A Clean Up The Lake Report

Results of the 2024 Donner Lake Deep Dive Cleanup – Town Of Truckee, CA

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Background

Donner Lake Litter Cleanup History

Litter deposition in the environment is a persistent issue. Not only are roadways and other land use areas still experiencing litter accumulation due to human activities, it is well known that litter is often transported into waterbodies[1]. While marine environments are often the subject of litter accumulation reports, freshwater systems and inland basins are also sites of concern.

Clean Up the Lake (CUTL) has been actively working to clean and restore the Donner Lake ecosystem since launching dive operations in 2020. Prior to the Donner Lake Deep Clean Project, CUTL had already removed over 13,000 pounds of underwater litter from the lake, primarily between the depths of 0 and 25 feet.

In 2020, CUTL completed the first full circumference submerged litter cleanup of Donner Lake. This effort focused on retrieving litter from the nearshore lakebed (0-25 feet), especially along the shoreline. Our team removed over 5,150 lbs. during the first cleanup, revealing a substantial litter problem in the waters of Donner Lake. Building on the momentum from this preliminary work, we partnered with local advocate, Ella Hoyer, to install litter awareness and educational signage at 37 public piers throughout the lake (*Figure 1*). This new understanding of freshwater litter accumulation in one of the region's most beloved lakes inspired our team to revisit the lake in 2022

Figure 1: *Educational signage installed at 37 Donner Lake public piers.*

In 2022, CUTL launched the Donner Lake Monitoring Project, which resulted in the removal of an additional 7,635.5 pounds of debris. This effort also included enhanced survey protocols for recording potential aquatic invasive species (AIS) and harmful algal blooms. The results of the AIS investigation aligned with those of other organizations, confirming the presence of crayfish and Asian clams in Donner, but also an encouraging lack of other invasive plants and animals. During this project, the CUTL team also conducted pilot dives to explore patterns of litter accumulation between 35 and 70 feet. The deep dives in 2022 revealed the presence of significant amounts of litter, particularly between depths of 35 and 55 feet, inspiring the 2024 Donner Lake Deep Clean Project.

[1] Bergmann, M. (2016). Marine Anthropogenic Litter. Springer International Pu.

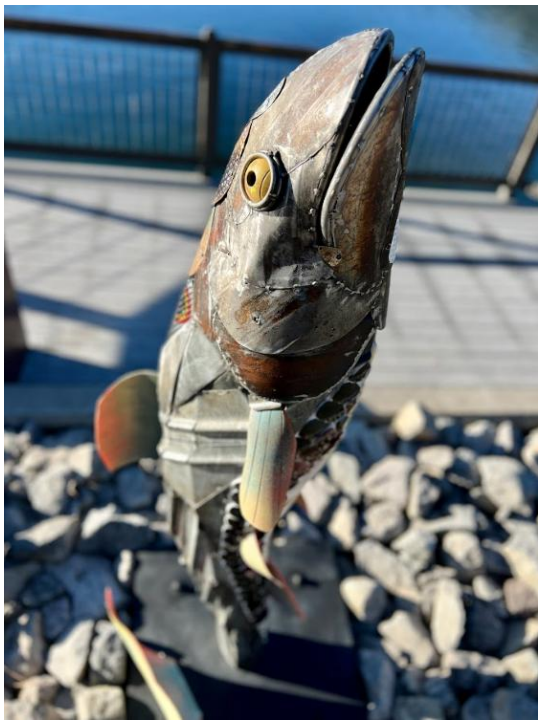


Figure 2: *West* End Boat Launch sculpture unveiled in October, 2023.

In 2023, CUTL's efforts expanded further into public engagement and awareness. Partnering with the Town of Truckee, the Truckee-Donner Recreation and Park District (TDRPD), and artists Joel Stockdill and Yustina Salinoka, a large-scale litter sculpture was installed at the West End Boat Launch. This collaborative art installation serves as a powerful reminder of the impact of underwater debris and continues to promote stewardship of Donner Lake.

Despite the significant efforts made on behalf of Donner Lake, the environment continues to face serious challenges related to litter accumulation and the threat of AIS. The deep dive surveys conducted in 2022 revealed the need for expanded underwater cleanup efforts, particularly in deeper zones. If left behind, the litter at these depths will continue to degrade over time, negatively impacting water quality and aquatic habitats. To ensure the long-term protection of Donner Lake, further assessment of the subsurface litter distribution will inform more comprehensive restoration strategies and help safeguard the lake's ecological and environmental integrity.

Additionally, the presence of AIS , such as Eurasian Milfoil, Curly-leaf Pondweed, and New Zealand Mudsnails, in nearby lakes poses a growing risk of introduction to Donner Lake. This highlights the importance of ongoing and vigilant AIS monitoring.

Methods

SCUBA-enabled litter cleanups have been recognized as an effective method for submerged litter removal in shallow environments.[2] This approach enables divers to thoroughly inspect the lakebed and manually remove litter items trapped in crevices or other challenging terrain. This approach results in minimal impact to the lakebed compared to other litter removal methods such as dredging.[3] SCUBA-enabled litter collection is the preferred method of aquatic litter removal in nearshore environments due to the minimally invasive approach.

Litter Collection, Dive Team, & Safety Protocols

Because Donner Lake is located at high altitude (5,936'), divers experience additional physiological limitations compared to diving at sea level. Particularly at deeper depths, allowable bottom times must be reduced due to the increased risk of decompression sickness. Given the deeper target depths of this cleanup effort, there was a need for increased diver mobility and efficiency compared to previous operations in 2020 and 2022. To enhance efficiency and expand the reach of cleanup efforts into the 35–55 foot zone during this project, CUTL dive teams used Diver Propulsion Vehicles (DPVs). These devices enable divers to move two to three times faster than traditional, unaided dives, allowing for greater coverage and more litter removal per dive. Divers also used enriched air nitrox (EANx)to further extend safe dive time and reduce the risk of decompression sickness. Together, the use of DPVs and nitrox allowed the teams to maximize impact in deeper zones.

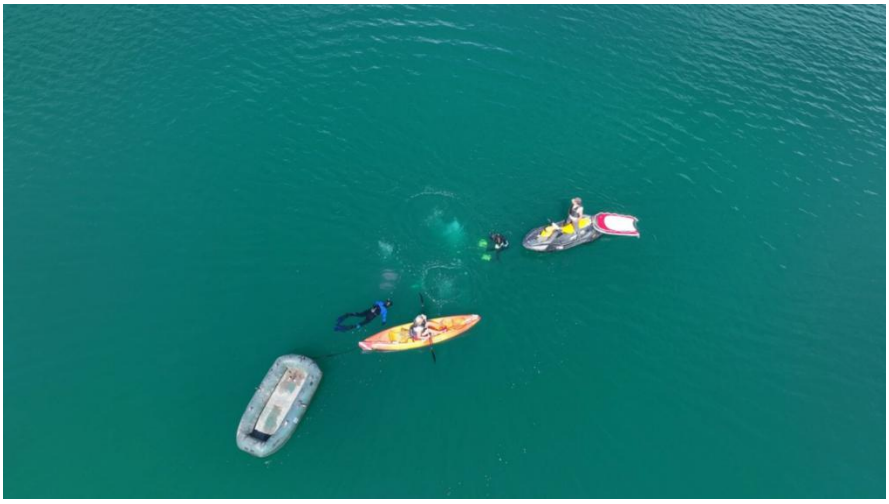


Figure 3: *Aerial image of the surface support team (kayaker, jet skier, and data collector) near two surfacing divers.*

Similar to the Donner Lake Monitoring Project (2022), the on-the-water team was composed of trained personnel who played specific roles to ensure safe and effective data and litter collection. A minimum of two to three SCUBA divers were present for each dive. At least one diver, certified at the Advanced Open Water (AOW) level or higher with recent dive experience, served as the designated safety diver. One or two additional SCUBA divers

[2] Dive Against Debris 2019

[3] Harrold, Z. West, C. Easler, S. (2023). Results of the 2022-2023 Lake Tahoe Monitoring Nevada Cleanup

focused on litter removal, all of whom followed Professional Association of Diving Instructors (PADI) high-altitude diving protocols. Due to increased target depths of these dives, this project comprised a team of highly experienced dive volunteers.

Unlike previous cleanup efforts, this project did not include free divers due to the increased target depths. Instead, surface support was provided by kayakers and jet ski operators. These team members assisted with GPS survey markings related to suspected AIS and other non-collection items including heavy-lift litter items, historic or unknown objects, and litter hotspots. Kayakers and jet ski captains also managed surface safety by coordinating with nearby boaters or personal watercraft.

