

The case of the missing microplastic:

Using computers to simulate the sources, pathways and fate of microplastics in the ocean



Erik van Sebille

Grantham Institute & Department of Physics

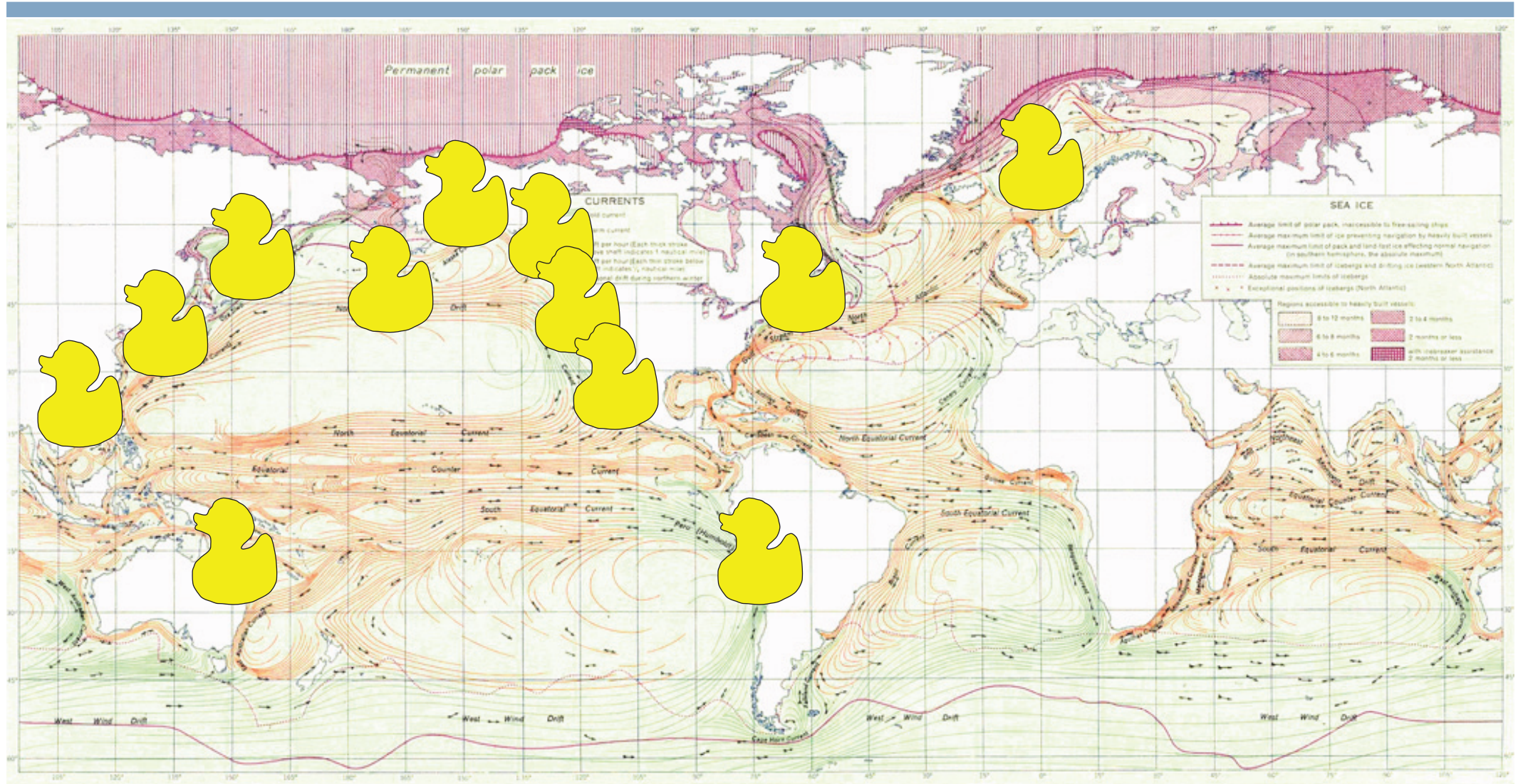
Imperial College London

www.erik.vansebille.com | @ErikvanSebille

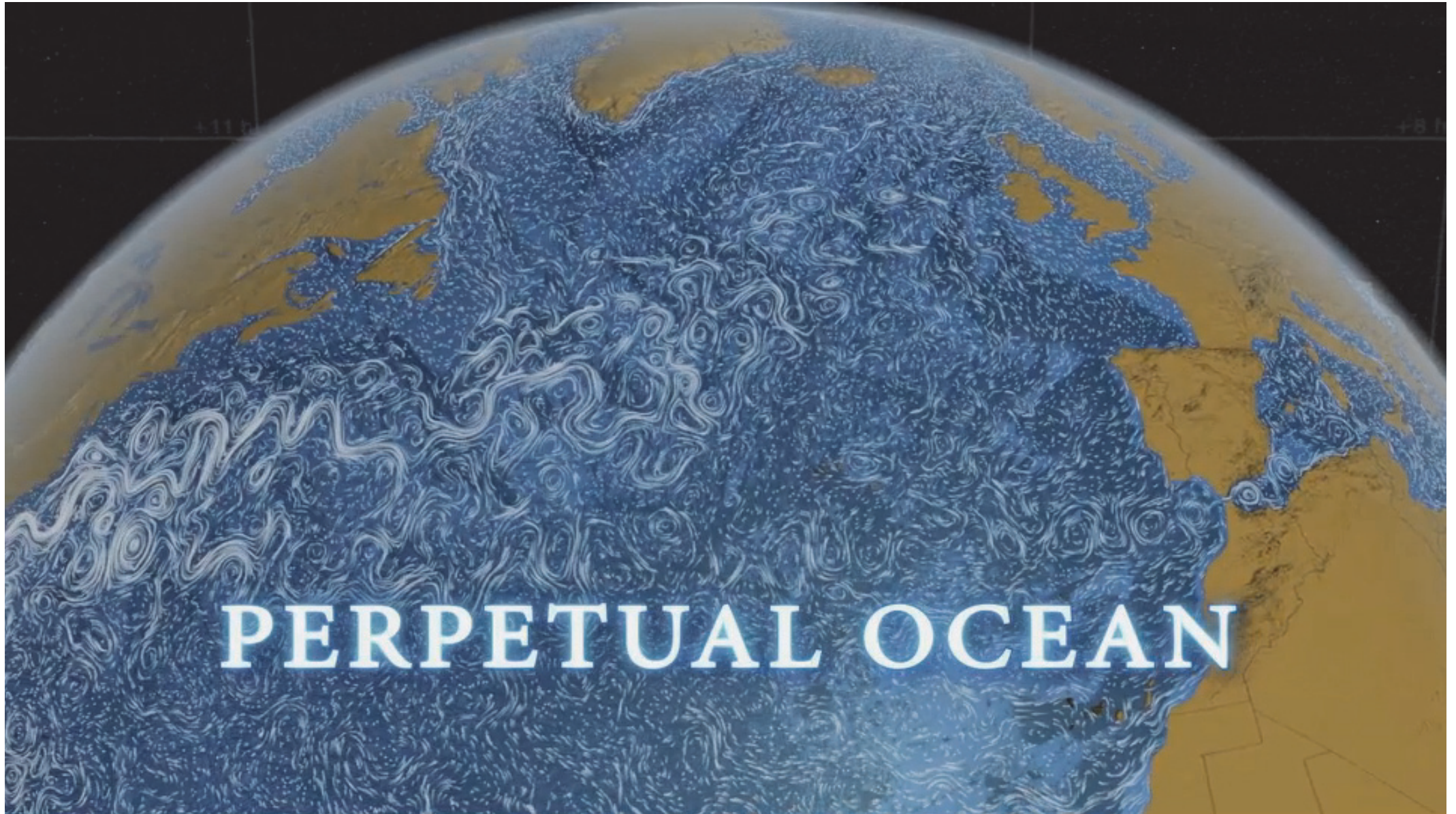
The question

