

Center for Marine
Debris Research



Biomonitoring program for plastic pollution in the Pacific Ocean:

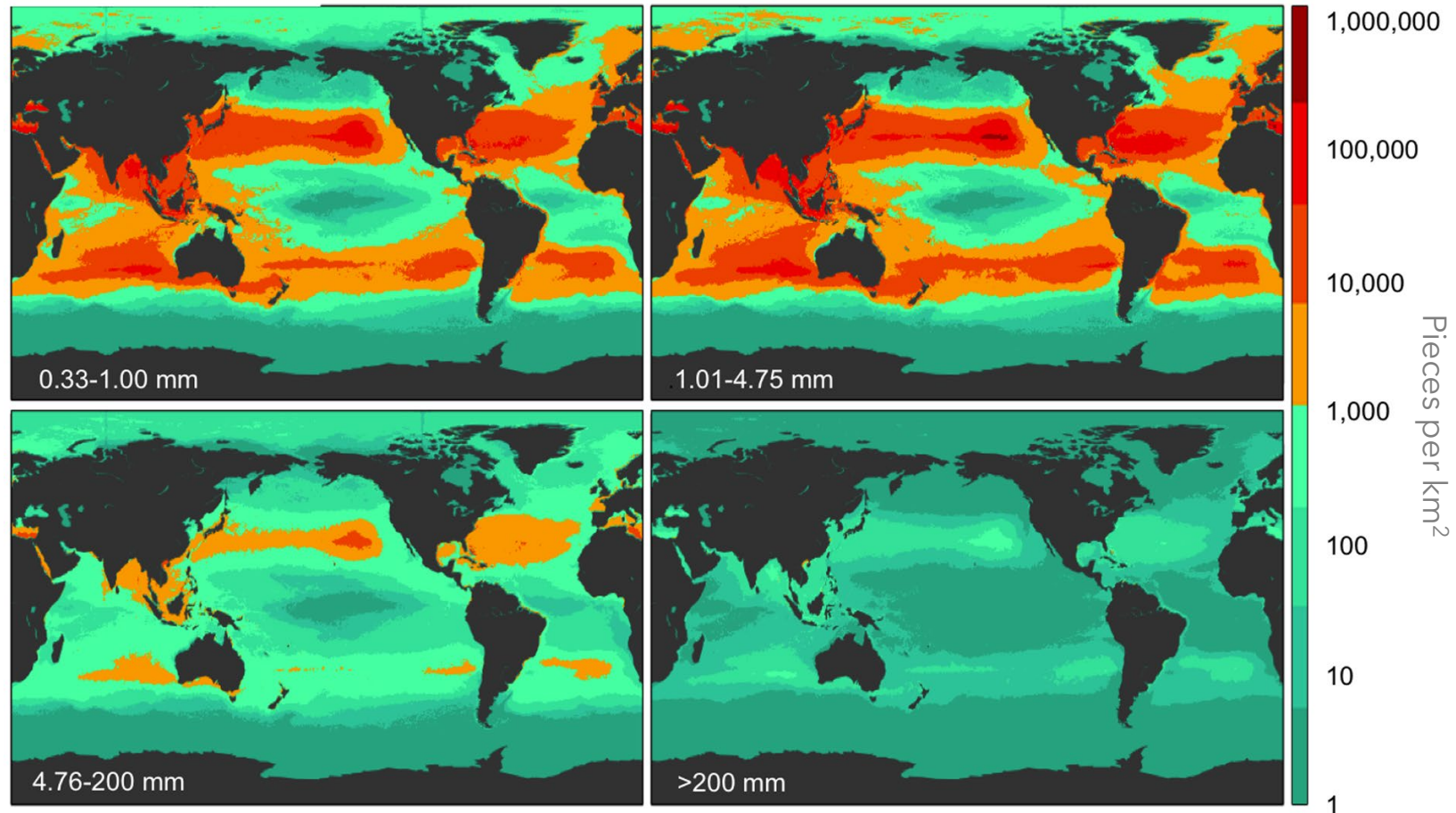
Sea turtles from the Hawaiian and American Samoan longline observer programs

JENNIFER LYNCH, KATHERINE SHAW, THIERRY WORK, SHANDELL BRUNSON,
GEORGE BALAZS, JAMIE MARCHETTI, REBECCA PUGH, SUMMER MARTIN, T. TODD JONES

Disclaimer

Certain commercial equipment, instruments, or materials are identified in this presentation to specify adequately the experimental procedure. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Global Plastic Pollution

