



UnSustainable Shipping & Port Development – Facts & Options



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Objectives of Presentation

- ❑ Shipping and Port Development
- ❑ Environmental Impact of Shipping and Ports
- ❑ Regulation and Control of Ship-source Pollution
- ❑ Strategies and Options for Sustainable Shipping and Port Development



‘There is only one pollution – it is water pollution, because everything ends up in the water . . . ‘
(Jacques-Yves Cousteau)



Development of International Seaborne Trade 1970 – 2008 (millions of tons loaded)

Year	Oil	Main bulks [*]	Other dry cargo	Total (all cargoes)
1970	1 442	448	676	2 566
1980	1 871	796	1 037	3 704
1990	1 755	968	1 285	4 008
2000	2 163	1 288	2 533	5 984
2006	2 648	1 888	3 009	7 545
2007	2 705	2 013	3 164	7 882
2008	2 749	2 097	3 322	8 168

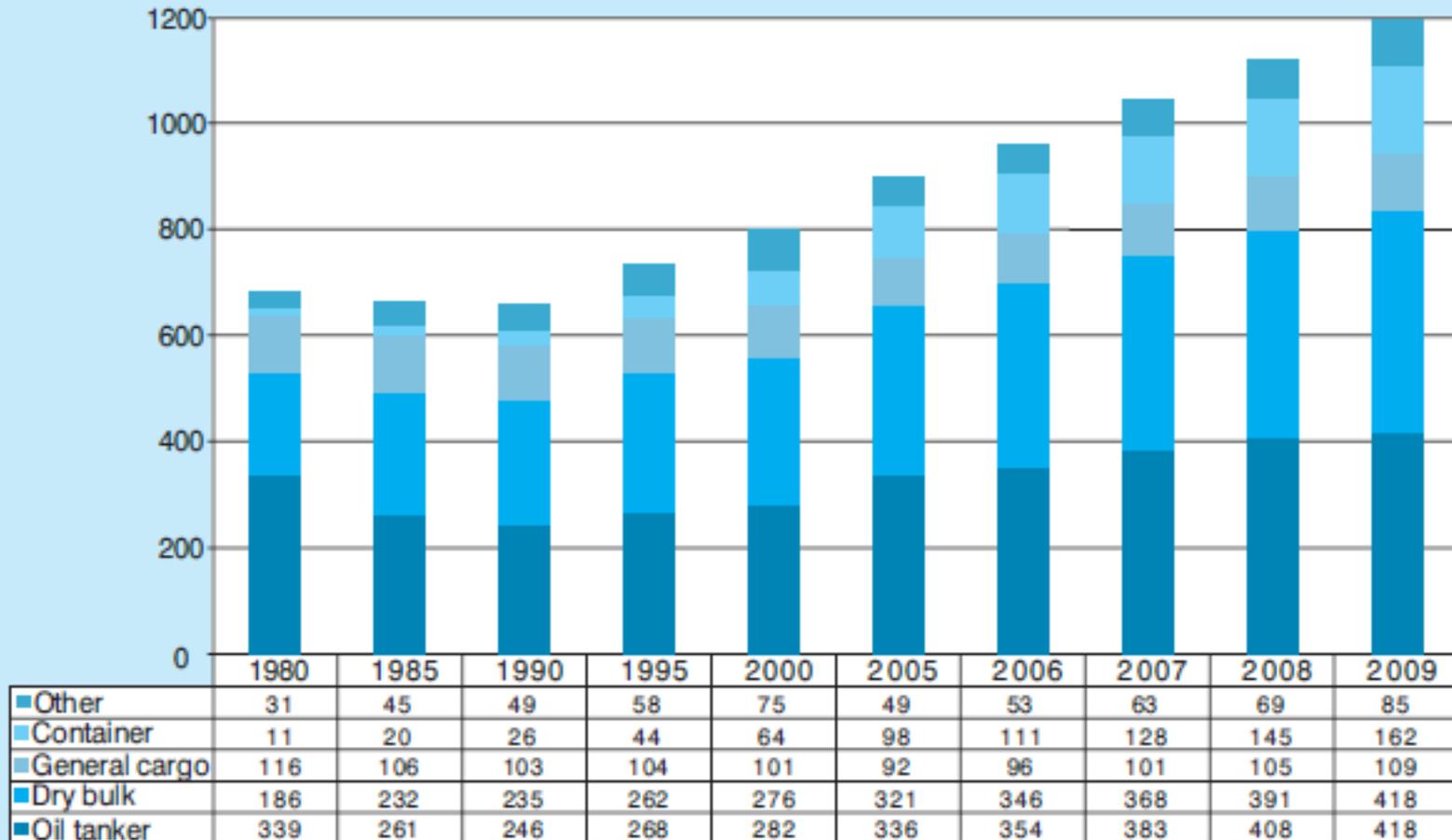
* Iron ore, grain, coal, bauxite/alumina and phosphate.

Source: UNCTAD: Review of Maritime Transport 2009



World Fleet by Principal Vessel Types 2009

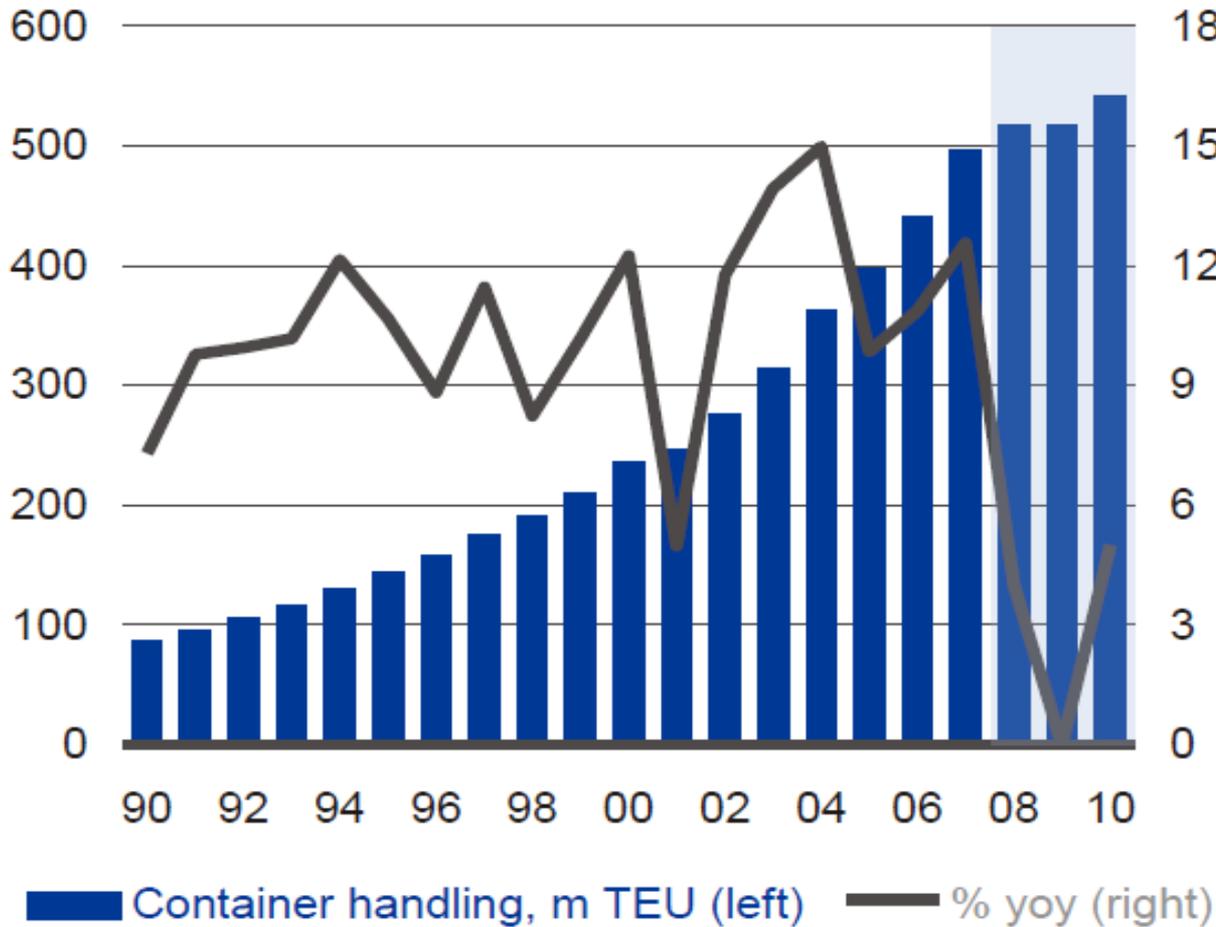
(Vessels of > 100 grt / millions of dwt)



