The Panama Canal Expansion - an Expanded Pathway for Invasive Species?

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Joint GSARP & WRP Meeting

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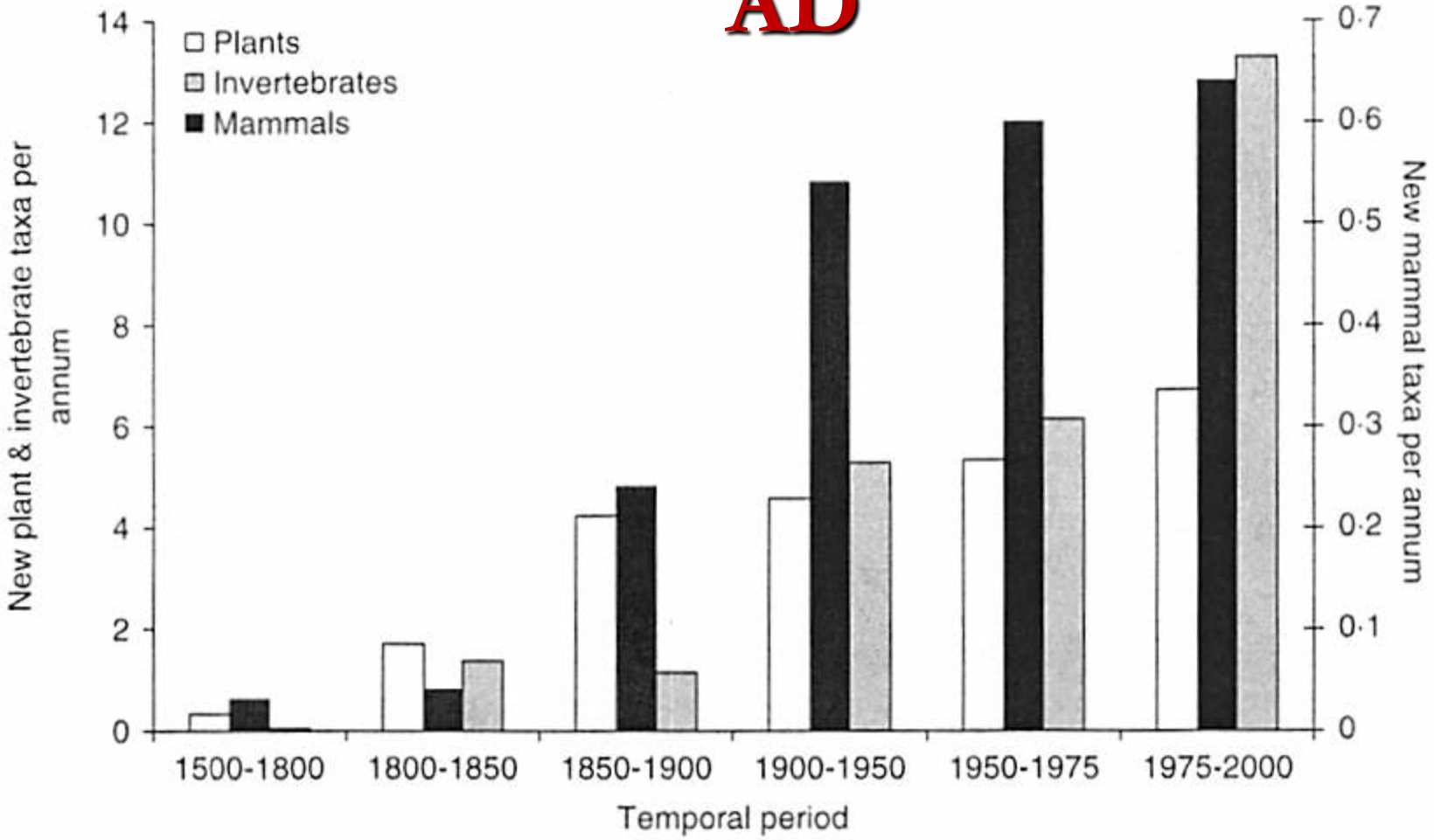
Shipping – Invasive Pathway

