Showfish

NOV 2005

NEWSLETTER OF THE COAST FISH CLUB VOLUME 14, ISSUE 11

What's Inside —

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Edited by Charlotte Marelius

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Items for publication in Showfish are due within one week after the monthly meeting and will be included as space and time permit within constraints of club bylaws. Articles received after the deadline will be used in the next newsletter as permitted.

Editorial Team: C. Marelius, Mike McCabe, and John Skocilic

November 6th Meeting — Mark Binkley Presentation: Native North American Fishes

Mark is an active member of the North American Native Fish Association, which deals with Canadian, American and Mexican fish. He runs a native fish fish store out of Thousand Oaks. Those who attended Findig last year may have heard him give one of his talks up there.

Mark plans to bring collecting equipment, such as seines, and books to sell; he may be able to bring a few native fish to sell as well. To see some of the fish and equipment he has for sale, see/contact Jonah's Aquarium, Thousand Oaks, CA 91359, Toll Free 877-417-4871, Phone 330-347-9275, website http://www.jonahsaquarium.com

MEETING WILL BE IN HARPER ROOM, 1 TO 5 P.M.

Unexpected changes to Board of Directors —

Our president, Art North, resigned from the club and the Board of Directors in October, citing only personal reasons. Brian Downing graciously moved up to assume the responsibility of president. Due to this change, we need to elect a new Vice-President; anyone interested in the position please contact Brian Downing at 858-759-4841.

THE DOWNING DRAINER, A DO-IT-YOURSELF PROJECT FOR YOUR FISHROOM — A Design for a Safety Siphon Auto-drainer

from Brian Downing

When Brian showed his safety siphon to the club in October, the first thing he said was "this siphon is not for use in living rooms". It is for fishrooms, where it won't matter if the floor gets soaking wet – a concrete floor with a drain would be a good example.

The siphon is built from half inch diameter PVC pipe (Brian used the ubiqitousSchedule 40, but as the pipes are not under pressure, lighter weight pipe can be used) with 90° elbow fittings, a Tee fitting, and endcaps. All the joints except for the endcaps are glued together with standard PVC pipe etchant and adhesive. The only tools needed are a pipe cutter and a drill with a small drill bit (1/16th – 1/8th inch diameter).

To use it, the entire assembly (except endcaps) must be submersed, either in the tank to be drained or in a tub or bucket, and filled with water. Once full, put the endcaps back on, hang the double pipe portion of the siphon inside on the side of the tank. Position your bucket underneath the long single drain pipe, and remove end caps; you decide if the inside or outside caps come off first. (cont sh 2)

The Downing Drainer — a safety siphon

Editor's comment: if intake and outflow pipes were threaded, the siphon could be used for widely varying depth tanks by switching between longer and shorter intakes and the outflow could be finished with a quick disconnect hose fitting and hooked to a garden hose.

MATERIALS:

PVC pipe, Schedule 40 or lighter, ½" or ¾" [inside] diameter, 5 to 6 ft

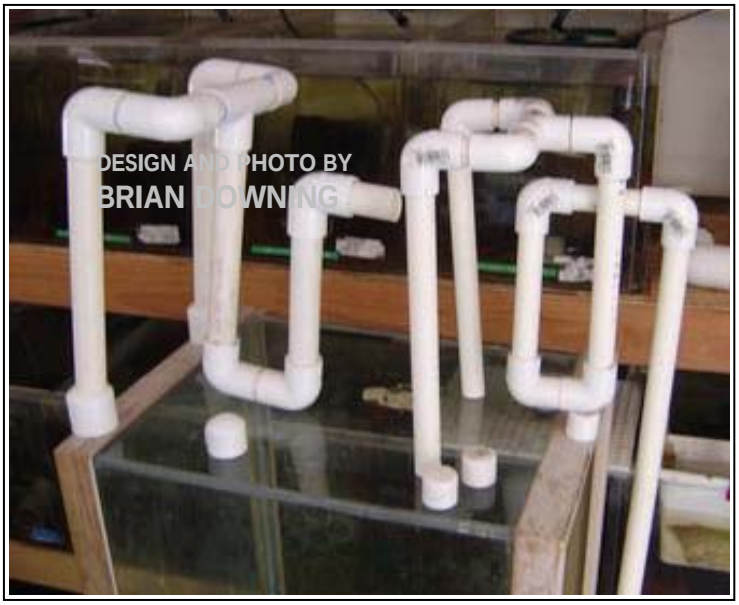
Cutting schedule:

2 pieces (pc) 10" long (or as long as you want the water to drain down to)
5 pc 2 1/8" long
1 pc 2 ¾" long
1 pc 4 3/4" long
1 pc 7" long
1 pc 9" long
1 pc 12" minimum long (short enough the whole assembly can be submersed in the tank, long enough to drain into bucket).
Note: Pipe slips into fitting a maximum of one inch.

Tee fitting, slip, 1 ea
Elbow fitting, 90° (corner), slip, 9 ea
End cap, slip, 3 ea
PVC pipe etchant and adhesive

TOOLS:

Pipe cutter
Drill motor
Drill bit, 1/16" to 1/8th inch diameter



(Illustrations shown on page 9)

Membership News —

New/Returning Members

The following people recently joined COAST – Welcome and Thanks!

Stan Sung

Renewals Received

The following people have renewed their memberships—Thank You!

