



PRESENTATION TO:

25th IMPA Congress – Cancun 2022

MARINE PILOTAGE IN CANADA: A COST BENEFIT ANALYSIS



JUNE 16, 2022

Presentation By:

TEMAS

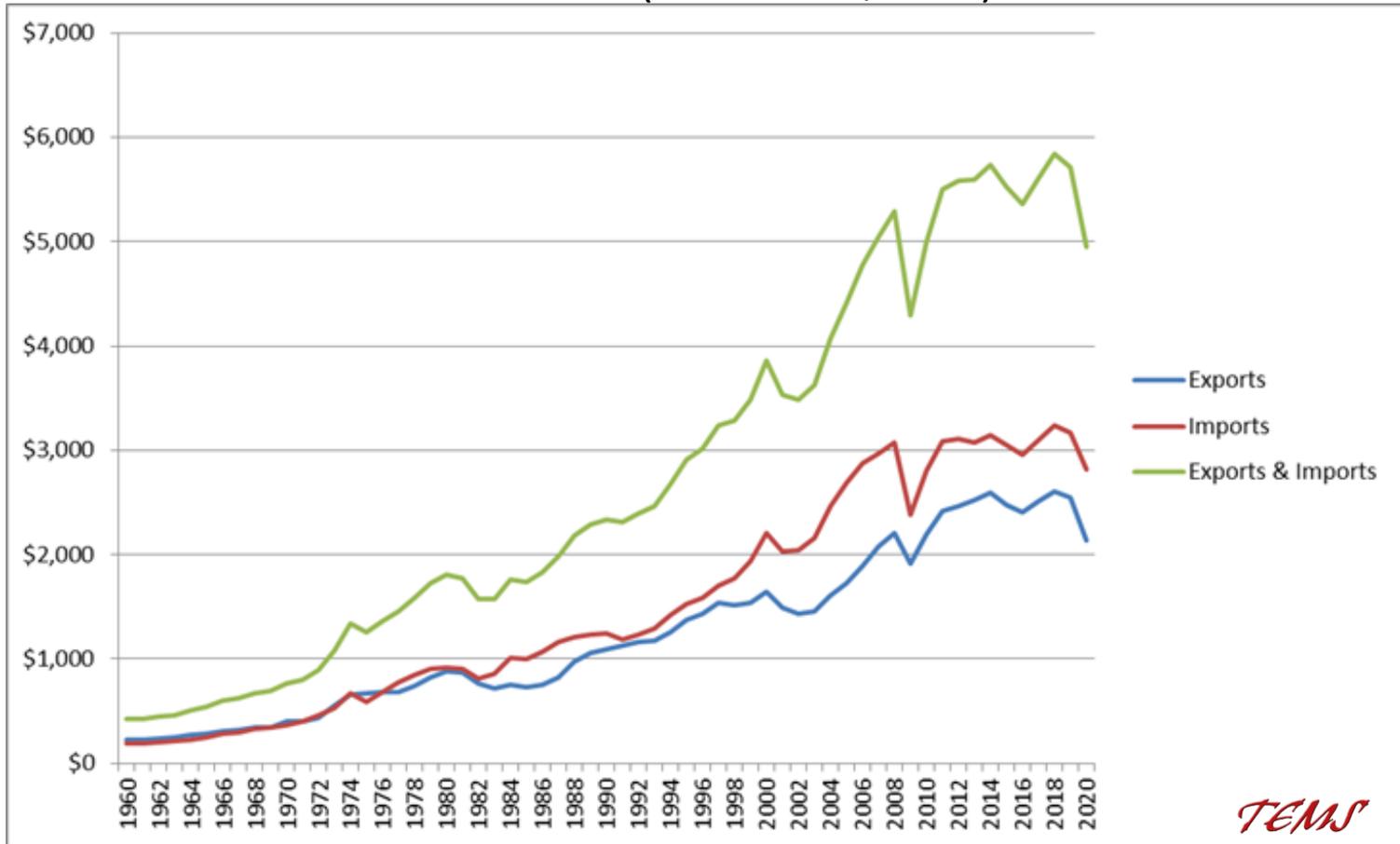
Transportation Economics & Management Systems, Inc.