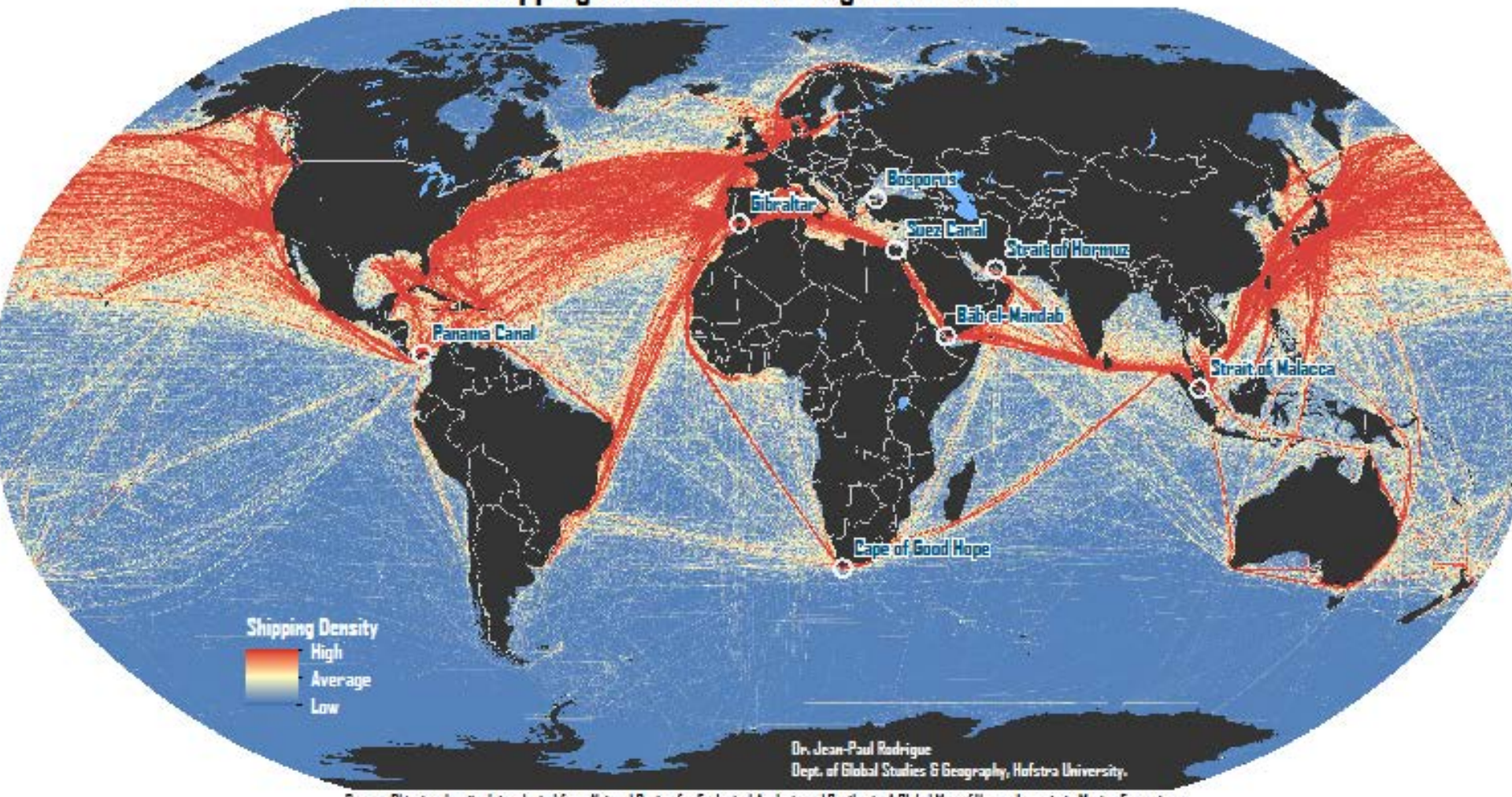
- Transport and release of untreated ballast water
  - Primary cause of introductions into navigable waters (NRC 1996)
- Hull fouling
- Superstructure
- Product
- Shipping containers