John Skocilic

Member Renewals Due November

Please remember to renew your membership this month.

Sandy Binder
Vin Kutty
Alan Rosen

Member Renewals Due December

Kevin Bruner
Don Foltz
Kevin Joseph
Karen Peyser
Ed and Barbara Semanski
Jason and Jennifer Kucera

Showfish is not sent to people whose memberships have been expired more than one month.

Member Renewals Past Due

►Michael Booth
►Brian Downing
►Barbara Healy-Sprague Sept
►A J Sprague due September
►Paul, Virginia Engen
►Bryan Lampl
►Lawrence Leshinski
►Bonnie Lewis
►Mike and Elaine McCabe
►Joseph Shuryan
►Machiel and Kathy Van Dam

►This symbol means this is your last Showfish until you renew.

Renewing members, please fill in a fresh membership application and mail it to John Skocilic. Application and John's address are on the last sheet of the newsletter. **Membership number and due date are on the Showfish address label.**

Board of Directors

President:
Brian Downing 858-759-4841
brianjdowning@msn.com

Vice President
Open

Treasurer
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Email jskoc@yahoo.com

Recording Secretary
Ron Nash

Corresponding Secretary
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Email unknown
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Mike McCabe 562-888-1992
mccabeprint@yahoo.com

Positions Needing Warm Bodies
Refreshment Chair

COAST fish club meets the first Sunday of every month, in Costa Mesa from 1:00 p.m. to 5:00 p.m.

Costa Mesa Neighborhood Community Center, Victoria Room
1845 Park Avenue,
Costa Mesa, CA 92627

For map, see Orange County Thomas Bros Guide pg 888 Zone J3 or www.fishclub.freeservers.com

COAST MEETING DATES:
October 2, November 6, December 4, January TBD (8th??), February 5

Local Fish Store Reviews

By Christina Marvel

STRICTLY FISH in Lakewood area off the 605 and Carson Blvd (?) Small store with great selection and variety of freshwater fish and plants, healthy and well-kept. Prices reasonable. Dry goods selection a little limited, prices comparable with other local fish stores. During summer months, pond plants available. Small selection of koi and pond equipment.

The best part about this store is the customer service — everyone is very knowledgeable and helpful. Great sales every 3 months or so, if you give them your address to receive the adverts.

TONG'S in Fountain Valley (near 405 on Magnolia and Ellis (?)). LARGE store, extensive selection of fish, plants, and dry goods, including biggest selection of tanks and stands you'll ever see. There's practically nothing in the fish world they don't have. Lots of koi too, but very limited pond equipment selection. Prices on everything seem a little high. Condition of live goods can be iffy. Sometimes, everything's healthy, sometimes there seem to be a lot of sick/dead fish.

Sales staff is also spotty. There are a few people there who are very knowledgeable/ helpful. But there are also a few people there (especially the girls) who don't seem to know much about fish or take much care in catching/bagging them for you.

DISCOUNT TROPICAL FISH in La Habra on La Habra Blvd. and **PACIFIC REEF in Anaheim** on Lincoln Blvd. are also good. Neither has the wide selection of the two mentioned above, but are good for knowledge /customer service. They also have better prices on some things like tanks/stands.

PACIFIC REEF in Huntington Beach on Brookhurst Ave. is like an art gallery for saltwater fish and anemones/coral. Their drygoods and freshwater selection isn't very extensive, and I can't remember what their prices were like, but it's worth a visit just to look at the salt water stuff.

PETTOWN in Lakeforest is supposed to be very good. I've only been once, and found the selection of plants to be almost none, and the condition of fish to not be very good, but regular customers have said that PETTOWN is their favorite store. It seems to be especially popular for planted tank enthusiasts.

DRY GOODS —

As far as dry goods like filters and other equipment are concerned, most of the local fish stores above have pretty high prices. Petsmart and Petco's prices (if you can find the same item there) are usually better, and even better than these are the online stores like Big Al's, Petsolutions, and Drs. Foster & Smith (and eBay). ■■

OUR SPONSORS — Manufacturers Who Support Our Club

When making buying decisions, please assess these companies' products and remember the investment they make in the tropical fish hobby.

MARINELAND
FOR THE LIFE OF YOUR FISH
TROPICAL FISH HOBBYIST
The Leading Aquarium Magazine For Over Half a Century
Mardel Labs
TOP FIN
Dainichi CICHLID
DOC WELLFISH
AQUARIUM PHARMACEUTICALS, INC.
Hikari
Tetra
Kordon
EHEIM
Brine Shrimp DIRECT
PRODUCTS TO MAKE YOUR TANK THRIVE!
SAN FRANCISCO BAY BRAND
BARRON'S

Science Bit — Shipping practices in the Ornamental Fish Industry

by Brian Cole, M.S., Clyde S. Tamaru, Ph.D., Rich Bailey, B.S. Sea Grant Extension Service /Aquaculture Development Program School of Ocean and Earth Science and Technology; Christopher Brown, Ph.D. Hawaii Institute of Marine Biology; Harry Ako, Department of Environmental Biochemistry, College of Tropical Agriculture and Human Resources February 1999, CTSA Publication No. 131 (No © notice shown; Sea Grants are usually in public domain)

Shipping Additives

Over the last 15 years, several additives to shipping water have been developed or adapted to help reduce stress and increase survivability. They generally fall into three categories: sedatives water quality stabilizers, and antibiotics.

