

# Cultural Tipping Points Associated with Global Pollutants



Biogeochemistry of  
Global Contaminants  
HARVARD

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(with Russell Fielding and Yoshi Ota)

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# Human activities are transforming the global environment

## Environmental Releases



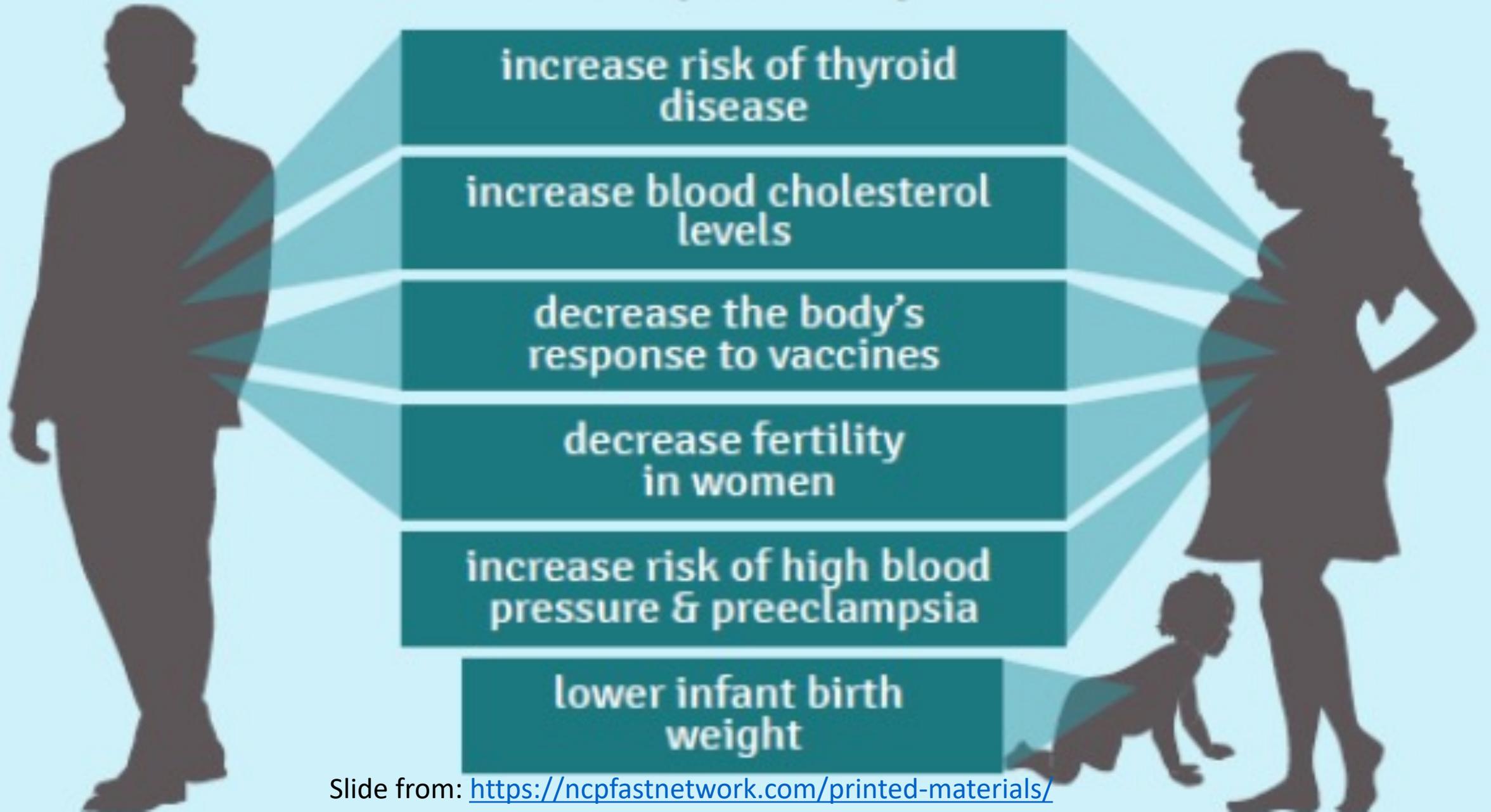
More than carbon

Fossil fuel feedstocks provide a cheap source of the parent chemicals to most synthetic organic substances

