

# Best Management Practices for Freshwater and Marine Ornamental Wholesaler and Distributor Operations

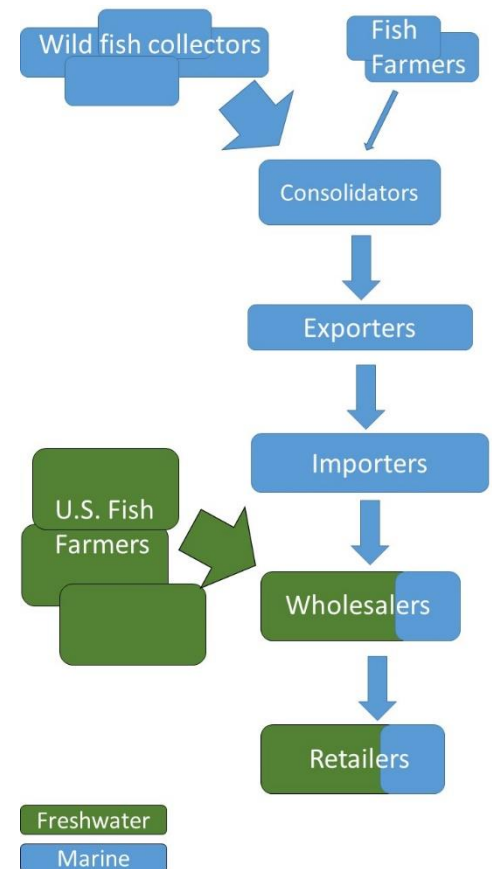
## Introduction

The ornamental aquarium trade in the U.S. continues to grow, with over 13 million households caring for 105 million freshwater and marine fish. Roughly 90% of these households keep freshwater species (APPA 2015). Collectively the aquarium industry is worth hundreds of millions in \$US throughout the various levels of the supply chain.

Ornamental fish and invertebrates travel through a complex supply chain on their way to the consumer. Animals are either collected from the wild (primarily marine species) or cultured on farms of varying scale and sophistication.

From there they progress through the distribution network, ultimately arriving at the retail level, where they are offered for sale to hobbyist consumers. Because the majority of marine ornamentals are wild-collected from remote tropical seas, their pathway to the customer can be longer and more complex than that of many freshwater species. Most of the freshwater ornamentals are aquacultured at specialized farms, large and small, many of which are in the state of Florida.

In each of these pathways, the wholesaler or distributor is a vital link between the collector/producer and the customer. Wholesalers receive ornamentals from a variety of (usually distant) sources that must be acclimatized to a holding facility, and in some cases trained to eat artificial diets over the course of a few days or even a few weeks while maintaining animal health and vitality. The animals must ultimately be re-packaged to fulfill orders from dozens to hundreds of trade customers across the U.S. and abroad.



*Livebearer farm in Malaysia, fish are grown in hapas nets in large ponds. (photo courtesy OFI 2016)*

The wholesaler/distributor's mission of delivering high quality fish specimens to retail stores and ultimately to the consumer requires attention to a host of specialized factors. These include: overall animal health and appearance, nutrition, disease management, facility water quality, transportation considerations, and environmental impacts. This document describes basic Best Management Practices (BMP) to ensure the health and survival of ornamentals at wholesale/distribution facilities. Above and beyond the recommendations for successful handling and distribution, these BMP call for record keeping that will provide data with which you may assess your progress in meeting the objectives of your facility.

The supply chain as a whole is dependent upon the provision of healthy, viable livestock, and maintaining quality control and value as product moves toward the consumer. This must start with the source level collection or production. Consequently, the BMP also address appropriate methods for collection, holding, and transportation of wild-caught fish. For many aquacultured species, other BMP, regulations, and refined industry practices already exist in many parts of the world.



***Large scale ornamental fish farm in Florida. Indoor production provides excellent biosecurity and quality control (photo courtesy Shane Willis 2016)***

## **Purpose of the Best Management Practices**

These practices, crafted with the input of industry leaders and reviewed by others, will enable ours to be a self-policing industry and minimize the need for intervention by well-meaning regulators who do not understand the intricacies involved in the culture, collection, housing, and the logistics and distribution of ornamental fish. Unlike government regulations, these Best Management Practices for wholesalers and distributors are a flexible set of recommendations that can be tailored to a variety of operations. Although the "how" will differ across the wholesale landscape, the unifying principle in these BMP is our commitment to

- **the animals:** we promote the humane care of the animals in our facilities and throughout the supply chain;

- **the environment:** we seek not only to minimize the environmental impact of our operations and businesses but to *actively improve the environment in all places where we interact*,
- **our customers:** we seek to establish BMP in a transparent fashion that provides our customers with the best value and satisfaction on a consistent basis. This principle extends not only to our retail customers but to the consumers they serve as well.

