



Marine conservation and vessel discharges in Canada

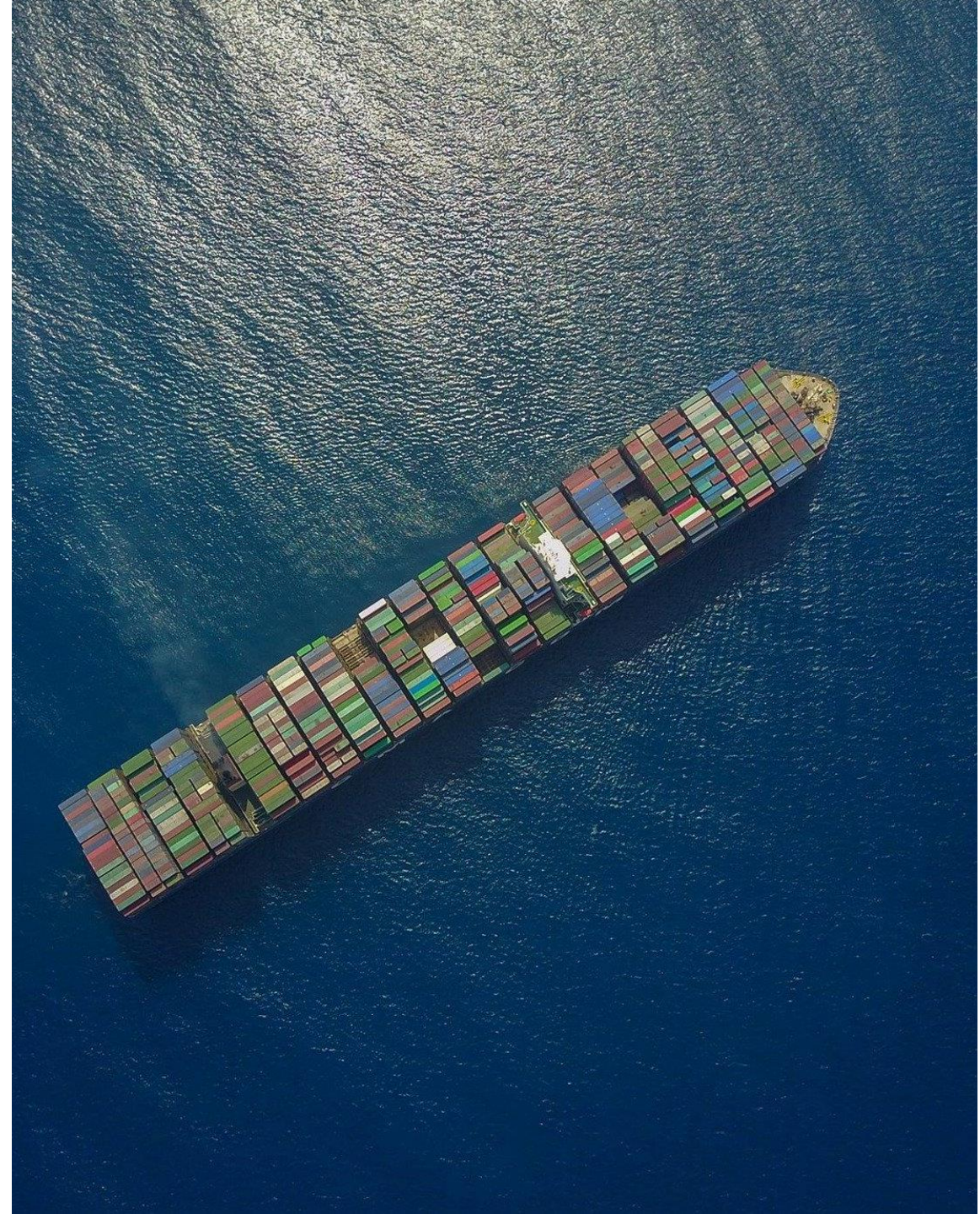
Gaps and recommendations for mitigating risks and impacts

August 30, 2022
Shipping Risk Mitigation Workshop



Canada's marine conservation commitments

- Canada has conserved 13.8 per cent of its marine territory in protected areas and committed to 30 per cent by 2030
- Committed to adopting minimum standards for new federal protected areas
 - No oil & gas activities
 - No bottom trawling
 - No mining
 - **No dumping**





Gaps in the minimum standards

- Minimum standards will apply only to **new** federal protected areas
- OECMs (e.g., marine refuges) are not included
- Unclear how **dumping** will be operationally defined in the context of minimum standards
- Vessel discharges remain a possible blind spot

	New	Existing
Oceans Act Marine Protected Areas	✓	✗
National Marine Conservation Areas	✓	✗
Marine National Wildlife Areas	✓	✗
National Parks*	✓	✗
National Wildlife Areas*	✓	✗
Migratory Bird Sanctuaries*	✓	✗
Other Effective Area Based Conservation Measures	✗	✗

*Marine components



Closing the knowledge gap

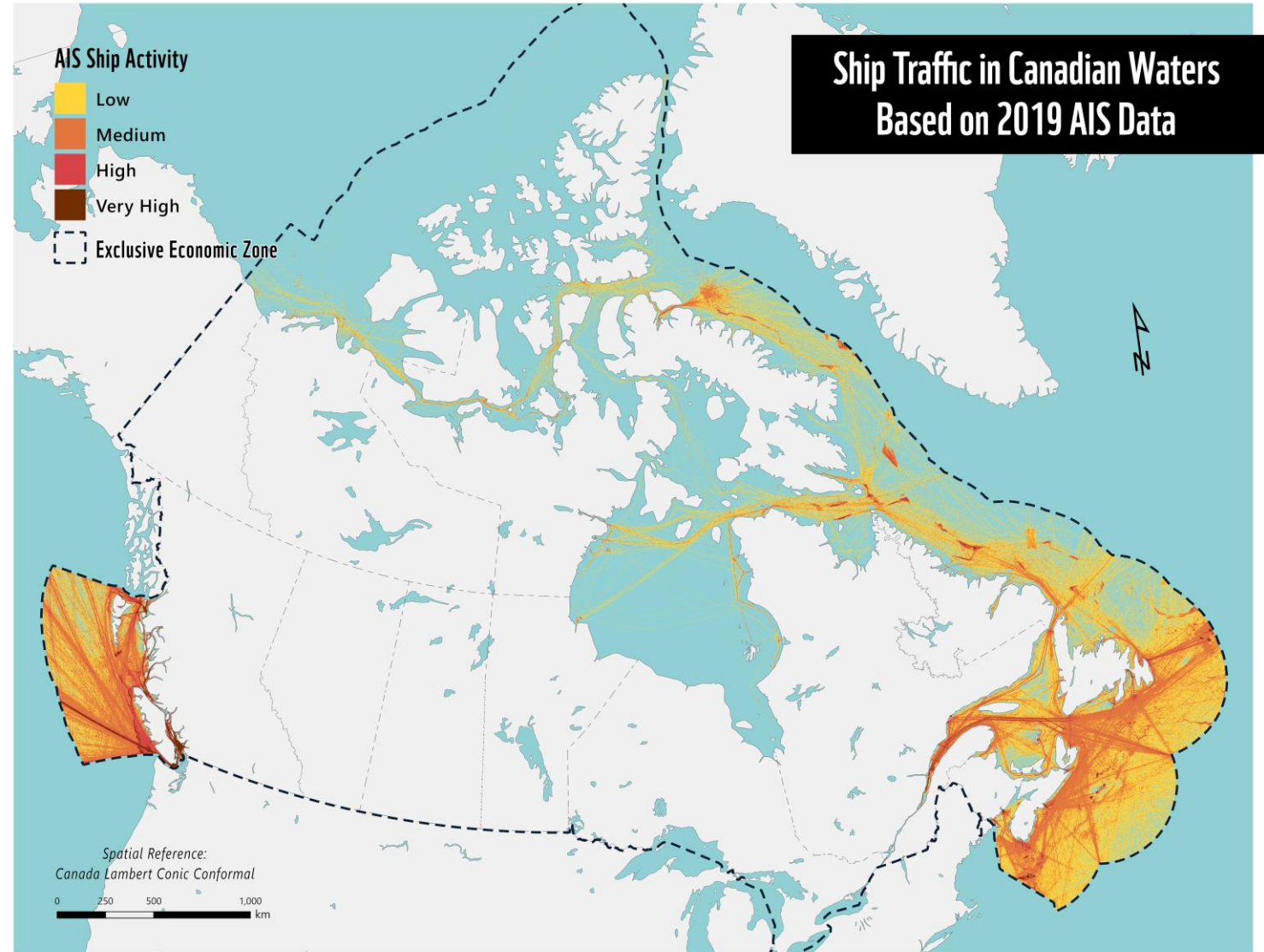
- Disposal of operational wastes at sea is a source of chronic pollution
- There is a lack of information about the amount and distribution of waste produced by vessels
- WWF's "*National Vessel Dumping Assessment*"
 - How much waste is produced annually?
 - Which protected areas are most impacted?
 - Which ships produce the most waste?