Source: UNCTAD: Review of Maritime Transport 2009



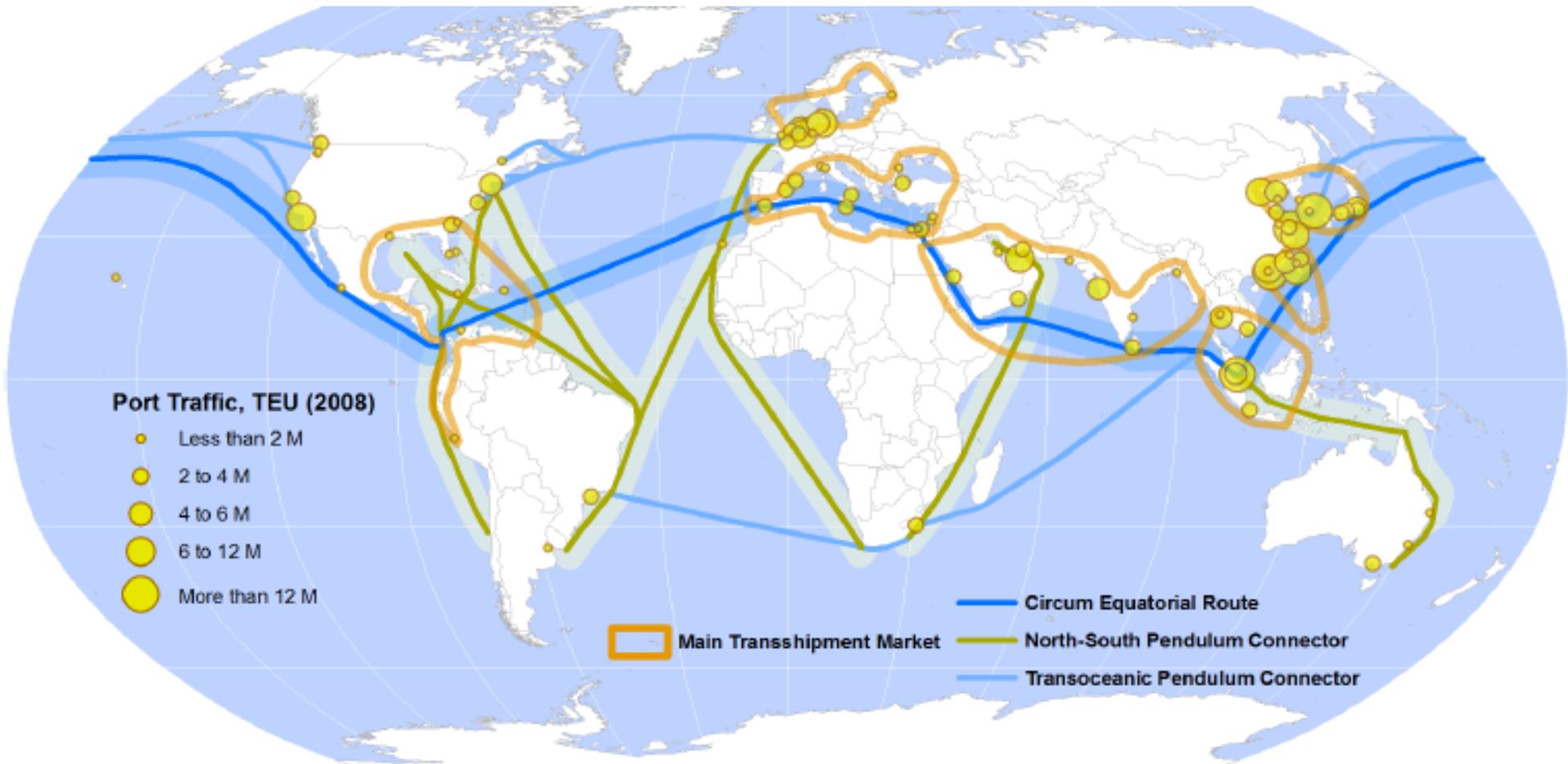
World Container Port Throughput [million TEU]



Source: Deutsche Bank Research (2009)



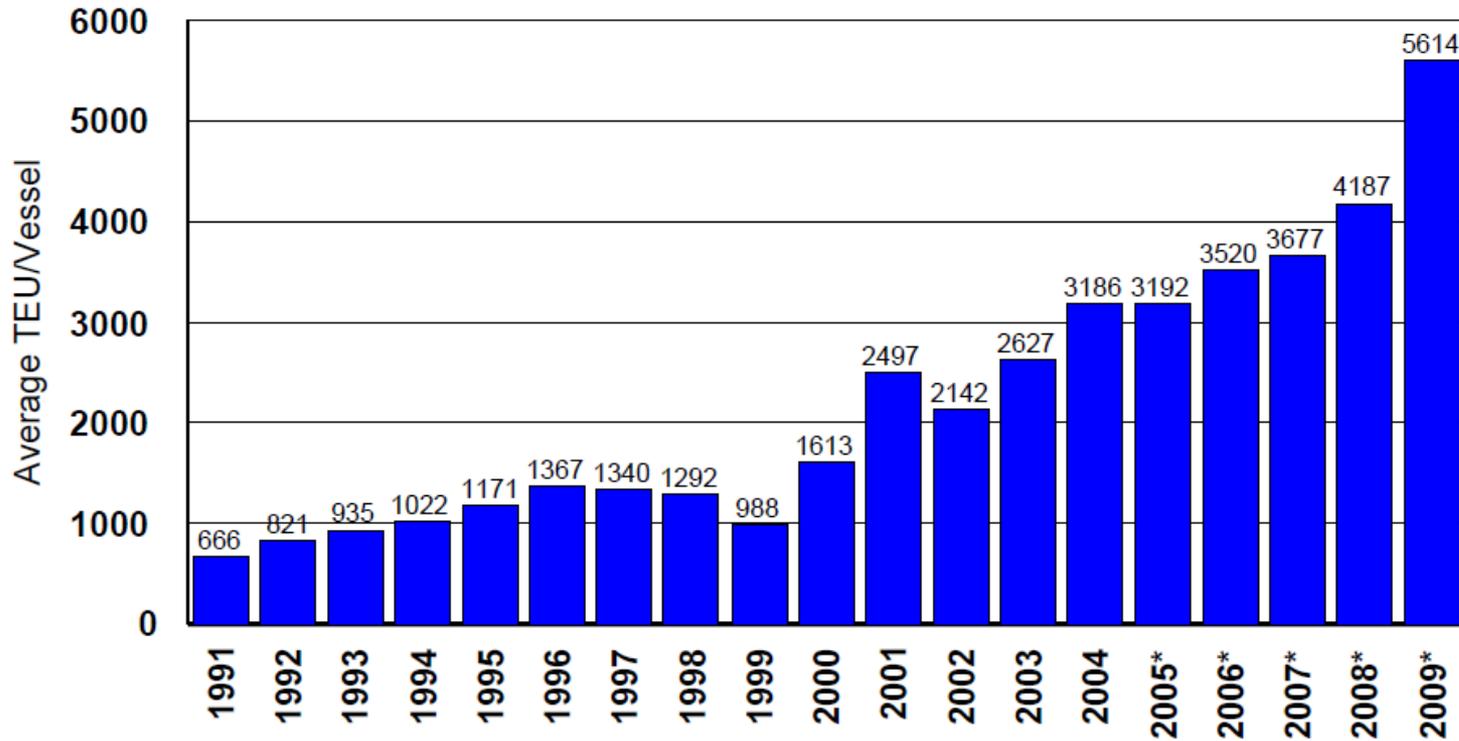
Emerging Global Container Transport System



