

## Appendix 3: Environmental Enrichment for Aquatic Species

### Introduction

A major objective of the NIH Intramural Research Program (IRP) Animal Care and Use Program is to promote the humane care and use of animals in biomedical research. *The Guide for the Care and Use of Laboratory Animals* (1) (*Guide*), promotes the humane care and use of laboratory aquatic animals and strives to enhance aquatic animal well-being, the quality of research, and the advancement of scientific knowledge that is relevant to both humans and aquatic animals.

Individual ICs housing aquatic species should establish environmental enrichment programs for aquatic species that are consistent with their research needs. Whenever possible, social housing for social species should be employed as a default enrichment option. Prior to the introduction of any foreign objects within the primary enclosure, a risk assessment should be completed to identify potential hazards into the aquatic system. All enrichment products must be approved by the Lead aquatic facility IC to ensure proper risk assessment testing.

### Environmental Enrichment Strategies

For the purpose of this document, the environment is defined as, “the primary enclosure (tank, holding water and the animal)” which defines the limits of an animal’s immediate environment. Enrichment is defined as, “alterations in the environment to promote adaptability and good welfare (3).” The *Guide* states that animal programs should address the behavioral, physiological, and physical needs of the species, stocks, or strains of animals held in the laboratory and, “when used, enrichment should elicit species-appropriate behaviors and be evaluated for safety and utility.”

Therefore, the end goal of enrichment is to provide the aquatic animals with the option and ability to engage in species typical behaviors and promote psychological well-being through the use of social, physical, sensory, dietary, and occupational activity-based opportunities (4). A successful enrichment program considers all aspects of a species’ natural behavior, including social organization, foraging behavior, and daily activity of the animal (5, 6). When ICs are establishing their enrichment program (Table 1), a risk assessment on items introduced into the primary enclosure and aquatic system should be completed to identify potential hazards, such as chemical leaching or pathogen introduction into the aquatic system. An aquatic enrichment program may include housing animals in social groups, housing animals with structural or activity-based cage supplementations, or both (see Table 1).

Table 1: Five Categories of Environmental Enrichment for Aquatic Species (7-10)

Social	Physical	Sensory
<ul style="list-style-type: none"> <li>- Default housing in the NIH IRP</li> <li>- Establish social hierarchies</li> <li>- Display species-specific behaviors</li> </ul>	<ul style="list-style-type: none"> <li>- Structure (plants, lily pads)</li> <li>- Physical habitat (hide tube, tunnel)</li> <li>- Air stones</li> <li>- Water quality</li> <li>- Tank size (space for frogs)</li> </ul>	<ul style="list-style-type: none"> <li>- Visual (conspecifics in other tanks, gravel)</li> <li>- Light cycle (dusk/dawn simulation)</li> <li>- Cognitive (feeding schedule)</li> <li>- Tinting of tanks, opaque flooring</li> <li>- Mirrors or images</li> </ul>
Dietary	Occupational	
<ul style="list-style-type: none"> <li>- Live prey, such as <i>Artemia</i> spp., rotifers, blood worms</li> <li>- Frequency of feeding</li> </ul>	<ul style="list-style-type: none"> <li>- Optional access to water flow</li> <li>- Novel exploration</li> <li>- Mazes and shuttleboxes</li> </ul>	

## **Summary**

The aquatic environmental enrichment programs will vary based on species and research needs therefore each program should continually evaluate their program to ensure that it meets the species, research needs and allows for effective care.

This guidance serves as a source to help ICs establish an environmental enrichment program for aquatic animals to include zebrafish and *Xenopus spp.* (2)

## **References**

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