



# 5GYRES

[WWW.5GYRES.ORG](http://WWW.5GYRES.ORG)



**IDEALISM**  
(Throw Away Living, Life Magazine, 1955)







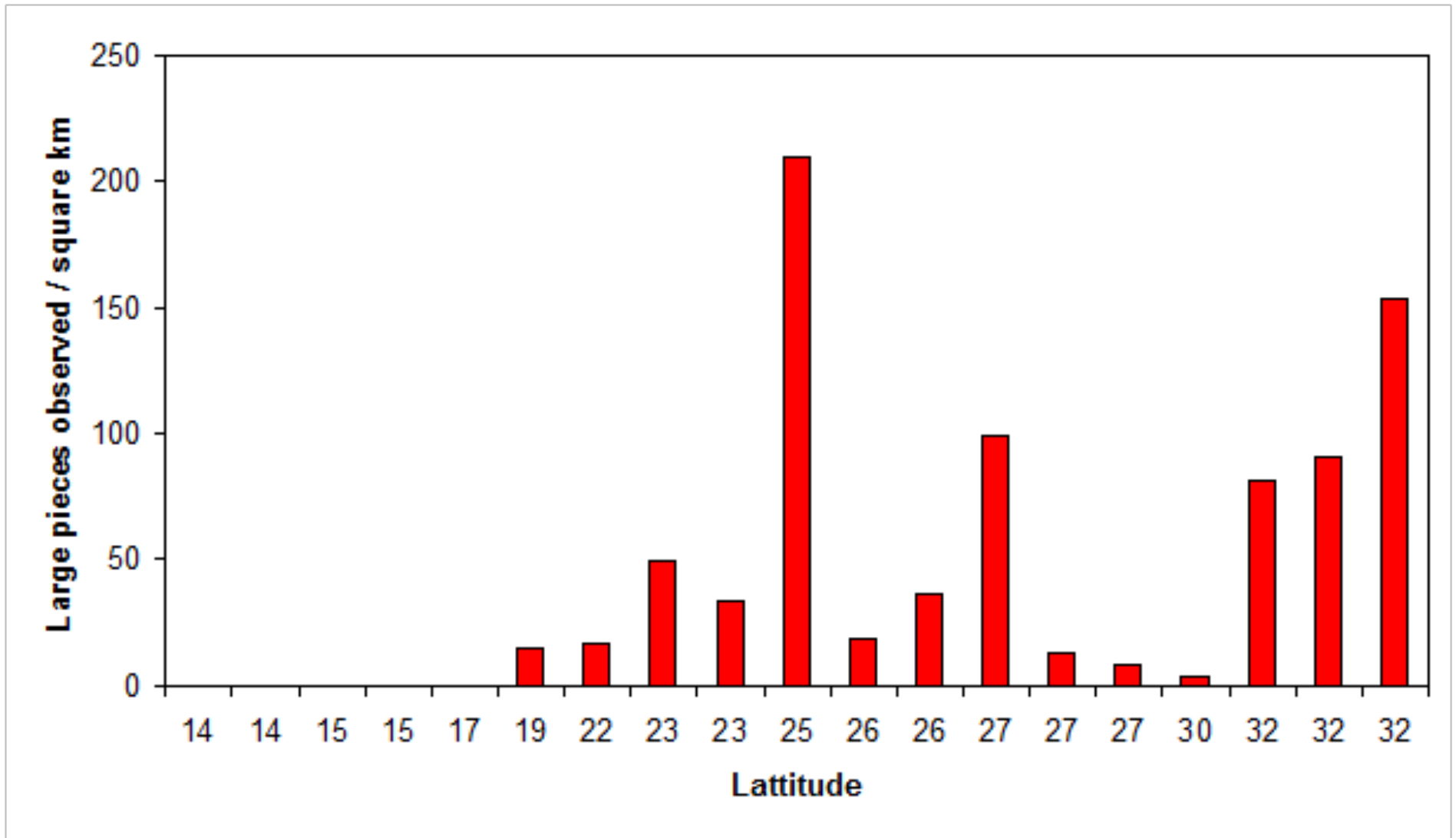


WESTERN NPG EXPEDITION 2012 – Majuro Atoll to Tokyo, Japan







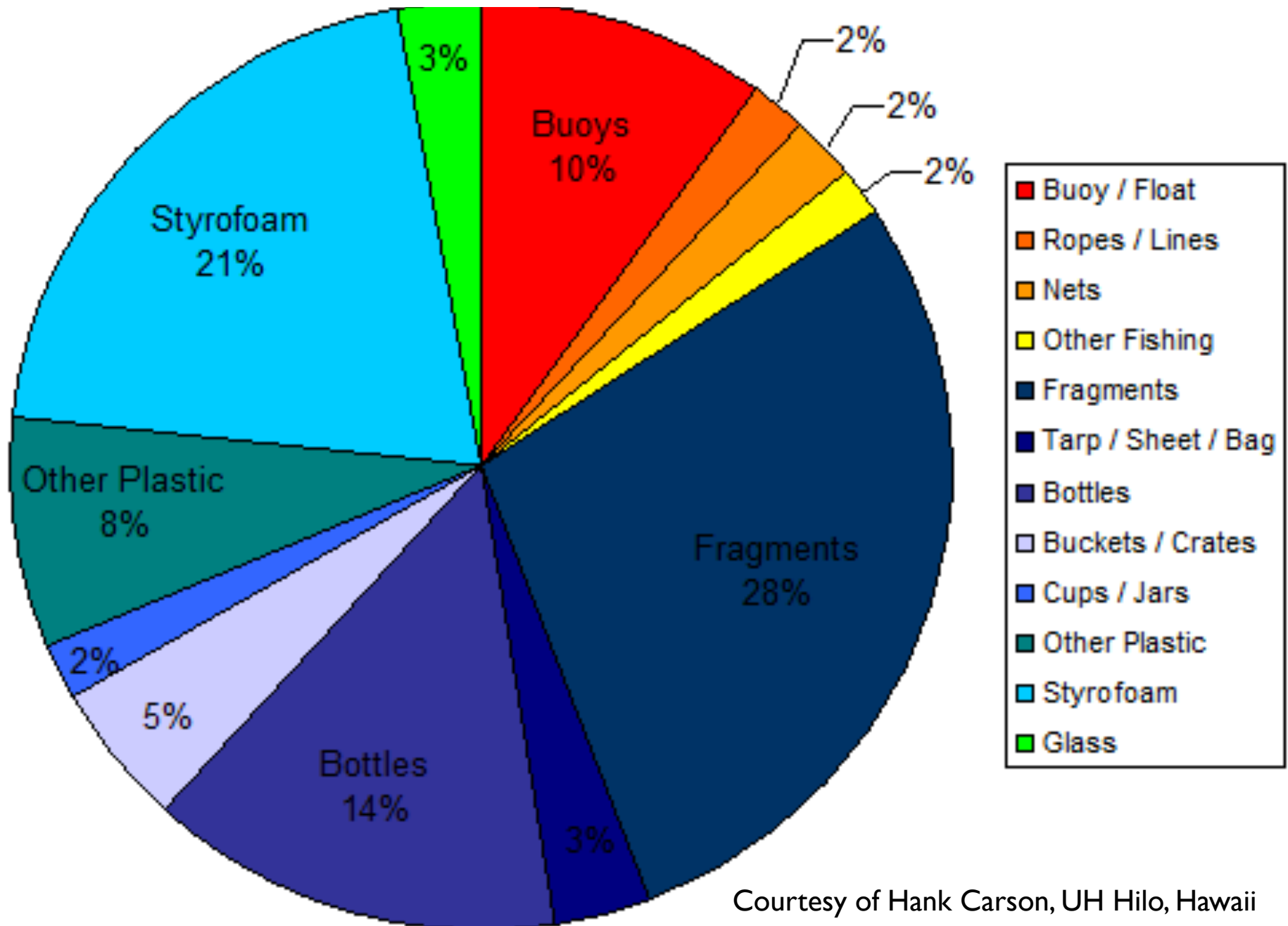


Courtesy of Hank Carson, UH Hilo, Hawaii



IN 20 hrs of timed observations we saw 151 pieces

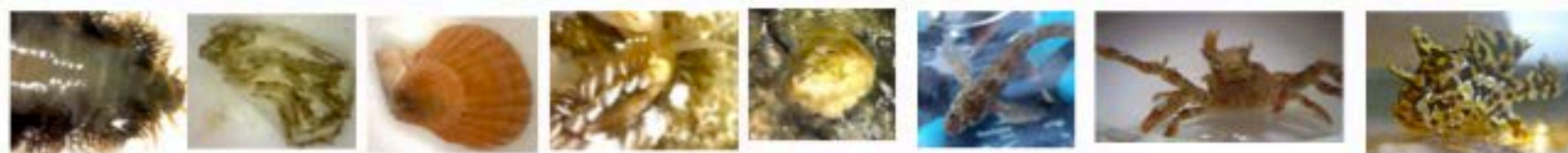












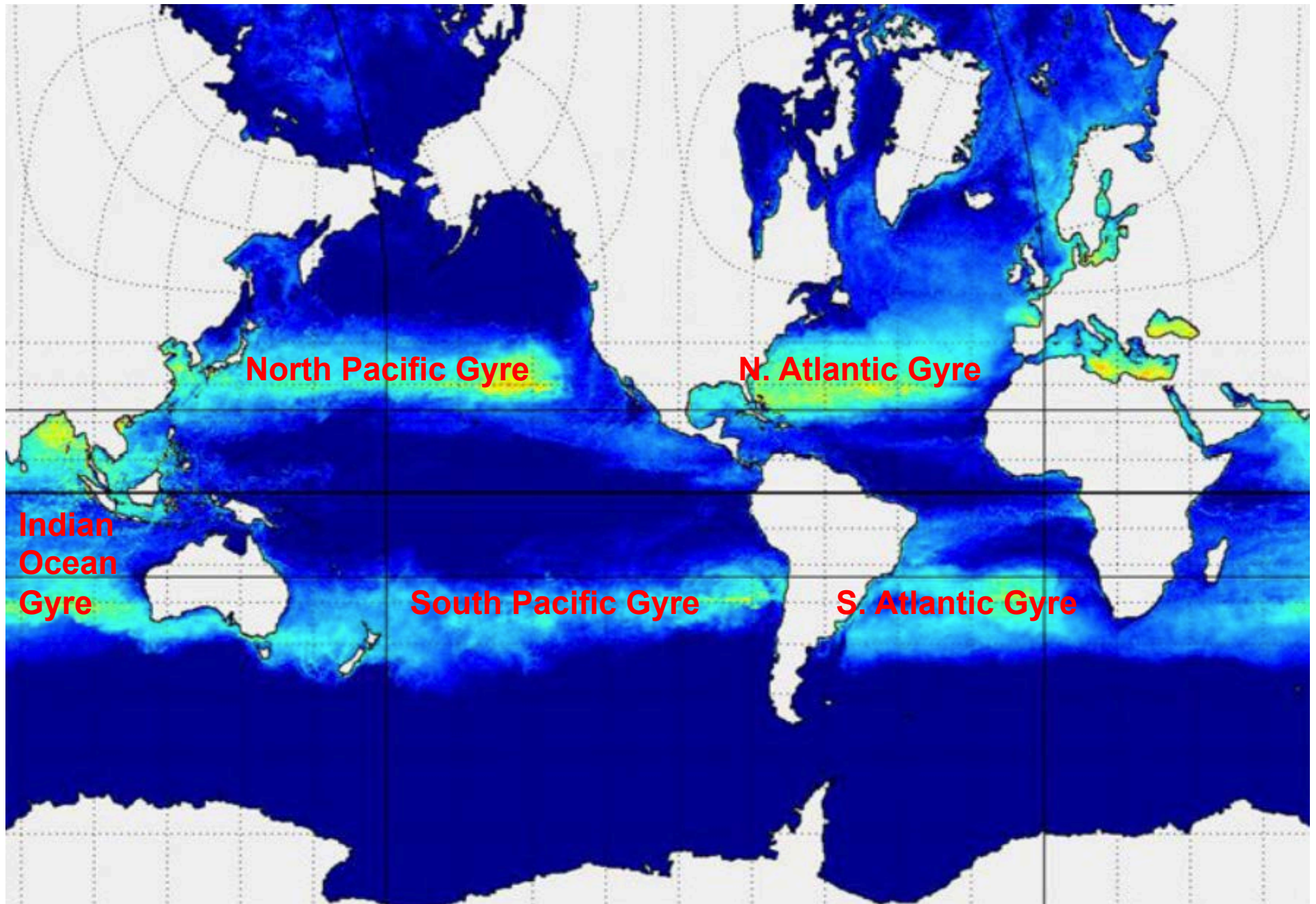
**THE NEW REEF**  
North Pacific Expedition 2012  
325 pound tangled net  
89 different types of line  
133 different plastic pieces  
36 species macrofauna  
3 entangled fish

