2020 Emergency Towing Vessel Monitoring Report

November 2021

(Credit: Alex McCluskey)

Prepared by:
Nuka Research and Planning Group for the
Proactive Vessel Management Pilot Project on Haida Gwaii Project Committee

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1 INTRODUCTION

This Emergency Towing Vessel (ETV) monitoring report was prepared by Nuka Research and Planning Group for the Proactive Vessel Management (PVM) pilot project on Haida Gwaii project committee, consisting of the Council of the Haida Nation (CHN), Transport Canada (TC), and the maritime shipping industry. The 14-month trial Voluntary Protection Zone (VPZ) for shipping on the west coast of Haida Gwaii is an outcome of the PVM pilot project on Haida Gwaii, as part of the umbrella PVM initiative under Canada's Oceans Protection Plan. The PVM project committee identified the need to better understand ETV operations in relation to the VPZ as part of trial monitoring considerations and related discussions for improving the marine safety system.

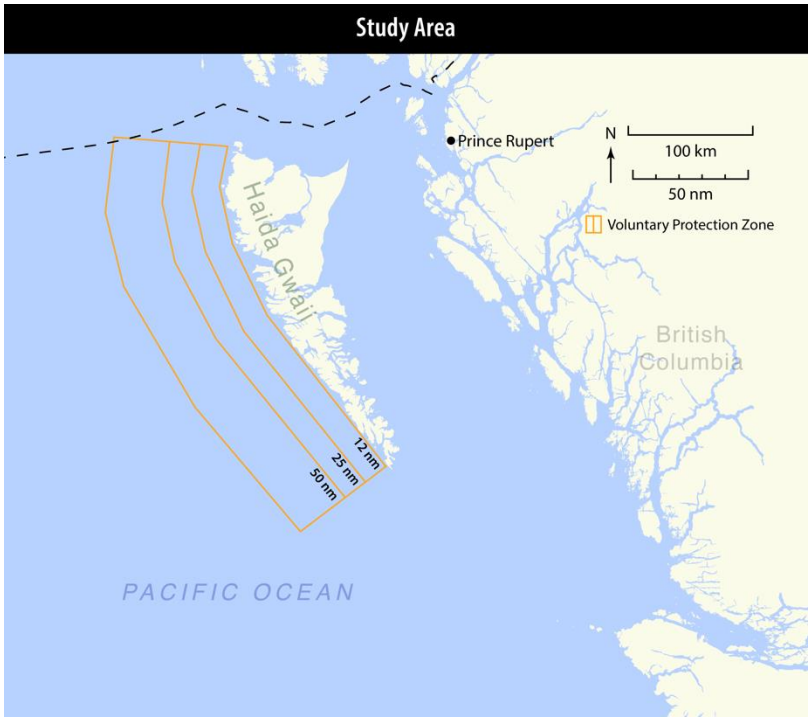

Figure 1. Study area and Voluntary Protection Zones (VPZ)

An ETV can intervene in a potential drift grounding incident by taking a disabled vessel into tow. This can reduce the risk of groundings, pollution incidents, loss of vessels and cargo, and loss of life. This report analyzes the locations of the two ETVs leased by the Canadian Coast Guard (CCG), Atlantic Raven and Atlantic Eagle, in relation to vessels approaching (within 75 nm) or entering the VPZ to estimate response readiness (e.g., whether the vessel is in crew change) by recording ETV positioning, distance from the vessel, and weather/sea state to estimate time to respond if an incident were to develop. This information may be used to inform consideration of trial results and development of long-term measures, including Canada's National Strategy on Emergency Towing (NSET).

This report uses Automatic Identification System (AIS) data on ETV movements provided by exactEarth and the Enhanced Maritime Situational Awareness (EMSA) system.

2 OBJECTIVE AND RESEARCH QUESTIONS

The objective of this analysis is to understand the activities and locations of the two ETVs in 2020 and determine, based on that year, how quickly they may respond to a drifting vessel in the Voluntary Protection Zones (VPZ) off Haida Gwaii. This report answers the following research questions:

1. Where did the ETVs travel in 2020?
2. How much time did the ETVs spend in each operation area?
3. How much time did the ETVs spend in each sub-area?

4. How much time did the ETVs spend in port?
5. How much time did the ETVs spend underway patrolling vs. stopped?
6. What were the average and maximum speeds of the ETVs when underway (patrolling vs. going to rescue)?
7. How long could it take the ETVs to get to a disabled vessel in the Voluntary Protection Zone near Haida Gwaii?
8. How much is ETV speed reduced as the sea state worsens?
9. How many times were the ETVs dispatched, and what were the outcomes?

3 BACKGROUND

As part of the Ocean Protections Plan (OPP), the CCG leased two ETVs for deployment on the west coast of Canada as an interim measure to increase capacity while the NSET is being developed. Both high-powered ETVs, the Atlantic Eagle and Atlantic Raven, arrived in Victoria, BC, in late 2018. These sister ships have the following characteristics in common:

- Length: 68 m
- Breadth: 18 m
- Draft: 6.4 m
- Gross Tonnage: 2,981
- Horsepower: 14,000 BHP
- Maximum Speed: 17 knots

CCG Victoria operates the ETVs, including determining their day-to-day tasking. The ETVs patrol the coastal waters and may be involved in training and other incidental duties but always remain on-call for dispatch to a rescue incident. Generally, one ETV patrols the CCG's Northern Area of Responsibility (AOR), and one patrols the Southern AOR. When dispatched to a rescue incident, the ETVs are tasked by the Joint Rescue Coordination Center Victoria which coordinates all actions associated with the incident.[1]

Figure 2. Atlantic Eagle, one of two ETVs chartered by the Canadian Coast Guard (credit: Alex McCluskey)

[1] Colin Henthorne, CCG Western Region, Senior Fleet Officer Ashore, personal communication, March 2021.

