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Aquaculture In The Mid Atlantic/USTFA Joint Meeting

Don Webster, Eastern Shore Area Agent

"Aquaculture In The Mid Atlantic" (AMA), the largest continuing aquaculture education program in the region, will join with the United States Trout Farmers Association (USTFA) this fall for a joint convention and trade show. It promises to be an excellent program and you should make plans now for attending.

The program will be held on September 26-28, 1996 at Chateau Camelback in the Pocono region of Pennsylvania. Educational programs will be held along with social events and the trade show. Workshop topics will include subjects for cold water fish production, water quality management, fish health and many other useful topics for current and prospective fish farmers.

The 1996 program marks a change for Aquaculture In The Mid Atlantic, which conducted its 1995 program with Aquaculture Expo at a major national program in Washington, D.C. AMA now intends to move its meetings from spring to fall at the request of industry. The program will also change to developing more focused topics at meetings, rather than the broad range aquaculture programs that have been held in the past.

Put the dates on your calendar now and start planning for this event. Further information will be available in this newsletter as the program develops.

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Pond Management Program

by Don Webster, Eastern Shore Area Agent

Are you thinking of putting in a new pond? Do you have one that needs management? Do you have problems with aquatic weeds during the summer? Would you like to have a pond with a good population of fish to catch? These will be some of the topics discussed in at the Rising Sun Library

in Cecil County on May 1, 1996 at a Pond Management Program sponsored by the University of Maryland Cooperative Extension Service.

Don Webster and Reggie Harrell of the Sea Grant Extension Program will join host Dave Wilson in an evening program designed to help you plan and manage your ponds for maximum enjoyment. The program will start at 7 pm and conclude by 10 pm. It is free and open to all citizens regardless of race, color, national origin, sex, religion, or handicap, but a call to the Cecil County Extension Office at 410-996-5280 will be appreciated so that we can have enough program material for everyone to take home.

Ponds can be used for many purposes and can be a source of great enjoyment. But they can just as easily become major annoyances for their owners. Each year the Extension Service receives many calls from pond owners who have had fish die or had their ponds taken over by unsightly weeds because of poor planning or management. Taking preventative steps now can keep you from having to deal with these problems later.

We will be discussing some of the design considerations for new ponds and ways to fix problems in older ones. Water quality management topics will be presented along with some ways that you can ensure that your pond will be healthy and productive for many years to come. Since fishing is one of the primary uses of many ponds, we'll go over stocking programs recommended in this area to produce healthy populations of fish. And, because aquatic plants can quickly get out of hand and become a source of trouble, we'll be showing you some of the most common plants and talking about methods to control them so that you can enjoy a trouble free season with your pond this year.

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Bohn Becomes NAA/USTFA Executive Director

by Don Webster, Eastern Shore Area Agent

He began his career picking oysters on the tidal flats of the Pacific Northwest --certainly one of the most humble forms of learning a job "from the ground up". He recently left the University of Maryland to take a position as Executive Director of the National Aquaculture Association and the United States Trout Farmers Association. In between, Rich Bohn learned a lot about aquaculture. And he passed that knowledge on to many others.

Rich came to Maryland eight years ago to serve as the Area Agent in Southern Maryland. He had previously been at the Virginia Institute of Marine Science operating their oyster hatchery. Before that, he had been employed by a commercial oyster producer in the state of Washington. Rich was a graduate of the University of Washington where he joined that long list known generically as "another one 'a Ken Chew's students".

Eight years ago aquaculture offered a lot of development potential in Maryland. The Maryland Sea Grant Extension Program had decided to move an area agent position to St. Mary's County and staff it with someone who knew how to raise shellfish as well as finfish. After an extensive search, Rich was hired and brought a lot of expertise to our region. He worked with farmers to develop cooperative demonstration projects and became involved in 4-H projects and community events designed to help spur production and create demand for locally produced aquaculture products.

Rich enthusiastically supported state and regional programs in aquaculture such as Aquaculture In The Mid Atlantic, our annual conference providing educational seminars and a trade show for the industry. He served as Chairman of the conference when it was held in Annapolis in 1992 and thereafter became a member of the Board of Directors. He continued to work on the program so that it would continue as one of the best in the country. Due to his continuing support, the 1996 conference will be held jointly with the US Trout Farmers Association (see article in this issue), allowing us to continue working together on yet another project. Other regional activities included appointment to the Technical Committee of the Northeastern Regional Aquaculture Center (NRAC).