Can we use **computer simulations** to **track plastic** around the global oceans?

An atlas of ocean currents



The turbulent ocean



<https://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=3827>

Rubber duckies that phone home

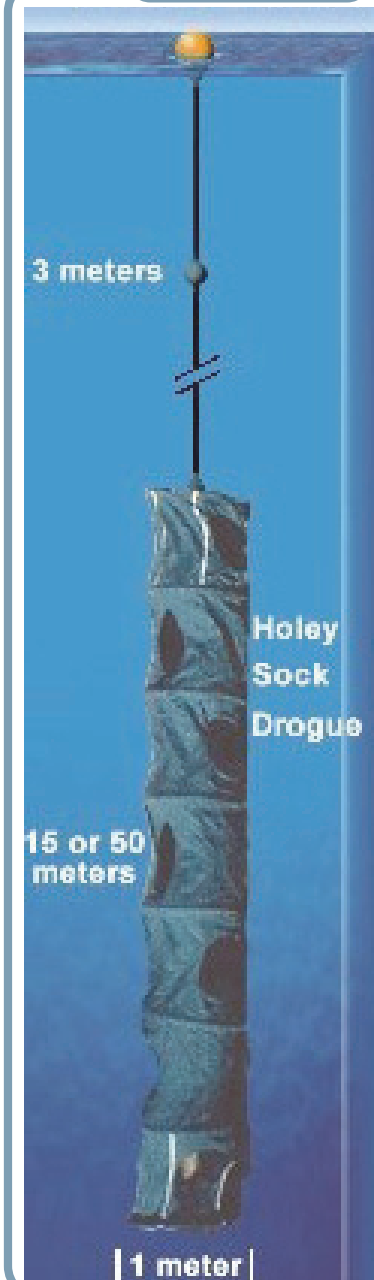
Deploying a Surface buoy



And overboard...



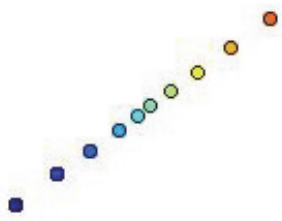
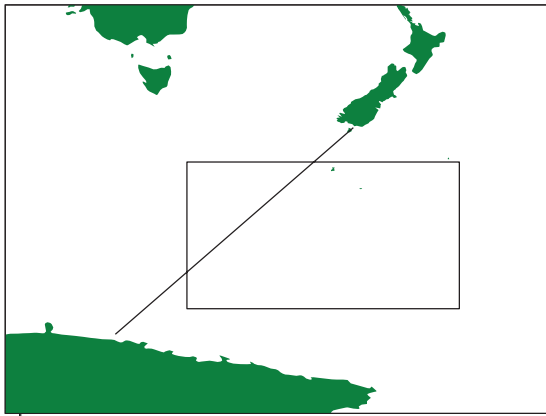
Surface buoy



