CATFISH WATER USE IN THE MISSISSIPPI DELTA

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INTRODUCTION

Water is no longer the unlimited resource in the Mississippi Delta that it was once considered. Heavy pumpage of the Mississippi River Alluvial Aquifer has produced both declining water levels and rising concerns for the future of local industries which depend on a reliable source of inexpensive water. Proper management of these groundwater supplies is essential. Gathering accurate water use data is the first step in formulating a plan to ensure water availability.

Rice farming and catfish production are the two largest consumers of water supplied by the alluvial aquifer. While studies have recently been completed measuring water used in rice production, little effort has been put into directly measuring the water used in catfish production, even though there are 100,000 acres of catfish ponds in Mississippi. The critical need for catfish water use information is emphasized by the fact that the areas of the Delta where catfish production is most intensive are also the areas where the greatest declines in groundwater levels have occurred over the past twenty-five years.

PURPOSE AND SCOPE

Over 95 percent of Mississippi's catfish production is carried out in the areas served by the 17-county Yazoo-Mississippi Delta Joint Water Management District (YMD). All of that water is taken from the alluvial aquifer. With over 1650 permitted aquaculture wells within YMD District boundaries, previous estimates of water use may no longer be adequate for efficient resource management and planning. Water use information on catfish production has been collected indirectly. Interviews with catfish producers led the Mississippi Department of Environmental Quality to establish a permitted volume of 60 acre inches per acre per year for catfish production. Computer modeling indicated that it was possible for established ponds to use as little as 15 inches per year (Pote et al. 1988). This required a rainfall-capture management technique. The 6/3 method, as it is known, was tested on ponds in Leflore county in 1991. Rodrigue et al. (1992) found that ponds managed by this method used 11 inches of the water compared to 22 inches used by traditionally managed control ponds in the test. The results were encouraging as to the reduction in water use by fine tuning management. The total water use figures for both the 6/3 managed ponds and the traditionally managed ponds were far lower than expected.

The objective of the study reported in this paper was to directly measure the groundwater pumped at a number of randomly selected catfish production sites located throughout the Delta.

METHODS

Sites were randomly selected from the list of permitted catfish production wells. The sites were field inspected to determine compatibility with the equipment to be used, then the producers were contacted directly and asked to participate. No other action by the producers was required, and response was generally positive. A total of 12 sites were selected in 1991 and 33 in 1992. To measure operation time of each well, running-time totalizers were installed on the well or its power supply. The initial totalizer placements were made during March of both years and site locations are given in Figures 1 and 2. Periodic visits were made to each study well at roughly two to three week intervals to check totalizer function and to record hours of operation. Final hours of operation were recorded in November of 1991 and 1992.

Flow measurements from each well were made using a portable ultrasonic flowmeter. A Cross-Correlation meter was used for 1991 measurements. In 1992, a Tyme-Flyte meter was used at most sites, primarily due to its greater accuracy and shorter time required to take flow readings. The Cross-Correlation meter was used on those wells with more turbulent flows which the Tyme-Flyte could not read. One to two flow measurements were made on each well. On wells where more than one flow reading was made, the average measurement was used in water volume calculations. Since flow rates of catfish production wells do not usually fluctuate widely during the pumping season, flow rates obtained for each well were assumed to apply for all hours of operation. Flow readings were taken from April to November in both 1991 and 1992.

Pond water acreages were determined by one or more of the following: operator supplied information, examination of ASCS county maps, or direct ground measurements.

Total water used per site was calculated using the following:

$$\frac{\text{Hours of Operation} \times \text{Flow Rate of Well}}{\text{Pond Water Acreages}} = \text{Water Use/Acre}$$

RESULTS

Five of the 12 sites in 1991 delivered reliable results which are given in Table 1, along with the water pumped at the traditionally managed ponds in Leflore county by Rodrigue et al. (1992). The 7 sites which are not reported were lost due to equipment failure or to changes at the site. In 1992, 20 of the original 33 locations yielded results (Table 2). Sites were lost due to a variety of causes such as equipment failure, destruction of totalizers by farm implements, and totalizer disconnection or removal by farm workers who were unaware of the equipment's purpose.

For the six sites yielding results in 1991, the mean water use figure was 24.7 inches for water pumped from early April to early November. The twenty sites in 1992 gave a mean water use of 22.0 inches from mid-March through mid-November, with a range of 14.7 to 31.1 inches. The standard deviation for both 1991 and 1992 data was 3.9 inches.

SUMMARY AND CONCLUSION

The information gathered by this study places average summer seasonal water use for catfish production in the range of 22 to 25 inches. This value is for the time period of March through November and does not reflect water use for winter pond maintenance. Too little information is available at this time to make a definitive statement concerning winter water consumption. Rough estimation of winter pond maintenance is 8 to 12 inches, which would place the average annual water use in the range of 30 to 37 inches. This still is exclusive of the water required to refill drained ponds. Further study in this area will be necessary to gain a more exact figure.

It appears that even though catfish water use is lower than originally thought, it is far from the lower limit predicted by computer models. Cultural practices which include a formal rainfall technique method such as the 6/3 method provide room for further reductions in annual water requirements. Widespread adoption of this method by area producers could provide a significant benefit to local water conservation efforts. Continued study of both the summer and winter water needs will provide better understanding of catfish water use.

ACKNOWLEDGEMENTS

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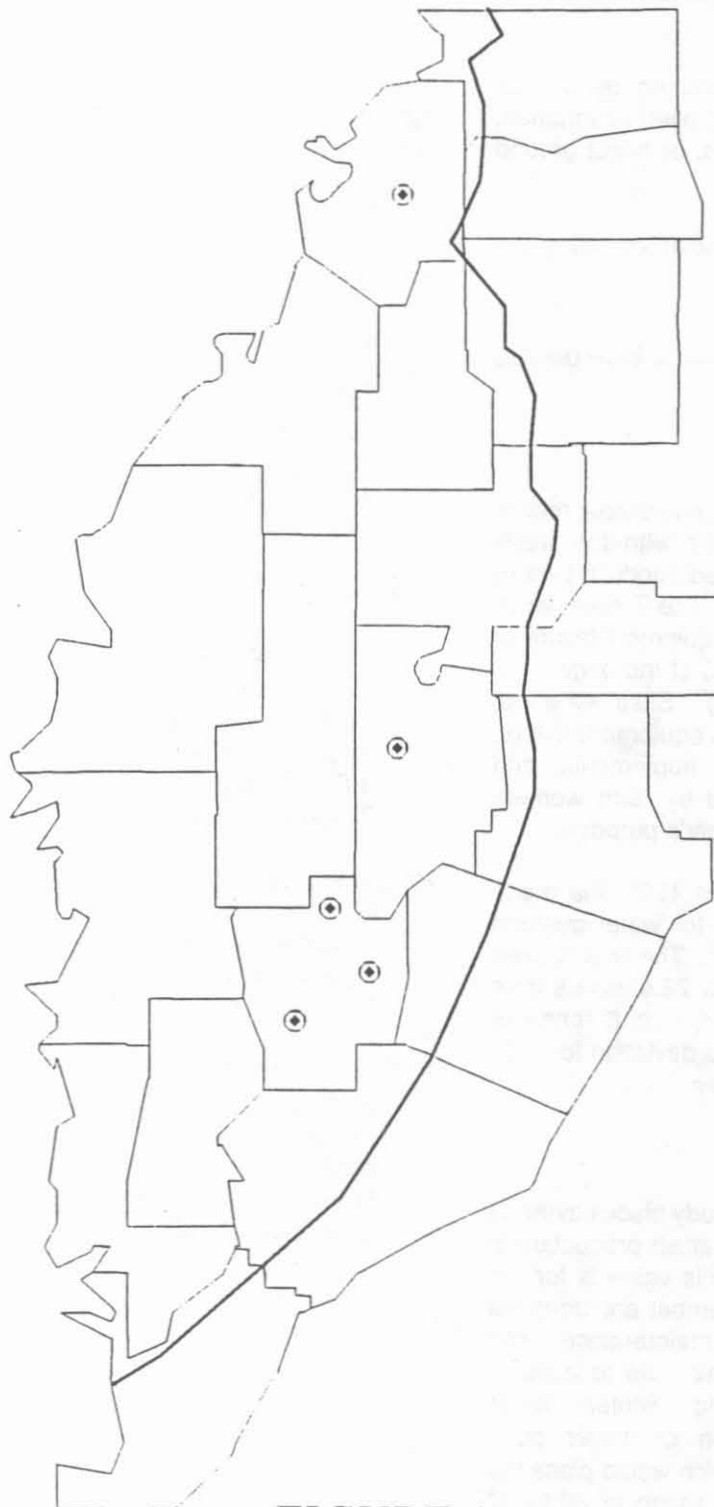

FIGURE 1.
Location of 1991 sites

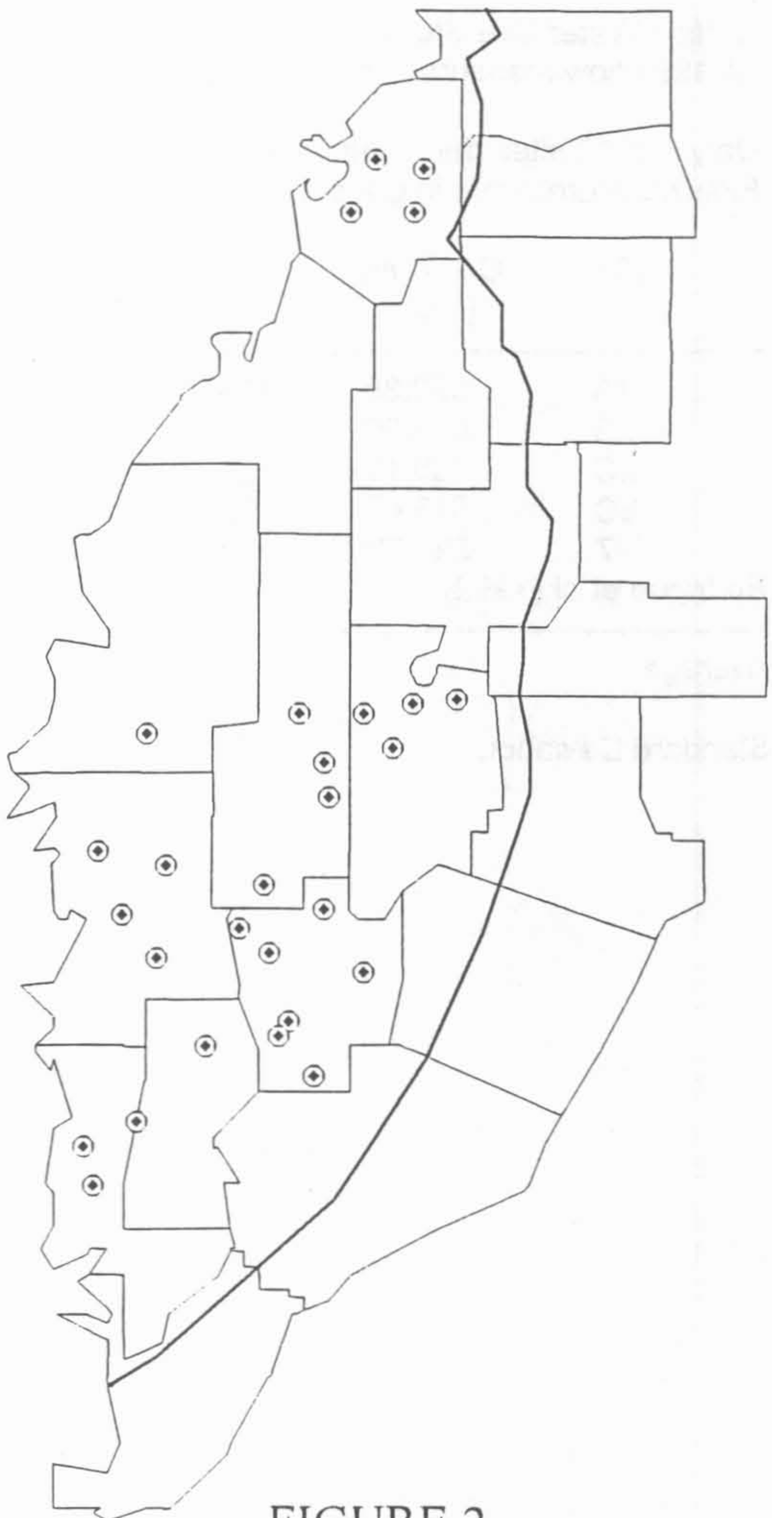

FIGURE 2.
Location of 1992 sites

TABLE 1.

Catfish Water Use Study Results for 1991.
All 1991 flow measurements taken with Correlation meter.

Only 5 of 12 sites delivered measurable results.
Flow measurements in gallons per minute (GPM).

Site	Op. Time (Hours)	Flow (GPM)	Water (Acres)	Water use (Inches)
1A	530.35	1775	64	32.5
2B	628.20	1071	68	21.9
2C	735.19	1151	76	24.6
3C	516.47	1182	65	20.7
7	524.60	1502	68	25.6
Rodrigue et al (1992)				22.0
Average				24.5 Inches
Standard Deviation				3.9 Inches

TABLE 2.

Catfish Water Use Study Results for 1992.
Water use based on data from mid-March to mid-November.
33 initial sites
20 yielding results

Flow readings taken using Tyme-Flyte(T.O.F) or Correlation (Corr).
Flow measurements in gallons per minute (GPM).

Site	Date Installed	Op.Time (Hours)	Flow (GPM)	Flow Method	Water (Acres)	Water use (Inches)
1	06-Mar-92	420.97	1284	T.O.F.	61	19.7
2	16-Mar-92	297.90	1518	T.O.F.	56	17.9
4	12-Mar-92	388.25	1306	T.O.F.	60	18.8
5	12-Mar-92	360.14	1578	T.O.F.	74	17.0
6	12-Mar-92	567.92	972	T.O.F.	61	20.1
7	12-Mar-92	314.49	674	T.O.F.	32	14.7
8	07-Mar-92	Totalizer Failed				
9	07-Mar-92	Totalizer Failed				
10	05-Mar-92	475.12	1415	T.O.F.	60	24.9
11	01-Apr-92	558.51	1590	T.O.F.	69	28.6
12	11-Mar-92	549.75	1320	T.O.F.	62	26.0
13	06-Mar-92	Totalizer disconnected				
14	06-Mar-92	Totalizer Missing				
15	06-Mar-92	Totalizer Failed				
16	12-Mar-92	569.04	1046	T.O.F.	56	23.6
17	11-Mar-92	327.29	1640	T.O.F.	56	21.3
18	11-Mar-92	314.10	1680	T.O.F.	56	20.9
19	11-Mar-92	Totalizer Failed				
19A	11-Mar-92	296.37	1875	T.O.F.	68	18.2
25	12-Mar-92	Totalizer damaged				
27	10-Mar-92	492.51	878	Corr.	42	22.9
30	07-Apr-92	426.81	1057	T.O.F.	41	24.3
32	16-Mar-92	Totalizer Failed				
33	07-Mar-92	377.17	1100	T.O.F.	46	19.9
34	07-Mar-92	684.91	1050	Corr.	65	24.6
36	06-Mar-92	638.81	858	T.O.F.	56	21.6
37	06-Mar-92	Electrical Problems with well				
38A	06-Mar-92	1349.22	768	T.O.F.	74	31.1
38B	08-Mar-92	Totalizer Failed				
40	12-Mar-92	392.95	986	T.O.F.	35	24.6
42	12-Mar-92	Totalizer Failed				
43	12-Mar-92	586.87	Unable to obtain reading			
Averages		326.74	1230		57	22.0
Standard Deviation						3.9 Inches