For several years Rich became involved in the development of fish health policy in the state and region. In this "hot button" area he worked closely with industry and agencies in trying to see that regulations and procedures were developed that would help the aquaculture industry protect itself while being realistic. His connections to agriculture brought an appreciation of the policies developed for other animal livestock and the belief that these could be expanded to include

aquaculture with maximum effect and minimal difficulty.

We worked closely during his years here. I always looked forward to speaking with him, as I did frequently, and we planned and conducted many programs during that time. From pond management to aquatic weed control to crab shedding to cage aquaculture, we enjoyed teaching people and making new friends from those who came to the programs. Perhaps that's one of the best rewards about a career in extension. That interest in people will serve Rich well in his new job. While we will miss his expertise, we wish him well in his new position and look forward to helping support the efforts of the organizations he will be working for in developing the aquaculture industry.

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In Service Training For Teachers

Aquaculture has found a ready home in many school systems where it is used to teach biology, water chemistry, production, and other topics. The National Council for Agricultural Education has been a leader in developing curricula and providing training for teachers through Regional Aquaculture Learning Centers. They have announced teacher in-service programs for 1996 for agriscience teachers interested in infusing aquaculture education into their vocational agriculture curriculum. Other secondary and post-secondary teachers, educators, and extension personnel are also welcome to attend.

Sessions are hands-on and focus on aquaculture education techniques using instructional materials developed by the Council in partnership with USDA. The formal training program for the Mid Atlantic will be held in Pennsylvania on May 9 and 10 with three or more Introductory Workshops to be announced for later dates. For more information on these programs, contact a member of the Sea Grant Extension Program.

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Successes And Failures In Commercial Recirculating Aquaculture

Virginia Tech's outreach programs are a class act. Now they, in conjunction with USDA, the [National Sea Grant College Program](#), and others will be holding a three day conference in Roanoke on July 19-21 on recirculation aquaculture systems. It promises to be one of the best that has been seen on the subject. If you're interested in controlled production, this should be a program you will want to attend. The wide ranging topics will feature experts with practical experience in commercial scale recirculating aquaculture systems. It will be designed to educate producers as well as many others who have an interest in the application and success of these production systems.

Individual sessions will include fish health and welfare, business plans and management, food safety and quality, system design and management, waste and byproduct recovery, and the application of these systems for shellfish as well as finfish. Tours will include commercial and research facilities.

For registration and lodging information on the conference contact a member of the [Maryland Sea Grant Extension Program](#).

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New Invaders From Ballast Water

Rich Bohn, Southern Maryland Area Agent

Aquaculture is often considered to play a major role in the movement of non-native aquatic species. As fish and shellfish are moved for restocking or grow out, transport water may contain unidentified passengers. However, [Maryland Sea Grant research](#) may have identified another, less recognized transport mechanism by examining ballast water in ocean going vessels. And the

success of the transplants may be far greater than has been previously suspected.

Researchers at the Smithsonian Environmental Research Center have been examining the ballast water from ships landing in Norfolk, Virginia and Baltimore, Maryland. These are primarily bulk tankers which carry the largest volumes of ballast. While over half of the ships were from the Northeastern Atlantic and Mediterranean, a wide variety of other originating ports were identified. Interestingly, most of the ships appear to arrive with ballast water of high temperature and salinity. Less than 20% of the ships ballast had salinities below 15 parts per thousand or temperatures below 15 degrees C. (59 degrees F.)

Using 80 micron mesh nets, over 90% of the ballasts were found to contain live organisms. Barnacles, bivalve molluscs, copepods, diatoms, dinoflagellates, and polychaete worms were found on over 40% of the ships sampled. Nearly 100 of the over 150 organisms found have been identified by species. Small live plankton have been identified in about 90% of the ballasts checked using whole water samples, and sediment samples from the ballasts have shown plankton cysts and/or vegetative cells in about 70% of the ships sampled.

Are the organisms viable, or simple present? Over 190 cultures of species have been successfully started from the ballast of 36 ships. Current testing examines survival in differing salinities and temperatures, with early indications that invasive success depends on the quality of the receiving water. Discharging the ballast from the ship is also being examined to determine the effect upon potential survival.

