

# Biofouling management in CA:

Recent practices, research, proposed regulations, and future goals



Chris Scianni  
CSLC – Marine Invasive Species Program  
Pacific Ballast Water Group  
April 15, 2015 – Seattle, WA





# Topics to cover

1. Recent vessel practices

2. Biofouling research

3. Proposed regulations

4. Future goals

# Topic 1: Recent Vessel Practices

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:

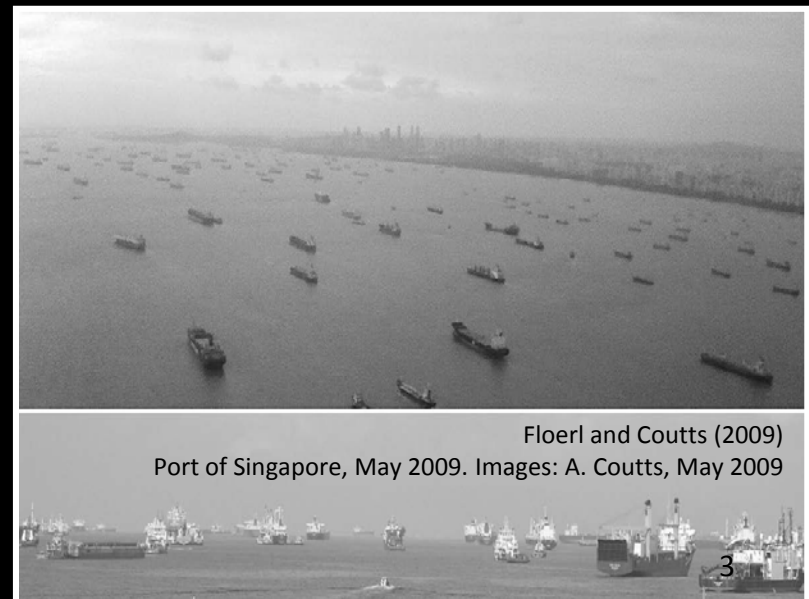
Delivery date (Day/Month/Year):	
Port or Position:	Country:

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 <input type="checkbox"/>	
Yes, partial coat <input type="checkbox"/>	Date last full coat applied (Day/Month/Year):
No coat applied <input type="checkbox"/>	Date last full coat applied (Day/Month/Year):

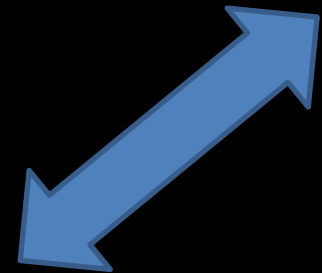
3. For the most recent **full coat** application of anti-fouling treatment, what type of anti-fouling treatment was applied and to which specific **sections** of the submerged portion of the vessel was it applied?

Manufacturer/Company:	
Product Name:	
Applied on (Check all that apply):	
Hull Sides <input type="checkbox"/>	Hull Bottom <input type="checkbox"/>
Sea Chests <input type="checkbox"/>	Sea Chest Gratings <input type="checkbox"/>
Propeller <input type="checkbox"/>	Rope Guard/Propeller Shaft <input type="checkbox"/>
Previous Docking Blocks <input type="checkbox"/>	Thrusters <input type="checkbox"/>
Rudder <input type="checkbox"/>	Bilge Keels <input type="checkbox"/>



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





# Great Recession Impacts on Maritime Shipping

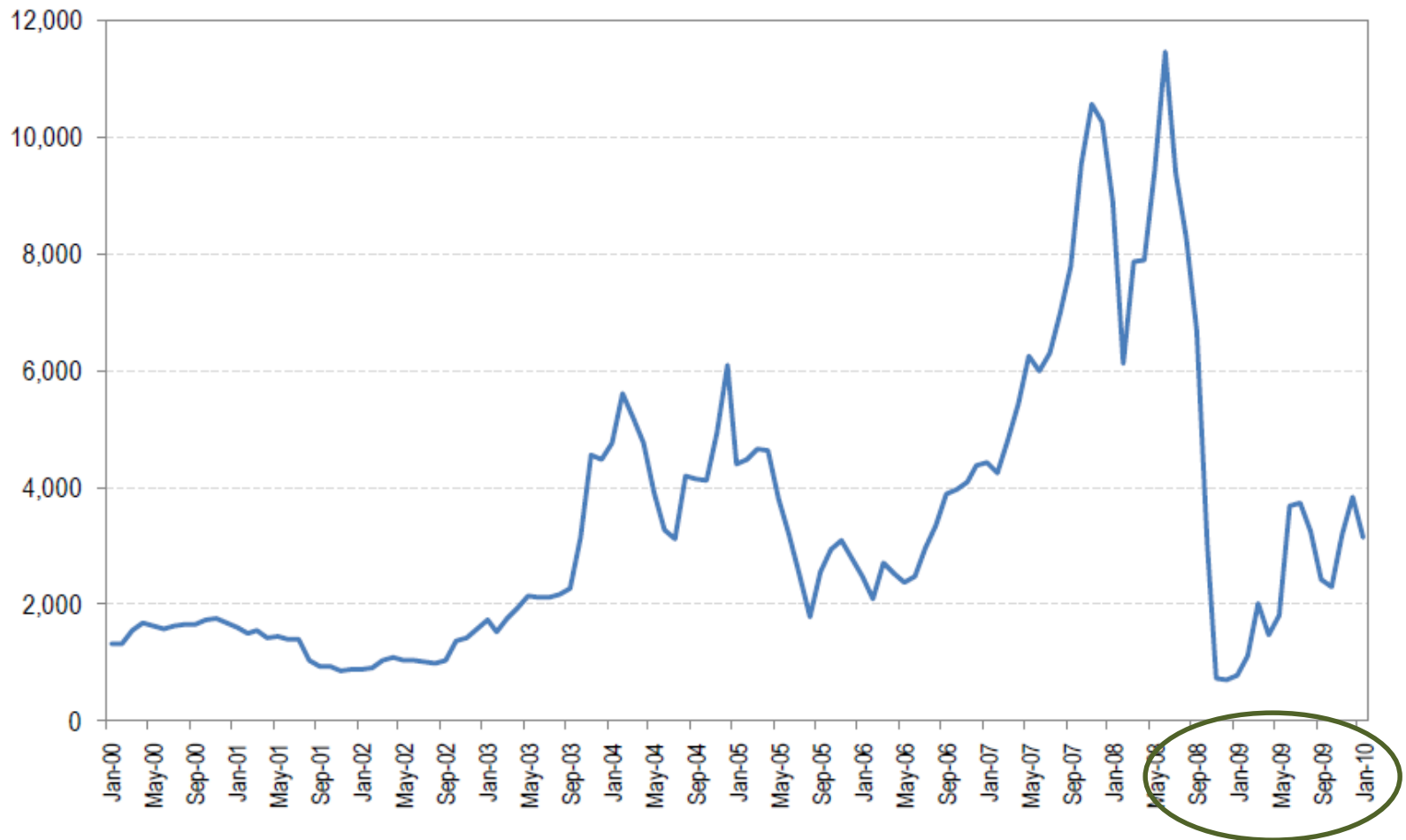


Figure 5 - Baltic Dry Index, 2000-2009 (Monthly Value). Source: The Baltic Exchange.

# Great Recession Impacts on Maritime Shipping

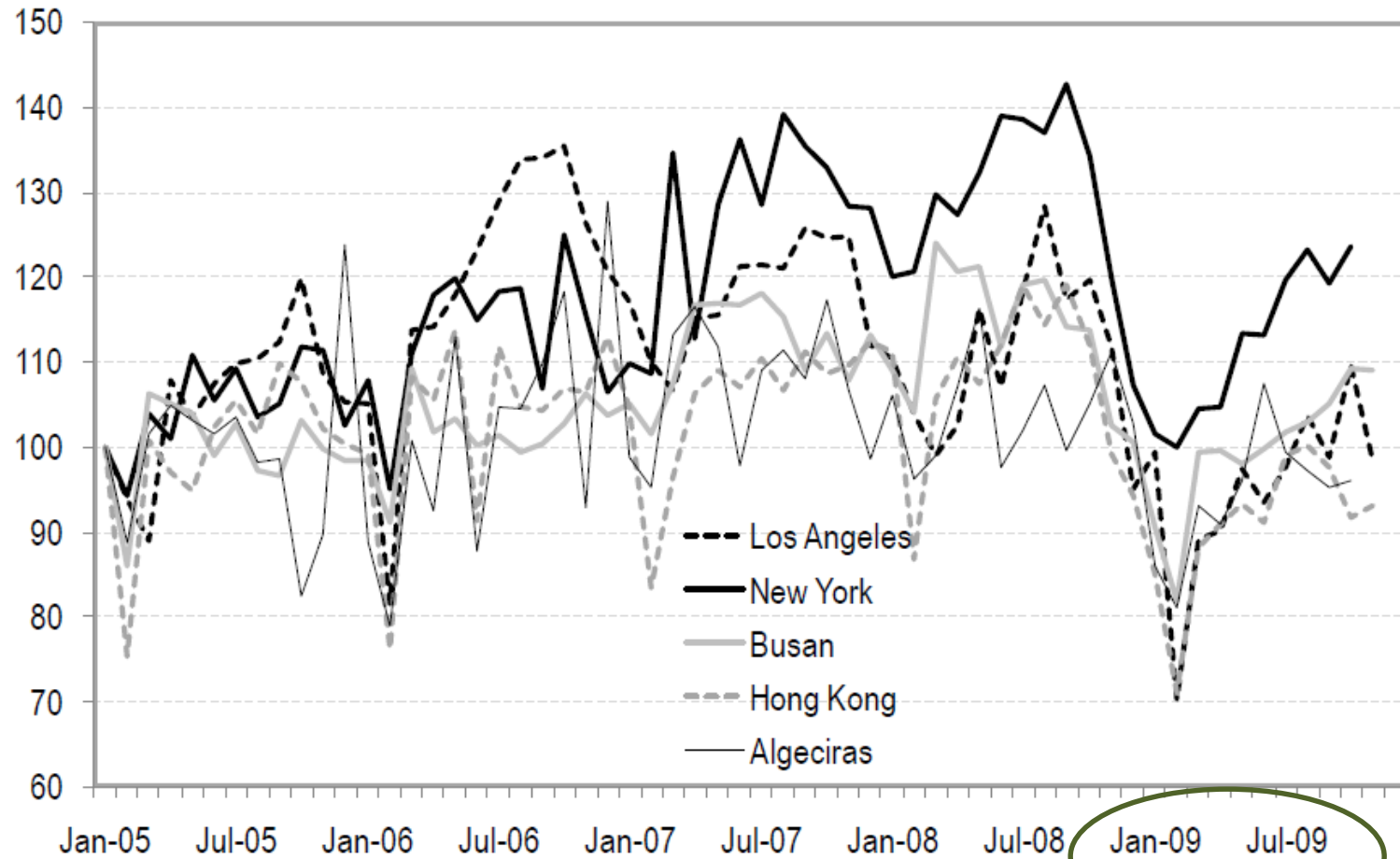


Figure 6: Monthly Total Container Traffic at Selected Ports (Jan 2005=100)



# Prolonged Residency Periods

## Cargo Ships Treading Water Off Singapore, Waiting for Work



Charles Pertwee for The New York Times

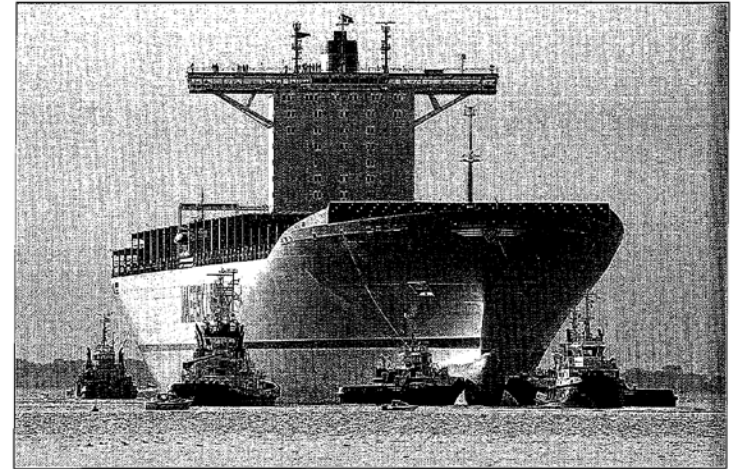
Sunrise in the Strait between Indonesia and Singapore, where 735 cargo ships were gathered Tuesday because of a sharp decline in global exports.

By KEITH BRADSHER  
Published: May 12, 2009

TWITTER

[http://www.nytimes.com/2009/05/13/business/global/13ship.html?pagewanted=all&\\_r=0#](http://www.nytimes.com/2009/05/13/business/global/13ship.html?pagewanted=all&_r=0#)

## More Than 500 Box Ships Laid Up



Maersk Line, which has been taking delivery of a large number of container carriers, and is considered the world's largest operator of such tonnage, plans to lay up 25 vessels because of an unprecedented drop in demand. Photo courtesy of Maersk.

The idled fleet of container ships around the world rose to 506 vessels representing 1.34 million TEUs of capacity at the end of April according to AXS-Alphaliner, a Paris-based shipping consultant. The idled vessels represent about 10.6 percent of the world container fleet and it is estimated that the top 20 container ship operators may

report losses exceeding \$4 billion for this year's first quarter alone, the largest ever quarterly loss in the industry's history. Nevertheless, they will also be taking delivery of more capacity, with 44 vessels of 8,000 TEU capacity or greater scheduled to come on line this year and many more ships to follow between 2010 and 2012. PMM

10 Pacific Maritime • June 2009 • [www.pacmar.com](http://www.pacmar.com)

# Prolonged Residency Periods

- Negatively affects coating performance
  - Marine Science and Ecology, 2002. DAFF Report, Australia
  - Floerl et al., 2005. Biological Invasions 7, 459-475





# Prolonged Residency Periods

- Negatively affects coating performance
  - Marine Science and Ecology, 2002. DAFF Report, Australia
  - Floerl et al., 2005. Biological Invasions 7, 459-475
- Positive relationship: residency period and propagule interaction with vessel
  - Coutts, 1999. Australian Maritime College, Tasmania
  - Floerl and Inglis, 2005. Biological Invasions 7, 589-606
  - Inglis et al., 2008. MAFBNZ Report, New Zealand

# HHRF Data: Residency Periods

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:

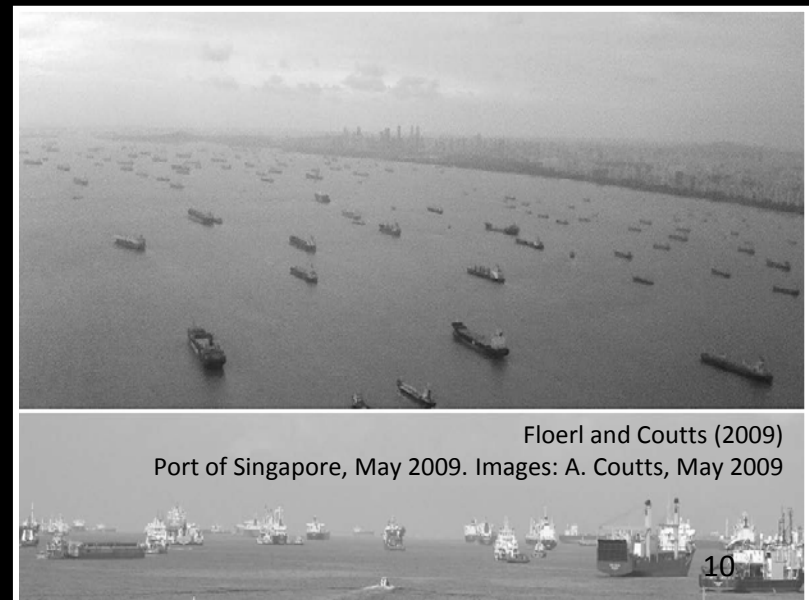
Delivery date (Day/Month/Year):	
Port or Position:	Country:

