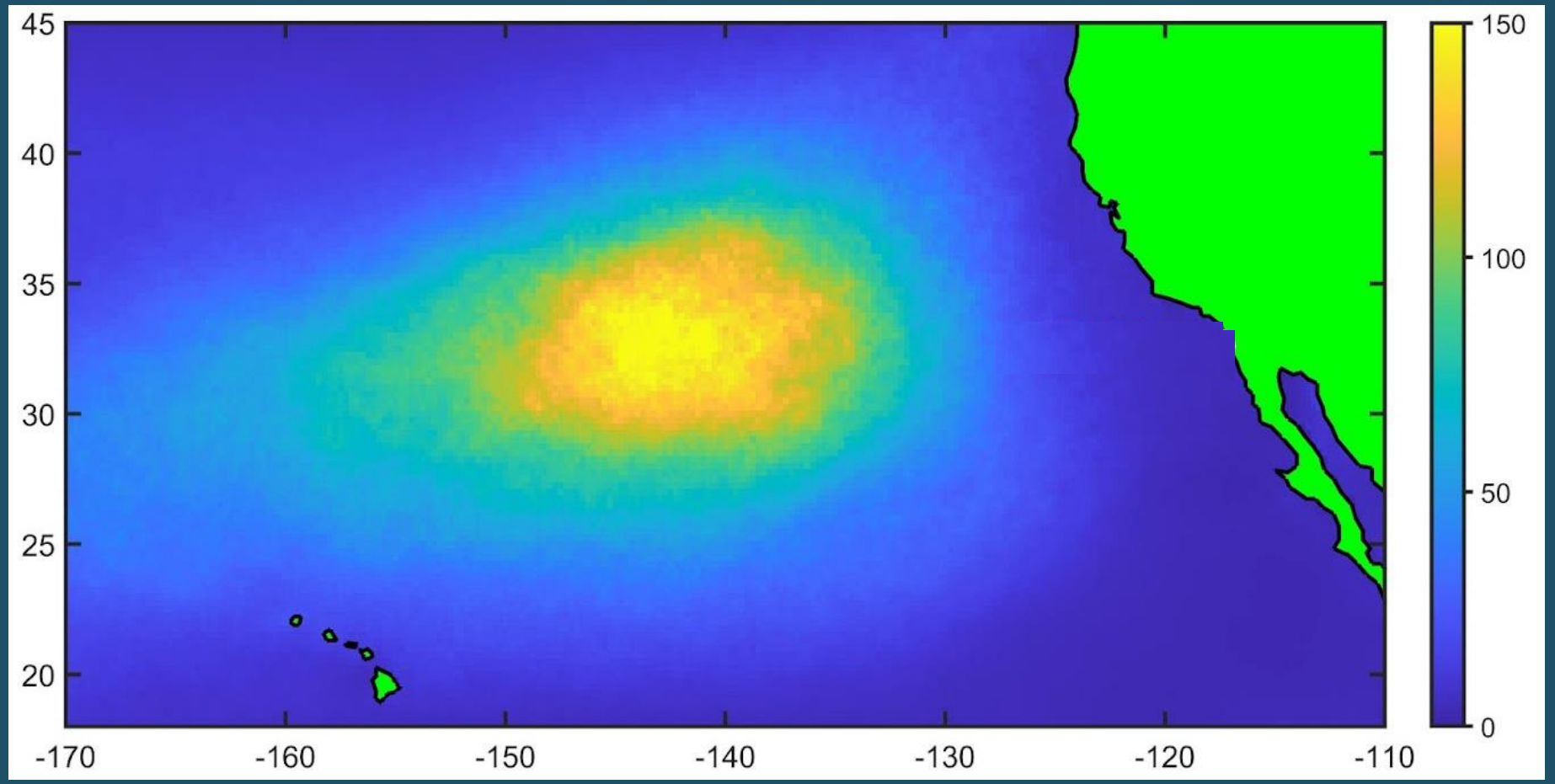
An overview of marine debris removal, sourcing, and recycling in the Hawaiian archipelago

- Jennifer Lynch, National Institute of Standards and Technology and Hawai‘i Pacific University Center for Marine Debris Research
- Mafalda de Freitas, Hawai‘i Pacific University, Center for Marine Debris Research
- Katherine A. Stevens, Hawai‘i Pacific University, Center for Marine Debris Research
- Cara Megill, Hawai‘i Pacific University, Center for Marine Debris Research
- Mandy-Tanita Brinkmann, Hawai‘i Pacific University, Center for Marine Debris Research
- Paige White, Hawai‘i Pacific University, Center for Marine Debris Research
- Eric Kingman, Hawai’i Longline Association
- Eileen Nalley, University of Hawai'i Sea Grant College Program
- Darren Lerner, University of Hawai'i Sea Grant College Program

North Pacific Garbage Patch (NPGP)