**25th IMPA CONGRESS
CANCUN 2022**

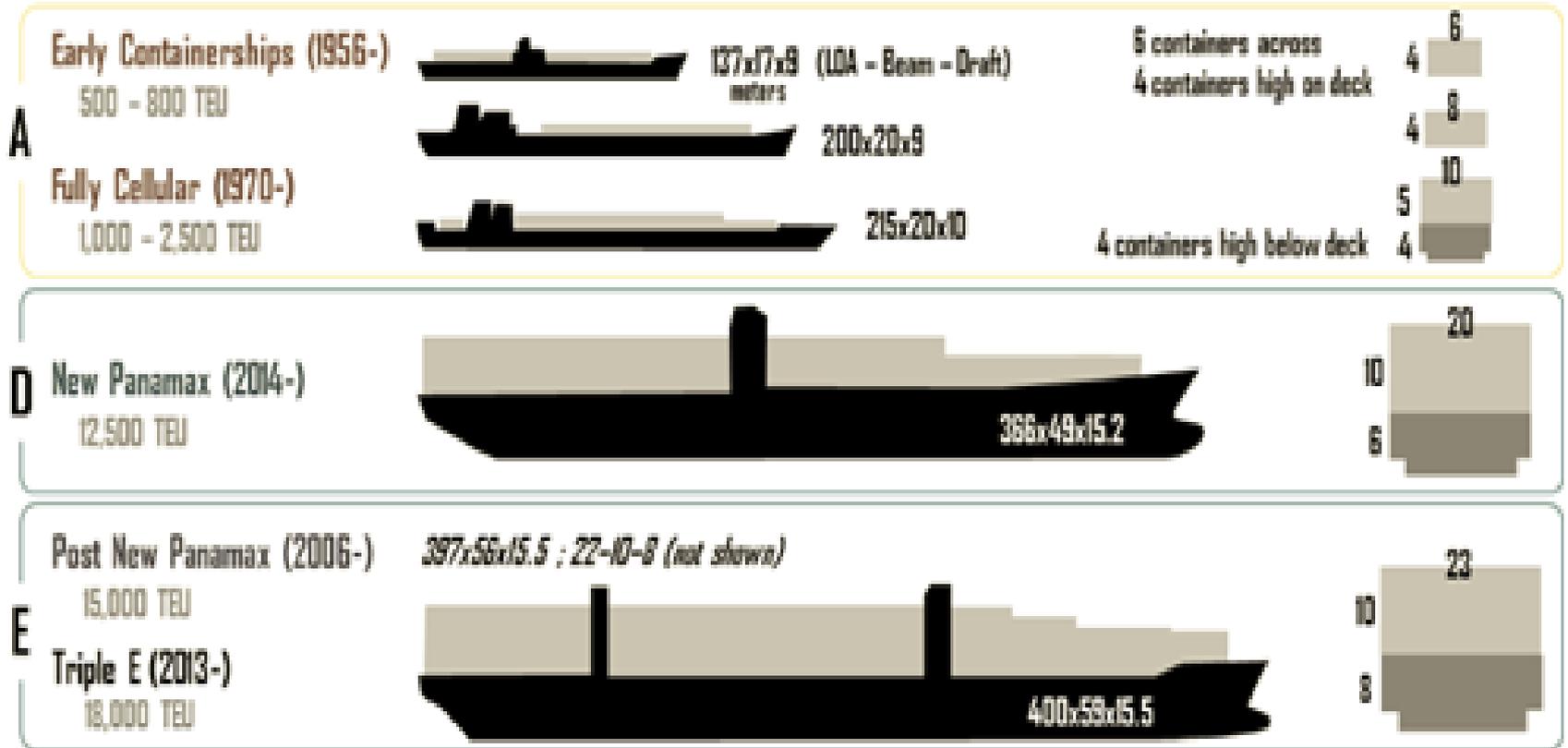
GROWTH IN IMPORT AND EXPORT TRADE

North America Imports and Exports, 1960-2020 (Billions of \$2020)

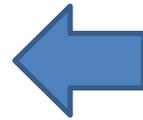


TEMS

INCREASING SIZE OF SHIPS



DEEP DRAFT PORTS



Prince Rupert

Vancouver



Halifax

*Pilots Improved
Docking
Procedures*

SHALLOW DRAFT PORTS



Pilots Optimized Utilization of the Shipping Channel for Increased Capacity and for Handling Larger Ships