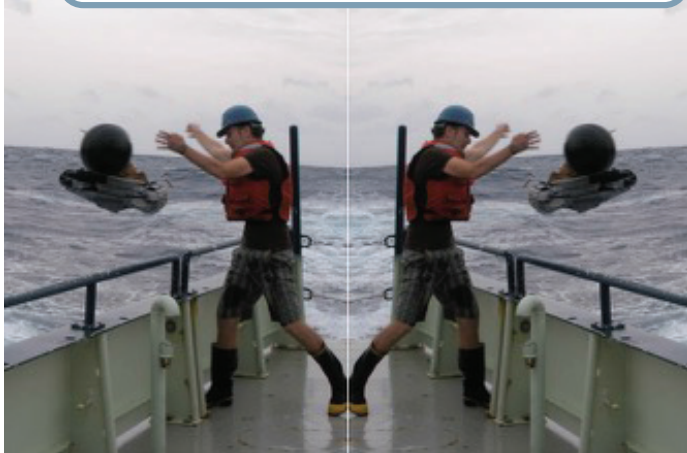
Photos: Chris Meinen

The AAE: Pairs of drifters in the Southern Ocean

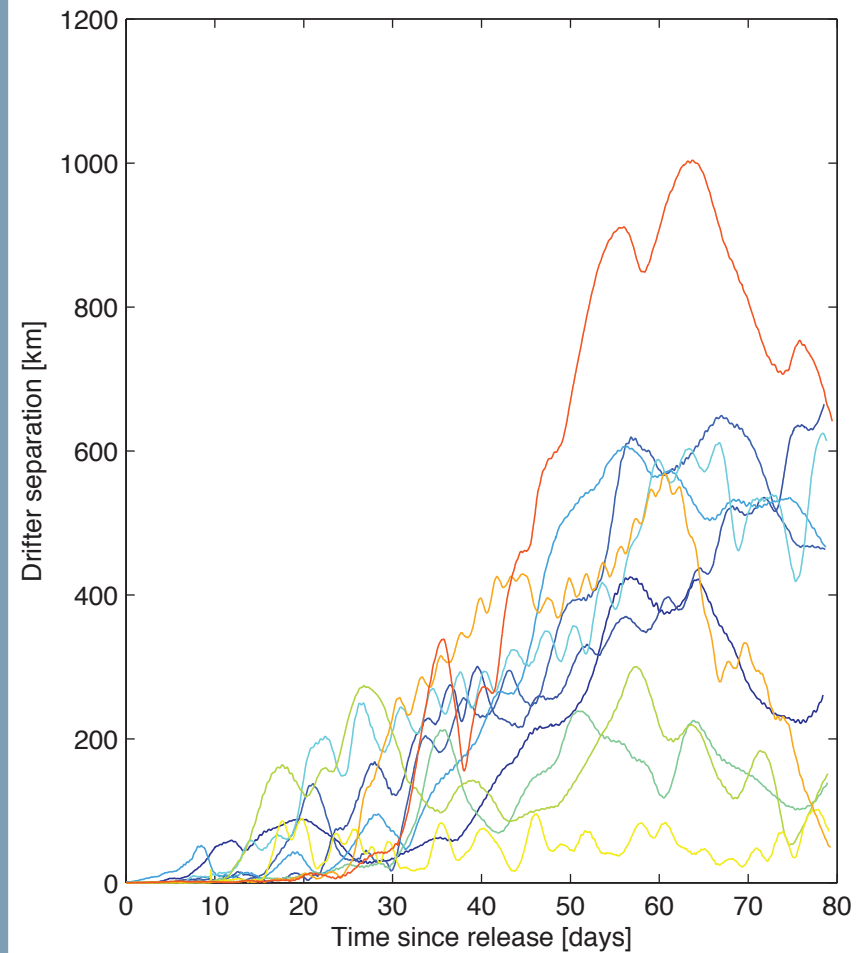
Movie of pairs of surface buoys



Trick photo of deploying a pair of buoys