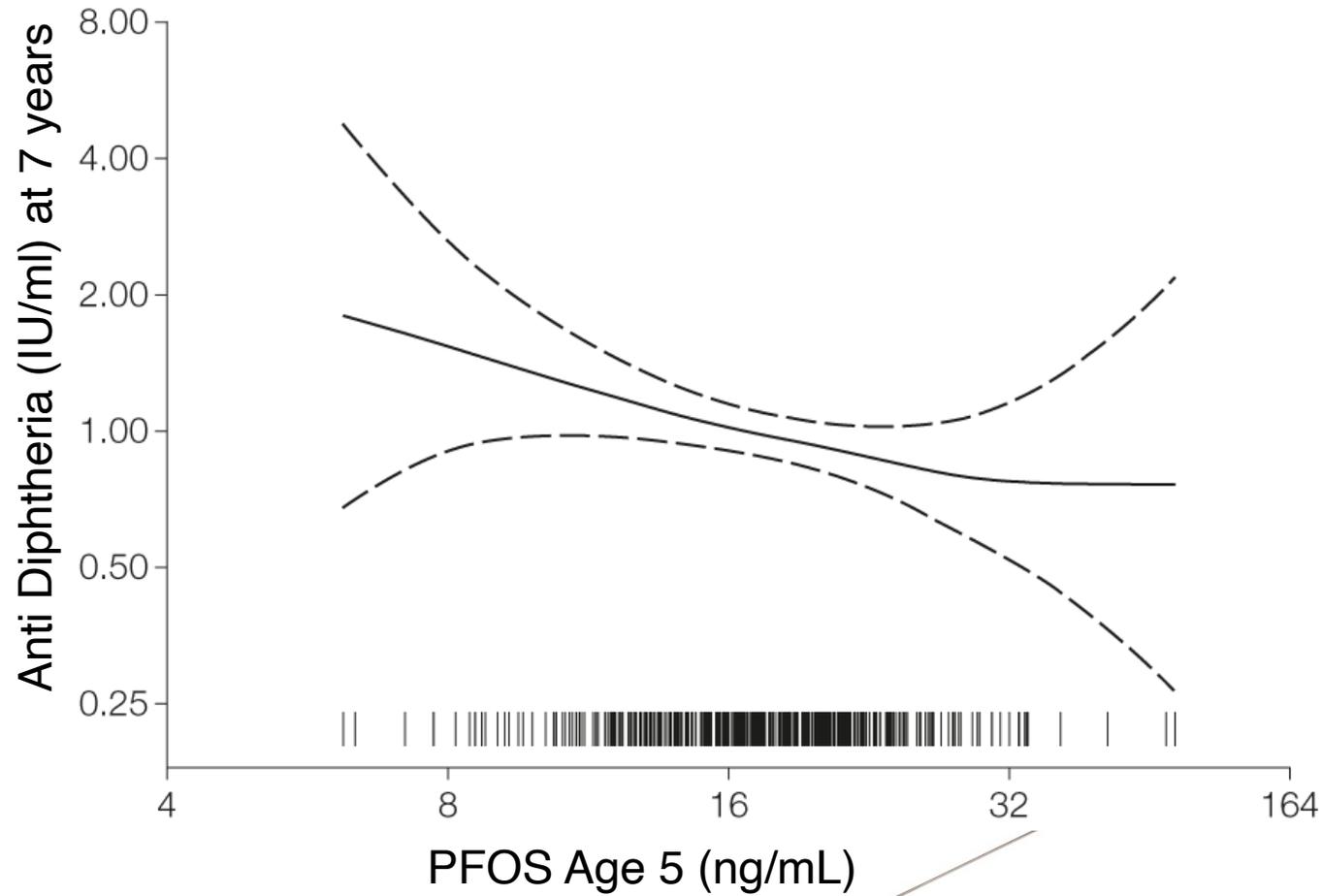
- 1-in-6 children suffer from a neurodevelopmental abnormality, mostly of unknown causes.
- Epidemiological studies note alarming rises in allergy, atopy, asthma, diabetes, obesity, autism spectrum disorders, etc. that are not linked to lifestyle changes.