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 <input type="checkbox"/>	
Yes, partial coat <input type="checkbox"/>	Date last full coat applied (Day/Month/Year):
No coat applied <input type="checkbox"/>	Date last full coat applied (Day/Month/Year):

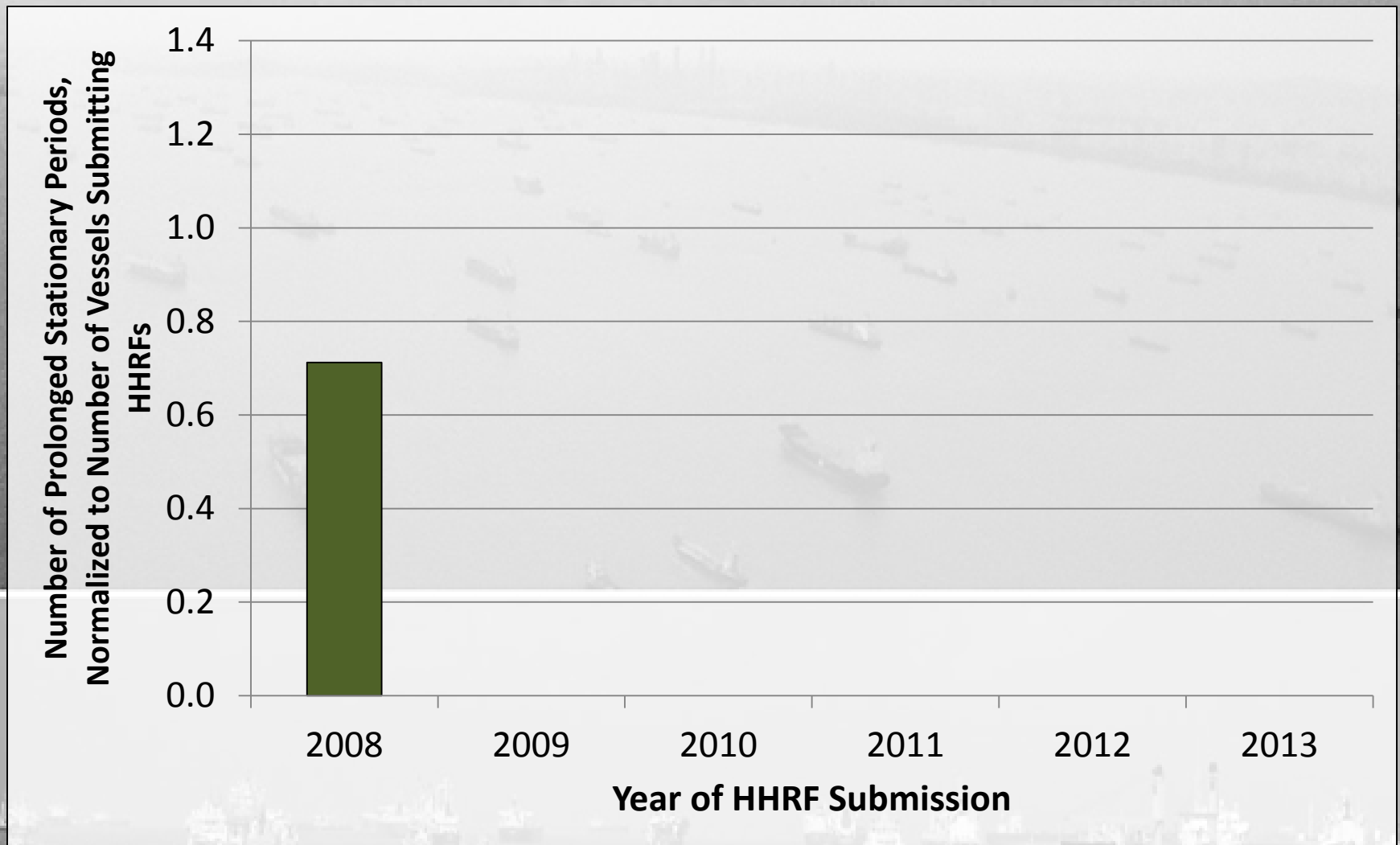
3. For the most recent **full coat** application of anti-fouling treatment, what type of anti-fouling treatment was applied and to which specific **sections** of the submerged portion of the vessel was it applied?

Manufacturer/Company:	
Product Name:	
Applied on (Check all that apply):	
Hull Sides <input type="checkbox"/> Hull Bottom <input type="checkbox"/> Sea Chests <input type="checkbox"/>	
Sea Chest Gratings <input type="checkbox"/> Propeller <input type="checkbox"/> Rope Guard/Propeller Shaft <input type="checkbox"/>	
Previous Docking Blocks <input type="checkbox"/> Thrusters <input type="checkbox"/> Rudder <input type="checkbox"/> Bilge Keels <input type="checkbox"/>	



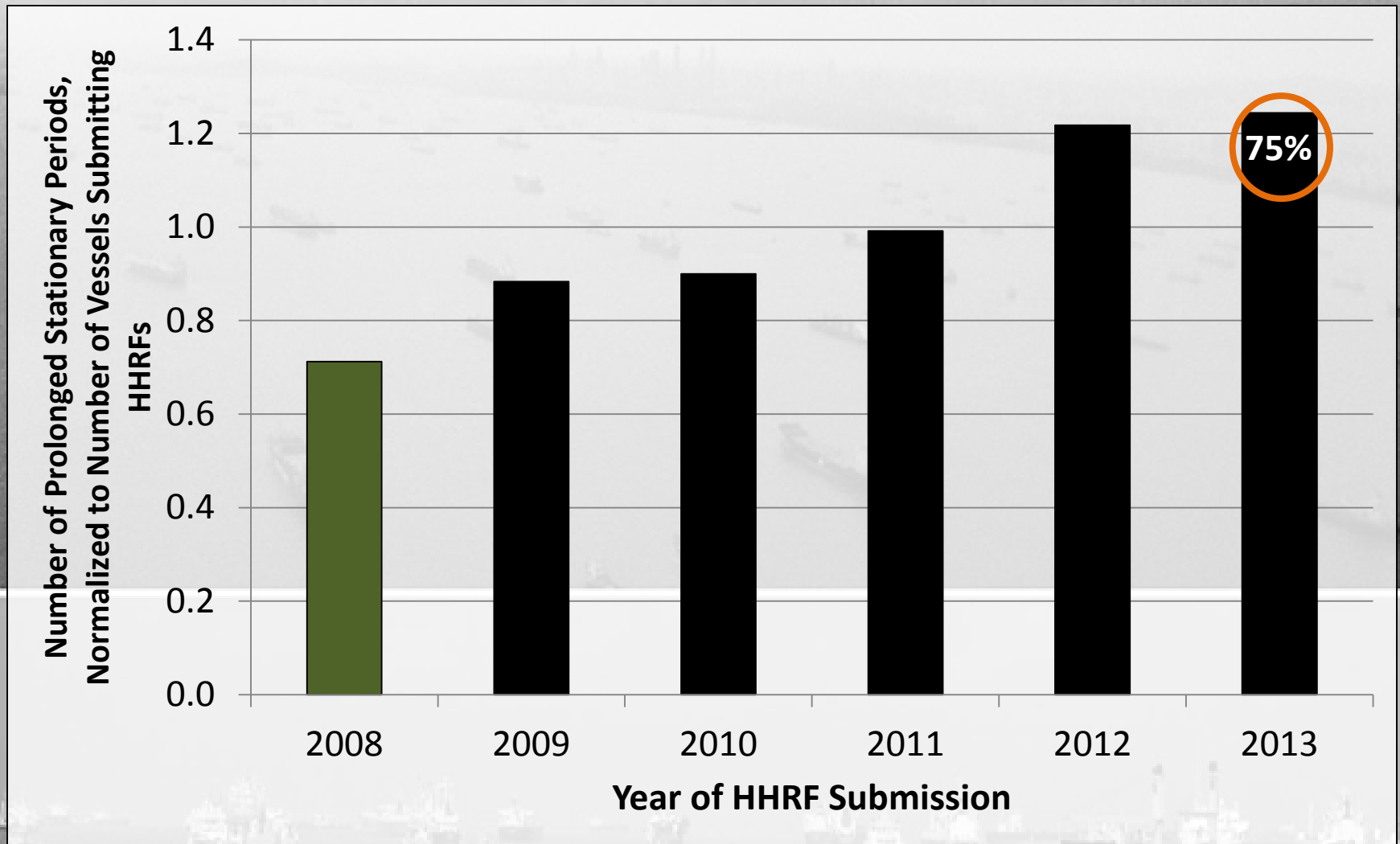
Floerl and Coutts (2009)  
Port of Singapore, May 2009. Images: A. Coutts, May 2009

# Prolonged Residency Periods, 10+ Days

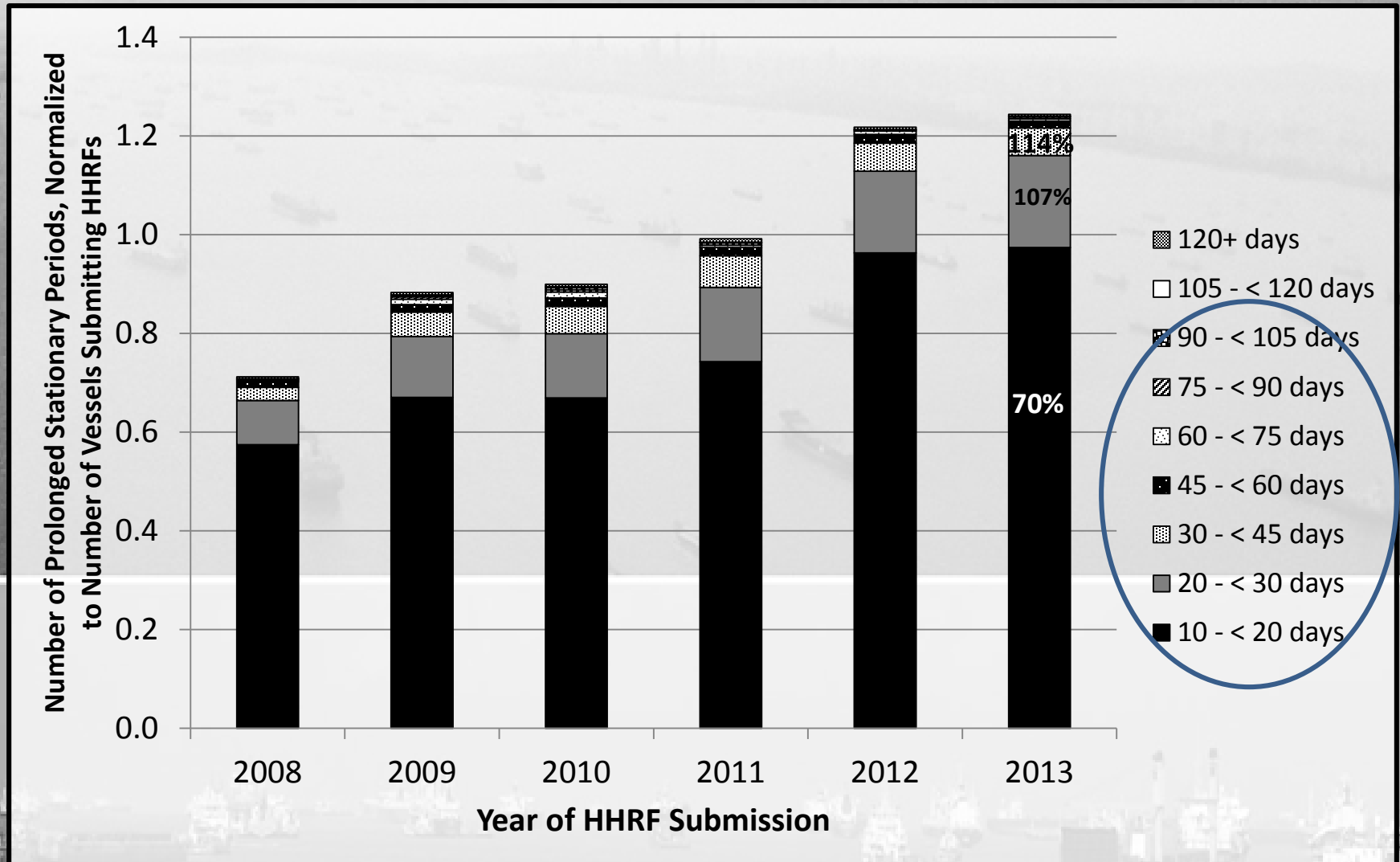




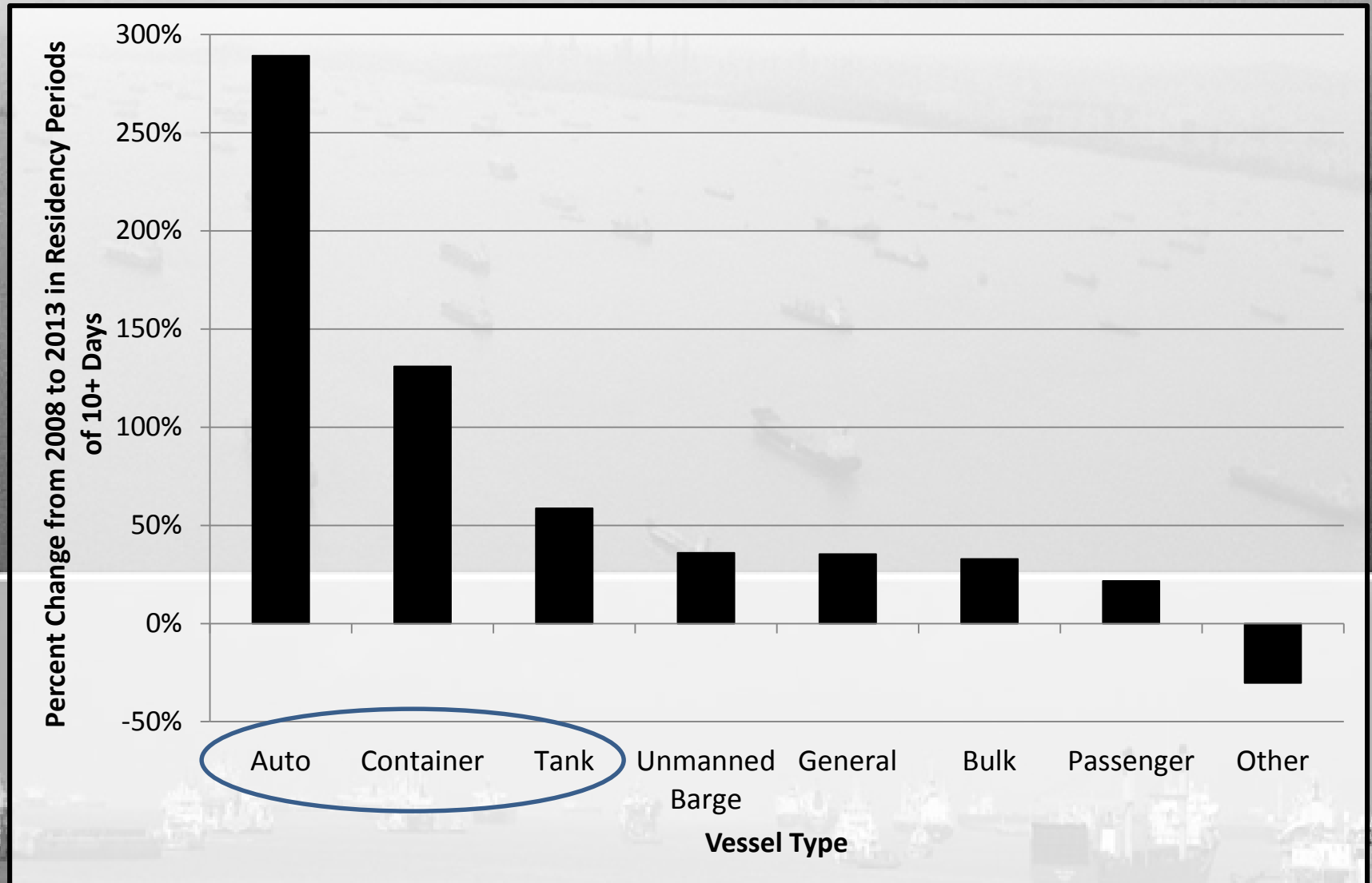
# Prolonged Residency Periods, 10+ Days



# Prolonged Residency Periods, 10+ Days



# Prolonged Residency Periods, 10+ Days





# Traveling Speed

The Economist

Schumpeter  
Business and management

## The shipping industry Slow steaming, uphill

Aug 1st 2012, 11:19 by I.C.

