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Marine Debris in the Maui 4- Island Region, Hawaii

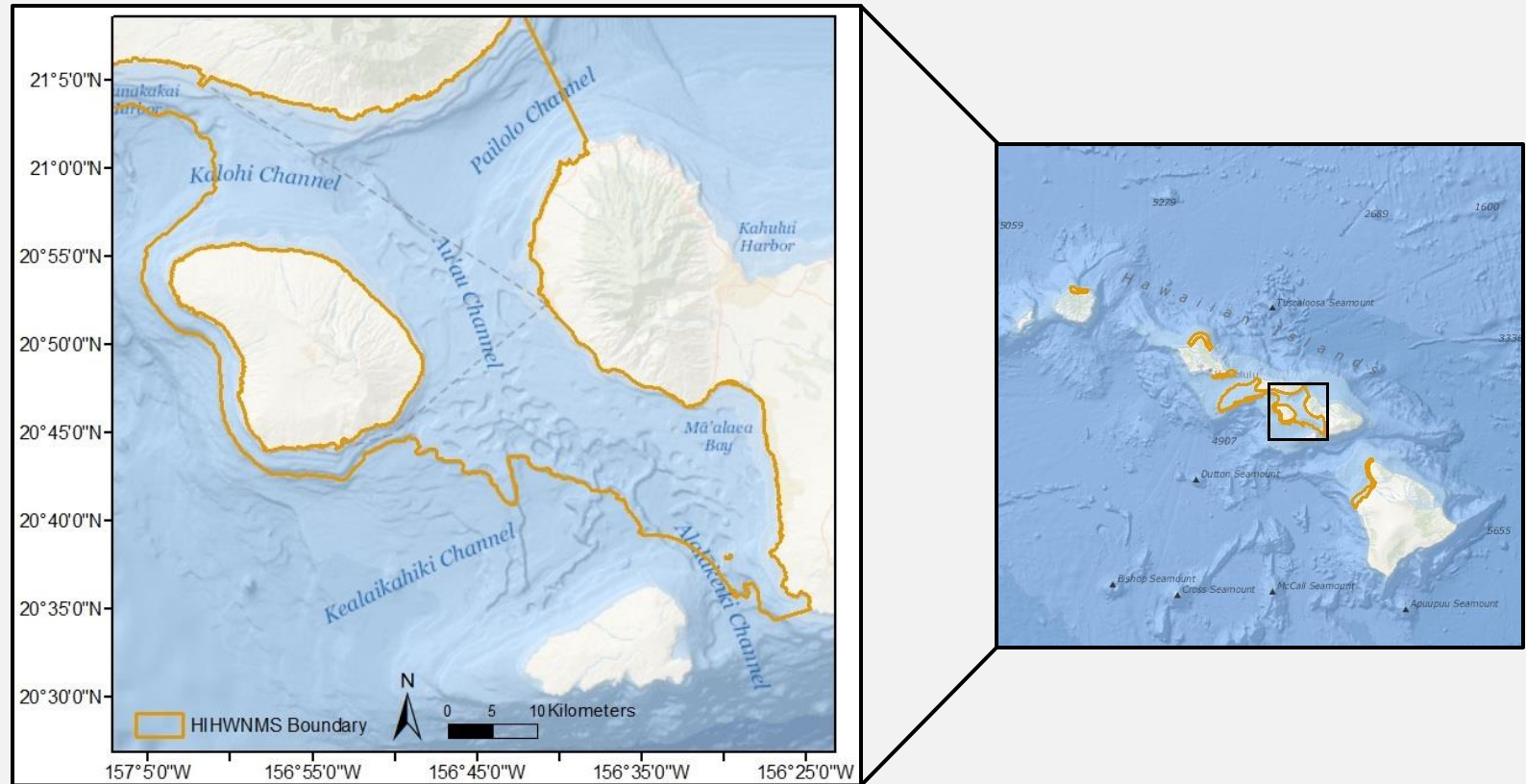
Accumulation, Trends, and
Distribution

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The Maui 4-island region

STUDY AREA



Surrounded by Maui, Moloka'i, Lana'i, and Kaho'olawe.
Within the Hawaiian Islands Humpback Whale National Marine Sanctuary.
Recreation, tourism, endangered marine species overlap.

Marine debris hotspot

A CONSERVATION CONCERN

Within the subtropical convergence zone.

