

AI and Digital Tools for Sustainable Port Development and Environmental Protection

Presentation By: Lisa Drake, PhD
OAS CIP
09 June 2026, Bridgetown

Drake Marine Environmental Services
www.drakemes.com

OUTLINE

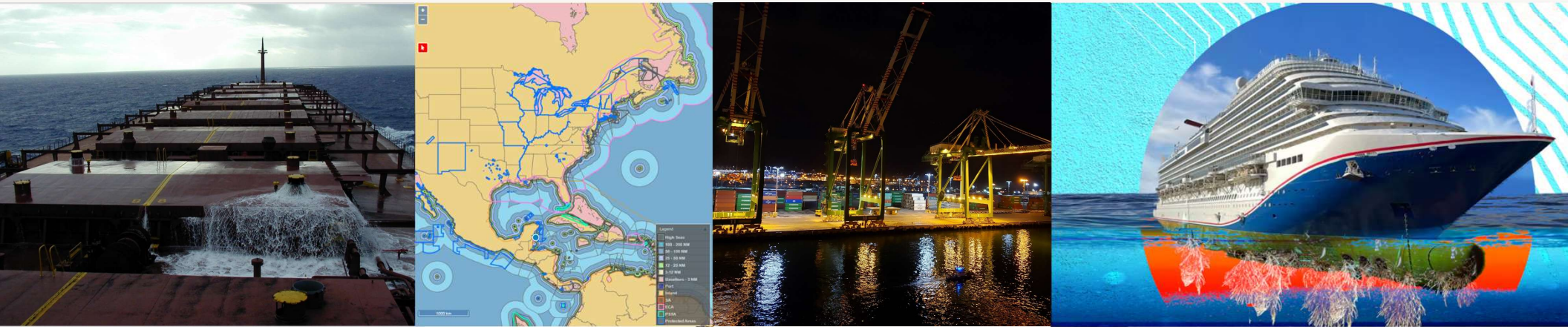
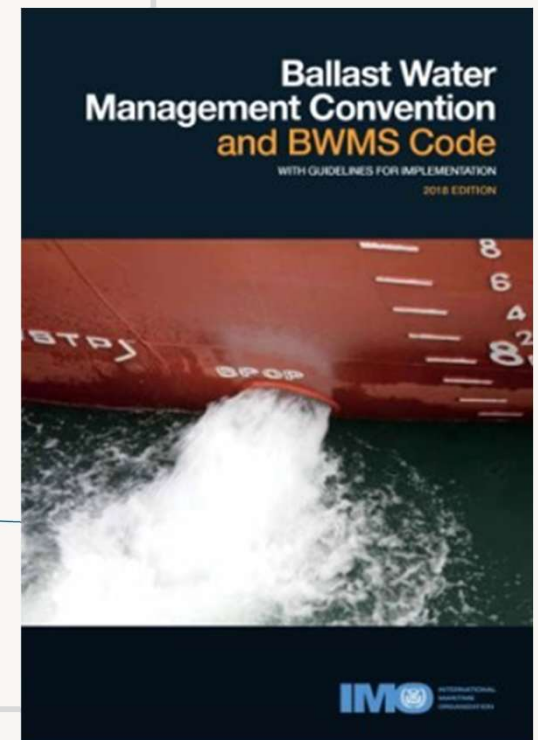
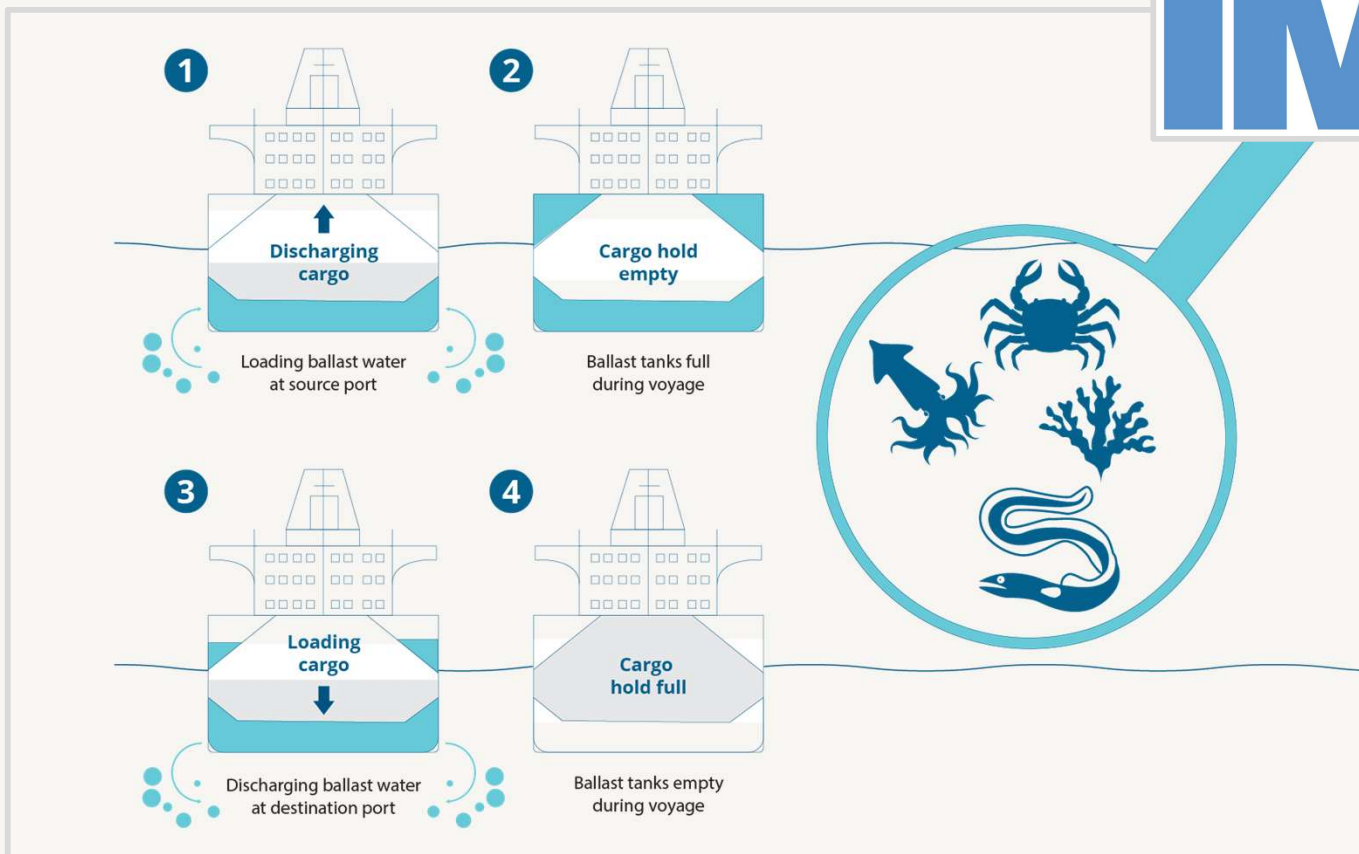