Project Scope

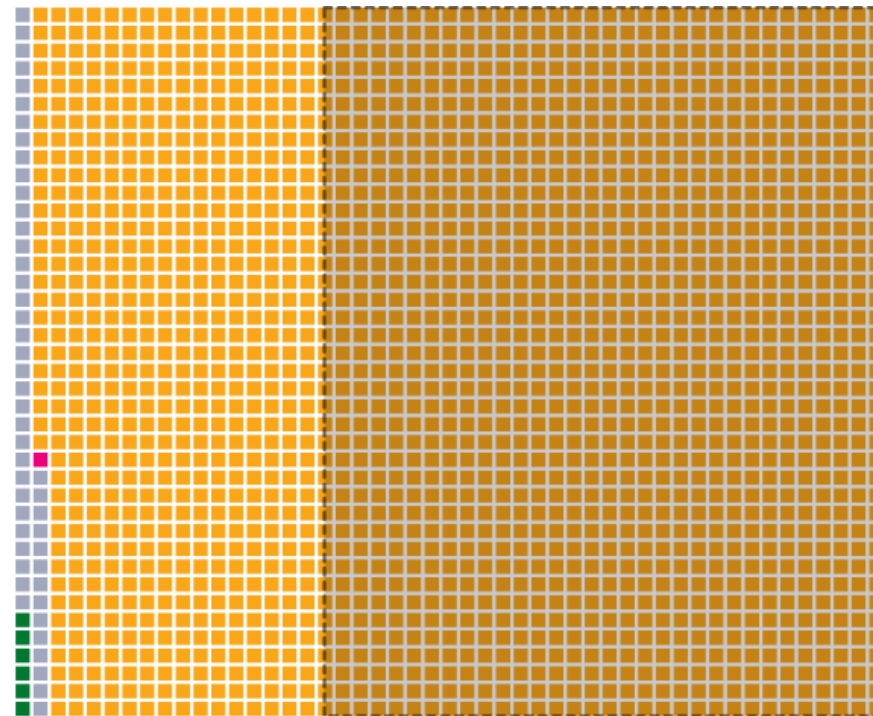
- All Canadian marine waters
- 129 federally designated protected areas
- Quantifies waste production from 5,546 unique ships
 - Sewage
 - Greywater
 - Bilge water
 - Scrubber washwater





Ships produce 59,000 Olympic swimming pools of waste in Canada annually

- 147 billion liters of waste is produced annually:
 - 143 billion L scrubber washwater
 - 3.5 billion L greywater
 - 550 million L sewage
 - 77.5 million L bilge water

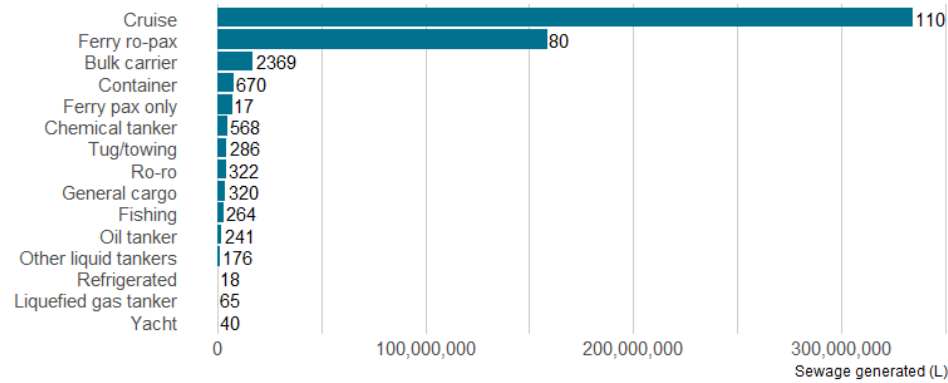


1 square = 30 Olympic swimming pools

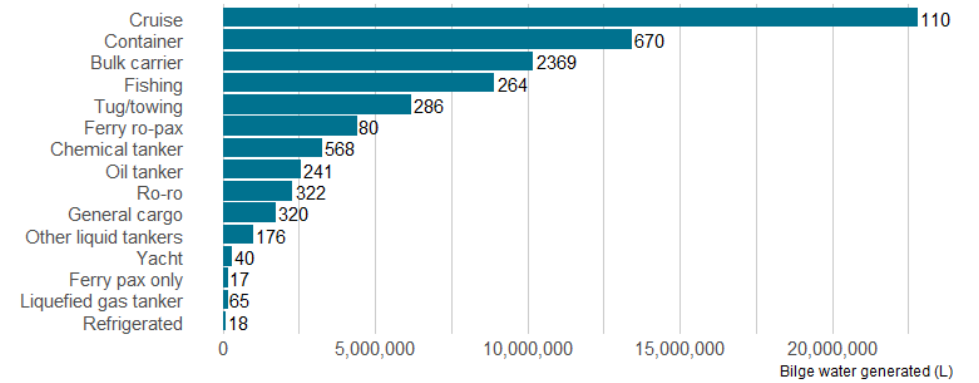


Breakdown of waste production by ship type

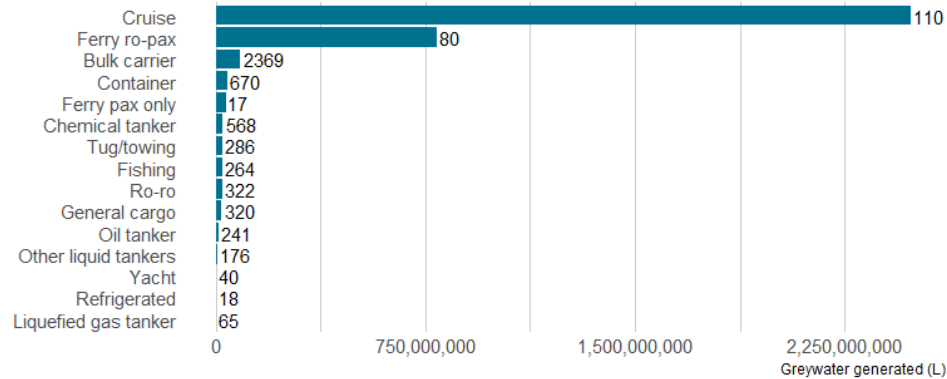
Sewage (550 million L)



