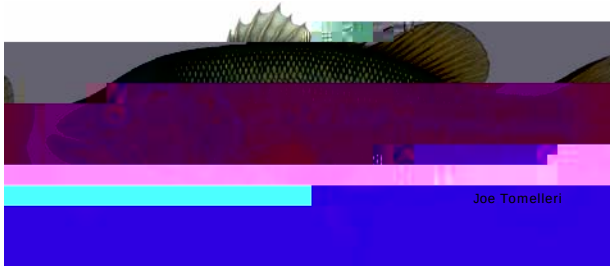
Texas Farm Ponds:
Stocking, Assessment, and Management Recommendations



Special Publication Number 1

Texas Chapter of the American Fisheries Society

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Introduction

Most farm ponds and small impoundments in Texas are not managed at their highest potential for fish production. This is unfortunate, since an estimated 20 percent of fishing trips in Texas are to these waters. This publication presents a concise set of guidelines for stocking and managing fish in new, renovated, or old ponds.

This publication was prepared by the Texas Chapter of the American Fisheries Society to provide information to the pond owner who has little or no knowledge of fishery management. Specific information on assessment techniques, interpretation of assessment data, and corrective management strategies are included to help the pond owner develop long-range management plans.

This information is intended primarily for ponds less than 5 acres in surface area, but may be useful for larger impoundments as well; however, you should discuss the management of these larger bodies of water and/or unusual management problems with a qualified fisheries biologist. Stocking and management advice is available from various state and federal agencies, universities, private consultants, and fish farmers.

Management Considerations and Objectives

Before you can develop a management plan for

designs exist, ranging from surface-release drains to bottom-siphoning systems. For fishing ponds, the bottom-release designs are considered more desirable because poorer quality water near the bottom is passed through while retaining higher quality surface water. Design emergency spillways to allow passage of flood waters (usually around the end of the dam) with care to avoid soil erosion.

5. Design your pond shoreline slopes. Slopes of at least 2.5:1 ratio (2.5-feet drop per 1 foot from shore) are best to avoid large expanses of shallow water. Shallow water (< 3 feet deep) allows sunlight to penetrate to bottom sediments, which can encourage excessive aquatic plant growth. Steeper slopes can also position fish within easier casting distance of bank anglers. However, slopes should also depend on soil type and effort should be given to guard against erosion of steeply sloping banks.

6. The final planning stage should be devoted to including habitat improvement structures to be added prior to pond filling. Fish habitat can be added later, but is much easier before the pond fills with water. For information concerning pond habitat and fish attraction structures, see the Pond Habitat section and the Habitat heading within the References section.

Pond Size. The size of your pond is the major factor that will determine what fish to stock, the degree of management needed to maintain these fish, and how many fish you can harvest each year. Most farm ponds in Texas are built for livestock watering

primary productivity. For this reason, muddy ponds should not be fertilized. In addition, sight-feeding fish such as largemouth bass are less successful at feeding in ponds with severe turbidity.

level. An aeration system can be used to help prevent fish kills during low water months when fish are crowded (see Aeration section). Porous soils and leaks under or through the dam can cause water levels to drop rapidly or maintain water below desirable levels. In some cases, walking behind the dam can reveal soggy or wet soils that may indicate a leak in the dam.

In certain situations, planned or manual water-level manipulations can be beneficial. Scheduled draw-downs can assist with aquatic vegetation control by allowing shallow bottom sediments to be subject to freezing or desiccation (drying out). Low water levels provide favorable conditions to repair damage to shorelines caused by erosion or cattle trampling, and to re-shape shallow bank slopes to 2.5:1. This may also be a good time to excavate silt deposits. Also, draw-downs can be used purposefully to reduce water volume if rotenone is applied to reclaim a pond for restocking. The References section of this manual can assist pond owners with information to prevent and fix leaky ponds.

