Update on California's Marine Invasive Species Program

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California's Programmatic Origins

1999 Ballast Water Management Control for Nonindigenous Species Act

- Focus on foreign ballast water & ballast water exchange
- Prior to federal requirements (USCG & VGP)

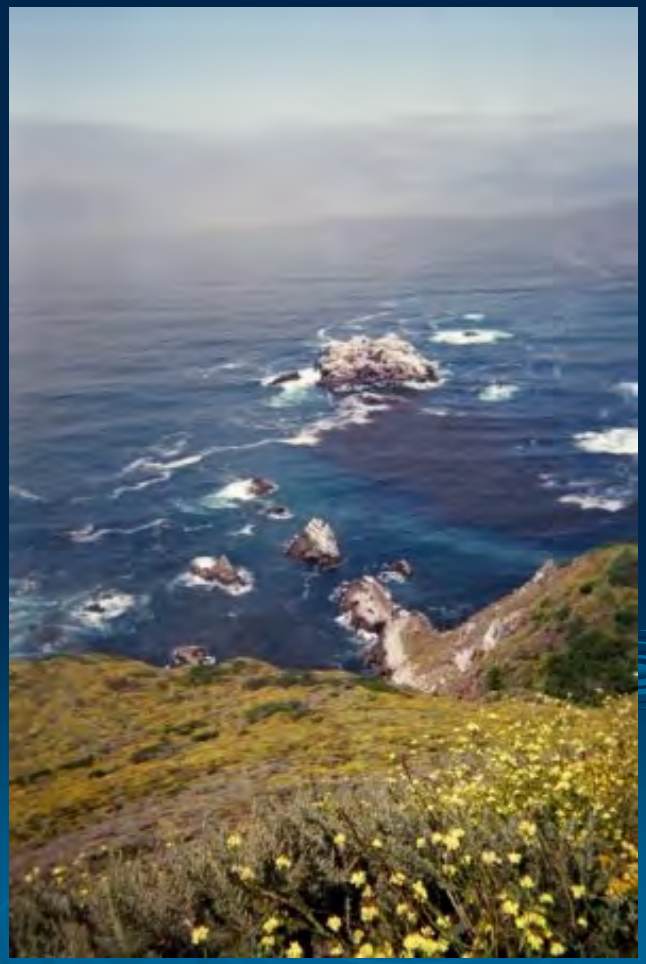
2003 Marine Invasive Species Act (Reauthorization & Expansion)

- Performance Standards/treatment technologies
- Vessel Vectors other than Ballast Water: Vessel Fouling

California's Performance Standards for Ballast Water Discharge

California Coastal Ecosystems Protection Act of 2006

- 2003 Marine Invasive Species Act: Recommend Performance Standards
  - Report/recommendations completed in 2006
- California Coastal Ecosystems Protection Act of 2006: Adopt performance standards in regulation
  - Completed October 2007
- Required reports assessing efficacy, availability and environmental impacts, including water quality, of currently available ballast water treatment technologies before each implementation date



Performance Standards

Organism Size Class	California	IMO Regulation D-2
Organisms greater than 50 µm in minimum dimension	No detectable living organisms	< 10 viable organisms per cubic meter
Organisms 10 – 50 µm in minimum dimension	< 0.01 living organisms per ml	< 10 viable organisms per ml
Living organisms less than 10 µm in minimum dimension	< 10^3 bacteria/100 ml < 10^4 viruses/100 ml	
Escherichia coli	< 126 cfu/100 ml	< 250 cfu/100 ml
Intestinal enterococci	< 33 cfu/100 ml	< 100 cfu/100 ml
Toxicogenic *Vibrio cholerae* (O1 & O139)	< 1cfu/100 ml or < 1cfu/gram wet weight zoological samples	< 1 cfu/100 ml or < 1 cfu/gram wet weight zooplankton samples

California Implementation Schedule

Ballast Water Capacity of Vessel	Standards apply to new vessels in this size class constructed on or after	Standards apply to all other vessels in this size class beginning in
< 1500 metric tons	2010	2016
1500 – 5000 metric tons	2010	2014
> 5000 metric tons	2012	2016

Challenges of Technology Assessment

- Limited data: Small range of shipboard and environmental conditions
- Technology testing programs not tailored to CA standards
  - Questions related to statistical confidence
- Therefore staff evaluates systems for potential to comply
  - Staff does not currently have practical ability to test systems for approval
- Testing/statistical challenges discussed in recent federal (EPA) and state (Great Lakes) technology assessment reports