Settlement plates placed in both Norfolk and Baltimore harbors to look for invaders have resulted in at least three new species descriptions for Chesapeake Bay, all only from organisms known from sites at least one thousand miles away. All three were identified from Norfolk harbor. Samples from 1995 are still being examined, but it seems likely that further study will only increase the number of invaders identified. By understanding the circumstances of successful transport, it is hoped that economical and safe methods of removing non-native species from ballast water can be achieved.

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FEATURE: Pond Management In Maryland

Reginal M. Harrell, Finfish Aquaculture Specialist

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Part I: Species Considerations and Pond Stocking

Recreational fishing has long been a favorite pastime in North America, and the nation's farm and recreational fishing pond program has contributed to the continued interest and success in this outdoor recreation sport. According to the 1991 national hunting and fishing survey conducted by the U.S. Fish and Wildlife Service and the Department of Commerce, 35.6 million U.S. residents over the age of 16 spent over 511 million days fishing in 1991. These trips related to \$24 billion dollars spent of fishing and fishing related expenses. The survey covered the nation's lakes, rivers, streams, and oceans, but a large percentage of those hours were spent relaxing on the banks of a farm pond.

Not only do small private or public ponds provide hours of stress reducing fishing enjoyment in our hectic lives, but ponds have many other hidden treasures just waiting to be found. For instance, a pond is a natural ecosystem with complex interactions between plants, animals, nutrients, and

man. Much of our current knowledge of aquatic ecology has its roots in understanding the intricacies of and interactions of small lakes and ponds.

You don't have to fish to enjoy the pleasures a pond offers. Take your children and spend some quality time together by sitting quietly on the banks and enjoying what nature has to offer. Observation is a powerful educational tool. Allan Eckett uses a small lake on the Illinois-Wisconsin border to exemplify the complexities of nature insightful book in his book *Wild Season* (Bantam Books, Inc.) when he notes that, "...there is a purpose to all things and among all creatures: there is a purpose in being born and in living; there is a purpose in reproducing and in the raising of young; there is purpose even in death, for while death among wild creatures in nature may be harsh and unexpected, it is, unlike death in man, rarely tragic, rarely needless and never wasteful."

Maryland has well over 13,000 farm ponds, and most have potential to be managed for hours of enjoyable fishing. Others may be suited for wildlife and waterfowl management, for production of fish for sale, or for irrigation or fire safety purposes. All have a small, but collectively significant, role in conservation of Maryland's natural resources, whether helping to prevent silt and agricultural or urban nutrient runoff from entering the Bay, providing sanctuary for migrating waterfowl, or helping to recharge aquifers. They also offer a unique perspective of nature. If you are fortunate enough to have a pond, enjoy the beauties and pleasures it offers, and appreciate the value and role these small ecosystems play in protecting our resources.

We will assume you already have a pond and won't go into details about construction. We also assume you want to manage your pond for recreational fishing. If you do not have a pond on your property and are considering constructing one, or if you are not interested in fishing but want to know more about it's ecology, contact Maryland's Department of Natural Resources (DNR), your local County Extension Service Office, the Maryland Sea Grant Extension Service, or the Natural Resources Conservation Service.

Stocking

Before you stock your pond with fish there are a few items to improve your success. Proper management requires that you follow basic principles to maximize harvestable fish. Following these guidelines doesn't mean that catch all you desire every time, but will improve the quality of your fishing and the frequency of success.

Successful management involves using a combination the right species of fish, proper stocking rate, and maintaining a controlled harvest to produce the correct balance of predators (for example, largemouth bass) to prey (for example, bluegill). Maintaining a balanced population should provide you with long and enjoyable hours of fishing. Often, productive fishing versus unproductive depends upon the pond owners willingness to carry out the recommended procedures and management practices.

Pre-stocking Procedures

One of the hardest things pond owners have to do reclaim their pond. Reclamation requires eliminating existing fish so you can start at the beginning. If you stock fish on top of an existing population, you will fail because it's difficult to achieve the right predator-prey balance.

Pond reclamation can be achieved through the use of a fish toxicant, most often rotenone. The chemical enters the fish's bloodstream through the gills and interferes with the respiratory system by inhibiting oxygen transport in the red blood cells. The fish then suffocate. Rotenone is quite effective in eliminating all the fish in a pond. It is widely available, relatively inexpensive, and is most effective if applied in warm weather such as August or early September. It also detoxifies more rapidly in warm water.