4 METHODS

Transport Canada provided Automatic Identification System (AIS) data for the two ETVs for the time period of September 1, 2019, to December 31, 2020. AIS data consists of information about the vessel's identification and location transmitted on a regular basis. These data were processed to develop tracks that represent the vessels' movements. Tracks are interrupted when the vessel stops moving, such as when it is tied to a dock or at anchor. Track data were analyzed to show where a vessel traveled. Geo-fences were also established as lines or polygons. Tracks were analyzed against these geo-fences to note passages across or through them and time spent inside. Only data from 2020 are presented in this report.

5 RESULTS

This section presents the results of the analysis conducted to answer each of the research questions.

5.1 Where did the ETVs travel in 2020?

Figure 3 provides a general sense of where the ETVs spent time in 2020, depicting both the vessel routes in grey and cells where an ETV was present more than 1% and less than 10% of the time, or more than 10% but less than 35%. Areas, where there are no cell colors, indicate that an ETV was present ≤ 1% of the time. The maximum time spent in one of the dark orange cells was 33% in the northern cell near Prince Rupert. The other orange cell near Victoria contained an ETV 12% of the time.

Figure 3. Distribution of ETV presence in western Pacific waters, 2020

5.2 How much time did the ETVs spend in each Area of Responsibility?

Figure 4 shows the North and South AORs that CCG identified for ETV operations. Table 1 indicates the percentage of time in 2020 that each ETV spent in each of the two AORs. Note that the total number of operating days for two vessels for the year is 730, and the table only accounts for 707.7 days. This is because the program calculates time in an area based when a vessel enters and exits from an area. So, the times in the first and last areas of the year are not calculated. Overall, there was an ETV in the Northern AOR 82% of the time in 2020 and in the Southern AOR 100%.

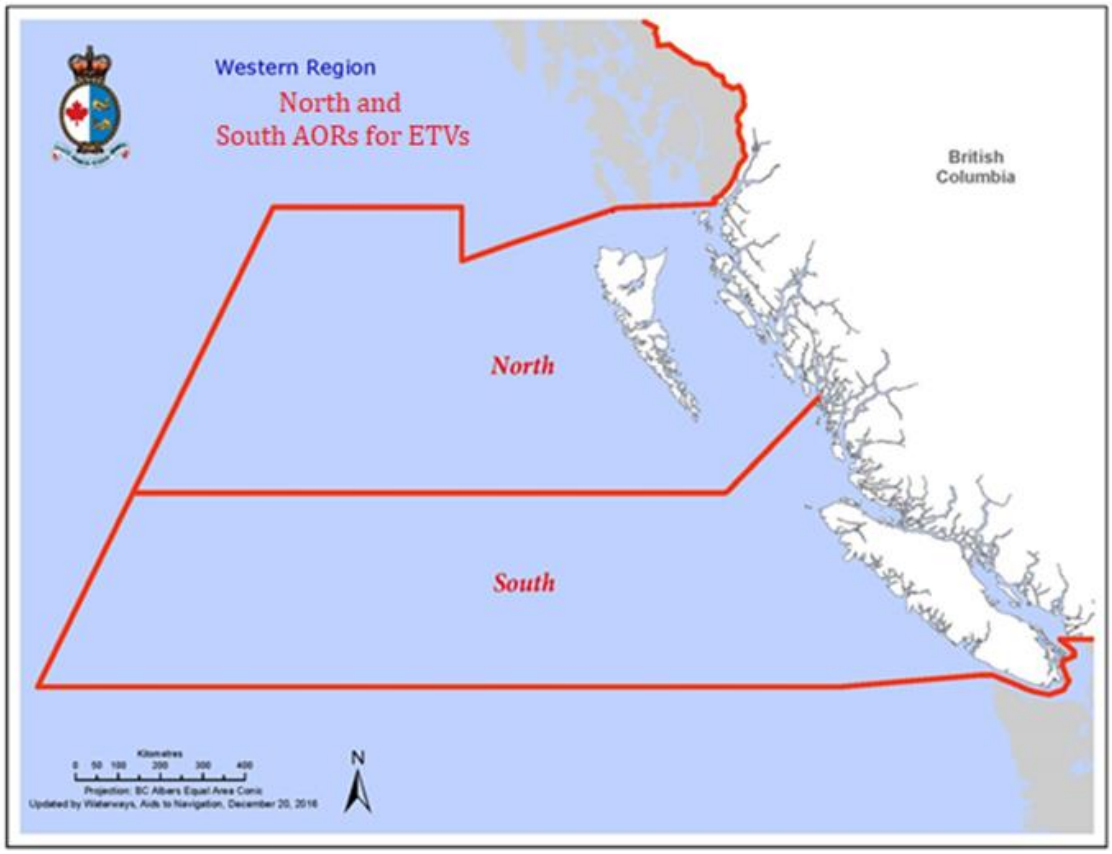

Figure 4. CCG Areas of Responsibility for ETVs

Table 1. Percentage of time in 2020 that each ETV spent in each AOR (individually and combined)

Area	Atlantic Eagle		Atlantic Raven		Both	
	Days	Percentage	Days	Percentage	Days	Percentage
North	174.5	50%	123.2	34%	297.7	42%
South	175.9	50%	234.2	66%	410.1	58%
Total	350.4	100%	357.3	100%	707.7	100%

5.3 How much time did the ETVs spend in each sub-area?

For this question, the AORs were subdivided to look at more specific areas as depicted in Figure 5, which shows the total percentage of 2020 that an ETV was identified as being in each sub-area. The Northern AOR was divided into Dixon Entrance, Hecate Strait, Prince Rupert, and West Haida Gwaii Offshore. The Southern AOR was divided into Queen Charlotte Sound, Queen Charlotte Strait, Strait of Georgia, Strait of Juan de Fuca, Vancouver Island Nearshore,[2] and Vancouver Island Offshore. Table 2 presents the information for the individual ETVs as well as the two combined. In the Northern AOR, the ETVs spent the most time in the Prince Rupert sub-area (20.9%) and the least time in the West Haida Gwaii Offshore (0.1%). In the Southern AOR, the ETVs spent the most time in the Vancouver Island Nearshore sub-area (27.4%) and the least time in the Vancouver Island Offshore (0.4%).

