

Win-Win: Biofouling Management for Operational Efficiency and Environmental Protection

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CSLC Marine Invasive Species Program
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Vessel Biofouling



Impacts: Shipping Industry

Facilitates corrosion

- Microbially-influenced corrosion (MIC)



Reduces operational efficiency

Biofouling → Drag → Fuel consumption → \$\$ Operating costs \$\$

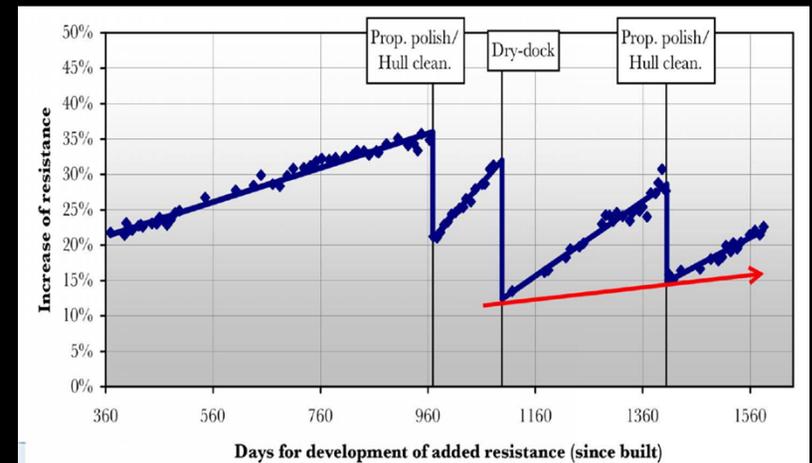


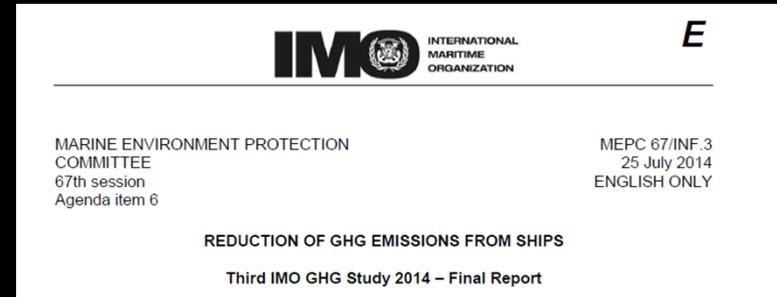
Figure courtesy of Daniel Kane, Propulsion Dynamics.

Expensive



Impacts: Environmental

Air Quality



Biofouling → Drag → Fuel consumption → Greenhouse gas emissions

Less biofouling = fewer emissions



Impacts: Environmental

Nonindigenous Species



Connectivity



Biofouling and Nonindigenous Species

Biofouling believed responsible for:



Global

(Hewitt & Campbell 2010)

42.6% of established NIS



North America

(Foffonoff et al. 2003)

Up to 67% of established NIS



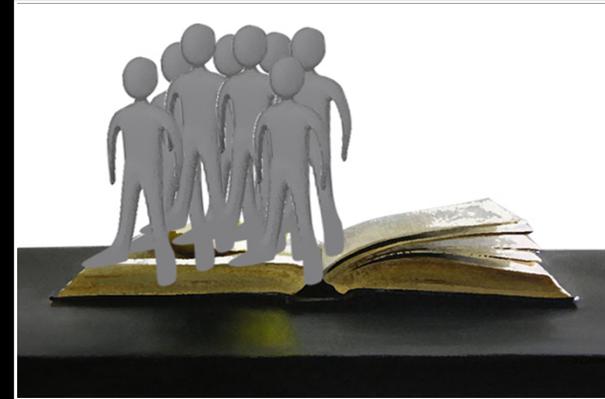
California

(Ruiz et al. 2011)

Up to 60% of established NIS



Shared Interests

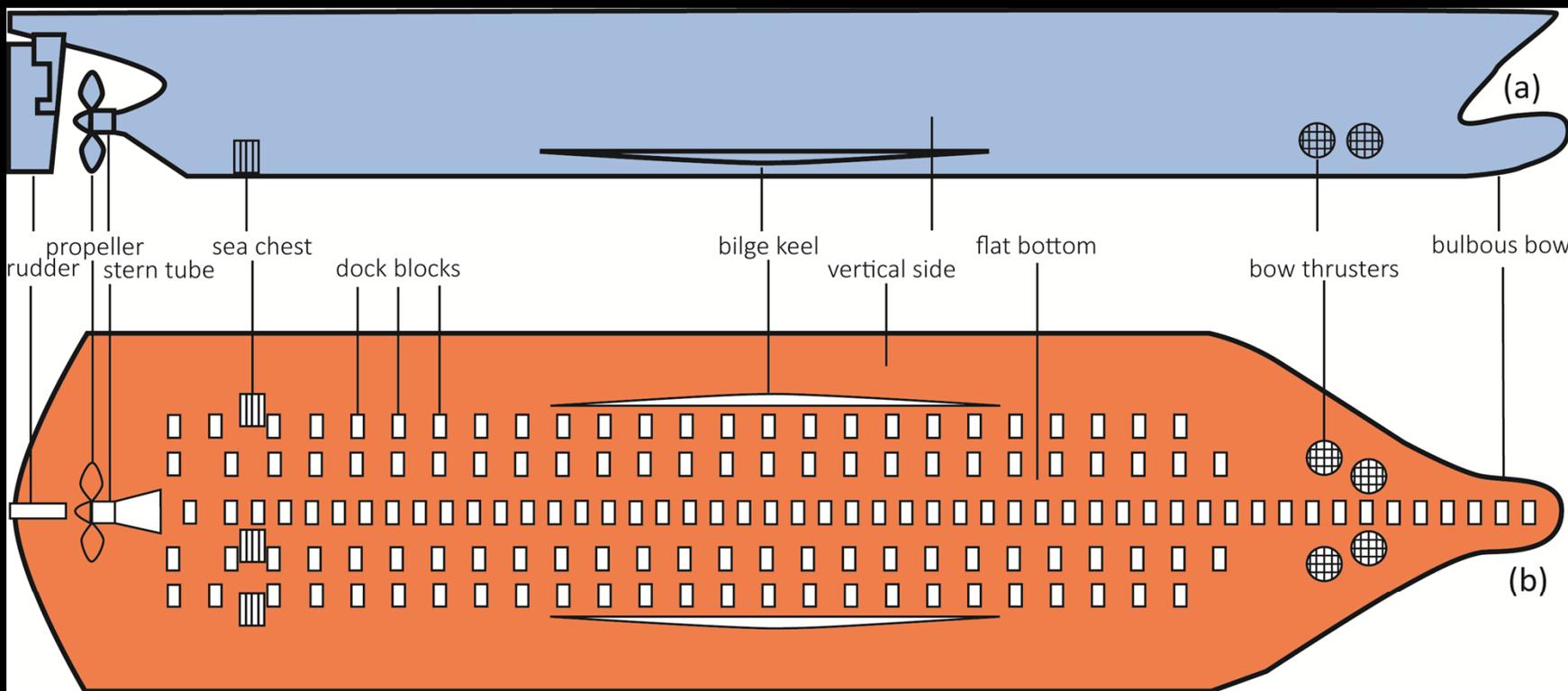


Biofouling - Negative impacts on:

- Ship operations
 - ✓ Corrosion
 - ✓ Fuel efficiency
- Environment
 - ✓ GHG emissions
 - ✓ Nonindigenous species



Gaps Still Exist



Davidson et al. 2016. Biofouling 32(4): 411-428



Shipping Industry Economics

Shipping industry economics



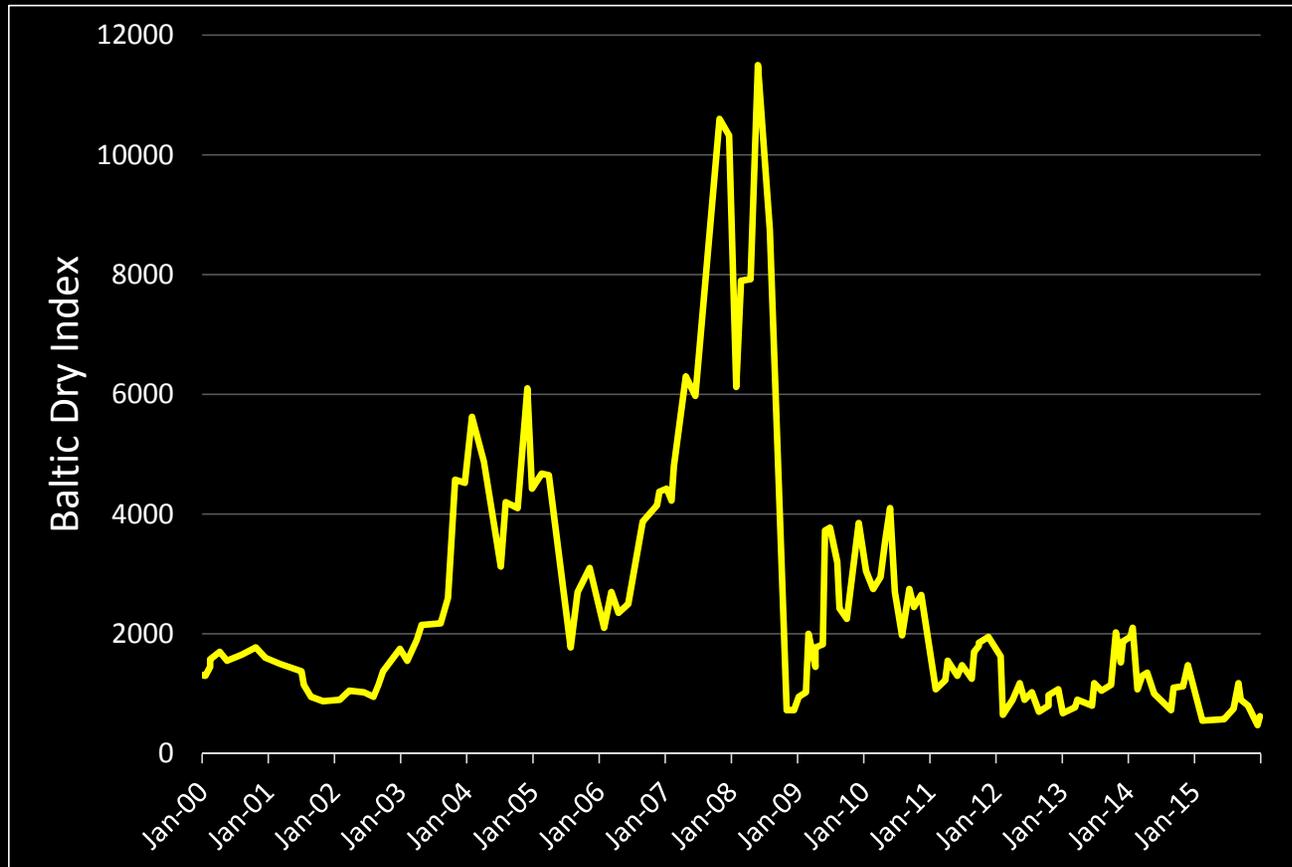
Operational practices and profiles



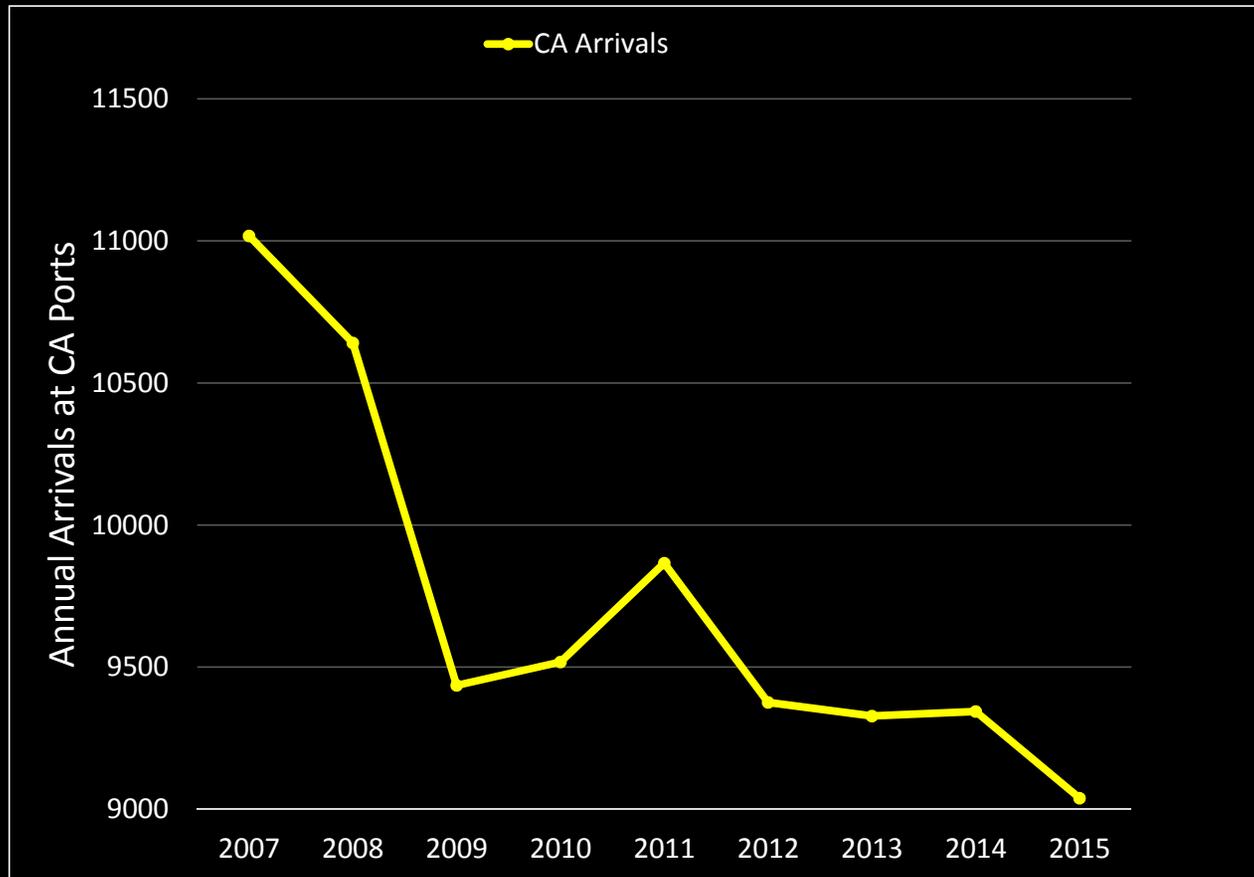
Nonindigenous species
introduction risk



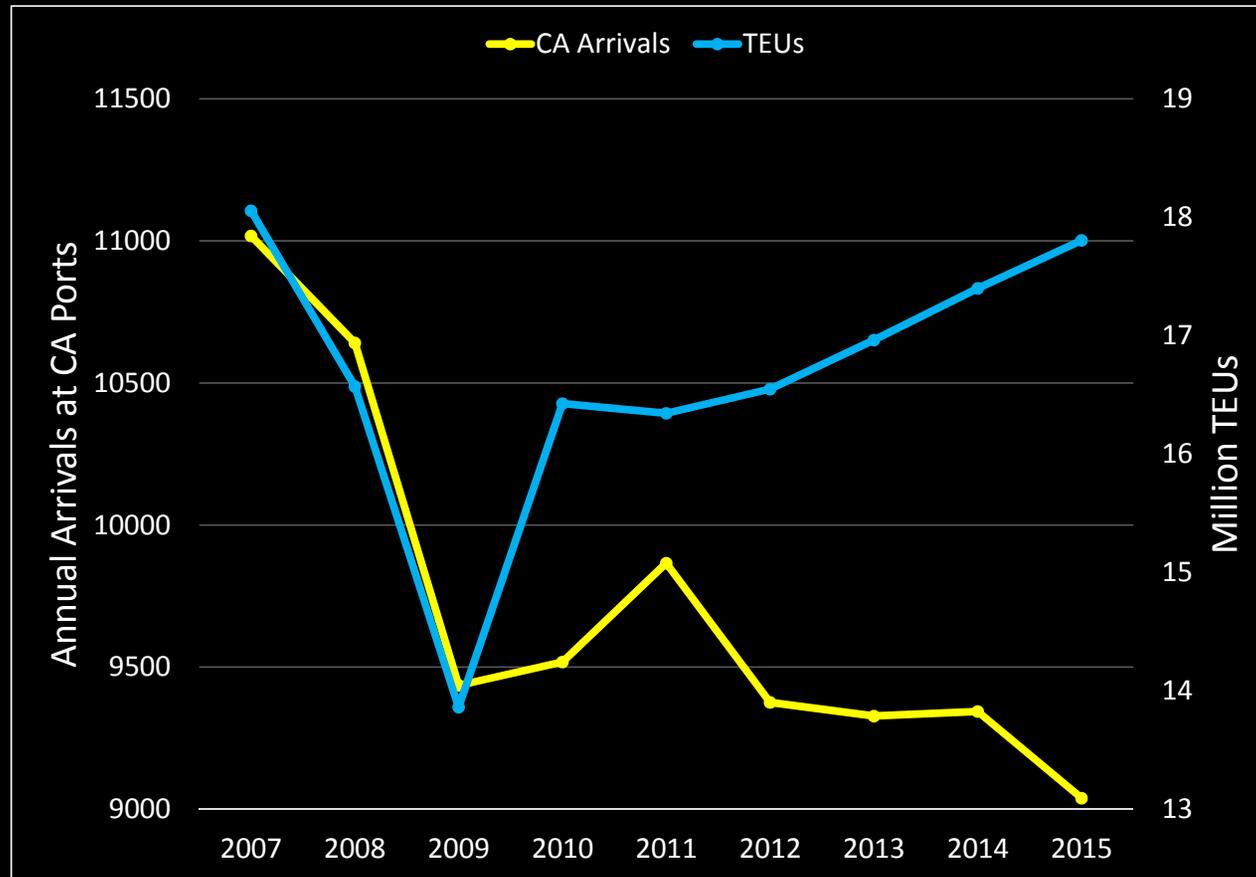
Shipping Industry Economics



California Vessel Arrivals



California Vessel Arrivals



Operational Changes: Layups



Shinji Yamada: http://www.nippon-foundation.or.jp/en/what/spotlight/ocean_outlook/photos/

Long residency periods = Greater likelihood of biofouling accumulation

- Negative impacts on antifouling/foul-release coating performance
 - Marine Science and Ecology 2002 (DAFF Report)
 - Floerl et al. 2005 Biological Invasions 7: 459-475
- Increases likelihood of propagules interaction with vessel
 - Coutts 1999. Australian Maritime College, Tasmania.
 - Floerl and Inglis 2005. Biological Invasions 7: 589-606



HHRF: Residency Period Data

Print

California State Lands Commission
Marine Invasive Species Program
Hull Husbandry Reporting Form
 Public Resources Code – 71205(e) and 71205(f)
 June 6, 2008
Part I: Reporting Form

Vessel Name: _____

Official / IMO Number: _____

Responsible Officer's Name and Title: _____

Date Submitted (Day/Month/Year): _____

Hull Husbandry Information

1. Since delivery, has this vessel ever been removed from the water for maintenance?
 Yes No

a. If Yes, enter the date and location of the most recent out-of-water maintenance:
 Last date out of water (Day/Month/Year): _____
 Port or Position: _____ Country: _____

b. If No, enter the delivery date and location where the vessel was built:
 Delivery date (Day/Month/Year): _____
 Port or Position: _____ Country: _____

2. Were the submerged portions of the vessel coated with an anti-fouling treatment or coating during the **out-of-water** maintenance or shipbuilding process listed above?
 Yes, full coat applied
 Yes, partial coat Date last full coat applied (Day/Month/Year) _____
 No coat applied Date last full coat applied (Day/Month/Year) _____

