27.1

Public Aquaria

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Abstract

Public aquaria have an intimate relationship with the commercial trade in ornamental aquatic species. They rely in part on the global aquatic animal trade to acquire their exhibit specimens, both directly sourcing from the trade itself or by collecting animals in the same locales as commercial collectors. Being centers of research, education and conservation, public aquaria should practice model behaviour when sourcing marine fishes, working with fisheries to ensure that stocks are well managed, ecosystems are preserved, and local communities benefit from collection activities. Model behaviour also implies that indirect participation in wild fisheries (e.g., when using paid or commercial collectors) must also adhere to these sustainability goals. Public aquaria have large multi-taxa exhibits, in which animals frequently exhibit reproductive behaviour. This behaviour allows for guided and opportunistic breeding programs, which can reduce the number of animals sourced from the wild. Maximum benefit to the ornamental aquatic animal trade will come from a balanced approach to *in situ* conservation and *ex situ* aquatic culture.

Keywords *Aquaculture; fisheries; ornamental fish; sourcing; sustainability; wildlife trade*

27.1.1 Introduction

The basic premise of a public aquarium is that visitors will spend their disposable income to be entertained and to learn more about the "blue" planet. A 2008 global survey showed that 700 million people visited zoos and aquariums, and US$350 million was spent on nature conservation, annually. These impressive figures demonstrate the high potential for zoos and aquariums to play an essential role in education and conservation (Gusset & Dick, 2011). To ensure there is a strategic approach to research and

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conservation, the regional associations of aquariums and zoological gardens (e.g., the World Association of Zoos and Aquaria (WAZA), the European Association of Zoos and Aquaria (EAZA) and the Association of Zoos and Aquariums (AZA)) have been working toward enhancing the education, conservation and research efforts of their member institutions. These Associations define standards, policies and procedures, which help zoos and aquariums improve their work practices, including, but not limited to, sustainable collections management, best practice animal husbandry and welfare, immersive informal education and robust conservation research.

Focusing on public aquaria WAZA recently published *Turning the Tide – A Global Aquarium Strategy for Conservation and Sustainability* (Penning *et al.*, 2009), which outlines a proposed implementation of the World Zoo and Aquarium Conservation Strategy by WAZA members. *Turning the Tide* describes the role public aquaria can play in the conservation of aquatic species and highlights the point that livestock acquisition operates within the context of a larger international hobby trade, not only for fishes but for reptiles and invertebrates as well (Penning *et al.*, 2009). In 2005 the AZA noted that 1375 species were held by public aquaria (AZA, 2010), of which 54.3% were declared on import documentation as a "...marine aquarium tropical fish..." (Rhyne *et al.*, 2012). Public aquaria undeniably overlap with the aquarium hobby trade, leading Penning *et al.* (2009) to suggest that aquariums should look to the "trade" to "...draw on their expertise and engage in partnership initiatives...". Tlusty *et al.* (2013) examined these partnership opportunities and identified four key mechanisms for public aquaria to increase the sustainability of the ornamental fishes trade. These mechanisms include: (1) providing technical knowledge (Tlusty *et al.*, 2013); (2) participating in research activities (Brittsan & Jones, 2008; Tlusty *et al.*, 2013); (3) collaborating with national regulatory authorities, such as CITES (Jones, 2008); and (4) educating the general public about the need for the sustainability of the ornamental fish and coral trade (Gamain, 2008; Jones, 2008; Tlusty *et al.*, 2013).

Many suppliers used by public aquaria provide animals for the ornamental fish trade too (Thoney *et al.*, 2003; Tlusty *et al.*, 2013). We posit that because of their conservation, research and education commitments, public aquaria are well placed to model best practices for the trade. Given that the main criticism of the trade surrounds issues related to the fishery itself, public aquaria should be leaders in developing and supporting fishery best practices that equally value intact habitats, sustainable wild collections, and animal welfare.