IT NEVER rains but it pours for the shipping industry. Since the great recession began in 2009 its troubles have multiplied: first came a price war among operators of container lines; then a slump in rates for chartering the giant bulk vessels that transport coal, iron and grain around the world; and now it has to cope with a glut of all types of vessels, as ships ordered in the boom times are launched into the slump.



<http://www.economist.com/blogs/schumpeter/2012/08/shipping-industry/print>

Los Angeles Times | ARTICLE COLLECTIONS

← Back to Original Article

## Ocean shipping lines cut speed to save fuel costs

*'Slow steaming' upsets some customers, who worry about delays in delivery. But it also keeps more ships in service and emissions.*

July 31, 2010 | By Ronald D. White, Los Angeles Times

On the high seas, full speed ahead is being replaced by slow and steady.

Eager to cut fuel costs, ocean shipping lines have ordered their sea captains to throttle back the engines for what is gaining momentum.

<http://articles.latimes.com/print/2010/jul/31/business/la-fi-slow-sailing-20100731>

The New York Times

This copy is for your personal, noncommercial use only. You can order presentation-ready copies for distribution to your colleagues, clients or customers [here](#) or use the "Reprints" tool that appears next to any article. Visit [www.nytreprints.com](http://www.nytreprints.com) for samples and additional information. Order a reprint of this article now.

February 17, 2010

## Slow Trip Across Sea Aids Profit and Environment

By [ELISABETH ROSENTHAL](#)

It took more than a month for the container ship Ebba Maersk to steam from Germany to Guanajuato, Mexico, but it did two years ago.

But for the owner, the Danish shipping giant Maersk, that counts as progress.

[http://www.nytimes.com/2010/02/17/business/energy-environment/17speed.html?\\_r=0&pagewanted=print](http://www.nytimes.com/2010/02/17/business/energy-environment/17speed.html?_r=0&pagewanted=print)

THE WALL STREET JOURNAL  
WSJ.com

BUSINESS | December 30, 2012, 4:11 p.m. ET

## Container Ships Bulk Up, and Slow Down

By INTI LANDAURO

ZEEBRUGGE, Belgium—The new Marco Polo ship can load 16,000 containers and reach a speed of 24 knots, cruising back to China at 14 knots.

The Marco Polo's size and pace on the Europe-to-Asia route show an interesting dynamic at work: As capacity and declining shipping fares, companies such as CMA CGM of France, owner of the ship, have ordered the biggest-possible ships so they can benefit from economies of scale, and run them at moderate speeds.



The Marco Polo, recently acquired by CMA CGM, is the world's largest container ship and just completed her maiden voyage. WSJ's Inti Landauro reports via #WorldStream.

Slowing down ships, a technique known as slow steaming, helps offset the additional capacity created by their big size. Analysts say the practice has helped avoid a container price war.

"Surely, if we did not have slow-steaming at all in the world, it would be higher than a few dollars per container," said a shipping industry official.

The Marco Polo trumps Maersk Line's Emma Maersk, the world's largest container ship, and CMA CGM has orders in place for more ships. Malcom McLean pioneered the concept of shipping in containers.

<http://online.wsj.com/article/SB10001424127887323300404578207320544238546.html>

# Traveling Speed

- 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 Data: Traveling Speed

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 <input type="checkbox"/>	
Yes, partial coat <input type="checkbox"/>	Date last full coat applied (Day/Month/Year):
No coat applied <input type="checkbox"/>	Date last full coat applied (Day/Month/Year):

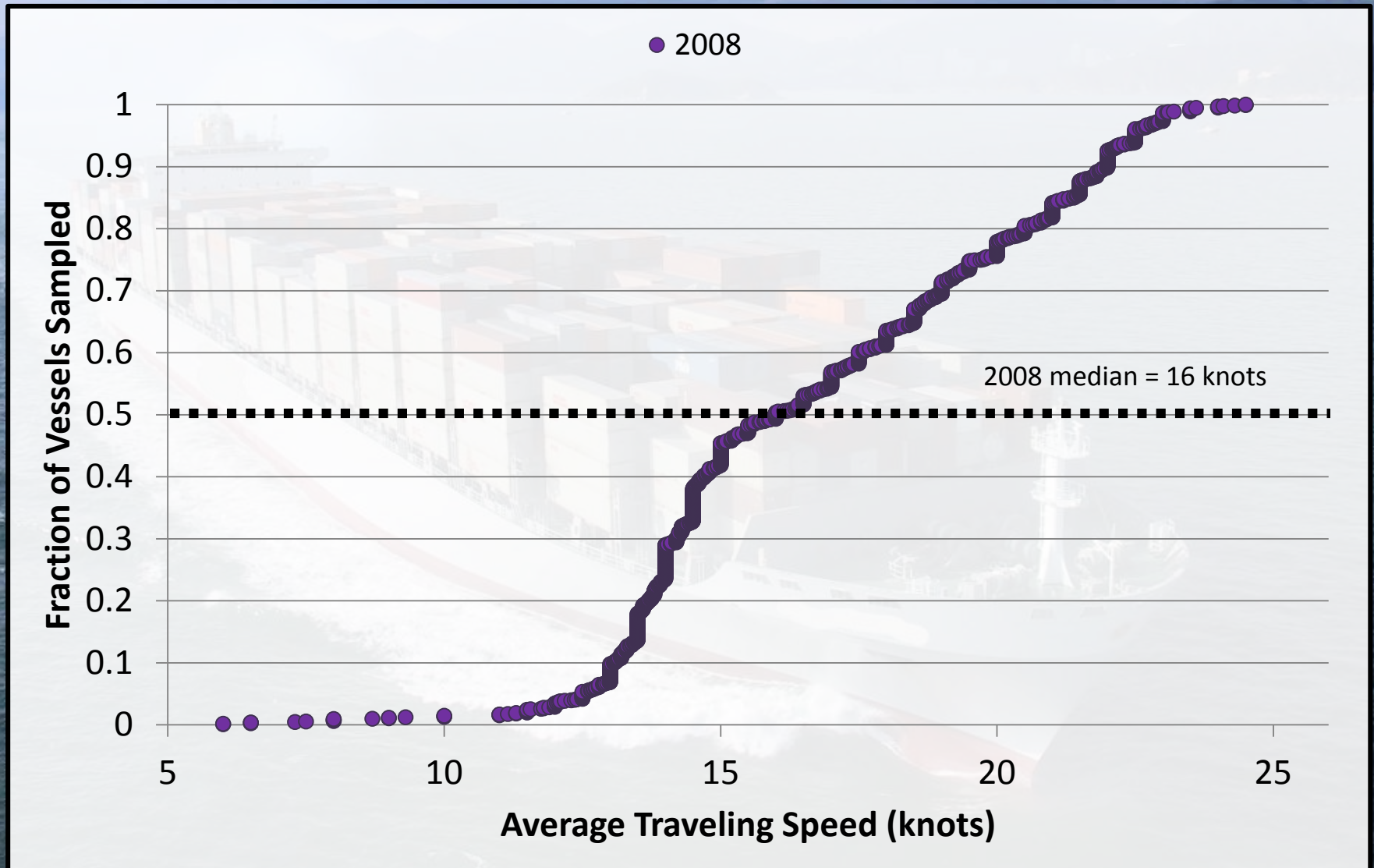
3. For the most recent **full coat** application of anti-fouling treatment, what type of anti-fouling treatment was applied and to which specific **sections** of the submerged portion of the vessel was it applied?

Manufacturer/Company:	
Product Name:	
Applied on (Check all that apply):	
Hull Sides <input type="checkbox"/>	Hull Bottom <input type="checkbox"/>
Sea Chests <input type="checkbox"/>	Sea Chest Gratings <input type="checkbox"/>
Propeller <input type="checkbox"/>	Rope Guard/Propeller Shaft <input type="checkbox"/>
Previous Docking Blocks <input type="checkbox"/>	Thrusters <input type="checkbox"/>
Rudder <input type="checkbox"/>	Bilge Keels <input type="checkbox"/>

