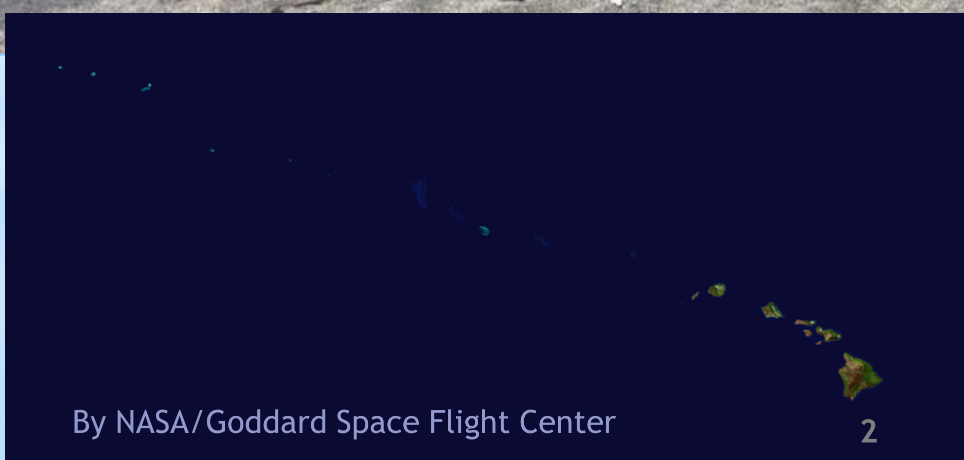
Maui Polystyrene Food Service Bill 127

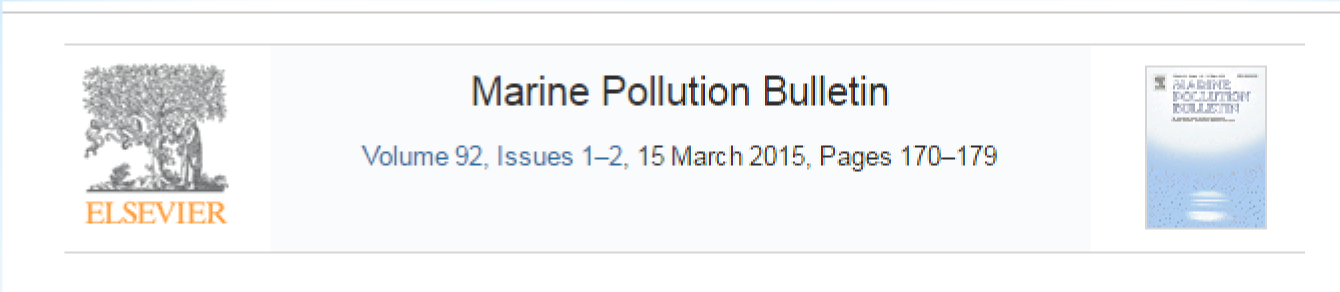
Megan Lamson, Hawai‘i Wildlife Fund
May 2017 – megan@wildhawaii.org



By NASA/Goddard Space Flight Center

Over **242 tons of marine debris removed** from Maui, Hawai‘i Island, Midway & French Frigate Shoals.

From **Marine Pollution Bulletin** 92:1-2 pp. 170-179 (March 2015)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Marine Pollution Bulletin

Volume 92, Issues 1–2, 15 March 2015, Pages 170–179

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tent

1) **Science**

* Negative impact to marine resources (fish, turtles, seabirds, etc.)
* Global chemical contamination from polystyrene

2) **Locally-sourced marine debris**

* Sources vs. Sinks paper
* International Coastal Cleanup Data (Maui County)
* The success of the Maui plastic-bag ban (2011)

3) **Common sense**

* Overflowing landfills and DOT report
* Solid Waste Management for Island Ecosystems

From **Science Magazine** 252:6290 p. 1213 (June 2016)

24-hour maximum of η_{elec} = 27 ± 4% (n = 3) (Fig. 3F). The achieved titers are higher than previous reported values, and η_{elec} values have increased by a factor of at least 20 to 50 (*10*, *18*). *R. eutropha* has demonstrated tolerance toward isopropanol (fig. S14), allowing for enriched product concentrations under extended operation.