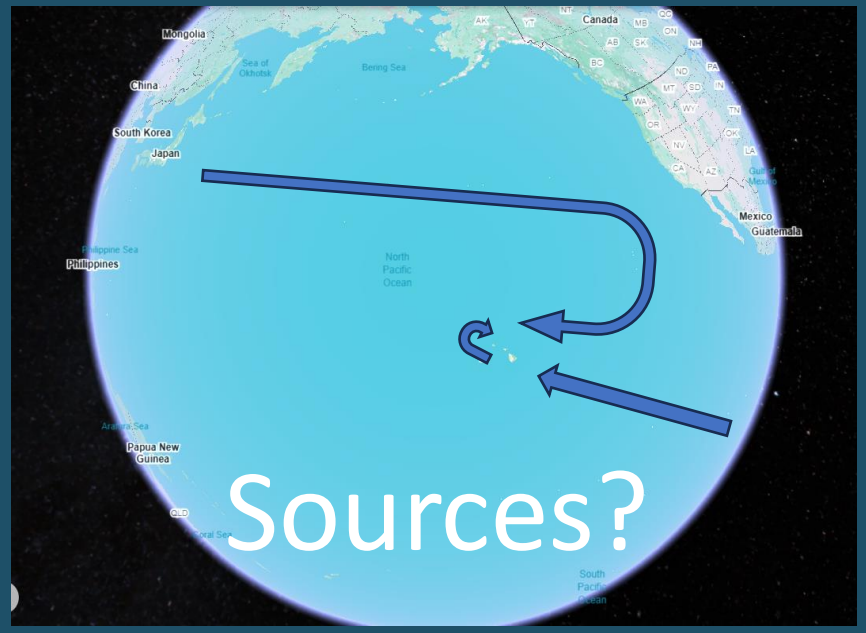


Dr. Maximenko and Hafner, IPRC, University of Hawai‘i




NPG_56

Megaplastics Program Objectives

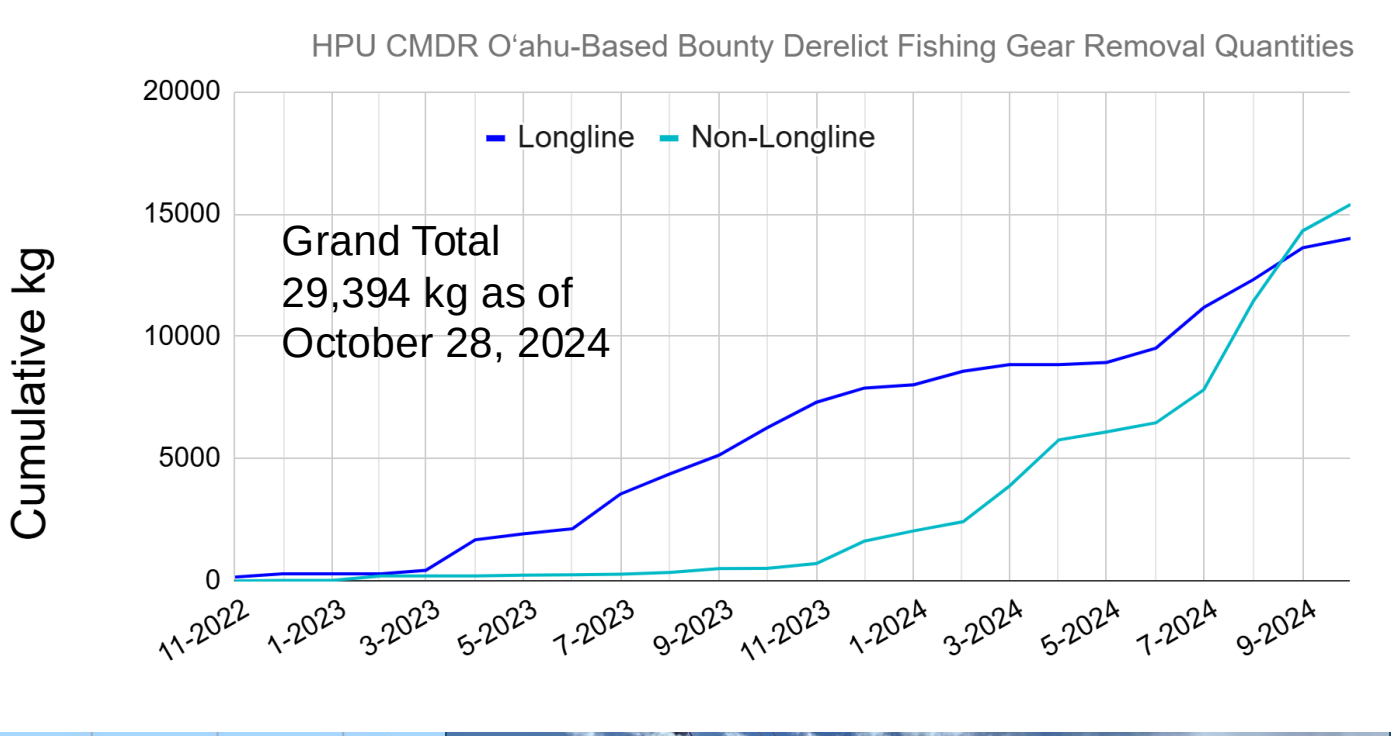


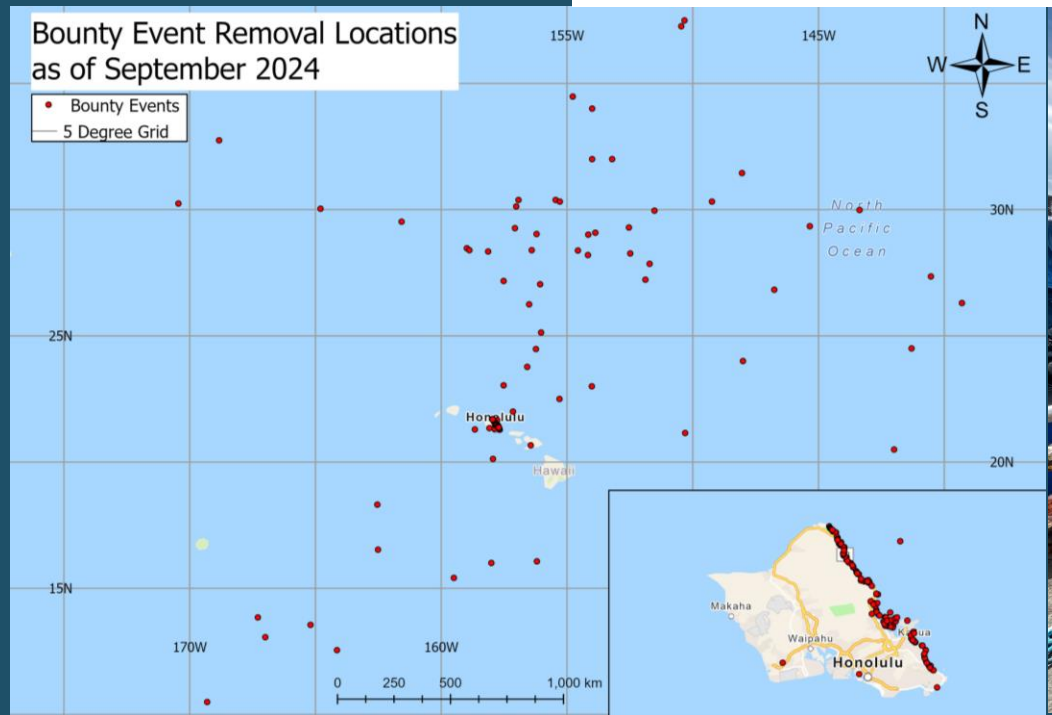
REMOVE

PREVENT

RECYCLE

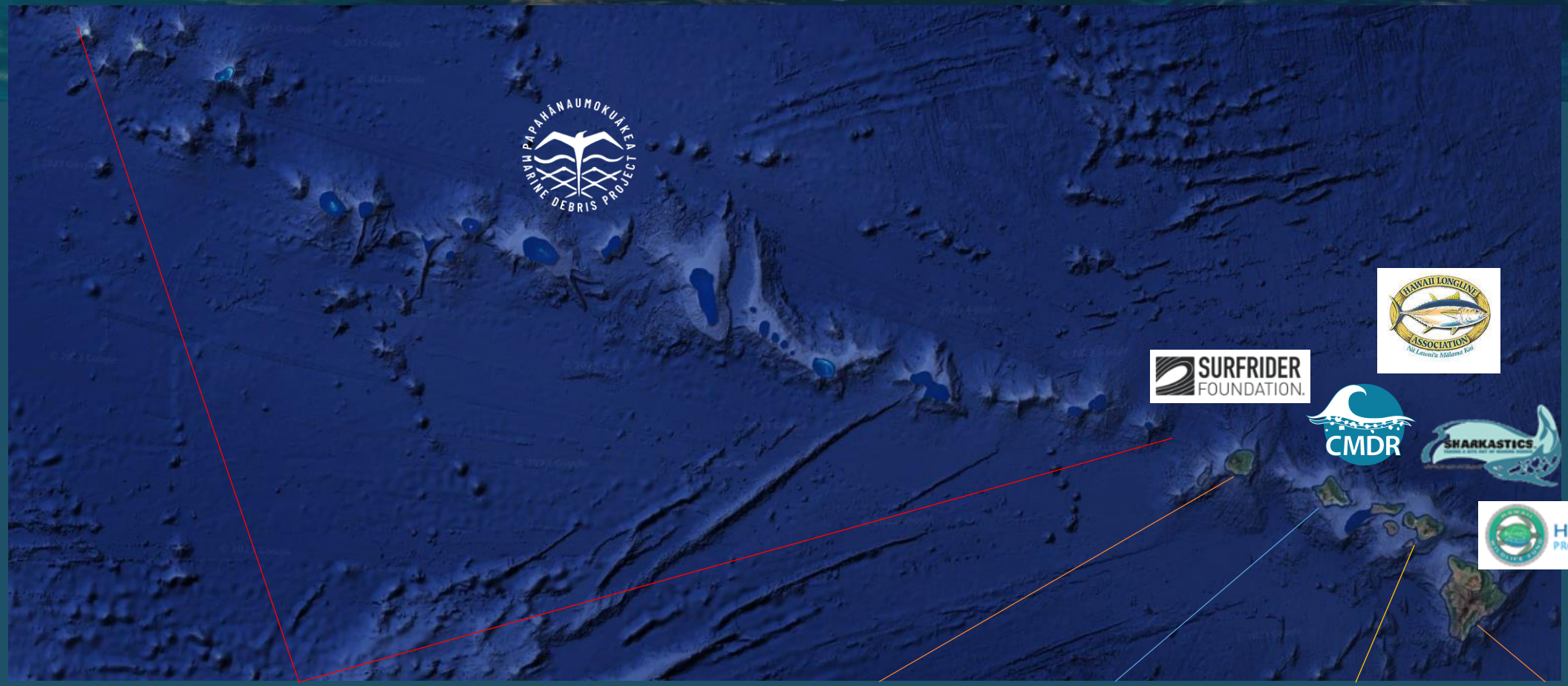
Remove


HPU CMDR O‘ahu-Based Bounty Derelict Fishing Gear Removal Quantities
Cumulative kg
20000
15000
10000
5000
0
Longline
Non-Longline
Grand Total
29,394 kg as of
October 28, 2024
11-2022
1-2023
3-2023
5-2023
7-2023
9-2023
11-2023
1-2024
3-2024
5-2024
7-2024
9-2024


Bounty Event Removal Locations
as of September 2024
Bounty Events
5 Degree Grid
155W
145W
N
W
E
S
North Pacific Ocean
30N
25N
20N
15N
Honolulu
Hawaii
170W
160W
0
250
500
1,000 km
Makaha
Waipahu
Honolulu