Technology Assessments

- December 2007 Review: Technologies not available
- January 2009 Review: 2 systems show potential
  - On January 1, 2010 standards implemented for new build vessels with a ballast water capacity ≤ 5000 MT
  - New Build = Construction began on or after January 1, 2010
  - 1 Vessel visited CA in June, 2011 (did not discharge)
- August 2010 Review: New build vessels with a ballast water capacity > 5000 MT
  - 8 systems show potential
  - 3 systems show potential on more than 50% of multiple tests
  - Implementation date currently set as January 1, 2012
- Commission requested update of 2010 report by September 1, 2011

2011 Update Report (Sept. 1, 2011)

- 60 systems reviewed
- 38 systems with data, 17 with “reliable data”
  - Reliable = reports include methods, results, and testing as part of formal Type Approval process (i.e. not R&D)
- 10 systems demonstrated potential to meet CA standards
  - All commercially available
- 5 systems show potential over more than 50% of multiple tests
  - One system met CA standards 100% time during shipboard tests
  - One system met CA standards 100% during shipboard tests, but did not test for total bacteria
    - Vendor willing to self-certify to CA standards

2011 Update Report: Summary of Testing Data

Manufacturer	>50		10 - 50		<10 (bacteria)		*E. coli*		Enterococci		*Vibrio*		Literature Cited[2]
	Land	Ship	Land	Ship	Land	Ship	Land	Ship	Land	Ship	Land	Ship	
Alfa Laval[1]	4/10	1/4	3/10	1/4	0/10	2/2	10*/10	4*/4	10*/10	4*/4	10*/10	4*/4	59,61,65
Auramarine	3/11		5/11		0/11		11*/11		11*/11		11*/11		66
Ecochlor	**8/15**	**3/3**	**9/11**	**3/3**	**8/11**		**10/10**	**3/3**	**11/11**	**3/3**	**1/1 (lab)**	**3*/3**	**15,54,69**
ERMA First	5/12	0/2	9/12	2/2	0/Unk[3]		10*/10	2*/2	10/10	2/2		2*/2	16,57
Hyde	1/10	3/3	0/10	1/3	5/10	3/3	10*/10	3*/3	10*/10	3*/3		3*/3	55,76
JFE	6/11	3/6	11/11	5/6	3/11		11*/11	6/6	11/11	6/6	11*/11	6*/6	23,62
MSI	0/5		0/5		3/5		5/5		5/5		5*/5		51
NEI	1/5	1/2	0/1	Unk	0/2	0/2	0/1	2*/2	0/1	Unk		2*/2	71,72,73
NK-03	5/14	1/5	9/14	4/5	0/14	1/1	10*/10	5*/5	10*/10	5*/5	10*/10	5*/5	26,28
Nutech	0/3	2/3	0/2	0/3	3/3	2/2		3*/3		3*/3		3*/3	18,77
OptiMarin	8/12	0/8	6/12	2/8	2/12		12*/12	8*/8	12*/12	8*/8	12*/12	8*/8	58,60
Panasia	1/1		1/1										27
Qingdao	**4/13**	**3/3**	**8/13**	**3/3**	**9/13**	**3/3**	**13*/13**	**3*/3**	**13*/13**	**3*/3**	**13*/13**	**3*/3**	**63,68**
RWO	**0/13**	**4/5**	**6/13**	**3/3**	**7/13**		**13*/13**	**5*/5**	**13*/13**	**5/5**	**13*/13**	**5*/5**	**13,64**
Severn Trent	**7/11**	**2/4**	**8/11**	**1/3**	**10/11**	**2/4**	**10*/10**	**4/4**	**10/10**	**4/4**		**4*/4**	**12,56**
Siemens	0/10		5/10		0/10		10/10		7/10		10*/10		17,52
Techcross	**8/11**	**3/3**	**9/11**	**3/3**	**5/5**	**1/1**	**10/10**	**3/3**	**11/11**	**3/3**	**11*/11**	**3*/3**	**29,30**
Wilhelmsen	2/2	2/3	1/2	0/3			2/2	3*/3	2/2	3/3	2/2	3*/3	2,14

Report available at:
http://www.slc.ca.gov/Spec_Pub/MFD/Ballast_Water/Ballast_Water_Default.html