Image: Total Marine Solutions

Photo: Claudio Schwartz

- 3 buckets:
 - Data management
 - Data tools
 - Technology
- Caveats

DATA MANAGEMENT – BALLAST WATER



DATA MANAGEMENT – BALLAST WATER: WEST COAST

Long history of collaboration among states

New discovery: Golden Mussel (*Limnoperna fortunei*) in 2024 in California; transport along the coast is a concern



Fred Greaves for CalMatters

DATA MANAGEMENT – BALLAST WATER: MARINER

US STATE OF OREGON – MARINER DATABASE

Automatically
updated with ship
arrivals from the
Columbia River

Automate tasks
(form compliance),
increase efficiency,
analyze data

Regional aspirations

The screenshot shows the MARINER web application interface. At the top left is the MARINER logo with the text 'Oregon Department of Environmental Quality Ballast Water Program'. To the right are 'Support' and 'Account' links. A left sidebar contains a 'Dashboard' link. The main content area is titled 'Ballast Water Management Report' for vessel 'SAA ROCKET'. A progress bar at the top of the form shows six steps: 1. Vessel (checked), 2. Voyage (checked), 3. Ballast Water (checked), 4. Tanks (unchecked), 5. Certification (unchecked), and 6. Review (unchecked). Below the progress bar is the 'Vessel Information' section, which includes several input fields: Vessel Type (dropdown menu with 'Tank (Chemical, Crude, LNG, Other)' selected), Vessel Name (text input 'SAA ROCKET'), IMO/Official Number (text input '7000016'), Country of Registry (dropdown menu with 'United States' selected), Owner/Operator (text input 'TEST OWNER'), Other Owner/Operator (text input 'Enter Other Owner'), Gross Tonnage (text input '10000'), Total Ballast Water Capacity (text input '17000' with a unit dropdown 'm3'), Number of Tanks (text input '4'), Onboard BW Management System (dropdown menu with '162.060/2/4 (Alfa Laval)' selected), and Last Dry Dock Date (calendar input '06/04/2023'). At the bottom of the form are 'Save and Continue' and 'Cancel' buttons.