27.1.2 Increasing the Sustainability of Animal Collections – the Overlap with the Ornamental Trade

The AZA has developed an *Aquatic Sustainable Collection Plan* and Thoney (2011) enumerated nine "needs" for the *Plan* to become reality (Table 27.1.1). These needs can be summarized as follows: assessing the variety of production methods (i.e., wild caught vs. propagated), for each species, to ensure continued availability of animals in a manner that optimally benefits the natural environments from whence they originate. It is not a simple decision of whether all species should be cultured or not, but rather how culture can impact the overall conservation of the species in question.

Table 27.1.1 The needs of the Association of Zoos and Aquariums (AZA) Aquatic Sustainable Collection Plan (after Thoney, 2011).

1	Need to ensure that wild collection of fishes and invertebrates will remain an option into the future where sustainability is proven.
2	Need to develop a certified list of aquaculture operations, sustainable fish collectors and distributors, and encourage all AZA members to purchase through these sustainable suppliers when appropriate.
3	Need to support *in situ* sustainability efforts (i.e., Project Piaba, Project Seahorse) to support local sustainable fisheries and avoid unsustainable collecting methods/operations.
4	Collaboratively operated extractive reserves should be considered.
5	Need to purchase captive reared fishes and invertebrates when available; however, culture operations should be evaluated to ensure that they are operating sustainably.
6	Need to continue, and expand our ability to breed and rear fishes and invertebrates at our institutions. Staff training in aquaculture techniques and budgetary commitments are important components of institutional support. However, raising fishes will not be the only solution considering the large diversity of animals required for our exhibits.
7	Need to pursue further research into the breeding and rearing of difficult marine tropical fishes with small larvae. More effort needs to be put into forming partnerships with academia that will result in funding and technical assistance that zoos and aquaria cannot provide on their own. There has been inadequate attention devoted to fostering this sort of collaboration, and aquaria might benefit from AZA assistance in facilitating such relationships.
8	Need to develop techniques (i.e., artificial fertilization) that will increase our ability to breed large sharks and sawfishes (an area that also may benefit from AZA support).
9	Need to build large elasmobranch exhibits with the intent of breeding. This initiative will mean a serious re-thinking of how exhibits are themed to achieve success beyond display and public viewing outcomes.

27.1.3 Conservation – *In Situ* Fisheries Improvements and Ecosystem Preservation

A majority of AZA-accredited zoos and aquaria refer to "conservation" and "education" in their mission statements (Patrick *et al.*, 2007). The same is true for accredited institutions in other regions (e.g., EAZA members, etc.). Many public aquaria directly participate in, finance, and support, *in situ* conservation projects.

The overall working hypothesis for many public aquaria is: that numerous aquatic species have specific life history characteristics that make them well-suited to be harvested from the wild; that wild populations will not be threatened as long as there is adequate fisheries management (or an adequate balance between harvest levels and stock sizes); and that capture methods ensure animal welfare and ecosystem health (Tlusty, 2002; Thoney *et al.*, 2003). Ecosystems where these species originate can even benefit from the collection of fishes, since local communities will better care for the environment in order to maintain associated economic activities through time (Tlusty *et al.*, 2013). If these fisheries are closed and this income stream lost, the result will likely be an increase in the biomass removed from the ecosystem, given that the fishers may switch to higher biomass, lower value, food species (Rhyne *et al.*, 2014). In addition to the increased biomass extraction, the local communities may also switch to more environmentally-destructive practices (e.g., reef removal for building materials, etc.).

The interplay between collection of exhibit animals and the trade in marine ornamental fishes cannot be down-played nor ignored. Field-collection activities by public aquaria typically taps into existing local export resources, available only through the trade (e.g., shipping supplies, paperwork skills, etc.; B. Shepherd, California Academy of Sciences, pers. comm.). Many species on exhibit are purchased through vendors that also supply the home hobby sector of the trade.