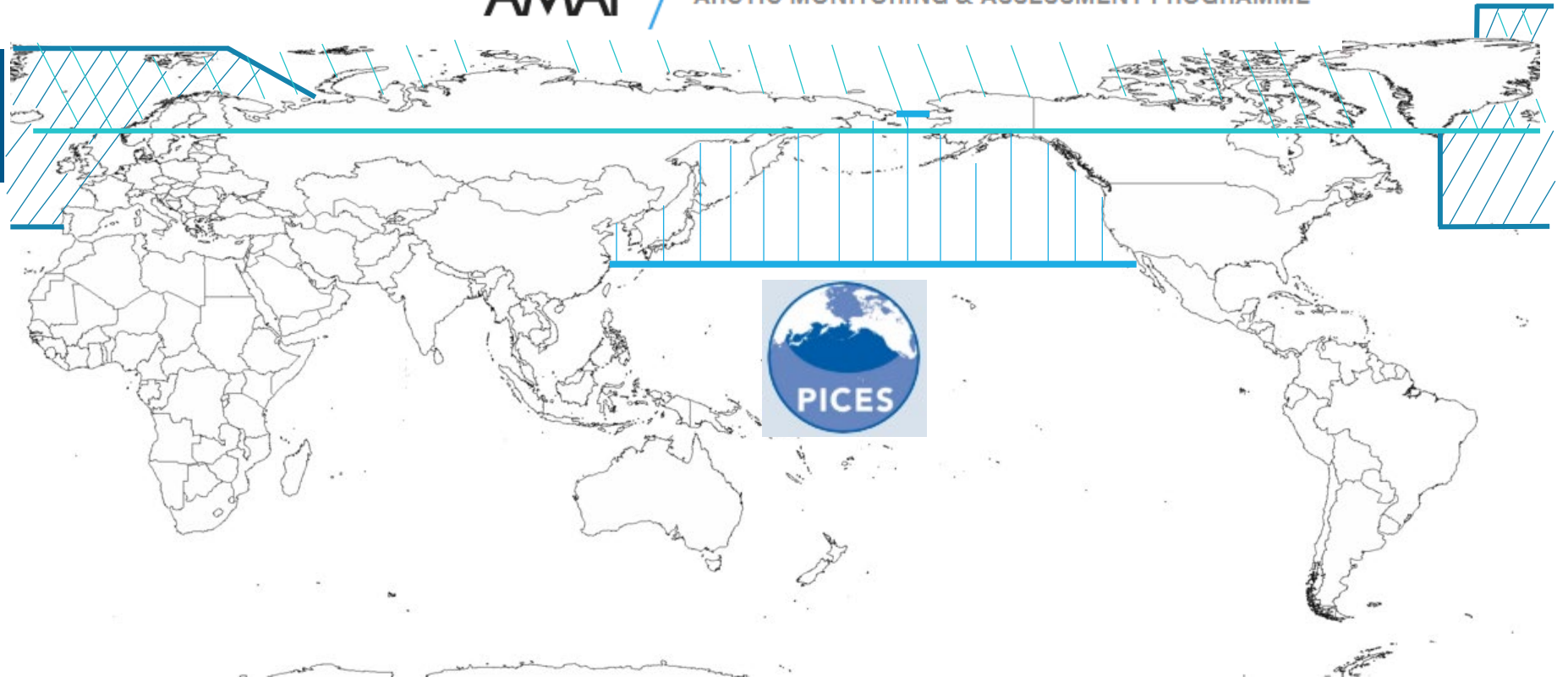


Eriksen et al 2014

Regional Working Groups



AMAP / ARCTIC MONITORING & ASSESSMENT PROGRAMME



INSIDE MONITORING & ASSESSING MARINE LITTER

- Beach Litter →
- Seabed Litter →
- Plastic Particles in Fulmars →
- ← Marine Litter

