

# The Last Meal: Diet Analysis of Stranded Green Turtles (*Chelonia mydas*) on East Hawai'i Island.

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# Green Turtle Diet Studies Provide Critical Information

- Feeding ecology influences growth rate, age of maturity, reproductive output, and population size growth (Balazs & Chaloupka 2004)
- Recognition of dietary items guides sea turtle and habitat management (Forbes 1999)



Photo credit: Tui De Roy

# Research Question and Objective

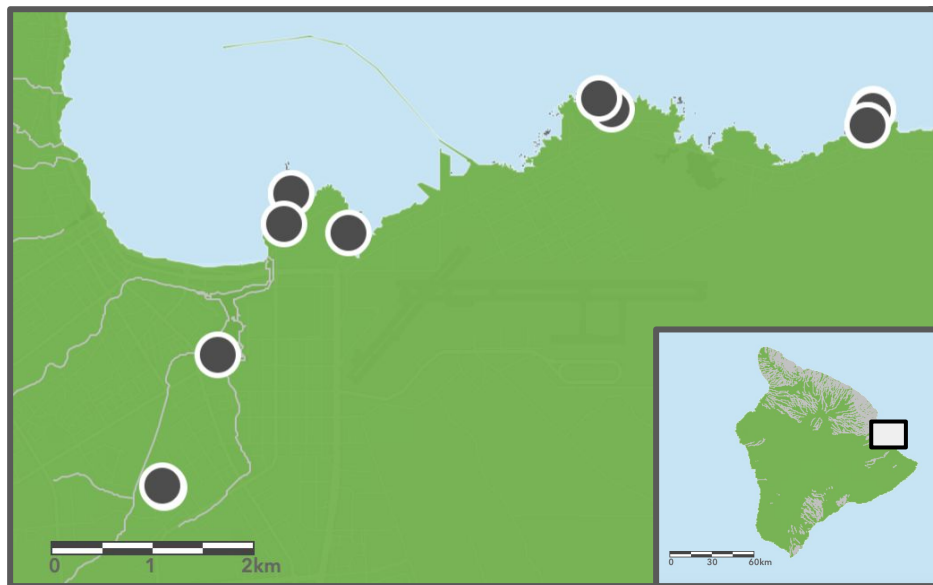
- What is the diet of green turtles (*Chelonia mydas*) on East Hawai'i Island?
- To analyze the esophagus and crop contents of green turtles (*Chelonia mydas*) found stranded or dead on the east coast of Hawai'i Island to determine the dietary composition of green turtles in this area





# East Hawai'i Study Sites

## Hilo



## Punalu'u



March 2020 - June 2022

# Sea Turtle Internal Anatomy

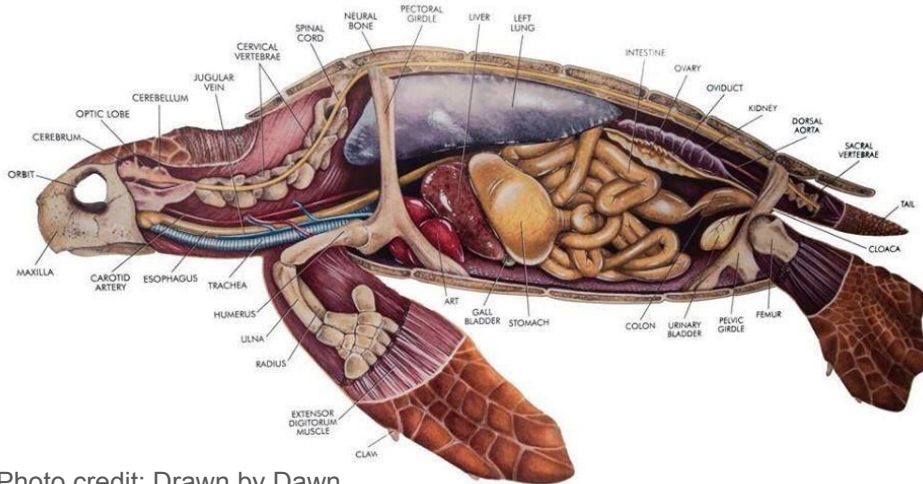
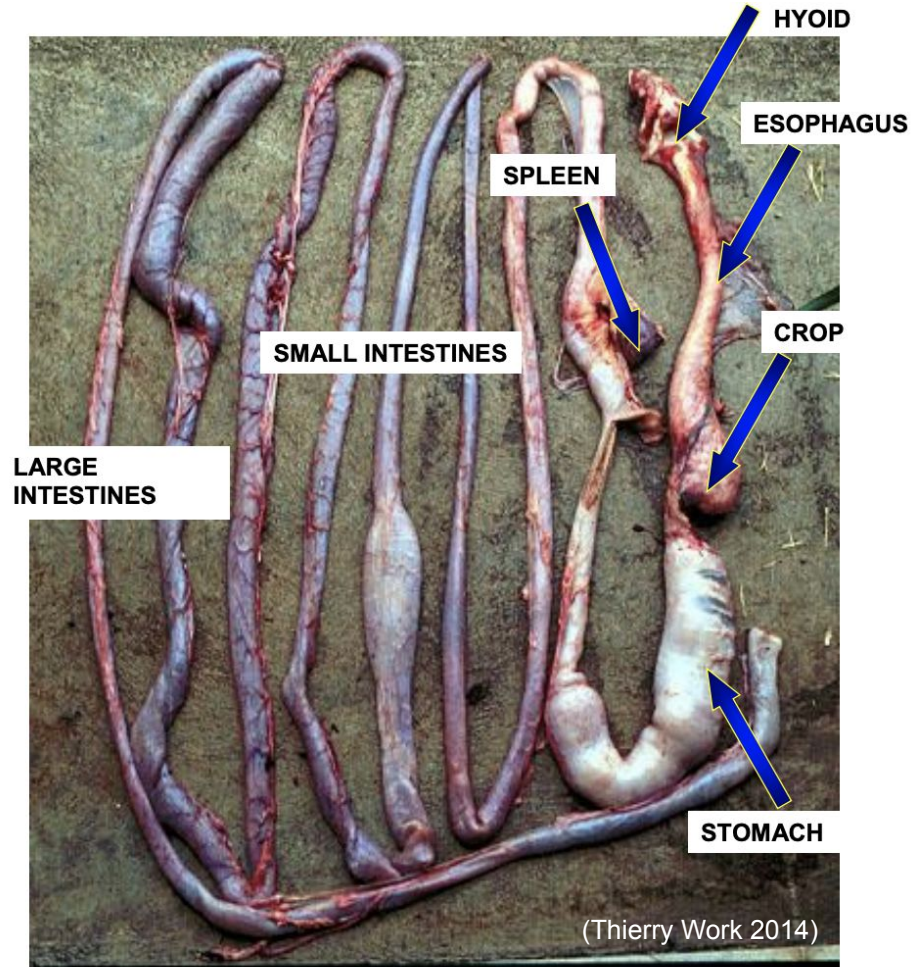


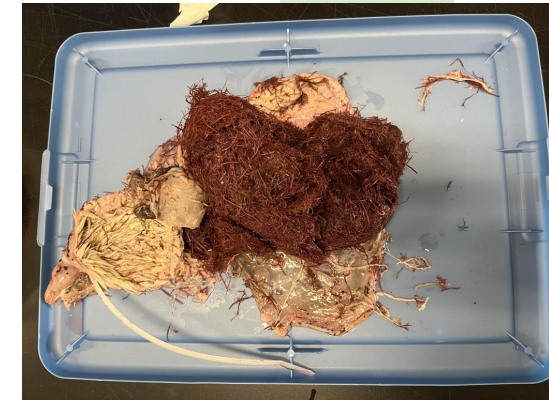
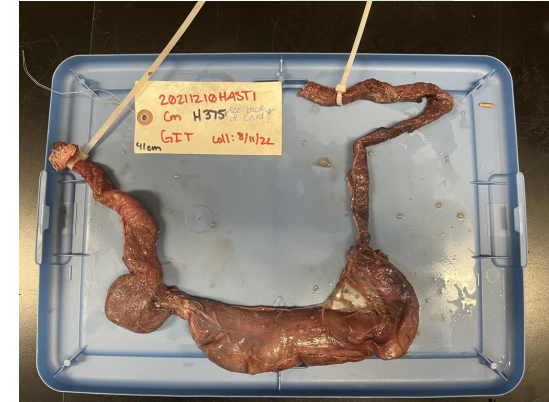
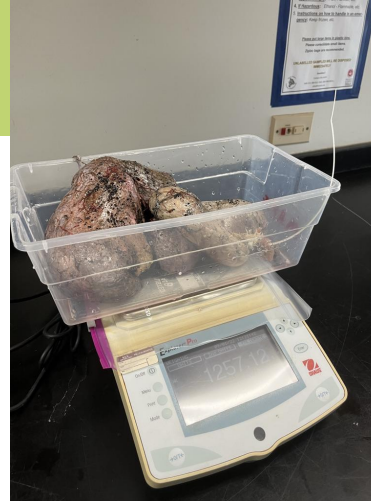
Photo credit: Drawn by Dawn



(Thierry Work 2014)

# Sample Processing

1. Entire organs and contents weighed
2. Organs opened with vertical incision and sectioned





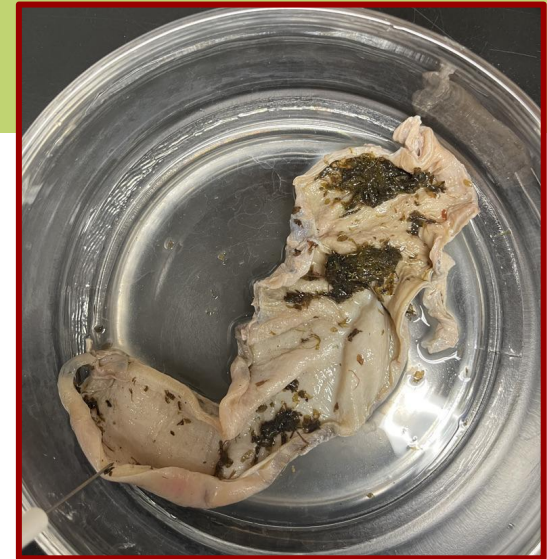
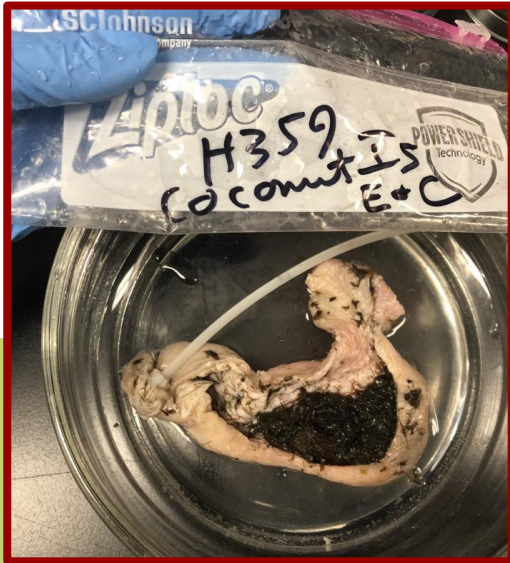
# Sample Processing

3. Contents sorted with microscope
4. Permanent slide vouchers made
5. Diet items identified to lowest possible taxonomic level  
(Abbot 1999, Abbott & Huisman 2004, Huisman et al. 2007, Russell & Balazs 2000)
6. Dry weights measured



