



De-Oxygenation in the Ocean

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Low Oxygen waters

$$\text{O}_2 < 1\text{-}2 \text{ mg/l}$$

(oxygen concentration in the atmosphere = 300 mg/l)





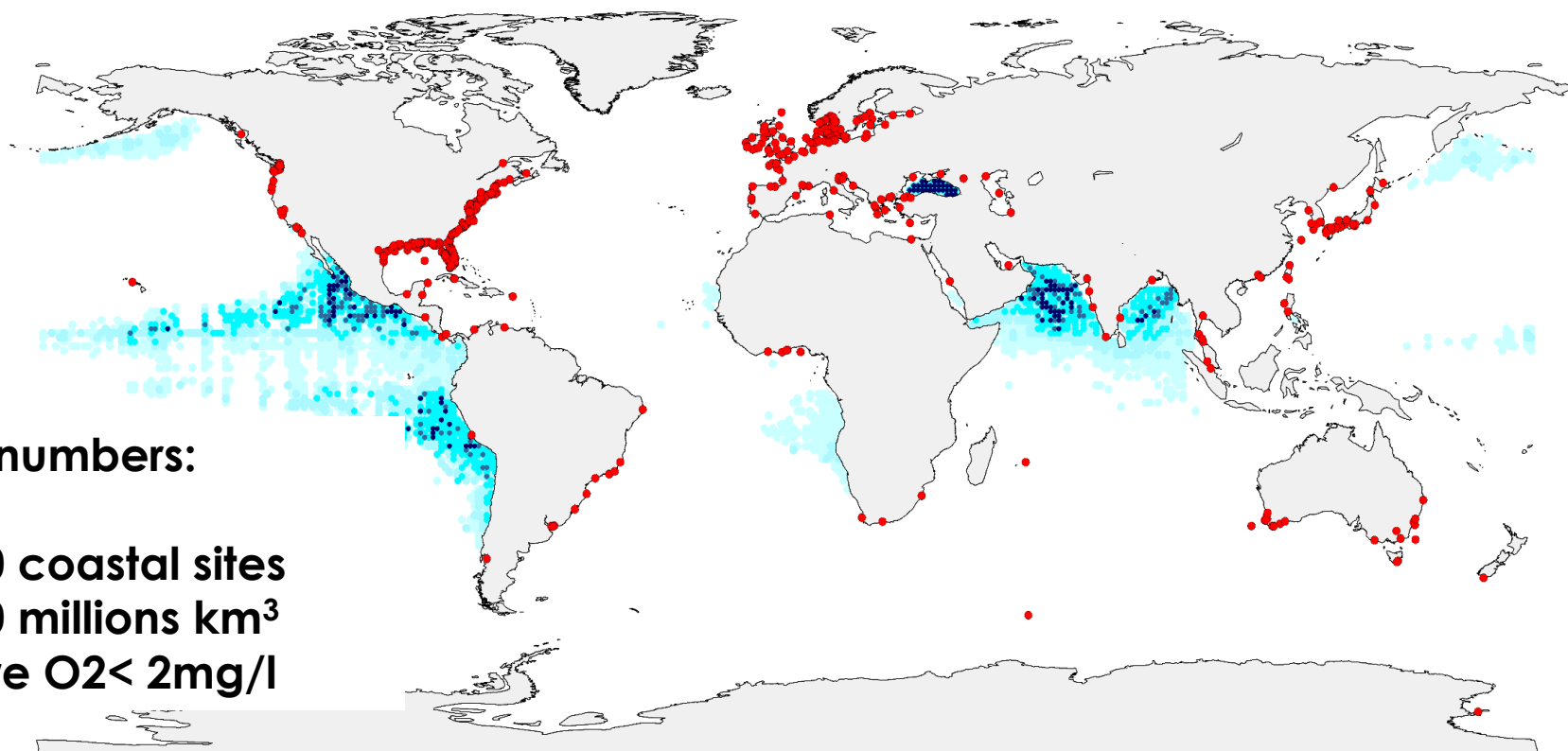
Where do we have Low Oxygen waters?



Low Oxygen waters are found in the coastal and open ocean.

