Can Sinners Become Saints in Freshwater Fish Conservation?

PART 2: Aquarium hobbyists as a gateway to fish knowledge and its conservation

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Many rare fishes are little known by scientists and largely neglected by governments and conservation organizations, and their plight has received the attention of only a few specialist hobbyists. These species (mainly livebearer, cichlids and killifish species) are exclusively available at aquarist meetings or via online exchanges upon request among serious hobbyists. For example, in south-western Europe, a survey revealed that about 300 of 1133 aquarium species (27%) were only found in the aquaria of members belonging to hobbyist organizations (Maceda-Veiga et al. 2013). Some hobbyist associations maintain open access to lists of names and origins of the species kept by their

Black Spot Allotoca: female (*Allotoca maculata)*

members (e.g. http://www.sekweb.org/censo/ index.php). Most interestingly, many of these aquarist consortiums lead to extensive database depositories in which valuable information on the biology, ecology, distributional range and behaviour of a myriad of fish species can be found, such as the Cat-eLog with datasheets of more than 3000 catfish species including 14 000 images and videos (http://www.planetcatfish.com/).

In addition, the hobbyists often contribute to the development of basic knowledge about the biology and ecology of the species through the technical notes and reports they publish on the maintenance and breeding experiences of these species in hobbyist journals such as Rio Negro, Practical Fishkeeping, Conscientious Aquarist Magazine, various aquarium websites like www.aquabotanic.com, or the large number of aquarium association bulletins published on a regular basis. Unfortunately, the scientific rigour of this information is often uncertain (see Kullander 2012), but some of these aquarist magazines may record relevant information for some researchers. For instance, first reports of the introduction/location of species in Argentina and adjacent areas are often published in the bulletin Ichthyological Contributions of 'Peces Criollos' of the Argentinean Killifish Club.

The content of the articles published by many hobbyists and the by-laws of their associations demonstrate that they are concerned for the welfare of the species they keep and for the effective transfer of knowledge. Together with aquarium hobbyist reports, knowledge exchange is achieved by organizing regular meetings, such as the International Killifish Show in the Netherlands, as well as by hobbyists maintaining their own personal websites and blogs where they publicize their accomplishments, such as the first breeding event of chocolate gourami (Sphaerihchtys osphromenoides, Osphronemidae) in captivity (www.aquarticles.com/articles/breeding/Xema_Chocolate_Gourami.html). Sometimes the results from devoted aquarium hobbyists working on vulnerable species also reach international scientific events, such as the participation of the aquarist association 'Sociedad de Estudios Ictiol□ogicos (SEI)' in the International Union for the Conservation of Nature held in Barcelona in 2008.

Black Spot Allotoca: male (*Allotoca maculata)*

Likewise, several livebearer fish hobbyist associations participate in the International Symposia on Viviparous Fishes held biannually in Mexico.

Other examples of knowledge transfer among hobbyists are the various training courses that occur regularly at aquarium hobbyist associations. These courses are typically taught by experienced aquarium hobbyists or invited scientists. Many courses are designed to increase the success of maintaining and breeding new wild species being brought into the domestication and often focus on the characteristics of the natural habitat of these species. Some aquatic retailers also provide free training courses on topics such as fish welfare or treatment of diseases in collaboration with academics such as AQA Espai and the University of Barcelona in Spain. Aquarium hobbyist associations, such as the Barcelona Aquarium Association, also collaborate with certain specialized aquarium retailers to conduct courses and outreach activities. Whilst the primary reason that most retailers hold such courses is to attract more customers, the courses nevertheless encourage good aquarium practices and link hobbyists with knowledgeable and responsible sources of fish and information.

On the more applied conservation side of the hobby, the populations of fishes maintained in captivity through networks of devoted aquarists provide a germplasm reservoir to prevent the total extinction of the species and to develop reintroduction programmes (Dibble 2010; Dom□Inguez 2010; Grist 2010). Although their merits are part of an ongoing debate (e.g. Gippoliti 2012; Bowkett 2014), ex situ conservation programmes often arise to save species with a reduced distributional range and exposed to high anthropogenic pressure (Conde et al. 2011; Dom□Inguez et al. 2005; Dom□Inguez 2010). A good example of the achievements of devoted aquarium hobbyists in this area is an in situ and ex situ conservation project in Mexico for two species of goodeids extinct (or nearly so) in nature: the Crescent Zoe (*Zoogoneticus tequila*, Goodeidae, see title photo) and the Golden Skiffia (*Skiffia francesae*, Goodeidae), whose populations had been kept by private aquarium hobbyists around the world for 25 years.

In Spain, members of the SEI also carry out a successful captive-breeding programme of the endangered Spanish toothcarp (*Aphanius iberus*,

Bold Characodon: male (*Characodon sp.)* © Juan Carlos Merino

Cyprinodontidae) with the release of reared individuals in restored lagoons in the Llobregat delta. The Spanish Killifish Association (SEK) leads another captive-breeding programme for three endangered Aphanius species (*A. apodus, A. danfordii* and *A. sirhani*) and the wild-extinct Potosi Pupfish (*C. alvarezi*). Besides captive-breeding programmes, such devoted aquarists also participate in the assessment of some populations of *A. iberus* and Valencia Toothcarp (*Valencia hispanica*, Valenciidae) in coastal lagoons in north-eastern Spain. Likewise, the distributional range of the Mediterranean Killifish (*Aphanius fasciatus*, Cyprinodontidae) in Italy is being assessed by members of the Italian Killifish Association (AIK) through the 'Progetto Aphanius'.