The most common sedatives are quinaldine or quinaldine sulfate, and Tricane methane sulfonate (MS-222), with commonly used concentrations listed in Table 1. Quinaldine is used 25 ppm in shipping water, MS-222 at 60 to 70 ppm with adjustments made for sensitive species. These compounds reduce the metabolic rate of fish, and can also prevent injury from jumping or swimming into the sides of the box.

Water quality stabilizers include pH buffers, zeolite at 20 gms/ liter (which removes ammonia), activated carbon also at 20 gms/liter, ice or heat packs to maintain temperature, and sodium chloride at 9.0 ppt.

Other products have become available from the bait minnow industry these usually contain a combination chelating agents, buffers, ammonia or chlorine removers and some form of antibiotic.

Caution should be used in the application of antibiotics. These compounds are subject to regulatory controls, which should be considered

(Cont sh 8)

Gratitude Payments —

John Skocilic picked up and brought in pizza for the club members. Pizza is a special treat. It costs about a dollar a slice (same as anyone else buying pizza), but it's so worth it.

Many thanks to Brian Downing for accepting the responsibility of presidency with no pleading or pressure whatsoever.

Kudos to Steve Ehrlich for VOLUNTEERING — I kid you not — to be Program Chair this year. His first effort brings us November's speaker.

Events elsewhere in the hobby —

Desert Fish Club, a brand new club in Palm Desert, meets the third Sunday of the month in a local aquarium store. For more information, call Wanda Jacobson at 760-328-8842.

San Diego Tropical Fish Society meets the second Sunday of the month. For more information talk to Brian Downing at one of our meetings. **SEE PAGE 6 FOR NOVEMBER AUCTION AND SHOW EVENTS** for SD TFS and San Diego Guppy Association

coastfishclub DISCUSSION GROUP ON YAHOO

COAST has a discussion group on Yahoo that is open to all (and only) COAST members. We announce meetings, talk about speakers and articles desired, ask for and give advice, post items for sale or want, post the membership roster, auction forms, and membership application/ renewal forms. **Brian Downing is the moderator; if you want to join, just tell him in an email to brianjdowning@msn.com** .
Here's the link to the group: http://groups.yahoo.com/group/coastfishclub/

Species Profile — Etheostoma blennioides **"Greenside Darter"**

Spawning and Raising the Greenside Darter, *Etheostoma blennioides* , with a Note on the Eggs of the Rainbow Darter, *E. caeruleum*

Bob Muller, 625 S. Altadena, Royal Oak MI 48067 Michiganfish@aol.com

From "*American Currents*, Publication of the North American Native Fishes Association," Volume 26, No. 2, Spring (May) 2000

Fig. 1. Greenside darter, *Etheostoma blennioides*. Photograph © William Roston.

Five years ago, I got back into keeping fish after a 15-year hiatus. I joined the Greater Detroit Aquarium Society and, with my one aquarium, sat back to enjoy the hobby. An old friend, knowing I used to keep native fishes, asked if I would give a talk for the club. I dusted off my 20-year-old slides and was severely disappointed. Living fish would be necessary for the talk, so out came the collecting gear. I returned to my old collecting sites and, luckily, time had been kind to them. In a short time, I had black stripe topminnows, hogsuckers, mottled sculpins, blacknose dace, and fantail, rainbow, and greenside darters (Fig. 1). The talk went well. Most of the fish were given away. Some came home with me. And that was the end of having only one aquarium.

The blackstripe topminnows and greenside darters went into a 20-gallon high aquarium. This seemed to work well— topminnows at the top, darters on the bottom, lots of empty space in between. I hadn't bred fish in years, so I decided to start with the topminnows. I placed a floating yarn mop in the tank and within a few days I was gathering eggs. Some of the eggs, however, were odd-looking with yellow centers.

They were darter eggs! The greensides had been fighting their way to the floating mops to spawn. The following spring, I decided to concentrate on spawning and raising the greenside darters. I collected more greensides as well as some rainbows from a tributary of the Clinton River, which flows though the northern suburbs of Detroit. The stream is 6-12 feet wide, and varies from six inches to three-feet deep. In the shallow areas, water flows over gravel and rocks, providing a great habitat for darters. When I returned home, I placed several rainbows and greensides into a 30-gallon tank equipped with an undergravel filter and a powerhead to provide current. I also added a number of rocks and pieces of wood to give the darters some hiding places. Since the tank is located in a basement room with an (continued page 7)

North American Native Fish Association Conservation Research Award Competition Announced

APPLICATIONS AVAILABLE AT: http://www.nanfa.org/education/conservation/conservationflyer.pdf

The following information was copied from NANFA's website, http://www.nanfa.org

"Hobbyists and researchers alike are concerned about the continued survival of our native fishes," Dr. Stallsmith said. "This program, however, lets all NANFA members play a part in actually doing something about it." Many of North America's roughly 1,060 fish species are either extinct or fighting for survival, Dr. Stallsmith said. Currently, 40 species and subspecies of American fishes are extinct. About 34 percent of remaining species are either endangered or threatened with extinction or at risk of becoming endangered or threatened by minor disturbances to their habitat. Even abundant species are in peril, because North America's fresh waters are among the most degraded habitats on earth. In fact, North America's freshwater fish and other freshwater animals are dying out at a rate five times faster than those on land.