Within this context there are some key mechanisms available for public aquaria to advance the sustainability of the ornamental aquatic trade (Tlusty *et al.*, 2013). Public aquaria can influence the sustainability of the trade by choosing collectors that meet specific criteria. The AZA proposes an "A-list" of collectors that "...have sustainable conservation plans, follow all governmental and international organization regulations, and can guarantee known sustainable chain of custody of aquatic animals from capture to final destination..." (Thoney, 2010). However, to best and positively influence the continued effort to increase sustainability, we suggest that the AZA and WAZA create an aspirational "preferred collector" category. This category would stipulate mandates that reduce environmental impacts, including, but not limited to, participating in population surveys and fishery management schemes, certified assurance of environmentally benign animal capture techniques, and responsible quarantine chemical use and disposal. Creating aspirational goals will ensure the aquatic trade does not stagnate, but rather, continues to advance animal collection sustainability. In this spirit, the European Union of Aquarium Curators (EUAC) recently formulated *Guidelines for Acquisition* to assist public aquarium personnel when making informed and responsible choices about sourcing display specimens.

Another way to advance the sustainability of the ornamental trade is the creation of extractive reserves (Firchau *et al.*, 2013), whereby large tracts of marine and freshwater habitats are managed and effectively protected for the purpose of regulated specimen collection by stakeholders. These reserves can build on the positive social and environmental aspects of the trade in ornamental fishes, and represent a major step toward ecosystem sustainability because of the combined and balanced benefits to the environment, and to local economies and communities. Extractive reserves should result in a well-managed and balanced socio-ecological system that accentuates the benefits of an intact biodiverse ecosystem.

Collaborative work with commercial collectors *in situ* can also have an important impact on sustainable wild extraction by helping organize fishermen and ensuring jobs for local communities. Although a freshwater example, and not a sole extractive reserve, Project Piaba had been working since 1991 on the ornamental fishery in the Rio Negro, Amazonas, Brazil (Chao *et al.*, 2000). The main fishes extracted from this region are the cardinal tetra (*Paracheirodon axelrodi*) and the discus (*Symphysodon discus*). Despite the enormous amount of fishes harvested annually (i.e., >20 million individuals) there are no demonstrated negative impacts on wild populations. The harvest methods are benign, with selective harvest, and no by-catch mortality. The communities of this region depend on these fisheries for their economic livelihood and understand that an intact ecosystem will provide for a resilient fishery. Project Piaba works with collectors to improve their animal capture, handling and transport methods, and also works with commercial wholesalers and pet suppliers encouraging use of animals that have been sustainably extracted. Project Piaba highlights an example fishery where maintenance of wild capture is more beneficial to the environment than wholesale replacement by *ex situ* aquaculture.

Marine ornamental fisheries do not yet have a true Piaba-like model, yet it is proposed that this model can be just as relevant as it is for their freshwater analogs. One promising initiative, described elsewhere in this volume (see Chapter 18), is a collaborative effort initiated by Olazul (www.olazul.org) and the New England Aquarium. In this case, post-settlement reef fishes are collected in Bali and grown out in modified aquaculture cages. This project has the benefit of engaging local fishermen, as well as harvesting fishes prior to the high mortality threshold associated with larval settlement. In addition, the fishes are preconditioned to handling and to dry foods so, once grown, they can enter the commercial supply chain, experience lower stress and ultimately lower mortality.

To advance sustainability of collection species, public aquaria must work to ensure adequate resource management, ecosystem preservation and community benefit. Activities can include the hiring and training of local collectors, conducting fisheries surveys in support of local management plans, and the education of local peoples. Where field-collections are not conducted directly, public aquaria must ensure commercial collectors adhere to rigorous resource sustainability protocols and animal handling practices. Public aquaria can also inform their visitors of the benefits of sustainable extraction activities and promote sustainable choices by consumers.