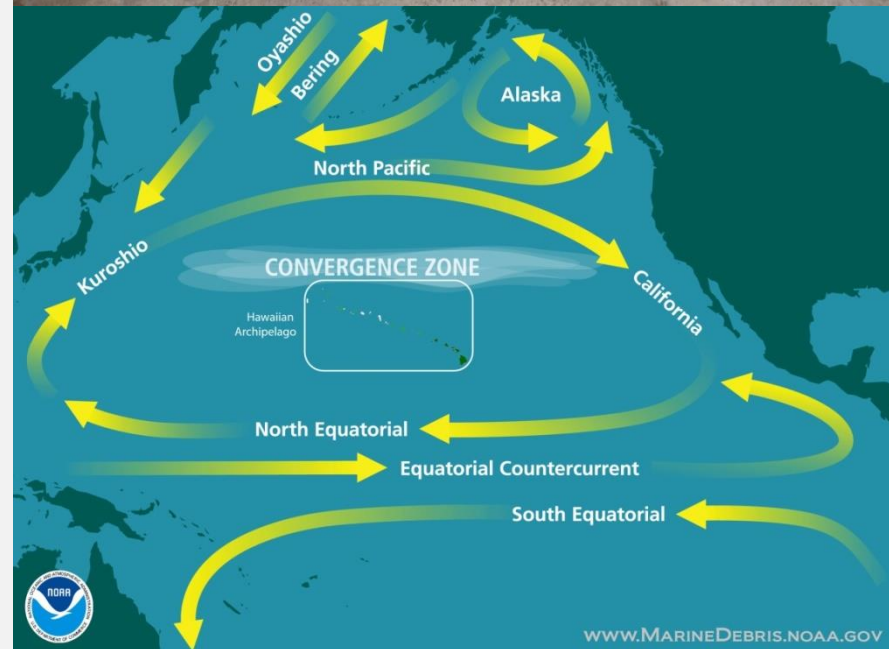
The Hawaiian archipelago is subject to high debris loads, receiving >52 metric tons/year.

Accumulation is the result of a multistep process.

Origin of Hawaii's debris varies greatly.



NOAA PIFSC, Coral Reef Ecosystem Program



Understanding **Marine Debris** in Maui

QUANTIFYING TYPES AND TRENDS

Work to document the rate and process of marine debris accumulation in the Maui 4-island region.

Boat-based marine debris data collection minimal.



Data collection

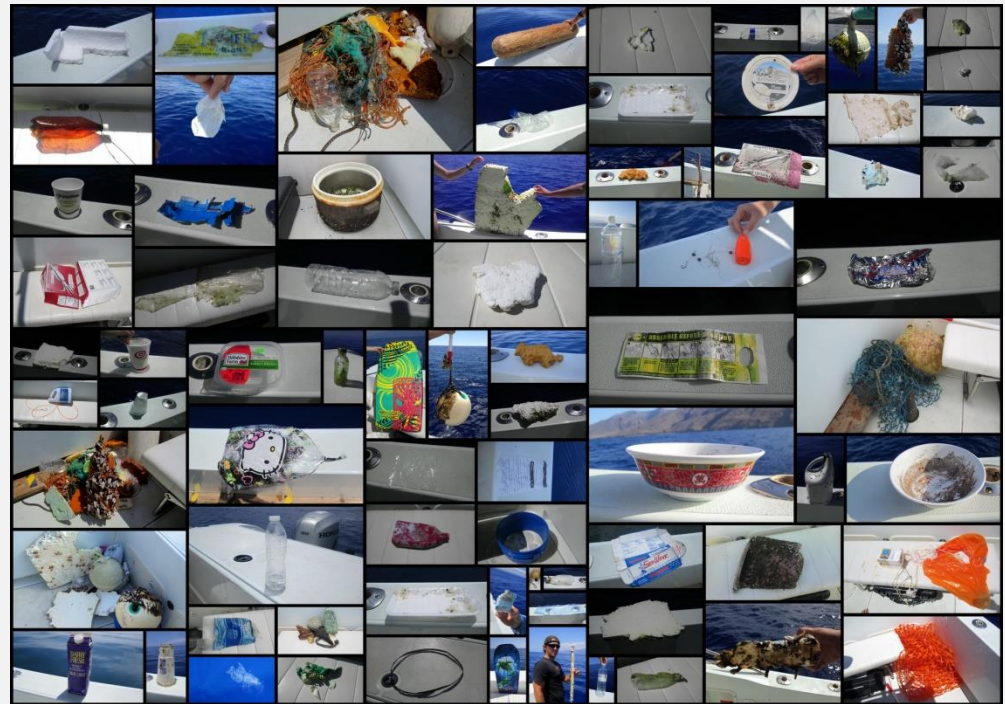
OCEAN SURVEYS

All debris items sighted during surveys were collected:

- GPS location
- Type of material (category)
- % biofouling (coverage)
- Photograph

We later determined:

- Origin of item (land, ocean, or unknown)
- Country of origin (where possible)

