



Mammoth Lakes 2025: Expanding Our Alpine Research Efforts

Final Project Report

PROJECT SUMMARY



Project Objective:

Complete a full underwater circumnavigation of McLeod Lake (9,333 ft elevation) to collect submerged litter and conduct AIS testing, assessing how altitude and hiking access influence litter accumulation and retrieval efficiency. The project also expanded into AIS surveys and targeted submerged litter collection at Lakes George, Mary, Twin, and Mamie, building a broader dataset across multiple water bodies that feed into Mammoth Lakes' drinking water supply.

Primary Focuses:

- Perform AIS surveys within connected watershed lakes contributing to Mammoth Lakes' drinking water supply and send to California Department of Agriculture for analysis
- Document and categorize collected litter using CUTL's standardized methods and UNEP/IOC data protocols
- Test logistics and diver performance in high-altitude, low-temperature, and limited-access lake conditions

PROJECT METRICS

Dates: September 15th - September 23rd 2025

Total Distance Covered: 5.35 miles

Miles Cleaned & Surveyed for AIS: 2.94 miles

AIS-Only Survey Distance: 2.41 miles

Weight Removed: 396 lbs

Items Removed: 1,331

Fishing Gear Items Removed: 697

Total Cleanup Dives: 14

Unique Volunteers: 24

Volunteer Participations: 76

Volunteer Hours: 548

AIS Sampled: 32



UNIQUE CHALLENGES

- **High-Altitude Diving:** Thin air at 8,000+ ft reduced surface oxygen, requiring longer surface intervals and careful dive planning.
- **Cold Water and Thermoclines:** Rapid temperature drops below 15 ft shortened bottom times and reduced dexterity during retrieval.
- **Access and Gear Transport:** Steep, rocky trails at McLeod and Lake Mary made moving cylinders and equipment difficult — even with mule support.
- **Fire-Related Logistics:** Regional fires limited campsites and lodging, forcing emergency housing for staff and volunteers.
- **Data and QA/QC Issues:** Cold conditions and silty substrates complicated underwater documentation, requiring added verification after dives.



