

Transport and Care of Small Desert Fishes

by
Ann M. Widmer,
Corissa J. Carveth,
and
Scott A. Bonar



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Arizona Cooperative Fish and Wildlife Research Unit

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Important Note:

This booklet is meant for university and agency staff holding proper permits. Transporting fishes, especially native, endangered species is subject to specific federal and state laws. It is up to the user of this manual to make sure all laws and procedures are being followed before holding or transporting fishes.

Acknowledgements

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Introduction

This booklet details methods we have used successfully to transport small desert fishes and to hold them in captivity for several years at the University of Arizona. The equipment used is low cost and most items can be purchased from local pet stores and hardware stores. The advice of a number of fisheries professionals in Arizona and Colorado was supplemented with various practical suggestions gained from our experience.

Transporting Fish

Transport containers

Check with state and federal conservation agencies for sampling and collection recommendations and restrictions. Fish can be transported easily in 45-L plastic coolers fitted with a battery-operated aerator and digital thermometer. Before going into the

field, drill a hole through the lid of the cooler for vinyl aquarium tubing to pass through, and secure the aerator to the lid with Velcro. Make sure the tubing is long enough that the air stone will be submerged in water when the cooler is approximately $\frac{3}{4}$ full. The digital thermometer (Lifegard[®]¹) has a sensor at the end of a long wire. Immediately before transport, put the sensor inside the cooler, shut the lid over the wire, and tape the display portion to the lid (Figure 1).

Tips:

- Velcro alone will not hold in hot weather; reinforce equipment with duct tape.
- Bring a spare aerator and extra batteries.
- Do not get Lifegard[®] thermometers wet. Attach immediately before transport.

¹ Available from Aquatic Ecosystems, 1767 Benbow Court, Apopka, FL 32703, www.aquaticceco.com