Before you begin **always remember to have the proper permits** or have a certified pesticide applicator make the application. Fish toxicants are considered a pesticide and you must have the permits before you treat a pond. Contact your County Extension Service office, the DNR, or the Department of Agriculture for the latest procedure and permit requirements.

While there are many different strategies for recreational fishing pond management, the best technique involves starting in late summer or the fall of the year by stocking your prey population (bluegill) and in the following spring stocking your predator population (largemouth bass). The bluegill can be fished in the first summer after stocking but the largemouth bass should not be fished until the second year.

By reclaiming the pond in late summer it will provide plenty of time for the pond to be refilled by the fall and be ready to receive your bluegill for stocking. If you need to reclaim a pond at another time of year, it is best to apply the rotenone at least three weeks before you plan to stock your fish to allow time for the chemical to detoxify.

The pond can be prepared by drawing the water down as low as possible. This serves the purpose of concentrating the fish and providing a much lower volume of water that is to be treated thereby lowering costs by reducing the total amount of toxicant you have to use. Lowering the water also helps ensure a total kill and it helps prevent treated water from escaping downstream. Make sure all drains are closed and that there are no leaks. You do not want rotenone treated water to move downstream and cause a fish kill as you may be legally and financially responsible for fish killed beyond the pond.

Rotenone is applied at a rate of one to three parts per million or milligrams per liter of water. Three parts per million is approximately one gallon of 5% liquid rotenone, or 8.1 pounds of 5% emulsifiable powdered rotenone, per acre foot (one surface acre of water with an average depth of one foot). As an example, consider that your pond is initially five acres in size and averages ten feet deep, or 50 acre feet. However if you draw the pond down to one acre with an average depth of two feet you reduce the volume to two acre feet. By drawing the pond down instead of needing 50 gallons of rotenone (or 405 pounds) to treat the full pond at a rate of three parts per million you now only need two gallons or 16.2 pounds.

If the pond is fed by a stream that originates on your property you need to treat the entire stream. If the stream originates somewhere other than on your property consult Maryland's DNR about your options. In either case, to be on the safe side, it would be wise to consult the DNR. You can treat the stream at a rate of one quart or one and one-half pounds of powdered rotenone for every 300 linear feet of stream. Remember to have the pond drawn down so there is no overflow of the rotenone downstream of the pond.

As mentioned, it is best to apply the rotenone when the water temperatures are warm (above 70 degrees F). At these temperatures rotenone should detoxify within seven days. It takes longer to detoxify in cooler water. For instance, at 60 degrees F detoxification will take about two weeks, and at 50 degrees F it will take almost a month. To protect your investment in new fish it is wise to place a small cage in the pond and put a few bluegill or minnows in the cage for 24 or more hours to determine if the rotenone has detoxified. If, after 24 hours, the fish are still alive, it is ready to stock. The water should also not be used for livestock watering during this time.

Liquid rotenone is best applied by a sprayer or by pouring a diluted solution in the prop-wash of an outboard motor. In deeper ponds you may have to use a pump and a perforated hose to get the chemical down toward the bottom. The powdered form is cheaper than the liquid and can be mixed with water to form a slurry and then sprayed in the pond. In ponds with heavy vegetation or those exceptionally deep, the powder can be mixed with sand in a 1:3 ratio and a small amount of gelatin to form a paste, which can then be applied to the area of concern. Be careful not to disturb much of the pond bottom when applying the chemical as organic matter decreases the effectiveness of the toxicant. Most important however, when applying any herbicide or pesticide **READ AND FOLLOW THE LABEL AND WEAR THE APPROPRIATE PROTECTIVE CLOTHING!**

Most fish will die within 24 hours after treatment and will come to the surface, although you may continue to find fish for several days, especially if the water is cool. The Food and Drug Administration has not approved the use of rotenone for human consumption so all the fish should be netted and buried. Applying quick lime over the top of the buried fish will control odor and the fish will decompose quicker.

Selecting the Proper Fish

Many fishermen like a variety of fish to catch and often will put many kinds of fish in a pond assuming they will reproduce and become established. While this can happen often it is not to the point that the pond owner had hoped and the fish become stunted (grow very slowly and do not reach harvestable size). They can also compete with more desirable species, or cause disease problems. Because wild fish or certain combinations of species are not suited for recreational fishing ponds due to the imbalances of the predator-prey ratios, it is recommended that only certain species of fish be stocked in recreational fishing ponds. These include largemouth bass, bream (bluegill, redear, or hybrid sunfish) and, if desired, channel catfish. Considerable research has been conducted over the last 50 years and the proper combinations of these species have been established and proven successful over most of the United States. In Maryland only largemouth bass, bluegill, and catfish are approved for stocking without special permission. If you

want to stock redear, hybrid sunfish, or hybrid striped bass, you will have to get approval from Maryland's DNR. Also on the approved list are the forage (prey) species fathead minnows and golden shiners, but these are not generally recommended.

