Investigation of the hull coating impact on fuel consumption and URN

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Project Goals

- Quantify the impact of the new hull coating on the fuel consumption.

- Understand the relation between the hull coating condition and URN (Underwater Radiated Noise).

- Find the optimum ship operation practice by analyzing the data collected from ship's performance monitoring system.
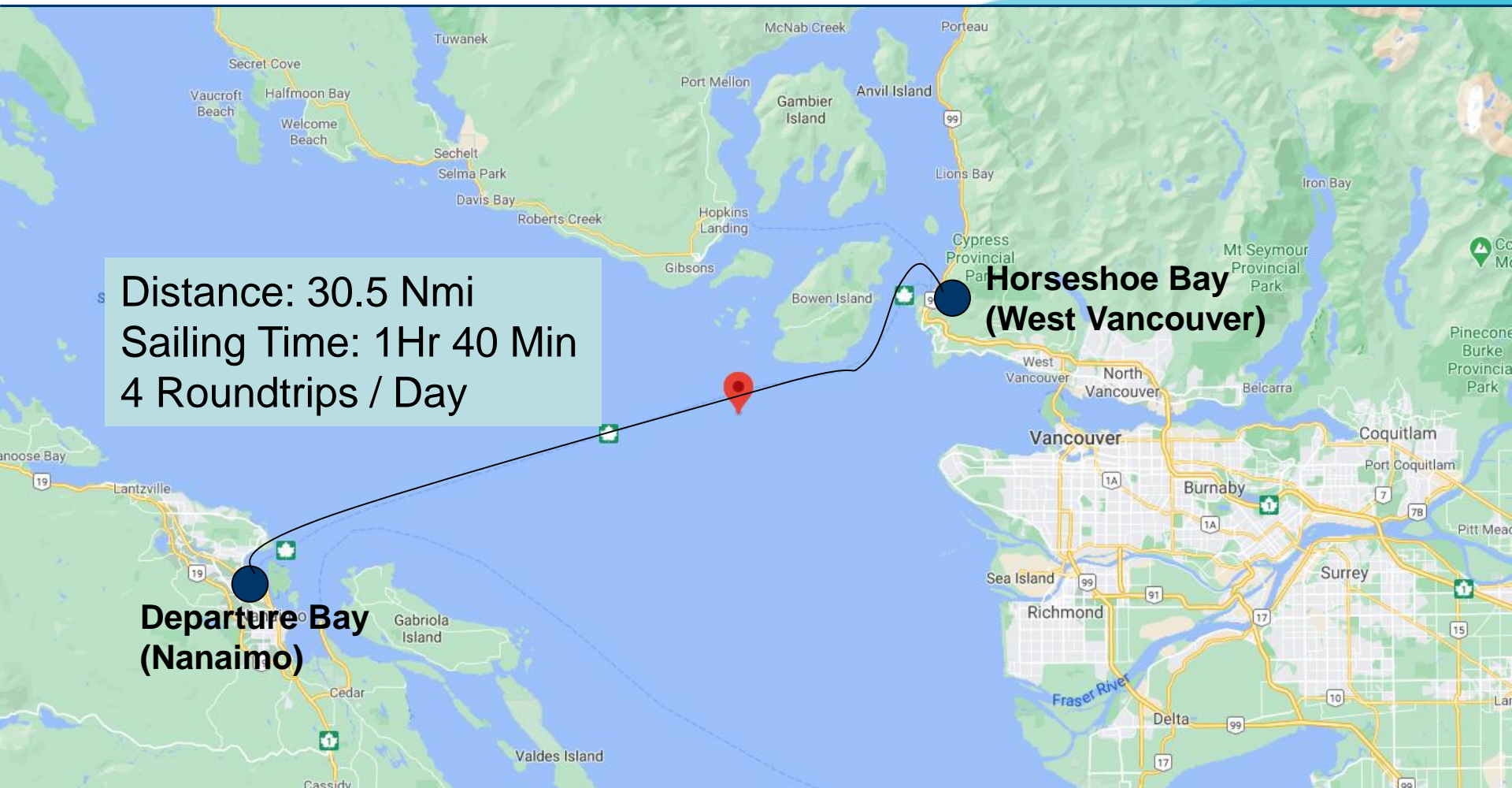
Target Vessel: Queen of Oak Bay