Remove

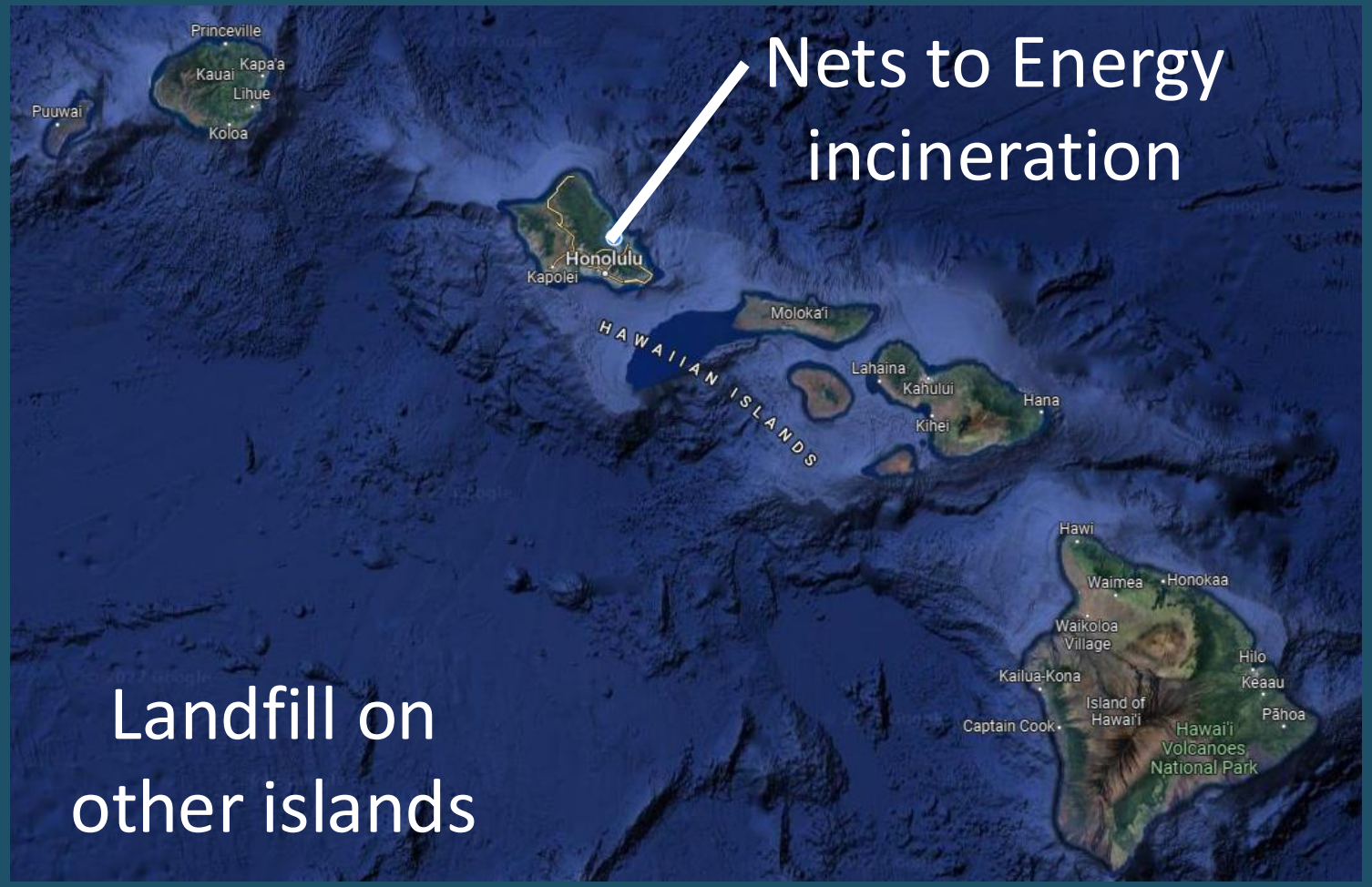
On-going daily, weekly, monthly, or biannually large scale operations



NWHI	Kaua‘i	O‘ahu & Pelagic	Maui	Hawai‘i
96,348 kg	22,800 kg	6,787 kg	2,636 kg	13,434 kg

2023 Hawaiian Archipelago
Total 142,005 kg

Disposal Options



Transport & Store

Kaua‘i

O‘ahu

Maui

Hawai‘i

Princeville
Kauai
Puuwai
Koloa
Kapolei
Moloka'i
HAWAIIAN ISLANDS
Lahaina
Kihei
Hana
Hawi
Waimea
Honokaa
Waikoloa Village
Kailua-Kona
Captain Cook
Island of Hawai'i
Hilo
Keaau
Pāhoa
Hawai'i Volcanoes National Park

CMDR

Plastic Recycling Research Facility (PRRF)