# GLOBAL DISTRIBUTION OF PLASTIC POLLUTION



5GYRES





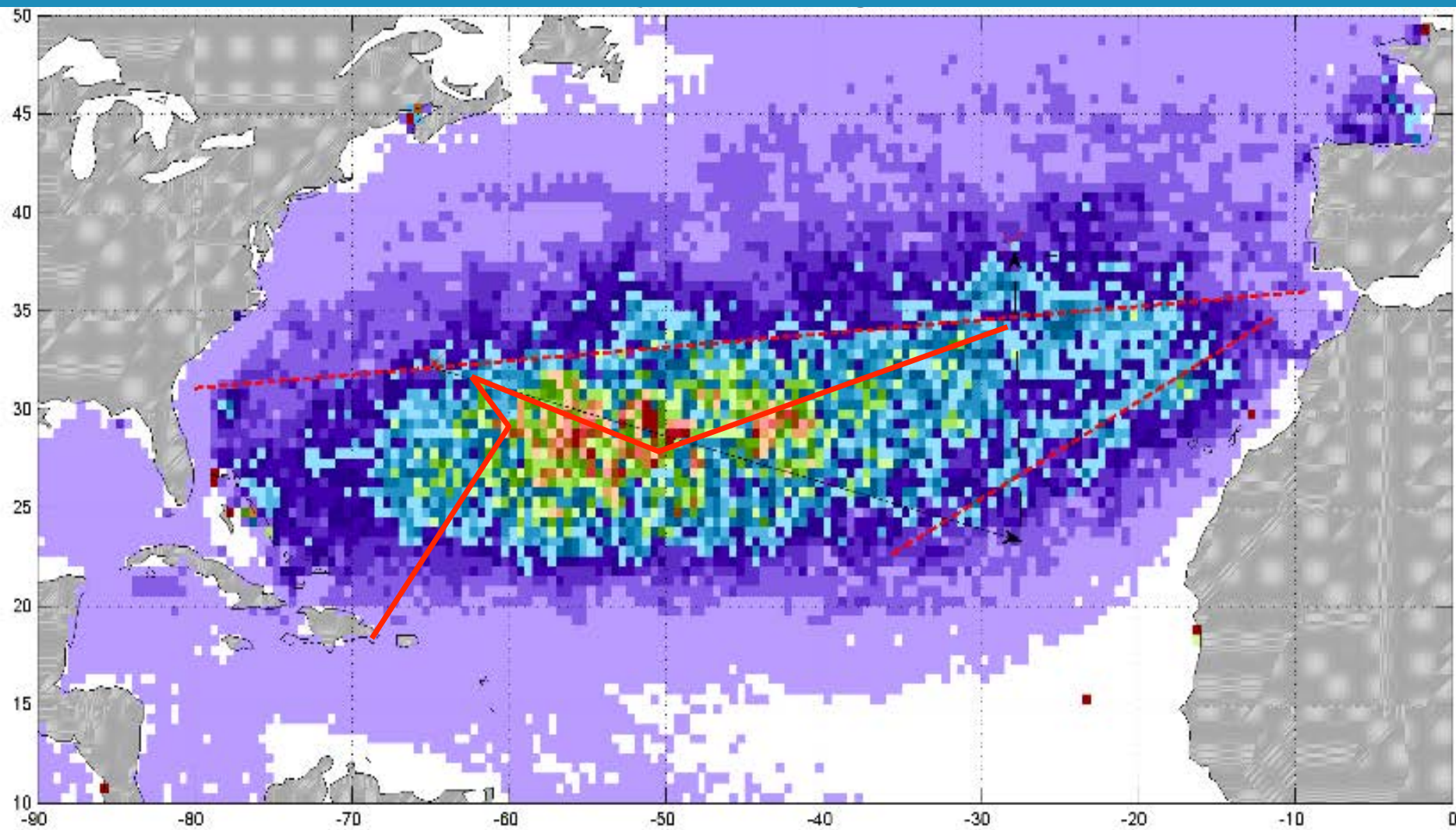
Plastic Pollution Accumulation Zones (Lebreton et al., Mar. Pol. Bul., 2012)





