Responsible Manufacturing, Construction, and Deployment of Plastic Habitat

Freshwater fish habitat declines as water bodies age due to the cumulative ecological processes of increased sedimentation, nutrient buildup, and decay of submerged wood and other plant materials. As this process occurs, habitat restoration has emerged as an essential and popular fisheries management strategy to reinvigorate aging fisheries. Artificial habitats offer a promising approach in many systems to counteract decline, with plastic structures emerging as a solution.

Plastics resist natural decay and are impervious to the forces that degrade traditional materials like wood. Their longevity ensures the structures endure in dynamic environments, providing lasting support for aquatic life. Additionally, their lightweight and adaptable properties enable efficient transport and deployment, making them a practical choice for both small- and large-scale habitat restoration efforts. When sourced from recycled materials, plastic habitats also present an opportunity to repurpose waste, simultaneously addressing ecological and environmental challenges.

Despite the growing popularity of plastic artificial fish habitats, the field lacks standardization. Clear guidelines for manufacturing, ecological compatibility, and on-site assembly are essential to maximize their benefits while ensuring environmental safety. Establishing these standards is critical to safely scaling up the use of plastic habitats and unlocking their full potential to restore, sustain, and enhance freshwater ecosystems.

Avoidance of Toxic Additives

One of the primary concerns when using plastic in freshwater habitats is the potential leaching of toxic additives or chemicals into the water. Compounds such as phthalates, heavy metals, and certain stabilizers can negatively impact water quality and harm aquatic life. To mitigate these risks, materials should be chosen based on their safety and environmental compliance certification. The NSF/ANSI 61 certification addresses concerns regarding the safety assessment of plastic used for potable water. Additionally, selecting plastics that do not require a Proposition 65 (Prop 65) warning is vital. Prop 65 is a regulatory framework in California that identifies substances

known to the State of California to cause cancer, birth defects, or reproductive harm. Plastics that are certified free of Prop 65-listed chemicals are considered safe for use in sensitive environments. Manufacturers can ensure compliance by sourcing materials with verified safety data sheets (SDS) and certifications attesting to the absence of harmful substances.

Durability Considerations

In addition to ecological safety, the long-term success of artificial habitats depends on their durability. With growing concerns regarding the impacts on human health from microplastics (small pieces of plastic less than 5 millimeters in length), the structural integrity and, therefore, longevity of habitat materials must be a priority. Two critical factors in material performance are UV stability and abrasion resistance.

UV Stability: Exposure to sunlight can cause many plastics to degrade over time, resulting in brittleness, fading, or loss of structural integrity. UV-stabilized plastics, which incorporate additives such as hindered amine light stabilizers (HALS) or UV-absorbing pigments, are designed to resist photodegradation. This property is significant for habitats deployed in shallow waters or areas with considerable sun exposure, ensuring their effectiveness and longevity. UV stabilizers should be avoided if the goal of the artificial habitat is to promote the growth of aquatic organisms on the material's surface. Stabilizers may also not be necessary if structures are deployed at an adequate depth to avoid UV exposure.

Abrasion Resistance: Freshwater habitats often encounter mechanical wear from sediment movement, flowing water, wave action, and human interactions. Specially engineered thermoplastics offer high abrasion resistance. These plastics maintain their surface integrity and structural strength even under harsh conditions, making them well-suited for environments with high friction or turbulence. Additionally, the deployment depth and location of the habitat can mitigate the potential for mechanical breakdowns. Sites should be selected considering boat traffic, water flow, and wave action. Placement in areas such as coves or on the slopes of a secondary point may provide protective refuge not available in the main channel, on shallow flats, or in high-traffic areas.

Virgin, Recycled, and Reclaimed Plastic

When selecting plastics, it is crucial to consider sustainability and safety. Prioritize using recycled or reclaimed plastics to reduce the demand for virgin materials, conserve resources, and minimize environmental impact. However, when working with reclaimed plastics, it is essential to thoroughly understand their prior usage to assess potential contaminants or compromises in material integrity. This ensures that reclaimed materials are safe and suitable for their intended applications, striking a balance between environmental responsibility and functionality. Both recycled and reclaimed plastics offer the opportunity to close the loop on plastic waste, with recycled plastic minimizing the risk of unknown previous use.

