Ballast Water Management Compliance of Commercial Vessels Operating in California, a Ten-Year Perspective

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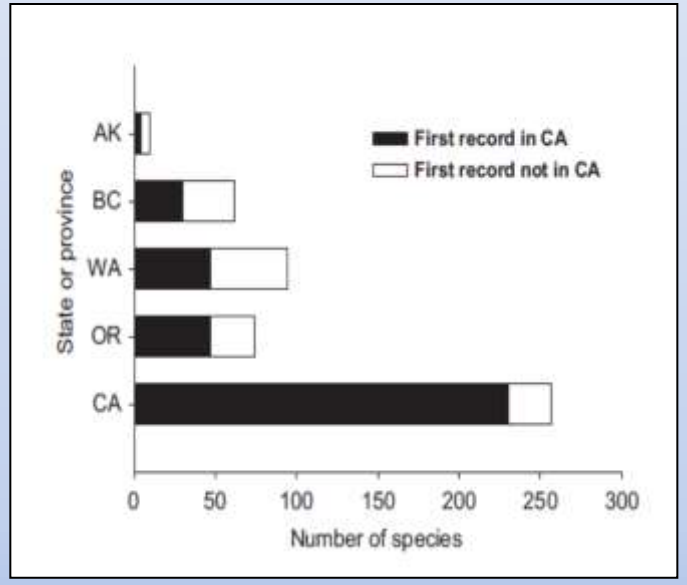
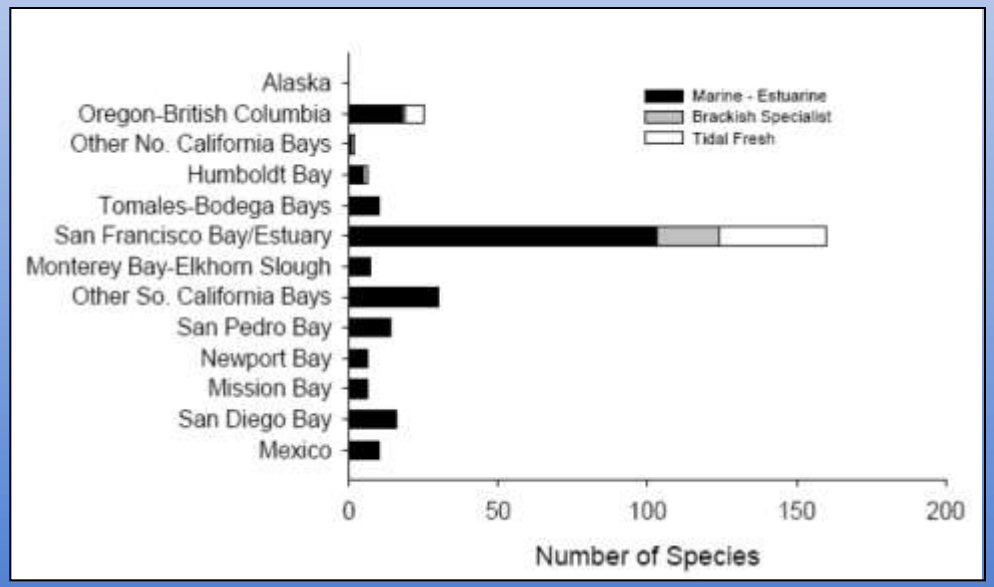
Why Manage Ballast Water?
Nonindigenous Species



(Ruiz et al., 2011)

- CA is the "entry point" for 79% of NIS found on the west coast.
- 89% (257 out of 290) of known west coast NIS are established in California coastal waters.
  - SF Bay one of most heavily invaded water bodies in the world



- **59%** of established NIS on Pacific west coast were first recorded from the San Francisco Bay/Estuary
- **65%** of established NIS in CA were first recorded from the San Francisco Bay/Estuary

Why Manage Ballast Water?
Nonindigenous Species

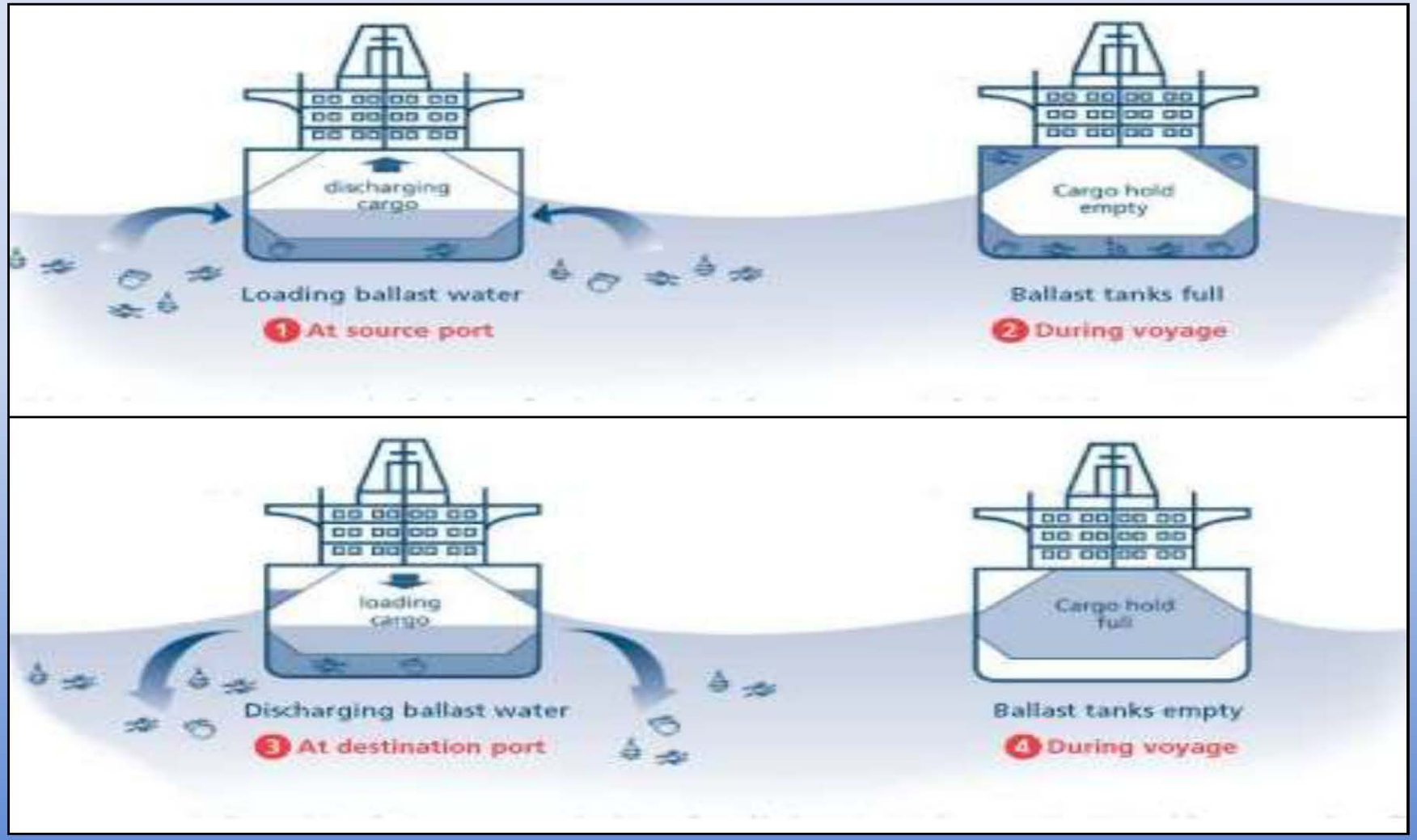
Potential Impacts = Economic, Ecological, and Social/Human Health

$120,000,000,000 in losses and damages **per year** in U.S.
(Pimental et al. 2005)

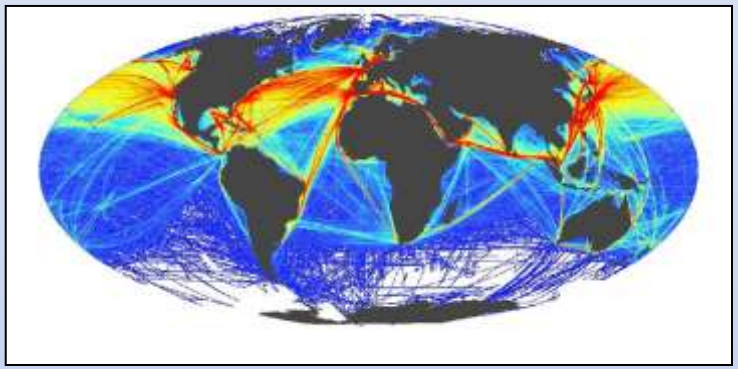
- CA's Ocean-based economy (2009)
  - 1st in ocean-based employment in U.S.
  - 2nd largest ocean-based GDP in U.S.
  - Tourism and recreational boating ~ $15 Billion

- Several vectors for NIS into CA, but shipping most significant.

Commercial Shipping Vectors



Commercial Shipping Vectors



- Roughly **7000** species are moved around the world in ballast on a daily basis (Carlton 1999).
- Each ballast water discharge event has the potential to release over **21.2** million individual organisms (Minton et al. 2005).
- CA receives approximately **10,000** commercial vessel arrivals annualy.
- **81%** of non-indigenous species (NIS) in California are attributed to commercial shipping, including ballast water and vessel biofouling (Ruiz et al. 2011).