Biological Indicators



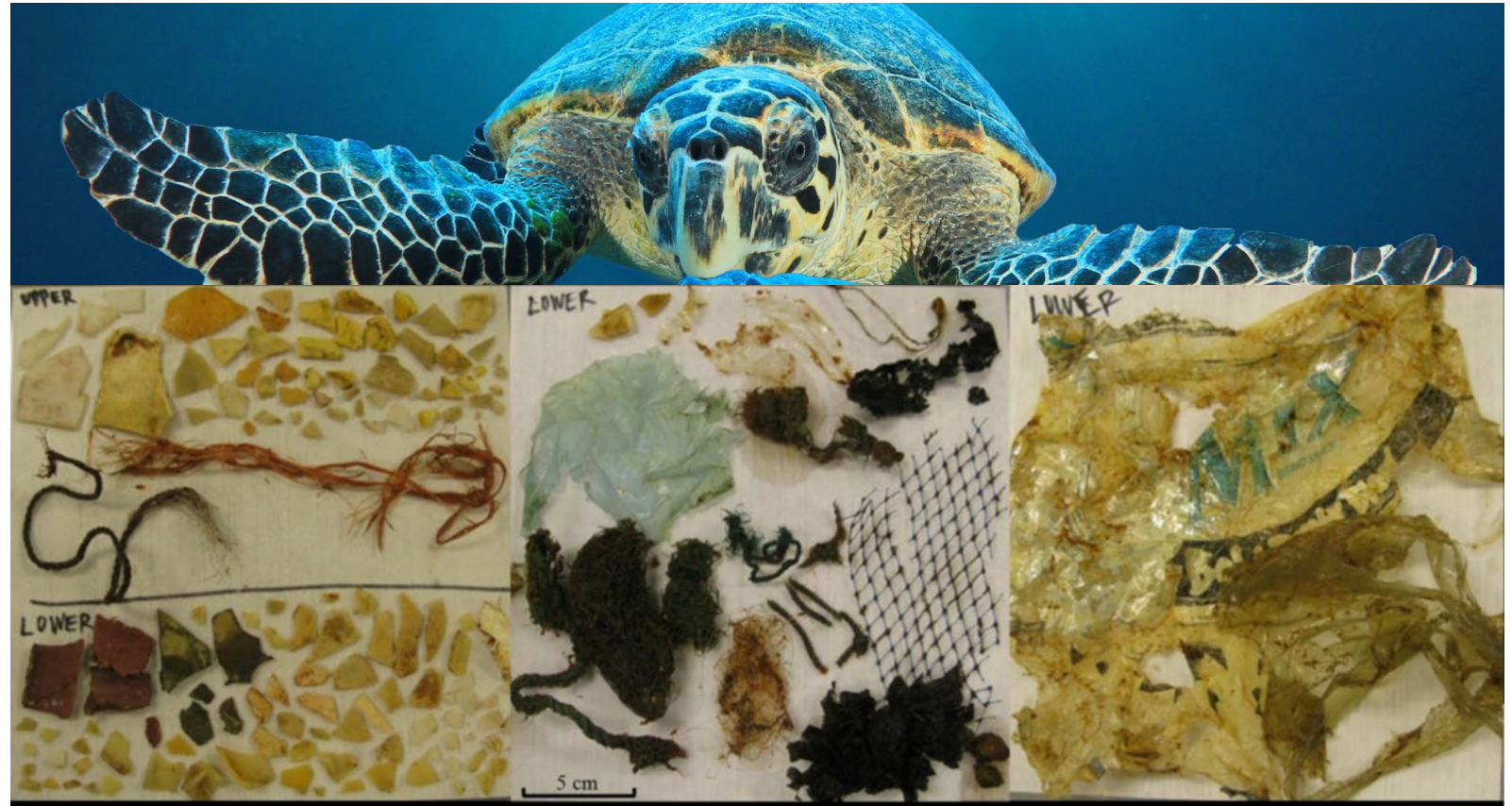
Sea Turtles

Circum-global



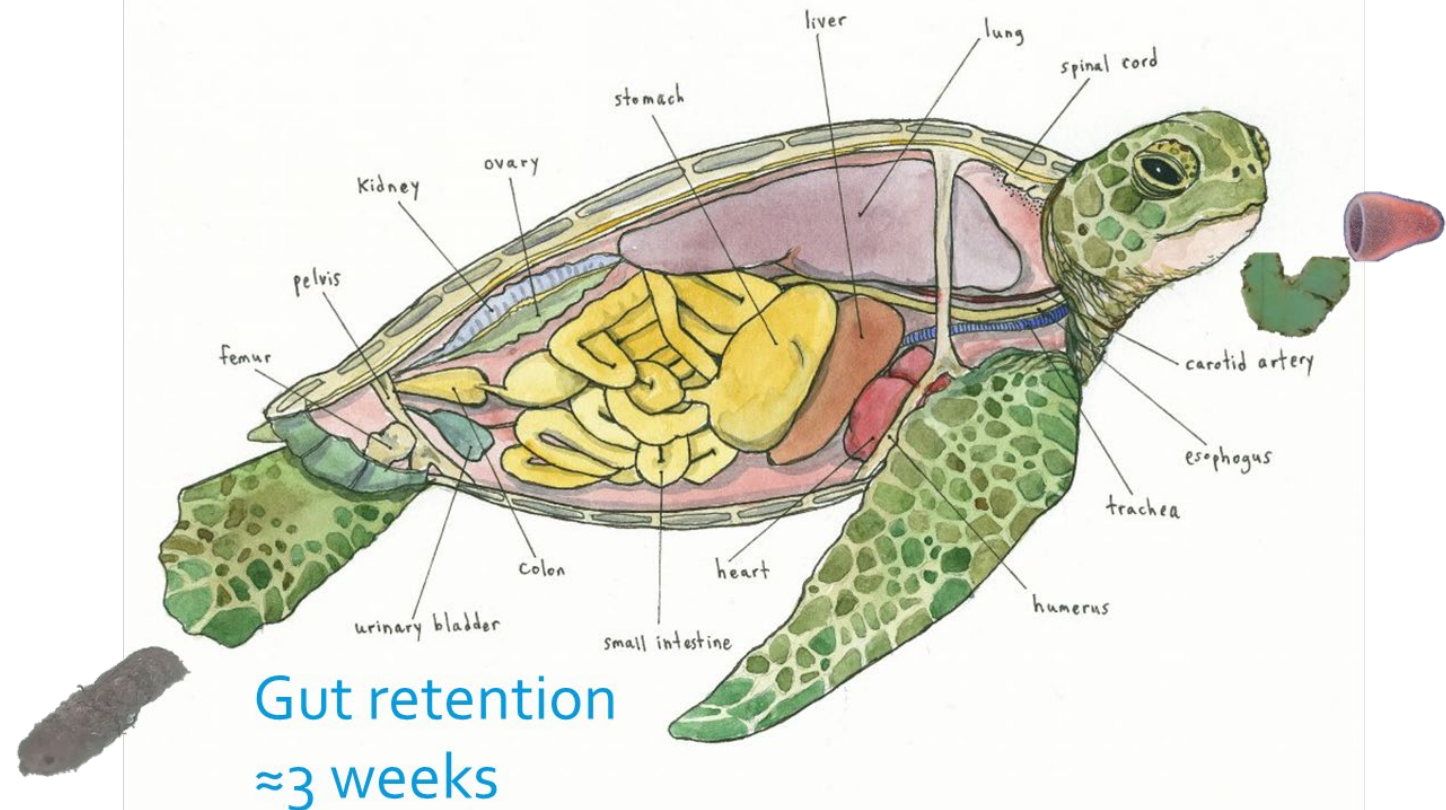
Sea Turtles

Eat plastic



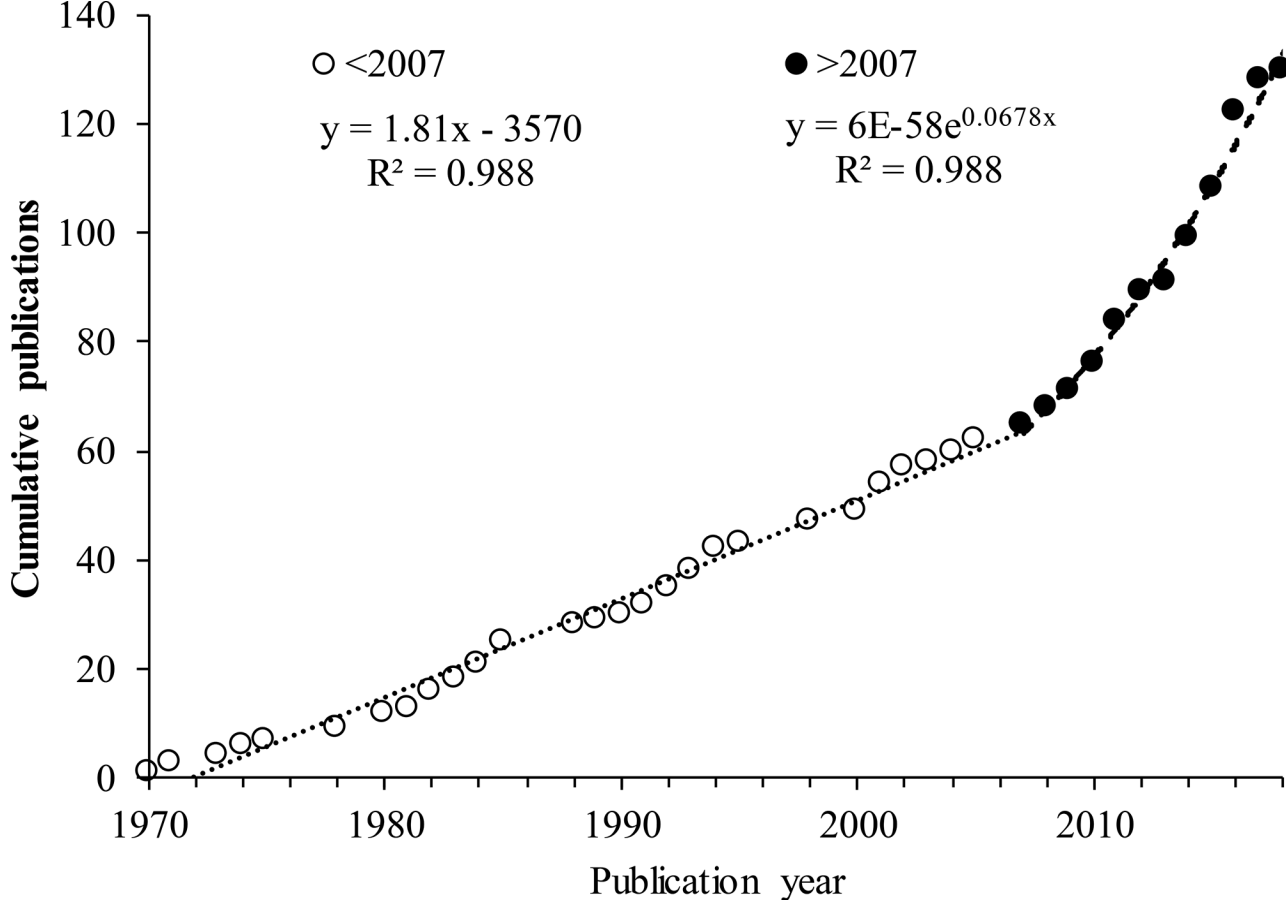
Sea Turtles

Long gut retention



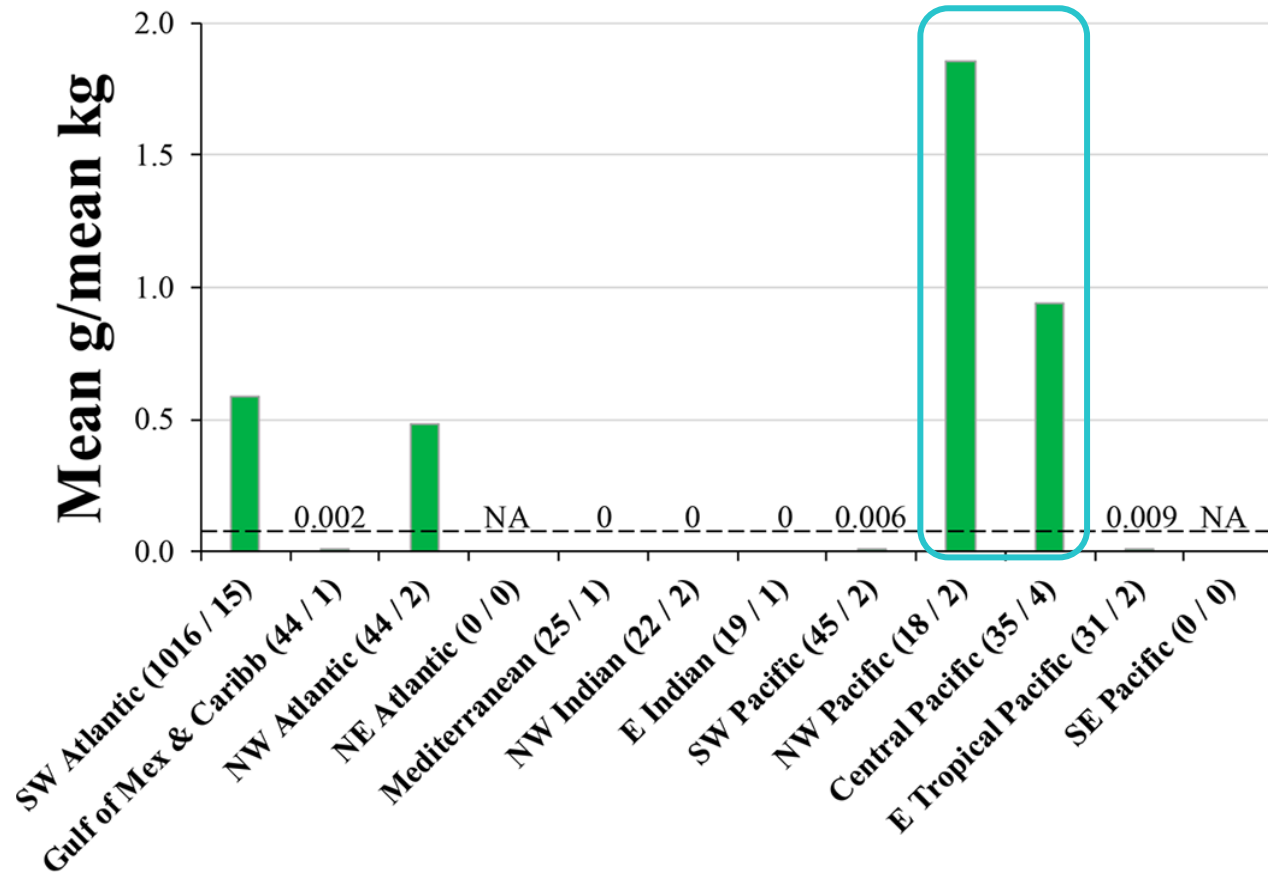
Sea Turtles

Historical data



Sea Turtles

Standardized
Methods



Sea Turtles

Existing program

Biological and Environmental Monitoring and Archival of Sea Turtle Tissues (BEMAST): Rationale, Protocols, and Initial Collections of Banked Sea Turtle Tissues

Jennifer M. Keller
Rebecca S. Pugh
Paul R. Becker

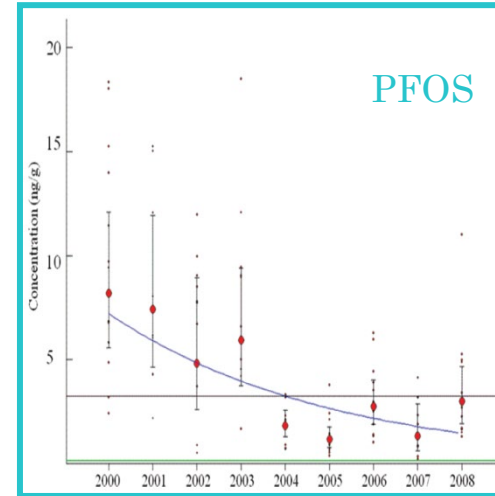
<http://dx.doi.org/10.6028/NIST.IR.7996>



NIST
National Institute of
Standards and Technology
U.S. Department of Commerce

Keller et al 2014

BEMAST



Archive tissues from sea turtles in a world class biorepository for real-time and retrospective contaminant and health-related research studies

BEMAST

Renaguli et al 2021. Characterization of Halogenated Organic Compounds in Pelagic Sharks and Sea Turtles Using a Nontargeted Approach. *Environ Sci Technol* 55:16390-16401

Wood et al 2021. Sea turtles across the North Pacific are exposed to perfluoroalkyl acid contaminants. *Environ Pollut* 279:116875