<http://braindrain.dk>

## Human studies suggest PFAS exposure may...



# Children from the Faroe Islands

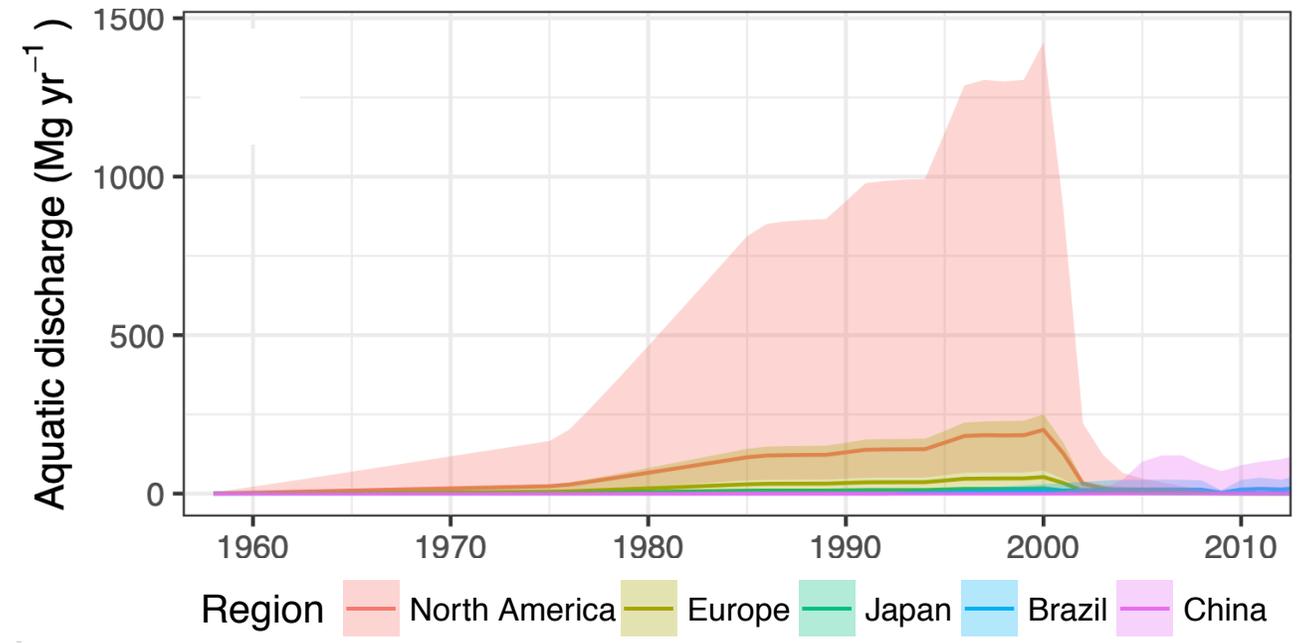
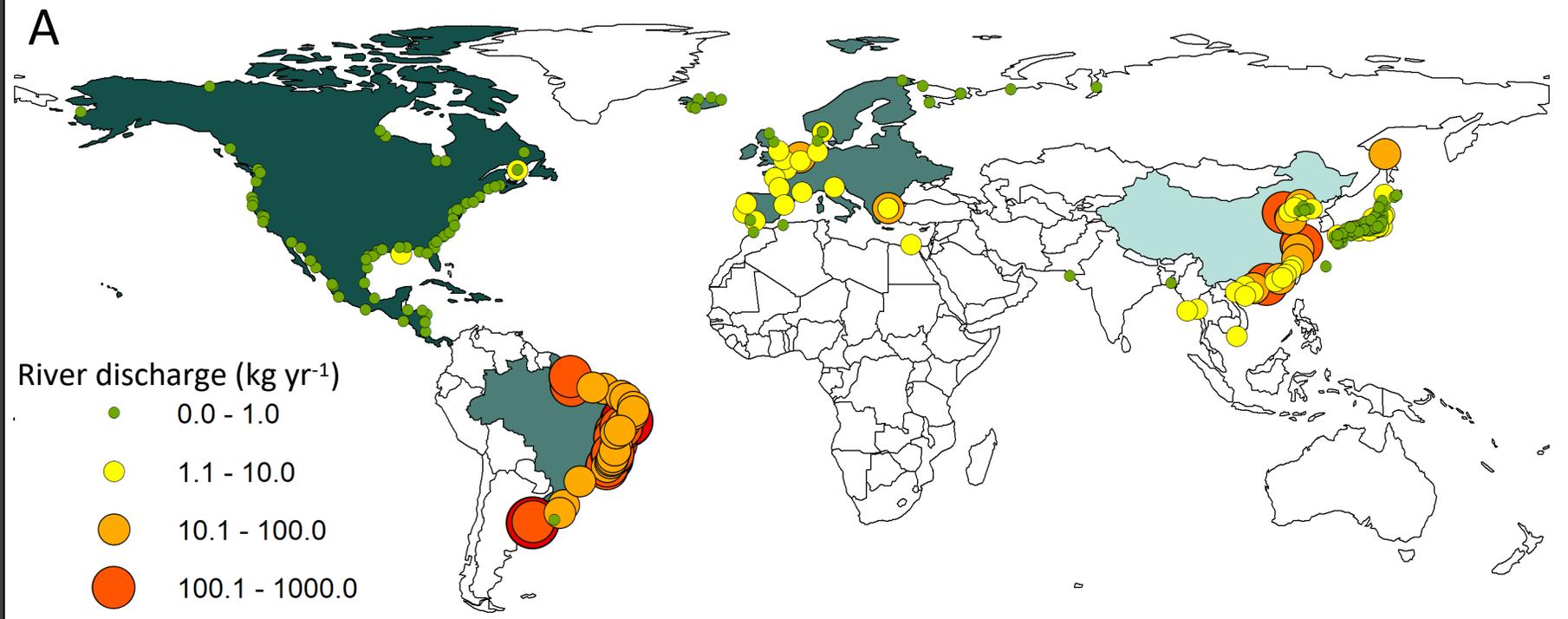