Receiving

Sorting and Documenting

HDPE

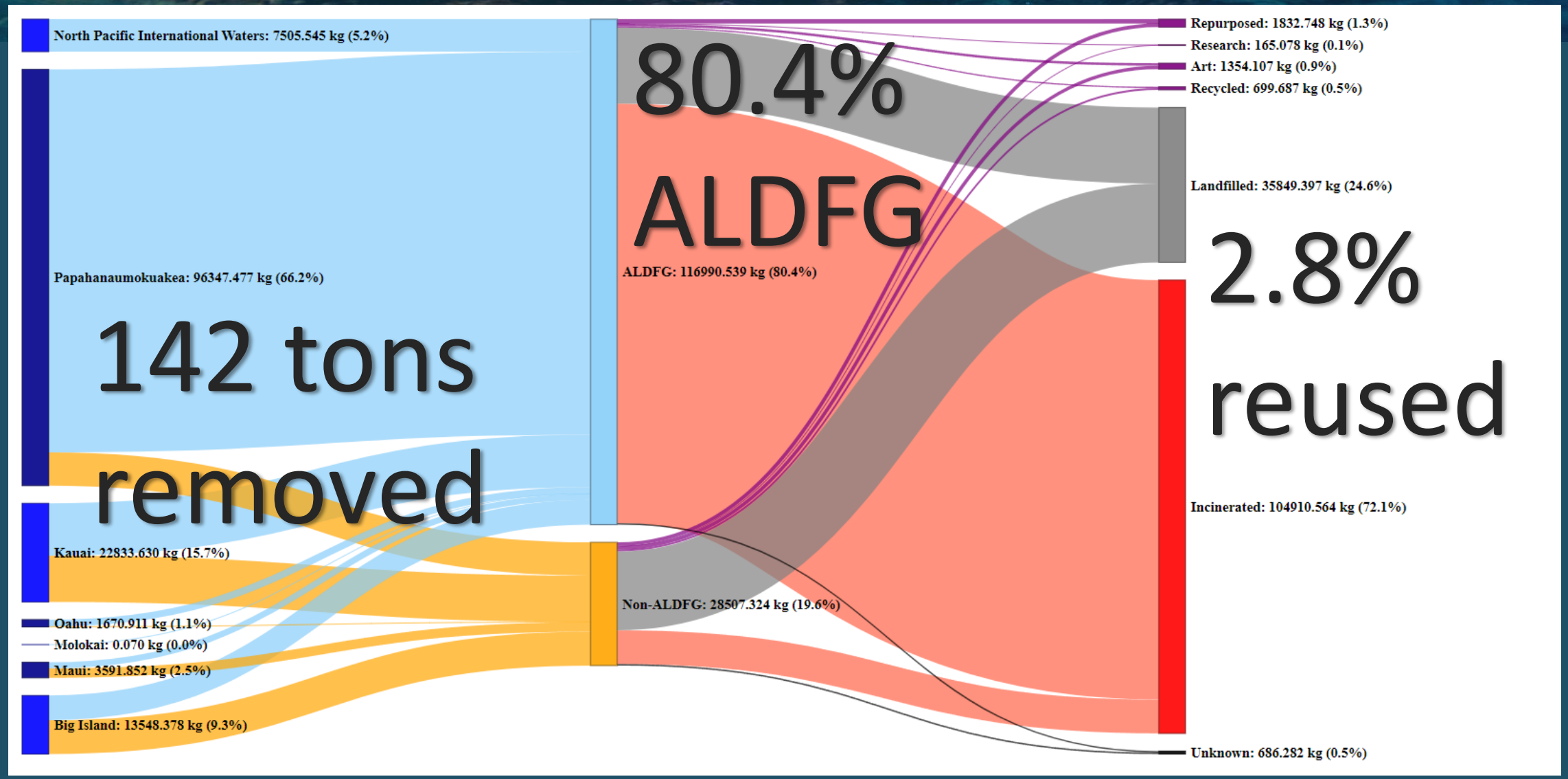
Nylon

PVC

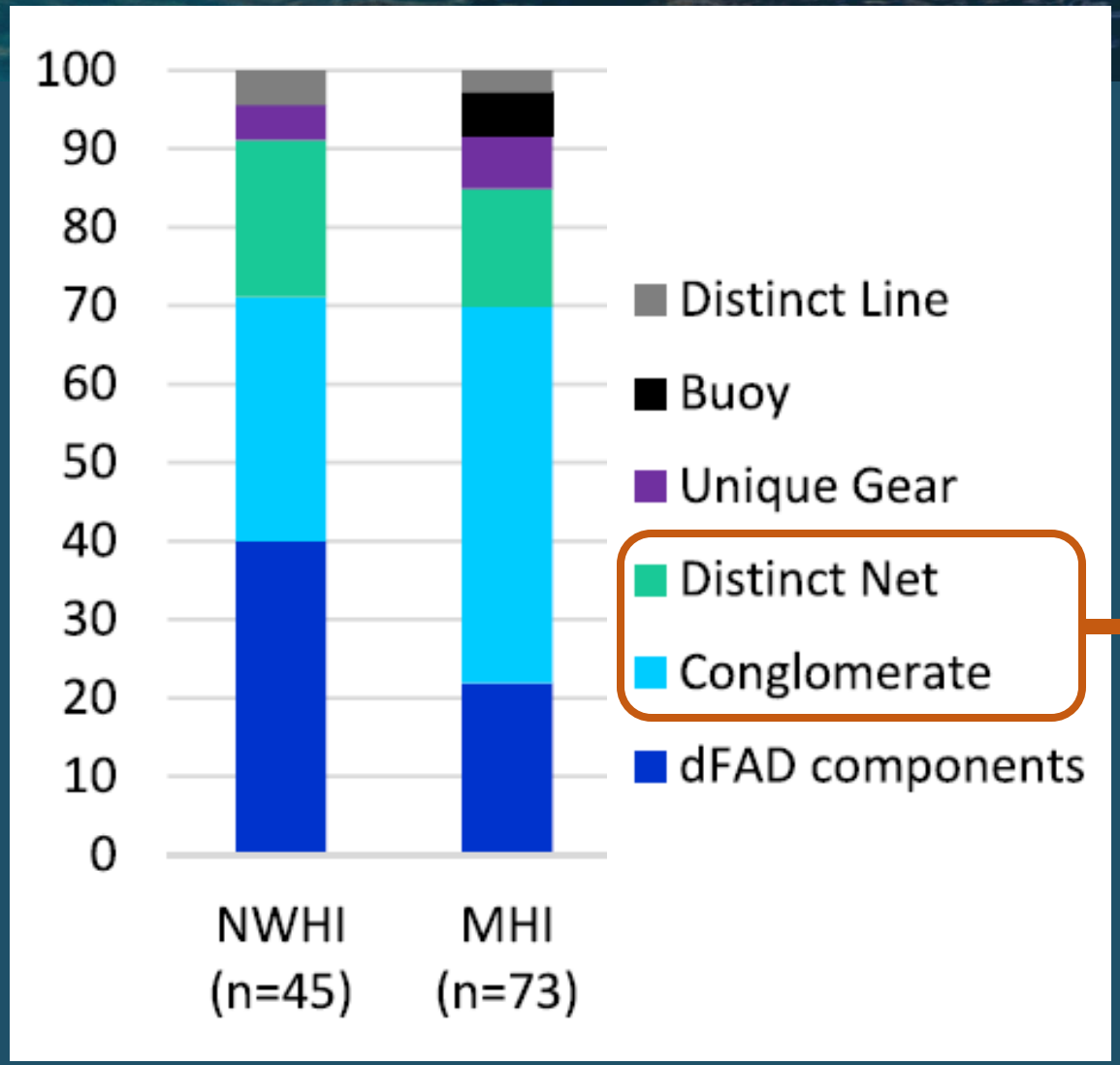
Converting

Hopper
Twin-screw extruder
Compounder
Twin-screw extruder