North Atlantic Gyre





North Atlantic Gyre

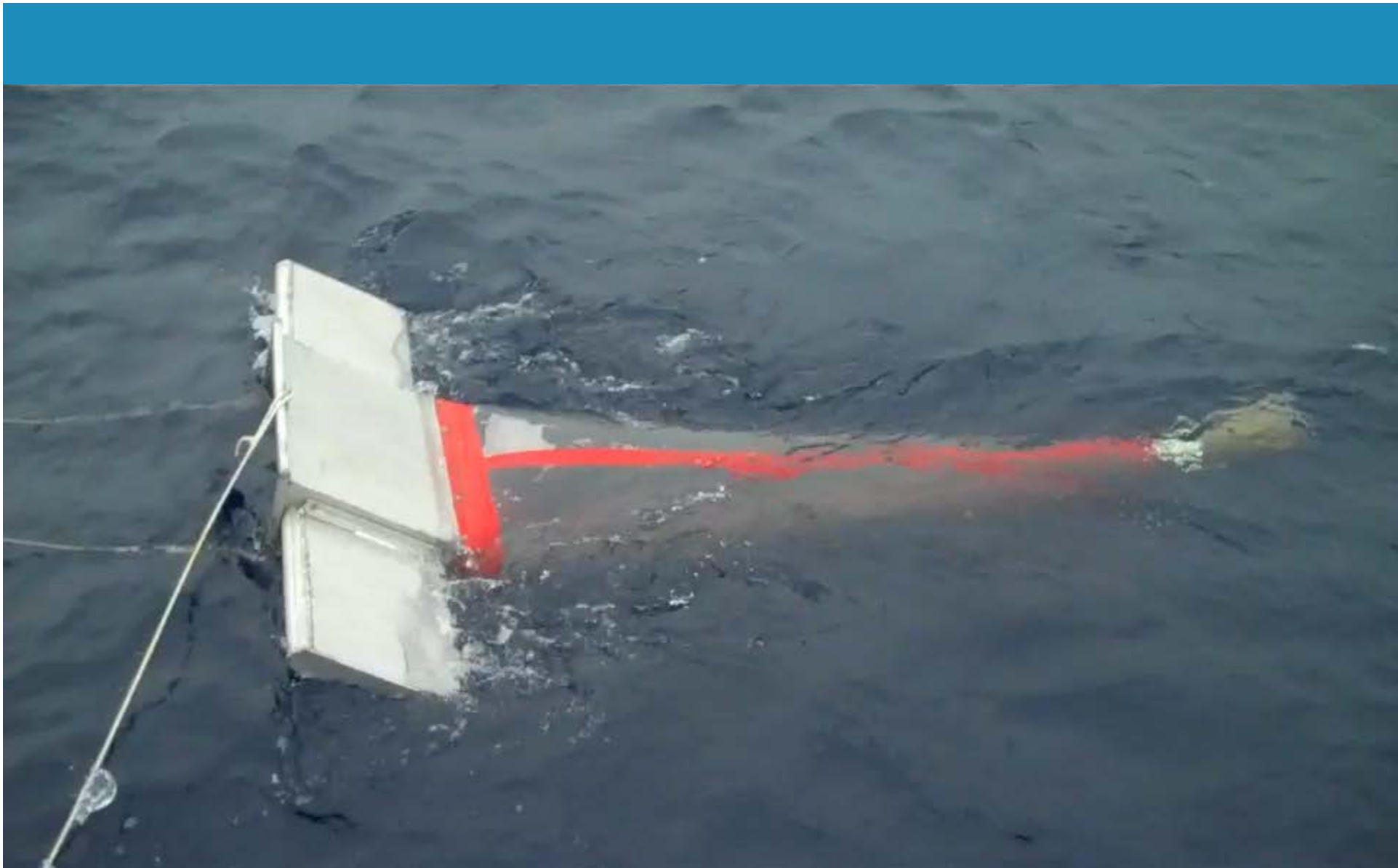




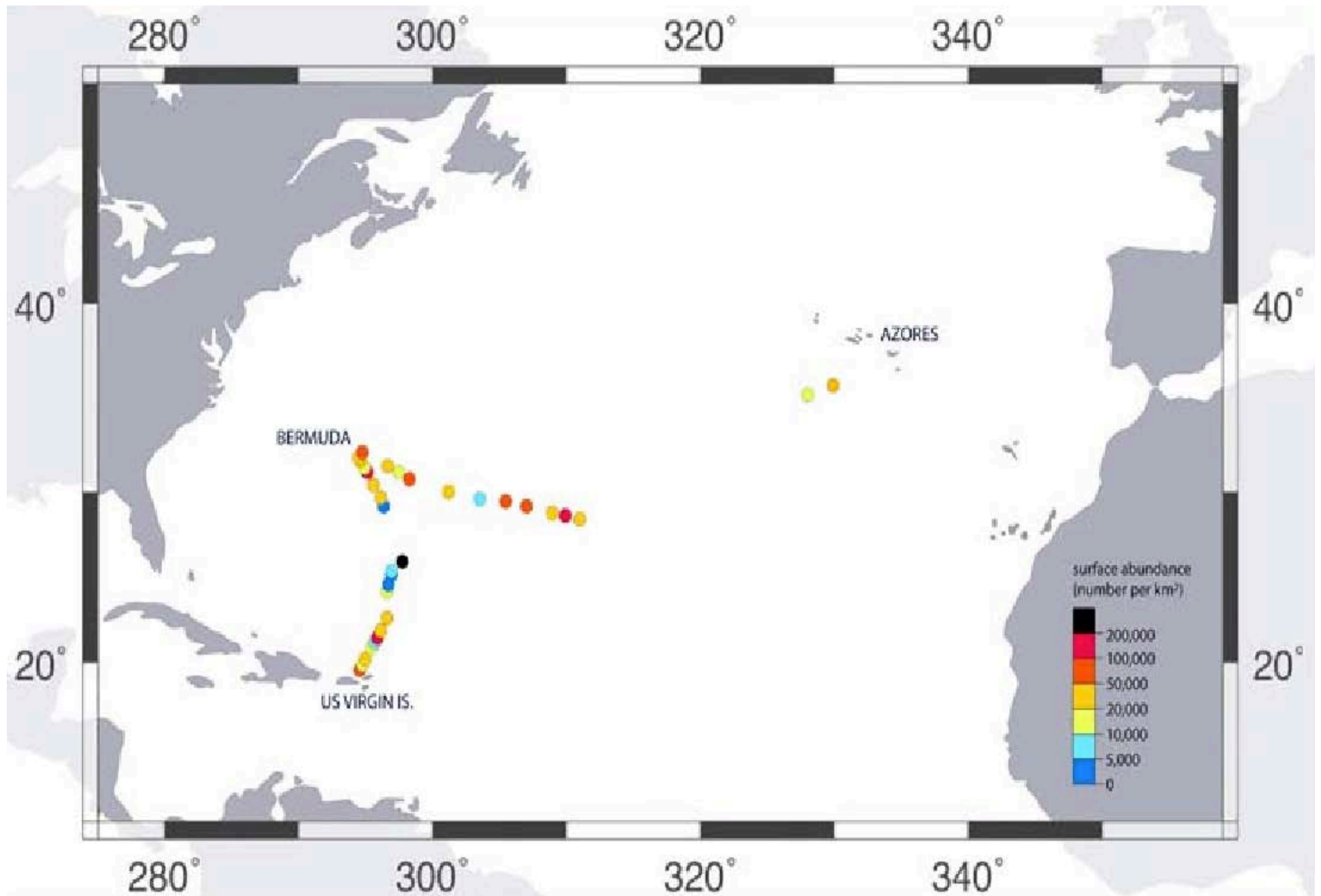
5GYRES

North Atlantic Gyre - Mats of sargassum trap plastic



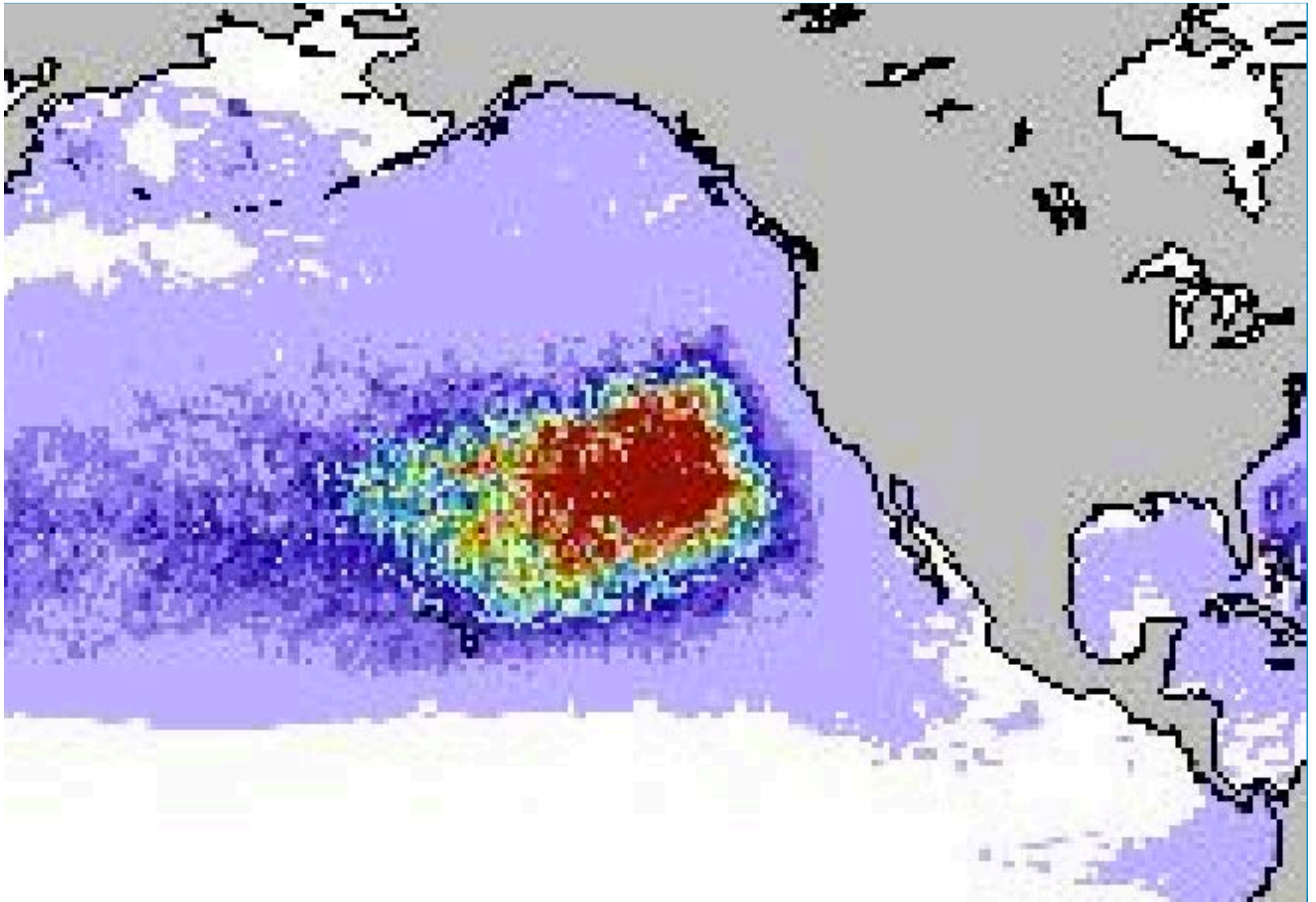


SGYRES



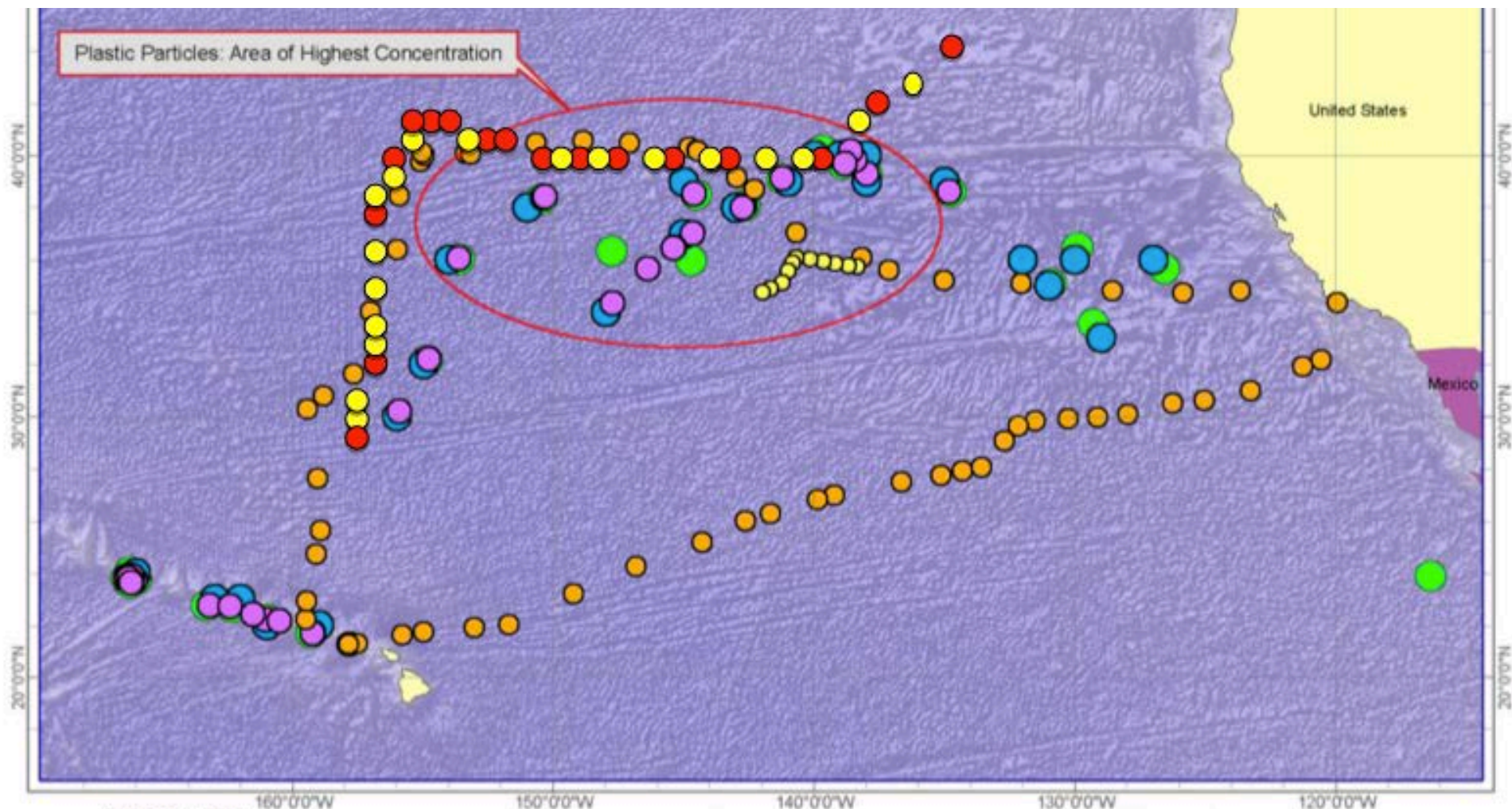
North Atlantic Gyre





North Pacific Gyre – 2008





## Overview Map of Study Area

### Collection Sites GPS Locations

- Gyre 1999 Manta Trawls
- Gyre 2000 Manta Trawls
- Gyre 2002 Manta Trawls
- Gyre 2002 Bongo 10m Trawls
- Gyre 2002 Bongo 30m Trawls
- Gyre 2011 Manta & ● Hi-Speed Trawls



