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**HAWAII
PACIFIC**
UNIVERSITY



SEA TURTLES AS INDICATORS OF PLASTIC MARINE DEBRIS QUANTITIES AND TYPES IN THE CENTRAL PACIFIC

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Station

NOAA Pacific Islands Fisheries Science Center



THE PROBLEM WITH PLASTIC

- Entanglement
- Habitat damage
- Ingestion



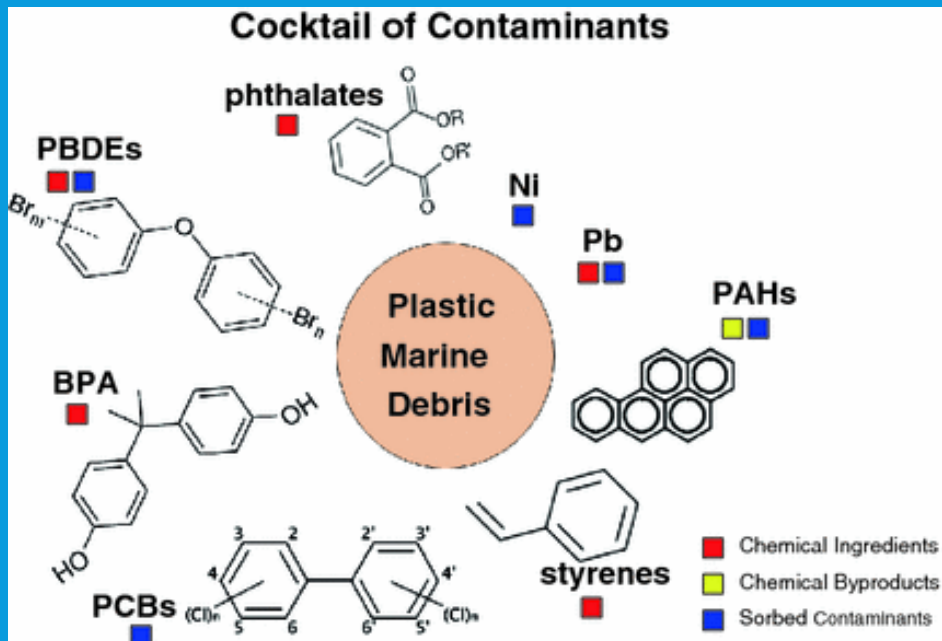
POTENTIAL EFFECTS OF INGESTION

Sublethal:

- Exposure to harmful chemicals (Rochman et al., 2013)
- Dilution of nutrients (McCauley & Bjorndal, 1999)

Lethal:

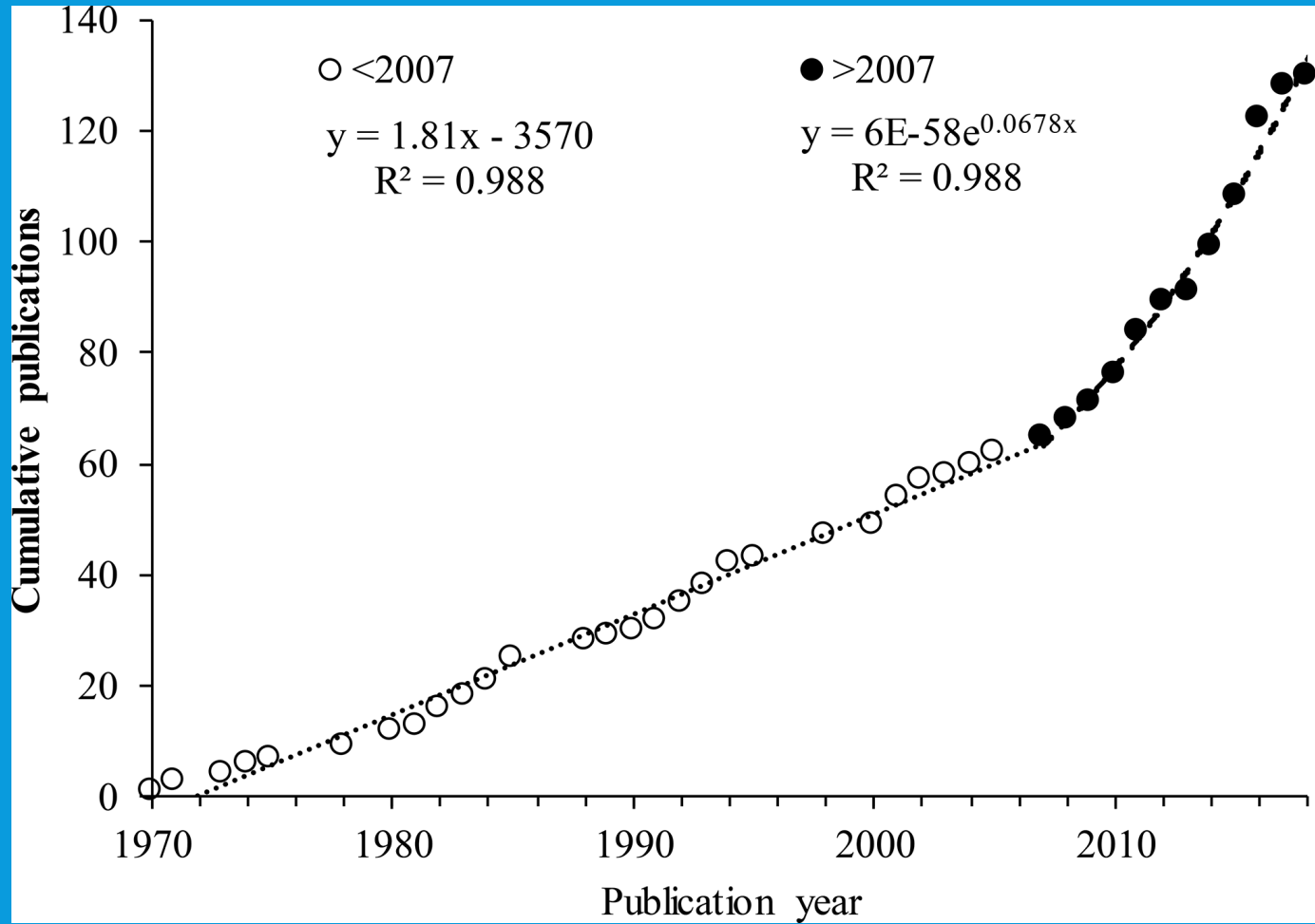
- Obstruction (Balazs, 1985)
- Perforation (Mascarenhas et al., 2004)
- Plications



Rochman, 2015

PLASTIC INGESTION BY SEA TURTLES

First report
in the late
1950's
Archie Carr
(reported in
Balazs 1985)



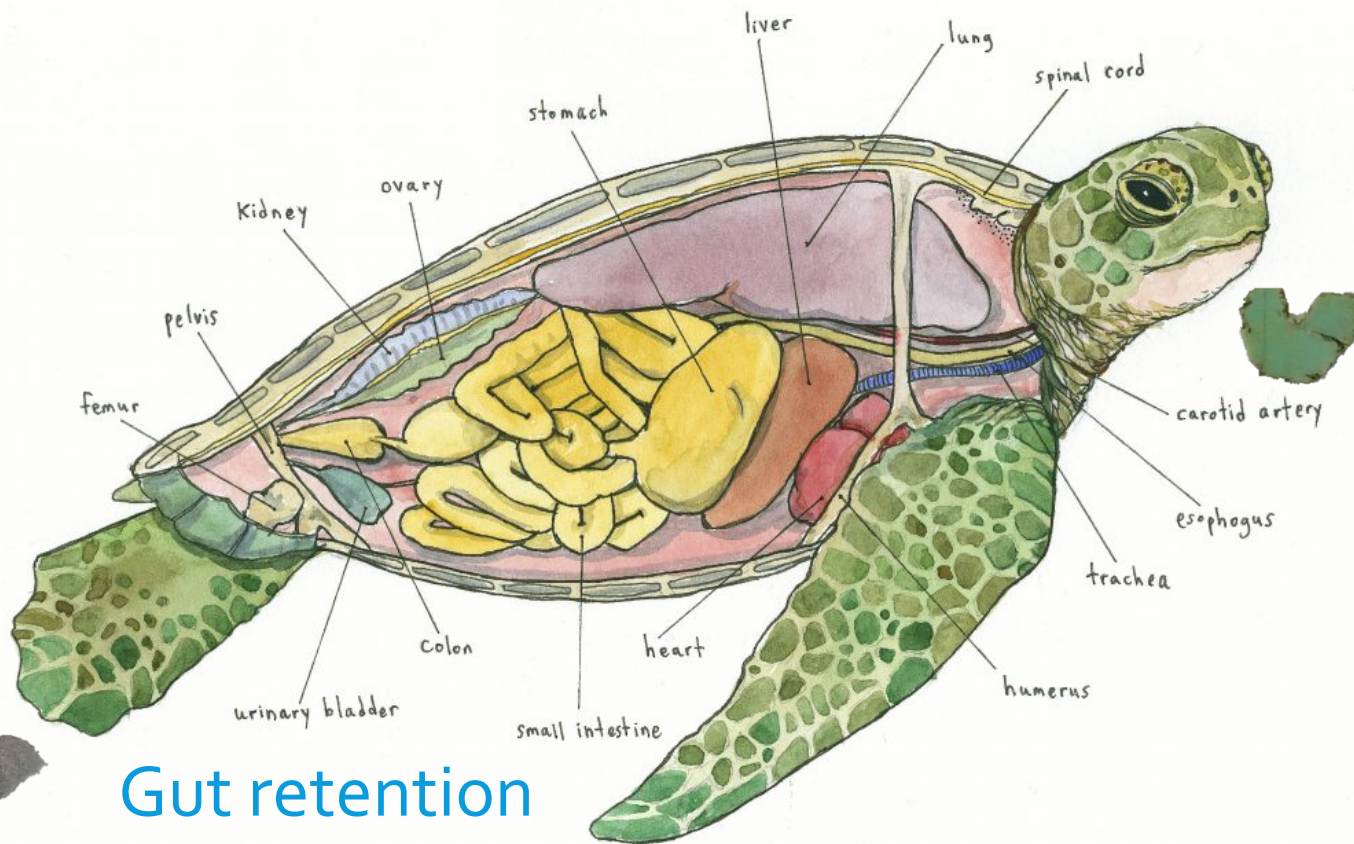
SEA TURTLES MAKE GOOD INDICATORS



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SEA TURTLES MAKE GOOD INDICATORS