27.1.4 Culture – *Ex Situ* Conservation and Improvements to Husbandry and Breeding

Overall, collection of wild fishes should be supported for their larger societal and ecosystem benefit. However, for those species whose habitats are threatened, *in situ* conservation efforts should be complemented with *ex situ* projects like breeding programs in zoos and aquaria (IUCN, 2002).

Because the majority of marine species have never been assessed, to determine their conservation status in the wild, and taking into account the general trend in marine habitat degradation, it is anticipated that many marine species will be classified as threatened in the near future (Thoney *et al.*, 2003). The implication for public aquaria is that much of global aquatic biodiversity is threatened (Helfman, 2007) and that the collection of wild specimens will not be able to continue as currently practiced (Conway, 2010), therefore highlighting the importance of breeding programs, even for species that are not currently assessed as threatened (Conde *et al.*, 2011).

One benefit of the natural exhibits within zoos and aquaria is that many species do reproduce while on display, providing these institutions with an opportunity to lead breeding programs and participate in head-start partnerships. WAZA has mandated the development of sustainable collections of aquatic animals and plants through in-house breeding programs (Penning *et al.*, 2009). The AZA is similarly interested in the captive rearing of aquatic species and in 2010 awarded the prestigious Edward Bean Award to two institutions (i.e., the Cabrillo Marine Aquarium and the New England Aquarium) for the captive propagation of marine fishes. In 2010 the AZA, through the Conservation Endowment Fund, supported the "Rising Tide" initiative, to help construct a central rearing facility and establish a supply chain of eggs and larvae from public aquaria. The intended goal of this initiative was to improve the commercial production of select marine fish species for the home hobbyist. While the rearing of fishes in one central location can certainly assist in the sustainability of collections for public aquaria, a significant effort needs to be made to materially impact the enormous diversity of species currently maintained on exhibit. In 2010 approximately 1375 marine fish species were held in North American public zoos and aquaria (AZA, 2010), yet only about 2% of these species have ever been reared in captivity. Marine fishes hatch in an undeveloped state, have notoriously small larvae, and require small and specific live foods for first feeding. While is it unlikely there will ever be a point in time in which *all* species on exhibit can be raised in captivity – in part as a result of the substantial space and resources required for captive breeding populations – husbandry staff at aquatic institutions need to develop the knowledge, skills and abilities to rear any species breeding at their respective institutions. The MoLaRS (Modular Larval Rearing System) project, funded by the Institute of Museum and Library Services (IMLS), and coordinated by the New England Aquarium and Roger Williams University, was developed to address this need. MoLaRS created common protocols and physical systems for rearing marine fish larvae that are readily scalable and shared with a large number of institutions. To date, aquarists from 20 different facilities have been trained to rear larval fishes, eggs have been collected from nearly 60 species, and approximately 3500 individual fishes have been returned to exhibit, the details of which have been summarized in Table 27.1.2. This outcome is a significant step toward the goal of sustainable collections.

Some target species in zoos and aquaria are managed through studbooks, as well as breeding programs like the European Endangered Species Programme (EEP) and the North American Species Survival Plan (SSP). The goal of these management plans is to maintain sustainable, captive populations over time, which "...must be demographically robust, genetically representative of wild counterparts and able to sustain these characteristics for the foreseeable future..." (www.waza.org). Under the auspices of EAZA, the first two European studbooks for fish species were created in 2007, the Zebra Shark European Studbook and the Blue-Spotted Stingray European Studbook. By 2013, the number of studbooks managed by the EAZA's Fish and Invertebrate Taxon Advisory Group (FAITAG) had increased to 10. These studbooks have resulted in positive outcomes for many species. Before the creation of the Blue Spotted Stingray Studbook breeding events were rare, but now several institutions breed this species, the number of captive births has increased significantly, and captive bred animals are being sent to several aquaria throughout Europe. Increasing the number of studbook-managed species will promote the dissemination of successful husbandry and breeding information; reducing specimen mortality rates, increasing captive breeding and reducing pressure on wild stocks.