"North America's temperate ecosystems are dying out as fast as those in tropical forests, yet few people are even aware of it," he said. Dr. Stallsmith explained that, with **the new research grant program**, all NANFA members, through their dues and other support for the club, **will further much needed research to conserve the continent's native fishes. In 2005, $1000 will be awarded to the most qualified applicant or applicants.** The award may also be divided among one or more individuals. "The beauty of this program is that even members not involved in conservation research can still support it," said Dr. Stallsmith. "Their contributions -- provided through their yearly dues -- will help fund some badly needed research."

Dr. Stallsmith explained that NANFA is a partnership between researchers, fisheries biologists, and aquarium hobbyists. For example, hobbyists often accompany professionals on collecting or surveying missions. NANFA member Peter Unmack, himself a doctoral candidate, often leads trips to remove harmful exotics from the habitats of endangered desert pupfish and springfish. NANFA's focus is on the fishes of Canada, the United States, and Mexico. Similarly, the group's quarterly journal, American Currents, features articles by both professionals and hobbyists.

"It's been a two way street," Dr. Stallsmith said. "Researchers have taken hobbyist observations from our journal and used them to refine breeding and research programs of their own. And our home aquarist members have also used research accounts to improve on their collecting, breeding, and fish keeping techniques." Dr. Stallsmith said that the NANFA conservation research award advances this tradition of cooperation between professionals and hobbyists.

Award recipients will be asked to describe their research findings in a non-technical article for American Currents, and are invited to present their findings at the NANFA Annual Convention. "My only regret is that we can't award an even greater amount," Dr. Stallsmith said. "Still, NANFA can make an important contribution to conserving our native fish species." To qualify for the award, applicants must submit to NANFA a proposal of two double-spaced pages, a budget and timeline for the research, a one-page resume, and a letter of recommendation from an academic professor, research advisor or someone familiar with the applicant's background and research history. Applicant must also be a member of NANFA and can opt to join when they submit their proposals. **The deadline for applying is January 20, 2005.**

The award decision will be announced by March 31, 2005. Questions about the award may be addressed to:

Dr. Bruce Stallsmith, Department of Biological Sciences, University of Alabama in Huntsville, Huntsville, AL 35899 256-824-6992. Contact Bruce Stallsmith, email fundulus@hotmail.com?subject=Research Grant Project
(Complete applications in MS Word format may be sent to above e-mail address.)

San Diego Tropical Fish Society Events

The San Diego Tropical Fish Society will hold its two biggest events of the year in November. We would like to extend a special invitation to members of the COAST Fish Club. Those events are:

- The **Annual Show November 5 and 6, 2005** will be open from 10:00 a.m. to 5:00 pm on Saturday and 10:00 a.m. to 4:00 pm on Sunday. There will be a wide variety of categories, and also a **special Show Guppies section sponsored by the San Diego Guppy Association**

- The **Annual Auction November 13, 2005** will be open at 5:00 p.m. for entry of items to be auctioned and selling will begin at 7:00 p.m. There will be a 75% seller and 25% SDTFS split of proceeds. You must join SDTFS as a member to be eligible to sell. Adult individual membership for one year is $12.

Both events will be held at our regular **meeting location: Room 101 Casa del Prado in San Diego's Balboa Park**. You can view a map from our web site, http://www.sandiegotropicalfish.com. For information phone (619) 281-FISH.■

(SPAWINING THE GREENSIDE DARTER, Continued from page 5)

uninsulated cement ceiling that was directly under my front porch, its temperature stayed around 45°F (7°C) for most of the winter. And since there are no windows in this room, I created a photoperiod with lights and a timer to match the conditions outside.

By early April, the light was on 12-1/2 hours a day and the temperature was 60°F (15.5°C). I removed the rainbows, leaving one male and two female greensides in the tank. I then added a weighted yarn mop and waited.

I wanted to watch the greensides spawn, but every time I approached the tank they detected my presence and stopped. Even at 10 feet away in a dark room with only the tank light on, the darters would stop to watch me watching them. I finally resorted to sitting in the dark 20 feet away watching through a pair of binoculars! (At this point, my wife came gave me some very strange looks.) I saw the female and male chase each other around the tank. Then the female would perch on top of the mop. As the male approached, she would burrow into the mop at the knotted end. The male soon followed and in a few seconds they would be back to chasing each other again.

Since I enjoy watching eggs develop, I always harvest them. After several days, I checked the mop and found 207 eggs. Amazing! The following table lists the dates and quantities of eggs gathered:

Egg Counts in Spawning Rainbow Darters

As some additional information for darter enthusiasts, I am including my records on rainbow darter eggs. I placed six females and one male into a bare 30-gallon tank. I then added a 4" x 18" x 2" container filled with standard aquarium gravel. I regularly worked though the gravel and removed clusters of eggs and gravel that were stuck together. I then carefully separated the eggs from the gravel and placed the eggs in glass bowls until they hatched. I kept track of the amount of eggs gathered each day. For a 5-day period during the spawning, I also counted the number of eggs in each cluster from each spawning act. The following table lists my results.

