MARINE FISHES TAXON ADVISORY GROUP

REGIONAL COLLECTION PLAN

2017

Third Edition

MARINE FISHES TAXON ADVISORY GROUP REGIONAL COLLECTION PLAN

CONTENTS

Acknowledgements

The Marine Fishes Taxon Advisory Group would like to thank all those who generously volunteered their time and energy to assist in the development and drafting of this document.

MFTAG logo *provided by Kelli Cadenas, SEA LIFE Michigan Aquarium, Auburn Hills, Michigan 2016*

The MFTAG wishes to dedicate this 2017 Regional Collection Plan to Dr Bruce Carlson. His vision and efforts in 1990s, set a strong foundation for the work detailed in this document. A career champion of the public aquarium industry, Dr Carlson has been a mentor, advisor, advocate, partner, and friend to all those who seek the ethical and humane management of marine fishes in human care and science-based management of wild populations.

MARINE FISHES TAXON ADVISORY GROUP

MISSION

The mission of the Marine Fishes Taxon Advisory Group (MFTAG) is to coordinate the management of captive marine, diadromous, and estuarine fishes in AZA collections and to be a resource for institutional collection plan development at AZA institutions. It is an information resource for AZA conservation initiatives and sustainability strategies. The MFTAG also identifies significant in-situ and ex-situ conservation efforts and encourages AZA member participation in and support of such efforts.

GOALS

The MFTAG is organized to:

- Identify and develop guidelines for coordinating space use for marine fish species in AZA member institutions.
- Define marine fish species/population guidelines, conservation status and program goals, and communicate these to AZA member institutions directly and through the MFTAG Regional Collection Plan.
- Define effective strategies that promote sustainability of marine fish species for AZA member collections.
- Identify marine fish species in need of conservation action through review of natural history, governmental management strategies, peer-reviewed population surveys and assessments.
- Develop and encourage the use of species selection criteria when developing institutional collection plans and exhibit strategic plans at AZA member institutions.
- Recommend published husbandry material and develop and distribute husbandry information to help ensure the proper care and maintenance of marine fish species in AZA member institutions.
- Communicate and network with the national and international scientific community, government agencies and non-governmental agencies to identify opportunities of ex-situ and in-situ research, and conservation education collaboration.
- Assist in the development of conservation education programming materials related to species in this TAG for use by member and non- member AZA institutions as needed or requested.

- Review and highlight programs conducted by partners that help support the strategic goals of the TAG. (See MFTAG Highlighted Programs APPENDIX 1)
- Collaborate with international zoological institutions to optimize resource utilization, maximize effort return, and encourage a global approach to marine fish species issues such as conservation and sustainability.
- Support the AZA Saving Animals From Extinction (SAFE): Shark and Ray Program (APPENDIX 2)

MARINE FISHES TAXON ADVISORY GROUP ORGANIZATION

MFTAG Leadership and Guidance

The activities of the MFTAG are directed by a steering committee composed of at least nine and no more than 15 members including the Chair, Vice Chair, and Secretary and excluding appointed advisors. The MFTAG Steering Committee will recruit, add, and remove advisors to the Steering Committee, as it deems appropriate or necessary. Steering Committee advisors are non-voting members that serve to advise the MFTAG on topics including, but not limited to, aquarium science, nutrition, animal health management, sustainability, conservation, research, and legislative considerations. Advisors will be selected and retained per the MFTAG ADVISORY CORPS: Terms and Criteria for Selection of Advisors (APPENDIX 3). The MFTAG will be supported in its efforts by a Wildlife Conservation Management Committee (WCMC) liaison, appointed by the WCMC chair.

MFTAG Steering Committee

MFTAG Steering Committee members are Institutional Representatives (IRs) nominated and elected by IRs of AZA member institutions. Each IR has one vote for electing committee members by a majority vote. Steering Committee member terms are three years from the date of the MFTAG IR meeting immediately following their election. As much as possible, term of service should be staggered to allow approximately one third of the committee members' terms to expire each year.

In the event only one individual is nominated for a vacant Steering Committee position, an election will not be held. The MFTAG Chair can appoint that individual to the Steering Committee following a vote of confidence by the current members of the MFTAG Steering Committee.

There is no limit on the number of terms an IR can be elected to the Steering Committee. In the event of an early term resignation, the Steering Committee will nominate and elect a new member from the IRs by majority vote. The newly elected member will serve for the remainder of the term.
MFTAG Executive Officers

MFTAG executive officers are the Chair, Vice Chair, and Secretary and are members of the Steering Committee. Executive officer terms of service are for one year from the date of election. A vote of confidence by all IRs will be held for the Chair, Vice Chair, and Secretary if their tenure exceeds one term (one year) and for every term thereafter. There are no term limits for MFTAG executive officers.

In the event an executive officer resigns or is removed, vacant officer positions are filled by IRs nominated and elected by the current Steering Committee members by a majority vote.

MFTAG Elections

Nominations to fill vacancies on the Steering Committee can be made by any IR. Only IRs designated by their facility Director can accept nomination and stand for election. Nominees are elected to fill vacancies by majority vote of MFTAG IRs. Each IR has one vote in Steering Committee elections and in votes of confidence for executive officers.

Nominations for Steering Committee members will be requested via the AZA MFTAG IR listserv starting August 1 and be open for 30 days. Nominees will be announced by October 1 via the AZA MFTAG IR listserv. Votes will be collected by the MFTAG Secretary via email immediately thereafter. Elections will be open for 7 days. Results of elections will be announced via the AZA MFTAG IR listserv by December 15 to allow ample time to ensure that Steering Committee members can budget for attendance to the following year's Regional Aquatics Workshop where the AZA MFTAG Steering Committee meeting is held. Steering Committee member terms will run from AZA MFTAG IR meeting (held at the Regional Aquatics Workshop) to AZA MFTAG IR Meeting (held at the Regional Aquatics Workshop).

If only one individual is nominated for a vacant Steering Committee position, an election will not be held. The MFTAG Chair will appoint that individual to the Steering Committee following a vote of confidence by the current members of the MFTAG Steering Committee.

MFTAG Communications

The main form of communication among members of the MFTAG occurs using AZA sponsored listservs. (APPENDIX 5)

The MFTAG listserv is considered a closed forum and is intended for use by Institutional Representatives (IR), Steering Committee members and MFTAG advisors only. AZA listserv policy is strictly enforced. The MFTAG Secretary serves as the moderator for the listserv.

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MARINE FISHES TAXON ADVISORY GROUP REGIONAL COLLECTION PLAN

INTRODUCTION

The Marine Fishes Taxon Advisory Group (MFTAG) Regional Collection Plan (RCP) establishes the MFTAG, its role in the management of species of conservation concern, and guides Association of Zoo and Aquariums (AZA) member institutions in the development of institutional collection plans that promote sustainability and best practices. The first edition of the MFTAG RCP, approved in 2007, shed light on what is possible for aquatic collection management and identified areas where improvement was needed, such as better record keeping and reporting, as well as, enhanced Institutional Representative (IR) participation in TAG initiatives. It also established for the first time, formal population management programs for select species within the TAG's purview. Development and implementation of the first MFTAG RCP edition was an exhaustive and positive experience that produced a practical resource document for collection managers, and organized our community efforts.

The second edition of the RCP in 2010 continued to streamline and build upon the previous RCP, providing flexible guidelines and recommendations that could be used to manage marine fish collections in AZA institutions. The 2010 RCP also provided an extensive library of guiding recommendations and provided industry best practices and considerations that supported the mission of the TAG.

The third edition of the MFTAG RCP continues as a resource for successful species management. The document provides documentation of the TAG's status as a leader in sustainable, welfare-minded marine animal management, details opportunities for strong, growth-minded collaboration, provides a roadmap to our industry's future and how the TAG will play an active part. Additionally, this RCP provides opportunities for AZA member institutions to complement their collection planning with the Saving Animals From Extinction (SAFE): Shark and Ray Action Plan (MFTAG AZA SAFE Statement APPENDIX 2). This RCP is to be used as guide to meet institutional collection planning needs and for contributing to the goals of the MFTAG and AZA now and into the future.

GOALS

The MFTAG RCP serves as a reference document to aid directors, curators, and aquarists in the development of institutional collection plans while identifying conservation priorities and sustainability strategies that maximize the use of available TAG resources and expertise. The RCP provides clear practical guidance to collection

planners to ensure that the priorities of the MFTAG are readily achieved with reasonable effort. Recommendations contained within the 2017 RCP will encourage incorporation of taxa of conservation concern into aquatic collections and collaboration among institutions to advance husbandry standards and conservation efforts. The RCP is to be considered a living document; structured to provide sound support for effective collaborative animal management and institutional collection planning, yet flexible to allow creativity and institutional uniqueness to meet changes in the industry, technology, resources, and guest expectations.

TAXONOMIC, CONSERVATION STATUS, AND WILD STATUS ASSESSMENT REFERENCES

Taxonomic accuracy remains a challenge for fishes. Finding accurate taxonomic resources remains difficult as technological advances and exploration result in constant reorganization of taxonomy. To ensure that the most up to date information is utilized in the identification of fishes held at AZA institutions, the taxonomy in this RCP is consistent with FishBase (www.fishbase.com). FishBase is a global information resource developed by the WorldFish Center with the support and collaboration of the European Commission (EC) and the Food and Agricultural Organization of the United Nations (FAO). FishBase is a professionally accepted information resource and is currently supported by a consortium of the following international research facilities:

Museum National d'Histoire Naturelle
Africamuseum Tervuren
Swedish Museum of Natural
History Aristotle University of
Thessaloniki WorldFish Center
Food and Agriculture Organization of the United Nations
IFM-GEOMAR (The Leibniz Institute of Marine Sciences at the University of Kiel)
Fisheries Centre – University of British Columbia

FishBase provides links to conservation organizations and resources. These include but are not limited to:

Convention on International Trade in Endangered Species (CITES)
International Union for Conservation of Nature (IUCN) Red List
United States Fish and Wildlife Service (USFWS) Endangered Species List

Species conservation status and wild population assessment information for this RCP was obtained through these organizations and resources.

NOTE: The taxonomy presented in FishBase follows the Catalogue of Fishes published in 1998 and edited by William N. Eschmeyer, Curator Emeritus, California Academy of Sciences. The online Catalogue of Fishes database is currently maintained by William N. Eschmeyer and is available at:
(www.calacademy.org/research/ichthyology/catfishsearch)

SPACE SURVEY, POPULATION DATA, AND TAXONOMIC INCLUSION

The total number of fish species may range as high as 32,500 and marine fish species account for over 16,000 of the total known fish species (Nelson 2006). This is a large number of species to be considered under the auspices of a single TAG. To develop the first MFTAG RCP edition and properly address the unique characteristics and population management challenges of such a large group, a clear understanding of what species were present in AZA member collections was needed. In 2007, resources easily tapped for this purpose by other TAGs were not available for fish taxa. At that time, very few AZA institutions utilized data collection software to track their fish collections, so gathering accurate, real time, and complete information from such sources was not possible.

The first AZA marine fishes space survey was conducted in January 2007 with the purpose of compiling a reasonable catalogue of those marine fishes held at AZA member institutions. The results of this space survey were the basis of decisions made regarding population management program development included in the 2007 MFTAG RCP. FishBase was consulted for taxonomic accuracy and consistency. The following questions were asked in the 2007 survey:

Institution Name
Have?
Current Spaces? – Male; Current Spaces? – Female; Current Spaces? – Unknown
Acquire in Future?
Future Spaces? – Male; Future Spaces? – Female; Future Spaces? – Unknown
Order
Family
Genus
Species
Source: Wild Caught?; Source: Captive Bred?; Source: Purchase?
Source: Donated?; Source: Unknown?
Source: Purchased as a Marine Aquarium Council (MAC) fish?
Is there breeding at your facility?

The 2007 survey was sent to all 236 AZA member institutions. Of those institutions, 193 institutions participated in the survey for an 82% return rate. Of the 193 participating institutions, 74 institutions reported having marine fishes in their animal collections.

The 2007 survey documented space data by individuals within species and documented 109,321 individuals held or "spaces" being occupied in AZA facilities. These individuals represent 37 orders, 165 families, and 1,397 species (APPENDICES 6, 7, 8). These species identified are included in the purview of the AZA MFTAG.

For the purposes of the second edition of the MFTAG RCP, the MFTAG Steering Committee reviewed the 2007 survey data and, with a clear understanding that fish collection composition in AZA institutions would change very little over three years, decided that performing a comprehensive space survey again would be inefficient and yield very little new data that could not be acquired through a condensed space survey focused on marine fish species of conservation concern.

In 2010, an abridged space survey was sent to all AZA member institutions. This space survey listed only marine fishes of known conservation concern reported in the 2007 survey including those fish species that already had been assigned to a conservation program in the 2007 Regional Collection Plan. The following questions were asked in the survey:

Institution Name
Have?
Current Spaces? – Male Current; Spaces? – Female; Current Spaces? – Unknown
Acquire in Future?
Future Spaces? – Male Future; Future Spaces? – Female; Future Spaces? – Unknown
Order
Family
Genus
Species
Source: Wild Caught?; Source: Captive Bred?; Source: Purchase?; Source: Donated?; Source: Unknown
Is there breeding at your facility?
Conservation Citation

It is not uncommon for fish species to be listed as species of conservation concern regionally but not globally. All responders were asked to list additional notable species in their collections and add their known conservation status to the space survey to make sure that no species was eliminated from management consideration based on the level of conservation status or its geographical range.

The 2010 Space Survey was sent to all 236 AZA member institutions. Of the 236 AZA institutions sent the survey, 190 institutions responded for an 80% return rate. The AZA Conservation Office provided a list of 101 institutions with assigned MFTAG IRs. Of those 101 institutions, 83 responded to the 2010 Space Survey for an IR return rate of 82%.

The survey documented space data by individuals within species and reported 6,542 individuals of conservation concern or "spaces" being held in AZA facilities. These individuals represent 10 orders, 21 families, and 41 species.

The MFTAG again redefined the survey process for the 2017 RCP in consideration of

changes in approaches to collaborative management dictated by the AZA Wildlife Conservation Management Committee (WCMC) and the AZA Sustainability Considerations for Developing an Aquatic Invertebrate & Fish Collection Plan (2016) (APPENDIX 11). The TAG acknowledged that within reasonable expectations the overall composition of marine fish collections within member institutions was relatively unchanged since the sweeping space survey of 2007 and the species list derived from the survey would be an accepted list of species that could be considered within the purview of the TAG for the 2017 RCP. Survey efforts for the 2017 RCP would be focused not on identifying the extent of species held in human care at AZA facilities but rather on identifying species of conservation concern, based on IUCN categorization. These species would be eligible for organized, directed collaborative management among member institutions.

For the 2017 RCP, while technology advances provided for increased digital data collection, the industry was still not 100% collaborative in the means or methods by which data was collected or shared. For this reason, a space survey was again employed and focused on species of conservation concern at AZA member institutions. To address the breeding and conservation questions required in the RCP, the space survey listed only marine fishes of known conservation concern reported in the 2010 survey including those fish species that already had been assigned to a conservation program in the 2007 and 2010 RCPs. The survey was broken into four sections, each asking a slightly different question related to conservation status and breeding at AZA member institutions.

The first survey section listed species noted as being in AZA institutions in the 2007 and 2010 surveys or species that represent collaborative programs established by the 2007 and 2010 RCPs. The following questions were asked in the first section of the survey:

Institution Name
Have?
Current Spaces? – Male; Current Spaces? – Female; Current Spaces? - Unknown
Acquire in Future?
Future Spaces? – Male; Future Spaces? – Female; Future Spaces? – Unknown
Order
Family
Genus
Species
Source: Wild Caught?; Source: Captive Bred?; Source: Purchase?; Source:Donated?; Source: Unknown?
Is there active breeding but no viable young produced at your facility?
Is there active breeding creating viable fn generations?
Have young been produced from collected pregnant females or from collected eggs at your facility?

Conservation Concern Level and Citation

In the second section, survey participants were asked to provide the same information for new species that may not have been listed in the 2010 survey that could now be considered of conservation concern and that were actively breeding at an AZA institution.

In the third section, survey participants were asked to provide collection size and origination information for new species that may not have been listed in the 2010 survey that could now be considered of conservation concern and that were NOT actively breeding at an AZA institution.

The final section, required survey participants to provide the same information for new species that may not have been listed in the 2010 survey that were NOT of conservation concern but were actively breeding.

To compile the information for the 2017 RCP, a space survey was sent in December 2015 to 111 AZA member institutions with identified MFTAG institutional representatives. In August of 2016, the same survey was sent to AZA member institutions without recognized MFTAG IRs to ensure no fishes were missed due to lack of assigned institutional representation. Of the AZA 243 member institutions sent the survey, 221 institutions participated in the survey for a 91% return rate. Of the 111 participating institutions with recognized MFTAG IRs, 110 institutions reported having marine fishes in their animal collections for a 99% IR return rate.

A list of fish orders, families, and species held in AZA institutions as reported in the 2007 MFTAG RCP Space Survey are listed in appendices 6, 7, and 8, respectfully. Minor changes in either list due to new species or reclassified species as reported in the 2015 and 2016 surveys have been noted in all appendices.
Appendix 9 lists orders and families containing species of conservation concern reported in the 2015 and 2016 MFTAG Space Surveys.

Nelson, J.S., 2006. Fishes of the World. 4th ed. Hoboken (New Jersey, USA): John Wiley & Sons. xix+601p.

SPACE DEFINITIONS

Like taxa that are commonly managed in flocks, groups, or colonies, most marine fishes are managed in groups or schools. While identification systems technology is improving, becoming smaller and less expensive, individual fish collections are still rarely identified or managed uniquely unless those individuals can be easily PIT tagged, branded, banded, tattooed, or identified by permanent physical characteristics. In considering "space", the MFTAG recognizes that many marine fish species may

compete for current available and future "spaces" across species, families, and orders. Additionally, there are currently no established approved minimum enclosure requirements for any marine fish species held at AZA institutions. A "space definition" has been difficult to develop by the MFTAG since many AZA marine fishes collections are held in community systems where numbers of species coexist in the same "space". For purposes of the space survey, a marine fish "space" is equal to one individual, regardless of the species or its size.

Special Note:
The MFTAG recognizes that since the first RCP was approved, a shift in priorities within collaborative collection management has taken place resulting in a stronger emphasis on utilizing available space towards the long- term sustainability of AZA member collections in a manner that does not preclude or exclude conservation initiatives. The 2017 MFTAG RCP defines and utilizes space with an emphasis on the management of species with conservation concern and on whether the species is reproducing at AZA member institutions.

SPECIES SELECTION CRITERIA

The 1,397 species reported in the 2007 RCP as being held in AZA institutions is a large representative number providing a substantial selection from which marine fishes collections can be developed. These species also present many options for collaborative conservation efforts and sustainability strategies between AZA institutions. The MFTAG continues to encourage cooperative conservation efforts and sustainability strategies involving those species being held in AZA institutions before acquisition of additional individuals for such purposes is pursued. The TAG encourages all member institutions to review the AZA Board approved position and the white paper on Sustainability Considerations for Developing an Aquatic Invertebrate & Fish Collection Plan (APPENDICES 10 and 11) in complement with MFTAG RCP species selection recommendations when developing institutional collection plans.

Notes on Selection Criteria:
Developing an RCP that can respond to each species is very difficult given the number of species within the MFTAG purview. To streamline the extensive information needed to develop a collection plan at the species level, some species may be considered at the family or order level if most species of the family or genus share similar conservation considerations, husbandry and life support needs and health management expertise requirements.

Developing an RCP that can respond to all species within the MFTAG purview is very difficult given the number of species within the MFTAG purview. To streamline the extensive information needed to develop a collection plan at the species level, it was determined that only those species with a conservation concern identified by the IUCN at a level of endangered to critically endangered would ultimately be selected for formal

species management in new programs now.

Global conservation organizations recognize that fish species need conservation. While advances in technology and international collaboration have improved our understanding of species populations in the world ocean, data on wild populations, threats to populations, and recommendations for wild population management remain scarce in some cases. Regardless of their conservation and wild population status, many marine fish species would benefit from moderate to intense population management within AZA institutions to ensure availability of these species into the future. Because the husbandry and life support expertise for these species may be lacking, their selection for a managed program may not be possible now. In these cases, the MFTAG will encourage resource allocation for the development of this information and expertise only for such a point in time that suitable skills to maintain the species long term are available.

In consideration of the SAFE: Shark and Ray Program, elasmobranch species that may not have been selected for collaborative management based on their conservation status now, but that are breeding in human care or may be on the verge of doing so and are commonly held, popular species, may be selected for informal management at the studbook level. The "SAFE studbook" category of management created for this RCP will support a sustainability-for-exhibit approach to these species and encourage increased networking and collaboration related to their care among AZA member institutions.

Criteria used to evaluate taxa for inclusion in a management program within the TAG:

1. Is the species currently held in AZA member collections?
2. Is the taxon acquirable within AZA Acquisition and Disposition Policy requirements and available husbandry resources? Is the species listed as a local, regional, or global conservation concern?
3. Is there potential for a sustainable AZA population? Is breeding taking place at AZA member institutions?
4. Does the taxon have educational value/potential?
5. Does the taxon have exhibit value?
6. Does the taxon have conservation or research value or the potential to be a part of collaborative conservation or research efforts?

These criteria were developed into the Selection Criteria Decision Tree (Chart 1).

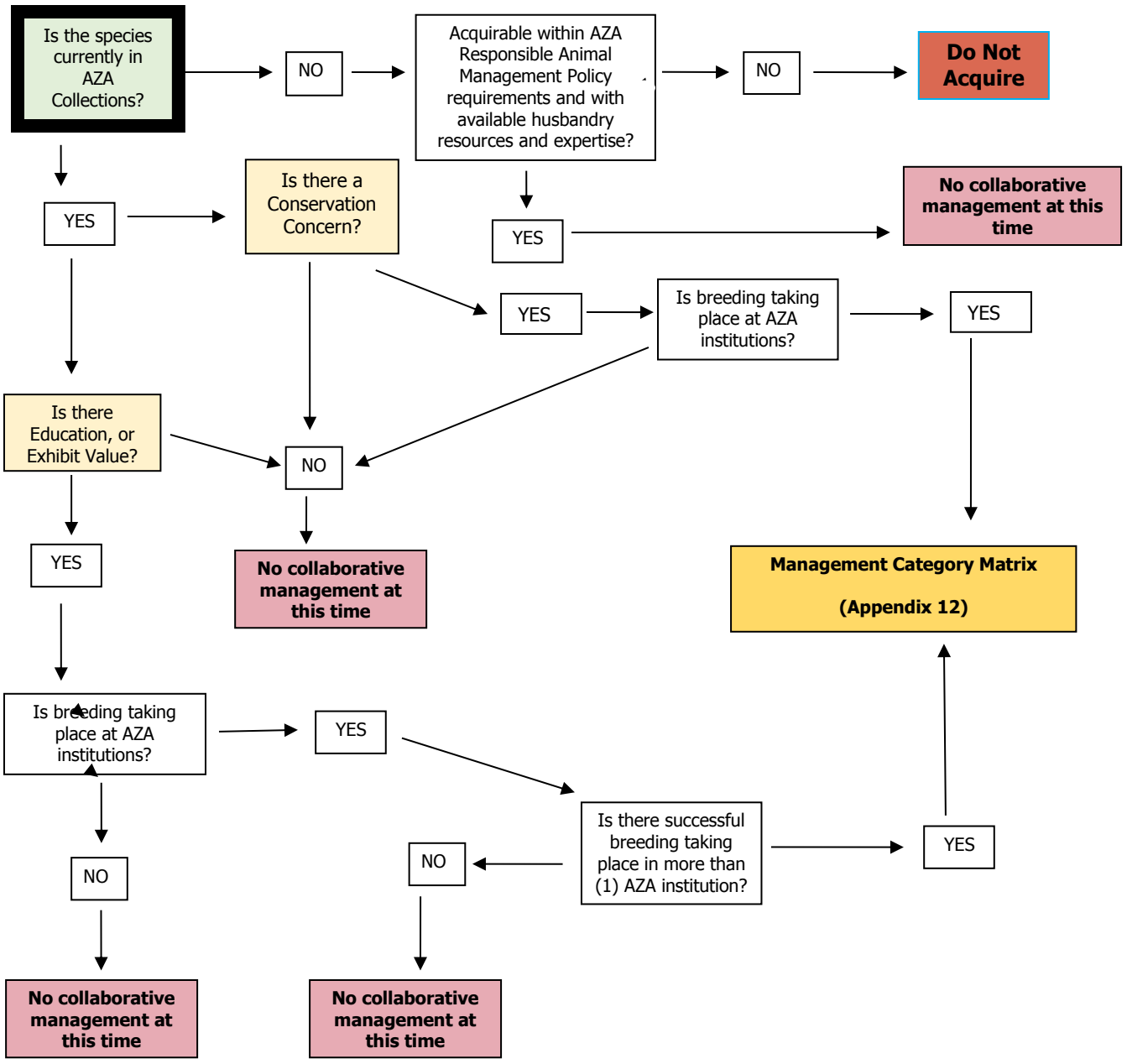

Chart 1. *Selection Criteria Decision Tree*

POPULATION MANAGEMENT PROGRAM CATEGORIES

Because most marine fish species are managed primarily as groups, it is particularly challenging for the MFTAG to develop programs that require tracking individual specimens and their genetic lineages, such as Species Survival Plans (SSPs). As stated previously, individual identification is a challenge for some fish populations. The physical size of some species often prevents identification of individuals using traditional marking methods. Additionally, the group spawning reproductive strategies of many species present unique challenges for tracking genetic relationships. Financial considerations also make the identification of individuals in large schools difficult for many institutions. It is expected that unless better group management strategies are developed that would ensure accurate genetic tracking, and low cost methods of identification for smaller individuals are created, many marine fishes will not able to be formally and collaboratively managed within the current structure of the SSPs.

All species reported in the 2015 and 2016 Space Surveys were evaluated using the MFTAG Selection Criteria Decision Tree (Chart 1). If this initial filter suggested that management of the species in AZA institutions was recommended, the species was then evaluated using the Management Program Matrix (APPENDIX 12). This matrix evaluated whether the species would be managed formally as an SSP, informally as a studbook or a SAFE studbook, or would not be managed at all at this time.

Notes on AZA SAFE Studbooks
In 2016 the AZA SAFE: Shark and Ray Program was created to address the global elasmobranch extinction crisis within AZA member institutions and in collaboration with non- member NGOs, governmental agencies, academia, and advocacy organizations. In recognition of this program and its action plan, the MFTAG has developed a special category of studbook, the SAFE studbook.

Species assigned to a SAFE studbook are recognized AZA SAFE species within SAFE. These elasmobranch species may not meet all criteria the MFTAG has established for formal program management, but would benefit from member organization towards increased species awareness, collaboration for sustainable collections, enhanced animal care, and research.

Species Survival Plan (SSP)

Those species that are considered SSP populations have associated intense management, a studbook, a genetic management goal, and a master plan that is required to include breeding recommendations. An SSP may be managed at one of three levels: Green SSP, Yellow SSP, and Red SSP. Participation in SSP programs is only required for species programs identified as green. A management group exists to oversee the SSP. Nonmember institutions wishing to participate in an SSP must be evaluated for eligibility depending on the management level.

GREEN SSP

- Population size of 50 or greater
- Number of AZA member holding AZA institutions is 3 or greater
- The projected %Genetic Diversity (GD) at 100 years or 10 generations is 90% or greater.
- The population is presently sustainable demographically with sufficiently large population size and a positive growth rate to reach 100 years or 10 generations.

YELLOW SSP

- Population size is 50 or greater
- Number of AZA member holding AZA institutions is 3 or greater
- The projected %Genetic Diversity (GD) at 100 years or 10 generations is less than 90%.
- The population may have never been formally planned, or was planned more than 5 years ago, so that the population sustainability score cannot be properly assessed.

RED SSP

- Population size is 20-49
- Number of AZA member holding AZA institutions is 3 or greater
- The projected %Genetic Diversity (GD) at 100 years or 10 generations is less than 90%.
- Species programs with population sizes between 20-49 individuals unless accepted models can demonstrate long-term sustainability, or the species is classified as extinct in the world, critically endangered, or endangered.

CANDIDATE PROGRAMS

Candidate programs are programs that do not currently meet criteria to be SSPs but the TAG hopes to grow program participation.

STUDBOOK

The MFTAG has determined that some species may benefit from increased member awareness or more focused community effort towards breeding sustainably in human care. This effort would be supported greatly by identifying holders and tracking individuals at a program level but do not yet meet the criteria needed for formal program designation. These species are identified as STUDBOOKS.

SAFE STUDBOOK

Species identified for SAFE Studbooks are elasmobranch (shark, ray, skate and chimaera) species that do not meet all established MFTAG criteria for formal management in an SSP, may or may not be considered of conservation concern currently, but have been identified for studbook status under the MFTAG selection criteria.

FUTURE SPACE CONSIDERATIONS

The 2007 MFTAG Space Survey documented 1,397 marine fish species held in AZA institutions. The 2010, 2015 and 2016 Space Surveys focused on those species of known conservation concern, and additionally in 2015 and 2016, on whether those species were actively reproducing in member institutions. In all surveys, facilities were also asked to report what species they intend to hold in the future. Of the 111 facilities that reported holding marine fishes of conservation concern in 2015 and 2016, 62 facilities reported that they intended to acquire animals included in the survey or added to the survey within the survey criteria in the future. The following information was acquired through analysis of the 2015 and 2016 Space Surveys' future space data:

1) While not reflected in the abridged 2015 and 2016 Space Surveys and with a good understanding of husbandry experimentation and research currently underway in public aquariums, the MFTAG anticipates that future acquisitions, over the next five years at AZA member institutions, will continue to include species from the orders identified in the 2007 MFTAG RCP.

A total of 3,038 spaces are anticipated to be filled by future acquisitions of species of conservation concern (IUCN Near Threatened to Critically Endangered in the wild). Assuming that all current spaces remain the same or filled over the next three years, this number represents a 56% increase in the current number of individuals or spaces devoted to marine fishes of conservation concern in AZA collections over the next five years.

2) Including the nine marine fish species currently being managed by AZA institutions (noted with * below), the 60 species of conservation concern (vulnerable to critically endangered) listed below are being held in AZA collections and are expected to be held in the future.

Scientific Name	**Common Name**
Acipenser oxyrinchus oxyrinchus	Atlantic sturgeon
*Aetobatus narinari**	spotted eagle ray
Amblyraja radiata	thorny skate
Anarhicas lupus	Atlantic wolfish
Anarhicas minor	spotted wolfish
Carcharhinus limbatus	blacktip shark
Carcharhinus plumbeus	sandbar shark
*Carcharias taurus**	sandtiger shark
Cheilinus undulatus	humphead wrasse
Chiloscyllium plagiosum	whitespotted bambooshark
Cromileptes altivelis	humphead grouper
Dipturus laevis	barndoor skate

Scientific Name	**Common Name**
Gadus morhua	Atlantic cod
*Hippocampus abdominalis**	big bellied seahorse
Hippocampus angustus	narrow-bellied seahorse
Hippocampus barbouri	Barbour's seahorse
Hippocampus borboniensis	Reunion seahorse
Hippocampus capensis	Knysna seahorse
Hippocampus comes	tiger tail seahorse
*Hippocampus erectus**	lined seahorse
Hippocampus fuscus	sea pony
Hippocampus guttulatus	long-snouted seahorse
Hippocampus hippocampus	short-snouted seahorse
Hippocampus ingens	Pacific seahorse
*Hippocampus kuda**	spoted seahorse
Hippocampus reidi	longsnout seahorse
Hippocampus spinosissimus	hedgehog seahorse
Hippocampus whitei	White's seahorse
Hippocampus zosterae	dwarf seahorse
Hypanus americanus	southern ray
Hypanus sabinus	Atlantic ray
Leucoraja ocellata	winter skate
Manta alfredi	reef manta
Manta brevirostris	giant manta
Mycteroperca microlepis	gag
Nebrius ferrugineus	tawny nurse shark
Neotrygon kuhlii	bluespotted ray
*Pristis pectinata**	smalltooth sawfish
*Pristis pristis**	largetooth sawfish
*Pristis zijsron**	green sawfish
Pterapogon kauderni	Banggai cardinalfish
Raja eleganteria	clearnose skate
Rhina ancylostoma	bowmouth guitarfish
Rhinoptera bonasus	cownose ray
Rhynchobatus djiddensis	giant guitarfish
Rhyncodon typus	whale shark
Scarus guacamaia	rainbow parrotfish
Sebastes fasciatus	Acadian redfish
Sebastes paucispinis	bocaccio
Sebastes pinniger	canary rockfish
Sebastes ruberrimus	yelloweye rockfish
Sphyrna lewini	scalloped hammerhead
Sphyrna mokarran	great hammerhead
Sphyrna tiburo	bonnethead
Squalus acanthias	piked dogfish
Squatina squatina	angelshark

Scientific Name	**Common Name**
*Stegostoma fasciatum**	zebra shark
Stereolepis gigas	giant black sea bass

3) When sourcing of individuals of conservation concern was detailed in the 2015 and 2016 Space Surveys, most acquisitions were to be from wild stock. While a relatively equal percentage of acquisitions are expected to be from captive births or purchases, it must be noted that no specification on original sourcing of "purchased" individuals was requested. It is assumed that most of these purchases will be from wild collection sources.

4) Breeding activity with varying f_n success rates of 39 species of conservation concern (listed below) at AZA member institutions was reported in the 2015 and 2016 Space Surveys. This is an increase of 50% since the 2010 RCP. The most common order being bred in captivity remains Syngnathiformes which includes seahorses and pipefishes.

Scientific Name	**Common Name**
Aetobatus narinari	spotted eagle ray
Carcharias taurus	sand tiger shark
Cheilinus undulatus	humphead wrasse
Cromileptes altivelis	humpback grouper
Dipturus laevis	barndoor skate
Epinephelus itajara	Itajara/Goliath grouper
Epinephelus niveatus	snowy grouper
Epinephelus drummondhayi	strawberry grouper
Gadus morhua	Atlantic cod
Hippocampus barbouri	Barbour's seahorse
Hippocampus abdominalis	big-bellied seahorse
Hippocampus zosterae	dwarf seahorse
Hippocampus kelloggi	great seahorse
Hippocampus erectus	lined seahorse
Hippocampus reidi	longsnout seahorse
Hippocampus guttulatus	long-snouted seahorse
Hippocampus ingens	Pacific seahorse
Hippocampus kuda	spotted seahorse
Hippocampus histrix	thorny seahorse
Hippocampus comes	tiger tail seahorse
Hippocampus whitei	White's seahorse
Mycteroperca microlepis	gag
Mycteroperca jordani	Gulf grouper
Nebrius ferrugineus	tawny nurse shark
Pristis pectinata	smalltooth sawfish
Pristis pristis	largetooth sawfish

Scientific Name	**Common Name**
Pristis zijsron	green sawfish
Pterapogon kauderni	Banggai cardinal
Rhina ancylostoma	bowmouth guitarfish
Rhynchobatus djiddensis	giant guitarfish
Scarus guacamaia	rainbow parrotfish
Sebastes fasciatus	Acadian redfish
Sebastes paucispinis	bocaccio
Squalus acanthias	piked dogfish
Squatina squatina	angelshark
Stegostoma fasciatum	zebra shark

5) The MFTAG encourages member institutions to fill future spaces of the fishes listed in the 2015 and 2016 Space Surveys with captive born offspring of adults currently being held and bred at AZA institutions when possible.

APPENDIX 13 details expected future spaces based on the 2015 and 2016 RCP Space Surveys that will be devoted to species of conservation concern (vulnerable to critically endangered).

MARINE FISHES TAXON ADVISORY GROUP REGIONAL COLLECTION PLAN RECOMMENDATIONS

In accordance with the AZA Sustainability Considerations for Developing an Aquatic Invertebrate & Fish Collection Plan (2016) (APPENDIX 11) and to also provide AZA members with responsible choices from which to develop their collection plans, the MFTAG filtered all reported species of conservation concern in the 2015 and 2016 Space Surveys through the TAG's Population Management Decision Tree and Management Criteria Matrix. This exercise ensured that no species of conservation concern locally, regionally, or globally, currently in AZA institutions, and had the potential to be managed as a program was over-looked for the sake of streamlining the RCP process.

RESULTS OF SPECIES SELECTION

Aquariums commonly manage fish collections in groups and the trend in exhibit design philosophy continues to be to display most fishes in communities rather than as individual specimens. This presents a unique challenge to aquarium curators when developing collection plans and managing populations for conservation purposes. Additionally, in many species, lack of sexual dimorphism prevents easy breeding group development and management. It should also be noted that while 1,400 species have been reported to be kept at AZA member facilities in previous MFTAG space surveys, breeding of the clear majority of these species has not been accomplished or not mastered to the point that sustainability can be assured over several generations.

While more facilities recognize the importance of putting resources to breeding fishes in managed programs many species are not yet being bred successfully and many member facilities still limit or have limited resources needed to aggressively undertake breeding programs.
While the first 2007 Space Survey details very little breeding effort by AZA members, it is significant to note that the 2010 Space Survey also revealed very little breeding taking place in any of the species listed as conservation concerns. Consistent, managed breeding and the successful repetitive rearing of offspring for many species remains a research challenge to AZA member institutions. Efforts such as the AZA SAFE: Shark and Ray Program draw attention, support the focusing of resources and strongly encourages member institutions towards captive elasmobranch breeding efforts. To that end, the 2017 RCP establishes a new studbook category, SAFE Studbook.

Each species reported in the 2015 and 2016 Space Surveys was filtered through the MFTAG Management Decision Tree (CHART 1) and Management Matrix (APPENDIX 12) when applicable.

Note on Exclusion of Species
Not all species IUCN listed as vulnerable, endangered, or critically endangered or noted in a CITES appendix were assigned to a MFTAG management program at this time. Exclusion of each these species from MFTAG management is justified and MFTAG considerations of the species are in APPENDIX 14.

All species listed in APPENDIX 8 are considered under the MFTAG purview in this 2017 RCP. Except for the species identified for managed programs, all species listed in APPENDIX 8 will be monitored by the TAG but no directed conservation plan will be developed for each species.

The following species were selected for program management in the 2010 RCP:

Scientific Name	**Common Name**
Aetobatus narinari	spotted eagle ray
Carcharias taurus	sandtiger shark
Hippocampus abdominalis	big bellied seahorse
Hippocampus erectus	lined seahorse
Hippocampus kuda	spotted seahorse
Pristis pectinata	smalltooth sawfish
Pristis pristis	largetooth sawfish
Pristis zijsron	green sawfish
Stegostoma fasciatum	zebra shark

APPENDICES 15 and 16 provide updates on and summaries of the progress and status

of these established programs. APPENDIX 17 provides program goals or anticipated trends for the next three to five years for each program if developed by the program at the time of the RCP development.

The following species will remain* or were selected for a new studbook, SAFE studbook or SSP management for the 2017 RCP:

Scientific Name	**Common Name**
*Aetobatus narinari**	spotted eagle ray
Carcharhinus melanopterus	blacktip reef shark
Carcharhinus plumbeus	sandbar shark
*Carcharias taurus**	sandtiger shark
Cheilinus undultaus	humphead wrasse
Chilloscyllium punctatum	brownbanded bambooshark
Epinephelus itajara	itajara/goliath grouper
Ginglystoma cirratum	nurse shark
Hemiscyllium ocellatum	epaulette shark
*Hippocampus abdominalis**	big bellied seahorse
Hippocampus barbouri	Barbour's seahorse
*Hippocampus erectus**	lined seahorse
*Hippocampus kuda**	spotted seahorse
Hypanus americanus	southern ray
Hypanus sabinus	Atlantic ray
Phycodurus eques	leafy seadragon
*Pristis pectinata**	smalltooth sawfish
*Pristis pristis**	largetooth sawfish
*Pristis zijsron**	green sawfish
Pterapogon kauderni	Banggai cardinal
Rhina ancylostoma	bowmouth guitarfish
Rhinoptera bonasus	cownose ray
*Stegostoma fasciatum**	zebra shark

Notes on Selection of SAFE Studbook Species

The creation of the SAFE Studbooks is in response to the SAFE: Shark and Ray SSP Action Plan that calls for the increased collaborative management of elasmobranches in human care. The MFTAG recognizes that the opportunity to include such work in the most recent edition of the MFTAG RCP is important to accomplishing that action item as a community.

Nine elasmobranch species were selected by the MFTAG Steering Committee's Population Management Working Group after review of the space survey data and based on industry knowledge related to the progress being made in breeding and

husbandry. While these species are not considered of conservation concern, they are species in high demand by collection managers, have proven histories of reproductive success, would benefit with heightened collaborative management, and are well suited for current and trending exhibit designs.

PROGRAM CATEGORIES: TAXA ASSIGNMENTS

The Management Category Matrix (MCM) provides a starting point for the MFTAG to evaluate selected species. However, additional review by the MFTAG provided the final assignment for each selected species and is listed in APPENDIX 18.

SPACE ANALYSIS SUMMARY FOR SELECTED SPECIES MANAGEMENT SPECIES AND TARGET POPULATIONS

The 2015 and 2016 Space Surveys detailed current species of conservation concern within AZA member institutions. Additionally, the survey solicited information on the number of individuals of these species or "spaces" anticipated in future acquisitions. APPENDIX 19 summarizes current populations and anticipated future acquired species and population sizes based on the information provided by the survey. It also details estimated target population sizes believed necessary for a successful conservation program for each species.

MFTAG animal programs are selected for action using the decision tree and selection criteria matrix discussed previously in this document. However, the MFTAG feels strongly now as it did during the 2006 and 2010 RCP drafting process, that the use of tools can only provide an initial filter and guidance related to animal program identification. Program identification must be made with knowledge of the industry, anticipated collection planning trends, institutional interest, and with regard to individual passion for a species. These should be balanced in response to conservation and sustainability considerations. The expertise and knowledge of the MFTAG Steering Committee has greatly supported program identification based on the program selection tools required by the WCMC.

In considering fish taxa and fish population sizes in AZA institutions, all species listed in APPENDIX 19 currently have relatively small populations related to the criteria of formal program status. For these programs and with the exclusion of those existing programs that have met with the Population Management Center (marked as **), target populations were not assigned by the MFTAG Steering Committee because methodology and information needed to quantitatively determine target population sizes needed to sustain a long term genetically diverse population aren't currently available.

Additionally, it must be noted that not all survey participants chose to detail their future interest and some could not divulge future interests due to the policies of their governing institutions. Therefore, while some space survey data reported in the

selection sheets do not reflect future interest, the MFTAG has confidence, based on personal communications with AZA member facilities, that such future interest is present. These interests where included in the future interest consideration for these species.

Over the last three years, the MFTAG has worked closely with program managers championing the programs established by previous RCPs. With the development of new programs under MFTAG management in this RCP, the TAG will begin supportive efforts towards filling spaces through the acquisition of genetically unrelated fishes from known sources and breeding species already being bred in AZA facilities. Over the next five years, these programs will attempt to increase their populations by advancing reproductive and rearing techniques, encouraging cooperative breeding consortiums among AZA members, and acquiring additional unrelated stocks from known locations or populations. By the end of 2018, the MFTAG Steering Committee will recruit members to champion the new programs established by this RCP and continue to mentor and support the work of current program leaders within the TAG.

The MFTAG continues to support increased efforts to develop statistical software that will allow the TAG to develop breeding strategies that fill AZA member needs for collections and support healthy genetically diverse and sustainable collections into the future.

MARINE FISHES TAXONOMIC ADVISORY GROUP
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APPENDICES

APPENDIX 1

MFTAG Highlighted Programs

One overarching goal of all AZA TAGs is to increase the sustainability of the taxa they manage. The MFTAG wishes to work closely with programs that improve sourcing of animals (e.g. reduced ecological and/or social impacts of animal collection), provide new sources of animals (e.g. captive-rearing, mariculture), and conserve habitats that are essential to the species AZA institutions exhibit. Ideally, programs must also include well designed educational and outreach initiatives.

The MFTAG wishes to highlight programs that help meet our goal of increasing the sustainability of animal collections and the habitats where these animals originate. Highlighted programs will include those that address broad scale sustainability of species within our collections and projects that increase awareness of significant conservation efforts. Institutionally, the MFTAG wishes to support efforts to protect species and habitats facing significant anthropogenic impacts.

The MFTAG has developed a process to evaluate projects and initiatives that support the MFTAG mission. The first step in becoming a MFTAG Highlighted Program is filling out an application to demonstrate adherence to program criteria *(applications can be obtained from a MFTAG Steering Committee member*). All questionnaires will be submitted to the MFTAG Steering Committee for discussion during the annual MFTAG working meeting typically held at the Regional Aquatics Workshop.

The deadline for submitting applications to the MFTAG will be 30 days prior to the MFTAG Steering Committee meeting held at the Regional Aquatics Workshop. Applicants will be recommended as Highlighted Programs based on a two-thirds majority vote of the MFTAG Steering Committee.

Following a favorable MFTAG recommendation, the application will be sent to additional AZA committees for review in the following order:

1) AZA Wildlife Conservation Management Committee (WCMC)
2) AZA Aquarium Affairs Committee (AAC)

With favorable responses from the WCMC and the Aquarium Affairs Committee, the AZA Conservation and Science Department will provide final review and comment.
If no additional approval is deemed necessary by the AZA Conservation and Science Department review, the application will be sent back to the MFTAG chair at which time the applicant will be considered a MFTAG Highlighted Program. The MFTAG chair will notify applicants.

If additional AZA staff (Conservation and Science Department) or AZA Board review is needed, such approval will be requested before the applicant is considered an MFTAG Highlighted Program.

It is important to keep in mind throughout the process that those projects, initiatives, and programs approved as MFTAG Highlight Programs will not be guaranteed access to additional funding, perks, or official AZA endorsement, but will be formally introduced to AZA MFTAG institutions and showcased during the MFTAG reporting meeting at the AZA Annual Conference.

Criteria for selecting a MFTAG Highlighted Program include:

1. Programs must define the sustainability issue that they are addressing, for example:
    a) Projects that clearly benefit species and/or habitats of interest to MFTAG (e.g. endangered or threatened species, species of critical importance to AZA, IUCN)
    b) Projects that target wildlife sustainability issues, including efforts to explore sustainable aquaculture or increase the sustainability of seafood through improved fisheries management and stock assessment, or to control and mitigate illegal wildlife trade.
2. Program must be outcome based.
    a) Programs must be scientifically significant and sound, logistically feasible, and have a high probability of success.
    b) Programs need a statement of intended outcomes and measures of success.
2. Furthermore, the project should:
    a) Be cooperative in nature and compatible with other AZA conservation initiatives and programs. It is recommended and encouraged that programs have two or more AZA member institutions as active participants.
    b) Build on previous work, including an established commitment to a conservation program. New projects need to demonstrate their commitment to become or contribute to a long-term conservation program.

APPENDIX 2

AZA SAVING SPECIES FROM EXTINCTION (SAFE): Shark and Ray Program

The Marine Fish Taxonomic Advisory Group (MFTAG) recognizes that elasmobranch populations worldwide are in precipitous decline and that little is known of the natural history and biology of many of the estimated 512 species of sharks, 500 of species skate and rays, and the 50 species of chimaera known to swim the world's oceans and rivers. The MFTAG also recognizes that elasmobranchs are incorporated into many AZA member institutional collection plans as important ambassadors for aquatic education and conservation inspiration.

AZA member institutions contributed over $2.1 million to elasmobranch conservation projects between 2010 and 2014 (www.aza.org/SAFE-shark-and-ray). Additionally, with the publication of the 2017 MFTAG Regional Collection Plan, AZA member institutions will collaborate to manage species survival programs for 15 elasmobranch species.

Conservation projects and collaborative management programs have contributed to our better understanding of elasmobranch biology and natural history. They have also contributed to creating a collective voice speaking out for conservation of these species. The fact remains, however, that wild populations are still in decline.

The AZA SAFE program provides a fresh mechanism for conservation collaboration. The SAFE: Shark and Ray Program highlights the need for even more combined efforts and resources, and focuses that need to a common goal, saving elasmobranchs from extinction.

The MFTAG supports the AZA SAFE: Shark and Ray Program on all levels and strongly encourages AZA member institution staff to volunteer as project coordinators and collaborators to support the completion of the program's three-year action plan.

For more information on AZA SAFE: Shark and Ray Program, and how to get involved: https://www.aza.org/SAFE-shark-and-ray

APPENDIX 3

MFTAG ADVISORY CORPS: Terms and Criteria for Selection of Advisors

I. Position Overview: (from AZA TAG handbook, p.17)

Advisors play a critical role in advising, designing, and executing conservation and management decisions within AZA Animal Programs. If a member of the Steering Committee has the appropriate expertise in an advisory area, then s/he may serve as that Advisor. TAGs are encouraged to fill as many Advisor positions as appropriate for their TAG in order to implement superlative species conservation and management initiatives. Advisors do not need to be employed by an AZA member institution. Advisors do not vote in elections or on TAG issues unless they also serve as an IR or a member of the TAG Steering Committee. Advisors are available to all Animal Programs within a TAG's purview.

II. Criteria for Advisors:

A. Advisors must bring appropriate expertise or knowledge to the MFTAG, or play a critical role in MFTAG strategic activities.
B. Advisors need not be employed by an AZA-accredited institution.
C. Advisors do not vote in elections or on TAG issues unless they also serve as an IR or a member of the TAG Steering Committee.

III. Selection and Term of Advisors:

A. The Steering Committee determines which advisory roles best serve the MFTAG.
B. Steering Committee members nominate MFTAG advisors with a formal letter of recommendation.
C. Steering Committee members who rotate off of the committee due to elections will be given the opportunity to serve a 3-year term as an advisor.
D. Advisors will be approved by a simple majority vote of the Steering Committee.
E. The MFTAG chair or their designate will query the advisors annually to determine if they wish to continue in their role supporting the TAG.
F. Advisors will serve a 3-year term, renewable by majority vote of the Steering Committee.

IV. Role and Function of Advisors: (from AZA TAG handbook, p.18)

A. Advise the TAG in their efforts to identify, develop, and implement Animal Program goals, as applicable.
B. Provide content for AZA taxa-related stories of interest related to the Advisor's area of expertise.

C. Provide expert advice regarding any topics, research proposals, and inquiries related to the Advisor's area of expertise.
D. Uphold TAG business confidentiality.
E. Provide input on the Animal Care Manuals within the TAG's purview as requested.
F. Assist in the development of education materials related to the advisor's area of expertise.
G. Assist with the development of research projects related to the Advisor's area of expertise.
H. Assist the TAG in reviewing taxa-related CGF grant proposals as requested.

V. Current Advisors:

Advisor	**Current**
Veterinary	Rob Jones DVM
Government Affairs	Joe Choromanski
Life Support Systems	Andy Aiken
WCMC Liaison	Jack Jewell
European Liaison	
Education	
General Advisor	Allan Marshall
General Advisor	Roy Drinnen
General Advisor	Doug Warmolts
General Advisor	Dennis Thoney
Animal Welfare	
Reproductive Sciences	Linda Penfold
Public Relations	
Enrichment & Behavior	
Research	
Nutrition	Lisa Hoopes
Field Conservation	

VI. Reference:

Association of Zoos and Aquariums (2014). Taxon Advisory Group (TAG) Handbook. Association of Zoos and Aquariums, Silver Spring, MD.

APPENDIX 4

MFTAG WORKING GROUPS

Grants Working Group – This working group is available to coach and support grant writing efforts and specifically is available to support Conservation Grant Fund (CGF) applicants with proposal submittal review.

Sustainability Working Group- This working group works to highlight sustainable aquatic invertebrate and fish collection planning best practices for AZA members.

Hawaiian Advocacy Working Group - This working group partners with the AZA Government Affairs office to monitor legislative activity impacting public aquarium interests in Hawaii.

APPENDIX 5

MFTAG INFORMATION COMMUNICATION AND RESOURCES

Husbandry Manuals

Elasmobranch Husbandry Manual

The Elasmobranch Husbandry Manual: Captive Care of Sharks, Rays, and their Relatives. Mark Smith, Doug Warmolts, Dennis Thoney, and Robert Hueter (editors). 2004. Special publication of the Ohio Biological Survey. Xv + 589 p.

For more information, contact:
www.elasmobranchhusbnadry.org
or
Doug Warmolts
Columbus Zoo and Aquarium
Doug.warmolts@columbuszoo.org

Syngnathid Husbandry Manual

Syngnathid Husbandry in Public Aquarium: 2005 Manual. Heather Koldewey. Zoological Society of London. 137p.

For electronic copies of the manual, additional resources, and documents, contact:
http://www.projectseahorse.org/conservation-tools/2005/1/01/syngnathid-husbandry-in-public-aquariums

For additional information, contact:
Heather Koldewey
Zoological Society of London
Heather.koldewey@zsl.org
or
George Parsons
John G Shedd Aquarium
gparsons@sheddaquarium.org

Water Quality Manual

Aquality: Water Quality Manual for Zoos and Aquariums
www.aqualitysymposium.org

For additional information on Aquality, contact:
Andy Aiken
National Aquarium
aaiken@aqua.org

E-Mail Subscription List Servers

AquaticInfo

thelist@aquaticinfo.org

AquaticInfo is a moderated aquarist forum.

Moderator Contact:
Brian Nelson
National Aquarium in Baltimore
bnelson@aqua.org

Aquatic Interest Group Listserve

AQUA-IG@lists.aza.org

The Aquatic Interest Group (AQIG) is established as a professional resource and forum of the public aquarium community for the coordination and support of its cooperative programs.

To get involved or for more information on AQIG contact the AQIG coordinator:
Eric Hovland
Florida Aquarium
ehovland@flaquarium.com

Marine Fishes Taxon Advisory Group Listserv

MFTAG@lists.AZA.org

MFTAG is a closed list, communications and announcements forum for AZA MFTAG Institutional Representatives, Program leaders and Advisors only.

Moderator Contact:
Becky Ellsworth
Columbus Zoo and Aquarium
Becky.Ellsworth@columbuszoo.org

Elasmobranch Husbandry Listserv

The Elasmobranch Husbandry Listserv is a google discussion list which is open to aquarists from public aquaria both within the AZA as well as internationally who are interested in discussing all aspects of elasmobranch husbandry.

Moderator Contact:
Mark Smith

New England Aquarium
msmith@neaq.org

For additional information or to join the list, visit this website link:
https://sites.google.com/site/elasmobranchhusbandry/discussion

Syngnathid Husbandry Listserv

The Syngnathid Husbandry (Syngnathidae) listserv was established to facilitate communication between syngnathid aquarist from public aquaria both within the AZA and internationally who are interested in discussing all aspects of Syngnathid husbandry.

Moderator Contact:
Colin Grist
Chester Zoo
col@smartserve.net

Seadragon Listserv

The Seadragon listserv was established to facilitate communication between seadragon aquarists from public aquaria both within the AZA and internationally who are interested in discussing all aspects of seadragon husbandry specifically.

Moderator Contact:
Jenn Moffatt
Birch Aquarium at Scripps
jmoffatt@uscd.edu

For additional information, or to be added to the list follow this link:
http://lists.aza.org/cgi-bin/mailman/listinfo/seadragons

Additional Resources

Regional Aquatics Workshop (RAW)

The Regional Aquatics Workshop (RAW) is not affiliated with AZA, or any other organization, NGO, or conservation initiative. RAW is the largest independent annual public aquarium congress. Many attendees have found it productive to conduct some of their other professional business at RAW sites during the congress. RAW has become the venue-of-choice for the annual working meetings of all AZA (Association of Zoos and Aquariums) aquatic conservation committees (Marine Fish TAG, Freshwater Fish TAG, Aquatic Invertebrate TAG, Coral CAP, and Lake Victoria SSP). Additionally, various international groups often use RAW to communicate and

collaborate with North American public aquarium professionals.

RAW meetings are organized by host institutions with informal help from previous hosts and other interested RAW enthusiasts. Attendance has grown from 20 to occasionally over 200. The sheer size of the meetings, increasingly complicated logistics, and associated communication issues prompted previous organizers to establish a RAW Advisory Committee in 2001. RAW meetings are held annually usually in late spring/early summer with the date and location chosen by the host institution.

RAW Advisory Committee Chair:
Jeff Gibula
Newport Aquarium
jgibula@newportaquarium.com

RAW Program Committee Chair:
Brian Dorn
North Carolina Aquarium – Fort Fisher
Brian.dorn@ncaquariums.com

DRUM AND CROAKER

http://drumandcroaker.org/

Drum and Croaker is a non-peer-reviewed journal that has acted as an "informal organ" for public aquarium professionals since 1958. It has a long history of providing a forum for the exchange of basic aquarium-based information and occasionally humor. It was conceived in the back seat of a car in 1957, and has remained erratic and irregular throughout most of its life, characteristics it shares with a colleague or two. The original name, "Grunt and Crappie" was rejected for scatological reasons, but it was perhaps no surprise that the first call for papers then heralded the periodical as "an irresponsible journal...by undedicated aquarists". More on the early history of Drum and Croaker can be found in contributions in Drum and Croaker by Bill Hagan [Drum and Croaker 70(1):3] and Rick Segedi [Drum and Croaker 77(2):17-18].

Drum and Croaker is currently published annually, but prior to 1985 was published on an erratic schedule of zero to four issues per year, depending on the whims of the editor or contributor enthusiasm. In the mid 1980's the journal dropped out of sight altogether for almost five years, apparently due to a general lack of interest at a variety of levels. John Kuhns, the editor of the Journal of Aquariculture and Aquatic Sciences, rescued a few lost contributions in 1989 and with these began to issue Drum and Croaker on a regular basis. In 1992, John graciously agreed to pass responsibility back to the public aquarium community through members of the Regional Aquatics Workshop (RAW). Pete Mohan has been the editor since that date.

Drum and Croaker has been published in an electronic format since 2000. Initially distributed as PDF attachments to email, these files found a permanent home on the Columbus Zoo and Aquarium's web site in November of 2001. Mike Brittsan (Columbus Zoo Curator) and Greg Bell (Columbus Zoo Finance and IT Director) are the institutional supporters that have made the site possible, while Kevin Bonifas (Columbus Zoo Web Developer) built and updates the pages. The many back issues now available on the site are also made possible, in part, by a 1999 Columbus Zoo and Aquarium grant that allowed the editor to purchase a scanner and Optical Character Recognition (OCR) software to restore original Drum and Croaker text and images. Ultimately, all of the old paper issues of Drum and Croaker will be transferred to pdf files, making them available to the public aquarium community as technical and historical references. Tony Moore (Aquarium Curator, The Mirage/MGM Grand, Las Vegas, NV) created and updates the Author Index and Contents Pages files that serve as searchable indexes.