Annual Rates of Increase of Non-native Species in Europe Since 1500 AD



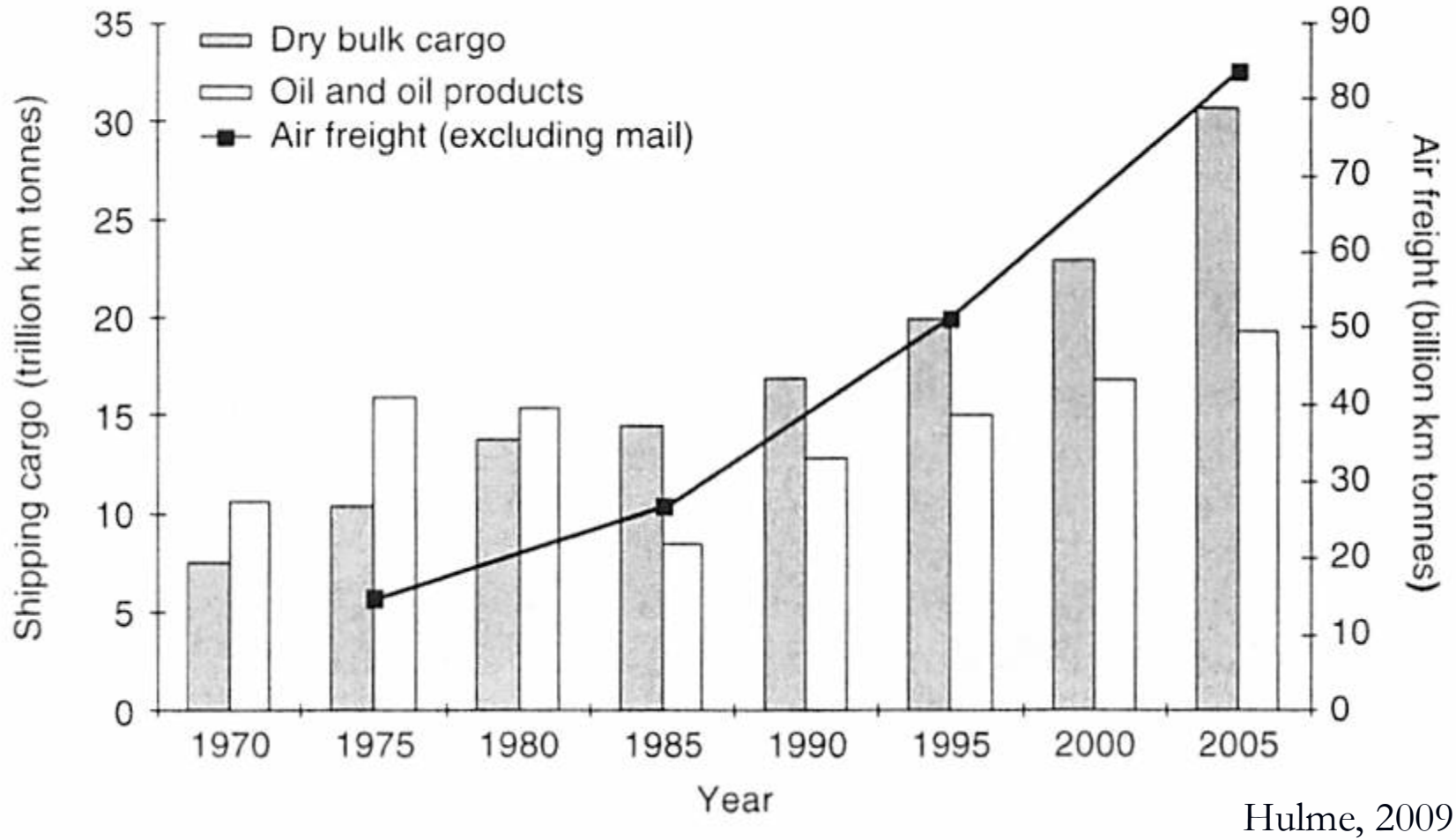
Hulme, 2009

Maritime Shipping Routes and Strategic Locations



Source: Shipping density data adapted from National Center for Ecological Analysis and Synthesis, A Global Map of Human Impacts to Marine Ecosystems.

Trends in Global Shipping



Hulme, 2009

Table 10. TOP 20 U.S. PORTS IN 2010-2011: TOTAL FOREIGN CARGO OF ALL TYPES, INCLUDING BULK CARGO
(Metric Tons - Millions)

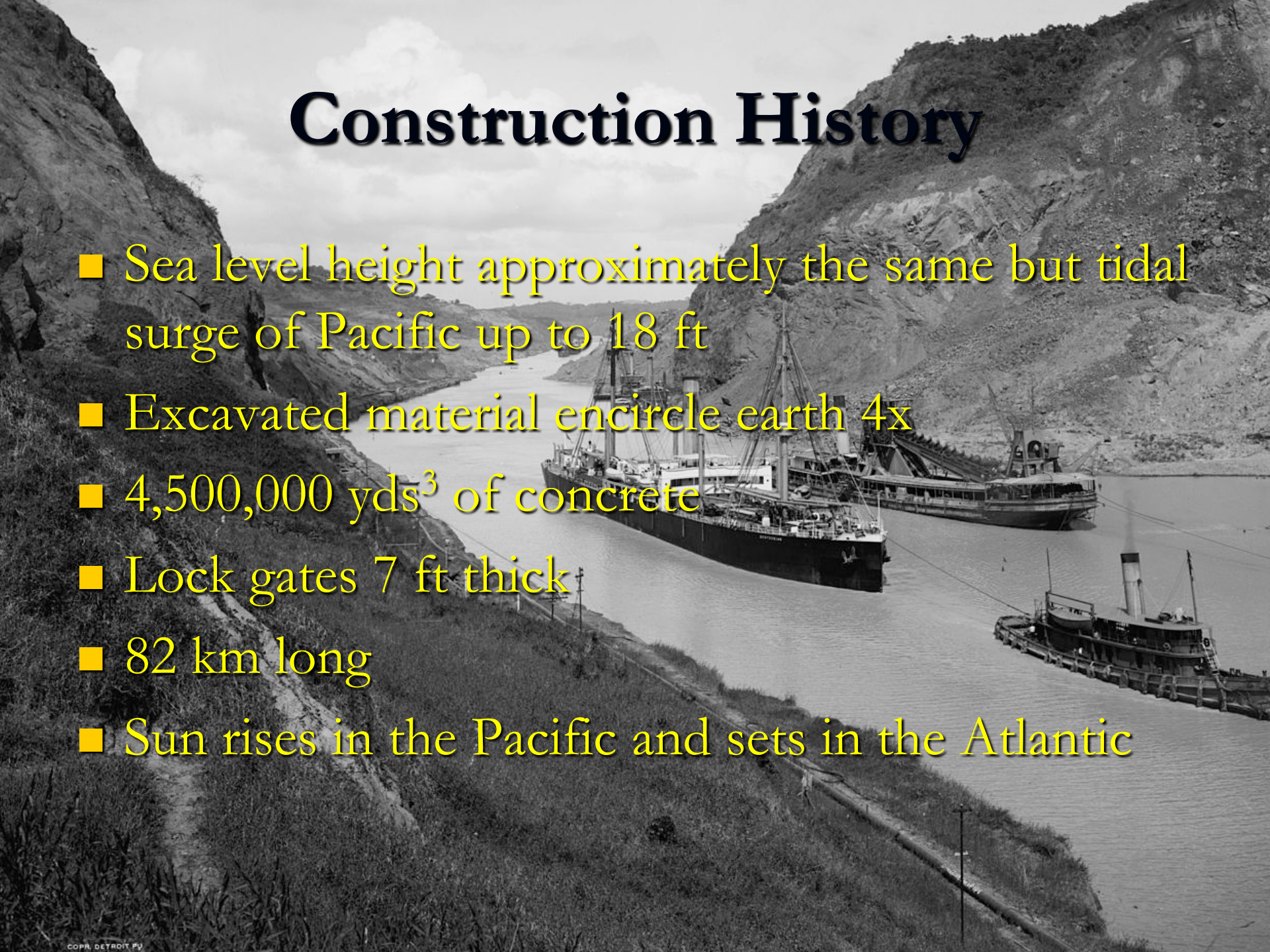
	Imports		Exports		Total	
	2010	2011	2010	2011	2010	2011
Total All Ports	**783.3**	**770.0**	**522.2**	**572.6**	**1,305.4**	**1,342.6**
Houston, TX	80.1	81.4	66.5	71.2	146.6	152.7
New Orleans, LA	26.1	30.2	61.4	65.4	87.5	95.5
New York/New Jersey	55.2	55.5	19.5	23.3	74.8	78.8
Los Angeles, CA	44.6	46.5	19.5	23.6	64.1	70.1
Gramercy, LA	22.5	22.1	35.4	39.2	57.9	61.3
Corpus Christi, TX	36.8	32.7	12.0	14.7	48.8	47.4
Morgan City, LA	45.1	44.9	0.0	0.0	45.1	44.9
Long Beach, CA	19.3	18.8	23.8	25.0	43.1	43.7
Port Arthur, TX	30.2	32.4	8.0	7.8	38.3	40.2
Norfolk, VA	8.3	8.6	23.8	28.3	32.0	36.9
Philadelphia, PA	36.5	34.1	1.8	2.7	38.3	36.8
Baltimore, MD	13.8	12.7	15.7	21.5	29.5	34.2
Texas City, TX	27.7	25.0	7.3	7.7	35.0	32.7
Savannah, GA	15.4	14.8	16.0	17.3	31.4	32.1
Lake Charles, LA	24.5	24.3	5.9	7.0	30.4	31.2
Mobile, AL	13.5	13.0	13.4	13.6	26.9	26.6
Pascagoula, MS	18.9	18.6	5.9	7.1	24.8	25.7
Beaumont, TX	19.7	13.9	7.3	10.3	27.0	24.2
Baton Rouge, LA	13.4	14.9	5.9	6.8	19.3	21.7
Seattle, WA	7.8	7.6	13.1	13.8	21.0	21.5

