OKLAHOMA COOPERATIVE EXTENSION SERVICE SRAC-141

Forage Species
Production Techniques

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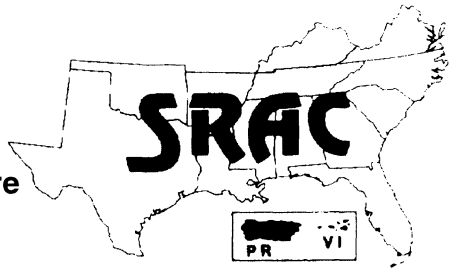
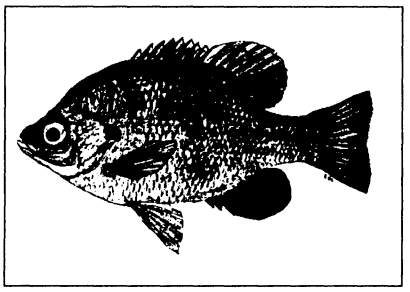
Southern Regional Aquaculture Center



Bluegill



Bluegill

The bluegill has been extensively stocked as the principal forage for largemouth bass throughout the Southeast. Bluegills produce numerous young because of characteristic multiple spawning throughout the warm months. Their high reproductive potential has resulted in some criticism due to overpopulation. However, in most ponds stocked with largemouth bass/bluegill combinations, research has shown that bluegill overpopulation is usually caused by bass overharvest. Depending on geographical area and water quality, the bluegill can be stocked alone as forage or in combination with redear sunfish, fathead minnows, golden shiners, and/or threadfin shad.

The bluegill is among the easiest species to culture; therefore, almost any type of pond can be utilized. Some culturists prefer ponds with a maximum depth of 3 to 5 feet with some shallow areas 1 foot deep. The pond bottom should be designed to facilitate seining.

Features such as bottom drainpipes and supplemental water supplies are desirable to maintain desirable water quality, especially in heavily fertilized ponds or in ponds where fish are supplementally fed. Desirable water quality parameters include a pH range of 6.5 to 8.5 and a minimum total alkalinity of 20 ppm.

Ponds should be filled with well or filtered surface water 2 to 4 weeks prior to initiated spawning. A plankton bloom should also be established prior to the anticipated spawning period. Both inorganic and organic fertilizers have been utilized successfully with initial applications made during March. Application rates of 100 pounds/surface acre of 16-20-0 or 80 pounds/surface acre of 20-20-5 have produced desirable results. Reduced rate applications are necessary to maintain the bloom throughout the spawning season. Blooms may be more easily maintained with small, frequent (1 to 3 applications weekly), reduced rate applications rather than large applications made every 2 to 4 weeks. Cottonseed meal has been used successfully as an organic fertilizer at initiated rates of 100 pounds/surface acre followed by small, frequent, reduced rate applications. Oxygen depletions may occur in fertile ponds; therefore, a supplemental water source should be available for improving water quality as needed.

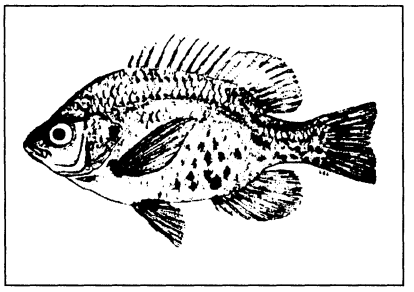
Broodfish should be maintained on a floating feed ration prior to spawning. Feed at the rate of 3 percent body weight as soon as the ration is accepted in the spring. Broodfish at least 2 years old and weighing between 0.3 to 0.6 pounds are the most reliable spawners and should be stocked at the rate of 20 to 40 pairs/surface acre. Smaller 1-year-old brooders have been used successfully but stocking rates should be increased. The use of small broodfish may also result in less uniform spawning. As spawning season approaches, mature males become visibly darker than females, making broodfish selection easier. Spawning activities begin as water temperatures rise above 70° F. Males fan out nests and following egg fertilization, guard the eggs and offspring for several days. Production of 375,000 fry/100 broodfish has been achieved.