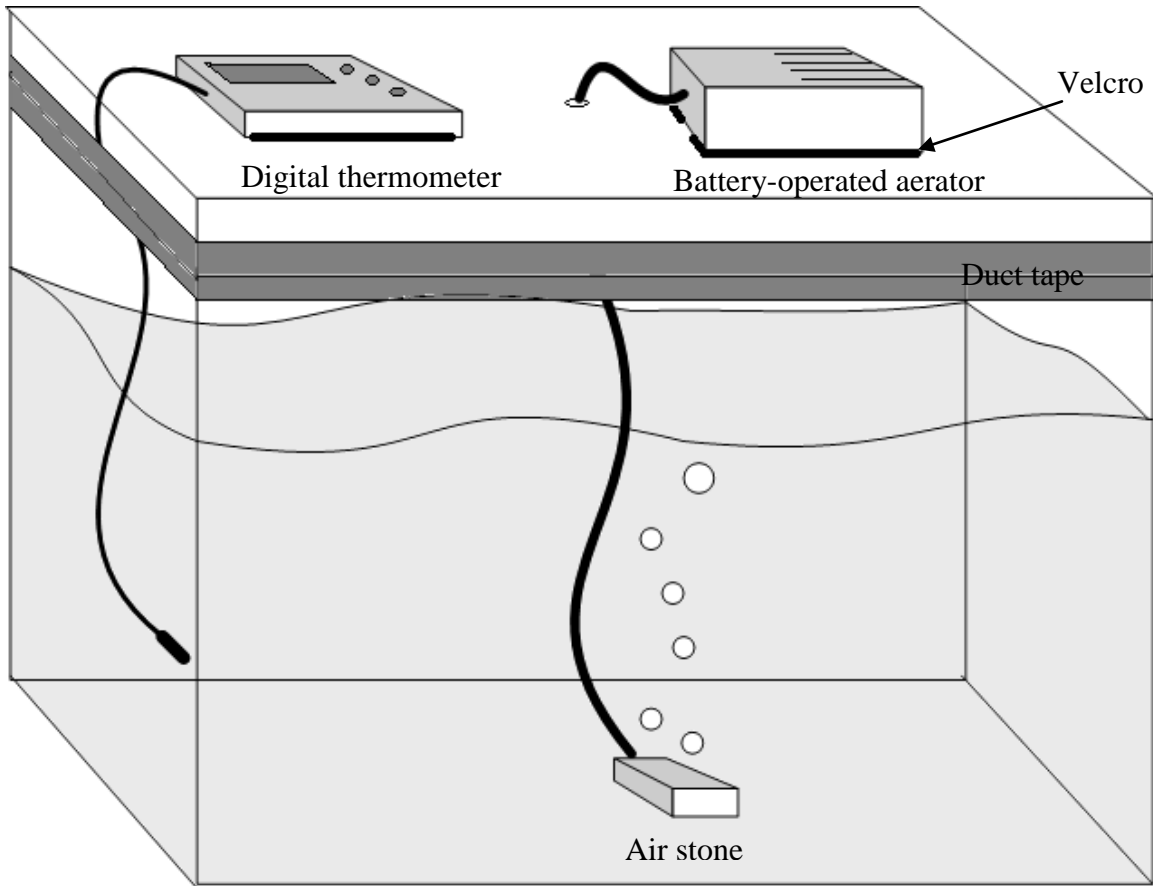


Figure 1. Transport Cooler.

Water conditioners

In the field, fill the cooler $\frac{3}{4}$ full with water from the collection site and condition it with non-iodized salt and Stresscoat^{® 2} prior to adding fish. We used 0.6% salt solution for transport. Fish tolerate handling and transportation stress better in saline solutions (Piper et al. 1982). Stresscoat[®] helps repair damage to the slimecoat of fish that may have occurred during handling; add according to the manufacturer's directions. Mix the water until salt crystals have completely dissolved before adding fish to the cooler.

² Water conditioner with aloe vera manufactured by Aquarium Pharmaceuticals, Inc., P.O. Box 218, Chalfont, PA 18914. Available at local pet stores or from Aquatic Ecosystems.

Tips:

- To calculate amount of non-iodized salt needed to treat a cooler $\frac{3}{4}$ full with water: **g salt = (.75*[cooler capacity in L]*1000g/L) * 0.006**
(e.g., a 45 L cooler filled $\frac{3}{4}$ full with water needs 202 g of salt)
- Measure non-iodized salt into plastic bags before going into the field.
- Either non-iodized table salt or rock salt can be used. Rock salt is cheaper but takes a long time to dissolve because of the large crystals.
- Place the cooler in the shade or water temperature will rise significantly above normal stream temperatures and cause stress in the fish.

Density and Travel

We transported approximately 120 mm of fish per liter water (e.g., 100, 40-mm fish in a 45-L cooler filled $\frac{3}{4}$ full with water). Low transport densities minimize stress to the fish, which is especially important when handling sensitive species.

To minimize water leakage, seal up the cooler with duct tape. If possible, transport fish inside an air-conditioned vehicle to minimize temperature changes. Periodically check the temperature on the digital thermometers and add freezer bags filled with ice cubes if it changes more than about 2°C in an hour.

Clean-up between sites

It is important to sterilize the transport coolers, inside and out, between sites. Sterilization helps prevent the transportation of parasites and diseases between streams and between fish collections.

To sterilize the cooler, first remove mud or plant materials. Apply straight household bleach to all surfaces using a spray bottle and let sit for one minute. Rinse thoroughly with tap water.

Nets and field gear should also be bleached. The easiest way is to fill the transport cooler with water and approximately ½ cup bleach. Soak nets and other sampling gear for 5 minutes in the bleach solution and then rinse thoroughly with tap water.

Acclimating Fish to Captivity

Water changes

A guideline for bringing fish into the laboratory is “one stressor per day.” The day fish are brought in, water changes are the only necessary additional stressor. Fill tanks half with transport water and half with municipal water treated with Stresscoat[®]. Once this water mixture is within 2°C of the transport water, fish can be added. We usually put fish into the tanks in the evening and then waited to do additional water changes until the next morning. On the second day, change water 3 times, 4 hours apart (e.g., at 8:00 am, 12:00 pm, 4:00 pm), each time replacing 20% of the water in the tank with room-temperature dechlorinated water. After these 3 water changes, fish are treated for Ich and the frequency of water changes is reduced to once per day.

Tip:

- Dechlorinate water in Aquatainers[®]³ (22-L plastic cube with spigot) 24 hours before use. Water added to tanks already will be at room temperature.

Treatment for Ich

Ich (*Ichthyophthirius*) is a parasite that is common in streams throughout the desert Southwest and may quickly become lethal to fish in captivity. After fish have been in captivity 24 hours (2nd day, 2nd stressor) and water changes have been completed for the day, start a prophylactic treatment for Ich with a formalin-based medication, such as Quickcure[®]⁴. Use medication according to package directions for a minimum of 5 days. Scaleless fishes should be treated at half-dose. During treatment, exchange 20% of the water each day before adding medication. After treatment is completed, reduce frequency of 20% water changes to once every other day. Do not treat fish for bacterial infections unless symptoms of infection are present (examples of symptoms: bulging eyes or stomachs, rotting fins, and hemorrhaging). Try not to collect fish that appear sick in the field.