To request information and to submit articles to Drum and Croaker, contact:
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APPENDIX 6

MARINE FISH ORDERS HELD IN AZA INSTITUTIONS
Based on Marine Fish TAG 2007 Species Space Survey Data

The 2007 Marine Fish TAG Regional Collection Plan Space Survey reported 37 orders being held in AZA member institutions.

Acipenseriformes
Albuliformes
Anguilliformes
Atheriniformes
Aulopiformes
Batrachoidiformes
Beloniformes
Beryciformes
Carcharhiniformes
Chimaeriformes
Clupeiformes
Cyprinodontiformes
Elopiformes
Gadiformes
Gasterosteiformes
Gobiesociformes
Gonorynchiformes
Heterodontiformes
Hexanchiformes
Lamniformes
Lophiiformes
Myliobatiformes
Myxiniformes
Ophidiiformes
Orectolobiformes
Osmeriformes
Perciformes
Pleuronectiformes
Rajiformes
Rhinopristiformes
Salmoniformes
Scorpaeniformes
Siluriformes
Squaliformes
Squatiniformes
Syngnathiformes
Tetradontiformes
Zeiformes

APPENDIX 7

MARINE FISH FAMILIES HELD IN AZA INSTITUTIONS
Based on Marine Fish TAG 2007 Species Space Survey Data

The 2007 Marine Fish TAG Regional Collection Plan Space Survey reported 165 families being held in AZA member institutions. The 2015 and 2016 Space Surveys reported an additional six orders because of taxonomic reclassification or new acquisitions heretofore not recorded for a total family count of 171.

Acanthuridae
Achiridae
Acipenseridae
Agonidae
Albulidae
Ammodytidae
Anablepidae
Anarhichadidae
Anguillidae
Anomalopidae
Anoplopomatidae
Antennariidae
Apoginidae
Aracanidae
Ariidae
Atherinidae
Atherinopsidae
Aulorhynchidae
Aulostomidae
Balistidae
Bathymasteridae
Batrachoididae
Belonidae
Blennidae
Bothidae
Bovichtidae
Bythitidae
Caesionidae
Callionymidae
Caproidae
Carangidae
Carcharhinidae
Centriscidae
Centropomidae
Chaenopsidae
Chaetodontidae
Chanidae
Cheilodactylidae
Chimaeridae
Cirrhitidae
Clinidae
Clupeidae
Congridae
Coryphaenidae
Cottidae
Cyclopteridae
Cynoglossidae
Cyprinodontidae
Dactylopteridae
Dasyatidae
Dasyatidae
Diodontidae
Echeneidae
Eleotridae
Elopidae
Embiotocidae
Engraulididae
Enoplosidae
Ephippidae
Epinephelidae
Fistulariidae
Fundulidae
Gadidae
Gasterosteidae
Gerreidae
Ginglymostomatidae
Gobiesocidae
Gobiidae
Grammatidae
Gymnuridae
Haemulidae
Hemiscylliidae
Hemitripteridae
Heterodontidae
Hexagrammidae
Hexanchidae
Holocentridae
Kuhliidae
Kyphosidae
Labridae
Labrisomidae
Lamnidae
Lethrinidae
Liparidae
Lobotidae
Lophiidae
Lotidae
Lutjanidae
Malacanthidae
Megalopidae
Mobulidae
Microdesmidae
Molidae
Monacanthidae
Monocentridae
Monodactylidae
Moronoidae
Mugilidae
Mullidae
Muraenidae
Myliobatidae
Myxinidae
Nemipteridae
Odontaspidae
Ogcocephalidae
Ophichthidae
Ophidiidae
Opistognathidae
Oplegnathidae
Orectolobidae
Osmeridae

Ostraciidae
Paralichthyidae
Pegasidae
Pempheridae
Pentacerotidae
Pholidae
Pholidichthyidae
Phycidae
Pinguipedidae
Plesiopidae
Pleuronectidae
Plotosidae
Poeciliidae
Polynemidae
Polyprionidae
Pomacanthidae
Priacanthidae
Pristidae
Pseudochromidae
Ptereleotridae
Rachycentridae
Rajidae
Rhamphocottidae
Rhincodontidae
Rhinobatidae
Rhinopteridae
Salmonidae
Scaridae
Scatophagidae
Sciaendidae
Sciaenidae
Scombridae
Scophthalmidae
Scorpaenidae
Scyliorhinidae
Sebastidae
Serranidae
Siganidae
Sparidae
Sphyraenidae
Sphyrnidae
Squalidae
Squatinidae
Stegostomatidae
Stetarchidae
Stichaeidae
Synanceiidae
Syngnathidae
Terapontidae
Tetradontidae
Tetrarogidae
Toxotidae
Triakidae
Triglidae
Uranoscopidae
Urolophidae
Urotrygonidae
Zanclidae
Zoarcidae

APPENDIX 8

MARINE FISH SPECIES HELD IN AZA INSTITUTIONS
Based on Marine Fish TAG 2007 Species Space Survey Data

The 2007 Marine Fish TAG Regional Collection Plan Space Survey reported 1397 species being held in AZA member institutions. The 2015 and 2016 surveys reported an additional three species because of taxonomic reclassification or new acquisitions heretofore not recorded to bring the total to 1400 species. *(**A**lpha by Genus)*

Genus	Species	Common Name
Abalistes	*stellatus*	Abalistes stellatus
Ablabys	*macracanthus*	spiny waspfish
Ablabys	*taenianotus*	cockatoo waspfish
Ablabys	*binotatus*	redskinfish
Ablennes	*hians*	flat needlefish
Abudefduf	*sordidus*	blackspot sergeant
Abudefduf	*abdominalis*	green damselfish
Abudefduf	*vaigiensis*	Indo-Pacific sergeant
Abudefduf	*troschelii*	Panamanic sergeant major
Abudefduf	*sexfasciatus*	scissortail sergeant
Abudefduf	*saxatilis*	sergeant major
Acantheblemaria	*macrospilus*	barnacle blenny
Acanthemblemaria	*spinosa*	spinyhead blenny
Acanthopagrus	*latus*	yellowfin seabream
Acanthostracion	*quadricornis*	scrawled cowfish
Acanthurus	*achilles*	Achilles tang
Acanthurus	*gahhm*	black surgeonfish
Acanthurus	*coeruleus*	blue tang surgeonfish
Acanthurus	*nigroris*	bluelined surgeonfish
Acanthurus	*nigrofuscus*	brown surgeonfish
Acanthurus	*pyroferus*	chocolate surgeonfish
Acanthurus	*triostegus*	convict surgeonfish
Acanthurus	*chirurgus*	doctorfish
Acanthurus	*tennentii*	doubleband surgeonfish
Acanthurus	*mata*	elongate surgeonfish
Acanthurus	*nigricauda*	epaulette surgeonfish
Acanthurus	*dussumieri*	eyestripe surgeonfish
Acanthurus	*grammoptilus*	finelined surgeonfish
Acanthurus	*japonicus*	Japan surgeonfish
Acanthurus	*lineatus*	lined surgeonfish
Acanthurus	*bahianus*	ocean surgeon

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Acanthurus	*olivaceus*	orangespot surgeonfish
Acanthurus	*leucosternon*	powderblue surgeonfish
Ac*anthurus*	*blochii*	ringtail surgeon
Acanthurus	sohal	Sohal surgeonfish
Acanthurus	*leucopareius*	whitebar surgeonfish
Acanthurus	*albipectoralis*	whitefin surgeonfish
Acanthurus	*guttatus*	whitespotted surgeonfish
Acanthurus	*xanthopterus*	yellowfin surgeonfish
Acanthurus	*thompsoni*	Thompson's surgeonfish
Acanthurus	*nigricans*	whitecheek surgeonfish
Achirus	*lineatus*	lined sole
Acipensar	*oxyrinchus oxyrinchus*	Atlantic sturgeon
Acipenser	*tranfmontanus*	white sturgeon
Aeoliscus	*strigatus*	razorfish
Aeoliscus	*punctulatus*	speckled shrimpfish
Aetobatus	*narinari*	spotted eagle ray
Agonopsis	*vulsa*	northern spearnose poacher
Albula	*vulpes*	bonefish
Alectis	*ciliaris*	African pompano
Alectis	*indicus*	Indian threadfin
Alosa	*sapidissima*	American shad
Alosa	*aestivalis*	blueback shad
Alticus	*saliens*	leaping blenny
Aluterus	*schoepfii*	orange filefish
Aluterus	*scriptus*	scrawled filefish
Amblycirrhitus	*pinos*	redspotted hawkfish
Amblyeleotris	*wheeleri*	gorgeous prawn-goby
Amblyeleotris	*aurora*	pinkbar goby
Amblyeleotris	*randalli*	Randall's prawn-goby
Amblyeleotris	*guttata*	spotted prawn-goby
Amblyglyphidodon	*aureus*	golden damselfish
Amblyglyphidodon	*ternatensis*	ternate damsel
Amblyglyphidodon	*leucogaster*	yellowbelly damsel
Amblygobius	*phalaena*	banded goby
Amblygobius	*rainfordi*	old glory
Amblygobius	*sphynx*	sphynx goby
Amblyraja	*radiata*	thorny skate
Ammodytes	*americanus*	American sand lance
Amphiprion	*akindynos*	Barrier Reef anemonefish
Amphiprion	*leucokranos*	bonnethead anemonefish
Amphiprion	*ocellaris*	clown anemonefish
Amphiprion	*melanopus*	fire clownfish

Amphiprion	*nigripes*	Maldive anemonefish
Amphiprion	*tricinctus*	maroon clownfish
Amphiprion	*percula*	orange clownfish
Amphiprion	*perideraion*	pink anemonefish
Amphiprion	*rubrocinctus*	red anemonefish
Amphiprion	*ephippium*	saddle anemonefish
Amphiprion	*polymnus*	saddleback clownfish
Amphiprion	*sebae*	sebae anemonefish
Amphiprion	*akallopisos*	skunk clownfish
Amphiprion	*frenatus*	tomato clownfish
Amphiprion	*bicinctus*	twoband anemonefish
Amphiprion	*allardi*	twobar anemonefish
Amphiprion	*sandaracinos*	yellow clownfish
Amphiprion	*clarkii*	yellowtail clownfish
Amphistichus	*argenteus*	barred surfperch
Amphistichus	*koelzi*	calico surfperch
Amphistichus	*rhodoterus*	redtail surfperch
Anableps	*anableps*	largescale foureyes
Anarhichas	*minor*	spotted wolffish
Anarhichas	*lupus*	wolf-fish
Anarrhichthys	*ocellatus*	wolf-eel
Ancylopsetta	*ommata*	Gulf of Mexico ocellated flounder
Anguilla	*rostrata*	American eel
Anisotremus	*surinamensis*	black margate
Anisotremus	*taeniatus*	Panamic porkfish
Anisotremus	*virginicus*	porkfish
Anisotremus	*davidsonii*	Xantic sargo
Anomalops	*katoptron*	splitfin flashlightfish
Anoplarchus	*purourescens*	high cockscomb
Anoplarchus	*insignis*	slender cockscomb
Anoplocapros	*lenticularis*	white-barred boxfish
Anoplopoma	*fimbria*	sablefish
Antennarius	*commerson*	Commerson's frogfish
Antennarius	*multiocellatus*	longlure frogfish
Antennarius	*pictus*	painted frogfish
Antennarius	*radiosus*	singlespot frogfish
Antennarius	*striatus*	striated frogfish
Antennarius	*tuberosus*	tuberculated frogfish
Antennarius	*maculatus*	warty frogfish
Anthias	*anthias*	swallowtail seaperch

Anthias	*tenuis*	threadnose bass
Anyperodon	*leucogrammicus*	slender grouper
Apeltes	*quadracus*	fourspine stickleback
Apodichthys	*flavidus*	penpoint gunnel
Apodichthys	*fucorum*	rockweed gunnel
Apogon	*sp.*	Apogon sp.
Apogon	*binotatus*	barred cardinalfish
Apogon	*retrosella*	barspot cardinalfish
Apogon	*townsendi*	belted cardinalfish
Apogon	*fraenatus*	bridled cardinalfish
Apogon	*evermanni*	Evermann's cardinalfish
Apogon	*maculatus*	flamefish
Apogon	*guadalupensis*	Guadalupe cardinalfish
Apogon	*kallopterus*	iridescent cardinalfish
Apogon	*compressus*	ochre-striped cardinalfish
Apogon	*planifrons*	pale cardinalfish
Apogon	*margaritophorus*	red-striped cardinalfish
Apogon	*dovii*	tailspot cardinalfish
Apogon	*leptacanthus*	threadfin cardinalfish
Apogon	*pseudomaculatus*	twospot cardinalfish
Apogon	*cyanosoma*	yellowstriped cardinalfish
Apolemichthys	*xanthopunctatus*	goldspotted angelfish
Apolemichthys	*trimaculatus*	threespot angelfish
Apolemichthys	*xanthurus*	yellowtail angelfish
Aracana	*ornata*	ornate cowfish
Aracana	*aurita*	striped cowfish
Archosargus	*probatocephalus*	sheepshead seabream
Archosargus	*rhomboidalis*	Western Atlantic seabream
Argyrozona	*argyrozona*	carpenter seabream
Arius	*felis*	hardhead sea catfish
Arius	*sp.*	Arius sp.
Arothron	*nigropunctatus*	blackspotted puffer
Arothron	*meleagris*	guineafowl puffer
Arothron	*diadematus*	masked puffer
Arothron	*manilensis*	narrow-lined puffer
Arothron	*stellatus*	starry toadfish
Arothron	*hispidus*	white-spotted puffer
Artedius	*corallinus*	coralline sculpin
Artedius	*fenestralis*	padded sculpin
Artedius	*harringtoni*	scalyhead sculpin
Artedius	*notospilotus*	smoothhead sculpin
Ascelichthys	*rhodorus*	rosylip sculpin

Assessor	*flavissimus*	yellow devilfish
Astroscopus	*y-graecum*	southern stargazer
Atelomycterus	*marmoratus*	coral catshark
Atherinops	*affinis*	topsmelt silverside
Atherinopsis	*californiensis*	jack silverside
Atractoscion	*nobilis*	white weakfish
Atule	*mate*	yellowtail scad
Aulorhynchus	*flavidus*	tube-snout
Aulostomus	*chinensis*	Chinese trumpet fish
Aulostomus	*maculatus*	trumpetfish
Bagre	*marinus*	gafftopsail sea catfish
Bairdiella	*chrysoura*	silver croaker
Balistapus	*undulatus*	orange-lined triggerfish
Balistes	*conspicillum*	clown triggerfish
Balistes	*capriscus*	grey triggerfish
Balistoides	*vetula*	queen triggerfish
Balistoides	*viridescens*	titan triggerfish
Bathyagonus	*pentacanthus*	bigeye poacher
Bathygobius	*soporator*	frillfin goby
Bathytoshia	*centroura*	roughtail stingray
Blenniellia	*chrysospilos*	red-spotted blenny
Blepsias	*cirrhosus*	silverspotted sculpin
Bodianus	*axillaris*	axilspot hogfish
Bodianus	*diana*	Diana's hogfish
Bodianus	*eclancheri*	harlequin wrasse
Bodianus	*anthioides*	lyretail hogfish
Bodianus	*diplotaenia*	Mexican hogfish
Bodianus	*rufus*	Spanish hogfish
Bodianus	*mesothorax*	splitlevel hogfish
Bodianus	*pulchellus*	spotfin hogfish
Bodianus	*bilunulatus*	tarry hogfish
Bodianus	*bimaculatus*	twospot hogfish
Bodianus	*masudai*	Bodianus masudai
Bodianus	*sp.*	Cuban hogfish
Boleophthalmus	*boddarti*	Boddart's goggle-eyed goby
Boopsoidea	*inornata*	fransmadam
Bothus	*sp.*	Bothus sp.
Bothus	*ocellatus*	eyed flounder
Bothus	*mancus*	flowery flounder
Bothus	*lunatus*	platefish
Bovichtus	*variegatus*	thornfish
Brachyistius	*frenatus*	kelp perch
Brevoortia	*tyrannus*	Atlantic menhaden

Brevoortia	*patronus*	Gulf menhaden
Brosmophycis	*marginata*	red brotula
Caesio	*lunaris*	lunar fusilier
Caesio	*cuning*	redbelly yellowtail fusilier
Caesio	*teres*	yellow and blueback fusilier
Caesioperca	*rasor*	barber perch
Caesioperca	*lepidoptera*	butterfly perch
Calamus	*arctifrons*	grass porgy
Calamus	*bajonado*	jolthead porgy
Calamus	*pennatula*	pluma porgy
Calamus	*calamus*	saucereye porgy
Calamus	*penna*	sheepshead porgy
Calloplesiops	*altivelis*	comet
Cantherhines	*macrocerus*	American white spotted filefish
Cantherhines	*pullus*	orangespotted filefish
Cantherhines	*dumerili*	whitespotted filefish
Canthidermis	*sufflamen*	ocean triggerfish
Canthidermis	*maculatus*	spotted oceanic triggerfish
Canthigaster	*rostrata*	Caribbean sharpnose-puffer
Canthigaster	*jactator*	Hawaiian white-spotted toby
Canthigaster	*janthinoptera*	honeycomb toby
Canthigaster	*epilampra*	lantern toby
Canthigaster	*solandri*	spotted sharpnose
Canthigaster	*valentini*	Valentinni's sharpnose puffer
Capros	*aper*	boarfish
Carangoides	*ruber*	bar jack
Carangoides	*bartholomaei*	yellow jack
Caranx	*sexfasciatus*	bigeye trevally
Caranx	*crysos*	blue runner
Caranx	*melampygus*	bluefin trevally
Caranx	*hippos*	crevalle jack
Caranx	*ignobilis*	giant trevally
Caranx	*latus*	horseeye jack
Carcharhinus	*acronotus*	blacknose shark
Carcharhinus	*melanopterus*	blacktip reef shark
Carcharhinus	*limbatus*	blacktip shark
Carcharhinus	*leucas*	bull shark
Carcharhinus	*galapagensis*	Galapagos shark
Carcharhinus	*plumbeus*	sandbar shark
Carcharias	*taurus*	sandtiger shark
Carcharodon	*carcharias*	white shark

Caulolatilus	*princeps*	ocean whitefish
Cebidichthys	*violaceus*	monkeyface prickleback
Centropomus	*undecimalis*	common snook
Centropomus	*parallelus*	fat snook
Centropristis	*ocyurus*	bank sea bass
Centropristis	*striata*	black seabass
Centropristis	*philadelphica*	rock sea bass
Centropyge	*bicolor*	bicolor angelfish
Centropyge	*eibli*	blacktail angelfish
Centropyge	*sp.*	Centropyge sp.
Centropyge	*argi*	cherubfish
Centropyge	*multispinis*	dusky angelfish
Centropyge	*loricula*	flame angelfish
Centropyge	*aurantonotus*	flameback angelfish
Centropyge	*tibicen*	keyhole angelfish
Centropyge	*flavissimus*	lemonpeel angelfish
Centropyge	*shepardi*	mango angelfish
Centropyge	*nox*	midnight angelfish
Centropyge	*multicolor*	multicolored angelfish
Centropyge	*vrolicki*	pearlscale angelfish
Centropyge	*potteri*	russet angelfish
Centropyge	*ferrugata*	rusty angelfish
Centropyge	*bispinosus*	twospined angelfish
Centropyge	*heraldi*	yellow angelfish
Cephalopholis	*formosa*	bluelined hind
Cephalopholis	*boenak*	chocolate hind
Cephalopholis	*fulva*	coney
Cephalopholis	*miniata*	coral hind
Cephalopholis	*cruentata*	graysby
Cephalopholis	*polleni*	harlequin hind
Cephalopholis	*argus*	peacock hind
Cephalopholis	*sonnerati*	tomato hind
Cephaloscyllium	*ventriosum*	swell shark
Cetoscarus	*bicolor*	bicolor parrotfish
Chaetodermis	*penicilligerus*	prickly leatherback
Chaetodipterus	*faber*	Atlantic spadefish
Chaetodipterus	*zonatus*	Pacific spadefish
Chaetodon	*argentatus*	Asian butterflyfish
Chaetodon	*mertensii*	atoll butterfly
Chaetodon	*striatus*	banded butterfly
Chaetodon	*aya*	bank butterflyfish
Chaetodon	*flavirostris*	black butterfly
Chaetodon	*melannotus*	blackback butterfly

Chaetodon	*falcula*	blackwedged butterfly
Chaetodon	*semilarvatus*	bluecheek butterfly
Chaetodon	*bennetti*	bluelashed butterflyfish
Chaetodon	*fremblii*	bluestriped butterflyfish
Chaetodon	*trifascialis*	chevron butterflyfish
Chaetodon	*fasciatus*	diagonal butterfly
Chaetodon	*marleyi*	doublesash butterflyfish
Chaetodon	*octofasciatus*	eightband butterflyfish
Chaetodon	*paucifasciatus*	Eritrean butterflyfish
Chaetodon	*capistratus*	foureye butterfly
Chaetodon	*quadrimaculatus*	fourspot butterfly
Chaetodon	*tinkeri*	Hawaiian butterfly
Chaetodon	*weibeli*	Hong Kong butterfly
Chaetodon	*larvatus*	hooded butterflyfish
Chaetodon	*decussates*	Indian vagabond butterfly
Chaetodon	*rafflesii*	latticed butterfly
Chaetodon	*lineolatus*	lined butterfly
Chaetodon	*declivis*	Marquesas butterflyfish
Chaetodon	*miliaris*	millet butterfly
Chaetodon	*ulietensis*	Pacific double-saddle butterfly
Chaetodon	*xanthurus*	pearlscale butterfly
Chaetodon	*multicinctus*	pebbled butterfly
Chaetodon	*guttatissimus*	peppered butterfly
Chaetodon	*adiergastos*	Phillipine butterfly
Chaetodon	*lunula*	raccoon butterfly
Chaetodon	*rainfordi*	Rainford's butterflyfish
Chaetodon	*collare*	redtail butterfly
Chaetodon	*sedentarius*	reef butterfly
Chaetodon	*ephippium*	saddle butterfly
Chaetodon	*citrinellus*	speckled butterflyfish
Chaetodon	*punctatofasciatus*	spotband butterflyfish
Chaetodon	*ocellatus*	spotfin butterfly
Chaetodon	*kleinii*	sunburst butterflyfish
Chaetodon	*pelewensis*	sunset butterflyfish
Chaetodon	*trichrous*	Tahiti butterflyfish
Chaetodon	*unimaculatus*	teardrop butterfly
Chaetodon	*auriga*	threadfin butterflyfish
Chaetodon	*humeralis*	threebanded butterflyfish
Chaetodon	*vagabundus*	vagabond butterflyfish
Chaetodon	*mesoleucos*	whitefaced butterfly
Chaetodon	*xanthocephalus*	yellowhead butterflyfish
Chaetodontoplus	*melanosoma*	black-velvet angelfish

Chaetodontoplus	*personifer*	blueface angelfish
Chaetodontoplus	*septentrionalis*	bluestriped angelfish
Chaetodontoplus	*meredithi*	Queensland yellowtail angelfish
Chaetodontoplus	*duboulayi*	scribbled angelfish
Chaetodontoplus	*mesoleucus*	vermiculated angelfish
Chanos	*chanos*	milkfish
Chasmodes	*bosquianus*	striped blenny
Cheilinus	*lunulatus*	broomtail wrasse
Cheilinus	*undulatus*	humphead wrasse
Cheilinus	*fasciatus*	redbreast wrasse
Cheilinus	*oxycephalus*	snooty wrasse
Cheilodactylus	*fasciatus*	redfingers
Cheilotrema	*saturnum*	black croaker
Cheimerius	*nufar*	Santer seabream
Chelmon	*muelleri*	blackfin coralfish
Chelmon	*rostratus*	copperband butterfly
Chelmonops	*truncatus*	truncate coralfish
Chilara	*taylori*	spotted cusk-eel
Chilomycterus	*spilostylus*	spotbase burrfish
Chilomycterus	*reticulatus*	spotfin burrfish
Chilomycterus	*schoepfi*	striped burrfish
Chiloscyllium	*arabicum*	Arabian carpetshark
Chiloscyllium	*griseum*	grey bambooshark
Chiloscyllium	*plagiosum*	whitespotted bambooshark
Chiloscyllium	*punctatum*	brownbanded bambooshark
Chirolophis	*decoratus*	decorated warbonnet
Chirolophis	*nugator*	mosshead warbonnet
Chitonotus	*pugetensis*	roughback sculpin
Chloroscombrus	*chrysurus*	Atlantic bumper
Chlorurus	*bowersi*	Bower's parrotfish
Chlorurus	*sordidus*	daisy parrotfish
Choerodon	*fasciatus*	harlequin tuskfish
Chorisochismus	*dentex*	rocksucker
Chromis	*margaritifer*	bicolor chromis
Chromis	*atripectoralis*	black-axil chromis
Chromis	*punctipinnis*	blacksmith
Chromis	*cyanea*	blue chromis
Chromis	*viridis*	blue green damsel
Chromis	*multilineata*	brown chromis
Chromis	*chromis*	damselfish
Chromis	*opercularis*	doublebar chromis
Chromis	*caerulea*	green chromis

Chromis	*ovalis*	Hawaiian chromis
Chromis	*limbaughi*	Limbaugh's damselfish
Chromis	*scotti*	purple reeffish
Chromis	*atrilobata*	scissortail damselfish
Chromis	*insolata*	sunshinefish
Chromis	*verator*	threespot chromis
Chromis	*vanderbilti*	Vanderbilt's chromis
Chromis	*enchrysura*	yellowtail reeffish
Chrysiptera	*hemicyanea*	azure demoiselle
Chrysiptera	*parasema*	goldtail demoiselle
Chrysiptera	*rex*	king demoiselle
Chrysiptera	*cyanea*	sapphire devil
Chrysiptera	*taupou*	southseas devil
Chrysiptera	*talboti*	Talbot's demoiselle
Chrysoblephus	*gibbiceps*	red stumpnose seabream
Chrysoblephus	*laticeps*	Roman seabream
Cirrhilabrus	*cyanopleura*	blueside wrasse
Cirrhilabrus	*randalli*	Randall’s wrasse
Cirrhilabrus	*rubrisquamis*	red velvet fairy wrasse
Cirrhilabrus	*solorensis*	clown fairy wrasse
Cirrhilabrus	*exquisitus*	exquisite wrasse
Cirrhilabrus	*labouti*	Laboute's wrasse
Cirrhilabrus	*lubbocki*	Lubbock's wrasse
Cirrhilabrus	*lineatus*	purplelined wrasse
Cirrhilabrus	*rubripinnis*	redfin wrasse
Cirrhilabrus	*scottorum*	Scott's wrasse
Cirrhilabrus	*rubriventralis*	social wrasse
Cirrhilabrus	*filamentosus*	whip-fin wrasse
Cirrhitichthys	*oxycephalus*	coral hawkfish
Cirrhitichthys	*falco*	dwarf hawkfish
Cirrhitichthys	*aprinus*	spotted hawkfish
Cirrhitops	*fasciatus*	redbarred hawkfish
Cirrhitus	*rivulatus*	giant hawkfish
Cirrhitus	*pinnulatus*	stocky hawkfish
Cirripectes	*variolosus*	red-speckled blenny
Citharichthys	*sordidus*	Pacific sanddab
Citharichthys	*stigmaeus*	speckled sanddab
Cleidopus	*gloriamaris*	pineapplefish
Clepticus	*parrae*	creole wrasse
Clinocottus	*embryum*	calico sculpin
Clinocottus	*globiceps*	mosshead sculpin
Clinocottus	*analis*	woolly sculpin

Clupeapallasii	*pallasii*	Pacific herring
Colomesus	*asellus*	Amazon pufferfish
Congrogadus	*subducens*	carpet eel-blenny
Coris	*aygula*	clown coris
Coris	*formosa*	queen coris
Coris	*gaimard*	yellowtail coris
Coryphaena	*hippurus*	common dolphinfish
Coryphaena	*equiselis*	pompano dolphinfish
Coryphopterus	*glaucofraenum*	bridled goby
Coryphopterus	*dicrus*	Colon gobie
Coryphopterus	*hyalinus*	glass goby
Coryphopterus	*personatus*	masked goby
Coryphopterus	*punctipectophorus*	spotted goby
Corythoichthys	*intestinalis*	scribbled pipefish
Cosmocampus	*elucens*	shortfin pipefish
Cottus	*asper*	prickly sculpin
Cromileptes	*altivelis*	humpback grouper
Cryptocentrus	*lutheri*	Luther's prawn-goby
Cryptocentrus	*leptocephalus*	pink-speckled shrimpgoby
Cryptocentrus	*cinctus*	yellow prawn-goby
Ctenochaetus	*hawaiiensis*	chevron surgeonfish
Ctenochaetus	*cyanocheilus*	short-tail bristle-tooth
Ctenochaetus	*strigosus*	spotted surgeonfish
Ctenochaetus	*striatus*	striated surgeonfish
Ctenochaetus	*marginatus*	striped-fin surgeonfish
Ctenochaetus	*binotatus*	twospot surgeonfish
Ctenochaetus	*tominiensis*	Tomini surgeonfish
Ctenogobiops	*tangaroai*	tangaroa
Cyclichthys	*orbicularis*	birdbeak burrfish
Cyclopterus	*lumpus*	lumpsucker
Cymatogaster	*aggregata*	shiner perch
Cynoscion	*regalis*	gray weakfish
Cynoscion	*arearius*	sand weakfish
Cynoscion	*nebulosus*	spotted weakfish
Cyprinodon	*variegatus variegatus*	sheepshead minnow
Dactyloptena	*orientalis*	Oriental flying gunard
Dactyloptena	*macracantha*	spotwing flying gurnard
Dactylopterus	*volitans*	flying gurnard
Dascyllus	*melanurus*	blacktail humbug
Dascyllus	*carneus*	cloudy dascyllus
Dascyllus	*sp.*	Dascyllus sp.
Dascyllus	*albisella*	Hawaiian dascyllus