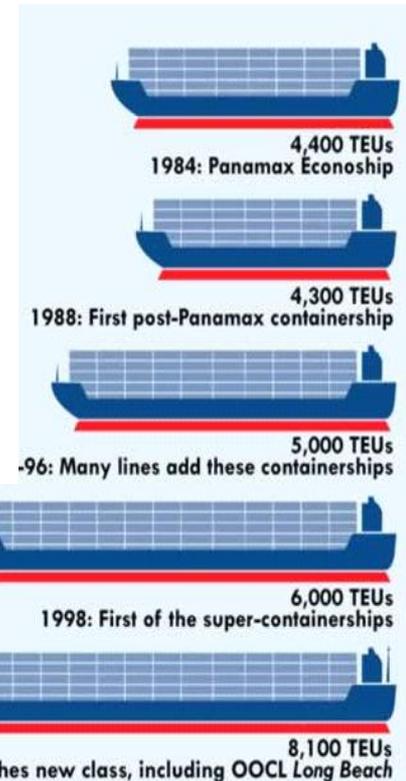
Source: International Transport Forum (ITF): Maritime Transportation: Drivers for the Shipping and Port Industries (2010)



Container Vessel Deliveries: Average TEU/Vessel

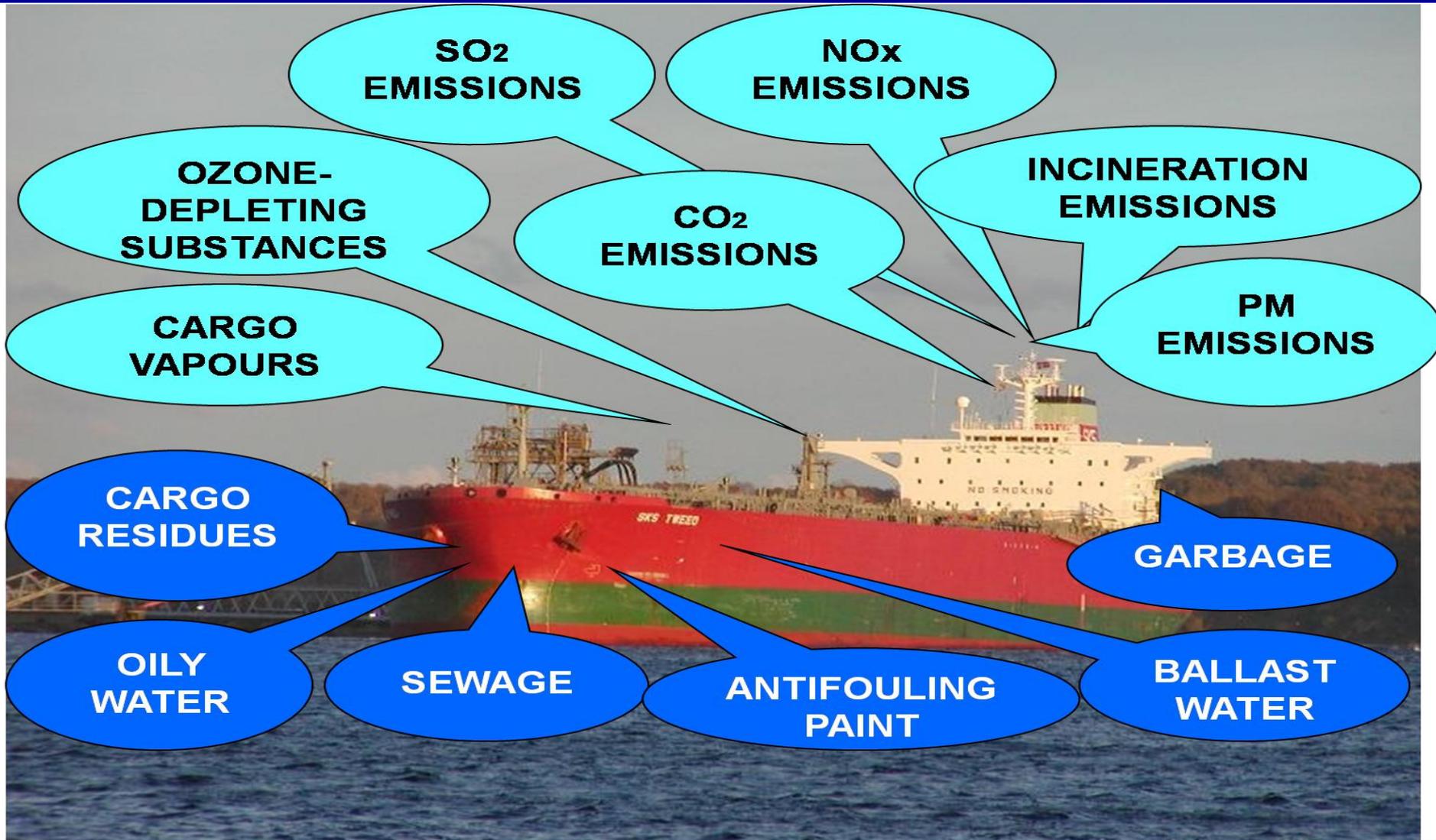


Source: Containerisation International (2009)