Implementation of Standards: Next Steps

- How to move forward?
  - Options discussed with Technical Advisory Panel (December 2010)
  - Change standards? BAT? Compliance protocols?
- Strategy: Establish compliance verification protocols
  - Specify methods to collect BW samples and analyze to assess vessel discharge compliance
  - Clarity: Vendors/vessel owners can self-verify systems meet CA standards.
  - Flexibility: Revise protocols as detection limits improve
    - Include grandfathering
  - Technical advisory panel meetings: July, August, October
  - Propose regulations by late-fall 2011, implementation mid-2012

California's Proposed Regulations for Biofouling Management

Background: Vessel Biofouling

Fouling Community: Direct attachment and associated mobile organisms

- N. America: At least 36% of shipping introductions (Fofonoff et al. 2003)
- Hawaii: Most important marine vector (Eldredge & Carlton 2002)
- North Sea: Up to 66% of shipping introductions (Gollasch 2002)
- California: Up to 60% of marine/estuarine introductions (Ruiz et al. 2011)
  - 18%: Vessel biofouling is the only possible vector
  - Additional 42%: Fouling is one of several possible vectors
  - CA is a center for first introduction on Pacific Coast.

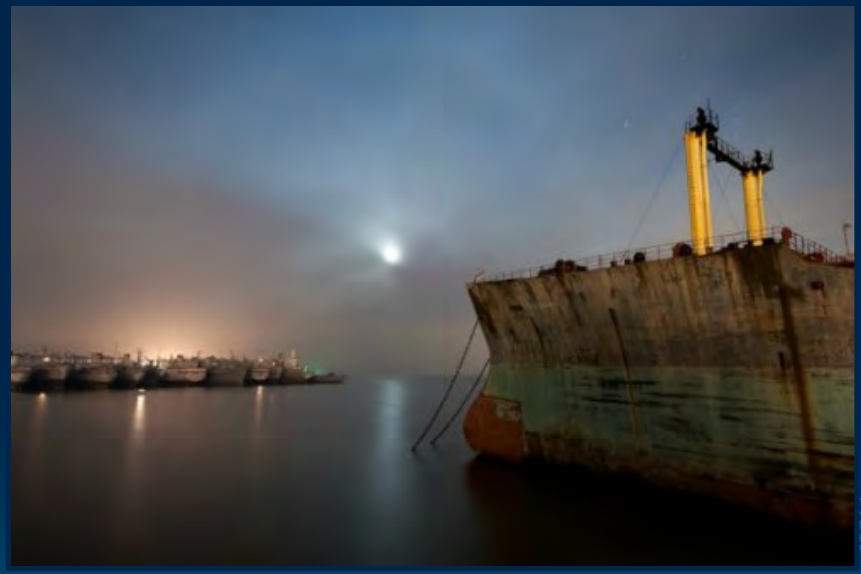
2003 Marine Invasive Species Act

- Directive: Evaluate risk & provide recommendations
- 2006 Report - Findings
  - Hull maintenance important to merchant fleet
  - Certain vessel characteristics exacerbate fouling accumulation
    - ✓ Slow speeds
    - ✓ Long immobile periods
    - ✓ Sheltered “nooks & crannies”
    - ✓ Old antifouling paint, unpainted areas
  - Little biological data esp. for Regular North American fleet
  - Very exaggerated characteristics = high invasion risk