Shaw et al 2021. Trace element concentrations in blood and scute tissues from wild and captive Hawaiian green sea turtles (*Chelonia mydas*). *Environ Toxicol Chem* 40:208-218

Keller et al 2014. Investigating the potential role of persistent organic pollutants in Hawaiian green sea turtle fibropapillomatosis. *Environ Sci Technol* 48:7807-7816

Banerjee et al 2021. Species and population specific gene expression in blood transcriptomes of marine turtles. *BMC Genomics* 22:346

Schock et al 2013. Metabotyping of a Protected Non-Model Organism, Green Sea Turtle (*Chelonia mydas*), using 1H NMR Spectroscopy and Optimized Plasma Methods for Metabolomics. *Current Metabolomics* 1:279-290

Jung et al 2018. Polymer Identification of Plastic Debris Ingested by Pelagic-phase Sea Turtles in the Central Pacific. *Environ Sci Technol* 52:11535-11544

Jung et al 2018. Validation of ATR FT-IR to identify polymers of plastic marine debris, including those ingested by marine organisms. *Mar Pollut Bull* 127:704-716

Clukey et al 2018. Persistent Organic Pollutants in Fat of Three Species of Pacific Pelagic Longline Caught Sea Turtles: Accumulation in Relation to Ingested Plastic Marine Debris. *Sci Total Environ* 610-611:402-411