Marine Invasive Species Program - Authority and Origins

1999 Ballast Water Management Control for Nonindigenous Species Act

- Authority: Vessels over 300 GRT capable of carrying ballast water
- Only Foreign Ballast Water Managed

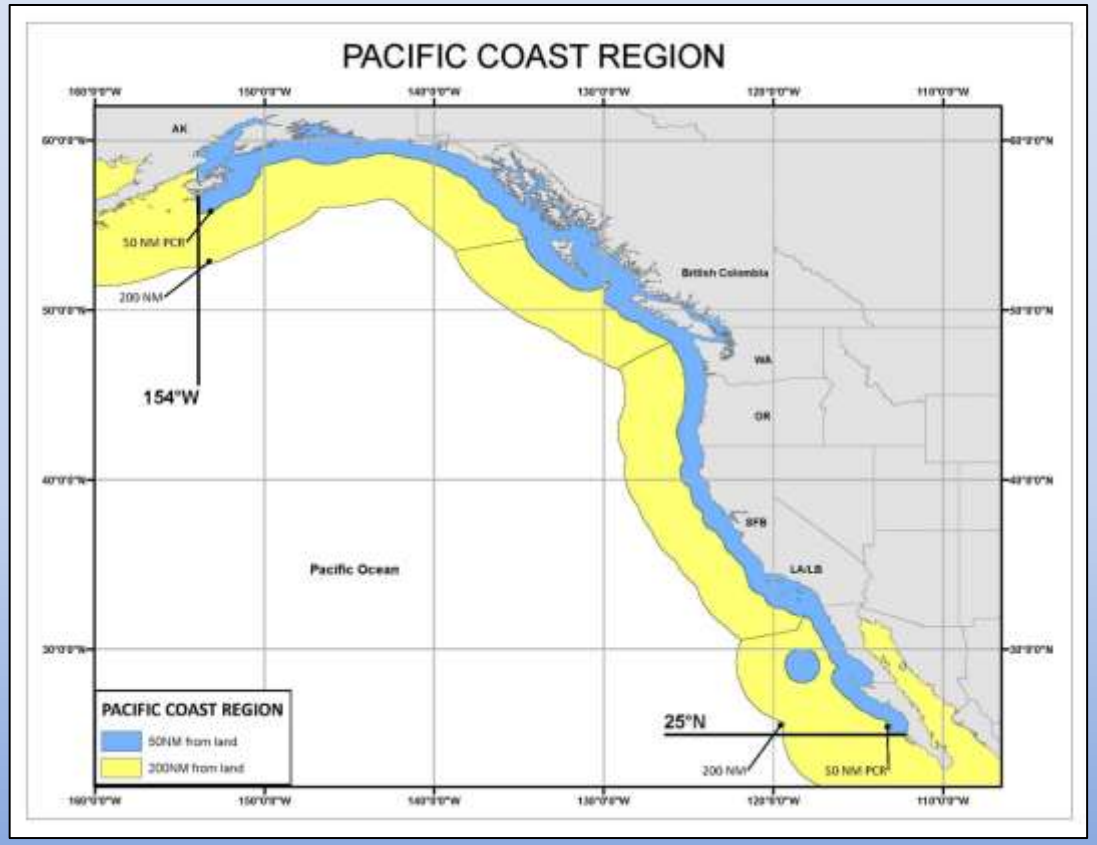
2003 Marine Invasive Species Act (Reauthorization & Expansion)

- Required Management of Coastal Ballast Water (Regs put in place 2006)
- Analyze the role other potential vectors associated with shipping (i.e. biofouling)
- Recommend Ballast Water Discharge Performance Standards to the CA Legislature

Ballast Water Management Options

- Retain all ballast on board/no discharge (~84%)
- Discharge to a shore–based reception facility (none currently exist)
- Use of approved alternative ballast water treatment
- **Ballast water exchange (BWE)**

Current Ballast Water Exchange Requirements



- **As of 2006, vessels discharging ballast in CA must manage in accordance with the rules of the Pacific Coast Region (PCR)**

- Arrivals from within PCR, ballast water from within: Exchange >50 nm
- Arrivals from within PCR, ballast water from outside: Exchange >200 nm
- Arrivals from outside PCR: Exchange >200 nm

There are no exempted commercial vessels (e.g. Domestic oil tankers)

Assessing Compliance

Ballast Water Reporting Forms: Database

- Forms contain information on source, exchange location and type, and discharge port
- Quality controlled database extending back to 2002

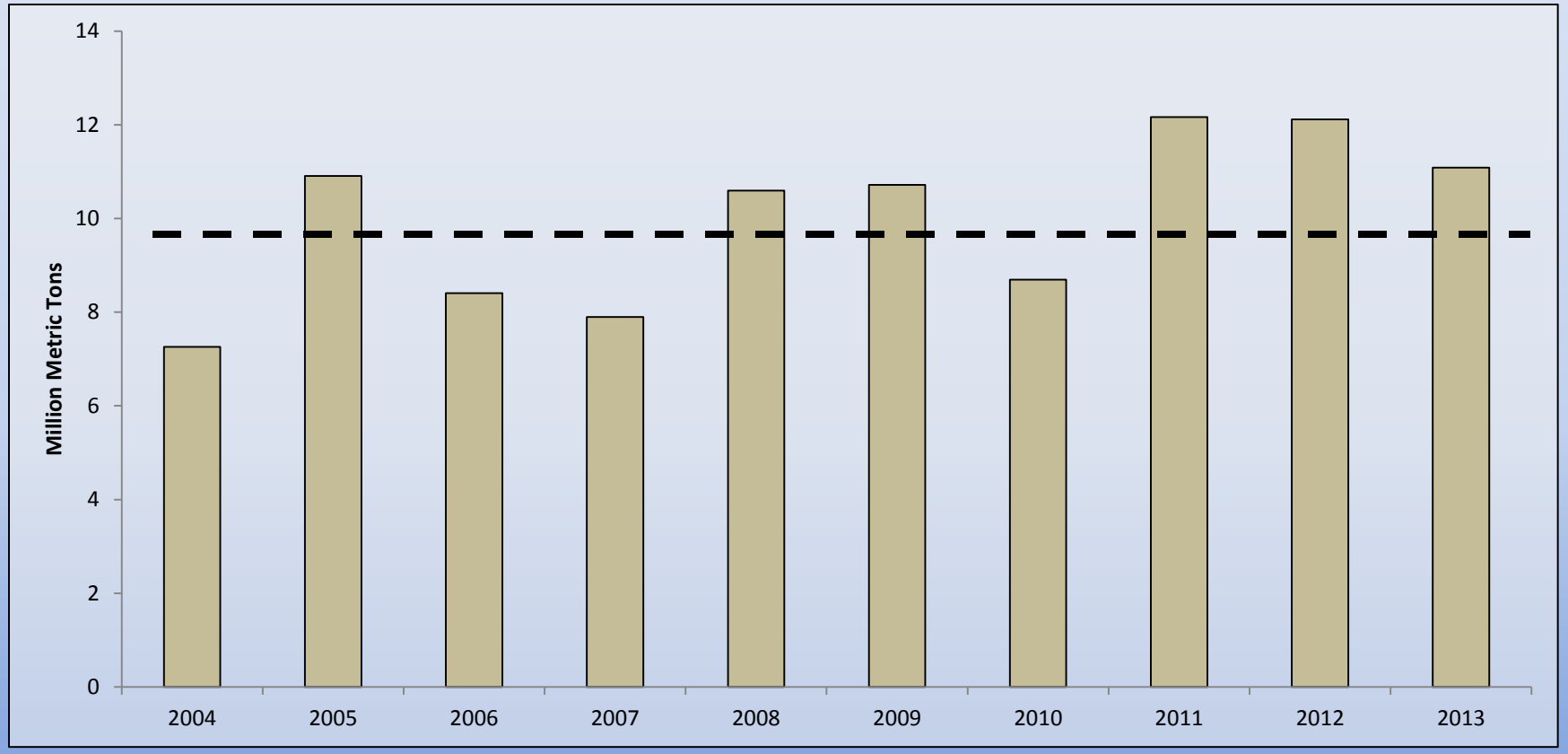
On board ship inspections:

- Marine Safety Personnel from SLC's Marine Facilities Division are mandated to board and inspect at least 25% of all CA arrivals
- Check Ballast Water Logs/Management Plan, verify exchange locations, test ballast salinity, perform outreach

Analysis using Geographic Information System software:

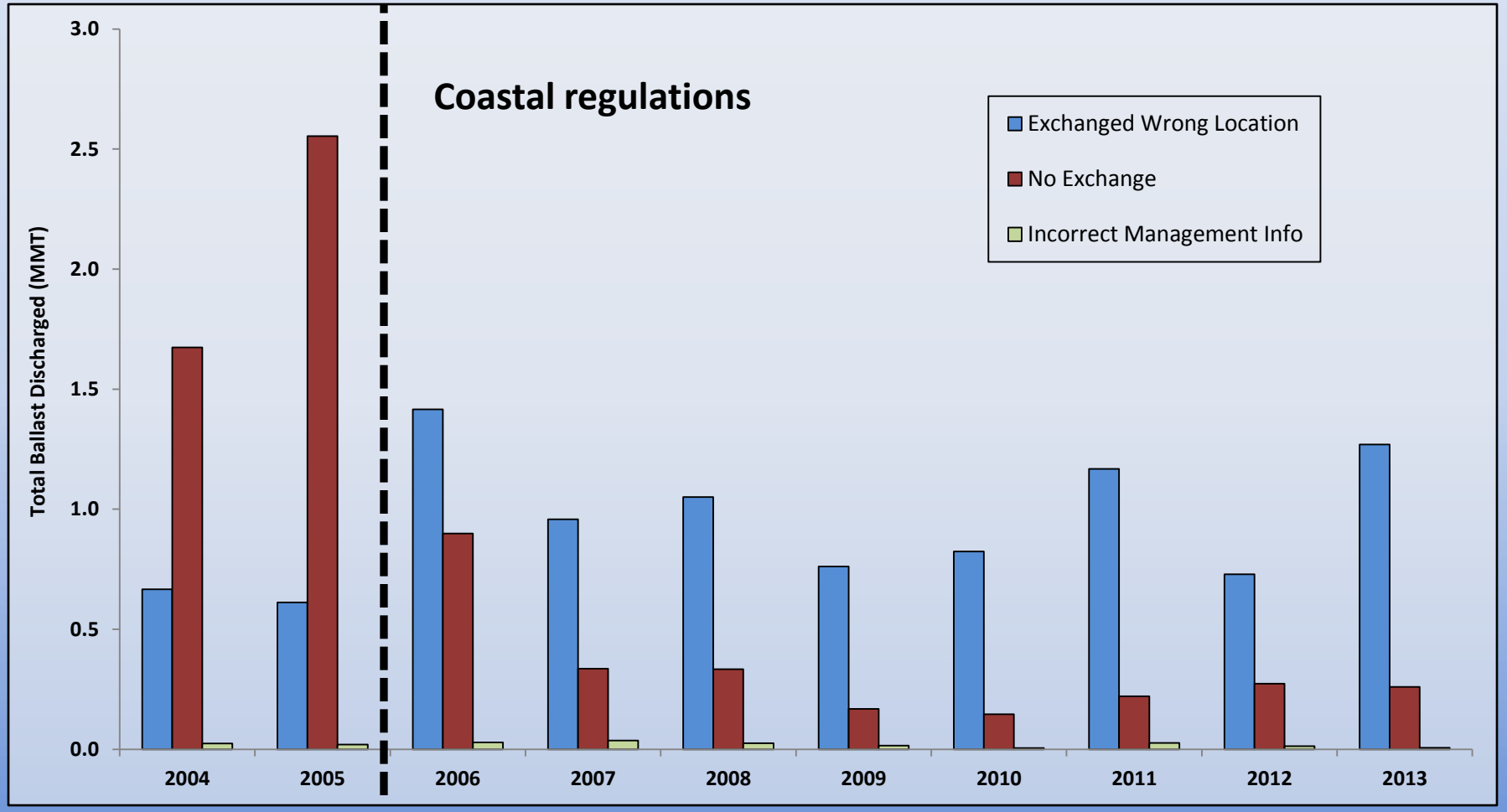
- Evaluates compliance with legal exchange distances
- Helps identify potential underlying reasons for violations
- Allows for the analysis of very large datasets

Annual Ballast Water Discharges

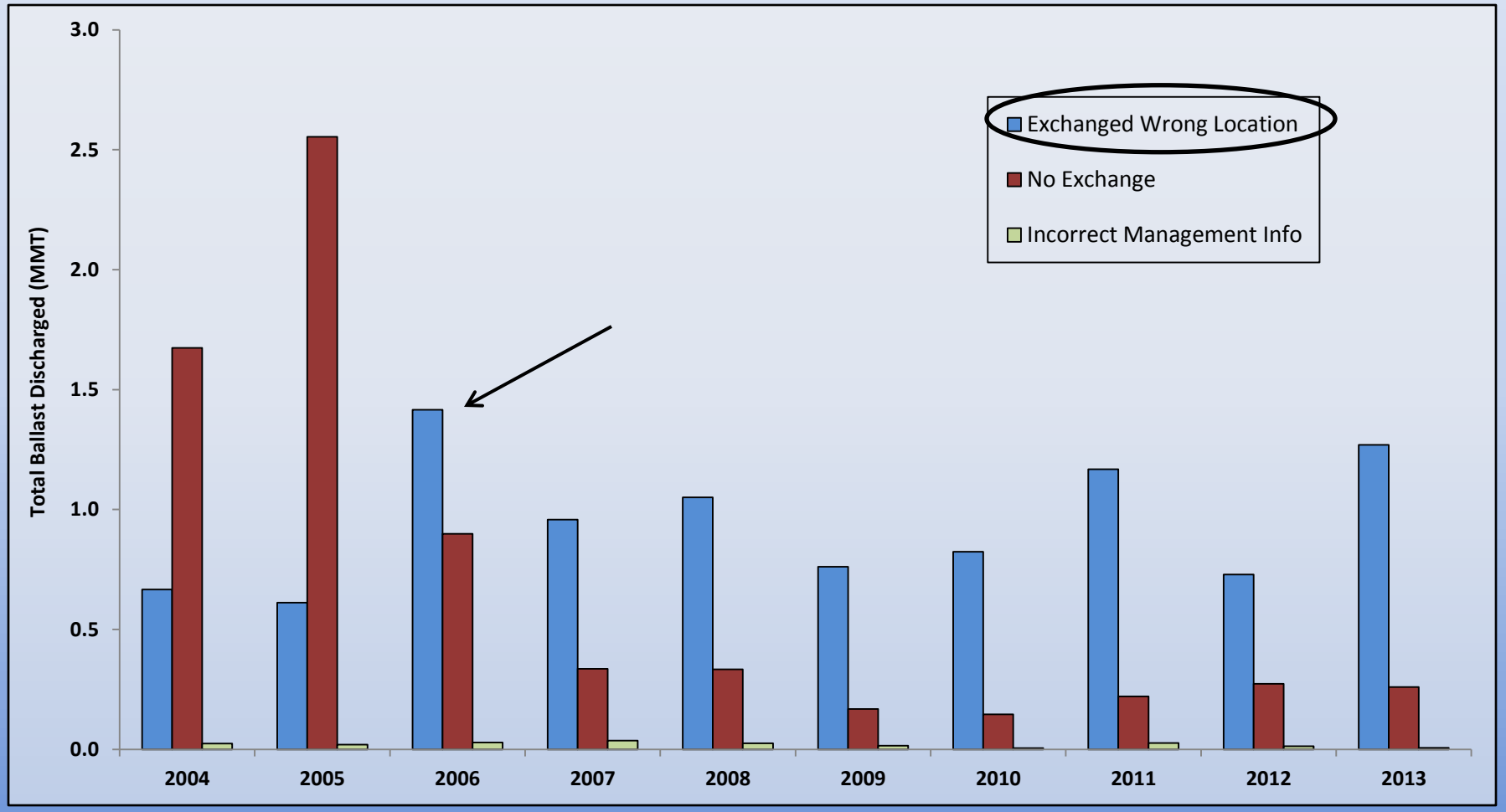


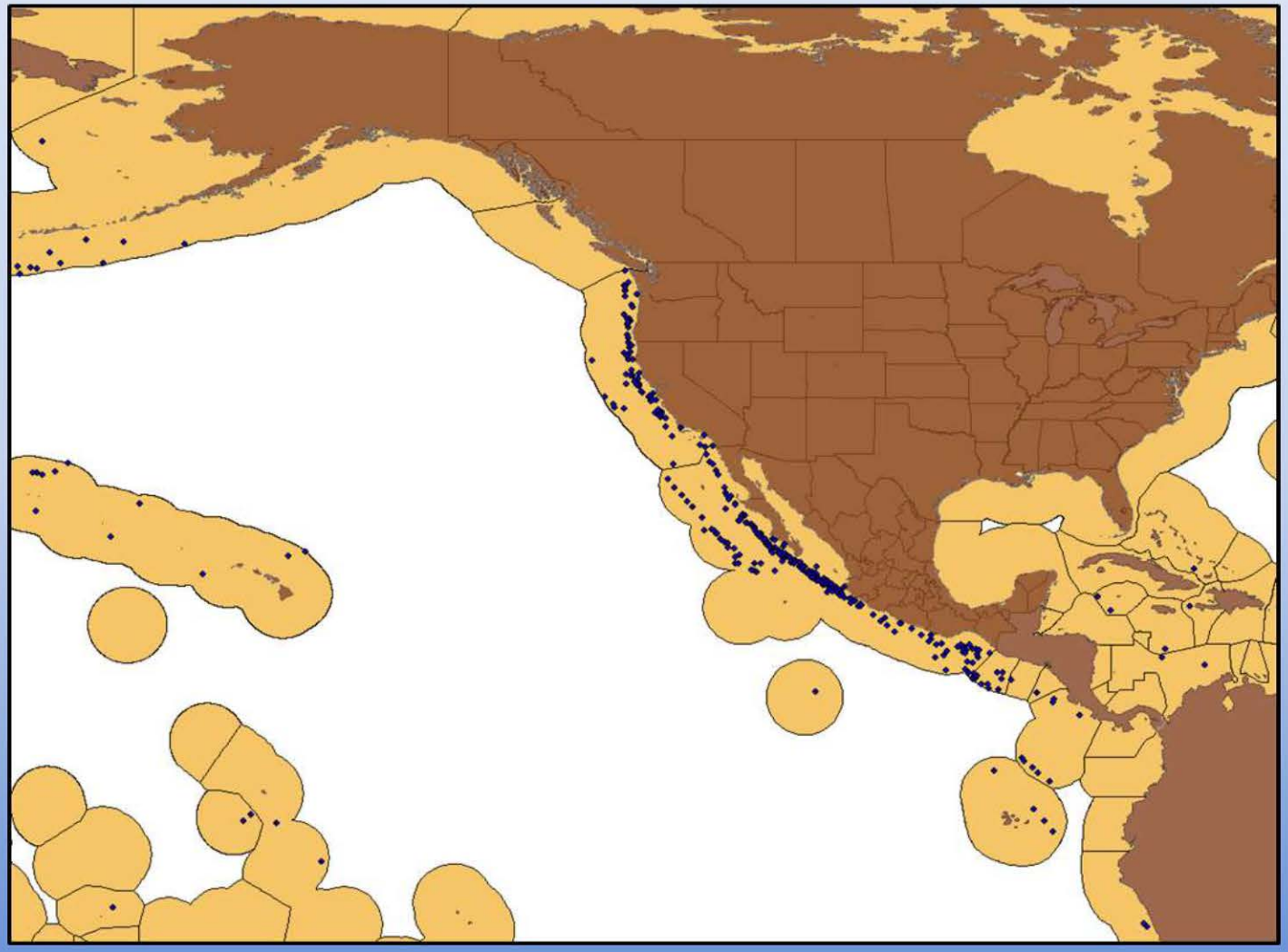
- State annual avg. ~10 MMT
- San Francisco Estuary annual avg. ~5.5 MMT