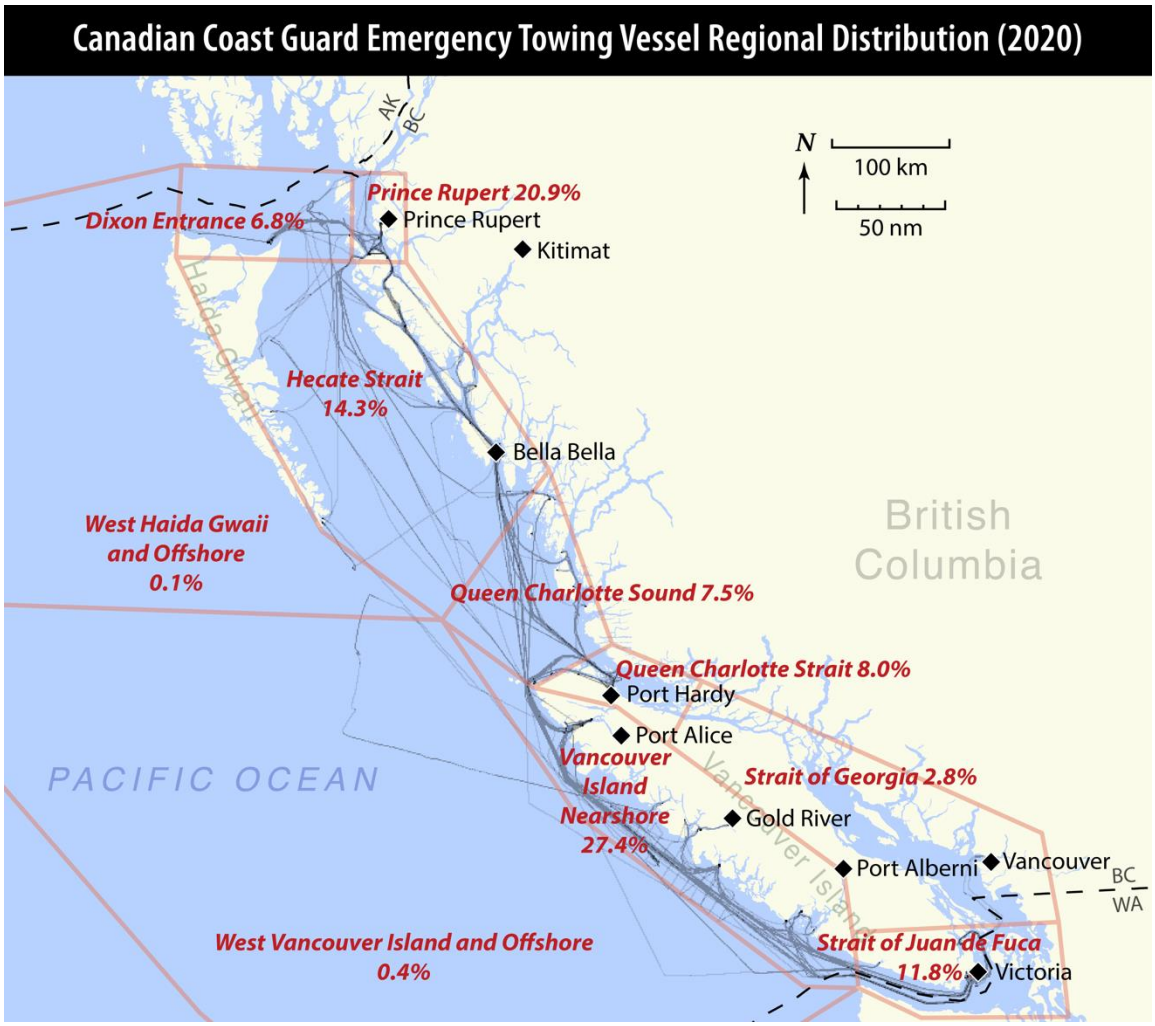

Figure 5. Total percentage of time in 2020 that the ETVs spent in each sub-area

[2] Within ~ 12 nautical miles of the coast

Table 2. Percentage of time in 2020 that each ETV spent in each sub-area (individually and combined)

Sub-Area	Atlantic Eagle		Atlantic Raven		Both	
	Days	Percentage	Days	Percentage	Days	Percentage
Northern AOR						
Dixon	32.1	9.1%	16.1	4.5%	48.2	6.8%
Haida Gwaii Offshore		0.0%	0.6	0.2%	0.6	0.1%
Hecate	40.2	11.5%	61.0	17.1%	101.2	14.3%
Prince Rupert	102.3	29.2%	45.5	12.7%	147.8	20.9%
Southern AOR						
Queen Charlotte Sound	25.9	7.4%	27.5	7.7%	53.4	7.5%
Queen Charlotte Strait	14.5	4.1%	41.8	11.7%	56.3	8.0%
Strait of Georgia	20.1	5.7%		0.0%	20.1	2.8%
Strait of Juan de Fuca	38.0	10.9%	45.3	12.7%	83.3	11.8%
Vancouver Is Offshore	1.6	0.5%	1.6	0.4%	3.2	0.4%
Vancouver Island Nearshore	75.8	21.6%	118.0	33.0%	193.8	27.4%
Total	350.4	100.0%	357.3	100.0%	707.7	100.0%

5.4 How much time did the ETVs spend in port?

ETVs spent time in four main ports: Prince Rupert, Port Hardy, Sidney, and Victoria. Figure 6 shows the key ports and tracks between them. Table 3 shows the amount of time each ETV spent in each of these ports. The most time was spent in Victoria (just over 15 and 21 days for the Atlantic Eagle and Atlantic Raven, respectively). Overall, the ETVs spent 12.6% of the time in a port. Both vessels spent far more time underway or at anchor than in port.