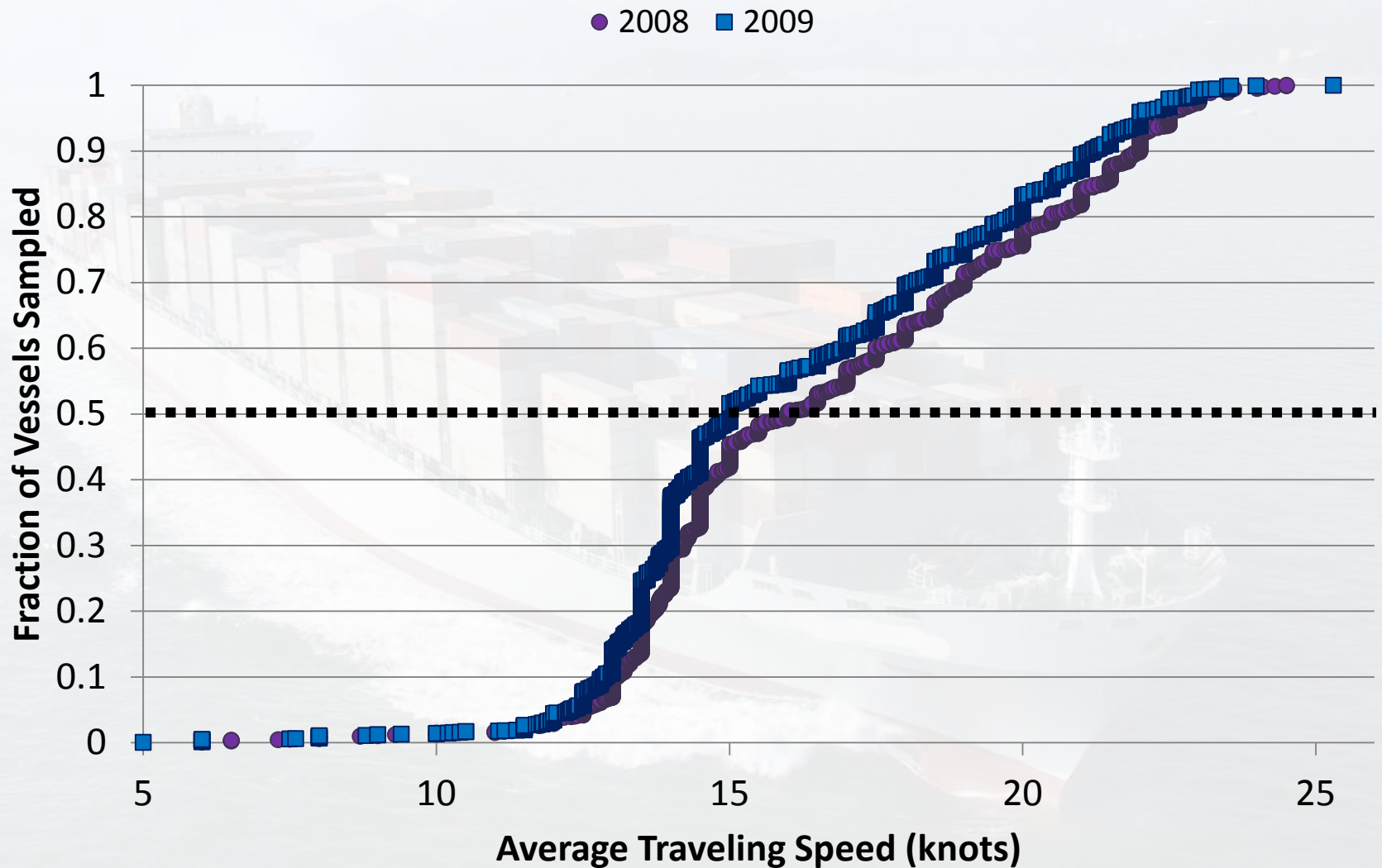




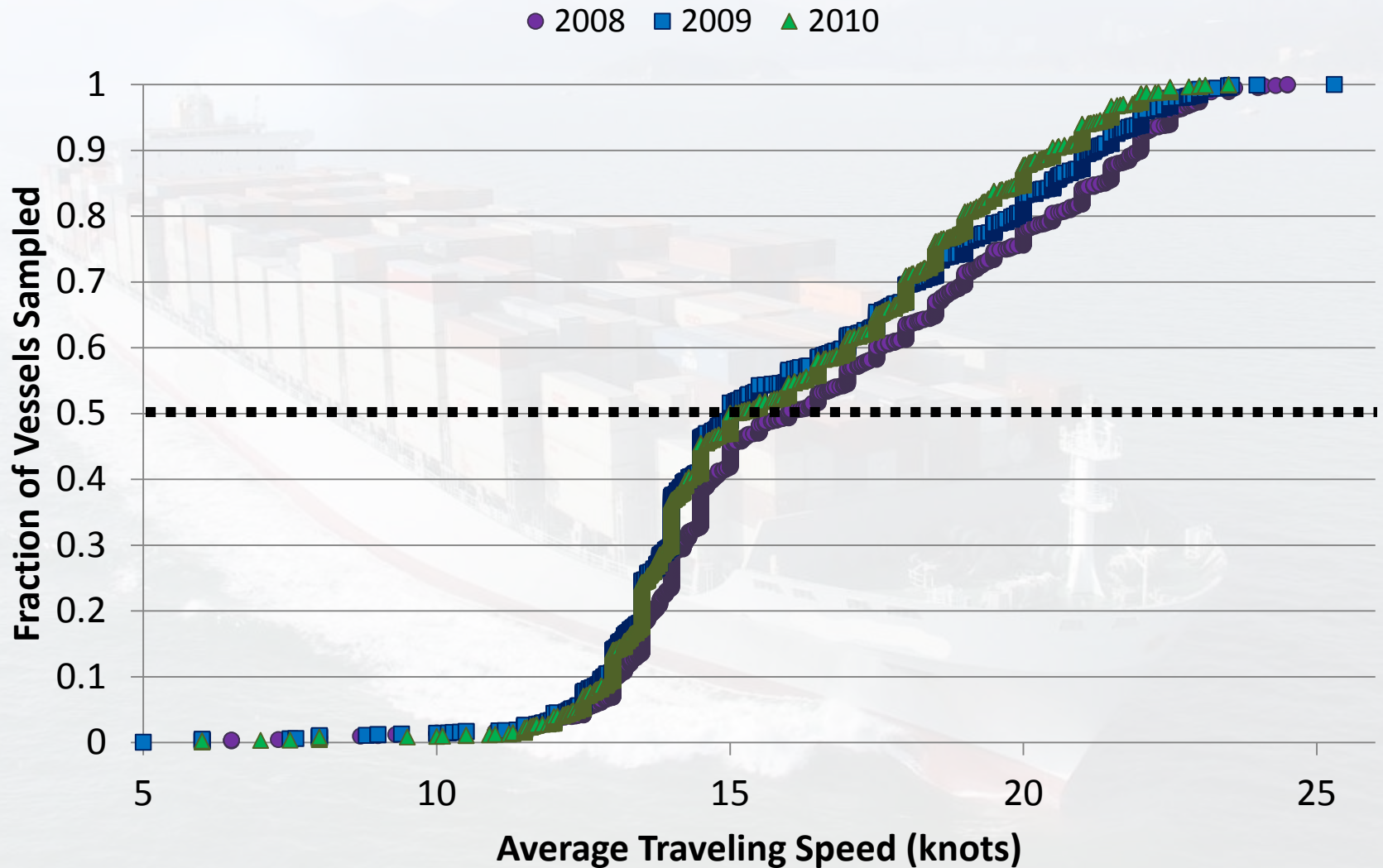
# Traveling Speed



# Traveling Speed

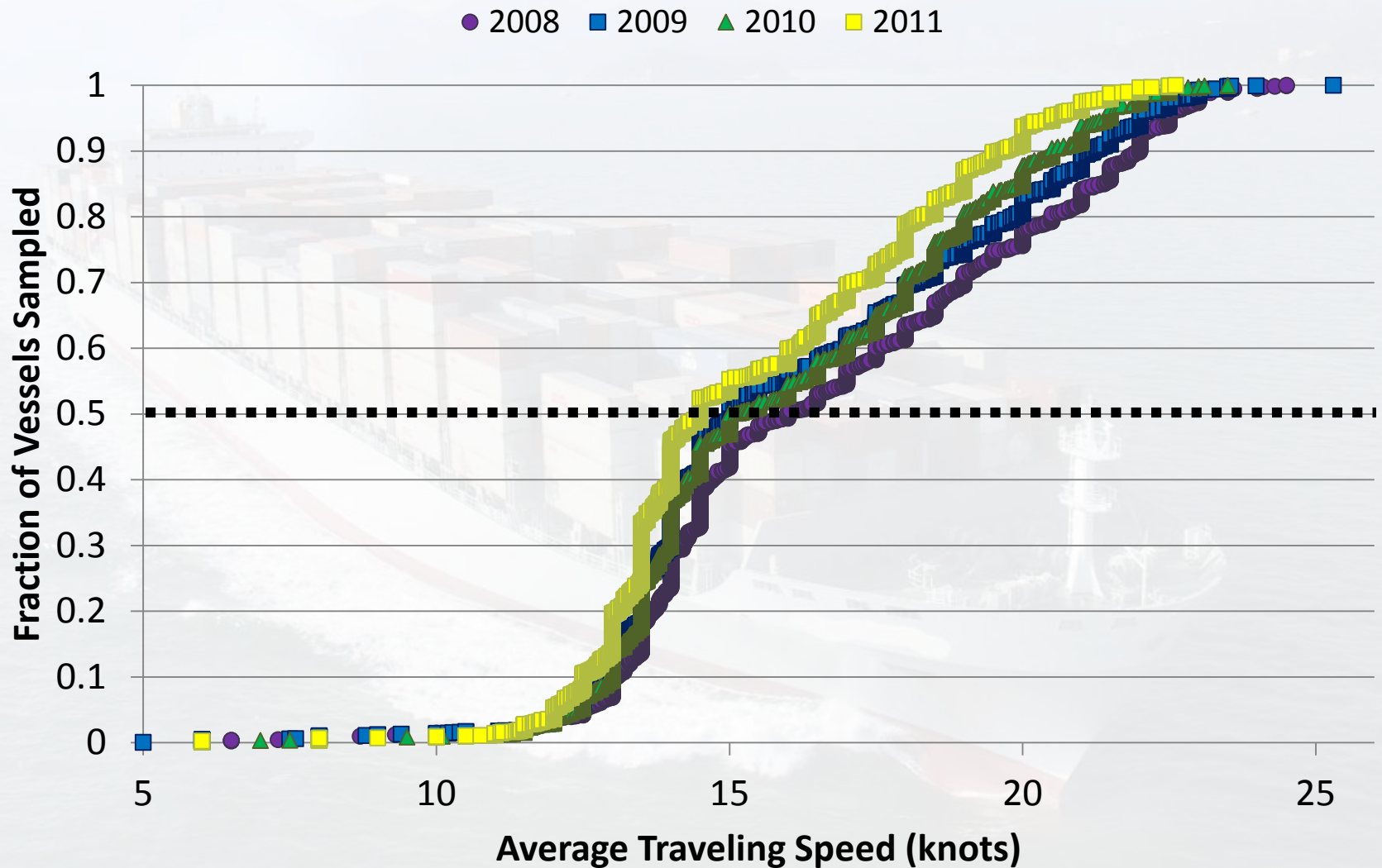


# Traveling Speed

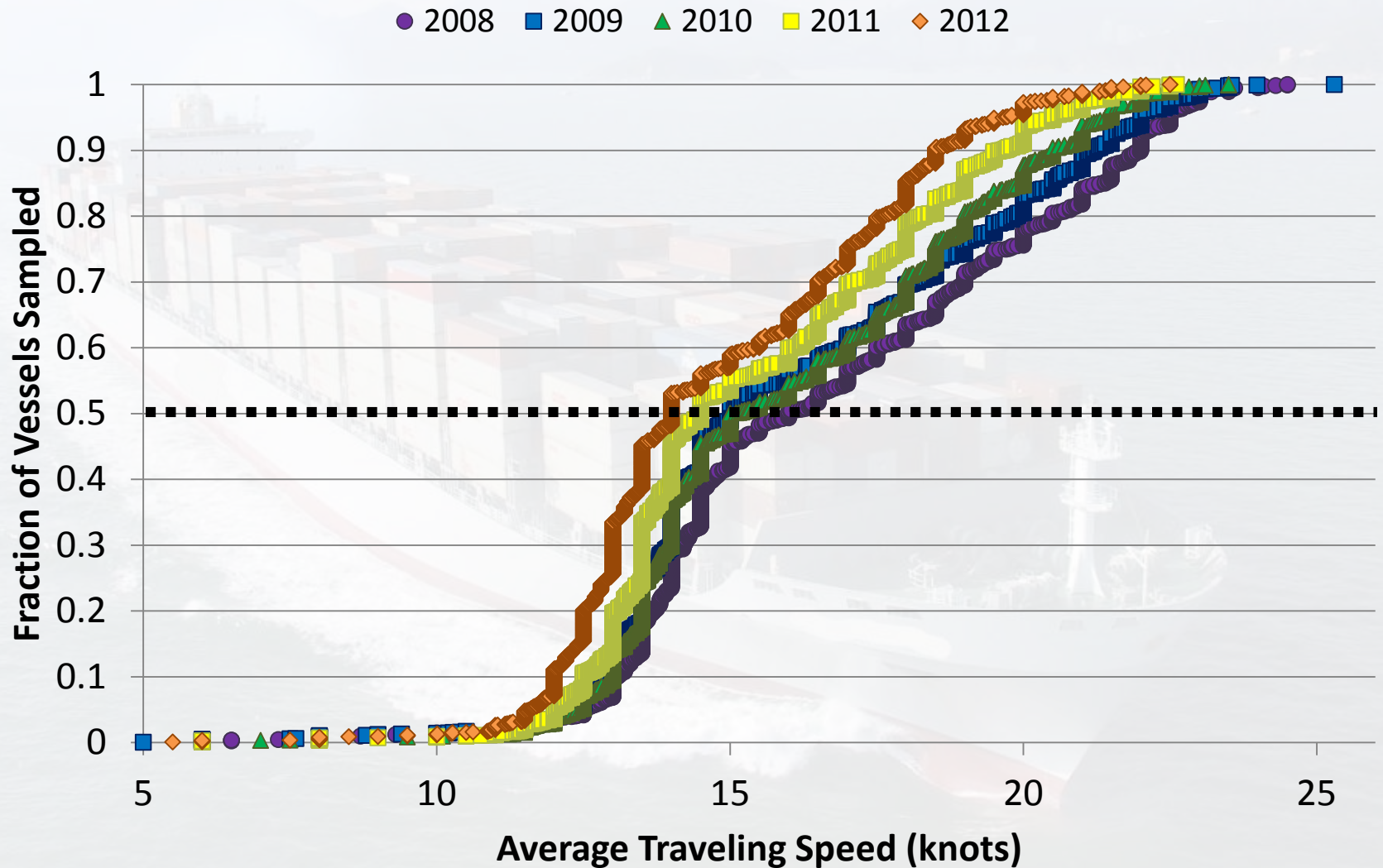




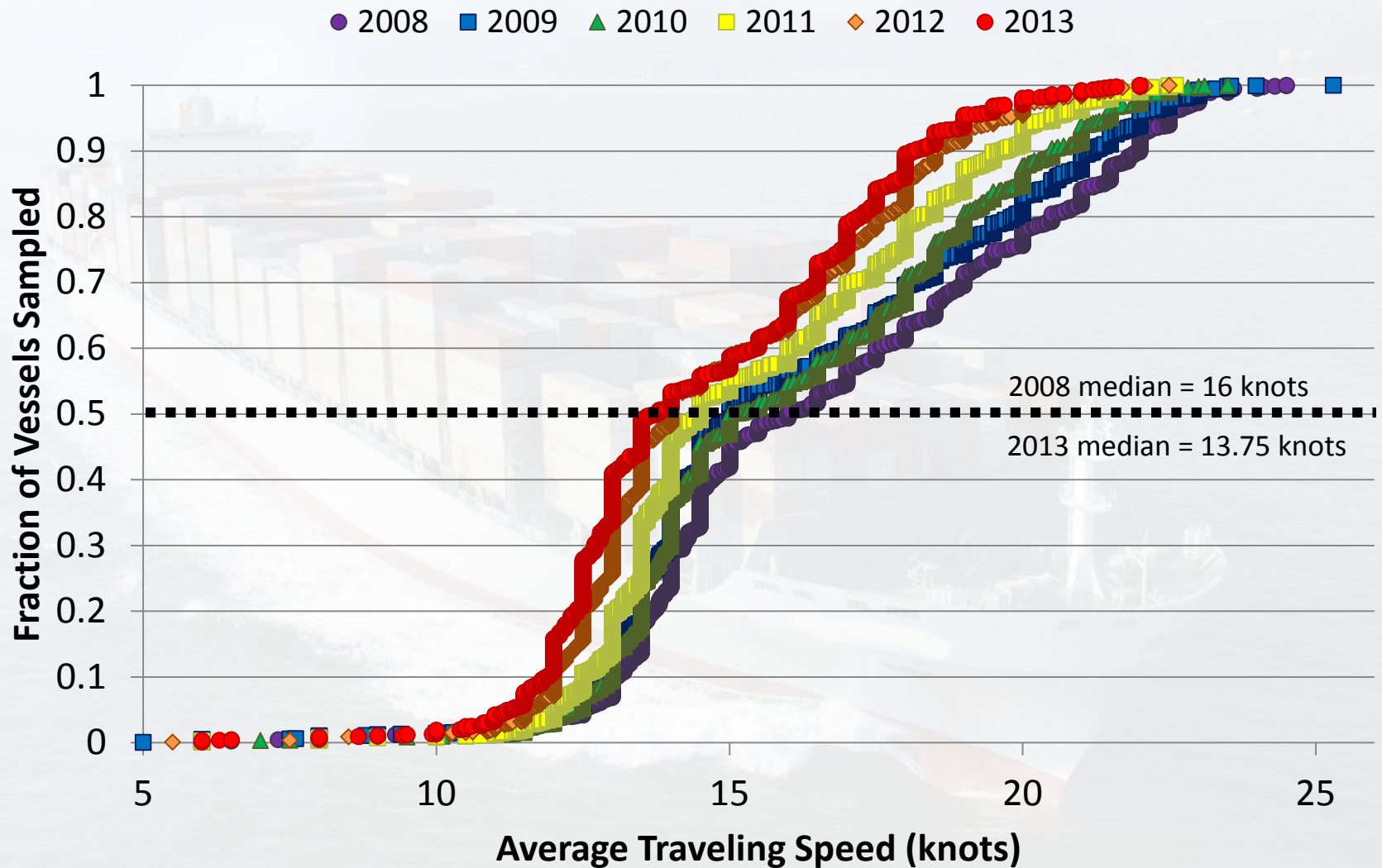
# Traveling Speed



# Traveling Speed

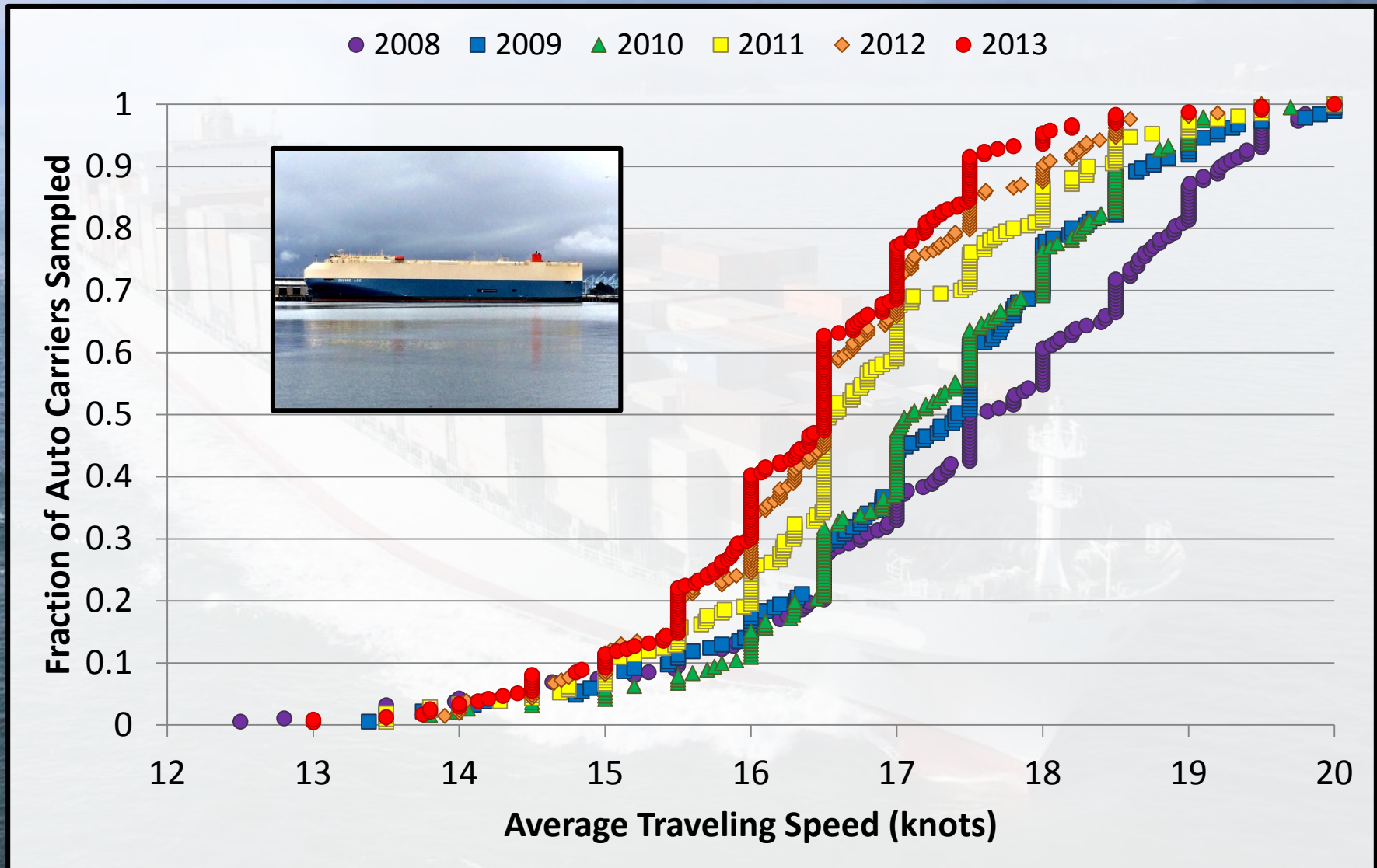


# Traveling Speed



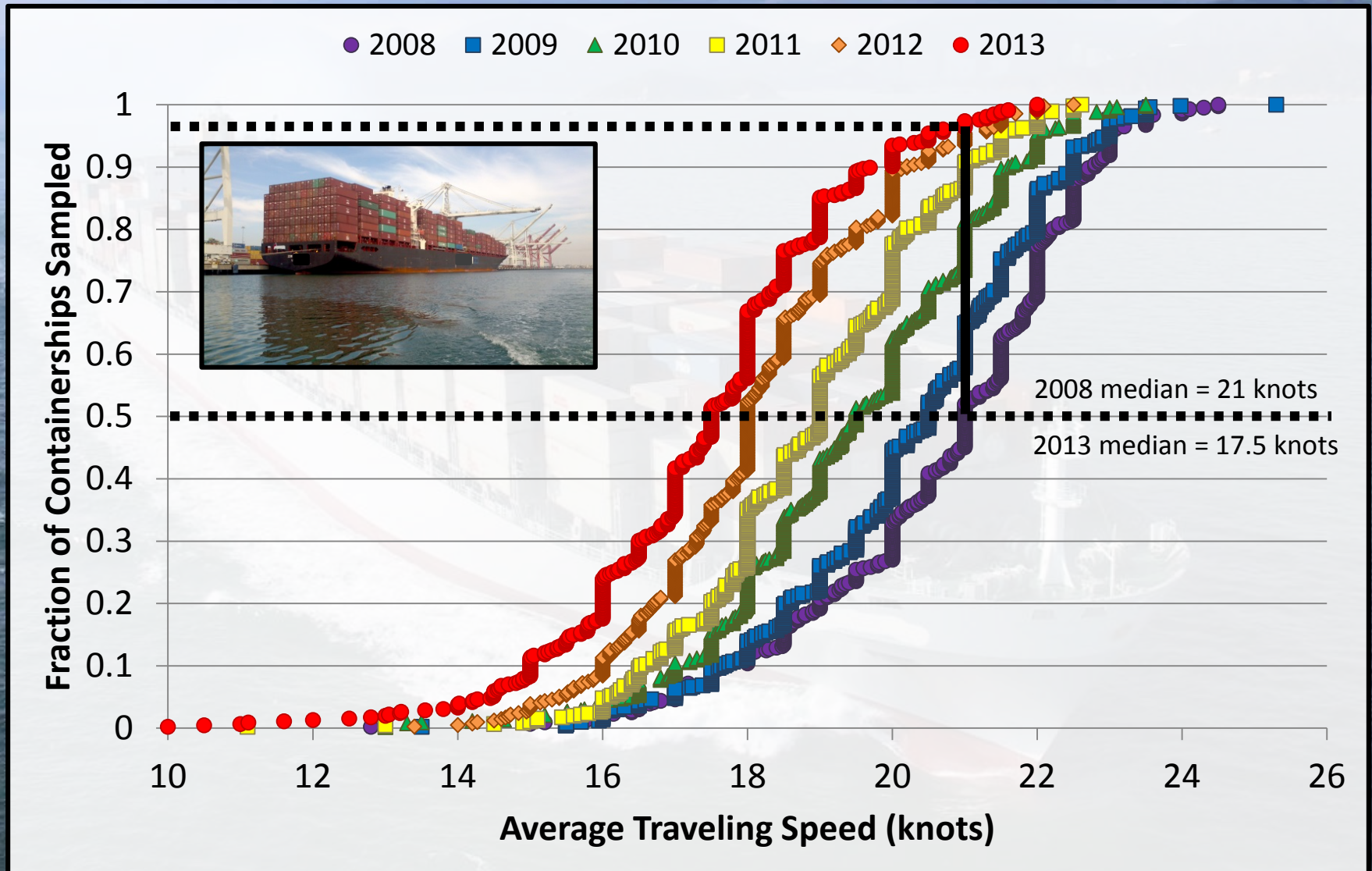


# Traveling Speed – Auto Carrier Vessels

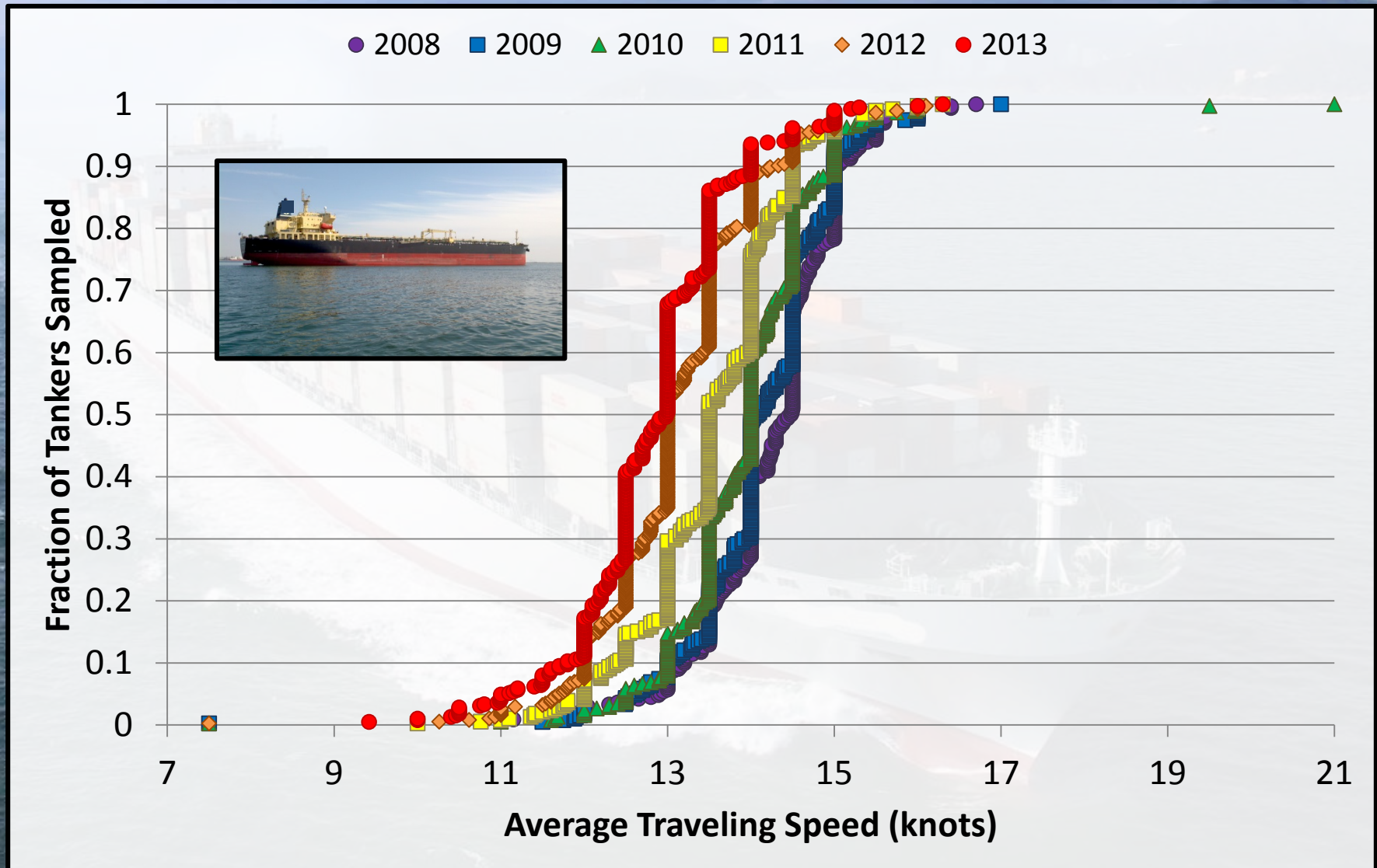