50% Reduction in antibody concentrations for each doubling of PFASs



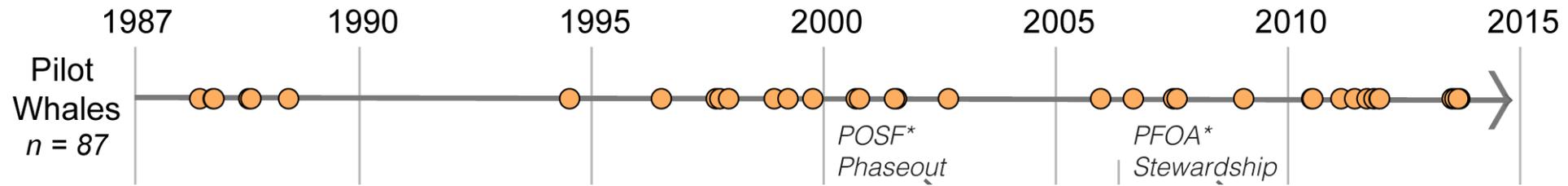
Grandjean et al., 2012

Modeled  
global  
PFOS  
discharges  
from rivers  
to the  
oceans ca.  
2010

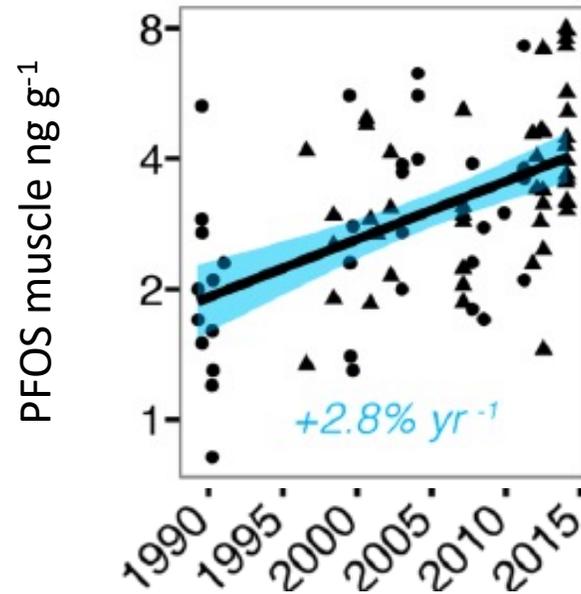




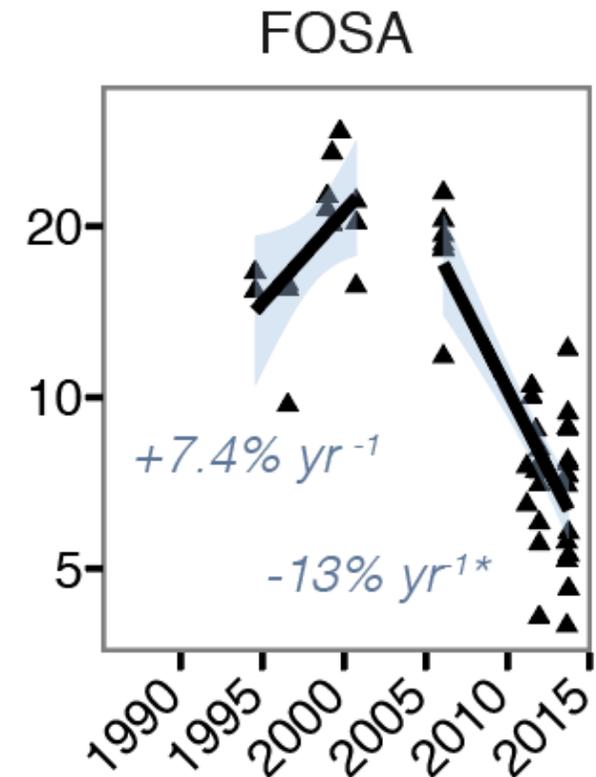
# Changing Concentrations of PFAS in Pilot Whales over Time