DATE	NUMBER
April 12	207
April 15	65
April 16	46
April 19	14
April 20	23
April 21	52
April 29	31
April 30	5
May 4	9
May 5	9
May 14	5
Total	**466**

DATE	EGGS	PER CLUSTER
April 12	98	—
April 14	89	—
April 16	93	6, 6, 8, 9, 10, 10, 14, 14, 16
April 19	35	—
April 21	113	5, 6, 7, 7, 8, 9, 11, 15, 18, 27
April 23	80	8, 8, 9, 10, 12, 14, 19
April 26	73	7, 10, 12, 14, 14, 16
April 28	117	5, 10, 12, 13, 13, 13, 15, 17, 19
May 3	132	—
May 5	5	—
May 8	41	—
May 12	53	—
May 14	45	—
Total	**974**	

(Continued page 8)

DAY	OBSERVATION
2	Tubular body forming
4	Head and eyes visible
5	Tail movement
7	Pupils formed on the eyes
8	Beating heart seen
10	Small amount of pigment on the tail

I placed the eggs into small glass bowls with a few drops of MarOxy to help prevent fungus. I covered each bowl with plastic wrap and wrote the date on each bowl. The following lists my observations on their development:

The fry are pelagic, totally transparent, and too small to eat brine shrimp nauplii. At first, I tried a commercial fry food from the local aquarium shop. It had a tendency to foul the water, causing all the fry to die in a matter of days. I then tried APR (artificial protozoa and rotifers) from Wet Thumb Aquatics and that worked. After about five days of eating APR, the fry were big enough to eat the nauplii. This has an added benefit in that the nauplii in fry guts make the fry easier to see.

When the fry were two weeks old they would occasionally go to the bottom of the tank and act like adults. I also found that when I was away and missed even a day's feeding, the fry would die. Greenside darter fry are very delicate and even the slightest change in feeding or water quality causes mortality.

By the time the fry were 10-15 mm long, I had no more trouble with die-offs. (In contrast, rainbow darter fry I was raising at the same time were very hardy and showed no noticeable mortality.)

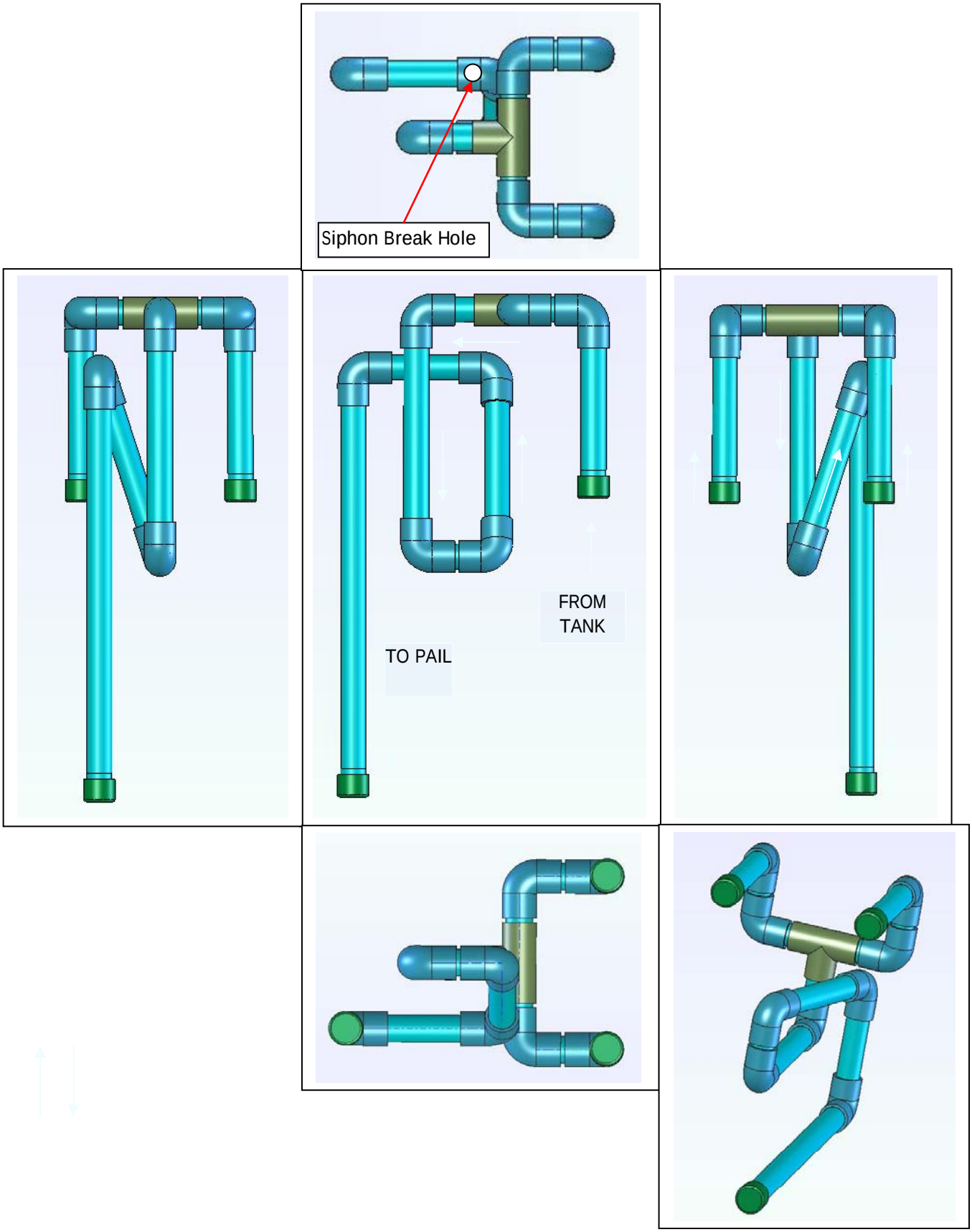
This greenside darter spawning occurred in the spring of 1998. At one year of age they were 25-35 mm long. I did not attempt to spawn them at that size. As of January 2000, they are 50-65 mm long. I plan to spawn them this spring.