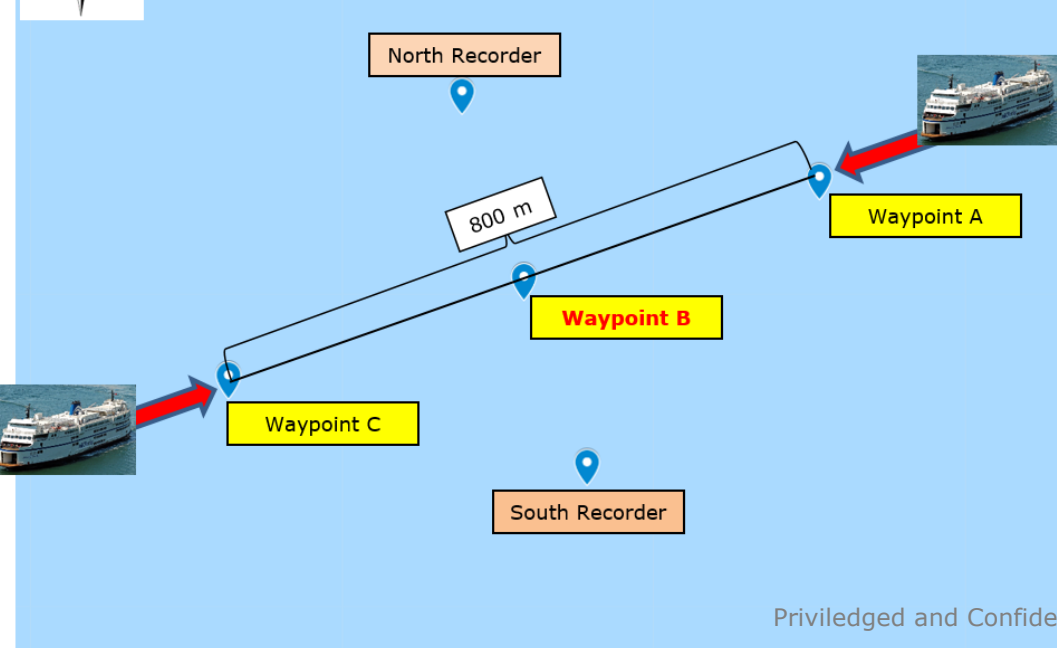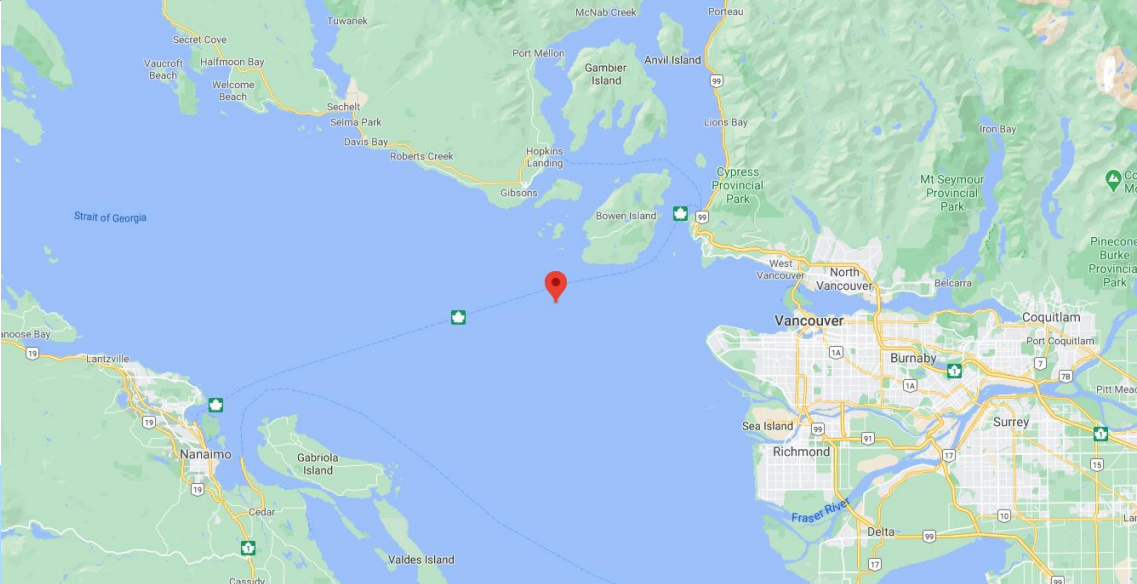|	
Length:	139.3 m
Beam:	27.0 m
Draft:	5.9 m
Installed power:	11,860 kW
Propulsion:	2 X MAK 12M551AK
Speed:	20.5 Knots
Capacity:	•1,494 person •308 vehicles
Built in:	1981
Operation Rt.	Horseshoe Bay – Departure Bay
Propeller Info	3.81m Dia. 4 Blade CPP