- $O_2 < 2 \text{ mg/l}$
- $O_2 < 0,7 \text{ mg/l}$
- $O_2 < 0.07 \text{ mg/l}$

- Coastal hypoxic sites ($O_2 < 2 \text{ mg/l}$ - $62 \mu\text{mol/l}$)



Some numbers:

- * > 500 coastal sites
- * ~ 100 millions km^3 where $O_2 < 2 \text{ mg/l}$





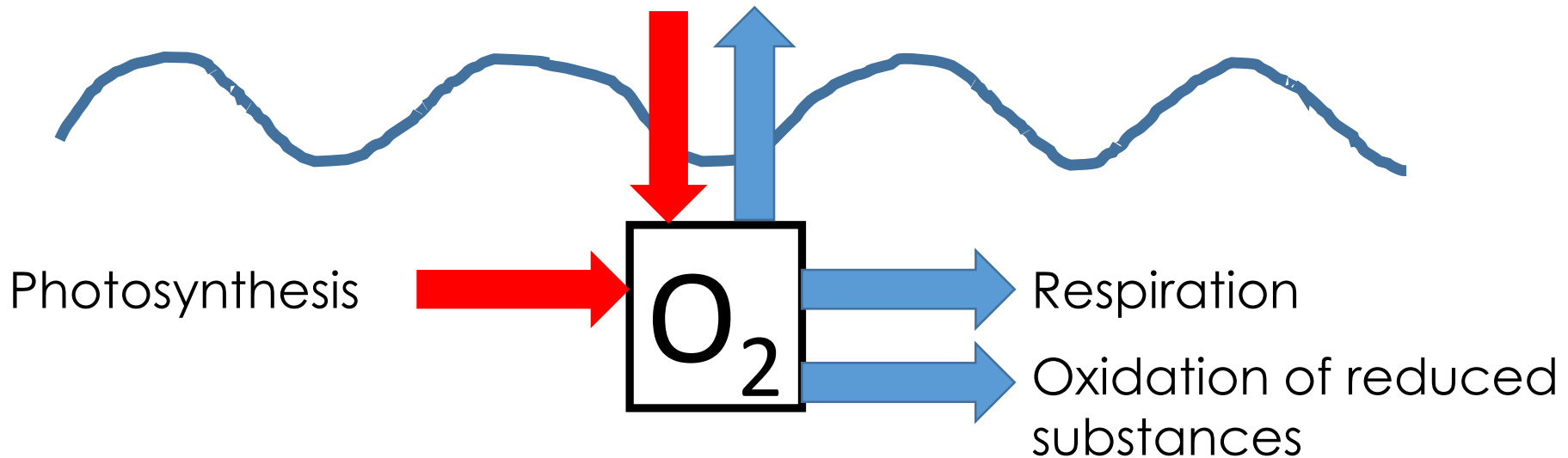
Why ocean deoxygenation is ongoing?