Compliance of Discharged Ballast Water



Breakdown of Noncompliant Ballast Water



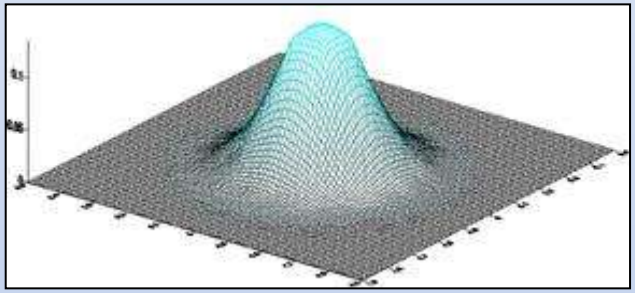


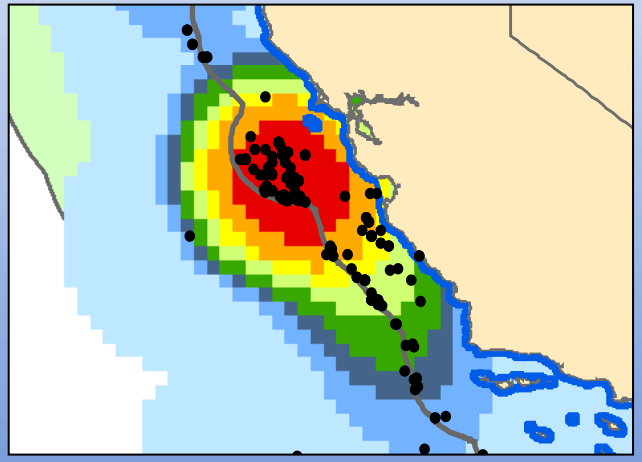
Noncompliant Ballast Water Exchange: Geography

Where are illegal exchanges concentrated/clustered?

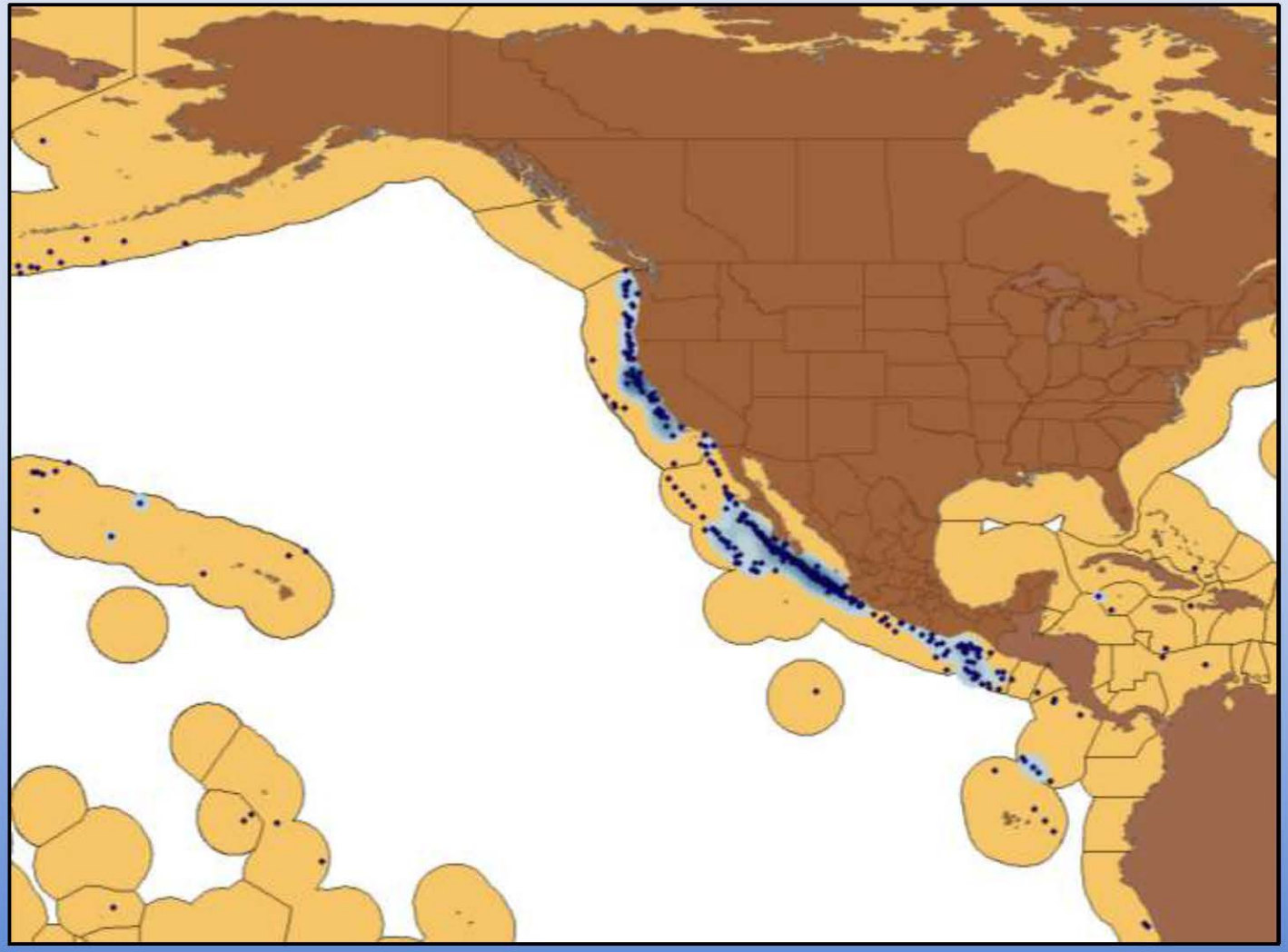
ESRI ArcGIS/ArcMap 10.1

- Kernel Density Function (Spatial Analyst) - Calculates density of "events" per unit area
- Inputs:
  - Point locations of illegal exchanges
  - Search radius: 2 degrees
  - Cell Size: 0.2 degrees
  - Weighted by ballast water discharge volumes