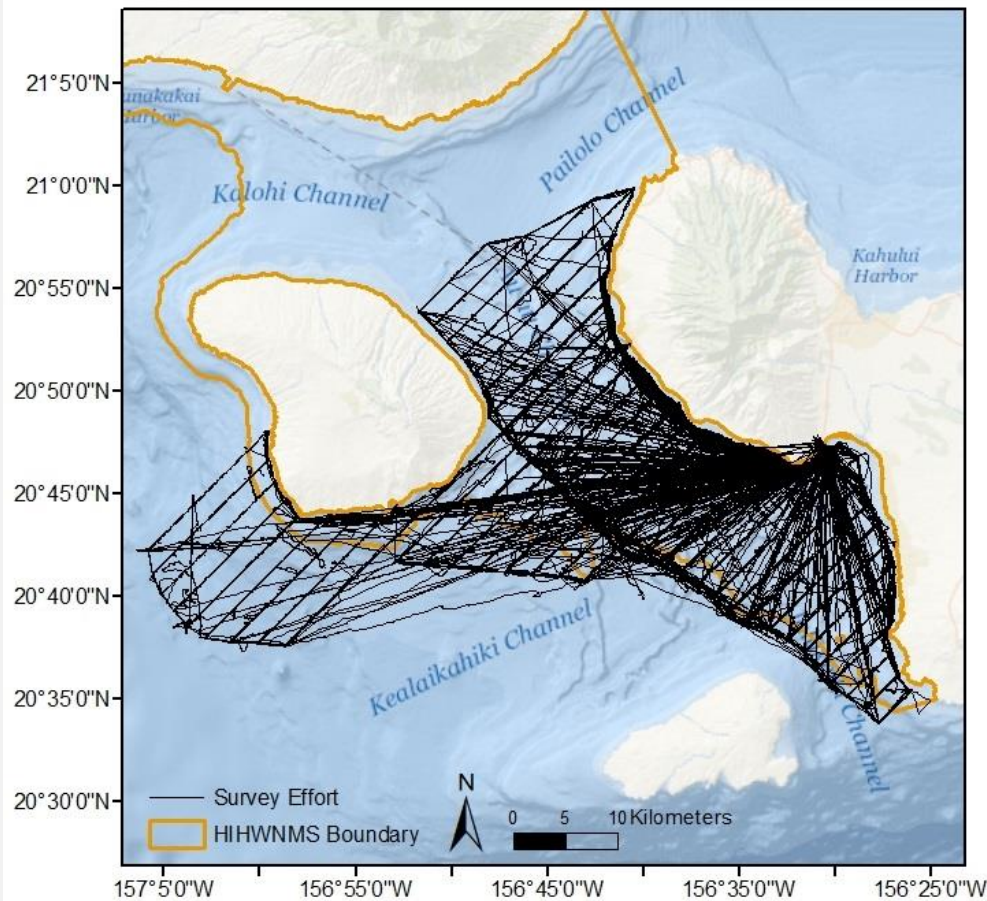


260 Days at sea

APRIL 2013 – OCTOBER 2017

Removed and documented 2,118 items of debris.

Surveyed 38,269.86 km.



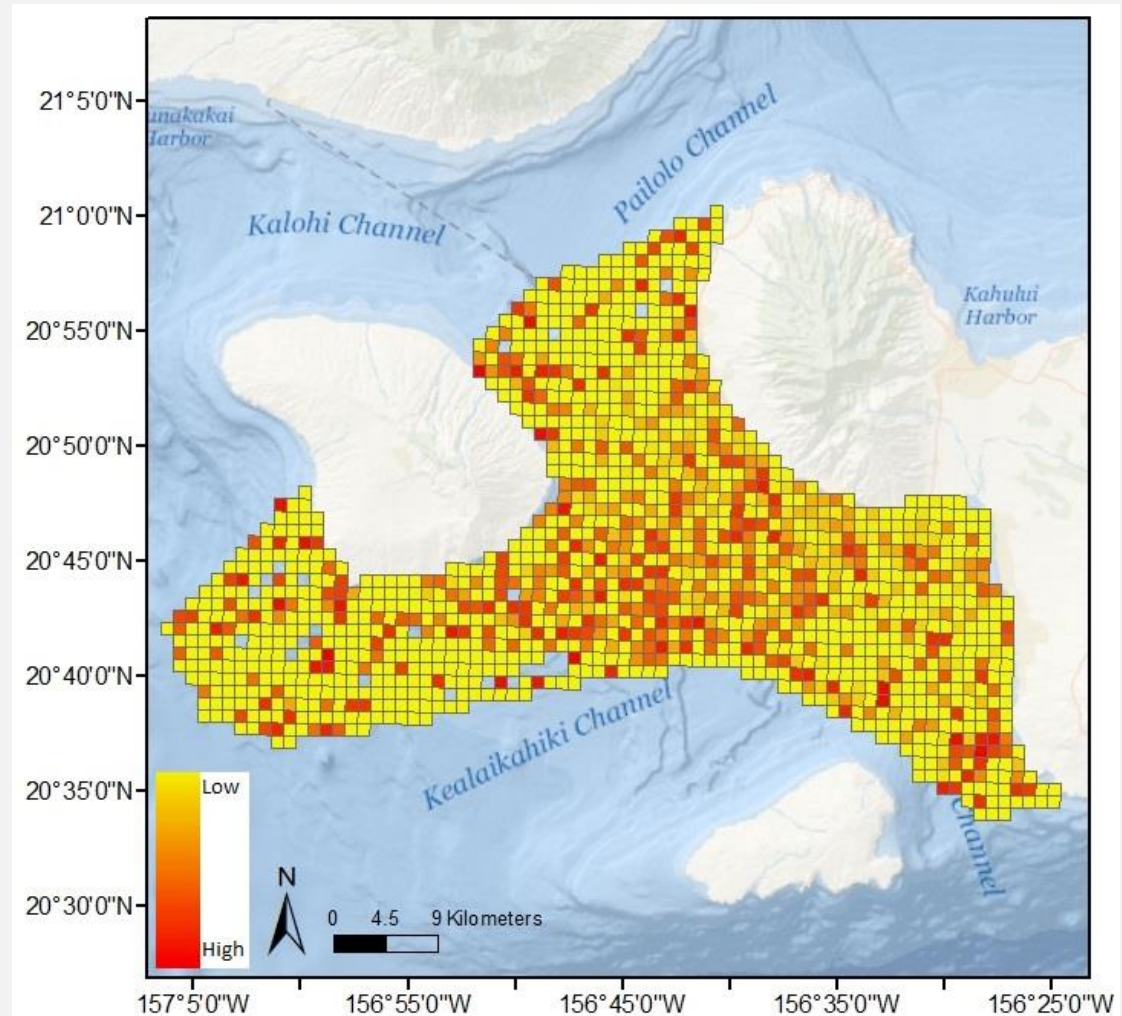
Marine Debris almost everywhere

POTENTIAL CONVERGENCE ZONE

Quantified the number of items per km², and standardized data for effort.