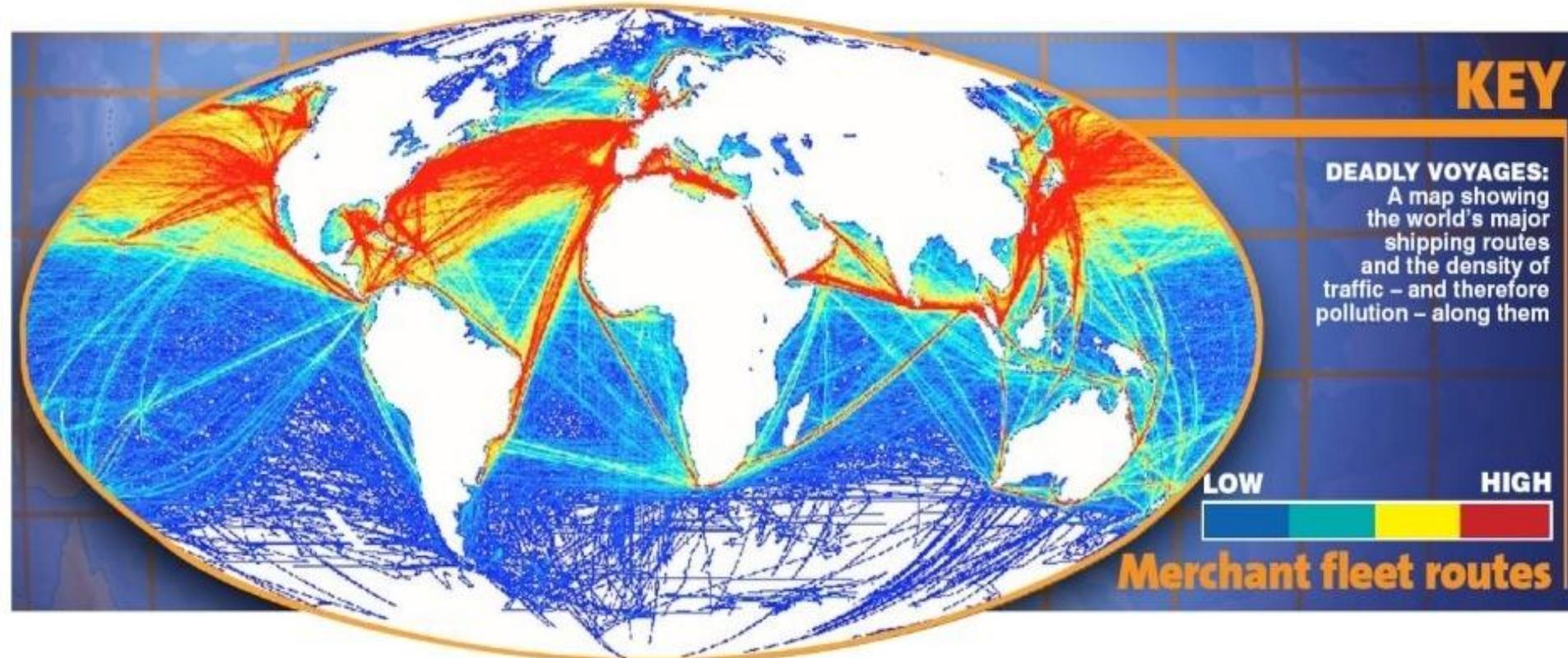


Shipping's Environmental Impact





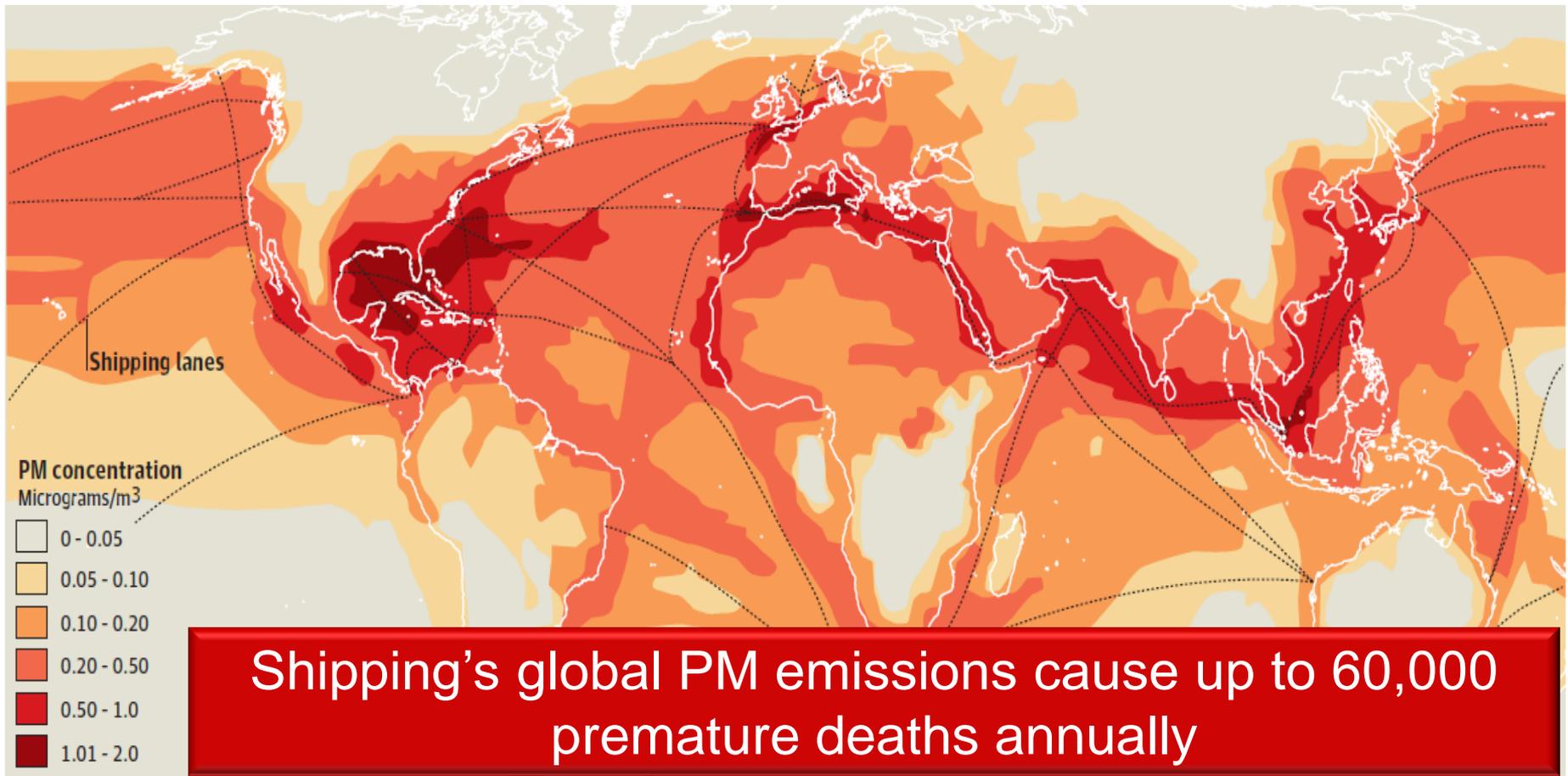
Major Shipping Routes – Major Pollution



- ❑ Shipping burns about 370 million tons / year of low-quality residual fuels with high amounts of sulphur and heavy metals
- ❑ 70% of shipping within 400 km of land
- ❑ Major ports located in areas surrounded by large populations



Particulate Matter (PM) Pollution on Major Shipping Routes

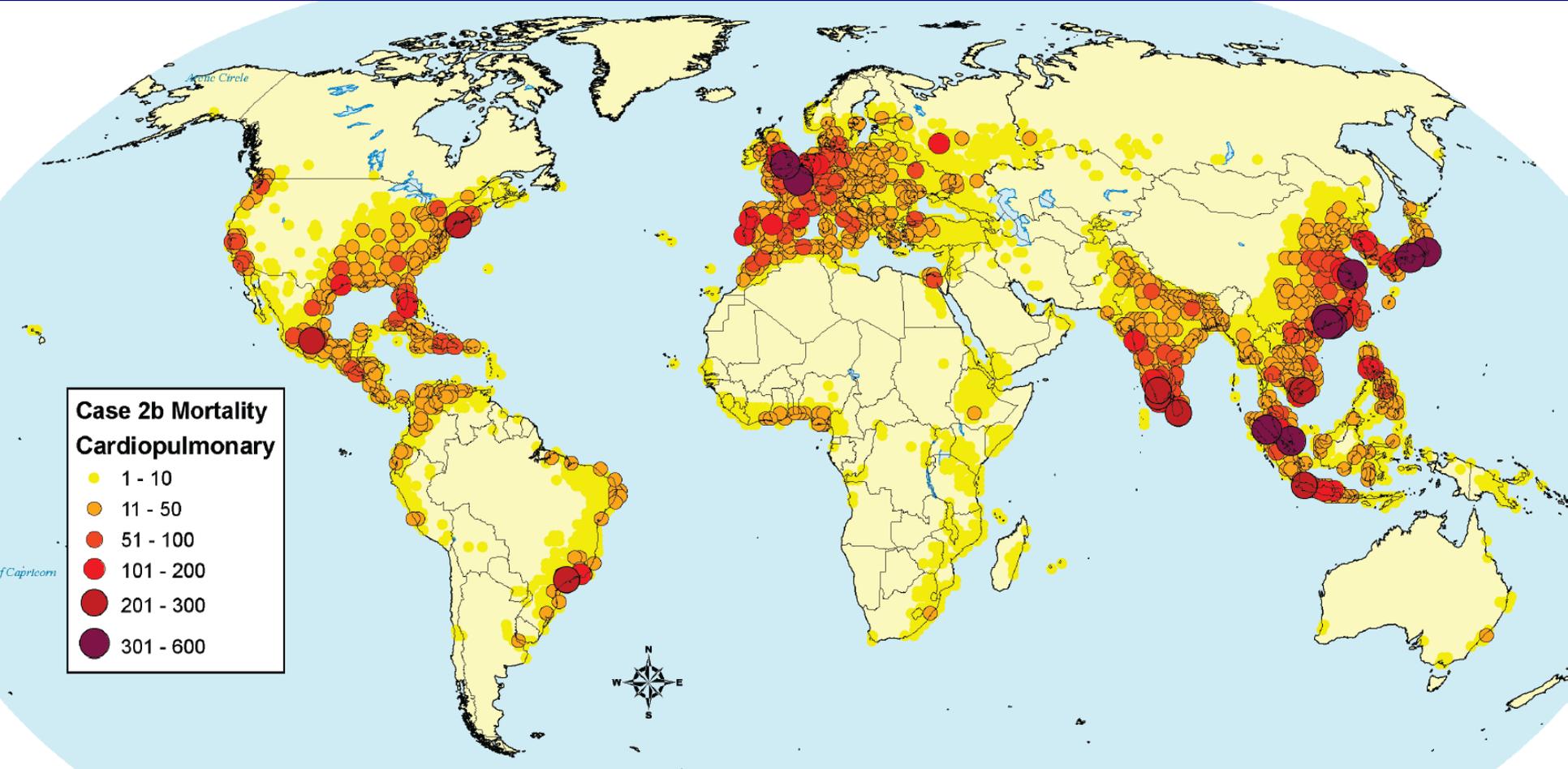


Shipping's global PM emissions cause up to 60,000 premature deaths annually

Sources: American Chemical Society 2007 / U.S. National Academy of Science (NAS)



