Thirteen years of sea turtle plastic ingestion monitoring in the Central Pacific

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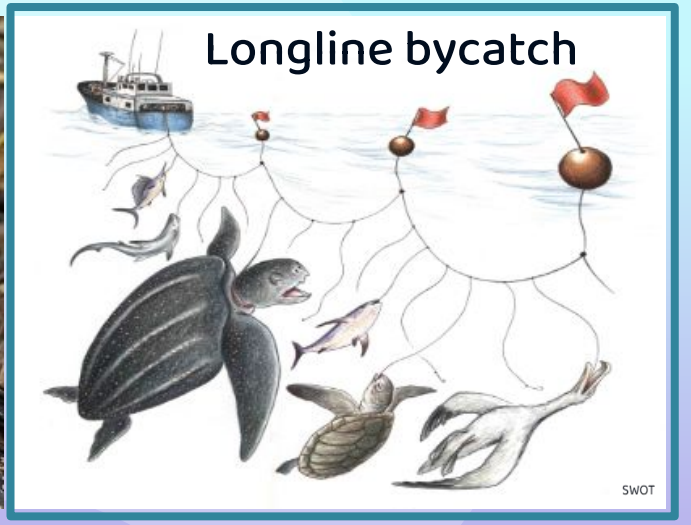
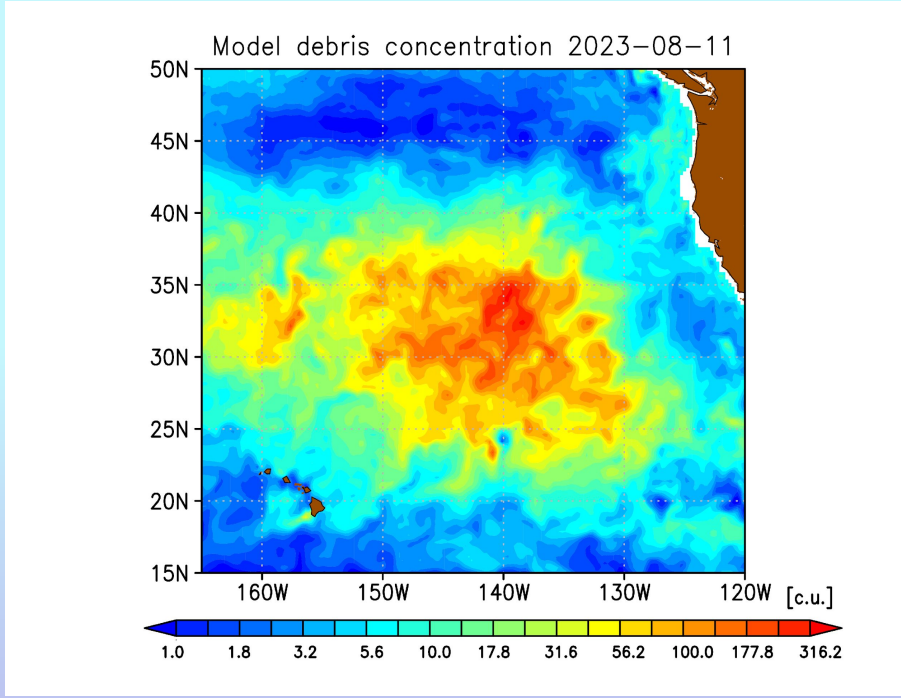
BEMAST

Biological & Environmental Monitoring & Archival of Sea Turtle Tissues

- Long term national biomonitoring project
- Collect and store samples for future research
- Standardized reporting measurements (Lynch et al 2018)



Pelagic lifestage turtles near GPGP at risk



Dr. Maximenko and Hafner, IPRC, University of Hawai'i

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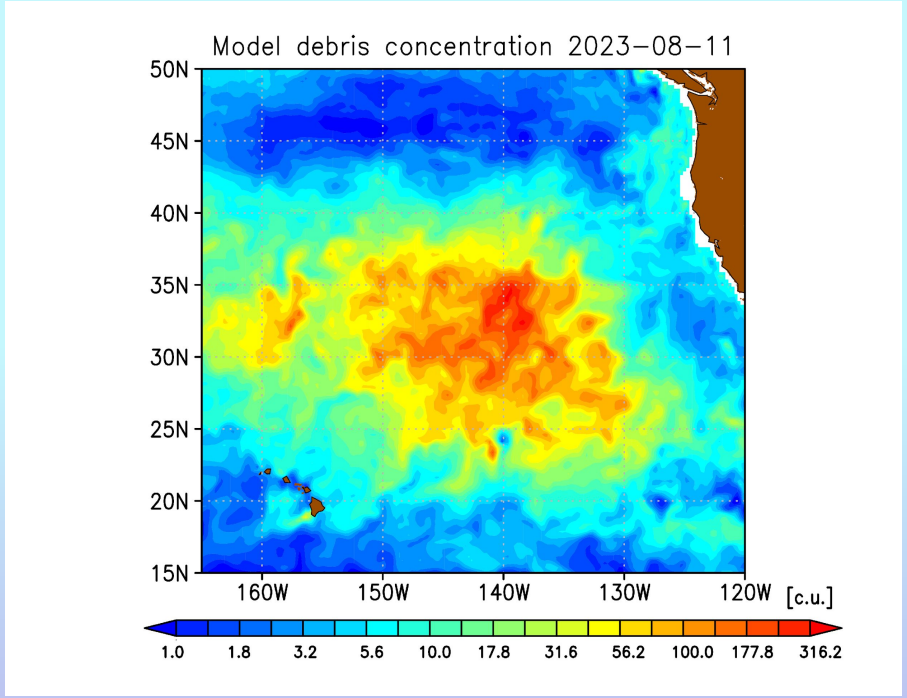

