Poeciliid Research

The contribution of the diversity of Poeciliid fishes and their genetic plasticity to the development of the aquarium hobby and the aquarium market

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Abstract. This paper aims to show the importance of aquariology to human health, and the importance of Poeciliid fishes to aquarium science, aquariology and the aquarium trade. The aquarium hobby can have a range of positive effects on mental, emotional, and even physical well-being. It provides a unique blend of entertainment, education, and therapeutic benefits for individuals across different age groups. The diversity and genetic plasticity of Poeciliid fish have significantly shaped the aquarium hobby and market. Their vibrant colors, ease of breeding, and adaptability have made them appealing to a broad range of hobbyists, contributing to the growth, diversity, and commercial success of the aquarium industry. The potential for Poeciliids to become invasive highlights the importance of responsible pet ownership and the proper disposal of unwanted aquarium fish. Releasing non-native species into the wild can have significant ecological consequences and is generally discouraged to protect the integrity of natural ecosystems. Ultimately, ethical considerations in keeping animals in aquariums revolve around balancing the educational, conservation, and entertainment aspects with the welfare and conservation needs of the animals involved. Transparent practices, education, and ongoing efforts to improve standards contribute to the ethical evolution of the aquarium industry.
Key Words: aquariology, aquarium, aquarium trade, ethics, human health, Poeciliidae, therapeutic.

Introduction. Poeciliids, a family of freshwater fish, include popular aquarium species such as guppies (*Poecilia reticulata*), mollies (*Poecilia sphenops*), and swordtails (*Xiphophorus* spp.) (Petrescu-Mag 2007; Gavriloaie et al 2016a, b). This paper aims to show the importance of aquariology to human health, and the importance of Poeciliid fishes to aquarium science, aquariology and the aquarium trade.

The importance of aquarium as hobby for human health. Aquariums can be a beneficial and enjoyable hobby for individuals of all ages, including the elderly and children (Petrescu-Mag & Bud 2017). Next, we will present some of the potential benefits for human health.

Stress reduction. Watching the serene movements of fish and the overall calm environment in an aquarium can have a soothing effect on the mind. This can help reduce stress and anxiety levels (Julius et al 2013; Saunders et al 2017; Clements et al 2019).

Mood improvement. Interacting with an aquarium or simply observing the underwater world can trigger the release of neurotransmitters like serotonin, which contributes to mood elevation and a sense of well-being (Julius et al 2013; Saunders et al 2017; Clements et al 2019).

Cognitive stimulation. Maintaining an aquarium requires attention and care, stimulating cognitive functions (Liu et al 2022). This is especially relevant for the elderly, as it can help keep their minds active and engaged (Carolin 2022).

Therapeutic benefits. Aquariums are sometimes used in therapeutic settings to help individuals with conditions like Alzheimer's disease or dementia. The visual and sensory stimulation can be therapeutic and promote a sense of connection with the natural world (Carolin 2022).

Responsibility and routine. Taking care of an aquarium instills a sense of responsibility and routine, which can be particularly beneficial for children (Cocker 2012). It teaches them about the needs of living organisms and the importance of consistency in care.

Educational value. Aquariums offer an opportunity for learning about marine life, ecosystems, and the importance of environmental conservation (Collins et al 2020). This educational aspect is valuable for children and adults alike (Schilbert & Scheersoi 2023).

Social interaction. Aquariums can serve as a focal point for social interaction. Families, friends, or community groups may gather around the aquarium, providing an opportunity for shared experiences and conversations (Briseño-Garzón et al 2007).

Sensory stimulation. The vibrant colors, graceful movements of fish, and the sound of water can provide sensory stimulation, especially for individuals with sensory processing disorders (Levinson 1979).

Physical health. Maintaining an aquarium involves activities such as cleaning, feeding, and water testing. These activities can provide light physical exercise, contributing to overall physical health (Levinson 1979).