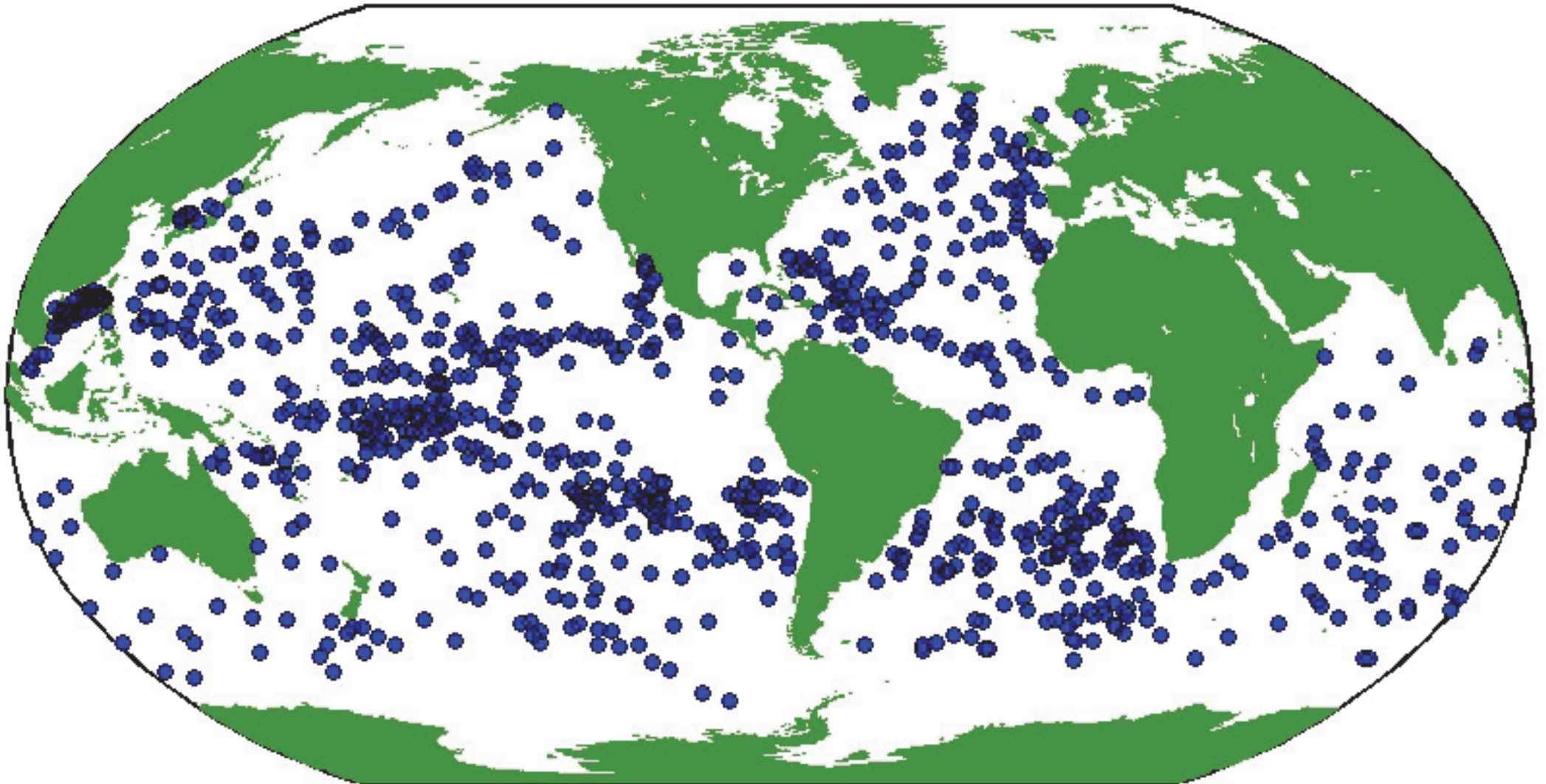
Separation statistics of buoy pairs



The global array of surface drifting buoys

Movie of surface buoys

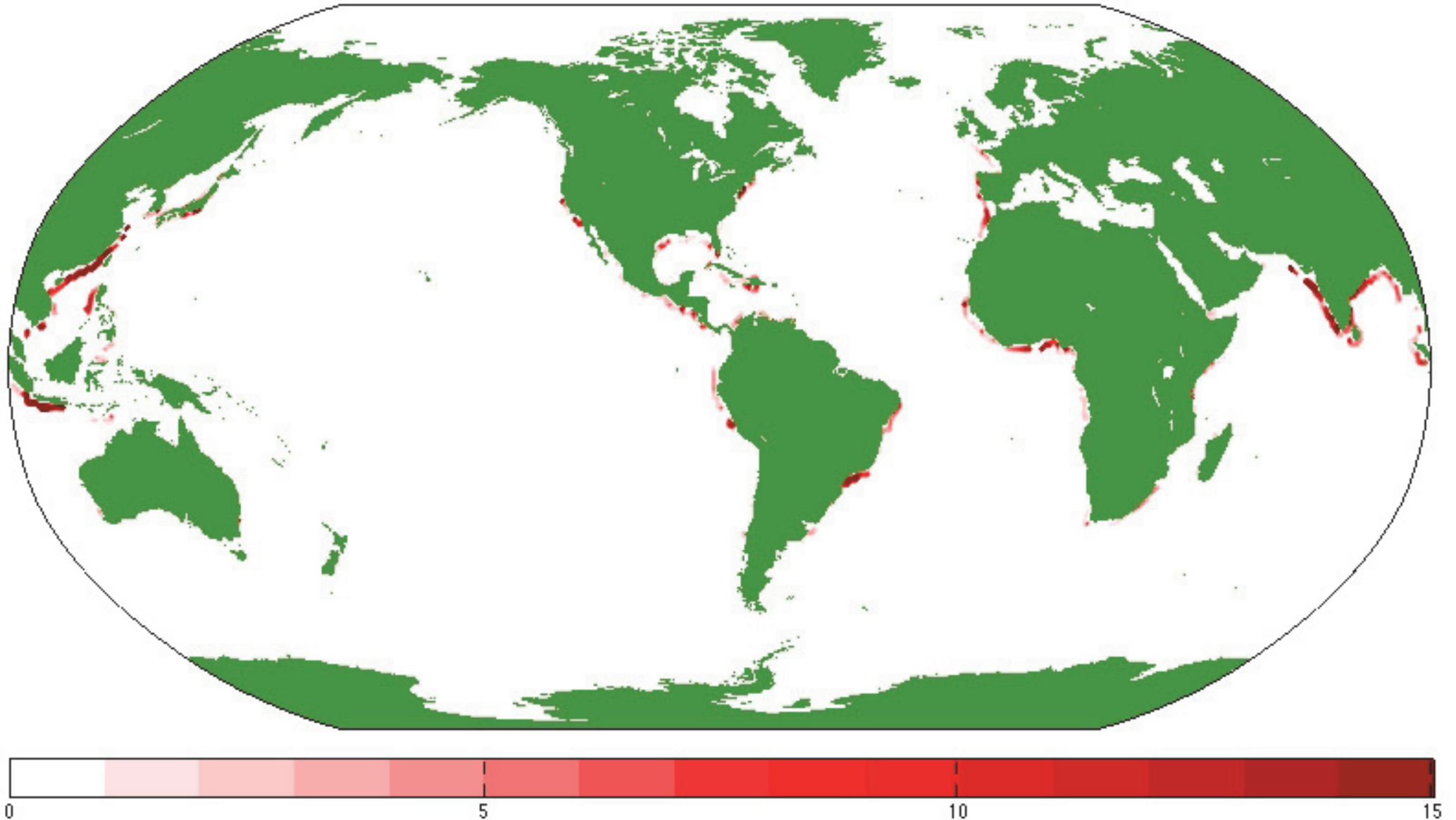
Locations of drifting buoys on 01 Jan 2005