Highest encounter rate observed was 7.96 items per km of effort.

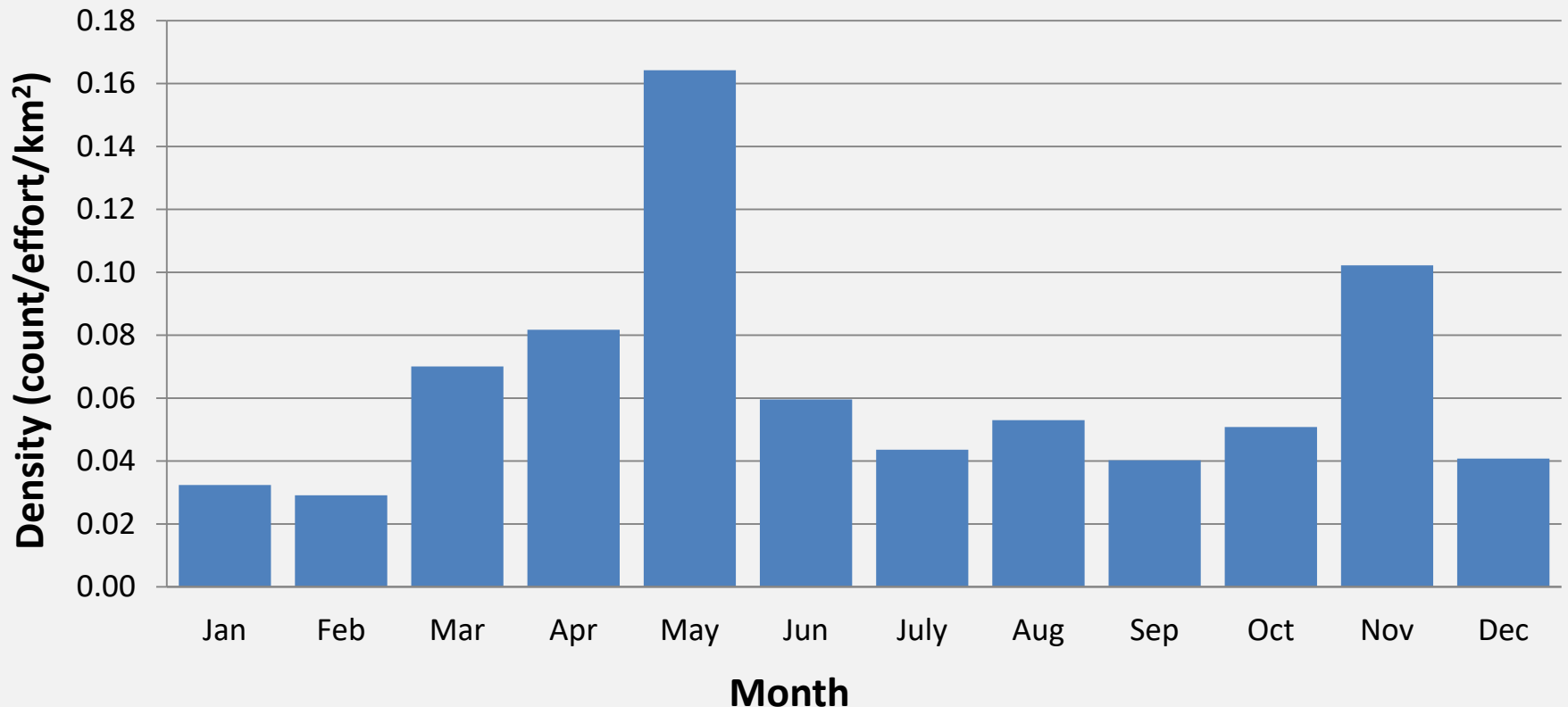
Densities were highest where the Au'au, Kealaikahiki, and Alalakeiki channels meet.