Interestingly, thanks to these aquarium hobbyist expeditions, species considered extinct by scientists, such as the Black Spot Allotoca (*Allotoca maculata* Goodeidae, see previous pages) and Ameca Shiner (*Notropis amecae*, Cyprinidae), were rediscovered, and the declining conservation status of other fish species in arid areas of Mexico, such as the Bold Characodon (*Characodon "audux" species*, Goodeidae, see above) and Red Prince (*Characodon "audux" species*, Goodeidae, see opposite page), was brought to the attention of scientists and conservationists (see Kempkes et al. 2013). Most of these in situ and ex situ conservation efforts led by aquarists are funded by their associations or themselves, and some even do crowd funding through personal websites or fish auctions to fund scientific research, such as 'The PlanetXingu project' in Brazil.

Public education and engagement in conservation activities is another beneficial role of the hobby. As aquarists develop a greater awareness of freshwater conservation, they are more likely to become involved in conservation initiatives that benefit a wide variety of organisms and habitats, not just fish (Taylor 1993; Reid et al. 2013; Tlusty et al. 2013). In fact, early experiences keeping fish in aquariums helped lead many aquatic scientists and conservationists, including the authors of this article, into their professions.

But even for nonprofessionals, experiences in the aquarium hobby can build a strong and active conservation ethic. Admittedly, the aesthetic component of an

Red Prince: male (*Characodon sp.)* Frank Kroenke

aquarium fuels the entry of members into the hobby, but at the same time, as the maintenance of an aquarium mirrors the functioning of natural systems, it also promotes acquiring basic knowledge about ecological processes. An example of the importance of this aspect in the aquarium hobby is the book entitled 'The Ecology of the Planted Aquarium' (Walstad 2003). Under the philosophy of creating an ecosystem in an aquarium, two tendencies can be observed. On the one hand, there is the business-led approach of creating the most sophisticated aquatic landscape possible and with a goal of receiving recognition for it. On the other hand, there is the approach of creating aquatic landscapes that mirror the biotope from where the species originated.

The attractiveness of aquarium landscapes also furnishes a basis by which aquaria can be used by aquarium hobbyist associations and other private and public entities to increase public conservation awareness (Taylor 1993; Cainey et al. 2012; Reid et al. 2013; Schwan et al. 2014). In essence, an aquarium reveals the often hidden aquatic world to the general public in much the same way as films and other media do (Monroe et al. 2009; Cooke et al. 2013). As an example, the BAA invited the University of Barcelona to set up an information panel and several aquaria with native and introduced fish species found in Spanish rivers to increase public awareness for the conservation of native fish species during the Barcelona Aquarium Meeting in the Mascota Festival and Expo (formerly SIZOO), which attracts more than 26,300 visitors annually. Likewise, the Argentinean Killifish Club Association set up information panels and exhibition aquaria to show different aspects on the conservation of freshwater fish to visitors of the Natural Science Museum in Buenos Aires. As another example, the SEI association has an ongoing collaboration with the Zaragoza Aquarium for the ex situ conservation of endangered native Spanish species along with increasing public awareness of other native fauna. Sometimes these eco-friendly initiatives have become, for some aquarists, a way of living, as

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occurred with the development of an eco-tourism enterprise in Brazil.

By virtue of their attractiveness and charismatic nature, fish can also be a symbol in their own right to increase conservation awareness among the general public, especially in schools. For instance, the 'Associacio per la Defensa i Estudi de la Flora i Fauna Autoctones' in Santa Maria de Merles, Spain, works for the restoration of the local freshwater fish fauna through studies of the ecology and biology of native species, such as the endangered River Blenny (*S. fluviatilis*) or the European Bullhead (*Cottus hispaniolensis*, Cottidae), and assists with education in schools about the conservation of aquatic ecosystems. Similarly, aquarium hobbyists from the LVSSP have contributed to the development of a children's coloring book that offers youngsters in the region an entertaining approach to learn about the ecology and problems facing Lake Victoria in Africa (Hemdal 2008).

At a more local scale, the SEI Spanish toothcarp project has a strong educational component. Students at 10 schools are taught about the threats to native fish species in the region and how to maintain Spanish toothcarp and collect their eggs and raise fry. The students participate in the release of their captive-reared Spanish toothcarp in selected natural lagoons in the Llobregat Delta guided by the SEI during a social event termed the 'The Spanish Toothcarp Party'. Local media are invited to publicize the conservation and education initiatives of this project. In doing so, enthusiastic aquarists increase public conservation awareness of local aquatic resources and also urge citizens to join international initiatives to assess the status of freshwater fish populations, such as the recently launched 'Global Freshwater Fish Bio Blitz.'

The interests of aquarium hobbyists can go further than just the study of particular fish species and lead to collaborations with government and management agencies in monitoring studies of freshwater ecosystems. For instance, members of the BAA in Spain participate in river water-quality monitoring through the 'projecte rius', which is a long-term government project that uses macroinvertebrates as bioindicators. Members of another aquarium association to which a co-author belongs also assist in monitoring of populations of the endangered White-Clawed Crayfish (*Austropotamobius pallipes*) supervised by technicians from the Autonomous Government of Catalonia, Spain. Other examples of the broad scope of aquarium hobbyist in nature conservation are the field trips organized by the Galician Association of Aquarium Hobbyists to ecologically relevant natural areas, such as the Ancares-Courel Reserve within Nature Network 2000 in Galicia, Spain.

Whilst the relationship between conservationists and the aquarium hobby has often been antagonistic in recent years, ultimately most biologists and aquarists share a love of the species they study or maintain, and this common interest could be the basis for a more positive and productive relationship.