Photo Source: Wikipedia.

Project Time Line

Year / Month	Event
2019 / 03	Installation of the performance monitoring system
2019 / 11	Underwater Sound Measurement System Installation
2019 / 12	Conduct URN Measurement Before the New Coating
2020 / 1,2	Vessel in Drydock for Refit (New Coating Work)
2020 / 03	Conduct URN Measurement After the New Coating
2020 / 08	URN Measurement Report
2020 / 11	Data is still being recorded in the cloud.

Route Information - Queen of Oak Bay

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Distance: 30.5 Nmi
Sailing Time: 1Hr 40 Min
4 Roundtrips / Day

Horseshoe Bay
(West Vancouver)

Departure Bay
(Nanaimo)

URN Measurement Location

URN Measurement Works

Data Log Sheet Example

Pass	Time (PDT) (e.g., 14:23:15)			Sail Track (x)		Speed Setup(x)					StW	SoG	Drafts		Vessel			Notes
	WayPt A		WayPt C	West	East	FA	SS	r2	r4	HS	kts	kts	Fwd	Aft	Prop RPM	Pitch Angle	Engs ON	e.g., distance to nearby vessels
1				X													2	
2	09:38:08	09:37:33	09:36:49		X		X				19.8	19.6	5.49	5.35	184	90%	2	
3	11:17:50	11:19:16	11:20:30	X						X	9.9	9.7	5.89	5.47	136	50%	2	
4	14:09:18	14:08:35	14:07:52		X		X				19	18.5	5.46	5.64	168	90%	2	
5				X													2	Traffic
6	19:19:30	19:18:20	19:17:10		X					X	10.8	10.7	5.58	5.43	144	50%	2	
7	20:57:24	20:58:08	20:58:52	X				X			17.1	17	5.45	5.23	160	90%	2	
8	23:29:30	23:28:43	23:28:00		X			X			16.9	16.7	5.84	5.22	160	90%	2	