Ocean Oxygen budget

ATMOSPHERE

Air-Sea Exchanges



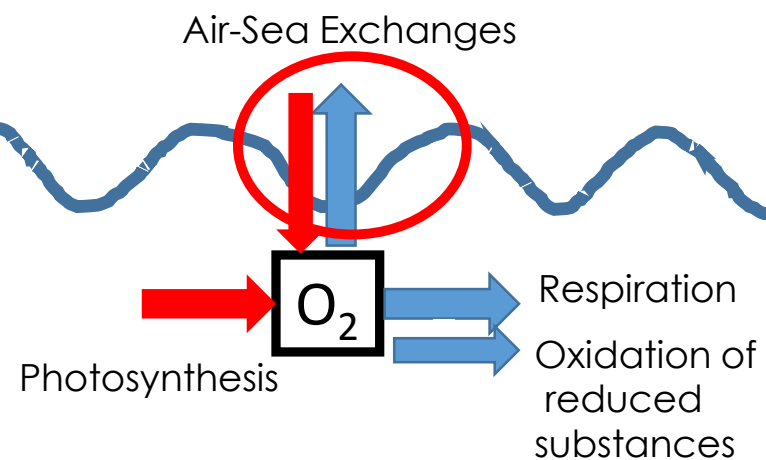
OCEAN



OPEN OCEAN

SOLUBILITY EFFECT

STRATIFICATION EFFECT

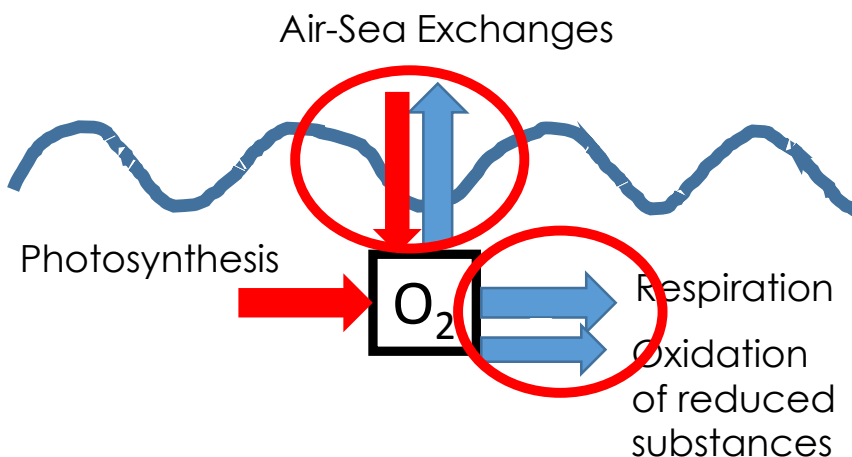


COASTAL OCEAN

SOLUBILITY EFFECT

STRATIFICATION EFFECT

EUTROPHICATION EFFECT





Impact of deoxygenation on ecosystem goods and services



A fish kill in Bolinao, Philippines, in 2002.

Loss of thousands of kilos of fish
in aquaculture pens and cages.

Lost wages, Lost food,
Histamine seafood poisoning.

Economic losses on the order of
500 million Philippine pesos.

(San Diego-McGlone et al., 2008).

Photo: <http://fernandoymas.blogspot.com/2011/05/fish-kill-in-pangasinan-and-batangas.html>