Dascyllus	*marginatus*	marginatus dascyllus
Dascyllus	*reticulatus*	reticulate dascyllus
Dascyllus	*trimaculatus*	threespot dascyllus
Dascyllus	*aruanus*	whitetail dascyllus
Dasyatis	*kuhlii*	bluespotted stingray
Dasyatis	*say*	bluntnose stingray
Dasyatis	*latus*	brown stingray
Dasyatis	*brevis*	whiptail stingray
Decapterus	*punctatus*	round scad
Dendrochirus	*brachypterus*	shortfin turkeyfish
Dendrochirus	*biocellatus*	twospot turkeyfish
Dendrochirus	*zebra*	zebra turkeyfish
Dermatolepis	*dermatolepis*	leather bass
Diapterus	*auratus*	Irish mojarra
Dibranchus	*atlanticus*	Atlantic batfish
Diodon	*liturosus*	black-blotched porcupinefish
Diodon	*holocanthus*	long-spined porcupinefish
Diodon	*hystrix*	spot-fin porcupinefish
Diplectrum	*formosum*	sand seabass
Diplodus	*holbrookii*	spottail pinfish
Dipturus	*laevis*	barndoor skate
Dipturus	*binoculata*	big skate
Dischistodus	*perspicillatus*	white damselfish
Doryrhamphus	*excisus excisus*	bluestriped pipefish
Doryrhamphus	*pessuliferus*	yellowbanded pipefish
Doryrhamphus	*janssi*	Janss' pipefish
Doryrhamphus	*multiannulatus*	many-banded pipefish
Doryrhamphus	*dactyliophorus*	ringed pipefish
Echeneis	*naucrates*	sharksucker
Echidna	*catenata*	chain moray
Echidna	*nebulosa*	snowflake moray
Ecsenius	*bicolor*	bicolor blenny
Ecsenius	*midas*	Persian blenny
Elacatinus	*genie*	cleaner goby
Elacatinus	*puncticulatus*	redhead goby
Elacatinus	*oceanops*	neon goby
Elacatinus	*evelynae*	sharknose goby
Elacatinus	*macrodon*	tiger goby
Elacatinus	*horstii*	yellowline goby
Elacatinus	*randalli*	yellownose goby
Elagatis	*bipinnulata*	rainbow runner
Eleotris	*pisonis*	spinycheek sleeper

Elops	*saurus*	ladyfish
Embiotoca	*jacksoni*	black perch
Embiotoca	*lateralis*	striped seaperch
Embiotoca	*jacksoni*	black perch
Emblemaria	*pandionis*	sailfin blenny
Enchelycore	*anatina*	fangtooth moray
Enchelycore	*pardalis*	leopard moray
Enchelycore	*nigricans*	mulatto conger
Enchelyurus	*flavipes*	yellowfin blenny
Engraulis	*mordax*	Californian anchovy
Enophrys	*bison*	buffalo sculpin
Enoplosus	*armatus*	old wife
Epibulus	*insidiator*	slingjaw wrasse
Epinephelus	*flavocaeruleus*	blue and yellow grouper
Epinephelus	*fuscoguttatus*	brown-marbled grouper
Epinephelus	*marginatus*	dusky grouper
Epinephelus	*clippertonensis*	Clipperton grouper
Epinephelus	*lanceolatus*	giant grouper
Epinephelus	*merra*	honeycomb grouper
Epinephelus	*itajara*	itajara/goliath grouper
Epinephelus	*malabaricus*	Malabar grouper
Epinephelus	*striatus*	Nassau grouper
Epinephelus	*tukula*	potato grouper
Epinephelus	*morio*	red grouper
Epinephelus	*guttatus*	red hind
Epinephelus	*adscensionis*	rock hind
Epinephelus	*niveatus*	snowy grouper
Epinephelus	*cyanopodus*	speckled blue grouper
Epinephelus	*analogus*	spotted grouper
Epinephelus	*labriformes*	starry grouper
Epinephelus	*caeruleopunctatus*	whitespotted grouper
Epinephelus	*ongus*	white-streaked grouper
Epinephelus	*nigritis*	Warsaw grouper
Eptatretus	*stoutii*	Pacific hagfish
Equetus	*iwamotoi*	blackbar drum
Equetus	*umbrosus*	cubbyu
Equetus	*lanceolatus*	jack-knife fish
Equetus	*punctatus*	spotted drum
Eucinostomus	*havana*	bigeye mojarra
Eucinostomus	*sp.*	Eucinostomus sp.
Eucinostomus	*melanopterus*	flagfin mojara
Eucinostomus	*gula*	Jenny mojara
Eucinostomus	*lefroyi*	mottled mojara

Eucinostomus	*argentus*	silver mojara
Eugerres	*plumieri*	striped mojarra
Eumicrotremus	*orbis*	Pacific spiny lumpsucker
Eurypegasus	*draconis*	short dragonfish
Euthynnus	*alletteratus*	little tunny
Fistularia	*tabacaria*	cornet fish
Forcipiger	*flavissimus*	longnose butterfly
Fundulus	*diaphanous*	banded killfish
Fundulus	*parvipinnis*	California killifish
Fundulus	*grandis*	gulf killifish
Fundulus	*confluentus*	marsh killifish
Fundulus	*heteroclitus heteroclitus*	mummichog
Fundulus	*majalis*	striped killifish
Fundulus	*similis*	longnose killifish
Gadus	*morhua*	Atlantic cod
Gadus	*macrocephalus*	Pacific cod
Galeorhinus	*zyopterus*	tope shark
Gambusia	*holbrooki*	eastern mosquitofish
Gasterosteus	*aculeatus aculeatus*	three-spined stickleback
Genicanthus	*watanabei*	blackedged angelfish
Genicanthus	*lamarck*	blackstriped angelfish
Genicanthus	*semifasciatus*	Japanese swallow
Genicanthus	*bellus*	ornate angelfish
Genicanthus	*melanospilos*	spotbreast angelfish
Genicanthus	*caudovittatus*	zebra angelfish
Genyonemus	*lineatus*	white croaker
Gerres	*cinereus*	yellow fin mojara
Gibbonsia	*montereyensis*	crevice kelpfish
Gibbonsia	*elegans*	spotted kelpfish
Gibbonsia	*metzi*	striped kelpfish
Gillichthys	*mirabilis*	longjaw mudsucker
Ginglymostoma	*cirratum*	nurse shark
Girella	*nigricans*	opaleye
Gnathanodon	*speciosus*	golden trevally
Gnathodentex	*aureolineatus*	striped large-eye bream
Gobiesox	*maeandricus*	northern clingfish
Gobiesox	*strumosus*	skilletfish
Gobiodon	*histrio*	broad-barred goby
Gobiodon	*quinquestrigatus*	five-lined coral fish
Gobiodon	*sp.*	Gobiodon sp.
Gobiodon	*okinawae*	Okinawa goby
Gobiodon	*citrinus*	poison goby
Gobionellus	*oceanicus*	highfin goby

Gobiosoma	*bosc*	naked goby
Gobiosoma	*oceanops*	neon goby
Gobiosoma	*ginsburgi*	seaboard goby
Gomphosus	*varius*	bird wrasse
Gomphosus	*caeruleus*	green birdmouth wrasse
Gracila	*albomarginata*	masked grouper
Gramma	*melacara*	blackcap basslet
Gramma	*loreto*	royal gramma
Grammistes	*sexlineatus*	sixline soapfish
Gymnocrotaphus	*curvidens*	janbruin
Gymnomuraena	*zebra*	zebra moray
Gymnothorax	*nigromarginatus*	blackedge moray
Gymnothorax	*mordax*	California moray
Gymnothorax	*javanicus*	giant moray
Gymnothorax	*miliaris*	goldentail moray
Gymnothorax	*funebris*	green moray
Gymnothorax	*thyrsoideus*	greyface moray
Gymnothorax	*sp.*	Gymnothorax sp.
Gymnothorax	*favagineus*	laced moray
Gymnothorax	*saxicola*	ocellated moray
Gymnothorax	*pictus*	peppered moray
Gymnothorax	*vicinus*	purple mouth moray
Gymnothorax	*moringa*	spotted moray
Gymnothorax	*meleagris*	turkey moray
Gymnothorax	*undulatus*	undulated moray
Gymnothorax	*flavimarginatus*	yellow-edged moray
Gymnura	*altavela*	spiny butterfly ray
Haemulon	*sciurus*	bluestripe grunt
Haemulon	*carbonarium*	Caesar grunt
Haemulon	*melanurum*	cottonwick grunt
Haemulon	*flavolineatum*	French grunt
Haemulon	*plumierii*	grunt
Haemulon	*parra*	sailor's grunt
Haemulon	*chrysargyreum*	smallmouth grunt
Haemulon	*macrostomum*	Spanish grunt
Haemulon	*striatum*	striped grunt
Haemulon	*aurolineatum*	tomtate grunt
Haemulon	*album*	white margate
Haemulon	*flaviguttatum*	yellowspotted grunt
Halichoeres	*chrysus*	canary wrasse
Halichoeres	*dispilus*	chameleon wrasse
Halichoeres	*hortulanus*	checkerboard wrasse
Halichoeres	*maculipinna*	clown wrasse

Halichoeres	*ornatissimus*	ornamented wrasse
Halichoeres	*radiatus*	puddingwife wrasse
Halichoeres	*biocellatus*	red-lined wrasse
Halichoeres	*semicinctus*	rock wrasse
Halichoeres	*bivittatus*	slippery dick
Halichoeres	*nicholsi*	spinster wrasse
Halichoeres	*melanurus*	tail-spot wrasse
Halichoeres	*chierchiae*	wounded wrasse
Halichoeres	*cyanocephalus*	yellowcheek wrasse
Halichoeres	*garnoti*	yellowhead wrasse
Halichoeres	*pictus*	rainbow wrasse
Haploblepharus	*pictus*	dark shyshark
Haploblepharus	*edwardsii*	puffadder shyshark
Harengula	*clupeola*	false herring
Harengula	*jaguana*	scaled herring
Helicolenus	*percoides*	red gurnard perch
Hemanthias	*vivanus*	red barbier
Hemicaranx	*amblyrhynchus*	bluntnose jack
Hemigymnus	*fasciatus*	barred thicklip
Hemigymnus	*melapterus*	blackeye thicklip
Hemilepidotus	*spinosus*	brown Irish lord
Hemilepidotus	*hemilepidotus*	red Irish lord
Hemiscyllium	*ocellatum*	epaulette shark
Hemitaurichthys	*zoster*	brown-and-white butterfly
Hemitaurichthys	*polylepis*	pyramid butterfly
Hemitripterus	*americanus*	sea raven
Heniochus	*diphreutes*	false moorish idol
Heniochus	*monoceros*	masked bannerfish
Heniochus	*acuminatus*	pennant coralfish
Heniochus	*pleurotaenia*	phantom bannerfish
Heniochus	*singularis*	singular bannerfish
Heniochus	*chrysostomus*	threeband bannerfish
Hermosilla	*azurea*	zebra-perch sea chub
Heteroclinus	*tristis*	sharp-nose weedfish
Heteroconger	*hassi*	spotted garden eel
Heterodontus	*francisci*	horn shark
Heterodontus	*portusjacksoni*	Port Jackson shark
Heteropriacanthus	*cruentatus*	glasseye
Heterostichus	*rostratus*	giant kelpfish
Hexagrammos	*decagrammus*	kelp greenling
Hexagrammos	*lagocephalus*	rock greenling
Hexagrammos	*stelleri*	whitespotted greenling
Himantura	*uarnak*	honeycomb stingray

Himantura	*undulate*	leopard whipray
Himantura	*granulata*	mangrove whipray
Hippocampus	*barbouri*	Barbour's seahorse
Hippocampus	*abdominalis*	big-bellied seahorse
Hippocampus	*zosterae*	dwarf seahorse
Hippocampus	*kelloggi*	giant seahorse
Hippocampus	*procerus*	high-crown seahorse
Hippocampus	*capensis*	Knysna seahorse
Hippocampus	*erectus*	lined seahorse
Hippocampus	*reidi*	longsnout seahorse
Hippocampus	*ingens*	Pacific seahorse
Hippocampus	*fuscus*	sea pony
Hippocampus	*breviceps*	short-head seahorse
Hippocampus	*kuda*	spotted seahorse
Hippocampus	*subelongatus*	West Australian seahorse
Hippocampus	*whitei*	White's seahorse
Hippoglossus	*hippoglossus*	Atlantic halibut
Hippoglossus	*stenolepis*	Pacific halibut
Histrio	*histrio*	sargassumfish
Holacanthus	*bermudensis*	angelfish
Holacanthus	*clarionensis*	clarion angel
Holacanthus	*limbaughi*	Clipperton angelfish
Holacanthus	*bermudensis x ciliarus*	Holacanthus bermudensis x ciliarus
Holacanthus	*passer*	king angelfish
Holacanthus	*ciliaris*	queen angelfish
Holacanthus	*tricolor*	rock beauty
Holocentrus	*rufus*	longspine squirrelfish
Holocentrus	*adscensionis*	squirrelfish
Hoplolatilus	*purpureus*	purple sand tilefish
Hoplolatilus	*marcosi*	redback sand tilefish
Hoplolatilus	*starcki*	Starck's tilefish
Hoplolatilus	*luteus*	yellow tilefish
Hoplopagrus	*guntheri*	barred pargo
Hydrolagus	*colliei*	spotted ratfish
Hyperprosopon	*ellipticum*	silver surfperch
Hyperprosopon	*argenteum*	walleye surfperch
Hypleurochilus	*geminatus*	crested blenny
Hypleurochilus	*aequipinnus*	oyster blenny
Hypanus	*americanus*	southern ray
Hypanus	*Sabina*	Atlantic ray
Hypoplectrus	*puella*	barred hamlet
Hypoplectrus	*nigricans*	black hamlet
Hypoplectrus	*gemma*	blue hamlet

Hypoplectrus	*unicolor*	butter hamlet
Hypoplectrus	*indigo*	indigo hamlet
Hypoplectrus	*guttavarius*	shy hamlet
Hypsoblennius	*gentilis*	bay blenny
Hypsoblennius	*hentz*	feather blenny
Hypsoblennius	*gilberti*	rockpool blenny
Hypsoblennius	*jenkinsi*	mussel blenny
Hypsopsetta	*guttulata*	diamond turbot
Hypsurus	*caryi*	rainbow seaperch
Hypsypops	*rubicundus*	garibaldi
Icelinus	*fimbriatus*	fringed sculpin
Icelinus	*borealis*	northern sculpin
Icelinus	*tenuis*	spotfin sculpin
Icelinus	*filamentosus*	threadfin sculpin
Icelinus	*quadriseriatus*	yellowchin sculpin
Inimicus	*didactylis*	bearded ghoul
Istiogobius	*decoratus*	decorated goby
Johnrandallia	*nigrirostris*	blacknosed butterfly
Jordania	*zonope*	longfin sculpin
Kuhlia	*mugil*	barred flagtail
Kuhlia	*sandvicensis*	Hawaiian flagtail
Kyphosis	*bigibbus*	grey sea chub
Kyphosus	*spectator*	Bermuda sea chub
Kyphosus	*elegans*	Cortez sea chub
Kyphosus	*sp.*	Kyphosus sp.
Kyphosus	*incisor*	yellow sea chub
Labracinus	*cyclophthalmus*	fire-tail devil
Labracinus	*lineatus*	lined dottyback
Labrisomus	*nuchipinnis*	hairy blenny
Labroides	*bicolor bicolor*	cleaner wrasse
Labroides	*dimidiatus*	bluestreak cleaner wrasse
Labroides	*phthirophagus*	Hawaiian cleaner wrasse
Lachnolaimus	*maximus*	hogfish
Lactophrys	*trigonus*	buffalo trunkfish
Lactophrys	*polygonius*	honeycomb cowfish
Lactophrys	*triqueter*	smooth trunkfish
Lactoria	*cornuta*	longhorn cowfish
Lactoria	*fornasini*	thornback cowfish
Lagocephalus	*laevigatus*	smooth puffer
Lagodon	*rhomboids*	pinfish
Larimus	*fasciatus*	banded drum
Lates	*calcarifer*	barramundi
Leiostomus	*xanthurus*	spot croaker

Lepidosetta	*bilineata*	rock sole
Leptocottus	*armatus*	Pacific staghorn sculpin
Lethrinus	*nebulosus*	spangled emperor
Leucoraja	*erinacea*	little skate
Leucoraja	*ocellata*	winter skate
Limanda	*ferruginea*	yellowtail flounder
Liopropoma	*carmabi*	candy basslet
Liopropoma	*swalesi*	Swales swiss guard basslet
Liopropoma	*pallidum*	pallid bass
Liopropoma	*rubre*	peppermint bass
Liopropoma	*eukrines*	wrasse bass
Liparis	*liparis liparis*	striped seasnail
Liza	*carinata*	keeled mullet
Liza	*richardsonii*	South African mullet
Liza	*vaigiensis*	squaretail mullet
Lobotes	*surinamensis*	Atlantic tripletail
Lophius	*americanus*	American angler
Lumpenus	*sagitta*	snake prickleback
Lutjanus	*buccanella*	blackfin snapper
Lutjanus	*ehrenbergii*	blackspot snapper
Lutjanus	*fulvus*	blacktail snapper
Lutjanus	*viridis*	blue and gold snapper
Lutjanus	*kasmira*	common bluestripe snapper
Lutjanus	*erythropterus*	crimson snapper
Lutjanus	*cyanopterus*	cubera snapper
Lutjanus	*jocu*	dog snapper
Lutjanus	*fulviflamma*	dory snapper
Lutjanus	*sebae emperor*	red snapper
Lutjanus	*griseus*	grey snapper
Lutjanus	*gibbus*	humpback red snapper
Lutjanus	*synagris*	lane snapper
Lutjanus	*mahogoni*	mahogany red snapper
Lutjanus	*argentimaculatus*	mangrove red snapper
Lutjanus	*analis*	mutton snapper
Lutjanus	*campechanus*	northern red snapper
Lutjanus	*russellii*	Russell's snapper
Lutjanus	*apodus*	schoolmaster snapper
Lutjanus	*bohar*	two-spot red snapper
Lycodopsis	*pacifica*	blackbelly eelpout
Lythrypnus	*dalli*	bluebanded goby
Lythrypnus	*zebra*	zebra goby
Macropharyngodon	*geoffroy*	Geoffroy's wrasse
Macroramphosus	*scolopax*	longspine snipefish

Malacanthus	*plumieri*	sand tilefish
Malacoctenus	*sp.*	Malacoctenus sp.
Malacoctenus	*triangulates*	saddled blenny
Manta	*birostris*	giant manta
Manta	*alfredi*	Alfred manta
Medialuna	*californiensis*	halfmoon
Megalops	*cyprinoides*	Indo-Pacific tarpon
Megalops	*atlanticus*	tarpon
Meiacanthus	*nigrolineatus*	blackline fangblenny
Meiacanthus	*oualaunensis*	canary fang blenny
Melanogrammus	*aeglefinus*	haddock
Melichthys	*niger*	black triggerfish
Melichthys	*indicus*	Indian triggerfish
Melichthys	*vidua*	pinktail triggerfish
Menidia	*menidia*	Atlantic silverside
Menidia	*peninsulae*	Tidewater silverside
Mentiairrhus	*americanus*	southern kingcroaker
Menticirrhus	*saxatilis*	northern kingcroaker
Menticirrhus	*littoralis*	gulf kingcroaker
Microcanthus	*strigatus*	stripey
Microgadus	*tomcod*	Atlantic tomcod
Microgadus	*proximus*	Pacific tomcod
Microgobius	*carri*	Seminole goby
Micrometrus	*minimus*	dwarf perch
Micrometrus	*aurora*	reef perch
Micropogon	*undulatus*	Atlantic croaker
Microspathodon	*dorsalis*	giant damselfish
Microspathodon	*chrysurus*	yellowtail damelfish
Microstomus	*pacificus*	Dover sole
Mobula	*modular*	giant devil ray
Mobula	*munkiana*	Munk's devil ray
Mola	*mola*	ocean sunfish
Molva	*molva*	ling
Monacanthus	*chinensis*	fan-bellied leatherjack
Monacanthus	*setifer*	pygmy filefish
Monocentris	*japonica*	pineconefish
Monodactylus	*sebae*	African moony
Monodactylus	*falciformis*	full moony
Monodactylus	*argenteus*	silver moony
Morone	*saxatilis*	striped bass
Morone	*americana*	white perch
Mugil	*cephalus*	flathead mullet

Mugil	*curema*	white mullet
Mulloidichthys	*martinicus*	yellow goatfish
Mulloidichthys	*vanicolensis*	yellowfin goatfish
Mulloidichthys	*flavolineatus*	yellowstripe goatfish
Muraena	*helena*	Mediterranean moray
Muraena	*retifera*	reticulate moray
Muraena	*melanotis*	honeycomb moray
Muraena	*lentiginosa*	jewel moray
Mustelus	*henlei*	brown smooth-hound
Mustelus	*canis*	dusky smoothhound
Mustelus	*californicus*	grey smoothound
Mycteroperca	*bonaci*	black grouper
Mycteroperca	*xenarcha*	broomtail grouper
Mycteroperca	*microlepis*	gag
Mycteroperca	*jordani*	gulf grouper
Mycteroperca	*rubra*	mottled grouper
Mycteroperca	*phenax*	scamp
Myliobatis	*californica*	bat eagle ray
Myliobatis	*freminvillei*	bullnose eagle ray
Myliobatis	*californica*	California bat-ray
Myoxocephalus	*aenaeus*	grubby
Myoxocephalus	*octodecemspinosus*	longhorn sculpin
Myoxocephalus	*scorpius*	shorthorn sculpin
Myrichthys	*breviceps*	sharptail eel
Myripristis	*jacobus*	blackbar soldierfish
Myripristis	*berndti*	blotcheye soldierfish
Myripristis	*amaena*	brick soldierfish
Myripristis	*sp.*	Myripristis sp.
Myripristis	*leiognathos*	Panamic soldierfish
Myripristis	*murdjan*	pinecone soldierfish
Myripristis	*adusta*	shadowfin soldierfish
Myripristis	*kuntee*	shoulderbar soldierfish
Naso	*valmingii*	bignose unicornfish
Naso	*unicornis*	bluespine unicornfish
Naso	*elegans*	elegant unicornfish
Naso	*lopezi*	elongate unicornfish
Naso	*brachycentron*	humpback unicornfish
Naso	*lituratus*	orangespine unicornfish
Naso	*hexacanthus*	sleek unicornfish
Naso	*brevirostris*	spotted unicornfish
Nautichthys	*oculofasciatus*	sailfin sculpin
Nebrius	*ferrugineus*	tawny nurse shark
Negaprion	*brevirostris*	lemon shark

Nemateleotris	*decoraelegant*	firefish
Nemateleotris	*magnifica*	fire goby
Neocirrhites	*armatus*	flame hawkfish
Neoclinus	*uninotatus*	onespot fringehead
Neoclinus	*blanchardi*	sarcastic fringehead
Neoclinus	*stephensae*	yellowfin fringehead
Neoglyphidodon	*nigroris*	black-and-gold chromis
Neoglyphidodon	*oxyodon*	bluestreak damselfish
Neoglyphidodon	*melas*	bowtie damselfish
Neoglyphidodon	*carlsoni*	Carlson's damsel
Neoglyphidodon	*polyacanthus*	multispine damselfish
Neogobius	*melanostomus*	round goby
Neoniphon	*marianus*	longjaw squirrelfish
Neoniphon	*sp.*	Neoniphon sp.
Neoniphon	*sammara*	Sammara soldierfish
Neopomacentrus	*nemurus*	coral demoiselle
Notorynchus	*cepedianus*	broadnose sevengill shark
Novaculichthys	*taeniourus*	rockmover wrasse
Ocyurus	*chrysurus*	yellowtail snapper
Odontopyxis	*trispinosa*	pygmy poacher
Odontoscion	*dentex*	reef croaker
Odonus	*niger*	redtoothed triggerfish
Ogcocephalus	*nasutus*	shortnose batfish
Oligocottus	*snyderi*	fluffy sculpin
Oligocottus	*maculosus*	tidepool sculpin
Oligoplites	*saurus*	leatherjack
Oncorhynchus	*tshawytscha*	chinook salmon
Oncorhynchus	*kisutch*	coho salmon
Oncorhynchus	*mykiss*	rainbow trout
Ophichthus	*gomesii*	shrimp eel
Ophichthus	*zophochir*	yellow snake-eel
Ophidion	*welshi*	crested cusk-eel
Ophioblennius	*atlanticus*	Ophioblennius atlanticus
Ophioblennius	*macclurei*	redlip blenny
Ophiodon	*elongatus*	lingcod
Opisthonema	*oglinum*	Atlantic threadfin herring
Opistognathus	*rosenblatti*	blue-spotted jawfish
Opistognathus	*whitehursti*	dusky jawfish
Opistognathus	*aurifrons*	yellowhead jawfish
Oplegnathus	*fasciatus*	barred knifejaw
Opsanus	*beta*	gulf toadfish
Opsanus	*pardusleopard*	toadfish
Opsanus	*tau*	oyster toadfish

Orectolobus	*japonicus*	Japanese wobbegong
Orectolobus	*ornatus*	ornate wobbegong
Orectolobus	*maculatus*	spotted wobbegong
Orectolobus	*dasypogon*	tasselled wobbegong
Orthonopias	*triacis*	snubnose sculpin
Orthopristis	*chrysoptera*	pigfish
Osmerus	*mordax*	Atlantic rainbow smelt
Ostracion	*rhinorhyncos*	horn-nosed boxfish
Ostracion	*cubicus*	yellow boxfish
Oxycirrhites	*typus*	longnose hawkfish
Oxyjulis	*californica*	senorita
Oxylebius	*pictus*	painted greenling
Oxymonacanthus	*longirostris*	harlequin filefish
Pachymetopon	*aeneum*	blue hottentot
Pagrus	*pagrus*	common seabream
Paracanthurus	*hepatus*	palette surgeonfish
Paracheilinus	*filamentosus*	filamentous wrasse
Paracheilinus	*carpenteri*	pink flasher
Paracheilinus	*octotaenia*	Red Sea eightline flasher
Paracirrhites	*arcatus*	arc-eye hawkfish
Paracirrhites	*forsteri*	blackside hawkfish
Paraglyphidodon	*sp.*	Paraglyphidodon sp.
Paralabrax	*nebulifer*	barred sand bass
Paralabrax	*clathratus*	kelp bass
Paralabrax	*maculatofasciatus*	spotted sand bass
Paralichthys	*californicus*	California flounder
Paralichthys	*albigutta*	Gulf flounder
Paralichthys	*lethostigma*	southern flounder
Paralichthys	*dentatus*	summer flounder
Paraluteres	*prionurus*	blacksaddle filefish
Paranthias	*furcifer*	creole-fish
Paranthias	*colonus*	Pacific creole-fish
Parapercis	*multifasciata*	gold-birdled sandsmelt
Parapercis	*schauinslandii*	redspotted sandperch
Paraplesiops	*meleagris*	blue devil
Pareques	*acuminatus*	high-hat
Paricelinus	*hopliticus*	thornback sculpin
Parmaturus	*xaniurus*	filetale catshark
Parophrys	*velulus*	English sole
Parupeneus	*barberinoides*	bicolor goatfish
Parupeneus	*cyclostomus*	goldsaddle goatfish
Parupeneus	*multifasciatus*	manybar goatfish
Parupeneus	*porphyreus*	Parupeneus porphyreus

Parupeneus	*forsskali*	Red Sea goatfish
Parupeneus	*pleurostigma*	sidespot goatfish
Pempheris	*schomburgkii*	glassy sweeper
Pentaceros	*japonicus*	Japanese armorhead
Pentapodus	*sp.*	Pentapodus sp.
Periophthalmus	*barbarus*	Atlantic mudskipper
Periophthalmus	*argentilineatus*	barred mudskipper
Pervagor	*melanocephalus*	redtail filefish
Pervagor	*spilosoma*	fantail filefish
Phanerodon	*furcatus*	white seaperch
Pholidichthys	*leucotaenia*	convict blenny
Pholis	*laeta*	crescent gunnel
Pholis	*clemensi*	longfin gunnel
Pholis	*gunnellus*	rock gunnel
Pholis	*ornata*	saddleback gunnel
Photoblepharon	*palpebratum*	eyelight fish
Phycodurus	*eques*	leafy seadragon
Phyllopteryx	*taeniolatus*	common seadragon
Pictilabrus	*laticlavius*	patrician wrasse
Platax	*pinnatus*	dusky batfish
Platax	*orbicularis*	orbicular batfish
Platax	*teira*	tiera batfish
Platichthys	*stellatus*	starry flounder
Platyrhinoidis	*triseriata*	thornback guitarfish
Plectorglyphidodon	*lacrymatus*	whitespotted devil
Plectorhinchus	*gaterinus*	blackspotted rubberlip
Plectorhinchus	*chaetodonoides*	harlequin sweetlips
Plectorhinchus	*orientalis*	Oriental sweetlips
Plectorhinchus	*diagrammus*	striped sweetlips
Plectorhinchus	*pictus*	trout sweetlips
Plectorhinchus	*albovittatus*	two-striped sweetlips
Plectorhinchus	*lineatus*	yellowband sweetlips
Plectranthias	*inermis*	chequered perchlet
Plectropomus	*laevis*	black saddled coralgrouper
Plectropomus	*maculatus*	spotted coralgrouper
Plectrypops	*lima*	shy soldier
Pleuronichthys	*coenosus*	C-O sole
Pleuronichthys	*verticalis*	hornyhead turbot
Pleuronichthys	*ritteri*	spotted turbot
Pleuronichthys	*decurrens*	curlfin sole
Plotosus	*lineatus*	striped eel catfish
Podothecus	*accipenserinus*	sturgeon poacher
Poecilia	*latipinna*	sailfin molly