Introducing food

On the third day, fish may finally be given food. Although it is not intuitive, new food is a stressor. We found that most fish readily accepted a mixture of dry foods,

³ Aquatainers[®] may be purchased at Walmart or outdoor equipment stores

⁴ Manufactured by Aquarium Products, Inc., Glen Burnie, MD, 21061. Available at local pet stores.

described in the next section. Food should be ground small enough for the fish to eat easily. If fish are reluctant to start feeding on dry food, live foods may be more stimulating. Live brine shrimp nauplii⁵ may be used to get fish actively feeding before introducing dry food the first times. Live foods can generally be phased out after the first week or two.

Tip:

- These methods are for adult and juvenile fish. Larval fish may need to be fed earlier to prevent starvation. Ask hatchery personnel for instructions.

Holding Fish in Captivity

Fish tanks

Fish less than 100 mm can be held in 117-L Rubbermaid® plastic storage tubs. They are cheap, durable, and relatively easy to clean. Unfortunately, fish are difficult to see in these containers and it can be difficult to monitor fish health. Glass aquariums make fish easily visible. If using glass tanks, paper flaps over the sides of the tank reduce visual disturbances to fish and help to prevent stress. Paper flaps can be attached with tape along the top, making it easy to lift and observe fish. No substrate material is necessary, but cover may be provided with plastic plants or terra cotta pot shards. Approximately 25 mm of fish can be held per liter of water (e.g., 12, 100-mm fish, 31, 40-mm fish, or 62, 20-mm fish in 50 L water). Some fish, such as longfin dace (*Agosia chrysogaster*) and spikedace (*Meda fulgida*), are more tolerant of crowding than other

⁵ Brine shrimp eggs are available at local pet stores or Aquatic Ecosystems, Inc. Follow preparation directions provided by manufacturer. Shrimp take approximately 24 hours to hatch after preparation.

fish, such as loach minnow (*Tiaroga cobitis*). Keep water depth in aquaria similar to natural stream levels, but low enough that fish cannot jump out (approximately 20 cm depth).

Tips:

- Fish are easier to see in the lighter colored tubs (e.g., light blue).
- Pieces of PVC pipe do not make good fish cover. If there is a current, pieces of pipe roll and can smash fish. This is a particular problem with loach minnow.
- If fish are held at lower densities, water changes may be less frequent.

Tank biofilters

A home-made bucket biofilter situated above a fish tank can remove waste and denitrify water. A biofilter can be made from a 20-L bucket with a lid (Figure 2). Drill a hole in the bottom of the bucket and use silicone aquarium sealant to affix a plastic spout. The spout is made from a 2.5-cm diameter poly insert male adapter⁶, which has a tapered end that goes through the bottom of the bucket. If the adapter is threaded on the other end, the threads should be sawn off so that the top of the adapter lies relatively flat against the inside bottom of the bucket. This spout will help to direct water back into the fish tank without splashing. It is important that all components, including screws, are either made of plastic or covered in plastic. Brass, copper, and galvanized metals release ions into water that are harmful to fish. Use four 8-cm long plastic-coated screws through the bucket wall to support a plastic grate 15 cm off the bottom of the bucket.

⁶ Available at local hardware stores in the drip irrigation supplies

Use aquarium sealant around the screws. On top of the plastic grate, add about 15 cm of plastic bioballs (approximately 3 cm diameter) or other biofilter medium⁷. The holes in the grate should be small enough that the bioballs do not fall through. Add two layers of 3-cm thick polyester filter pad⁸, cut to fit the bucket, on top of the bioballs. Filter pads can be rinsed and re-used. Other layers can be added to the biofilter as necessary to maintain water quality, such as charcoal, oyster shells, or zyolite. Use a powerhead (Rio 1100[®] works well) submerged in the tank to pump water to the top of the biofilter. Drill a hole in the lid of the bucket for vinyl tubing to go through, allowing the water to fall directly onto the filter pads. This tubing can be stabilized against the side of the bucket using the handle of the bucket. The size of the tubing is determined by the size of the outlet on the powerhead. After trickling through the layers in the bucket, water falls back into the tank. The falling water adds oxygen to the tank and supplemental air sources should not be needed. Use Stresszyme^{® 9} to seed the biofilter with live beneficial bacteria during the first few days of use.