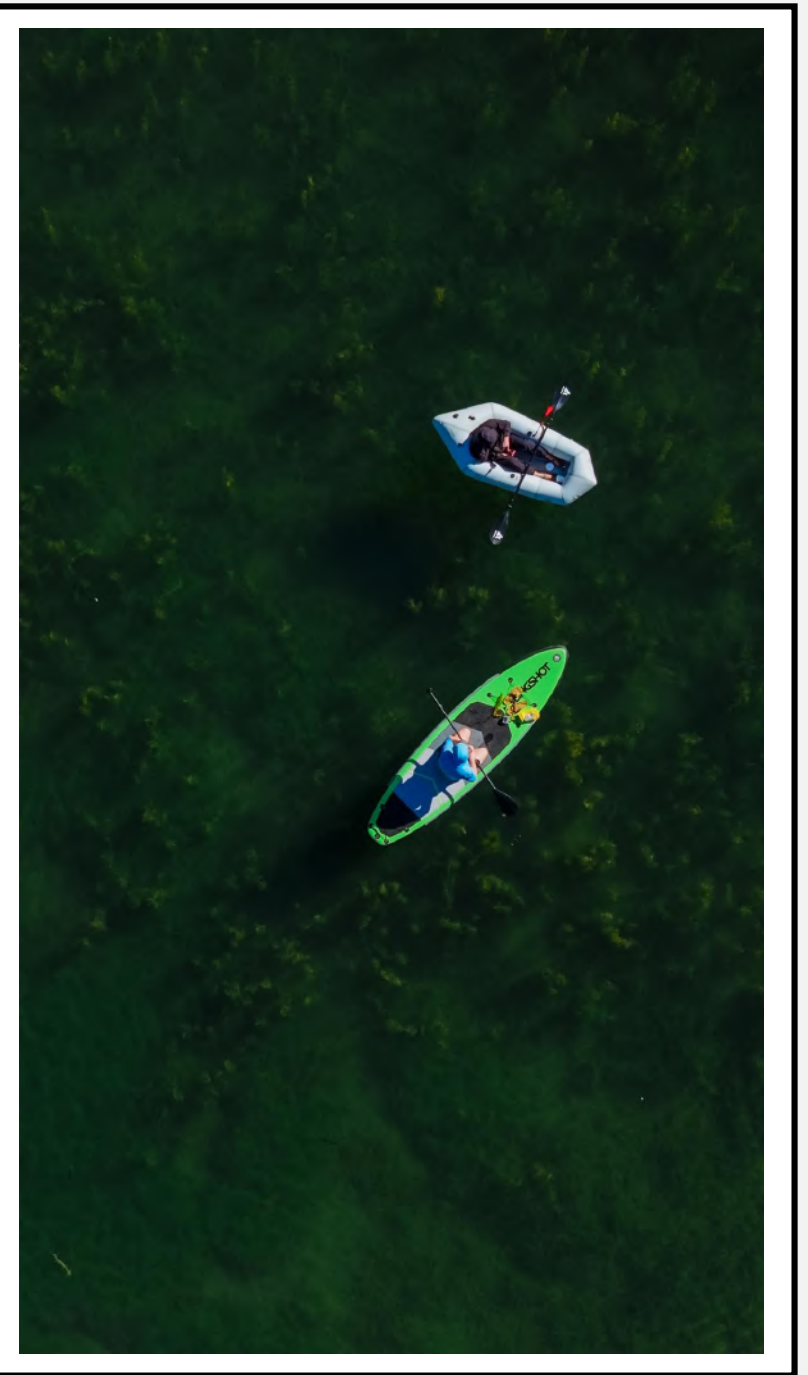
NON-COLLECTION ITEMS

Aside from removing small litter items our team also identified items/areas of interest called non-collection items using GPS location, photo collection, item description.

- **Total Non-Collection items: 32**

- **Aquatic Species Samples: 32**

- *Potential AIS sightings are identified, sampled and GPS points dropped for future monitoring.*



Aquatic Invasive Species



- The AIS survey was the standout part of this project, delivering noteworthy scientific results
- Clean Up The Lake and the California Department of Agriculture tested 27 of 32 aquatic species samples to create a regional baseline of native & invasive plants. Genetic sequencing of three *Myriophyllum*, commonly known as milfoil, samples from Twin Lakes confirmed two as invasive *Eurasian watermilfoil* and one native *Northern watermilfoil*.

The 24 other samples sent in for testing came back as California Native species with characteristics of high-elevation, oligotrophic lakes. These include:

- Sponges & Algae
- Quillworts & Monocots
- Pondweeds
- Milfoils
- Waterweed
- Water Buttercup
- Mare's-tail

Potential concerns or uncertainties:

- *Myriophyllum* spp. — required genetic confirmation (native vs invasive).
- *Elodea canadensis* — considered native to parts of North America but can behave like a colonizing species in disturbed Sierra habitats; treat as “regionally naturalized.”
- *Possible Colonial Cyanobacteria* — Department of Agriculture did a morphological ID that they believed could be a type of cyanobacteria or protozoan colony in Lake Mary. Additional samples will be taken in 2026.