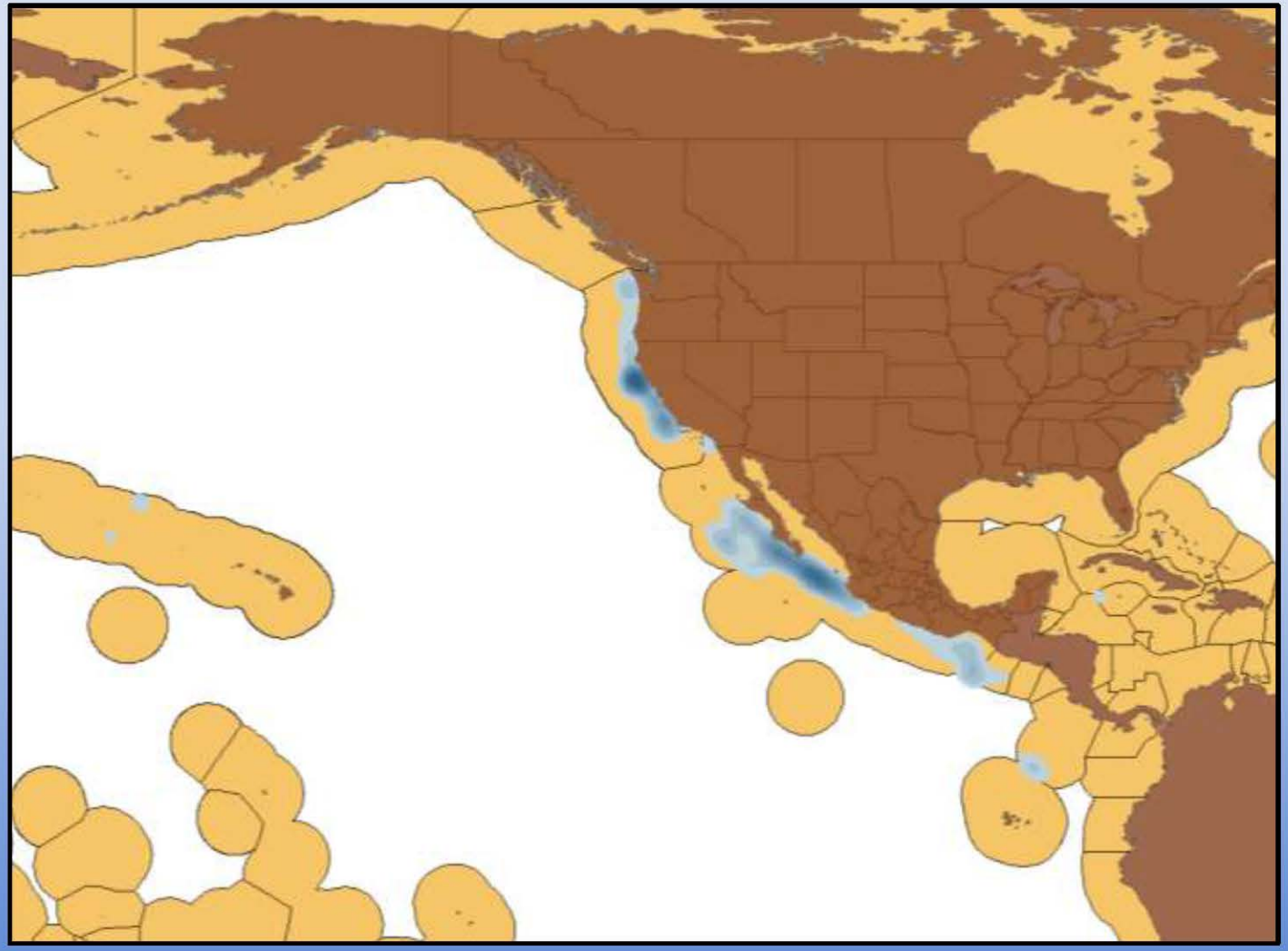




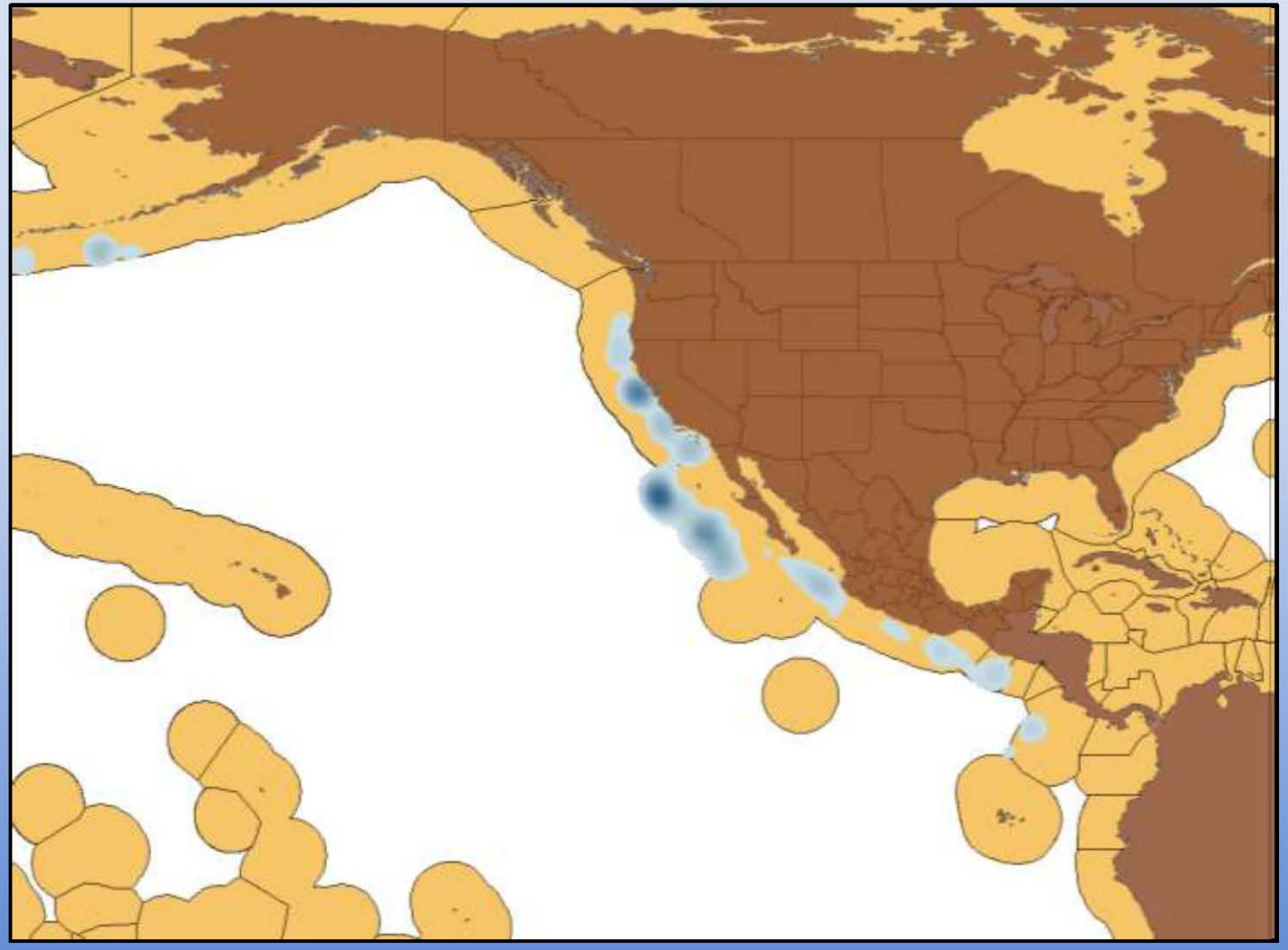
Noncompliant Exchange – 2004

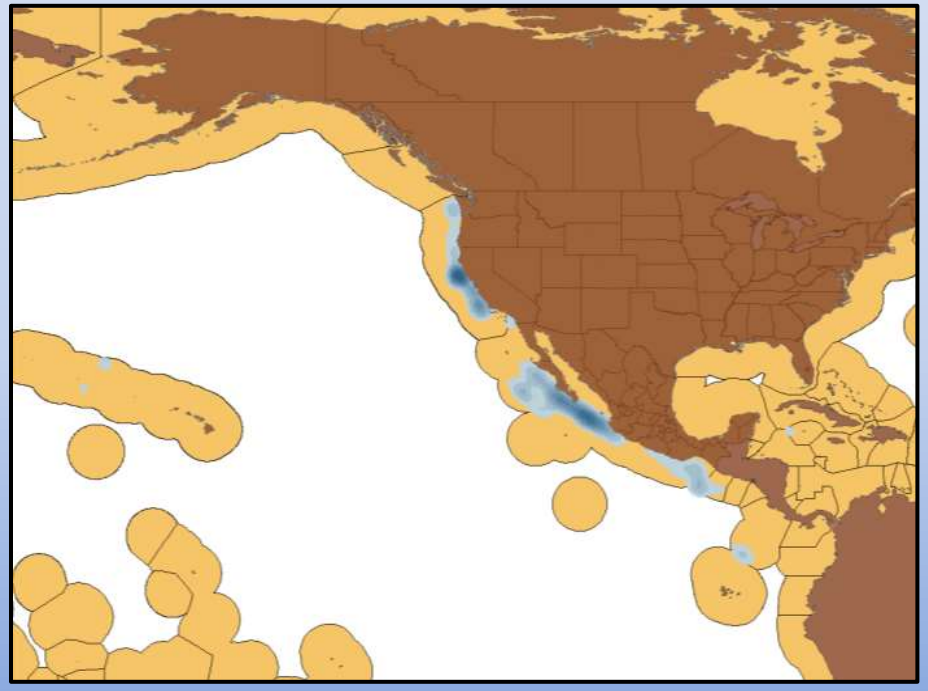


Noncompliant Exchange – 2004



Noncompliant Exchange – 2012





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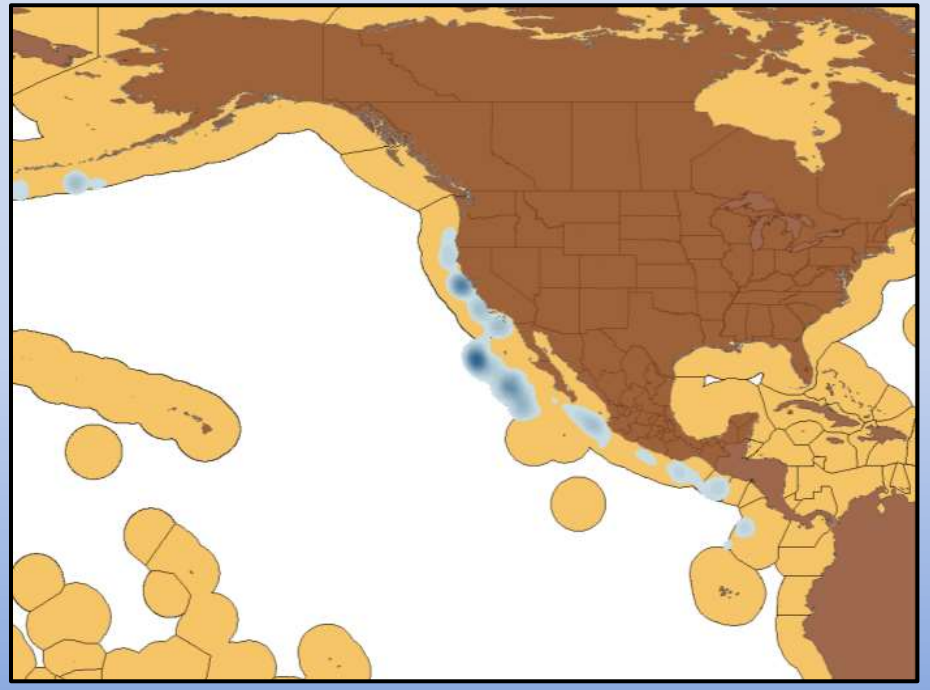