Entertainment and relaxation. Aquariums offer a source of entertainment and relaxation, providing a break from the fast-paced and often stressful aspects of daily life (Levinson 1979).

Teaching empathy. Caring for living organisms fosters empathy and compassion, important values that can be instilled in children through the aquarium hobby (Anderson et al 2006).

The aquarium hobby can have a range of positive effects on mental, emotional, and even physical well-being. It provides a unique blend of entertainment, education, and therapeutic benefits for individuals across different age groups.

Poeciliid fishes, aquariology and aquarium market. Poeciliids, a family of freshwater fish that includes popular aquarium species, have made significant contributions to the development of the aquarium hobby and market. Their characteristics, including diversity (Petrescu-Mag & Popa 2018) and genetic plasticity (Petrescu-Mag & Proorocu 2022), play a crucial role in the popularity and sustainability of the aquarium industry (Mag et al 2005).

Variety and coloration. Poeciliids exhibit a wide range of colors, patterns, and fin shapes, making them attractive choices for aquarium enthusiasts (Petrescu-Mag 2008). This diversity contributes to the availability of visually appealing fish in the aquarium market, attracting hobbyists looking to create vibrant and diverse tank setups.

Ease of breeding. Poeciliids are known for their relatively simple breeding requirements. Many species give birth to live young, and their reproductive behaviors are fascinating to observe. The ease of breeding makes these fish suitable for both beginner and experienced hobbyists, contributing to the popularity of the aquarium hobby (Petrescu-Mag 2008).

Genetic plasticity. Poeciliids are known for their genetic plasticity, meaning they can adapt to different environmental conditions. This adaptability has led to the development of numerous color morphs and variations through selective breeding. This genetic

diversity has fueled the creation of unique and desirable strains, appealing to collectors and enthusiasts (Petrescu-Mag et al 2008; Păsărin & Petrescu-Mag 2011; Petrescu-Mag & Popa 2018; Petrescu-Mag & Proorocu 2022).

Educational value. Poeciliids, particularly livebearers like guppies, provide an excellent opportunity for educational activities (Petrescu-Mag et al 2013). Breeding projects and observing the genetic inheritance of traits can be engaging for both students and hobbyists. This educational aspect contributes to the overall appeal of keeping Poeciliids in aquariums.

Community tank compatibility. Many Poeciliid species are compatible with community tanks, allowing for the creation of diverse and dynamic aquatic ecosystems. Their social behaviors and peaceful nature make them suitable companions for a variety of other fish species, enhancing the possibilities for aquarium enthusiasts.

Sustainability and availability. The ability of Poeciliids to adapt and reproduce readily contributes to their sustainability in the aquarium trade. Their availability in the market is relatively consistent, making them accessible to hobbyists. This steady supply supports the growth and stability of the aquarium industry.

Hybridization and innovation. The genetic plasticity of Poeciliids has led to the development of hybrid strains, further expanding the options available to aquarium enthusiasts (Mag-Mureșan & Pop 2004). Hybridization allows for the creation of novel color patterns and traits, driving innovation in the aquarium market (Petrescu-Mag & Popa 2018).

Commercial importance. Poeciliids, being popular and easily bred, have become commercially important in the aquarium trade (Mag et al 2005). Their affordability and widespread availability contribute to the economic viability of the aquarium industry.

The diversity and genetic plasticity of Poeciliid fish have significantly shaped the aquarium hobby and market. Their vibrant colors, ease of breeding, and adaptability have made them appealing to a broad range of hobbyists, contributing to the growth, diversity, and commercial success of the aquarium industry.

Potential invasive outside of their natural range. Certain Poeciliid fish species have been recognized as invasive outside of their natural ranges (Tsang & Dudgeon 2021). When released into non-native environments, these fish can establish populations and negatively impact local ecosystems (Mag et al 2009). We explain below the reasons why poeciliid fish can be considered invasive.