Addenda: Using the accelerated photo period method described by Clifford Zoller in *American Currents* (Fall 1998 and Fall 1999), my F-1 rainbow darters started spawning February 10, 2000, which is about six weeks earlier than normal. I've also since learned that a finer aquarium gravel (2-3 mm) makes it easier for the eggs to form clusters. When I used a coarser grade gravel (4-5 mm), it was almost impossible to find the eggs in the gravel. ■■

(SHIPPING PRACTICES IN THE ORNAMENTAL FISH INDUSTRY cont)

carefully before any applications. One of the most widely used antibiotics for shipping and treatment of fish has been tetracycline at 5-20 ppm. This antibiotic has been used extensively, especially from fish shipped out of Asia. There are several indications that some bacteria have developed an immunity to tetracycline due to its wide use, which is one of the reasons that we do not recommend its use (J. Brock, DVM, personal communication). Other antibiotics commonly used in shipping are furnace at 0.05-0.2 ppm, and neutral acriflavine at 3-10 ppm. Other antibiotics such as kanamycin and phenicol are used much less frequently and are primarily used as on-farm treatments for disease. The different sulfa base drugs are currently being used due to bacterial resistance to other forms of antibiotics historically used in the industry.

To demonstrate the effect of density on total ammonia concentration during transport, tiger barbs were used as test animals packed in three liters of water and inflated with pure oxygen. Samples of the water were taken at zero, 24, 48 and 72 hours and tested for total ammonia nitrogen by the Hach calorimetric method. Any readings of 3.0 parts per million (ppm) are assumed to be 3.0 ppm and above, (all tests except those that were less than 3.0 ppm were significantly off scale), since this is the upper limit of accurate readings by this test method. Fish were 1.25 inches long and were packed either starved for 48 hours or fed normally prior to packing. For each of the starved and fed treatments, there were either no additives placed in the shipping water, zeolite added at 20 grams per liter, or MS 222 at 20 milligrams per liter added to the shipping water. Figures 1 and 2 show the increase in total ammonia nitrogen concentration over a 72 hour period for fish packed at two different densities with various treatments. Zeolite was the only additive that had a significant effect on ammonia concentrations. (Cont sh 10)


Siphon Break Hole
FROM TANK
TO PAIL

(SHIPPING PRACTICES IN THE ORNAMENTAL FISH INDUSTRY cont)

Ammonia climbs to 1.5 ppm in the first 24 hours then levels out for the next 24 hours as the zeolite binds with the ammonia. From hour 48 to hour 72 the ammonia starts to climb again as the saturation point of the zeolite is reached. In the bag where the fish were fed prior to bagging and the sedative MS 222 was added, there was a fifty percent mortality by hour 48 and a I00 percent mortality by hour 72. Figure 2 shows a similar pattern to Figure 1 with all treatments, but with fish at a higher packing density. Fish were packed at 200 fish in three liters with all other treatments the same as in Figure 1. The zeolite treatment is the only treatment that had a significant impact on total ammonia nitrogen. Zeolite is commonly used in bags that have been overpacked or in shipments of fish that produce large quantities of ammonia, such as *Corydoras* spp. and *Carassius auratus*. This adds a negligible cost to each bag and may substantially reduce the risk of mortality- check with local suppliers for current pricing. The treatment that was fed normally with the addition of MS 222 resulted in a 50 percent mortality by hour 48 and a 100 percent mortality rate by hour 72. Survival was 100% in other treatments. These results suggest that a combination of MS-222 and feeding should be avoided, and that zeolite may be a cost-effective shipping additive.

Receiving Fish

Most farms that ship fish will also be receiving fish, either to resell or to add to their broodstock line. Appropriate care and handling of incoming shipments of fish is another critical function to a successful farm or transship operation.

Arriving shipments should be inspected immediately, particularly those that have been shipped over long distances or those which have been subject to delays. Fish that are densely packed in bags that have taken longer than expected to arrive may be suffering from exposure to accumulations of ammonia, thermal shock, or other problems. A quick assessment of the condition of the arriving fish can limit losses in such cases.

In order to implement a successful receiving program you must first have a working knowledge of what changes are taking place, chemically and physically, inside the shipping bag during the transport period. Once a bag has water, fish and oxygen sealed inside it, certain chemical changes take place due to the metabolism of the fish. When fish breathe, they absorb oxygen and excrete other gases and metabolites, primarily carbon dioxide (CO_2) and nitrogen in the form of ammonia. Total ammonia nitrogen for the purposes of this manual, consists of two forms of nitrogen that exist in a pH and temperature dependent equilibrium of unionized ammonia (NH_3) and the ammonium ion (NH_4). The un-ionized form (NH_3) is toxic to fish while the ammonium ion (NH_4) is not toxic to fish (Boyd, 1979). The proportion of NH_4 (non toxic) to NH_3 (toxic) increases with decreasing pH and decreases with increasing pH (Boyd 1979). The percentage of NH_3 also rises with increasing temperatures - so conditions with both relatively high pH and elevated temperature are especially dangerous. Since NH_3 cannot be measured directly, several tables have been created based on an equilibrium formula that predict the relative percentages of unionized ammonia at different temperatures and pH. Table 2 was created for the aquaculture industry and reproduced from Boyd 1979.