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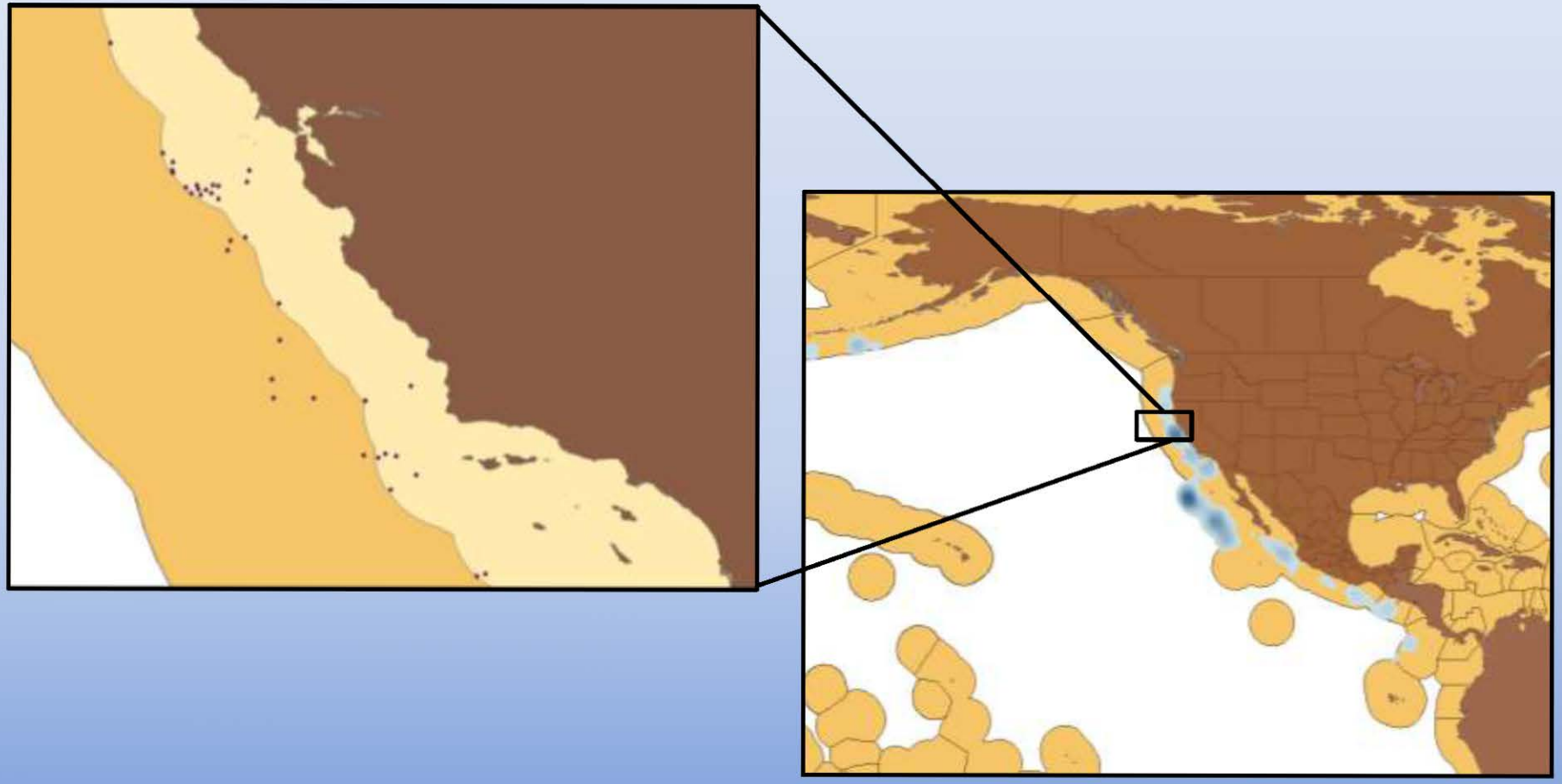
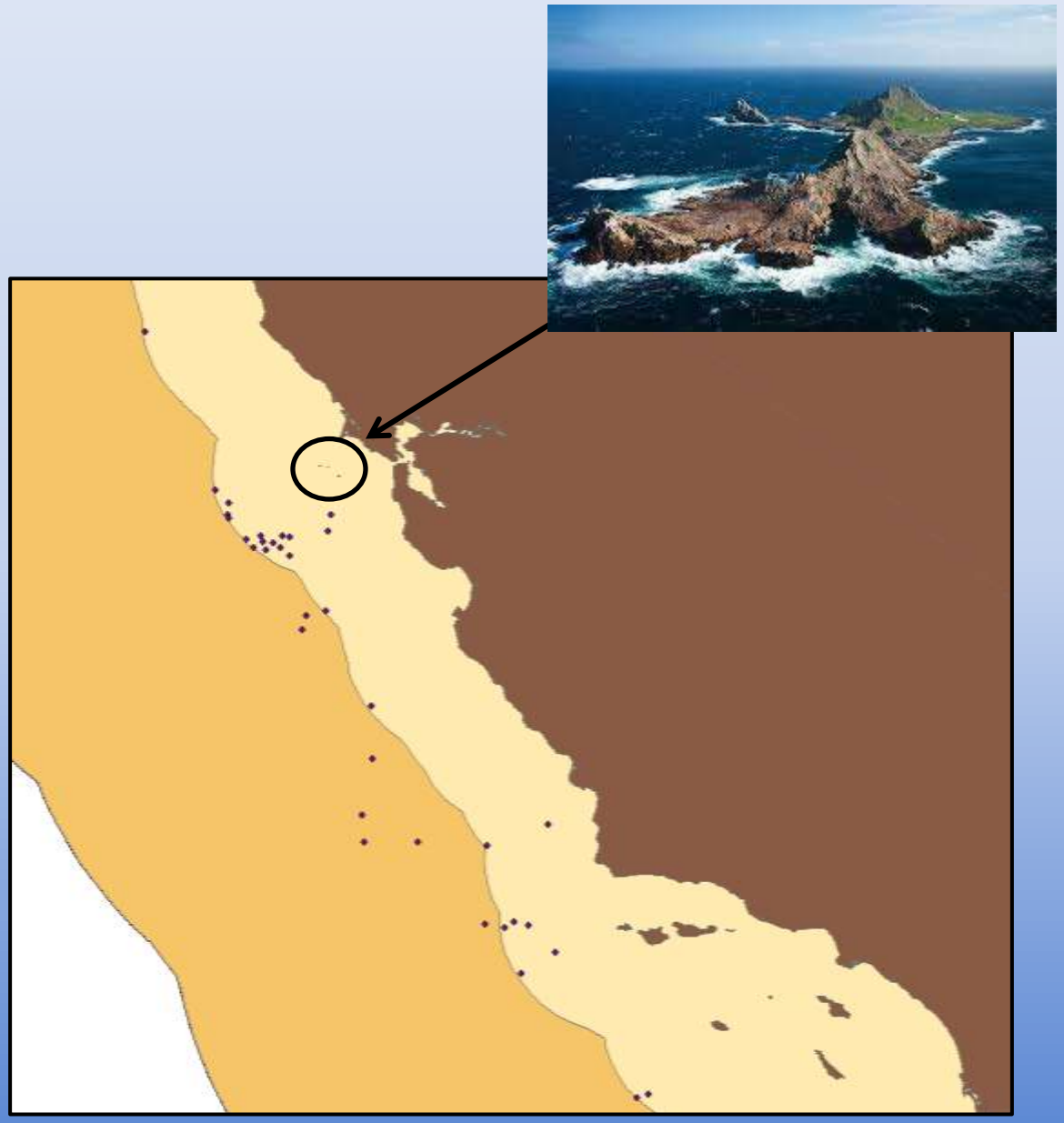
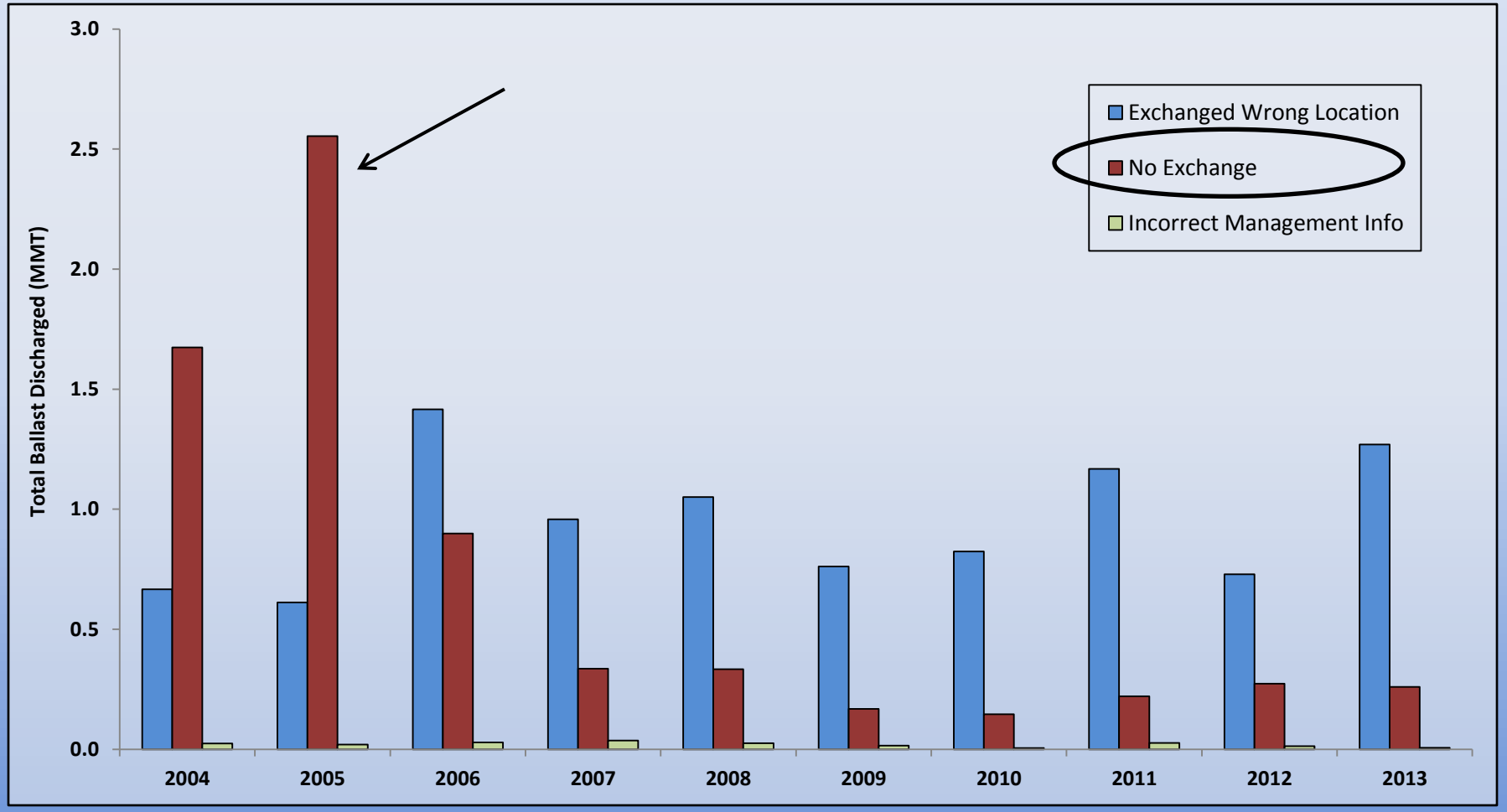