Let's play the (coastal) blame game

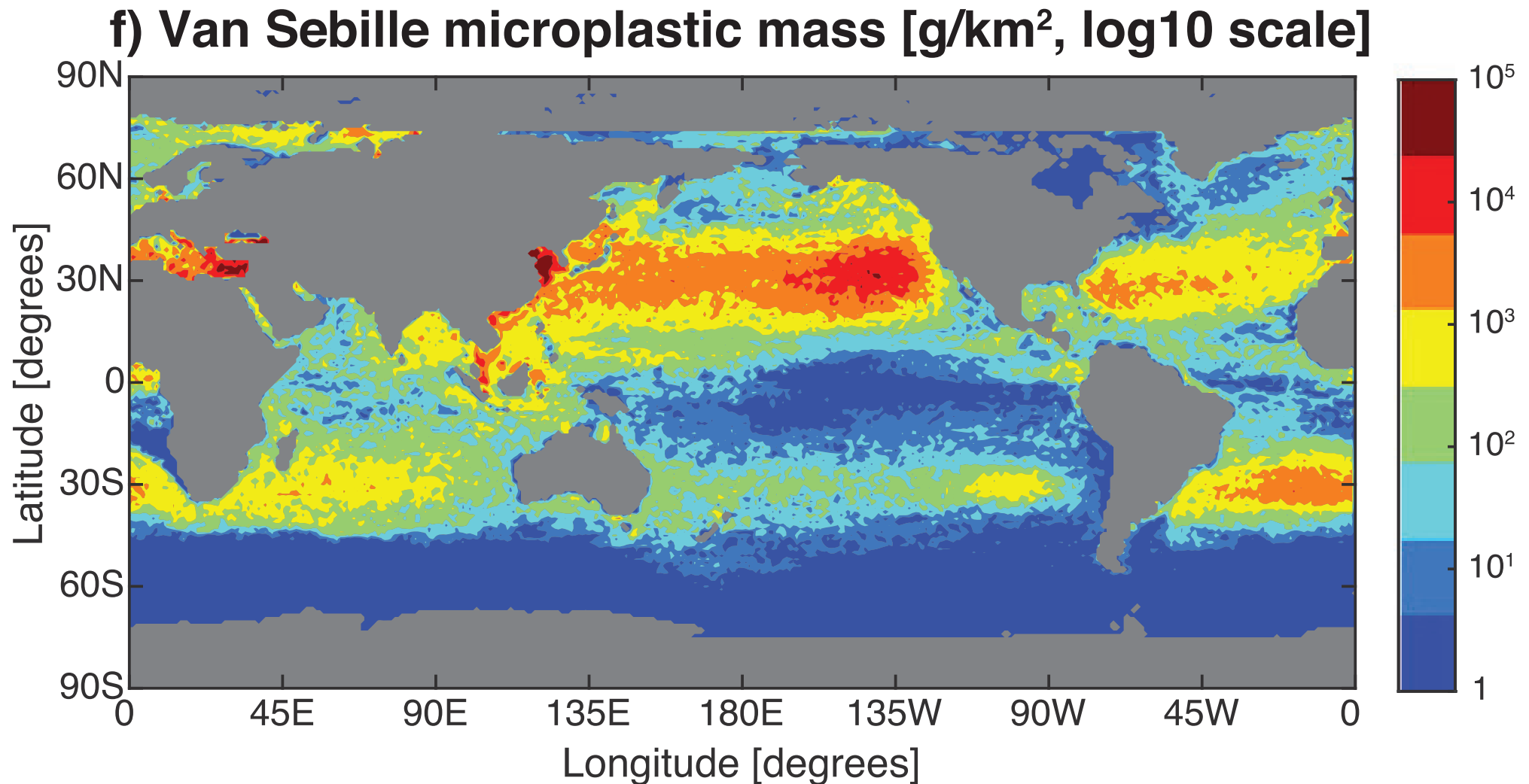
Releasing tracer scaled to coastal population

Tracer accumulation factor 0 years and 00 months after release



Estimating the mass of small floating plastic

Total amount of floating plastic smaller than 20cm



Total amount of 'small' plastic floating on the ocean:
15 to 51 trillion particles; weighing 93 to 236 thousand metric tonnes