0 125 250 500 750 1,000 Nautical Miles

Data Sources: Algalita Marine Research Foundation, ESRI, and ETOPO

Map Prepared by Veronica Rojas August 17, 2005



5GYRES

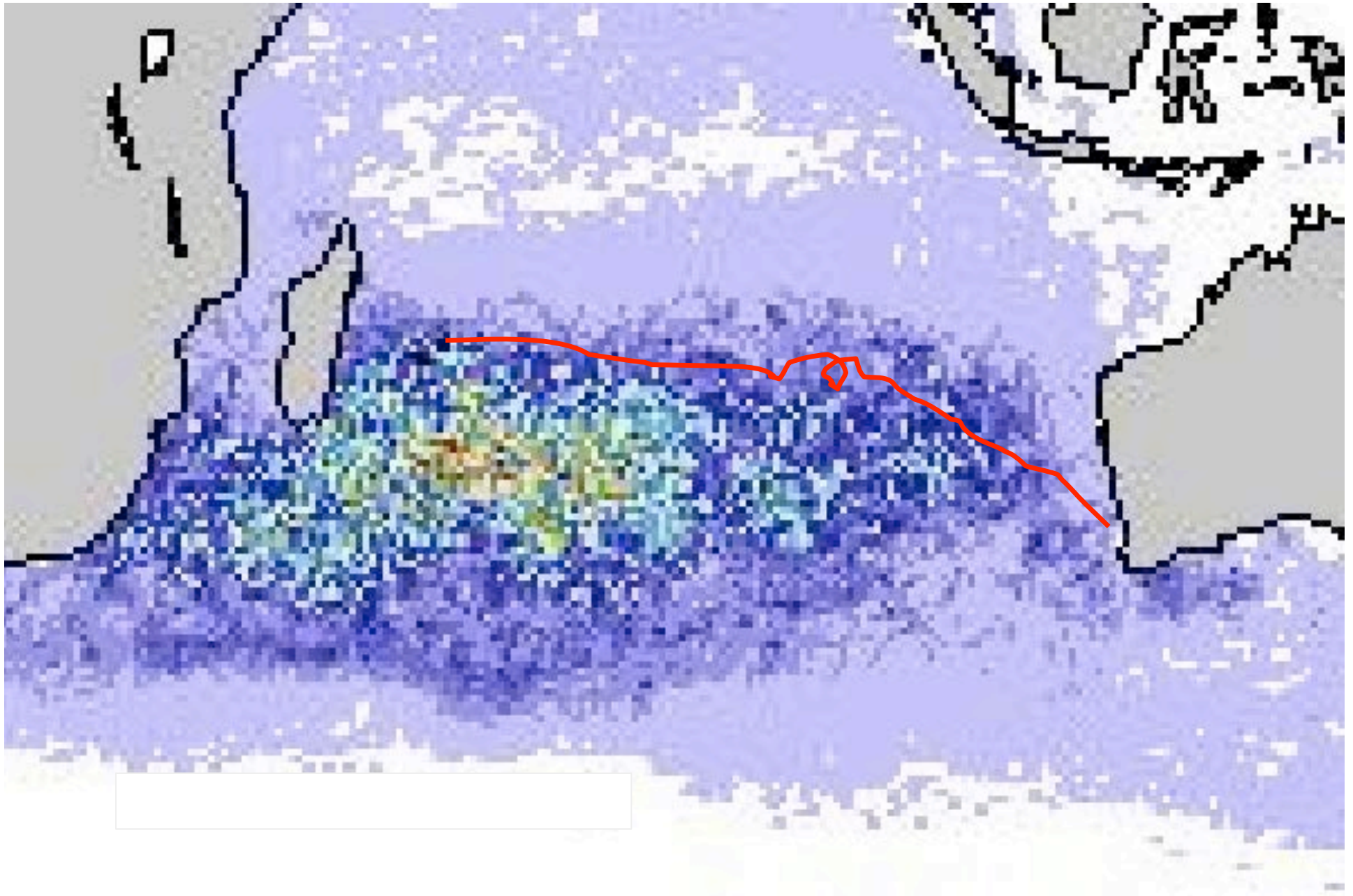
# North Pacific Gyre





North Pacific Gyre



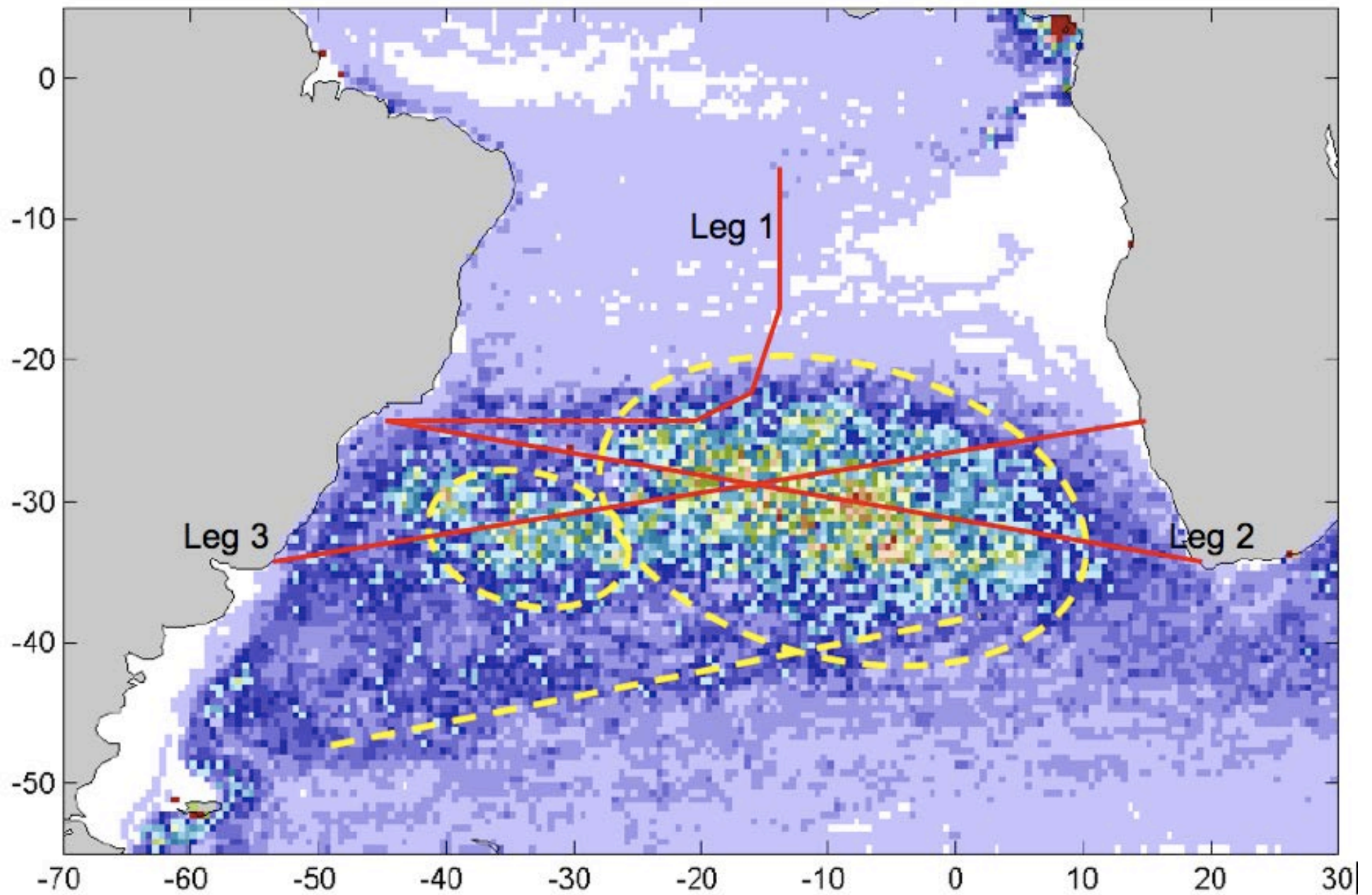


Indian Ocean Gyre





Indian Ocean Gyre



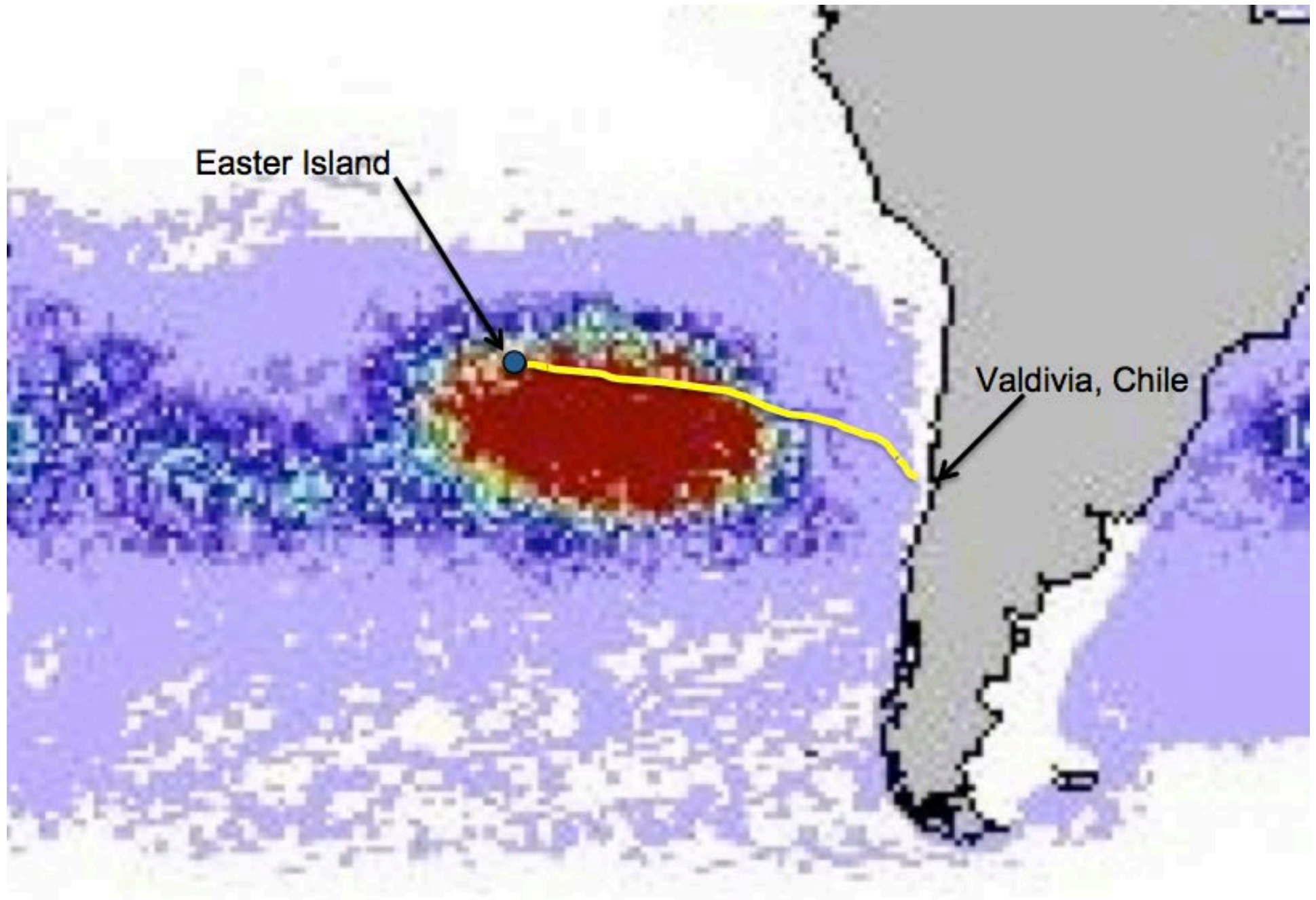
South Atlantic Gyre





South Atlantic Gyre





South Pacific Gyre



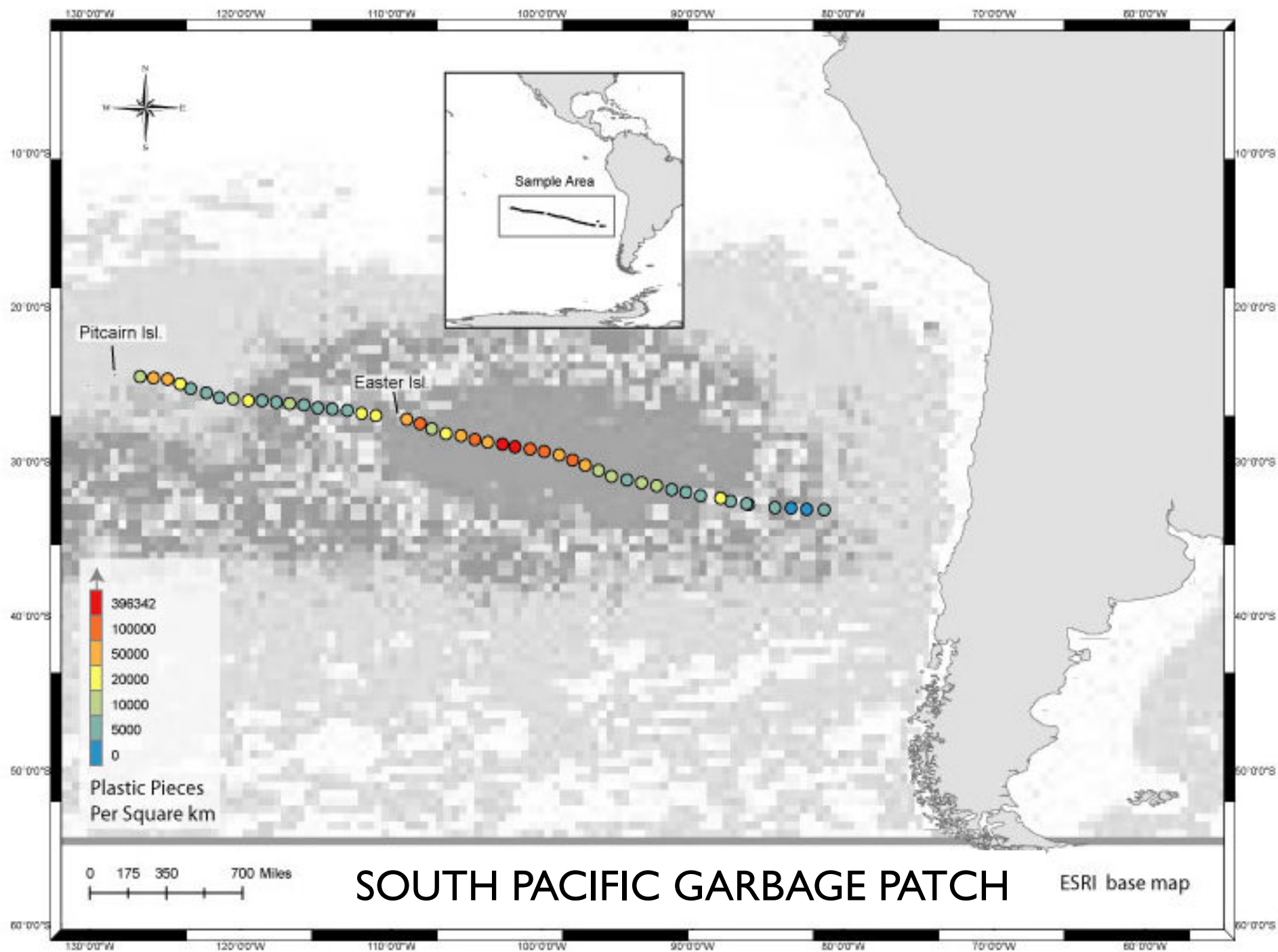


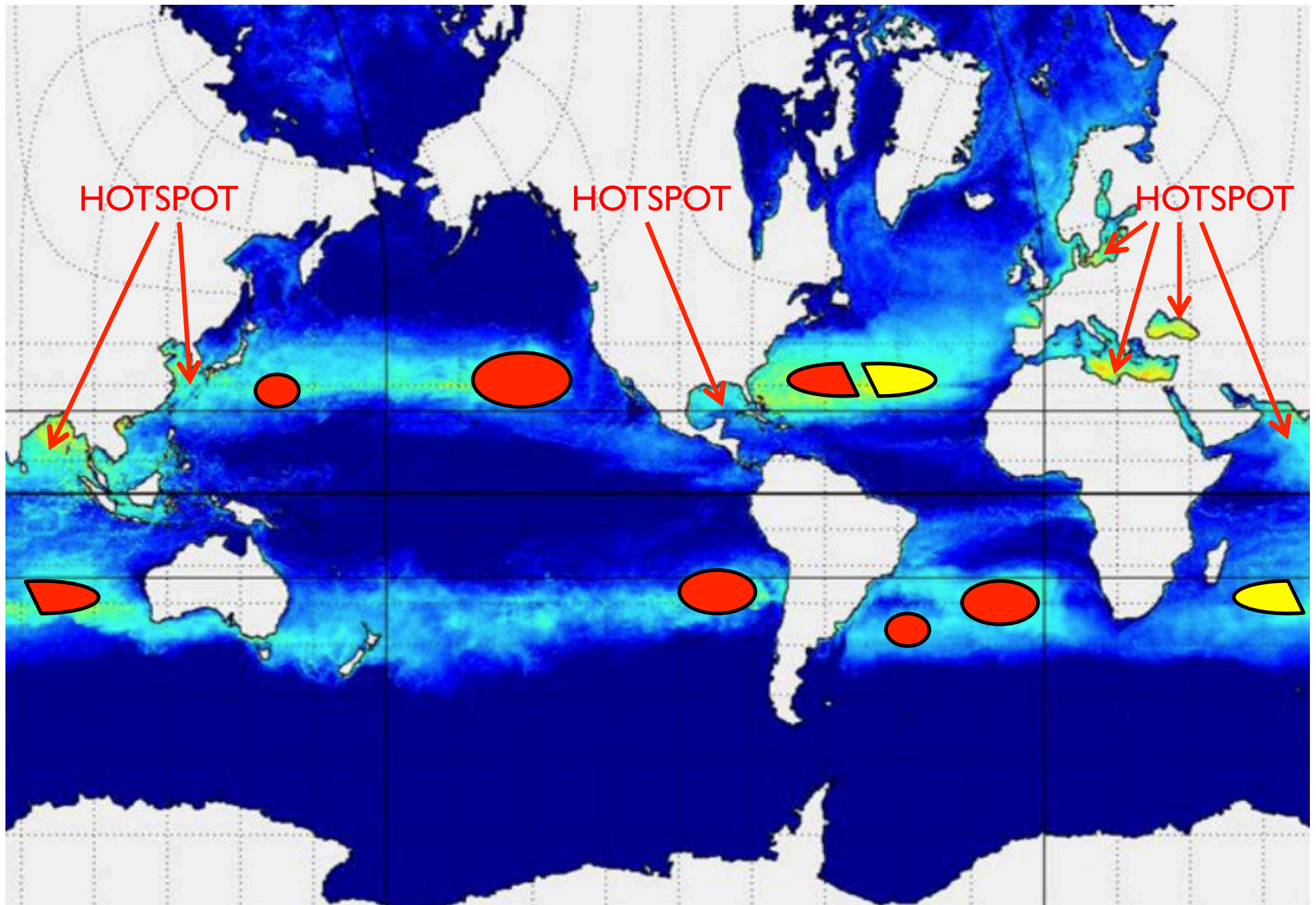




South Pacific Gyre







## GARBAGE PATCHES AND HOTSPOTS



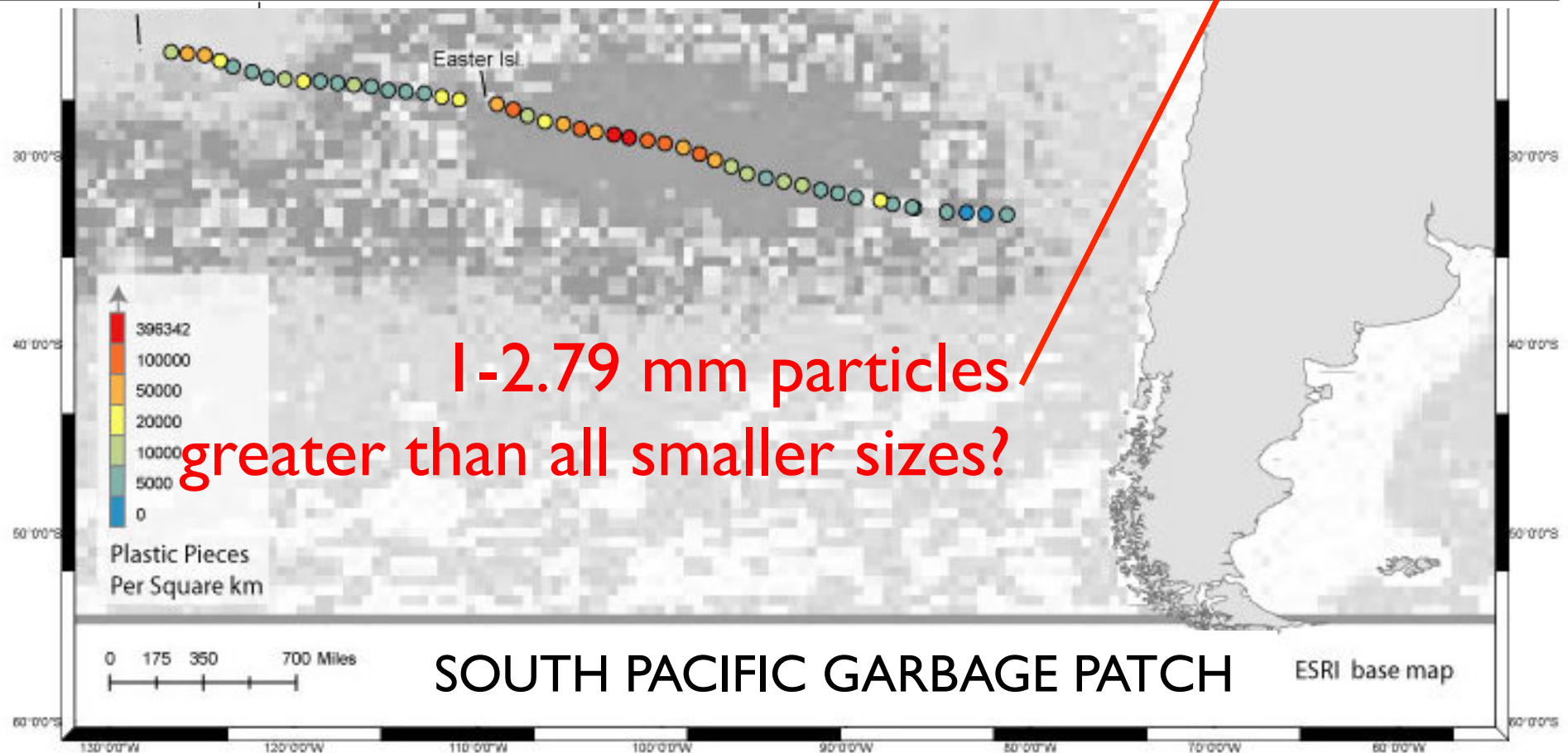
