

Hardy Lake

Fish and Wildlife Research and Management Notes

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Title: Hardy Lake, Scott and Jefferson Counties

INTRODUCTION

Hardy Lake is a 741-acre impoundment located in Scott and Jefferson Counties, six miles east of Austin and about three miles north of State Road 256. The Indiana Department of Natural Resources (IDNR), through the Division of Parks and Reservoirs, has provided modern and primitive camping areas, a swimming beach with bathhouse, picnic areas, hunting zones, hiking trails, four concrete boat ramps, two fish cleaning stations, and three fishing piers. The fishing pier at the beach is handicapped accessible.

Alpha Marina provides seasonal mooring, rental rowboats, and gasoline. Approximately 65 percent of the lake is zoned for idle speed to accommodate anglers (Figure). IDNR launching permits are required on boats using the lake. Maps of the property are available from Hardy Lake State Recreation Area, 4171 East Harrod Road, Scottsburg, Indiana 47170.

The motivation for the construction of Hardy Lake (originally called Quick Creek Reservoir) was the need to solve the water supply problems of Scott County and adjacent areas. In fact, the IDNR has an agreement with the Stucker Fork Conservancy District to sell it water when the district's normal source of water, the East Fork of the Muscatatuck River, cannot meet their needs.

Largemouth bass, bluegill, redear sunfish, and black crappie were stocked into Hardy Lake for the IDNR by the Division of Fish and Wildlife (DFW) when construction was completed in 1970. As expected, these species have maintained their populations through natural reproduction.

Other species which have been stocked at Hardy Lake and maintained through supplemental stockings by the DFW due to a lack of natural reproduction include 10,302,350 walleye fry from 1970 through 1983, 1,898 northern pike fingerlings from 1976 through 1983, 16,203 tiger muskie fingerlings from 1985 through 1996, 8,847 muskie fingerlings from 1997 through 1998, and 57,705 channel catfish fingerlings from 1970 through 1997. As recommended by the DFW, Hardy Lake personnel stocked 1,150 triploid grass carp into the lake in June of 1996 to control submersed aquatic vegetation.

Numerous fishery surveys and several creel surveys have been conducted in the past to monitor fish populations and fish harvest at Hardy Lake. This survey was conducted to update information on largemouth bass, bluegill, gizzard shad, and aquatic vegetation since the last survey in 1998. A similar survey is also scheduled for 2000 as part of work plan 98737.

METHODS

A fish management survey was conducted June 7-17, 1999. Some physical and chemical characteristics of the water were measured in the deep area near the principal spillway.

Fish were collected by DC electrofishing the shoreline at night with two dippers for 1.5 hours. Three experimental-mesh gill nets were fished overnight for three nights. Three trap nets were fished overnight for two nights.

All fish collected were measured to the nearest 0.1 inch in total length and weighed to the nearest 0.01 pound. Fish scale samples were taken from selected species for age and growth analysis. Electrofishing catch rates include all age groups of fish unless stated otherwise. Fish survey data are in appendix.

Submersed aquatic vegetation was mapped three times from May through August. A Lowrance depth finder, Model X-15B, was used to find the edge of the weed beds. Kinds of vegetation were noted visually.

The creel survey was conducted from April 1 through October 31, 1999. It was a non-uniform probability design (Fleener 1971). Four boat ramps, 3 shoreline areas, and 1 private campground were sampled based on angler use probabilities as estimated by the assistant property manager at Hardy Lake (Table 1).