Source: U.S. Census Bureau, Foreign Trade Data, May 2012


ARIBBEAN SEA
Punta de Manzanillo
Golfo de San Blas
Colón
Canal de Panamá
Lago Gatún
Lago Bayano
San Miguelito
PANAMÁ
Golfo de los Mosquitos
PANAMA
Archipiélago de las Perlas
Aguadulce
Santiago
Chitré
Golfo de Panamá
Punta Mala
PACIFIC OCEAN

HISTORY

Construction History



- Sea level height approximately the same but tidal surge of Pacific up to 18 ft
- Excavated material encircle earth 4x
- 4,500,000 yds^3 of concrete
- Lock gates 7 ft thick
- 82 km long
- Sun rises in the Pacific and sets in the Atlantic

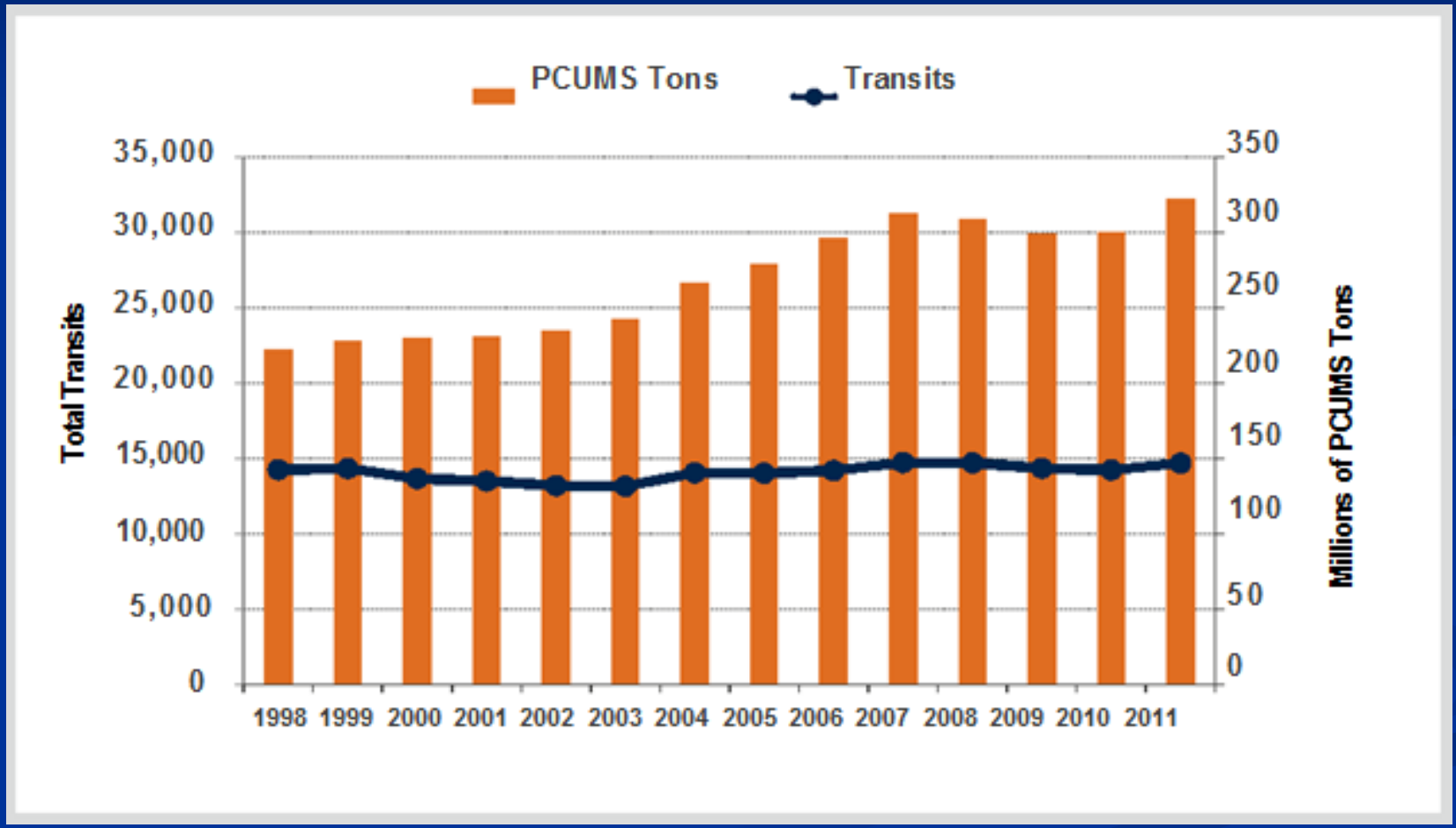
Business History

- Maximum capacity : 37 – 42 ships / day
- Canal Water Time (CWT): 24 hours
- ~5% of global cargo volume
- 5,000 TEU (twenty-foot equivalent units) vessels