Litter Categorization

All litter collected by divers was sorted in a comprehensive litter categorization process. This process utilizes an expanded UNEP/ IOC marine litter categorization table[4] that has been modified to fit the needs of inland freshwater systems but retains the integrity of the initial methodology. This allows the resulting freshwater litter data to be comparable to other litter data sets (e.g., freshwater, and marine) that use similar litter categorization criteria. CUTL has been sorting litter using the same or a similar methodology since 2020 to standardize the litter data collection. CUTL relies on volunteer community members and interns to complete the litter categorization process. This process involves utilizing a series of customized tarps with sorting grids corresponding to each of the UNEP/IOC litter categories (*Figure 4*). Litter collected during each cleanup dive is sorted on the tarps and each use-type category is weighed, counted, and photographed.

Figure 4: *Lakebed litter retrieved from dive site and sorted onto tarps using litter categorization methods.*

Field Data Collection

Comprehensive data collection is integral to the work that CUTL does. To achieve high quality data that contributes to the understanding of aquatic litter, CUTL utilizes custom field data collection forms built in the WildNote app. This method ensures data standardization and organization.

[4] Cheshire, A., & Adler, E. (2009). *UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter (Regional Seas Reports and Studies No. 186; IOC Technical Series No. 83)*. Texas A&M University at Galveston Institutional Repository. https://tamug-ir.tdl.org/server/api/core/bitstreams/2cfd582c-9c3c-4b66-86a5-a31add804c0c/content

Aquatic Invasive Species (AIS) Protocols

During the Donner Lake Deep Clean project, CUTL dive teams implemented established protocols for collecting aquatic invasive species (AIS) data alongside litter removal efforts. Divers deployed delayed surface marker buoys (DSMBs) to mark the GPS coordinates of suspected AIS sightings, which were recorded using the WildNote platform. Suspected AIS were also documented through photographs and videos taken during monitoring dives. Any unknown species encountered were collected and submitted to the California Department of Food and Agriculture for identification. With the introduction of New Zealand Mud Snails in nearby Lake Tahoe, these AIS survey efforts have become increasingly important for Donner Lake. Throughout the project, divers actively monitored for new AIS populations and tracked the expansion of any existing ones.

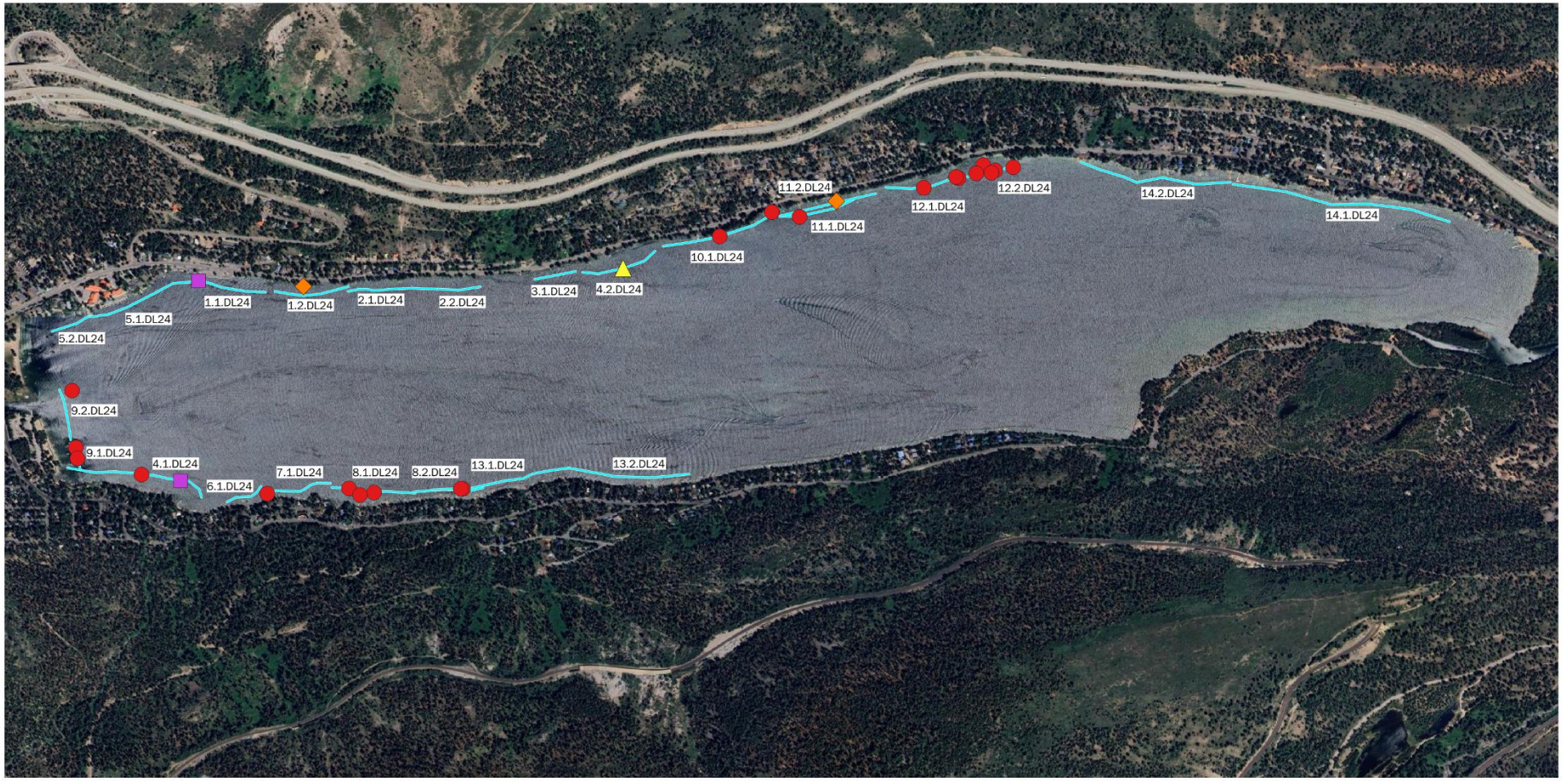
Non-collection Items

In addition to marking suspected AIS, CUTL dive teams used DSMBs and GPS markers to record the locations of three categories of non-collection items: litter hotspots, heavy-lift items, and unknown or potentially historical artifacts. These data points are essential for documenting areas requiring future attention and for ensuring that large litter items are extracted safely.

Heavy-lift items are operationally defined as anthropogenic debris weighing more than 35 pounds and/or too large or unwieldy to be safely collected by divers without specialized equipment. Examples include cement blocks, boat hulls, metal drums, and processed lumber. These items were marked for future removal using proper surface support and safety considerations.

Litter hotspots are defined as localized areas within the diver's field of view that show significantly elevated concentrations of litter. These areas were identified based on qualitative assessments made by the dive team. In some cases, divers are only able to remove only a portion of the debris from a hotspot before moving on to complete the planned dive segment. The documentation of these hotspots is critical for guiding and prioritizing future cleanup efforts.

Unknown or possibly historical artifacts were also marked and left undisturbed. These items were reported to the Town of Truckee and the California State Office of Historic Preservation, in accordance with established heritage preservation protocols.



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Elizabeth Everest

CLEAN UP THE LAKE

DONNER LAKE 2024 DEEP DIVE CLEAN-UP

Dive Paths

Aquatic Invasive Species

Non-Collection Items

Heavy Lift Items

Litter Hotspots

Unknown Items

Figure 5: *Map of Donner Lake 2024 Deep Dive Clean Up Project.*

Project Summary

Project Objective

This project aimed to conduct a targeted SCUBA based cleanup of the Donner Lake lakebed between the depths of 35–55 feet and complete a full circumnavigation of the shoreline (*Figure 5: Map of Donner Lake 2024 Deep Dive Clean Up Project.*). The primary objectives were to 1) remove submerged litter from these deeper zones, 2) categorize debris by material type to better understand human impacts, and 3) inform future mitigation strategies for recreational users, local agencies, and businesses. In addition to debris removal, CUTL teams used GPS to mark heavy-lift items too large for manual extraction, litter hotspots requiring additional attention, and unidentified or potentially historical artifacts. The project also aimed to monitor underwater habitat conditions, including the presence of aquatic invasive species (AIS) and algal blooms. Suspected AIS were photographed, sampled, and submitted to the California Department of Food and Agriculture for species identification.

Project Totals

Between August 2024 and May 2025, the Donner Lake Deep Clean project has carried out fourteen dedicated dive days. During that time, twenty-four dives were conducted covering approximately 3.5 miles of the lake bottom (*Figure* 5). Divers identified twenty-two heavy lift litter items which were too large to be removed without additional support and safety considerations, two deep litter hot spots with large amounts of litter which could be the focus of future efforts, and one unknown item that may have historical or cultural significance. Divers also documented two locations with AIS.