Table 1. Weight of sample sites and sample periods at Hardy Lake, 1999.

| Sample Site | Sample Weight* | Time of Day | Sample Weight | Day of Week | Sample Weight |
|---------------------|-----------------------|--------------------|----------------------|------------------------------|----------------------|
| Alpha Ramp | 0.25 | A Shift | 0.40 | Weekdays Weekdays & Holidays | 0.025 |
| Wooster Ramp | 0.25 | B Shift | 0.60 | | |
| Sunnyside Ramp | 0.15 | | | | 0.051 |
| Carmel Ramp | 0.15 | | | | |
| Dam shoreline | 0.07 | | | | |
| Marina | 0.07 | | | | |
| Overlook | 0.03 | | | | |
| Lakeside Campground | 0.03 | | | | |

*Due to low water, only one ramp (Alpha) of four was usable in September and October. Therefore it was assigned a sample weight of 0.80 for two months.

The fishing day was divided into two 7.5-hour periods. The morning period (A shift) ran from 6 AM to 1:30 PM throughout the survey. The evening period (B shift) ran from 1:30 PM to 9 PM during April, May, September, and October. During June, July, and August, it ran from 2:30 PM to 10 PM to cover the longer daylight period better. Only one 7.5 hour period was sampled by the clerk per day.

Sites, time periods, and dates to be sampled by the creel clerk were assigned based on the probabilities listed in Table 1. Most anglers were interviewed by the clerk at the end of their fishing trip. However, some shore anglers still fishing at the end of a work shift were interviewed just before the clerk went off duty. Thus, a few interviews are not for complete fishing trips.

Each interview included the start and stop time of fishing trip, number in fishing party, angler preference, and county of residence. The number of channel catfish, sublegal and legal largemouth bass, and sublegal and legal tiger muskies and/or muskies caught and released were recorded. Anglers were not asked to differentiate between tiger muskies and/or muskies. Harvested fish were identified, counted, and measured to the nearest half inch in total length. Anglers were also asked to rate their satisfaction with their fishing experience at Hardy Lake that day.

Data were expanded separately for boat and shore by using a spreadsheet developed for the Quattro Pro spreadsheet application. Expansion and standard errors were calculated according to a procedure developed for the Missouri Department of Conservation by Pam Haverland and adapted by Bob Ball, southern fisheries research biologist with DFW. Yield estimates (pounds of fish harvested) were calculated by half-inch groups using length frequency data with average weights from Hardy Lake surveys or other fishery surveys in southeastern Indiana.

Confidence limits (95 percent) for all estimates of the number of anglers, number of angler parties, hours fished, and fish harvested or caught are very wide. The standard deviations range from 81 percent to 100 percent and greater for each parameter each month. Only the estimate is used in the discussion of the creel data.

RESULTS AND DISCUSSION

Hardy Lake is approximately 38 feet deep. Water clarity, as measured with a secchi disk, was 8.25 feet. As is typical for southern Indiana lakes in the summer time, Hardy Lake was stratified into warm and cold layers. Dissolved oxygen concentrations in the cold bottom layer were not adequate for fish survival below 20 feet. This stratified and anoxic condition is corrected each year during fall turnover when the water in the lake is mixed by the wind and falling temperatures.

A total of 1,220 fish, representing 14 species and naturally occurring hybrid sunfish, was collected during this survey. Total weight of the fish sample was approximately 366 pounds. Species not collected in Hardy Lake this time but that have been collected in the past include walleye, northern pike, tiger muskie, white sucker, grass pickerel, steelcolor shiner, bluntnose minnow, longear sunfish, green sunfish, and blackstripe topminnow.

Bluegill ranked first by number (52 percent) and third by weight (8 percent) in the survey sample. The bluegill electrofishing catch rate declined from 721 per hour in 1998 to 198 per hour in 1999 which represents a decline of 75 percent in bluegill density as measured by electrofishing. Growth rates for 3-year-old and older bluegill have declined slightly since last measured in 1998. According to back-calculated lengths, bluegills are reaching six inches during their fifth year of growth.

The Proportional Stock Density (PSD) for bluegill is the proportion or percentage of stock-size bluegill (less than 3.0 inches) captured by electrofishing that are quality-size (greater than 6.0 inches). PSD values for balanced bluegill populations range from 20 to 40 (Novinger and Dillard, 1978). PSD values have improved from nine in 1998 to 19 in this survey.