Pogonias	*cromis*	black drum
Pogonoperca	*punctata*	spotted soapfish
Pollachius	*virens*	pollock
Polydactylus	*sexfilis*	sixfinger threadfin
Pomacanthus	*asfur*	Arabian angelfish
Pomacanthus	*navarchus*	bluegirdled angelfish
Pomacanthus	*annularis*	bluering angelfish
Pomacanthus	*zonipectus*	Cortez angelfish
Pomacanthus	*imperator*	emperor angelfish
Pomacanthus	*paru*	French angelfish
Pomacanthus	*chrysurus*	goldtail angelfish
Pomacanthus	*arcuatus*	gray angelfish
Pomacanthus	*tricolor*	rock beauty
Pomacanthus	*semicirculatus*	semicircle angelfish
Pomacanthus	*sexstriatus*	sixbar angelfish
Pomacanthus	*maculosus*	yellowbar angelfish
Pomacanthus	*xanthometapon*	yellowface angelfish
Pomacentrus	*alleni*	Andaman damsel
Pomacentrus	*nigromarginatus*	blackmargined damsel
Pomacentrus	*caeruleus*	Caerulean damselfish
Pomacentrus	*nigromanus*	goldback damsel
Pomacentrus	*auriventris*	goldbelly damsel
Pomacentrus	*moluccensis*	lemon damselfish
Pomacentrus	*coelestis*	neon damselfish
Pomacentrus	*trichourus*	paletail damsel
Pomacentrus	*sp.*	Pomacentrus sp.
Pomacentrus	*pavo*	sapphire damsel
Pomacentrus	*sulfureus*	sulphur damsel
Pomacentrus	*chrysurus*	whitetail damselfish
Pomadasys	*olivaceus*	olive grunt
Pomatomus	*saltatrix*	bluefish
Porichthys	*notatus*	plainfin midshipman
Porichthys	*plectrodon*	Atlantic midshipman
Poroderma	*africanum*	striped catshark
Premnas	*biaculeatus*	spinecheek anemonefish
Priacanthus	*arenatus*	Atlantic bigeye
Prionotus	*carolinus*	northern searobin
Prionotus	*evolans*	striped searobin
Prionotus	*tribulus*	bighead searobin
Prionotus	*scitulus*	leopard searobin
Prionurus	*punctatus*	yellowtail surgeonfish
Pristigenys	*serrula*	popeye catalufa

Pristigenys	*alta*	short bigeye
Pristis	*pectinata*	smalltooth sawfish
Pristis	*pristis*	largetooth sawfish
Pristis	*zisjron*	green sawfish
Prognathodes	*aya*	bank bannerfish
Prognathodes	*aculeatus*	longsnout butterflyfish
Prognathodes	*falcifer*	scythemarked butterflyfish
Psettichthys	*melanostictus*	Pacific sand sole
Pseudanthias	*pascalus*	amethyst anthias
Pseudanthias	*barlettorum*	Bartlett's anthias
Pseudanthias	*bicolor*	bicolor anthias
Pseudanthias	*ventralis ventralis*	longfin anthias
Pseudanthias	*lori*	Lori's anthias
Pseudanthias	*pictilis*	painted anthias
Pseudanthias	*dispar*	peach fairy basslet
Pseudanthias	*truncatus*	stocky anthias
Pseudanthias	*rubrizonatus*	red-belted anthias
Pseudanthias	*huchtii*	red-cheeked fairy basslet
Pseudanthias	*squamipinnis*	sea goldie
Pseudanthias	*pleurotaenia*	square-spot fairy basslet
Pseudanthias	*bimaculatus*	two-spot basslet
Pseudanthias	*hutomoi*	whitespotted anthias
Pseudanthias	*evansi*	yellowback anthias
Pseudanthias	*luzonensis*	yellowlined anthias
Pseudanthias	*tuka*	yellowstriped fairy basslet
Pseudobalistes	*flavimarginatus*	yellowmargin triggerfish
Pseudobalistes	*fuscus*	yellow-spotted triggerfish
Pseudocheilinus	*tetrataenia*	four-line wrasse
Pseudocheilinus	*hexataenia*	sixline wrasse
Pseudochromis	*springeri*	blue-striped dottyback
Pseudochromis	*fuscus*	brown dottyback
Pseudochromis	*diadema*	diadem dottyback
Pseudochromis	*porphyreus*	magenta dottyback
Pseudochromis	*aldabraensis*	orange dottyback
Pseudochromis	*fridmani*	orchid dottyback
Pseudochromis	*elongatus*	elongate dottyback
Pseudochromis	*sp.*	Pseudochromis sp.
Pseudochromis	*paccagnellae*	royal dottyback
Pseudochromis	*sankeyi*	striped dottyback
Pseudochromis	*flavivertex*	sunrise dottyback
Pseudoginglymostoma	*brevicaudatum*	short-tail nurse shark
Pseudopleuronectes	*americanus*	winter flounder

Pseudupeneus	*maculatus*	spotted goatfish
Psuedogramma	*gregoryi*	Atlantic reef bass
Pterapogan	*kauderni*	Bangaii cardinalfish
Ptereleotris	*evides*	blackfin dartfish
Ptereleotris	*microlepis*	blue gudgeon
Ptereleotris	*zebra*	Chinese zebra goby
Pterocaesio	*pisang*	banana fusilier
Pterocaesio	*tile*	black banded fusilier
Pterocaesio	*chrysozona*	goldband fusilier
Pterois	*antennata*	broadbarred firefish
Pterois	*miles*	devil firefish
Pterois	*radiata*	radial firefish
Pterois	*volitans*	red lionfish
Pteroplatytrygon	*violacea*	pelagic stingray
Pungitius	*pungitius*	nine spined stickleback
Pygoplites	*diacanthus*	royal angelfish
Rachycentron	*canadum*	cobia
Radulinus	*taylori*	spinynose sculpin
Raja	*binoculata*	big skate
Raja	*inornata*	California ray
Raja	*eglanteria*	clearnose skate
Raja	*rhina*	longnose skate
Raja	*stellulata*	starry skate
Raja	*inornata*	California skate
Rathbunella	*hypoplecta*	stripedfin ronquil
Remora	*remora*	common remora
Rhabdosargus	*globiceps*	white stumpnose
Rhacochilus	*vacca*	pile perch
Rhacochilus	*toxotes*	rubberlip seaperch
Rhamphocottus	*richardsonii*	grunt sculpin
Rhina	*ancylostoma*	bowmouth guitarfish
Rhinecanthus	*aculeatus*	blackbar triggerfish
Rhinecanthus	*lunula*	halfmoon picassofish
Rhinecanthus	*assasi*	Picaso triggerfish
Rhinecanthus	*rectangulus*	wedge-tail triggerfish
Rhinobatos	*lentiginosus*	Atlantic guitarfish
Rhinobatos	*typos*	giant shovelnose ray
Rhinobatos	*productus*	shovelnose guitarfish
Rhinogobiops	*nicholsii*	blackeye goby
Rhinomuraena	*quaesita*	ribbon moray
Rhinopias	*eschmeyeri*	Eschmeyer's scorpionfish
Rhinopias	*frondosa*	weedy scorpionfish
Rhinoptera	*bonasus*	cownose ray

Rhizoprionodon	*terraenovae*	Atlantic sharpnose shark
Rhomboplitesauro	*rubens*	vermilion snapper
Rhynchobatus	*djiddensis*	giant guitarfish
Roncador	*stearnsii*	spotfin croaker
Ronquilis	*jordani*	northern ronquil
Ruscarius	*meanyi*	Puget Sound sculpin
Ruscarius	*creaseri*	roughcheek sculpin
Rypticus	*subbifrenatus*	spotted soapfish
Rypticus	*maculatus*	whitespotted soapfish
Sacura	*margaritacea*	cherry anthias
Salaria	*pavo*	peacock blenny
Salarias	*foresteri*	banded blenny
Salarias	*fasciatus*	jewelled blenny
Salmo	*salar*	Atlantic salmon
Salmo	*trutta*	sea trout
Salvelinus	*alpinus alpinus*	charr
Sarda	*sarda*	Atlantic bonito
Sarda	*chiliensis chiliensis*	Eastern Pacific bonito
Sardinops	*sagax*	South American pilchard
Sargocentron	*tiere*	blue lined squirrelfish
Sargocentron	*diadema*	crown squirrelfish
Sargocentron	*bullisi*	deepwater squirrelfish
Sargocentron	*vexillarium*	dusky squirrelfish
Sargocentron	*xantherythrum*	Hawaiian squirrelfish
Sargocentron	*rubrum*	redcoat
Sargocentron	*coruscum*	reef squirrelfish
Sargocentron	*spiniferum*	sabre squirrelfish
Sargocentron	*caudimaculatum*	silverspot squirrelfish
Sargocentron	*microstoma*	smallmouth squirrelfish
Sargocentron	*punctatissimum*	speckled squirrelfish
Sargocentron	*suborbitalis*	tinsel squirrelfish
Sarpa	*salpa*	salema
Scartella	*cristata*	molly miller
Scarus	*coeruleus*	blue parrotfish
Scarus	*psittacus*	common parrotfish
Scarus	*rubroviolaceus*	ember parrotfish
Scarus	*coelestinus*	midnight parrotfish
Scarus	*taeniopterus*	princess parrotfish
Scarus	*vetula*	queen parrotfish
Scarus	*guacamaia*	rainbow parrotfish
Scarus	*sp.*	Scarus sp.
Scarus	*iseri*	striped parrotfish
Scatophagus	*argus*	spotted scat

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Sciaenops	*ocellatus*	red drum
Scolopsis	*ghanam*	Arabian monocle bream
Scolopsis	*bilineata*	two-lined monocle bream
Scomber	*scombrus*	Atlantic mackerel
Scomber	*japonicus*	chub mackerel
Scomberoides	*commersonnianus*	Talang queenfish
Scophthalmus	*aquosus*	windowpane
Scorpaena	*brasiliensis*	barbfish
Scorpaena	*guttata*	California scorpionfish
Scorpaena	*grandicornis*	plumed scorpionfish
Scorpaena	*papillosa*	red rock cod
Scorpaena	*sp.*	Scorpaena sp.
Scorpaena	*notata*	small red scorpionfish
Scorpaena	*plumieri*	spotted scorpionfish
Scorpaenichthys	*marmoratus*	cabezon
Scorpaenodes	*parvipinnis*	lowfin scorpionfish
Scorpaenodes	*xyris*	rainbow scorpionfish
Scorpaenodes	*caribbaeus*	reef scorpionfish
Scorpaenopsis	*barbata*	bearded scorpionfish
Scorpaenopsis	*brevifrons*	bigmouth scorpionfish
Scorpaenopsis	*diabolus*	false stonefish
Scorpaenopsis	*cirrosa weedy*	stingfish
Scorpis	*lineolata*	silver sweep
Scuticaria	*tigrina*	tiger reef-eel
Scyliorhinus	*retifer*	chain catshark
Scyliorhinus	*torazame*	cloudy catshark
Scyliorhinus	*canicula*	small-spotted catshark
Sebastapistes	*cyanostigma*	yellowspotted scorpionfish
Sebastes	*fasciatus*	Acadian redfish
Sebastes	*chrysomales*	black and yellow rockfish
Sebastes	*melanops*	black rockfish
Sebastes	*mystinus*	blue rockfish
Sebastes	*paucispinis*	bocaccio
Sebastes	*auriculatus*	brown rockfish
Sebastes	*dallii*	calico rockfish
Sebastes	*pinniger*	canary rockfish
Sebastes	*goodei*	chilipepper rockfish
Sebastes	*nebulosus*	China rockfish
Sebastes	*caurinus*	copper rockfish
Sebastes	*crameri*	darkblotched rockfish
Sebastes	*ciliatus*	dusky rockfish
Sebastes	*rubivinctus*	flag rockfish
Sebastes	*lentiginosus*	freckled rockfish

Sebastes	*carnatus*	gopher rockfish
Sebastes	*rastrelliger*	grass rockfish
Sebastes	*chlorostictus*	greenspotted rockfish
Sebastes	*elongatus*	greenstriped rockfish
Sebastes	*semicinctus*	halfbanded rockfish
Sebastes	*umbrosus*	honeycomb rockfish
Sebastes	*atrovirens*	kelp rockfish
Sebastes	*serranoides*	olive rockfish
Sebastes	*emphaeus*	Puget Sound rockfish
Sebastes	*maliger*	quillback rockfish
Sebastes	*babcocki*	redbanded rockfish
Sebastes	*helvomaculatus*	rosethorn rockfish
Sebastes	*rosaceus*	rosy rockfish
Sebastes	*joyneri*	Sebastes joyneri
Sebastes	*schlegelii*	Korean rockfish
Sebastes	*diploproa*	splitnose rockfish
Sebastes	*constellatus*	starry rockfish
Sebastes	*nigrocinctus*	tiger rockfish
Sebastes	*serriceps*	treefish
Sebastes	*miniatus*	vermilion rockfish
Sebastes	*entomelas*	widow rockfish
Sebastes	*ruberrimus*	yelloweye rockfish
Sebastes	*flavidus*	yellowtail rockfish
Sebastes	*chrysomelas*	black-and-yellow rockfish
Sebastes	*rosenblatti*	greenblotched rockfish
Sebastes	*saxicola*	stripetail rockfish
Sebastes	*serriceps*	treefish
Selene	*setapinnis*	Atlantic moonfish
Selene	*vomer*	lookdown
Selene	*peruviana*	Pacific moonfish
Semicossyphus	*pulcher*	California sheephead
Seriolari	*volianan*	Almaco jack
Seriola	*zonata*	banded rudderfish
Seriola	*dumerili*	greater amberjack
Seriola	*lalandi*	yellowtail amberjack
Serranocirrhitus	*latus*	hawkfish anthias
Serranus	*subligarius*	belted sandfish
Serranus	*tortugarum*	chalk bass
Serranus	*tigrinus*	harlequin bass
Serranus	*baldwini*	lantern bass
Serranus	*annularis*	orangeback bass
Serranus	*fasciatus*	barred serrano
Serranus	*tabacarius*	tobaccofish

Serranus	*phoebe*	tattler
Siganus	*virgatus*	barhead spinefoot
Siganus	*doliatus*	barred spinefoot
Siganus	*uspi*	bicolored foxface
Siganus	*unimaculatus*	blotched foxface
Siganus	*corallinus*	bluespotted spinefoot
Siganus	*stellatus*	brownspotted spinefoot
Siganus	*vulpinus*	foxface
Siganus	*punctatus*	goldspotted spinefoot
Siganus	*spinus*	little spinefoot
Siganus	*magnificus*	magnificent rabbitfish
Siganus	*puellus*	masked spinefoot
Siganus	*guttatus*	orange-spotted spinefoot
Siganus	*canaliculatus*	white-spotted spinefoot
Signigobius	*biocellatus*	twinspot goby
Sparisoma	*radians*	bucktooth parrotfish
Sparisoma	*cretense*	parrotfish
Sparisoma	*aurofrenatum*	redband parrotfish
Sparisoma	*rubripinne*	redfin parrotfish
Sparisoma	*chrysopterum*	redtail parrotfish
Sparisoma	*viride*	stoplight parrotfish
Sphaeramia	*orbicularis*	orbiculate cardinalfish
Sphaeramia	*nematoptera*	pajama cardinalfish
Sphoeroides	*spengleri*	bandtail puffer
Sphoeroides	*parvus*	least puffer
Sphoeroides	*maculatus*	northern pufferfish
Sphyraena	*barracuda*	great barracuda
Sphyraena	*argentea*	Pacific barracuda
Sphyrna	*tiburo*	bonnethead
Sphyrna	*lewini*	scalloped hammerhead
Squalus	*acanthias*	piked dogfish
Squatina	*squatina*	angelshark
Squatina	*californica*	Pacific angel shark
Stegastes	*leucostictus*	beaugregory
Stegastes	*partitus*	bicolor damselfish
Stegastes	*fuscus*	Brazilian damsel
Stegastes	*variabilis*	cocoa damselfish
Stegastes	*rectifraenum*	Cortez damselfish
Stegastes	*nigricans*	dusky farmerfish
Stegastes	*fasciolatus*	Pacific gregory
Stegastes	*planifrons*	threespot damselfish
Stegastes	*obreptrus*	western gregory
Stegastes	*adustus*	dusky damselfish

St – Th

Stegostoma	fasciatum	zebra shark
Stenotomus	chrysops	scup
Stephanolepis	hispidus	planehead filefish
Stereolepis	gigas	giant sea bass
Stethojulis	balteata	belted wrasse
Stonogobiops	nematodes	filament-finned prawn goby
Strongylura	marina	Atlantic needlefish
Strongylura	notata notata	redfin needlefish
Sufflamen	bursa	boomerang trigger
Sufflamen	verres	orangeside triggerfish
Symphorichthys	spilurus	sailfin snapper
Symphurus	civitatium	offshore tongue fish
Synanceia	verrucosa	stonefish
Synchiropus	splendidus	mandarinfish
Synchiropus	ocellatus	ocellated dragonet
Synchiropus	picturatus	picturesque dragonet
Syngnathoides	biaculeatus	alligator pipefish
Syngnathus	leptorhynchus	bay pipefish
Syngnathus	louisianae	chain pipefish
Syngnathus	scovelli	gulf pipefish
Syngnathus	fuscus	northern pipefish
Synodus	foetens	inshore lizard fish
Taenianotus	triacanthus	leaf scorpionfish
Taeniura	lymma	bluespotted ribbontail ray
Taeniura	grabata	round stingray
Tautoga	onitis	tautog
Tautogolabrus	adspersus	cunner
Terapon	jarbua	Jarbua terapon
Tetraodon	fluviatilis	green pufferfish
Tetraodon	nigroviridis	spotted green pufferfish
Tetrosomus	gibbosus	humpback terretfish
Thalassoma	bifasciatum	bluehead wrasse
Thalassoma	amblycephalum	blunthead wrasse
Thalassoma	trilobatum	Christmas wrasse
Thalassoma	lucasanum	Cortez rainbow wrasse
Thalassoma	quinquevittatum	five stripe wrasse
Thalassoma	rueppellii	Klungzinger's wrasse
Thalassoma	lunare	moon wrasse
Thalassoma	pavo	ornate wrasse
Thalassoma	duperrey	saddle wrasse
Thalassoma	hardwicke	sixbar wrasse
Thalassoma	grammaticum	sunset wrasse
Thalassoma	purpureum	surge wrasse

Thalassoma	lutescens	yellow-brown wrasse
Theragra	chalcogramma	Alaska pollock
Thunnus	orientalis	Pacific bluefin tuna
Thunnus	albacares	yellowfin tuna
Tilodon	sexfasciatum	moonlighter
Toxotes	jaculatrix	banded archerfish
Toxotes	chatareus	largescale archerfish
Trachinops	caudimaculatus	southern hulafish
Trachinotus	carolinus	Florida pompano
Trachinotus	goodei	palometa
Trachinotus	falcatus	permit
Trachurus	symmetricus	Pacific jack mackerel
Triaenodon	obesus	whitetip reef shark
Triakis	semifasciata	leopard shark
Triakis	megalopterus	sharptooth houndshark
Trinectes	maculatus	hogchoker
Trygonorhina	fasciata	southern fiddler
Ulvaria	subbifurcata	radiated shanny
Umbrina	roncador	yellowfin drum
Uranoscopus	scaber	Atlantic stargazer
Urobatis	jamaicensis	yellow stingray
Urolophus	halleri	Haller's round ray
Urophycis	chuss	red hake
Urophycis	regia	spotted hake
Urophycis	tenuis	white hake
Uropterygius	macrocephalus	needle-tooth moray
Valenciennea	strigata	blueband goby
Valenciennea	puellaris	maiden goby
Valenciennea	wardii	Ward's sleeper
Variola	louti	yellow-edged lyretail
Vincentia	conspersa	southern cardinalfish
Wetmorella	nigropinnata	sharpnose wrasse
Xanthichthys	auromarginatus	gilded triggerfish
Xanthichthys	mento	redtail triggerfish
Xanthichthys	ringens	sargassum triggerfish
Xenistius	californiensis	Californian salema
Xiphister	mucosus	rock prickleback
Xyrichtys	novacula	pearly razorfish
Xystreurys	liolepis	fantail flounder
Zanclus	cornutus	moorish idol
Zaniolepis	latipinnis	longspine combfish
Zaniolepis	frenata	shortspine combfish
Zapteryx	exasperate	banded guitarfish

Zebrasoma	rostratum	longnose surgeonfish
Zebrasoma	veliferum	sailfin tang
Zebrasoma	gemmatum	spotted tang
Zebrasoma	scopas	twotone tang
Zebrasoma	flavescens	yellow tang
Zebrasoma	xanthurum	yellowtail tang
Zebrasoma	desjardinii	Desjardin's sailfin tang
Zoarces	americanus	ocean pout

APPENDIX 9

LIST OF TAXONOMIC ORDERS AND FAMILIES CONTAINING SPECIES OF CONSERVATION CONCERN AS REPORTED IN 2015 and 2016 MFTAG SPACE SURVEYS

(For complete 2015 and 2016 MFTAG RCP Space Survey data contact Beth Firchau bfirchau@audubooninstitute.org)

Order	***Family***
Acipenseriformes	*Acipenseridae*
Anguilliformes	*Anguillidae*
Batrachoidiformes	*Batrachoididae*
Carcharhiniformes	*Carcharhinidae*
	Sphyrnidae
Cyprinodontiformes	*Fundulidae*
Elopiformes	*Megalopidae*
Gadiformes	*Gadidae*
Lamniformes	*Odontaspididae*
Myliobatiformes	*Dasyatidae*
	Mobulidae
	Myliobatidae
	Rhinopteridae
	Urotrygonidae
Orectolobiformes	*Ginglymostomatidae*
	Orectolobidae
	Rhincodontidae
	Stegostomatidae
	Hemiscylliidae
Perciformes	*Anarhichadidae*
	Apogonidae
	Embiotocidae
	Epinephelidae
	Haemulidae
	Labridae
	Moronidae
	Polyprionidae
	Pomacanthidae
	Scaridae
	Serranidae
Plueronectiformes	*Pleuronectidae*
Rhinopristiformes	*Pristidae*
Rajiformes	*Rajidae*
	Rhinobatidae
Scorpaeniformes	*Sebastidae*
Squaliformes	*Squalidae*
Squatiniformes	*Squatinidae*
Syngnathiformes	*Syngnathidae*
Tetraodontiformes	*Balistidae*

APPENDIX 10

AZA POSITION ON SUSTAINABILITY CONSIDERATION FOR DEVELOPING AN AQUATIC INVERTEBRATE & FISH COLLECTION PLAN

Approved by the AZA Board of Directors January 12, 2016

The Association of Zoos and Aquariums (AZA) believes that the acquisition of aquatic invertebrates and fishes should be conducted in a manner that maintains or, if warranted, increases the genetic diversity of these populations in the care of zoos and aquariums but does not reduce the long-term sustainability of these populations in their natural ranges. Therefore, it is recommended that AZA-accredited zoos and aquariums and certified related facilities (AZA member institutions) exhibiting these animals develop, implement, and maintain an Aquatic Invertebrate & Fish Collection Plan that assists curators in continuing to advance fish survivability and in making the most appropriate acquisition decisions possible to achieve these goals. By acquiring aquatic invertebrates and fishes in a sustainable manner, AZA member institutions will be able to continue fulfilling their important missions of conservation, education, and science with these animals long into the future and will set a leadership example for related industries.

APPENDIX 11

AZA WHITE PAPER ON SUSTAINABILITY CONSIDERATIONS FOR DEVELOPING AN AQUATIC INVERTEBRATE & FISH COLLETCION PLAN

Approved by the AZA Board of Directors January 12, 2016

AZA Position

The Association of Zoos and Aquariums (AZA) believes that the acquisition of aquatic invertebrates and fishes should be conducted in a manner that maintains or, if warranted, increases the genetic diversity of these populations in the care of zoos and aquariums but does not reduce the long-term sustainability of these populations in their natural ranges. Therefore, it is recommended that AZA-accredited zoos and aquariums and certified related facilities (AZA member institutions) exhibiting these animals develop, implement, and maintain an Aquatic Invertebrate & Fish Collection Plan that assists curators in continuing to advance fish survivability and in making the most appropriate acquisition decisions possible to achieve these goals. By acquiring aquatic invertebrates and fishes in a sustainable manner, AZA member institutions will be able to continue fulfilling their important missions of conservation, education, and science with these animals long into the future and will set a leadership example for related industries.

Rationale

AZA-accredited aquariums and zoos are experienced in caring for and advancing the survivability rate of more than 3,500 species of fishes and aquatic invertebrates belonging to 15 different phyla. Three types of aquatic animal acquisition practices are typically utilized to maintain or increase their populations' taxonomic diversity, genetic and demographic health, and long-term sustainability including:

- Aquarium breeding
- Commercial breeding
- Wild-sourced acquisition

Each of these acquisition practices has potential advantages and challenges that may affect the long- term sustainability of aquatic animal populations in their natural ranges. In accordance with the Association's Policy on Responsible Population Management (RPM Policy), AZA member institutions should consider these advantages and challenges when developing, implementing, and/or adapting an aquarium collection plan to make certain that their aquatic invertebrates and fishes are acquired in a sustainable manner. "In general, aquaculture production of ornamental species should be pursued when species are difficult to obtain from the

wild, breeding supports a conservation program, or there is some environmental benefit or elimination of environmental damage via the breeding program. Aquaculture production of ornamental species should be avoided when it would replace a harvest of wild animal that maintains habitat, a cultural benefit, or an economic benefit" (Tlusty, 2001). AZA support for Project Piaba is a classic example of the need to support a sustainably managed wild fishery to assure socio-ecological integrity and sustainable use of rain forest resources by local residents in lieu of sourcing these same species through aquaculture.

Aquarium Breeding

Successes: AZA member public aquariums have successfully bred or cloned more than 200 species of invertebrates (Aquatic Invertebrate Taxon Advisory Group [TAG] Regional Collection Plan [RCP]) and bred more than 108 marine species of fish (Marine Fishes TAG RCP) and 250 species of freshwater fish (Freshwater Fishes TAG RCP). The animals bred have been limited mostly to freshwater species, small sharks, rays, live bearing marine teleosts (e.g., *Embiotocidae*), and those marine teleosts that are nest layers and/or with relatively large larvae (e.g., *Pomacentridae, Gobiidae, Pseudochrominae, Cottidae, Syngnathidae*). While most marine species have proven to be difficult to breed, more than 57 ornamental fishes were listed in a survey as being purposely bred by public aquariums (Hall & Warmolts, 2003). This number is presumed to be an underestimate as only a small number of responses were received from those surveyed. More recently, there has been significant success in the propagation of jellyfishes and corals by public aquariums that have been distributed to other institutions.

Several AZA-accredited aquariums are expanding their ability to breed fishes and aquatic invertebrates by providing the adequate space, trained staff, and associated resources needed to establish stable long- term fish breeding programs. Many also are maximizing collaborations with universities and commercial aquaculturists to expand expertise and aquaculture facility space. For example, *Rising Tide Conservation Conservation* is a collaborative effort through which a number of AZA-accredited aquariums are working in conjunction with universities to develop methods to collect eggs and larvae from spawning fish populations in public aquaria and rearing them in a laboratory setting at a university. Building on initial successes, the *Rising Tide Conservation Conservation* program has expanded its focus and is now integrating efforts of display aquaria, the hobbyist industry, and academia to create a platform for the promotion and dissemination of information related to marine tropical fish aquaculture.

Over the last ten or more years, several AZA-accredited aquariums began expanding their efforts to breed and raise sawfishes and other species of large sharks using population management techniques typically utilized with terrestrial animals. Because these fishes can be individually-managed, rather than group-managed, studbooks have been developed for several elasmobranch species.

Challenges: In general, managed propagation is an important method of acquiring animals, but only if it makes logistical, ecological, and fiscal sense to do so. The majority of marine tropical species are broadcast spawners with small larvae that require specialized diets (e.g., protozoans, copepods, rotifers, *Artemia*) that change as they grow (Olivotto et al., 2011). The inability to supply properly sized and appropriate densities of food organisms that are required at each ontogenetic stage contributes significantly to our challenges in being able to raise these fishes. Successes have been sporadic and are often the result of opportunistic work with unplanned spawnings that are difficult to reliably replicate, although invaluable information is usually gained. The high concentration of food items tried during these different ontogenetic stages can results in poor water quality and disease outbreak, causing additional challenges for raising these fishes.