Overall, we successfully removed 1,316 additional pieces of litter from Donner Lake (*Figure 6*), totaling 2,317 lbs. in initial or “wet” weight. After meticulous litter categorization and processing, the dry litter was reweighed, totaling 1,741 lbs. (*Figure 10*). This decrease in weight is attributed to the loss of water between the initial weighing and the start of the categorization. Only the sorted (dry) weight is used for analysis in this report.

Litter data from three dives—3.1.DL24, 5.1.DL24, and 5.2.DL24 (*Figure 5*)—were omitted from the detailed analysis due to labeling and data collection issues during the litter sorting process. While the initial wet weights for these dives were successfully recorded and are included in the total wet weight reported above, the corresponding dry weights and litter categorization data were not captured. As a result, the actual weight and count of items removed during this project are greater than the reported totals of 1,316 litter items and 1,741 pounds of dry weight.

Results and Discussion

Litter Breakdown by Category

The most abundant category of litter removed during the Donner Lake Deep Clean was plastics, with 474 pieces making up 36% of all items collected (*Figure 6*). Metals were the second most common, totaling 381 pieces and accounting for 29% of the project's litter. Glass and ceramic debris ranked third, with 181 pieces contributing an additional 14% to the total. Together, these top three categories represented 79% of all litter items removed from the 35–55 foot depth zone. The remaining categories contributed less than 10% each to the overall total number of items collected during the 2024 cleanup.

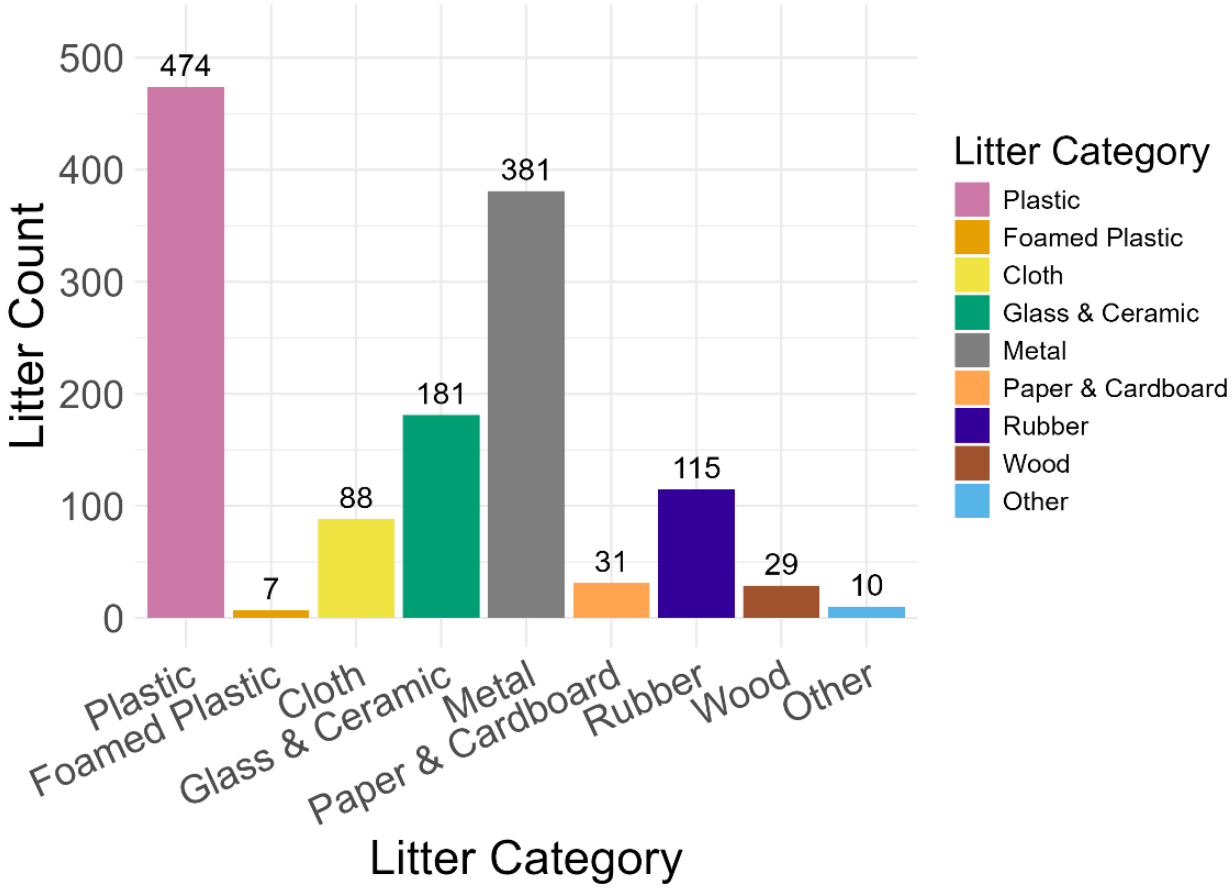

***Figure 6**: Total litter count by category collected during the Donner Lake Deep Clean through May 2025. Plastic, metal, and glass & ceramic litter were the most abundant categories, accounting for 79% of the litter removed.*

By count, the plastic litter removed from Donner Lake was primarily composed of food packaging (145 pieces), unidentified plastic fragments categorized as “other plastic” (98 pieces), and toys or recreational equipment (46 pieces). These three categories alone accounted for 62% of all plastic items documented during the cleanup. Additionally, smaller but notable quantities of fishing and boating related debris, including fishing line (27 pieces), fishing gear (20 pieces), and rope (9 pieces). The composition of plastic litter suggests that shoreline and boater recreation as well as general plastic degradation are significant contributors to underwater litter in Donner Lake.

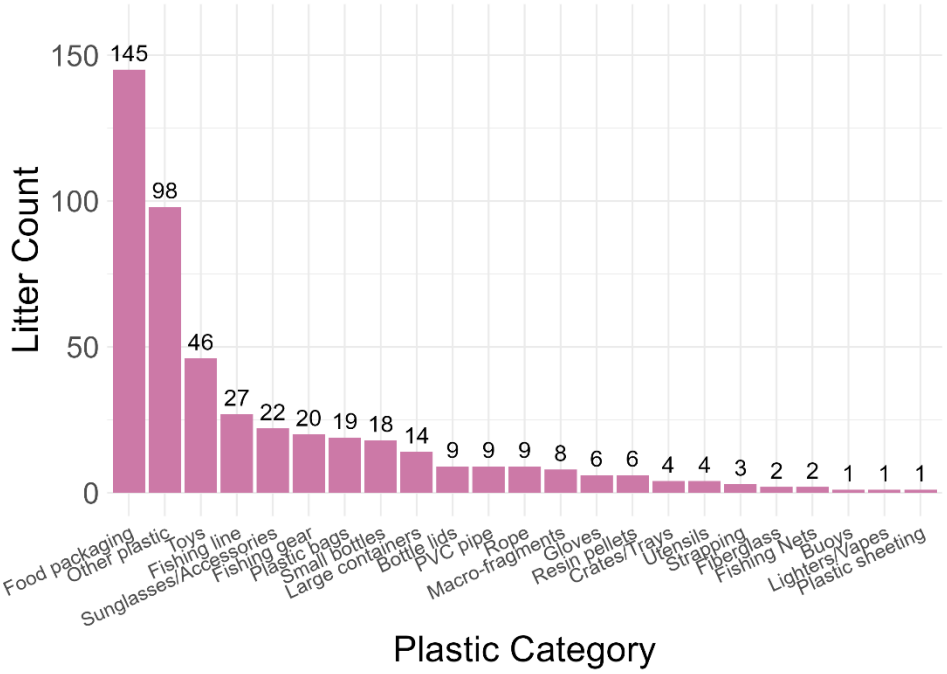

Figure 7: *Count of plastic litter items collected from Donner Lake, categorized by type.*

Aluminum cans were the most abundant type of metal litter removed from the deeper zone of Donner Lake, with 201 cans accounting for 53% of all metal debris by count. Fishing gear was the second most common metal category, comprising 63 pieces and 17% of the total. An additional 27 items categorized as "other metal" contributed 7%, reflecting the presence of unidentifiable or miscellaneous metal debris. The remaining categories - including foil, metal lids, unknown fragments, and various small items like wire, utensils, and anchors - each contributed less than 6% of the total metal litter. The dominance of single-use beverage containers and recreational fishing equipment suggests a strong link between recreational activities and the accumulation of metal debris underwater.

