

The logo features a stylized white wave icon above the text "CLEAN UP THE LAKE" in a sans-serif font, with "2023" in a larger font below it.

CLEAN UP
THE LAKE
2023

The title "Lake Tahoe Litter Summit" is written in a large, white, serif font. To the left of the text are two overlapping light blue circles. The background is a scenic view of Lake Tahoe with clear turquoise water, rocky shores, and evergreen trees under a blue sky.

Lake Tahoe Litter Summit

COLLABORATING FOR A CLEANER FUTURE



CLEAN UP THE LAKE:

A LOOK INTO CLEANING SUBMERGED LITTER FROM OUR NATION'S LAKES

Focus: Lake Tahoe

Dr. Zoe Harrold

Colin West



Clean Up The Lake
Registered 501(c)3 in NV, WA, & CA

THE DECISION TO MAKE A DIFFERENCE



WHAT WE

DO

A Tahoe-based NPO focused on scuba clean ups, beach and community clean ups, and waste reduction strategies in Lake Tahoe and beyond.

ACCOMPLISHM

ENTS

72 Mile Clean Up of Lake Tahoe
We have completed an unprecedented effort, our clean-up teams have successfully circumnavigated the lake, removing litter from every mile of the sub-surface 72-mile shoreline of Lake Tahoe.

NonProfit of the Year Award

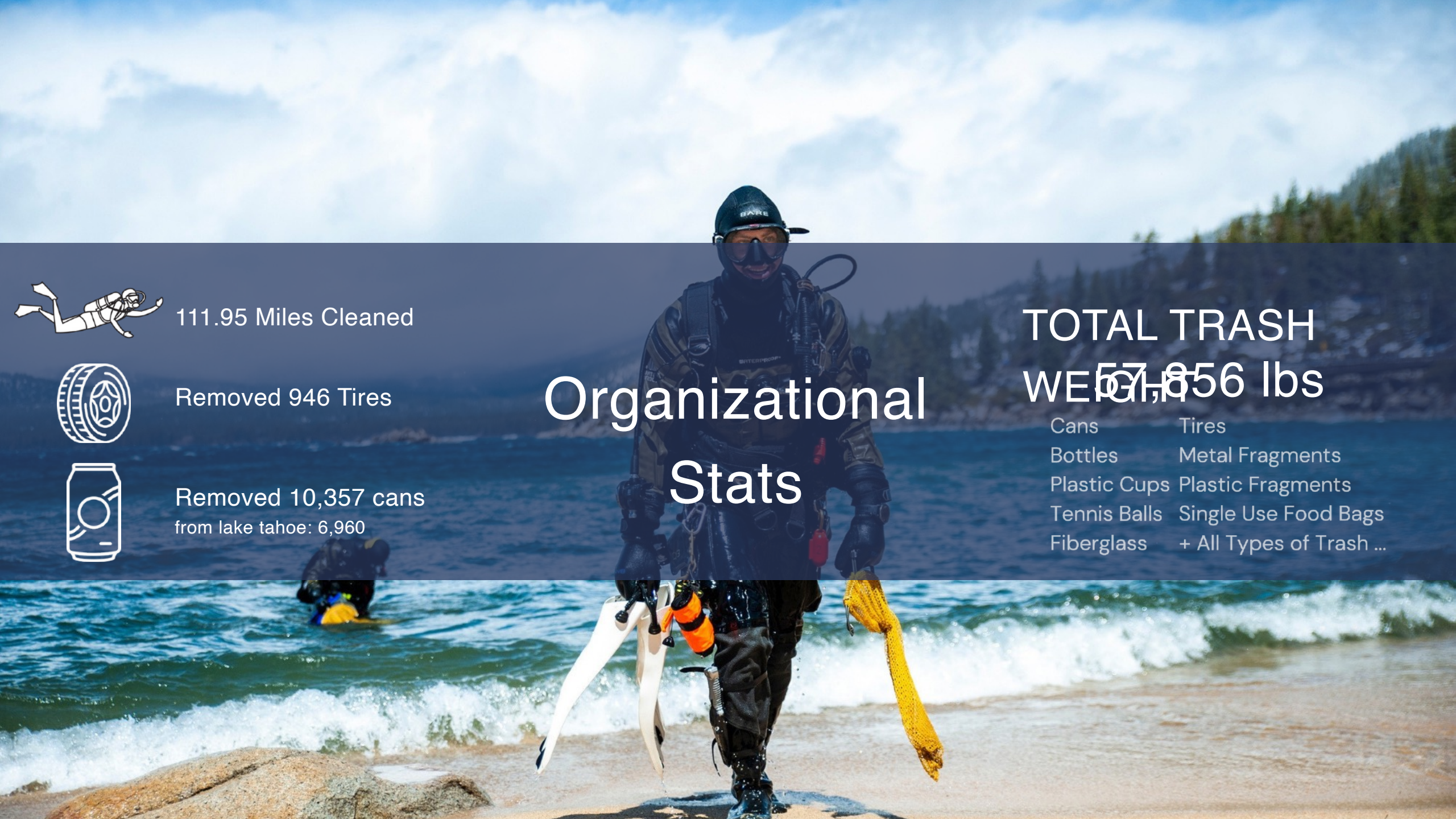
We were honored by Senator Brian Dahle (R-Bieber) to be named 1st Senate District Nonprofit of the year for 2021.

Clean Up The Lake Day

On April 18th, 2022 Governor Sisolak of Nevada proclaimed that day, the Monday of Earth Week as our own little holiday called Clean Up The Lake Day.



AN UNPRECEDENTED
EFFORT
TO
CLEAN UP THE
LAKE



111.95 Miles Cleaned



Removed 946 Tires



Removed 10,357 cans
from lake tahoe: 6,960

Organizational Stats

TOTAL TRASH
WEIGHT 57,856 lbs

- | | |
|--------------|--------------------------|
| Cans | Tires |
| Bottles | Metal Fragments |
| Plastic Cups | Plastic Fragments |
| Tennis Balls | Single Use Food Bags |
| Fiberglass | + All Types of Trash ... |

Clean Up The Lake Crew

TRASH TEAM



COLIN WEST
Founder and Chief
Executive Officer



BRAD FLORA
Director Of Operations



SADYE EASLER
Director of Programs



DR. ZOE HARROLD
Environmental Scientist &
Grant Writer



CARA HOLLIS
Youth Programs
Coordinator



HAYDEN FARRIS
Organizational &
Administrative Assistant



EDEN FOSTER
Data Management
Coordinator

THE BOARD



MEGHAN BURK
President of the Board



KATIE SENFT
Board Member



MIKE PERON
Board Member



STUART MAAS
Board Member



JEFF COWEN
Board Member

Our The Strategy Method

Utilizing key roles to complete our organization's mission.

- Each team consists of scuba divers, free divers, kayakers, jet ski captains and a boat captain.
- The team size each day correlates with area that was being cleaned.
- On average our teams consisted of 3-5 divers per day, 2 days per week.
- Each dive covered at least +/- .75 miles per day.
-

The Tactic

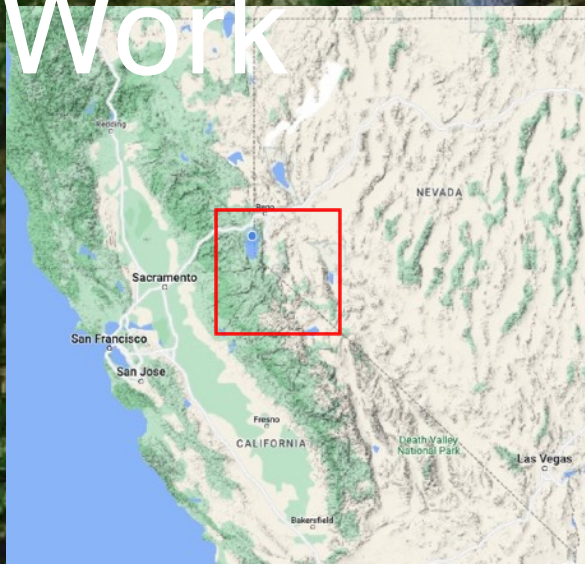
Area of focus - Shoreline to 25' deep dives.

- Shoreline focus increased our ability to remove litter in an efficient way in areas with concentrated litter.
- Utilizing WildNote, a field data collection software, our teams are able to GPS mark "hotspot areas," heavier lift litter items, and historical items in order to monitor or remove in future monitoring projects as well as aquatic invasive species and algal blooms.
- Highly trafficked areas are approached with a larger team when a concern for large accumulations of trash is perceived.
- A weighted rope pulley concept assists in the removal of slightly heavier items from the lakebed.





Scope of our FY22-FY23 Work

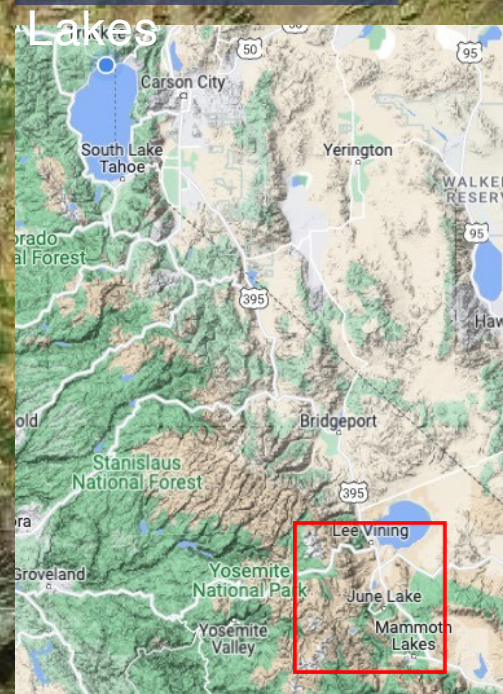


LAKE
TAHOE

Donner Lake Monitoring

C
A
N
V

Mammoth



Fallen Leaf Lake Cleanup

June
Lake



2018

CLEANUPS BEGIN

AN IDEA IS
BORN

2019

INITIAL SURVEY DIVES

DIVERS BEGIN TO SURVEY
FOR SUBMERGED LITTER

2020

DONNER LAKE CLEANUP

OUR ORGANIZATION'S
FIRST FULL SCALE
CLEANUP

2022

DONNER LAKE
MONITORING
DEEP DIVES &
HOTSPOTS

2020-2021

72 MILE CLEANUP

CLEAN UP THE
LAKE'S FLAGSHIP
PROJECT

2020

6 MILE CLEANUP
CLEAN UP THE LAKE'S FIRST
OFFICIAL LAKE TAHOE
PROJECT

2022

FALLEN LEAF LAKE CLEANUP

THE MOST LITTERED
LAKE WE'VE SEEN YET

2022

JUNE LAKE CLEANUP

OUR FLAGSHIP
EXPANSION PROJECT

2023

LAKE TAHOE MONITORING

DEEP DIVES &
HOTSPOTS



Cleanups

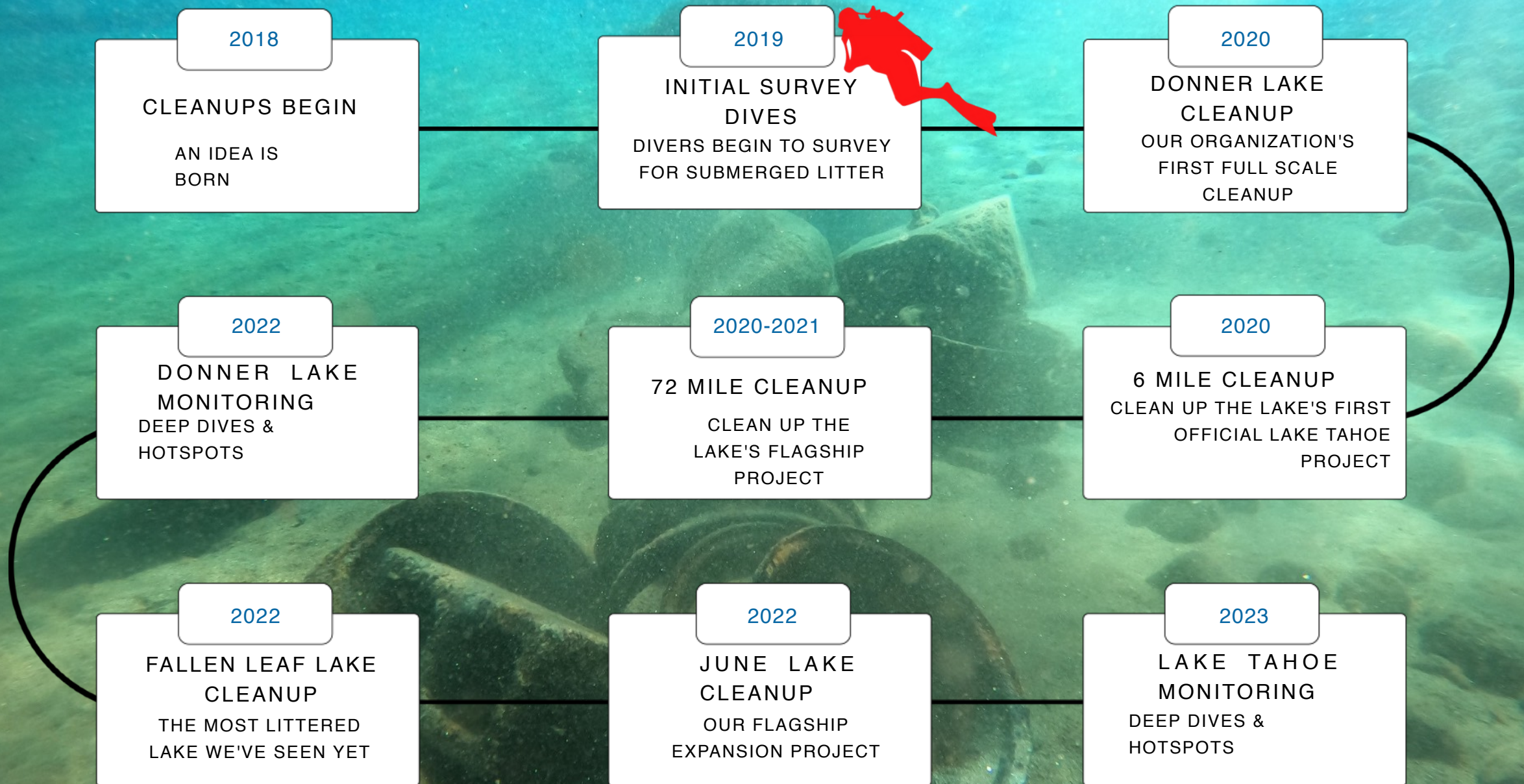
An Idea Is Born

Begin



- 2018 Clean Up The Lake is founded and beach cleanups begin.
- Kings Beach, CA
 - Community members simultaneously dive at Bonsai Rock and remove over 600lbs (unofficial data).



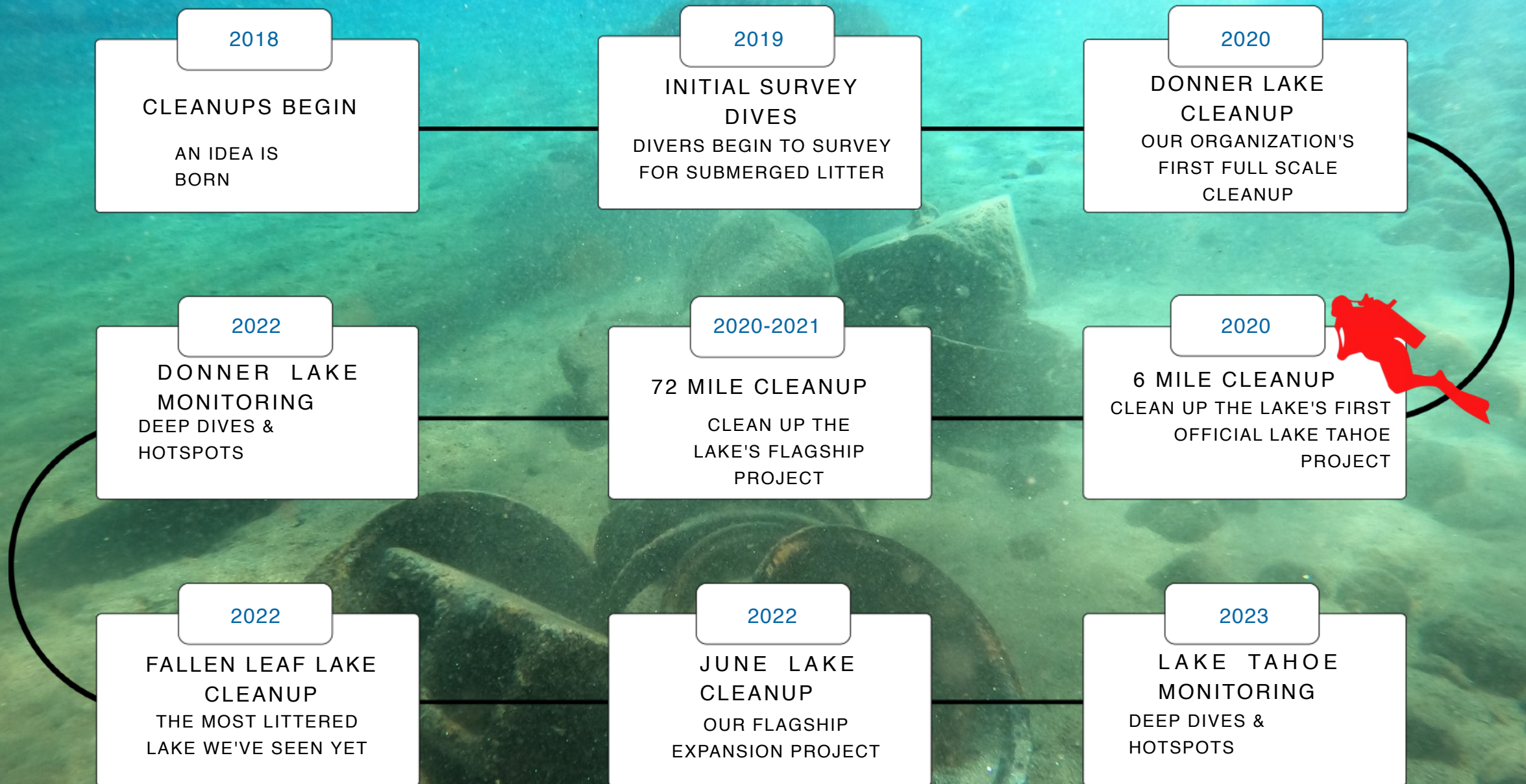


INITIAL SURVEY DIVES

Divers Begin Surveying For Submerged Litter

- 3 survey dives conducted.
 - Hidden Beach
 - Secret Cove
 - Whale Beach
- 1,817 Lbs removed
- Widespread submerged litter observed.