← Montreal

Saint John NB →

Pilots Improved Docking Procedures for Large Offshore Oil Tankers

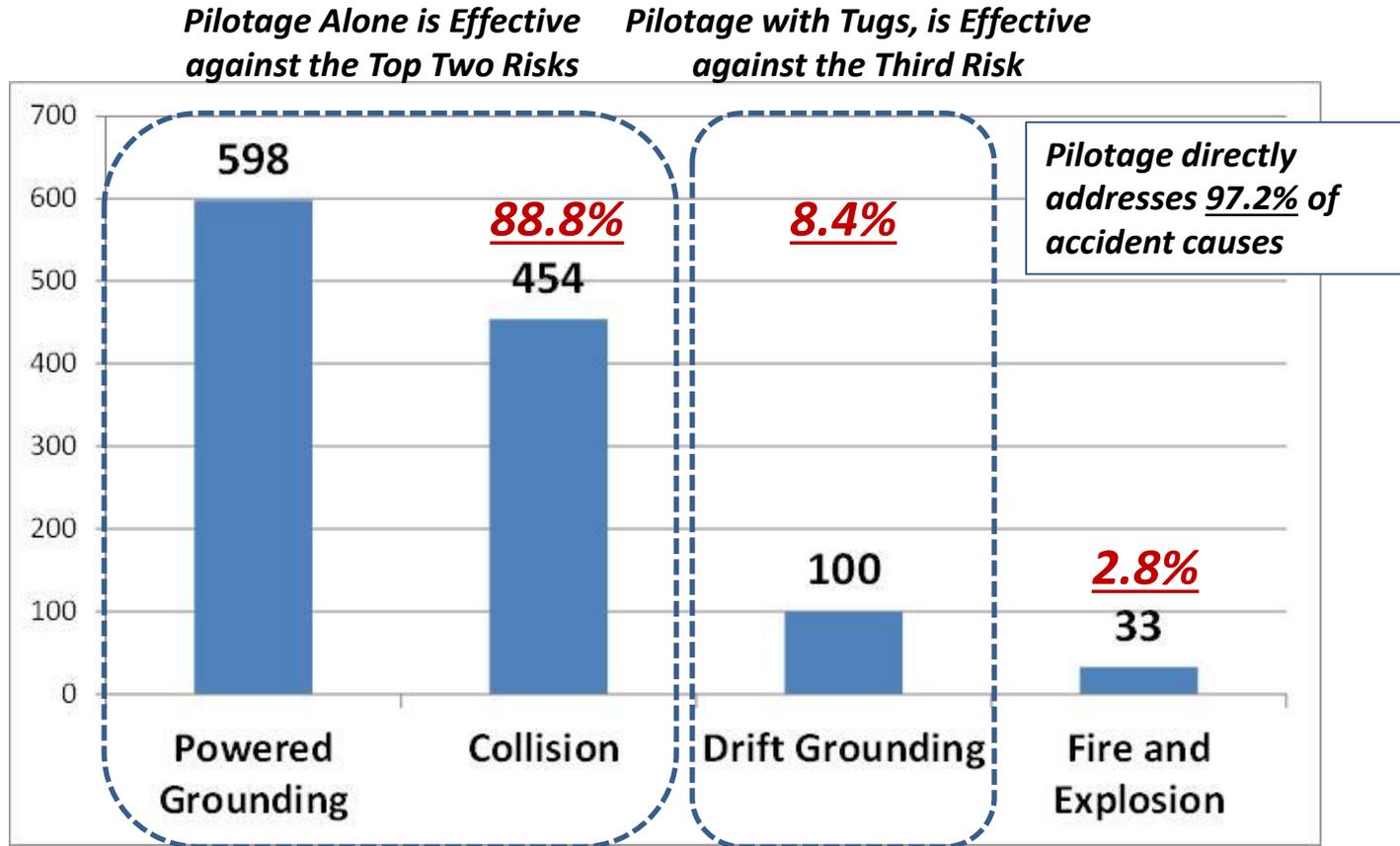


BENEFIT COST ANALYSIS METHODOLOGY

1. Safety Contribution of Pilots
2. How Pilots and Tugs Reduce the Risk of Maritime Accidents
3. Productivity Benefits (Partial, Case Study Based)

