A Scalable Method

of

Raising *Hippocampus erectus*

by

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FOREWORD

I have been asked by several people to write an article about our fry raising methods with *H. erectus* fry. Initially I was hesitant. I would have preferred to have proven success and attained some personal goals with the broods before attempting to write something significant. However, people keep asking, and we have had some success. Our success rates seem to improve with each batch of fry.

We do not by any means want to discount or take away from any methods used by others. This method is based on our own experiences and objectives.

INTRODUCTION

Seahorse husbandry is still in its' infancy. There is still much to be learned. There may be several ways to raise fry successfully. What works for one species may or may not work for another, or it may work with some slight modification.

Figure 1. The seahorse room in the early stages.

Successful intensive culturing of *H. erectus* fry requires many resources. Aside from the costs of tanks, filters, stands, tools, test kits, salt, frozen and live foods, electricity, water, etc. it requires a massive amount of time. We spend 14 to 16 hours a day, 7 days a week, working in our seahorse room. Time is spent cleaning tanks and filters, feeding, preparing food cultures, testing water parameters, record keeping, working on new setups, research and a lot of observation. Fortunately we are a two person team who are both dedicated to this project. I do not believe either of us could do this by ourselves!

Our initial attempts to raise *H. erectus* fry failed. We tried using small tanks and quickly became frustrated. Despite all attempts, we just weren't able to get fry past 4 weeks. We also noted was that each brood were very labor intensive since we were splitting up the fry into several small tanks.

Dissatisfied, we researched and experimented to come up with a feasible method that would work for us. Our objectives were to have a simple system that would enjoy a high percentage of survivability, minimal amount of maintenance, and provide scalability to support a larger operation but still remain cost effective.

After coming up with the method described in this document and putting it into effect, we immediately began to have some success. As our experience increases and with small tweaks, our fry survival ratio continues to improve. This method is simple, does not require the use of green water, reduces the need for water changes and is easy to maintain. It is easily duplicated and allows you to have several broods going at any time, provided that you set up more systems and have adequate grow out space.

Hopefully this will answer most questions you may have regarding how we rear our *H. erectus* fry.

BASIC SYSTEM DESCRIPTION

Initial Fry Tank - For an initial fry tank we use a 15 gallon tall aquarium.
The goal was:
1. a tank that was inexpensive
2. had as much water volume as possible with decent depth
3. could keep the food density reasonable
4. hold as many fry as possible.

The shape and water movement in the 15 gallon tall with this setup allows you to have somewhat of a Kreisel effect. It does not prevent fry from going to the surface. However, it does gently force the lazy floaters to go back down.

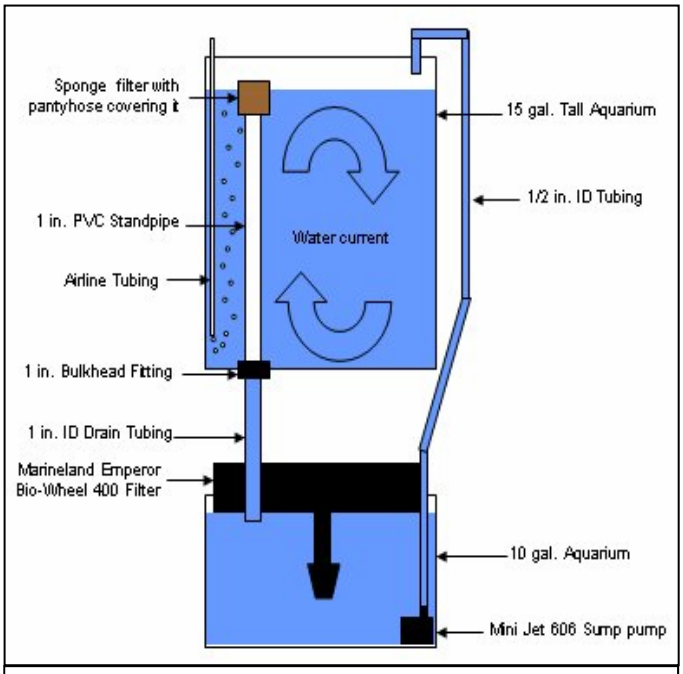

Figure 2. Basic diagram of initial fry tank.

Figure 3. 2 week old H. *erectus* fry. Note the painted bottom. The contrast makes it very easy to see a dirty bottom.