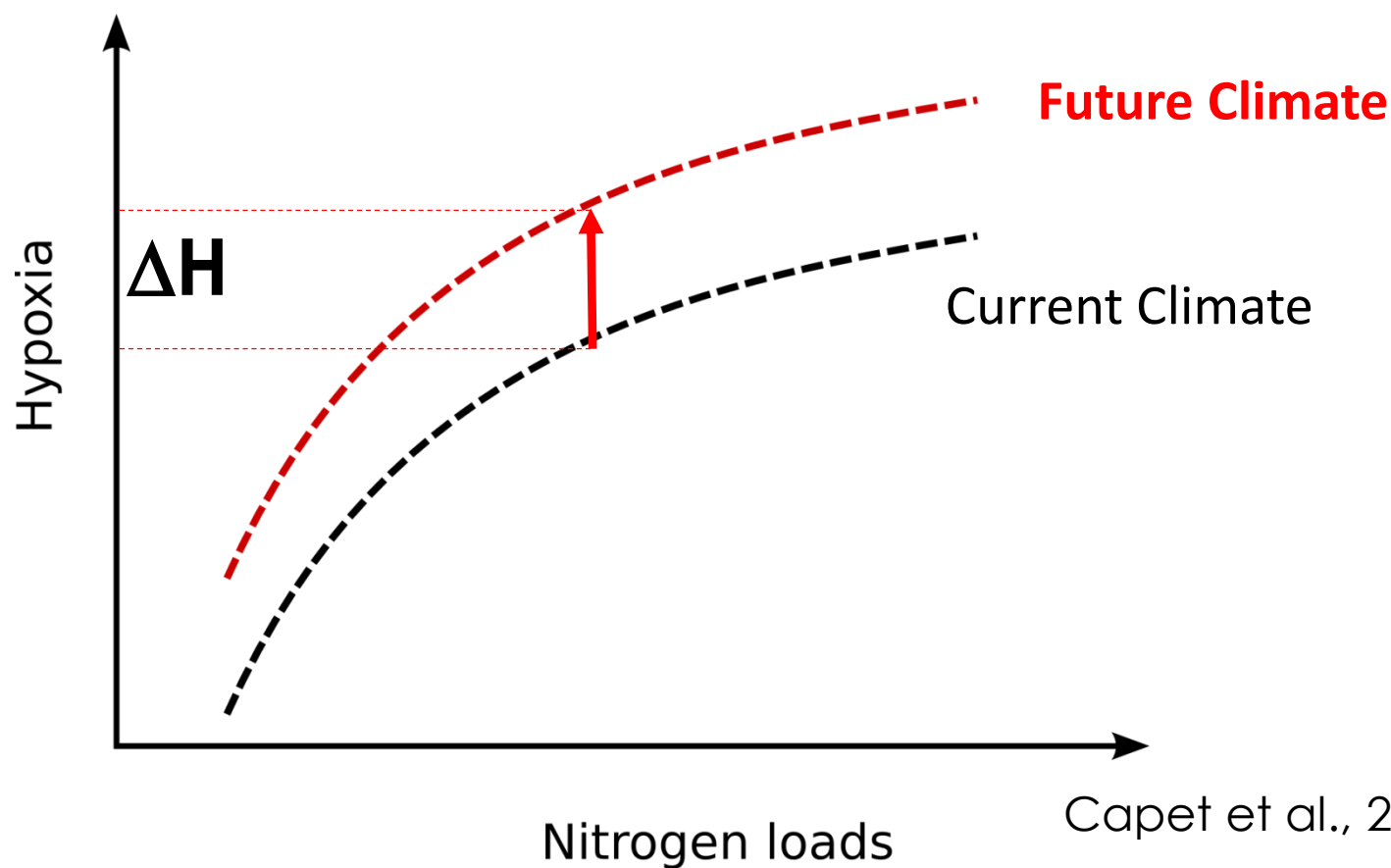




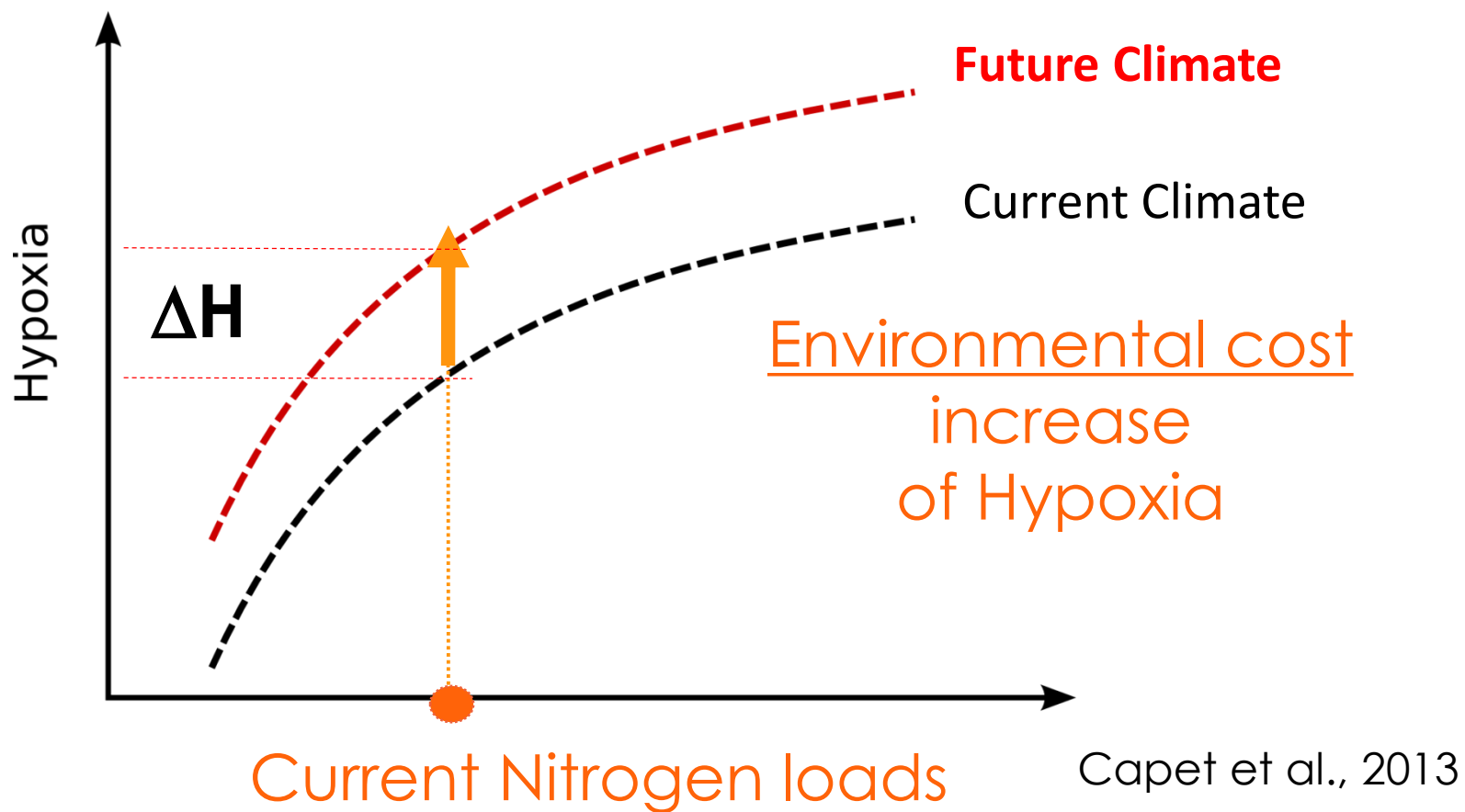
Managing deoxygenation in a warming world



Warming adds to eutrophication!