For the best chance of having a well balanced pond, you need to stock an appropriate ratio of largemouth bass, bluegill (and redear or hybrid sunfish alone if you like variety), and channel catfish. The stocking rate will be dependent on how much effort you are going to put into managing and fishing your pond. Small ponds (less than one acre) are difficult to manage for bass and bream fishing. As a general rule of thumb however you stock the pond in a ratio of bream to bass of 10:1.

If you are not going to aggressively manage and fish your pond you should stock with 350 bluegill, 150 redear, and 50 largemouth bass per surface acre. Depth is not important in these recommendations because most natural food is produced in the upper few feet of a pond. You can also stock 50 channel catfish fingerlings. The bluegill and redear sunfish should be one to two inches long and are normally stocked in late summer or the fall of the year. The largemouth bass should be two to four inches and are stocked in the summer following bream stocking. Channel catfish are stocked at two to four inches and are stocked in the fall along with the bluegill or eight to 10 inches if they are stocked in a pond with adult largemouth bass to prevent the bass from eating them. Hybrid sunfish (normally a cross between a bluegill and a green sunfish) can be substituted if desired but will probably have to be restocked since most hybrid sunfish are males. Ponds with hybrid bream need to be periodically drained, poisoned, and restocked. Also hybrid bream should not be stocked in a pond with adult largemouth bass unless the bream are over five inches in length because the bass will eat them.

If you want to double fishing success for pounds of fish that can be taken from your pond then you need an aggressive management program. You will have to fertilize your pond and fish it more actively. If you are not going to aggressively fish your pond it is not recommended that you start this accelerated management program. If you are going to, then you will double your initial stocking density. That is 700 bluegill, 300 redear, and 100 largemouth bass to the acre. The channel catfish stocking rate is 100 per pond or 50 per acre, whichever is greater. Channel catfish usually do not reproduce in recreational fishing ponds and will have to be occasionally restocked.

Recently, pond owners have been stocking hybrid striped bass at 100 per acre. Stocking hybrid striped bass in ponds in Maryland also requires special permission from Maryland's DNR. Hybrid striped bass should be eight to ten inches long at stocking. Although hybrids are another predator to the pond, indications to date do not reveal negative impact upsetting the predator-prey balance as bream often remain in the shallow waters while the hybrid striped bass prefer the open water. Stocking pure striped bass in your pond is usually unsuccessful as survival in ponds less than 500 acres in size is rare.

Another option if the water is too cold during the summer months (constantly less than 65 degrees F) for a good bass-bream pond is to stock rainbow or brook trout. It is normally best to stock fall spawned fish that are five to six inches long, although they are more expensive. Fall spawned fish are less variable and unpredictable compared to spring fish. In either case, fish should be harvestable size by the spring following stocking. Do not stock trout during the warm season, and normal stocking rates for trout are about 600 fall fingerlings or 1,500 to 2,000 spring fingerlings per surface acre. You can improve your trout production by daily feeding with an artificial diet.

As an important reminder, do not stock any other fish species in your pond. It will only lead to trouble and an unbalanced situation where the fish will become overcrowded and stunted, which leads to poor fishing. Common carp will only muddy the pond and grass carp are illegal in Maryland. Crappie and bullhead are competitors with the bream and will also lead to stunting and overcrowding. Shiners and other minnows can become too large for the bass to eat and compete with the bream for food as well.

Obtaining Your Fish

Maryland's Department of Natural Resources has just recently started a sportfishing management program. They will set up a site visit for your pond and make recommendations. They will also provide largemouth bass and bluegill, but not redear sunfish or channel catfish. These will have to come from commercial suppliers. Remember that you will need special permission to have redear sunfish. Applications for fish from DNR have to be in to the Annapolis office by 15 May. Other species of fish are occasionally delivered to various locations around the state. Contact your local feed and seed stores to find if they are a cooperator with fish suppliers.