Fertilization. The application of commercial inorganic fertilizer can result in up to a four-fold increase in pond fish production. Fertilization stimulates the growth of phytoplankton (microscopic single-celled algae) that forms the base of the pond's food chain. When properly managed, fertilization can also control submerged aquatic vegetation in water deeper than three feet. However, a poorly executed fertilization program will provide little benefit, and can easily cause fish kills if too much fertilizer is used.

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time period. In all cases, if the fertilizer product you purchase has instructions, follow their recommended application rates and intervals for best results.

Do not fertilize muddy ponds, ponds infested with aquatic weeds, ponds with low total alkalinity, or ponds that are flushed with large volumes of water until these problems are corrected. Ponds stocked only with catfish, and are fed more than three times per week, should not be fertilized. Several available publications (listed in the References section) give detailed instructions for pond fertilization. Consult them before beginning a fertilization program for your pond.

Aeration. Aeration can help to prevent low dissolved oxygen (DO) levels from negatively impacting pond fish populations. In addition, certain types of aeration equipment can effectively mix the water in a pond to prevent water-layer stratification, which can occur in deeper ponds (see Pond Habitat section) during warm months. Low DO levels can stress or even kill fish, whereas water stratification can limit fish use of cooler, deeper pond areas because of poorly oxygenated water. Anoxic (i.e., lacking oxygen) water does not permit bacteria to adequately process waste products, which then build-up on top of the pond's bottom sediments.

DO in ponds is naturally affected by photosynthesis, temperature, salinity, wind, supplemental feeding of fish, fish density, and pond depth. The natural sources of dissolved oxygen are photosynthesis by aquatic plants and diffusion from the air. Photosynthesis is the process by which plants (especially algae) use sun light to manufacture food. One of the byproducts of this process is oxygen. In a pond, DO is also consumed through respiration by fish, aquatic plants and algae, plankton, bacteria, and a host of other organisms. The most common DO problem occurs when the consumption of oxygen through respiration exceeds production through photosynthesis and diffusion. During summer, calm and/or cloudy days may reduce oxygen production by plants while fish continue to respire, and at higher rates as water becomes warmer. On occasion, algae or submerged plants in the pond die suddenly and no longer produce oxygen. As the algae or plants decay, bacteria grow and consume even larger amounts of oxygen. In deeper ponds, fall destratification (turn-over) can cause the DO level to crash as deep, anoxic water mixes with surface water. Although pond fish can survive short periods of low DO concentrations, prolonged exposure can cause stress or even death. DO can be measured using a chemical kit or an electronic oxygen meter. The preferred times to monitor DO are at daybreak and nightfall.

The general rule of thumb in determining the need for an aeration system is whether the pond contains greater than 1,000 pounds of fish biomass per surface acre. In most bass/sunfish ponds this carrying capacity is rarely exceeded. However, in fed catfish ponds, this threshold is occasionally exceeded by unknowing pond owners who do not harvest fish appropriately. Often, pond owners derive such pleasure from watching their "pets" grow and feed that they fail to harvest sufficiently to keep biomass within the 1,000-pounds-per-acre limit. For example, a pond owner who stocks 250, 6-inch channel catfish in a 1-acre pond, and feeds regularly, is safe within the limit. But in a couple years when those same 250 fish average 4 pounds each (total biomass = 1,000 pounds), a cloudy, summer morning could spell disaster. Aeration can serve as a pond owner's insurance against such occurrences.

A variety of aeration and destratification systems exist to assist the pond owner. Pump sprayer aerators, surface spray aerators, paddlewheel aerators, diffused air systems, and propeller-aspirator pump aerators each bring advantages and disadvantages to each specific pond environment. A thorough review of the sources found in the References section will greatly assist the pond owner in deciding which system best fits any particular pond or budget.