A REGIONAL APPROACH MATTERS

[Caribbean](#) [Economy & Business](#) [Energy & Environment](#) [Infrastructure Protection](#) [Maritime Security](#) [Resilience & Society](#)
[Security & Defense](#) [Technology & Innovation](#) [Trade and tariffs](#) [United States and Canada](#)

Issue Brief | June 1, 2026

US-Caribbean maritime cooperation: Why stronger ports, supply chains, and security matter now

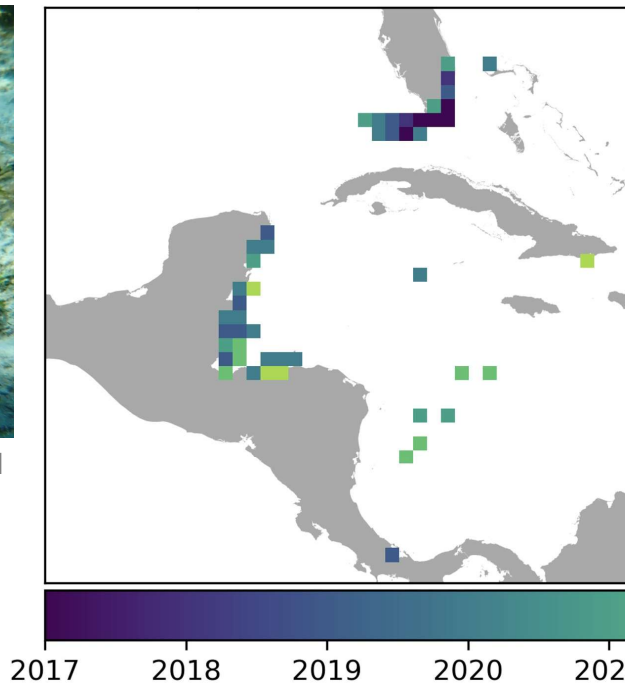
By [Maite Latorre Yerou](#) and [Patricia R. Francis](#)



A REGIONAL APPROACH MATTERS



Cayman Compass 2021



[nature](#) > [scientific reports](#) > [articles](#) > [article](#)

Article | [Open access](#) | Published: 10 November 2022

Transmission of stony coral tissue loss disease (SCTLD) in simulated ballast water confirms the potential for ship-born spread

[Michael S. Studivan](#) , [Michelle Baptist](#), [Vanessa Molina](#), [Scott Riley](#), [Matthew First](#), [Nash Soderberg](#), [Ewelina Rubin](#), [Ashley Rossin](#), [Daniel M. Holstein](#) & [Ian C. Enochs](#)

Scientific Reports **12**, Article number: 19248 (2022) | [Cite this article](#)

How mariners can help slow the spread of coral disease

March 3, 2025 | By LCDR Thomas Ashley, Office of Operating and Environmental Standards

To prevent SCTLD from moving into currently unaffected regions, the Coast Guard encourages vessel owners and operators to familiarize themselves with existing **ballast water requirements** [USCG: [33 CFR Part 151](#) and [46 CFR Part 162.060](#); EPA: [2013 Vessel General Permit \(VGP\)](#), as codified by the [Vessel Incidental Discharge Act](#)] and ballast water management recommendations in [MSIB 07-19](#).

Vessel owners and operators are also encouraged to familiarize themselves with **biofouling** management and cleaning regulations and recommended practices (e.g., [33 CFR Part 151.2050](#); [EPA 2013 VGP Sec. 2.2.23](#)).

DATA MANAGEMENT – ENVIRONMENTAL COMPLIANCE

OCEAN GUARDIAN® – SUBSCRIPTION FOR SHIPS (Ft. Lauderdale, Florida)



Automatic Identification System (AIS) + global regulatory database → bridge
>17,000 regulations (updated daily)



Find Vessel Lat / Long



Search Ships



Demo Company



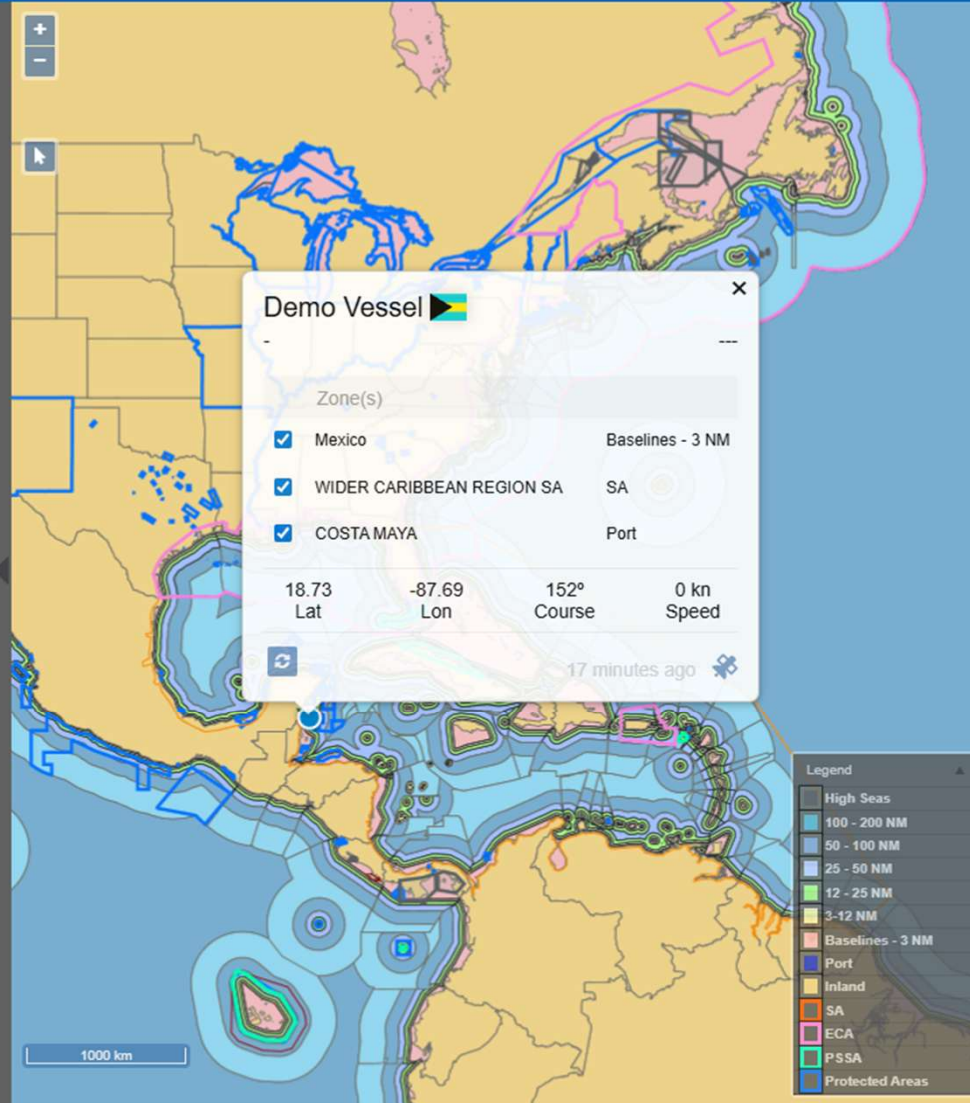
Demo Company



Demo Vessel



Last Selection:

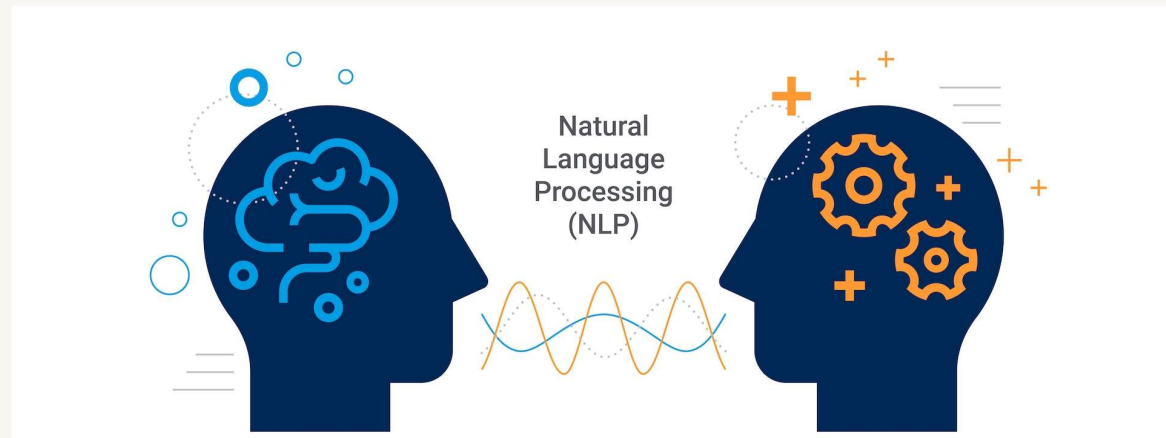
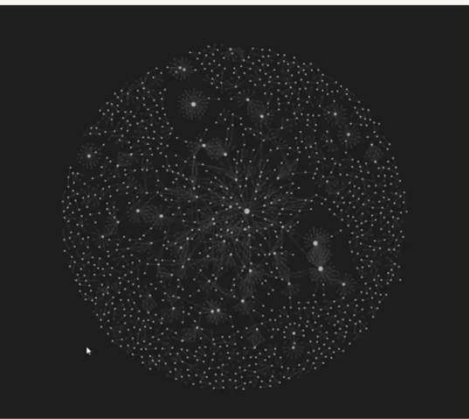






Environmental Regulations	Port of Call - Checklists	Vessel Documents
Categories	Global	Company
Air Emissions: EGCS Other	✗	✗
Air Emissions: EGCS Wash Water	⚠	⚠
Air Emissions: EGR Bleed Off Water	⚠	⚠
Air Emissions: Fuel Requirements	⚠	⚠
Air Emissions: Incinerator	⚠	⚠
Air Emissions: NOx	⚠	⚠
Air Emissions: Ozone Depleting Substances	✗	✗
Air Emissions: Shipboard Incineration	⚠	⚠
Ballast Water	✗	✗
Ballast Water: Ballast Water Exchange	⚠	⚠
Cargo	✗	✗
Cargo: Noxious Liquid Substances	⚠	⚠
Garbage	✗	✗
Garbage: Animal Carcasses	✗	✗
Garbage: Cargo Residue	✗	✗
Garbage: Cleaning Agents & Additives/Deckwater Washing	⚠	⚠
Garbage: Comminuted Food Waste	⚠	⚠
Garbage: Noncomminuted Food Waste	✗	✗
Garbage: Other- See Detailed View	✗	✗
MISC: Carriage Ban	✗	✗
MISC: Other- See Detailed View	⚠	⚠
Oil: Other- See Detailed View	✗	✗

DATA MANAGEMENT – ENVIRONMENTAL COMPLIANCE



AI AGENTS AND TOOLS

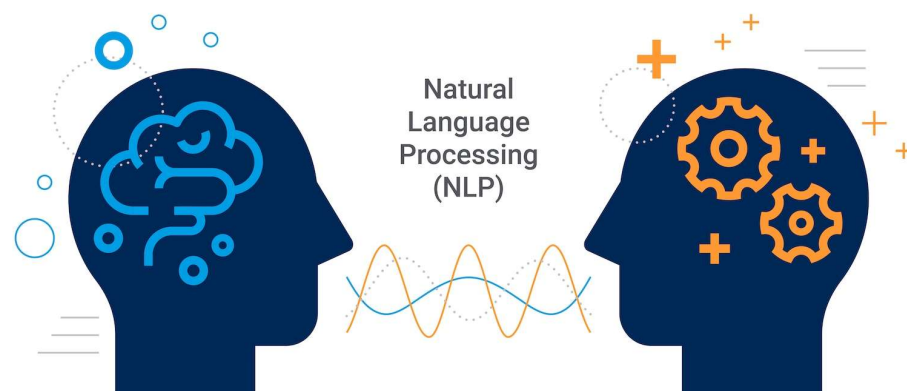
In use now by Ocean Guardian®:
network approach to reduce
search time (and token use)

AI FUTURE

Queries using “natural language processing”

Ultra-specific queries can be answered: “Make a graph of all ships in the last 6 months out of compliance for scrubber washwater pH by 10%”

This approach could be used for ports' environmental data (internally, and on public dashboards) increasing efficiencies and allowing trends to be identified



AI AGENTS AND TOOLS

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DATA TOOLS – HOW TO CAPTURE PHYSICAL OPERATIONS?

Standard operating procedures (SOPs):

Easy to capture for administrative tasks

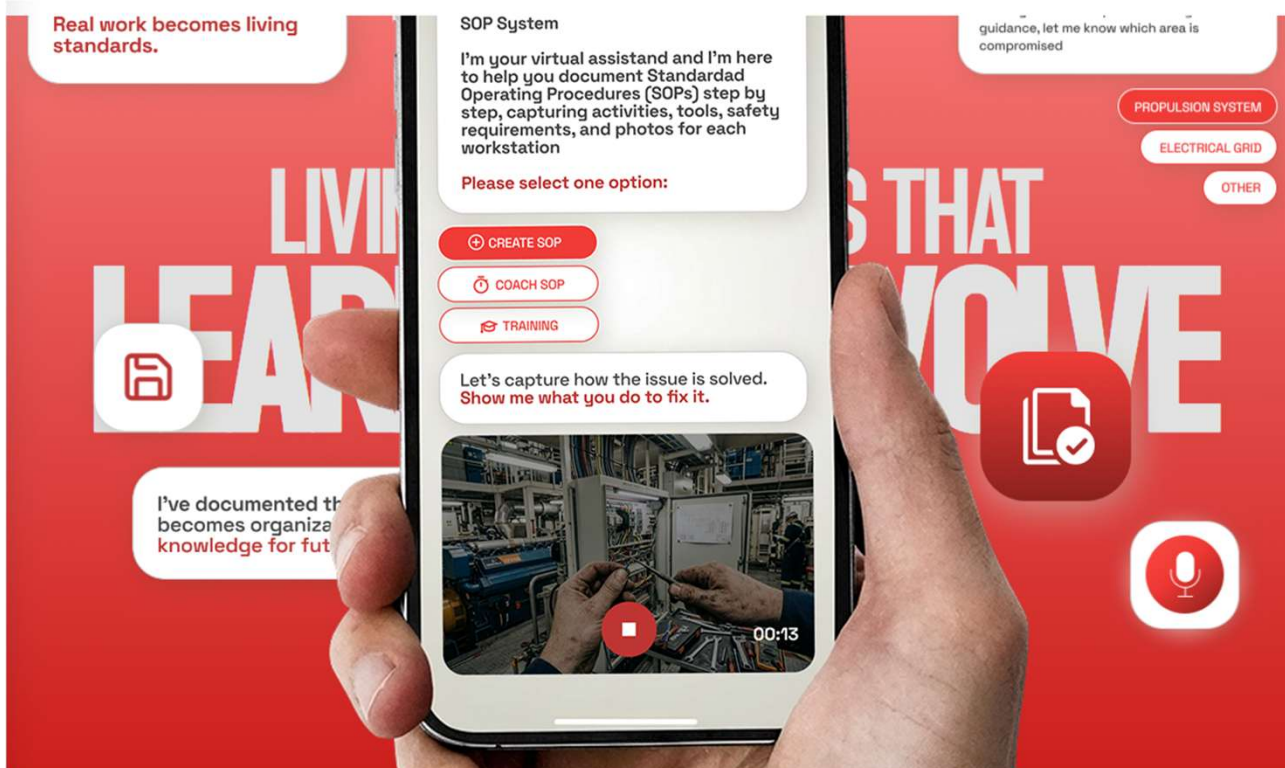
How to capture knowledge, details, and processes for physical operations?



SenseiLab (Miami, Florida)

Expert in the field **+** AI-trained algorithm asking iterative questions **→**
detailed, *living* standard

DATA TOOLS – HOW TO CAPTURE PHYSICAL OPERATIONS?



Real-world environmental example:
Fueling operations at a dock: Check process, train

TECHNOLOGY – CLEANING SHIPS' BIOFOULING



Claudio Schwartz

TECHNOLOGY – CLEANING SHIPS' BIOFOULING

Autonomous robots

1

Clean biofouling (while the ship is underway, at sea)

2

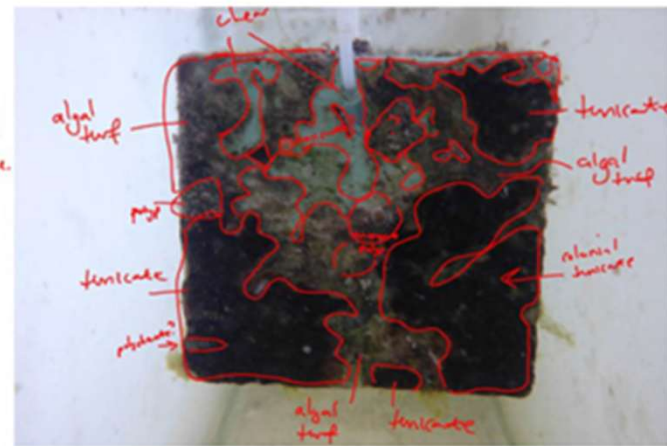
Collect geo-referenced inspection data →
real-time “hull condition”
(to inform cleaning timing and frequency)



(Boston,
Massachusetts)



TECHNOLOGY – IMAGING SHIPS' BIOFOULING



Management of Biological Invasions (2021) Volume 12, Issue 3: 599–617

Rapid quantification of biofouling with an inexpensive, underwater camera and image analysis

Matthew R. First^{1,*}, Scott C. Riley², Kazi Aminul Islam³, Victoria Hill⁴, Jiang Li³, Richard C. Zimmerman⁴ and Lisa A. Drake^{5,6}

TECHNOLOGY – IMAGING SHIPS' BIOFOULING

Regarding the potential power of AI in
biofouling imaging and data management:
“AI can tidy data that would take weeks to analyze”
—Abigail Robinson,
Chief Sustainability Officer, ECOsubsea
(Austevoll, Norway)

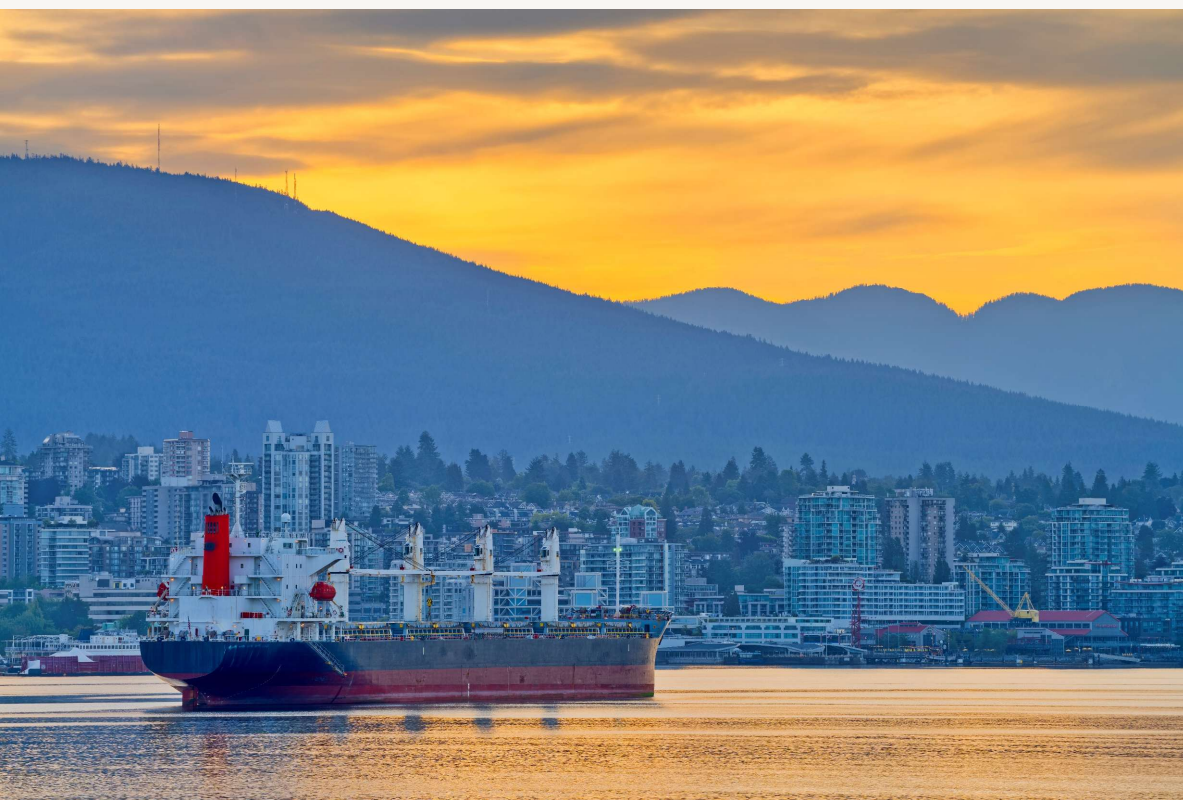


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CAVEATS



AI does not replace expertise – its value comes from the **intellectual property, scientific understanding, and operational expertise** that guide its application

— Trevor Tasker
CEO, ShipCarePro Biosecurity Ltd
North Saanich, Canada

Environmental regulations need to be implemented in a **globally consistent** manner

Technology approvals need to be **standardized and transparent**

CONCLUSIONS

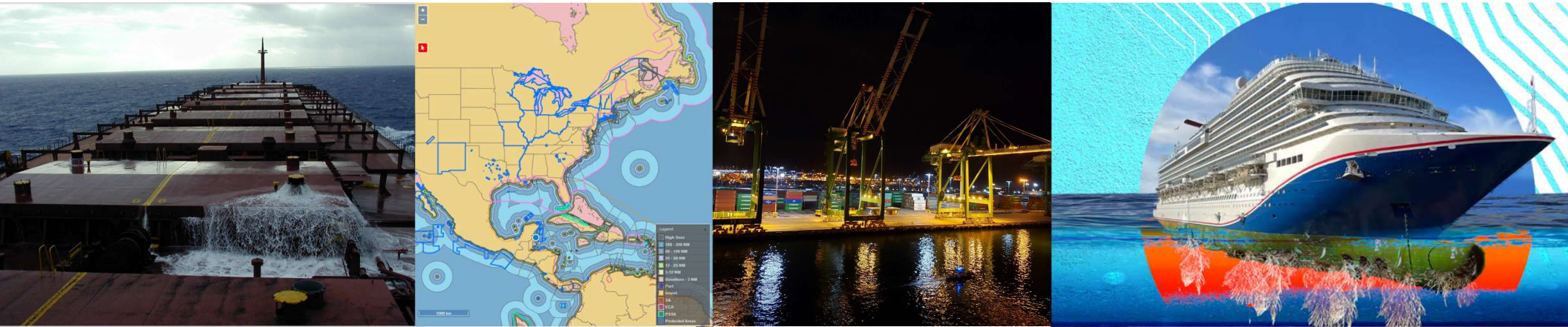


Image: Total Marine Solutions

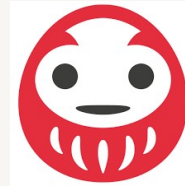
Photo: Claudio Schwartz

- AI and digitization are now used in environmental management
- **Natural language processing** is poised to change the way data are analyzed, making the process more accessible
 - (also, change will likely come with the integration of sensor arrays)
- AI tools must be maintained using human expertise, and the regulations they are used to determine compliance with must be consistently implemented

ACKNOWLEDGEMENTS

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Chris Scianni



SENSEILAB

Liza Kharoubi Eschenique, PhD

FLEET ROBOTICS

Anjali Boyd, PhD



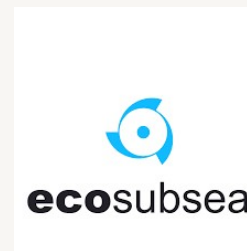
TOTAL MARINE SOLUTIONS

Alexandra Anagnostis-Irons
Carlos Carus



ECOsubsea

Abigail Robinson



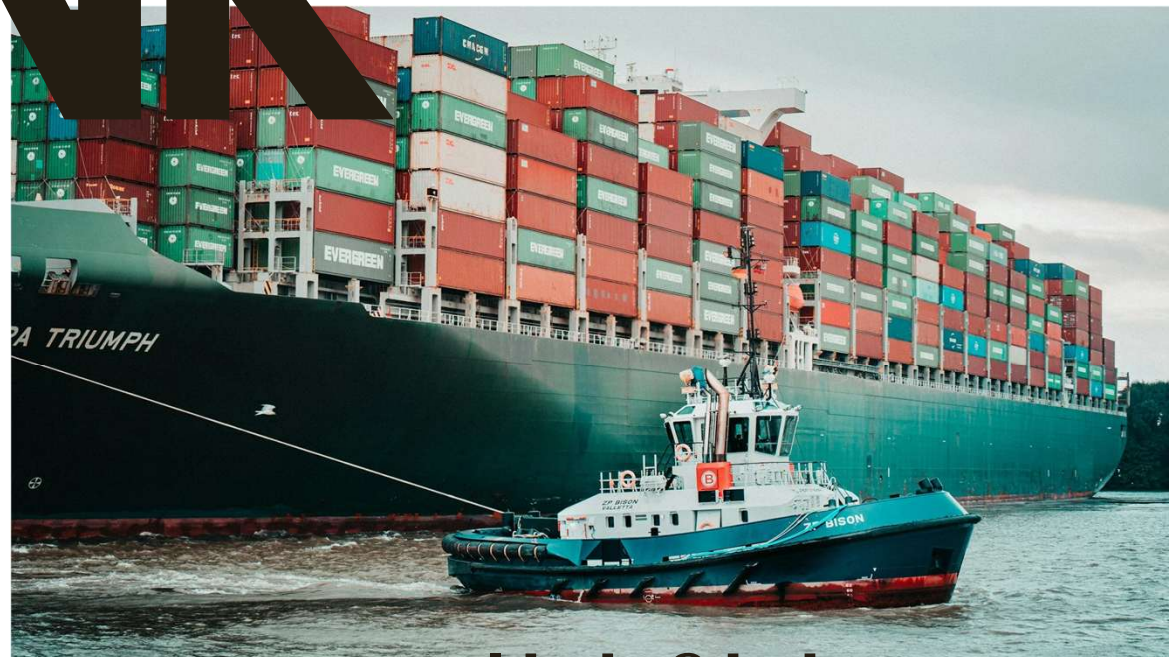
ShipCarePro Biosecurity Ltd

Trevor Tasker





**THANK
YOU**



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