Since we were using a bare 15 gallon tall tank, we painted the bottom dark blue so it would be easy to see waste on the bottom and have some contrast so the fry could see the food.

These tanks are available locally and are inexpensive at $19.95 each.

Secondary Fry Grow Out Tank (29 gal aquarium**) -** Our choice here was based on space utilization and price. We stack the 29 gallon tanks side by side to reduce the

amount of space needed. Using the same filtration scheme as with the 15 gallon tanks. We have also placed some of them on a larger 40-50 gallon sump system with multiple tanks. In our experience both ways work well. On a larger scale it is more practical to go with large sump system. When the fry outgrow these, we then divide them up into additional 29 gallon tanks as needed.

Figure 4. Initial fry setup on a metal rack. Note the ease of access and inspection of the sump.

The Sump

We wanted as much filtration as possible without the problem of fry being sucked up into the system. Another goal was to increase the water volume used for stability. By opting to go with a sump we can use any filter desired. The only caveat to overcome was the problem of fry getting sucked into the sump. This was easily handled by using a 1 inch standpipe with a sponge covering it.

Initial Fry Setup - We like having each batch of fry on their own independent system for the first 3 – 5 weeks. This seems to be where they are most sensitive and allows us to treat each batch as necessary without affecting other batches. We use 10 gallon tanks as a sump because of price, $9.00 to $10.00 locally, and because it has the same footprint as the 15 tall. This way we can place it directly below the 15 on a stand either made from 2x4's or wrought iron.

Figure 5. Picture of a basic fry tank. This store bought stand makes sump maintenance more difficult than a metal or 2x4 wood frame stand.

Secondary Fry Grow Out – At this point we have gone two ways, both have shown success. We have continued using the 10 gal sump with individual filtration and have also used a rack of tanks on a larger sump system. It really depends on the scale of the operation and budget concerns as to which way to go.

Filtration

Initial Fry Setup - We went with the Marineland Emperor 400 Bio-wheel filter which we get from

Drs Foster & Smith for about $45.00 each. This allows us to have mechanical, chemical and biological filtration in one unit. Some may feel it is oversized, but so far it has done well with keeping up the bio-load. There has been some talk on Reef Central (www.reefcentral.com) about bio-wheels causing a nitrate problem. We have yet to see this. Bio balls are also added to the sump, for extra surface area for the beneficial bacteria. These are loose and circulate in the water. Kind of like a quasi fluidized filter.

Secondary Fry Grow Out – on a small scale the initial filter scheme as cited above works well. We prefer to have a couple of separate systems with multiple tanks on a larger sump. This allows us to run additional equipment such as UV Sterilizers and Protein Skimmers, cuts down on some of the labor for maintenance and becomes more economically feasible when scaling up.

Figure 6. Another view of fry in a 15 gallon fry setup.

Tank Construction

Water Circulation

In using a sump we had to decide between an overflow box or drilling the tanks. Overflows take up space inside the tank, require more maintenance, run the risk of U tubes getting air trapped in them and we worry about the fry getting trapped behind the boxes. We also found that fry seem to get caught in the screen we placed around the overflows. Therefore we chose to drill the tanks whenever possible.

Initial Fry Setup - After drilling the bottom of the tank a 1 inch bulkhead is installed. We place the hole 4 inches from one end, centered and use 1 inch PVC for the standpipe. At the top of the standpipe a sponge filter from the overflow boxes is installed. First, it is cut in half, then covered with pantyhose to protect the fry from entering the sponge pores until the fry reach 7 to 10 days of age. The surface area of the sponge is much greater than that of the slits in the overflow box. The water current in the drain is reduced and even with a 35 gal/hr flow, 1 day old fry do not get plastered to the sides of the sponge.

To return water back to the tank from the sump we went with a Mini Jet 606 pump. We run ½" ID hose from it to the tank. Instead of finding and purchasing a U shape return, at the top of the tank, we run the tubing through ¾" PVC with 2 elbows. It merely hangs on the side of the tank and requires no special brackets. A heater bracket can be used if securing it is desired. (See Figure 5)

By placing the return line to the tank on one end and running an airline without an air stone on the opposite end, a circular type flow is created in the tank. We have found that a flow rate of about 20 to 25 gal an hour for the return works quite well in the initial setup.