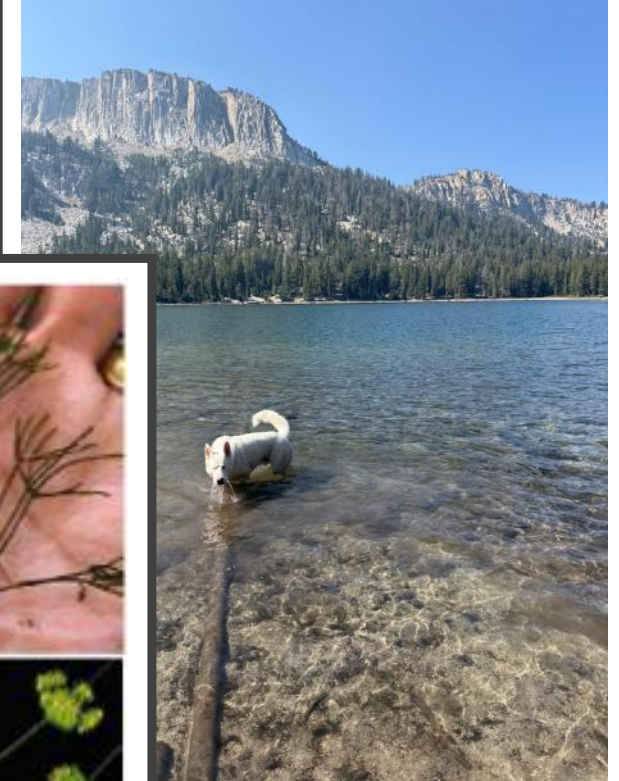
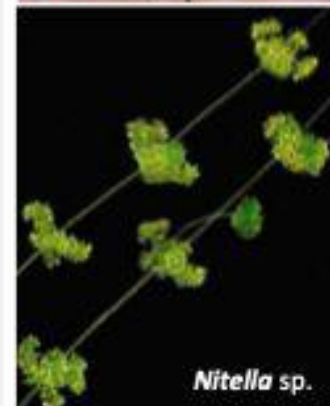
Aquatic Plants Survey



McLeod Lake: Aquatic Plants Survey

Aquatic Plants Species Findings (Results Pending)

- **Clam** — species identification pending
- **Stoneworts** (*Nitella sp.* and *Chara sp.*) — **native green algae**
- **Young Monocot** — being cultivated for formal identification