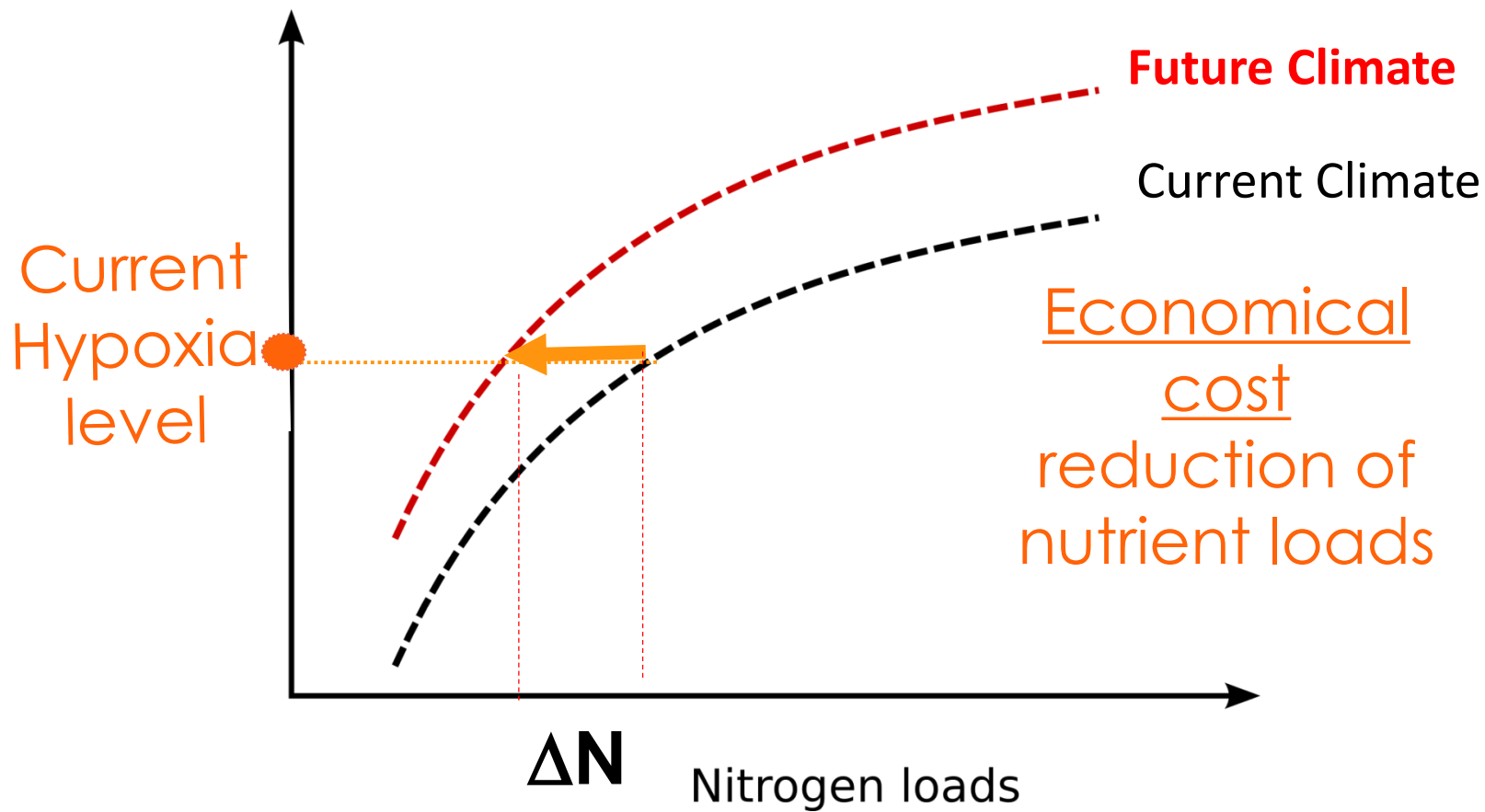


The cost of warming



The cost of warming

Nutrient reduction policies should account for realistic climatic scenarios.