Clukey et al 2017. Investigation of Plastic Debris Ingestion by Four Species of Sea Turtles Collected as Bycatch in Pelagic Pacific Longline Fisheries. *Mar Pollut Bull* 120(1-2):117-125

BEMAST



Eggs

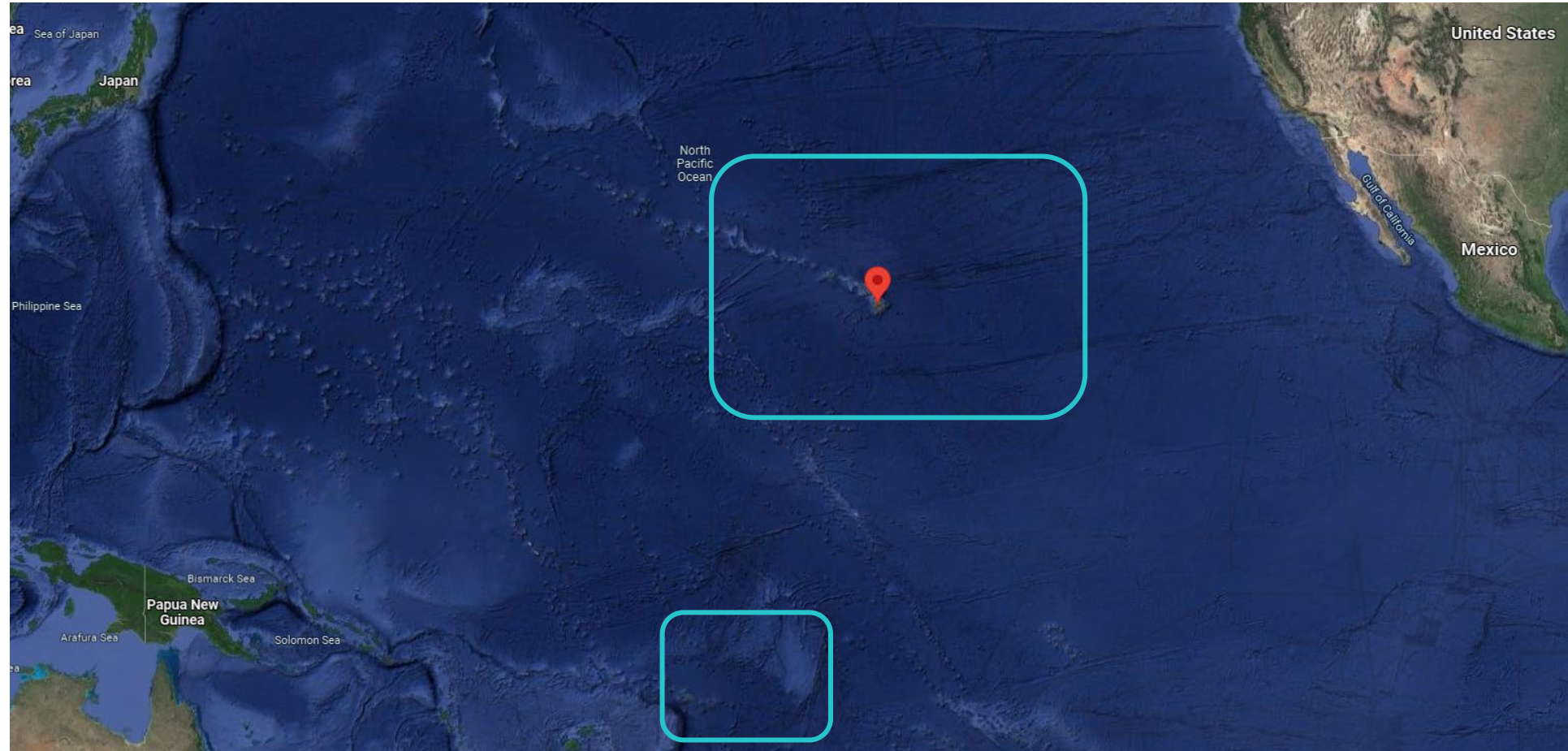
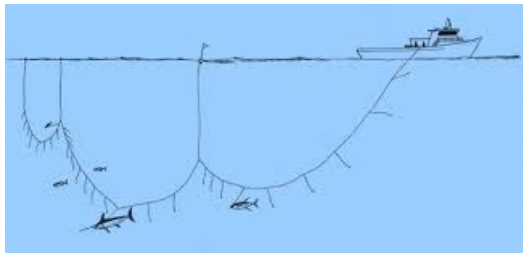