Tips:

- This model works well, but a sprayer to distribute the dirty water more evenly over the filter pads would be useful. This could be as simple as a piece of PVC pipe with holes drilled into it.
- The spout on the bottom can be knocked out of place somewhat easily.
Do not rest weight of bucket on the spout.

⁷ Aquatic Ecosystems, Inc. has a wide selection of bioballs, filter pads, and other biofilter media

⁸ Such as Aquatic Ecosystems washable filter material PF17

⁹ Manufactured by Aquarium Pharmaceuticals, Inc. Available at local pet stores.

- A simple way to mount bucket biofilters above a row of fish tanks is to place two pieces of wood (2x4s) across the top of the tanks and then just set a biofilter on the wood above each tank with the spout positioned between the two pieces of wood.

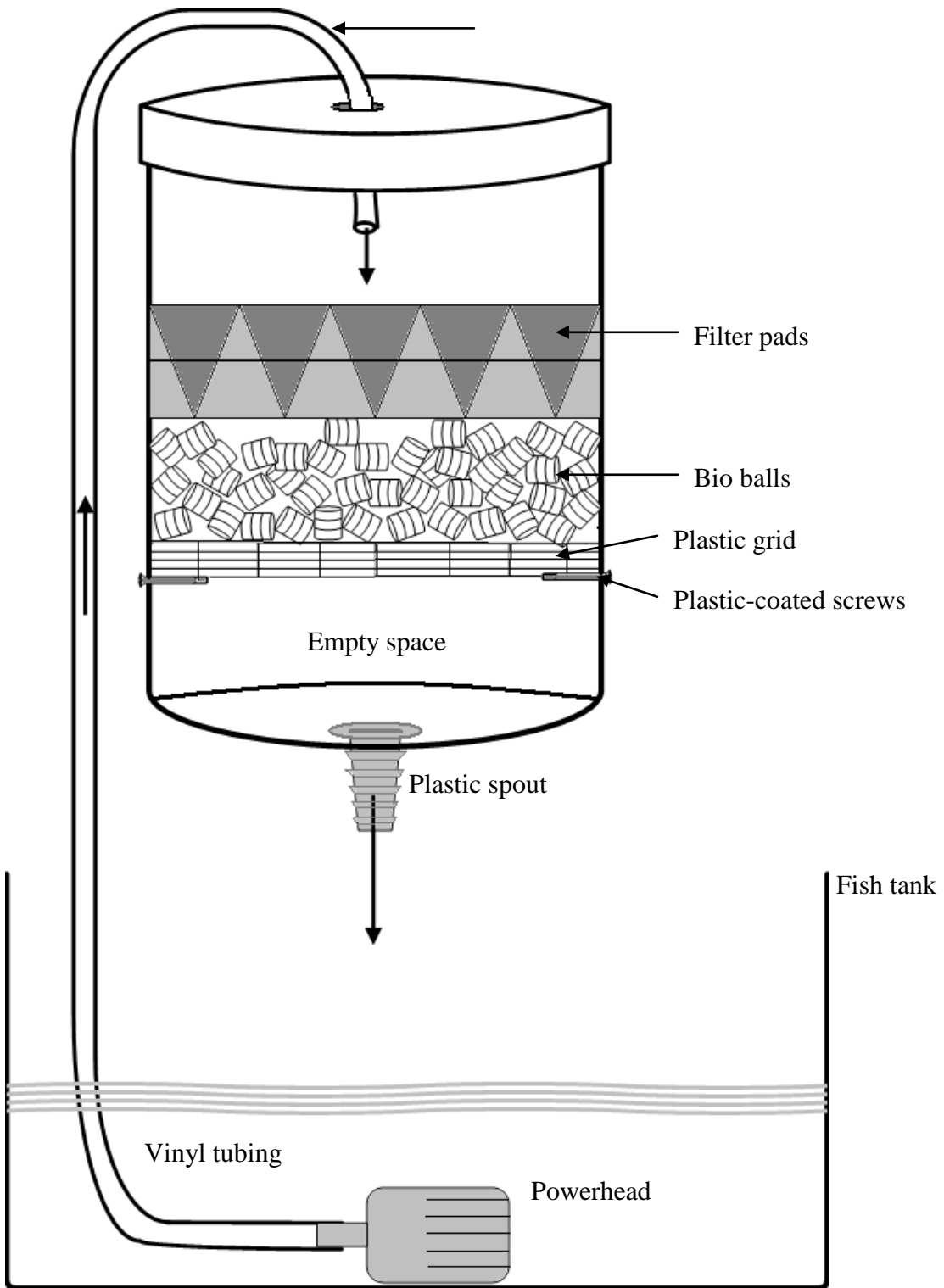


Figure 2. Bucket biofilter.