Seasonality of marine debris

MAY and NOV peaks

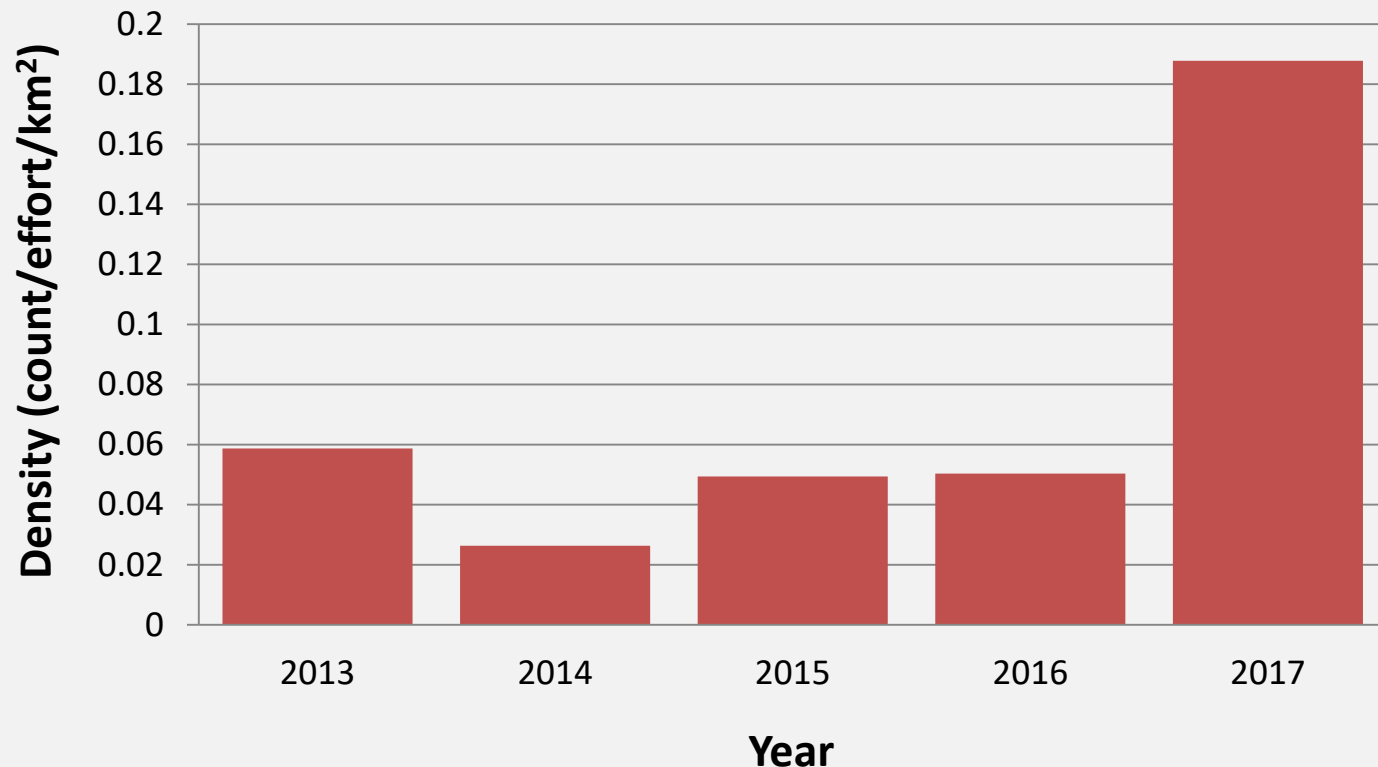
Density for May more than twice that of all months except November.