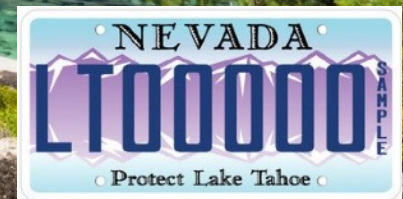


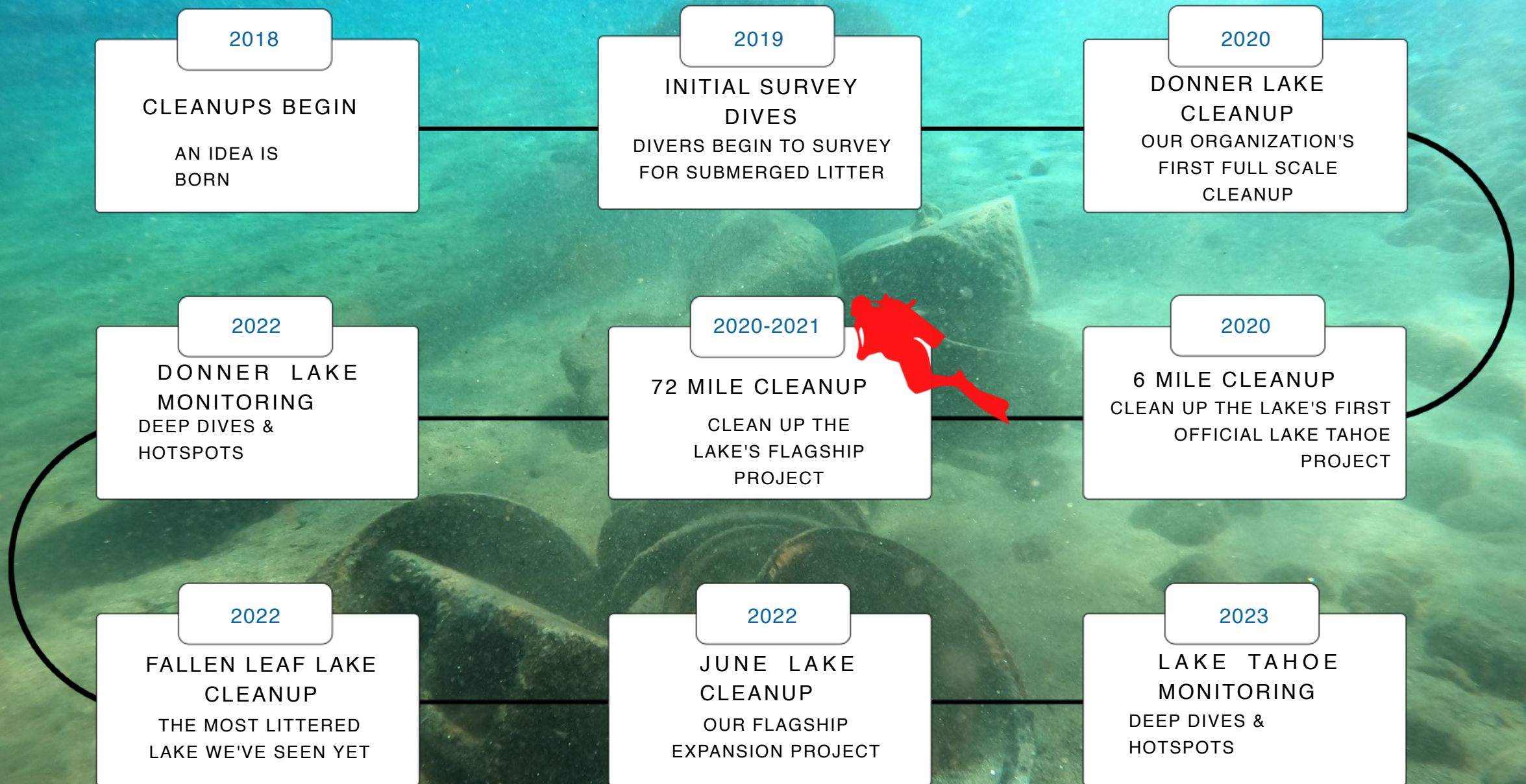


6 Mile

Clean Up The Lake's First Official Cleanup Cleanup

Distance	6 Mi.
Trash Weight Collected	2,338 Lbs.
Total Pieces of Litter Removed	3,607 items
Volunteers Hours to Date	451 hrs.

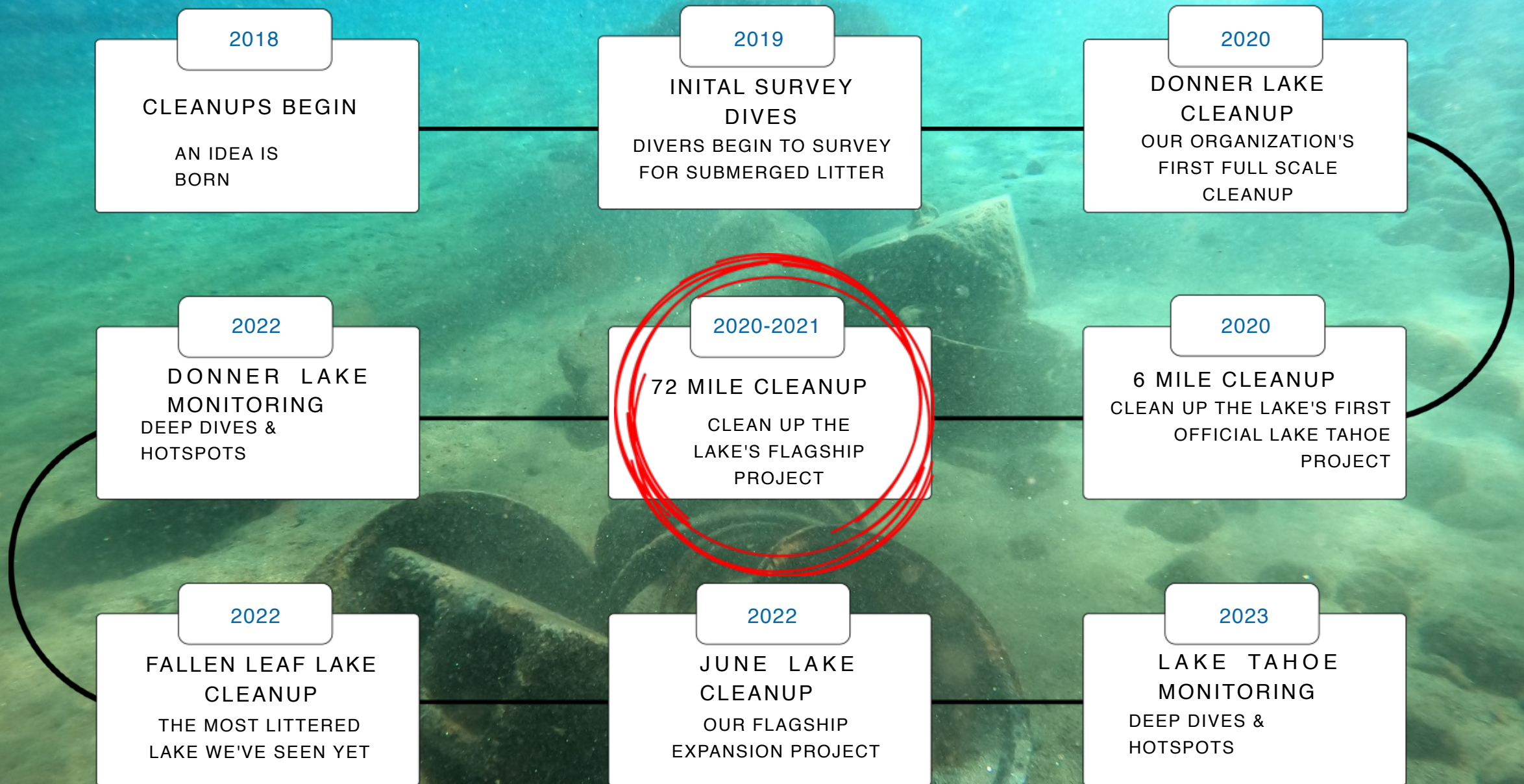




72 Mile Clean Up The Lake's Flagship Project Cleanup

Circumference	72 Mi.
Trash Weight Collected	25,281 Lbs.
Total Pieces of Litter Removed	24,825 items
Volunteers Hours to Date	6,715.75 hrs.





LAKE TAHOE - NV LITTER (2021)

ABOUT LAKE TAHOE



LITTER INPUTS

LAKE TAHOE, NV LITTER

LITTER BY MATERIAL

LITTER BY CATEGORY

LITTER BY SHORELINE USE

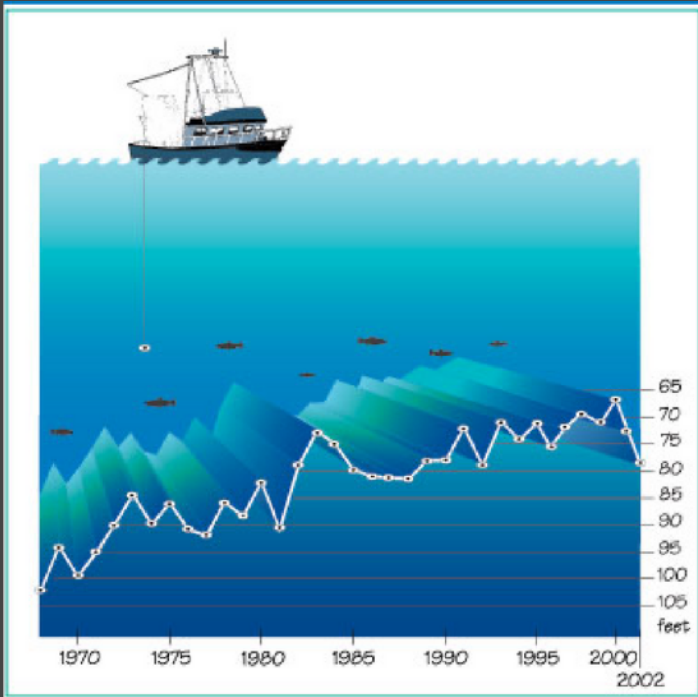
LITTER BY LAKEBED SUBSTRATE

LITTER BY LOCATION

Lake Tahoe – The largest alpine lake in North America

- ~ 6,225' above sea level
- 72 miles of shoreline, 28 miles in NV
- 1,645 ft. deep – 2nd deepest in the US (10th in the world)
- The sixth largest freshwater lake by volume, after the Great Lakes.
- Basin formed by faulting, carved by glaciers, and dammed by volcanic deposits.





Lake Tahoe – Quality & Clarity

- Ultra-oligotrophic water
- Superb drinking water quality
 - Tahoe Water Suppliers association is exempt from filtration
- Known for its clarity
 - Historically had low algal bloom
- activity
- Low sediment loads
- Critical habitat - threatened Lahontan Cutthroat Trout

Lake clarity has been declining due to runoff and algal blooms.



As it lay there with the shadows of the mountains brilliantly photographed upon its still surface, I thought it must surely be the fairest picture the whole earth affords.

- Mark Twain

Lake Tahoe – Tourism & Recreation

- As early as 1864, Tahoe City was established as a resort community.
- Today, Lake Tahoe draws about 15 million visitors every year.
- As with any popular destination, anthropogenic impacts threaten this natural resource – including litter accumulation.



LAKE TAHOE - NV LITTER (2021)

ABOUT LAKE TAHOE

LITTER INPUTS



LAKE TAHOE, NV LITTER

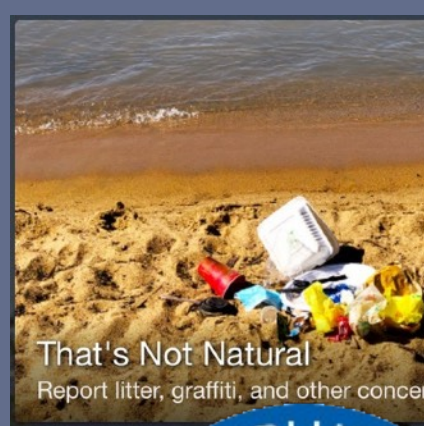
LITTER BY MATERIAL

LITTER BY CATEGORY

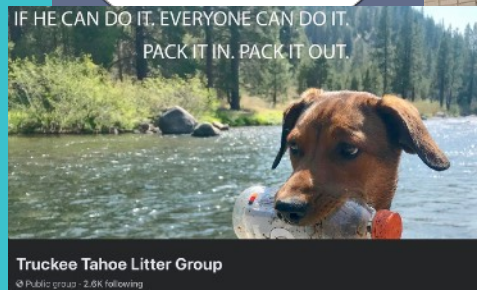
LITTER BY SHORELINE USE

LITTER BY LAKEBED SUBSTRATE

LITTER BY LOCATION



Everyone likes
a drink on the rocks...
except the rocks.

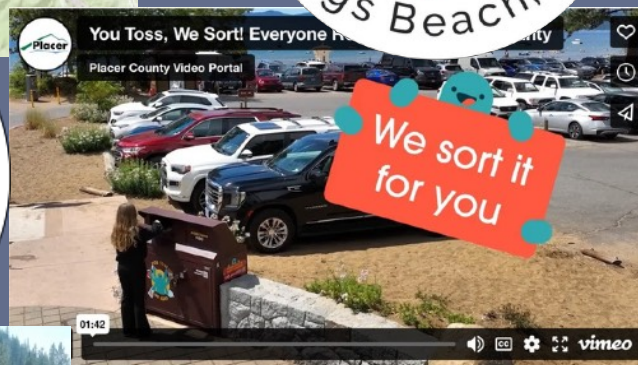


Bottles go in the can.
Rock on at takecaretahoe.org

Take
care.



Expanded Polystyrene
(a.k.a. Styrofoam)
Regulations in the
City of South Lake Tahoe



Littering is a persistent problem in the Tahoe Basin

- Efforts to manage littering include:
 - City and state laws
 - Citizen science reporting
 - Non-profit led, land-based cleanups
 - Grassroots/community led land-based cleanups
 - Local government and non-profit awareness campaigns

CUTL freshwater litter cleanups
complement efforts that are focused on
land-based littering behaviors and
accumulations.



Litter is transported into lakes – not just oceans

Transport processes include:

- Wind
- Rivers
- Storm water/runoff
- Direct input (accidental, intentional)



Submerged litter slowly degrades releasing organic & inorganic toxins

- Degradation by: physical abrasion, UV, chemical processes.
- 1 – 100+ years to degrade submerged litter. Degradation can produce:
 - Plastic leachates (e.g. PAHs, BPA, Styrenes)
 - Al solubilization (Al-Cans)
 - Microplastics (tires, clothing, plastics)
 - Nutrients? (Fe, P)

The only way to stop the degradation process is to remove the litter.

LAKE TAHOE - NV LITTER (2021)

ABOUT LAKE TAHOE

LITTER INPUTS

LAKE TAHOE, NV LITTER



LITTER BY MATERIAL

LITTER BY CATEGORY

LITTER BY SHORELINE USE

LITTER BY LAKEBED SUBSTRATE

LITTER BY LOCATION



DAY 16 | 535.75 lbs, 470 items



DAY 12 | 650 lbs, 323 items



DAY 11 | 353.5 lbs, 724 items



DAY 23 | 493.8 lbs, 337 items



DAY 4 | 250 lbs, 414 items



DAY 30 | 1067 lbs, 156 items



DAY 32 | 576 lbs, 1053 items



DAY 33 | 473 lbs, 315 items

Litter recovered from the nearshore lakebed - Lake Tahoe, NV

Cleanup Year	Phase	Litter weight	Litter Count	Location Data
2019	Exploratory Pilot	Totals and some items (e.g. cans)	NA	Estimated
2020 ¹⁰	Advanced Pilot/ Development Phase	UNEP/IOC	NA, or estimated	GPS
2021+	72- mile Cleanup	Expanded UNEP/IOC	Expanded UNEP/IOC	GPS - advanced

2020 totals (6 miles):

-1,611 lbs. (dry weights)

-268.5 lbs./mile

2021 totals (28 miles):

-16,615 pieces

-11,821 lbs. (dry weight)

-Averages 422 lbs./mile

Litter removed from the nearshore lakebed of Lake Tahoe, Nevada in 2021

Plastic
Foamed
Plastic

No.	Material	Code	Litter type
1	Plastic	PL01	Bottle caps & lids
2	Plastic	PL02	Bottles < 2 L (fl)
3	Plastic	PL03	Bottles (fl), drums, jerrycans & buckets > 2 L
4	Plastic	PL04	Kitchen, forks, spoons, straws, straws, (cutlery)
5	Plastic	PL05	Drum package mgs, six pack rings, ring carriers
6	Plastic	PL06	Food containers (flat food, cups, lunch boxes & similar) [plates, takeaways, any food packaging inc. bags]
7	Plastic	PL07	Plastic bags (opaque & clear) [other non-food packaging]
8	Plastic	PL08	Toy & recreational equipment
9	Plastic	PL09	Gloves
10	Plastic	PL10	Cigarette lighters (vape devices)
11	Plastic	PL11	Cigarettes, butts & filters
12	Plastic	PL12	Syringes
13	Plastic	PL13	Baskets, crates & trays
14	Plastic	PL14	Plastic bags
15	Plastic	PL15	Mesh bags (vegetable, oyster nets & mussel bags)
16	Plastic	PL16	Sheeting (tarpaulin or other woven plastic bags, pallet wrap)
17	Plastic	PL17	Fishing gear (lures, traps & pots)
18	Plastic	PL18	Marine/float line
19	Plastic	PL19	Rope
20	Plastic	PL20	Fishing net
21	Plastic	PL21	Strapping
22	Plastic	PL22	Plastic fragments
23	Plastic	PL23	Neon pellets
24	Plastic	PL24	Other (specify)
25	Plastic	PL25	PVC pipe
26	Plastic	PL26	Plastic fragments (micro, < 5cm)
27	Plastic	PL27	Sunbaths and other accessories
28	Foamed Plastic	FP01	Foam sponge
29	Foamed Plastic	FP02	Cups & food packs
30	Foamed Plastic	FP03	Foam buoys
31	Foamed Plastic	FP04	Foam (insulation & packaging)
32	Foamed Plastic	FP05	Other (specify)
33	Cloth	CL01	Clothing, shoes, hats & towels
34	Cloth	CL02	Backpacks & bags
35	Cloth	CL03	Canvas, sailcloth & sailing (hoses)
36	Cloth	CL04	Rope & string
37	Cloth	CL05	Carpet & furnishing
38	Cloth	CL06	Other cloth (including rags)
39	Cloth	CL07	Masks (cloth and medical)
40	Glass & ceramic	GO01	Construction material (brick, cement, pipes)
41	Glass & ceramic	GO02	Bottles & jars (separate intact and broken)
42	Glass & ceramic	GO03	Tableware (plates & cups)
43	Glass & ceramic	GO04	Light globes/bulbs
44	Glass & ceramic	GO05	Fluorescent light tubes
45	Glass & ceramic	GO06	Glass buoys
46	Glass & ceramic	GO07	Glass, ceramic fragments (unknown source)
47	Glass & ceramic	GO08	Other (specify)
48	Metal	ME01	Metal plates, cups, cutlery
49	Metal	ME02	Bottle caps, lids & pull tabs
50	Metal	ME03	Aluminum cans (fl)
51	Metal	ME04	Other cans (< 4 L)
52	Metal	ME05	Glass bottles, drums, buckets
53	Metal	ME06	Foil wrappers
54	Metal	ME07	Fishing gear (lures, traps & pots)
55	Metal	ME08	Fasteners (unknown source)
56	Metal	ME09	Wire, wire mesh, barbed wire (metal cording and coils)
57	Metal	ME10	Other (specify), including appliances
58	Metal	ME11	Anchors
59	Paper/cardboard	PC01	Paper incl. newspaper, magazines
60	Paper/cardboard	PC02	Cardboard boxes & fragments (non-food packaging)
61	Paper/cardboard	PC03	Cups, food trays, food wrappers, cigarette packs, drink containers
62	Paper/cardboard	PC04	Tubes for fireworks
63	Paper/cardboard	PC05	Other (specify)
64	Rubber	RB01	Balloons, balls, toys
65	Rubber	RB02	Footwear (flip-flops)
66	Rubber	RB03	Gloves
67	Rubber	RB04	Tires
68	Rubber	RB05	Inner-tubes and rubber sheet
69	Rubber	RB06	Rubber bands (hair ties)
70	Rubber	RB07	Condoms
71	Rubber	RB08	Other (specify)
72	Wood	WD01	Corks
73	Wood	WD02	Fishing traps and pots
74	Wood	WD03	Ice cream sticks, chip forks, chopsticks & toothpicks (wood utensils)
75	Wood	WD04	Lumber, processed timber and pallet crates
76	Wood	WD05	Matchboxes & fireworks
77	Wood	WD06	Other (specify)
78	Other	OT01	Pepper/fin or wax
79	Other	OT02	Sanitary (napkins, cotton buds, tampon applicators, toothbrushes) [toiletries]
80	Other	OT03	Appliances & Electronics
81	Other	OT04	Batteries (torch type)
82	Other	OT05	Other (specify)
83	Other	OT06	Residual memo-tracks (< 5 cm)

Litter removed from the lake is categorized

9 Materials (including other)

83 Categories

Categories correspond to use Case/
specific items

(e.g. bottles, tires)

Litter are sorted by volunteers and local
college interns.