Generally when a bag of fish reaches its final destination it has been in transit for 24 to 48 hours. During this period of time there has been enough carbon dioxide produced to reduce the pH of the water down to 6.5 - 7.0. As you can see from Table 2, using a temperature of 24°C and a pH of 7.0, the toxic fraction is only 0.52 percent. If the total ammonia nitrogen reading is 10.0 parts per million (ppm) then the toxic fraction is only 0.052 ppm. (0.0052 x 10.0 = 0.052 ppm). This amount of toxic ammonia (NH3) is well within the tolerable limits for long term exposure to most species without doing any serious physiological damage to the fish (Post, 1987). However, if the pH in that same bag of fish is 10.0 and the temperature is 24°C the un-ionized toxic fraction of ammonia from Table 2 is 84.0 percent, or 8.4 ppm (0.84 x 10.0 = 8.4 ppm). At this level severe stress, physiological damage and even death may occur at exposure times as short as 30 minutes or less (Post, 1987).

It is critically important when receiving fish to be aware of the temperature and pH differences between the water in the shipping bag and the receiving water. The recommended method for acclimating fish is to float the sealed bag in the tank or pond that is to receive them for a period of at least five minutes per degree of temperature difference or until the temperature of the bag is within two degrees of the receiving water. The bag should be kept out of direct sunlight to avoid photic shock to the fish and elevated water temperatures in the bag from a greenhouse effect. At this point in the receiving procedure un-iodized salt may be added to reduce stress. Fish should also be inspected under the microscope for any parasites or disease and the proper treatment applied. When the bag is unsealed, the fish can be dipped out and placed directly into the receiving water. Generally, water in shipping bags is discarded rather than introduced into the culture system as a means of limiting possible introductions of pathogens, anesthetics, etc.

If the bag is unsealed prior to this, the CO2 in the shipping water will dissipate into the atmosphere and the pH of

the shipping water in the bag will begin to increase rapidly along with the toxic fraction of ammonia, potentially causing severe stress or death. Adding water to an unsealed bag may only increase stress if the water being added has a high pH and temperature. If your water naturally has a low pH and you do choose to add water to the bag, remove an amount equal to what you would replace for acclimation. This will at least reduce the total amount of nitrogen present in the shipping water.

Summary and Conclusions

Even the most effectively run ornamental fish production operation is likely to fail if insufficient attention is paid to fish packing and shipping procedures. To some extent, this can be summarized as a matter of minimizing risks at every step of the packing and transport process, without going to the costly excess of shipping underpacked bags. Packing methods should take into account the species being shipped and the expected time in transit. Concentrating sales in easily reached destinations, and adherence to established packing methods, materials, and densities described in this manual will contribute to the consistent delivery offish in excellent condition. We recommend the use of an effectively designed packing room, with harvests prepared appropriately in anticipation of shipping deadlines.

TABLE 1. COMMON SHIPPING ADDITIVES AND CONCENTRATIONS (Adapted from Herwig 1979)

CHEMICAL	CONCENTRATION
Quinaldine	25 ppm
Tricaine methane sulfonate (MS-222)	60 — 70 ppm
Buffer, pH	per label instructions
Zeolite	20 grams / liter
Activated carbon	20 grams / liter
Salt (NaCl)	9.0 ppt
Commercial mixtures	per label instructions
Furanace	0.05 — 0.2 ppm
Neutral Acriflavine	3 — 10 ppm

