**HMSC Aquatic Animal Husbandry**

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Aquatic animal husbandry encompasses all aspects of captive animal care; including system design, animal collection, water quality monitoring, day to day care, and end point disposition. Ultimately, if you are in charge of animal husbandry, you are responsible for every aspect of the health and well-being of the animals in your care. Building on the HMSC Animal Care Plan Guidelines, this document outlines additional information about aquatic animal care and provides specific species care recommendations.

**I. General Aquatic Animal Husbandry**

**Life Support System Design**:

When designing an aquatic life support system, one must consider both the specific species or species complex to be held, as well as, the duration of captivity. These factors should drive the tank parameters, habitat needs, and water quality requirements. Aquatic animals should be housed in tanks that meet their general physiological and social needs. The proper tank size and shape are dictated by these species‐specific requirements. For certain species, burying, climbing, hiding and/or schooling behaviors will need to be considered. Stocking densities, the number of animals in a tank, can be evaluated by observing changes in behaviors and health. Densities should be adjusted based on these observations. Supplemental habitat should be added to the tanks that allow species to engage in typical behaviors as much as possible without interfering with activity objectives. Both the Guidelines and this document assume the use of HMSC’s flow through salt water system for water quality control. Review the *Open Saltwater System Best Practices* before use. Flows should be check daily and basic parameters should be periodically checked. Water temperature, waste removal, and dissolved oxygen can be augmented by altering the rate of tank flow and directional of flow. Dissolved oxygen can be increased with added aeration or cascading water features. Any stagnate or recirculating systems will need to manage these parameters closely. Use of HMSC fresh water in tanks will need to be dechlorinated before use. Additionally, any life support system should have an emergency plan in place for loss of power, running seawater, or system failure. The back-up system should be able to maintain the animals for at least 24 hours. See the Animal Care Resource list for additional support.

**Trainings:**

In addition to the basic [Lab Safety Training](http://oregonstate.edu/ehs/training/lab_safety_training), OSU requires an [Animal Handlers Safety Training](http://oregonstate.edu/ehs/training/animal_handler_training) and Health Assessment if you work with any vertebrate animal. HMSC recommends taking the animal handlers safety training if you are working with any animal.

**Feeding:**

There is a lot to consider when it comes to feeding aquatic animals in captivity. Diets may include live, dry, frozen, fresh or freeze dried food. Foods need to be nutritionally adequate, palatable, and appropriate for use in the open saltwater system. For example, it is preferred that seaweed, fish and shellfish not be fed live but should be frozen for 24 hour prior to being used as food. Another example, supplemental food should be considered for filter feeders. HMSC seawater is only coarsely filtered and still contains phytoplankton and zooplankton however, what is available in the ambient water might not be the adequate diversity and quantity to support filter feeders for long durations in captivity. If necessary to feed live food, it should be native and preferably collected from Yaquina Bay. Feeding is more than just diet. Feeding also includes feeding schedules, feeding methods, and food quality and quantity. Feeding must be based, not only on the species and specific feeding behavior, but also the animal’s life stage. One must also consider the collection or storage of the food. For example, most stock commercial foods should be used within six months and might need to be refrigerated or frozen in sealed containers until use.

**System and Animal Monitoring:**

Depending on your species and life support system there might be daily, weekly, and/or monthly monitoring requirements. This includes weekend and holiday care. Tanks should be clean, water flowing at an adequate rate, and the standpipe seated and not blocked. Individual or group health logs should be used to document any signs of disease or injury. Signs of disease can include changes in animal color (paleness, redness, bleeding), changes in shape (weight loss, bloating, deformities) external lesions, or behavioral changes (slow or rapid breathing, lethargy, abnormal movements, and /or changes in feeding activity or behavior). Contact the Animal Care Committee (Committee) for diagnostic assistance or system suggestions if signs of disease are observed. Water quality records are also highly recommended to document research conditions but also as a diagnostic tool. Remember each tank must have a waterproof lab tag. The tag should be clearly displayed and note the care givers’ name, lab name, phone number (day and after hours), the species in captivity, the start and anticipated end date, and any additional necessary notes. If your activity is working outside the Animal Care Plan Guidelines, please submit a copy of your best practice SOPs to the committee and make an easily accessible copy of your best practice SOPs available in your lab.

