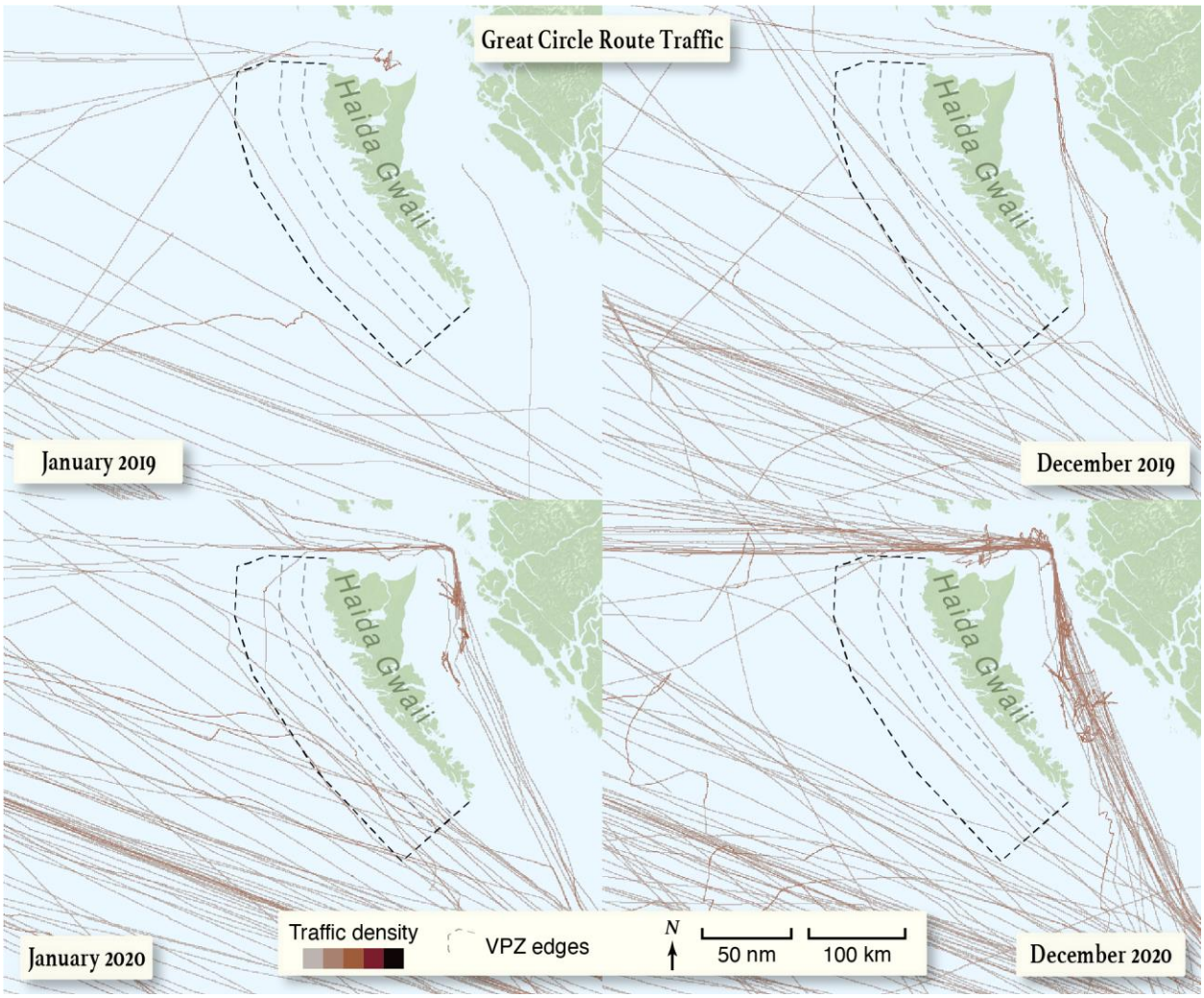


*Figure 3 – Comparison of GCR vessel tracks included in the study. January and December 2019 show winter months when the ECA is in effect. In January 2020, more of these vessels are visible within the EEZ off Haida Gwaii or using Hecate Strait following the start of the IMO 2020 sulphur cap. The use of Hecate Strait in particular increases throughout the VPZ trial in December 2020.*

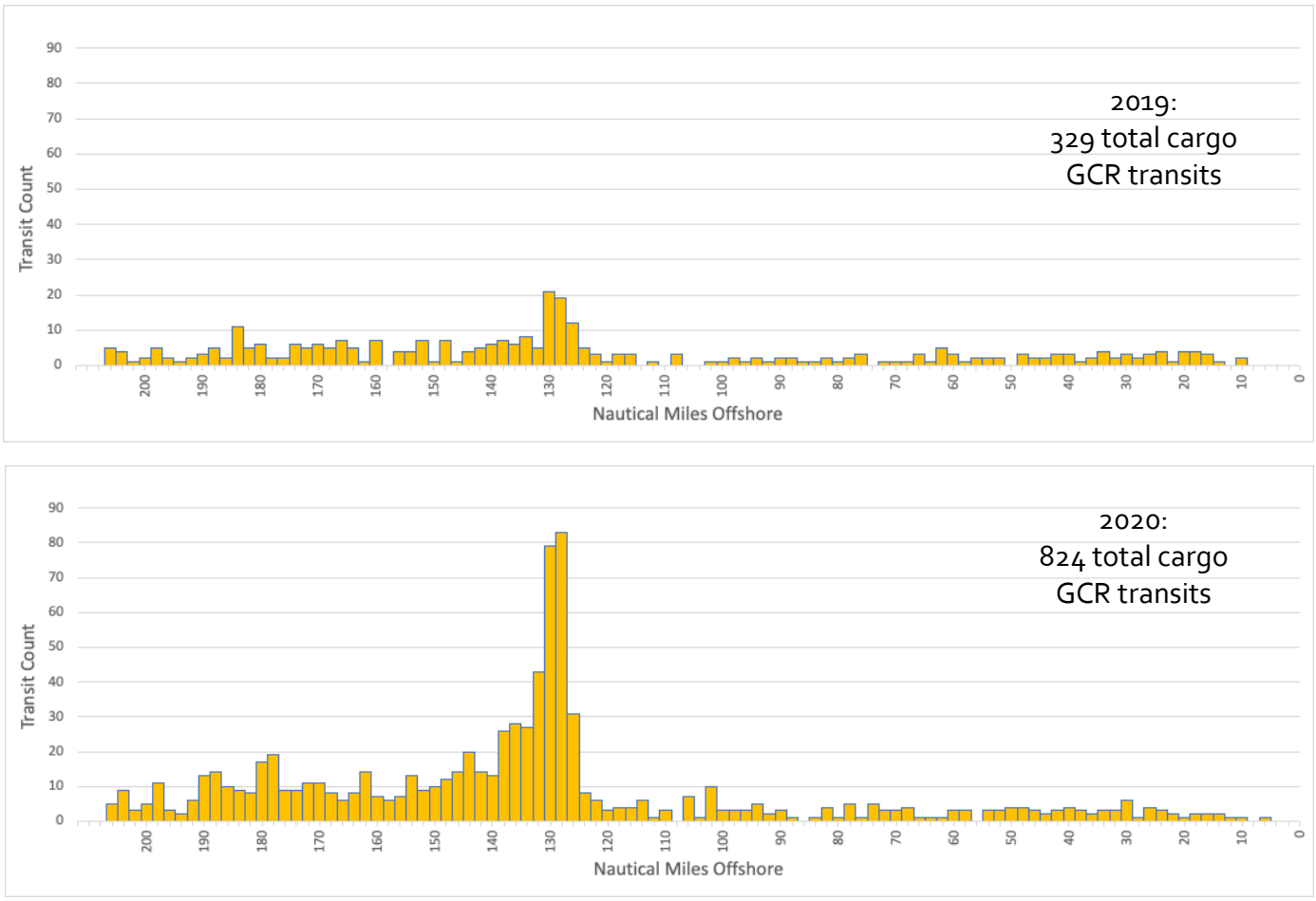


*Figure 4 – Number of cargo vessel transits across the Southern Haida Gwaii Passage Line in 2019 (top) and 2020 (bottom), and how many nautical miles off Haida Gwaii the transits occurred (the value of 0, on the far right, represents the Haida Gwaii coast)*