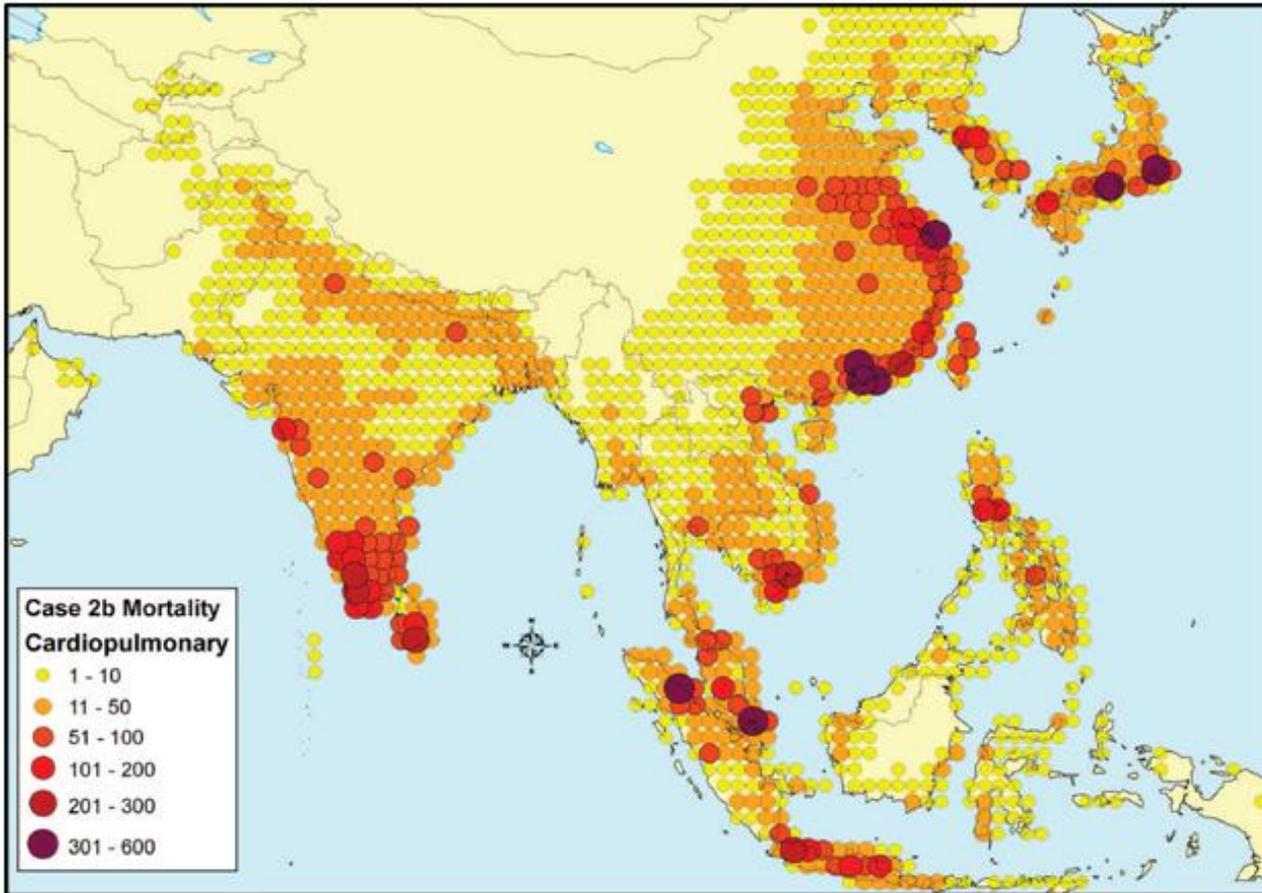
Annual Cardiopulmonary Mortality Attributable to Ship PM_{2.5} Emissions Worldwide



Source: James Corbett et al: **Mortality from Ship Emission: A Global Assessment (2007)**



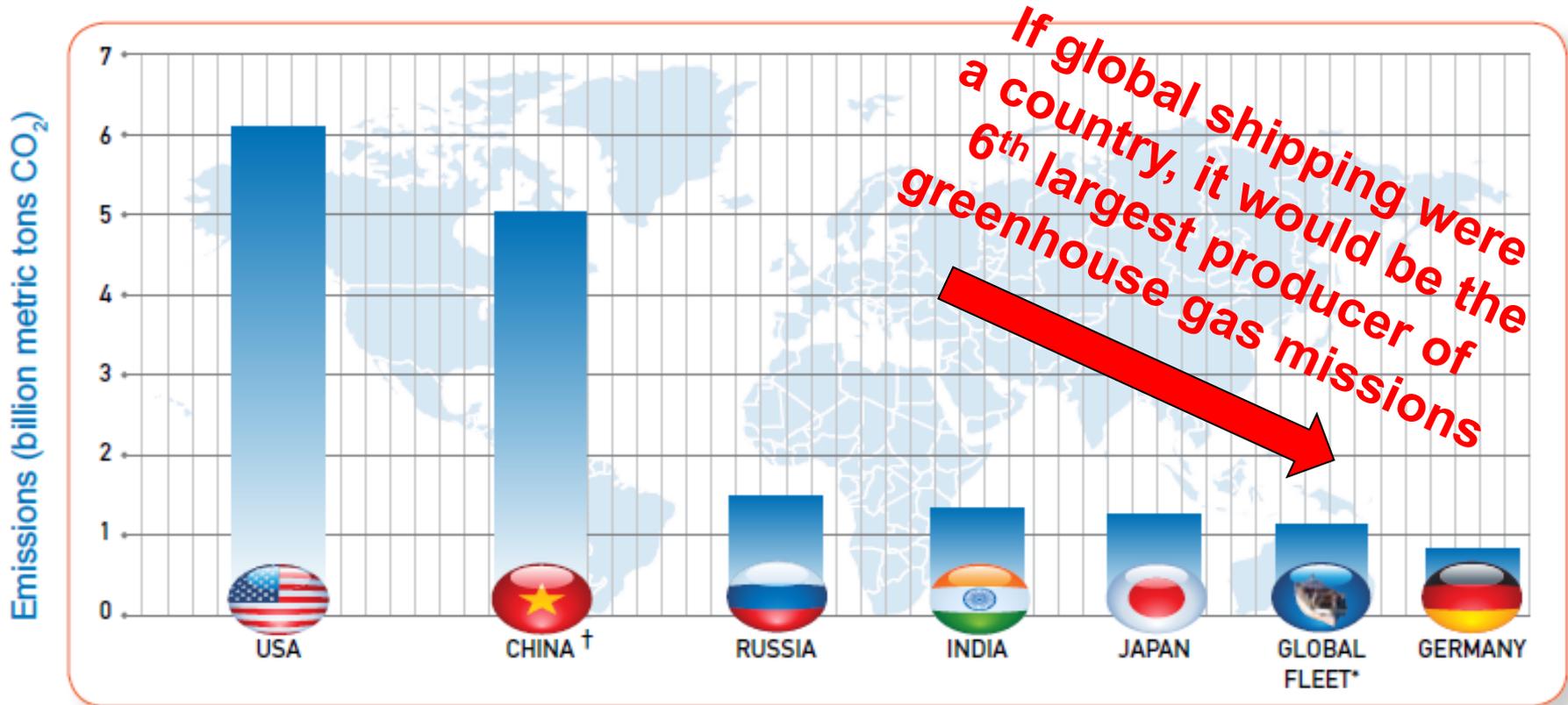
Annual Cardiopulmonary Mortality Attributable to Ship PM_{2.5} Emissions for Asia