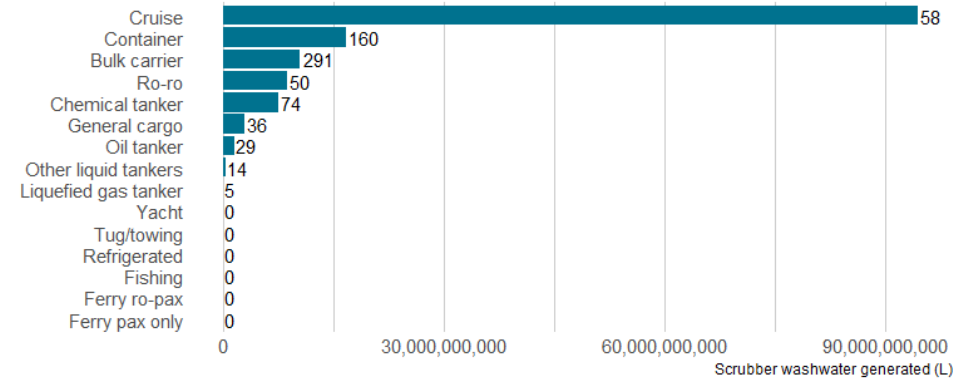
Bilge water (77.5 million L)



Greywater (3.5 billion L)



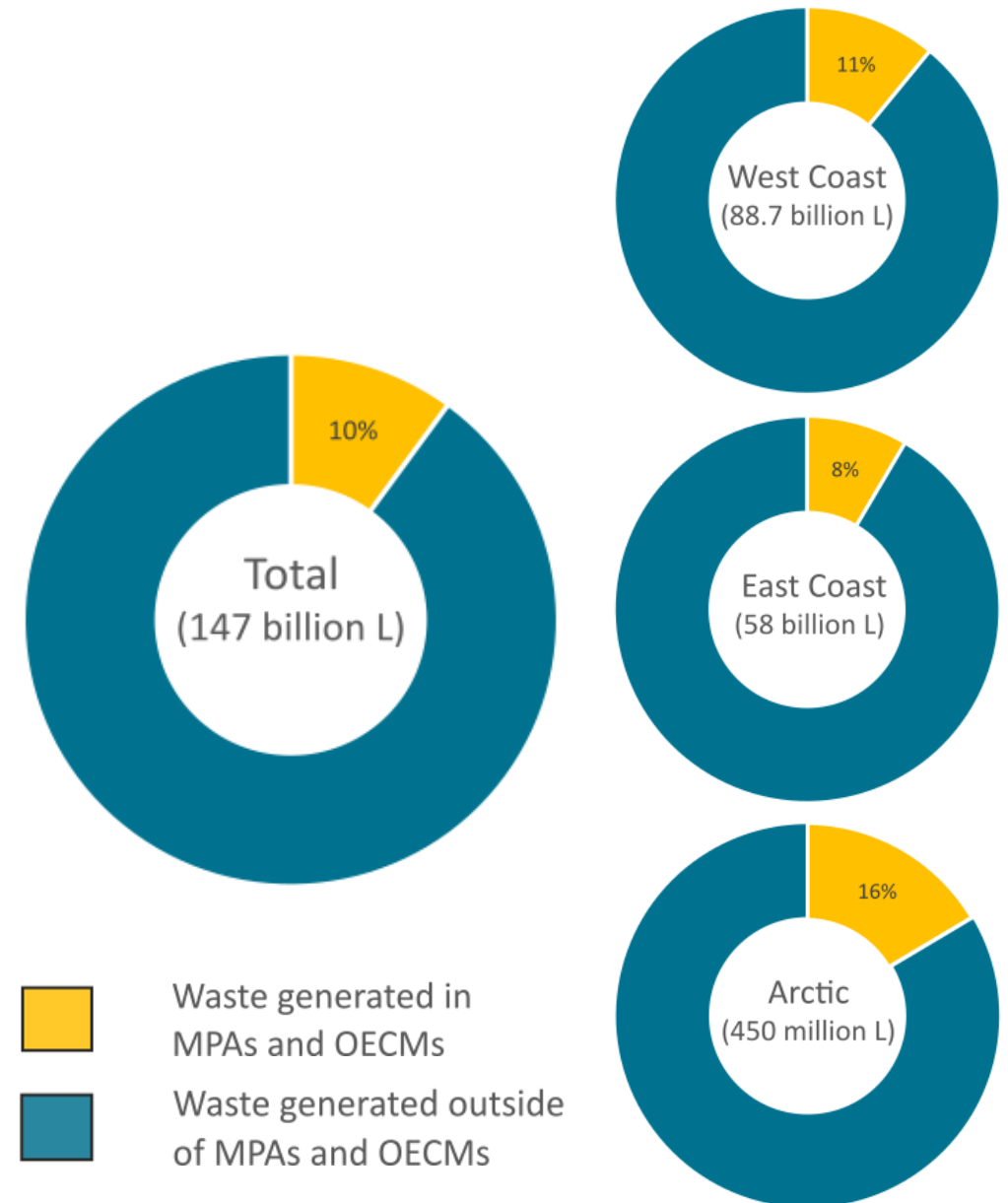
Scrubber washwater (143 billion L)





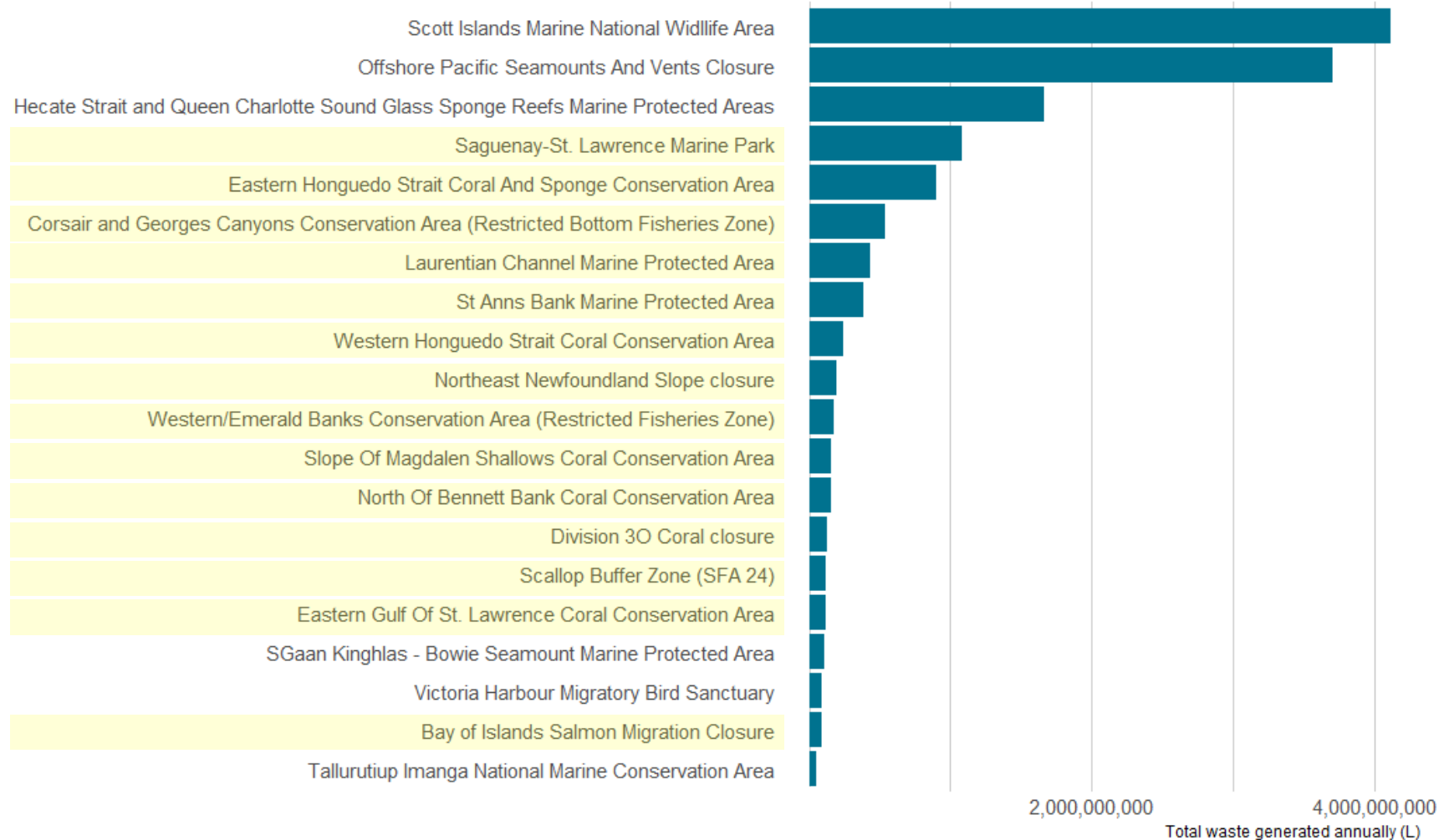
Geographic breakdown of waste production