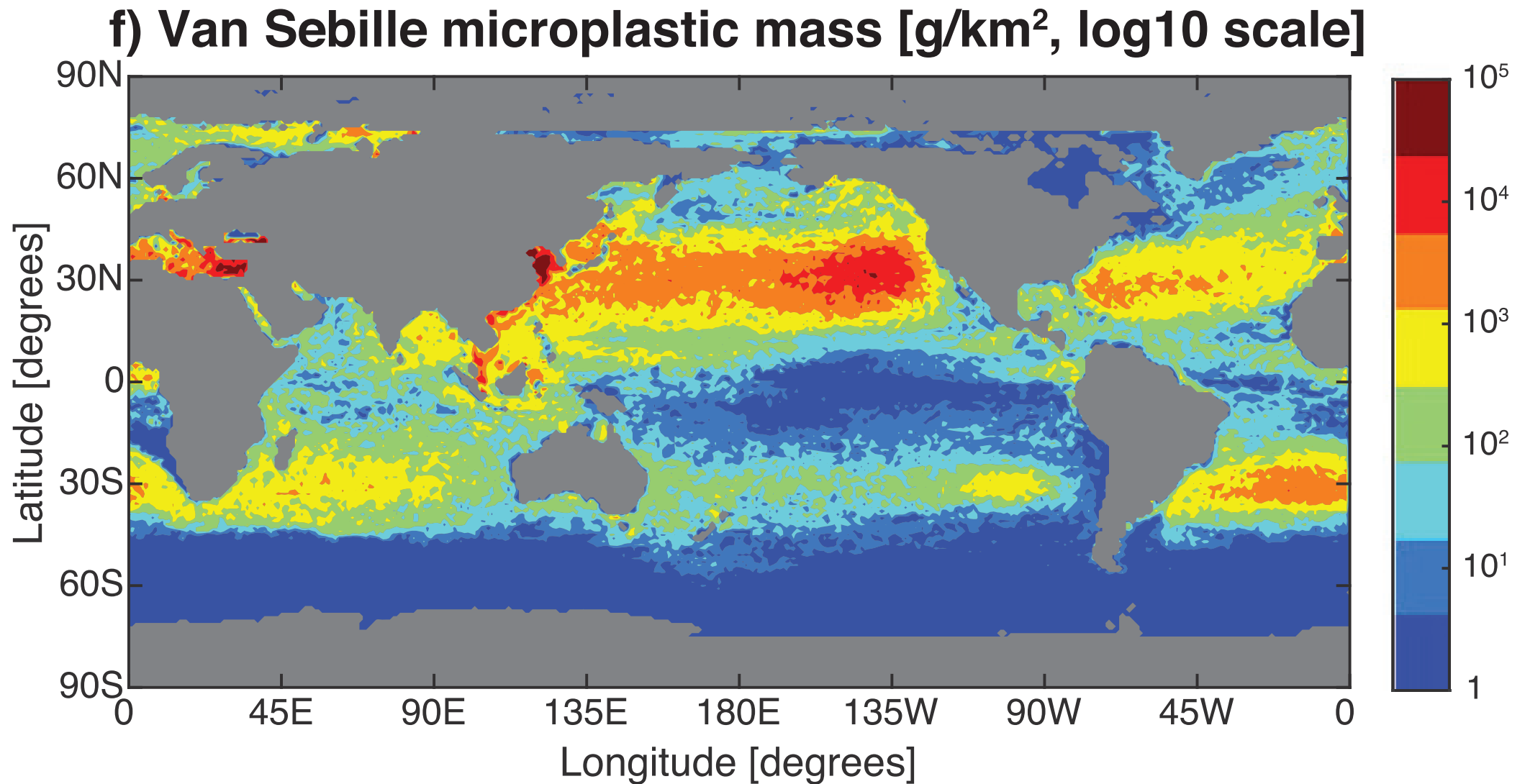
van Sebille, Wilcox, Lebreton, Maximenko, Hardesty, van Franeker, Eriksen, Siegel, Galgani, and Law, 2015, Environ Res Lett

So **plastic is everywhere**
in the ocean

Where does the **plastic** most
impact marine life?