Species Profiles

Largemouth bass. This species is the major predator in the pond and is a highly sought after game fish. Actually not a bass at all, largemouth bass are a member of the sunfish family which includes the bluegill, redear sunfish, green sunfish, pumpkinseed, and many others including smallmouth bass and spotted bass. The true bass family includes species such as striped bass, white bass, and white perch. The largemouth bass is dark green to light green with dark stripes or blotches on the sides and a white belly. As the name says it is also recognized by its large mouth.

Largemouth bass normally feed on insects, fish, crawfish, frogs, snakes, ducklings, or just about any animal that it can swallow. Young fish are active feeders all day long while the adults mostly feed late in the evening and early in the morning. The adults usually spawn during their second spring at a size of 9 to 12 inches long. Spawning usually begins when the water temperature reaches 60 to 70 degrees F and occurs only once a year. The male makes a nest on the bottom using his tail to fan out a depression up to two feet in diameter and six inches deep. The size of the nest is usually dependent on the size of the male. Although the nest may be made in muddy bottoms, gravel substrate is usually best. Once the nest is made, the male courts a female and encourages her to lay her eggs in the nest. A female can lay between 2,000 to 15,000 eggs, dependent on size and condition. After the female lays her eggs the male runs the female off and protects the nest. He aerates and keeps silt off the eggs by fanning the nest with his tail.

Once the eggs hatch (three to 12 days depending on water temperature) and the fry begin to actively feed around the nest in a school. The male still provides protection for his offspring for about 10 more days, after which the fry fend for themselves. The fry will remain in schools until they are about one inch long then they will head to shallow water for protection from predators.

Several factors can affect largemouth bass reproduction and survival. The first is water temperature.

Sudden drops in water temperature while the eggs or fry are on the nest can be fatal. Secondly, the eggs and fry are easy targets for predators such as the bluegill or other fish. Last, there may be insufficient food in the pond to support the young fish when they leave the nest.

Bluegill. Probably the most popular and sought after fish in North America the bluegill is a deep-bodied panfish that has a small head and an irregularly shaped black spot located at the base of the soft dorsal (top) fin. Known by most people as bream (also a collective name for many sunfish), it also has broad, dark vertical bands often seen on the sides of the fish when it is in water. The males are dark and gray to bluish on the sides with the belly being a deep orange especially when it is spawning season. Females have a lighter cream-colored belly and light yellow or light gray sides. Both sexes have an elongated dark blue or black "ear flap" or operculum.

Bluegill prefer to eat insects but will occasionally eat small fish. They will also occasionally eat small crawfish, snails, and worms. During times of food scarcity they may feed on algae and aquatic plants.

Spawning usually occurs at one year of age and the spawning season runs from mid-May through the summer and into the fall if the temperature is high enough (over 80 degrees F). Bluegill can spawn more than once a year and produce 2,000 to over 50,000 eggs. The fish nests in colonies in water one to three feet deep. Like the largemouth bass the male makes the nest (12-16 inches) with his tail. The female lays her eggs in the nest and the male fertilizes them and then guards the nest. The eggs hatch in two to five days depending on temperature and the fry remain in the nest for an additional three to five days before they move into shallower waters. Because they are so prolific, they are the primary source of food for the largemouth bass.

Redear Sunfish. More commonly known as a "shellcracker" because of their proclivity to eat snails and small mussels, the fish is a popular sportfish due to their large sizes. Fish over a pound in size are not uncommon. Although the growth rate is similar to bluegill the redear is usually the larger of the two due to the fact that they are harder to catch. The redear has a beautiful "earflap" which is black with a red-orange border. During the spawning season, the males have a bright-orange border. The pectoral fin, the one right behind the gill cover on each side of the fish) is very long and pointed. The rear portion of the fish does not have the dark spot found in bluegill.

Reproduction occurs when the fish is one year old and it nests in similar colonies as the bluegill. However, it prefers building its nest near aquatic vegetation if it exists within the pond. A female redear lays between 2,000 and 10,000 eggs depending on size and condition. After spawning is completed, like the bluegill the female redear leaves or is driven from the nest and the male takes

up the role of protector.

Hybrid Sunfish. As mentioned above, if you desire to stock your pond with hybrid sunfish instead of bluegill you will need special permission from Maryland's DNR. Hybrid sunfish are attractive to pond owners because of their fast growth, hybrid vigor, susceptibility to angling, and their ability to occupy different habitats within a pond.