Live Capture



Necropsy

Longline Bycatch



Tissues Archived

Scute

Inorganic contaminants, stable isotopes

Fat

Organic contaminants

Liver

Organic and inorganic contaminants, biomarkers

Bile

Organic contaminants

Ingesta

Plastic pollution

Sample Size



2012 to 2019 111 sea turtles

83 Olive ridley

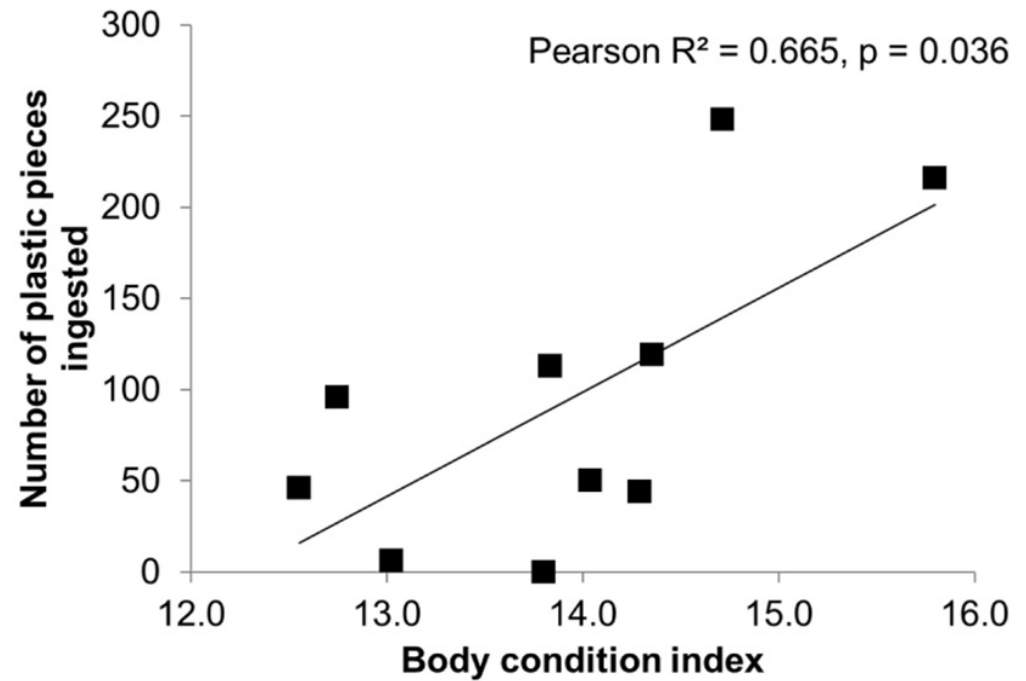
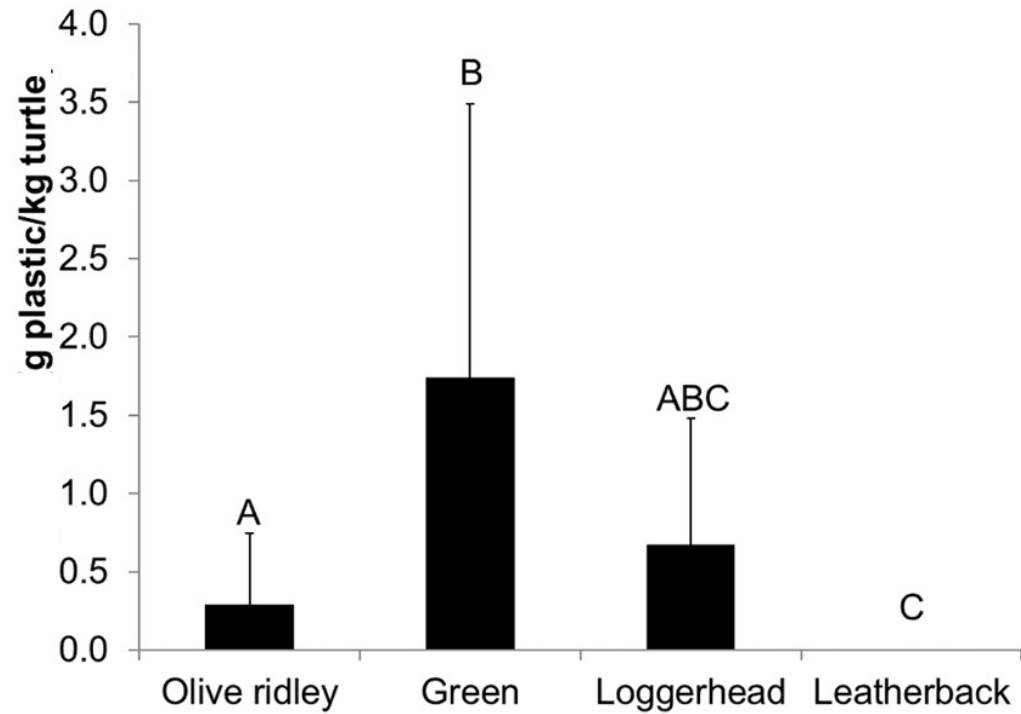
21 Green

7 Loggerhead

3 Leatherback

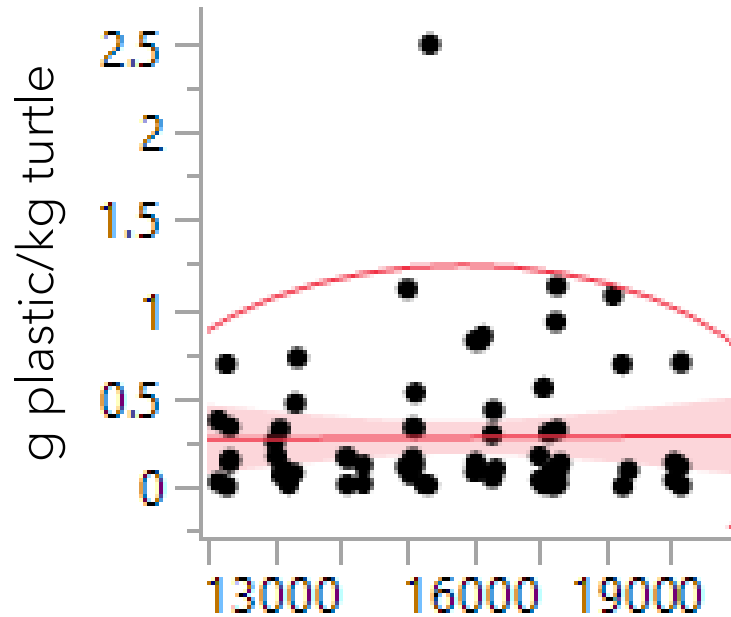
1 Hawksbill

2012 to 2016 Results



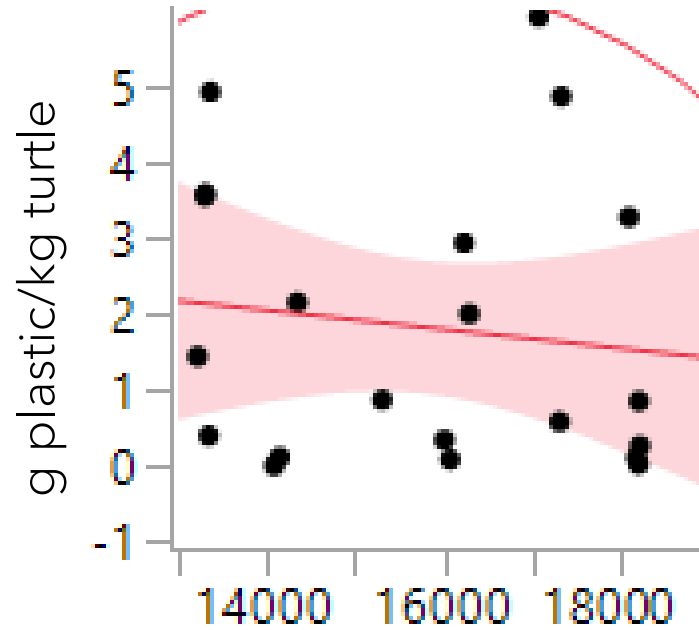
2012 to 2019 Temporal Trend

Olive ridley



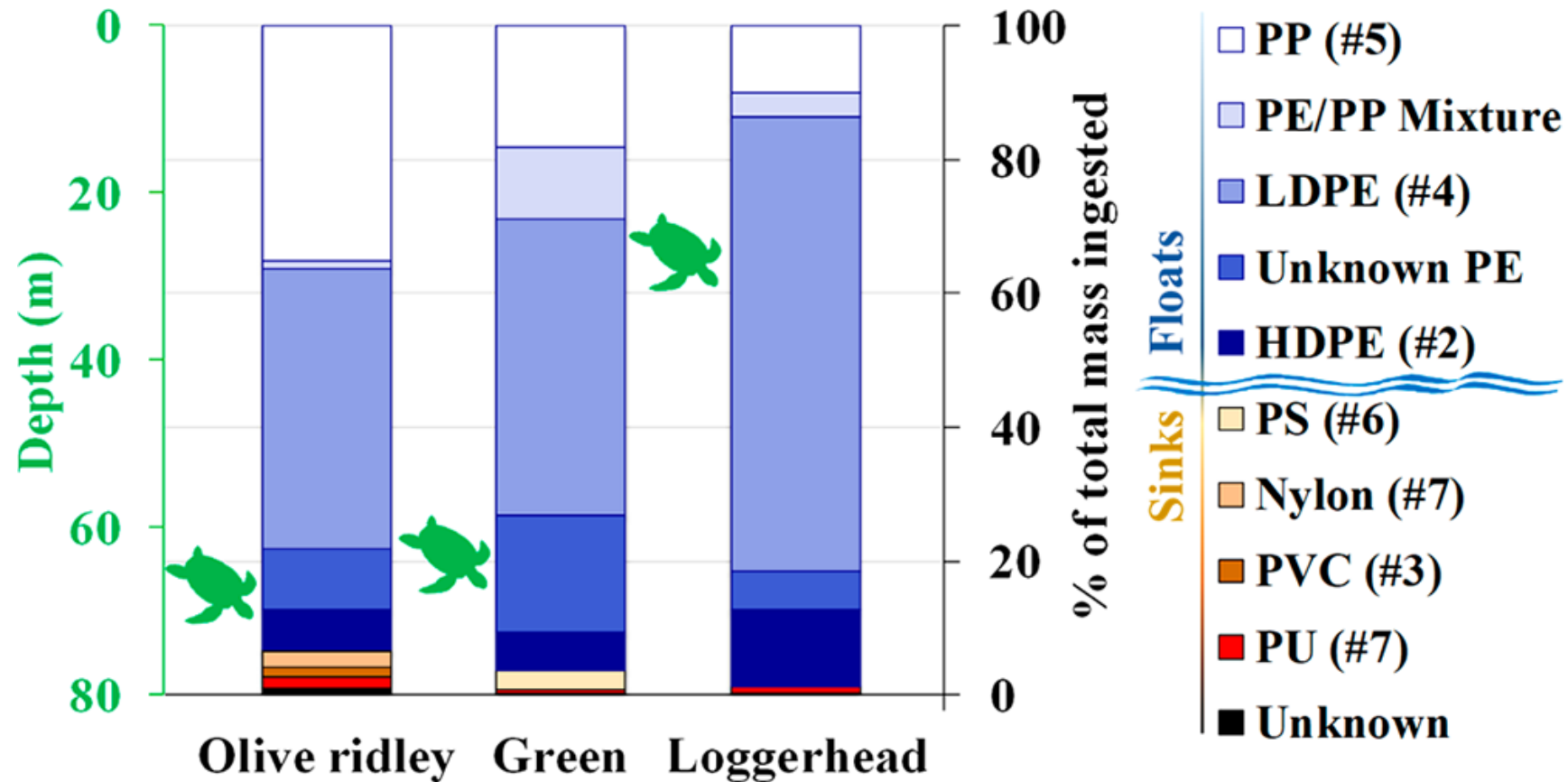
Rho = -0.122, p = 0.330

Green

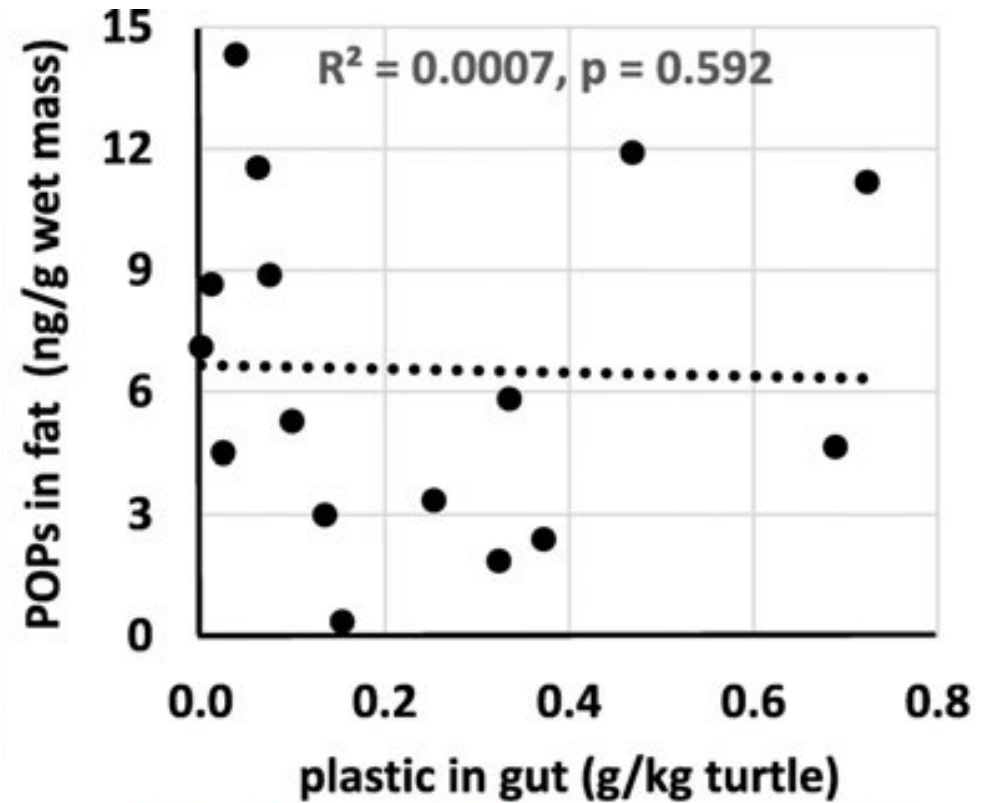
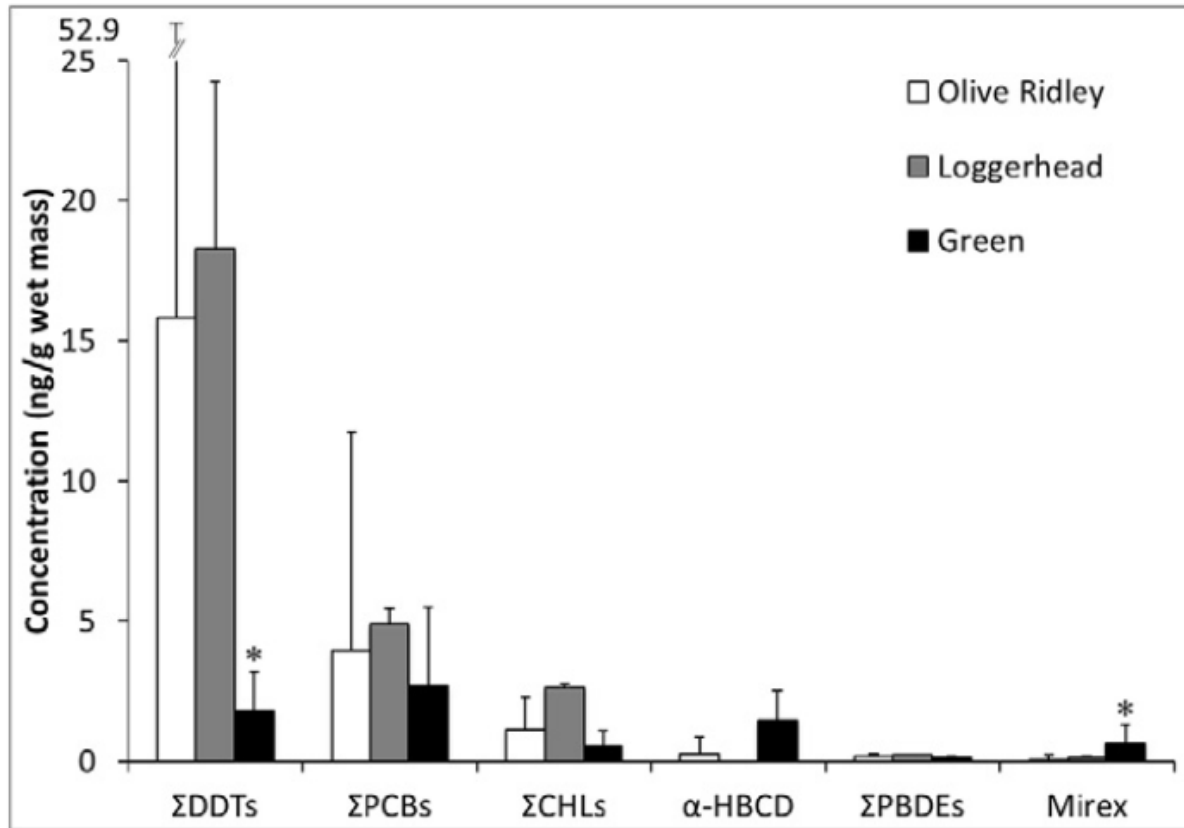