# FATE OF PLASTIC POLLUTION IN THE MARINE ENVIRONMENT



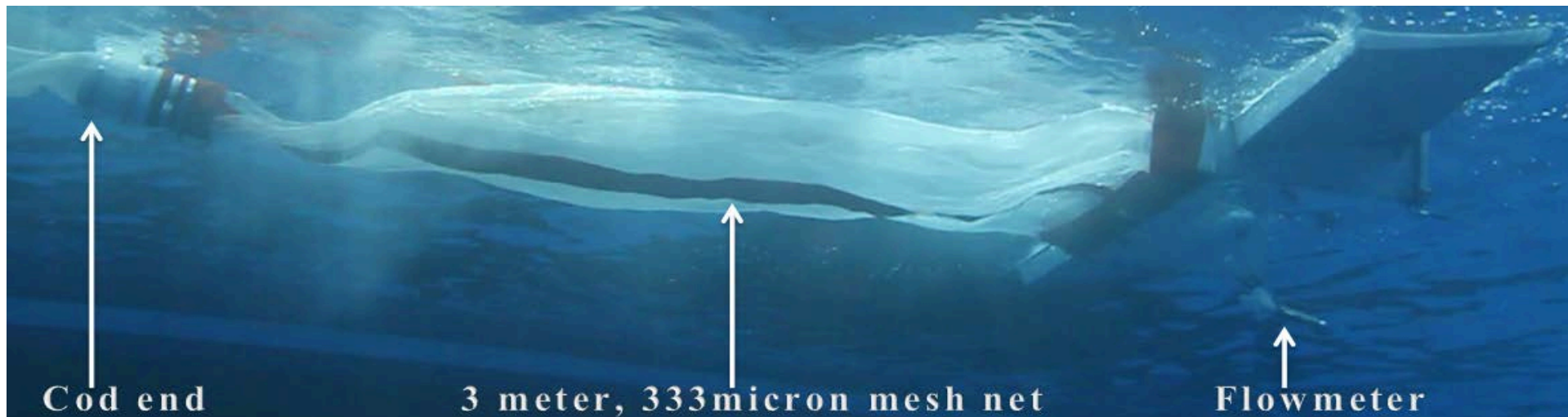
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# Samples 1-48 : Average Count Density

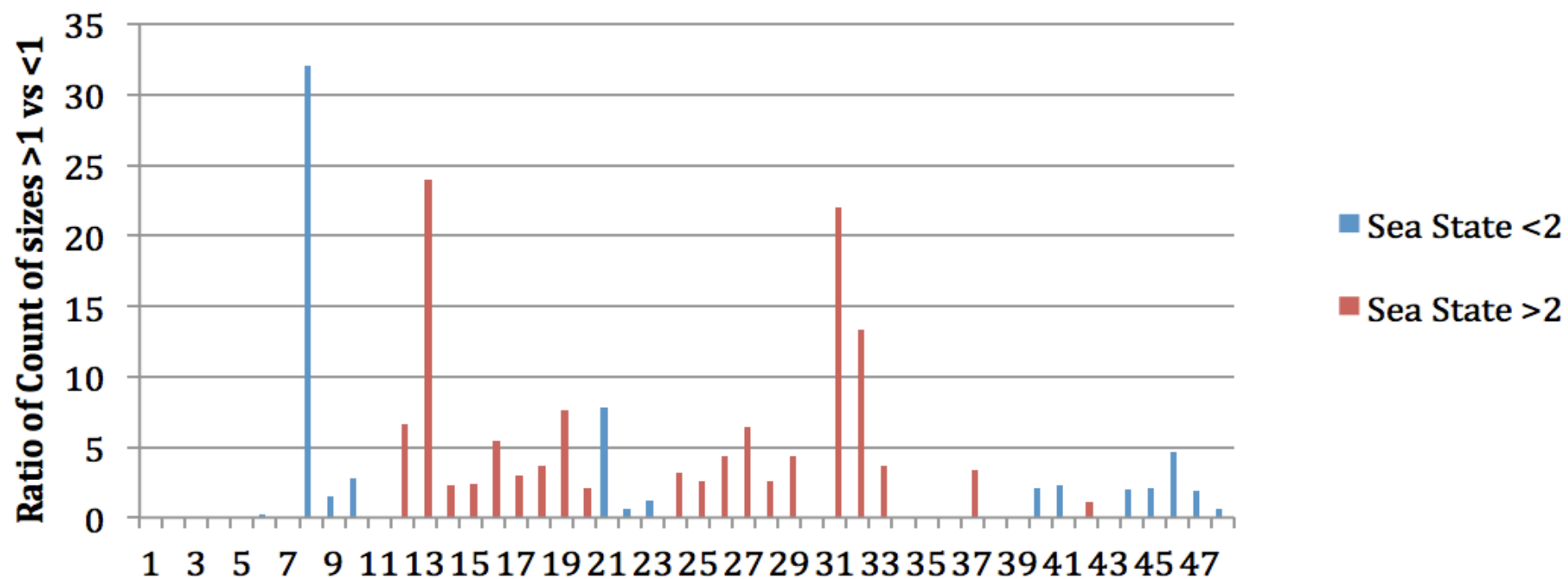
	Fragment	Pellet	Line	Film	Foam	TOTAL
>4.75mm	351.93	6.38	1879.73	161.71	0	2399.76
2.80-4.749 mm	2407.49	347.01	687.10	333.04	0	3774.65
1.00-2.79 mm	9612.69	180.58	804.19	591.79	0	11189.27
0.710-0.999 mm	3374.94	41.55	188.62	250.02	0	3855.14
0.500-0.709 mm	2910.44	17.93	55.17	0	0	2983.54
0.355-0.499 mm	2689.33	0	6.83	0	0	2696.16
	21346.84	593.47	3621.66	1336.57	0	