Remove – Source – Recycle in 2023



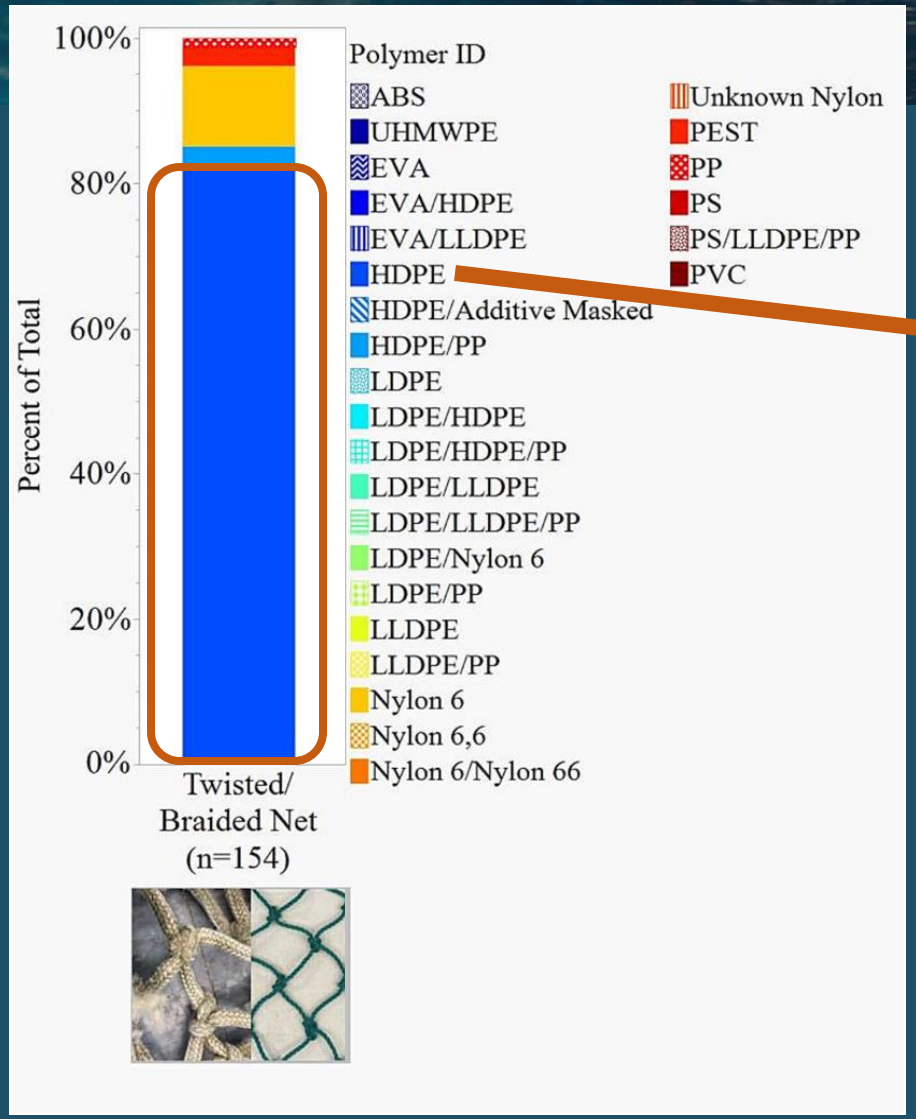
Source – Nets and Conglomerates



60% of ALDFG is nets or conglomerates

Royer et al., 2023

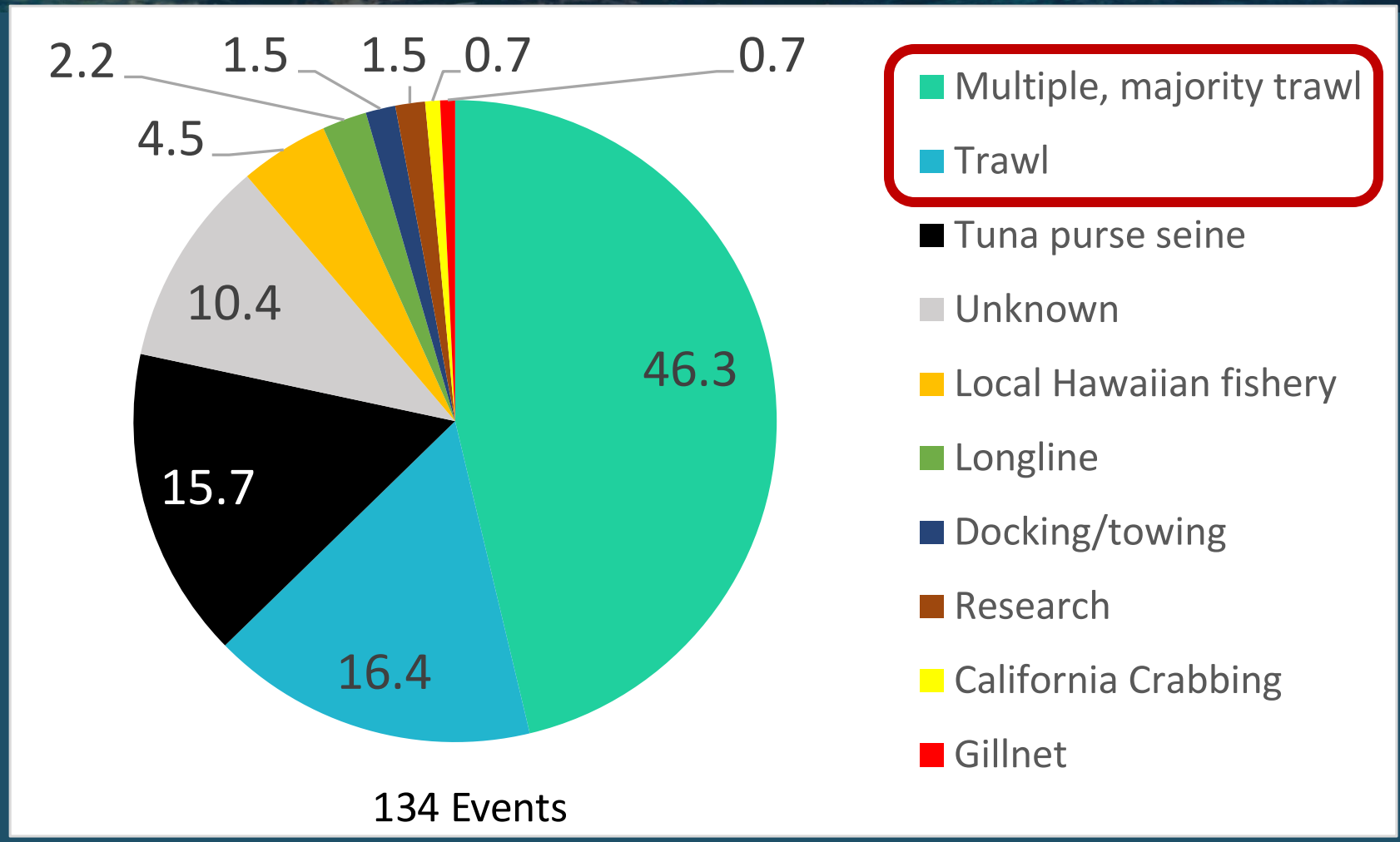
Source – Nets



