# An Internet Survey of Private Pond Owners and Managers in Texas

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*Abstract:* The primary emphasis of this survey was to determine what specific problems Texas private impoundment owners/managers confront, how widely these problems occur, and where owners/managers get their information on pond management. A secondary emphasis was to examine the potential utilization of the Internet to gather information and distributed outreach materials. A random sample of 2,999 private impoundment (i.e., no public waters) applicants for Triploid Grass Carp Permits from Texas Parks and Wildlife was utilized as the survey mailing list. A 49-question survey was developed and placed on a secure web site. Each questionnaire contained five sections: general pond characteristics, physical pond characteristics, aquatic vegetation, fish and other wildlife, and management goals. Two post-card mailings were made asking recipients to go to the online web site and fill out the survey. The overall response rate was 21.3% (excluding non-deliverable postcards and unusable submitted surveys). Summary statistics for each question were calculated and then analyzed in order to gain a clearer picture of pond management practices employed by Texas impoundment owners/ managers. Results indicated some initial discrepancies between management practices and preferences and common management recommendations. This was illustrated most dramatically in aquatic vegetation management and basic understanding of management principles.

*Key Words:* algae, aquatic vegetation management, fishing, internet survey, pond management, private impoundment, Texas

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## Introduction to Private Pond Management in Texas

An estimated 1,000,000 private impoundments can be found throughout Texas. Also known statewide as ponds or tanks, these impoundments have multiple uses including fishing, irrigation, livestock watering, water gardening, and wildlife attraction. Different pond uses and pond management goals dictate discrete management practices. Even so, there are basic issues common to most ponds. Six steps are critical in pond management: 1) construction, 2) soil and water quality management, 3) developing the food chain, 4) stocking, 5) maintaining balance, and 6) controlling aquatic vegetation and other problems (Masser 1996).

The first step to a healthy pond, regardless of its intended use, is proper physical construction; poor construction can lead to problems such as leaking, whether through the dam or the pond bottom. To maintain adequate water levels, ponds also need a sufficient watershed (the land surrounding a pond that channels runoff).

The soils of the pond site and watershed affect pond productivity. Many Texas soils, especially those in eastern regions, are highly acidic. Often, liming is recommended to improve response to fertilization by decreasing the amount of phosphorus that needs to be added in the form of fertilizers (Boyd 1974). Once soil and water pH and alkalinity have been addressed, increased productivity can be attained by fertilizing a pond to maintain algal blooms (Masser et al. 1999).

Pond water quality is affected by a number of variables that all must be in balance to maintain a healthy pond ecosystem. The most important of these to recreational ponds are dissolved oxygen, ammonia, and nitrite (Brunson et al. 1994, Boyd 1995, Hargreaves and Brunson 1996). Research on pond productivity has shown that phytoplankton-based food chains are superior to macrophyte-based ones (Garg and Bhatnager 2000). Moriarty (1997) cited three major reasons that microbial food webs have a direct effect on overall productivity: 1) algae and bacteria are responsible for a pond's oxygen content, 2) microorganisms contribute directly to the food web as nutrition for grazers (whereas most macrophytes do not), and 3) nitrogen and phosphorus are recycled by heterotrophic decomposers. To establish a plankton-based food chain, fertilizers can be applied to promote phytoplankton growth. Garg and Bhatnager (2000) found fish production increased with an increase in primary productivity (phytoplankton) as a result of fertilization.

Once the physical and chemical preparation of the pond is complete, the emphasis turns to stocking of appropriate species. Optimum stocking rates are dependent not only on the carrying capacity of the pond

system, but on the management goals and fishing pressures the pond will receive. Just as there can be many different pond management goals, species selection and stocking can reflect a range of fishing needs and goals. According to the Texas Chapter of the American Fisheries Society (2005), improper harvesting is the most commonly cited reason for poor bass fishing in Texas ponds. A combined bass and bluegill system generally is successful only in ponds of ≥1 acre. Smaller ponds generally are recommended for catfish stocking (Davies 1973, Masser 1996). Greater productivity can be achieved from catfish systems, as well as other stocking strategies, by using commercial feeds to supplement the natural forage available (Bennett 1971, Davies 1985, Stickney 1985, Egna and Boyd 1997).

Aquatic vegetation is present to some extent in all aquatic systems. The level to which it is tolerated by specific pond owners dictates differing management goals and thus differing aquatic vegetation management strategies. According to Participant Surveys at Bass 101 workshops, 53% of attendees in 2001 and 44% of attendees in 2003 stated that aquatic vegetation was their biggest problem. Not all aquatic vegetation is nuisance or needs to be managed. It is only a problem once it inhibits use of a pond, or is deemed undesirable by the pond owner.

Overall pond management, including watershed management, can provide for many pond uses instead of, or in addition to, fishing. Wildlife is attracted to ponds as water sources, and this provides opportunities for wildlife watching, a hobby that, according to the U.S. Fish and Wildlife Service (2001), is growing steadily in popularity. The growth of wildlife-related spending shows that there is a market today for wildlife-related activities and indicates an increasing need for information about these new nature-related activities and the means by which to pursue and manage them.

Ponds are dynamic systems, but, while no two are exactly alike, similar ponds contend with similar problems. Although there are differences observed between management practices in different states, similar general guidelines are applied to ponds across the United States. Most of the issues concerning pond owners are well understood by professionals, yet, the need and desire for information by pond owners as well as the relative importance of problems is not as well documented.

The primary purpose of this study was to determine the specific problems Texas pond owners are facing, how widely these problems are occurring, and where pond owners get the information they use to deal with these problems. Having a basic description of the common problems that pond owners see and the options they use to deal with these problems will help with the content development of educational programs and information packets designed for private pond owners. A secondary emphasis of the project was to examine the potential the internet presents for information gathering and distribution. Utilizing internet survey methods will serve to gauge the response by pond owners to determine if these methods can be applied more widely, and also to discover the drawbacks of internet-based methods, and make preliminary recommendations on future use of this tool.

**Mail/Internet Survey Methodology**

In November 2003, a random sample was taken of 2,999 private applicants for Triploid Grass Carp Permits from the Texas Parks and Wildlife Department; no public entities were included at this time. The use of the permit application list was determined to be the most appropriate way to target pond owners while avoiding bias in the sample toward Extension clients.

A 49-question survey was constructed using Dillman's (2000) Tailored Design Method. The survey contained five sections: general pond characteristics, physical pond characteristics, aquatic vegetation, fish and other wildlife, and management goals. The first section dealt with general characteristics of the pond, beginning with the number of ponds owned, type of watershed, pond construction, pond use, and general pond problems encountered. The next section encompassed the physical and biological characteristics of pond water testing, water sources, fertilization, liming, and Rotenone use. The third section dealt with aquatic vegetation: preferences, problems, and management treatments. Fourth, questions were asked about fish and other wildlife in and around the pond area. These included fish stocking, accidental inhabitation by undesirable fishes, fishing preferences and goals, fish kills and disease problems, and predators and other

animal pest problems. The final section related to achieving management goals using four questions; two concerned the use of private pond consultants, and two concerned present and future annual pond management expenditures.

An initial postcard mailing informed sample members of their selection and provided the web address at which the survey could be accessed. One week later, a second thank-you-and-reminder card was mailed out to respondents. The survey period closed after three weeks, creating a 4-week sampling period. Mailing addresses were run through print services software before mailing to check for undeliverable addresses, and corrections to address formats were made as applicable. Of 2,999 original contacts, 1,819 postcards were deliverable, 423 surveys were completed online, and of these, 387 were useable, yielding a 21.3% overall response rate.

**Discussion of Survey Findings**

Private pond owners in the state of Texas had a number of public and private resources available to them to aid in pond creation and management. These included agency personnel, programs, and printed and online information. Although most information regarding management techniques can be applied to situations that involve any number of ponds, most programs and presentations currently in use are tailored to private owners responsible for only a small number of ponds.

The most commonly encountered general pond problem reported by county Extension agents was excessive aquatic vegetation (80.9%) (Figure 1). This category does not include algae problems, which was the next most commonly reported problem in the survey. The least commonly reported problems included fish and other wildlife related issues, including stocking, harvesting, disease, and pests.

Pond water testing, either by individuals or professionals, is strongly encouraged to maintain a healthy pond environment, but only 15% of pond owners reported having such tests performed. Nearly 50% more respondents engaged in fertilization, a process whose success can be linked to proper water chemistry as determined by testing, than did those who tested their pond water. Fertilization without preliminary water testing is not recommended, as the proper types and doses are based on individual water chemistry

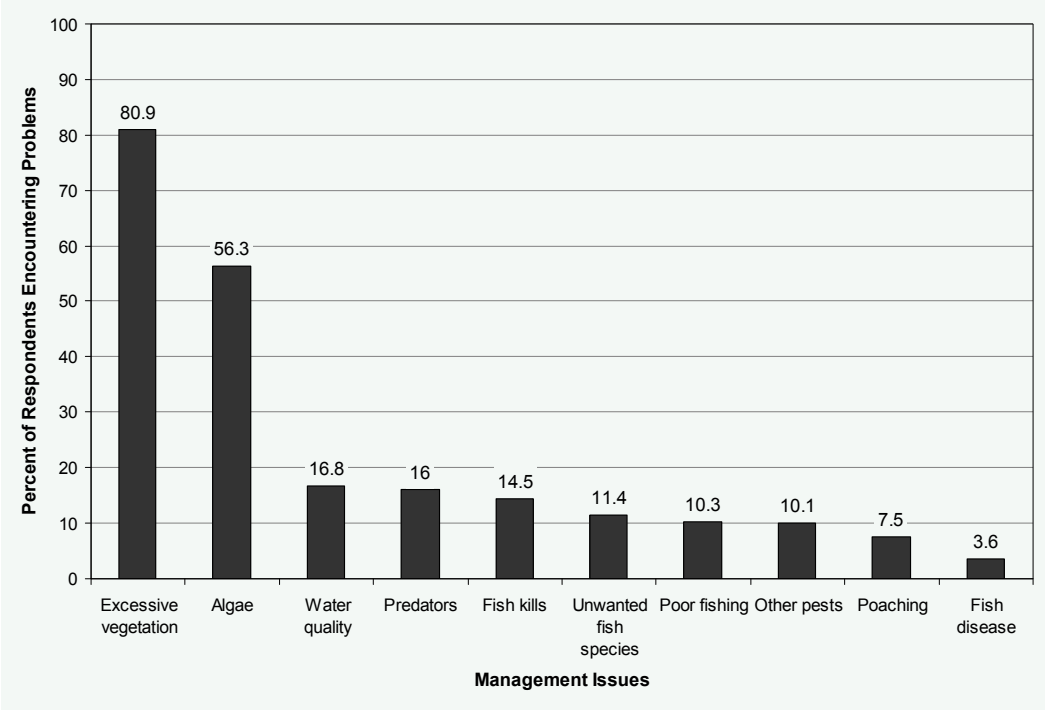


**Figure 1. Overall occurrence of pond management issues encountered by survey respondents.**

characteristics. Such testing can indicate the need for pond liming, a step often necessary before fertilization can be successful. Respondents indicated low occurrence of liming, and both liming and fertilization together were reported only 5% of the time. This suggests a lack of understanding among respondents of natural pond food chains or how they can be enhanced.

Despite the fact that county agents and pond owners alike reported that aquatic vegetation was the most common problem faced by pond owners, the same vegetation was considered important to their ponds by two-thirds of respondents. The most commonly reported types of vegetation added, were water lilies, cattails, and duckweed, all species that can become serious management issues in many areas, and difficult to eradicate once they inhabit a pond system. Aquatic vegetation inaccurately was thought to be a necessary component for many pond uses, most notably fishing, however, whereas algae are important to a healthy food web in bass-bluegill systems, rooted aquatic vegetation is not necessary and often detrimental.

Nearly half of all respondents reported vegetation problems of each of the following types: filamentous algae (55.6%), submerged vegetation (51.7%), and emergent vegetation (49.1%). When ponds were treated, nearly all owners reported self-treatment of their ponds (91.5%).

Of the 20 species of fish intentionally stocked in ponds, the most common included bass, catfish, fathead minnows, and bluegill (Table 1). All other fish were stocked by <20% of respondents. Traditionally, more attention is placed on the bass-bluegill system; however, the suitability of catfish for small ponds should not be overlooked, neither by owners nor professionals. Whereas bass and bluegill are part of a balanced system, only two-thirds of pond owners reported stocking both bass and bluegill together. This discrepancy suggests that pond owners lack understanding of the importance of balance between bass and bluegill in the predator-prey relationship.

Fishing frequency is an indicator of possible balance problems. In our survey, most (>50%) respondents reported a fishing frequency of once per month. Not adequately harvesting sufficient numbers of fish can lead to stunting and reports of poor fishing quality, but the problem often is insufficient frequency of fishing. Problems with pond balance can also come from harvesting strategies, even if the pond is fished

**Table 1. Species of fish purposely stocked and invasive species that have accidentally inhabited private ponds in Texas 1998-2003 by percentage of total respondents.**

| fish species | purposely stocked (by % total respondents) | invasive species (by % total respondents) |
|---|---|---|
| bass | 54.8 | 13.2 |
| bluegill | 48.8 | 10.1 |
| crappie | 15.8 | 8.0 |
| redear sunfish | 18.6 | n/a[1] |
| green sunfish | n/a[1] | 8.8 |
| other sunfish/perch | 17.6 | 19.1 |
| channel catfish | 54.5 | 10.1[2] |
| blue catfish | 19.4 | n/a[1] |
| fathead minnow | 49.1 | 15.8[3] |
| golden shiner | 12.1 | n/a[1] |
| trout | 0.5 | n/a[1] |
| goldfish/carp/koi | 18.1 | 4.7 |
| bullhead/mudcat/pollywogs | 12.4 | 20.7 |
| none | 10.1 | 32.3 |

[1] category not included within the question
[2] invasive species list includes combined category for all catfish
[3] invasive species list includes combined cate gory for all minnows

often. Most respondents (55%) reported keeping only a select few fish caught. The second most popular harvest regime indicated was to release all fish (31.7%). Under-harvesting can cause predator-prey balance problems in short periods of time. Ponds, especially those that are fertilized, stocked, and/or fed, need to be harvested properly. The practice of catch-and-release, a viable and environmentally responsible option in public waters, is a poor choice for private ponds. Although the distribution of harvest strategies indicates that a large number of ponds would benefit from appropriate balance checks, only 7.3% of respondents reported ever having paid a private consultant to check pond balance.

The private sector approach available to pond owners who wish to improve their pond management is to employ a pond consultant. Pond owners indicated that a willingness to employ a private consultant (58.4%), but 50.0% of currently spending ≤$50 per acre per year. However, if they could better reach management goals, spending would significantly increase (>25% increase) (Figure 2).

The sources from which pond owners got their information were both public and private and included Natural Resources Conservation Service (NRCS), Texas Cooperative Extension (TCE - formerly Texas Agricultural Extension Service), Texas Parks and Wildlife Department (TPWD), and private contractors. For pond-building advice, the largest percentage used private contractors (21.7%), followed closely by NRCS (19.1%). Recommendations received were reportedly followed >80% of the time by three-quarters of pond owners who reported the sources from which they received information. For water testing purposes, Extension testing services were used most frequently (28.0%), followed by private labs (22.8%), and consultants (24.6%). One of the areas of greatest problems, aquatic vegetation, showed treatment advice came predominantly from TPWD (27.4%) and Extension (25.6%), but also notably from retail stores (20.7%) and private consultants (20.4%). In this case, 67% reported compliance with the advice >80% of the time. When stocking fish, the most common recommendations came directly from hatcheries themselves (38.0%) and respondents reported (68.7%) adhering to recommendations >80% of the time. Thus, even when information is actively sought by pond owners and managers, advice is not always followed.

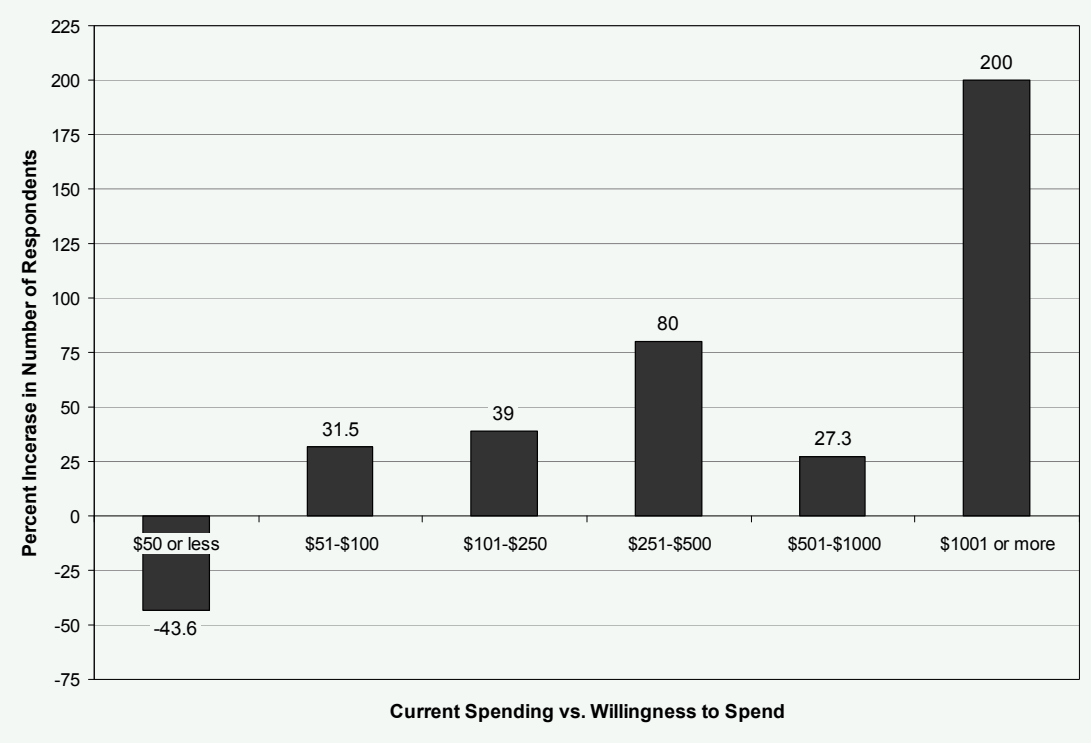


**Figure 2. Difference in respondents' current spending levels versus their willingness to spend more in order to reach personal management goals.**

## Implications of Survey Findings to Future Pond Management Programs

The internet-based survey worked effectively to dramatically lower the cost of distribution and the workload of data entry compared to traditional mail surveys: although response rate was low (compared to mail survey response rates). When the proportion of households with internet access is taken into consideration (41.5% in 2000, according to Newberger 2001), the relative response rate was higher than expected.

The results of this preliminary survey can be used to give direction to professionals in agencies and the private sector in creating programs and information directed at meeting the needs of private pond owners. Most notably, respondents currently implement few management recommendations, especially those related to aquatic vegetation and pond balance. These topics have a great deal of research-based literature available to the public, but some common misconceptions may be clouding the issues when they are applied directly to management of private ponds. We suggest that development of additional resources in these areas should continue. Efforts should also be put toward ensuring that pond owners properly understand management issues, and separate management myth from solid pond management practices.

## Literature Cited


Bennett, G. W. 1971. Management of Lakes and Ponds. Van Nostrand Reinhold Co., New York, NY.

Boyd, C. E. 1974. Lime requirements of Alabama fish ponds. Bulletin 459, Agricultural Experiment Station, Auburn University, Auburn, AL.

Boyd, C. E. 1995. Bottom Soils, Sediment, and Pond Aquaculture. Chapman and Hall, New York, NY.

Brunson, M. W., C. G. Lutz, and R. M. Durborow. 1994. Algae blooms in commercial fish production ponds. Southern Regional Aquaculture Center Publication No. 466, Texas A&M University, College Station, TX.

Davies, W. D. 1973. Managing small impoundments and community lakes. Proceedings of the Annual Conference, Southeastern Association of Game and Fish Commissioners 27:347-355.

Davies, W. D. 1985. Sportfish management in ponds. Pp. 1-9 *in*: Proceedings of the Symposium on Pond Management in Oklahoma. The Noble Foundation, Oklahoma City, OK.

Dillman, D. A. 2000. Mail and Internet Surveys: The Tailored Design Method. John Wiley and Sons, Inc., New York, NY.

Egna, H. S., and C. E. Boyd. 1997. Dynamics of pond aquaculture. CRC / Lewis Publishers, Boca Raton, FL.

Garg, S. K., and A. Bahtnagar. 2000. Effect of fertilization frequency on pond productivity and fish biomass in still water ponds stocked with *Cirrhinus mrigala* (Ham.). Aquaculture Research 31:409-414.

Hargreaves, J., and M. Brunson. 1996. Carbon dioxide in fish ponds. Southern Regional Aquaculture Center Publication No. 468, Texas A&M University, College Station, TX.

Masser, M. P. 1996. Management of recreational fish ponds in Alabama. Publ. ANR-577, Alabama Cooperative Extension, Auburn, AL.

Masser, M. P., D. Steinbach, and B. Higginbotham. 1999. Catfish ponds for recreation. Publ. B-1319, Texas Agricultural Extension Service, College Station, TX.

Moriarty, D. J. 1997. The role of microorganisms in aquaculture ponds. Aquaculture 151:333-349.

Newburger, E. C. 2001. Home computers and internet use in the United States: August 2000. U.S. Census Bureau P23-207, U.S. Department of Commerce, Washington DC.

Stickney, R. R. 1985. Aquaculture in ponds. Pp. 10-24 *in*: Proceedings of the Symposium on Pond Management in Oklahoma, The Noble Foundation, Oklahoma City, OK.

TCAFS (Texas Chapter of the American Fisheries Society). 2005. Texas farm ponds: stocking, assessment, and management recommendations. Special Publication Number 1, Austin, TX.

USFWS (United States Fish and Wildlife Service). 2001. National survey of fishing, hunting, and wildlife-associated recreation. U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau, Washington, DC.