Source: James Corbett et al: **Mortality from Ship Emissions: A Global Assessment (2007)**



Global Shipping Activity - Among the Largest Carbon Dioxide Emitters



Source: OCEANA: Shipping Impacts on Climate: A Source with Solutions (2008)



Oil Entering the Marine Environment from Shipping Activities

	Tons / Year
TOTAL OIL INPUTS FROM SHIPS	460,000
OPERATIONAL DISCHARGES	208,000
Fuel oil sludge, bilge oil	189,000
Cargo-related discharges	19,000
ACCIDENTAL DISCHARGES	169,000
AIR EMISSION (VOC)	68,000
SHIP SCRAPPING	15,000



Source: IMO: Estimates of oil entering the marine environment from sea-based activities, (2007)

Total Oil Inputs
6.2 million tons

Marine

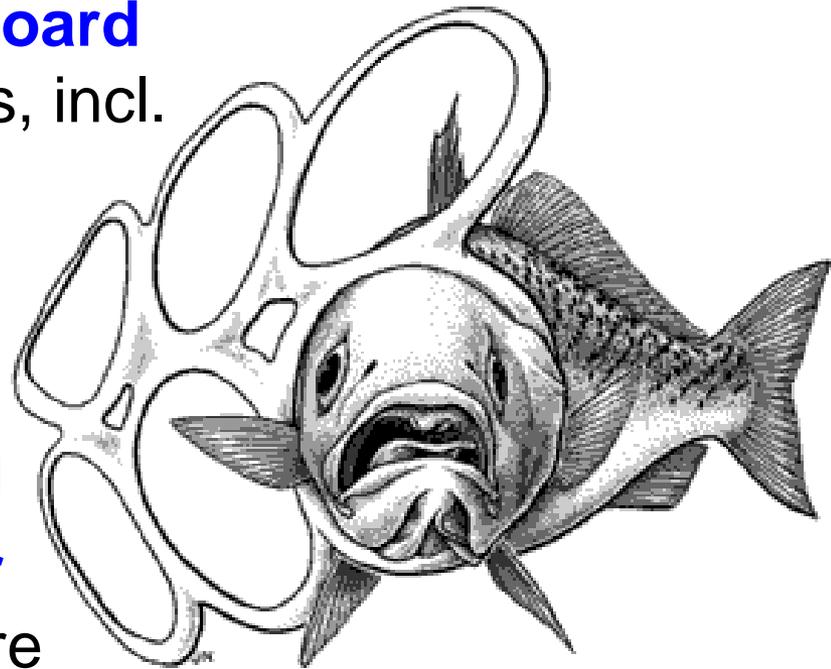
Litter





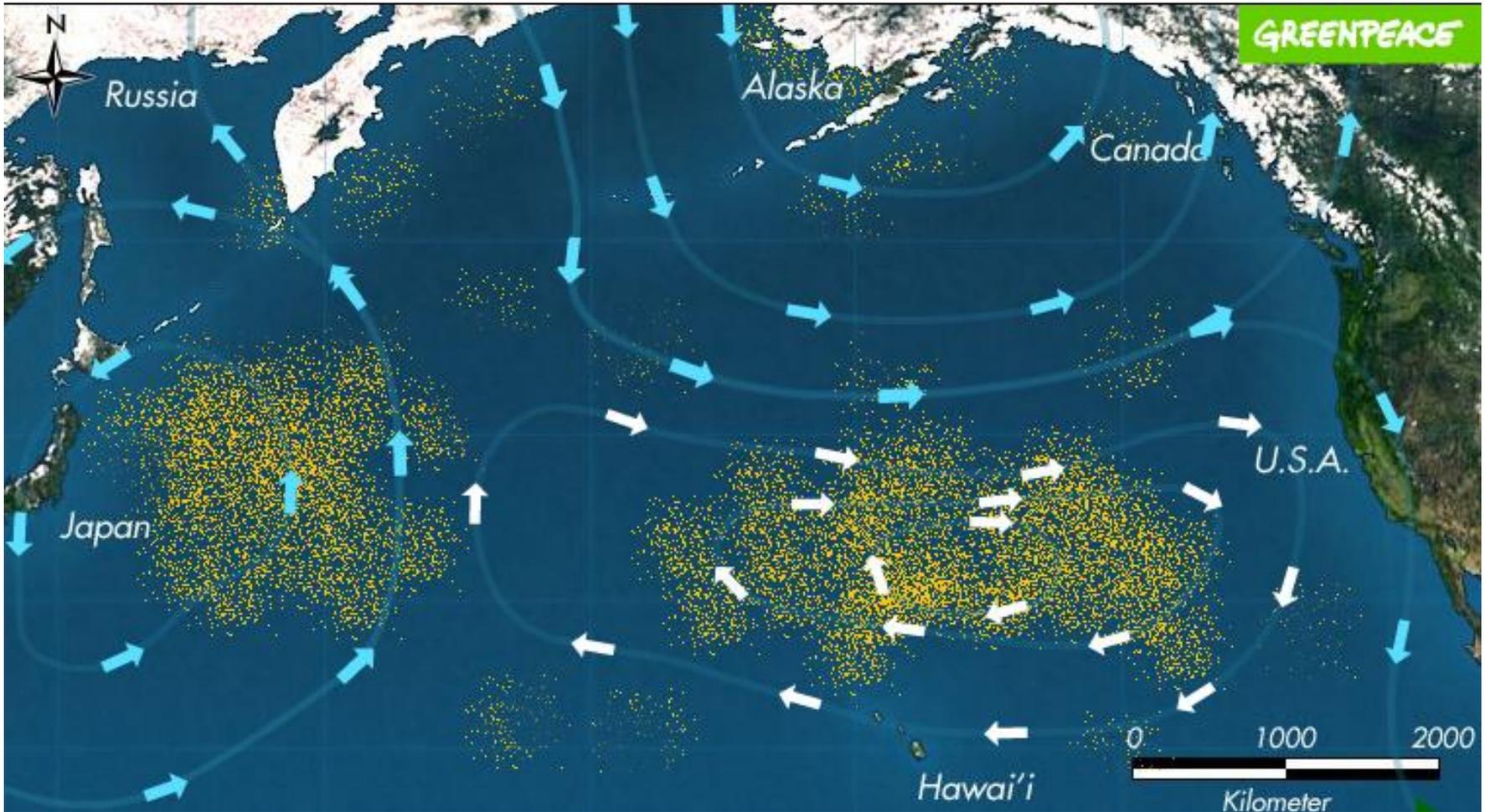
Marine Pollution from Solid Waste Oceans = Global Garbage Can

- ❑ **8 million items of marine litter** enter oceans every day
- ❑ **5.5 million items thrown overboard** every day from commercial ships, incl.
 - **4.8 million metal containers**
 - **640,000 plastic containers**
 - **300,000 glass containers**
- ❑ **> 5.6 million tons** from shipping
- ❑ **> 13,000 pieces of plastic litter** floating on every square kilometre
- ❑ Three times more garbage thrown into the ocean each year than fish taken out





North Pacific Plastic Islands = Size of Texas



Source: Greenpeace (2010)