**End Point Disposition:**

It is preferable to return and release animals to the site of capture in accordance with collection permit requirements when the activity is concluded. The length and type of activity, collection site, or animal health may preclude this option. Do not return an animal to a site different than where it was collected, if the animal is unhealthy, or might have been exposed to disease or invasive (controlled) animals. If any anesthetic chemical or medicine has been used on an animal during its holding at HMSC, the animal must not be released before the drug withdrawal time in accordance with permit guidelines. Ask the Committee about appropriate drug withdrawal periods. Withdrawal time should be on the label of an anesthetic or medicines in degree-days. Healthy animals may be donated to the HMSC Visitor Center at the senior aquarist’s discretion. If it is not possible to return or donate the animals in your care, humane euthanasia might be necessary. For many aquatic invertebrates, there are no clear indicators of death and confirming death is difficult. If euthanasia is required, Researchers (as defined in the Animal Care Plan) must ask for Committee assistants or be trained on euthanasia procedures. Not all euthanasia methods are suitable for every species, talk to a member of the Committee or review the *AVMA Guidelines for Euthanasia* for additional information. Please note, death by anoxia and desiccation, pithing, freezing, or boiling alone are unacceptable euthanasia methods. For disposition of euthanized animals, double bag, freeze, and dispose animal(s) in the dumpster (preferably the night before trash pickup). Remember disposition records are required for most end of the year collection permit reports.

**II. Species Specifics**

*\* this section is a work in progress. If you need additional details about a specific group of animals, please contact the Committee.*

**A. Arthropoda**

**Decopoda**

Collection and Transportation Hints:

Habitat:

* Rocks, sediment and fake seaweed should be put in tanks to provide habitat and minimize stress
* Intertidal species should have unsubmerged rocks/shells in the center of the tank to allow them to occasionally climb out of the water, but not out of the system

Feeding:

* 3x week
* Most local crabs will feed on chopped frozen fish, squid and bivalves
* The smaller species, particularly the hermit crabs, porcelain crabs, and shore crabs will feed on fish flakes
* Shore crabs and kelp crabs will also feed on macroalgae such as ulva and eelgrass
* Porcelain crabs and mole crabs are filter feeders and need supplemental feedings of plankton if held for periods longer than 1 weeks as the amount of plankton in the seawater system is not adequate to sustain them for long periods
* Shrimp are predators and scavengers, with many feeding on detritus

Stocking Density:

Common Problems:

Other:

* Lids are necessary as all crabs are good climbers
* Tank should be large enough to give crabs plenty of space to avoid one another and prevent ‘squabbles’

**Cirripedia**

Collection and Transportation Hints:

Habitat:

* Barnacles cannot be pried from rocks and should be brought back on the rock or object on which they reside

Feeding:

* Barnacles are filter feeders, actively processing water for microscopic food
* They need supplemental feedings of plankton if held for periods longer than 3 weeks as the amount of plankton in the seawater system is not adequate to sustain them for long periods

Stocking Density:

Common Problems:

Other:

* Gooseneck and giant barnacles need a strong water current to be stimulated to come out and feed

**Amphipoda**

Collection and Transportation Hints:

Habitat:

* Rocks, sediment and fake seaweed should be put in tanks to provide habitat and minimize stress
* Intertidal species should have unsubmerged rocks/shells in the center of the tank to allow them to occasionally climb out of the water, but not out of the system

Feeding:

* Amphipods can be fed with microscopic organisms and algae

Stocking Density:

Common Problems:

Other:

* Can be held in small screened containers with a constant flow of seawater and aeration

**Isopoda**

Collection and Transportation Hints:

Habitat:

* Rocks, sediment and fake seaweed should be put in tanks to provide habitat and minimize stress
* Intertidal species should have unsubmerged rocks/shells in the center of the tank to allow them to occasionally climb out of the water, but not out of the system

Feeding:

* Isopods can be fed with microscopic organisms and algae

Stocking Density:

Common Problems:

Other:

* Can be held in small screened containers with a constant flow of seawater and aeration

**B. Mollusca**

**Bivalvia**

Collection and Transportation Hints:

Habitat:

* Almost all bivalves require sand or mud to bury themselves, the deeper the better but be cautious of anoxic sediment
* Insure bivalves are completely submerged to allow adequate filter feeding

Feeding:

* Almost all bivalves are filter feeders, actively processing water for microscopic food
* They need supplemental feedings of plankton if held for periods longer than 3 weeks as the amount of plankton in the seawater system is not adequate to sustain them for long periods

Stocking Density:

Common Problems:

Other:

* Occasionally stirring up the sediment by hand can help eliminate anoxic areas
* If necessary to move mussels, byssal threads should be cut to prevent ripping them out which can be lethal to the animal

**Gastropoda (snails)**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**Gastropoda (nudibranchs)**

Collection and Transportation Hints:

Habitat:

Feeding:

* Nudibranchs are usually feeding specialist- they will need their host species (e.g., sponge, hydroid) to survive for extended periods in captivity. Note- the host will need their own care/feeding routine as well.