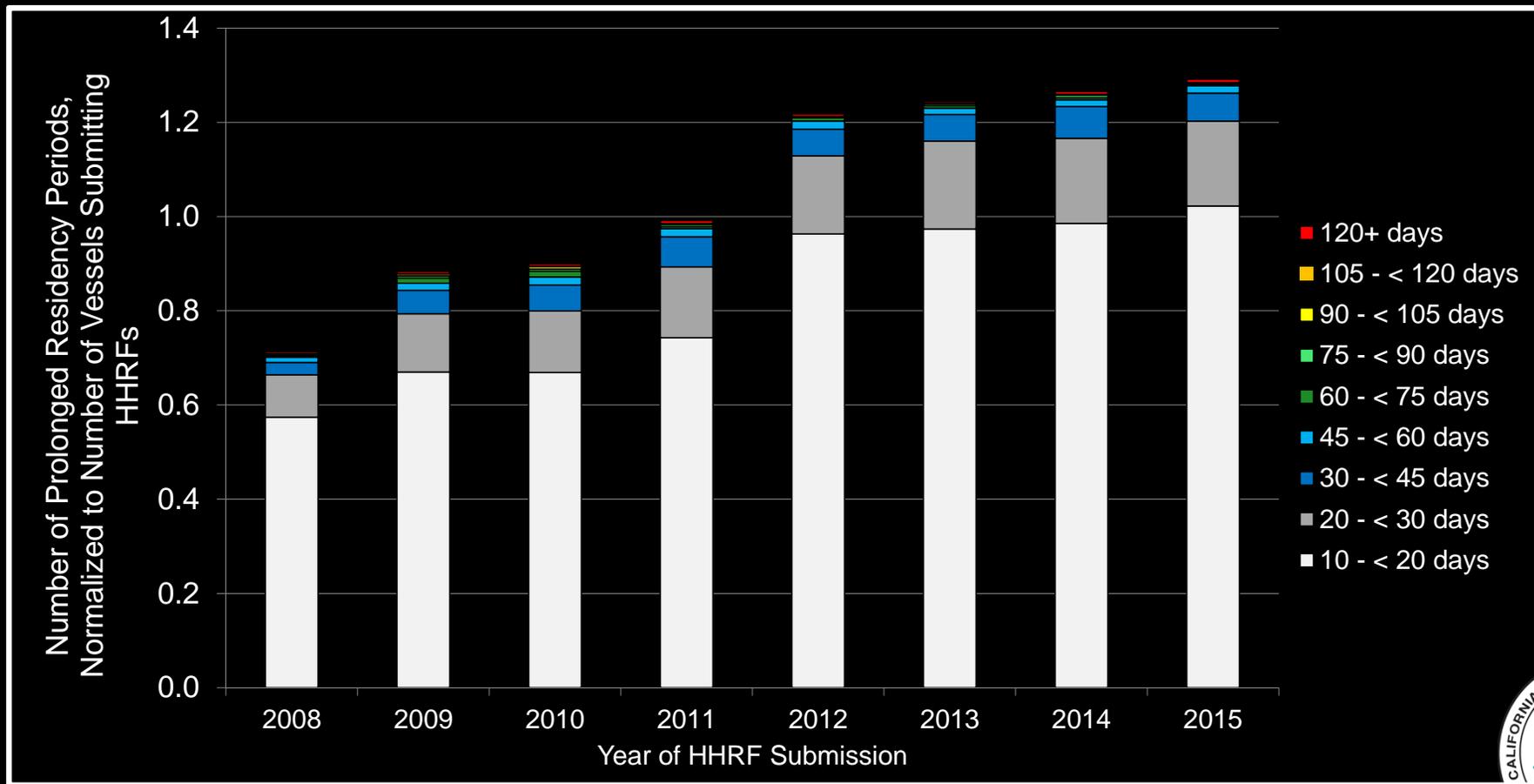
3. For the most recent **full coat** application of anti-fouling treatment, what type of anti-fouling treatment was applied and to which specific **sections** of the submerged portion of the vessel was it applied?
 Manufacturer/Company: _____
 Product Name: _____
 Applied on (Check all that apply): Hull Sides Hull Bottom Sea Chests
 Sea Chest Gratings Propeller Rope Guard/Propeller Shaft
 Previous Docking Blocks Thrusters Rudder Bilge Keels



Floerl and Coutts (2009)
 Port of Singapore, May 2009. Images: A. Coutts, May 2009



HHRF: Residency Period Data

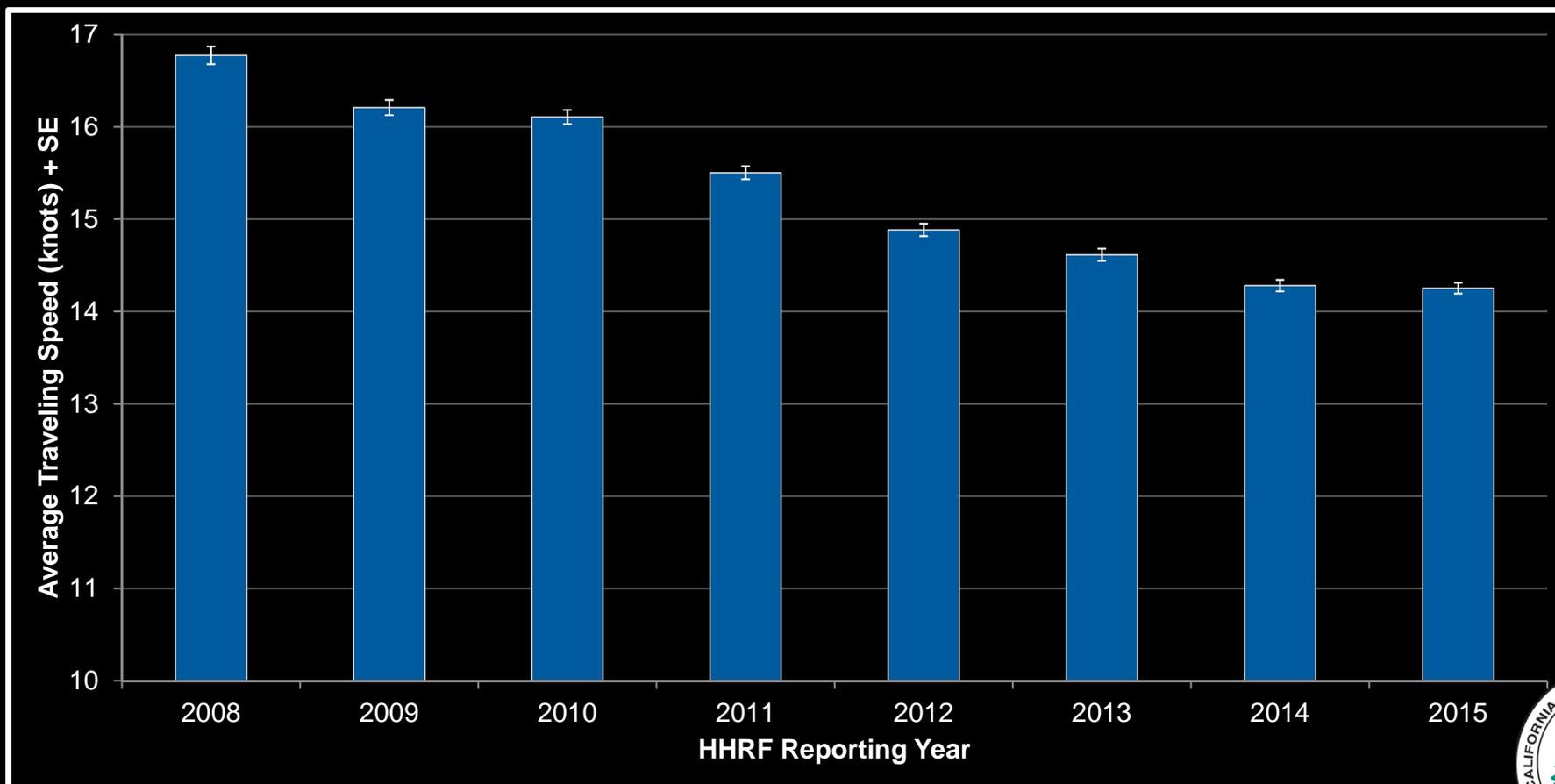


Slower speeds = greater survivorship

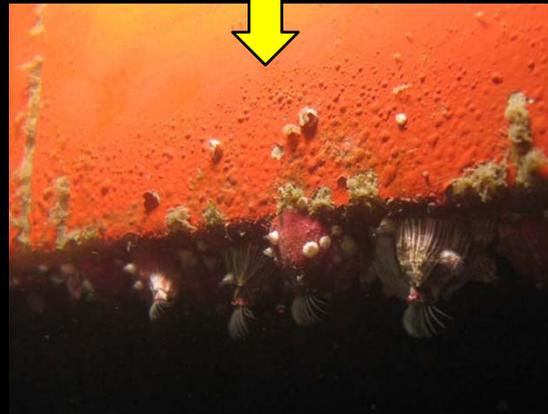
- Greater % cover and diversity compared to faster speeds
- Coutts *et al.* 2010a. *Biofouling* 26(1): 1-13
- Coutts *et al.* 2010b. *Biofouling* 26(5): 539-553