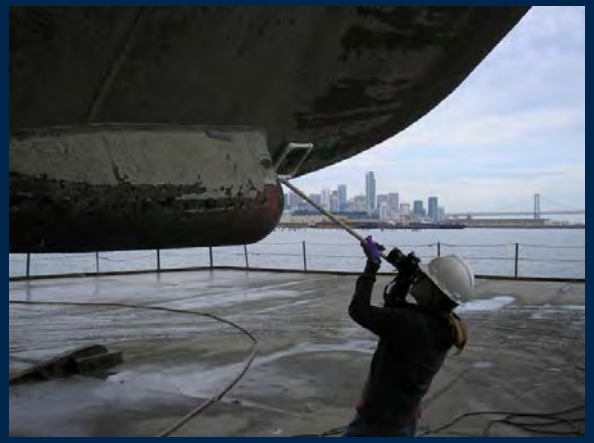
Suisun Bay Reserve Fleet

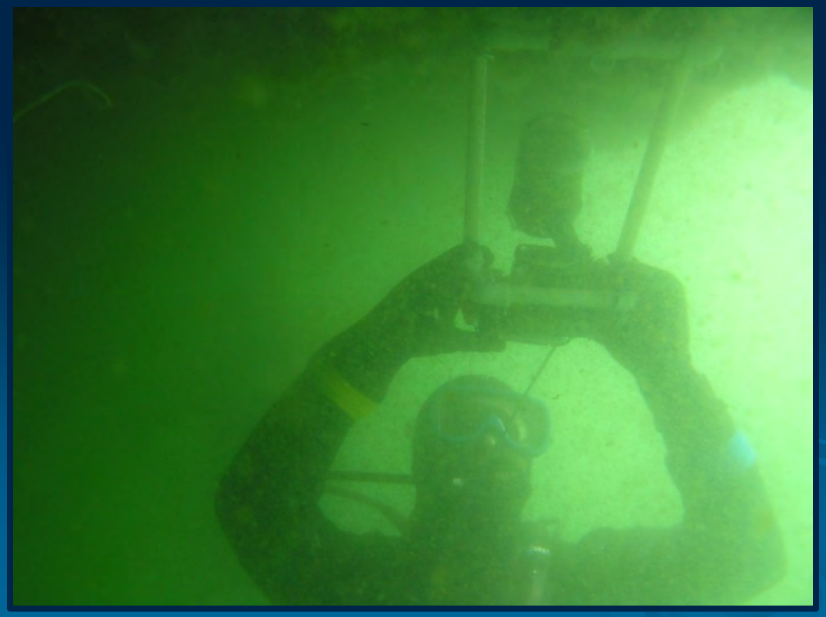
2006 Recommendations to the Legislature

- Recommendations (April 2006)
  - Address high risk vessels
  - Fill biological & hull husbandry information gaps
  - Revisit – develop regulations by 1/1/2012
- Assembly Bill 740 (2007)
  - "Regular" removal of fouling (~ every 5 years)
  - Collection of hull husbandry information
  - Regulations by 1/1/2012



Information Collection & Research





- Biological Research
  - Aquatic Bioinvasion Research and Policy Institute
  - Drydock, SCUBA, ROV surveys
  - Synthesis of worldwide data
  - Salinity shock
- Annual Hull Husbandry Reporting Form (2008)
  - Collect form at first port of call in CA
  - Data on hull maintenance practices, vessel behavior

Research – General Conclusions

- Little fouling on laminar hull
  - Exceptions: Old or damaged antifouling paint
- Hotspots: "Niche areas"
  - Don't affect vessel fuel consumption - less frequent cleaning
  - Shelter = more settlement
  - Bow thrusters, stabilizer, rudder, sea chests, ladder holes, gratings, etc.
  - Gravid organisms on several vessels (barnacles, crustaceans)
- Marine growth prevention systems can work very well
- Other studies tell the same story

Development of California's Biofouling Rule

- Technical Advisory Group
  - Industry, researchers, government regulators, paint manufacturers, hull cleaning companies, international agencies, IMO chairs
  - 4 Meetings (Aug 2010 – April 2011)

- International Activities
  - IMO: Biofouling management guidelines – Approved July 2011
  - Australia: Guidelines (2009). Currently developing requirements.
  - New Zealand: 2010 Draft Import Health Standard for Vessel Biofouling (final under development)

Smithsonian Institution

PMSA

Matson Navigation Company

Chevron

NIWA Taihoro Nukurangi

Transport Canada

Commercial Diving Muldoon Marine Services

Aquatic Bioinvasions Research & Policy Institute
Portland State University environmental sciences & resources

MAF BIOSECURITY NEW ZEALAND

International

California Water Boards
State Water Resources Control Board
Regional Water Quality Control Boards

FARWEST Corrosion Control

Australian Government
Department of Agriculture, Fisheries and Forestry

California's Proposed Regulations for Biofouling Management

- Cleanliness standards for laminar hull and niche areas
- Maintain documentation of hull survey and/or cleaning
  - Within 6 months of arrival
- Biofouling Management Plan
- Biofouling Record Book
- Vessels with extended residency period (≥ 90 days) must inspect before arrival to CA
  - Must meet cleanliness standards
- Submit Annual Hull Husbandry Reporting Form
- Published September 16, 2011
  - 66-Day Comment Period (ends November 21, 2011)
  - All documents posted: http://www.slc.ca.gov/Spec_Pub/MFD/Ballast_Water/Ballast_Water_Default.html

Questions?

Photo courtesy of the Smithsonian Environmental Research Center