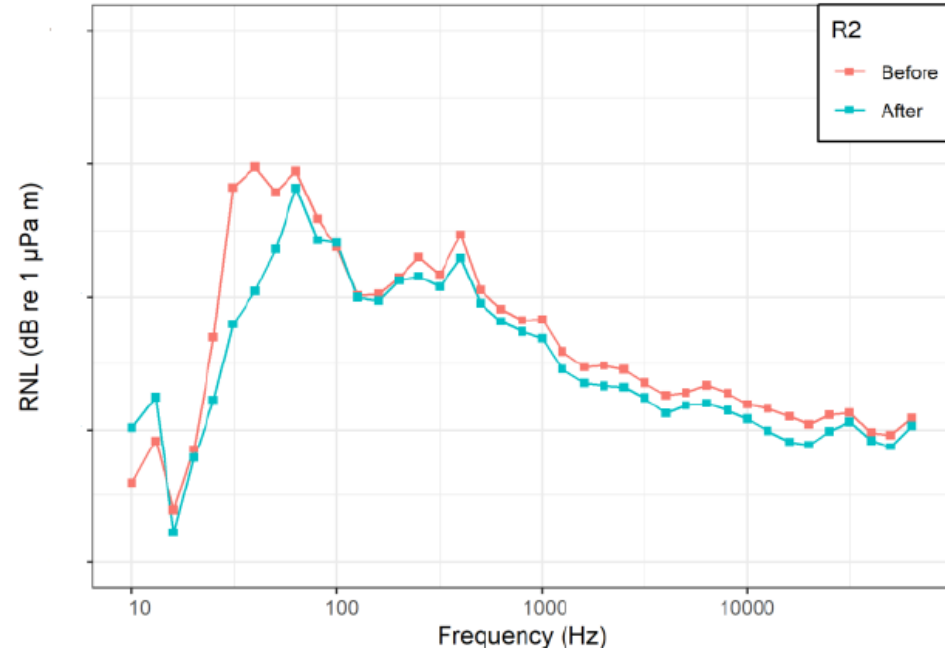| Total Number of Measurement	488
Accepted for Analysis	343
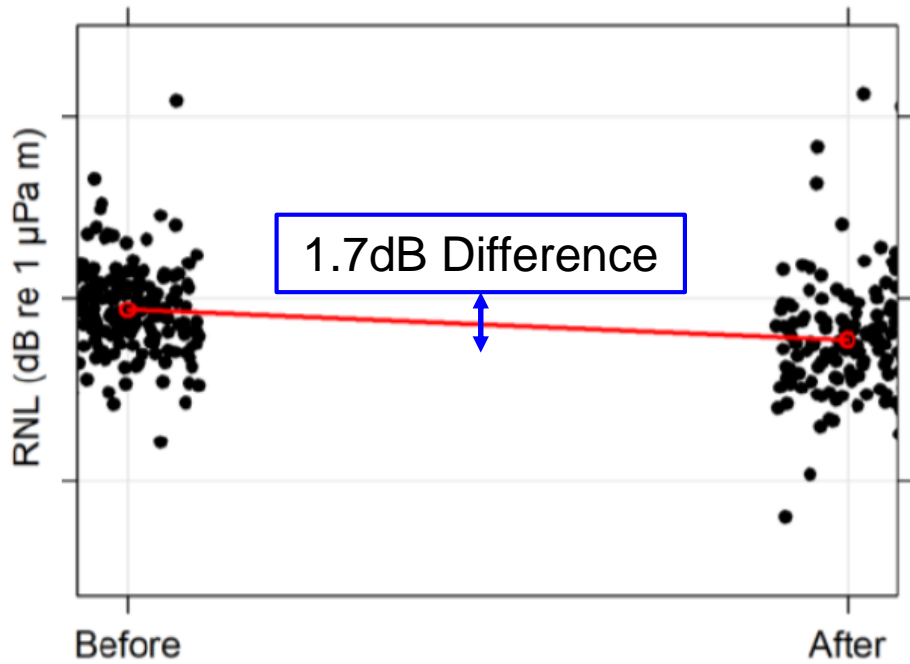
Hull Surface Effect on URN
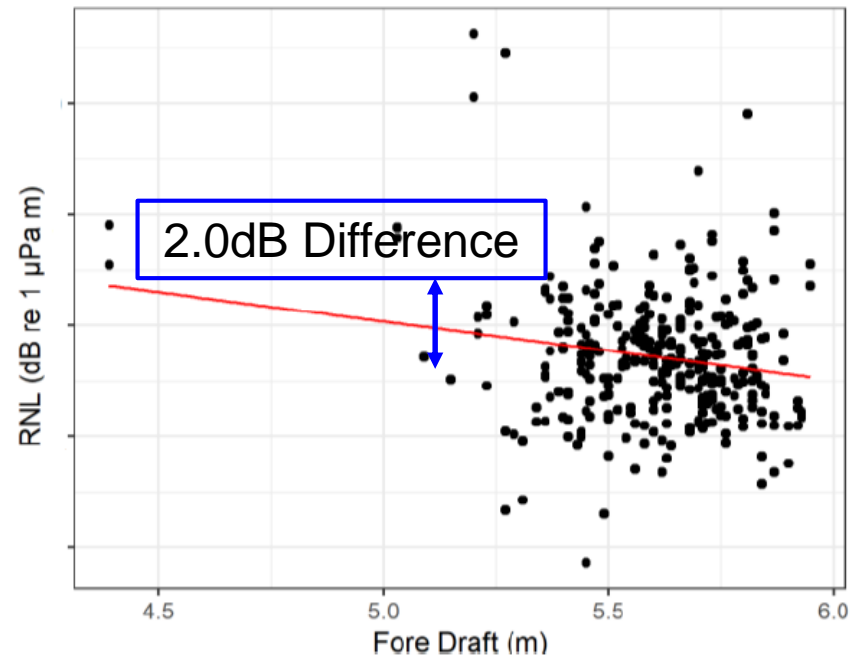
Draft Effect on URN