We believe these BMP should reach beyond importers/distributors to benefit the ornamental industry as a whole. It is incumbent to share and promote standards that will benefit all stakeholders in the ornamental fish industry.

## Data Collection, Analysis, and Continuous Improvement

This is not a static document. We seek to create an engaging environment where those with experience and a thorough working knowledge of our industry continue to improve these BMP to ensure the strongest standards of performance and compliance. To reach that goal, we encourage individual companies to collect and analyze data to establish performance benchmarks for yields as wholesalers/distributors, as well as at other points in the pathway:

- survival of wild-caught fish held at collection stations, consolidation stations, import facilities
- survival of fish in transport from exporter, importer, wholesaler
- survival of fish through acclimation and re-packaging



***Biosecurity can be improved through the use of concrete ponds and bird netting (photo courtesy of OFI 2016)***

In addition, when possible, data should be collected on the input and output factors related to yield, including:

- wild-caught or cultured
- collection method
- conveyance time
- nature of holding stations (type of vessel, size)
- density of fish in transit and at holding stations
- nutrition at holding stations
- length of residence at holding stations
- water quality, temperature

Making the commitment to collect data to assess performance and seek improvements will result in increased fish health and survival, enhance your yield and margin, and ultimately boost hobbyists' success and satisfaction.

## References

American Pet Products Association. Pet Industry Market Size and Ownership Statistics.

[http://americanpetproducts.org/press\\_industrytrends.asp](http://americanpetproducts.org/press_industrytrends.asp)

American Veterinary Medical Association. AVMA Guidelines for the Euthanasia of Animals.

2013 Edition. <https://www.avma.org/KB/Policies/Documents/euthanasia.pdf>

CITES. Convention on International Trade in Endangered Species of Wild Fauna and Flora.

<https://cites.org/>

## **BEST MANAGEMENT PRACTICES FOR FRESHWATER AND MARINE ORNAMENTAL WHOLESALERS AND DISTRIBUTORS**

### **GENERAL FACILITY CONSTRUCTION AND MAINTENANCE**

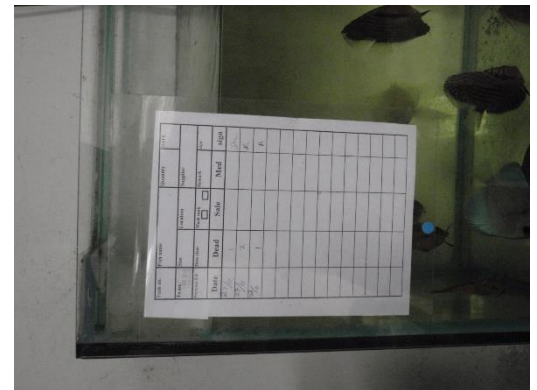
- The general outdoor appearance of the facility should be neat and clean and in compliance with all relevant building codes.
  - Landscaping and parking areas should be properly maintained.
  - There should be adequate drainage away from the building.
- All buildings should provide adequate shelter from the elements (wind, rain, airborne material).
- The facility should be able to be secured to prevent unauthorized entry.
- Facility should have emergency event monitoring.
- Buildings and facilities should have warning systems for critical equipment failure.
- Buildings and grounds should have barriers to pests and vermin.
- Buildings and grounds should have redundant containment barriers to prevent escape of aquatic organisms if necessary (see [DISEASE CONTROL/BIOSECURITY](#))
  - Perimeter ditches should be inspected and maintained regularly.
  - If applicable berms should be mowed and maintained regularly.
  - Dry bed discharge areas should be inspected regularly and kept free of excessive vegetation.
- Establish a regular maintenance and cleaning schedule with staff or outside contractor.
- Interior lighting should be sufficient for proper cleaning and inspection purposes.
- Facility design should minimize rapid changes/fluctuations in temperature.
- The power supply and equipment should be adequate for year-round conditions.
  - Backup power or electric generators should be available.
- Drinking water should be from a municipal source or verified as potable.

### **HOUSING OF AQUATIC SPECIMENS**

- Tanks/vats provided should be of adequate size and appropriate configuration for the fish and aquatic organisms contained within, i.e., fish should be able to swim normally and maintain normal posture.
  - Hiding places or visual barriers to minimize stress (rocks, tubes, wood, plants, sand or other structures) should be in place for fish that are skittish or aggressive.