Most hybrid sunfish are a cross between male bluegill and a female green sunfish, although combinations of bluegill and redear or redear and green sunfish are also produced. So the fish is of mixed parentage and because of that the progeny are usually intermediate in appearance between the two parents.

Hybrid sunfish have differing capacities for reproduction because of differential sex ratios, which is dependent on who were the parents. For instance, a cross between redear sunfish and green sunfish (the female is usually listed first) results in a progeny sex ratio of almost 1:1. But a cross between bluegill and redear results in almost 100% of the offspring being male.

One problem with hybrid sunfish is that the nests they make can be very large and deep. In fact the fish can make a nest depression in the pond bottom so deep that if you had to put clay in your pond to prevent seepage, the nest may go through that layer and cause the pond to leak.

Reduction and population decline in the hybrid sunfish is due to fishing pressure, predation by largemouth bass, and reduced reproductive success. Unfortunately hybrid sunfish are unable to maintain an adequate prey base in the pond for largemouth bass, which causes the bass population quality to decline.

Before you consider stocking hybrid sunfish in your pond you should think out all the pros and cons of each cross, and the fact that you will have to restock the pond on a frequent basis. Otherwise, hybrid sunfish can be a fun group of fish to have in the pond from a fishing perspective.

Channel Catfish. Channel catfish are fun fish to have in a pond because they are a bonus fish in that they provide an additional source of meat and sport. Actually channel catfish can be stocked in a pond by themselves and offer a good sportfishing opportunity. Normally channel catfish reproduce in sportfishing ponds unless there are suitable structure such as hollowed out logs or muskrat dens for them to lay their eggs. For those fish that do reproduce however, if the pond is clear, the eggs and young are usually eaten by the bass and/or bluegill.

Channel catfish will eat almost anything they can get into their mouths. However, they prefer insects, small fish, worms, snails, and crawfish, and they readily accept an artificial diet such as catfish chow. The average weight of channel catfish in ponds is around two pounds.

If channel catfish are stocked as the only species in the pond then they should be stocked at a rate of no more than 200 per acre in an unfertilized pond, or no more than 500 per surface acre in a fertilized pond. If you are going to feed the fish with an artificial diet on a daily basis then you can stock as high as 2,000 per surface acre. Ponds smaller than one acre are usually stocked with channel catfish alone and provide excellent fishing with little management.

In future editions of the Maryland Aquafarmer we will cover effectively managing your pond to maximize success. Also, we will discuss proper harvesting ratio between largemouth bass and bream to maintain a balanced predator-prey relationship.

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Aquatic Vegetation Management Tip

Reginal M. Harrell, Finfish Aquaculture Specialist

As spring temperatures begin to warm your pond, you will notice the emergence of algal mats and the beginnings of vascular plants starting to show up. Now is the time to be proactive in aquatic vegetation control. As these mats and patches of vegetation develop, spot-treat the area with the appropriate herbicide. If you start early you should be able to keep the plant growth under control and prevent the aquatic plant from becoming an aquatic weed. Remember, aquatic vegetation is a natural part of the pond's ecology and plants are very beneficial to the overall health of a pond. It is only when the plant growth becomes out-of-control that radical measures must be taken. It is a lot cheaper to spot-treat your pond as opposed to a complete eradication effort. **Do not forget you**

must have the proper permit to apply herbicides. Also do not wait until the plants have taken over the pond to apply for the permit. Be proactive! Plan ahead!

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Aquacruising The Web

Dan Jacobs, Computer Systems Manager

The World Wide Web is an excellent source of information on aquaculture and aquaculture related issues. While visiting our web site, you can read the latest issue of the Maryland Aquafarmer at <http://www.mdsg.umd.edu/Extension/Aquafarmer>. After a few minutes of searching, many other sites were found. The following are some of the more interesting (and useful) sites:

AquaNIC - Aquaculture Network Information Center

<http://aq.ansc.purdue.edu/aquanic/>

An excellent clearinghouse of aquaculture information available on the Internet (e.g. publications, newsletters, calendar of events, news, and jobs). It also provides information on how to obtain aquaculture information that is not on the Internet.

Aquatic Network - Information Service for the Aquatic World

<http://www.brainiac.com/aquanet/>

Another excellent clearinghouse. Subject areas covered include aquaculture, conservation, fisheries, marine science and oceanography, maritime heritage, ocean engineering, and seafood. For example, the Grants and Funding Sources section (http://www.brainiac.com/aquanet/grants/aq_bus3.html) includes world wide sources of grants and funding.