Our combined catalyst design mitigates biotoxicity at a systems level, allowing water-splitting catalysis to be interfaced with engineered organisms to realize high CO_2 reduction efficiencies that exceed natural photosynthetic systems. Because E_{appl} required for water splitting is low (1.8 to 2.0 V), high η_{elec} values are achieved that translate directly to high solar-to-chemical efficiencies (η_{SCE}) when coupled to a typical solar-to-electricity device ($\eta_{SCE} = \eta_{solar} \times \eta_{elec}$). For a photovoltaic device of η_{solar} = 18%, the Co-P|CoP$_i$| *R. eutropha* hybrid system can achieve η_{SCE} = 9.7% for biomass, 7.6% for bioplastic, and 7.1% for fusel alcohols. This approach allows for the development of artificial photosynthesis with efficiencies well beyond that of natural photosynthesis, thus providing a platform for the distributed solar production of chemicals.

REFERENCES AND NOTES

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Appl. Microbiol. Biotechnol. **98**, 4277–4290 (2014).

10.1126/science.aaf5039

ECOTOXICOLOGY

Environmentally relevant concentrations of microplastic particles influence larval fish ecology

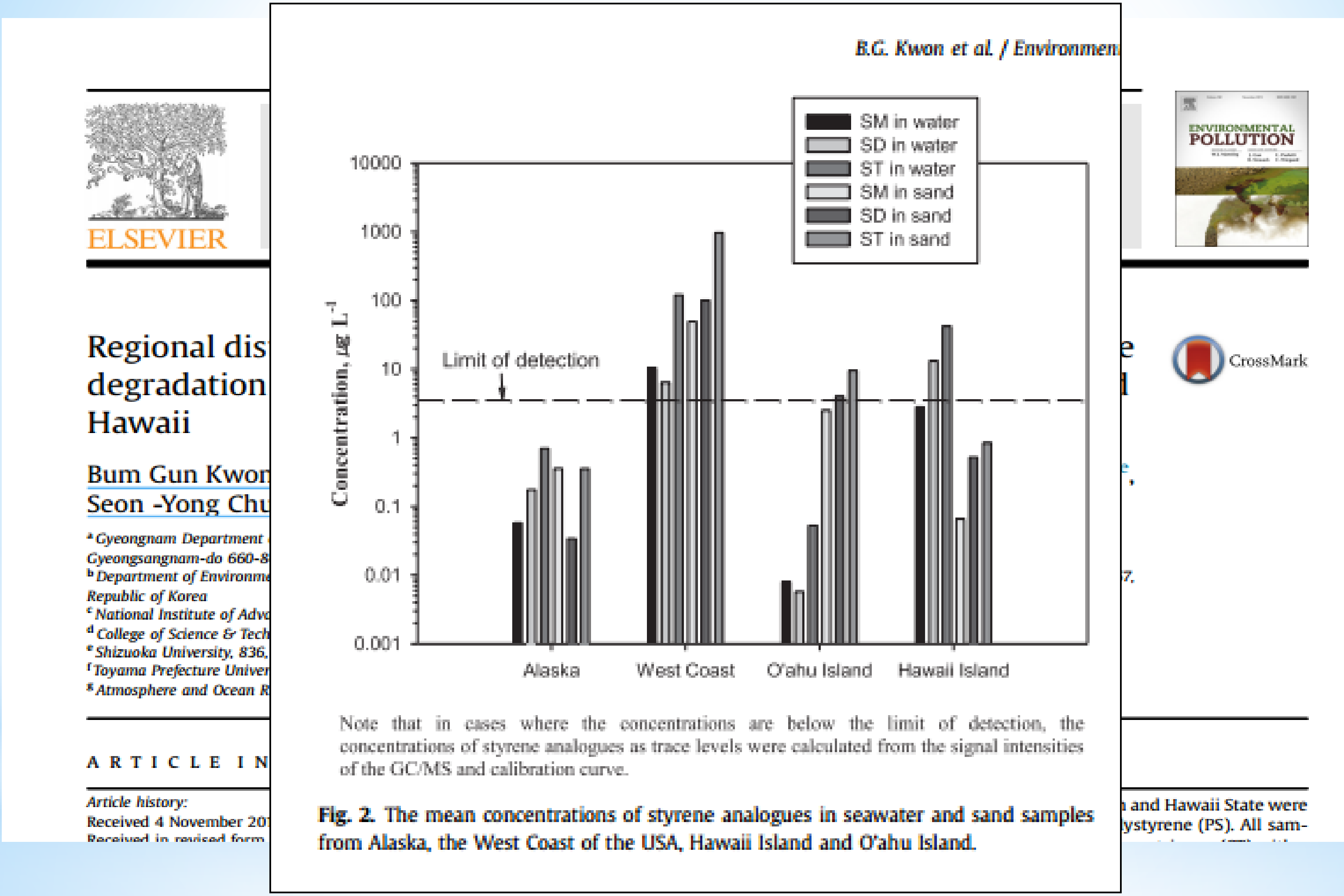
Oona M. Lönnstedt* and Peter Eklöv

The widespread occurrence and accumulation of plastic waste in the environment have become a growing global concern over the past decade. Although some marine organisms have been shown to ingest plastic, few studies have investigated the ecological effects of plastic waste on animals. Here we show that exposure to environmentally relevant concentrations of microplastic polystyrene particles (90 micrometers) inhibits hatching, decreases growth rates, and alters feeding preferences and innate behaviors of European perch (*Perca fluviatilis*) larvae. Furthermore, individuals exposed to microplastics do not respond to olfactory threat cues, which greatly increases predator-induced mortality rates. Our results demonstrate that microplastic particles operate both chemically and physically on larval fish performance and development.

bal plastic production is estimated to be bout 300 million metric tons (MMT) anually and is increasing by 20 MMT per