**Ratio of particle count >1 vs <1 compared to sea states  $\leq 2$  (Blue) and > 2 (Red)**

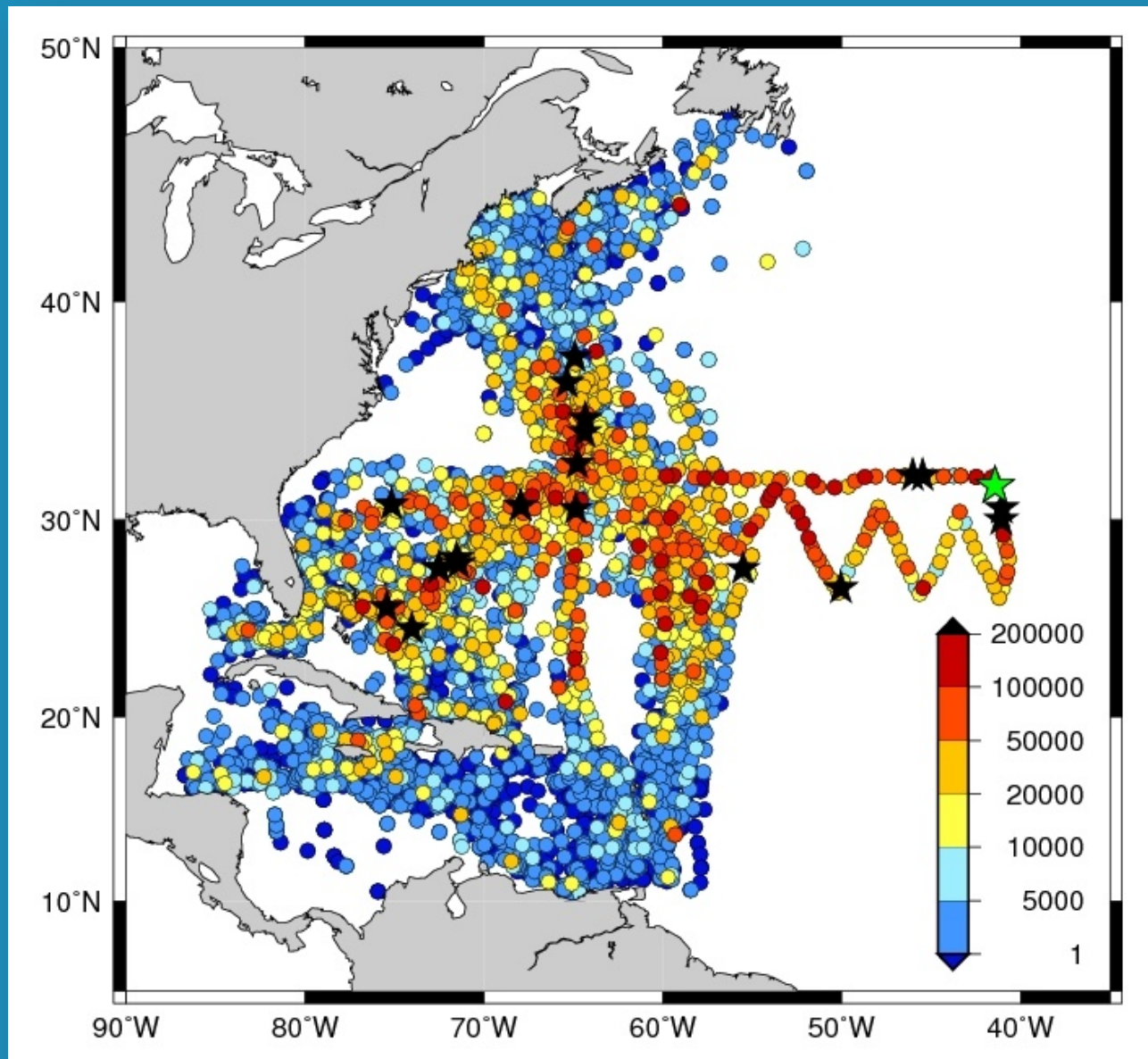






UV DEGRADATION & EMBRITTLEMENT



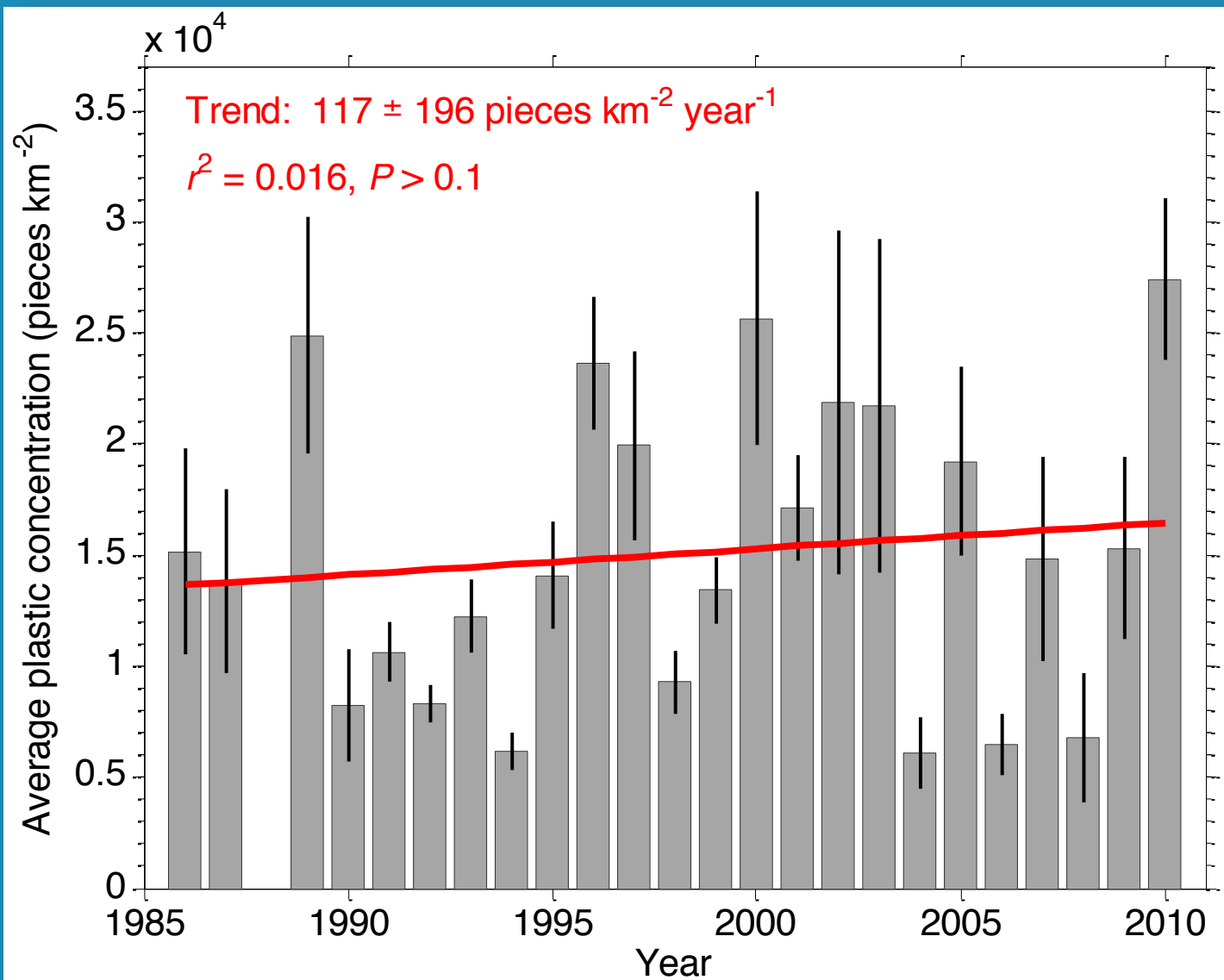


[www.sea.edu](http://www.sea.edu)

Courtesy of SEA Education Association – Woods Hole, MA



6000 surface tows in the North Atlantic spanning 22 years



[www.sea.edu](http://www.sea.edu)

Courtesy of SEA Education Association – Woods Hole, MA



No significant increase in 22 years





WASHED ASHORE - Azores, North Atlantic





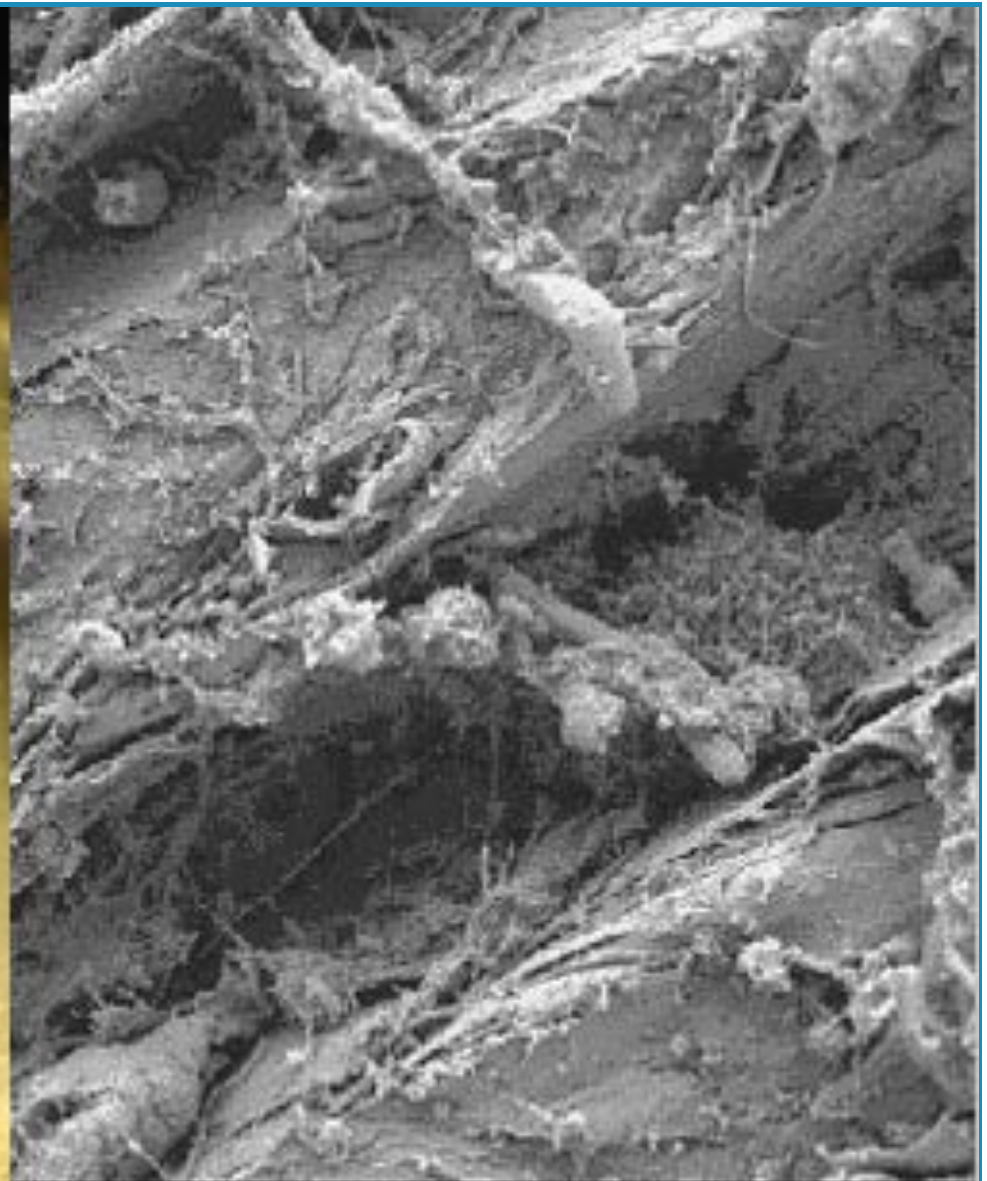
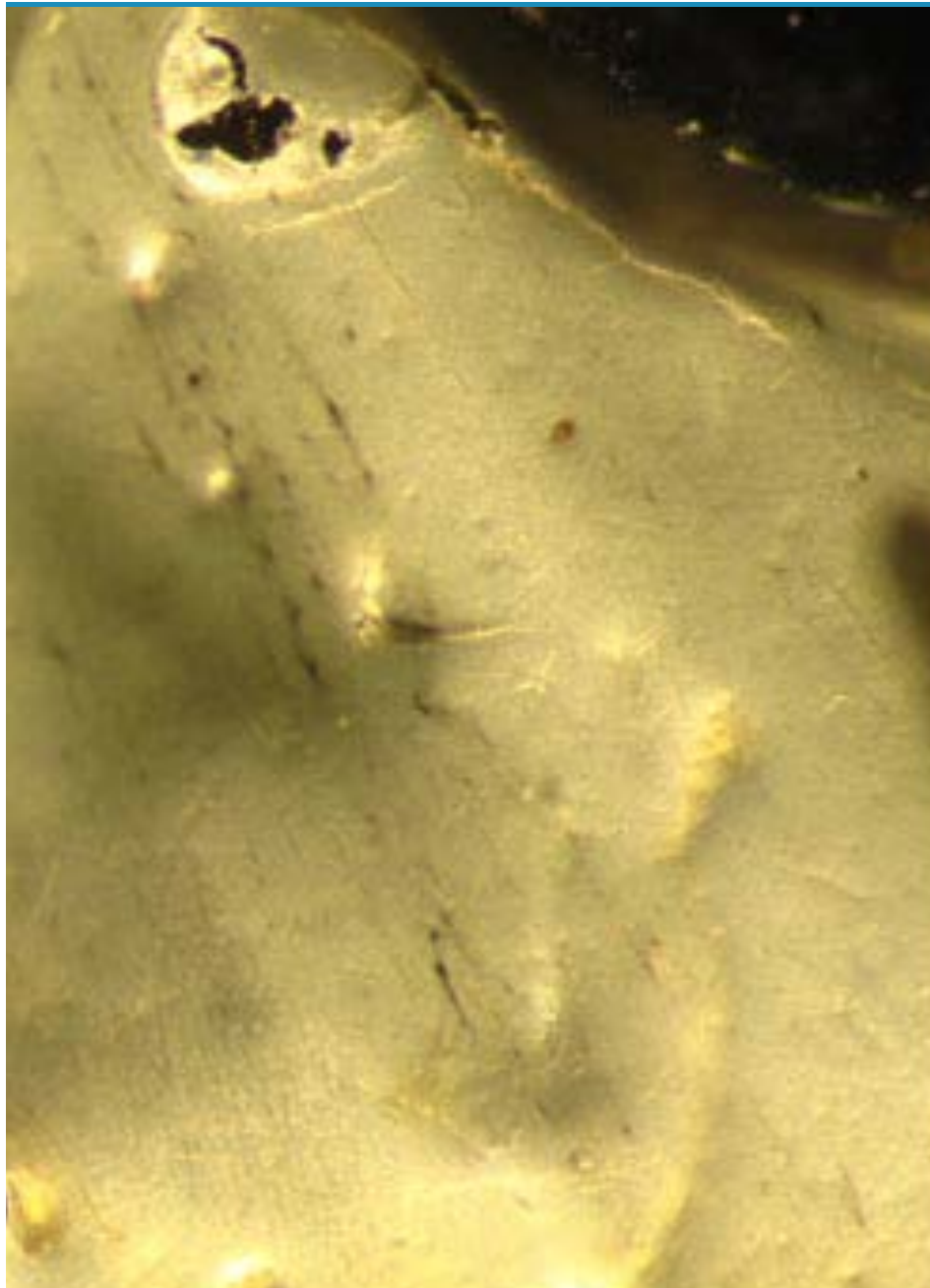
WASHED ASHORE - Easter Island, South Pacific