Rho = -0.213, p = 0.354

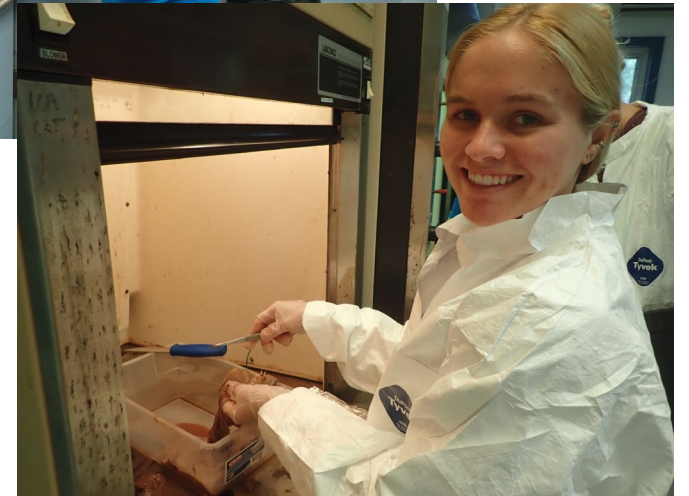
2012 to 2016 Results



2012 to 2016 Results



Next Steps: Continue collections



Next Steps: Plastic Additives

Antioxidants

Light stabilizers

Flame retardants

Plasticizers



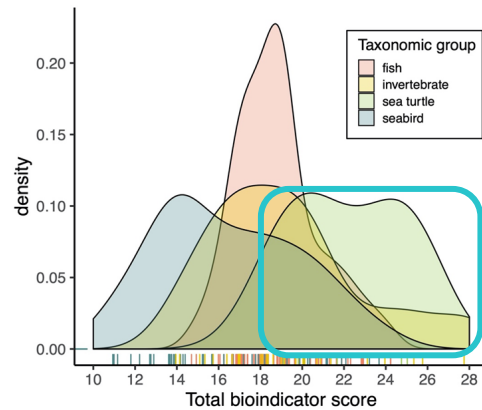
Ingested plastics

G.I. fluids

Liver

Fat

Conclusions



- Sea turtles are priority biological indicators of plastic pollution
 - Circum-global
 - Eat plastic and retain it
 - Historical data
- BEMAST is an excellent candidate for a pollution monitoring program
 - Uses standardized protocols from 2012
 - Has large geographic coverage in the North and South Pacific Ocean
 - Has paired internal tissue samples for chemical, biomarker, or health analyses



Acknowledgements



Longline fishers
NOAA Longline Observers



In loving memory of
Shandell Brunson
1976-2022



Center for Marine
Debris Research





Learn more at OSM!

Session	Speaker	Title
ME07	Ray Aivazian III	A novel method for collecting, separating and quantifying shoreline microplastic marine debris
CT04	Kellie Teague	From nano to megaplastics: An overview of chemical methods for plastic pollution
CT04	Katherine Shaw	Three Stage Screening Process Finds No Ingested Plastics in Marshall Islands Reef Fish
CT04	Raquel Corniuk	Utilizing chemometrics to differentiate polymers comprising floating derelict fishing gear on O'ahu
OC25	Cara Megill	A meta-analysis of plastic additives measured in the ocean using a comprehensive database compiled from a scientific literature review
PS08	Andrew McWhirter	Comparison of floating derelict fishing gear composition from three central North Pacific regions
PS08	Sarah-Jeanne Royer	Polyolefins and the effect of biofouling on their sinking behaviors in the oceanic water column

More Information

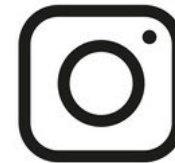
BEMAST: <https://www.nist.gov/programs-projects/biological-and-environmental-monitoring-and-archival-sea-turtle-tissues-bemast>



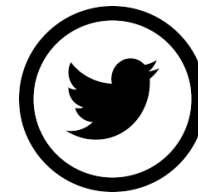
CMDR: <https://www.hpu.edu/cncs/cmdr/>



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