A number of invertebrate species have also been reared. In recent years important advances in coral husbandry and propagation has allowed many public aquaria to maintain large coral reef exhibits. Species that were difficult to maintain in the past, are now flourishing and are even propagated by fragmentation (Thoney *et al.*, 2003). As the exchange of coral fragments between institutions has increased, many public aquaria have started exhibiting corals without the need to collect from wild stocks. In 2004, 24 species of corals were identified as displaying sexual reproduction in aquaria and 16 of those had established an F1 generation (Petersen *et al.*, 2007). A survey conducted three years later identified 45 scleractinian species reproducing sexually in aquaria, with successful recruitment for 29 of those species. (Petersen, 2008). Despite this demonstrable

Table 27.1.2 Species collected from on exhibit spawning, reared, and returned to exhibit as part of the MoLaRS (Modular Larval Rearing System) project (as of March, 2015, see http://www.larvalcultureproject.org).

Scientific name	Common name	*Scientific name*	Common name
Acanthochromis polyacanthus	Spiny chromis	*Haemulon* spp.	Grunts (unknown)
Amblyglyphidodon ternatensis	Ternate chromis	*Heterostichus rostratus*	Giant kelpfish
Amphiprion clarkii	Clark's anemonefish	*Hippocampus bargibanti*	Pygmy seahorse
Amphiprion frenatus	Tomato clownfish	*Hippocampus erectus*	Lined seahorse
Amphiprion ocellaris	Ocellaris clownfish	*Hippocampus reidi*	Long snout seahorse
Amphiprion percula	Orange clownfish	*Kuhlia mugil*	Barred flagtail
Amphiprion sebae	Sebae clownfish	*Lysmata amboinensis*	Pacific cleaner shrimp
Apogon dovii	Tailspot cardinalfish	*Lythrypnus dalli*	Lythrypnus dalli
Astraea tecta	Astraea snail	*Melanotaenia boesemani*	Boeseman rainbow
Atherinopsis californiensis	Jacksmelt	*Neoglyphidodon melas*	Bowtie damsel
Diodon holocanthus	Balloon fish	*Pomacanthus* sp.	Marine angelfish
Doryrhamphus dactyliophorus	Banded pipefish	*Pygocentrus nattereri*	Red belly piranha
Dunckerocampus pessuliferus	Yellow multibanded pipefish	*Stephanolepis hispidus*	Planehead filefish
Elacatinus oceanops	Neon goby	*Syngnathus floridae*	Dusky pipefish
Eumicrotremus orbis	Pacific spiny lumpsucker	*Syngnathus leptorhynchus*	Bay pipefish
Haemulon chrysargyreum	Smallmouth grunt	*Syngnathus scovelli*	Gulf pipefish
Haemulon flavolineatum	French grunt	*Trachinops caudimaculatus*	Southern hula fish
Haemulon sciurus	Blue-striped grunt	*Trachinotus falcatus*	Permit

success, more work is yet to be done to develop breeding techniques for the many other species of corals that are not yet propagated in *ex situ* conditions (Petersen, 2008).

An interesting collaborative project in the realm of coral propagation is CORALZOO, a SME-friendly (micro, small and medium-sized enterprises-friendly) European Breeding Program for hard corals. The Sixth Framework Project Program for Science and Technology of the European Union financed this project between 2005 and 2009. Three Universities, one research institution, 10 zoos and aquaria, a coral culture company, and the European Association of Zoos and Aquaria (EAZA) participated in this project, consisting of several work packages, including: (1) bioassay development; (2) fragmentation; (3) sexual reproduction; (4) abiotic factors; (5) nutrition; (6) health control; (7) transport and acclimation; (8) morphogenetic modeling; (9) protocol composition and dissemination; and (10) training (Osinga, 2008). One of the most important deliverables from this project was the *Book of Protocols for the Breeding and Husbandry of Scleractinian Corals*, which includes 70 protocols on various topics related to hard coral husbandry and breeding (Osinga *et al.*, 2012). The CORALZOO *Book of Protocols* is available on-line through a dedicated website (www.coralzoo.org) and demonstrates that zoos and aquaria can add great value to scientific research efforts (Osinga *et al.*, 2012).