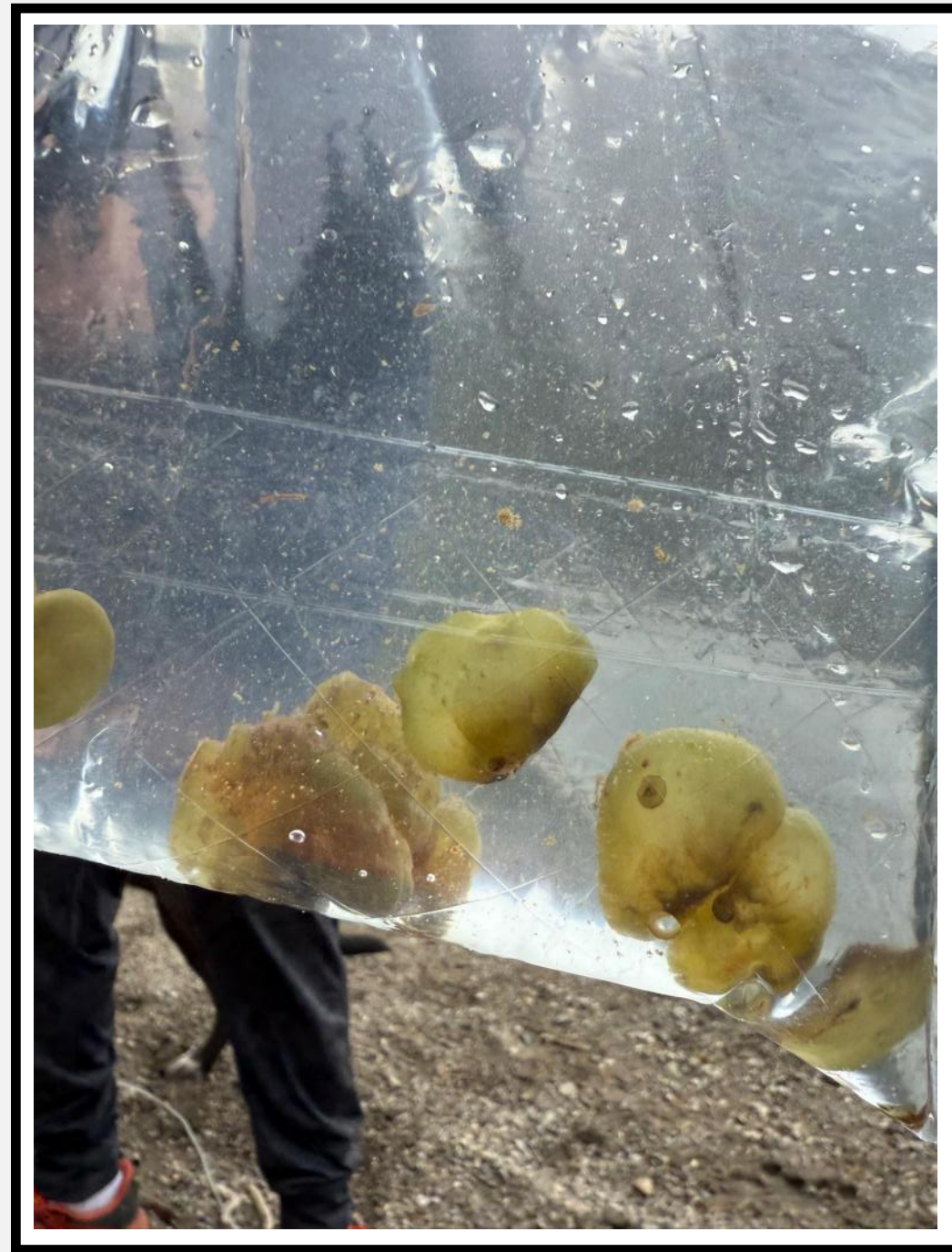
Lake Mary: Aquatic Plants Survey

Confirmed Results from 2024 Surveys:

- **Richardson Pondweed (*Potamogeton richardsonii*)** — Native
- **Common Stonewort (*Chara sp.*)** — Native
- **Canadian Waterweed (*Elodea canadensis*)** — Native

Aquatic Species Flagged for Additional Research

- **Possible Colonial Cyanobacteria** - Department of Agriculture did a morphological ID that they believed could be a type of cyanobacteria or protozoan colony in Lake Mary. *Continued Cyanobacteria testing and monitoring in Lake Mary due to observations made in 2025.*



Lake George: Aquatic Plants Survey

Aquatic Plant Species Findings:

- **Spongilla** (*Spongilla lacustris*) — Native
- **Stonewort** (*Nitella sp.*) — Native
- **Nuttall's Quillwort** (*Isoetes nuttallii*) — Native
- **Common Stonewort** (*Chara sp.*) — Native