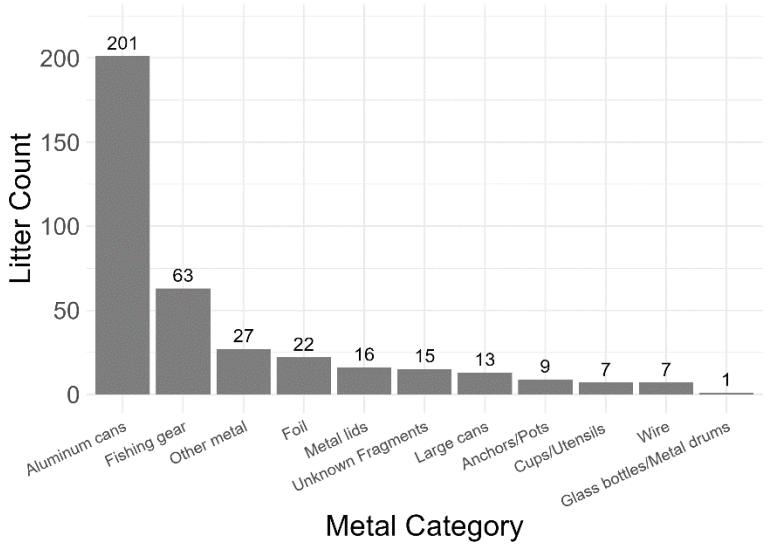

Figure 8: *Count of metal items removed from Donner Lake in 2024, categorized by type. Aluminum cans accounted for the majority of the metal litter by count, followed by fishing gear.*

Glass and ceramic litter from Donner Lake was dominated by glass bottles and jars, which made up 69% of the total glass debris, with 125 individual items collected. The second most common category was construction material, accounting for 26 items (14%), primarily consisting of cement blocks and bricks. Notably, many of these “construction materials” had ropes attached or other indicators suggesting they were used as mooring anchors. Glass fragments added another 12% to the total, with 22 pieces recovered. The remaining categories, including glassware and other glass items, each made up just 2% of the total count. These findings suggest that single use beverage bottles and recreational anchoring practices contribute significantly to glass and ceramic litter in deeper zones of the lake.

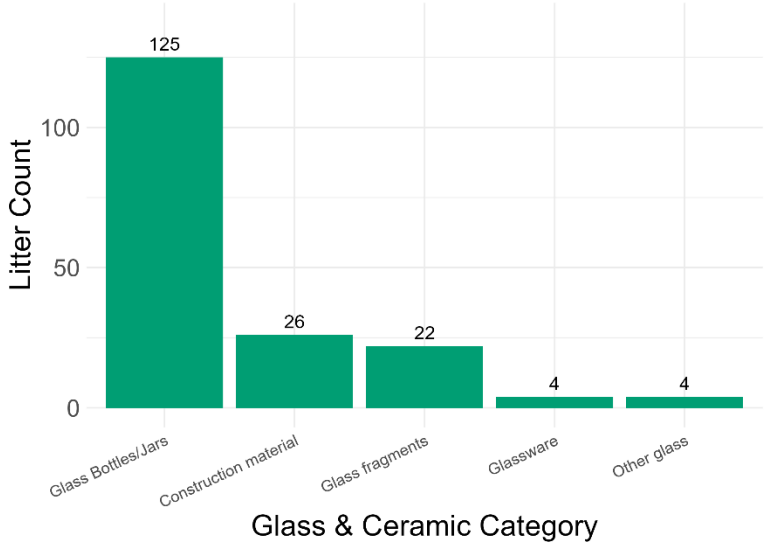

Figure 9: *Count of glass and ceramic litter items collected from Donner Lake. Glass bottles and jars accounted for most of the glass and ceramic litter by count.*

By weight, rubber, metals, glass & ceramic, and plastics were the dominant litter categories, collectively accounting for 95% of the total debris removed from Donner Lake (*Figure 10*). Rubber alone made up 30% of the total weight (523.27 lbs), with 99% of that attributed to the recovery of 80 tires (*Figure 11and Figure 12*). These tires also represented 70% of the total number of rubber items collected by count. Metal litter comprised 27% (467.99 lbs), followed by glass & ceramics at 25% (438.48 lbs), and plastic at 13% (228.71 lbs). The remaining categories—including cloth, wood, paper & cardboard, foamed plastic, and miscellaneous items—contributed just 5% of the total litter weight. Items such as balls, toys, and other debris were negligible in terms of weight, highlighting that heavy and durable materials remain some of the most persistent types of submerged litter in Donner Lake.

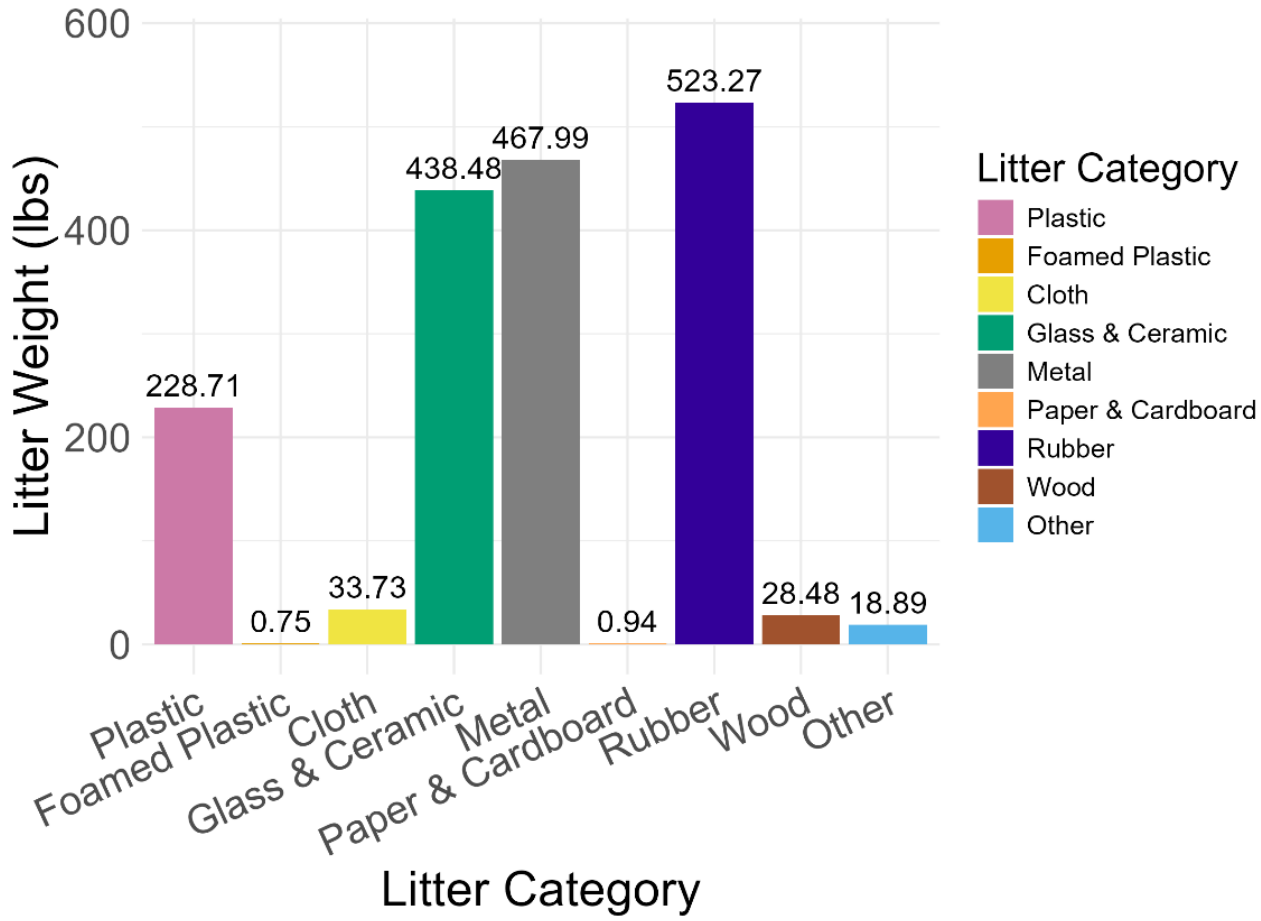

Figure 10: *Total litter weight by category collected during cleanup efforts at Donner Lake through May 2025. Rubber, metal, glass & ceramic, and plastic litter were the heaviest categories, accounting for 95% of the litter removed.*

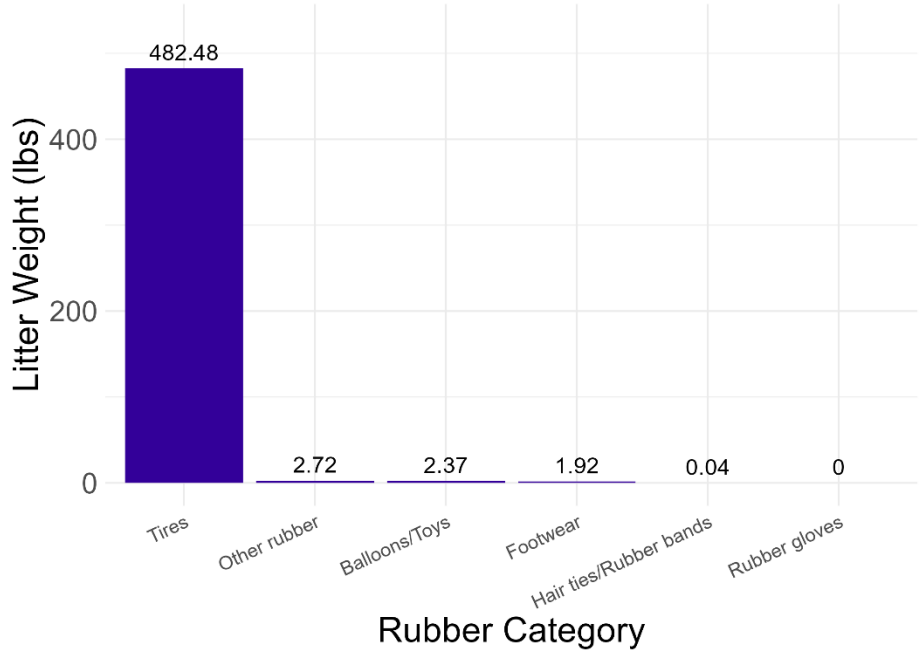

Figure 11: *Weight (lbs.) of rubber litter removed from Donner Lake in 2024, categorized by type. Tires account for the majority of the rubber litter by weight.*

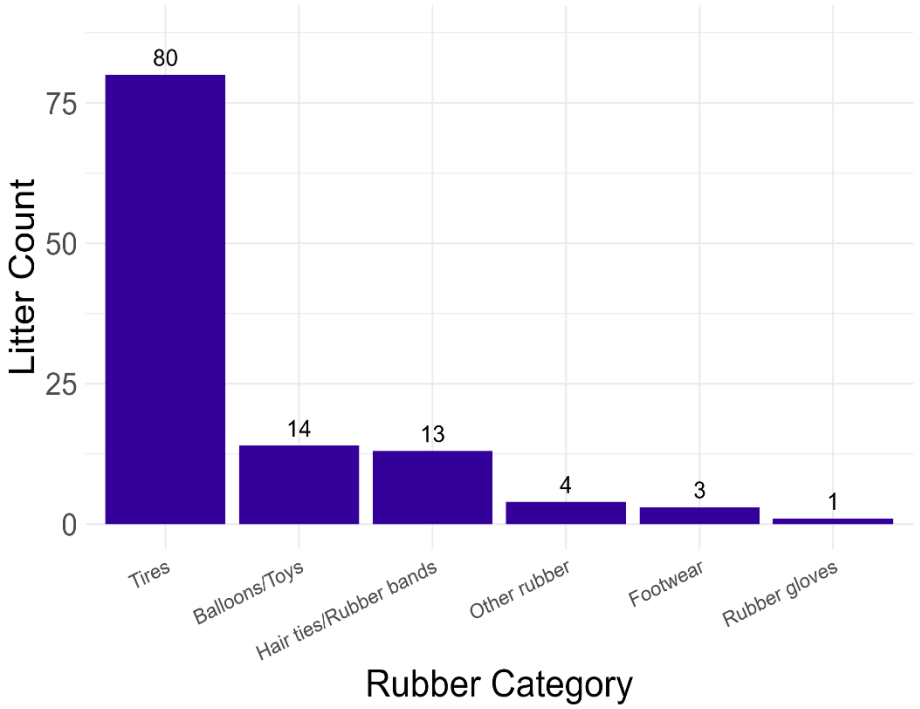

Figure 12: *Count of rubber litter items collected from Donner Lake in 2024, categorized by type. Tires were the most abundant rubber item encountered.*

The majority of metal litter removed from Donner Lake was composed of anchors and anchor pots, which contributed 255.62 pounds and over half (55%) of the total metal weight (*Figure 13*). The next largest category, “other metal,” accounted for 106.87 pounds (23%), reflecting a mix of metal debris including metal piping and construction materials like rebar. Aluminum cans, although high in count, contributed 60.9 pounds and13% by of the metals by weight. Fishing gear followed at 22.77 pounds making up 5%. All remaining categories, including wire, metal lids, large cans, and foil, each made up less than 2% of the total metal weight. This breakdown highlights a key contrast between litter count and weight, emphasizing that while lightweight items like beverage containers are more numerous, heavier debris such as anchors and metal construction materials contribute significantly to the overall metal litter on the lakebed.

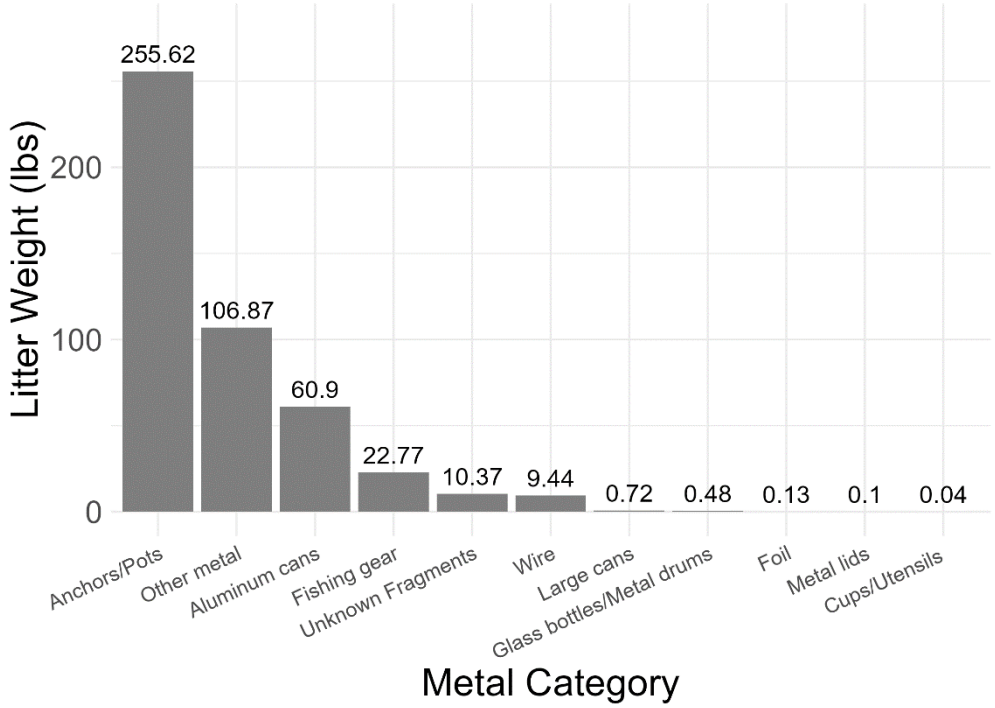

***Figure 13**: Weight (lbs.) of metal litter items collected from Donner Lake in 2024, categorized by type. Anchors and pots accounted for the majority of the metal debris by weight, followed by other metal items and aluminum cans.*

Construction materials made up the vast majority (91%) of the glass and ceramic debris removed from Donner Lake by weight, totaling 399.81 pounds. As mentioned above, this category primarily consisted of bricks and concrete blocks, many of which showed signs of previous use as mooring anchors. Glass bottles and jars contributed 9% of the total weight in this category, amounting to 37.61 pounds. Other glass items, including fragments, glassware, and miscellaneous pieces, collectively weighed less than one pound and were negligible in their overall contribution.

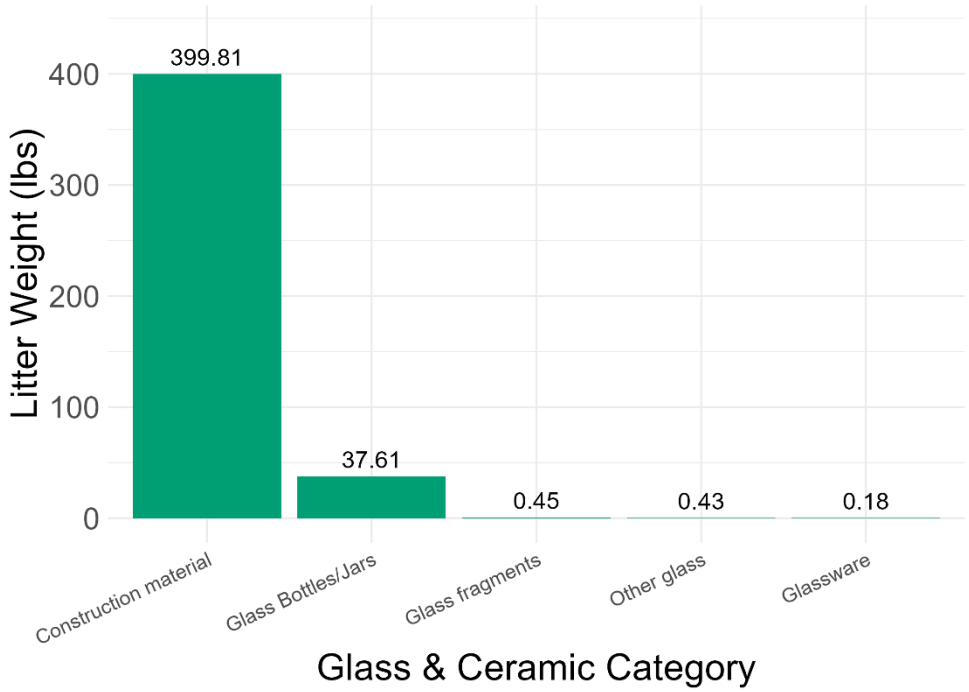

Figure 14: *Weight (lbs.) of glass and ceramic litter removed from Donner Lake. Construction materials account for a majority of this category by weight.*