High reproductive rates. Poeciliids are known for their prolific reproductive capabilities, particularly live-bearing species. Females give birth to live young, and under favorable conditions, they can reproduce rapidly, leading to large populations in a short period (Petrescu-Mag 2008).

Versatile habitats. Poeciliids are adaptable and can thrive in various aquatic habitats, including freshwater streams, ponds, and estuarine environments. This adaptability allows them to colonize a wide range of ecosystems (De Bona 2019).

Aggressive feeding habits. Some Poeciliid species are opportunistic feeders and may outcompete native species for resources such as food and shelter (D'Amore et al 2019). This can disrupt the balance of the ecosystem and negatively impact local biodiversity.

Lack of predators. In their native habitats, Poeciliids may have natural predators that help control their populations. However, when introduced to new environments where these predators are absent, Poeciliids may experience reduced predation pressure, contributing to their invasive success.

Disease vectors. Introduced Poeciliid populations can serve as potential vectors for diseases that may affect native fish species. This can lead to the spread of pathogens that local species are not adapted to, causing additional ecological disruptions (Gomez-Maldonado et al 2023).

It is important to note that not all Poeciliid species exhibit invasive behavior, and the specific impact of a species can vary depending on local environmental conditions and the presence of competing species. However, the potential for Poeciliids to become invasive highlights the importance of responsible pet ownership and the proper disposal of unwanted aquarium fish. Releasing non-native species into the wild can have significant ecological consequences and is generally discouraged to protect the integrity of natural ecosystems.

Educating and raising public awareness of the risks of releasing fish into the wild. Educating the public about the invasive potential of certain Poeciliid fish species is crucial to prevent their release into the wild. Below, we show some educational ideas to raise awareness and promote responsible aquarium practices.

Public workshops and seminars. Host workshops and seminars at local community centers, schools, or aquarium clubs to educate the public about the impacts of releasing non-native fish species. Include information on the specific Poeciliid species that pose a threat to local ecosystems.

Aquarium society presentations. Collaborate with aquarium societies and hobbyist groups to give presentations on responsible aquarium keeping. Emphasize the importance of not releasing unwanted fish into natural habitats and the potential consequences for native ecosystems.

Online webinars and resources. Create online webinars or educational resources, including videos, infographics, and articles, that explain the invasive potential of certain Poeciliids. Share these resources through social media, aquarium forums, and educational platforms.

Invasive species awareness events. Organize events focused on invasive species awareness, where experts can discuss the ecological impact of released aquarium fish. Include hands-on activities, demonstrations, and interactive displays to engage the public.

Collaboration with conservation organizations. Partner with local conservation organizations to develop educational materials and campaigns. These organizations often have the expertise and resources to communicate the ecological consequences of invasive species effectively.

School programs. Work with schools to incorporate lessons about responsible pet ownership and the potential impacts of releasing aquarium fish into local ecosystems. Develop age-appropriate educational materials and activities for students.

Demonstration tanks. Set up demonstration tanks at public events or in local aquarium stores. Use these tanks to showcase invasive Poeciliid species and provide information on their biology, reproduction, and potential impacts on native species.

Public service announcements (PSAs). Create and distribute PSAs through local media outlets, emphasizing the importance of responsible aquarium practices. Highlight the message that releasing non-native fish into natural environments can harm ecosystems.

Citizen science projects. Encourage the public to participate in citizen science projects focused on monitoring and reporting invasive species. Provide resources and tools for individuals to identify and report any unusual or potentially invasive fish sightings.

Interactive mobile apps. Develop mobile apps that allow users to explore the potential invasive species in their region. Include information on responsible aquarium practices, local regulations, and how to safely rehome unwanted aquarium fish.

Regulatory information. Include information on local regulations and legal consequences related to releasing non-native species into the wild. Ensure that the public is aware of the potential legal ramifications of irresponsible actions.

Community partnerships. Partner with local businesses, pet stores, and aquarium suppliers to promote responsible practices. Encourage stores to provide information to customers about the proper disposal of unwanted aquarium fish.