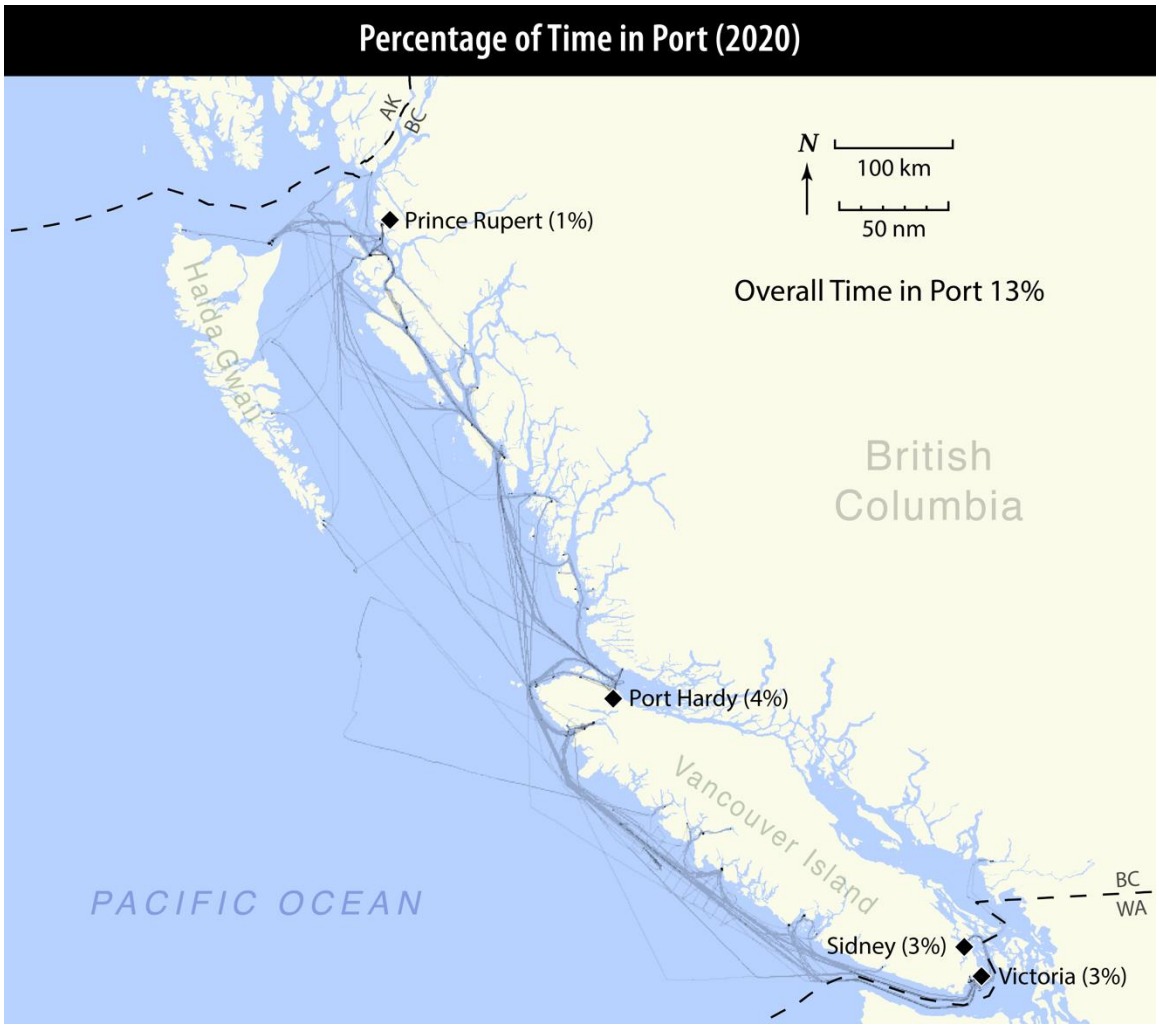

Figure 6. Key ports and routes used by the ETVs in 2020

Table 3. Number of days spent in each of the four key ports used by the ETV in 2020 (individually and combined)

Port	Atlantic Eagle		Atlantic Raven		Both	
	Days	Percentage	Days	Percentage	Days	Percentage
Port Hardy	4.9	1.4%	20.9	5.9%	25.8	3.6%
Prince Rupert Port	3.0	0.9%	6.4	1.8%	9.5	1.3%
Sidney	8.9	2.5%	8.6	2.4%	17.5	2.5%
Victoria	15.4	4.4%	21.2	5.9%	36.5	5.2%
Total	32.1	9.2%	57.1	16.0%	89.2	12.6%

5.5 How much time did the ETVs spend underway patrolling vs. stopped?

By examining vessel tracks, anchorages can be identified. Figure 3 shows the locations of primary and secondary anchorages used by the ETVs during 2020. Primary anchorages are locations used by an ETV to anchor more than 8 times in 2020. Secondary anchorages were used less frequently. The figure reveals that, generally, ETV anchorages were widely distributed around the region. However, no anchorages were used on the west coast of Haida Gwaii.

The computer code can identify when a vessel is underway (not anchored or docked) versus when it is stopped (anchored or at a dock)[3]. While the ETVs did not spend much time in a port (as shown above in Table 3), they did spend more time stopped (either at anchor or tied to a dock) than underway. The breakdown on time stopped vs. underway was similar for each ETV, with both underway about 37% of the time stopped about 63% of the time, as shown in Table 4. This equates to the vessel underway about 9 hours a day and stopped about 15 hours a day.

Table 4. Percentage of 2020 spent underway vs stopped for each ETV and combined

Status	Atlantic Eagle		Atlantic Raven		Both	
	Days	Percentage	Days	Percentage	Days	Percentage
Underway	128.4	36%	133.8	38%	262.2	37%
Stopped	225.9	64%	215.8	62%	441.7	63%
Both	354.3	100%	349.6	100%	703.9	100%

5.6 What were the ETVs' average and maximum speeds when underway (patrolling vs. going to rescue)?

The maximum speed of each of the ETVs is listed as 17 knots in the vessel specifications. Vessel speed can be derived in two ways. First, each vessel periodically broadcasts its speed over ground taken from the vessel's onboard GPS. This speed data is logged along with the vessel's position. Only speeds associated with tracks where the vessel was considered to be underway were considered for this method. Secondly the speed over ground can be calculated by calculating the distance between and two successive locations as reported by AIS and dividing by the time it took to move that distance. This method is useful for obtaining maximum speed because it is not an instantaneous measurement, but rather a measurement over a distance. For this analysis the average speed was calculated using the first method and the maximum speed was calculated using the second method. Table 5 shows the average and maximum speeds calculated for each vessel based on the AIS data. These speeds are reflective of speeds the vessels travel while patrolling. Both vessels' maximum speed was about 15 knots, which matches well with their specifications. The average speeds were also approximately 8 knots, which is a fuel-efficient cruising speed for this type of vessel.

[3] The code considers a vessel stopped if its speed is less than 0.1 knots and it moves less than 2 nm for a period of time longer than 1 hour.

Table 5. Average and maximum speeds of the Atlantic Eagle and Atlantic Raven

Speed Over Ground	Atlantic Eagle	Atlantic Raven
	Knots	Knots
Maximum	15.2	14.6
Average	8.3	8.2

An ETV's speed while going to a rescue varies considerably based on a number of factors, such as the assessed urgency of the situation, navigational risks along the route, and the weather and ocean conditions. In calm conditions, without any navigational hazards and an urgent time-dependent situation, the ETVs would likely travel in the 15-17 knot range. However, as the sea state and wind increase, the maximum speed diminishes (as discussed below). If the ETV has to navigate through a constricted waterway, shoal waters, or uncharted waters, the prudent mariner will reduce speed to a speed that is safe given the circumstance. If the disabled vessel is a considerable distance offshore and not in immediate danger, the ETV master may choose to run at less than maximum speed to prevent damage to the vessel or crew.

5.7 How long could it take the ETV to reach a disabled vessel in the Voluntary Protection Zone near Haida Gwaii?

To answer this question, one must know where the ETV starts from, the destination, what route it will take, and the speed it will travel while en route. We took the approach of trying to estimate a range of transit times that might be representative of typical times give a variety of start locations, destinations, and speeds. Figure 7 shows the eight start locations selected, including two ports, four primary anchorages, and two secondary anchorages close to Haida Gwaii. Four locations were selected as destinations as potential places to intercept a drifting vessel. These destinations are all close to the shoreline because, in a worst-case scenario, the ETV would be racing to meet a drifting vessel before it reaches a grounding point along the shore. Distances were calculated from each start location to each destination along the shortest safe route (see Table 6). Three travel times were calculated for each route using a fast speed of 15 knots, a mid-speed of 10 knots, and a slow speed of 7 knots to bracket a range of likely speeds. Figure 8 shows the results of these calculated times as a bar ranging across the fast, mid, and slow estimates for each destination from each start location.