Finally, plastics were the fourth heaviest litter category removed from the 35-55 foot zone in Donner Lake, contributing 228.71 pounds and 13% of the total litter weight (*Figure 10*). Most of this weight (88%) came from three categories: 1) “Other plastics,” 2) food packaging, and 3) toys or recreational equipment. The dominance of the "Other plastic" category was primarily due to the recovery of several large pieces of a damaged dock removed during dive 11.1.LM24 and weighing approximately 76 pounds. The remaining 7 pounds in the other plastics category came from miscellaneous and unidentifiable plastic fragments. Food packaging accounted for 65 pounds, or 29% of the total plastic weight, highlighting the prevalence of single-use items accumulating in deeper depths. Toys and recreational equipment contributed 49.86 pounds (22%), much of which was attributed to the recovery of several beach chairs. These findings indicate that large, bulky plastic items, often linked to shoreline infrastructure and recreation, make up a significant portion of the submerged plastic litter.

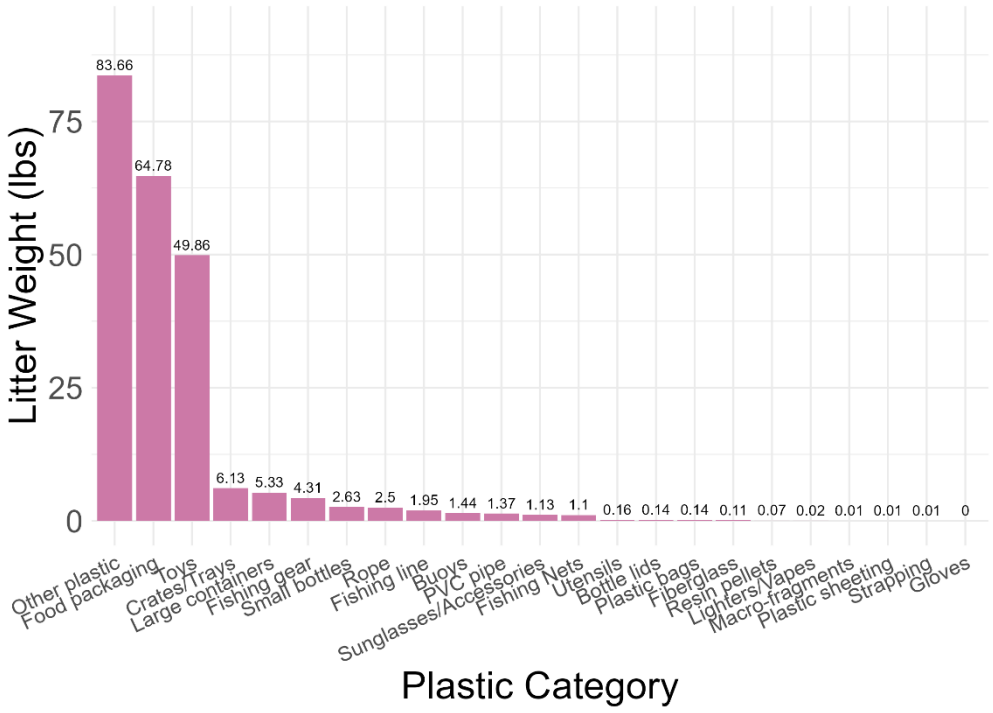

Figure 15: *Weight (lbs.) of plastic litter items collected from Donner Lake in 2024, categorized by type. Several large pieces of a broken dock removed during dive 11.1.DL24 accounted for the dominance of the "other plastic" category.*

Dive Breakdown

To date, twenty-four SCUBA dives have been completed as part of this project, covering approximately 3.5 miles of Donner Lake's shoreline (*Figure 5*). On average, each dive yielded 83±74 pounds of litter. The high standard deviation (74 pounds) highlights substantial variability in debris accumulation across different dive sites. This variability may reflect localized differences in litter deposition due to high-traffic recreational areas, shoreline activity, or environmental dynamics such as wind, wave action, and lakebed contours that redistribute litter over time. The average number of items collected during each dive was 63 ± 34. This range in item count further reinforces the spatial heterogeneity of submerged litter. It may also reflect operational constraints, including limited bottom time, particularly during deeper dives. Safety protocols in the 35-55 foot zone of Donner Lake reduce available collection time and diver capacity depending on the type of debris encountered and the equipment and effort required to safely remove it from depth.

Dives 1.1.DL24, 1.2.DL24, 10.1.DL24, and 11.1.DL24 yielded some of the highest litter weights and item counts, contributing significantly to the total debris removed during the project. Collectively, these four dives accounted for 47% of the total litter weight (
*Figure **16***) and 32% of total item count (*Figure 17)*. These dives are all located on the northwest and north shore of Donner Lake, near the public piers along Donner Pass Road (*Figure 5*). This is a popular area for recreational visitors and activity. Our previous work and litter collection from 2020 and 2022 also indicated that this area is a significant source of litter deposition in both the shallow (0-25 foot) and deep (35-55 foot) zones.

In contrast, many dives along the southern shore - including 4.1.DL24, 6.1.DL24, 8.1.DL24, 8.2.DL24, 12.1.DL24, and 13.2.DL24 - contributed less to the overall litter totals by both weight and count. Combined, these 6 dives contribute 25% of the total number of items removed, and only 8% of the total weight. These areas, situated near private homes and docks along South Shore Drive, may experience less public access and boat traffic, resulting in reduced litter input (*Figure 5*). Interestingly, dives 9.1.DL24 and 9.2.DL24 contributed only 5% of the total weight (24.7 lbs) and just 1% of the total item count (64 items), despite their proximity to the high-use area of West End Beach. Southwest winds, wave, and water movement may push litter from this area toward the northern shore or into deeper water which cannot be safely surveyed by dive teams.

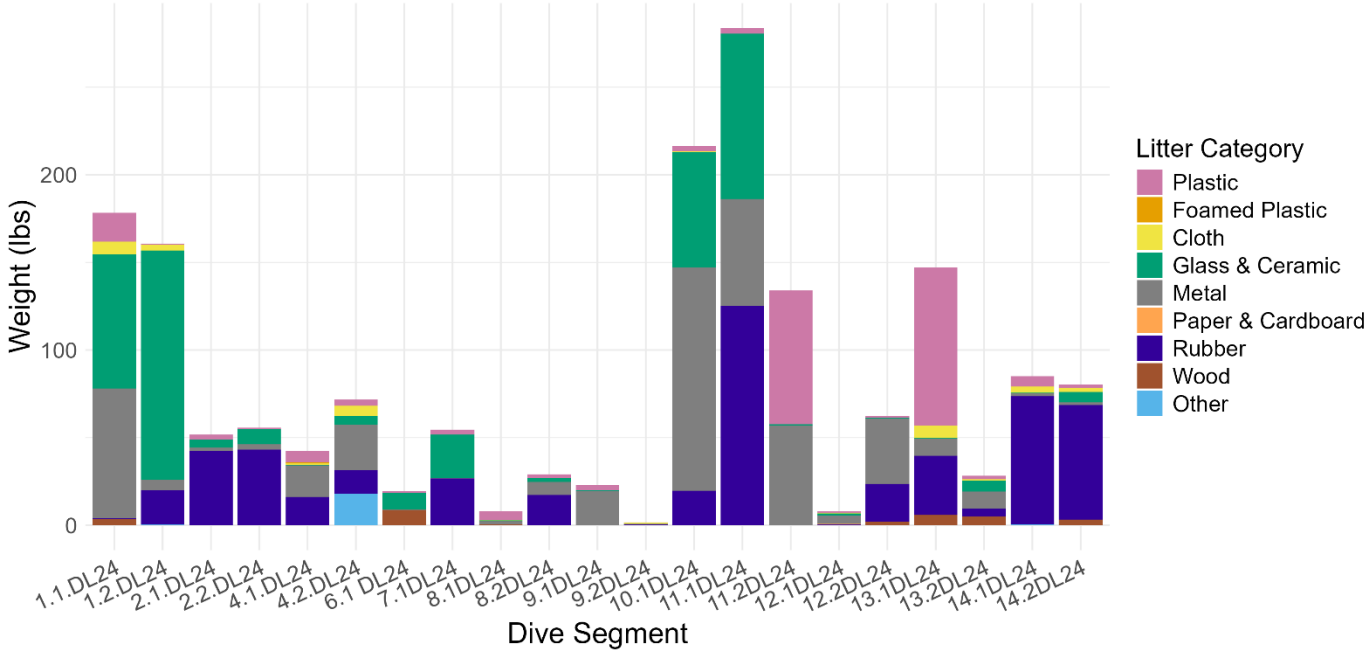

***Figure 16**: Weight (lbs.) of litter collected during each dive during the Donner Lake Deep Clean project through May 2025, categorized by material type. Each bar represents the total litter weight, with color-coded contributions from each litter category.*