Secondary Fry Grow Out - On the 29 gallon tanks, we went with a modified overflow design. The placement of the tanks does not allow for the bottom to have a bulkhead and we are using cheap tanks, so we were afraid to drill the sides or bottoms. Our solution was to drill the overflow box for a 1" bulkhead. We come out from the bottom of the overflow box with 1" PVC pipe to create a U design that allows the use the sponge again. The overflow box is raised so that the only water coming in, comes from the PVC. (See Figure 7)

Figure 7. Overflow box modification.

Lighting
We use a cheap clip on utility light from Home Depot. They run about $6.00. We use compact fluorescent bulb in the 7 to 10 watt range. The light is clipped onto whatever is available so the it shines down at about the midway point on the side of the aquarium and does not shine directly into the tank. This helps keep the food more towards the center of the tank.
The light is left on for about 14 hours a day. Once the fry begin to take foods other than BBS we move the light up to the top.

SYSTEM PARAMETERS

Water
After much research we opted to go with plain old city tap water. We gave a lot of consideration towards RO water, but chose not to, due to the amounts of water needed and extra cost. None of the local commercial hatcheries use RO water. They either used sterilized sea water (location dependant) or tap water. So we use tap water that is either aged for 24-48 hours to degas, or in a pinch, dosed with Sodium Thiosulfate to remove the chlorine.

Temperature
Tank temperature is kept at around 75 degrees F. Initially, we had it closer to 80 degrees. Although ther were no specific issues, we are under the impression that cooler water leads to less bacterial infections. Also identified, is that cooler water leads to a longer pregnancy. While not having done any controlled studies ourselves, or know of any that have been done, the initial survival rate (1st Week) seems to be higher with longer pregnancies.

Salinity
Salinity in all tanks is kept around 30 ppt (1.022 - 1.023 SG). We have tried higher and lower

salinities but have not noticed any impact in either the brood stock or the fry.

pH
Because we use bare bottom tanks, there is nothing to act as a buffer for the pH so occasionally some buffer has to be added. On the larger systems with a sump, we have thrown crushed clam shell in a porous bag into the sump. This seems to help keep the pH more constant.

Water Parameter Testing
Temperature and salinity are checked daily. pH, Ammonia, Nitrites are checked twice a week or anytime something seems out of whack or if we just get a gut feeling that it needs to be done. Calcium is checked about every two weeks.

TANK MAINTENANCE

Each tank or tank system has its' own set of tools. We do not use them between different setups to prevent any possibility of cross contamination. Also, there is a strict policy of washing before touching any of the tanks, food etc and when going from one system to another.

Cleaning
We routinely clean the tanks twice a day. Once, before the first feeding of the day and again, after the last feeding of day. Since we use bare bottom tanks with a dark background this is done very easily. A Micro Brush Vacuum Attachment is connected to tubing in order to siphon and brush the bottoms of the tanks (See Figure 8). On the smaller fry we reduce the size of the tubing down to airline size to slow down the flow and avoid sucking up the fry. When cleaning the tanks with new fry we use clean white buckets. This allows us to see any fry that may have accidentally been siphoned out.

Figure 8. Micro Brush Cleaner used for cleaning bare bottom

The filter pads on the Emperor 400's and the larger sump are cleaned weekly. The sponges on the stand pipes are cleaned as needed which is usually daily with new fry, and after several days with older fry or juveniles.

Whenever a setup becomes empty we tear down everything, including the tank, hitching posts, tools, tubing etc, clean it and soak it in Sodium Hypochlorite (Bleach). On the larger grow out system we can't tear down the whole thing, but we do the same to each tank whenever they are empty.

Water Changes
In the course of cleaning the tanks we replace the water taken out, over the course of a week this would equal between a 30% to 50% water change.

FOODS

Copepods

When we have them, they are offered. They are not practical in terms of maintaining a sustainable culture for our needs, so we do not rely upon them.

Rotifers

Probably not essential for *H. erectus* fry, but we have them, they eat them, and we have good survival rates during the first two weeks, so we continue to offer them the first few days.

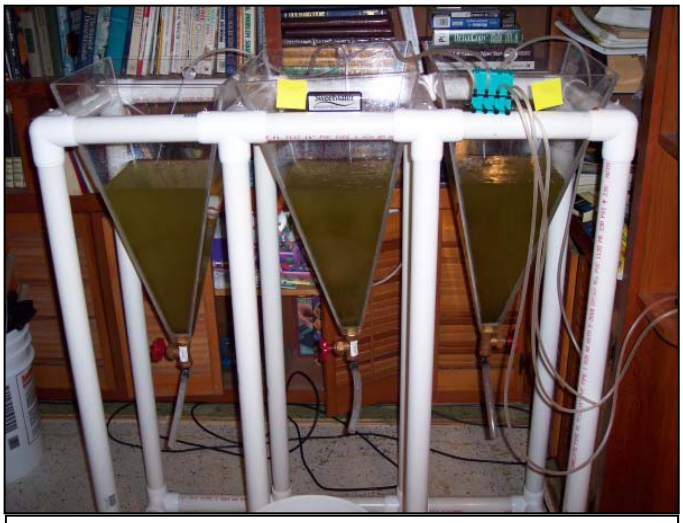

Figure 9. Large 5.5 gallon culture cones used for both brine shrimp and rotifers. Having a drain valve on the bottom of both large and small culture cones is very handy.

Brine Shrimp

Baby Brine Shrimp (BBS) – San Francisco Bay strain are used and decapsulated before hatching. We have several hatchers and always have at least two going just in case something happens to a culture. Larger cones are also available for rearing the BBS to several days old as needed.

Figure 10. Small hatching cones for baby brine shrimp. We also use them for enriching brine.

Adult Brine Shrimp

These are easily obtained from the local live fish stores so we do not bother to try to raise them.

CYCLOP-EEZE®

This is available freeze dried or frozen. Although the freeze dried is more readily available and cheaper, it requires re-hydration, thus more work. We have also found the seahorses don't take to it as well as the frozen. So we use the frozen. It is a great intermediate food and seems to make the transition over to frozen mysis easier.

Frozen Mysis

We use the Hikari brand. It seems to be a good quality food, is clean and the pieces are typically smaller the PE Mysis. We are now buying the 16 oz. flat packs in bulk.

HUSBANDRY

Birth

As soon as the fry are born, we use a plastic ladle to scoop the fry out and move them to the 15 gallon tank. We also take a count during this process and record it. Generally we find it easiest if two people work together doing this. One person does the moving and the other keeps track with a notepad on the count. It is very easy to lose count during this process.

We start with an initial stocking density of 15 - 25 per gallon. We have had success on both ends of the stocking density. If a higher initial stocking density is used and a high survival rate is attained they do have to be split out sooner for grow out.

Hitching posts are placed in the tank from the beginning. *H. erectus* fry will hitch at night from birth.

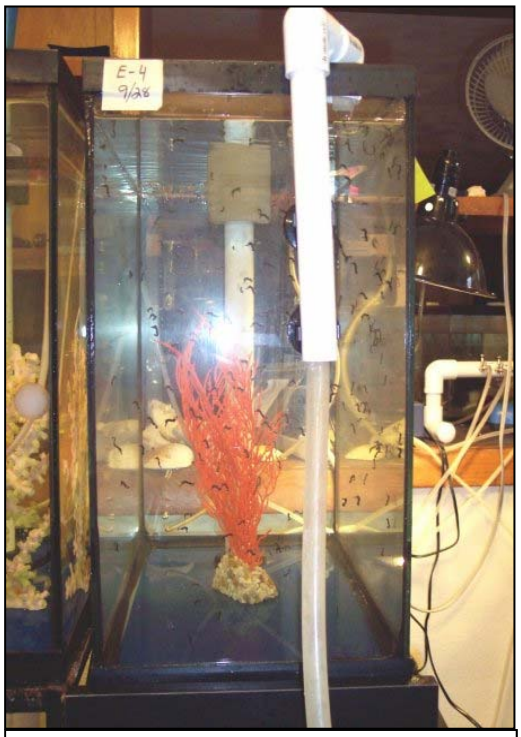

Figure 11. Fry at 1 week old.

The first couple of feedings are of Rotifers, newly hatched BBS, and if we have them, Copepods are mixed in as well. We give the first feeding immediately upon moving the fry to the rearing tank.

Figure 12. An example of high stocking density. The fry in this tank are just under 3 weeks old and need to be split out to a lower density

Birth to 1 Week

During the first week the fry are fed Rotifers and newly hatched BBS. At the beginning of the week it's primarily rotifers and some BBS. By the end of the week we are mostly giving BBS with Rotifers mixed in. The fry are fed 4 to 5 times a day. We try very hard not to overfeed. Our goal is to only provide the amount of food that can be consumed within 1 hour. Sometimes this takes a little experimentation and observation. If we over or under feed, adjustments are made on the next feeding until we get it right.