80% of nets are HDPE

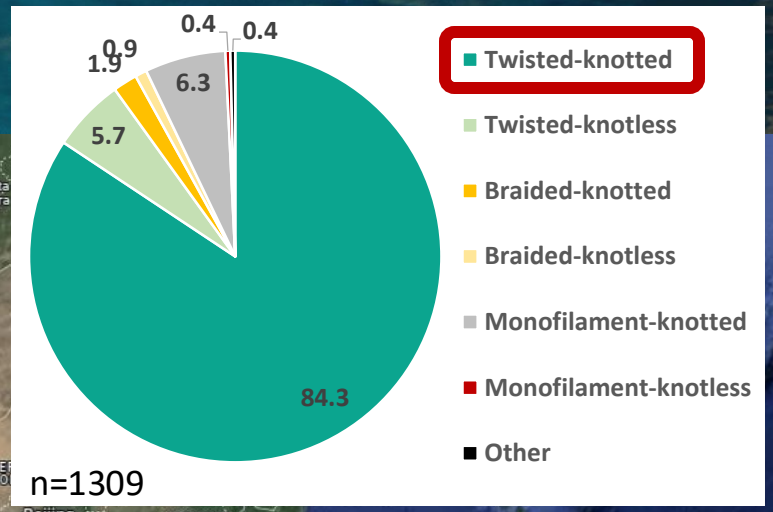
Corniuk et al., 2023

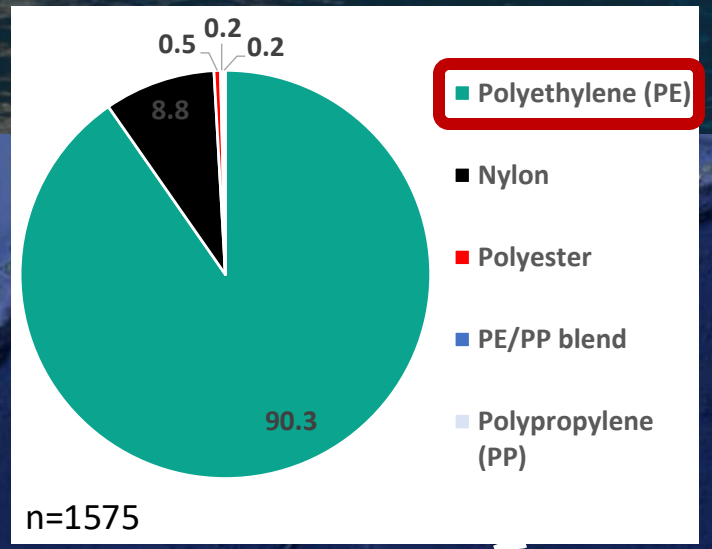
Source – Fisheries

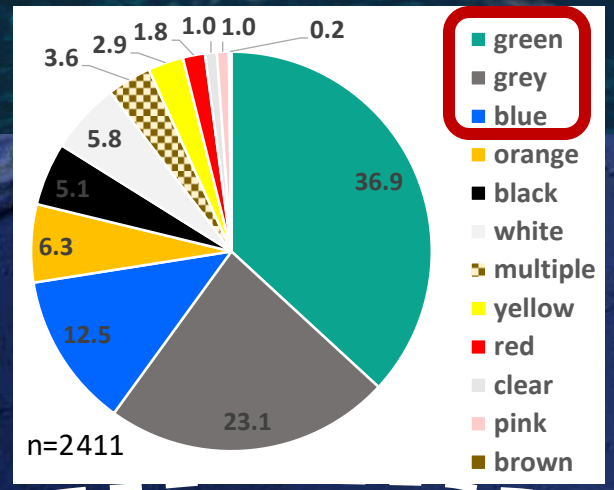


Lynch et al. (in prep)