## Research question #3

***For each trade:***

- ***Were there changes in traffic patterns pre-trial (January 1, 2019 – August 30, 2020) and during the VPZ trial (September 1, 2020 – October 31, 2021)?***
- ***What is the percent of tracks inside or outside the VPZ footprint?***
- ***How much time did vessels spend in the VPZ?***

***Did frequent fliers participate in the trial?***

This question considers VPZ adherence for the four trades discussed in Section 2: Cruise Ships, Pacific Northwest, Northern BC, and GCR. For each trade, monthly averages are used to

compare the number of transits within the VPZ area for the 20 months of data before there was a VPZ to the transits that entered the relevant part of the VPZ during the 14-month trial.

In addition to monthly averages for vessels entering the VPZ-12, VPZ-25, and VPZ, percentages are used to describe VPZ adherence. For each trade, the percentage of transits entering the relevant VPZ tier during the trial is considered based on the number of entries observed against the total number of voyages entering the West Haida Gwaii polygon. This same method is used for the pre-trial timeframe, recognizing that there was no VPZ at that time. The question of how much time is spent in relevant VPZ tier is also answered for each trade.

### *Cruise Ship Trade*

Although cruise ship operations in 2020 were severely limited by the pandemic, there was significant adherence to the VPZ-12 as cruise travel began to rebound in 2021. During the pre-trial period, 43% of transits west of Haida Gwaii passed within 12-nm of the coast. During the trial only 2% entered the VPZ-12 and then only very briefly (45 minutes total) near the VPZ-12 line. See Table 3 and Figures 5 and 6.

**Table 3 - Cruise ship trade behavior relative to VPZ-12, pre-trial and trial**

| Measure of Vessel Tracks | Pre-trial (Jan 1, 2019–Aug 30, 2020) | Trial (Sep 1, 2020–Oct 31, 2021) |
|---|---|---|
| Total tracks in West Haida Gwaii Polygon | 245 | 82 |
| Total tracks entering inside 12 nm | 139 | 2 |
| Monthly average entering inside 12 nm | 7 | .01 |
| Percent staying *outside* 12 nm | 43% | 98% |

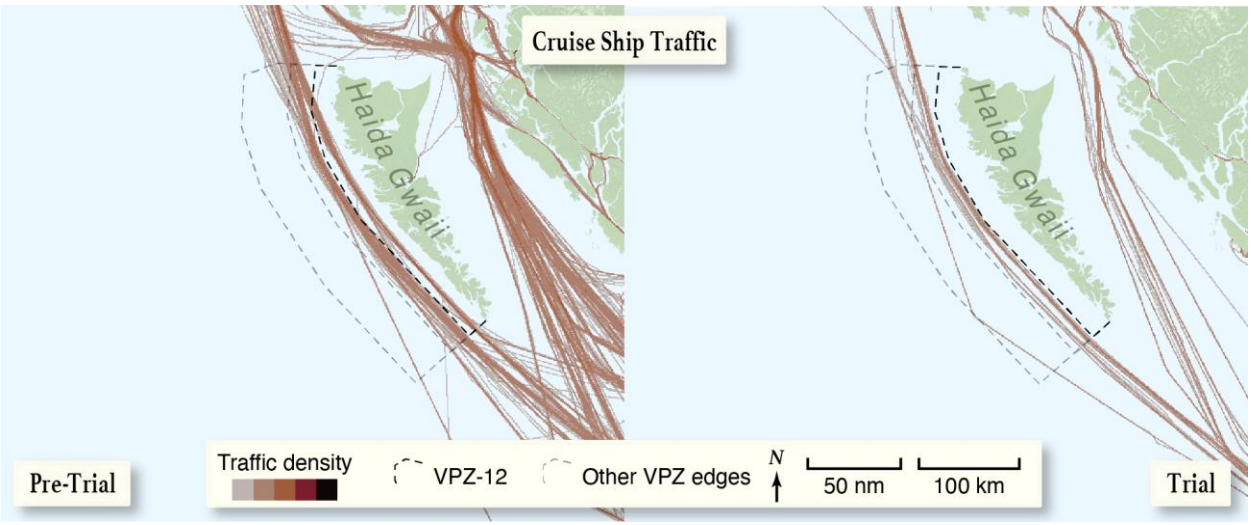


*Figure 5 – Cruise ship trade tracks for the pre-trial and trial periods*

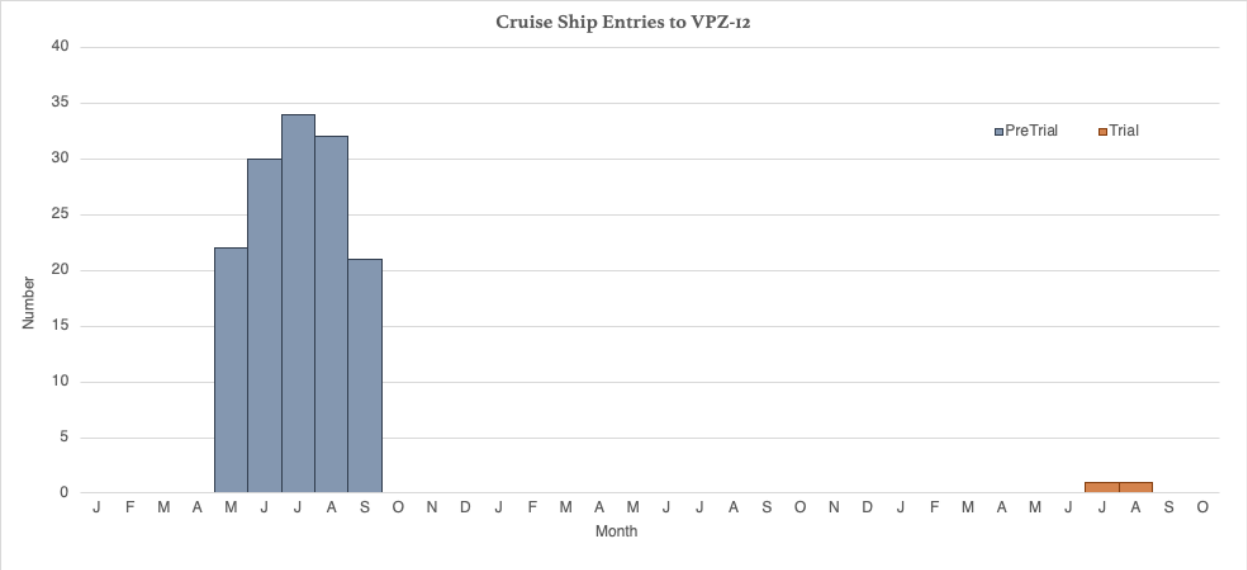


*Figure 6 – Cruise ship trade entries into the VPZ-12 by month (January 2019–October 2021)*

### *Pacific Northwest Trade*

A reduction in Pacific Northwest trade voyages entering the VPZ-25 area was also observed. Pre-trial, 36% of transits associated with this trade entered the area that would become the VPZ-25. During the trial, this dropped to 4% of transits entering the VPZ-25. See Table 4 and Figures 7 and 8.

**Table 4 - Pacific Northwest trade behavior relative to VPZ-25, pre-trial and trial**

| **Measure of Vessel Tracks** | **Pre-trial** (Jan 1, 2019–Aug 30, 2020) | **Trial** (Sep 1, 2020–Oct 31, 2021) |
|---|---|---|
| Total tracks in West Haida Gwaii Polygon | 739 | 505 |
| Total tracks entering inside 25 nm | 268 | 20 |
| Monthly average entering inside 25 nm | 13 | 1.4 |
| Percent staying *outside* 25 nm | 64% | 96% |

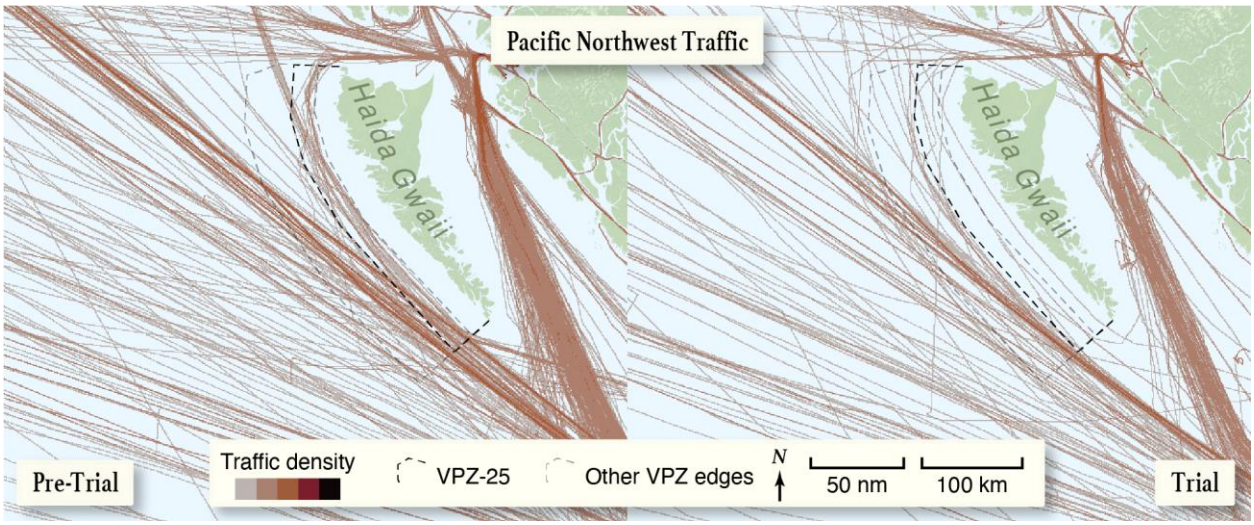


*Figure 7 – Pacific Northwest trade tracks for the pre-trial and trial periods*

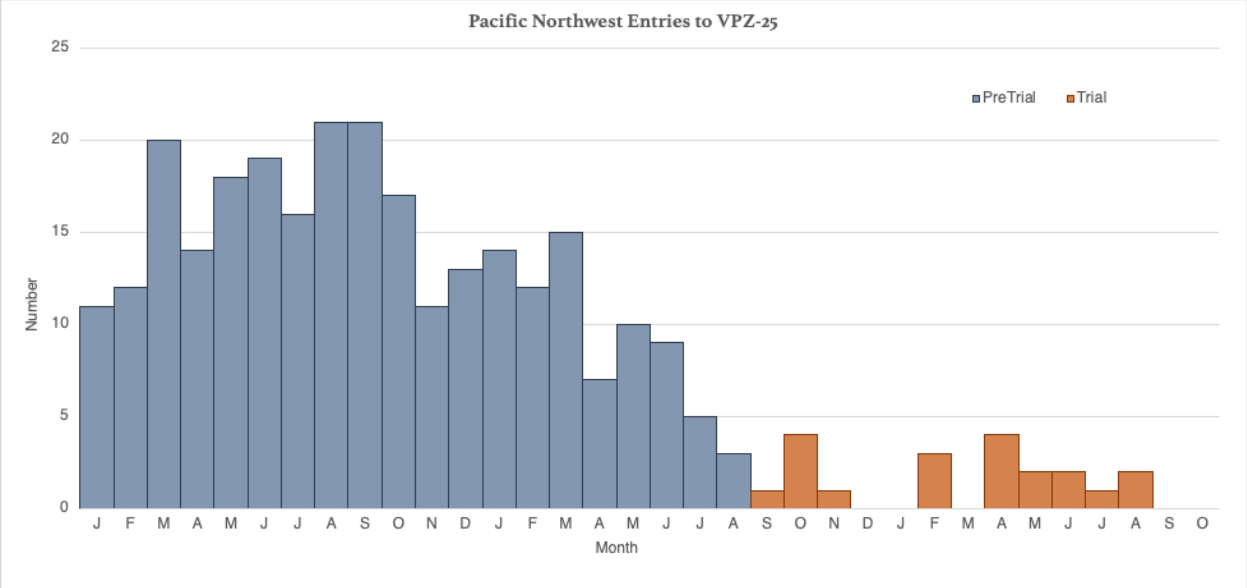


*Figure 8 – Pacific Northwest trade entries into the VPZ-25 by month (January 2019–October 2021)*

### *Northern BC Trade*

In the pre-trial period, 35% of tracks associated with the Northern BC trade entered the area that would become the VPZ. This dropped to 28% during the trial. See Table 5. Most of the entrances to the VPZ were made by vessels crossing the northwestern corner of the VPZ (Figure 9). Figure 10 shows the count by month.

| Table 5 - Northern BC trade behavior relative to VPZ, pre-trial and trial | | |
|---|---|---|
| **Measure of Vessel Tracks** | **Pre-trial** (Jan 1, 2019–Aug 30, 2020) | **Trial** (Sep 1, 2020–Oct 31, 2021) |
| Total tracks in West Haida Gwaii Polygon | 679 | 464 |
| Total tracks entering inside 50 nm | 235 | 130 |
| Monthly avg. entering inside 50 nm | 12 | 9.3 |
| Percent staying *outside* 50 nm | 65% | 72% |