Dassuncao et al., 2017, ES&T

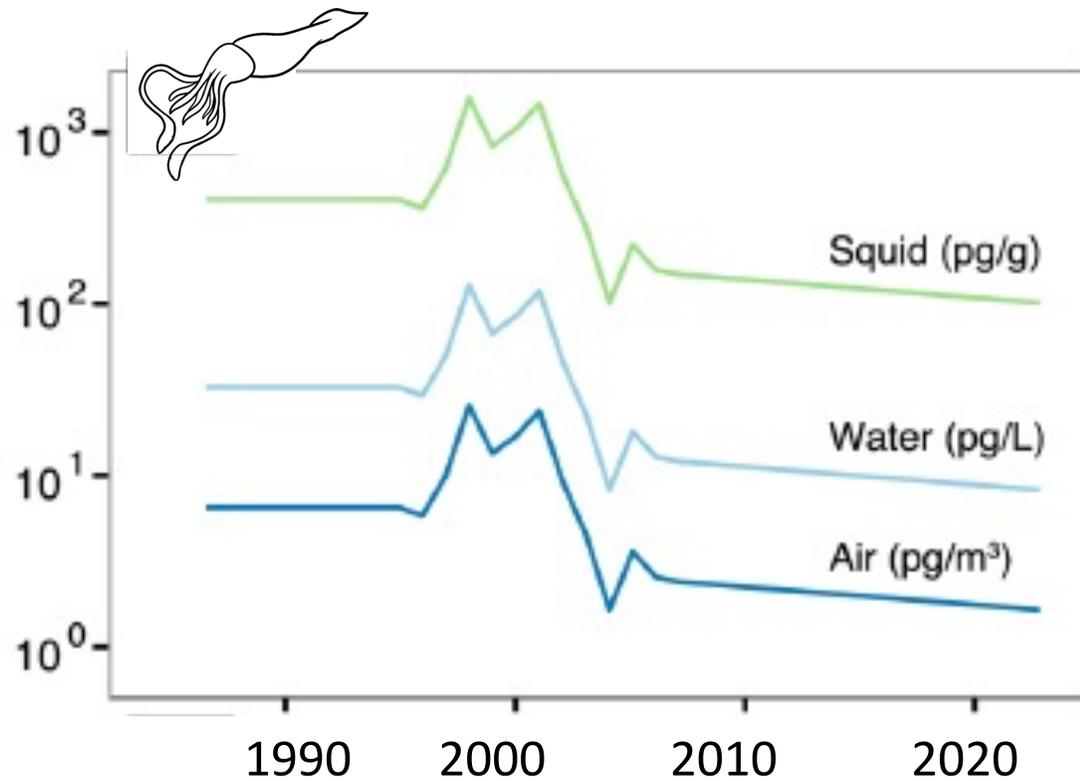


Juvenile males 9-12 years

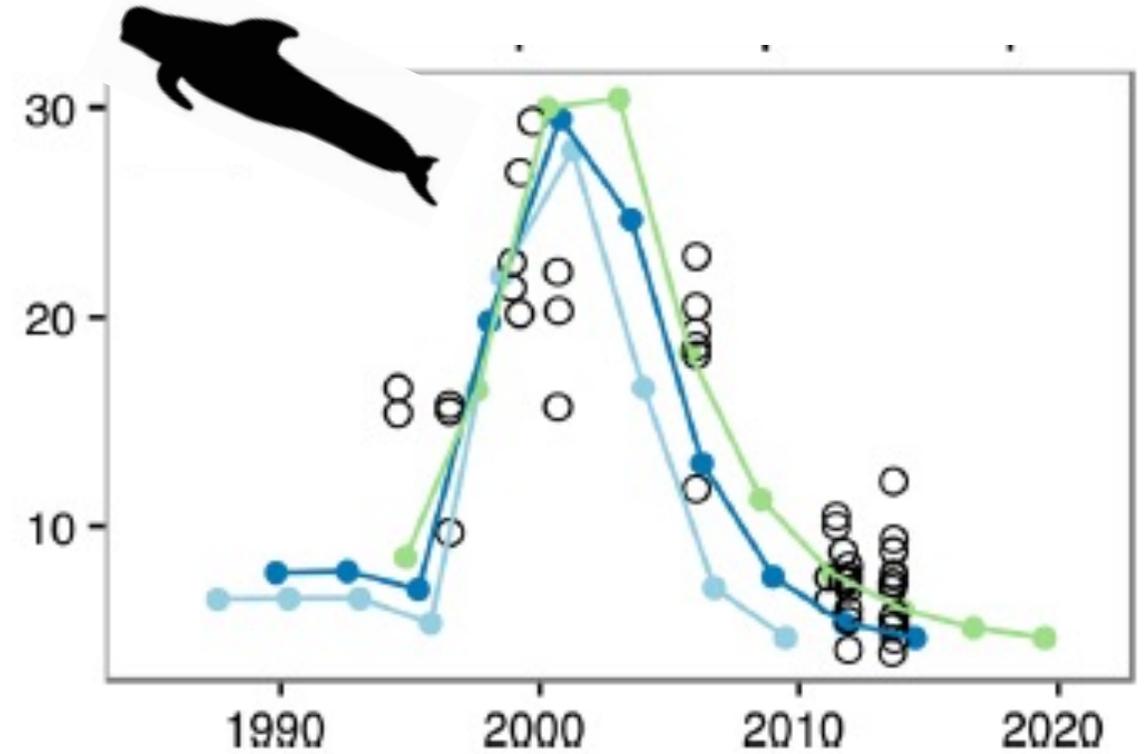