- **10 per cent** is produced in protected areas
- **60 per cent** is produced off the B.C. Coast
- *Proportionately*, more waste is produced in Arctic protected areas than anywhere else in Canada



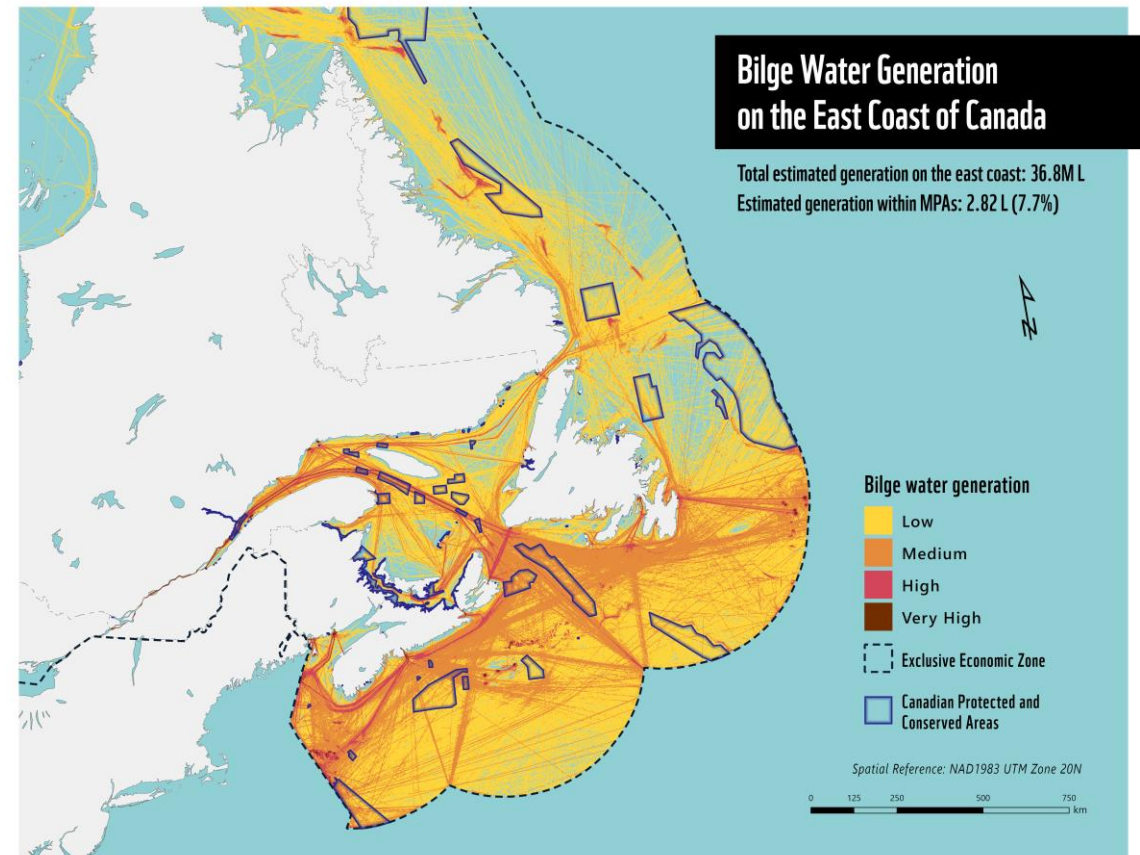
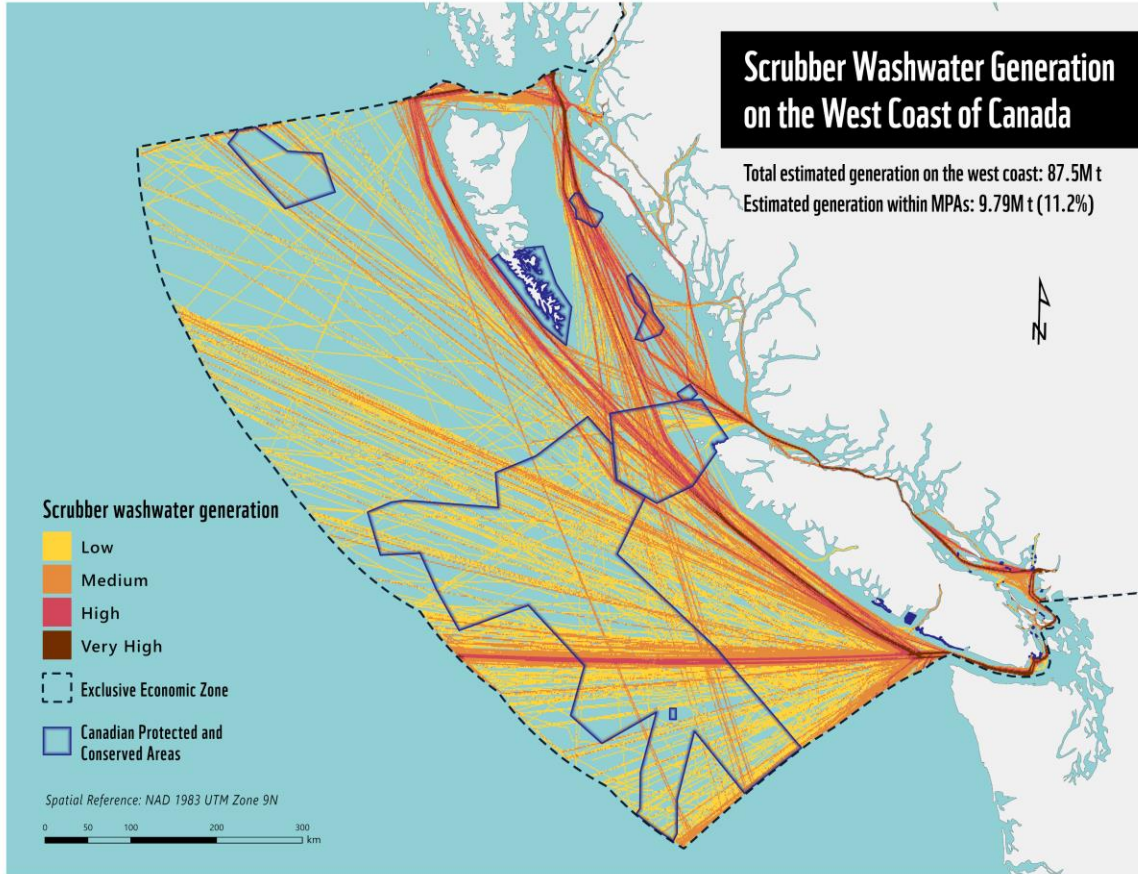


