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

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CSLC Marine Invasive Species Program
Prevention First 2016 – Session 1C
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Vessel Biofouling
Facilitates corrosion
- Microbially-influenced corrosion (MIC)

Reduces operational efficiency

Expensive

Figure courtesy of Daniel Kane, Propulsion Dynamics.
Impacts: Environmental

Air Quality

San Pedro Bay Ports Clean Air Action Plan

Biofouling $\rightarrow$ Drag $\rightarrow$ Fuel consumption $\rightarrow$ 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


CSLC: Serving the Public Trust Since 1938
Shipping Industry Economics

Shipping industry economics → Operational practices and profiles → Nonindigenous species introduction risk
Shipping Industry Economics

Baltic Dry Index

Jan-00 Jan-01 Jan-02 Jan-03 Jan-04 Jan-05 Jan-06 Jan-07 Jan-08 Jan-09 Jan-10 Jan-11 Jan-12 Jan-13 Jan-14 Jan-15
California Vessel Arrivals

![Graph showing annual arrivals at CA ports from 2007 to 2015. The arrivals decrease overall with a slight increase in 2011.](image-url)
California Vessel Arrivals

The chart shows the annual arrivals at CA ports, measured in millions of TEUs (Twenty-Foot Equivalent Units), from 2007 to 2015. The data indicates a significant decrease in arrivals in 2009, followed by a recovery in the subsequent years, with a slight dip in 2015 compared to 2014.
Operational Changes: Layups

Long residency periods = Greater likelihood of biofouling accumulation

- Negative impacts on antifouling/foul-release coating performance
  - Floerl et al. 2005 Biological Invasions 7: 459-475

- Increases likelihood of propagules interaction with vessel
  - Floerl and Inglis 2005. Biological Invasions 7: 589-606

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

<table>
<thead>
<tr>
<th>Vessel Name</th>
</tr>
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<tbody>
<tr>
<td>Official / IMO Number</td>
</tr>
<tr>
<td>Responsible Officer's Name and Title</td>
</tr>
<tr>
<td>Date Submitted (Day/Month/Year)</td>
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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 [ ]
   - No coat applied [ ]
   - Date last full coat applied (Day/Month/Year)
   - Date last partial 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, Big Keel

Images: A. Coutts, May 2009

Floerl and Coutts (2009)
**HHRF: Residency Period Data**

A bar chart showing the number of prolonged residency periods, normalized to the number of vessels submitting HHRFs, from 2008 to 2015. The x-axis represents the year of HHRF submission, and the y-axis represents the number of prolonged residencies normalized to HHRFs. The data is color-coded as follows:

- Red: 120+ days
- Yellow: 105 - < 120 days
- Green: 90 - < 105 days
- Blue: 75 - < 90 days
- Turquoise: 60 - < 75 days
- Purple: 45 - < 60 days
- Dark blue: 30 - < 45 days
- Light blue: 20 - < 30 days
- Black: 10 - < 20 days

The chart shows an increase in prolonged residencies from 2008 to 2015, with a peak in 2012.
Slower speeds = greater survivorship

- Greater % cover and diversity compared to faster speeds
  - Coutts et al. 2010b. Biofouling 26(5): 539-553
HHRF: Speed Data

Average Traveling Speed (knots) + SE

HHRF Reporting Year

- 2008
- 2009
- 2010
- 2011
- 2012
- 2013
- 2014
- 2015
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
  o Mid-October

• 45-day public comment period

• Public hearing
  o Location: TBD
  o Date: Late November/early December

• Mailing list
  o Subscribe at www.slc.ca.gov

• Availability of rulemaking documents
  o www.slc.ca.gov
  o 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

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