- A covering system should be installed for tanks/vats that house fish varieties that commonly jump when lights come on, when startled, when hand-netted, etc.
- Every tank should have a label or other method of identifying its fish and aquatic organisms. Useful labeling information may include:
  - date of arrival
  - inventory SKU
  - coding for origin and vendor
  - treatments in us
  - nutritional instructions



**Labelling ranges from simple writing on tanks to use of tank charts to record more detailed information, e.g., type of fish, source, coding, tank history (photos courtesy of Shane Willis 2016)**

- Tanks and equipment should be regularly cleaned and inspected.
  - Pumps and filtration should be on a maintenance schedule.
  - Accumulated waste should be flushed or removed regularly.
  - Holding facilities and associated equipment should be sanitized prior to receiving new shipments.
- Tanks should be protected from exposure to excessive heat, cold, rain and light. Upper and lower temperature control limits should be set and controlled for water and/or air.
- Holding facilities should have means to provide the appropriate photoperiod (optimally up to 18 hours light for aquatic tropical species).

- Fish and other aquatic organisms that may be aggressive to each other should be segregated to prevent fighting.
  - Attention should be given to factors such as density, where higher density of certain species often reduces aggression.

***Species that are highly aggressive toward each other require special housing. Bettas they must be kept in individual containers (photo courtesy Shane Willis 2016)***



## SOURCING AND RECEIVING AQUATIC SPECIMENS

- Import permits must be obtained and maintained for species listed under [CITES](#).
- Health certificates must be obtained for species susceptible for Spring Viremia of Carp (SVC) per [USDA regulations](#).
- Wholesalers/distributors should have written agreements regarding collection and transport of wild-caught fish to local holding facilities.
- Collecting fish by the use of cyanide or habitat destruction is unacceptable.
- Only those wild-collected species considered appropriate for sustainable collection should be available for trade.
- Provisions should be in place to protect the safety of fish collectors.
- Time from collection to holding stations should be minimized.
- Where possible, animals should be collected as near as possible to shipping dates.
- Density of fish held at collection and holding stations must not exceed tank carrying capacity. They should not be overcrowded, and water quality must be maintained.
- Holding time should be minimized.
- Wholesalers/distributors should have an agreement with suppliers of wild fish regarding consolidation facilities standards.
  - Systems deployed in consolidation facilities should conform to [HOUSING](#), [WATER QUALITY](#), [EUTHANASIA](#), [FEEDING AND NUTRITION](#), [DISEASE CONTROL/BIOSECURITY](#), [RECORD KEEPING](#) and [SHIPPING AQUATIC SPECIMENS](#) BMP.
- Feeding fish received from collectors and source suppliers
  - Animals held for 72 hours or more should be fed aggressively to maintain health and weight.

- Diet should be specific to nutritional requirements for the species. (photo?)
- Fish staged for shipment should be purged to ensure health during transportation.
  - Fish should not be fed for a minimum 24 and a maximum 72 hours prior to shipment.
  - Purging duration is depending on species and size and digestion rate, e.g., Plecos ~48 hours, Danios ~6 hours
- Wholesalers/distributors should communicate regularly with source suppliers regarding shipping practices.
  - Packing environment and density should be designed to maximize survival under expected shipping conditions, e.g., anticipated transit time and temperature.
  - Depending upon the transit time in shipping, suitable water should be prepared with appropriate additives such as ChlorAm-X<sup>®</sup>, buffers and clean water covered with an abundance of pure oxygen.
  - Appropriate heat or cold packs should be used to maintain water temperature within the normal range for fish in transit for the duration of the shipment.
  - Immediate feedback should be provided to source suppliers following shipments with excessive mortality or with fish showing clinical signs of illness or injury.

## WATER RESOURCE MANAGEMENT

- Waste water and effluent should be disposed of properly in compliance with local, state and federal regulations.
- Permits must be acquired and renewed for acquisition and discharge at the state and local level, if appropriate.
  - Saline water should not be discharged to freshwater environments.
  - Intake and discharge pipes should not interfere with navigation.
  - Discharge pipes should be configured to minimize impacts, e.g., scouring of the substrate.
- Water conservation practices should be implemented to minimize water use and discharge of effluent with elevated nutrients. Options include
  - recirculation systems (see below)
  - maintaining proper free-board levels
  - maintaining perimeter ditches (to avoid excess evapotranspiration)
  - retaining production water on site for re-use in production ponds
  - alternate water sources
- Recirculation Water Systems for Fish
  - Design for no off-site discharge of water in holding tanks/ponds.