Litter data are collected at a
granularity of 0.1 to 0.75-miles

(each dive tank segment)



LAKE TAHOE - NV LITTER (2021)

ABOUT LAKE TAHOE

LITTER INPUTS

LAKE TAHOE, NV LITTER

LITTER BY MATERIAL



LITTER BY CATEGORY

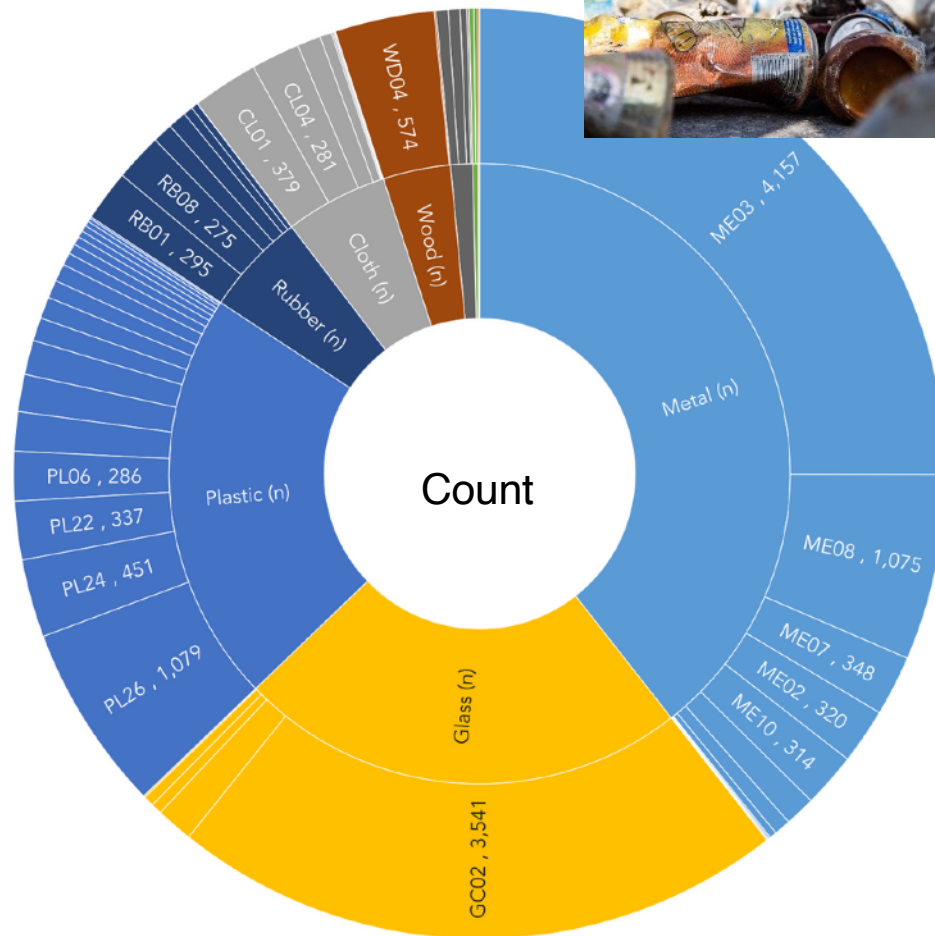
LITTER BY SHORELINE USE

LITTER BY LAKEBED SUBSTRATE

LITTER BY LOCATION

Litter By Material

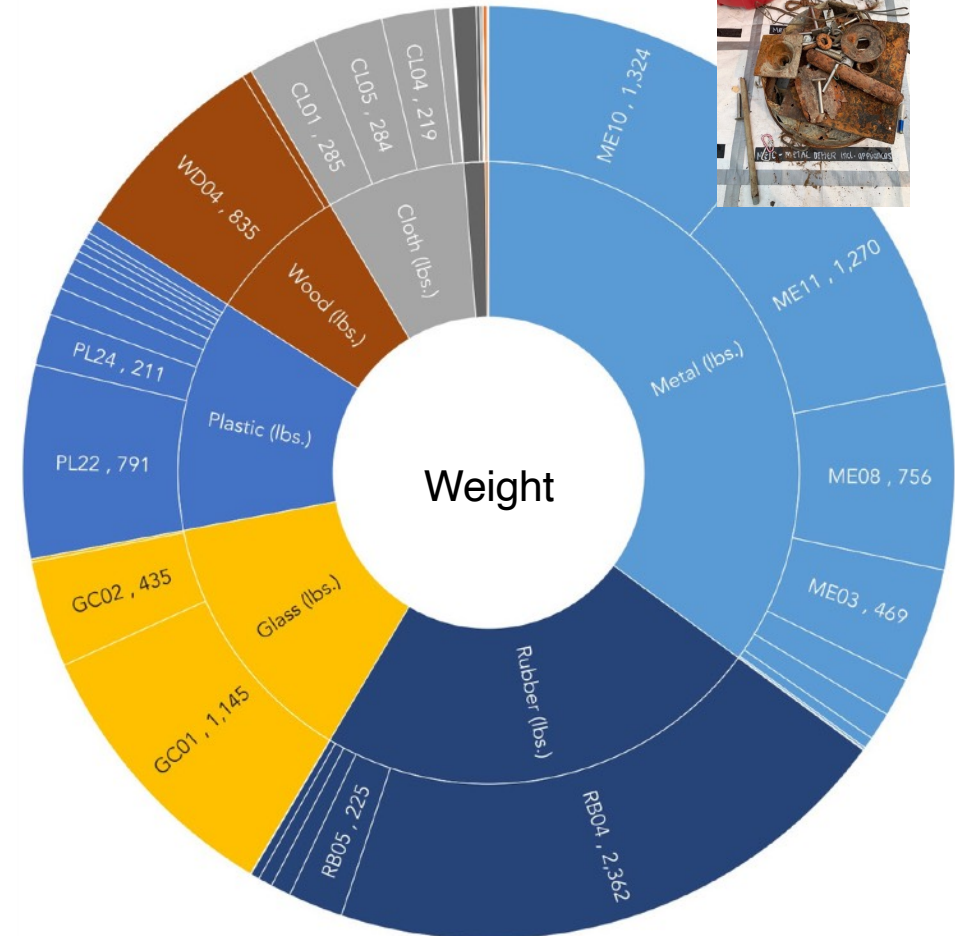
- Each material includes items with a range of densities
- Litter size is highly variable



Litter is dominated by 4 materials:

Metal, rubber, glass, and plastic.

Weight can inform potential impact, while count can inform littering frequency.



LAKE TAHOE - NV LITTER (2021)

ABOUT LAKE TAHOE

LITTER INPUTS

LAKE TAHOE, NV LITTER

LITTER BY MATERIAL

LITTER BY CATEGORY

LITTER BY SHORELINE USE

LITTER BY LAKEBED SUBSTRATE

LITTER BY LOCATION



Top 10 - Litter items by weight

2,362 lbs.
Rubber
Tires



20.0%

1,324 lbs.
Metal
Other



11.2%

1,270 lbs.
Metal
Anchors



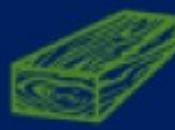
10.7%

1,145 lbs.
Glass/Ceramic
Construction materials



9.7%

835 lbs.
Wood
Processed



7.1%

791 lbs.
Plastic
Fiberglass



6.7%

756 lbs.
Metal
Fragments



6.4%

469 lbs.
Aluminum
Cans



4.0%

435 lbs.
Glass
Bottles



3.7%

285 lbs.
Cloth
Clothing



2.4%

- Top 5 items = 59% of total lbs.
- Top 10 items = 82% of total lbs.

These data can help inform litter impact assessments and mitigation approach:

- Nutrient sources?
- Microplastic potential on a weight basis.
- Address littering behaviors that introduce these items.

Top 10 - Litter items by count

4,175
Aluminum
Cans



25.0%

3,541
Glass
Bottles



21.3%

1,079
Plastic
Fragments



6.5%

1,075
Metal
Fragments



6.5%

574
Wood
Processed



3.5%

451
Plastic
Other



2.7%

379
Cloth
Clothing



2.3%

348
Metal
Fishing Gear



2.1%

337
Plastic
Fiberglass



2.0%

320
Metal
Caps



1.9%

- Top 10 = 64.2% of total (n)
- Single use drink containers dominate nearshore lakebed litter. (direct input?, density?)
- Fragments point to physical breakdown. (e.g. microplastic formation)

Count data can inform dominant littering behaviors, mitigation approach, and active breakdown processes.

Lake litter distributions are likely caused by many factors

Transport processes include: •

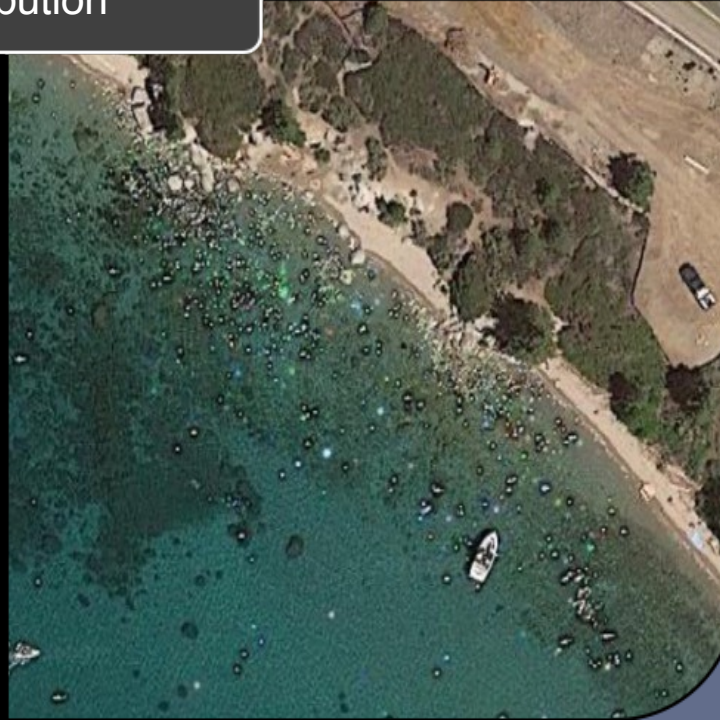
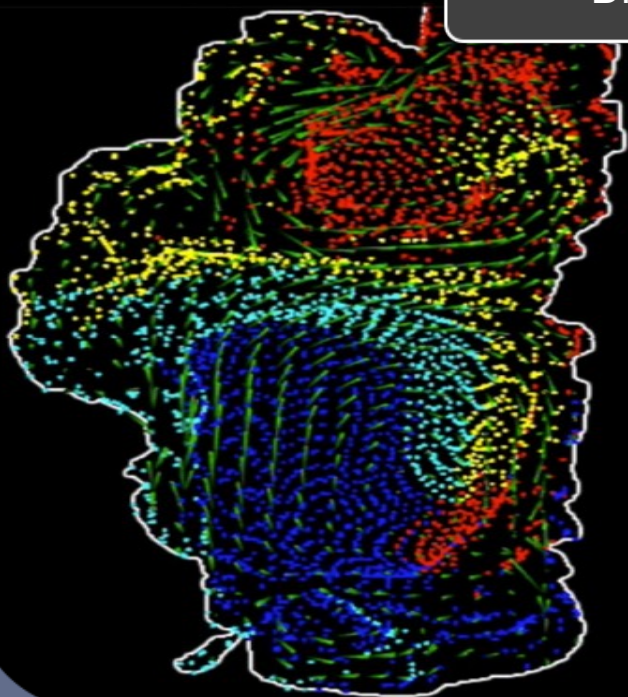
Direct input/input pathway • Wind

- Lakebed substrate

- Currents

- Bathymetry

Distribution



LAKE TAHOE - NV LITTER (2021)

ABOUT LAKE TAHOE

LITTER INPUTS

LAKE TAHOE, NV LITTER

LITTER BY MATERIAL

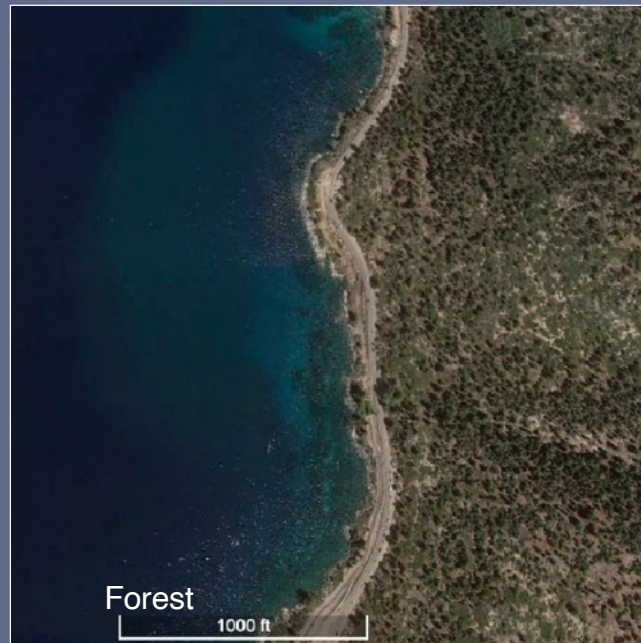
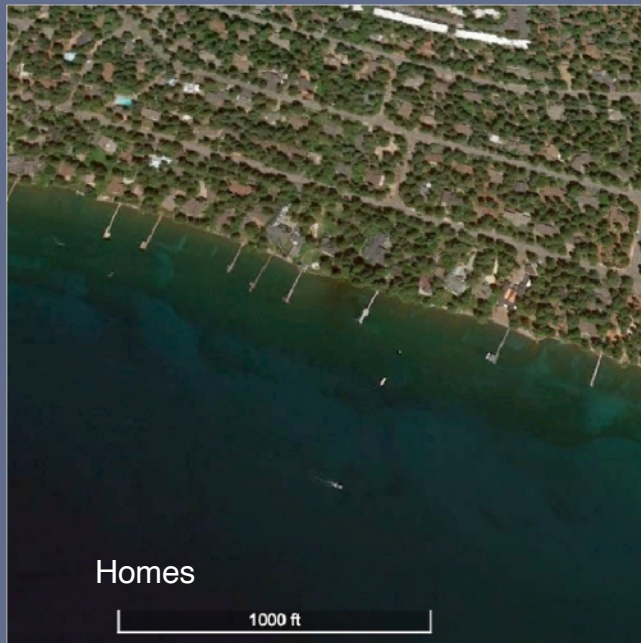
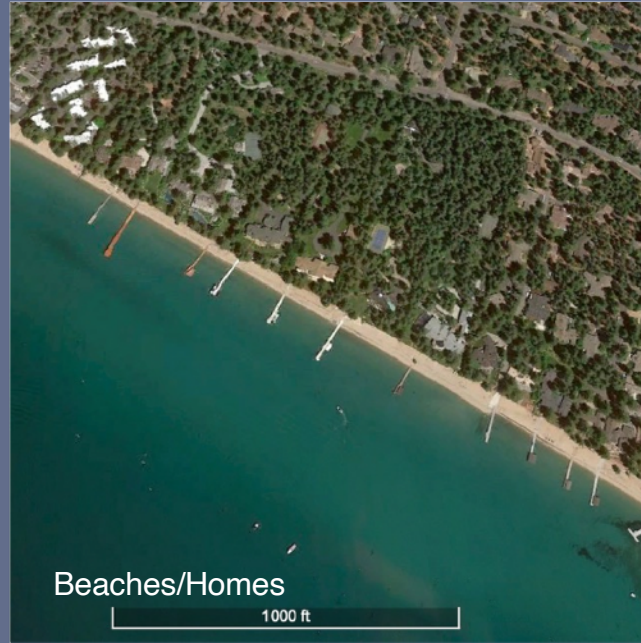
LITTER BY CATEGORY

LITTER BY SHORELINE USE

LITTER BY LAKEBED SUBSTRATE

LITTER BY LOCATION

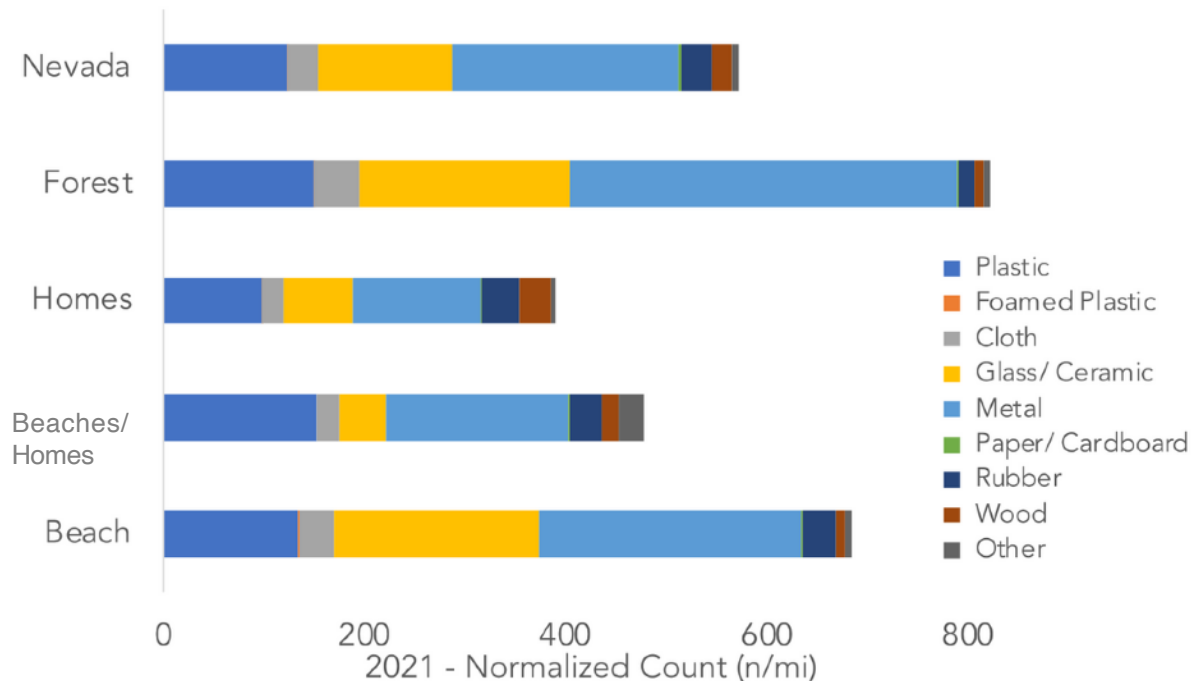
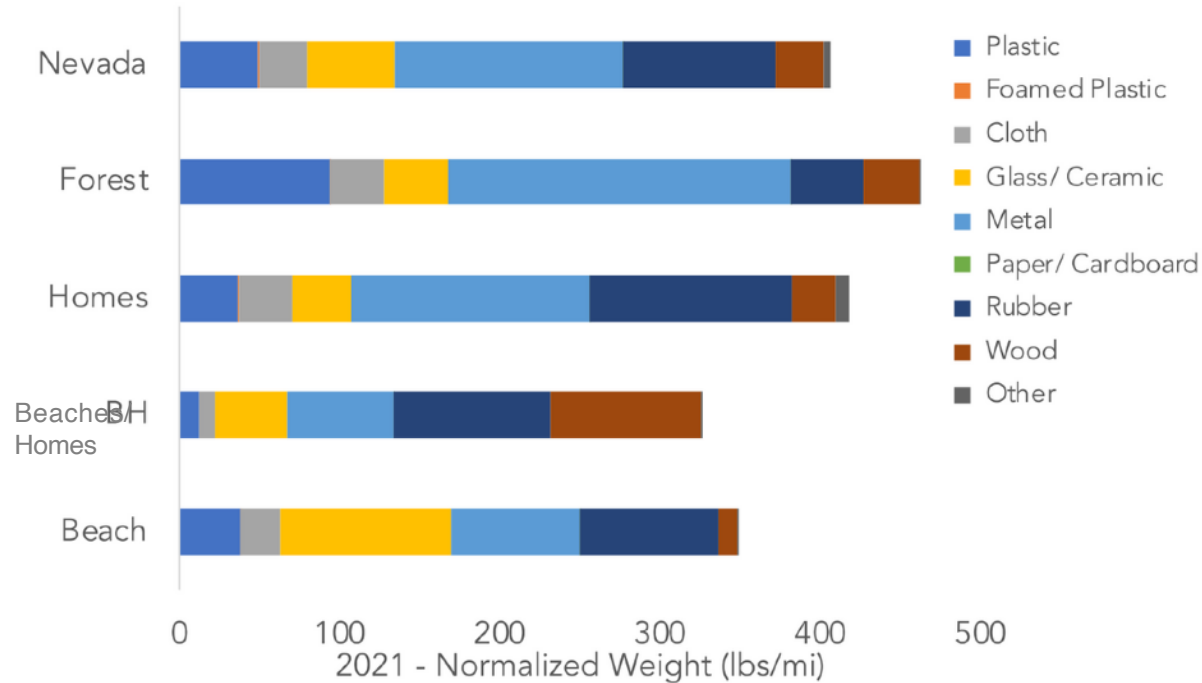




Dive sites were categorized by shoreline use

Forest	7.2 mi.
Beach	6.8 mi.
Beaches/homes	2 mi.
Homes	13.1 mi.