HHRF: Speed Data



Shipping Economic Impacts on NIS Introduction Risk



Recent Example: Port of LA – February 26, 2015



Recent Example: Hanjin Vessel(s) – September 2016



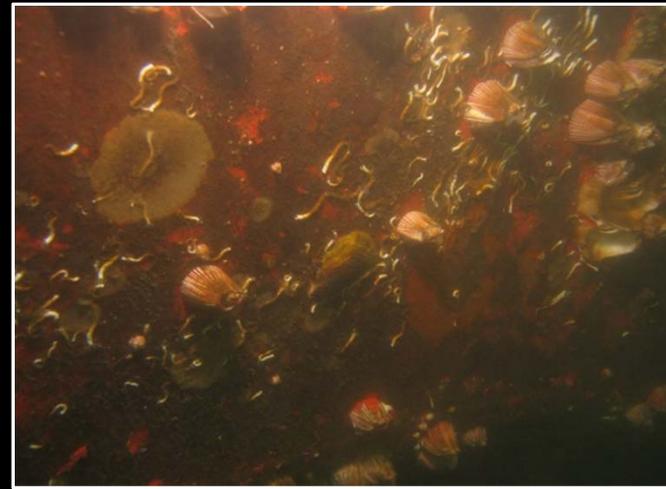
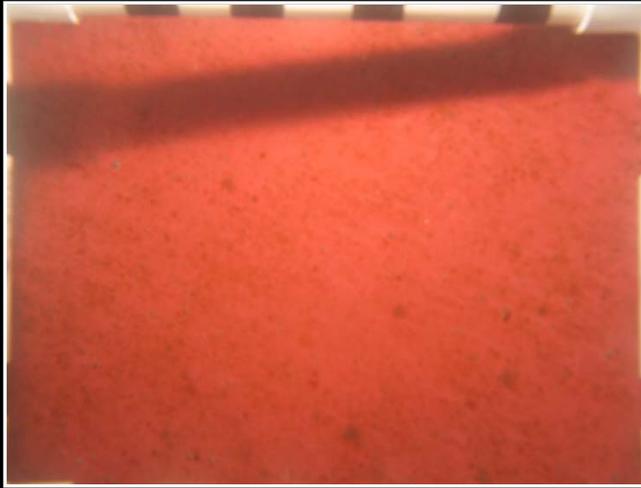
Marcus Yam: Los Angeles Times



Finding a Solution Through Collaboration



Proposed Biofouling Management Regulations



- Recordkeeping and reporting
- Best preventive practices
- Targeting high-risk ships



Proposed Biofouling Regulations: Public Rulemaking Process

- Publication of proposed rule
 - Mid-October
- 45-day public comment period
- Public hearing
 - Location: TBD
 - Date: Late November/early December
- Mailing list
 - Subscribe at www.slc.ca.gov
- Availability of rulemaking documents
 - www.slc.ca.gov
 - CSLC offices – Sacramento and Long Beach



Stay Tuned: Session 1E: Local-to-Global Perspectives on Biofouling Research and Management

- Antifouling Coatings Used on Vessels Arriving at California Ports
 - Raya Nedelcheva – CSLC
- Barnacles and Mussels and Copper, Oh My! What are the Concerns with In-Water Cleaning?
 - Chris Scianni – CSLC
- In-Water Hull Cleaning tests Update – SF Bay Region
 - David Elias – San Francisco Regional Water Quality Control Board
- In-Water Cleaning – How Do We Know it Works?
 - Eugene Georgiades – New Zealand Ministry for Primary Industries
- Australian Perspectives on Regulation of Vessels Biofouling
 - Sonia Gorgula – Australian Department of Agriculture and Water Resources



Thank You

- For more information:

www.slc.ca.gov

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