Another initiative, SECORE (SExual COral REproduction), was started in 2001 coordinated by the Rotterdam Zoo and the University of Duisburg-Essen, with the participation of several public aquaria and research institutions. The primary goal of SECORE is the sustainable management of captive coral populations through sexual reproduction and the sharing propagated corals between institutions (Petersen *et al.*, 2006). In 2005 the first SECORE workshop was held in Rotterdam, where participants were taught techniques for coral larvae collection and settlement. This workshop represented the first step for a number of aquaria in Europe to start collecting and settling the larvae of several different species of coral. The Oceanopolis, in Brest, collected planulae from nine different species of corals on display in their aquaria: *Favia fragum*, *Pocillopora damicornis*, *P. verrucosa*, *Stylophora pistillata*, *Seriatopora hystrix*, *Porites* sp., *Euphyllia paradivisa*, *Stylocoeniella guentheri* and *Pavona cactus* (Barthelemy, 2008).

A follow-up SECORE workshop was held in Puerto-Rico, where participants from European and North American institutions had the opportunity to collect gametes and larvae during mass spawning events, and to improve techniques for coral fertilization and settlement. Primary coral polyps resulting from the workshop were distributed to several public aquaria to aid in the development of elkhorn coral husbandry techniques. In more recent years, SECORE workshops have been held in Guam and the Philippines in support of *ex situ* culturing programs that ultimately have (or in the future will have) transitioned to *in situ* restoration projects. In this way, SECORE has grown to be a globally important coral conservation initiative involving both conservation scientists and public aquarium professionals. The combined knowledge and experience of dozens aquarium professionals was essential for the success of this important initiative (www.secore.org).

In addition to breeding animals, public aquaria have a wealth of technical expertise related to the husbandry and care of aquatic life. Species that were difficult or even impossible to maintain in aquaria years ago, can now be maintained with relative ease through advances in animal husbandry. Research in the field of animal husbandry and captive breeding, as well as other associated investigations, is frequently conducted within public aquaria, the results of which are disseminated at professional meetings and via scientific journals and the grey literature (Hutchins & Thompson, 2008). In recent years, dedicated professional symposiums have focused on a particular aspect of aquarium science. Key meetings have included: the *1st International Elasmobranch Husbandry Symposium* held in Orlando in 2001, *Aquality: Water Quality and Water Treatment in Zoos and Aquaria* held in Lisbon in 2004, the *1st International Symposium of Coral Husbandry in Public Aquaria* held in Arnhem in 2007, and the *Husbandry, Management and Conservation of Syngnathids* held in Chicago in 2011. With support from public aquaria, commercial industry peers and other philanthropic organizations, proceedings from some of these meetings have already been published as dedicated husbandry manuals – the *Elasmobranch Husbandry Manual: Captive Care of Sharks, Rays, and Their Relatives* (Smith *et al.*, 2004) and *Advances in Coral Husbandry in Public Aquaria* (Leewis & Janse, 2008). These industry handbooks are available to buy in hardcopy form or to download for free as PDF documents (refer to www.elasmobranch husbandry.org and www.burgerszoo.com/about-burgers-zoo/coralhusbandryorg/). Follow-up elasmobranch husbandry and water quality meetings were held in 2013 and 2014, respectively, and proceedings from these meetings are currently in review. These manuals not only act as a bridge between public aquarium professionals and dedicated research scientists, they represent an invaluable source of information, compiling the latest advances in husbandry, care and breeding of several marine species.