1 Week to 2 Weeks

The fry are fed BBS 4 to 5 times a day without any rotifers. 1 day old BBS enriched with Selco are added to the diet.

2 Weeks to 3 Weeks

The feeding schedule of 4 to 5 times a day continues but with a change to a mix of newly hatched

BBS and 1 to 3 day old BBS. The older BBS are enriched with Selco before feeding.

3 Weeks to 5 Weeks
Frozen CYCLOP-EEZE® are added to the diet of BBS. The CYCLOP-EEZE® are started by adding small amounts at first then increasing the amount given based on how much of it they eat. The CYCLOP-EEZE® are given about the same time as the BBS.

At 3 weeks we lower the stocking density to 7 - 10 per gallon. How this is done depends upon the original brood size, survivability rates and availability of tanks. Generally we divide them up into a second 15 gallon tank. We have moved them to the 29 gallon tanks before but prefer the 15's at this point.

5 Weeks to 7 Weeks
At around 5 weeks we begin to add enriched adult brine shrimp. Like the CYCLOP-EEZE® it is started slowly at first, and gradually phased in if it is eaten. In the same fashion small amounts of finely chopped frozen Hikari Mysis are added to the diet. When we begin to frozen mysis we keep a sharp eye on the water parameters. If you overfeed and are not diligent in cleaning up the excess uneaten food an ammonia spike occurs. By the 7th week almost all are eating the chopped mysis.


Figure 13. Feeding time for 13 week olds.

Around 7 weeks we move the fry to a 29 gallon grow out tank(s) with a stocking density of 3 - 4 per gallon.

7 Weeks to 10 Weeks
We continue with the feeding of the chopped mysis and the Selco enriched adult BBS.

By the 10th week, typically a second 29 gallon grow out tank is needed as we reduce the stocking density to 2 - 3 per gallon.

10 Weeks to 12 Weeks
We continue with the same feeding regimen as in weeks 7-10. By the 12th week some of the males begin to develop their pouches. Although the pouch may not be visible initially, there is usually a darkened area of skin where the pouch will soon begin to grow.

Also during this time frame we sort out the smallest of the brood and place them in their own tank. These seahorses are much smaller than the rest. By moving them they do not have to

compete against the larger horses. Many will take off in a growth spurt, some just do not seem to grow despite the change in conditions.

12 Weeks to 14 Weeks
We continue feeding the frozen mysis. We also begin the converting them to 3 feedings per day. This is done by dropping a feeding per day each week.

14 Weeks to 17 Weeks
We begin separating the Males and Females. Depending upon the size of the brood, another 29 gallon tank may be employed as we reduce the stocking density to 1 - 2 per gallon..

By the 17th week we are ready to start shipping the seahorses to their new caretakers. After the 17th week, we maintain a stocking density of about 1 per gallon.

HELPFUL TIPS

These are some of our observations. While they may not work for everyone, they do work for us.

- Read everything you can find on breeding seahorses, but don't believe everything you read. Seahorse husbandry is still in its' infancy. An article just a few years old can be outdated irregardless of the author. However, you can pick up ideas and information. You will have to assemble the information and test it for yourself.

- If you can not devote full time attention to your fry, consider working with a small batch with a lower stocking density.

- A larger the volume of water used for the system, creates a more stable environment for the fry.

- If you are going to run a bio-filter consider not using greenwater. It can clog you filter and will increase the bio-load.

- Keep records of each batch. After a few batches it is very easy to forget and confuse data with different batches.

- Always have extra saltwater mixed, aged and ready to use. It will be easier on the fry if you have to do a sudden water change.

- If you are relying on water changes instead of bio-filtration, consider several smaller water changes instead of one big water change. There is less likelihood of shock this way.

- *H. Erectus* fry are benthic and hitch from birth. Make sure you provide adequate hitching material.

- Never mix the fry tank tools and materials between systems.

- Decapsulate your brine shrimp eggs. One round of hydroids can wipe out your fry.
- If you are having a tough time, seek support for morale. You may find it will take several attempts before you are successful.
- Always overlap when changing foods. Not all the fry will convert at the same time.
- If you are having a hard time switching to frozen mysis, try adding some enriched adult brine shrimp. This helps the fry get used to a larger food.
- With high stocking densities, watch your water parameters closely when changing to different foods, especially frozen foods.