Estimating the mass of small floating plastic

Total amount of floating plastic smaller than 20cm



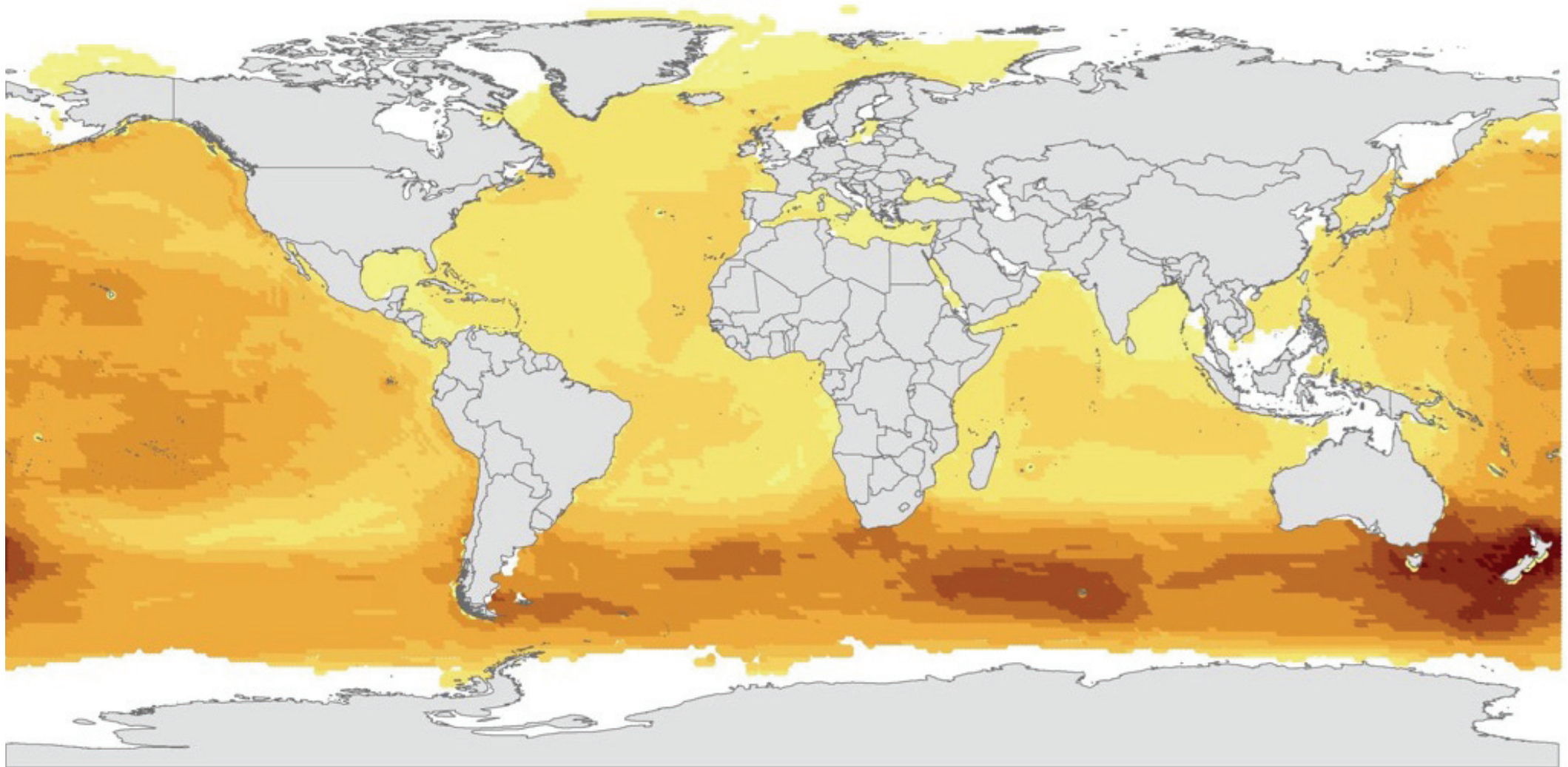
van Seville, Wilcox, Lebreton, Maximenko, Hardesty, van Franeker, Eriksen, Siegel, Galgani, and Law, 2015, Environ Res Lett