Overall URN Change by the Speed
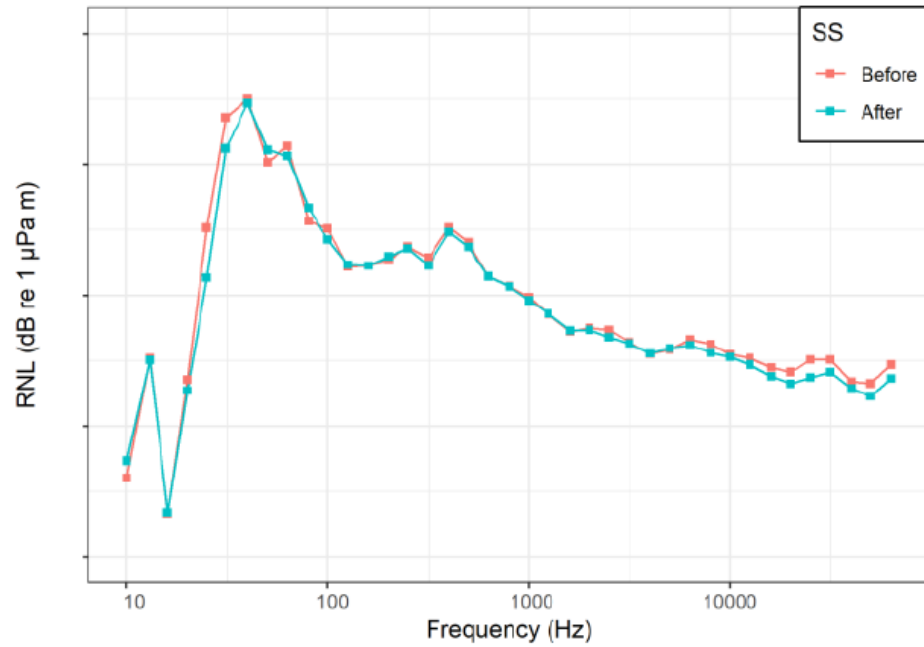
Real Time Monitoring: TT-Sense

Stored Data

Speed(SOG, STW)
GPS Location
Ship's Heading
Wind Speed
Fuel Consumption
Torque
Thrust
….
and More