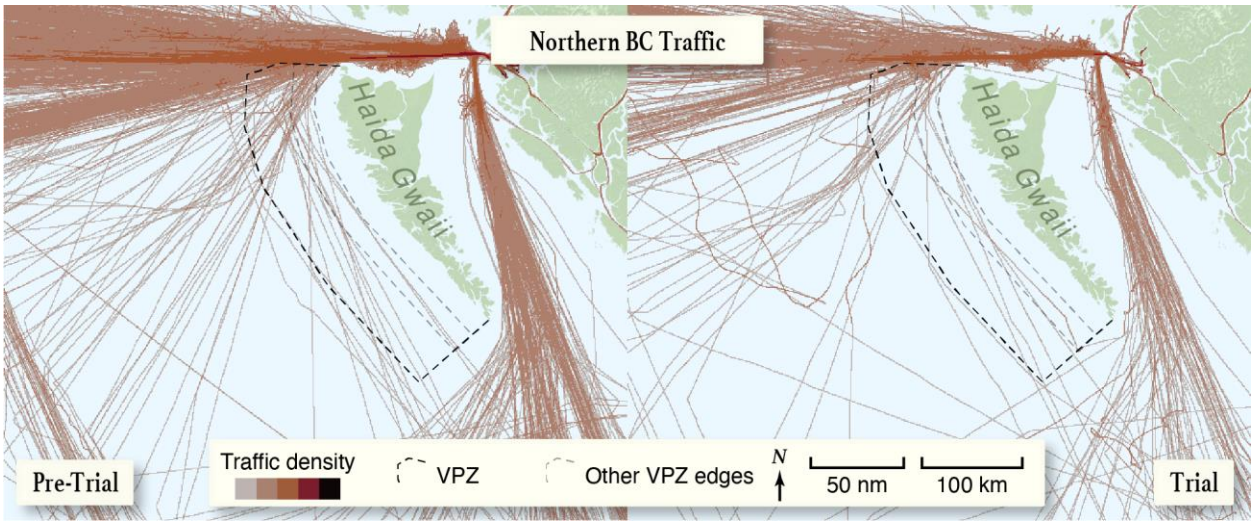


*Figure 9 – Northern BC trade tracks for the pre-trial and trial periods*

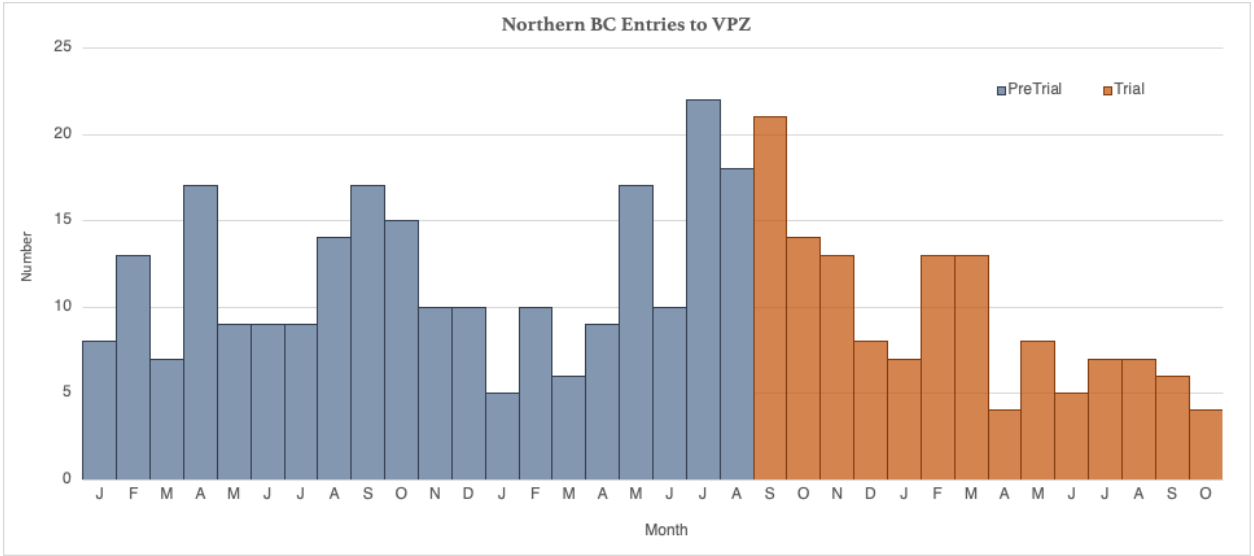


*Figure 10 – Northern BC trade entries into the VPZ by month (January 2019–October 2021)*

### *Great Circle Route Trade*

Much of the Great Circle Route trade normally stays more than 50 nm from Haida Gwaii, even considering the shift discussed in research question #2. In the pre-trial period, 12% of the Great Circle Route trade traffic entered what would become the VPZ, dropping to 7% during the trial. See Table 6 and Figures 11 and 12.

**Table 6 - Great Circle Route trade behavior relative to VPZ, pre-trial and trial**

| Measure of Vessel Tracks | Pre-trial (Jan 1, 2019–Aug 30, 2020) | Trial (Sep 1, 2020–Oct 31, 2021) |
|---|---|---|
| Total tracks in West Haida Gwaii Polygon | 1266 | 1386 |
| Total tracks entering inside 50 nm | 152 | 97 |
| Monthly average entering inside 50 nm | 7.6 | 6.9 |
| Percent staying *outside* 50 nm | 88% | 93% |

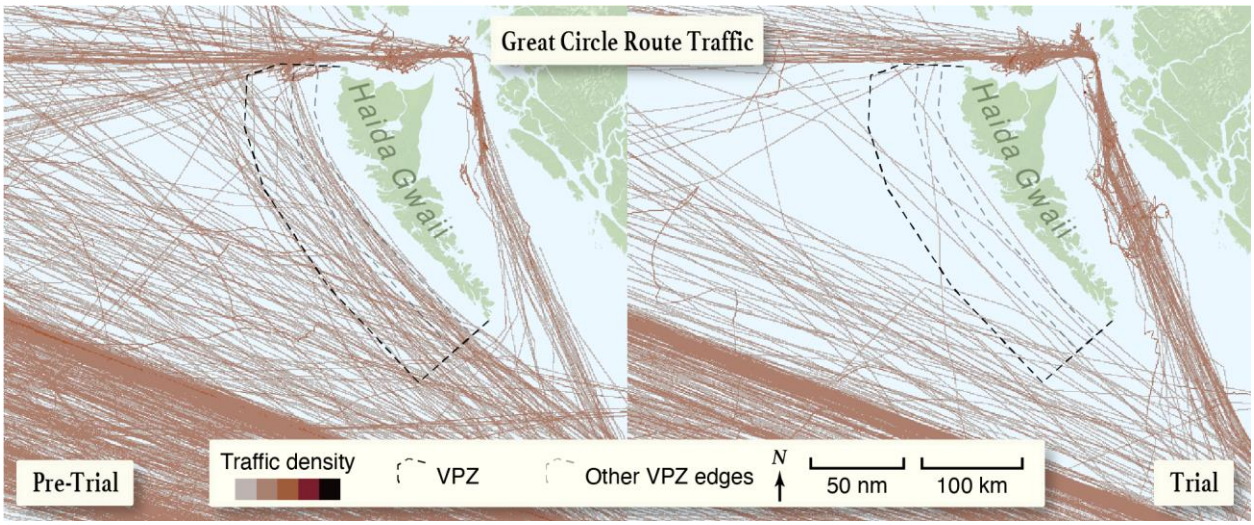


*Figure 11 – Great Circle Route Trade tracks for the pre-trial and trial periods*

