Issue 04
April 2012
Division of Technical Resources
Office of Research Facilities
National Institutes of Health
Technical News BULLETIN

Part IV: Aquatic Facilities NEW in 'The Guide' 8th Edition

Overview

Chapter 3 of the 2010 Guide addresses aquatic species for the first time. The environmental housing needs for aquatics are described. Aquatic species include fish, amphibians and reptiles. Each has unique housing needs because they have limited ability to maintain their core temperature. The micro/macro environments are important when designing aquatic facilities. The micro-environment can be affected by the design of the primary enclosure and macro-environmental conditions. The micro-environment (tank, raceway, or pond) is characterized by water quality, illumination, noise, vibration, and temperature. Macro-environment is the physical environment of the secondary enclosure such as a room.

Critical Aquatic Design Considerations

- **Water Quality** – Characteristics of the water that may affect its appropriateness include temperature, pH, alkalinity, nitrogen waste products (ammonia, nitrite, and nitrate), phosphorus, chlorine/bromine, ion and metal content, oxidation-reduction potential, dissolved oxygen conductivity/salinity, total gas pressure, hardness (osmolality/dissolved minerals) and the established microbial ecology of the tank. Standards for acceptable water quality must be identified with the program prior to facility design.

- **Life Support System -** Physical structure used to contain the water, animals as well as the ancillary equipment used to move and/or treat the water; water source; Recirculating systems are common in research facilities and may contain pumps, filtration, skimmers, components to aerate and/ or degas, and to heat or cool as well as dosing systems to maintain pH and conductivity

- **Illumination-** Aquatic species are often sensitive to changes in photo-period, light intensity, and wavelength. Gradual changes in room light intensity are recommended. Some aquatic species may need full-spectrum lighting and/or heat lamps to provide supplemental heating to facilitate adequate physiological function.

- **Temperature and Humidity-** HVAC systems must be designed to compensate for the thermal and moisture loads that result from the volume of water contained in the space. Control of excessive moisture that may result in condensation on walls, ceilings, and tank lids. Excessive moisture can lead to microbial growth and source of contamination or create a conducive environment for metal corrosion. In a dry environment, evaporation rates may be higher, potentially requiring the addition of large quantities of water to the system and monitoring for increases in salinity/conductivity, contaminants, or other water quality aberrations.

- **Ventilation** - Room air exchange rates are typically governed by thermal and moisture loads. The micro-environmental air quality may affect water quality; volatile organic compounds and ammonia may dissolve in tank water and affect animal health. As the aerosolization of water can lead to the spread of aquatic animal pathogens within or throughout an aquatic animal facility, this process should be minimized as much as possible.

- **Noise and Vibration -** Aquatic species may be sensitive to noise and vibration, which are readily transmitted through water. Minimize vibration through floors by using isolation pads under aquaria racks. Major components of the life support system should be placed outside animal rooms as much as possible to reduce vibration and noise and facilitate maintenance.

- **Waste Disposal-** Wastewater treatment and disposal must be considered based on water volume, quality and chemical constituents.

- **Sanitation of Aquatic Environment –**The life support system, should be designed to process the bio-load and maintain nitrogenous wastes within an acceptable range. Solids may be removed by siphoning and/or filtration. Filters need routine cleaning or replacement or, if self-cleaning, proper maintenance; Reducing organic solids limits the quantities of nitrogen and phosphorus that need to be removed from the system. Nitrate, is removed through water changes, Disinfection is accomplished through water treatment (e.g., filtration and application of UV light or ozone) and/or water changes. Chlorine and most chemical disinfectants are inappropriate for aquatic systems. Limiting algal growth is important for viewing of the animals.

Detailed Aquatic Facility Design will be addressed in a future bulletin series.

References & Resources:

Brenner FJ, Brenner PE. 1969. The influence of light and temperature on body fat and reproductive conditions of *Rana pipiens*. Ohio J Sci 69:305-312.

Guide for the Care and Use of Laboratory Animals: Eighth Edition
http://www.nap.edu/catalog/12910.html

Koerber AS, Kalishman J. 2009. Preparing for a semi-annual IACUC inspection of a satellite zebrafish (*Danio rerio*) facility. JAALAS 48:65-75.

Pough FH. 1991. Recommendations for the care of amphibians and reptiles in academic institutions. ILAR J 33:1-16.

Roberts-Thomson A, Barnes A, Filder DS, Lester RJG, Adlard RD. 2006. Aerosol dispersal of the fish pathogen *Amyloodinium ocellatum*. Aquaculture 257:118-123.

St. Claire MB, Kennett MJ, Thomas ML, Daly JW. 2005. The husbandry and care of dendrobatid frogs. Contemp Top Lab Anim Sci 44:8-14.

Wooster GA, Bowser PR. 2007. The aerobiological pathway of a fish pathogen: Survival and disseminaton of *Aeromonas salmonicida* in aerosols and its implications in fish health management. J World Aquacul Soc 27:7-14.

Yanong RPE. 2003. Fish health management considerations in recirculating aquaculture systems, part 2: Pathogens. IFAS, University of Florida.