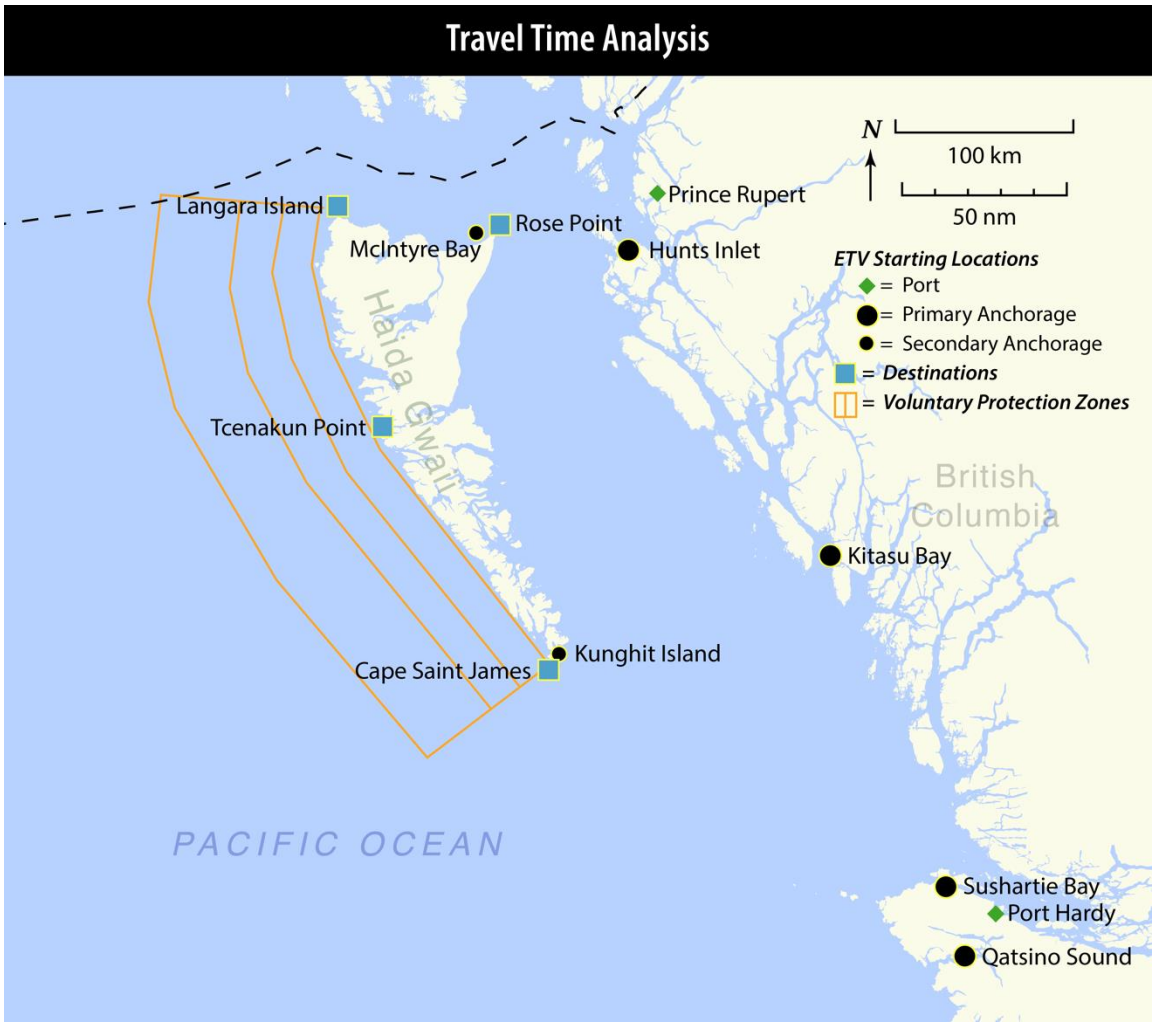

Figure 7. ETV start locations and destinations used to analyze potential travel times to the VPZ near Haida Gwaii.

Table 6. Distances from ETV start locations to selected destinations along the Haida Gwaii coast.

Start Location	Distance to Destination (nm)			
	Rose Pt	Langara Is	Cape St James	Tcenakun Pt
Prince Rupert	53	106	160	180
Hunts Inlet	42	95	140	169
Kitasu Bay	145	199	93	193
Port Hardy	263	316	150	250
Sushartie Bay	246	300	131	231
Qatsino Sound	283	330	156	257
McIntyre Bay	10	46	156	120
Kunghit Island	139	193	10	108

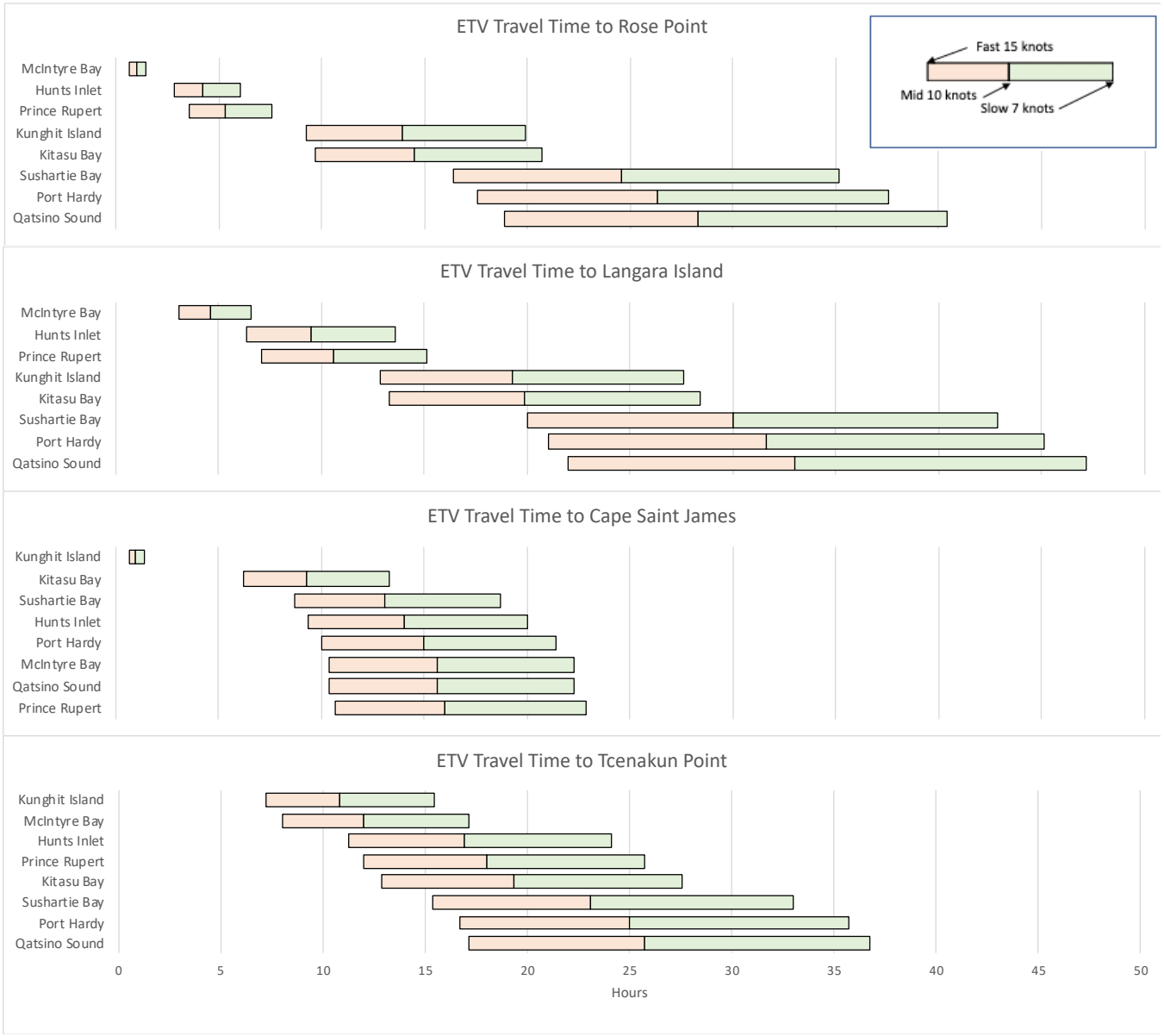

Figure 8. Fast, middle, and slow travel times between ERV start locations and selected destinations along the Haida Gwaii Coast

Travel times range from less than an hour for an ETV starting at Kunghit Island traveling to Cape Saint James at 15 knots to almost 4 days (47 hours) for an ETV starting at Quatsino Sound traveling to Langara Island at 7 knots. An ETV starting at Hunts Inlet or Prince Rupert would take between 6 and 15 hours to get to Langara Island. An ETV starting at Hunts Inlet, Prince Rupert, Port Hardy, or Quatsino Sound would take between 9 and 23 hours to get to Cape Saint James, but an ETV starting in Kitasu Bay could arrive faster in 6 to 20 hours.