Lake Mamie: Aquatic Plants Survey

Aquatic Plant Species Findings

- **Richardson Pondweed** (*Potamogeton richardsonii*) — Native



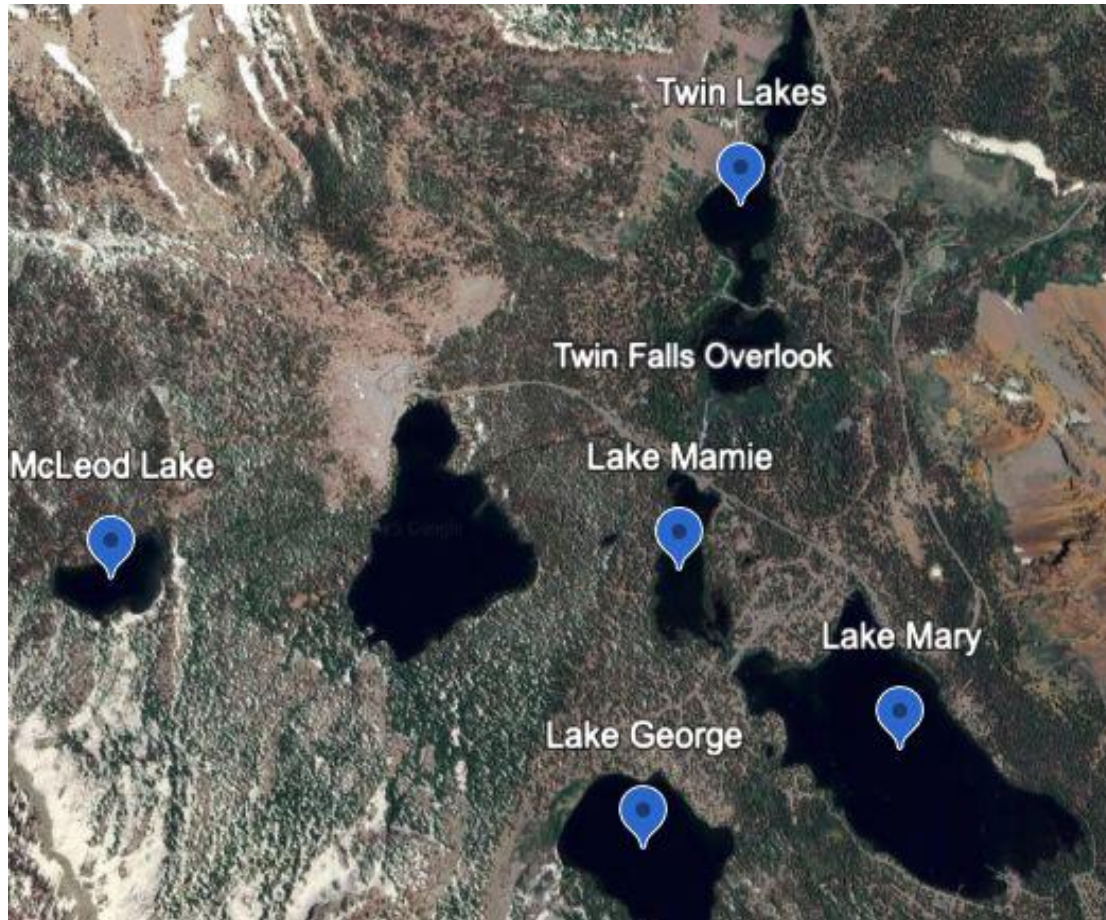
Twin Lakes: Aquatic Plants Survey

Aquatic Plant Species Findings

- **Eurasian Watermilfoil** (*Myriophyllum spicatum*) — **Invasive**
- **Canadian Waterweed** (*Elodea canadensis*) — Native
- **Richardson Pondweed** (*Potamogeton richardsonii*) — Native
- **Pondweed** (*Potamogeton sp.*) — Pending Identification
- **White Water Buttercup** (*Ranunculus aquatilis*) — Native
- **Spike Rush** (*Eleocharis sp.*) — Native
- **Common Mare's-Tail** (*Hippuris vulgaris*) — Native
- **Northern Watermilfoil** (*Myriophyllum sibiricum*) — Native
- **Algae-Covered Moss** — Native / Pending
- **Colonial Cyanobacteria** — Pending Identification



DIVE SITES



McLeod Lake

- **Weight:** 294 lbs
- **Item Count:** 236
- **AIS Samples Collected:** 4
- **Distance:** 2.01 miles

Twin Lakes

- **AIS Samples Collected:** 23
- **Distance:** 1.61 miles

Lake Mamie

- **AIS Samples Collected:** 1
- **Distance:** 0.8 miles

Lake Mary

- **Weight:** 102 lbs
- **Item Count:** 365
- **AIS Samples Collected:** 1
- **Distance:** 0.28 miles