Canal Traffic

- 2009 → 299.1 million tons of shipping
- Annual number of ocean-going transits:
  - 2003 11,725 vessels
  - 2007 13,233 vessels
  - 2009 12,855 vessels

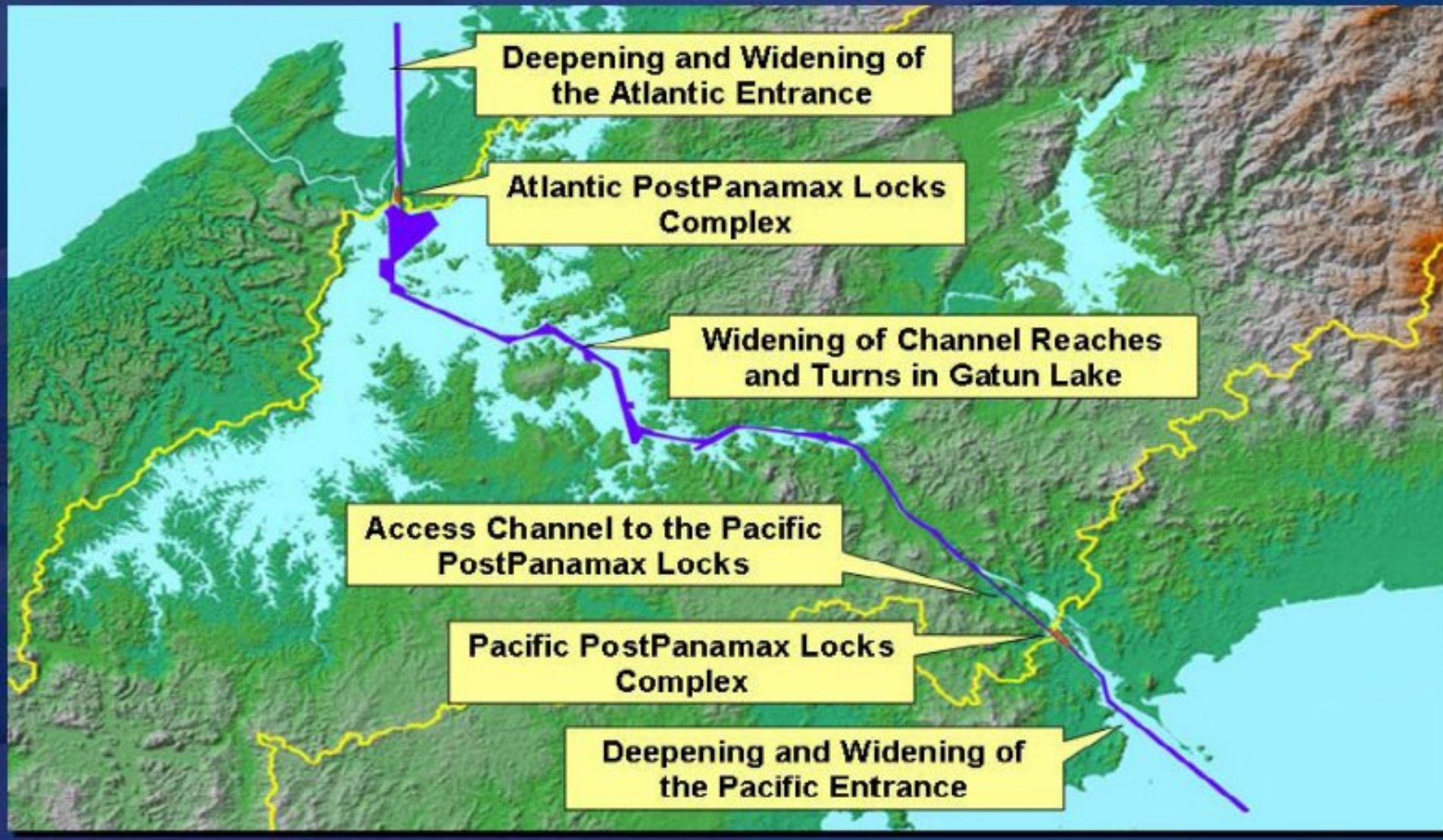
CANAL UTILIZATION 1998 TO 2011



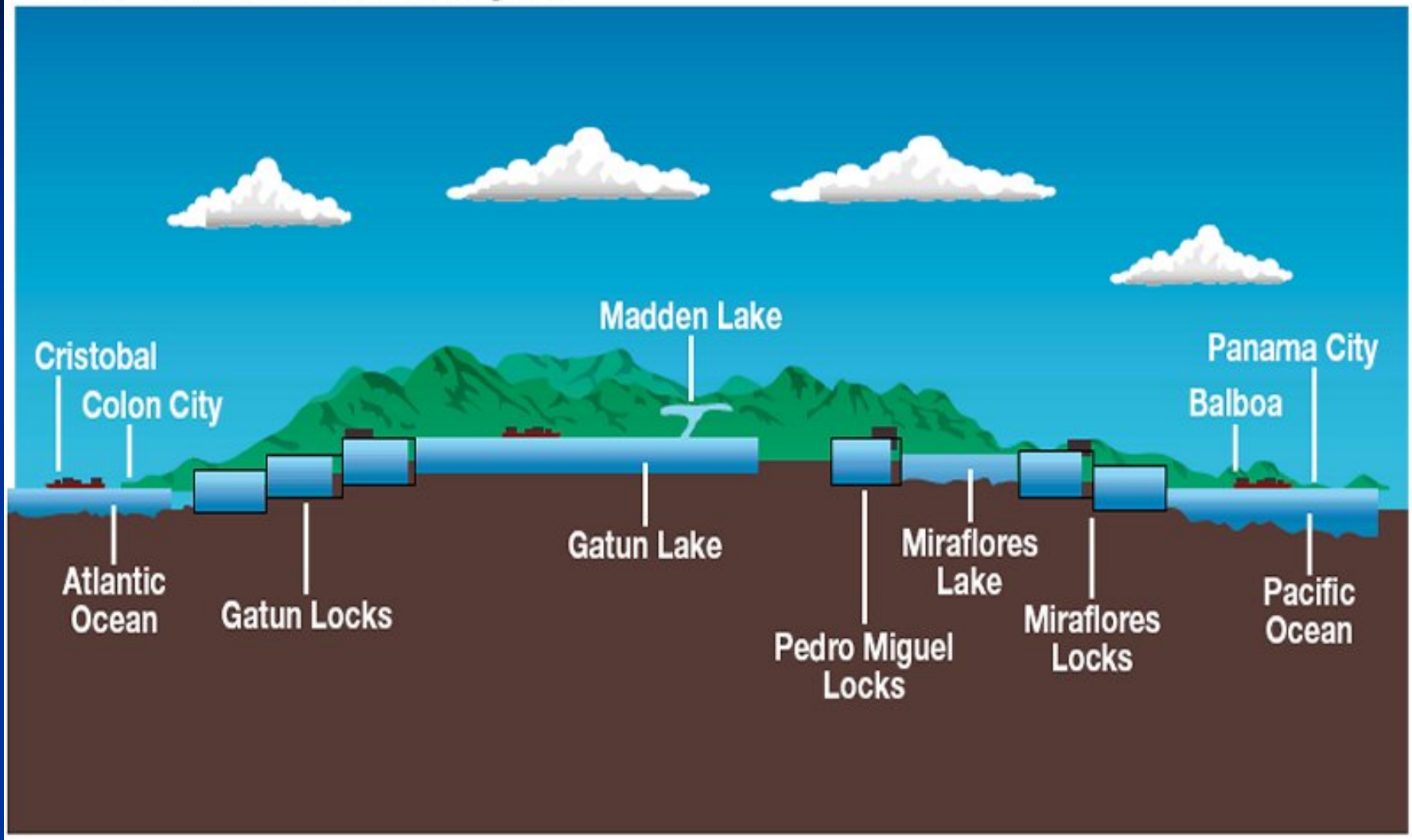
Source: Panama Canal Authority, May 2012

EXPANSION

Program Components



Profile of the Panama Canal System



SOURCE: Panama Canal Commission

Increased Capacity

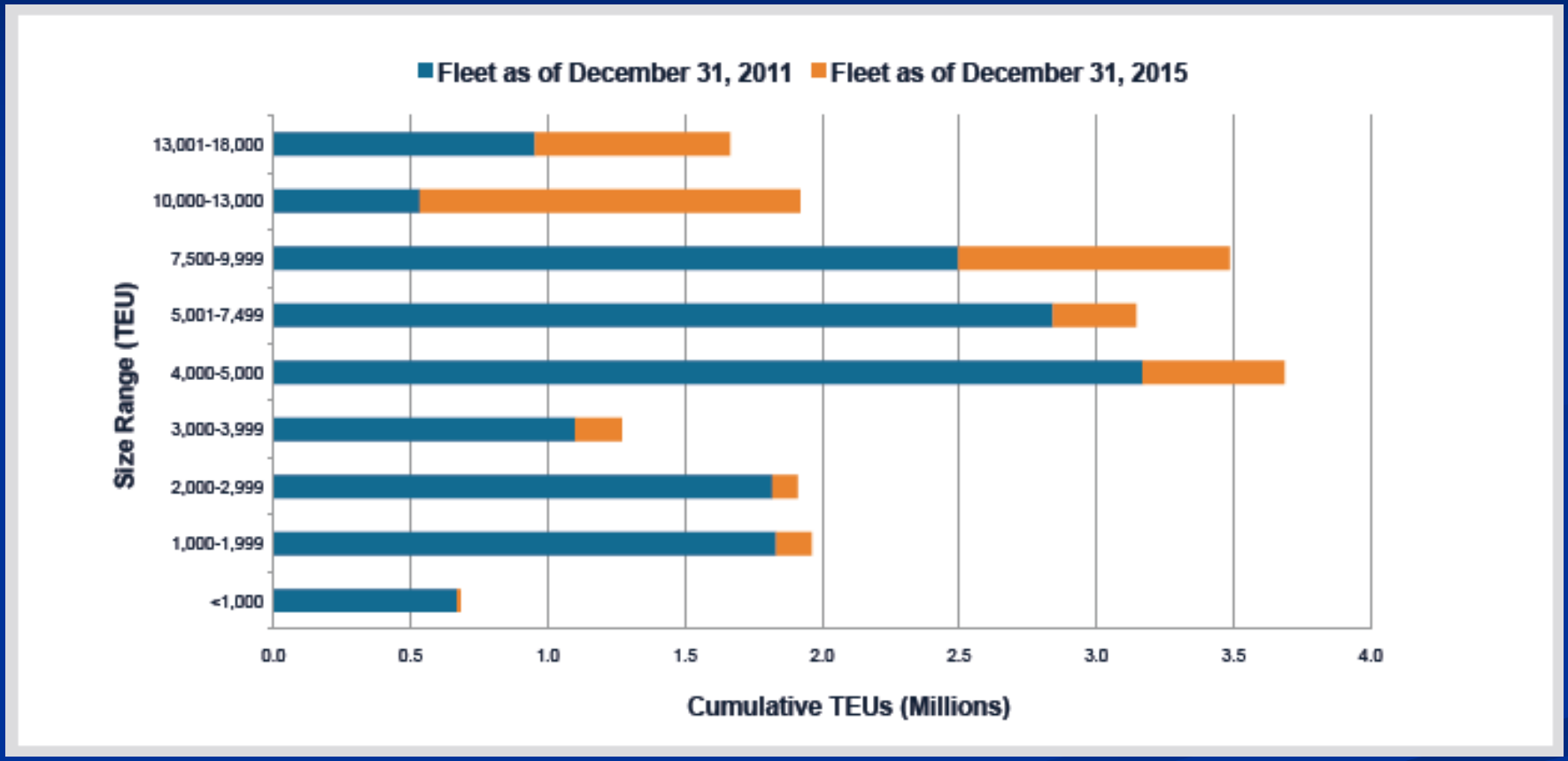
- Add 12 – 14 larger vessels / day
- Container ships up to 13,000 TEUs
- Expect to double capacity from 300 million tons PC/UMCs (Panama Canal/Universal Measurement System)to 600 million tons
  - 1 PC/UMS net ton is equivalent to 100 cubic feet of capacity