The Bluegill Fishing Potential (BGFP) Index is an objective rating system which was developed in Indiana to assess bluegill fishing in lakes and ponds (Ball and Tousignant, 1996). Criteria used to calculate this index include bluegill density based on electrofishing catch rates, back-calculated lengths for bluegill at 3-year-old and 4-year-old, bluegill PSD value, and RSD₈ (Relative Stock Density for 8-inch or preferred-size bluegill). Out of a possible 40 points in the index, the current bluegill fishery scored 11 points which falls within the marginal category (Table 2).

Table 2. Range of scores for each category in the bluegill fishing potential index.

| POOR | MARGINAL | FAIR | GOOD | EXCELLENT |
|-------------|-----------------|-------------|-------------|------------------|
| 0 - 7.0 | 7.1 - 12.9 | 13.0 - 18.9 | 19.0 - 25.9 | 26.0 - 40.0 |

The BGFP index score in 1998 was 17 points. The decline in the score can be attributed to a decline in bluegill density and growth and an absence of bluegill over 8 inches collected by electrofishing.

Gizzard shad, which ranged in size from 9.0 to 14.9 inches, ranked second by number (25 percent) and first by weight (39 percent) in the sample. Electrofishing catch rates declined from 217 per hour in 1998 to 79 per hour in 1999.

Shad present several problems for the Hardy Lake fishery. It is true that small gizzard shad provide forage for many fishes such as largemouth bass and crappies. However, this can lower predation rates by largemouth bass on small bluegills which is needed to keep bluegill numbers under control which in turn promotes good bluegill growth rates.

Another negative effect of shad results from their competition with other fish for zooplankton. A large population of shad can eat so many of the microscopic animals that only a few of the young bass and bluegill, which also eat those small animals, can survive and fishing will decline.

Largemouth bass ranked third by number (12 percent) and second by weight (22 percent) in the sample. They ranged in length from 4.5 to 16.0 inches and averaged 9.9 inches. Bass electrofishing catch rate declined from 103 per hour in 1998 to 97 per hour in 1999 which represents a decline of six percent in the catch rate.

Largemouth bass appear to be reaching the legal size limit of 14 inches during their sixth year of growth. Of 152 bass collected, 11 (seven percent) were 14 inches long or larger which is down from 10 percent in 1998. Although still satisfactory, bass growth rates have declined slightly since last measured in 1998.

The Proportional Stock Density (PSD) for largemouth bass is the proportion or percentage of stock-size bass (greater than 8.0 inches) captured by electrofishing that are quality-size (greater

than 12.0 inches). PSD values for balanced largemouth bass populations range from 40 to 60 (Novinger and Dillard, 1978). The PSD value for bass at Hardy Lake has declined from 57 in 1998 to 44 in this survey.

Fifty nine redear were collected that ranged in size from 2.8 to 9.3 inches. They ranked fourth by number and seventh by weight in the sample. Twenty-eight redear over four inches (stock size) were collected by electrofishing. Twenty-four (86 percent) of these fish were seven inches (quality size) or longer.

Over 6,500 black crappie were harvested in the creel survey but only five were collected in the fishery survey. It is not unusual for crappie to be under sampled in routine fishery surveys.

Tiger muskellunge (also called hybrid muskie) were introduced into Hardy Lake in 1985 to provide some variety for anglers. Fish were stocked 10 times in the 12-year period from 1985 through 1996. Total number stocked was 16,203 fish which ranged from 8.3 to 12.0 inches. However, only three of these fish have ever been collected in any fishery surveys. One small tiger (20.5 inches) was collected in the 1987 survey and two tigers (23 inches and 24 inches) were collected in the 1998 survey.

The DFW stopped producing the hybrid muskie after 1996 and switched to pure muskies. Hardy Lake received 4,401 muskies (average 8.5 to 9.0 inches) in 1997 and 4,446 muskies (average 10.5 inches) in 1998. However, no muskies from those stockings were collected in this survey.