# Esophagus, Crop, and Stomach Fill and Conditions

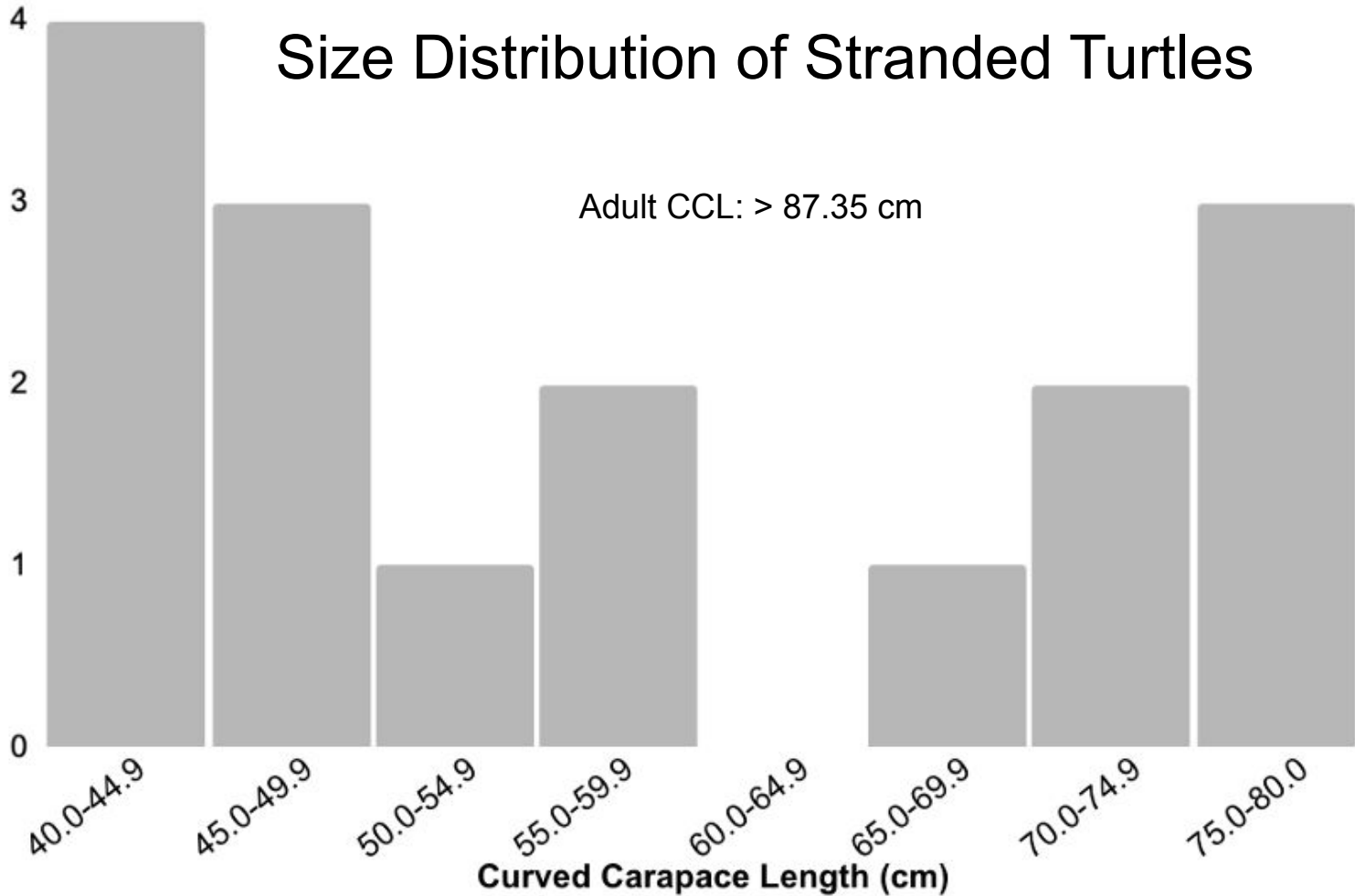
- Some full, others nearly empty
- Discoloration of algae
- Content preservation
- Mucus





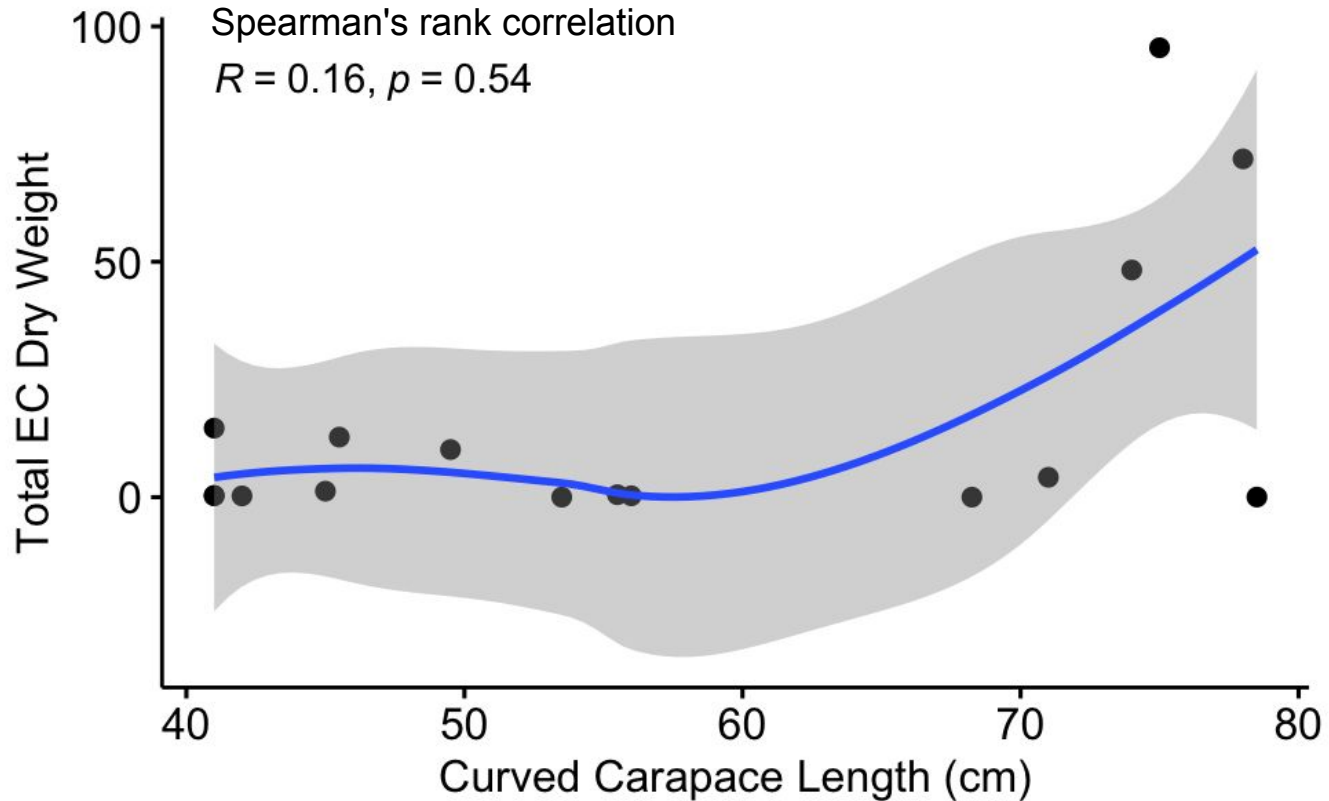
# Size Distribution of Stranded Turtles

Number of turtles



(Balazs 1980, Chaloupka et al. 2008))

# EC Fill vs Turtle Size (Curved Carapace Length in cm)







# Red Macroalgae Were the Most Common

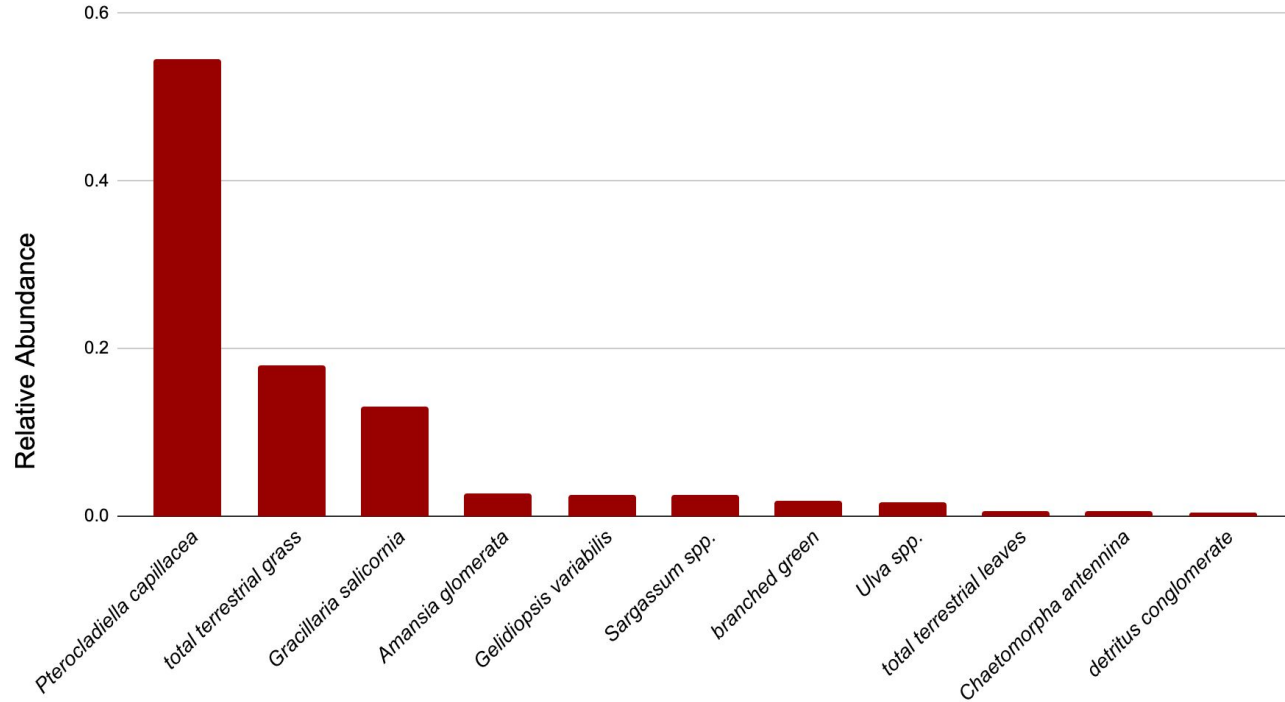
Red Macroalgae  
FO% = 87.50

Green Macroalgae  
FO% = 56.25

Brown Macroalgae  
FO% = 31.25

$$\text{Frequency of Occurrence (FO\%)} = \frac{\text{\# of turtles containing diet item type}}{\text{total \# of turtles}} * 100$$

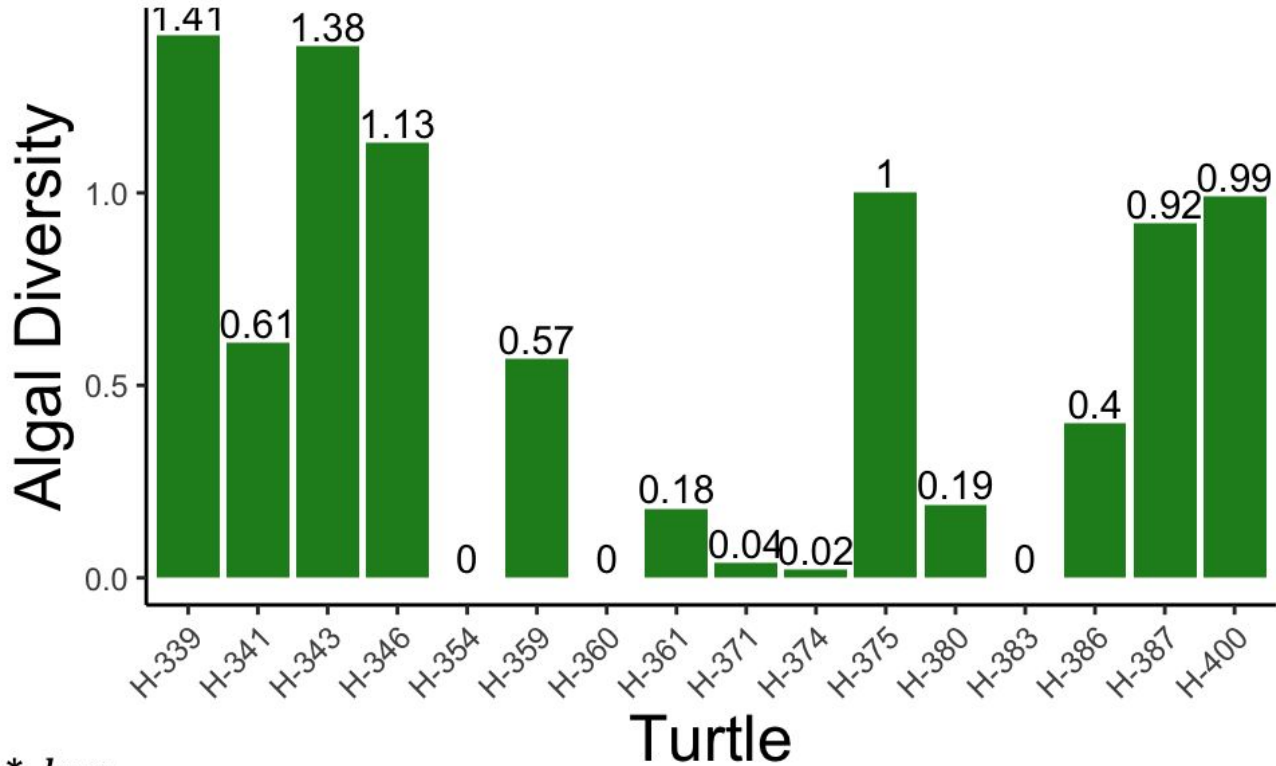
# Most Abundant Diet Items



$$\text{Relative Abundance} = \frac{\text{dry weight of diet item}}{\text{total dry weight}}$$

Diet Item

# Shannon-Weiner Diversity Index

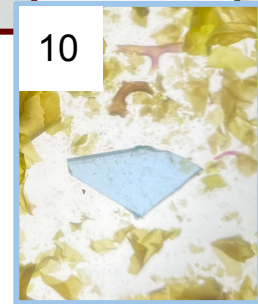
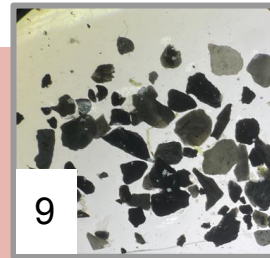
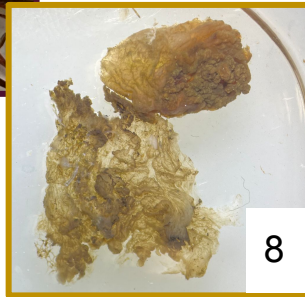
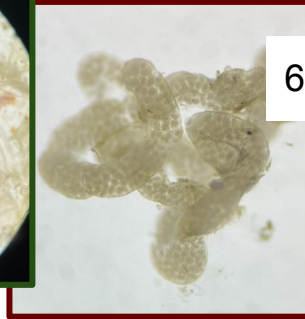
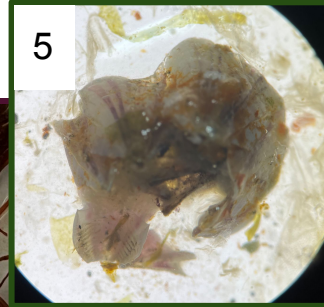
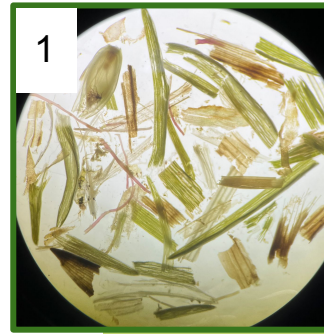


$$H' = - \sum_{i=1}^s p_i * \ln p_i$$



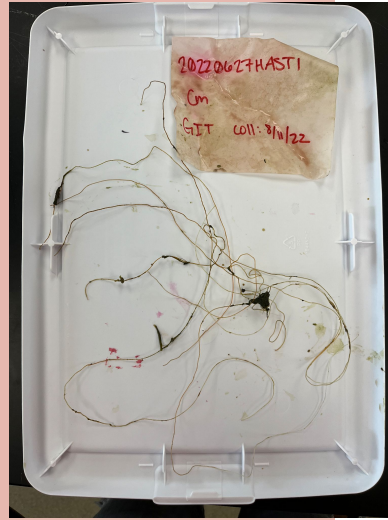
# Non-algal Items in Contents

1. Terrestrial grass (McDermid et al. 2015)
  - a. *Paspalum vaginatum*
2. Segmented worm
3. Trematodes (flukes)
  - a. *Cricocephalus albus* (Gomez-Puerta et al. 2017)
4. Gastropods
5. Barnacle
6. Eggs
7. Sponge
8. Hair
9. Tumor
10. Sand
11. Plastics
  - a. Fishing line



# Fishing Line Effects

- Present in 4 turtles
- 2 turtles with fishing line running through the organs
- Bruising
- Gouging
- Plaque
- Obstruction of passage for diet items





# Conclusions

- Samples from 16 turtles processed
- Algal based diet
- Non-algal and non-food items present
- Fishing line caused negative effects



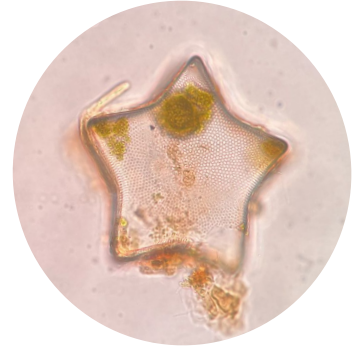
Photo credit: Terry Lilley





# Acknowledgements

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**Thank you!**

**Questions?**

# References

Abbott IA (1999) Marine red algae of the Hawaiian Islands. Bishop Museum Press

Abbott IA, Huisman JM (2004) Marine Green and Brown Algae of the Hawaiian Islands. Bishop Museum Press, Honolulu, Hawai'i

Balazs GH (1980) Synopsis of biological data on the green turtle in the Hawaiian islands. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Center, Honolulu Laboratory, Honolulu, HI

Balazs GH, Chaloupka M (2004) Spatial and temporal variability in somatic growth of green sea turtles (*Chelonia mydas*) resident in the Hawaiian Archipelago. Marine Biology 145:1043–1059

Chaloupka M, Work TM, Balazs GH, Murakawa SK, Morris R (2008) Cause-specific temporal and spatial trends in green sea turtle strandings in the Hawaiian Archipelago (1982–2003). Marine Biology 154:887–898

Forbes (1999) Diet Sampling and Diet Component Analysis. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication 4:1-5

Gomez-Puerta LA, Bachmann V, Quiñones J, Quispe S, Torres D, Macalupu J (2017) Primer Reporte de *Cricocephalus albus* (Digenea: Pronocephalidae) en el Perú, Parásito de la Tortuga Verde del Pacífico Este (*Chelonia mydas agassizii*). Revista Peruana de Biología 24:217–222

Huisman JM, Abbott IA, Smith CM (2007) Hawaiian reef plants. Univ. of Hawai'i Sea Grant College Program, Honolulu

McDermid KJ, Lefebvre JA, Balazs GH (2015) Nonnative Seashore paspalum, *Paspalum vaginatum* (Poaceae), consumed by Hawaiian green sea turtles (*Chelonia mydas*): Evidence for nutritional benefits. Pacific Science 69:48–57

Russell DJ, Balazs GH (2000) Identification manual for dietary vegetation of the Hawaiian green turtle *Chelonia mydas*. U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, Honolulu, HI

Work TM (2014) Sea Turtle Necropsy Manual. U S Geological Survey National Wildlife Health Center Hawaii Field Station



# Additional Information



# Frequency of Occurrence: Non-algal Diet Items

Animal Material  
FO% = 43.75

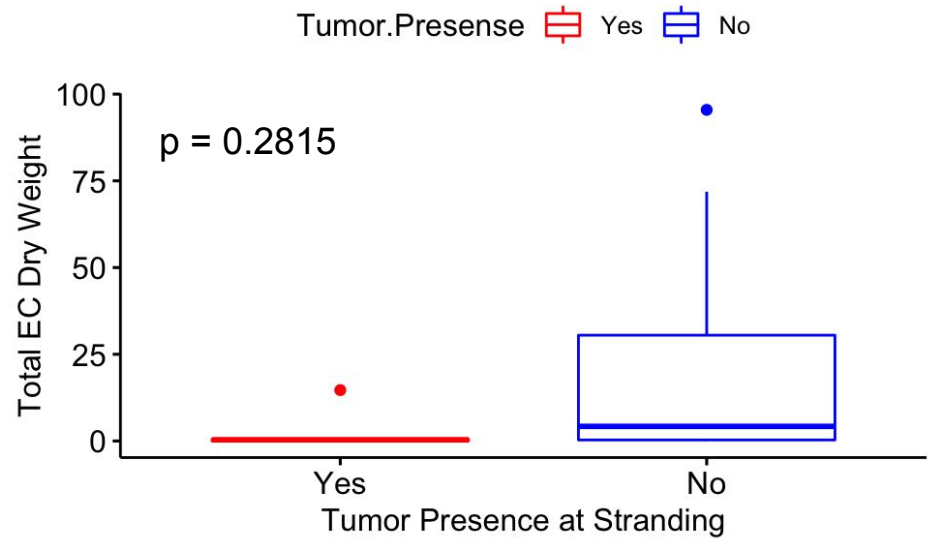
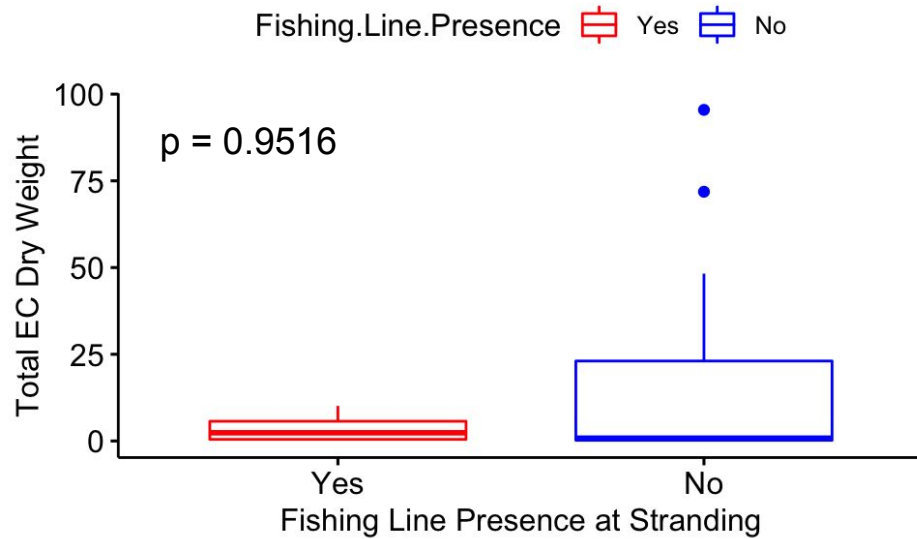
Nonfood Items  
FO% = 56.25

Terrestrial Material  
FO% = 56.25

Cyanobacteria  
FO% = 12.50

$$\text{Frequency of Occurrence (FO\%)} = \frac{\text{\# of turtles containing diet item type}}{\text{total \# of turtles}} * 100$$

# Relationship of EC Fill and Stranding Cause



Wilcoxon Rank Sum Test