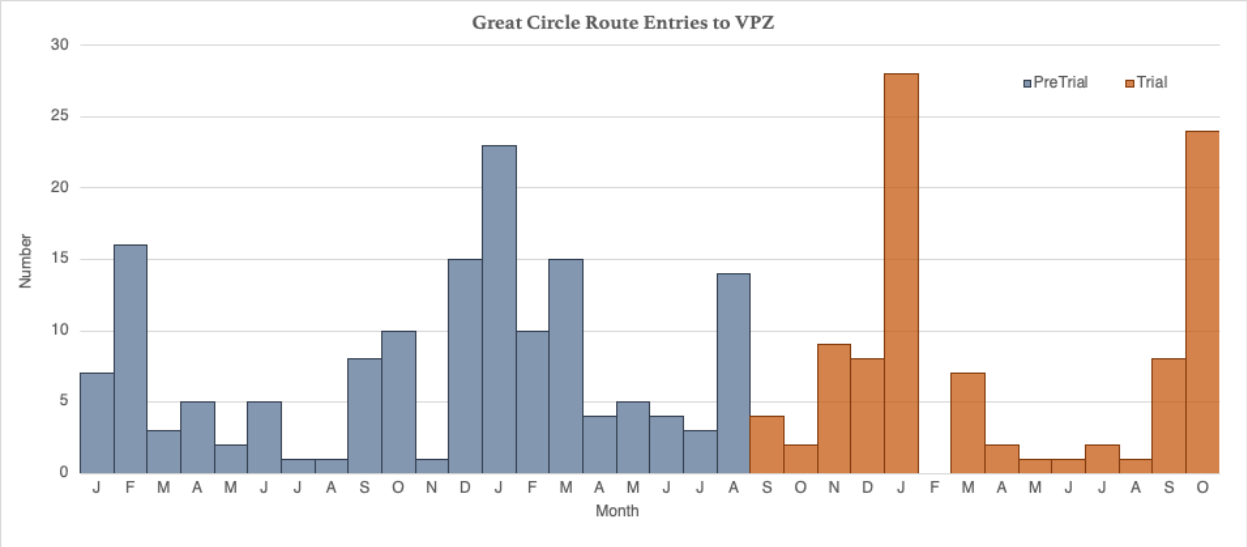


*Figure 12 – GCR trade entries into the VPZ by month (January 2019–October 2021)*

### *Time Spent in the VPZ by Trade during the Trial*

The two cruise ship entries inside the VPZ-12 were very brief, totaling less than 45 minutes each. Within the VPZ-25, Pacific Northwest vessels spent a bit longer, with a few of them spending most of their voyage in the VPZ-25 (Figure 13). Time spent by both Northern BC and GCR traffic within the VPZ is shown in Figure 14.

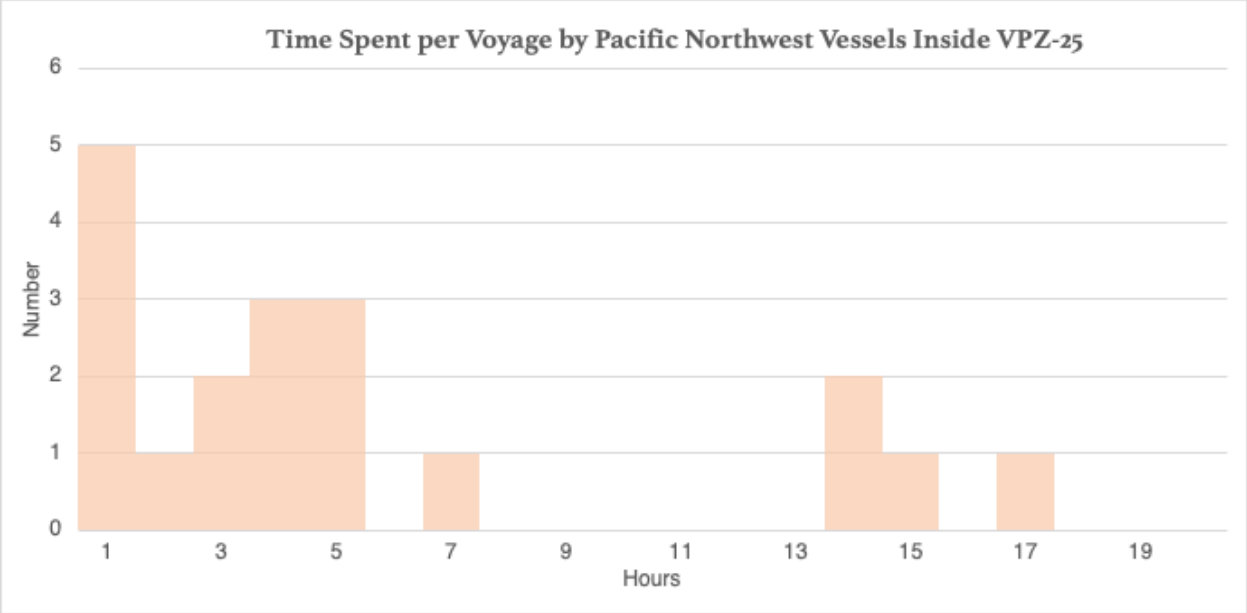


*Figure 13 – Time spent (hours) per Pacific Northwest voyage within VPZ-25 during trial*

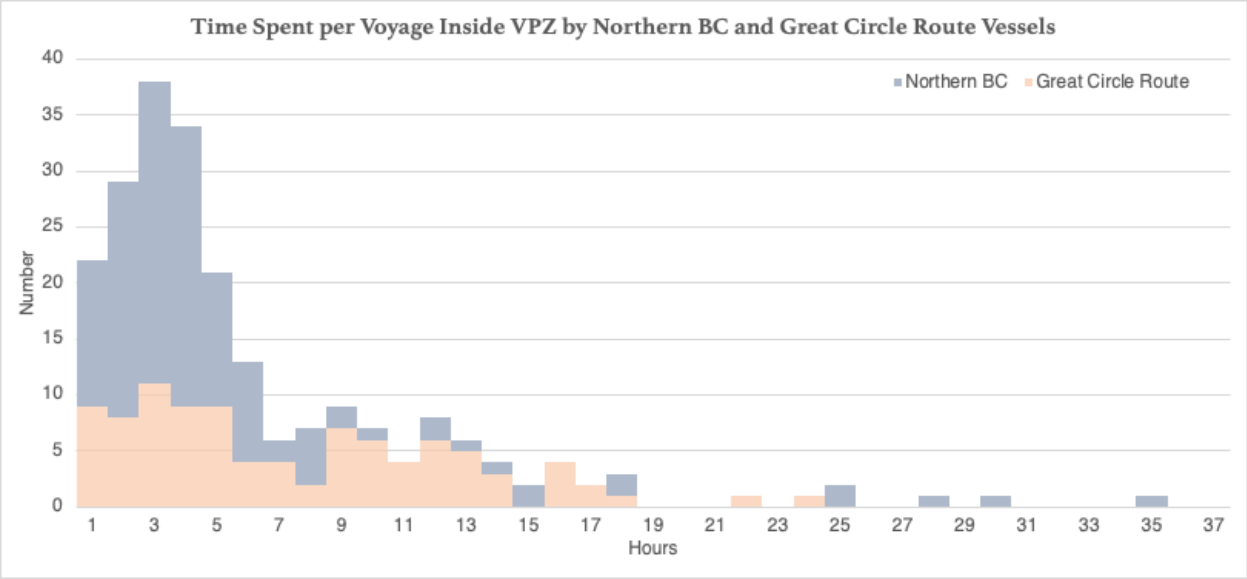


*Figure 14 – Time spent (hours) per Northern BC and GCR voyages within VPZ during trial*

***Frequent flier participation***

Vessels identified as frequent fliers did adjust their behavior relative to the VPZ during the trial. Table 7 shows that while 54% of transits within the relevant VPZ area (by vessel type) were by frequent flier vessels in the pre-trial period, this dropped to just 11%. Of the 28 entries noted, 17 were made by just three individual vessels calling at Prince Rupert that traversed the northern corner of the VPZ.