Aquariums for larval fish

The powerheads used with the bucket biofilters are too powerful for use with larval fish. Keep larval fish in 10-gal glass aquariums with a sponge filter and air stones. The sponge filter will remove particles and denitrify the water. Seed the sponge filter with Stresszyme[®] as with the bucket biofilter. Battery-powered gravel vacuums¹⁰ with small intake valves are useful for cleaning tanks with larval fish because they do not produce a powerful suction and are easy to control. Sponges should occasionally be rinsed under cool water. Hot water and bleach can kill the bacteria in the sponge and should not be used.

Water changes

Dechlorinate municipal water before use. Stresscoat[®] and Amquel^{® 11} are good for this purpose and can be purchased by the gallon from Aquatic Ecosystems, Inc. Dechlorinate water in Aquatainers[®] and allow to sit for 24 hours. If fish are kept at room temperature, this preparation will prevent sudden temperature swings with water changes. Change approximately 10% of the water every other day. This is crucial for maintaining water quality, especially at higher fish densities. Each tank should be assigned its own water pitcher for removing water to prevent contamination between tanks. A siphon may also be used to remove water but should be bleached prior to use in other tanks.

¹⁰ Hagen Marina Multi-Vac Battery Powered Vacuum, available from www.marinedepot.com

¹¹ Manufactured by Kordon, 2242 Davis Court, Hayward, CA 94545. Available from Aquatic Ecosystems, Inc.

Food

Feed fish dry food 1-2 times per day. Most fish will accept a finely ground dry food mixture. We used a mixture that was 1 part freeze-dried bloodworms (such as Hikari brand), 1 part sinking pellet food (Aquatic Ecosystems' dense culture food, 45% protein), and 2 parts tropical flake food (40% protein, mixture of brine shrimp flake, bloodmeal flake, and spirulina flake from Aquatic Ecosystems). A mortar and pestle were used to reduce the food particles to the size of ground pepper. The diet for herbivorous fish was supplemented with spirulina pellets¹². Larval fish ate a combination of the dry food mixture, ground to a powder, and powdered egg yolk¹³.

Tip:

- Refrigeration of foods, although not vital, will help to extend shelf-life.

Tank cleaning

Tanks needed to be completely scrubbed once a month. Net fish out and keep them in a 20-L bucket with a battery-powered aerator during cleaning. This is a good opportunity to count fish and take a closer look at fish health. Biofilters and hoses should also be sprayed out at this time. Do not bleach the biofilter or the beneficial bacteria will need to be re-established. Filter pads can be reused after being sprayed out with clean water. If there are problems with water quality in tanks, filter pads should be sprayed out more often (e.g., every 2 weeks).

¹² Pellets available at local pet stores.

¹³ Egg yolk flakes are available from Aquatic Ecosystems, Inc.

Metric to English Converstions

To go from	To	Multiply by
centimeters	inches	0.3937
centimeters	feet	0.0328
grams	ounces	0.035
grams	pounds	0.002
kilograms	ounces	35.274
kilograms	pounds	2.2046
kilometers	feet	3280.84
kilometer	miles	0.621
kilometer	yards	1093
liters	cups	4.226
liters	gallons	0.264
liters	quarts	1.057
meters	feet	3.281
meters	inches	39.37
meters	miles	0.0006214
meters	yards	1.093

Additional Reading

Arizona Game and Fish Department. Unpublished. Small-bodied, warm water native fish collection, transport, and stocking protocol. Phoenix, AZ.

Childs, M. 2005. Bubbling ponds hatchery development for native fishes. Protocol for collection, transport, quarantine, maintenance, propagation, and repatriation of native fishes. Arizona Game and Fish Department Research Branch Report.

Piper, R.G., I. B. McElwain, L. E. Orme, J. P. McCraren, L. G. Fowler, and J. R. Leonard. 1982. Fish Hatchery Management. United States Department of the Interior, Fish and Wildlife Service, Washington D.C. (Updated edition available from the American Fisheries Society).