Yearly accumulation trends

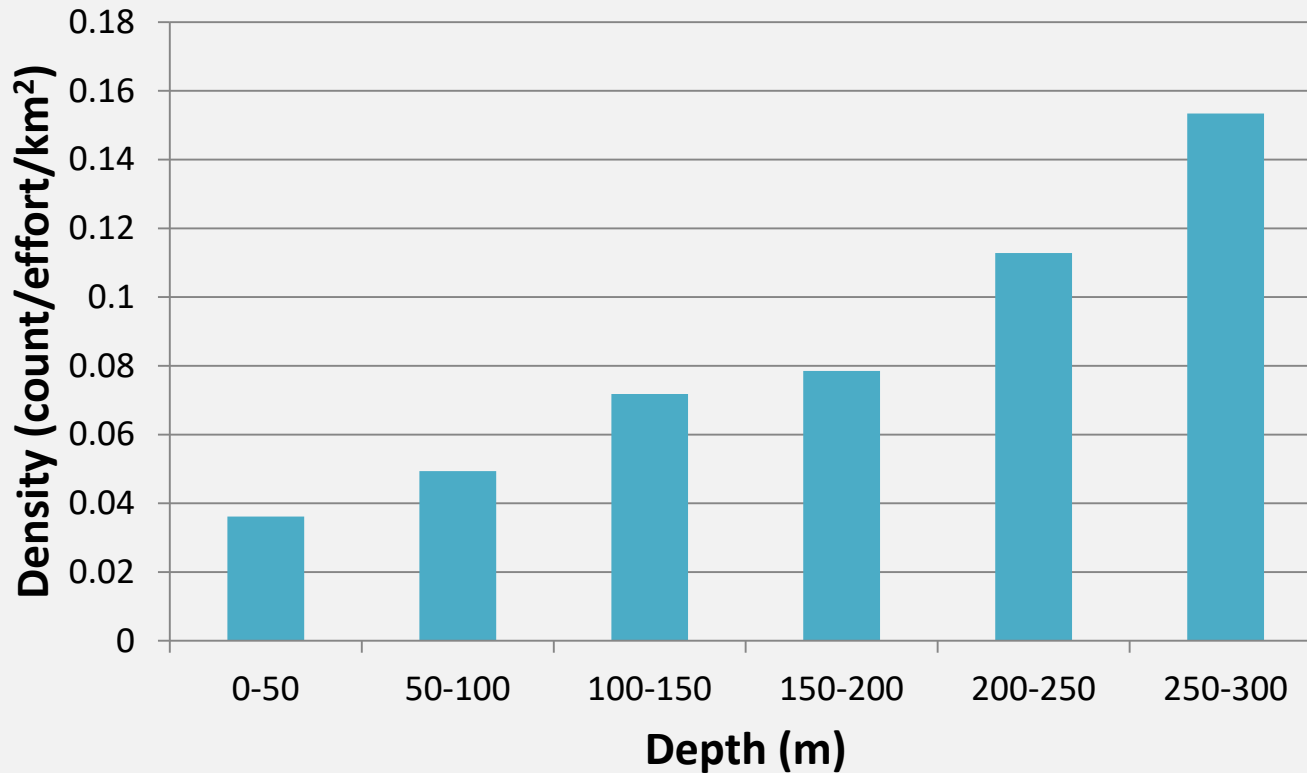
2017 PEAK

Debris density was 219 % greater in 2017 than the next highest year.



Higher density with depth

INCREASING TREND



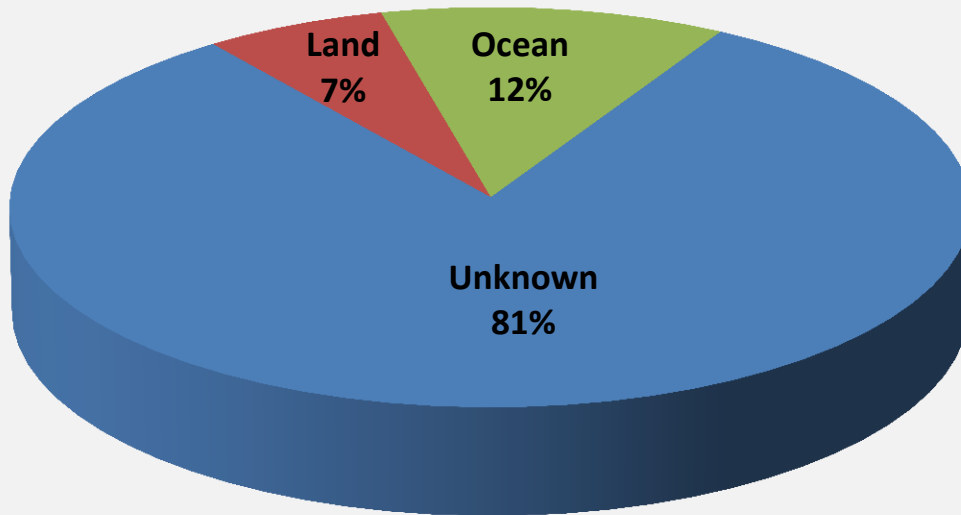
Linear mixed-effects model:

Estimate: 0.0003; t-value: 3.335097; p-value: 0.0009

Minimal sampling beyond 300m.

Identifying origins

MOSTLY AN UNKNOWN



Land:

30 % Balloons (n = 40)

Ocean Items:

41 % Buoys (n = 105)

13 % Nets (n=36)

11% Fishing Gear (n = 29)

Unknown:

14 % Styrofoam (n = 245)

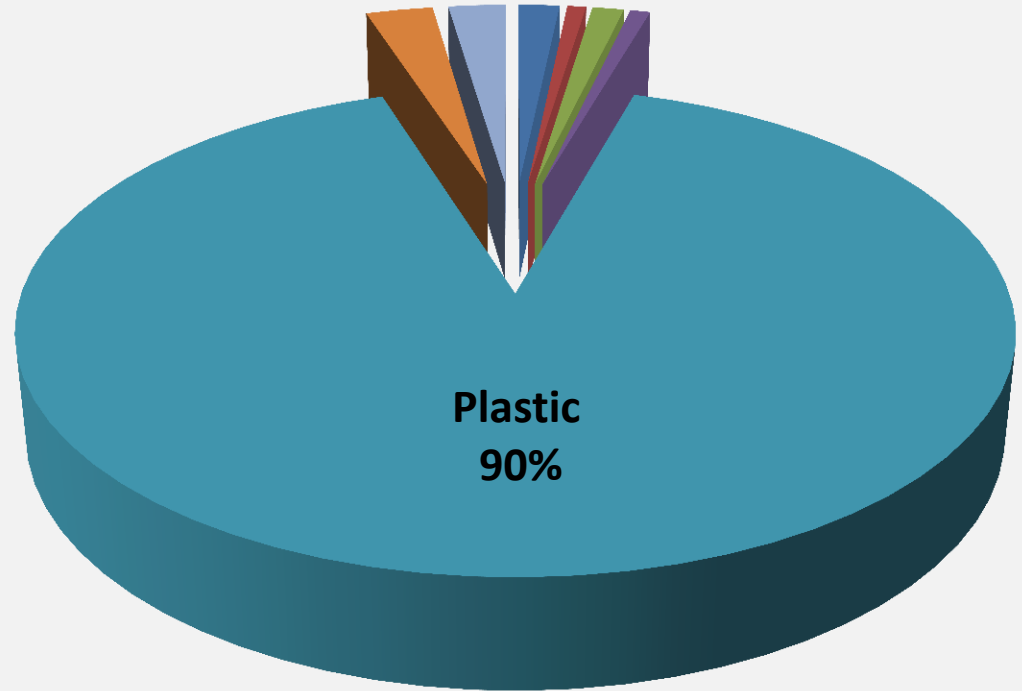
0.3 % Single use plastic bags (n=5)