# Traveling Speed – Container Vessels

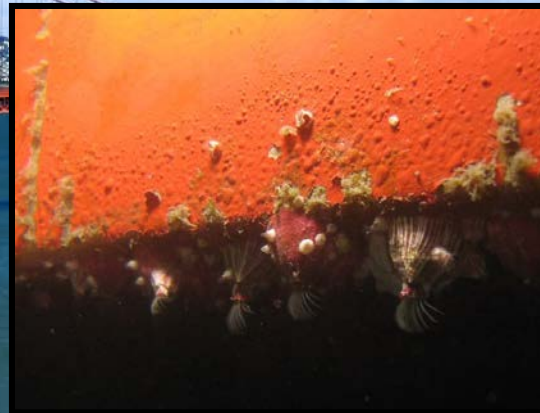
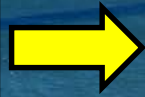
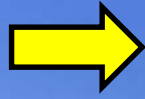


# Traveling Speed – Tank Vessels





# Great Recession Impacts on NIS Introduction Risk



# Recent Example: Port of LA – February 26, 2015





# Topic 2: Recent Biofouling Research



## Evaluating ship biofouling and emerging management tools for reducing biofouling-mediated species incursions

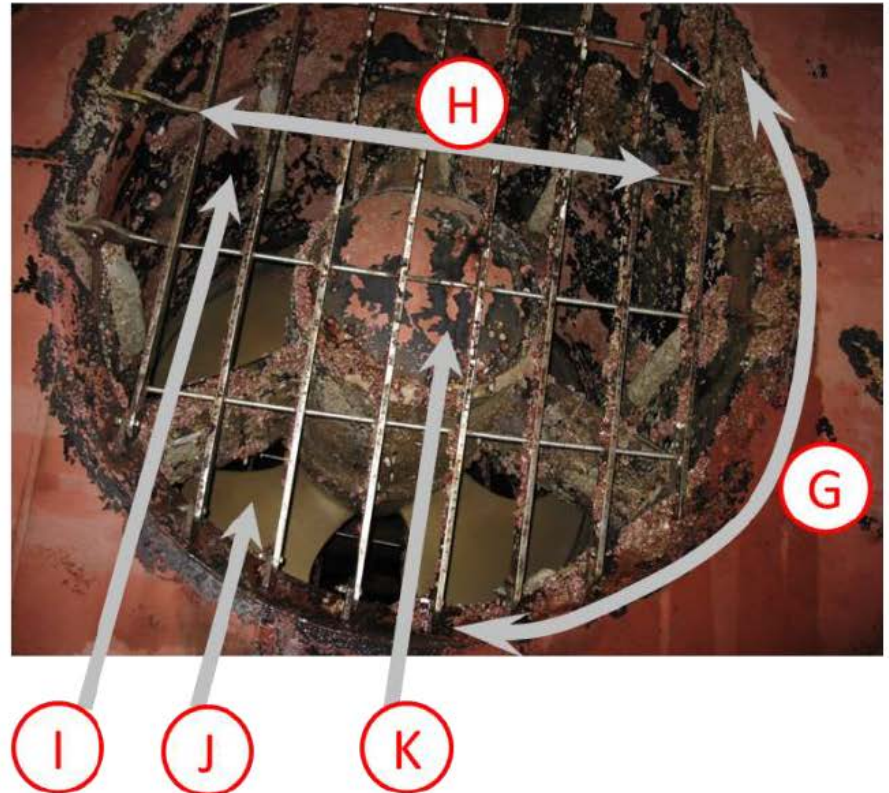
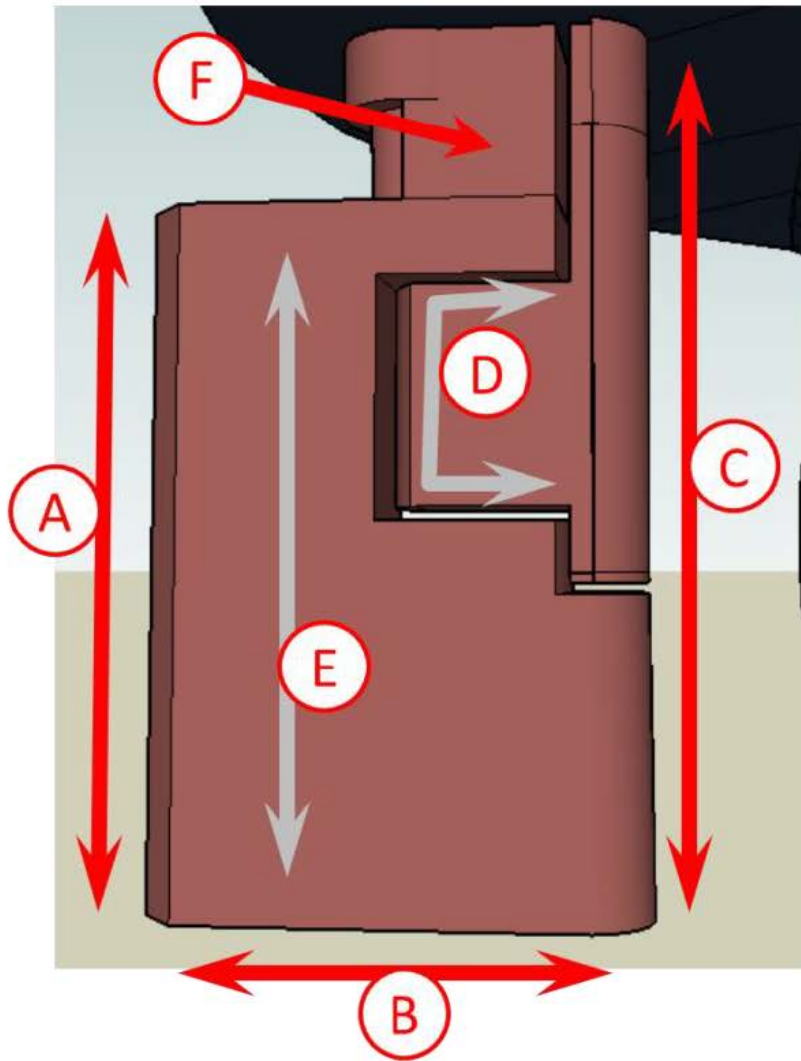
Final Report  
December 2014