Supplemental feed in the form of a floating mash or crumble should be offered to fry as they become visible. One-inch fish are produced in 30 to 40 days by this method. As growth progresses, fry produced early in the season often feed on fry resulting from late hatches. Two-inch fish can be expected in 60 days or more and 3-inch fish are possible by the end of the growing season if a regular feeding program is maintained.

Bluegills less than 1 inch long are extremely difficult to harvest without causing massive mortality. To facilitate harvest, ponds should be lowered to one-half the original level. Fresh water introduced to the lowered pond attracts the fingerlings to the water source and eases harvest. An additional benefit is the tempering effect the fresh water has on fingerlings prior to transport.

Hybrid sunfish crosses utilizing the bluegill as one parent should not be cultured for stocking as a forage fish. The reproductive potential of these hybrids is greatly reduced and the resulting offspring are insufficient for sustaining a bass population.

Redear sunfish



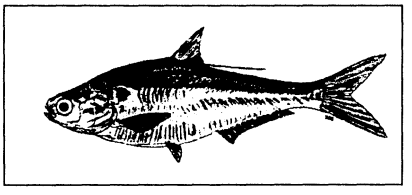
Redear sunfish

The redear sunfish, also known as the shellcracker, is often stocked as forage in conjunction with the bluegill in the Southeast and in other waters that remain turbid. Bass may not be able to readily see their prey in these waters and as a result, bluegill may not be satisfactorily utilized. The redear is less prolific than the bluegill and since their young compete for food, may help reduce total sunfish reproduction.

The principles of redear production are similar to those utilized in the culture of bluegills. However, redears do not adapt to formulated feeds as readily as bluegills because of their more predatory nature. Artificial diets can be fed at 0.5 to 2 percent of body weight depending on temperatures. Ponds rich in zooplankton and aquatic insect life should assist in increasing production.

Hybrid sunfish crosses utilizing the redear sunfish as one parent should not be cultured or stocked as a forage fish. The reproductive potential of these hybrids is greatly reduced and the resulting offspring are insufficient for sustaining a bass population.

Threadfin shad



Threadfin shad

The threadfin shad is considered to be one of the most important forage species present in many southeastern ponds and reservoirs. This species has recently been stocked in many smaller impoundments as an additional forage fish for largemouth bass, catfish, and crappie. Research has clearly shown the value of threadfin shad introductions under the proper circumstances.

Culture ponds typically utilized for threadfin shad production vary from 0.5 to 1.0 surface acres in size. Success has been achieved in larger, deeper lakes but harvesting becomes more difficult. The ponds should have an individual water supply line and a bottom drainpipe. Ponds should also slope smoothly from 2 to 6 feet in depth to facilitate harvest.

Well water or filtered lake water are the preferred water sources for threadfin production; a minimum quantity of 30 gallons/minute/surface acre is preferred. Well water is especially desirable due to its fairly constant temperature. This characteristic is important for "warming ponds" during the winter to prevent threadfin die-offs which typically occur when water temperatures decrease below 42° F. Water supplies with a pH of 6.5 to 8.5 and a minimum total alkalinity of 20 ppm are preferred. Water exchange is normally required to prevent oxygen depletion from occurring in warm weather.

Threadfin shad ponds should be filled and fertilized in mid-March. Inorganic fertilizers such as 20-20-5 at the rate of 80 pounds/surface acre are applied as needed to maintain the resulting bloom. Fertilization should cease by June 1 unless the pond water is routinely exchanged. Some culturists have reported good results by fertilizing in March with 2,000-3,000 pounds of fresh cow manure/surface acre. Another fertilization technique involves the use of 500 pounds of cottonseed meal/surface acre. Repeat applications are then made at 4- to 6-week intervals.

Following fertilization, adult threadfin shad (21/2 inches and larger) are stocked at the rate of 100-200/surface acre. Threadfin begin spawning when water temperatures reach 65° to 70° F with peak spawning occurring at 75° F. Spawning has been documented from April to mid-September. Early fall spawners are typically fry that were hatched during spring spawning. Spawning mortality of adults may be responsible for the short (1 to 2 years) life span.

Spawning occurs along the shoreline on submerged vegetation. Spawning habitat such as broken hay bales (6-inch layers) or Spanish moss mats should be provided. Spawning activity usually occurs around daylight. Several fish farmers have successfully transported the eggs (attached to the spawning surface) to clean fertilized ponds for grow-out purposes. The fertilized eggs normally hatch in 3 to 5 days at 70° to 80° F.