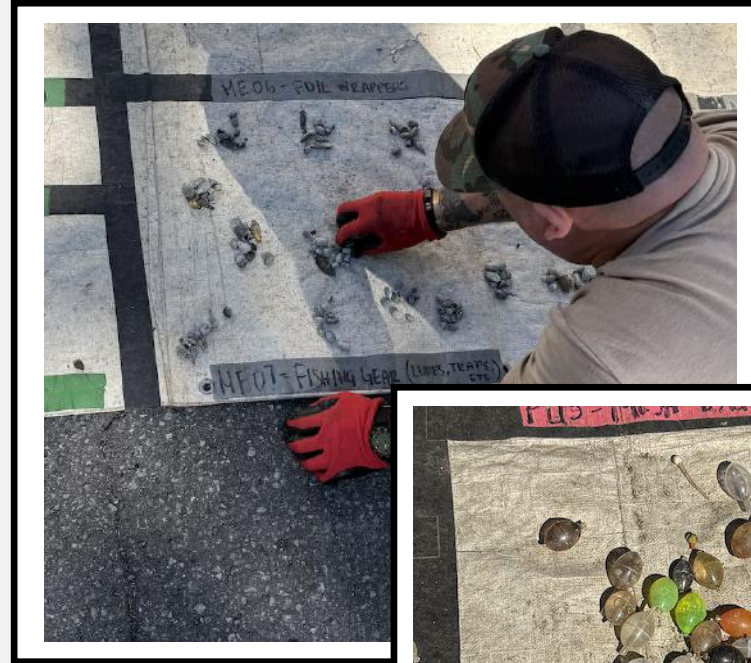
Lake George

- **Weight:** 55 lbs
- **Item Count:** 730
- **AIS Samples Collected:** 3
- **Distance:** 0.65 miles

LITTER CATEGORIZATION

To collect impactful data on litter removed from lake environments we have adopted the United Nations Environmental Programme (UNEP) Marine Litter Categorization standard to produce a nationally recognized data set. This method separates litter into 77 different categories. CUTL with help from UC Davis TERC and DRI has adapted this system to freshwater litter and created additional categories for a total of 83 categories.

- 9 different **material categories**: plastic, foamed plastic, cloth, glass & ceramic, metal, paper/cardboard, rubber, wood and other.
- Within the material categories there are specific **use categories** which further define the item- there 83 in total. For example- fishing equi
- We have created templates on sorting tarps that outline each category. After the litter is sorted, we photograph, count, and weigh each category.

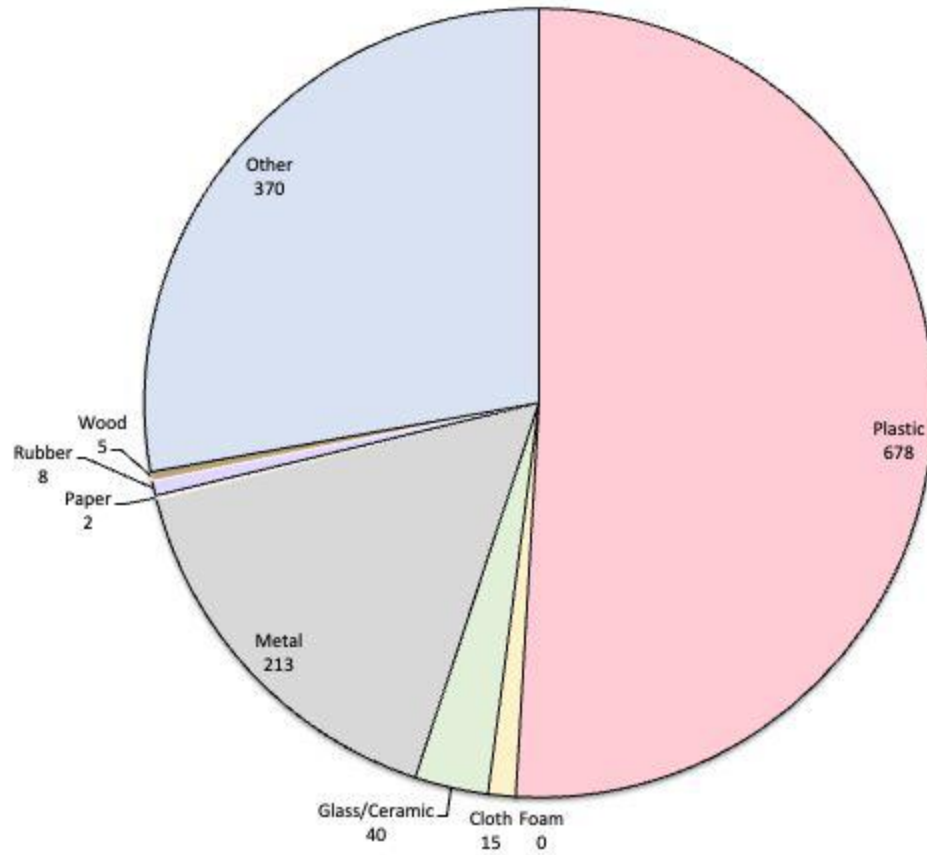


PROJECT TOTALS – CATEGORY SPECIFIC

Material Data	Weight (lbs)	Item Count
Plastic	47.13	678
Foam	0	0
Cloth	3.03	15
Glass/Ceramic	87.6	40
Metal	214.3	213
Paper/Cardboard	0.01	2
Rubber	1.68	8
Wood	0.43	5
Other	6.86	370
Project Totals	361	1331