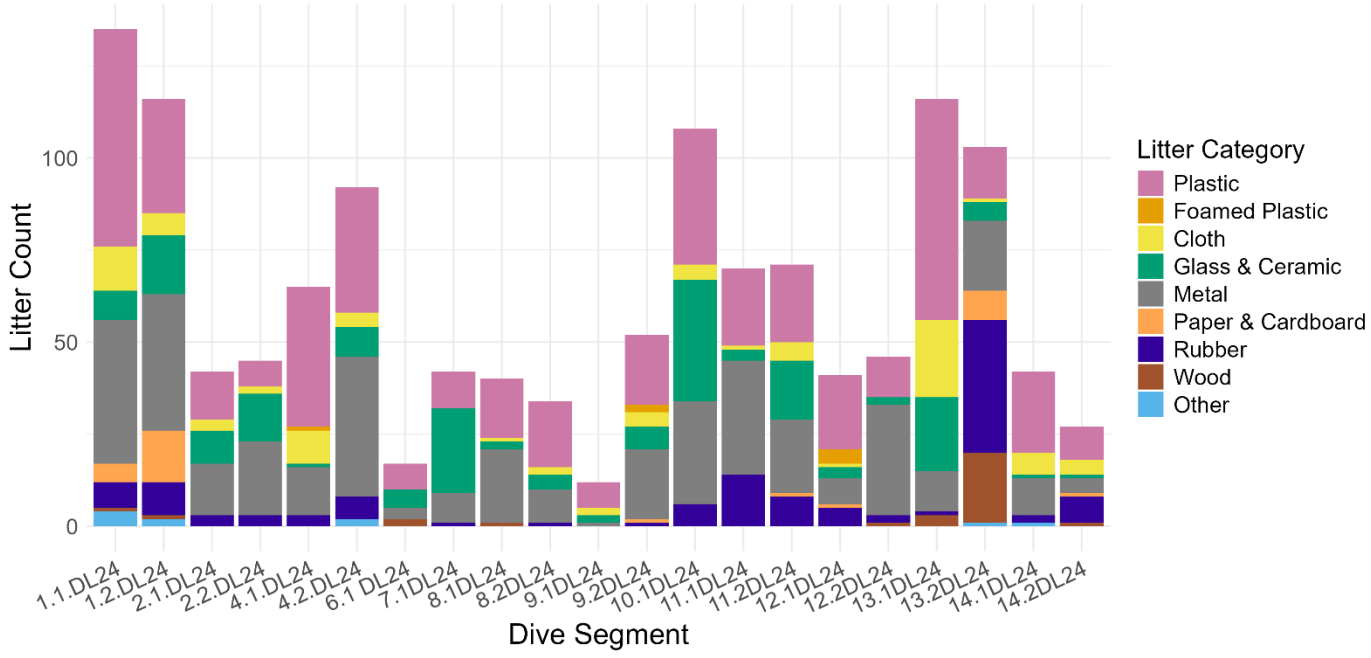

***Figure 17:** Count of litter items collected during each dive during the Donner Lake Deep Clean Project through May 2025, categorized by material type. Each bar represents the total number of litter items removed, with color-coded contributions from each litter category.*

Dive 11.1.LM24 yielded the highest amount of litter removed by weight, with a total of 284 pounds (*Figure 18*). However, it accounted for only 5% of the total number of litter items removed by count. Notably, divers recovered 14 tires during this dive, which alone made up 44% of the total weight collected at this location. This illustrates that when divers encounter large, heavy debris, they may remove fewer individual items, yet still remove a significant amount of litter from the underwater environment. It also demonstrates the importance of considering both item count and weight when assessing cleanup effectiveness.

Figure 18: *Lakebed litter retrieved from dive site 11.1.DL24.*

The dive with the highest number of items removed was dive 1.1.DL24 with a total of 135 pieces (*Figure 19).* It also accounted for 10% of the overall litter removed by both weight and count. While plastics made up the highest proportion of items collected during this dive by count (44%), they only contributed 9% of the total weight, indicating the presence of small lightweight plastic litter. In contrast, metal and glass & ceramic debris, though smaller in number (29% and 6% of total items, respectively), accounted for a combined 85% of the total litter weight removed during this dive. The image below shows the successful removal of a beach chair, several concrete block, and a variety of metal items including piping and rebar.

Figure 19: *Lakebed litter retrieved from dive site 1.1.DL24.*

Non-Collection Heavy Lift Litter Items

Divers on the Donner Lake Deep Dive project identified a total of twenty-one heavy lift items in the 35-55 foot zone (see table below). As mentioned in the methods section, these are defined as large or unwieldy debris that exceed safe removal protocols for routine dives. Removal of these items typically requires specialized equipment and additional safety protocols for divers and surface support teams. The heavy lift items were located across a range of depths, from as shallow as 6 feet (identified by surface support) to over 45 feet. Some items, such as illegal buoys and moorings close to shore, may be retrievable with minimal equipment and diver support. Others, items located at greater depths may require professional dive crews for safe removal.

Date	Dive	Depth (ft)	Description
8/30/2024	4.1.DL24	45	Cement bucket with plastic floating carton
12/4/2024	7.1.DL24	25	Engine block
12/6/2024	8.1.DL24	45	Oven *(Figure 20)*
12/6/2024	8.2.DL24	NA	Beach Chair
12/6/2024	8.1.DL24	36	Mooring with concrete block attached to plastic jug
12/6/2024	8.1.DL24	10	Illegal buoy close to shore
12/6/2024	8.2.DL24	NA	Mooring with nothing attached
12/10/2024	9.1.DL24	30	Cement block (pyramid shaped with flat top)
12/10/2024	9.1.DL24	29	Second cement block (pyramid shaped with flat top)
12/10/2024	9.2.DL24	44	Bucket with cement
1/15/2025	10.1.DL24	40-45	Two big illegal moorings
1/15/2025	10.1.DL24	6	Two 5 gallon buckets filled with concrete. Spotted from the jet ski.
1/21/2025	11.1.DL24	45	Boat, possibly a smaller race sailing dingy *(Figure 20)*
5/14/2025	12.1.DL24	NA	Canoe off public dock #27. *(Figure 20)*
5/14/2025	12.1.DL24	NA	Metal shaft & cylinder
5/14/2025	12.1.DL24	34	Plywood off dock #30.
5/14/2025	12.1.DL24	NA	Anchor
5/14/2025	12.1.DL24	NA	Scenic item only - large old-growth tree
5/14/2025	12.2.DL24	NA	Buoy/anchor
5/14/2025	12.2.DL24	NA	Large buoy
5/14/2025	12.2.DL24	NA	Wood lattice and frame

There was a notable concentration of heavy lift items along the northern shoreline, particularly in the vicinity of dives 10.1.DL24, 12.1.DL24, and 12.2.DL24. These dives also were high-yield litter dives, suggesting that these areas not only accumulate higher concentrations of debris but also have a significant amount of bulky and heavy items. Focusing future cleanup efforts in these areas would target some of the most significant concentrations of litter in onner Lake. Several heavy lift items were also documented along the southern shoreline, including an engine block (7.1.DL24) and an oven (8.1.DL24, ***Error! Reference source not found.***). While litter density may be lower in some southern areas compared to northern dive sites, large

debris still persists in the 35-55 foot zone and these areas should also be targets for continued cleanup efforts.

Figure 20: *Notable heavy lift items documented but not removed during the 2024 Deep Dive Cleanup. Left: Boat observed during dive 11.1.DL24. Upper right: Oven identified during dive 8.1.DL24. Lower right: Canoe located off public pier #27.*

This data provides a critical foundation for prioritizing future litter retrieval projects, particularly in areas where clusters of heavy debris, abandoned mooring structures, and other difficult-to-remove items exist. These findings highlight the need for collaboration with professional dive crews and surface support with heavy lift capabilities to ensure the safe removal of larger underwater objects. Our work in Donner Lake from 2020 to today presents a compelling case for organizing a dedicated Donner Lake Heavy Lift Cleanup. This project could focus on targeted removal of these heavy lift items utilizing lift bags, boats, and additional diver support to extract large-scale pollutants.

