

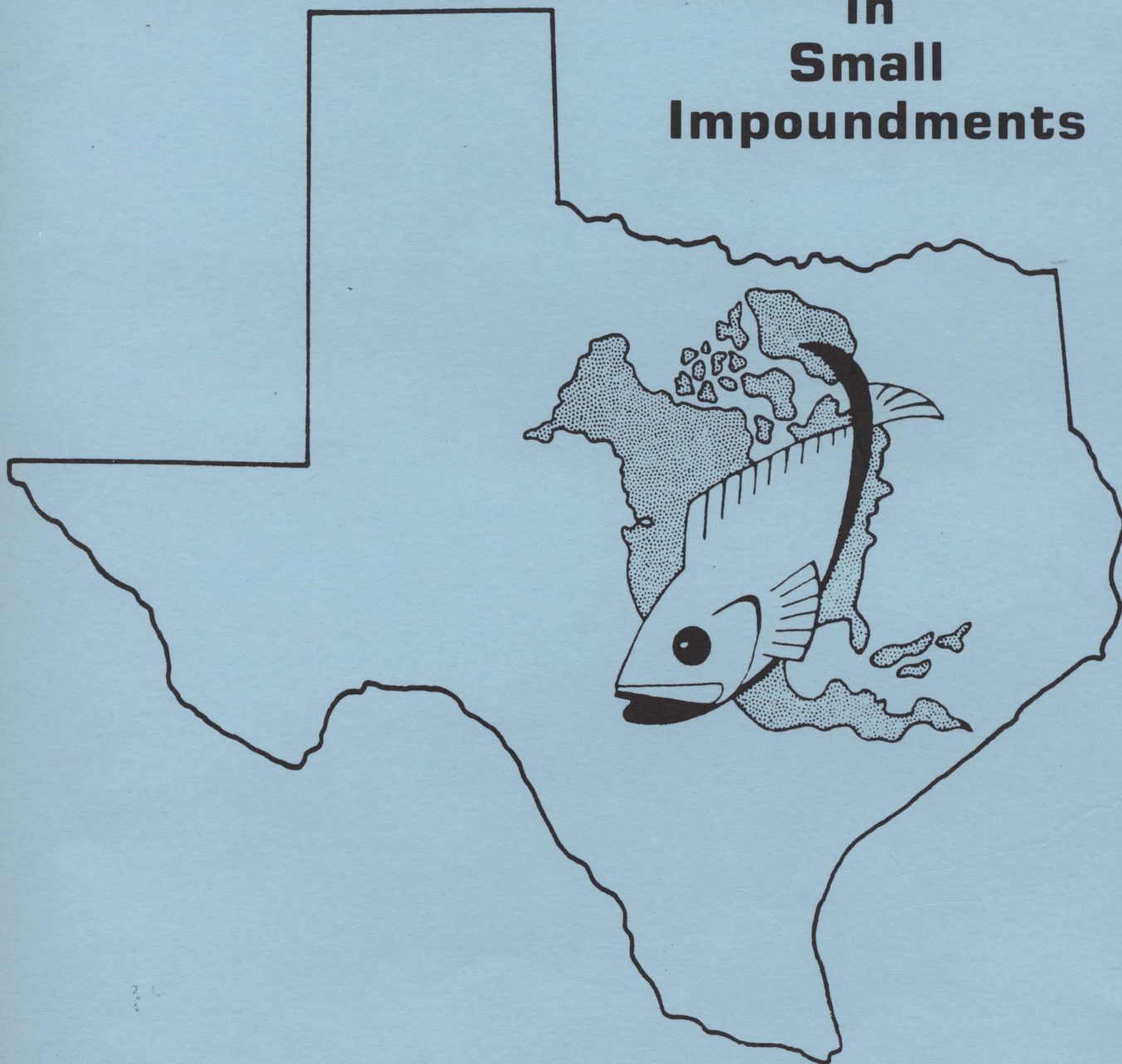
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Texas Agricultural Extension Service

People Helping People

Assessment and Corrective Management For Fish Populations in Small Impoundments



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ASSESSMENT AND CORRECTIVE MANAGEMENT FOR FISH POPULATIONS

in

SMALL IMPOUNDMENTS

Special Publication No. 2
Texas Chapter
American Fisheries Society

January 1985

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ACKNOWLEDGEMENT

This publication was prepared by the Pond Management Committee of the Texas Chapter of the American Fisheries Society. It represents a consensus on assessing and correcting fish populations in Texas farm ponds. Special thanks are extended to Roxanne Pfister for her drawings of fish species contained in this publication. Thanks also go to Rita Harris and Phyllis Guinn for their clerical support in preparation of this publication.

INTRODUCTION

Purpose

The majority of Texas farm ponds and small impoundments are not managed at their fish production potential. This is especially unfortunate since an estimated 20 percent of fishing trips in Texas are to these waters.

This ASSESSMENT publication was developed by the Texas Chapter of the American Fisheries Society as a companion volume to STOCKING AND MANAGEMENT RECOMMENDATIONS FOR TEXAS FARM PONDS and represents expertise gathered from fisheries biologists, producers and managers across the state. This publication should provide valuable management information to the pondowner with little or no fishery management knowledge. Specific information detailing techniques for assessment, interpretation of assessment data and corrective management techniques are included for development of long-range management plans.

Owners of ponds less than five acres in size can expect satisfactory results when using this publication. However, unusual management problems or management of larger impoundments should be discussed with a qualified fisheries biologist.

Management Objectives

Before a management plan can be developed, the pondowner must first identify objectives that are both desirable and attainable. These objectives are greatly influenced by the pondowner's preferences for certain species. Are fewer trophy fish more desirable than numerous small fish? Is a wide variety of species preferred or is one species more appropriate? Hopefully, the pondowner can find the answers to these and other pertinent questions within this publication.

Several additional factors influence the status of fish populations and should therefore be considered when developing management objectives for a particular pond. These include water quality and clarity, fertilization, pond size and depth, and abundance of aquatic vegetation. The specific effects of these factors are discussed in another Texas Chapter AFS publication, STOCKING AND MANAGEMENT RECOMMENDATIONS FOR TEXAS FARM PONDS, and in other references listed in Appendix 1.

Management Considerations

Species composition evaluation can also be influenced by pond size and water clarity. Ponds less than one surface acre and all ponds that remain muddy due to high colloidal clay content should be managed specifically for a single species such as channel catfish and/or blue catfish or hybrid sunfish. These fish will provide the most angling opportunity and food for the table, especially if a supplemental feeding program is practiced.

Why is bass management not very practical in small ponds? It is possible, but not very rewarding to the pondowner if fish are to be harvested. Only about 20 pounds of bass should be harvested per surface acre per year

in a typical pond, otherwise bass may be overharvested allowing overpopulation by forage species. If owners of small ponds insist on managing for bass despite this drawback, care must be taken to release almost all bass caught.

Likewise, muddy ponds are not good candidates for bass production, regardless of pond size (visibility must be at least 8 inches throughout most of the year). Since bass are primarily sight feeding predators, muddy conditions limit their ability to locate forage. As a result, forage may again overpopulate, due to the inability of bass to limit their numbers. A fisheries biologist can outline the steps necessary to achieve adequate water clarity for bass management.

Ponds larger than one surface acre provide more options for management opportunities. One option would be to manage for a single species as previously described, but most owners of larger ponds prefer multi-species management.

The most popular multi-species plans include largemouth bass, bluegill and channel and/or blue catfish. The bluegill must be present for satisfactory bass production, therefore seine samples and sunfish catches should be examined carefully to verify their presence. The bluegill is one of the few species that can withstand the pressure of bass predation through its ability to spawn several times throughout the warm months. This results in an abundance of small forage for use by the bass.

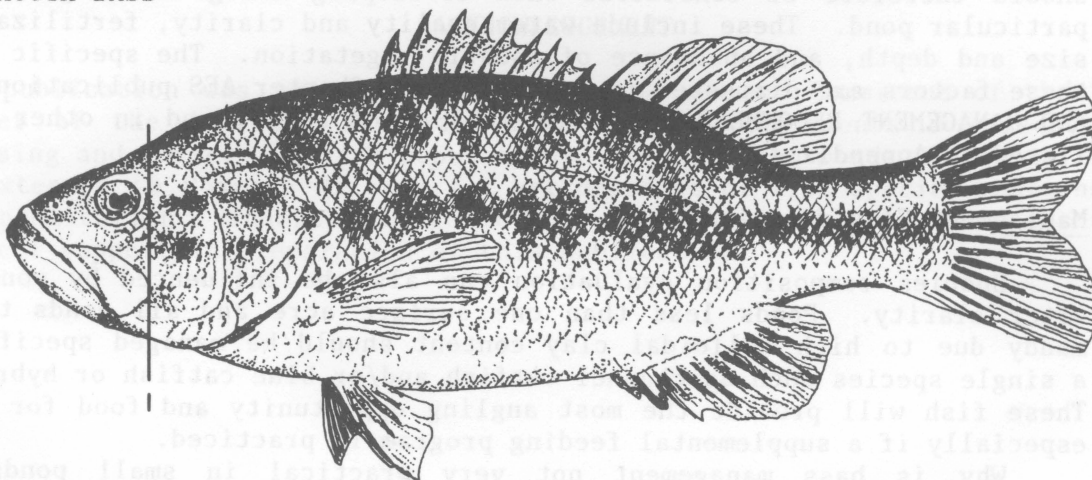
Additional forage species that may supplement the bluegill include redear sunfish, threadfin shad and golden shiners. The supplemental forage appropriate for a particular pond is dependent upon a variety of factors outlined in the STOCKING AND MANAGEMENT publication.

II

IDENTIFICATION OF FISH SPECIES

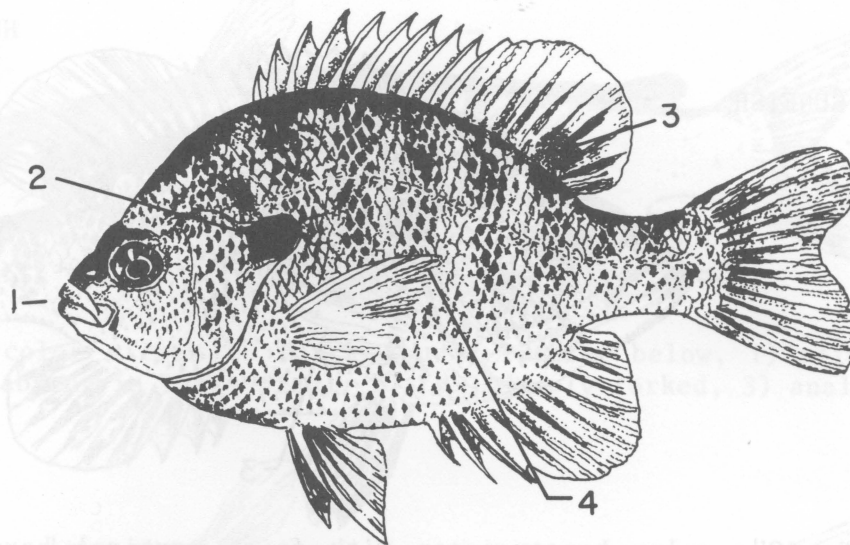
The identification of major sport, forage and rough fish species is essential for the pondowner to interpret assessment information. While it is not practical or necessary to include each species and sub-species found in Texas, the ability to identify the following species will enhance the pondowner's management efforts.

LARGEMOUTH BASS



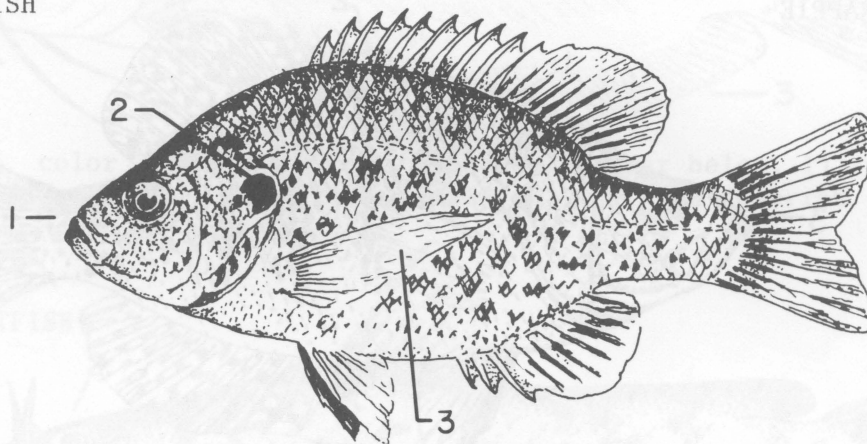
Size to 24", color black and green to gray, 1) upper jaw extends beyond eye.

BLUEGILL



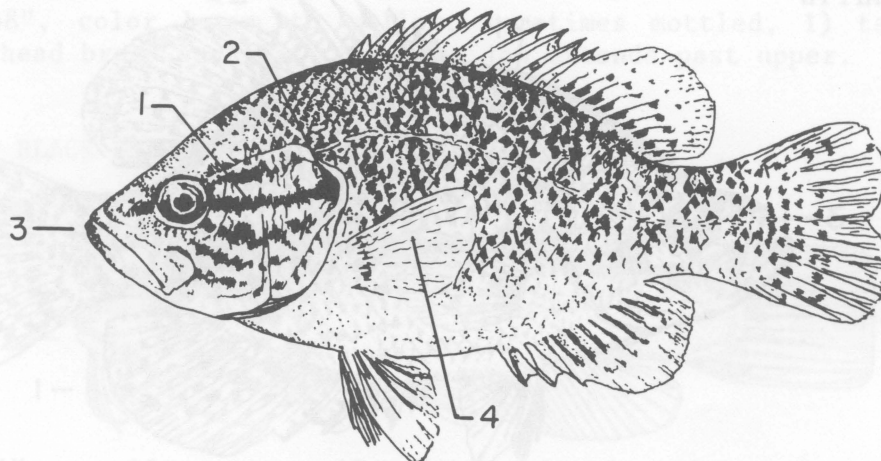
Size to 10", color green to brown with dark bands, 1) small mouth, 2) black ear flap, 3) dark spot on dorsal fin, 4) pointed pectoral fins.

REDEAR SUNFISH



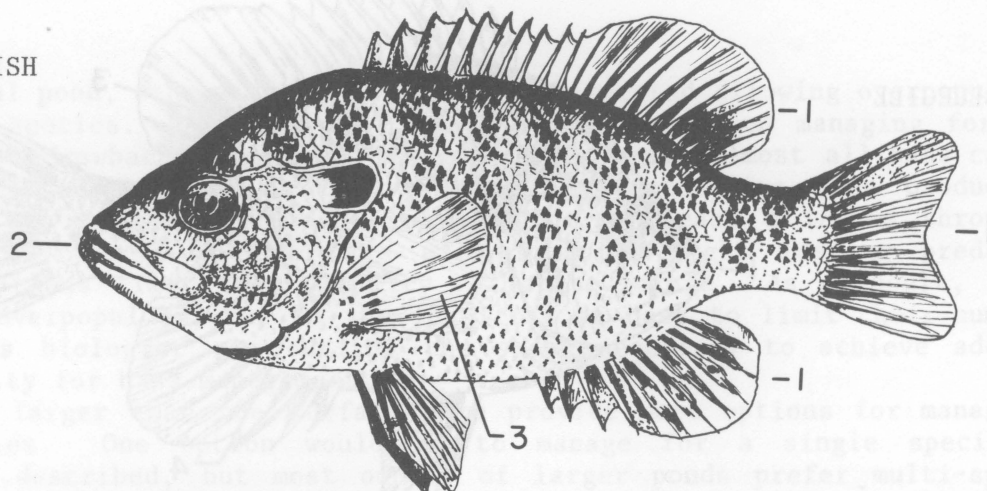
Size to 12", color green to brown with dark checker-board pattern, 1) small mouth, 2) black ear flap with red or orange margin, 3) pointed pectoral fins.

WARMOUTH



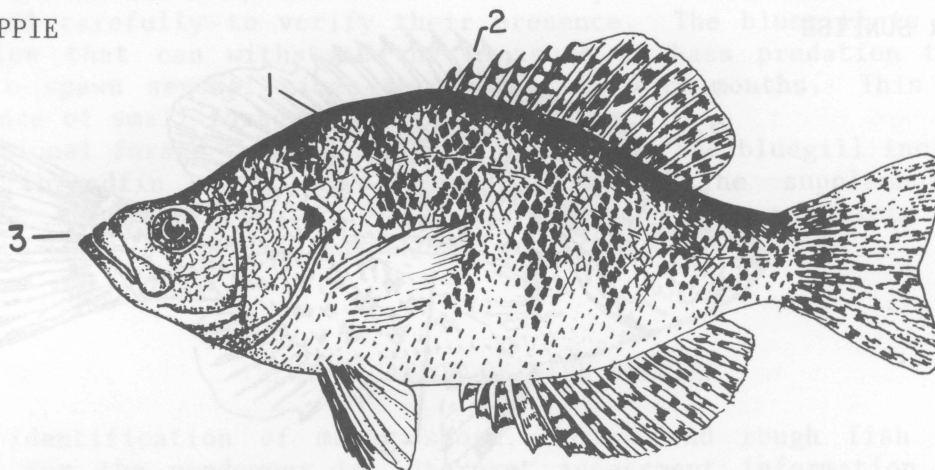
Size to 10", color mottled dark brown, 1) dark bars on cheek, 2) may have reddish ear flap, 3) large mouth, 4) rounded pectoral fins.

GREEN SUNFISH



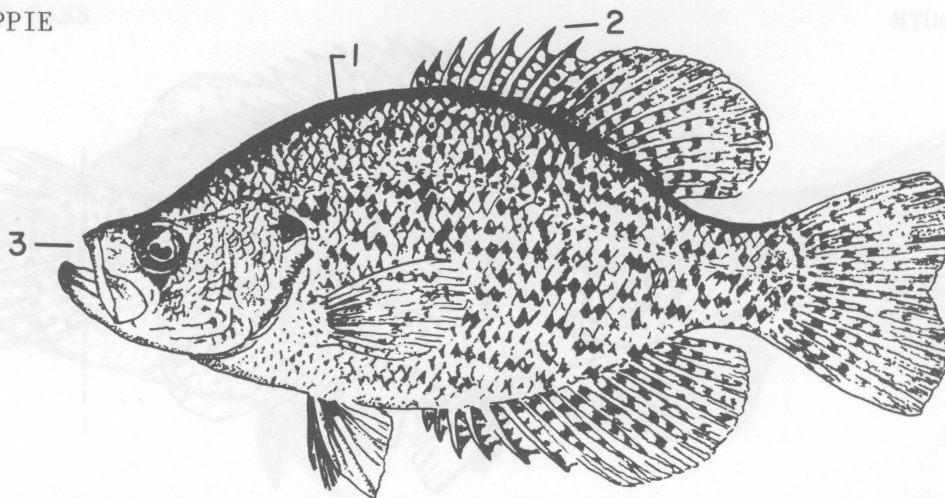
Size to 10", color brassy-green with faint vertical bars, green streaks on cheek, 1) dorsal and anal fins and tail edged yellow-orange, 2) large mouth, 3) rounded pectoral fins.

WHITE CRAPPIE



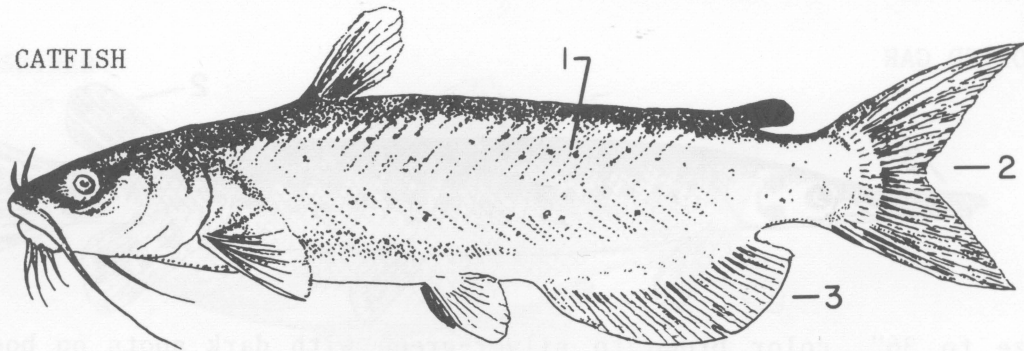
Size to 10", color silver to blue-green, 1) dark spots on sides in vague bars, 2) sharp dorsal spines less than 7, 3) large mouth.

BLACK CRAPPIE



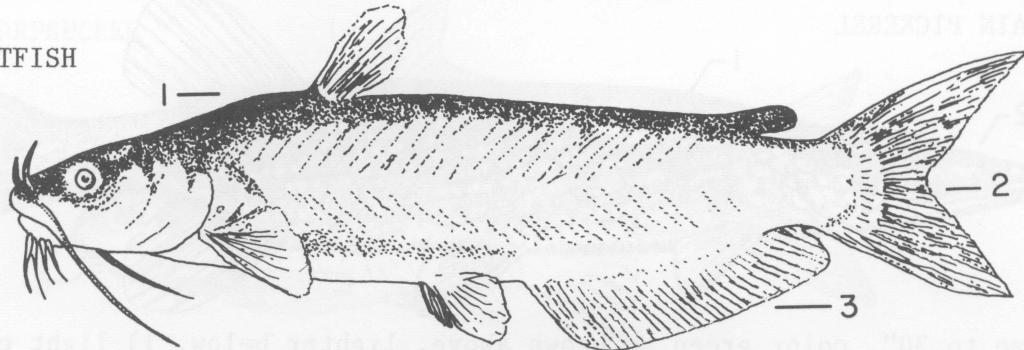
Size to 12", color silver to blue-green, 1) dark spots on sides not in bars, 2) sharp dorsal spines 7 or more, 3) large mouth.

CHANNEL CATFISH



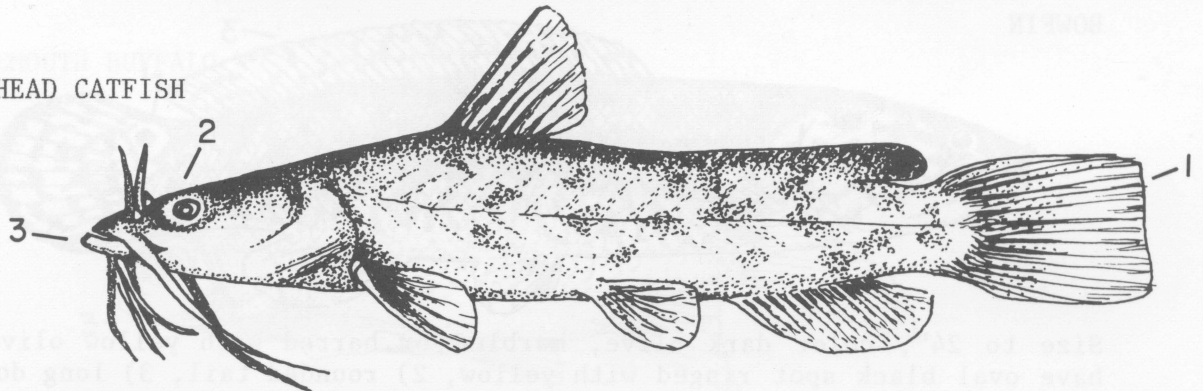
Size to 30", color silver to black above, lighter below, 1) olive or black spots (may be absent in large fish), 2) tail deeply forked, 3) anal fin rounded.

BLUE CATFISH



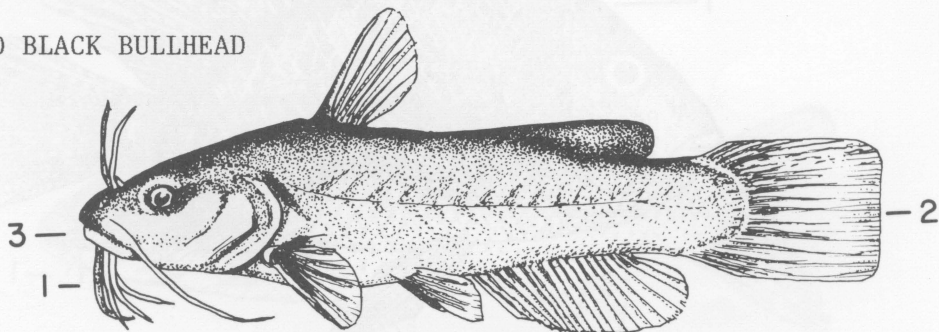
Size to 30", color pale blue to black above, lighter below, 1) fleshy hump in front of dorsal fin, 2) tail deeply forked, 3) anal fin squarish.

FLATHEAD CATFISH



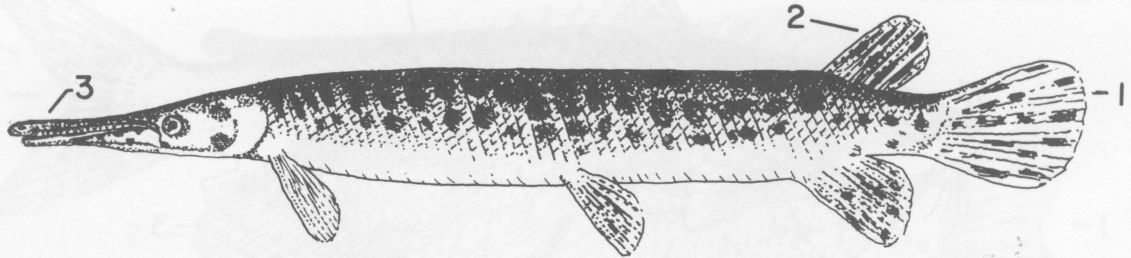
Size to 48", color brown to yellow, sometimes mottled, 1) tail square to round, 2) head broad and flat, 3) lower jaw extends past upper.

YELLOW AND BLACK BULLHEAD



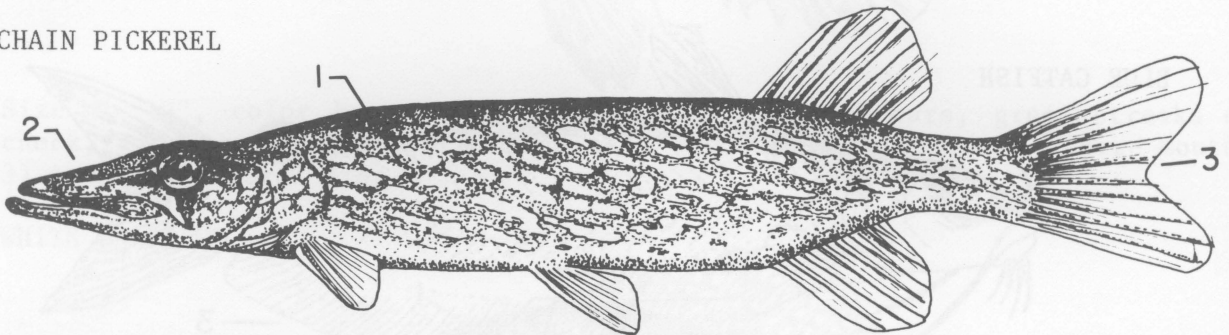
Size to 14", usually much smaller, color black to brown or yellow, 1) chin barbels white or black, 2) tail not forked, 3) lower jaw shorter than upper. Both black and yellow bullheads are very similar.

SPOTTED GAR



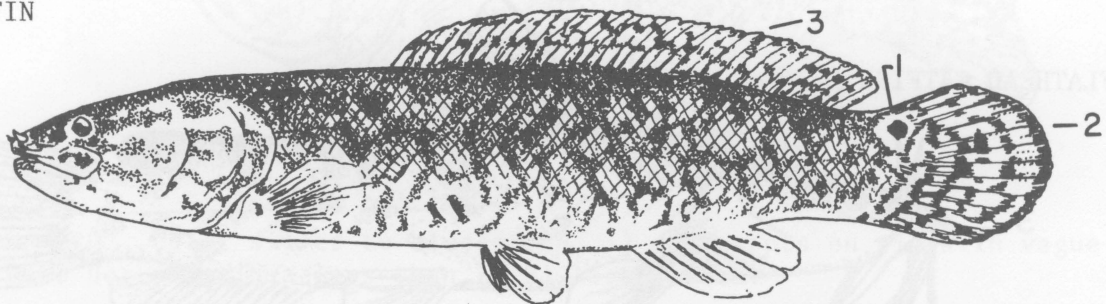
Size to 36", color brown to silver-green with dark spots on body and fins, 1) tail rounded, 2) dorsal fin far back on body, 3) long, toothy snout.

CHAIN PICKEREL



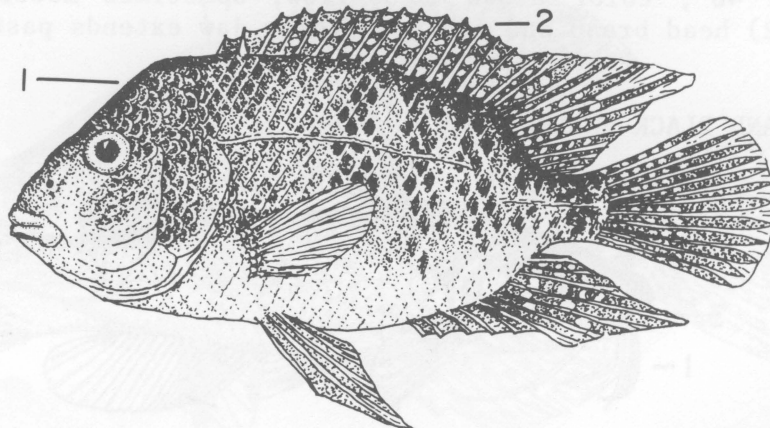
Size to 30", color green to brown above, lighter below, 1) light chain markings on sides, 2) snout duck-billed, 3) forked tail.

BOWFIN



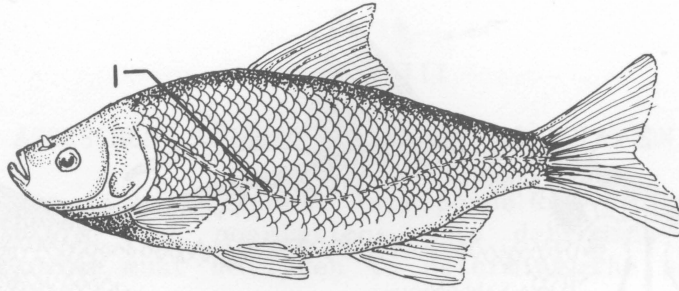
Size to 24", color dark olive, marbled or barred with yellow olive, 1) may have oval black spot ringed with yellow, 2) rounded tail, 3) long dorsal fin.

RIO GRANDE PERCH



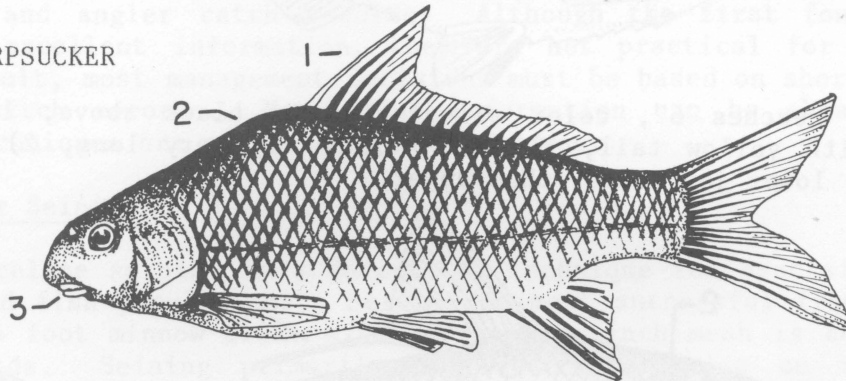
Size to 8", color speckled brown, 1) "humped" forehead, 2) long dorsal fin. Common only in south Texas.

GOLDEN SHINER



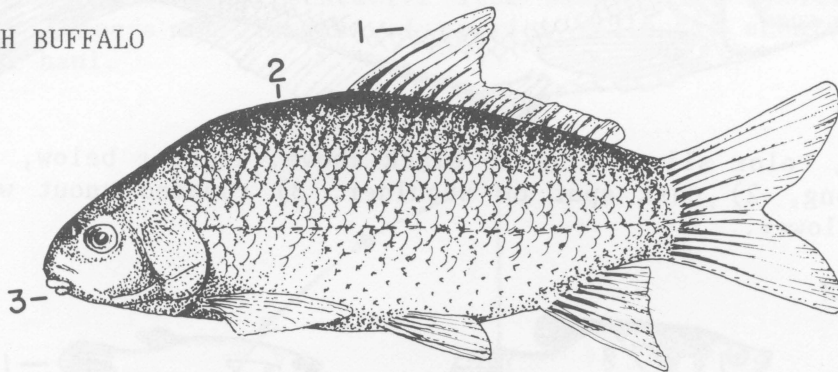
Size to 10", color gold to yellow-brown, 1) lateral line deeply curved.

RIVER CARPSUCKER



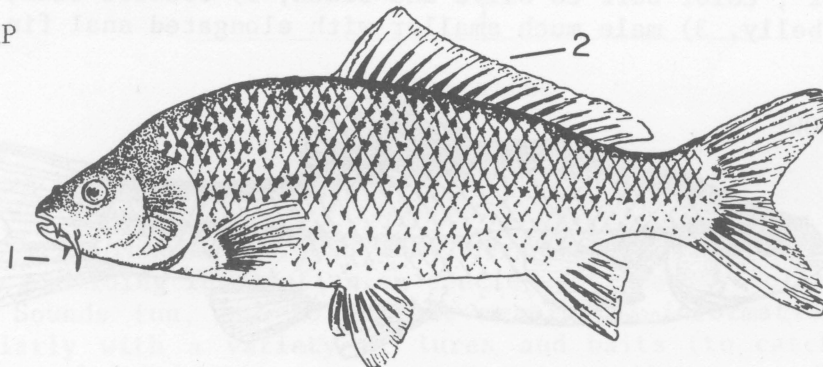
Size to 15", color silver-gray to brown, 1) first dorsal rays longer than others, 2) humped back, 3) mouth on bottom of head behind nostrils.

SMALLMOUTH BUFFALO



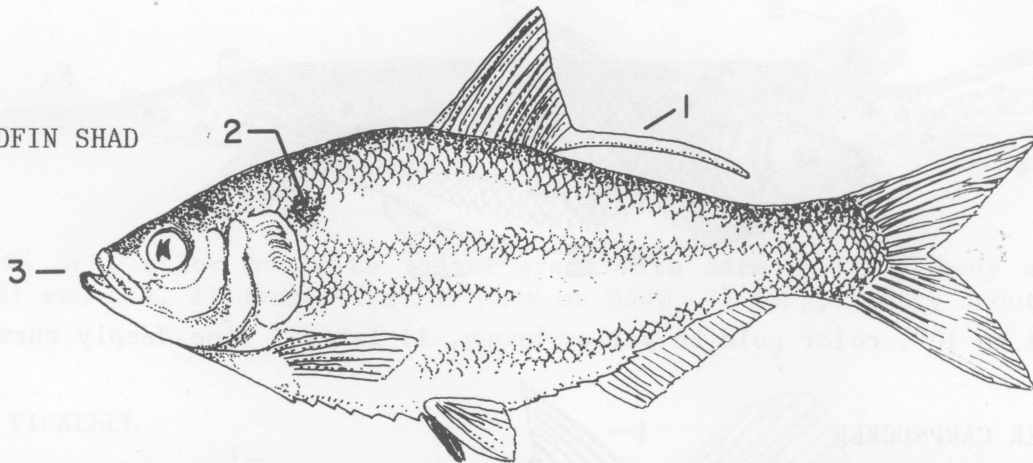
Size to 30", color silver-gray to brown, 1) first dorsal rays longer than others, 2) humped back, 3) small mouth forward of nostrils.

COMMON CARP



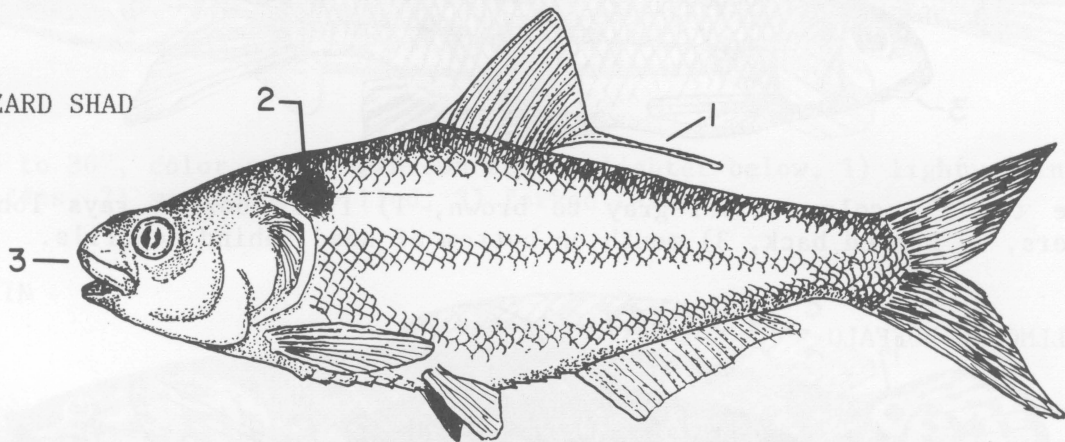
Size to 30", color olive-green to brown above, yellow below, 1) prominent barbels on mouth, 2) long dorsal fin with even edge.

THREADFIN SHAD



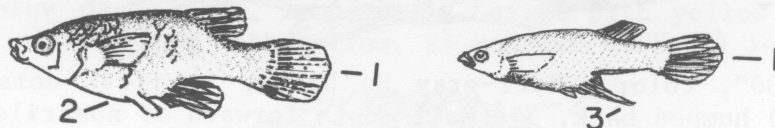
Size seldom reaches 6", color silver-blue to black above, lighter below, sometimes with yellow tail, 1) last dorsal ray very long, 2) dark spot on shoulder, 3) lower jaw longer than upper.

GIZZARD SHAD



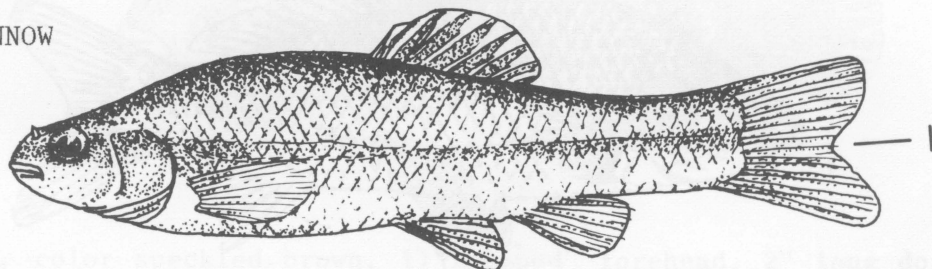
Size to 14", color silver-blue to black above, lighter below, 1) last dorsal ray very long, 2) dark spot on shoulder, 3) rounded snout with upper jaw overhanging lower.

MOSQUITO FISH



Size to 1 1/2", color buff to olive and black, 1) rounded tail, 2) female has rounded belly, 3) male much smaller with elongated anal fin.

FATHEAD MINNOW



Size to 4", color dark green to black above, lighter below, 1) forked tail.

III

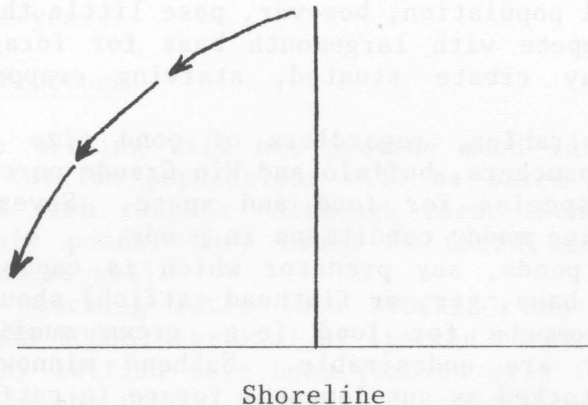
ASSESSMENT TECHNIQUES FOR FISH POPULATION ANALYSES

Poor quality fishing in most farm ponds can be attributed to unbalanced and/or undesirable fish populations. To determine the status of a fish population, samples must be taken to determine the species composition and size distribution.

Several methods are available to sample fish populations including partial rotenone treatments, electro-shockers, gill nets, traps, shoreline seining and angler catch records. Although the first four techniques can provide excellent information, they are not practical for most pondowners. As a result, most management decisions must be based on shoreline seining and angler catch records. Meaningful information can be obtained if both of these techniques are employed by the pondowner.

Shoreline Seining

Shoreline seining is a recognized technique for assessing the status of many pond fish populations. Seining is most successful from June-September. A 20 x 4 foot minnow seine with one-quarter inch mesh is adequate to sample most ponds. Seining primarily provides information on the presence and reproductive success of several key species, particularly largemouth bass and bluegill. Excessive aquatic vegetation and brush will hamper seining attempts. A minimum of three quadrant hauls should be made in different areas to collect a representative fish sample from shoreline habitat (see diagram). Numbers and lengths of species collected should be recorded for each seine haul.



Angler Catch Records

Assessment information can also be obtained from angler catch records, frequently providing information on species not readily collected by shoreline seining. Sounds fun, but to collect meaningful information, anglers should fish regularly with a variety of lures and baits (to catch as many species present as possible) or consistently with similar gear from year to year (to identify changes in length and abundance). An example record form

(Appendix 2) has been included to indicate pertinent information to be recorded. Assessment using angler catch records is only as good as the information collected; therefore extra effort should be used to record the numbers and lengths of all species caught, along with other pertinent observations. Definite trends in harvest composition will become apparent over time, providing the pondowner with reliable information necessary for management decisions.

IV

INTERPRETATION OF ASSESSMENT

Once assessment data has been collected, decisions must be made to properly interpret the information into future management plans. Interpretations are based on the composition of the fish species present and size distribution, especially for multi-species populations. Interpretation of catfish assessment information should also be considered in single and multi-species ponds.

Species Composition

Interpretation of assessment is initially determined by the presence or absence of certain key species. If undesirable fish have been stocked or otherwise entered the pond, decisions on their impact as competitors or predators of desirable species must be made. Species such as gar, bowfin, flathead catfish or chain pickerel compete with largemouth bass for available forage.

Green sunfish, hybrid sunfish and warmouth produce low numbers of young and/or compete for forage with small largemouth bass. As a result, largemouth bass do not perform well in ponds with only green sunfish, hybrid sunfish or warmouth present. The presence of these species in conjunction with an adequate bluegill population, however, pose 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 pond size include black bullheads, common carp, carpsuckers, buffalo and Rio Grande perch. These species compete with desirable species for food and space. Several of these species are capable of creating muddy conditions in ponds.

In catfish ponds, any predator which is capable of feeding on catfish (e.g. largemouth bass, gar, or flathead catfish) should be avoided. Likewise, species which compete for food (e.g. green sunfish, golden shiners, and black bullheads) are undesirable. Fathead minnows are the only species that should be stocked as supplemental forage in catfish only ponds.

Bass-Bluegill Population Structure

After the pondowner has determined that the appropriate species are present and undesirable species do not pose a problem, the size distribution and relative abundance of bass and bluegill should be evaluated. These two species provide the basis for predator-prey relationships in Texas farm ponds.

Data collected by the quadrant seine haul technique should be evaluated using Table 1. Since seining provides only basic information regarding bluegill and bass reproduction, the pondowner should supplement this technique with angler catch records whenever possible.

Angler catch records provide information on adult sport species for evaluating existing populations. Accurate records of the numbers and sizes of species caught are essential for assessment interpretation.

A technical index commonly used to analyze the size distribution of bass-bluegill populations from catch records is Percentage Size Distribution (PSD). To determine the angling PSD for bass, the number of quality bass (12 inches and longer) x 100 is divided by the total number of bass; a balanced bass population should have an angling PSD between 20% and 60%. EXAMPLE: Catch records indicate 100 bass caught, 33 of which were over 12 inches. The PSD would be:

$$\frac{33 \text{ (bass over 12 inches)} \times 100}{100 \text{ (all bass)}} = 33\%.$$

A PSD (bass) of 33% means that of all bass caught, one-third were at least 12 inches long.

For bluegill, the number of quality bluegill (6 inches and longer) x 100 is divided by the total number of bluegill; a satisfactory bluegill angling PSD range is 50% to 80%. EXAMPLE: Catch records indicate 40 bluegills caught, 20 of which were over 6 inches. The PSD would be:

$$\frac{20 \text{ (bluegill over 6 inches)} \times 100}{40 \text{ (all bluegill)}} = 50\%$$

A PSD (bluegill) of 50% means that of all bluegill caught, one-half were at least 6 inches long.

Pondowners should strive to maintain PSD values for both species within the suggested ranges to achieve balanced populations. Table 2 indicates evaluations based on angling PSD. Those values that fall outside the suggested ranges may be in need of corrective management. Care should be exercised to fish with a variety of lures and baits with angling effort spread throughout the year.

Catfish Population Structure

Since shoreline seining will not provide much information on catfish, most assessment of catfish populations will be based on catch records and general condition of fish caught. Although these techniques apply specifically to catfish only ponds, they could be useful for catfish assessment in multi-species ponds as well.

At appropriate stocking rates (see STOCKING AND MANAGEMENT RECOMMENDATIONS FOR TEXAS FARM PONDS) survival of stocked catfish will approach 100%. Knowledge of how many catfish have been removed will facilitate calculation of how many remain in the pond. Under no circumstances should total weight of catfish present exceed 1000 pounds/surface acre during the warm months.

Although some pondowners do not regularly feed their catfish, occasional feeding (at intervals of 1 to 3 weeks) with floating pellets allows the owner to determine whether major declines in abundance have occurred. If the number of catfish coming to feed declines markedly and remains low over a variety of weather conditions, the population has likely suffered mortality due to disease or vandalism.

Hook and line assessment should also include visual notation of plumpness (condition) of the catfish. Since apparent condition is biased by fullness of the gut (reflected by distention of the belly), attention should be focused on the thickness of the flesh while observing the fish from above.

If catfish are overstocked and/or the food supply is insufficient, they will become "skinnier" over time. This sometimes occurs if unexpected natural spawning occurs. In contrast, as abundance of fish declines due to fishing (or other mortality), the flesh will become thicker and "fattier".

V

CORRECTIVE MANAGEMENT

Three techniques are available to the pondowner for correcting unbalanced or undesirable fish populations. These include renovation, harvest manipulation and supplemental stocking. However, if unsatisfactory fish populations are a result of poor water quality, improper pond design or an over-abundance of aquatic vegetation, the suggested corrective techniques alone may not be successful.

Renovation

Total renovation using rotenone should be considered for a farm pond if species such as gar, bowfin, flathead catfish, chain pickerel, black bullheads, common carp, buffalo and carpsuckers are present. If crappie are present, stunting (poor growth) and over-population can sometimes occur and renovation may be necessary. The presence of warmouth and green sunfish does not require renovation if bluegill are present or can be supplementally stocked.

Ponds less than one surface acre in size and all muddy ponds are best suited for single species management for channel or blue catfish or hybrid sunfish. If other species are present, renovation is recommended.

Scalefish that infest ponds managed for catfish only can usually be removed without resorting to total renovation. The use of a selective toxicant such as Antimycin A will remove scalefish without harming catfish populations.

Harvest Manipulation

Angler harvest is an important management tool utilized to adjust the population structure of sport species. For bass and bluegill ponds, harvest recommendations are determined by the relative abundance of the two species and their size distributions based on angling records and PSD values (Table 2). Harvest recommendations for balanced bass-bluegill populations indicate that all largemouth bass 12 to 15 inches in length should be returned to the pond. This means that the harvest removed from the pond will be represented by bass less than 12 inches and greater than 15 inches. By following this "slot limit", the more numerous small bass are thinned sufficiently to reduce competition for available forage. As a result, the remaining small bass grow faster. Bass 12 to 15 inches are returned when caught since they are the primary broodstock present. By returning bass in this size range, overharvest of broodstock will be prevented. Bass over 15 inches can be kept or released at the discretion of the angler. Enough bass must be removed (10 pounds/surface acre/year) for a slot limit to be effective in maintaining pond balance. The following chart provides the angler with

average weights of bass based on their lengths for estimating total pounds removed/surface acre/year.

<u>Bass Length (inches)</u>	<u>Average Weight (lbs.)</u>
8	0.25
9	0.35
10	0.50
11	0.70
12	0.90
13	1.10
14	1.50
15	1.80
16	2.25
17	2.70
18	3.30
19	3.90
20	4.50
21	5.40

For blue or channel catfish and hybrid sunfish, harvest records should be maintained to determine the number of the original stocking removed. Balanced bass and bluegill populations may limit catfish reproduction even if catfish spawning habitat is provided. If catfish appear to be in poor condition (skinny body), harvest should be increased substantially to reduce competition for the food supply.

All other species caught should be removed from the pond regardless of size and number. These include gar, bowfin, flathead catfish, chain pickerel, bullheads, Rio Grande perch, common carp, buffalo, carpsuckers, green sunfish, warmouth and crappie.

Table 1. Assessment of fish populations based on seining.

<u>Seine Contents</u>	<u>Status</u>	<u>Recommendations</u>
Young bass (less than 4 inches) present many recently hatched bluegills (less than 2 inches)	Population Balanced	Continue assessment using angler harvest records
Young bass (less than 4 inches) present no recently hatched bluegills	Bluegills absent or undesirable species competing with bluegills	Verify bluegill presence by angling
No young bass present many recently hatched bluegills (less than 2 inches)	Bluegills or bass crowded or bass not present in pond	Verify bass presence by angling.
No young bass present no recently hatched bluegills, undesirable species collected.	Overpopulation or absence of bluegills or undesirable fish species overpopulated.	Verify bass and/or bluegill presence by angling

Table 2. Harvest recommendations based on angling PSD values.

Catch Composition	Angling PSD(%)		Harvest Recommendations
	Bass	Bluegill	
Bass average 12"-15". Bluegill average range from 3"-6" or larger.	20-60	50-80	Balanced pond-release 12"-15" bass
Bass average 12"-15". Bluegill caught are less than 5".	20-60	less than 50	Bluegill reaching over- crowded condition - Harvest more bluegill release 12"-15" bass
Most bass caught are 12" or larger. Bluegill caught are less than 5".	greater than 60	less than 50	Bluegill overcrowded - Harvest more bluegill release all bass
Bass are easy to catch and most are less than 12". Bluegill range from 3"-6" or larger.	less than 20	50-80	Bass reaching overcrowded condition - Harvest more bass less than 12"; release 12"-15" bass
Bass are easy to catch and most less than 12" long. Bluegill (6" plus) frequent.	less than 20	greater than 80	Bass overcrowded - Harvest more bass less than 12" and over 15"; release 12"-15" bass and all bluegill
Undesirable species			Consider renovation

Supplemental Stocking

Occasionally pond assessment evaluations determine that supplemental stocking be used to restore balance or establish a fishery. If shoreline seining and angler records reveal that bass are not present, a population could be established by stocking 20 6-8 inch bass/surface acre, providing forage is available. If bluegills are abundant and stunted at about 3 inches, increase this rate to 40/surface acre. Stocking of smaller fingerlings will typically result in poor survival in ponds with established populations.

A common, yet unwise practice of many avid bass anglers is to stock bass just because "that's what I like to catch". If bass are already unable to sustain their numbers because of poor water quality or inadequate forage availability, the addition of fingerlings will not correct the situation.

The only instance when bass should be stocked on top of an existing bass population is if Florida bass are introduced to hybridize with native bass. The resulting F1 cross of the two sub-species may grow faster and larger than the parents, provided proper forage, habitat and water quality are present. The genetic background of the existing bass population and the Florida bass to be stocked may also greatly effect results. Twenty advanced (6-8 inch) Florida bass fingerlings/surface acre should establish a breeding

population in most ponds. However, pondowners should first consult with a fisheries biologist prior to supplementally stocking Florida bass.

If assessment techniques indicate that bluegill are not present, advanced fingerlings (3 inches up) should be supplementally stocked at the rate of 30/surface acre. This technique is often necessary in ponds where warmouth and green sunfish are the only forage species present for bass.

Several species can be stocked in the presence of bluegill to further increase forage availability. The threadfin shad is often stocked at 200-500/surface acre, although restocking is sometimes necessary 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.

Redear sunfish and golden shiners are also recommended as supplemental forage in certain geographic areas of Texas. The pondowner is referred to the STOCKING AND MANAGEMENT publication listed in Appendix 1 for additional information.

Fathead minnows should not be supplementally stocked in a pond with an established bass population. This species is a relatively slow swimmer and will usually be rapidly eliminated.

In established multi-species ponds, channel and/or blue catfish can be stocked (when absent) at the rate of 100/surface acre. Fingerlings should be no smaller than 8 inches to avoid predation if adult bass are present. Re-stocking may be necessary every 3-5 years at 100/surface acre since bass and bluegill populations often limit the natural reproduction of catfish.

Re-stocking of catfish in catfish ponds should not occur before 50% of the original number are removed. However, total weight of catfish present should never exceed 1000 pounds/surface acre during the warm months. The stocking rate utilized should be based on pond size, condition and total weight of catfish present and the frequency of feeding. Fathead minnows are often supplementally stocked in catfish only ponds at the rate of 500-1000/surface acre to provide additional forage. Although catfish do not normally spawn in small ponds, catfish stocked alone should not be encouraged to reproduce by adding spawning habitat since reproduction cannot be controlled and overpopulation/stunting may result.

VI

SUMMARY

The intent of this Texas Chapter of the American Fisheries Society publication is to provide management information to pondowners to increase the recreational value of their sport fishery.

Pondowners using ASSESSMENT should be able to manage their pond under most conditions. After initial assessment and necessary corrective measures have been implemented, the pondowner should continue to monitor fish populations. Shoreline seining and accurate catch records will provide sufficient assessment information for future management efforts.

If special problems or conditions exist, advice is available from qualified fisheries biologists with consulting firms, fish farms, universities and state and federal agencies.

VII

APPENDICES

APPENDIX 1

U.S. Department of Agriculture
Soil Conservation Service
101 South Main Street
Temple, Texas 76501

Building A Pond. Farmers Bulletin No. 2256. 1973. 13 pp.

Dillon, Olan W., Jr., et al. Warm-Water Fishponds. Farmers Bulletin No. 2250. 1977. 44 pp.

Catfish Farming. Farmers Bulletin No. 2260. 1981.

Ponds - Planning, Design, Construction. Agricultural Handbook No. 590. 1982. 51 pp.

Renfro, George, Jr., Sealing Leaking Ponds and Reservoirs. Pamphlet No. SCS-TP-150. 1968. 6 pp.

Texas Parks and Wildlife Department
4200 Smith School Road
Austin Texas 78744

Forshage, Allen A., and Kenneth R. Moore. Fish Habitat Improvement in Reservoirs. PWD Booklet 3000-12. Printed May 1980.

Inman, C. R. Construction Hints and Preliminary Management Practices for New Ponds and Lakes. PWD Booklet 3000-7. Printed March 1980. 10 pp.

Kemp, Robert J. Freshwater Fishes of Texas. 1971. 40 pp.

Menn, C. T. Rotenone: Its Use in Fisheries Management. PWD Brochure 3000-77. October 1979.

Smith, Dwane Q., and John M. Mitchell. The Ecology of Farm Pond Fertilization. PWD Brochure 3000-24. Printed June 1978.

Texas Agricultural Extension Service
Department of Wildlife and Fisheries
Nagle Hall - Texas A&M
College Station, Texas 77843

Higginbotham, Billy. Threadfin Shad Management and Culture. Coded L-2085. 2 pages.

Higginbotham, Billy and Donny W. Steinbach. Renovation of Farm Ponds. Coded L-2084. 2 pages.

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Klussmann, Wallace. Texas Agricultural Progress. "What Makes Fish Bite?"
Vol 12, No. 1, pages 7-8. TAP 420. Winter 1966.

Lock, Joe and Wallace Klussmann. Improve Your Farm Fish Pond. 18 pp.

Lock, Joe and James Davis. Liming Farm Fish Ponds in East Texas. Coded
L-1864. 2 pp.

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Recreation. Manuscript of MP-1142. Reprint. 14 pp.

Steinbach, Donny W. and Richard Noble. Largemouth Bass. Coded L-2083.
2 pages.

Texas Chapter-American Fisheries Society 1/

Texas Chapter, American Fisheries Society. Stocking and Management
Recommendations for Texas Farm Ponds. 11 pages.

1/ This publication is available from offices of the Texas Parks and
Wildlife, Soil Conservation Service and the Texas Agricultural
Extension Service.

ADDITIONAL REFERENCES

Anderson, R. O. 1983. Managing Ponds For Good Fishing. Missouri Cooperative
Extension Service. Coded 9410. 4 pp.

Gabelhouse, Donald W., Richard L. Hager and Harold E. Klaassen. 1982.
Producing Fish and Wildlife From Kansas Ponds. Kansas Fish and Game
Commission. 57 pp.

One fisherman from the group should sign his initials, just in case some further information is needed.

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Educational programs conducted by the Texas Agricultural Extension Service serve people of all ages regardless of socioeconomic level, race, color, sex, religion, handicap or national origin.

Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture. Zerle L. Carpenter, Director, Texas Agricultural Extension Service, The Texas A&M University System.

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