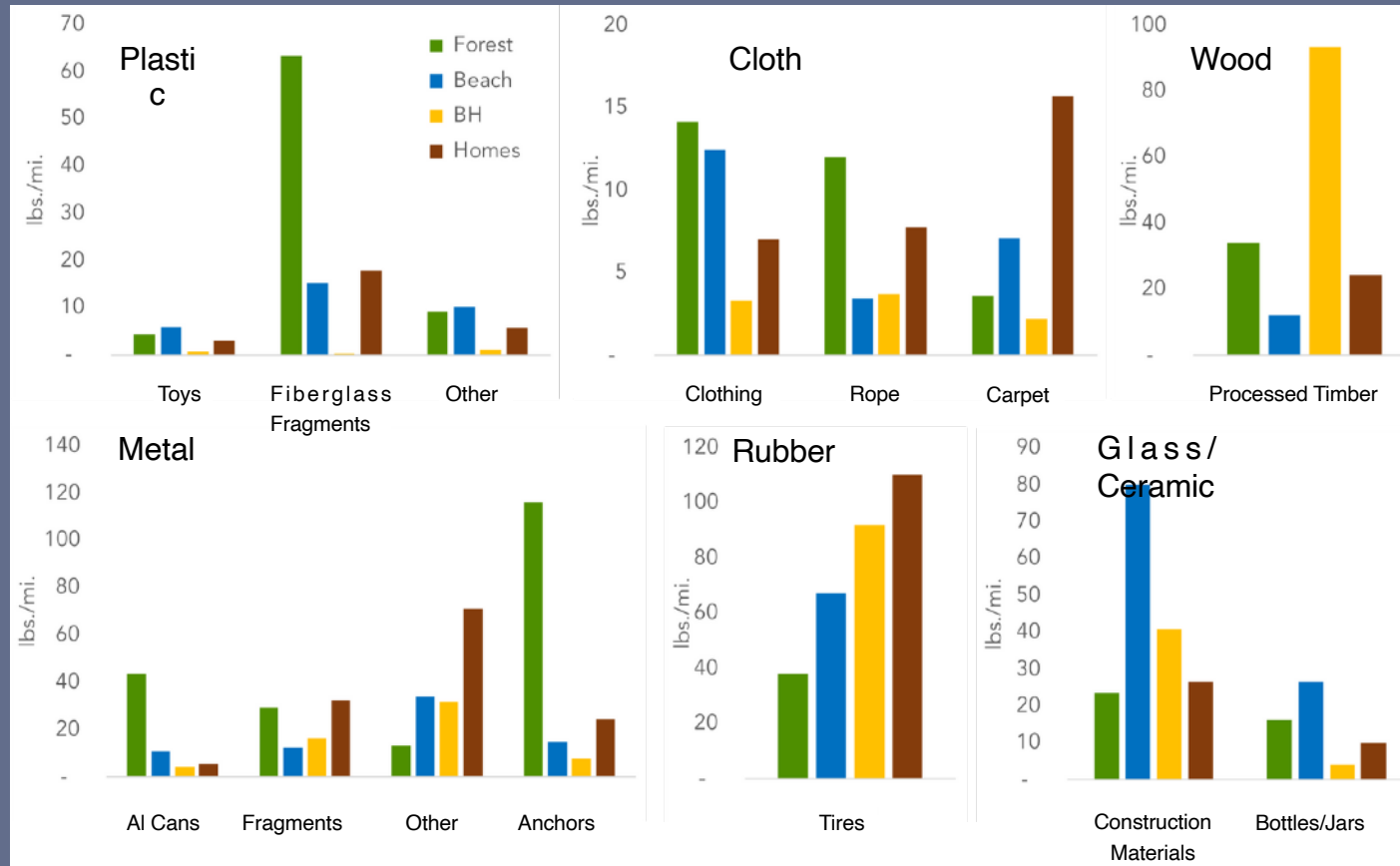
Litter material weight & count are generally distributed across shoreline use



- Material trends
 - Beaches/homes – more processed wood (lbs.)
 - Beaches – more glass (lbs., n)
 - Forests – less rubber (lbs., n)
 - Forest & beaches – more litter (n)

Highly popular shorelines are associated with more litter.

Litter category weight & count show shoreline use trends



- Forest and beach litter
 - Fiberglass fragments
 - Rope
 - Anchors (Forest)
- Homes
 - Boat materials
 - Tires (from dock bumpers?)
 - Processed timber (docks?)
 - Home furnishings
- Clothing
- Plastic toys
- Al Cans
- Bottles & jars

Direct littering during recreation on the lake or at the shoreline is likely contributing to lakebed accumulations.

LAKE TAHOE - NV LITTER (2021)

ABOUT LAKE TAHOE

LITTER INPUTS

LAKE TAHOE, NV LITTER

LITTER BY MATERIAL

LITTER BY CATEGORY

LITTER BY SHORELINE USE

LITTER BY LAKEBED SUBSTRATE

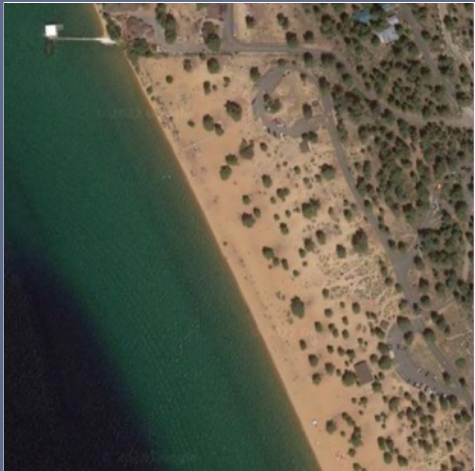
LITTER BY LOCATION



Dive sites were categorized by lakebed substrate

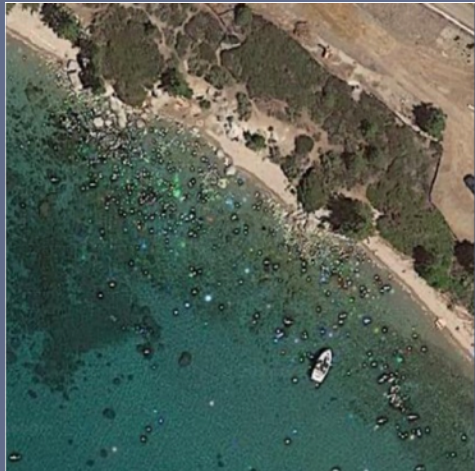
Sandy/Small Rocks (SSR)

e.g. Nevada Beach, 3.1A



Large Boulders with Sand (LBS)

e.g. Hidden Beach, 28.3A



Large Boulders (LB)

e.g. Deadman Point, 16.3A



Lakebed substrate – the size of material that comprises the nearshore lakebed, where CUTL divers conducted SCUBA enabled cleanups.

Shorelines were classified according to three types:

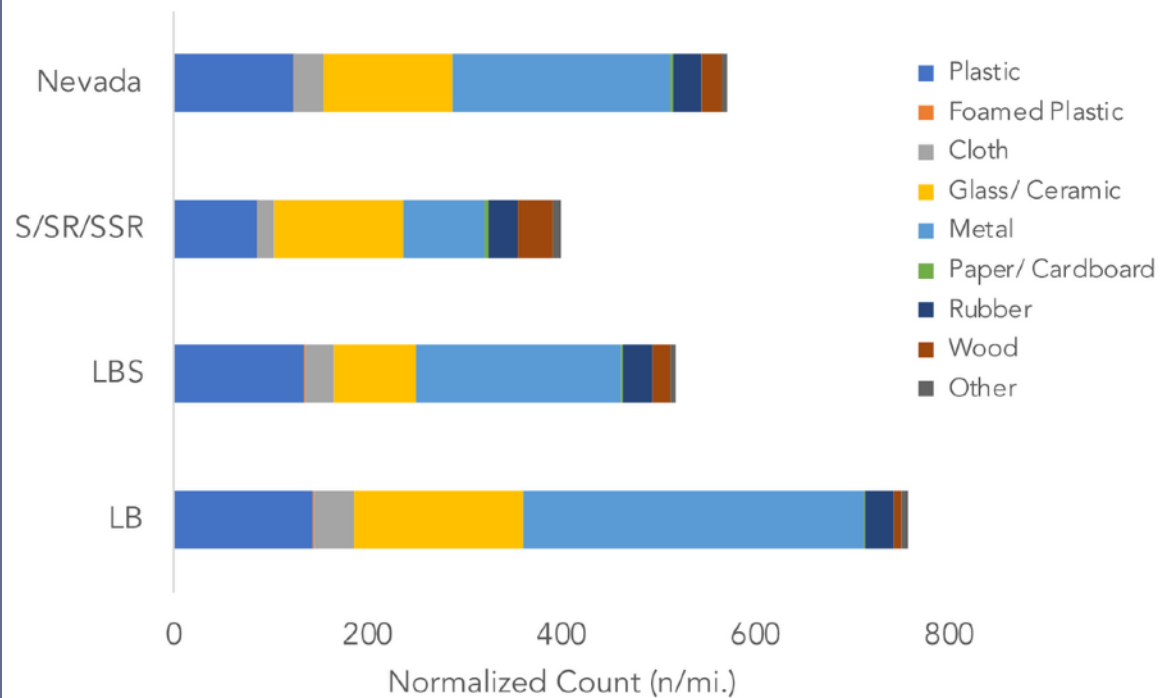
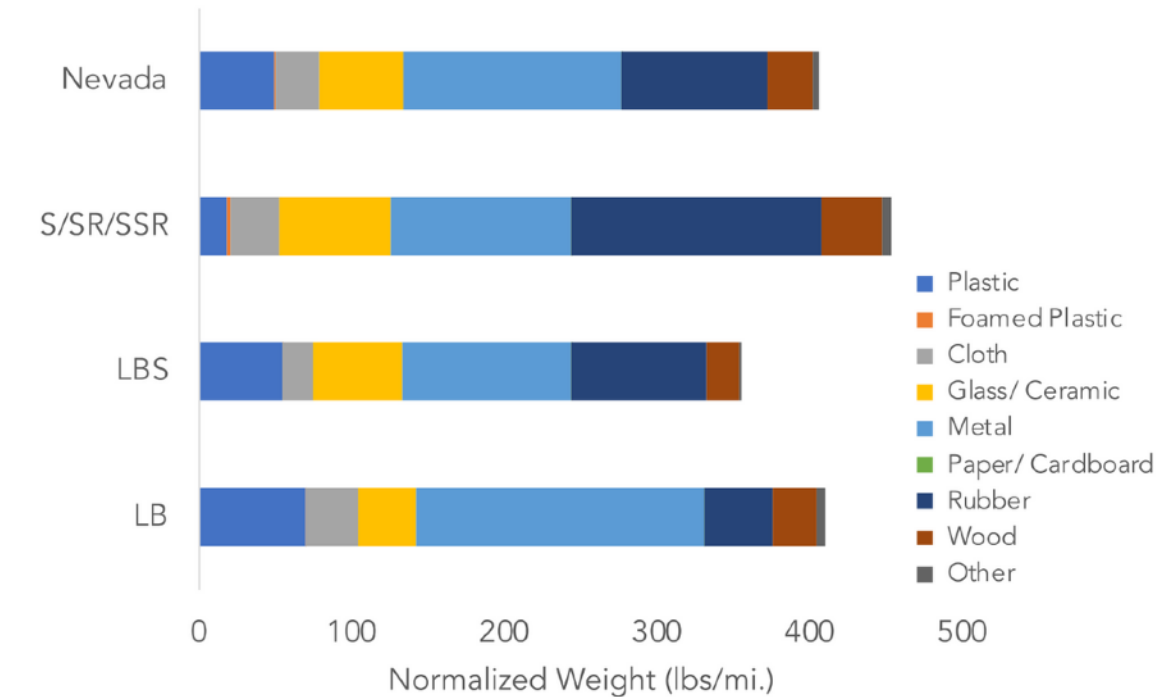
- Sandy/small rocks (SSR)
- Large boulders with sand (LBS)
- Large boulder fields (LB)

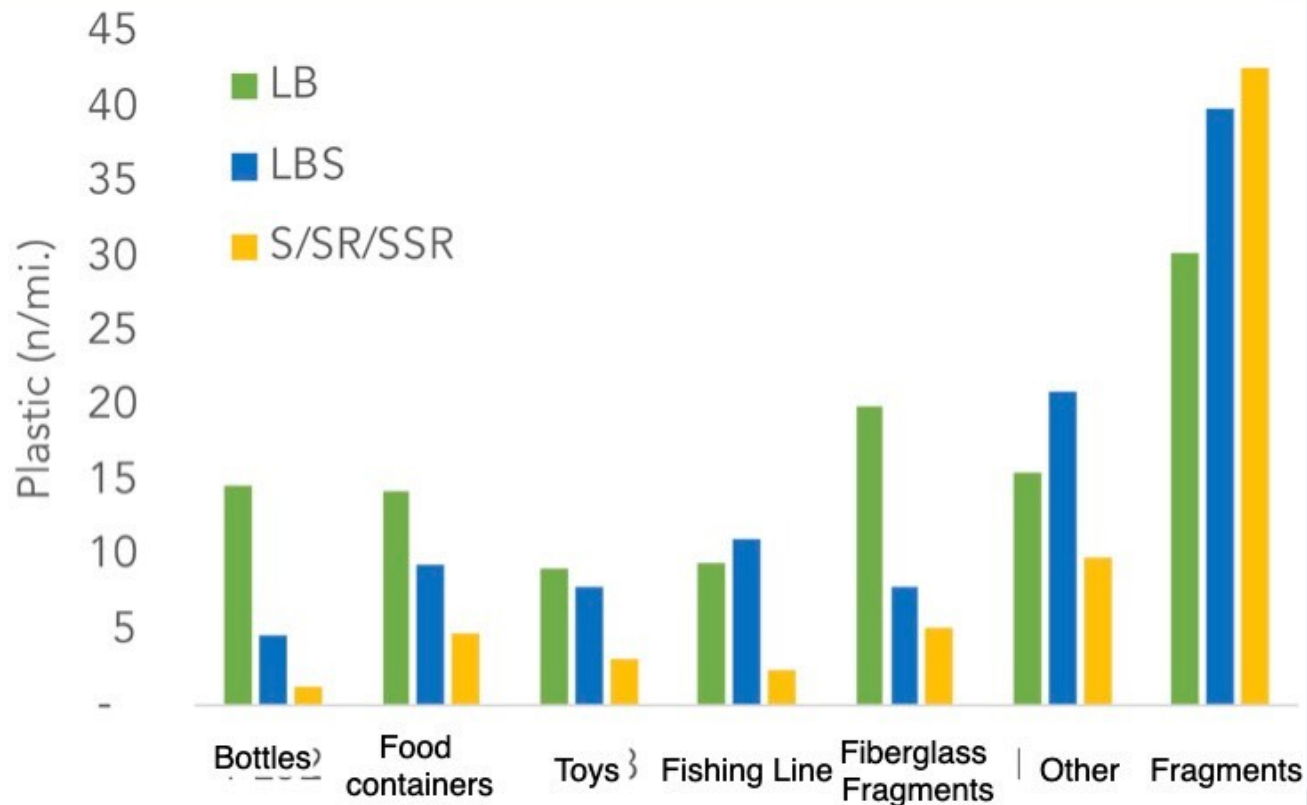
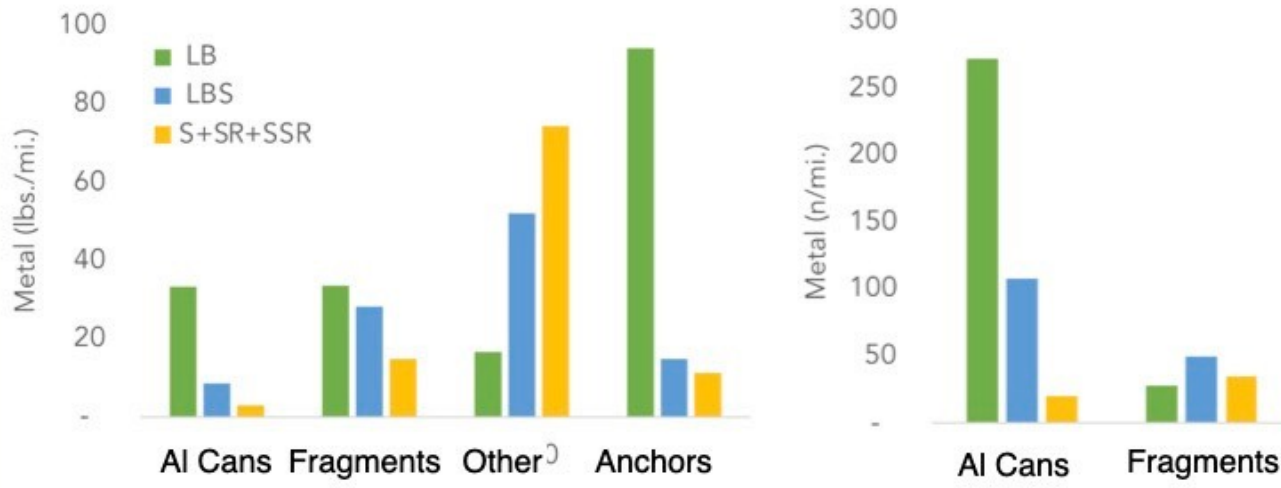
Litter material weight & count based on lakebed substrate

- Sandy/small rocks – more rubber (lbs.)
- Large boulders – more litter (n)



Litter materials are generally evenly distributed across lakebed substrate.





Litter category weight & count based on lakebed substrate

Large Boulders accumulate	Potential pathways:	
	Direct input	Transported
Al Cans	X	X
Plastic Bottles	X	X
Toys		X
Fishing Line	X	X
Fiberglass Fragments (boats)	X	X
Anchors	X	

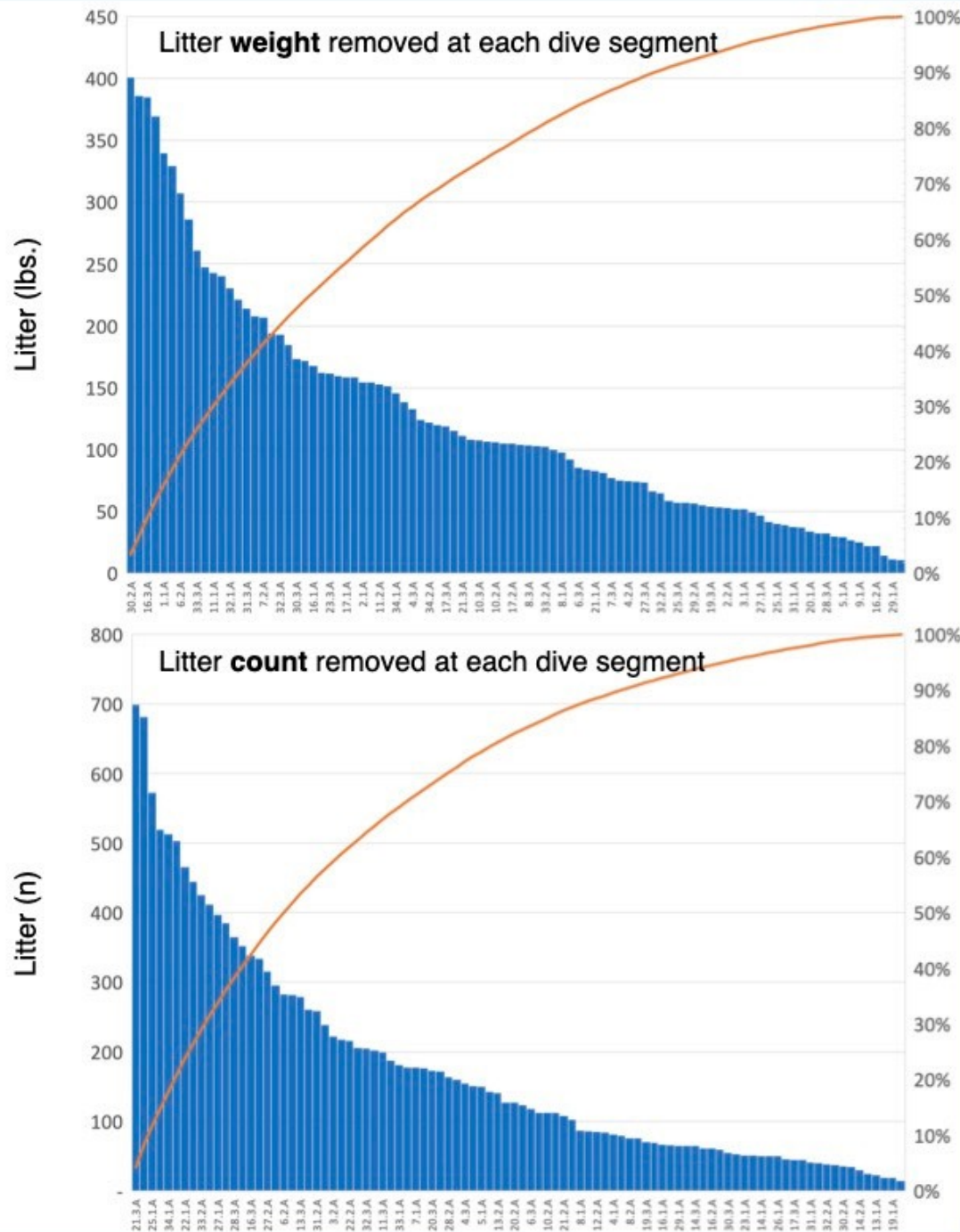
1. Litter that preferentially accumulates in large boulder fields may come from recreational boating and/or lake transport processes.

2. Metal and plastic fragment counts are generally distributed between lakebed types.

Litter is concentrated in “hotspots”, or accumulation zones

- 94 dive segments
- Dive segments = 0.04–0.73 mi.
- Weight basis
 - 50% of litter in 23 of 94 segments
- Count basis
 - 50% of litter in 19 of 94 segments

**Litter is concentrated in hotspots.
This facilitates efficient submerged
litter monitoring and removal.**



LAKE TAHOE - NV LITTER (2021)

ABOUT LAKE TAHOE

LITTER INPUTS

LAKE TAHOE, NV LITTER

LITTER BY MATERIAL

LITTER BY CATEGORY

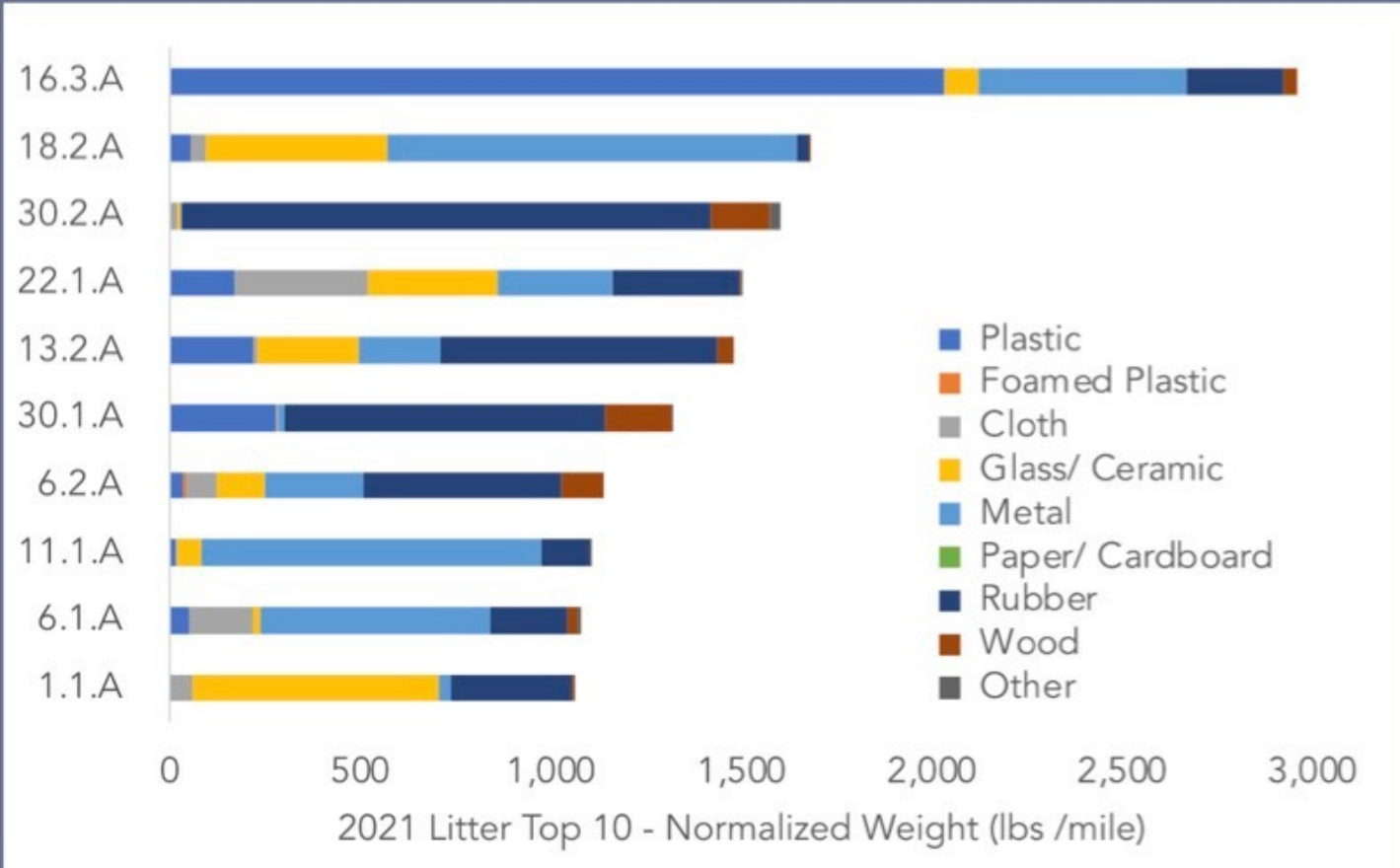
LITTER BY SHORELINE USE

LITTER BY LAKEBED SUBSTRATE

LITTER BY LOCATION



Top 10 Hotspots – weight per mile



Lakebed substrate:

Sandy/small rocks: 1.32 mi

Large boulders: 0.66 mi

Large boulders + Sand: 0.25 mi

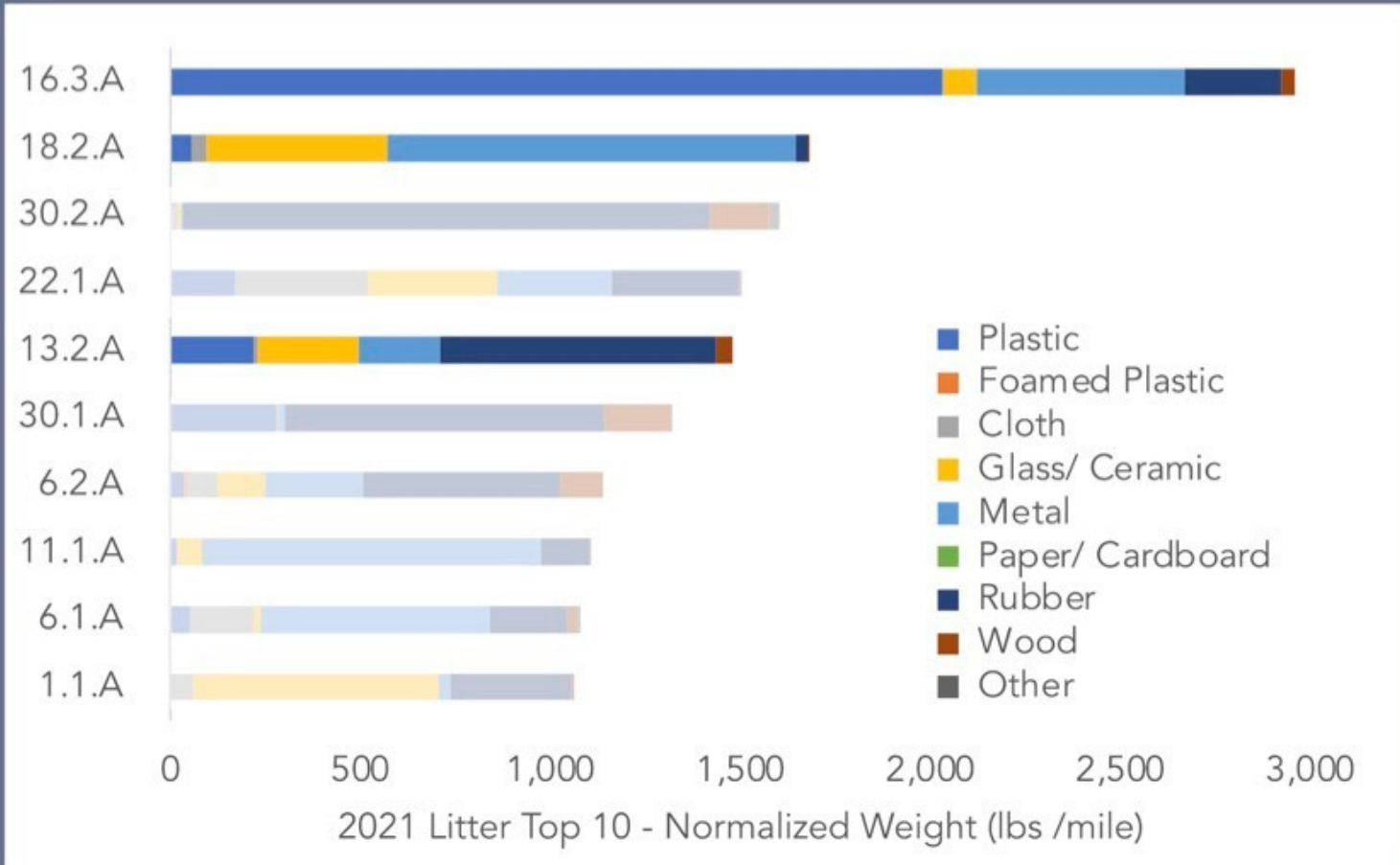
Shoreline use

Beach: 0.84 mi.

Homes: 0.73 mi.

Forest: 0.66 mi.

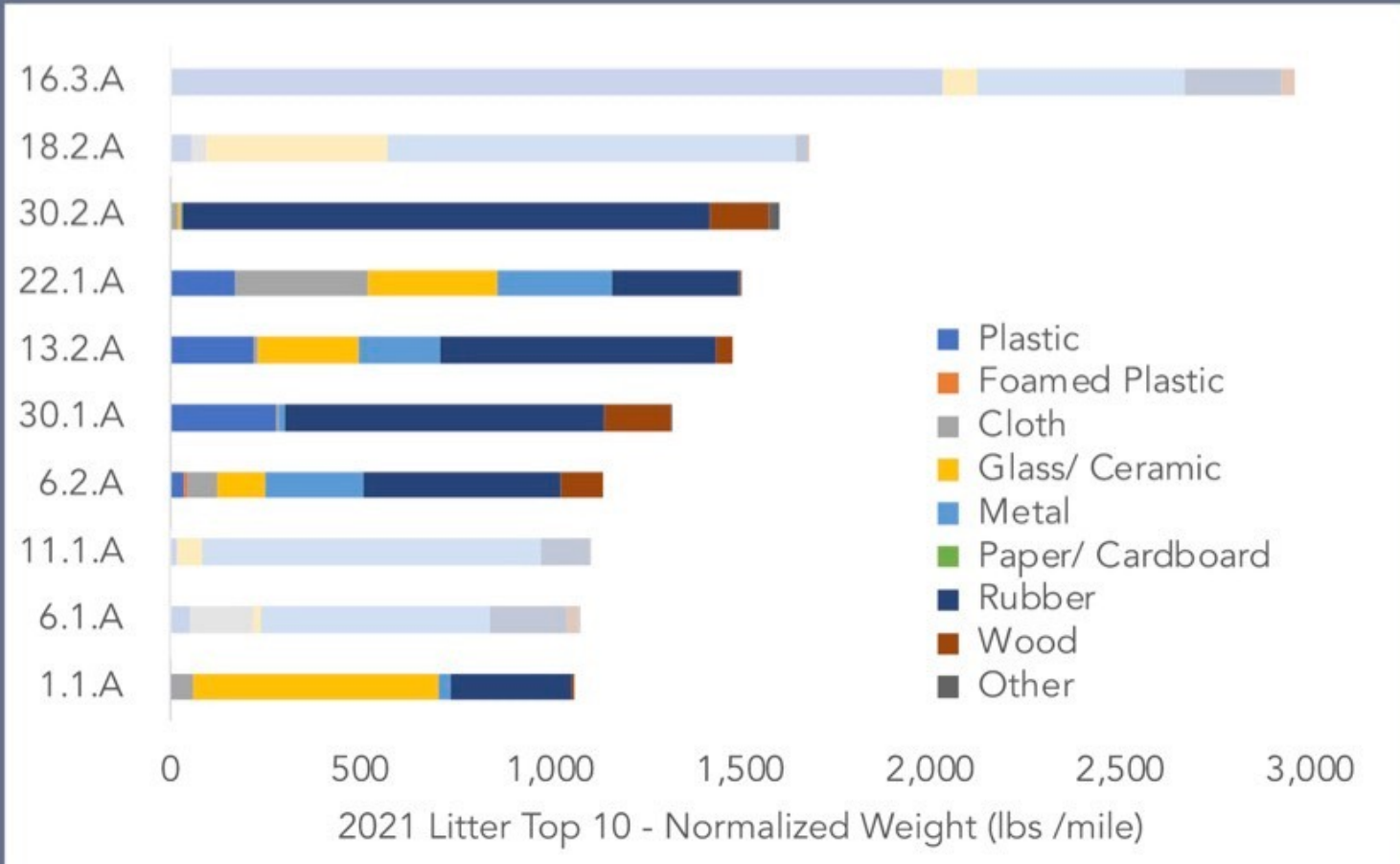
Top 10 Hotspots – weight per mile



16.3	Large boulder field, forested [Deadman's Point]	Fiberglass fragments, fishing gear, metal fragments
18.2	Large boulder field, forested [S Skunk Harbor (N of 16.3)]	Anchors, construction materials
13.2	Large boulders + sand, beach	Fiberglass fragments, construction material, metal fragments, tires

Fiberglass fragments and anchors suggest boat traffic and damage on rocks.

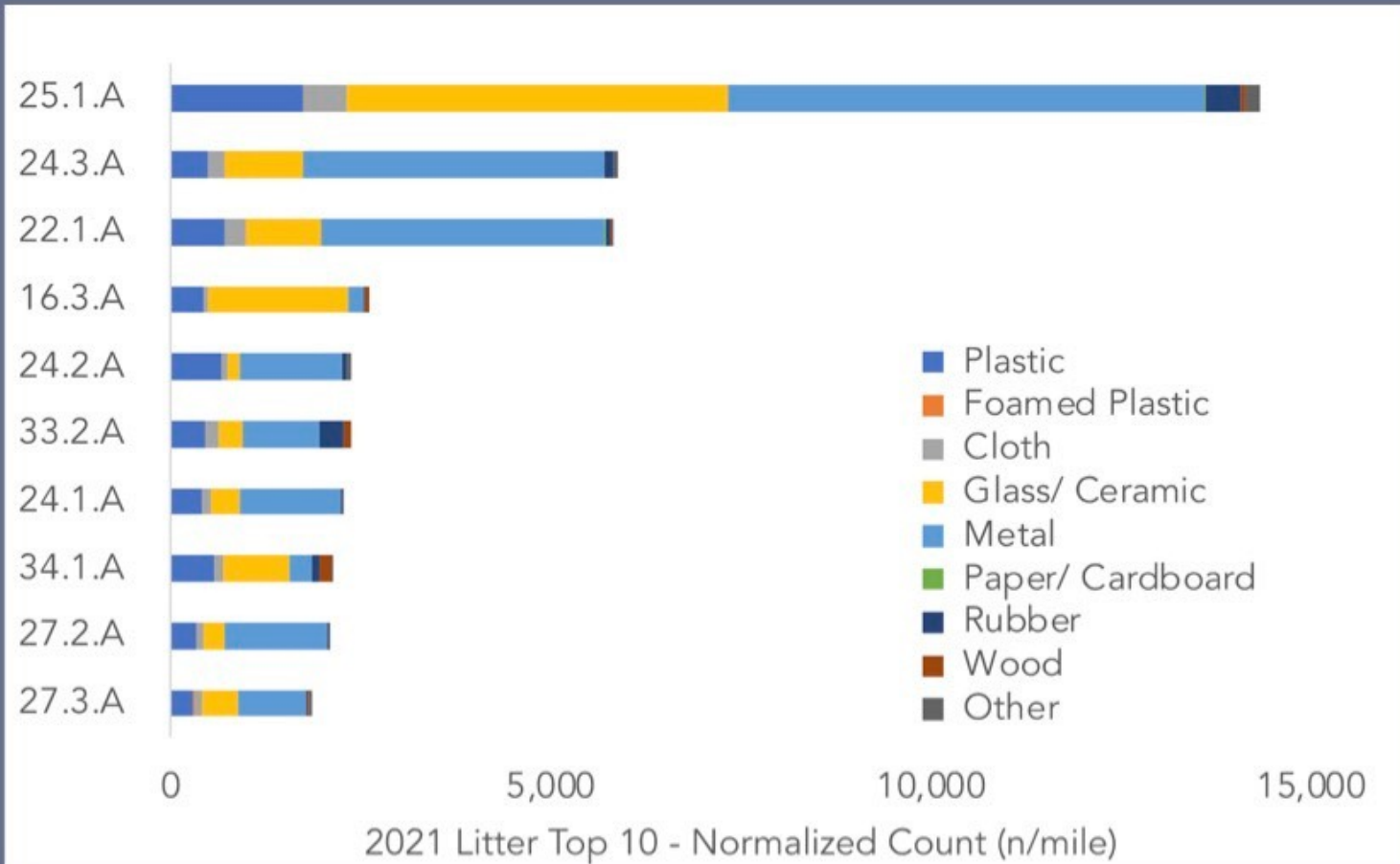
Top 10 Hotspots – weight per mile



30.1, 30.2	Sandy private beaches, N Tahoe	Tires
22.1	Large boulder field, forested [N Chimney Beach]	Tires, cloth, Al-Cans
13.2	Large boulders + sand, beach	Tires, fiberglass fragments, construction material, metal fragments
6.2	Sand Harbor, public beaches	Tires
1.1	Sand, beach	Tires, construction materials

Tires are high density and suggest direct input events (boat bumpers, "anchors"?)

Top 10 Hotspots – count per mile



Lakebed substrate:

Sandy/small rocks: 0 mi
Large boulders: 0.99 mi
Large boulders + Sand: 0.42 mi

Shoreline use

Forest: 0.88 mi.
Homes: 0.42 mi.
Beach: 0.11 mi.