Processes

Stringent quality control measures throughout manufacturing, packaging, construction, and deployment should ensure that no substandard materials enter ecosystems. Manufacturing artificial habitats requires a meticulous approach to minimize environmental impact, particularly regarding material waste and preventing "passenger plastics"- unintended plastic fragments that can degrade into microplastics. The cutting and shaping processes should be optimized for minimal waste. Any off-cuts and defective products should be recaptured and recycled. Additionally, suppose products are to be scarified or textured to encourage the colonization of aquatic organisms. In that case, the resulting product must once again be cleaned before packaging or construction to ensure the removal of all “passenger plastic”.

Once located within the watershed, the onsite construction element of artificial habitat offers a final opportunity to prevent the unintended introduction of “passenger plastics” into the environment. Using ground cover (such as tarps or sheeting), minimizing onsite alterations, and recapturing plastic waste ensures that the artificial habitat enters the system as clean as possible.

Proper anchoring and deployment of artificial habitats are crucial to ensuring their stability, functionality, and longevity. The anchoring system must use appropriate weights and durable materials to securely hold the habitat, preventing displacement

caused by mechanical wave action, wind, or boat traffic. The deployment depth should be carefully chosen to avoid high-energy zones where such forces are most potent while also considering seasonal water level fluctuations and potential drawdowns to ensure the habitat remains effective and accessible. Flexibility in project design should allow for adjustments to accommodate changes, maintaining habitat benefits across varying conditions. Additionally, it is essential to plan for the reclamation of the habitat, incorporating features that enable safe and efficient removal of structures if they become damaged, obsolete, or need relocation, thereby preventing debris accumulation and preserving the integrity of the aquatic ecosystem.

Summary Review

The restoration of freshwater fish habitats using plastic structures offers a practical and innovative approach to countering the ecological decline of aging water bodies. Plastics provide durability, adaptability, and sustainability through their long-lasting properties and potential for recycling. Ensuring the safety and effectiveness of these habitats requires a careful selection of materials, with an understanding of toxic additive leaching, UV degradation, abrasion resistance, and the use of recycled materials. Adopting best management practices that include stringent manufacturing standards, waste plastic recapture, and thoughtful deployment practices will be essential to fully realize the potential of plastic fish habitat while safeguarding environmental integrity.

For further information on habitat best management practices in reservoirs in general, refer to Best Management Practices Manual - Friends of Reservoirs

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Standardized Questionnaire for Artificial Habitat Manufacturers	
Are the plastic types of all materials known? (PVC, HDPE, LDPE, Other)	
Do you review the plastic supplier's ingredients and additives through an SDS sheet?	
Does the plastic contain plasticizers or have potentially toxic coatings?	
Does the product carry a Prop 65 Warning?	
Is the material recycled or reclaimed?	
If recycled or reclaimed, is the previous use known?	
Do you recapture drill cuts and skeleton plastic?	
Is your product cleaned before shipping?	
Are your products packaged to minimize waste?	
Are tools required to build your product on-site?	
Will the product need to be altered before deployment?	

Standardized Questionnaire for Internal Review of Projects	
Is the planned habitat commercially manufactured?	
If YES, is it manufactured according to the above-recommended guidelines?	
If NO, is the planned habitat homemade using plastic?	
Are the plastic types of all materials known? (PVC, HDPE, LDPE, Other)	
Does each plastic component of the habitat have an NSF/ANSI 61 certification stamp?	
Does the plastic contain plasticizers or have potentially toxic coatings?	
Are the plastic materials recycled or reclaimed?	
If the material is recycled or reclaimed, is the previous use known?	
Will you recapture drill cuts and skeleton plastic?	
Will glues or adhesives be used?	
Will the habitat be built within the watershed?	
Will a tarp or ground covering be used at the build site?	
Is the habitat cleaned before deployment?	
Does the water body experience drawdowns or drought?	
Do we have a current hydrographic map of the water body to determine optimum locations?	
Have sites been selected to avoid mechanical wear?	

Commitment to Review and Adopt

Below is a list of reviewers who have committed to following or implementing the standards. Manufacturers have provided SDS sheets and a review of their manufacturing process to the authors and are committed to providing the same to your organization.

If you would like to add your name to the list below as an official reviewer and adopter, please contact the author above.

Commercial Manufacturers Who Have Committed to Adopt

MossBack Fish Habitat - David King, President/Owner
Submit SDS request to Tracey Rosenau at tracey@mossbackfishhabitat.com

Pond King Inc. - Brad Metzler, President/Owner
Submit SDS request to Jill Roush at marketing@pondking.com

Texas Hunter Products - Cody Borgfeld
Submit SDS request to cody@texashunterproducts.com