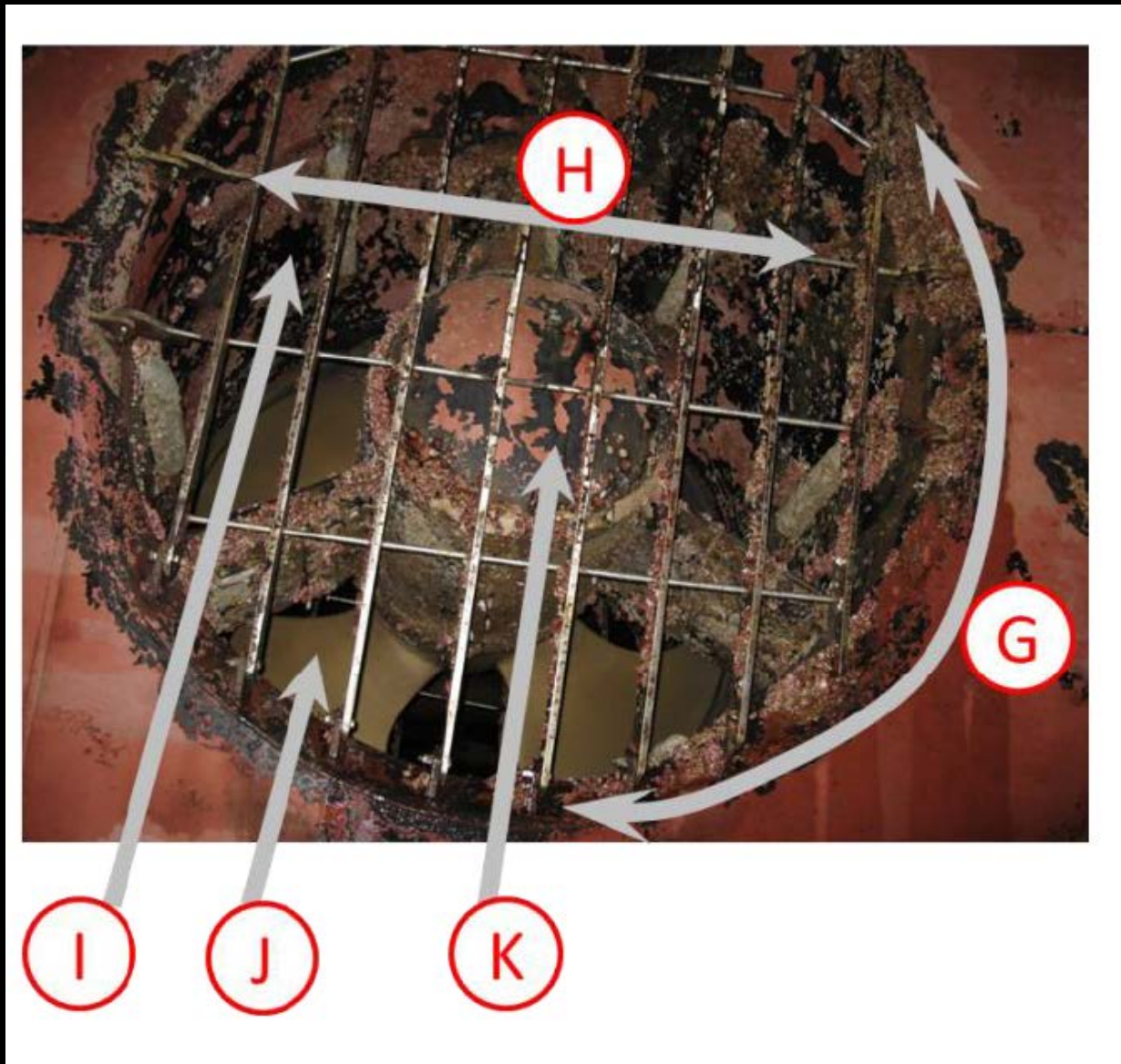
By

Ian Davidson, Chris Scianni, Lina Ceballos, Chela Zabin, Gail Ashton, and Greg Ruiz

*Aquatic Bioinvasion Research & Policy Institute*

A partnership between Portland State University & the Smithsonian Environmental Research Center





### Thruster sub-niches

G = Thruster rim

H = Grates

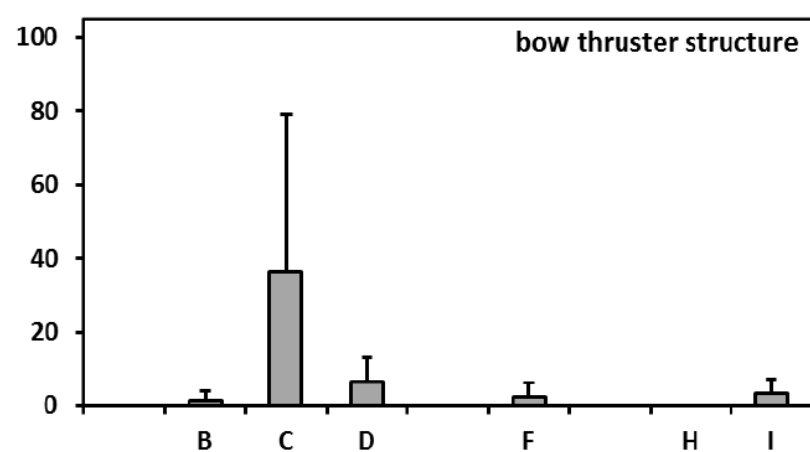
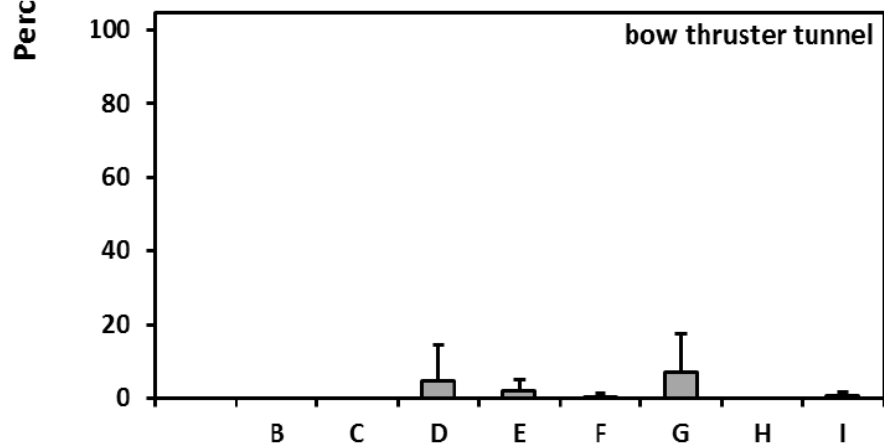
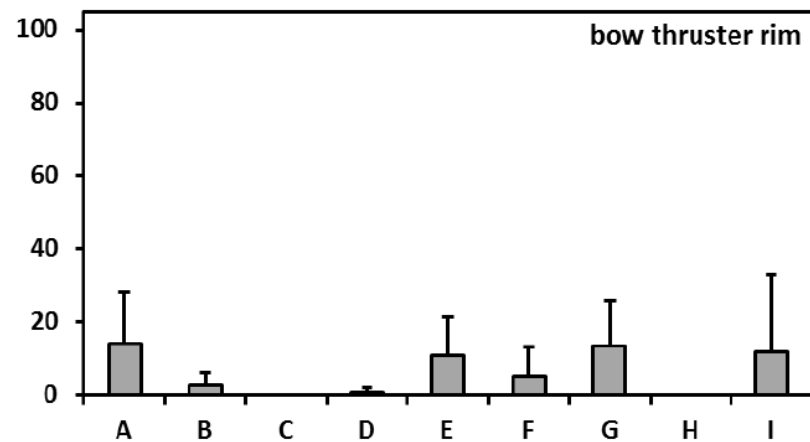
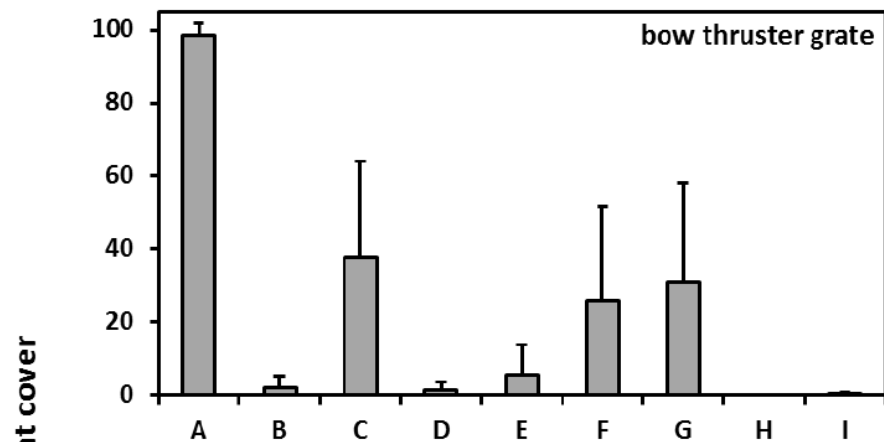
I = Tunnel

J = Propeller blades\*

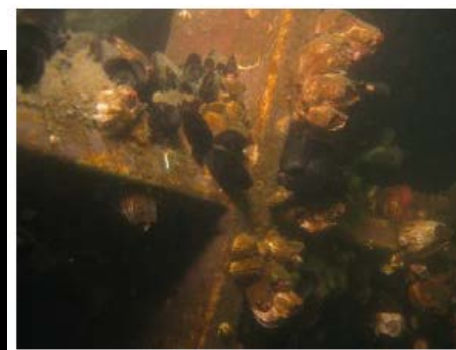
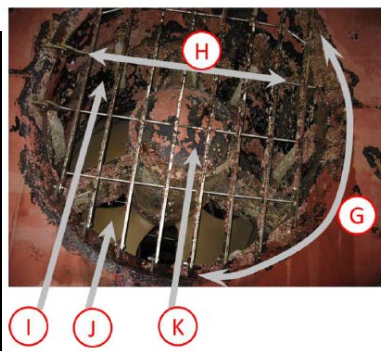
K = Thruster assembly