Dominant litter

Al-cans
Glass bottles
Plastic bottles
Plastic fragments

Cans and bottles



4,175 Aluminum Cans 	3,541 Glass Bottles 
25.0%	21.3%

50% of cans are located in just
1.63 of 29 miles total (6%)

55% of bottles are located in
1.95 mi of 29 miles total (7%)

Top 10 – *least* littered areas

Litter was found at every dive segment, including areas previously cleaned

Lakebed substrate:

Large boulders: 2.76 mi
Large boulders + Sand: 0.92 mi
Sandy/small rocks: 0.73 mi

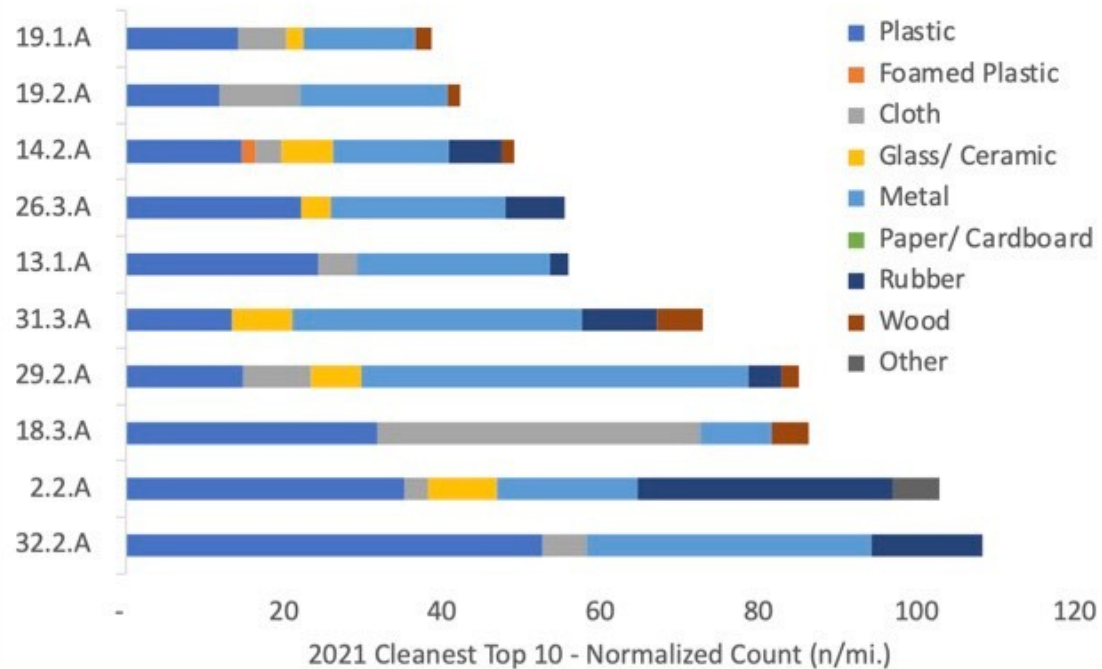
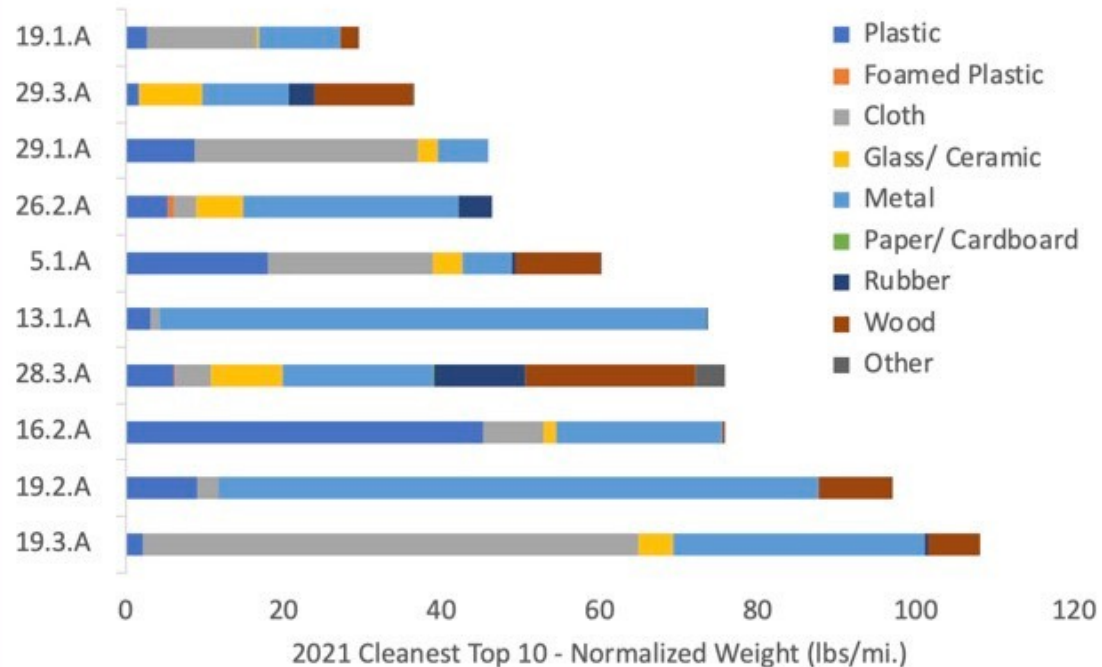
Shoreline use

Homes: 1.88 mi.
Forest: 1.37 mi.
Beach: 1.16 mi.

Litter is distributed between categories, showing no clear trends in littering.

Factors contributing to low litter loads may include:

Land management/stewardship, lakebed bathymetry, currents, wind, etc.

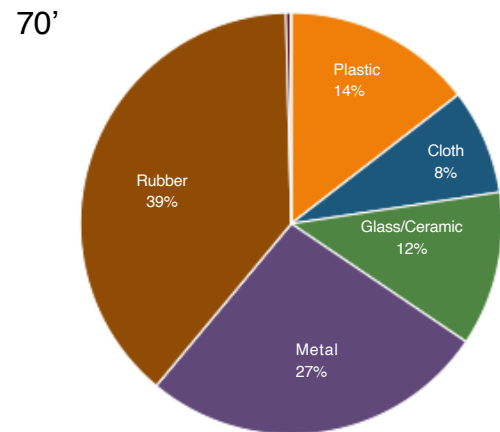
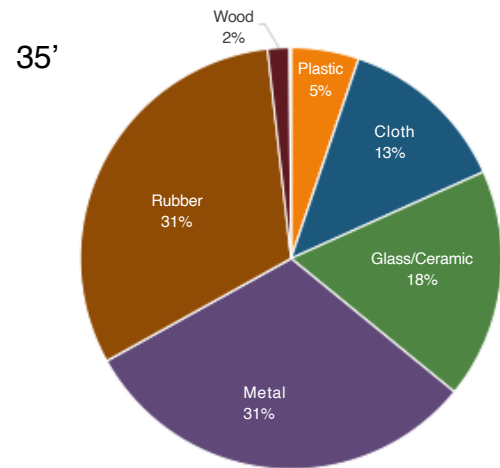
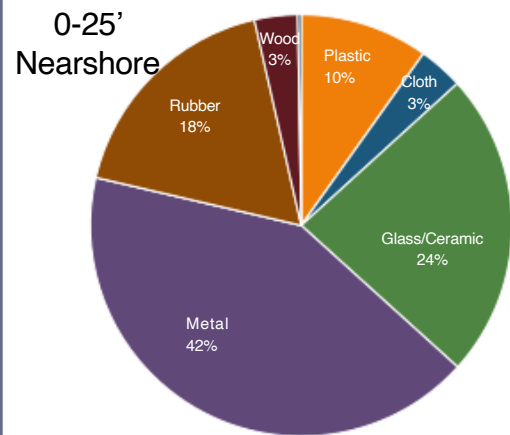


2022-2023 Litter by Depth

Litter weight by material at multiple depths.

All common litter materials are found at depths down to 70'

Everything is everywhere...



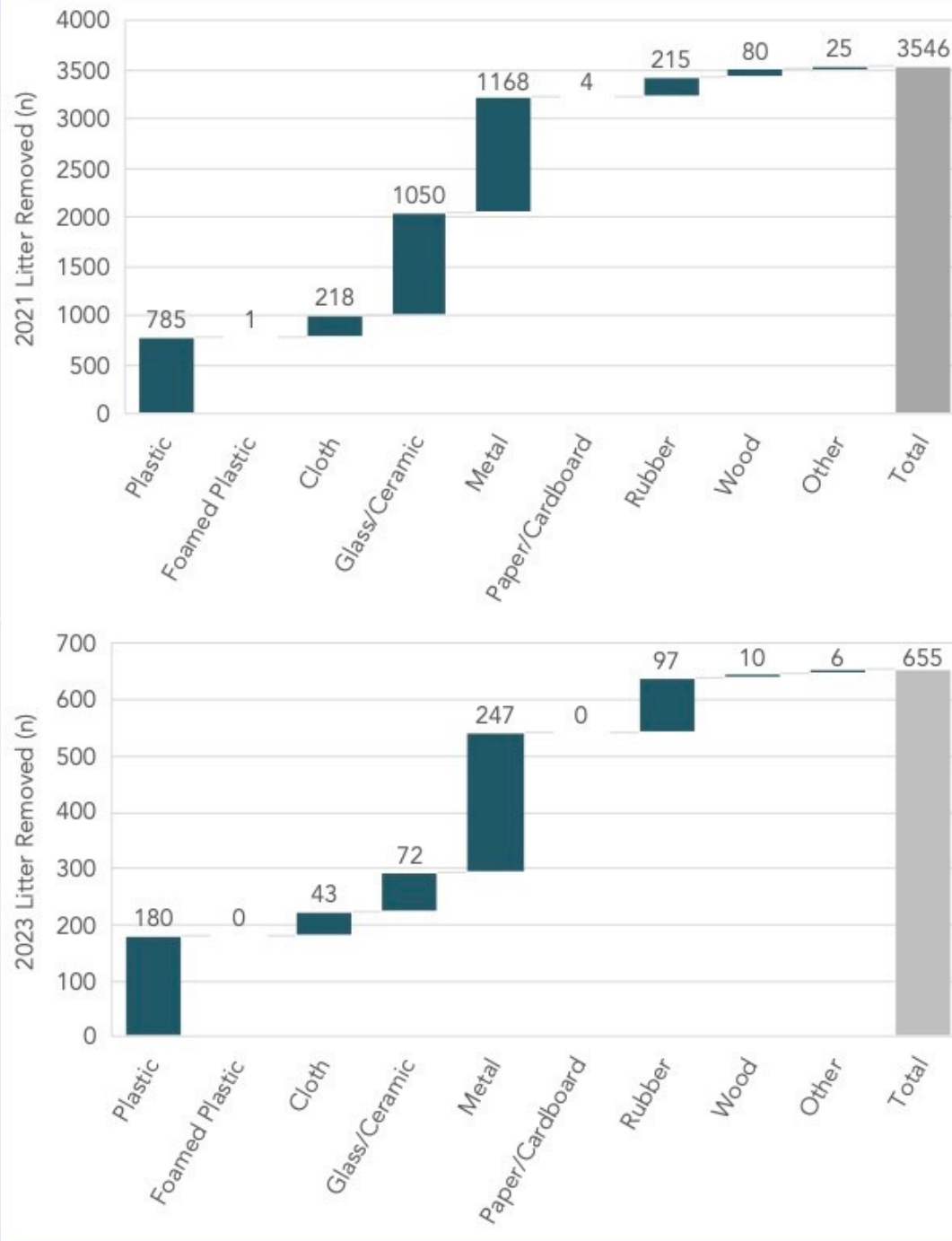
2022-2023 Hot Spot Cleanup

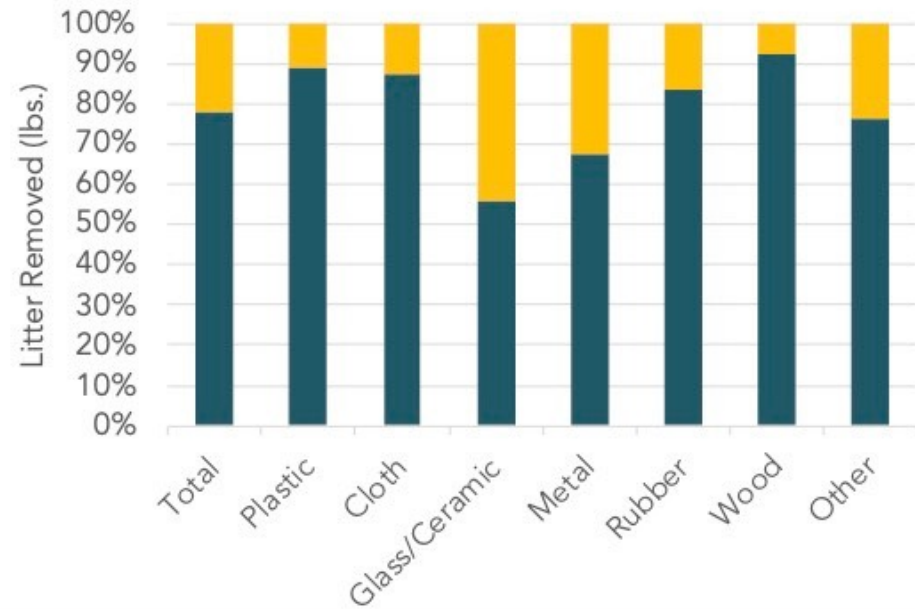
The 72-mile cleanup was a success, removing:

- 85% of nearshore litter based on count
- 75% of nearshore litter based on weight

Many factors on the W versus E shores (e.g. currents, wind, population, visitors) may impact litter distributions and hot spot accumulation rates.

SCUBA-enabled nearshore cleanups are an effective way to remove litter, collect detailed data, and inform granular accumulation zones.





2022-2023 Hot Spot Cleanup

The 72-mile cleanup was a success:

- 85% of nearshore litter based on count
- 75% of nearshore litter based on weight
- Observations show both older and newer litter

Many factors on the W versus E shores (e.g. currents, wind, population, visitors) may impact litter distributions and hot spot accumulation rates.

SCUBA-enabled nearshore cleanups are an effective way to remove litter, collect detailed data, and inform granular accumulation zones.

Conclusions

- Foamed plastic and paper/cardboard were rarely found during Lake Tahoe cleanup dives, perhaps due to low inputs (foam bans) and/or rapid transport and degradation (low density materials).
- Litter is dominated by metal, plastic, glass, rubber, and to a lesser extent cloth, wood and "other".
- 82% Lake Tahoe litter weight is comprised of just 10 items. Rubber tires are the number 1 contributor (20%) followed by metal (other 11% and anchors 11%).
- 64% of Lake Tahoe litter items (n) is attributes to 10 items, including: Al-Cans (25%), Glass bottles (21%), and plastic (6.5%) and metal (6.5%) fragments.
- 50% of Lake Tahoe litter is concentrated in approximately 25% of 94 dive segments, resulting in localized litter "hotspots".
- The highest litter count per mile dive segments are located along rocky shoreline with boulders. This suggest entrapment of direct litter inputs or transported litter.
- Some litter trends suggest localized littering events or behaviors.
 - Fiberglass fragments, anchors, fishing equipment, glass bottles and jars along rocky shorelines suggest recreational boating, fishing and subsequent boat damage.
 - Cans and bottle accumulations alongside or near popular public shorelines suggest littering during recreational activities.
- Additional factors that could contribute to litter distributions include prevailing winds and currents (gyres), lakebed bathymetry (slope, "terrain traps"), litter density etc. Future work will begin to elucidate the influence of these factors on litter distributions.

2018

CLEANUPS BEGIN

AN IDEA IS
BORN

2019

INITIAL SURVEY DIVES

DIVERS BEGIN TO SURVEY
FOR SUBMERGED LITTER

2020

DONNER LAKE CLEANUP

OUR ORGANIZATIONS
FIRST FULL SCALE
CLEANUP

2022

DONNER LAKE
MONITORING
DEEP DIVES &
HOTSPOTS

2020-2021

72 MILE CLEANUP

CLEAN UP THE
LAKE'S FLAGSHIP
PROJECT

2020

6 MILE CLEANUP
CLEAN UP THE LAKE'S FIRST
OFFICIAL LAKE TAHOE
PROJECT

2022

FALLEN LEAF LAKE CLEANUP

THE MOST LITTERED
LAKE WE'VE SEEN YET

2022

JUNE LAKE CLEANUP

OUR FLAGSHIP
EXPANSION PROJECT

2023

LAKE TAHOE MONITORING

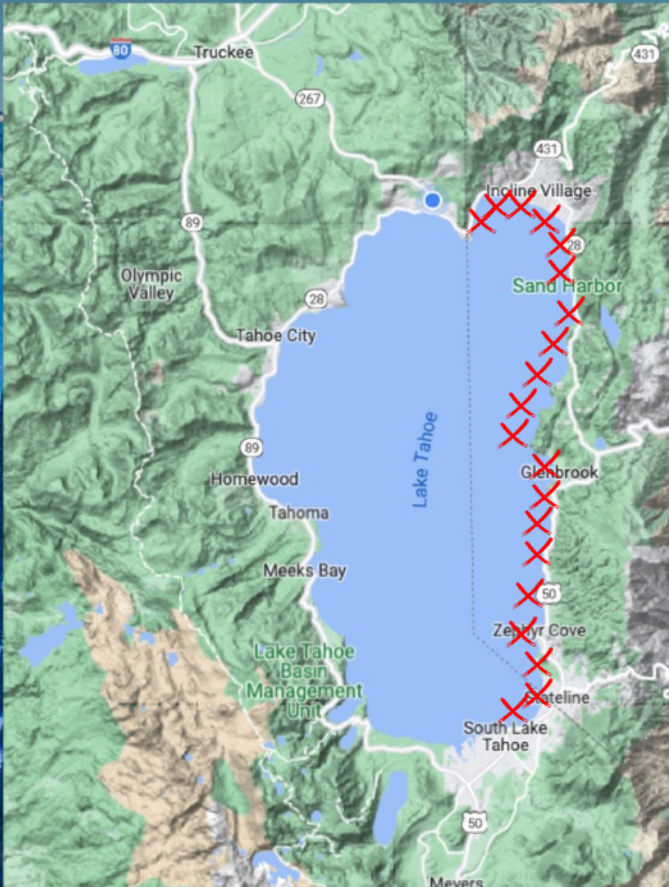
DEEP DIVES &
HOTSPOTS



2023 Lake Tahoe Deep Dives & Hotspots Monitoring

Diver Identified Hotspots 20

Days of Diving 20



2023

Upcoming Projects

Donner Lake Litter Prevention

Lake Tahoe, Nv Terrain Map

Lake Tahoe, Ca Monitoring

California Pilot Research

Mammoth Lakes

June Lake

Fallen Leaf Lake Cleanup





Questions?



info@Cleanupthelake.org



colin@Cleanupthelake.org



The logo features a stylized white wave icon above the text "CLEAN UP THE LAKE" in a sans-serif font, with "2023" in a larger font below it. The background is a scenic view of Lake Tahoe with clear turquoise water, rocky shores, and evergreen trees under a blue sky.

CLEAN UP
THE LAKE
2023

Lake Tahoe Litter Summit

COLLABORATING FOR A CLEANER FUTURE



CLEAN UP
THE LAKE
2023

Lake Tahoe Litter Summit

COLLABORATING FOR A CLEANER FUTURE



CLEAN UP
THE LAKE

The Role of Tourism Agencies in Litter Prevention in the Tahoe Basin

Stuart Maas

Senior Director of Marketing & Business Development
Lake Tahoe Visitors Authority (Visit Lake Tahoe)



Our Vision

In 10 years, we aspire to be in the top 10% of destination marketing organizations known for leading sustainable tourism* around the world, all while continuing to fulfill our organizational mission to market the South Shore of Lake Tahoe as a unique, year-round destination to the global marketplace and to favorably impact the South Shore economy through overnight stays and tourism spending.

**Sustainable tourism is defined as balancing social, environmental and economic factors while continuing to thrive as a destination.*

Perceptions of Visitor Impact on Litter in the Tahoe Basin

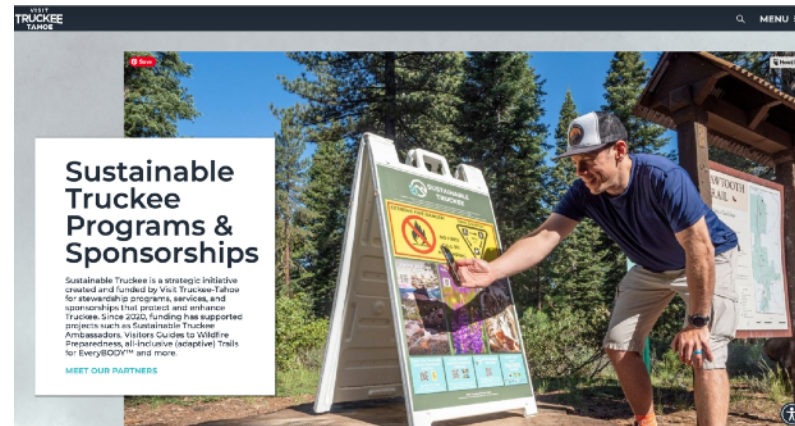


How do we communicate best practices to the visitor? In Market

- Ambassador program
- Blue Crews & Voluntourism
- Signage
- Local Media
- Local Support



How do we communicate best practices to the visitor? Website



Ready to get started? Here's a short list of DOs and DONTs.

DO leave no trace by packing out your trash (and any other trash you see).

DONT litter on trails, beaches, the lake, or anywhere. There's no maid service out there.

DO avoid single-use products – think disposable masks, water bottles, plastic cutlery, and sleds.

DONT make your trash someone else's problem. Take it all with you, including those single-use items!

DO put trash and recyclables in a trash can.

DONT leave your trash next to a full or overflowing can – take it with you instead. (See: No maid service.)

DO pick up after your dog and dispose of it in a trash receptacle.

DONT leave your poop bag on the trail. There is no poop bag fairy!

DO stop to pick up your snack wrapper, tissue, or other pieces of trash when it falls out of your pocket or bag. And DO pick up small pieces of litter when you see them on the trail, beach, or bike path.

DONT think your one piece of trash won't make a difference.

DO reduce plastic pollution at Lake Tahoe by skipping the straw or bringing a reusable one with you.

DO share the trail and be kind to other users.