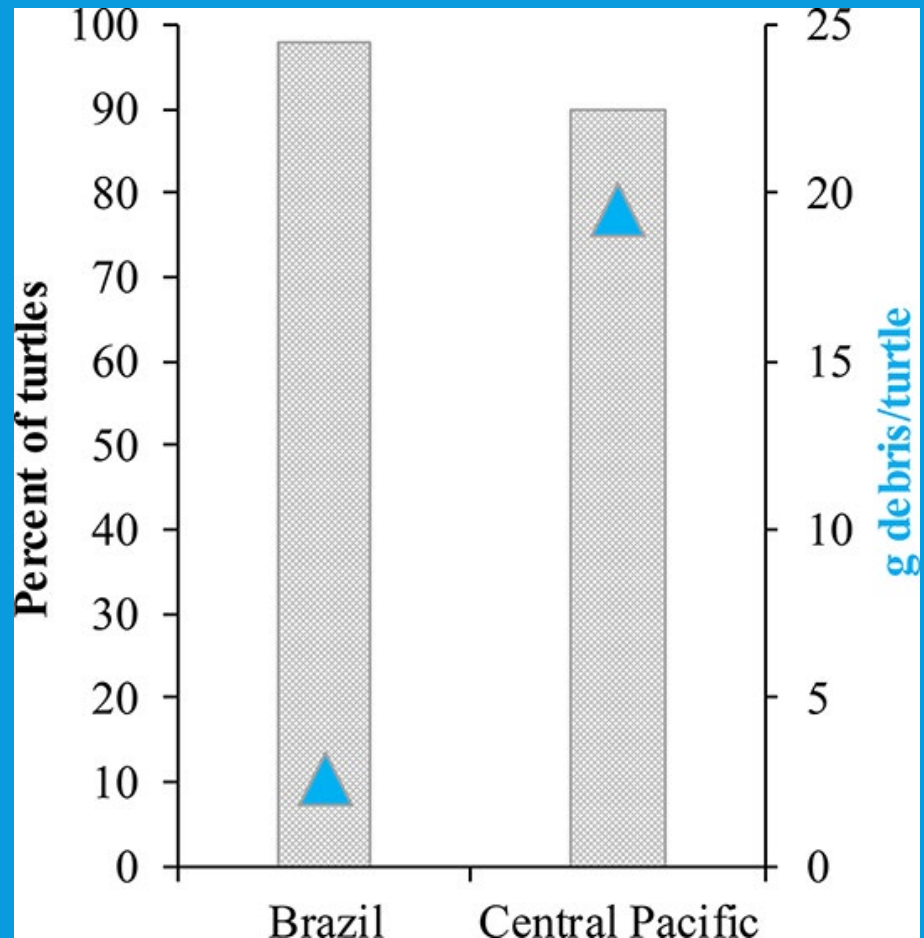
Gut retention
≈ 3 weeks

SEA TURTLES INGEST A LOT OF PLASTIC



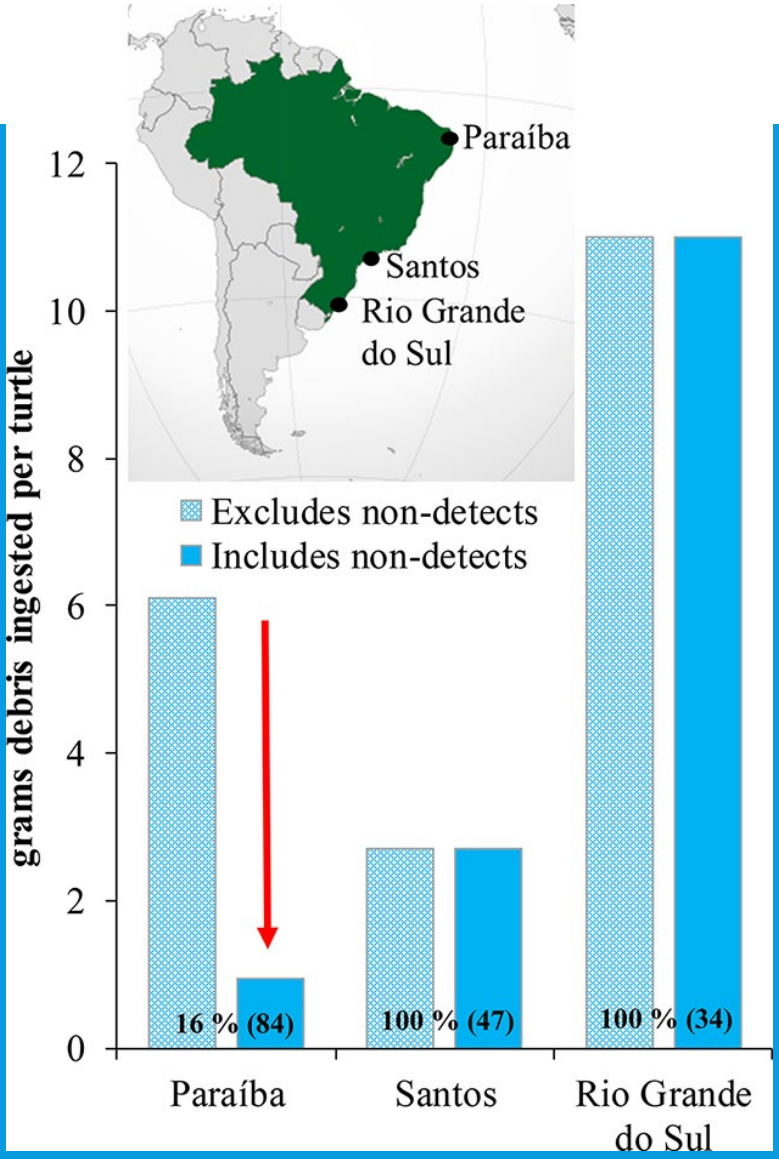
BEST REPORTING UNITS

- Quantities are better than percent occurrence
- Include non-detects
- Report particle counts, size, and mass of polymers
- g/kg is best unit for biota



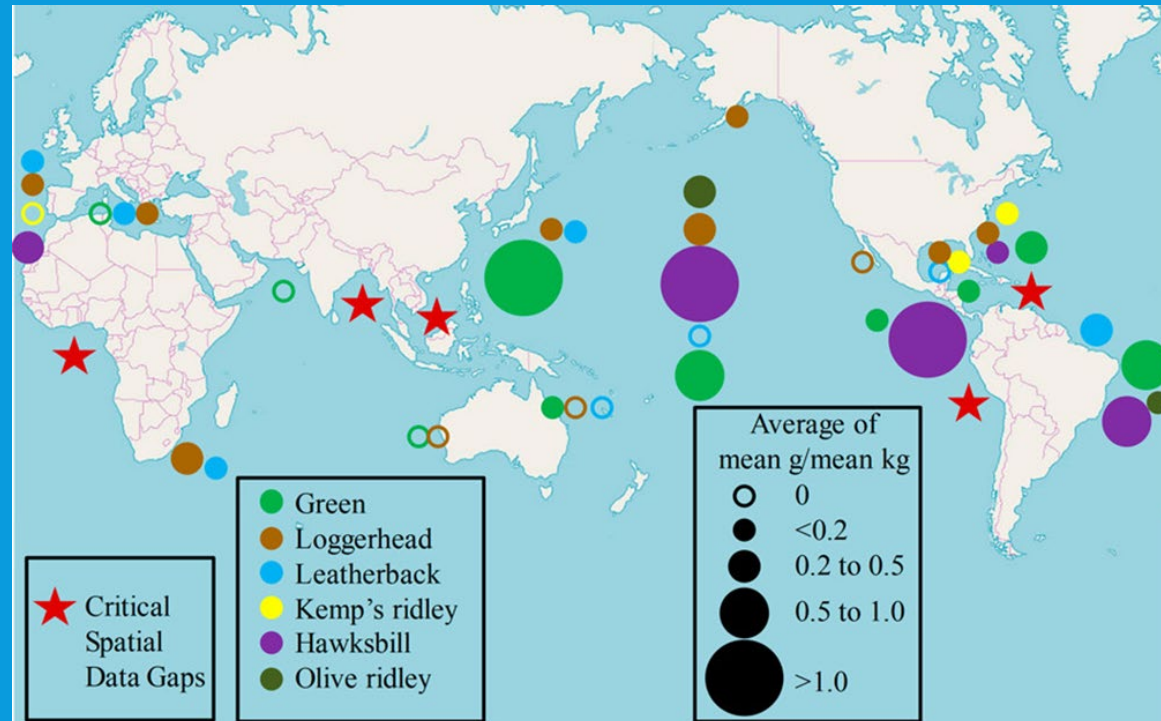
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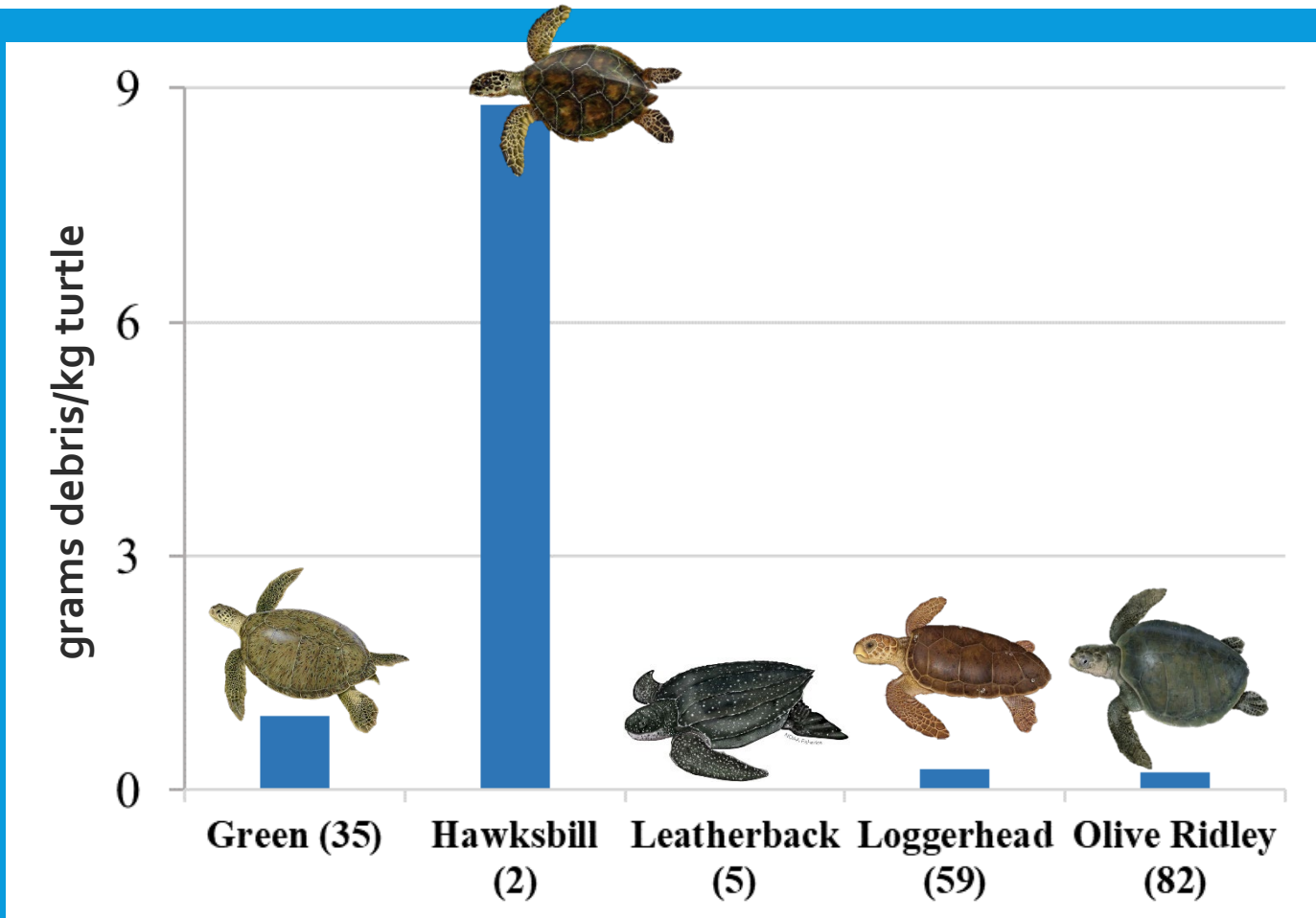


BEST REPORTING UNITS

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HAWKSIBILLS IN CENTRAL PACIFIC



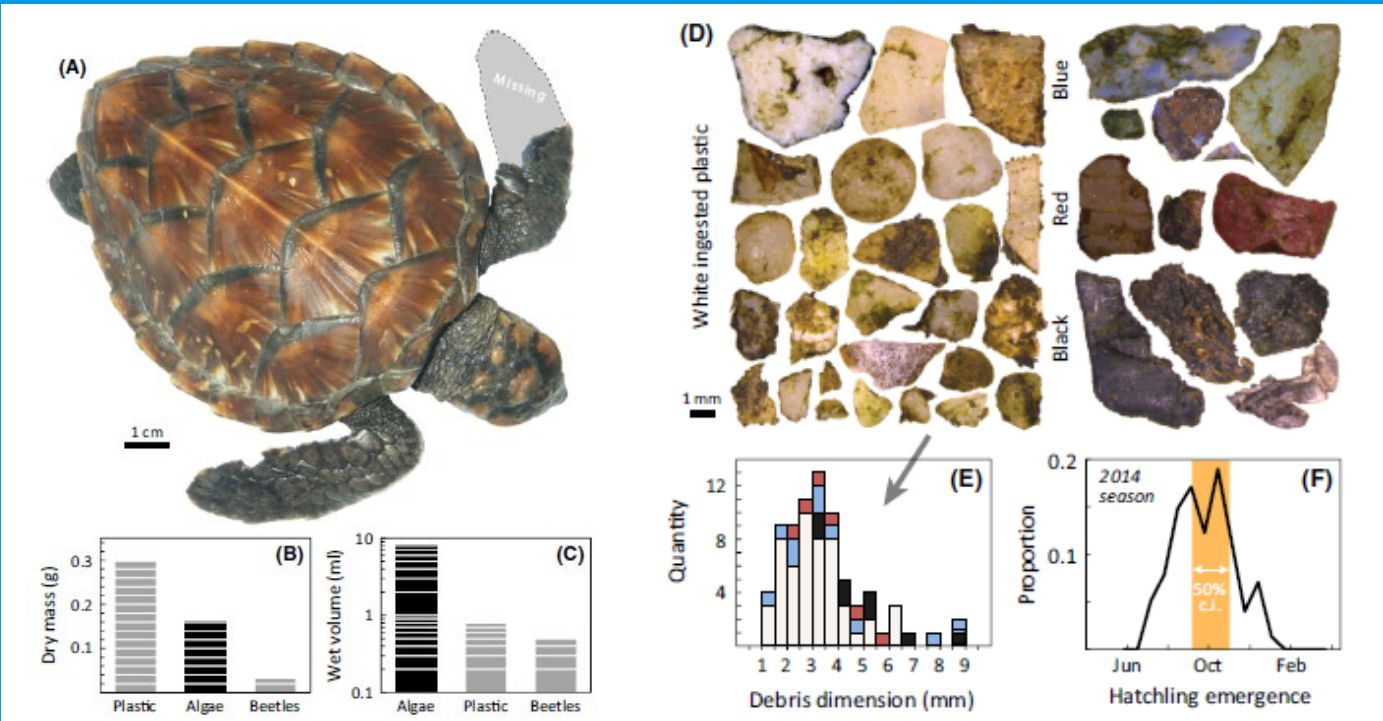
HAWKSBILL FROM OAHU 1984



5.4 kg turtle with ≈ 741 pieces or 116 grams of debris
21.5 g debris/kg

Balazs 1985

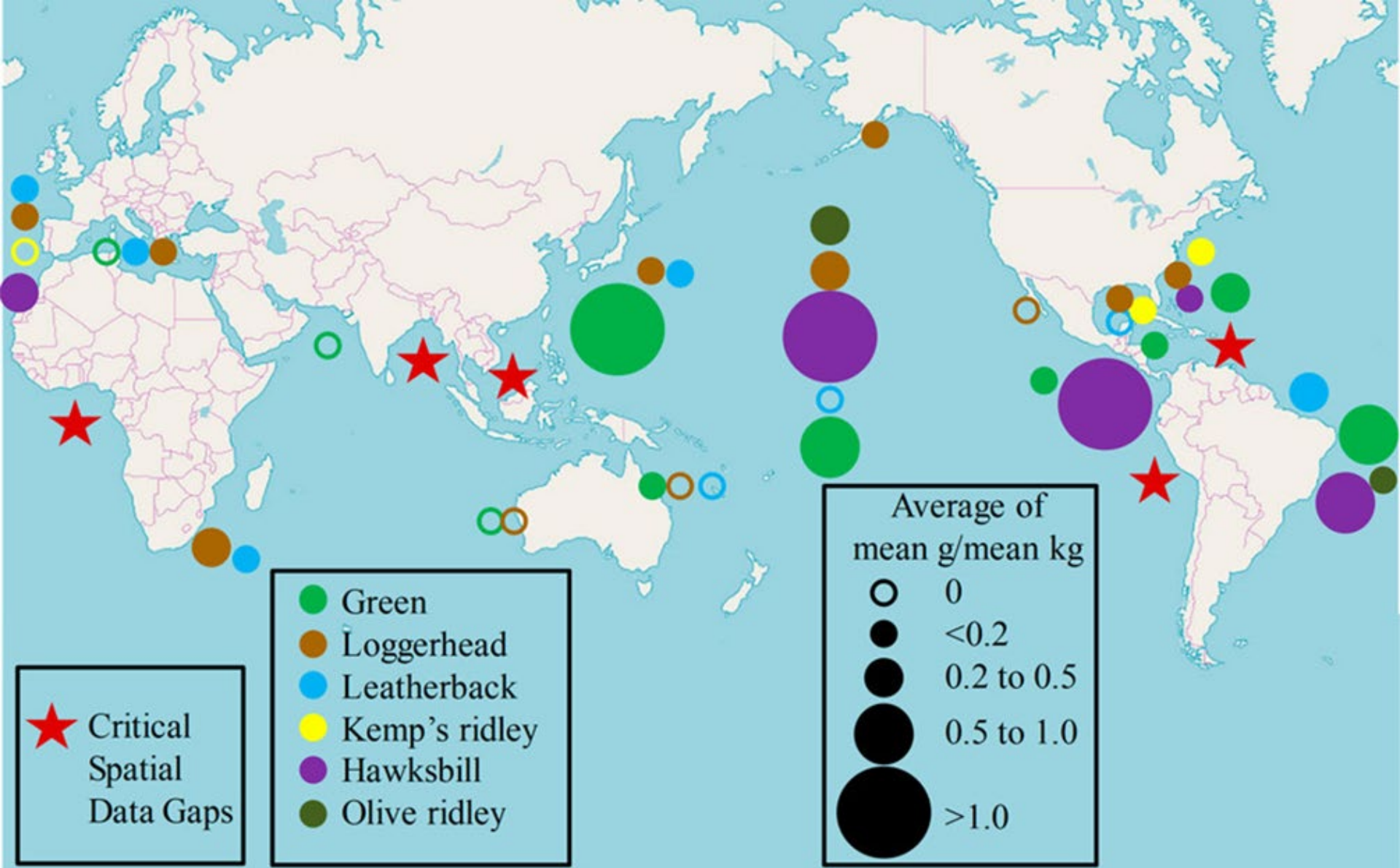
HAWKSBILL FROM KAUAI 2015



9.2 cm \approx 0.096 kg turtle with 41 pieces or 0.3 grams of debris

3.11 g/kg

Van Houtan et al., 2016



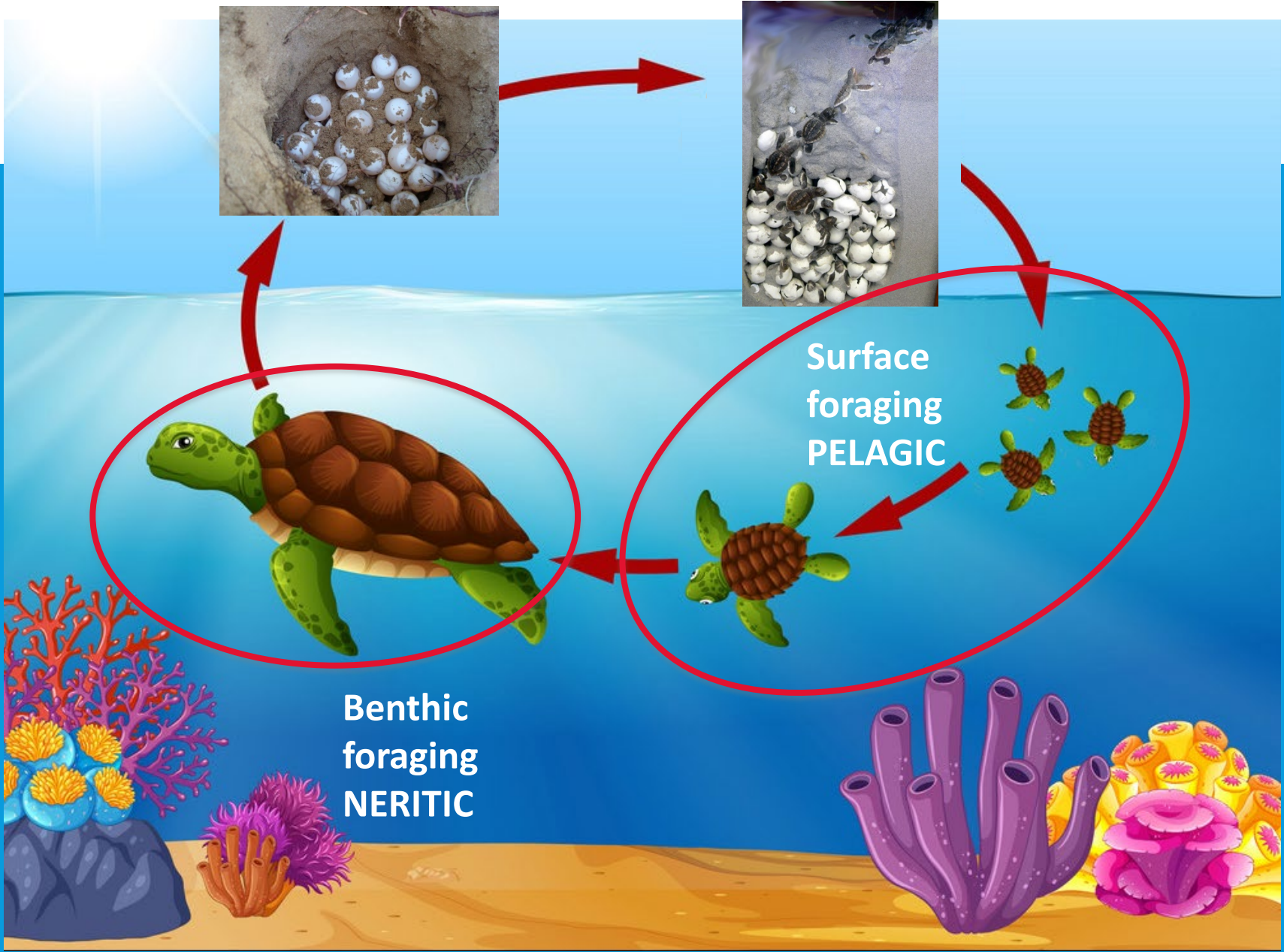
Lynch, J.M., 2018. Quantities of marine debris ingested by sea turtles: global meta-analysis highlights need for standardized data reporting methods and reveals relative risk. *Environmental Science & Technology*, 52(21), pp.12026-12038.

OBJECTIVE

Increase the sample size of hawksbills from the Central Pacific to assess size class differences and update species and spatial comparisons



LIFE CYCLE OF SEA TURTLES



STAGE ESTIMATED BY SIZE



Pelagic
post-
hatchling
(4-9 cm)

Pelagic
juvenile
(28-41 cm)

Neritic
(46-71 cm)

N = 7(1)

4(1)

4

● Pelagic post-hatchling; N = 7

● Pelagic juvenile; N = 4

● Neritic; N = 4

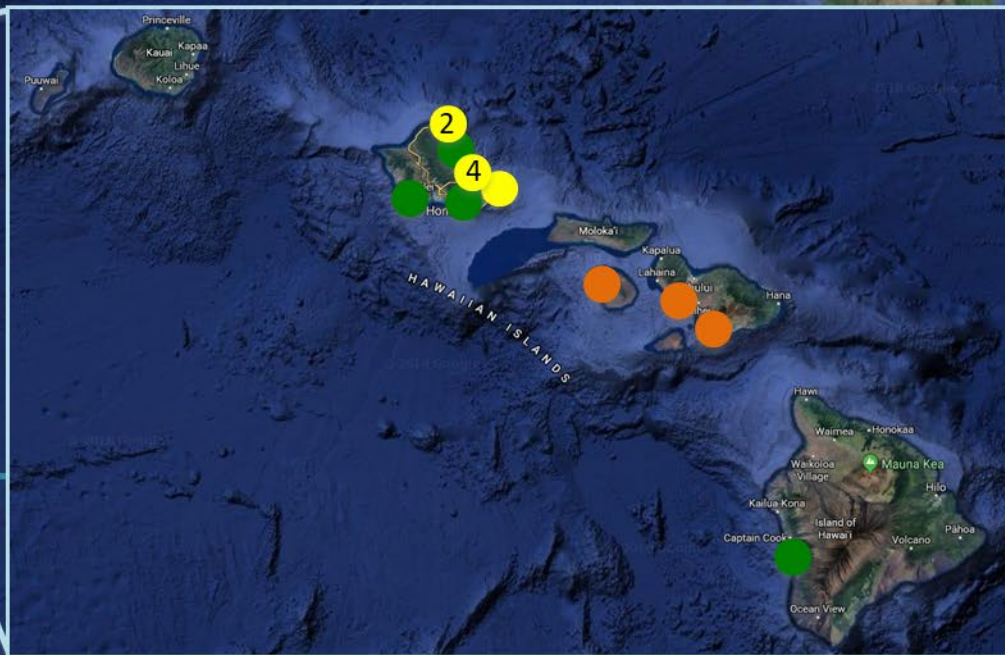
United States

North
Pacific
Ocean

Gulf of California

Mexico

Hawaii



Equator

American
Samoa



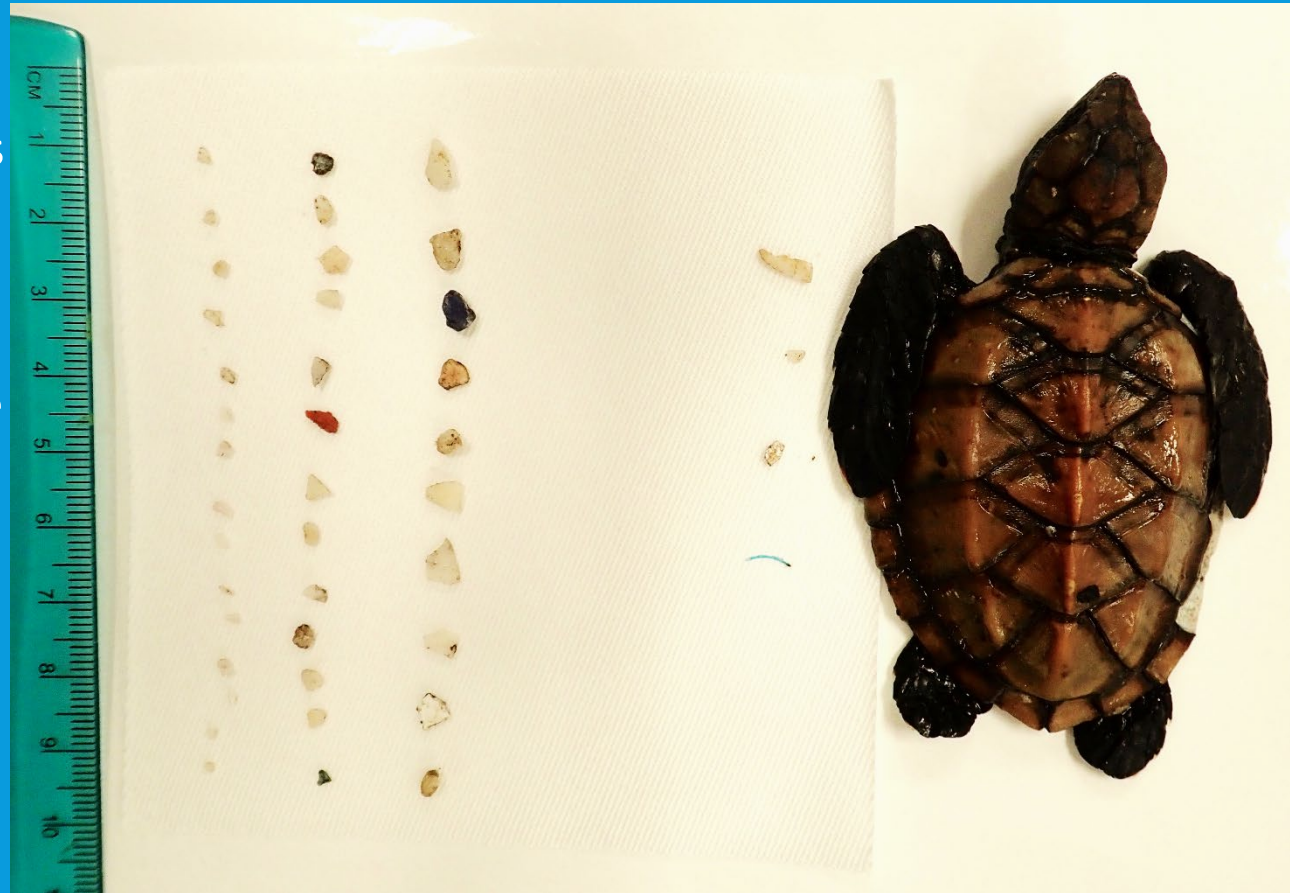
Google



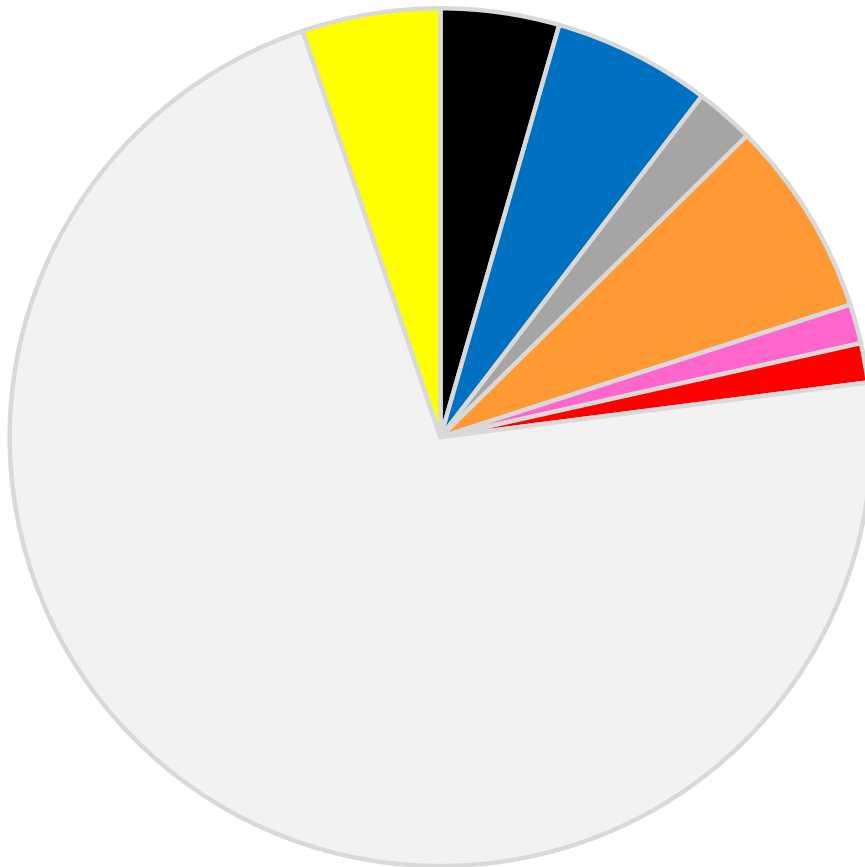
1000 km

SAMPLE COLLECTION

- Necropsy
- Examine entire GI tracts
- Record color, type, size, mass
- Store plastics and tissues in LN2 for future chemical analysis
- Calculate per turtle
 - # of pieces
 - mass
 - g/kg



COLORS



■ black

■ blue

■ grey

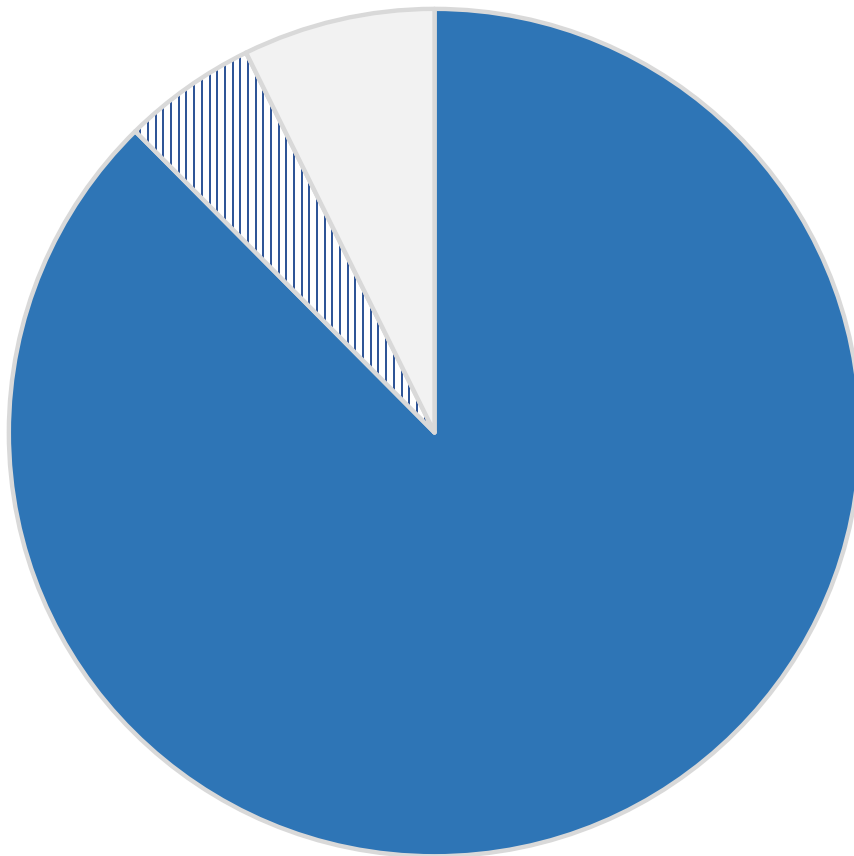
■ orange

■ pink

■ red

■ white

TYPES

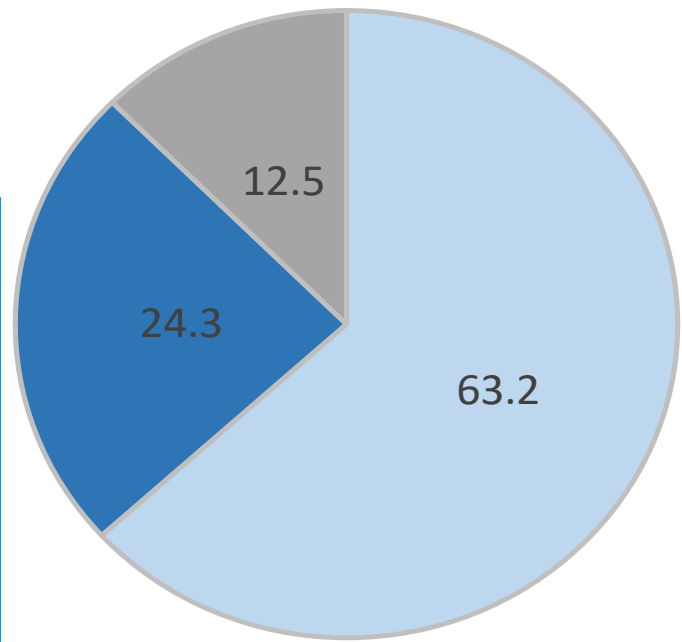


■ fragment

▨ line

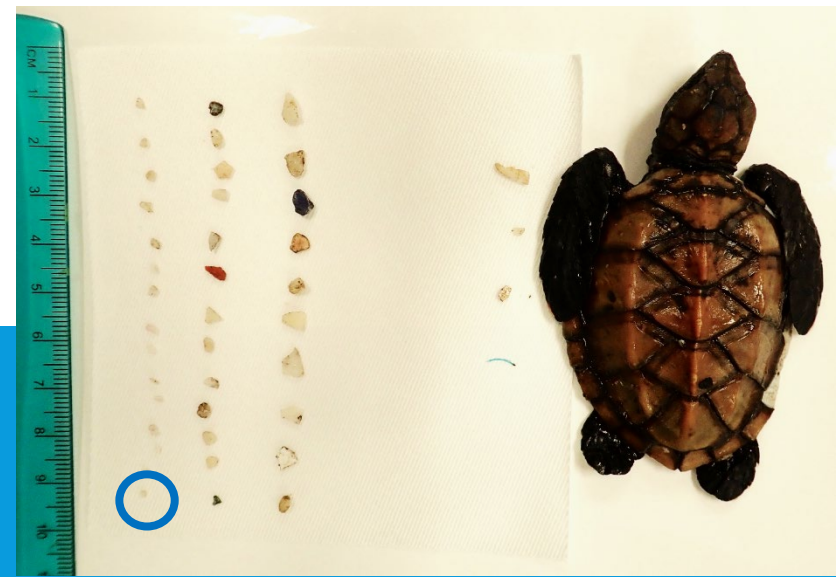
□ sheet

SIZES

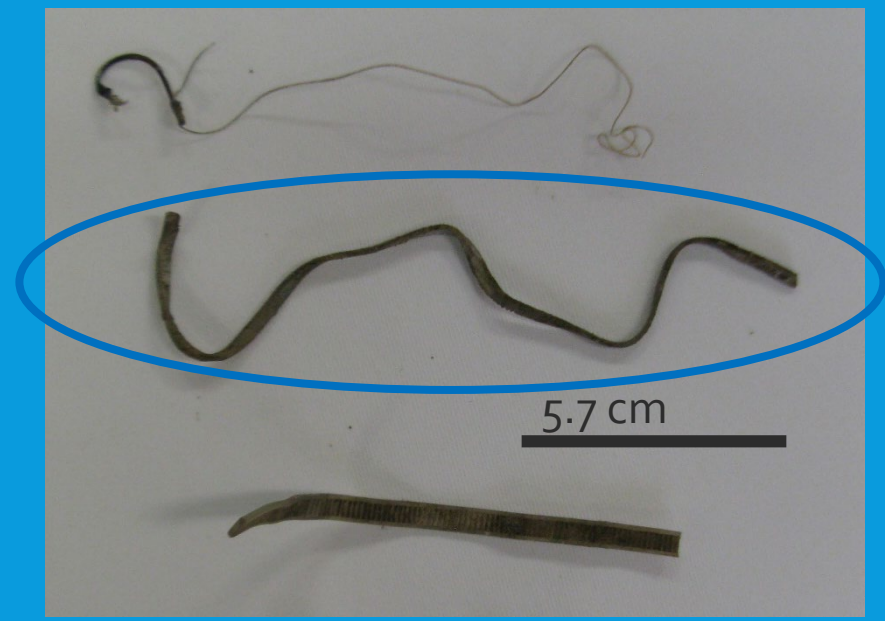


- microplastics (<5mm)
- mesoplastics (5-25mm)
- macroplastics (25-1000 mm)

Mean: 1.13 cm SD: 1.90 cm

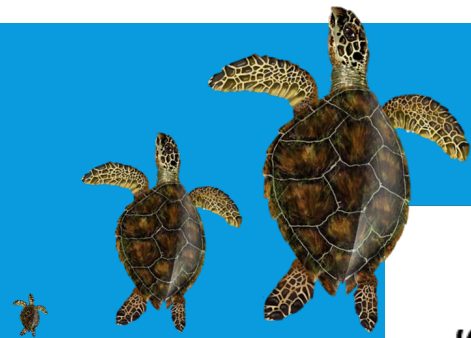


Minimum: 1 x 1 x 0.5 mm

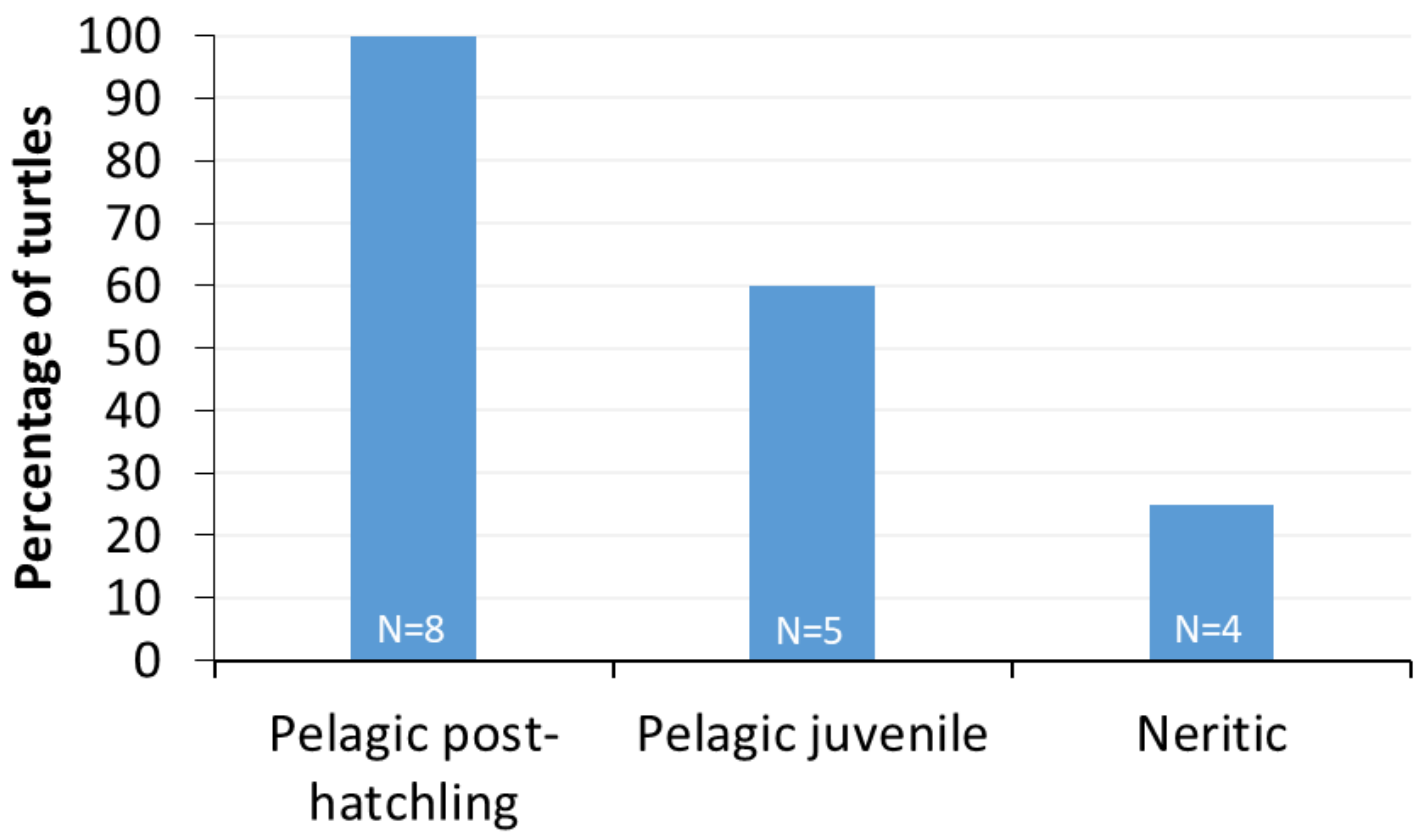


Maximum: 14 x 0.5 x 0.1 cm

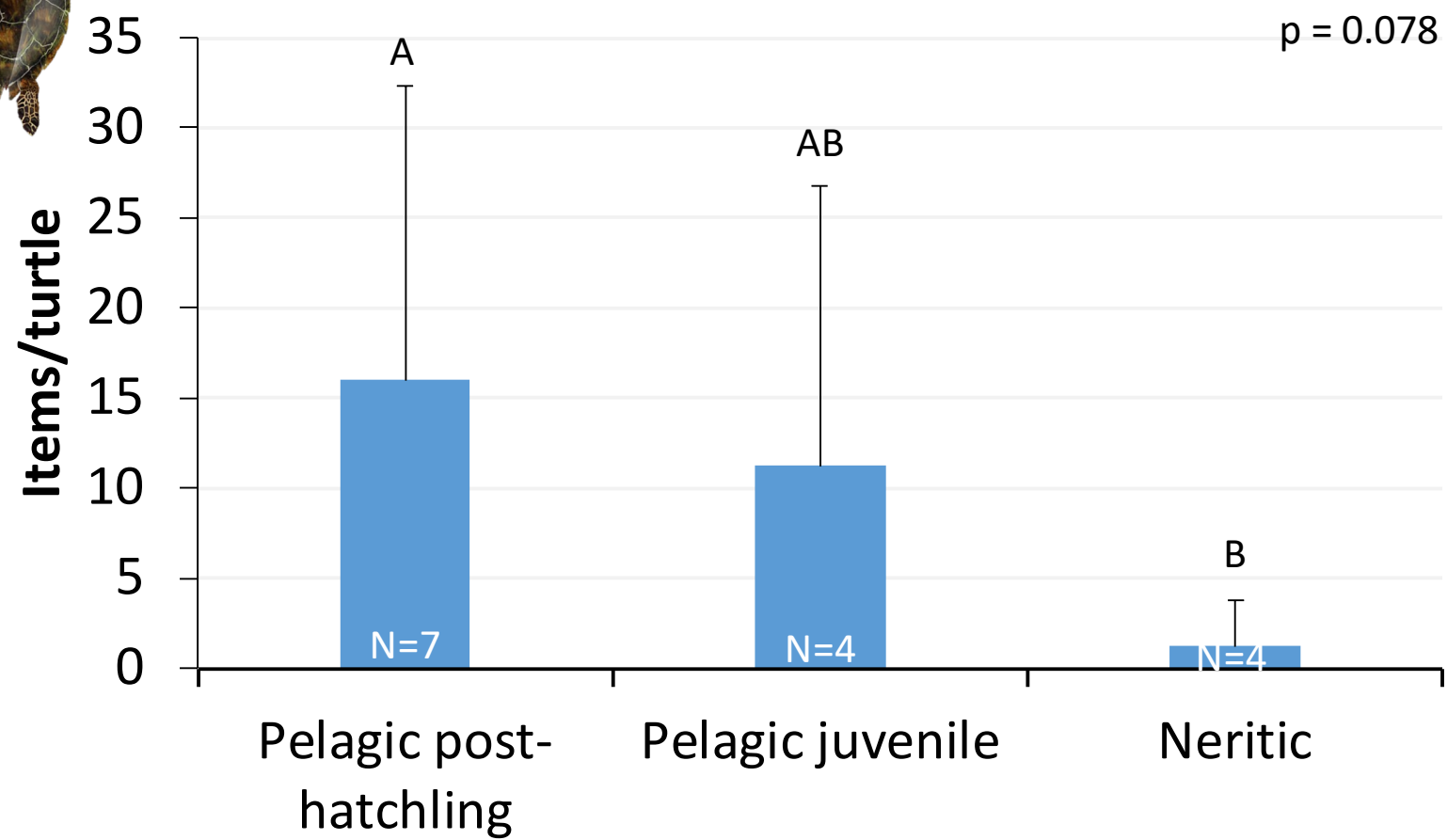
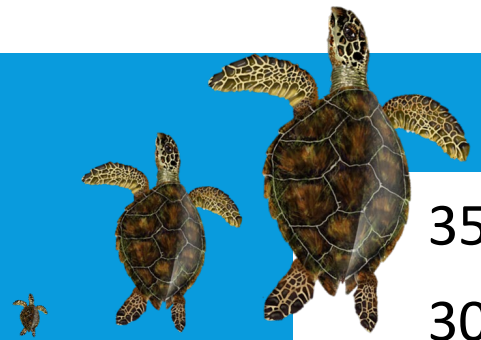
FREQUENCY OF OCCURRENCE



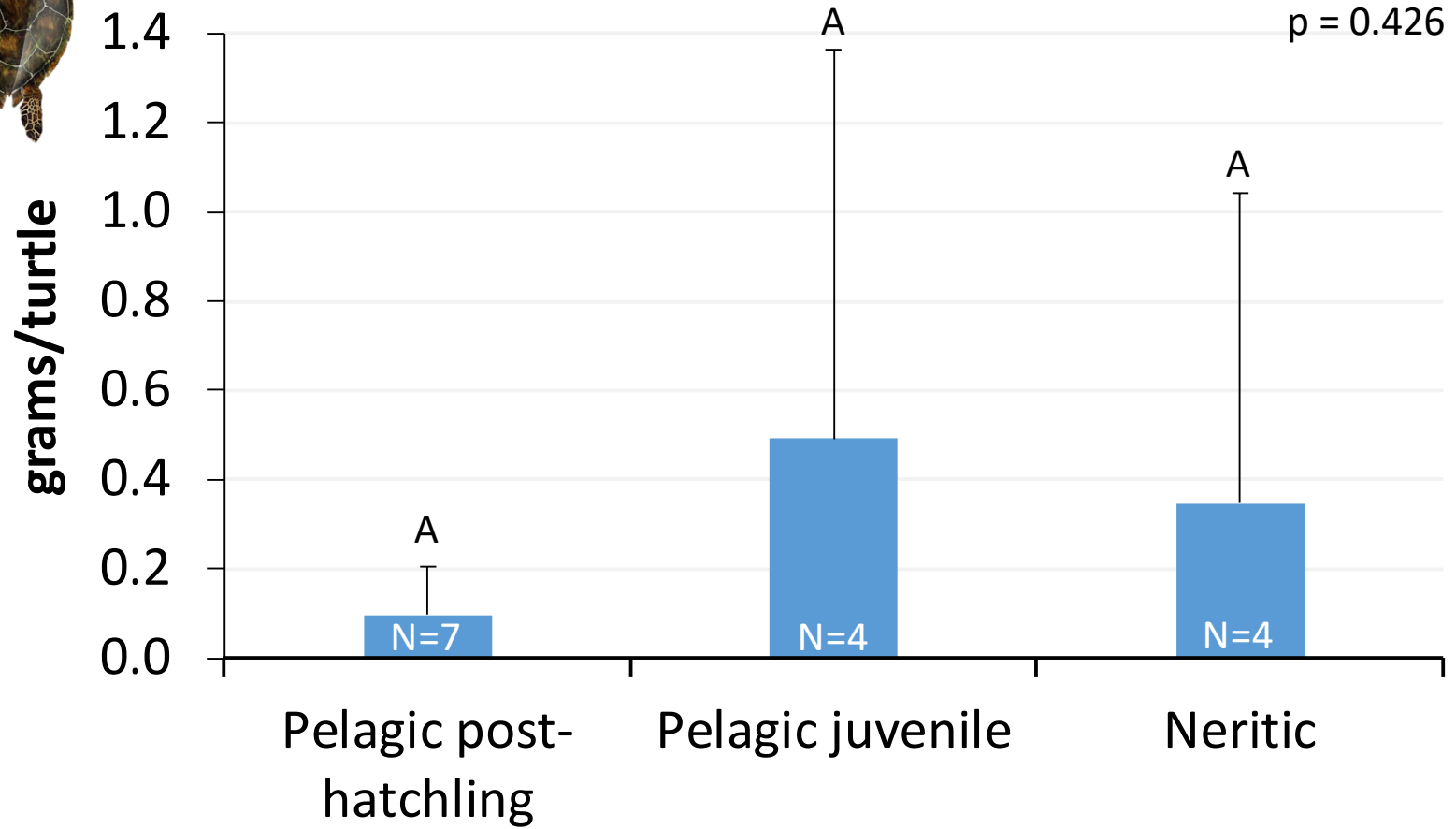
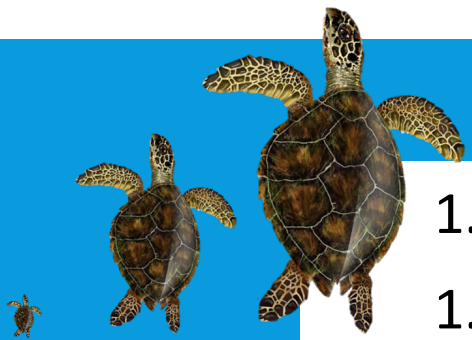
70.6 % N = 17



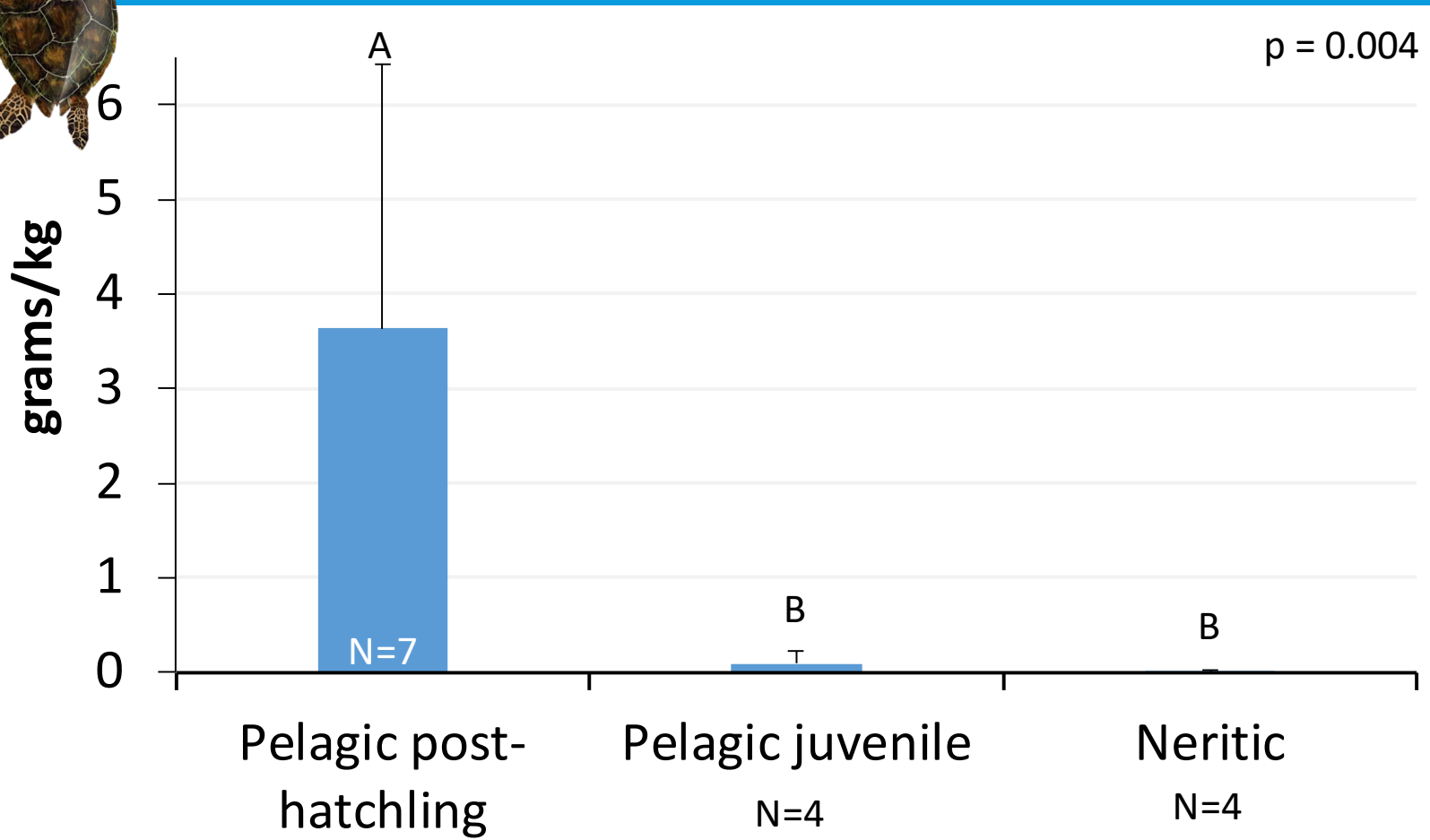
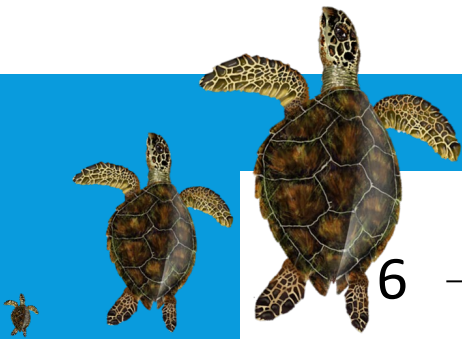
QUANTITIES: COUNT/TURTLE



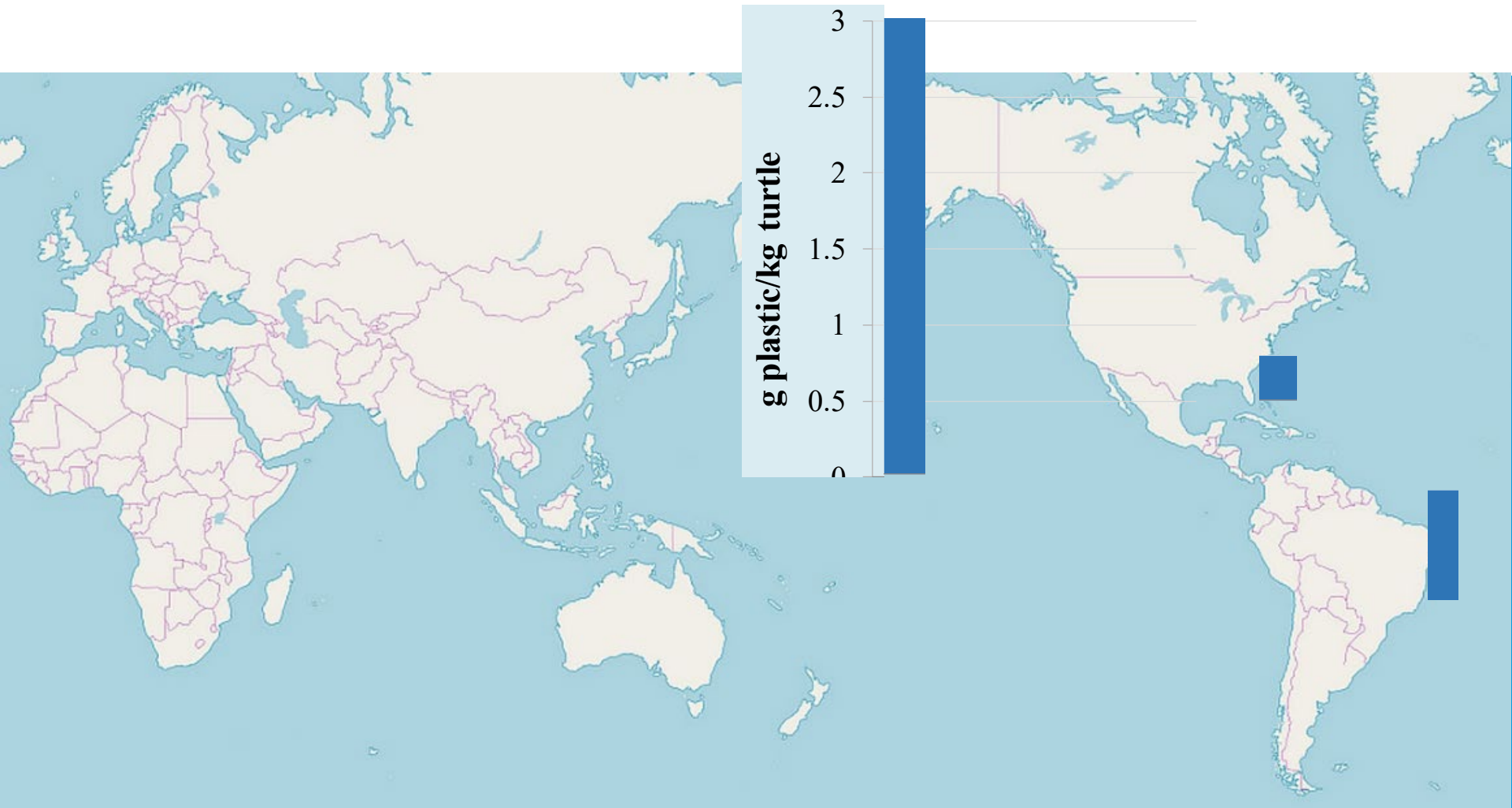
QUANTITIES: GRAMS/TURTLE



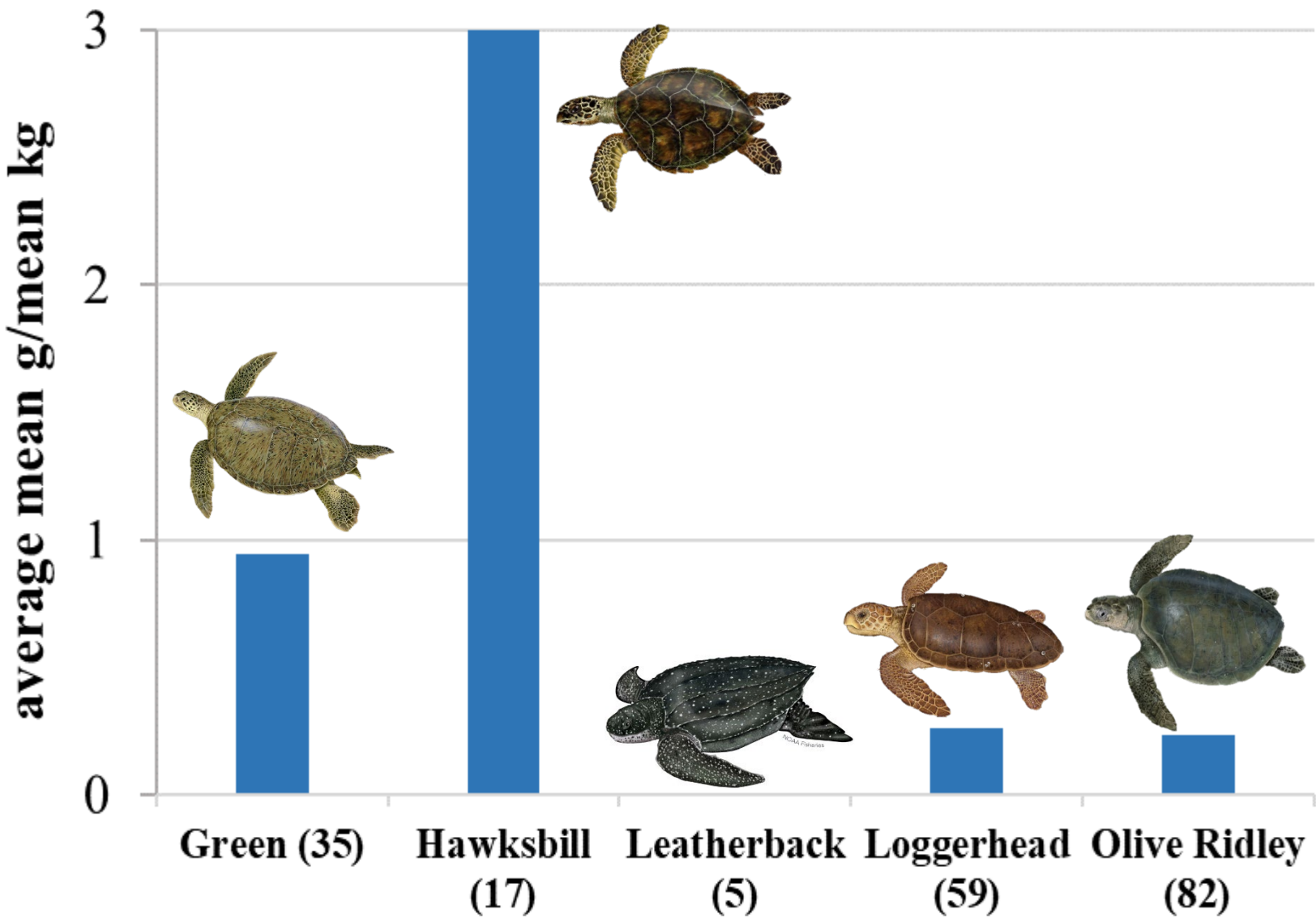
QUANTITIES: GRAMS/KG



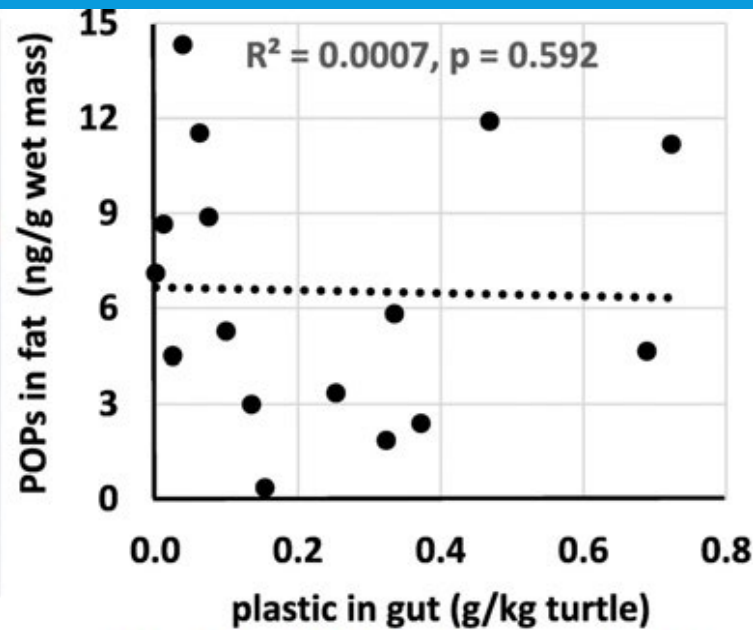
UPDATED HAWKSBILL GLOBAL COMPARISON



UPDATED SPECIES COMPARISON



EFFECTS OF PLASTIC INGESTION?



Plastic ingestion not correlated to POPs in sea turtles.

Clukey et al. 2018 Sci Total Environ

- No dietary dilution
- No gut obstructions, perforations, torsions
- Source of POP exposure is likely food > plastic

CONCLUSIONS

- Report data in multiple, proper units
- Focus on younger, pelagic-phase turtles in plastic polluted regions
- Investigate effects



THANK YOU!



- Paul Becker, John Kucklick, Rebecca Pugh, Katy Shaw



- Brenda Jensen, Kayla Brignac, Frannie Nilsen, Angela Hansen, Adam Kurtz, Elise Kohli, Jennette Vanderjagt



- Devon Francke, Wendy Marks, Irene Nurzia Hamburg



- Bob Rameyer, Renee Breeden



- Katharine Clukey

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