ppm=parts per million; ppt=parts per trillion

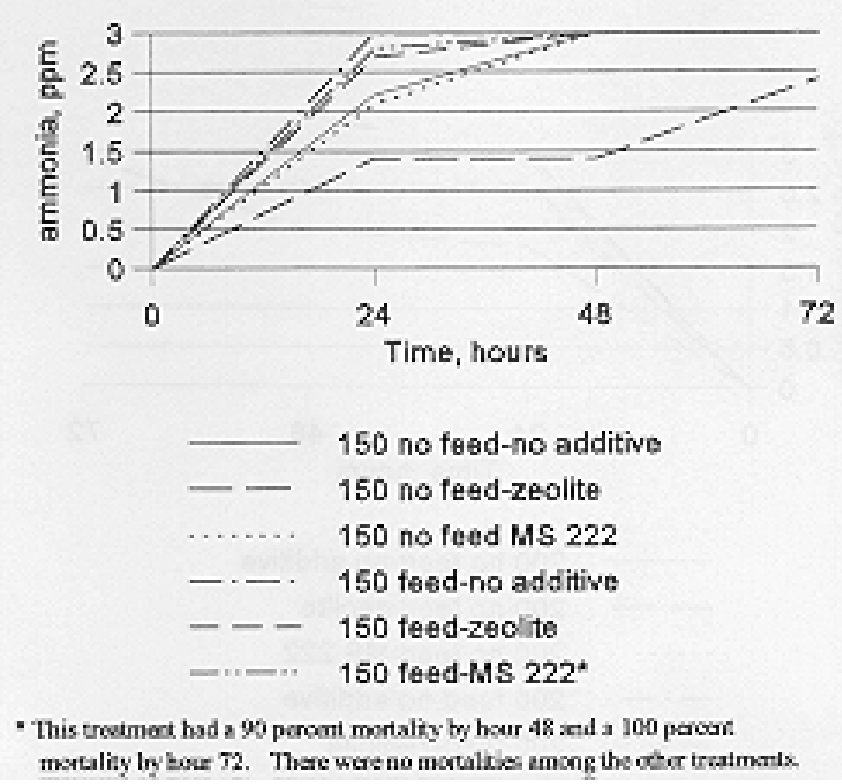


FIGURE 1 — Ammonia concentrations over time for fish packed with various additives.

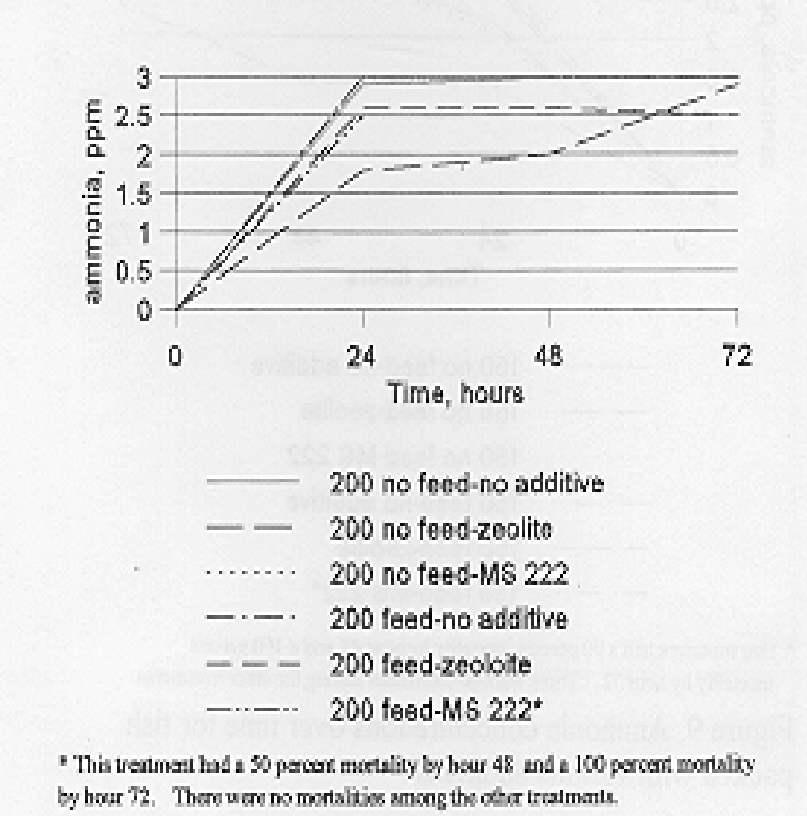


FIGURE 2. Changes in total ammonia nitrogen concentrations in bags packed for a 48 hour transit time.

TABLE 2. PERCENTAGE OF UN-IONIZED AMMONIA IN SOLUTION AT DIFFERENT pH VALUES AND TEMPERATURES. (REPR FROM BOYD 1979).

	TEMPERATURE								
pH	**16°C**	**18°C**	**20°C**	**22°C**	**24°C**	**26°C**	**28°C**	**30°C**	**32°C**
7.0	0.30	0.34	0-40	0.46	0.52	0.60	0.70	0.81	0.95
7.2	0.47	0.54	0.63	0.72	0.82	0.95	1.10	1.27	1.50
7.4	0.74	0.86	0.99	1.14	1.30	1.50	1.73	2.00	2.36
7.6	1.17	1.35	1.56	1.79	2.05	2.35	2.72	3.13	3.69
7.8	1.84	2.12	2.45	2.80	3.21	3.68	4.24	4.88	5.72
8.0	2.88	3.32	3.83	4-37	4.99	5.71	6.55	7.52	8.77
8.2	4.49	5.16	5.94	6.76	7.68	8.75	10.00	11.41	13.22
8.4	6.93	7.94	9.09	10.30	11.65	13.20	14.98	16.96	19.46
8.6	10.56	12.03	13.68	15.40	17.28	19.42	21.83	24.45	27.68
8.8	15.76	17.82	20.08	22.38	24.88	27.64	30.68	33.90	37.76
9.0	22.87	25.57	28.47	31.37	34.42	37.71	41.23	44.84	49.02
9.2	31.97	35.25	38.69	42.01	45.41	48.96	52.65	56.30	60.38
9.4	42.68	46.32	50.00	53.45	56.86	60.33	63.79	67.12	70.72
9.6	54.14	57.77	61.31	64.54	67.63	70.67	73.63	76.39	79.29
9.8	65.17	68.43	71.53	74.25	76.81	79.25	81.57	83.68	85.85
10.0	74.78	77.46	79.92	82.05	84.00	85.82	87.52	89.05	90.58
10.2	82.45	84.48	86.32	87.87	89.27	90.56	91.75	92.80	93.84