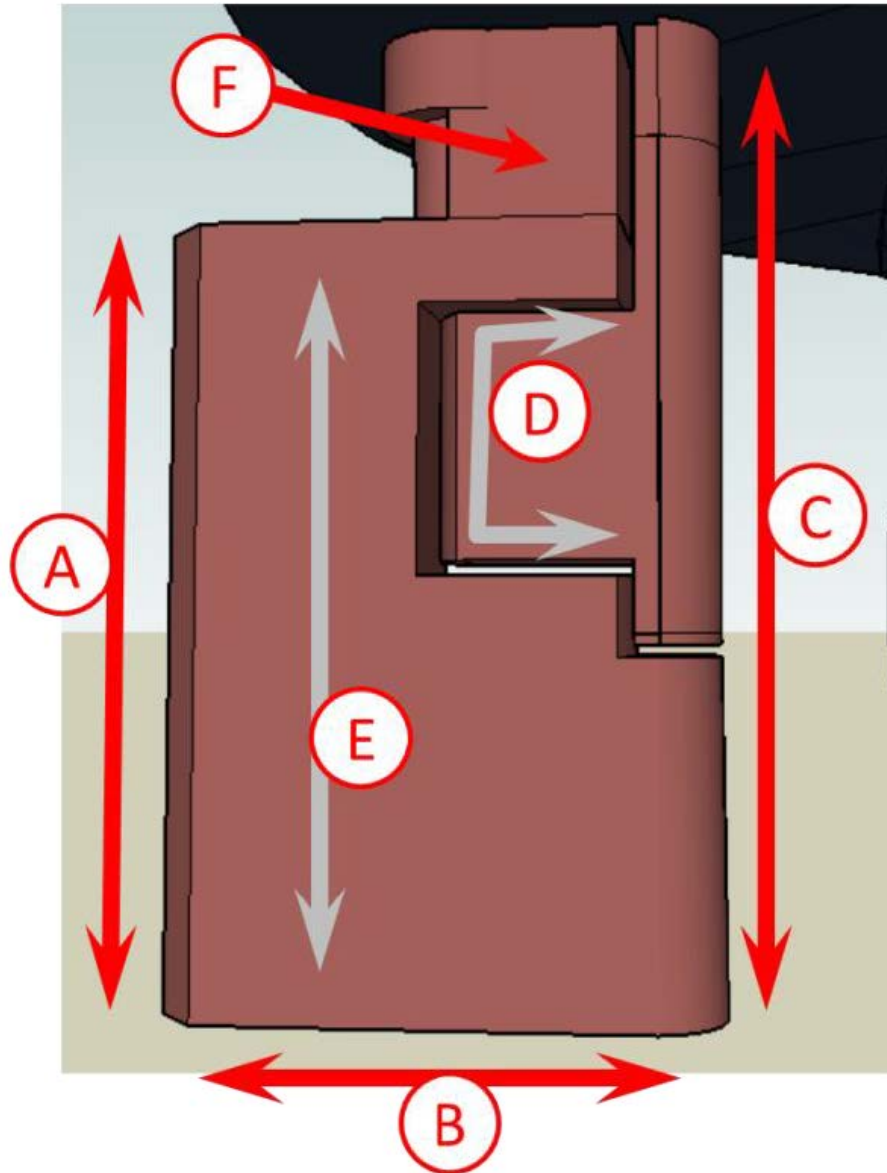
\*not always accessible





Ship





### Rudder sub-niches

A = Trailing edge

B = Bottom edge

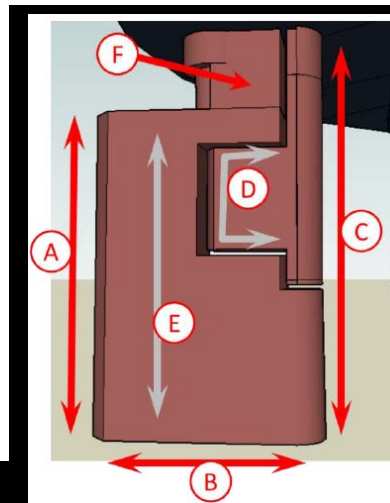
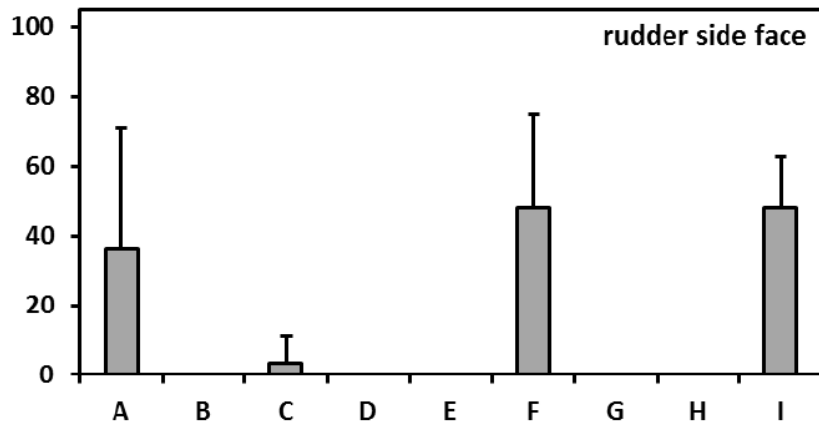
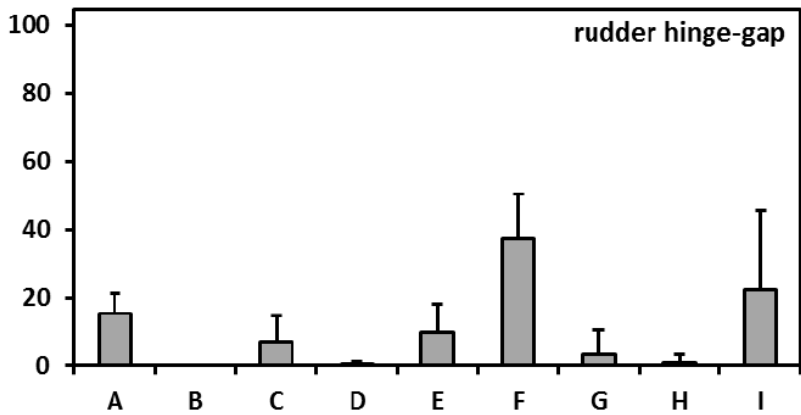
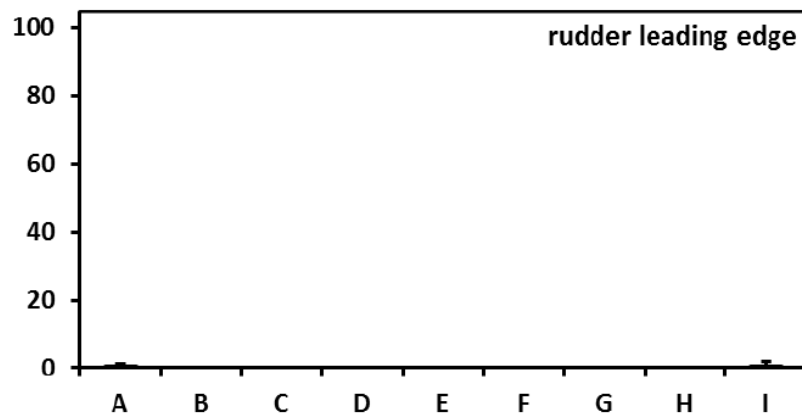
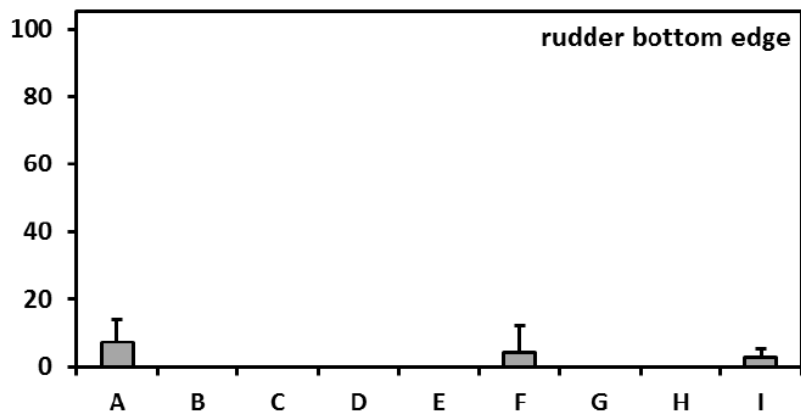
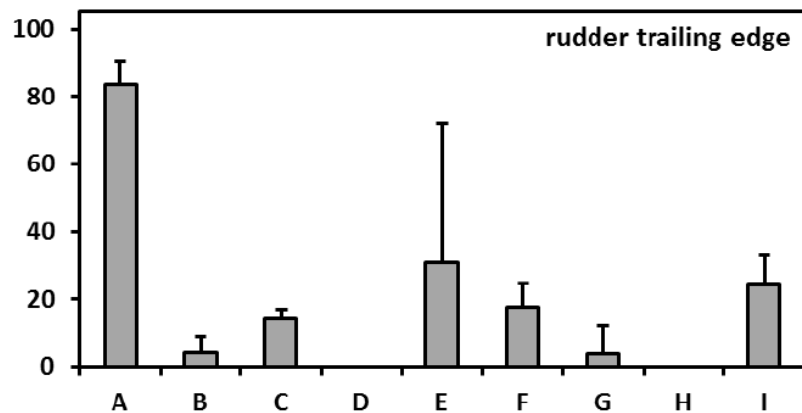
C = Leading edge

D = Hinge gap

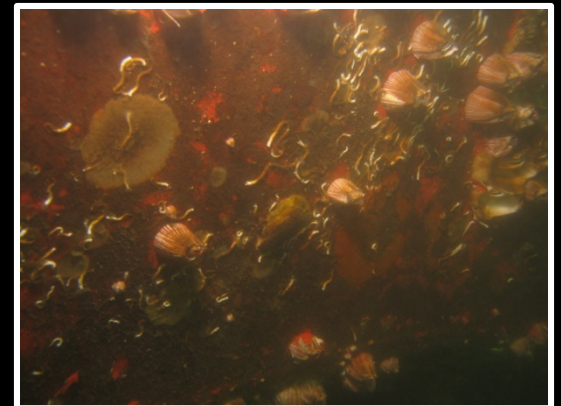
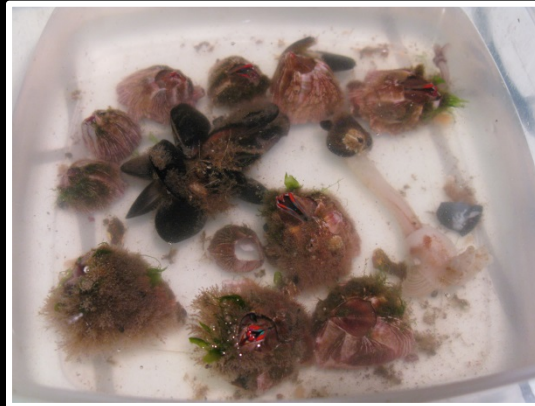
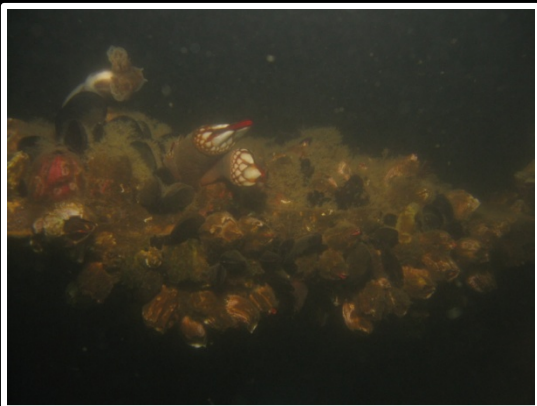
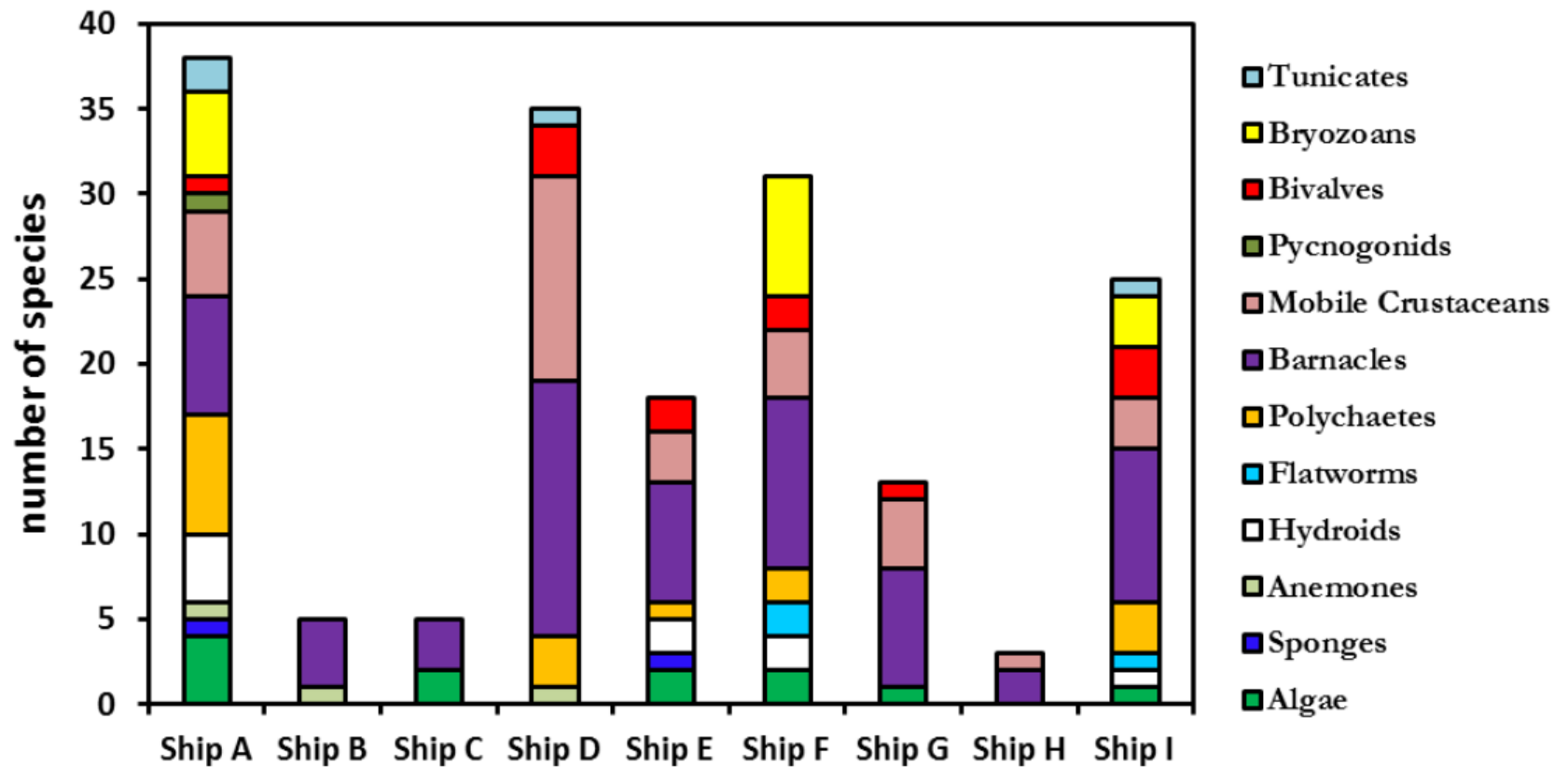
E = Side face

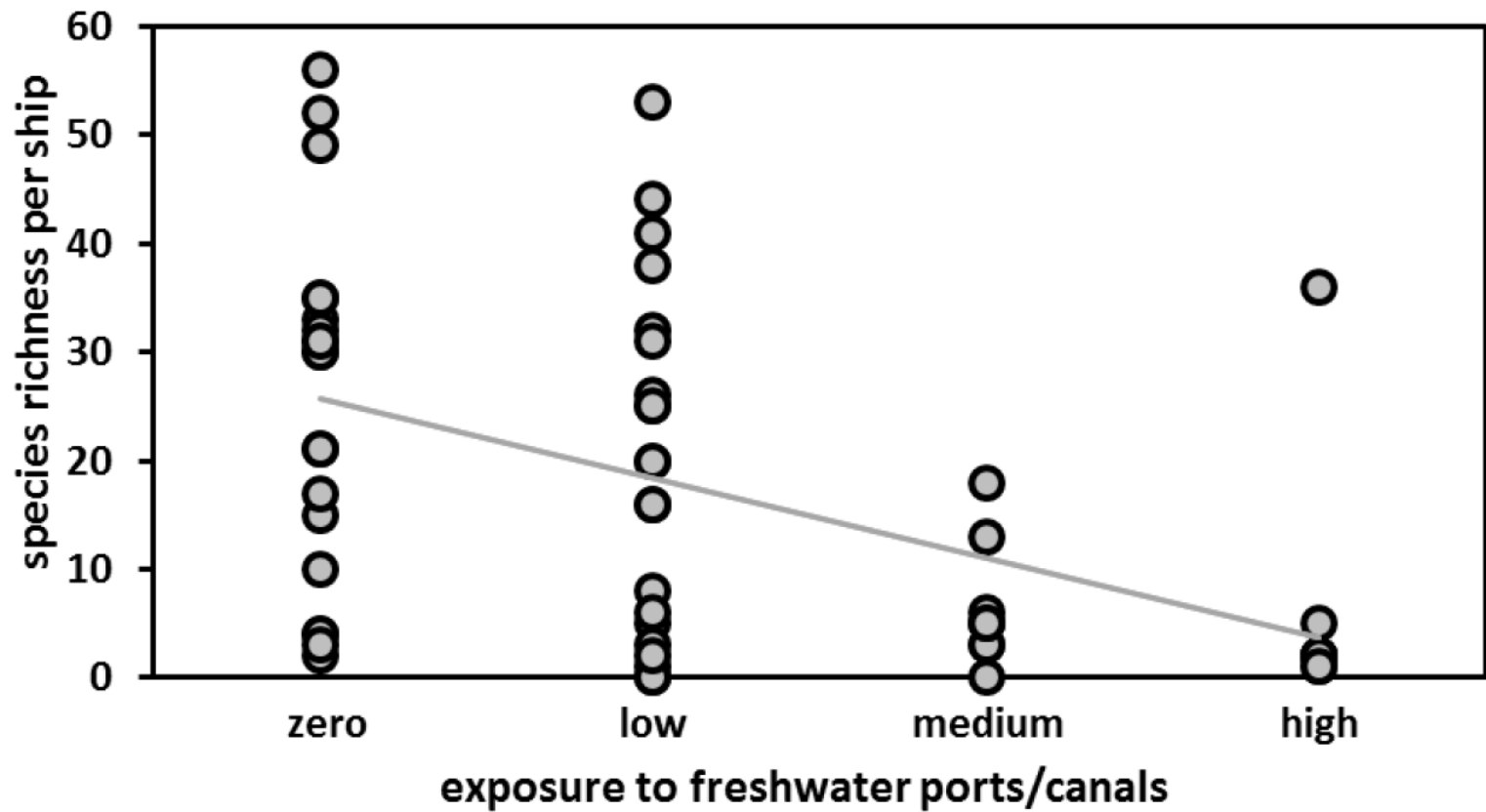
F = Articulation\*

\*not always accessible

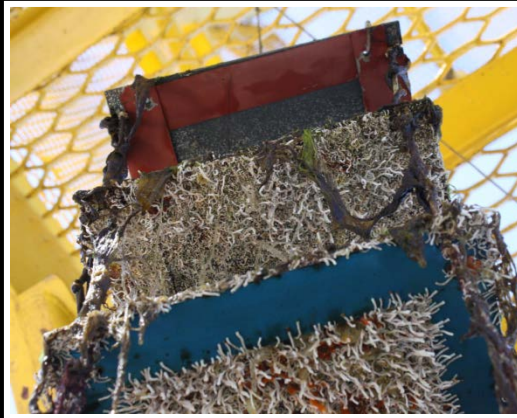






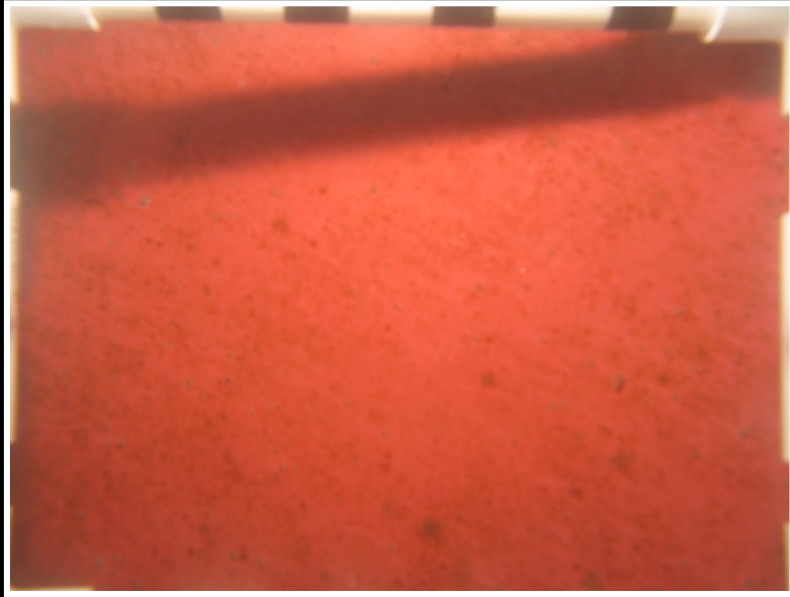


# Copper Tolerance






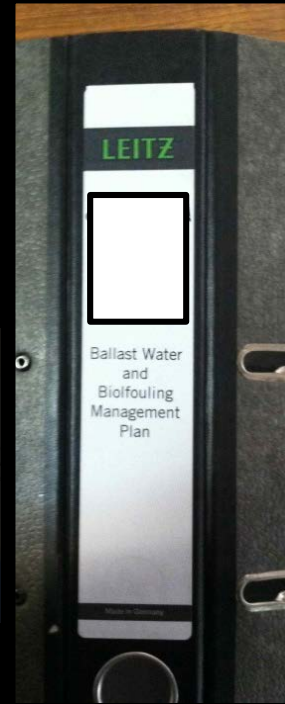
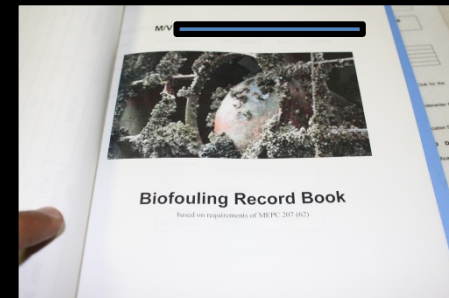
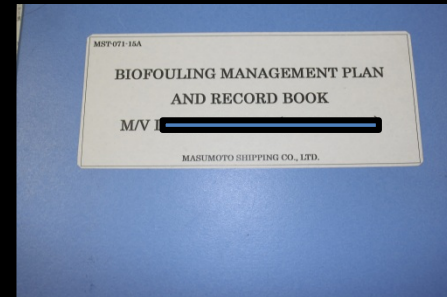
# Topic 3: Proposed Biofouling Management Regulations