DONT assume other trail users see or hear you on the trail. Let them know you're coming (a friendly hello goes a long way!).

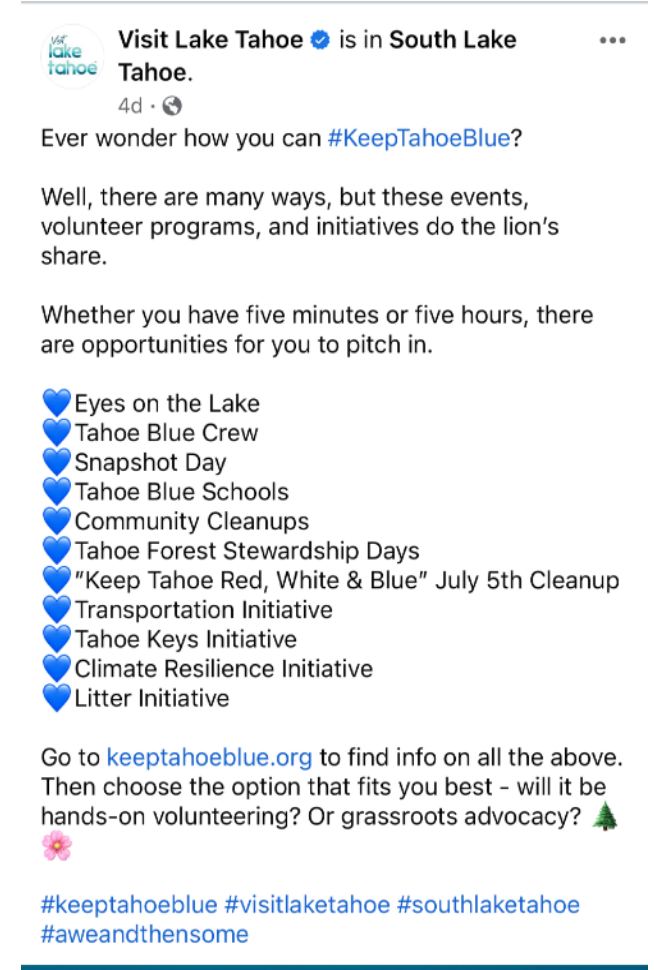
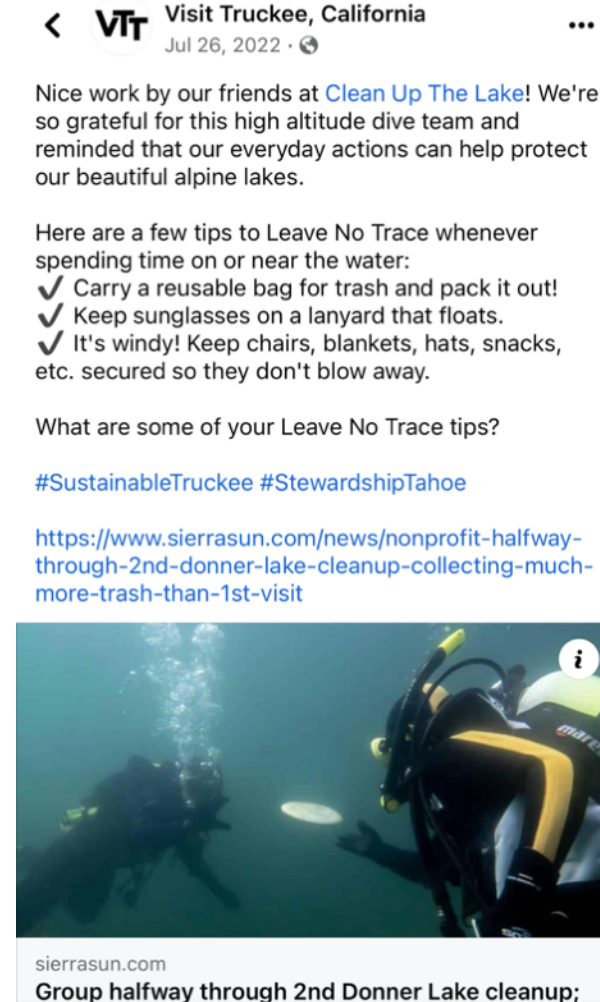
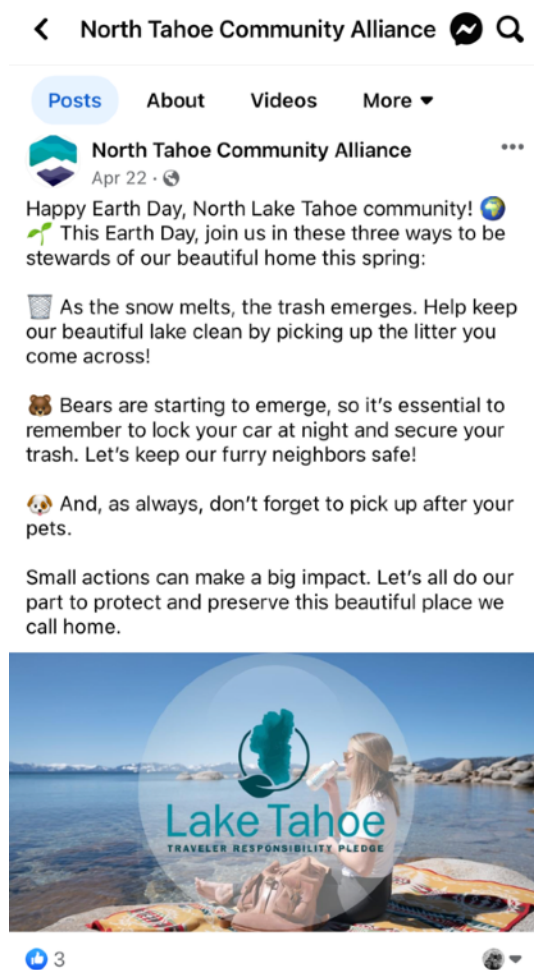
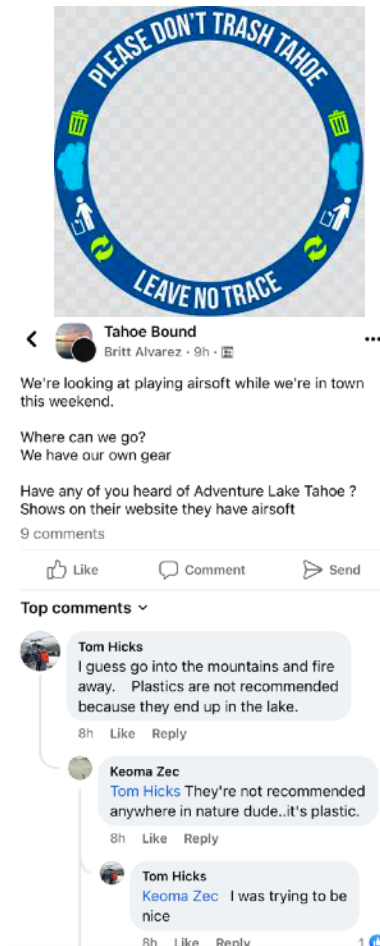
DO take your plastic sled with you. Especially if it's broken!

DONT leave your sled behind, as plastic pollution can impact Lake Tahoe's wildlife and drinking water.

DO use established access points to get in and out of the river.

DONT leave rafts, supplies, trash, or family members behind.

How do we communicate best practices to the visitor? Social Channels



How do we communicate best practices to the visitor? OOH & Billboards - Take Care Tahoe & Keep Tahoe Blue



What are the current challenges in developing programs to implement litter reduction?

- Ongoing Financial Commitment
- Consistent Lakewide Messaging
- Stakeholder Engagement
 - Lodging
 - Restaurants
 - Activity Providers
- Destination Infrastructure



What role can our Lake Wide Tourism Agencies play in litter prevention?

Lake Tahoe Destination Stewardship Plan

LAKE TAHOE DESTINATION
STEWARDSHIP PLAN

[WHO WE ARE](#) [ROADMAP](#) [FAQ](#) [NEWS & UPDATES](#)

WHO WE ARE



The shift from Destination *Marketing* Organizations to Destination *Management* Organizations & Stewards

Shift that all
DMOs are
going
through:



**We are the destination stewards
for visitors, residents, and stakeholders**

Case Study - Visit Lake Tahoe Sustainability Audience Campaign

New Sustainability Audience Insights

We launched paid media for the sustainability audience in Fall 2022 to Seattle and Portland DMAs. On Facebook/Instagram, we saw 11% higher CTR compared to our main brand audiences. In addition, for display we saw a 325% higher CTR than benchmark.

- **Open rate of 24.7%** (12% higher than benchmark)
- **39% increase** in organic sessions YoY
- **602% increase** in organic partner referrals from these DMAs



Case Study - Visit Lake Tahoe

Sustainability Audience Insights

In Market Insights

When considering in market visitation from the sustainability audience from Aug 2022 - March 2023, we can see:

- **9% increase** in share of overnight visitors YoY
- **8% higher** overnight visitor percentage than overall visitors
- **2% growth** in average visitor spending YoY
- This audience engages with Accommodations content **11% more than our overall visitor**
- This audience visits over touristed areas less frequently than our overall visitor
 - Emerald Bay **5% less**
 - Stateline **10% less**



Thank
You!

Questions?





CLEAN UP
THE LAKE
2023

Lake Tahoe Litter Summit

COLLABORATING FOR A CLEANER FUTURE

Regional Litter Action

Lake Tahoe Litter Summit

Devin Middlebrook, Tahoe Regional Planning Agency

May 18, 2023



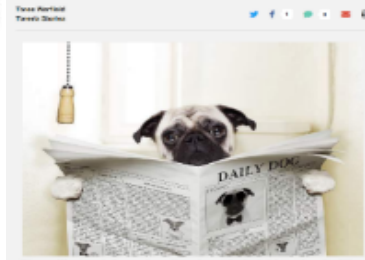


"Overtourism"

In this month's Cover Story, editor Heather Gould explores the recent phenomena of "overtourism," its impact on Tahoe, and what experts are doing to control it.

Keep Tahoe poop-free: Protect the environment, pick up after your pets

News [FOLLOW NEWS](#) | December 16, 2019



There would be a lot more if our position could ever be taken seriously. But that's just not the reality of things. Only images: photographs. LAKE TAHOE — Interestingly, 55 percent of American households include at least one dog. One survey rough calculation and research involving the populations around the lake combined with that statistic to conservatively estimate that the dog population in communities bordering Lake Tahoe is somewhere around 60,000.



Our fight against aquatic invasive species (Opinion)

News [FOLLOW NEWS](#) | August 14, 2020

Joane S. Marchetta
 Guest column



Lake Tahoe forest officials seeing increase in illegal campfires

News [FOLLOW NEWS](#) | July 23, 2020



Lacey Griffin [FOLLOW](#)
 lgriffin@tahoedaily.com



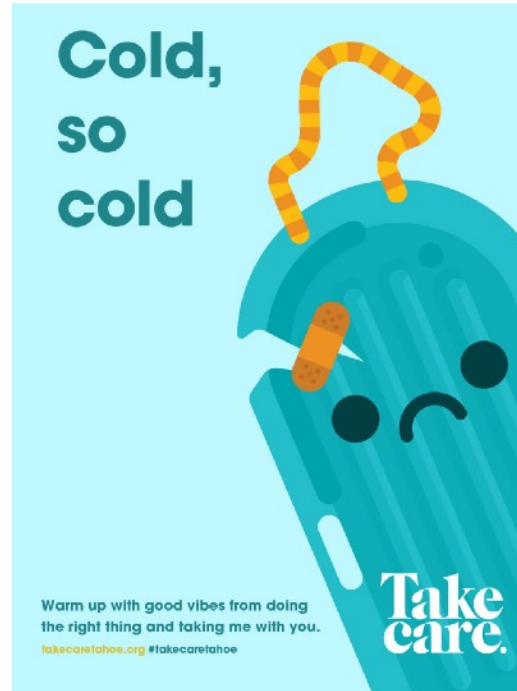
AT&T M-Cell 7:29 PM
 Bruce Toy Jr. [Incline Village](#)
 6m ·

Is this acceptable? We didn't think so. A false alarm call at Secret Cove, the Lake Tahoe Fire Dept, Engine and 11 crews cleaned all of this up. We all do better.



**TAHOE
 REGIONAL
 PLANNING
 AGENCY**

Gaining Momentum Locally



StewardshipTahoe.org

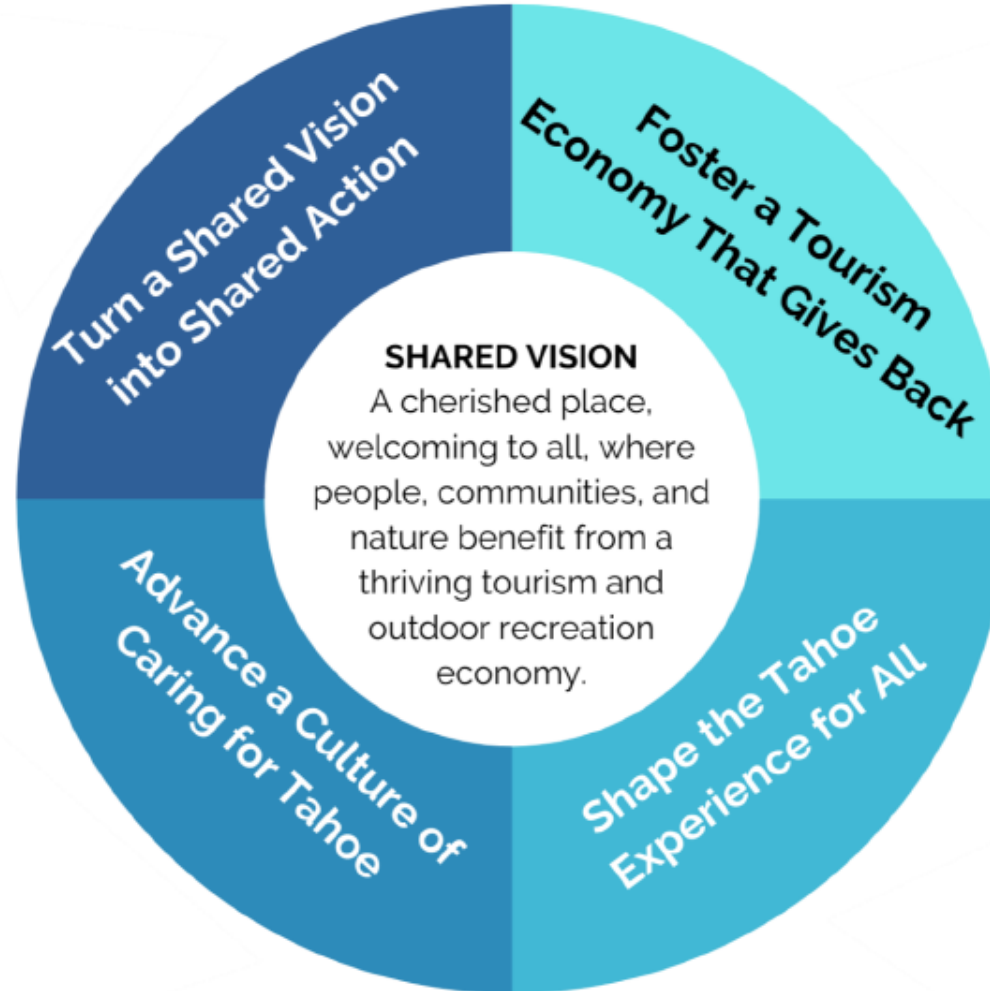
LAKE TAHOE DESTINATION STEWARDSHIP PLAN

TAKING CARE OF TAHOE

Epic Collaboration



Vision and Strategic Pillars



Litter Actions in the Plan

- Prioritize litter enforcement on peak weekends and holidays.
- Support and publicize opportunities to join Blue Crews, Clean Tahoe and other volunteer litter abatement programs.
- Prioritize installing bilingual litter signage at all recreation sites, especially site entrances and walk in locations.

Measuring Success

- More frequent waste collection at high use sites
- Reduced waste in sensitive areas and lake
- Increased visitor contribution to litter abatement and/or waste management services
- Increased awareness of litter reduction measures

TRPA Role

- Regional Collaborator
- EIP
- Partnership builder



LAKE TAHOE

ENVIRONMENTAL IMPROVEMENT PROGRAM

- **25** years of collaboration
- **700+** projects
- **80+** partners

EIP Focus Areas

SUSTAINABLE RECREATION AND TRANSPORTATION

GOALS

1. Preserve and improve air quality.
2. Improve outdoor experiences for visitors and residents while protecting natural resources.
3. Increase the use of alternative modes of transportation and decrease reliance on the private automobile.

ACTION PRIORITIES

- Improve Public Access
- Improve Public Recreation Facilities
- Build, Enhance and Maintain Trail Networks
- Build, Enhance, Operate and Maintain Transit Systems

SCIENCE, STEWARDSHIP, AND ACCOUNTABILITY

GOALS

1. Implement leading-edge science to continuously improve projects and promote adaptive management.
2. Protect EIP investments and benefits.
3. Maintain transparency and accountability.
4. Cultivate environmental stewardship.

ACTION PRIORITIES

- Conduct Applied Scientific Research
- Implement Programmatic Monitoring and Reporting
- Engage Communities in Environmental Stewardship
- Utilize Innovative Technology

Boating

- 2018 Shoreline Plan brought new opportunities with boaters
 - On-the-water boat crews for no-wake zone education & monitoring
 - Tahoe Boating App – delivers stewardship messages
 - Partnerships with marinas, boat concessionaires, and ramp operators.
 - [Boat Like a Tahoe Pro Video](#)
 - Construction waste monitoring



Questions



CLEAN UP
THE LAKE
2023

Lake Tahoe Litter Summit

COLLABORATING FOR A CLEANER FUTURE

Global to Local Perspectives on Plastic Pollution

Monica Arienzo, PhD
Associate Research Professor
marienzo@dri.edu



Impactful science, inspiring solutions.

In Summary

- Many of the policy efforts being developed focus on:
 - Reduction of plastics production and use.
 - “problem plastics” (polymers of concern or frequently littered)
 - Reusing plastics.
 - Redesigning plastics/sustainable alternatives
 - Strengthening waste management.
 - Monitoring of litter and micro/nanoplastics.
- Plastic pollution is a global issue with lots of potential for research/outreach/education across the globe.

Global Efforts to Address Plastic Pollution

- March 2022 - United Nations Environmental Programme's Environmental Assembly to began developing an international, legally binding policy on plastic pollution.
- First effort to end plastic pollution globally.
- Highlights the importance of an international approach to plastic pollution.
- Potential for actions from production through disposal and reduction of the leakage of plastic.

United Nations Environment Assembly of the United Nations Environment Programme
Fifth session
Nairobi (hybrid), 22 and 23 February 2021
and 28 February–2 March 2022

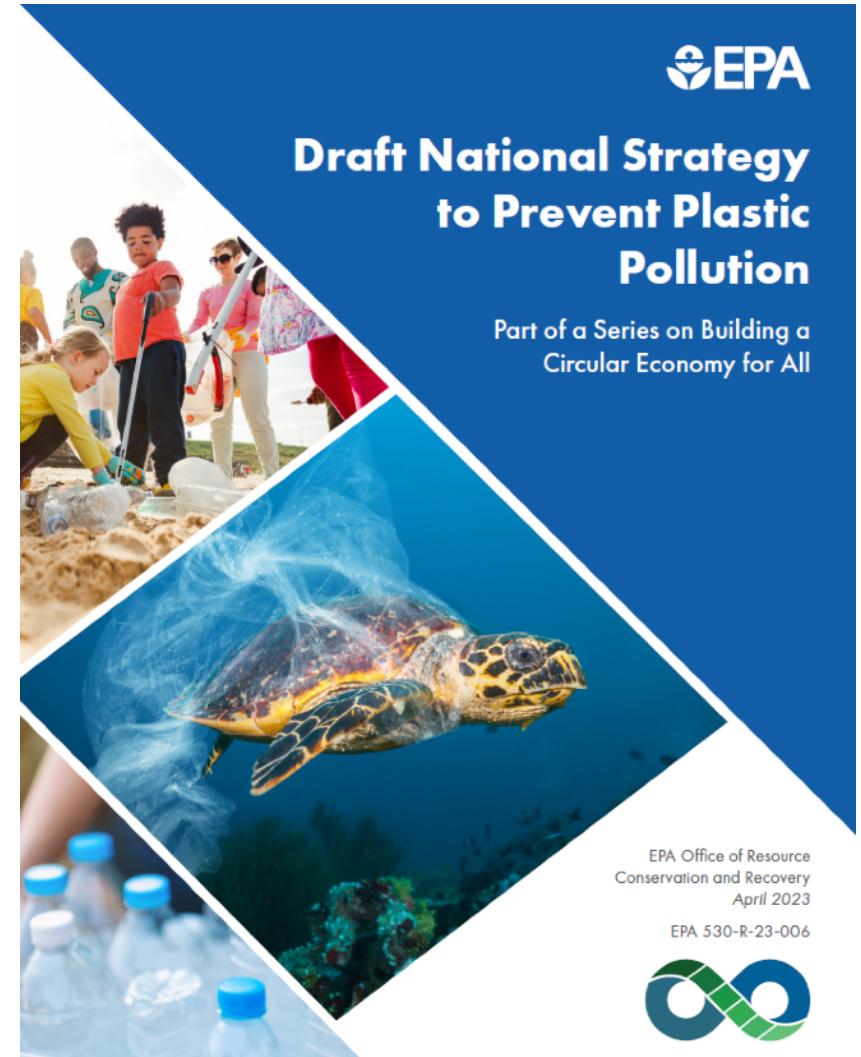
Resolution adopted by the United Nations Environment Assembly on 2 March 2022

5/14. End plastic pollution: towards an international legally binding instrument

The United Nations Environment Assembly,

National Efforts to Address Plastic Pollution

- Objective A: Reduce pollution during plastic production
- Objective B: Improve post-use materials management
- Objective C: Prevent trash and micro/nanoplastics from entering waterways and remove escaped trash from the environment



Local Efforts to Address Plastic Pollution



February 2022

Local Efforts to Address Plastic Pollution

Solutions

multi-benefit solutions the state can act upon now while the scientific knowledge of microplastics further develops.