Managed propagation of aquatic invertebrates and fishes in aquariums requires that dedicated facilities, staff time and staff training be made available. Although most institutions provide limited resources to breed fishes and invertebrates, the costs associated with these efforts can easily supersede those associated with purchasing these species from commercial dealers.

Commercial Breeding

Successes: Many tropical freshwater species of fishes are bred for the ornamental trade and are readily available through a long-established network of commercial breeders, which has significantly reduced the need to acquire many of these fishes from the wild. It is important, however, that AZA-accredited institutions select commercial breeders that utilize aquaculture methods that are environmentally friendly and thus sustainable.

Challenges: There are few well managed aquaculture facilities for aquatic invertebrates and fishes for the wide variety of tropical ornamental fishes and aquatic invertebrates. Poorly managed aquaculture facilities can oftentimes cause significantly more environmental issues, typically related to water quality discharge, the use of chemotherapeutics, habitat destruction, release of exotic species (Mohan, 2003), and genetic modification of fishes, than wild-sourced acquisitions.

Other challenges related to developing widespread conservation-oriented commercial breeding programs include: 1) the high taxonomic diversity in aquatic animals (fishes alone represent ~40% of all vertebrate species); 2) the resultant variety in their reproductive methods; 3) their diverse ecological, behavioral, physiological, and nutritional needs; and 4) the lack of specific knowledge on their husbandry and medical care (Thoney et al., 2003; Olivotto et al., 2011).

Olivotto et al. (2011) reviewed many of the challenges associated with marine ornamental aquaculture including spawning, larval rearing, plankton culturing for food, and rearing system design and there have been notable success. However, several companies that have attempted to raise marine fishes commercially have found this

to be more costly than the lower costs associated with wild-sourced acquisitions of these animals (Koldewey and Martin-Smith, 2011).

Wild-Sourced Acquisition

Successes: Several characteristics of wild aquatic fish and invertebrate populations make them suitable candidates for sustainable sources of acquisition. For instance, most marine teleosts are "r-selected" meaning that they have an extremely high fecundity. Additionally, many species are widely distributed, and have the ability to disperse over long distances (Thoney et al., 2003).

Wild-sourced acquisition practices of these species should be conducted with minimal impacts to the ecosystem and managed as sustainable fisheries to assure their long-term sustainability. Several fishery and harvest area management approaches could be incorporated to accomplish this, including the creation of refuges that supply propagules to harvested areas, the rotation of areas fished, the establishment of species-specific size limits and seasons, and the standardization of collecting, handling, and transportation techniques (Thoney et al., 2003).

Challenges: For AZA-accredited aquariums, direct acquisition of many wild-sourced aquatic fishes and invertebrates typically requires traveling to remote locations and collaborating with local residents. Logistics associated with efforts are difficult and are becoming more so with new legislation requiring additional governmental acquisition and import permits and procedures.

Indirect acquisition of wild-sourced aquatic fishes and invertebrates typically requires purchasing animals from commercial dealers. AZA-accredited aquariums and their curators should make certain that the commercial dealers they work with employ sustainable and environmentally safe acquisition methods including, but not limited to, making sure that animals are not overfished, and that they are acquired without damaging habitat, transported safely and appropriately, and quarantined properly to prevent potential disease outbreaks. The recommended aquatic animal supplier list that has been developed by the aquatic Taxon Advisory Groups provides a means to evaluate aquatic animal suppliers.

Complete chains of custody should be evaluated for these animals, from their point of acquisition by the commercial dealer to their final location with the aquarium, to be sure they were acquired in a sustainable and environmentally safe manner. These chains of custody can prove to be long and often complicated particularly when considering the international origin of most aquatic fishes and invertebrates; however they serve as valuable tools that allow curators to confirm that the animals have been acquired sustainably.

"In all likelihood, moderate levels of collecting have minimal impact, especially for abundant species….. The challenge is determining the level at which moderate becomes excessive" (Helfman, 2007). It should be noted that collections for public

aquariums in themselves are typically far below the moderate levels of collecting published by Helfman (2007), which supports the need for aquariums to cooperate with sustainable fisheries.

Developing an Aquatic Invertebrate & Fish Collection Plan

It is vitally important that aquarium and zoo visitors continue to be educated about, inspired by, and connected to genetically diverse populations of aquatic invertebrates and fishes. Therefore, AZA recommends that its accredited members who care for these species develop, implement, and maintain an Aquatic Invertebrate & Fish Collection Plan that identifies the ways in which their populations' genetic diversity will be maintained or, if warranted, increased in a manner that does not reduce the long-term sustainability of the species' populations in their natural ranges.

The advantages and challenges identified for aquarium breeding, commercial breeding, and wild-sourced acquisitions have important sustainability considerations that should be weighed carefully when developing this Collection Plan. It is further recommended that the following eight action items be incorporated into a decision-making process (e.g., decision tree) to help curators make the most appropriate acquisition decisions possible.

<u>Actions Recommended for the Decision- Making Process</u>

1) Foster relationships between AZA-accredited zoos and aquariums and government entities toward the development of a regulatory framework that supports sustainable acquisition of fishes and invertebrates that are part of approved AZA Regional Collection Plans (RCPs) and/or conservation projects.
    a. Provide input and/or support important causes that might affect your institution's ability to sustainably acquire wild-sourced aquatic invertebrates and fishes.
    b. Inform the AZA Government Affairs department of any regulatory proposals or changes that might affect the trade of aquatic invertebrates and fishes.
2) Promote the practice of acquiring sustainably bred aquatic invertebrates and fishes when available.
    a. Evaluate commercial aquaculture breeding operations to assure that they do not cause environmental issues (i.e., do not release exotic species, destroy habitat, or disperse toxicants including antibiotics and nutrients).
    b. Develop methods to select and recruit an approved list of commercial breeders and empower your institution's curators to use the commercial breeders identified on the approved list (ie. Recommended Aquatic Animal Supplier List).
    c. Develop a system to consistently monitor the approved commercial

breeders to make certain they continue utilizing environmentally safe operational practices.

d. Continue and/or expand your institution's internal efforts to breed and rear aquatic invertebrates and fishes and communicate successes.
e. Collaborate with external aquatic invertebrate and fish breeding and rearing research projects (e.g., Rising Tide Conservation Conservation) to advance your institution's ability to acquire sustainably bred animals.

3) Advance your institution's participation in AZA's efforts to increase shark breeding as identified in the Marine Fish TAG RCP.
   a. Determine if your institution is able to participate in the testing of methodologies that would evaluate what environmental parameters are required to trigger reproduction in specific species (e.g., seasonal photoperiod, temperature, and feeding, exhibit size).
   b. Determine if your institution is able to participate in the testing of methodologies that would develop techniques that will increase our ability to breed large sharks and sawfishes (e.g., artificial fertilization).
   c. Talk to experts in shark facility designing or the Marine Fishes TAG If your institution is designing a new, or renovating an older elasmobranch exhibit, to determine the best ways to make certain that it incorporates the habitat preference features of the species (and not only exhibition features) to increase the probability of successful reproduction.
   d. Consider building a breeding center for elasmobranchs at your institution.
   e. Support AZA's SAFE initiative for sharks.

4) Develop a process for evaluating collectors and/or distributors that supply wild-sourced aquatic invertebrates and fishes to make certain that their acquisition practices do not reduce the long- term sustainability of these populations in their natural ranges (ie. Recommended Aquatic Animal Supplier List).
   a. Develop criteria for identifying suppliers who utilize sustainable practices.
   b. Develop methods to select and recruit an approved list of suppliers and empower your institution's curators to use the suppliers identified on this list.
   c. Develop a system to consistently monitor the approved suppliers to make certain they continue utilizing sustainable practices.

5) Develop a process to measure the results and outcomes of fish sustainability initiatives.
   a. Develop criteria and databases to measure and track fish survivability rates in your institution and sustainability initiative outcomes.
   b. Evaluate the feasibility and value of developing a "median life expectancy" database similar to what has been developed of terrestrial species
   c. Develop a strategy to disseminate this information and encourage innovation in sustainability and welfare.

6) Support in-situ conservation efforts that advance sustainable wild acquisition practices of aquatic invertebrates and fishes to boost the livelihoods of local communities and/or efforts that prevent acquisition practices that negatively impact the sustainability of species in their natural ranges.
    a. Identify these types of currently recognized in-situ conservation efforts (e.g., Project Piaba) and empower your institution's curators to acquire aquatic invertebrates and fishes from them.
    b. Network with other aquariums, NGOs, and local fishers to establish these types of new in-situ conservation efforts, especially for priority aquarium species.
    c. Build partnerships with NGOs working on aquarium fisheries to explore the potential of a sustainable aquarium trade as a viable livelihood option for local communities. This may involve training local peoples in sustainable catching practices, handling, and shipping fishes and on the economics of the trade.

7) Determine if it is a viable option for your institution to operate, or to collaborate with others who operate aquatic invertebrate or fish extractive reserves.
    a. Determine if appropriate areas are available (should also be discussed in relation to 5 above).
    b. Establish a committee to review legislation and assess viability, develop a strategy, build local partnerships, and evaluate the logistics associated with establishing an extractive reserve.
    c. Determine the potential conservation successes and challenges associated with each extractive reserve approach in partnership with academia, using sound scientific studies.

8) Make certain that fishes fed to the animals in your institution also are acquired in a sustainable manner.
    a. Develop criteria for identifying vendors who utilize acquisition practices that do not reduce the long-term sustainability of these food-fish populations in their natural ranges (ie. Ocean Wise or Sea Food Watch).
    b. Develop methods to select and recruit an approved list of food-fish vendors and empower your institution's curators to use the vendors identified on the approved list.
    c. Develop a system to consistently monitor the approved vendors to make certain they continue utilizing sustainable practices.

9) Institutional commitment to *in situ* & *ex situ* objectives
    a. Institutional commitment to give preference to animals from certified sources.

b. Each institution commits to providing resources or space in support of # 2 & 3.
c. Each institution commit to supporting an in situ conservation initiatives under # 4, 5, & 6.

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APPENDIX 12

MFTAG 2017 RCP SPECIES MANAGEMENT PROGRAM MATRIX

CRITERIA	SSP Program or Candidate Program	Studbook ONLY	No Management
Availability within AZA	YES	YES	YES
Availability outside of AZA	YES	YES	YES
Conservation Status	YES	-	No Concern
Demand within AZA > (1) institution	YES	YES	NO
Breeding producing viable young occurring at >1 institutions	YES	NO	NO
Institutional commitment to breeding or unproductive breeding occurring in >/= (2) institutions	YES	YES	NO
Opportunities for International Partnerships and Programs	YES	YES	NO
Links to Conservation of Wild Habitat Programs	YES	YES	NO
Under United States Gov't Management	NO	_	YES

APPENDIX 13

FUTURE SPACES DEVOTED TO SPECIES OF CONSERVATION CONCERN AS REPORTED* IN 2015 and 2016 MFTAG RCP SPACE SURVEY *(Alpha by Order)*
(For complete 2015 and 2016 MFTAG RCP Space Survey data contact Beth Firchau bfirchau@audubonistitute.org)

Order	***Family***	***Genus***	***Species***	**Common Name**	**Number of Spaces****
Acipenseriformes	*Acipenseridae*	*Acipenser*	*o. oxyrinchus*	Atlantic sturgeon	11
Acipenseriformes	*Acipenseridae*	*Acipenser*	*oxyrinchus*	Gulf sturgeon	3
Carcharhiniformes	*Sphyrnidae*	*Sphyrna*	*lewini*	scalloped hammerhead	2
Carcharhiniformes	*Sphyrnidae*	*Sphyrna*	*tiburo*	bonnethead shark	12
Gadiformes	*Gadidae*	*Gadus*	*morhua*	Atlantic cod	17
Lamniformes	*Odontaspididae*	*Carcharias*	*taurus*	sandtiger shark	65
Myliobatiformes	*Dasyatidae*	*Hypanus*	*americanus*	southern ray	10
Myliobatiformes	*Dasyatidae*	*Hypanus*	*sabinus*	Atlantic ray	10
Myliobatiformes	*Dasyatidae*	*Neotrygon*	*kuhlii*	bluespotted ray	1
Myliobatiformes	*Myliobatidae*	*Aetobatus*	*narinari*	spotted eagle ray	71
Myliobatiformes	*Myliobatidae*	*Manta*	*birostris*	manta ray	2
Myliobatiformes	*Myliobatidae*	*Mobula*	*hypostoma*	lesser devil ray	6
Myliobatiformes	*Myliobatidae*	*Rhinopetera*	*bonasus*	cownose ray	36
Orectolobiformes	*Rhincodontidae*	*Rhincodon*	*typus*	whale shark	2
Orectolobiformes	*Stegostomatidae*	*Stegostoma*	*fasciatum*	zebra shark	34
Perciformes	*Anarhichadidae*	*Anarhichas*	*lupus*	Atlantic wolffish	32
Perciformes	*Anarhichadidae*	*Anarhichas*	*minor*	spotted wolffish	32
Perciformes	*Apogonidae*	*Pterapogon*	*kauderni*	Banggai cardinal	643
Perciformes	*Epinephelidae*	*Epinephelus*	*drummondhayi*	strawberry grouper	4
Perciformes	*Epinephelidae*	*Epinephelus*	*itajara*	itajara/goliath grouper	9
Perciformes	*Epinephelidae*	*Epinephelus*	*niveatus*	snowy grouper	14
Perciformes	*Epinephelidae*	*Mycteroperca*	*jordani*	gulf grouper	5
Perciformes	*Epinephelidae*	*Mycteroperca*	*microlepis*	gag	32
Perciformes	*Labridae*	*Cheilinus*	*undulatus*	humphead wrasse	9
Perciformes	*Labridae*	*Lachnolaimus*	*maximus*	hogfish	2
Perciformes	*Moronidae*	*Morone*	*saxatilis*	striped Bass	50
Perciformes	*Scaridae*	*Scarus*	*guacamaia*	rainbow parrotfish	68
Perciformes	*Serranidae*	*Epinephelus*	*striatus*	Nassau grouper	1
Rajiformes	*Rajidae*	*Amblyraja*	*radiata*	thorny Skate	15
Rajiformes	*Rajidae*	*Dipturus*	*laevis*	barndoor skate	10
Rajiformes	*Rajidae*	*Leucoraja*	*erinacea*	little Skate	10
Rajiformes	*Rajidae*	*Leucoraja*	*ocellata*	winter Skate	15

Order	*Family*	*Genus*	*Species*	Common Name	Number of Spaces**
Rajiformes	*Rhinobatidae*	*Rhynchobatus*	*djiddensis*	giant guitarfish	3
Rhinopristiformes	*Pristidae*	*Pristis*	*pristis*	largetooth sawfish	5
Scorpaeniformes	*Stetarchidae*	*Sebastes*	*paucispinis*	bocaccio	24
Squatiniformes	*Squatinidae*	*Squatina*	*squatina*	angelshark	1
Syngnathiformes	*Syngnathidae*	*Hippocampus*	*abdominalis*	big-bellied seahorse	251
Syngnathiformes	*Syngnathidae*	*Hippocampus*	*barbouri*	Barbour's seahorse	110
Syngnathiformes	*Syngnathidae*	*Hippocampus*	*comes*	tiger tail seahorse	100
Syngnathiformes	*Syngnathidae*	*Hippocampus*	*erectus*	lined seahorse	701
Syngnathiformes	*Syngnathidae*	*Hippocampus*	*guttulatus*	long-snouted seahorse	20
Syngnathiformes	*Syngnathidae*	*Hippocampus*	*histrix*	thorny seahorse	20
Syngnathiformes	*Syngnathidae*	*Hippocampus*	*ingens*	Pacific seahorse	67
Syngnathiformes	*Syngnathidae*	*Hippocampus*	*kelloggi*	great seahorse	20
Syngnathiformes	*Syngnathidae*	*Hippocampus*	*kuda*	spotted seahorse	94
Syngnathiformes	*Syngnathidae*	*Hippocampus*	*reidi*	longsnout seahorse	157
Syngnathiformes	*Syngnathidae*	*Hippocampus*	*whitei*	White's seahorse	279
Syngnathiformes	*Syngnathidae*	*Phycodurus*	*eques*	leafy seadragon	20

*The MFTAG recognizes that this data represents the plans of only those facilities who could identify their future needs at the time of the survey or represents information that facilities wish to include in the survey. It is not an exhaustive list of future space needs and is to be used only for reference and not detailed planning purposes.
**In some cases sex ratios were provided for some species. For the purpose of this document, only total spaces were detailed.

APPENDIX 14

MFTAG 2017 RCP SPECIES REVIEW AND SELECTION FOR MANAGEMENT MATRIX *(based on 2015 and 2016 Space Survey results)*

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2017): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Abudefduf	saxatilis	Sergeant major			No Management				
Acipenser	oxyrinchus oxyrinchus	Atlantic sturgeon			No Management				
Acipenser	brevirostrum	Shortnose sturgeon			No Management				
Acipenser	oxyrinchus	Gulf sturgeon			No Management				
Aetobatus	narinari	Spotted eagle ray		Studbook	Current MFTAG Yellow SSP	X			
Amblyraja	radiata	Thorny skate			No Management				
Amphiprion	ocellaris	Clown anemonefish			No Management				

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2016): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Anarhichas	lupus	Atlantic wolfish			No Management				
Anarhichas	minor	Spotted wolffish			No Management				
Anguilla	rostrata	American eel			No Management				
Balistes	capriscus	Gray triggerfish			No Management				
Balistes	vetula	Queen triggerfish			No Management				
Carcharias	taurus	Sandtiger shark	PMP	PMP	Current MFTAG Yellow SSP				
Carcharhinus	melanopterus	Blacktip reef shark			Consider Management			X1	
Carcharhinus	plumbeus	Sandbar Shark			Consider Management			X1	

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2016): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Cheilinus	undulatus	Humphead wrasse			Consider Management		X2		
Chiloscyllium	plagiosum	Whitespotted bambooshark			Consider Management			X3	
Chiloscyllium	punctatum	Brownbanded bambooshark			Consider Management			X3	
Cromileptes	altivelis	Humpback grouper			No Management				
Cymatogaster	aggregata	Shiner perch			No Management				
Dipturus	laevis	Barndoor skate	Studbook	No Management	Consider Management				X4
Embiotoca	lateralis	Striped surfperch			No Management				

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2016): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Epinephelus	itajara	Itajara/Goliath grouper			Consider Management		X2		
Epinephelus	lanceolatus	Giant grouper			No Management				
Epinephelus	niveatus	Snowy grouper			No Management				
Epinephelus	striatus	Nassau grouper			No Management				
Fundulus	heteroclitus	Mummichog			No Management				
Gadus	morhua	Atlantic cod			No Management				
Ginglymostoma	cirratum	Nurse Shark			Consider Management			X5	

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2016): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Glaucostegus	typus	Giant shovelnose ray			No Management				
Haemulon	flavolineatum	French grunt			No Management				
Haliichthys	taeniophorus	Ribboned pipefish			No Management				
Hemiscyllium	ocellatum	Epaulette shark			Consider Management			X3	
Hippocampus	abdominalis	Big-bellied seahorse		PMP	Current MFTAG Yellow SSP awaiting Program Leadership				
Hippocampus	barbouri	Barbour's seahorse	PMP	No Management	Consider Management	X6			
Hippocampus	comes	Tiger tail seahorse			No Management				
Hippocampus	erectus	Lined seahorse	PMP	PMP	Current MFTAG Yellow SSP	X			

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2016): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Hippocampus	fuscus	Sea pony			No Management				
Hippocampus	guttulatus	Long-snouted seahorse			No Management				
Hippocampus	hippocampus	Short-snouted seahorse			No Management				
Hippocampus	histrix	Thorny seahorse			No Management				
Hippocampus	ingens	Pacific seahorse			No Management				
Hippocampus	kelloggi	Great seahorse			No Management				
Hippocampus	kuda	Spotted seahorse	PMP	PMP	Selected to be a program; Awaiting leadership	X			
Hippocampus	reidi	longsnout seahorse			No Management				

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2016): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Hippocampus	trimaculatus	Longnose seahorse			No Management				
Hippocampus	whitei	White's seahorse			No Management				
Hippocampus	zosterae	Dwarf seahorse			No Management				
Hypanus	americanus	Southern ray			Consider Management			X3	
Hypanus	sabinus	Atlantic ray			Consider Management			X3	
Leucoraja	ocellata	Winter skate			No Management				
Manta	alfredi	Alfred manta			No Management				
Manta	birostris	Giant manta			No Management				

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2016): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Megalops	atlanticus	Tarpon			No Management				
Mobula	hypostoma	Lesser devil ray			No Management				
Morone	saxatilis	Striped bass			No Management				
Mycteroperca	jordani	Gulf grouper			No Management				
Mycteroperca	microlepis	Gag			No Management				
Nebrius	ferrugineus	Tawny nurse shark			No Management				
Neotrygon	kuhlii	Bluespotted stingray			No Management				
Opsanus	tau	Oyster toadfish			No Management				

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2016): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Orectolobus	ornatus	Ornate wobbegong			No Management				
Phycodurus	eques	Leafy seadragon			Consider Management		X7		
Phyllopteryx	taeniolatus	Common seadragon			Consider Management				X8
Pomacanthus	semicurculatus	Koran angelfish			No Management				
Pristis	pectinata	Smalltooth sawfish	PMP	Studbook	Current MFTAG Red SSP	X			
Pristis	pristis	Largetooth sawfish	PMP	Studbook	Current MFTAG Red SSP	X			
Pristis	zijsron	Green sawfish	PMP	Studbook	Current MFTAG Red SSP	X			

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2016): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Pterapogon	kauderni	Banggai cardinal			Consider Management	X9			
Raja	eleganteria	Clearnose skate			No Management				
Rhina	ancylostoma	Bowmouth guitarfish			Consider Management			X10	
Rhincodon	typus	Whale shark			No Management				
Rhinobatus	lentiginosus	Atlantic guitarfish			No Management				
Rhinoptera	bonasus	Cownose ray			Consider Management			X3	
Rhynchobatus	djiddensis	Giant guitarfish			No Management				

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2016): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Scarus	guacamaia	Rainbow parrotfish			No Management				
Sebastes	fasciatus	Acadian redfish			No Management				
Sebastes	paucispinis	Bocaccio			No Management				
Sebastes	pinniger	Canary rockfish			No Management				
Sebastes	ruberrimus	Yelloweye rockfish			No Management				
Sphyrna	lewini	Scalloped hammerhead			No Management				
Sphyrna	mokarran	Great hammerhead			No Management				

Genus	Species	Common Name	MFTAG Program (2007)	MFTAG Program (2011)	MFTAG Decision Tree (2016): Management Result	Program Selection Criteria			
						SSP Program or Candidate Program	Studbook Only	SAFE Studbook	No Management
Sphyrna	tiburo	Bonnethead shark			No Management				
Squalus	acanthias	Piked dogfish			No Management				
Squatina	squatina	Angelshark			No Management				
Stegostoma	fasciatum	Zebra shark	PMP	PMP	Current MFTAG SSP	X			
Stereolepsis	gigas	Giant sea bass			No Management				
Syngnathus	fuscus	Northern pipefish			No Management				
Syngnathus	scovelli	Gulf pipefish			No Management				
Urobatis	jamaicensis	Yellow stingray			No Management				

APPENDIX 15

MFTAG 2017 ANIMAL PROGRAM UPDATES

Program	Program Management	Program Leader*	Program Leader Approved	Completion of PM1	Studbook Publication	SSP Breeding and Transfer Plan
Aetobatus narnari (spotted eagle ray)	Studbook and Yellow SSP	James Kinsler	8/6/2012	11/2013 (Becca Thomas)	Published December 2014	Pending 2017 planning meeting
Stegostoma fasciatum (zebra shark)	Studbook and Yellow SSP	Lise Watson	6/11/2008	11/2009	Published December 2015	May 18, 2015
Carcharias taurus (sandtiger)	Studbook and Yellow SSP	Chris Schreiber	5/12/2014	11/2010 (David Littlehale)	Published December 2014	Pending 2017 planning meeting
Hippocampus abdominalis	Studbook and Yellow SSP	Vacant**		11/2015 (Laurel Johnson)	Published December 2015	Pending 2017 planning meeting
Hippocampus erectus (lined seahorse)	Studbook and Yellow SSP	Steven Yong	6/11/2008	11/2009	Published April 2016	October 2015
Hippocampus kuda (spotted seahorse)	Studbook	*VACANT*				
Pristis pectinata (smalltooth sawfish)	Studbook and Red SSP	Stacia White	2/11/2009	11/2009	Published November 2014	February 2017
Pristis pristis (largetooth sawfish)	Studbook and Red SSP	Stacia White	2/11/2009	11/2009	Published November 2014	February 2017
Pristis zijsron (green sawfish)	Studbook and Red SSP	Stacia White	2/11/2009	11/2009	Published November 2014	February 2017

**Full Program Leader contact information can be found on pages 12-13 of this document.*
*** Laurel Johnson is studbook keeper*

APPENDIX 16 MFTAG 2017 ANIMAL PROGRAM SUMMARY TABLE

Common Name (Genus species)	Date of last PVA/ Breeding and Transfer Plan	Current Population Size (N)	Current Number of Participating AZA Member Institutions	Projected %GD at 100 years or 10 generations**	2011 RCP Program Designation	Current Program Designation	5 year target Population Size	Population Trend Since 2011 RCP (increase, decrease, stable)	Space Needed (Future Population Size)	USFW IUCN CITES Designation
Spotted Eagle Ray (*Aetobatus narnari*)	Pending 2017 meeting	35.25.0 (60)	17	TBD	Candidate Program	Yellow Program	TBD	Stable	TBD	USFWS- NA IUCN Red List- Near Threatened CITES – NA
Zebra Shark (*Stegostoma fasciatum*)	May 18, 2015	143	35 As of 12/07/16	80.6% Published in May 2015 Breeding and Transfer plan **2015 *S. fasciatum* published Studbook	Yellow Program	Yellow Program	130	Stable	182	USFWS–NA IUCN Red List- Endangered trend decreasing CITES -NA
Sandtiger Sharks (Carcharias taurus)	Pending 2017 meeting	174	32	TBD	Yellow Program	Yellow Program	200	Stable	200	USFWS –NA NMFS- (Species of Concern) IUCN Red List- Vulnerable CITES- NA
Big-belly Seahorse (Hippocampus abdominalis)	Pending 2017 meeting	374.296 .308 As of Nov, 2016	36	TBD	Candidate Program	Yellow Program	TBD	TBD	TBD	USFWS- NA IUCN Red List- Data Deficient CITES- Appendix II
Lined Seahorse (*Hippocampus erectus)*	October 30, 2015	431.539 .76 As of January 2016	53	Per 2014 *H. erectus* Studbook, this program doesn't track population genetics only individual genetics	Yellow Program	Yellow Program	0.0.120 0	Increasing	154	USFWS- NA IUCN Red List - Vulnerable CITES- Appendix II

Common Name (*Genus species*)	Date of last PVA/Breeding and Transfer Plan	Current Population Size (N)	Current Number of Participating AZA Member Institutions	Projected %GD at 100 years or 10 generations**	2011 RCP Program Designation	Current Program Designation	5 year target Population Size	Population Trend Since 2011 RCP (increase, decrease, stable)	Space Needed (Future Population Size)	USFW IUCN CITES Designation
Spotted Seahorse (*Hippocampus kuda*)					Inactive Program					
Largetooth Sawfish (*Pristis pristis*)	November 2016 Draft Breeding and Transfer Plan sent out	11.6.0	8	Genetic analyses could not be performed due to the small population size and no reproduction ** 2016 Draft Breeding and Transfer Plan	Red Program	Red Program	11.7.0	Decreasing	11.7.2	USFWS – NA NMFS Endangered Species Act (ESA) IUCN Red List –CR CITES– Appendix 1
Smalltooth Sawfish (*Pristis pectinata*)	November 2016 Draft Breeding and Transfer Plan sent out	5.8.0	4	68.75% ** 2016 Draft Breeding and Transfer Plan	Red Program	Red Program	5.8.0	Increasing	5.8.2	USFWS – NA NMFS Endangered Species Act (ESA) IUCN Red List –CR CITES– Appendix 1
Green Sawfish (*Pristis zijsron*)	November 2016 Draft Breeding and Transfer Plan sent out	7.5.0	6	genetic analyses could not be performed due to the small population size and no reproduction ** 2016 Draft Breeding and Transfer Plan	Red Program	Red Program	7.5.0	Decreasing	7.5.3	USFWS – NA NMFS Endangered Species Act (ESA) IUCN Red List –CR CITES– Appendix 1

APPENDIX 17

MFTAG ANIMAL PROGRAM 3-5 YEAR GOALS AND TRENDS

Tables define annual program goals at the time of RCP2017 publication and provide insight into possible goals program leaders wish to attain or trends they envision their program addressing in the next 3-5years.