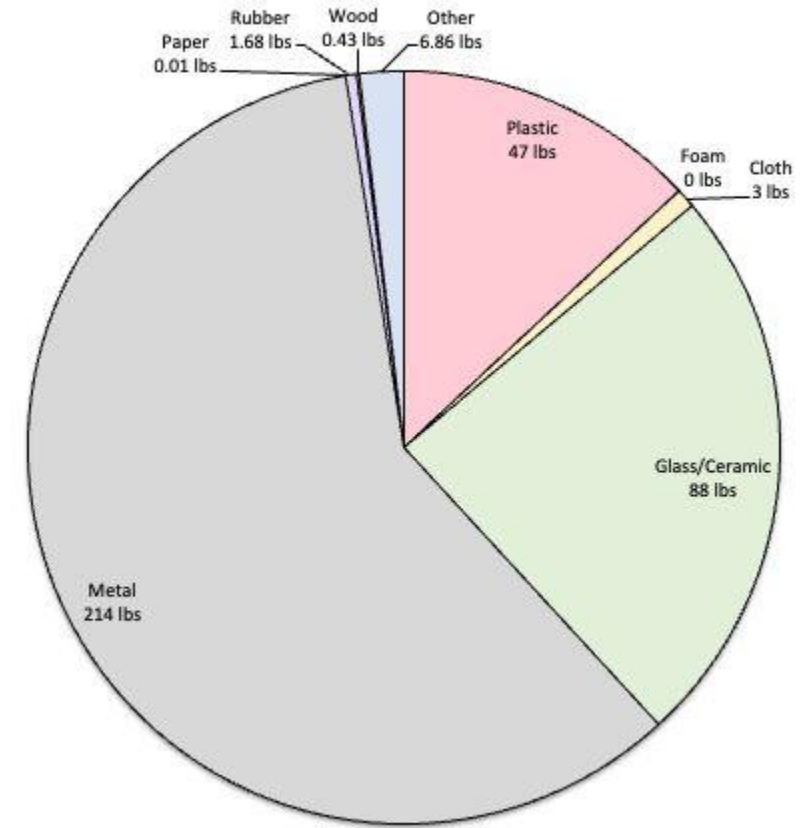
LITTER BY MATERIAL (COUNT): Mammoth Lakes

Total Count: 1,331



LITTER BY MATERIAL (WEIGHT): Mammoth Lakes

Total Weight: 361 lbs (DRY)



LITTER BREAKDOWN

Community Engagement



CONCLUSION

The Mammoth Lakes Project successfully completed high-altitude cleanup and aquatic vegetation surveys across five alpine lakes, confirming that Clean Up The Lake's operational model can be effectively executed at elevations exceeding 9,000 ft, *most importantly - in remote wilderness accessible by backpacking and/or mules carrying heavy gear*. Fieldwork yielded a full circumnavigation and litter removal of McLeod Lake, detailed aquatic species mapping across the basin, and new insight into the logistical and physiological challenges of alpine diving.

RECOMMENDATIONS

- **Encourage government agencies to implement a community education effort focused on responsible recreation and promote **CLEAN, DRAIN, DRY** of all motorized and non-motorized equipment, with special focus on movement from Twin Lakes to other areas in Mammoth to avoid the spread of Eurasian Watermilfoil.**
- Continued Cyanobacteria testing and monitoring in Lake Mary and Twin Lakes due to observations made in 2025.
- Conduct targeted cleanup dives at Lake Mamie, where only AIS surveys were completed this year.
- Continue cleanup operations at Lake Mary and Lake George, where data indicate higher residual litter densities and sustained recreation-based inputs.
- Continue collaboration with the California Department of Agriculture on vegetation sequencing and expand AIS coordination within the Mammoth water basin.

PROJECT PARTNERS