# Declining atmospheric FOSA successfully predicts observed changes in pilot whale FOSA concentrations

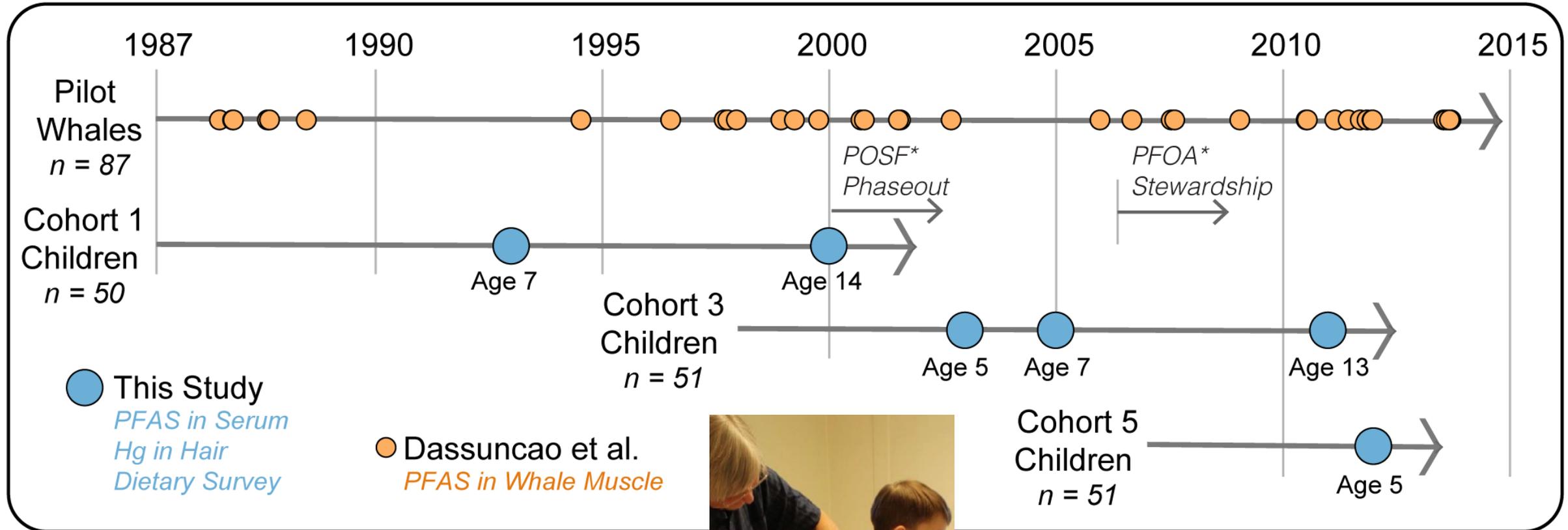
## Environmental Concentration