Aquatic Vegetation. While plants are the base or start of all food chains, uncontrolled rooted aquatic vegetation (macrophytes) and macro-algaes create numerous sportfish management problems. These plants tend to cover large areas of most ponds because of the abundance of relatively shallow water (< 8 feet). Few aquatic animals directly consume macrophytes or macro-algaes and so these plants tie up valuable nutrients and retard the flow of energy through the food chain to fish. Often the high densities of these plants allow prey to hide effectively and lead to stunted fish populations. Other common problems created by macrophytes include: limiting access to the water, increased evaporation rates, creation of environments for disease bearing insects (mosquitoes) and parasites, and degraded water quality.

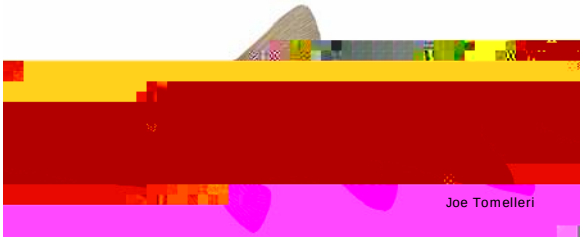
Aquatic plants are usually grouped into 4 categories: 1) algae, 2) true floating plants, 3) submerged plants, and 4) emergent plants (see

Reference section). Algae are very primitive plants that have no true roots, stems, or leaves and do not produce flowers or seeds. Microscopic algae are important in the aquatic food chain and can be promoted through fertilization (see fertilization section). Filamentous and macro-algaes (like chara) often cover large areas and need to be controlled to improve access and reduce oxygen depletions. True floating plants (duckweed, salvinia, water hyacinth,

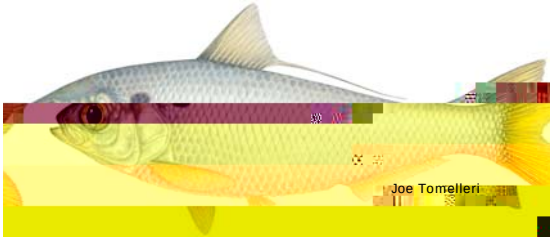
However, expect them to become the dominant

or in new bass-bluegill ponds to increase first-year growth of the bass and bluegill.

Grass Carp (White Amur). This species, when stocked in proper numbers, can provide long-term, cost-effective control of submerged aquatic vegetation in ponds; however, only specially produced sterile (triploid) grass carp are legal in Texas ponds, and a permit is required. Contact the Texas Parks and Wildlife Department for details.



Threadfin Shad. This species is an excellent supplemental forage species for bass; however, like the fathead minnow, generally cannot withstand bass predation for an extended period of time in a small pond. They are also sensitive to cold temperatures and perform best in South Texas, but can survive mild winters in North, East, and Central Texas. A fertilization program will greatly increase the success of threadfin shad introductions by reducing water clarity and increasing productivity.



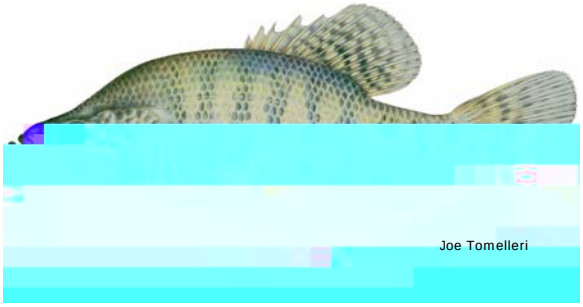
Undesirable Fish Species

Many other species of fish have been stocked in Texas ponds, but none have been as consistently successful as largemouth bass, channel catfish, bluegill, redear sunfish, fathead minnows, or combinations of these fish. While other species may do well in streams, lakes or reservoirs, they often cause problems in ponds or are not suited for pond environments. Do not stock the following species or any species not listed without first consulting a fisheries biologist.