- Effluents discharged on site should use the following treatment methods, individually or in combination:
  - Percolation ponds
  - Irrigation system
  - Filter strips
- Effluent discharged to sanitary sewer system must be permitted from the local municipal wastewater treatment authority.

## WATER QUALITY FOR AQUATIC SPECIMENS

- To the extent possible, water in holding tanks/ponds should reflect the natural environment for the species held.
- Biological filters are recommended for water quality maintenance. Options include
  - sand filter
  - sponge filter
  - fluidized bed filter
  - trickle filter



***Sponge filters are excellent filters that are relatively inexpensive and easy to manage (photo courtesy Shane Willis 2016)***



***Fluidized bed filters are high performance filters with a very high filtration capacity (photo courtesy Shane Willis 2016)***

- Filters must be inspected and cleaned on a regular basis, dependent on frequency of use and density of organisms held.
- Ultraviolet treatment is recommended for returning water in recirculation systems to prevent transmission of disease vectors.
- Relevant water quality parameters should be maintained within appropriate ranges.
- Water quality parameters should be tested daily no less than 3 days per week, depending on system size and inventory levels / animal density in systems.
  - Commercially available test kit and/or instruments should be used.

- Instruments must be calibrated on a regular basis.
- pH meters used in waters with variable salinity should be calibrated daily.
- Appropriate records of critical water quality data (e.g., pH, temperature, total dissolved solids, total ammonia nitrogen, nitrite, nitrate) should be maintained to monitor fluctuations (see [RECORD KEEPING](#)).

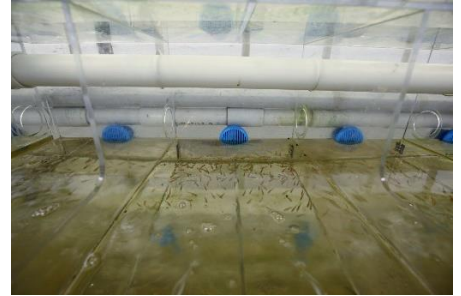
## DISEASE CONTROL/BIOSECURITY

- Incoming animals should be acclimated in a dedicated area to avoid potential disease transmission.
  - If practical, animals should be treated for external parasites and bacteria before being introduced into the holding system to prevent cross-contamination.
  - Special attention should be given to animals that are more sensitive to the acclimation process.
- Fish from different points of origin should be housed in separate tanks to avoid cross contamination.
  - Tanks should have dedicated nets and disinfection stations for staff.
- Fish and other aquatic organisms should be handled and transferred minimally to avoid stress.
- Tanks should be cleaned regularly to remove feces, excess feed, algae and other unwanted matter.
  - Cleaning dates should be recorded and kept near tanks/holding areas.
  - Aquatic life should be kept safe and secure while cleaning tanks and handled in a manner that prevents escape to different tanks.
- Disinfectant foot baths at the entrance to each building should be considered.
  - Disinfectant should be replaced regularly to maintain efficacy.
- Net dip solutions should be replaced periodically.
  - Check label for efficacy information.
  - Exposure to UV light and organic material may decrease effective time.
- A self-contained isolation system should be provided for ill or injured aquatic animals.
  - Sanitation measures should be in place to prevent cross-contamination between isolation areas and other holding tanks.
  - Nets, aeration, filtration and other equipment used in isolation systems (areas) should be dedicated and used exclusively in that area only.
  - Hand washing stations should be located in or close to every aquatic life holding area. Soap and water or alcohol gel should be available.
  - If using gloves, provide a separate supply and disposal for each area.