Diver-Identified Litter Hotspots

Cleanup divers also recorded the location of two litter hotspot areas within the 35–55 foot depth zone. These diver-identified hotspots are based on qualitative assessments of high concentrations of debris observed during a dive. In many cases, divers are only able to collect a portion of the litter present in these hotspots before needing to continue the planned dive segment. As such, these areas should be prioritized in the planning of future cleanup efforts.

The hotspots were located near dives 1.2.DL24 and 11.2.DL24, further highlighting the consistently high density of debris observed along the northern shoreline. This pattern aligns with other findings from the project, suggesting that this section of the lake accumulates

significant litter across both shallow and deep zones. The high debris density may be driven by increased recreational activity associated with nearby public piers and Donner Pass Road. Additionally, environmental conditions—such as prevailing southwest winds and wave action—may transport and concentrate floating litter along the northern shore, compounding accumulation over time.

Aquatic Invasive Species (AIS)

During the 2024 Deep Dive survey, two aquatic invasive species (AIS) were observed in Donner Lake: Asian clams (Corbicula fluminea) and Signal crayfish (likely Pacifastacus leniusculus). On dive 1.1.LM24, divers documented Asian clam shells scattered across an area roughly the size of a tennis court. On dive 4.1, divers noted both Asian clams and Signal crayfish, reinforcing previous findings of AIS presence in Donner Lake. Established populations of these species have a significant ecological impact. In large abundances, Asian clams can outcompete native benthic organisms, alter nutrient cycling, and interfere with water intake systems and other infrastructure. In addition, Signal crayfish, although common in Sierra Nevada lakes, are not native and are known to disrupt food webs, uproot aquatic vegetation, and displace native species, especially near subsurface structures and debris fields.

While populations of Asian clams and Signal crayfish have been well documented in Donner Lake, notably absent were other high-risk invasive species such as Eurasian milfoil, Curly-leaf pondweed, and New Zealand mudsnails. These species have been detected in nearby water bodies. This absence highlights the importance and effectiveness of ongoing public awareness and stewardship campaigns, particularly those promoting the Clean, Drain, Dry protocols. Continued monitoring, along with proactive education and community engagement, is crucial for preventing the introduction of new AIS and safeguarding the long-term ecological integrity of Donner Lake.

Litter Removal Challenges

Since the beginning, Donner Lake has been an area of critical interest for our organization. Our dedication to restoring the lake's ecosystem has driven us to explore new depths, both literally and figuratively. Each phase of our work at Donner Lake has pushed us to evolve – enhancing our operational strategies, deepening our dive expertise, and refining our cleanup protocols. Every new challenge in the underwater environment has helped us adapt, improve, and better fulfill our mission to protect aquatic ecosystems.

Our deep-dive circumnavigation of Donner Lake presented a unique set of challenges that demanded innovation and the development of new techniques. At 5,936 feet above sea level, Donner Lake requires specific conditions for high-altitude diving. Reduced atmospheric pressure at elevation affects how gases behave in both divers' bodies and equipment. As a result, dives beyond 30 feet must be treated as significantly deeper and pose an increased risk of decompression sickness. These altitude and depth specific risks required our teams to limit bottom time, increase surface intervals, and follow strict safety protocols. Even with the use of

Diver Propulsion Vehicles (DPVs) and enriched air nitrox (EANx), managing the effects of shortened dive durations remained a major hurdle. Deep cleanup efforts also required highly trained and certified dive teams, further limiting the number of personnel available for each dive day. Combined, these constraints significantly reduced how much ground we could cover in a single day.

Adding to the complexity of deep dives at altitude was the unexpected volume of submerged litter found in the 35–55 foot zone. The density of trash at these depths far exceeded our initial projections. On some dives, divers were physically unable to carry enough collection gear - such as collection bags, lift bags, and DSMBs - to accommodate the volume of litter in a single dive. In addition, a significant number of large debris items, including tires and anchors, were retrieved. These objects require more time, planning, and safety measures to remove properly during a dive.

Environmental conditions also influenced our progress. Deeper depths resulted in lower light levels and reduced visibility, slowing dive teams and requiring strict adherence to PADI protocols to maintain team contact and safety. Many of these dives were also conducted in the late fall and early spring. While this means divers are safer from recreational boaters and surface traffic, cold water temperatures shortened bottom time and led to occasional equipment issues, such as regulator free-flow.

These factors—altitude, gear capacity, limited visibility, cold temperatures, and diver safety—required us to adopt a more strategic and adaptive cleanup model, concentrating efforts in zones with the greatest environmental return. While a full circumnavigation of the lake remains the goal of this project in the upcoming months, recent dives have focused on high-impact areas identified through previous monitoring efforts. These locations were selected for their high concentration of debris, allowing our team to maximize impact within the constraints of safety and efficiency. Though the challenges tested our limits, each obstacle helped refine our protocols, improve our practices, and build a stronger foundation for more effective operations in the future.

Conclusions

The Donner Lake Deep Dive project marks a significant milestone in understanding and addressing litter accumulation in one of the Sierra Nevada's most important lakes. Donner Lake is valued not only for its ecological importance and recreational popularity, but also as a critical drinking water source for hundreds of thousands of people. When combined with previous years of monitoring, this project provides the most detailed picture to date of the types, sources, and distribution of underwater litter in Donner Lake. It also offers one of the most comprehensive surveys of underwater litter available for water bodies in the region. This depth of experience and knowledge empowers Clean Up the Lake to partner with the Town of Truckee, local non-profits, community organizations, and policymakers to drive informed, data-backed action to restore and protect Donner Lake for future generations.

Survey results confirm that litter accumulation remains a pressing concern across both shallow (0–25 feet) and deeper (35–55 feet) zones. In the deeper sections, single-use plastics, beverage containers, and fishing gear emerged as the most abundant types of litter. The wide variety and high abundance of these items highlight the complexity of managing litter deposition in Donner Lake. They also suggest a strong link between shoreline and boater recreation and the accumulation of litter underwater. These patterns underscore the need for continued cleanup efforts and a strategic focus on prevention through educational programs and infrastructure development. In addition to signage already installed at public piers, a "Pack In, Pack Out" campaign tailored to shoreline users—especially day-use visitors and anglers—could promote responsible waste management. Providing trash bags, designated disposal locations for fishing-related litter, and recycling options for single-use beverage containers could further reinforce this message and help reduce future litter accumulation.

Equally important was the identification of a significant number of larger litter items. These included tires and construction materials, which were removed from the lake, as well as abandoned mooring buoys, boats, and other heavy-lift debris that were marked for future cleanup efforts. These findings raise concerns about illegal dumping and unauthorized mooring activity throughout the lake. The management of large, heavy debris discovered during this project could benefit from local tire disposal and recycling initiatives. Local agencies and waste management providers could play a key role in encouraging the responsible recovery and disposal of materials such as tires and construction waste. The removal of heavy lift items should also be a focus of future cleanup operations, supported by experienced dive teams, enhanced safety protocols, and surface support equipped to handle large-scale debris removal.

At the same time, public education and aquatic invasive species (AIS) monitoring should remain key priorities. We recommend the installation of updated Clean, Drain, Dry signage at key public access points. This could be paired with community outreach to educate lake users on how to prevent the introduction and spread of invasive species. Collaborations with regional AIS task forces and advocacy for a CD3 cleaning station at the Donner Lake boat launch would

further support these prevention efforts by offering boaters the tools and information needed to decontaminate vessels properly.

Looking ahead, continued annual survey dives would be highly valuable for assessing long-term trends in litter accumulation, composition, and aquatic invasive species (AIS) presence in Donner Lake. These monitoring efforts could focus on areas of known high litter density or sites with significant numbers of large debris, helping to track changes over time. The data collected would not only guide more efficient and informed cleanup strategies, but also serve as a powerful tool for public engagement. Sharing these findings through public reports, press coverage, and community events ensures that the broader community remains informed and invested in the ongoing efforts to protect Donner Lake.

It's important to recognize that the litter being removed is the legacy of decades of recreational use in the area. These underwater cleanup efforts are the results of only three years, but they represent a critical shift toward prioritizing the removal of past pollution and the prevention of future degradation. Clean Up the Lake remains committed to completing a full deep-dive circumnavigation of Donner Lake. Future dive operations will focus on currently unassessed zones, particularly areas where high densities of litter were found at shallower depths. By targeting these regions, we aim to expand the impact of our research and gain deeper insight into Donner Lake's underwater ecosystem. Building on this foundation, we can develop comprehensive education and management strategies to reduce litter accumulation and preserve Donner Lake as a clean, healthy resource for generations to come.