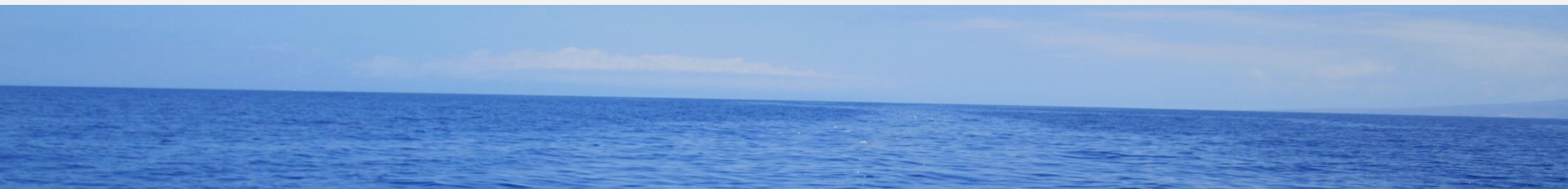
Identifying **types**

A PLASTIC OCEAN

We found an average of 1.5 items of plastic per km² within study area.

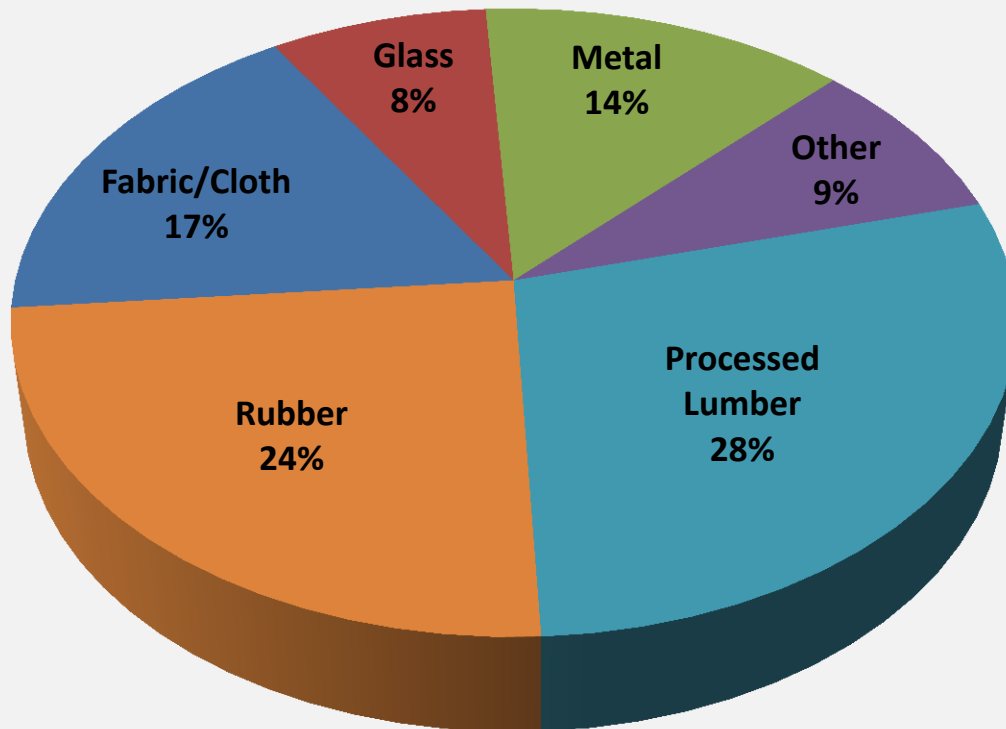


■ Fabric/Cloth ■ Glass ■ Metal ■ Other ■ Plastic ■ Processed Lumber ■ Rubber



Identifying **types**

THE REMAINING 211 ITEMS



Processed Lumber:

40 % paper/cardboard (n = 23)

42 % pieces of wood (n=24)

Rubber:

65 % balloon/latex material (n = 32)

28 % recreational gear (n=14)

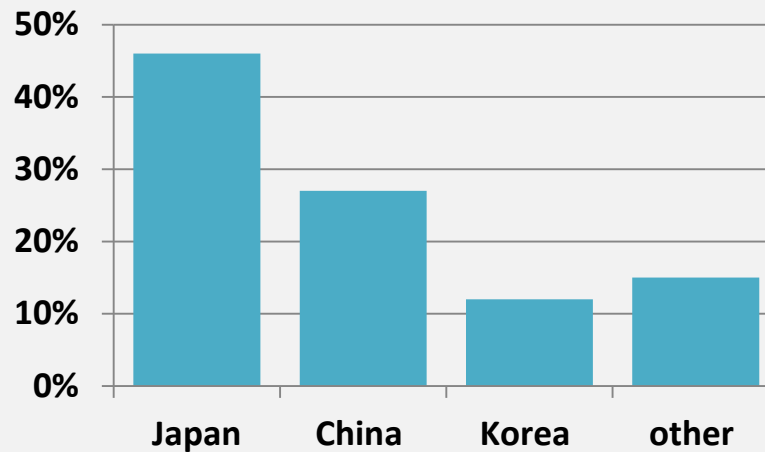
Fabric/Cloth:

22 % hats/clothing (n=8)

Country of origin

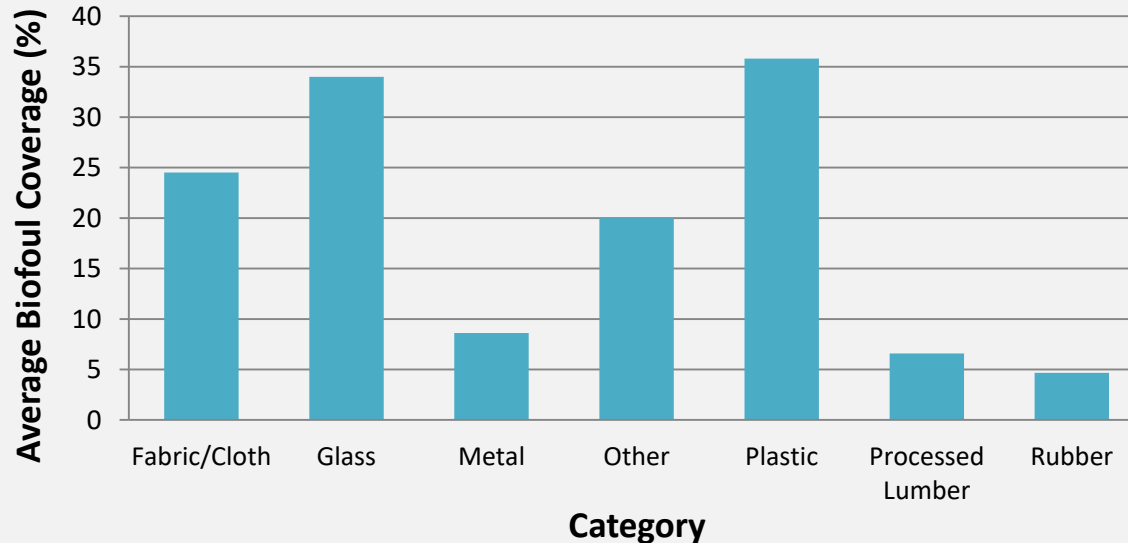
41 ITEMS IDENTIFIED

China, Japan, and the rest of Asia account ~49% of worldwide plastic production. China is 1 of the 5 top countries where more than half of land-based waste originates.

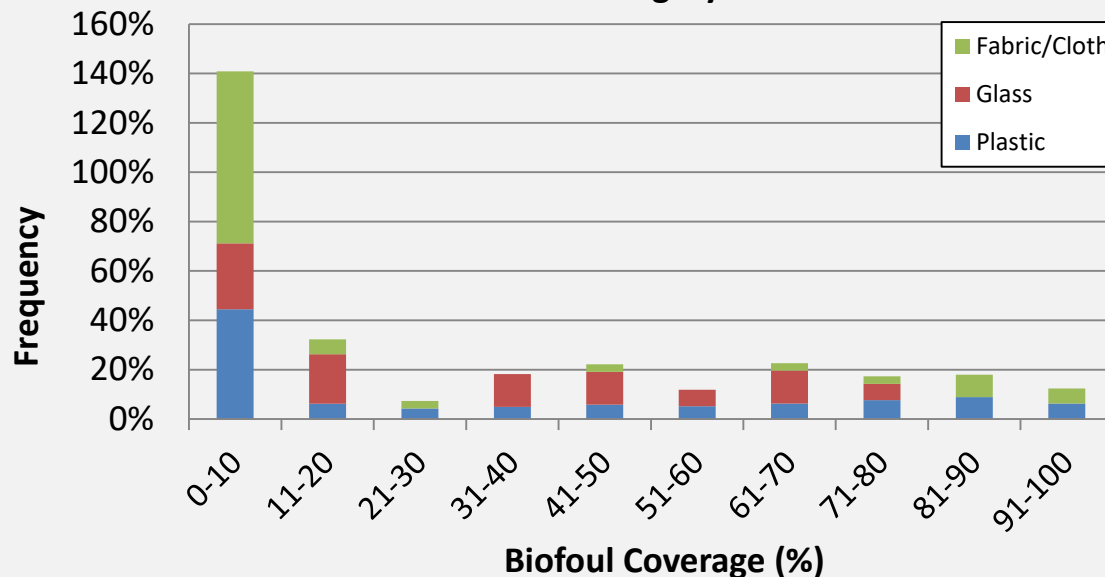


Biofouling by debris type

FACTOR OF TIME?



Plastics, glass, and fabric/cloth have similar average biofouling coverage.



Soak time may play a role in percent surface area covered with biofouling.

What did we learn?

SUMMARY

Debris accumulation hotspot within the Maui 4-island region.

Peak densities occur in May and November.

Significant increase in debris accumulation observed in 2017.

Depth plays a role in debris accumulation trends.

We found positive examples of successful mitigation measures and data to support upcoming legislation.



Acknowledgements

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Thank you for listening