By employing a combination of these educational strategies, it is possible to raise awareness about the invasive potential of certain Poeciliid fish species and promote responsible behavior within the aquarium hobby community.

The ethics of keeping animals in aquariums. The ethics of keeping animals in aquariums is a complex and debated topic that involves considerations related to animal welfare, conservation, education, and responsible pet ownership. We present further some key points and perspectives on the ethics of keeping animals in aquariums.

Positive aspects

i) Education and awareness. Aquariums provide an opportunity for the public to learn about marine life, ecosystems, and conservation. Educational programs and exhibits can foster a greater understanding and appreciation for aquatic environments;
ii) Conservation efforts. Some aquariums actively participate in conservation and research initiatives. They may engage in breeding programs for endangered species, habitat restoration projects, and public awareness campaigns to promote marine conservation;
iii) Scientific research. Aquariums can contribute to scientific research by providing controlled environments for studying marine biology, behavior, and physiology. This research can have implications for the conservation of both captive and wild populations;
iv) Rescue and rehabilitation. Some aquariums focus on rescuing and rehabilitating injured or stranded marine animals. These facilities play a crucial role in providing care for animals that may not survive in the wild due to injuries or other issues.

Ethical concerns

i) Animal welfare. One of the primary ethical concerns is ensuring the well-being of animals in captivity. Critics argue that the confinement of animals in aquariums may lead to stress, unnatural behaviors, and health issues (Eșanu et al 2015a, b), particularly for species with complex social structures and large home ranges;
ii) Capture and transport. The process of capturing and transporting wild animals for aquariums can be stressful and detrimental to their health. Sustainable and ethical sourcing practices, such as captive breeding, are advocated to reduce the impact on wild populations;
iii) Enclosure size and complexity. The size and complexity of enclosures are important considerations. Some animals, especially large or highly active species, may require more space and environmental enrichment to exhibit natural behaviors. Inadequate living conditions can contribute to stress and behavioral abnormalities;

iv) Commercial exploitation. Concerns exist about the commercial exploitation of marine life for the aquarium trade. Overcollection of species from the wild can have negative impacts on ecosystems, disrupting natural populations and habitats;
v) Species-specific needs. Different species have varied requirements, and ensuring that these needs are met in captivity is a critical ethical consideration. This includes appropriate water conditions, diet, social structures, and mental stimulation;
vi) Release of exotic species. Irresponsible release of aquarium pets into the wild can lead to invasive species issues, disrupting local ecosystems and threatening native flora and fauna.

Responsible practices

i) Accreditation and standards. Supporting and visiting accredited aquariums that adhere to high standards of animal care, conservation, and education can contribute to responsible practices;
ii) Captive breeding programs. Encouraging and supporting captive breeding programs helps reduce the demand for wild-caught animals and promotes sustainable practices;
iii) Research and conservation initiatives. Aquariums that actively contribute to scientific research, conservation efforts, and public education play a positive role in the ethical landscape;
iv) Public engagement and advocacy. Engaging the public in ethical discussions about aquariums and advocating for responsible pet ownership can contribute to positive changes in the industry.

Ultimately, ethical considerations in keeping animals in aquariums revolve around balancing the educational, conservation, and entertainment aspects with the welfare and conservation needs of the animals involved. Transparent practices, education, and ongoing efforts to improve standards contribute to the ethical evolution of the aquarium industry.

Conclusions. The aquarium hobby can have a range of positive effects on mental, emotional, and even physical well-being. It provides a unique blend of entertainment, education, and therapeutic benefits for individuals across different age groups.

The diversity and genetic plasticity of Poeciliid fish have significantly shaped the aquarium hobby and market. Their vibrant colors, ease of breeding, and adaptability have made them appealing to a broad range of hobbyists, contributing to the growth, diversity, and commercial success of the aquarium industry.

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Conflict of interest. The author declares that there is no conflict of interest.

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