Tcenakun Point is mid-island on the outer coast of Haida Gwaii. It represents a good example for planning purposes to estimate travel time. In order to make a successful rescue tow, an ETV must

intercept the drifting vessel before it reaches the shoreline. This example offers a challenging place for an ETV to reach given their typical distribution, as shown in Figure 3. ETVs traveling to Tcenakun Point from starting locations in the Northern AOR where ETVs are typically found[4] would take from 12 to 28 hours based on start location and speed. The 12 hours is for a 15-knot speed starting from Hunts Inlet. The 28 hours is for a 7-knot speed starting from Kitasu Bay. The mid-time when travel at 10 knots from these start locations is approximately 18 hours.

Additional calculations were undertaken to estimate the amount of time it would take to get to any point in the VPZ once an ETV reached either Langara Island or Cape Saint James. At the fast speed of 15 knots, the additional time could be up to 14 hours. At the mid-speed of 10 knots, the additional time could be up to 22 hours. At the slow speed of 7 knots, the additional time could be 31 hours.

5.8 How much is ETV speed reduced as the sea state worsens?

As the sea state increases, the maximum speed of any vessel will be diminished, but circumstances will determine the extent of the speed reduction. Steep seas with short period waves (such as often occur in Hecate Strait) will hamper a vessel's speed more than large swells with a long wave period. The direction of the sea relative to the direction of travel is also important. Running into a sea or traveling in a beam sea will reduce boat speed more than running with the sea. Crew safety is another consideration when the motion of the vessel becomes severe. Even in vessels the type and size of the Atlantic Eagle and Atlantic Raven, it is possible that no headway will be made in extreme sea states such as could be generated by hurricane-force winds. Generally, the range of speeds considered in the travel time analysis (7 to 15 knots) would be typical of the range of speed expected for these ETVs under the expected conditions of sea state in these waters.

5.9 How many times were the ETVs dispatched, and what were the outcomes?

CCG provided the following summary of the times since the inception of the program that the ETVs were dispatched to assist other vessels or participate in a search and rescue.

<u>Summary of significant taskings (by both ETVs):</u>

- Foreign-going cargo ships:
  - Stood by disabled ships: 6
  - Escorted ships with mechanical trouble: 2
  - Towed: 1
- Tugs:
  - Stood by disabled tugs: 2
  - Rescued crew from sinking tug: 1
  - Towed tug and barge: 1
- Divers:
  - Rescued diver: 1

[4] Hunts Inlet, Price Rupert, and Kitasu Bay

- Fishing vessels (coastal):
    - Rescued crew from vessel on fire: 1
    - Towed fishing vessels: 6
- Coastal vessels, other:
    - Escort: 1
    - Rescue: 1
- Yachts:
    - Towed: 1
    - Rescued yacht taking on water: 1
- Deep-sea trawlers:
    - Towed: 5
- Man overboard search: 2
- Medevacs: 5
- Mechanical assistance: 1

- Grounding: 1

In all, the ETVs were dispatched for assistance 39 times since their deployment in November 2018.

5.9.1 Wooyang Venus disabled in Dixon Entrance November 2020

On November 13th, 2020, the 229 m bulk carrier Wooyang Venus was inbound through Dixon Entrance. The ETV Atlantic Eagle had departed her anchorage at Hunt's Inlet at 18:21 hours and was underway headed south at 8 knots in Hecate Strait 45 nm away. At 23:20, the Atlantic Eagle turned north and proceed to the Wooyang Venus location at speeds of 13 - 14 knots. The Atlantic Eagle arrived in the vicinity of the Wooyang Venus at about 03:00 on November 14th. Figure 9 shows the AIS movement of the vessels on a small scale, and Figure 10 shows the maneuvering on a large scale as they came together. The Wooyang Venus appeared to drift intermittently and, at other times, maneuver. The Atlantic Eagle escorted the Wooyang Venus to an anchorage on the west side of Prescott Island, arriving about 23:27 on November 14th.