Aquaculture Information Center (AIC)

http://www.nalusda.gov/answers/info_centers/aic/aic.html

<gopher://sprout.nalusda.gov:70/11/infocntr/aic>

The AIC is one of 10 information centers at the National Agricultural Library (USDA/ARS). It serves as a national clearinghouse for aquaculture information and provides materials to a variety of clientele including aquafarmers, consumers, industry personnel, educators, government agencies, associations, libraries, the media, students, scientists, and prospective farmers.

Aquaculture, University of Tasmania

http://info.utas.edu.au/docs/aquaculture/Home_Page.html

<http://info.utas.edu.au/docs/aquaculture/Pages/Menu.html>

The University of Tasmania has established Australia's first Department of Aquaculture. This site provides information about Australian aquaculture efforts as well as what is offered by the Department of Aquaculture. For example, you read "Austasia Aquaculture", an electronic version of the paper-based magazine.

FINS

<http://www.actwin.com/fish>

An archive of information about aquariums. It covers both freshwater and marine, tropical, and temperate.

The Global Aquaculture Network

<http://gatekeeper.unicc.org/untpdc/eto/associates/snr/>

A development project to increase efficiency within the shrimp industry, using information technology to vertically integrate all shrimp related activities including production management, trade and information. The Global Aquaculture Network was launched in Thailand at World Aquaculture 96 and the Bangkok Seafood Show during 1996.

Hydro/Aquatic Technologies

<http://www.intercom.net/biz/aquaedu/hatech/index.html>

A homepage designed to provide schools and educators information about hydroponics, aquaculture and aquaponics. This includes theory as well as practical advice.

International Center for Aquaculture and Aquatic Environments

<http://www.aq.auburn.edu/dept/faa/icaae1.html>

Department of Fisheries and Allied Aquaculture

<http://www.ag.auburn.edu/dept/faa/faa1.html>

Both sites are part of Auburn University. The Center, in partnership with the Department of Fisheries and Allied Aquaculture's, goal is to improve and facilitate the sustainable development of aquatic resources. The Department site provides information about the academic and extension programs, publications and employment opportunities.

Northwest Fisheries Center (NMFS/NOAA)

<http://listeria.nwfsc.noaa.gov>

This is a web site for a research facility of the Northwest Region of the National Marine Fisheries Service, NOAA. The Center is responsible for providing scientific and technical support for the management, conservation, and development of the Pacific Northwest region's anadromous and marine fishery resources (e.g. water recirculation project).

Seafood Net

<http://multiplaza.com/seafood/index.htm>

Seafood Net is focused on Seafood, Fish, and Fishing. There are five main areas of interest: (a) general information on seafood, of interest to consumers; (b) information for seafood processors, traders, and buyers; (c) information for the fishing industry; (d) fisheries science and research resources; and (e) fish and recreation. Besides general information, there are forums for on-going discussions and Seafood TradeNet, an electronic do-it-yourself seafood trading floor.

Wisconsin Sea Grant - Advisory Services/Aquaculture

<http://h2o.seagrant.wisc.edu/advisory/AQUACULTURE/aquacult.html>

Similar to World Wide Guide to Aquaculture, this site is a good source of links to aquaculture web sites as well as other Sea Grant efforts.

World Wide Guide to Aquaculture

<http://www.theworld.com/SCIENCE/AQUACULT/SUBJECT.HTM>

This is one of many, many web directories maintained by WorldWide Net. Aquaculture sites may have their web listed for free.

World Aquaculture Society

<http://ag.ansc.purdue.edu/aquanic/was/was.html>

The World Aquaculture Society (WAS) plays an important role in assuring the progressive development of aquaculture worldwide by meeting the increased global demand for science based information and technology. This site is part of AquaNIC and provides information about WAS.

ERS Situation and Outlook Reports

<http://www.mannlib.cornell.edu/usda/>

USDA's Economic Research Service publishes the Aquaculture Situation and Outlook Report. You can use this access for these as well as the NASS catfish and trout reports. If you want the reports "sent" to your computer automatically on the day of their release then with your fax modem's touch-tone phone or keyboard dial 202 690 3944 and request Fact Sheet #3811 or send e-mail inquiry to: help@usda.mannlib.cornell.edu

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