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Title: Husbandry Care for Salamanders

I. Purpose:

The purpose of this policy is to outline the minimum standards of care for Salamanders.

II. Policy:

All departments providing care for salamanders must meet or exceed these minimum requirements which are based on the Public Health Service Policy, and the ILAR ***Guide for the Care and Use of Laboratory Animals***.

III. Procedure:

All facilities housing Tiger Salamanders, must follow the conditions specified in the UCD's California Department of Fish and Game Permit to import, transport, or possess Research Detrimental Species (Permit # 537) For example water being drained from tanks housing tiger salamanders must be screened or treated to prevent escape of tiger salamanders and release of reproductive material. A copy of this permit must be posted near or on the Vivarium door.

Daily Procedures: **(365 days a year without exception)**
Rinse tanks or as needed based on cleanliness and disinfect nets after each use. Check room temperature 65-70º F (18-21º C) as well as water temperature if the salamanders are housed in standing or drip through water tanks. Temperatures may be adjusted as needed to emulate natural seasonal temperature variations. Observe each animal and check for health issues. Signs to look for include red (or other) discoloration of the skin, failure to feed properly (or weight loss), open cuts or abrasions, bloating, and lethargy. Contact Campus Veterinary Services to report sick salamanders. Check that each tank has individual identification and the total salamander count, and adjust posted salamander count as needed. Record deaths and euthanasia on the room log sheet. Document the room activities on room log sheet (feeding, animal number, room temperature).

Weekly Procedures:
Feed should be based on manufacturer's recommendations. This can range from daily to 2 times per week, depending on the type of food offered. Wash tanks, containers and standing water bowls weekly (or more frequently as needed- it is suggested that static tanks should be cleaned twice a week). Check and record water quality, pH (6.5-7.5) and conductivity (500-2500 µS). If water quality values are out of the normal range contact your supervisor or PI to correct the issue. Document tank checks on room log sheet.

Suggested water quality should be kept in the following ranges for optimal growth and maintenance:

- *175-300 mg/L Hardness ($CaCO_3$)*
- *50-200 mg/L Alkalinity ($CaCO_3$)*
- *> 7 mg/L Dissolved Oxygen*
- *< 0.02 mg/L Ammonia (NH_3)*
- *< 0.5 mg/L Nitrite (NO_2-N)*
- *< 50 mg/L Nitrate (NO_3-N)*

Standing water tanks:
Transfer salamanders to a clean tank containing water as described in water quality section. Use dedicated nets and accessories to that specific tank. Drain the water from the dirty tank.
If the tank is hand cleaned, use a clean sponge or brush to aid in removing deposited debri. For disinfection, food grade hypochlorite, (e.g. 'Klorite') at 200ml/70L (0.28% solution), 3-10% bleach or Betadine scrub should be used. It is critical that the tanks are thoroughly rinsed clean of any residual chemical before placing salamanders into the tank.

Drip Through water tanks:
Clean tanks in place with a brush to remove mild algae accumulation on an "as needed" schedule. For heavily soiled cages, transfer the salamander to a clean tank. Stop water flow to that specific tank and remove the tank from the system.

Biweekly Procedures:
Sweep/squeegee floors to remove dust, dirt, and excess water. Wipe down shelves used for housing when containers are removed for washing. Follow the UCD House Keeping Policy.

Monthly Procedures:
Disinfect and sanitize shelves/racks and scrub brushes, sponges, enrichment devices, holding containers, and floors.

Identification: Each tank or holding container should be individually identified and have total salamander count.

Environmental Enrichment: All salamanders should be provided with a refuge or wet pad as an environmental enrichment. Other forms of enrichment are acceptable as long as they are non-porous, do not harm the salamanders, and can be cleaned and disinfected.

Facilities & Monitoring:
Floors should be moisture-resistant, nonabsorbent, impact-resistant, and relatively smooth. Tanks may not be directly housed on the floor. Walls should be moisture resistant and have GFI electrical outlets that are properly positioned to eliminate possible safety hazards.

Temperature, Humidity and Illumination:
Heating and air in salamander rooms should be controlled in a manner that supports species specific needs. Room temperatures should typical be maintained between 65-70º F (18-21º C), but the temperature may vary when mimicking seasonal variation is required, for example for

breeding. Room temperature should be recorded on a room log sheet and close to the temperature of the tank water to prevent having to adjust tank water temperatures as a result of fluctuations in room temperatures. Humidity at the room level does not directly impact salamanders however high levels of humidity can be detrimental to electronic equipment. Regular monitoring of the HVAC system is important and is best performed at the room level. Illumination schedules should be limited to a duration that will not compromise the well-being of the species being housed. UV lighting is not required, but a regular light-dark cycle mimicking that of the salamanders' native geographic area should be maintained using incandescent lighting, preferably controlled by a timer.

Caging:

Holding containers or tanks should be constructed of non-porous material that can be cleaned and disinfected regularly and allow for daily observation of the animals. Holding containers or tanks should provide a safe environment and not be constructed of materials that may cause injury to the salamanders. Primary enclosures should meet the general needs of individually or group housed amphibians based on species needs, behavior, and goals of the study. The volume of water provided should be based on the size of the larva. Post hatching larva should be kept in approximately 3oz of water for the first 2 weeks, and then moved to adult size containers. Filtration is not required if water changes are frequent enough to limit the accumulation of ammonia. The cages of tiger salamanders require more frequent cleaning because of the amount of waste produced. Water offered should be dechlorinated and chloramine free water, or charcoal filtered modified Holtfreter's solution. Adult size and older salamanders should not be housed with smaller salamanders.

Feeding:

Tiger salamanders have a healthy appetite, and should not be overfed as they will become obese. Larva can be fed aquatic invertebrates such as Daphnia and brine shrimp, insects, small fish, and worms. Adults can be fed a selection of feeder insects such as crickets, earthworms, and wax worms, a selection of wild caught insects as long as the area from which these are collected is not sprayed with pesticides. Live food sources need to be maintained and managed to ensure steady supply and the health and suitability of the organism being used as a food source.

References:

1. **American Association for Laboratory Animal Science.** Animal Care and Use Courses. Aquatic Animal Husbandry and Management. https://www.aalas.org/
2. **Institute for Laboratory Animal Resources.** 1974. Amphibians. *In*: Guidelines for the breeding, care and management of laboratory animals. National Academy of Sciences, Washington, D.C.
3. **Institute for Laboratory Animal Resources.** 1991. Recommendations for the care of amphibians and reptiles in academic institutions. National Academy of Sciences, Washington, D.C.
4. **Scientists Center for Animal Welfare.** 1992. The care and use of amphibians, reptiles, and fish in research. Schaeffer, D. O., K. M. Kleinow, L. Krulisch (eds.). Scientists Center for Animal Welfare, Greenbelt, MD.
5. **American Society of Ichthyologists and Herpetologists, American Fisheries Society, American Institute of Fisheries Research Biologists.** 1987. Guidelines for the use of fishes in field research. Fish. J. 13(2):1-14.