**Table 7 – Frequent Flier Behaviour Relative to VPZ Pre-Trial and Trial**

| **Measure of Vessel Tracks** | **Pre-Trial** (Jan 1, 2019–Aug 30, 2020) | **Trial** (Sep 1, 2020–Oct 31, 2021) |
|---|---|---|
| **Total vessel entrances to the VPZ areas (adjusted by vessel type)** | 790 | 248 |
| **Number of entrances to VPZ areas by frequent fliers (adjusted by vessel type)** | 425 | 28 |
| **% of total** | **54%** | **11%** |

## Research question #4

***What are the reasons for non-participation in the trial?***

This question is answered based on the vessel operators' responses to Transport Canada's questionnaire about trial participation. Sixty-three responses, received from May 2021–January 7, 2022, were tallied for the trial evaluation.

The questionnaire asked:

1. Were you aware of the VPZ?
2. If yes, why did the ship enter the VPZ?
    - Adverse weather
    - Overriding factors affecting safety of vessel
    - Other factors (convenience, saving fuel, etc.)

Operator responses were tallied as follows:

- 16 of 63 operators reported they were unaware of the VPZ (25% of total respondents)[11]
- Of the 45 that knowingly entered the VPZ:
    - 32 (50% of total respondents) entered to avoid weather
    - 13 (21% of total respondents) cited another reason for entering the VPZ, including: drifting to adjust arrival time at port, a medical emergency, needing to enter to reach the port destination, saving fuel/reducing emissions, taking the shortest route, thinking that the VPZ did not apply to a vessel in innocent passage, and needing to enter Dixon Entrance without going into U.S. waters.

As noted in Section 2, the response about needing to access Dixon Entrance without going into U.S. waters resulted in a change in the northwestern corner of the VPZ during the trial.

## Research question #5

***Did weather conditions affect vessel participation in the VPZ trial?***

In addition to asking vessel operators about their reasons for entering the VPZ during the trial, the project committee sought data about weather conditions in the area of interest to understand whether this affected vessel behaviour.

[11] Two respondents did not answer the question about awareness of the VPZ.

From discussions with weather routing services and industry partners during the development of the VPZ (Nuka Research and CHN, 2020), the project committee understands that vessel routing in the vicinity of Haida Gwaii can be affected by weather conditions on the other side of the Pacific. GCR ships select routes to avoid low pressure systems as far away as the Aleutian Islands or the western Pacific Ocean. Weather avoidance was the most common reason questionnaire respondents gave for entering the VPZ (as discussed for research question #5), and comparison between entries to the VPZ and average wave heights for two locations supports this as well. Two locations were used for this analysis: one location in the vicinity of the SK-B Seamount, just over 100 nm off Haida Gwaii, and a second location 178 nm southwest of the island of Adak in the Aleutian Island chain.

Analysis to respond to this research question used both the AIS data for VPZ entries and modelled weather data as discussed above. From January 2019 to October 2021, the seasonal fluctuations in average weekly wave heights at the two locations were similar. A similar pattern of fluctuations of entries to the VPZ area (noting that there was no VPZ until September 2020) is evident as well. However, as discussed in research question #3, it is also apparent that despite more GCR vessels within the EEZ in 2020 compared to 2019, there were fewer incursions even in the winter months when average wave heights were higher. This may be at least partly explained by a corresponding increase in GCR vessels traveling *east* of Haida Gwaii through Hecate Strait during the winter months. While this was a route GCR vessels sometimes used pre-trial, there is an increase in GCR vessels in Hecate Strait after the IMO 2020 sulphur cap took effect, and a further increase during the trial period.

Figure 15 shows the average weekly wave height at the location off Haida Gwaii, GCR entries to the VPZ, and the portion of all GCR movements in Hecate Strait.

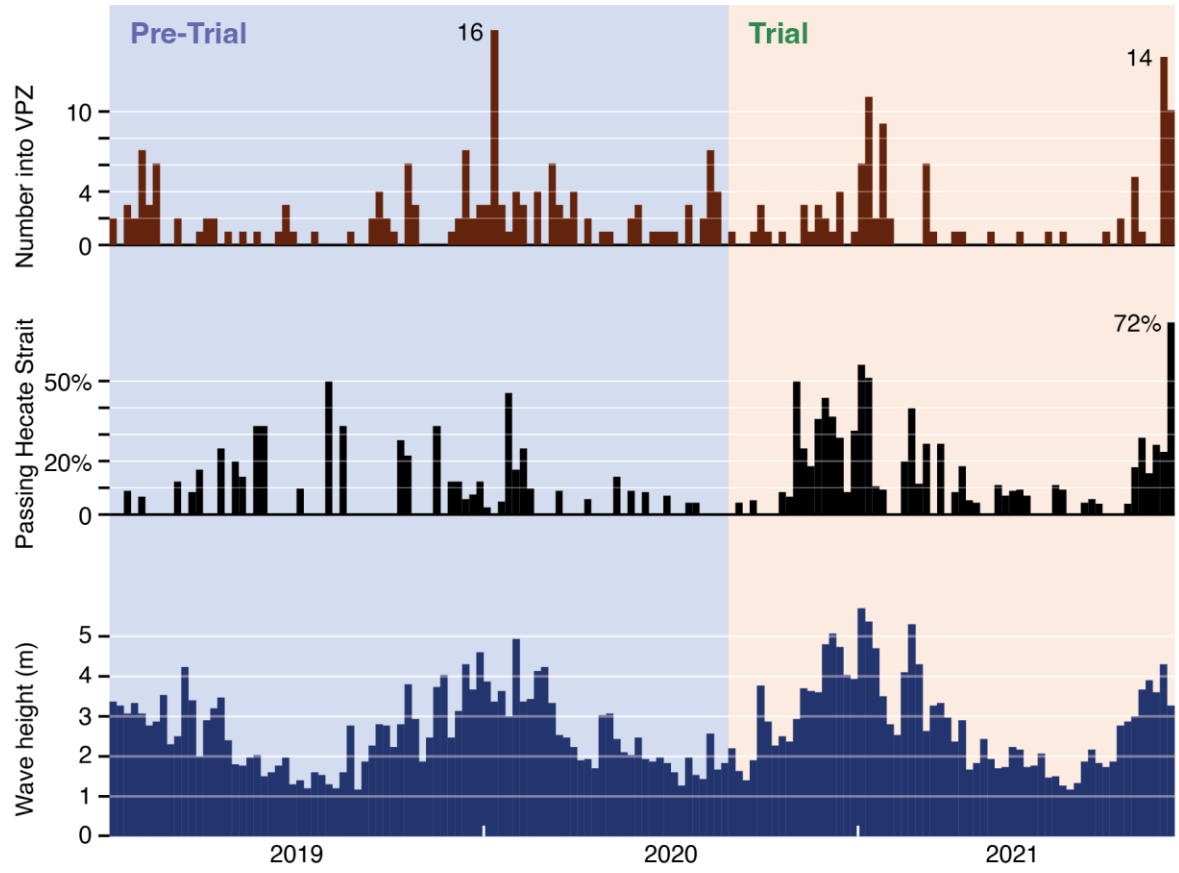


*Figure 15 – Comparison of the number of GCR vessels entering the VPZ, portion of GCR vessels using Hecate Strait (of all GCR vessels identified in the study), and the average weekly wave height off Haida Gwaii, by week for 2019–October 2021*

## Research question #6

***Were unintended consequences observed as a result of the trial (e.g., increases in traffic through Hecate Strait and* SGaan Kinghlas-*Bowie Seamount Marine Protected Area)?***

The project committee was concerned about the potential for unintended consequences resulting from the creation of the VPZ. The concern that asking vessels to stay *out* of an area when going *into* it might be the safest option was alleviated by using an entirely voluntary approach to the VPZ, and by acknowledging that the ship's master is ultimately responsible for safe operations. There were also concerns that vessel traffic might re-route through Hecate Strait, or through the *SGaan Kinghlas*-Bowie Seamount Marine Protected Area (MPA). This question was addressed by counting vessel transits through Hecate Strait using a passage line and counting transits through the MPA.

Table 8 shows the number of transits across Hecate Strait for vessels based on trade. For the purpose of comparison across the 20 months of pre-trial data and 14 months of the trial, the percentage of total transits in the study area is shown.

As already noted in the previous discussion of weather avoidance, there was an increase in GCR transits through Hecate Strait during the trial (September 2020–October 2021) as compared to before the trial (January 2019–August 2020). This is also visible in Figures 10 and 14 above. There were fewer transits through Hecate Strait by Pacific Northwest trade vessels during the trial than in the pre-trial period. Because of the pandemic, the number of cruise ship transits was reduced overall.

**Table 8 - Crossings of Hecate Strait passage line by trade, pre-trial and trial**

| | **Pre-trial** (Jan 1, 2019–Aug 30, 2020) | **Trial** (Sep 1, 2020–Oct 31, 2021) | **Pre-trial %** (Jan 1, 2019–Aug 30, 2020) | **Trial %** (Sep 1, 2020–Oct 31, 2021) | **Difference** |
|---|---|---|---|---|---|
| **Cruise Ship** | 548 | 78 | 58% | 44% | -14% |
| **Pacific Northwest** | 334 | 208 | 28% | 26% | -2% |
| **Northern BC** | 255 | 188 | 17% | 18% | +1% |
| **Great Circle Route** | 54 | 205 | 4% | 13% | +9% |

The *SGaan Kinghlas*-Bowie Seamount is approximately 100 nm off the west coast of Haida Gwaii. An MPA surrounds this important ecological and cultural site.[12] The number of transits into the MPA polygon was counted by trade. There was little change in the percentage of transits through the MPA (compared to overall transits in the study) for GCR or Northern BC vessels. Both trades typically avoid the area. Cruise ships are not included because they do not travel that far offshore in this region. See Table 9.

**Table 9 - Entrances to the *SGaan Kinghlas* - Bowie Seamount MPA, pre-trial and trial**

| **Trade** | **Pre-trial** (Jan 1, 2019–Aug 30, 2020) | **Trial** (Sep 1, 2020–Oct 31, 2021) | **Pre-trial %** (Jan 1, 2019–Aug 30, 2020) | **Trial %** (Sep 1, 2020–Oct 31, 2021) | **Difference** |
|---|---|---|---|---|---|
| Great Circle Route | 33 | 38 | 2% | 2% | 0% |
| Northern BC | 51 | 40 | 3% | 4% | 0% |
| Pacific NW | 291 | 213 | 25% | 27% | +2% |

[12] Council of the Haida Nation and Fisheries and Oceans Canada. (2019). *SGaan Kinghlas* - Bowie Seamount *Gin Siigee Tl'a Damaan Kinggangs Gin K'aalaagangs* Marine Protected Area Management Plan.

## Research question #7

***What were tug and fishing vessel traffic patterns like on the west coast of Haida Gwaii during the trial?***

Although tugs and fishing vessels are excluded from the VPZ trial, the project committee was interested in understanding their presence in the VPZ. It is important to note that many fishing vessels and some tugs do not use AIS, so these data are likely to be less complete than for the larger commercial vessels. However, the same general method was applied to identify vessels of these two types that entered the West Haida Gwaii polygon that was used for the other vessels included in the study. The two figures below show tracks associated with fishing vessels (Figure 16) and fishing vessels (Figure 17) that traveled into the West Haida Gwaii polygon at some point during the trial.

Fishing vessels identified with the AIS dataset entered the West Haida Gwaii polygon 30 times during the trial. Twenty-nine of these entrances were by Canadian-flagged vessels, and one, seen much farther offshore, by a US flagged vessel.

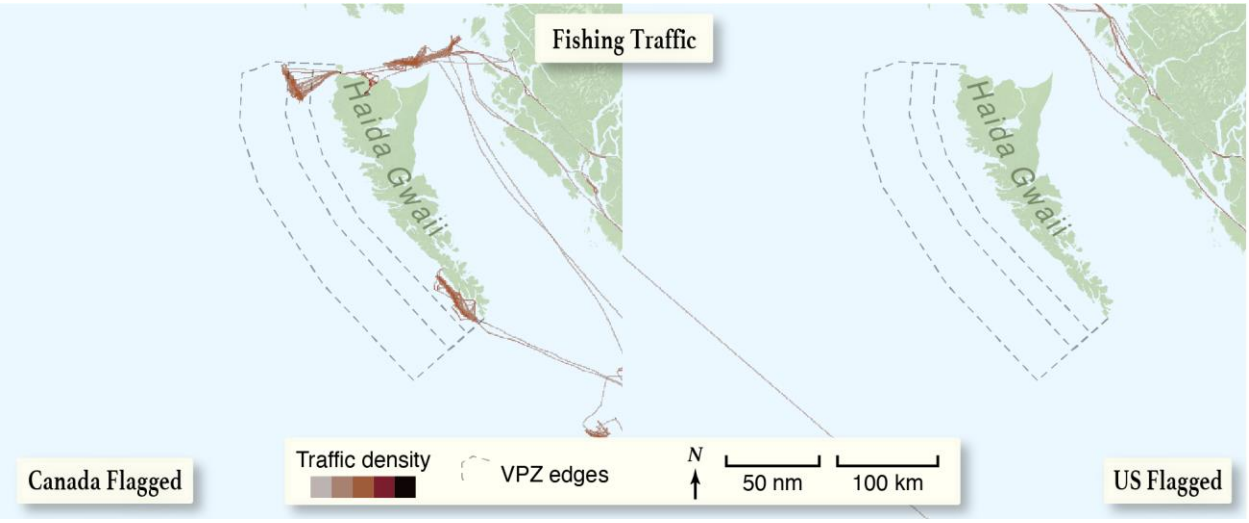


*Figure 16 – Fishing vessels identified by AIS within the study area during the VPZ trial (fishing vessels are excluded from the VPZ)*

US flagged tugs entered the VPZ polygon 15 times during the trial. Of these, 10 entered the VPZ-25 and 6 entered the VPZ-12. Canadian flagged tugs were not counted as they were calling at ports along the west coast of Haida Gwaii, not transiting through.

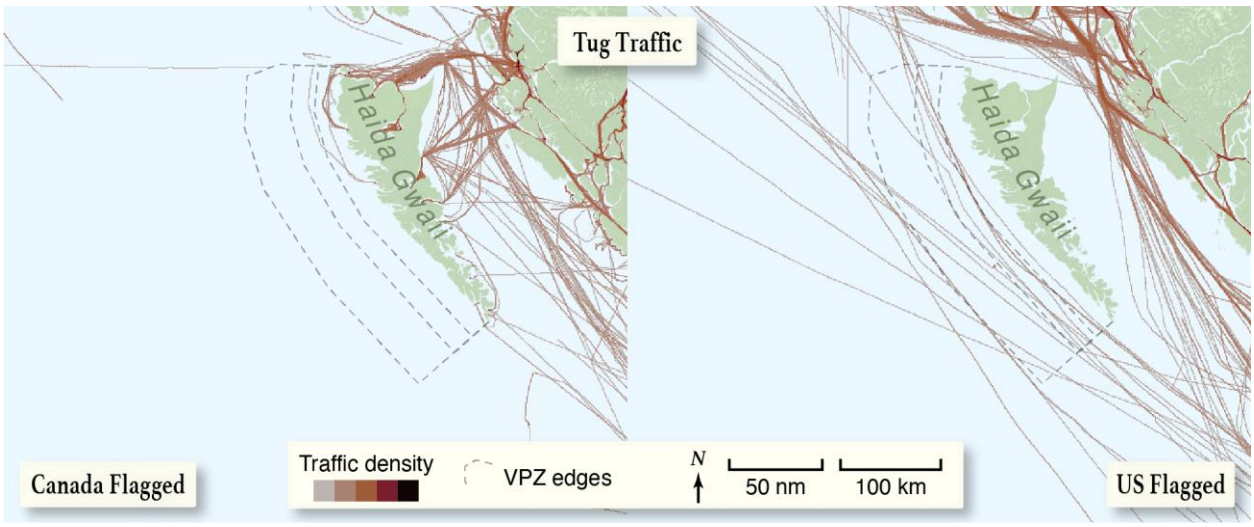


*Figure 17 – Tugs identified by AIS within the study area during the VPZ trial (tugs are excluded from the VPZ)*

# 4 Summary of Findings

***Comparison of commercial vessel traffic between 2016 and 2019–2021***

While commercial vessel traffic activity around Haida Gwaii in 2019 was similar to 2016 activity overall, there were two primary changes observed during 2019–2021:

- Cargo vessel transits increased by 31% from 2019 to 2020 and remained high in 2021.
- Cruise ship transits fell to zero in 2020 due to the pandemic and recovered to roughly 19% of the 2019 level in 2021.

The increase in cargo vessel transits does not necessarily reflect a change in the volume of cargo movements (not all ships moving cargo to BC ports travel into the study area). Instead, it appears to reflect a shift in Great Circle Route voyages that occurred after the IMO 2020 global sulphur cap took effect in January 2020, after which cargo ships in this trade began to use Hecate Strait more often in winter. This shift was even greater in the winter of 2021 after the VPZ trial began.

***Entrances to the VPZ***

Vessels in all trades reduced entrances into the VPZ during the trial as compared to the months immediately pre-trial. This is shown in Figure 18, which contrasts the percentage of voyages that entered the VPZ area (or, for the pre-trial baseline, the area that would become the VPZ) as compared to the total number of voyages for a particular trade off the west coast of Haida Gwaii. Cruise ships showed the most pronounced change, with just 2% of voyages entering the VPZ-12 during the trial for a total of just 45 minutes. Pacific Northwest trade vessels also made a significant change, reducing to just 4% of voyages entering the VPZ-25.

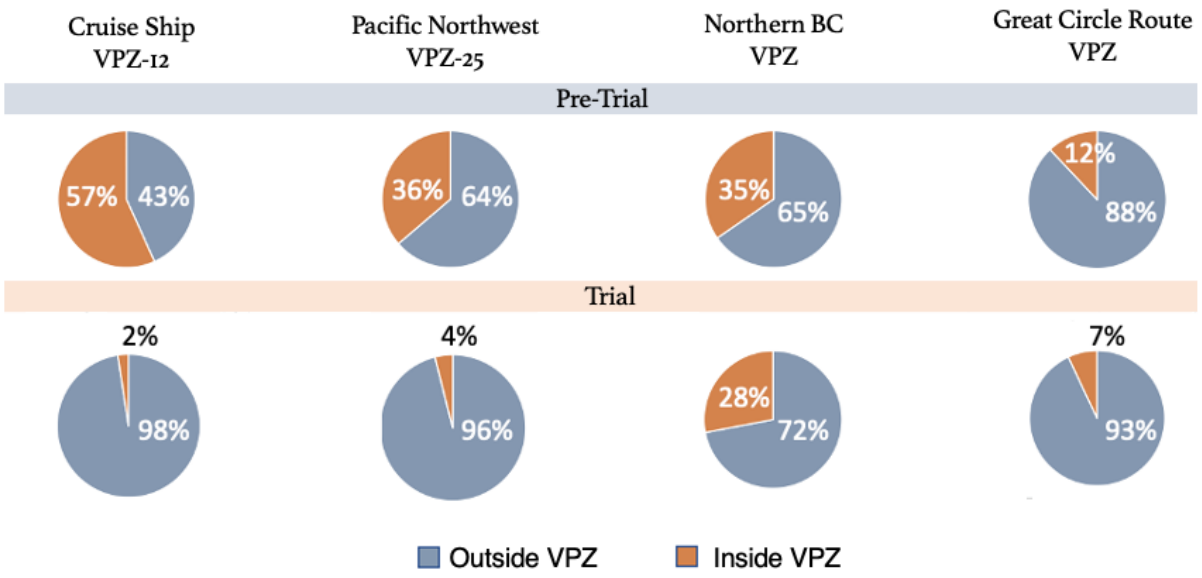


*Figure 18 – Comparison of entries into the VPZ (or area that would become the VPZ) by trade*

***Reasons vessels enter the VPZ***

Based on survey responses and an examination of wave height data, it appears that if a vessel entered the VPZ most likely did so to avoid bad weather. When wave heights were higher off the coast of Haida Gwaii, vessels on the Great Circle Route were more likely to enter the VPZ or go through Hecate Strait.

***Potential for unintended consequences of the trial***

The possibility that the VPZ would push vessels into the SK-B MPA or into Hecate Strait was acknowledged in the discussions about developing the VPZ trial. While there was essentially no change to transits of the SK-B MPA, there was an increase in transits through Hecate Strait – particularly in bad weather. This shift appears to have started at the onset of the IMO global sulphur cap and continued, with a slight increase, during the VPZ trial. This can continue to be monitored, particularly during the winter.

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