DOES INGESTION, ENTANGLEMENT, BIOMASS = NEGATIVE BUOYANCY





10  $\mu\text{m}$  Width = 97.21  $\mu\text{m}$  EH1 = 2  
File Name = bag08.tif WD = 8



MICOBIAL DECOMPOSITION AT SEA



# SUMMARY OF THE PROBLEM OF PLASTIC POLLUTION





GLOBAL DISTRIBUTION, INGESTION, VECTOR FOR POPs





LITTER AND DESIGN PROBLEM









WASTE MANAGEMENT PROBLEM





YAMUNA RIVER – New Delhi, India











# Plastic Pollution is a Petroleum Spill



But unlike most oil spills, Plastic Pollution is:  
Non-biodegradable  
Occurs in international waters  
No corporate responsibility

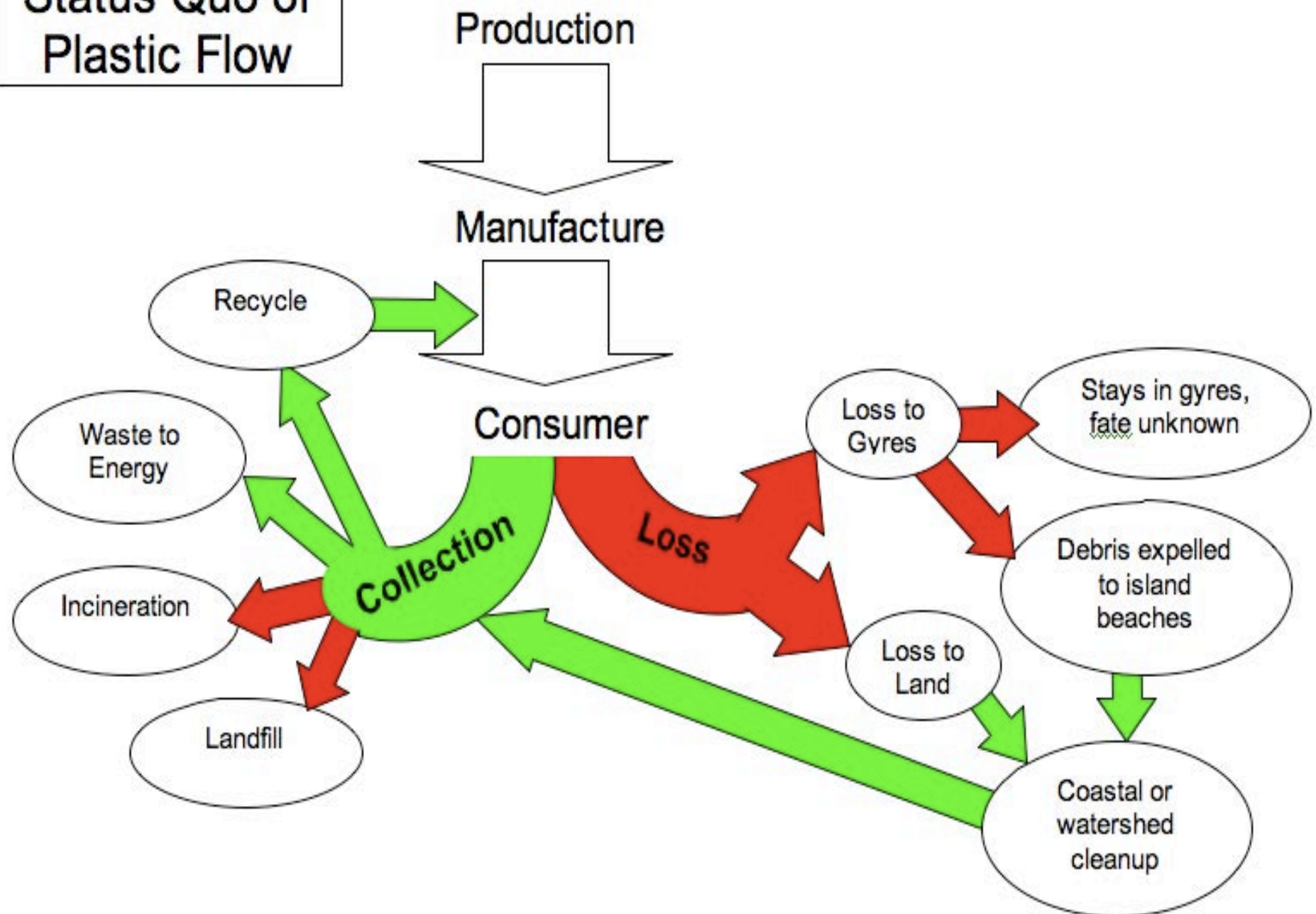
# FOCUS ON SOLUTIONS TO PLASTIC POLLUTION

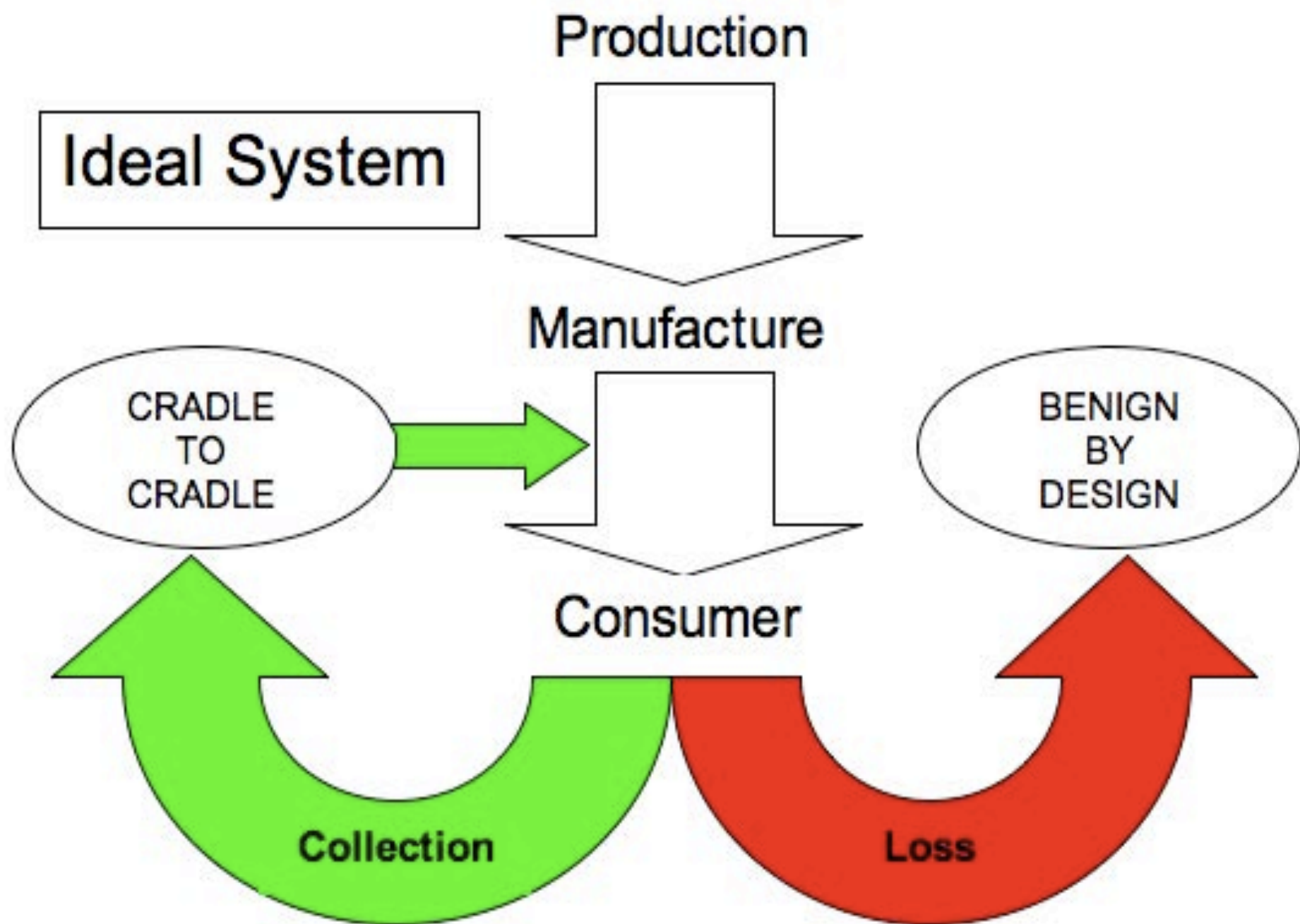


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# Status Quo of Plastic Flow







	Community			Business			Government/Waste Mgmt.		
	<u>home</u>	<u>office</u>	<u>school</u>	<u>retail</u>	<u>product</u>	<u>material</u>	Waste Mgt.	Local/state/federal	Intl.
<b>Low-tech</b>									
<b>Hi-tech</b>									
<b>No-tech (regulation)</b>								-	



	<b>Community</b>		
	Home	Office	School
<b>Low-tech</b>	BRING YOUR OWN	Water fountains	Waste-free lunch
<b>Hi-tech</b>	Compost	Waste Audit	Use real silverware
<b>No-tech (regulation)</b>	Pay as you throw	Business Participation in Recycling	No vending machines



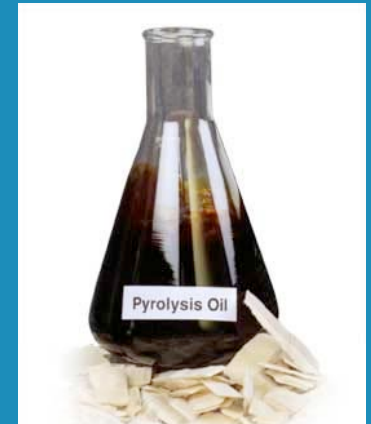
Bring Your Own



School recycling



	<b>Business</b>		
	Retail	Product	Material
<b>Low-tech</b>	Customer incentives to recover <u>depackaging</u>	Refillable Containers	Handling pellets BMP
<b>Hi-tech</b>	<u>Wal-mart</u> sandwich bale  Stock recyclables	Design for recyclability in product and packaging	R & D on alternate polymers/additives
<b>No-tech (regulation)</b>	Ban bad designs	Voluntary EPR	<b>Green Chemistry</b>



Pyrolysis



Biopolymers



Voluntary  
EPR

	<b>Government/Waste Mgmt.</b>		
	Waste Mgt.	Local/state/federal	Intl.
<b>Low-tech</b>	Recycle bins – curb/store/office	Bottle Bill	Plastic brick
<b>Hi-tech</b>	Plasma <u>Gassification</u>  <u>Pyrolysis</u>	Waste to Energy	Standardize recycling
<b>No-tech (regulation)</b>	\$/kilo.	Containment  EPR –	MARPOL



Structural Controls



Bad design obsolete



Plasma Gasification



# MAY 24, 2012 LOS ANGELES BANS PLASTIC BAGS

Thanks to:  
Clean Seas Coalition  
Heal the Bay  
Environment California  
....and many others.