## Pilot whale FOSA concentration (ng<sup>-1</sup> g<sup>-1</sup>)

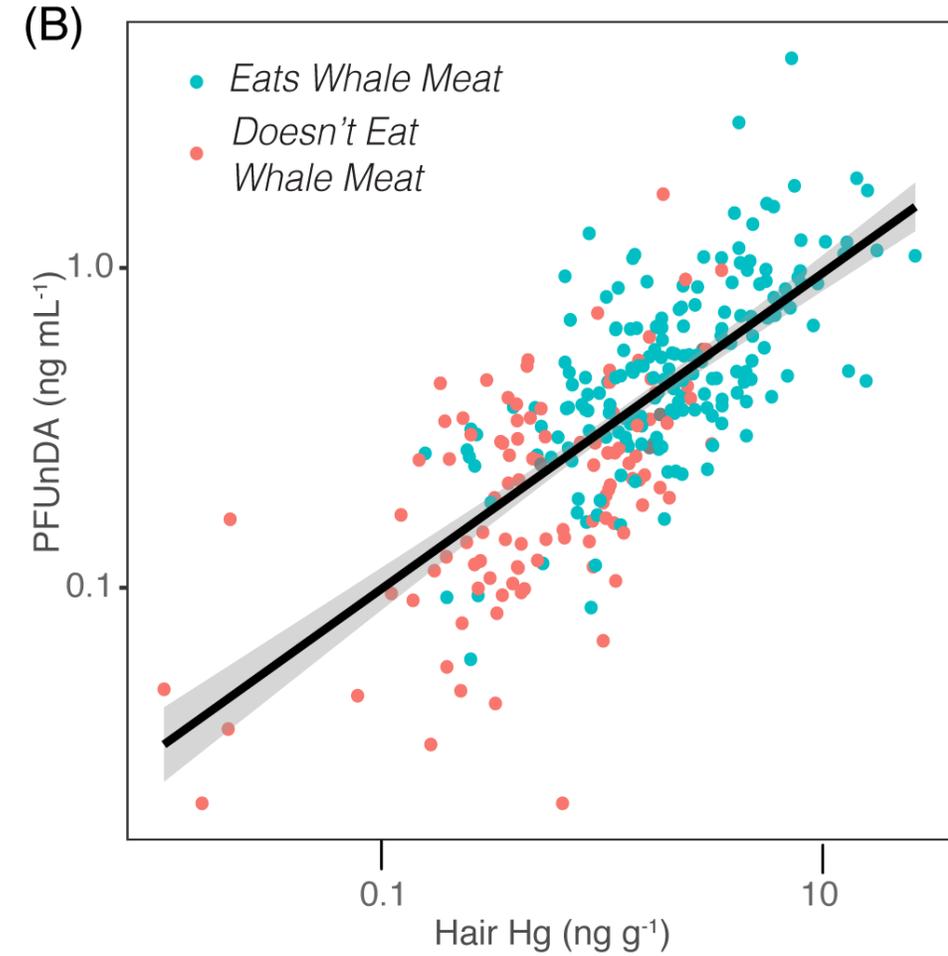
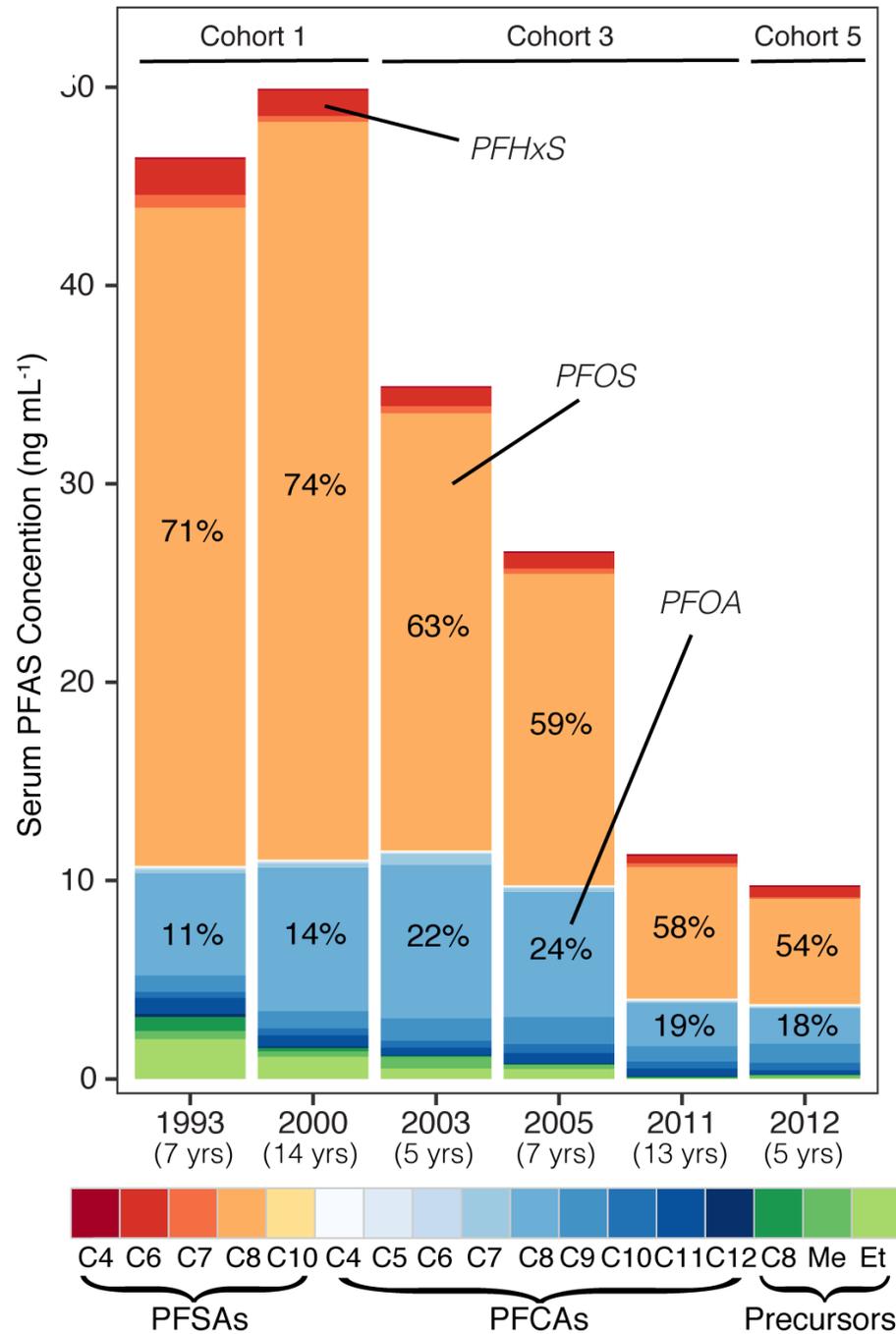