Source – Trawl Nets







Trawl

Lynch et al. (in prep)

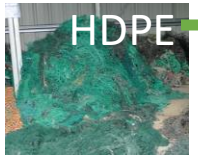
Recycle – Mechanical, Local, Necessary, Long-term

CMDR

Plastic Recycling Research Facility (PRRF)

Receiving

Sorting and Documenting



Converting

Marine Debris Program

Hawai'i Nets to Energy Program

Recycle – Nets to Roads

1000 pounds of HDPE trawl nets paved into an O‘ahu road in April 2024 (0.1% final pavement content)

Recycle – Nets to Boards

200 pounds of HDPE trawl nets to be trialed for plastic lumber

THE LAST POUND

Recycle – Nets to Walls

200 pounds of HDPE trawl nets to be trialed in a concrete forming system

10. Educate

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

Training for Improving Plastics Circularity (TIPC)

Collaborative Learning Bridge in Plastic Circularity

Industry Experts

Short Course Series for Professionals
- **Taught by Whom?** HPU CMDR
- **When?** Beginning Summer 2024
- **Where?** Hawaii

Seminar Speakers: Advances in Plastics Sustainability
- **Given by Whom?** Non-HPU experts
- **When?** Beginning Spring 2024
- **Where?** Hawaii

Plastic Sustainability Internships for undergraduates
- **Mentored by Whom?** Non-HPU experts
- **When?** Beginning Summer 2025
- **Where?** Anywhere

Hawaii Pacific University Undergraduates

Goals

1. Mutual understanding of plastic pollution problem and urgency of solutions
2. Collaborations, Internships, and Career Opportunities to expand Plastic Circularity

Plastic Circularity for Environmental Solutions Minor

- **Required Courses**
  - Plastic Fantastic! (3 credit hours)
  - Advances in Plastic Sustainability Seminar (1 credit hour)
  - Polymer Science in the 21st Century (3 credit hours)
  - Plastic Sustainability Internship (3 credit hours)
- **Choose Two Electives**
  - BUS/ECON Course – Manufacturing and Production/Environmental Economics (3 credit hours)
  - ENGR Course – Materials Science (3 credit hours)
  - ENVS Course – Sustainability and the Environment (3 credit hours)

- Existing Course
- New Course
- New Modules in Existing Course

Collaborations

6. Sort

Marine Pollution Bulletin 196 (2023) 115570

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Polymer identification of floating derelict fishing gear from O'ahu, Hawai'i

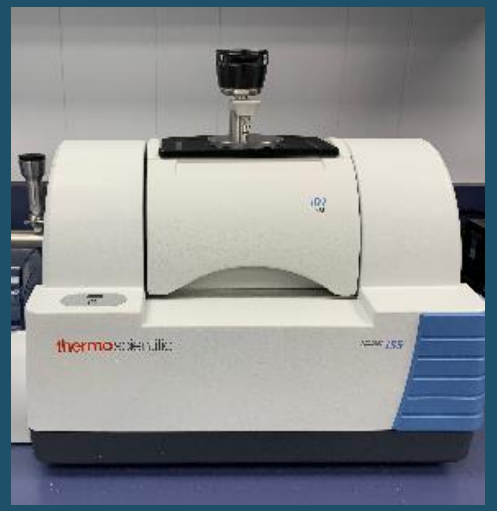
Raquel N. Corniuk [a,*], Katherine R. Shaw [a,b], Andrew McWhirter [a], Harry W. Lynch IV [c], Sarah-Jeanne Royer [a,1], Jennifer M. Lynch [a,b]

Fishing gear type

- Net
- Line
- dFAD
- Oyster spacer
- Eel trap entrance

+

Polymer (plastic material)



- Polyethylene
- Polypropylene
- Polystyrene
- Nylon

=

WHY?

Source fishery
- Trawl
- Purse seine
- Pot
- Gillnet
- Aquaculture

See Talk 1871
Wed 8:30am
Room 319B

→ Prevention

→ Mechanical recycling

Cascading mechanical recycling

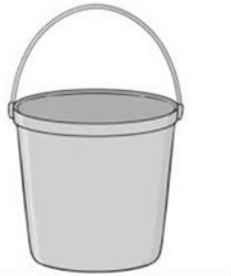
Natural resources → Virgin plastic pellets → Food and drug packaging → Structurally safe to protect human life → Structurally sound long-term use → Structurally sound short-term use → Additives to infrastructure and pavements to replace other virgin materials

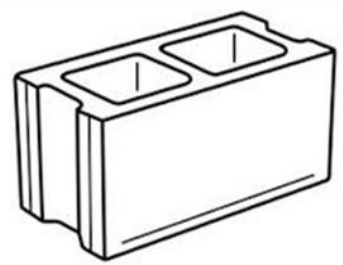











Days to weeks | 1-2 decades | 2-5 decades | 1-2 years | 2-10 decades

Original material is used five times for a total of 51 to 172 years