Priviledged and Confidential

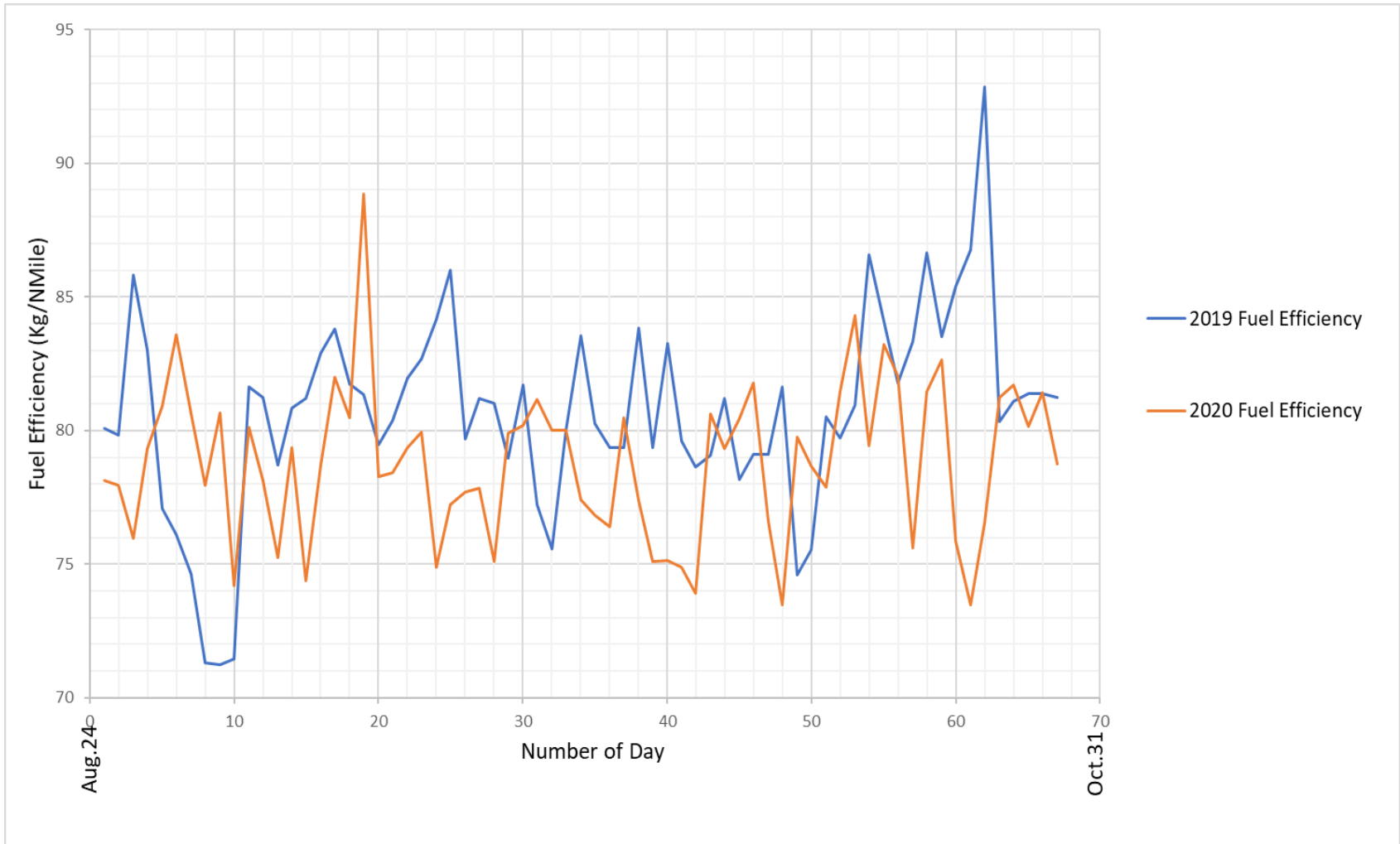# Big Data Analysis Example
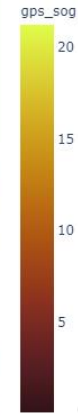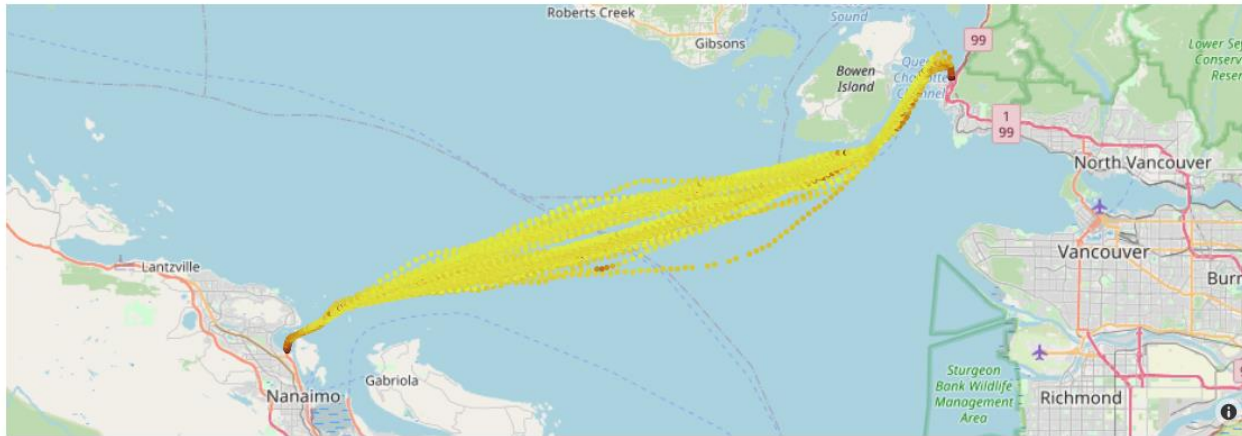
(Speed Vs. GPS Location)

windspeed vs Total Fuel Consumption
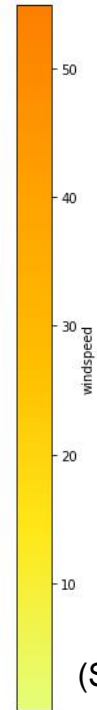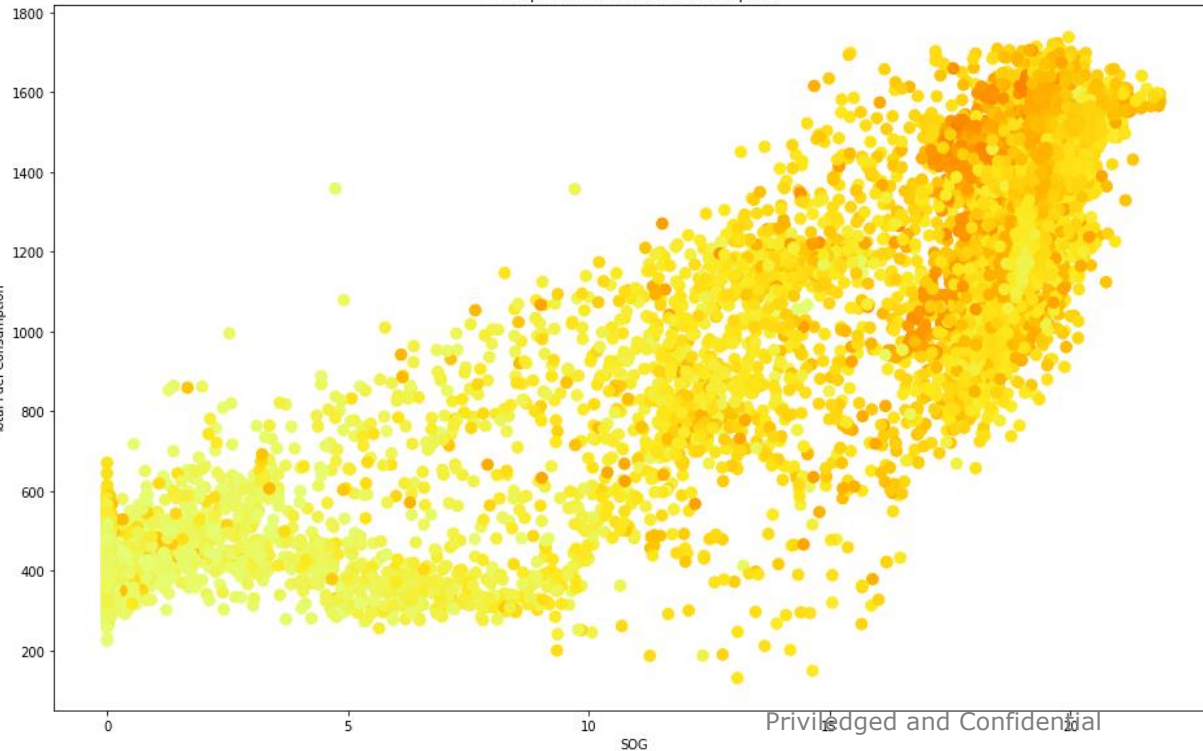
(Speed Vs. Fuel Vs. Wind Speed)

Fuel Consumption Comparison

27.6 Tons of Fuel Saved (2.2%) during Same Period with a New Coating.

Note: The fuel amount in this chart is collected only when the vessel is in motion.

Conclusion & Future Work

1. The hull surface condition can affect the level of URN.
2. Clean hull surface reduced 1.7dB in URN level.
3. The new hull coating lowered the fuel consumption by 2.2%.
4. The long term investigation is necessary to know how long the new coating's effectiveness lasts.
5. More research is needed for better usage of the collected performance data.

Special Thanks to:

- TC Innovation Centre

- Port Vancouver

- JASCO

- All the crew members of the Queen of Oak Bay