years, where they break down into smaller pieces owing to ultraviolet radiation, physical forces, and hydrolysis (*4*). Hence, plastic particles continue to

From **Environmental Pollution 188:45-49** (2014)



Note that in cases where the concentrations are below the limit of detection, the concentrations of styrene analogues as trace levels were calculated from the signal intensities of the GC/MS and calibration curve.

Fig. 2. The mean concentrations of styrene analogues in seawater and sand samples from Alaska, the West Coast of the USA, Hawaii Island and O'ahu Island.

"Our results suggest the presence of new global chemical contaminants derived from PS in the ocean, and along coasts."


FOAM
FREE
FUTURE

From **Marine Environmental Research** 84 pp. 76-83 (2013)

Marine Environmental Research 84 (2013) 76–83

Contents lists available at SciVerse ScienceDirect

Marine Environmental Research

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

Tracking the sources and sinks of local marine debris in Hawai'i

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A R T I C L E I N F O

Article history:
Received 14 July 2012
Received in revised form
3 December 2012
Accepted 4 December 2012

Keywords:
Plastics
Marine debris
Hawaii
Drifters
Retention booms
Ocean models
Sources
Pathways
Waste disposal

A B S T R A C T

Plastic pollution has biological, chemical, and physical effects on marine environments
effects on coastal communities. These effects are acute on southeastern Hawai'i Island, wh
remove 16 metric tons of debris annually from a 15 km coastline. Although the majority is
a portion is locally-generated. We used floating debris-retention booms in two urban
measure the input of debris from Hilo, the island's largest community, and released woo
nearby coastal waters to track the fate of that debris. In 205 days, 30 kilograms of debris
were retained from two watersheds comprising 10.2% of Hilo's developed land area. O
drifters released offshore of Hilo in four events, 23.3% were recovered locally, 1.4% at dis
and 6.5% on other islands. Comparisons with modeled surface currents and wind were mi
the importance of nearshore and tidal dynamics not included in the model. This study dem
local pollutants can be retained nearby, contribute to the island's debris-accumulation are
contaminate other islands.