Common Name/Scientific Name	**Sandtiger Shark / *Carcharias taurus***
Animal Program Designation	**Yellow Program**
Primary Role	Education/Exhibit Needs; Research
Goal #1/Essential Actions 2015-2016	Refine and document husbandry practices. (1) Develop and distribute questionnaire regarding current husbandry practices. (2) Develop and share results as a reference for stakeholders
Progress towards Goal #1	Several surveys distributed with results being tabulated and remaining areas in question being identified.
Goal #2/Essential Actions 2015-201	Development of Artificial Insemination Program. (1) Work with research partners and Sandtiger stakeholders to provide samples for analysis. (2) Communicate results regularly to participating institutions. (3) Increase sample size by actively recruiting more institutional participation.
Progress Toward Goal #2	North Carolina Aquarium, Florida Aquarium, Georgia Aquarium (Marineland), Ripley's Aquariums and Disney's Living Seas Adventure Aquarium, Aquarium of the Pacific, and the National Aquarium are working with SEZARC to improve our understanding of *Carcharias taurus* and other shark species to produce offspring via natural breeding and through artificial insemination techniques. A 2015 workshop identified several areas of need including a better understanding of reproductive and dominance behavior in *C. taurus* and a need for exchange of information between institutions especially with regard to shark handling and transfer. Participating stakeholders met December 2015 and 2016 with minutes, action items, and progress being distributed to participating members first, then all stakeholders.
Goal #3/Essential Actions 2015-2016	Improve communication amongst stakeholders. (1) Create forum in which information can be easily shared.
Progress toward Goal #3	Google Group created, Session and presentations done at following meetings – AZA National 2015, RAW 2015, AZA National 2016
ADD NEW GOALS BELOW:	
Goal or Trend #1/Essential Action 2017-2021	Meet with AZA Population Management Center to generate a draft Population Management Plan. (Spring 2017)
Goal or Trend #2/Essential Action 2017-2021	Work with stakeholders to refine acquisition plans for next 5 years.
Goal or Trend #3 /Essential Action 2017-2021	One, successful live birth.

Common Name/Scientific Name	**Lined seahorse / *Hippocampus erectus***
Animal Program Designation	**Yellow Program**
Primary Role	Education/Exhibit Needs AND Research
Goal #1/Essential Actions 2015-2016	Increase overall population and gene diversity. Prioritize breeding for genetically valuable pairs while increasing overall population by ~ 200.
Progress towards Goal #1	During 2016, a program participant imported WILD founder animals and successfully produced ~140 offspring. These animals were distributed amongst 13 participating institutions.
Goal #2/Essential Actions 2015-2016	Increase research opportunities related to SSP. 1. Investigate research or conservation programs for the program. 2. Maintain communication with researchers and conservation organizations.
Progress Toward Goal #2	SyngBio 2017 attendance is planned.
Goal #3/Essential Actions 2015-2016	Connect Stakeholders. 1. Encourage and increase frequency of communication and cooperative efforts among stakeholders. 2. Frequent communication and updates from the SSP to stakeholders.
Progress toward Goal #3	Ongoing.
ADD NEW GOALS BELOW:	
Goal or Trend #1/Essential Action 2017-2021	Maintain a population of ~1500 animals at ~ 50 holding institutions while maximizing genetic diversity.
Goal or Trend #2/Essential Action 2017-2021	Increase research and species conservation opportunities related to SSP.

Common Name/Scientific Name	**Big Bellied Seahorse**
Animal Program Designation	**Yellow Program**
Primary Role	Education/Exhibit Needs
Goal #1/Essential Actions 2015-2016	Assemble and complete North American Regional studbook
Progress towards Goal #1	Completed and published North American Regional Studbook
Goal #2/Essential Actions 2015-2016	Husbandry Protocols Create a communication structure to gather baseline of husbandry protocols within AZA institutions Institutional Needs/Goals for Big-Bellied Seahorse Determine institutional goals of participating facilities (breeding, rearing, holding, display)
Progress Toward Goal #2	Published a summary of husbandry protocols within stakeholder Institutions within Studbook
Goal #3/Essential Actions 2015-2016	Communicate with Stakeholders. Create a mechanism to encourage communications among stakeholders and between stakeholders and Program Update Studbook
Progress toward Goal #3	Ongoing
ADD NEW GOALS BELOW:	
Goal or Trend #1/Essential Action 2017-2021	Recruit Program Leader
Goal or Trend #2/Essential Action 2017-2021	Yearly update of Studbook census data and foster of communication and information sharing among stakeholders
Goal or Trend #3 /Essential Action 2017-2021	Identify and explore research and in situ conservation opportunities

Common Name/Scientific Name	**Sawfish/ P. pristis, P. zijsron, P. pectinata**
Animal Program Designation	**Red Program**
Primary Role	Education/Exhibit Needs
Goal #1/Essential Actions 2015-2016	Monitoring of conservation programs and advocacy issues involving Sawfish. 1. Champion sawfish within the SAFE: Shark and Ray program 2. Create an International Sawfish Awareness Day
Progress towards Goal #1	Participated in several conference calls pertaining to SAFE: Shark and Ray program and the creation of the Action Plans. Sawfish Awareness Day has been set for October 17th and material is beginning to be created.
Goal #2/Essential Actions 2015-2016	Publish the PMC breeding/ transfer plan
Progress Toward Goal #2	The Breeding and Transfer Plan Draft has been created and sent to Stakeholders with comments being taken until end of December 2016.
Goal #3/Essential Actions 2015-2016	Completing AZA Animal Care manuals for each Pristid species. Develop strategies for collecting information and drafting documents.
Progress toward Goal #3	Following a Sawfish Workshop with Stakeholders and SEZARC established some goals and items that need to be surveyed among all stakeholders and the SSP leadership is starting the process of creating questionnaires/survey.
ADD NEW GOALS BELOW:	
Goal or Trend #1/Essential Action 2017-2021	International Sawfish Awareness day has been established for October 17th. Begin producing materials to be used at participating institutions and continue to grow from year to year.
Goal or Trend #2/Essential Action 2017-2021	Begin collaboration with SEZARC and all stakeholder institutions to work toward more captive reproduction, conservation and education outreach
Goal or Trend #3 /Essential Action 2017-2021	Identify Sawfish conservation projects/programs around the world that AZA Institutions can become involved in to promote Sawfish conservation through the SAFE program.

Common Name/Scientific Name	**Spotted Eagle Ray/ *Aetobatus narinari***
Animal Program Designation	**Yellow Program**
Primary Role	Education/Exhibit Needs
Goal #1/Essential Actions 2015-2016	Monogene Treatment Protocol/General Quarantine Practices. (1) Improve communication among participating facilities engaged in treatment study. (2) Evaluate efficacy of individual treatment protocols among participating facilities. (3) Determine finalized protocol for treatment of monogene.
Progress towards Goal #1	Efforts towards improving communications between facilities and developing protocols are ongoing processes. A stakeholder from Ripley's Aq. Of Canada will be presenting on their quarantine studies and findings at RAW in May 2017 and have published this study in Drum and Croaker 2017 Edition.
Goal #2/Essential Actions 2015-2016	Institutional Needs/Goals for Spotted Eagle Rays Increase dialogue between stakeholder facilities. Determine institutional goals and expectations for SER's at each participating facility (breeding, rearing, holding, display only).
Progress Toward Goal #2	Surveys gathering wants and needs are being distributed in preparation to meeting with PMC to develop a Breeding and Transfer Plan.
Goal #3/Essential Actions 2015-2016	Develop Breeding and Transfer Plan Once Institutional needs are determined, focus on breeding/transfer plan based on facility involvement.
Progress toward Goal #3	This meeting is scheduled for March 2017.
ADD NEW GOALS BELOW:	
Goal or Trend #1/Essential Action 2017-2021	2nd Studbook Publication is due 12/1/2017
Goal or Trend #2/Essential Action 2017-2021	Increase communication between SSP and Stakeholders, including conducting mid-year population updates for studbook.

Common Name/Scientific Name	**Zebra shark/ *Stegostoma fasciatum***
Animal Program Designation	**Yellow SSP**
Primary Role	Educational / Exhibit Needs
Goal #1/Essential Actions 2015-2016	**Increase population gene diversity** (1) Increase the number of breeding founders to be able to supply the program with all of the animals that are needed while maintaining genetic diversity. (2) Encourage genetic testing of offspring for definitive dam and sire confirmation and to identify reproduction through parthenogenesis. This will help provide improved accuracy to the genetic diversity program projections. Continue to work with stakeholders to improve fulfillment of outstanding breeding and transfer recommendations. Improve communication between stakeholders and SSP to help facilitate program objectives.
Progress towards Goal #1	Ongoing Some new founders come into the program but breeding activity has decreased over this past year. More work needs to be done in the upcoming year to stimulate breeding among the recommended animals. More work on this to start in early 2017. Stakeholders are being asked not to incubate eggs from sharks where parthenogenetic reproduction is probable to help maintain and improve the genetic diversity of the population.
Goal #2/Essential Actions 2015-2016	**Increase long-term population sustainability** Improve and standardize husbandry of the juveniles to increase survival rate of juveniles Co-authored husbandry paper for the upcoming Elasmobranch Husbandry Manual to improve juvenile viability.
Progress Toward Goal #2	Ongoing Elasmobranch husbandry manual final draft stage. Overall viability has been improving at the majority of participating facilities.
Goal #3/Essential Actions 2015-2016	**Champion Zebra sharks within the SAFE: Sharks program**
Progress toward Goal #3	Ongoing
ADD NEW GOALS BELOW:	
Goal or Trend #1/Essential Action 2017-2021	Work with researchers towards in situ conservation possibilities.
Goal or Trend #2/Essential Action 2017-2021	Get updates from stakeholders in terms of their wants and needs.

APPENDIX 18

MFTAG RECOMMENDATIONS FOR SELECTED SPECIES

Scientific Name	**Common Name**	**IUCN CS**	**Management**	**Program Leader+**
Aetobatus narinari	spotted eagle ray	NT	Yellow SSP	Jim Kinsler
Carcharhinus melanopterus	blacktip reef shark	NT	SAFE studbook	TBD
Carcharhinus plumbeus	sandbar shark	V	SAFE studbook	TBD
Carcharias taurus	sandtiger shark	V	Yellow SSP	Chris Schreiber
Cheilinus undultaus	humphead wrasse	E	studbook	TBD
Chilloscyllium punctatum	brownbanded bambooshark	NT	SAFE studbook	TBD
Epinephelus itajara	itajara/goliath grouper	CE	studbook	TBD
Ginglystoma cirratum	nurse shark	DD	SAFE studbook	TBD
Hemiscyllium ocellatum	epaulette shark	LC	SAFE studbook	TBD
Hippocampus abdominalis	big bellied seahorse	DD	Yellow SSP	Vacant
Hippocampus barbouri	Barbour's seahorse	V	Candidate Program	TBD
Hippocampus erectus	lined seahorse	V	Yellow SSP	Steven Yong
Hippocampus kuda	spotted seahorse	V	Candidate Program	Vacant
Hypanus americanus	southern ray	DD	SAFE studbook	TBD
Hypanus sabinus	Atlantic ray	LC	SAFE studbook	TBD
Phycodurus eques	leafy seadragon	NT	studbook	TBD
Pristis pectinata	smalltooth sawfish	CE	Red SSP**	Stacia White
Pristis pristis	largetooth sawfish	CE		
Pristis zijsron	green sawfish	CE		
Pterapogon kauderni	Banggai cardinal	E	Candidate Program	TBD
Rhina ancylostoma	bowmouth guitarfish	V	SAFE studbook	TBD
Rhinoptera bonasus	cownose ray	NT	SAFE studbook	TBD
Stegostoma fasciatum	zebra shark	E	Yellow SSP	Lise Watson

IUCN CS = IUCN Conservation Status

+Complete contact information for current program leaders can be found in "Current MFTAG Steering Committee, Advisors and Program Leaders Contact Information"

*** The MFTAG manages ONE studbook to include all Pristids currently in or to be obtained in the future by AZA member institutions.*

TBD – studbook or program leadership will be recruited from the MFTAG IRs and be approved by the MFTAG steering committee.

Vacant – program was established in 2010 RCP and leadership position remains or is currently vacant.

APPENDIX 19

SPACE ANALYSIS SUMMARY OF SELECTED POPULATION MANAGEMENT PROGRAM SPECIES

Scientific Name	Common Name	Current Population Size	Anticipated Population Size	Estimated* Target Population for Management
Aetobatus narinari	spotted eagle ray	35.25.0	35.25.0	PMC analysis to be completed early 2017
Carcharhinus melanopterus	blacktip reef shark	TBD	>50	TBD
Carcharhinus plumbeus	sandbar shark	TBD	>50	TBD
Carcharias taurus	sandtiger shark	116.84.0	120.100.00	PMC analysis not completed to date
Cheilinus undultaus	humphead wrasse	8.3.12	5.3.4	TBD
Chilloscyllium punctatum	brownbanded bambooshark	TBD	>50	TBD
Epinephelus itajara	itajara/goliath grouper	0.0.18	0.0.6	TBD
Ginglystoma cirratum	nurse shark	TBD	>50	TBD
Hemiscyllium ocellatum	epaulette shark	TBD	>50	TBD
Hippocampus abdominalis	big bellied seahorse	374.296.308	>374.296.308	PMC analysis to be completed early 2017
Hippocampus barbouri	Barbour's seahorse	TBD	TBD	TBD
Hippocampus erectus	lined seahorse	431.539.76	600.600.0	600.600.0 (1200 total/ratios variable)
Hippocampus kuda	spotted seahorse	TBD	TBD	TBD
Hypanus americanus	southern ray	TBD	>50	TBD
Hypanus sabinus	Atlantic ray	TBD	>50	TBD
Phycodurus eques	leafy seadragon	TBD	TBD	TBD
Pristis pectinata	smalltooth sawfish	5.8.0	5.8.0	5.8.2
Pristis pristis	largetooth sawfish	11.6.0	11.7.0	11.7.2
Pristis zijsron	green sawfish	7.5.0	7.5.0	7.5.3
Pterapogon kauderni	Banggai cardinal	60.64.519	0.0.600	TBD
Rhina ancylostoma	bowmouth guitarfish	7.13.0	>50	TBD
Rhinoptera bonasus	cownose ray	TBD	>50	TBD
Stegostoma fasciatum	zebra shark	60.83.0	60.83.39	60.83.0

TBD –Additional surveys will determine exact numbers of animals present in collections not identified in the 2015 and 2016 surveys

APPENDIX 20

AZA POLICY ON RESPONSIBLE ANIMAL MANAGEMENT

Approved by the AZA Board of Directors January 12, 2016

PREAMBLE

The stringent requirements for AZA accreditation, and high ethical standards of professional conduct, are unmatched by similar organizations and far surpass the United States Department of Agriculture's Animal and Plant Health Inspection Service's requirements for licensed animal exhibitors. Every AZA member must abide by a Code of Professional Ethics (https://www.aza.org/Ethics/). In order to continue these high standards, AZA-accredited institutions and certified related facilities should make it a priority, when possible, to acquire animals from and transfer them to other AZA member institutions, or members of other regional zoo associations that have professionally recognized accreditation programs.

AZA-accredited institutions and certified related facilities cannot fulfill their important missions of conservation, education, and science without live animals. Responsible management and the long-term sustainability of living animal populations necessitates that some individuals be acquired and transferred, reintroduced or even humanely euthanized at certain times. The acquisition and transfer of animals should be prioritized by the long-term sustainability needs of the species and AZA-managed populations among AZA-accredited and certified related facilities, and between AZA member institutions and non-AZA entities with animal care and welfare standards aligned with AZA. AZA member institutions that acquire animals from the wild, directly or through commercial vendors, should perform due diligence to ensure that such activities do not have a negative impact on species in the wild. Animals should only be acquired from non-AZA entities that are known to operate legally and conduct their business in a manner that reflects and/or supports the spirit and intent of the AZA Code of Professional Ethics as well as this Policy.

I. INTRODUCTION

This AZA Policy on Responsible Population Management provides guidance to AZA members to:

1. Assure that animals from AZA member institutions and certified related facilities are not transferred to individuals or organizations that lack the appropriate expertise or facilities to care for them [*see taxa specific appendices (in development)*],

2. Assure that the health and conservation of wild populations and ecosystems are carefully considered as appropriate,

3. Maintain a proper standard of conduct for AZA members during acquisition and transfer/reintroduction activities, including adherence to all applicable laws and regulations,

4. Assure that the health and welfare of individual animals is a priority during acquisition and transfer/reintroduction activities, and

5. Support the goals of AZA's cooperatively managed populations and associated Animal Programs [Species Survival Plans® (SSPs), Studbooks, and Taxon Advisory Groups (TAGs)].

This AZA Policy on Responsible Population Management will serve as the default policy for AZA member institutions. Institutions should develop their own AZA Policy on Responsible Population Management in order to address specific local concerns. Any institutional policy must incorporate and not conflict with the AZA acquisition and transfer/transition standards.

II. LAWS, AUTHORITY, RECORD-KEEPING, IDENTIFICATION AND DOCUMENTATION

The following must be considered with regard to the acquisition or transfer/management of all living animals and specimens (their living and non-living parts, materials, and/or products):

1. Any acquisitions, transfers, euthanasia and reintroductions must meet the requirements of all applicable local, state, federal and international laws and regulations. Humane euthanasia must be performed in accordance with the established euthanasia policy of the institution and follow the recommendations of current AVMA Guidelines for the Euthanasia of Animals (2013 Edition https://www.avma.org/KB/Policies/Documents/euthanasia.pdf) or the AAZV's Guidelines on the Euthanasia of Non-Domestic Animals. Ownership and any applicable chain-of-custody must be documented. If such information does not exist,

an explanation must be provided regarding such animals and specimens. Any acquisition of free-ranging animals must be done in accordance with all local, state, federal, and international laws and regulations and must not be detrimental to the long-term viability of the species in the wild.

2. The Director/Chief Executive Officer of the institution must have final authority for all acquisitions, transfers, and euthanasia.

3. Acquisitions or transfers/euthanasia/reintroductions must be documented through institutional record keeping systems. The ability to identify which animal is being transferred is very important and the method of identifying each individual animal should be documented. Any existing documentation must accompany all transfers. Institutional animal records data, records guidelines have been developed for certain species to standardize the process (https://www.aza.org/AnimalCare/detail.aspx?id=3150).

4. For some colonial, group-living, or prolific species, it may be impossible or highly impractical to identify individual animals when these individuals are maintained in a group. These species can be maintained, acquisitioned, transferred, and managed as a group or colony, or as part of a group or colony.

5. If the intended use of specimens from animals either living or non-living is to create live animal(s), their acquisition and transfer should follow the same guidelines. If germplasm is acquired or transferred with the intention of creating live animal(s), ownership of the offspring must be clearly defined in transaction documents (e.g., breeding loan agreements).

   Institutions acquiring, transferring or otherwise managing specimens should consider current and possible future uses as new technologies become available. All specimens from which nuclear DNA could be recovered should be carefully considered for preservation as these basic DNA extraction technologies already exist.

6. AZA member institutions must maintain transaction documents (e.g., confirmation forms, breeding agreements) which provide the terms and conditions of animal acquisitions, transfers and loans, including documentation for animal parts, products and materials. These documents should require the potential recipient or provider to adhere to the AZA Policy on Responsible Population Management, and the AZA Code of Professional Ethics, and must require compliance with the applicable laws and regulations of local, state, federal, and international authorities.

7. In the case of animals (living or non-living) and their parts, materials, or products (living or non-living) held on loan, the owner's written permission should be obtained prior to any transfer and documented in the institutional records.

8. AZA SSP and TAG necropsy and sampling protocols should be accommodated.

9. Some governments maintain ownership of the species naturally found within their borders. It is therefore incumbent on institutions to determine whether animals they are acquiring or transferring are owned by a government entity, foreign or domestic, and act accordingly by reviewing the government ownership policies available on the AZA website. In the case of government owned animals, proposals for and/or notifications of transfers must be sent to the species manager for the government owned species.

I. ACQUISITION REQUIREMENTS

A. General Acquisitions

1. Acquisitions must be consistent with the mission of the institution, as reflected in its Institutional Collection Plan, by addressing its exhibition/education, conservation, and/or scientific goals regarding the individual or species.

2. Animals (wild, feral, and domestic) may be held temporarily for reasons such as assisting governmental agencies or other institutions, rescue and/or rehabilitation, research, propagation or headstarting for reintroduction, or special exhibits.
3. Any receiving institution must have the necessary expertise and resources to support and provide for the professional care and management of the species, so that the physical, psychological, and social needs of individual animals and species are met.

4. If the acquisition involves a species managed by an AZA Animal Program, the institution should communicate with the Animal Program Leader and, in the case of Green SSP Programs, must adhere to the AZA Full Participation Policy (http://www.aza.org/full- participation-in-ssp-program-policy/).

5. AZA member institutions should consult AZA Wildlife Conservation and Management Committee (WCMC)-approved TAG Regional Collection Plans (RCPs), Animal Program Leaders, and AZA Animal Care Manuals (ACMs) when making acquisition decisions.

6. AZA member institutions that work with commercial vendors that acquire animals from the wild, must perform due diligence to assure the vendors' collection of animals is legal and using ethical practices. Commercial vendors should have conservation and animal welfare goals similar to those of AZA institutions.

7. AZA member institutions may acquire animals through public donations and other non-AZA entities when it is in the best interest of the animal and/or species.

B. Acquisitions from the Wild

Maintaining wild animal populations for exhibition, education and wildlife conservation purposes is a core function of AZA-member institutions. AZA zoos and aquariums have saving species and conservation of wildlife and wildlands as a basic part of their public mission. As such, the AZA recognizes that there are circumstances where acquisitions from the wild are needed in order to maintain healthy, diverse animal populations. Healthy, sustainable populations support the objectives of managed species programs and the core mission of AZA members. In some cases, acquiring individuals from the wild may be a viable option in addition to, or instead of, relying on breeding programs with animals already in human care.

Acquiring animals from the wild can result in socioeconomic benefit and environmental protection and therefore the AZA supports environmentally sustainable/beneficial acquisition from the wild when conservation is a positive outcome.

1. Before acquiring animals from the wild, institutions are encouraged to examine alternative sources including other AZA institutions and other regional zoological associations or other non-AZA entities.

2. When acquiring animals from the wild, both the long-term health and welfare impacts on the wild population as well as on individual animals must be considered. In crisis situations, when the survival of a population is at risk, rescue decisions will be made on a case-by-case basis by the appropriate agency and institution.

3. AZA zoos and aquariums may assist wildlife agencies by providing homes for animals born in nature if they are incapable of surviving on their own (eg in case of orphaned or injured animals) or by euthanizing the animals because they pose a risk to humans or for humane reasons.

4. Institutions should only accept animals from the wild after a risk assessment determines the zoo/aquarium can mitigate any potential adverse impacts on the

health, care and maintenance of the existing animals already being housed at the zoo or aquarium, and the new animals being acquired.

II. TRANSFER, EUTHANASIA AND REINTRODUCTION REQUIREMENTS

A. Living Animals

Successful conservation and animal management relies on the cooperation of many entities, both AZA and non-AZA. While preference is given to placing animals with AZA-accredited institutions or certified related facilities, it is important to foster a cooperative culture among those who share AZA's mission of saving species and excellence in animal care.

1. AZA members should assure that all animals in their care are transferred, humanely euthanized and/or reintroduced in a manner that meets the standards of AZA, and that animals are not transferred to those not qualified to care for them properly. Refer to IV.12, below, for further requirements regarding euthanasia.

2. If the transfer of animals or their specimens (parts, materials, and products) involves a species managed by an AZA Animal Program, the institution should communicate with that Animal Program Leader and, in the case of Green SSP Programs must adhere to the AZA Full Participation Policy (http://www.aza.org/full-participation-in-ssp-program-policy/).

3. AZA member institutions should consult WCMC-approved TAG Regional Collection Plans, Animal Program Leaders, and Animal Care Manuals when making transfer decisions.

4. Animals acquired solely as a food source for animals in the institution's care are not typically accessioned. There may be occasions, however, when it is appropriate to use accessioned animals that exceed population carrying capacity as feeder animals to support other animals. In some cases, accessioned animals may have their status changed to "feeder animal" status by the institution as part of their program for long-term sustained population management of the species.

5. In transfers to non-AZA entities, AZA members must perform due diligence and should have documented validation, including one or more letters of reference, for example from an appropriate AZA Professional Fellow or other trusted source with expertise in animal care and welfare, who is familiar with the proposed recipient and their current practices, and that the recipient has the expertise and

resources required to properly care for and maintain the animals. Any recipient must have the necessary expertise and resources to support and Provide for the professional care and management of the species, so that the physical, psychological, and social needs of individual animals and species are met within the parameters of modern zoological philosophy and practice. Supporting documentation must be kept at the AZA member institution (see #IV.9 below).

6. Domestic animals should be transferred in accordance with locally acceptable humane farming practices, including auctions, and must be subject to all relevant laws and regulations.

7. AZA members must not send any non-domestic animal to auction or to any organization or individual that may display or sell the animal at an animal auction. *See certain taxa-specific appendices to this Policy (in development) for information regarding exceptions*.

8. Animals must not be sent to organizations or individuals that allow the hunting of these individual animals; that is, no individual animal transferred from an AZA institution may be hunted. For purposes of maintaining genetically healthy, sustainable zoo and aquarium populations, AZA-accredited institutions and certified related facilities may send animals to non-AZA organizations or individuals (refer to #IV.5 above). These non-AZA entities (for instance, ranching operations) should follow appropriate ranch management practices and other conservation minded practices to support population sustainability.

9. Every loaning institution must annually monitor and document the conditions of any loaned specimen(s) and the ability of the recipient(s) to provide proper care (refer to #IV.5 above). If the conditions and care of animals are in violation of the loan agreement, the loaning institution must recall the animal or assure prompt correction of the situation. Furthermore, an institution's loaning policy must not be in conflict with this AZA Policy on Responsible Population Management.

10. If living animals are sent to a non-AZA entity for research purposes, it must be a registered research facility by the U.S. Department of Agriculture and accredited by the Association for the Assessment & Accreditation of Laboratory Animal Care, International (AAALAC), if eligible. For international transactions, the receiving facility must be registered by that country's equivalent body having enforcement over animal welfare. In cases where research is conducted, but governmental oversight is not required, institutions should do due diligence to assure the welfare of the animals during the research.

11. Reintroductions and release of animals into the wild must meet all applicable local, state, and international laws and regulations. Any reintroduction requires adherence to best health and veterinary practices to ensure that non-native pathogens are not released into the environment exposing naive wild animals to danger. Reintroductions may be a part of a recovery program and must be compatible with the IUCN Reintroduction Specialist Group's Reintroduction Guidelines (http://www.iucnsscrsg.org/index.php).

12. Humane euthanasia may be employed for medical reasons to address quality of life issues for animals or to prevent the transmission of disease. AZA also recognizes that humane euthanasia may be employed for managing the demographics, genetics, and diversity of animal populations. Humane euthanasia must be performed in accordance with the established euthanasia policy of the institution and follow the recommendations of current AVMA Guidelines for the Euthanasia of Animals (2013 Edition https://www.avma.org/KB/Policies/Documents/euthanasia.pdf) or the AAZV's Guidelines on the Euthanasia of Non-Domestic Animals.

B. Non-Living Animals and Specimens

AZA members should optimize the use and recovery of animal remains. All transfers must meet the requirements of all applicable laws and regulations.

1. Optimal recovery of animal remains may include performing a complete necropsy including, if possible, histologic evaluation of tissues which should take priority over specimens' use in education/exhibits. AZA SSP and TAG necropsy and sampling protocols should be accommodated. This information should be available to SSP Programs for population management.

2. The educational use of non-living animals, parts, materials, and products should be maximized, and their use in Animal Program sponsored projects and other scientific projects that provide data for species management and/or conservation must be considered.

3. Non-living animals, if handled properly to protect the health of the recipient animals, may be utilized as feeder animals to support other animals as deemed appropriate by the institution.

4. AZA members should consult with AZA Animal Program Leaders prior to transferring or disposing of remains/samples to determine if existing projects or protocols are in place to optimize use.

AZA member institutions should develop agreements for the transfer or donation of non- living animals, parts, materials, products, and specimens and associated documentation, to non-AZA entities such as universities and museums. These agreements should be made with entities that have appropriate long term curation/collections capacity and research protocols, or needs for educational programs and/or exhibits.

Appendix I: DEFINITIONS

Acquisition: Acquisition of animals can occur through breeding (births, hatchings, cloning, and division of marine invertebrates = "fragging"), trade, donation, lease, loan, transfer (inter- and intra-institution), purchase, collection, confiscation, appearing on zoo property, or rescue and/or rehabilitation for release.

Annual monitoring and Due diligence: Due diligence for the health of animals on loan is important. Examples of annual monitoring and documentation include and are not limited to inventory records, health records, photos of the recipient's facilities, and direct inspections by AZA professionals with knowledge of animal care. The level of due diligence will depend on professional relationships.

AZA member institution: In this Policy "AZA member institutions" refers to AZA-accredited institutions and certified related facilities (zoological parks and aquariums). "AZA members" may refer to either institutions or individuals.

Data sharing: When specimens are transferred, the transferring and receiving institutions should agree on data that must be transferred with the specimen(s). Examples of associated documentation include provenance of the animal, original permits, tags and other metadata, life history data for the animal, how and when specimens were collected and conserved, etc.

Dispose: "Dispose/Disposing of" in this document is limited to complete and permanent removal of an individual via incineration, burying or other means of permanent destruction

Documentation: Examples of documentation include ZIMS records, "Breeding Loan" agreements, chain-of-custody logs, letters of reference, transfer agreements, and transaction documents. This is documentation that maximizes data sharing.

Domestic animal: Examples of domestic animals may include certain camelids, cattle, cats, dogs, ferrets, goats, pigs, reindeer, rodents, sheep, budgerigars, chickens, doves, ducks, geese, pheasants, turkeys, and goldfish or koi.