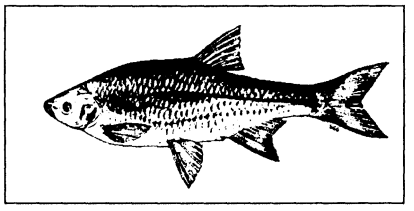
Supplemental feeding has served to increase production in some culture ponds. A floating catfish ration fed at the rate of 8 pounds/surface acre (5 days a week) resulted in the production of 50,000-100,000 (400-800 pounds) shad/surface acre at one farm.

Threadfin shad are extremely delicate and must be worked with care. Scale loss normally results in mortality. A soft, small-mesh seine works best for harvesting threadfin shad. Fish should not be overcrowded in the seine and fresh water should be provided to maintain water quality at the seine holding site. For this reason, most culturists seine toward the water supply pipe. Fish should be carefully dipped from the seine and placed in tubs containing water. The tubs should immediately be moved to hauling tanks for loading and transport. Oxygen is preferred over agitators for aeration. As with all species of fish, temperature and pH shock should be avoided by tempering the hauling water.

A hauling formula of one gram MS-222 per 12 gallons of hauling water plus four pounds of salt per 100 gallons of hauling water has provided excellent hauling success when used in conjunction with oxygen for aeration. While cool weather hauling is preferred, success has been achieved with this method during the summer months.

If broodstock are to be overwintered and well water is not available to maintain pond temperatures about 41° to 45° F, transferring the fish to a larger, deeper body of water may be desirable. Broodfish can be collected the next spring by attracting them to running water or seining at night near a well-lit area.

Golden shiner



Golden shiner

Golden shiners are one of the most commonly cultured baitfishes in the southeastern United States. This species exhibits a high reproductive capacity and multiple spawning potential. In some waters, the golden shiner may grow to a length of over 8 inches and overpopulate, which can result in direct competition with bluegill.

Pond design, water quality, and water quantity requirements for golden shiner production are similar to those utilized for fathead minnow production. Pond preparations prior to introduction of broodstock are also similar to the requirements for fathead minnows. Overfertilization can curtail spawning activity; therefore, fresh water should be available for pond exchange purposes.

Broodstock should be 1 year old and range in length from 3 to 8 inches. The ovaries of older females are often destroyed by a protozoan parasite, *Pistophora ovariae,* resulting in lower production. Females are typically larger than males of the same age; therefore, some culturists recommend that 50 percent of the broodstock should be less than 5 inches long to prevent sex ratio bias. Large females are capable of producing up to 10,000 eggs.

Spawning habitat can be provided by placing mats of Spanish moss or synthetic grass-like materials held in frames along the pond edge. If these materials are not available, lower the water level several months prior to stocking and establish a suitable grass cover near the pond edge.

Broodfish stocking rates depend upon the production needed. In the extensive or open pond method, 200-1,000 broodfish/surface acre are recommended for small ponds but large ponds may be stocked as high as 2,000-3,000 broodfish/surface acre.

Spawning activity begins when water temperatures rise to 65° F. Eggs are deposited on the surfaces of spawning habitat and are allowed to hatch in the pond. If spawning subsides, an increase in water level often restimulates activity. Eggs hatch in 4 or 5 days at water temperatures near 75° F. Spawning activity ceases as water temperatures reach 80° F but can be restimulated if the ponds can be "cooled down" with additional water. Often the broodfish are removed at the end of the spawning season, or some predation of fry will occur.

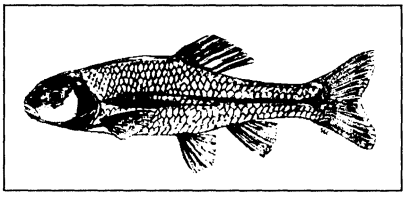
Supplemental feeding is desirable for increased production. Large ponds stocked with high rates of broodfish may produce up to 60,000 fingerlings/surface acre.