MĀLAMA MAUI NUI
KEEP AMERICA BEAUTIFUL AFFILIATE

Ocean Conservancy

Summary — Maui County, HI, USA

#	Clean Up Summary	Total	%
1	Cigarette Butts	16628	34.96%
2	Plastic Pieces	5817	12.23%
3	Food Wrappers (candy, chips, etc.)	3462	7.28%
4	**Foam Pieces**	**3324**	**6.99%**
5	Bottle Caps (Metal)	3139	6.60%
6	Bottle Caps (Plastic)	1869	3.93%
7	Glass Pieces	1645	3.46%
8	**Other Plastic/Foam Packaging**	**886**	**1.86%**
9	Fishing Line (1 yard/meter = 1 piece)	792	1.67%
10	Beverage Bottles (Plastic)	749	1.57%

FOAM Total - MAUI	Total	%
Foam Pieces	3324	6.99%
Other Plastic/ Foam Packaging	886	1.86%
Take Out/Away Containers (Foam)	436	0.92%

4,646 foam items / 9.77% of total collected

2015 worldwide ICC data.

PHOTOS COURTESY OF THE MAUI NEWS / MATTHEW THAYER

From **Marine Pollution Bulletin105:292-298** (April 2016)

Marine Pollution Bulletin 105 (2016) 292–298

Contents lists available at ScienceDirect

Marine Pollution Bulletin

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

Trends and drivers of debris accumulation on Maui shorelines: Implications for local mitigation strategies

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ARTICLE INFO

Article history:
Received 18 August 2015
Received in revised form 29 December 2015
Accepted 1 February 2016
Available online 28 February 2016

Keywords:
Marine debris
Hawaii
Accumulation rates

ABSTRACT

Marine debris, particularly plastic, is an identified concern for coastal areas and is known to accumulate in large quantities in the North Pacific. Here we present results from the first study to quantify and compare the types and amounts of marine debris on Maui shorelines. Surveys were conducted monthly between May 2013 and December 2014, with additional daily surveys conducted on Maui's north shore during January 2015. Debris accumulation rates, loads, and sources varied between sites, with plastics being the most prevalent type of debris at all sites. Large debris loads on windward shores were attributed to the influence of the North Pacific Subtropical Gyre and northerly trade winds. Daily surveys resulted in a significantly higher rate of debris deposition than monthly surveys. The efficacy of local policy in debris mitigation showed promise, but was dependent upon the level of enforcement and consumer responsibility.

"Over the course of 17 months, 78 debris clean ups, and a total of 10,074 debris items, we did not collect any plastic grocery bags." -- **Lauren Blickley**


#HOLDTHEFOAM

From **Marine Pollution Bulletin** 28:11 pp. 649-652 (1994)

Pergamon

0025-326X(94)00146-4

Marine Pollution Bulletin, Vol. 28, No. 11, pp. 649–652, 1994

0025–326X/94 $7.00+0.00

LAWS OF THE SEA

Land-Based Discharges of Marine Debris: From Local to Global Regulation

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This article outlines the major regulatory requirements involved in the control of land-based discharges of marine debris, and reviews the main developments in the process towards more appropriate international controls of such discharges.

Marine debris poses a continuing threat to marine ecosystems. Most visibly, it has resulted in entanglement of marine wildlife. Debris washing up on beaches may

Sea, the Baltic Sea, the Black Sea and the Arctic) are covered by more or less operational programmes for land-based pollution, whereas programmes for the South East Pacific and the Persian Gulf are as yet dormant (Nollkemper, 1992). Equally significant, existing programmes have been inadequate. They have not addressed the full range of sources of marine debris; they have treated land-based pollution too much as an isolated problem, as if unrelated to waste generation; and have provided insufficient inducements by way of information exchange, technical co-operation and financial assistance to move marine debris higher on the agenda of, in particular, developing states. Each of these problems will be elaborated below.