- **Pollution Prevention**
to eliminate plastic waste at the source (products or materials from which microplastics originate)
- **Pathway Interventions**
to intervene within specific pathways that mobilize microplastics from a specific source into California waters
- **Education**
to inform the public and industries of microplastics sources, impacts, and solutions

Science to Inform Future Action

research priorities to advance scientific knowledge of microplastics to develop and refine future solutions.

- **Monitoring**
to understand and identify trends of microplastic pollution statewide
- **Risk**
to improve understanding of critical thresholds at which aquatic life and humans are adversely impacted by microplastic exposure
- **Sources & Pathways Prioritization**
to identify and prioritize future management solutions based on predominant ways microplastics enter California waters
- **Evaluating New Solutions**
to develop and implement potential future solutions

The Microplastics and Environmental Chemistry group



Associate Research Professor
Monica Arienzo, PhD



Associate Research Scientist
Meghan Collins, MS



Asst. Research Scientist
Daniel Saftner, MS



UNR PhD student
Rachel Kozloski



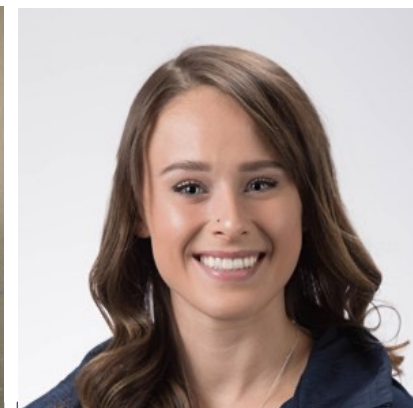
UNR MSc student
Hannah Lukasik



UNR PhD student
Kerri Minatre, MS



UNR undergraduate student
Angelique DuPaw



UNR undergraduate student
Erika Robtoy

Efforts to study plastic pollution internationally

- Rapidly growing country
- No waste management system (sanitation and hygiene)



Wonders of the Mekong

A Foundation for Sustainable Development and Resilience



USAID
FROM THE AMERICAN PEOPLE



University of Nevada, Reno



- Plastic pollution has impacted fishing communities
- Questions remain about additional impacts to ecology of the rivers



- Microplastic pollution in the rivers of Cambodia and comparison to other pollutants



Kozloski et al. In Prep

Efforts to study plastic pollution regionally



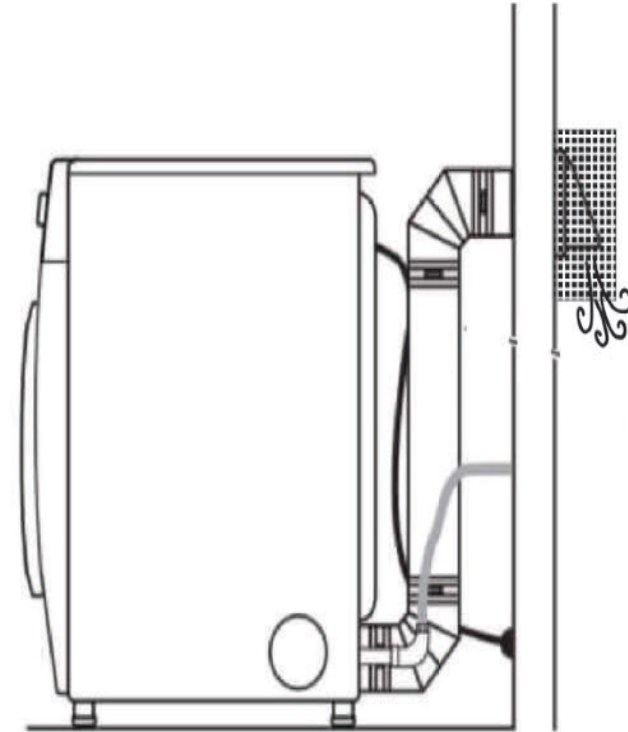
Are microplastics in
Sierra Nevada snow?



Are microplastics in Black
Rock, NV hot springs?



Are microplastics in the
Colorado River? Truckee
River?



Are clothes dryers a source of
microplastics to the
environment?

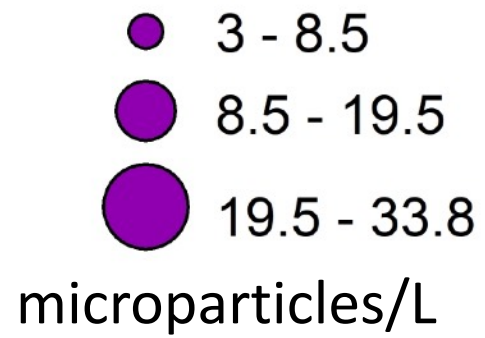
Want to learn more?

- Check out our website!





Photo by WoM



- Core obligations options include control measures and voluntary approaches, and relate to, inter alia:
- Phasing out and/or reducing the supply of, demand for, and use of primary plastic polymers;
- Banning, phasing out, and/or reducing the use of problematic and avoidable plastic products;
- Banning, phasing out, and/or reducing the production, consumption, and use of chemicals and polymers of concern;
- Reducing microplastics;
- Strengthening waste management;
- Fostering design for circularity;
- Encouraging “reduce, reuse and repair” of plastic products and packaging;
- Promoting the use of safe and sustainable alternatives and substitutes; and
- Eliminating the release and emission of plastics to water, soil, and air.

Global Efforts to Address Plastic Pollution

- Over the last 20 years, the global annual production of plastics has more than doubled.
- In 2019, ~23 percent of global plastic waste was either improperly disposed, burned, or leaked into the environment (OECD, 2022a).
- ~70 and 80 percent of all waste that ends up in land and marine environments is plastic (UNEP, 2021; NASEM, 2022).
- These observations led the United Nations Environmental Programme's Environmental Assembly to begin developing an international, legally binding policy on plastic pollution (UNEA, 2022).

Global Efforts to Address Plastic Pollution

- Potential for actions from production through disposal and reduction of the leakage of plastic.
- Aim of completing its work by the end of 2024, when the treaty would be ready for ratification.
- Currently a document with potential options has been made public.

**Intergovernmental negotiating committee to develop
an international legally binding instrument on plastic
pollution, including in the marine environment**

Second session

Paris, 29 May–2 June 2023

Item 4 of the provisional agenda*

**Preparation of an international legally binding instrument on
plastic pollution, including in the marine environment**

**Potential options for elements towards an international legally
binding instrument, based on a comprehensive approach that
addresses the full life cycle of plastics as called for by
United Nations Environment Assembly resolution 5/14**

Questions



CLEAN UP
THE LAKE
2023

Lake Tahoe Litter Summit

COLLABORATING FOR A CLEANER FUTURE

A brown bear is sitting on a pile of trash on a sandy beach, looking towards a large pile of garbage on the left. The bear is brown and appears to be looking at the trash. The background is a sandy beach with scattered debris.

Do Parks Have a Trash Problem???

Kevin Fromherz
Conservation Staff Specialist

Nevada Tahoe Resource Team

Department of Conservation and Natural Resources

The Short Answer is Yes

Historically major national parks such as Yellowstone and Yosemite had no trash management plan. It provided visitors an opportunity to see bears. This practice was ended in the 1970s



When we think of trash management in parks

- Bear Proof Trash Cans
- Recycling Options
- Fuel Canister Recycling
- Well Labeled
- Pack it in Pack it Out
- Leave No Trace
- Zero Waste



Yet it seems like we see more
of this





So How Do Parks Collect Trash?



The Sand Harbor Trash Collection Plan

- Sand Harbor relies on a series of trash cans and dumpsters to collect trash.
- Trash is collected from cans and taken to a park owned trash truck.
- The trash truck also services the dumpsters one to two times a day.
- Park staff are qualified to run the truck.

Does it Work?

- Yet even with our own trash service it seems impossible to stay ahead of the visitors.
- Cans like this one are serviced three or four times a day during the summer.
- Long distances such as Hidden Beach to Sand Harbor decrease staff efficiency.



Pack It In Pack It Out

- Part of LNT Principals
- Accepted practice by Wilderness Trail Users
- Was a suggested solution to overflowing trash cans during COVID.



Does it Work



- Is an accepted practice by experienced wilderness users.
- What about the inexperienced wilderness user?
- Is this why litter seems more common closer to trailhead?
- “Providing a trash can next to a sign that says pack it pack it out sends a conflicting message to visitors” Dr. Ed Krumpke, Professor Emeritus University of Idaho.



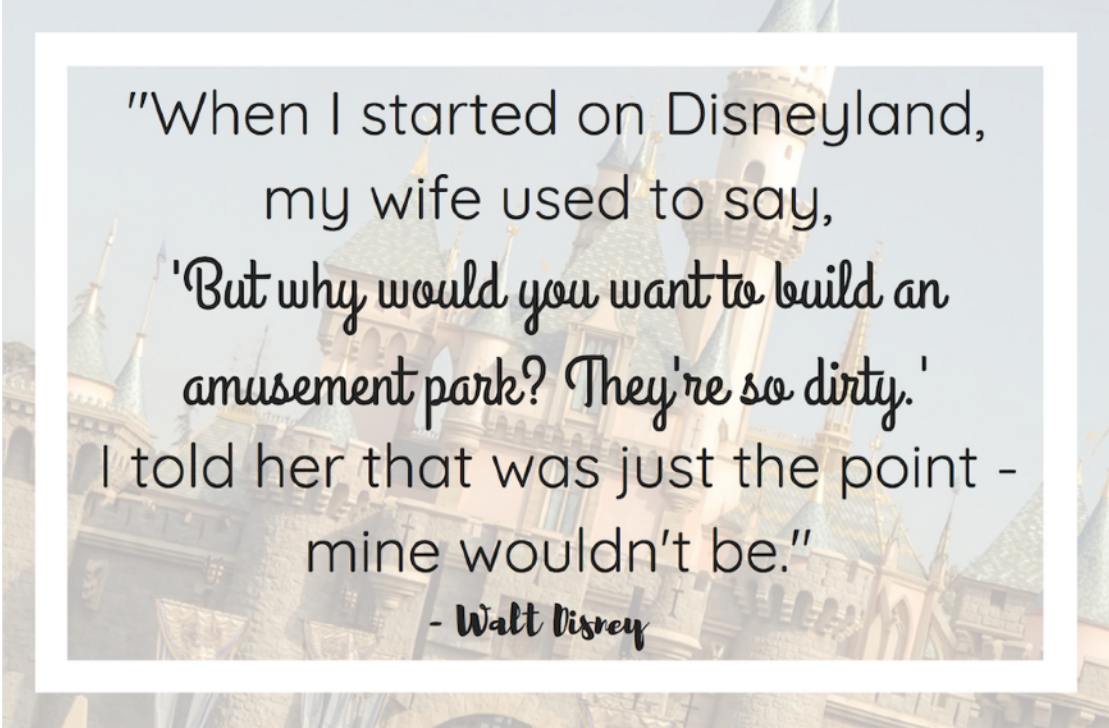
Centralized Trash Service

- The idea of placing one large trash can at a central location.
- Visitors are expected to haul their trash to the central trash can.
- Is common practice in campgrounds and at trailheads.
- Oregon State Parks has adopted the practice and utilizes a trash compactor to keep dumpsters from overflowing.

Does it Work?

- In a campground setting it works as the amount of visitor use is controlled by the number of available sites.
- Trailheads and day use areas have an undefined amount of visitor use.
- If visitor use exceeds capacity the site will experience a trash problem.
- The method is more efficient as it is easier to empty a dumpster instead of changing out trash bags.





"When I started on Disneyland,
my wife used to say,
'But why would you want to build an
amusement park? They're so dirty.'
I told her that was just the point -
mine wouldn't be."

- Walt Disney

Do you Approach the
Problem like Walt
Disney?

The Disney Approach

Cans are designed to fit into the landscape.

Rumor has it Walt researched how far the average visitor is willing to walk to a trash can.

Walt discovered the magic number is 30 feet.

Frontier Land alone has over 120 trash cans or 14 cans an acre.





Would it Work?

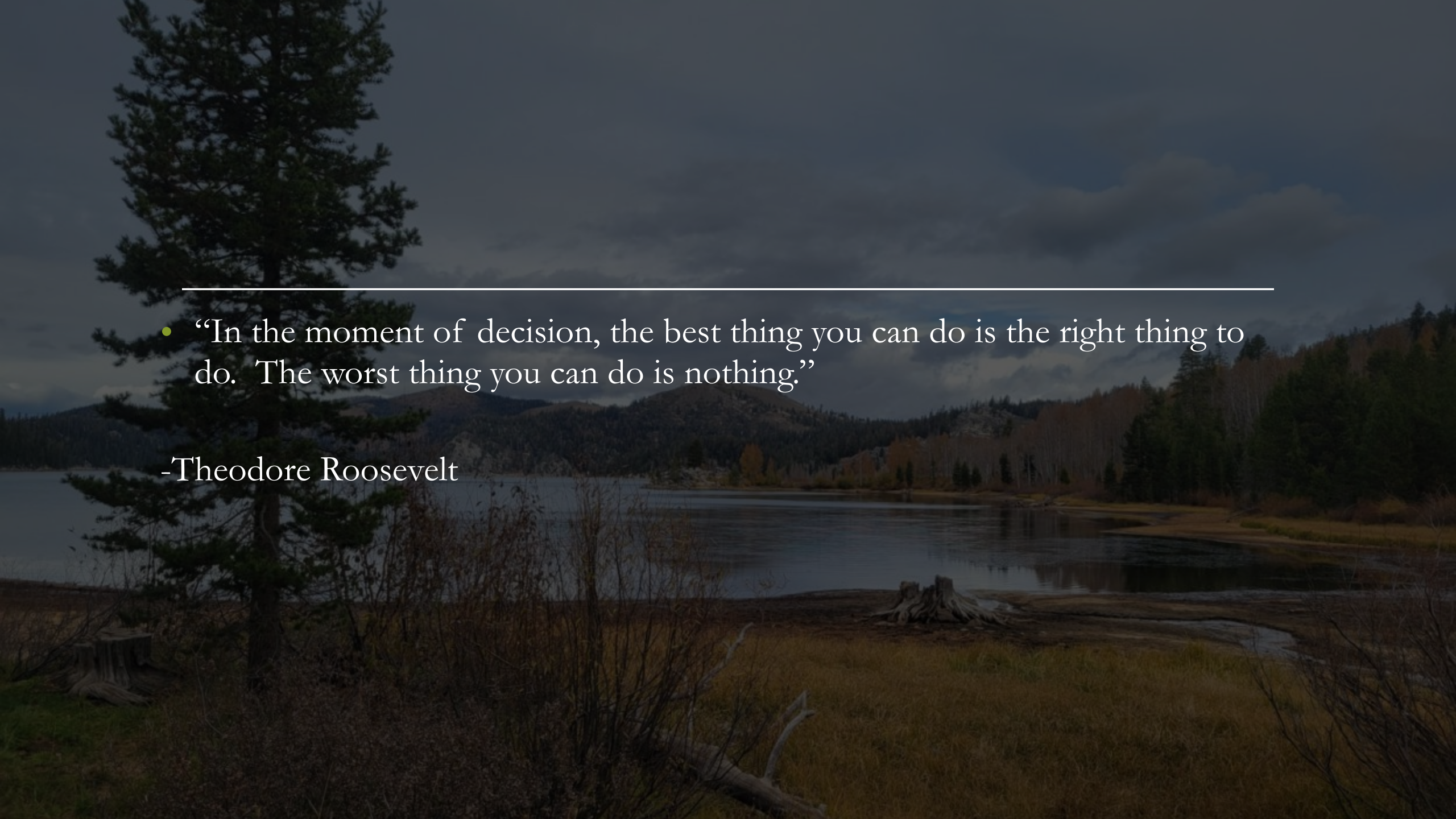
- At 55 acres, using the Disney approach the park would need 770 trash cans.
- Currently the park has 11 dumpsters and approximately 30 trash cans.
- “But the real lesson here lies in what Disney didn’t do. He didn’t plaster the park with signs (NO LITTERING!), or play a recording over the loudspeaker every few minutes (“Please dispose of your trash in a receptacle. Thank you.”) He didn’t try to change his guests’ behavior, in other words. He simply accounted for it and designed around it”
Jonathan Vieker
- But was it the right decision????

I don't have the answers, but I have some observations

- COVID demonstrated the value of parks. However, many users just simply don't understand how to use the park as designed.
- Trash cans, especially bear proof ones are hard to use if you don't know how to use it.
- When parks added 6 new trash cans at Sand Harbor they were used, however litter was still present in the parking lot. Did it solve the litter problem and just provide a more convenient location for visitors to dispose of trash?
- I will never understand why someone would leave a dog waste bag on the side of the trail.
- We live in a disposable society it is not uncommon to find new grills, rafts, beach toys, and other items used once and just left after the visit is complete.
- Then there are the foam coolers that are used once and stuffed into a trash can.

The Trash Management Challenge

- **Leadership is disrupting a system** with a goal of **making positive and meaningful change** to the system at a **rate the system can handle**.
- Our decision to be here demonstrates a recognition of a real problem and desire to disrupt the current system.
- Can we make a positive and meaningful change to the system?
- Is the system capable of changing and if so at what rate?

- 
-
- “In the moment of decision, the best thing you can do is the right thing to do. The worst thing you can do is nothing.”

-Theodore Roosevelt

Questions



CLEAN UP
THE LAKE
2023



Lake Tahoe Litter Summit

COLLABORATING FOR A CLEANER FUTURE

Tackling litter: community engagement, data collection and policy solutions



Marilee Movius
Senior Community Engagement Manager

TEN YEARS OF CLEANUPS



PEOPLE LITTER FOR THREE MAIN REASONS

- They feel no attachment for the area
- They think someone will clean up after them
- They see litter already accumulated



CLEANUPS BY THE NUMBERS

From 2014 - 2022, over 9,000 volunteers removed:

- 74,625 pounds of litter
- 195,691 cigarette butts
- 15,297 plastic bags
- 16,673 plastic bottles
- 25,943 plastic caps
- 17,209 plastic straws
- 27,661 styrofoam items





KEEP TAHOE BLUE'S SIGNATURE CLEANUPS

The Keep Tahoe Red, White and Blue Beach
Cleanup the past ten years





TAHOE BLUE CREW

- 169 total assigned crews
- 1,161 total cleanups





INNOVATIVE SOLUTIONS

The Bebot

Red White & Tahoe Blue Cleanup 7-5-2022



SCIENCE TO SOLUTIONS





Questions? See you at the breakout session.

Contact me:
Marilee Movius
marilee@keeptahoeblue.org

Download the
Citizen Science Tahoe App
www.citizensciencetahoe.org





CLEAN UP
THE LAKE
2023

Lake Tahoe Litter Summit

COLLABORATING FOR A CLEANER FUTURE