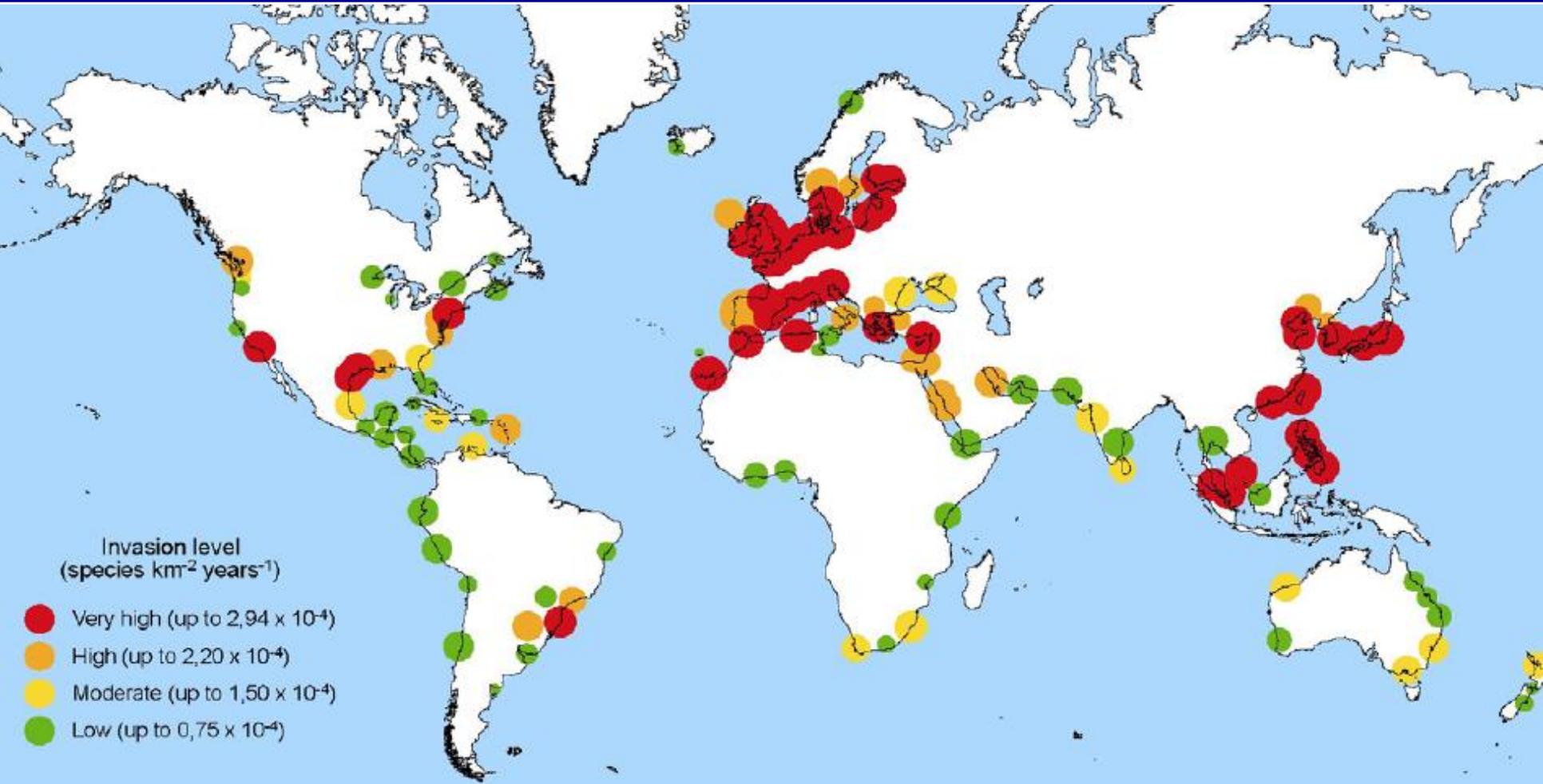
Plastic Beach Hong Kong



Source: Der Spiegel (2010)



Biological Invasions by Ballast Water



Source: Claude Comtois and Brian Slack: Restructuring the Maritime Transportation Industry: Global Overview of Sustainable Development Practices, Études et Recherches en Transport (2007)



10 Countries and Territories with the Largest Controlled Deadweight Tonnage (2009)

Country or territory of ownership	Number of Vessels			Deadweight tonnage		
	National flag	Foreign flag	Total	Total	Foreign flag as % of total	Total as % of world total
Japan	733	2 987	3 720	173 285 235	92.96	15.68
Greece	720	2 344	3 064	169 426 690	68.82	15.33
Germany	479	3 043	3 522	104 953 712	83.39	9.50
China	1 944	1 555	3 499	92 799 221	59.91	8.40
Norway	783	1 244	2 027	50 216 235	77.01	4.54
Republic of Korea	797	438	1 235	46 623 226	55.26	4.22
United States	867	915	1 782	39 965 883	48.44	3.62
Hong Kong	307	373	680	33 723 826	45.75	3.05
Denmark	347	567	914	31 595 523	62.15	2.86
United Kingdom	398	520	918	30 916 501	63.85	2.80

Source: UNCTAD: Review of Maritime Transport 2009



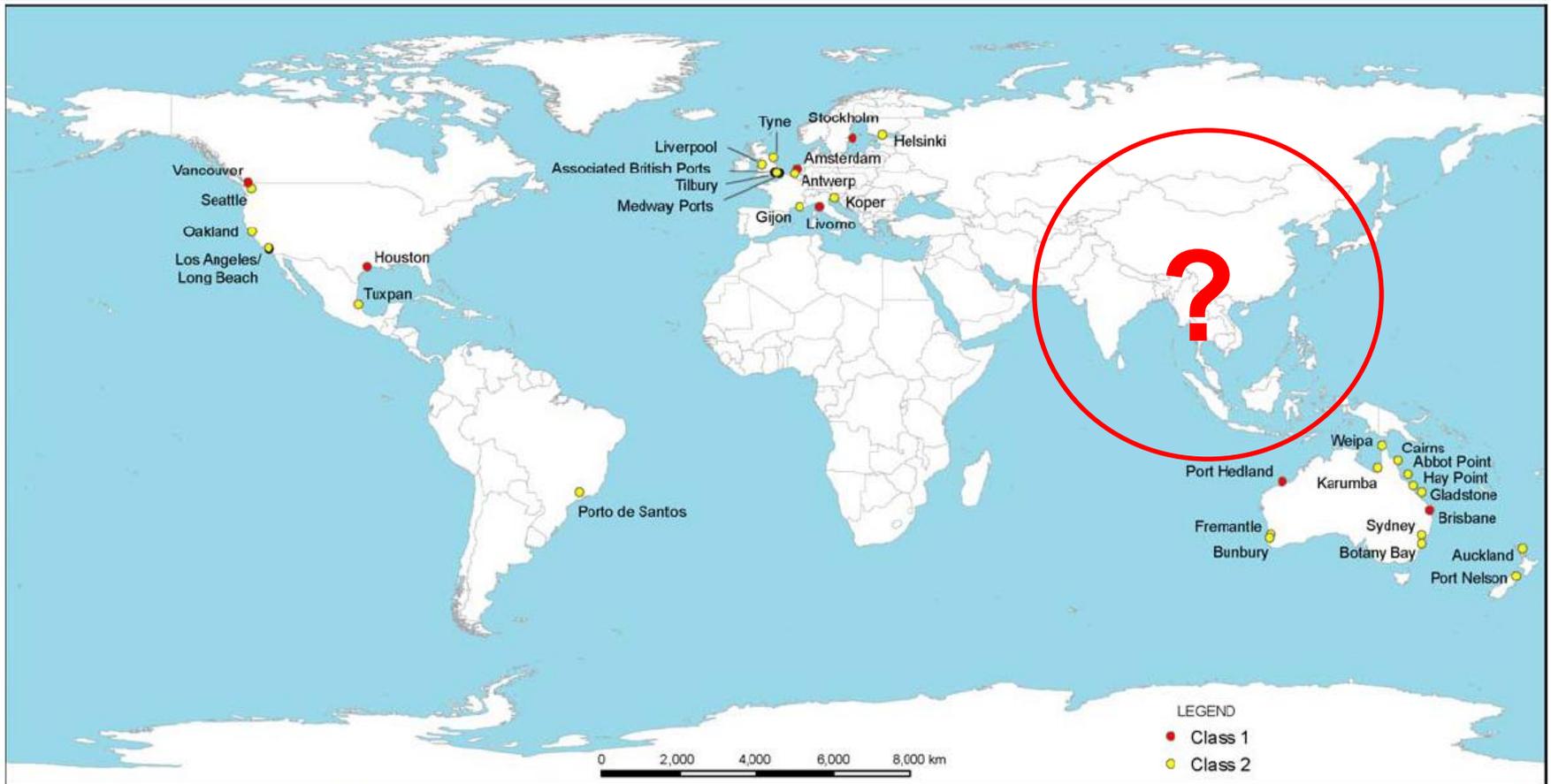
10 Flags of Registration with the Largest Registered Deadweight Tonnage (2009)