Top 20 protected areas ranked by total waste production



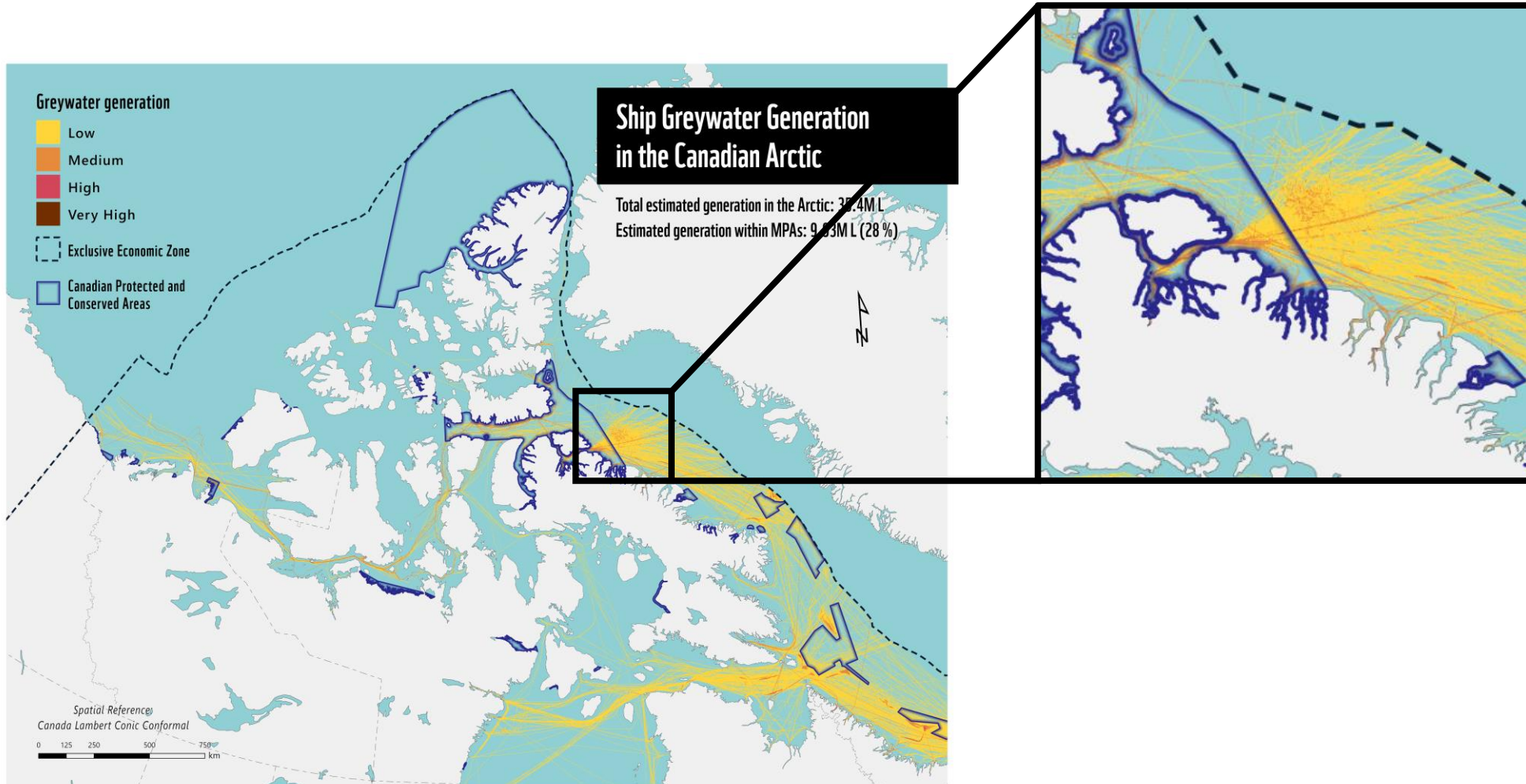


Where in Canada is waste produced?





Where in Canada is waste produced?





Recommendations to Canada

1. Extend minimum standards to all areas counting towards Canada's marine conservation targets
2. Define and operationalize a comprehensive definition of 'dumping' within the context of minimum standards
3. Expand the new cruise ship measures to address additional waste streams and include provisions for protected areas
4. Introduce a national scrubber ban and support measures at the IMO to prohibit scrubbers globally





Where is the use of scrubbers restricted?

Prohibited in territorial waters	Prohibited within 3 nm	Prohibited in port	Prohibited in some ports/terminals/specific areas
Belize	Belgium	Bahrain	Brazil (Vale terminals only)
Ghana	France	Bermuda	Canada (Ports of Vancouver & Sept-Iles)
Gibraltar		Croatia	China (Inland river ECAs, ports within coastal ECAs, Bohai Sea)
Ivory Coast		Kenya	Egypt (Suez Canal)
Malaysia		Romania	Finland (Port of Porvoo)
Mauritius		Singapore	Germany (Inland waterways, canals)
Oman			Ireland (Ports of Dublin, Cork, Waterford)
Qatar			Mozambique (Port of Nacala)
Saudi Arabia			Norway (World Heritage Fjords; Ports of Geirangerfjord & Naeroyfjord)
Slovenia			Pakistan (Ports of Karachi & Bin Qasim)
Turkey			Panama (Panama Canal)
UAE-Fujairah			Spain (Ports of Algeciras, Valencia, Cartagena, Huelva; restricted in Bilbao & Cadiz)
UAE-Dubai			Sweden (Ports of Gothenburg, Stockholm, Trelleborg, Petroport, Stenungsund)
USA-California			UK-England (Port of Tilbury)
USA-Connecticut			UK-Scotland (Ports of Forth & Tay)
			UK-Wales (Port of Milford Haven)
			USA-Washington (*only applies to cruise ships at berth in Port of Seattle)

North of England P&I Association. *Industry News: No Scrubs: More Ports Declare Ban on EGCS Discharges*. North P&I. <https://www.nepia.com/industry-news/no-scrubs-more-ports-declare-ban-on-egcs-discharges-update/>



Recommendations to operators

1. Avoid discharging in designated protected areas
2. Use to reception facilities when feasible
3. Treat waste to the highest possible standard if discharging at sea
4. Use distillate or cleaner alternative fuels





Thank you



Supplemental information



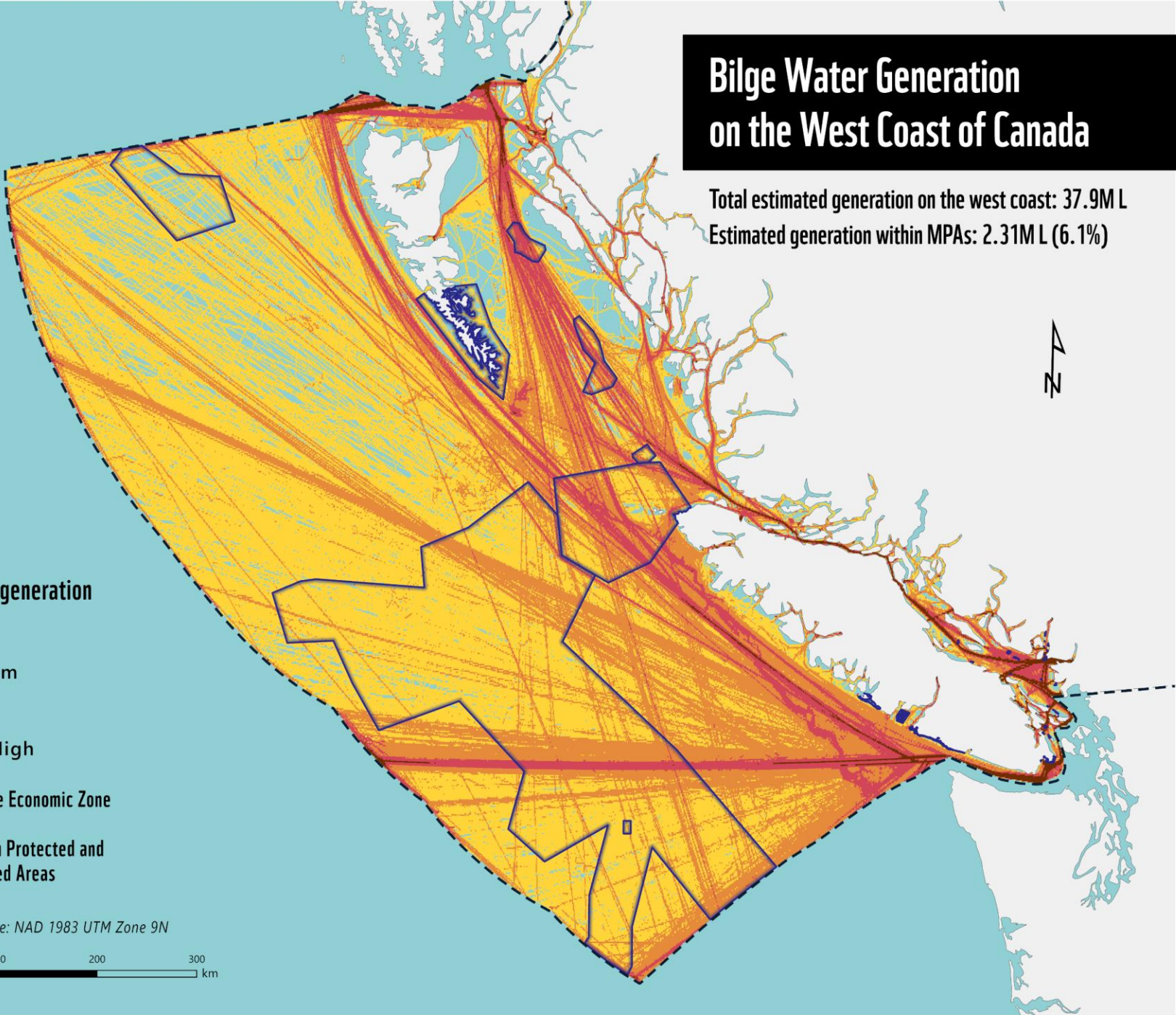
Bilge Water Generation on the West Coast of Canada

Total estimated generation on the west coast: 37.9M L
Estimated generation within MPAs: 2.31M L (6.1%)

Bilge water generation

- Low
- Medium
- High
- Very High
- Exclusive Economic Zone
- Canadian Protected and Conserved Areas

Spatial Reference: NAD 1983 UTM Zone 9N





Ship Sewage Generation on the West Coast of Canada

Total estimated generation on the west coast: 354M L
Estimated generation within MPAs: 15.4M L (4.3%)

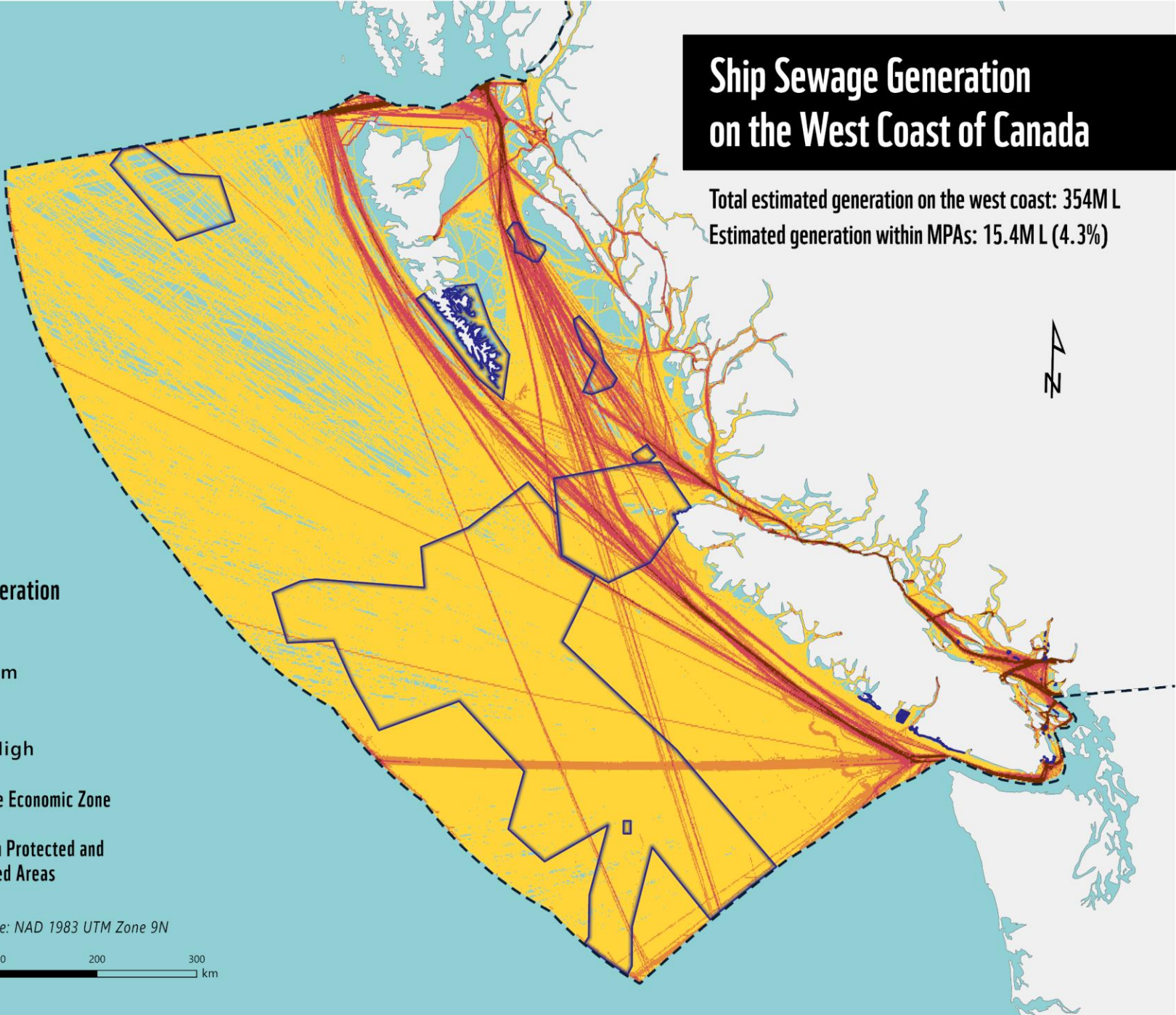
Sewage generation

- Low
- Medium
- High
- Very High

Exclusive Economic Zone

Canadian Protected and Conserved Areas

Spatial Reference: NAD 1983 UTM Zone 9N





Ship Greywater Generation on the West Coast of Canada

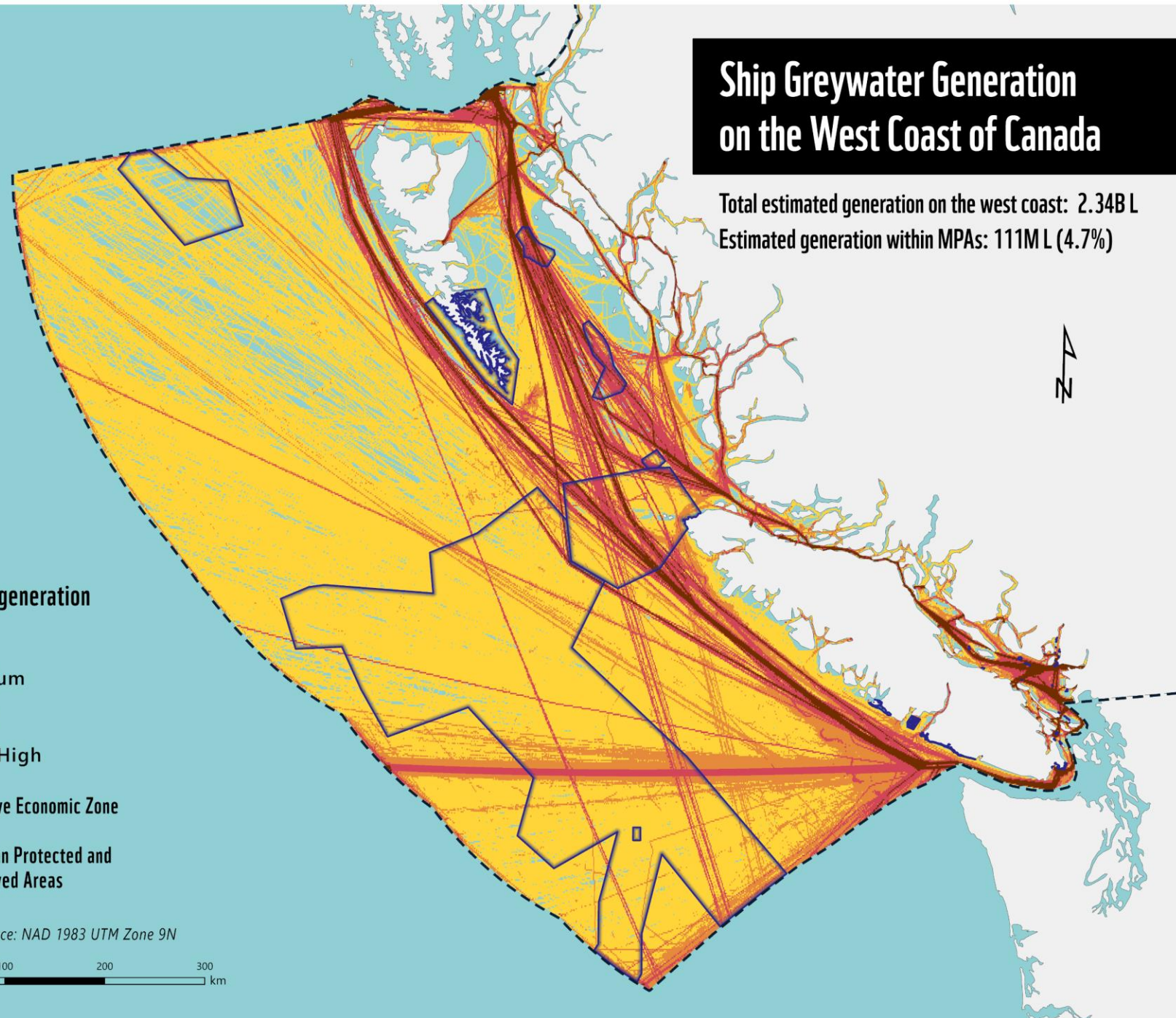
Total estimated generation on the west coast: 2.34B L
Estimated generation within MPAs: 111M L (4.7%)

Greywater generation

- Low
- Medium
- High
- Very High

- Exclusive Economic Zone
- Canadian Protected and Conserved Areas

Spatial Reference: NAD 1983 UTM Zone 9N





Scrubber Washwater Generation on the West Coast of Canada

Total estimated generation on the west coast: 87.5M t
Estimated generation within MPAs: 9.79M t (11.2%)

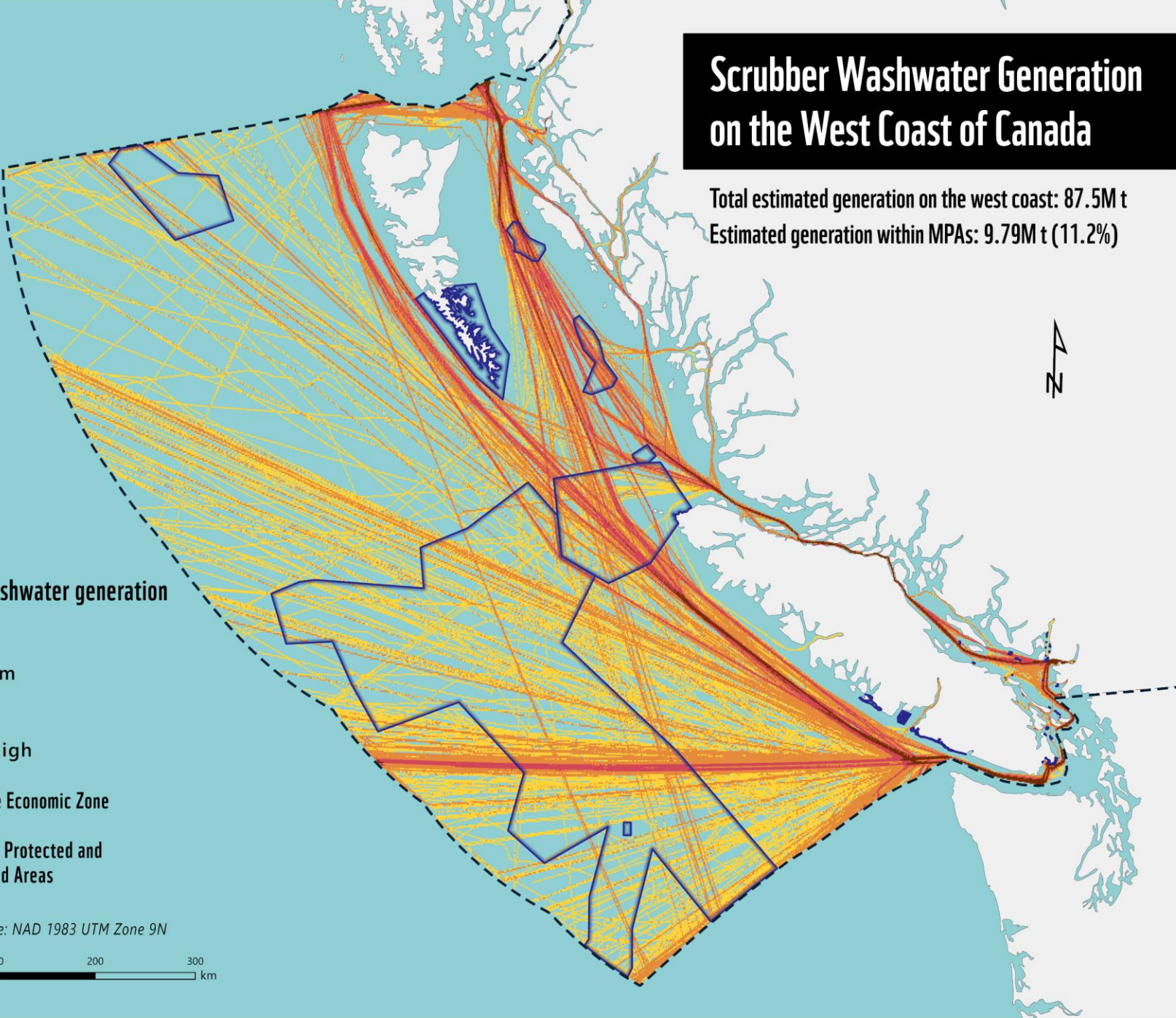
Scrubber washwater generation

- Low
- Medium
- High
- Very High

Exclusive Economic Zone

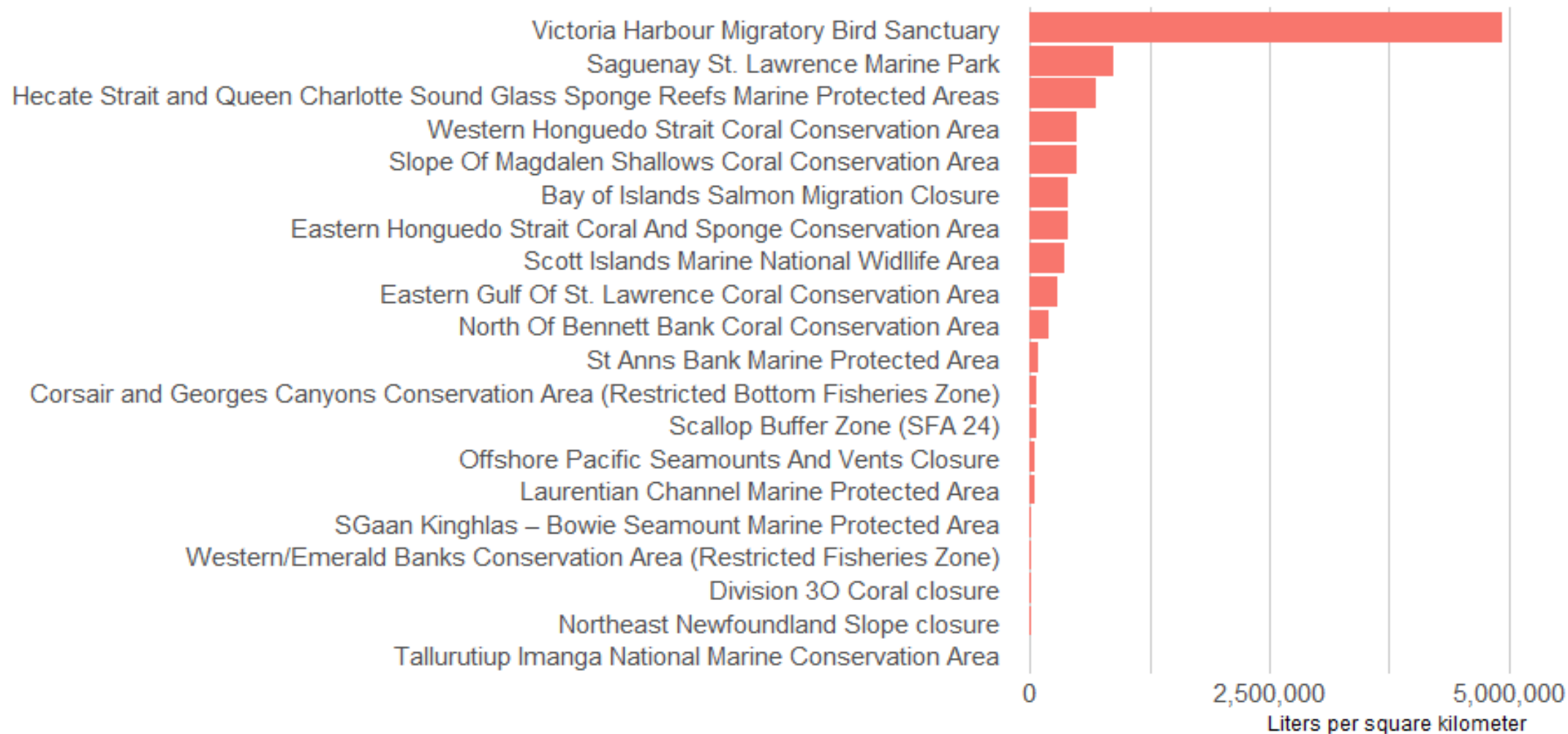
Canadian Protected and Conserved Areas

Spatial Reference: NAD 1983 UTM Zone 9N





Waste production in protected areas (liters/km²)





International Council for the Exploration of the Sea on scrubbers

“Scrubbers discharge large amounts of metals and polycyclic aromatic hydrocarbons in dissolved, readily bioavailable form. These contaminants may concentrate at ultra-trace levels in the water column and bioaccumulate in plankton, fish, and marine mammals, to levels that may impair vital functions and population productivity. Concentrations of contaminants may be hundreds to million times higher in plankton than in the surrounding seawater.”

“In areas of intense maritime traffic where scrubber water discharge is permitted, scrubber-related ocean acidification could be similar to that induced by carbon dioxide over several years to decades.”

“It has been estimated that for each tonne of sulphur dioxide discharged by scrubber water, the ocean uptake of atmospheric carbon dioxide is reduced by half a tonne, thereby reducing the ability of the ocean to contribute to offsetting global climate change.”

-ICES, MEPC 76/INF.5



Calculations



Bilge water

PASSENGER SHIPS:

$$BW = (0.131284 p + 373.416) \times \Delta t / 24$$

NON-PASSENGER SHIPS:

$$BW = (0.024696 p + 154.4874) \times \Delta t / 24$$

Where:

- BW* = total bilge water generation (L)
p = installed main engine power, by ship (kW)
Δt = time between AIS points (h)



Greywater & sewage

$$GW \text{ or } SW = g \times POB \times \Delta t / 24$$

Where:

- GW** = total greywater generation (L)
- SW** = total sewage generation (L)
- g** = wastewater generation rate (L/person/day), based on ship type
- POB** = assumed people on board, based on ship type and capacity
- Δt** = time between AIS points (h)

g

Sewage = 34 L per person per day

Greywater = 170 to 254 L per person per day

SHIP CLASS	DEFAULT ASSUMED PEOPLE ON BOARD
Bulk carrier	20
Chemical tanker	15
Container	20
Cruise	Determined individually from World Fleet Register ⁹¹
Ferry, passenger only (pax only)	50 per cent of passenger capacity
Ferry, roll-on passenger (ro-pax)	50 per cent of passenger capacity
Fishing	7
General cargo	20
Liquefied gas tanker	20
Oil tanker	15
Other liquid tankers	15
Refrigerated bulk	15
Ro-ro	30
Tug/towing	6
Yacht	Estimated individually based on ship size (0.25* length overall)

Ferry ro-pax	$0.03 \times LOA^2 + 3.7 \times LOA$
Cruise	$0.0113 \times LOA^{2.1642}$
Ferry pax only	$10.5 \times LOA$
Yacht	$0.25 \times LOA$
Ro-ro	$0.12 \times LOA$



Scrubber washwater

$$D = r \times TED \times \Delta t$$

Where:

- D** = total washwater generation (t)
- r** = discharge rate (t/MWh)
- TED** = total energy demand per ship (MW)
- Δt** = time between AIS points (h)

$$TED = ME + AE + BO$$

$$TED = (p \times LF) + AE + BO$$

TABLE 6. Normalized washwater discharge rates (r).

SCRUBBER TYPE	DISCHARGE RATE (T/MWH)
Open-loop	45
Closed-loop	0.1
Hybrid	45

$$LF = \left(\frac{SOG \times SAF}{V_{max}} \right) \times HFF \times W \times DAF$$

Where:

- LF** = main engine load factor, by ship
- SOG** = speed over ground, knots
- SAF** = speed adjustment factor
- V_{max}** = maximum vessel speed, knots
- HFF** = hull fouling factor, by ship
- W** = weather adjustment factor, based on ship location
- DAF** = draught adjustment factor, by ship



Scrubber washwater

$$TED = ME + AE + BO$$

$$TED = (p \times LF) + AE + BO$$

TABLE 7. Decision matrix for assigning auxiliary engine and boiler output values.

MAIN ENGINE POWER (<i>p</i>)	AE (kW)	BO (kW)
0–150 kW	0	0
150–500 kW	0.05 × <i>p</i>	Refer to Appendix II
>500 kW	Refer to Appendix II	Refer to Appendix II

		<=1 nautical mile (nm) from port	1–5 nm from port*	<=5 nm from coast	>=5 nm from coast
Speed over ground	<1 knot	Berth	Berth	Anchor	Anchor
	1–3 knots	Anchor	Anchor	Anchor	Anchor
	3–5 knots	Maneuvering	Maneuvering	Maneuvering	Cruising
	>5 knots	Maneuvering	Cruising	Cruising	Cruising

TABLE I. Decision matrix for determining auxiliary engine and boiler output by ship class, capacity, and operational phase.

SHIP CLASS	SIZE	UNIT	AUXILIARY BOILER POWER OUTPUT (kW)				AUXILIARY BOILER POWER OUTPUT (kW)			
			Berth	Anchor	Maneuvering	Cruising	Berth	Anchor	Maneuvering	Cruising
BULK CARRIER	0–34,999	DWT	70	70	60	0	110	180	500	190
	35,000–59,999		130	130	120	0	150	250	680	260
	>60,000		260	260	240	0	240	400	1,100	410
CHEMICAL TANKER	0–4,999	DWT	670	160	130	0	110	170	190	200
	5,000–9,999		670	160	130	0	330	490	560	580
	10,000–19,999		1,000	240	200	0	330	490	560	580
	>20,000		1,350	320	270	0	790	550	900	660