VEGETATION SURVEY

Trips were taken around Hardy Lake with the depth finder on May 25, July 14, and August 26, 1999 to determine the depth of the edge of the submersed weed beds. The average depth was found to be nine feet for the edge of the weed beds. Using a planimeter and a map of Hardy Lake (Division of Water, March 1972) with 10 foot contours, it was determined that 212 acres were covered with submersed plants. This is 29 percent of the lake's area which is higher than the optimum level of 20 to 25 percent.

Watermilfoil and coontail were the dominant submersed plants throughout the season. Watermilfoil appears to be more common in the lower end of the lake while coontail was more common in the upper end. Coontail was already to the surface at some places by May 25 and could be found as deep as 12 feet. A few naiads were seen in May and were very noticeable by July. Lotus and purple loosestrife started blooming in July. At this time of year, coontail at the surface tends to turn brown. A dead, 24-inch grass carp was observed at the Wooster Ramp on August 26. A 33-inch grass carp, which weighed over 20 pounds, was collected during the fishery survey in June.

Anglers often complain to Hardy Lake personnel about the “weeds” because they interfere with fishing. Submersed aquatic vegetation covers an estimated 29 percent of Hardy Lake four seasons after 1,150 grass carp, which is one per three of the recommended rate of 15 per acre of vegetation, were stocked in June 1996. Consequently, submersed vegetation continues to be a problem for anglers as well as for bass and bluegill management at this impoundment.

Largemouth bass and bluegill should benefit if the amount of vegetation was reduced to 20 percent or 25 percent so that bass could find and eat their prey, especially bluegill, more easily.

Research in Mississippi (Brunson 1994) indicates that grass carp slow down to eating only about 25 percent of their body weight per day after they reach 13 pounds. In light of the fact that the 1996 stocking was one per three of the recommended rate, that mortality has reduced grass carp numbers, and that they are becoming less and less efficient at plant control due to their age and size, it is time to add more triploid grass carp.

CREEL SURVEY

Fishing Pressure and Harvest Rates by Month

A total of 148 days were sampled during the 214 day period from April 1 through October 31, 1999. During that time, the creel clerk came in contact with 1,224 anglers (1,150 boat and 74 shore) of which 1,169 (96 percent) granted interviews. With the exception of two boat anglers and 11 shore anglers, interview data is for completed fishing trips. After expanding and combining boat and shore data, it was estimated that 15,346 anglers spent 64,229 hours fishing at Hardy Lake (Table 3). Total fishing pressure equaled 87 hours per acre during the survey. Fishing pressure peaked in May at 15,870 hours and then declined to a low of 3,449 hours in October (Table 3).

The best harvest rate of 0.73 fish per hour was observed in July. The lowest harvest rate of 0.19 fish per hour was observed in August. During this seven-month survey, the overall harvest rate equaled 0.44 fish per hour (Table 3).

Table 3. Estimated number of anglers, hours spent fishing, number of fish harvested, and harvest rates by month during the 1999 creel survey at Hardy Lake. Boat and shore data are combined.

| Month | Number of Anglers | Fishing Pressure (Hrs) | Number of Fish Harvested | Harvest Rate (Fish per Hour) |
|---------------|-------------------|------------------------|--------------------------|------------------------------|
| April | 2,934 | 11,527 | 5,254 | 0.46 |
| May | 4,086 | 15,870 | 11,042 | 0.70 |
| June | 3,296 | 14,209 | 2,846 | 0.20 |
| July | 1,756 | 5,770 | 4,218 | 0.73 |
| August | 1,578 | 7,677 | 1,431 | 0.19 |
| September | 1,080 | 5,727 | 2,180 | 0.38 |
| October | 616 | 3,449 | 1,467 | 0.43 |
| Totals | 15,346 | 64,229* | 28,438 | 0.44 |

*Total fishing pressure = 64,229 hours per 741 acres = 86.7 hours per acre.

Angler Preference

To measure their preference, the creel clerk asked anglers the following question: “What were you fishing for?” Responses from the 1,169 anglers that were interviewed fit into 10 categories (Table 4).

Forty three percent of the anglers at Hardy Lake indicated they were fishing for largemouth bass (Table 4). Hardy is a popular spot for bass tournaments by local bass clubs and a number of these anglers were interviewed during the survey. Eighteen percent of the anglers were fishing for bluegills, nine percent for crappie, and four percent for channel catfish. Fifteen percent of the anglers were fishing for various combinations of these four species. Ten percent of the anglers did not have a preference for any certain kind of fish. These anglers were fishing for “anything” (Table 4).

Table 4. Preference categories of anglers fishing at Hardy Lake from April 1 through October 31, 1999.

| Preference Category | Percent of Anglers |
|-----------------------------|---------------------------|
| Largemouth bass | 43.4 |
| Bluegill | 17.7 |
| Anything | 9.9 |
| Crappie | 9.4 |
| Bluegill per Crappie | 8.0 |
| Largemouth bass and Panfish | 6.6 |
| Channel catfish | 4.1 |
| Channel catfish and Panfish | 0.5 |
| Panfish | 0.2 |
| Tiger muskie and/or Muskie | 0.1 |

Interest in fishing for tiger muskie or muskie is very low as it was estimated that only eight anglers were fishing for those fish. This number is based on one interview of one angler on September 27 and one interview of one angler on October 6, 1999.

Harvest by Number and Weight

The creel clerk counted and identified 2,384 fish at Hardy Lake during the 7-month creel survey. After expansion of the data, it is estimated that 28,438 fish weighing 11,042 pounds were harvested during the survey (Table 5). This equals a yield of approximately 38 fish per acre that weighed 14.90 pounds per acre.

Table 5. Estimated harvest by number and weight of fishes harvested at Hardy Lake from April 1 through October 31, 1999. Average size and size range of each species is also listed.

| Species | Number | Percent | Weight | | Length (inches) | |
|-----------------|---------------|---------|---------------|---------|-----------------|-----------|
| | | | Pounds | Percent | Average | Range |
| Bluegill | 14,601 | 51.3 | 2,628 | 23.8 | 6.1 | 4.0-9.5 |
| Crappie | 6,640 | 23.3 | 2,722 | 24.7 | 9.0 | 5.0-14.0 |
| Redear sunfish | 5,741 | 20.2 | 1,895 | 17.2 | 7.4 | 4.5-10.0 |
| Channel catfish | 680 | 2.4 | 2,992 | 27.1 | 20.4 | 14.5-30.0 |
| Warmouth | 395 | 1.4 | 95 | 0.9 | 6.7 | 5.5-7.5 |
| Largemouth bass | 372 | 1.3 | 677 | 6.1 | 15.2 | 14.0-18.0 |
| Walleye | 7 | < 0.1 | 28 | 0.3 | 23.0 | 23.0 |
| Bullhead | 2 | < 0.1 | 5 | < 0.1 | 16.0 | 16.0 |
| Totals | 28,438 | | 11,042 | | | |

Bluegills were the most abundant fish in the harvest by number at 51 percent (Table 5). They ranked third by weight (24 percent) after channel catfish and crappie. They ranged in size up to 9.5 inches and averaged 6.1 inches long. Approximately 58 percent of the bluegills were quality size (greater than 6 inches) and 8 percent were preferred size (greater than 8 inches).

Crappies ranked second by number and weight in the harvest. They ranged in length from 5 to 14 inches. Approximately 77 percent were quality size (greater than 8 inches). Of the 1,169 anglers interviewed by the creel clerk, five anglers harvested their limit of 25 crappies. Fifty-three percent of the crappies were harvested in April. Areas with standing timber are popular places to fish for crappie.

Channel catfish ranked fourth by number and first by weight (27 percent) in the harvest (Table 5). Supplemental stockings of 8-inch channel catfish every two years maintain this species in Hardy Lake. Popular catfishing sites for shoreline anglers are the dam and overlook areas.

It was estimated that 372 largemouth bass were harvested. They ranged in size from 14 to 18 inches and averaged 15 inches. More anglers said they were fishing for largemouth bass than any other species at Hardy Lake.

A few walleye from past stockings apparently are still present in the lake. It was estimated that seven walleye were harvested during this creel survey. This is based on the harvest of one walleye on May 1 by a crappie angler. Another angler reported harvesting an 8.5 pound walleye in 1998.

Catch and Release Fishing

Each party, when interviewed by the creel clerk, was asked for the number of channel catfish, the number and size of largemouth bass, and the number and size of tiger muskie and/or muskie that had been caught and released. Anglers reported catching and releasing 2,365 sublegal bass, 194 legal bass, six channel catfish, two sublegal tiger muskie and/or muskie, and one legal tiger muskie and/or muskie.

From this information, it was estimated that anglers caught and released 31,210 bass, 88 channel catfish, and 32 tiger muskies and/or muskies (Table 6). This included 2,286 legal bass and five legal tiger muskies and/or muskies. One angler reported releasing a 5.5 and a 6.75-pound bass.

There is some emphasis today by anglers to release legal fish for others to catch and release over and over. During this creel survey, it was estimated that anglers caught 2,658 legal bass. Fourteen percent (372) were harvested and 86 percent (2,286) were released. The total catch rate (harvest rate plus release rate) for bass at Hardy Lake during this creel survey was 0.492 bass per hour.

Table 6. Estimated number of largemouth bass, channel catfish, and tiger muskie per muskie caught and released by anglers at Hardy Lake from April 1 through October 31, 1999. Catch rates are also included.

| Species | Estimated Number | Catch Rate (Fish per Hour) |
|--------------------------------------------|-------------------------|-----------------------------------|
| Largemouth bass (< 13.9 inches) | 28,924 | 0.45 |
| Largemouth bass (> 14.0 inches) | 2,286 | 0.04 |
| Total | 31,210 | 0.49 |
| Channel catfish (all sizes) | 88 | < 0.01 |
| Tiger muskie and/or muskie (< 35.9 inches) | 27 | < 0.01 |
| Tiger muskie and/or muskie (> 36.0 inches) | 5 | < 0.01 |

Angler Satisfaction

Each angler party was asked the following question, "On a scale of 0 to 10 with 0 being "not satisfied at all" and 10 being "extremely satisfied", how would you rate your satisfaction with your fishing experience at Hardy Lake today?"

Table 7. Satisfaction ratings by angler parties at Hardy Lake from April 1 through October 31, 1999.

| Satisfaction Rating | Number of Angler Parties | Percent |
|----------------------------|---------------------------------|----------------|
| 0 - Not satisfied at all | 94 | 14.6 |
| 1 | 33 | 5.1 |
| 2 | 85 | 13.2 |
| 3 | 55 | 8.6 |
| 4 | 48 | 7.4 |
| 5 - Neutral | 128 | 19.9 |
| 6 | 42 | 6.5 |
| 7 | 54 | 8.4 |
| 8 | 57 | 8.9 |
| 9 | 11 | 1.7 |
| 10 - Extremely satisfied | 36 | 5.6 |
| Total | 643 | |

Approximately 49 percent of the angler parties were less than satisfied and rated their fishing experience from 0 through 4, 20 percent were “neutral” and rated their fishing experience as a 5, and the remaining 31 percent were satisfied and rated their fishing experience from 6 through 10 (Table 7).

Each angler party was also asked the following question, “What would increase your satisfaction with your fishing experience at Hardy Lake?” The clerk recorded 777 responses which fit into five categories as follows: biological 582, social 76, environmental 46, other 46, and facilities 27.

Seventy-five percent of the comments fit into a category that could be labeled as biological. Within this category, 33 percent of the anglers wanted to catch more fish, 24 percent wanted to catch bigger fish, 20 percent wanted a slot size limit, 13 percent wanted the lake to be stocked better, three percent wanted weed control, two percent wanted the tiger muskie out of the lake, and one percent wanted the shad out of the lake. Suggestions of fish to stock included largemouth bass, bluegill, redear sunfish, hybrids, smallmouth bass, white bass, walleye, muskies, different kinds of catfish, and yellow perch.

Approximately 10 percent of the comments fit into a category that could be labeled as social. Anglers said they would be more satisfied if Indiana built more lakes, if their boat was bigger, if tournaments were stopped, if they had more time, if big boats, ski boats, and jet skis were banned, and if there was less boat traffic, etc. Nearly one per three of the comments, which was the single largest group in this category, expressed the desire to change the speed limit and make

it lower. Presently, there is no speed limit in 35 percent of Hardy lake which is not included in the idle zone.

The environmental category (seven percent) included comments about too much wind and weather that was too hot or too cold. Approximately 50 percent of the comments in this group were complaints related to the drought in 1999. In fact, so much water was withdrawn from the lake by the Stucker Fork Conservancy District during the drought that by the end of August, Alpha was the only ramp where anglers could launch a boat.

Seven percent of the comments were things like “ok” or “nothing.” These comments are included in the category labeled “other.”

Under the category of facilities (three percent), anglers made comments about the physical conditions of the boat ramps, lack of trash cans, need for security lights, and putting protective coverings on boat docks so their boats would not be damaged. These comments have been passed on to the manager at Hardy Lake.

Angler Origin and Economic Value of the Hardy Lake Fishery

Anglers visiting Hardy Lake came from 30 counties in Indiana and from locations outside Indiana (Table 8). Of 643 angler parties interviewed during this survey, 25.3 percent were from Scott County where the lake is primarily located. Approximately 53.4 percent came from the five counties of Clark, Jackson, Jennings, Jefferson, and Washington which are immediately adjacent to Scott County. Approximately 19 percent came from 24 other counties in Indiana and two percent came from outside the state.

Table 8. Origin of angler parties fishing at Hardy Lake, April 1 through October 31, 1999.

| County | Total | Percent |
|---------------|--------------|----------------|
| Scott | 163 | 25.3 |
| Clark | 147 | 22.9 |
| Jackson | 81 | 12.6 |
| Jennings | 59 | 9.2 |
| Jefferson | 48 | 7.4 |
| Bartholomew | 21 | 3.3 |
| Floyd | 17 | 2.6 |
| Johnson | 10 | 1.6 |
| Washington | 9 | 1.4 |
| Ripley | 8 | 1.2 |
| Shelby | 8 | 1.2 |
| Decatur | 7 | 1.1 |
| Madison | 7 | 1.1 |
| Huntington | 5 | 0.8 |
| Marion | 5 | 0.8 |

| | | |
|---------------|-----|-----|
| Ohio | 5 | 0.8 |
| Delaware | 4 | 0.6 |
| Harrison | 4 | 0.6 |
| Noble | 4 | 0.6 |
| Brown | 3 | 0.5 |
| Dearborn | 3 | 0.5 |
| Henry | 3 | 0.5 |
| Clinton | 2 | 0.3 |
| Hancock | 2 | 0.3 |
| Allen | 1 | 0.2 |
| Lawrence | 1 | 0.2 |
| Morgan | 1 | 0.2 |
| Orange | 1 | 0.2 |
| Switzerland | 1 | 0.2 |
| Tipton | 1 | 0.2 |
| Out-of-state | 3 | 2.0 |
| Totals | 31 | |
| Locations | 643 | |

In 1996, the U.S. Fish and Wildlife Service determined that the value of one angler's fishing trip in Indiana was \$50 (U.S. Department of the Interior, et al 1998). This figure includes expenditures for food, lodging, transportation, equipment, license fees, and related fishing expenditures. It was estimated that 15,346 angler days of fishing occurred at Hardy Lake during the seven month period covered by this creel survey. At \$50 per trip, the estimated economic value of fishing during the creel survey period was approximately \$767,300. Fishing at Hardy Lake is very important to the local and state economy.

CONCLUSION

The primary function of Hardy Lake is to serve as an emergency water supply to the Stucker Fork Conservancy District. Recreational activities such as fishing, hunting, boating, and swimming are secondary considerations in its management. Because this large impoundment is a standby water supply, the number of techniques available to fish biologists to manage the fish populations is limited.

Creel survey results indicated that bluegill, redear, and crappie are providing some panfishing opportunities. A few warmouth also will add to the panfish catch. Largemouth bass are providing abundant catch-and-release fishing of sublegal fish as well as some harvest opportunities of legal fish.

In spite of stocking over 16,000 tiger muskie from 1985 through 1996 and 8,800 muskie from 1997 through 1998, very few of these fish appear to be present in Hardy Lake. Only three of

these fish have been collected in any fishery survey. The creel survey indicated that the number of anglers fishing for tiger muskies or muskies is very low, less than 0.1 percent.

Forty-nine percent of the anglers were less than satisfied with their fishing experience at Hardy. Some of the factors listed by anglers that would improve their satisfaction were catching more fish, catching bigger fish, a bass slot limit, stocking the lake better, weed control, removing the tiger muskies, and removing the gizzard shad.

Gizzard shad were not known to be present in Hardy Lake prior to a survey in 1987 when six were collected. Since that time, their numbers have expanded so that presently they constitute 25 percent of the fish population by number and 39 percent by weight. Consequently, fewer fish are available to anglers.

The primary fish management goals at Hardy Lake are: 1) maintain quality fishing opportunities for panfish (chiefly bluegills) and channel catfish; 2) maintain adequate bass growth to provide fishing opportunities for bass exceeding the size limit, and 3) explore the possibility of creating a striped bass fishery. In order to meet those goals, the following recommendations are made:

- The DFW should maintain the 14-inch minimum size limit to prevent overharvest of largemouth bass, the primary source of predation at this time on small panfish and gizzard shad in Hardy Lake. Contrary to angler opinion, the bass population in Hardy Lake has not stockpiled to the point that a 12 to 15-inch slot limit is necessary.
- If the fish are available, the DFW should make an experimental stocking of hybrid striped bass or striped bass (preferred) fingerlings at 5 per acre (3,705 fish) into Hardy Lake in 2001. This open-water predator is an ideal fish to feed on the abundant gizzard shad population. Survival of this fish will be monitored to determine if additional stocking would be warranted.
- The Division of Parks and Reservoirs should stock an additional 1,060 triploid grass carp in 2000 to assist those grass carp present to control submersed vegetation. This equals a stocking rate of 5 fish per acre of vegetation. The grass carp should be eight inches or longer to reduce predation losses to bass. A stocking permit from the DFW is required before the fish can be stocked into Hardy Lake.
- Hardy Lake personnel should continue to cut paths through the lotus beds with their mechanical harvester to create fishing lanes for anglers.
- The DFW should continue to stock 4,446 channel catfish every two years. These channel catfish should average at least 8 inches long to reduce mortality from bass predation. The next regular stocking is scheduled for 2001.
- Anglers have no interest in fishing for tiger muskie or muskie at Hardy Lake. The DFW should discontinue the muskie stocking in light of the lack of interest in this type of fish and their apparent poor rate of survival.

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creel clerk. Participation in a creel survey by all anglers, whether they catch fish or not, is essential for an accurate evaluation of fishing pressure, fish harvest, and management programs.

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