Ethics of Acquisition/Transfer/Euthanasia: Attempts by members to circumvent AZA Animal Programs in the acquisition of animals can be detrimental to the Association and its Animal Programs. Such action may also be detrimental to the species involved and may be a violation of the Association's Code of Professional Ethics. Attempts by members to circumvent AZA Animal Programs in the transfer, euthanasia or reintroduction of animals may be detrimental to the Association and its Animal Programs (unless the animal or animals are deemed extra in the Animal Program population by the Animal Program Coordinator). Such action may be detrimental to the species involved and may be a violation of the Association's Code of Professional Ethics.

"Extra" or Surplus: AZA's scientifically-managed Animal Programs, including SSPs, have successfully bred and reintroduced critically endangered species for the benefit of humankind. To accomplish these critical conservation goals, populations must be managed within "carrying capacity" limits. At times, the number of individual animals in a population exceeds carrying capacity, and while meaning no disrespect for these individual animals, we refer to these individual animals as "extra" within the managed population.

Euthanasia: Humane death. This act removes an animal from the managed population. Specimens can be maintained in museums or cryopreserved collections. Humane euthanasia must be performed in accordance with the established euthanasia policy of the institution and follow the recommendations of current AVMA Guidelines for the Euthanasia of Animals (2013 Edition https://www.avma.org/KB/Policies/Documents/euthanasia.pdf) or the AAZV's Guidelines on the Euthanasia of Non-Domestic Animals.

Feral: Feral animals are animals that have escaped from domestication or have been abandoned to the wild and have become wild, and the offspring of such animals. Feral animals may be acquired for temporary or permanent reasons.

Group: Examples of colonial, group-living, or prolific species include and are not limited to certain terrestrial and aquatic invertebrates, fish, sharks/rays, amphibians, reptiles, birds, rodents, bats, big herds, and other mammals,

Lacey act: The Lacey Act prohibits the importation, exportation, transportation, sale, receipt, acquisition or purchase of wildlife taken or possessed in violation of any law, treaty or regulation of the United States or any Indian tribal law of wildlife law. In cases when there is no documentation accompanying an acquisition, the animal(s) may not be transferred across state lines. If the animal was illegally acquired at any

time then any movement across state or international borders would be a violation of the Lacey Act.

Museum: It is best practice for modern zoos and aquariums to establish relationships with nearby museums or other biorepositories, so that they can maximize the value of animals when they die (e.g., knowing who to call when they have an animal in necropsy, or specimens for cryopreservation). Natural history museums that are members of the Natural Science Collections Alliance (NSCA) and frozen biorepositories that are members of the International Society of Biological and Environmental Repositories (ISBER) are potential collaborators that could help zoos find appropriate repositories for biological specimens.

Non-AZA entity: Non – AZA entities includes facilities not accredited or certified by the AZA, facilities in other zoological regions, academic institutions, museums, research facilities, private individuals, etc.

Reintroduction: Examples of transfers outside of a living zoological population include movements of animals from zoo/aquarium populations to the wild through reintroductions or other legal means.

Specimen: Examples of specimens include animal parts, materials and products including bodily fluids, cell lines, clones, digestive content, DNA, feces, marine invertebrate (coral) fragments ("frags"), germplasm, and tissues.

Transaction documents: Transaction documents must be signed by the authorized representatives of both parties, and copies must be retained by both parties*. In the case of loans, the owner's permission for appropriate activities should be documented in the institutional records. This document(s) should be completed prior to any transfer. In the case of rescue, confiscation, and evacuation due to natural disasters, it is understood that documents may not be available until after acceptance or shipping. In this case documentation (e.g., a log) must be kept to reconcile the inventory and chain of custody after the event occurs. (*In the case of government owned animals, notification of transfers must be sent to species manager for the government owned species).

Transfer: Transfer occurs when an animal leaves the institution for any reason. Reasons for transfer or euthanasia may include cooperative population management (genetic, demographic or behavioral management), animal welfare or behavior management reasons (including sexual maturation and individual management needs). Types of transfer include withdrawal through donation, trade, lease, loan, inter- and intra- institution transfers, sale, escape, theft. Reintroduction to the wild,

humane euthanasia or natural death are other possible individual animal changes in a population.

Appendix 2: RECIPIENT PROFILE EXAMPLE

Example questions for transfers to non-AZA entities (from AZA-member Recipient Profile documents):

Has your organization, or any of its officers, been indicted, convicted, or fined by a State or Federal agency for any statute or regulation involving the care or welfare of animals housed at your facility? (If yes, please explain on a separate sheet).

Recipients agree that the specimen(s) or their offspring will not be utilized, sold or traded for any purpose contrary to the Association of Zoos and Aquariums (AZA) Code of Ethics (enclosed)

References, other than employees, 2 minimum (please provide additional references on separate sheet):

Reference Name Phone
Facility Fax
Address E-mail
City State Zip
Country AZA Member?

Reference Name Phone
Facility Fax
Address E-mail
City State Zip
Country AZA Member?

Veterinary

Veterinarian Phone
Clinic/Practice Fax
Address E-mail
City State Zip
Country

How are animals identified at your facility? If animals are not identified at your facility, please provide an explanation about why they are not here:

Where do you acquire and send animals? (Select all that apply)

AZA Institutions	Non-AZA Institutions	Exotic Animal Auctions	Pet Stores
Hunting Ranches	Dealers	Private Breeders	Non-hunting Game Ranches
Entertainment Industry	Hobbyists	Research Labs	Wild
Other			

What specific criteria are used to evaluate if a facility is appropriate to receive animals from you?
Please provide all of the information listed below: Required:

1. Please provide a brief statement of intent for the specimens requested.
2. Resumes of primary caretakers and those who will be responsible for the husbandry and management of animals.
3. Description (including photographs) of facilities and exhibits where animals will be housed.
4. Copy of your current animal inventory.

Only if Applicable:

5. Copies of your last two USDA inspection reports (if applicable).
6. Copies of current federal and state permits.
7. Copy of your institutional acquisition/disposition policy.

(in-house use only) In-Person Inspection of this facility (Staff member/Date, attach notes):

(Local institution: provide Legal language certifying that the information contained herein is true and correct)

(Validity of this: This document and all materials associated will be valid for a period of 2 years from date of signature.)

Example agreement for Receiving institution (agrees to following condition upon signing):

RECIPIENT AGREES THAT THE ANIMAL(S) AND ITS (THEIR) OFFSPRING WILL NOT BE UTILIZED, SOLD OR TRADED FOR THE PURPOSE OF COMMERCE OR SPORT HUNTING, OR FOR USE IN ANY STRESSFUL OR TERMINAL RESEARCH OR SENT TO ANY ANIMAL AUCTION. RECIPIENT FURTHER AGREES THAT IN THE EVENT THE RECIPIENT INTENDS TO DISPOSE OF AN ANIMAL DONATED BY (INSITUTION), RECIPIENT WILL FIRST NOTIFY (INSTITUTION) OF THE IDENTITY OF THE PROPOSED TRANSFEREE AND THE TERMS AND

CONDITIONS OF SUCH DISPOSITION AND WILL PROVIDE (INSTITUTION) THE OPPORTUNITY TO ACQUIRE THE ANIMAL(S) WITHOUT CHARGE. IF (INSTITUTION) ELECTS NOT TO RECLAIM THE ANIMAL WITHIN TEN (10) BUSINESS DAYS FOLLOWING SUCH NOTIFICATION, THEN, IN SUCH EVENT, (INSTITUTION) WAIVES ANY RIGHT IT MAY HAVE TO THE ANIMAL AND RECIPIENT MAY DISPOSE OF THE ANIMAL AS PROPOSED.

Institutional note: The text above is similar to the language most dog breeders use in their contracts when they sell a puppy. If people can provide that protection to the puppies they place, zoos/aquariums can provide it for animals that we place too! Some entities have been reluctant to sign it, and in that case we revert to a loan and our institution retains ownership of the animal. Either way, we are advised of the animal's eventual placement and location.

APPENDIX 21

MFTAG QUARANTINE OF MARINE FISH SPECIES RECOMMENDATIONS

General Comments:

The MFTAG recognizes that quarantine standards for nonaquatic collections cannot always be applied to fishes, and modifications must be made to the proposed procedures as they apply to fish populations. Proper and appropriate quarantine is a vital component of any successful health management program for fishes. Quarantine procedures must be tailored to individual species and may require greater variation than quarantine approaches or techniques. It is in the interest of accredited institutions to carry out quarantine procedures that are both effective and practical, leading to improved animal health. As defined in the AZA Accreditation Standards, AZA member institutions with aquatic collections must:

1) have holding facilities or procedures for the quarantining of newly arrived animals and isolation facilities or procedures for the treatment of sick or injured animals.
2) have written, formal procedures for quarantine that must be available and familiar to all staff working with quarantined animals.

Quarantine Facility:

Separate life support systems (LSS) with the ability to isolate fishes should exist when possible. The LSS should be operated in such a way as to preclude disease transfer from one system to another and/or introduction into natural waters.

Quarantine aquariums should have viewing that is adequate to observe the fish for behavior and signs of pathology; the LSS should be adequate to maintain the health of the quarantine population. If an aquarium does not have a separate LSS, it should have the ability to divert flow through the quarantine systems, bypass the common filter, and discharge the water. Disinfection of the discharge water prior to release is advisable. In addition, discharge of this water must comply with federal, state, and local environmental regulations.

Quarantine Length:

A quarantine period of 30 days is an adequate standard; however, it must be recognized that certain species or disease problems may require more or less time. Quarantine should not be longer than necessary to prevent or control disease and reduce stress.

Quarantine Personnel:

The institution will appoint the staff it feels has the most expertise to supervise and operate the quarantine program. All equipment (boots, nets, cleaning equipment, etc.) should be confined to the quarantine area. Access to and from the area should be restricted so as to minimize cross-contamination. Precautions must be taken to minimize the risk of zoonotic disease to personnel.

Quarantine Protocol:

Each institution must have a written quarantine protocol. During quarantine, appropriate prophylactic measures should be instituted. Complete medical records should be maintained for specimens during the quarantine period.

Individual fish or a representative sample of groups of fishes that die during quarantine should be necropsied. Care must be taken that all equipment used in the husbandry of quarantined specimens or in the maintenance of quarantine systems is separate from other equipment. (If this is not possible, adequate disinfection procedures must be employed before equipment is used for non-quarantine specimens or systems.)

Required Quarantine Protocols:

Because of the great diversity in fishes, required quarantine procedures are difficult to establish. The institution should follow the guidelines stated in the above sections and the AZA Accreditation Guidelines to fashion a quarantine program best suited to their needs.

Additional Resources:

For additional information, you can also refer to the "Guidelines for Zoo and Aquarium Veterinary Medical Programs and Veterinary Hospitals", 6th edition prepared by: American Association of Zoo Veterinarians 2016

http://c.ymcdn.com/sites/www.aazv.org/resource/resmgr/files/aazvveterinaryguidelines2016.pdf

The MFTAG suggests that institutions contact other AZA member institutions to obtain established protocols as needed. Contacting the MFTAG Veterinary Advisor for additional information is also recommended.

APPENDIX 22

MFTAG ANIMAL CARE AND ANIMAL HUSBANDRY MANUAL RECOMMENDATIONS

The MFTAG recognizes the value of Animal Care Manuals (ACMs) in the management of populations in human care. However, the number of species under the MFTAG's purview makes it difficult to create ACMs for all species. Animal care manuals published at the family or order level would produce information that is too generic and therefore not meaningful for the user. Furthermore, there is a vast amount of published peer reviewed and not peer reviewed information in the aquarium literature that covers the same range of topics adequately.

Traditionally, animal care manuals provide animal care professionals with information on husbandry, behavioral, and health management best practices. The MFTAG husbandry manuals include these topics as well as provide additional information and resources crucial to promoting excellence in aquatic animal care and welfare.

Historically, the MFTAG has partnered to create in-depth husbandry manuals covering groups of species that are of specific interest to the TAG, are species typically managed only by public aquariums, and are species whose husbandry is poorly addressed in the current available literature. The creation of these manuals has been international in scope and participation. Moving forward, and in concert with husbandry manual efforts, the MFTAG will work to recruit collaborators from member institutions to gather husbandry information and publish ACMs.

To date, the TAG has partnered to support two MFTAG species specific husbandry manuals and one water quality manual.

MFTAG endorsed marine species specific manuals are:

1. Elasmobranch Husbandry

The Elasmobranch Husbandry Manual: Captive Care of Sharks, Rays, and their Relatives. Mark Smith, Doug Warmolts, Dennis Thoney, and Robert Hueter (editors). 2004. Special publication of the Ohio Biological Survey. Xv + 589 p.

For more information, contact:
www.elasmobranchhusbandry.org

Doug Warmolts
Columbus Zoo and Aquarium
doug.warmolts@columbuszoo.org
The second edition of this manual is currently *In Press*.

2. Syngnathid Husbandry
Syngnathid Husbandry in Public Aquarium: 2005 Manual. Heather Koldewey. Zoological Society of London. 137p.
http://seahorse.fisheries.ubc.ca/Resources/books.html

For more information, contact:

George Parsons
John G Shedd Aquarium
gparsons@sheddaquarium.org
or
Heather Koldewey
Zoological Society of London
heather.koldewey@zsl.org

3. Water Quality
Aquality: Water Quality Manual for Zoos and Aquaria – *In Press*

http://www.aqualitysymposium.org/

APPENDIX 23

MFTAG ANIMAL WELFARE AND ETHICS IN AZA AQUARIUMS RECOMMENDATIONS

The MFTAG recognizes the importance of the AZA Animal Welfare Committee and its responsibilities to our organization. The TAG supports the guidelines and initiatives established by the Animal Welfare Committee and encourages opportunities for collaboration.

The MFTAG recognizes that AZA member aquariums maintain the highest, ethical standards in wildlife management, husbandry techniques, and breeding which meet or exceed legislative or regulatory standards. The Code of Ethics adopted by the members of AZA is the common ground upon which wildlife conservation activities are based. If conflicts of interest exist between the welfare of individual animals, the conservation of species or populations, and long term sustainability of AZA populations, priorities with regard to these considerations must be determined. Member institutions should pursue goals of conservation and sustainability balancing those goals with the health and welfare requirements of the individuals for which they are responsible.

The MFTAG recognizes that AZA member aquariums maintain animals without risk of injury or disease to visitors.

The MFTAG strongly supports the Sustainability Considerations for Developing an Aquatic Invertebrate & Fish Collection Plan (APPENDIX 11).

Acquisition of Animals

The MFTAG strongly supports AZA member aquariums acquiring captive bred or cultured specimens from confirmed reputable aquaculture enterprises that do not use destructive practices, contribute to the degradation of the environment, or pose risks of exotic introductions or disease transfer to local waters. While producing specimens in captivity may reduce direct collection pressure on the wild stocks it may also remove incentive or reason to conserve the wild stocks and their habitats at the local level. Aquariums should support responsibly managed inland and marine fisheries that provide direct economic return to the conservation of a species in its native habitat.

Reintroduction of Animals

The reintroduction of animals to the wild should have a foundation in an established conservation program. With regard to animal welfare, any such

actions must abide by any applicable AZA policies, recognized international guidelines (e.g. IUCN) and all government regulations.

Exhibit Design Considerations

Design and maintenance of aquarium systems should strive to provide species appropriate environments, meeting physiological requirements, water chemistry requirements, light quality and photoperiod needs, and appropriate spatial requirements. The MFTAG strongly encourages a focus on animal welfare as influenced by system design.

Collection Enrichment and Behavioral Training

The MFTAG recognizes enrichment and training as animal welfare best practices. The TAG supports collection enrichment and behavioral training guidelines established by the AZA Accreditation Commission.

APPENDIX 24

MFTAG LARGE MARINE FISH SPECIES AND AQUARIUMS RECOMMENDATIONS

AZA member aquariums are contacted by concerned hobbyists looking for homes for large unwanted pet fish. Aquariums work to help the hobbyists, but often have difficulty finding a place in collection plans for these animals. The demand for homes for large fishes is greater than the available capacity to accept them.

Pet owners acquire these fish for reasons including but not limited to:

1) Believing the false assurance by the pet vendor at the time of purchase that the nearest public aquarium would be happy to take their fish when it outgrows it current aquarium
2) Falling victim to the myth that fish never outgrow their aquariums
3) Initially intending to purchase a larger aquarium as the fish grows, but then is unable to do so
4) Lacking investment in proper research prior to acquiring a particular species

Since public aquariums are frequently targeted as depots for large, unwanted marine fish species, the industry is interested in proactively addressing the issue within our local communities. The MFTAG encourages the education of visitors and both consumers and dealers when possible about the fate of the largest of these fish species, so that these animals don't make it into the trade at all and potential marine species owners can make informed decisions and proper pet choices. Self-regulation of the sale of unmanageably large species can be practiced by the home aquarium industry and the MFTAG strongly supports such regulation.

The AZA Policy on Responsible Population Management (Appendix 18) sets forth guidelines that assist institutions interacting with the pet trade and private hobbyists. Member institutions should reference these documents when making animal transaction decisions involving the pet trade and private hobbyists.

The largest regularly available home aquarium holds 180 gallons (680 liters). Any fish capable of outgrowing that size aquarium should therefore be avoided by home aquarists. Commonly seen examples of marine fish that fit this category include:

Blacktip reef shark, *Carcharhinus melanopterus*
Giant grouper, *Epinephelus lanceolatus*
Golden trevally, *Gnathanodon speciosus*
Nurse shark, *Ginglymostoma cirratum*
Panther grouper, *Cromileptes altivelis*

AZA member institutions are invited to review the following articles as tools to assist in the communication of this issue and it consequences to local pet store businesses, fish clubs, and hobbyists:

Hemdal, J.F. Animal to Avoid. http://fishchannel.com/fish-health/choosing-fish/once-bitten.aspx

Mohan, P. J., J. Hemdal, and P. Loiselle. 1997. *Tropical Lunkers: A fatal attraction for big fish?* Aquarium Fish Magazine. 9(7): 60-67.

Mohan, P. 2006. *Got a big tank to fill?* Marine Fish and Reef - 2006 Annual. 8: 7-12.

APPENDIX 25

MFTAG NON-INDIGENOUS SPECIES RECOMMENDATIONS

The MFTAG recognizes invasive exotic animals are a threat to indigenous fauna. AZA member institutions must comply with local and federal regulations regarding care and maintenance of exotic species. Appropriate precautions must be taken by AZA institutions to prevent the escape or release of exotic organisms.
For additional information refer to the AZA Policy on Non-native Invasive Species
https://www.aza.org/assets/2332/final_board_approved_aza_invasive_species_policy.pdf

See also MFTAG RCP APPENDIX 18: AZA Policy on Responsible Population Management

APPENDIX 26

MFTAG TOUCHPOOL RECOMMENDATIONS

Touchpools have grown in popularity with the public in recent years. Touchpools provide visitors with a personal, up-close encounter with animals. The MFTAG recognizes the value of touch pools to conservation education and the mission of AZA member aquariums and zoos. Touchpools should be designed, constructed, managed and promoted to ensure the safety and well-being of the collections housed within them and the safety of visitors who participate in touchpool experiences.

The AZA has established guidelines for Animal Contact with the General Public, and Ambassador Animal Programs. Those guidelines are general in scope and should be referred to when planning touch pool exhibits.

The following is a list of guidelines and recommendations that the MFTAG supports with regard to touchpools:

Pool Design- Collection Considerations

The MFTAG recommends when designing new touchpools or evaluating existing touchpools with regard to spatial considerations of the resident collection, the following should be considered:

1) Species collection plan (selected species and natural habitat of selected species)
2) Length of species residency in pool
3) Size and number of individuals to be kept in the pool
4) Species movement requirements
5) Species feeding requirements
6) Husbandry and health management experience and expertise of managing staff

Pool Design: Collection Selection

Touchpool collection choices should be made carefully. The MFTAG encourages the following considerations to be made when choosing livestock for touchpool collections:

1) Pool volume, pool shape, pool surface area and depth
2) Acquisition and disposition of livestock
3) Size and number of individuals to be kept in the pool
4) Species compatibility, especially if a multi-species exhibit is planned
5) Species movement requirements
6) Species feeding requirements
7) Species natural history (species from intertidal zones and those not sensitive to tactile stimulus are encouraged)

Special Notes on Livestock

- There are some venomous animals that should not be considered for touchpool exhibits (e.g. stonefish, lionfish, toadfish).
- Animals that can exhibit aggressive biting behavior should not be considered for touchpool exhibits.
- Marine teleosts make excellent touchpool enhancement species, but are not recommended as animals suitable for physical contact with visitors.
- Animals with barbs or spines should be considered carefully. Spines on rays should be clipped on a regular basis to keep the spines blunt and as short as possible. The MFTAG does not recommend complete spine or barb removal for rays or skates in touchpools.
- Animals that grow to a large size may be inappropriate for long term residency in touchpool situations and can pose a disposition challenge (e.g. nurse sharks). Each touchpool and each species being considered for touching should be carefully evaluated.

Pool Design- Life Support Systems

System Capacity
The MFTAG recommends, as a baseline estimation, that the life support system for any touchpool be designed to adequately handle a biological load of at least 3-4X greater than a system not part of a touchpool experience. "Turnover rate" or the rate at which the entire volume of pool water is passed through 100% of the life support system should be at such a rate as to quickly remove wastes and contact by- products from the water. Turnover rate will be dependent on the number, size, and species of animals involved, the expected volume of visitors participating in touching at any given time, and the pool's water volume. Consideration of the number, size, and species of animals involved, the expected greatest number of visitors participating in touching at any given time, and the pool's water volume should be evaluated when making life support system capacity design decisions.

System Components
The MFTAG recommends that any touchpool life support system be capable of biologically, mechanically and chemically processing the water of the pool.

- Biological Filtration

The MFTAG recognizes that adequate biological filtration is crucial to the health of a touchpool system. It is highly recommended that any touchpool be provided with sufficient time to establish biologically before animals are introduced to the system and visitors allowed to interact with the animals in the pool. It is recognized that a system running at marine or freshwater system maintained at a water temperature of 74F/23C will require at least 30-40 days to establish a biological stability adequate for supporting aquatic life. The cycling system

should be monitored daily to assess the progress of bacterial growth within the LSS.

- Mechanical Filtration

The MFTAG recommends that both foam fractionation and large particulate removal in the form of mechanical filters such as pressurized sandfilters be part of any touchpool life support system design.

- Chemical Filtration

The MFTAG recognizes that touchpools are possible vectors for the spread of zoonotic diseases. It strongly recommends that ozone application methods and/or UV sterilization be included in any life support system design. Regular water quality testing and fecal coliform monitoring is suggested for touchpool systems. (See Pool Design- Visitor Considerations)

Pool Design- Visitor Considerations

The MFTAG recommends when designing new touchpools or evaluating existing touchpools with regard to visitor considerations and interacting with the pool collection, the following considerations should be considered:

1) Access to the pool's collection should be one that is comfortable for the smallest visitor.
2) Underwater viewing is an excellent method of connecting with marine species and should be provided whenever possible.
3) The TAG suggests that special considerations be incorporated into new pool designs and existing pool designs be considered for modifications that accommodate visitors with special needs.
4) Adequate space around the pool and in touching areas should be given to allow easy access and egress from the pool.
5) Hand wash stations or alcohol-free and surfactant-free hand sanitizer dispensers should be located in close proximity of any touching area. Hand disinfection, sanitation and water quality testing, should comply with all applicable local health standards.
6) Whenever the pool is open to the public, there should be adequate staff or trained volunteer supervision of the pool. If the pool is located outside of a building with security, appropriate security of the pool after-hours should be provided.
7) Whenever possible, a conservation message should be shared with visitors participating in touchpool experiences. Labels identifying the pool's inhabitant should be part of any touchpool design.

Interaction Management: Collection Rotation and Rest Periods

The MFTAG recognizes that animals in touchpool situations must be provided opportunities when interaction with visitors does not occur. The MFTAG recommends that any touchpool management protocol include a required rotation of livestock at set times for adequate duration when the pool is open to

visitors. Adequate holding behind the scenes should be provided to accommodate this rotation.

In those cases when livestock rotation is not possible for various reasons such as the size of animals involved or facility design restrictions, "rest" or "no contact" areas should be provided in the pools that allow livestock to move away from areas of visitor interaction.

Staff and volunteers assigned to monitor touchpools should be trained in identifying when animals need rest periods or rotation of animals must be scheduled at set times in anticipation of the needs of the collection with consideration of visitor interaction demand.

Animal and Visitor Safety Considerations

The MFTAG recognizes that the safety of the visitors participating in touchpool experiences and the animals living in touchpools must always be considered and guaranteed.

Appropriate signage explaining touchpool safety and etiquette should be posted in clear view of visitors participating in touchpool activities.

Visitors should be monitored closely and appropriate touching techniques should be demonstrated and encouraged by staff or trained volunteers monitoring touchpools.

It is highly recommended that contact with the touchpool collection be restricted to the bodies of animals. Mouths, gills, and eyes should be avoided.

Touchpools as Temporary Exhibits, Fee-based Programs, or Rented Visitor Enhancements.

In some situations, especially at zoos, temporary touchpools can be installed by companies that specialize in this type of exhibit. The MFTAG recognizes the success of such arrangements and their value to institutions that venture into such arrangements. Institutions considering these types of temporary exhibits should carefully research the companies providing the exhibits.

- According to AZA Accreditation Standards, the hosting institution of a rented or "changing exhibit" touchpool is responsible for ensuring that animal acquisition and disposition practices employed by the companies providing the exhibit follow AZA Policy on Responsible Population Management guidelines and should include all appropriate permitting and licensing.
- The welfare of the animals used in touchpools must be ensured during transport, acclimation and display of the touchpool collection.

- Appropriate training in collection husbandry, health maintenance and management and life support management should be part of any temporary touchpool program.

The MFTAG encourages AZA institutions to design and manage temporary touchpool exhibits with the care and best practices associated with any permanent aquatic exhibit.

APPENDIX 27

MFTAG "SWIM WITH" PROGRAMS RECOMMENDATIONS

The MFTAG recognizes the rising popularity in "swim with" programs as an attractive revenue generating and educational opportunity. Ensuring guest safety, as well as, ensuring animal safety is of utmost importance.

The AZA has established guidelines for Animal Contact with the General Public, and Ambassador Animal Programs. Those guidelines are general in scope and should be referred to when planning "swim with" programs.

Programs and associated documents or manuals related to such programs should address the following:

- equipment to be used during the program
- emergency response protocols and procedures including drills and incident reviews
- experience and skill requirements and trainings required of staff leading the programs and those guests participating in the program
- program curriculum and goals that include conservation messages

The MFTAG encourages the consideration of the following:

- Design of new or modification of existing exhibits to allow safe access and egress from the exhibit in compliance with ADA standards for participants
- Program agenda should include appropriate briefing and instruction to participants (participants' behavior, communication, do's/don'ts, safety and emergency response measures)
- If the program requires SCUBA skills, supervising staff and participants must be certified by a recognized SCUBA certifying agency and should be evaluated in accordance with industry standards and in compliance with OSHA or AAUS
- All equipment should be maintained in good condition and in working order Scheduled regular maintenance routines should be established and records of maintenance kept
- Appropriate dry side protocols and emergency response equipment must be identified and accessible (e.g. oxygen, extraction equipment, AED, communication, first aid, etc.)
- When appropriate, protection measures and equipment should be provided and utilized (cages, barriers, tenders, etc.)
- Institutional physical evaluation minimums for participants and staff should be established and enforced. Liability thresholds need to be determined by the institution and reflected in program participation

requirements

- Educational information provided about the exhibit and natural history, behaviors and conservation of the species housed within
- Design of new and modification of existing exhibits should allow for natural animal movement and areas of no contact when the program is in progress (e.g. no dead ends or corners and the animals can avoid contact with the participants)
- Program activities should not create situations where animals feel threatened or cannot maintain normal behavior or activities
- Written guidelines should be in place for the staff to assess animal behaviors and individual animal welfare resulting from the program
- Accurate and consistent record keeping is strongly encouraged
- Regular water chemistry analysis and life support management is strongly encouraged
- Participation limits (e.g. participant to staff ratios per day per program, number of dives staff can perform a day, break time requirements between dives) that ensure safety of the participants, supervising staff, and collection should be determined and enforced
- Consideration of animal rotations should be made where appropriate
- Husbandry staff should be consulted in the selection of exhibits and collections to be used in "swim with" programming
- The MFTAG recommends when designing new exhibits or evaluating existing exhibits with regard to use as "swim with" exhibits and spatial and species selection considerations of the resident collection, the following should be considered:
    - Species collection plan (selected species and natural habitat of selected species)
    - Length of species residency in exhibit
    - Size and number of individuals in the exhibit
    - Species movement requirements
    - Species feeding requirements and feeding routines and stations
    - Exhibit volume, depth, shape, and water surface area

APPENDIX 28

MFTAG PROFESSIONAL DEVELOPMENT RECOMMENDATIONS

The MFTAG recognizes the importance of staff participation in AZA programs, AZA conferences, and AZA professional development courses as well as other professional training opportunities, and the Regional Aquatics Workshop (RAW). The MFTAG is supportive of the continued staff development opportunities that these activities provide and their importance in furthering the mission of the AZA and the MFTAG.

The MFTAG encourages AZA institutions to participate in its programs and initiatives by appointing an Institutional Representative (IR) and providing support for the IR and other staff members to attend conferences, courses, or meetings that promote aquatic animal husbandry advances, institutional collaboration, or research. Whenever possible, AZA institutions are encouraged to consider their staff for participation through service as a steering committee members, studbook keepers, or program leaders.