IMPLICATIONS

Invasion Risk

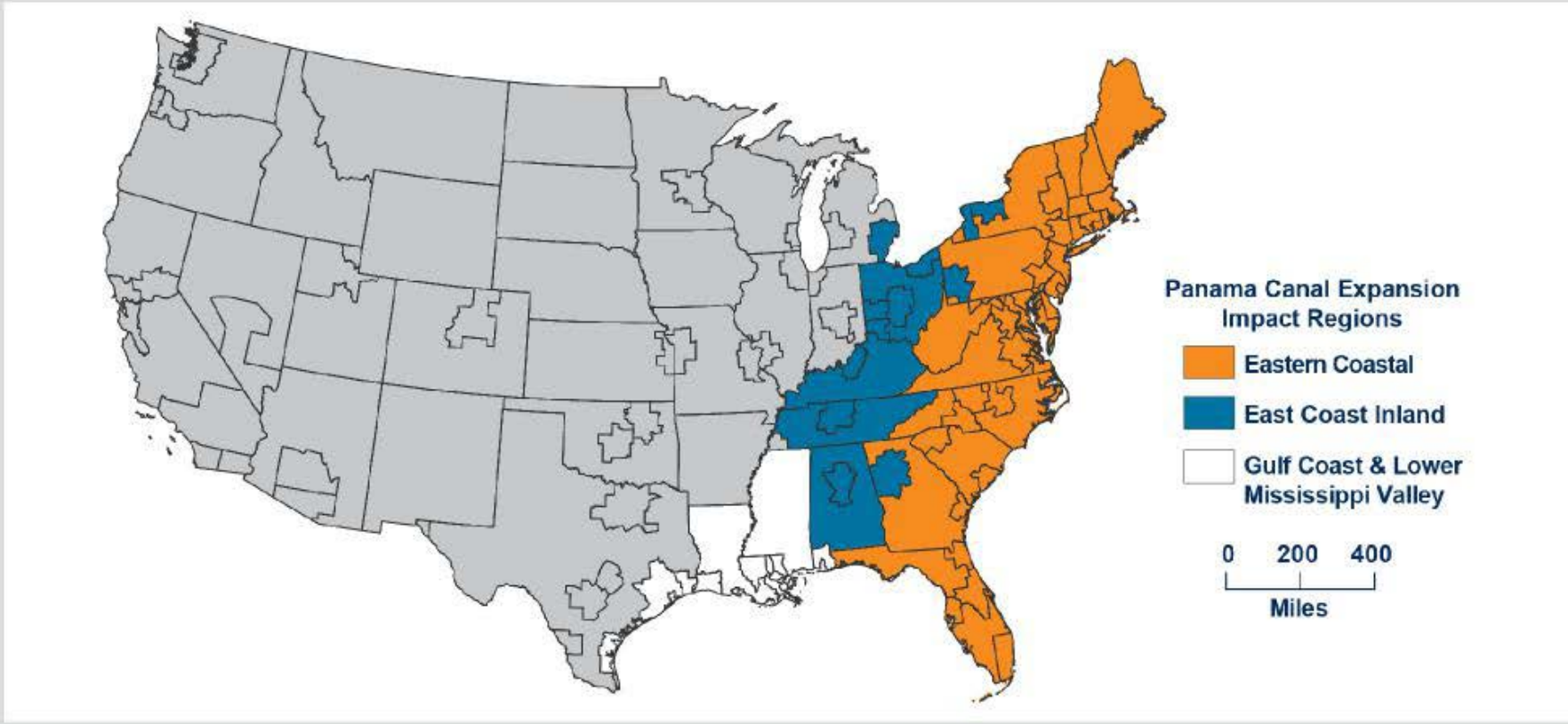
- Shipping intensity
- Local ecological conditions
- Distance between donor and recipient sites
  - 8,000 – 10,000 km (Seebens *et al*, 2013)

SIZE AND USE OF CONTAINER SHIPS



Source: Alphaliner Cellular Fleet Forecast, June 2012

U.S. REGIONS AFFECTED BY PANAMA CANAL EXPANSION – CONTAINER TRADES



PANAMA CANAL EXPANSION STUDY – *PHASE I REPORT 2013*

Business Consequences of Larger Vessels

- Expanded Container Storage (2x)
  - 100 acre storage
- Increased trucking
- Increased rail
- Use of foreign transshipment ports
- Limited Ports of Call
  - Inevitable transshipment
- Potential shift from West Coast to East Coast Ports of Call