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

# Proposed Biofouling Regulations: Recordkeeping and reporting

- Biofouling Management Plan
- Biofouling Record Book
- 
- Hull Husbandry Reporting Form



California State Lands Commission  
Marine Invasive Species Program  
Hull Husbandry Reporting Form  
Public Resources Code - 71255(a) and 71255(f)  
June 5, 2018  
Part I: Reporting Form

Vessel Name	
Officer / 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

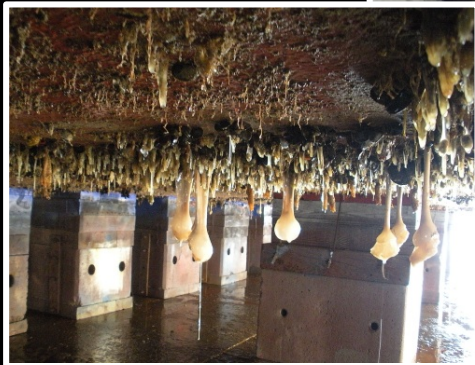
2. Were the submerged portions of the vessel coated with an anti-fouling treatment or coating during the out-of-water maintenance or shipbuilding process listed above?  
Yes, full coat applied ☐  
Yes, partial coat ☐ Date last full coat applied (Day/Month/Year)   
No coat applied ☐ Date last full coat 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 <input type="checkbox"/> Hull Bottom <input type="checkbox"/> Sea Chests <input type="checkbox"/> Sea Chest Gratings <input type="checkbox"/> Propeller <input type="checkbox"/> Rope Guard/Propeller Shaft <input type="checkbox"/> Previous Docking Blocks <input type="checkbox"/> Thrusters <input type="checkbox"/> Rudder <input type="checkbox"/> Bilge Keels <input type="checkbox"/>

# Proposed Biofouling Regulations: Biofouling Management – Niche Areas

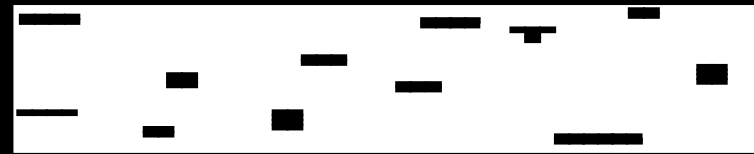
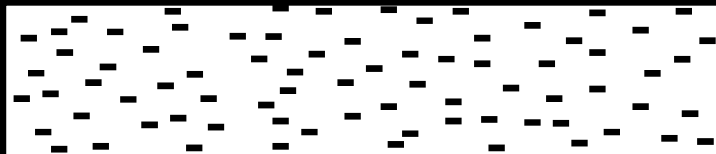
- Manage in some way
- Document management actions





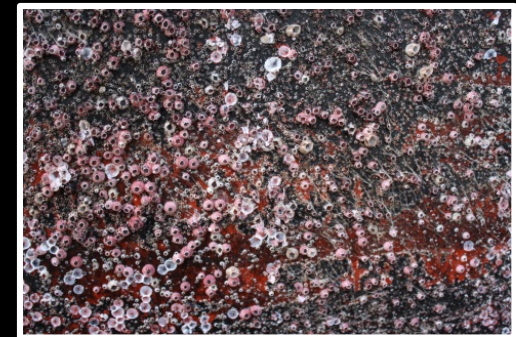
# Proposed Biofouling Regulations: Biofouling Management - Hulls

- Codify best preventive practices:
  - Anti-fouling or foul-release coatings within effective lifespan
- If not using best preventive practices, 5% cover threshold



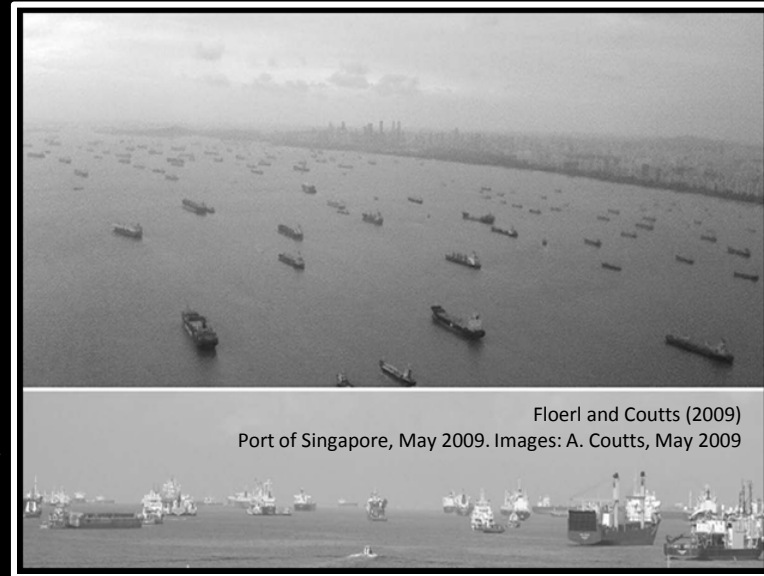
# Proposed Biofouling Regulations: Obviously Excessive Biofouling

- Biofouling above 15% cover
  - Excessive drag, fuel, emissions
  - Greater risk of NIS introduction
- Hints at ineffective planning and/or coating
- Biofouling must be reduced to 5% cover or less



# Proposed Biofouling Regulations: Extended Residency Periods

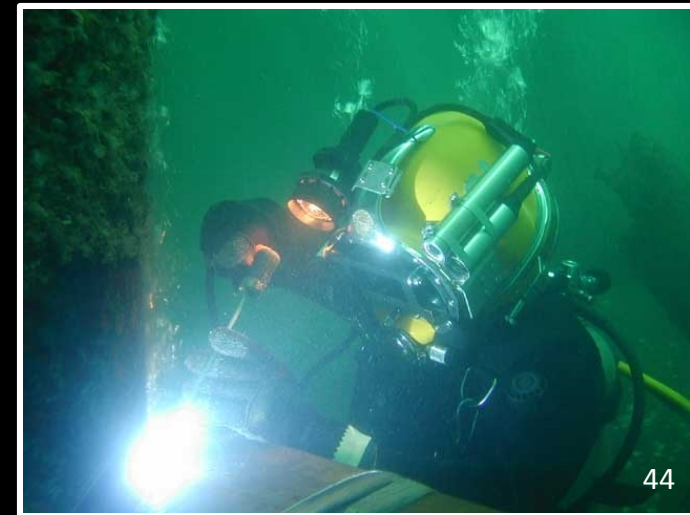
- Remaining in one location for 45+ days
- Greater likelihood of heavy biofouling accumulation
- Should inspect and clean (if necessary) prior to arrival at CA
  - Biofouling must be at or below 5% cover





# Proposed Biofouling Regulations: Alternatives and Emergency Exemptions

- Alternatives:
  - Blueprint for how to petition for alternative ways of achieving the goals of the regulations
- Emergency Exemptions:
  - Specific criteria for exemptions under emergency situations



# Proposed Biofouling Regulations: Public Rulemaking Process

- Publication of proposed rule [expected May 1, 2015]
- 45-day public comment period
- Public hearing
  - Port of Long Beach
  - Date: TBD [mid June]
- Mailing list
  - Raya.Nedelcheva@slc.ca.gov
  - Chris.Scianni@slc.ca.gov
- Availability of rulemaking documents
  - [www.slc.ca.gov](http://www.slc.ca.gov)
  - CSLC offices – Sacramento and Long Beach



# Topic 4: Future Goals

- Regulatory guidance document
  - Translate regulatory language - “Cliffs Notes”
  - Sample BF Management Plan and Record Book
- ROV-based Biofouling Compliance Assessment Protocols





# Future Goals

- CSU COAST (Council on Ocean Affairs, Science, and Technology) Internship projects
  - Waterline biofouling

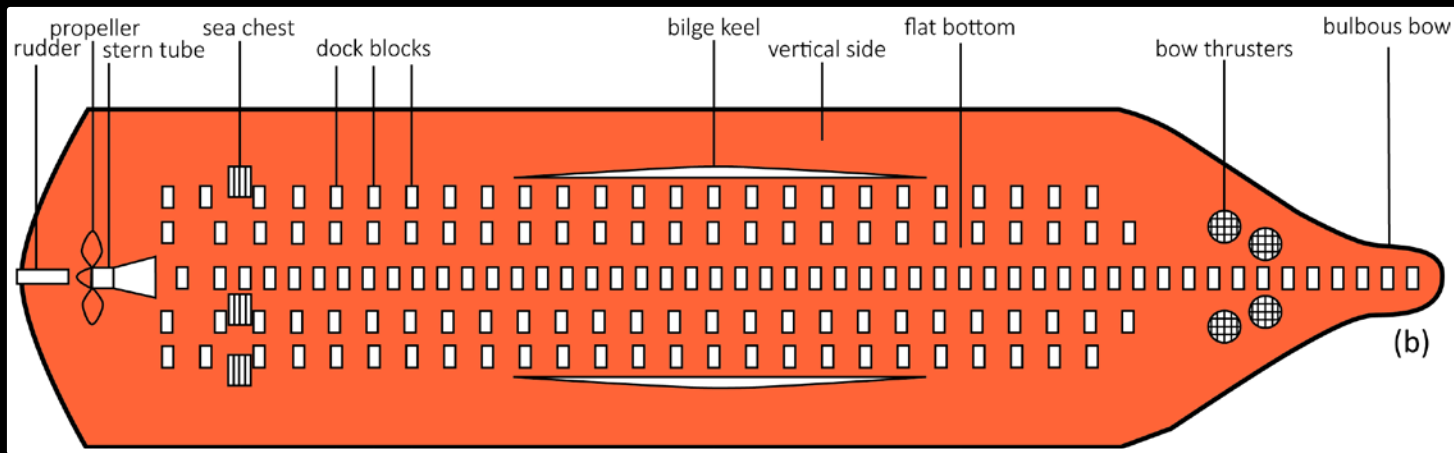


- Coatings database expansion



# Future Goals

- Manuscripts for publication
  - Disconnect between biofouling management for operational efficiency and NIS prevention purposes (SERC, MERC, NRL, NSWCC, Univ. Waikato)

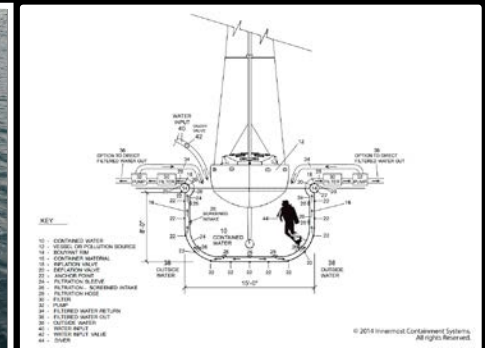
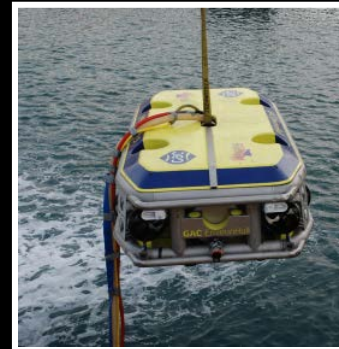
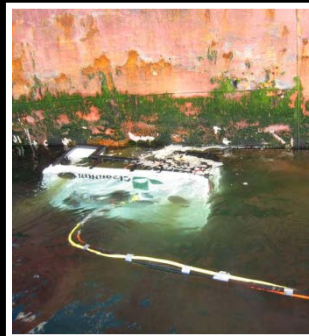
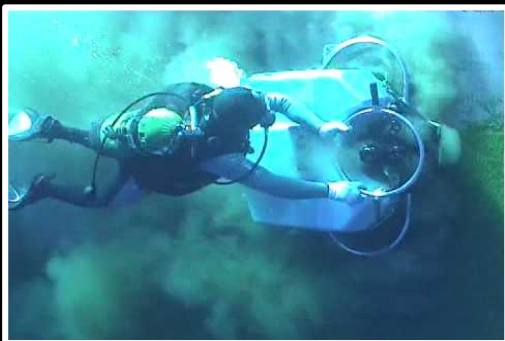
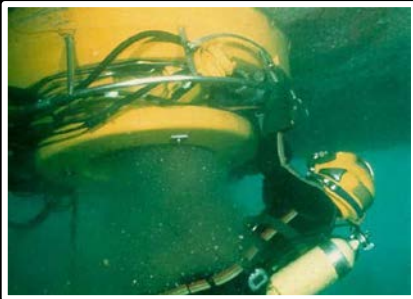


- Impacts of Great Recession on risk of introducing NIS
- Analysis of coatings used for vessels arriving at CA

# Future Goals

- Continue to engage EPA, CA State Water Board, CA Regional Water Boards, and CA ports on responsible in-water cleaning (recapture and treatment)

\*\*\*No Endorsement implied\*\*\*





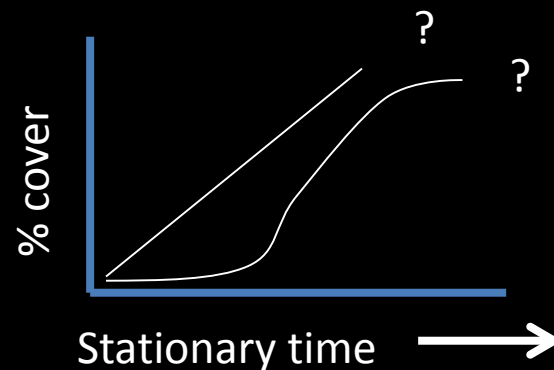
# Future Goals

- Biofouling Research
  - Copper tolerance
    - Inter- and intra-specific variability
    - Vessel traffic
    - Background pollution (Cu)
    - Facilitates successful transfer



- Stationary periods and biofouling development

- Port
- Coating type
- Season



# Thank You



[chris.scianni@slc.ca.gov](mailto:chris.scianni@slc.ca.gov)