- Isolated animals must be inspected daily.
  - Isolated organisms should be labeled to include type, vendor, origin, treatments, date of arrival, special instructions, etc.
  - Isolation tanks and areas should be clearly identified to prevent shipping prior to determination of health status.
  - To avoid contamination of healthy animals, staff should attend to the needs of the isolated animals last.
- Each facility should have a veterinarian and an on-call system.
- The veterinarian should visit the facility at least once annually.
  - The on call veterinarian should be licensed and USDA-accredited in the state in which the facility is located.
- Every effort should be taken to minimize airborne transmission.
- Ventilation systems should have appropriate filters that are maintained or changed regularly.
  - Care should be taken when placing fans or blowers.
- Stock flow should be one way, e.g., fish from distribution/wholesale facilities must never be returned to breeders.
- Prophylactic treatment and disease management should follow a veterinarian-reviewed protocol (including antibiotics, sedatives, vaccines, vital dyes, and similar products).
- Medications must be EPA- and/or FDA-approved or indexed and used following label directions.
  - Medications should be stored properly (i.e., appropriate temperature, light, humidity) to maintain efficacy.
- Treatment date/time, medication, and dose must be prominently posted for each treatment vessel.
- Appropriate records of disease treatment must be maintained (see [RECORD KEEPING](#)).
- Regular, scheduled rounds checking animal health should be made frequently through the day. Deceased animals must be removed as quickly as possible. If specific tanks/ponds exhibit high mortality, those should be inspected with greater frequency.
- Sick or diseased animals should be removed from community tanks immediately.
- Animals should be moved to isolation tanks until ailment is determined and documented.
  - Depending on nature of the illness, animals may be placed in quarantine/treatment area.
- Animal mortalities should be removed from tanks immediately.
- Cause of death should be determined and documented.
  - Assess mortality trends from external (suppliers) and internal (facility performance) sources.



- Deceased organisms removed from systems should be disposed of in a safe, hygienic manner appropriate to biosecurity protocols, site-specific accommodations, and local regulations. Some producing regions have governing industry BMPs in place.
- Holding, transport, and culture systems should consist of a solid construction, and be designed to prevent the escape of adult fish, juvenile fish, and eggs to the wild.
  - Opening/mesh size of drains, grates and screens should be sized based on the sizes of aquatic organisms in transport.
- Pest/vermin control measures should be ongoing.



## EUTHANASIA

- Staff involved in euthanizing fish or other aquatic organisms must have training in use of appropriate methods and chemicals.
- Written instructions on the euthanasia procedure(s) used at the facility should be posted and readily available for all staff involved.
- Euthanasia procedures must conform to the current American Veterinary Medical Association (AVMA) [guidelines](#) for humane euthanasia (see pages 67-74) and state legal requirements.
  - [Additional information](#) is available from the University of Florida.
- Records of euthanized animals should be maintained (see [RECORD KEEPING](#)).

## FEEDING AND NUTRITION

- Fish should be transitioned to prepared feed as soon as possible.
  - Fish should be fed within three hours of arrival.
  - Fish should be fed several times daily (with the exception of larger predatory species).
  - Initially wild fish should be presented with live feeds, transitioning to artificial feeds within 24 hours.
  - An aggressive feeding response should occur by the third feeding.
    - If fish are not feeding by third presentation, change the diet or investigate for parasites or disease.
- Fish should maintain body weight during the holding period.
- Feeding protocols should be modified when the specimens are in good condition and scheduled for shipment (see [SHIPPING AQUATIC SPECIMENS](#))
- Food items should be stored properly.
  - Feed should be stored in closed containers to minimize the risk of insect or rodent infestations.

- All unopened food containers/bags should be kept off the ground.
- Feed containers should be prominently labeled.
  - date of arrival
  - expiration date
  - date package was opened
- Feed must be used within the recommended time frame to avoid nutrient degradation:
  - within 2 months if stored at ambient temperature
  - within 6 months if refrigerated/frozen
  - within 1-2 days if open bags/containers are stored at room temperature

## SHIPPING AQUATIC SPECIMENS

- Generally, feeding should be discontinued 24 hours prior to shipping to a store. This has species and size considerations, as some species should have more purge time, while others may not
- Feed should never be added to a shipping bag.
- Fish should be packed securely for all stages of transport.
  - Poly bags designed for transportation of fish are recommended.
  - Bag liners should be used if the fish have spines sharp enough to puncture the bags.
  - Bags should never be re-used.
  - Shipping boxes should be designed to prevent collapse under pressure expected during transit.
  - Boxes must be disinfected prior to re-use.
- Fish should be packed in appropriate water volumes relative to quantity and size being shipped, to maintain optimal water quality and animal health throughout the duration of the shipment.
  - Only new water should be used; water quality should be tested regularly.
  - Supplemental O<sub>2</sub> should be added.
  - Use of a sedative (with veterinarian's guidance and approval) is recommended for freshwater fish to reduce stress during transit.
  - Heating and cooling packs should be used to minimize temperature fluctuations, taking into account weather conditions at the destination as well as at any transfer points in route.
  - Heat and cold packs should be placed in boxes in such a way that they cannot come in direct contact with an animal's shipping water, or transport bag.