Combining seabird distributions with plastic distributions

Map of relative risk of finding seabird species with plastic in gut

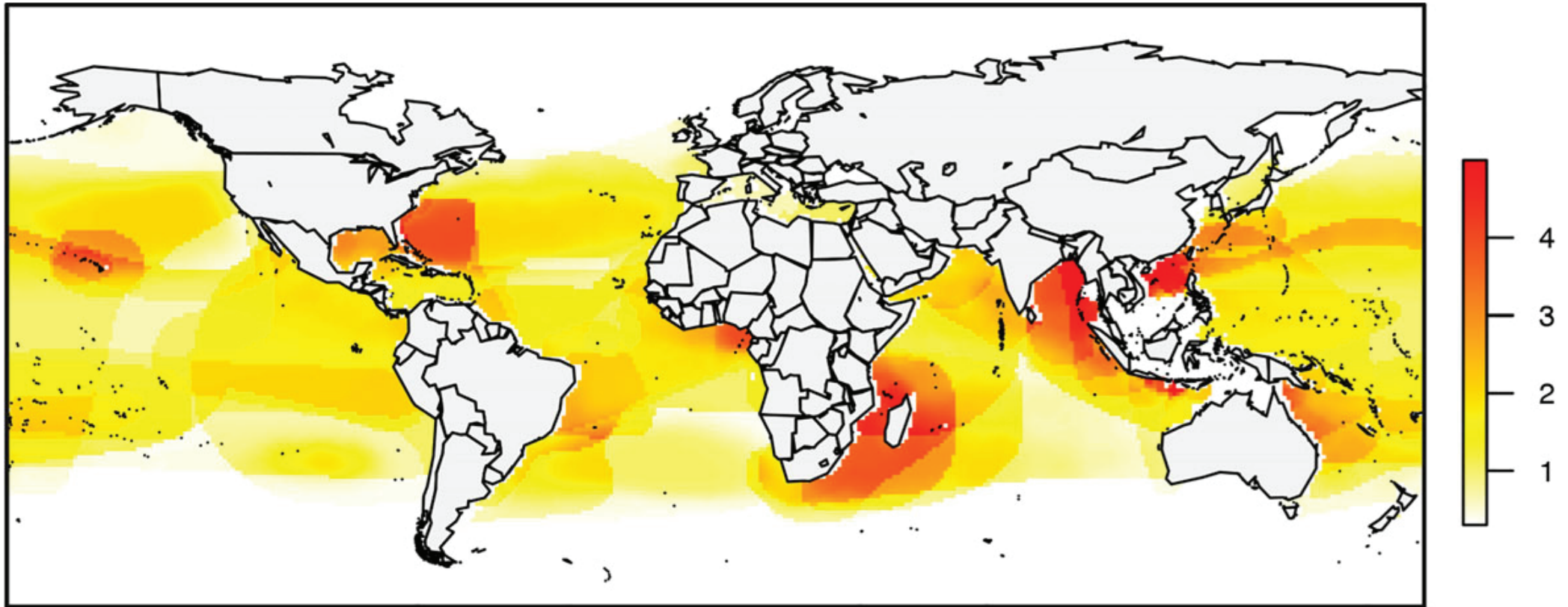
Number of Species

0 - 5 6 - 10 11 - 15 16 - 20 21 - 25 26 - 30 31 - 35 36 - 40 41 - 45 46 - 50



And for sea turtles

Map of relative risk of turtle encountering plastic



Now try yourself at plasticadrift.org

PLASTICADRIFT.ORG

Home

How do we know?

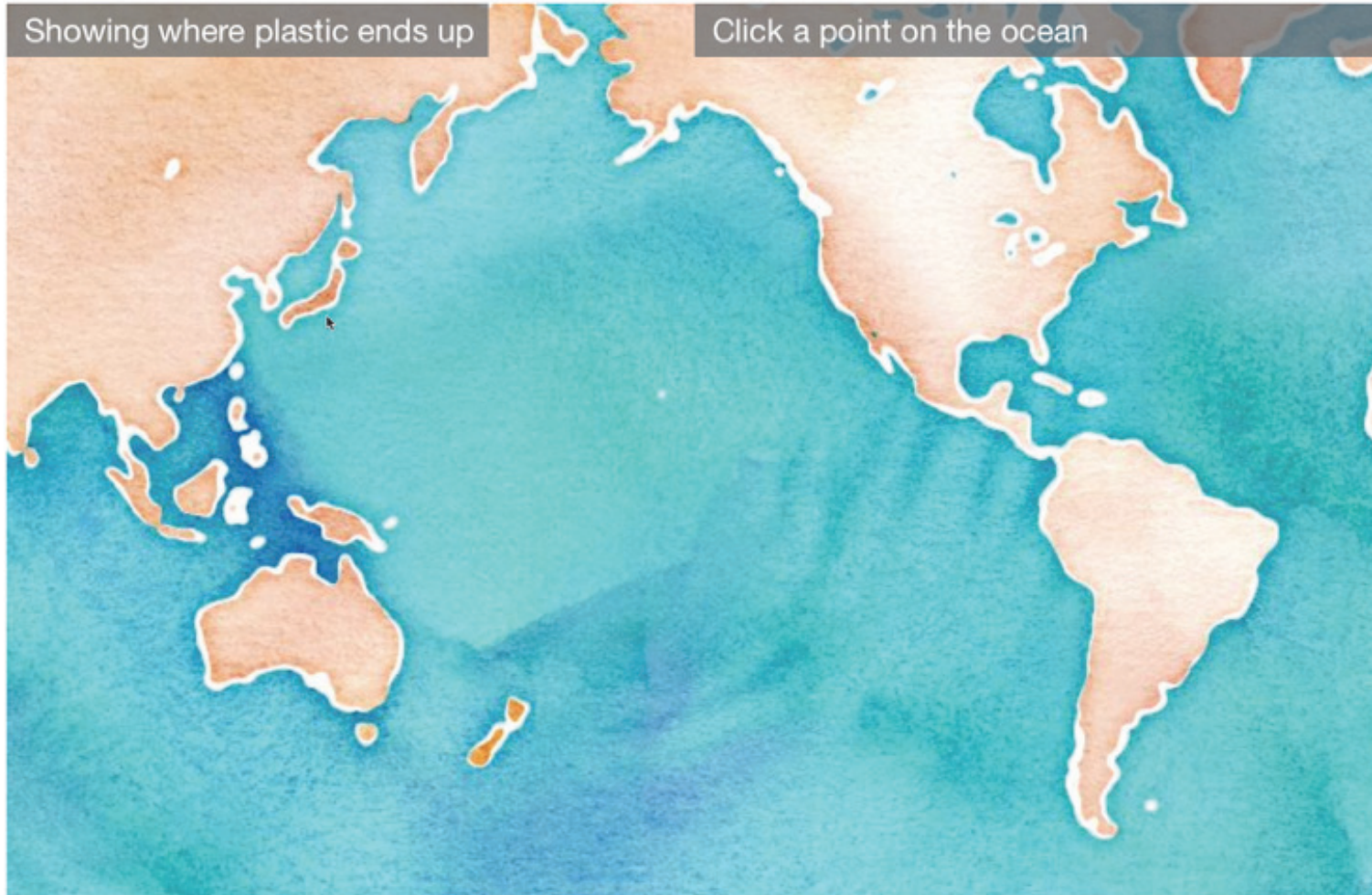
FAQ

Team

Duckies & Other Plastic

Showing where plastic ends up

Click a point on the ocean



You are welcome and free to use the data in the file above for your scientific work. I just ask that you cite this scientific article in any publications that use the data. Both the data and the paper are licensed under a Creative Commons Attribution-NonCommercial-ShareAlike license. If you have any questions on how to use the data, please contact me

Imperial College
London

Data Science
Institute