LOW TECH, LOW COST, LOW TEMP, SAFE, ECONOMIC INCENTIVE

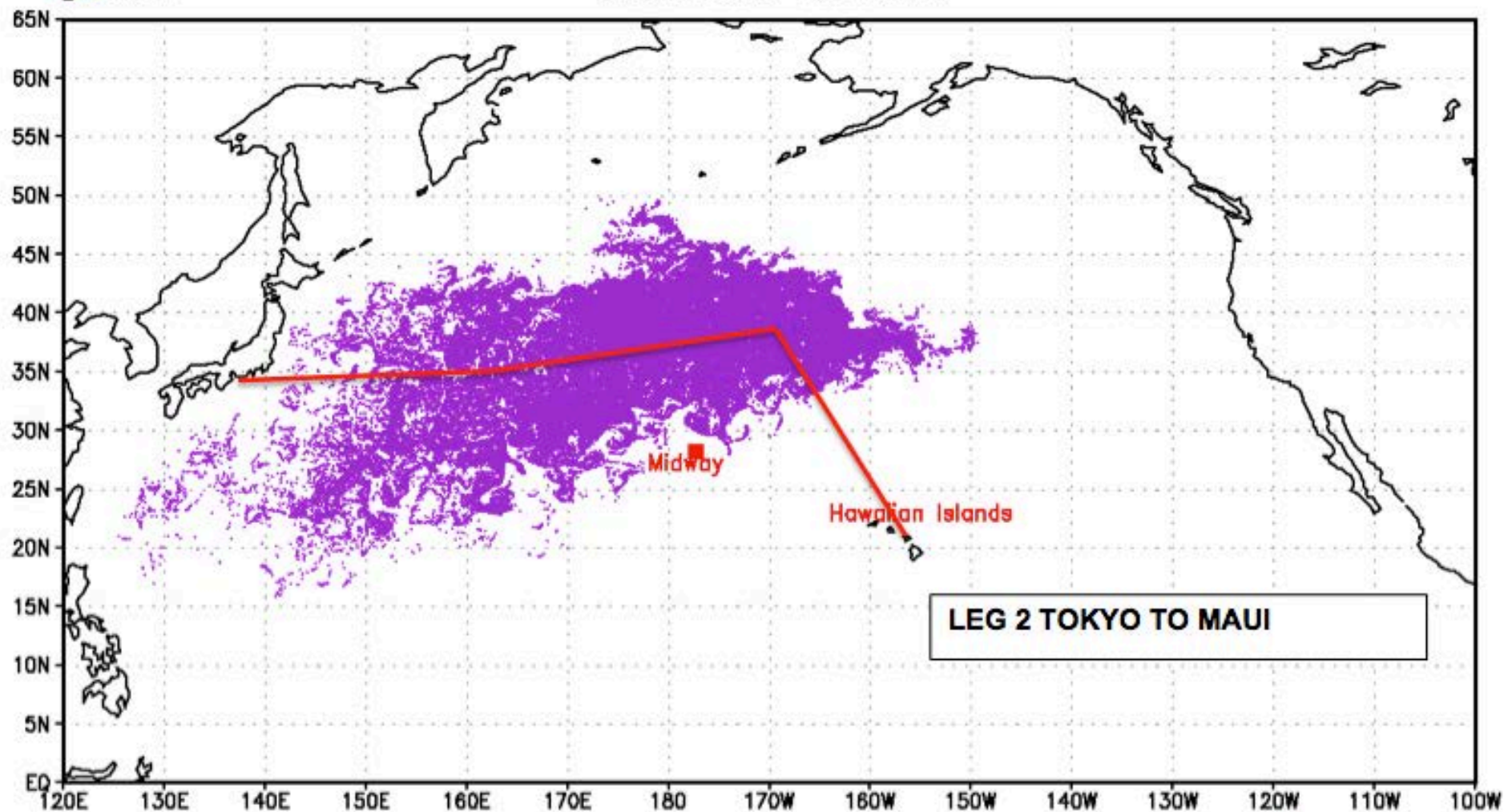


# NEXT STEPS FOR 5 GYRES



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00Z03APR2012

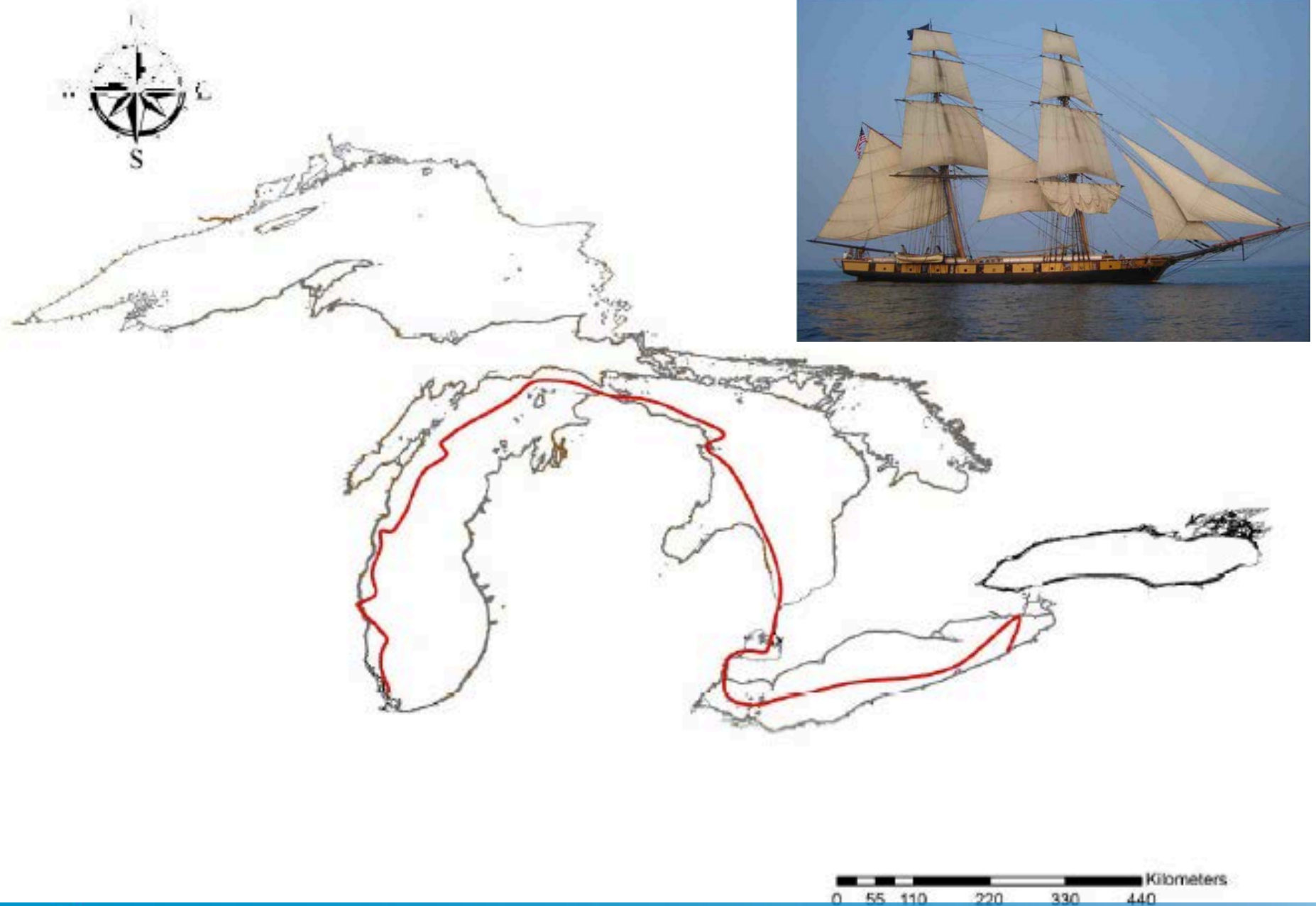


Source: Maximenko, Hafner IPRC/SOEST U. of Hawaii



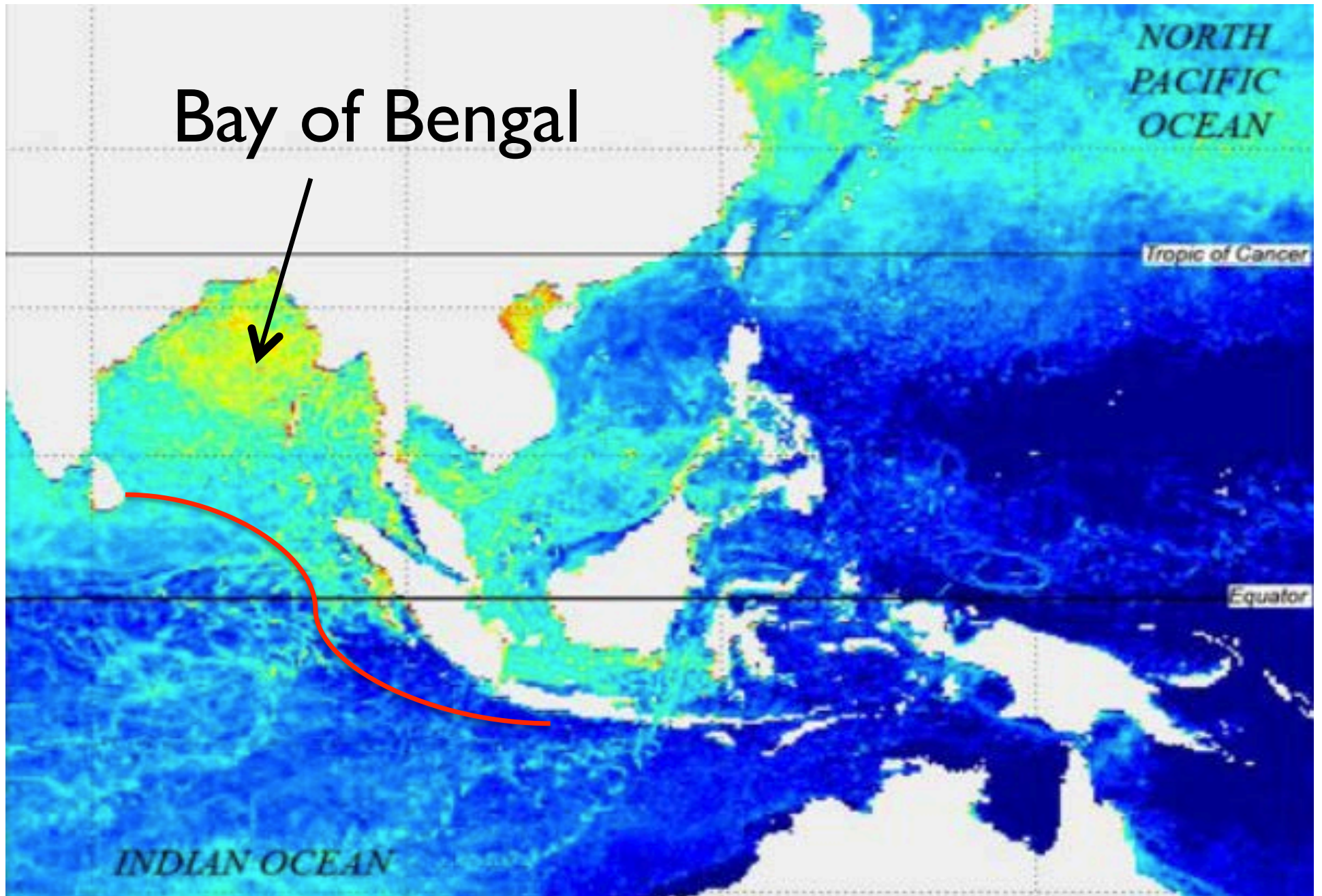
- Type and abundance of debris
- Rafting communities of marine organisms
- Population density of Halobates
- POPs in ambient seawater/plastic
- DNA of microbes on plastic/seawater







# Bay of Bengal



BAY OF BENGAL HOT SPOT, 2013





INSPIRE AMBASSADORS FOR OCEAN CONSERVATION





CITIZEN SCIENTIST – TRAWL TRAWL LOAN PROGRAM





TRAVELING  
EXHIBIT 2013





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