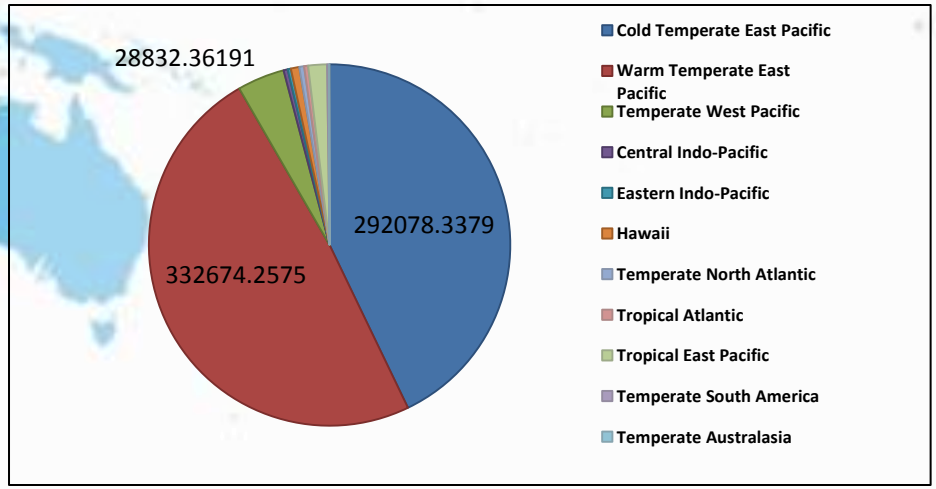
- Incorrect exchange violations are often due to ships being too close to islands
- Legal exchange must occur at the proper distance from ANY land
- Often misinterpreted as distance from mainland coast

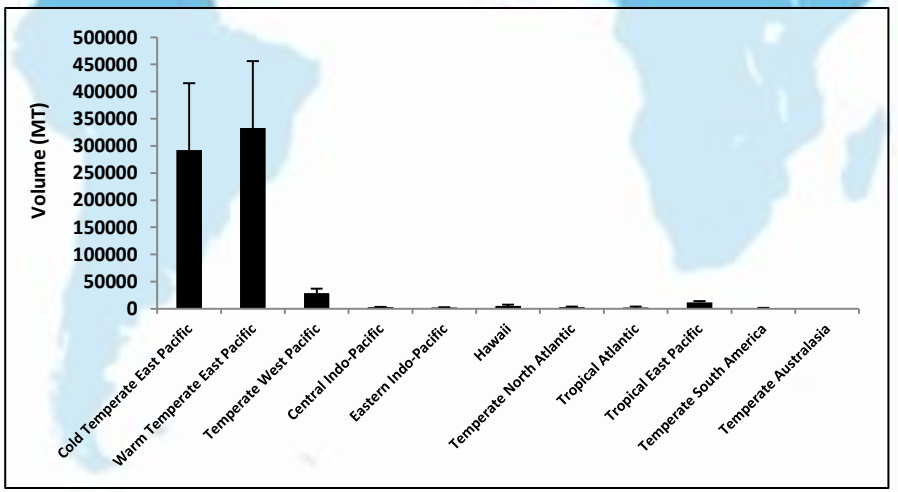
We have been increasing outreach to vessels and shipping agents regarding exchange requirements near Farallone Islands, Channel Islands, etc.