# Identify the contribution to exposure from seafood using longitudinal data from children in the Faroe Islands



# Declining serum PFAS in Faroese children driven by PFOS and FOSA

Dassuncao et al., 2018



## Policy & Governance

Global  
Pollution  
Agreements



International  
Governance



Health,  
Well-Being,  
Culture

## Human Component



Cultural Keystone  
Species



## Integrated Socio-Environmental System

*Indicator Fishing Communities*  
e.g., Faroe Islands, North Atlantic



Release of Hg, PCBs, PFAS



Atmospheric  
Transport

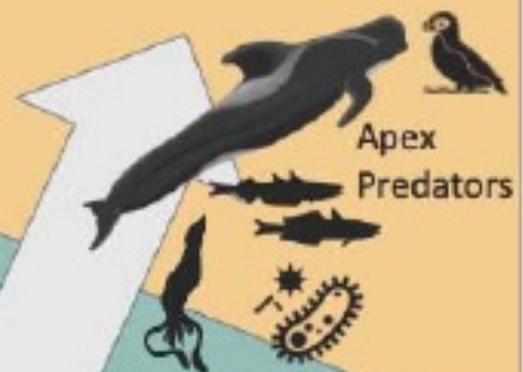
## Natural Component



Deposition  
to the Ocean



Seawater Warming/Ecosystem Changes



Apex  
Predators

Bioaccumulation in  
Marine Food-Webs