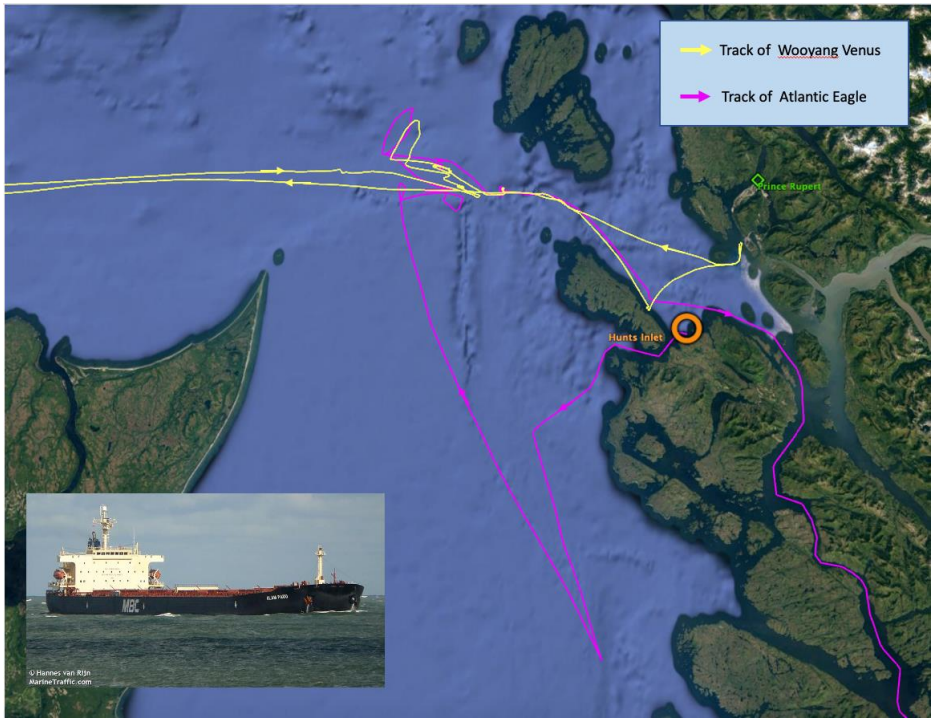

Figure 9. Tracks of the ETV Atlantic Eagle and the bulk carrier Wooyang Venus between November 13th and 17th 2020. Photo credit Hannes van Rijn MarineTraffic.com

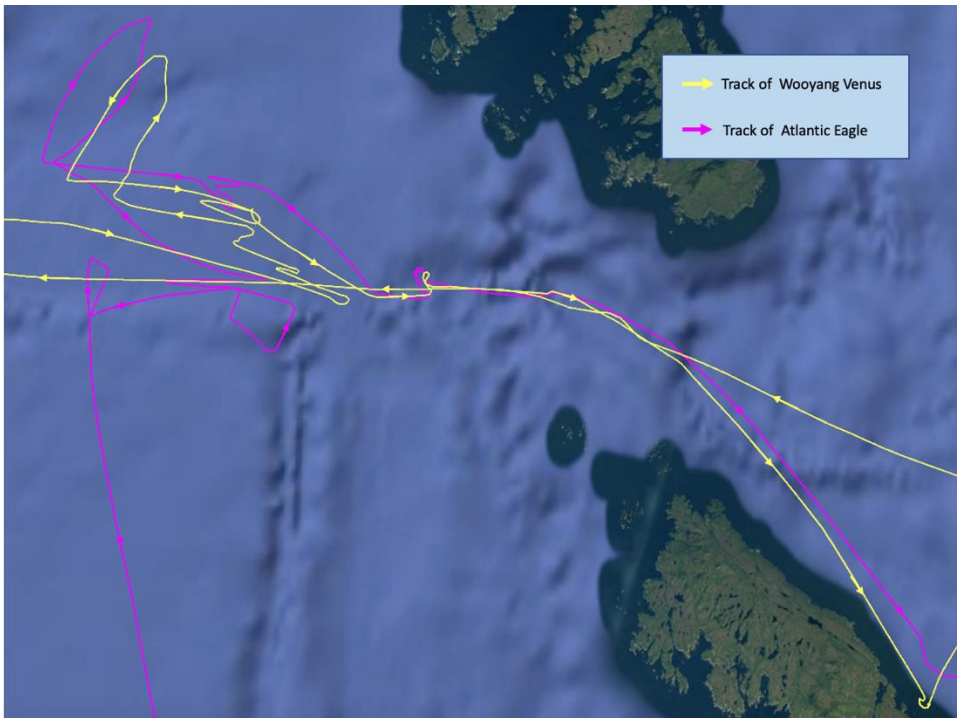

Figure 10. Tracks of the ETV Atlantic Eagle and the bulk carrier Wooyang Venus between November 13th and 17th 2020

6 SUMMARY AND CONCLUSION

The objective of this analysis was to understand the activities and locations of the two ETVs in 2020 and determine, based on that year, how quickly they may respond to a drifting vessel in the VPZ on the west coast of Haida Gwaii. The following is a brief summary of the answers to the research questions based on 2020 data:

1. Where did the ETVs travel in 2020?

The ETVs traveled widely along the western coast of Canada, but they did not spend time in the waters offshore of Haida Gwaii.

2. How much time did the ETVs spend in each operation area?

The ETVs spent approximately equal times in each operating area.

3. How much time did the ETVs spend in each sub-area?

The ETVs spent most of the time in the western Vancouver Island Nearshore and the Prince Rupert sub-areas. They spent the least amount of time in the Offshore areas.

4. How much time did the ETVs spend in port?

Overall, they spent approximately 13% of time in port.

5. How much time did the ETVs spend underway vs. stopped?

The ETVs spent about 40% of the time underway and 60% of the time at anchor or at a dock.

6. What were the average and maximum speeds when ETVs were underway (patrolling vs. going to rescue)?

The average speed when patrolling was approximately 8 knots. The maximum speed when patrolling was approximately 15 knots. It is difficult to determine the maximum speed when going to a rescue since it is situationally dependent.

7. How long could it take the ETVs to reach a disabled vessel in the Voluntary Protection Zone near Haida Gwaii?

The amount of time could vary greatly depending on the ETV starting location and speed. An ETV traveling to Tcenakun Point on the outer coast of Haida Gwaii could take 12 to 28 hours to arrive when departing from common places of operations in the northern AOR. The mid-speed estimate is approximately 18 hours.

8. How much is ETV speed reduced as the sea state worsens?

The speed reduction due to sea state is difficult to estimate due to the number of factors involved. The expected speed in good condition is 15 knots, and this speed would slow as conditions degrade. Under extreme conditions, the ETV may not be able to make any headway.

9. How many times were the ETVs dispatched, and what were the outcomes?

The ETVs have been dispatched 39 times since the beginning of the program, and every case resulted in a positive outcome.

Overall, the ETVs are operating as planned and have provided a valuable service to mariners in Canadian waters. However, given their current operating patterns, it could take 12 to 33 hours for them to reach a vessel drifting inside the Haida Gwaii VPZ. This emphasizes the advantage of having vessels travel far enough offshore to allow the ETV to reach a disabled vessel before it drifts to the shoreline.