**Sum of Safety + Productivity =
Total Benefit of Pilotage to
produce the Benefit Cost Ratio**

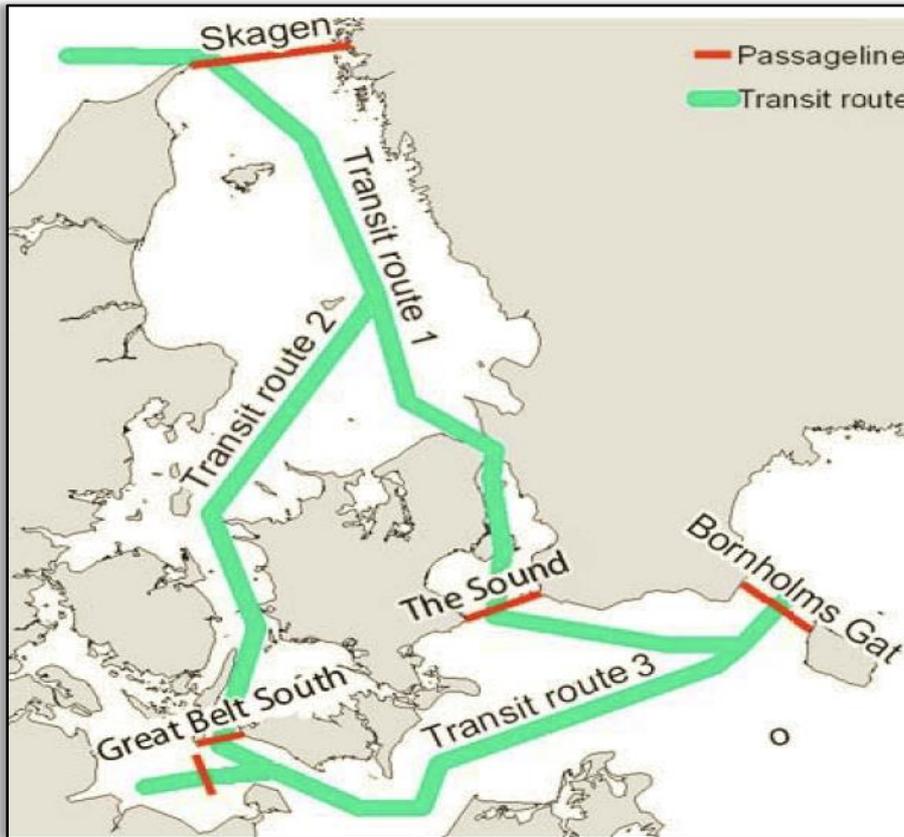
PILOTS DIRECTLY ADDRESS THE TOP CAUSES OF MARITIME ACCIDENT



Source: Det Norske Veritas (DNV): the number of accidents per Billion NM sailed, international shipping experience. The risk of Foundering is less than 1 incident per billion miles in port areas. Foundering is mostly a risk in open ocean sailing so this category is not included in the Exhibit above. Prince Rupert Marine Risk Assessment, DNV:

http://legacy.rupertport.com/media/dnv/marine_risk_assessment_highlights.pdf

QUANTIFYING THE SAFETY IMPACT OF PILOTS VS NO PILOTS BASED ON BALTIC SEA DATA*



The Baltic Sea is one of the few places in the world where data has been collected on the impact of having pilots vs. no pilots

Great Belt – Route 2:

Without Pilots (Actual):

67 ships, 6.3 groundings (9.4%)

With Pilots but no Tugs (Actual):

1,743 ships, 0 groundings (0.0%)

* Denmark to IMO, *Consideration of the Reports and Recommendations of the Maritime Safety Committee, The advantages of taking a Pilot*, October 14, 2005.

BALTIC SEA DATA ANALYSIS USING CLOPPER PEARSON FORMULA CONFIDENCE INTERVALS (CI)

$$\sum_{k=0}^k \binom{n}{k} p_{UB}^k (1 - p_{UB})^{n-k} = \frac{\alpha}{2}$$

$$\sum_{k=x}^n \binom{n}{k} p_{LB}^k (1 - p_{LB})^{n-k} = \frac{\alpha}{2}$$

Clopper-Pearson formulas were used to estimate Confidence intervals on the probabilities of accident occurrences:

Results:

Without Pilots (Actual):

67 ships, 6.3 groundings (9.4%)

95% CI Range = [0.03358, 0.18480]

With Pilots but no Tugs (Actual):