Biological Consequences of Larger Vessels

Cons

- Expanded potential for hitchhikers within cargo containers
- Concentration of traffic in fewer Ports
- Increased frequency of traffic in fewer Ports
- Shipping of cargo further inland

Pros

- Reduced shipping costs
- Proportional potential reduction in Wet Hull Surface Area (WSE)
- New vessels have mandated better control technology
- Improved coatings

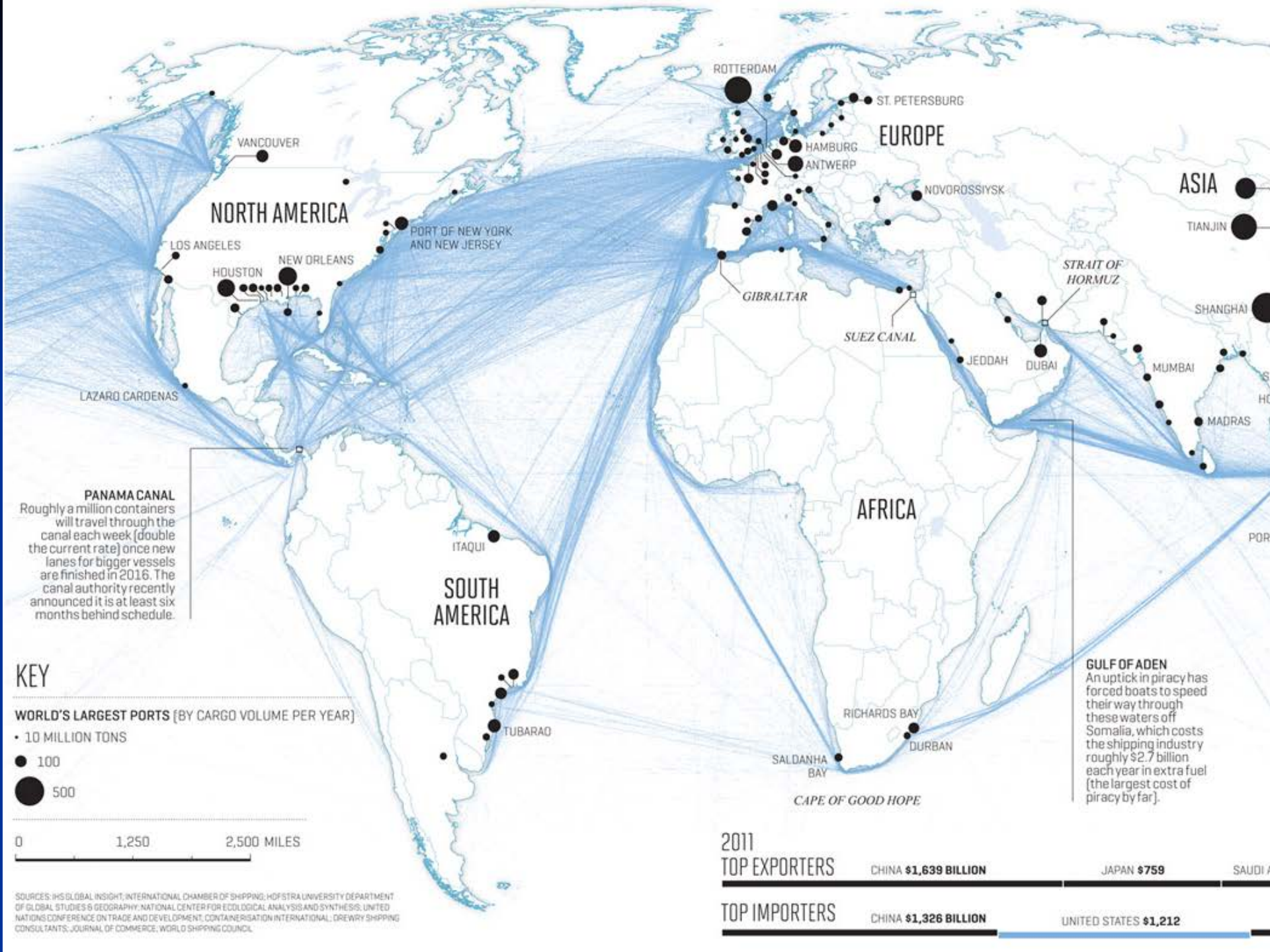
Pathway Alterations

- Increased area for hull fouling?
  - Increased fuel efficiency (27 knots) and improved coatings
- Increased transit traffic →
  - Increased direct trade
  - Increased cargo contamination
  - Increased container contamination
- Perturbated habitat

Implications:

- Expanding the Panama Canal *MAY*
  - Concentrate new ballast water invasions
  - Insert container contaminations inland
  - Reduce WSA invasions
  - Impact hot spot areas for invasions
- Expanding the Panama Canal *MAY NOT*
  - Increase global invasive risks


DISCUSSION?



SOURCES: IHS GLOBAL INSIGHT; INTERNATIONAL CHAMBER OF SHIPPING; HOFSTRA UNIVERSITY DEPARTMENT OF GLOBAL STUDIES & GEOGRAPHY; NATIONAL CENTER FOR ECOLOGICAL ANALYSIS AND SYNTHESIS; UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT; CONTAINERISATION INTERNATIONAL; DREWRY SHIPPING CONSULTANTS; JOURNAL OF COMMERCE; WORLD SHIPPING COUNCIL