27.1.5 Creating a Comprehensive Collections Plan

The culture of marine ornamental fishes and invertebrates by public aquaria is of growing importance as ecosystems become increasingly impacted by human activities. As we have reiterated throughout this chapter, however, the role of aquaculture and captive culture needs to be balanced against the benefits of, and the risks to, wild fisheries (Tlusty, 2002). Any comprehensive collection plan needs to draw on animals from many sources – i.e., originating from well-managed wild fisheries, from responsible collectors and aquaculturists, from the growout of species breeding on exhibit, and through trading of surplus animals with sister institutions (Figure 27.1.1). Balanced sourcing, however, is only one of

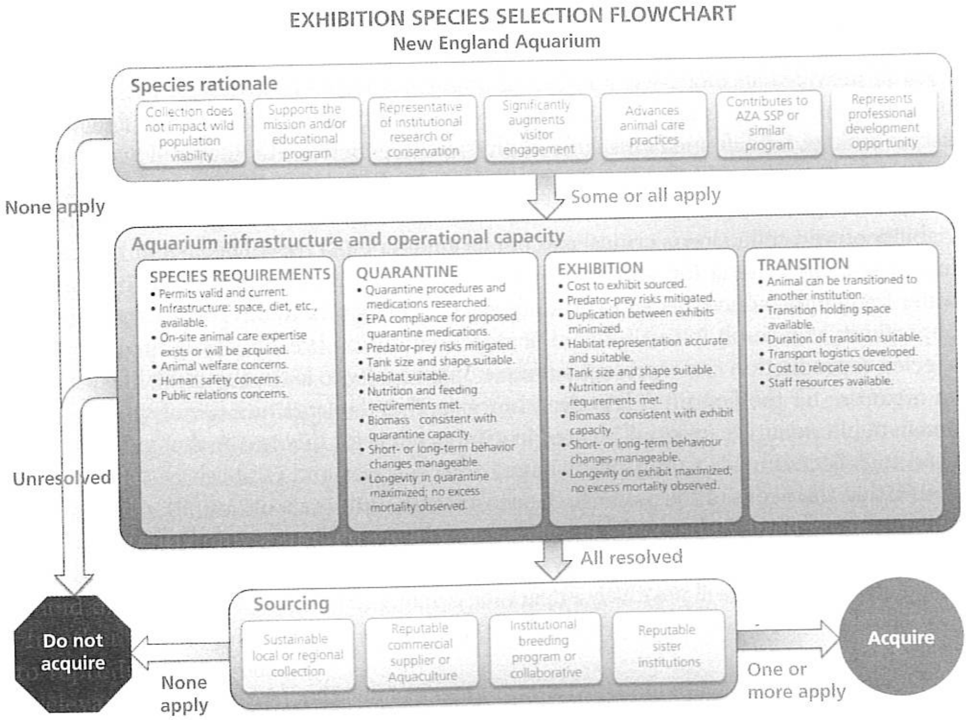
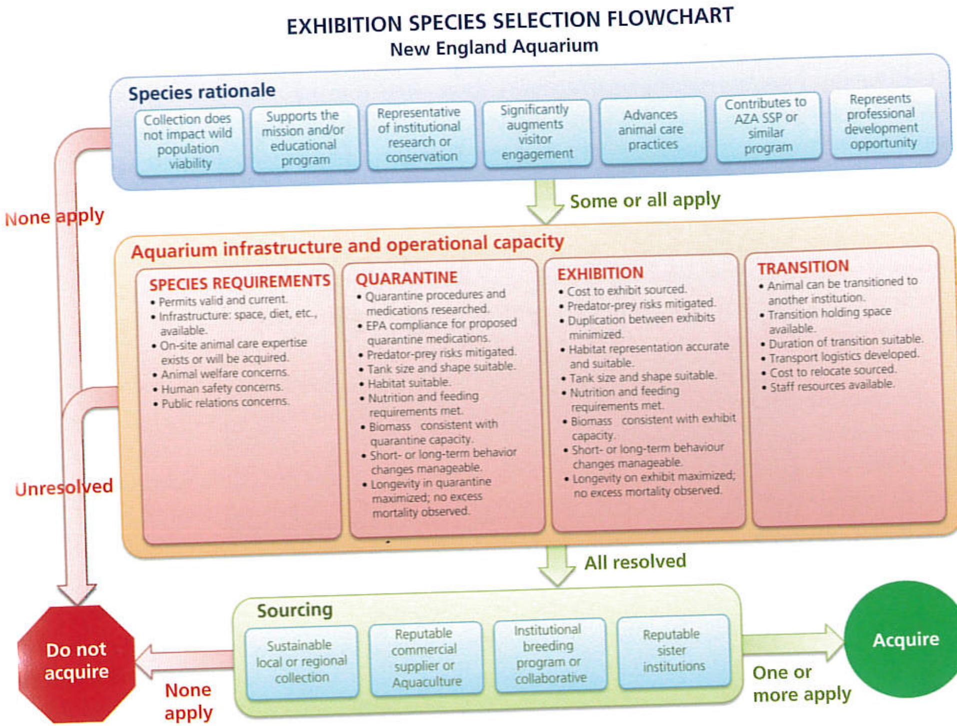