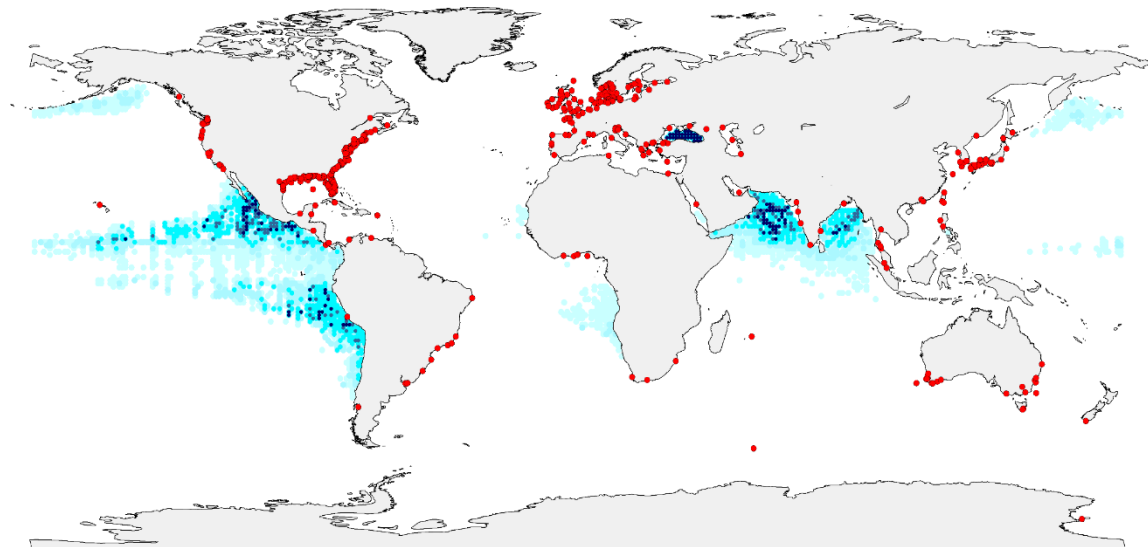
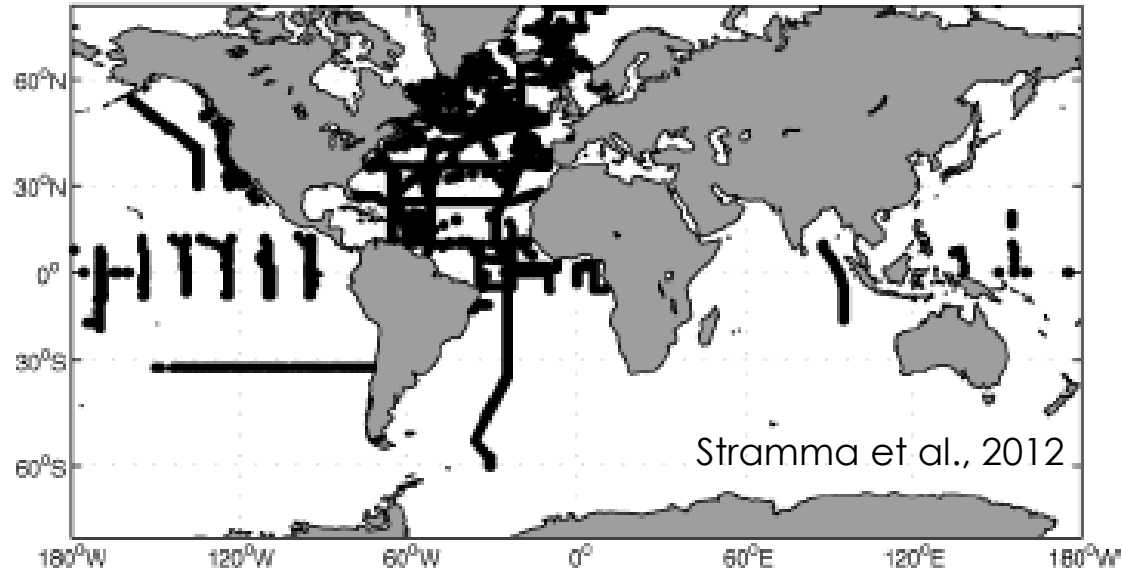
Observing Oxygen



More data (Integration) are needed

Data in database from 2000-2010

- The lack and quality of current data in some regions challenge a sound assessment of crucial questions
- Data management needs to be reinforced at a global level.



GO₂NE (Global Ocean Oxygen Network)



United Nations
Educational, Scientific and
Cultural Organization



Intergovernmental
Oceanographic
Commission



Paris, September 7-9th 2016