The bleak prospects for adequate regional solutions rightly has set in motion a global process. Responding to the imperatives set forth in Agenda 21 (adopted at the 1992 UNCED), a global programme of action for land-based sources of marine pollution is now being

"The very policies that reduce generation of solid wastes will prevent them from entering the environment."

From **NRDC Report** “WASTE IN OUR WATER: THE ANNUAL COST TO CALIFORNIA COMMUNITIES OF REDUCING LITTER THAT POLLUTES OUR WATERWAYS” (2013):

Table 7: Total Annual Direct Cost of Debris Management

Community Size	Population Range	Range of Reported Annual Costs	Average Reported Annual Cost	Average Reported Per Capita Cost
Largest	250,000 or more	$2,877,400–$36,360,669	$13,929,284	$11.239
Large	75,000–249,999	$350,158–$2,379,746	$1,131,156	$8.938
Midsize	15,000–74,999	$44,100–$2,278,877	$457,100	$10.486
Small	Under 15,000	$300–$890,000	$144,469	$18.326

For detail, see Appendix B: Data Tables.

From Hawai‘i State DOT “**Trash Protection Plan**” (2016)

6.4 Long-Term Plan Enhanced Control Measures (p. 73)

- **Consider an ordinance to ban Styrofoam.**
- Expand the Plastic Bag Ordinance.
- Increase school and community outreach related to trash.
- Conduct additional outreach and/or inspections of businesses that may exacerbate trash issues (e.g., fast food restaurants).
- Review the street sweeping schedule to enhance the effectiveness of street sweeping.
- Install additional full trash capture devices, such as trash skimmers