Stocking Density:

Common Problems:

Other:

**Cephalopoda**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**Polyplacophora**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**C. Echinodermata**

**Asteroidae**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**Ophiuroidea**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**Holothuroidea**

Collection and Transportation Hints:

Habitat:

* Rocks and sediment should be put in tanks to provide habitat
* *P. chitonoides* does not need rocks to attach to but since they are difficult to pry off the sides of a tank without injury it is best to provide them with a rock or two

Feeding:

* All sea cucumbers feed on detritus
* *P. californicus* also feeds on small organisms such as zooplankton

Stocking Density:

Common Problems:

Other:

* *P. californicus* can be placed with sea urchins to help eliminate their waste

**Echinoidea**

Collection and Transportation Hints:

Habitat:

* Sand dollars require sand in order to orient themselves to filter feed
* Urchins…

Feeding:

* Sand dollars are filter feeders, actively processing water for microscopic food
* They need supplemental feedings of plankton if held for periods longer than 3 weeks as the amount of plankton in the seawater system is not adequate to sustain them for long periods
* Urchins should be feed 2-3x week to reduce the chance of them chewing through sea tables
* Urchins feed mainly on seaweed such as bullkelp, macrokelp and sealettuce
* They should be given chopped up fish, squid, or bivalves 1x month

Stocking Density:

Common Problems:

Other:

* Urchins must have enough room that they do not injure one another with their spines

**Crinoidea**

Collection and Transportation Hints:

Habitat:

* Provide variety of rocks, as crinoids (feather stars) like to anchor to a roughened rock surface and will move around until they find an appropriate rock

Feeding:

* Crinoids are filter feeders, actively processing water for microscopic food
* They require supplemental feedings of plankton every 3rd to 5th day

Stocking Density:

Common Problems:

Other:

* Be very careful when moving the feather stars, as their arms will break off very easily

**E. Branchiopoda**

Collection and Transportation Hints:

Habitat:

* Branchiopods cannot be pried from rocks and should be brought back on the rock or object on which they reside

Feeding:

* Branchiopods are filter feeders, actively processing water for microscopic food
* They need supplemental feedings of plankton if held for periods longer than 3 weeks as the amount of plankton in the seawater system is not adequate to sustain them for long periods

Stocking Density:

Common Problems:

Other:

* Branchiopod valves are dorsal and ventral, rather than lateral as in bivalves

**F. Bryozoa**

Collection and Transportation Hints:

Habitat:

* Encrusting bryozoans can be scraped off surfaces using a spatula, but it is better to collect them with whatever substrate they are on
* For optimum success hold in container with continually strong-flowing seawater directed to make a current
* Minimal handling and no exposure to air increases survival

Feeding:

* Bryozoans should be feed on small phytoplanktonic organisms
* Supplemental feedings every 4-6 days is necessary for survival of animals

Stocking Density:

Common Problems:

Other:

* Bryozoans are notoriously difficult to keep alive in facilities for long term
* Tank cleaning is extremely hard on bryozoans and should only be done when absolutely necessary
* If holding tank is kept under strong enough flow, waste should be moved out volitionally

**G. Worms**

**Annelida**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**Nemertea**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**Nematoda**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**Platyhelminthes**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**H. Porifera**

Collection and Transportation Hints:

Habitat:

* Sponges can be scraped off surfaces using a spatula, but it is better to collect them with whatever substrate they are on
* For optimum success hold in container with continually strong-flowing seawater directed to make a current
* Minimal handling and no exposure to air increases survival

Feeding:

* Sponges are filter feeders, actively processing water for microscopic food
* They need supplemental feedings of plankton if held for periods longer than 3 weeks as the amount of plankton in the seawater system is not adequate to sustain them for long periods

Other:

* Many of the subtidal species cannot tolerate being exposed to air at all: once they have been exposed to air, they tend to die over a period of a couple of weeks

**I. Cnidaria**

**Hydrozoa**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**Scyphozoa**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**Anthozoa**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**Ctenophora**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other:

**J. Chordata (not including vertebrata)**

Collection and Transportation Hints:

Habitat:

Feeding:

Stocking Density:

Common Problems:

Other: