# Pet Amphibian Keeping in Central Europe: Underestimated Contagious Hobby

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#### Introduction:

Nursing pet animals is an organisation of one's leisure time with a continually increasing social impact in Western societies. Because of space cramping and time famine mammalian keeping is deemphasising, whereas the creation of ornamental aquaria or aquaterraria is constantly gaining prestige. More than 12 million households in the USA harbour an aquarium, and you will find amphibians or reptiles as companions in more than one million German families and in about 100.000 Austrian ones. Although I estimate that pet reptiles are about five times more frequent than pet amphibians, dwarf clawed frogs (Hymenochirus sp.) and axolotls (*Ambystoma mexicanum*) are common ornamental aquaria stockings, and frogs, toads, newts, and salamanders are favourite pets of terrarium freaks.

For a long time salmonellae are well known as health hazard of amphibian pets to man, 21% of aquarium-housed clawed frogs may excrete Salmonella species threatening human health. But, apart from mentioning *Mycobacterium marinum* and Chlamydia as health harassments, and the statement of an unknown origin of 28% of the cases of human salmonellosis, no data are available about the risk of an acquisition of an infectious disease from pet amphibians during transport, care, and breeding of the specimens. Our interest is focused on the question of the emergence of pathogens within the interface between pet and fodder animals, man, and equipment.

#### **Problem:**

Housing captive amphibians usually span a few types of animal husbandry only: due to their biology amphibians are mostly unsuitable for thrilling public exhibitions and for conservation breeding for re-naturalisation.



Pet amphibian keeping usually is a long standing maintenance process for a minor number of ornamental aquaterraria per site. Few individuals of a small, selected number of feasible amphibian species housing in a few tanks, most of them overaged and overmedicated, show-pieces provided with sympathy, mostly fed on diligently gathered insects, worms, and snails - nutriments appropriate for the species - are typical inmates of this type of amphibian keeping.

Sometimes amphibians are bred on a grand scale, either for the satisfaction of pet market needs or for food. Lots of individuals of only one amphibian species, densely packed, nursed in numerous bare aquaria or terraria, due to efficiency considerations being in their best of health and accurately hygienic monitored, efficiently fed up with industrially produced forage - frequently inappropriate for the species - are archetypic for this type of amphibian breeding.

### The paradigm: *Weeksella virosa*





Bacteria of the species Weeksella virosa are non-saccharolytic, oxidase- and catalase-positive, non-motile, non-sporulating, gram negative, plump rods of about 0.5 x 1 µm in size. They are common, ubiquitous environmental inhabitants of soil, water, and sewage, but they are also usually harmlessly colonising the skin and the intestine of vertebrates. In some cases, frequently associated with an immunodeficiency of the host of undiscernible origin or after traumas, these bacteria become virulent and may cause pneumonia, meningitis, peritonitis, purulent inflammation foci (see left), and sepsis in man as well as in other vertebrates, even in cold-blooded ones. Perchance they may cause or at least irritate by colonising a neoplasm in a neotropical tree frog (Hyla crepitans) living close to heavily polluted water (see left).

Aeromonas and Pseudomonas, a very closely related bacterium, are known to cause a fatal opportunistic infection in frogs, the red leg disease, and to cause severe opportunistic infections in man also. The role of pet frogs as an allocator or as an acceptor of these bacteria is unknown.

#### **Preliminaries:**

The natural habitat of pathogens in case of keeping captive amphibians is composed of four partitions: amphibium, human caretaker, fodder animals, and the inanimate environment; that covers all things not existing without amphibian husbandry or used elsewise. A fifth partition, an introducing vector or an obligatory secondary host, is usually not available in aquaria or terraria. This circumstance eliminates all infectious diseases whose causing



agents depend on such hosts during the

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These unequal ecological niches are populated by diverse spectra of pathogens, mostly ubiquitous, and frequent opportunists with a wide host range.

#### Material, Methods & Discussion:

Between 1998 and 2005 77 faeces samples and 2 corpses of amphibians living either in a vivarium or in households, 50 water samples and 98 swap samples of amphibian populated aquaterraria were analysed for the occurrence of parasite stages, enterobacteria, mycobacteria, and pathogenic fungi applying standard microbiological identification procedures. Our findings were compared and amended with data of other authors.

Changes in human behaviour and social structure have open up new ecological niches for the emergence of novel infectious diseases. Close gathering between man and pet amphibians is such an anthropogenic change to habitats that increases the flow of pathogens, creates new infection routes, and thereby fosters disease emergence in man. Pet amphibian husbandry leads to the formation of a niche in which well-known, but rare infectious diseases increase in incidence (e.g. exotic salmonellosis) or diseases will move into a new host population (e.g. MOTTs). Although until now no newly evolved pathogens have been detected, captive amphibians may very well – at least quantitatively - be affected by infectious diseases not found in free-living populations (e.g. infections with Mycobacterium ulcerans). As few captive amphibians are fed on rodents, mammalian parasites play an underpart only. Essential pathogens potentially threatening human health in the course of pet amphibian keeping are therefore found in the taxa Pseudomonadaceae, Enterobacteriaceae, atypical Mycobacteriaceae, and - maybe - free-living amoebas also (Tab.1). All these pathogens are common, ubiquitous, and more or less facultative infectious agents.

#### Resumé:

Although pet animal keeping is regarded as important contribution to quality of human life and well-being, and serious pet amphibian husbandry has the reputation of a hygienic harmless, but academic profound screwiness, this leisure activity creates a new, previously unknown ecological niche for emerging infectious diseases. Some of these maladies may even threaten human health, thus foiling the positive emotional and social effects of pet keeping. In connection with amphibian husbandry Pseudomonades, Enterobacteria, atypical Mycobacteria, and free-living, potentially pathogenic amoebas were identified as probable pathogens of emerging infectious diseases; all causative organisms are common, ubiquitous, and most of them facultative infectious pathogens. Particularly senior and immunodeficient amphibian keepers should be aware of the health hazards originating in their hobby, and live amphibians are no toys for children. amphibians' adaptation phase to captivity (quarantine) already. In addition, mere amphibian diseases are usually eliminated after a little while of husbandry due to care procedures and artificial epidemiological effects.

Only pathogens subsisting in subareas 1 (mutual contact zone), 2 (biofilms), and 3 (subsequent zoonosis area) are subjects of our interest.

#### **Results:**

Tab. 1 Pathogens potentially threatening human `s health during pet amphibian keeping.

species	denomination	sub- area	human disease	animal host taxon
Aeromonas hydrophila	Pseudomonadaceae	1	systemic infections	amphibians
Pseudomonas aeruginosa	Pseudomonadaceae	1	enteritis, systemic infections	amphibians
Weeksella virosa	Pseudomonadaceae	1	pneumonia, meningitis, peritonitis	amphibians
Salmonella arizonae (serovar III)	Enterobacteriaceae	1	gastroenteritis	frogs
Salmonella abidjan	Enterobacteriaceae	1	gastroenteritis	frogs
Salmonella berta	Enterobacteriaceae	1	gastroenteritis	frogs
Salmonella bovis-morbificans	Enterobacteriaceae	1	gastroenteritis	frogs
Salmonella hadar	Enterobacteriaceae	1	gastroenteritis	frogs
Salmonella saint paul	Enterobacteriaceae	1	gastroenteritis	frogs
Salmonella wandsworth	Enterobacteriaceae	1	gastroenteritis	frogs
Salmonella worthington	Enterobacteriaceae	1	gastroenteritis	amphibians
Salmonella typhimurium	Enterobacteriaceae	1	gastroenteritis	frogs
Mycobacterium marinum	Mycobacteriaceae	2	cutaneous infection	-
Mycobacterium ulcerans	Mycobacteriaceae	1, 2	Buruli ulcer	amphibians
Mycobacterium fortuitum	Mycobacteriaceae	2	Cutaneous infection, ocular disease, osteomyelitis	-
Mycobacterium szulgai	Mycobacteriaceae	1, 2	pulmonary infection, keratitis	Xenopus sp.
Chlamydia psittaci	Chlamydiales	1	psittacosis	amphibians
Chlamydophila (= Clamydia) pneumoniae, C. abortus	Chlamydiales	1	systemic infections	anura
Basidiobolus ranarum (= B. haptosporus?)	Zygomycetes	1	cutaneous infection	amphibians
Glugea sp.	Microsporea	1	systemic infections	anura
Pleistophora sp.	Microsporea	1	systemic infections	amphibians
Tetramitus enterica	Vahlkampfiidae	1, 2	keratitis?	frogs
Trichobilharzia spp., Bilharziella sp.	Trematoda	2, 3	dermatitis	snails
Rodentolepis (Hymenolepis) nana	Cestoda	3	gut infestation	rodents
Capillaria hepatica (= Calodium hepaticum)	Nematoda	3	liver infestation	rodents
Myobia musculi	Acari	3	skin irritation	rodents

#### **Selected References:**

- Bartlett K.H., Trust T.J., Lior H. (1977): Small pet aquarium frogs as a source of Salmonella. Appl Environ Microbiol. 33: 1026 – 1029.
- Daszak P., Cunningham A.A., Hyatt A.D. (2001): Anthropogenic environmental change and the emergence of infectious diseases in wildlife. Acta Tropica 78: 103 – 116.
- Hassl, A. (2000): Disease and Immunology; In: Hofrichter, R. (Ed): Amphibians. The world of frogs, toads, salamanders and newts; Buffalo, New York (Firefly Books). pp. 108 - 110.
- Hassl A., Url A, Rebel-Bauder B. (2001): Weeksella virosa HOLMES et al., 1987 colonised epidermal cysts in Hyla crepitans WIED-NEUWIED, 1824 (Anura: Hylidae). Herpetozoa 14 (3/4): 127 - 131.
- Hassl A., Pfleger S., Benyr G. (2001): Salmonellen-Infestationen in Amphibien und Reptilien. Mitt Österr Ges Tropenmed Parasitol. 23: 39 - 42.
- Hassl A., Benyr G. (2003): Hygienic evaluation of terraria inhabitated by amphibians and reptiles: cryptosporidia, free-living amebas, salmonella. Wiener Klinische Wochenschrift 115 [Suppl 3]: 68 - 71.
- Ippen R., Zwart P. (1996): Infectious and parasitic disease of captive reptiles and amphibians,



with special emphasis on husbandry practices which prevent or promote diseases. Rev Sci Tech. 15: 43 – 54.

 Pfleger S., Benyr G., Sommer R., Hassl A. (2003): Pattern of Salmonella Excretion in Amphibians and Reptiles in a Vivarium. Intern J Hyg Environ Health 206: 53 - 59.

 Trust T.J., Bartlett K.H., Lior H. (1981): Importation of salmonellae with aquarium species. Can J Microbiol. 27: 500 – 504.