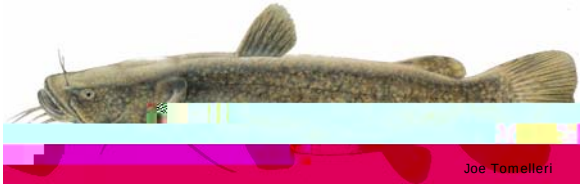
Gizzard shad can rapidly grow too large for most sportfish to consume. Without predation on large adult gizzard shad, they become overpopulated. Research has also proven that at high densities, gizzard shad can decrease production of young bluegill through interspecific competition for zooplankton resources. Never stock gizzard shad into a pond with newly stocked bass and bluegill populations. The only scenario where gizzard shad are desired is in ponds with existing bass populations that are managed for trophy-sized fish. In this scenario, large bass are able to benefit from the availability of larger prey and the pond owner is aware of the potential risk of a negative impact on bass and bluegill recruitment of young fish to adult sizes. Consult a professional fisheries biologist before stocking this species.

Golden shiners are occasionally stocked in established ponds to increase forage for bass. They should not be stocked in new ponds as they are heavy consumers of fish fry and eggs and could prevent the successful reproduction and establishment of the newly stocked game fishes.

Crappie are also very undesirable for stocking in ponds. They compete with bass for food, eat small bass, and tend to overpopulate and become stunted.



Flathead (opelousas or yellow) **catfish** are often stocked in ponds by the pond owner or well-meaning anglers, but this is a big mistake. This predator consumes large numbers of all species of fish, including largemouth bass.



Hybrid sunfish are often touted as a “superfish”; however, the crosses used to produce these hybrids are not good forage fish and should not be stocked alone for bass prey. Hybrid sunfish perform best

Large Ponds. For this discussion, ponds larger than 1 acre are considered “large ponds.” Many

Table 1. Recommended Numbers of Fingerlings to Stock for Various Management Options in Texas Farm Ponds.

	Number per Surface Acre to Stock	
	Un-Fed	Fed[1]

If bass have not been harvested properly, you may need to make adjustments to the fish community. It is likely that the bass have been overharvested if anglers are catching mainly 3- to 5-inch bluegills and a few or no bass. This problem can be corrected by stocking 8- to 12-inch bass at forty per acre. Until small bass become abundant, make sure that all bass caught are released. Then, bass smaller than 12 inches and larger than 15 inches can again be harvested.

If many small bass and only a few large bluegill are caught, the bass have been underharvested. In this case, stock 30 bluegill, at least 5 inches long, per acre. Harvest about twenty-five 8- to 12-inch bass per acre each year thereafter. Again, bass 12 inches long and larger should be released.

Some pond owners want to maximize production of quality-size (15 – 20 inches) or larger bass, especially in ponds greater than 10 acres. Under this scenario, bluegill growth and high angler catch rates are sacrificed for the opportunity for anglers to catch fewer, but larger bass. Pond owners may consider utilizing a 14- to 18-inch or even a 15- to 22-inch slot length limit, and attempt to remove twenty-five 8- to 15-inch bass (weighing a total of 15 – 40 pounds) per acre each year. Total number and sizes of bass removed each year also depends on numbers of young bass recruiting to catchable size and available prey-fish supply.

If you decide to stock a new pond with limited numbers of advanced bass and bluegill rather than fingerling fish, the few bass must be returned to the pond and carefully protected. You cannot afford to lose the original fish, as they are present in limited numbers.

Catfish. You may begin harvesting catfish whenever the fish reach an edible size. Check catfish of catchable size for body condition. Numerous "skinny" catfish could be caused by overcrowding (corrected by increased harvest) and/or inadequate food supply (corrected by increased feeding frequency).

Catch records are important for determining when supplemental stocking is needed. In catfish-only ponds, at least half of the original fish should be caught before restocking. The total weight of catfish in these ponds should not exceed 1,000 pounds per surface acre during the warm months to decrease the risk of fish losses from oxygen depletion. In ponds where catfish were stocked in combination with largemouth bass and forage, occasional restocking may be needed to maintain the catfish populations over time. In these ponds supplementally stock catfish at least 10 inches in length at the rate of 25 to 50 per surface acre at 2- to 4-year intervals. The total weight of catfish in "combination" ponds, however, should not exceed 250 pounds per surface acre to reduce potential competition for food between species.

Identifying Fish Species

Identifying major sport, forage, and rough fish species is essential for interpreting assessment information. While it is neither practical to include every species and subspecies found in Texas in this publication nor necessary for you to know them, being able to identify the species discussed here will enhance your management efforts.

Assessment Techniques for Analyzing Fish Populations

Poor-quality fishing in most farm ponds is caused by unbalanced and/or undesirable fish populations. To determine the status of a fish population, you must take samples to assess the species composition and size distribution in your pond. You can use one of several methods to sample fish populations, including partial rotenone treatments, electroshocking, gill netting, trap netting, shoreline seining, and angler catch records. Although the first four techniques can provide excellent information, they are not practical for most pond owners. So, most pond owners rely on shoreline seining and angler catch records for making management decisions.

Shoreline Seining

Shoreline seining (Figure 1) is a good technique for assessing the status of many fish populations. Seine during June. A 15-x-4-foot minnow seine with a ¼-inch mesh is good for most ponds. Seining provides information on the presence and reproductive success of largemouth bass and

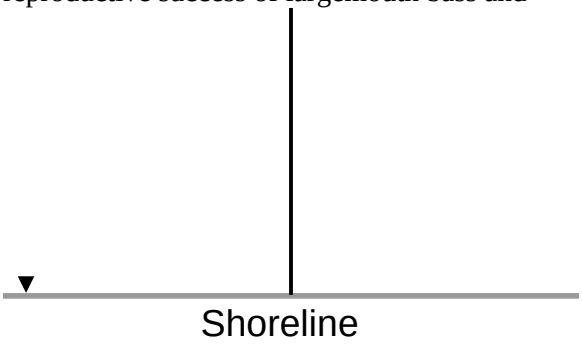


Figure 1. Quadrant seine haul technique.

bluegill. Excessive aquatic vegetation and brush will make seining difficult. Make a minimum of three quadrant seine hauls (more in larger lakes) in different areas to collect a representative fish sample from shoreline habitat. Record the numbers and sizes of each species collected for each seine haul.

Angler Catch Records

You can also gather assessment information from angler catch records, which often provide information on species not easily collected by shoreline seining. It sounds like fun, but to collect meaningful information, anglers should fish regularly with a variety of lures and baits (to catch as many of the species as possible) or fish consistently with similar gear from year to year (to identify changes in length and abundance). A sample record form (see Appendix B.) has been included to

ponds with only those species. The presence of these species in a pond with an adequate bluegill population, however, poses little threat to bass populations.

Crappie also compete with largemouth bass for forage, and their high reproductive rate may create stunted, starving crappie populations in small impoundments.

Other undesirables, regardless of the size of the pond, include black or yellow bullhead, common carp, carpsucker, buffalo, and Rio Grande cichlid. These species compete with desirable species for food and space. Several of these species can create muddy conditions in ponds.

In ponds managed for catfish only, any predator capable of feeding on catfish (such as largemouth bass, gar, or flathead catfish) should be avoided. Likewise, species that compete with the catfish for food (like green sunfish, golden shiners, and black or yellow bullheads) are undesirable.

Bass-Bluegill Population Structure. After you have determined which species are present, seine to determine the presence or absence of bass and bluegill reproduction. These two species provide the basis for predator-prey relationships in Texas farm ponds. The seine is the best method for gathering information on overall pond balance. Use Table 3 to evaluate the data collected by the quadrant seine haul technique. The presence or absence of bass and bluegill reproduction should almost always provide the information required for pond management decisions. Supplement this information with angler catch records whenever possible to provide information on the sizes of adult sport species in the pond. Some pond owners can use accurate records of numbers and sizes of fish caught by anglers for more in-depth assessment and management. A detailed description of the methods is contained in the Appendix.

Catfish Population Structure. Since shoreline seining will not provide much information on catfish, base your assessment of catfish populations on catch records and the general condition of the fish caught. Although these techniques apply specifically to catfish-only ponds, they can be useful for catfish assessment in multi-species ponds as well. At appropriate stocking rates (see Table 1), survival of stocked catfish will approach 100 percent. Knowing how may catfish have been removed will allow you to calculate how many remain in the pond. Under no circumstances should the total weight of catfish exceed 1,000 pounds per surface acre during the warm months.

Although some pond owners do not regularly feed their catfish, occasional feeding (at intervals of 1 to 3 weeks) with floating pellets allows you to determine whether the population has declined. If the number of catfish coming to feed drops markedly and remains low even in a variety of weather conditions, the population has probably been reduced by disease or vandalism. When you collect the catfish for population assessment, also make note of their body condition (plumpness). Since a distended gut can be misleading when you are making visual appraisals, concentrate on the thickness of the flesh when you observe the fish from above. If the catfish are overstocked and/or the food supply is insufficient, the fish will become "skinnier" over time. This sometimes happens if unexpected natural spawning occurs. In contrast, as the fish population declines because of fishing (or other mortality), the flesh will become thicker and "fatter."

Corrective Management

Table 3. Assessment of Fish Populations and Management Recommendations Based on Seining June to October.

Seine Contents	Status	Recommendations
Young bass[1]		

surface acre should establish a breeding population in most ponds. However, you should first consult with a fisheries biologist before you supplementally stock Florida bass. If your assessment indicates that bluegill are not present, you should stock advanced bluegill fingerlings (3 inches and larger) at a rate of 40 per surface acre. This is often needed in ponds where warmouth and green sunfish are the only forage species available for bass. Several species can be stocked with the bluegill to further increase forage availability. Threadfin shad are often stocked at 200 to 500 per surface acre, although restocking is sometimes needed in small shallow ponds because of die-offs due to this species' sensitivity to water temperatures below 42°F and/or over-predation by the bass. This species is a relatively slow swimmer and will often be rapidly eliminated.

In established multi-species ponds, you can stock channel and/or blue catfish (if none are already present) at the rate of 100 per surface acre. Fingerlings should be no smaller than 10 inches to avoid predation by adult bass. Restocking may be needed every 3 to 5 years at rates of up to 100 fingerlings per surface area, since bass and bluegill populations often limit the natural reproduction of catfish. Do not restock catfish-only ponds until half of the original number have been removed. The total weight of catfish present should never exceed 1,000 pounds per surface acre during the warm months. The stocking rate you use should be based on the size of the pond, the condition and total weight of the catfish present, and the frequency of feeding. Fathead minnows are often supplementally

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Pond Boss Magazine
http://www.pondboss.com

Pond Management Manual Download
http://www.sdafs.org/tcafs/manuals/pond/ponds.htm

Southern Ponds and Wildlife
http://www.southernpondsandwildlife.com

Southern Regional Aquaculture Center Publications
http://srac.tamu.edu

Texas Cooperative Extension
http://wildlife.tamu.edu

Texas Parks and Wildlife Department
http://www.tpwd.state.tx.us/fish/infish/ponds

Appendix A.

Assessing Population Size Structure

A technical index commonly used to analyze the size distribution of bass-bluegill populations from catch records is Proportional Stock Density (PSD). To determine the angling PSD for bass, the number of quality bass (12 inches and longer) is divided by the total number of bass and then multiplied by 100. A balanced bass population should have an angling PSD between 20 and 60 percent.

Example: Catch records indicate that 100 bass were caught, 33 of which were 12 inches or longer. The PSD would be:

Appendix B.

Angler Catch Record Chart

			Bass			Bluegill		Catfish			Other
			8 – 12 in.	12 – 15 in.	15+ in.	3 – 6 in.	6+ in.				