The second method of golden shiner production is the egg transfer technique. Pond preparation is the same as that used for extensive culture; however, care should be taken not to supply excess spawning habitat. Spanish moss or synthetic grass is utilized as spawning habitat to facilitate egg transfer. Mats should be placed in a horizontal fashion 1 inch below the water surface. Broodfish should be stocked at the rate of 4,000 to 8,000/surface acre. Mats should be checked 2 to 8 times daily and removed when they become egg laden. Estimation of the number of eggs transferred to grow-out ponds is difficult. Grow-out ponds should be fertilized and supplemental daily feeding should be initiated at the rate of 10 pounds/surface acre using a finely ground 32 to 34 percent protein catfish ration or minnow meal. Feeding should not exceed 30 pounds/surface acre/day unless water exchange is practiced.

The fry transfer technique is the third method of golden shiner production. The ponds are prepared and stocked the same as ponds used for the egg transfer method. Fry are collected from the ponds using soft, small-mesh seines or lift nets and stocked in fertilized grow-out ponds at the rate of 50,000-300,000 fry/surface acre. Daily feeding is desirable. Good production (2- to 3-inch fingerlings) will result in 50 percent survival of the fry stocked.

Harvesting and handling golden shiners at water temperatures below 75° F will assist in reducing stress. Scale loss should be avoided whenever possible.

Fathead minnow



Fathead minnow

The fathead minnow is widely distributed and commonly cultured as a baitfish and for stocking recreational lakes and ponds for (1) providing forage for catfish where supplemental feeding is not practiced, and (2) promoting first year growth of largemouth bass fingerlings.

Ponds utilized for small scale culture of other warm water species are also suitable for fathead minnow production. Ideal ponds are those that are completely drainable via a bottom drainpipe, slope from 3 to 6 feet in depth, and incorporate levees with a 3:1 slope. Sizes for small retail operations vary from 0.2 to 1.0 surface acre while larger commercial operations often consist of ponds up to 10 surface acres.

A well capable of producing a minimum of 30 gallons/minute/surface acre is the preferred water source. The water pH should range from 6.5 to 8.5 and total alkalinity should be at least 40 ppm.

Two types of rearing methods are utilized for fathead minnow production. Extensive or open pond spawning production consists of fertilizing culture ponds in mid- to late-March (2-4 weeks prior to stocking brooders). An inorganic fertilizer such as 20-20-5 at 50 pounds/surface acre is recommended. Reduced rate applications of 25 pounds/surface acre should be made at 2 to 4 week intervals to maintain plankton production. If a supplemental water source is not available, fertilization should be discontinued by June 1. Otherwise, the risks of summer oxygen depletions will increase.

Brood ponds should be stocked in early April since spawning begins when water temperatures warm to 60° to 65°F. Spawning occurs on the underside of solid materials including boards, boats, plants, or rocks. Submerged metal drums, soft drink cases and wooden pallets have also been used successfully as spawning habitat.

Broodfish should not be stocked on the basis of size since males are typically larger than females. The two sexes are readily distinguishable during the breeding season because the males become dark in color. Some culturists prefer stocking 1,000 11/2- to 3-inch broodfish per surface acre of water. Since the fathead minnow is a short-lived species (12 to 15

months) and considerable mortality occurs during spawning activity, some culturists prefer to stock a mix of 60 percent adults and 40 percent immature fish to maximize production throughout the growing season. Females have been observed to spawn as many as 12 times in 11 weeks, and may produce as many as 4,000 eggs during one spawning season. Eggs hatch in 4 to 7 days, and fry will mature and spawn in 4 to 8 weeks. Spawning usually ends when water temperatures rise to about 85° F, but the addition of cool water often triggers additional spawning. The extensive culture method can produce up to 600 pounds of fathead minnows per surface acre.

Daily feeding over a large portion of the pond is necessary for best production. A finely ground ration containing 32 to 34 percent protein has been utilized successfully. Feed should be offered in the morning hours before 10 a.m. at an initial rate of 10 pounds/surface acre. This rate is increased as growth increases but should not exceed 30 pounds/surface acre unless a continual water source is provided. Six to 10 weeks are required to produce 2-inch fish. This method can produce up to 1,500 pounds of minnows per surface acre and is preferred by many bailfish culturists.

For more information about aquaculture in Oklahoma, see your local OSU county Extension agent.

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