1,743 ships, 0 groundings

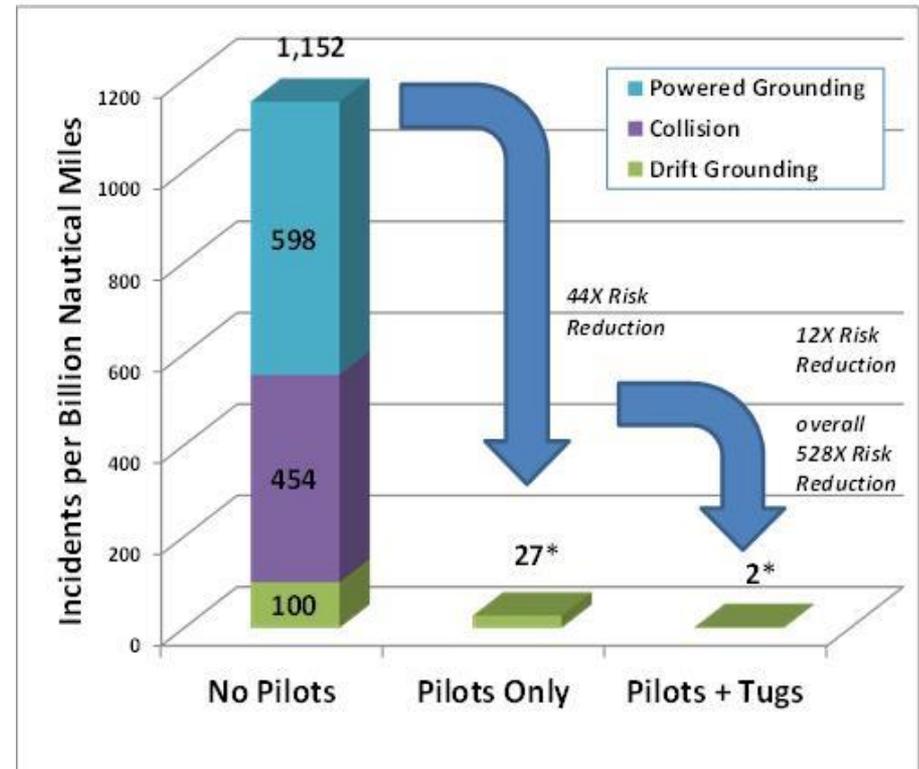
95% CI Range= [0.00000 , 0.00211]

*CI Ranges do not Overlap:
Results are Statistically Significant*

PILOTAGE RISK REDUCTION FROM THE ANALYSIS

By comparison to risk factors identified by DNV, this suggests that:

- Pilotage alone practically eliminates Powered Grounding and Collision incidents; it can even prevent around $\frac{2}{3}$ of Drift Grounding incidents. **Risk reduction 44x.**
- Utilization of tugs almost fully eliminates (98%) Drift Grounding incidents. However tugs are almost always available (either standby or tethered) to support marine operations in pilotage areas.
- **Overall assumed risk reduction factor of 528x** compared to not having Pilots. *Actual risk reduction is likely to be greater than this.*



REPRESENTATIVE PRODUCTIVITY CASE STUDIES

District	Productivity Benefit Category	Productivity Benefit (CDN \$Mil)
Laurentian	Nighttime Winter Navigation	\$3.03
	Shuttle Tankers Montreal to Quebec	\$34.00
	Larger Tankers to Montreal	\$3.75
	Larger Tankers to Quebec	\$2.00
		<u>\$42.78</u>
Pacific	2nd Narrows Added Tanker Draft	\$2.70
	Larger Container Ships in Vancouver	\$24.40
		<u>\$27.10</u>
Atlantic	St John Harbor Opening	\$504.20
	Larger Container Ships in Halifax	\$2.70
	Fishing Boats in Placentia Bay	\$0.50
		<u>\$507.40</u>
Lakes	Extended Seaway Season	\$45.00
		<u>\$45.00</u>
TOTAL		\$622.28

Productivity Benefits NPV over 20 Years

Results not normalized for all of Canada, so they are very conservative

COMBINED BENEFITS SUMMARY

The Overall Result is a Huge 22.25 Benefit Cost Ratio

District	Pilots- Expected Case				
	Reduced Cost of Accidents (CDN \$Mil)	Productivity Benefit (CDN \$Mil)	Total Benefit (CDN \$Mil)	Pilotage Cost (CDN \$Mil)	Benefit Cost Ratio
Laurentian	\$2,015.04	\$42.78	\$2,057.82	\$85.10	24.18
Pacific	\$548.79	\$27.10	\$575.89	\$74.63	7.72
Atlantic	\$1,206.65	\$507.40	\$1,714.05	\$22.48	76.24
Lakes	\$164.79	\$45.00	\$209.79	\$22.60	9.28
TOTAL	\$3,935.28	\$622.28	\$4,557.56	\$204.82	22.25

Canadian Marine Pilots Association, *Marine Pilotage in
Canada: A Cost Benefit Analysis*, see:

[https://www.marinepilots.ca/news-docs/Canadian-
Marine-Pilotage-Cost-Benefit-Analysis-2017.pdf](https://www.marinepilots.ca/news-docs/Canadian-Marine-Pilotage-Cost-Benefit-Analysis-2017.pdf)

THANK YOU

FOR MORE INFORMATION CONTACT

ALEXANDER E. METCALF, PHD

PRESIDENT

TEMS

AMETCALF@TEMSINC.COM

CKRAFT@TEMSINC.COM