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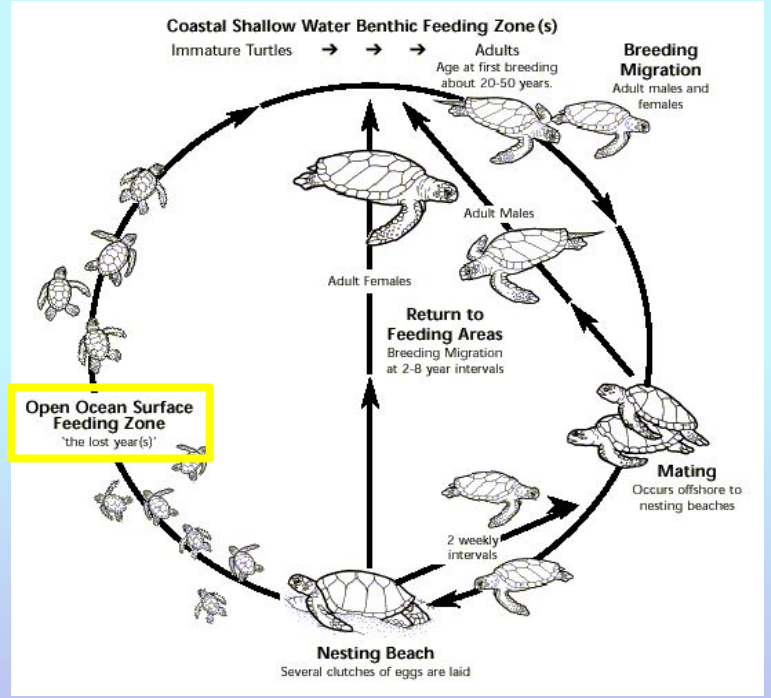

Lanyon et al. 1989

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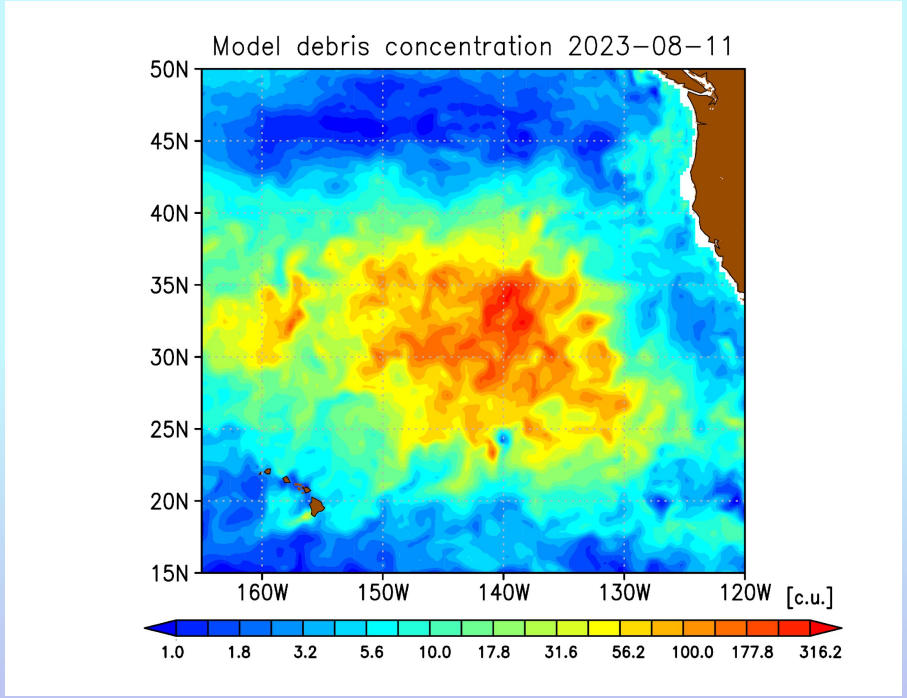

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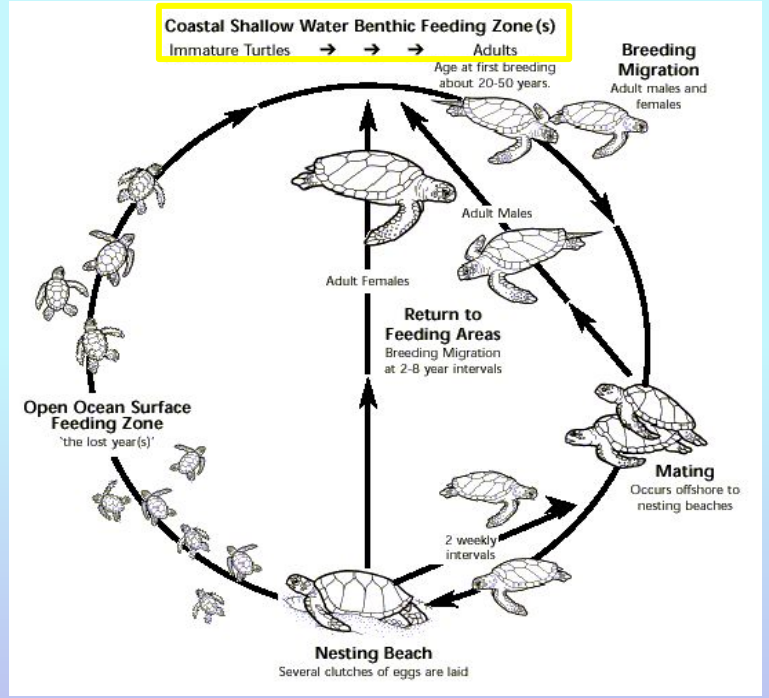
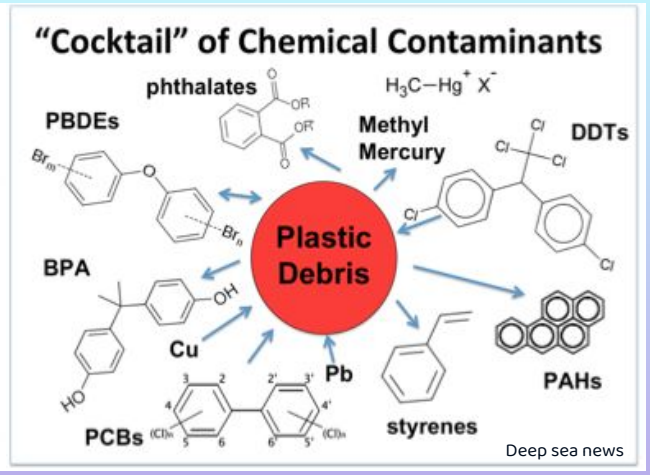


Lanyon et al. 1989

Effects of plastic ingestion

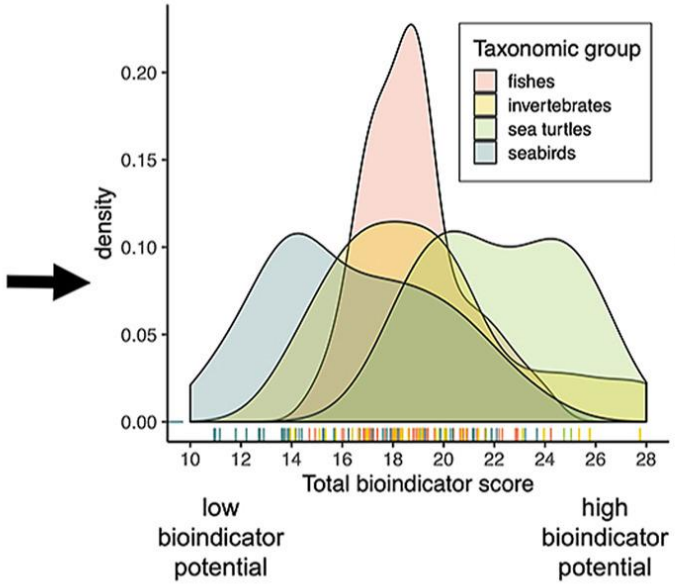
- Juvenile and pelagic stage turtles ingest more plastic (Schuyler et al 2012)
- Lethal effects: obstruction/perforation of gastrointestinal tract (GI)
- Sublethal effects: dietary dilution and plastic chemical leaching

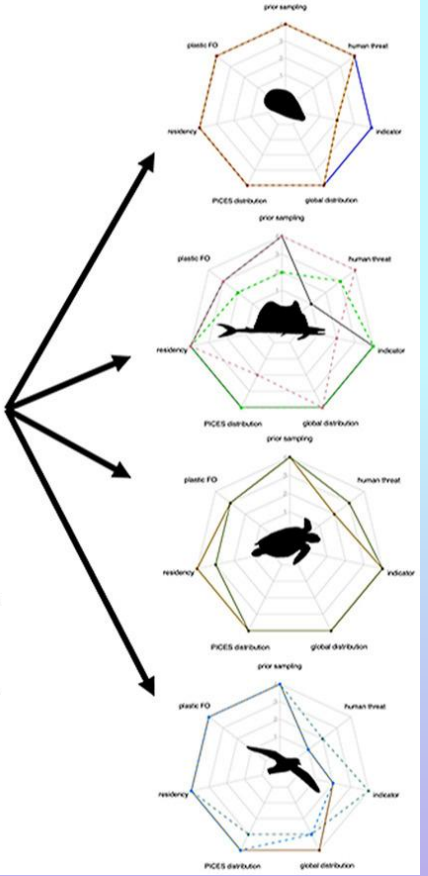


Sea turtles are good bioindicators

Loggerheads and greens were assessed

Bioindicator Rubric
Prior sampling conducted in the PICES Region
Plastic frequency of occurrence in the PICES region
Species distribution in PICES region
Species distribution globally
Threat of human exposure
Residency in the PICES region
Is it (or a congener) already an indicator of plastic ingestion?





Savoca et al 2022

Loggerhead (*Caretta caretta*)

IUCN global status: Vulnerable

- N. Pacific Ocean subpopulation is of least concern
- S. Pacific Ocean subpopulation is critically endangered

Threats: human consumption, fisheries bycatch (Koch et al. 2006, Peckham et al. 2008)

Juvenile foraging habitat in Central North Pacific (Polovina et al. 2006, Abecassis et al. 2013)

Green (*Chelonia mydas*)

Cultural importance in Hawaii: sacred, ʻaumakua

IUCN global status: Endangered
- C. Pacific Ocean subpopulation is of least concern

Known to ingest more plastic than other species (Clukey et al 2017)

More opportunistic feeders (Arthur and Balazs 2008)

Threats: plastic ingestion, fisheries bycatch

Leatherback (*Dermochelys coriacea*)

IUCN global status: Vulnerable

- W. Pacific Ocean subpopulation is critically endangered
- E. Pacific Ocean subpopulation is critically endangered

Immature leatherbacks from Pacific LL have not ingested plastic (n=5) (Clukey et al 2017)

Threats: entanglement, climate change

Found entangled in nylon fishing line (n=2) (Wedemeyer-Strombel et al 2015)

Hawksbill (*Eretmochelys imbricata*)

Cultural importance in Hawaii: sacred, ‘aumakua

IUCN global status is critically endangered

Circumglobal tropical range (Wallace et al 2010)

Very small nesting populations (avg 5-25 individuals/year) in Hawaii (Gaos et al 2021)

“The smallest sea turtle population on the planet” (Van Houtan et al 2016)

Threats: harvest, fisheries bycatch, habitat loss, plastic pollution (Becker et al 2019)

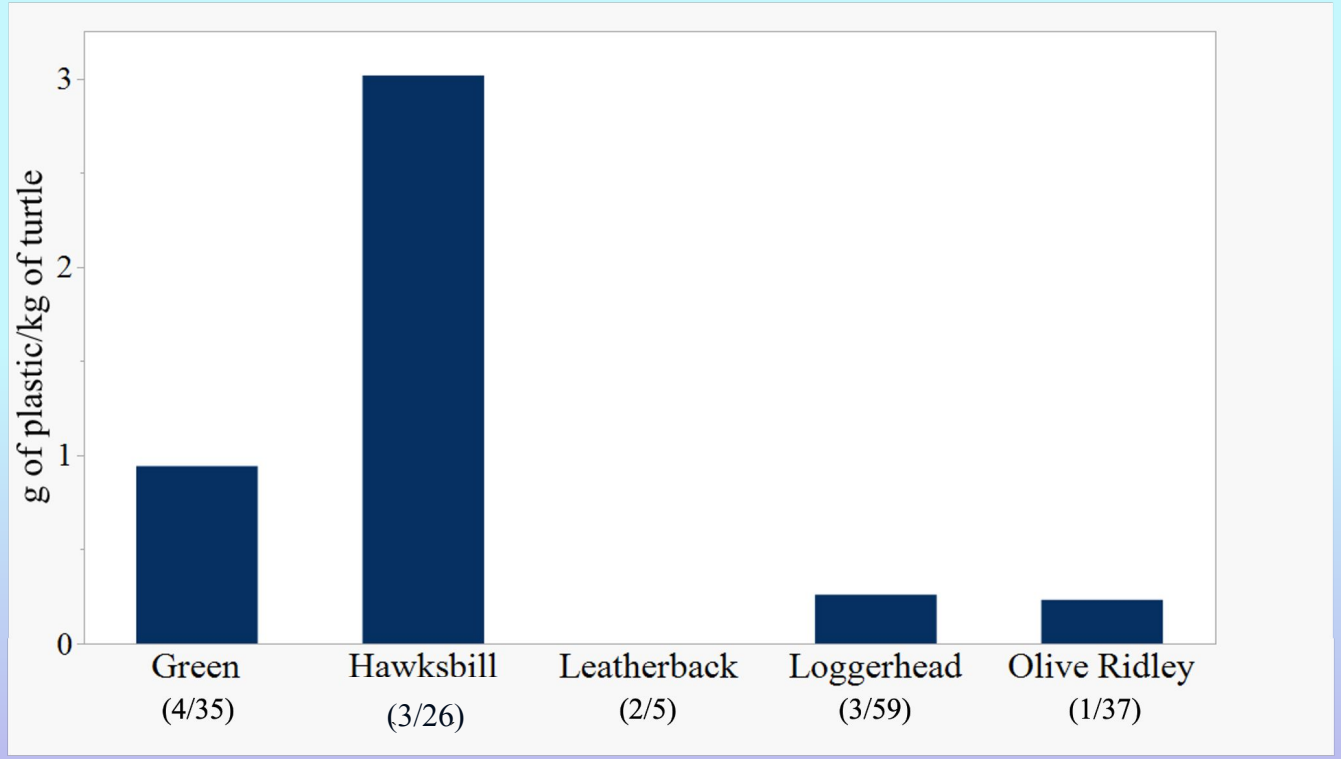
Olive Ridley (*Lepidochelys olivacea*)

IUCN status: Vulnerable

Most abundant and most widely distributed of all species
(Caceres-Farias et al 2022)

Threats: plastic ingestion, fishing gear entanglement, fisheries bycatch, climate change
(Wedemeyer-Strombel 2015; Caceres-Farias et al 2022)

Plastic ingestion rates in the Central Pacific



Species (# of studies/# of individuals)

Updated from Lynch et al 2018

Goals of the study

Increase current sample size to perform a global comparison

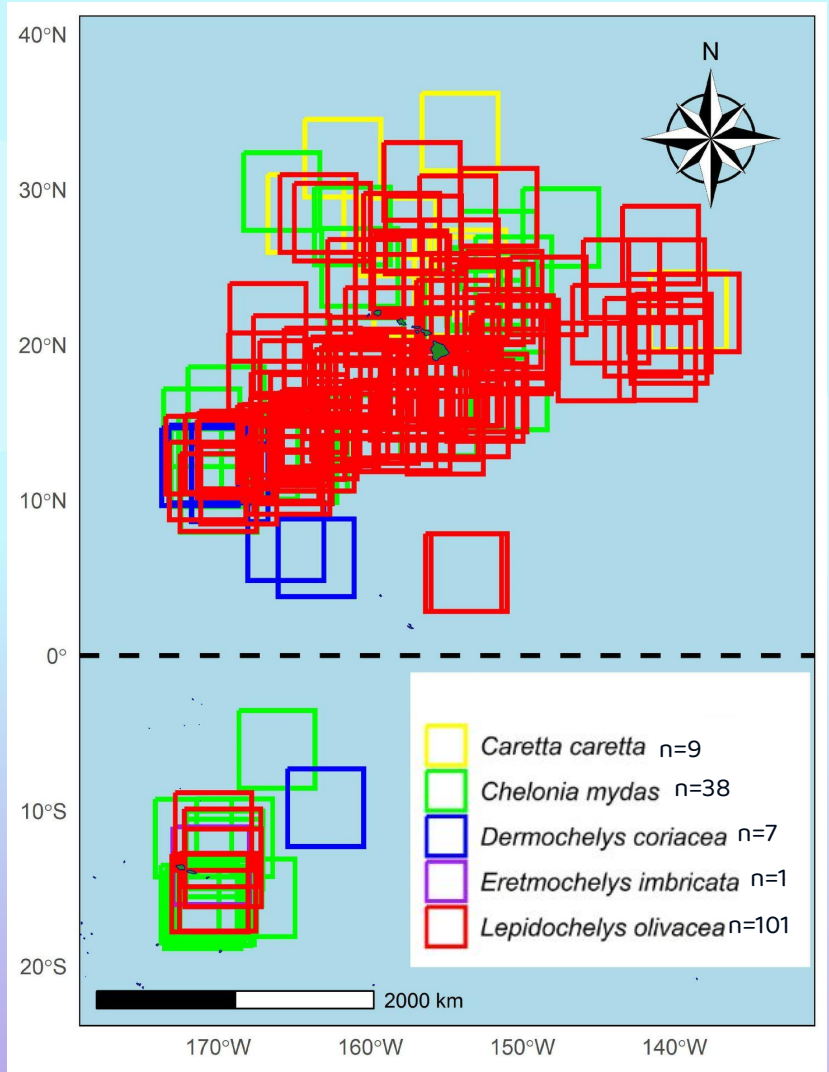
Determine plastic mass/body mass ratio for all species

Compare the average amount of plastic ingested across the years

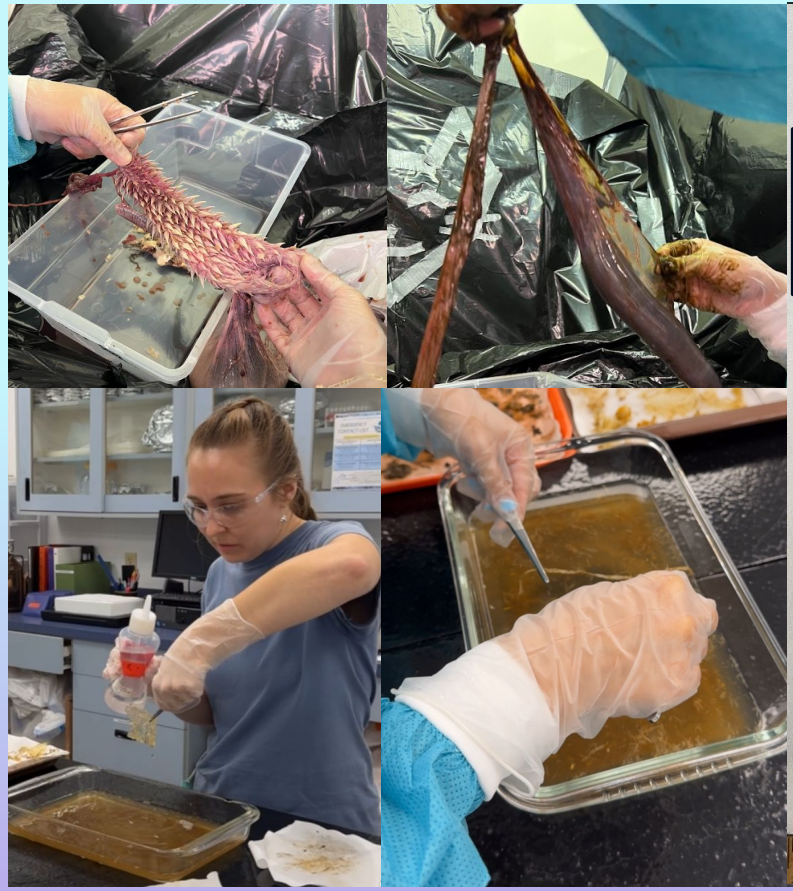
Determine size, mass, and polymer type of plastic ingested

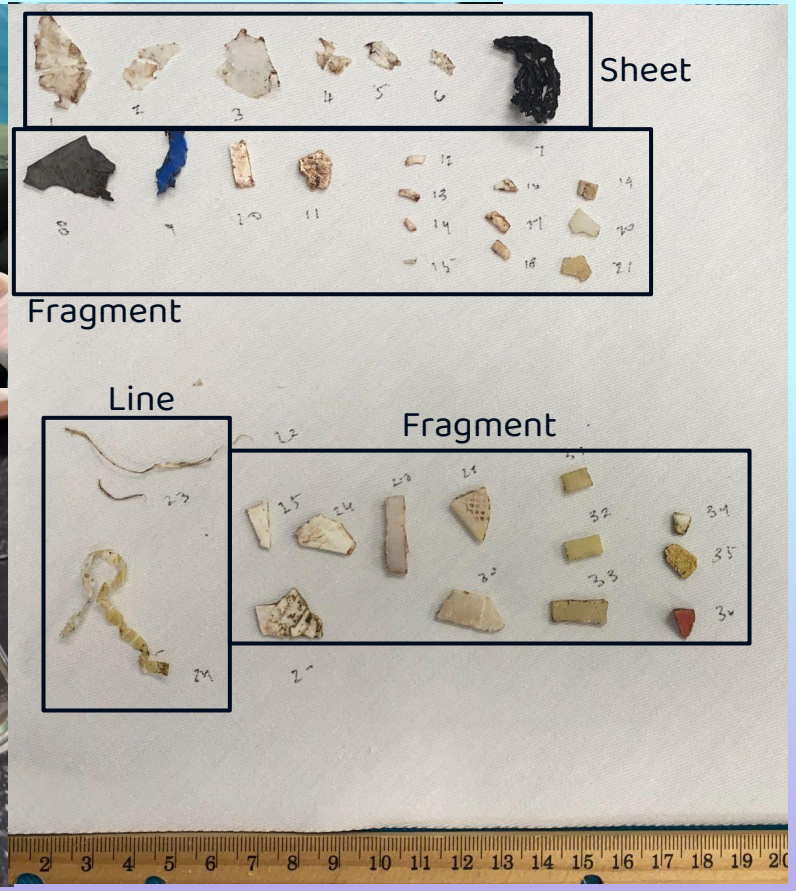
Compare the average amount of plastic ingested across all species

Capture Location of LL bycaught turtles



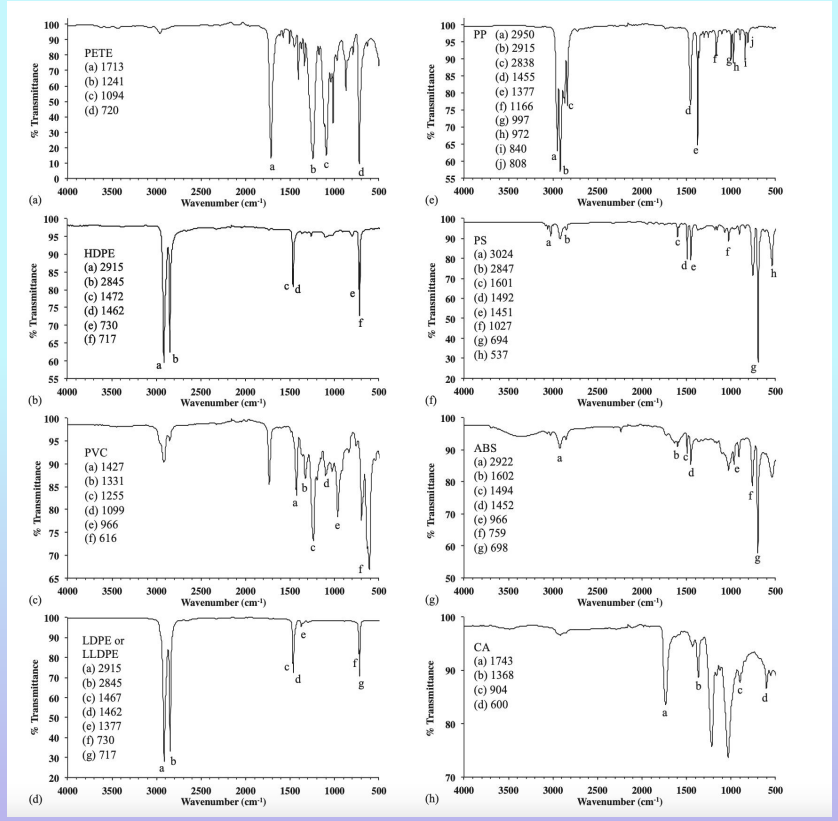
Collection of plastics / Categorization





Polymer Identification

Attenuated Total Reflection-Fourier Transform Infrared Spectroscopy: chemical bonds

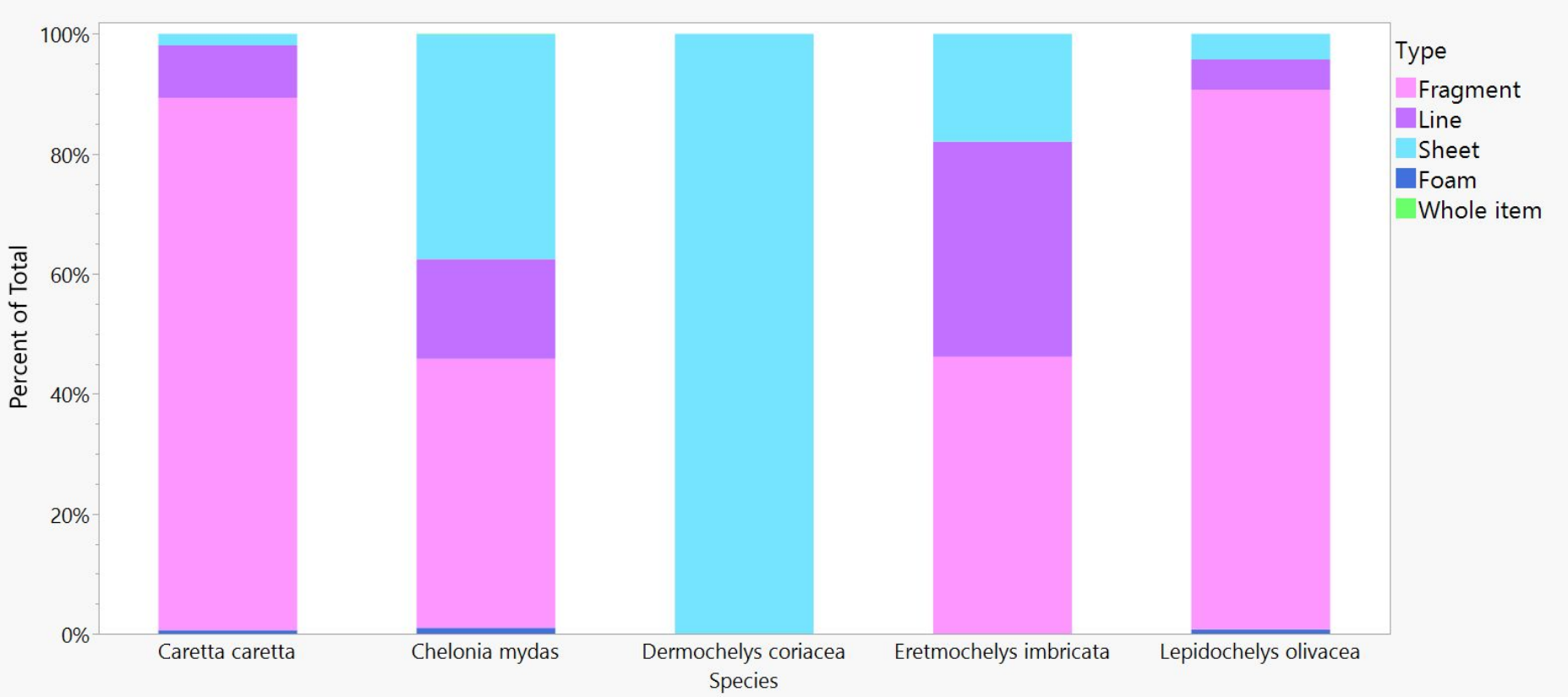


Jung et al. 2018

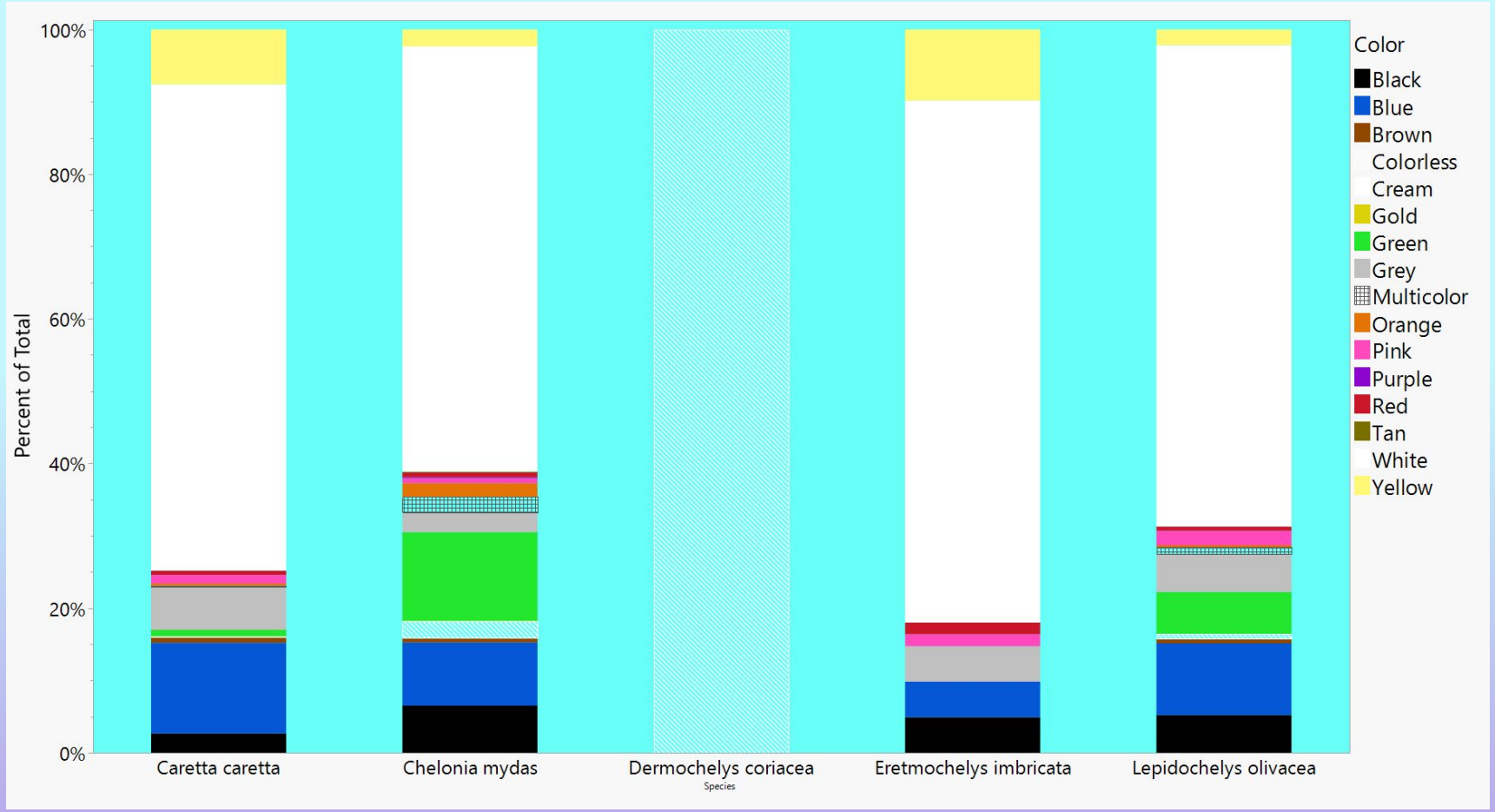
Results

Loggerhead	Green	Leatherback	Hawksbill	Olive Ridley
n=9	n=38	n=7	n=1	n=101
FO: 88%	FO: 97%	FO: 0%	FO: 100%	FO: 95%
74 ± 83 pcs	143 ± 166 pcs	0 pieces	33 pieces	37 ± 49 pcs
23.77 ± 27.98 g	16.75 ± 16.47 g	0 grams	1.79 grams	5.24 ± 7.22 g
0.55 ± 0.62 g/kg	1.51 ± 1.65 g/kg	0 g/kg	0.281 g/kg	0.241 ± 0.37 g/kg

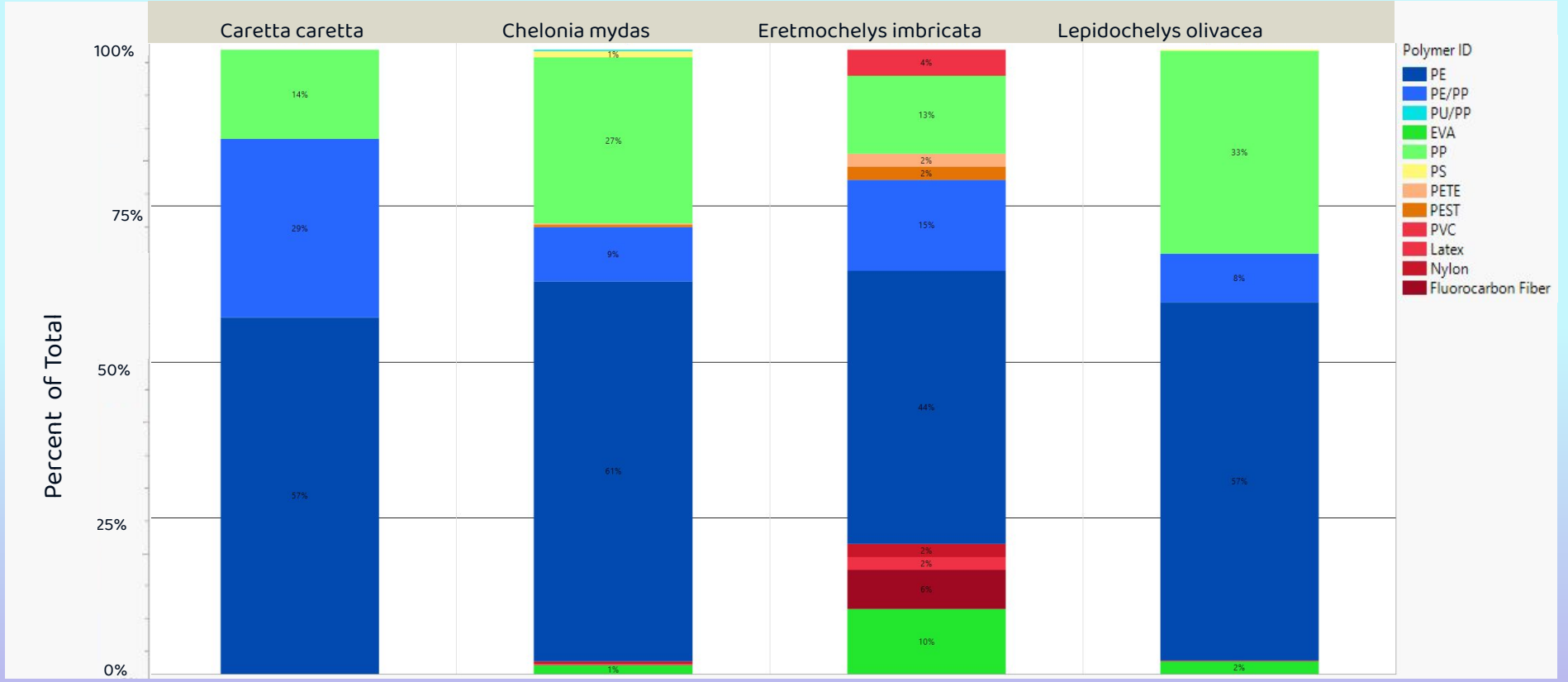
Plastic Type



Plastic Color



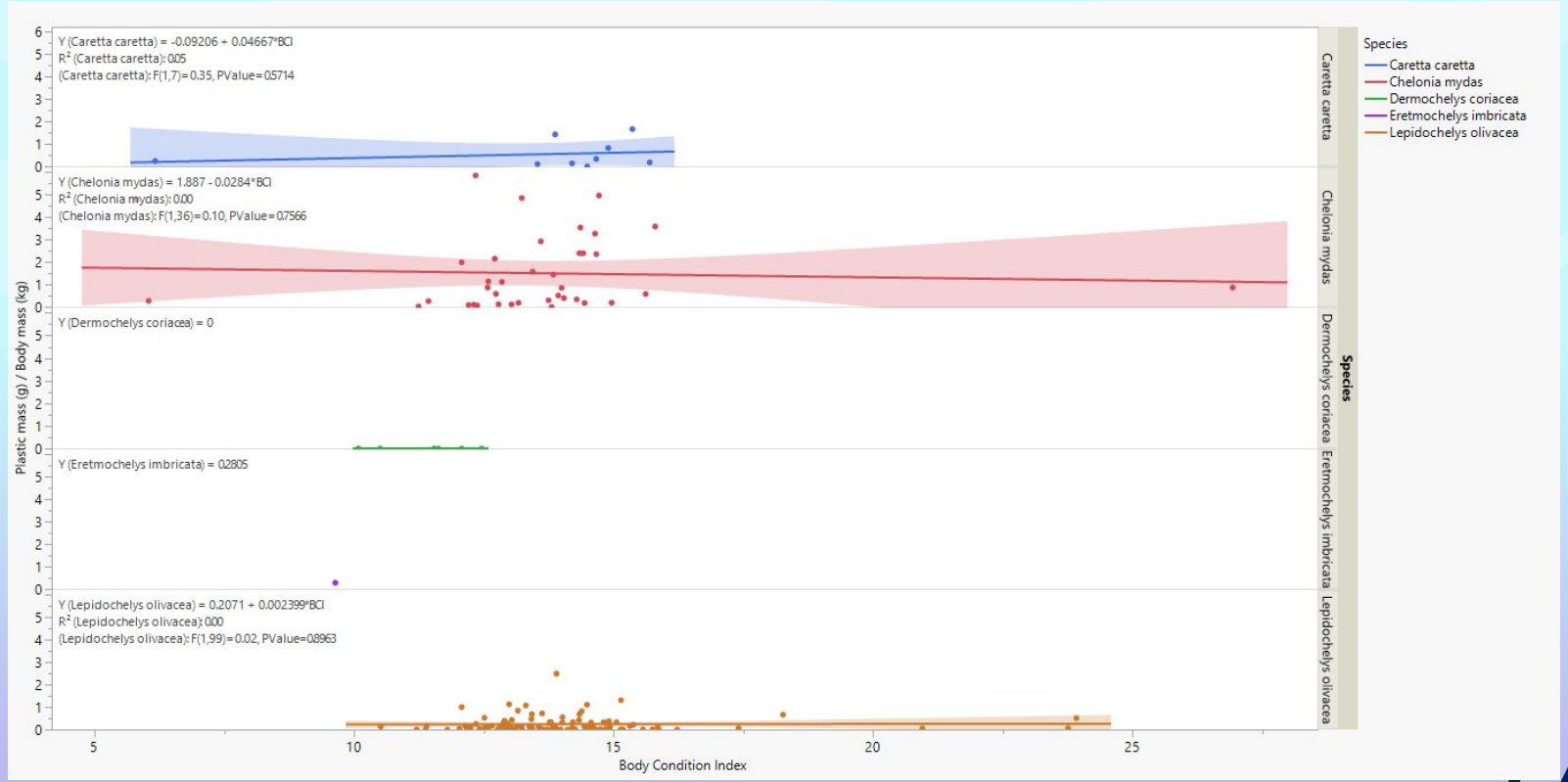
Polymer ID


Caretta caretta
Chelonia mydas
Eretmochelys imbricata
Lepidochelys olivacea
100%
75%
50%
25%
0%
Percent of Total
14%
29%
57%
1%
27%
9%
61%
1%
4%
13%
2%
2%
15%
44%
2%
2%
6%
10%
33%
8%
57%
2%
Polymer ID
PE
PE/PP
PU/PP
EVA
PP
PS
PETE
PEST
PVC
Latex
Nylon
Fluorocarbon Fiber

Pelagic juvenile green

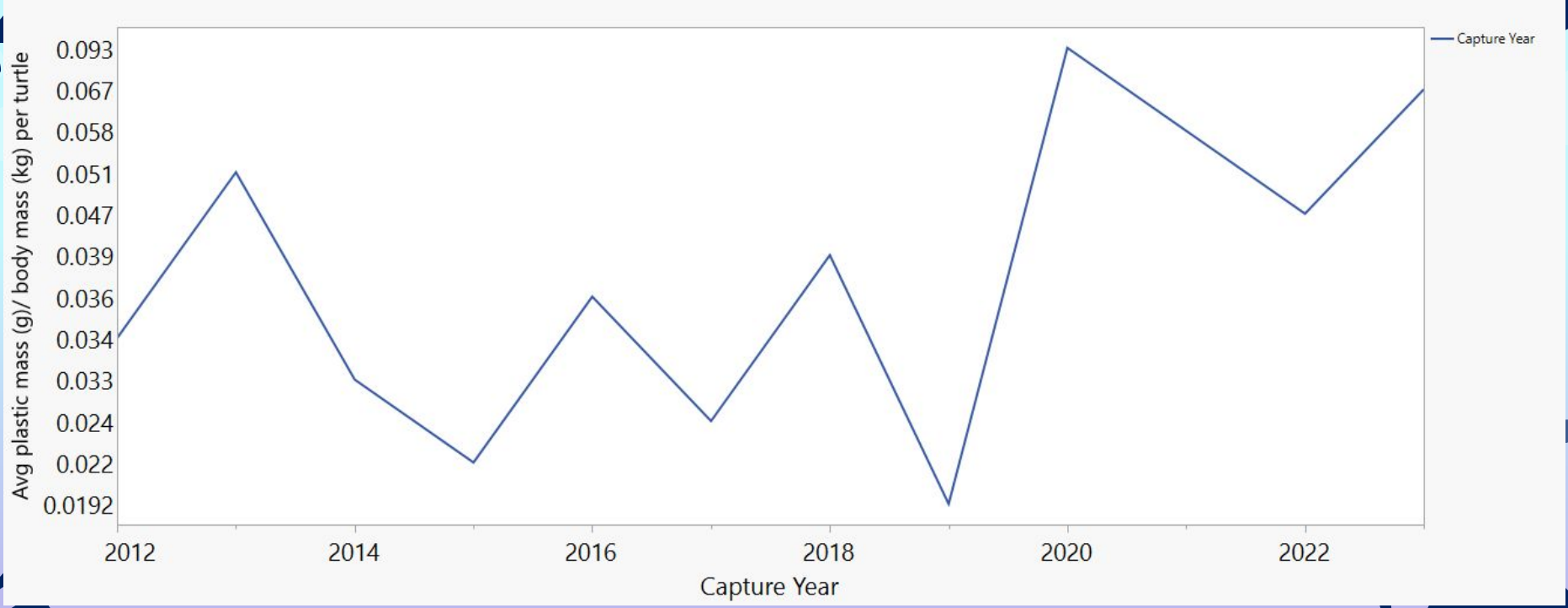
830 pieces
48 grams!
Plastic mass/body mass= 2.356 g/kg

Is plastic load related to body condition?



Skinny turtle → Fat turtle

Plastic ingestion rates over time



Next Steps

More studies

Continue studying plastic ingestion for all species

Monitor trends

Continue monitoring plastic ingestion rates over time

Consistent data

More detailed and standardized reporting guidelines

Acknowledgements:

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United States Geological Survey

Golden Honu Services of Oceania

Check out our website!

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