Figure 27.1.1 An exhibition species selection flowchart as developed by the New England Aquarium. The purpose of this flowchart is to provide a broad overview of the collections plan, and to ensure exhibit animals are selected to meet the institutional mission, can be cared for appropriately, and are sourced in a sustainable manner, including the use of responsible wild fisheries and/or *ex situ* cultivation of species. (*See insert for color representation of the figure.*)



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three core considerations within a comprehensive animal collection plan, the others being the rationale for species choice, and the available infrastructure and operational capacity. The first consideration for a collection plan is to determine whether a species should be on exhibit at all. Criteria for this choice have been summarized in Figure 27.1.1. If some or all of the species rationale apply, an assessment then needs to be made of the infrastructure and operational capacity of the aquarium in support of the chosen species (Figure 27.1.1). This assessment includes animal husbandry and welfare considerations, as well as long-term deaccession plans. All three of these core choice categories are important components of a broader collections plan. If any is found to be deficient, then the responsible choice may well be to not acquire the species for exhibition.

27.1.6 Conclusions

Modern public aquaria have large exhibits that allow for the representation of ecosystems, and the maintenance of species, that typically cannot be managed in a smaller home aquarium. Many of these species are not easy to study in their natural habitat, so public aquaria present a great opportunity for scientists to study aspects of their biology, physiology and behaviour. Many researchers contact public aquaria in order to complement their field research with information drawn from animals in human care. Information gathered from public aquaria can provide important support information for *in-situ* conservation work on threatened species. The increasing number of species maintained by public aquaria provides an increased number of opportunities for fruitful research collaborations and contributions to a wide array of disciplines including, but not limited to, conservation biology, wildlife medicine, animal physiology, genetics, ethology and taxonomy.

In order to engage the public and instill a sense of care about marine and freshwater ecosystems, public aquaria need to display a wide variety of aquatic species. The ongoing viability of wild collection is critical and public aquaria must model behaviour by developing sustainable criteria for sourcing animals. Natural aquatic theming and high-quality water frequently induce species to produce eggs or young on exhibit. For many species this opportunity can result in institutional or multi-institution breeding programs. For other species, reproduction can represent a unique opportunity to learn about the life history of an organism for the first time. It is clear, however, that the large number of species exhibited in public aquaria cannot *all* be bred in captivity. It is for this reason that public aquaria need to collect animals from well-managed wild fisheries and establish best practices to ensure that the needs of the animals, the ecosystems, and local communities are satisfied. It is only through this balance of *ex situ* culture and *in situ* conservation that public aquaria will be able to reach their sustainability goals and realize their conservation missions. In so doing, public aquaria will positively impact the ornamental fish trade.

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