From **EPA.gov Advancing Sustainable Materials Management** 2014 Fact Sheet

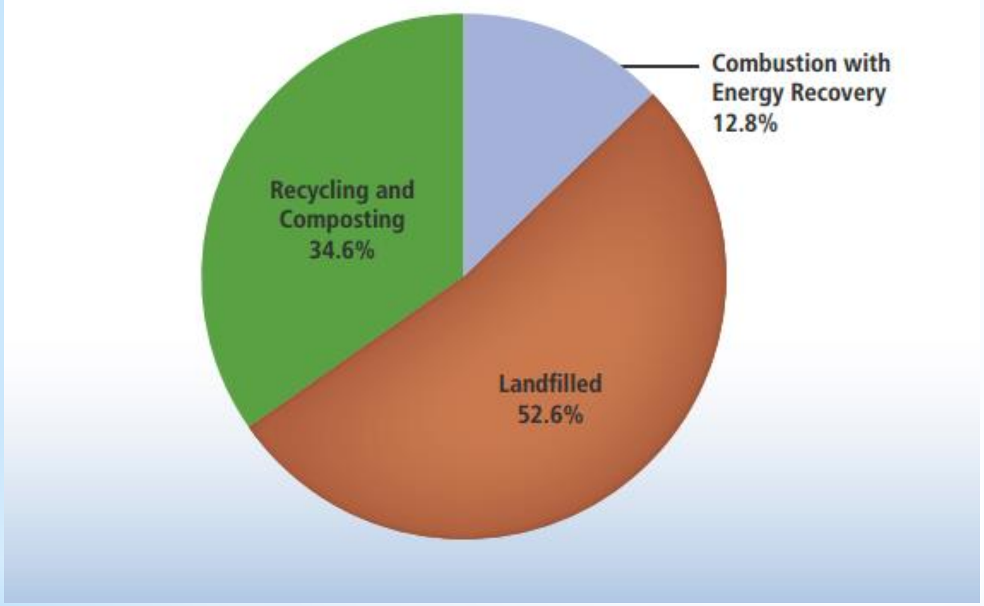

Figure 4. Management of MSW in the United States, 2014

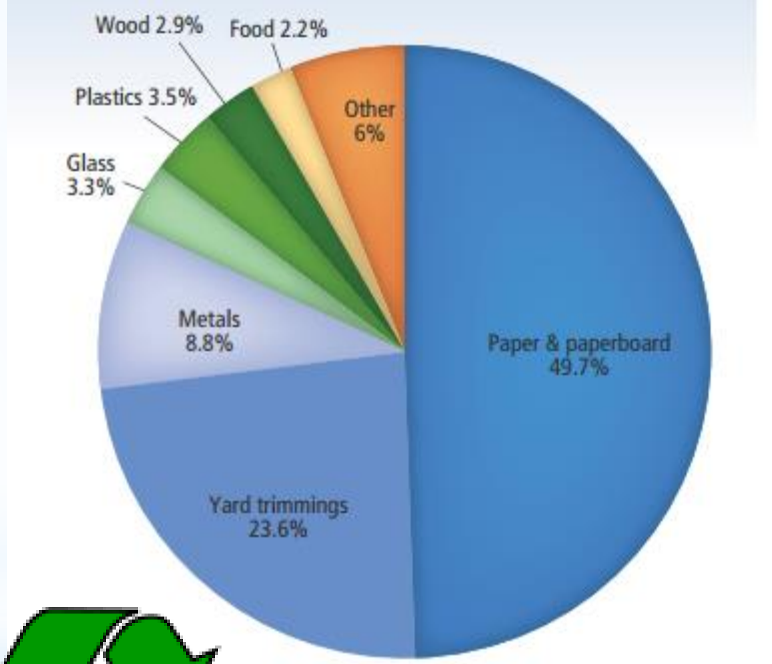

Figure 6. Total MSW Recycling and Composting (by material), 2014 89 Million Tons

According to **Smithsonian Magazine** (2014): "Styrofoam or expanded polystyrene is made of plastic #6. The general rule is the higher the number of plastic, the harder it is to recycle."

From **SpringerPlus 2:398** (2013)

Yousif and Haddad *SpringerPlus* 2013, **2**:398
http://www.springerplus.com/content/2/1/398

SpringerPlus
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REVIEW **Open Access**

Photodegradation and photostabilization of polymers, especially polystyrene: review

Emad Yousif* and Raghad Haddad

Abstract

Exposure to ultraviolet (UV) radiation may cause the significant degradation of many materials. UV radiation causes photooxidative degradation which results in breaking of the polymer chains, produces free radical and reduces the molecular weight, causing deterioration of mechanical properties and leading to useless materials, after an unpredictable time. Polystyrene (PS), one of the most important material in the modern plastic industry, has been used all over the world, due to its excellent physical properties and low-cost. When polystyrene is subjected to UV irradiation in the presence of air, it undergoes a rapid yellowing and a gradual embrittlement. The mechanism of PS photolysis in the solid state (film) depends on the mobility of free radicals in the polymer matrix and their bimolecular recombination. Free hydrogen radicals diffuse very easily through the polymer matrix and combine in pairs or abstract hydrogen atoms from polymer molecule. Phenyl radical has limited mobility. They may abstract

"Polystyrene waste requires the transportation of big large volume of materials, which is costly and makes recycling economically unfeasible."

* According to **Mauicounty.gov**

Recycling, Refuse & Landfill Guide (pg. 4)

Plastics:

- **#1 and #2 only**
- Rinse clean, discard lids
- No food residue
- No toys
- No Styrofoam
- No plastic bags

Plastic #6 or PS is NOT recyclable on Maui

… or Hawai‘i Island or O‘ahu …

* Foam Alternatives are Available

SUSTAINABLE ISLAND PRODUCTS

Styrophobia

COMPOSTABLE

Biodegradable Products Institute | US Composting Council

Maui Chemical & Paper Products

Supplying Hawaii Since 1969

VIP Foodservice

NATURAL MARKET

Mahalo nui loa…

Megan Lamson, Hawaiʻi Wildlife Fund

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