Flag of registration	Number of vessels	Share of world total (vessels)	Deadweight tonnage (1 000 dwt)	Share of world total (dwt)	Cumulated share (dwt)	Average vessel size (dwt)	Dwt growth 2009/2008 (per cent)
Panama	8 065	8.09	273 961	22.98	22.98	33 969	8.47
Liberia	2 306	2.31	125 993	10.57	33.54	54 637	7.21
Marshall Islands	1 265	1.27	68 451	5.74	39.28	54 111	14.85
Hong Kong	1 371	1.37	64 183	5.38	44.67	46 814	8.40
Greece	1 498	1.50	63 036	5.29	49.95	42 080	2.69
Bahamas	1 446	1.45	62 013	5.20	55.15	42 886	3.80
Singapore	2 451	2.46	60 798	5.10	60.25	24 805	9.45
Malta	1 532	1.54	50 666	4.25	64.50	33 072	12.05
China	3 916	3.93	39 998	3.35	67.86	10 214	7.74
Cyprus	1 016	1.02	31 388	2.63	70.49	30 893	6.65

Source: UNCTAD: Review of Maritime Transport 2009



Ports with best Environmental Performance



Class 1: Uses a certified environmental management system, mentions environmental impact of its activities, has an environmental policy, presents sustainable development objectives and publishes an annual report pertaining to sustainability;

Class 2: Uses a certified environmental management system, has an environmental policy, mentions environmental impact of its activities, publishes a report.

Source: Claude Comtois and Brain Slack: **Restructuring the Maritime Transportation Industry: Global Overview of Sustainable Development Practices**, Études et Recherches en Transport, (2007)



Clean Shipping

Integrated approach focusing on three fronts:

1. Clean Ship

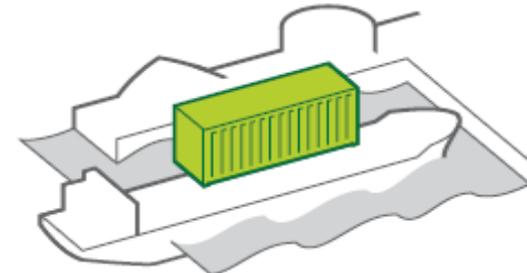
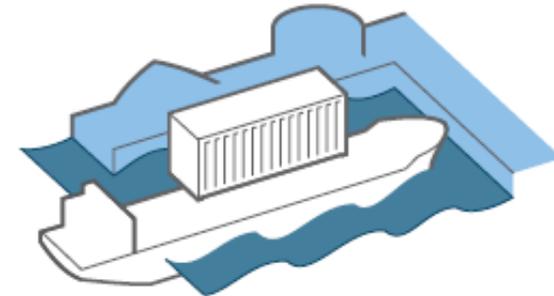
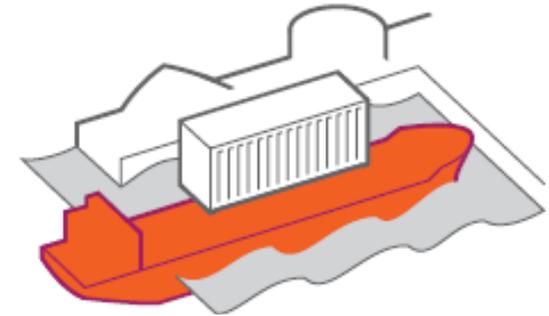
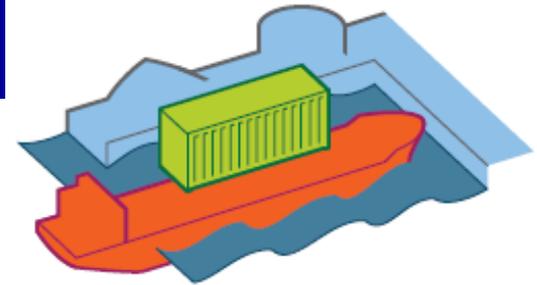
- ❑ State of the art ship that causes no negative effects to the environment. The long-term objective is zero emission

2. Clean Port

- ❑ Highly efficient port with excellent environmental management and strong incentives to facilitate clean shipping

3. Clean Cargo

- ❑ To improve their corporate footprint, cargo owners include environmental issues when contracting carriers





Options for Future Improvements

Sector	Category	Measure
Ports	Operations	Ship loading / unloading optimization, stacking optimization, gate access, traffic management
	Terminal design	Improved nautical profile, yard design, automation, integration with inland transport systems
	Alternative fuels & power	Electrification / alternative fuels of cargo handling equipment (CNG) for yard equipment and trucking, cold ironing
Shipping	Operations	Speed reduction, optimized routing, reduced port time
	Ship design & propulsion	New hull coatings and propellers, fuel efficiency optimization, engines optimization
	Alternative fuels & power	Marine diesel oil (MDO), liquefied natural gas (LNG), wind power



Slow Steaming - Impact of Speed Reduction on Vessel Fuel Consumption (8500 TEU Container Ship)

% Speed Reduction	Speed (knots)	Main engine fuel consumption/day (tons)	% Reduction in Fuel Consumption
0	25.0	230	
10%	22.5	168	27%
20%	20.0	118	49%
30%	17.5	79	66%
40%	15.0	50	78%
50%	12.5	29	87%

Source: Philippe Crist: **Greenhouse Gas Emissions Reduction Potential from International Shipping**, OECD and the International Transport Forum, May (2009)



Strategies and Options for Sustainable Shipping and Port Development

Air Pollution & Climate Secretariat (AirClim)

- **Market-based instruments for NOx abatement in the Baltic Sea** (2009)

American Association of Port Authorities (AAPA)

- **Environmental Management Handbook** (1998)

Clean Shipping Project

- **Clean Shipping Index Guidance Document** (2010)
- **Clean solutions for ships – Examples from the Port of Göteborg** (2006)



Strategies and Options for Sustainable Shipping and Port Development

Civic Exchange

- **Green Harbours: Hong Kong and Shenzhen – Reducing Marine and Port-related Emissions (2008)**

CE Delft / Germanischer Lloyd / MARINTEK

- **Greenhouse Gas Emissions for Shipping and Implementation Guidance for the Marine Sulphur Directive (2006)**

Det Norske Veritas (DNV)

- **Pathways to low carbon shipping – Abatement potential towards 2030 (2009)**



Strategies and Options for Sustainable Shipping and Port Development

International Association of Ports and Harbors (IAPH) / World Ports Climate Initiative (WPCI)

- **Onshore Power Supply** (2010)
- **Air quality and Greenhouse Gas Tool Box** (2009)
- **World Ports Climate Initiative** (2008)

International Council on Clean Transportation (ICCT)

- **Air Pollution and Greenhouse Gas Emissions from Ocean-going Ships: Impacts, Mitigation Options and Opportunities for Managing Growth** (2007)



Strategies and Options for Sustainable Shipping and Port Development

International Institute for Sustainable Seaports

- **Inventory of Innovative Technologies for the US Seaports (2010)**
- **Environmental Initiatives at Seaports Worldwide: A Snapshot of Best Practices (2010)**

International Maritime Organization (IMO)

- **Prevention of Air Pollution from Ships - Second IMO GHG Study (2009)**
- **Main events in IMO's work on limitation and reduction of greenhouse gas emissions from international shipping (2008)**



Strategies and Options for Sustainable Shipping and Port Development

Organization for Economic Co-operation and Development (OECD) / International Transport Forum

- **Globalisation, Transport and the Environment** (2010)
- Policy Instruments to Limit Negative Environmental Impacts from Increased International Transport - An Economic Perspective (2009)

Partnership in Environmental Management in the Seas of East Asia (PEMSEA)

- **Port Safety and Health and Environmental Management (PSHEM) Code** (2007)



Strategies and Options for Sustainable Shipping and Port Development

United States Environmental Protection Agency (EPA)

- **Options for the Marine Ports Sector: Green Strategies for Sustainable Ports** (2008)
- **Port Technologies and Management Strategies** (2010)
- **Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories** (2009)
- **An Environmental Management System (EMS) Primer for Ports: Advancing Port Sustainability** (2009)
- **Clean Ports USA: Navigating Toward Cleaner Air** (2005)



Drivers of Change for Future Shipping and Port Development