Breakdown of Noncompliant Ballast Water

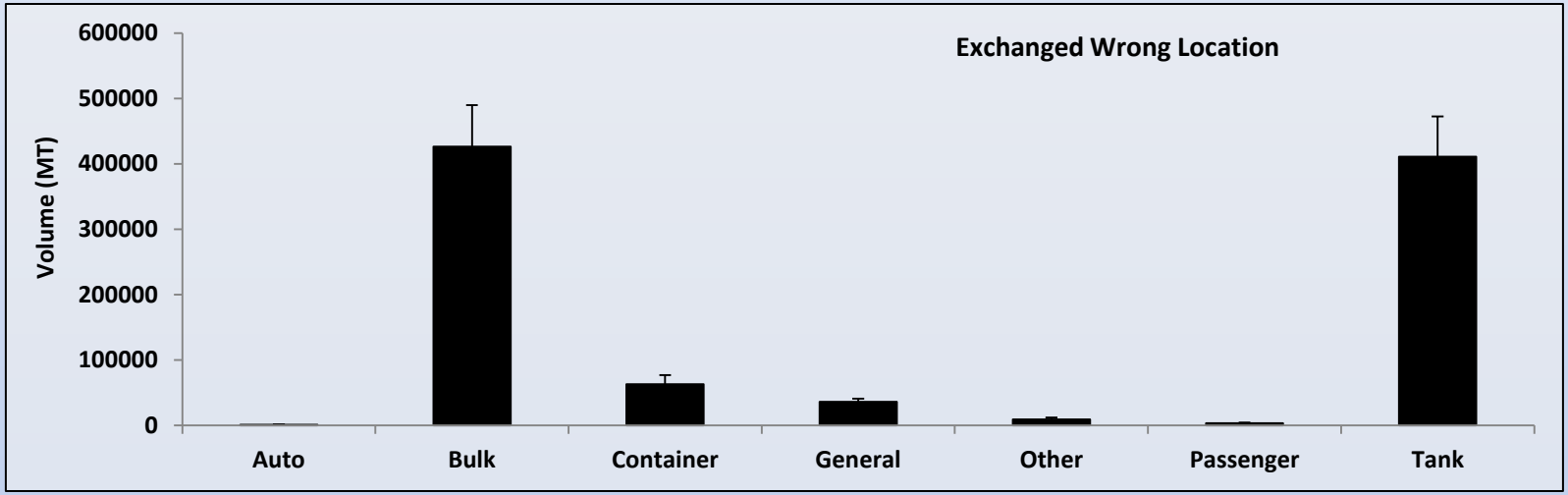


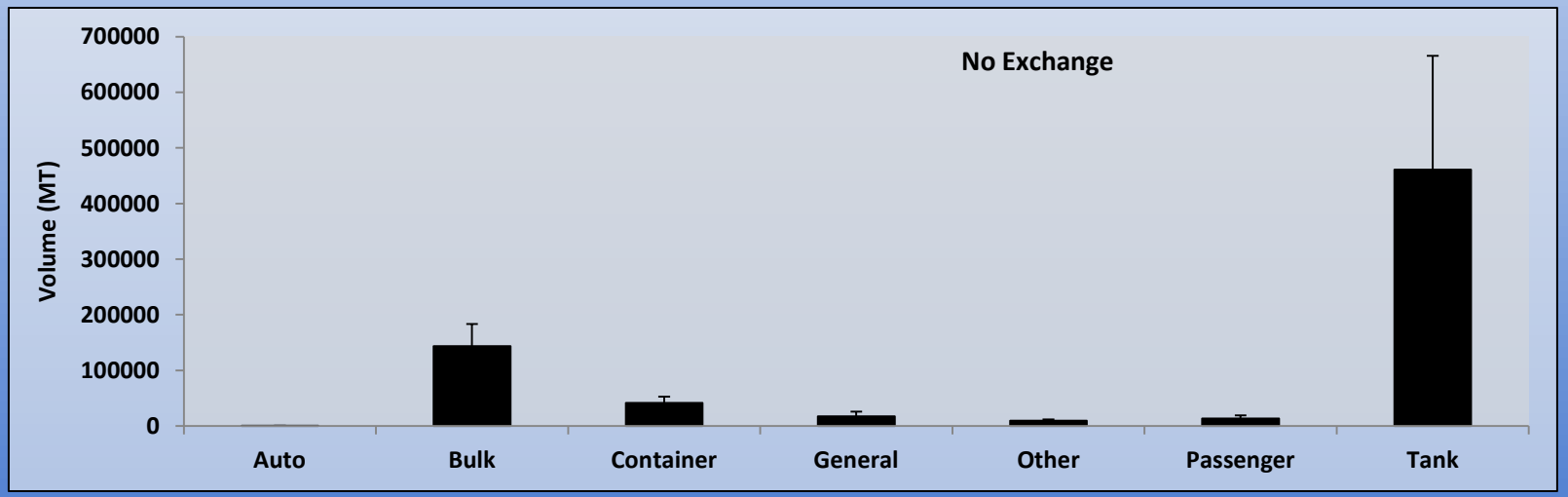
Unexchanged Ballast Water - Source

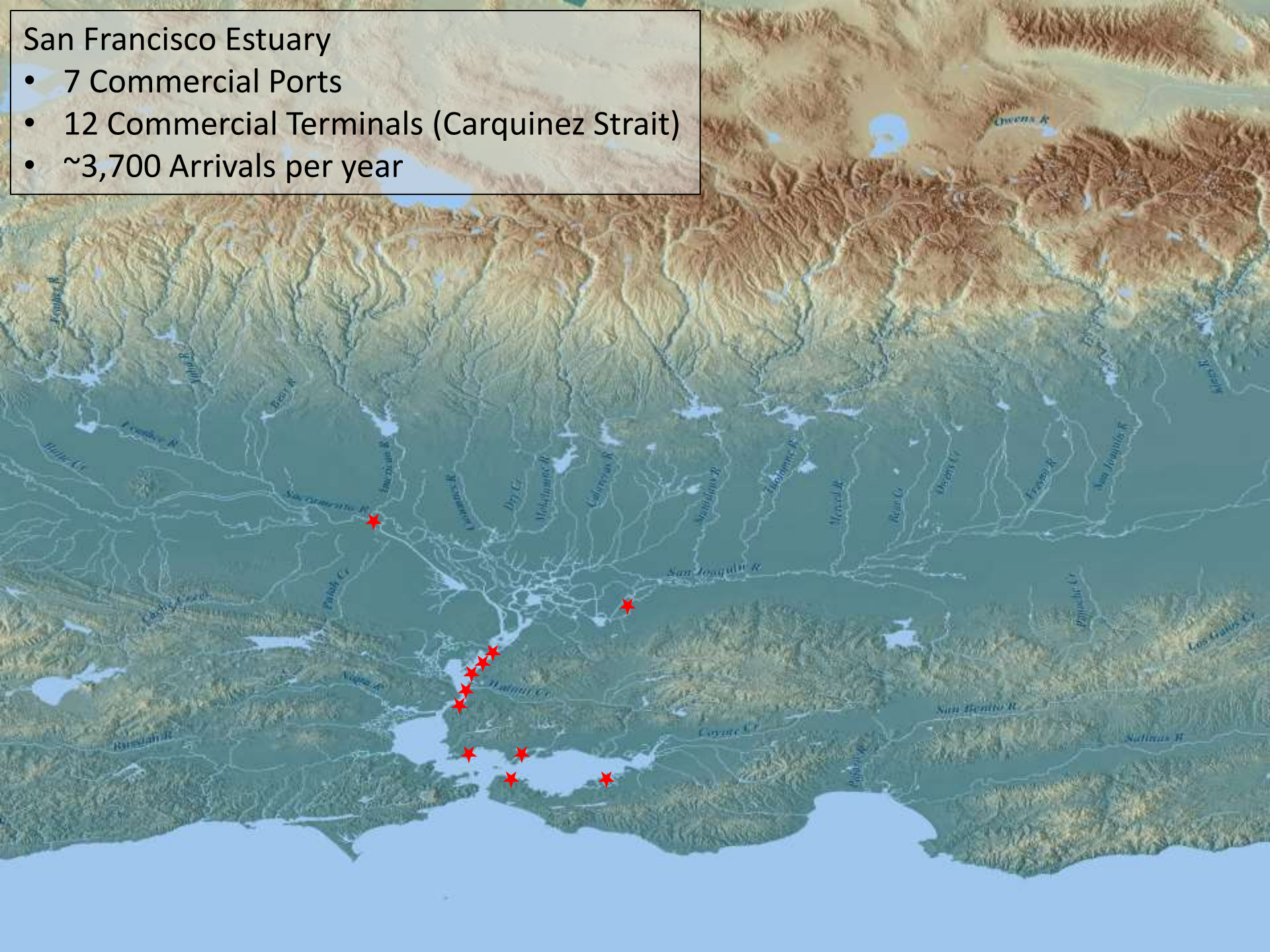




Noncompliant Discharges - Vessel Type

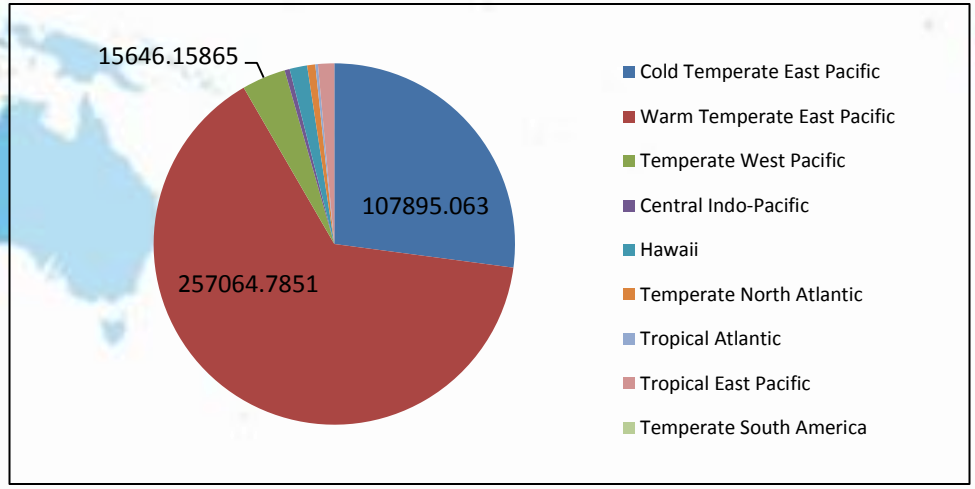


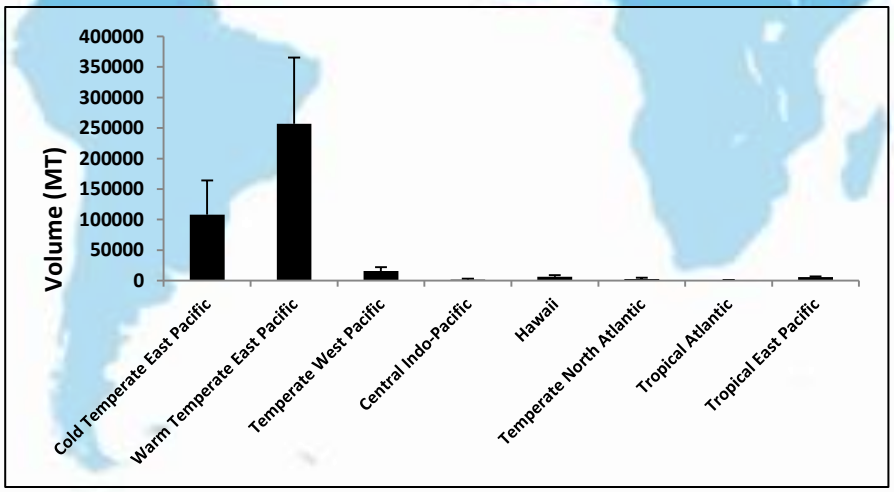


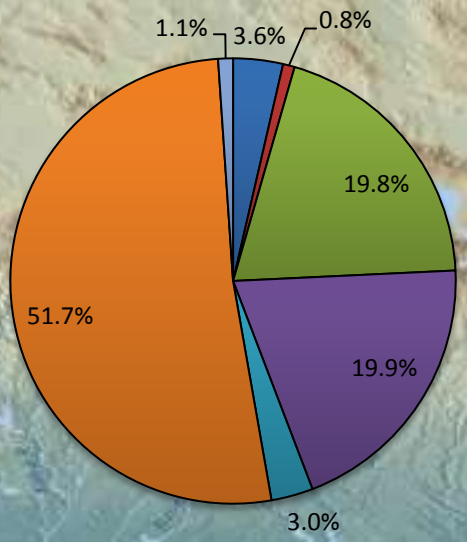

San Francisco Estuary
• 7 Commercial Ports
• 12 Commercial Terminals (Carquinez Strait)
• ~3,700 Arrivals per year

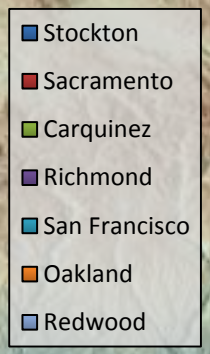
Unexchanged Ballast Water – Source

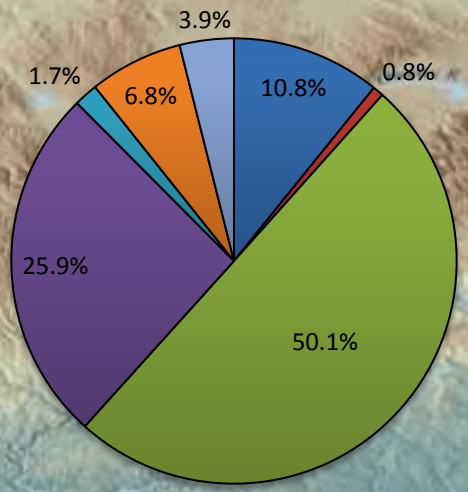
San Francisco Estuary Only











Total Arrivals*
(n=18,768)

Total Volume Discharged*
(n=1,458,552MT)

24.2% of all arrivals to SFB

61.7% of all noncompliant discharges by volume

44.1% of all arrivals to SFB

81.6% of all noncompliant discharges by volume

***Data from 2006-2013**

Summary

- The coastal exchange regulation put in place in 2006 has created a drastic decrease in the amount of unexchanged (hi-risk) ballast water discharge into CA

Since 2006:

- The majority (>90%) of discharged ballast water in California has been properly managed and/or exchanged
- The majority of noncompliant ballast water still underwent some level of exchange
- While comparatively low in overall volume, unexchanged discharges continue to represent the highest level of risk for species introduction to CA waters

Noncompliant exchange hotspots regularly occur off of the middle/lower Baja Peninsula and central California

- Appear to be mainly due to misinterpretation of current law regarding distance from any land, including islands
- MISP is currently increasing outreach efforts to vessels owners, operators, and agents in order to clarify the rules and developing enforcement regulations in hopes of increasing compliance even further.

Summary (Cont.)

- Bulkers and tankers are consistently the largest contributors of improperly managed ballast water discharges
- The freshwater/brackish ports within SFB receive a disproportionate amount of the improperly managed ballast water discharges
- Source locations for the majority of unexchanged ballast water discharges are similar in broad physical parameters to California waters, but further analyses of both source and recipient port characteristics (e.g. salinity, temp) are necessary to fully understand the associated risk

Thank you!

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916-574-0236

California's Marine Invasive Species Program Website:
www.slc.ca.gov
Click "Divisions" Tab
"Marine Facilities Division" link
and "Marine Invasive Species Program" link