- Use sufficient water volume to cover the entire bodies of all aquatic organisms.
- Shipping water volume should be adequate for fish to swim in all directions.
- Shipments must be properly labeled.
  - A packing slip or similar document should list the common name and quantity of the species being shipped.
  - Scientific name may be required for export documentation or at the request of the customer.
  - Bags containing aquatic organisms or fish that are hazardous to humans should be prominently marked as such.
- Fish should be packed at the last possible hour, and not more than 12 hours prior to pick-up/drop-off at the carrier.
  - Contact information should be prominently displayed on shipping labels in the event that scheduled shipment is delayed. Wholesaler should attempt to verify departure.
  - Every effort should be made to retrieve shipments that aren't loaded on their scheduled flight.
  - Fish should be repacked in the event the carrier does not show up for that day's shipment or if the shipment failed to make a flight forcing the shipment to be shipped the next day.
- Shippers must comply with [IATA](#) regulations for the care and transportation of live animals.
- The facility should maintain posters, reference sheets, software, or other methods to ensure no fish or aquatic organisms are sold or shipped to a location where they are prohibited by regulations.
- Records of fish shipments and losses should be retained (see [RECORD KEEPING](#)).

## STAFF TRAINING

- A comprehensive training/orientation program should be implemented for new staff.
- There should be recurring training for current staff that addresses
  - facility Best Management Practices and protocols
  - company policies, ethics and expectations
  - modular training focused on specific tasks at the facility, e.g., feeding, water quality, filtration maintenance
- Maintain records to document that staffs have completed the appropriate training.
- Personnel involved with picking orders should be trained in recognizing signs of disease and parasites, and have reasonable fish knowledge.
  - Staff should have the visual acuity to spot and identify injured or diseased fish and aquatic organisms.
  - Pickers should have a general practical knowledge of appropriate quality and physical characteristics of the species with which they are working.

- Reference materials, photos, pamphlets, etc. should be available for all staff.

## DISASTER PLANNING

- Prepare a written disaster plan and review with employees.
  - Assign a staff member to coordinate with disaster preparedness officials.
  - Notify officials if live animals remain on premises, including types of animals.
- Prepare a facility diagram and post in a prominent location for employees and first responders
- Emergency phone numbers for ambulance, fire, police, veterinarian and animal control should be posted in a convenient location.
- Mock disaster plan execution should be practiced periodically.

## RECORD KEEPING

- Documentation should be maintained for shipments, all fish and aquatic organisms imported into the country and state, where appropriate.
- Retention of fish shipment records must conform to state regulatory requirements.
- Records should be kept for dates and remedies for some routine, as well as all significant events, including
  - Disease, disease control, and biosecurity
  - water quality, including fluctuations or extremes in critical water quality parameters
  - mortality
  - euthanasia (species, dates, methods, disposition)
- Records should be maintained for equipment installation, calibration, and significant system changes.
- Fish losses in shipping (as a percentage of sales and shipping volume) should be documented.
- Records should be maintained for veterinary visits.
- Backup copies of records should be maintained in a remote location (including remote on-line servers).

## PERMITTING, LEGAL, AWARENESS/PRO-ACTION

- Acquire and maintain all local, state, and federal permits and licenses required for operating as an aquatics livestock wholesaler/distributor:
  - Local environmental permits and business licenses
  - State permits such as:
    - wildlife possession/exhibition

- animal resale
  - water use
  - water quality/effluent and environmental, species-specific allowances
  - restricted species special permissions
  - live animal transportation
  - aquaculture facility certifications, special permits, etc.
- Federal permits including [USFWS import/export](#), [Exception to Designated Port](#), EPA (when applicable)
- Shipment-specific special permits such as [CITES](#) certifications (referred to in [SOURCING AND RECEIVING AQUATIC SPECIMENS](#))
- Develop a response plan in the case you inadvertently receive from a supplier any species that is prohibited under a law, regulation or permit relevant to your operation. Options include
  - Self-report to permitting or enforcement agency
  - Contact supplier immediately
  - Offer animals for confiscation by appropriate authorities
- Provide legal and husbandry information to your customers as appropriate
  - Compile summaries of regulations and permit requirements for their jurisdiction on request.
  - Contact customers immediately if they order species not permitted in their jurisdiction.
  - Summarize information ethical animal importation, including responsible sourcing, environmentally sustainable collection, wildlife conservation, standards for healthy transportation, husbandry.
- Legal
  - Maintain current knowledge of applicable local, state, interstate, and federal regulations applicable to all points in your supply chain.
  - Check for revisions to regulations and permitting requirements at least annually.